Appendix A
Geotechnical Engineering Report

CITY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
BUREAU OF ENGINEERING

GEOTECHNICAL ENGINEERING DIVISION

GEOTECHNICAL ENGINEERING REPORT
LA RIVER PHASE IV PROJECT
RIVERSIDE DRIVE TO FOREST LAWN DRIVE

W.O. # E1908933
GED FILE #21-122
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1.0 INTRODUCTION

The Geotechnical Engineering Division (GED) prepared this report in response to the LA Department of Transportation (LADOT) request dated September 1, 2021. This geotechnical report presents the results of a subsurface geotechnical study for the proposed LA River Phase IV project. This bike path project is located on the south bank of the Los Angeles River Flood Control Channel, north of the 134 Ventura Freeway between Forest Lawn Drive and Riverside Drive in the City of Los Angeles. A site vicinity map of the project area is shown in Figure 1, Site Vicinity Map.

This investigation was conducted to evaluate subsurface characteristics and to provide geotechnical recommendations and parameters for design and construction of the project. At the request of GED, the Department of General Services, Standards Division (Standards) performed subsurface exploration at the site and laboratory testing of samples collected from the site. The results of their field investigation and laboratory tests are included in their Report of Subsurface Investigation dated January 20, 2022, presented in Appendix A. GED has reviewed the Report of Subsurface Investigation, concurs with its findings and accepts responsibility for the use of its contents.

The geotechnical parameters presented herein are expected to be representative of the general site area. However, subsurface variation exists and may be encountered during construction of the proposed project. When varying subsurface conditions are encountered during construction of the proposed project, GED shall be notified to evaluate the exposed conditions.

2.0 PROJECT BACKGROUND AND SCOPE

Our understanding of the scope of this project is based on the request received from the LADOT and discussion with project design personnel. The proposed project is located along the south bank of the LA River Channel where an existing bike path exists as shown in Figure 2, Boring Locations Map. The scope consists of an approximately 4,600-foot new asphalt concrete bike path, asphalt concrete service road and soil equestrian path with retaining walls. The retaining walls include 300 feet of bulkhead wall supported on CIDH piles and lagging, and 120 feet of cantilever wall. In addition, the project includes concrete fencing, street lighting, and some utility relocation.

Since a detailed design plan and other details about the proposed construction was not available at the time this report was prepared, the recommendations presented herein may be subject to change based on the final design. If the project scope is modified to include additional or larger structures or relocation of improvements, this report should not be considered adequate for design or construction of the modified project scope. In such a case, a supplemental report to address the altered scope will be required.

No habitable structures or roof will be included for the LA River Phase IV project. Therefore, the project should be categorized under Group U Occupancy per City of Los Angeles Building Code (LABC) 2020, Section 312. According to Los Angeles Department of Building and Safety (LADBS) information bulletin P/BC 2020-044, structures of Group U Occupancy are exempt from the investigation requirement of Code Sections 1803.5.11 and 1803.5.12 for slope instability, liquefaction, differential settlement, and surface rupture due to faulting or lateral spreading.

3.0 GEOTECHNICAL INVESTIGATION

3.1 FIELD EXPLORATION

Under the supervision of GED, Standards drilled three (3) exploratory hollow-stem auger (HSA) borings and conducted laboratory tests on collected soil samples. Borings B-1 and B-3 were advanced to a depth of approximately 25 feet below ground surface (bgs) on December 2, 2021 using a truck mounted CME HT-55. Boring B-2 was advanced to a depth of approximately 50 feet bgs on December 10, 2021 using a truck-mounted CME HT-75 drilling rig. The approximate boring locations are shown on Figure 2, Boring Locations Map, and in the Standards report in Appendix A.

Relatively undisturbed soil (ring) samples were obtained from all borings in the upper 10 feet using a California split barrel drive sampler lined with 1-inch high brass rings. Ring and Standard Penetration Test (SPT) samples were collected alternately in the borings at 2.5-foot intervals between 12.5 feet to 20 feet bgs and then at 5-foot intervals to the explored depths. The ring sampler was 3.5-inch outside diameter and 3-inch inside diameter lined with 2.875-inch inside diameter brass rings.

The SPT sampler was 2-inch outside diameter and 1.375-inch inside diameter and consists of a split-tube barrel (1.5-inch inside diameter) with space for liners, but no liners were used during the current sampling.

The ring and SPT samplers were driven into the bottom of borings using a 140-pound automatic trip hammer falling 30 inches in general accordance with ASTM D1586. The blows required to advance the samplers each six inches of penetration are shown on the boring logs presented in Appendix A. For the SPT samples, the number of hammer blows required to advance the SPT sampler the last 12 inches of an 18-inch sample interval is the SPT field “N” value.

Each collected sample was inspected and described in general conformance with the Unified Soil Classification System (USCS). The descriptions were entered on the boring logs. Bulk samples were also collected from the upper 2.5 feet of the exploratory borings. The results of field drilling are included in the Report of Subsurface Investigation, attached in Appendix A.

3.2 LABORATORY TESTING

Laboratory tests were conducted on selected samples to characterize certain engineering (physical) properties of the on-site soils. GED staff assigned the specific tests after reviewing the field boring logs. Laboratory tests were conducted in general accordance with appropriate ASTM and California Test Methods as indicated. Selected soil samples were tested for the following properties.

- In-Place Dry Density and Field Moisture (ASTM D2937)
- Laboratory Maximum Dry Density and Optimum Moisture Content (ASTM D1557)
- Consolidation (ASTM D2435)
- Direct Shear (ASTM D3080)

- Partice Size Distribution (ASTM D6913)

Laboratory test results are presented in the Standards report, attached in Appendix A. Results of moisture content and dry density testing are displayed directly on the boring logs.

4.0 SITE CONDITIONS

4.1 SURFACE AND SITE CONDITIONS

The proposed project site is located between the LA River channel and the 134 Ventura Freeway and includes an existing bike path. The site slopes downward along the alignment from Forest Lawn Drive to Riverside Drive at +492 feet above mean sea level (MSL) to +472 MSL. On the west side of the project site, where retaining walls are proposed, the site mildly slopes downward from the freeway of about +488 to 496 MSL towards the existing flat 2-inch think asphalt bike path at about +488 to 492 MSL. It then slopes downward toward the top of the channel at approximately +480 MSL. During a field visit, GED observed portions of the pavement showing distress including alligator cracking and depressions. Landscaping exists along both sides of the existing bike path.

4.2 SUBSURFACE CONDITIONS

4.2.1 Soil Materials

Fill materials were identified in all borings to depths of 12 feet below ground surface (bgs). Fills were generally described as dry silty fine sands with trace of gravels. GED does not have any documentation of the fills placed, therefore, the fills at the site are considered uncertified.

Below the fill, native soil materials encountered in the borings consist primarily of moist and dense poorly graded sand with silt and silty sands to depths of about 20 to 37 feet bgs. Gravelly sand and poorly graded gravel with sand were encountered from 20 feet to the final depth of 26.5 feet bgs in Boring B-1 and from 38 feet bgs to the maximum explored depth of 51.5 feet bgs in Boring B-2. More complete descriptions of the materials encountered are provided in the boring logs presented in Appendix A.

Soil parameters used for design purposes are summarized in Table 1, Soil Design Parameters.

TABLE 1 – SOIL DESIGN PARAMETERS

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Friction (degrees)
Fill Soils	100	0	20
Native Soils	110	50	32

4.2.2 Groundwater

Groundwater was not encountered in any of the borings during the current investigation. However, the California Division of Mines and Geology, Historic Ground Water (CDMG, 1998), indicated the shallowest reported historic groundwater depth of approximately 10 feet bgs within the project site as shown in Figure 3, Historic Ground Water Map. For our design analysis, groundwater is assumed to be at a depth of 10 feet bgs. Groundwater levels can fluctuate with seasonal rainfall, dry weather (i.e. drought conditions), pumping activities in the vicinity of the site, and other factors not readily evident.

4.3 SEISMIC DESIGN PARAMETERS

Seismic design parameters for the project were developed in accordance with the 2020 City of Los Angeles Building Code (2020 LABC). The parameters are based on mapped spectral acceleration values in the 2019 California Building Code (CBC) and ASCE 7-16, and the site condition.

According to the State of California Seismic Hazard Zones Map and NavigateLA, the site is located within an area that has potential for liquefaction. Based on the field exploration data and the site soil properties, the site is classified in accordance with Chapter 20 of ASCE7-16 as Site Class D, but due to site potential for liquefaction, the site would be classified as Site Class F. Based on a preliminary design concept of the proposed improvements, fundamental periods of vibrations will be less than 0.5 seconds. For structures with a fundamental period of vibration of less than 0.5 seconds, in accordance with Section 20.3.1 of ASCE 7-16, site response analysis per Section 21.1 is waived and the site can be classified as Site Class D. Section 11.4.8 of ASCE 7-16 states that a ground motion hazard analysis shall be performed in accordance with Section 21.2 of ASCE 7-16 for the structure on Site Class D site with S_1 greater than or equal to 0.2. However, the ground motion hazard analysis is waived if Seismic Response Coefficient, Cs, for Equivalent Lateral Force analysis is determined by Equation 12.8-2 of ASCE 7-16.

The seismic design parameters for the site are summarized in Table 2, Seismic Design Parameters. These values were obtained from the Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps Web Services at (https://seismicmaps.org) using the site coordinates, Site Class D, and Risk Category II.

TABLE 2 – SEISMIC DESIGN PARAMETERS

Parameter	Value
Site Coordinates	34.156004^0 N, -118.308278^0 W
Site Class	D
S_s	2.105g
S_1	0.746g
S_{MS}	2.526g
S_{M1}	1.268g
S_{DS}	1.684g
S_{D1}	0.845g
Fa	1.2
Fv	1.7
T_L	8 seconds
PGA_M	1.076g

5.0 RECOMMENDATIONS

5.1 GENERAL

Our primary geotechnical consideration with respect to the proposed construction is the appropriate support for the proposed retaining walls and other miscellaneous improvements. Based on our analysis of data collected during the subsurface investigations and the depth of uncertified fill, it is recommended that the retaining walls be supported on either shallow footings with fill removal or pile foundations.

The following opinions, conclusions, and recommendations are based on the properties of materials encountered in the previous exploratory borings and laboratory tests. GED shall observe all excavations prior to the placement of reinforcing steel and concrete for foundations. The contractor shall be responsible for protecting excavations from inundation and erosion during wet weather, maintaining the excavations free of loose and/or disturbed material, and maintaining the proper moisture content of the footing excavations until the placement of concrete.

5.2 SITE PREPARATION AND EARTHWORK

All earthwork should be performed in accordance with the recommendations presented in this report. Furthermore, all earthwork should be performed under the observation and testing of a qualified Geotechnical Engineer or designated representative.

5.2.1 Site Clearing

Site clearing is expected to consist of the demolition of the existing bike path and associated improvements as needed. All organic or inorganic materials shall be removed from the construction area and disposed of outside the site. All existing soil at

the site may be re-used for fill or backfill provided it is free of organic material, highly expansive clay, deleterious debris, and brick and concrete rubble larger than 3 inches in diameter. Such unsuitable material shall be removed and disposed of outside the site.

Any utilities, whether active or inactive shall be identified, and if required, properly abandoned or relocated. Any depressions resulting from removal of any existing foundations or utility lines shall be properly backfilled and compacted in accordance with the recommendations of the following sections.

Any utilities crossing under the proposed new foundations may be sleeved or encased if they are not able to support the new foundations loads. The sleeve or encasement must be designed to withstand the proposed foundation pressure. Due to the low compressibility of the sleeve or encasement relative to the surrounding soil, the sleeve or encasement would attract more loads and this must be considered in its design.

5.2.2 Overexcavation

If shallow or spread footings are used for the support of the retaining walls, the existing fill soils below the foundation footprint shall be removed and replaced with compacted engineered fill. For retaining walls up to 6 feet high, a minimum of 3 feet of fill soils below the bottom of the foundation must be removed and replaced with compacted engineered fill. For retaining walls higher than 6 feet up to 10 feet high, a minimum of 5 feet of fill soils below the bottom of the foundation must be removed and replaced with compacted engineered fill. Excavations should extend laterally outside the proposed foundation footprint, a distance equal to the depth of excavation or at least 3 feet. Overexcavation is not required for retaining walls supported on pile foundations.

If native soils encountered at the bottom of retaining walls, at least 2 feet of soils underneath the foundation shall be removed and replaced with compacted engineered fill.

Based on the current borings and field observations, the surficial soils along the bike path alignment include several areas of loose and soft fill soils. At a minimum, all subgrade soils beneath the bike path and service road shall be over excavated to minimum of 12 inches below the bottom of the pavement section and replaced with compacted engineered fills.

ROAD

5.2.3 Temporary Excavation

The soil at the site should be readily excavated by conventional earthmoving equipment in good operating condition.

All temporary excavations shall conform to the State of California Construction Safety Orders (CAL/OSHA). Unsurcharged, temporary vertical excavations shall not exceed 4 feet in height. Unsurcharged excavations greater than 4 feet and up to a maximum of 7 feet shall be sloped at a 1:1 H:V (horizontal to vertical). Excavations deeper than 7 feet and up to 15 feet bgs shall be sloped 1.5:1 H:V or flatter; otherwise temporary shoring will be required.

Any excavation that enters the influence zone of an adjacent structure, equipment foundation, or right-of-way subject to vehicle loading shall utilize shoring. The influence

zone is defined as a projection at 1:1 (H:V) down and away from the lower edge of an adjacent improvement.

5.2.4 Slot Cuts

Where sloped excavations are limited, slot cuts for unsurcharged excavations may be used per the following recommendations:

The excavation side shall be initially slopped uniformly at an inclination of 1:1 with the top of the slope placed two feet from the edge of the footing of the existing structure, and the bottom of the slope at the bottom of the over-excavation. Slots shall be constructed in an A, B, C sequence with neither adjacent slot excavated until the slot cut is completely backfilled to the grade of the initial 1:1 slope. Maximum width of slots shall not exceed 8 feet and maximum height of slots shall not exceed 7 feet. Following completion of the slot cutting, all fill placed adjacent to the initial 1:1 slope (horizontal to vertical) shall be benched into the slope in maximum 2-foot steps. Backfill placed in the slots shall be tested for compaction as it is placed.

Poorly graded sands are often susceptible to sloughing or raveling at shallow excavation depths, limiting effective excavation of slot cuts. The condition and nature of subsurface materials will be evaluated during construction. If the soils show indications of excessive sloughing and caving, the allowable size of the slot cuts may be reduced, or temporary shoring will be required per the recommendations of this report. Recommendations can be provided for slot cutting of surcharged excavations on a case by case basis.

All excavation of the slots shall be performed under the continuous observation of the geotechnical engineer of record or a GED representative working under direct supervision of the geotechnical engineer of record.

5.2.5 Temporary Shoring

Shoring may be designed in accordance with Section 306-1.1.6 of the Standard Specification for Public Works Construction, latest edition (SSPWC), Title 8, Division 1, Chapter 4, Subchapter 4 of the California code of Regulations: CAL/OSHA Construction Safety Orders, and/or the lateral earth pressure distributions recommended herein. Based on the soil classification of the Construction Safety Orders, the existing surface soils at the project site shall be considered to be Type C soil.

Cantilevered shoring, supporting a level ground surface, shall be designed to withstand an active equivalent fluid pressure (EFP) of **35** pounds per cubic foot (pcf). Cantilevered shoring is not recommended adjacent to existing structures or utilities that cannot tolerate at least ½ inch of lateral or vertical movement. Braced shoring is recommended in areas where shoring will be located close to existing structures and/or utilities where it is necessary to limit shoring deflections. Braced shoring can be designed using a uniform rectangular soil pressure of **24H** pounds per square foot, where H is equal to the depth of the excavation in feet being shored. No factors of safety are included in the above soil pressures.

These design pressures assume a level backslope. These shoring pressures are for unsurcharged excavations only. If active traffic, heavy construction equipment or an

existing improvement is within a distance equal to the depth of excavation, additional surcharge loads will apply.

A surcharge load equivalent to an additional 2 feet of retained soil shall be applied to the upper 10 feet of the shoring for the light vehicular traffic anticipated to pass within 0.7H feet of the face of the shoring.

Thirty percent (30%) and fifty percent (50%) of any uniform areal surcharges placed at the top of a cantilever shoring and restrained (braced) shoring act as a uniform horizontal pressure over the entire height of the shoring, respectively.

Wheel or outrigger loads of heavy construction equipment that are located within a distance equal to 0.7H feet of the face of the shoring shall be considered as surcharge loads in shoring calculations.

For any excavation that enters the influence zone of an adjacent improvement, the shoring will be subject to additional surcharge. The influence zone is defined as the area below a 1:1 projection down and away from the bottom of an adjacent foundation. This surcharge may be evaluated per Los Angeles Department of Building and Safety (LADBS) Information Bulletin P/BC 2020-083, Section 3. If requested, specialized surcharges can be evaluated by GED as needed in a supplemental report.

Resistance of shoring to lateral loads may be provided by passive earth pressure. An allowable passive bearing may be taken as an equivalent fluid pressure per foot of depth (pcf per foot) as 250 pcf to maximum of 2,500 psf. Below groundwater, an allowable passive lateral earth pressure of 140 psf per foot of depth up to a maximum of 1,400 psf may be used for shoring installed against undisturbed natural soil. Groundwater level can be assumed to be 10 feet below the existing ground surface for construction purposes.

All proposed shoring system designs including supporting documentation and calculations shall be submitted to GED for review and approval. All shoring systems must meet the following minimum requirements to be considered for review.

- Shoring shall directly support the sides of the excavation. Shoring shall be designed to minimize the development and presence of voids behind shoring support.
- Shoring shall utilize solid sheeting or continuous support to minimize ground loss. Any voids developed behind shoring shall be immediately filled with clean sand (Sand Equivalent of 20 or greater) or Controlled Low Strength Material (CLSM) material.
- Shoring installation procedures shall be designed so that no person is required to enter an unsupported excavation greater than 5 feet in depth at any time.

5.2.6 Design and Installation of Pile-Supported Shoring

When shoring consists of soldier piles and lagging, drilled holes for soldier piles shall be backfilled with Controlled Low Strength Material slurry (CLSM, Greenbook Section 201, with a minimum of one sack of Portland cement per cubic yard of slurry and a maximum of two sacks of Portland cement per cubic yard of slurry) from the bottom of the drilled hole to the ground surface. Alternatively, drilled holes can be backfilled with structural concrete (from the bottom of the drilled hole to the proposed depth of excavation) and slurry above the proposed excavation depth.

Passive pressures presented in this report are based on the assumptions that slurry or concrete will be used to backfill the soldier piles. Use of granular backfill would result in larger deflections and a significant decrease in the allowable passive resistance and therefore is not acceptable. If slurry is used as backfill below the proposed depth of excavation, then the effective width of the pile for the purpose of calculating passive resistance shall be taken as the width of the steel beam. If structural concrete is used then the effective width of the pile for the purpose of calculating passive resistance shall be taken as the width of the drilled hole. To account for the effect of "passive arching" the effective width can be doubled for piles spaced a minimum of 2-1/2 diameters on center. Hole excavations shall be plumb to a tolerance of not more than 1/2-inch per 1 foot.

Based on the results of the current investigation, the potential to encounter caving soils during pile excavation is considered moderate. Gravels and occasional cobbles shall be anticipated during the installation of shoring. Any shoring plan submitted by the contractor must include the intended means to deal with caving soils and oversize materials.

Where caving soils are encountered, casing or other methods approved by the geotechnical engineer of record shall be used to support the sides of the excavations. The inside diameter of casing shall be at least as large as the diameter of the pile as indicated on the plans. Drilling shall be accomplished within the casing. If drilling fluids are proposed to support the sides of the excavation, the fluid data and means of application will be submitted to and approved by GED before usage.

At the completion of drilling, secure covers shall be placed over the excavations. Concrete placement shall be completed within 12 hours of drilling.

Concrete pumps, tremies, chutes or other such devices shall be used to place slurry/concrete. In dry holes, slurry/concrete placement shall be done in a manner such that the slurry/concrete does not hit the side of the drilled hole and so that the alignment of the steel pile is not affected. The web of the steel section may be used as a vertical chute for the placement of slurry or concrete provided the slurry/concrete does not impact the sides of the drilled hole during placement.

If slurry/concrete is placed under water, it shall be placed using concrete pumps and steel pipes, or approved equal, extending to the bottom of the pile excavation. A head of at least 3 feet of slurry/concrete shall always be maintained over the end of the concrete pump pipe so that water and disturbed soils are forced upward from the excavation.

Any temporary casing shall be raised slowly as the pile excavation is filled with slurry/concrete, provided that the bottom of the casing is always a minimum of 3 feet below the level of the slurry/concrete.

5.2.7 Subgrade Preparation

If soft, yielding, or unsuitable soils are exposed at the subgrade surface, then the unsuitable soils shall be removed and replaced with properly compacted fill soils. If additional removal causes an uneven bottom, GED may require additional excavation to provide a suitable subgrade transition.

The excavation bottom shall be compacted to firmness where needed, but a specified relative compaction is not required.

The excavation bottom shall be observed, probed, and approved by a representative of GED prior to placement of certified fill or any foundations. After the acceptance of the subgrade, the area of excavation shall be scarified by 6-inches and recompacted before the placement of fill.

Also, if unstable subgrade is encountered at the base of over excavations, disturbance in these areas shall be minimized. This can be accomplished by limiting the use of equipment and selecting the appropriate equipment to complete the work. At the first signs of pumping, the contractor shall take precautionary measures to avoid further disturbance.

After the acceptance of the subgrade, fill material may be placed in accordance with the following recommendations. Subgrade soils shall be kept moist (between 0 to 2 percent above the optimum moisture content) but not flooded until covered with subsequent fill, CLSM, or construction.

5.2.8 Fill Materials

Fill soils shall consist of on-site soils or approved import material. The on-site soils encountered during the previous geotechnical investigations are acceptable for use as fill material for this project. Before being used as fill, on-site soils shall be cleaned of all organic or inorganic debris and all materials with any dimension larger than 3 inches. Drying of wet site soils or mixing of these soils with dryer soils may be required prior to being used as compacted fill. Import material for use as fill for this project shall be predominantly granular (minimum 80% passing number 4 sieve and 35% or less passing the number 200 sieve), non-expansive (EI less than 20), and shall be free of organic or inorganic debris, contamination and materials with any dimension larger than 3 inches. Import material shall be tested and approved by GED prior to importing to the job site. GED shall be notified a minimum of three working days prior to scheduled importing of soil to the project site.

5.2.9 Fill and Backfill Placement and Compaction

Fill shall only be placed on approved surfaces/subgrades prepared in accordance with Section 5.2.6 of this report. Fill material shall be placed in loose lifts not exceeding 8 inches in thickness, moisture-conditioned between 0 to 2 percent over the optimum moisture content and mechanically compacted. Clayey fill soils (soils with 15% or more finer than 0.005 mm) shall be compacted to a minimum of 90 percent relative compaction, as determined by ASTM Test Method D1557. Fill soils with less than 15% finer than 0.005 mm shall be compacted to a minimum of 95 percent relative compaction, as determined by ASTM Test Method D1557. Any aggregate base should be moisture-conditioned between optimum and two percent above optimum-moisture and compacted to a minimum of 95 percent relative compaction.

Fill compaction shall be tested and recorded by a certified compaction testing agency working under the direct supervision of GED. Densification by flooding or jetting is not allowed. Compacted fill soils shall be kept moist, (at or slightly above the specified moisture content at the time of compaction) but not flooded, until covered with

subsequent construction. If fill soils are softened or eroded by excessive moisture or construction disturbance, they shall be replaced or recompacted at the discretion of the Geotechnical Engineer before additional fill or construction is placed. Inspection approvals for compromised soils are void and invalid.

5.2.10 CLSM Backfill

In lieu of compacted fill, Controlled Low-Strength Material (CLSM) per LADBS Information Bulletin P/BC 2020-121 may be used. Per this Bulletin, testing under the continuous inspection by a concrete deputy inspector is required to verify the bearing capacity of CLSM if it is used as structural fill for support of footings. If testing is required, it should be performed in accordance with procedures and specifications outlined in the Bulletin P/BC 2020-121.

The CLSM mix design shall be developed by the contractor and approved by GED before use. The mix design shall meet the requirements for CLSM in Section 201-6 of the 2012 edition of the SSPWC except that it shall contain no more than 20 percent fly ash.

CLSM having not less than 1-sack sand/cement mix and an unconfined compressive strength of 50 psi may be used. CLSM used as backfill shall only be placed on suitable surfaces meeting the requirements for regular fill placement under Section 5.2.6 for Subgrade Preparation.

