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Established 1927

March 21, 2014

Columbus Engineering Consultants, Inc.
870 Michigan Ave.
Columbus, Ohio 43215-1109

Attention: Jack Jang, Ph.D., P.E.
President

Reference: Structure Foundation Exploration
CLA-CR314-0.09 - Replacement Structure
Bridge #1204 over Honey Creek
Bethel Township, Clark County, Ohio
CTL Project No. 13050157COL

Dear Dr. Jang:

CTL Engineering, Inc. has completed the Structure Foundation Exploration for the above referenced project. A PDF copy of the report is being submitted.

Thank you for the opportunity to work with you on this project. If you have any questions or need further information, please feel free to contact our office.

Respectfully Submitted

CTL ENGINEERING, INC.

Joe Grani, P.E.
Project Engineer

STRUCTURE FOUNDATION EXPLORATION

STRUCTURE FOUNDATION EXPLORATION
CLA-CR 314-0.09-REPLACEMENT STRUCTURE
BRIDGE #1204 OVER HONEY CREEK
BETHEL TOWNSHIP, CLARK COUNTY, OHIO
CTL PROJECT NO. 13050157COL

PREPARED FOR:

COLUMBUS ENGINEERING CONSULTANTS
840 MICHIGAN AVE.
COLUMBUS, OHIO 43215

PREPARED BY:

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March 21, 2014

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I. PROJECT LOCATION AND DESCRIPTION

The project consists of constructing a replacement structure for CLA-CR314-0.09 in Bethel Township, Clark County, Ohio. The new structure will be a single-span bridge constructed at essentially the same location as the existing structure. The new bridge will be a 90-foot long, single-span bridge with semi-integral abutments.

II. SUBSURFACE EXPLORATION

Two (2) test borings were performed for this project. Borings B-001-0-13 and B-002-0-13 were drilled near the proposed Rear and Forward Abutment for the planned bridge, respectively. The borings were drilled at the approximate locations indicated on the appended Structure Foundation Exploration sheet.

The test borings were performed with a truck-mounted drill rig utilizing hollow stem augers (HSA) on September 23 and 24, 2013. Standard penetration tests were conducted using a 140-pound hammer falling 30 inches to drive 2-inch O.D. split barrel samplers. The energy transfer ratios associated with the automatic SPT hammers for the drill rig was 80.9 percent. The hammer was calibrated on September 27, 2011.

Soil samples obtained were preserved in glass jars, visually classified in the field and laboratory, and tested for natural moisture content. Representative soil samples were subjected to laboratory testing including grain size distribution, Atterberg limits and unconfined compression.

Ground surface elevations at the boring locations were provided by personnel from Columbus Engineering Consultants.

III. SITE GEOLOGY

According to the Ohio Department of Natural Resources, *Physiographic Regions of Ohio*, the site lies on the Southern Ohio Loamy Till Plain.

According to Bedrock Geologic Map of Ohio (2006), the bedrock below the site consists of Upper Ordovician Age shale, limestone and dolomite of the Cincinnati Group.

According to information from the ODNR website, no mapped deep mines are located in the area of the bridge. According to the ODNR Ohio Karst Areas map, no mapped probable Karst areas are present at the bridge location. However, several probable Karst areas have been identified with 10 miles of the site, both to the east and west, toward Springfield and Tipp City. The bedrock below the bridge site consists of solution prone interbedded Ordovician Age shale and limestone, at depths greater than 20 feet.

According to web based mapping from the United States Department of Agriculture, Natural Resources Conservation Service, the soils at the site consist primarily of Genesee silt loam (Gn) west of the creek and Westland silty clay loam (Wt) east of the creek. According to the *Soil Survey of Clark County, Ohio*, the Gn and Wt soils exhibit permeability rates in the range of 0.6 to 2 inches per hour.

According to the Clark County Ground Water Resources Map, the structure is located in an area were wells yield 100 gallons of water per minute or more, from regionally thick deposits of sand and gravel within the glacial deposits.

A site reconnaissance was performed on September 24, 2013. The bridge is located on New Carlisle Pike in Clark County, just east of New Carlisle. Pavement leading up to both sides of the bridge exhibited only a few transverse and longitudinal cracks. The bridge steel was corroded, particularly in areas where salt spray would have occurred.

The stream banks in the area were relatively steep; however, no major signs of slope instability were noted in the vicinity of the structure.

The surrounding area is primarily agricultural and residential.

IV. EXPLORATION FINDINGS

The borings exhibited 7 to 8 inches of asphalt at the surface. No distinct granular base layer was noted between the asphalt layer and the underlying granular soil.

The borings then exhibited fill, described as coarse and fine sand (A-3a) or gravel and/or stone fragments with sand and silt (A-2-4) to depths of 6.0 to 13.5 feet. The fill exhibited corrected standard penetration (N_{60}) values ranging from 8 blows per foot (bpf) to 50 blows for 3 inches of penetration, and natural moisture content values ranging from 3 to 7 percent.

The borings then exhibited native soils consisting of interbedded gravel and/or stone fragments (A-1-a), gravel and/or stone fragments with sand (A-1-b), gravel and/or stone fragments with sand and silt (A-2-4) coarse and fine sand (A-3a), and sandy silt (A-4a) to the boring completion depths of 40.0 feet each. These soils exhibited N_{60} values ranging from 3 bpf to 50 blows for 6 inches of penetration, and natural moisture content values ranging from 6 to 21 percent.

Groundwater depths were recorded during the field investigation, as tabulated below.

Boring No.	Groundwater Depth (feet)		Cave in Depth (feet)
	During Drilling	At Completion	
B-001-0-13	11.5	15.5	19.0
B-002-0-13	15.0	13.5	18.0

V. ANALYSIS AND RECOMMENDATIONS

A. Creek Bed Material

For the purpose of scour analysis D_{50} values and type of materials encountered are tabulated below.

Boring No.	Sample No.	Depth (feet)	D_{50} (mm)	Soil Type
B-001-0-13	SS-8	15.5 – 17.0	2.517	A-1-a
	SS-10	18.5 – 20.0	0.26	A-2-4
	SS-12	23.5 – 25.0	0.138	A-4a
B-002-0-13	SS-7	16.0 – 17.5	4.381	A-1-b
	SS-9	21.0 – 22.5	2.25	A-1-a
	SS-10	23.5 – 25.0	0.032	A-4a

B. Settlement

The proposed bridge is to be constructed at essentially the same location as the existing structure. Very little new fill will be required for this project, except to allow for some potential minor roadway widening. As a result, it is expected that settlement of the roadway embankment will not present a problem for this project.

C. Bridge Foundation Support

Cast-in-place (CIP) reinforced concrete piles are to be used for the proposed structure. The maximum allowable axial design loads, estimated pile tip elevation and pile lengths are tabulated below. The estimated pile tip elevation values were computed using a safety factor of 2.0. The estimated pile lengths include a 1-foot penetration into the pile cap and were rounded up to the nearest 5-foot pile length.

Location	Bottom of Pile Cap Elevation	Pile Type	Ultimate Bearing Value (Kips)	Estimated Pile Tip Elevation	Estimated Pile Length (feet)
Rear Abutment	883	12" CIP	330	860	25
Forward Abutment	883	12" CIP	330	846	40

The estimated pile tip elevations are based upon the above outlined assumptions, and do not include the affects of scour. If potential scour information becomes available, these recommendations can be updated.

Dense to very-dense granular soils, were encountered in the borings between depths of about 8.5 to 23.0 feet. It is possible that the piles will achieve the required design loads at embedment depths of about 10 feet below the expected bottom of pile cap elevation of 883. The estimated pile tip elevations and pile lengths presented in the foregoing table represent the conservative assumption that these piles will penetrate the upper dense granular soils, and extend into the underlying dense soils.

Pile driving should follow ODOT Construction and Material Specifications Item 507. Stress applied to the pile from the pile-driving hammer should be monitored during driving so as not to damage the pile. A Pile Driving Analyzer (PDA) should be used to monitor the pile during driving and to determine the driving criteria of the piles.

Pile driveability analyses were performed for the CIP piles using the GRLWEAP computer program. A copy of the GRLWEAP output is included. The driveability analyses indicates that a pile hammer with a rated energy of about 27 Kip-ft should be sufficient to drive the recommended piles for this project. However, the analyses indicate that for the 12-inch CIP piles, Grade 3 steel and wall thicknesses of 0.312 inch would be required so that the maximum computed compressive stress in the pile would not exceed the generally allowable 0.9 F_y (0.9 times 50 Ksi, or 45 Ksi).

D. Proposed Sheet Pile Wall

A sheet pile wall is planned between the Rear Abutment and the stream for this project. The top of this wall is to be at about elevation 888, the will have a 10 foot exposed height and an 18 foot embedment.

CTL Engineering, Inc. has performed a driveability analyses for the proposed sheet pile wall. This analysis was performed using the GRL-WEAP computer program. Results from the DRIVEN computer program, based upon subsurface conditions from boring B-1, were used as the input for the WEAP (Wave Equation Analysis Program) analyses.

The analysis was performed based upon an SZ-14.5 sheet pile section, produced by Shoreline Steel. This pile section was selected because the Section Modulus was 13 in^3 per foot, just slightly greater than the reported minimum required value of 12 in^3 per foot.

Several different pile hammers were evaluated. The pile hammer selected for the analysis was an APE Model 50 Vibratory Driver Extractor, with a rated drive force of 53 tons. This hammer type was selected because it is about the smallest generally available hammer that the analysis shows should be able to advance the sheet piles through the upper very dense granular soils encountered at this site, and then to the required depth.

Results of the WEAP analyses are included with this report. The analysis indicates that an APE Model 50 hammer should be able to advance the selected sheet pile sections to the required penetration depth of 18 feet, with a final penetration rate of about 8 seconds per foot. However, the estimated penetration rate through the upper very dense granular soils would be about 70 seconds per foot. The maximum calculated stresses in the pile during driving were about 26 Kips per square inch (Ksi), as compared to the normally allowable value of 45 Ksi (0.9 times the allowable stress of 50 Ksi).

It is CTL's opinion that an APE Model 50 hammer, or a similar vibratory hammer with a rated drive force of about 53 tons, should be able to advance the selected sheet pile sections to the required penetration depth of 18 feet. Prior to construction, the actual proposed sheet pile type and size, and the pile hammer and drive system configuration should be evaluated.

E. Abutments and Wingwalls

Abutments and wingwalls attached to the bridge should be supported on the same type of foundation as the bridge. The active pressure on the abutment walls can be computed using an equivalent friction angle of 30 degrees for the retained soils.

The design of the walls should also take into account the influence of loads that will be applied adjacent to the structures, such as vehicular traffic. Lateral pressure equivalent to the applied load should be added to the soil pressure when designing these walls.

A drainage layer should be placed immediately behind the walls. The drainage layer should consist of free draining granular material such as washed No. 57.

F. General Construction and Earthwork

General construction and earthwork recommendations for this project are provided in the following paragraphs. Site preparation and earthwork should be performed in accordance with the City of Columbus Construction and Material Specifications (CMS). Particularly:

1. All surface objects, brush, and roots should be cleared and/or grubbed. Clearing, grubbing and/or scalping should be performed in accordance with CMS Item 201 and related sections.

2. Prior to fill placement, the exposed grade should be compacted and/or proofrolled in the presence of the Soils Engineer. Compaction of the exposed subgrade should be performed in accordance with the CMS Item 204.

3. During construction, adequate drainage should be provided on the surface of the exposed soils. Absorption of heavy rainfall, accumulations of water and heavy construction traffic may result in softening these soils, hence, severely weakening the strength of the subgrade soils.

4. Backfill required for grade restoration and embankments should be placed and compacted in accordance with CMS Item 203 and related sections. Topsoil and organically contaminated materials are not acceptable for use as fill. All fill materials should be observed and approved by the Soils Engineer.

5. Where new embankment fill will be placed on or adjacent to existing natural slopes or existing embankments, slopes that are steeper than 8:1 Horizontal to Vertical (H:V) should be continuously benched over those areas. Procedures should follow the recommendations outlined in ODOT Geotechnical Bulletin GB2.

6. Spill-thru and/or embankment side slopes constructed at a rate of 2:1 H:V are generally considered safe against sliding and slope failure. The spill-thru slopes should be protected with riprap over permeable geotextile fabric, while the side slopes should be seeded and vegetation growth permitted to limit erosion, sloughing and slope failure.

7. Temporary excavations in excess of 4 feet in depth should be sloped or shored according to OSHA requirements.

VI. CHANGED CONDITIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions using generally accepted geotechnical engineering practices. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates drilled, they are not necessarily representative of the subsurface conditions between boring locations or subsurface conditions during other seasons of the year.

In the event that changes in the project are proposed, additional information becomes available, or if it is apparent that subsurface conditions are different from those provided in this report, CTL Engineering should be notified so that our recommendations can modified, if required.

VII. TESTING AND OBSERVATION

During the design process, it is recommended that CTL Engineering work with the project designers to confirm that the geotechnical recommendations are properly incorporated into the final plans and specifications, and to assist with establishing criteria for the construction observation and testing.

CTL Engineering is not responsible for independent conclusions, opinions and recommendations made by others based on the data and recommendations provided in this report. It is recommended that CTL be retained to provide construction quality control services on this project. If CTL Engineering is not retained for these services, CTL shall assume no responsibility for compliance with the design concepts or recommendations provided.

VIII. CLOSING

This report has been prepared for the exclusive use of the client for this project only. Our services have been performed in accordance with generally accepted Geotechnical Engineering principles and practices. No warranty is either expressed or implied.

This report addresses only the geotechnical aspects of this project and does not include any environmental issues.

Specific design and construction recommendations have been provided in this report. Therefore, the report should be used in its entirety.

Respectfully Submitted,

CTL ENGINEERING, INC.

