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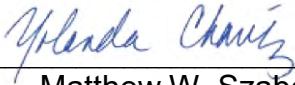
**TRANSMITTAL**

|  |                        |                  |
|--|------------------------|------------------|
| TO<br>The City Council                                   | DATE<br>11-01-24       | COUNCIL FILE NO. |
| FROM<br>Proposition K – L.A. For Kids Steering Committee | COUNCIL DISTRICT<br>10 |                  |

At its meeting held on October 31, 2024, the L.A. for Kids Steering Committee approved the recommendations of the attached Bureau of Engineering (BOE) report, which is hereby transmitted for Council consideration, subject to the concurrence of the Mayor. Adoption of the report recommendations would find that the gymnasium expansion portion of the specified scope defined for the Proposition K – L.A. For Kids (Prop K) Ardmore Recreation Center AKA Seoul International Project (S87) is infeasible due to the age of the existing structure, differential settlement, and programming impracticalities if constructed as a stand-alone structure. A replacement gymnasium is outside the scope of work specified in the Ballot Measure.

The Ardmore Recreation Center Project is a Proposition K specified project with a scope that includes the expansion of the gymnasium and the installation of fencing and edge treatment. The fencing and edge treatment was previously installed as part of the Dodger Dream Field project. At this time there are project savings of approximately \$871,000 which will be reprogrammed in a subsequent report, subject to the approval of the City Council.

There is no impact to the General Fund as a result of these actions.

  
for Matthew W. Szabo  
City Administrative Officer  
Chair, L.A. For Kids Steering Committee

MWS:MMG:05250067c

**CITY OF LOS ANGELES**  
INTER-DEPARTMENTAL CORRESPONDENCE  
L.A. FOR KIDS STEERING COMMITTEE MEETING, OCTOBER 31, 2024  
AGENDA ITEM (3)  
BUREAU OF ENGINEERING

Date: October 31, 2024

To: Proposition K – L.A. for Kids Steering Committee

From: Ohaji Abdallah, RA, Interim Program Manager *Ohaji K. Abdallah, R.A.*  
Proposition K, L.A. for Kids Program  
Bureau of Engineering

Subject: **AMENDED - ARDMORE RECREATION CENTER (PROPOSITION K- ID# S87) FINDING OF INFEASIBILITY**

## RECOMMENDATIONS

That the L.A. for Kids Steering Committee recommends the City Council:

Determine that the scope defined for Ardmore Recreation Center Project (S87) as specified in the 1996 Proposition K Ballot Measure, is infeasible due to the following:

- The expansion of the gym as initially specified would construct a building that will limit the replacement of the existing 65-year-old gym.
- The expansion of the gym as initially specified would also construct a building with a pile foundation that will experience differential settlement when compared to the existing gym to which it is attached, causing on-going maintenance and accessibility issues.
- The viable alternative location options to construct an expansion to the original gym is limited given the geographical layout of the park and would negatively impact the Department of Recreation and Park's ability to operate current programming at the park utilizing current staff.
- That, based on additional discussion with the staff of Council District 10 (CD10) and the Department of Recreation and Parks, as requested by the Steering Committee at its meeting of June 27, 2024, no additional alternatives have been identified that would satisfy the legal requirements of the Proposition K – L.A. for Kids ballot measure within the remaining Proposition K Program remaining timeline, and the current and anticipated programming and operational needs of RAP and the community at this time.

## **BACKGROUND**

On June 27, 2024, a Bureau of Engineering (BOE) report supporting findings of infeasibility for the Ardmore Recreation Center project (Proposition K Project ID No. S87, Council District 10) was presented to the LAFKSC as agenda item 6. Subsequent to discussion among the Steering Committee members and City staff, the report was continued for 60 days. That report is attached hereto, and incorporated herein, except as amended herein.

The concerns raised at the meeting were from Bernyce Hollins, representing the Office of the Mayor, who concurred with the infeasibility of the gymnasium expansion portion of the specified project scope at Ardmore Recreation Center, but requested that BOE investigate alternative siting options in the surrounding area where a similar project may be funded.

BOE agreed that further analysis could be performed to explore options to increase access to recreational facilities within the surrounding area. Ms. Hollins then moved that the report come back to the Committee after such analysis with options for an alternative delivery method as appropriate.

As requested by the Steering Committee, BOE has conducted additional meetings with RAP to review optional sites that could accommodate the scope and deliver the improvements within the area. The sites investigated include the Queen Ann Recreation Center, Normandie Recreation Center, Lafayette Multipurpose Community Center, and Shatto Recreation Center. Based on the results of those meetings, BOE was not able to identify any alternative projects that could be implemented in a manner that would not negatively impact the Department of Recreation and Park's ability to operate current programming at those parks utilizing current staff. Therefore, at this time, there are no alternatives available that would change the above recommendation that the project be found to be infeasible.

However, CD10, in recognition of the need to provide recreation facilities to the densest park poor neighborhood in America, Koreatown, has introduced a motion (CF 24-1093) that directs BOE, RAP, and BSS to investigate the expansion and Master planning of the park, which will not utilize Prop K Funds.

## **FISCAL IMPACT**

The requested infeasibility finding will have no negative impact on the General Fund.

Staff will report back to the Steering Committee on the proposed reprogramming of the unused funding capacity as part of the financial reconciliation of the overall program anticipated during the first quarter of 2025-26.

Attachment No. 1: L.A. for Kids Steering Committee Report - Ardmore Recreation Center  
(Proposition K- ID# S87) Finding of Infeasibility, Dated June 27, 2024

**CITY OF LOS ANGELES**  
**INTER-DEPARTMENTAL CORRESPONDENCE**  
**L.A. FOR KIDS STEERING COMMITTEE MEETING, JUNE 27, 2024**  
**AGENDA ITEM ( )**  
**BUREAU OF ENGINEERING**

Date: June 27, 2024

To: Proposition K – L.A. for Kids Steering Committee

From: Ohaji Abdallah, RA, Interim Program Manager      Electronically signed by:  
Proposition K, L.A. for Kids Program      Neil L. Drucker for  
Bureau of Engineering

Subject: **ARDMORE RECREATION CENTER (PROPOSITION K- ID# S87)**  
**FINDING OF INFEASIBILITY**

## **RECOMMENDATIONS**

That the L.A. for Kids Steering Committee recommends the City Council:

Determine that the scope defined for Ardmore Recreation Center Project (S87) as specified in the 1996 Proposition K Ballot Measure, is infeasible due to the following:

- The expansion of the gym as initially specified would construct a building that will limit the replacement of the existing 65-year-old gym.
- The expansion of the gym as initially specified would also construct a building with a pile foundation that will experience differential settlement when compared to the existing gym to which it is attached, causing on-going maintenance and accessibility issues.
- The viable alternative location options to construct an expansion to the original gym is limited given the geographical layout of the park and would negatively impact the Department of Recreation and Park's ability to operate current programming at the park utilizing current staff.

## **BACKGROUND**

The Ardmore Recreation Center Project (Project) is a Proposition K (Prop K) specified project with a project scope that entails the expansion of the existing gym at Ardmore Recreation Center, AKA Seoul International Park, along with installation of fencing and edge treatments. Prop K funds of \$1,000,000 were initially awarded to the Project per the Prop K Ballot Measure. The description of this Prop K specified project as set forth in the ballot measure is as follows: "Expand Gymnasium; Install Fencing and Edge Treatment".



Previous Council District 10 (CD10) leadership conveyed a vision to utilize the Prop K funding as leverage for additional funding requests to support a master plan and subsequent phased implementation of the park's wholistic rehabilitation and possible expansion. Unfortunately, budget and time constraints prevent the realization of this plan at this time. The Department of Recreation and Parks (RAP) and CD10 have requested siting options for a new recreation center be considered when implementing an expansion of the existing 65 year old recreation center.

CD10 and the RAP provided direction to the Bureau of Engineering (BOE) Architectural Division to move forward with the design of a  $\pm 1,500$  square foot addition to the existing gym, community garden, and fencing that would meet the Proposition K specified scope.

This report will detail the technical and programming hurdles that staff believes cannot be overcome to fulfill this Prop K specified project.

### ***Soil Conditions***

During the Pre-Design Phase for this project, BOE conducted a Geotechnical investigation to understand the existing soil's ability to support the proposed structure, hardscape and retaining walls.

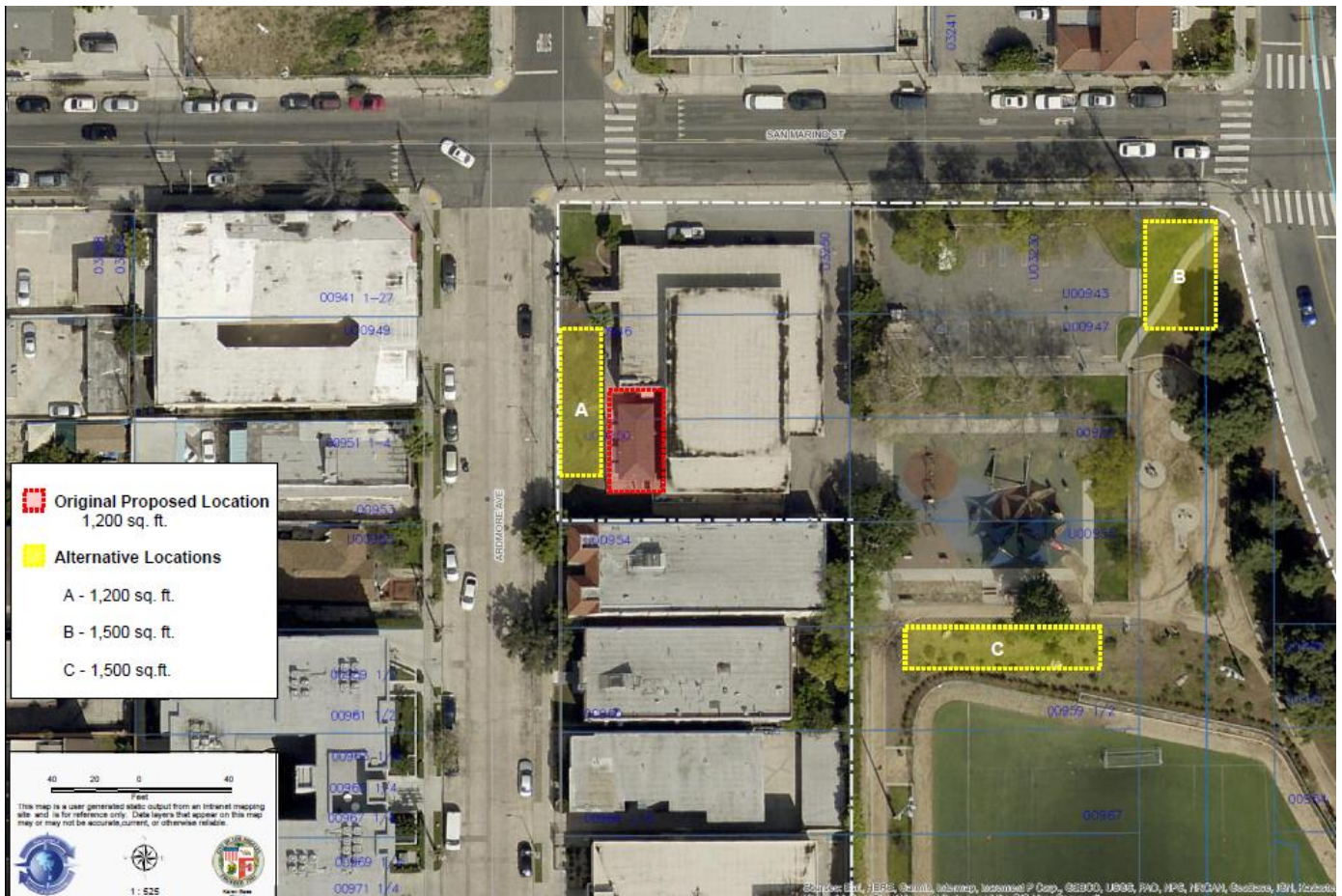
The Geotechnical report (Attachment No 1) identified layers of compacted fill that were added to the site prior to the building's construction in 1949, which also included a cut to fill approach to balance the site's excavation. Exploratory soil borings revealed compacted fill in various compositions up to 26 feet deep. Native soil is encountered around the same depth and is composed of stable sandy lean clay-like soil.

This revelation now places a requirement for the inclusion of piles down to the stable earth, 26' below ground, for any structure with a maximum applied static bearing pressure not expected to exceed 2,000 pounds per square foot (psf). The inclusion of a pile supported foundation not only affects the project costs, but it also impacts the location of the structure, as constructing the new building directly adjacent to the existing building will result in uneven settlement between the two buildings which, over a 30-year span, would create on-going maintenance and accessibility issues. Constructing piles underneath the existing gym would be cost prohibitive. Due to this analysis, staff cannot recommend an "expansion" of the existing gym as being part of or attached to the original gym.

### ***Alternate Locations***

As a result of the new geotechnical information noted above, BOE worked with RAP to explore options to locate a new structure away from the existing building but which could still be used to expand the capacity of programming at the existing building. These options seek to resolve two issues: the first is to ensure that the new structure will comply with accessibility standards under applicable disability laws, and the second is to ensure that the new structure will not prevent or limit the siting of a new recreation center at the park in the future. Specified Prop K funded facilities are required to be in place as constructed for a minimum of 30 years. Since the existing gymnasium is approximately 65-years old, RAP has identified it as a facility that is in need of replacement with a more appropriately sized recreation center (i.e. larger than the current size).

BOE analyzed three alternate locations as indicated in the diagram below.



Option A: This option relocates the new structure to the street level and to a distance roughly 30' away from the existing structure. While this option retains RAP's ability to operate programming near the existing building, it drastically limits the development of a new recreation center in this area of the park. In addition, it is inconsistent with RAP's preferred setbacks of its facility from the street.

Option B: This option locates the new structure to the Northeast side of the park. This location reduces the impact of future park-wide development efforts, but it impacts RAP's ability to program the space in conjunction with other similar after school programming. This location would require additional staff to operate the new facility as well as measures to ensure the safety of children. This option also places a fairly small structure at an elevated and prominent corner of the park, which may be preferred to be used as a future recreation center site. Finally, RAP has indicated that such a placement would be inconsistent with RAP's park planning processes as it blocks the main entrance into the park and impairs the visuals into the park itself from that entrance.

Option C: Option C locates the new structure in an area between the existing playground and the soccer fields. This option allows park developments to occur in the entire North side of the Park, and has a programming nexus with the adjacent playground and soccer

fields. Unfortunately, its distance to the existing gym would also require additional staff to operate the new facility, which would create staffing difficulties. One of RAP's objectives in constructing facilities and parks is that all programming be housed in one place to ensure proper staffing and oversight of programming and its participants.

### **INFEASIBILITY**

The analysis of the proposed development options, and their effect on the park's future possible development efforts, as well as the increased general funded/RAP funded staff costs, have led our team to seek an infeasibility determination for this project.

Provisions within Section 5 of the Ballot Measure provides details on the reprogramming of Prop K projects deemed infeasible, and states:

*"Funds shall be used for purposes set forth in Attachment A hereto. Should any project become infeasible for any reason determined by the City Council or there are project savings, the City Council may reprogram the applicable funds during the process described in Section 13"*

### **FISCAL IMPACT**

The requested infeasibility finding will have no negative impact on the General Fund.

Staff will report back to the Steering Committee on the proposed reprogramming of the unused funding capacity as part of the financial reconciliation of the overall program anticipated during the first quarter of 2025-26.

### **SUMMARY**

The program management team recommends Council approval to:

- Determine that the specified scope defined for the Ardmore Recreation Center project is infeasible due to the lack of viable development options that will retain the Park's ability to expand or be redeveloped in future years, while concurrently retaining the operability of programming on site using current staff.

Attachment No. 1: BOE Geotechnical Report Dated October 10, 2023.



**CITY OF LOS ANGELES**  
DEPARTMENT OF PUBLIC WORKS  
BUREAU OF ENGINEERING

**GEOTECHNICAL ENGINEERING DIVISION**



**GEOTECHNICAL ENGINEERING REPORT  
ARDMORE RECREATION CENTER – GYM EXPANSION  
3250 SAN MARINO STREET  
LOS ANGELES, CALIFORNIA**

**W.O. #E170495A  
GED FILE # 23-156  
OCTOBER 10, 2023**

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Figure 1 – Vicinity Map

Figure 2 – Site Location Map

Figure 3 – Geologic Map

Figure 4 – Earthquake Zones of Required Investigation

Figure 5 – Lateral Earth Pressures for Temporary Shoring Systems

Appendix A – Tetra Tech BAS, Inc., Geotechnical Data Report, Ardmore Recreation Center – Gym Expansion Project, 3250 San Marino Street, Los Angeles, California dated September 20, 2023.

Appendix B – Plans and Topographic Survey Map

Appendix C – Results of LPILE Analysis

## **1.0 INTRODUCTION**

This report presents the results of our geotechnical investigation for the proposed Ardmore Recreation Center – Gym Expansion Project (Project). The Project site, as shown on Figure 1 – Vicinity Map, is located on the southeast corner of San Marino Street and South (S) Ardmore Avenue in the Koreatown area. The site address is 3250 San Marino Street. The purposes of this investigation were to evaluate the nature and engineering properties of the subsurface materials and develop geotechnical recommendations for design and construction of the Project. The City of Los Angeles, Department of Public Works, Bureau of Engineering, Geotechnical Engineering Division (GED) has prepared this report in response to the Architectural Division's request.

## **2.0 PROJECT DESCRIPTION**

The project includes construction of an approximate 1,500-square-foot addition on the west side of the existing gym. The approximate location of the proposed addition is presented on Figure 2 – Site Location Map. The addition will consist of a two-story multipurpose room.

Structural load information for the proposed addition was not provided at the time this report was prepared. The maximum applied static bearing pressure is not expected to exceed 2,000 pounds per square foot (psf).

The final grades in the proposed gym expansion area are expected to be within 6 inches of the existing ones. If significant changes to the project are proposed, the findings and recommendations in this report may not be applicable, and a supplemental report may be required. The GED shall be provided an opportunity to review any proposed changes and determine if a supplemental report is required.

## **3.0 GEOTECHNICAL INVESTIGATION**

Our geotechnical investigation included data review, field exploration and laboratory testing. The field exploration and laboratory testing were completed by Tetra Tech BAS, Inc. (Tetra Tech). Tetra Tech summarized their findings in a data report, and a copy of their data report is provided in Appendix A of this report. The GED has reviewed Tetra Tech's report, concurs with the information contained in it, and accepts responsibility for the use of its contents.

### **3.1 REVIEW OF EXISTING INFORMATION**

The GED reviewed several plans for the existing recreation center, including a plot plan, grading plan, and architectural plans/details. The plans were prepared by the City's Department of Recreation and Parks and are dated May 1, 1949. Copies of the relevant sheets are provided in Appendix B of this report. Key information from our review is discussed in Sections 4.2 and 4.3 of this report.

### **3.2 FIELD EXPLORATION**

Tetra Tech drilled three limited access exploratory borings, and two additional borings that were used for borehole infiltration testing. The boring locations are presented on Tetra Tech's "Figure 2 – Site Plan and Soil Exploration Map" in Appendix A. The exploratory borings were advanced to depths ranging from approximately 21½ to 26½ feet below ground surface (bgs). The infiltration test borings, IT-1 and IT-2, were drilled to a depth of approximately 5 and 10 feet bgs, respectively. The subsurface conditions and infiltration test results are discussed in Sections 4.3 and 4.5 of this report, respectively.

### **3.3 LABORATORY TESTING**

Laboratory tests were performed on selected samples to characterize the engineering properties of the onsite soils. The laboratory testing program included in-situ moisture content and dry density, direct shear, resistance (R-) value, expansion index (EI), particle size distribution, hydrometer, percent passing the No. 200 sieve (i.e. fines content), Atterberg Limits, and corrosion potential. The test results are discussed in Section 4.6 of this report, and the individual results are included in Tetra Tech's report (Appendix A).

## **4.0 DISCUSSION OF FINDINGS**

The following discussion of findings is based on the results of the field exploration and laboratory testing programs.

### **4.1 GEOLOGIC SETTING**

The Geologic Map by Thomas W. Dibblee Jr. (1991), as shown on Figure 3 – Geologic Map, indicates the site is underlain by Older Surficial Sediments from the Pleistocene Epoch. These sediments are comprised of alluvial gravel, sand, and clay (Qae).

### **4.2 SITE CONDITIONS**

The Project site is bounded by S Ardmore Avenue to the west, San Marino Street to the north, the Seoul International Park to the east, and a private residential property to the south. There is an existing 3-story apartment building on the adjacent southern property, and the north side of this apartment building extends very close to the property boundary.

The Project site includes 3 separate parcels, and each parcel is approximately 130 feet long by 45.5 feet wide. The total Project site area is 17,720 square feet. The site is occupied by an existing recreation center, which was previously referred to as a "Clubhouse." Although we were unable to find actual as-built plans, the design plans were prepared in 1949. The plans show portions of the building are single-story and other portions are two stories. The building footprint extends over portions of all three parcels. The proposed gym expansion area will extend over portions of the middle and southern parcels.

The Project site is currently accessed from San Marino Street. The north side of the building was constructed with an overhanging canopy supported on steel columns, which provides covered parking. The ground surface on the north and east sides of the building is paved with asphalt concrete. There are two separate chain link security fences; one that extends along most of the western and southern property boundary, and another parallel



one closer to the building. The chain link fence, which extends along most of the western and southern property boundaries, was constructed over a concrete retaining wall. The maximum wall height is approximately 3 feet. The western area between the fences is undeveloped and the ground surface is unpaved. The southern area between the fences consists of a 3-foot-high graded slope that descends to the south. The sloping ground is paved with Portland Cement Concrete (PCC). At the time of this report, the proposed gym expansion area is occupied by wood-framed shade canopy and several aluminum picnic tables. The ground surface is paved with PCC. There is a concrete retaining wall that extends around the west and south sides of the gym expansion area, and the maximum wall height is approximately 2 feet.

The (1949) Grading Plan indicates the building was constructed over a cut-to-fill transition pad. The northeast portion was excavated (i.e. cut) and fill was placed in the southwest portion. The plan shows the finished floor elevation of the building is 197 feet, and the topographic contours across the building footprint range from approximately 192 feet to 198 feet. A recent 2023 topographic survey map, which is also provided in Appendix B, shows the existing ground surface in the gym expansion area is slightly higher than 197 feet (approximately 199 feet). The gym expansion area is relatively flat (El. = 199 feet); however, the elevation difference between the southwest corner of the gym expansion area and the southwestern property boundary adjacent to S Ardmore Avenue is about 10 feet. The ground surface descends to the west/southwest at an inclination of approximately 3.5:1 horizontal:vertical (H:V).

#### **4.3 SUBSURFACE CONDITIONS**

Uncertified fill was encountered in all three exploratory borings, which is consistent with the information on the (1949) Grading Plan. Based on the (1949) Grading Plan, the fill thickness in the expansion area is approximately 8 to 10 feet; however, the fill thickness encountered in the borings ranges from approximately 12 to 14½ feet. The GED is of the opinion that this inconsistency is due to the site conditions prior to construction of the building pad. The construction of the building pad circa 1949 may have included placement of fill over existing fill. The fill is comprised of sandy lean clay and clayey sand. Fill indicators such as red brick and charcoal fragments were observed in all three borings. The field Standard Penetration Test (SPT) blow counts range from 4 to 7, which indicates a loose relative density or medium consistency.

The underlying native soil consists of sandy lean clay to the maximum explored depth of approximately 26½ feet bgs. Based on the field SPT blow counts, the native clayey soil is generally very stiff to hard.

#### **4.4 GROUNDWATER**

Groundwater was not encountered in the three borings, which were advanced to a maximum explored depth of approximately 26½ feet bgs. Groundwater information from the California Department of Conservation, Division of Mines and Geology (DMG, 1998) indicates the shallowest reported historic groundwater depth is approximately 20 feet. Groundwater levels at the site are expected to vary. Groundwater levels can also fluctuate with seasonal rainfalls, dry weather (i.e. drought conditions), and pumping activities in the vicinity of the site. Based on the results of the field exploration, groundwater is not expected to affect the proposed construction.

#### **4.5 BOREHOLE INFILTRATION TEST RESULTS**

Two borehole infiltration tests were performed to evaluate the feasibility of onsite stormwater infiltration. The soils within the infiltration zone(s) consist of existing uncertified fill. The infiltration rates were estimated using the guidelines presented in the County of Los Angeles, Department of Public Works, Geotechnical and Materials Engineering Division's (2021) Administrative Manual. The infiltration rates were averaged over a period where a steady-state flow condition could be achieved. The *unadjusted* infiltration rate was found to range between approximately 0 and 24 inches per hour. The feasibility of stormwater infiltration is discussed in Section 6.6 of this report.

#### **4.6 LABORATORY TEST RESULTS**

Laboratory tests were performed on selected samples to characterize the engineering properties of the existing uncertified fill and native soil.

Moisture and dry density determinations were performed on samples from the three exploratory borings to evaluate the in-situ unit weights of the fill and native soil. Test results indicate the moisture content and dry density of the fill ranges from about 10.6 to 18.7 percent and 84 to 113 pounds per cubic foot (pcf), respectively. The total unit weight of the fill ranges from approximately 97 to 124 pcf with an average value of 118 pcf. Test results indicate the moisture content and dry density of the native soil ranges from about 15.6 to 18.4 percent and 111 to 117 pcf, respectively. The total unit weight of the native soil ranges from approximately 129 to 135 pcf with an average value of 133 pcf.

Particle size distribution / fines contents tests were performed on 10 samples; 7 of the fill and 3 of the native soil. The test results indicate both the fill and native soil contain trace amounts of fine gravel (less than 5 percent). The test results indicate the fines content of the fill is generally between 25 to 62 percent and the fines content of the native soil is generally between 57 and 62 percent.

Also, hydrometer tests were performed on two samples from B-3; one of the fill and the other native soil. The hydrometer test results indicate the clay content (percent finer than 0.005 mm) of the fill and native soil is approximately 24 and 26 percent.

An EI test was performed on a bulk sample of the fill material from B-2. The test results indicate the EI value is 56, which indicates a medium expansion potential.

Atterberg Limits tests were performed on 4 samples to evaluate the shrink-swell behavior of the fill and native soil. The test results indicate the plasticity index (PI) of the fill ranges from 6 to 26 and the PI of the native soil ranges from 10 to 13. Based on these test results, most of the soils are expected to exhibit a moderately low shrink-swell behavior; however, the near surface fill is expected to exhibit moderate shrink-swell behavior.

Direct shear tests were performed on four relatively undisturbed samples; two of the fill and two of the native soil. The direct shear test results indicate the ultimate friction angle of the fill is 31 degrees for both samples tested. The ultimate cohesion value of the fill ranges from 100 to 25 psf, respectively. The direct shear test results indicate the ultimate friction angle and cohesion value of the native clayey soil ranges from 27 to 29 degrees and 300 to 550 psf, respectively.

Finally, an R-value test was performed on a bulk sample of the existing clayey fill material from B-2. The test results indicate the R-value is 9.

## 5.0 SEISMIC CONSIDERATIONS

The following sections present seismic design parameters and discuss seismic hazards for the site.

### 5.1 2020 LABC SEISMIC DESIGN PARAMETERS

Seismic design parameters for the project were developed in accordance with the 2020 Los Angeles Building Code (2020 LABC), which are based on the procedures outlined in ASCE 7-16. The seismic design parameters for the site are summarized in Table 1.

TABLE 1 – SEISMIC DESIGN PARAMETERS

| Parameter  | Value                     |
|------------|---------------------------|
| Site Class | D                         |
| $S_s$      | 1.961                     |
| $S_1$      | 0.696                     |
| $S_{MS}$   | 2.353                     |
| $S_{M1}$   | Null – see Section 11.4.8 |
| $S_{DS}$   | 1.569                     |
| $S_{D1}$   | Null – see Section 11.4.8 |

The site modified peak ground acceleration ( $PGA_M$ ) at the site is 0.92g.

### 5.2 SEISMIC HAZARDS

This section provides the results of our evaluation of earthquake-related geologic/geotechnical hazards for the site, including surface fault rupture, and liquefaction. Figure 4 presents the California Geological Survey's (CGS') Earthquake Zones of Required Investigation for the relevant area of the Hollywood Quadrangle (1999).

#### 5.2.1 Surface Fault Rupture

As shown on Figure 4, the project site is not located within a State of California Alquist-Priolo Earthquake Fault Zone (NavigateLA). Furthermore, the site is not located within a City of Los Angeles Fault Rupture Study Area; therefore, the potential for surface fault rupture to affect the project is considered remote.

#### 5.2.2 Liquefaction Evaluation

As shown on Figure 4, the project site is not located within a liquefaction zone. Groundwater was not encountered in the borings to the maximum explored depth of approximately 26½ feet. The potential for liquefaction is expected to be very low.

## **6.0 RECOMMENDATIONS**

Based on the results of our investigation, the proposed project is considered geotechnically feasible provided the recommendations presented in this report are incorporated into the design and construction. If changes in the design are made, or variations or changed conditions are encountered during construction, the GED shall be notified to determine if supplemental recommendations are required.

### **6.1 EARTHWORK**

All earthwork shall be performed in accordance with the geotechnical recommendations presented in this report and the Los Angeles Department of Building and Safety (LADBS), Grading Division's requirements. Furthermore, all earthwork should be performed under the observation and testing of the GED.

#### **6.1.1 Site Preparation**

Site preparation will initially involve the demolition of existing pavement and structures within the construction area. Following demolition, the construction area should be cleared of any vegetation and stripped of miscellaneous debris and other deleterious material. These materials shall be removed from the construction area and hauled to a proper disposal area. Organic matter and other material that may interfere with the completion of the work should be removed from the limits of the construction area. Vegetation and organic matter should not be incorporated into the compacted fill. Organic rich soil, if present, may be stockpiled for future landscaping. Voids resulting from the demolition shall be backfilled with properly compacted fill.

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

#### **6.1.2 Over-Excavation**

Over-excavation and recompaction is not required for the proposed gym expansion as the floor will consist of a pile-supported structural slab (see Sections 6.2 and 6.3).

The existing soil beneath new pavement areas shall be removed to a depth of at least 18 inches below the proposed pavement section. The excavation shall extend laterally at least 18 inches beyond each edge of the pavement or to the property boundary, whichever is less. The over-excavation and recompaction, including subgrade preparation (see Section 6.1.3 below), shall result in at least 24 inches of compacted fill beneath the aggregate base.

The soil beneath non-structural footings (planters, fences, and non-retaining site walls) shall be removed to a depth of 18 inches below the bottom of footing. The excavation shall extend laterally at least 2 feet beyond the edge of the footing or to the property boundary, whichever is less. The over-excavation and recompaction, including subgrade preparation (see Section 6.1.3 below), shall result in at least 24 inches of compacted fill beneath footings.

### **6.1.3 Subgrade Preparation**

Excavation bottoms shall be scarified to a depth of 6 inches, moisture conditioned between 0 and 3 percent above the optimum moisture content, and compacted to at least 90 percent relative compaction (RC), as determined by ASTM Test Method D1557. Excavation bottoms shall be approved by a GED representative and the LADBS Grading Inspector prior to backfill.

### **6.1.4 Temporary Excavations**

Based on our observations during subsurface investigation and results of laboratory tests, the materials 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 5 feet. Unsurcharged excavations greater than 5 feet and to a maximum of 12 feet shall be sloped at a 1:1 (H:V) or flatter inclination from the ground surface to the bottom of the excavation. If deeper excavations are proposed, they shall be reviewed by the GED, and supplemental recommendations may be required.

### **6.1.5 Temporary Shoring**

Cantilever or braced shoring may be considered at this site as an alternative to temporary excavations. Shoring deflections shall not exceed ½-inch unless it can be clearly demonstrated with calculations that adjacent structures, utilities, and/or streets will not be impacted. Sheet piles, box shoring, and/or trench shields (i.e. speed shores) are generally not acceptable. The GED may approve them; however, approval depends on several factors. If they are proposed, the GED will review each situation on a case-by-case basis.

Settlement of structures behind shoring will occur in proportion to both the distance between the shoring and the structure, and the amount of horizontal deflection of the shoring system. Vertical settlement will be a maximum at the shoring face and decrease as the horizontal distance from the shoring increases. Beyond a distance from the shoring equal to the height of the shoring, the settlement is expected to be negligible. The maximum vertical settlement is expected to be about 75 percent of the horizontal deflection of the shoring system. Prior to excavation, it is recommended that walls, structures, or portions of structures within a horizontal distance of 1½ times the depth of the excavation be inspected to determine their present condition. For documentation purposes, photographs should be taken of preconstruction conditions and level surveys should be performed.

#### **6.1.5.1 Lateral Earth Pressures**

Cantilever or braced shoring shall be designed for the lateral earth pressures shown on Figure 5 – Lateral Earth Pressures for Temporary Shoring Systems. These values are based on the assumption that (1) the shored soil material is level at ground surface, (2) the exposed height of the shoring is no greater than 15 feet, and (3) the shoring is temporary, and will not be required to support the soil longer than about six months.

Surcharge coefficients of 0.31 and 0.47 may be used with uniform vertical surcharges for cantilever and braced shoring lateral earth pressures, respectively. These surcharge pressures should be added to the lateral earth pressures.

#### *6.1.5.2 Soldier Piles and Lagging Design*

Drilled holes for soldier piles shall be backfilled with Controlled Low Strength Material (CLSM) per Section 201-6 of the 2021 Edition “Greenbook” Standard Specifications for Public Works Construction. CLSM shall extend from the bottom of lagging (i.e. proposed excavation depth) to the ground surface. The CLSM shall contain 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. Drilled holes below the excavation bottom shall be backfilled with structural concrete. To reduce the potential for sloughing and caving of the soils, continuous lagging shall be installed between the soldier piles. All lumber shall be pressure-treated in accordance with Specification C-2 of the American Wood Preservers Association.

#### *6.1.5.3 Construction Consideration for Soldier Piles*

Based on the results of the investigation, the potential for soil caving to occur during pile excavation is considered low. If caving conditions are encountered, temporary steel casing 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 shown on the shoring plans. Drilling shall be accomplished within the steel casing.

Even though the piles will be used for temporary shoring, it will be necessary for the contractor to remove loose soil from the bottom of the pile excavation. Upon completion of drilling, secure covers shall be placed over the excavations. Concrete placement shall be completed within 12 hours of drilling and drilled holes shall not be left open overnight. Drilled excavations shall be observed and approved by the GED prior to installation of steel reinforcement.

Concrete placement by the pumping and tremie method will be required. The steel reinforcement shall be installed and the concrete pumped immediately after drilling is completed. No drilled hole should be drilled immediately adjacent to another pile until the concrete in the other pile has attained its initial set. The tremie pipe should extend to the bottom of the pile excavation. During concrete placement, the bottom of the tremie pipe shall remain embedded in at least 3 feet of concrete at all times. During concrete placement, the casing shall be removed slowly. Furthermore, the casing shall extend above ground surface and shall always be filled with a sufficient head of concrete above the bottom of the casing before it is pulled out.

#### **6.1.6 Fill Materials and Backfill Placement**

The existing fill is suitable for reuse as compacted fill, except within the upper 12 inches beneath new pavements. The upper 12 inches beneath new pavement shall consist of import granular soil. Due to the clayey nature of the existing fill, an active mixing/blending operation may be required to achieve a uniformly moisture conditioned fill material. It is the contractor's responsibility (i.e. means and methods) to achieve a “uniformly” moisture conditioned fill material.

Import soil shall be predominantly granular (minimum 80% passing the No. 4 sieve and between 10% and 35% passing the No. 200 sieve), non-expansive (EI less than 20). All fill shall be free of organic or inorganic debris, contamination and materials with any dimension larger than 3 inches. Proposed import soil shall be reviewed by the GED for approval prior to delivery to the job site. The GED shall be notified a minimum of three working days prior to scheduled delivery to the site.

Fill material shall be placed in loose lifts not exceeding 8 inches in thickness, moisture-conditioned to between 0 and 3 percent above the optimum moisture content and mechanically compacted. The upper 12 inches of import granular fill beneath pavements, crushed aggregate base (CAB), and crushed miscellaneous base (CMB) shall be compacted to at least 95 percent RC. All remaining “secondary structural” fill may be compacted to at least 90 percent RC.

Fill placement and compaction shall be observed and tested by a certified compaction testing agency working under the direct supervision of the GED. 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 compacted fill soils become softened or disturbed, they shall be replaced or recompacted at the discretion of the GED before additional fill or construction is placed. Certification and inspection approvals for compromised soils are void and invalid.

#### **6.1.7 Utility Trench Backfill**

Trench excavations for utility pipes may be backfilled with onsite soils under the observation of a representative of the 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 above (Section 6.1.5). Densification by flooding or jetting is not allowed.

#### **6.1.8 Controlled Low Strength Material**

CLSM is an acceptable alternative to secondary structural fill; however, the requirements for secondary structural fill are different than those for temporary shoring. If CLSM is used in lieu of secondary structural fill, it shall meet the requirements outlined in Section III of the LADBS’ Bulletin P/BC 2020-121.

#### **6.1.9 Fill Certification**

Upon successful completion of fill placement and compaction, the GED will issue a Compaction Certification for the fill. Unless approved by the Building Inspector during construction, the Contractor shall not pour footings until an approval letter is issued by the LADBS, Grading Division for the Compaction Certification. The contractor may excavate in compacted fill for foundation elements before the fill certification approval letter is issued but does so at his/her own risk.

### **6.2 DEEP FOUNDATIONS – MULTIPURPOSE ROOM ADDITION**

We recommend the addition be supported on cast-in-drilled-hole (CIDH) piles. The minimum pile diameters shall be 24 inches. The minimum pile spacing shall be 3 diameters

on center. If the adjacent piles have different diameters, the pile spacing shall be based on the pile with the larger diameter.

### **6.2.1 Allowable Axial Capacity in Compression**

The axial compression capacity assumes the CIDH piles develop their capacity solely from skin friction or side resistance. Also, all skin friction shall be neglected in the upper 15 feet bgs. As mentioned, the proposed construction will not include raising the site grade in the proposed gym expansion area; therefore, the GED is of the opinion that the effects of downdrag forces on the CIDH piles will be negligible. The pile recommendations in this report do not account for downdrag forces. An allowable adhesion value of 650 psf may be used below 15 feet. The minimum pile embedment depth shall be 20 feet; however, the actual depth(s) may be deeper and will likely depend on the required lateral loads. We anticipate the piles will be isolated (i.e. spaced at least 3 pile diameters on center), and therefore, group effects are not anticipated. The total settlement for each pile is not expected to exceed ½-inch provided the piles are properly constructed (see Section 6.2.4).

### **6.2.2 Allowable Axial Capacity in Tension**

The allowable axial tensile capacity may be assumed to be ½ the axial capacity in compression (see Section 6.2.1 above). The weight of the embedded portion of the concrete shaft may be added to the tensile capacity.

### **6.2.3 Lateral Load Behavior**

The lateral load behavior of the CIDH piles was evaluated using the LPILE (Ensoft, 2016) software program. LPILE (2016) uses load deflection (p-y) curves to approximate the relationship between soil resistance and pile deflection. LPILE analysis was performed for 24-, 30-, and 36-inch diameter CIDH piles. The lateral load behavior was evaluated based on an allowable deflection of ½-inch at the pile head for both a free and fixed head condition. We assumed a concrete compressive strength of 3,000 psi for our analyses and a steel reinforcement equal to approximately 1.0 percent of the total pile cross-sectional area.

The main inputs in the LPILE software for each soil layer are the unit weight and soil shear strength. The existing uncertified fill was assumed to behave as “sand” with a total unit weight of 98 pcf, effective friction angle of 20 degrees, and no cohesion. A request for modification of building ordinances for deriving lateral support from the existing uncertified fill will be submitted concurrently with this report. The existing native soil below 14½ feet was assumed to behave as “stiff clay without free water.” This material was modeled assuming a total unit weight of 130 pcf and an undrained shear strength value of 1,500 psf. The results of the LPILE analyses are included in Appendix C of this report.

The structural engineer shall review the results of our analyses once the actual loads have been determined. Supplemental analyses may be required.

### **6.2.4 CIDH Pile Construction**

The recommendations presented in Section 6.1.5.3 are applicable to CIDH pile construction for the proposed gym expansion.



### **6.3 STRUCTURAL FLOOR SLAB**

The floor slab for the proposed gym expansion shall be entirely supported on CIDH piles and not rely on any support from the underlying fill material. It is the structural engineer's responsibility to design the slab thickness and steel reinforcement.

Also, the subgrade shall be prepared in accordance with the recommendations in Section 6.1.3 of this report. Furthermore, the subgrade soil shall not be allowed to dry out between the time the subgrade preparation has been completed and the time concrete is placed.

Care shall be taken to avoid slab curling if concrete is placed in hot weather. Slabs should be designed and constructed as promulgated by the Portland Cement Association. Prior to the slab pour, all utility trenches should be properly backfilled and compacted.

If a moisture-sensitive floor covering such as vinyl, tile or carpet is proposed, the slab can be protected by placing a minimum 10-mil-thick polyethylene vapor barrier between the slab and compacted subgrade. If the barrier is used, it should be placed between two 1-inch layers of sand to protect it from punctures and to aid in the concrete cure. Vapor barrier seams should be overlapped a minimum of 6 inches and taped or otherwise sealed. The actual requirements for a barrier and protective sand layer shall be determined by the designer.

### **6.4 PLANTER, FENCE WALL, AND NON-STRUCTURAL FOUNDATIONS**

Continuous and/or isolated footings may be used to support planter, fence, and other non-structural (i.e. non-retaining) site walls less than 8 feet tall. Non-structural footings shall be structurally isolated from adjacent structural foundations. Also, the footings shall bear on at least 24 inches of compacted fill. The structural engineer is responsible for designing the steel reinforcement.

Footings with a minimum width of 12 inches and embedded a minimum of 18 inches below the lowest adjacent grade, bearing on properly compacted fill, may be designed for an allowable bearing capacity of 1,000 psf. The allowable bearing capacity includes dead-load and sustained live-loads. The value may be increased by one-third for short durations of loading which will include the effect of wind or seismic forces.

Lateral load resistance will be developed by passive soil pressure against the footings and by friction acting along the base of the footings. An allowable passive pressure of 150 psf per foot of depth may be used for design purposes. Passive pressure shall begin at a depth of 12 inches below the ground surface; however, if the structure is located adjacent to an exterior slab or pavement, passive pressure may begin at the ground surface. The allowable passive pressure is only applicable for level (ground slope equal to or flatter than 5:1) conditions. An allowable coefficient of friction of 0.35 may be used for dead and sustained live loads for frictional resistance.

### **6.5 DRAINAGE**

Final grades should be sloped to direct surface water away from foundations and slabs and towards discharge facilities. Surface water should not be allowed to pond anywhere onsite. Water from downspouts, if any, should be collected in closed pipes and conveyed to storm drains or other appropriate discharge locations.

## **6.6 FEASIBILITY OF STORMWATER INFILTRATION**

The requirements outlined in LADBS' Information Bulletin P/BC 2020-118 typically don't allow for storm water infiltration into existing uncertified fill material. Due to the potential for significant settlement to occur in the existing fill materials, the GED does not consider this site to be feasible for "shallow" stormwater infiltration. Deeper stormwater infiltration via a dry well system may be feasible; however, it would require an additional investigation. Also, due to the clayey composition of the native soil, the infiltration rate is expected to be low. If the adjusted infiltration rate is less than approximately ½-inch per hour, a dry well would not be an acceptable alternative to a "shallow" infiltration pit. A supplemental report will need to be prepared if a dry well system becomes incorporated into the project scope. To meet the City's LID BMP requirements, the civil designer should consider other alternatives such as biofiltration and/or a capture-and-use system.

## **6.7 SULFATE ATTACK AND CORROSION POTENTIAL**

Corrosion Potential tests were performed on a sample of the existing fill and on a sample of the native soil. The test results are presented in Tetra Tech's report (Appendix A). The soil pH ranges from 7.9 to 8.5, the chloride concentration ranges from 19 to 21 parts per million (ppm), and the sulfate content ranges from 37 to 74 ppm. For structural elements, Caltrans (2021) considers a soil to be corrosive if one or more of the following conditions exist:

- Chloride concentration is 500 ppm or greater;
- Sulfate concentration is 1,500 ppm or greater;
- pH is 5.5 or less.

Based on Caltran's (2021) criteria, the onsite soils are not corrosive when in contact with ferrous metals. According to criteria by other agencies such as NAVFAC, however, the onsite soils may be classified as mildly or slightly corrosive. If desired or required, a corrosion specialist should be consulted regarding selection of construction materials and/or protective design.

The results of the sulfate concentration tests indicate that, based on the American Concrete Institute (ACI) criteria, the onsite soils have an exposure category of S0. Refer to Table 19.3.2.1 in the ACI 318-19 Manual for appropriate concrete mix design. Concrete that will be exposed to sulfate-containing solutions or soils shall comply with the maximum water-cementitious materials ratios and/or minimum specified compressive strength and be made with the appropriate type of cement in accordance with ACI 318-19, Table 19.3.2.1.

## **6.8 PAVEMENT DESIGN**

The following pavement designs have been prepared for parking areas and driveways based on an R-value of 9. In all pavement areas, the subgrade shall consist of 12 inches of compacted import granular fill (minimum 95 percent RC). In addition, the compacted import granular fill shall be underlain by at least 12 inches of compacted soil (minimum 90 percent RC).

### 6.8.1 Asphalt Pavement Sections

Traffic indexes (TIs) were not provided to us at the time of this report. Pavement sections were calculated for the range of TIs shown in the table below.

TABLE 2 – ASPHALT PAVEMENT SECTION LAYER THICKNESSES (INCHES)

| Layer                                     | Traffic Index = 5.0 | Traffic Index = 6.0 | Traffic Index = 7.0 | Traffic Index = 8.0 | Traffic Index = 9.0 |
|---|---------------------|---------------------|---------------------|---------------------|---------------------|
| Asphalt Concrete Surface                  | 3.0                 | 4.5                 | 5.0                 | 6.0                 | 8.0                 |
| CAB/CMB (95 percent RC)                   | 9                   | 10                  | 12                  | 15                  | 14                  |
| Compacted Subgrade (90 and 95 percent RC) | 24                  | 24                  | 24                  | 24                  | 24                  |

### 6.8.2 Portland Cement Concrete Pavement

Portland cement concrete (PCC) pavement may be used instead of asphalt concrete. For TIs between 6 and 7, a section of 6 inches of PCC over 8 inches of crushed aggregate base or crushed miscellaneous base is recommended. For TIs of 8 and 9, the PCC section should be increased to 7 and 8 inches, respectively. The Portland Cement Concrete should have a minimum modulus of rupture of 650 psi at 28 days.

## 7.0 SUPPLEMENTAL GEOTECHNICAL SERVICES

### 7.1 REVIEW OF PLANS AND SPECIFICATIONS

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

### 7.2 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:

- During demolition;
- Upon completion of site clearing;
- During site excavation;

- During subgrade preparation;
- During fill placement and compaction;
- During CIDH pile excavation for the multipurpose room addition;
- During excavation and backfilling of all utility trenches; and
- When any unusual or unexpected geotechnical conditions are encountered.

## 8.0 CLOSURE

If you have any questions regarding this report, please contact Easton Forcier at (213) 847-0476.

*Mahmood Nabils*

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Mahmood Nabils  
Civil Engineering Associate II



*Easton Forcier* 10-10-23

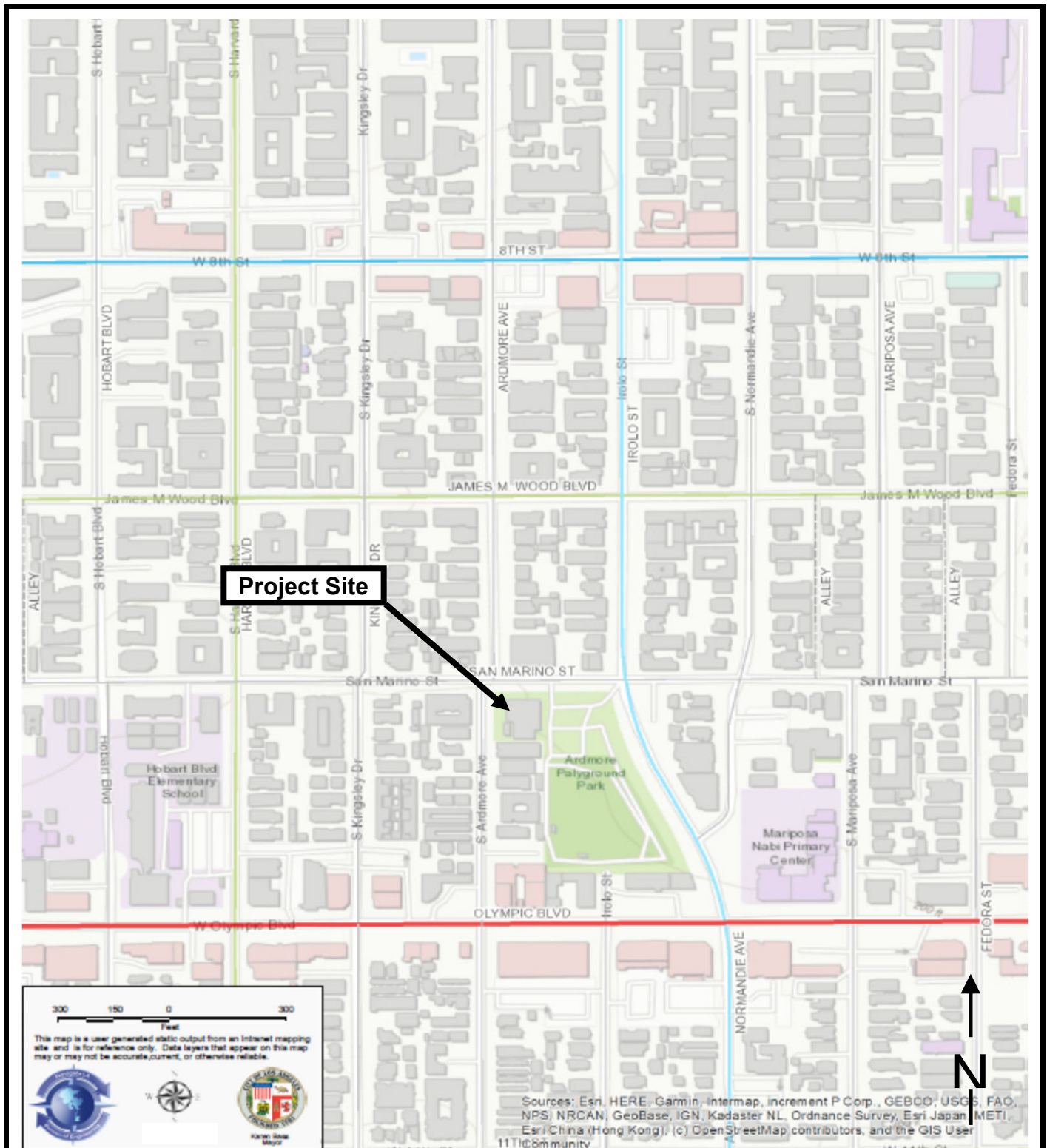
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Easton Forcier, GE 2948  
Geotechnical Engineer II

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## **FIGURES**



## Vicinity Map

**ARDMORE RECREATION  
CENTER  
GYM EXPANSION**  
3250 San Marino Street  
Los Angeles, CA

**BUREAU OF ENGINEERING  
GEOTECHNICAL ENGINEERING DIVISION  
(GED)**  
GED FILE No.: 23-156  
OCTOBER 2023

**Figure  
No. 1**





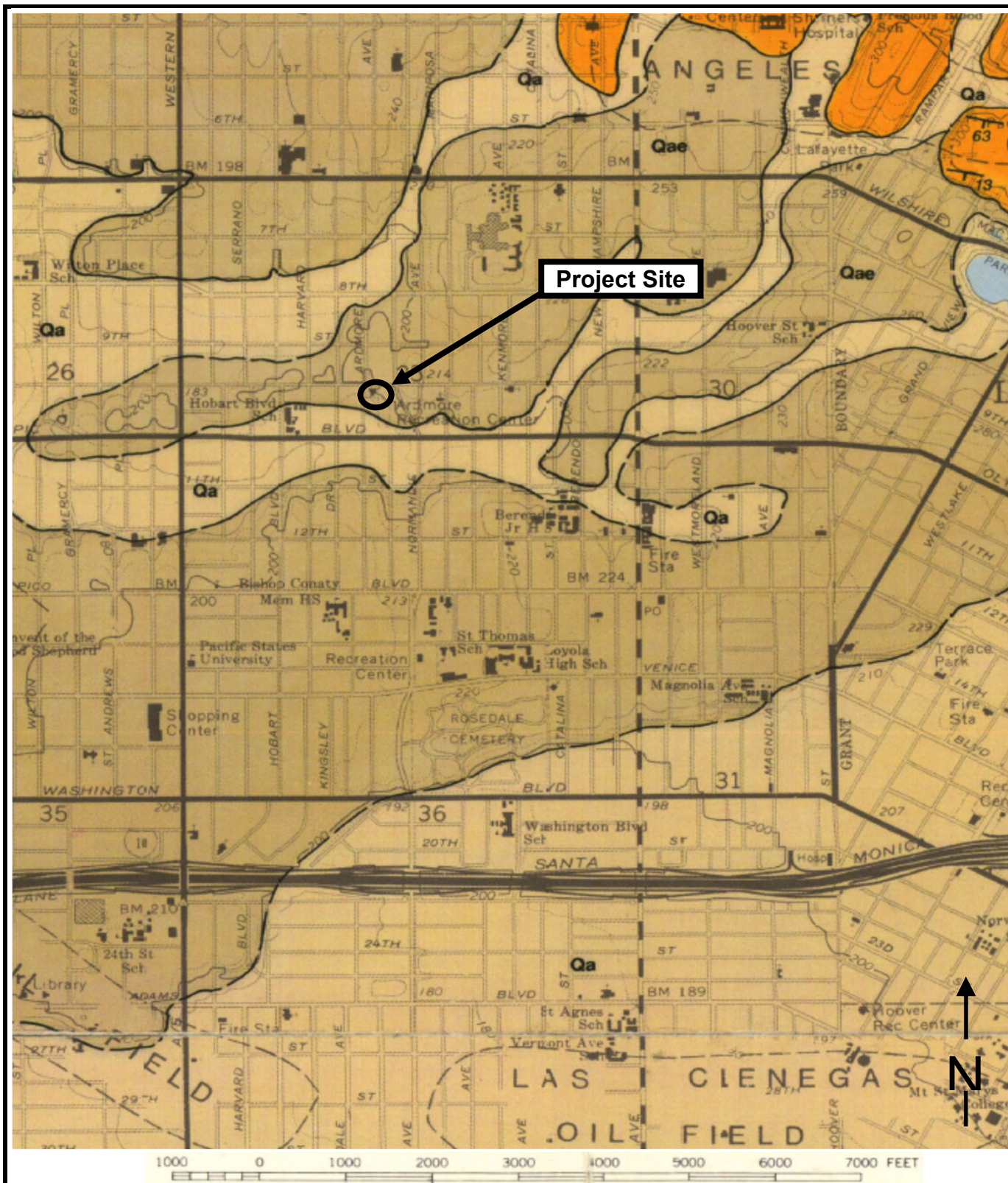
## Site Location Map

**ARDMORE RECREATION  
CENTER  
GYM EXPANSION**  
 3250 San Marino Street  
 Los Angeles, CA

**BUREAU OF ENGINEERING  
GEOTECHNICAL ENGINEERING DIVISION  
(GED)**  
 GED FILE No.: 23-156  
 OCTOBER 2023

**Figure  
No. 2**





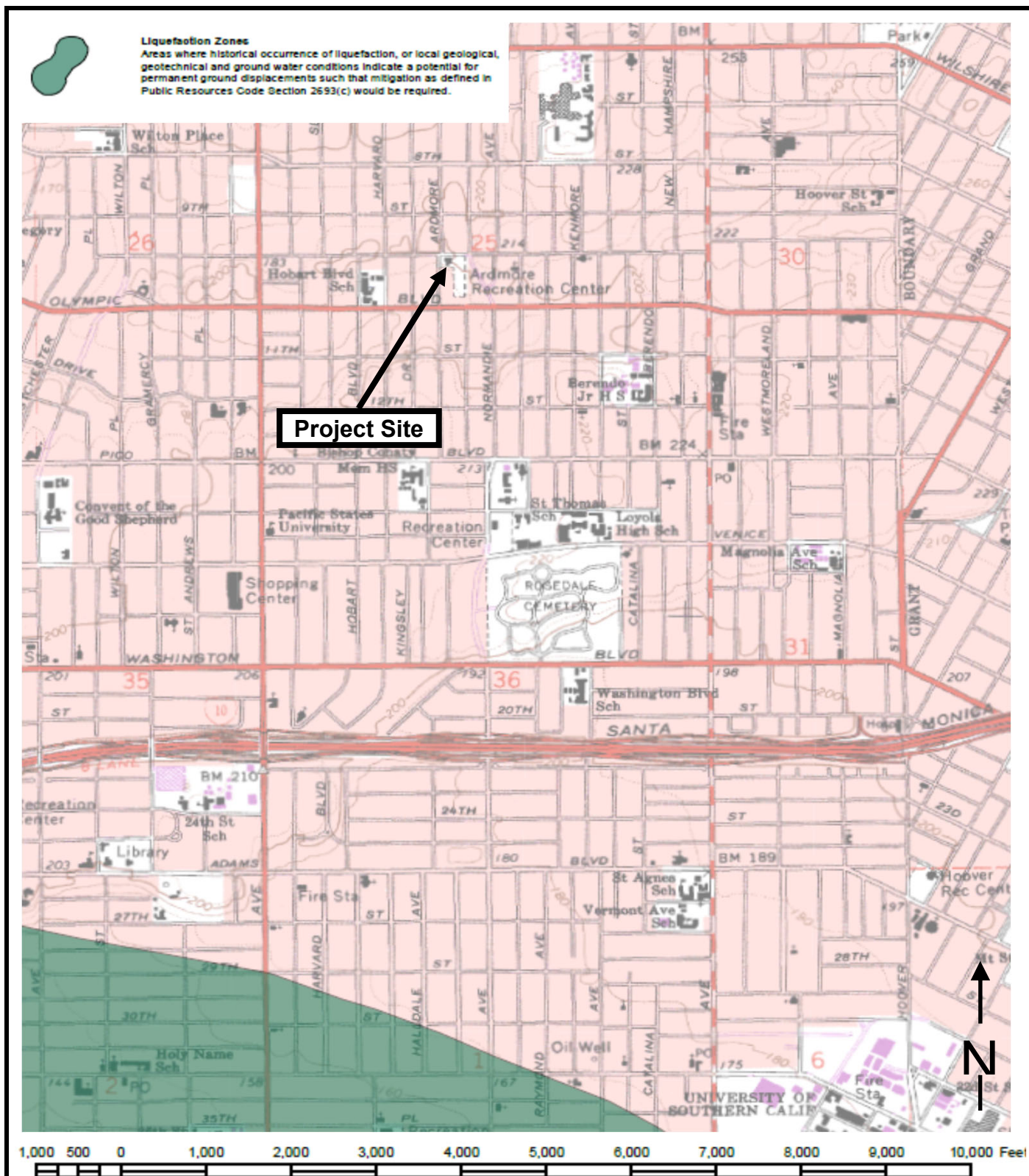
## Geologic Map

**ARDMORE RECREATION  
CENTER  
GYM EXPANSION**  
3250 San Marino Street  
Los Angeles, CA

BUREAU OF ENGINEERING  
GEOTECHNICAL ENGINEERING DIVISION  
(GED)  
GED FILE No.: 23-156  
OCTOBER 2023

Figure  
No. 3



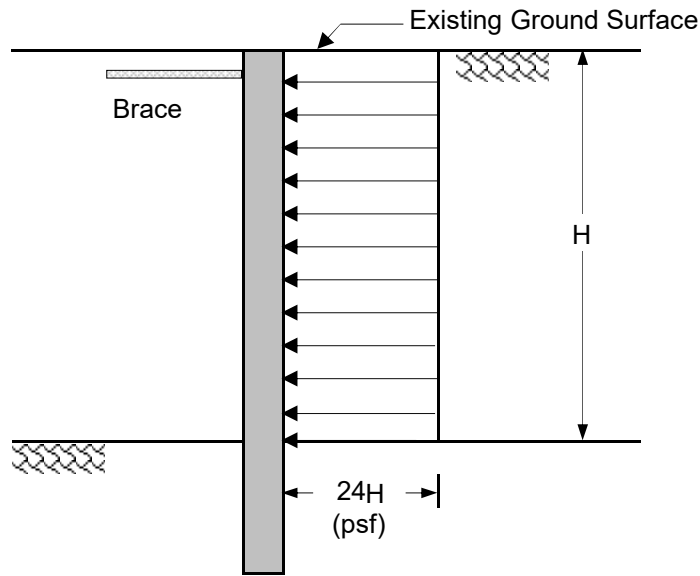


## Earthquake Zones of Required Investigation

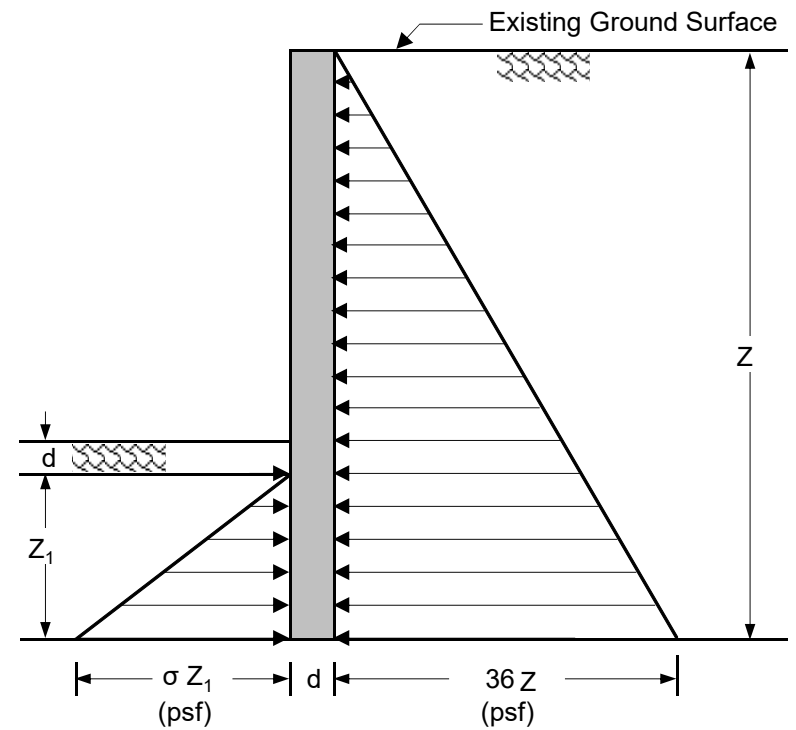
**ARDMORE RECREATION  
CENTER  
GYM EXPANSION**  
3250 San Marino Street  
Los Angeles, CA

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Figure  
No. 4



BRACED SHORING



CANTILEVER SHORING

$\sigma = 510$  pcf for soldier piles spaced at least  $2.5d$  apart  
 $\sigma = 250$  pcf for soldier piles spaced less than  $2.5d$  apart  
 $\sigma$  assumes structural concrete backfill below excavation bottom

Notes:

1. Not to scale.
2. Dimensions are in feet.
3. Earth pressures shown are based on level backfill conditions behind shoring elements and groundwater below bottom of shoring elements.