5.2.11 Utility Trench Backfill

Trench excavations for utility pipes may be backfilled with onsite soils under the observation of a representative of GED. After utility pipes have been laid, properly bedded, and covered per the project specifications, they shall be backfilled to the ground surface or design subgrade with controlled backfill. Controlled backfill shall be moisture conditioned, placed and compacted in accordance with the recommendations presented in Section 5.2.8. Densification by flooding or jetting is not allowed. Alternatively, utility trenches may be backfilled with CLSM materials placed in accordance with Section 5.2.9.

5.3 RETAINING WALLS

5.3.1 Lateral Loads

Cantilevered retaining walls that retain a level granular (sand equivalent of 30 or greater) non-expansive backfill for a horizontal distance equal to or greater than the height of the wall may be designed for an active equivalent fluid pressure of 35 pounds per cubic foot (pcf). Walls that are fixed against rotation (no movement allowed) supporting a level ground surface and retaining native soils or granular (sand equivalent of 30 or greater) non-expansive backfill for a horizontal distance equal to or greater than the height of the wall can be designed using an at-rest equivalent fluid pressure of 56 pcf. For walls greater than 6 feet in height, an additional lateral seismic load of 31H of retained height starting from 0 at the base of the wall and increasing to a maximum at the top of the wall shall be considered for seismic conditions. No factors of safety are included in the above soil pressures.

In addition to the above lateral pressures from retained earth, lateral pressures from other superimposed loads, such as those from vehicle traffic and adjacent structures, should be added, if the loads fall within a 1:1 projection of wall foundations. The effects of any surcharge loads should be added to the above recommended lateral earth pressures.

Backfill should be placed in 8-inch or thinner loose lifts and compacted to a minimum of 95 percent of the ASTM Test Method D1557 maximum density. Compaction should be performed by mechanical means only and monitored by testing during construction. Care should be taken not to damage walls during backfill operations. Concrete should attain the strength specified by the structural designer prior to placement of large quantities of backfill.

Earth pressures presented herein also assume that only hand operated compaction equipment will be used within five feet of walls to limit compaction induced lateral stresses. The operation of compaction equipment behind retaining walls can induce horizontal pressures in excess of the at-rest pressures on the wall. To help reduce the development of excessive horizontal pressures over-compaction should be avoided.

Earth pressures used in the design of the walls should be indicated on the retaining wall plans. All retaining wall designs and plans should be reviewed by GED to confirm that the appropriate soil parameters are used.

The above-recommended values do not include lateral pressures due to hydrostatic forces. All permanent walls should be provided with adequate drainage to prevent hydrostatic build-up behind the wall. Backfill behind retaining walls should consist of free-draining granular soil as described in Section 5.3.1. Backfill should be placed in 8-inch or thinner loose lifts and compacted to a minimum of 90 percent of the ASTM Test Method D1557 maximum density. If the backfills support the bike path or service road, then the backfills should be compacted to a minimum of 95 percent of the ASTM Test Method 1557 maximum density in the upper 12 inches below the subgrade. Compaction should be performed by mechanical means only and monitored by testing during construction.

Lateral drainage should be provided by installing a perforated drainage pipe behind the base of the wall, or weepholes at 8 feet on-center maximum spacing. If perforated pipe is used, the pipe should be a schedule 40 PVC with a minimum diameter of 4 inches, surrounded with at least 1 square foot per linear foot of wall (1 cubic foot) of free-draining ¾-inch crushed rock or gravel wrapped in geofabric. A non-woven geofabric should be used to prevent fines from piping into the drainage material. Drainage water should be controlled and directed to proper drainage devices in an acceptable manner.

The geo-fabric shall be placed fuzzy side out around the gravel and have at least the following the attributes:

- Density: 6 ounces per square yard
- Grab Tensile Strength (ASTM D- 4632): 120 pounds
- Grab Tensile Elongation (ASTM D- 4632): 50%, minimum
- Trapezoidal Tear Strength (ASTM D- 4355): 50 pounds

5.3.2 Lateral Resistance

Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. A coefficient of friction equal to 0.4 between the base of the foundations and the subgrade may be assumed. The passive resistance of native soil or properly certified primary structural fill may be assumed to be equal to that developed by a fluid with a density of 250 pounds per square foot. The passive resistance is limited to a maximum of 2,500 psf. This allowable passive pressure is applicable for level (ground slope equal to or flatter than 5H:1V) conditions only.

5.3.3 Spread Footings

All foundations should be a minimum of 18 inches wide and established at a minimum depth of 18 inches below the lowest adjacent final grade. Foundations with these minimum sizes, bearing on the required compacted fill or competent native soils, may be designed for a net allowable vertical bearing pressure of 1,500 pounds per square foot (psf) for dead-plus-live loads. A 1/3 increase may be used for short term loading conditions such as wind or seismic forces.

We recommend that all continuous footings be reinforced with a minimum of two No.5 steel reinforcing bars at the top and bottom to provide structural continuity and to permit spanning of local irregularities. The structural engineer should design the actual foundations reinforcement.

Total static settlement of the proposed foundation designed and constructed in accordance with the recommendations presented herein, should not exceed ½ -inch for the anticipated net bearing pressure of 1,500 psf. Differential settlements should not exceed one-half of the total settlement between adjacent foundations.

GED shall observe all footing excavations prior to the placement of reinforcing steel and concrete. The contractor shall be responsible for protecting footing excavations from inundation and erosion during wet weather, maintaining the excavations free of loose and/or disturbed material, and maintaining the proper moisture content of the footing excavations until the placement of concrete.

5.3.4 CIDH Piles

The Los Angeles River was channelized between 1938 and 1960. It is anticipated the fills along the bike path might have placed during the construction of the channel walls. Due to the age of the fills, significant future settlement of the fill soils are not anticipated. While no downdrag loads from the fill were considered in the analysis, the fill soils do not provide vertical capacity in the analysis either. A nominal weight and friction angle of the fill soils were considered for lateral resistance.

As an alternative to shallow foundations, the retaining walls may be supported on 24-inch diameter CIDH piles. The CIDH piles should be established at least 8 feet into native ground and a minimum depth of 20 feet below the lowest adjacent level grade to obtain adequate support in friction from the surrounding soils. The allowable down and upward vertical capacities are 12 kips. Additional axial downward and upward capacities of 2.5 and 2 kips may be obtained for each additional foot of embedment beyond 20 feet, up to a maximum depth of 30 feet, respectively.

The allowable downward values given above are net capacities and the weight of the pile and the embedded portion of the pile cap is accounted for. These capacities may be increased by 33 percent when considering seismic or short term, temporary loads.

Piles should have a minimum center-to-center spacing of 3 pile diameters. With this spacing there is no reduction in axial capacity for group action. For piles with center-to-center spacing of 2 diameters, the axial capacity should be reduced by 33 percent.

The estimated total vertical static settlement of the pile foundation should be less than ½-inch under the allowable loads. Differential settlements between similarly loaded pile foundations should be about half of the total settlement.

Lateral Capacity

Lateral load analyses of 24-inch diameter 20-foot deep CIDH piles were performed based on pile-top deflections of 0.5 and 1.0 inch for fixed-head conditions using the computer program, LPile. The profiles of deflection, shear force, induced bending moment, bending curvature, mobilized bending stiffness, and mobilized soil reaction along the length of the pile are presented in Appendix B. The profiles of lateral load versus maximum bending moment and pile-head deflection versus lateral load are also provided in the Appendix B. The profiles can be assumed to be applicable to any combination of dead- and live-loads. The analyses are based upon the following assumptions: 1) concrete compressive strength of 4,000 pounds per square inch (psi) and reinforcing yield stress and elastic modulus of 60,000 psi and 29,000,000 psi respectively; 2) minimum reinforcement of 1.05% of cross-sectional area. The pile design parameters for different conditions are summarized in Table 3, Pile Design Parameters.

TABLE 3 – PILE DESIGN PARAMETERS

Deflection (inches)	Lateral Load (kips)	Induced Bending Moment (ft-kips)
0.5	21	130
1.0	40	216

There is no reduction in lateral capacities if there is a center-to-center spacing of at least 3 pile diameters in an orientation normal to the loading and center-to-center spacing of at least 8 pile diameters in an orientation parallel to the loading direction. At a center-to-center spacing of 3 pile diameters parallel to the direction of loading, the lateral capacity should be reduced by 50 percent. Interpolation may be used for center-to-center spacing between 3 and 8 pile diameters.

Construction

Installation of all CIDH piles shall be performed in accordance with the "Specification for the Construction of Drilled Piers", ACI 336.1-01 or its most recent version. All aspects of CIDH pile installation shall comply with the acceptance criteria for cast-in-drilled-hole piles presented in the following paragraphs.

1. Pile installation shall be performed under the continuous observation of the geotechnical engineer of record to confirm that the recommended soils are penetrated, and that pile installation has been performed as recommended herein.

The Contractor shall provide necessary facilities at his expense to accommodate pile observations.

2. The pile excavation shall be plumb to a tolerance of not more than 2 percent.

3. The borings encountered gravels, and some cobbles. Gravels and some occasional cobbles shall be anticipated during the installation of CIDH piles. Due to dry and low cementation of the alluvial and fills soils, caving should be anticipated at shallow depths and contractor should be prepared to accommodate anticipated drilling conditions. Casing or other methods approved by the geotechnical engineer shall be used to support the sides of excavations. The inside diameter of casing shall be at least as large as the diameter of the pile as indicated on the plans. Drilling shall be accomplished within the casing.

4. If drilling fluids are proposed to support the sides of the excavation, the fluid data and means of application shall be submitted and approved by GED before usage. Drilling fluids that reduce the frictional bonding between the pile and native site soils used for support will not be accepted.

5. Where groundwater is encountered in the pile excavation, a head of at least 3 feet above the natural groundwater level shall be maintained in the hole to prevent suction or heaving during drilling. The head shall be established by the addition of water or approved drilling fluid to the hole during excavation.

6. At the completion of drilling, secure covers shall be placed over the pile excavation. Concrete placement shall be completed within eight hours after completion of drilling. Placed concrete shall have a slump of 6 inches, with a tolerance of 1 inch.

7. Concrete placed in dry holes shall not be allowed to fall freely more than 5 feet. Concrete pumps, tremies or other such devices shall be used to comply with these requirements.

8. Concrete placed under water or drilling fluid shall be placed using concrete pumps and hoses, or equal, extending to the bottom of the pile excavation. A head of at least 4 feet of concrete shall always be maintained over the end of the concrete pump pipe so that water and disturbed soils are forced from the excavation.

9. Any temporary casing shall be raised slowly as the pile excavation is filled with concrete, provided that the bottom of the casing is always a minimum of 3 feet below the level of the concrete.

10. Concrete placement shall continue until suitable concrete extends to the top of the pile excavation. The tremie or concrete pump pipe shall be slowly raised as the pile excavation is filled with concrete, provided that the bottom of the pipe is never more than 5 feet above the level of the concrete in dry holes.

11. Piles spaced closer than 2.5 pile diameters center to center shall be drilled and concreted alternately, allowing at least 12 hours after concrete placement in one pile before drilling of an adjacent pile.

5.4 SHORT PIERS

Short piers with a minimum diameter of 24 inches may be used for support of lightly loaded improvements such as light poles, power poles, signage, or similar structures. The locations of short piers may be potentially underlain by up to 12 feet of fill soils; therefore, the piers should be established at a minimum depth of 5 feet into the native soils to obtain adequate support in friction from the surrounding soils. Assuming 10 feet of fill and a 15-foot pier depth, the allowable downward and uplift vertical capacities are 5 and 7 kips, respectively. Assuming 5 feet of fill and a 10-foot pier depth, the allowable downward and uplift vertical capacities are 3.5 and 4.5 kips, respectively.

The allowable downward values given above are net capacities and the weight of the pile and the embedded portion of the pile cap is accounted for. Downdrag due to settlement of the uncertified fill has not been considered due to the age and consistency of the fill. These capacities may be increased by 33 percent when considering seismic or short term, temporary loads. Piles should have a minimum center-to-center spacing of 3 pile diameters.

Resistance to lateral loads will be provided by the resistance of the soil against the pile, pile caps, and grade beams. Passive pressure available in undisturbed native soils may be estimated as equivalent to the pressure exerted by a fluid weighing 250 pounds per cubic foot. The passive earth pressure should be limited to 2,500 psf. Below groundwater, an allowable passive lateral earth pressure of 140 psf per foot of depth up to a maximum of 1,400 psf may be used. The passive resistance for piles and connecting grade beams may also include a nominal resistance of 100 psf in the fill materials. For piles located in a roughly 2:1 descending slope, the above values may be reduced by 50%. These values include a calculated factor of safety at least 1.5. The passive pressure may be assumed to act over a width of 2 times the diameter of the short piers.

5.5 DRAINAGE

Control of surface water is critical to the long-term performance of the retaining structures and surrounding slopes. Uncontrolled surface drainage may accelerate erosion and result in slope failures along other portions of the nearby slope(s). The retaining structures shall be protected against infiltration of surface water. If possible, the road surface adjacent to the retaining structures should be sloped such that water drains freely away from the retaining structures and will not pond. Surface drainage shall be collected and discharged to an approved outlet.

5.6 PAVEMENTS

To provide uniform and adequate support for the service road, all pavement areas should be underlain by at least 12 inches of granular fill compacted to 95 percent relative density.

The recommended minimum thickness of flexible pavements for Traffic Index (TI) value of 4 for a subgrade with a minimum R-value of 10 is provided below:

TABLE 4 – PAVEMENT DESIGN PARAMETERS

Pavement Description	Traffic Index (TI)	Pavement Thickness (inches)	
		Asphaltic Concrete	Crushed Miscellaneous Base
Service Road	4	4	6

Crushed Miscellaneous Base (CMB) should satisfy the specifications contained in "Standard Specification for Public Works Construction". All gradation and R-value should be confirmed during construction. All base materials should be compacted to a minimum of 95 percent of the maximum dry density per ASTM D-1557.

6.0 SUPPLEMENTAL GEOTECHNICAL SERVICES

6.1 REVIEW OF PLANS AND SPECIFICATIONS

The grading plans and specifications should implement the recommendations presented in this report and should be reviewed by GED to ensure proper interpretation and application of our recommendations.

6.2 GEOTECHNICAL OBSERVATION AND TESTING DURING CONSTRUCTION

All grading, excavation, and construction of foundations should be performed under the observation and testing of the Geotechnical Engineer at the following stages:

- Upon completion of site clearing;
- During site excavation;
- During subgrade preparation;
- During installation of shoring and CLSM placement;
- During fill placement;
- During construction of CIDH piles
- During installation of drainage and backfill of retaining walls
- During excavation and backfilling of all utility trenches; and
- When any unusual or unexpected geotechnical conditions are encountered.

7.0 CLOSURE

If you have any questions regarding this report, please contact S. Nesarajah (Nesa) at (213) 847-0534 or saddanathapillai.nesarajah@lacity.org.

S. Nesarajah, PhD, GE 2717
Geotechnical Engineer I

Benjamin Moore, GE 2858
Geotechnical Engineer II

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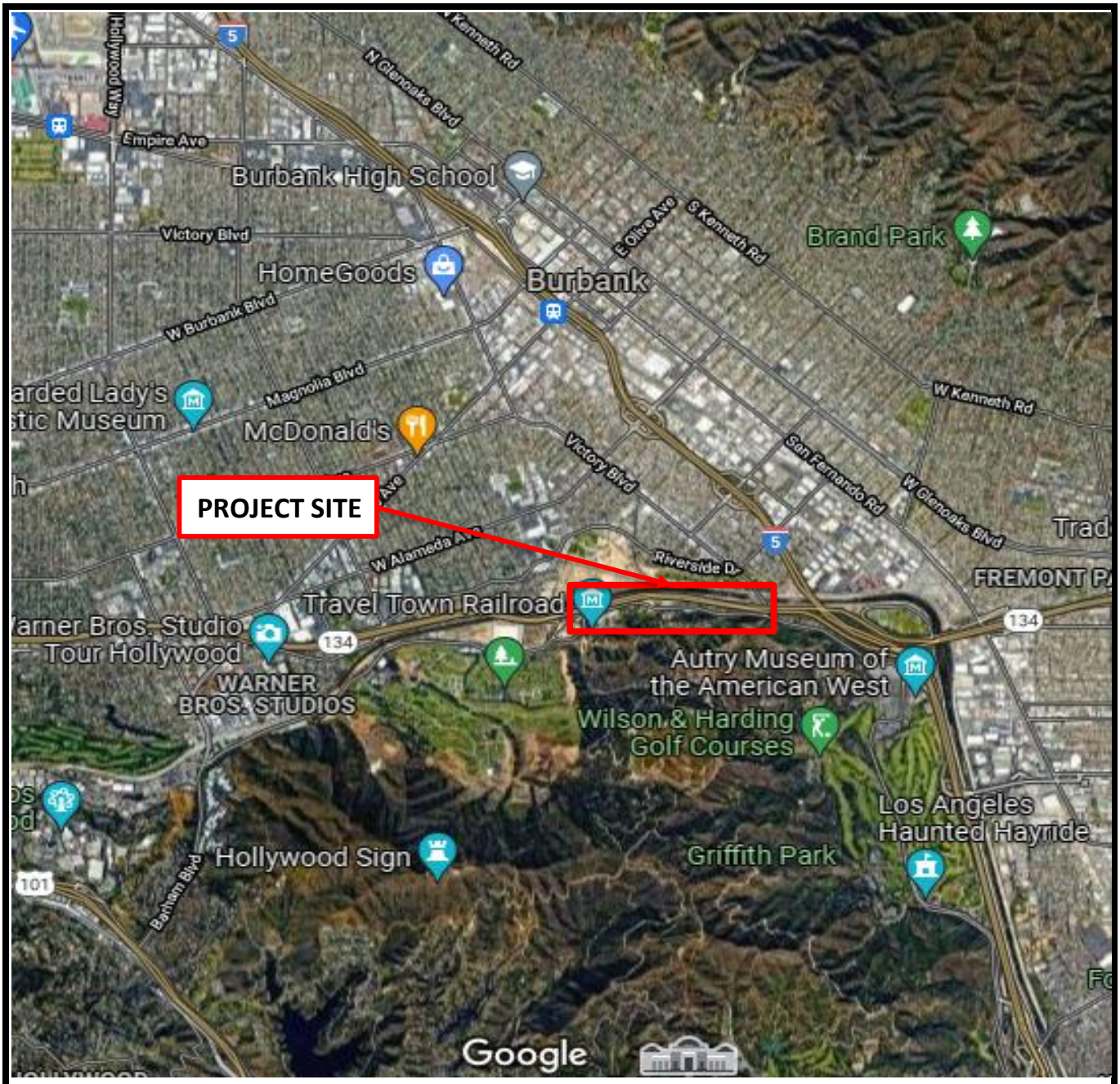
REFERENCES

City of Los Angeles Building Code, 2020.

NavigateLA, City of Los Angeles, http://boemaps.eng.ci.la.ca.us/index01.cfm

United States Geological Survey (USGS), 2008, Interactive Deaggregations, (https://geohazards.usgs.gov/deaggint/2008/).

FIGURES



N

Not to scale

Site Vicinity Map

LA River Bike Path Phase IV **W.O. E1908933** **LA River Channel from Forest Lawn Dr. to Riverside Dr.**	BUREAU OF ENGINEERING GEOTECHNICAL ENGINEERING DIVISION (GED) GED File No.: 21-122 Date: September 2023	**FIGURE No. 1**

LEGEND

B-3, 25' — Boring Approx. Location, Boring Number, Depth in feet

New Bike and Equestrian Path Alignment

Approximate Retaining Walls Location

N

Not to scale

Boring Locations Map

LA River Bike Path Phase IV **W.O. E1908933** **LA River Channel from Forest Lawn Dr. to Riverside Dr.**	BUREAU OF ENGINEERING GEOTECHNICAL ENGINEERING DIVISION (GED) GED File No.: 21-122 Date: September 2023	**FIGURE No. 2**

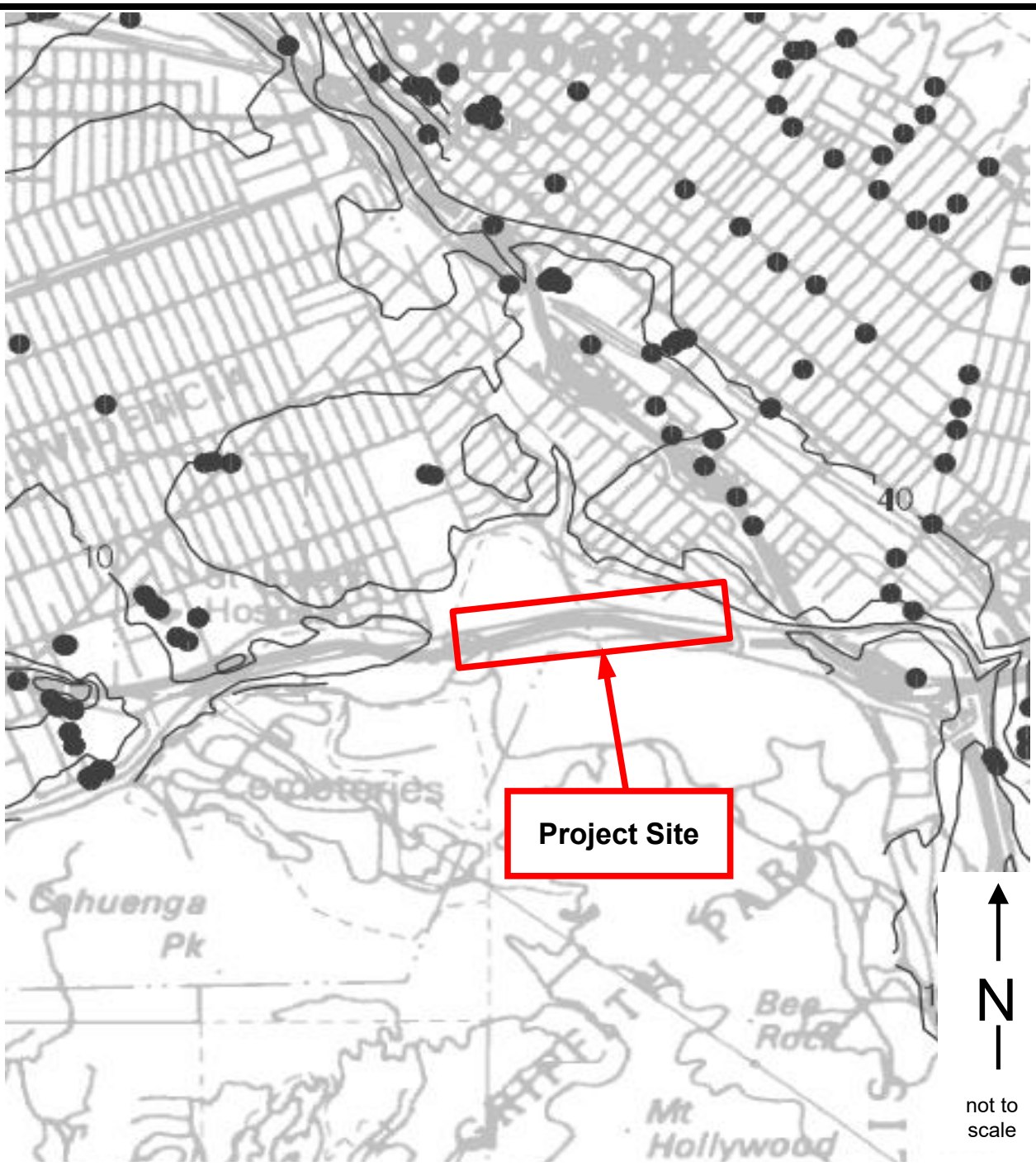


Plate 1.2 Historically Highest Ground Water Contours and Borehole Log Data Locations, Burbank Quadrangle.

● Borehole Site

30 Depth to ground water in feet

Historic Ground Water Map

LA River Bike Path Phase IV **W.O. E1908933** **LA River Channel from Forest Lawn Dr. to Riverside Dr.**	BUREAU OF ENGINEERING GEOTECHNICAL ENGINEERING DIVISION (GED) GED File No.: 21-122 Date: Septermber 2023	**FIGURE No. 3**

APPENDIX A

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION

LA RIVER BIKE PATH PHASE IV

LAB NO. 140-6301

W.O. NO. E1908933
JANUARY 2022

GEOTECHNICAL SERVICES FILE: 21-122

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS
2319 DORRIS PLACE
LOS ANGELES, CA 90031
(213) 485-2242
fax (213) 485-5075

Lab. No. 140-6301

Received: 11-09-21
NTP: 11-18-21
Reported: 01-20-22

LA RIVER BIKE PATH
PHASE IV
WO No: E1908933
GED File No: 21-122

TO: Gary L. Moore, City Engineer.
Public Works / Bureau of Engineering

Attention: Patrick Schmidt

Report of
SUBSURFACE INVESTIGATION

Transmitted herewith are results of the subsurface investigation performed by Standards on the above-named project as requested by the Geotechnical Engineering Division (GED) of the Bureau of Engineering. The logs of the test borings, the Unified Soil Classification and the results of the laboratory tests requested by the Engineer are parts of this report. The descriptions reported on the "Log of Test Boring" sheets are based on field identification procedures, examination of the samples in the laboratory and soil classification tests. The soil classification is based on the attached Unified Soils Classification System.