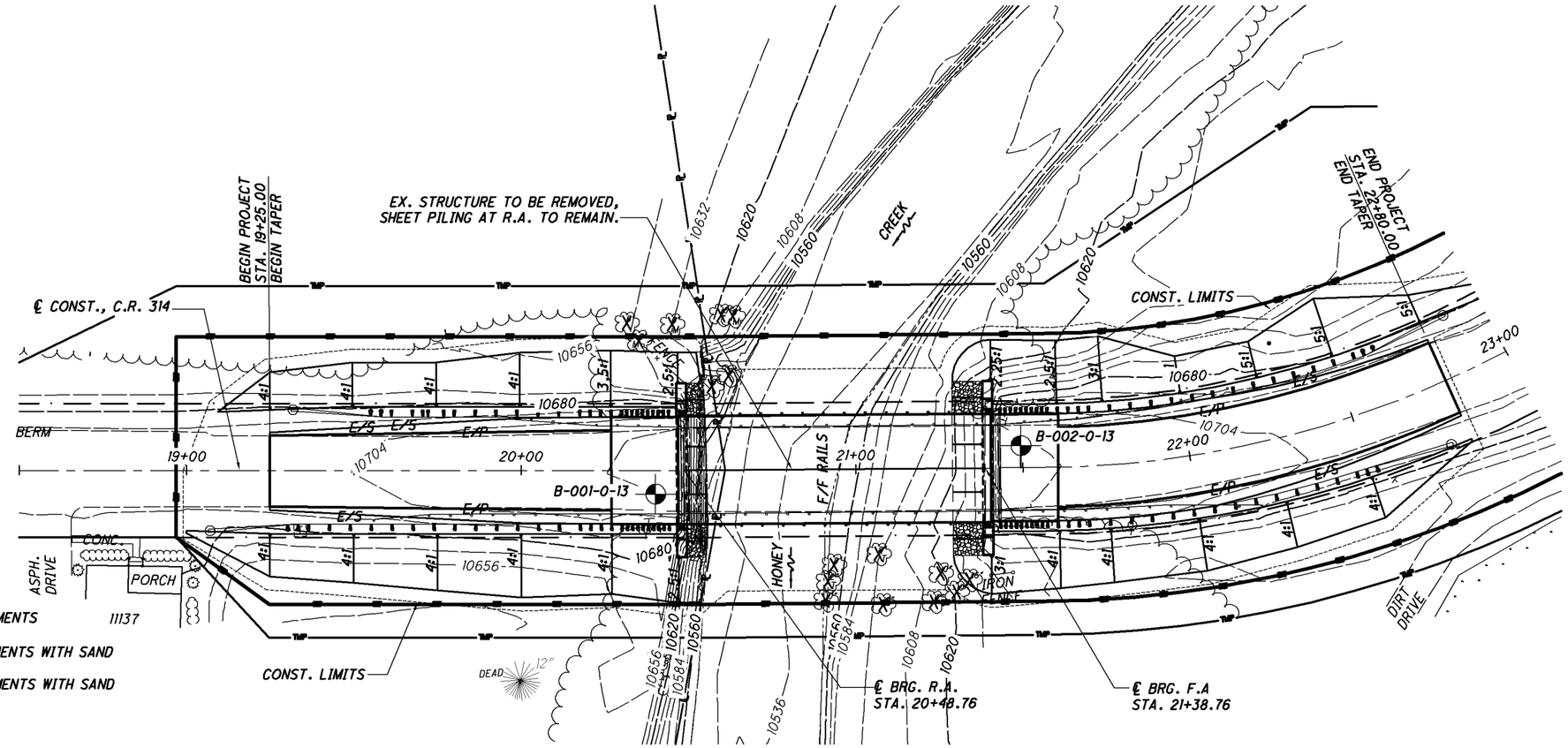
Roger Evans, P.E.
Project Engineer

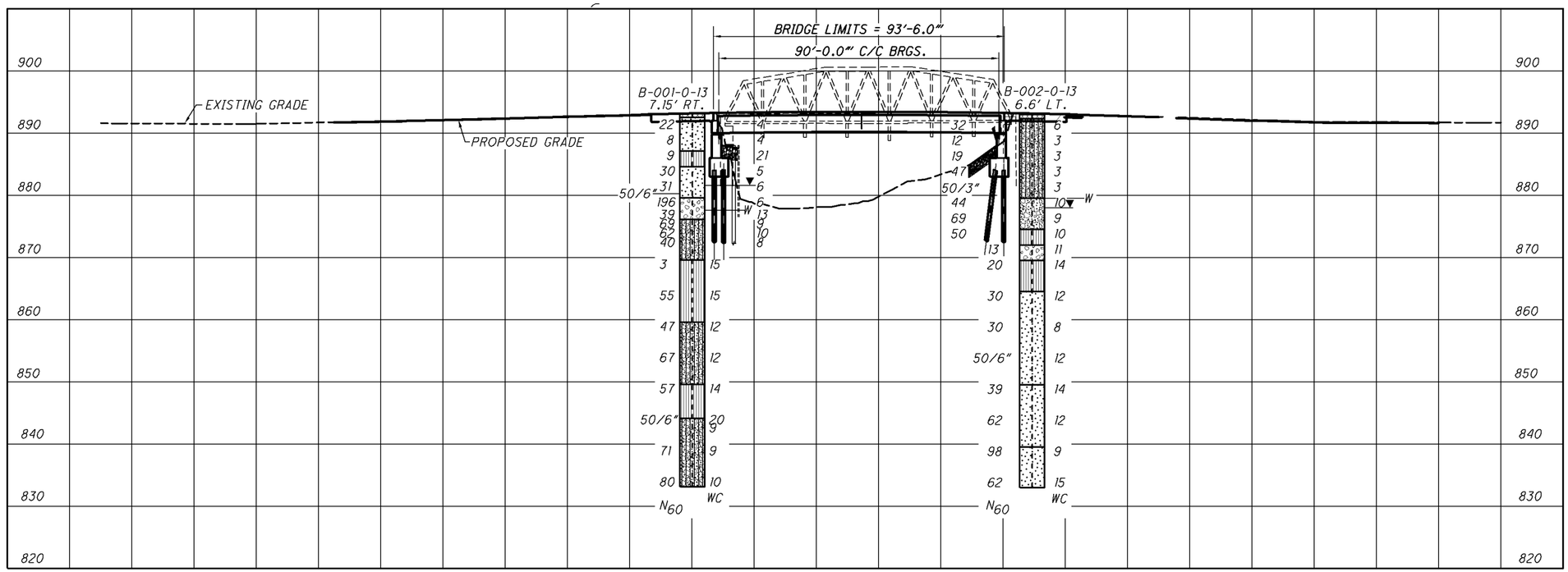
Joe Grani, P.E.
Project Engineer

APPENDIX A
STRUCTURE FOUNDATION EXPLORATION SHEET

NOTE:

- BORING LOCATION- PLAN VIEW
- DRIVEN SAMPLE AND/OR ROCK CORE BORING PLOTTTED TO VERTICAL SCALE ONLY. HORIZONTAL BAR INDICATES A CHANGE IN STRATIGRAPHY
- WC — INDICATES WATER CONTENT IN PERCENT
- N_{60} — INDICATES STANDARD PENETRATION RESISTANCE NORMALIZED TO 60% DRILL ROD ENERGY RATIO
- W — INDICATES FREE WATER ELEVATION
- INDICATES STATIC WATER ELEVATION
- SS — INDICATES A SPLIT SPOON SAMPLE
- OHIO DOT: A-1-a — GRAVEL AND/OR STONE FRAGMENTS
- OHIO DOT: A-1-b — GRAVEL AND/OR STONE FRAGMENTS WITH SAND
- OHIO DOT: A-2-4 — GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT
- OHIO DOT: A-3a — COARSE AND FINE SAND
- OHIO DOT: A-4a — SANDY SILT
- PAVEMENT AND/OR AGGREGATE BASE





STRUCTURE FOUNDATION EXPLORATION
BRIDGE NO. CLA-CR 314-00.09
C.R. 314 OVER HONEY CREEK

CLA-CR 314-0.09

DRAWN N.K.S.
CHECKED NZ

HORIZONTAL SCALE IN FEET
0 10 20 40

- / -

APPENDIX B
TEST BORING RECORDS

SOIL DESCRIPTION

Descriptors for soil consistency used in this report are based upon the Standard Penetration Test (SPT), ASTM D 1587, with the penetration (N) values corrected to N_{60}, based upon the efficiency of the SPT Hammer used for the soil sampling.

Descriptors for both non-cohesive and cohesive soils are presented below, with the corresponding range of corrected penetration values.

NON-COHESIVE SOIL DESCRIPTION	CORRECTED PENETRATION VALUES BLOWS PER FOOT (BPF)
Very Loose	0 – 4
Loose	5 – 10
Medium Dense	11- 30
Dense	31 – 50
Very Dense	Over 50

COHESIVE SOIL DESCRIPTION	CORRECTED PENETRATION VALUES BLOWS PER FOOT (BPF)
Very Soft	0 – 1
Soft	2 – 4
Medium Stiff	5 – 8
Stiff	9 – 15
Very Stiff	16 –30
Hard	Over 30

Moisture term descriptors for both non-cohesive and cohesive soils are presented below.

NON-COHESIVE SOIL DESCRIPTION	MOISTURE TERMS	COHESIVE SOIL DESCRIPTION
Powdery	Dry	Powdery
Some Moisture	Damp	Below Plastic Limit
Damp to the Touch	Moist	Above Plastic, Below Liquid Limit
Free Water	Wet	Above Liquid Limit

GTL ENGINEERING INC

PROJECT: CLA-CR314-0.09	DRILLING FIRM / OPERATOR: CTL / BK	DRILL RIG: 0305R025-11	STATION / OFFSET:
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: CTL / BK	HAMMER: CME AUTOMATIC	ALIGNMENT:
PID: BR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/27/11	ELEVATION: 893.1 (MSL) EOB: 60.0 ft.
START: 9/24/13 END: 9/24/13	SAMPLING METHOD:	ENERGY RATIO (%): 80.9	COORD: 10.000 N, 10.000 E

EXPLORATION ID B-001-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 893.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INST.
Asphalt (7")	892.5																	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, TRACE GRAVEL, FILL, MOIST TO DAMP		1, 2	10 9 7	22	56	SS-1	-	-	-	-	-	-	-	-	-	5	A-3a (V)	
@3.5'; LOOSE		3, 4, 5	3 3 3	8	0	SS-2	-	-	-	-	-	-	-	-	-	5	A-3a (V)	
VERY STIFF, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, DAMP	887.1	6, 7, 8	2 4 3	9	72	SS-3	-	1	9	45	33	12	29	20	9	21	A-4a (2)	
MEDIUM DENSE, BROWN, **COARSE AND FINE SAND**, TRACE SILT, DAMP	884.6	9, 10	9 9 13	30	67	SS-4	-	-	-	-	-	-	-	-	-	6	A-3a (V)	
@11.0'; DENSE		11, 12, 13	11 11 12	31	56	SS-5	-	-	-	-	-	-	-	-	-	7	A-3a (V)	
VERY DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS**, SOME SAND, LITTLE SILT, TRACE CLAY, CONTAINING COBBLES, WET	879.6	14	50	-	0	SS-6	-	-	-	-	-	-	-	-	-	7	A-1-a (V)	
@15.5'; DENSE		15, 16	81 85 60	196	0	SS-7	-	-	-	-	-	-	-	-	-	-	A-1-a (V)	
VERY DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, TRACE CLAY, WET	876.1	17	10 13 16	39	56	SS-8	-	53	20	12	13	2	18	15	3	13	A-1-a (0)	
@20.0'; DENSE		18, 19, 20, 21	13 32 19	69	50	SS-9	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
			14 24 22	62	61	SS-10	3.50	26	16	29	22	7	NP	NP	NP	10	A-2-4 (0)	
			8 14 16	40	89	SS-11	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	
SOFT, BROWN AND GRAY, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, WET	869.6	22, 23, 24, 25, 26, 27, 28	1 1 1	3	83	SS-12	-	22	12	24	27	15	17	11	6	15	A-4a (1)	
@28.5'; HARD		29	9 17 24	55	94	SS-13	-	-	-	-	-	-	-	-	-	15	A-4a (V)	

W

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 3/21/14 16:45 - J:\DEPT5\13 PROJECTS\13050157COL-CEC-CLA-CR314-0.09-BRIDGE 1204\REPORTS\LOGS\13050157COL.GPJ

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 3/21/14 16:45 - J:\DEPT5\13 PROJECTS\13050157COL-CEC-CLA-CR314-0.09-BRIDGE 1204\REPORTS\LOGS\13050157COL.GPJ

PID:	BR ID:	PROJECT: CLA-CR314-0.09	STATION / OFFSET:	START: 9/24/13	END: 9/24/13	PG 2 OF 2	B-001-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INST.
SOFT, BROWN AND GRAY, **SANDY SILT**, SOME GRAVEL, LITTLE CLAY, WET *(continued)*	863.1	31, 32, 33																
	859.6																	
DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, TRACE COBBLE, WET		34, 35	9 16 19	47	61	SS-14	-	-	-	-	-	-	-	-	-	12	A-4b (V)	
		36, 37, 38																
@38.5'; VERY DENSE		39, 40	14 26 24	67	94	SS-15	-	28	33	25	12	2	NP	NP	NP	13	A-1-b (0)	
		41, 42, 43																
	849.6																	
VERY DENSE, BROWN, **SANDY SILT**, TRACE GRAVEL, WET		44, 45	28 20 22	57	56	SS-16	-	-	-	-	-	-	-	-	-	15	A-4a (V)	
		46, 47, 48																
	844.1	49	12 50	-	92	SS-17	3.00 -	- -	- -	- -	- -	- -	- -	- -	- -	21 9	A-4a (V) A-2-4 (V)	
VERY DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, TRACE COBBLE, WET		50, 51, 52, 53																
		54, 55	9 25 28	71	67	SS-18	-	-	-	-	-	-	-	-	-	9	A-2-4 (V)	
		56, 57, 58																
	833.1	59, 60 EOB	22 36 23	80	67	SS-19	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	