**LATERAL EARTH PRESSURES FOR TEMPORARY SHORING SYSTEMS**

**Ardmore Recreation Center - Gym Expansion  
Los Angeles, California**

|   |                    |                     |
|---|--------------------|---------------------|
| By: ERF   | Date: October 2023 | GED Fil No.: 23-156 |
| City of Los Angeles, DPW, BOE,<br>Geotechnical Engineering Division |                    | Figure <b>5</b>     |

## **APPENDIX A**

**Geotechnical Data Report**  
**Ardmore Recreation Center – Gym Expansion Project**  
**3250 San Marino Street**  
**Los Angeles, California**  
**by Tetra Tech dated September 20, 2023**

# Geotechnical Data Report

**Ardmore Recreation Center – Gym Expansion Project**  
**3250 San Marino Street**  
**Los Angeles, California**



Prepared for:

Geotechnical Engineering Division  
City of Los Angeles  
1149 S. Broadway, Suite 120  
Los Angeles, California 90015

Prepared by:

Tetra Tech,  
21700 Copley Drive Suite 200  
Diamond Bar, California 91765

September 20, 2023  
Project No. ciLA 23-05E





Project No. ciLA 23-05E  
September 20, 2023

Mr. Patrick Schmidt  
Geotechnical Engineering Division  
1149 S. Broadway, Suite 120  
Los Angeles, California 90015-2213

Subject: **GEOTECHNICAL DATA REPORT**  
**ARDMORE RECREATION CENTER – GYM EXPANSION PROJECT**  
**3250 San Marino Street**  
**City of Los Angeles, California**

Dear Mr. Schmidt:

Tetra Tech is pleased to submit this Geotechnical Data Report for the Ardmore Recreation Center gym expansion project located at 3250 San Marino Street, in the City of Los Angeles. Our work was performed in general accordance with the scope of services as outlined in the City of Los Angeles' TOS 23-156, Work Order #E170495A, dated July 10, 2023, under Contract No. C-141868. This report includes a brief description of site conditions, the proposed development, discussion regarding our field investigation, and description of subsurface soil conditions. The appendices to the report include logs of borings, logs of infiltration testing, and laboratory testing data.

We appreciate the opportunity to provide our professional services on this project. If you have any questions regarding this report or if we can be of further service, please do not hesitate to contact the undersigned.

Respectfully submitted,  
**Tetra Tech BAS, Inc.**

Shawn Morrish  
Staff Geologist

Fernando Cuenca, Ph.D., G.E.  
Senior Engineer



Peter Skopek, Ph.D., G.E.  
Principal Engineer



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Filename: 2023-09-20 Ardmore Recreation Center Data FINAL RPT.docx

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| 8. SELECTED REFERENCES .....        | 8                  |

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Figure 1 – Site Location Map

Figure 2 – Site Plan and Soil Exploration Map

### Appendices

Appendix A – Logs of Exploratory Borings

Appendix B – Logs of Infiltration Testing

Appendix C – Laboratory Testing Results

## 1. INTRODUCTION

Presented herein is Tetra Tech’s Geotechnical Data Report for the Ardmore Recreation Center gym expansion project located at 3250 San Marino Street, in the City of Los Angeles. Our work was performed in general accordance with the scope of services as outlined in the City of Los Angeles’ TOS 23-156, Work Order #E170495A, dated July 10, 2023 under Contract No. C-141868. It is our understanding that the City of Los Angeles is planning to construct a 1,500 ft<sup>2</sup> multipurpose room addition to the existing gym. The project also includes construction of new planters and an Americans with Disabilities Act (ADA) walkway ramp on the west of the multipurpose room addition. The planters will be used for a community garden. The ADA walkway ramp will provide access to the planters and multipurpose room from S. Ardmore Avenue. The approximate location of the project site is shown in Figure 1 – Site Location Map.

A geotechnical investigation is required, to provide information regarding the subsurface materials at the site and to provide information to the Geotechnical Engineering Division (GED), the Engineer of Record for the project, so that foundation design and grading recommendations can be developed for the proposed improvements. This report presents the geotechnical data collected from our field exploration program including laboratory test data in support of the design and construction of the subject project. Infiltration rates derived from field infiltration testing are also provided herein, in order to assist GED with the proposed design of infiltration Best Management Practices (BMPs).

## 2. SCOPE OF SERVICES

Tetra Tech’s scope of services for this project was performed in general accordance with the requirements outlined in Task Order Solicitation (TOS) of City of Los Angeles TOS 23-156, Work Order #E170495A, dated July 10, 2023. The scope of services for this project consisted of the following tasks:

- Preparation of a health and safety plan;
- Perform a reconnaissance site visit to observe ground conditions and mark boring locations in coordination with GED staff and City of Los Angeles Department of Recreation and Parks personnel;
- Coordinate with GED staff and Underground Service Alert (USA) to locate underground utilities at the site;
- Perform coring, before drilling, through an existing concrete slab located on the west side of the gym;
- Conduct a subsurface investigation including the excavating, logging, and sampling of 3 exploratory borings to a maximum depth of 26.5 feet;
- Perform air quality monitoring during drilling;
- Advance two additional borings for infiltration testing to depths of approximately 5 and 10 feet and conduct infiltration testing using a falling head test method in general accordance with Los Angeles County Public Works (LACPW) Administrative Manual GS200.1 (2021);
- Transport selected soil samples obtained from the borings to the laboratory;



- Perform laboratory testing on select samples as requested by GED staff; and,
- Prepare this Geotechnical Data Report in conformance with the scope specified in Section 2.6 of the TOS.

### 3. FIELD EXPLORATION PROGRAM

Prior to starting the field exploration program, a field reconnaissance program was conducted to observe access conditions and to mark the locations of the planned exploratory and infiltration boreholes under the direction of the GED staff and in agreement with personnel from the City of Los Angeles Department of Recreation and Parks. Underground Service Alert, GED staff, City of Los Angeles Department of Recreation and Parks personnel, were notified of the subsurface exploration schedule at least 48 hours prior to drilling.

The subsurface soil and groundwater conditions beneath the site were explored on August 29 and 30, 2023. The field program included the drilling, logging, and sampling of 3 exploratory geotechnical borings denoted B-1 through B-3 and two additional borings for infiltration testing denoted I-1 and I-2 (see Figure 2 – Site Plan and Soil Exploration Map). Prior to drilling concrete coring was performed through the concrete slab located on the west side of the gym at the marked boring locations within the slab footprint (B-1 through B-3). Coring was also performed through the asphalt pavement at boring I-2 located in the north parking lot. All the borings were advanced using a mini-mole track-mounted limited access rig equipped with 6-inch diameter solid stem augers. The mini-mole limited access rig had the following dimensions: 3 feet wide, 10 feet long, and 6.5 feet high when towered down. The use of this rig was deemed necessary given the access constraints to the site. The borings were drilled at the approximate locations shown on Figure 2. At least one GED representative was present at the site during all field activities.

The approximate longitude and latitude of the as-drilled boring locations were obtained with a handheld NAD 83 Coordinate System Global Positioning System (GPS) unit and are summarized in Table 1 below. The approximate ground surface elevation was obtained from the topographic contours provided by the City of Los Angeles and from Google Earth. The highlighted cells in light blue correspond to infiltration test locations.

One bulk sample was collected within the upper 5 feet at each boring location. Disturbed and relatively undisturbed soil samples were collected every 2.5 feet to a depth of 15 feet. Below 15 feet, soil samples were collected every 5 feet. The relatively undisturbed samples were collected utilizing a California-type driven ring sampler. Disturbed soil samples were collected using a standard split-poon sampler (inner diameter = 1 3/8 inches) without liners. Standard Penetration Tests (SPT) and driven ring samplers were advanced with a 140-pound safety hammer with a manual drop of 30 inches in general accordance with ASTM D1586. Field blowcounts were recorded for every 6 inches of penetration. Per DMG Special Publication 117 (Southern California Earthquake Center, 1999) the hammer efficiency is estimated to be about 60 percent.

**Table 1**  
**Boring Information**

| Exploration Number   | General Location                          | Approximate  |               |                                 |              |
|--|---|--------------|---------------|---------------------------------|--------------|
|  |   | Latitude     | Longitude     | Ground Surface Elevation (feet) | Depth (feet) |
| B-1  | Northwest corner of patio/slab area       | 34.054176° N | 118.301918° W | 192                             | 21.5         |
| B-2  | Center of eastern edge of patio/slab area | 34.054128° N | 118.301853° W | 193                             | 21.5         |
| B-3  | Southwest corner of patio/slab area       | 34.054071° N | 118.301911° W | 192                             | 26.5         |
| I-1  | Greenscape area near flag pole            | 34.054389° N | 118.301930° W | 194*                            | 5            |
| I-2  | North parking area                        | 34.054386° N | 118.301689° W | 196*                            | 10           |
| Highlighted cells in blue denote boreholes used for infiltration testing |   |              |               |                                 |              |
| *Obtained from Google Earth  |   |              |               |                                 |              |

Recovered cuttings from the soil borings and in-situ samples were logged by a Tetra Tech Geologist in general accordance with the visual-manual procedure for description and identification of soils, ASTM D2488. The soil samples were also prepared for subsequent examination and laboratory testing. Additional details pertinent to material types encountered in the borings, groundwater conditions, and sampling depths and types are presented in the boring logs included in Appendix A.

A MultiRAE Photoionization Detector (PID) was used for air quality monitoring during drilling. Readings were obtained for Oxygen levels (O<sub>2</sub>), Carbon Dioxide (CO<sub>2</sub>), Hydrogen Sulfide (H<sub>2</sub>S), combustible LEL, Volatile Organic Compounds (VOCs), on every retrieved soil sample placed within a plastic bag or a plastic liner. All PID readings were consistent i.e., O<sub>2</sub>=20.9%, CO<sub>2</sub>= 0 ppm, LEL = 0%, H<sub>2</sub>S = 0 ppm, and VOCs= 0 ppm, with the exception of one reading taken from a soil sample retrieved from a depth of 7.5 feet in boring B-2 which indicated VOCs concentration of 0.1 ppm.

Following drilling, all exploratory soil boreholes were backfilled with tamped soil cuttings. Exploratory borings through the concrete slab, B-1 through B-3, were capped with a concrete patch at the surface. Upon completion of infiltration testing, the PVC casings were removed from infiltration borings I-1 and I-2, and then the borings were backfilled with tamped soil cuttings generated during drilling. Boring I-1 had grass sod replaced at the surface and boring I-2 was capped with an asphalt cold patch.

#### 4. FIELD INFILTRATION TESTING

Infiltration testing was performed by Tetra Tech on August 29, 2023. Infiltration borehole I-1 was advanced to a depth of approximately 5 feet, and borehole I-2 to a depth of approximately 10 feet. It is noted that the infiltration tests were performed within fill materials. Per City of Los Angeles P/BC 2017-118 (LADBS, 2017) no infiltration facility should be placed to infiltrate water into fill

material unless the exceptions listed in that document are met. Given that the depth of fill extends to about 14.5 feet, historical groundwater depth is as shallow as 20 feet, and the fact that fine-grained materials were encountered to the maximum explored depth of 26.5 feet, it is surmised that this site is not a suitable candidate for stormwater infiltration.

The installation of the infiltration borings and the infiltration testing were performed in general accordance with the small diameter boring infiltration test procedure described in the LACPW GS200.1 Guidelines (2021). The infiltration test boring was constructed by placing  $\frac{3}{4}$ -inch gravel at the bottom of the boring and then installing a 3-inch-diameter perforated pipe (PVC casing) with  $\frac{5}{8}$ -inch-diameter holes. The casing extended from the bottom of the boring to the ground surface and was wrapped in a protective cloth filter sock to limit the migration of soil particles into the pipe. The annular space between the PVC casing and the borehole wall was filled with  $\frac{3}{4}$ -inch gravel pack up to a few feet above the zone of infiltration testing. The  $\frac{3}{4}$ -inch gravel was selected as the pack material since it has a hydraulic conductivity significantly larger than that of the surrounding soil and it provides borehole stability during infiltration testing.

Prior to starting the infiltration testing, each borehole was presoaked for at least 4 hours. Based on the infiltration rate observed during the presoaking it was determined that a falling head test would be utilized for assessing the infiltration rate.

For a falling head test, an initial water level of approximately 1.1 to 1.4 feet was established above the bottom of each borehole and then the subsequent fall in water level was recorded over a 30-minute time interval. The water level after 30 minutes was refilled to approximately the initial water level for each successive test. Infiltration testing was performed at the boring locations until a stabilized drop rate was obtained (per GS 200.1 a stabilized rate is obtained when the highest and lowest readings are within 10 percent from each other for 3 consecutive readings), with no less than 6 readings taken. The water levels were measured using a water sounder. Logs of the infiltration tests are included in Appendix B.

The results of the infiltration testing are provided in Table 2 below. The falling head infiltration rate was converted, as indicated in the infiltration test logs in Appendix B, to a corrected field infiltration rate using the Porchet method and considering the effect of the porosity of the gravel pack i.e., approximately 0.35. It is noted that negligible infiltration was observed at boring I-2. According to the City of Los Angeles Planning and Land Development Handbook for Low Impact Development (LID) (2016) a design Factor of Safety is required to be applied to the field infiltration rate to obtain a design infiltration rate. A minimum Factor of Safety of 3 is required for the design of stormwater facilities. The design infiltration rates for stormwater facilities is provided in Table 2. It is noted that even though the design infiltration rate at I-1 appears to be suitable, this may be the result of localized conditions perhaps influenced by the presence of roots from a nearby tree and other debris within the fill. Furthermore, as noted before, this location may also not be considered acceptable due to the presence of fill materials and the fact that the site is underlain by fine-grained materials.

**Table 2**  
**Results of Small Diameter Borehole Infiltration Tests**

| Infiltration Boring Number | Soil Type at Bottom of Hole    | Approx. Ground Elevation (ft) | Depth to Bottom of Borehole (ft) | Infiltration Rate (in/hr) |               |
|----------------------------|--------------------------------|-------------------------------|----------------------------------|---------------------------|---------------|
|                            |                                |                               |                                  | Field                     | Design FS=3.0 |
| I-1                        | FILL: Lean CLAY with Sand (CL) | 194                           | 5                                | 2.8                       | 0.9           |
| I-2                        | FILL: Lean CLAY with Sand (CL) | 196                           | 10                               | 0                         | 0             |

## 5. LABORATORY TESTING

Laboratory tests were performed on selected samples recovered from the borings to aid in the classification of soils and to evaluate pertinent engineering properties of the foundation soils. The following tests were performed as requested by GED:

- In-situ Moisture Content and Dry Density, ASTM D2937;
- Grain Size Distribution, ASTM D6913 and D7928;
- Percent Passing #200 Sieve, ASTM D1140;
- Atterberg Limits, ASTM D4318;
- Expansion Index, ASTM D4829;
- Direct Shear, ASTM D3080;
- R-Value, ASTM D2844; and,
- Corrosion Testing: Minimum electrical resistivity and pH, CTM 643;  
Sulphate Content, CTM 417;  
Chloride Content, CTM 422.

Testing was performed in general accordance with applicable indicated ASTM Standards and California Test Methods. Results of all laboratory tests are presented in Appendix C. For ease of reference, a summary of laboratory test results is presented in Table C-1 in Appendix C. In addition, for ease of reference to the soil profile, selected laboratory test results have also been included in the boring logs in Appendix A.

## 6. SUBSURFACE SOIL CONDITIONS

Based on geological mapping (Dibblee and Ehrenspeck, 1991), the site is underlain by older alluvial deposits of Quaternary age (Qae). As encountered in the borings, fill soils about 12 to 14.5 feet thick mantle the native alluvium. Generalized descriptions of the encountered units are provided below. More detailed descriptions of the soil conditions encountered at the boring locations are presented on the boring logs in Appendix A.

## **6.1. Fill**

Undocumented fill (af) was encountered in all the borings to depths ranging from 12 feet near the eastern edge of the patio area against the building to 14.5 feet in the southwest corner of the patio area. The fills consisted mostly of multicolored brown to black to yellowish brown soft to stiff sandy lean clays. Trace amounts of red brick fragments, angular gravel, and charcoal were generally observed.

## **6.2. Alluvium**

Alluvial soils (Qae) encountered in the 3 exploratory borings B-1 through B-3 consisted mostly of olive brown firm to hard sandy lean clays.

## **6.3. Groundwater**

At the time of our exploration, groundwater was not encountered in any of the borings. Mapping by the State of California (California Department of Conservation, Division of Mines and Geology, 1998) for the Hollywood 7.5-minute Quadrangle indicates that the historic high groundwater level at the site is estimated to be less than 20 feet. It should be noted that groundwater levels may fluctuate due to factors such as seasonal variations, rainfall, and irrigation. The evaluation of such factors is beyond the scope of this investigation.

## **7. LIMITATIONS**

The geotechnical data presented in this report are based on Tetra Tech's review of background documents and on information obtained from field explorations and infiltration testing performed at the site. No evaluation regarding the history of the site was performed. No environmental evaluation or assessment of the site was performed, except for limited air quality monitoring performed during drilling as recorded in the boring logs. Due to the limited nature of the field explorations, conditions not observed and described in this report may be present on the site. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration and infiltration testing. Additional subsurface evaluation, laboratory testing, and infiltration testing can be performed upon request. It should be understood that conditions different from those anticipated in this report may be encountered during grading operations, for example, the extent of unsuitable soil and the associated additional effort required to mitigate them.

Site conditions, including groundwater level, can change with time as a result of natural processes or the activities of man at the subject site or at nearby sites. Changes to the applicable laws, regulations, codes, and standards of practice may occur as a result of government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Tetra Tech has no control.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Tetra Tech should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document. Reliance by others on the data

presented herein or for purposes other than those stated in the text is authorized only if so permitted in writing by Tetra Tech. It should be understood that such an authorization may incur additional expenses and charges.

Tetra Tech has endeavored to perform its evaluation using the degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical professionals with experience in this area and similar soil conditions. No other warranty, either expressed or implied, is made as to the conclusions and recommendations contained in this report.

## **8. SELECTED REFERENCES**

California Department of Conservation, Division of Mines and Geology, 2008, Guidelines for Evaluation and Mitigation of Seismic Hazards in California: Special Publication 117A.

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County of Los Angeles, Public Works, (2021). Guidelines For Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration.

Dibblee, T.W. and Ehrenspeck, H.E., ed., 1991, Geologic map of the Hollywood and Burbank (south 1/2) quadrangles, Los Angeles, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-30, scale 1:24,000.

Southern California Earthquake Center, 1999. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. Dated March.

## **Figures**





FIGURE 1



**TETRA TECH**

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ARDMORE RECREATION CENTER - LOS ANGELES, CA

## SITE LOCATION MAP

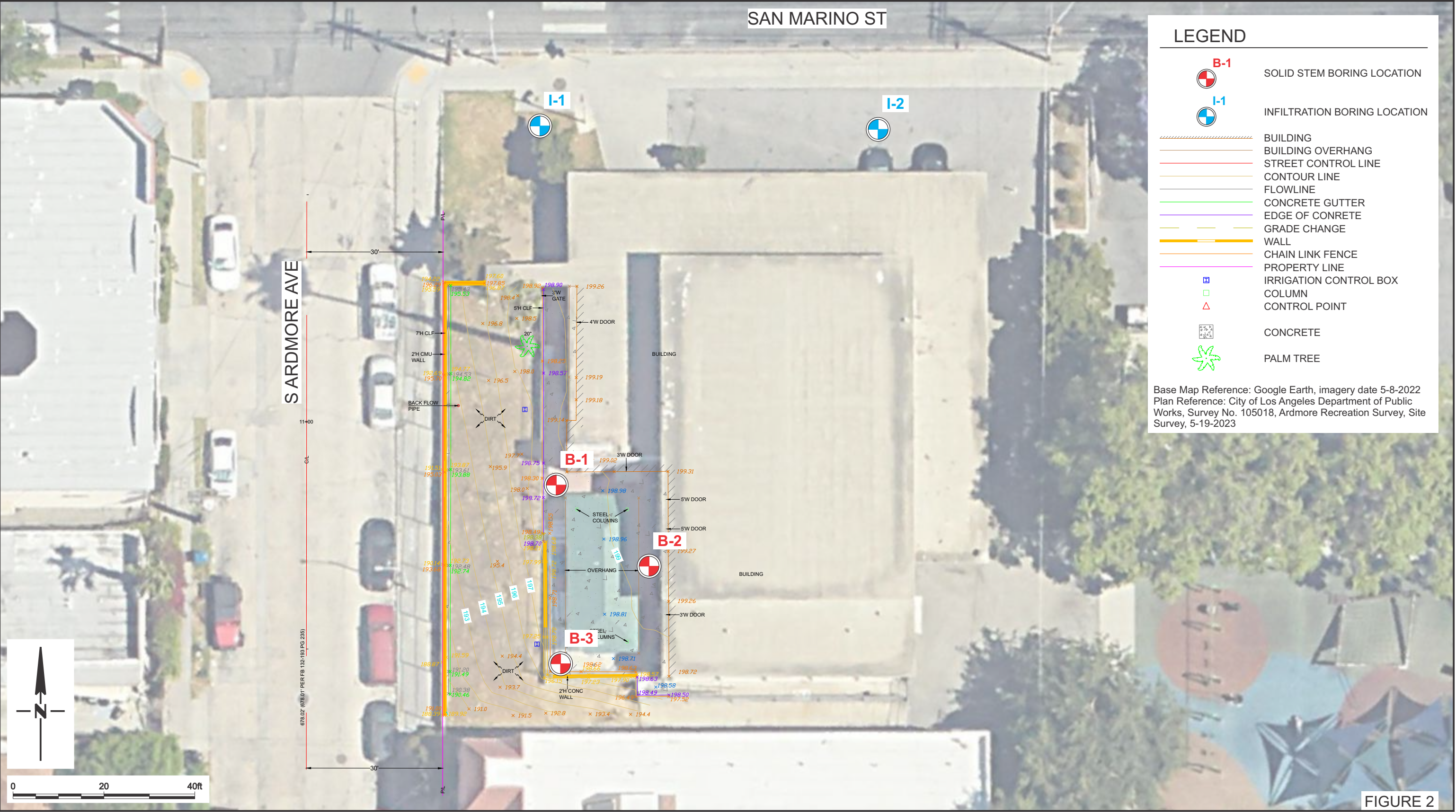
JOB NO.  
ciLA 23-05E

DATE  
SEP 2023

DRAWN BY  
SCM

CHECKED BY  
FC





## **Appendix A**

### **Log of Exploratory Borings**

## **Appendix A**

### **Logs of Exploratory Borings**

Bulk and relatively undisturbed driven samples were obtained in the field during our subsurface evaluation. The samples were tagged in the field and transported to our laboratory for observation and testing. The driven samples were obtained using the California Split Barrel Drive, Shelby Tube, or Standard Penetration Test (SPT) sampler as described below.

#### **California Split Barrel Drive Sampler**

The split barrel drive sampler was driven with a 140-pound hammer allowed to drop freely 30 inches. The number of blows per foot recorded during sampling is presented in the logs of exploratory borings. The sampler has external and internal diameters of approximately 3.0 and 2.4 inches, respectively, and the inside of the sampler is lined with 1-inch-long brass rings. The relatively undisturbed soil sample within the rings is removed, sealed, and transported to the laboratory for observation and testing.







#### **Standard Penetration Test Sampler**

The standard penetration test sampler is driven with a 140-pound hammer allowed to drop freely 30 inches in general accordance with ASTM D1586. The number of blows (N-value) required to drive the SPT sampler 12 inches is shown on the boring logs. The sampler has external and internal diameters of approximately 2.0 and 1.4 inches respectively. The sampling tube consists of an unlined split-tube barrel. The disturbed soil sample is removed, sealed, and transported to the laboratory for testing.





## Sheet 1 of 1

| DEPTH<br>(ft)        | SAMPLE TYPE<br>NUMBER | BLOW/COUNT<br>blows/6" (bpf) | GRAPHIC LOG | USCS | <div> <div>  Standard Penetration Test (SPT)  No Recovery  Shelby Tube </div> <div>  California-Type Ring Sample  No Recovery  Grab/Bulk Sample </div> </div> | DRY UNIT WT.<br>(pcf) | MOISTURE<br>CONTENT (%) | Notes  | ELEVATION<br>(ft) |
|----------------------|-----------------------|------------------------------|-------------|------|---|-----------------------|-------------------------|--|-------------------|
| MATERIAL DESCRIPTION |                       |                              |             |      |   |                       |                         |  |                   |
| 0                    |                       |                              |             |      | 4" thick concrete slab atop 1" void space<br>[FILL]   |                       |                         |  | 190               |
| 5                    | SK-1                  |                              |             | CL   | Sandy Lean CLAY, soft, brown (10YR 4/3), damp, fine grained sand, trace coarse sand, brick fragments  |                       |                         | Hand excavated to 5' depth per direction of LA City<br>LL=40/PL=14/PI=26;<br>Corr. |                   |
|                      | R-2                   | 4-3-7<br>(10)                |             | SC   | Lens of Clayey SAND, loose, brown (10YR 4/3), damp, fine-grained with a trace of coarse-grained   | 109.8                 | 11.3                    | <#200 = 25.3%, DS  |                   |
|                      |                       |                              |             | CL   | ...(6.5') 5" angular brick fragment   |                       |                         |  | 185               |
|                      | SPT-3                 | 3-3-4<br>(7)                 |             |      | ...(7.5') as above interlayered with Poorly Graded SAND and crushed brick fragments   |                       |                         | SPT-3 poor recovery  |                   |
| 10                   |                       |                              |             |      | ...(10.0') as above, with trace crushed brick   | 83.9                  | 15.3                    | R-4 slough in upper ~2 rings   | 180               |
|                      | SPT-5                 | 5-2-4<br>(6)                 |             |      | ...(12.5') as above, with trace roots   |                       |                         | SPT-5 poor recovery (~3 inches)  |                   |
| 15                   | R-6                   | 12-18-22<br>(40)             |             | CL   | [NATIVE]<br>Sandy Lean CLAY, very stiff, olive gray (5Y 4/2), damp, fine grained sand, trace fine gravel and carbonate stringers  | 116.9                 | 15.6                    | G/S/F = 0/38/62; DS  | 175               |
| 20                   | SPT-7                 | 13-11-13<br>(24)             |             |      | ...(20.5') 6" layer of Poorly Graded SAND with Clay, brown (10YR 4/3), damp, medium to coarse grained   |                       |                         | LL=24/PL=14/PI=10  |                   |

Notes:

- 1) Total depth: 21.5' bgs.
- 2) Groundwater not encountered.
- 3) PID readings nominal unless indicated (O2= 20.9%, CO2=0ppm, LEL=0%, H2S=0ppm, VOC=0ppm)
- 4) Backfilled with tamped cuttings and 4" thick concrete at surface.
- 5) Location from handheld GPS, elevation from topographic map of area



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# BORING B-2

Sheet 1 of 1

**PROJECT NAME** Ardmore Recreation Center **CLIENT** City of Los Angeles **GROUND ELEVATION** 193 ft  
**PROJECT NUMBER** ciLA 23-05E **PROJECT LOCATION** Los Angeles, CA **GROUNDWATER DEPTH** Not encountered  
**DATES DRILLED** 8/29/2023 **DRILLING CONTRACTOR** Pacific Drilling **BOREHOLE DEPTH** 21.5 ft  
**LOGGED/CHECKED BY** SCM/FC **DRILLING METHOD** Solid Stem Auger **BOREHOLE DIAMETER** 6 in  
**COORDINATES** 34.054128°, -118.301853° **HAMMER DATA** 140 lbs, 30" manual drop **BACKFILL** Tamped Cuttings  
**LOCATION DESCRIPTION** Center of eastern edge of patio area (next to building)

| DEPTH<br>(ft) | SAMPLE TYPE<br>NUMBER | BLOWCOUNT<br>blows/6" (bpf) | GRAPHIC LOG | USCS | <div> <div>  Standard Penetration Test (SPT)            No Recovery            Shelby Tube         </div> <div>  California-Type Ring Sample            No Recovery            Grab/Bulk Sample         </div> </div> | DRY UNIT WT.<br>(pcf) | MOISTURE<br>CONTENT (%) | Notes   | ELEVATION<br>(ft) |
|---------------|-----------------------|-----------------------------|-------------|------|---|-----------------------|-------------------------|---|-------------------|
| 0             |                       |                             |             |      | <b>MATERIAL DESCRIPTION</b>   |                       |                         |   |                   |
|               | SK-1                  |                             |             | CL   | 4" thick concrete slab<br>[FILL]<br>Sandy Lean CLAY, firm, brown (10YR 4/3), moist, fine grained sand, trace coarse sand, brick fragments and charcoal  |                       |                         | Hand excavated to 5' depth per direction of LA City<br>G/S/F = 0/46/54;<br>EI=56; R-Val=9 | 190               |
| 5             | SPT-2                 | 2-2-2 (4)                   |             | SC   | Clayey SAND, loose, multicolored black (5Y 2.5/1) and light olive gray (5Y 6/2), damp, trace angular gravel   |                       |                         | <#200 = 34%   |                   |
|               | R-3                   | 3-2-2 (4)                   |             |      | ...(7.5') very loose, black (5Y 2/5/1), with coarse sand  | 107.2                 | 16.0                    | DS<br>VOC=0.1ppm  | 185               |
| 10            | SPT-4                 | 2-2-4 (6)                   |             |      | ...(10.0') loose, brown (10YR 4/3), increase in sand content  |                       |                         | <#200 = 33%   |                   |
|               | R-5                   | 4-5-9 (14)                  |             | CL   | [NATIVE]<br>Sandy Lean CLAY, stiff, olive gray (5Y 4/2), damp, fine grained sand, trace fine gravel   | 110.5                 | 16.6                    |   | 180               |
| 15            | SPT-6                 | 7-11-15 (26)                |             |      | ...(15.0') very stiff, trace carbonate strings, no gravel   |                       |                         | LL=26/PL=13/PI=13   |                   |
| 20            | R-7                   | 14-18-28 (46)               |             |      | ...(20.0') hard   | 112.8                 | 18.4                    | Corr.   | 175               |

**Notes:**

- 1) Total depth: 21.5' bgs.
- 2) Groundwater not encountered.
- 3) PID readings nominal unless indicated (O2= 20.9%, CO2=0ppm, LEL=0%, H2S=0ppm, VOC=0ppm)
- 4) Backfilled with tamped cuttings and 4" thick concrete at surface.
- 5) Location from handheld GPS, elevation from topographic map of area



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# BORING B-3

Sheet 1 of 1

**PROJECT NAME** Ardmore Recreation Center **CLIENT** City of Los Angeles **GROUND ELEVATION** 192 ft  
**PROJECT NUMBER** ciLA 23-05E **PROJECT LOCATION** Los Angeles, CA **GROUNDWATER DEPTH** Not encountered  
**DATES DRILLED** 8/29/2023 -8/30/2023 **DRILLING CONTRACTOR** Pacific Drilling **BOREHOLE DEPTH** 26.5 ft  
**LOGGED/CHECKED BY** SCM/FC **DRILLING METHOD** Solid Stem Auger **BOREHOLE DIAMETER** 6 in  
**COORDINATES** 34.054071°, -118.301911° **HAMMER DATA** 140 lbs, 30" manual drop **BACKFILL** Tamped Cuttings  
**LOCATION DESCRIPTION** Southwest corner of patio area

| DEPTH<br>(ft) | SAMPLE TYPE<br>NUMBER | BLOWCOUNT<br>blows/6" (bpf) | GRAPHIC LOG | USCS | <div> <div> <div>Standard Penetration Test (SPT)</div> <div>California-Type Ring Sample</div> </div> <div> <div>No Recovery</div> <div>No Recovery</div> </div> <div> <div>Shelby Tube</div> <div>Grab/Bulk Sample</div> </div> </div> | DRY UNIT WT.<br>(pcf) | MOISTURE<br>CONTENT (%) | Notes  | ELEVATION<br>(ft) |
|---------------|-----------------------|-----------------------------|-------------|------|--|-----------------------|-------------------------|--|-------------------|
| 0             |                       |                             |             |      | <b>MATERIAL DESCRIPTION</b>  |                       |                         |  |                   |
|               | SK-1                  |                             |             | SC   | 4" thick concrete slab<br>[FILL]<br>Clayey SAND, loose, brown (10YR 4/3), damp, fine grained with trace of coarse sand, brick fragments and charcoal   |                       |                         | G/S/F = 1/51/48<br>Hand excavated to 5' depth per direction of LA City | 190               |
| 5             | R-2                   | 5-6-9<br>(15)               |             | CL   | Sandy lean CLAY, stiff, brown (10YR 4/3), damp, fine-grained sand<br>...(6.0') 2" coarse sand layer  | 103.8                 | 18.7                    |  | 185               |
|               | SPT-3                 | 3-3-3<br>(6)                |             |      | ...(7.5') as above, firm   |                       |                         | <#200 = 62%  |                   |
| 10            | R-4                   | 7-5-6<br>(11)               |             | CL   | ...(10.0') multicolored brown (10YR 4/3) and black (5Y 2.5/1), firm, trace gravel up to 1" diameter  | 112.5                 | 10.6                    | LL=21/PL=15/PI=6   | 180               |
|               | SPT-5                 | 2-3-4<br>(7)                |             | CL   | ...(12.0') trace brick<br>[NATIVE]<br>Sandy Lean CLAY, firm, olive gray (5Y 4/2), moist, fine to medium grained sand   |                       |                         | <#200 = 60%  |                   |
| 15            | R-6                   | 10-17-24<br>(41)            |             |      | ...(15.0') very stiff, with carbonate stringers  | 114.1                 | 16.4                    | DS   | 175               |
| 20            | SPT-7                 | 10-14-17<br>(31)            |             |      | ...(20.0') olive brown (2.5Y 4/3), trace coarse sand<br>...(21.0') hard, brown (10YR 4/3), increase in medium grained sand content   |                       |                         |  | 170               |
| 25            | R-8                   | 14-17-19<br>(36)            |             |      | ...(25.0') very stiff, mottled brown (10YR 4/3) and olive gray (5Y 4/2), decrease in sand content  | 114.3                 | 16.0                    | Proceeded to 25' depth per direction of LA City; G/S/F = 2/41/57       |                   |

**Notes:**

- 1) Total depth: 26.5' bgs.
- 2) Groundwater not encountered.
- 3) PID readings nominal unless indicated (O2= 20.9%, CO2=0ppm, LEL=0%, H2S=0ppm, VOC=0ppm)
- 4) Backfilled with tamped cuttings and 4" thick concrete at surface.
- 5) Location from handheld GPS, elevation from topographic map of area





Tetra Tech  
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Diamond Bar, CA 91765  
9098607777

# WELL I-1

Sheet 1 of 1

**PROJECT NAME** Ardmore Recreation Center **CLIENT** City of Los Angeles **GROUND ELEVATION** 194 ft  
**PROJECT NUMBER** 197-4693-0005 **PROJECT LOCATION** Los Angeles, CA **GROUNDWATER DEPTH** Not encountered  
**DATES DRILLED** 8/29/2023 **DRILLING CONTRACTOR** Pacific Drilling **BOREHOLE DEPTH** 5 ft  
**LOGGED/CHECKED BY** MKM/FC **DRILLING METHOD** Solid Stem Auger **BOREHOLE DIAMETER** 6" in  
**COORDINATES** 34.054389°, -118.301930° **HAMMER DATA** NA **BACKFILL** Tamped Cuttings  
**LOCATION DESCRIPTION** Greenscape area

| DEPTH<br>(ft) | SAMPLE TYPE<br>NUMBER | RECOVERY % | REMARKS   | U.S.C.S. | GRAPHIC<br>LOG | MATERIAL DESCRIPTION  | Elevation (ft) | WELL DIAGRAM |
|---------------|-----------------------|------------|-----------|----------|----------------|---|----------------|--------------|
| 0             |                       |            |           |          |                |   |                |              |
|               |                       |            |           | CL       |                | Grass cover at surface<br>[Fill] Artificial Fill (af)<br>Lean CLAY with SAND, olive brown (2.5Y 4/3),<br>slightly moist, very fine to fine-grained sand |                |              |
|               |                       |            |           |          |                |   | 190.5          |              |
| 5             | SK<br>1               | 100        | <#200=47% | SC       |                | Clayey SAND, yellowish brown (10YR 5/6), slightly<br>moist, ~25% fine sand, some brick fragments, within<br>root zone of adjacent tree                  | 189.0          |              |

Total depth: 5.0 feet  
Groundwater not encountered  
No caving  
Percolation pipe installed and percolation test  
conducted  
Elevation data from topographic map of area

Casing Top Elev: 194 (ft)  
Screened  
pipe  
Filterpack:  
All-purpose  
Rock #1

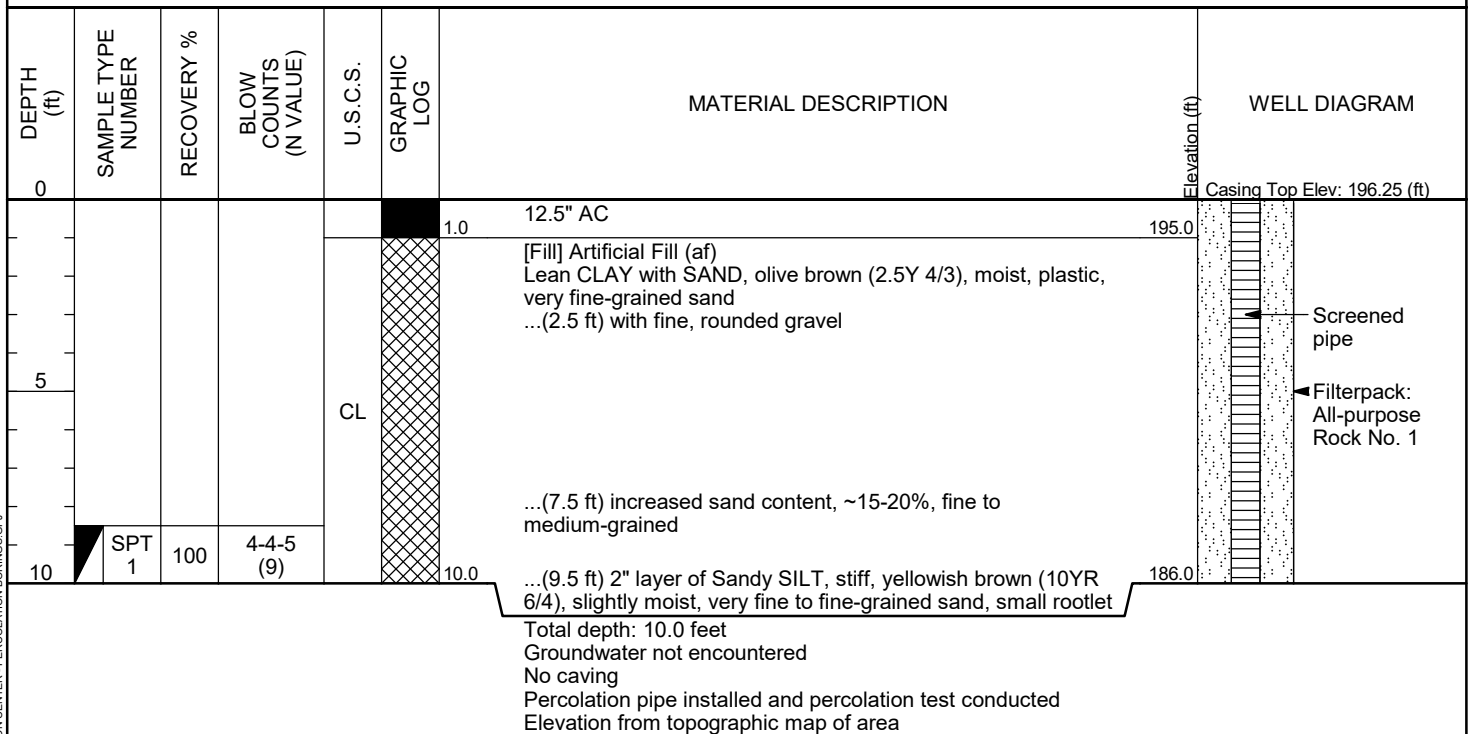


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# WELL I-2

Sheet 1 of 1

PROJECT NAME Ardmore Recreation Center CLIENT City of Los Angeles GROUND ELEVATION 196 ft  
PROJECT NUMBER 197-4693-0005 PROJECT LOCATION Los Angeles, CA GROUNDWATER DEPTH Not encountered  
DATES DRILLED 8/29/2023 DRILLING CONTRACTOR Pacific Drilling BOREHOLE DEPTH 10 ft  
LOGGED/CHECKED BY MKM/FC DRILLING METHOD Solid Stem Auger BOREHOLE DIAMETER 6" in  
COORDINATES 34.054386°, -118.301689° HAMMER DATA NA BACKFILL Tamped Cuttings  
LOCATION DESCRIPTION Paved parking area



GENERAL BH / TP / WELL - GINT STD US LAB GDT - L03 - TECHNICAL RESOURCES\02 SOFTWARE LIBRARY\GINT\PROJECTS\14 23-05 ARDMORE RECREATION CENTER - PERCOLATION BORINGS.GPJ

## **Appendix B**

### **Logs of Infiltration Testing**



|                                |                           |        |                      |                          |                      |
|--------------------------------|---------------------------|--------|----------------------|--------------------------|----------------------|
| Project:                       | Ardmore Recreation Center |        | Job No:              | cILA 23-05E              |                      |
| Test Hole No:                  | I-1                       |        | Date Excavated:      | Tuesday, August 8, 2023  |                      |
| Test Hole Depth (feet):        | 5.0                       | feet   | Soil Classification: | SC (FILL)                |                      |
| Stick up Length (feet):        | 0.0                       | foot   | Gravel Porosity:     | 1.00                     |                      |
| Sandy Soil Criteria Tested By: |                           |        | Presoak Date:        | Tuesday, August 29, 2023 | Presoak: 4 hr        |
| Actual Infiltration Tested By: | MM                        |        | Test Date:           | Tuesday, August 29, 2023 |                      |
| Test Hole Diameter (inches):   | 6                         | inches | Latitude:            | 34.0544                  | Longitude: -118.3019 |
| Casing Diameter (inches):      | 3                         | inches | Elevation:           | 194 feet                 |                      |

[illegible]



|                                |                           |        |                      |                          |                      |
|--------------------------------|---------------------------|--------|----------------------|--------------------------|----------------------|
| Project:                       | Ardmore Recreation Center |        | Job No:              | ciLA 23-05E              |                      |
| Test Hole No:                  | I-2                       |        | Date Excavated:      | Tuesday, August 8, 2023  |                      |
| Test Hole Depth (feet):        | 10.0                      | feet   | Soil Classification: | CL (Fill)                |                      |
| Stick up Length (feet):        | 0.3                       | foot   | Gravel Porosity:     | 0.40                     |                      |
| Sandy Soil Criteria Tested By: |                           |        | Presoak Date:        | Tuesday, August 29, 2023 | Presoak: 4 hr        |
| Actual Infiltration Tested By: | MM                        |        | Test Date:           | Tuesday, August 29, 2023 |                      |
| Test Hole Diameter (inches):   | 6                         | inches | Latitude:            | 34.0544                  | Longitude: -118.3017 |
| Casing Diameter (inches):      | 3                         | inches | Elevation:           | 196 feet                 |                      |

[illegible]

## **Appendix C**

### **Laboratory Testing Results**



TABLE C-1

9/20/2023

| Sample Information |               |            |                      |       | In Situ Condition |                         |                       | Atterberg Limits |               |                  | EI              | Gradation  |          |           |                          | Direct Shear Strength (CD) |           |         |               | R-value | Corrosivity |                           |                       |                        |
|--------------------|---------------|------------|----------------------|-------|-------------------|-------------------------|-----------------------|------------------|---------------|------------------|-----------------|------------|----------|-----------|--------------------------|----------------------------|-----------|---------|---------------|---------|-------------|---------------------------|-----------------------|------------------------|
| Boring Number      | Sample Number | Depth (ft) | Material Designation | USCS  | Water Content (%) | Total Unit Weight (pcf) | Dry Unit Weight (pcf) | Liquid Limit     | Plastic Limit | Plasticity Index | Expansion Index | Gravel (%) | Sand (%) | Fines (%) | Clay Fraction, % - 0.005 | Strength                   | Test      | c (psf) | phi (degrees) | R-value | pH          | Min. Resistivity (ohm-cm) | Sulfate Content (ppm) | Chloride Content (ppm) |
| B-1                | SK-1          | 0-5        | Fill                 | CL    |                   |                         |                       | 40               | 14            | 26               |                 |            |          |           |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-1                | R-2           | 5-6.5      | Fill                 | SC    | 11.3              | 122.2                   | 109.8                 |                  |               |                  |                 |            |          | 25.3      |                          | peak                       | DS (slow) | 100     | 31            |         | 8.5         | 1,440                     | 37                    | 19                     |
|                    |               |            |                      |       |                   |                         |                       |                  |               |                  |                 |            |          |           |                          | ultimate                   | DS (slow) | 100     | 31            |         |             |                           |                       |                        |
| B-1                | R-4           | 10-11.5    | Fill                 | CL    | 15.3              | 96.7                    | 83.9                  |                  |               |                  |                 |            |          |           |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-1                | R-6           | 15-16.5    | Native               | CL    | 15.6              | 135.1                   | 116.9                 |                  |               |                  |                 | 0          | 38       | 62        |                          | peak                       | DS (slow) | 1050    | 29            |         |             |                           |                       |                        |
|                    |               |            |                      |       |                   |                         |                       |                  |               |                  |                 |            |          |           |                          | ultimate                   | DS (slow) | 550     | 29            |         |             |                           |                       |                        |
| B-1                | SPT-7         | 20-21.5    | Native               | CL    |                   |                         |                       | 24               | 14            | 10               |                 |            |          |           |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-2                | SK-1          | 0-5        | Fill                 | CL    |                   |                         |                       |                  |               |                  | 56              | 0          | 46       | 54        |                          |                            |           |         |               | 9       |             |                           |                       |                        |
| B-2                | SPT-2         | 5-6.5      | Fill                 | SC    |                   |                         |                       |                  |               |                  |                 |            |          | 34        |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-2                | R-3           | 7.5-9      | Fill                 | CL    | 16.0              | 124.3                   | 107.2                 |                  |               |                  |                 |            |          |           |                          | peak                       | DS (slow) | 250     | 31            |         |             |                           |                       |                        |
|                    |               |            |                      |       |                   |                         |                       |                  |               |                  |                 |            |          |           |                          | ultimate                   | DS (slow) | 250     | 31            |         |             |                           |                       |                        |
| B-2                | SPT-4         | 10-11.5    | Fill                 | SC    |                   |                         |                       |                  |               |                  |                 |            |          | 33        |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-2                | R-5           | 12.5-14    | Native               | CL    | 16.6              | 128.8                   | 110.5                 |                  |               |                  |                 |            |          |           |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-2                | SPT-6         | 15-16.5    | Native               | CL    |                   |                         |                       | 26               | 13            | 13               |                 |            |          |           |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-2                | R-7           | 20-21.5    | Native               | CL    | 18.4              | 133.6                   | 112.8                 |                  |               |                  |                 |            |          |           |                          |                            |           |         |               |         | 7.9         | 1,326                     | 74                    | 21                     |
| B-3                | SK-1          | 0-5        | Fill                 | SC    |                   |                         |                       |                  |               |                  |                 | 1          | 51       | 48        | 24                       |                            |           |         |               |         |             |                           |                       |                        |
| B-3                | R-2           | 5-6.5      | Fill                 | CL    | 18.7              | 123.2                   | 103.8                 |                  |               |                  |                 |            |          |           |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-3                | SPT-3         | 7.5-9      | Fill                 | CL    |                   |                         |                       |                  |               |                  |                 |            |          | 62        |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-3                | R-4           | 10-11.5    | Fill                 | CL-ML | 10.6              | 124.4                   | 112.5                 | 21               | 15            | 6                |                 |            |          |           |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-3                | SPT-5         | 12.5-14    | Native               | CL    |                   |                         |                       |                  |               |                  |                 |            |          | 60        |                          |                            |           |         |               |         |             |                           |                       |                        |
| B-3                | R-6           | 15-16.5    | Native               | CL    | 16.4              | 132.9                   | 114.1                 |                  |               |                  |                 |            |          |           |                          | peak                       | DS (slow) | 500     | 27            |         |             |                           |                       |                        |
|                    |               |            |                      |       |                   |                         |                       |                  |               |                  |                 |            |          |           |                          | ultimate                   | DS (slow) | 300     | 27            |         |             |                           |                       |                        |
| B-3                | R-8           | 25-26.5    | Native               | CL    | 16.0              | 132.6                   | 114.3                 |                  |               |                  |                 | 2          | 41       | 57        | 26                       |                            |           |         |               |         |             |                           |                       |                        |
| I-1                | SK-1          | 3.5-5      | Fill                 | SC    |                   |                         |                       |                  |               |                  |                 |            |          | 47        |                          |                            |           |         |               |         |             |                           |                       |                        |



# MOISTURE CONTENT AND DENSITY

ASTM D7263

|             |                          |                 |           |
|-------------|--------------------------|-----------------|-----------|
| Job Name:   | Admore Recreation Center | Date Sampled:   | 8/20/2023 |
| Job Number: | CILA-23-05E              | Date Completed: | 9/13/2023 |
| Tested By:  | MG                       | Note:           | 1 of 1    |

| Boring / Test Pit / Trench |                 | B-1           | B-2                | B-3                | B-3           | B-3      |  |  |  |  |
|----------------------------|-----------------|---------------|--------------------|--------------------|---------------|----------|--|--|--|--|
| Sample Number              |                 | R-4           | R-5                | R-2                | R-4           | R-8      |  |  |  |  |
| Sample Depth               | ft              | 10-11.5       | 12.5-14            | 5.0-6.5            | 10-11.5       | 25-26.5  |  |  |  |  |
| USCS Soil Description      |                 | Brown CL Fill | Dark Brown CL Fill | Dark Brown CL Fill | Brown CL Fill | Brown CL |  |  |  |  |
| Number of Rings            |                 | 6             | 6                  | 6                  | 6             | 6        |  |  |  |  |
| Total Weight Rings + Soil  | grams           | 966.50        | 1198.30            | 1158.30            | 1166.40       | 1226.00  |  |  |  |  |
| Volume of Rings            | ft <sup>3</sup> | 0.0159        | 0.0159             | 0.0159             | 0.0159        | 0.0159   |  |  |  |  |
| Weight of Rings            | grams           | 266.56        | 266.56             | 266.56             | 266.56        | 266.56   |  |  |  |  |
| Weight of Soil             | grams           | 699.94        | 931.74             | 891.74             | 899.84        | 959.44   |  |  |  |  |
| Wet Density                | pcf             | 96.78         | 128.83             | 123.30             | 124.42        | 132.66   |  |  |  |  |
| Container ID               |                 | X20           | X2                 | X23                | X8            | X43      |  |  |  |  |
| Tare                       | grams           | 10.5          | 10.5               | 10.5               | 10.5          | 10.5     |  |  |  |  |
| Wet Soil + Tare            | grams           | 410.8         | 321.5              | 339.5              | 272.3         | 325.5    |  |  |  |  |
| Dry Soil + Tare            | grams           | 357.6         | 277.2              | 287.6              | 247.3         | 282      |  |  |  |  |
| Weight of Water            | grams           | 53.2          | 44.3               | 51.9               | 25            | 43.5     |  |  |  |  |

|                  |     |      |       |       |       |       |  |  |  |  |
|------------------|-----|------|-------|-------|-------|-------|--|--|--|--|
| Dry Density      | pcf | 83.9 | 110.5 | 103.8 | 112.5 | 114.3 |  |  |  |  |
| Moisture Content | %   | 15.3 | 16.6  | 18.7  | 10.6  | 16.0  |  |  |  |  |

[illegible]



|             |                           |                 |           |
|-------------|---------------------------|-----------------|-----------|
| Job Name:   | Ardmore Recreation Center | Date Completed: | 8/20/2023 |
| Job Number: | CILA-23-05E               | Date Sampled:   | 9/13/2023 |
| Note:       |                           |                 |           |
| Tested By : | MG                        |                 |           |