Three test borings were drilled on this project with a truck-mounted Central Mine Equipment Model-55HT and Model-75HT drill rig using an 8-inch diameter hollow stem auger. "Undisturbed" samples were obtained from the test borings at depths indicated on the log sheets with a 3½-inch outside diameter (O.D.) by 3-inch inside diameter (I.D.) Split Spoon sampler lined with 2⅞-inch inside diameter (I.D.) by 1-inch high brass tubes. The sampler was driven into the soil or bedrock with the weight of a 140-pound automatic trip hammer falling approximately 30 inches.

Standard Penetration Test (SPT) ASTM D1586 was performed. The SPT test involves penetration of soil around the tip of a Split Spoon sampler for a condition of constant energy transmittal. The Split Spoon, 2-inch outside diameter (O.D.) by 1⅜-inch inside diameter (I.D.), is driven eighteen (18) inches. The sampler is seated in the first six (6) inches and the number of blows required to drive the sampler the last twelve (12) inches is recorded as the value SPT blow count. The driving energy is provided by a 140-pound automatic trip hammer dropped thirty (30) inches at depths indicated on the log sheets.

The following tests were performed on samples from the test borings:

In-place Dry Density and Field Moisture (ASTM D2937)

Laboratory Maximum Dry Density and Optimum Moisture Content (ASTM D1557)

Consolidation (ASTM D2435)

Direct Shear (ASTM D3080)

Particle Size Distribution (ASTM D6913)

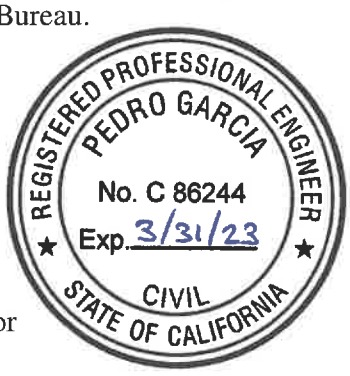
Whenever possible, the in-place dry density and field moisture content were determined from the total undisturbed sample before being prepared for other laboratory tests. These are reported to the nearest 0.1 pound per cubic foot (nearest 1 pound per cubic foot on the log sheets) and 0.1 percent respectively.

Each direct shear test was performed on 2⅞-inch diameter by 1-inch high undisturbed or remolded soil specimens that were soaked for at least 24 hours before being tested. During soaking, the specimens were confined between two perforated brass plates to prevent swelling. The specimens were tested under various normal loads, with a different specimen being used for each normal load, while submerged in water. The rate of shearing is listed on the data sheet. Peak shear load values (represented by solid symbols) and ultimate shear load values at 0.250-inch displacement of the sheared specimens (represented by symbols which are not solid) are reported.

Each consolidation test was performed on 2⅞-inch diameter by 1-inch high undisturbed or remolded soil specimen in a floating ring type consolidometer. The specimen was retained in the 2⅞-inch I.D. brass ring during the test and porous disks were placed on the top and bottom of the specimen. The specimen was initially tested at field moisture to the normal load indicated on the data sheet. When the testing at field moisture was completed, sufficient water was added to cover the specimen and the consolidation test was continued with the specimen under water. At the conclusion of the test, the submerged specimen was allowed to rebound by decreasing the load in decrements shown on the data sheet, concluding with the normal load of 0.1 ton per square foot, and the corresponding rebound readings taken.

The GED gave the Notice to Proceed with the Subsurface Investigation to Standards on 11-18-2021. S. Nesarajah of your Bureau was notified at least 24 hours prior to the drilling and sampling operations. A boring location map is included in this report.

All soil samples for the above-named project that were delivered to Standards Division - Soil Laboratory are presently being stored. These samples will be discarded 45 days after the date of this report unless a specific written request to retain the samples for additional testing or for a longer storage period is submitted by your Bureau.



For RICARDO VILLACORTA, Acting Director
General Services/Standards

RV:PG:RL

N

Legend:

= Test Boring Location

Test Hole No.:, Location:

B-1, CL Bike Path, 211' E/o CL Forest Lawn Drive
B-2, CL Bike Path, 486' E/o CL Forest Lawn Drive
B-3, CL Bike Path, 923' E/o CL Forest Lawn Drive

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION

TEST BORING
LOCATION MAP
& AERIAL PHOTO

PROJECT TITLE: LA River Bike Path Phase IV

W.O. NO. E1908933

LAB. NO. 140-6301 | Checked By: PK

DATE: 12-14-21 | Sheet 1 of 1

LOG OF TEST BORING

LAB. NO.: 140- 6301 **PROJECT:** LA River Bike Path Phase IV

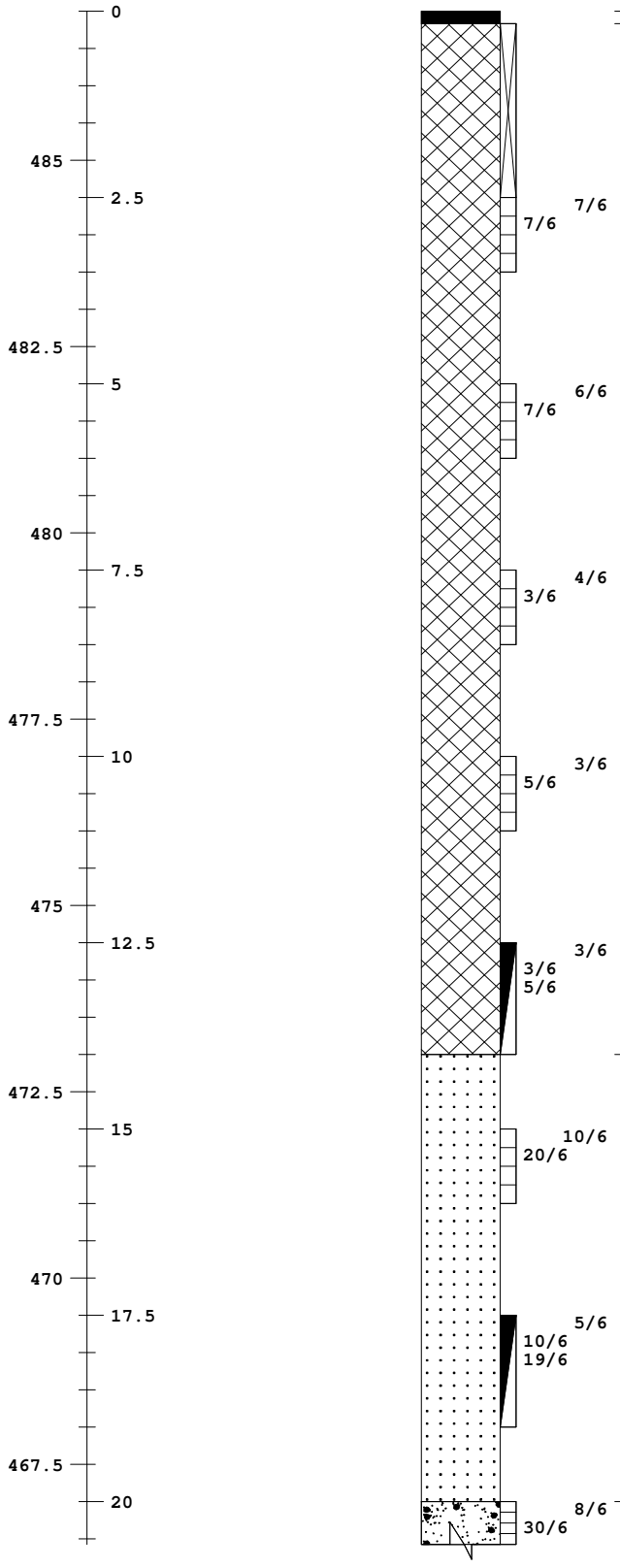
BORING NO.: B-1 **ELEVATION:** 487' **DRILLING DATE:** 12/02/2021

BORING COORDINATES: CL Bike Path, 211' E/o CL Forest Lawn Drive

DRILL RIG TYPE: CME-55HT using 8" hollow stem augers

DEPTH TO STANDING WATER: No Water **DEPTH TO WATER SEEPAGE:** No Seepage

DRILLER: P. Adams **LOGGER:** J. Kunesh **ENGINEER:** S. Nesarajah



ELEVATION / DEPTH (ft)	USCS	Field Description	Moist. %	Dens. Pcf
		2" asphalt pavement in poor condition. FILL MATERIAL. Light brown silty fine sand with traces of rounded gravel (all sizes), cobbles and plant roots. Dry and firm. Bulk soil sample was taken from 2"-2.5' depth.	2.2	109
		5' split spoon sample disturbed by cobble in drive shoe . Only 4 rings retained.		
		Silt content decreasing at 7' depth.	2.1	103
	SP	Light tan fine sand with little amounts of small rounded gravel and traces of silt. Moist and dense.	4.2	102
		2" thick silt lense at 18' depth.		
	SW	Gravely moderately graded sand. Moist and	1.9	119

LOG OF TEST BORING

LAB. NO.: 140- 6301 **PROJECT:** LA River Bike Path Phase IV

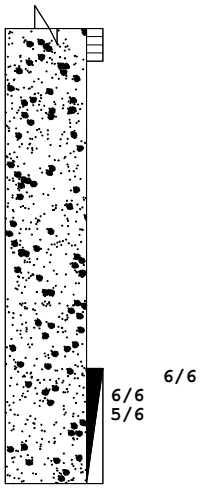
BORING NO.: B-1 **ELEVATION:** 487' **DRILLING DATE:** 12/02/2021

BORING COORDINATES: CL Bike Path, 211' E/o CL Forest Lawn Drive

DRILL RIG TYPE: CME-55HT using 8" hollow stem augers

DEPTH TO STANDING WATER: No Water **DEPTH TO WATER SEEPAGE:** No Seepage

DRILLER: P. Adams **LOGGER:** J. Kunesh **ENGINEER:** S. Nesarajah

ELEVATION / DEPTH (ft)	SOIL SYMBOLS, SAMPLER SYMBOLS AND BLOWS/INCHES	USCS	Field Description	Moist. %	Dens. Pcf
465 / 22.5			dense.		
462.5 / 25			--- Test Boring Location Coordinates: 34° 09' 20.41" North 118° 18' 36.86" West ---		
460 / 27.5					
457.5 / 30					
455 / 32.5					
452.5 / 35					
450 / 37.5					
447.5 / 40					

LOG OF TEST BORING

LAB. NO.: 140- 6301 **PROJECT:** LA River Bike Path Phase IV

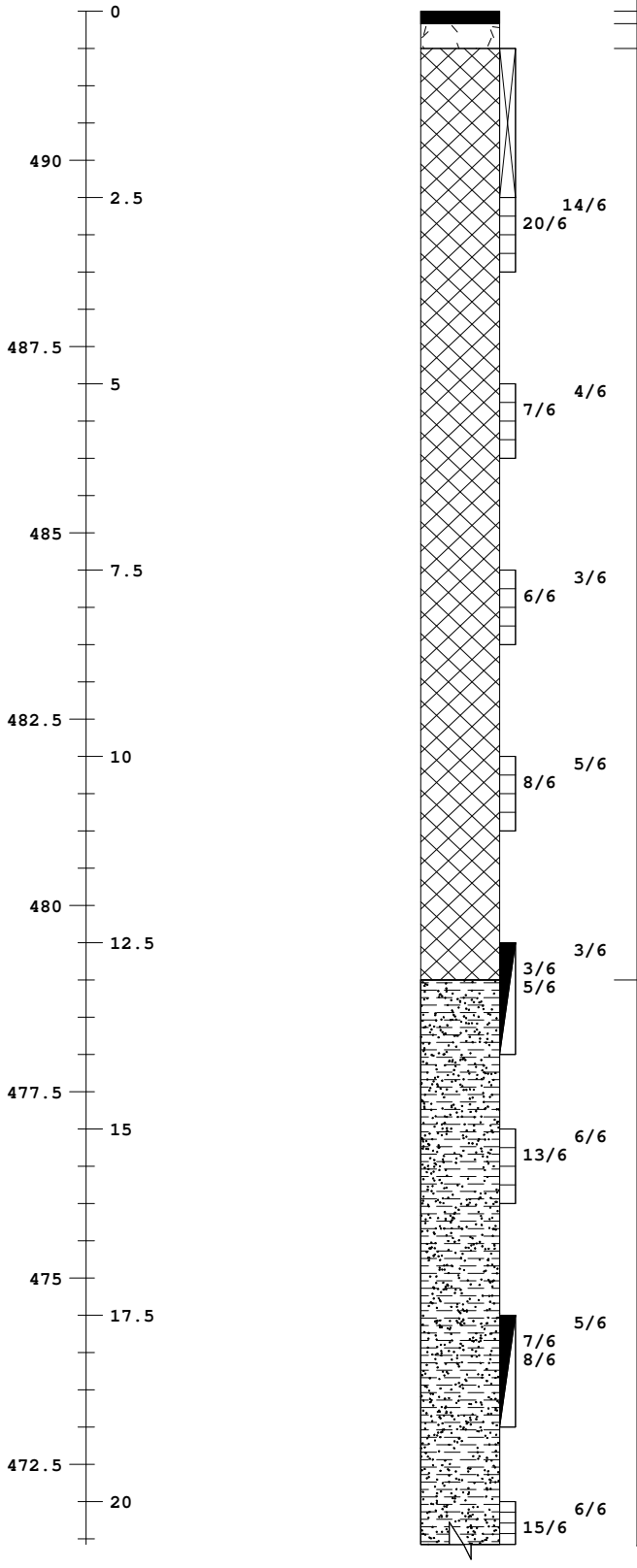
BORING NO.: B-2 **ELEVATION:** 492' **DRILLING DATE:** 12/10/2021

BORING COORDINATES: CL Bike Path, 486' E/o CL Forest Lawn Drive

DRILL RIG TYPE: CME-75HT using 8" hollow stem augers

DEPTH TO STANDING WATER: No Water **DEPTH TO WATER SEEPAGE:** No Seepage

DRILLER: P. Adams **LOGGER:** J. Kunesh **ENGINEER:** C. Law



ELEVATION / DEPTH (ft)	USCS	Field Description	Moist. %	Dens. Pcf
		2" asphalt pavement in poor condition.		
		4" orange-brown decomposed granite subgrade.		
		FILL MATERIAL. Yellow-brown clayey silt/silty lean clay. Moist and firm. Bulk soil sample was taken from 6"-2.5' depth.		
		FILL MATERIAL. Light brown silty fine sand. Dry and firm.		
5			3.2	96
		Silt content decreasing at 7' depth.		
7.5			1.7	90
12.5	SP-SM	Light tan poorly graded sand with silt. Moist and firm. 1' brown oxided silt lense at 13.5' depth.		
15			1.3	99
		1' brown oxided silt lense at 18.5' depth.		
20		Traces of plant roots at 20' depth.	4.2	91

LOG OF TEST BORING

LAB. NO.: 140- 6301 **PROJECT:** LA River Bike Path Phase IV

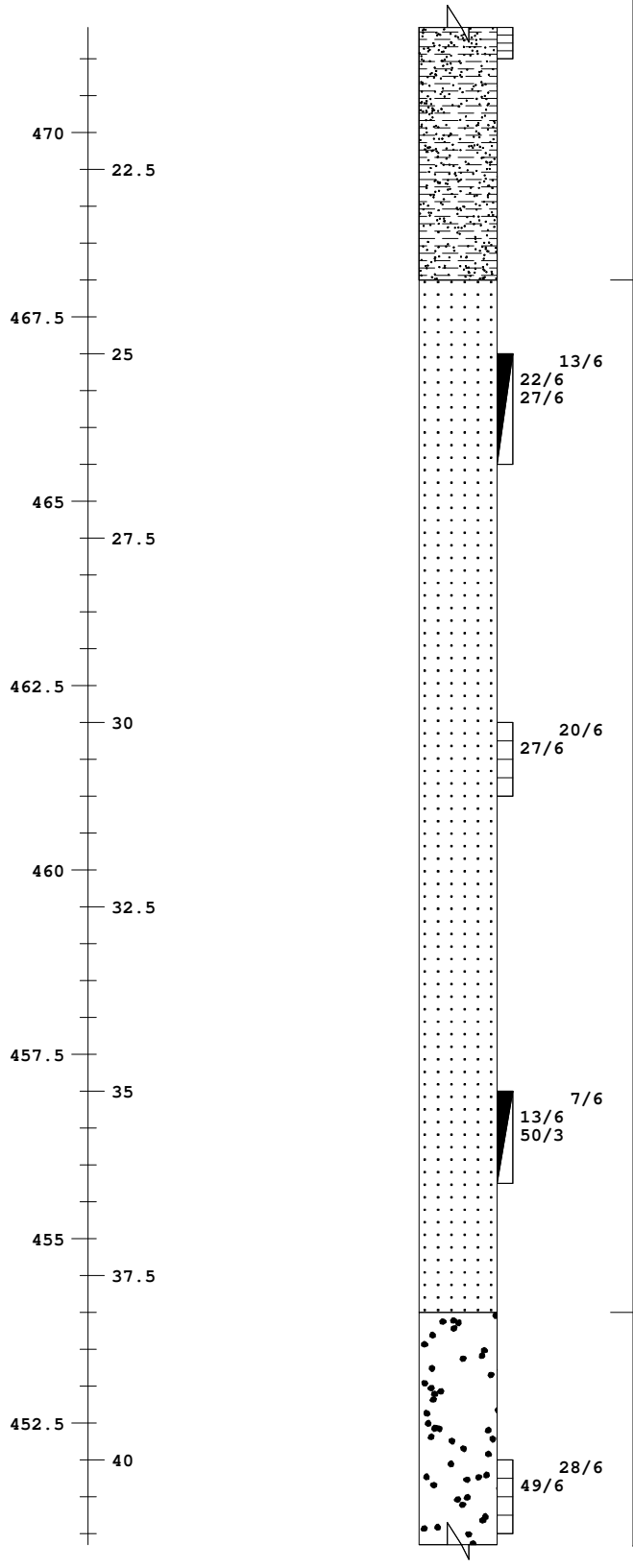
BORING NO.: B-2 **ELEVATION:** 492' **DRILLING DATE:** 12/10/2021

BORING COORDINATES: CL Bike Path, 486' E/o CL Forest Lawn Drive

DRILL RIG TYPE: CME-75HT using 8" hollow stem augers

DEPTH TO STANDING WATER: No Water **DEPTH TO WATER SEEPAGE:** No Seepage

DRILLER: P. Adams **LOGGER:** J. Kunesh **ENGINEER:** C. Law



ELEVATION / DEPTH (ft)	USCS	Field Description	Moist. %	Dens. Pcf
	SP	Light tan medium-fine sand with little amounts of small rounded gravel and traces of silt. Sand gradation increasing with depth. Moist and dense.	2.8	117
	GP	Brown poorly graded gravel with sand. Moisture increasing with depth. Moist and very dense.	1.7	119

LOG OF TEST BORING

LAB. NO.: 140- 6301 **PROJECT:** LA River Bike Path Phase IV

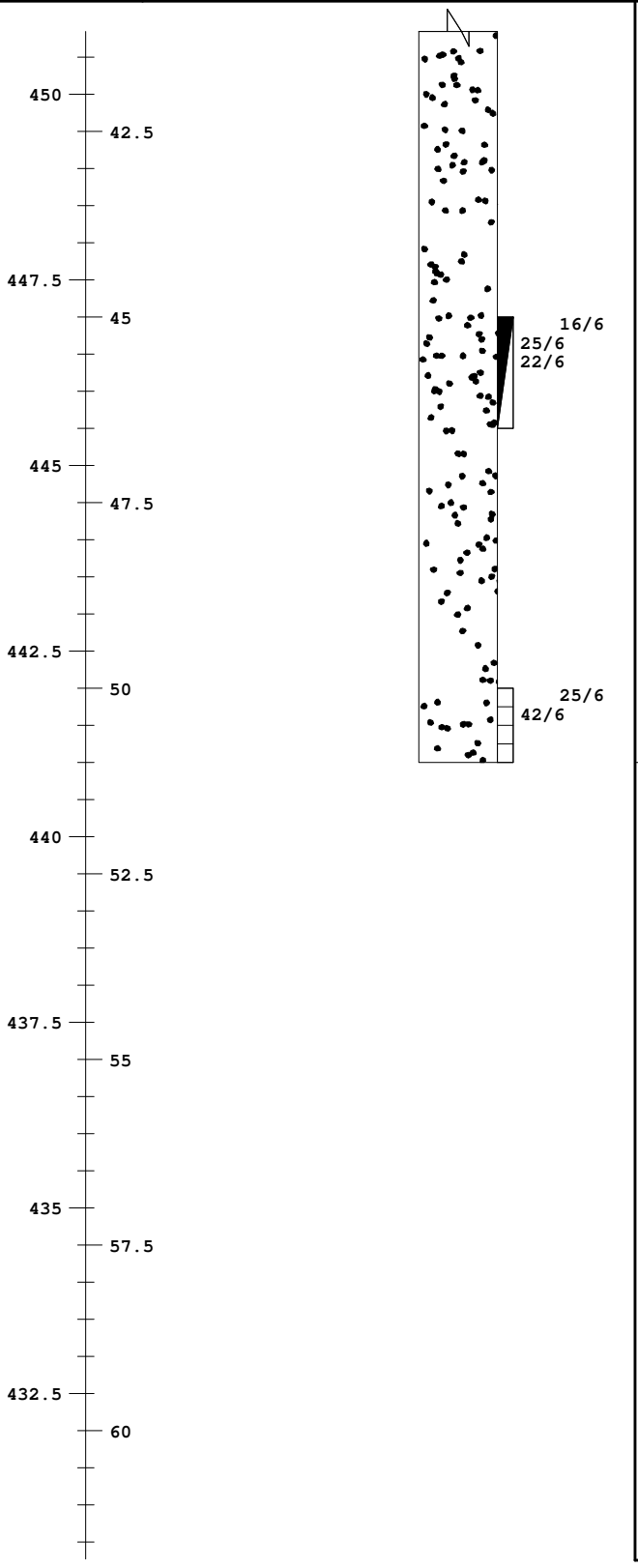
BORING NO.: B-2 **ELEVATION:** 492' **DRILLING DATE:** 12/10/2021

BORING COORDINATES: CL Bike Path, 486' E/o CL Forest Lawn Drive

DRILL RIG TYPE: CME-75HT using 8" hollow stem augers

DEPTH TO STANDING WATER: No Water **DEPTH TO WATER SEEPAGE:** No Seepage

DRILLER: P. Adams **LOGGER:** J. Kunesh **ENGINEER:** C. Law



ELEVATION / DEPTH (ft)	SOIL SYMBOLS, SAMPLER SYMBOLS AND BLOWS/INCHES	USCS	Field Description	Moist. %	Dens. Pcf
				1.7	111
			--- Test Boring Location Coordinates: 34° 09' 20.76" North 118° 18' 33.60" West ---		

LOG OF TEST BORING

LAB. NO.: 140- 6301 **PROJECT:** LA River Bike Path Phase IV

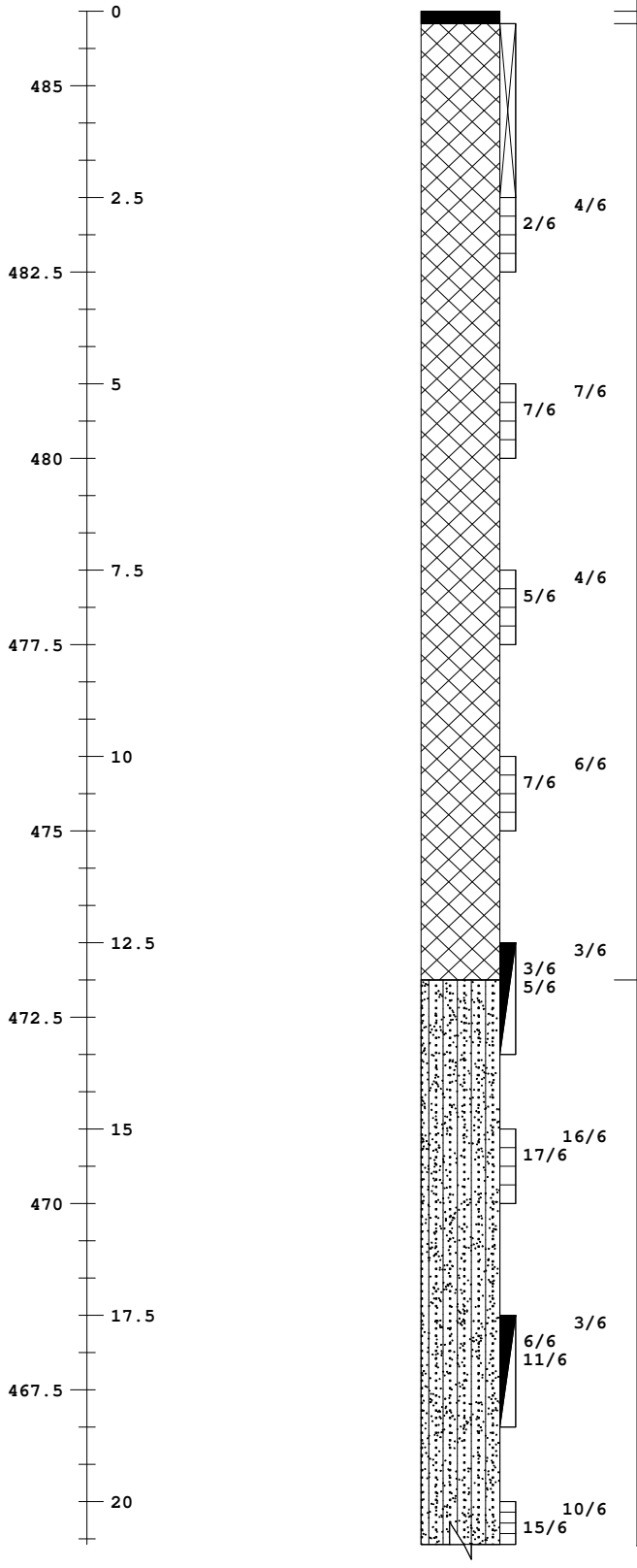
BORING NO.: B-3 **ELEVATION:** 486' **DRILLING DATE:** 12/02/2021