NOTES: CAVED AT 19.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 3 BAG CONCRETE PATCH AND WATER; 3 BAG HOLE PLUG; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 3/21/14 16:45 - J:\DEPT5\13 PROJECTS\13050157COL-CEC-CLA-CR314-0.09-BRIDGE 1204\REPORTS\LOGS\13050157COL.GPJ

PROJECT: CLA-CR314-0.09	DRILLING FIRM / OPERATOR: CTL / BK	DRILL RIG: 0305R025-11	STATION / OFFSET:
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: CTL / BK	HAMMER: CME AUTOMATIC	ALIGNMENT:
PID: BR ID:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 9/27/11	ELEVATION: 893.0 (MSL) EOB: 60.0 ft.
START: 9/23/13 END: 9/23/13	SAMPLING METHOD:	ENERGY RATIO (%): 80.9	COORD: 20.000 N, 20.000 E

EXPLORATION ID B-002-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 893.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INST.
Asphalt (8")	892.3																	
DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, FILL, MOIST		1, 2	10 5 19	32	78	SS-1	-	-	-	-	-	-	-	-	-	7	A-2-4 (V)	
@3.5'; MEDIUM DENSE		3, 4, 5	7 6 3	12	11	SS-2	-	-	-	-	-	-	-	-	-	4	A-2-4 (V)	
		6, 7	5 6 8	19	22	SS-3	-	-	-	-	-	-	-	-	-	3	A-2-4 (V)	
@8.5'; DENSE		8, 9, 10	19 25 10	47	33	SS-4	-	-	-	-	-	-	-	-	-	4	A-2-4 (V)	
@11.0'; VERY DENSE, CONTAINS COBBLES		11, 12	50/3"	-	67	SS-5	-	-	-	-	-	-	-	-	-	3	A-2-4 (V)	
	879.5	13 W																
DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, WET		14, 15	13 16 17	44	44	SS-6	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
@16.0'; VERY DENSE		16, 17	20 29 22	69	39	SS-7	-	59	15	9	13	4	18	15	3	9	A-1-b (0)	
	874.5	18																
DENSE, GRAY, **SANDY SILT**, LITTLE GRAVEL, MOIST		19, 20	15 19 18	50	67	SS-8	0.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
	872.0	21																
MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, TRACE SILT, WET		22	4 7 3	13	39	SS-9	-	54	22	16	8	0	NP	NP	NP	12	A-1-a (0)	
	869.5	23																
VERY STIFF, GRAY, **SANDY SILT**, LITTLE GRAVEL, SOME CLAY, MOIST		24, 25, 26, 27, 28	4 6 9	20	56	SS-10	3.50	14	9	19	30	28	23	13	10	14	A-4a (5)	
	864.5																	
MEDIUM DENSE, BROWN TO GRAY, **COARSE AND FINE SAND**, SOME GRAVEL, TRACE SILT, WET		29	5 10 12	30	67	SS-11	-	-	-	-	-	-	-	-	-	12	A-3a (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 3/21/14 16:45 - J:\DEPT5\13 PROJECTS\13050157COL-CEC-CLA-CR314-0.09-BRIDGE 1204\REPORTS\LOGS\13050157COL.GPJ

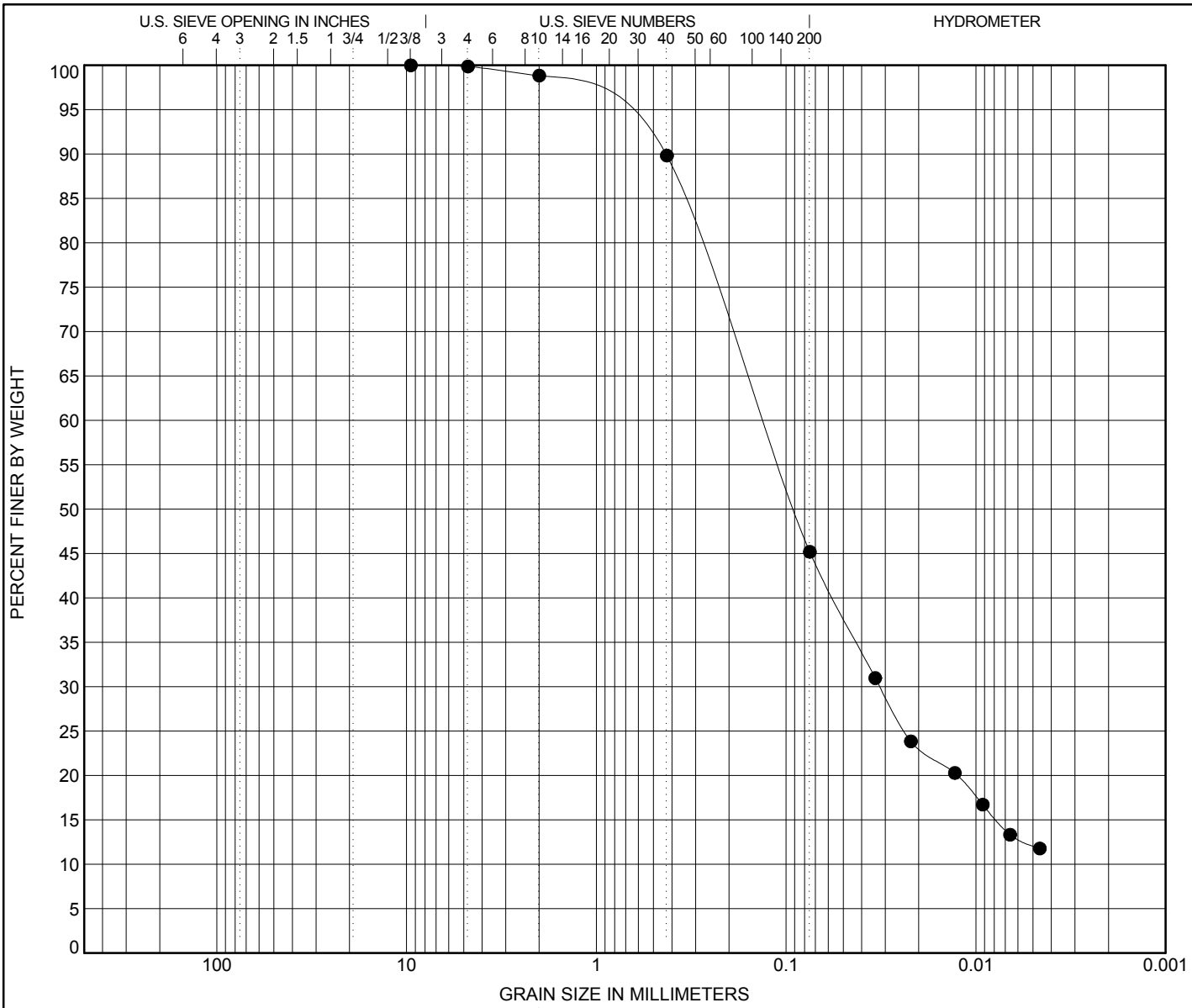
PID:	BR ID:	PROJECT: CLA-CR314-0.09	STATION / OFFSET:	START: 9/23/13	END: 9/23/13	PG 2 OF 2	B-002-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INST.
MEDIUM DENSE, BROWN TO GRAY, **COARSE AND FINE SAND**, SOME GRAVEL, TRACE SILT, WET *(continued)*	863.0	31, 32, 33																
@33.5'; TRACE STONE FRAGMENTS		34, 35	7 11 11	30	83	SS-12	-	-	-	-	-	-	-	-	-	8	A-3a (V)	
		36, 37, 38																
@38.5'; VERY DENSE		39	46 50	-	33	SS-13	-	-	-	-	-	-	-	-	-	12	A-3a (V)	
		40, 41, 42, 43																
DENSE, BROWN, **COARSE AND FINE SAND**, SOME SILT, TRACE CLAY, TRACE GRAVEL, MOIST	849.5	44	14 11 18	39	78	SS-14	1.50	5	30	34	22	9	18	15	3	14	A-3a (0)	
		45, 46, 47, 48																
@48.5'; VERY DENSE, LITTLE GRAVEL		49, 50	14 26 20	62	44	SS-15	0.50	-	-	-	-	-	-	-	-	13	A-3a (V)	
		51, 52, 53																
VERY DENSE, GRAY, **COARSE AND FINE SAND**, LITTLE SILT, LITTLE GRAVEL, MOIST	839.5	54, 55	24 31 42	98	83	SS-16	-	-	-	-	-	-	-	-	-	10	A-3a (V)	
		56, 57, 58																
@58.5'; WET		59	24 21 25	62	83	SS-17	-	-	-	-	-	-	-	-	-	16	A-3a (V)	
	833.0	EOB 60																

NOTES: CAVED AT 18.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: 1/2 BAG ASPHALT PATCH; 2 BAG BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

APPENDIX C
LABORATORY TEST SHEETS



COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-13	**6.0**	**A-4a(2)**	**21**	**29**	**20**	**9**		
		SANDY SILT						

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-13	**6.0**	**9.5**	**0.133**	**0.09**	**0.032**		**1**	**9**	**45**	**33**	**12**

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Fax: 614-276-6377

GRAIN SIZE DISTRIBUTION

Project: CLA-CR314-0.09
Location:CLA COUNTY
CTL Project Number:13050157COL

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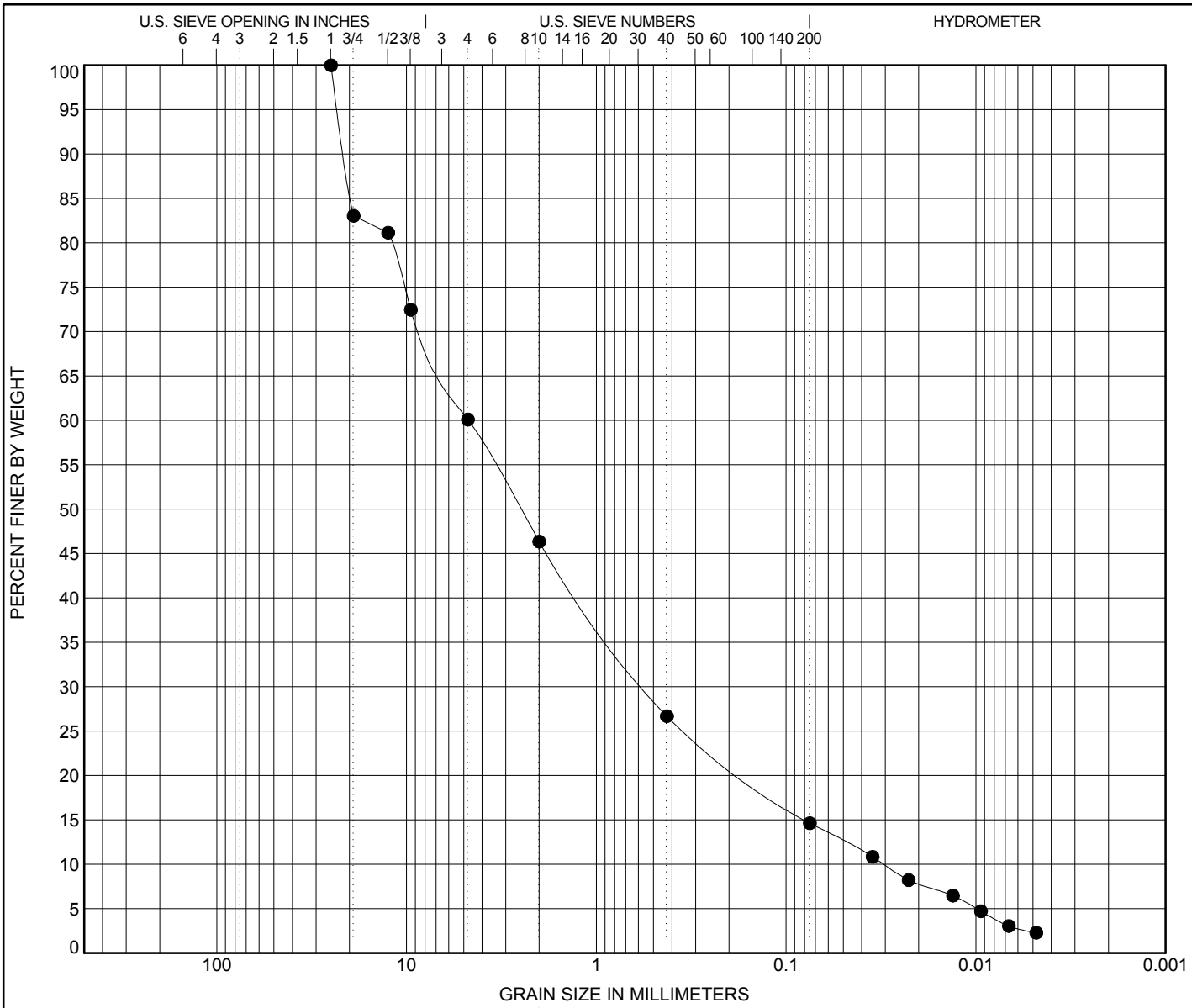

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-13	**15.5**	**A-1-a(0)**	**13**	**18**	**15**	**3**	**2.12**	**155.32**
		GRAVEL AND/OR STONE FRAGMENTS						

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-13	**15.5**	**25**	**4.721**	**2.517**	**0.552**	**0.03**	**53**	**20**	**12**	**13**	**2**