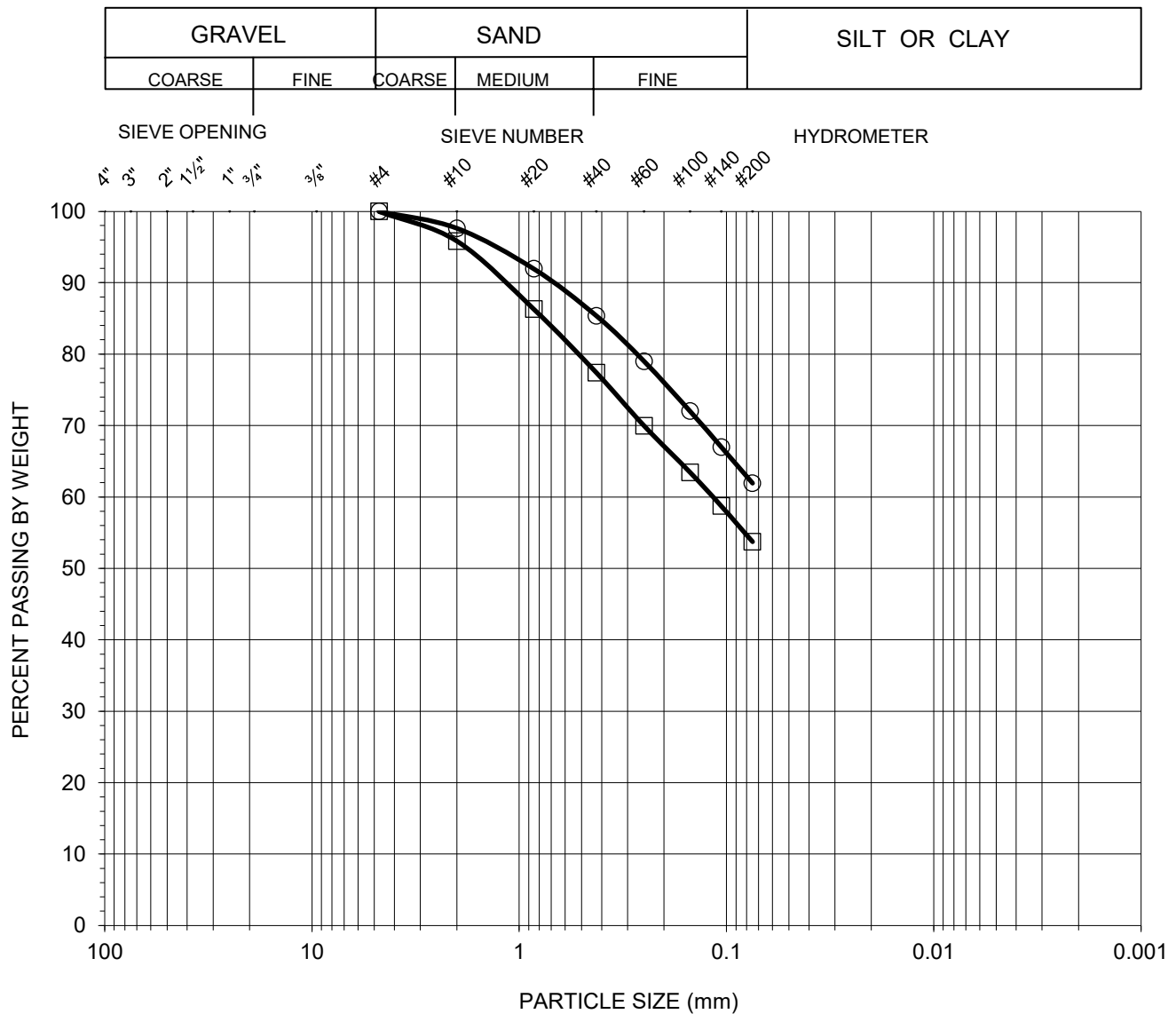
| Boring Number | Sample Number | Depth (ft) | Weight Before Wash - Dry (grams) | Weight After Wash - Dry (grams) | Percent Passing # 200 Sieve | USCS Classification |
|---------------|---------------|------------|----------------------------------|---------------------------------|-----------------------------|---------------------|
| B-2           | SPT-2         | 5-6.5      | 356.6                            | 236.4                           | 34%                         | SC                  |
| B-2           | SPT-4         | 10-11.5    | 374.9                            | 250.4                           | 33%                         | SC                  |
| B-3           | SPT-3         | 7.5-9      | 306.2                            | 115.8                           | 62%                         | CL                  |
| B-3           | SPT-5         | 12.5-14    | 348.7                            | 138.5                           | 60%                         | CL                  |
| I-1           | SK-1          | 3.5-5      | 357.7                            | 190.2                           | 47%                         | SC                  |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |
|               |               |            |                                  |                                 |                             |                     |

[illegible]



## GRAIN SIZE DISTRIBUTION CURVE ASTM D 6913

Client Name: Tetra Tech Tested by: SM Date: 09/12/23  
Project Name: Ardmore Recreation Center Computed by: JP Date: 09/12/23  
Project No.: ciLA 23-05E Checked by: AP Date: 09/12/23



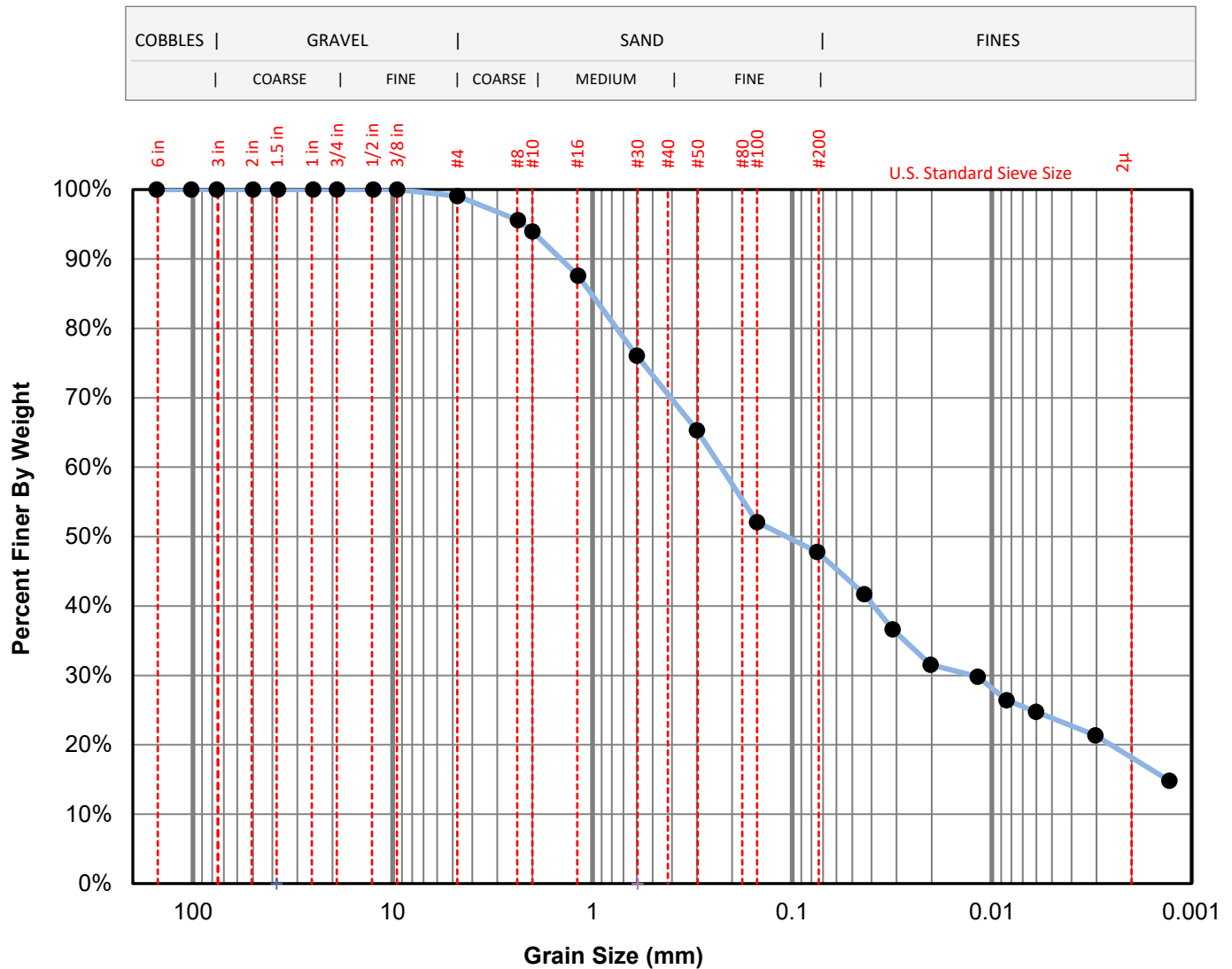
| Symbol | Boring No. | Sample No. | Sample Depth (feet) | Percent |      |             | Atterberg Limits<br>LL:PL:PI | Soil Type<br>U.S.C.S |
|--------|------------|------------|---------------------|---------|------|-------------|------------------------------|----------------------|
|        |            |            |                     | Gravel  | Sand | Silt & Clay |                              |                      |
| ○      | B-1        | R-6        | 15-16.5             | 0       | 38   | 62          | N/A                          | CL*                  |
| □      | B-2        | SK-1       | 0-5                 | 0       | 46   | 54          | N/A                          | CL*                  |
|        |            |            |                     |         |      |             |                              |                      |

\*Note: Based on visual classification of sample





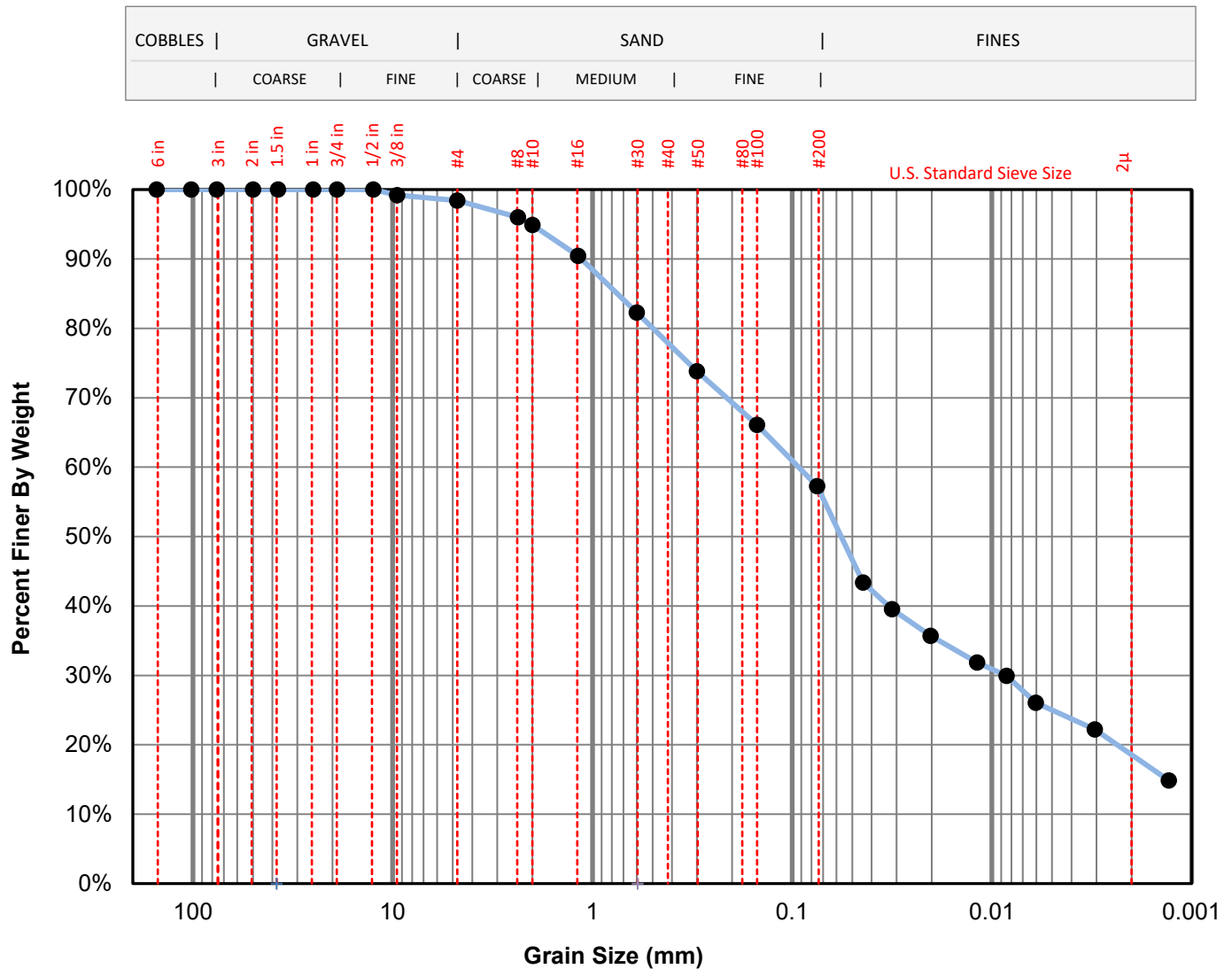
|                     |                           |                        |           |
|---------------------|---------------------------|------------------------|-----------|
| Job Name:           | Ardmore Recreation Center | Date Sampled:          | 8/20/2023 |
| Job Number:         | CILA-23-05E               | Date Completed:        | 9/13/2023 |
| Tested By:          | MG                        | Sample Identification: | B-3, SK-1 |
| Note:               |                           | Sample Depth:          | 0-5       |
| Sample Description: | Brown Calyey SAND, SC     |                        |           |



| Symbol | Boring No. | Sample No. | Depth | LL | PI | USCS | Cobbles | Gravel | Sand | Fines | 2 $\mu$ |
|--------|------------|------------|-------|----|----|------|---------|--------|------|-------|---------|
| ●      | B-3        | SK-1       | 0-5   |    |    | SC   | 0%      | 1%     | 51%  | 48%   | 18%     |



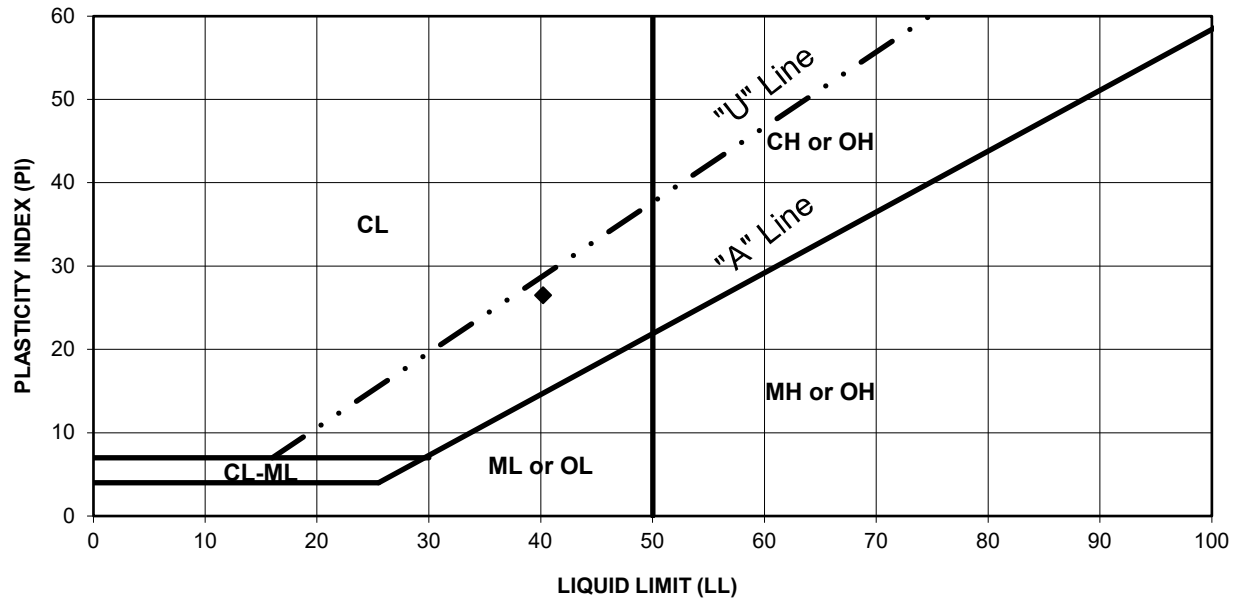
|                     |                               |                        |           |
|---------------------|-------------------------------|------------------------|-----------|
| Job Name:           | Ardmore Recreation Center     | Date Sampled:          | 8/20/2023 |
| Job Number:         | CILA-23-05E                   | Date Completed:        | 9/13/2023 |
| Tested By:          | MG                            | Sample Identification: | B-3, R-8  |
| Note:               |                               | Sample Depth:          | 25-26.5   |
| Sample Description: | Brown Lean CLAY with SAND, CL |                        |           |





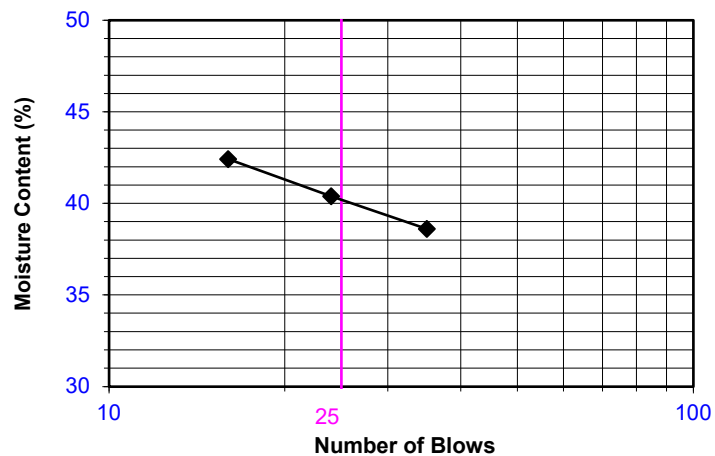
## ATTERBERG LIMITS ASTM D 4318

Client Name: Tetra Tech Tested By: LS Date: 09/08/23  
Project Name: Ardmore Recreation Center Computed By: JP Date: 09/12/23  
Project No.: ciLA 23-05E Checked By: AP Date: 09/12/23



### PROCEDURE USED

- ☐ Wet Preparation  
☒ Dry Preparation  
☒ Procedure A  
Multipoint Test  
☐ Procedure B  
One-point Test



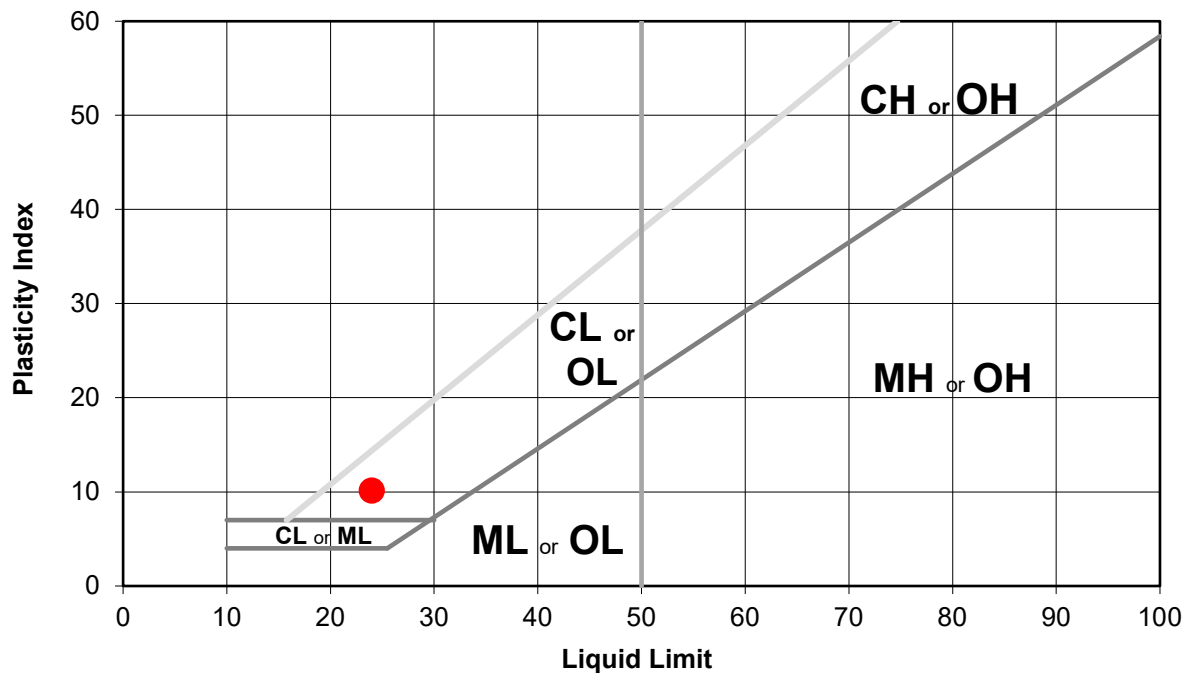
| Symbol | Boring Number | Sample Number | Depth (feet) | LL | PL | PI | Plasticity Chart Symbol |
|--------|---------------|---------------|--------------|----|----|----|-------------------------|
| ◆      | B-1           | SK-1          | 0-5          | 40 | 14 | 26 | CL                      |
|        |               |               |              |    |    |    |                         |



|                     |                               |                        |            |
|---------------------|-------------------------------|------------------------|------------|
| Job Name:           | Ardmore Recreation Center     | Date Sampled:          | 8/20/2023  |
| Job Number:         | CILA-23-05E                   | Date Completed:        | 9/11/2023  |
| Tested By:          | MG                            | Sample Identification: | B-1, SPT-7 |
| Note:               |                               | Sample Depth:          | 20-21.5ft  |
| Sample Description: | Brown Lean CLAY with Sand, CL |                        |            |

|                            |       | Plastic Limit |       |
|----------------------------|-------|---------------|-------|
| Test No.                   |       | 1             | 2     |
| Number of Blows            |       |               |       |
| Container ID               |       | F6            | F8    |
| Wet Weight of Soil + Cont. | grams | 31.77         | 32.53 |
| Dry Weight of Soil + Cont. | grams | 29.44         | 30.12 |
| Weight of Container        | grams | 12.56         | 12.80 |
| Moisture Weight            | grams | 2.33          | 2.41  |
| Weight of Dry Soil         | grams | 16.88         | 17.32 |
| Moisture Content           | %     | 13.8          | 13.9  |

| Liquid Limit |       |       |   |
|--------------|-------|-------|---|
| 1            | 2     | 3     | 4 |
| 34           | 26    | 15    |   |
| A35          | N14   | N4    |   |
| 63.83        | 58.79 | 54.75 |   |
| 56.81        | 52.36 | 49.11 |   |
| 25.69        | 24.96 | 25.89 |   |
| 7.02         | 6.43  | 5.64  |   |
| 31.12        | 27.40 | 23.22 |   |
| 22.6         | 23.5  | 24.3  |   |



Plastic Limit 14  
 Liquid Limit 24  
 Plasticity Index 10

USCS Classification **CL**

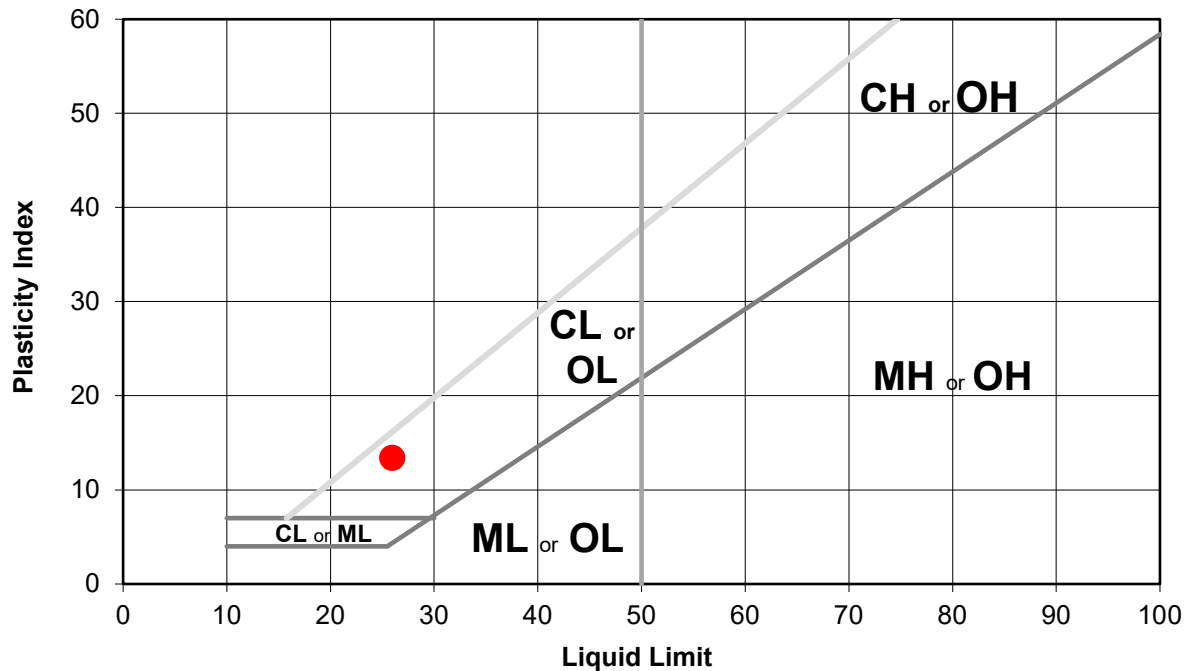
Based on Atterberg Limits only



|                     |                                |                        |            |
|---------------------|--------------------------------|------------------------|------------|
| Job Name:           | Ardmore Recreation Center      | Date Sampled:          | 8/20/2023  |
| Job Number:         | CILA-23-05E                    | Date Completed:        | 9/11/2023  |
| Tested By:          | MG                             | Sample Identification: | B-2, SPT-6 |
| Note:               |                                | Sample Depth:          | 15-16.5ft  |
| Sample Description: | Dark Brown Sandy Lean CLAY, CL |                        |            |

|                            |       | Plastic Limit |       |
|----------------------------|-------|---------------|-------|
| Test No.                   |       | 1             | 2     |
| Number of Blows            |       |               |       |
| Container ID               |       | P1            | V7    |
| Wet Weight of Soil + Cont. | grams | 31.63         | 35.63 |
| Dry Weight of Soil + Cont. | grams | 29.49         | 33.04 |
| Weight of Container        | grams | 12.34         | 12.66 |
| Moisture Weight            | grams | 2.14          | 2.59  |
| Weight of Dry Soil         | grams | 17.15         | 20.38 |
| Moisture Content           | %     | 12.5          | 12.7  |

| Liquid Limit |       |       |   |
|--------------|-------|-------|---|
| 1            | 2     | 3     | 4 |
| 32           | 24    | 18    |   |
| P38          | P36   | T18   |   |
| 56.39        | 53.45 | 62.17 |   |
| 50.65        | 47.71 | 54.40 |   |
| 26.85        | 25.43 | 25.81 |   |
| 5.74         | 5.74  | 7.77  |   |
| 23.80        | 22.28 | 28.59 |   |
| 24.1         | 25.8  | 27.2  |   |



Plastic Limit 13  
Liquid Limit 26  
Plasticity Index 13

USCS Classification **CL**

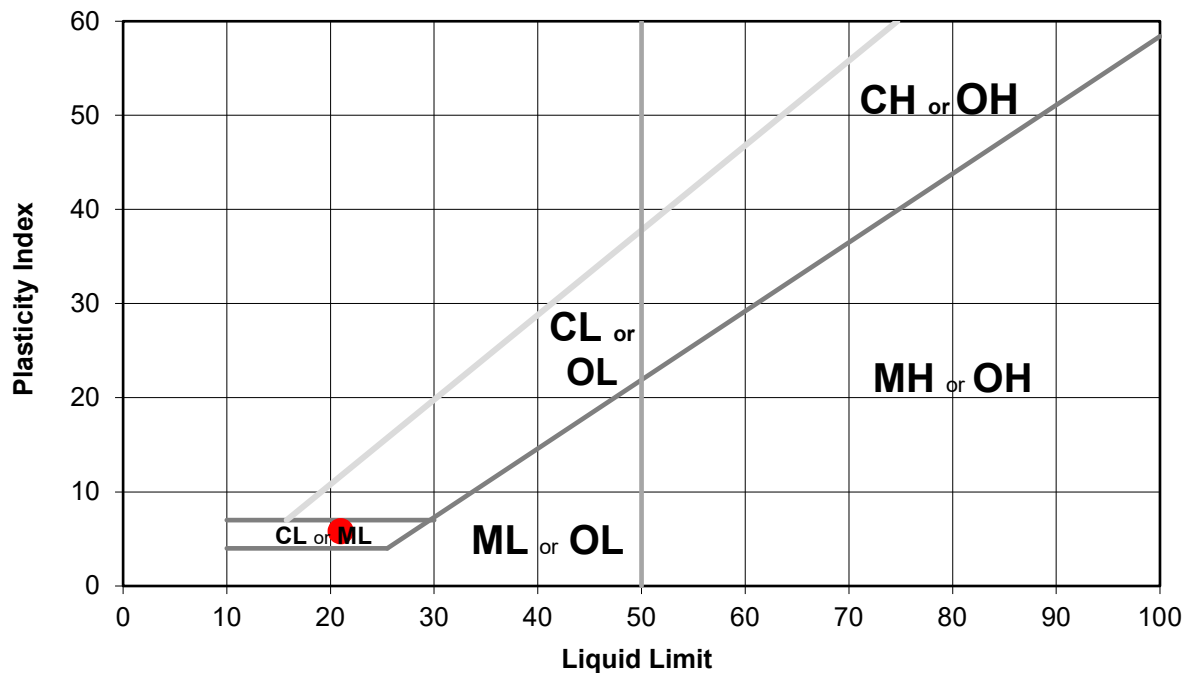
Based on Atterberg Limits only



|                     |                                      |                        |           |
|---------------------|--------------------------------------|------------------------|-----------|
| Job Name:           | Ardmore Recreation Center            | Date Sampled:          | 8/20/2023 |
| Job Number:         | CILA-23-05E                          | Date Completed:        | 9/11/2023 |
| Tested By:          | MG                                   | Sample Identification: | B-3, R-4  |
| Note:               |                                      | Sample Depth:          | 10-11.5ft |
| Sample Description: | Dark Brown Sandy CLAYEY SILT, CL -ML |                        |           |

|                            |       | Plastic Limit |       |
|----------------------------|-------|---------------|-------|
| Test No.                   |       | 1             | 2     |
| Number of Blows            |       |               |       |
| Container ID               |       | F10           | A1    |
| Wet Weight of Soil + Cont. | grams | 27.13         | 26.55 |
| Dry Weight of Soil + Cont. | grams | 25.18         | 24.74 |
| Weight of Container        | grams | 12.59         | 12.56 |
| Moisture Weight            | grams | 1.95          | 1.81  |
| Weight of Dry Soil         | grams | 12.59         | 12.18 |
| Moisture Content           | %     | 15.5          | 14.9  |

| Liquid Limit |       |       |   |
|--------------|-------|-------|---|
| 1            | 2     | 3     | 4 |
| 36           | 26    | 16    |   |
| M34          | S24   | P16   |   |
| 49.68        | 56.51 | 54.64 |   |
| 45.60        | 51.34 | 49.43 |   |
| 25.38        | 26.42 | 26.20 |   |
| 4.08         | 5.17  | 5.21  |   |
| 20.22        | 24.92 | 23.23 |   |
| 20.2         | 20.7  | 22.4  |   |



Plastic Limit 15  
 Liquid Limit 21  
 Plasticity Index 6

USCS Classification **CL - ML**

Based on Atterberg Limits only



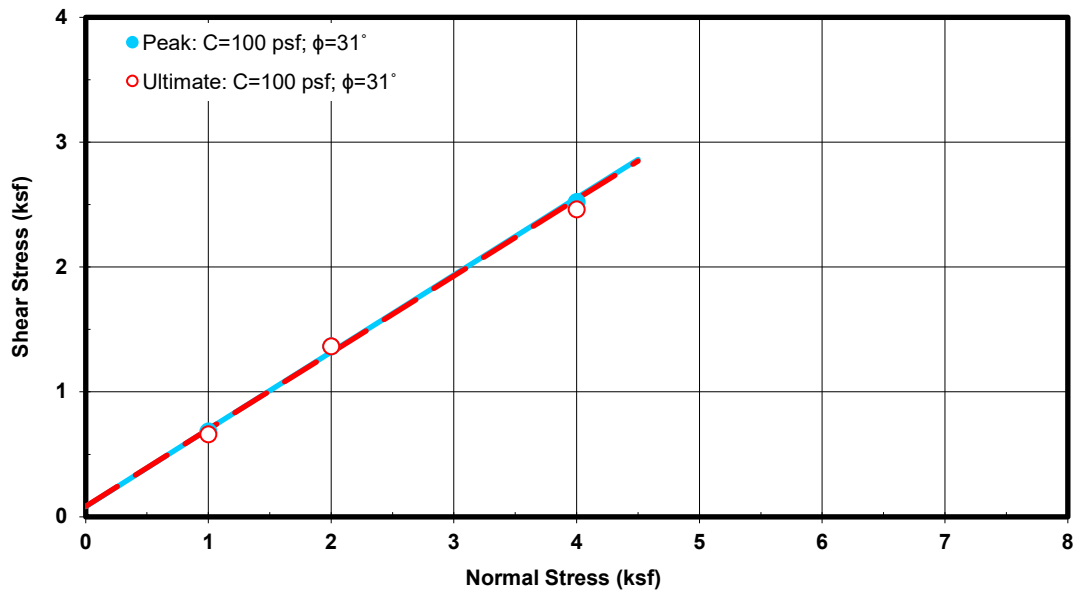
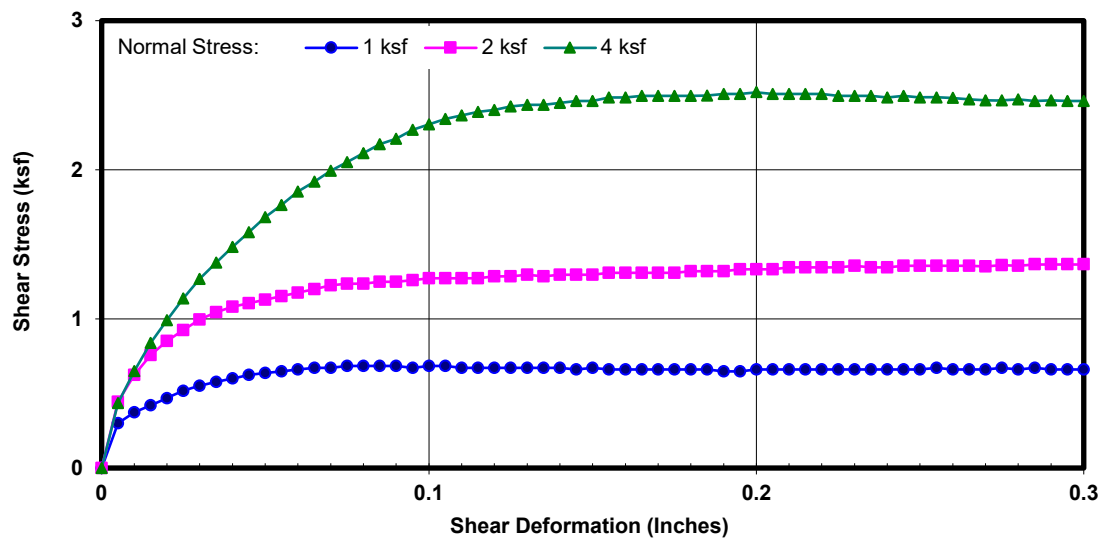


## DIRECT SHEAR TEST RESULTS ASTM D 3080

**Project Name:** Ardmore Recreation Center  
**Project No.:** ciLA 23-05E  
**Boring No.:** B-1  
**Sample No.:** R-2 **Depth (ft):** 5-6.5  
**Sample Type:** Mod. Cal.  
**Soil Description:** Silty Sand  
**Test Condition:** Inundated **Shear Rate:** 0.005 in/min

**Tested By:** ST **Date:** 09/08/23  
**Computed By:** JP **Date:** 09/12/23  
**Checked by:** AP **Date:** 09/12/23

| Wet<br>Unit Weight<br>(pcf) | Dry<br>Unit Weight<br>(pcf) | Initial<br>Moisture<br>Content (%) | Final<br>Moisture<br>Content (%) | Initial Degree<br>Saturation<br>(%) | Final Degree<br>Saturation<br>(%) | Normal<br>Stress<br>(ksf) | Peak<br>Shear<br>Stress (ksf) | Ultimate<br>Shear<br>Stress (ksf) |
|-----------------------------|-----------------------------|------------------------------------|----------------------------------|-------------------------------------|-----------------------------------|---------------------------|-------------------------------|-----------------------------------|
| 122.2                       | 109.8                       | 11.3                               | 17.7                             | 57                                  | 89                                | 1                         | 0.684                         | 0.660                             |
|                             |                             |                                    |                                  |                                     |                                   | 2                         | 1.366                         | 1.366                             |
|                             |                             |                                    |                                  |                                     |                                   | 4                         | 2.520                         | 2.461                             |



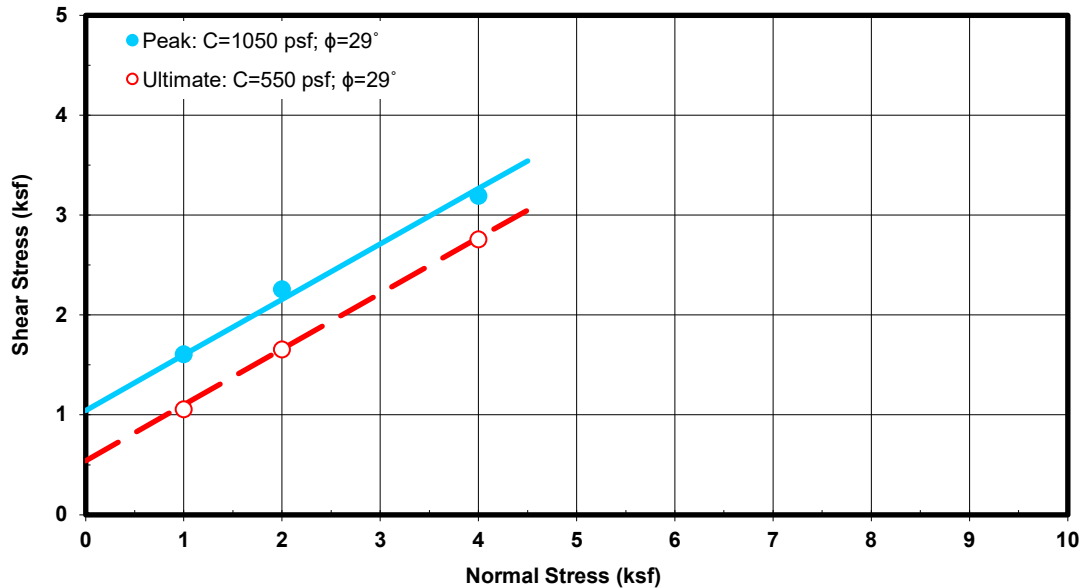
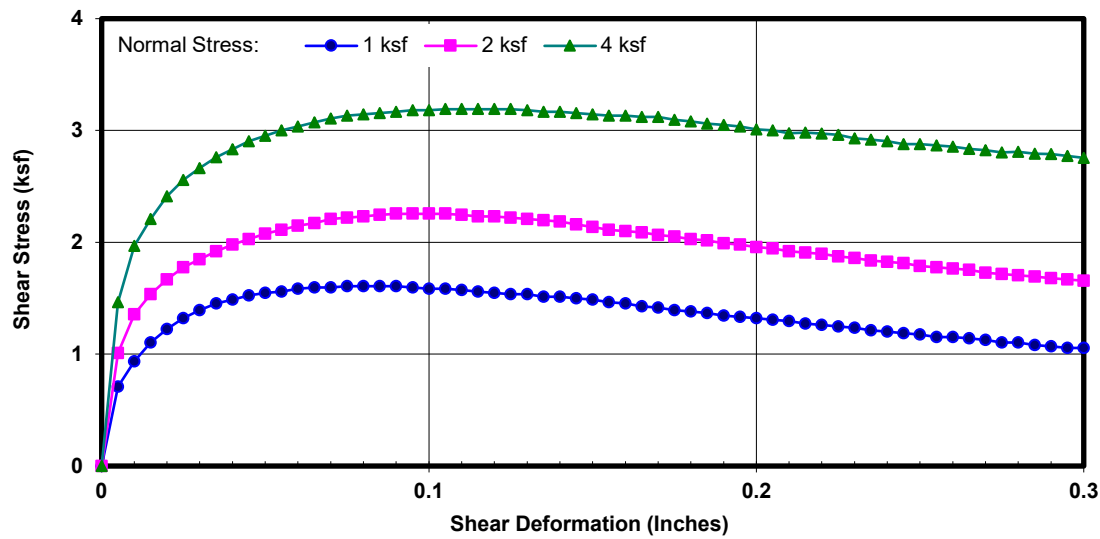


## DIRECT SHEAR TEST RESULTS ASTM D 3080

**Project Name:** Ardmore Recreation Center  
**Project No.:** ciLA 23-05E  
**Boring No.:** B-1  
**Sample No.:** R-6 **Depth (ft):** 15-16.5  
**Sample Type:** Mod. Cal.  
**Soil Description:** Sandy Clay  
**Test Condition:** Inundated **Shear Rate:** 0.005 in/min

**Tested By:** ST **Date:** 09/08/23  
**Computed By:** JP **Date:** 09/12/23  
**Checked by:** AP **Date:** 09/12/23

| Wet<br>Unit Weight<br>(pcf) | Dry<br>Unit Weight<br>(pcf) | Initial<br>Moisture<br>Content (%) | Final<br>Moisture<br>Content (%) | Initial Degree<br>Saturation<br>(%) | Final Degree<br>Saturation<br>(%) | Normal<br>Stress<br>(ksf) | Peak<br>Shear<br>Stress (ksf) | Ultimate<br>Shear<br>Stress (ksf) |
|-----------------------------|-----------------------------|------------------------------------|----------------------------------|-------------------------------------|-----------------------------------|---------------------------|-------------------------------|-----------------------------------|
| 135.1                       | 116.9                       | 15.6                               | 16.4                             | 95                                  | 100                               | 1                         | 1.608                         | 1.056                             |
|                             |                             |                                    |                                  |                                     |                                   | 2                         | 2.256                         | 1.656                             |
|                             |                             |                                    |                                  |                                     |                                   | 4                         | 3.192                         | 2.756                             |



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DBE|MBE|SBE

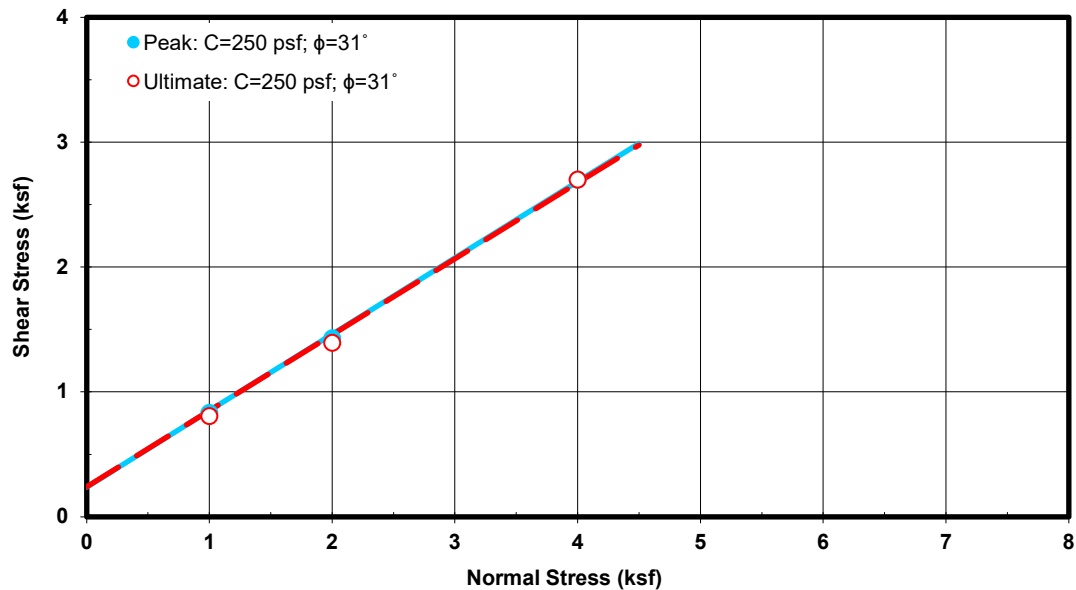
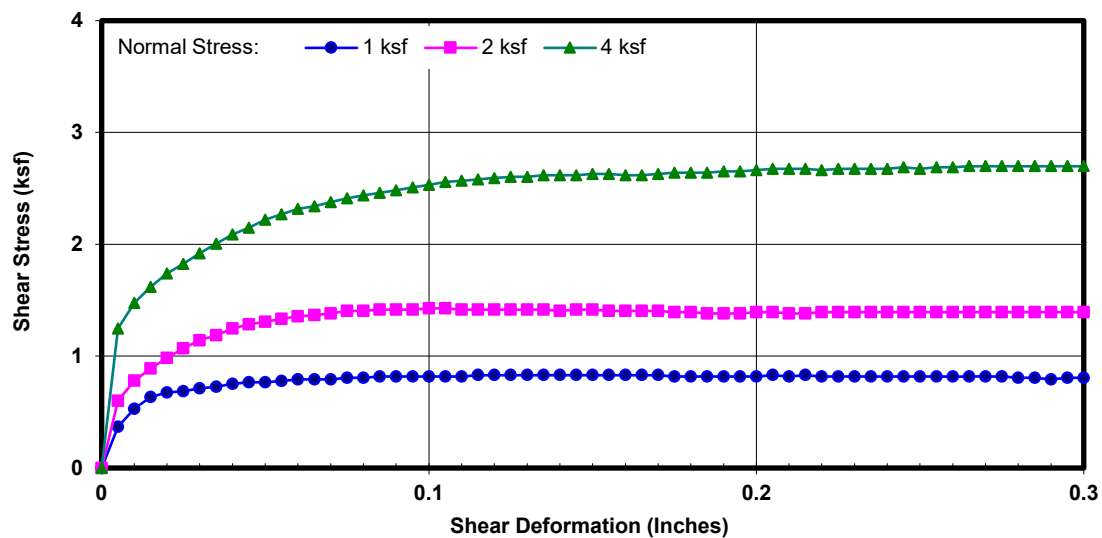
2607 Pomona Boulevard | Pomona, CA 91768

t. 909.869.6316 | f. 909.869.6318 | [www.aplaboratory.com](http://www.aplaboratory.com)**DIRECT SHEAR TEST RESULTS**  
**ASTM D 3080**

**Project Name:** Ardmore Recreation Center  
**Project No.:** ciLA 23-05E  
**Boring No.:** B-2  
**Sample No.:** R-3 **Depth (ft):** 7.5-9  
**Sample Type:** Mod. Cal.  
**Soil Description:** Clay w/sand  
**Test Condition:** Inundated **Shear Rate:** 0.005 in/min

**Tested By:** ST **Date:** 09/11/23  
**Computed By:** JP **Date:** 09/12/23  
**Checked by:** AP **Date:** 09/12/23

| Wet Unit Weight (pcf) | Dry Unit Weight (pcf) | Initial Moisture Content (%) | Final Moisture Content (%) | Initial Degree Saturation (%) | Final Degree Saturation (%) | Normal Stress (ksf) | Peak Shear Stress (ksf) | Ultimate Shear Stress (ksf) |
|-----------------------|-----------------------|------------------------------|----------------------------|-------------------------------|-----------------------------|---------------------|-------------------------|-----------------------------|
| 124.3                 | 107.2                 | 16.0                         | 19.3                       | 75                            | 91                          | 1                   | 0.832                   | 0.805                       |
|                       |                       |                              |                            |                               |                             | 2                   | 1.428                   | 1.392                       |
|                       |                       |                              |                            |                               |                             | 4                   | 2.700                   | 2.700                       |



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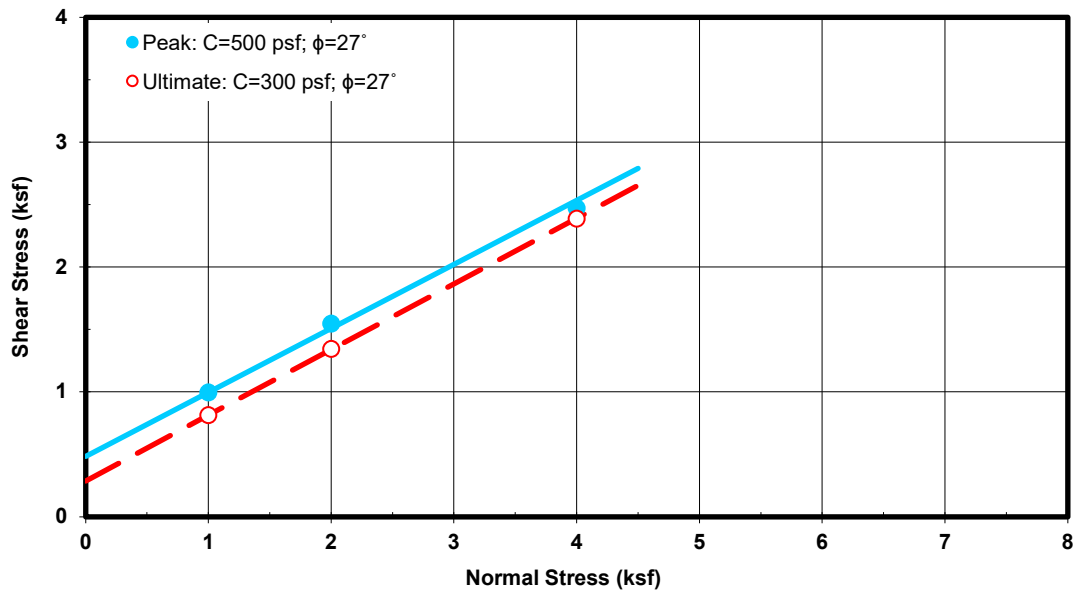
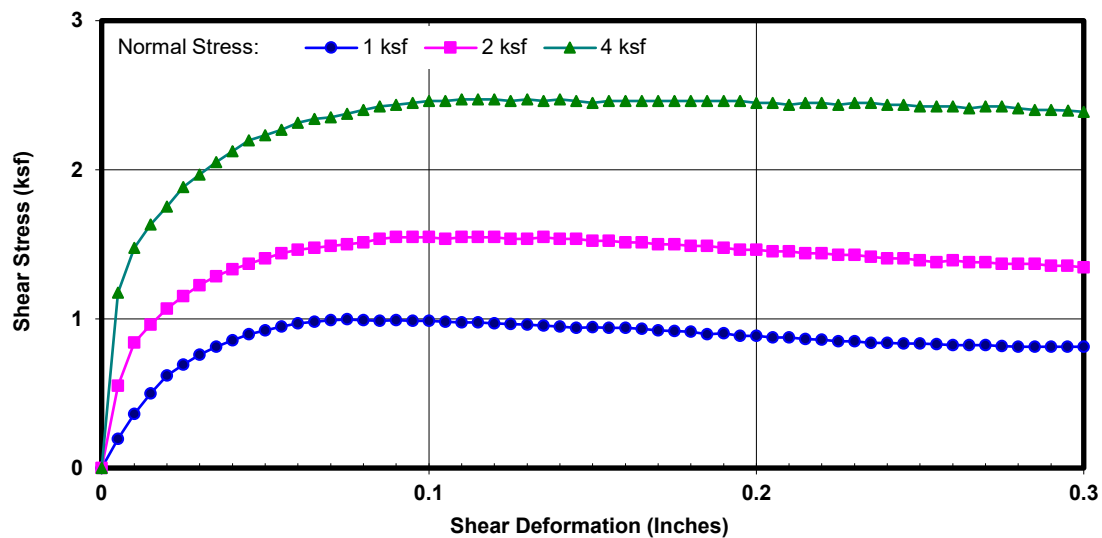
2607 Pomona Boulevard | Pomona, CA 91768

t. 909.869.6316 | f. 909.869.6318 | [www.aplaboratory.com](http://www.aplaboratory.com)**DIRECT SHEAR TEST RESULTS**  
**ASTM D 3080**

**Project Name:** Ardmore Recreation Center  
**Project No.:** ciLA 23-05E  
**Boring No.:** B-3  
**Sample No.:** R-6 **Depth (ft):** 15-16.5  
**Sample Type:** Mod. Cal.  
**Soil Description:** Clay  
**Test Condition:** Inundated **Shear Rate:** 0.005 in/min

**Tested By:** ST **Date:** 09/11/23  
**Computed By:** JP **Date:** 09/12/23  
**Checked by:** AP **Date:** 09/12/23

| Wet Unit Weight (pcf) | Dry Unit Weight (pcf) | Initial Moisture Content (%) | Final Moisture Content (%) | Initial Degree Saturation (%) | Final Degree Saturation (%) | Normal Stress (ksf) | Peak Shear Stress (ksf) | Ultimate Shear Stress (ksf) |
|-----------------------|-----------------------|------------------------------|----------------------------|-------------------------------|-----------------------------|---------------------|-------------------------|-----------------------------|
| 132.9                 | 114.1                 | 16.4                         | 17.6                       | 93                            | 100                         | 1                   | 0.997                   | 0.813                       |
|                       |                       |                              |                            |                               |                             | 2                   | 1.548                   | 1.344                       |
|                       |                       |                              |                            |                               |                             | 4                   | 2.472                   | 2.388                       |



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ASTM D 4829

Client Name: Tetra TechAP Job No.: 23-0906Project Name: Ardmore Recreation CenterDate: 09/11/23Project No.: ciLA 23-05E

| Boring No. | Sample No. | Depth (ft) | Soil Description | Molded Dry Density (pcf) | Molded Moisture Content (%) | Init. Degree Saturation (%) | Measured Expansion Index | Corrected Expansion Index |
|------------|------------|------------|------------------|--------------------------|-----------------------------|-----------------------------|--------------------------|---------------------------|
|            |            |            |                  |                          |                             |                             |                          |                           |
| B-2        | SK-1       | 0-5        | Sandy Clay       | 106.0                    | 11.3                        | 51.7                        | 55                       | 56                        |
|            |            |            |                  |                          |                             |                             |                          |                           |
|            |            |            |                  |                          |                             |                             |                          |                           |
|            |            |            |                  |                          |                             |                             |                          |                           |
|            |            |            |                  |                          |                             |                             |                          |                           |
|            |            |            |                  |                          |                             |                             |                          |                           |
|            |            |            |                  |                          |                             |                             |                          |                           |

**ASTM EXPANSION CLASSIFICATION**

| Expansion Index | Classification |
|-----------------|----------------|
| 0-20            | V. Low         |
| 21-50           | Low            |
| 51-90           | Medium         |
| 91-130          | High           |
| >130            | V. High        |

**AP Engineering and Testing, Inc.**

DBE|MBE|SBE

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t. 909.869.6316 | f. 909.869.6318 | [www.aplaboratory.com](http://www.aplaboratory.com)**R-VALUE TEST DATA**

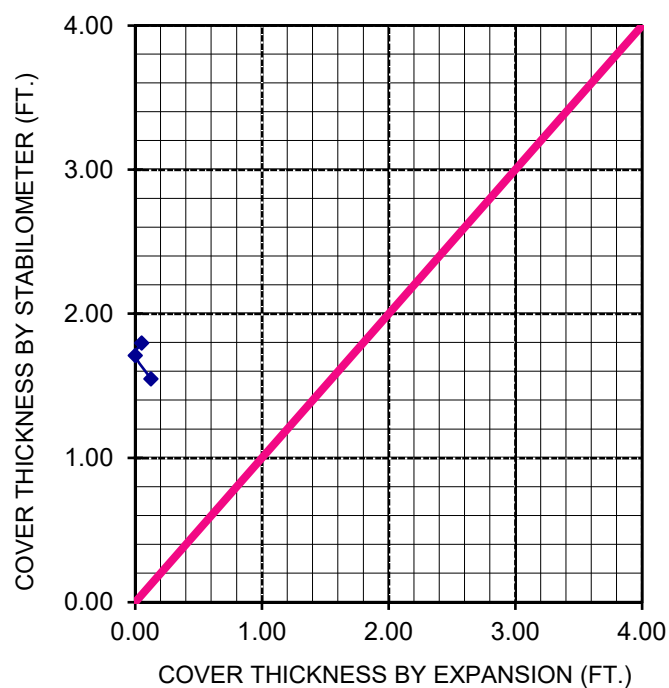
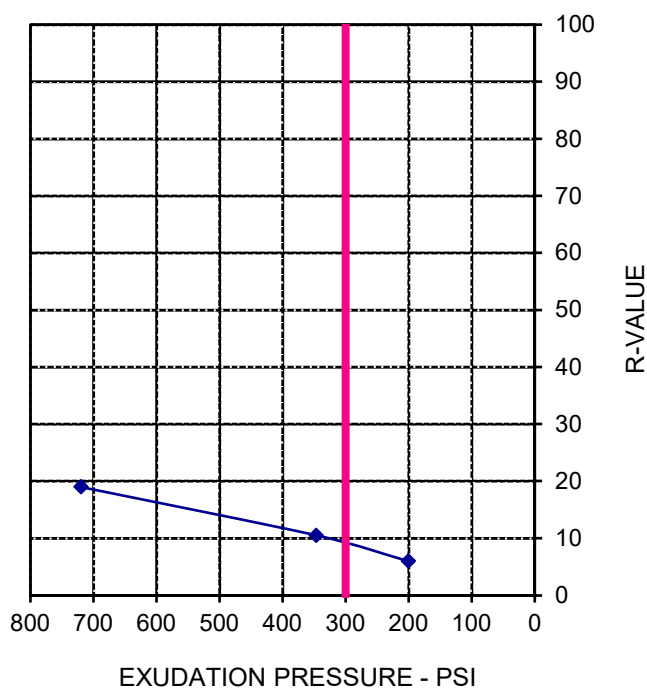
ASTM D2844

Project Name: Ardmore Recreation Center  
Project Number: ciLA 23-05E  
Boring No.: B-2  
Sample No.: SK-1 Depth (ft.): 0-5  
Location: N/A  
Soil Description: Sandy Clay

Tested By: ST Date: 09/07/23  
Computed By: KM Date: 09/08/23  
Checked By: AP Date: 09/12/23

|                                    |        |        |        |  |
|------------------------------------|--------|--------|--------|--|
| Mold Number                        | C      | A      | B      |  |
| Water Added, g                     | 61     | 41     | 21     |  |
| Compact Moisture(%)                | 19.7   | 17.7   | 15.6   |  |
| Compaction Gage Pressure, psi      | 80     | 90     | 200    |  |
| Exudation Pressure, psi            | 200    | 346    | 720    |  |
| Sample Height, Inches              | 2.7    | 2.6    | 2.6    |  |
| Gross Weight Mold, g               | 3115   | 3069   | 3073   |  |
| Tare Weight Mold, g                | 1967   | 1966   | 1965   |  |
| Net Sample Weight, g               | 1148   | 1103   | 1108   |  |
| Expansion, inches $\times 10^{-4}$ | 15     | 0      | 37     |  |
| Stability 2,000 (160 psi)          | 65/145 | 52/132 | 44/120 |  |
| Turns Displacement                 | 4.78   | 4.63   | 3.72   |  |
| R-Value Uncorrected                | 5      | 10     | 18     |  |
| R-Value Corrected                  | 6      | 11     | 19     |  |
| Dry Density, pcf                   | 107.6  | 109.3  | 111.7  |  |
| Traffic Index                      | 8.0    | 8.0    | 8.0    |  |
| G.E. by Stability                  | 1.80   | 1.71   | 1.55   |  |
| G.E. by Expansion                  | 0.05   | 0.00   | 0.12   |  |

|         |   |      |
|---------|---|------|
| R-VALUE | By Exudation:   | 9    |
|         | By Expansion:   | *N/A |
|         | At Equilibrium:<br>(by Exudation)                               | 9    |
| Remarks | Gf = 1.34, and 0.4 %<br>Retained on the 3/4"<br>*Not Applicable |      |