BORING COORDINATES: CL Bike Path, 923' E/o CL Forest Lawn Drive

DRILL RIG TYPE: CME-55HT using 8" hollow stem augers

DEPTH TO STANDING WATER: No Water **DEPTH TO WATER SEEPAGE:** No Seepage

DRILLER: P. Adams **LOGGER:** J. Kunesh **ENGINEER:** C. Law



ELEVATION / DEPTH (ft)	USCS	Field Description	Moist. %	Dens. Pcf
		2" asphalt pavement in poor condition.		
		FILL MATERIAL. Light brown silty fine sand with traces of small rounded gravel and plant roots. Dry and firm. Bulk soil sample was taken from 2"-2.5' depth.	1.8	97
		Glass fragments present at 6' depth.	1.7	106
		10' split spoon sample not retained due to dryness of soil.		
	SM	Light tan silty sand. 4" silt lense at 13'. Moist and dense.		
		Sand appears oxided at 15'.	3.2	112
		4" silt lense at 18' depth.		
		Sand texture is medium-fine at 20'.	2.2	105

LOG OF TEST BORING

LAB. NO.: 140- 6301 **PROJECT:** LA River Bike Path Phase IV

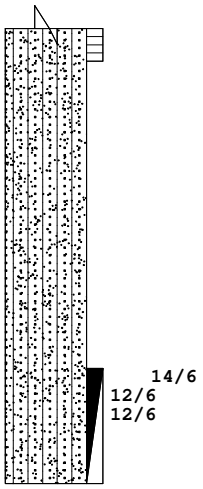
BORING NO.: B-3 **ELEVATION:** 486' **DRILLING DATE:** 12/02/2021

BORING COORDINATES: CL Bike Path, 923' E/o CL Forest Lawn Drive

DRILL RIG TYPE: CME-55HT using 8" hollow stem augers

DEPTH TO STANDING WATER: No Water **DEPTH TO WATER SEEPAGE:** No Seepage

DRILLER: P. Adams **LOGGER:** J. Kunesh **ENGINEER:** C. Law

ELEVATION / DEPTH (ft)	SOIL SYMBOLS, SAMPLER SYMBOLS AND BLOWS/INCHES	USCS	Field Description	Moist. %	Dens. Pcf
465 / 22.5 / 462.5 / 25 / 460					
27.5 / 457.5 / 30 / 455 / 32.5 / 452.5 / 35 / 450 / 37.5 / 447.5 / 40 / 445			--- Test Boring Location Coordinates: 34° 09' 21.81" North 118° 18' 28.60" West ---		

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	AC pavement.
	Fill
	Poorly graded sands or gravelly sands, little or no fines
	Well graded sands, gravely sands, little or no fines
	Granite
	Poorly graded sand with silt.
	Poorly graded gravels or gravel-sand mixtures, little or no fines

Symbol	Description
	Silty sands, sand-silt mixtures
Misc. Symbols	
	Boring continues
Soil Samplers	
	Bulk sample taken from Auger
	Split Spoon
	Standard penetration test

Notes:

1. Three exploratory borings drilled on 12/02/2021 and 12/10/2021 with CME-55HT and CME-75HT using 8" diameter hollow stem augers.

2. Free water was not encountered during the drilling of this project.

3. Boring locations were provided by Geotechnical Engineering Division and verified by Standards.

4. Abbreviations used on logs:

N/o =	north of	NCF =	north curb face	NE =	northeast
S/o =	south of	SCF =	south curb face	NW =	northwest
E/o =	east of	ECF =	east curb face	SE =	southeast
W/o =	west of	WCF =	west curb face	SW =	southwest
CL =	center line	PL =	property line		
AC =	asphalt concrete	PCC =	Portland cement concrete		
OVA =	organic vapor analyzer	LEL =	lower explosive limit		
PPM =	parts per million	HT =	high torque		

5. The stratification lines indicated on the boring maps and profiles represent the approximate boundary between material types and the transition may be gradual.

6. The materials, boundaries, and conditions have been established only at the boring locations, and are not necessarily representative of subsurface conditions elsewhere across the site.

UNIFIED SOIL CLASSIFICATION SYSTEM *

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No.200 sieve size)	GRAVELS (More than 50 % of coarse fraction is LARGER than the No.4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silt gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No.4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% 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 or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possesssing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

No.200 No.40 No.10 No.4 3/4 in. 3 in. 12 in.

U. S. STANDARD SIEVE SIZE

* Reference:
The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. I, March 1953. (Revised April, 1960)

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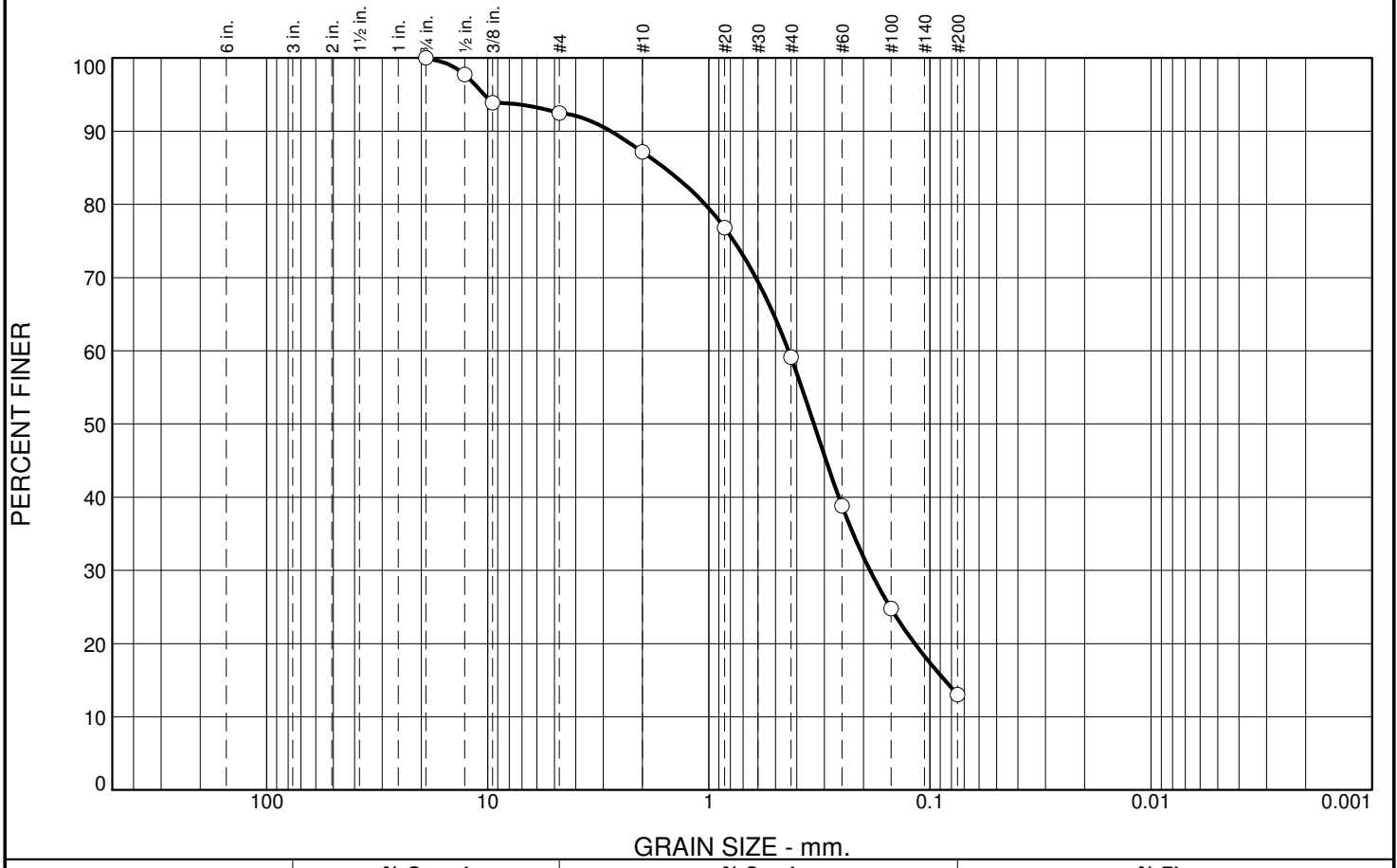
Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	8	5	28	46	13	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100		
1/2"	98		
3/8"	94		
#4	92		
#10	87		
#20	77		
#40	59		
#60	39		
#100	25		
#200	13		

* (no specification provided)

Soil Description

Silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 2.7836 D_{85}= 1.5911 D_{60}= 0.4359
D_{50}= 0.3347 D_{30}= 0.1869 D_{15}= 0.0857
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

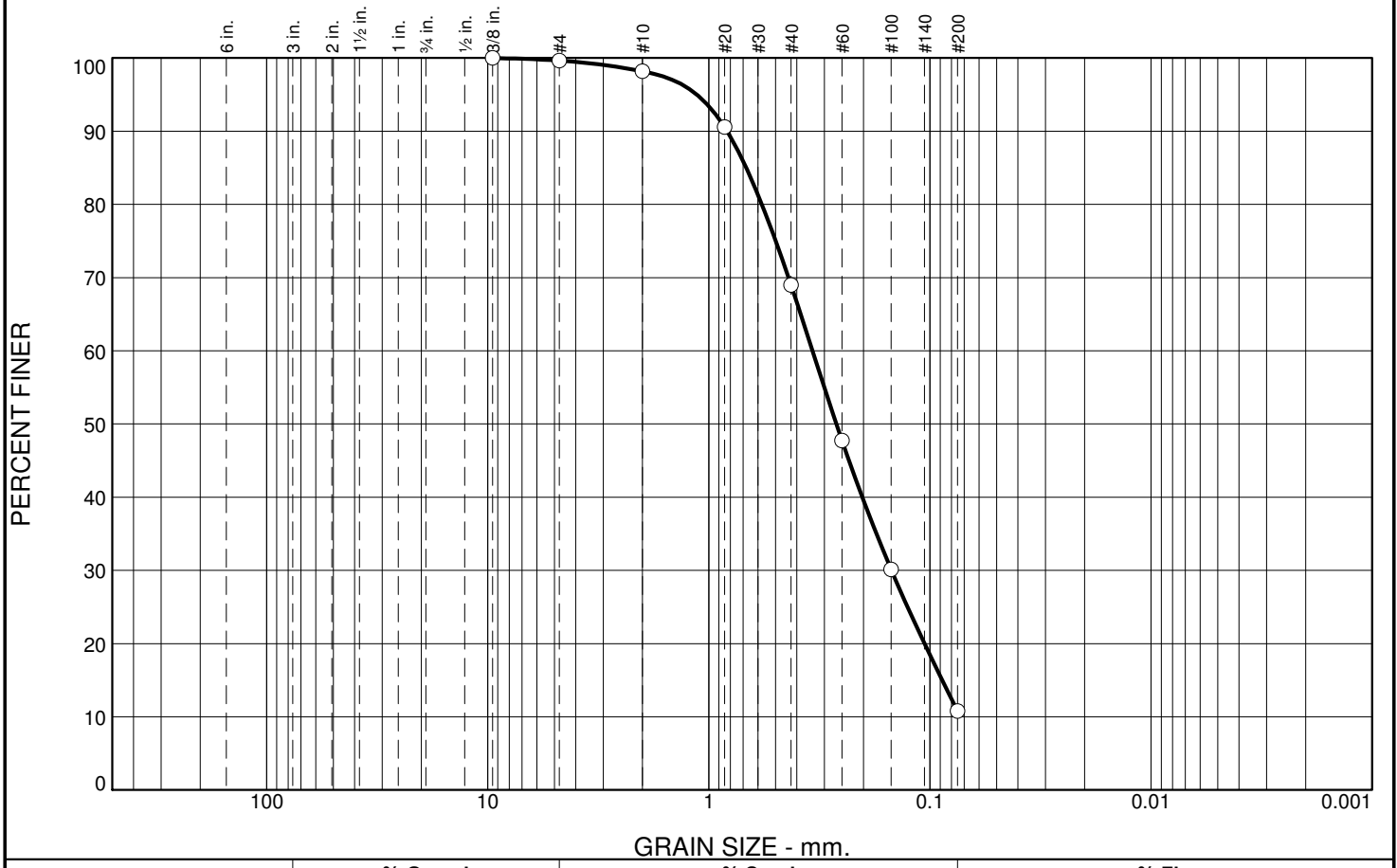
Sample Number: B-1 **Depth:** 10'

Date: 12/02/2021

CITY OF LOS ANGELES - STANDARDS DIVISION

Client: DPW - Geotechnical Engineering
Project: LA River Bike Path Phase IV
Project No: 140-6301 / E1908933 **Figure** B1@10

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	2	29	58	11	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100		
#4	100		
#10	98		
#20	91		
#40	69		
#60	48		
#100	30		
#200	11		

* (no specification provided)

Soil Description

Poorly graded sand with silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.8273 D_{85}= 0.6775 D_{60}= 0.3397
D_{50}= 0.2651 D_{30}= 0.1493 D_{15}= 0.0879
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-2-4(0)

Remarks

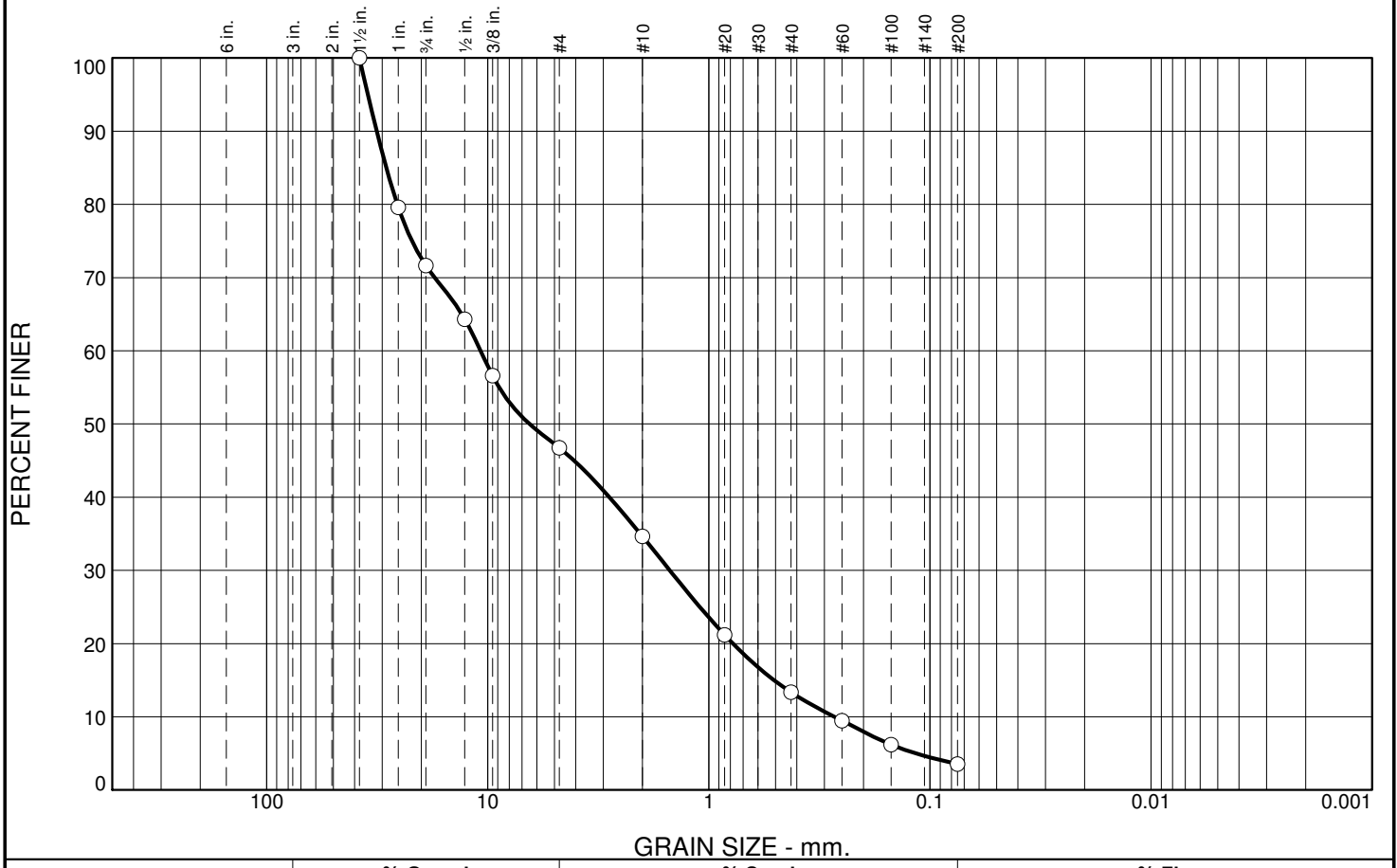
Sample Number: B-2 **Depth:** 15'

Date: 12/10/2021

CITY OF LOS ANGELES - STANDARDS DIVISION

Client: DPW - Geotechnical Engineering
Project: LA River Bike Path Phase IV
Project No: 140-6301 / E1908933 **Figure** B2@15

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	28	25	12	22	9	4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100		
1"	80		
3/4"	72		
1/2"	64		
3/8"	57		
#4	47		
#10	35		
#20	21		
#40	13		
#60	9		
#100	6		
#200	3.5		

* (no specification provided)

Soil Description

Poorly graded gravel with sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 31.7846 D_{85}= 28.7821 D_{60}= 10.8000
D_{50}= 6.4789 D_{30}= 1.5036 D_{15}= 0.5067
D_{10}= 0.2699 C_u= 40.02 C_c= 0.78

Classification

USCS= GP AASHTO= A-1-a

Remarks

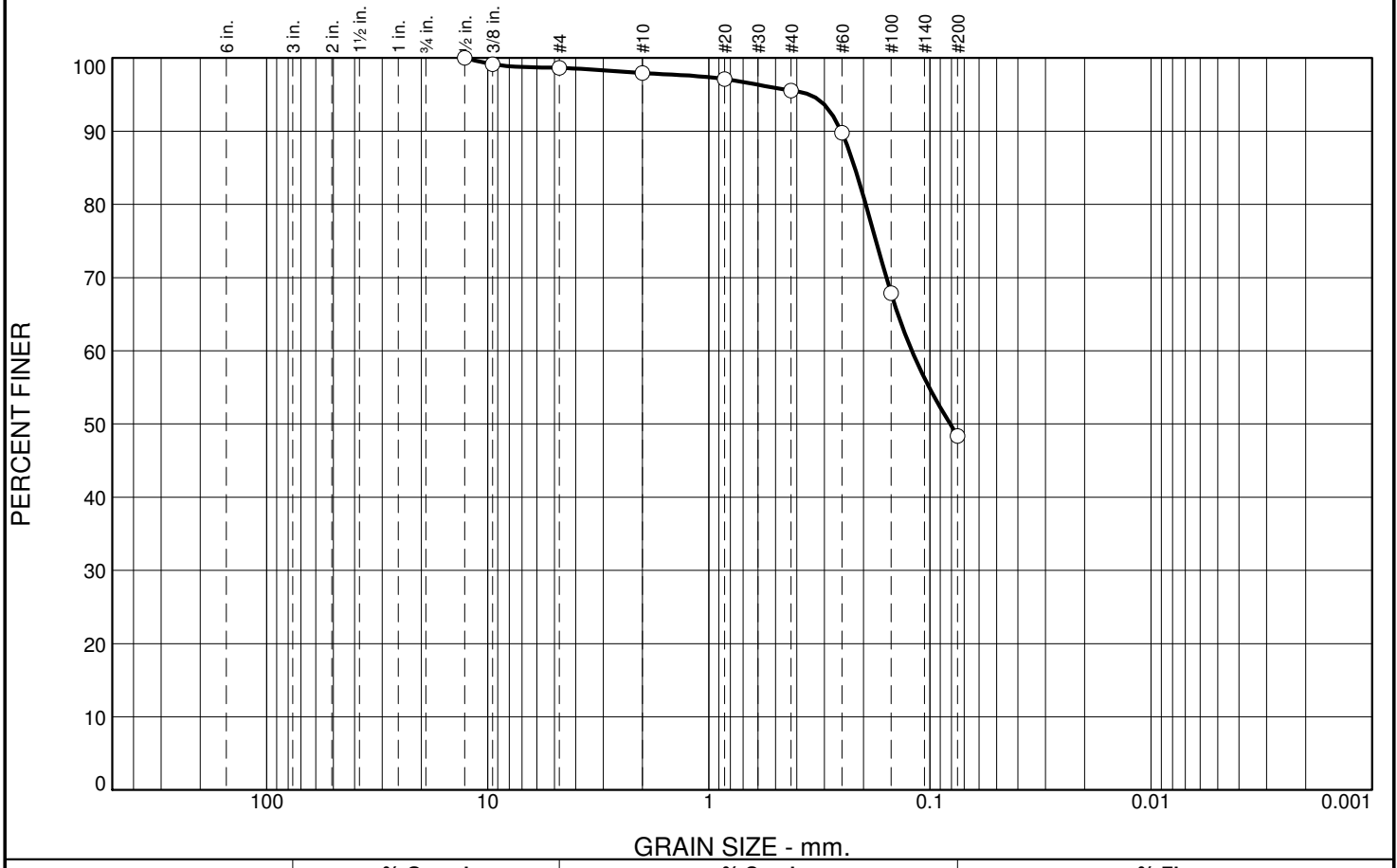
Sample Number: B-2 **Depth:** 40'

Date: 12/10/2021

CITY OF LOS ANGELES - STANDARDS DIVISION

Client: DPW - Geotechnical Engineering
Project: LA River Bike Path Phase IV
Project No: 140-6301 / E1908933 **Figure** B2@40

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	1	2	48	48	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100		
3/8"	99		
#4	99		
#10	98		
#20	97		
#40	96		
#60	90		
#100	68		
#200	48		

* (no specification provided)

Soil Description

Silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.2518 D_{85}= 0.2187 D_{60}= 0.1206
D_{50}= 0.0809 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

