Los Angeles County Department of Public Works
Morris Dam Control House

FINAL
Geotechnical Report

Black & Veatch Corporation
Project No. 96231
File 96231.C.1.1

Revision 2.0

March 2003

BLACK & VEATCH

Los Angeles County Department of Public Works
Morris Dam Control House

Geotechnical Report

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1.0 Introduction

This report presents a summary of the subsurface site conditions, geotechnical data, laboratory work, and geotechnical design recommendations for the Los Angeles County Department of Public Works ("LADPW") Morris Dam Control House Project located near the city of Azusa, California. The geotechnical investigation was performed at Morris Dam in October 2002.

The purpose of this investigation is to provide geotechnical information to support the construction of a new Control House for Morris Dam. The investigation consisted of two soil borings and associated laboratory testing. This report includes the following information:

- Site location and description.
- Project description.
- Details of the subsurface investigation program.
- Results of laboratory tests on soil samples.
- Subsurface characterization, including boring logs.
- Geotechnical engineering recommendations.

The analysis, conclusions, and recommendations in this report were based on site conditions existing at the time of the investigation and on the assumption that the information obtained from the borings is representative of the subsurface conditions throughout the site. Unanticipated conditions may be encountered during construction because of variations not detected during the investigation program. If, during construction, conditions differ due to natural or manmade causes, this report should be reviewed by qualified professionals to determine the applicability of the conclusions and recommendations concerning the differences in conditions.

This report was prepared solely for the benefit of LADPW by Black & Veatch Corporation (B&V) under the terms and conditions of the written agreement dated February 29, 2002, and its amendments, between LADPW and B&V ("the Agreement") and is based on information not within the control of LADPW or B&V. Neither LADPW nor B&V have made analyses, verified, or rendered an independent judgment on the validity of the information provided by others. WHILE IT IS BELIEVED THAT THE INFORMATION, DATA, AND OPINIONS CONTAINED HEREIN WILL BE RELIABLE UNDER THE CONDITIONS AND SUBJECT TO THE LIMITATIONS SET FORTH HEREIN, LADPW AND B&V DO NOT GUARANTEE THE ACCURACY THEREOF. EXCEPT AS OTHERWISE ALLOWED BY THE AGREEMENT, THIS REPORT MAY NOT BE USED BY ANYONE WITHOUT THE EXPRESS WRITTEN AUTHORIZATION OF B&V, AND SUCH USE SHALL CONSTITUTE AGREEMENT BY THE USER THAT ITS RIGHTS, IF ANY, ARISING FROM THIS REPORT SHALL BE SUBJECT TO THE TERMS OF

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2.0 Summary

Conclusions and recommendations based on information obtained during the current investigation are summarized below:

- The project site is suitable for the planned development from a geotechnical point of view.
- The subsurface soil profile consists of about 10 to 12 feet of fill material overlying bedrock.
- The fill material consists of a dense to very dense sand with gravel and boulders. The gravel content within the fill increases with depth.
- The bedrock material was characterized as a quartz diorite. The bedrock is extremely weathered in the upper 2 feet and grades to moderately weathered to slightly weathered thereafter.
- Groundwater was not encountered during drilling.
- The stability of the MWD-placed fill has been checked under static and seismic loading. The static analysis indicates that the slope meets required criteria. The seismic analysis indicates that the slope does not meet the required factor of safety, but simplified deformation analyses indicate less than 1 cm of movement.
- The piers have been sized for 1 inch or less of settlement.
- The Control House will be supported on drilled piers sitting on bedrock. An allowable end bearing pressure of 40 ksf can be used to determine axial pier capacity. Since the piers will be considered "short" for lateral loads, an embedment of at least 5 feet into the moderately weathered rock is recommended to provide a fixity point at the base. LPILE analyses with a lateral load of 20 kips have been performed.
- A full length pilot hole, continuously cored in rock, should be drilled at each pier location to elevation 1,160. Each pilot hole should be grouted upon completion.
- If unconsolidated material is encountered in the pilot hole, the pier should be deepened to provide the required axial load for shaft resistance in the rock, with no consideration of base resistance. The shaft resistance should be taken as 5 ksf in rock. Shaft resistance in the unconsolidated material should be discounted.
- The pilot hole and pier hole drilling must be inspected by a licensed geotechnical engineer and licensed engineering geologist. The inspectors

should also descend into the pier holes to examine the proposed bearing surface.

- The pier hole must be approved by the inspectors prior to pouring concrete.
- Inspections shall be made by a licensed engineering geologist and a licensed soils engineer. Monthly inspection reports must be submitted directly to the Geology and Soils Section by the engineering geologist and soils engineer. The engineering geologist shall be onsite during all foundation drilling operations to completely log all borings, record depth to bedrock and verify embedment depths into bedrock.
- Based on chemical test results, the site soils are noncorrosive. Type I cement can be used for foundation concrete as recommended in ACI 318-95 - Building Code Requirements for Structural Concrete.
- Southern California is in Seismic Zone 4 according to the 1997 Uniform Building Code. Based on the subsurface profile for this project, the site soil profile is S_B. Referring to Tables 16-S and 16-T of the Uniform Building Code, the near-source factors, N_a and N_v, have values of 1.3 and 1.6, respectively. According to Tables 16-Q and 16-R of the Uniform Building Code, seismic coefficients C_a and C_v have values of 0.40 N_a and 0.40 N_v, or 0.52 and 0.64, respectively.
- A CBR value of 36 should be used for pavement design based on the CBR test performed.
- The proposed building or grading construction will have no anticipated effects on the geologic stability outside the building site. The building site for the proposed structure will not be subject to landslide, settlement, or slippage.

3.0 Site and Project Description

3.1 Site Location

Morris Dam is located approximately 4 miles north of the city of Azusa, California. The site location is shown on Figure 3-1.

3.2 Facility Description

Morris Dam, formerly Pine Canyon Dam, was constructed in 1934 for water supply by the city of Pasadena and sold to Metropolitan Water District of Southern California (Metropolitan) in 1935. Ownership of the dam was transferred from Metropolitan to the Los Angeles County Department of Public Works in 1995. The dam is a concrete gravity dam with a straight center section and curved ends to fit the topography of the abutments. It has a structural height of 328 feet (lowest point of foundation to crest) and a crest length of approximately 800 feet. The crest of the dam is at elevation 1,175 feet (245 feet above stream bed) and accommodates a 20 foot wide east-west roadway. The dam was constructed in vertical blocks with contraction joints generally spaced at 50 foot intervals. The blocks are numbered 00 through 17. A gated overflow spillway with crest at elevation 1,152 feet is located approximately 200 feet west of the west abutment.

A new Control House will be constructed in the area between the dam and the spillway. The building will house a storage room, break room, control room, and a relief quarters room. The proposed Control House is located in the west abutment, at the edge of Block 17. Figure 3-2 shows the location of the proposed Control House.

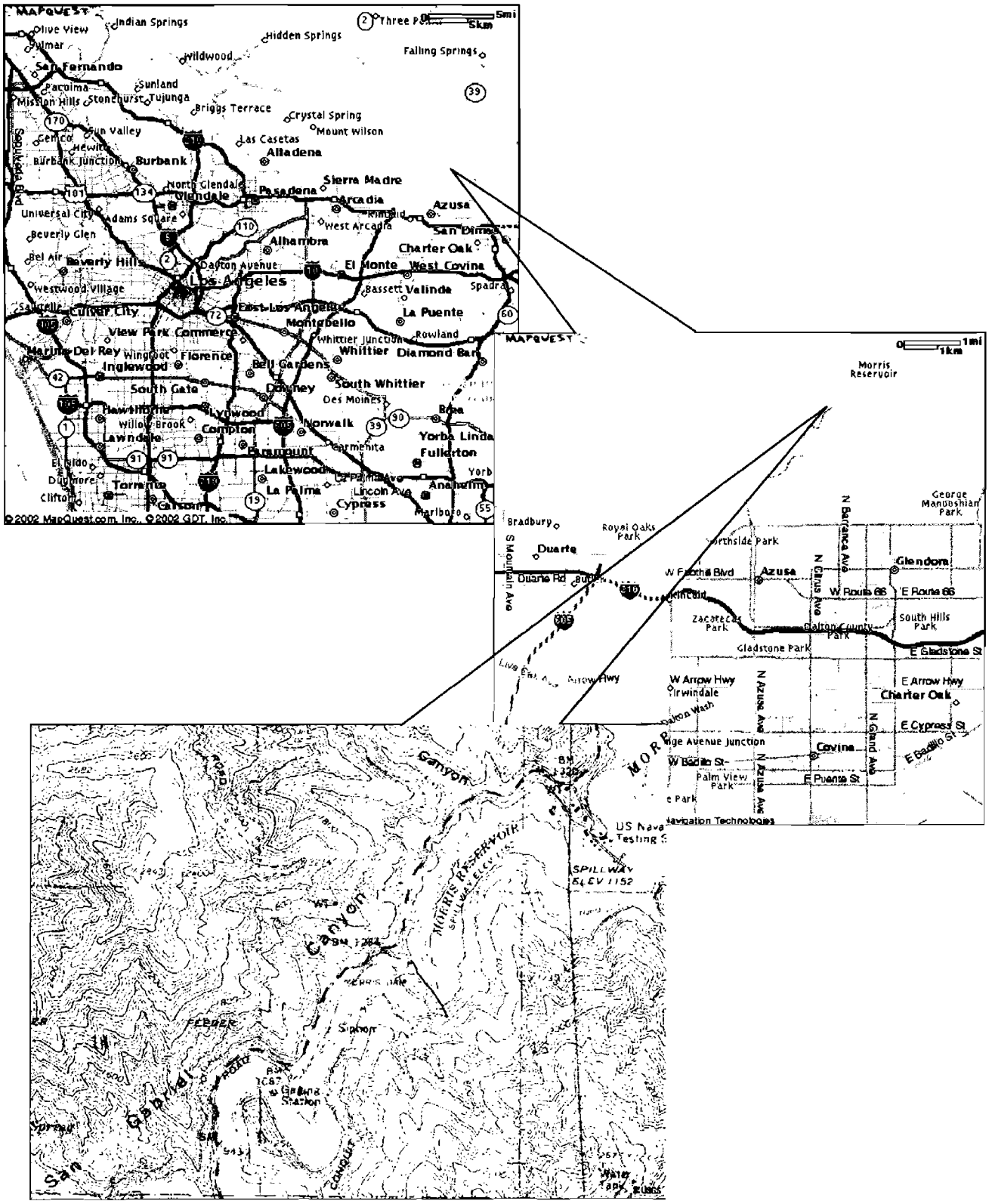


Figure 3-1
Site Location Map

Figure 3-2
Control House Location

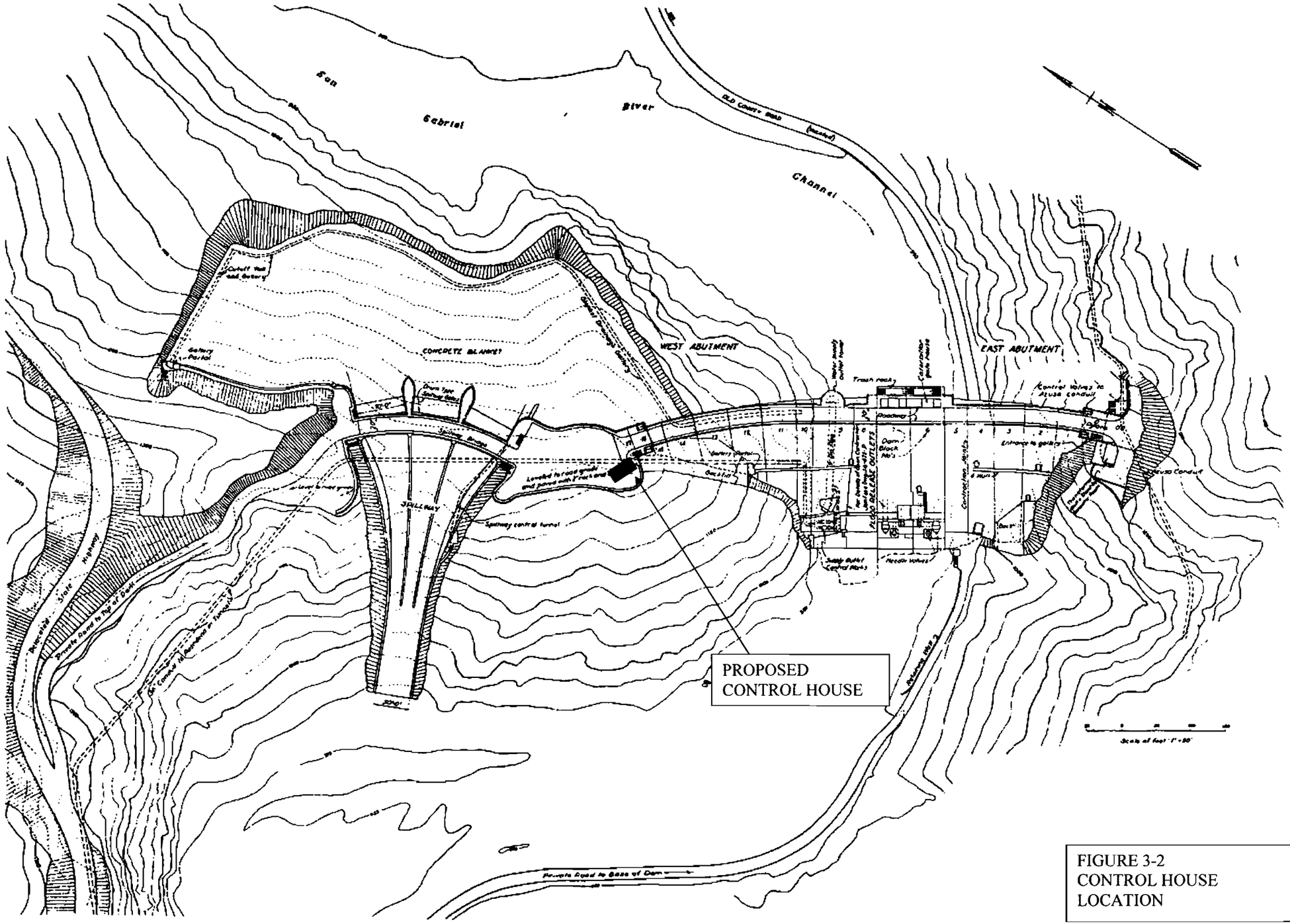


FIGURE 3-2
CONTROL HOUSE
LOCATION

4.0 Subsurface Investigation

The subsurface exploration was performed by B&V at the site in October 2002 to aid in the determination of the design site subsurface profile and to provide pertinent geotechnical engineering properties of the soils for final geotechnical design and construction recommendations.

4.1 Field Testing Program

The field investigation included the drilling and sampling of two soil borings and associated laboratory testing. The borings were located in the field by a B&V representative by measuring from existing site features. The borings were designated as BH-1 and BH-2 and were drilled at the locations shown on Figure 4-1. Test boring elevations were estimated based on available site topographic plans using mean sea level (msl) as the elevation datum.

4.1.1 Soil Borings

The borings were drilled by West Hazmat Drilling Corporation of Anaheim, California. Soil borings were advanced using a 5-5/8 inch diameter tri-cone roller bit with compressed air as drilling fluid. Upon refusal, the borings were advanced by NX size double tube core barrel with a diamond impregnated bit using water as drilling fluid in order to obtain samples of the bedrock. Ten feet of rock coring was performed in each boring.

A Schramm RotaDrill T-450W truck mounted drill rig was used to drill the borings. A B&V representative was present throughout the fieldwork to observe drilling, assist in obtaining samples, and prepare descriptive logs of the test borings. Upon completion of drilling, all borings were backfilled with cement-bentonite grout to ground level.

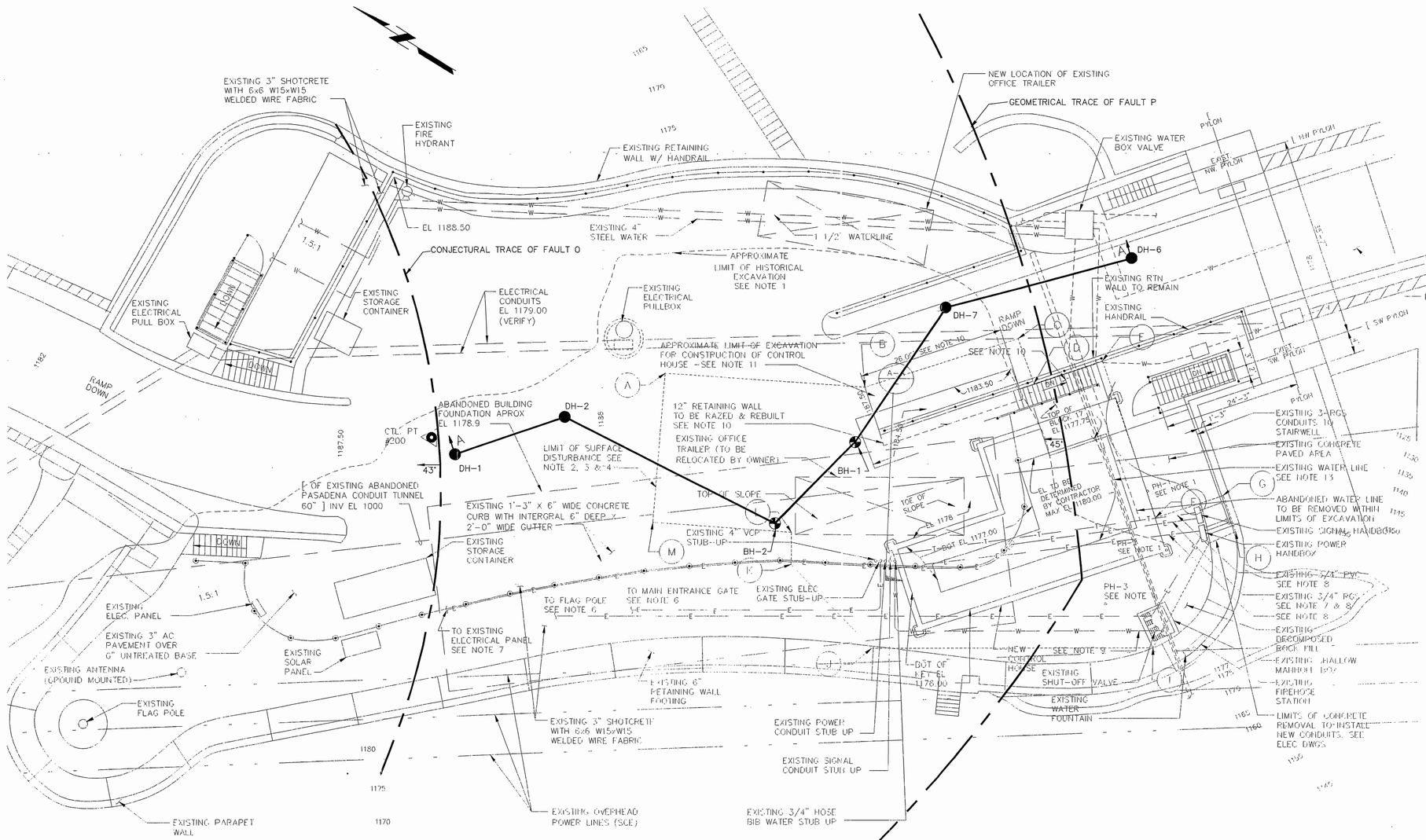
Soil samples were obtained via the Penetration Test, using a 2.5 inch ring lined sampler driven with a 140 pound safety hammer. All samples were secured, sealed, and sent to Maxim Technologies, Inc., laboratory in Kansas City, Kansas, for further testing.

The sampling intervals, soil descriptions, blow count results, and other pertinent field data are summarized on individual boring logs presented in Appendix A.

4.2 Laboratory Testing

A laboratory test program was performed to classify the soils encountered at the site and to estimate engineering properties. The laboratory test program was developed by B&V and performed by Maxim Technologies, Inc., of Kansas City, Kansas.

Figure 4-1
Subsurface Investigation Plan



PLAN
1" = 10'-0"

NOTES:

● APPROXIMATE LOCATION OF DRILL HOLES FOR 1982 SUBSURFACE INVESTIGATION BY INTERNATIONAL ENGINEERING CO. RESULTS PUBLISHED IN RINAL REPORT ON INVESTIGATION AND REANAIYSS OF MORRIS DAM OCTOBER 1982.

◐ APPROXIMATE LOCATION OF BLACK & VEATCH OCTOBER 2002 INVESTIGATION.

FAULTS O AND P ARE TRACED FROM PLATE 1 OF THE FINAL GEOLOGICAL REPORT ON MORRIS DAM SITE BY F.P. RAWSOME AND J.P. BUWAIDA DATED MARCH 12, 1935. THE FAULT DIPS ARE TAKEN FROM PLATE 2 OF THE SAME REPORT.

45° MEASURED DIP OF FAULT.

LIMITS OF SURFACE DISTURBANCE		
POINT	NORTH	EAST
A	1886122.02	6597551.60
B	1886091.01	6597568.55
C	1886072.70	6597590.43
D	1886066.08	6597585.25
E	1886058.01	6597595.22
F	1886035.38	6597577.14
G	1886027.32	6597586.82
H	1886022.09	6597582.74
I	1886023.11	6597557.40

LIMITS OF SURFACE DISTURBANCE		
POINT	NORTH	EAST
J	1886065.10	6597530.45
K	1886085.25	6597535.32
L	1886088.31	6597540.16
M	1886109.79	6597528.44

BENCH MARK
CONTROL POINT #200
N 1886150.813
E 6597519.736
EL 1188.045

NOT TO BE USED FOR CONSTRUCTION

B&V DWG NO.: DP1-C101 — REV C

MORRIS DAM INLET/OUTLET REHABILITATION PROJECT

COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS

FIGURE 4-1

SUBSURFACE INVESTIGATION PLAN

BLACK & VEATCH Corporation
800 WILSHIRE BLVD SUITE 600
LOS ANGELES, CA., 90017

B&V PROJECT NO. 96231

DATE	MK	DESCRIPTION	BY	CHK	APP
04/06/01	C	100% OWNER REVIEW	AMS	JRH	JRH
10/18/00	B	90% OWNER REVIEW	AMS	RLT	JRH
7/14/00	A	50% OWNER REVIEW	AMS	–	–

PROJECT ENGINEER — DATE

JOB H0300573 | DWG 53-F94 | SHEET OF

DRAFTER TINH V. LAI | DESIGNER R.D. BOYCE | CHECKER | CADD PROJECT FILE NAME 96231-DP1-G101.DWG | REVIEWED BY | DATE

N:/ACAD/MORRIS_D/PLANVIEW.DWG 01/31/03 07:50:31

The various laboratory tests performed on the soil samples recovered from the field included the following:

- Moisture content determination of soil samples.
- Dry density determination on selected soil samples.
- Grain size analysis.
- A direct shear test on a compacted soil sample.
- Chemical analysis, including pH, chloride content, sulfate content, and resistivity of select soil samples.
- Unconfined compression tests on selected rock samples.
- Moisture-dry density relationship (Proctor tests) on selected bag samples.
- A California Bearing Ratio (CBR) test for pavement design.

All testing was performed in accordance with established ASTM testing procedures. Laboratory test results are presented in Appendix B.

4.3 Previous Reports

Copies of previous geotechnical reports performed at the Morris Dam site were provided to B&V by LADPW. These reports have been reviewed as part of the present subsurface investigation for the proposed Control House. Following is a list of the geotechnical reports made available to B&V:

- Final Report on Investigation and Reanalysis of Morris Dam, Vols I and II. International Engineering Company. Report prepared for the Los Angeles County Flood Control District, October 1982.
- Technical Report on the Construction of Morris Dam. Pasadena Water Department, 1935.
- Final Geological Report on Morris Dam Site. F. L. Ransome and J. P. Buwalda, Consulting Geologists, March 1935.

5.0 Subsurface Conditions

5.1 Geologic Conditions

5.1.1 Regional Geology

Morris Dam is located in the San Gabriel Canyon, about 4 miles north of the town of Azusa. Geologically, this area corresponds to the central portion of the San Gabriel Mountains in the Transverse Range province of Southern California.

The mountains are composed of igneous and metamorphic rocks that range in age from Precambrian through Cretaceous. The mountains rose to their current elevation beginning in the Pleistocene era as the ancient rocks were thrust upward and toward the south along range-bounding faults belonging to the Sierra Madre fault system. Uplift of the mountains has produced a topographic surface of high relief, with steep narrow canyons, active erosion, and rockslides.

Streams draining from the San Gabriel Mountains have deposited alluvial fans in the valley. The largest stream in the mountains, the San Gabriel River, drains a watershed of over 200 square miles. The river enters the valley west of Azusa and has deposited a large alluvial fan that extends to the south across the valley.

Major crystalline bedrock units mapped in the Azusa Quadrangle include gneissic rock or gneiss, mapped as undifferentiated biotite and hornblend gneiss, calcium silicated marble and amphibolite, and a mixture of intensely fractured gneiss and quartz diorite.

5.1.2 Site Geology

Diorite gneiss and amphibolite are widespread in the central part of the range and are the most prevalent rocks at the dam site. The diorite gneiss probably represents an originally intrusive rock of granitic texture that has been modified by intense pressure under heavy load, long subsequent to its crystallization as an igneous rock. From a standpoint of strength and durability, the intact rock can be regarded as massive diorite (Reference 4). Associated with the gneiss are irregular masses of lighter colored granitic or aplitic rock. This rock is scarce at the site and, where present, is in irregular masses, representing original intrusions into the gneiss. The aplitic rock is a more brittle rock than the gneiss and is jointed and fractured. The youngest rock at the site is a fine grained, greenish gray rock termed the diabase. The diabase is a hard, compact rock and is generally traversed by many closely spaced, irregular, tight fractures. The fractures are thought to be the results of the cooling of the diabase after its injection into the gneiss. The contact between the diabase and the gneiss is very tight, and both rock types can be considered to behave as a practically homogeneous rock (Reference 4).

The proposed Control House is located in the west abutment at the edge of Block 17. Boring logs DH-1 and DH-2, taken at the west abutment during the 1982 investigation (Reference 1), indicate that the subsurface stratigraphy comprises approximately 14 feet of a gravelly sand fill overlying bedrock. The bedrock was characterized as a quartz diorite with very closely spaced fractures, moderately hard, and moderately weathered. The B&V investigation of October 2002 revealed a very similar soil stratigraphy as the one described in Borings DH-1 and DH-2. A geologic map of Morris Dam obtained from Reference 1 is shown on Figure 5-1.

5.1.3 Seismicity

Southern California is an area of intensive seismic activity. According to the California Bureau of Mines, the crystalline rocks of the San Gabriel Mountains have undergone repeated tectonic movement and compression, resulting in a pervasive fracturing that imparts a common strength characteristic to all the rock units. The tectonic history dominates other characteristics related to age and mineralogy (Reference 2).

The fault that represents the most significant seismic hazard to Morris Dam is the Sierra Madre fault. The Sierra Madre fault is often divided into five main segments, labeled with the letters A through E, to more easily characterize this fairly complex system. The different segments appear, however, to be part of a single fault system. Morris Dam is located approximately 1.7 miles north of segment D (Duarte fault) of the Sierra Madre fault zone. Associated with the Sierra Madre fault is the Raymond fault, which trends southwest from the point of intersection of the two faults approximately 6.1 miles west of the dam. Other potential sources of seismic hazard to Morris Dam are the San Andreas and Cucamonga faults.

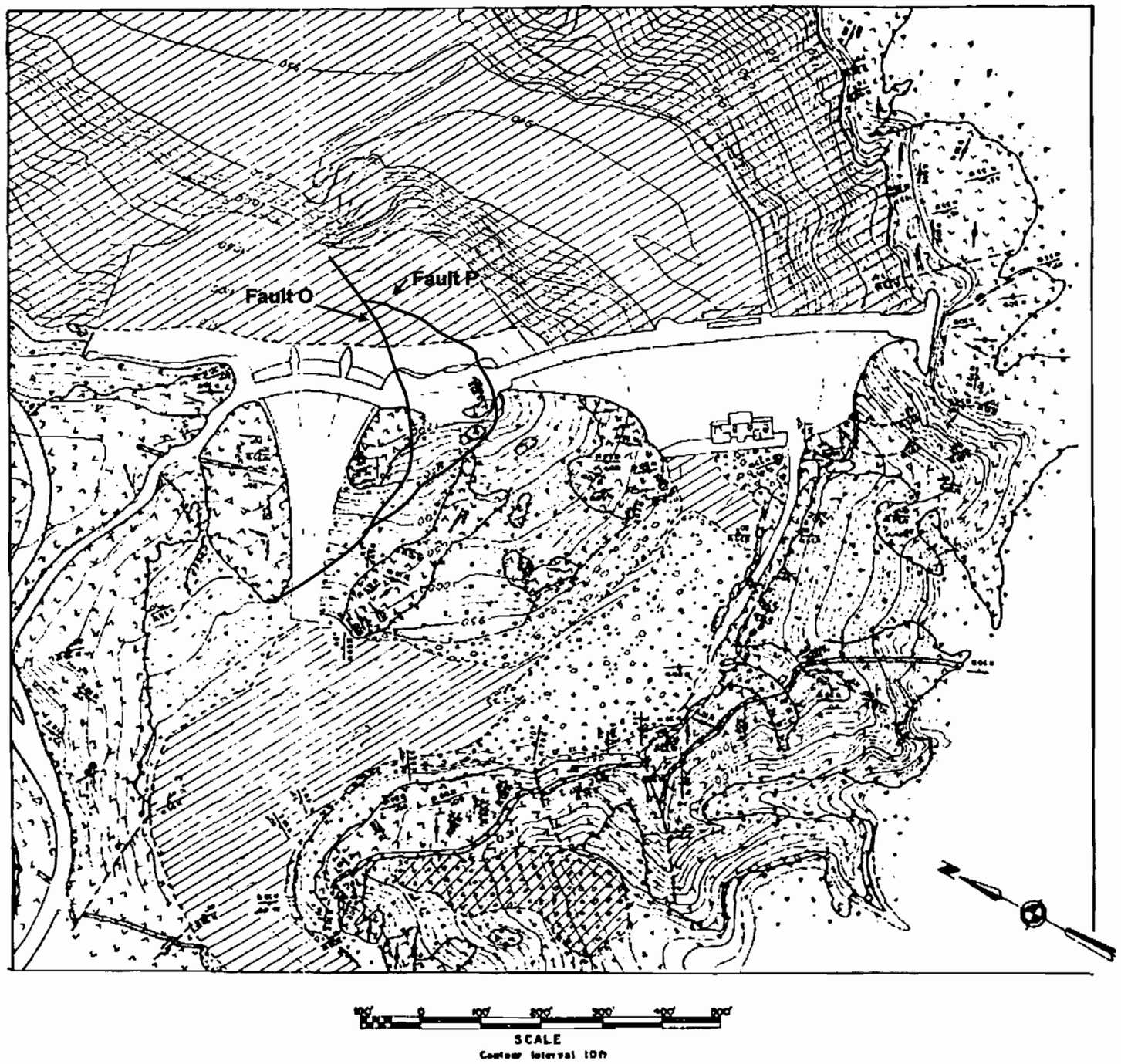
Faults crossing the actual dam site have been studied extensively prior to and during the construction of the dam, as indicated in References 3, 4, and 5. The majority of the faults strike approximately northeast, or roughly parallel with the course of the San Gabriel River. Two faults, "O" and "P," cross the area around the Control House. The approximate locations of these faults are shown on Figure 5-1.

As indicated in Reference 4, none of the faults have the characteristics that could indicate present or recent geological time activity, and a seismic event originating in these faults has not been considered in the seismic evaluation of the dam (Reference 1).

According to the USGS National Seismic Hazard Mapping Project (NSHMP), the peak ground acceleration at Morris Dam with a 10 percent probability of exceedance in 50 years is 0.7 times the acceleration of gravity. This is in agreement with the Sierra Madre event described in Reference 1. The Sierra Madre event is considered to be the primary contributor to the seismic hazard for Morris Dam.

Figure 5-1
Geologic Map

Geologic Map (1982 investigation and reanalysis of Morris Dam)



EXPLANATION

Quaternary

- Rocky Slopewash — Silty sand and rock fragments, brown, unconsolidated
- Alluvium — Silty, sandy gravel, brown, rock fragments predominantly hard and fresh, unconsolidated.
- Terrace Deposit — Gravelly, sandy silt (Clay) orange brown with hard and soft rock fragments; poorly consolidated

Miocene

- Diabasic Intrusions — Andesite, (and/or Basalt), green gray to black, hard and very hard, moderately fractured (NOTE: Andesite dikes shown only to and in fault interpretation, not all andesite outcrops are shown on map.

Jurassic(?)

- Granitic Intrusions — Chiefly Diorite, Diorite gneiss and Aplite, but includes several granitic rock types, moderately to closely fractured, moderately hard to very hard

FAULT, showing strike and dip, and relative displacement (NOTE only a representative fault pattern as related to the foundation are shown. Nearly all fractures show some displacement.)

JOINT, vertical and 70° dip. (NOTE only a representative pattern shown.)

CONTACT between Alluvium or Terrace Deposits and surrounding material

STRIKE AND DIP of Andesite dike

WATER in plunge pool and reservoir

ROCK OUTCROP

NOTE: Base map from MWD DWG NO. SG-1040-C

FIGURE 5-1
MORRIS DAM GEOLOGIC MAP

5.1.4 Geologic Hazards

5.1.4.1 Landslides. According to the Seismic Hazard Evaluation of the Azusa Quadrangle (Reference 2), Morris Dam is situated in an area where previous occurrence of landslide movement, or local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements. Shallow rock-slides appear to be the most important hazard at Morris Dam. Several slopes near the dam have been shotcreted to secure unstable zones; however, the Control House is located in an area where rockslides do not appear to be a cause for concern.

5.1.4.2 Liquefaction Potential. Liquefaction prone areas exist along the river valley downstream of the dam as indicated in Reference 2; however, they do not represent a hazard for the dam site or the Control House.

5.1.4.3 Ground Rupture. As indicated in Subsection 5.1.3, the site is not located within a designated active fault zone; therefore, the potential for ground rupture at the site is considered low.

5.2 Site-Specific Soil Conditions

5.2.1 Soil Subsurface Conditions

Subsurface soils at the proposed site generally consist of fill overlying bedrock. Asphalt pavement approximately 3-1/2 inches thick overlies most of the area near the proposed Control House. The distinct geologic units can be characterized as follows:

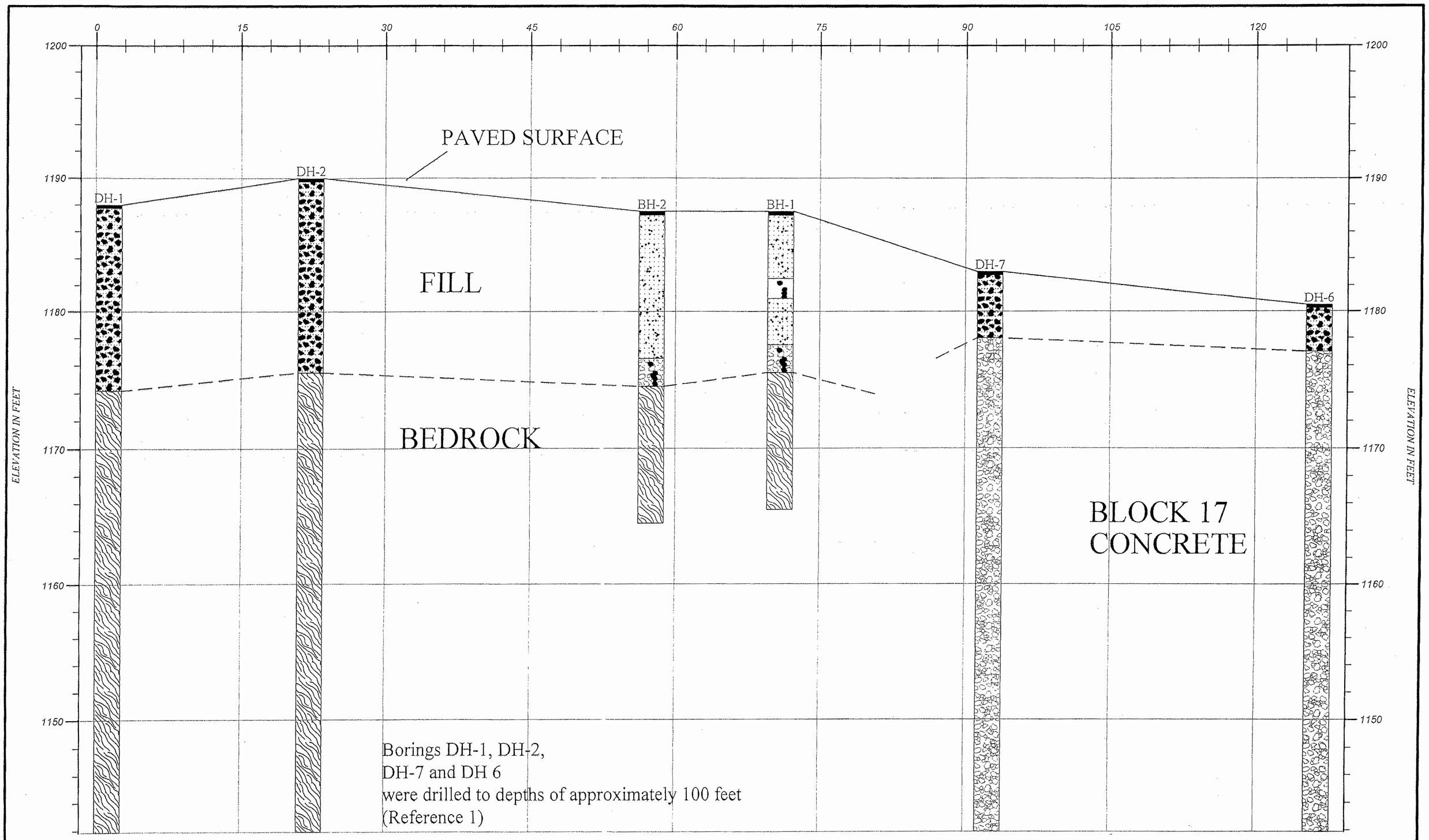
- Fill Layer--Fill soils encountered at the site consisted of a dark brown sand with gravel to boulder size rock fragments and traces of silt. The gravel/boulder content increases with depth. The fill extends to approximately 10 feet below ground surface. The blow counts indicated that the relative density of the fill ranges from dense to very dense.
- Highly Weathered Bedrock--Underlying the fill is a highly weathered bedrock/residual soil unit. The weathering process has transformed the parent rock into a mixture of sand, gravel, and cobbles that were found to a depth of approximately 12 to 13 feet below ground surface.
- Bedrock--Quartz diorite with very closely spaced fractures, moderately hard to very hard, and moderately weathered to slightly weathered. Unconfined compression tests on rock samples indicate compressive strengths ranging from 5,700 pounds per square inch (psi) to 15,100 psi. Core recoveries ranged from 25 percent to 100 percent. Rock quality designation (RQD) values ranged from 39 percent to 49 percent for the upper 10 feet of the bedrock.

A generalized soil profile for the Control House area is shown on Figure 5-2. The figure includes BH-1 and BH-2, as well as Borings DH-1, DH-2, DH-6, and DH-7 drilled during the 1982 investigation (Reference 1).

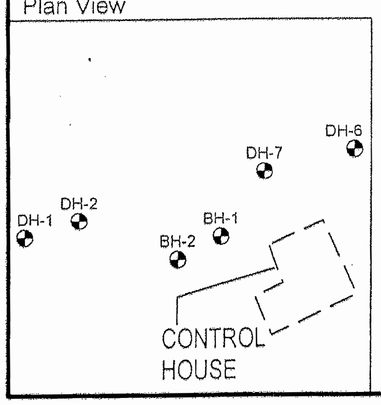
5.2.2 Groundwater Conditions

No groundwater was encountered in any of the borings during the geotechnical investigation and has not been reported in any of the previous borings drilled near the proposed Control House.

Figure 5-2
Generalized Soil Profile



Plan View



Strata symbols

- Paving
- Sand & Gravel
- Metamorphic rocks
- Gravelly Sand
- SAND/GRAVEL/COBBLES
- Cobbles
- CONCRETE

This cross section is based on interpretation of the boring logs included in this report. Unanticipated conditions may be encountered during construction because of variations that were not detected during the subsurface investigation program. No warranty for the contents of this drawing, neither expressed nor implied is made except that Black & Veatch professional services were performed in accordance with generally accepted principles and practices.

BLACK & VEATCH GENERALIZED SOIL PROFILE		
HORIZONTAL SCALE: 1"=(proportional)' VERTICAL SCALE: 1"=10'	DRAWN BY/APPROVED BY	DATE DRAWN 1/30/2003
Morris Dam		
PROJECT NO. 096231		FIGURE 5-2

6.0 Engineering Design Recommendations

Engineering design parameters and design recommendations were developed from the results of the field investigation, soil descriptions, and laboratory test results. Design recommendations are presented in the following sections.

6.1 Material Characterization

6.1.1 Index and Engineering Properties

Average design soil and bedrock properties are summarized in Tables 6-1 and 6-2, respectively. The design soil profile is based on the results of laboratory tests, blow counts, and the review of the available previous geotechnical reports at the site. The soil profile throughout the proposed site area is uniform and correlates well with previous findings.

Table 6-1
Fill Properties

Property	Value
Depth (feet)	0 – 10
Moisture Content (percent)	6.0
Total Unit Weight (pcf)	For d = 0 - 4 feet, 107; for d = 4 - 10 feet, 96
Average Blow Count Value (bpf)	>50
Angle of Internal Friction (degrees)	38
Relative Density (percent)	>90
Fines Content (percent)	5.4

Table 6-2
Bedrock Properties

Property	Value
Depth (feet)	>13
Total Unit Weight (pcf)	130
Unconfined Compressive Strength (psi)	6,800

6.2 Slope Stability Analysis

On the southwest side of the Control House, there is an existing slope faced with shotcrete. A cross section perpendicular to this slope is shown on Figure 6-1. The cross section on Figure 6-1 also shows the relative locations of columns A-2 and A-3 projected onto the cross section.

This section presents the results of a slope stability analysis performed on the shotcrete-faced slope section. The slope contains fill reportedly placed by MWD. Estimated fill properties are provided in Table 6-1. A shear strength of 25,000 psf was estimated for the shotcrete.

B&V analyzed this slope using two potential sliding surfaces. The first surface exits the slope through the shotcrete just above the toe. The second surface exits the slope through the fill just below the toe.

Both slip surfaces were analyzed to determine the static factor of safety. Both slip surfaces were also analyzed under seismic conditions using a pseudostatic slope stability analysis. In the pseudostatic analysis, a horizontal inertial force was applied to the weight of the potential sliding mass. The horizontal component was varied from 0.1g to 0.7g, where 0.7g is the estimated peak ground acceleration described in Section 5.1.3. Table 6-3 provides a summary of the slope stability analysis results along with county minimum requirements. Analysis plots are provided in Appendix D.

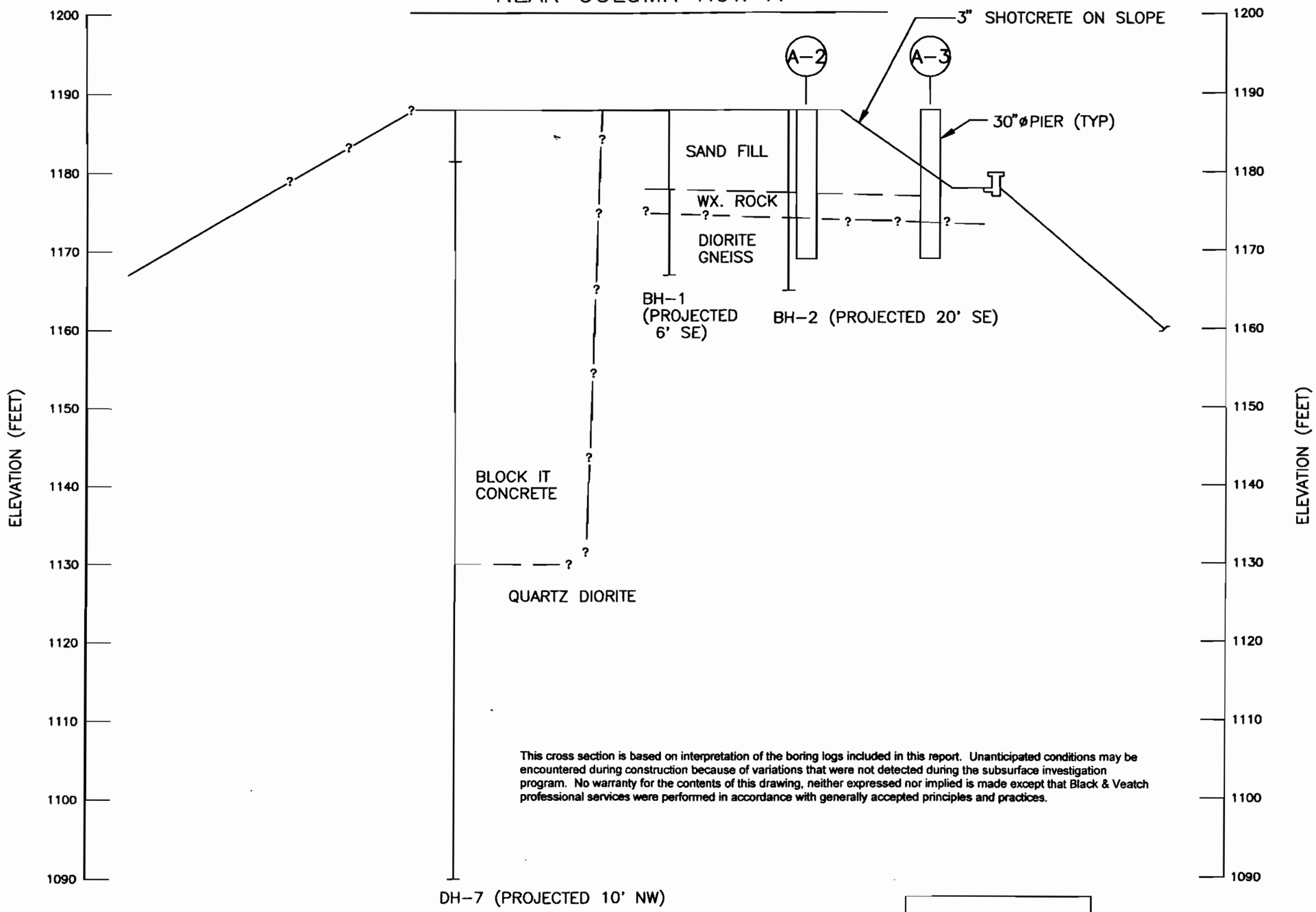
Table 6-3
Slope Stability Analysis Results

Surface	Case	Horizontal Acceleration	Calculated Factor of Safety	Required Factor of Safety
1 (Exits slope through shotcrete)	Static	-	4.2	1.5
1	Seismic	0.7g	1.4	1.1
2 (Exits through fill)	Static	-	1.9	1.5
2	Seismic	0.27g	1.0	1.1

B&V evaluated the slope's estimated movement using Makdisi and Seed's simplified method (Reference 13). The information used was a 10 foot high slope, a limiting (yield) acceleration of 0.27g, a base acceleration of 0.7g, and a magnitude 7.0 earthquake.