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t. 909.869.6316 | f. 909.869.6318 | [www.aplaboratory.com](http://www.aplaboratory.com)**CORROSION TEST RESULTS**Client Name: Tetra TechAP Job No.: 23-0906Project Name: Ardmore Recreation CenterDate: 09/08/23Project No.: ciLA 23-05E

| Boring No. | Sample No. | Depth (feet) | Soil Description | Minimum Resistivity (ohm-cm) | pH  | Sulfate Content (ppm) | Chloride Content (ppm) |
|------------|------------|--------------|------------------|------------------------------|-----|-----------------------|------------------------|
|            |            |              |                  |                              |     |                       |                        |
| B-1        | SK-1       | 0-5          | Lean Clay        | 1,440                        | 8.5 | 37                    | 19                     |
| B-2        | R-7        | 20-21.5      | Lean Clay        | 1,326                        | 7.9 | 74                    | 21                     |
|            |            |              |                  |                              |     |                       |                        |
|            |            |              |                  |                              |     |                       |                        |
|            |            |              |                  |                              |     |                       |                        |
|            |            |              |                  |                              |     |                       |                        |
|            |            |              |                  |                              |     |                       |                        |
|            |            |              |                  |                              |     |                       |                        |
|            |            |              |                  |                              |     |                       |                        |
|            |            |              |                  |                              |     |                       |                        |

NOTES: Resistivity Test and pH: California Test Method 643

Sulfate Content : California Test Method 417

Chloride Content : California Test Method 422

ND = Not Detectable

NA = Not Sufficient Sample

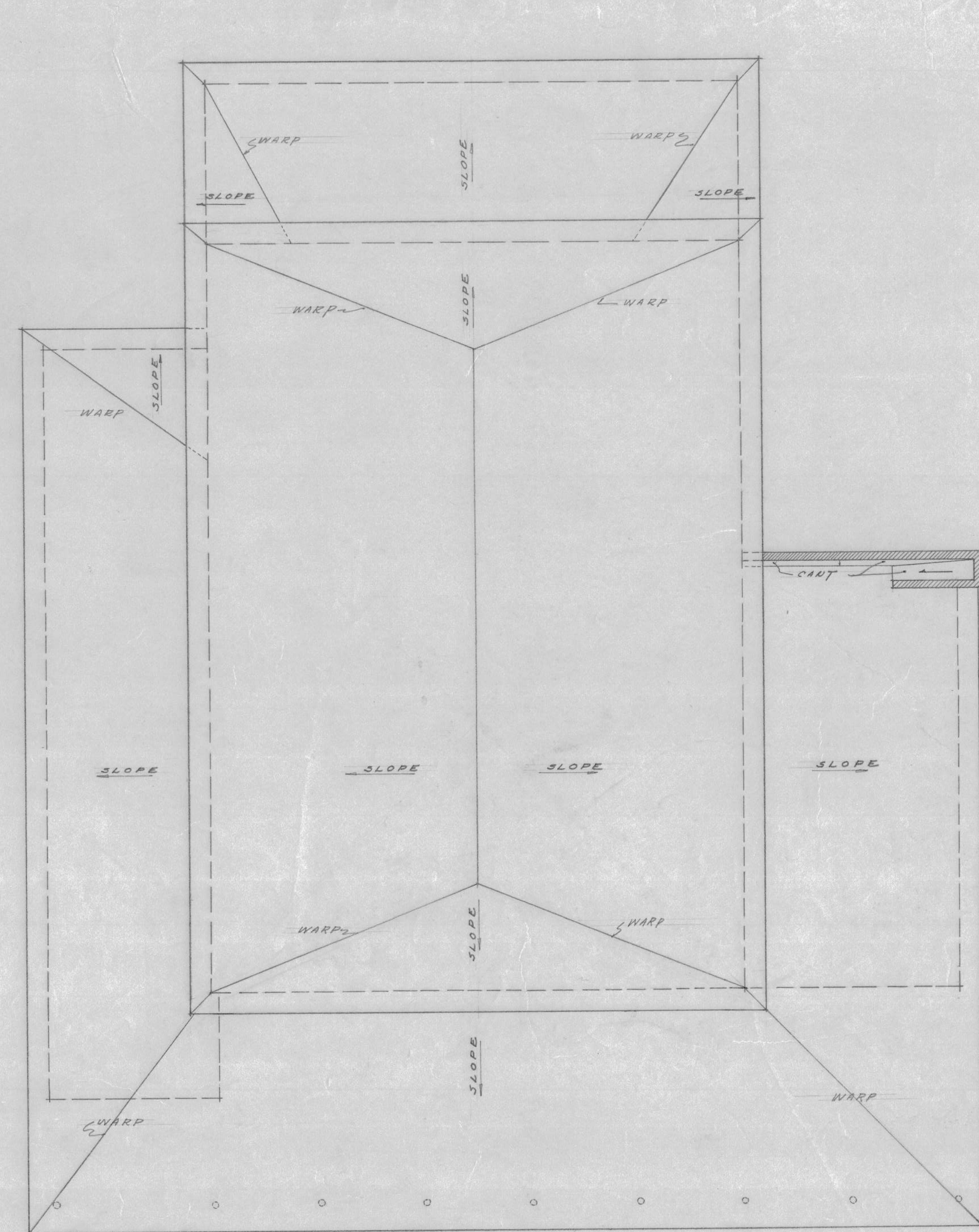
NR = Not Requested



## **APPENDIX B**

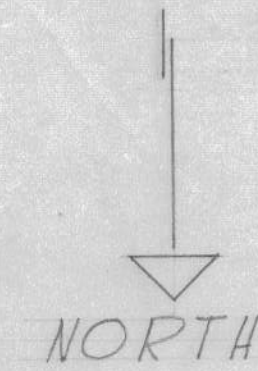
### **Plans and Recent Topographic Survey Map**





ROOF PLAN

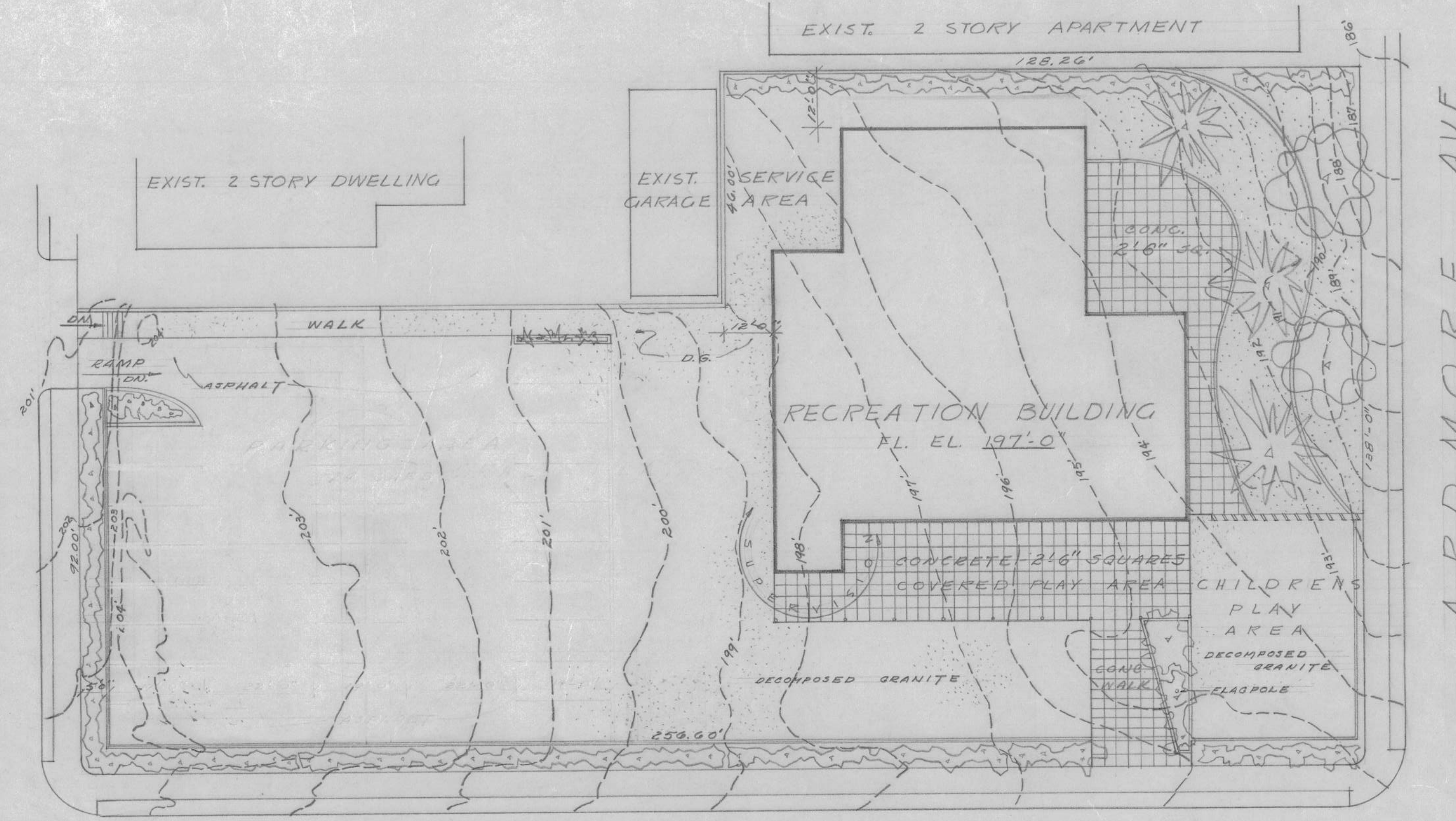
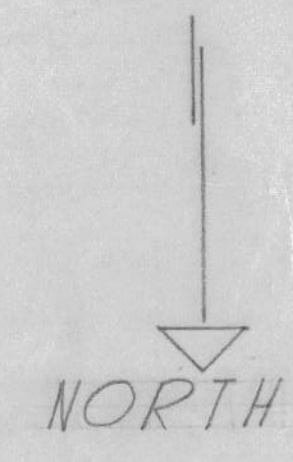
SCALE 1/8" = 1'-0"



**MATERIAL SCHEDULE**

|  |                                   |
|--|-----------------------------------|
|  | 5" PRECAST REINFORCED WALL PANELS |
|  | BRICK                             |
|  | STUD, METAL LATH & PLASTER        |
|  | CONCRETE                          |
|  | METAL IN SECTION                  |
|  | METAL IN ELEVATION                |
|  | WOOD IN SECTION                   |
|  | WOOD IN ELEVATION                 |
|  | TERRAZZO                          |
|  | PLASTER                           |
|  | FIBER GLAS                        |

IROLA ST.

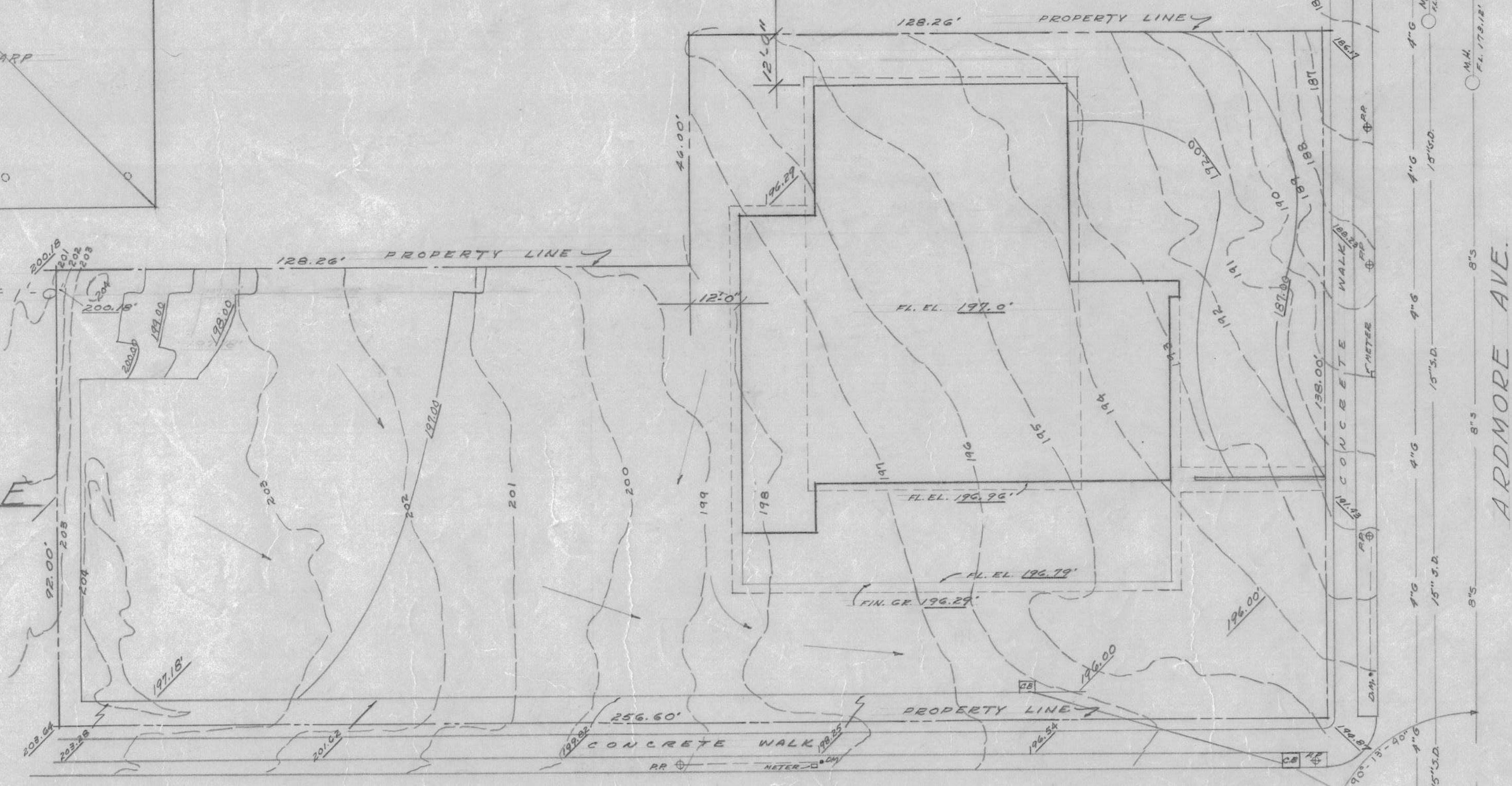


PLOT PLAN

SCALE 1" = 20'-0"

**PLOT PLAN LEGEND**

|     |                 |
|-----|-----------------|
| --- | EXISTING GRADES |
| --- | FINISH GRADES   |



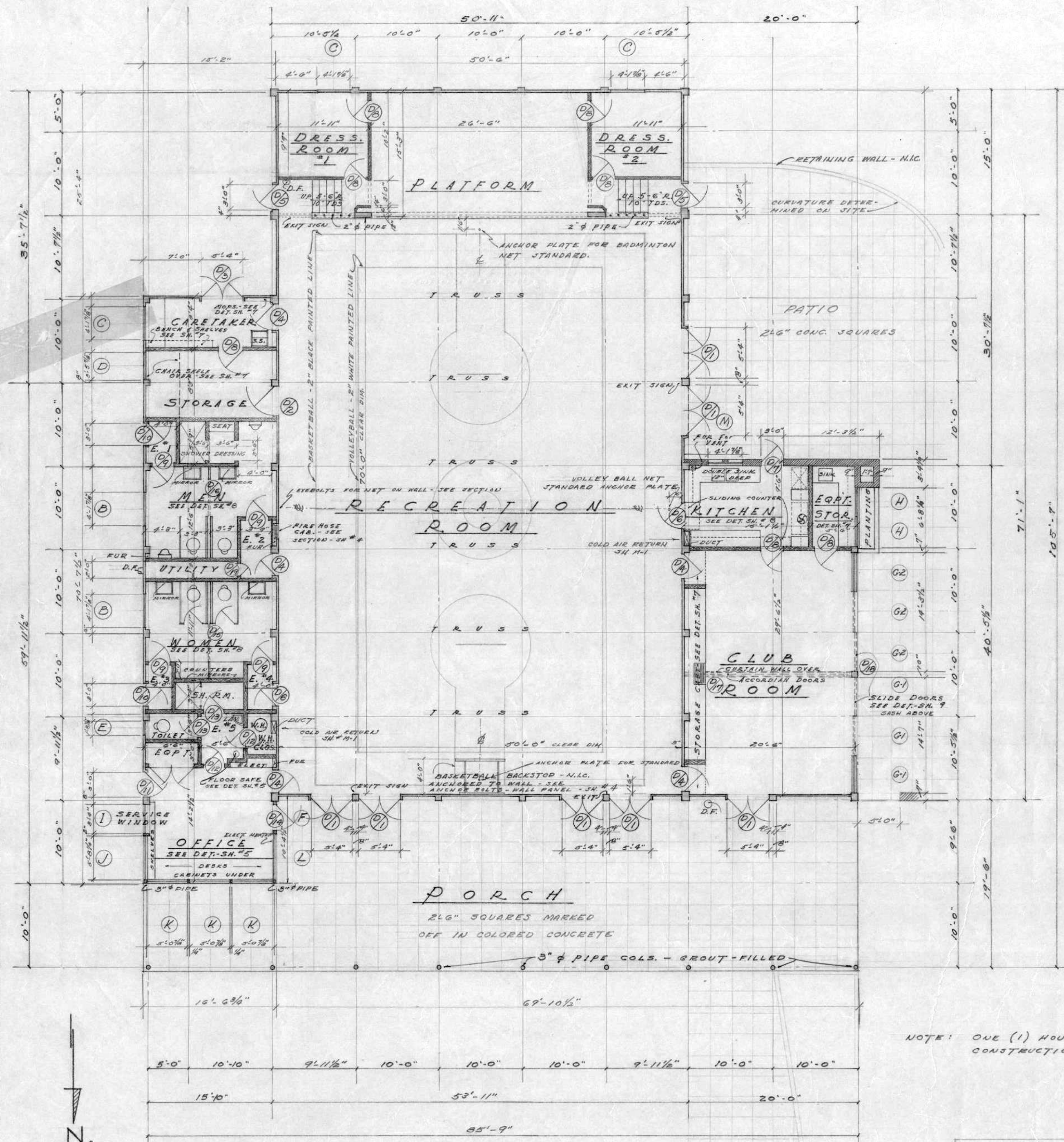
GRADING PLAN

**SHEET INDEX**

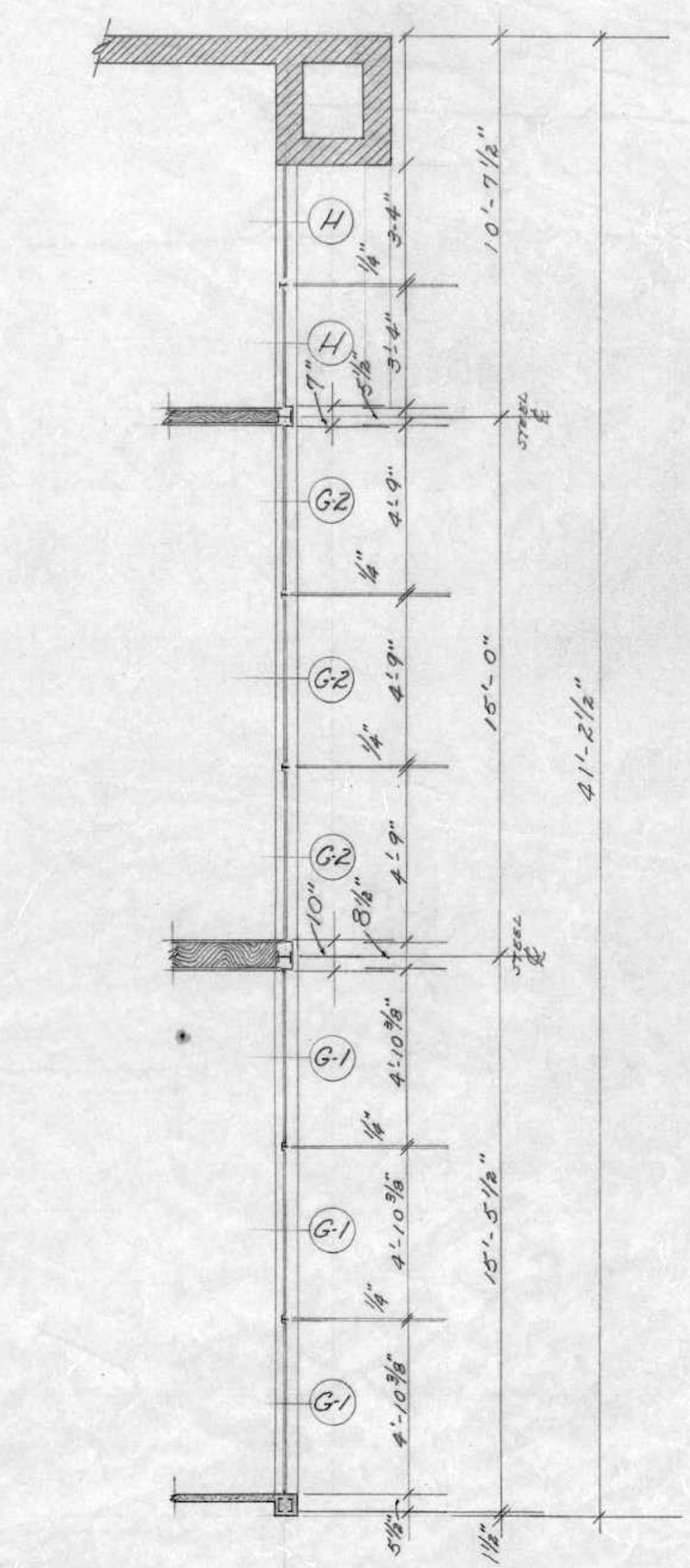
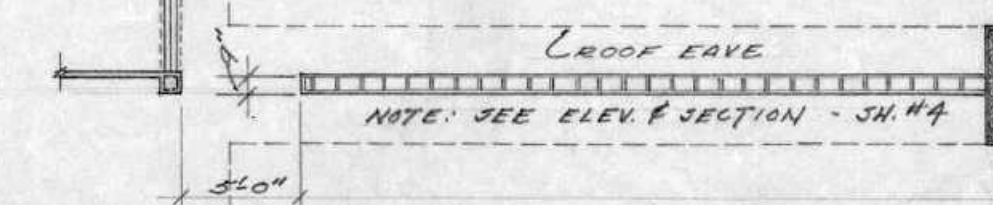
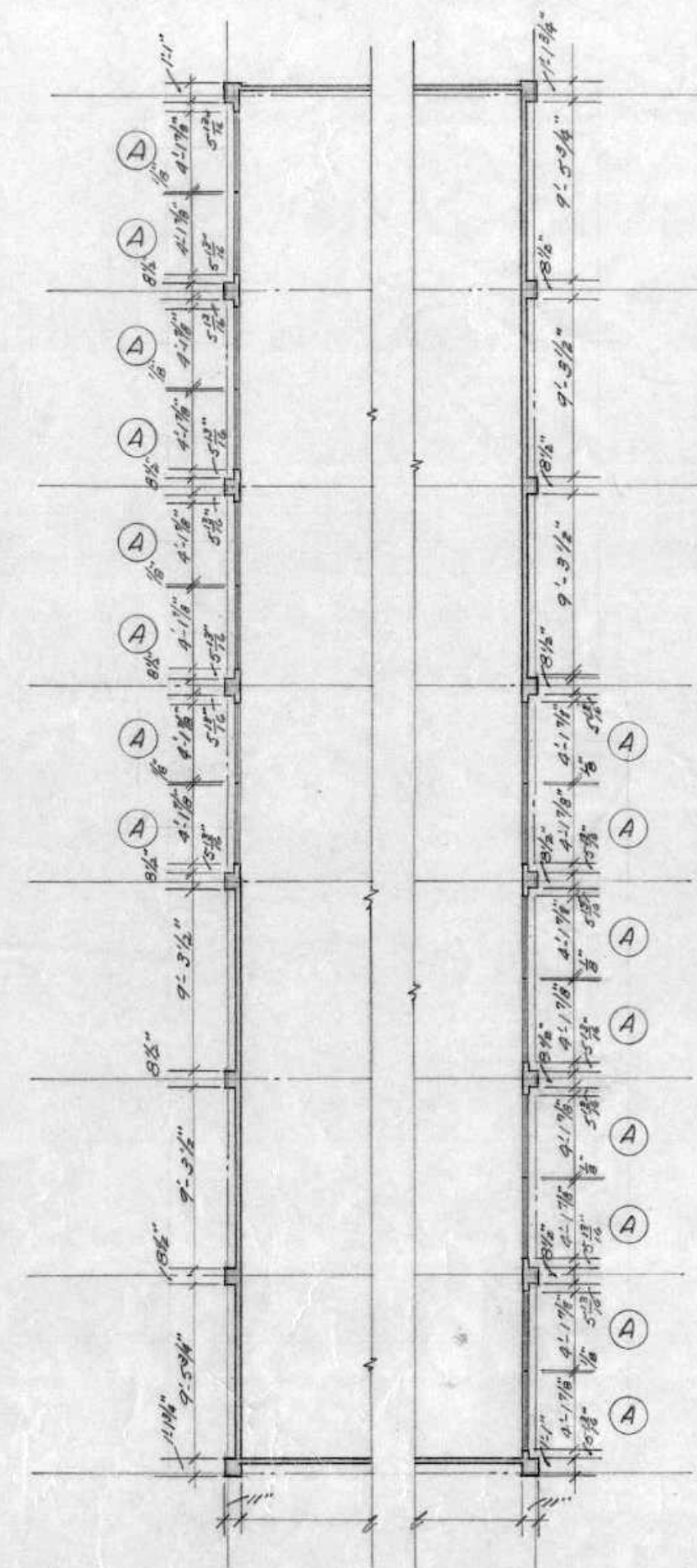
| SHEET NO. | DESCRIPTION                       |
|-----------|-----------------------------------|
| 1         | PLOT PLAN, ROOF PLAN              |
| 2         | FLOOR PLAN                        |
| 3         | ELEVATIONS AND EAVE DETAILS       |
| 4         | SECTIONS AND MISC. DETAILS        |
| 5         | DIRECTOR'S ROOM DETAILS           |
| 6         | PLATFORM DETAILS                  |
| 7         | CLUBROOM CABINETS & MISC. DETAILS |
| 8         | TOILETS AND KITCHEN DETAILS       |
| 9         | DOOR SCHEDULE AND DOOR DETAILS    |
| 10        | WINDOW SCHEDULE & WINDOW DETAILS  |
| 3-1       | FOUNDATION PLAN AND DETAILS       |
| 3-2       | ROOF FRAMING PLAN AND DETAILS     |
| 3-3       | STRUCTURAL SECTIONS               |
| 3-4       | WALL PANEL DETAILS                |
| 3-5       | SECTION AND DETAILS               |
| 3-6       | WALL PANEL ELEVATIONS             |
| E-1       | ELECTRICAL                        |
| M-1       | PLUMBING AND HEATING              |

|                             |  |                                  |           |
|-----------------------------|--|----------------------------------|-----------|
| <b>PLOT &amp; ROOF PLAN</b> |  | <b>CLUBHOUSE BUILDING</b>        |           |
| PRESIDENT                   |  | ARDMORE PLAYGROUND               |           |
| GENERAL MANAGER             |  | 3250 SAN MARINO STREET           |           |
| SUPERINTENDENT OF PARKS     |  | LOS ANGELES CALIFORNIA           |           |
|                             |  | PREPARED FOR                     |           |
|                             |  | DEPARTMENT OF RECREATION & PARKS |           |
|                             |  | LOS ANGELES CALIFORNIA           |           |
|                             |  | PREPARED BY                      |           |
|                             |  | DEPARTMENT OF RECREATION & PARKS |           |
|                             |  | LOS ANGELES CALIFORNIA           |           |
|                             |  | DATE                             | DATE      |
|                             |  | MAY 1 1949                       | B.O. 1683 |
|                             |  | DR. M.E. R.M.B.                  | CH        |
|                             |  | SHEET NO.                        | 1         |





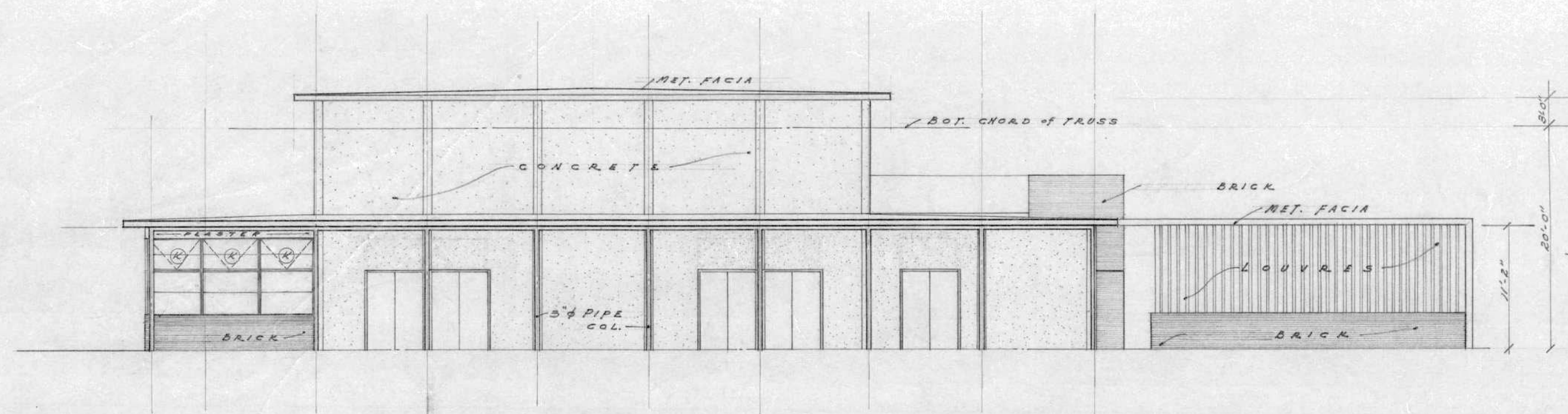
**PAINT LEGEND**  
E - ENAMEL  
F - FLAT  
V - VARNISH  
L - LITHITEX



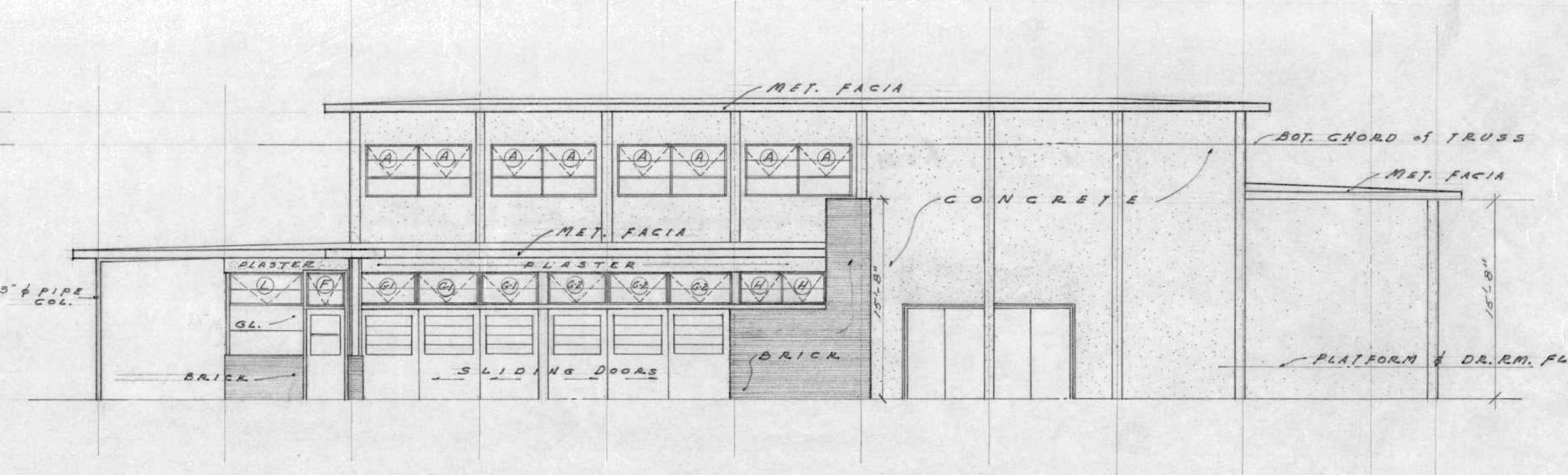
| FINISH SCHEDULE |      |        |       |         |          |     |  |  |  | REMARKS |
|-----------------|------|--------|-------|---------|----------|-----|--|--|--|---------|
| FLOOR           | BASE | WAINS. | WALLS | CEILING | PAINTING | CH. |  |  |  |         |
| RECREATION RM.  |      |        |       |         |          |     |  |  |  |         |
| CLUB RM.        |      |        |       |         |          |     |  |  |  |         |
| KITCHEN         |      |        |       |         |          |     |  |  |  |         |
| OFFICE          |      |        |       |         |          |     |  |  |  |         |
| MENS TOILET     |      |        |       |         |          |     |  |  |  |         |
| WOMENS TOILET   |      |        |       |         |          |     |  |  |  |         |
| TOILET          |      |        |       |         |          |     |  |  |  |         |
| SHOWER          |      |        |       |         |          |     |  |  |  |         |
| W.H. CLOSET     |      |        |       |         |          |     |  |  |  |         |
| E. #5           |      |        |       |         |          |     |  |  |  |         |
| CARETAKER       |      |        |       |         |          |     |  |  |  |         |
| PLATFORM        |      |        |       |         |          |     |  |  |  |         |
| DR. RMS. 1 & 2  |      |        |       |         |          |     |  |  |  |         |
| STORAGE         |      |        |       |         |          |     |  |  |  |         |
| E. 2 & 4        |      |        |       |         |          |     |  |  |  |         |
| PORCH           |      |        |       |         |          |     |  |  |  |         |
| E. 1 & 3        |      |        |       |         |          |     |  |  |  |         |
| EQUIP. STOR.    |      |        |       |         |          |     |  |  |  |         |
| PATIO           |      |        |       |         |          |     |  |  |  |         |
| WALK            |      |        |       |         |          |     |  |  |  |         |

|   |  |   |                |
|---|--|---|----------------|
| FLOOR PLAN  |  | CLUBHOUSE BUILDING  |                |
| PRESIDENT<br><i>Geo. H. Helt</i><br>GENERAL MANAGER<br><i>W. H. Helt</i><br>SUPERINTENDENT OF PARKS |  | ARDMORE PLAYGROUND<br>3250 SAN MARINO STREET<br>LOS ANGELES CALIFORNIA<br>PREPARED FOR<br>DEPARTMENT OF RECREATION & PARKS<br>LOS ANGELES CALIFORNIA<br>PREPARED BY<br>DEPARTMENT OF RECREATION & PARKS<br>LOS ANGELES CALIFORNIA |                |
|   |  | DATE<br>MAY 1 1949  | SHEET NO.<br>2 |

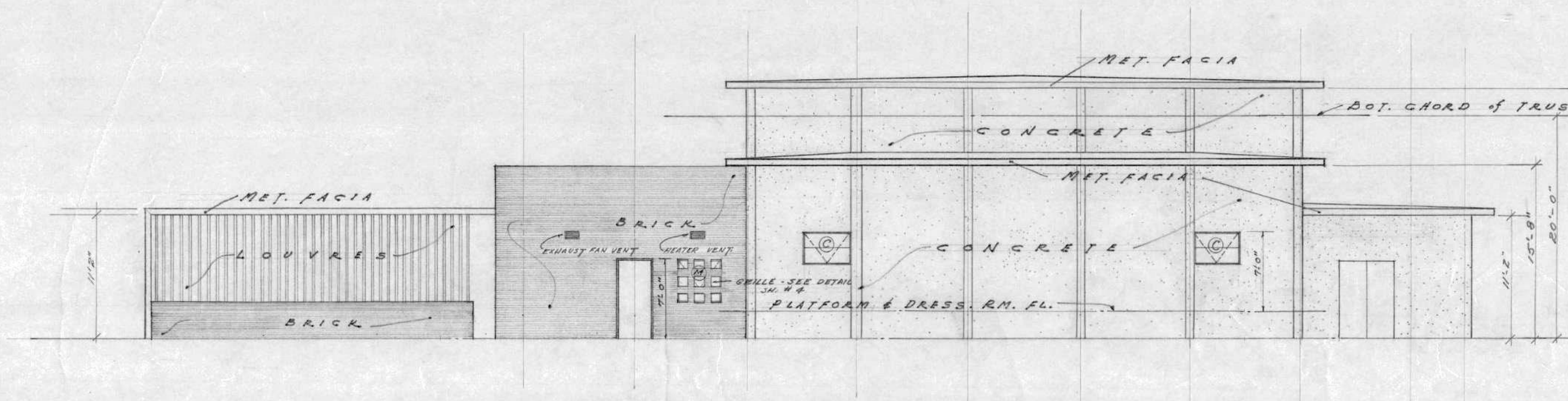




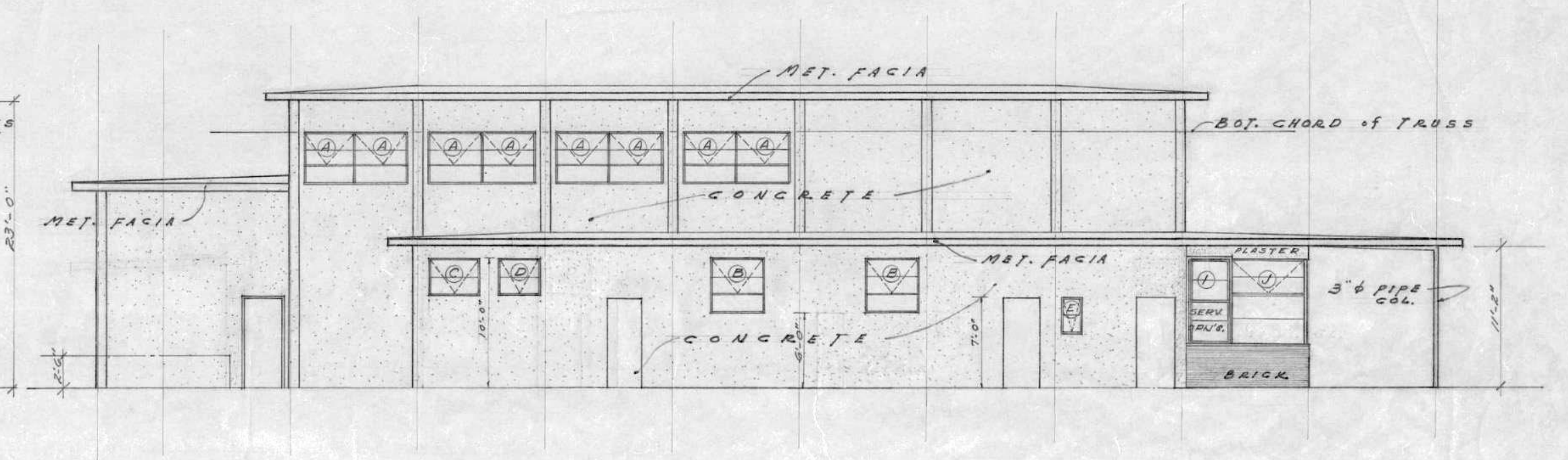
SAN MARINO ST. ELEVATION



ARDMORE AVE. ELEVATION

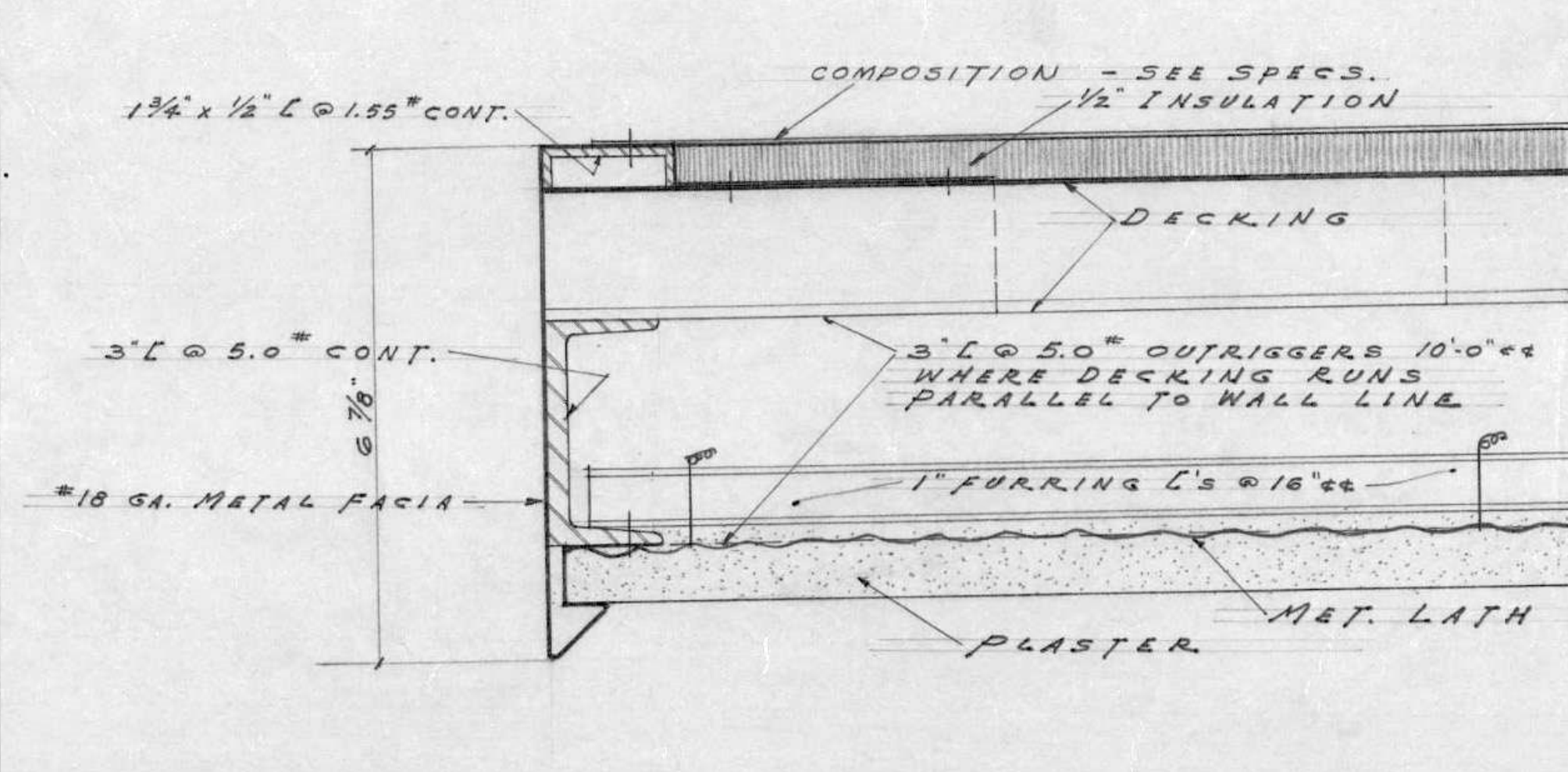


SOUTH ELEVATION

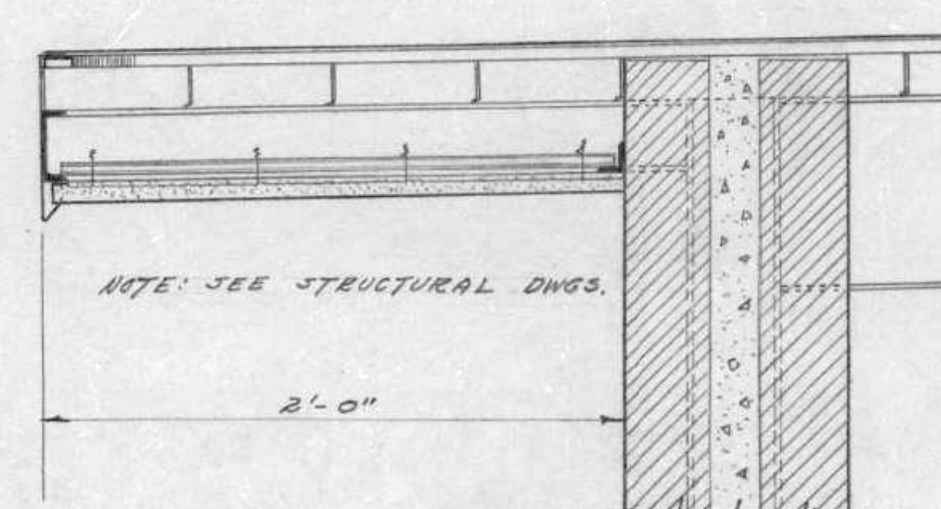


EAST ELEVATION

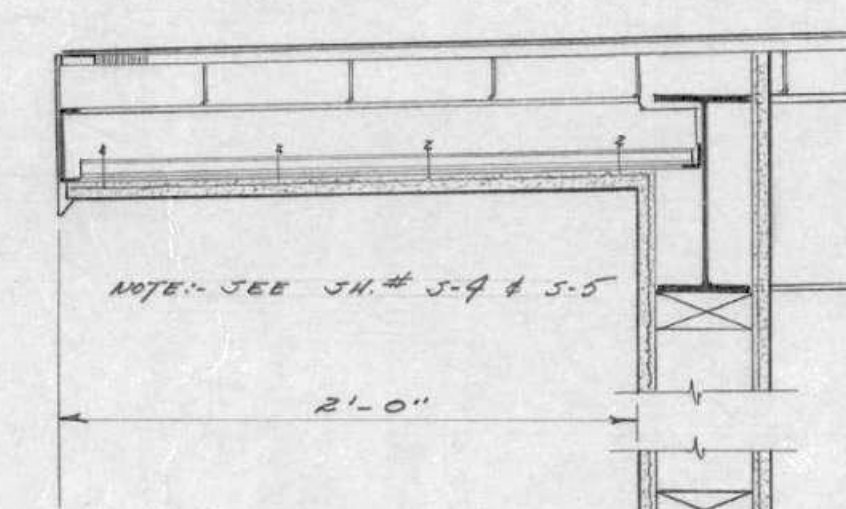
ELEVATIONS  
SCALE 1/8" = 1'-0"



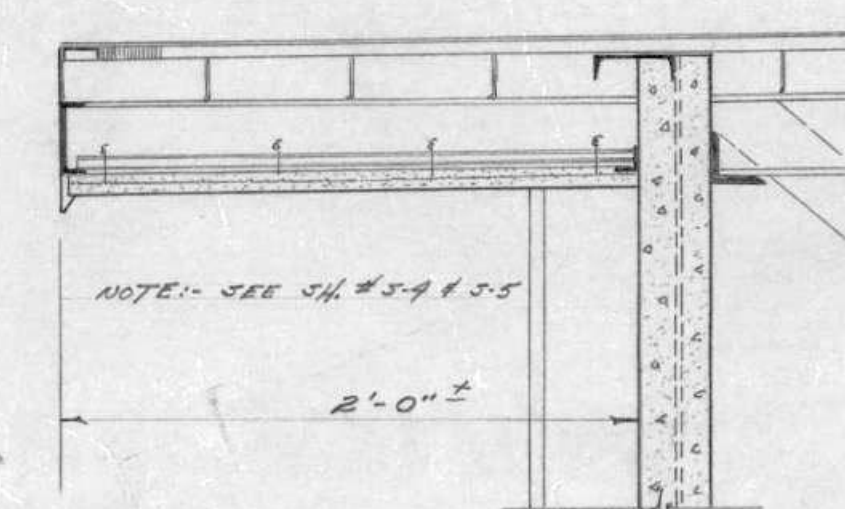
TYPICAL ROOF EAVE  
NOSING DETAIL  
SCALE 6" = 1'-0"



9" BRICK WALL



STUD & PLASTER WALL

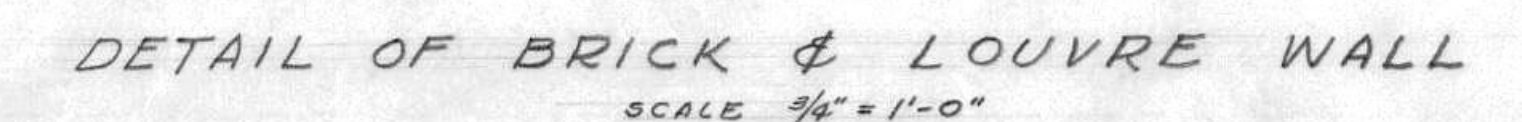
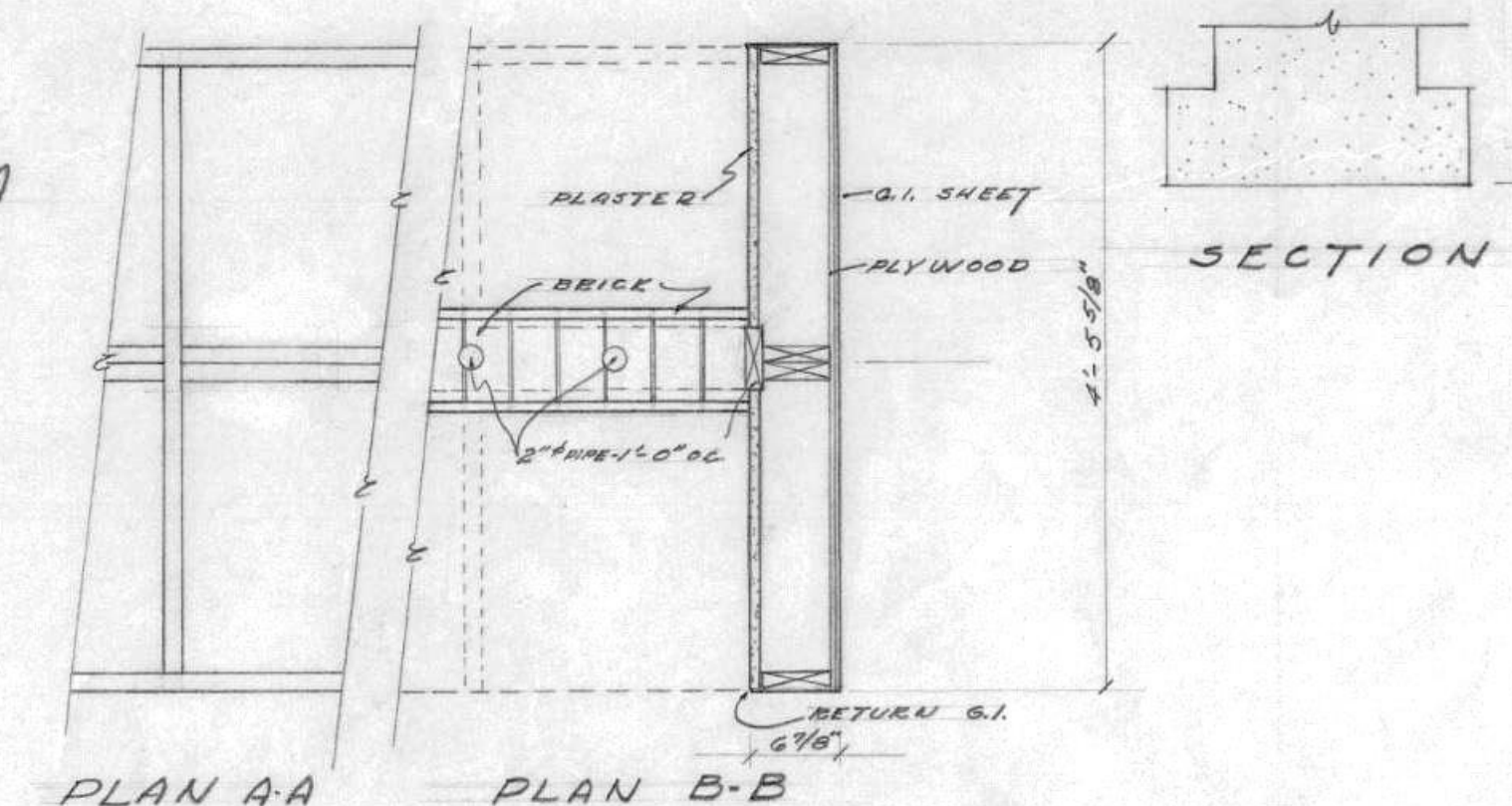
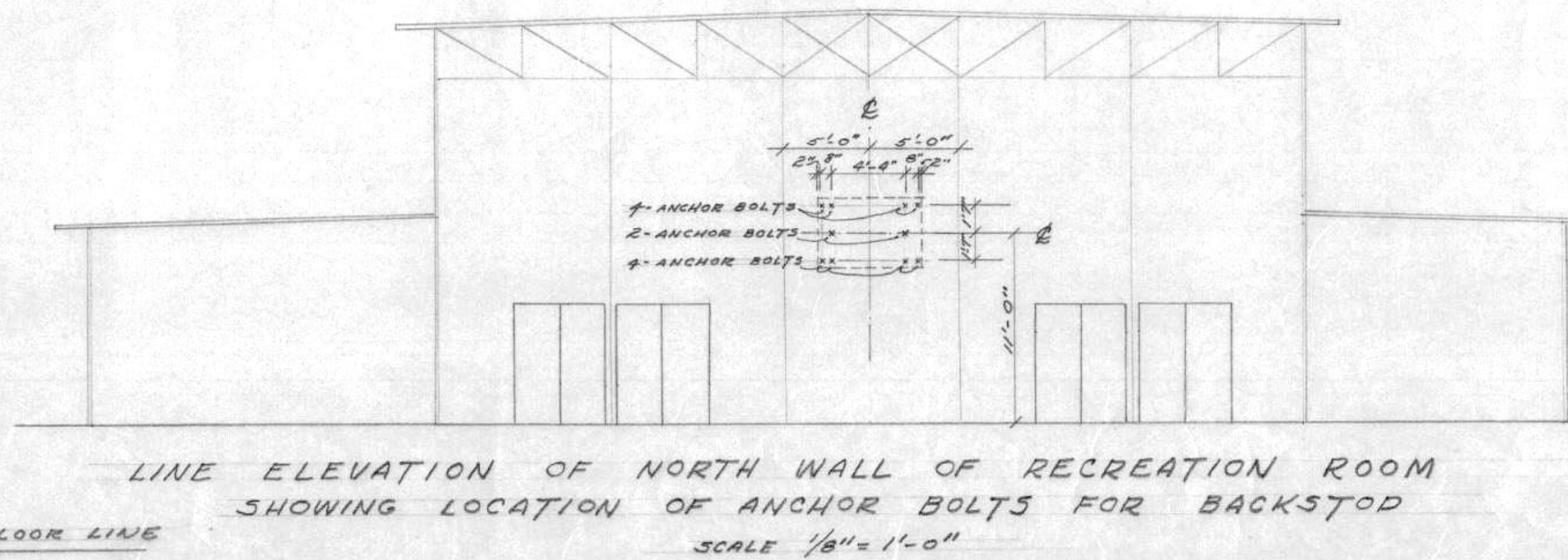
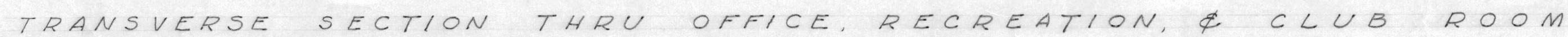
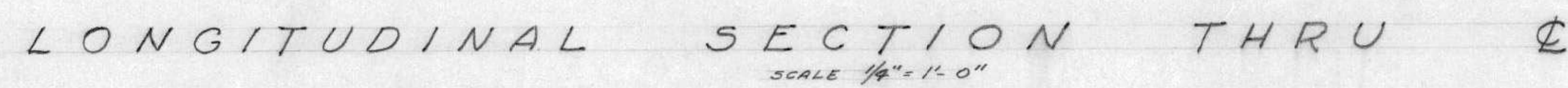


3" PRECAST WALL PANEL

DETAILS SHOWING ROOF EAVE  
CONNECTIONS TO TYPICAL WALL SECTIONS  
SCALE 1 1/2" = 1'-0"

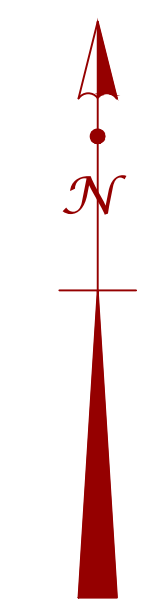
| ELEVATIONS & DETAIL   |  | CLUBHOUSE BUILDING     |  |
|---|--|------------------------|--|
| <p>PRESIDENT<br/><i>Geatfield</i></p> <p>GENERAL MANAGER<br/><i>St. Paul</i></p> <p>SUPERINTENDENT OF PARKS</p> | <p>ARDMORE PLAYGROUND<br/>3250 SAN MARINO STREET<br/>LOS ANGELES CALIFORNIA</p> <p>PREPARED FOR<br/>DEPARTMENT OF RECREATION &amp; PARKS<br/>LOS ANGELES CALIFORNIA</p> <p>PREPARED BY<br/>DEPARTMENT OF RECREATION &amp; PARKS<br/>LOS ANGELES CALIFORNIA</p> | DATE<br>MAY 1 1949     |  |
|   |  | B.O. 1683              |  |
|   |  | DR. H.M.B.<br>TR<br>CH |  |
|   |  | SHEET NO.<br>3         |  |





|                                       |  |                                  |
|---------------------------------------|--|----------------------------------|
| SECTIONS & DETAILS                    | CLUBHOUSE BUILDING   |                                  |
| PRESIDENT<br><i>Geo. Hjelte</i>       | ARDMORE PLAYGROUND<br>3250 SAN MARINO STREET<br>LOS ANGELES CALIFORNIA     | DATE<br>B.O. 10.19<br>B.O. 16.83 |
| GENERAL MANAGER<br><i>Geo. Hjelte</i> | PREPARED FOR<br>DEPARTMENT OF RECREATION & PARKS<br>LOS ANGELES CALIFORNIA | DR<br>TR<br>CH                   |
| SUPERINTENDENT OF PARKS               | PREPARED BY<br>DEPARTMENT OF RECREATION & PARKS<br>LOS ANGELES CALIFORNIA  | SHEET NO.<br>4                   |





SCALE IN FEET  
SCALE: 1"=10'  
CONTOUR INTERVAL IS 1'

ARDMORE REC CENTER  
SOUTH EST'LY CORNER OF  
SAN MARINO ST. & ARDMORE AVE.  
W.O. E170495A

## TOPOGRAPHIC SURVEY MAP

BUREAU OF ENGINEERING  
GEOTECHNICAL ENGINEERING DIVISION

File No. 23-156

Date: SEP 2023

CADD by: ES

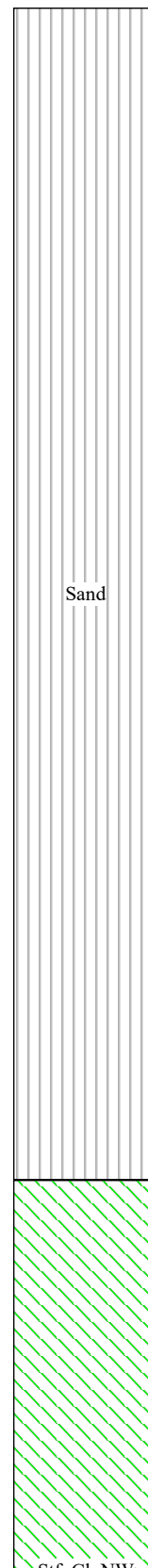
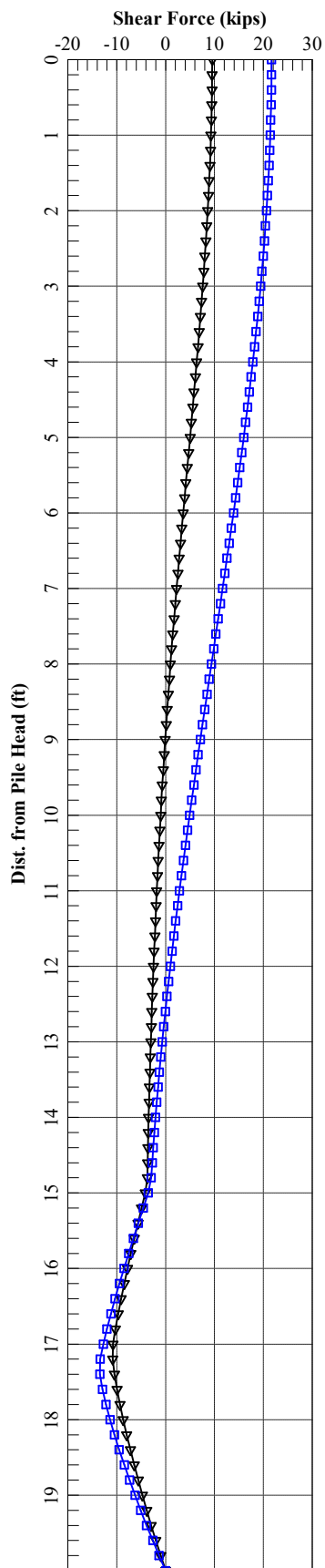
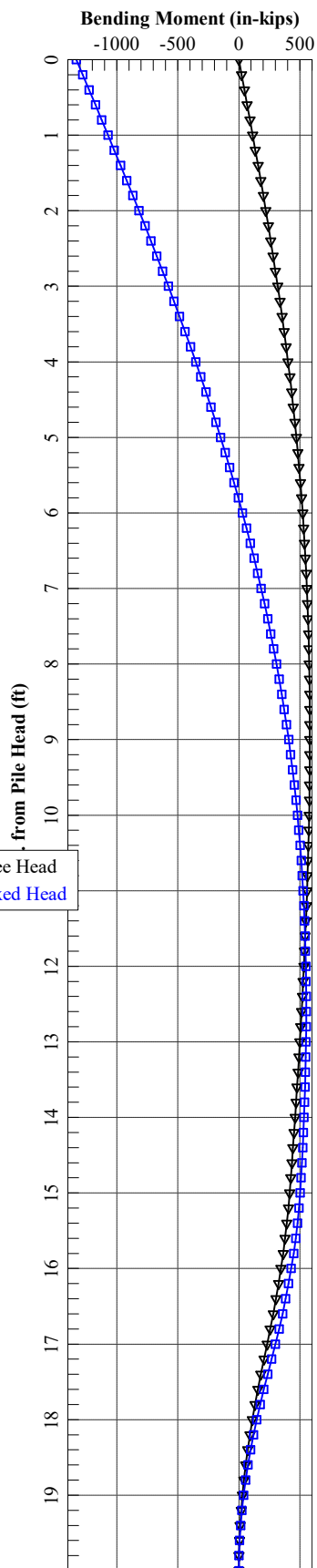
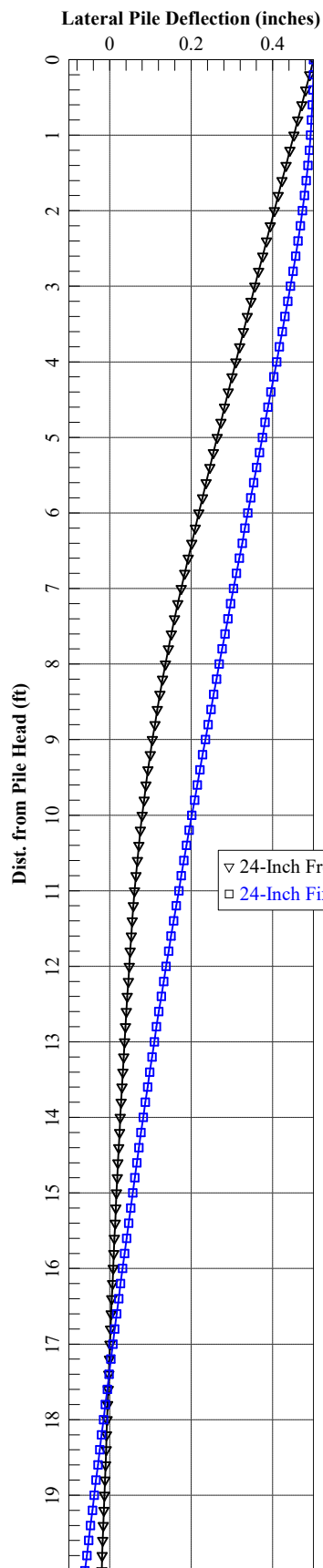
Checked by: EF

Supervised by: EF

## **APPENDIX C**

### **Results of LPILE Analysis**





=====

LPILE for Windows, Version 2022-12.006

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

This copy of LPILE is being used by:

Easton Forcier  
Bureau of Engineering

Serial Number of Security Device: 225227467

This copy of LPILE is licensed for exclusive use by:

L.A. Bureau of Engineering, Los Angeles, CA

Use of this software by employees of L.A. Bureau of Engineering  
other than those of the office site in Los Angeles, CA  
is a violation of the software license agreement.