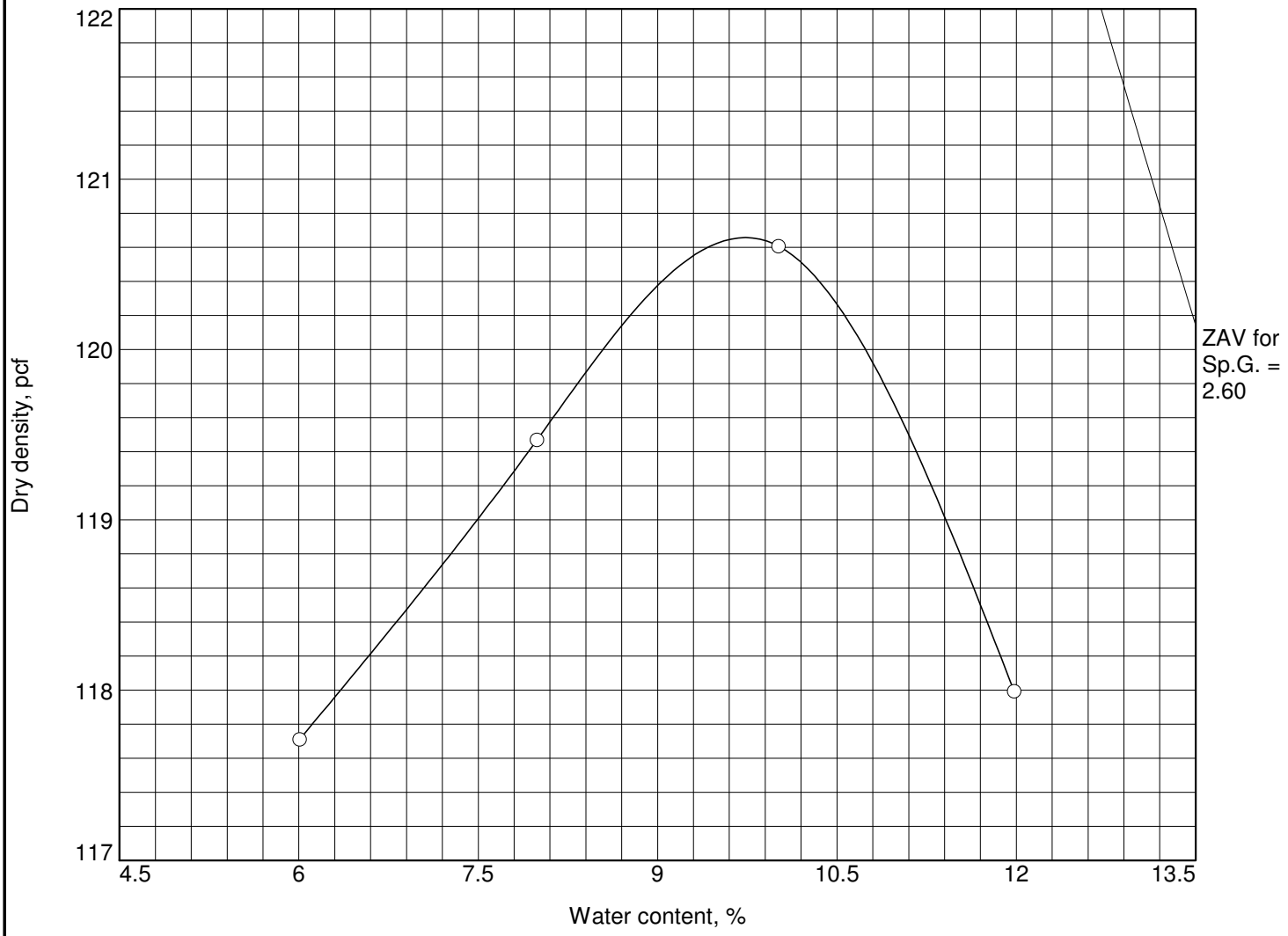
Sample Number: B-3 **Depth:** 15'

Date: 12/02/2021

CITY OF LOS ANGELES - STANDARDS DIVISION

Client: DPW - Geotechnical Engineering
Project: LA River Bike Path Phase IV
Project No: 140-6301 / E1908933 **Figure** B3@15

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified
ASTM D4718-15 Oversize Correction Applied to Final Results

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
0-2.5				2.6			7	

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 122.9 pcf	120.7 pcf	Silty fine sand with traces of rounded gravel
Optimum moisture = 9.2 %	9.7 %	

Project No. 140-6301 / **Client:** DPW - Geotechnical Engineering
Project: LA River Bike Path Phase IV

○ **Sample Number:** B-1

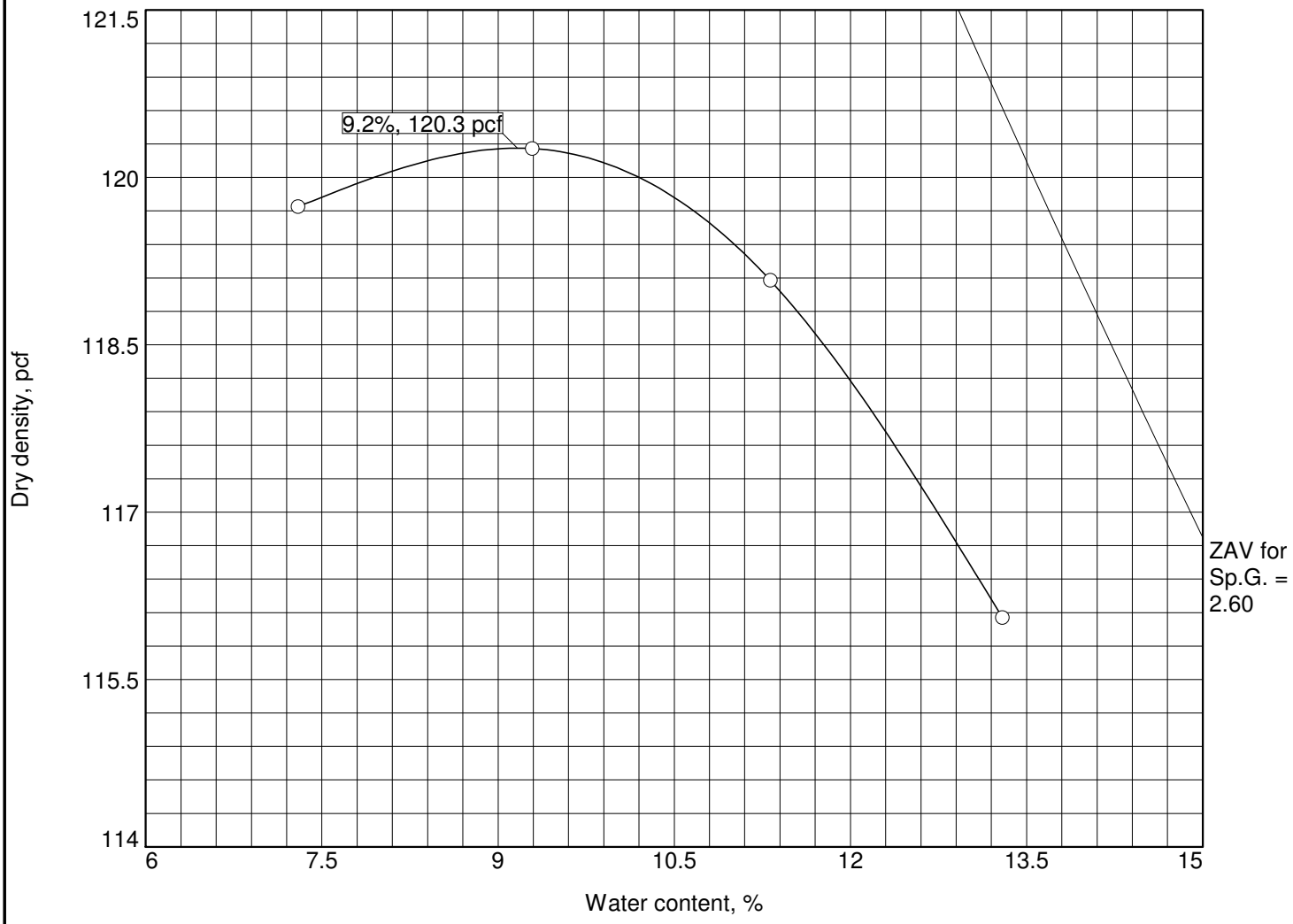
Remarks:
Date Tested: 12/17/21

CITY OF LOS ANGELES - STANDARDS DIVISION

Figure B1@0-2.5

Tested By: TN/TW **Checked By:** RL

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
0-2.5				2.6				

TEST RESULTS

Maximum dry density = 120.3 pcf

Optimum moisture = 9.2 %

MATERIAL DESCRIPTION

Light brown silty fine sand w/traces of rounded gravel and plate root

Project No. 140-6301 / **Client:** DPW - Geotechnical Engineering

Project: LA River Bike Path Phase IV

○ **Sample Number:** B-3

Remarks:

Date Tested: 12/20/21

CITY OF LOS ANGELES - STANDARDS DIVISION

Figure B3@0-2.5

Tested By: TW **Checked By:** RL

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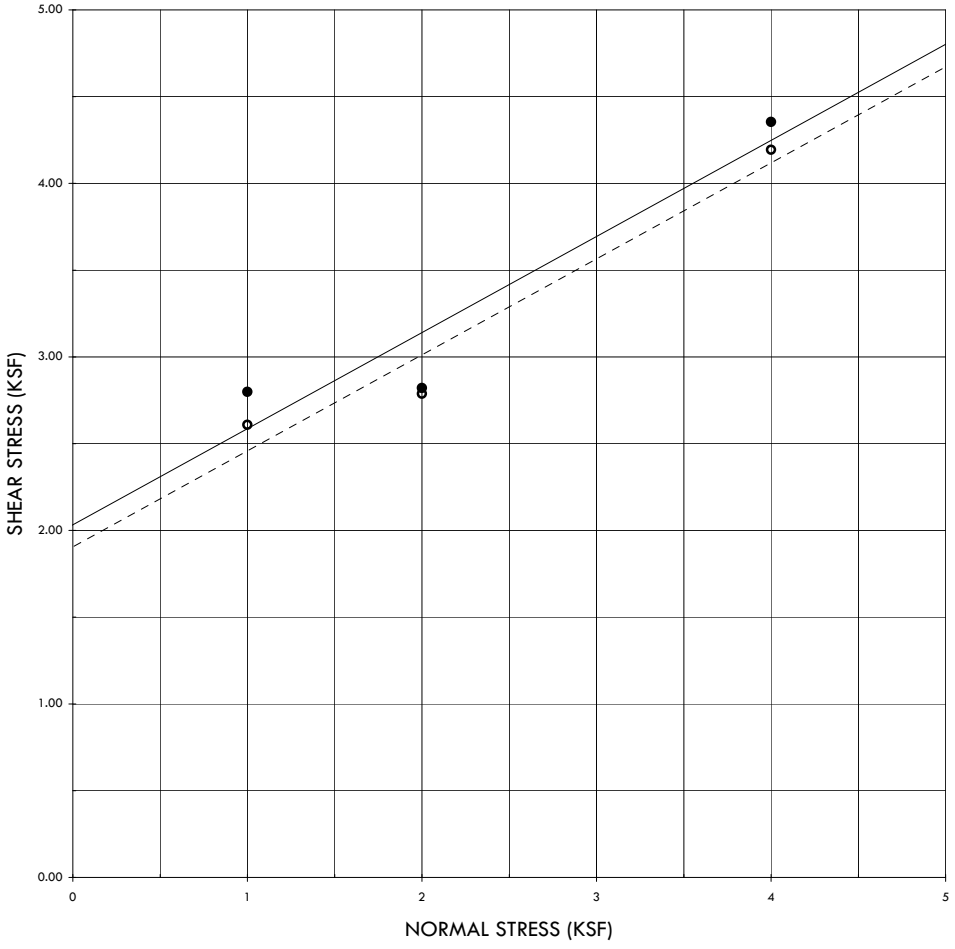
(213) 485-2242

DIRECT SHEAR TEST REPORT (ASTM D 3080)

Project No.:	140-6301
WO No.:	E1908933
Project Title:	LA River Bike Path - Phase IV
Boring No.:	B-1
Depth, feet:	20
Date Sampled:	12/2/2021
Diameter, in:	2.847
Soil Description:	Gravelly moderately graded sand
Disp. Rate, in/min:	0.01
Dry Density, PCF:	118.4
Initial Moisture, %:	2.7%
Final Moisture, %:	16.9%
Test By:	egj/ac
Remarks:	Inundated w/ H2O; Mach: 2

SHEAR TEST RESULTS

legend:	●——●	- - ○ - -
NORMAL STRESS, KSF	*PEAK SHEAR STRESS, KSF*	*FINAL SHEAR STRESS, KSF*
1	2.80	2.61
2	2.82	2.79
4	4.35	4.19
C =	**2.03 ksf**	**1.91 ksf**
TAN Φ =	**0.55**	**0.55**
Φ =	**29.0°**	**29.0°**



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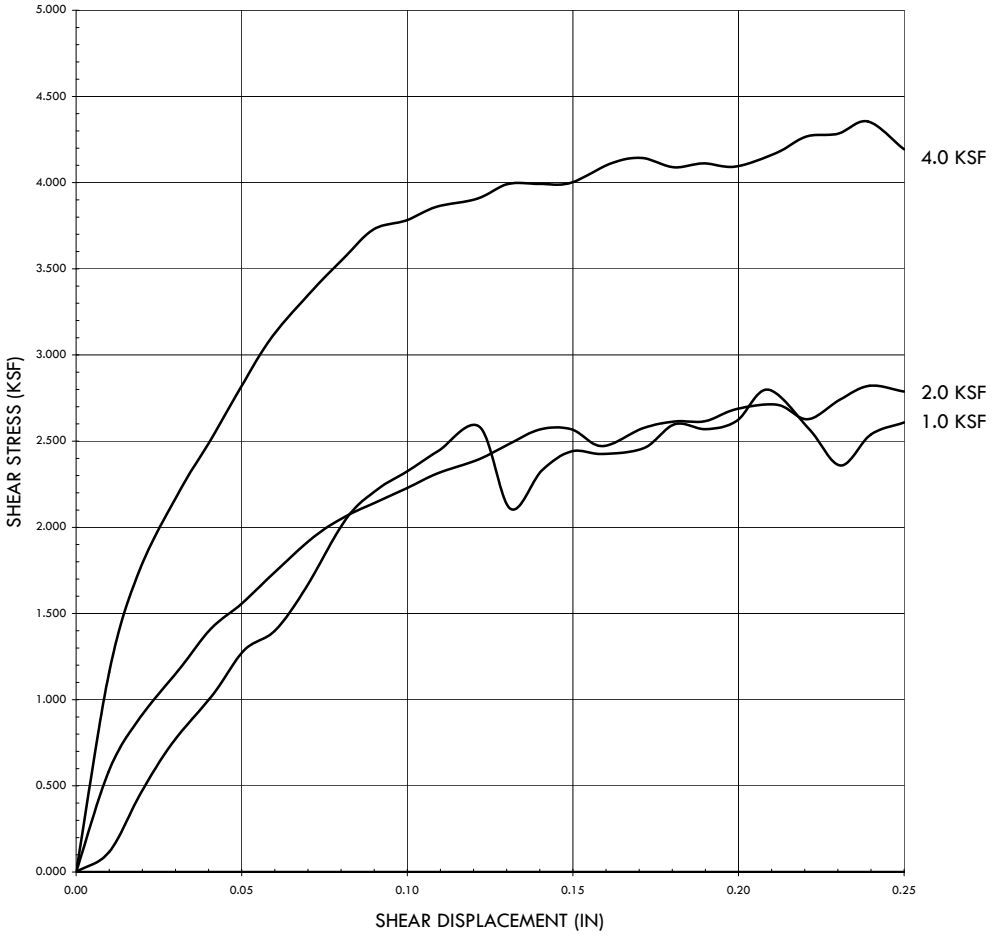
DIRECT SHEAR TEST REPORT (ASTM D 3080)

Project No.:	140-6301
WO No.:	E1908933
Project Title:	LA River Bike Path - Phase IV
Boring No.:	B-1
Depth, feet:	20
Date Sampled:	12/2/2021
Diameter, in:	2.847
Soil Description:	Gravelly moderately graded sand
Disp. Rate, in/min:	0.01
Dry Density, PCF:	118.4
Initial Moisture, %:	2.7%
Final Moisture, %:	16.9%
Test By:	egj/ac
Remarks:	Inundated w/ H2O; Mach: 2

SHEAR TEST RESULTS

NORMAL STRESS, KSF	*PEAK SHEAR STRESS, KSF*	*FINAL SHEAR STRESS, KSF*
1	2.80	2.61
2	2.82	2.79
4	4.35	4.19
C =	**2.03 ksf**	**1.91 ksf**
TAN Φ =	**0.55**	**0.55**
Φ =	**29.0°**	**29.0°**



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STANDARDS DIVISION, SOILS TESTING LAB
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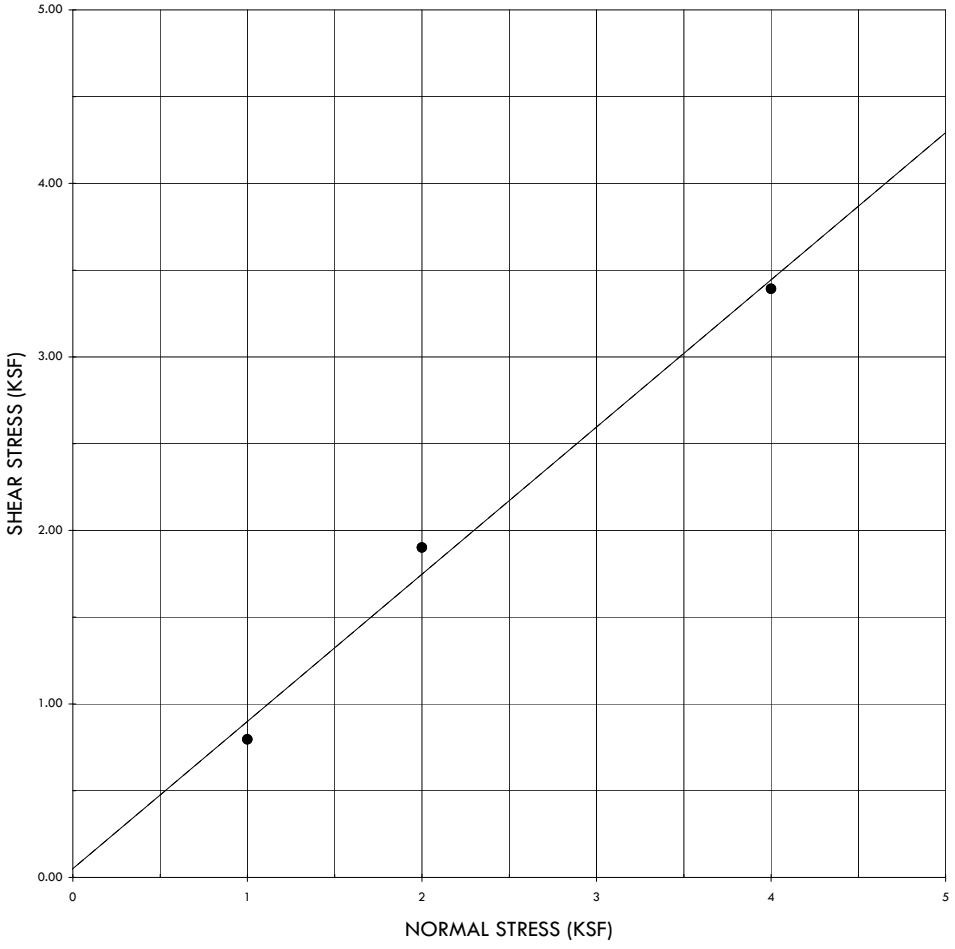
DIRECT SHEAR TEST REPORT (ASTM D 3080)

Project No.:	140-6301
WO No.:	E1908933
Project Title:	LA River Bike Path - Phase IV
Boring No.:	B-2
Depth, feet:	7.5
Date Sampled:	12/10/2021
Diameter, in:	2.847
Soil Description:	Light brown silty fine sand
Disp. Rate, in/min:	0.01
Dry Density, PCF:	89.3
Initial Moisture, %:	2.7%
Final Moisture, %:	29.3%
Test By:	egj
Remarks:	Inundated w/ H2O; Mach: 2

SHEAR TEST RESULTS

legend:	●——●	- - ⊖ - -
NORMAL STRESS, KSF	*PEAK SHEAR STRESS, KSF*	*FINAL SHEAR STRESS, KSF*
1	0.80	0.80
2	1.90	1.90
4	3.39	3.39
C =	**0.05 ksf**	**0.05 ksf**
TAN Φ =	**0.85**	**0.85**
Φ =	**40.3°**	**40.3°**



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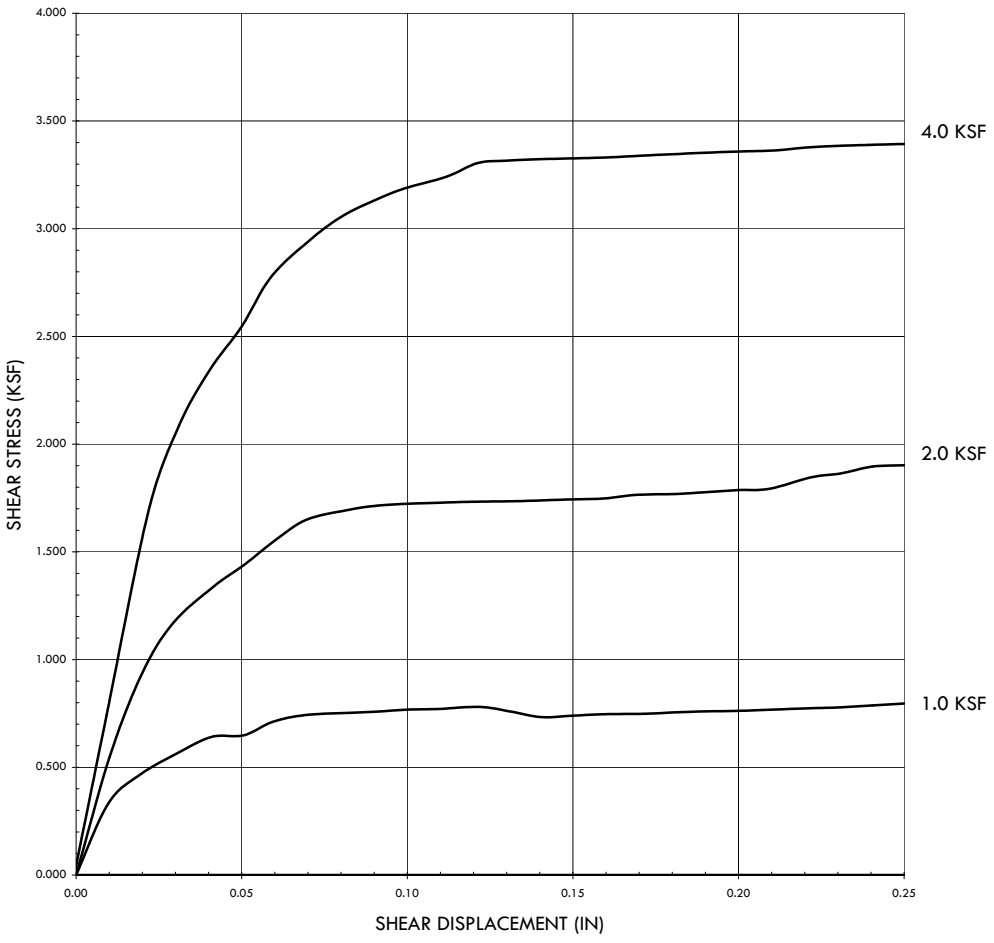
(213) 485-2242

DIRECT SHEAR TEST REPORT (ASTM D 3080)

Project No.:	140-6301
WO No.:	E1908933
Project Title:	LA River Bike Path - Phase IV
Boring No.:	B-2
Depth, feet:	7.5
Date Sampled:	12/10/2021
Diameter, in:	2.847
Soil Description:	Light brown silty fine sand
Disp. Rate, in/min:	0.01
Dry Density, PCF:	89.3
Initial Moisture, %:	2.7%
Final Moisture, %:	29.3%
Test By:	egj
Remarks:	Inundated w/ H2O; Mach: 2

SHEAR TEST RESULTS

NORMAL STRESS, KSF	*PEAK SHEAR STRESS, KSF*	*FINAL SHEAR STRESS, KSF*
1	0.80	0.80
2	1.90	1.90
4	3.39	3.39
C =	**0.05 ksf**	**0.05 ksf**
TAN Φ =	**0.85**	**0.85**
Φ =	**40.3°**	**40.3°**