Figure 6-1
Section Perpendicular to Slope Near Column Row A

SECTION PERPENDICULAR TO SLOPE NEAR COLUMN ROW A



This cross section is based on interpretation of the boring logs included in this report. Unanticipated conditions may be encountered during construction because of variations that were not detected during the subsurface investigation program. No warranty for the contents of this drawing, neither expressed nor implied is made except that Black & Veatch professional services were performed in accordance with generally accepted principles and practices.

FIGURE 6-1

BQ... 9 ACA_ ..05
OUTLINE 1=1
01/30/03 11:03:43

Because of the low slope height, the base and crest accelerations will be similar, therefore, a 25 percent increase between the base and crest was assumed, making the crest acceleration 0.88g.

To get the average slice acceleration, a reduction factor based on the depth of the failure surface is used. For a full height slope failure surface, the reduction factor is 0.35, and the average slice acceleration is 0.88g x 0.35, or 0.31g. The ratio of yield acceleration to average slice acceleration is 0.27/0.31 = 0.88. Using Makdisi and Seed's chart that relates ky/ks to movement for a magnitude 7.5 earthquake indicates that movements would be expected to be less than 1 cm for a magnitude 7.5 earthquake. A significant slope movement would not be expected.

However, since the factor of safety for Surface 2 exceeds the required factor of safety, consideration of the potential effects on the piers supporting the Control House needs to be provided.

6.3 Foundations

6.3.1 Analysis

The Control House will be supported with drilled piers sitting on bedrock. Allowable end bearing capacity for piers bearing directly on rock is 40 ksf.

LPILE Plus Version 4 was used to analyze various drilled pier diameters under various loading conditions. LPILE parameters for the fill and bedrock used in the analyses are provided in Table 6-4.

Table 6-4
Drilled Piers - LPILE Parameters

Layer	Depth (in)	Soil Type	Effective Unit Weight (pci)	Horizontal Modulus of Subgrade Reaction (K_h)(pci)
Fill	0 - 156	Sand	0.059	440
Bedrock	> 156	Strong Rock	0.075	-

Two general cases were reviewed for the Control House drilled piers. The first case involved applying additional load to the drilled pier from the potential slope movement during a seismic event described in Section 6.2. The second general case analyzed the case where the pier is unsupported on the uppermost 10 feet.

Because there is a potential for 1 centimeter or less of movement for the fill slope during a seismic event, additional loading was applied to the pier from a wedge of soil with a sloping surface. In order to determine the force to add, LPILE was run with a

short pier in the fill with a boundary condition of 1 centimeter displacement under free head conditions. The resulting ultimate soil resistances were then input as distributed loads onto the pile and LPILE was run to determine the allowable lateral load on the pier.

The second case involved running LPILE for several different pier diameters. The allowable lateral load was developed by determining the lateral load required to move the pier about 0.25 inch, and checking the maximum moment in the pier for that lateral load. Estimated steel reinforcement of approximately 0.5 percent of the gross area was provided for each section. Because of the unsupported length, a fixed head condition at the top of the pier was required to develop the loads. Allowable lateral loads, maximum moments, and recommended embedment depths for the pier sizes analyzed are shown in Table 6-5. Analysis details are provided in Appendix E. These analyses should be used as a guide in designing the pier foundations. Additional analyses should be performed once actual pier loads are known.

Table 6-5
Allowable Lateral Loads for Drilled Piers with Fixed Head Conditions

Case	Pier Diameter (inches)	Allowable Lateral Load (kips)	Maximum Moment (in.-kips)	Required Embedment in Rock (ft)
Addt'l Distributed Load	30	20	1640	5
10' Unsupported	30	20	1600	5

6.3.2 Drilled Pier Design and Construction Recommendations

Because of the unsupported length of the piers at Columns A-3, B-3, and C-3, the piles should be designed for fixed head conditions. Fixed head conditions require the pier cap connection to develop the full moment of the pier head into the pier cap, preventing rotation of the pier head.

At the time of this report, pier loads were not specifically known. The pier structural designer should consult with the geotechnical engineer once final loading conditions are known so that a final confirmation analysis can be performed.

As noted in Section 5.1.3, two inactive faults (Faults "O" and "P") cross the area around the Control House. The approximate locations of these faults are provided on Figures 4-1 and 5-1. As shown on Figure 4-1, the trace of Fault P appears to intersect the footprint of the Control House. The faults are described in Reference 1 as having gouge zones ranging from a fraction of an inch to about 5 feet in thickness. The zones are also described as usually containing recemented breccia.

Considering that drilled pier installations may encounter the fault zone, some installation precautions should be provided to ensure that design conditions are met in the pier installation. These recommendations are outlined as follows:

- Each pier should have a minimum penetration of 5 feet into rock.
- A full length pilot hole, continuously cored in rock, should be drilled at each pier location to elevation 1,160. Each pilot hole should be grouted upon completion.
- If unconsolidated material is encountered in the pilot hole, the pier should be deepened to provide the required axial load for shaft resistance in the rock, with no consideration of base resistance. The shaft resistance should be taken as 5 ksf in rock. Shaft resistance in the unconsolidated material should be discounted.
- The pilot hole and pier hole drilling must be inspected by a licensed geotechnical engineer and a licensed engineering geologist. The inspectors should also descend into the pier holes to examine the proposed bearing surface.
- The pier hole must be approved by the inspectors prior to pouring concrete.
- Inspections must be made by a licensed engineering geologist and a licensed soils engineer. Monthly inspection reports must be submitted directly to the Geology and Soils Section by the engineering geologist and soils engineer. The engineering geologist shall be onsite during all foundation drilling operations to completely log all borings, record depth to bedrock and verify embedment depths into bedrock.

6.4 Near Source Factors

Southern California is in Seismic Zone 4 according to the 1997 Uniform Building Code (Reference 10). The Seismic Zone Factor Z is 0.40 for Seismic Zone 4. Based on the subsurface stratigraphy, the site soil profile is characterized as S_B. Soil profile type S_B was selected based on shear wave velocity measurements taken in the west abutment of the dam (Reference 1), which indicate values ranging from 2,370 feet per second (fps) in the near surface to 6,400 fps under the dam.

The near source factors are determined in accordance with the 1997 UBC Tables 16-S and 16-T and are based on the distance to a known Holocene active fault near-source zone and the classification of the fault. A Holocene fault is a fault that has had a tectonic displacement in the past 11,000 years.

The ICBO "Map of Known Active Fault Near Source Zones in California and Adjacent Portions of Nevada" (Reference 7) shows that Morris Dam is within 2 kilom-

eters of a Type B fault (Sierra Madre fault); therefore, in accordance with Tables 16-S and 16-7 of the Uniform Building Code, the near-source factors, N_a and N_v, have values of 1.3 and 1.6, respectively. Based on Tables 16-Q and 16-R of the California Building Code, seismic coefficients C_a and C_v have values of 0.40 N_a and 0.40 N_v, or 0.52 and 0.64, respectively. Figure 6-2 shows the design response spectra for Morris Dam.

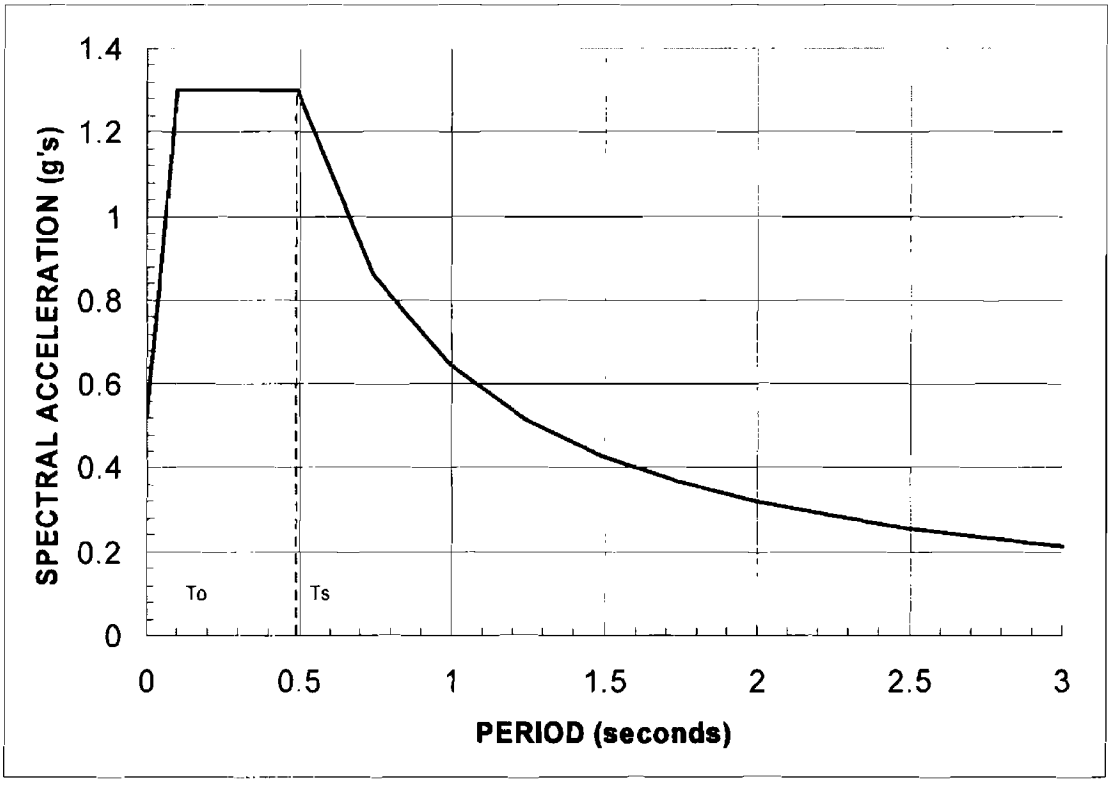


Figure 6-2
Design Response Spectra

6.5 Corrosion Potential

As indicated in Reference 12, soil is considered corrosive if any one of the following indicators show critical values:

- Soil resistivity below 2,000 ohm-cm.
- pH values below 4.0.
- Chloride content above 100 ppm.
- Sulfate content above 200 ppm.

The laboratory soil resistivity test performed on a select soil sample indicates soil resistivity values of 36,000 ohm-cm. Chemical analysis tests on select soil samples indicate a pH of 8.6. Chloride content was found to be approximately 0.5 part per million (ppm). Sulfate content was found to be 1.9 ppm.

Based on these results, the site soils are noncorrosive. Type I cement should be used for foundation concrete as recommended in ACI 318-95 - Building Code Requirements for Structural Concrete (Reference 10). Soil resistivity and chemical test data are included in Appendix B.

7.0 Additional Recommendations

7.1 Earthwork

7.1.1 Fill Materials

Fill material shall be earth only and shall be free from rocks or stones larger than 6 inches in their greatest dimension, brush, stumps, logs, roots, debris, and organic or other deleterious materials. In general, the fill material should have a liquid limit less than 40 percent and a plasticity index less than 15 percent.

7.1.2 Compaction Requirements

Compaction backfills at the site should be categorized as structural fill (beneath structures or roads), structure backfill (on sides of structures) or general fill (fill located away from structures at a distance at least equal to twice the fill thickness).

Structural fill and structure backfill should be placed in uniform, horizontal, loose lifts, moisture conditioned as necessary and compacted by mechanical means to at least 95 percent of maximum dry density as determined by ASTM D1557 (Modified Proctor). Moisture content should fall within the range of ±2 to plus 2 percent of optimum moisture content. Backfill lifts should be limited to 8 inches or less in uncompacted lift thickness. Particles larger than 3 inches should be excluded from the top 1 foot of fill.

General site fill should be compacted to 95 percent of maximum dry density as determined by ASTM D1557 (Modified Proctor). Moisture content should fall within the range of ±2 percent of optimum moisture content. Backfill lifts should be limited to 8 inches or less in compacted thickness.

Pavements shall be designed in accordance with the specifications. A CBR value of 36 should be used for pavement design based on the CBR test performed.

7.2 Temporary Excavations

All temporary excavations, such as those required for utility trenches, should be constructed in accordance with CAL-OSHA regulations. Excavation spoils should not be stockpiled adjacent to cut slopes. A minimum setback equal to the depth of the excavation should be maintained between the top of the cut slope and the toe of the spoil piles. Temporary excavations more than 5 feet deep will require sloped sides or temporary support. Slopes on temporary excavations less than 20 feet deep should slope at a grade of 1.5H:1V. Exposed excavations should be protected from erosion and saturation by rainfall and runoff using berms, diversion ditches, plastic sheeting, and/or other suitable methods.

No trench or foundation excavations deeper than 20 feet are expected to be performed at this site.

Appendix A
Boring Logs

8.0 References

1. Final Report on Investigation and Reanalysis of Morris Dam, Vols I and II. Report prepared by International Engineering Company, Inc., for the Los Angeles County Flood Control District, October 1982.

2. *Seismic Hazard Evaluation of the Azusa 7.5-Minute Quadrangle, Los Angeles County, California.* California Department of Conservation, Division of Mines and Geology, Open File Report 98-12, Revised 1998.

3. Technical Report on the Construction of Morris Dam. Report prepared by the Pasadena Water Department, October 1935.

4. Second Report on the Geology of The Pine Canyon No. 2 Dam Site. F. L. Ransome, Report Number 263, May 1930.

5. Final Report on the Geology of the Pine Canyon No. 2 Dam Site. F. L. Ransome, Report Number 263, August 1930.

6. Final Geological Report on Morris Dam. F. L. Ransome and J. P Buwalda, March 1935.

7. *Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada.* California Department of Conservation, Division of Mines and Geology, published by the International Conference of Building Officials, February 1998.

8. USGS National Seismic Mapping Project, http://eqint.cr.usgs.gov/eq/html/lookup.shtml (input lat 34°10'26'', long -117°52'44'').

9. 1998 Uniform Building Code, Chapter 16.

10. Building Code Requirements for Structural Concrete (ACI 318-95) and Commentary (ACI 318R-95), American Concrete Institute, 1995.

11. County of Los Angeles Department of Public Works, "Manual for Preparation of Geotechnical Reports," May 2001.

12. FHWA, Publication No. FHWA-HI-97-013, "Design and Construction of Driven Pile Foundations," December 1996.

13. Makdisi and Seed, "Simplified Procedure for Estimating Dam and Embankment Earthquake-Induced Deformations," ASCE Journal of the Geotechnical Engineering Division, July 1978.

BLACK & VEATCH

BORING LOG

BORING NO. BH-1

CLIENT	PROJECT	PROJECT NO.
Los Angeles County Department of Public Works	Morris Dam	096231

PROJECT LOCATION	COORDINATES	GROUND ELEVATION (DATUM)	TOTAL DEPTH
Azusa, CA	N 0.0 E 72.0	1187.5 ft (MSL)	21.8 (FEET)

SURFACE CONDITIONS	COORDINATE SYSTEM	DATE START	DATE FINISHED
Paved surface (dam west abutment)		10/10/02	10/11/02

LOGGED BY	CHECKED BY	APPROVED BY
Boris W Leoro	Boris W Leoro	Mark M Petersen

SAMPLING							CORING											
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH (FEET)	ELEVATION (FEET)	CLASSIFICATION OF MATERIALS	REMARKS
CA	1	12	40	35	75	1.5								0		ASPHALT PAVEMENT (3 1/2 inches)	
																0.3 SAND; brown; dense to very dense;moist; fine to coarse grained; subangular; well graded; with gravel and cobbles; trace silt	Boring advanced with 5 5/8" tri-cone roller bit using compressed air.
														2	1186		
														4	1184		
														6	1182		boulder size rock from 5' to 6.5'
CA	2	19	45	50/4"	>50	0.4								8	1180	grading with increasing gravel content	gasoline/diesel smell emanated from borehole. Possible hydrocarbon spill.
															1178		
CA	3	22	50/3"	–	>50	0.5								10		10.0 SAND/GRAVEL/COBBLES (highly weathered rock)	decayed wood at 11 feet
															1176		
2.0	1	1.5	12.0 1.5	1.0	100	66								12		12.0 DIORITE GNEISS; gray; fine grained; slightly to moderately weathered; very strong rock; very hard	Boring continued with NX size double tube core barrel with diamond bit using water as drilling fluid.
2.0	2	1.0	13.5 1.0	0.92	100	92								14	1174	60 degree fracture at 14'	
2.0	3	3.0	14.5 2.3	1.75	77	58								16	1172	60 degree fracture at 15' and 17'	
2.0	4	4.25	17.5 3.0	1.33	71	31								18	1170	highly fractured from 17.5' to 18'	
														20	1168		
															1166	intensely fractured from 21' to 21.75'	
														22		21.8	Bottom of boring at 21.75 feet. Groundwater not encountered. Boring backfilled to ground surface with cement-bentinite grout.
														24	1164		
														26	1162		
														28	1160		
														30	1158		

BLACK & VEATCH

BORING LOG

BORING NO. BH-2

CLIENT	PROJECT	PROJECT NO.
Los Angeles County Department of Public Works	Morris Dam	096231

PROJECT LOCATION	COORDINATES	GROUND ELEVATION (DATUM)	TOTAL DEPTH
Azusa, CA	N -8.0 E 56.0	1187.5 ft (MSL)	23.5 (FEET)

SURFACE CONDITIONS	COORDINATE SYSTEM	DATE START	DATE FINISHED
Paved Surface (dam west abutment)		09/10/02	09/10/02

LOGGED BY	CHECKED BY	APPROVED BY
Boris W Leoro	Boris W Leoro	Mark M Petersen

SAMPLING							CORING							DEPTH (FEET)	SAMPLE TYPE	ELEVATION (FEET)	GRAPHIC LOG	CLASSIFICATION OF MATERIALS	REMARKS
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD						
														0				ASPHALT PAVEMENT (3 1/2 inches) 0.3	Boring advanced with 5 5/8" tri-cone roller bit using compressed air.
														2		1186		SAND; brown; dense to very dense;moist; fine to coarse grained; subangular; well graded; with gravel and cobbles; trace silt	
														4		1184			
CA	1	78/6"	–	–	>50	0.5								6		1182			
														8		1180			
														10		1178			
CA	2	6	50/4"	–	>50	0.5												grading with asphaltic material at bottom of sample	
							2.0	1	2.0	11.0 0.5	0.0	25	0	12		1176		11.0 SAND/ GRAVEL/ COBBLES (highly weathered rock)	Boring continued with NX size double tube core barrel with diamond bit using water as drilling fluid.
							2.0	2	3	13.0 2.0	0.0	66	0	14		1174		13.0 DIORITE GNEISS; gray; fine grained; extremely weathered to highly weathered; weak rock; moderately hard	
														16		1172		grading to moderately weathered at 14 feet	
							2.0	3	2.75	16.0 2.0	1.3	73	48	18		1170		60 degree fracture at 17.2' 30 degree fracture at 18'	
							2.0	4	4.75	18.75 4.75	2.6	100	54	20		1168		grading to slightly weathered 60 degree fracture at 20'	
														22		1166		highly fractured from 22' to 23.5'	
														24		1164			Bottom of boring at 23.5 feet. Groundwater not encountered. Boring backfilled to ground surface with cement-bentinite grout.
														26		1162			
														28		1160			
														30		1158			

11/12/2002 3:27 PM MORRIS DAM

Appendix B
Laboratory Test Results

November 6, 2002

Boris Leoro
Black & Veatch
8400 Ward Parkway
Kansas City, MO 64114

Re: Morris Dam
Project #96231
Lab #38195 Maxim #3390031

REPORT OF TEST RESULTS

Material ID: Soil Samples
Sample ID: Bag from 0'-5'

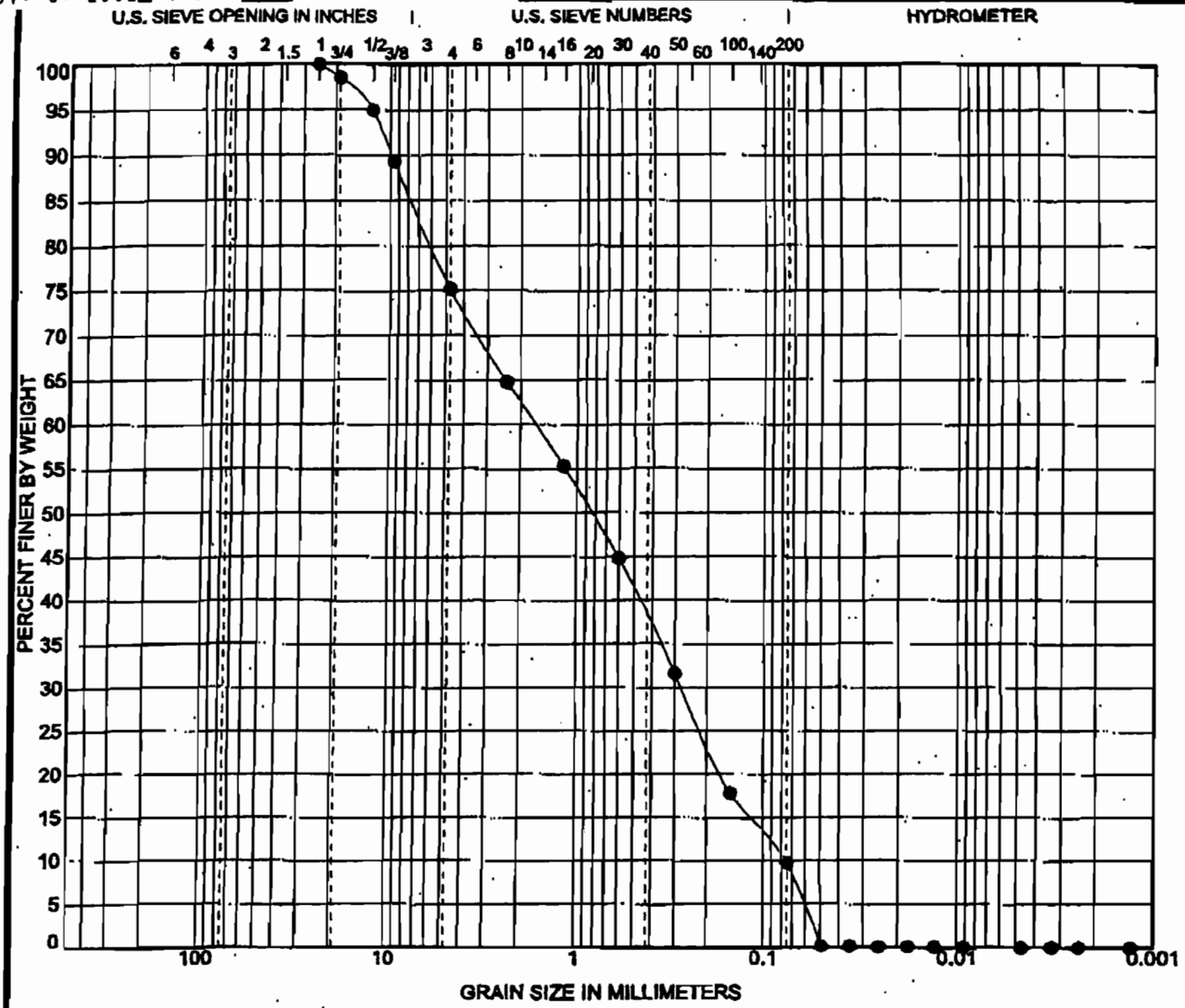
Sieve Size Analysis – ASTM C117, C136

Sieve Size	Opening (mm)	% Retained	% Passing
1"	25.0	0	100
3/4"	19.0	1.5	98.5
1/2"	12.5	5.0	95.0
3/8"	9.5	10.7	89.3
No. 4	4.75	24.8	75.2
No. 8	2.36	35.2	64.8
No. 16	1.18	44.7	55.3
No. 30	0.600	55.2	44.8
No. 50	0.300	68.4	31.6
No. 100	0.150	82.2	17.8
No. 200	0.075	90.2	9.8

Chemical Analysis
Resistivity ASTM D2216, G57
Sample location: Bag depth from 0'-5'
Sample description: Silty sand with gravel, SM
Electrode spacing, ft. = .108
Average measured resistance = 1770
Average Resistivity, /ft = 1200
Moisture content = 4.9
Dry density = 120.4

Chloride 0.531 mg/kg
Sulfate 1.92 mg/kg
PH 8.59 su

 Results relate only to sample tested. Reports shall not be reproduced except in full without the written approval of Maxim.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● Bag	0.0'-5.0'	SW-SM Sand, some gravel, trace silt, brown				0.60	21.71

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	Specific Gravity
● Bag	0.0'-5.0'	25	1.663	0.277	0.077	24.8	65.4	9.7	0.0	

GRAIN SIZE 2 3390031.GPJ US LAB.GDT 11/5/02

MAXIM Technologies, Inc.
721 S. Packard
Kansas City, KS 66105
Telephone: 913-321-8100
Fax: 913-321-8181

GRAIN SIZE DISTRIBUTION

Project: Black & Veatch

Location: Morris Dam

Number: 3390031

MAXIM TECHNOLOGIES INC

Maxim Technologies Inc.
721 South Packard
Kansas City, Kansas 66105
Telephone: (913) 321-8100
FAX: (913) 321-8181

REPORT OF MOISTURE-DENSITY RELATIONS

CLIENT: BLACK & VEATCH
ATTN: BORIS LEORO
8400 WARD PARKWAY
KANSAS CITY, MO 64114

PROJECT: BLACK & VEATCH PROJ #96231
LABORATORY TESTING

PAGE 1 OF 1

PROJECT NO.: 3390031
REPORT NO.: 38110
DATE OF SERVICE: 10/28/2002
AUTHORIZATION:
REPORT DATE: 11/01/2002

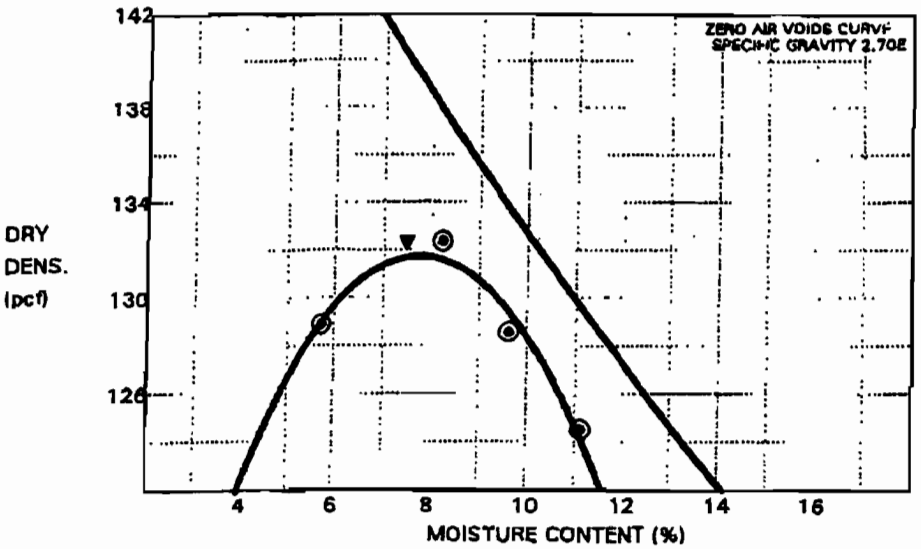
SERVICES: Obtain sample of material used for construction, prepare samples and perform moisture-density relations test to establish the maximum density and optimum moisture of the material.

PROJECT DATA

CONTRACTOR: BLACK & VEATCH
DATE SAMPLED: 10/28/2002
SAMPLED BY: Ahmad Deep, EIT
TEST FOR: Modified Proctor
SAMPLE LOCATION: Bag, 0'-5.0'

TEST DATE: 11/04/2002
MATERIAL: Silty Sand, w/gravel
CLASSIFICATION: SM-SW
MATERIAL PREPARATION METHOD: Moist
RAMMER TYPE: Mechanical
METHOD OF TEST: ASTM D1557, Method C

REPORT OF TESTS



MAXIMUM DENSITY, PCF: 132.0

OPTIMUM MOISTURE (%): 7.5

E = Estimated Value

Technician: Ahmad Deep, EIT

Report Distribution:
(1) BLACK & VEATCH

MAXIM TECHNOLOGIES INC.

Ahmad Deep, EIT

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MAXIM TECHNOLOGIES INC®
A TETRA TECH COMPANY

Boris Leoro
Black & Veatch
Morris Dam
Project #96231

Specimen ID	Soil Classification	% Moisture	Dry Density, pcf.	Unconfined compression, qu (psi)
BH-1 (2.5'-3')	SM	4.8	100.6	—
BH-1 (3'-3.5')	SM	6.1	103.0	—
BH-1 (6.5'-8')	SM	1.9	—	—
BH-2 (5'-5.5')	SM	6.6	90.1	—
BH-2 (10'-11')	SM	7.3	90.4	—
BH-1 @ 12.5'	Rock	—	—	15140
BH-1 @ 14.5'	Rock	—	—	7900
BH-2 @ 16.5'	Rock	—	—	5710
BH-2 @ 21'	Rock	—	—	11740

Thank you for your continued interest in Maxim Technologies, Inc.®

Respectfully submitted,
MAXIM TECHNOLOGIES, INC.®

Ahmad Deep
Laboratory Supervisor

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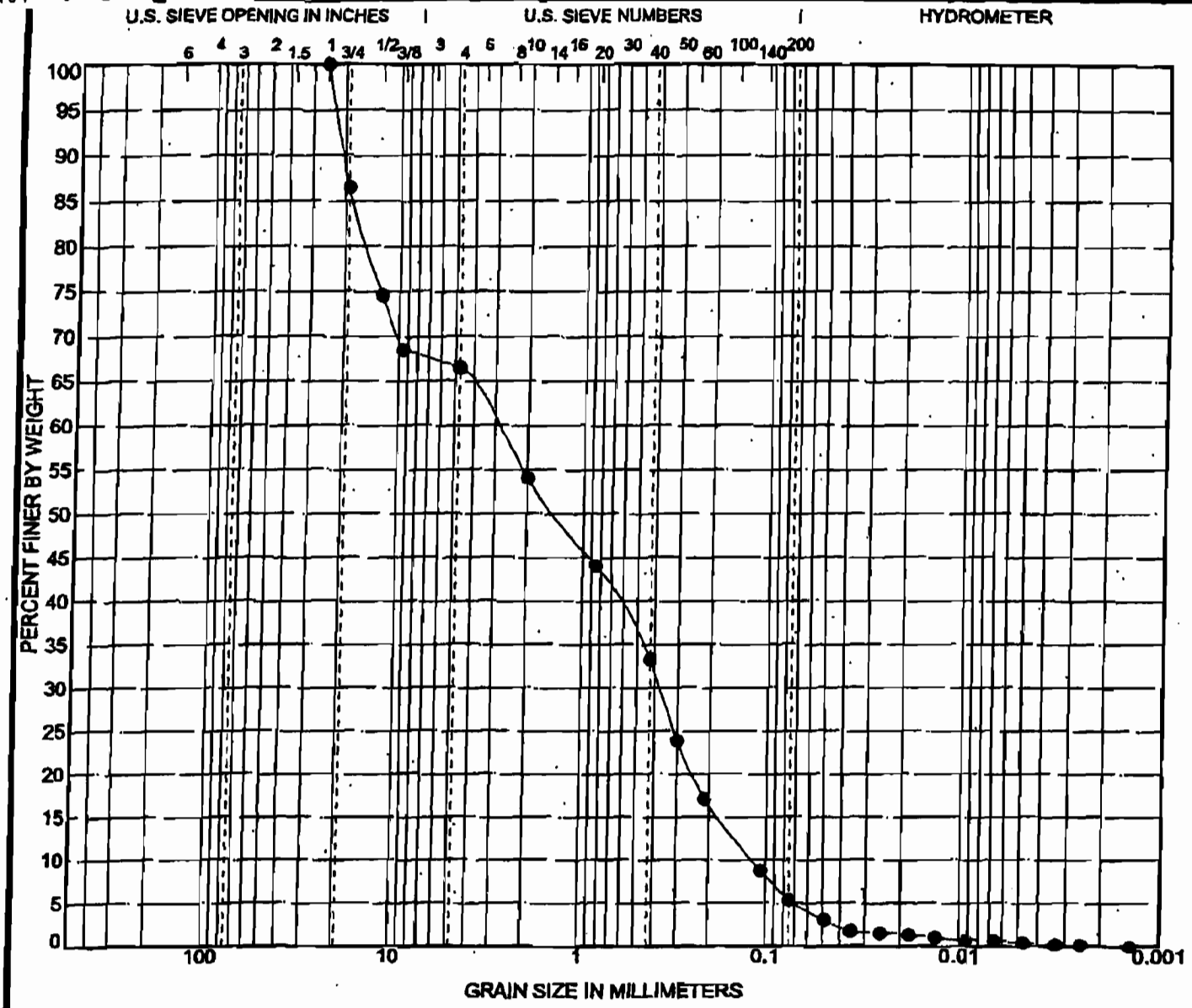


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● BH-1	2.5'-4.0'	SW-SM Sand, some gravel, trace silt, brown				0.40	25.72

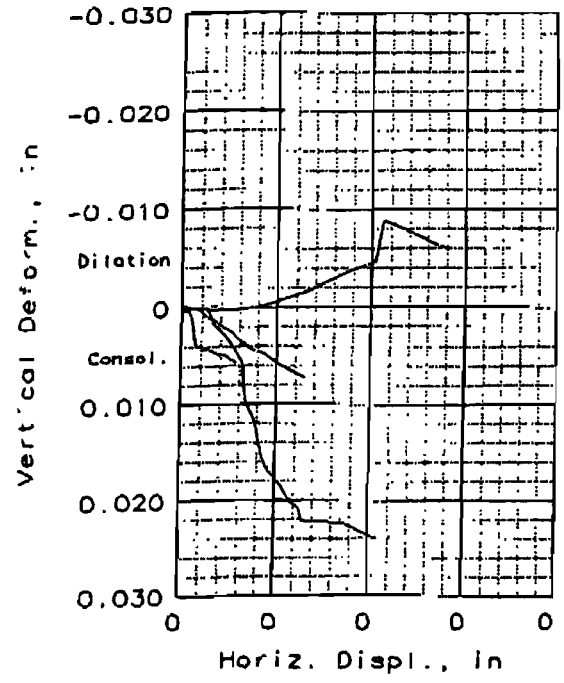
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	Specific Gravity
● BH-1	2.5'-4.0'	25	3.028	0.377	0.118	33.5	61.1	4.9	0.5	2.68

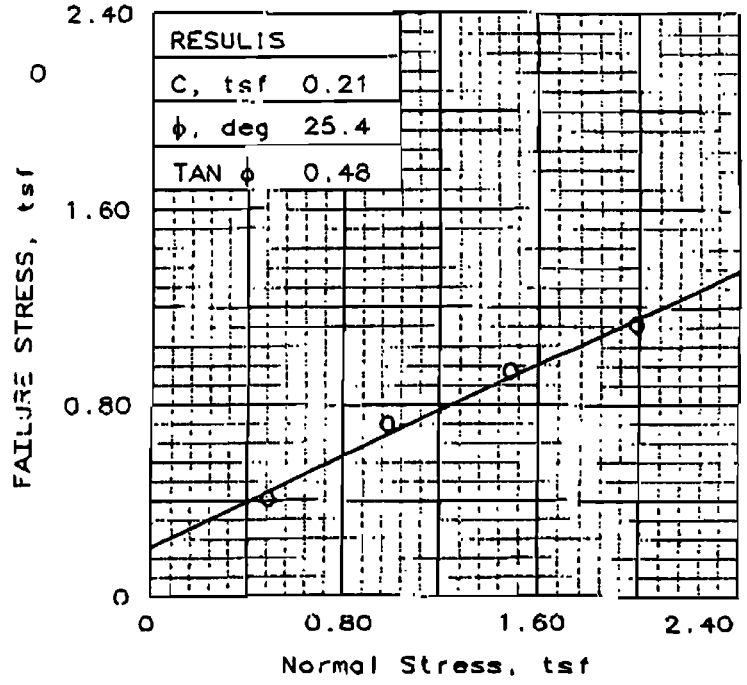
GRAIN SIZE 2 3390031.GPJ US LAB.GDT 11/8/02

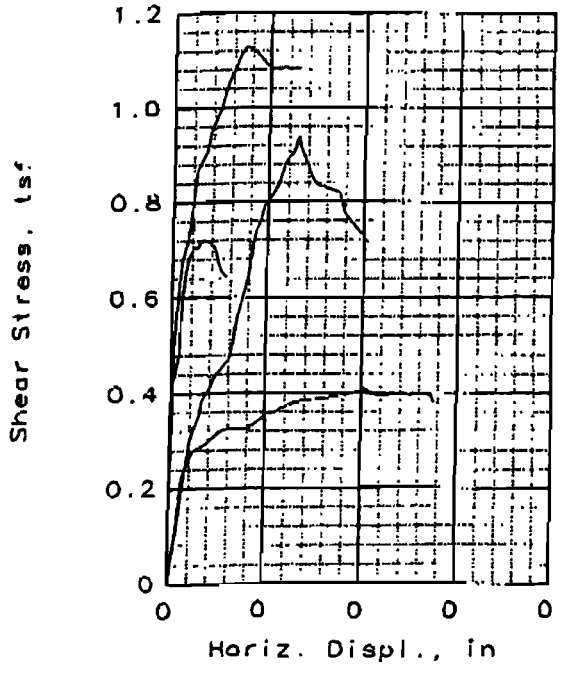
MAXIM Technologies, Inc.
721 S. Packard
Kansas City, KS 66105
Telephone: 913-321-8100
Fax: 913-321-8181

GRAIN SIZE DISTRIBUTION

Project: Black & Veatch
Location: Morris Dam
Number: 3390031







SAMPLE NO.:		1	2	3	4
INITIAL	WATER CONTENT, %	5.3	5.3	5.7	5.2
	DRY DENSITY, pcf	112.2	106.6	105.9	108.8
	SATURATION, %	29.2	25.1	26.4	26.1
	VOID RATIO	0.491	0.569	0.580	0.538
	DIAMETER, in	2.50	2.50	2.50	2.50
	HEIGHT, in	1.63	1.63	1.63	1.63
AT TEST	WATER CONTENT, %	15.2	15.6	14.9	14.0
	DRY DENSITY, pcf	113.1	112.4	111.3	116.0
	SATURATION, %	84.7	85.8	79.1	84.6
	VOID RATIO	0.480	0.489	0.503	0.443
	DIAMETER, in	2.50	2.50	2.50	2.50
	HEIGHT, in	1.61	1.54	1.55	1.52
NORMAL STRESS, tsf		0.50	1.00	1.50	2.00
FAILURE STRESS, tsf		0.41	0.72	0.94	1.13
DISPLACEMENT, in		0.01	0.00	0.01	0.00
ULTIMATE STRESS, tsf		0.41	0.72	0.94	1.13
DISPLACEMENT, in		0.01	0.00	0.01	0.00
Strain rate, in/min		0.0010	0.0010	0.0010	0.0010

SAMPLE TYPE: remolded
DESCRIPTION: Gravelly Sand, trace clay, dark gray

SPECIFIC GRAVITY= 2.68
REMARKS:

CLIENT: Black & Veatch

PROJECT: Morris Dam

SAMPLE LOCATION: BH-1 2.5'-4.0'

PROJ. NO.: 3390031 DATE: 11/11/2002

DIRECT SHEAR TEST REPORT

MAXIM TECHNOLOGIES, INC.