-----

Files Used for Analysis

-----

Path to file locations:

\Users\357611\Box\GED\PROJECTS\2023\23-156 Ardmore Recreation Center\Analysis\

Name of input data file:

24-inch Free and Fixed LPILE (USCS units).lp12d

Name of output report file:

24-inch Free and Fixed LPILE (USCS units).lp12o

Name of plot output file:

24-inch Free and Fixed LPILE (USCS units).lp12p

Name of runtime message file:

24-inch Free and Fixed LPILE (USCS units).lp12r

-----

Date and Time of Analysis

-----  
Date: October 4, 2023

Time: 14:33:42

-----  
Problem Title  
-----

Project Name: ARDMORE RECREATION CENTER

Job Number: 23-156

Client: Arch

-----  
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

- Use of p-y modification factors for p-y curves not selected
- 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<br>No. | Depth Below<br>Pile Head<br>feet | Pile<br>Diameter<br>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

---

### 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 | = | 15.000000 ft   |
| Effective unit weight at top of layer        | = | 98.000000 pcf  |
| Effective unit weight at bottom of layer     | = | 98.000000 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 stiff clay without free water

|  |   |                |
|--|---|----------------|
| Distance from top of pile to top of layer    | = | 15.000000 ft   |
| Distance from top of pile to bottom of layer | = | 25.000000 ft   |
| Effective unit weight at top of layer        | = | 130.000000 pcf |
| Effective unit weight at bottom of layer     | = | 130.000000 pcf |
| Undrained cohesion at top of layer           | = | 1500. psf      |
| Undrained cohesion at bottom of layer        | = | 1500. psf      |
| Epsilon-50 at top of layer                   | = | 0.0000         |
| Epsilon-50 at bottom of layer                | = | 0.0000         |

NOTE: Default values for Epsilon-50 will be computed for this layer.

(Depth of the lowest soil layer extends 5.000 ft below the pile tip)

---

### Summary of Input Soil Properties

---

| Layer<br>E50<br>Num.<br>or<br>krm | Soil Type<br>Name<br>(p-y Curve Type)<br>kpy<br>pci | Layer<br>Depth<br>ft | Effective<br>Unit Wt.<br>pcf | Cohesion<br>psf | Angle of<br>Friction<br>deg. |
|-----------------------------------|---|----------------------|------------------------------|-----------------|------------------------------|
|-----------------------------------|---|----------------------|------------------------------|-----------------|------------------------------|

|         |                 |         |          |       |         |
|---------|-----------------|---------|----------|-------|---------|
| 1       | Sand            | 0.00    | 98.0000  | --    | 20.0000 |
| --      | default         |         |          |       |         |
| --      | (Reese, et al.) | 15.0000 | 98.0000  | --    | 20.0000 |
| --      | default         |         |          |       |         |
| 2       | Stiff Clay      | 15.0000 | 130.0000 | 1500. | --      |
| default | --              |         |          |       |         |
|         | w/o Free Water  | 25.0000 | 130.0000 | 1500. | --      |
| default | --              |         |          |       |         |

#### 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<br>Compute<br>No. | Load<br>Top y<br>Type | Condition<br>Run Analysis<br>1 | Condition<br>2    | Axial Thrust<br>Force, lbs |
|------------------------|-----------------------|--------------------------------|-------------------|----------------------------|
| 1                      | 4                     | y = 0.500000 in                | M = 0.0000 in-lbs | 0.0000000                  |
|                        | N.A.                  | Yes                            |                   |                            |
| 2                      | 5                     | y = 0.500000 in                | S = 0.0000 in/in  | 0.0000000                  |
|                        | 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 = $0.85 F_c A_c + F_y A_s$ | = | 1425.906 kips |
| Tensile Load for Cracking of Concrete                     | = | -177.999 kips |
| Nominal Axial Tensile Capacity                            | = | -284.400 kips |

Reinforcing Bar Dimensions and Positions Used in Computations:

| Bar<br>Number | Bar Diam.<br>inches | Bar Area<br>sq. in. | X<br>inches | Y<br>inches |
|---------------|---------------------|---------------------|-------------|-------------|
| -----         | -----               | -----               | -----       | -----       |
| 1             | 1.000000            | 0.790000            | 8.500000    | 0.00000     |
| 2             | 1.000000            | 0.790000            | 4.250000    | 7.361216    |
| 3             | 1.000000            | 0.790000            | -4.25000    | 7.361216    |
| 4             | 1.000000            | 0.790000            | -8.50000    | 0.00000     |
| 5             | 1.000000            | 0.790000            | -4.25000    | -7.36122    |
| 6             | 1.000000            | 0.790000            | 4.250000    | -7.36122    |

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       | = | 3000. psi      |
| Modulus of Elasticity of Concrete      | = | 3122019. psi   |
| Modulus of Rupture of Concrete         | = | -410.79192 psi |
| Compression Strain at Peak Stress      | = | 0.001634       |
| Tensile Strain at Fracture of Concrete | = | -0.0001160     |
| Maximum Coarse Aggregate Size          | = | 0.750000 in    |

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

| Number | Axial Thrust Force<br>kips |
|--------|----------------------------|
| -----  | -----                      |
| 1      | 0.000                      |

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 318-14, Section 21.2.3.

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 = 0.000 kips

| Bending<br>Max Conc<br>Curvature<br>Stress<br>rad/in.<br>ksi | Bending<br>Max Steel<br>Moment<br>Stress<br>in-kip<br>ksi | Bending<br>Run<br>Stiffness<br>Msg<br>kip-in2 | Depth to<br>N Axis<br>in | Max Comp<br>Strain<br>in/in | Max Tens<br>Strain<br>in/in |
|--|---|---|--------------------------|-----------------------------|-----------------------------|
|--|---|---|--------------------------|-----------------------------|-----------------------------|

-----

|            |              |           |            |            |             |
|------------|--------------|-----------|------------|------------|-------------|
| 0.00000125 | 79.9823465   | 63985877. | 12.0001000 | 0.00001500 | -0.00001500 |
| 0.0542960  | 0.2827536    |           |            |            |             |
| 0.00000250 | 159.5028001  | 63801120. | 12.0001004 | 0.00003000 | -0.00003000 |
| 0.1080962  | 0.5655073    |           |            |            |             |
| 0.00000375 | 238.5613608  | 63616363. | 12.0001008 | 0.00004500 | -0.00004500 |
| 0.1614006  | 0.8482610    |           |            |            |             |
| 0.00000500 | 317.1580286  | 63431606. | 12.0001012 | 0.00006000 | -0.00006000 |
| 0.2142091  | 1.1310147    |           |            |            |             |
| 0.00000625 | 395.2928036  | 63246849. | 12.0001017 | 0.00007500 | -0.00007500 |
| 0.2665218  | 1.4137684    |           |            |            |             |
| 0.00000750 | 472.9656856  | 63062091. | 12.0001021 | 0.00009000 | -0.00009000 |
| 0.3183387  | 1.6965222    |           |            |            |             |
| 0.00000875 | 550.1766747  | 62877334. | 12.0001025 | 0.0001050  | -0.000105   |
| 0.3696597  | 1.9792760    |           |            |            |             |
| 0.00001000 | 550.1766747  | 55017667. | 6.0925147  | 0.00006093 | -0.000179   |
| 0.2153581  | -3.975171 C  |           |            |            |             |
| 0.00001125 | 550.1766747  | 48904593. | 6.0949895  | 0.00006857 | -0.000201   |
| 0.2418119  | -4.471260 C  |           |            |            |             |
| 0.00001250 | 550.1766747  | 44014134. | 6.0974713  | 0.00007622 | -0.000224   |
| 0.2681615  | -4.967167 C  |           |            |            |             |
| 0.00001375 | 550.1766747  | 40012849. | 6.0999601  | 0.00008387 | -0.000246   |
| 0.2944067  | -5.462891 C  |           |            |            |             |
| 0.00001500 | 550.1766747  | 36678445. | 6.1024559  | 0.00009154 | -0.000268   |
| 0.3205471  | -5.958432 C  |           |            |            |             |
| 0.00001625 | 550.1766747  | 33857026. | 6.1049587  | 0.00009921 | -0.000291   |
| 0.3465825  | -6.453788 C  |           |            |            |             |
| 0.00001750 | 550.1766747  | 31438667. | 6.1074687  | 0.0001069  | -0.000313   |
| 0.3725128  | -6.948960 C  |           |            |            |             |
| 0.00001875 | 550.1766747  | 29342756. | 6.1099858  | 0.0001146  | -0.000335   |
| 0.3983377  | -7.443945 C  |           |            |            |             |
| 0.00002000 | 550.1766747  | 27508834. | 6.1125100  | 0.0001223  | -0.000358   |
| 0.4240570  | -7.938744 C  |           |            |            |             |
| 0.00002125 | 550.1766747  | 25890667. | 6.1150416  | 0.0001299  | -0.000380   |
| 0.4496704  | -8.433356 C  |           |            |            |             |
| 0.00002250 | 550.1766747  | 24452297. | 6.1175803  | 0.0001376  | -0.000402   |
| 0.4751776  | -8.927779 C  |           |            |            |             |
| 0.00002375 | 550.1766747  | 23165334. | 6.1201214  | 0.0001454  | -0.000425   |
| 0.5005782  | -9.422016 C  |           |            |            |             |
| 0.00002500 | 550.1766747  | 22007067. | 6.1225730  | 0.0001531  | -0.000447   |
| 0.5258640  | -9.916135 C  |           |            |            |             |
| 0.00002625 | 550.1766747  | 20959111. | 6.1250314  | 0.0001608  | -0.000469   |
| 0.5510423  | -10.410070 C |           |            |            |             |
| 0.00002750 | 550.1766747  | 20006425. | 6.1274966  | 0.0001685  | -0.000491   |
| 0.5761127  | -10.903821 C |           |            |            |             |
| 0.00002875 | 550.1766747  | 19136580. | 6.1299688  | 0.0001762  | -0.000514   |
| 0.6010749  | -11.397388 C |           |            |            |             |
| 0.00003000 | 550.1766747  | 18339222. | 6.1324478  | 0.0001840  | -0.000536   |
| 0.6259289  | -11.890770 C |           |            |            |             |
| 0.00003125 | 550.1766747  | 17605654. | 6.1349339  | 0.0001917  | -0.000558   |

|            |              |           |           |           |           |
|------------|--------------|-----------|-----------|-----------|-----------|
| 0.6506743  | -12.383966 C |           |           |           |           |
| 0.00003250 | 550.1766747  | 16928513. | 6.1374270 | 0.0001995 | -0.000581 |
| 0.6753109  | -12.876975 C |           |           |           |           |
| 0.00003375 | 550.1766747  | 16301531. | 6.1399271 | 0.0002072 | -0.000603 |
| 0.6998384  | -13.369796 C |           |           |           |           |
| 0.00003500 | 550.1766747  | 15719334. | 6.1424344 | 0.0002150 | -0.000625 |
| 0.7242567  | -13.862429 C |           |           |           |           |
| 0.00003625 | 550.1766747  | 15177288. | 6.1449488 | 0.0002228 | -0.000647 |
| 0.7485654  | -14.354873 C |           |           |           |           |
| 0.00003750 | 550.1766747  | 14671378. | 6.1474703 | 0.0002305 | -0.000669 |
| 0.7727643  | -14.847126 C |           |           |           |           |
| 0.00003875 | 550.1766747  | 14198108. | 6.1499991 | 0.0002383 | -0.000692 |
| 0.7968532  | -15.339188 C |           |           |           |           |
| 0.00004000 | 550.1766747  | 13754417. | 6.1525352 | 0.0002461 | -0.000714 |
| 0.8208318  | -15.831059 C |           |           |           |           |
| 0.00004125 | 550.1766747  | 13337616. | 6.1550785 | 0.0002539 | -0.000736 |
| 0.8446999  | -16.322737 C |           |           |           |           |
| 0.00004250 | 550.1766747  | 12945334. | 6.1576293 | 0.0002617 | -0.000758 |
| 0.8684572  | -16.814222 C |           |           |           |           |
| 0.00004375 | 550.1766747  | 12575467. | 6.1601874 | 0.0002695 | -0.000780 |
| 0.8921035  | -17.305512 C |           |           |           |           |
| 0.00004500 | 563.4643352  | 12521430. | 6.1627530 | 0.0002773 | -0.000803 |
| 0.9156385  | -17.796607 C |           |           |           |           |
| 0.00004625 | 578.8877575  | 12516492. | 6.1653260 | 0.0002851 | -0.000825 |
| 0.9390620  | -18.287506 C |           |           |           |           |
| 0.00004750 | 594.2982437  | 12511542. | 6.1679066 | 0.0002930 | -0.000847 |
| 0.9623736  | -18.778209 C |           |           |           |           |
| 0.00004875 | 609.6957439  | 12506579. | 6.1704948 | 0.0003008 | -0.000869 |
| 0.9855732  | -19.268713 C |           |           |           |           |
| 0.00005125 | 640.4515839  | 12496616. | 6.1756940 | 0.0003165 | -0.000913 |
| 1.0316352  | -20.249125 C |           |           |           |           |
| 0.00005375 | 671.1548689  | 12486602. | 6.1809241 | 0.0003322 | -0.000958 |
| 1.0772457  | -21.228734 C |           |           |           |           |
| 0.00005625 | 701.8051844  | 12476537. | 6.1861854 | 0.0003480 | -0.001002 |
| 1.1224026  | -22.207535 C |           |           |           |           |
| 0.00005875 | 732.4021095  | 12466419. | 6.1914784 | 0.0003637 | -0.001046 |
| 1.1671039  | -23.185519 C |           |           |           |           |
| 0.00006125 | 762.9452168  | 12456248. | 6.1968033 | 0.0003796 | -0.001090 |
| 1.2113472  | -24.162678 C |           |           |           |           |
| 0.00006375 | 793.4340722  | 12446025. | 6.2021607 | 0.0003954 | -0.001135 |
| 1.2551303  | -25.139005 C |           |           |           |           |
| 0.00006625 | 823.8682347  | 12435747. | 6.2075509 | 0.0004113 | -0.001179 |
| 1.2984511  | -26.114493 C |           |           |           |           |
| 0.00006875 | 854.2472566  | 12425415. | 6.2129743 | 0.0004271 | -0.001223 |
| 1.3413071  | -27.089132 C |           |           |           |           |
| 0.00007125 | 884.5706828  | 12415027. | 6.2184314 | 0.0004431 | -0.001267 |
| 1.3836961  | -28.062916 C |           |           |           |           |
| 0.00007375 | 914.8380512  | 12404584. | 6.2239225 | 0.0004590 | -0.001311 |
| 1.4256157  | -29.035835 C |           |           |           |           |
| 0.00007625 | 945.0488920  | 12394084. | 6.2294482 | 0.0004750 | -0.001355 |

|            |              |           |           |           |           |
|------------|--------------|-----------|-----------|-----------|-----------|
| 1.4670635  | -30.007882 C |           |           |           |           |
| 0.00007875 | 975.2027277  | 12383527. | 6.2350088 | 0.0004910 | -0.001399 |
| 1.5080372  | -30.979048 C |           |           |           |           |
| 0.00008125 | 1005.        | 12372912. | 6.2406049 | 0.0005070 | -0.001443 |
| 1.5485342  | -31.949325 C |           |           |           |           |
| 0.00008375 | 1035.        | 12362238. | 6.2462368 | 0.0005231 | -0.001487 |
| 1.5885521  | -32.918702 C |           |           |           |           |
| 0.00008625 | 1065.        | 12351505. | 6.2519051 | 0.0005392 | -0.001531 |
| 1.6280883  | -33.887172 C |           |           |           |           |
| 0.00008875 | 1095.        | 12340712. | 6.2576103 | 0.0005554 | -0.001575 |
| 1.6671402  | -34.854725 C |           |           |           |           |
| 0.00009125 | 1125.        | 12329858. | 6.2633527 | 0.0005715 | -0.001618 |
| 1.7057054  | -35.821353 C |           |           |           |           |
| 0.00009375 | 1155.        | 12318943. | 6.2691331 | 0.0005877 | -0.001662 |
| 1.7437811  | -36.787044 C |           |           |           |           |
| 0.00009625 | 1185.        | 12307965. | 6.2749517 | 0.0006040 | -0.001706 |
| 1.7813646  | -37.751791 C |           |           |           |           |
| 0.00009875 | 1214.        | 12296924. | 6.2808093 | 0.0006202 | -0.001750 |
| 1.8184532  | -38.715583 C |           |           |           |           |
| 0.0001013  | 1244.        | 12285819. | 6.2867062 | 0.0006365 | -0.001793 |
| 1.8550442  | -39.678409 C |           |           |           |           |
| 0.0001038  | 1273.        | 12274650. | 6.2926431 | 0.0006529 | -0.001837 |
| 1.8911348  | -40.640260 C |           |           |           |           |
| 0.0001063  | 1303.        | 12263415. | 6.2986206 | 0.0006692 | -0.001881 |
| 1.9267221  | -41.601125 C |           |           |           |           |
| 0.0001088  | 1332.        | 12252113. | 6.3046391 | 0.0006856 | -0.001924 |
| 1.9618033  | -42.560994 C |           |           |           |           |
| 0.0001113  | 1362.        | 12240744. | 6.3106992 | 0.0007021 | -0.001968 |
| 1.9963753  | -43.519856 C |           |           |           |           |
| 0.0001138  | 1391.        | 12229307. | 6.3168017 | 0.0007185 | -0.002011 |
| 2.0304352  | -44.477700 C |           |           |           |           |
| 0.0001163  | 1420.        | 12217800. | 6.3229469 | 0.0007350 | -0.002055 |
| 2.0639799  | -45.434515 C |           |           |           |           |
| 0.0001188  | 1449.        | 12206224. | 6.3291357 | 0.0007516 | -0.002098 |
| 2.0970064  | -46.390289 C |           |           |           |           |
| 0.0001213  | 1479.        | 12194577. | 6.3353686 | 0.0007682 | -0.002142 |
| 2.1295116  | -47.345010 C |           |           |           |           |
| 0.0001238  | 1508.        | 12182857. | 6.3416463 | 0.0007848 | -0.002185 |
| 2.1614923  | -48.298667 C |           |           |           |           |
| 0.0001263  | 1537.        | 12171065. | 6.3479694 | 0.0008014 | -0.002229 |
| 2.1929451  | -49.251247 C |           |           |           |           |
| 0.0001288  | 1565.        | 12159198. | 6.3543385 | 0.0008181 | -0.002272 |
| 2.2238669  | -50.202738 C |           |           |           |           |
| 0.0001313  | 1594.        | 12147261. | 6.3607210 | 0.0008348 | -0.002315 |
| 2.2542462  | -51.153255 C |           |           |           |           |
| 0.0001338  | 1623.        | 12135285. | 6.3668963 | 0.0008516 | -0.002358 |
| 2.2840265  | -52.103651 C |           |           |           |           |
| 0.0001363  | 1652.        | 12123235. | 6.3731156 | 0.0008683 | -0.002402 |
| 2.3132648  | -53.052976 C |           |           |           |           |
| 0.0001388  | 1680.        | 12111110. | 6.3793797 | 0.0008851 | -0.002445 |

|           |               |           |           |           |           |
|-----------|---------------|-----------|-----------|-----------|-----------|
| 2.3419578 | -54.001221 C  |           |           |           |           |
| 0.0001413 | 1709.         | 12098911. | 6.3856891 | 0.0009020 | -0.002488 |
| 2.3701021 | -54.948371 C  |           |           |           |           |
| 0.0001438 | 1737.         | 12086634. | 6.3920445 | 0.0009189 | -0.002531 |
| 2.3976940 | -55.894414 C  |           |           |           |           |
| 0.0001463 | 1766.         | 12074281. | 6.3984467 | 0.0009358 | -0.002574 |
| 2.4247301 | -56.839337 C  |           |           |           |           |
| 0.0001488 | 1794.         | 12061849. | 6.4048964 | 0.0009527 | -0.002617 |
| 2.4512068 | -57.783128 C  |           |           |           |           |
| 0.0001588 | 1900.         | 11968843. | 6.4229797 | 0.0010196 | -0.002790 |
| 2.5495931 | -60.000000 CY |           |           |           |           |
| 0.0001688 | 1947.         | 11540677. | 6.3743238 | 0.0010757 | -0.002974 |
| 2.6242319 | -60.000000 CY |           |           |           |           |
| 0.0001788 | 1978.         | 11064501. | 6.3114995 | 0.0011282 | -0.003162 |
| 2.6879749 | -60.000000 CY |           |           |           |           |
| 0.0001888 | 2008.         | 10636504. | 6.2563584 | 0.0011809 | -0.003349 |
| 2.7460048 | -60.000000 CY |           |           |           |           |
| 0.0001988 | 2037.         | 10249618. | 6.2084698 | 0.0012339 | -0.003536 |
| 2.7983921 | -60.000000 CY |           |           |           |           |
| 0.0002088 | 2066.         | 9897878.  | 6.1668431 | 0.0012873 | -0.003723 |
| 2.8450274 | -60.000000 CY |           |           |           |           |
| 0.0002188 | 2095.         | 9576410.  | 6.1306718 | 0.0013411 | -0.003909 |
| 2.8857960 | -60.000000 CY |           |           |           |           |
| 0.0002288 | 2123.         | 9280905.  | 6.0979993 | 0.0013949 | -0.004095 |
| 2.9204000 | -60.000000 CY |           |           |           |           |
| 0.0002388 | 2151.         | 9008239.  | 6.0691263 | 0.0014490 | -0.004281 |
| 2.9488972 | -60.000000 CY |           |           |           |           |
| 0.0002488 | 2178.         | 8755731.  | 6.0442344 | 0.0015035 | -0.004466 |
| 2.9712540 | -60.000000 CY |           |           |           |           |
| 0.0002588 | 2205.         | 8520985.  | 6.0229254 | 0.0015584 | -0.004652 |
| 2.9873261 | -60.000000 CY |           |           |           |           |
| 0.0002688 | 2231.         | 8301956.  | 6.0048655 | 0.0016138 | -0.004836 |
| 2.9969600 | -60.000000 CY |           |           |           |           |
| 0.0002788 | 2257.         | 8096883.  | 5.9897789 | 0.0016697 | -0.005020 |
| 2.9994511 | -60.000000 CY |           |           |           |           |
| 0.0002888 | 2282.         | 7904151.  | 5.9774934 | 0.0017260 | -0.005204 |
| 2.9998511 | -60.000000 CY |           |           |           |           |
| 0.0002988 | 2307.         | 7722483.  | 5.9677890 | 0.0017829 | -0.005387 |
| 2.9989928 | -60.000000 CY |           |           |           |           |
| 0.0003088 | 2331.         | 7550874.  | 5.9604012 | 0.0018403 | -0.005570 |
| 2.9968854 | -60.000000 CY |           |           |           |           |
| 0.0003188 | 2355.         | 7388169.  | 5.9549302 | 0.0018981 | -0.005752 |
| 2.9999887 | -60.000000 CY |           |           |           |           |
| 0.0003288 | 2376.         | 7226409.  | 5.9470273 | 0.0019551 | -0.005935 |
| 2.9987366 | -60.000000 CY |           |           |           |           |
| 0.0003388 | 2392.         | 7061187.  | 5.9334892 | 0.0020100 | -0.006120 |
| 2.9978063 | -60.000000 CY |           |           |           |           |
| 0.0003488 | 2403.         | 6891142.  | 5.9132381 | 0.0020622 | -0.006308 |
| 2.9988727 | -60.000000 CY |           |           |           |           |
| 0.0003588 | 2409.         | 6715896.  | 5.8853587 | 0.0021114 | -0.006499 |



|           |            |     |          |           |           |           |
|-----------|------------|-----|----------|-----------|-----------|-----------|
| 2.9991144 | -60.000000 | CY  |          |           |           |           |
| 0.0003688 | 2411.      |     | 6538052. | 5.8492264 | 0.0021569 | -0.006693 |
| 2.9969711 | -60.000000 | CY  |          |           |           |           |
| 0.0003788 | 2412.      |     | 6368337. | 5.8142303 | 0.0022021 | -0.006888 |
| 2.9994425 | -60.000000 | CY  |          |           |           |           |
| 0.0003888 | 2413.      |     | 6207067. | 5.7815001 | 0.0022476 | -0.007082 |
| 2.9984318 | -60.000000 | CY  |          |           |           |           |
| 0.0003988 | 2414.      |     | 6053647. | 5.7510109 | 0.0022932 | -0.007277 |
| 2.9962060 | -60.000000 | CY  |          |           |           |           |
| 0.0004088 | 2415.      |     | 5907605. | 5.7224049 | 0.0023390 | -0.007471 |
| 2.9989695 | -60.000000 | CY  |          |           |           |           |
| 0.0004188 | 2416.      |     | 5768409. | 5.6955543 | 0.0023850 | -0.007665 |
| 2.9999941 | -60.000000 | CY  |          |           |           |           |
| 0.0004288 | 2416.      |     | 5635485. | 5.6705320 | 0.0024312 | -0.007859 |
| 2.9946135 | -60.000000 | CY  |          |           |           |           |
| 0.0004388 | 2417.      |     | 5508515. | 5.6469872 | 0.0024776 | -0.008052 |
| 2.9970767 | -60.000000 | CY  |          |           |           |           |
| 0.0004488 | 2417.      |     | 5386808. | 5.6230310 | 0.0025233 | -0.008247 |
| 2.9992590 | -60.000000 | CY  |          |           |           |           |
| 0.0004588 | 2418.      |     | 5270193. | 5.5996473 | 0.0025688 | -0.008441 |
| 2.9999996 | -60.000000 | CY  |          |           |           |           |
| 0.0004688 | 2418.      |     | 5158394. | 5.5777636 | 0.0026146 | -0.008635 |
| 2.9948553 | -60.000000 | CY  |          |           |           |           |
| 0.0004788 | 2418.      |     | 5051205. | 5.5570392 | 0.0026604 | -0.008830 |
| 2.9952974 | -60.000000 | CY  |          |           |           |           |
| 0.0004888 | 2419.      |     | 4948345. | 5.5374017 | 0.0027064 | -0.009024 |
| 2.9980635 | -60.000000 | CY  |          |           |           |           |
| 0.0004988 | 2419.      |     | 4849550. | 5.5187898 | 0.0027525 | -0.009218 |
| 2.9996271 | -60.000000 | CY  |          |           |           |           |
| 0.0005088 | 2419.      |     | 4754565. | 5.5011947 | 0.0027987 | -0.009411 |
| 2.9989148 | -60.000000 | CY  |          |           |           |           |
| 0.0005188 | 2419.      |     | 4663137. | 5.4846464 | 0.0028452 | -0.009605 |
| 2.9940071 | -60.000000 | CY  |          |           |           |           |
| 0.0005288 | 2419.      |     | 4575127. | 5.4689090 | 0.0028917 | -0.009798 |
| 2.9937899 | -60.000000 | CY  |          |           |           |           |
| 0.0005388 | 2419.      |     | 4490344. | 5.4539400 | 0.0029383 | -0.009992 |
| 2.9968542 | -60.000000 | CY  |          |           |           |           |
| 0.0005488 | 2419.      |     | 4408609. | 5.4397003 | 0.0029850 | -0.010185 |
| 2.9988935 | -60.000000 | CY  |          |           |           |           |
| 0.0006088 | 2419.      |     | 3974085. | 5.3634567 | 0.0032650 | -0.011345 |
| 2.9973332 | -60.000000 | CYT |          |           |           |           |
| 0.0006688 | 2419.      |     | 3617532. | 5.3015245 | 0.0035454 | -0.012505 |
| 2.9899787 | -60.000000 | CYT |          |           |           |           |
| 0.0007288 | 2419.      |     | 3319690. | 5.2536516 | 0.0038286 | -0.013661 |
| 2.9981742 | -60.000000 | CYT |          |           |           |           |

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Summary of Results for Nominal Moment Capacity for Section 1  
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Moment values interpolated at maximum compressive strain = 0.003  
or maximum developed moment if pile fails at smaller strains.

| Load<br>Tens.<br>No.<br>Strain | Axial Thrust<br><br>kips | Nominal Mom. Cap.<br><br>in-kip | Max. Comp.<br><br>Strain | Max. |
|--------------------------------|--------------------------|---------------------------------|--------------------------|------|
| -----<br>-----                 | -----                    | -----                           | -----                    |      |
| 1<br>-0.01024697               | 0.000                    | 2419.224                        | 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 (0.75).

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to ACI 318, 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<br>Stiff.<br>Load<br>Ult Mom<br>No.<br>kip-in^2 | Resist.<br>Factor | Nominal<br>Ax. Thrust<br>kips | Nominal<br>Moment Cap<br>in-kips | Ult. (Fac)<br>Ax. Thrust<br>kips | Ult. (Fac)<br>Moment Cap<br>in-kips | Bend.<br>at |
|---|-------------------|-------------------------------|----------------------------------|----------------------------------|-------------------------------------|-------------|
| -----<br>-----  | -----             | -----                         | -----                            | -----                            | -----                               |             |
| 1<br>12156300.  | 0.65              | 0.0000                        | 2419.                            | 0.0000                           | 1572.                               |             |
| 1<br>12044084.  | 0.75              | 0.0000                        | 2419.                            | 0.0000                           | 1814.                               |             |
| 1<br>8762084.   | 0.90              | 0.0000                        | 2419.                            | 0.0000                           | 2177.                               |             |

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Layering Correction Equivalent Depths of Soil & Rock Layers  
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| 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                      | 110105.                   |
| 2         | 15.0000                         | 8.4666                                  | No                             | No                                   | 110105.                   | 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.

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Computed Values of Pile Loading and Deflection  
for Lateral Loading for Load Case Number 1  
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Pile-head conditions are Displacement and Moment (Loading Type 4)

Displacement of pile head = 0.500000 inches  
Moment at pile head = 0.0 in-lbs  
Axial load at pile head = 0.0 lbs

| Depth Res. | Deflect. Soil Spr. | Bending Distrib. Moment | Shear Force | Slope S  | Total Stress | Bending Stiffness | Soil p |
|------------|--------------------|-------------------------|-------------|----------|--------------|-------------------|--------|
| X          | y                  | Lat. Load               |             |          |              |                   |        |
| Es*H       |                    |                         |             |          |              |                   |        |
| feet       | inches             | in-lbs                  | lbs         | radians  | psi*         | lb-in^2           |        |
| lb/inch    | lb/inch            | lb/inch                 |             |          |              |                   |        |
| 0.00       | 0.5000             | 0.00                    | 9534.       | -0.00402 | 0.00         | 6.40E+10          |        |
| 0.00       | 0.00               | 0.00                    |             |          |              |                   |        |
| 0.2000     | 0.4903             | 22881.                  | 9523.       | -0.00402 | 0.00         | 6.40E+10          |        |
| -8.691     | 42.5370            | 0.00                    |             |          |              |                   |        |
| 0.4000     | 0.4807             | 45713.                  | 9493.       | -0.00402 | 0.00         | 6.40E+10          |        |
| -17.039    | 85.0740            | 0.00                    |             |          |              |                   |        |
| 0.6000     | 0.4710             | 68446.                  | 9442.       | -0.00402 | 0.00         | 6.40E+10          |        |
| -25.046    | 127.6111           | 0.00                    |             |          |              |                   |        |
| 0.8000     | 0.4614             | 91034.                  | 9373.       | -0.00402 | 0.00         | 6.39E+10          |        |
| -32.711    | 170.1481           | 0.00                    |             |          |              |                   |        |
| 1.0000     | 0.4518             | 113435.                 | 9285.       | -0.00401 | 0.00         | 6.39E+10          |        |
| -40.034    | 212.6851           | 0.00                    |             |          |              |                   |        |
| 1.2000     | 0.4421             | 135605.                 | 9181.       | -0.00401 | 0.00         | 6.38E+10          |        |
| -47.018    | 255.2221           | 0.00                    |             |          |              |                   |        |

|          |          |         |       |          |      |          |
|----------|----------|---------|-------|----------|------|----------|
| 1.4000   | 0.4325   | 157504. | 9060. | -0.00400 | 0.00 | 6.38E+10 |
| -53.661  | 297.7592 | 0.00    |       |          |      |          |
| 1.6000   | 0.4229   | 179094. | 8924. | -0.00400 | 0.00 | 6.37E+10 |
| -59.966  | 340.2962 | 0.00    |       |          |      |          |
| 1.8000   | 0.4133   | 200338. | 8773. | -0.00399 | 0.00 | 6.37E+10 |
| -65.933  | 382.8332 | 0.00    |       |          |      |          |
| 2.0000   | 0.4038   | 221203. | 8608. | -0.00398 | 0.00 | 6.36E+10 |
| -71.564  | 425.3702 | 0.00    |       |          |      |          |
| 2.2000   | 0.3942   | 241655. | 8430. | -0.00397 | 0.00 | 6.36E+10 |
| -76.859  | 467.9072 | 0.00    |       |          |      |          |
| 2.4000   | 0.3847   | 261665. | 8239. | -0.00396 | 0.00 | 6.36E+10 |
| -81.821  | 510.4443 | 0.00    |       |          |      |          |
| 2.6000   | 0.3752   | 281204. | 8037. | -0.00395 | 0.00 | 6.35E+10 |
| -86.451  | 552.9813 | 0.00    |       |          |      |          |
| 2.8000   | 0.3657   | 300244. | 7825. | -0.00394 | 0.00 | 6.35E+10 |
| -90.750  | 595.5183 | 0.00    |       |          |      |          |
| 3.0000   | 0.3563   | 318762. | 7602. | -0.00393 | 0.00 | 6.34E+10 |
| -94.721  | 638.0553 | 0.00    |       |          |      |          |
| 3.2000   | 0.3469   | 336734. | 7370. | -0.00392 | 0.00 | 6.34E+10 |
| -98.365  | 680.5924 | 0.00    |       |          |      |          |
| 3.4000   | 0.3375   | 354140. | 7130. | -0.00390 | 0.00 | 6.33E+10 |
| -101.685 | 723.1294 | 0.00    |       |          |      |          |
| 3.6000   | 0.3281   | 370960. | 6883. | -0.00389 | 0.00 | 6.33E+10 |
| -104.682 | 765.6664 | 0.00    |       |          |      |          |
| 3.8000   | 0.3188   | 387177. | 6628. | -0.00388 | 0.00 | 6.33E+10 |
| -107.358 | 808.2034 | 0.00    |       |          |      |          |
| 4.0000   | 0.3095   | 402776. | 6368. | -0.00386 | 0.00 | 6.32E+10 |
| -109.717 | 850.7404 | 0.00    |       |          |      |          |
| 4.2000   | 0.3003   | 417742. | 6102. | -0.00385 | 0.00 | 6.32E+10 |
| -111.761 | 893.2775 | 0.00    |       |          |      |          |
| 4.4000   | 0.2911   | 432065. | 5832. | -0.00383 | 0.00 | 6.32E+10 |
| -113.491 | 935.8145 | 0.00    |       |          |      |          |
| 4.6000   | 0.2819   | 445734. | 5558. | -0.00381 | 0.00 | 6.31E+10 |
| -114.911 | 978.3515 | 0.00    |       |          |      |          |
| 4.8000   | 0.2728   | 458742. | 5280. | -0.00380 | 0.00 | 6.31E+10 |
| -116.023 | 1021.    | 0.00    |       |          |      |          |
| 5.0000   | 0.2637   | 471081. | 5001. | -0.00378 | 0.00 | 6.31E+10 |
| -116.830 | 1063.    | 0.00    |       |          |      |          |
| 5.2000   | 0.2546   | 482747. | 4720. | -0.00376 | 0.00 | 6.30E+10 |
| -117.335 | 1106.    | 0.00    |       |          |      |          |
| 5.4000   | 0.2456   | 493737. | 4438. | -0.00374 | 0.00 | 6.30E+10 |
| -117.540 | 1148.    | 0.00    |       |          |      |          |
| 5.6000   | 0.2367   | 504050. | 4156. | -0.00372 | 0.00 | 6.30E+10 |
| -117.449 | 1191.    | 0.00    |       |          |      |          |
| 5.8000   | 0.2278   | 513687. | 3875. | -0.00370 | 0.00 | 6.30E+10 |
| -117.063 | 1234.    | 0.00    |       |          |      |          |
| 6.0000   | 0.2189   | 522649. | 3595. | -0.00368 | 0.00 | 6.29E+10 |
| -116.387 | 1276.    | 0.00    |       |          |      |          |
| 6.2000   | 0.2101   | 530941. | 3316. | -0.00366 | 0.00 | 6.29E+10 |
| -115.423 | 1319.    | 0.00    |       |          |      |          |

|          |         |         |          |          |      |          |
|----------|---------|---------|----------|----------|------|----------|
| 6.4000   | 0.2013  | 538568. | 3041.    | -0.00364 | 0.00 | 6.29E+10 |
| -114.174 | 1361.   | 0.00    |          |          |      |          |
| 6.6000   | 0.1926  | 545538. | 2769.    | -0.00362 | 0.00 | 3.81E+10 |
| -112.643 | 1404.   | 0.00    |          |          |      |          |
| 6.8000   | 0.1840  | 551858. | 2501.    | -0.00357 | 0.00 | 2.03E+10 |
| -110.853 | 1446.   | 0.00    |          |          |      |          |
| 7.0000   | 0.1755  | 557541. | 2237.    | -0.00348 | 0.00 | 1.25E+10 |
| -108.853 | 1489.   | 0.00    |          |          |      |          |
| 7.2000   | 0.1673  | 562596. | 1978.    | -0.00337 | 0.00 | 1.25E+10 |
| -106.717 | 1531.   | 0.00    |          |          |      |          |
| 7.4000   | 0.1593  | 567036. | 1725.    | -0.00326 | 0.00 | 1.25E+10 |
| -104.459 | 1574.   | 0.00    |          |          |      |          |
| 7.6000   | 0.1516  | 570875. | 1477.    | -0.00315 | 0.00 | 1.25E+10 |
| -102.094 | 1616.   | 0.00    |          |          |      |          |
| 7.8000   | 0.1441  | 574126. | 1235.    | -0.00305 | 0.00 | 1.25E+10 |
| -99.638  | 1659.   | 0.00    |          |          |      |          |
| 8.0000   | 0.1370  | 576803. | 998.8258 | -0.00293 | 0.00 | 1.25E+10 |
| -97.105  | 1701.   | 0.00    |          |          |      |          |
| 8.2000   | 0.1301  | 578920. | 768.8856 | -0.00282 | 0.00 | 1.25E+10 |
| -94.511  | 1744.   | 0.00    |          |          |      |          |
| 8.4000   | 0.1234  | 580493. | 545.2272 | -0.00271 | 0.00 | 1.25E+10 |
| -91.871  | 1787.   | 0.00    |          |          |      |          |
| 8.6000   | 0.1170  | 581537. | 327.9450 | -0.00260 | 0.00 | 1.25E+10 |
| -89.198  | 1829.   | 0.00    |          |          |      |          |
| 8.8000   | 0.1109  | 582068. | 117.0981 | -0.00249 | 0.00 | 1.25E+10 |
| -86.508  | 1872.   | 0.00    |          |          |      |          |
| 9.0000   | 0.1051  | 582099. | -87.289  | -0.00238 | 0.00 | 1.25E+10 |
| -83.815  | 1914.   | 0.00    |          |          |      |          |
| 9.2000   | 0.09951 | 581649. | -285.227 | -0.00227 | 0.00 | 1.25E+10 |
| -81.133  | 1957.   | 0.00    |          |          |      |          |
| 9.4000   | 0.09421 | 580730. | -476.760 | -0.00216 | 0.00 | 1.25E+10 |
| -78.477  | 1999.   | 0.00    |          |          |      |          |
| 9.6000   | 0.08917 | 579360. | -661.965 | -0.00204 | 0.00 | 1.25E+10 |
| -75.860  | 2042.   | 0.00    |          |          |      |          |
| 9.8000   | 0.08440 | 577553. | -840.953 | -0.00193 | 0.00 | 1.25E+10 |
| -73.296  | 2084.   | 0.00    |          |          |      |          |
| 10.0000  | 0.07989 | 575324. | -1014.   | -0.00182 | 0.00 | 1.25E+10 |
| -70.799  | 2127.   | 0.00    |          |          |      |          |
| 10.2000  | 0.07565 | 572686. | -1181.   | -0.00171 | 0.00 | 1.25E+10 |
| -68.381  | 2169.   | 0.00    |          |          |      |          |
| 10.4000  | 0.07167 | 569655. | -1342.   | -0.00160 | 0.00 | 1.25E+10 |
| -66.055  | 2212.   | 0.00    |          |          |      |          |
| 10.6000  | 0.06796 | 566244. | -1498.   | -0.00149 | 0.00 | 1.25E+10 |
| -63.835  | 2254.   | 0.00    |          |          |      |          |
| 10.8000  | 0.06450 | 562465. | -1649.   | -0.00139 | 0.00 | 1.25E+10 |
| -61.732  | 2297.   | 0.00    |          |          |      |          |
| 11.0000  | 0.06130 | 558330. | -1795.   | -0.00128 | 0.00 | 1.25E+10 |
| -59.759  | 2340.   | 0.00    |          |          |      |          |
| 11.2000  | 0.05836 | 553851. | -1936.   | -0.00118 | 0.00 | 1.41E+10 |
| -57.927  | 2382.   | 0.00    |          |          |      |          |

|          |         |         |        |           |      |          |
|----------|---------|---------|--------|-----------|------|----------|
| 11.4000  | 0.05565 | 549038. | -2073. | -0.00110  | 0.00 | 2.25E+10 |
| -56.219  | 2425.   | 0.00    |        |           |      |          |
| 11.6000  | 0.05307 | 543902. | -2206. | -0.00105  | 0.00 | 3.71E+10 |
| -54.560  | 2467.   | 0.00    |        |           |      |          |
| 11.8000  | 0.05059 | 538451. | -2335. | -0.00103  | 0.00 | 6.29E+10 |
| -52.897  | 2510.   | 0.00    |        |           |      |          |
| 12.0000  | 0.04815 | 532695. | -2460. | -0.00101  | 0.00 | 6.29E+10 |
| -51.199  | 2552.   | 0.00    |        |           |      |          |
| 12.2000  | 0.04575 | 526645. | -2580. | -9.86E-04 | 0.00 | 6.29E+10 |
| -49.467  | 2595.   | 0.00    |        |           |      |          |
| 12.4000  | 0.04341 | 520310. | -2697. | -9.66E-04 | 0.00 | 6.29E+10 |
| -47.703  | 2637.   | 0.00    |        |           |      |          |
| 12.6000  | 0.04112 | 513700. | -2809. | -9.47E-04 | 0.00 | 6.30E+10 |
| -45.910  | 2680.   | 0.00    |        |           |      |          |
| 12.8000  | 0.03887 | 506825. | -2917. | -9.27E-04 | 0.00 | 6.30E+10 |
| -44.088  | 2722.   | 0.00    |        |           |      |          |
| 13.0000  | 0.03666 | 499697. | -3021. | -9.08E-04 | 0.00 | 6.30E+10 |
| -42.240  | 2765.   | 0.00    |        |           |      |          |
| 13.2000  | 0.03451 | 492325. | -3120. | -8.89E-04 | 0.00 | 6.30E+10 |
| -40.367  | 2807.   | 0.00    |        |           |      |          |
| 13.4000  | 0.03240 | 484721. | -3215. | -8.71E-04 | 0.00 | 6.30E+10 |
| -38.471  | 2850.   | 0.00    |        |           |      |          |
| 13.6000  | 0.03033 | 476895. | -3305. | -8.52E-04 | 0.00 | 6.31E+10 |
| -36.554  | 2893.   | 0.00    |        |           |      |          |
| 13.8000  | 0.02831 | 468858. | -3390. | -8.34E-04 | 0.00 | 6.31E+10 |
| -34.617  | 2935.   | 0.00    |        |           |      |          |
| 14.0000  | 0.02633 | 460623. | -3471. | -8.17E-04 | 0.00 | 6.31E+10 |
| -32.661  | 2978.   | 0.00    |        |           |      |          |
| 14.2000  | 0.02439 | 452199. | -3547. | -7.99E-04 | 0.00 | 6.31E+10 |
| -30.688  | 3020.   | 0.00    |        |           |      |          |
| 14.4000  | 0.02249 | 443598. | -3618. | -7.82E-04 | 0.00 | 6.31E+10 |
| -28.699  | 3063.   | 0.00    |        |           |      |          |
| 14.6000  | 0.02063 | 434832. | -3685. | -7.65E-04 | 0.00 | 6.31E+10 |
| -26.695  | 3105.   | 0.00    |        |           |      |          |
| 14.8000  | 0.01882 | 425912. | -3746. | -7.49E-04 | 0.00 | 6.32E+10 |
| -24.677  | 3148.   | 0.00    |        |           |      |          |
| 15.0000  | 0.01704 | 416850. | -4158. | -7.33E-04 | 0.00 | 6.32E+10 |
| -318.102 | 44811.  | 0.00    |        |           |      |          |
| 15.2000  | 0.01530 | 405956. | -4915. | -7.17E-04 | 0.00 | 6.32E+10 |
| -313.224 | 49145.  | 0.00    |        |           |      |          |
| 15.4000  | 0.01359 | 393258. | -5660. | -7.02E-04 | 0.00 | 6.33E+10 |
| -307.590 | 54309.  | 0.00    |        |           |      |          |
| 15.6000  | 0.01193 | 378788. | -6390. | -6.88E-04 | 0.00 | 6.33E+10 |
| -301.054 | 60588.  | 0.00    |        |           |      |          |
| 15.8000  | 0.01029 | 362584. | -7104. | -6.74E-04 | 0.00 | 6.33E+10 |
| -293.417 | 68421.  | 0.00    |        |           |      |          |
| 16.0000  | 0.00869 | 344689. | -7797. | -6.60E-04 | 0.00 | 6.34E+10 |
| -284.394 | 78526.  | 0.00    |        |           |      |          |
| 16.2000  | 0.00712 | 325157. | -8467. | -6.48E-04 | 0.00 | 6.34E+10 |
| -273.553 | 92168.  | 0.00    |        |           |      |          |



|          |           |         |         |           |      |          |
|----------|-----------|---------|---------|-----------|------|----------|
| 16.4000  | 0.00558   | 304049. | -9107.  | -6.36E-04 | 0.00 | 6.35E+10 |
| -260.190 | 111833.   | 0.00    |         |           |      |          |
| 16.6000  | 0.00407   | 281442. | -9711.  | -6.25E-04 | 0.00 | 6.35E+10 |
| -243.023 | 143232.   | 0.00    |         |           |      |          |
| 16.8000  | 0.00259   | 257436. | -10266. | -6.14E-04 | 0.00 | 6.36E+10 |
| -219.247 | 203482.   | 0.00    |         |           |      |          |
| 17.0000  | 0.00112   | 232167. | -10745. | -6.05E-04 | 0.00 | 6.36E+10 |
| -179.849 | 384327.   | 0.00    |         |           |      |          |
| 17.2000  | -3.19E-04 | 205861. | -10843. | -5.97E-04 | 0.00 | 6.37E+10 |
| 97.5598  | 734611.   | 0.00    |         |           |      |          |
| 17.4000  | -0.00174  | 180118. | -10480. | -5.90E-04 | 0.00 | 6.37E+10 |
| 204.9181 | 282331.   | 0.00    |         |           |      |          |
| 17.6000  | -0.00315  | 155555. | -9947.  | -5.83E-04 | 0.00 | 6.38E+10 |
| 240.0291 | 182945.   | 0.00    |         |           |      |          |
| 17.8000  | -0.00454  | 132375. | -9340.  | -5.78E-04 | 0.00 | 6.38E+10 |
| 265.7042 | 140406.   | 0.00    |         |           |      |          |
| 18.0000  | -0.00592  | 110725. | -8677.  | -5.73E-04 | 0.00 | 6.39E+10 |
| 286.7808 | 116210.   | 0.00    |         |           |      |          |
| 18.2000  | -0.00729  | 90726.  | -7966.  | -5.70E-04 | 0.00 | 6.39E+10 |
| 305.1012 | 100395.   | 0.00    |         |           |      |          |
| 18.4000  | -0.00866  | 72486.  | -7214.  | -5.66E-04 | 0.00 | 6.40E+10 |
| 321.5809 | 89158.    | 0.00    |         |           |      |          |
| 18.6000  | -0.01001  | 56097.  | -6424.  | -5.64E-04 | 0.00 | 6.40E+10 |
| 336.7454 | 80716.    | 0.00    |         |           |      |          |
| 18.8000  | -0.01136  | 41648.  | -5599.  | -5.62E-04 | 0.00 | 6.40E+10 |
| 350.9262 | 74114.    | 0.00    |         |           |      |          |
| 19.0000  | -0.01271  | 29221.  | -4741.  | -5.61E-04 | 0.00 | 6.40E+10 |
| 364.3458 | 68791.    | 0.00    |         |           |      |          |
| 19.2000  | -0.01406  | 18892.  | -3851.  | -5.60E-04 | 0.00 | 6.40E+10 |
| 377.1613 | 64398.    | 0.00    |         |           |      |          |
| 19.4000  | -0.01540  | 10736.  | -2931.  | -5.59E-04 | 0.00 | 6.40E+10 |
| 389.4873 | 60702.    | 0.00    |         |           |      |          |
| 19.6000  | -0.01674  | 4823.   | -1982.  | -5.59E-04 | 0.00 | 6.40E+10 |
| 401.4098 | 57545.    | 0.00    |         |           |      |          |
| 19.8000  | -0.01808  | 1222.   | -1005.  | -5.59E-04 | 0.00 | 6.40E+10 |
| 412.9945 | 54812.    | 0.00    |         |           |      |          |
| 20.0000  | -0.01942  | 0.00    | 0.00    | -5.59E-04 | 0.00 | 6.40E+10 |
| 424.2929 | 26211.    | 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      | = | -0.0040235 radians               |
| Maximum bending moment           | = | 582099. inch-lbs                 |
| Maximum shear force              | = | -10843. lbs                      |
| Depth of maximum bending moment  | = | 9.00000000 feet below pile head  |
| Depth of maximum shear force     | = | 17.20000000 feet below pile head |
| Number of iterations             | = | 55                               |
| 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 | = | 0.500000  | inches  |
| Rotation of pile head     | = | 0.000E+00 | radians |
| Axial load on pile head   | = | 0.0       | lbs     |

| Depth<br>Res. | Soil<br>X               | Deflect.<br>Spr. | Distrib.<br>y             | Bending<br>Moment<br>Load | Shear<br>Force | Slope<br>S | Total<br>Stress | Bending<br>Stiffness | Soil<br>p |
|---------------|-------------------------|------------------|---------------------------|---------------------------|----------------|------------|-----------------|----------------------|-----------|
|               | Es*H<br>feet<br>lb/inch |                  | Lat.<br>inches<br>lb/inch |                           |                |            |                 |                      |           |
|               |                         |                  |                           | in-lbs<br>lb/inch         | lbs            | radians    | psi*            | lb-in^2              |           |
| 0.00          | 0.00                    | 0.5000           | 0.00                      | -1329729.                 | 21686.         | 0.00       | 0.00            | 1.23E+10             |           |
| -8.856        | 42.5370                 | 0.4997           | 0.00                      | -1277708.                 | 21665.         | -2.55E-04  | 0.00            | 1.23E+10             |           |
| -17.680       | 85.0740                 | 0.4988           | 0.00                      | -1225739.                 | 21633.         | -5.00E-04  | 0.00            | 1.23E+10             |           |
| -26.441       | 127.6111                | 0.4973           | 0.00                      | -1173871.                 | 21580.         | -7.34E-04  | 0.00            | 1.23E+10             |           |
| -35.111       | 170.1481                | 0.4953           | 0.00                      | -1122155.                 | 21506.         | -9.58E-04  | 0.00            | 1.23E+10             |           |
| -43.662       | 212.6851                | 0.4927           | 0.00                      | -1070642.                 | 21411.         | -0.00117   | 0.00            | 1.23E+10             |           |
| -52.068       | 255.2221                | 0.4896           | 0.00                      | -1019380.                 | 21297.         | -0.00137   | 0.00            | 1.24E+10             |           |
| -60.308       | 297.7592                | 0.4861           | 0.00                      | -968418.                  | 21162.         | -0.00157   | 0.00            | 1.24E+10             |           |
| -68.358       | 340.2962                | 0.4821           | 0.00                      | -917804.                  | 21007.         | -0.00175   | 0.00            | 1.24E+10             |           |
| -76.199       | 382.8332                | 0.4777           | 0.00                      | -867583.                  | 20834.         | -0.00192   | 0.00            | 1.24E+10             |           |
| -83.813       | 425.3702                | 0.4729           | 0.00                      | -817801.                  | 20642.         | -0.00208   | 0.00            | 1.24E+10             |           |