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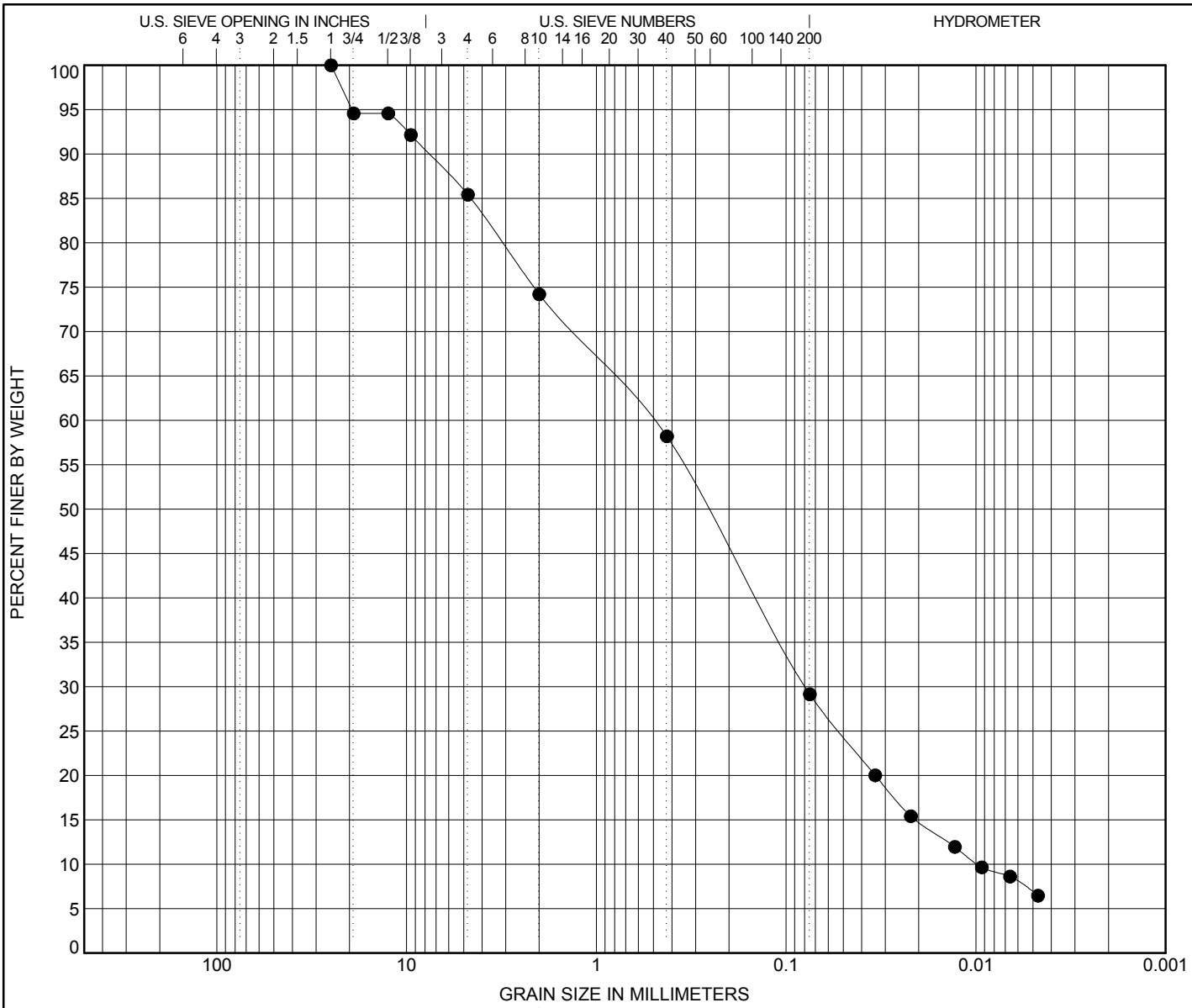

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-13	**18.5**	**A-2-4(0)**	**10**	**NP**	**NP**	**NP**	**1.26**	**51.76**
		GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT						

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-13	**18.5**	**25**	**0.506**	**0.26**	**0.079**	**0.01**	**26**	**16**	**29**	**22**	**7**

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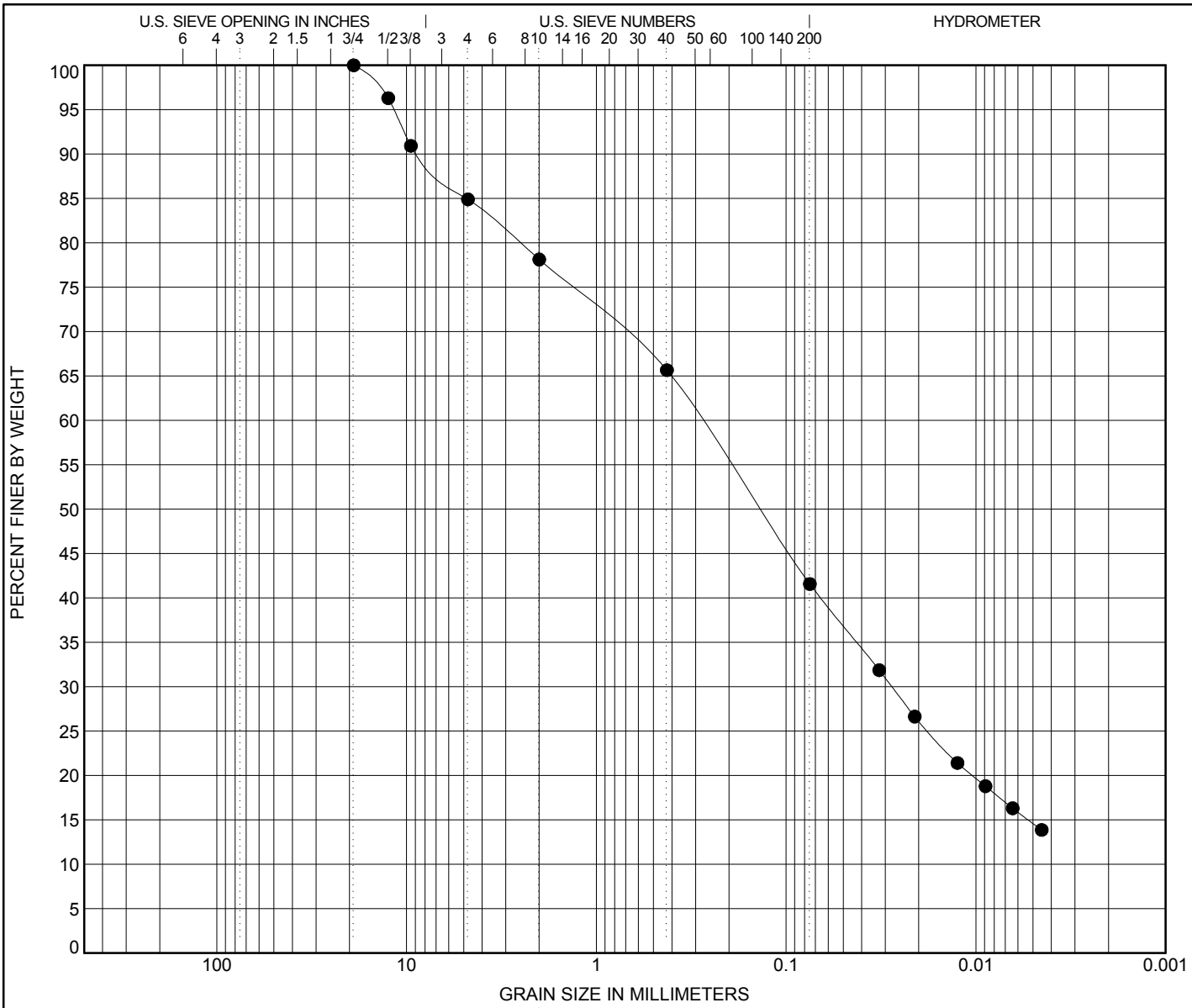

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-13	**23.5**	**A-4a(1)**	**15**	**17**	**11**	**6**		
		SANDY SILT						

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-13	**23.5**	**19**	**0.283**	**0.138**	**0.028**		**22**	**12**	**24**	**27**	**15**

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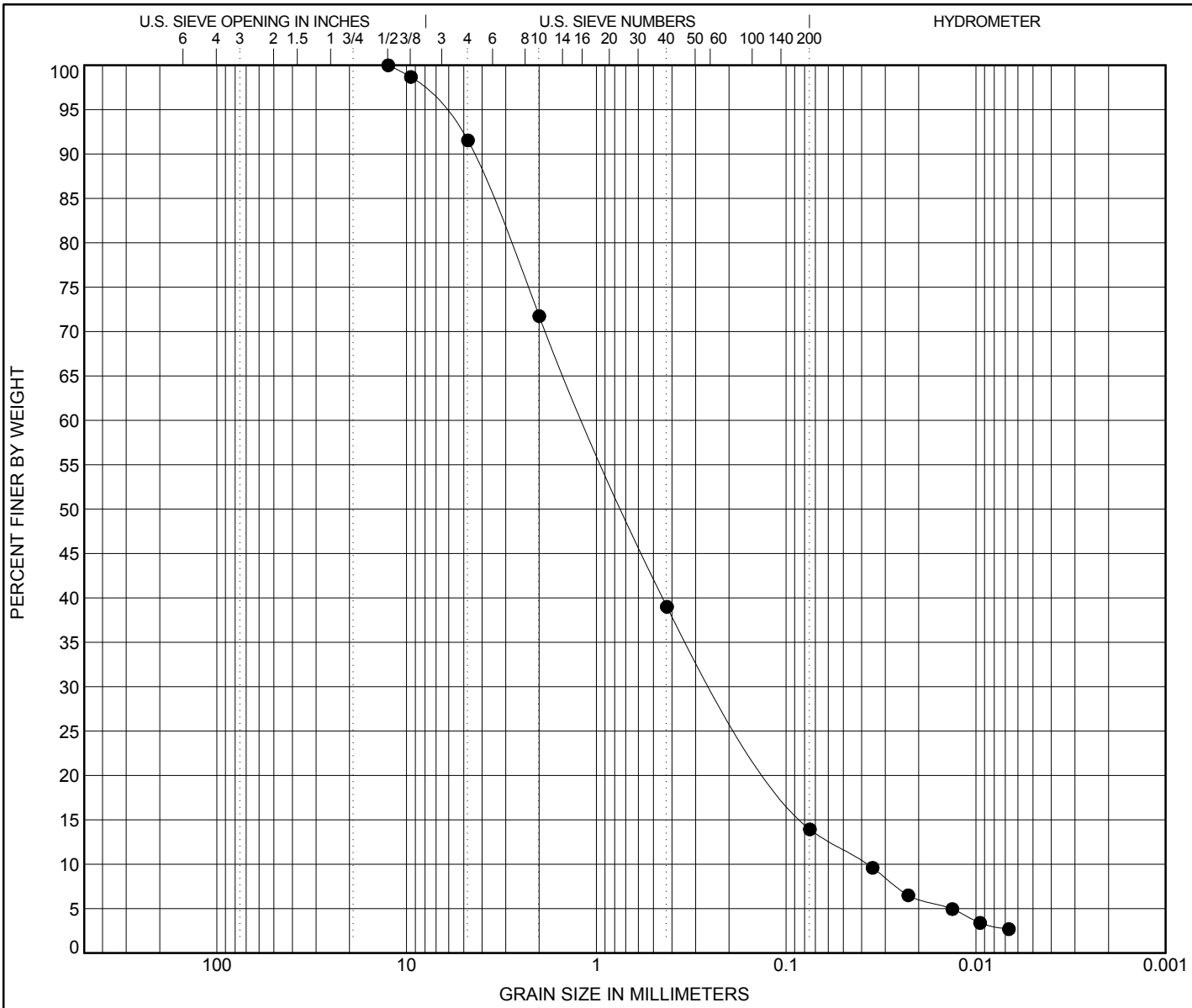

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-001-0-13	**38.5**	**A-1-b(0)**	**13**	**NP**	**NP**	**NP**	**1.21**	**30.60**
		GRAVEL AND/OR STONE FRAGMENTS WITH SAND						

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-001-0-13	**38.5**	**12.5**	**1.147**	**0.715**	**0.228**	**0.038**	**28**	**33**	**25**	**12**	**2**

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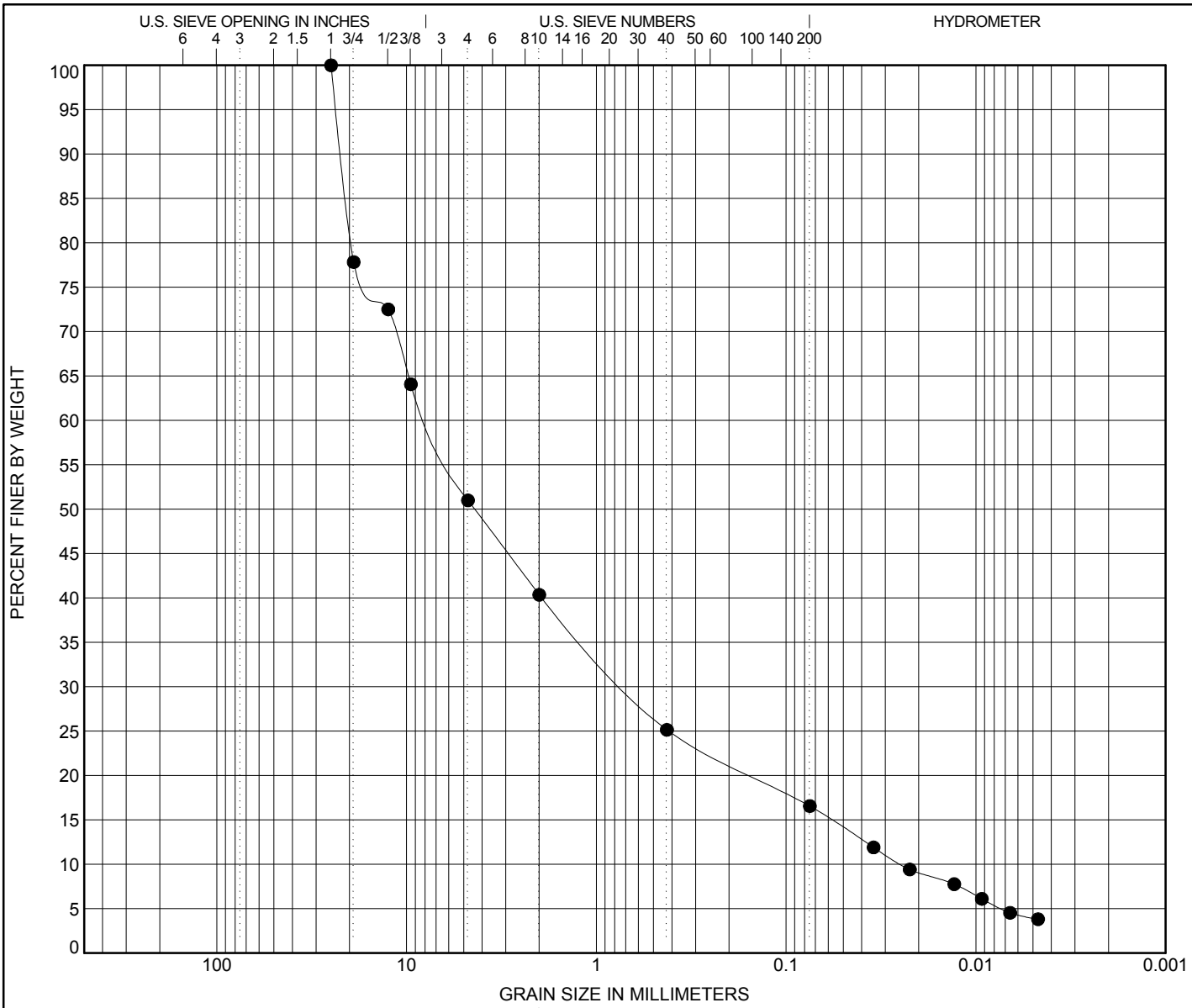