Fig. No.:

DIRECT SHEAR TEST 11-12-1902

Project and Sample Data

Date: 11/11/2002
Client: Black & Veatch
Project: Morris Dam
Sample location: BH-1 2.5'-4.0'
Sample description: Gravelly Sand, trace clay, dark gray
Remarks:

Fig no.: 2nd page Fig no. (if applicable):
Type of sample: remolded
Specific gravity= 2.68 LL= PL= PI=

Specimen Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Wt. moist soil and tare:	265.550		178.260
Wt. dry soil and tare:	256.010		165.000
Wt. of tare:	77.530		77.530
Weight, gms:	247.5		
Diameter, in:	2.500	2.500	
Area, in²:	4.909	4.909	
Height, in:	1.625	1.613	
Net decrease in height, in:		0.012	
% Moisture:	5.3	15.2	15.2
Wet density, pcf:	118.2	130.2	
Dry density, pcf:	112.2	113.1	
Void ratio:	0.4911	0.4798	
% Saturation:	29.2	84.7	

Test Readings Data for Specimen No. 1

Deformation dial constant= 0.0001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 1 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Normal Stress = 0.500 tsf
Strain rate, in/min = 0.0010
FAILURE STRESS = 0.411 tsf at reading no. 10
ULTIMATE STRESS = 0.411 tsf at reading no. 10

No.	HORIZONTAL Dial Reading	HORIZONTAL Def. in	Load Dial Units	Load lbs	Shear Stress tsf	VERTICAL Dial Reading	VERTICAL Def. in
0	0	0.000	0.00	0.0	0.000	0	0.0000
1	1	0.000	1.00	1.0	0.015	0	0.0000
2	6	0.001	15.00	15.0	0.220	-2	0.0002
3	12	0.001	19.00	19.0	0.279	-2	0.0002
4	19	0.002	20.00	20.0	0.293	-3	0.0003
5	27	0.003	22.00	22.0	0.323	-3	0.0003
6	40	0.004	22.00	22.0	0.323	0	0.0000
7	50	0.005	24.00	24.0	0.352	6	-0.0006
8	66	0.007	26.00	26.0	0.381	16	-0.0016
9	91	0.009	27.00	27.0	0.396	39	-0.0039

Test Readings Data for Specimen No. 1

No.	HORIZONTAL Dial Reading	HORIZONTAL Def. in	Load Dial Units	Load lbs	Shear Stress tsf	VERTICAL Dial Reading	VERTICAL Def. in
10	102	0.010	28.00	28.0	0.411	45	-0.0045
11	106	0.011	27.00	27.0	0.396	89	-0.0089
12	137	0.014	27.00	27.0	0.396	62	-0.0062
13	138	0.014	26.00	26.0	0.381	62	-0.0062

Specimen Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Wt. moist soil and tare:	155.990		178.700
Wt. dry soil and tare:	150.130		159.950
Wt. of tare:	40.050		40.050
Weight, gms:	235.1		
Diameter, in:	2.500	2.500	
Area, in²:	4.909	4.909	
Height, in:	1.625	1.541	
Net decrease in height, in:		0.084	
% Moisture:	5.3	15.6	15.6
Wet density, pcf:	112.3	130.0	
Dry density, pcf:	106.6	112.4	
Void ratio:	0.5693	0.4885	
% Saturation:	25.1	85.8	

Test Readings Data for Specimen No. 2

Deformation dial constant= 0.0001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 1 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Normal Stress = 1.000 tsf
Strain rate, in/min = 0.0010
FAILURE STRESS = 0.719 tsf at reading no. 10
ULTIMATE STRESS = 0.719 tsf at reading no. 10

No.	HORIZONTAL Dial Reading	Def. in	Load Dial Units	Load lbs	Shear Stress tsf	VERTICAL Dial Reading	Def. in
0	0	0.000	0.00	0.0	0.000	0	0.0000
1	1	0.000	29.00	29.0	0.425	-3	0.0003
2	4	0.000	33.00	33.0	0.484	-4	0.0004
3	5	0.001	37.00	37.0	0.543	-9	0.0009
4	6	0.001	42.00	42.0	0.616	-19	0.0019
5	7	0.001	44.00	44.0	0.645	-35	0.0035
6	8	0.001	46.00	46.0	0.675	-40	0.0040
7	9	0.001	47.00	47.0	0.689	-41	0.0041
8	11	0.001	48.00	48.0	0.704	-42	0.0042
9	13	0.001	48.00	48.0	0.704	-43	0.0043
10	15	0.002	49.00	49.0	0.719	-44	0.0044
11	19	0.002	49.00	49.0	0.719	-48	0.0048
12	22	0.002	48.00	48.0	0.704	-48	0.0048
13	25	0.003	45.00	45.0	0.660	-54	0.0054
14	28	0.003	44.00	44.0	0.645	-56	0.0056

Specimen Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Wt. moist soil and tare:	145.630		291.220
Wt. dry soil and tare:	139.910		258.760
Wt. of tare:	39.980		40.240
Weight, gms:	234.4		
Diameter, in:	2.500	2.500	
Area, in²:	4.909	4.909	
Height, in:	1.625	1.546	
Net decrease in height, in:		0.079	
% Moisture:	5.7	14.9	14.9
Wet density, pcf:	111.9	127.8	
Dry density, pcf:	105.9	111.3	
Void ratio:	0.5801	0.5032	
% Saturation:	26.4	79.1	

Test Readings Data for Specimen No. 3

Deformation dial constant= 0.0001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 1 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Normal Stress = 1.500 tsf
Strain rate, in/min = 0.0010
FAILURE STRESS = 0.939 tsf at reading no. 23
ULTIMATE STRESS = 0.939 tsf at reading no. 23

No.	HORIZONTAL Dial Reading	HORIZONTAL Def. in	Load Dial Units	Load lbs	Shear Stress tsf	VERTICAL Dial Reading	VERTICAL Def. in
0	0	0.000	0.00	0.0	0.000	0	0.0000
1	10	0.001	20.00	20.0	0.293	0	0.0000
2	12	0.001	22.00	22.0	0.323	0	0.0000
3	15	0.002	24.00	24.0	0.352	-9	0.0009
4	16	0.002	26.00	26.0	0.381	-17	0.0017
5	20	0.002	28.00	28.0	0.411	-24	0.0024
6	23	0.002	30.00	30.0	0.440	-31	0.0031
7	30	0.003	32.00	32.0	0.469	-50	0.0050
8	32	0.003	34.00	34.0	0.499	-57	0.0057
9	33	0.003	36.00	36.0	0.528	-83	0.0083
10	34	0.003	38.00	38.0	0.557	-97	0.0097
11	36	0.004	40.00	40.0	0.587	-105	0.0105
12	38	0.004	42.00	42.0	0.616	-114	0.0114
13	40	0.004	44.00	44.0	0.645	-126	0.0126
14	41	0.004	46.00	46.0	0.675	-136	0.0136
15	42	0.004	48.00	48.0	0.704	-142	0.0142
16	43	0.004	50.00	50.0	0.733	-152	0.0152
17	46	0.005	52.00	52.0	0.763	-166	0.0166
18	48	0.005	54.00	54.0	0.792	-172	0.0172
19	53	0.005	56.00	56.0	0.821	-183	0.0183
20	56	0.006	58.00	58.0	0.851	-192	0.0192
21	58	0.006	60.00	60.0	0.880	-200	0.0200
22	63	0.006	62.00	62.0	0.909	-208	0.0208
23	65	0.007	64.00	64.0	0.939	-221	0.0221
24	67	0.007	62.00	62.0	0.909	-222	0.0222
25	70	0.007	60.00	60.0	0.880	-221	0.0221

Test Readings Data for Specimen No. 3

No.	HORIZONTAL Dial Reading	HORIZONTAL Def. in	Load Dial Units	Load lbs	Shear Stress tsf	VERTICAL Dial Reading	VERTICAL Def. in
26	73	0.007	58.00	58.0	0.851	-222	0.0222
27	76	0.008	57.00	57.0	0.836	-222	0.0222
28	87	0.009	56.00	56.0	0.821	-223	0.0223
29	90	0.009	53.00	53.0	0.777	-226	0.0226
30	102	0.010	49.00	49.0	0.719	-238	0.0238

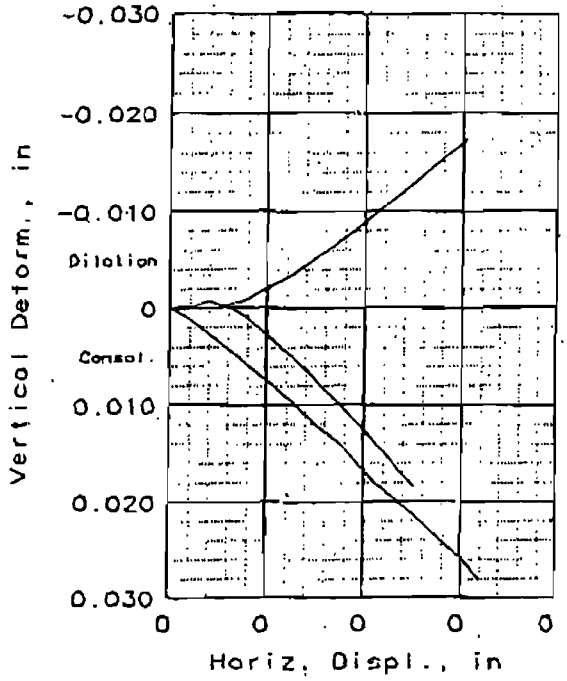
Specimen Parameters for Specimen No. 4

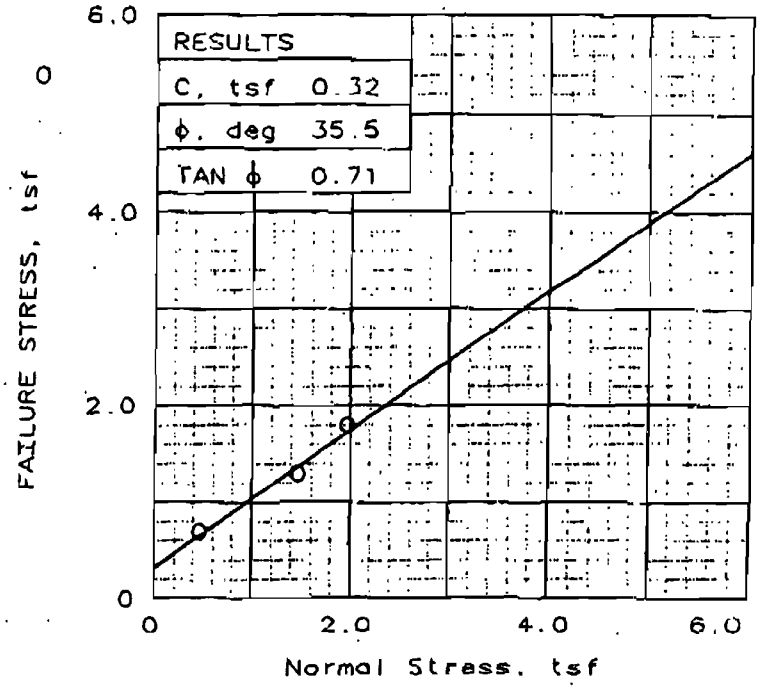
Specimen Parameter	Initial	Consolidated	Final
Wt. moist soil and tare:	122.330		121.980
Wt. dry soil and tare:	118.250		111.950
Wt. of tare:	40.230		40.220
Weight, gms:	239.7		
Diameter, in:	2.500	2.500	
Area, in²:	4.909	4.909	
Height, in:	1.625	1.525	
Net decrease in height, in:		0.101	
% Moisture:	5.2	14.0	14.0
Wet density, pcf:	114.5	132.2	
Dry density, pcf:	108.8	116.0	
Void ratio:	0.5379	0.4428	
% Saturation:	26.1	84.6	

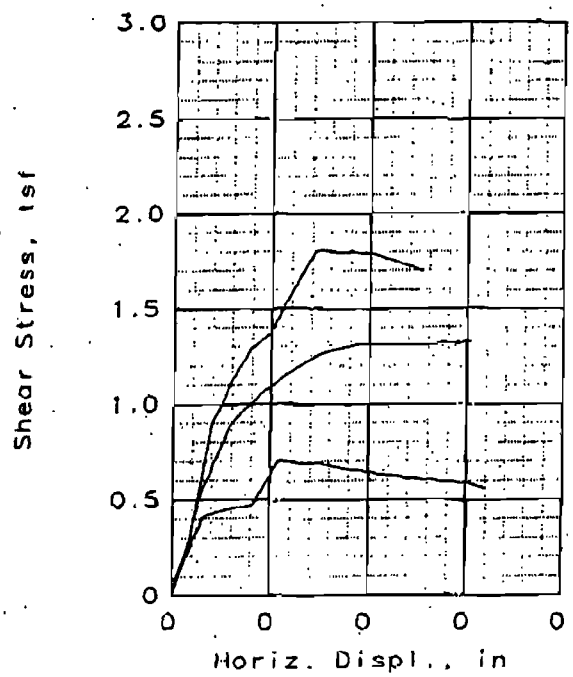
Test Readings Data for Specimen No. 4

Deformation dial constant= 0.0001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 1 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Normal Stress = 2.000 tsf
Strain rate, in/min = 0.0010
FAILURE STRESS = 1.129 tsf at reading no. 15
ULTIMATE STRESS = 1.129 tsf at reading no. 15

No.	HORIZONTAL Dial Reading	HORIZONTAL Def. in	Load Dial Units	Load lbs	Shear Stress tsf	VERTICAL Dial Reading	VERTICAL Def. in
0	0	0.000	0.00	0.0	0.000	0	0.0000
1	1	0.000	34.00	34.0	0.499	0	0.0000
2	2	0.000	36.00	36.0	0.528	0	0.0000
3	3	0.000	40.00	40.0	0.587	0	0.0000
4	5	0.001	46.00	46.0	0.675	0	0.0000
5	8	0.001	49.00	49.0	0.719	-1	0.0001
6	10	0.001	53.00	53.0	0.777	-4	0.0004
7	11	0.001	56.00	56.0	0.821	-7	0.0007
8	12	0.001	59.00	59.0	0.865	-9	0.0009
9	17	0.002	62.00	62.0	0.909	-14	0.0014
10	19	0.002	65.00	65.0	0.953	-17	0.0017
11	25	0.003	69.00	69.0	1.012	-25	0.0025
12	28	0.003	72.00	72.0	1.056	-31	0.0031
13	31	0.003	74.00	74.0	1.085	-35	0.0035
14	34	0.003	76.00	76.0	1.115	-39	0.0039
15	37	0.004	77.00	77.0	1.129	-44	0.0044
16	43	0.004	76.00	76.0	1.115	-46	0.0046
17	50	0.005	74.00	74.0	1.085	-57	0.0057
18	65	0.007	74.00	74.0	1.085	-72	0.0072







	SAMPLE NO.:	1	2	3
INITIAL	WATER CONTENT, %	5.8	5.5	6.2
	DRY DENSITY, pcf	126.0	122.4	121.7
	SATURATION, %	49.3	41.5	46.0
	VOID RATIO	0.313	0.351	0.360
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	1.63	1.63	1.63
AT TEST	WATER CONTENT, %	11.3	12.4	9.7
	DRY DENSITY, pcf	127.0	124.1	123.8
	SATURATION, %	98.8	98.5	76.5
	VOID RATIO	0.303	0.334	0.337
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	1.61	1.60	1.60
	NORMAL STRESS, tsf	0.50	1.50	2.00
	FAILURE STRESS, tsf	0.70	1.31	1.80
	DISPLACEMENT, in	0.01	0.01	0.01
	ULTIMATE STRESS, tsf	0.70	1.31	1.80
	DISPLACEMENT, in	0.01	0.01	0.01
	Strain rate, in/min	0.0010	0.0010	0.0010

SAMPLE TYPE: remolded
DESCRIPTION: Sand, some gravel and silt, dark gray

SPECIFIC GRAVITY= 2.65
REMARKS:

CLIENT: Black & Veatch

PROJECT: Morris Dam

SAMPLE LOCATION: Bag 0'-5.0'

PROJ. NO.: 3390031 DATE: 11/26/2002

DIRECT SHEAR TEST REPORT

MAXIM TECHNOLOGIES, INC.

Fig. No.: _____

DIRECT SHEAR TEST

11-27-1902

Project and Sample Data

Date: 11/26/2002
Client: Black & Veatch
Project: Morris Dam
Sample location: Bag 0'-5.0'
Sample description: Sand, some gravel and silt, dark gray
Remarks:

Fig no.: 2nd page Fig no. (if applicable):
Type of sample: remolded
Specific gravity= 2.65 LL= PL= PI=

Specimen Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Wt. moist soil and tare:	124.500		171.230
Wt. dry soil and tare:	118.820		157.950
Wt. of tare:	21.300		40.230
Weight, gms:	279.2		
Diameter, in:	2.500	2.500	
Area, in²:	4.909	4.909	
Height, in:	1.625	1.612	
Net decrease in height, in:		0.013	
% Moisture:	5.8	11.3	11.3
Wet density, pcf:	133.3	141.3	
Dry density, pcf:	126.0	127.0	
Void ratio:	0.3129	0.3027	
% Saturation:	49.3	98.8	

Test Readings Data for Specimen No. 1

Deformation dial constant= 0.0001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 1 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Normal Stress = 0.500 tsf
Strain rate, in/min = 0.0010
FAILURE STRESS = 0.704 tsf at reading no. 5
ULTIMATE STRESS = 0.704 tsf at reading no. 5

No.	HORIZONTAL Dial Reading	Def. in	Load Dial Units	Load lbs	Shear Stress tsf	VERTICAL Dial Reading	Def. in
0	0	0.000	0.00	0.0	0.000	128	0.0000
1	1	0.000	3.00	3.0	0.044	128	0.0000
2	16	0.002	28.00	28.0	0.411	108	0.0020
3	29	0.003	31.00	31.0	0.455	88	0.0040
4	41	0.004	32.00	32.0	0.469	68	0.0060
5	54	0.005	48.00	48.0	0.704	48	0.0080
6	65	0.007	47.00	47.0	0.689	28	0.0100
7	75	0.008	47.00	47.0	0.689	8	0.0120
8	88	0.009	45.00	45.0	0.660	-12	0.0140
9	106	0.011	43.00	43.0	0.631	-52	0.0180

Test Readings Data for Specimen No. 1

No.	HORIZONTAL Dial Reading	Def. in	Load Dial Units	Load lbs	Shear Stress tsf	VERTICAL Dial Reading	Def. in
10	118	0.012	42.00	42.0	0.616	-72	0.0200
11	151	0.015	40.00	40.0	0.587	-132	0.0260
12	160	0.016	38.00	38.0	0.557	-152	0.0280

Specimen Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Wt. moist soil and tare:	123.200		183.400
Wt. dry soil and tare:	117.560		167.540
Wt. of tare:	15.000		39.680
Weight, gms:	270.4		
Diameter, in:	2.500	2.500	
Area, in²:	4.909	4.909	
Height, in:	1.625	1.604	
Net decrease in height, in:		0.022	
% Moisture:	5.5	12.4	12.4
Wet density, pcf:	129.1	139.4	
Dry density, pcf:	122.4	124.1	
Void ratio:	0.3515	0.3336	
% Saturation:	41.5	98.5	

Test Readings Data for Specimen No. 2

Deformation dial constant= 0.0001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 1 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Normal Stress = 1.500 tsf
Strain rate, in/min = 0.0010
FAILURE STRESS = 1.305 tsf at reading no. 16
ULTIMATE STRESS = 1.305 tsf at reading no. 16

No.	HORIZONTAL Dial Reading	HORIZONTAL Def. in	Load Dial Units	Load lbs	Shear Stress tsf	VERTICAL Dial Reading	VERTICAL Def. in
0	0	0.000	0.00	0.0	0.000	0	0.0000
1	1	0.000	2.00	2.0	0.029	0	0.0000
2	2	0.000	6.00	6.0	0.088	0	0.0000
3	5	0.001	11.00	11.0	0.161	1	-0.0001
4	9	0.001	17.00	17.0	0.249	1	-0.0001
5	11	0.001	26.00	26.0	0.381	0	0.0000
6	15	0.002	37.00	37.0	0.543	0	0.0000
7	19	0.002	43.00	43.0	0.631	0	0.0000
8	23	0.002	50.00	50.0	0.733	0	0.0000
9	29	0.003	60.00	60.0	0.880	3	-0.0003
10	35	0.004	65.00	65.0	0.953	7	-0.0007
11	41	0.004	69.00	69.0	1.012	11	-0.0011
12	45	0.005	72.00	72.0	1.056	17	-0.0017
13	55	0.006	77.00	77.0	1.129	26	-0.0026
14	65	0.007	82.00	82.0	1.203	37	-0.0037
15	75	0.008	86.00	86.0	1.261	52	-0.0052
16	92	0.009	89.00	89.0	1.305	76	-0.0076
17	152	0.015	90.00	90.0	1.320	173	-0.0173

Specimen Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Wt. moist soil and tare:	108.500		204.730
Wt. dry soil and tare:	103.410		190.150
Wt. of tare:	21.900		40.260
Weight, gms:	270.7		
Diameter, in:	2.500	2.500	
Area, in²:	4.909	4.909	
Height, in:	1.625	1.598	
Net decrease in height, in:		0.027	
% Moisture:	6.2	9.7	9.7
Wet density, pcf:	129.3	135.8	
Dry density, pcf:	121.7	123.8	
Void ratio:	0.3595	0.3368	
% Saturation:	46.0	76.5	

Test Readings Data for Specimen No. 3

Deformation dial constant= 0.0001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 1 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Normal Stress = 2.000 tsf
Strain rate, in/min = 0.0010
FAILURE STRESS = 1.804 tsf at reading no. 7
ULTIMATE STRESS = 1.804 tsf at reading no. 7

No.	HORIZONTAL Dial Reading	HORIZONTAL Def. in	Load Dial Units	Load lbs	Shear Stress tsf	VERTICAL Dial Reading	VERTICAL Def. in
0	0	0.000	0.00	0.0	0.000	0	0.0000
1	10	0.001	22.00	22.0	0.323	0	0.0000
2	20	0.002	61.00	61.0	0.895	8	-0.0008
3	30	0.003	76.00	76.0	1.115	1	-0.0001
4	40	0.004	88.00	88.0	1.291	-10	0.0010
5	50	0.005	94.00	94.0	1.379	-27	0.0027
6	60	0.006	108.00	108.0	1.584	-45	0.0045
7	72	0.007	123.00	123.0	1.804	-67	0.0067
8	102	0.010	122.00	122.0	1.789	-129	0.0129
9	126	0.013	116.00	116.0	1.701	-185	0.0185

MAXIM TECHNOLOGIES INC

Black & Veatch
Morris Dam
3390031

CALIFORNIA BEARING RATIO
LABORATORY REPORT - ASTM D1883

SAMPLE ID: BH-1 0'-5'

DATE: 11/21/2002

SAMPLE PREPARATION:

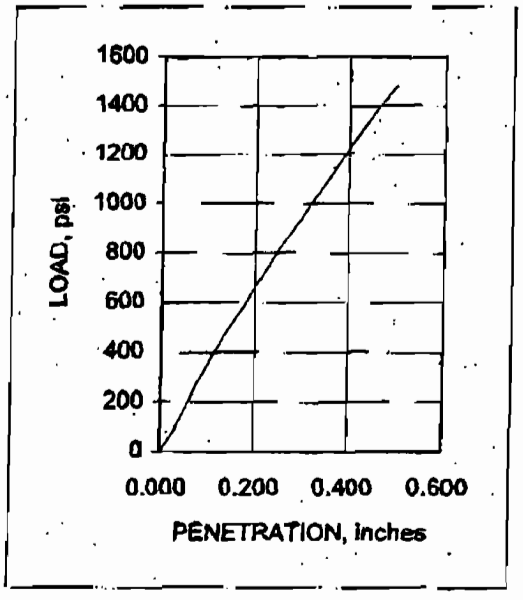
Compaction Method:	ASTM D 698
Surcharge Weight:	4548.3 g
Condition of Sample:	Soaked

TEST DATA:

Density		
Initial:	128.5	lbs/cu ft
Final:	129.8	lbs/cu ft
Compaction:	97.3	percent
Moisture		
Initial:	7.8	percent
Final		
Top 1" Layer:	10.9	percent
Total Average:	9.4	percent
Swell		
based on initial height:	0.0	percent
Bearing Ratio		
at 0.1 inches penetration:	35.5	percent
at 0.2 inches penetration:	44.1	percent

PENETRATION DATA:

Penetration inches	Load psi
0.1	355.0
0.2	662.0
0.3	948.0
0.4	1225.0
0.5	1485.0



DESCRIPTION:
Sandy Clay, some gravel, dark brown

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October 29, 2002

Mr. Mark Petersen
BLACK & VEATCH
11401 Lamar Avenue
Overland Park, KS 66211

RE: Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

Dear Mr. Petersen:

Enclosed are the analytical results for sample(s) received by the laboratory on October 16, 2002. Results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report.

If you have any questions concerning this report please feel free to contact me.

Sincerely,

for Angie Brown
angela.brown@pacelabs.com
Project Manager

Kansas/NELAP Certification Number E-10116

Enclosures

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SAMPLE SUMMARY

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

Project Sample Number	Sample Number	Client Sample ID	Matrix	Date Collected	Date Received
6063928-001	605528116	DRUM SAMPLE 5 FT	Soil	10/11/02 15:00	10/16/02 12:20

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Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

Solid results are reported on a dry weight basis

Lab Sample No: 605528116 | Project Sample Number: 6063928-001 | Date Collected: 10/11/02 15:00
Client Sample ID: DRUM SAMPLE 5 FT | Matrix: Soil | Date Received: 10/16/02 12:20

Parameters	Results	Units	Report Limit	Analyzed	By	CAS No.	Qual	RegLmt
GC/MS Semivolatiles								
Semivolatile Organics	Prep/Method: EPA 3550 / EPA 8270							
Phenol	ND	ug/kg	380	10/28/02 22:08	WAW	108-95-2		
bis(2-Chloroethyl) ether	ND	ug/kg	380	10/28/02 22:08	WAW	111-44-4		
2-Chlorophenol	ND	ug/kg	380	10/28/02 22:08	WAW	95-57-8		
1,3-Dichlorobenzene	ND	ug/kg	380	10/28/02 22:08	WAW	541-73-1		
1,4-Dichlorobenzene	ND	ug/kg	380	10/28/02 22:08	WAW	106-46-7		
Benzyl alcohol	ND	ug/kg	760	10/28/02 22:08	WAW	100-51-6		
1,2-Dichlorobenzene	ND	ug/kg	380	10/28/02 22:08	WAW	95-50-1		
2-Methylphenol (o-Cresol)	ND	ug/kg	380	10/28/02 22:08	WAW	95-48-7		
bis(2-Chloroisopropyl) ether	ND	ug/kg	380	10/28/02 22:08	WAW	39638-32-9		
4-Methylphenol (p-Cresol)	ND	ug/kg	380	10/28/02 22:08	WAW	106-44-5		
N-Nitroso-di-n-propylamine	ND	ug/kg	380	10/28/02 22:08	WAW	621-64-7		
Hexachloroethane	ND	ug/kg	380	10/28/02 22:08	WAW	67-72-1		
Nitrobenzene	ND	ug/kg	380	10/28/02 22:08	WAW	98-95-3		
Isophorone	ND	ug/kg	380	10/28/02 22:08	WAW	78-59-1		
2-Nitrophenol	ND	ug/kg	380	10/28/02 22:08	WAW	88-75-5		
2,4-Dimethylphenol	ND	ug/kg	380	10/28/02 22:08	WAW	105-67-9		
Benzoic acid	ND	ug/kg	1900	10/28/02 22:08	WAW	65-85-0		
bis(2-Chloroethoxy)methane	ND	ug/kg	380	10/28/02 22:08	WAW	111-91-1		
2,4-Dichlorophenol	ND	ug/kg	380	10/28/02 22:08	WAW	120-83-2		
1,2,4-Trichlorobenzene	ND	ug/kg	380	10/28/02 22:08	WAW	120-82-1		
Naphthalene	ND	ug/kg	380	10/28/02 22:08	WAW	91-20-3		
4-Chloroaniline	ND	ug/kg	760	10/28/02 22:08	WAW	106-47-8		
Hexachloro-1,3-butadiene	ND	ug/kg	380	10/28/02 22:08	WAW	87-68-3		
4-Chloro-3-methylphenol	ND	ug/kg	760	10/28/02 22:08	WAW	59-50-7		
2-Methylnaphthalene	ND	ug/kg	380	10/28/02 22:08	WAW	91-57-6		
Hexachlorocyclopentadiene	ND	ug/kg	380	10/28/02 22:08	WAW	77-47-4		
2,4,6-Trichlorophenol	ND	ug/kg	380	10/28/02 22:08	WAW	88-06-2		
2,4,5-Trichlorophenol	ND	ug/kg	380	10/28/02 22:08	WAW	95-95-4		
2-Chloronaphthalene	ND	ug/kg	380	10/28/02 22:08	WAW	91-58-7		
2-Nitroaniline	ND	ug/kg	1900	10/28/02 22:08	WAW	88-74-4		
Dimethylphthalate	ND	ug/kg	380	10/28/02 22:08	WAW	131-11-3		
Acenaphthylene	ND	ug/kg	380	10/28/02 22:08	WAW	208-96-8		
2,6-Dinitrotoluene	ND	ug/kg	380	10/28/02 22:08	WAW	606-20-2		
3-Nitroaniline	ND	ug/kg	1900	10/28/02 22:08	WAW	99-09-2		
Acenaphthene	ND	ug/kg	380	10/28/02 22:08	WAW	83-32-9		
2,4-Dinitrophenol	ND	ug/kg	1900	10/28/02 22:08	WAW	51-28-5		

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Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

Lab Sample No: 605528116 | Project Sample Number: 6063928-001 | Date Collected: 10/11/02 15:00
Client Sample ID: DRUM SAMPLE 5 FT | Matrix: Soil | Date Received: 10/16/02 12:20

Parameters	Results	Units	Report Limit	Analyzed	By	CAS No.	Qual	RegLmt
4-Nitrophenol	ND	ug/kg	1900	10/28/02 22:08	WAW	100-02-7		
Dibenzofuran	ND	ug/kg	380	10/28/02 22:08	WAW	132-64-9		
2,4-Dinitrotoluene	ND	ug/kg	380	10/28/02 22:08	WAW	121-14-2		
Diethylphthalate	ND	ug/kg	380	10/28/02 22:08	WAW	84-66-2		
4-Chlorophenylphenyl ether	ND	ug/kg	380	10/28/02 22:08	WAW	7005-72-3		
Fluorene	ND	ug/kg	380	10/28/02 22:08	WAW	86-73-7		
4-Nitroaniline	ND	ug/kg	1900	10/28/02 22:08	WAW	100-01-6		
4,6-Dinitro-2-methylphenol	ND	ug/kg	1900	10/28/02 22:08	WAW	534-52-1		
N-Nitrosodiphenylamine	ND	ug/kg	380	10/28/02 22:08	WAW	86-30-6		
4-Bromophenylphenyl ether	ND	ug/kg	380	10/28/02 22:08	WAW	101-55-3		
Hexachlorobenzene	ND	ug/kg	380	10/28/02 22:08	WAW	118-74-1		
Pentachlorophenol	ND	ug/kg	1900	10/28/02 22:08	WAW	87-86-5		
Phenanthrene	940	ug/kg	380	10/28/02 22:08	WAW	85-01-8		
Anthracene	ND	ug/kg	380	10/28/02 22:08	WAW	120-12-7		
Di-n-butylphthalate	ND	ug/kg	380	10/28/02 22:08	WAW	84-74-2		
Fluoranthene	2700	ug/kg	380	10/28/02 22:08	WAW	206-44-0		
Pyrene	2500	ug/kg	380	10/28/02 22:08	WAW	129-00-0		
Butylbenzylphthalate	ND	ug/kg	380	10/28/02 22:08	WAW	85-68-7		
3,3'-Dichlorobenzidine	ND	ug/kg	760	10/28/02 22:08	WAW	91-94-1		
Benzo(a)anthracene	940	ug/kg	380	10/28/02 22:08	WAW	56-55-3		
Chrysene	1300	ug/kg	380	10/28/02 22:08	WAW	218-01-9		
bis(2-Ethylhexyl)phthalate	480	ug/kg	380	10/28/02 22:08	WAW	117-81-7		
Di-n-octylphthalate	ND	ug/kg	380	10/28/02 22:08	WAW	117-84-0		
Benzo(b)fluoranthene	1600	ug/kg	380	10/28/02 22:08	WAW	205-99-2		
Benzo(k)fluoranthene	860	ug/kg	380	10/28/02 22:08	WAW	207-08-9		
Benzo(a)pyrene	1100	ug/kg	380	10/28/02 22:08	WAW	50-32-8		
Indeno(1,2,3-cd)pyrene	860	ug/kg	380	10/28/02 22:08	WAW	193-39-5		
Dibenz(a,h)anthracene	420	ug/kg	380	10/28/02 22:08	WAW	53-70-3		
Benzo(g,h,i)perylene	940	ug/kg	380	10/28/02 22:08	WAW	191-24-2		
Nitrobenzene-d5 (S)	73	%		10/28/02 22:08	WAW	4165-60-0		
2-Fluorobiphenyl (S)	78	%		10/28/02 22:08	WAW	321-60-8		
Terphenyl-d14 (S)	94	%		10/28/02 22:08	WAW	1718-51-0		
Phenol-d6 (S)	75	%		10/28/02 22:08	WAW	13127-88-3		
2-Fluorophenol (S)	75	%		10/28/02 22:08	WAW	367-12-4		
2,4,6-Tribromophenol (S)	60	%		10/28/02 22:08	WAW			
Date Extracted	10/23/02			10/23/02				

Organics Prep

Percent Moisture Method:

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Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

Lab Sample No: 605528116 | Project Sample Number: 6063928-001 | Date Collected: 10/11/02 15:00
Client Sample ID: DRUM SAMPLE 5 FT | Matrix: Soil | Date Received: 10/16/02 12:20

Parameters	Results	Units	Report Limit	Analyzed	By	CAS No.	Qual	RegLmt
Percent Moisture	13.7	%		10/23/02	PLH			

GC/MS Volatiles

GC/MS VOCs in Soil by 8260	Method: EPA 8260							
1,1,1,2-Tetrachloroethane	ND	ug/kg	5.8	10/25/02 16:59	BME	630-20-6		
1,1,1-Trichloroethane	ND	ug/kg	5.8	10/25/02 16:59	BME	71-55-6		
1,1,2,2-Tetrachloroethane	ND	ug/kg	5.8	10/25/02 16:59	BME	79-34-5		
1,1,2-Trichloroethane	ND	ug/kg	5.8	10/25/02 16:59	BME	79-00-5		
1,1-Dichloroethane	ND	ug/kg	5.8	10/25/02 16:59	BME	75-34-3		
1,1-Dichloroethene	ND	ug/kg	5.8	10/25/02 16:59	BME	75-35-4		
1,1-Dichloropropene	ND	ug/kg	5.8	10/25/02 16:59	BME	563-58-6		
1,2,3-Trichlorobenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	87-61-6		
1,2,3-Trichloropropane	ND	ug/kg	5.8	10/25/02 16:59	BME	96-18-4		
1,2,4-Trichlorobenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	120-82-1		
1,2,4-Trimethylbenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	95-63-6		
1,2-Dibromo-3-chloropropane	ND	ug/kg	5.8	10/25/02 16:59	BME	96-12-8		
1,2-Dibromoethane (EDB)	ND	ug/kg	5.8	10/25/02 16:59	BME	106-93-4		
1,2-Dichlorobenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	95-50-1		
1,2-Dichloroethane	ND	ug/kg	5.8	10/25/02 16:59	BME	107-06-2		
1,2-Dichloropropane	ND	ug/kg	5.8	10/25/02 16:59	BME	78-87-5		
1,3,5-Trimethylbenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	108-67-8		
1,3-Dichlorobenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	541-73-1		
1,3-Dichloropropane	ND	ug/kg	5.8	10/25/02 16:59	BME	142-28-9		
1,4-Dichlorobenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	106-46-7		
2,2-Dichloropropane	ND	ug/kg	5.8	10/25/02 16:59	BME	594-20-7		
2-Chloroethylvinyl ether	ND	ug/kg	5.8	10/25/02 16:59	BME	110-75-8		
2-Chlorotoluene	ND	ug/kg	5.8	10/25/02 16:59	BME	95-49-8		
4-Chlorotoluene	ND	ug/kg	5.8	10/25/02 16:59	BME	106-43-4		
Benzene	ND	ug/kg	5.8	10/25/02 16:59	BME	71-43-2		
Bromobenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	108-86-1		
Bromochloromethane	ND	ug/kg	5.8	10/25/02 16:59	BME	74-97-5		
Bromodichloromethane	ND	ug/kg	5.8	10/25/02 16:59	BME	75-27-4		
Bromoform	ND	ug/kg	5.8	10/25/02 16:59	BME	75-25-2		
Bromomethane	ND	ug/kg	5.8	10/25/02 16:59	BME	74-83-9		
Carbon tetrachloride	ND	ug/kg	5.8	10/25/02 16:59	BME	56-23-5		
Chlorobenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	108-90-7		
Chloroethane	ND	ug/kg	5.8	10/25/02 16:59	BME	75-00-3		
Chloroform	ND	ug/kg	5.8	10/25/02 16:59	BME	67-66-3		
Chloromethane	ND	ug/kg	5.8	10/25/02 16:59	BME	74-87-3		

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Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

Lab Sample No: 605528116 | Project Sample Number: 6063928-001 | Date Collected: 10/11/02 15:00
Client Sample ID: DRUM SAMPLE 5 FT | Matrix: Soil | Date Received: 10/16/02 12:20

Parameters	Results	Units	Report Limit	Analyzed	By	CAS No.	Qual	RegLmt
cis-1,2-Dichloroethene	ND	ug/kg	5.8	10/25/02 16:59	BME	156-59-2		
cis-1,3-Dichloropropene	ND	ug/kg	5.8	10/25/02 16:59	BME	10061-01-5		
Dibromochloromethane	ND	ug/kg	5.8	10/25/02 16:59	BME	124-48-1		
Dibromomethane	ND	ug/kg	5.8	10/25/02 16:59	BME	74-95-3		
Dichlorodifluoromethane	ND	ug/kg	5.8	10/25/02 16:59	BME	75-71-8		
Ethylbenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	100-41-4		
Hexachloro-1,3-butadiene	ND	ug/kg	5.8	10/25/02 16:59	BME	87-68-3		
Isopropylbenzene (Cumene)	ND	ug/kg	5.8	10/25/02 16:59	BME	98-82-8		
m&p-Xylene	ND	ug/kg	5.8	10/25/02 16:59	BME			
Methylene chloride	ND	ug/kg	5.8	10/25/02 16:59	BME	75-09-2		
Naphthalene	ND	ug/kg	12.	10/25/02 16:59	BME	91-20-3		
n-Butylbenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	104-51-8		
n-Propylbenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	103-65-1		
o-Xylene	ND	ug/kg	5.8	10/25/02 16:59	BME	95-47-6		
p-Isopropyltoluene	ND	ug/kg	5.8	10/25/02 16:59	BME	99-87-6		
sec-Butylbenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	135-98-8		
Styrene	ND	ug/kg	5.8	10/25/02 16:59	BME	100-42-5		
tert-Butylbenzene	ND	ug/kg	5.8	10/25/02 16:59	BME	98-06-6		
Tetrachloroethene	ND	ug/kg	5.8	10/25/02 16:59	BME	127-18-4		
Toluene	ND	ug/kg	5.8	10/25/02 16:59	BME	108-88-3		
trans-1,2-Dichloroethene	ND	ug/kg	5.8	10/25/02 16:59	BME	156-60-5		
trans-1,3-Dichloropropene	ND	ug/kg	5.8	10/25/02 16:59	BME	10061-02-6		
Trichloroethene	ND	ug/kg	5.8	10/25/02 16:59	BME	79-01-6		
Trichlorofluoromethane	ND	ug/kg	5.8	10/25/02 16:59	BME	75-69-4		
Vinyl chloride	ND	ug/kg	5.8	10/25/02 16:59	BME	75-01-4		
Acetone	ND	ug/kg	23.	10/25/02 16:59	BME	67-64-1		
2-Butanone (MEK)	ND	ug/kg	12.	10/25/02 16:59	BME	78-93-3		
4-Methyl-2-pentanone (MIBK)	ND	ug/kg	12.	10/25/02 16:59	BME	108-10-1		
2-Hexanone	ND	ug/kg	120	10/25/02 16:59	BME	591-78-6		
Methyl-tert-butyl ether	ND	ug/kg	5.8	10/25/02 16:59	BME	1634-04-4		
Dibromofluoromethane (S)	27	%		10/25/02 16:59	BME	1868-53-7	1	
Toluene-d8 (S)	99	%		10/25/02 16:59	BME	2037-26-5		
4-Bromofluorobenzene (S)	95	%		10/25/02 16:59	BME	460-00-4		
1,2-Dichloroethane-d4 (S)	99	%		10/25/02 16:59	BME	17060-07-0		

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Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

PARAMETER FOOTNOTES

ND	Not detected at or above adjusted reporting limit
NC	Not Calculable
J	Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit
MDL	Adjusted Method Detection Limit
(S)	Surrogate
[1]	Low surrogate recovery was confirmed as a matrix effect by a second analysis.

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

QC Batch: 132358
QC Batch Method: EPA 3550
Associated Lab Samples: 605528116

Analysis Method: EPA 8270
Analysis Description: Semivolatile Organics

METHOD BLANK: 605545755
Associated Lab Samples: 605528116

Parameter	Units	Blank Result	Reporting Limit	Footnotes
Phenol	ug/kg	ND	330	
bis(2-Chloroethyl) ether	ug/kg	ND	330	
2-Chlorophenol	ug/kg	ND	330	
1,3-Dichlorobenzene	ug/kg	ND	330	
1,4-Dichlorobenzene	ug/kg	ND	330	
Benzyl alcohol	ug/kg	ND	660	
1,2-Dichlorobenzene	ug/kg	ND	330	
2-Methylphenol (o-Cresol)	ug/kg	ND	330	
bis(2-Chloroisopropyl) ether	ug/kg	ND	330	
4-Methylphenol (p-Cresol)	ug/kg	ND	330	
N-Nitroso-di-n-propylamine	ug/kg	ND	330	
Hexachloroethane	ug/kg	ND	330	
Nitrobenzene	ug/kg	ND	330	
Isophorone	ug/kg	ND	330	
2-Nitrophenol	ug/kg	ND	330	
2,4-Dimethylphenol	ug/kg	ND	330	
Benzoic acid	ug/kg	ND	1600	
bis(2-Chloroethoxy)methane	ug/kg	ND	330	
2,4-Dichlorophenol	ug/kg	ND	330	
1,2,4-Trichlorobenzene	ug/kg	ND	330	
Naphthalene	ug/kg	ND	330	
4-Chloroaniline	ug/kg	ND	660	
Hexachloro-1,3-butadiene	ug/kg	ND	330	
4-Chloro-3-methylphenol	ug/kg	ND	660	
2-Methylnaphthalene	ug/kg	ND	330	
Hexachlorocyclopentadiene	ug/kg	ND	330	
2,4,6-Trichlorophenol	ug/kg	ND	330	
2,4,5-Trichlorophenol	ug/kg	ND	330	
2-Chloronaphthalene	ug/kg	ND	330	
2-Nitroaniline	ug/kg	ND	1600	
Dimethylphthalate	ug/kg	ND	330	

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

METHOD BLANK: 605545755
Associated Lab Samples: 605528116

Parameter	Units	Blank Result	Reporting Limit	Footnotes
Acenaphthylene	ug/kg	ND	330	
2,6-Dinitrotoluene	ug/kg	ND	330	
3-Nitroaniline	ug/kg	ND	1600	
Acenaphthene	ug/kg	ND	330	
2,4-Dinitrophenol	ug/kg	ND	1600	
4-Nitrophenol	ug/kg	ND	1600	
Dibenzofuran	ug/kg	ND	330	
2,4-Dinitrotoluene	ug/kg	ND	330	
Diethylphthalate	ug/kg	ND	330	
4-Chlorophenylphenyl ether	ug/kg	ND	330	
Fluorene	ug/kg	ND	330	
4-Nitroaniline	ug/kg	ND	1600	
4,6-Dinitro-2-methylphenol	ug/kg	ND	1600	
N-Nitrosodiphenylamine	ug/kg	ND	330	
4-Bromophenylphenyl ether	ug/kg	ND	330	
Hexachlorobenzene	ug/kg	ND	330	
Pentachlorophenol	ug/kg	ND	1600	
Phenanthrene	ug/kg	ND	330	
Anthracene	ug/kg	ND	330	
Di-n-butylphthalate	ug/kg	ND	330	
Fluoranthene	ug/kg	ND	330	
Pyrene	ug/kg	ND	330	
Butylbenzylphthalate	ug/kg	ND	330	
3,3'-Dichlorobenzidine	ug/kg	ND	660	
Benzo(a)anthracene	ug/kg	ND	330	
Chrysene	ug/kg	ND	330	
bis(2-Ethylhexyl)phthalate	ug/kg	ND	330	
Di-n-octylphthalate	ug/kg	ND	330	
Benzo(b)fluoranthene	ug/kg	ND	330	
Benzo(k)fluoranthene	ug/kg	ND	330	
Benzo(a)pyrene	ug/kg	ND	330	
Indeno(1,2,3-cd)pyrene	ug/kg	ND	330	
Dibenz(a,h)anthracene	ug/kg	ND	330	
Benzo(g,h,i)perylene	ug/kg	ND	330	
Nitrobenzene-d5 (S)	%	54		
2-Fluorobiphenyl (S)	%	62		

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

METHOD BLANK: 605545755
Associated Lab Samples: 605528116

Parameter	Units	Blank Result	Reporting Limit	Footnotes
Terphenyl-d14 (S)	%	75		
Phenol-d6 (S)	%	67		
2-Fluorophenol (S)	%	69		
2,4,6-Tribromophenol (S)	%	74		

LABORATORY CONTROL SAMPLE: 605545763

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Footnotes
Phenol	ug/kg	1667.00	1150	69	29-120	
bis(2-Chloroethyl) ether	ug/kg	1667.00	1081	65	28-120	
2-Chlorophenol	ug/kg	1667.00	1174	70	30-120	
1,3-Dichlorobenzene	ug/kg	1667.00	953.8	57	27-120	
1,4-Dichlorobenzene	ug/kg	1667.00	1070	64	18-120	
Benzyl alcohol	ug/kg	1667.00	1054	63	1-142	
1,2-Dichlorobenzene	ug/kg	1667.00	1036	62	28-120	
2-Methylphenol (o-Cresol)	ug/kg	1667.00	1192	72	40-120	
bis(2-Chloroisopropyl) ether	ug/kg	1667.00	1113	67	55-175	
4-Methylphenol (p-Cresol)	ug/kg	1667.00	1248	75	39-120	
N-Nitroso-di-n-propylamine	ug/kg	1667.00	1284	77	36-120	
Hexachloroethane	ug/kg	1667.00	894.1	54	20-120	
Nitrobenzene	ug/kg	1667.00	973.6	58	36-120	
Isophorone	ug/kg	1667.00	1122	67	44-120	
2-Nitrophenol	ug/kg	1667.00	1160	70	10-120	
2,4-Dimethylphenol	ug/kg	1667.00	1224	73	37-115	
Benzoic acid	ug/kg	1667.00	1253	75	10-120	
bis(2-Chloroethoxy)methane	ug/kg	1667.00	1103	66	40-120	
2,4-Dichlorophenol	ug/kg	1667.00	1304	78	44-120	
1,2,4-Trichlorobenzene	ug/kg	1667.00	1083	65	29-120	
Naphthalene	ug/kg	1667.00	1058	64	31-120	
4-Chloroaniline	ug/kg	1667.00	477.4	29	10-120	
Hexachloro-1,3-butadiene	ug/kg	1667.00	1049	63	27-115	
4-Chloro-3-methylphenol	ug/kg	1667.00	1299	78	44-120	
2-Methylnaphthalene	ug/kg	1667.00	1217	73	38-120	
Hexachlorocyclopentadiene	ug/kg	1667.00	1137	68	1-120	

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

LABORATORY CONTROL SAMPLE: 605545763

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Footnotes
2,4,6-Trichlorophenol	ug/kg	1667.00	1172	70	39-120	
2,4,5-Trichlorophenol	ug/kg	1667.00	1263	76	48-120	
2-Chloronaphthalene	ug/kg	1667.00	989.5	59	43-120	
2-Nitroaniline	ug/kg	1667.00	1033	62	12-134	
Dimethylphthalate	ug/kg	1667.00	1298	78	44-120	
Acenaphthylene	ug/kg	1667.00	1168	70	42-120	
2,6-Dinitrotoluene	ug/kg	1667.00	1352	81	51-120	
3-Nitroaniline	ug/kg	1667.00	748.0	45	15-120	
Acenaphthene	ug/kg	1667.00	1190	71	45-120	
2,4-Dinitrophenol	ug/kg	1667.00	1213	73	10-118	
4-Nitrophenol	ug/kg	1667.00	1518	91	35-120	
Dibenzofuran	ug/kg	1667.00	1189	71	47-120	
2,4-Dinitrotoluene	ug/kg	1667.00	1371	82	51-120	
Diethylphthalate	ug/kg	1667.00	1348	81	47-120	
4-Chlorophenylphenyl ether	ug/kg	1667.00	1318	79	42-120	
Fluorene	ug/kg	1667.00	1335	80	46-120	
4-Nitroaniline	ug/kg	1667.00	1477	89	10-120	
4,6-Dinitro-2-methylphenol	ug/kg	1667.00	1336	80	25-125	
N-Nitrosodiphenylamine	ug/kg	1667.00	1498	90	45-120	
4-Bromophenylphenyl ether	ug/kg	1667.00	1203	72	40-120	
Hexachlorobenzene	ug/kg	1667.00	1203	72	47-120	
Pentachlorophenol	ug/kg	1667.00	1790	107	36-113	
Phenanthrene	ug/kg	1667.00	1104	66	46-120	
Anthracene	ug/kg	1667.00	1034	62	45-120	
Di-n-butylphthalate	ug/kg	1667.00	1066	64	45-120	
Fluoranthene	ug/kg	1667.00	1044	63	44-120	
Pyrene	ug/kg	1667.00	1143	69	43-122	
Butylbenzylphthalate	ug/kg	1667.00	1290	77	49-119	
3,3'-Dichlorobenzidine	ug/kg	1667.00	793.2	48	10-129	
Benzo(a)anthracene	ug/kg	1667.00	1266	76	52-120	
Chrysene	ug/kg	1667.00	1231	74	44-119	
bis(2-Ethylhexyl)phthalate	ug/kg	1667.00	1302	78	47-118	
Di-n-octylphthalate	ug/kg	1667.00	1403	84	43-120	
Benzo(b)fluoranthene	ug/kg	1667.00	1362	82	47-120	
Benzo(k)fluoranthene	ug/kg	1667.00	1164	70	41-120	
Benzo(a)pyrene	ug/kg	1667.00	1242	74	48-120	
Indeno(1,2,3-cd)pyrene	ug/kg	1667.00	1153	69	44-118	