CITY OF LOS ANGELES

DEPARTMENT OF GENERAL SERVICES

STANDARDS DIVISION, SOILS TESTING LAB

2319 DORRIS PLACE, LOS ANGELES, CA 90031

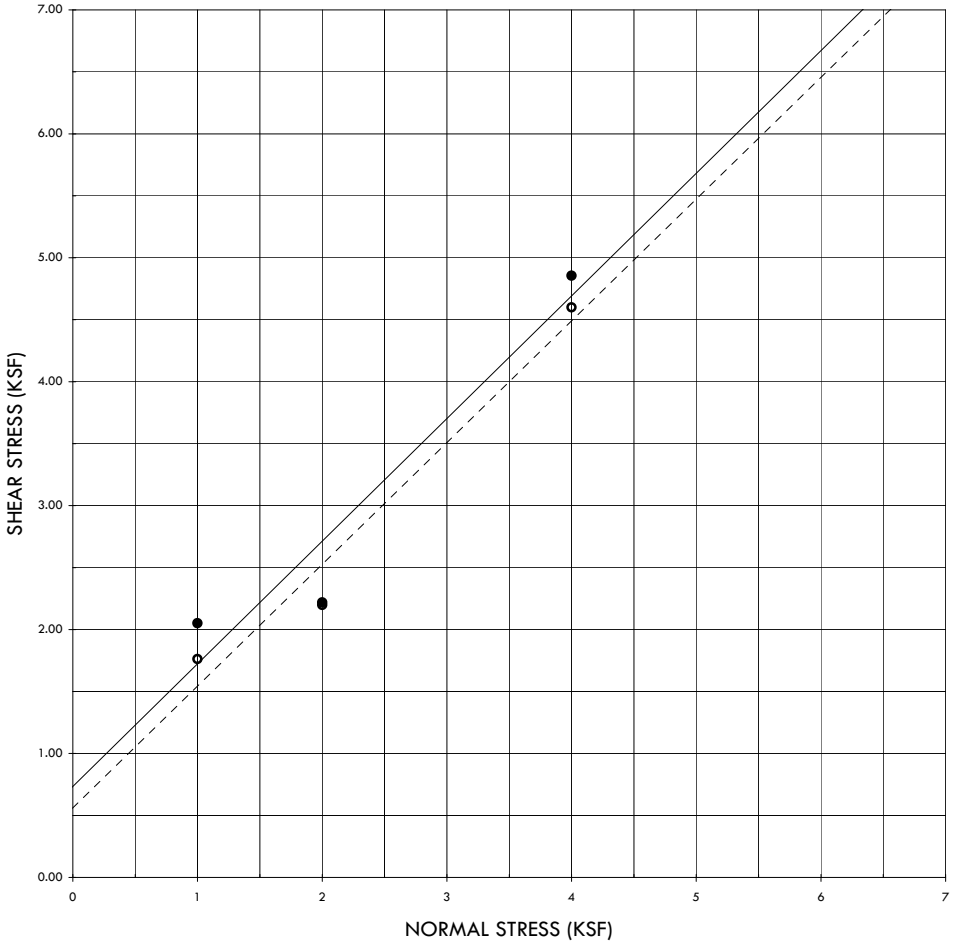
(213) 485-2242

DIRECT SHEAR TEST REPORT (ASTM D 3080)

Project No.:	140-6301
WO No.:	E1908933
Project Title:	LA River Bike Path - Phase IV
Boring No.:	B-2
Depth, feet:	40
Date Sampled:	12/10/2021
Diameter, in:	2.847
Soil Description:	Brown poorly graded gravel with sand
Disp. Rate, in/min:	0.01
Dry Density, PCF:	118.2
Initial Moisture, %:	2.6%
Final Moisture, %:	17.1%
Test By:	ac/egj
Remarks:	Inundated w/ H2O; Mach: 2

SHEAR TEST RESULTS

legend:	●—●	- - ⊖ - -
NORMAL STRESS, KSF	*PEAK SHEAR STRESS, KSF*	*FINAL SHEAR STRESS, KSF*
1	2.05	1.76
2	2.22	2.20
4	4.86	4.60
C =	**0.73 ksf**	**0.56 ksf**
TAN Φ =	**0.99**	**0.98**
Φ =	**44.7°**	**44.5°**



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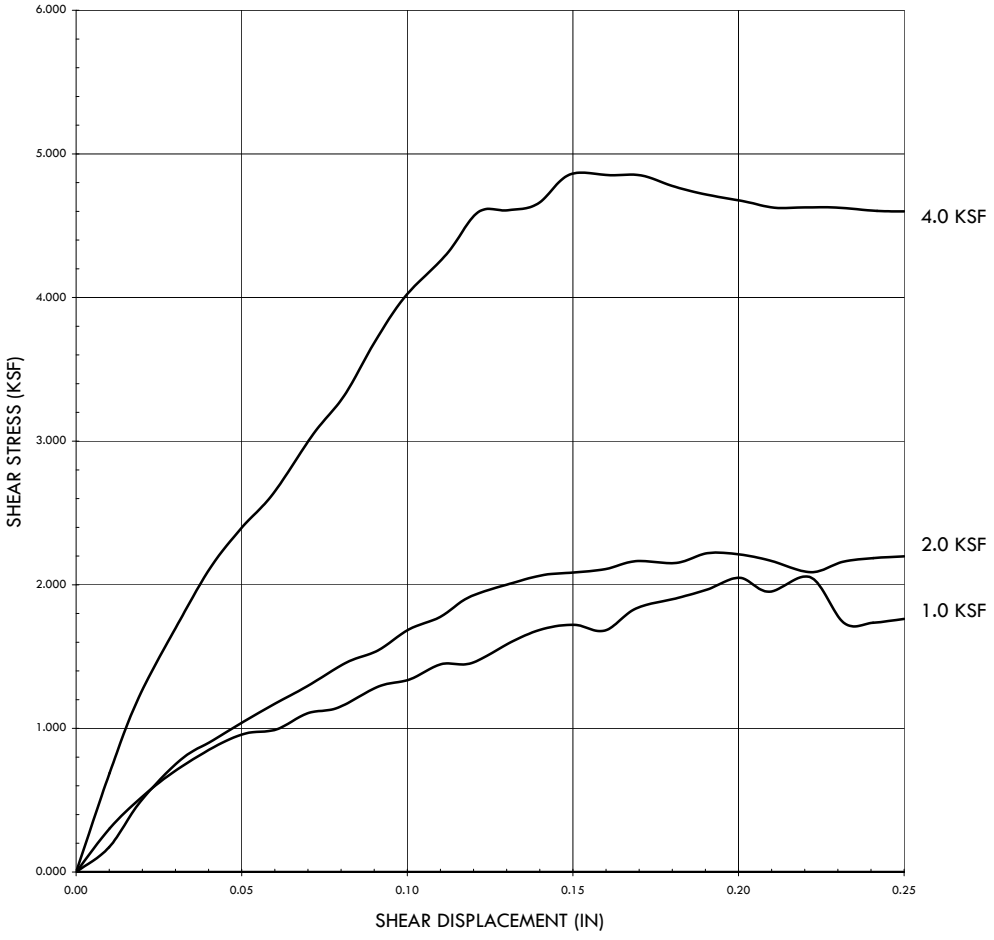
2319 DORRIS PLACE, LOS ANGELES, CA 90031
(213) 485-2242

DIRECT SHEAR TEST REPORT (ASTM D 3080)

Project No.:	140-6301
WO No.:	E1908933
Project Title:	LA River Bike Path - Phase IV
Boring No.:	B-2
Depth, feet:	40
Date Sampled:	12/10/2021
Diameter, in:	2.847
Soil Description:	Brown poorly graded gravel with sand
Disp. Rate, in/min:	0.01
Dry Density, PCF:	118.2
Initial Moisture, %:	2.6%
Final Moisture, %:	17.1%
Test By:	ac/egj
Remarks:	Inundated w/ H2O; Mach: 2

SHEAR TEST RESULTS

NORMAL STRESS, KSF	*PEAK SHEAR STRESS, KSF*	*FINAL SHEAR STRESS, KSF*
1	2.05	1.76
2	2.22	2.20
4	4.86	4.60
C =	**0.73 ksf**	**0.56 ksf**
TAN Φ =	**0.99**	**0.98**
Φ =	**44.7°**	**44.5°**



CITY OF LOS ANGELES

DEPARTMENT OF GENERAL SERVICES

STANDARDS DIVISION, SOILS TESTING LAB

2319 DORRIS PLACE, LOS ANGELES, CA 90031

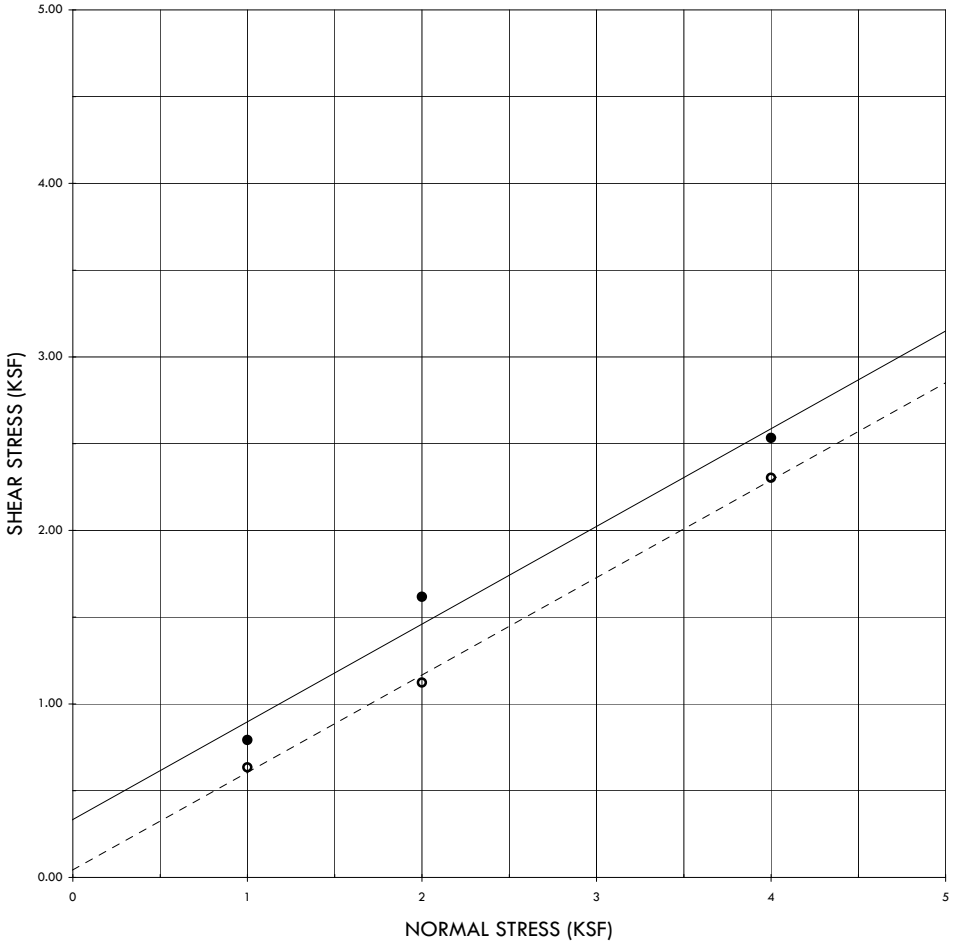
(213) 485-2242

DIRECT SHEAR TEST REPORT (ASTM D 3080)

Project No.:	140-6301
WO No.:	E1908933
Project Title:	LA River Bike Path - Phase IV
Boring No.:	B-3
Depth, feet:	15
Date Sampled:	12/2/2021
Diameter, in:	2.847
Soil Description:	Light tan silty sand
Disp. Rate, in/min:	0.01
Dry Density, PCF:	109.7
Initial Moisture, %:	5.1%
Final Moisture, %:	30.7%
Test By:	egj
Remarks:	Inundated w/ H2O; Mach: 2

SHEAR TEST RESULTS

legend:	●——●	- - ○ - -
NORMAL STRESS, KSF	*PEAK SHEAR STRESS, KSF*	*FINAL SHEAR STRESS, KSF*
1	0.79	0.63
2	1.62	1.12
4	2.53	2.30
C =	**0.33 ksf**	**0.04 ksf**
TAN Φ =	**0.56**	**0.56**
Φ =	**29.4°**	**29.3°**



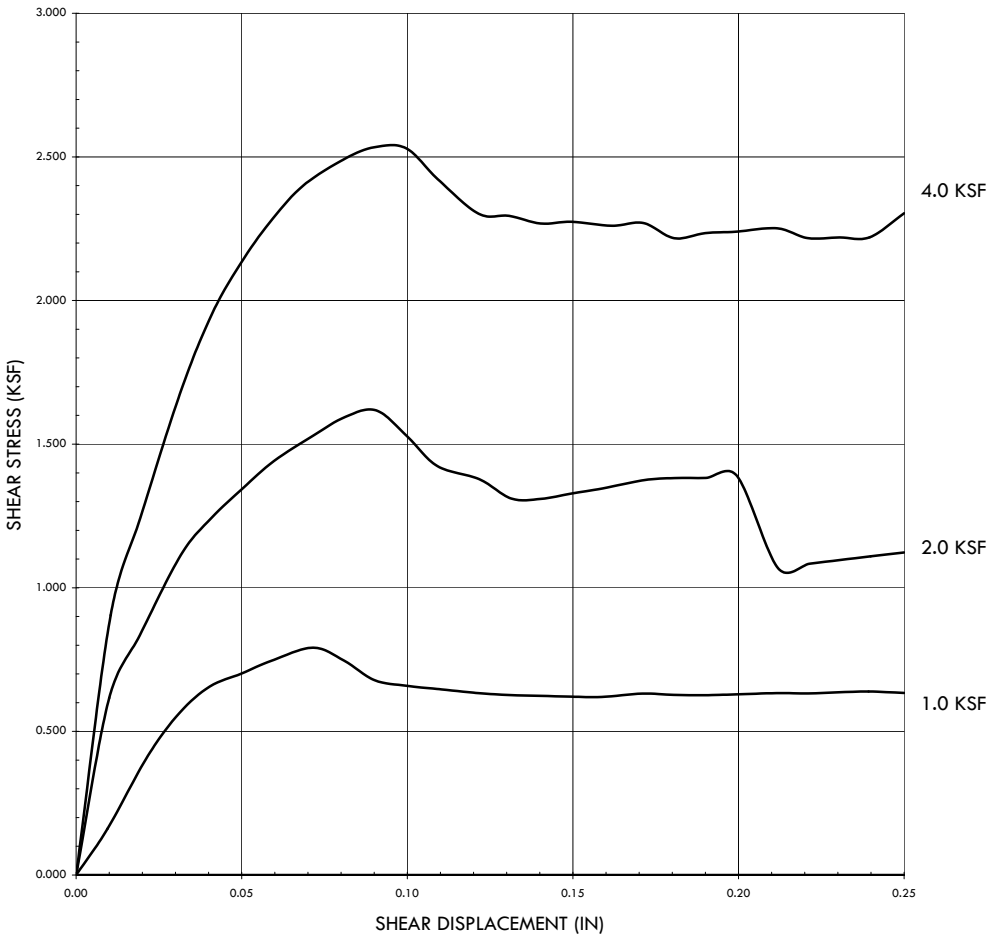
CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION, SOILS TESTING LAB
2319 DORRIS PLACE, LOS ANGELES, CA 90031
(213) 485-2242

DIRECT SHEAR TEST REPORT (ASTM D 3080)

Project No.:	140-6301
WO No.:	E1908933
Project Title:	LA River Bike Path - Phase IV
Boring No.:	B-3
Depth, feet:	15
Date Sampled:	12/2/2021
Diameter, in:	2.847
Soil Description:	Light tan silty sand
Disp. Rate, in/min:	0.01
Dry Density, PCF:	109.7
Initial Moisture, %:	5.1%
Final Moisture, %:	30.7%
Test By:	egj
Remarks:	Inundated w/ H2O; Mach: 2

SHEAR TEST RESULTS

NORMAL STRESS, KSF	*PEAK SHEAR STRESS, KSF*	*FINAL SHEAR STRESS, KSF*
1	0.79	0.63
2	1.62	1.12
4	2.53	2.30
C =	**0.33 ksf**	**0.04 ksf**
TAN Φ =	**0.56**	**0.56**
Φ =	**29.4°**	**29.3°**

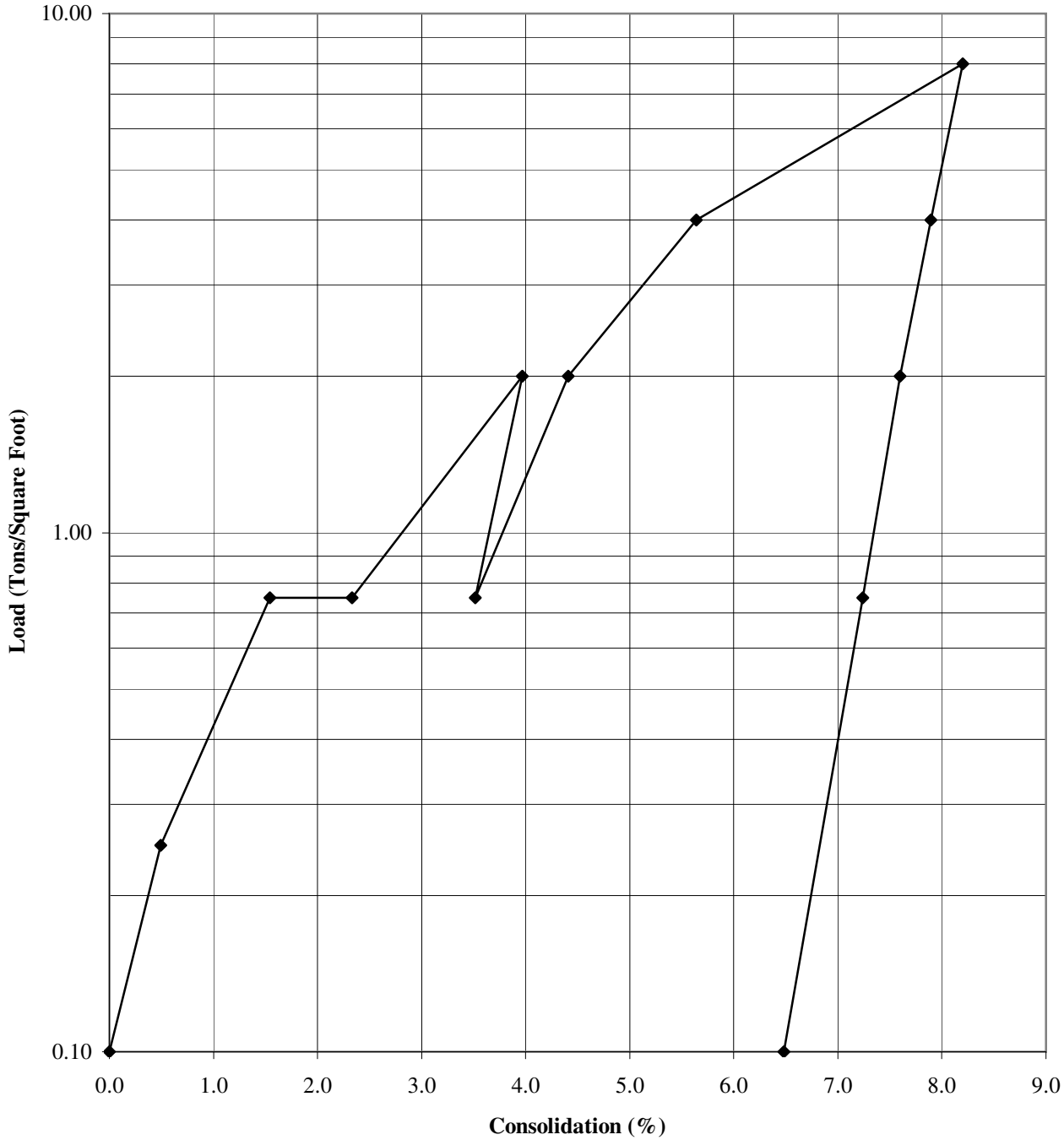


City of Los Angeles
Department of General Services
Standards Divison

CONSOLIDATION DIAGRAM

Job Title: LA River Bike Path - Phase IV W.O. NO.: E1908933

BORING No.	DEPTH (Feet)	LOAD WATER ADDED (Tons per Square Foot)	IN-PLACE DRY DENSITY (Pounds per Cubic Foot)	MOISTURE	
				START	END
B-2	15	0.75	100.8	0.1%	24.4%



6301.b2@15.con,CHART

CITY OF LOS ANGELES
DEPARTMENT OF GENERAL SERVICES
STANDARDS DIVISION
2319 DORRIS PLACE
LOS ANGELES
(213) 485-2242

Project No.: 140-6301

TEST BORING DATA

Project Title: LA River Bike Path Phase IV

WO No: E1908933

Test Boring No.	B-1									
Sample Depth, ft.	0-2.5	2.5	7.5	10	15	20				
In Place Dry Density, pcf		108.7	103.1		102.3	119.3				
Field Moisture, %		2.2	2.1		4.2	1.9				
Lab Max Dry Density, pcf	122.9									
Lab Optimum Moisture, %	9.2									
Expansion Index										
R-Value										
Mechanical Analysis (% passing)										
3/4"				100						
No. 4				92						
No. 10				87						
No. 20				77						
No. 40				59						
No. 60				39						
No. 100				25						
No. 200				13						
5 μ (micron), %										
Liquid Limit, %				NV						
Plasticity Index, %				NP						

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TEST BORING DATA

Project Title: LA River Bike Path Phase IV

WO No: E1908933

Test Boring No.	B-2									
Sample Depth, ft.	5	7.5	15	20	30	40	50			
In Place Dry Density, pcf	96.4	90.2	99.3	90.7	117.4	119.3	111.3			
Field Moisture, %	3.2	1.7	1.3	4.2	2.8	1.7	1.7			
Lab Max Dry Density, pcf										
Lab Optimum Moisture, %										
Expansion Index										
R-Value										
Mechanical Analysis (% passing)										
3/4"			100			72				
No. 4			100			47				
No. 10			98			35				
No. 20			91			21				
No. 40			69			13				
No. 60			48			9				
No. 100			30			6				
No. 200			11			3.5				
5 μ (micron), %										
Liquid Limit, %			NV							
Plasticity Index, %			NP							

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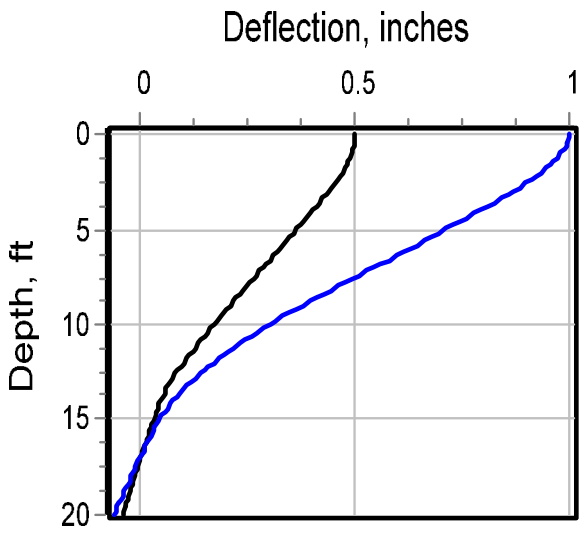
TEST BORING DATA

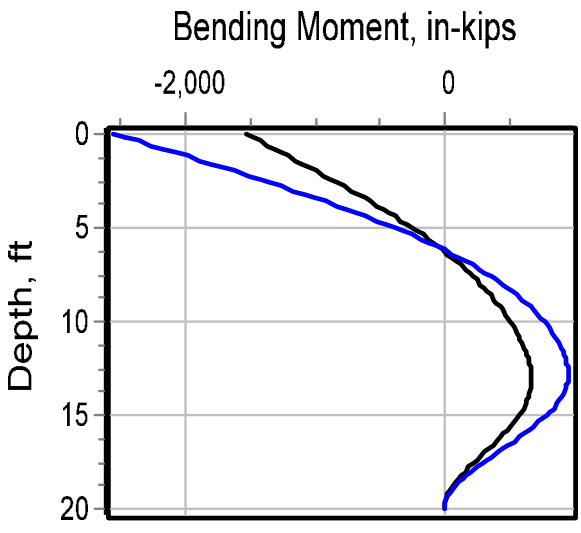
Project Title: LA River Bike Path Phase IV

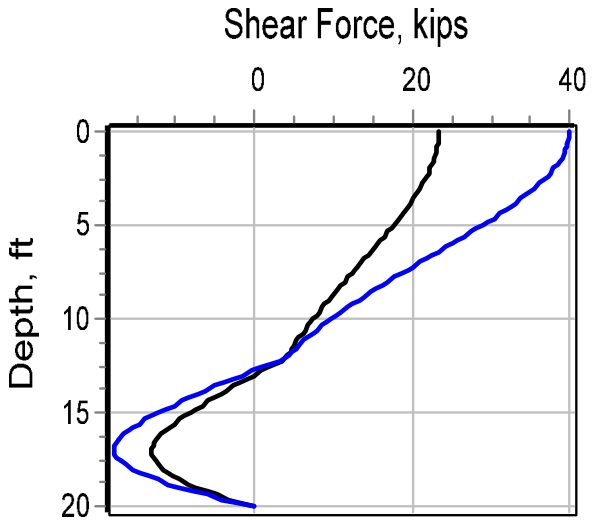
WO No: E1908933

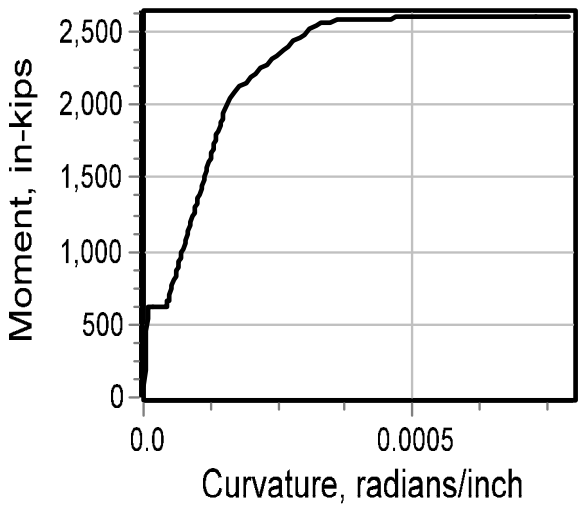
Test Boring No.	B-3									
Sample Depth, ft.	0-2.5	2.5	7.5	15	20					
In Place Dry Density, pcf		97.2	105.5	111.8	104.7					
Field Moisture, %		1.8	1.7	3.2	2.2					
Lab Max Dry Density, pcf	120.3									
Lab Optimum Moisture, %	9.2									
Expansion Index										
R-Value										
Mechanical Analysis (% passing)										
3/4"				100						
No. 4				99						
No. 10				98						
No. 20				97						
No. 40				96						
No. 60				90						
No. 100				68						
No. 200				48						
5 μ (micron), %										
Liquid Limit, %				NV						
Plasticity Index, %				NP						