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-13	**16.0**	**A-1-b(0)**	**9**	**18**	**15**	**3**	**2.56**	**309.72**
		GRAVEL AND/OR STONE FRAGMENTS WITH SAND						

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-13	**16.0**	**25**	**7.656**	**4.381**	**0.697**	**0.025**	**59**	**15**	**9**	**13**	**4**

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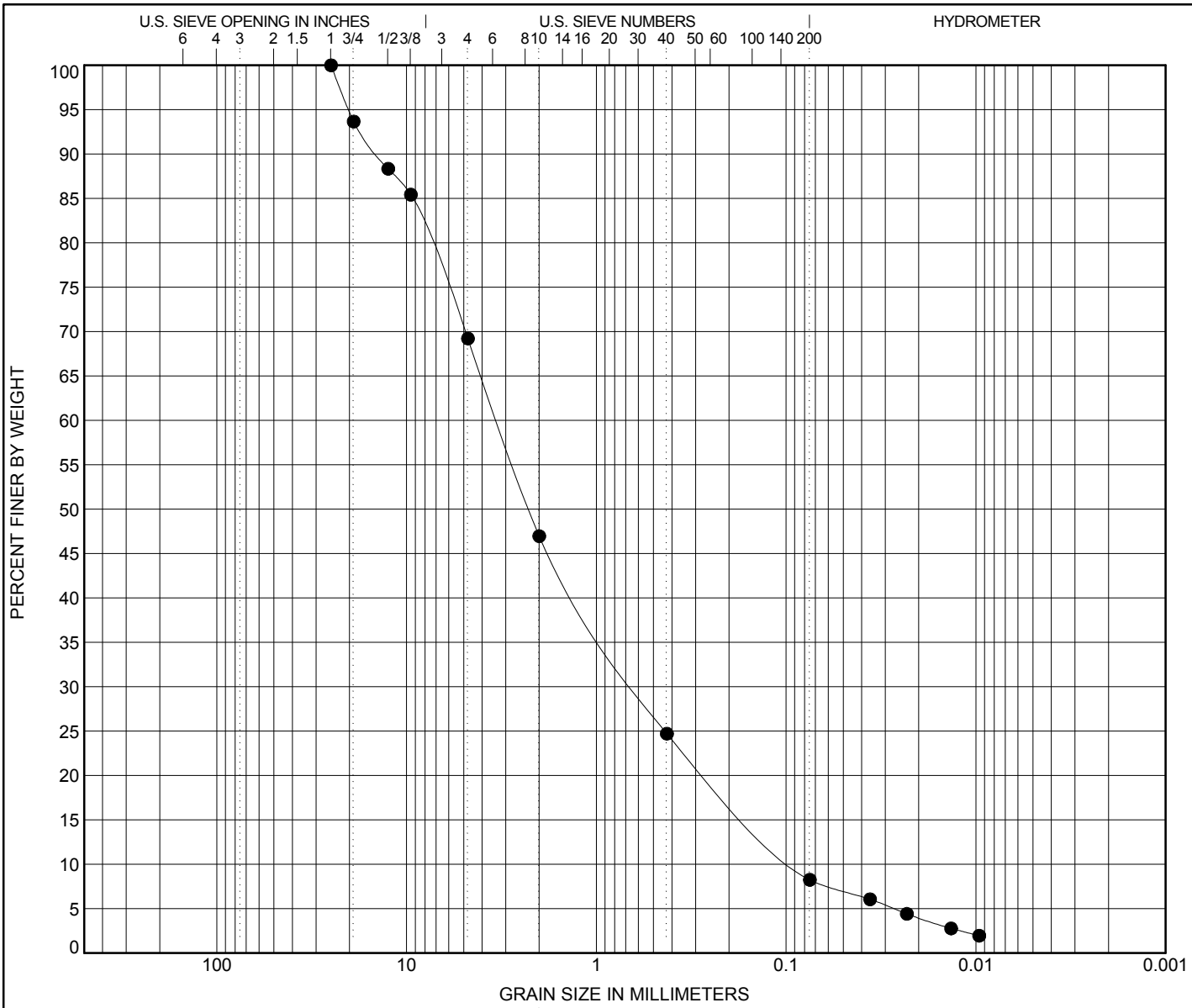

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-13	**21.0**	**A-1-a(0)**	**12**	**NP**	**NP**	**NP**	**1.26**	**36.81**
		GRAVEL AND/OR STONE FRAGMENTS						

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-13	**21.0**	**25**	**3.319**	**2.25**	**0.614**	**0.09**	**54**	**22**	**16**	**8**	**0**

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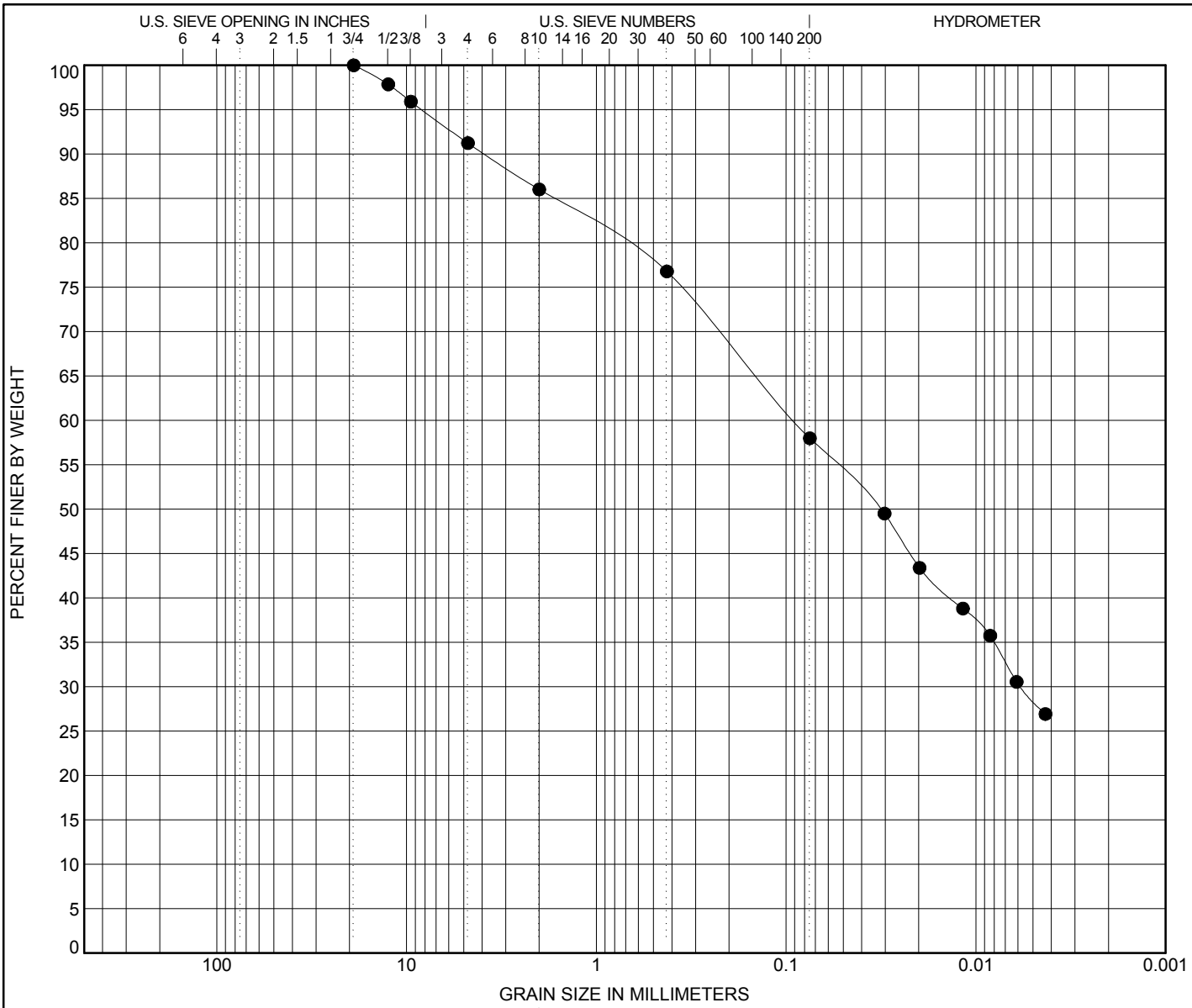

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-13	**23.5**	**A-4a(5)**	**14**	**23**	**13**	**10**		
		SANDY SILT						

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-13	**23.5**	**19**	**0.09**	**0.032**	**0.006**		**14**	**9**	**19**	**30**	**28**

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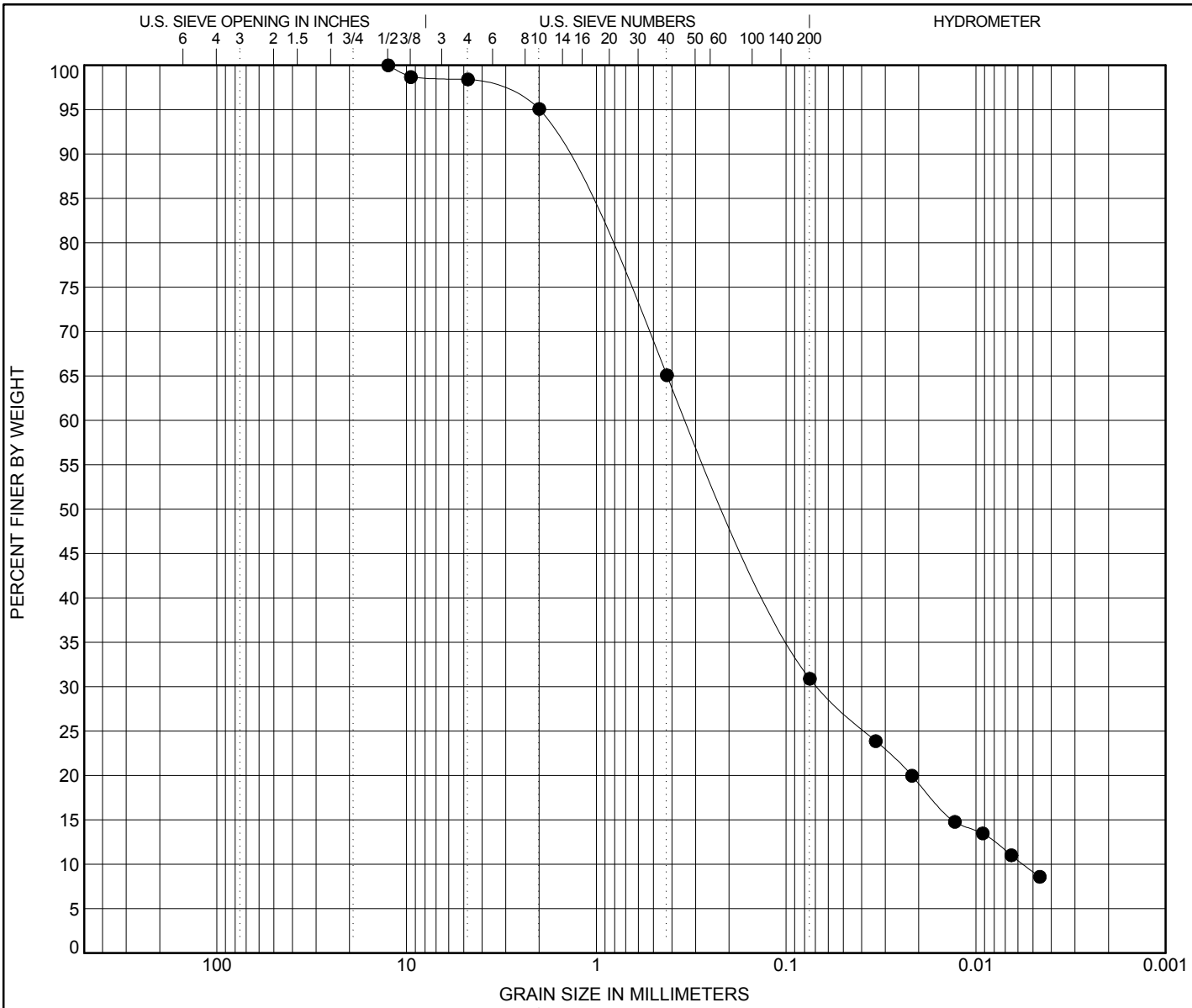