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

LABORATORY CONTROL SAMPLE: 605545763

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Footnotes
Dibenz(a,h)anthracene	ug/kg	1667.00	1169	70	40-115	
Benzo(g,h,i)perylene	ug/kg	1667.00	1115	67	42-120	
Nitrobenzene-d5 (S)				54	24-115	
2-Fluorobiphenyl (S)				63	22-120	
Terphenyl-d14 (S)				65	35-115	
Phenol-d6 (S)				68	24-114	
2-Fluorophenol (S)				66	10-127	
2,4,6-Tribromophenol (S)				90	16-143	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 605545771 605545789

Parameter	Units	605531425 Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Footnotes
Phenol	ug/kg	0	1898.00	1498	1405	79	74	24-109	6	30	
bis(2-Chloroethyl) ether	ug/kg		1898.00	1920	1766			19-120	8	27	
2-Chlorophenol	ug/kg	0	1898.00	1438	1354	76	71	30-120	6	25	
1,3-Dichlorobenzene	ug/kg		1898.00	1260	1187			28-120	6	28	
1,4-Dichlorobenzene	ug/kg		1898.00	1275	1224			21-120	4	26	
Benzyl alcohol	ug/kg		1898.00	1430	1414			10-157	1	34	
1,2-Dichlorobenzene	ug/kg		1898.00	1295	1270			29-120	2	26	
2-Methylphenol (o-Cresol)	ug/kg	0	1898.00	1441	1439	76	76	29-117	0	32	
bis(2-Chloroisopropyl) ether	ug/kg		1898.00	1339	1275			44-175	5	27	
4-Methylphenol (p-Cresol)	ug/kg	0	1898.00	1415	1354	74	71	24-120	4	28	
N-Nitroso-di-n-propylamine	ug/kg		1898.00	1502	1398			27-118	7	31	
Hexachloroethane	ug/kg		1898.00	326.3	458.7			17-120	34	29	
Nitrobenzene	ug/kg		1898.00	1516	1370			32-120	10	34	
Isophorone	ug/kg		1898.00	1570	1452			33-123	8	23	
2-Nitrophenol	ug/kg	0	1898.00	1127	1095	59	58	31-120	3	23	
2,4-Dimethylphenol	ug/kg	0	1898.00	1485	1423	78	75	24-129	4	32	
Benzoic acid	ug/kg		1898.00	1415	1224			10-110	14	35	
bis(2-Chloroethoxy)methane	ug/kg		1898.00	1461	1435			34-120	2	22	
2,4-Dichlorophenol	ug/kg	0	1898.00	1420	1344	75	71	40-120	5	24	
1,2,4-Trichlorobenzene	ug/kg		1898.00	1320	1232			35-120	7	26	
Naphthalene	ug/kg		1898.00	1641	1531			29-120	7	28	
4-Chloroaniline	ug/kg		1898.00	510.8	431.2			10-112	17	35	
Hexachloro-1,3-butadiene	ug/kg		1898.00	1270	1202			29-120	5	25	

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 605545771 605545789

Parameter	Units	605531425 Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Footnotes
4-Chloro-3-methylphenol	ug/kg	0	1898.00	1529	1409	80	74	33-115	8	31	
2-Methylnaphthalene	ug/kg		1898.00	1483	1408			23-115	5	30	
Hexachlorocyclopentadiene	ug/kg		1898.00	0	0			1-120	0	32	
2,4,6-Trichlorophenol	ug/kg	0	1898.00	1566	1481	82	78	37-120	6	26	
2,4,5-Trichlorophenol	ug/kg	0	1898.00	1629	1518	86	80	40-109	7	28	
2-Chloronaphthalene	ug/kg		1898.00	1555	1425			30-120	9	27	
2-Nitroaniline	ug/kg		1898.00	1777	1529			33-119	15	32	
Dimethylphthalate	ug/kg		1898.00	1762	1674			30-120	5	24	
Acenaphthylene	ug/kg		1898.00	1995	1771			28-120	12	26	
2,6-Dinitrotoluene	ug/kg		1898.00	1338	1304			27-126	3	28	
3-Nitroaniline	ug/kg		1898.00	1037	921.7			10-118	12	37	
Acenaphthene	ug/kg		1898.00	1634	1507			31-118	8	26	
2,4-Dinitrophenol	ug/kg	0	1898.00	534.8	587.1	28	31	10-114	9	30	
4-Nitrophenol	ug/kg	0	1898.00	2128	1939	112	102	10-134	9	37	
Dibenzofuran	ug/kg		1898.00	1670	1579			34-120	6	24	
2,4-Dinitrotoluene	ug/kg		1898.00	1260	1222			39-115	3	26	
Diethylphthalate	ug/kg		1898.00	1771	1653			32-120	7	23	
4-Chlorophenylphenyl ether	ug/kg		1898.00	1536	1450			33-120	6	27	
Fluorene	ug/kg		1898.00	1639	1573			34-120	4	27	
4-Nitroaniline	ug/kg		1898.00	1400	1225			15-113	13	33	
4,6-Dinitro-2-methylphenol	ug/kg	0	1898.00	466.3	582.1	25	31	10-123	22	25	
N-Nitrosodiphenylamine	ug/kg		1898.00	1733	1587			27-118	9	28	
4-Bromophenylphenyl ether	ug/kg		1898.00	1719	1686			29-120	2	23	
Hexachlorobenzene	ug/kg		1898.00	1538	1472			38-120	4	26	
Pentachlorophenol	ug/kg	0	1898.00	1470	1459	77	77	10-127	1	31	
Phenanthrene	ug/kg		1898.00	3248	2979			39-110	9	24	
Anthracene	ug/kg		1898.00	2101	1938			38-120	8	22	
Di-n-butylphthalate	ug/kg		1898.00	2204	2014			27-122	9	25	
Fluoranthene	ug/kg		1898.00	4249	3500			40-120	19	25	
Pyrene	ug/kg		1898.00	4789	4480			40-116	7	28	
Butylbenzylphthalate	ug/kg		1898.00	2273	2253			33-132	1	25	
3,3'-Dichlorobenzidine	ug/kg		1898.00	661.6	624.5			10-134	6	38	
Benzo(a)anthracene	ug/kg		1898.00	2894	2693			40-116	7	22	
Chrysene	ug/kg		1898.00	2901	2702			44-120	7	22	
bis(2-Ethylhexyl)phthalate	ug/kg		1898.00	2530	2556			27-130	1	29	
Di-n-octylphthalate	ug/kg		1898.00	2452	2228			25-133	10	27	
Benzo(b)fluoranthene	ug/kg		1898.00	3078	2733			34-118	12	35	

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 605545771 605545789

Parameter	Units	605531425 Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Footnotes
Benzo(k)fluoranthene	ug/kg		1898.00	2400	2195			31-118	9	34	
Benzo(a)pyrene	ug/kg		1898.00	2831	2359			37-120	18	30	
Indeno(1,2,3-cd)pyrene	ug/kg		1898.00	2586	2139			37-112	19	25	
Dibenz(a,h)anthracene	ug/kg		1898.00	2218	1864			31-115	17	31	
Benzo(g,h,i)perylene	ug/kg		1898.00	2776	2255			35-120	21	24	
Nitrobenzene-d5 (S)						71	65	24-115			
2-Fluorobiphenyl (S)						81	75	22-120			
Terphenyl-d14 (S)						94	94	35-115			
Phenol-d6 (S)						79	73	24-114			
2-Fluorophenol (S)						73	69	10-127			
2,4,6-Tribromophenol (S)						73	69	16-143			

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

QC Batch: 132451
QC Batch Method: EPA 8260
Associated Lab Samples: 605528116

Analysis Method: EPA 8260
Analysis Description: GC/MS VOCs in Soil by 8260

METHOD BLANK: 605549195
Associated Lab Samples: 605528116

Parameter	Units	Blank Result	Reporting Limit	Footnotes
1,1,1,2-Tetrachloroethane	ug/kg	ND	5.0	
1,1,1-Trichloroethane	ug/kg	ND	5.0	
1,1,2,2-Tetrachloroethane	ug/kg	ND	5.0	
1,1,2-Trichloroethane	ug/kg	ND	5.0	
1,1-Dichloroethane	ug/kg	ND	5.0	
1,1-Dichloroethene	ug/kg	ND	5.0	
1,1-Dichloropropene	ug/kg	ND	5.0	
1,2,3-Trichlorobenzene	ug/kg	ND	5.0	
1,2,3-Trichloropropane	ug/kg	ND	5.0	
1,2,4-Trichlorobenzene	ug/kg	ND	5.0	
1,2,4-Trimethylbenzene	ug/kg	ND	5.0	
1,2-Dibromo-3-chloropropane	ug/kg	ND	5.0	
1,2-Dibromoethane (EDB)	ug/kg	ND	5.0	
1,2-Dichlorobenzene	ug/kg	ND	5.0	
1,2-Dichloroethane	ug/kg	ND	5.0	
1,2-Dichloropropane	ug/kg	ND	5.0	
1,3,5-Trimethylbenzene	ug/kg	ND	5.0	
1,3-Dichlorobenzene	ug/kg	ND	5.0	
1,3-Dichloropropane	ug/kg	ND	5.0	
1,4-Dichlorobenzene	ug/kg	ND	5.0	
2,2-Dichloropropane	ug/kg	ND	5.0	
2-Chloroethylvinyl ether	ug/kg	ND	5.0	
2-Chlorotoluene	ug/kg	ND	5.0	
4-Chlorotoluene	ug/kg	ND	5.0	
Benzene	ug/kg	ND	5.0	
Bromobenzene	ug/kg	ND	5.0	
Bromochloromethane	ug/kg	ND	5.0	
Bromodichloromethane	ug/kg	ND	5.0	
Bromoform	ug/kg	ND	5.0	
Bromomethane	ug/kg	ND	5.0	
Carbon tetrachloride	ug/kg	ND	5.0	

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

METHOD BLANK: 605549195
Associated Lab Samples: 605528116

Parameter	Units	Blank Result	Reporting Limit	Footnotes
Chlorobenzene	ug/kg	ND	5.0	
Chloroethane	ug/kg	ND	5.0	
Chloroform	ug/kg	ND	5.0	
Chloromethane	ug/kg	ND	5.0	
cis-1,2-Dichloroethene	ug/kg	ND	5.0	
cis-1,3-Dichloropropene	ug/kg	ND	5.0	
Dibromochloromethane	ug/kg	ND	5.0	
Dibromomethane	ug/kg	ND	5.0	
Dichlorodifluoromethane	ug/kg	ND	5.0	
Ethylbenzene	ug/kg	ND	5.0	
Hexachloro-1,3-butadiene	ug/kg	ND	5.0	
Isopropylbenzene (Cumene)	ug/kg	ND	5.0	
m&p-Xylene	ug/kg	ND	5.0	
Methylene chloride	ug/kg	ND	5.0	
Naphthalene	ug/kg	ND	10.	
n-Butylbenzene	ug/kg	ND	5.0	
n-Propylbenzene	ug/kg	ND	5.0	
o-Xylene	ug/kg	ND	5.0	
p-Isopropyltoluene	ug/kg	ND	5.0	
sec-Butylbenzene	ug/kg	ND	5.0	
Styrene	ug/kg	ND	5.0	
tert-Butylbenzene	ug/kg	ND	5.0	
Tetrachloroethene	ug/kg	ND	5.0	
Toluene	ug/kg	ND	5.0	
trans-1,2-Dichloroethene	ug/kg	ND	5.0	
trans-1,3-Dichloropropene	ug/kg	ND	5.0	
Trichloroethene	ug/kg	ND	5.0	
Trichlorofluoromethane	ug/kg	ND	5.0	
Vinyl chloride	ug/kg	ND	5.0	
Dibromofluoromethane (S)	%	100		
Toluene-d8 (S)	%	100		
4-Bromofluorobenzene (S)	%	96		
1,2-Dichloroethane-d4 (S)	%	96		

REPORT OF LABORATORY ANALYSIS
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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

LABORATORY CONTROL SAMPLE: 605549203

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Footnotes
1,1,1,2-Tetrachloroethane	ug/kg	50.00	55.87	112	82-123	
1,1,1-Trichloroethane	ug/kg	50.00	53.39	107	74-130	
1,1,2,2-Tetrachloroethane	ug/kg	50.00	57.76	116	71-130	
1,1,2-Trichloroethane	ug/kg	50.00	54.41	109	82-122	
1,1-Dichloroethane	ug/kg	50.00	51.56	103	75-126	
1,1-Dichloroethene	ug/kg	50.00	52.66	105	73-128	
1,1-Dichloropropene	ug/kg	50.00	50.58	101	71-132	
1,2,3-Trichlorobenzene	ug/kg	50.00	52.83	106	69-136	
1,2,3-Trichloropropane	ug/kg	50.00	57.99	116	69-136	
1,2,4-Trichlorobenzene	ug/kg	50.00	51.45	103	67-132	
1,2,4-Trimethylbenzene	ug/kg	50.00	55.82	112	77-121	
1,2-Dibromo-3-chloropropane	ug/kg	50.00	61.77	124	64-145	
1,2-Dibromoethane (EDB)	ug/kg	50.00	54.81	110	80-124	
1,2-Dichlorobenzene	ug/kg	50.00	56.51	113	78-123	
1,2-Dichloroethane	ug/kg	50.00	46.98	94	78-125	
1,2-Dichloropropane	ug/kg	50.00	52.33	105	78-126	
1,3,5-Trimethylbenzene	ug/kg	50.00	56.94	114	77-122	
1,3-Dichlorobenzene	ug/kg	50.00	54.48	109	77-121	
1,3-Dichloropropane	ug/kg	50.00	52.50	105	79-123	
1,4-Dichlorobenzene	ug/kg	50.00	53.79	108	75-122	
2,2-Dichloropropane	ug/kg	50.00	52.59	105	74-128	
2-Chlorotoluene	ug/kg	50.00	57.95	116	79-120	
4-Chlorotoluene	ug/kg	50.00	56.01	112	73-126	
Benzene	ug/kg	50.00	45.59	91	79-123	
Bromobenzene	ug/kg	50.00	54.43	109	77-126	
Bromochloromethane	ug/kg	50.00	52.56	105	75-131	
Bromodichloromethane	ug/kg	50.00	57.34	115	79-129	
Bromoform	ug/kg	50.00	59.00	118	73-135	
Bromomethane	ug/kg	50.00	38.84	78	22-165	
Carbon tetrachloride	ug/kg	50.00	52.83	106	74-129	
Chlorobenzene	ug/kg	50.00	52.06	104	83-116	
Chloroethane	ug/kg	50.00	34.47	69	33-149	
Chloroform	ug/kg	50.00	57.19	114	77-125	
Chloromethane	ug/kg	50.00	38.47	77	38-149	
cis-1,2-Dichloroethene	ug/kg	50.00	52.67	105	78-125	
cis-1,3-Dichloropropene	ug/kg	50.00	54.23	108	79-128	
Dibromochloromethane	ug/kg	50.00	57.44	115	82-124	

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

LABORATORY CONTROL SAMPLE: 605549203

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Footnotes
Dibromomethane	ug/kg	50.00	51.39	103	76-130	
Dichlorodifluoromethane	ug/kg	50.00	21.63	43	12-161	
Ethylbenzene	ug/kg	50.00	52.66	105	79-121	
Hexachloro-1,3-butadiene	ug/kg	50.00	52.79	106	66-136	
Isopropylbenzene (Cumene)	ug/kg	50.00	50.80	102	76-124	
m&p-Xylene	ug/kg	100.00	104.8	105	78-121	
Methylene chloride	ug/kg	50.00	56.65	113	69-132	
Naphthalene	ug/kg	50.00	54.20	108	61-143	
n-Butylbenzene	ug/kg	50.00	54.35	109	67-131	
n-Propylbenzene	ug/kg	50.00	58.01	116	76-124	
o-Xylene	ug/kg	50.00	53.92	108	81-121	
p-Isopropyltoluene	ug/kg	50.00	54.93	110	73-124	
sec-Butylbenzene	ug/kg	50.00	58.65	117	74-126	
Styrene	ug/kg	50.00	54.77	110	80-124	
tert-Butylbenzene	ug/kg	50.00	57.89	116	72-133	
Tetrachloroethene	ug/kg	50.00	52.92	106	59-150	
Toluene	ug/kg	50.00	50.87	102	78-123	
trans-1,2-Dichloroethene	ug/kg	50.00	61.14	122	70-133	
trans-1,3-Dichloropropene	ug/kg	50.00	55.00	110	72-139	
Trichloroethene	ug/kg	50.00	55.61	111	78-126	
Trichlorofluoromethane	ug/kg	50.00	46.86	94	57-140	
Vinyl chloride	ug/kg	50.00	38.88	78	48-141	
Dibromofluoromethane (S)				101	85-113	
Toluene-d8 (S)				99	87-112	
4-Bromofluorobenzene (S)				96	72-124	
1,2-Dichloroethane-d4 (S)				94	80-125	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 605557438 605557446

Parameter	Units	605551308 Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Footnotes
1,1-Dichloroethene	ug/kg	0	50.00	52.05	60.90	104	122	55-143	16	22	
Benzene	ug/kg	0	50.00	43.68	50.15	87	100	71-126	14	18	
Chlorobenzene	ug/kg	0	50.00	49.87	50.31	100	101	65-127	1	19	
Toluene	ug/kg	0	50.00	52.18	58.41	104	117	62-130	11	22	
Trichloroethene	ug/kg	0	50.00	55.63	60.81	111	122	57-136	9	19	

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 605557438 605557446

Parameter	Units	605551308 Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Footnotes
Dibromofluoromethane (S)						99	117	85-113			1
Toluene-d8 (S)						105	110	87-112			
4-Bromofluorobenzene (S)						94	92	72-124			

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QUALITY CONTROL DATA

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

QC Batch: 132288
QC Batch Method:
Associated Lab Samples: 605528116

Analysis Method:
Analysis Description: Percent Moisture

SAMPLE DUPLICATE: 605543263

Parameter	Units	605543115 Result	DUP Result	RPD	RPD	Footnotes
Percent Moisture	%	19.00	19.90	5		

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Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

QUALITY CONTROL DATA PARAMETER FOOTNOTES

Consistent with EPA guidelines, unrounded concentrations are displayed and have been used to calculate % Rec and RPD values.

LCS(D)	Laboratory Control Sample (Duplicate)
MS(D)	Matrix Spike (Duplicate)
DUP	Sample Duplicate
ND	Not detected at or above adjusted reporting limit
NC	Not Calculable
J	Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit
MDL	Adjusted Method Detection Limit
RPD	Relative Percent Difference
(S)	Surrogate
[1]	The sample matrix affected the Matrix Spike and Matrix Spike Duplicate (MS/MSD) compound recovery. The successful recovery of the Laboratory Control Sample (LCS) demonstrates the analytical system was in control for this QA/QC sample group.

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QUALITY CONTROL DATA

CROSS REFERENCE TABLE

Lab Project Number: 6063928
Client Project ID: MORRIS DAM 96231.0136

Lab Sample No Identifier	Client Sample Identifier	QC Batch Method	QC Batch Identifier	Analytical Method	Analytical Batch Identifier
605528116	DRUM SAMPLE 5 FT	EPA 3550	132358	EPA 8270	132713
605528116	DRUM SAMPLE 5 FT	EPA 8260	132451		
605528116	DRUM SAMPLE 5 FT		132288		

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Appendix C
Previous Geotechnical Boring Logs
DH-1, DH-2, DH-6, and DH-7

PROJECT NO. 80-1318

CORE HOLE LOG

ConverseWardDavisDixon

HOLE NO. 1

PROJECT MORRIS DAM FEATURE DAM CREST LOCATION RIGHT ABUTMENT

INCLINATION 0° BEARING - STARTED 2-3-81 COMPLETED 2-17-81

TOTAL DEPTH 109.9' GROUND ELEV. 1188 HOLE SIZE 3 7/8"

ELEV. WATER TABLE NONE WATER PRESSURE TESTS NONE TO ____ NO. CORE BOXES 9

LOGGED BY MBS/JRS CONTRACTOR LACFCD DRILL FOREMAN M. FEIKER

Elev. 1188	Sample No.	Depth	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
					ASPHALT PAVING	Drill is Longyear Model 34B ~ core rig Set Casing to 14.0'
					FILL-sand and gravel	
		5				
1178		10				
		15	30%		BEDROCK-Quartz Diorite color ~ 5GY 2/1, v. closely spaced fractures, moderately hard, moderately weathered	
1168		20	48%			
			77%			
			68%			
		25	51%			
			100%			
1158		30				
			71%			
			97%		34.0'-36.5'-Shear Zone, rock is intensely fractured, clay seams with slicked surfaces, slicks dip ± 40°	
		35				
			95%		37.0'-38.0'-Granitic Dike, hard, moderately weathered to fresh	
			35%			

PROJECT NO. 80-1318

CORE HOLE LOG
ConverseWardDavisDixon

SHEET 2 OF 3

HOLE NO. 1

Elev. 1148	Sample No.	Depth 40	Core Rec. σ_c	Graphic Log	Classification and Physical Condition	Drilling Information
			35%		38.0'-42.5'-Shear Zone, rock moderately hard, highly weathered, clay filled fractures dip 70°-80°	
			95%		42.6'-48.5'-Quartz Diorite-v. hard, fresh	
		45	100%			
			95%		48.2'-48.5'- Granitic Dike	
			83%		48.5'-59.0'-Quartz Diorite, calcite filled fractures extremely closely spaced, moderately hard, moderately weathered	
1138		50	100%			
			100%			
			80%			
			86%			
			62%			
			87%			
		55	77%			
			100%			
			54%			
					59.0'-60.0' Shear Zone, extensive clay gouge, minor slicks dip approximately 30°	
1128		60	63%		60.0'- 62.0' Quartz Diorite, fractures closely spaced, moderately hard to hard, moderately to slightly weathered	
		65	66%		62.0'-64.2' Volcanic Dike, 5Y3/2, fine grained, closely spaced fractures, Quartz fracture filling, hard, fresh	
					64.2'-66.0' Quartz Diorite as above	
			90%		66.0'-67.0' Volcanic Dike as above	
					67.0'-68.0' Quartz Diorite as above	
1118		70			68.0'-70.0' Volcanic Dike as above	
			21%		70.0'-78.8' Quartz Diorite, fractures v. closely spaced to extremely closely spaced, moderately hard to hard, moderately to highly weathered	
			35%			
		75	80%			
			100%		78.8'-79.4' Shear Zone, clay gouge with minor slicked surfaces	
					79.4'-80.0' Quartz Diorite as above	
					80.0'-80.3' Granitic Dike	
1108		80			80.3'-84.0' Quartz Diorite as above	
			89%			
			100%		84.0'-85.0' Volcanic Dike 5Y3/2, fine grained texture, closely spaced fractures	
		85				
			74%			

PROJECT NO. [illegible]

ConverseWardDavisDixon

HOLE NO. 1

Elev.	Sample No.	Depth	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
1098		90	90%		88.5'-95.0' Diorite Gneiss, total mineral segregation, hard, slightly weathered	
			84%			
		95	100%		95.0'-98.7' Volcanic Dike, fine grained, fresh, hard, fractures calcite filled, fractures dip 15°-20°	
			86%		98.7'-109.9' Granitic Dike, 5GY6/1, course grained, fractures extremely closely spaced, hard to v. hard, fresh	
1088		100	100%			
			100%			
			77%			
		105				
			68%			
1078		110			END BORING 109.9'	

PROJECT NO. 80-1318

CORE HOLE LOG

ConverseWardDavisDixon

SHEET 1 of 3

HOLE NO. 2

PROJECT: MORRIS DAM | FEATURE: DAM CREST | LOCATION: RIGHT ABUTMENT

INCLINATION: 0° | BEARING: - | STARTED: 1-19-81 | COMPLETED: 2-2-81

TOTAL DEPTH: 110.6 | GROUND ELEV.: 1190' | HOLE SIZE: NX

ELEV. WATER TABLE: NONE | WATER PRESSURE TESTS: 28' TO 110' | NO. CORE BOXES: 9

LOGGED BY: MBS/JRS JRS | CONTRACTOR: LACFCD | DRILL FOREMAN: M. FEIKER

Elev.	Sample No.	Depth	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
					ASPHALT PAVING	Drill is Longyear Model 34B Hole cased from 0 to 14.5'
		5, 10			FILL-sand and gravel	
		15	30%		BEDROCK - QUARTZ DIORITE 14.5'-21.0' 5GY3/1, Quartz Diorite, fractures v. closely spaced, moderately hard, moderately weathered	
		20	60%			
			50%		21.0'-29.0' Granitic Dike, fractures extremely closely spaced, moderately hard, moderately to highly weathered	
		25	32%			
			13%			
		30	83%		29.0'-32.5' Quartz Diorite, fractures very closely spaced, hard, moderately weathered	
			65%			
			92%		32.5'-34.0' Granitic Dike, N7-N8, fractures are v. closely spaced, hard, fresh to moderately weathered	
		35	100%		34.0'-47.5' Quartz Diorite, closely spaced to v. closely spaced fractures, hard to v. hard, fresh to moderately weathered, fractures dip 50°-70°	

PROJECT NO. 80-1318

CORE HOLE LOG

ConverseWardDavisDixon

HOLE NO. 2

Elev.	Sample No.	Depth 40	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
			100%			
		45	100%			
					47.5'-48.0' Shear Zone, clay seams with slicked surfaces dip at approximately 45°	
		50	100%		48.0'-52.6' Quartz Diorite, fractures are closely spaced, rock is hard to v. hard, fresh to slightly weathered	
			100%		52.6'-54.8' Shear Zone, extensive clay gouge with slicked surfaces dip at ±40°	
		55	90%		54.8'-58.6' Quartz Diorite, fractures are closely spaced, rock is hard to v. hard, fresh to slightly weathered	
		60	77%		58.6'-62.0' Volcanic Dike, 5Y 3/2, fine grained, v. closely spaced fractures, rock is hard, fresh	
		65	29%		62.0'-68.5' Quartz Diorite, fractures closely spaced, rock is hard to v. hard, fresh	
			67%			
			100%		68.5'-69.0' Volcanic Dike, same as 58.6'-62.0'	
		70	100%		69.0'-71.0' Quartz Diorite, same as above	
			86%		71.0'-72.0' Granitic Dike, hard to v. hard, fresh	
		75	100%		72.0'-76.2' Quartz Diorite, v. closely spaced fractures, hard to v. hard, fresh	
		80	49%		76.2'-88.7' Volcanic Dike, 5Y 3/2, fractures v. closely spaced, rock is hard to v. hard, fresh to moderately weathered along fractures	
			70%			
		85	88%			
			95%			

PROJECT NO. 80-1318

CORE HOLE LOG
ConverseWardDavisDixon

HOLE NO. 2

Elev.	Sample No.	Depth	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
			94%		88.7'-93.0' Quartz Diorite, fractures are v. closely spaced, hard to v. hard, fresh	
		90	58%			
			100%		93.0'-97.9' Volcanic Dike, fractures are v. closely spaced, dip 60° to vertical, rock is hard to v. hard, fresh	
			100%			
		95	100%			
					97.9'-106.2' Quartz Diorite, fractures are closely spaced, v. hard, fresh	
		100	100%			
		105	100%		106.2'-106.7' Granitic Dike, hard to v. hard, fresh to slightly weathered	
			100%		106.7'-110.6' Quartz Diorite, same as above	
		110				
					END BORING 110.6'	

PROJECT NO. 80-1318

CORE HOLE LOG

ConverseWardDavisDixon

SHEET 1 OF 3

HOLE NO. 6

PROJECT MORRIS DAM FEATURE DAM CREST LOCATION RIGHT ABUTMENT

INCLINATION 0° BEARING - STARTED 2-19-81 COMPLETED 2-25-81

TOTAL DEPTH 93.5' GROUND ELEV. 1180.5' HOLE SIZE 3 7/8"

ELEV. WATER TABLE NONE WATER PRESSURE TESTS NONE TO ____ NO. CORE BOXES 10

LOGGED BY JRS/MBS SJS CONTRACTOR LACFCD DRILL FOREMAN M. FEIKER

Elev.	Sample No.	Depth	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
				4" CASING	ASPHALT PAVING	Drill Rig is Skid Mounted Longyear 34B
					FILL-sand and gravel to 1" placed during dam modification.	Tri-Cone to 4.2', Grout 4" casing to 4.0'
		5	81%		CONCRETE/AGGREGATE, average aggregate size is 1.5", occasional cobble to 5", core is mechanically broken, concrete appears in good condition	
			100%			
		10	96%			
			100%			
		15				
			100%			
		20	92%		22.2'-22.4'-Wood Form	
					23.1'- Copper sheet (1/8")	
		25	100%			
		30	100%			
		35	100%			
			100%			

PROJECT NO. 80-1318

CORE HOLE LOG
ConverseWardDavisDixon

HOLE NO. 6

Elev.	Sample No.	Depth	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
		40			CONCRETE/AGGREGATE, as above	
			98%			
		45				
			95%			
		50	100%			
		55	100%			
		60	100%			
		65	100%		BEDROCK-QUARTZ DIORITE 5GY2/1, fractures are very closely spaced, rock is moderately hard to hard, moderately weathered	
		70	100%			
			100%		72.9'-73.9' Granitic Dike, fractures extremely closely spaced, rock is hard, slightly to moderately weathered	
		75			74.9- 1" thick clay gouge with slicked surfaces dip approximately 30°	
			100%			
		80				
			100%		82.0'-82.9' Granitic Dike, fractures extremely closely spaced, hard to v. hard, fresh	
		85	100%		86.5'-86.7' Granitic Dike same as 82.0'-82.9'	

PROJECT NO. 80-1318

CORE HOLE LOG
ConverseWardDavisDixon

HOLE NO. 6

Elev.	Sample No.	Depth	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
			100%		BEDROCK-QUARTZ DIORITE, as above	
		90	100%			
					91.0'-91.2' Shear Zone, slicked surfaces dip approximately 40°	
			80%		93.1'-½" Clay Gouge Zone	
					END BORING 93.5'	

PROJECT NO. 80-1318

CORE HOLE LOG

ConverseWardDavisDixon

SHEET 1 OF 3

HOLE NO. 7

PROJECT: MORRIS DAM | FEATURE: DAM CREST | LOCATION: RIGHT ABUTMENT

INCLINATION: 0° | BEARING: - | STARTED: 2-18-81 | COMPLETED: 2-25-81

TOTAL DEPTH: 96.0' | GROUND ELEV.: 1183.0' | HOLE SIZE: NX

ELEV. WATER TABLE: NONE | WATER PRESSURE TESTS: 9' TO 96' | NO. CORE BOXES: 10

LOGGED BY: MBS/JRS SQS | CONTRACTOR: LACFCD | DRILL FOREMAN: M. FEIKER

Elev. 1183	Sample No.	Depth	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
					ASPHALT PAVING	Drill Rig is Skid Mounted Longyear 34B, Tri-Cone to 6.0', set and grout 3.5" casing to 6.0'.
					FILL-sand and gravel placed during recect dam modification	
		5			CONCRETE/AGGREGATE, average aggregate is 1" occasional cobbles to 3", core is mechanically broken, concrete appears in good condition.	
			100%			
1173		10	98%			
		15	100%			
1163		20	96%			
		25	100%			
1153		30	100%			
			100%			
		35	100%			
			100%			

PROJECT NO. 80-1318

CORE HOLE LOG
ConverseWardDavisDixon

SHEET 2 OF 3

HOLE NO. 7

Elev. 1143	Sample No.	Depth 40	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
			100%		CONCRETE/AGGREGATE as above	
		45	96%			
1133		50	100%			
		55	100%			
			100%		BEDROCK-VOLCANIC DIKE, 5G 2/1, fractures v. closely spaced, rock is hard to v. hard, fresh to slightly weathered, most fractures contain grout.	
1123		60	100%		Quartz Diorite, 5GY 2/1, fractures v. closely spaced, hard to moderately hard, slightly to moderately weathered.	
			100%			
		65	96%			
			100%			
1113		70	100%		71.8'-72.5' Granitic Dike, fractures extremely closely spaced, v. hard, fresh	
			100%		73.4'-74.2' Granitic Dike, fractures v. closely spaced, hard to v. hard, fresh	
		75	97%			
1103		80	100%			
			100%			
		85	100%		83.8'-84.1' Granitic Dike, v. hard, fresh	
			100%			

PROJECT NO. 80-1318

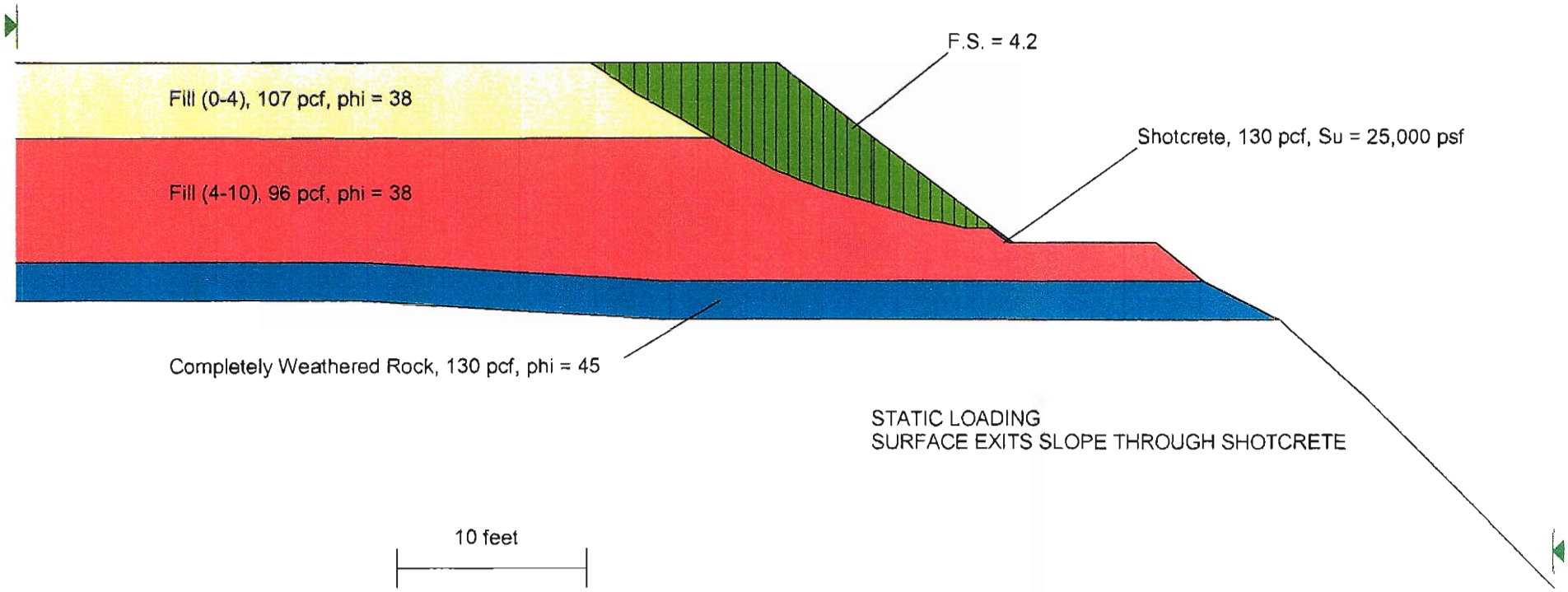
CORE HOLE LOG
ConverseWardDavisDixon

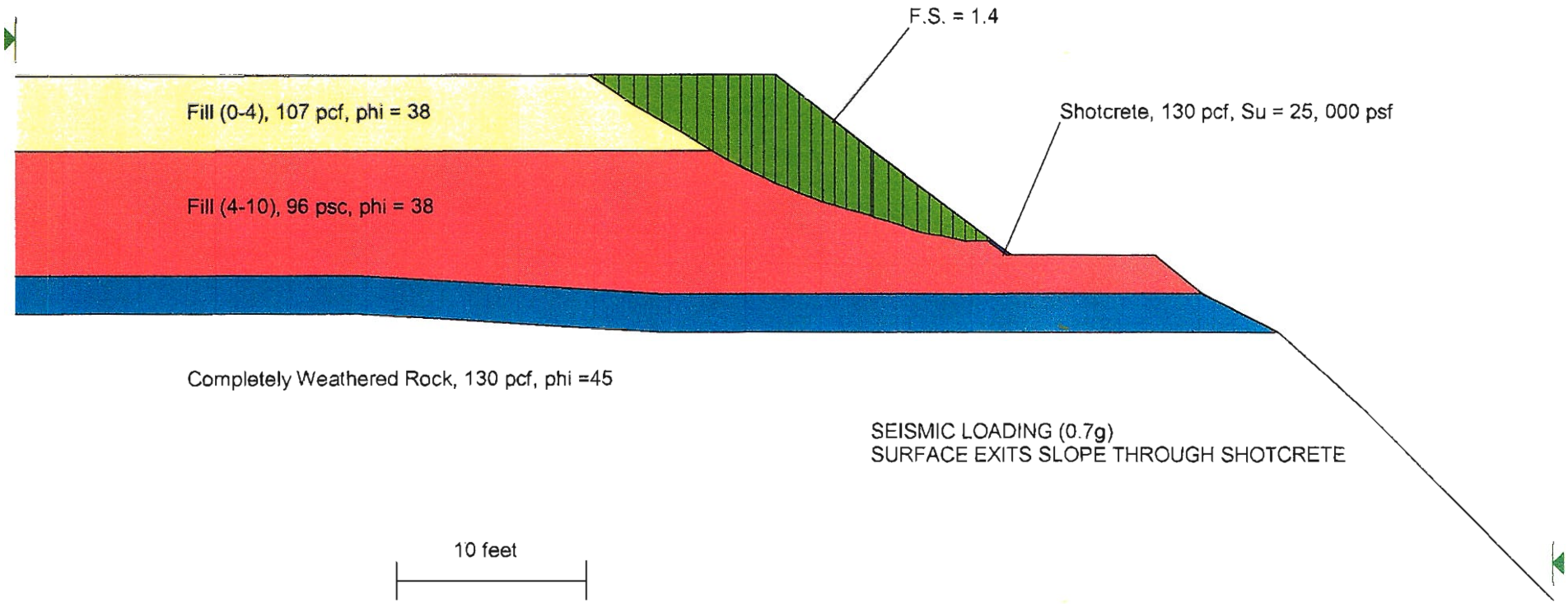
SHEET 3 OF 3

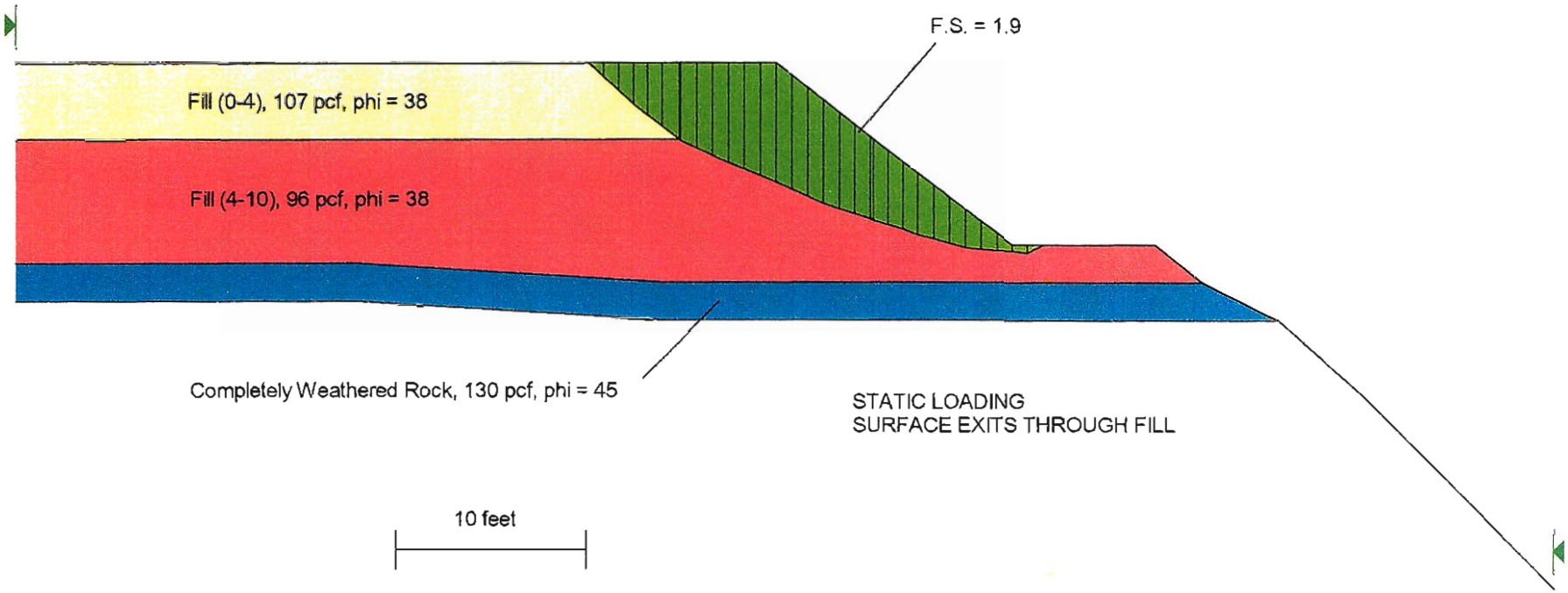
HOLE NO. 7

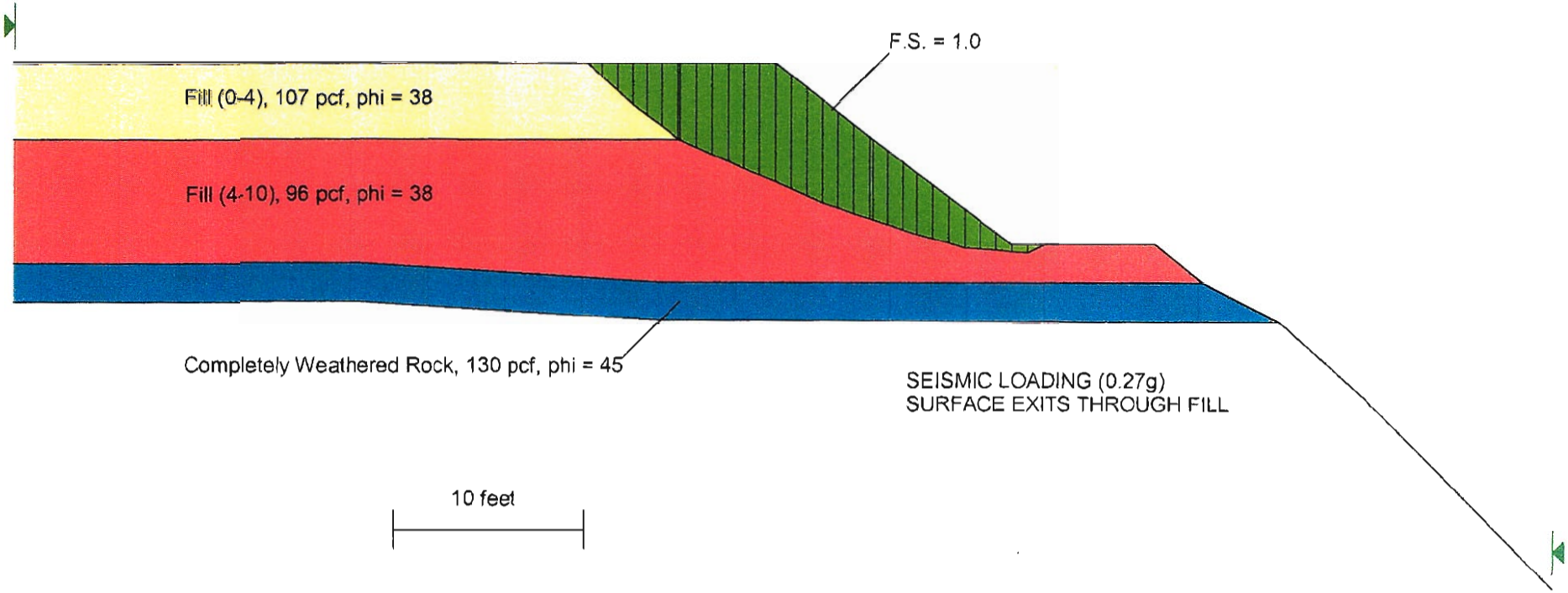
Elev.	Sample No.	Depth	Core Rec. %	Graphic Log	Classification and Physical Condition	Drilling Information
1093		90	100%		87.6'-87.7' GRANITIC DIKE, v. hard, fresh	
			46%			
			71%		94.1'-94.4' Shear Zone, clay gouge, indeterminate dip.	
			91%		95.5'-96.0' Shear Zone, clay gouge, indeterminate dip.	
		95	94%			
					END BORING 96.0'	

Appendix D
Slope Stability Analysis


F.S. = 4.2
Fill (0-4), 107 pcf, phi = 38
Shotcrete, 130 pcf, Su = 25,000 psf
Fill (4-10), 96 pcf, phi = 38
Completely Weathered Rock, 130 pcf, phi = 45
STATIC LOADING
SURFACE EXITS SLOPE THROUGH SHOTCRETE
10 feet


F.S. = 1.4
Shotcrete, 130 pcf, Su = 25, 000 psf
Fill (0-4), 107 pcf, phi = 38
Fill (4-10), 96 psc, phi = 38
Completely Weathered Rock, 130 pcf, phi =45
SEISMIC LOADING (0.7g)
SURFACE EXITS SLOPE THROUGH SHOTCRETE
10 feet


F.S. = 1.9
Fill (0-4), 107 pcf, phi = 38
Fill (4-10), 96 pcf, phi = 38
Completely Weathered Rock, 130 pcf, phi = 45
STATIC LOADING
SURFACE EXITS THROUGH FILL
10 feet


F.S. = 1.0
Fill (0-4), 107 pcf, phi = 38
Fill (4-10), 96 pcf, phi = 38
Completely Weathered Rock, 130 pcf, phi = 45
SEISMIC LOADING (0.27g)
SURFACE EXITS THROUGH FILL
10 feet

Appendix E
LPILE Analysis

DETERMINE ULTIMATE SOIL RESISTANCES FOR 0.4 INCH (1 cm) LATERAL MOVEMENT

```
LPILEP4
LA - DPW_Morris Dam; 30 inch Drilled Pier
1       3       1       0       0       0
60      2       0       120     0
0       30      15904   707     3605000
120     30      15904   707     3605000
3       6       6       0       0
4       0       48      440     440
4       48      156     440     440
6       156     240     0       0
0       0.062
48      0.062
48      0.056
156     0.056
156     0.075
240     0.075
0       0       38      0       0
48      0       38      0       0
48      0       38      0       0
156     0       38      0       0
156     6800    0       0       0
240     6800    0       0       0
0       1       1
1
4       0.4     0       0
0
1       1       0
100     1E-5    100
2       1
0
4000    60000   60000   29000000
0       30      0       0       0
0.6     6       0       3
```

==========

LPILE Plus for Windows, Version 4.0

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

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==========

This program is licensed to:

Mark Petersen
Black & Veatch

Path to file locations: C:\Documents and Settings\pet08890.NA\My Documents\BV-Users D\Infrastructure\Morris Dam\
Name of input data file: 096231 30in_DP 02.lpd
Name of output file: 096231 30in_DP 02.lpo
Name of plot output file: 096231 30in_DP 02.lpp
Name of runtime file: 096231 30in_DP 02.lpr

Time and Date of Analysis

Date: February 1, 2003 Time: 5:26:27

Problem Title

LA - DPW_Morris Dam; 30 inch Drilled Pier

Program Options

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 3:
- Computation of Nonlinear Bending Stiffness and Ultimate Bending Moment Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 60
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 120.00 in
Depth of ground surface below top of pile = .00 in
Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	30.000	15904.0000	707.0000	3605000.000
2	120.0000	30.000	15904.0000	707.0000	3605000.000

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of moment of inertia and modulus of are not used for any computations other than total stress due to combined axial loading and bending.