|          |          |          |        |          |      |          |
|----------|----------|----------|--------|----------|------|----------|
| 2.2000   | 0.4677   | -768502. | 20432. | -0.00224 | 0.00 | 1.25E+10 |
| -91.182  | 467.9072 | 0.00     |        |          |      |          |
| 2.4000   | 0.4621   | -719728. | 20205. | -0.00238 | 0.00 | 1.25E+10 |
| -98.291  | 510.4443 | 0.00     |        |          |      |          |
| 2.6000   | 0.4563   | -671520. | 19960. | -0.00251 | 0.00 | 1.25E+10 |
| -105.127 | 552.9813 | 0.00     |        |          |      |          |
| 2.8000   | 0.4501   | -623918. | 19700. | -0.00264 | 0.00 | 1.25E+10 |
| -111.677 | 595.5183 | 0.00     |        |          |      |          |
| 3.0000   | 0.4436   | -576959. | 19425. | -0.00275 | 0.00 | 1.25E+10 |
| -117.932 | 638.0553 | 0.00     |        |          |      |          |
| 3.2000   | 0.4369   | -530679. | 19135. | -0.00282 | 0.00 | 6.29E+10 |
| -123.882 | 680.5924 | 0.00     |        |          |      |          |
| 3.4000   | 0.4301   | -485113. | 18830. | -0.00284 | 0.00 | 6.30E+10 |
| -129.578 | 723.1294 | 0.00     |        |          |      |          |
| 3.6000   | 0.4232   | -440293. | 18513. | -0.00286 | 0.00 | 6.31E+10 |
| -135.020 | 765.6664 | 0.00     |        |          |      |          |
| 3.8000   | 0.4163   | -396251. | 18183. | -0.00287 | 0.00 | 6.32E+10 |
| -140.205 | 808.2034 | 0.00     |        |          |      |          |
| 4.0000   | 0.4094   | -353017. | 17840. | -0.00289 | 0.00 | 6.33E+10 |
| -145.134 | 850.7404 | 0.00     |        |          |      |          |
| 4.2000   | 0.4025   | -310618. | 17486. | -0.00290 | 0.00 | 6.34E+10 |
| -149.806 | 893.2775 | 0.00     |        |          |      |          |
| 4.4000   | 0.3955   | -269083. | 17121. | -0.00291 | 0.00 | 6.35E+10 |
| -154.221 | 935.8145 | 0.00     |        |          |      |          |
| 4.6000   | 0.3885   | -228435. | 16746. | -0.00292 | 0.00 | 6.36E+10 |
| -158.379 | 978.3515 | 0.00     |        |          |      |          |
| 4.8000   | 0.3815   | -188700. | 16362. | -0.00293 | 0.00 | 6.37E+10 |
| -162.280 | 1021.    | 0.00     |        |          |      |          |
| 5.0000   | 0.3745   | -149900. | 15968. | -0.00293 | 0.00 | 6.38E+10 |
| -165.924 | 1063.    | 0.00     |        |          |      |          |
| 5.2000   | 0.3674   | -112055. | 15565. | -0.00294 | 0.00 | 6.39E+10 |
| -169.313 | 1106.    | 0.00     |        |          |      |          |
| 5.4000   | 0.3604   | -75186.  | 15155. | -0.00294 | 0.00 | 6.40E+10 |
| -172.447 | 1148.    | 0.00     |        |          |      |          |
| 5.6000   | 0.3533   | -39310.  | 14738. | -0.00294 | 0.00 | 6.40E+10 |
| -175.328 | 1191.    | 0.00     |        |          |      |          |
| 5.8000   | 0.3462   | -4444.   | 14314. | -0.00295 | 0.00 | 6.40E+10 |
| -177.956 | 1234.    | 0.00     |        |          |      |          |
| 6.0000   | 0.3392   | 29397.   | 13884. | -0.00294 | 0.00 | 6.40E+10 |
| -180.334 | 1276.    | 0.00     |        |          |      |          |
| 6.2000   | 0.3321   | 62200.   | 13449. | -0.00294 | 0.00 | 6.40E+10 |
| -182.463 | 1319.    | 0.00     |        |          |      |          |
| 6.4000   | 0.3250   | 93951.   | 13009. | -0.00294 | 0.00 | 6.39E+10 |
| -184.344 | 1361.    | 0.00     |        |          |      |          |
| 6.6000   | 0.3180   | 124641.  | 12564. | -0.00294 | 0.00 | 6.39E+10 |
| -185.980 | 1404.    | 0.00     |        |          |      |          |
| 6.8000   | 0.3109   | 154259.  | 12116. | -0.00293 | 0.00 | 6.38E+10 |
| -187.372 | 1446.    | 0.00     |        |          |      |          |
| 7.0000   | 0.3039   | 182798.  | 11665. | -0.00292 | 0.00 | 6.37E+10 |
| -188.524 | 1489.    | 0.00     |        |          |      |          |

|          |        |         |          |          |      |          |
|----------|--------|---------|----------|----------|------|----------|
| 7.2000   | 0.2969 | 210251. | 11212.   | -0.00292 | 0.00 | 6.37E+10 |
| -189.437 | 1531.  | 0.00    |          |          |      |          |
| 7.4000   | 0.2899 | 236613. | 10756.   | -0.00291 | 0.00 | 6.36E+10 |
| -190.114 | 1574.  | 0.00    |          |          |      |          |
| 7.6000   | 0.2829 | 261880. | 10299.   | -0.00290 | 0.00 | 6.35E+10 |
| -190.558 | 1616.  | 0.00    |          |          |      |          |
| 7.8000   | 0.2760 | 286050. | 9842.    | -0.00289 | 0.00 | 6.35E+10 |
| -190.771 | 1659.  | 0.00    |          |          |      |          |
| 8.0000   | 0.2691 | 309120. | 9384.    | -0.00288 | 0.00 | 6.34E+10 |
| -190.756 | 1701.  | 0.00    |          |          |      |          |
| 8.2000   | 0.2622 | 331092. | 8926.    | -0.00287 | 0.00 | 6.34E+10 |
| -190.516 | 1744.  | 0.00    |          |          |      |          |
| 8.4000   | 0.2553 | 351966. | 8470.    | -0.00285 | 0.00 | 6.33E+10 |
| -190.055 | 1787.  | 0.00    |          |          |      |          |
| 8.6000   | 0.2485 | 371746. | 8014.    | -0.00284 | 0.00 | 6.33E+10 |
| -189.374 | 1829.  | 0.00    |          |          |      |          |
| 8.8000   | 0.2417 | 390435. | 7561.    | -0.00282 | 0.00 | 6.33E+10 |
| -188.478 | 1872.  | 0.00    |          |          |      |          |
| 9.0000   | 0.2349 | 408038. | 7110.    | -0.00281 | 0.00 | 6.32E+10 |
| -187.369 | 1914.  | 0.00    |          |          |      |          |
| 9.2000   | 0.2282 | 424562. | 6662.    | -0.00279 | 0.00 | 6.32E+10 |
| -186.051 | 1957.  | 0.00    |          |          |      |          |
| 9.4000   | 0.2215 | 440014. | 6217.    | -0.00278 | 0.00 | 6.31E+10 |
| -184.526 | 1999.  | 0.00    |          |          |      |          |
| 9.6000   | 0.2149 | 454404. | 5776.    | -0.00276 | 0.00 | 6.31E+10 |
| -182.799 | 2042.  | 0.00    |          |          |      |          |
| 9.8000   | 0.2083 | 467741. | 5340.    | -0.00274 | 0.00 | 6.31E+10 |
| -180.873 | 2084.  | 0.00    |          |          |      |          |
| 10.0000  | 0.2017 | 480035. | 4908.    | -0.00272 | 0.00 | 6.30E+10 |
| -178.750 | 2127.  | 0.00    |          |          |      |          |
| 10.2000  | 0.1952 | 491300. | 4482.    | -0.00271 | 0.00 | 6.30E+10 |
| -176.434 | 2169.  | 0.00    |          |          |      |          |
| 10.4000  | 0.1887 | 501549. | 4062.    | -0.00269 | 0.00 | 6.30E+10 |
| -173.928 | 2212.  | 0.00    |          |          |      |          |
| 10.6000  | 0.1823 | 510796. | 3647.    | -0.00267 | 0.00 | 6.30E+10 |
| -171.237 | 2254.  | 0.00    |          |          |      |          |
| 10.8000  | 0.1759 | 519057. | 3240.    | -0.00265 | 0.00 | 6.29E+10 |
| -168.362 | 2297.  | 0.00    |          |          |      |          |
| 11.0000  | 0.1696 | 526348. | 2840.    | -0.00263 | 0.00 | 6.29E+10 |
| -165.307 | 2340.  | 0.00    |          |          |      |          |
| 11.2000  | 0.1633 | 532687. | 2447.    | -0.00261 | 0.00 | 6.29E+10 |
| -162.076 | 2382.  | 0.00    |          |          |      |          |
| 11.4000  | 0.1571 | 538092. | 2062.    | -0.00259 | 0.00 | 6.29E+10 |
| -158.671 | 2425.  | 0.00    |          |          |      |          |
| 11.6000  | 0.1509 | 542583. | 1685.    | -0.00257 | 0.00 | 6.29E+10 |
| -155.096 | 2467.  | 0.00    |          |          |      |          |
| 11.8000  | 0.1447 | 546181. | 1318.    | -0.00255 | 0.00 | 6.29E+10 |
| -151.353 | 2510.  | 0.00    |          |          |      |          |
| 12.0000  | 0.1387 | 548907. | 958.9575 | -0.00252 | 0.00 | 4.98E+10 |
| -147.447 | 2552.  | 0.00    |          |          |      |          |

|          |         |         |          |          |      |          |
|----------|---------|---------|----------|----------|------|----------|
| 12.2000  | 0.1326  | 550784. | 609.9505 | -0.00249 | 0.00 | 3.98E+10 |
| -143.393 | 2595.   | 0.00    |          |          |      |          |
| 12.4000  | 0.1267  | 551835. | 270.8241 | -0.00246 | 0.00 | 3.43E+10 |
| -139.213 | 2637.   | 0.00    |          |          |      |          |
| 12.6000  | 0.1208  | 552084. | -58.142  | -0.00242 | 0.00 | 3.19E+10 |
| -134.926 | 2680.   | 0.00    |          |          |      |          |
| 12.8000  | 0.1151  | 551556. | -376.706 | -0.00238 | 0.00 | 3.18E+10 |
| -130.544 | 2722.   | 0.00    |          |          |      |          |
| 13.0000  | 0.1094  | 550276. | -684.647 | -0.00234 | 0.00 | 3.40E+10 |
| -126.074 | 2765.   | 0.00    |          |          |      |          |
| 13.2000  | 0.1039  | 548270. | -981.751 | -0.00230 | 0.00 | 3.88E+10 |
| -121.512 | 2807.   | 0.00    |          |          |      |          |
| 13.4000  | 0.09840 | 545564. | -1268.   | -0.00227 | 0.00 | 4.73E+10 |
| -116.850 | 2850.   | 0.00    |          |          |      |          |
| 13.6000  | 0.09299 | 542184. | -1542.   | -0.00224 | 0.00 | 6.14E+10 |
| -112.074 | 2893.   | 0.00    |          |          |      |          |
| 13.8000  | 0.08763 | 538160. | -1806.   | -0.00222 | 0.00 | 6.29E+10 |
| -107.169 | 2935.   | 0.00    |          |          |      |          |
| 14.0000  | 0.08232 | 533518. | -2057.   | -0.00220 | 0.00 | 6.29E+10 |
| -102.134 | 2978.   | 0.00    |          |          |      |          |
| 14.2000  | 0.07706 | 528287. | -2296.   | -0.00218 | 0.00 | 6.29E+10 |
| -96.973  | 3020.   | 0.00    |          |          |      |          |
| 14.4000  | 0.07185 | 522498. | -2522.   | -0.00216 | 0.00 | 6.29E+10 |
| -91.687  | 3063.   | 0.00    |          |          |      |          |
| 14.6000  | 0.06668 | 516181. | -2736.   | -0.00214 | 0.00 | 6.30E+10 |
| -86.278  | 3105.   | 0.00    |          |          |      |          |
| 14.8000  | 0.06157 | 509367. | -2936.   | -0.00212 | 0.00 | 6.30E+10 |
| -80.748  | 3148.   | 0.00    |          |          |      |          |
| 15.0000  | 0.05650 | 502088. | -3548.   | -0.00210 | 0.00 | 6.30E+10 |
| -429.242 | 18235.  | 0.00    |          |          |      |          |
| 15.2000  | 0.05147 | 492337. | -4572.   | -0.00208 | 0.00 | 6.30E+10 |
| -424.205 | 19780.  | 0.00    |          |          |      |          |
| 15.4000  | 0.04649 | 480142. | -5583.   | -0.00207 | 0.00 | 6.30E+10 |
| -418.276 | 21593.  | 0.00    |          |          |      |          |
| 15.6000  | 0.04155 | 465537. | -6579.   | -0.00205 | 0.00 | 6.31E+10 |
| -411.300 | 23755.  | 0.00    |          |          |      |          |
| 15.8000  | 0.03666 | 448564. | -7556.   | -0.00203 | 0.00 | 6.31E+10 |
| -403.075 | 26387.  | 0.00    |          |          |      |          |
| 16.0000  | 0.03181 | 429269. | -8512.   | -0.00201 | 0.00 | 6.32E+10 |
| -393.324 | 29677.  | 0.00    |          |          |      |          |
| 16.2000  | 0.02699 | 407709. | -9442.   | -0.00200 | 0.00 | 6.32E+10 |
| -381.652 | 33931.  | 0.00    |          |          |      |          |
| 16.4000  | 0.02222 | 383950. | -10340.  | -0.00198 | 0.00 | 6.33E+10 |
| -367.458 | 39692.  | 0.00    |          |          |      |          |
| 16.6000  | 0.01748 | 358074. | -11201.  | -0.00197 | 0.00 | 6.33E+10 |
| -349.768 | 48032.  | 0.00    |          |          |      |          |
| 16.8000  | 0.01277 | 330184. | -12013.  | -0.00196 | 0.00 | 6.34E+10 |
| -326.799 | 61428.  | 0.00    |          |          |      |          |
| 17.0000  | 0.00809 | 300412. | -12759.  | -0.00194 | 0.00 | 6.35E+10 |
| -294.617 | 87411.  | 0.00    |          |          |      |          |

|          |          |         |         |          |      |          |
|----------|----------|---------|---------|----------|------|----------|
| 17.2000  | 0.00344  | 268942. | -13401. | -0.00193 | 0.00 | 6.35E+10 |
| -240.326 | 167787.  | 0.00    |         |          |      |          |
| 17.4000  | -0.00119 | 236088. | -13465. | -0.00192 | 0.00 | 6.36E+10 |
| 186.3614 | 375977.  | 0.00    |         |          |      |          |
| 17.6000  | -0.00580 | 204308. | -12906. | -0.00192 | 0.00 | 6.37E+10 |
| 279.5799 | 115779.  | 0.00    |         |          |      |          |
| 17.8000  | -0.01038 | 174138. | -12179. | -0.00191 | 0.00 | 6.38E+10 |
| 326.7104 | 75520.   | 0.00    |         |          |      |          |
| 18.0000  | -0.01495 | 145850. | -11353. | -0.00190 | 0.00 | 6.38E+10 |
| 361.4915 | 58015.   | 0.00    |         |          |      |          |
| 18.2000  | -0.01951 | 119644. | -10451. | -0.00190 | 0.00 | 6.39E+10 |
| 390.1847 | 47991.   | 0.00    |         |          |      |          |
| 18.4000  | -0.02406 | 95686.  | -9484.  | -0.00189 | 0.00 | 6.39E+10 |
| 415.2045 | 41416.   | 0.00    |         |          |      |          |
| 18.6000  | -0.02860 | 74119.  | -8461.  | -0.00189 | 0.00 | 6.40E+10 |
| 437.7567 | 36735.   | 0.00    |         |          |      |          |
| 18.8000  | -0.03313 | 55074.  | -7385.  | -0.00189 | 0.00 | 6.40E+10 |
| 458.5360 | 33215.   | 0.00    |         |          |      |          |
| 19.0000  | -0.03766 | 38669.  | -6262.  | -0.00189 | 0.00 | 6.40E+10 |
| 477.9814 | 30461.   | 0.00    |         |          |      |          |
| 19.2000  | -0.04218 | 25018.  | -5092.  | -0.00188 | 0.00 | 6.40E+10 |
| 496.3885 | 28242.   | 0.00    |         |          |      |          |
| 19.4000  | -0.04670 | 14227.  | -3880.  | -0.00188 | 0.00 | 6.40E+10 |
| 513.9662 | 26411.   | 0.00    |         |          |      |          |
| 19.6000  | -0.05123 | 6395.   | -2626.  | -0.00188 | 0.00 | 6.40E+10 |
| 530.8676 | 24872.   | 0.00    |         |          |      |          |
| 19.8000  | -0.05575 | 1622.   | -1332.  | -0.00188 | 0.00 | 6.40E+10 |
| 547.2080 | 23559.   | 0.00    |         |          |      |          |
| 20.0000  | -0.06026 | 0.00    | 0.00    | -0.00188 | 0.00 | 6.40E+10 |
| 563.0764 | 11212.   | 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             | = | 0.50000000 inches             |
| Computed slope at pile head      | = | 0.000000 radians              |
| Maximum bending moment           | = | -1329729. inch-lbs            |
| Maximum shear force              | = | 21686. 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             | = | 52                            |
| 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<br>Shear<br>Case<br>Pile<br>No. | Load<br>Max<br>Type<br>1 | Load<br>Moment<br>Pile-head<br>Load 1 | Load<br>Type<br>2 | Load<br>Pile-head<br>Load 2 | Axial<br>Loading<br>lbs | Pile-head<br>Deflection<br>inches | Pile-head<br>Rotation<br>radians | Max<br>in |
|--------------------------------------|--------------------------|---------------------------------------|-------------------|-----------------------------|-------------------------|-----------------------------------|----------------------------------|-----------|
| 1                                    | y, in                    | 0.5000                                | M, in-lb          | 0.00                        | 0.00                    | 0.5000                            | -0.00402                         |           |
| -10843.                              |                          | 582099.                               |                   |                             |                         |                                   |                                  |           |
| 2                                    | y, in                    | 0.5000                                | S, rad            | 0.00                        | 0.00                    | 0.5000                            | 0.00                             |           |
| 21686.                               |                          | -1329729.                             |                   |                             |                         |                                   |                                  |           |

Maximum pile-head deflection = 0.5000000000 inches

Maximum pile-head rotation = -0.0040234839 radians = -0.230529 deg.

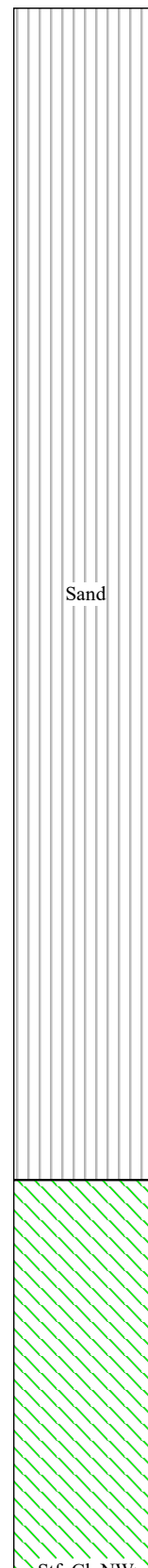
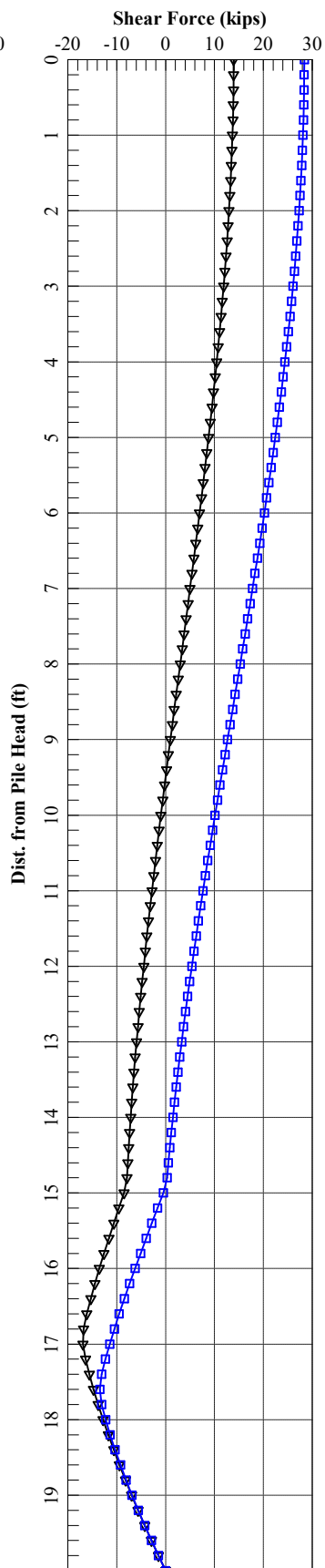
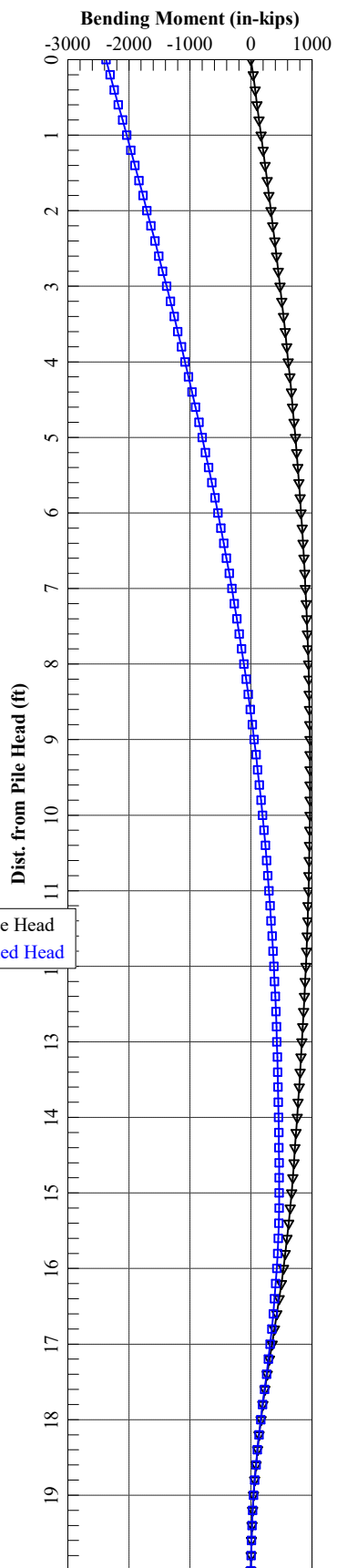
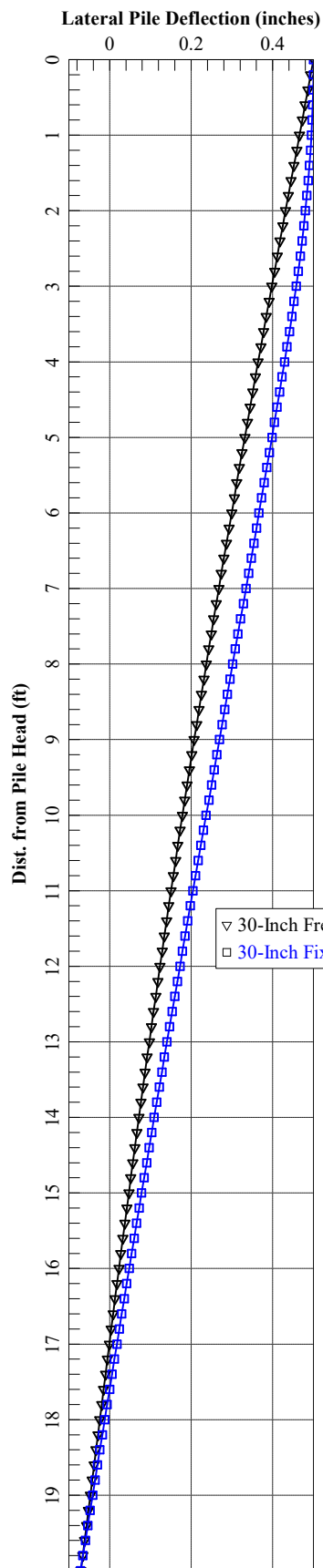
-----  
Summary of Warning Messages  
-----

The following warning was reported 3974 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.





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LPILE for Windows, Version 2022-12.006

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

-----

Path to file locations:

\Users\357611\Box\GED\PROJECTS\2023\23-156 Ardmore Recreation Center\Analysis\

Name of input data file:

30-inch Free and Fixed LPILE (USCS units).lp12d

Name of output report file:

30-inch Free and Fixed LPILE (USCS units).lp12o

Name of plot output file:

30-inch Free and Fixed LPILE (USCS units).lp12p

Name of runtime message file:

30-inch Free and Fixed LPILE (USCS units).lp12r

-----

Date and Time of Analysis

-----  
Date: October 4, 2023

Time: 14:41:27

-----  
Problem Title  
-----

Project Name: ARDMORE RECREATION CENTER

Job Number: 23-156

Client: Arch

-----  
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

- Use of p-y modification factors for p-y curves not selected
- 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<br>No. | Depth Below<br>Pile Head<br>feet | Pile<br>Diameter<br>inches |
|--------------|----------------------------------|----------------------------|
| 1            | 0.000                            | 30.0000                    |
| 2            | 20.000                           | 30.0000                    |

#### 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 = 30.000000 in

---

### 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 | = | 15.000000 ft   |
| Effective unit weight at top of layer        | = | 98.000000 pcf  |
| Effective unit weight at bottom of layer     | = | 98.000000 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 stiff clay without free water

|  |   |                |
|--|---|----------------|
| Distance from top of pile to top of layer    | = | 15.000000 ft   |
| Distance from top of pile to bottom of layer | = | 25.000000 ft   |
| Effective unit weight at top of layer        | = | 130.000000 pcf |
| Effective unit weight at bottom of layer     | = | 130.000000 pcf |
| Undrained cohesion at top of layer           | = | 1500. psf      |
| Undrained cohesion at bottom of layer        | = | 1500. psf      |
| Epsilon-50 at top of layer                   | = | 0.0000         |
| Epsilon-50 at bottom of layer                | = | 0.0000         |

NOTE: Default values for Epsilon-50 will be computed for this layer.

(Depth of the lowest soil layer extends 5.000 ft below the pile tip)

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### Summary of Input Soil Properties

---

| Layer<br>E50<br>Num.<br>or<br>krm | Soil Type<br>Name<br>(p-y Curve Type)<br>kpy<br>pci | Layer<br>Depth<br>ft | Effective<br>Unit Wt.<br>pcf | Cohesion<br>psf | Angle of<br>Friction<br>deg. |
|-----------------------------------|---|----------------------|------------------------------|-----------------|------------------------------|
|-----------------------------------|---|----------------------|------------------------------|-----------------|------------------------------|

|         |                 |         |          |       |         |
|---------|-----------------|---------|----------|-------|---------|
| 1       | Sand            | 0.00    | 98.0000  | --    | 20.0000 |
| --      | default         |         |          |       |         |
| --      | (Reese, et al.) | 15.0000 | 98.0000  | --    | 20.0000 |
| --      | default         |         |          |       |         |
| 2       | Stiff Clay      | 15.0000 | 130.0000 | 1500. | --      |
| default | --              |         |          |       |         |
|         | w/o Free Water  | 25.0000 | 130.0000 | 1500. | --      |
| default | --              |         |          |       |         |

#### 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<br>Compute<br>No. | Load<br>Top y<br>Type | Condition<br>Run Analysis<br>1 | Condition<br>2    | Axial Thrust<br>Force, lbs |
|------------------------|-----------------------|--------------------------------|-------------------|----------------------------|
| 1                      | 4                     | y = 0.500000 in                | M = 0.0000 in-lbs | 0.0000000                  |
|                        | N.A.                  | Yes                            |                   |                            |
| 2                      | 5                     | y = 0.500000 in                | S = 0.0000 in/in  | 0.0000000                  |
|                        | 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                                     | = | 30.000000 in       |
| Concrete Cover Thickness (to edge of long. rebar)  | = | 3.000000 in        |
| Number of Reinforcing Bars                         | = | 9 bars             |
| Yield Stress of Reinforcing Bars                   | = | 60000. psi         |
| Modulus of Elasticity of Reinforcing Bars          | = | 29000000. psi      |
| Gross Area of Shaft                                | = | 706.858347 sq. in. |
| Total Area of Reinforcing Steel                    | = | 7.110000 sq. in.   |
| Area Ratio of Steel Reinforcement                  | = | 1.01 percent       |
| Edge-to-Edge Bar Spacing                           | = | 6.866463 in        |
| Maximum Concrete Aggregate Size                    | = | 0.750000 in        |
| Ratio of Bar Spacing to Aggregate Size             | = | 9.16               |
| Offset of Center of Rebar Cage from Center of Pile | = | 0.0000 in          |

Axial Structural Capacities:  
-----

|   |   |               |
|---|---|---------------|
| Nom. Axial Structural Capacity = $0.85 F_c A_c + F_y A_s$ | = | 2210.958 kips |
| Tensile Load for Cracking of Concrete                     | = | -277.234 kips |
| Nominal Axial Tensile Capacity                            | = | -426.600 kips |

Reinforcing Bar Dimensions and Positions Used in Computations:

| Bar<br>Number | Bar Diam.<br>inches | Bar Area<br>sq. in. | X<br>inches | Y<br>inches |
|---------------|---------------------|---------------------|-------------|-------------|
| -----         | -----               | -----               | -----       | -----       |
| 1             | 1.000000            | 0.790000            | 11.500000   | 0.00000     |
| 2             | 1.000000            | 0.790000            | 8.809511    | 7.392058    |
| 3             | 1.000000            | 0.790000            | 1.996954    | 11.325289   |
| 4             | 1.000000            | 0.790000            | -5.75000    | 9.959292    |
| 5             | 1.000000            | 0.790000            | -10.80647   | 3.933232    |
| 6             | 1.000000            | 0.790000            | -10.80647   | -3.93323    |
| 7             | 1.000000            | 0.790000            | -5.75000    | -9.95929    |
| 8             | 1.000000            | 0.790000            | 1.996954    | -11.32529   |
| 9             | 1.000000            | 0.790000            | 8.809511    | -7.39206    |

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

Minimum spacing between any two bars not equal to zero = 6.866 inches  
between bars 3 and 4.

Ratio of bar spacing to maximum aggregate size = 9.16

#### Concrete Properties:

|  |   |                |
|--|---|----------------|
| Compressive Strength of Concrete       | = | 3000. psi      |
| Modulus of Elasticity of Concrete      | = | 3122019. psi   |
| Modulus of Rupture of Concrete         | = | -410.79192 psi |
| Compression Strain at Peak Stress      | = | 0.001634       |
| Tensile Strain at Fracture of Concrete | = | -0.0001160     |
| Maximum Coarse Aggregate Size          | = | 0.750000 in    |

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

| Number | Axial Thrust Force<br>kips |
|--------|----------------------------|
| -----  | -----                      |
| 1      | 0.000                      |

#### 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 318-14, Section 21.2.3.  
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 = 0.000 kips

| Bending<br>Max Conc<br>Curvature<br>Stress | Bending<br>Max Steel<br>Moment<br>Stress | Bending<br>Run<br>Stiffness<br>Msg | Depth to<br>N Axis | Max Comp<br>Strain | Max Tens<br>Strain |
|--|--|------------------------------------|--------------------|--------------------|--------------------|
|--|--|------------------------------------|--------------------|--------------------|--------------------|

| rad/in.<br>ksi | in-kip<br>ksi | kip-in2    | in         | in/in      | in/in       |
|----------------|---------------|------------|------------|------------|-------------|
| -----          |               |            |            |            |             |
| 0.00000125     | 196.7704967   | 157416397. | 15.0000943 | 0.00001875 | -0.00001875 |
| 0.0677924      | 0.4295659     |            |            |            |             |
| 0.00000250     | 392.1340069   | 156853603. | 15.0000948 | 0.00003750 | -0.00003750 |
| 0.1348101      | 0.8591319     |            |            |            |             |
| 0.00000375     | 586.0905306   | 156290808. | 15.0000953 | 0.00005625 | -0.00005625 |
| 0.2010531      | 1.2886979     |            |            |            |             |
| 0.00000500     | 778.6400679   | 155728014. | 15.0000958 | 0.00007500 | -0.00007500 |
| 0.2665213      | 1.7182639     |            |            |            |             |
| 0.00000625     | 969.7826186   | 155165219. | 15.0000963 | 0.00009375 | -0.00009375 |
| 0.3312147      | 2.1478300     |            |            |            |             |
| 0.00000750     | 1160.         | 154602424. | 15.0000969 | 0.0001125  | -0.000112   |
| 0.3951335      | 2.5773961     |            |            |            |             |
| 0.00000875     | 1160.         | 132516364. | 7.5308211  | 0.00006589 | -0.000197   |
| 0.2325190      | -4.902242 C   |            |            |            |             |
| 0.00001000     | 1160.         | 115951818. | 7.5345617  | 0.00007535 | -0.000225   |
| 0.2651016      | -5.601477 C   |            |            |            |             |
| 0.00001125     | 1160.         | 103068283. | 7.5383151  | 0.00008481 | -0.000253   |
| 0.2975244      | -6.300437 C   |            |            |            |             |
| 0.00001250     | 1160.         | 92761455.  | 7.5420815  | 0.00009428 | -0.000281   |
| 0.3297870      | -6.999120 C   |            |            |            |             |
| 0.00001375     | 1160.         | 84328595.  | 7.5458611  | 0.0001038  | -0.000309   |
| 0.3618888      | -7.697525 C   |            |            |            |             |
| 0.00001500     | 1160.         | 77301212.  | 7.5496537  | 0.0001132  | -0.000337   |
| 0.3938296      | -8.395651 C   |            |            |            |             |
| 0.00001625     | 1160.         | 71354965.  | 7.5534597  | 0.0001227  | -0.000365   |
| 0.4256088      | -9.093495 C   |            |            |            |             |
| 0.00001750     | 1160.         | 66258182.  | 7.5572790  | 0.0001323  | -0.000393   |
| 0.4572260      | -9.791056 C   |            |            |            |             |
| 0.00001875     | 1160.         | 61840970.  | 7.5611117  | 0.0001418  | -0.000421   |
| 0.4886808      | -10.488333 C  |            |            |            |             |
| 0.00002000     | 1160.         | 57975909.  | 7.5649580  | 0.0001513  | -0.000449   |
| 0.5199727      | -11.185324 C  |            |            |            |             |
| 0.00002125     | 1160.         | 54565562.  | 7.5688180  | 0.0001608  | -0.000477   |
| 0.5511014      | -11.882028 C  |            |            |            |             |
| 0.00002250     | 1160.         | 51534141.  | 7.5726917  | 0.0001704  | -0.000505   |
| 0.5820662      | -12.578444 C  |            |            |            |             |
| 0.00002375     | 1160.         | 48821818.  | 7.5765792  | 0.0001799  | -0.000533   |
| 0.6128669      | -13.274569 C  |            |            |            |             |
| 0.00002500     | 1160.         | 46380727.  | 7.5804807  | 0.0001895  | -0.000560   |
| 0.6435029      | -13.970401 C  |            |            |            |             |
| 0.00002625     | 1160.         | 44172121.  | 7.5843962  | 0.0001991  | -0.000588   |
| 0.6739738      | -14.665941 C  |            |            |            |             |
| 0.00002750     | 1160.         | 42164298.  | 7.5883259  | 0.0002087  | -0.000616   |
| 0.7042791      | -15.361185 C  |            |            |            |             |
| 0.00002875     | 1160.         | 40331067.  | 7.5922698  | 0.0002183  | -0.000644   |
| 0.7344184      | -16.056132 C  |            |            |            |             |



|            |              |           |           |           |           |
|------------|--------------|-----------|-----------|-----------|-----------|
| 0.00003000 | 1160.        | 38650606. | 7.5962281 | 0.0002279 | -0.000672 |
| 0.7643911  | -16.750782 C |           |           |           |           |
| 0.00003125 | 1160.        | 37104582. | 7.6002008 | 0.0002375 | -0.000700 |
| 0.7941968  | -17.445130 C |           |           |           |           |
| 0.00003250 | 1160.        | 35677483. | 7.6041881 | 0.0002471 | -0.000728 |
| 0.8238351  | -18.139178 C |           |           |           |           |
| 0.00003375 | 1160.        | 34356094. | 7.6081902 | 0.0002568 | -0.000756 |
| 0.8533054  | -18.832921 C |           |           |           |           |
| 0.00003500 | 1160.        | 33129091. | 7.6122069 | 0.0002664 | -0.000784 |
| 0.8826072  | -19.526360 C |           |           |           |           |
| 0.00003625 | 1160.        | 31986708. | 7.6162386 | 0.0002761 | -0.000811 |
| 0.9117402  | -20.219492 C |           |           |           |           |
| 0.00003750 | 1184.        | 31566249. | 7.6202853 | 0.0002858 | -0.000839 |
| 0.9407037  | -20.912315 C |           |           |           |           |
| 0.00003875 | 1223.        | 31551933. | 7.6243472 | 0.0002954 | -0.000867 |
| 0.9694973  | -21.604827 C |           |           |           |           |
| 0.00004000 | 1262.        | 31537571. | 7.6284243 | 0.0003051 | -0.000895 |
| 0.9981204  | -22.297028 C |           |           |           |           |
| 0.00004125 | 1300.        | 31523163. | 7.6325167 | 0.0003148 | -0.000923 |
| 1.0265727  | -22.988914 C |           |           |           |           |
| 0.00004250 | 1339.        | 31508707. | 7.6366246 | 0.0003246 | -0.000950 |
| 1.0548535  | -23.680485 C |           |           |           |           |
| 0.00004375 | 1378.        | 31494205. | 7.6407481 | 0.0003343 | -0.000978 |
| 1.0829623  | -24.371738 C |           |           |           |           |
| 0.00004500 | 1417.        | 31479655. | 7.6448874 | 0.0003440 | -0.001006 |
| 1.1108987  | -25.062672 C |           |           |           |           |
| 0.00004625 | 1455.        | 31465057. | 7.6490424 | 0.0003538 | -0.001034 |
| 1.1386621  | -25.753284 C |           |           |           |           |
| 0.00004750 | 1494.        | 31450424. | 7.6530839 | 0.0003635 | -0.001061 |
| 1.1662343  | -26.443752 C |           |           |           |           |
| 0.00004875 | 1532.        | 31435749. | 7.6571016 | 0.0003733 | -0.001089 |
| 1.1936262  | -27.133960 C |           |           |           |           |
| 0.00005125 | 1610.        | 31406258. | 7.6651819 | 0.0003928 | -0.001145 |
| 1.2478828  | -28.513436 C |           |           |           |           |
| 0.00005375 | 1686.        | 31376577. | 7.6733229 | 0.0004124 | -0.001200 |
| 1.3014327  | -29.891645 C |           |           |           |           |
| 0.00005625 | 1763.        | 31346703. | 7.6815254 | 0.0004321 | -0.001255 |
| 1.3542717  | -31.268574 C |           |           |           |           |
| 0.00005875 | 1840.        | 31316633. | 7.6897906 | 0.0004518 | -0.001311 |
| 1.4063954  | -32.644207 C |           |           |           |           |
| 0.00006125 | 1916.        | 31286365. | 7.6981192 | 0.0004715 | -0.001366 |
| 1.4577995  | -34.018528 C |           |           |           |           |
| 0.00006375 | 1993.        | 31255895. | 7.7065125 | 0.0004913 | -0.001421 |
| 1.5084794  | -35.391522 C |           |           |           |           |
| 0.00006625 | 2069.        | 31225221. | 7.7149713 | 0.0005111 | -0.001476 |
| 1.5584305  | -36.763174 C |           |           |           |           |
| 0.00006875 | 2145.        | 31194340. | 7.7234968 | 0.0005310 | -0.001532 |
| 1.6076481  | -38.133465 C |           |           |           |           |
| 0.00007125 | 2220.        | 31163248. | 7.7320901 | 0.0005509 | -0.001587 |
| 1.6561276  | -39.502381 C |           |           |           |           |

|            |               |           |           |           |           |
|------------|---------------|-----------|-----------|-----------|-----------|
| 0.00007375 | 2296.         | 31131942. | 7.7407522 | 0.0005709 | -0.001642 |
| 1.7038641  | -40.869904 C  |           |           |           |           |
| 0.00007625 | 2371.         | 31100420. | 7.7494843 | 0.0005909 | -0.001697 |
| 1.7508526  | -42.236015 C  |           |           |           |           |
| 0.00007875 | 2447.         | 31068676. | 7.7582876 | 0.0006110 | -0.001752 |
| 1.7970881  | -43.600698 C  |           |           |           |           |
| 0.00008125 | 2522.         | 31036709. | 7.7671633 | 0.0006311 | -0.001806 |
| 1.8425657  | -44.963934 C  |           |           |           |           |
| 0.00008375 | 2597.         | 31004515. | 7.7761125 | 0.0006512 | -0.001861 |
| 1.8872800  | -46.325704 C  |           |           |           |           |
| 0.00008625 | 2671.         | 30972090. | 7.7851367 | 0.0006715 | -0.001916 |
| 1.9312257  | -47.685989 C  |           |           |           |           |
| 0.00008875 | 2746.         | 30939430. | 7.7942370 | 0.0006917 | -0.001971 |
| 1.9743975  | -49.044770 C  |           |           |           |           |
| 0.00009125 | 2820.         | 30906531. | 7.8034148 | 0.0007121 | -0.002025 |
| 2.0167898  | -50.402026 C  |           |           |           |           |
| 0.00009375 | 2894.         | 30873390. | 7.8126715 | 0.0007324 | -0.002080 |
| 2.0583971  | -51.757737 C  |           |           |           |           |
| 0.00009625 | 2968.         | 30840002. | 7.8220084 | 0.0007529 | -0.002135 |
| 2.0992135  | -53.111881 C  |           |           |           |           |
| 0.00009875 | 3042.         | 30806364. | 7.8314271 | 0.0007734 | -0.002189 |
| 2.1392334  | -54.464438 C  |           |           |           |           |
| 0.0001013  | 3116.         | 30772472. | 7.8409289 | 0.0007939 | -0.002244 |
| 2.1784506  | -55.815385 C  |           |           |           |           |
| 0.0001038  | 3189.         | 30738320. | 7.8505155 | 0.0008145 | -0.002298 |
| 2.2168592  | -57.164699 C  |           |           |           |           |
| 0.0001063  | 3262.         | 30703904. | 7.8601883 | 0.0008351 | -0.002352 |
| 2.2544528  | -58.512357 C  |           |           |           |           |
| 0.0001088  | 3335.         | 30669221. | 7.8699490 | 0.0008559 | -0.002407 |
| 2.2912253  | -59.858335 C  |           |           |           |           |
| 0.0001113  | 3406.         | 30612019. | 7.8778361 | 0.0008764 | -0.002461 |
| 2.3267900  | -60.000000 CY |           |           |           |           |
| 0.0001138  | 3467.         | 30479668. | 7.8790462 | 0.0008962 | -0.002516 |
| 2.3602186  | -60.000000 CY |           |           |           |           |
| 0.0001163  | 3521.         | 30292292. | 7.8751918 | 0.0009155 | -0.002572 |
| 2.3918327  | -60.000000 CY |           |           |           |           |
| 0.0001188  | 3574.         | 30096310. | 7.8704621 | 0.0009346 | -0.002628 |
| 2.4224472  | -60.000000 CY |           |           |           |           |
| 0.0001213  | 3621.         | 29862604. | 7.8619513 | 0.0009533 | -0.002684 |
| 2.4515143  | -60.000000 CY |           |           |           |           |
| 0.0001238  | 3660.         | 29577682. | 7.8481780 | 0.0009712 | -0.002741 |
| 2.4787693  | -60.000000 CY |           |           |           |           |
| 0.0001263  | 3696.         | 29272354. | 7.8321216 | 0.0009888 | -0.002799 |
| 2.5047970  | -60.000000 CY |           |           |           |           |
| 0.0001288  | 3730.         | 28974291. | 7.8165819 | 0.0010064 | -0.002856 |
| 2.5301381  | -60.000000 CY |           |           |           |           |
| 0.0001313  | 3765.         | 28686835. | 7.8019190 | 0.0010240 | -0.002913 |
| 2.5548666  | -60.000000 CY |           |           |           |           |
| 0.0001338  | 3800.         | 28409385. | 7.7880868 | 0.0010417 | -0.002971 |
| 2.5789786  | -60.000000 CY |           |           |           |           |

|           |               |           |           |           |           |
|-----------|---------------|-----------|-----------|-----------|-----------|
| 0.0001363 | 3834.         | 28141383. | 7.7750426 | 0.0010593 | -0.003028 |
| 2.6024704 | -60.000000 CY |           |           |           |           |
| 0.0001388 | 3868.         | 27877489. | 7.7621901 | 0.0010770 | -0.003085 |
| 2.6252376 | -60.000000 CY |           |           |           |           |
| 0.0001413 | 3898.         | 27593064. | 7.7466173 | 0.0010942 | -0.003143 |
| 2.6467686 | -60.000000 CY |           |           |           |           |
| 0.0001438 | 3922.         | 27284937. | 7.7278515 | 0.0011109 | -0.003202 |
| 2.6670059 | -60.000000 CY |           |           |           |           |
| 0.0001463 | 3943.         | 26963132. | 7.7070330 | 0.0011272 | -0.003260 |
| 2.6861784 | -60.000000 CY |           |           |           |           |
| 0.0001488 | 3963.         | 26645300. | 7.6863298 | 0.0011433 | -0.003319 |
| 2.7046823 | -60.000000 CY |           |           |           |           |
| 0.0001588 | 4043.         | 25468370. | 7.6097744 | 0.0012081 | -0.003554 |
| 2.7730333 | -60.000000 CY |           |           |           |           |
| 0.0001688 | 4121.         | 24423469. | 7.5435350 | 0.0012730 | -0.003790 |
| 2.8325828 | -60.000000 CY |           |           |           |           |
| 0.0001788 | 4196.         | 23473989. | 7.4851678 | 0.0013380 | -0.004025 |
| 2.8831484 | -60.000000 CY |           |           |           |           |
| 0.0001888 | 4245.         | 22488362. | 7.4131254 | 0.0013992 | -0.004263 |
| 2.9224494 | -60.000000 CY |           |           |           |           |
| 0.0001988 | 4283.         | 21551340. | 7.3418600 | 0.0014592 | -0.004503 |
| 2.9531335 | -60.000000 CY |           |           |           |           |
| 0.0002088 | 4321.         | 20698300. | 7.2758480 | 0.0015188 | -0.004744 |
| 2.9760237 | -60.000000 CY |           |           |           |           |
| 0.0002188 | 4357.         | 19919775. | 7.2180492 | 0.0015789 | -0.004984 |
| 2.9914079 | -60.000000 CY |           |           |           |           |
| 0.0002288 | 4393.         | 19205867. | 7.1674675 | 0.0016396 | -0.005223 |
| 2.9990988 | -60.000000 CY |           |           |           |           |
| 0.0002388 | 4428.         | 18548169. | 7.1233498 | 0.0017007 | -0.005462 |
| 2.9981745 | -60.000000 CY |           |           |           |           |
| 0.0002488 | 4462.         | 17938327. | 7.0845811 | 0.0017623 | -0.005700 |
| 2.9965117 | -60.000000 CY |           |           |           |           |
| 0.0002588 | 4491.         | 17354640. | 7.0454711 | 0.0018230 | -0.005939 |
| 2.9999762 | -60.000000 CY |           |           |           |           |
| 0.0002688 | 4510.         | 16781909. | 6.9993456 | 0.0018811 | -0.006181 |
| 2.9986485 | -60.000000 CY |           |           |           |           |
| 0.0002788 | 4524.         | 16230236. | 6.9518568 | 0.0019378 | -0.006425 |
| 2.9975938 | -60.000000 CY |           |           |           |           |
| 0.0002888 | 4537.         | 15711197. | 6.9077379 | 0.0019946 | -0.006668 |
| 2.9990700 | -60.000000 CY |           |           |           |           |
| 0.0002988 | 4549.         | 15225608. | 6.8678489 | 0.0020518 | -0.006911 |
| 2.9969053 | -60.000000 CY |           |           |           |           |
| 0.0003088 | 4560.         | 14770190. | 6.8318122 | 0.0021093 | -0.007153 |
| 2.9987252 | -60.000000 CY |           |           |           |           |
| 0.0003188 | 4572.         | 14342343. | 6.7991030 | 0.0021672 | -0.007395 |
| 2.9983968 | -60.000000 CY |           |           |           |           |
| 0.0003288 | 4583.         | 13939367. | 6.7695717 | 0.0022255 | -0.007637 |
| 2.9972870 | -60.000000 CY |           |           |           |           |
| 0.0003388 | 4593.         | 13559256. | 6.7418821 | 0.0022838 | -0.007879 |
| 2.9998805 | -60.000000 CY |           |           |           |           |

|           |                |           |           |           |           |
|-----------|----------------|-----------|-----------|-----------|-----------|
| 0.0003488 | 4603.          | 13199522. | 6.7150233 | 0.0023419 | -0.008121 |
| 2.9941335 | -60.000000 CY  |           |           |           |           |
| 0.0003588 | 4613.          | 12859218. | 6.6904880 | 0.0024002 | -0.008362 |
| 2.9981530 | -60.000000 CY  |           |           |           |           |
| 0.0003688 | 4623.          | 12536854. | 6.6680082 | 0.0024588 | -0.008604 |
| 2.9999781 | -60.000000 CY  |           |           |           |           |
| 0.0003788 | 4632.          | 12230740. | 6.6477104 | 0.0025178 | -0.008845 |
| 2.9933377 | -60.000000 CY  |           |           |           |           |
| 0.0003888 | 4642.          | 11939941. | 6.6290985 | 0.0025771 | -0.009085 |
| 2.9974304 | -60.000000 CY  |           |           |           |           |
| 0.0003988 | 4651.          | 11663333. | 6.6120201 | 0.0026365 | -0.009326 |
| 2.9997850 | -60.000000 CY  |           |           |           |           |
| 0.0004088 | 4660.          | 11399707. | 6.5965663 | 0.0026963 | -0.009566 |
| 2.9957470 | -60.000000 CY  |           |           |           |           |
| 0.0004188 | 4668.          | 11147870. | 6.5822042 | 0.0027563 | -0.009806 |
| 2.9943809 | -60.000000 CY  |           |           |           |           |
| 0.0004288 | 4676.          | 10906024. | 6.5679070 | 0.0028160 | -0.010047 |
| 2.9982454 | -60.000000 CY  |           |           |           |           |
| 0.0004388 | 4684.          | 10674929. | 6.5547324 | 0.0028759 | -0.010287 |
| 2.9999261 | -60.000000 CY  |           |           |           |           |
| 0.0004488 | 4689.          | 10449543. | 6.5394660 | 0.0029346 | -0.010528 |
| 2.9954117 | -60.000000 CY  |           |           |           |           |
| 0.0004588 | 4694.          | 10232934. | 6.5246039 | 0.0029932 | -0.010769 |
| 2.9917896 | -60.000000 CY  |           |           |           |           |
| 0.0004688 | 4699.          | 10024297. | 6.5097204 | 0.0030514 | -0.011011 |
| 2.9961277 | -60.000000 CYT |           |           |           |           |
| 0.0004788 | 4702.          | 9820697.  | 6.4926503 | 0.0031084 | -0.011254 |
| 2.9987560 | -60.000000 CYT |           |           |           |           |
| 0.0004888 | 4704.          | 9625316.  | 6.4765562 | 0.0031654 | -0.011497 |
| 2.9999333 | -60.000000 CYT |           |           |           |           |
| 0.0004988 | 4707.          | 9436750.  | 6.4607797 | 0.0032223 | -0.011740 |
| 2.9963249 | -60.000000 CYT |           |           |           |           |
| 0.0005088 | 4708.          | 9254197.  | 6.4440056 | 0.0032784 | -0.011984 |
| 2.9912206 | -60.000000 CYT |           |           |           |           |
| 0.0005188 | 4709.          | 9078371.  | 6.4265078 | 0.0033338 | -0.012229 |
| 2.9909957 | -60.000000 CYT |           |           |           |           |
| 0.0005288 | 4711.          | 8909146.  | 6.4098511 | 0.0033892 | -0.012473 |
| 2.9947191 | -60.000000 CYT |           |           |           |           |
| 0.0005388 | 4712.          | 8746154.  | 6.3939916 | 0.0034448 | -0.012718 |
| 2.9974653 | -60.000000 CYT |           |           |           |           |
| 0.0005488 | 4713.          | 8589052.  | 6.3788885 | 0.0035004 | -0.012962 |
| 2.9992206 | -60.000000 CYT |           |           |           |           |
| 0.0006088 | 4720.          | 7753653.  | 6.3027310 | 0.0038368 | -0.014426 |
| 2.9928797 | -60.000000 CYT |           |           |           |           |

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Summary of Results for Nominal Moment Capacity for Section 1  
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Moment values interpolated at maximum compressive strain = 0.003  
or maximum developed moment if pile fails at smaller strains.

| Load<br>Tens.<br>No.<br>Strain | Axial Thrust<br>kips | Nominal Mom. Cap.<br>in-kip | Max. Comp.<br>Strain | Max. |
|--------------------------------|----------------------|-----------------------------|----------------------|------|
| -----<br>-----                 | -----                | -----                       | -----                |      |
| 1<br>-0.01079771               | 0.000                | 4694.890                    | 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 (0.75).

The above values should be multiplied by the appropriate strength reduction  
factor to compute ultimate moment capacity according to ACI 318,  
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<br>Stiff.<br>Load<br>Ult Mom<br>No.<br>kip-in^2 | Resist.<br>Factor | Nominal<br>Ax. Thrust<br>kips | Nominal<br>Moment Cap<br>in-kips | Ult. (Fac)<br>Ax. Thrust<br>kips | Ult. (Fac)<br>Moment Cap<br>in-kips | Bend.<br>at |
|---|-------------------|-------------------------------|----------------------------------|----------------------------------|-------------------------------------|-------------|
| -----<br>-----  | -----             | -----                         | -----                            | -----                            | -----                               |             |
| 1<br>30801966.  | 0.65              | 0.0000                        | 4695.                            | 0.0000                           | 3052.                               |             |
| 1<br>30293365.  | 0.75              | 0.0000                        | 4695.                            | 0.0000                           | 3521.                               |             |
| 1<br>22878487.  | 0.90              | 0.0000                        | 4695.                            | 0.0000                           | 4225.                               |             |

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Layering Correction Equivalent Depths of Soil & Rock Layers  
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Top of      Equivalent

| Layer No. | Layer Below Pile Head ft | 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                      | 123991.                   |
| 2         | 15.0000                  | 8.1117                       | No                             | No                                   | 123991.                   | 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.