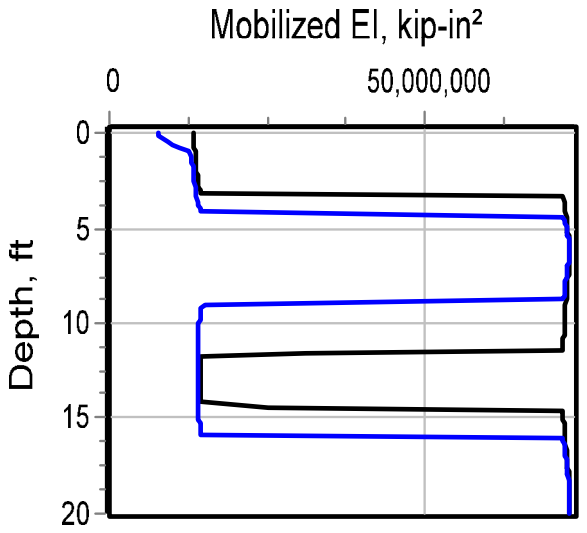
APPENDIX B

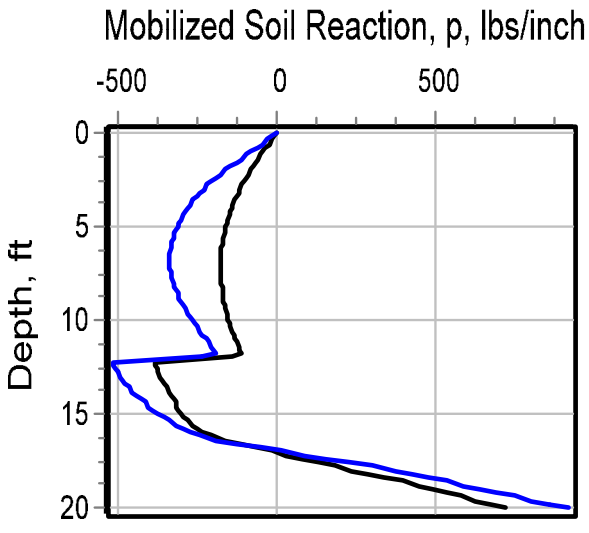

Deflection, inches
0
0.5
1
Depth, ft
0
5
10
15
20


Bending Moment, in-kips
-2,000
0
Depth, ft
0
5
10
15
20


Shear Force, kips
0
20
40
Depth, ft
0
5
10
15
20


Moment, in-kips
2,500
2,000
1,500
1,000
500
0
0.0
0.0005
Curvature, radians/inch


Mobilized EI, kip-in²
0
50,000,000
Depth, ft
0
5
10
15
20


Mobilized Soil Reaction, p, lbs/inch
-500
0
500
Depth, ft
0
5
10
15
20

LPile for Windows, Version 2019-11.002

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

This copy of LPile is being used by:

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Files Used for Analysis

Path to file locations:
\PROJECTS\2021\21-122 LA River Phase IV\Geotech Report\

Name of input data file:
24-inch diameter CIDH piles.lp11

Name of output report file:
24-inch diameter CIDH piles.lp11

Name of plot output file:
24-inch diameter CIDH piles.lp11

Name of runtime message file:
24-inch diameter CIDH piles.lp11

Date and Time of Analysis

Date: March 3, 2022 Time: 10:49:58

Problem Title

Project: LA River Bike Path- Phase IV

Job Number: 21-122

Client: LADOT

Engineer: SN, CL

Description: 24-inch Cast-In-Drilled Hole Piles

Program Options and Settings

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 20.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	24.0000
2	20.000	24.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

   Section 1 is a round drilled shaft, bored pile, or CIDH pile
   Length of section = 20.000000 ft
   Shaft Diameter = 24.000000 in
   Shear capacity of section = 0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees
= 0.000 radians

Pile Batter Angle = 0.000 degrees
= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

```
   Distance from top of pile to top of layer           =       0.0000 ft
   Distance from top of pile to bottom of layer        =    12.000000 ft
   Effective unit weight at top of layer               =   100.000000 pcf
   Effective unit weight at bottom of layer            =   100.000000 pcf
   Friction angle at top of layer                      =    20.000000 deg.
   Friction angle at bottom of layer                   =    20.000000 deg.
   Subgrade k at top of layer                          =       0.0000 pci
   Subgrade k at bottom of layer                       =       0.0000 pci

   NOTE: Default values for subgrade k will be computed for this layer.

Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =    12.000000 ft
   Distance from top of pile to bottom of layer        =    50.000000 ft
   Effective unit weight at top of layer               =   110.000000 pcf
   Effective unit weight at bottom of layer            =   110.000000 pcf
   Friction angle at top of layer                      =    32.000000 deg.
   Friction angle at bottom of layer                   =    32.000000 deg.
   Subgrade k at top of layer                          =       0.0000 pci
   Subgrade k at bottom of layer                       =       0.0000 pci

   NOTE: Default values for subgrade k will be computed for this layer.

 (Depth of the lowest soil layer extends 30.000 ft below the pile tip)



--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer      Effective    Angle of
Layer           Name             Depth       Unit Wt.    Friction        kpy
 Num.     (p-y Curve Type)        ft           pcf         deg.          pci
-----   ------------------   ----------   ----------   ----------   ----------
  1           Sand                0.00     100.0000      20.0000     default
         (Reese, et al.)       12.0000     100.0000      20.0000     default
  2           Sand               12.0000     110.0000      32.0000     default
         (Reese, et al.)       50.0000     110.0000      32.0000     default


--------------------------------------------------------------------------------
                    p-y Modification Factors for Group Action
--------------------------------------------------------------------------------

Distribution of p-y modifiers with depth defined using 4 points

Point      Depth X         p-mult         y-mult
 No.          ft
-----     ----------     ----------     ----------
  1           0.000         1.0000         1.0000
  2          12.000         1.0000         1.0000
  3          12.010         1.0000         1.0000
  4          50.000         1.0000         1.0000



--------------------------------------------------------------------------------
                              Static Loading Type
--------------------------------------------------------------------------------

Static loading criteria were used when computing p-y curves for all analyses.



--------------------------------------------------------------------------------
               Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 2

Load    Load         Condition              Condition           Axial Thrust      Compute Top y     Run Analysis
 No.    Type            1                      2                 Force, lbs      vs. Pile Length
-----   ----   --------------------   ----------------------   ----------------   ---------------    ------------
   1     5     y =     0.500000 in    S =       0.0000 in/in          12000.          N.A.               Yes
   2     5     y =     1.000000 in    S =       0.0000 in/in          12000.          N.A.               Yes

V = shear force applied normal to pile axis
```

M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	20.000000 ft
Shaft Diameter	=	24.000000 in
Concrete Cover Thickness (to edge of long. rebar)	=	3.000000 in
Number of Reinforcing Bars	=	6 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	452.389342 sq. in.
Total Area of Reinforcing Steel	=	4.740000 sq. in.
Area Ratio of Steel Reinforcement	=	1.05 percent
Edge-to-Edge Bar Spacing	=	7.500000 in
Maximum Concrete Aggregate Size	=	0.750000 in
Ratio of Bar Spacing to Aggregate Size	=	10.00
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As	=	1806.408 kips
Tensile Load for Cracking of Concrete	=	-202.040 kips
Nominal Axial Tensile Capacity	=	-284.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.000000	0.790000	8.500000	0.00000
2	1.000000	0.790000	4.250000	7.361216
3	1.000000	0.790000	-4.250000	7.361216
4	1.000000	0.790000	-8.500000	0.00000
5	1.000000	0.790000	-4.250000	-7.361216
6	1.000000	0.790000	4.250000	-7.361216

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 7.500 inches
between bars 4 and 5.

Ratio of bar spacing to maximum aggregate size = 10.00

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi
Compression Strain at Peak Stress	=	0.001886
Tensile Strain at Fracture of Concrete	=	-0.0001154
Maximum Coarse Aggregate Size	=	0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force

	kips
1	12.000

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 12.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	91.3419526	73073562.	16.7312033	0.00002091	-0.00000909	0.0875790	0.4542561	
0.00000250	182.3061247	72922450.	14.3728522	0.00003593	-0.00002407	0.1496946	0.7375318	
0.00000375	272.8104741	72749460.	13.5868935	0.00005095	-0.00003905	0.2113157	1.0208247	
0.00000500	362.8532367	72570647.	13.1939623	0.00006597	-0.00005403	0.2724406	1.3041246	
0.00000625	452.4341909	72389471.	12.9582308	0.00008099	-0.00006901	0.3330691	1.5874294	
0.00000750	541.5532824	72207104.	12.8010962	0.00009601	-0.00008399	0.3932011	1.8707384	
0.00000875	630.2104907	72024056.	12.6888728	0.0001110	-0.00009897	0.4528366	2.1540515	
0.00001000	630.2104907	63021049.	7.9108124	0.00007911	-0.0001609	0.3235981	-3.4478644	C
0.00001125	630.2104907	56018710.	7.7137065	0.00008678	-0.0001832	0.3541152	-3.9431532	C
0.00001250	630.2104907	50416839.	7.5530192	0.00009441	-0.0002056	0.3843538	-4.4395305	C
0.00001375	630.2104907	45833490.	7.4173258	0.0001020	-0.0002280	0.4142333	-4.9375913	C
0.00001500	630.2104907	42014033.	7.3039706	0.0001096	-0.0002504	0.4439723	-5.4357727	C
0.00001625	630.2104907	38782184.	7.2052647	0.0001171	-0.0002729	0.4734068	-5.9352690	C
0.00001750	630.2104907	36012028.	7.1209178	0.0001246	-0.0002954	0.5027370	-6.4346342	C
0.00001875	630.2104907	33611226.	7.0468297	0.0001321	-0.0003179	0.5318715	-6.9345363	C
0.00002000	630.2104907	31510525.	6.9808560	0.0001396	-0.0003404	0.5607940	-7.4351034	C
0.00002125	630.2104907	29656964.	6.9228602	0.0001471	-0.0003629	0.5896134	-7.9355373	C
0.00002250	630.2104907	28009355.	6.8715132	0.0001546	-0.0003854	0.6183295	-8.4358376	C
0.00002375	630.2104907	26535179.	6.8251999	0.0001621	-0.0004079	0.6468900	-8.9363935	C
0.00002500	630.2104907	25208420.	6.7825802	0.0001696	-0.0004304	0.6752387	-9.4376293	C
0.00002625	630.2104907	24008019.	6.7441996	0.0001770	-0.0004530	0.7034852	-9.9387280	C
0.00002750	630.2104907	22916745.	6.7094805	0.0001845	-0.0004755	0.7316295	-10.4396892	C
0.00002875	630.2104907	21920365.	6.6779459	0.0001920	-0.0004980	0.7596712	-10.9405126	C
0.00003000	630.2104907	21007016.	6.6491981	0.0001995	-0.0005205	0.7876102	-11.4411976	C
0.00003125	630.2104907	20166736.	6.6229032	0.0002070	-0.0005430	0.8154464	-11.9417438	C
0.00003250	630.2104907	19391092.	6.5987284	0.0002145	-0.0005655	0.8431733	-12.4421984	C
0.00003375	630.2104907	18672903.	6.5756169	0.0002219	-0.0005881	0.8706870	-12.9433648	C
0.00003500	630.2104907	18006014.	6.5542976	0.0002294	-0.0006106	0.8980987	-13.4443878	C
0.00003625	630.2104907	17385117.	6.5345856	0.0002369	-0.0006331	0.9254082	-13.9452668	C
0.00003750	630.2104907	16805613.	6.5163206	0.0002444	-0.0006556	0.9526155	-14.4460013	C
0.00003875	630.2104907	16263497.	6.4993630	0.0002519	-0.0006781	0.9797203	-14.9465907	C
0.00004000	630.2104907	15755262.	6.4835907	0.0002593	-0.0007007	1.0067223	-15.4470347	C
0.00004125	630.2104907	15277830.	6.4688963	0.0002668	-0.0007232	1.0336216	-15.9473327	C
0.00004250	630.2104907	14828482.	6.4551851	0.0002743	-0.0007457	1.0604178	-16.4474843	C
0.00004375	639.6612183	14620828.	6.4423732	0.0002819	-0.0007681	1.0871107	-16.9474889	C
0.00004500	655.6462847	14569917.	6.4303861	0.0002894	-0.0007906	1.1137002	-17.4473460	C
0.00004625	671.6205429	14521525.	6.4191573	0.0002969	-0.0008131	1.1401861	-17.9470551	C
0.00004750	687.5839599	14475452.	6.4086273	0.0003044	-0.0008356	1.1665682	-18.4466157	C
0.00004875	703.5365030	14431518.	6.3987428	0.0003119	-0.0008581	1.1928464	-18.9460273	C
0.00005125	735.4088341	14349441.	6.3807223	0.0003270	-0.0009030	1.2450898	-19.9444013	C
0.00005375	767.2372687	14274182.	6.3647646	0.0003421	-0.0009479	1.2969150	-20.9421730	C
0.00005625	799.0178479	14204762.	6.3501884	0.0003572	-0.0009928	1.3482408	-21.9400050	C
0.00005875	830.7525895	14140470.	6.3370347	0.0003723	-0.0010377	1.3991113	-22.9375270	C
0.00006125	862.4430414	14080703.	6.3253134	0.0003874	-0.0010826	1.4495635	-23.9344120	C
0.00006375	894.0889154	14024924.	6.3148585	0.0004026	-0.0011274	1.4995957	-24.9306552	C
0.00006625	925.6899198	13972678.	6.3055293	0.0004177	-0.0011723	1.5492063	-25.9262518	C
0.00006875	957.2457593	13923575.	6.2972053	0.0004329	-0.0012171	1.5983937	-26.9211969	C
0.00007125	988.7561323	13877279.	6.2897832	0.0004481	-0.0012619	1.6471561	-27.9154855	C
0.00007375	1020.	13833502.	6.2831736	0.0004634	-0.0013066	1.6954918	-28.9091125	C
0.00007625	1052.	13791990.	6.2772990	0.0004786	-0.0013514	1.7433990	-29.9020728	C
0.00007875	1083.	13752527.	6.2720916	0.0004939	-0.0013961	1.7908762	-30.8943606	C
0.00008125	1114.	13714916.	6.2674920	0.0005092	-0.0014408	1.8379214	-31.8859716	C
0.00008375	1146.	13678989.	6.2634481	0.0005246	-0.0014854	1.8845328	-32.8769001	C

0.00008625	1177.	13644597.	6.2599137	0.0005399	-0.0015301	1.9307087	-33.8671405 C
0.00008875	1208.	13611604.	6.2568479	0.0005553	-0.0015747	1.9764471	-34.8566874 C
0.00009125	1239.	13579894.	6.2542143	0.0005707	-0.0016193	2.0217463	-35.8455352 C
0.00009375	1270.	13549359.	6.2519803	0.0005861	-0.0016639	2.0666044	-36.8336782 C
0.00009625	1301.	13519904.	6.2501170	0.0006016	-0.0017084	2.1110195	-37.8211106 C
0.00009875	1332.	13491445.	6.2485982	0.0006170	-0.0017530	2.1549896	-38.8078267 C
0.0001013	1363.	13463903.	6.2474004	0.0006325	-0.0017975	2.1985128	-39.7938203 C
0.0001038	1394.	13437209.	6.2465024	0.0006481	-0.0018419	2.2415872	-40.7790856 C
0.0001063	1425.	13411300.	6.2458850	0.0006636	-0.0018864	2.2842107	-41.7636165 C
0.0001088	1456.	13386118.	6.2455309	0.0006792	-0.0019308	2.3263813	-42.7474066 C
0.0001113	1486.	13361611.	6.2454242	0.0006948	-0.0019752	2.3680970	-43.7304497 C
0.0001138	1517.	13337731.	6.2455507	0.0007104	-0.0020196	2.4093557	-44.7127394 C
0.0001163	1548.	13314434.	6.2458970	0.0007261	-0.0020639	2.4501553	-45.6942692 C
0.0001188	1578.	13291681.	6.2464514	0.0007418	-0.0021082	2.4904937	-46.6750325 C
0.0001213	1609.	13269434.	6.2472028	0.0007575	-0.0021525	2.5303687	-47.6550226 C
0.0001238	1639.	13247659.	6.2481413	0.0007732	-0.0021968	2.5697783	-48.6342327 C
0.0001263	1670.	13226326.	6.2492575	0.0007890	-0.0022410	2.6087201	-49.6126558 C
0.0001288	1700.	13205405.	6.2505429	0.0008048	-0.0022852	2.6471919	-50.5902849 C
0.0001313	1731.	13184870.	6.2519899	0.0008206	-0.0023294	2.6851915	-51.5671129 C
0.0001338	1761.	13164695.	6.2535913	0.0008364	-0.0023736	2.7227166	-52.5431325 C
0.0001363	1791.	13144858.	6.2553403	0.0008523	-0.0024177	2.7597649	-53.5183362 C
0.0001388	1821.	13125338.	6.2572309	0.0008682	-0.0024618	2.7963339	-54.4927167 C
0.0001413	1851.	13106114.	6.2592574	0.0008841	-0.0025059	2.8324214	-55.4662663 C
0.0001438	1881.	13087167.	6.2614147	0.0009001	-0.0025499	2.8680249	-56.4389772 C
0.0001463	1911.	13068482.	6.2636977	0.0009161	-0.0025939	2.9031420	-57.4108416 C
0.0001488	1941.	13050040.	6.2661022	0.0009321	-0.0026379	2.9377701	-58.3818513 C
0.0001588	2046.	12891052.	6.2618581	0.0009941	-0.0028159	3.0664710	-60.0000000 CY
0.0001688	2088.	12370972.	6.1940305	0.0010452	-0.0030048	3.1660523	-60.0000000 CY
0.0001788	2121.	11863977.	6.1272994	0.0010953	-0.0031947	3.2579001	-60.0000000 CY
0.0001888	2153.	11407837.	6.0659382	0.0011449	-0.0033851	3.3438393	-60.0000000 CY
0.0001988	2185.	10995947.	6.0116167	0.0011948	-0.0035752	3.4247681	-60.0000000 CY
0.0002088	2217.	10622069.	5.9637120	0.0012449	-0.0037651	3.5007517	-60.0000000 CY
0.0002188	2249.	10280959.	5.9213725	0.0012953	-0.0039547	3.5717151	-60.0000000 CY
0.0002288	2280.	9968286.	5.8838966	0.0013459	-0.0041441	3.6375807	-60.0000000 CY
0.0002388	2311.	9679936.	5.8488345	0.0013964	-0.0043336	3.6977482	-60.0000000 CY
0.0002488	2342.	9413424.	5.8175160	0.0014471	-0.0045229	3.7527006	-60.0000000 CY
0.0002588	2372.	9166245.	5.7897560	0.0014981	-0.0047119	3.8024218	-60.0000000 CY
0.0002688	2402.	8936211.	5.7651899	0.0015494	-0.0049006	3.8468203	-60.0000000 CY
0.0002788	2431.	8721443.	5.7435071	0.0016010	-0.0050890	3.8858001	-60.0000000 CY
0.0002888	2460.	8520321.	5.7244421	0.0016529	-0.0052771	3.9192610	-60.0000000 CY
0.0002988	2489.	8331442.	5.7077668	0.0017052	-0.0054648	3.9470979	-60.0000000 CY
0.0003088	2517.	8153178.	5.6931060	0.0017577	-0.0056523	3.9691796	-60.0000000 CY
0.0003188	2541.	7972049.	5.6744819	0.0018087	-0.0058413	3.9849299	-60.0000000 CY
0.0003288	2558.	7782047.	5.6487992	0.0018570	-0.0060330	3.9946974	-60.0000000 CY
0.0003388	2569.	7582819.	5.6137605	0.0019017	-0.0062283	3.9992827	-60.0000000 CY
0.0003488	2574.	7379284.	5.5723583	0.0019434	-0.0064266	3.9952222	-60.0000000 CY
0.0003588	2576.	7181193.	5.5307596	0.0019842	-0.0066258	3.9989014	-60.0000000 CY
0.0003688	2579.	6993368.	5.4919040	0.0020251	-0.0068249	3.9980816	-60.0000000 CY
0.0003788	2581.	6815060.	5.4557725	0.0020664	-0.0070236	3.9975010	-60.0000000 CY
0.0003888	2584.	6645673.	5.4219928	0.0021078	-0.0072222	3.9998455	-60.0000000 CY
0.0003988	2586.	6484160.	5.3895815	0.0021491	-0.0074209	3.9941517	-60.0000000 CY
0.0004088	2587.	6329731.	5.3571688	0.0021897	-0.0076203	3.9982122	-60.0000000 CY
0.0004188	2589.	6182497.	5.3267194	0.0022306	-0.0078194	3.9999375	-60.0000000 CY
0.0004288	2590.	6041834.	5.2982826	0.0022716	-0.0080184	3.9932159	-60.0000000 CY
0.0004388	2592.	5907399.	5.2715574	0.0023129	-0.0082171	3.9974928	-60.0000000 CY
0.0004488	2593.	5778810.	5.2463793	0.0023543	-0.0084157	3.9996899	-60.0000000 CY
0.0004588	2595.	5655613.	5.2227666	0.0023959	-0.0086141	3.9955406	-60.0000000 CY
0.0004688	2596.	5537472.	5.2006070	0.0024378	-0.0088122	3.9949177	-60.0000000 CY
0.0004788	2597.	5424152.	5.1796733	0.0024798	-0.0090102	3.9983378	-60.0000000 CY
0.0004888	2598.	5315353.	5.1598837	0.0025219	-0.0092081	3.9998979	-60.0000000 CY
0.0004988	2599.	5210341.	5.1391883	0.0025632	-0.0094068	3.9941844	-60.0000000 CY
0.0005088	2599.	5109338.	5.1196421	0.0026046	-0.0096054	3.9936250	-60.0000000 CY
0.0005188	2600.	5012154.	5.1010911	0.0026462	-0.0098038	3.9972643	-60.0000000 CY
0.0005288	2601.	4918571.	5.0834831	0.0026879	-0.0100021	3.9993934	-60.0000000 CY
0.0005388	2601.	4828372.	5.0668000	0.0027297	-0.0102003	3.9990539	-60.0000000 CY
0.0005488	2602.	4741298.	5.0511691	0.0027718	-0.0103982	3.9907485	-60.0000000 CY
0.0006088	2604.	4277663.	4.9724383	0.0030270	-0.0115830	3.9884979	-60.0000000 CYT
0.0006688	2605.	3895210.	4.9138689	0.0032861	-0.0127639	3.9888295	-60.0000000 CYT
0.0007288	2605.	3574506.	4.8647456	0.0035452	-0.0139448	3.9999922	-60.0000000 CYT
0.0007888	2605.	3302595.	4.8281043	0.0038082	-0.0151218	3.9951394	-60.0000000 CYT

Summary of Results for Nominal Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain