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = .000 in
Distance from top of pile to bottom of layer = 48.000 in
p-y subgrade modulus k for top of soil layer = 440.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 440.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 48.000 in
Distance from top of pile to bottom of layer = 156.000 in
p-y subgrade modulus k for top of soil layer = 440.000 lbs/in**3

p-y subgrade modulus k for bottom of layer = 440.000 lbs/in**3

Layer 3 is strong rock (vuggy limestone)
Distance from top of pile to top of layer = 156.000 in
Distance from top of pile to bottom of layer = 240.000 in

(Depth of lowest layer extends 120.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	.00	.06200
2	48.00	.06200
3	48.00	.05600
4	156.00	.05600
5	156.00	.07500
6	240.00	.07500

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	.000	.00000	38.00	------	------
2	48.000	.00000	38.00	------	------
3	48.000	.00000	38.00	------	------
4	156.000	.00000	38.00	------	------
5	156.000	6800.00000	.00	------	------
6	240.000	6800.00000	.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Static loading criteria was used for computation of p-y curves

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .400 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Computations of Ultimate Moment Capacity and Nonlinear Bending Stiffness

Pile Description:

The sectional shape is a circular drilled shaft (bored pile).

Outside Diameter = 30.000 In

Material Properties:

Compressive Strength of Concrete = 4.000 Kip/In**2
Yield Stress of Reinforcement = 60. Kip/In**2
Modulus of Elasticity of Reinforcement = 29000. Kip/In**2
Number of Reinforcing Bars = 6
Area of Single Bar = .60000 In**2
Number of Rows of Reinforcing Bars = 3
Cover Thickness (edge to bar center) = 3.000 In

Ultimate Axial Squash Load Capacity = 2607.08 Kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement In**2	Distance to Centroidal Axis In
1	1.200000	10.3923
2	1.200000	.0000
3	1.200000	-10.3923

Axial Thrust Force = .00 lbs

Bending Moment in-lbs	Bending Stiffness lb-in2	Bending Curvature rad/in	Maximum Strain in/in	Neutral Axis Position inches
152091.575	1.52092E+11	.00000100	.00001505	15.051
752550.949	1.50510E+11	.00000500	.00007525	15.050
1340359.251	1.48929E+11	.00000900	.00013545	15.050

1340359.251	1.03105E+11	.00001300	.00008100	6.23073578
1340359.251	7.88447E+10	.00001700	.00010605	6.23828888
1340359.251	6.38266E+10	.00002100	.00013117	6.24607086
1340359.251	5.36144E+10	.00002500	.00015634	6.25362396
1340359.251	4.62193E+10	.00002900	.00018158	6.26140594
1340359.251	4.06169E+10	.00003300	.00020689	6.26941681
1340359.251	3.62259E+10	.00003700	.00023226	6.27719879
1340359.251	3.26917E+10	.00004100	.00025769	6.28520966
1340359.251	2.97858E+10	.00004500	.00028321	6.29344940
1340359.251	2.73543E+10	.00004900	.00030877	6.30146027
1340359.251	2.52898E+10	.00005300	.00033441	6.30970001
1595840.429	1.92270E+10	.00008300	.00052906	6.37424469
2102324.201	1.86046E+10	.00011300	.00072130	6.38317108
2250319.062	1.57365E+10	.00014300	.00087034	6.08631134
2395781.946	1.38485E+10	.00017300	.00102502	5.92494965
2535443.980	1.24899E+10	.00020300	.00117549	5.79059601
2632591.594	1.12987E+10	.00023300	.00131518	5.64456940
2652546.593	1.00857E+10	.00026300	.00143901	5.47153473
2664199.986	9.09283E+09	.00029300	.00154689	5.27950287
2674635.697	8.28061E+09	.00032300	.00165589	5.12660980
2684007.378	7.60342E+09	.00035300	.00176614	5.00324249
2694878.146	7.03624E+09	.00038300	.00189143	4.93846893
2699661.839	6.53671E+09	.00041300	.00199724	4.83592987
2702991.778	6.10156E+09	.00044300	.00210429	4.75009918
2705885.825	5.72069E+09	.00047300	.00221269	4.67800140
2707938.397	5.38358E+09	.00050300	.00232287	4.61803436
2709833.445	5.08412E+09	.00053300	.00243433	4.56722260
2711315.295	4.81584E+09	.00056300	.00254686	4.52373505
2711315.295	4.57220E+09	.00059300	.00266846	4.49993134
2711315.295	4.35203E+09	.00062300	.00280346	4.49993134
2715060.938	4.15783E+09	.00065300	.00293621	4.49649811
2715060.938	3.97520E+09	.00068300	.00305063	4.46651459
2715060.938	3.80794E+09	.00071300	.00316700	4.44179535
2715060.938	3.65419E+09	.00074300	.00328444	4.42050934
2715060.938	3.51237E+09	.00077300	.00340255	4.40174103
2715060.938	3.38115E+09	.00080300	.00352155	4.38549042
2715060.938	3.25938E+09	.00083300	.00364129	4.37129974
2715060.938	3.14607E+09	.00086300	.00376196	4.35916901
2715060.938	3.04038E+09	.00089300	.00388395	4.34932709

Ultimate Moment Capacity at a Concrete Strain of 0.003 = 2715.061 In-Kip

---

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

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .400000 in
Specified bending moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X	Deflect. y	Moment M	Shear V	Slope S	Total Stress	Flx. Rig. EI	Soil Res p

in	in	lbs-in	lbs	Rad.	lbs/in**2	lbs-in**2	lbs/in
0.000	.400000	0.0	25609.5	-.004708	0.0	1.52E+11	0.000
2.000	.390584	51219.1	25578.6	-.004708	48.3077	1.52E+11	-30.918
4.000	.381169	102314.5	25483.9	-.004707	96.4988	1.52E+11	-63.857
6.000	.371758	153154.5	25321.5	-.004705	144.4	1.52E+11	-98.515
8.000	.362350	203600.4	25088.4	-.004703	192.0	1.52E+11	-134.588
10.000	.352947	253508.0	24782.0	-.004700	239.1	1.52E+11	-171.773
12.000	.343551	302728.5	24400.5	-.004696	285.5	1.52E+11	-209.767
14.000	.334164	351109.9	23942.4	-.004692	331.2	1.52E+11	-248.268
16.000	.324785	398498.2	23406.8	-.004687	375.8	1.51E+11	-287.358
18.000	.315417	444737.1	22792.5	-.004681	419.5	1.51E+11	-326.962
20.000	.306061	489668.2	22099.0	-.004675	461.8	1.51E+11	-366.508
22.000	.296717	533133.2	21326.8	-.004668	502.8	1.51E+11	-405.740
24.000	.287388	574975.3	20476.6	-.004661	542.3	1.51E+11	-444.405
26.000	.278074	615039.8	19550.0	-.004653	580.1	1.51E+11	-482.255
28.000	.268776	653175.2	18548.7	-.004645	616.0	1.51E+11	-519.042
30.000	.259496	689234.5	17475.1	-.004636	650.1	1.51E+11	-554.524
32.000	.250234	723075.6	16330.9	-.004626	682.0	1.51E+11	-589.722
34.000	.240991	754557.9	15117.8	-.004616	711.7	1.51E+11	-623.375
36.000	.231768	783546.7	13839.1	-.004606	739.0	1.50E+11	-655.264
38.000	.222566	809914.4	12498.7	-.004596	763.9	1.50E+11	-685.172
40.000	.213386	833541.5	11100.6	-.004585	786.2	1.50E+11	-712.884
42.000	.204228	854317.0	9649.6	-.004573	805.8	1.50E+11	-738.191
44.000	.195092	872139.7	8150.5	-.004562	822.6	1.50E+11	-760.884
46.000	.185980	886918.9	6606.8	-.004550	836.5	1.50E+11	-782.818
48.000	.176891	898566.8	5023.8	-.004538	847.5	1.50E+11	-800.120
50.000	.167826	907014.3	3408.0	-.004526	855.5	1.50E+11	-815.692
52.000	.158786	912198.9	1763.9	-.004514	860.3	1.50E+11	-828.418
54.000	.149770	914070.0	97.3969	-.004502	862.1	1.50E+11	-838.108
56.000	.140778	912588.5	-1585.3	-.004490	860.7	1.50E+11	-844.566
58.000	.131810	907728.9	-3277.4	-.004478	856.1	1.50E+11	-847.594
60.000	.122867	899478.8	-4972.0	-.004466	848.4	1.50E+11	-846.984
62.000	.113948	887840.8	-6665.8	-.004454	837.4	1.50E+11	-846.821
64.000	.105052	872815.5	-8356.2	-.004442	823.2	1.50E+11	-843.549
66.000	.096179	854416.0	-10036.1	-.004431	805.9	1.50E+11	-836.326
68.000	.087330	832671.3	-11697.2	-.004419	785.3	1.50E+11	-824.843
70.000	.078502	807627.1	-13330.8	-.004408	761.7	1.50E+11	-808.737
72.000	.069696	779348.0	-14927.1	-.004398	735.0	1.50E+11	-787.563
74.000	.060911	747918.7	-16475.4	-.004388	705.4	1.51E+11	-760.755
76.000	.052145	713446.3	-17963.7	-.004378	672.9	1.51E+11	-727.509
78.000	.043399	676063.9	-19377.5	-.004369	637.6	1.51E+11	-686.277
80.000	.034670	635936.3	-20698.9	-.004360	599.8	1.51E+11	-635.186
82.000	.025958	593268.1	-21905.4	-.004352	559.5	1.51E+11	-571.266
84.000	.017262	548314.8	-22965.3	-.004344	517.1	1.51E+11	-488.621
86.000	.008581	501406.9	-23777.7	-.004337	472.9	1.51E+11	-323.782
88.000	-8.73E-05	453204.0	-24098.1	-.004331	427.4	1.51E+11	3.372
90.000	-.008744	405014.5	-23749.4	-.004325	382.0	1.51E+11	345.309
92.000	-.017389	358206.3	-22937.3	-.004320	337.8	1.52E+11	466.801
94.000	-.026025	313265.3	-21924.9	-.004316	295.5	1.52E+11	545.624
96.000	-.034653	270506.8	-20768.9	-.004312	255.1	1.52E+11	610.388
98.000	-.043274	230189.8	-19491.9	-.004309	217.1	1.52E+11	666.557
100.000	-.051888	192539.1	-18108.6	-.004306	181.6	1.52E+11	716.769
102.000	-.060498	157755.4	-16629.3	-.004304	148.8	1.52E+11	762.501
104.000	-.069103	126021.8	-15062.2	-.004302	118.9	1.52E+11	804.659
106.000	-.077705	97506.8	-13413.7	-.004300	91.9644	1.52E+11	843.833
108.000	-.086305	72367.1	-11689.4	-.004299	68.2537	1.52E+11	880.423

110.000	-.094903	50749.1	-9894.3	-.004298	47.8645	1.52E+11	914.707
112.000	-.103499	32790.0	-8032.7	-.004298	30.9261	1.52E+11	946.884
114.000	-.112094	18618.3	-6108.7	-.004298	17.5600	1.52E+11	977.093
116.000	-.120689	8355.1	-4126.2	-.004297	7.8802	1.52E+11	1005.437
118.000	-.129284	2113.6	-2088.8	-.004297	1.9934	1.52E+11	1031.984
120.000	-.137879	0.0	0.0	-.004297	0.0	1.52E+11	1056.784

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.40000000	in
Computed slope at pile head	=	-.00470797	
Maximum bending moment	=	914069.958	lbs-in
Maximum shear force	=	25609.544	lbs
Depth of maximum bending moment	=	54.000	in
Depth of maximum shear force	=	0.000	in
Number of iterations	=	14	
Number of zero deflection points	=	1	

Summary of Pile-head Response

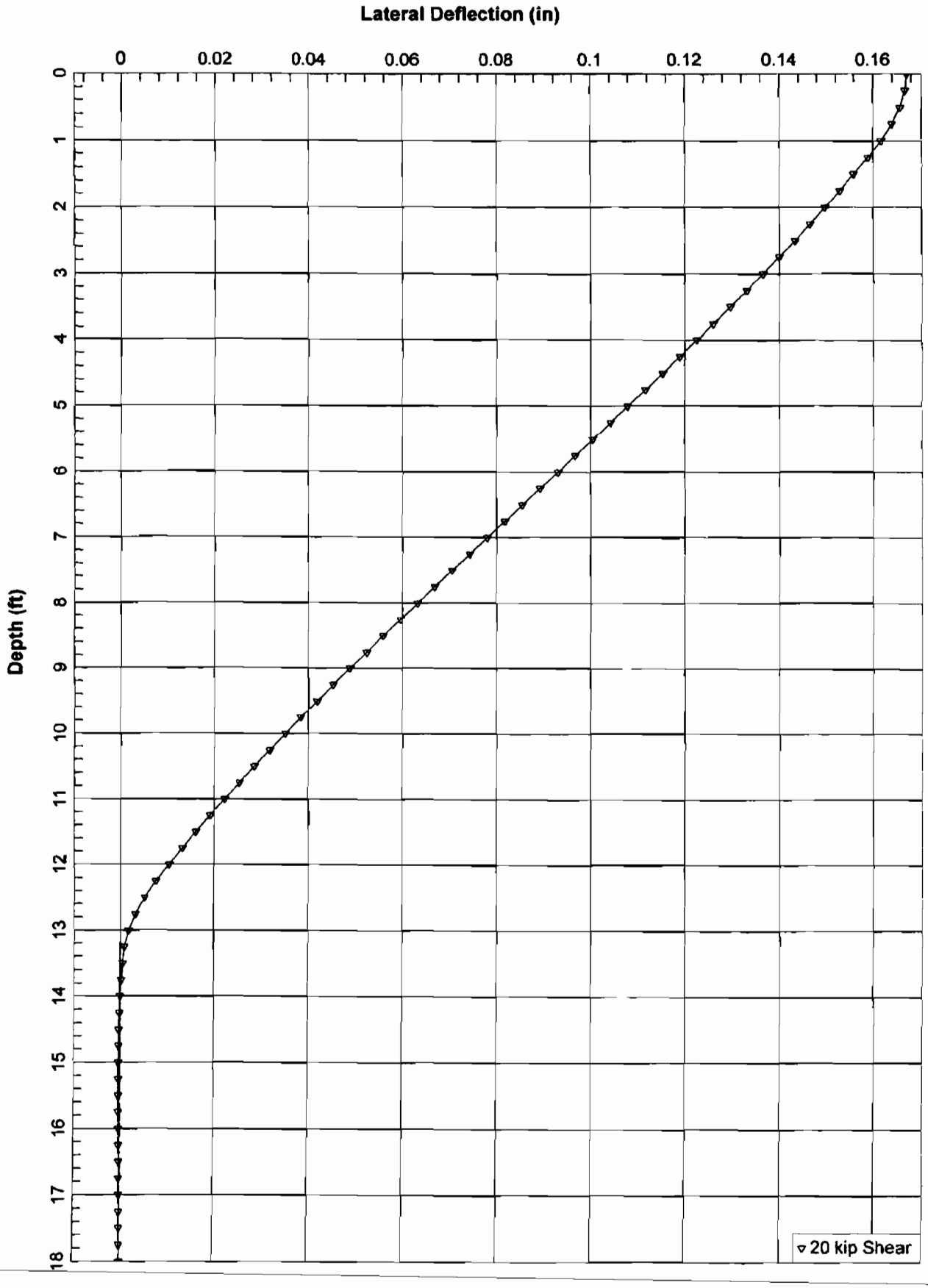
Definition of symbols for pile-head boundary conditions:

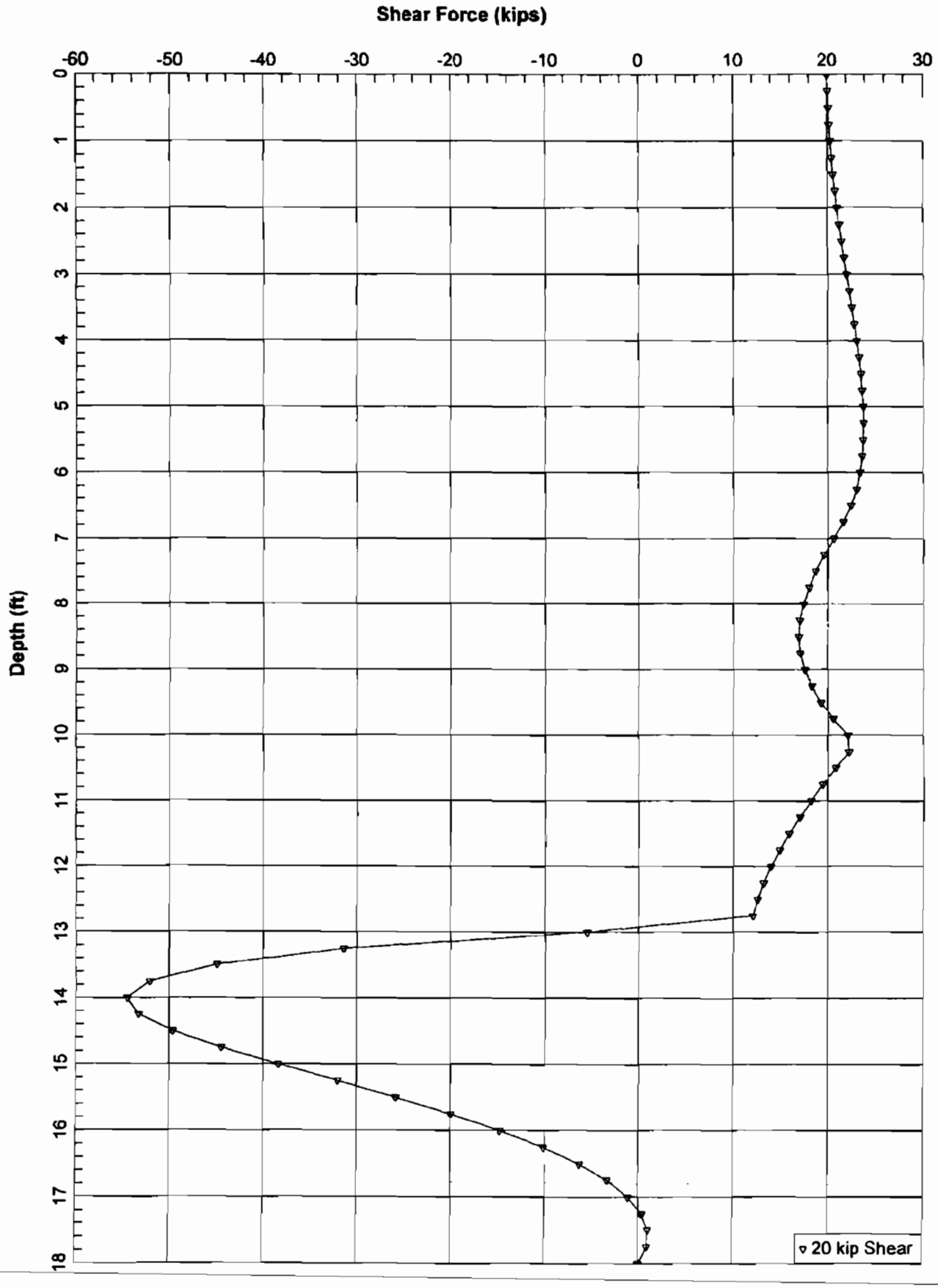
y = pile-head displacment, in
M = pile-head moment, lbs-in
V = pile-head shear force, lbs
S = pile-head slope, radians
R = rotational stiffness of pile-head, in-lbs/rad

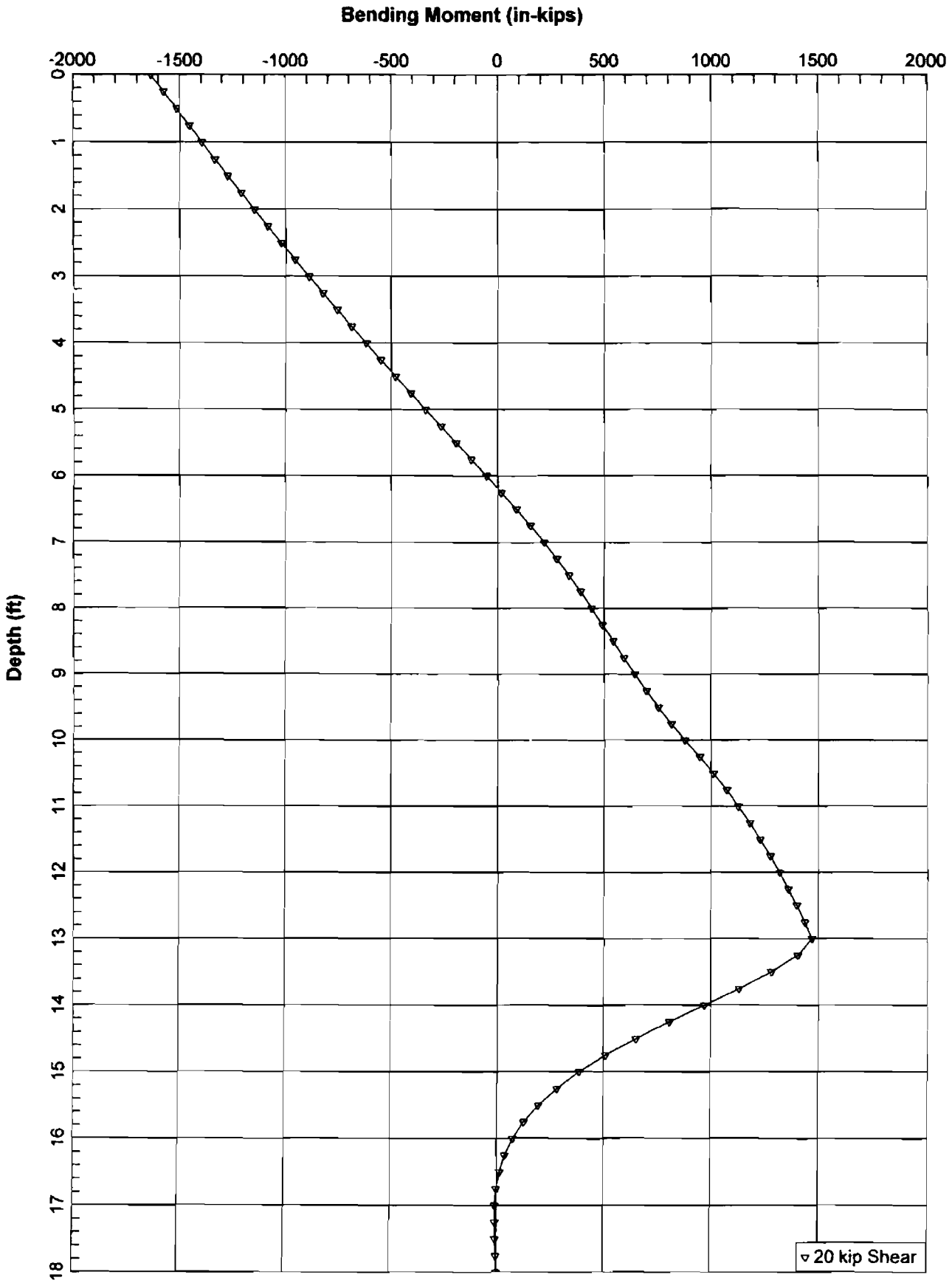
BC Type	Boundary Condition 1	Boundary Condition 2	Axial Load lbs	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .400000	M= 0.000	0.0000	.4000	9.141E+05	25609.5435

The analysis ended normally.

APPLY 20 KIP SHEAR AND DISTRIBUTED LATERAL LOAD FOR 0.4 INCH (1cm) MOVEMENT, FIXED HEAD


Lateral Deflection (in)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
20 kip Shear


Shear Force (kips)
-60
-50
-40
-30
-20
-10
0
10
20
30
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
20 kip Shear


Bending Moment (in-kips)
-2000
-1500
-1000
-500
0
500
1000
1500
2000
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
20 kip Shear

096231 30in_DP 03B.lpd

```
LPILEP4
LA - DPW_Morris Dam; 30 inch Drilled Pier
1       3       1       0       0       0
72      2       0       216     0
0       30      15904   707     3605000
216     30      15904   707     3605000
3       6       6       0       0
4       0       48      440     440
4       48      156     440     440
6       156     240     0       0
0       0.062
48      0.062
48      0.056
156     0.056
156     0.075
240     0.075
0       0       38      0       0
48      0       38      0       0
48      0       38      0       0
156     0       38      0       0
156     6800    0       0       0
240     6800    0       0       0
11      1       1
0       0
12      210
24      444
36      655
48      800
60      847
72      787
84      488
96      610
108     880
120     1056
1
2       20000   0       0
0
1       1       0
100     1E-5    100
2       1
0
4000    60000   60000   29000000
0       30      0       0       0
0.6     6       0       3
```

==========

LPILE Plus for Windows, Version 4.0

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

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==========

This program is licensed to:

Mark Petersen
Black & Veatch

Path to file locations: C:\Documents and Settings\pet08890.NA\My Documents\BV-Users D\Infrastructure\Morris Dam\
Name of input data file: 096231 30in_DP 03B.lpd
Name of output file: 096231 30in_DP 03B.lpo
Name of plot output file: 096231 30in_DP 03B.lpp
Name of runtime file: 096231 30in_DP 03B.lpr

Time and Date of Analysis

Date: February 1, 2003 Time: 5:31:43

Problem Title

LA - DPW_Morris Dam; 30 inch Drilled Pier

Program Options

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 3:
- Computation of Nonlinear Bending Stiffness and Ultimate Bending Moment Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 72
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 216.00 in
Depth of ground surface below top of pile = .00 in
Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	30.000	15904.0000	707.0000	3605000.000
2	216.0000	30.000	15904.0000	707.0000	3605000.000

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of moment of inertia and modulus of are not used for any computations other than total stress due to combined axial loading and bending.

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = .000 in
Distance from top of pile to bottom of layer = 48.000 in
p-y subgrade modulus k for top of soil layer = 440.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 440.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 48.000 in
Distance from top of pile to bottom of layer = 156.000 in
p-y subgrade modulus k for top of soil layer = 440.000 lbs/in**3

p-y subgrade modulus k for bottom of layer = 440.000 lbs/in**3

Layer 3 is strong rock (vuggy limestone)
Distance from top of pile to top of layer = 156.000 in
Distance from top of pile to bottom of layer = 240.000 in

(Depth of lowest layer extends 24.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	.00	.06200
2	48.00	.06200
3	48.00	.05600
4	156.00	.05600
5	156.00	.07500
6	240.00	.07500

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	.000	.00000	38.00	------	------
2	48.000	.00000	38.00	------	------
3	48.000	.00000	38.00	------	------
4	156.000	.00000	38.00	------	------
5	156.000	6800.00000	.00	------	------
6	240.000	6800.00000	.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Static loading criteria was used for computation of p-y curves

Distributed lateral load intensity defined using 11 points

Point No.	Depth X in	Dist. Load lbs/in
1	.000	.00000
2	12.000	210.00000
3	24.000	444.00000
4	36.000	655.00000
5	48.000	800.00000
6	60.000	847.00000
7	72.000	787.00000
8	84.000	488.00000
9	96.000	610.00000
10	108.000	880.00000
11	120.000	1056.00000

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 20000.000 lbs
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head condition)

Computations of Ultimate Moment Capacity and Nonlinear Bending Stiffness

---

Pile Description:

The sectional shape is a circular drilled shaft (bored pile).

Outside Diameter = 30.000 In

Material Properties:

Compressive Strength of Concrete = 4.000 Kip/In**2
Yield Stress of Reinforcement = 60. Kip/In**2
Modulus of Elasticity of Reinforcement = 29000. Kip/In**2
Number of Reinforcing Bars = 6
Area of Single Bar = .60000 In**2
Number of Rows of Reinforcing Bars = 3
Cover Thickness (edge to bar center) = 3.000 In

Ultimate Axial Squash Load Capacity = 2607.08 Kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement In**2	Distance to Centroidal Axis In
1	1.200000	10.3923
2	1.200000	.0000
3	1.200000	-10.3923

Axial Thrust Force = .00 lbs

Bending Moment in-lbs	Bending Stiffness lb-in2	Bending Curvature rad/in	Maximum Strain in/in	Neutral Axis Position inches
152091.575	1.52092E+11	.00000100	.00001505	15.051
752550.949	1.50510E+11	.00000500	.00007525	15.050
1340359.251	1.48929E+11	.00000900	.00013545	15.050
1340359.251	1.03105E+11	.00001300	.00008100	6.23073578
1340359.251	7.88447E+10	.00001700	.00010605	6.23828888
1340359.251	6.38266E+10	.00002100	.00013117	6.24607086
1340359.251	5.36144E+10	.00002500	.00015634	6.25362396
1340359.251	4.62193E+10	.00002900	.00018158	6.26140594
1340359.251	4.06169E+10	.00003300	.00020689	6.26941681
1340359.251	3.62259E+10	.00003700	.00023226	6.27719879
1340359.251	3.26917E+10	.00004100	.00025769	6.28520966
1340359.251	2.97858E+10	.00004500	.00028321	6.29344940
1340359.251	2.73543E+10	.00004900	.00030877	6.30146027
1340359.251	2.52898E+10	.00005300	.00033441	6.30970001
1595840.429	1.92270E+10	.00008300	.00052906	6.37424469
2102324.201	1.86046E+10	.00011300	.00072130	6.38317108
2250319.062	1.57365E+10	.00014300	.00087034	6.08631134
2395781.946	1.38485E+10	.00017300	.00102502	5.92494965
2535443.980	1.24899E+10	.00020300	.00117549	5.79059601
2632591.594	1.12987E+10	.00023300	.00131518	5.64456940
2652546.593	1.00857E+10	.00026300	.00143901	5.47153473
2664199.986	9.09283E+09	.00029300	.00154689	5.27950287
2674635.697	8.28061E+09	.00032300	.00165589	5.12660980
2684007.378	7.60342E+09	.00035300	.00176614	5.00324249
2694878.146	7.03624E+09	.00038300	.00189143	4.93846893
2699661.839	6.53671E+09	.00041300	.00199724	4.83592987
2702991.778	6.10156E+09	.00044300	.00210429	4.75009918
2705885.825	5.72069E+09	.00047300	.00221269	4.67800140
2707938.397	5.38358E+09	.00050300	.00232287	4.61803436
2709833.445	5.08412E+09	.00053300	.00243433	4.56722260
2711315.295	4.81584E+09	.00056300	.00254686	4.52373505
2711315.295	4.57220E+09	.00059300	.00266846	4.49993134
2711315.295	4.35203E+09	.00062300	.00280346	4.49993134
2715060.938	4.15783E+09	.00065300	.00293621	4.49649811
2715060.938	3.97520E+09	.00068300	.00305063	4.46651459
2715060.938	3.80794E+09	.00071300	.00316700	4.44179535
2715060.938	3.65419E+09	.00074300	.00328444	4.42050934
2715060.938	3.51237E+09	.00077300	.00340255	4.40174103
2715060.938	3.38115E+09	.00080300	.00352155	4.38549042
2715060.938	3.25938E+09	.00083300	.00364129	4.37129974

2715060.938	3.14607E+09	.00086300	.00376196	4.35916901
2715060.938	3.04038E+09	.00089300	.00388395	4.34932709

Ultimate Moment Capacity at a Concrete Strain of 0.003 = 2715.061 In-Kip

---

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

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 20000.000 lbs
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	.167116	-1.64E+06	20000.0	-9.25E-18	1543.1	2.04E+10	0.000
3.000	.166754	-1.58E+06	20022.0	-2.37E-04	1486.5	2.04E+10	-37.830
6.000	.165696	-1.52E+06	20082.5	-4.65E-04	1429.8	2.04E+10	-79.364
9.000	.163967	-1.46E+06	20171.6	-6.69E-04	1372.9	2.35E+10	-123.736
12.000	.161680	-1.39E+06	20282.1	-8.48E-04	1315.7	2.45E+10	-170.078
15.000	.158881	-1.33E+06	20418.5	-9.63E-04	1258.1	6.67E+10	-217.513
18.000	.155902	-1.27E+06	20584.6	-.001006	1200.1	1.49E+11	-267.228
21.000	.152846	-1.21E+06	20776.3	-.001031	1141.6	1.49E+11	-317.480
24.000	.149717	-1.15E+06	20992.9	-.001054	1082.6	1.49E+11	-367.624
27.000	.146519	-1.08E+06	21227.0	-.001077	1022.8	1.50E+11	-417.025
30.000	.143256	-1.02E+06	21473.3	-.001098	962.4	1.50E+11	-465.058
33.000	.139931	-955638.1	21733.8	-.001118	901.3	1.50E+11	-513.014
36.000	.136550	-890035.2	22011.8	-.001136	839.4	1.50E+11	-558.917
39.000	.133114	-823567.5	22289.4	-.001153	776.8	1.50E+11	-602.221
42.000	.129630	-756298.5	22550.6	-.001169	713.3	1.51E+11	-642.396
45.000	.126100	-688263.6	22805.5	-.001183	649.1	1.51E+11	-678.925
48.000	.122529	-619465.3	23063.5	-.001196	584.3	1.51E+11	-712.862
51.000	.118922	-549882.7	23296.5	-.001208	518.6	1.51E+11	-743.518
54.000	.115281	-479686.0	23478.6	-.001218	452.4	1.51E+11	-770.379
57.000	.111612	-409011.3	23621.5	-.001227	385.8	1.51E+11	-793.084
60.000	.107919	-337957.1	23738.3	-.001234	318.7	1.52E+11	-811.290
63.000	.104205	-266581.4	23792.8	-.001240	251.4	1.52E+11	-831.394
66.000	.100476	-195200.3	23747.0	-.001245	184.1	1.52E+11	-848.107
69.000	.096735	-124099.2	23612.6	-.001248	117.0	1.52E+11	-860.495
72.000	.092987	-53524.5	23402.9	-.001250	50.4822	1.52E+11	-868.322
75.000	.089236	16318.2	23042.2	-.001250	15.3907	1.52E+11	-871.373
78.000	.085485	84728.9	22453.3	-.001249	79.9128	1.52E+11	-871.005
81.000	.081740	151038.0	21648.7	-.001247	142.5	1.52E+11	-865.652
84.000	.078003	214621.0	20643.8	-.001243	202.4	1.52E+11	-854.994
87.000	.074280	274901.1	19612.7	-.001239	259.3	1.52E+11	-838.919
90.000	.070572	332297.4	18729.6	-.001233	313.4	1.52E+11	-817.362
93.000	.066885	387278.4	17991.8	-.001225	365.3	1.51E+11	-802.981
96.000	.063220	440248.1	17393.5	-.001217	415.2	1.51E+11	-785.377

99.000	.059581	491639.4	17001.8	-.001208	463.7	1.51E+11	-763.225
102.000	.055972	542259.2	16885.9	-.001198	511.4	1.51E+11	-736.586
105.000	.052395	592954.7	17058.9	-.001186	559.3	1.51E+11	-705.575
108.000	.048854	644612.5	17533.7	-.001174	608.0	1.51E+11	-670.371
111.000	.045351	698157.0	18287.3	-.001161	658.5	1.51E+11	-631.225
114.000	.041889	754336.4	19295.8	-.001146	711.5	1.51E+11	-588.464
117.000	.038473	813931.7	20569.3	-.001131	767.7	1.50E+11	-542.504
120.000	.035105	877752.5	22116.8	-.001114	827.9	1.50E+11	-493.850
123.000	.031791	946632.6	22246.7	-.001096	892.8	1.50E+11	-475.569
126.000	.028532	1.01E+06	20846.3	-.001076	953.8	1.50E+11	-458.027
129.000	.025335	1.07E+06	19503.0	-.001055	1010.8	1.50E+11	-437.506
132.000	.022202	1.13E+06	18226.0	-.001033	1064.1	1.50E+11	-413.832
135.000	.019137	1.18E+06	17025.1	-.001010	1113.9	1.49E+11	-386.784
138.000	.016143	1.23E+06	15910.8	-9.86E-04	1160.5	1.49E+11	-356.072
141.000	.013224	1.28E+06	14894.7	-9.60E-04	1204.0	1.49E+11	-321.278
144.000	.010381	1.32E+06	13990.2	-9.34E-04	1244.8	1.46E+11	-281.766
147.000	.007620	1.36E+06	13212.8	-8.76E-04	1283.1	4.64E+10	-236.465
150.000	.005122	1.40E+06	12577.1	-7.47E-04	1319.5	2.44E+10	-187.373
153.000	.003140	1.44E+06	12080.3	-5.70E-04	1354.3	2.38E+10	-143.797
156.000	.001702	1.47E+06	-5492.6	-3.84E-04	1387.9	2.31E+10	-11571.507
159.000	8.35E-04	1.40E+06	-31368.3	-2.02E-04	1323.2	2.44E+10	-5678.937
162.000	4.87E-04	1.28E+06	-44855.3	-1.03E-04	1210.4	1.49E+11	-3312.393
165.000	2.17E-04	1.13E+06	-52032.9	-7.88E-05	1069.4	1.49E+11	-1472.667
168.000	1.43E-05	971121.0	-54387.6	-5.77E-05	915.9	1.50E+11	-97.137
171.000	-1.30E-04	807521.1	-53210.3	-3.99E-05	761.6	1.50E+11	881.977
174.000	-2.25E-04	651859.0	-49588.7	-2.54E-05	614.8	1.51E+11	1532.417
177.000	-2.82E-04	509988.7	-44412.7	-1.39E-05	481.0	1.51E+11	1918.269
180.000	-3.08E-04	385382.7	-38388.9	-4.98E-06	363.5	1.51E+11	2097.633
183.000	-3.12E-04	279655.5	-32060.5	1.60E-06	263.8	1.52E+11	2121.297
186.000	-2.99E-04	193019.9	-25830.2	6.27E-06	182.0	1.52E+11	2032.184
189.000	-2.74E-04	124674.0	-19984.0	9.41E-06	117.6	1.52E+11	1865.346
192.000	-2.42E-04	73116.2	-14713.4	1.14E-05	68.9602	1.52E+11	1648.342
195.000	-2.06E-04	36393.5	-10138.0	1.24E-05	34.3248	1.52E+11	1401.916
198.000	-1.68E-04	12288.0	-6323.9	1.29E-05	11.5895	1.52E+11	1140.846
201.000	-1.29E-04	-1549.9	-3300.4	1.30E-05	1.4618	1.52E+11	874.832
204.000	-8.96E-05	-7514.2	-1074.0	1.29E-05	7.0871	1.52E+11	609.441
207.000	-5.10E-05	-7993.7	360.8	1.28E-05	7.5393	1.52E+11	347.073
210.000	-1.29E-05	-5349.4	1013.3	1.27E-05	5.0453	1.52E+11	87.923
213.000	2.49E-05	-1913.9	891.6	1.26E-05	1.8051	1.52E+11	-169.076
216.000	6.25E-05	0.0	0.0	1.26E-05	0.0	1.52E+11	-425.304

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection = .16711608 in
Computed slope at pile head = -9.25186E-18
Maximum bending moment = -1636130.023 lbs-in

Maximum shear force	=	-54387.594	lbs
Depth of maximum bending moment	=	0.000	in
Depth of maximum shear force	=	168.000	in
Number of iterations	=	29	
Number of zero deflection points	=	2	

Summary of Pile-head Response

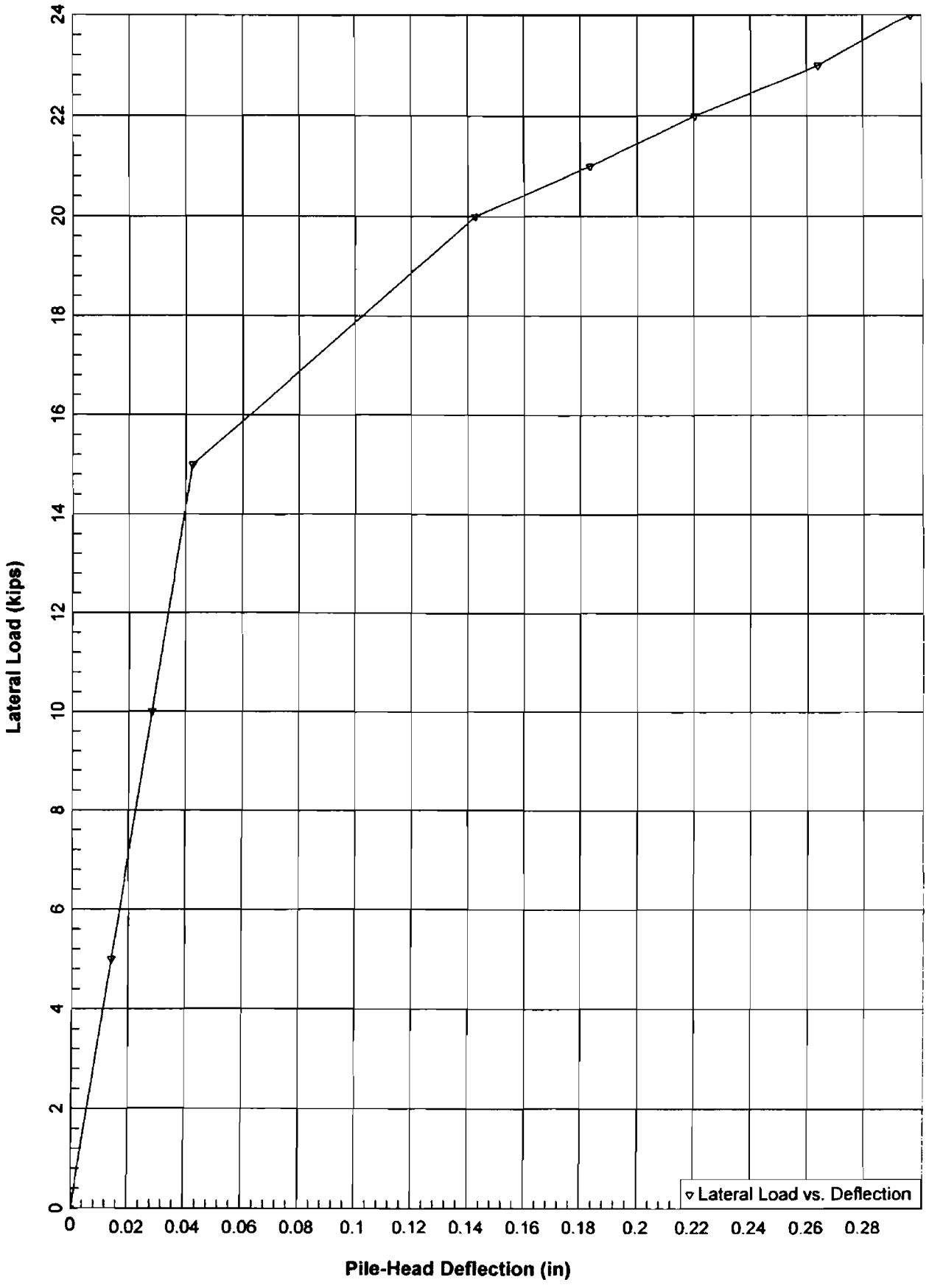
Definition of symbols for pile-head boundary conditions:

y = pile-head displacment, in
M = pile-head moment, lbs-in
V = pile-head shear force, lbs
S = pile-head slope, radians
R = rotational stiffness of pile-head, in-lbs/rad

BC Type	Boundary Condition 1	Boundary Condition 2	Axial Load lbs	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
2	V= 20000.000	S= 0.000	0.0000	.1671	-1.636E+06	-54387.5936

The analysis ended normally.