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 Computed Values of Pile Loading and Deflection  
 for Lateral Loading for Load Case Number 1  
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Pile-head conditions are Displacement and Moment (Loading Type 4)

Displacement of pile head = 0.500000 inches  
 Moment at pile head = 0.0 in-lbs  
 Axial load at pile head = 0.0 lbs

| Depth<br>Res. | Deflect.<br>Soil Spr. | Bending<br>Distrib. | Shear  | Slope    | Total  | Bending   | Soil |
|---------------|-----------------------|---------------------|--------|----------|--------|-----------|------|
| X             | y                     | Moment              | Force  | S        | Stress | Stiffness | p    |
| Es*H          | Lat.                  | Load                |        |          |        |           |      |
| feet          | inches                | in-lbs              | lbs    | radians  | psi*   | lb-in^2   |      |
| lb/inch       | lb/inch               | lb/inch             |        |          |        |           |      |
| 0.00          | 0.5000                | 0.00                | 13936. | -0.00286 | 0.00   | 1.57E+11  |      |
| 0.00          | 0.00                  | 0.00                |        |          |        |           |      |
| 0.2000        | 0.4931                | 33448.              | 13926. | -0.00286 | 0.00   | 1.57E+11  |      |
| -8.740        | 42.5370               | 0.00                |        |          |        |           |      |
| 0.4000        | 0.4863                | 66845.              | 13895. | -0.00286 | 0.00   | 1.57E+11  |      |
| -17.237       | 85.0740               | 0.00                |        |          |        |           |      |
| 0.6000        | 0.4794                | 100143.             | 13844. | -0.00286 | 0.00   | 1.57E+11  |      |
| -25.491       | 127.6111              | 0.00                |        |          |        |           |      |
| 0.8000        | 0.4726                | 133294.             | 13773. | -0.00286 | 0.00   | 1.57E+11  |      |
| -33.502       | 170.1481              | 0.00                |        |          |        |           |      |
| 1.0000        | 0.4657                | 166252.             | 13683. | -0.00285 | 0.00   | 1.57E+11  |      |
| -41.270       | 212.6851              | 0.00                |        |          |        |           |      |
| 1.2000        | 0.4589                | 198972.             | 13575. | -0.00285 | 0.00   | 1.57E+11  |      |
| -48.795       | 255.2221              | 0.00                |        |          |        |           |      |
| 1.4000        | 0.4520                | 231411.             | 13449. | -0.00285 | 0.00   | 1.57E+11  |      |

|          |          |         |        |          |      |          |
|----------|----------|---------|--------|----------|------|----------|
| -56.079  | 297.7592 | 0.00    |        |          |      |          |
| 1.6000   | 0.4452   | 263528. | 13306. | -0.00284 | 0.00 | 1.57E+11 |
| -63.122  | 340.2962 | 0.00    |        |          |      |          |
| 1.8000   | 0.4384   | 295280. | 13146. | -0.00284 | 0.00 | 1.57E+11 |
| -69.924  | 382.8332 | 0.00    |        |          |      |          |
| 2.0000   | 0.4315   | 326630. | 12971. | -0.00284 | 0.00 | 1.57E+11 |
| -76.487  | 425.3702 | 0.00    |        |          |      |          |
| 2.2000   | 0.4247   | 357540. | 12780. | -0.00283 | 0.00 | 1.57E+11 |
| -82.810  | 467.9072 | 0.00    |        |          |      |          |
| 2.4000   | 0.4180   | 387972. | 12573. | -0.00282 | 0.00 | 1.57E+11 |
| -88.895  | 510.4443 | 0.00    |        |          |      |          |
| 2.6000   | 0.4112   | 417893. | 12353. | -0.00282 | 0.00 | 1.57E+11 |
| -94.742  | 552.9813 | 0.00    |        |          |      |          |
| 2.8000   | 0.4044   | 447267. | 12119. | -0.00281 | 0.00 | 1.57E+11 |
| -100.354 | 595.5183 | 0.00    |        |          |      |          |
| 3.0000   | 0.3977   | 476064. | 11872. | -0.00280 | 0.00 | 1.57E+11 |
| -105.730 | 638.0553 | 0.00    |        |          |      |          |
| 3.2000   | 0.3910   | 504251. | 11612. | -0.00280 | 0.00 | 1.56E+11 |
| -110.873 | 680.5924 | 0.00    |        |          |      |          |
| 3.4000   | 0.3843   | 531800. | 11340. | -0.00279 | 0.00 | 1.56E+11 |
| -115.782 | 723.1294 | 0.00    |        |          |      |          |
| 3.6000   | 0.3776   | 558682. | 11056. | -0.00278 | 0.00 | 1.56E+11 |
| -120.461 | 765.6664 | 0.00    |        |          |      |          |
| 3.8000   | 0.3709   | 584871. | 10762. | -0.00277 | 0.00 | 1.56E+11 |
| -124.909 | 808.2034 | 0.00    |        |          |      |          |
| 4.0000   | 0.3643   | 610339. | 10457. | -0.00276 | 0.00 | 1.56E+11 |
| -129.129 | 850.7404 | 0.00    |        |          |      |          |
| 4.2000   | 0.3577   | 635064. | 10142. | -0.00275 | 0.00 | 1.56E+11 |
| -133.122 | 893.2775 | 0.00    |        |          |      |          |
| 4.4000   | 0.3511   | 659023. | 9818.  | -0.00274 | 0.00 | 1.56E+11 |
| -136.889 | 935.8145 | 0.00    |        |          |      |          |
| 4.6000   | 0.3445   | 682192. | 9486.  | -0.00273 | 0.00 | 1.56E+11 |
| -140.433 | 978.3515 | 0.00    |        |          |      |          |
| 4.8000   | 0.3379   | 704553. | 9144.  | -0.00272 | 0.00 | 1.56E+11 |
| -143.754 | 1021.    | 0.00    |        |          |      |          |
| 5.0000   | 0.3314   | 726086. | 8796.  | -0.00271 | 0.00 | 1.56E+11 |
| -146.854 | 1063.    | 0.00    |        |          |      |          |
| 5.2000   | 0.3249   | 746773. | 8440.  | -0.00270 | 0.00 | 1.56E+11 |
| -149.736 | 1106.    | 0.00    |        |          |      |          |
| 5.4000   | 0.3185   | 766597. | 8077.  | -0.00269 | 0.00 | 1.56E+11 |
| -152.401 | 1148.    | 0.00    |        |          |      |          |
| 5.6000   | 0.3120   | 785544. | 7709.  | -0.00268 | 0.00 | 1.56E+11 |
| -154.851 | 1191.    | 0.00    |        |          |      |          |
| 5.8000   | 0.3056   | 803598. | 7334.  | -0.00266 | 0.00 | 1.56E+11 |
| -157.088 | 1234.    | 0.00    |        |          |      |          |
| 6.0000   | 0.2992   | 820748. | 6955.  | -0.00265 | 0.00 | 1.56E+11 |
| -159.113 | 1276.    | 0.00    |        |          |      |          |
| 6.2000   | 0.2929   | 836982. | 6571.  | -0.00264 | 0.00 | 1.56E+11 |
| -160.929 | 1319.    | 0.00    |        |          |      |          |
| 6.4000   | 0.2866   | 852288. | 6183.  | -0.00263 | 0.00 | 1.55E+11 |

|          |        |         |          |          |      |          |
|----------|--------|---------|----------|----------|------|----------|
| -162.537 | 1361.  | 0.00    |          |          |      |          |
| 6.6000   | 0.2803 | 866658. | 5791.    | -0.00261 | 0.00 | 1.55E+11 |
| -163.940 | 1404.  | 0.00    |          |          |      |          |
| 6.8000   | 0.2740 | 880084. | 5396.    | -0.00260 | 0.00 | 1.55E+11 |
| -165.139 | 1446.  | 0.00    |          |          |      |          |
| 7.0000   | 0.2678 | 892559. | 4998.    | -0.00259 | 0.00 | 1.55E+11 |
| -166.137 | 1489.  | 0.00    |          |          |      |          |
| 7.2000   | 0.2616 | 904076. | 4599.    | -0.00257 | 0.00 | 1.55E+11 |
| -166.936 | 1531.  | 0.00    |          |          |      |          |
| 7.4000   | 0.2555 | 914633. | 4197.    | -0.00256 | 0.00 | 1.55E+11 |
| -167.537 | 1574.  | 0.00    |          |          |      |          |
| 7.6000   | 0.2494 | 924224. | 3795.    | -0.00254 | 0.00 | 1.55E+11 |
| -167.943 | 1616.  | 0.00    |          |          |      |          |
| 7.8000   | 0.2433 | 932848. | 3391.    | -0.00253 | 0.00 | 1.55E+11 |
| -168.155 | 1659.  | 0.00    |          |          |      |          |
| 8.0000   | 0.2372 | 940503. | 2988.    | -0.00251 | 0.00 | 1.55E+11 |
| -168.177 | 1701.  | 0.00    |          |          |      |          |
| 8.2000   | 0.2312 | 947189. | 2584.    | -0.00250 | 0.00 | 1.55E+11 |
| -168.009 | 1744.  | 0.00    |          |          |      |          |
| 8.4000   | 0.2252 | 952908. | 2182.    | -0.00248 | 0.00 | 1.55E+11 |
| -167.654 | 1787.  | 0.00    |          |          |      |          |
| 8.6000   | 0.2193 | 957661. | 1780.    | -0.00247 | 0.00 | 1.55E+11 |
| -167.114 | 1829.  | 0.00    |          |          |      |          |
| 8.8000   | 0.2134 | 961452. | 1380.    | -0.00246 | 0.00 | 1.55E+11 |
| -166.391 | 1872.  | 0.00    |          |          |      |          |
| 9.0000   | 0.2075 | 964284. | 981.4688 | -0.00244 | 0.00 | 1.55E+11 |
| -165.487 | 1914.  | 0.00    |          |          |      |          |
| 9.2000   | 0.2017 | 966163. | 585.5987 | -0.00243 | 0.00 | 1.55E+11 |
| -164.404 | 1957.  | 0.00    |          |          |      |          |
| 9.4000   | 0.1958 | 967095. | 192.5406 | -0.00241 | 0.00 | 1.55E+11 |
| -163.144 | 1999.  | 0.00    |          |          |      |          |
| 9.6000   | 0.1901 | 967087. | -197.283 | -0.00240 | 0.00 | 1.55E+11 |
| -161.709 | 2042.  | 0.00    |          |          |      |          |
| 9.8000   | 0.1843 | 966148. | -583.454 | -0.00238 | 0.00 | 1.55E+11 |
| -160.100 | 2084.  | 0.00    |          |          |      |          |
| 10.0000  | 0.1787 | 964286. | -965.558 | -0.00237 | 0.00 | 1.55E+11 |
| -158.320 | 2127.  | 0.00    |          |          |      |          |
| 10.2000  | 0.1730 | 961513. | -1343.   | -0.00235 | 0.00 | 1.55E+11 |
| -156.371 | 2169.  | 0.00    |          |          |      |          |
| 10.4000  | 0.1674 | 957839. | -1716.   | -0.00234 | 0.00 | 1.55E+11 |
| -154.253 | 2212.  | 0.00    |          |          |      |          |
| 10.6000  | 0.1618 | 953277. | -2083.   | -0.00232 | 0.00 | 1.55E+11 |
| -151.970 | 2254.  | 0.00    |          |          |      |          |
| 10.8000  | 0.1562 | 947839. | -2445.   | -0.00231 | 0.00 | 1.55E+11 |
| -149.523 | 2297.  | 0.00    |          |          |      |          |
| 11.0000  | 0.1507 | 941540. | -2801.   | -0.00229 | 0.00 | 1.55E+11 |
| -146.913 | 2340.  | 0.00    |          |          |      |          |
| 11.2000  | 0.1452 | 934394. | -3150.   | -0.00228 | 0.00 | 1.55E+11 |
| -144.142 | 2382.  | 0.00    |          |          |      |          |
| 11.4000  | 0.1398 | 926419. | -3493.   | -0.00226 | 0.00 | 1.55E+11 |



|          |         |         |         |          |      |          |
|----------|---------|---------|---------|----------|------|----------|
| -141.211 | 2425.   | 0.00    |         |          |      |          |
| 11.6000  | 0.1344  | 917630. | -3828.  | -0.00225 | 0.00 | 1.55E+11 |
| -138.123 | 2467.   | 0.00    |         |          |      |          |
| 11.8000  | 0.1290  | 908045. | -4155.  | -0.00223 | 0.00 | 1.55E+11 |
| -134.879 | 2510.   | 0.00    |         |          |      |          |
| 12.0000  | 0.1236  | 897684. | -4475.  | -0.00222 | 0.00 | 1.55E+11 |
| -131.479 | 2552.   | 0.00    |         |          |      |          |
| 12.2000  | 0.1183  | 886565. | -4786.  | -0.00221 | 0.00 | 1.55E+11 |
| -127.927 | 2595.   | 0.00    |         |          |      |          |
| 12.4000  | 0.1130  | 874710. | -5089.  | -0.00219 | 0.00 | 1.55E+11 |
| -124.221 | 2637.   | 0.00    |         |          |      |          |
| 12.6000  | 0.1078  | 862138. | -5382.  | -0.00218 | 0.00 | 1.55E+11 |
| -120.365 | 2680.   | 0.00    |         |          |      |          |
| 12.8000  | 0.1026  | 848874. | -5666.  | -0.00217 | 0.00 | 1.55E+11 |
| -116.360 | 2722.   | 0.00    |         |          |      |          |
| 13.0000  | 0.09740 | 834939. | -5941.  | -0.00215 | 0.00 | 1.56E+11 |
| -112.205 | 2765.   | 0.00    |         |          |      |          |
| 13.2000  | 0.09224 | 820358. | -6205.  | -0.00214 | 0.00 | 1.56E+11 |
| -107.903 | 2807.   | 0.00    |         |          |      |          |
| 13.4000  | 0.08712 | 805156. | -6459.  | -0.00213 | 0.00 | 1.56E+11 |
| -103.454 | 2850.   | 0.00    |         |          |      |          |
| 13.6000  | 0.08203 | 789358. | -6701.  | -0.00212 | 0.00 | 1.56E+11 |
| -98.860  | 2893.   | 0.00    |         |          |      |          |
| 13.8000  | 0.07696 | 772990. | -6933.  | -0.00210 | 0.00 | 1.56E+11 |
| -94.121  | 2935.   | 0.00    |         |          |      |          |
| 14.0000  | 0.07193 | 756080. | -7153.  | -0.00209 | 0.00 | 1.56E+11 |
| -89.237  | 2978.   | 0.00    |         |          |      |          |
| 14.2000  | 0.06692 | 738656. | -7361.  | -0.00208 | 0.00 | 1.56E+11 |
| -84.211  | 3020.   | 0.00    |         |          |      |          |
| 14.4000  | 0.06194 | 720747. | -7557.  | -0.00207 | 0.00 | 1.56E+11 |
| -79.042  | 3063.   | 0.00    |         |          |      |          |
| 14.6000  | 0.05699 | 702383. | -7740.  | -0.00206 | 0.00 | 1.56E+11 |
| -73.730  | 3105.   | 0.00    |         |          |      |          |
| 14.8000  | 0.05206 | 683594. | -7911.  | -0.00205 | 0.00 | 1.56E+11 |
| -68.277  | 3148.   | 0.00    |         |          |      |          |
| 15.0000  | 0.04716 | 664411. | -8521.  | -0.00204 | 0.00 | 1.56E+11 |
| -440.680 | 22428.  | 0.00    |         |          |      |          |
| 15.2000  | 0.04228 | 642691. | -9570.  | -0.00203 | 0.00 | 1.56E+11 |
| -433.418 | 24604.  | 0.00    |         |          |      |          |
| 15.4000  | 0.03742 | 618474. | -10600. | -0.00202 | 0.00 | 1.56E+11 |
| -424.872 | 27247.  | 0.00    |         |          |      |          |
| 15.6000  | 0.03259 | 591809. | -11608. | -0.00201 | 0.00 | 1.56E+11 |
| -414.761 | 30542.  | 0.00    |         |          |      |          |
| 15.8000  | 0.02778 | 562756. | -12589. | -0.00200 | 0.00 | 1.56E+11 |
| -402.682 | 34785.  | 0.00    |         |          |      |          |
| 16.0000  | 0.02299 | 531383. | -13538. | -0.00199 | 0.00 | 1.56E+11 |
| -388.038 | 40501.  | 0.00    |         |          |      |          |
| 16.2000  | 0.01822 | 497775. | -14447. | -0.00198 | 0.00 | 1.56E+11 |
| -369.861 | 48706.  | 0.00    |         |          |      |          |
| 16.4000  | 0.01347 | 462037. | -15307. | -0.00198 | 0.00 | 1.57E+11 |

|          |           |         |         |          |      |          |
|----------|-----------|---------|---------|----------|------|----------|
| -346.408 | 61702.    | 0.00    |         |          |      |          |
| 16.6000  | 0.00874   | 424303. | -16099. | -0.00197 | 0.00 | 1.57E+11 |
| -313.941 | 86206.    | 0.00    |         |          |      |          |
| 16.8000  | 0.00402   | 384762. | -16789. | -0.00196 | 0.00 | 1.57E+11 |
| -260.961 | 155724.   | 0.00    |         |          |      |          |
| 17.0000  | -6.82E-04 | 343717. | -16897. | -0.00196 | 0.00 | 1.57E+11 |
| 170.6578 | 600315.   | 0.00    |         |          |      |          |
| 17.2000  | -0.00537  | 303654. | -16348. | -0.00195 | 0.00 | 1.57E+11 |
| 286.7586 | 128069.   | 0.00    |         |          |      |          |
| 17.4000  | -0.01005  | 265244. | -15598. | -0.00195 | 0.00 | 1.57E+11 |
| 338.4736 | 80795.    | 0.00    |         |          |      |          |
| 17.6000  | -0.01472  | 228783. | -14741. | -0.00194 | 0.00 | 1.57E+11 |
| 375.8635 | 61262.    | 0.00    |         |          |      |          |
| 17.8000  | -0.01939  | 194488. | -13802. | -0.00194 | 0.00 | 1.57E+11 |
| 406.4179 | 50312.    | 0.00    |         |          |      |          |
| 18.0000  | -0.02404  | 162533. | -12795. | -0.00194 | 0.00 | 1.57E+11 |
| 432.9058 | 43214.    | 0.00    |         |          |      |          |
| 18.2000  | -0.02869  | 133072. | -11727. | -0.00194 | 0.00 | 1.57E+11 |
| 456.6826 | 38201.    | 0.00    |         |          |      |          |
| 18.4000  | -0.03334  | 106241. | -10605. | -0.00193 | 0.00 | 1.57E+11 |
| 478.5196 | 34451.    | 0.00    |         |          |      |          |
| 18.6000  | -0.03798  | 82167.  | -9432.  | -0.00193 | 0.00 | 1.57E+11 |
| 498.9004 | 31529.    | 0.00    |         |          |      |          |
| 18.8000  | -0.04261  | 60966.  | -8212.  | -0.00193 | 0.00 | 1.57E+11 |
| 518.1489 | 29182.    | 0.00    |         |          |      |          |
| 19.0000  | -0.04725  | 42749.  | -6946.  | -0.00193 | 0.00 | 1.57E+11 |
| 536.4935 | 27251.    | 0.00    |         |          |      |          |
| 19.2000  | -0.05188  | 27623.  | -5638.  | -0.00193 | 0.00 | 1.57E+11 |
| 554.1012 | 25632.    | 0.00    |         |          |      |          |
| 19.4000  | -0.05652  | 15689.  | -4287.  | -0.00193 | 0.00 | 1.57E+11 |
| 571.0977 | 24252.    | 0.00    |         |          |      |          |
| 19.6000  | -0.06115  | 7044.   | -2897.  | -0.00193 | 0.00 | 1.57E+11 |
| 587.5803 | 23062.    | 0.00    |         |          |      |          |
| 19.8000  | -0.06578  | 1784.   | -1468.  | -0.00193 | 0.00 | 1.57E+11 |
| 603.6256 | 22024.    | 0.00    |         |          |      |          |
| 20.0000  | -0.07041  | 0.00    | 0.00    | -0.00193 | 0.00 | 1.57E+11 |
| 619.2952 | 10554.    | 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 | = | -0.0028605 radians |

Maximum bending moment = 967095. inch-lbs  
 Maximum shear force = -16897. lbs  
 Depth of maximum bending moment = 9.40000000 feet below pile head  
 Depth of maximum shear force = 17.00000000 feet below pile head  
 Number of iterations = 17  
 Number of zero deflection points = 1

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

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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 = 0.0 lbs

| Depth<br>Res. | Soil<br>Spr. | Deflect.<br>Distrib. | Bending<br>Moment | Shear<br>Force | Slope<br>S | Total<br>Stress | Bending<br>Stiffness | Soil<br>p |
|---------------|--------------|----------------------|-------------------|----------------|------------|-----------------|----------------------|-----------|
| X             | Es*H         | y<br>Lat. Load       |                   |                |            |                 |                      |           |
| feet          |              | inches               | in-lbs            | lbs            | radians    | psi*            | lb-in^2              |           |
| lb/inch       |              | lb/inch              | lb/inch           |                |            |                 |                      |           |
| 0.00          |              | 0.5000               | -2376498.         | 28364.         | 0.00       | 0.00            | 3.11E+10             |           |
| 0.00          |              | 0.00                 | 0.00              |                |            |                 |                      |           |
| 0.2000        |              | 0.4998               | -2308449.         | 28343.         | -1.81E-04  | 0.00            | 3.11E+10             |           |
| -8.858        | 42.5370      |                      | 0.00              |                |            |                 |                      |           |
| 0.4000        |              | 0.4991               | -2240452.         | 28311.         | -3.56E-04  | 0.00            | 3.12E+10             |           |
| -17.693       | 85.0740      |                      | 0.00              |                |            |                 |                      |           |
| 0.6000        |              | 0.4981               | -2172556.         | 28258.         | -5.26E-04  | 0.00            | 3.12E+10             |           |
| -26.483       | 127.6111     |                      | 0.00              |                |            |                 |                      |           |
| 0.8000        |              | 0.4966               | -2104813.         | 28184.         | -6.91E-04  | 0.00            | 3.12E+10             |           |
| -35.207       | 170.1481     |                      | 0.00              |                |            |                 |                      |           |
| 1.0000        |              | 0.4948               | -2037272.         | 28089.         | -8.50E-04  | 0.00            | 3.12E+10             |           |
| -43.845       | 212.6851     |                      | 0.00              |                |            |                 |                      |           |
| 1.2000        |              | 0.4925               | -1969984.         | 27974.         | -0.00100   | 0.00            | 3.13E+10             |           |
| -52.377       | 255.2221     |                      | 0.00              |                |            |                 |                      |           |
| 1.4000        |              | 0.4899               | -1902998.         | 27838.         | -0.00115   | 0.00            | 3.13E+10             |           |
| -60.785       | 297.7592     |                      | 0.00              |                |            |                 |                      |           |
| 1.6000        |              | 0.4870               | -1836362.         | 27682.         | -0.00130   | 0.00            | 3.13E+10             |           |
| -69.051       | 340.2962     |                      | 0.00              |                |            |                 |                      |           |
| 1.8000        |              | 0.4837               | -1770124.         | 27507.         | -0.00143   | 0.00            | 3.13E+10             |           |
| -77.160       | 382.8332     |                      | 0.00              |                |            |                 |                      |           |
| 2.0000        |              | 0.4801               | -1704330.         | 27312.         | -0.00157   | 0.00            | 3.14E+10             |           |
| -85.095       | 425.3702     |                      | 0.00              |                |            |                 |                      |           |
| 2.2000        |              | 0.4762               | -1639026.         | 27098.         | -0.00169   | 0.00            | 3.14E+10             |           |

|          |          |           |        |          |      |          |
|----------|----------|-----------|--------|----------|------|----------|
| -92.840  | 467.9072 | 0.00      |        |          |      |          |
| 2.4000   | 0.4720   | -1574257. | 26867. | -0.00182 | 0.00 | 3.14E+10 |
| -100.384 | 510.4443 | 0.00      |        |          |      |          |
| 2.6000   | 0.4675   | -1510066. | 26617. | -0.00194 | 0.00 | 3.14E+10 |
| -107.711 | 552.9813 | 0.00      |        |          |      |          |
| 2.8000   | 0.4627   | -1446496. | 26350. | -0.00205 | 0.00 | 3.15E+10 |
| -114.809 | 595.5183 | 0.00      |        |          |      |          |
| 3.0000   | 0.4576   | -1383587. | 26066. | -0.00216 | 0.00 | 3.15E+10 |
| -121.668 | 638.0553 | 0.00      |        |          |      |          |
| 3.2000   | 0.4523   | -1321379. | 25766. | -0.00226 | 0.00 | 3.15E+10 |
| -128.276 | 680.5924 | 0.00      |        |          |      |          |
| 3.4000   | 0.4468   | -1259909. | 25451. | -0.00236 | 0.00 | 3.15E+10 |
| -134.624 | 723.1294 | 0.00      |        |          |      |          |
| 3.6000   | 0.4410   | -1199215. | 25120. | -0.00245 | 0.00 | 3.16E+10 |
| -140.702 | 765.6664 | 0.00      |        |          |      |          |
| 3.8000   | 0.4350   | -1139332. | 24776. | -0.00251 | 0.00 | 8.56E+10 |
| -146.501 | 808.2034 | 0.00      |        |          |      |          |
| 4.0000   | 0.4290   | -1080292. | 24417. | -0.00254 | 0.00 | 1.55E+11 |
| -152.061 | 850.7404 | 0.00      |        |          |      |          |
| 4.2000   | 0.4229   | -1022128. | 24046. | -0.00255 | 0.00 | 1.55E+11 |
| -157.391 | 893.2775 | 0.00      |        |          |      |          |
| 4.4000   | 0.4167   | -964871.  | 23662. | -0.00257 | 0.00 | 1.55E+11 |
| -162.489 | 935.8145 | 0.00      |        |          |      |          |
| 4.6000   | 0.4105   | -908550.  | 23266. | -0.00258 | 0.00 | 1.55E+11 |
| -167.355 | 978.3515 | 0.00      |        |          |      |          |
| 4.8000   | 0.4043   | -853192.  | 22859. | -0.00260 | 0.00 | 1.55E+11 |
| -171.988 | 1021.    | 0.00      |        |          |      |          |
| 5.0000   | 0.3981   | -798826.  | 22441. | -0.00261 | 0.00 | 1.56E+11 |
| -176.386 | 1063.    | 0.00      |        |          |      |          |
| 5.2000   | 0.3918   | -745475.  | 22013. | -0.00262 | 0.00 | 1.56E+11 |
| -180.549 | 1106.    | 0.00      |        |          |      |          |
| 5.4000   | 0.3855   | -693164.  | 21575. | -0.00263 | 0.00 | 1.56E+11 |
| -184.477 | 1148.    | 0.00      |        |          |      |          |
| 5.6000   | 0.3792   | -641916.  | 21128. | -0.00264 | 0.00 | 1.56E+11 |
| -188.168 | 1191.    | 0.00      |        |          |      |          |
| 5.8000   | 0.3728   | -591752.  | 20672. | -0.00265 | 0.00 | 1.56E+11 |
| -191.623 | 1234.    | 0.00      |        |          |      |          |
| 6.0000   | 0.3664   | -542691.  | 20208. | -0.00266 | 0.00 | 1.56E+11 |
| -194.841 | 1276.    | 0.00      |        |          |      |          |
| 6.2000   | 0.3600   | -494753.  | 19737. | -0.00267 | 0.00 | 1.57E+11 |
| -197.822 | 1319.    | 0.00      |        |          |      |          |
| 6.4000   | 0.3536   | -447954.  | 19259. | -0.00268 | 0.00 | 1.57E+11 |
| -200.566 | 1361.    | 0.00      |        |          |      |          |
| 6.6000   | 0.3472   | -402311.  | 18774. | -0.00268 | 0.00 | 1.57E+11 |
| -203.073 | 1404.    | 0.00      |        |          |      |          |
| 6.8000   | 0.3408   | -357837.  | 18284. | -0.00269 | 0.00 | 1.57E+11 |
| -205.344 | 1446.    | 0.00      |        |          |      |          |
| 7.0000   | 0.3343   | -314546.  | 17789. | -0.00269 | 0.00 | 1.57E+11 |
| -207.377 | 1489.    | 0.00      |        |          |      |          |
| 7.2000   | 0.3278   | -272449.  | 17289. | -0.00270 | 0.00 | 1.57E+11 |

|          |        |          |        |          |      |          |
|----------|--------|----------|--------|----------|------|----------|
| -209.175 | 1531.  | 0.00     |        |          |      |          |
| 7.4000   | 0.3214 | -231558. | 16785. | -0.00270 | 0.00 | 1.57E+11 |
| -210.737 | 1574.  | 0.00     |        |          |      |          |
| 7.6000   | 0.3149 | -191880. | 16278. | -0.00270 | 0.00 | 1.57E+11 |
| -212.063 | 1616.  | 0.00     |        |          |      |          |
| 7.8000   | 0.3084 | -153423. | 15768. | -0.00271 | 0.00 | 1.57E+11 |
| -213.154 | 1659.  | 0.00     |        |          |      |          |
| 8.0000   | 0.3019 | -116195. | 15255. | -0.00271 | 0.00 | 1.57E+11 |
| -214.011 | 1701.  | 0.00     |        |          |      |          |
| 8.2000   | 0.2954 | -80199.  | 14741. | -0.00271 | 0.00 | 1.57E+11 |
| -214.635 | 1744.  | 0.00     |        |          |      |          |
| 8.4000   | 0.2889 | -45439.  | 14225. | -0.00271 | 0.00 | 1.57E+11 |
| -215.026 | 1787.  | 0.00     |        |          |      |          |
| 8.6000   | 0.2823 | -11918.  | 13709. | -0.00271 | 0.00 | 1.57E+11 |
| -215.185 | 1829.  | 0.00     |        |          |      |          |
| 8.8000   | 0.2758 | 20363.   | 13193. | -0.00271 | 0.00 | 1.57E+11 |
| -215.113 | 1872.  | 0.00     |        |          |      |          |
| 9.0000   | 0.2693 | 51406.   | 12677. | -0.00271 | 0.00 | 1.57E+11 |
| -214.811 | 1914.  | 0.00     |        |          |      |          |
| 9.2000   | 0.2628 | 81211.   | 12162. | -0.00271 | 0.00 | 1.57E+11 |
| -214.279 | 1957.  | 0.00     |        |          |      |          |
| 9.4000   | 0.2563 | 109782.  | 11648. | -0.00271 | 0.00 | 1.57E+11 |
| -213.520 | 1999.  | 0.00     |        |          |      |          |
| 9.6000   | 0.2498 | 137123.  | 11137. | -0.00271 | 0.00 | 1.57E+11 |
| -212.533 | 2042.  | 0.00     |        |          |      |          |
| 9.8000   | 0.2433 | 163240.  | 10628. | -0.00270 | 0.00 | 1.57E+11 |
| -211.320 | 2084.  | 0.00     |        |          |      |          |
| 10.0000  | 0.2368 | 188140.  | 10123. | -0.00270 | 0.00 | 1.57E+11 |
| -209.883 | 2127.  | 0.00     |        |          |      |          |
| 10.2000  | 0.2304 | 211831.  | 9621.  | -0.00270 | 0.00 | 1.57E+11 |
| -208.221 | 2169.  | 0.00     |        |          |      |          |
| 10.4000  | 0.2239 | 234322.  | 9124.  | -0.00270 | 0.00 | 1.57E+11 |
| -206.337 | 2212.  | 0.00     |        |          |      |          |
| 10.6000  | 0.2174 | 255625.  | 8631.  | -0.00269 | 0.00 | 1.57E+11 |
| -204.232 | 2254.  | 0.00     |        |          |      |          |
| 10.8000  | 0.2110 | 275752.  | 8144.  | -0.00269 | 0.00 | 1.57E+11 |
| -201.906 | 2297.  | 0.00     |        |          |      |          |
| 11.0000  | 0.2045 | 294715.  | 7662.  | -0.00268 | 0.00 | 1.57E+11 |
| -199.361 | 2340.  | 0.00     |        |          |      |          |
| 11.2000  | 0.1981 | 312531.  | 7187.  | -0.00268 | 0.00 | 1.57E+11 |
| -196.599 | 2382.  | 0.00     |        |          |      |          |
| 11.4000  | 0.1917 | 329213.  | 6719.  | -0.00267 | 0.00 | 1.57E+11 |
| -193.620 | 2425.  | 0.00     |        |          |      |          |
| 11.6000  | 0.1852 | 344781.  | 6258.  | -0.00267 | 0.00 | 1.57E+11 |
| -190.425 | 2467.  | 0.00     |        |          |      |          |
| 11.8000  | 0.1788 | 359252.  | 5805.  | -0.00266 | 0.00 | 1.57E+11 |
| -187.017 | 2510.  | 0.00     |        |          |      |          |
| 12.0000  | 0.1725 | 372645.  | 5361.  | -0.00266 | 0.00 | 1.57E+11 |
| -183.396 | 2552.  | 0.00     |        |          |      |          |
| 12.2000  | 0.1661 | 384983.  | 4925.  | -0.00265 | 0.00 | 1.57E+11 |



|          |         |         |          |          |      |          |
|----------|---------|---------|----------|----------|------|----------|
| -179.563 | 2595.   | 0.00    |          |          |      |          |
| 12.4000  | 0.1597  | 396285. | 4499.    | -0.00265 | 0.00 | 1.57E+11 |
| -175.520 | 2637.   | 0.00    |          |          |      |          |
| 12.6000  | 0.1534  | 406577. | 4083.    | -0.00264 | 0.00 | 1.57E+11 |
| -171.268 | 2680.   | 0.00    |          |          |      |          |
| 12.8000  | 0.1471  | 415883. | 3677.    | -0.00263 | 0.00 | 1.57E+11 |
| -166.808 | 2722.   | 0.00    |          |          |      |          |
| 13.0000  | 0.1407  | 424227. | 3282.    | -0.00263 | 0.00 | 1.57E+11 |
| -162.141 | 2765.   | 0.00    |          |          |      |          |
| 13.2000  | 0.1344  | 431638. | 2899.    | -0.00262 | 0.00 | 1.57E+11 |
| -157.268 | 2807.   | 0.00    |          |          |      |          |
| 13.4000  | 0.1282  | 438143. | 2528.    | -0.00261 | 0.00 | 1.57E+11 |
| -152.191 | 2850.   | 0.00    |          |          |      |          |
| 13.6000  | 0.1219  | 443771. | 2169.    | -0.00261 | 0.00 | 1.57E+11 |
| -146.911 | 2893.   | 0.00    |          |          |      |          |
| 13.8000  | 0.1156  | 448553. | 1823.    | -0.00260 | 0.00 | 1.57E+11 |
| -141.429 | 2935.   | 0.00    |          |          |      |          |
| 14.0000  | 0.1094  | 452520. | 1490.    | -0.00259 | 0.00 | 1.57E+11 |
| -135.746 | 2978.   | 0.00    |          |          |      |          |
| 14.2000  | 0.1032  | 455706. | 1171.    | -0.00259 | 0.00 | 1.57E+11 |
| -129.863 | 3020.   | 0.00    |          |          |      |          |
| 14.4000  | 0.09700 | 458143. | 867.0559 | -0.00258 | 0.00 | 1.57E+11 |
| -123.780 | 3063.   | 0.00    |          |          |      |          |
| 14.6000  | 0.09082 | 459868. | 577.5196 | -0.00257 | 0.00 | 1.57E+11 |
| -117.500 | 3105.   | 0.00    |          |          |      |          |
| 14.8000  | 0.08465 | 460915. | 303.2922 | -0.00257 | 0.00 | 1.57E+11 |
| -111.023 | 3148.   | 0.00    |          |          |      |          |
| 15.0000  | 0.07850 | 461323. | -430.672 | -0.00256 | 0.00 | 1.57E+11 |
| -500.614 | 15305.  | 0.00    |          |          |      |          |
| 15.2000  | 0.07237 | 458848. | -1626.   | -0.00255 | 0.00 | 1.57E+11 |
| -495.813 | 16443.  | 0.00    |          |          |      |          |
| 15.4000  | 0.06625 | 453517. | -2810.   | -0.00254 | 0.00 | 1.57E+11 |
| -490.155 | 17756.  | 0.00    |          |          |      |          |
| 15.6000  | 0.06016 | 445362. | -3978.   | -0.00254 | 0.00 | 1.57E+11 |
| -483.510 | 19290.  | 0.00    |          |          |      |          |
| 15.8000  | 0.05407 | 434423. | -5129.   | -0.00253 | 0.00 | 1.57E+11 |
| -475.714 | 21114.  | 0.00    |          |          |      |          |
| 16.0000  | 0.04801 | 420743. | -6260.   | -0.00252 | 0.00 | 1.57E+11 |
| -466.550 | 23324.  | 0.00    |          |          |      |          |
| 16.2000  | 0.04196 | 404376. | -7366.   | -0.00252 | 0.00 | 1.57E+11 |
| -455.723 | 26068.  | 0.00    |          |          |      |          |
| 16.4000  | 0.03592 | 385384. | -8445.   | -0.00251 | 0.00 | 1.57E+11 |
| -442.818 | 29586.  | 0.00    |          |          |      |          |
| 16.6000  | 0.02990 | 363841. | -9489.   | -0.00251 | 0.00 | 1.57E+11 |
| -427.221 | 34292.  | 0.00    |          |          |      |          |
| 16.8000  | 0.02389 | 339838. | -10491.  | -0.00250 | 0.00 | 1.57E+11 |
| -407.950 | 40980.  | 0.00    |          |          |      |          |
| 17.0000  | 0.01790 | 313485. | -11440.  | -0.00250 | 0.00 | 1.57E+11 |
| -383.272 | 51400.  | 0.00    |          |          |      |          |
| 17.2000  | 0.01191 | 284924. | -12320.  | -0.00249 | 0.00 | 1.57E+11 |

|          |           |         |         |          |      |          |
|----------|-----------|---------|---------|----------|------|----------|
| -349.587 | 70435.    | 0.00    |         |          |      |          |
| 17.4000  | 0.00594   | 254349. | -13095. | -0.00249 | 0.00 | 1.57E+11 |
| -296.626 | 119886.   | 0.00    |         |          |      |          |
| 17.6000  | -2.62E-05 | 222066. | -13442. | -0.00248 | 0.00 | 1.57E+11 |
| 7.3760   | 675233.   | 0.00    |         |          |      |          |
| 17.8000  | -0.00598  | 189826. | -13070. | -0.00248 | 0.00 | 1.57E+11 |
| 302.7564 | 121457.   | 0.00    |         |          |      |          |
| 18.0000  | -0.01193  | 159329. | -12271. | -0.00248 | 0.00 | 1.57E+11 |
| 363.2235 | 73060.    | 0.00    |         |          |      |          |
| 18.2000  | -0.01788  | 130925. | -11348. | -0.00248 | 0.00 | 1.57E+11 |
| 405.6190 | 54460.    | 0.00    |         |          |      |          |
| 18.4000  | -0.02381  | 104857. | -10334. | -0.00247 | 0.00 | 1.57E+11 |
| 439.8226 | 44326.    | 0.00    |         |          |      |          |
| 18.6000  | -0.02975  | 81322.  | -9243.  | -0.00247 | 0.00 | 1.57E+11 |
| 469.2604 | 37858.    | 0.00    |         |          |      |          |
| 18.8000  | -0.03568  | 60490.  | -8085.  | -0.00247 | 0.00 | 1.57E+11 |
| 495.5596 | 33333.    | 0.00    |         |          |      |          |
| 19.0000  | -0.04161  | 42513.  | -6867.  | -0.00247 | 0.00 | 1.57E+11 |
| 519.6305 | 29971.    | 0.00    |         |          |      |          |
| 19.2000  | -0.04754  | 27528.  | -5593.  | -0.00247 | 0.00 | 1.57E+11 |
| 542.0367 | 27365.    | 0.00    |         |          |      |          |
| 19.4000  | -0.05347  | 15666.  | -4267.  | -0.00247 | 0.00 | 1.57E+11 |
| 563.1527 | 25279.    | 0.00    |         |          |      |          |
| 19.6000  | -0.05939  | 7048.   | -2891.  | -0.00247 | 0.00 | 1.57E+11 |
| 583.2406 | 23568.    | 0.00    |         |          |      |          |
| 19.8000  | -0.06532  | 1789.   | -1468.  | -0.00247 | 0.00 | 1.57E+11 |
| 602.4912 | 22137.    | 0.00    |         |          |      |          |
| 20.0000  | -0.07124  | 0.00    | 0.00    | -0.00247 | 0.00 | 1.57E+11 |
| 621.0476 | 10461.    | 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             | = | 0.50000000 inches             |
| Computed slope at pile head      | = | 0.000000 radians              |
| Maximum bending moment           | = | -2376498. inch-lbs            |
| Maximum shear force              | = | 28364. 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             | = | 32                            |
| 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<br>Shear<br>Case<br>Pile<br>No. | Load<br>Max<br>Type<br>in<br>1 | Load<br>Moment<br>Pile-head<br>Load 1<br>in-lbs | Load<br>Type<br>2 | Load<br>Pile-head<br>Load 2 | Axial<br>Loading<br>lbs | Pile-head<br>Deflection<br>inches | Pile-head<br>Rotation<br>radians | Max<br>in |
|--------------------------------------|--------------------------------|---|-------------------|-----------------------------|-------------------------|-----------------------------------|----------------------------------|-----------|
| 1                                    | y, in                          | 0.5000  | M, in-lb          | 0.00                        | 0.00                    | 0.5000                            | -0.00286                         |           |
| -16897.                              |                                | 967095.   |                   |                             |                         |                                   |                                  |           |
| 2                                    | y, in                          | 0.5000  | S, rad            | 0.00                        | 0.00                    | 0.5000                            | 0.00                             |           |
| 28364.                               |                                | -2376498.                                       |                   |                             |                         |                                   |                                  |           |

Maximum pile-head deflection = 0.5000000000 inches  
Maximum pile-head rotation = -0.0028605206 radians = -0.163896 deg.

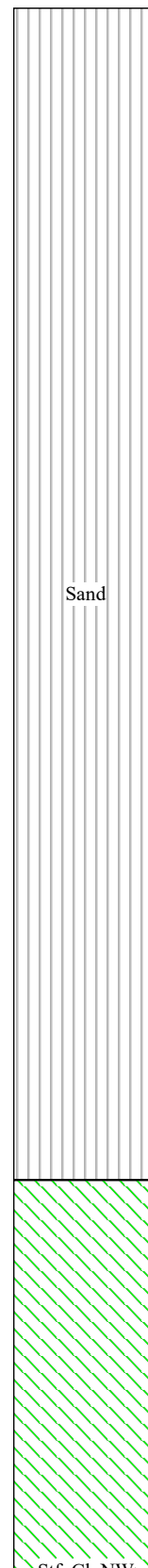
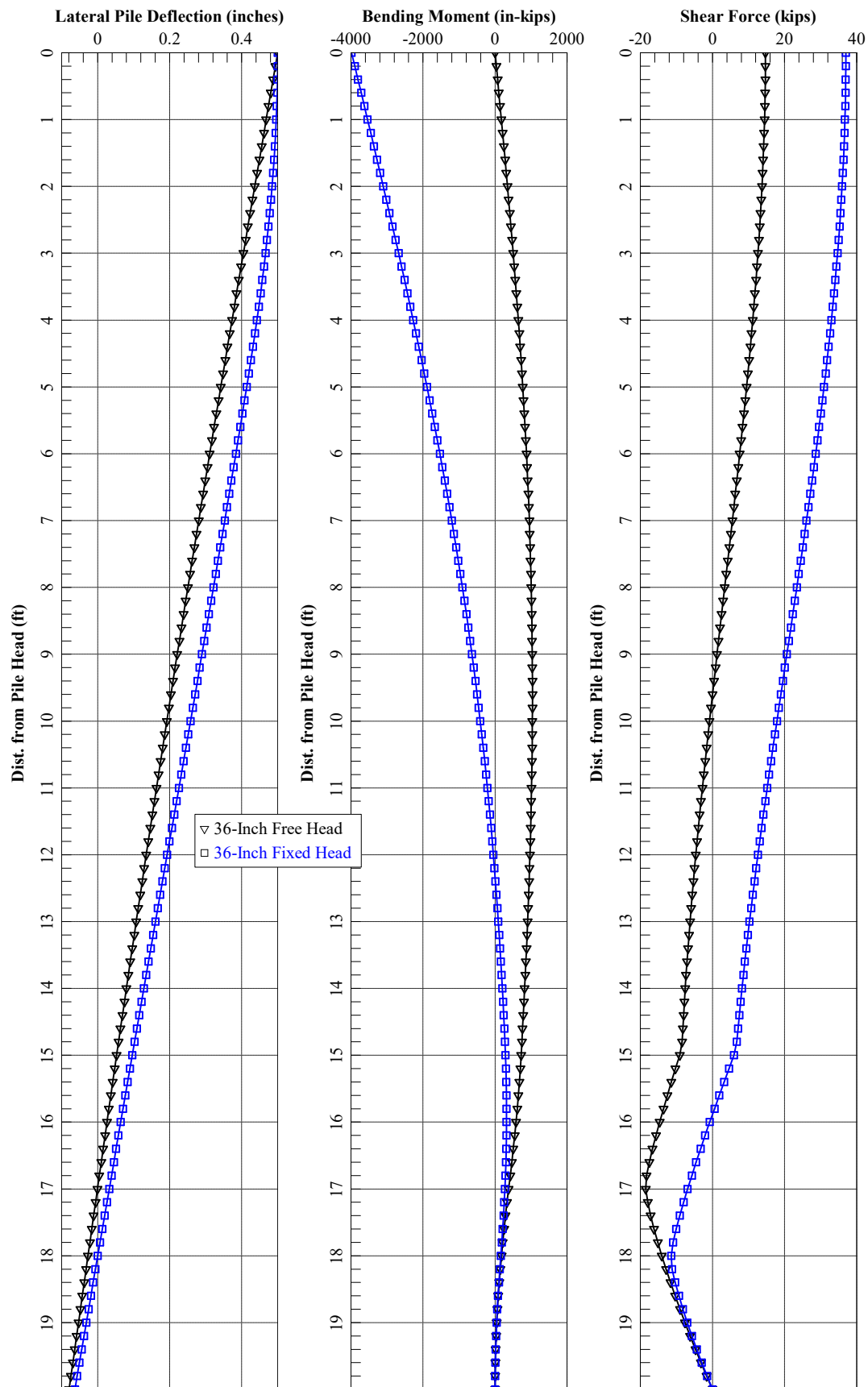
-----  
Summary of Warning Messages  
-----

The following warning was reported 2474 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.



=====

LPILE for Windows, Version 2022-12.006

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

-----

Path to file locations:

\Users\357611\Box\GED\PROJECTS\2023\23-156 Ardmore Recreation Center\Analysis\

Name of input data file:

36-inch Free and Fixed LPILE (USCS units).lp12d

Name of output report file:

36-inch Free and Fixed LPILE (USCS units).lp12o

Name of plot output file:

36-inch Free and Fixed LPILE (USCS units).lp12p

Name of runtime message file:

36-inch Free and Fixed LPILE (USCS units).lp12r

-----

Date and Time of Analysis



-----  
Date: October 4, 2023

Time: 14:43:14

-----  
Problem Title  
-----

Project Name: ARDMORE RECREATION CENTER

Job Number: 23-156

Client: Arch

-----  
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

- Use of p-y modification factors for p-y curves not selected
- 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<br>No. | Depth Below<br>Pile Head<br>feet | Pile<br>Diameter<br>inches |
|--------------|----------------------------------|----------------------------|
| 1            | 0.000                            | 36.0000                    |
| 2            | 20.000                           | 36.0000                    |

#### 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 = 36.000000 in

---

### 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 | = | 15.000000 ft   |
| Effective unit weight at top of layer        | = | 98.000000 pcf  |
| Effective unit weight at bottom of layer     | = | 98.000000 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 stiff clay without free water

|  |   |                |
|--|---|----------------|
| Distance from top of pile to top of layer    | = | 15.000000 ft   |
| Distance from top of pile to bottom of layer | = | 25.000000 ft   |
| Effective unit weight at top of layer        | = | 130.000000 pcf |
| Effective unit weight at bottom of layer     | = | 130.000000 pcf |
| Undrained cohesion at top of layer           | = | 1500. psf      |
| Undrained cohesion at bottom of layer        | = | 1500. psf      |
| Epsilon-50 at top of layer                   | = | 0.0000         |
| Epsilon-50 at bottom of layer                | = | 0.0000         |

NOTE: Default values for Epsilon-50 will be computed for this layer.

(Depth of the lowest soil layer extends 5.000 ft below the pile tip)

---

### Summary of Input Soil Properties

---

| Layer<br>E50<br>Num.<br>or<br>krm | Soil Type<br>Name<br>(p-y Curve Type)<br>kpy<br>pci | Layer<br>Depth<br>ft | Effective<br>Unit Wt.<br>pcf | Cohesion<br>psf | Angle of<br>Friction<br>deg. |
|-----------------------------------|---|----------------------|------------------------------|-----------------|------------------------------|
|-----------------------------------|---|----------------------|------------------------------|-----------------|------------------------------|

|         |                 |         |          |       |         |
|---------|-----------------|---------|----------|-------|---------|
| 1       | Sand            | 0.00    | 98.0000  | --    | 20.0000 |
| --      | default         |         |          |       |         |
| --      | (Reese, et al.) | 15.0000 | 98.0000  | --    | 20.0000 |
| --      | default         |         |          |       |         |
| 2       | Stiff Clay      | 15.0000 | 130.0000 | 1500. | --      |
| default | --              |         |          |       |         |
|         | w/o Free Water  | 25.0000 | 130.0000 | 1500. | --      |
| default | --              |         |          |       |         |

#### 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<br>Compute<br>No. | Load<br>Top y<br>Type | Condition<br>Run Analysis<br>1 | Condition<br>2    | Axial Thrust<br>Force, lbs |
|------------------------|-----------------------|--------------------------------|-------------------|----------------------------|
| 1                      | 4                     | y = 0.500000 in                | M = 0.0000 in-lbs | 0.0000000                  |
|                        | N.A.                  | Yes                            |                   |                            |
| 2                      | 5                     | y = 0.500000 in                | S = 0.0000 in/in  | 0.0000000                  |
|                        | 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                                     | = | 36.000000 in      |
| Concrete Cover Thickness (to edge of long. rebar)  | = | 3.000000 in       |
| Number of Reinforcing Bars                         | = | 13 bars           |
| Yield Stress of Reinforcing Bars                   | = | 60000. psi        |
| Modulus of Elasticity of Reinforcing Bars          | = | 29000000. psi     |
| Gross Area of Shaft                                | = | 1018. sq. in.     |
| Total Area of Reinforcing Steel                    | = | 10.270000 sq. in. |
| Area Ratio of Steel Reinforcement                  | = | 1.01 percent      |
| Edge-to-Edge Bar Spacing                           | = | 5.940154 in       |
| Maximum Concrete Aggregate Size                    | = | 0.750000 in       |
| Ratio of Bar Spacing to Aggregate Size             | = | 7.92              |
| Offset of Center of Rebar Cage from Center of Pile | = | 0.0000 in         |

Axial Structural Capacities:  
-----

|   |   |               |
|---|---|---------------|
| Nom. Axial Structural Capacity = $0.85 F_c A_c + F_y A_s$ | = | 3185.595 kips |
| Tensile Load for Cracking of Concrete                     | = | -399.311 kips |
| Nominal Axial Tensile Capacity                            | = | -616.200 kips |

Reinforcing Bar Dimensions and Positions Used in Computations:

| Bar<br>Number | Bar Diam.<br>inches | Bar Area<br>sq. in. | X<br>inches | Y<br>inches |
|---------------|---------------------|---------------------|-------------|-------------|
| -----         | -----               | -----               | -----       | -----       |
| 1             | 1.000000            | 0.790000            | 14.500000   | 0.00000     |
| 2             | 1.000000            | 0.790000            | 12.839112   | 6.738486    |
| 3             | 1.000000            | 0.790000            | 8.236939    | 11.933266   |
| 4             | 1.000000            | 0.790000            | 1.747782    | 14.394279   |
| 5             | 1.000000            | 0.790000            | -5.14177    | 13.557736   |
| 6             | 1.000000            | 0.790000            | -10.85341   | 9.615279    |
| 7             | 1.000000            | 0.790000            | -14.07866   | 3.470077    |
| 8             | 1.000000            | 0.790000            | -14.07866   | -3.47008    |
| 9             | 1.000000            | 0.790000            | -10.85341   | -9.61528    |
| 10            | 1.000000            | 0.790000            | -5.14177    | -13.55774   |
| 11            | 1.000000            | 0.790000            | 1.747782    | -14.39428   |



|    |          |          |           |           |
|----|----------|----------|-----------|-----------|
| 12 | 1.000000 | 0.790000 | 8.236939  | -11.93327 |
| 13 | 1.000000 | 0.790000 | 12.839112 | -6.73849  |

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

Minimum spacing between any two bars not equal to zero = 5.940 inches  
between bars 10 and 11.

Ratio of bar spacing to maximum aggregate size = 7.92

#### Concrete Properties:

-----

|  |   |                |
|--|---|----------------|
| Compressive Strength of Concrete       | = | 3000. psi      |
| Modulus of Elasticity of Concrete      | = | 3122019. psi   |
| Modulus of Rupture of Concrete         | = | -410.79192 psi |
| Compression Strain at Peak Stress      | = | 0.001634       |
| Tensile Strain at Fracture of Concrete | = | -0.0001160     |
| Maximum Coarse Aggregate Size          | = | 0.750000 in    |

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

| Number | Axial Thrust Force<br>kips |
|--------|----------------------------|
| -----  | -----                      |
| 1      | 0.000                      |

#### 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 318-14, Section 21.2.3.

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 = 0.000 kips

| Bending<br>Max Conc<br>Curvature<br>Stress<br>rad/in.<br>ksi | Bending<br>Max Steel<br>Moment<br>Stress<br>in-kip<br>ksi | Bending<br>Run<br>Stiffness<br>Msg<br>kip-in2 | Depth to<br>N Axis<br>in | Max Comp<br>Strain<br>in/in | Max Tens<br>Strain<br>in/in |
|--|---|---|--------------------------|-----------------------------|-----------------------------|
| -----  | -----   | ---   | -----                    | -----                       | -----                       |
| 6.25000E-07  | 205.9460352   | 329513656.                                    | 18.0000978               | 0.00001125                  | -0.00001125                 |
| 0.0407684  | 0.2707893   |   |                          |                             |                             |
| 0.00000125   | 411.0184369   | 328814750.                                    | 18.0000981               | 0.00002250                  | -0.00002250                 |
| 0.0812579  | 0.5415786   |   |                          |                             |                             |
| 0.00000188   | 615.2172050   | 328115843.                                    | 18.0000984               | 0.00003375                  | -0.00003375                 |
| 0.1214685  | 0.8123679   |   |                          |                             |                             |
| 0.00000250   | 818.5423395   | 327416936.                                    | 18.0000988               | 0.00004500                  | -0.00004500                 |
| 0.1614001  | 1.0831572   |   |                          |                             |                             |
| 0.00000313   | 1021.   | 326718029.                                    | 18.0000991               | 0.00005625                  | -0.00005625                 |
| 0.2010529  | 1.3539465   |   |                          |                             |                             |
| 0.00000375   | 1223.   | 326019122.                                    | 18.0000994               | 0.00006750                  | -0.00006750                 |
| 0.2404268  | 1.6247358   |   |                          |                             |                             |
| 0.00000438   | 1423.   | 325320215.                                    | 18.0000997               | 0.00007875                  | -0.00007875                 |
| 0.2795217  | 1.8955252   |   |                          |                             |                             |
| 0.00000500   | 1623.   | 324621308.                                    | 18.0001001               | 0.00009000                  | -0.00009000                 |
| 0.3183378  | 2.1663145   |   |                          |                             |                             |
| 0.00000563   | 1822.   | 323922402.                                    | 18.0001004               | 0.0001013                   | -0.000101                   |
| 0.3568749  | 2.4371039   |   |                          |                             |                             |
| 0.00000625   | 2020.   | 323223495.                                    | 18.0001007               | 0.0001125                   | -0.000112                   |
| 0.3951331  | 2.7078933   |   |                          |                             |                             |
| 0.00000688   | 2020.   | 293839541.                                    | 9.0505016                | 0.00006222                  | -0.000185                   |
| 0.2198134  | -4.762969 C   |   |                          |                             |                             |
| 0.00000750   | 2020.   | 269352912.                                    | 9.0531983                | 0.00006790                  | -0.000202                   |
| 0.2394531  | -5.195379 C   |   |                          |                             |                             |
| 0.00000813   | 2020.   | 248633457.                                    | 9.0559006                | 0.00007358                  | -0.000219                   |
| 0.2590351  | -5.627691 C   |   |                          |                             |                             |
| 0.00000875   | 2020.   | 230873925.                                    | 9.0586085                | 0.00007926                  | -0.000236                   |
| 0.2785594  | -6.059903 C   |   |                          |                             |                             |
| 0.00000938   | 2020.   | 215482330.                                    | 9.0613220                | 0.00008495                  | -0.000253                   |
| 0.2980259  | -6.492016 C   |   |                          |                             |                             |
| 0.00001000   | 2020.   | 202014684.                                    | 9.0640411                | 0.00009064                  | -0.000269                   |
| 0.3174345  | -6.924028 C   |   |                          |                             |                             |
| 0.00001063   | 2020.   | 190131467.                                    | 9.0667659                | 0.00009633                  | -0.000286                   |
| 0.3367851  | -7.355940 C   |   |                          |                             |                             |
| 0.00001125   | 2020.   | 179568608.                                    | 9.0694964                | 0.0001020                   | -0.000303                   |
| 0.3560777  | -7.787752 C   |   |                          |                             |                             |
| 0.00001188   | 2020.   | 170117629.                                    | 9.0722326                | 0.0001077                   | -0.000320                   |
| 0.3753120  | -8.219462 C   |   |                          |                             |                             |
| 0.00001250   | 2020.   | 161611747.                                    | 9.0749746                | 0.0001134                   | -0.000337                   |
| 0.3944881  | -8.651072 C   |   |                          |                             |                             |
| 0.00001313   | 2020.   | 153915950.                                    | 9.0777223                | 0.0001191                   | -0.000353                   |
| 0.4136059  | -9.082579 C   |   |                          |                             |                             |

|            |              |            |           |           |           |
|------------|--------------|------------|-----------|-----------|-----------|
| 0.00001375 | 2020.        | 146919770. | 9.0804758 | 0.0001249 | -0.000370 |
| 0.4326651  | -9.513985 C  |            |           |           |           |
| 0.00001438 | 2020.        | 140531954. | 9.0832351 | 0.0001306 | -0.000387 |
| 0.4516659  | -9.945289 C  |            |           |           |           |
| 0.00001500 | 2020.        | 134676456. | 9.0860002 | 0.0001363 | -0.000404 |
| 0.4706080  | -10.376490 C |            |           |           |           |
| 0.00001563 | 2020.        | 129289398. | 9.0887712 | 0.0001420 | -0.000420 |
| 0.4894913  | -10.807588 C |            |           |           |           |
| 0.00001625 | 2020.        | 124316729. | 9.0915481 | 0.0001477 | -0.000437 |
| 0.5083158  | -11.238583 C |            |           |           |           |
| 0.00001688 | 2020.        | 119712405. | 9.0943308 | 0.0001535 | -0.000454 |
| 0.5270814  | -11.669474 C |            |           |           |           |
| 0.00001750 | 2020.        | 115436962. | 9.0971196 | 0.0001592 | -0.000471 |
| 0.5457879  | -12.100262 C |            |           |           |           |
| 0.00001813 | 2020.        | 111456377. | 9.0999143 | 0.0001649 | -0.000488 |
| 0.5644354  | -12.530945 C |            |           |           |           |
| 0.00001875 | 2020.        | 107741165. | 9.1027149 | 0.0001707 | -0.000504 |
| 0.5830235  | -12.961524 C |            |           |           |           |
| 0.00001938 | 2020.        | 104265643. | 9.1055216 | 0.0001764 | -0.000521 |
| 0.6015524  | -13.391997 C |            |           |           |           |
| 0.00002000 | 2020.        | 101007342. | 9.1083344 | 0.0001822 | -0.000538 |
| 0.6200219  | -13.822366 C |            |           |           |           |
| 0.00002063 | 2020.        | 97946514.  | 9.1111532 | 0.0001879 | -0.000555 |
| 0.6384318  | -14.252629 C |            |           |           |           |
| 0.00002125 | 2020.        | 95065734.  | 9.1139781 | 0.0001937 | -0.000571 |
| 0.6567821  | -14.682786 C |            |           |           |           |
| 0.00002188 | 2020.        | 92349570.  | 9.1168091 | 0.0001994 | -0.000588 |
| 0.6750726  | -15.112837 C |            |           |           |           |
| 0.00002250 | 2020.        | 89784304.  | 9.1196462 | 0.0002052 | -0.000605 |
| 0.6933034  | -15.542781 C |            |           |           |           |
| 0.00002313 | 2020.        | 87357701.  | 9.1224896 | 0.0002110 | -0.000622 |
| 0.7114742  | -15.972618 C |            |           |           |           |
| 0.00002375 | 2020.        | 85058814.  | 9.1253391 | 0.0002167 | -0.000638 |
| 0.7295850  | -16.402348 C |            |           |           |           |
| 0.00002438 | 2020.        | 82877819.  | 9.1281949 | 0.0002225 | -0.000655 |
| 0.7476357  | -16.831970 C |            |           |           |           |
| 0.00002563 | 2020.        | 78834999.  | 9.1339252 | 0.0002341 | -0.000688 |
| 0.7835563  | -17.690889 C |            |           |           |           |
| 0.00002688 | 2020.        | 75168255.  | 9.1396808 | 0.0002456 | -0.000722 |
| 0.8192351  | -18.549374 C |            |           |           |           |
| 0.00002813 | 2020.        | 71827443.  | 9.1454618 | 0.0002572 | -0.000755 |
| 0.8546713  | -19.407420 C |            |           |           |           |
| 0.00002938 | 2020.        | 68770956.  | 9.1512686 | 0.0002688 | -0.000789 |
| 0.8898641  | -20.265025 C |            |           |           |           |
| 0.00003063 | 2098.        | 68504464.  | 9.1571013 | 0.0002804 | -0.000822 |
| 0.9248126  | -21.122187 C |            |           |           |           |
| 0.00003188 | 2182.        | 68468748.  | 9.1629602 | 0.0002921 | -0.000855 |
| 0.9595160  | -21.978901 C |            |           |           |           |
| 0.00003313 | 2267.        | 68432893.  | 9.1688455 | 0.0003037 | -0.000889 |
| 0.9939734  | -22.835165 C |            |           |           |           |