COBBLES	GRAVEL		SAND		SILT OR CLAY
	coarse	fine	coarse	fine	

Specimen Identification	Depth	Classification	MC	LL	PL	PI	Cc	Cu
B-002-0-13	**43.5**	**A-3a(0)**	**14**	**18**	**15**	**3**	**2.48**	**58.35**
		COARSE AND FINE SAND						

Specimen Identification	Depth	D100	D60	D50	D30	D10	%Gravel	%Coarse Sand	%Fine Sand	%Silt	%Clay
B-002-0-13	**43.5**	**12.5**	**0.328**	**0.198**	**0.068**	**0.006**	**5**	**30**	**34**	**22**	**9**

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GRAIN SIZE DISTRIBUTION

Project: CLA-CR314-0.09
Location:CLA COUNTY
CTL Project Number:13050157COL

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APPENDIX D
DRIVEN RESULTS

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\135157B1.DVN
Project Name: CLA-CR314-0.09 - B-1 Project Date: 10/16/2013
Project Client: CEC
Computed By: re
Project Manager: JG

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 19.00 ft
Diameter of Pile: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	14.00 ft
	- Driving/Restrike	14.00 ft
	- Ultimate:	14.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	23.50 ft	0.00%	125.00 pcf	36.0/36.0	Nordlund
2	Cohesionless	10.00 ft	33.00%	120.00 pcf	35.0/35.0	Nordlund
3	Cohesionless	10.00 ft	0.00%	130.00 pcf	40.7/40.7	Nordlund
4	Cohesionless	5.50 ft	17.00%	125.00 pcf	40.0/40.0	Nordlund
5	Cohesionless	11.00 ft	0.00%	130.00 pcf	41.0/41.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
19.00 ft	Cohesionless	2063.00 psf	21.17	N/A	0.00 Kips
23.01 ft	Cohesionless	2188.51 psf	21.17	N/A	14.09 Kips
23.49 ft	Cohesionless	2203.54 psf	21.17	N/A	15.88 Kips
23.51 ft	Cohesionless	2344.99 psf	20.59	N/A	15.95 Kips
32.51 ft	Cohesionless	2604.19 psf	20.59	N/A	48.70 Kips
33.49 ft	Cohesionless	2632.41 psf	20.59	N/A	52.66 Kips
33.51 ft	Cohesionless	2921.04 psf	23.92	N/A	52.78 Kips
42.51 ft	Cohesionless	3225.24 psf	23.92	N/A	123.71 Kips
43.49 ft	Cohesionless	3258.36 psf	23.92	N/A	132.24 Kips
43.51 ft	Cohesionless	3597.01 psf	23.52	N/A	132.42 Kips
48.99 ft	Cohesionless	3768.54 psf	23.52	N/A	182.81 Kips
49.01 ft	Cohesionless	3941.34 psf	24.13	N/A	183.00 Kips
58.01 ft	Cohesionless	4245.54 psf	24.13	N/A	276.38 Kips
59.99 ft	Cohesionless	4312.46 psf	24.13	N/A	298.72 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
18.99 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
19.00 ft	Cohesionless	2063.00 psf	77.60	119.07 Kips	87.18 Kips
23.01 ft	Cohesionless	2314.03 psf	77.60	119.07 Kips	97.64 Kips
23.49 ft	Cohesionless	2344.07 psf	77.60	119.07 Kips	98.89 Kips
23.51 ft	Cohesionless	2345.28 psf	64.00	84.51 Kips	79.75 Kips
32.51 ft	Cohesionless	2863.68 psf	64.00	84.51 Kips	84.51 Kips
33.49 ft	Cohesionless	2920.12 psf	64.00	84.51 Kips	84.51 Kips
33.51 ft	Cohesionless	2921.38 psf	188.14	373.19 Kips	327.23 Kips
42.51 ft	Cohesionless	3529.78 psf	188.14	373.19 Kips	373.19 Kips
43.49 ft	Cohesionless	3596.02 psf	188.14	373.19 Kips	373.19 Kips
43.51 ft	Cohesionless	3597.33 psf	160.00	327.98 Kips	327.98 Kips
48.99 ft	Cohesionless	3940.37 psf	160.00	327.98 Kips	327.98 Kips
49.01 ft	Cohesionless	3941.68 psf	203.26	397.49 Kips	397.49 Kips
58.01 ft	Cohesionless	4550.08 psf	203.26	397.49 Kips	397.49 Kips
59.99 ft	Cohesionless	4683.92 psf	203.26	397.49 Kips	397.49 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.00 ft	0.00 Kips	87.18 Kips	87.18 Kips
23.01 ft	14.09 Kips	97.64 Kips	111.73 Kips
23.49 ft	15.88 Kips	98.89 Kips	114.77 Kips
23.51 ft	15.95 Kips	79.75 Kips	95.70 Kips
32.51 ft	48.70 Kips	84.51 Kips	133.21 Kips
33.49 ft	52.66 Kips	84.51 Kips	137.17 Kips
33.51 ft	52.78 Kips	327.23 Kips	380.00 Kips
42.51 ft	123.71 Kips	373.19 Kips	496.90 Kips
43.49 ft	132.24 Kips	373.19 Kips	505.43 Kips
43.51 ft	132.42 Kips	327.98 Kips	460.40 Kips
48.99 ft	182.81 Kips	327.98 Kips	510.79 Kips
49.01 ft	183.00 Kips	397.49 Kips	580.49 Kips
58.01 ft	276.38 Kips	397.49 Kips	673.87 Kips
59.99 ft	298.72 Kips	397.49 Kips	696.21 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
19.00 ft	Cohesionless	2063.00 psf	21.17	N/A	0.00 Kips
23.01 ft	Cohesionless	2188.51 psf	21.17	N/A	14.09 Kips
23.49 ft	Cohesionless	2203.54 psf	21.17	N/A	15.88 Kips
23.51 ft	Cohesionless	2344.99 psf	20.59	N/A	15.93 Kips
32.51 ft	Cohesionless	2604.19 psf	20.59	N/A	37.87 Kips
33.49 ft	Cohesionless	2632.41 psf	20.59	N/A	40.53 Kips
33.51 ft	Cohesionless	2921.04 psf	23.92	N/A	40.64 Kips
42.51 ft	Cohesionless	3225.24 psf	23.92	N/A	111.57 Kips
43.49 ft	Cohesionless	3258.36 psf	23.92	N/A	120.10 Kips
43.51 ft	Cohesionless	3597.01 psf	23.52	N/A	120.25 Kips
48.99 ft	Cohesionless	3768.54 psf	23.52	N/A	162.07 Kips
49.01 ft	Cohesionless	3941.34 psf	24.13	N/A	162.27 Kips
58.01 ft	Cohesionless	4245.54 psf	24.13	N/A	255.65 Kips
59.99 ft	Cohesionless	4312.46 psf	24.13	N/A	277.98 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
18.99 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
19.00 ft	Cohesionless	2063.00 psf	77.60	119.07 Kips	87.18 Kips
23.01 ft	Cohesionless	2314.03 psf	77.60	119.07 Kips	97.64 Kips
23.49 ft	Cohesionless	2344.07 psf	77.60	119.07 Kips	98.89 Kips
23.51 ft	Cohesionless	2345.28 psf	64.00	84.51 Kips	79.75 Kips
32.51 ft	Cohesionless	2863.68 psf	64.00	84.51 Kips	84.51 Kips
33.49 ft	Cohesionless	2920.12 psf	64.00	84.51 Kips	84.51 Kips
33.51 ft	Cohesionless	2921.38 psf	188.14	373.19 Kips	327.23 Kips
42.51 ft	Cohesionless	3529.78 psf	188.14	373.19 Kips	373.19 Kips
43.49 ft	Cohesionless	3596.02 psf	188.14	373.19 Kips	373.19 Kips
43.51 ft	Cohesionless	3597.33 psf	160.00	327.98 Kips	327.98 Kips
48.99 ft	Cohesionless	3940.37 psf	160.00	327.98 Kips	327.98 Kips
49.01 ft	Cohesionless	3941.68 psf	203.26	397.49 Kips	397.49 Kips
58.01 ft	Cohesionless	4550.08 psf	203.26	397.49 Kips	397.49 Kips
59.99 ft	Cohesionless	4683.92 psf	203.26	397.49 Kips	397.49 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.00 ft	0.00 Kips	87.18 Kips	87.18 Kips
23.01 ft	14.09 Kips	97.64 Kips	111.73 Kips
23.49 ft	15.88 Kips	98.89 Kips	114.77 Kips
23.51 ft	15.93 Kips	79.75 Kips	95.68 Kips
32.51 ft	37.87 Kips	84.51 Kips	122.38 Kips
33.49 ft	40.53 Kips	84.51 Kips	125.03 Kips
33.51 ft	40.64 Kips	327.23 Kips	367.87 Kips
42.51 ft	111.57 Kips	373.19 Kips	484.77 Kips
43.49 ft	120.10 Kips	373.19 Kips	493.30 Kips
43.51 ft	120.25 Kips	327.98 Kips	448.23 Kips
48.99 ft	162.07 Kips	327.98 Kips	490.05 Kips
49.01 ft	162.27 Kips	397.49 Kips	559.75 Kips
58.01 ft	255.65 Kips	397.49 Kips	653.13 Kips
59.99 ft	277.98 Kips	397.49 Kips	675.47 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
19.00 ft	Cohesionless	2063.00 psf	21.17	N/A	0.00 Kips
23.01 ft	Cohesionless	2188.51 psf	21.17	N/A	14.09 Kips
23.49 ft	Cohesionless	2203.54 psf	21.17	N/A	15.88 Kips
23.51 ft	Cohesionless	2344.99 psf	20.59	N/A	15.95 Kips
32.51 ft	Cohesionless	2604.19 psf	20.59	N/A	48.70 Kips
33.49 ft	Cohesionless	2632.41 psf	20.59	N/A	52.66 Kips
33.51 ft	Cohesionless	2921.04 psf	23.92	N/A	52.78 Kips
42.51 ft	Cohesionless	3225.24 psf	23.92	N/A	123.71 Kips
43.49 ft	Cohesionless	3258.36 psf	23.92	N/A	132.24 Kips
43.51 ft	Cohesionless	3597.01 psf	23.52	N/A	132.42 Kips
48.99 ft	Cohesionless	3768.54 psf	23.52	N/A	182.81 Kips
49.01 ft	Cohesionless	3941.34 psf	24.13	N/A	183.00 Kips
58.01 ft	Cohesionless	4245.54 psf	24.13	N/A	276.38 Kips
59.99 ft	Cohesionless	4312.46 psf	24.13	N/A	298.72 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
18.99 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
19.00 ft	Cohesionless	2063.00 psf	77.60	119.07 Kips	87.18 Kips
23.01 ft	Cohesionless	2314.03 psf	77.60	119.07 Kips	97.64 Kips
23.49 ft	Cohesionless	2344.07 psf	77.60	119.07 Kips	98.89 Kips
23.51 ft	Cohesionless	2345.28 psf	64.00	84.51 Kips	79.75 Kips
32.51 ft	Cohesionless	2863.68 psf	64.00	84.51 Kips	84.51 Kips
33.49 ft	Cohesionless	2920.12 psf	64.00	84.51 Kips	84.51 Kips
33.51 ft	Cohesionless	2921.38 psf	188.14	373.19 Kips	327.23 Kips
42.51 ft	Cohesionless	3529.78 psf	188.14	373.19 Kips	373.19 Kips
43.49 ft	Cohesionless	3596.02 psf	188.14	373.19 Kips	373.19 Kips
43.51 ft	Cohesionless	3597.33 psf	160.00	327.98 Kips	327.98 Kips
48.99 ft	Cohesionless	3940.37 psf	160.00	327.98 Kips	327.98 Kips
49.01 ft	Cohesionless	3941.68 psf	203.26	397.49 Kips	397.49 Kips
58.01 ft	Cohesionless	4550.08 psf	203.26	397.49 Kips	397.49 Kips
59.99 ft	Cohesionless	4683.92 psf	203.26	397.49 Kips	397.49 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.00 ft	0.00 Kips	87.18 Kips	87.18 Kips
23.01 ft	14.09 Kips	97.64 Kips	111.73 Kips
23.49 ft	15.88 Kips	98.89 Kips	114.77 Kips
23.51 ft	15.95 Kips	79.75 Kips	95.70 Kips
32.51 ft	48.70 Kips	84.51 Kips	133.21 Kips
33.49 ft	52.66 Kips	84.51 Kips	137.17 Kips
33.51 ft	52.78 Kips	327.23 Kips	380.00 Kips
42.51 ft	123.71 Kips	373.19 Kips	496.90 Kips
43.49 ft	132.24 Kips	373.19 Kips	505.43 Kips
43.51 ft	132.42 Kips	327.98 Kips	460.40 Kips
48.99 ft	182.81 Kips	327.98 Kips	510.79 Kips
49.01 ft	183.00 Kips	397.49 Kips	580.49 Kips
58.01 ft	276.38 Kips	397.49 Kips	673.87 Kips
59.99 ft	298.72 Kips	397.49 Kips	696.21 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\135157B2.DVN
Project Name: CLA-CR314-0.09 - B-2 Project Date: 10/16/2013
Project Client: CEC
Computed By: re
Project Manager: JG