PIER UNSUPPORTED FOR 10 FEET, VARY LATERAL LOAD, FIXED HEAD


Lateral Load (kips)
0
2
4
6
8
10
12
14
16
18
20
22
24
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
0.28
Pile-Head Deflection (in)
Lateral Load vs. Deflection

096213 30in_DP 05D.lpd

```
LPILEP4
LA - DPW_Morris Dam; 30 inch Drilled Pier
1       3       1       0       0       0
108     2       120     216     0
0       30      15904   707     3605000
216     30      15904   707     3605000
2       4       4       0       0
4       120     156     440     440
6       156     360     0       0
120     0.056
156     0.056
156     0.075
360     0.075
120     0       38      0       0
156     0       38      0       0
156     6800    0       0       0
360     6800    0       0       0
0       1       1
9
2       0       0       0
2       5000    0       0
2       10000   0       0
2       15000   0       0
2       20000   0       0
2       21000   0       0
2       22000   0       0
2       23000   0       0
2       24000   0       0
0
1       1       0
100     1E-5    100
2       1
0
4000    60000   60000   29000000
0       30      0       0       0
0.6     6       0       3
```

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LPILE Plus for Windows, Version 4.0

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

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This program is licensed to:

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Black & Veatch

Path to file locations: C:\Documents and Settings\pet08890.NA\My Documents\BV-Users D\Infrastructure\Morris Dam\
Name of input data file: 096231 30in_DP 05D.lpd
Name of output file: 096231 30in_DP 05D.lpo
Name of plot output file: 096231 30in_DP 05D.lpp
Name of runtime file: 096231 30in_DP 05D.lpr

Time and Date of Analysis

Date: February 1, 2003 Time: 5:37: 1

Problem Title

LA - DPW_Morris Dam; 30 inch Drilled Pier

Program Options

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 3:
- Computation of Nonlinear Bending Stiffness and Ultimate Bending Moment Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 108
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 216.00 in
Depth of ground surface below top of pile = 120.00 in
Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	30.000	15904.0000	707.0000	3605000.000
2	216.0000	30.000	15904.0000	707.0000	3605000.000

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of moment of inertia and modulus of are not used for any computations other than total stress due to combined axial loading and bending.

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 = 120.000 in
Distance from top of pile to bottom of layer = 156.000 in
p-y subgrade modulus k for top of soil layer = 440.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 440.000 lbs/in**3

Layer 2 is strong rock (vuggy limestone)
Distance from top of pile to top of layer = 156.000 in
Distance from top of pile to bottom of layer = 360.000 in

(Depth of lowest layer extends 144.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 4 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	120.00	.05600
2	156.00	.05600
3	156.00	.07500
4	360.00	.07500

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 4 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	120.000	.00000	38.00	------	------
2	156.000	.00000	38.00	------	------
3	156.000	6800.00000	.00	------	------
4	360.000	6800.00000	.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Static loading criteria was used for computation of p-y curves

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Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 9

Load Case Number 1

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = .000 lbs

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Slope at pile head          =            .000 in/in
Axial load at pile head     =            .000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  2

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =        5000.000 lbs
Slope at pile head          =            .000 in/in
Axial load at pile head     =            .000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  3

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       10000.000 lbs
Slope at pile head          =            .000 in/in
Axial load at pile head     =            .000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  4

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       15000.000 lbs
Slope at pile head          =            .000 in/in
Axial load at pile head     =            .000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  5

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       20000.000 lbs
Slope at pile head          =            .000 in/in
Axial load at pile head     =            .000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  6

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       21000.000 lbs
Slope at pile head          =            .000 in/in
Axial load at pile head     =            .000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number  7

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head    =       22000.000 lbs
Slope at pile head          =            .000 in/in
Axial load at pile head     =            .000 lbs
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(Zero slope for this load indicates fixed-head condition)

Load Case Number 8

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 23000.000 lbs
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head condition)

Load Case Number 9

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 24000.000 lbs
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head condition)

Computations of Ultimate Moment Capacity and Nonlinear Bending Stiffness

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Pile Description:

The sectional shape is a circular drilled shaft (bored pile).

Outside Diameter = 30.000 In

Material Properties:

Compressive Strength of Concrete = 4.000 Kip/In**2
Yield Stress of Reinforcement = 60. Kip/In**2
Modulus of Elasticity of Reinforcement = 29000. Kip/In**2
Number of Reinforcing Bars = 6
Area of Single Bar = .60000 In**2
Number of Rows of Reinforcing Bars = 3
Cover Thickness (edge to bar center) = 3.000 In

Ultimate Axial Squash Load Capacity = 2607.08 Kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement In**2	Distance to Centroidal Axis In
1	1.200000	10.3923
2	1.200000	.0000
3	1.200000	-10.3923

Axial Thrust Force = .00 lbs

Bending Moment in-lbs	Bending Stiffness lb-in2	Bending Curvature rad/in	Maximum Strain in/in	Neutral Axis Position inches
152091.575	1.52092E+11	.00000100	.00001505	15.051
752550.949	1.50510E+11	.00000500	.00007525	15.050
1340359.251	1.48929E+11	.00000900	.00013545	15.050
1340359.251	1.03105E+11	.00001300	.00008100	6.23073578
1340359.251	7.88447E+10	.00001700	.00010605	6.23828888
1340359.251	6.38266E+10	.00002100	.00013117	6.24607086
1340359.251	5.36144E+10	.00002500	.00015634	6.25362396
1340359.251	4.62193E+10	.00002900	.00018158	6.26140594
1340359.251	4.06169E+10	.00003300	.00020689	6.26941681
1340359.251	3.62259E+10	.00003700	.00023226	6.27719879
1340359.251	3.26917E+10	.00004100	.00025769	6.28520966
1340359.251	2.97858E+10	.00004500	.00028321	6.29344940
1340359.251	2.73543E+10	.00004900	.00030877	6.30146027
1340359.251	2.52898E+10	.00005300	.00033441	6.30970001
1595840.429	1.92270E+10	.00008300	.00052906	6.37424469
2102324.201	1.86046E+10	.00011300	.00072130	6.38317108
2250319.062	1.57365E+10	.00014300	.00087034	6.08631134
2395781.946	1.38485E+10	.00017300	.00102502	5.92494965
2535443.980	1.24899E+10	.00020300	.00117549	5.79059601
2632591.594	1.12987E+10	.00023300	.00131518	5.64456940
2652546.593	1.00857E+10	.00026300	.00143901	5.47153473
2664199.986	9.09283E+09	.00029300	.00154689	5.27950287
2674635.697	8.28061E+09	.00032300	.00165589	5.12660980
2684007.378	7.60342E+09	.00035300	.00176614	5.00324249
2694878.146	7.03624E+09	.00038300	.00189143	4.93846893
2699661.839	6.53671E+09	.00041300	.00199724	4.83592987
2702991.778	6.10156E+09	.00044300	.00210429	4.75009918
2705885.825	5.72069E+09	.00047300	.00221269	4.67800140
2707938.397	5.38358E+09	.00050300	.00232287	4.61803436
2709833.445	5.08412E+09	.00053300	.00243433	4.56722260
2711315.295	4.81584E+09	.00056300	.00254686	4.52373505
2711315.295	4.57220E+09	.00059300	.00266846	4.49993134
2711315.295	4.35203E+09	.00062300	.00280346	4.49993134
2715060.938	4.15783E+09	.00065300	.00293621	4.49649811
2715060.938	3.97520E+09	.00068300	.00305063	4.46651459
2715060.938	3.80794E+09	.00071300	.00316700	4.44179535
2715060.938	3.65419E+09	.00074300	.00328444	4.42050934
2715060.938	3.51237E+09	.00077300	.00340255	4.40174103
2715060.938	3.38115E+09	.00080300	.00352155	4.38549042
2715060.938	3.25938E+09	.00083300	.00364129	4.37129974
2715060.938	3.14607E+09	.00086300	.00376196	4.35916901
2715060.938	3.04038E+09	.00089300	.00388395	4.34932709

Ultimate Moment Capacity at a Concrete Strain of 0.003 = 2715.061 In-Kip

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

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = .000 lbs
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
2.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
4.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
6.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
8.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
10.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
12.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
14.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
16.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
18.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
20.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
22.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
24.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
26.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
28.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
30.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
32.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
34.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
36.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
38.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
40.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
42.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
44.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
46.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
48.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
50.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
52.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
54.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
56.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
58.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
60.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
62.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
64.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
66.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
68.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
70.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
72.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
74.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
76.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
78.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
80.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
82.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
84.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
86.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
88.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
90.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000

92.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
94.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
96.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
98.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
100.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
102.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
104.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
106.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
108.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
110.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
112.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
114.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
116.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
118.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
120.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
122.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
124.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
126.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
128.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
130.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
132.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
134.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
136.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
138.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
140.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
142.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
144.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
146.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
148.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
150.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
152.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
154.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
156.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
158.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
160.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
162.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
164.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
166.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
168.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
170.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
172.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
174.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
176.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
178.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
180.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
182.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
184.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
186.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
188.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
190.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
192.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
194.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
196.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
198.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
200.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
202.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
204.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000

206.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
208.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
210.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
212.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
214.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000
216.000	0.000	0.0	0.0	0.000	0.0	1.52E+11	0.000

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.000	in
Computed slope at pile head	=	0.000	
Maximum bending moment	=	0.000	lbs-in
Maximum shear force	=	0.000	lbs
Depth of maximum bending moment	=	0.000	in
Depth of maximum shear force	=	0.000	in
Number of iterations	=	5	
Number of zero deflection points	=	0	

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

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 5000.000 lbs
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	.014009	-429851.4	5000.0	-1.26E-17	405.4	1.51E+11	0.000
2.000	.014003	-419851.4	5000.0	-5.61E-06	396.0	1.51E+11	0.000
4.000	.013987	-409851.4	5000.0	-1.11E-05	386.6	1.51E+11	0.000
6.000	.013959	-399851.4	5000.0	-1.64E-05	377.1	1.51E+11	0.000
8.000	.013921	-389851.4	5000.0	-2.17E-05	367.7	1.51E+11	0.000
10.000	.013872	-379851.4	5000.0	-2.67E-05	358.3	1.51E+11	0.000
12.000	.013814	-369851.4	5000.0	-3.17E-05	348.8	1.52E+11	0.000
14.000	.013746	-359851.4	5000.0	-3.65E-05	339.4	1.52E+11	0.000
16.000	.013668	-349851.4	5000.0	-4.12E-05	330.0	1.52E+11	0.000

18.000	.013581	-339851.4	5000.0	-4.57E-05	320.5	1.52E+11	0.000
20.000	.013485	-329851.4	5000.0	-5.01E-05	311.1	1.52E+11	0.000
22.000	.013380	-319851.4	5000.0	-5.44E-05	301.7	1.52E+11	0.000
24.000	.013267	-309851.4	5000.0	-5.86E-05	292.2	1.52E+11	0.000
26.000	.013146	-299851.4	5000.0	-6.26E-05	282.8	1.52E+11	0.000
28.000	.013017	-289851.4	5000.0	-6.65E-05	273.4	1.52E+11	0.000
30.000	.012880	-279851.4	5000.0	-7.02E-05	263.9	1.52E+11	0.000
32.000	.012736	-269851.4	5000.0	-7.39E-05	254.5	1.52E+11	0.000
34.000	.012585	-259851.4	5000.0	-7.74E-05	245.1	1.52E+11	0.000
36.000	.012426	-249851.4	5000.0	-8.07E-05	235.6	1.52E+11	0.000
38.000	.012262	-239851.4	5000.0	-8.39E-05	226.2	1.52E+11	0.000
40.000	.012091	-229851.4	5000.0	-8.70E-05	216.8	1.52E+11	0.000
42.000	.011914	-219851.4	5000.0	-9.00E-05	207.4	1.52E+11	0.000
44.000	.011731	-209851.4	5000.0	-9.28E-05	197.9	1.52E+11	0.000
46.000	.011542	-199851.4	5000.0	-9.55E-05	188.5	1.52E+11	0.000
48.000	.011349	-189851.4	5000.0	-9.81E-05	179.1	1.52E+11	0.000
50.000	.011150	-179851.4	5000.0	-1.01E-04	169.6	1.52E+11	0.000
52.000	.010947	-169851.4	5000.0	-1.03E-04	160.2	1.52E+11	0.000
54.000	.010739	-159851.4	5000.0	-1.05E-04	150.8	1.52E+11	0.000
56.000	.010527	-149851.4	5000.0	-1.07E-04	141.3	1.52E+11	0.000
58.000	.010311	-139851.4	5000.0	-1.09E-04	131.9	1.52E+11	0.000
60.000	.010091	-129851.4	5000.0	-1.11E-04	122.5	1.52E+11	0.000
62.000	.009868	-119851.4	5000.0	-1.12E-04	113.0	1.52E+11	0.000
64.000	.009642	-109851.4	5000.0	-1.14E-04	103.6	1.52E+11	0.000
66.000	.009413	-99851.4	5000.0	-1.15E-04	94.1758	1.52E+11	0.000
68.000	.009181	-89851.4	5000.0	-1.16E-04	84.7442	1.52E+11	0.000
70.000	.008947	-79851.4	5000.0	-1.18E-04	75.3126	1.52E+11	0.000
72.000	.008710	-69851.4	5000.0	-1.19E-04	65.8810	1.52E+11	0.000
74.000	.008472	-59851.4	5000.0	-1.19E-04	56.4494	1.52E+11	0.000
76.000	.008233	-49851.4	5000.0	-1.20E-04	47.0178	1.52E+11	0.000
78.000	.007992	-39851.4	5000.0	-1.21E-04	37.5862	1.52E+11	0.000
80.000	.007750	-29851.4	5000.0	-1.21E-04	28.1547	1.52E+11	0.000
82.000	.007507	-19851.4	5000.0	-1.22E-04	18.7231	1.52E+11	0.000
84.000	.007264	-9851.4	5000.0	-1.22E-04	9.2915	1.52E+11	0.000
86.000	.007020	148.6	5000.0	-1.22E-04	.1401	1.52E+11	0.000
88.000	.006776	10148.6	5000.0	-1.22E-04	9.5717	1.52E+11	0.000
90.000	.006533	20148.6	5000.0	-1.22E-04	19.0033	1.52E+11	0.000
92.000	.006290	30148.6	5000.0	-1.21E-04	28.4349	1.52E+11	0.000
94.000	.006048	40148.6	5000.0	-1.21E-04	37.8665	1.52E+11	0.000
96.000	.005808	50148.6	5000.0	-1.20E-04	47.2981	1.52E+11	0.000
98.000	.005568	60148.6	5000.0	-1.19E-04	56.7297	1.52E+11	0.000
100.000	.005330	70148.6	5000.0	-1.19E-04	66.1612	1.52E+11	0.000
102.000	.005094	80148.6	5000.0	-1.18E-04	75.5928	1.52E+11	0.000
104.000	.004860	90148.6	5000.0	-1.16E-04	85.0244	1.52E+11	0.000
106.000	.004628	100148.6	5000.0	-1.15E-04	94.4560	1.52E+11	0.000
108.000	.004399	110148.6	5000.0	-1.14E-04	103.9	1.52E+11	0.000
110.000	.004173	120148.6	5000.0	-1.12E-04	113.3	1.52E+11	0.000
112.000	.003950	130148.6	5000.0	-1.11E-04	122.8	1.52E+11	0.000
114.000	.003730	140148.6	5000.0	-1.09E-04	132.2	1.52E+11	0.000
116.000	.003514	150148.6	5000.0	-1.07E-04	141.6	1.52E+11	0.000
118.000	.003302	160148.6	5000.0	-1.05E-04	151.0	1.52E+11	0.000
120.000	.003095	170148.6	5000.0	-1.03E-04	160.5	1.52E+11	0.000
122.000	.002891	180148.6	4997.5	-1.00E-04	169.9	1.52E+11	-2.544
124.000	.002693	190138.4	4990.2	-9.80E-05	179.3	1.52E+11	-4.739
126.000	.002499	200109.2	4978.8	-9.54E-05	188.7	1.52E+11	-6.598
128.000	.002311	210053.7	4964.1	-9.27E-05	198.1	1.52E+11	-8.135
130.000	.002128	219965.7	4946.6	-8.99E-05	207.5	1.52E+11	-9.365

132.000	.001951	229840.1	4926.9	-8.69E-05	216.8	1.52E+11	-10.303
134.000	.001781	239673.4	4905.7	-8.39E-05	226.1	1.52E+11	-10.968
136.000	.001616	249462.8	4883.3	-8.06E-05	235.3	1.52E+11	-11.377
138.000	.001458	259206.7	4860.4	-7.73E-05	244.5	1.52E+11	-11.547
140.000	.001307	268904.3	4837.3	-7.38E-05	253.6	1.52E+11	-11.500
142.000	.001163	278556.0	4814.6	-7.02E-05	262.7	1.52E+11	-11.256
144.000	.001026	288162.7	4792.5	-6.65E-05	271.8	1.52E+11	-10.835
146.000	8.97E-04	297726.0	4771.4	-6.26E-05	280.8	1.52E+11	-10.261
148.000	7.76E-04	307248.3	4751.6	-5.86E-05	289.8	1.52E+11	-9.556
150.000	6.62E-04	316732.4	4733.3	-5.45E-05	298.7	1.52E+11	-8.744
152.000	5.58E-04	326181.5	4716.7	-5.03E-05	307.6	1.52E+11	-7.851
154.000	4.61E-04	335599.2	4701.9	-4.59E-05	316.5	1.52E+11	-6.902
156.000	3.74E-04	344989.2	2151.6	-4.14E-05	325.4	1.52E+11	-2543.396
158.000	2.96E-04	344205.7	-2403.0	-3.69E-05	324.6	1.52E+11	-2011.196
160.000	2.27E-04	335377.4	-5954.9	-3.24E-05	316.3	1.52E+11	-1540.758
162.000	1.66E-04	320386.1	-8626.2	-2.81E-05	302.2	1.52E+11	-1130.489
164.000	1.14E-04	300872.8	-10534.3	-2.40E-05	283.8	1.52E+11	-777.683
166.000	7.04E-05	278248.8	-11790.8	-2.01E-05	262.4	1.52E+11	-478.823
168.000	3.38E-05	253709.5	-12499.5	-1.66E-05	239.3	1.52E+11	-229.833
170.000	3.87E-06	228250.8	-12755.6	-1.35E-05	215.3	1.52E+11	-26.296
172.000	-2.01E-05	202687.0	-12645.5	-1.06E-05	191.2	1.52E+11	136.368
174.000	-3.86E-05	177668.7	-12246.4	-8.12E-06	167.6	1.52E+11	262.751
176.000	-5.26E-05	153701.3	-11626.3	-5.94E-06	145.0	1.52E+11	357.347
178.000	-6.24E-05	131163.4	-10844.5	-4.07E-06	123.7	1.52E+11	424.454
180.000	-6.88E-05	110323.2	-9952.0	-2.48E-06	104.1	1.52E+11	468.103
182.000	-7.24E-05	91355.5	-8991.8	-1.16E-06	86.1627	1.52E+11	492.023
184.000	-7.35E-05	74355.9	-8000.2	-6.86E-08	70.1294	1.52E+11	499.604
186.000	-7.26E-05	59354.6	-7006.7	8.11E-07	55.9809	1.52E+11	493.888
188.000	-7.02E-05	46329.0	-6035.3	1.51E-06	43.6956	1.52E+11	477.557
190.000	-6.66E-05	35213.5	-5104.8	2.04E-06	33.2119	1.52E+11	452.940
192.000	-6.21E-05	25909.8	-4229.8	2.44E-06	24.4371	1.52E+11	422.026
194.000	-5.68E-05	18294.3	-3421.3	2.73E-06	17.2544	1.52E+11	386.478
196.000	-5.11E-05	12224.6	-2687.2	2.93E-06	11.5297	1.52E+11	347.658
198.000	-4.51E-05	7545.6	-2032.9	3.06E-06	7.1167	1.52E+11	306.652
200.000	-3.89E-05	4093.1	-1461.9	3.14E-06	3.8605	1.52E+11	264.297
202.000	-3.25E-05	1697.9	-976.4	3.18E-06	1.6014	1.52E+11	221.210
204.000	-2.61E-05	187.5	-577.4	3.19E-06	.1769	1.52E+11	177.819
206.000	-1.98E-05	-611.6	-265.2	3.19E-06	.5768	1.52E+11	134.394
208.000	-1.34E-05	-873.1	-39.6941	3.18E-06	.8235	1.52E+11	91.079
210.000	-7.05E-06	-770.4	99.3043	3.17E-06	.7266	1.52E+11	47.920
212.000	-7.20E-07	-475.9	152.1	3.16E-06	.4489	1.52E+11	4.898
214.000	5.59E-06	-161.9	119.0	3.16E-06	.1527	1.52E+11	-38.038
216.000	1.19E-05	0.0	0.0	3.15E-06	0.0	1.52E+11	-80.945

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

Pile-head deflection	=	.01400914	in
Computed slope at pile head	=	-1.25767E-17	
Maximum bending moment	=	-429851.439	lbs-in
Maximum shear force	=	-12755.616	lbs
Depth of maximum bending moment	=	0.000	in
Depth of maximum shear force	=	170.000	in
Number of iterations	=	5	
Number of zero deflection points	=	2	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Shear and Slope (BC Type 2)

Specified shear force at pile head	=	10000.000	lbs
Specified slope at pile head	=	0.000E+00	in/in
Specified axial load at pile head	=	.000	lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	.028151	-859445.8	10000.0	2.60E-18	810.6	1.50E+11	0.000
2.000	.028140	-839445.8	10000.0	-1.13E-05	791.7	1.50E+11	0.000
4.000	.028106	-819445.8	10000.0	-2.23E-05	772.9	1.50E+11	0.000
6.000	.028051	-799445.8	10000.0	-3.31E-05	754.0	1.50E+11	0.000
8.000	.027974	-779445.8	10000.0	-4.36E-05	735.1	1.50E+11	0.000
10.000	.027876	-759445.8	10000.0	-5.38E-05	716.3	1.50E+11	0.000
12.000	.027758	-739445.8	10000.0	-6.38E-05	697.4	1.51E+11	0.000
14.000	.027621	-719445.8	10000.0	-7.35E-05	678.6	1.51E+11	0.000
16.000	.027465	-699445.8	10000.0	-8.29E-05	659.7	1.51E+11	0.000
18.000	.027289	-679445.8	10000.0	-9.21E-05	640.8	1.51E+11	0.000
20.000	.027096	-659445.8	10000.0	-1.01E-04	622.0	1.51E+11	0.000
22.000	.026886	-639445.8	10000.0	-1.10E-04	603.1	1.51E+11	0.000
24.000	.026658	-619445.8	10000.0	-1.18E-04	584.2	1.51E+11	0.000
26.000	.026414	-599445.8	10000.0	-1.26E-04	565.4	1.51E+11	0.000
28.000	.026154	-579445.8	10000.0	-1.34E-04	546.5	1.51E+11	0.000
30.000	.025879	-559445.8	10000.0	-1.41E-04	527.6	1.51E+11	0.000
32.000	.025589	-539445.8	10000.0	-1.49E-04	508.8	1.51E+11	0.000
34.000	.025285	-519445.8	10000.0	-1.56E-04	489.9	1.51E+11	0.000
36.000	.024966	-499445.8	10000.0	-1.62E-04	471.1	1.51E+11	0.000
38.000	.024635	-479445.8	10000.0	-1.69E-04	452.2	1.51E+11	0.000
40.000	.024291	-459445.8	10000.0	-1.75E-04	433.3	1.51E+11	0.000
42.000	.023935	-439445.8	10000.0	-1.81E-04	414.5	1.51E+11	0.000
44.000	.023567	-419445.8	10000.0	-1.87E-04	395.6	1.51E+11	0.000
46.000	.023188	-399445.8	10000.0	-1.92E-04	376.7	1.51E+11	0.000
48.000	.022799	-379445.8	10000.0	-1.97E-04	357.9	1.51E+11	0.000
50.000	.022400	-359445.8	10000.0	-2.02E-04	339.0	1.52E+11	0.000
52.000	.021991	-339445.8	10000.0	-2.07E-04	320.2	1.52E+11	0.000
54.000	.021573	-319445.8	10000.0	-2.11E-04	301.3	1.52E+11	0.000
56.000	.021147	-299445.8	10000.0	-2.15E-04	282.4	1.52E+11	0.000

58.000	.020712	-279445.8	10000.0	-2.19E-04	263.6	1.52E+11	0.000
60.000	.020271	-259445.8	10000.0	-2.22E-04	244.7	1.52E+11	0.000
62.000	.019822	-239445.8	10000.0	-2.26E-04	225.8	1.52E+11	0.000
64.000	.019368	-219445.8	10000.0	-2.29E-04	207.0	1.52E+11	0.000
66.000	.018907	-199445.8	10000.0	-2.32E-04	188.1	1.52E+11	0.000
68.000	.018442	-179445.8	10000.0	-2.34E-04	169.2	1.52E+11	0.000
70.000	.017971	-159445.8	10000.0	-2.36E-04	150.4	1.52E+11	0.000
72.000	.017497	-139445.8	10000.0	-2.38E-04	131.5	1.52E+11	0.000
74.000	.017018	-119445.8	10000.0	-2.40E-04	112.7	1.52E+11	0.000
76.000	.016537	-99445.8	10000.0	-2.41E-04	93.7932	1.52E+11	0.000
78.000	.016053	-79445.8	10000.0	-2.43E-04	74.9300	1.52E+11	0.000
80.000	.015567	-59445.8	10000.0	-2.43E-04	56.0668	1.52E+11	0.000
82.000	.015079	-39445.8	10000.0	-2.44E-04	37.2036	1.52E+11	0.000
84.000	.014590	-19445.8	10000.0	-2.44E-04	18.3404	1.52E+11	0.000
86.000	.014101	554.2	10000.0	-2.45E-04	.5227	1.52E+11	0.000
88.000	.013612	20554.2	10000.0	-2.44E-04	19.3859	1.52E+11	0.000
90.000	.013123	40554.2	10000.0	-2.44E-04	38.2491	1.52E+11	0.000
92.000	.012635	60554.2	10000.0	-2.43E-04	57.1123	1.52E+11	0.000
94.000	.012149	80554.2	10000.0	-2.42E-04	75.9755	1.52E+11	0.000
96.000	.011665	100554.2	10000.0	-2.41E-04	94.8386	1.52E+11	0.000
98.000	.011184	120554.2	10000.0	-2.40E-04	113.7	1.52E+11	0.000
100.000	.010706	140554.2	10000.0	-2.38E-04	132.6	1.52E+11	0.000
102.000	.010232	160554.2	10000.0	-2.36E-04	151.4	1.52E+11	0.000
104.000	.009761	180554.2	10000.0	-2.34E-04	170.3	1.52E+11	0.000
106.000	.009296	200554.2	10000.0	-2.31E-04	189.2	1.52E+11	0.000
108.000	.008836	220554.2	10000.0	-2.29E-04	208.0	1.52E+11	0.000
110.000	.008382	240554.2	10000.0	-2.26E-04	226.9	1.52E+11	0.000
112.000	.007934	260554.2	10000.0	-2.22E-04	245.7	1.52E+11	0.000
114.000	.007492	280554.2	10000.0	-2.19E-04	264.6	1.52E+11	0.000
116.000	.007059	300554.2	10000.0	-2.15E-04	283.5	1.52E+11	0.000
118.000	.006633	320554.2	10000.0	-2.11E-04	302.3	1.52E+11	0.000
120.000	.006215	340554.2	10000.0	-2.06E-04	321.2	1.52E+11	0.000
122.000	.005807	360554.2	9994.9	-2.02E-04	340.1	1.52E+11	-5.110
124.000	.005408	380533.8	9980.3	-1.97E-04	358.9	1.51E+11	-9.518
126.000	.005019	400475.3	9957.5	-1.92E-04	377.7	1.51E+11	-13.251
128.000	.004641	420363.8	9927.9	-1.86E-04	396.5	1.51E+11	-16.337
130.000	.004274	440186.9	9892.8	-1.81E-04	415.2	1.51E+11	-18.805
132.000	.003918	459934.8	9853.3	-1.75E-04	433.8	1.51E+11	-20.689
134.000	.003575	479600.0	9810.6	-1.68E-04	452.3	1.51E+11	-22.023
136.000	.003244	499177.0	9765.7	-1.62E-04	470.8	1.51E+11	-22.841
138.000	.002927	518662.7	9719.7	-1.55E-04	489.2	1.51E+11	-23.182
140.000	.002623	538055.7	9673.4	-1.48E-04	507.5	1.51E+11	-23.085
142.000	.002334	557356.3	9627.7	-1.41E-04	525.7	1.51E+11	-22.591
144.000	.002059	576566.6	9583.4	-1.34E-04	543.8	1.51E+11	-21.744
146.000	.001800	595689.9	9541.1	-1.26E-04	561.8	1.51E+11	-20.588
148.000	.001556	614730.8	9501.3	-1.18E-04	579.8	1.51E+11	-19.170
150.000	.001329	633695.1	9464.6	-1.09E-04	597.7	1.51E+11	-17.539
152.000	.001118	652589.2	9431.3	-1.01E-04	615.5	1.51E+11	-15.743
154.000	9.25E-04	671420.3	9401.7	-9.22E-05	633.3	1.51E+11	-13.836
156.000	7.49E-04	690196.1	4291.4	-8.31E-05	651.0	1.51E+11	-5096.486
158.000	5.92E-04	688585.9	-4833.3	-7.40E-05	649.4	1.51E+11	-4028.260
160.000	4.54E-04	670862.7	-11945.9	-6.50E-05	632.7	1.51E+11	-3084.334
162.000	3.33E-04	640802.2	-17291.7	-5.63E-05	604.4	1.51E+11	-2261.470
164.000	2.29E-04	601695.8	-21107.4	-4.80E-05	567.5	1.51E+11	-1554.184
166.000	1.40E-04	556372.6	-23616.9	-4.03E-05	524.7	1.51E+11	-955.347
168.000	6.72E-05	507228.1	-25029.0	-3.33E-05	478.4	1.51E+11	-456.710
170.000	7.26E-06	456256.7	-25535.0	-2.69E-05	430.3	1.51E+11	-49.345

172.000	-4.06E-05	405088.0	-25308.4	-2.12E-05	382.1	1.51E+11	275.994
174.000	-7.77E-05	355023.2	-24503.8	-1.62E-05	334.8	1.52E+11	528.570
176.000	-1.06E-04	307072.7	-23257.8	-1.19E-05	289.6	1.52E+11	717.432
178.000	-1.25E-04	261991.9	-21689.2	-8.11E-06	247.1	1.52E+11	851.230
180.000	-1.38E-04	220316.0	-19899.8	-4.94E-06	207.8	1.52E+11	938.085
182.000	-1.45E-04	182392.5	-17976.3	-2.29E-06	172.0	1.52E+11	985.493
184.000	-1.47E-04	148411.0	-15990.5	-1.10E-07	140.0	1.52E+11	1000.265
186.000	-1.45E-04	118430.5	-14001.7	1.64E-06	111.7	1.52E+11	988.495
188.000	-1.41E-04	92404.0	-12057.7	3.03E-06	87.1516	1.52E+11	955.545
190.000	-1.33E-04	70199.7	-10196.1	4.10E-06	66.2094	1.52E+11	906.069
192.000	-1.24E-04	51619.6	-8446.0	4.90E-06	48.6855	1.52E+11	844.039
194.000	-1.14E-04	36415.7	-6829.2	5.48E-06	34.3458	1.52E+11	772.777
196.000	-1.02E-04	24302.9	-5361.4	5.88E-06	22.9215	1.52E+11	695.003
198.000	-9.01E-05	14970.2	-4053.5	6.14E-06	14.1192	1.52E+11	612.883
200.000	-7.77E-05	8088.9	-2912.5	6.29E-06	7.6291	1.52E+11	528.085
202.000	-6.50E-05	3320.0	-1942.6	6.36E-06	3.1313	1.52E+11	441.840
204.000	-5.22E-05	318.5	-1145.8	6.39E-06	.3004	1.52E+11	355.002
206.000	-3.94E-05	-1263.0	-522.7	6.38E-06	1.1913	1.52E+11	268.107
208.000	-2.67E-05	-1772.2	-73.1130	6.36E-06	1.6714	1.52E+11	181.438
210.000	-1.40E-05	-1555.5	203.4	6.34E-06	1.4671	1.52E+11	95.086
212.000	-1.33E-06	-958.5	307.5	6.32E-06	.9040	1.52E+11	9.011
214.000	1.13E-05	-325.5	239.6	6.31E-06	.3070	1.52E+11	-76.891
216.000	2.39E-05	0.0	0.0	6.31E-06	0.0	1.52E+11	-162.736

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

Pile-head deflection	=	.02815147	in
Computed slope at pile head	=	2.60209E-18	
Maximum bending moment	=	-859445.753	lbs-in
Maximum shear force	=	-25535.035	lbs
Depth of maximum bending moment	=	0.000	in
Depth of maximum shear force	=	170.000	in
Number of iterations	=	5	
Number of zero deflection points	=	2	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Shear and Slope (BC Type 2)

Specified shear force at pile head	=	15000.000	lbs
Specified slope at pile head	=	0.000E+00	in/in

Specified axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	.042433	-1.29E+06	15000.0	2.43E-17	1215.5	1.49E+11	0.000
2.000	.042415	-1.26E+06	15000.0	-1.71E-05	1187.2	1.49E+11	0.000
4.000	.042364	-1.23E+06	15000.0	-3.38E-05	1158.9	1.49E+11	0.000
6.000	.042280	-1.20E+06	15000.0	-5.00E-05	1130.6	1.49E+11	0.000
8.000	.042164	-1.17E+06	15000.0	-6.59E-05	1102.3	1.49E+11	0.000
10.000	.042017	-1.14E+06	15000.0	-8.13E-05	1074.0	1.49E+11	0.000
12.000	.041839	-1.11E+06	15000.0	-9.64E-05	1045.8	1.50E+11	0.000
14.000	.041631	-1.08E+06	15000.0	-1.11E-04	1017.5	1.50E+11	0.000
16.000	.041395	-1.05E+06	15000.0	-1.25E-04	989.2	1.50E+11	0.000
18.000	.041131	-1.02E+06	15000.0	-1.39E-04	960.9	1.50E+11	0.000
20.000	.040839	-988776.7	15000.0	-1.52E-04	932.6	1.50E+11	0.000
22.000	.040521	-958776.7	15000.0	-1.65E-04	904.3	1.50E+11	0.000
24.000	.040178	-928776.7	15000.0	-1.78E-04	876.0	1.50E+11	0.000
26.000	.039809	-898776.7	15000.0	-1.90E-04	847.7	1.50E+11	0.000
28.000	.039417	-868776.7	15000.0	-2.02E-04	819.4	1.50E+11	0.000
30.000	.039002	-838776.7	15000.0	-2.13E-04	791.1	1.50E+11	0.000
32.000	.038564	-808776.7	15000.0	-2.24E-04	762.8	1.50E+11	0.000
34.000	.038105	-778776.7	15000.0	-2.35E-04	734.5	1.50E+11	0.000
36.000	.037625	-748776.7	15000.0	-2.45E-04	706.2	1.51E+11	0.000
38.000	.037125	-718776.7	15000.0	-2.55E-04	677.9	1.51E+11	0.000
40.000	.036606	-688776.7	15000.0	-2.64E-04	649.6	1.51E+11	0.000
42.000	.036069	-658776.7	15000.0	-2.73E-04	621.3	1.51E+11	0.000
44.000	.035514	-628776.7	15000.0	-2.82E-04	593.0	1.51E+11	0.000
46.000	.034943	-598776.7	15000.0	-2.90E-04	564.7	1.51E+11	0.000
48.000	.034355	-568776.7	15000.0	-2.97E-04	536.4	1.51E+11	0.000
50.000	.033753	-538776.7	15000.0	-3.05E-04	508.2	1.51E+11	0.000
52.000	.033136	-508776.7	15000.0	-3.12E-04	479.9	1.51E+11	0.000
54.000	.032506	-478776.7	15000.0	-3.18E-04	451.6	1.51E+11	0.000
56.000	.031864	-448776.7	15000.0	-3.24E-04	423.3	1.51E+11	0.000
58.000	.031209	-418776.7	15000.0	-3.30E-04	395.0	1.51E+11	0.000
60.000	.030543	-388776.7	15000.0	-3.35E-04	366.7	1.51E+11	0.000
62.000	.029868	-358776.7	15000.0	-3.40E-04	338.4	1.52E+11	0.000
64.000	.029182	-328776.7	15000.0	-3.45E-04	310.1	1.52E+11	0.000
66.000	.028488	-298776.7	15000.0	-3.49E-04	281.8	1.52E+11	0.000
68.000	.027786	-268776.7	15000.0	-3.53E-04	253.5	1.52E+11	0.000
70.000	.027077	-238776.7	15000.0	-3.56E-04	225.2	1.52E+11	0.000
72.000	.026362	-208776.7	15000.0	-3.59E-04	196.9	1.52E+11	0.000
74.000	.025641	-178776.7	15000.0	-3.62E-04	168.6	1.52E+11	0.000
76.000	.024916	-148776.7	15000.0	-3.64E-04	140.3	1.52E+11	0.000
78.000	.024186	-118776.7	15000.0	-3.65E-04	112.0	1.52E+11	0.000
80.000	.023454	-88776.7	15000.0	-3.67E-04	83.7305	1.52E+11	0.000
82.000	.022719	-58776.7	15000.0	-3.68E-04	55.4358	1.52E+11	0.000
84.000	.021982	-28776.7	15000.0	-3.68E-04	27.1410	1.52E+11	0.000
86.000	.021245	1223.3	15000.0	-3.69E-04	1.1538	1.52E+11	0.000
88.000	.020508	31223.3	15000.0	-3.68E-04	29.4486	1.52E+11	0.000
90.000	.019772	61223.3	15000.0	-3.68E-04	57.7433	1.52E+11	0.000
92.000	.019037	91223.3	15000.0	-3.67E-04	86.0381	1.52E+11	0.000
94.000	.018305	121223.3	15000.0	-3.65E-04	114.3	1.52E+11	0.000
96.000	.017576	151223.3	15000.0	-3.64E-04	142.6	1.52E+11	0.000

98.000	.016851	181223.3	15000.0	-3.61E-04	170.9	1.52E+11	0.000
100.000	.016130	211223.3	15000.0	-3.59E-04	199.2	1.52E+11	0.000
102.000	.015415	241223.3	15000.0	-3.56E-04	227.5	1.52E+11	0.000
104.000	.014707	271223.3	15000.0	-3.52E-04	255.8	1.52E+11	0.000
106.000	.014006	301223.3	15000.0	-3.49E-04	284.1	1.52E+11	0.000
108.000	.013312	331223.3	15000.0	-3.44E-04	312.4	1.52E+11	0.000
110.000	.012628	361223.3	15000.0	-3.40E-04	340.7	1.52E+11	0.000
112.000	.011953	391223.3	15000.0	-3.35E-04	369.0	1.51E+11	0.000
114.000	.011288	421223.3	15000.0	-3.30E-04	397.3	1.51E+11	0.000
116.000	.010634	451223.3	15000.0	-3.24E-04	425.6	1.51E+11	0.000
118.000	.009992	481223.3	15000.0	-3.18E-04	453.9	1.51E+11	0.000
120.000	.009363	511223.3	15000.0	-3.11E-04	482.2	1.51E+11	0.000
122.000	.008748	541223.3	14992.3	-3.04E-04	510.5	1.51E+11	-7.698
124.000	.008147	571192.5	14970.3	-2.97E-04	538.7	1.51E+11	-14.339
126.000	.007561	601104.4	14936.0	-2.89E-04	566.9	1.51E+11	-19.961
128.000	.006991	630936.4	14891.4	-2.81E-04	595.1	1.51E+11	-24.608
130.000	.006438	660670.0	14838.5	-2.72E-04	623.1	1.51E+11	-28.325
132.000	.005902	690290.2	14779.0	-2.63E-04	651.1	1.51E+11	-31.161
134.000	.005384	719785.9	14714.6	-2.54E-04	678.9	1.51E+11	-33.167
136.000	.004886	749148.8	14647.1	-2.44E-04	706.6	1.51E+11	-34.397
138.000	.004408	778374.2	14577.8	-2.34E-04	734.1	1.50E+11	-34.908
140.000	.003950	807459.9	14508.1	-2.24E-04	761.6	1.50E+11	-34.758
142.000	.003514	836406.7	14439.3	-2.13E-04	788.9	1.50E+11	-34.011
144.000	.003100	865217.3	14372.6	-2.01E-04	816.0	1.50E+11	-32.731
146.000	.002709	893897.1	14308.9	-1.90E-04	843.1	1.50E+11	-30.986
148.000	.002341	922452.9	14249.1	-1.77E-04	870.0	1.50E+11	-28.846
150.000	.001999	950893.3	14193.8	-1.65E-04	896.8	1.50E+11	-26.385
152.000	.001682	979228.1	14143.8	-1.52E-04	923.6	1.50E+11	-23.678
154.000	.001391	1.01E+06	14099.3	-1.39E-04	950.2	1.50E+11	-20.804
156.000	.001126	1.04E+06	6418.6	-1.25E-04	976.8	1.50E+11	-7659.828
158.000	8.90E-04	1.03E+06	-7292.8	-1.11E-04	974.4	1.50E+11	-6051.591
160.000	6.81E-04	1.01E+06	-17975.4	-9.77E-05	949.2	1.50E+11	-4630.999
162.000	4.99E-04	961241.4	-25999.5	-8.46E-05	906.6	1.50E+11	-3393.116
164.000	3.43E-04	902456.2	-31722.2	-7.22E-05	851.2	1.50E+11	-2329.593
166.000	2.10E-04	834352.7	-35481.4	-6.06E-05	786.9	1.50E+11	-1429.595
168.000	1.00E-04	760530.7	-37591.6	-5.00E-05	717.3	1.50E+11	-680.599
170.000	1.02E-05	683986.4	-38341.2	-4.04E-05	645.1	1.51E+11	-69.065
172.000	-6.16E-05	607165.8	-37991.3	-3.19E-05	572.7	1.51E+11	419.010
174.000	-1.17E-04	532021.2	-36774.6	-2.43E-05	501.8	1.51E+11	797.639
176.000	-1.59E-04	460067.2	-34896.5	-1.78E-05	433.9	1.51E+11	1080.494
178.000	-1.88E-04	392435.2	-32535.4	-1.21E-05	370.1	1.51E+11	1280.632
180.000	-2.07E-04	329925.7	-29844.5	-7.36E-06	311.2	1.52E+11	1410.295
182.000	-2.18E-04	273057.3	-26953.4	-3.38E-06	257.5	1.52E+11	1480.774
184.000	-2.21E-04	222112.1	-23970.3	-1.22E-07	209.5	1.52E+11	1502.318
186.000	-2.18E-04	177176.1	-20983.9	2.51E-06	167.1	1.52E+11	1484.091
188.000	-2.11E-04	138176.6	-18065.6	4.58E-06	130.3	1.52E+11	1434.165
190.000	-2.00E-04	104913.6	-15271.9	6.18E-06	98.9502	1.52E+11	1359.528
192.000	-1.86E-04	77088.8	-12646.3	7.37E-06	72.7070	1.52E+11	1266.127
194.000	-1.70E-04	54328.5	-10221.2	8.24E-06	51.2404	1.52E+11	1158.940
196.000	-1.53E-04	36203.9	-8020.2	8.83E-06	34.1461	1.52E+11	1042.037
198.000	-1.35E-04	22247.5	-6059.5	9.22E-06	20.9830	1.52E+11	918.660
200.000	-1.16E-04	11965.8	-4349.6	9.44E-06	11.2856	1.52E+11	791.303
202.000	-9.73E-05	4849.2	-2896.5	9.55E-06	4.5736	1.52E+11	661.807
204.000	-7.82E-05	379.9	-1703.2	9.59E-06	.3583	1.52E+11	531.443
206.000	-5.90E-05	-1963.6	-770.8	9.58E-06	1.8520	1.52E+11	401.012
208.000	-3.98E-05	-2703.1	-98.8202	9.55E-06	2.5495	1.52E+11	270.931
210.000	-2.08E-05	-2358.9	313.4	9.51E-06	2.2248	1.52E+11	141.334