|            |              |           |           |           |           |
|------------|--------------|-----------|-----------|-----------|-----------|
| 0.00003438 | 2351.        | 68396899. | 9.1747574 | 0.0003154 | -0.000922 |
| 1.0281839  | -23.690976 C |           |           |           |           |
| 0.00003563 | 2435.        | 68360768. | 9.1806673 | 0.0003271 | -0.000955 |
| 1.0621436  | -24.546360 C |           |           |           |           |
| 0.00003688 | 2519.        | 68324535. | 9.1863846 | 0.0003387 | -0.000989 |
| 1.0958307  | -25.401522 C |           |           |           |           |
| 0.00003813 | 2603.        | 68288164. | 9.1921271 | 0.0003504 | -0.001022 |
| 1.1292667  | -26.256242 C |           |           |           |           |
| 0.00003938 | 2687.        | 68251655. | 9.1978950 | 0.0003622 | -0.001055 |
| 1.1624507  | -27.110516 C |           |           |           |           |
| 0.00004063 | 2771.        | 68215007. | 9.2036885 | 0.0003739 | -0.001089 |
| 1.1953818  | -27.964342 C |           |           |           |           |
| 0.00004188 | 2855.        | 68178218. | 9.2095079 | 0.0003856 | -0.001122 |
| 1.2280591  | -28.817716 C |           |           |           |           |
| 0.00004313 | 2939.        | 68141288. | 9.2153534 | 0.0003974 | -0.001155 |
| 1.2604817  | -29.670636 C |           |           |           |           |
| 0.00004438 | 3022.        | 68104215. | 9.2212252 | 0.0004092 | -0.001188 |
| 1.2926486  | -30.523098 C |           |           |           |           |
| 0.00004563 | 3106.        | 68066997. | 9.2271237 | 0.0004210 | -0.001222 |
| 1.3245589  | -31.375099 C |           |           |           |           |
| 0.00004688 | 3189.        | 68029634. | 9.2330489 | 0.0004328 | -0.001255 |
| 1.3562118  | -32.226636 C |           |           |           |           |
| 0.00004813 | 3272.        | 67992125. | 9.2390013 | 0.0004446 | -0.001288 |
| 1.3876061  | -33.077706 C |           |           |           |           |
| 0.00004938 | 3355.        | 67954467. | 9.2449810 | 0.0004565 | -0.001321 |
| 1.4187411  | -33.928305 C |           |           |           |           |
| 0.00005063 | 3438.        | 67916661. | 9.2509884 | 0.0004683 | -0.001354 |
| 1.4496157  | -34.778430 C |           |           |           |           |
| 0.00005188 | 3521.        | 67878703. | 9.2570236 | 0.0004802 | -0.001387 |
| 1.4802289  | -35.628077 C |           |           |           |           |
| 0.00005313 | 3604.        | 67840594. | 9.2630869 | 0.0004921 | -0.001420 |
| 1.5105798  | -36.477244 C |           |           |           |           |
| 0.00005438 | 3687.        | 67802332. | 9.2691787 | 0.0005040 | -0.001453 |
| 1.5406674  | -37.325926 C |           |           |           |           |
| 0.00005563 | 3769.        | 67763915. | 9.2752991 | 0.0005159 | -0.001487 |
| 1.5704906  | -38.174120 C |           |           |           |           |
| 0.00005688 | 3852.        | 67725342. | 9.2814486 | 0.0005279 | -0.001520 |
| 1.6000484  | -39.021823 C |           |           |           |           |
| 0.00005813 | 3934.        | 67686612. | 9.2876272 | 0.0005398 | -0.001553 |
| 1.6293398  | -39.869031 C |           |           |           |           |
| 0.00005938 | 4017.        | 67647723. | 9.2938354 | 0.0005518 | -0.001586 |
| 1.6583639  | -40.715739 C |           |           |           |           |
| 0.00006063 | 4099.        | 67608673. | 9.3000734 | 0.0005638 | -0.001619 |
| 1.6871194  | -41.561946 C |           |           |           |           |
| 0.00006188 | 4181.        | 67569462. | 9.3063416 | 0.0005758 | -0.001652 |
| 1.7156054  | -42.407646 C |           |           |           |           |
| 0.00006313 | 4263.        | 67530088. | 9.3126401 | 0.0005879 | -0.001685 |
| 1.7438207  | -43.252836 C |           |           |           |           |
| 0.00006438 | 4345.        | 67490549. | 9.3189694 | 0.0005999 | -0.001718 |
| 1.7717643  | -44.097511 C |           |           |           |           |

|            |               |           |           |           |           |
|------------|---------------|-----------|-----------|-----------|-----------|
| 0.00006563 | 4426.         | 67450844. | 9.3253297 | 0.0006120 | -0.001751 |
| 1.7994352  | -44.941669 C  |           |           |           |           |
| 0.00006688 | 4508.         | 67410971. | 9.3317214 | 0.0006241 | -0.001783 |
| 1.8268321  | -45.785305 C  |           |           |           |           |
| 0.00006813 | 4590.         | 67370928. | 9.3381447 | 0.0006362 | -0.001816 |
| 1.8539539  | -46.628415 C  |           |           |           |           |
| 0.00006938 | 4671.         | 67330714. | 9.3446000 | 0.0006483 | -0.001849 |
| 1.8807996  | -47.470995 C  |           |           |           |           |
| 0.00007063 | 4752.         | 67290328. | 9.3510877 | 0.0006604 | -0.001882 |
| 1.9073680  | -48.313041 C  |           |           |           |           |
| 0.00007188 | 4834.         | 67249768. | 9.3576079 | 0.0006726 | -0.001915 |
| 1.9336578  | -49.154548 C  |           |           |           |           |
| 0.00007313 | 4915.         | 67209031. | 9.3641612 | 0.0006848 | -0.001948 |
| 1.9596680  | -49.995513 C  |           |           |           |           |
| 0.00007438 | 4996.         | 67168117. | 9.3707478 | 0.0006969 | -0.001981 |
| 1.9853973  | -50.835931 C  |           |           |           |           |
| 0.00007938 | 5318.         | 67002649. | 9.3974348 | 0.0007459 | -0.002112 |
| 2.0854818  | -54.192042 C  |           |           |           |           |
| 0.00008438 | 5639.         | 66834194. | 9.4246841 | 0.0007952 | -0.002242 |
| 2.1809737  | -57.539038 C  |           |           |           |           |
| 0.00008938 | 5957.         | 66647944. | 9.4518066 | 0.0008448 | -0.002373 |
| 2.2716741  | -60.000000 CY |           |           |           |           |
| 0.00009438 | 6214.         | 65847014. | 9.4485349 | 0.0008917 | -0.002506 |
| 2.3526295  | -60.000000 CY |           |           |           |           |
| 0.00009938 | 6414.         | 64545880. | 9.4186198 | 0.0009360 | -0.002642 |
| 2.4245130  | -60.000000 CY |           |           |           |           |
| 0.0001044  | 6576.         | 62999144. | 9.3733629 | 0.0009783 | -0.002779 |
| 2.4892913  | -60.000000 CY |           |           |           |           |
| 0.0001094  | 6720.         | 61440648. | 9.3257511 | 0.0010200 | -0.002917 |
| 2.5491924  | -60.000000 CY |           |           |           |           |
| 0.0001144  | 6849.         | 59886248. | 9.2760204 | 0.0010609 | -0.003057 |
| 2.6044004  | -60.000000 CY |           |           |           |           |
| 0.0001194  | 6951.         | 58224302. | 9.2167217 | 0.0011002 | -0.003197 |
| 2.6539614  | -60.000000 CY |           |           |           |           |
| 0.0001244  | 7049.         | 56675072. | 9.1616450 | 0.0011395 | -0.003338 |
| 2.7001279  | -60.000000 CY |           |           |           |           |
| 0.0001294  | 7146.         | 55236735. | 9.1101727 | 0.0011786 | -0.003479 |
| 2.7428996  | -60.000000 CY |           |           |           |           |
| 0.0001344  | 7227.         | 53782281. | 9.0540835 | 0.0012166 | -0.003621 |
| 2.7812576  | -60.000000 CY |           |           |           |           |
| 0.0001394  | 7291.         | 52312562. | 8.9933840 | 0.0012535 | -0.003764 |
| 2.8154237  | -60.000000 CY |           |           |           |           |
| 0.0001444  | 7353.         | 50930888. | 8.9371221 | 0.0012903 | -0.003907 |
| 2.8467182  | -60.000000 CY |           |           |           |           |
| 0.0001494  | 7415.         | 49638148. | 8.8857221 | 0.0013273 | -0.004050 |
| 2.8752304  | -60.000000 CY |           |           |           |           |
| 0.0001544  | 7476.         | 48425628. | 8.8387338 | 0.0013645 | -0.004193 |
| 2.9009227  | -60.000000 CY |           |           |           |           |
| 0.0001594  | 7536.         | 47283549. | 8.7940906 | 0.0014016 | -0.004336 |
| 2.9236000  | -60.000000 CY |           |           |           |           |



|           |               |           |           |           |           |
|-----------|---------------|-----------|-----------|-----------|-----------|
| 0.0001644 | 7585.         | 46145397. | 8.7450913 | 0.0014375 | -0.004480 |
| 2.9427460 | -60.000000 CY |           |           |           |           |
| 0.0001694 | 7624.         | 45012141. | 8.6929306 | 0.0014724 | -0.004625 |
| 2.9586944 | -60.000000 CY |           |           |           |           |
| 0.0001744 | 7659.         | 43923550. | 8.6424691 | 0.0015070 | -0.004770 |
| 2.9719650 | -60.000000 CY |           |           |           |           |
| 0.0001794 | 7694.         | 42893388. | 8.5956808 | 0.0015419 | -0.004916 |
| 2.9827151 | -60.000000 CY |           |           |           |           |
| 0.0001844 | 7728.         | 41916867. | 8.5522840 | 0.0015768 | -0.005061 |
| 2.9909103 | -60.000000 CY |           |           |           |           |
| 0.0001894 | 7762.         | 40989680. | 8.5120272 | 0.0016120 | -0.005206 |
| 2.9965145 | -60.000000 CY |           |           |           |           |
| 0.0001944 | 7796.         | 40107977. | 8.4746857 | 0.0016473 | -0.005350 |
| 2.9994910 | -60.000000 CY |           |           |           |           |
| 0.0001994 | 7829.         | 39267010. | 8.4386073 | 0.0016824 | -0.005495 |
| 2.9972994 | -60.000000 CY |           |           |           |           |
| 0.0002044 | 7861.         | 38463890. | 8.4040998 | 0.0017176 | -0.005640 |
| 2.9992204 | -60.000000 CY |           |           |           |           |
| 0.0002094 | 7892.         | 37691063. | 8.3710630 | 0.0017527 | -0.005785 |
| 2.9987391 | -60.000000 CY |           |           |           |           |
| 0.0002144 | 7917.         | 36931805. | 8.3368892 | 0.0017872 | -0.005930 |
| 2.9982658 | -60.000000 CY |           |           |           |           |
| 0.0002194 | 7939.         | 36189276. | 8.3019746 | 0.0018212 | -0.006076 |
| 2.9998931 | -60.000000 CY |           |           |           |           |
| 0.0002244 | 7957.         | 35461270. | 8.2662609 | 0.0018547 | -0.006223 |
| 2.9960023 | -60.000000 CY |           |           |           |           |
| 0.0002294 | 7973.         | 34759431. | 8.2318904 | 0.0018882 | -0.006369 |
| 2.9986711 | -60.000000 CY |           |           |           |           |
| 0.0002344 | 7989.         | 34086003. | 8.1994216 | 0.0019217 | -0.006516 |
| 2.9999428 | -60.000000 CY |           |           |           |           |
| 0.0002394 | 8005.         | 33439312. | 8.1690069 | 0.0019555 | -0.006662 |
| 2.9957865 | -60.000000 CY |           |           |           |           |
| 0.0002444 | 8020.         | 32818109. | 8.1403718 | 0.0019893 | -0.006808 |
| 2.9981884 | -60.000000 CY |           |           |           |           |
| 0.0002494 | 8035.         | 32221006. | 8.1133553 | 0.0020233 | -0.006954 |
| 2.9997708 | -60.000000 CY |           |           |           |           |
| 0.0002544 | 8050.         | 31645675. | 8.0868711 | 0.0020571 | -0.007100 |
| 2.9976213 | -60.000000 CY |           |           |           |           |
| 0.0002594 | 8064.         | 31090901. | 8.0607990 | 0.0020908 | -0.007247 |
| 2.9964301 | -60.000000 CY |           |           |           |           |
| 0.0002644 | 8078.         | 30556518. | 8.0361172 | 0.0021245 | -0.007393 |
| 2.9988146 | -60.000000 CY |           |           |           |           |
| 0.0002694 | 8092.         | 30041379. | 8.0127558 | 0.0021584 | -0.007539 |
| 2.9999191 | -60.000000 CY |           |           |           |           |
| 0.0002744 | 8106.         | 29544111. | 7.9908058 | 0.0021925 | -0.007685 |
| 2.9967480 | -60.000000 CY |           |           |           |           |
| 0.0003044 | 8182.         | 26881919. | 7.8785928 | 0.0023980 | -0.008559 |
| 2.9963057 | -60.000000 CY |           |           |           |           |
| 0.0003344 | 8226.         | 24600645. | 7.7689319 | 0.0025977 | -0.009440 |
| 2.9960853 | -60.000000 CY |           |           |           |           |

|           |                |           |           |           |           |
|-----------|----------------|-----------|-----------|-----------|-----------|
| 0.0003644 | 8255.          | 22655755. | 7.6660136 | 0.0027933 | -0.010324 |
| 2.9916044 | -60.000000 CY  |           |           |           |           |
| 0.0003944 | 8282.          | 21001300. | 7.5811480 | 0.0029898 | -0.011208 |
| 2.9984433 | -60.000000 CY  |           |           |           |           |
| 0.0004244 | 8308.          | 19577257. | 7.5130334 | 0.0031883 | -0.012089 |
| 2.9972617 | -60.000000 CYT |           |           |           |           |
| 0.0004544 | 8333.          | 18338871. | 7.4575471 | 0.0033885 | -0.012969 |
| 2.9922259 | -60.000000 CYT |           |           |           |           |
| 0.0004844 | 8356.          | 17251064. | 7.4122866 | 0.0035903 | -0.013847 |
| 2.9973507 | 60.0000000 CYT |           |           |           |           |
| 0.0005144 | 8375.          | 16281574. | 7.3702298 | 0.0037911 | -0.014726 |
| 2.9941859 | 60.0000000 CYT |           |           |           |           |
| 0.0005444 | 8375.          | 15384312. | 7.3637693 | 0.0040087 | -0.015589 |
| 2.9937445 | 60.0000000 CYT |           |           |           |           |

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Summary of Results for Nominal Moment Capacity for Section 1  
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Moment values interpolated at maximum compressive strain = 0.003  
or maximum developed moment if pile fails at smaller strains.

| Load<br>Tens.<br>No.<br>Strain | Axial Thrust<br>kips | Nominal Mom. Cap.<br>in-kip | Max. Comp.<br>Strain | Max. |
|--------------------------------|----------------------|-----------------------------|----------------------|------|
| ----                           | -----                | -----                       | -----                |      |
| 1<br>-0.01125291               | 0.000                | 8283.707                    | 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 (0.75).

The above values should be multiplied by the appropriate strength reduction  
factor to compute ultimate moment capacity according to ACI 318,  
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<br>Stiff.<br>Load<br>Ult Mom | Resist.<br>Factor | Nominal<br>Ax. Thrust | Nominal<br>Moment Cap | Ult. (Fac)<br>Ax. Thrust | Ult. (Fac)<br>Moment Cap | Bend.<br>at |
|------------------------------------|-------------------|-----------------------|-----------------------|--------------------------|--------------------------|-------------|
|------------------------------------|-------------------|-----------------------|-----------------------|--------------------------|--------------------------|-------------|

| No.<br>kip-in <sup>2</sup> |      | kips   | in-kips | kips   | in-kips |
|----------------------------|------|--------|---------|--------|---------|
| 1<br>66967953.             | 0.65 | 0.0000 | 8284.   | 0.0000 | 5384.   |
| 1<br>65851777.             | 0.75 | 0.0000 | 8284.   | 0.0000 | 6213.   |
| 1<br>48830483.             | 0.90 | 0.0000 | 8284.   | 0.0000 | 7455.   |

Layering Correction Equivalent Depths of Soil & Rock Layers

| Layer<br>No. | Top of<br>Layer<br>Below<br>Pile Head<br>ft | Equivalent<br>Top Depth<br>Below<br>Grnd Surf<br>ft | Same Layer<br>Type As<br>Layer<br>Above | Layer is<br>Rock or<br>is Below<br>Rock Layer | F0<br>Integral<br>for Layer<br>lbs | F1<br>Integral<br>for Layer<br>lbs |
|--------------|---|---|---|---|------------------------------------|------------------------------------|
| 1            | 0.00  | 0.00  | N.A.                                    | No  | 0.00                               | 141000.                            |
| 2            | 15.0000                                     | 7.9813  | No                                      | No  | 141000.                            | 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 Moment (Loading Type 4)

Displacement of pile head = 0.500000 inches  
 Moment at pile head = 0.0 in-lbs  
 Axial load at pile head = 0.0 lbs

|               |                       |                     |                |            |                 |                      |           |
|---------------|-----------------------|---------------------|----------------|------------|-----------------|----------------------|-----------|
| Depth<br>Res. | Deflect.<br>Soil Spr. | Bending<br>Distrib. | Shear<br>Force | Slope<br>S | Total<br>Stress | Bending<br>Stiffness | Soil<br>p |
| X             | y                     | Moment              |                |            |                 |                      |           |

| Es*H<br>feet<br>lb/inch | Lat.<br>inches<br>lb/inch | Load<br>in-lbs<br>lb/inch | lbs    | radians  | psi*  | lb-in^2  |
|-------------------------|---------------------------|---------------------------|--------|----------|-------|----------|
| -----                   | -----                     | -----                     | -----  | -----    | ----- | -----    |
| 0.00                    | 0.5000                    | 0.00                      | 14705. | -0.00266 | 0.00  | 3.30E+11 |
| 0.00                    | 0.00                      | 0.00                      |        |          |       |          |
| 0.2000                  | 0.4936                    | 35293.                    | 14695. | -0.00266 | 0.00  | 3.30E+11 |
| -8.749                  | 42.5370                   | 0.00                      |        |          |       |          |
| 0.4000                  | 0.4872                    | 70536.                    | 14664. | -0.00266 | 0.00  | 3.30E+11 |
| -17.271                 | 85.0740                   | 0.00                      |        |          |       |          |
| 0.6000                  | 0.4809                    | 105679.                   | 14612. | -0.00266 | 0.00  | 3.30E+11 |
| -25.568                 | 127.6111                  | 0.00                      |        |          |       |          |
| 0.8000                  | 0.4745                    | 140675.                   | 14541. | -0.00266 | 0.00  | 3.30E+11 |
| -33.638                 | 170.1481                  | 0.00                      |        |          |       |          |
| 1.0000                  | 0.4681                    | 175477.                   | 14451. | -0.00266 | 0.00  | 3.30E+11 |
| -41.482                 | 212.6851                  | 0.00                      |        |          |       |          |
| 1.2000                  | 0.4617                    | 210040.                   | 14342. | -0.00266 | 0.00  | 3.29E+11 |
| -49.101                 | 255.2221                  | 0.00                      |        |          |       |          |
| 1.4000                  | 0.4554                    | 244320.                   | 14216. | -0.00265 | 0.00  | 3.29E+11 |
| -56.494                 | 297.7592                  | 0.00                      |        |          |       |          |
| 1.6000                  | 0.4490                    | 278275.                   | 14072. | -0.00265 | 0.00  | 3.29E+11 |
| -63.662                 | 340.2962                  | 0.00                      |        |          |       |          |
| 1.8000                  | 0.4426                    | 311864.                   | 13910. | -0.00265 | 0.00  | 3.29E+11 |
| -70.605                 | 382.8332                  | 0.00                      |        |          |       |          |
| 2.0000                  | 0.4363                    | 345045.                   | 13733. | -0.00265 | 0.00  | 3.29E+11 |
| -77.323                 | 425.3702                  | 0.00                      |        |          |       |          |
| 2.2000                  | 0.4299                    | 377781.                   | 13540. | -0.00264 | 0.00  | 3.29E+11 |
| -83.818                 | 467.9072                  | 0.00                      |        |          |       |          |
| 2.4000                  | 0.4236                    | 410035.                   | 13331. | -0.00264 | 0.00  | 3.29E+11 |
| -90.089                 | 510.4443                  | 0.00                      |        |          |       |          |
| 2.6000                  | 0.4172                    | 441769.                   | 13107. | -0.00264 | 0.00  | 3.29E+11 |
| -96.136                 | 552.9813                  | 0.00                      |        |          |       |          |
| 2.8000                  | 0.4109                    | 472950.                   | 12870. | -0.00263 | 0.00  | 3.29E+11 |
| -101.961                | 595.5183                  | 0.00                      |        |          |       |          |
| 3.0000                  | 0.4046                    | 503543.                   | 12618. | -0.00263 | 0.00  | 3.28E+11 |
| -107.564                | 638.0553                  | 0.00                      |        |          |       |          |
| 3.2000                  | 0.3983                    | 533517.                   | 12354. | -0.00263 | 0.00  | 3.28E+11 |
| -112.945                | 680.5924                  | 0.00                      |        |          |       |          |
| 3.4000                  | 0.3920                    | 562841.                   | 12076. | -0.00262 | 0.00  | 3.28E+11 |
| -118.106                | 723.1294                  | 0.00                      |        |          |       |          |
| 3.6000                  | 0.3857                    | 591484.                   | 11787. | -0.00262 | 0.00  | 3.28E+11 |
| -123.046                | 765.6664                  | 0.00                      |        |          |       |          |
| 3.8000                  | 0.3794                    | 619418.                   | 11486. | -0.00261 | 0.00  | 3.28E+11 |
| -127.766                | 808.2034                  | 0.00                      |        |          |       |          |
| 4.0000                  | 0.3731                    | 646616.                   | 11174. | -0.00261 | 0.00  | 3.28E+11 |
| -132.268                | 850.7404                  | 0.00                      |        |          |       |          |
| 4.2000                  | 0.3669                    | 673053.                   | 10851. | -0.00261 | 0.00  | 3.28E+11 |
| -136.552                | 893.2775                  | 0.00                      |        |          |       |          |
| 4.4000                  | 0.3606                    | 698703.                   | 10519. | -0.00260 | 0.00  | 3.28E+11 |

|          |          |          |          |          |      |          |
|----------|----------|----------|----------|----------|------|----------|
| -140.619 | 935.8145 | 0.00     |          |          |      |          |
| 4.6000   | 0.3544   | 723543.  | 10177.   | -0.00260 | 0.00 | 3.28E+11 |
| -144.469 | 978.3515 | 0.00     |          |          |      |          |
| 4.8000   | 0.3482   | 747551.  | 9826.    | -0.00259 | 0.00 | 3.28E+11 |
| -148.103 | 1021.    | 0.00     |          |          |      |          |
| 5.0000   | 0.3420   | 770705.  | 9466.    | -0.00258 | 0.00 | 3.28E+11 |
| -151.523 | 1063.    | 0.00     |          |          |      |          |
| 5.2000   | 0.3358   | 792987.  | 9098.    | -0.00258 | 0.00 | 3.27E+11 |
| -154.729 | 1106.    | 0.00     |          |          |      |          |
| 5.4000   | 0.3296   | 814378.  | 8724.    | -0.00257 | 0.00 | 3.27E+11 |
| -157.722 | 1148.    | 0.00     |          |          |      |          |
| 5.6000   | 0.3234   | 834860.  | 8342.    | -0.00257 | 0.00 | 3.27E+11 |
| -160.503 | 1191.    | 0.00     |          |          |      |          |
| 5.8000   | 0.3173   | 854418.  | 7953.    | -0.00256 | 0.00 | 3.27E+11 |
| -163.073 | 1234.    | 0.00     |          |          |      |          |
| 6.0000   | 0.3111   | 873037.  | 7559.    | -0.00255 | 0.00 | 3.27E+11 |
| -165.433 | 1276.    | 0.00     |          |          |      |          |
| 6.2000   | 0.3050   | 890702.  | 7160.    | -0.00255 | 0.00 | 3.27E+11 |
| -167.583 | 1319.    | 0.00     |          |          |      |          |
| 6.4000   | 0.2989   | 907403.  | 6755.    | -0.00254 | 0.00 | 3.27E+11 |
| -169.526 | 1361.    | 0.00     |          |          |      |          |
| 6.6000   | 0.2928   | 923126.  | 6346.    | -0.00253 | 0.00 | 3.27E+11 |
| -171.261 | 1404.    | 0.00     |          |          |      |          |
| 6.8000   | 0.2867   | 937864.  | 5933.    | -0.00253 | 0.00 | 3.27E+11 |
| -172.791 | 1446.    | 0.00     |          |          |      |          |
| 7.0000   | 0.2807   | 951606.  | 5517.    | -0.00252 | 0.00 | 3.27E+11 |
| -174.115 | 1489.    | 0.00     |          |          |      |          |
| 7.2000   | 0.2746   | 964345.  | 5098.    | -0.00251 | 0.00 | 3.27E+11 |
| -175.235 | 1531.    | 0.00     |          |          |      |          |
| 7.4000   | 0.2686   | 976075.  | 4676.    | -0.00251 | 0.00 | 3.27E+11 |
| -176.152 | 1574.    | 0.00     |          |          |      |          |
| 7.6000   | 0.2626   | 986790.  | 4252.    | -0.00250 | 0.00 | 3.27E+11 |
| -176.868 | 1616.    | 0.00     |          |          |      |          |
| 7.8000   | 0.2566   | 996487.  | 3827.    | -0.00249 | 0.00 | 3.27E+11 |
| -177.382 | 1659.    | 0.00     |          |          |      |          |
| 8.0000   | 0.2506   | 1005161. | 3401.    | -0.00248 | 0.00 | 3.27E+11 |
| -177.697 | 1701.    | 0.00     |          |          |      |          |
| 8.2000   | 0.2447   | 1012813. | 2975.    | -0.00248 | 0.00 | 3.27E+11 |
| -177.813 | 1744.    | 0.00     |          |          |      |          |
| 8.4000   | 0.2388   | 1019440. | 2548.    | -0.00247 | 0.00 | 3.27E+11 |
| -177.731 | 1787.    | 0.00     |          |          |      |          |
| 8.6000   | 0.2328   | 1025043. | 2122.    | -0.00246 | 0.00 | 3.27E+11 |
| -177.452 | 1829.    | 0.00     |          |          |      |          |
| 8.8000   | 0.2269   | 1029624. | 1696.    | -0.00245 | 0.00 | 3.27E+11 |
| -176.977 | 1872.    | 0.00     |          |          |      |          |
| 9.0000   | 0.2211   | 1033186. | 1272.    | -0.00245 | 0.00 | 3.27E+11 |
| -176.308 | 1914.    | 0.00     |          |          |      |          |
| 9.2000   | 0.2152   | 1035732. | 850.3898 | -0.00244 | 0.00 | 3.27E+11 |
| -175.445 | 1957.    | 0.00     |          |          |      |          |
| 9.4000   | 0.2093   | 1037268. | 430.5872 | -0.00243 | 0.00 | 3.27E+11 |



|          |         |          |          |          |      |          |
|----------|---------|----------|----------|----------|------|----------|
| -174.390 | 1999.   | 0.00     |          |          |      |          |
| 9.6000   | 0.2035  | 1037799. | 13.5475  | -0.00242 | 0.00 | 3.27E+11 |
| -173.143 | 2042.   | 0.00     |          |          |      |          |
| 9.8000   | 0.1977  | 1037333. | -400.270 | -0.00242 | 0.00 | 3.27E+11 |
| -171.705 | 2084.   | 0.00     |          |          |      |          |
| 10.0000  | 0.1919  | 1035877. | -810.410 | -0.00241 | 0.00 | 3.27E+11 |
| -170.078 | 2127.   | 0.00     |          |          |      |          |
| 10.2000  | 0.1861  | 1033443. | -1216.   | -0.00240 | 0.00 | 3.27E+11 |
| -168.262 | 2169.   | 0.00     |          |          |      |          |
| 10.4000  | 0.1804  | 1030039. | -1618.   | -0.00239 | 0.00 | 3.27E+11 |
| -166.258 | 2212.   | 0.00     |          |          |      |          |
| 10.6000  | 0.1747  | 1025677. | -2014.   | -0.00239 | 0.00 | 3.27E+11 |
| -164.067 | 2254.   | 0.00     |          |          |      |          |
| 10.8000  | 0.1689  | 1020370. | -2405.   | -0.00238 | 0.00 | 3.27E+11 |
| -161.690 | 2297.   | 0.00     |          |          |      |          |
| 11.0000  | 0.1632  | 1014132. | -2790.   | -0.00237 | 0.00 | 3.27E+11 |
| -159.128 | 2340.   | 0.00     |          |          |      |          |
| 11.2000  | 0.1576  | 1006978. | -3169.   | -0.00236 | 0.00 | 3.27E+11 |
| -156.381 | 2382.   | 0.00     |          |          |      |          |
| 11.4000  | 0.1519  | 998922.  | -3541.   | -0.00236 | 0.00 | 3.27E+11 |
| -153.452 | 2425.   | 0.00     |          |          |      |          |
| 11.6000  | 0.1462  | 989983.  | -3905.   | -0.00235 | 0.00 | 3.27E+11 |
| -150.339 | 2467.   | 0.00     |          |          |      |          |
| 11.8000  | 0.1406  | 980178.  | -4262.   | -0.00234 | 0.00 | 3.27E+11 |
| -147.045 | 2510.   | 0.00     |          |          |      |          |
| 12.0000  | 0.1350  | 969526.  | -4611.   | -0.00233 | 0.00 | 3.27E+11 |
| -143.569 | 2552.   | 0.00     |          |          |      |          |
| 12.2000  | 0.1294  | 958047.  | -4951.   | -0.00233 | 0.00 | 3.27E+11 |
| -139.913 | 2595.   | 0.00     |          |          |      |          |
| 12.4000  | 0.1238  | 945762.  | -5282.   | -0.00232 | 0.00 | 3.27E+11 |
| -136.077 | 2637.   | 0.00     |          |          |      |          |
| 12.6000  | 0.1183  | 932693.  | -5604.   | -0.00231 | 0.00 | 3.27E+11 |
| -132.062 | 2680.   | 0.00     |          |          |      |          |
| 12.8000  | 0.1127  | 918864.  | -5916.   | -0.00231 | 0.00 | 3.27E+11 |
| -127.868 | 2722.   | 0.00     |          |          |      |          |
| 13.0000  | 0.1072  | 904298.  | -6217.   | -0.00230 | 0.00 | 3.27E+11 |
| -123.497 | 2765.   | 0.00     |          |          |      |          |
| 13.2000  | 0.1017  | 889020.  | -6508.   | -0.00229 | 0.00 | 3.27E+11 |
| -118.948 | 2807.   | 0.00     |          |          |      |          |
| 13.4000  | 0.09619 | 873058.  | -6788.   | -0.00229 | 0.00 | 3.27E+11 |
| -114.223 | 2850.   | 0.00     |          |          |      |          |
| 13.6000  | 0.09071 | 856437.  | -7056.   | -0.00228 | 0.00 | 3.27E+11 |
| -109.321 | 2893.   | 0.00     |          |          |      |          |
| 13.8000  | 0.08524 | 839187.  | -7313.   | -0.00227 | 0.00 | 3.27E+11 |
| -104.243 | 2935.   | 0.00     |          |          |      |          |
| 14.0000  | 0.07979 | 821337.  | -7557.   | -0.00227 | 0.00 | 3.27E+11 |
| -98.990  | 2978.   | 0.00     |          |          |      |          |
| 14.2000  | 0.07435 | 802916.  | -7788.   | -0.00226 | 0.00 | 3.27E+11 |
| -93.561  | 3020.   | 0.00     |          |          |      |          |
| 14.4000  | 0.06893 | 783956.  | -8005.   | -0.00226 | 0.00 | 3.28E+11 |

|          |           |         |         |          |      |          |
|----------|-----------|---------|---------|----------|------|----------|
| -87.958  | 3063.     | 0.00    |         |          |      |          |
| 14.6000  | 0.06352   | 764490. | -8210.  | -0.00225 | 0.00 | 3.28E+11 |
| -82.181  | 3105.     | 0.00    |         |          |      |          |
| 14.8000  | 0.05812   | 744550. | -8400.  | -0.00225 | 0.00 | 3.28E+11 |
| -76.229  | 3148.     | 0.00    |         |          |      |          |
| 15.0000  | 0.05274   | 724172. | -9078.  | -0.00224 | 0.00 | 3.28E+11 |
| -489.291 | 22267.    | 0.00    |         |          |      |          |
| 15.2000  | 0.04737   | 700975. | -10243. | -0.00224 | 0.00 | 3.28E+11 |
| -481.106 | 24376.    | 0.00    |         |          |      |          |
| 15.4000  | 0.04201   | 675007. | -11386. | -0.00223 | 0.00 | 3.28E+11 |
| -471.524 | 26938.    | 0.00    |         |          |      |          |
| 15.6000  | 0.03666   | 646322. | -12504. | -0.00223 | 0.00 | 3.28E+11 |
| -460.237 | 30127.    | 0.00    |         |          |      |          |
| 15.8000  | 0.03133   | 614987. | -13592. | -0.00222 | 0.00 | 3.28E+11 |
| -446.813 | 34229.    | 0.00    |         |          |      |          |
| 16.0000  | 0.02600   | 581078. | -14645. | -0.00222 | 0.00 | 3.28E+11 |
| -430.608 | 39741.    | 0.00    |         |          |      |          |
| 16.2000  | 0.02069   | 544689. | -15655. | -0.00221 | 0.00 | 3.28E+11 |
| -410.584 | 47625.    | 0.00    |         |          |      |          |
| 16.4000  | 0.01539   | 505935. | -16609. | -0.00221 | 0.00 | 3.28E+11 |
| -384.890 | 60035.    | 0.00    |         |          |      |          |
| 16.6000  | 0.01009   | 464964. | -17491. | -0.00220 | 0.00 | 3.29E+11 |
| -349.601 | 83145.    | 0.00    |         |          |      |          |
| 16.8000  | 0.00480   | 421980. | -18262. | -0.00220 | 0.00 | 3.29E+11 |
| -293.018 | 146382.   | 0.00    |         |          |      |          |
| 17.0000  | -4.76E-04 | 377307. | -18468. | -0.00220 | 0.00 | 3.29E+11 |
| 121.6399 | 613730.   | 0.00    |         |          |      |          |
| 17.2000  | -0.00575  | 333335. | -17947. | -0.00220 | 0.00 | 3.29E+11 |
| 312.5124 | 130465.   | 0.00    |         |          |      |          |
| 17.4000  | -0.01102  | 291163. | -17126. | -0.00219 | 0.00 | 3.29E+11 |
| 370.9505 | 80815.    | 0.00    |         |          |      |          |
| 17.6000  | -0.01628  | 251128. | -16186. | -0.00219 | 0.00 | 3.29E+11 |
| 412.6522 | 60839.    | 0.00    |         |          |      |          |
| 17.8000  | -0.02154  | 213470. | -15155. | -0.00219 | 0.00 | 3.29E+11 |
| 446.5117 | 49759.    | 0.00    |         |          |      |          |
| 18.0000  | -0.02679  | 178384. | -14048. | -0.00219 | 0.00 | 3.30E+11 |
| 475.7402 | 42619.    | 0.00    |         |          |      |          |
| 18.2000  | -0.03204  | 146038. | -12875. | -0.00219 | 0.00 | 3.30E+11 |
| 501.8920 | 37593.    | 0.00    |         |          |      |          |
| 18.4000  | -0.03729  | 116583. | -11642. | -0.00219 | 0.00 | 3.30E+11 |
| 525.8462 | 33844.    | 0.00    |         |          |      |          |
| 18.6000  | -0.04254  | 90156.  | -10353. | -0.00219 | 0.00 | 3.30E+11 |
| 548.1513 | 30928.    | 0.00    |         |          |      |          |
| 18.8000  | -0.04778  | 66887.  | -9012.  | -0.00219 | 0.00 | 3.30E+11 |
| 569.1740 | 28589.    | 0.00    |         |          |      |          |
| 19.0000  | -0.05303  | 46897.  | -7622.  | -0.00218 | 0.00 | 3.30E+11 |
| 589.1721 | 26667.    | 0.00    |         |          |      |          |
| 19.2000  | -0.05827  | 30300.  | -6185.  | -0.00218 | 0.00 | 3.30E+11 |
| 608.3338 | 25057.    | 0.00    |         |          |      |          |
| 19.4000  | -0.06351  | 17207.  | -4703.  | -0.00218 | 0.00 | 3.30E+11 |

|          |          |       |        |          |      |          |
|----------|----------|-------|--------|----------|------|----------|
| 626.8012 | 23686.   | 0.00  |        |          |      |          |
| 19.6000  | -0.06875 | 7725. | -3177. | -0.00218 | 0.00 | 3.30E+11 |
| 644.6839 | 22505.   | 0.00  |        |          |      |          |
| 19.8000  | -0.07399 | 1956. | -1609. | -0.00218 | 0.00 | 3.30E+11 |
| 662.0682 | 21474.   | 0.00  |        |          |      |          |
| 20.0000  | -0.07924 | 0.00  | 0.00   | -0.00218 | 0.00 | 3.30E+11 |
| 679.0238 | 10284.   | 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      | = | -0.0026596 radians               |
| Maximum bending moment           | = | 1037799. inch-lbs                |
| Maximum shear force              | = | -18468. lbs                      |
| Depth of maximum bending moment  | = | 9.60000000 feet below pile head  |
| Depth of maximum shear force     | = | 17.00000000 feet below pile head |
| Number of iterations             | = | 15                               |
| 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 | = | 0.500000 inches   |
| Rotation of pile head     | = | 0.000E+00 radians |
| Axial load on pile head   | = | 0.0 lbs           |

| Depth<br>Res. | Soil<br>X | Deflect.<br>Spr.<br>y | Bending<br>Distrib.<br>Moment<br>Load | Shear<br>Force | Slope<br>S | Total<br>Stress | Bending<br>Stiffness | Soil<br>p |
|---------------|-----------|-----------------------|---------------------------------------|----------------|------------|-----------------|----------------------|-----------|
|               | Es*H      | Lat.                  |                                       |                |            |                 |                      |           |
| feet          | inches    | inches                | in-lbs                                | lbs            | radians    | psi*            | lb-in^2              |           |
| lb/inch       | lb/inch   | lb/inch               | lb/inch                               |                |            |                 |                      |           |
| 0.00          | 0.5000    | -3982980.             | 37010.                                | 0.00           | 0.00       | 6.77E+10        |                      |           |
| 0.00          | 0.00      | 0.00                  |                                       |                |            |                 |                      |           |
| 0.2000        | 0.4998    | -3894181.             | 36989.                                | -1.40E-04      | 0.00       | 6.77E+10        |                      |           |

|          |          |           |        |           |      |          |
|----------|----------|-----------|--------|-----------|------|----------|
| -8.859   | 42.5370  | 0.00      |        |           |      |          |
| 0.4000   | 0.4993   | -3805433. | 36957. | -2.76E-04 | 0.00 | 6.77E+10 |
| -17.700  | 85.0740  | 0.00      |        |           |      |          |
| 0.6000   | 0.4985   | -3716787. | 36904. | -4.09E-04 | 0.00 | 6.78E+10 |
| -26.506  | 127.6111 | 0.00      |        |           |      |          |
| 0.8000   | 0.4974   | -3628293. | 36830. | -5.39E-04 | 0.00 | 6.78E+10 |
| -35.261  | 170.1481 | 0.00      |        |           |      |          |
| 1.0000   | 0.4959   | -3540003. | 36735. | -6.66E-04 | 0.00 | 6.79E+10 |
| -43.947  | 212.6851 | 0.00      |        |           |      |          |
| 1.2000   | 0.4942   | -3451965. | 36619. | -7.90E-04 | 0.00 | 6.79E+10 |
| -52.551  | 255.2221 | 0.00      |        |           |      |          |
| 1.4000   | 0.4921   | -3364231. | 36483. | -9.10E-04 | 0.00 | 6.80E+10 |
| -61.056  | 297.7592 | 0.00      |        |           |      |          |
| 1.6000   | 0.4898   | -3276848. | 36326. | -0.00103  | 0.00 | 6.80E+10 |
| -69.449  | 340.2962 | 0.00      |        |           |      |          |
| 1.8000   | 0.4872   | -3189865. | 36150. | -0.00114  | 0.00 | 6.80E+10 |
| -77.714  | 382.8332 | 0.00      |        |           |      |          |
| 2.0000   | 0.4843   | -3103330. | 35953. | -0.00125  | 0.00 | 6.81E+10 |
| -85.840  | 425.3702 | 0.00      |        |           |      |          |
| 2.2000   | 0.4812   | -3017289. | 35738. | -0.00136  | 0.00 | 6.81E+10 |
| -93.812  | 467.9072 | 0.00      |        |           |      |          |
| 2.4000   | 0.4778   | -2931788. | 35503. | -0.00147  | 0.00 | 6.81E+10 |
| -101.619 | 510.4443 | 0.00      |        |           |      |          |
| 2.6000   | 0.4741   | -2846873. | 35250. | -0.00157  | 0.00 | 6.82E+10 |
| -109.248 | 552.9813 | 0.00      |        |           |      |          |
| 2.8000   | 0.4703   | -2762587. | 34979. | -0.00167  | 0.00 | 6.82E+10 |
| -116.689 | 595.5183 | 0.00      |        |           |      |          |
| 3.0000   | 0.4662   | -2678974. | 34690. | -0.00176  | 0.00 | 6.83E+10 |
| -123.930 | 638.0553 | 0.00      |        |           |      |          |
| 3.2000   | 0.4618   | -2596074. | 34384. | -0.00185  | 0.00 | 6.83E+10 |
| -130.962 | 680.5924 | 0.00      |        |           |      |          |
| 3.4000   | 0.4573   | -2513928. | 34062. | -0.00194  | 0.00 | 6.83E+10 |
| -137.773 | 723.1294 | 0.00      |        |           |      |          |
| 3.6000   | 0.4525   | -2432576. | 33723. | -0.00203  | 0.00 | 6.84E+10 |
| -144.355 | 765.6664 | 0.00      |        |           |      |          |
| 3.8000   | 0.4475   | -2352056. | 33369. | -0.00211  | 0.00 | 6.84E+10 |
| -150.699 | 808.2034 | 0.00      |        |           |      |          |
| 4.0000   | 0.4423   | -2272403. | 33000. | -0.00220  | 0.00 | 6.84E+10 |
| -156.797 | 850.7404 | 0.00      |        |           |      |          |
| 4.2000   | 0.4370   | -2193654. | 32617. | -0.00227  | 0.00 | 6.85E+10 |
| -162.640 | 893.2775 | 0.00      |        |           |      |          |
| 4.4000   | 0.4314   | -2115841. | 32220. | -0.00235  | 0.00 | 6.85E+10 |
| -168.220 | 935.8145 | 0.00      |        |           |      |          |
| 4.6000   | 0.4257   | -2038998. | 31810. | -0.00242  | 0.00 | 8.29E+10 |
| -173.532 | 978.3515 | 0.00      |        |           |      |          |
| 4.8000   | 0.4198   | -1963154. | 31387. | -0.00246  | 0.00 | 1.72E+11 |
| -178.580 | 1021.    | 0.00      |        |           |      |          |
| 5.0000   | 0.4139   | -1888338. | 30953. | -0.00248  | 0.00 | 3.24E+11 |
| -183.391 | 1063.    | 0.00      |        |           |      |          |
| 5.2000   | 0.4079   | -1814579. | 30507. | -0.00249  | 0.00 | 3.24E+11 |

|          |        |           |        |          |      |          |
|----------|--------|-----------|--------|----------|------|----------|
| -187.976 | 1106.  | 0.00      |        |          |      |          |
| 5.4000   | 0.4019 | -1741903. | 30051. | -0.00251 | 0.00 | 3.24E+11 |
| -192.334 | 1148.  | 0.00      |        |          |      |          |
| 5.6000   | 0.3959 | -1670334. | 29584. | -0.00252 | 0.00 | 3.24E+11 |
| -196.464 | 1191.  | 0.00      |        |          |      |          |
| 5.8000   | 0.3898 | -1599897. | 29108. | -0.00253 | 0.00 | 3.25E+11 |
| -200.365 | 1234.  | 0.00      |        |          |      |          |
| 6.0000   | 0.3837 | -1530615. | 28623. | -0.00254 | 0.00 | 3.25E+11 |
| -204.036 | 1276.  | 0.00      |        |          |      |          |
| 6.2000   | 0.3776 | -1462507. | 28129. | -0.00255 | 0.00 | 3.25E+11 |
| -207.476 | 1319.  | 0.00      |        |          |      |          |
| 6.4000   | 0.3715 | -1395595. | 27627. | -0.00256 | 0.00 | 3.25E+11 |
| -210.685 | 1361.  | 0.00      |        |          |      |          |
| 6.6000   | 0.3653 | -1329896. | 27118. | -0.00257 | 0.00 | 3.26E+11 |
| -213.661 | 1404.  | 0.00      |        |          |      |          |
| 6.8000   | 0.3591 | -1265427. | 26602. | -0.00258 | 0.00 | 3.26E+11 |
| -216.405 | 1446.  | 0.00      |        |          |      |          |
| 7.0000   | 0.3529 | -1202206. | 26080. | -0.00259 | 0.00 | 3.26E+11 |
| -218.915 | 1489.  | 0.00      |        |          |      |          |
| 7.2000   | 0.3467 | -1140245. | 25552. | -0.00260 | 0.00 | 3.26E+11 |
| -221.191 | 1531.  | 0.00      |        |          |      |          |
| 7.4000   | 0.3404 | -1079558. | 25018. | -0.00261 | 0.00 | 3.26E+11 |
| -223.234 | 1574.  | 0.00      |        |          |      |          |
| 7.6000   | 0.3341 | -1020157. | 24480. | -0.00262 | 0.00 | 3.27E+11 |
| -225.041 | 1616.  | 0.00      |        |          |      |          |
| 7.8000   | 0.3278 | -962053.  | 23938. | -0.00263 | 0.00 | 3.27E+11 |
| -226.614 | 1659.  | 0.00      |        |          |      |          |
| 8.0000   | 0.3215 | -905253.  | 23393. | -0.00263 | 0.00 | 3.27E+11 |
| -227.952 | 1701.  | 0.00      |        |          |      |          |
| 8.2000   | 0.3152 | -849767.  | 22844. | -0.00264 | 0.00 | 3.27E+11 |
| -229.054 | 1744.  | 0.00      |        |          |      |          |
| 8.4000   | 0.3089 | -795600.  | 22294. | -0.00264 | 0.00 | 3.27E+11 |
| -229.921 | 1787.  | 0.00      |        |          |      |          |
| 8.6000   | 0.3025 | -742757.  | 21741. | -0.00265 | 0.00 | 3.28E+11 |
| -230.553 | 1829.  | 0.00      |        |          |      |          |
| 8.8000   | 0.2961 | -691243.  | 21187. | -0.00266 | 0.00 | 3.28E+11 |
| -230.950 | 1872.  | 0.00      |        |          |      |          |
| 9.0000   | 0.2898 | -641058.  | 20633. | -0.00266 | 0.00 | 3.28E+11 |
| -231.111 | 1914.  | 0.00      |        |          |      |          |
| 9.2000   | 0.2834 | -592205.  | 20078. | -0.00266 | 0.00 | 3.28E+11 |
| -231.036 | 1957.  | 0.00      |        |          |      |          |
| 9.4000   | 0.2770 | -544683.  | 19524. | -0.00267 | 0.00 | 3.28E+11 |
| -230.727 | 1999.  | 0.00      |        |          |      |          |
| 9.6000   | 0.2706 | -498489.  | 18971. | -0.00267 | 0.00 | 3.28E+11 |
| -230.182 | 2042.  | 0.00      |        |          |      |          |
| 9.8000   | 0.2641 | -453622.  | 18420. | -0.00268 | 0.00 | 3.29E+11 |
| -229.403 | 2084.  | 0.00      |        |          |      |          |
| 10.0000  | 0.2577 | -410075.  | 17870. | -0.00268 | 0.00 | 3.29E+11 |
| -228.389 | 2127.  | 0.00      |        |          |      |          |
| 10.2000  | 0.2513 | -367845.  | 17324. | -0.00268 | 0.00 | 3.29E+11 |



|          |         |          |        |          |      |          |
|----------|---------|----------|--------|----------|------|----------|
| -227.141 | 2169.   | 0.00     |        |          |      |          |
| 10.4000  | 0.2448  | -326922. | 16780. | -0.00268 | 0.00 | 3.29E+11 |
| -225.658 | 2212.   | 0.00     |        |          |      |          |
| 10.6000  | 0.2384  | -287300. | 16241. | -0.00269 | 0.00 | 3.29E+11 |
| -223.942 | 2254.   | 0.00     |        |          |      |          |
| 10.8000  | 0.2319  | -248967. | 15706. | -0.00269 | 0.00 | 3.29E+11 |
| -221.993 | 2297.   | 0.00     |        |          |      |          |
| 11.0000  | 0.2255  | -211913. | 15175. | -0.00269 | 0.00 | 3.29E+11 |
| -219.811 | 2340.   | 0.00     |        |          |      |          |
| 11.2000  | 0.2190  | -176125. | 14651. | -0.00269 | 0.00 | 3.30E+11 |
| -217.396 | 2382.   | 0.00     |        |          |      |          |
| 11.4000  | 0.2126  | -141589. | 14132. | -0.00269 | 0.00 | 3.30E+11 |
| -214.749 | 2425.   | 0.00     |        |          |      |          |
| 11.6000  | 0.2061  | -108291. | 13620. | -0.00269 | 0.00 | 3.30E+11 |
| -211.871 | 2467.   | 0.00     |        |          |      |          |
| 11.8000  | 0.1996  | -76212.  | 13115. | -0.00269 | 0.00 | 3.30E+11 |
| -208.761 | 2510.   | 0.00     |        |          |      |          |
| 12.0000  | 0.1932  | -45336.  | 12618. | -0.00270 | 0.00 | 3.30E+11 |
| -205.421 | 2552.   | 0.00     |        |          |      |          |
| 12.2000  | 0.1867  | -15644.  | 12130. | -0.00270 | 0.00 | 3.30E+11 |
| -201.850 | 2595.   | 0.00     |        |          |      |          |
| 12.4000  | 0.1802  | 12886.   | 11650. | -0.00270 | 0.00 | 3.30E+11 |
| -198.050 | 2637.   | 0.00     |        |          |      |          |
| 12.6000  | 0.1738  | 40276.   | 11179. | -0.00270 | 0.00 | 3.30E+11 |
| -194.021 | 2680.   | 0.00     |        |          |      |          |
| 12.8000  | 0.1673  | 66547.   | 10719. | -0.00269 | 0.00 | 3.30E+11 |
| -189.764 | 2722.   | 0.00     |        |          |      |          |
| 13.0000  | 0.1608  | 91726.   | 10269. | -0.00269 | 0.00 | 3.30E+11 |
| -185.278 | 2765.   | 0.00     |        |          |      |          |
| 13.2000  | 0.1544  | 115837.  | 9830.  | -0.00269 | 0.00 | 3.30E+11 |
| -180.565 | 2807.   | 0.00     |        |          |      |          |
| 13.4000  | 0.1479  | 138909.  | 9402.  | -0.00269 | 0.00 | 3.30E+11 |
| -175.625 | 2850.   | 0.00     |        |          |      |          |
| 13.6000  | 0.1414  | 160969.  | 8987.  | -0.00269 | 0.00 | 3.30E+11 |
| -170.459 | 2893.   | 0.00     |        |          |      |          |
| 13.8000  | 0.1350  | 182047.  | 8584.  | -0.00269 | 0.00 | 3.30E+11 |
| -165.068 | 2935.   | 0.00     |        |          |      |          |
| 14.0000  | 0.1285  | 202174.  | 8195.  | -0.00269 | 0.00 | 3.30E+11 |
| -159.451 | 2978.   | 0.00     |        |          |      |          |
| 14.2000  | 0.1221  | 221382.  | 7819.  | -0.00269 | 0.00 | 3.29E+11 |
| -153.610 | 3020.   | 0.00     |        |          |      |          |
| 14.4000  | 0.1156  | 239706.  | 7458.  | -0.00269 | 0.00 | 3.29E+11 |
| -147.546 | 3063.   | 0.00     |        |          |      |          |
| 14.6000  | 0.1092  | 257180.  | 7111.  | -0.00268 | 0.00 | 3.29E+11 |
| -141.258 | 3105.   | 0.00     |        |          |      |          |
| 14.8000  | 0.1027  | 273841.  | 6780.  | -0.00268 | 0.00 | 3.29E+11 |
| -134.748 | 3148.   | 0.00     |        |          |      |          |
| 15.0000  | 0.09630 | 289725.  | 5936.  | -0.00268 | 0.00 | 3.29E+11 |
| -568.818 | 14176.  | 0.00     |        |          |      |          |
| 15.2000  | 0.08987 | 302333.  | 4576.  | -0.00268 | 0.00 | 3.29E+11 |

|          |          |         |          |          |      |          |
|----------|----------|---------|----------|----------|------|----------|
| -564.689 | 15079.   | 0.00    |          |          |      |          |
| 15.4000  | 0.08345  | 311688. | 3226.    | -0.00268 | 0.00 | 3.29E+11 |
| -559.832 | 16100.   | 0.00    |          |          |      |          |
| 15.6000  | 0.07703  | 317819. | 1889.    | -0.00267 | 0.00 | 3.29E+11 |
| -554.153 | 17265.   | 0.00    |          |          |      |          |
| 15.8000  | 0.07062  | 320757. | 567.4098 | -0.00267 | 0.00 | 3.29E+11 |
| -547.542 | 18608.   | 0.00    |          |          |      |          |
| 16.0000  | 0.06421  | 320542. | -737.469 | -0.00267 | 0.00 | 3.29E+11 |
| -539.857 | 20178.   | 0.00    |          |          |      |          |
| 16.2000  | 0.05781  | 317218. | -2022.   | -0.00267 | 0.00 | 3.29E+11 |
| -530.919 | 22041.   | 0.00    |          |          |      |          |
| 16.4000  | 0.05141  | 310835. | -3284.   | -0.00266 | 0.00 | 3.29E+11 |
| -520.493 | 24297.   | 0.00    |          |          |      |          |
| 16.6000  | 0.04502  | 301454. | -4519.   | -0.00266 | 0.00 | 3.29E+11 |
| -508.260 | 27093.   | 0.00    |          |          |      |          |
| 16.8000  | 0.03864  | 289146. | -5721.   | -0.00266 | 0.00 | 3.29E+11 |
| -493.774 | 30671.   | 0.00    |          |          |      |          |
| 17.0000  | 0.03226  | 273993. | -6885.   | -0.00266 | 0.00 | 3.29E+11 |
| -476.374 | 35443.   | 0.00    |          |          |      |          |
| 17.2000  | 0.02588  | 256097. | -8003.   | -0.00266 | 0.00 | 3.29E+11 |
| -455.013 | 42193.   | 0.00    |          |          |      |          |
| 17.4000  | 0.01951  | 235579. | -9062.   | -0.00265 | 0.00 | 3.29E+11 |
| -427.858 | 52631.   | 0.00    |          |          |      |          |
| 17.6000  | 0.01314  | 212597. | -10045.  | -0.00265 | 0.00 | 3.29E+11 |
| -391.153 | 71425.   | 0.00    |          |          |      |          |
| 17.8000  | 0.00678  | 187362. | -10916.  | -0.00265 | 0.00 | 3.30E+11 |
| -334.526 | 118414.  | 0.00    |          |          |      |          |
| 18.0000  | 4.20E-04 | 160201. | -11452.  | -0.00265 | 0.00 | 3.30E+11 |
| -112.377 | 641999.  | 0.00    |          |          |      |          |
| 18.2000  | -0.00594 | 132392. | -11192.  | -0.00265 | 0.00 | 3.30E+11 |
| 329.1205 | 133042.  | 0.00    |          |          |      |          |
| 18.4000  | -0.01229 | 106478. | -10319.  | -0.00265 | 0.00 | 3.30E+11 |
| 398.3269 | 77772.   | 0.00    |          |          |      |          |
| 18.6000  | -0.01865 | 82859.  | -9306.   | -0.00265 | 0.00 | 3.30E+11 |
| 445.9199 | 57399.   | 0.00    |          |          |      |          |
| 18.8000  | -0.02500 | 61809.  | -8190.   | -0.00265 | 0.00 | 3.30E+11 |
| 483.9761 | 46468.   | 0.00    |          |          |      |          |
| 19.0000  | -0.03135 | 43546.  | -6990.   | -0.00265 | 0.00 | 3.30E+11 |
| 516.5417 | 39547.   | 0.00    |          |          |      |          |
| 19.2000  | -0.03770 | 28259.  | -5715.   | -0.00265 | 0.00 | 3.30E+11 |
| 545.5099 | 34730.   | 0.00    |          |          |      |          |
| 19.4000  | -0.04405 | 16114.  | -4374.   | -0.00265 | 0.00 | 3.30E+11 |
| 571.9304 | 31163.   | 0.00    |          |          |      |          |
| 19.6000  | -0.05040 | 7263.   | -2972.   | -0.00265 | 0.00 | 3.30E+11 |
| 596.4498 | 28405.   | 0.00    |          |          |      |          |
| 19.8000  | -0.05674 | 1847.   | -1513.   | -0.00265 | 0.00 | 3.30E+11 |
| 619.4962 | 26202.   | 0.00    |          |          |      |          |
| 20.0000  | -0.06309 | 0.00    | 0.00     | -0.00265 | 0.00 | 3.30E+11 |
| 641.3683 | 12199.   | 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 = 0.50000000 inches  
 Computed slope at pile head = 0.000000 radians  
 Maximum bending moment = -3982980. inch-lbs  
 Maximum shear force = 37010. 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 = 20  
 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 | Load 1    | Load 2        | Axial Loading | Pile-head Deflection | Pile-head Rotation | Max |
|---------------|-----------|-----------|---------------|---------------|----------------------|--------------------|-----|
|               |           | Shear lbs | Moment in-lbs |               | inches               | radians            | in  |
| 1             | y, in     | 0.5000    | M, in-lb      | 0.00          | 0.5000               | -0.00266           |     |
|               |           | -18468.   | 1037799.      |               |                      |                    |     |
| 2             | y, in     | 0.5000    | S, rad        | 0.00          | 0.5000               | 0.00               |     |
|               |           | 37010.    | -3982980.     |               |                      |                    |     |

Maximum pile-head deflection = 0.5000000000 inches  
 Maximum pile-head rotation = -0.0026596225 radians = -0.152385 deg.

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### Summary of Warning Messages

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The following warning was reported 1574 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.