1	12.000	2603.791	0.00300000

Note that the values of moment capacity in the table above are not factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to ACI 318, Section 9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding bending stiffnesses computed for common resistance factor values used for reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	2604.	7.800000	1692.	13210731.
1	0.75	2604.	8.400000	1953.	13032445.
1	0.90	2604.	9.000000	2343.	9398495.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	65125.
2	12.0000	7.8659	Yes	No	65125.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head = 0.500000 inches
Rotation of pile head = 0.000E+00 radians
Axial load on pile head = 12000.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.5000	-1529971.	23380.	0.00	0.00	1.33E+10	0.00	0.00	0.00
0.2000	0.4997	-1473881.	23359.	-2.70E-04	0.00	1.33E+10	-8.8560	42.5370	0.00
0.4000	0.4987	-1417834.	23327.	-5.30E-04	0.00	1.34E+10	-17.6777	85.0740	0.00
0.6000	0.4971	-1361881.	23274.	-7.78E-04	0.00	1.35E+10	-26.4328	127.6111	0.00
0.8000	0.4950	-1306074.	23200.	-0.00102	0.00	1.35E+10	-35.0907	170.1481	0.00
1.0000	0.4923	-1250462.	23106.	-0.00124	0.00	1.36E+10	-43.6227	212.6851	0.00
1.2000	0.4890	-1195096.	22991.	-0.00146	0.00	1.36E+10	-52.0020	255.2221	0.00
1.4000	0.4853	-1140022.	22856.	-0.00166	0.00	1.37E+10	-60.2036	297.7592	0.00
1.6000	0.4810	-1085290.	22702.	-0.00186	0.00	1.37E+10	-68.2042	340.2962	0.00
1.8000	0.4763	-1030945.	22529.	-0.00204	0.00	1.38E+10	-75.9822	382.8332	0.00
2.0000	0.4712	-977032.	22338.	-0.00222	0.00	1.39E+10	-83.5180	425.3702	0.00
2.2000	0.4657	-923596.	22129.	-0.00238	0.00	1.40E+10	-90.7934	467.9072	0.00
2.4000	0.4598	-870678.	21902.	-0.00253	0.00	1.41E+10	-97.7922	510.4443	0.00
2.6000	0.4535	-818319.	21660.	-0.00268	0.00	1.42E+10	-104.4997	552.9813	0.00
2.8000	0.4469	-766558.	21401.	-0.00281	0.00	1.43E+10	-110.9028	595.5183	0.00
3.0000	0.4400	-715433.	21128.	-0.00293	0.00	1.44E+10	-116.9900	638.0553	0.00

3.2000	0.4329	-664977.	20840.	-0.00305	0.00	1.45E+10	-122.7514	680.5924	0.00
3.4000	0.4254	-615226.	20539.	-0.00311	0.00	7.21E+10	-128.1788	723.1294	0.00
3.6000	0.4179	-566212.	20225.	-0.00313	0.00	7.22E+10	-133.3264	765.6664	0.00
3.8000	0.4104	-517965.	19899.	-0.00315	0.00	7.22E+10	-138.1930	808.2034	0.00
4.0000	0.4028	-470515.	19562.	-0.00317	0.00	7.23E+10	-142.7775	850.7404	0.00
4.2000	0.3952	-423886.	19214.	-0.00318	0.00	7.24E+10	-147.0793	893.2775	0.00
4.4000	0.3875	-378103.	18856.	-0.00320	0.00	7.25E+10	-151.0976	935.8145	0.00
4.6000	0.3798	-333191.	18489.	-0.00321	0.00	7.26E+10	-154.8323	978.3515	0.00
4.8000	0.3721	-289171.	18113.	-0.00322	0.00	7.27E+10	-158.2833	1021.	0.00
5.0000	0.3644	-246061.	17730.	-0.00323	0.00	7.28E+10	-161.4508	1063.	0.00
5.2000	0.3566	-203882.	17339.	-0.00323	0.00	7.29E+10	-164.3351	1106.	0.00
5.4000	0.3488	-162649.	16941.	-0.00324	0.00	7.29E+10	-166.9367	1148.	0.00
5.6000	0.3411	-122377.	16538.	-0.00325	0.00	7.30E+10	-169.2565	1191.	0.00
5.8000	0.3333	-83080.	16129.	-0.00325	0.00	7.31E+10	-171.2954	1234.	0.00
6.0000	0.3255	-44769.	15716.	-0.00325	0.00	7.31E+10	-173.0546	1276.	0.00
6.2000	0.3177	-7456.	15299.	-0.00325	0.00	7.31E+10	-174.5353	1319.	0.00
6.4000	0.3099	28852.	14879.	-0.00325	0.00	7.31E+10	-175.7390	1361.	0.00
6.6000	0.3021	64149.	14456.	-0.00325	0.00	7.31E+10	-176.6674	1404.	0.00
6.8000	0.2943	98427.	14031.	-0.00325	0.00	7.31E+10	-177.3223	1446.	0.00
7.0000	0.2865	131684.	13605.	-0.00324	0.00	7.30E+10	-177.7056	1489.	0.00
7.2000	0.2787	163917.	13178.	-0.00324	0.00	7.29E+10	-177.8195	1531.	0.00
7.4000	0.2709	195126.	12752.	-0.00323	0.00	7.29E+10	-177.6660	1574.	0.00
7.6000	0.2632	225311.	12326.	-0.00323	0.00	7.28E+10	-177.2477	1616.	0.00
7.8000	0.2554	254475.	11901.	-0.00322	0.00	7.28E+10	-176.5669	1659.	0.00
8.0000	0.2477	282622.	11479.	-0.00321	0.00	7.27E+10	-175.6263	1701.	0.00
8.2000	0.2400	309757.	11058.	-0.00320	0.00	7.27E+10	-174.4286	1744.	0.00
8.4000	0.2324	335887.	10642.	-0.00319	0.00	7.26E+10	-172.9766	1787.	0.00
8.6000	0.2247	361020.	10228.	-0.00318	0.00	7.26E+10	-171.2731	1829.	0.00
8.8000	0.2171	385166.	9820.	-0.00316	0.00	7.25E+10	-169.3212	1872.	0.00
9.0000	0.2095	408337.	9416.	-0.00315	0.00	7.25E+10	-167.1239	1914.	0.00
9.2000	0.2020	430545.	9018.	-0.00314	0.00	7.24E+10	-164.6844	1957.	0.00
9.4000	0.1945	451804.	8626.	-0.00312	0.00	7.24E+10	-162.0058	1999.	0.00
9.6000	0.1870	472129.	8241.	-0.00311	0.00	7.23E+10	-159.0915	2042.	0.00
9.8000	0.1796	491537.	7862.	-0.00309	0.00	7.23E+10	-155.9449	2084.	0.00
10.0000	0.1722	510047.	7492.	-0.00308	0.00	7.23E+10	-152.5692	2127.	0.00
10.2000	0.1648	527677.	7130.	-0.00306	0.00	7.22E+10	-148.9679	2169.	0.00
10.4000	0.1575	544449.	6777.	-0.00304	0.00	7.22E+10	-145.1445	2212.	0.00
10.6000	0.1502	560384.	6434.	-0.00302	0.00	7.22E+10	-141.1025	2254.	0.00
10.8000	0.1430	575506.	6100.	-0.00300	0.00	7.21E+10	-136.8455	2297.	0.00
11.0000	0.1358	589839.	5777.	-0.00298	0.00	7.21E+10	-132.3770	2340.	0.00
11.2000	0.1287	603409.	5465.	-0.00296	0.00	7.21E+10	-127.7006	2382.	0.00
11.4000	0.1216	616243.	5165.	-0.00294	0.00	7.20E+10	-122.8200	2425.	0.00
11.6000	0.1145	628369.	4876.	-0.00291	0.00	3.13E+10	-117.7387	2467.	0.00
11.8000	0.1076	639815.	4600.	-0.00283	0.00	1.46E+10	-112.5288	2510.	0.00
12.0000	0.1009	650610.	4297.	-0.00273	0.00	1.46E+10	-139.5440	3318.	0.00
12.2000	0.09452	660599.	3667.	-0.00262	0.00	1.46E+10	-385.7637	9795.	0.00
12.4000	0.08837	668362.	2744.	-0.00251	0.00	1.45E+10	-383.5251	10416.	0.00
12.6000	0.08248	673913.	1827.	-0.00240	0.00	1.45E+10	-380.2843	11065.	0.00
12.8000	0.07686	677270.	919.4583	-0.00229	0.00	1.45E+10	-376.0731	11743.	0.00
13.0000	0.07151	678458.	23.0525	-0.00217	0.00	1.45E+10	-370.9317	12449.	0.00
13.2000	0.06643	677506.	-859.9556	-0.00206	0.00	1.45E+10	-364.9084	13184.	0.00
13.4000	0.06162	674449.	-1728.	-0.00195	0.00	1.45E+10	-358.0596	13947.	0.00
13.6000	0.05707	669326.	-2578.	-0.00184	0.00	1.45E+10	-350.4495	14738.	0.00
13.8000	0.05279	662182.	-3409.	-0.00173	0.00	1.45E+10	-342.1494	15555.	0.00
14.0000	0.04877	653063.	-4219.	-0.00162	0.00	1.46E+10	-333.2376	16398.	0.00
14.2000	0.04501	642022.	-5010.	-0.00151	0.00	1.46E+10	-325.6710	17364.	0.00
14.4000	0.04151	629102.	-5787.	-0.00143	0.00	2.53E+10	-321.5296	18592.	0.00
14.6000	0.03814	614329.	-6552.	-0.00139	0.00	7.21E+10	-316.5759	19920.	0.00
14.8000	0.03483	597731.	-7305.	-0.00137	0.00	7.21E+10	-310.2923	21383.	0.00
15.0000	0.03156	579346.	-8040.	-0.00135	0.00	7.21E+10	-302.5494	23008.	0.00
15.2000	0.02834	559217.	-8755.	-0.00133	0.00	7.22E+10	-293.1922	24830.	0.00
15.4000	0.02516	537399.	-9445.	-0.00131	0.00	7.22E+10	-282.0313	26900.	0.00
15.6000	0.02203	513956.	-10106.	-0.00130	0.00	7.23E+10	-268.8294	29288.	0.00
15.8000	0.01894	488964.	-10733.	-0.00128	0.00	7.23E+10	-253.2797	32099.	0.00
16.0000	0.01588	462512.	-11319.	-0.00126	0.00	7.24E+10	-234.9700	35503.	0.00
16.2000	0.01287	434707.	-11850.	-0.00125	0.00	7.24E+10	-207.9332	38783.	0.00
16.4000	0.00989	405704.	-12294.	-0.00124	0.00	7.25E+10	-161.7182	39262.	0.00
16.6000	0.00694	375769.	-12626.	-0.00122	0.00	7.25E+10	-114.8473	39741.	0.00
16.8000	0.00402	345171.	-12844.	-0.00121	0.00	7.26E+10	-67.2996	40220.	0.00
17.0000	0.00112	314186.	-12948.	-0.00120	0.00	7.27E+10	-19.0512	40699.	0.00
17.2000	-0.00174	283091.	-12935.	-0.00119	0.00	7.27E+10	29.9239	41177.	0.00
17.4000	-0.00459	252168.	-12803.	-0.00118	0.00	7.28E+10	79.6540	41656.	0.00
17.6000	-0.00741	221704.	-12551.	-0.00117	0.00	7.28E+10	130.1690	42135.	0.00
17.8000	-0.01022	191989.	-12177.	-0.00117	0.00	7.29E+10	181.4999	42614.	0.00
18.0000	-0.01301	163319.	-11679.	-0.00116	0.00	7.29E+10	233.6787	43093.	0.00
18.2000	-0.01579	135995.	-11055.	-0.00116	0.00	7.30E+10	286.7375	43572.	0.00
18.4000	-0.01856	110323.	-10302.	-0.00115	0.00	7.30E+10	340.7083	44050.	0.00
18.6000	-0.02132	86613.	-9418.	-0.00115	0.00	7.31E+10	395.6225	44529.	0.00
18.8000	-0.02408	65182.	-8402.	-0.00115	0.00	7.31E+10	451.3074	44988.	0.00
19.0000	-0.02682	46350.	-7267.	-0.00114	0.00	7.31E+10	494.5193	44245.	0.00
19.2000	-0.02957	30366.	-6028.	-0.00114	0.00	7.31E+10	538.1876	43683.	0.00

19.4000	-0.03231	17483.	-4683.	-0.00114	0.00	7.31E+10	582.4272	43262.	0.00
19.6000	-0.03505	7954.	-3231.	-0.00114	0.00	7.31E+10	627.3297	42953.	0.00
19.8000	-0.03779	2039.	-1671.	-0.00114	0.00	7.31E+10	672.9687	42737.	0.00
20.0000	-0.04053	0.00	0.00	-0.00114	0.00	7.31E+10	719.4039	21299.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     0.50000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -1529971. inch-lbs
Maximum shear force              =         23380. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             46
Number of zero deflection points =              1
```

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

```
Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)
Displacement of pile head                          =     1.000000 inches
Rotation of pile head                              =    0.000E+00 radians
Axial load on pile head                            =      12000.0 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0000	-2551311.	39974.	0.00	0.00	7.86E+09	0.00	0.00	0.00
0.2000	0.9991	-2455404.	39938.	-7.65E-04	0.00	7.86E+09	-14.9494	35.9121	0.00
0.4000	0.9963	-2359563.	39884.	-0.00145	0.00	9.26E+09	-30.4965	73.4611	0.00
0.6000	0.9921	-2263879.	39791.	-0.00202	0.00	1.01E+10	-46.5354	112.5712	0.00
0.8000	0.9866	-2168448.	39660.	-0.00252	0.00	1.12E+10	-62.9604	153.1512	0.00
1.0000	0.9800	-2073366.	39489.	-0.00295	0.00	1.25E+10	-79.6655	195.0922	0.00
1.2000	0.9725	-1978732.	39278.	-0.00333	0.00	1.30E+10	-96.3847	237.8694	0.00
1.4000	0.9640	-1884642.	39026.	-0.00369	0.00	1.31E+10	-113.1048	281.5748	0.00
1.6000	0.9548	-1791194.	38735.	-0.00402	0.00	1.31E+10	-129.7138	326.0558	0.00
1.8000	0.9447	-1698483.	38404.	-0.00434	0.00	1.32E+10	-146.0999	371.1506	0.00
2.0000	0.9339	-1606605.	38034.	-0.00464	0.00	1.33E+10	-162.1512	416.6853	0.00
2.2000	0.9225	-1515653.	37626.	-0.00492	0.00	1.33E+10	-178.1049	463.3807	0.00
2.4000	0.9103	-1425719.	37180.	-0.00519	0.00	1.34E+10	-193.5877	510.3795	0.00
2.6000	0.8976	-1336892.	36699.	-0.00543	0.00	1.35E+10	-206.8084	552.9813	0.00
2.8000	0.8842	-1249250.	36188.	-0.00566	0.00	1.36E+10	-219.4107	595.5183	0.00
3.0000	0.8704	-1162866.	35647.	-0.00587	0.00	1.37E+10	-231.3999	638.0553	0.00
3.2000	0.8561	-1077808.	35078.	-0.00607	0.00	1.38E+10	-242.7589	680.5924	0.00
3.4000	0.8413	-994143.	34482.	-0.00625	0.00	1.39E+10	-253.4735	723.1294	0.00
3.6000	0.8260	-911933.	33862.	-0.00641	0.00	1.40E+10	-263.5319	765.6664	0.00
3.8000	0.8105	-831237.	33218.	-0.00656	0.00	1.41E+10	-272.9248	808.2034	0.00
4.0000	0.7945	-752109.	32553.	-0.00670	0.00	1.43E+10	-281.6453	850.7404	0.00
4.2000	0.7783	-674599.	31867.	-0.00682	0.00	1.45E+10	-289.6888	893.2775	0.00
4.4000	0.7618	-598755.	31163.	-0.00688	0.00	7.21E+10	-297.0527	935.8145	0.00
4.6000	0.7453	-524621.	30442.	-0.00690	0.00	7.22E+10	-303.8125	978.3515	0.00
4.8000	0.7287	-452237.	29706.	-0.00692	0.00	7.24E+10	-309.2603	1019.	0.00
5.0000	0.7121	-381633.	28960.	-0.00693	0.00	7.25E+10	-312.7084	1054.	0.00
5.2000	0.6954	-312830.	28202.	-0.00694	0.00	7.27E+10	-318.7528	1100.	0.00
5.4000	0.6788	-245864.	27431.	-0.00695	0.00	7.28E+10	-323.7720	1145.	0.00
5.6000	0.6621	-180761.	26649.	-0.00696	0.00	7.29E+10	-327.7142	1188.	0.00
5.8000	0.6454	-117547.	25859.	-0.00696	0.00	7.30E+10	-330.5285	1229.	0.00
6.0000	0.6286	-56236.	25064.	-0.00697	0.00	7.31E+10	-332.1651	1268.	0.00
6.2000	0.6119	3162.	24262.	-0.00697	0.00	7.31E+10	-336.2143	1319.	0.00
6.4000	0.5952	60624.	23453.	-0.00697	0.00	7.31E+10	-337.5768	1361.	0.00
6.6000	0.5785	116140.	22642.	-0.00696	0.00	7.30E+10	-338.3494	1404.	0.00
6.8000	0.5618	169708.	21830.	-0.00696	0.00	7.29E+10	-338.5349	1446.	0.00
7.0000	0.5451	221326.	21018.	-0.00695	0.00	7.28E+10	-338.1366	1489.	0.00
7.2000	0.5284	270995.	20208.	-0.00694	0.00	7.28E+10	-337.1577	1531.	0.00
7.4000	0.5118	318723.	19400.	-0.00693	0.00	7.26E+10	-335.6017	1574.	0.00
7.6000	0.4951	364517.	18598.	-0.00692	0.00	7.26E+10	-333.4725	1616.	0.00
7.8000	0.4785	408390.	17800.	-0.00691	0.00	7.25E+10	-330.7737	1659.	0.00
8.0000	0.4620	450357.	17011.	-0.00690	0.00	7.24E+10	-327.5096	1701.	0.00

8.2000	0.4454	490437.	16229.	-0.00688	0.00	7.23E+10	-323.6842	1744.	0.00
8.4000	0.4289	528653.	15457.	-0.00686	0.00	7.22E+10	-319.3020	1787.	0.00
8.6000	0.4125	565029.	14697.	-0.00684	0.00	7.22E+10	-314.3672	1829.	0.00
8.8000	0.3961	599593.	13949.	-0.00683	0.00	7.21E+10	-308.8844	1872.	0.00
9.0000	0.3797	632378.	13215.	-0.00677	0.00	1.54E+10	-302.8584	1914.	0.00
9.2000	0.3636	663415.	12496.	-0.00666	0.00	1.45E+10	-296.4456	1957.	0.00
9.4000	0.3477	692742.	11793.	-0.00655	0.00	1.45E+10	-289.6803	1999.	0.00
9.6000	0.3322	720397.	11106.	-0.00643	0.00	1.44E+10	-282.5876	2042.	0.00
9.8000	0.3169	746421.	10437.	-0.00631	0.00	1.43E+10	-275.1930	2084.	0.00
10.0000	0.3019	770856.	9785.	-0.00618	0.00	1.43E+10	-267.5223	2127.	0.00
10.2000	0.2872	793746.	9153.	-0.00605	0.00	1.42E+10	-259.6015	2169.	0.00
10.4000	0.2728	815137.	8539.	-0.00591	0.00	1.42E+10	-251.4566	2212.	0.00
10.6000	0.2588	835076.	7946.	-0.00577	0.00	1.41E+10	-243.1139	2254.	0.00
10.8000	0.2451	853611.	7373.	-0.00563	0.00	1.41E+10	-234.5997	2297.	0.00
11.0000	0.2318	870789.	6820.	-0.00548	0.00	1.41E+10	-225.9403	2340.	0.00
11.2000	0.2188	886663.	6288.	-0.00533	0.00	1.40E+10	-217.1619	2382.	0.00
11.4000	0.2062	901281.	5778.	-0.00518	0.00	1.40E+10	-208.2908	2425.	0.00
11.6000	0.1939	914695.	5289.	-0.00503	0.00	1.40E+10	-199.3533	2467.	0.00
11.8000	0.1821	926956.	4821.	-0.00487	0.00	1.40E+10	-190.3754	2510.	0.00
12.0000	0.1706	938115.	4310.	-0.00471	0.00	1.40E+10	-235.7979	3318.	0.00
12.2000	0.1595	947912.	3406.	-0.00454	0.00	1.39E+10	-517.0078	7781.	0.00
12.4000	0.1488	954727.	2168.	-0.00438	0.00	1.39E+10	-514.6295	8303.	0.00
12.6000	0.1384	958572.	937.8136	-0.00422	0.00	1.39E+10	-510.6983	8854.	0.00
12.8000	0.1285	959471.	-281.2742	-0.00405	0.00	1.39E+10	-505.2082	9435.	0.00
13.0000	0.1190	957455.	-1485.	-0.00389	0.00	1.39E+10	-498.1603	10048.	0.00
13.2000	0.1099	952565.	-2671.	-0.00372	0.00	1.39E+10	-489.5622	10695.	0.00
13.4000	0.1011	944851.	-3833.	-0.00356	0.00	1.39E+10	-479.4282	11377.	0.00
13.6000	0.09279	934370.	-4970.	-0.00340	0.00	1.40E+10	-467.7782	12099.	0.00
13.8000	0.08483	921190.	-6077.	-0.00324	0.00	1.40E+10	-454.6377	12862.	0.00
14.0000	0.07726	905387.	-7151.	-0.00308	0.00	1.40E+10	-440.0367	13670.	0.00
14.2000	0.07005	887045.	-8190.	-0.00293	0.00	1.40E+10	-426.1338	14600.	0.00
14.4000	0.06321	866244.	-9200.	-0.00278	0.00	1.41E+10	-415.2123	15765.	0.00
14.6000	0.05672	843047.	-10181.	-0.00263	0.00	1.41E+10	-402.9530	17049.	0.00
14.8000	0.05058	817525.	-11132.	-0.00249	0.00	1.42E+10	-389.3054	18472.	0.00
15.0000	0.04477	789757.	-12048.	-0.00235	0.00	1.42E+10	-374.2021	20060.	0.00
15.2000	0.03928	759829.	-12926.	-0.00222	0.00	1.43E+10	-357.5525	21847.	0.00
15.4000	0.03410	727838.	-13763.	-0.00210	0.00	1.44E+10	-339.2336	23879.	0.00
15.6000	0.02920	693890.	-14552.	-0.00198	0.00	1.45E+10	-319.0762	26222.	0.00
15.8000	0.02459	658101.	-15292.	-0.00187	0.00	1.46E+10	-296.8439	28975.	0.00
16.0000	0.02023	620598.	-15974.	-0.00180	0.00	7.20E+10	-272.1970	32289.	0.00
16.2000	0.01593	581527.	-16592.	-0.00178	0.00	7.21E+10	-242.8375	36595.	0.00
16.4000	0.01167	541057.	-17113.	-0.00177	0.00	7.22E+10	-190.8571	39262.	0.00
16.6000	0.00745	499487.	-17490.	-0.00175	0.00	7.23E+10	-123.3679	39741.	0.00
16.8000	0.00327	457206.	-17704.	-0.00173	0.00	7.24E+10	-54.8633	40220.	0.00
17.0000	-8.66E-04	414608.	-17752.	-0.00172	0.00	7.25E+10	14.6907	40699.	0.00
17.2000	-0.00497	372095.	-17632.	-0.00171	0.00	7.25E+10	85.3312	41177.	0.00
17.4000	-0.00905	330073.	-17341.	-0.00169	0.00	7.26E+10	157.0976	41656.	0.00
17.6000	-0.01310	288955.	-16877.	-0.00168	0.00	7.27E+10	230.0315	42135.	0.00
17.8000	-0.01713	249162.	-16236.	-0.00167	0.00	7.28E+10	304.1754	42614.	0.00
18.0000	-0.02114	211121.	-15421.	-0.00167	0.00	7.29E+10	374.9143	42564.	0.00
18.2000	-0.02513	175239.	-14457.	-0.00166	0.00	7.29E+10	427.9410	40867.	0.00
18.4000	-0.02911	141822.	-13367.	-0.00166	0.00	7.30E+10	480.6231	39625.	0.00
18.6000	-0.03308	111173.	-12150.	-0.00165	0.00	7.30E+10	533.3405	38698.	0.00
18.8000	-0.03704	83596.	-10807.	-0.00165	0.00	7.31E+10	586.3635	37998.	0.00
19.0000	-0.04099	59397.	-9335.	-0.00165	0.00	7.31E+10	639.8936	37469.	0.00
19.2000	-0.04493	38883.	-7734.	-0.00164	0.00	7.31E+10	694.0862	37072.	0.00
19.4000	-0.04888	22367.	-6002.	-0.00164	0.00	7.31E+10	749.0642	36780.	0.00
19.6000	-0.05282	10166.	-4138.	-0.00164	0.00	7.31E+10	804.9266	36573.	0.00
19.8000	-0.05676	2601.	-2138.	-0.00164	0.00	7.31E+10	861.7542	36436.	0.00
20.0000	-0.06070	0.00	0.00	-0.00164	0.00	7.31E+10	919.6131	18179.	0.00

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =     1.00000000 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =      -2551311. inch-lbs
Maximum shear force              =         39974. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =            139
Number of zero deflection points =              1
```

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.5000	S, rad	0.00	12000.	0.5000	0.00	23380.	-1529971.
2	y, in	1.0000	S, rad	0.00	12000.	1.0000	0.00	39974.	-2551311.

Maximum pile-head deflection = 1.0000000000 inches
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

Summary of Warning Messages

The following warning was reported 8479 times

**** Warning ****

The input value for friction angle is either smaller than 29 degrees or
higher than 41 degrees and no value of k has been specified for a soil layer
defined using the sand criteria. Program will assume an internal default value,
for k, but the friction angle is outside the range of data available.
Please check your input data for correctness.

The analysis ended normally.