212.000	-1.79E-06	-1449.4	466.9	9.49E-06	1.3670	1.52E+11	12.159
214.000	1.72E-05	-491.2	362.3	9.48E-06	.4633	1.52E+11	-116.757
216.000	3.61E-05	0.0	0.0	9.47E-06	0.0	1.52E+11	-245.585

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

Pile-head deflection	=	.04243269	in
Computed slope at pile head	=	2.42861E-17	
Maximum bending moment	=	-1288776.679	lbs-in
Maximum shear force	=	-38341.236	lbs
Depth of maximum bending moment	=	0.000	in
Depth of maximum shear force	=	170.000	in
Number of iterations	=	5	
Number of zero deflection points	=	2	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Shear and Slope (BC Type 2)

Specified shear force at pile head	=	20000.000	lbs
Specified slope at pile head	=	0.000E+00	in/in
Specified axial load at pile head	=	.000	lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	.142791	-1.60E+06	20000.0	1.39E-17	1513.3	2.07E+10	0.000
2.000	.142636	-1.56E+06	20000.0	-1.53E-04	1475.5	2.07E+10	0.000
4.000	.142180	-1.52E+06	20000.0	-3.02E-04	1437.8	2.07E+10	0.000
6.000	.141429	-1.48E+06	20000.0	-4.40E-04	1400.1	2.29E+10	0.000
8.000	.140420	-1.44E+06	20000.0	-5.66E-04	1362.4	2.37E+10	0.000
10.000	.139166	-1.40E+06	20000.0	-6.84E-04	1324.6	2.44E+10	0.000
12.000	.137682	-1.36E+06	20000.0	-7.52E-04	1286.9	1.41E+11	0.000
14.000	.136160	-1.32E+06	20000.0	-7.70E-04	1249.2	1.49E+11	0.000
16.000	.134602	-1.28E+06	20000.0	-7.88E-04	1211.5	1.49E+11	0.000
18.000	.133009	-1.24E+06	20000.0	-8.05E-04	1173.7	1.49E+11	0.000
20.000	.131383	-1.20E+06	20000.0	-8.21E-04	1136.0	1.49E+11	0.000
22.000	.129725	-1.16E+06	20000.0	-8.37E-04	1098.3	1.49E+11	0.000

24.000	.128035	-1.12E+06	20000.0	-8.52E-04	1060.6	1.50E+11	0.000
26.000	.126316	-1.08E+06	20000.0	-8.67E-04	1022.8	1.50E+11	0.000
28.000	.124567	-1.04E+06	20000.0	-8.81E-04	985.1	1.50E+11	0.000
30.000	.122791	-1.00E+06	20000.0	-8.95E-04	947.4	1.50E+11	0.000
32.000	.120988	-964475.7	20000.0	-9.08E-04	909.7	1.50E+11	0.000
34.000	.119159	-924475.7	20000.0	-9.21E-04	871.9	1.50E+11	0.000
36.000	.117305	-884475.7	20000.0	-9.33E-04	834.2	1.50E+11	0.000
38.000	.115428	-844475.7	20000.0	-9.44E-04	796.5	1.50E+11	0.000
40.000	.113528	-804475.7	20000.0	-9.55E-04	758.7	1.50E+11	0.000
42.000	.111607	-764475.7	20000.0	-9.66E-04	721.0	1.50E+11	0.000
44.000	.109666	-724475.7	20000.0	-9.75E-04	683.3	1.51E+11	0.000
46.000	.107705	-684475.7	20000.0	-9.85E-04	645.6	1.51E+11	0.000
48.000	.105727	-644475.7	20000.0	-9.94E-04	607.8	1.51E+11	0.000
50.000	.103731	-604475.7	20000.0	-.001002	570.1	1.51E+11	0.000
52.000	.101719	-564475.7	20000.0	-.001010	532.4	1.51E+11	0.000
54.000	.099692	-524475.7	20000.0	-.001017	494.7	1.51E+11	0.000
56.000	.097651	-484475.7	20000.0	-.001024	456.9	1.51E+11	0.000
58.000	.095598	-444475.7	20000.0	-.001030	419.2	1.51E+11	0.000
60.000	.093533	-404475.7	20000.0	-.001035	381.5	1.51E+11	0.000
62.000	.091457	-364475.7	20000.0	-.001040	343.8	1.52E+11	0.000
64.000	.089371	-324475.7	20000.0	-.001045	306.0	1.52E+11	0.000
66.000	.087277	-284475.7	20000.0	-.001049	268.3	1.52E+11	0.000
68.000	.085175	-244475.7	20000.0	-.001052	230.6	1.52E+11	0.000
70.000	.083067	-204475.7	20000.0	-.001055	192.9	1.52E+11	0.000
72.000	.080954	-164475.7	20000.0	-.001058	155.1	1.52E+11	0.000
74.000	.078836	-124475.7	20000.0	-.001060	117.4	1.52E+11	0.000
76.000	.076715	-84475.7	20000.0	-.001061	79.6740	1.52E+11	0.000
78.000	.074592	-44475.7	20000.0	-.001062	41.9476	1.52E+11	0.000
80.000	.072467	-4475.7	20000.0	-.001062	4.2213	1.52E+11	0.000
82.000	.070343	35524.3	20000.0	-.001062	33.5051	1.52E+11	0.000
84.000	.068219	75524.3	20000.0	-.001061	71.2315	1.52E+11	0.000
86.000	.066097	115524.3	20000.0	-.001060	109.0	1.52E+11	0.000
88.000	.063979	155524.3	20000.0	-.001058	146.7	1.52E+11	0.000
90.000	.061864	195524.3	20000.0	-.001056	184.4	1.52E+11	0.000
92.000	.059755	235524.3	20000.0	-.001053	222.1	1.52E+11	0.000
94.000	.057652	275524.3	20000.0	-.001050	259.9	1.52E+11	0.000
96.000	.055556	315524.3	20000.0	-.001046	297.6	1.52E+11	0.000
98.000	.053468	355524.3	20000.0	-.001041	335.3	1.52E+11	0.000
100.000	.051390	395524.3	20000.0	-.001036	373.0	1.51E+11	0.000
102.000	.049322	435524.3	20000.0	-.001031	410.8	1.51E+11	0.000
104.000	.047266	475524.3	20000.0	-.001025	448.5	1.51E+11	0.000
106.000	.045222	515524.3	20000.0	-.001018	486.2	1.51E+11	0.000
108.000	.043192	555524.3	20000.0	-.001011	523.9	1.51E+11	0.000
110.000	.041177	595524.3	20000.0	-.001004	561.7	1.51E+11	0.000
112.000	.039177	635524.3	20000.0	-9.96E-04	599.4	1.51E+11	0.000
114.000	.037195	675524.3	20000.0	-9.87E-04	637.1	1.51E+11	0.000
116.000	.035230	715524.3	20000.0	-9.78E-04	674.9	1.51E+11	0.000
118.000	.033284	755524.3	20000.0	-9.68E-04	712.6	1.51E+11	0.000
120.000	.031358	795524.3	20000.0	-9.58E-04	750.3	1.50E+11	0.000
122.000	.029454	835524.3	19985.8	-9.47E-04	788.0	1.50E+11	-14.225
124.000	.027572	875467.4	19942.7	-9.35E-04	825.7	1.50E+11	-28.821
126.000	.025713	915295.3	19870.4	-9.23E-04	863.3	1.50E+11	-43.555
128.000	.023878	954948.9	19768.6	-9.11E-04	900.7	1.50E+11	-58.192
130.000	.022069	994369.7	19637.9	-8.98E-04	937.8	1.50E+11	-72.496
132.000	.020287	1.03E+06	19479.2	-8.84E-04	974.8	1.50E+11	-86.234
134.000	.018532	1.07E+06	19293.8	-8.70E-04	1011.3	1.50E+11	-99.167
136.000	.016805	1.11E+06	19083.0	-8.56E-04	1047.5	1.50E+11	-111.662

138.000	.015109	1.15E+06	18851.6	-8.41E-04	1083.3	1.49E+11	-119.661
140.000	.013443	1.19E+06	18613.7	-8.25E-04	1118.7	1.49E+11	-118.297
142.000	.011809	1.22E+06	18381.1	-8.09E-04	1153.6	1.49E+11	-114.309
144.000	.010208	1.26E+06	18159.0	-7.92E-04	1188.0	1.49E+11	-107.792
146.000	.008640	1.30E+06	17952.3	-7.75E-04	1222.1	1.49E+11	-98.842
148.000	.007107	1.33E+06	17765.9	-7.57E-04	1255.7	1.49E+11	-87.562
150.000	.005610	1.37E+06	17604.3	-7.34E-04	1289.1	9.42E+10	-74.056
152.000	.004171	1.40E+06	17471.5	-6.62E-04	1322.2	2.44E+10	-58.733
154.000	.002962	1.44E+06	17368.5	-5.44E-04	1355.0	2.38E+10	-44.317
156.000	.001995	1.47E+06	3759.4	-4.20E-04	1387.7	2.32E+10	-13564.806
158.000	.001281	1.45E+06	-18518.2	-2.95E-04	1369.2	2.35E+10	-8712.764
160.000	8.14E-04	1.40E+06	-32769.4	-1.76E-04	1317.8	2.45E+10	-5538.376
162.000	5.76E-04	1.32E+06	-42225.9	-1.10E-04	1245.6	1.49E+11	-3918.210
164.000	3.73E-04	1.23E+06	-48683.3	-9.32E-05	1158.5	1.49E+11	-2539.152
166.000	2.04E-04	1.13E+06	-52606.4	-7.74E-05	1061.9	1.50E+11	-1383.977
168.000	6.38E-05	1.02E+06	-54424.0	-6.31E-05	960.0	1.50E+11	-433.633
170.000	-4.88E-05	908189.3	-54525.8	-5.02E-05	856.6	1.50E+11	331.885
172.000	-1.37E-04	799801.5	-53261.1	-3.89E-05	754.3	1.50E+11	932.822
174.000	-2.04E-04	695145.0	-50939.2	-2.89E-05	655.6	1.51E+11	1389.099
176.000	-2.53E-04	596044.9	-47830.2	-2.04E-05	562.2	1.51E+11	1719.877
178.000	-2.86E-04	503824.2	-44167.1	-1.31E-05	475.2	1.51E+11	1943.235
180.000	-3.05E-04	419376.6	-40147.9	-6.99E-06	395.5	1.51E+11	2075.940
182.000	-3.14E-04	343232.7	-35938.7	-1.95E-06	323.7	1.52E+11	2133.297
184.000	-3.13E-04	275621.9	-31676.3	2.13E-06	260.0	1.52E+11	2129.067
186.000	-3.05E-04	216527.5	-27471.8	5.37E-06	204.2	1.52E+11	2075.441
188.000	-2.92E-04	165734.8	-23413.3	7.88E-06	156.3	1.52E+11	1983.048
190.000	-2.74E-04	122874.3	-19569.2	9.78E-06	115.9	1.52E+11	1861.009
192.000	-2.52E-04	87457.8	-15991.2	1.12E-05	82.4866	1.52E+11	1716.994
194.000	-2.29E-04	58909.4	-12716.9	1.21E-05	55.5609	1.52E+11	1557.339
196.000	-2.04E-04	36590.2	-9772.4	1.28E-05	34.5104	1.52E+11	1387.148
198.000	-1.78E-04	19819.7	-7174.9	1.31E-05	18.6931	1.52E+11	1210.413
200.000	-1.51E-04	7890.8	-4934.3	1.33E-05	7.4423	1.52E+11	1030.134
202.000	-1.25E-04	82.4636	-3055.7	1.34E-05	7.78E-02	1.52E+11	848.444
204.000	-9.80E-05	-4332.1	-1540.5	1.33E-05	4.0859	1.52E+11	666.739
206.000	-7.14E-05	-6079.7	-388.0	1.33E-05	5.7341	1.52E+11	485.809
208.000	-4.50E-05	-5884.1	403.8	1.32E-05	5.5496	1.52E+11	305.966
210.000	-1.87E-05	-4464.6	836.9	1.31E-05	4.2108	1.52E+11	127.175
212.000	7.47E-06	-2536.4	913.3	1.31E-05	2.3922	1.52E+11	-50.817
214.000	3.36E-05	-811.5	634.1	1.30E-05	.7654	1.52E+11	-228.356
216.000	5.97E-05	0.0	0.0	1.30E-05	0.0	1.52E+11	-405.749

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

Pile-head deflection	=	.14279060 in
Computed slope at pile head	=	1.38778E-17
Maximum bending moment	=	-1604475.665 lbs-in

Maximum shear force	=	-54525.790	lbs
Depth of maximum bending moment	=	0.000	in
Depth of maximum shear force	=	170.000	in
Number of iterations	=	51	
Number of zero deflection points	=	2	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 21000.000 lbs
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	.183383	-1.68E+06	21000.0	-2.08E-17	1581.5	1.92E+10	0.000
2.000	.183208	-1.63E+06	21000.0	-1.73E-04	1541.9	1.92E+10	0.000
4.000	.182692	-1.59E+06	21000.0	-3.41E-04	1502.2	1.92E+10	0.000
6.000	.181844	-1.55E+06	21000.0	-4.97E-04	1462.6	2.12E+10	0.000
8.000	.180705	-1.51E+06	21000.0	-6.37E-04	1423.0	2.24E+10	0.000
10.000	.179295	-1.47E+06	21000.0	-7.68E-04	1383.4	2.33E+10	0.000
12.000	.177633	-1.42E+06	21000.0	-8.90E-04	1343.8	2.40E+10	0.000
14.000	.175734	-1.38E+06	21000.0	-.001006	1304.2	2.47E+10	0.000
16.000	.173610	-1.34E+06	21000.0	-.001071	1264.6	1.49E+11	0.000
18.000	.171451	-1.30E+06	21000.0	-.001088	1224.9	1.49E+11	0.000
20.000	.169257	-1.26E+06	21000.0	-.001106	1185.3	1.49E+11	0.000
22.000	.167029	-1.21E+06	21000.0	-.001122	1145.7	1.49E+11	0.000
24.000	.164768	-1.17E+06	21000.0	-.001138	1106.1	1.49E+11	0.000
26.000	.162476	-1.13E+06	21000.0	-.001154	1066.5	1.49E+11	0.000
28.000	.160154	-1.09E+06	21000.0	-.001168	1026.9	1.50E+11	0.000
30.000	.157803	-1.05E+06	21000.0	-.001183	987.3	1.50E+11	0.000
32.000	.155423	-1.00E+06	21000.0	-.001196	947.7	1.50E+11	0.000
34.000	.153017	-962772.4	21000.0	-.001209	908.0	1.50E+11	0.000
36.000	.150585	-920772.4	21000.0	-.001222	868.4	1.50E+11	0.000
38.000	.148129	-878772.4	21000.0	-.001234	828.8	1.50E+11	0.000
40.000	.145649	-836772.4	21000.0	-.001245	789.2	1.50E+11	0.000
42.000	.143147	-794772.4	21000.0	-.001256	749.6	1.50E+11	0.000
44.000	.140624	-752772.4	21000.0	-.001267	710.0	1.51E+11	0.000
46.000	.138081	-710772.4	21000.0	-.001276	670.4	1.51E+11	0.000
48.000	.135519	-668772.4	21000.0	-.001285	630.8	1.51E+11	0.000
50.000	.132939	-626772.4	21000.0	-.001294	591.1	1.51E+11	0.000
52.000	.130343	-584772.4	21000.0	-.001302	551.5	1.51E+11	0.000
54.000	.127731	-542772.4	21000.0	-.001310	511.9	1.51E+11	0.000
56.000	.125105	-500772.4	21000.0	-.001316	472.3	1.51E+11	0.000
58.000	.122465	-458772.4	21000.0	-.001323	432.7	1.51E+11	0.000
60.000	.119813	-416772.4	21000.0	-.001329	393.1	1.51E+11	0.000
62.000	.117151	-374772.4	21000.0	-.001334	353.5	1.52E+11	0.000

64.000	.114478	-332772.4	21000.0	-.001338	313.9	1.52E+11	0.000
66.000	.111797	-290772.4	21000.0	-.001343	274.2	1.52E+11	0.000
68.000	.109108	-248772.4	21000.0	-.001346	234.6	1.52E+11	0.000
70.000	.106412	-206772.4	21000.0	-.001349	195.0	1.52E+11	0.000
72.000	.103711	-164772.4	21000.0	-.001352	155.4	1.52E+11	0.000
74.000	.101006	-122772.4	21000.0	-.001353	115.8	1.52E+11	0.000
76.000	.098297	-80772.4	21000.0	-.001355	76.1812	1.52E+11	0.000
78.000	.095587	-38772.4	21000.0	-.001356	36.5685	1.52E+11	0.000
80.000	.092875	3227.6	21000.0	-.001356	3.0441	1.52E+11	0.000
82.000	.090163	45227.6	21000.0	-.001356	42.6568	1.52E+11	0.000
84.000	.087453	87227.6	21000.0	-.001355	82.2695	1.52E+11	0.000
86.000	.084745	129227.6	21000.0	-.001353	121.9	1.52E+11	0.000
88.000	.082040	171227.6	21000.0	-.001351	161.5	1.52E+11	0.000
90.000	.079340	213227.6	21000.0	-.001349	201.1	1.52E+11	0.000
92.000	.076645	255227.6	21000.0	-.001346	240.7	1.52E+11	0.000
94.000	.073957	297227.6	21000.0	-.001342	280.3	1.52E+11	0.000
96.000	.071277	339227.6	21000.0	-.001338	319.9	1.52E+11	0.000
98.000	.068606	381227.6	21000.0	-.001333	359.6	1.51E+11	0.000
100.000	.065945	423227.6	21000.0	-.001328	399.2	1.51E+11	0.000
102.000	.063295	465227.6	21000.0	-.001322	438.8	1.51E+11	0.000
104.000	.060658	507227.6	21000.0	-.001315	478.4	1.51E+11	0.000
106.000	.058034	549227.6	21000.0	-.001308	518.0	1.51E+11	0.000
108.000	.055424	591227.6	21000.0	-.001301	557.6	1.51E+11	0.000
110.000	.052830	633227.6	21000.0	-.001293	597.2	1.51E+11	0.000
112.000	.050253	675227.6	21000.0	-.001284	636.8	1.51E+11	0.000
114.000	.047694	717227.6	21000.0	-.001275	676.5	1.51E+11	0.000
116.000	.045154	759227.6	21000.0	-.001265	716.1	1.50E+11	0.000
118.000	.042634	801227.6	21000.0	-.001255	755.7	1.50E+11	0.000
120.000	.040135	843227.6	21000.0	-.001244	795.3	1.50E+11	0.000
122.000	.037659	885227.6	20984.8	-.001232	834.9	1.50E+11	-15.167
124.000	.035206	927166.9	20938.9	-.001220	874.5	1.50E+11	-30.743
126.000	.032778	968983.3	20861.7	-.001207	913.9	1.50E+11	-46.477
128.000	.030376	1.01E+06	20753.1	-.001194	953.2	1.50E+11	-62.112
130.000	.028001	1.05E+06	20613.6	-.001181	992.2	1.50E+11	-77.391
132.000	.025654	1.09E+06	20444.2	-.001166	1030.9	1.50E+11	-92.054
134.000	.023336	1.13E+06	20246.3	-.001151	1069.3	1.49E+11	-105.831
136.000	.021049	1.17E+06	20021.4	-.001136	1107.3	1.49E+11	-119.057
138.000	.018793	1.21E+06	19770.6	-.001120	1144.9	1.49E+11	-131.738
140.000	.016569	1.25E+06	19495.8	-.001103	1181.9	1.49E+11	-143.066
142.000	.014380	1.29E+06	19213.5	-.001086	1218.4	1.49E+11	-139.194
144.000	.012224	1.33E+06	18945.3	-.001069	1254.4	1.49E+11	-129.089
146.000	.010105	1.37E+06	18700.6	-.001050	1289.9	1.41E+11	-115.600
148.000	.008024	1.40E+06	18486.1	-9.83E-04	1324.9	2.43E+10	-98.859
150.000	.006175	1.44E+06	18305.7	-8.64E-04	1359.6	2.37E+10	-81.504
152.000	.004568	1.48E+06	18159.9	-7.39E-04	1394.0	2.30E+10	-64.317
154.000	.003218	1.51E+06	18047.5	-6.07E-04	1428.1	2.22E+10	-48.142
156.000	.002140	1.55E+06	3444.3	-4.66E-04	1462.1	2.13E+10	-14554.996
158.000	.001354	1.53E+06	-20319.1	-3.23E-04	1441.1	2.19E+10	-9208.397
160.000	8.47E-04	1.47E+06	-35286.7	-1.90E-04	1385.4	2.32E+10	-5759.270
162.000	5.93E-04	1.39E+06	-45077.6	-1.16E-04	1308.0	1.31E+11	-4031.583
164.000	3.81E-04	1.29E+06	-51701.4	-9.72E-05	1215.4	1.49E+11	-2592.266
166.000	2.04E-04	1.18E+06	-55681.8	-8.06E-05	1113.0	1.49E+11	-1388.077
168.000	5.86E-05	1.07E+06	-57468.6	-6.56E-05	1005.3	1.50E+11	-398.780
170.000	-5.84E-05	950156.3	-57470.6	-5.22E-05	896.1	1.50E+11	396.812
172.000	-1.50E-04	836008.7	-56053.7	-4.03E-05	788.5	1.50E+11	1020.088
174.000	-2.19E-04	725941.4	-53541.6	-2.99E-05	684.7	1.51E+11	1492.058
176.000	-2.70E-04	621842.4	-50216.6	-2.09E-05	586.5	1.51E+11	1832.898

178.000	-3.03E-04	525075.0	-46322.1	-1.33E-05	495.2	1.51E+11	2061.618
180.000	-3.23E-04	436554.1	-42064.6	-6.98E-06	411.7	1.51E+11	2195.826
182.000	-3.31E-04	356816.4	-37617.2	-1.74E-06	336.5	1.52E+11	2251.577
184.000	-3.30E-04	286085.1	-33122.4	2.49E-06	269.8	1.52E+11	2243.289
186.000	-3.21E-04	224326.9	-28695.4	5.86E-06	211.6	1.52E+11	2183.719
188.000	-3.06E-04	171303.6	-24427.7	8.46E-06	161.6	1.52E+11	2083.982
190.000	-2.87E-04	126616.2	-20390.1	1.04E-05	119.4	1.52E+11	1953.598
192.000	-2.65E-04	89743.3	-16635.9	1.18E-05	84.6422	1.52E+11	1800.570
194.000	-2.40E-04	60072.5	-13203.9	1.28E-05	56.6580	1.52E+11	1631.493
196.000	-2.13E-04	36927.8	-10120.7	1.35E-05	34.8288	1.52E+11	1451.673
198.000	-1.86E-04	19589.8	-7403.8	1.38E-05	18.4763	1.52E+11	1265.248
200.000	-1.58E-04	7312.7	-5063.2	1.40E-05	6.8971	1.52E+11	1075.320
202.000	-1.30E-04	-663.0	-3103.8	1.41E-05	.6253	1.52E+11	884.084
204.000	-1.02E-04	-5102.5	-1526.8	1.40E-05	4.8124	1.52E+11	692.966
206.000	-7.39E-05	-6770.0	-331.0	1.39E-05	6.3852	1.52E+11	502.761
208.000	-4.61E-05	-6426.6	485.5	1.39E-05	6.0613	1.52E+11	313.767
210.000	-1.85E-05	-4828.0	925.2	1.38E-05	4.5536	1.52E+11	125.922
212.000	8.98E-06	-2725.8	990.1	1.37E-05	2.5708	1.52E+11	-61.059
214.000	3.64E-05	-867.8	681.4	1.37E-05	.8185	1.52E+11	-247.553
216.000	6.38E-05	0.0	0.0	1.37E-05	0.0	1.52E+11	-433.892

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

```
Pile-head deflection              =      .18338299 in
Computed slope at pile head       =   -2.08167E-17
Maximum bending moment            =   -1676772.401 lbs-in
Maximum shear force               =     -57470.607 lbs
Depth of maximum bending moment   =          0.000 in
Depth of maximum shear force      =        170.000 in
Number of iterations              =             82
Number of zero deflection points  =              2
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 7

```
Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head  =       22000.000 lbs
Specified slope at pile head        =       0.000E+00 in/in
Specified axial load at pile head   =            .000 lbs
```

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	.220454	-1.78E+06	22000.0	-1.25E-16	1677.1	1.91E+10	0.000
2.000	.220268	-1.73E+06	22000.0	-1.84E-04	1635.6	1.91E+10	0.000
4.000	.219717	-1.69E+06	22000.0	-3.64E-04	1594.1	1.91E+10	0.000
6.000	.218812	-1.65E+06	22000.0	-5.38E-04	1552.6	1.92E+10	0.000
8.000	.217563	-1.60E+06	22000.0	-7.08E-04	1511.1	1.92E+10	0.000
10.000	.215981	-1.56E+06	22000.0	-8.65E-04	1469.6	2.10E+10	0.000
12.000	.214102	-1.51E+06	22000.0	-.001008	1428.1	2.22E+10	0.000
14.000	.211951	-1.47E+06	22000.0	-.001139	1386.6	2.32E+10	0.000
16.000	.209546	-1.43E+06	22000.0	-.001262	1345.1	2.40E+10	0.000
18.000	.206904	-1.38E+06	22000.0	-.001332	1303.6	1.31E+11	0.000
20.000	.204219	-1.34E+06	22000.0	-.001351	1262.1	1.49E+11	0.000
22.000	.201498	-1.29E+06	22000.0	-.001369	1220.6	1.49E+11	0.000
24.000	.198743	-1.25E+06	22000.0	-.001386	1179.2	1.49E+11	0.000
26.000	.195953	-1.21E+06	22000.0	-.001403	1137.7	1.49E+11	0.000
28.000	.193132	-1.16E+06	22000.0	-.001418	1096.2	1.49E+11	0.000
30.000	.190280	-1.12E+06	22000.0	-.001434	1054.7	1.50E+11	0.000
32.000	.187397	-1.07E+06	22000.0	-.001448	1013.2	1.50E+11	0.000
34.000	.184486	-1.03E+06	22000.0	-.001462	971.7	1.50E+11	0.000
36.000	.181548	-986214.3	22000.0	-.001476	930.2	1.50E+11	0.000
38.000	.178583	-942214.3	22000.0	-.001489	888.7	1.50E+11	0.000
40.000	.175593	-898214.3	22000.0	-.001501	847.2	1.50E+11	0.000
42.000	.172579	-854214.3	22000.0	-.001513	805.7	1.50E+11	0.000
44.000	.169542	-810214.3	22000.0	-.001524	764.2	1.50E+11	0.000
46.000	.166484	-766214.3	22000.0	-.001534	722.7	1.50E+11	0.000
48.000	.163405	-722214.3	22000.0	-.001544	681.2	1.51E+11	0.000
50.000	.160307	-678214.3	22000.0	-.001553	639.7	1.51E+11	0.000
52.000	.157192	-634214.3	22000.0	-.001562	598.2	1.51E+11	0.000
54.000	.154059	-590214.3	22000.0	-.001570	556.7	1.51E+11	0.000
56.000	.150911	-546214.3	22000.0	-.001578	515.2	1.51E+11	0.000
58.000	.147748	-502214.3	22000.0	-.001585	473.7	1.51E+11	0.000
60.000	.144572	-458214.3	22000.0	-.001591	432.2	1.51E+11	0.000
62.000	.141384	-414214.3	22000.0	-.001597	390.7	1.51E+11	0.000
64.000	.138185	-370214.3	22000.0	-.001602	349.2	1.52E+11	0.000
66.000	.134976	-326214.3	22000.0	-.001607	307.7	1.52E+11	0.000
68.000	.131758	-282214.3	22000.0	-.001611	266.2	1.52E+11	0.000
70.000	.128534	-238214.3	22000.0	-.001614	224.7	1.52E+11	0.000
72.000	.125302	-194214.3	22000.0	-.001617	183.2	1.52E+11	0.000
74.000	.122066	-150214.3	22000.0	-.001619	141.7	1.52E+11	0.000
76.000	.118826	-106214.3	22000.0	-.001621	100.2	1.52E+11	0.000
78.000	.115583	-62214.3	22000.0	-.001622	58.6780	1.52E+11	0.000
80.000	.112338	-18214.3	22000.0	-.001622	17.1790	1.52E+11	0.000
82.000	.109093	25785.7	22000.0	-.001622	24.3200	1.52E+11	0.000
84.000	.105849	69785.7	22000.0	-.001622	65.8190	1.52E+11	0.000
86.000	.102606	113785.7	22000.0	-.001621	107.3	1.52E+11	0.000
88.000	.099366	157785.7	22000.0	-.001619	148.8	1.52E+11	0.000
90.000	.096131	201785.7	22000.0	-.001616	190.3	1.52E+11	0.000
92.000	.092901	245785.7	22000.0	-.001613	231.8	1.52E+11	0.000
94.000	.089677	289785.7	22000.0	-.001610	273.3	1.52E+11	0.000
96.000	.086461	333785.7	22000.0	-.001606	314.8	1.52E+11	0.000
98.000	.083254	377785.7	22000.0	-.001601	356.3	1.52E+11	0.000
100.000	.080056	421785.7	22000.0	-.001596	397.8	1.51E+11	0.000
102.000	.076870	465785.7	22000.0	-.001590	439.3	1.51E+11	0.000

104.000	.073696	509785.7	22000.0	-.001584	480.8	1.51E+11	0.000
106.000	.070536	553785.7	22000.0	-.001576	522.3	1.51E+11	0.000
108.000	.067390	597785.7	22000.0	-.001569	563.8	1.51E+11	0.000
110.000	.064261	641785.7	22000.0	-.001561	605.3	1.51E+11	0.000
112.000	.061148	685785.7	22000.0	-.001552	646.8	1.51E+11	0.000
114.000	.058053	729785.7	22000.0	-.001542	688.3	1.51E+11	0.000
116.000	.054978	773785.7	22000.0	-.001532	729.8	1.50E+11	0.000
118.000	.051923	817785.7	22000.0	-.001522	771.3	1.50E+11	0.000
120.000	.048891	861785.7	22000.0	-.001511	812.8	1.50E+11	0.000
122.000	.045881	905785.7	21984.0	-.001499	854.3	1.50E+11	-15.969
124.000	.042895	949721.8	21935.7	-.001487	895.7	1.50E+11	-32.390
126.000	.039934	993528.4	21854.3	-.001474	937.1	1.50E+11	-48.997
128.000	.037000	1.04E+06	21739.8	-.001460	978.2	1.50E+11	-65.521
130.000	.034094	1.08E+06	21592.6	-.001446	1019.1	1.50E+11	-81.688
132.000	.031217	1.12E+06	21413.7	-.001431	1059.6	1.50E+11	-97.219
134.000	.028370	1.17E+06	21204.6	-.001416	1099.9	1.49E+11	-111.825
136.000	.025553	1.21E+06	20967.0	-.001400	1139.6	1.49E+11	-125.817
138.000	.022770	1.25E+06	20702.0	-.001383	1179.0	1.49E+11	-139.178
140.000	.020020	1.29E+06	20411.7	-.001366	1217.7	1.49E+11	-151.066
142.000	.017304	1.33E+06	20099.6	-.001349	1256.0	1.49E+11	-161.103
144.000	.014624	1.37E+06	19784.0	-.001330	1293.6	1.39E+11	-154.432
146.000	.011984	1.41E+06	19492.5	-.001262	1330.6	2.42E+10	-137.095
148.000	.009576	1.45E+06	19237.4	-.001142	1367.1	2.36E+10	-117.980
150.000	.007415	1.49E+06	19021.6	-.001016	1403.2	2.28E+10	-97.873
152.000	.005514	1.53E+06	18846.1	-8.81E-04	1438.9	2.20E+10	-77.632
154.000	.003890	1.56E+06	18710.2	-7.37E-04	1474.3	2.09E+10	-58.201
156.000	.002567	1.60E+06	1196.9	-5.78E-04	1509.5	1.92E+10	-17455.118
158.000	.001576	1.57E+06	-26978.2	-4.19E-04	1478.8	2.07E+10	-10719.985
160.000	8.89E-04	1.49E+06	-43744.3	-2.78E-04	1407.7	2.27E+10	-6046.118
162.000	4.64E-04	1.39E+06	-52948.6	-1.56E-04	1313.8	2.45E+10	-3158.190
164.000	2.67E-04	1.28E+06	-57922.3	-9.01E-05	1207.9	1.49E+11	-1815.500
166.000	1.04E-04	1.16E+06	-60444.3	-7.38E-05	1095.2	1.49E+11	-706.465
168.000	-2.81E-05	1.04E+06	-60959.6	-5.91E-05	979.9	1.50E+11	191.172
170.000	-1.32E-04	917409.8	-59868.3	-4.60E-05	865.3	1.50E+11	900.091
172.000	-2.12E-04	799473.4	-57525.5	-3.46E-05	754.0	1.50E+11	1442.731
174.000	-2.71E-04	687308.0	-54242.0	-2.47E-05	648.2	1.51E+11	1840.771
176.000	-3.11E-04	582505.6	-50286.4	-1.63E-05	549.4	1.51E+11	2114.745
178.000	-3.36E-04	486162.2	-45887.9	-9.21E-06	458.5	1.51E+11	2283.763
180.000	-3.48E-04	398953.8	-41238.8	-3.36E-06	376.3	1.51E+11	2365.333
182.000	-3.49E-04	321206.8	-36498.3	1.39E-06	302.9	1.52E+11	2375.249
184.000	-3.42E-04	252960.7	-31795.5	5.17E-06	238.6	1.52E+11	2327.554
186.000	-3.29E-04	194024.9	-27233.4	8.12E-06	183.0	1.52E+11	2234.541
188.000	-3.10E-04	144027.3	-22892.0	1.03E-05	135.8	1.52E+11	2106.804
190.000	-2.87E-04	102456.9	-18831.9	1.20E-05	96.6331	1.52E+11	1953.308
192.000	-2.62E-04	68699.6	-15097.1	1.31E-05	64.7947	1.52E+11	1781.490
194.000	-2.35E-04	42068.4	-11718.2	1.38E-05	39.6772	1.52E+11	1597.385
196.000	-2.07E-04	21826.7	-8715.1	1.42E-05	20.5860	1.52E+11	1405.757
198.000	-1.78E-04	7208.0	-6099.1	1.44E-05	6.7983	1.52E+11	1210.225
200.000	-1.49E-04	-2569.8	-3875.5	1.45E-05	2.4237	1.52E+11	1013.404
202.000	-1.20E-04	-8293.9	-2045.0	1.44E-05	7.8225	1.52E+11	817.043
204.000	-9.15E-05	-10749.9	-605.8	1.43E-05	10.1389	1.52E+11	622.165
206.000	-6.31E-05	-10717.2	445.5	1.41E-05	10.1081	1.52E+11	429.209
208.000	-3.50E-05	-8967.7	1112.9	1.40E-05	8.4580	1.52E+11	238.170
210.000	-7.17E-06	-6265.6	1399.8	1.39E-05	5.9094	1.52E+11	48.735
212.000	2.05E-05	-3368.4	1309.0	1.38E-05	3.1770	1.52E+11	-139.579
214.000	4.81E-05	-1029.6	842.1	1.38E-05	.9711	1.52E+11	-327.291
216.000	7.57E-05	0.0	0.0	1.38E-05	0.0	1.52E+11	-514.819

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 7:

Pile-head deflection	=	.22045438	in
Computed slope at pile head	=	-1.24900E-16	
Maximum bending moment	=	-1778214.327	lbs-in
Maximum shear force	=	-60959.554	lbs
Depth of maximum bending moment	=	0.000	in
Depth of maximum shear force	=	168.000	in
Number of iterations	=	47	
Number of zero deflection points	=	2	

Iteration 91, Y(top) = 2.6415E-01, dYmax = 4.3373E-05
Iteration 92, Y(top) = 2.6417E-01, dYmax = 1.6959E-05
Iteration 93, Y(top) = 2.6418E-01, dYmax = 6.2845E-06

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 8

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 23000.000 lbs
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	.264176	-1.87E+06	23000.0	3.61E-16	1759.4	1.90E+10	0.000
2.000	.263979	-1.82E+06	23000.0	-1.94E-04	1716.0	1.90E+10	0.000
4.000	.263398	-1.77E+06	23000.0	-3.84E-04	1672.6	1.90E+10	0.000
6.000	.262443	-1.73E+06	23000.0	-5.68E-04	1629.3	1.91E+10	0.000
8.000	.261126	-1.68E+06	23000.0	-7.47E-04	1585.9	1.91E+10	0.000
10.000	.259457	-1.64E+06	23000.0	-9.20E-04	1542.5	1.92E+10	0.000
12.000	.257447	-1.59E+06	23000.0	-.001085	1499.1	1.98E+10	0.000
14.000	.255115	-1.54E+06	23000.0	-.001238	1455.7	2.15E+10	0.000
16.000	.252496	-1.50E+06	23000.0	-.001376	1412.3	2.26E+10	0.000
18.000	.249612	-1.45E+06	23000.0	-.001504	1368.9	2.35E+10	0.000
20.000	.246481	-1.41E+06	23000.0	-.001623	1325.6	2.43E+10	0.000
22.000	.243120	-1.36E+06	23000.0	-.001690	1282.2	1.44E+11	0.000

24.000	.239720	-1.31E+06	23000.0	-.001709	1238.8	1.49E+11	0.000
26.000	.236285	-1.27E+06	23000.0	-.001726	1195.4	1.49E+11	0.000
28.000	.232816	-1.22E+06	23000.0	-.001743	1152.0	1.49E+11	0.000
30.000	.229315	-1.18E+06	23000.0	-.001759	1108.6	1.49E+11	0.000
32.000	.225782	-1.13E+06	23000.0	-.001774	1065.3	1.49E+11	0.000
34.000	.222218	-1.08E+06	23000.0	-.001789	1021.9	1.50E+11	0.000
36.000	.218626	-1.04E+06	23000.0	-.001803	978.5	1.50E+11	0.000
38.000	.215006	-991451.8	23000.0	-.001817	935.1	1.50E+11	0.000
40.000	.211360	-945451.8	23000.0	-.001830	891.7	1.50E+11	0.000
42.000	.207688	-899451.8	23000.0	-.001842	848.3	1.50E+11	0.000
44.000	.203992	-853451.8	23000.0	-.001853	804.9	1.50E+11	0.000
46.000	.200274	-807451.8	23000.0	-.001865	761.6	1.50E+11	0.000
48.000	.196534	-761451.8	23000.0	-.001875	718.2	1.50E+11	0.000
50.000	.192774	-715451.8	23000.0	-.001885	674.8	1.51E+11	0.000
52.000	.188995	-669451.8	23000.0	-.001894	631.4	1.51E+11	0.000
54.000	.185198	-623451.8	23000.0	-.001903	588.0	1.51E+11	0.000
56.000	.181385	-577451.8	23000.0	-.001910	544.6	1.51E+11	0.000
58.000	.177556	-531451.8	23000.0	-.001918	501.2	1.51E+11	0.000
60.000	.173714	-485451.8	23000.0	-.001925	457.9	1.51E+11	0.000
62.000	.169858	-439451.8	23000.0	-.001931	414.5	1.51E+11	0.000
64.000	.165991	-393451.8	23000.0	-.001936	371.1	1.51E+11	0.000
66.000	.162113	-347451.8	23000.0	-.001941	327.7	1.52E+11	0.000
68.000	.158227	-301451.8	23000.0	-.001945	284.3	1.52E+11	0.000
70.000	.154332	-255451.8	23000.0	-.001949	240.9	1.52E+11	0.000
72.000	.150431	-209451.8	23000.0	-.001952	197.5	1.52E+11	0.000
74.000	.146524	-163451.8	23000.0	-.001955	154.2	1.52E+11	0.000
76.000	.142612	-117451.8	23000.0	-.001956	110.8	1.52E+11	0.000
78.000	.138698	-71451.8	23000.0	-.001958	67.3904	1.52E+11	0.000
80.000	.134782	-25451.8	23000.0	-.001958	24.0051	1.52E+11	0.000
82.000	.130865	20548.2	23000.0	-.001958	19.3802	1.52E+11	0.000
84.000	.126949	66548.2	23000.0	-.001958	62.7655	1.52E+11	0.000
86.000	.123034	112548.2	23000.0	-.001957	106.2	1.52E+11	0.000
88.000	.119123	158548.2	23000.0	-.001955	149.5	1.52E+11	0.000
90.000	.115215	204548.2	23000.0	-.001952	192.9	1.52E+11	0.000
92.000	.111313	250548.2	23000.0	-.001949	236.3	1.52E+11	0.000
94.000	.107418	296548.2	23000.0	-.001946	279.7	1.52E+11	0.000
96.000	.103530	342548.2	23000.0	-.001942	323.1	1.52E+11	0.000
98.000	.099651	388548.2	23000.0	-.001937	366.5	1.51E+11	0.000
100.000	.095783	434548.2	23000.0	-.001931	409.8	1.51E+11	0.000
102.000	.091926	480548.2	23000.0	-.001925	453.2	1.51E+11	0.000
104.000	.088082	526548.2	23000.0	-.001919	496.6	1.51E+11	0.000
106.000	.084252	572548.2	23000.0	-.001911	540.0	1.51E+11	0.000
108.000	.080437	618548.2	23000.0	-.001903	583.4	1.51E+11	0.000
110.000	.076638	664548.2	23000.0	-.001895	626.8	1.51E+11	0.000
112.000	.072857	710548.2	23000.0	-.001886	670.2	1.51E+11	0.000
114.000	.069095	756548.2	23000.0	-.001876	713.5	1.50E+11	0.000
116.000	.065353	802548.2	23000.0	-.001866	756.9	1.50E+11	0.000
118.000	.061632	848548.2	23000.0	-.001855	800.3	1.50E+11	0.000
120.000	.057934	894548.2	23000.0	-.001843	843.7	1.50E+11	0.000
122.000	.054260	940548.2	22983.3	-.001831	887.1	1.50E+11	-16.683
124.000	.050611	986481.5	22932.8	-.001818	930.4	1.50E+11	-33.835
126.000	.046988	1.03E+06	22847.8	-.001805	973.6	1.50E+11	-51.173
128.000	.043393	1.08E+06	22728.2	-.001790	1016.6	1.50E+11	-68.407
130.000	.039826	1.12E+06	22574.6	-.001776	1059.3	1.50E+11	-85.243
132.000	.036290	1.17E+06	22387.9	-.001760	1101.8	1.49E+11	-101.372
134.000	.032785	1.21E+06	22170.1	-.001744	1143.8	1.49E+11	-116.475
136.000	.029312	1.26E+06	21922.8	-.001728	1185.4	1.49E+11	-130.822

138.000	.025873	1.30E+06	21647.6	-.001711	1226.5	1.49E+11	-144.350
140.000	.022469	1.34E+06	21347.1	-.001693	1267.1	1.48E+11	-156.152
142.000	.019101	1.39E+06	21025.2	-.001628	1307.1	2.47E+10	-165.757
144.000	.015958	1.43E+06	20690.9	-.001512	1346.4	2.40E+10	-168.519
146.000	.013054	1.47E+06	20373.1	-.001389	1385.1	2.32E+10	-149.332
148.000	.010402	1.51E+06	20095.6	-.001258	1423.3	2.24E+10	-128.150
150.000	.008020	1.55E+06	19861.6	-.001118	1460.9	2.13E+10	-105.864
152.000	.005929	1.59E+06	19672.3	-9.65E-04	1498.2	1.96E+10	-83.481
154.000	.004162	1.63E+06	19526.5	-7.99E-04	1535.1	1.92E+10	-62.262
156.000	.002734	1.67E+06	873.3	-6.27E-04	1571.9	1.91E+10	-18590.946
158.000	.001654	1.63E+06	-28966.8	-4.55E-04	1538.4	1.92E+10	-11249.193
160.000	9.15E-04	1.55E+06	-46436.1	-2.97E-04	1462.6	2.13E+10	-6220.025
162.000	4.67E-04	1.45E+06	-55831.7	-1.63E-04	1363.2	2.37E+10	-3175.601
164.000	2.64E-04	1.33E+06	-60800.8	-9.27E-05	1251.9	1.49E+11	-1793.517
166.000	9.61E-05	1.20E+06	-63248.1	-7.58E-05	1133.9	1.49E+11	-653.806
168.000	-3.92E-05	1.07E+06	-63635.0	-6.05E-05	1013.3	1.50E+11	266.888
170.000	-1.46E-04	947664.6	-62375.9	-4.70E-05	893.8	1.50E+11	992.300
172.000	-2.27E-04	824897.5	-59837.7	-3.52E-05	778.0	1.50E+11	1545.857
174.000	-2.87E-04	708313.8	-56341.7	-2.50E-05	668.1	1.51E+11	1950.148
176.000	-3.27E-04	599530.7	-52165.0	-1.63E-05	565.5	1.51E+11	2226.533
178.000	-3.52E-04	499653.8	-47543.6	-9.07E-06	471.3	1.51E+11	2394.864
180.000	-3.64E-04	409356.3	-42675.5	-3.06E-06	386.1	1.51E+11	2473.299
182.000	-3.64E-04	328951.9	-37724.0	1.81E-06	310.3	1.52E+11	2478.199
184.000	-3.56E-04	258460.4	-32821.7	5.68E-06	243.8	1.52E+11	2424.090
186.000	-3.42E-04	197665.3	-28073.9	8.68E-06	186.4	1.52E+11	2323.673
188.000	-3.22E-04	146164.8	-23562.4	1.09E-05	137.9	1.52E+11	2187.878
190.000	-2.98E-04	103415.9	-19348.5	1.26E-05	97.5376	1.52E+11	2025.943
192.000	-2.71E-04	68770.7	-15477.1	1.37E-05	64.8617	1.52E+11	1845.514
194.000	-2.43E-04	41507.6	-11978.8	1.44E-05	39.1483	1.52E+11	1652.785
196.000	-2.14E-04	20855.6	-8873.4	1.49E-05	19.6702	1.52E+11	1452.634
198.000	-1.84E-04	6014.2	-6172.0	1.50E-05	5.6723	1.52E+11	1248.752
200.000	-1.53E-04	-3832.3	-3879.4	1.50E-05	3.6144	1.52E+11	1043.795
202.000	-1.23E-04	-9503.5	-1996.1	1.50E-05	8.9633	1.52E+11	839.523
204.000	-9.37E-05	-11816.7	-519.6	1.48E-05	11.1450	1.52E+11	636.951
206.000	-6.42E-05	-11582.0	553.8	1.47E-05	10.9237	1.52E+11	436.492
208.000	-3.50E-05	-9601.4	1228.4	1.45E-05	9.0557	1.52E+11	238.105
210.000	-6.09E-06	-6668.4	1507.9	1.44E-05	6.2894	1.52E+11	41.434
212.000	2.27E-05	-3569.6	1395.3	1.43E-05	3.3667	1.52E+11	-154.044
214.000	5.13E-05	-1087.1	892.4	1.43E-05	1.0253	1.52E+11	-348.883
216.000	7.99E-05	0.0	0.0	1.43E-05	0.0	1.52E+11	-543.528

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 8:

Pile-head deflection = .26417560 in
Computed slope at pile head = 3.60822E-16
Maximum bending moment = -1865451.813 lbs-in

Maximum shear force = -63635.043 lbs
Depth of maximum bending moment = 0.000 in
Depth of maximum shear force = 168.000 in
Number of iterations = 93
Number of zero deflection points = 2

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 9

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 24000.000 lbs
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	.296147	-1.95E+06	24000.0	1.39E-17	1840.6	1.89E+10	0.000
2.000	.295940	-1.90E+06	24000.0	-2.04E-04	1795.3	1.89E+10	0.000
4.000	.295329	-1.86E+06	24000.0	-4.04E-04	1750.0	1.89E+10	0.000
6.000	.294325	-1.81E+06	24000.0	-5.98E-04	1704.8	1.90E+10	0.000
8.000	.292939	-1.76E+06	24000.0	-7.85E-04	1659.5	1.90E+10	0.000
10.000	.291184	-1.71E+06	24000.0	-9.67E-04	1614.2	1.91E+10	0.000
12.000	.289070	-1.66E+06	24000.0	-.001144	1569.0	1.91E+10	0.000
14.000	.286608	-1.62E+06	24000.0	-.001315	1523.7	1.92E+10	0.000
16.000	.283810	-1.57E+06	24000.0	-.001475	1478.4	2.07E+10	0.000
18.000	.280709	-1.52E+06	24000.0	-.001619	1433.1	2.21E+10	0.000
20.000	.277334	-1.47E+06	24000.0	-.001751	1387.9	2.32E+10	0.000
22.000	.273704	-1.42E+06	24000.0	-.001874	1342.6	2.40E+10	0.000
24.000	.269837	-1.38E+06	24000.0	-.001943	1297.3	1.38E+11	0.000
26.000	.265931	-1.33E+06	24000.0	-.001962	1252.1	1.49E+11	0.000
28.000	.261989	-1.28E+06	24000.0	-.001980	1206.8	1.49E+11	0.000
30.000	.258012	-1.23E+06	24000.0	-.001997	1161.5	1.49E+11	0.000
32.000	.254003	-1.18E+06	24000.0	-.002013	1116.2	1.49E+11	0.000
34.000	.249961	-1.14E+06	24000.0	-.002028	1071.0	1.49E+11	0.000
36.000	.245890	-1.09E+06	24000.0	-.002043	1025.7	1.50E+11	0.000
38.000	.241789	-1.04E+06	24000.0	-.002057	980.4	1.50E+11	0.000
40.000	.237661	-991510.3	24000.0	-.002071	935.2	1.50E+11	0.000
42.000	.233506	-943510.3	24000.0	-.002084	889.9	1.50E+11	0.000
44.000	.229326	-895510.3	24000.0	-.002096	844.6	1.50E+11	0.000
46.000	.225122	-847510.3	24000.0	-.002108	799.3	1.50E+11	0.000
48.000	.220895	-799510.3	24000.0	-.002119	754.1	1.50E+11	0.000
50.000	.216647	-751510.3	24000.0	-.002129	708.8	1.51E+11	0.000
52.000	.212380	-703510.3	24000.0	-.002139	663.5	1.51E+11	0.000
54.000	.208093	-655510.3	24000.0	-.002148	618.3	1.51E+11	0.000
56.000	.203789	-607510.3	24000.0	-.002156	573.0	1.51E+11	0.000
58.000	.199470	-559510.3	24000.0	-.002164	527.7	1.51E+11	0.000
60.000	.195135	-511510.3	24000.0	-.002171	482.4	1.51E+11	0.000
62.000	.190787	-463510.3	24000.0	-.002177	437.2	1.51E+11	0.000

64.000	.186426	-415510.3	24000.0	-.002183	391.9	1.51E+11	0.000
66.000	.182055	-367510.3	24000.0	-.002188	346.6	1.52E+11	0.000
68.000	.177673	-319510.3	24000.0	-.002193	301.3	1.52E+11	0.000
70.000	.173284	-271510.3	24000.0	-.002197	256.1	1.52E+11	0.000
72.000	.168887	-223510.3	24000.0	-.002200	210.8	1.52E+11	0.000
74.000	.164484	-175510.3	24000.0	-.002202	165.5	1.52E+11	0.000
76.000	.160077	-127510.3	24000.0	-.002204	120.3	1.52E+11	0.000
78.000	.155666	-79510.3	24000.0	-.002206	74.9909	1.52E+11	0.000
80.000	.151254	-31510.3	24000.0	-.002207	29.7192	1.52E+11	0.000
82.000	.146840	16489.7	24000.0	-.002207	15.5524	1.52E+11	0.000
84.000	.142427	64489.7	24000.0	-.002206	60.8240	1.52E+11	0.000
86.000	.138016	112489.7	24000.0	-.002205	106.1	1.52E+11	0.000
88.000	.133607	160489.7	24000.0	-.002203	151.4	1.52E+11	0.000
90.000	.129203	208489.7	24000.0	-.002201	196.6	1.52E+11	0.000
92.000	.124804	256489.7	24000.0	-.002198	241.9	1.52E+11	0.000
94.000	.120412	304489.7	24000.0	-.002194	287.2	1.52E+11	0.000
96.000	.116028	352489.7	24000.0	-.002190	332.5	1.52E+11	0.000
98.000	.111653	400489.7	24000.0	-.002185	377.7	1.51E+11	0.000
100.000	.107289	448489.7	24000.0	-.002179	423.0	1.51E+11	0.000
102.000	.102937	496489.7	24000.0	-.002173	468.3	1.51E+11	0.000
104.000	.098598	544489.7	24000.0	-.002166	513.5	1.51E+11	0.000
106.000	.094273	592489.7	24000.0	-.002158	558.8	1.51E+11	0.000
108.000	.089964	640489.7	24000.0	-.002150	604.1	1.51E+11	0.000
110.000	.085672	688489.7	24000.0	-.002141	649.4	1.51E+11	0.000
112.000	.081399	736489.7	24000.0	-.002132	694.6	1.51E+11	0.000
114.000	.077145	784489.7	24000.0	-.002122	739.9	1.50E+11	0.000
116.000	.072911	832489.7	24000.0	-.002111	785.2	1.50E+11	0.000
118.000	.068700	880489.7	24000.0	-.002100	830.4	1.50E+11	0.000
120.000	.064512	928489.7	24000.0	-.002088	875.7	1.50E+11	0.000
122.000	.060350	976489.7	23982.8	-.002075	921.0	1.50E+11	-17.152
124.000	.056213	1.02E+06	23930.9	-.002062	966.2	1.50E+11	-34.787
126.000	.052103	1.07E+06	23843.5	-.002048	1011.3	1.50E+11	-52.607
128.000	.048022	1.12E+06	23720.6	-.002033	1056.1	1.50E+11	-70.313
130.000	.043971	1.17E+06	23562.7	-.002018	1100.8	1.49E+11	-87.593
132.000	.039952	1.21E+06	23371.0	-.002002	1145.0	1.49E+11	-104.122
134.000	.035965	1.26E+06	23147.3	-.001985	1188.9	1.49E+11	-119.560
136.000	.032011	1.31E+06	22893.6	-.001968	1232.4	1.49E+11	-134.150
138.000	.028093	1.35E+06	22611.6	-.001950	1275.3	1.46E+11	-147.796
140.000	.024212	1.40E+06	22304.3	-.001883	1317.7	2.45E+10	-159.550
142.000	.020559	1.44E+06	21975.4	-.001766	1359.4	2.37E+10	-169.329
144.000	.017149	1.48E+06	21629.3	-.001640	1400.6	2.29E+10	-176.824
146.000	.013999	1.53E+06	21292.3	-.001505	1441.0	2.19E+10	-160.151
148.000	.011128	1.57E+06	20995.0	-.001359	1480.9	2.06E+10	-137.098
150.000	.008563	1.61E+06	20744.9	-.001199	1520.2	1.92E+10	-113.025
152.000	.006333	1.65E+06	20542.7	-.001029	1559.2	1.92E+10	-89.164
154.000	.004448	1.69E+06	20387.0	-8.54E-04	1597.7	1.91E+10	-66.541
156.000	.002918	1.73E+06	479.3	-6.74E-04	1636.1	1.91E+10	-19841.206
158.000	.001752	1.70E+06	-31273.6	-4.94E-04	1599.6	1.91E+10	-11911.713
160.000	9.41E-04	1.61E+06	-49581.8	-3.22E-04	1518.1	1.92E+10	-6396.442
162.000	4.65E-04	1.50E+06	-59138.4	-1.72E-04	1412.5	2.26E+10	-3160.141
164.000	2.54E-04	1.37E+06	-64023.2	-9.56E-05	1295.0	1.38E+11	-1724.669
166.000	8.24E-05	1.24E+06	-66308.3	-7.73E-05	1171.0	1.49E+11	-560.395
168.000	-5.55E-05	1.11E+06	-66491.1	-6.16E-05	1044.8	1.50E+11	377.537
170.000	-1.64E-04	975571.7	-64999.6	-4.76E-05	920.1	1.50E+11	1113.995
172.000	-2.46E-04	847800.6	-62212.1	-3.55E-05	799.6	1.50E+11	1673.448
174.000	-3.06E-04	726723.2	-58459.3	-2.50E-05	685.4	1.51E+11	2079.429
176.000	-3.46E-04	613963.5	-54025.7	-1.61E-05	579.1	1.51E+11	2354.138

178.000	-3.70E-04	510620.4	-49153.4	-8.68E-06	481.6	1.51E+11	2518.162
180.000	-3.81E-04	417349.9	-44044.9	-2.55E-06	393.6	1.51E+11	2590.299
182.000	-3.81E-04	334440.6	-38867.2	2.41E-06	315.4	1.52E+11	2587.456
184.000	-3.71E-04	261881.2	-33755.1	6.35E-06	247.0	1.52E+11	2524.613
186.000	-3.55E-04	199420.2	-28815.7	9.38E-06	188.1	1.52E+11	2414.847
188.000	-3.34E-04	146618.6	-24131.4	1.17E-05	138.3	1.52E+11	2269.388
190.000	-3.08E-04	102894.5	-19764.3	1.33E-05	97.0459	1.52E+11	2097.707
192.000	-2.81E-04	67561.3	-15759.0	1.44E-05	63.7210	1.52E+11	1907.625
194.000	-2.51E-04	39858.5	-12145.9	1.51E-05	37.5929	1.52E+11	1705.460
196.000	-2.20E-04	18977.6	-8944.3	1.55E-05	17.8989	1.52E+11	1496.167
198.000	-1.89E-04	4081.4	-6164.6	1.57E-05	3.8494	1.52E+11	1283.480
200.000	-1.57E-04	-5680.9	-3811.1	1.57E-05	5.3580	1.52E+11	1070.063
202.000	-1.26E-04	-11162.9	-1883.4	1.55E-05	10.5284	1.52E+11	857.663
204.000	-9.52E-05	-13214.3	-378.4	1.54E-05	12.4632	1.52E+11	647.258
206.000	-6.46E-05	-12676.7	708.0	1.52E-05	11.9562	1.52E+11	439.217
208.000	-3.43E-05	-10382.2	1380.7	1.51E-05	9.7921	1.52E+11	233.443
210.000	-4.34E-06	-7153.9	1643.7	1.49E-05	6.7473	1.52E+11	29.525
212.000	2.55E-05	-3807.6	1500.1	1.49E-05	3.5911	1.52E+11	-173.113
214.000	5.52E-05	-1153.6	951.9	1.48E-05	1.0881	1.52E+11	-375.070
216.000	8.48E-05	0.0	0.0	1.48E-05	0.0	1.52E+11	-576.821

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 9:

Pile-head deflection	=	.29614687	in
Computed slope at pile head	=	1.38778E-17	
Maximum bending moment	=	-1951510.319	lbs-in
Maximum shear force	=	-66491.118	lbs
Depth of maximum bending moment	=	0.000	in
Depth of maximum shear force	=	168.000	in
Number of iterations	=	59	
Number of zero deflection points	=	2	

Summary of Pile-head Response

Definition of symbols for pile-head boundary conditions:

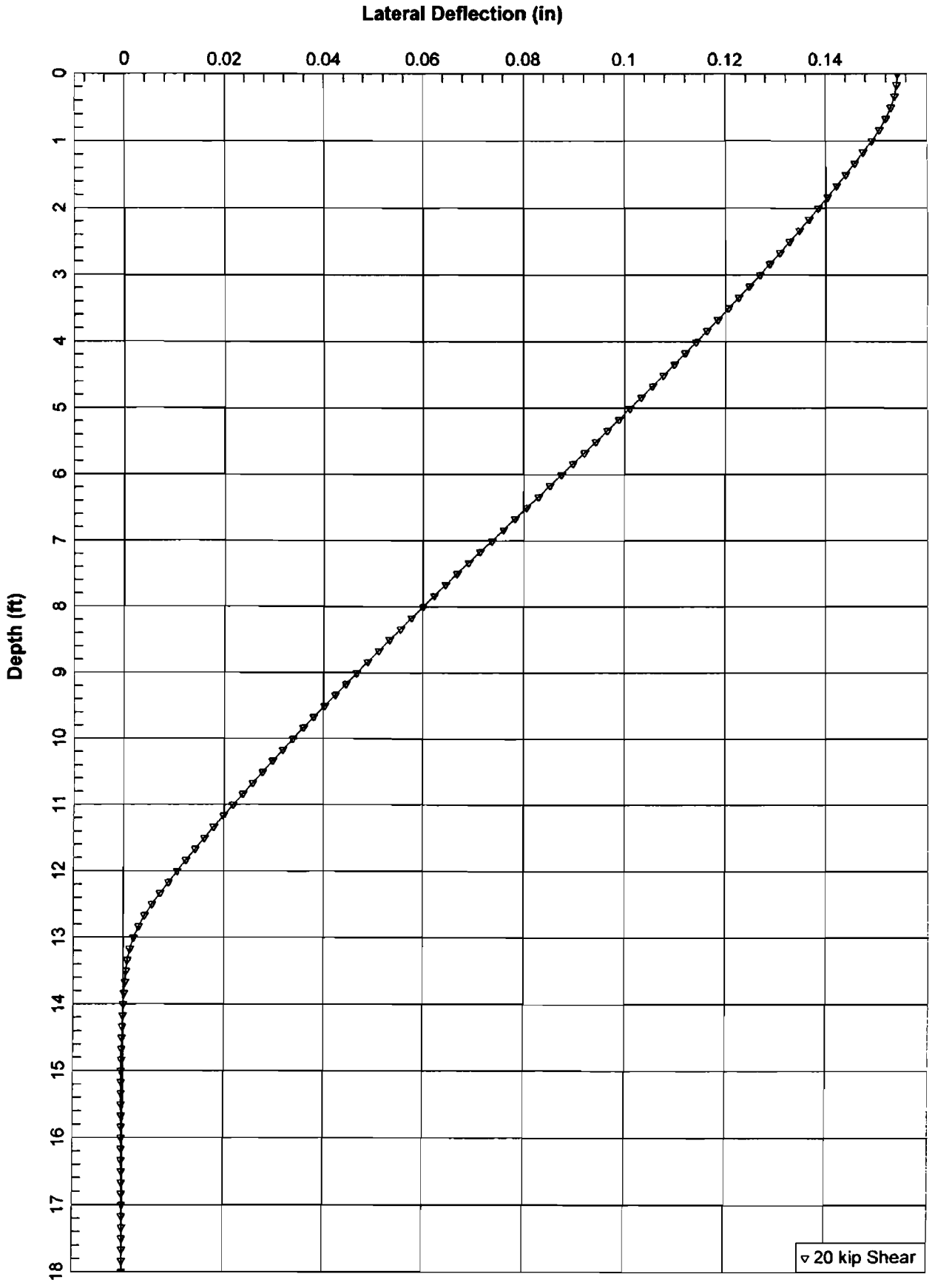
y = pile-head displacment, in
M = pile-head moment, lbs-in
V = pile-head shear force, lbs
S = pile-head slope, radians

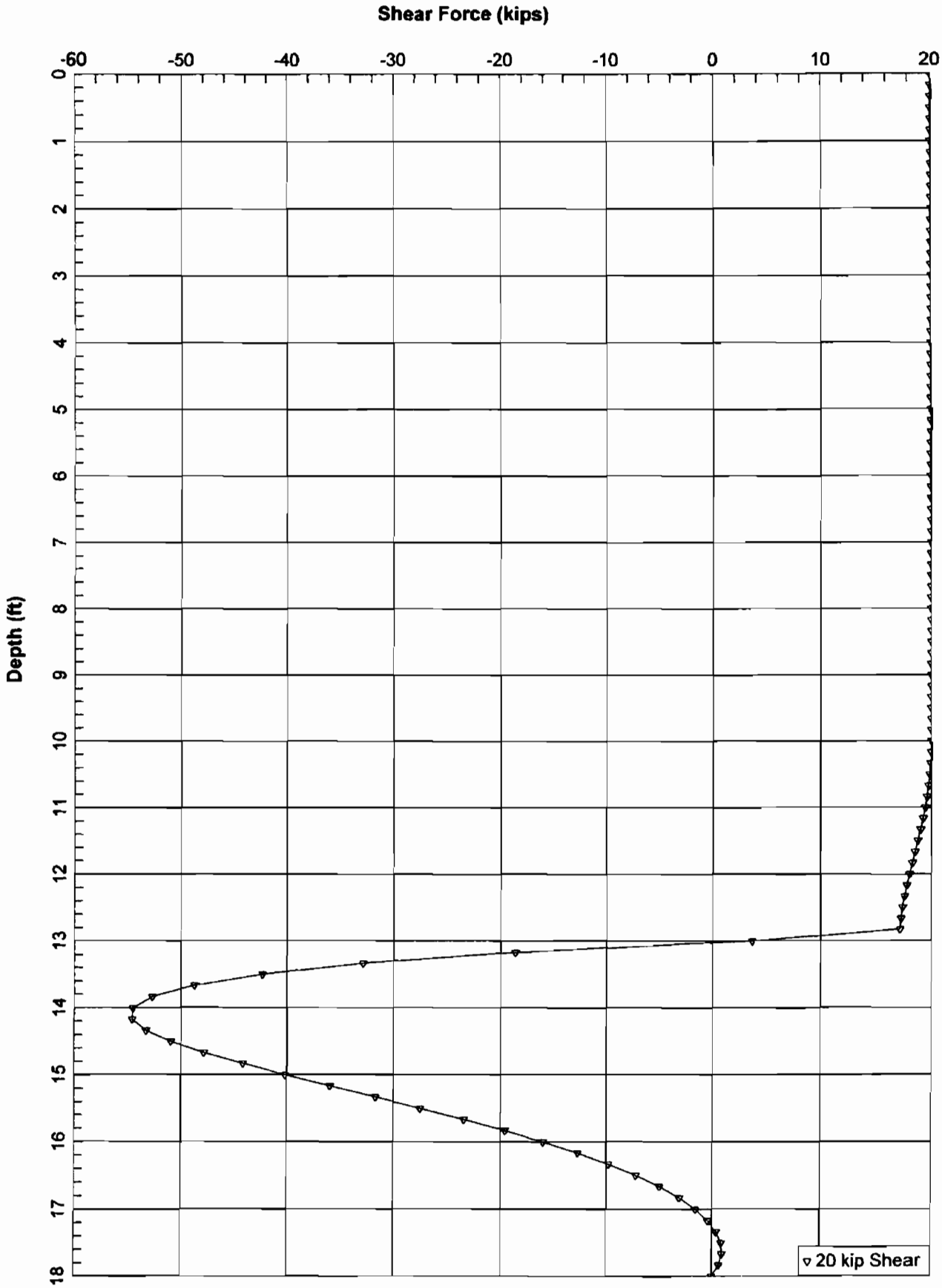
R = rotational stiffness of pile-head, in-lbs/rad

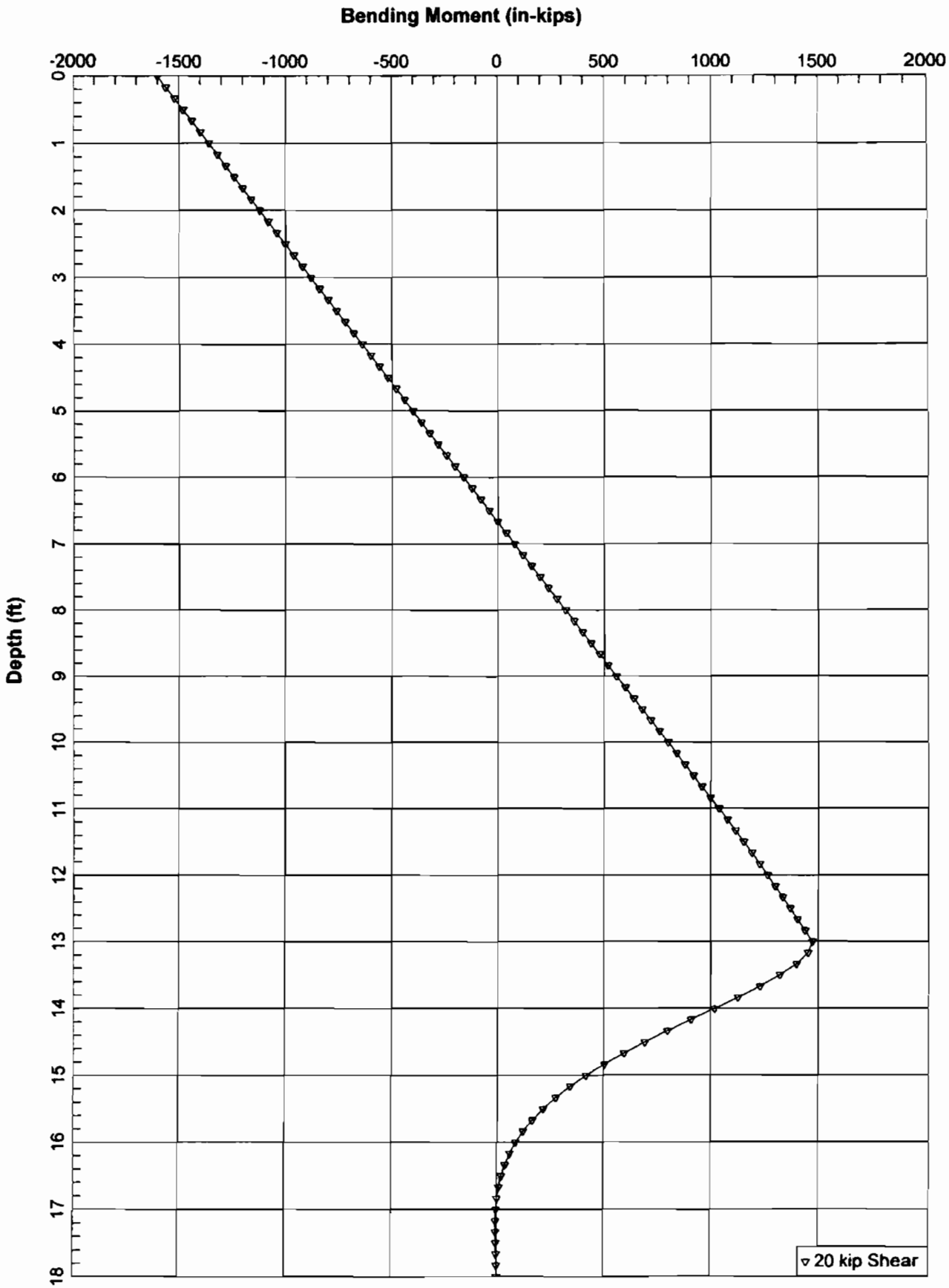
BC Type	Boundary Condition 1	Boundary Condition 2	Axial Load lbs	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
2	V= 0.000	S= 0.000	0.0000	0.0000	0.0000	0.0000
2	V= 5000.000	S= 0.000	0.0000	.014009	-4.299E+05	-12755.6158
2	V= 10000.000	S= 0.000	0.0000	.028151	-8.594E+05	-25535.0348
2	V= 15000.000	S= 0.000	0.0000	.042433	-1.289E+06	-38341.2364
2	V= 20000.000	S= 0.000	0.0000	.1428	-1.604E+06	-54525.7901
2	V= 21000.000	S= 0.000	0.0000	.1834	-1.677E+06	-57470.6071
2	V= 22000.000	S= 0.000	0.0000	.2205	-1.778E+06	-60959.5541
2	V= 23000.000	S= 0.000	0.0000	.2642	-1.865E+06	-63635.0425
2	V= 24000.000	S= 0.000	0.0000	.2961	-1.952E+06	-66491.1175

The analysis ended normally.

PIER UNSUPPORTED FOR 10 FEET, 20 KIP LATERAL LOAD,
FIXED HEAD


Lateral Deflection (in)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
20 kip Shear


Shear Force (kips)
-60
-50
-40
-30
-20
-10
0
10
20
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
20 kip Shear


Bending Moment (in-kips)
-2000
-1500
-1000
-500
0
500
1000
1500
2000
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
20 kip Shear

096231 30in_DP 05E.lpd

```
LPILEP4
LA - DPW_Morris Dam; 30 inch Drilled Pier
1       3       1       0       0       0
108     2       120     216     0
0       30      15904   707     3605000
216     30      15904   707     3605000
2       4       4       0       0
4       120     156     440     440
6       156     360     0       0
120     0.056
156     0.056
156     0.075
360     0.075
120     0       38      0       0
156     0       38      0       0
156     6800    0       0       0
360     6800    0       0       0
0       1       1
1
2       20000   0       0
0
1       1       0
100     1E-5    100
2       1
0
4000    60000   60000   29000000
0       30      0       0       0
0.6     6       0       3
```

==========

LPILE Plus for Windows, Version 4.0

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

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==========

This program is licensed to:

Mark Petersen
Black & Veatch

Path to file locations: C:\Documents and Settings\pet08890.NA\My Documents\BV-Users D\Infrastructure\Morris Dam\
Name of input data file: 096231 30in_DP 05E.lpd
Name of output file: 096231 30in_DP 05E.lpo
Name of plot output file: 096231 30in_DP 05E.lpp
Name of runtime file: 096231 30in_DP 05E.lpr

Time and Date of Analysis

Date: February 1, 2003 Time: 5:42: 3

Problem Title

LA - DPW_Morris Dam; 30 inch Drilled Pier

Program Options

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 3:
- Computation of Nonlinear Bending Stiffness and Ultimate Bending Moment Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only

- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 108
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 216.00 in
Depth of ground surface below top of pile = 120.00 in
Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	30.000	15904.0000	707.0000	3605000.000
2	216.0000	30.000	15904.0000	707.0000	3605000.000

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of moment of inertia and modulus of are not used for any computations other than total stress due to combined axial loading and bending.

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 = 120.000 in
Distance from top of pile to bottom of layer = 156.000 in
p-y subgrade modulus k for top of soil layer = 440.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 440.000 lbs/in**3

Layer 2 is strong rock (vuggy limestone)
Distance from top of pile to top of layer = 156.000 in
Distance from top of pile to bottom of layer = 360.000 in

(Depth of lowest layer extends 144.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 4 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	120.00	.05600
2	156.00	.05600
3	156.00	.07500
4	360.00	.07500

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 4 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	120.000	.00000	38.00	------	------
2	156.000	.00000	38.00	------	------
3	156.000	6800.00000	.00	------	------
4	360.000	6800.00000	.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Static loading criteria was used for computation of p-y curves

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Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 20000.000 lbs

Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head condition)

Computations of Ultimate Moment Capacity and Nonlinear Bending Stiffness

---

Pile Description:

The sectional shape is a circular drilled shaft (bored pile).

Outside Diameter = 30.000 In

Material Properties:

Compressive Strength of Concrete = 4.000 Kip/In**2
Yield Stress of Reinforcement = 60. Kip/In**2
Modulus of Elasticity of Reinforcement = 29000. Kip/In**2
Number of Reinforcing Bars = 6
Area of Single Bar = .60000 In**2
Number of Rows of Reinforcing Bars = 3
Cover Thickness (edge to bar center) = 3.000 In

Ultimate Axial Squash Load Capacity = 2607.08 Kip

Distribution and Area of Steel Reinforcement

Row Number	Area of Reinforcement In**2	Distance to Centroidal Axis In
1	1.200000	10.3923
2	1.200000	.0000
3	1.200000	-10.3923

Axial Thrust Force = .00 lbs

Bending Moment in-lbs	Bending Stiffness lb-in2	Bending Curvature rad/in	Maximum Strain in/in	Neutral Axis Position inches
152091.575	1.52092E+11	.00000100	.00001505	15.051
752550.949	1.50510E+11	.00000500	.00007525	15.050
1340359.251	1.48929E+11	.00000900	.00013545	15.050
1340359.251	1.03105E+11	.00001300	.00008100	6.23073578
1340359.251	7.88447E+10	.00001700	.00010605	6.23828888
1340359.251	6.38266E+10	.00002100	.00013117	6.24607086
1340359.251	5.36144E+10	.00002500	.00015634	6.25362396
1340359.251	4.62193E+10	.00002900	.00018158	6.26140594
1340359.251	4.06169E+10	.00003300	.00020689	6.26941681
1340359.251	3.62259E+10	.00003700	.00023226	6.27719879
1340359.251	3.26917E+10	.00004100	.00025769	6.28520966

1340359.251	2.97858E+10	.00004500	.00028321	6.29344940
1340359.251	2.73543E+10	.00004900	.00030877	6.30146027
1340359.251	2.52898E+10	.00005300	.00033441	6.30970001
1595840.429	1.92270E+10	.00008300	.00052906	6.37424469
2102324.201	1.86046E+10	.00011300	.00072130	6.38317108
2250319.062	1.57365E+10	.00014300	.00087034	6.08631134
2395781.946	1.38485E+10	.00017300	.00102502	5.92494965
2535443.980	1.24899E+10	.00020300	.00117549	5.79059601
2632591.594	1.12987E+10	.00023300	.00131518	5.64456940
2652546.593	1.00857E+10	.00026300	.00143901	5.47153473
2664199.986	9.09283E+09	.00029300	.00154689	5.27950287
2674635.697	8.28061E+09	.00032300	.00165589	5.12660980
2684007.378	7.60342E+09	.00035300	.00176614	5.00324249
2694878.146	7.03624E+09	.00038300	.00189143	4.93846893
2699661.839	6.53671E+09	.00041300	.00199724	4.83592987
2702991.778	6.10156E+09	.00044300	.00210429	4.75009918
2705885.825	5.72069E+09	.00047300	.00221269	4.67800140
2707938.397	5.38358E+09	.00050300	.00232287	4.61803436
2709833.445	5.08412E+09	.00053300	.00243433	4.56722260
2711315.295	4.81584E+09	.00056300	.00254686	4.52373505
2711315.295	4.57220E+09	.00059300	.00266846	4.49993134
2711315.295	4.35203E+09	.00062300	.00280346	4.49993134
2715060.938	4.15783E+09	.00065300	.00293621	4.49649811
2715060.938	3.97520E+09	.00068300	.00305063	4.46651459
2715060.938	3.80794E+09	.00071300	.00316700	4.44179535
2715060.938	3.65419E+09	.00074300	.00328444	4.42050934
2715060.938	3.51237E+09	.00077300	.00340255	4.40174103
2715060.938	3.38115E+09	.00080300	.00352155	4.38549042
2715060.938	3.25938E+09	.00083300	.00364129	4.37129974
2715060.938	3.14607E+09	.00086300	.00376196	4.35916901
2715060.938	3.04038E+09	.00089300	.00388395	4.34932709

Ultimate Moment Capacity at a Concrete Strain of 0.003 = 2715.061 In-Kip

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

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 20000.000 lbs
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Flx. Rig. EI lbs-in**2	Soil Res p lbs/in
0.000	.154312	-1.60E+06	20000.0	-3.47E-17	1510.5	2.09E+10	0.000
2.000	.154159	-1.56E+06	20000.0	-1.51E-04	1472.8	2.09E+10	0.000
4.000	.153706	-1.52E+06	20000.0	-2.99E-04	1435.0	2.09E+10	0.000
6.000	.152962	-1.48E+06	20000.0	-4.36E-04	1397.3	2.30E+10	0.000

8.000	.151961	-1.44E+06	20000.0	-5.62E-04	1359.6	2.37E+10	0.000
10.000	.150715	-1.40E+06	20000.0	-6.80E-04	1321.8	2.44E+10	0.000
12.000	.149240	-1.36E+06	20000.0	-7.92E-04	1284.1	2.50E+10	0.000
14.000	.147548	-1.32E+06	20000.0	-8.55E-04	1246.4	1.49E+11	0.000
16.000	.145820	-1.28E+06	20000.0	-8.73E-04	1208.7	1.49E+11	0.000
18.000	.144057	-1.24E+06	20000.0	-8.90E-04	1170.9	1.49E+11	0.000
20.000	.142261	-1.20E+06	20000.0	-9.06E-04	1133.2	1.49E+11	0.000
22.000	.140433	-1.16E+06	20000.0	-9.22E-04	1095.5	1.49E+11	0.000
24.000	.138574	-1.12E+06	20000.0	-9.37E-04	1057.8	1.50E+11	0.000
26.000	.136685	-1.08E+06	20000.0	-9.52E-04	1020.0	1.50E+11	0.000
28.000	.134767	-1.04E+06	20000.0	-9.66E-04	982.3	1.50E+11	0.000
30.000	.132821	-1.00E+06	20000.0	-9.80E-04	944.6	1.50E+11	0.000
32.000	.130848	-961511.4	20000.0	-9.93E-04	906.9	1.50E+11	0.000
34.000	.128850	-921511.4	20000.0	-.001005	869.1	1.50E+11	0.000
36.000	.126827	-881511.4	20000.0	-.001017	831.4	1.50E+11	0.000
38.000	.124781	-841511.4	20000.0	-.001029	793.7	1.50E+11	0.000
40.000	.122712	-801511.4	20000.0	-.001040	756.0	1.50E+11	0.000
42.000	.120622	-761511.4	20000.0	-.001050	718.2	1.50E+11	0.000
44.000	.118512	-721511.4	20000.0	-.001060	680.5	1.51E+11	0.000
46.000	.116383	-681511.4	20000.0	-.001069	642.8	1.51E+11	0.000
48.000	.114235	-641511.4	20000.0	-.001078	605.0	1.51E+11	0.000
50.000	.112071	-601511.4	20000.0	-.001086	567.3	1.51E+11	0.000
52.000	.109890	-561511.4	20000.0	-.001094	529.6	1.51E+11	0.000
54.000	.107695	-521511.4	20000.0	-.001101	491.9	1.51E+11	0.000
56.000	.105486	-481511.4	20000.0	-.001108	454.1	1.51E+11	0.000
58.000	.103264	-441511.4	20000.0	-.001114	416.4	1.51E+11	0.000
60.000	.101030	-401511.4	20000.0	-.001119	378.7	1.51E+11	0.000
62.000	.098786	-361511.4	20000.0	-.001124	341.0	1.52E+11	0.000
64.000	.096533	-321511.4	20000.0	-.001129	303.2	1.52E+11	0.000
66.000	.094270	-281511.4	20000.0	-.001133	265.5	1.52E+11	0.000
68.000	.092001	-241511.4	20000.0	-.001136	227.8	1.52E+11	0.000
70.000	.089725	-201511.4	20000.0	-.001139	190.1	1.52E+11	0.000
72.000	.087444	-161511.4	20000.0	-.001142	152.3	1.52E+11	0.000
74.000	.085158	-121511.4	20000.0	-.001144	114.6	1.52E+11	0.000
76.000	.082869	-81511.4	20000.0	-.001145	76.8782	1.52E+11	0.000
78.000	.080579	-41511.4	20000.0	-.001146	39.1518	1.52E+11	0.000
80.000	.078287	-1511.4	20000.0	-.001146	1.4255	1.52E+11	0.000
82.000	.075995	38488.6	20000.0	-.001146	36.3009	1.52E+11	0.000
84.000	.073704	78488.6	20000.0	-.001145	74.0272	1.52E+11	0.000
86.000	.071415	118488.6	20000.0	-.001144	111.8	1.52E+11	0.000
88.000	.069129	158488.6	20000.0	-.001142	149.5	1.52E+11	0.000
90.000	.066847	198488.6	20000.0	-.001139	187.2	1.52E+11	0.000
92.000	.064571	238488.6	20000.0	-.001137	224.9	1.52E+11	0.000
94.000	.062301	278488.6	20000.0	-.001133	262.7	1.52E+11	0.000
96.000	.060038	318488.6	20000.0	-.001129	300.4	1.52E+11	0.000
98.000	.057784	358488.6	20000.0	-.001125	338.1	1.52E+11	0.000
100.000	.055539	398488.6	20000.0	-.001120	375.8	1.51E+11	0.000
102.000	.053305	438488.6	20000.0	-.001114	413.6	1.51E+11	0.000
104.000	.051082	478488.6	20000.0	-.001108	451.3	1.51E+11	0.000
106.000	.048872	518488.6	20000.0	-.001102	489.0	1.51E+11	0.000
108.000	.046675	558488.6	20000.0	-.001095	526.7	1.51E+11	0.000
110.000	.044494	598488.6	20000.0	-.001087	564.5	1.51E+11	0.000
112.000	.042328	638488.6	20000.0	-.001079	602.2	1.51E+11	0.000
114.000	.040179	678488.6	20000.0	-.001070	639.9	1.51E+11	0.000
116.000	.038048	718488.6	20000.0	-.001061	677.6	1.51E+11	0.000
118.000	.035936	758488.6	20000.0	-.001051	715.4	1.50E+11	0.000
120.000	.033845	798488.6	20000.0	-.001040	753.1	1.50E+11	0.000

122.000	.031775	838488.6	19985.5	-.001030	790.8	1.50E+11	-14.509
124.000	.029727	878430.6	19941.6	-.001018	828.5	1.50E+11	-29.399
126.000	.027702	918254.9	19867.8	-.001006	866.1	1.50E+11	-44.430
128.000	.025702	957901.6	19764.0	-9.94E-04	903.5	1.50E+11	-59.361
130.000	.023727	997310.8	19630.7	-9.81E-04	940.6	1.50E+11	-73.950
132.000	.021779	1.04E+06	19468.8	-9.67E-04	977.5	1.50E+11	-87.952
134.000	.019859	1.08E+06	19279.7	-9.53E-04	1014.1	1.50E+11	-101.118
136.000	.017967	1.11E+06	19064.8	-9.38E-04	1050.2	1.50E+11	-113.805
138.000	.016106	1.15E+06	18824.9	-9.23E-04	1086.0	1.49E+11	-126.043
140.000	.014275	1.19E+06	18573.2	-9.08E-04	1121.3	1.49E+11	-125.618
142.000	.012476	1.23E+06	18326.9	-8.91E-04	1156.1	1.49E+11	-120.764
144.000	.010709	1.26E+06	18093.0	-8.75E-04	1190.4	1.49E+11	-113.091
146.000	.008977	1.30E+06	17877.2	-8.57E-04	1224.3	1.49E+11	-102.697
148.000	.007279	1.33E+06	17684.8	-8.40E-04	1257.9	1.49E+11	-89.683
150.000	.005618	1.37E+06	17521.0	-7.76E-04	1291.0	2.49E+10	-74.154
152.000	.004176	1.40E+06	17388.1	-6.63E-04	1324.0	2.44E+10	-58.798
154.000	.002965	1.44E+06	17284.9	-5.45E-04	1356.6	2.38E+10	-44.355
156.000	.001996	1.47E+06	3669.3	-4.21E-04	1389.2	2.31E+10	-13571.203
158.000	.001281	1.45E+06	-18614.7	-2.95E-04	1370.5	2.35E+10	-8712.834
160.000	8.14E-04	1.40E+06	-32863.0	-1.76E-04	1318.9	2.44E+10	-5535.500
162.000	5.76E-04	1.32E+06	-42313.3	-1.10E-04	1246.5	1.49E+11	-3914.821
164.000	3.73E-04	1.23E+06	-48763.6	-9.32E-05	1159.3	1.49E+11	-2535.439
166.000	2.03E-04	1.13E+06	-52679.1	-7.74E-05	1062.5	1.50E+11	-1380.095
168.000	6.32E-05	1.02E+06	-54488.9	-6.31E-05	960.6	1.50E+11	-429.709
170.000	-4.94E-05	908616.5	-54582.9	-5.02E-05	857.0	1.50E+11	335.749
172.000	-1.38E-04	800122.2	-53310.6	-3.89E-05	754.6	1.50E+11	936.547
174.000	-2.05E-04	695374.1	-50981.4	-2.89E-05	655.8	1.51E+11	1392.627
176.000	-2.53E-04	596196.5	-47865.6	-2.04E-05	562.3	1.51E+11	1723.166
178.000	-2.86E-04	503911.6	-44196.2	-1.31E-05	475.3	1.51E+11	1946.258
180.000	-3.06E-04	419411.6	-40171.3	-6.97E-06	395.6	1.51E+11	2078.681
182.000	-3.14E-04	343226.4	-35956.8	-1.93E-06	323.7	1.52E+11	2135.749
184.000	-3.13E-04	275584.2	-31689.9	2.15E-06	259.9	1.52E+11	2131.232
186.000	-3.05E-04	216467.0	-27481.3	5.39E-06	204.2	1.52E+11	2077.325
188.000	-2.92E-04	165659.0	-23419.3	7.90E-06	156.2	1.52E+11	1984.663
190.000	-2.74E-04	122789.7	-19572.3	9.80E-06	115.8	1.52E+11	1862.367
192.000	-2.53E-04	87369.8	-15991.8	1.12E-05	82.4036	1.52E+11	1718.111
194.000	-2.29E-04	58822.4	-12715.5	1.21E-05	55.4789	1.52E+11	1558.231
196.000	-2.04E-04	36507.9	-9769.4	1.28E-05	34.4328	1.52E+11	1387.830
198.000	-1.78E-04	19744.8	-7170.7	1.31E-05	18.6225	1.52E+11	1210.901
200.000	-1.52E-04	7825.2	-4929.3	1.33E-05	7.3804	1.52E+11	1030.440
202.000	-1.25E-04	27.4259	-3050.3	1.34E-05	2.59E-02	1.52E+11	848.580
204.000	-9.80E-05	-4376.0	-1535.0	1.33E-05	4.1273	1.52E+11	666.715
206.000	-7.14E-05	-6112.7	-382.7	1.33E-05	5.7652	1.52E+11	485.633
208.000	-4.49E-05	-5906.7	408.6	1.32E-05	5.5710	1.52E+11	305.644
210.000	-1.86E-05	-4478.2	841.0	1.31E-05	4.2237	1.52E+11	126.711
212.000	7.56E-06	-2542.9	916.2	1.31E-05	2.3984	1.52E+11	-51.421
214.000	3.37E-05	-813.3	635.7	1.31E-05	.7670	1.52E+11	-229.098
216.000	5.98E-05	0.0	0.0	1.31E-05	0.0	1.52E+11	-406.630

Please note that because this analysis makes computations of ultimate moment capacity and pile response using nonlinear bending stiffness that the above values of total stress due to combined axial stress and bending may not be representative of actual conditions.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.15431218	in
Computed slope at pile head	=	-3.46945E-17	
Maximum bending moment	=	-1601511.394	lbs-in
Maximum shear force	=	-54582.905	lbs
Depth of maximum bending moment	=	0.000	in
Depth of maximum shear force	=	170.000	in
Number of iterations	=	85	
Number of zero deflection points	=	2	

Summary of Pile-head Response

Definition of symbols for pile-head boundary conditions:

y = pile-head displacment, in
M = pile-head moment, lbs-in
V = pile-head shear force, lbs
S = pile-head slope, radians
R = rotational stiffness of pile-head, in-lbs/rad

BC Type	Boundary Condition 1	Boundary Condition 2	Axial Load lbs	Pile Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
2	V= 20000.000	S= 0.000	0.0000	.1543	-1.602E+06	-54582.9053

The analysis ended normally.