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 19.00 ft
Diameter of Pile: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	14.00 ft
	- Driving/Restrike	14.00 ft
	- Ultimate:	14.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	18.50 ft	0.00%	120.00 pcf	36.0/36.0	Nordlund
2	Cohesive	2.50 ft	17.00%	120.00 pcf	1000.00 psf	T-80 Sand
3	Cohesionless	2.50 ft	0.00%	130.00 pcf	28.1/30.8	Nordlund
4	Cohesive	5.00 ft	17.00%	120.00 pcf	2500.00 psf	T-80 Sand
5	Cohesionless	15.00 ft	0.00%	130.00 pcf	28.1/35.0	Nordlund
6	Cohesionless	16.50 ft	0.00%	130.00 pcf	28.1/40.9	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	1000.00 psf	0.00 Kips
20.99 ft	Cohesive	N/A	N/A	1000.00 psf	6.25 Kips
21.01 ft	Cohesionless	2083.54 psf	16.52	N/A	6.30 Kips
23.49 ft	Cohesionless	2167.36 psf	16.52	N/A	10.31 Kips
23.51 ft	Cohesive	N/A	N/A	2500.00 psf	10.41 Kips
28.49 ft	Cohesive	N/A	N/A	2500.00 psf	49.52 Kips
28.51 ft	Cohesionless	2540.54 psf	16.52	N/A	49.62 Kips
37.51 ft	Cohesionless	2844.74 psf	16.52	N/A	68.74 Kips
43.49 ft	Cohesionless	3046.86 psf	16.52	N/A	83.70 Kips
43.51 ft	Cohesionless	3554.54 psf	16.52	N/A	83.76 Kips
52.51 ft	Cohesionless	3858.74 psf	16.52	N/A	109.69 Kips
59.99 ft	Cohesionless	4111.56 psf	16.52	N/A	134.36 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
18.49 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	N/A	7.07 Kips
20.99 ft	Cohesive	N/A	N/A	N/A	7.07 Kips
21.01 ft	Cohesionless	2083.88 psf	34.32	15.25 Kips	15.25 Kips
23.49 ft	Cohesionless	2251.52 psf	34.32	15.25 Kips	15.25 Kips
23.51 ft	Cohesive	N/A	N/A	N/A	17.67 Kips
28.49 ft	Cohesive	N/A	N/A	N/A	17.67 Kips
28.51 ft	Cohesionless	2540.88 psf	63.83	83.97 Kips	83.97 Kips
37.51 ft	Cohesionless	3149.28 psf	63.83	83.97 Kips	83.97 Kips
43.49 ft	Cohesionless	3553.52 psf	63.83	83.97 Kips	83.97 Kips
43.51 ft	Cohesionless	3554.88 psf	198.22	389.39 Kips	389.39 Kips
52.51 ft	Cohesionless	4163.28 psf	198.22	389.39 Kips	389.39 Kips
59.99 ft	Cohesionless	4668.92 psf	198.22	389.39 Kips	389.39 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.00 ft	0.00 Kips	7.07 Kips	7.07 Kips
20.99 ft	6.25 Kips	7.07 Kips	13.32 Kips
21.01 ft	6.30 Kips	15.25 Kips	21.55 Kips
23.49 ft	10.31 Kips	15.25 Kips	25.56 Kips
23.51 ft	10.41 Kips	17.67 Kips	28.08 Kips
28.49 ft	49.52 Kips	17.67 Kips	67.19 Kips
28.51 ft	49.62 Kips	83.97 Kips	133.59 Kips
37.51 ft	68.74 Kips	83.97 Kips	152.71 Kips
43.49 ft	83.70 Kips	83.97 Kips	167.68 Kips
43.51 ft	83.76 Kips	389.39 Kips	473.15 Kips
52.51 ft	109.69 Kips	389.39 Kips	499.08 Kips
59.99 ft	134.36 Kips	389.39 Kips	523.75 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	1000.00 psf	0.00 Kips
20.99 ft	Cohesive	N/A	N/A	1000.00 psf	5.19 Kips
21.01 ft	Cohesionless	2083.54 psf	16.52	N/A	5.24 Kips
23.49 ft	Cohesionless	2167.36 psf	16.52	N/A	9.25 Kips
23.51 ft	Cohesive	N/A	N/A	2500.00 psf	9.33 Kips
28.49 ft	Cohesive	N/A	N/A	2500.00 psf	41.79 Kips
28.51 ft	Cohesionless	2540.54 psf	16.52	N/A	41.89 Kips
37.51 ft	Cohesionless	2844.74 psf	16.52	N/A	61.01 Kips
43.49 ft	Cohesionless	3046.86 psf	16.52	N/A	75.98 Kips
43.51 ft	Cohesionless	3554.54 psf	16.52	N/A	76.03 Kips
52.51 ft	Cohesionless	3858.74 psf	16.52	N/A	101.97 Kips
59.99 ft	Cohesionless	4111.56 psf	16.52	N/A	126.63 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
18.49 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	N/A	7.07 Kips
20.99 ft	Cohesive	N/A	N/A	N/A	7.07 Kips
21.01 ft	Cohesionless	2083.88 psf	34.32	15.25 Kips	15.25 Kips
23.49 ft	Cohesionless	2251.52 psf	34.32	15.25 Kips	15.25 Kips
23.51 ft	Cohesive	N/A	N/A	N/A	17.67 Kips
28.49 ft	Cohesive	N/A	N/A	N/A	17.67 Kips
28.51 ft	Cohesionless	2540.88 psf	63.83	83.97 Kips	83.97 Kips
37.51 ft	Cohesionless	3149.28 psf	63.83	83.97 Kips	83.97 Kips
43.49 ft	Cohesionless	3553.52 psf	63.83	83.97 Kips	83.97 Kips
43.51 ft	Cohesionless	3554.88 psf	198.22	389.39 Kips	389.39 Kips
52.51 ft	Cohesionless	4163.28 psf	198.22	389.39 Kips	389.39 Kips
59.99 ft	Cohesionless	4668.92 psf	198.22	389.39 Kips	389.39 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.00 ft	0.00 Kips	7.07 Kips	7.07 Kips
20.99 ft	5.19 Kips	7.07 Kips	12.26 Kips
21.01 ft	5.24 Kips	15.25 Kips	20.48 Kips
23.49 ft	9.25 Kips	15.25 Kips	24.50 Kips
23.51 ft	9.33 Kips	17.67 Kips	27.00 Kips
28.49 ft	41.79 Kips	17.67 Kips	59.46 Kips
28.51 ft	41.89 Kips	83.97 Kips	125.86 Kips
37.51 ft	61.01 Kips	83.97 Kips	144.98 Kips
43.49 ft	75.98 Kips	83.97 Kips	159.95 Kips
43.51 ft	76.03 Kips	389.39 Kips	465.42 Kips
52.51 ft	101.97 Kips	389.39 Kips	491.36 Kips
59.99 ft	126.63 Kips	389.39 Kips	516.02 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	1000.00 psf	0.00 Kips
20.99 ft	Cohesive	N/A	N/A	1000.00 psf	6.25 Kips
21.01 ft	Cohesionless	2083.54 psf	16.52	N/A	6.30 Kips
23.49 ft	Cohesionless	2167.36 psf	16.52	N/A	10.31 Kips
23.51 ft	Cohesive	N/A	N/A	2500.00 psf	10.41 Kips
28.49 ft	Cohesive	N/A	N/A	2500.00 psf	49.52 Kips
28.51 ft	Cohesionless	2540.54 psf	16.52	N/A	49.62 Kips
37.51 ft	Cohesionless	2844.74 psf	16.52	N/A	68.74 Kips
43.49 ft	Cohesionless	3046.86 psf	16.52	N/A	83.70 Kips
43.51 ft	Cohesionless	3554.54 psf	16.52	N/A	83.76 Kips
52.51 ft	Cohesionless	3858.74 psf	16.52	N/A	109.69 Kips
59.99 ft	Cohesionless	4111.56 psf	16.52	N/A	134.36 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
18.49 ft	Cohesionless	0.00 psf	77.60	119.07 Kips	0.00 Kips
18.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	N/A	7.07 Kips
20.99 ft	Cohesive	N/A	N/A	N/A	7.07 Kips
21.01 ft	Cohesionless	2083.88 psf	34.32	15.25 Kips	15.25 Kips
23.49 ft	Cohesionless	2251.52 psf	34.32	15.25 Kips	15.25 Kips
23.51 ft	Cohesive	N/A	N/A	N/A	17.67 Kips
28.49 ft	Cohesive	N/A	N/A	N/A	17.67 Kips
28.51 ft	Cohesionless	2540.88 psf	63.83	83.97 Kips	83.97 Kips
37.51 ft	Cohesionless	3149.28 psf	63.83	83.97 Kips	83.97 Kips
43.49 ft	Cohesionless	3553.52 psf	63.83	83.97 Kips	83.97 Kips
43.51 ft	Cohesionless	3554.88 psf	198.22	389.39 Kips	389.39 Kips
52.51 ft	Cohesionless	4163.28 psf	198.22	389.39 Kips	389.39 Kips
59.99 ft	Cohesionless	4668.92 psf	198.22	389.39 Kips	389.39 Kips

ULTIMATE - SUMMARY OF CAPACITIES

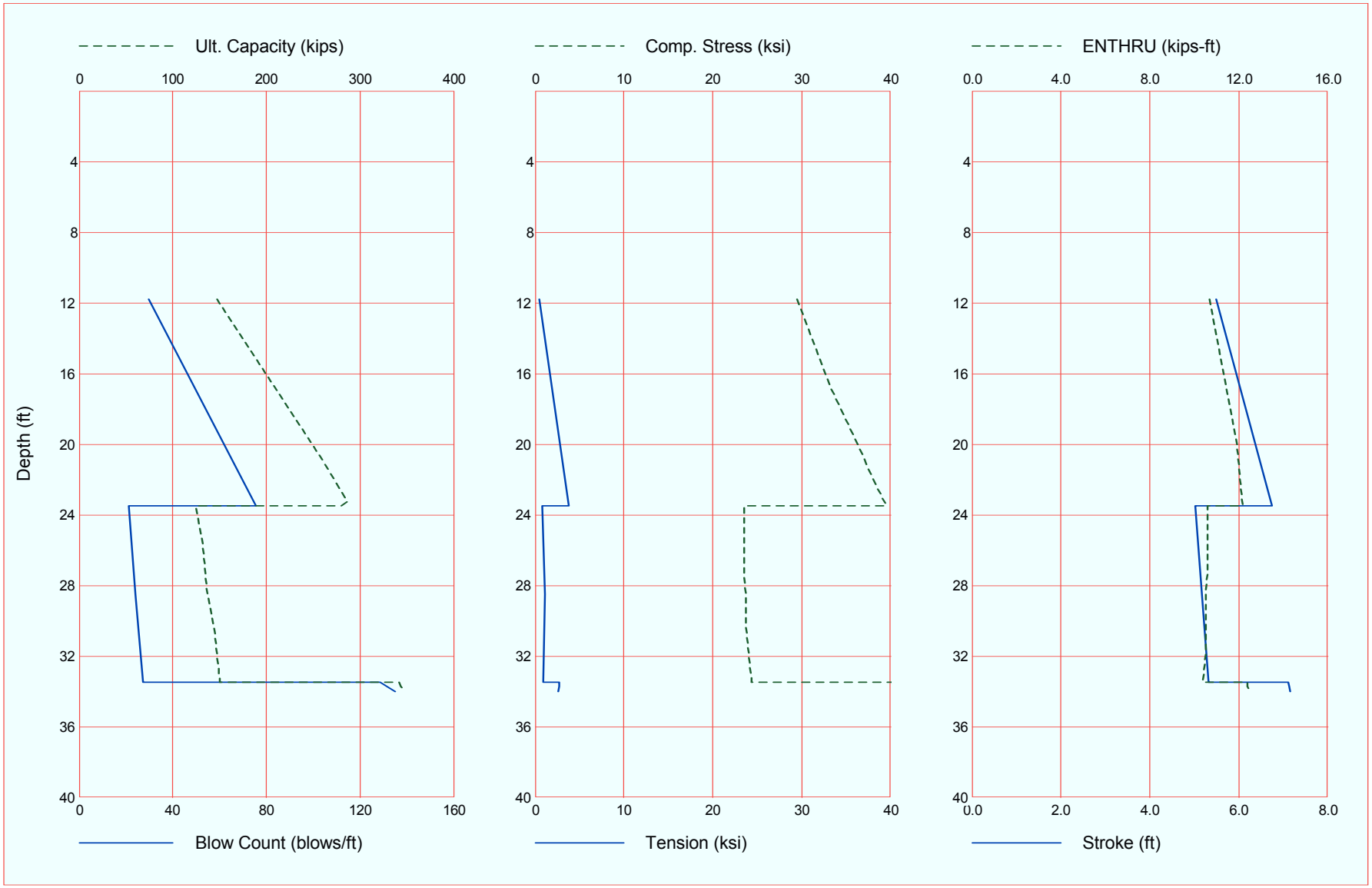
Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.00 ft	0.00 Kips	7.07 Kips	7.07 Kips
20.99 ft	6.25 Kips	7.07 Kips	13.32 Kips
21.01 ft	6.30 Kips	15.25 Kips	21.55 Kips
23.49 ft	10.31 Kips	15.25 Kips	25.56 Kips
23.51 ft	10.41 Kips	17.67 Kips	28.08 Kips
28.49 ft	49.52 Kips	17.67 Kips	67.19 Kips
28.51 ft	49.62 Kips	83.97 Kips	133.59 Kips
37.51 ft	68.74 Kips	83.97 Kips	152.71 Kips
43.49 ft	83.70 Kips	83.97 Kips	167.68 Kips
43.51 ft	83.76 Kips	389.39 Kips	473.15 Kips
52.51 ft	109.69 Kips	389.39 Kips	499.08 Kips
59.99 ft	134.36 Kips	389.39 Kips	523.75 Kips

APPENDIX E
WEAP RESULTS

CTL Engineering Inc
CLA-CR314-0.09 - B-1 : 10/16/2013 : re

Mar 18 2014
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.604 / 1.000



CTL Engineering Inc
CLA-CR314-0.09 - B-1 : 10/16/2013 : re

Mar 18 2014
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.604 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
11.8	147.1	5.8	141.3	29.9	29.471	-0.457	5.49	10.7
23.5	287.6	62.1	225.5	75.5	39.470	-3.811	6.76	12.2
23.5	124.9	62.2	62.6	21.4	23.499	-0.846	5.03	10.6
28.5	137.4	72.7	64.7	24.1	23.694	-1.093	5.17	10.5
33.5	150.7	84.4	66.4	27.5	24.349	-0.895	5.32	10.4
33.5	341.6	84.5	257.0	128.8	40.798	-2.673	7.12	12.4
33.7	344.0	86.1	257.9	131.6	40.929	-2.691	7.13	12.4
34.0	346.9	88.0	259.0	134.9	41.082	-2.644	7.16	12.5

Total Continuous Driving Time 23.00 minutes; Total Number of Blows 1104

GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

Copyright (c) 1998-2010, Pile Dynamics, Inc.

ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local non-axial stresses and prestress effects must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of building and other factors.

```
 Input  File: J:\DEPT5\13 PROJECTS\13050157COL-CEC-CLA-CR314-0.09-BRIDGE 1204
\DESIGN\B1 REAR ABUT.GWW
 Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2003.GW
 Hammer File Version:  2003 (3/21/2012)

                        Input File Contents
     CLA-CR314-0.09 - B-1 : 10/16/2013 : re
 OUT OSG HAM STR FUL PEL  N SPL N-U P-D %SK ISM  0 PHI RSA ITR H-D MXT     DEx
-100   0   4   0   0   0  0   0   0   1   0   0  0   0   0   0   0   0   0.000
    Pile g  Hammer g  Toe Area Pile Size           Pile Type
    32.170    32.170   113.090    12.000                Pipe
      W Cp      A Cp      E Cp      T Cp       CoR      ROut      StCp
     1.700   227.000     530.0     2.000     0.800     0.010       0.0
      A Cu      E Cu      T Cu       CoR      ROut      StCu
     0.000       0.0     0.000     0.000     0.000       0.0
      LPle      APle      EPle      WPle      Peri        CI       CoR      ROut
    34.000     11.45   29000.0   492.000     3.141         0     0.850     0.010
 Manufac  Hmr Name  HmrType No Seg-s
 DELMAG   D 15          1       5
    Ram Wt     Ram L   Ram Dia   MaxStrk   RtdStrk    Efficy
      3.30    120.00     11.81     10.80      8.21      0.80
    IB. Wt     IB. L    IB.Dia    IB CoR     IB RO
      0.81     21.27     11.81     0.900     0.010
 CompStrk A Chamber V Chamber   C Delay  C Duratn Exp Coeff VolCStart  Vol CEnd
    13.30    109.60    123.90     0.002     0.002     1.250      0.00      0.00
     P atm        P1        P2        P3        P4        P5
    14.70   1250.00      0.00      0.00      0.00      0.00
    Stroke    Effic.  Pressure  R-Weight   T-Delay Exp-Coeff   Eps-Str  Total-AW
    8.2100    0.8000 1250.0000    0.0000    0.0000    0.0000    0.0100    0.0000
        Qs        Qt        Js        Jt        Qx        Jx      Rati      Dept
     0.100     0.100     0.150     0.150     0.000     0.000     0.000     0.000
 Research Soil Model: Atoe, Plug,  Gap, Q-fac
     0.000     0.000     0.000     0.000
 Research Soil Model: RD-skn: m, d, toe: m, d
     0.000     0.000     0.000     0.000
 Res. Distribution
    Dpth    Rskn      Rtoe      Qs      Qt      Js      Jt   SU F    LimD   SU T
    0.01    0.00      0.00    0.10    0.10    0.05    0.15   1.00    0.00    0.0
    9.01    0.00      0.00    0.10    0.10    0.05    0.15   1.00    0.00    0.0
    9.99    0.00      0.00    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   10.00    0.97    120.27    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   13.99    1.36    168.26    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   14.01    1.36    168.44    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   23.01    1.80    222.65    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   23.49    1.82    225.54    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   23.51    1.04     62.63    0.10    0.10    0.05    0.15   1.49    0.00    0.0
   32.51    1.27     66.37    0.10    0.10    0.05    0.15   1.49    0.00    0.0
   33.49    1.30     66.37    0.10    0.10    0.05    0.15   1.49    0.00    0.0
   33.51    2.27    256.99    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   34.00    2.30    258.95    0.10    0.10    0.05    0.15   1.00    0.00    0.0
 Gain/Loss factors: shaft and toe
  0.60400   0.63700   0.67000   0.70300   0.73600
  1.00000   1.00000   1.00000   1.00000   1.00000
     Dpth         L      Wait      Strk      Pmx%      Eff.      Stff       CoR
    11.75      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    23.48      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    23.52      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    28.50      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    33.48      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    33.52      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    33.74      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    34.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
     0.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
        1         0   8.210000        10.80000
```

GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CLA-CR314-0.09 - B-1 : 10/16/2013 : re

Hammer Model: D 15 Made by: DELMAG

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.660				
2	0.660	132366.0	1.000	0.0100	
3	0.660	132366.0	1.000	0.0100	
4	0.660	132366.0	1.000	0.0100	
5	0.660	132366.0	1.000	0.0100	
Imp Block	0.810	70174.2	0.900	0.0100	
Helmet	1.700	60155.0	0.800	0.0100	5.3
Combined Pile Top		8138.5			

HAMMER OPTIONS:

Hammer File ID No.	4	Hammer Type	OE Diesel
Stroke Option	FxdP-VarS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	3.30	Ram Length	(inch)	120.00
Maximum Stroke	(ft)	10.80			
Rated Stroke	(ft)	8.21	Efficiency		0.800
Maximum Pressure	(psi)	1250.00	Actual Pressure	(psi)	1250.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	11.81			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION			PILE CUSHION		
Cross Sect. Area	(in2)	227.00	Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	530.0	Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	2.00	Thickness	(inch)	0.00
Coeff of Restitution		0.8	Coeff of Restitution		1.0
RoundOut	(ft)	0.0	RoundOut	(ft)	0.0
Stiffness	(kips/in)	60155.0	Stiffness	(kips/in)	0.0

CLA-CR314-0.09 - B-1 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 11.8
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
34.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 4.115

Pile and Soil Model Total Capacity Rut (kips) 147.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.133	8138	0.010	0.000	0.85	0.0	0.000	0.100	3.40	3.1	11.4
2	0.133	8138	0.000	0.000	1.00	0.0	0.000	0.100	6.80	3.1	11.4
7	0.133	8138	0.000	0.000	1.00	0.0	0.050	0.100	23.80	3.1	11.4
10	0.133	8138	0.000	0.000	1.00	5.8	0.050	0.100	34.00	3.1	11.5
Toe						141.3	0.150	0.100			

1.330 kips total unreduced pile weight (g= 32.17 ft/s2)
1.330 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:
Uniform pile Pile Segments: Automatic
No. of Slacks/Splices 0 Pile Damping (%) 1
Pile Damping Fact.(k/ft/s) 0.402

Driveability Analysis
Soil Damping Option Smith
Max No Analysis Iterations 0 Time Increment/Critical 160
Output Time Interval 1 Analysis Time-Input (ms) 0
Output Level: Normal
Gravity Mass, Pile, Hammer: 32.170 32.170 32.170
Output Segment Generation: Automatic

Depth ft	Stroke ft	Pressure Ratio	Efficy
11.75	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
147.1	29.9	5.49	5.47	-0.46	9	50	29.47	10	4	10.7	50.3
147.1	29.9	5.49	5.47	-0.46	9	50	29.47	10	4	10.7	50.3
147.1	29.9	5.49	5.47	-0.46	9	50	29.47	10	4	10.7	50.3
147.1	29.9	5.49	5.47	-0.46	9	50	29.47	10	4	10.7	50.3
147.1	29.9	5.49	5.47	-0.46	9	50	29.47	10	4	10.7	50.3
1		0	8.210000		10.80000						

CLA-CR314-0.09 - B-1 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 23.5
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
34.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 4.115

Pile and Soil Model Total Capacity Rut (kips) 287.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.133	8138	0.010	0.000	0.85	0.0	0.000	0.100	3.40	3.1	11.4
2	0.133	8138	0.000	0.000	1.00	0.0	0.000	0.100	6.80	3.1	11.4
4	0.133	8138	0.000	0.000	1.00	0.0	0.050	0.100	13.60	3.1	11.4
7	0.133	8138	0.000	0.000	1.00	11.7	0.050	0.100	23.80	3.1	11.4
8	0.133	8138	0.000	0.000	1.00	15.0	0.050	0.100	27.20	3.1	11.4
9	0.133	8138	0.000	0.000	1.00	16.8	0.050	0.100	30.60	3.1	11.4
10	0.133	8138	0.000	0.000	1.00	18.6	0.050	0.100	34.00	3.1	11.5
Toe						225.5	0.150	0.100			

1.330 kips total unreduced pile weight (g= 32.17 ft/s2)
1.330 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
23.48	8.21	1.00	0.800

CLA-CR314-0.09 - B-1 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
287.6	75.5	6.76	6.79	-3.81	7	16	39.47	1	6	12.2	45.3
287.6	75.5	6.76	6.79	-3.81	7	16	39.47	1	6	12.2	45.3
287.6	75.5	6.76	6.79	-3.81	7	16	39.47	1	6	12.2	45.3
287.6	75.5	6.76	6.79	-3.81	7	16	39.47	1	6	12.2	45.3
287.6	75.5	6.76	6.79	-3.81	7	16	39.47	1	6	12.2	45.3

1 0 8.210000 10.80000

CLA-CR314-0.09 - B-1 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 23.5
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
34.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 4.115

Pile and Soil Model Total Capacity Rut (kips) 124.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.133	8138	0.010	0.000	0.85	0.0	0.000	0.100	3.40	3.1	11.4
2	0.133	8138	0.000	0.000	1.00	0.0	0.000	0.100	6.80	3.1	11.4
4	0.133	8138	0.000	0.000	1.00	0.0	0.050	0.100	13.60	3.1	11.4
7	0.133	8138	0.000	0.000	1.00	11.8	0.050	0.100	23.80	3.1	11.4
8	0.133	8138	0.000	0.000	1.00	15.0	0.050	0.100	27.20	3.1	11.4
9	0.133	8138	0.000	0.000	1.00	16.8	0.050	0.100	30.60	3.1	11.4
10	0.133	8138	0.000	0.000	1.00	18.5	0.050	0.100	34.00	3.1	11.5
Toe						62.6	0.150	0.100			

1.330 kips total unreduced pile weight (g= 32.17 ft/s2)
1.330 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
23.52	8.21	1.00	0.800

CLA-CR314-0.09 - B-1 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
124.9	21.4	5.03	5.04	-0.85	7	27	23.50	7	3	10.6	52.4
124.9	21.4	5.03	5.04	-0.85	7	27	23.50	7	3	10.6	52.4
124.9	21.4	5.03	5.04	-0.85	7	27	23.49	7	3	10.6	52.4
124.9	21.4	5.03	5.04	-0.84	7	27	23.51	7	3	10.6	52.4
124.9	21.4	5.03	5.04	-0.85	7	27	23.49	7	3	10.6	52.4

1 0 8.210000 10.80000

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CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 28.5
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
34.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 4.115

Pile and Soil Model Total Capacity Rut (kips) 137.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.133	8138	0.010	0.000	0.85	0.0	0.000	0.100	3.40	3.1	11.4
2	0.133	8138	0.000	0.000	1.00	0.0	0.050	0.100	6.80	3.1	11.4
5	0.133	8138	0.000	0.000	1.00	4.9	0.050	0.100	17.00	3.1	11.4
6	0.133	8138	0.000	0.000	1.00	13.6	0.050	0.100	20.40	3.1	11.4
7	0.133	8138	0.000	0.000	1.00	15.9	0.050	0.100	23.80	3.1	11.4
8	0.133	8138	0.000	0.000	1.00	17.7	0.050	0.100	27.20	3.1	11.4
9	0.133	8138	0.000	0.000	1.00	13.3	0.050	0.100	30.60	3.1	11.4
10	0.133	8138	0.000	0.000	1.00	7.3	0.050	0.100	34.00	3.1	11.5
Toe						64.7	0.150	0.100			

1.330 kips total unreduced pile weight (g= 32.17 ft/s2)
1.330 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
28.50	8.21	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
137.4	24.1	5.17	5.18	-1.09	5	48	23.69	6	3	10.5	51.7
138.0	24.3	5.18	5.19	-1.09	5	48	23.71	6	3	10.5	51.6
138.5	24.4	5.18	5.19	-1.09	5	48	23.72	6	3	10.5	51.6
139.1	24.5	5.19	5.20	-1.09	5	48	23.75	6	3	10.5	51.6
139.7	24.6	5.20	5.20	-1.10	5	48	23.77	6	3	10.5	51.6
1		0	8.210000		10.80000						

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Depth (ft) 33.5
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
34.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 4.115

Pile and Soil Model Total Capacity Rut (kips) 150.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.133	8138	0.010	0.000	0.85	0.0	0.050	0.100	3.40	3.1	11.4
2	0.133	8138	0.000	0.000	1.00	0.0	0.050	0.100	6.80	3.1	11.4
4	0.133	8138	0.000	0.000	1.00	10.9	0.050	0.100	13.60	3.1	11.4
5	0.133	8138	0.000	0.000	1.00	14.9	0.050	0.100	17.00	3.1	11.4
6	0.133	8138	0.000	0.000	1.00	16.7	0.050	0.100	20.40	3.1	11.4
7	0.133	8138	0.000	0.000	1.00	18.5	0.050	0.100	23.80	3.1	11.4
8	0.133	8138	0.000	0.000	1.00	7.8	0.050	0.100	27.20	3.1	11.4
9	0.133	8138	0.000	0.000	1.00	7.5	0.050	0.100	30.60	3.1	11.4
10	0.133	8138	0.000	0.000	1.00	8.1	0.050	0.100	34.00	3.1	11.5
Toe						66.4	0.150	0.100			

1.330 kips total unreduced pile weight (g= 32.17 ft/s2)
1.330 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
33.48	8.21	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
150.7	27.5	5.32	5.33	-0.89	4	45	24.35	4	2	10.4	51.0
151.9	27.7	5.32	5.33	-0.91	4	45	24.37	4	2	10.4	51.0
153.2	27.7	5.38	5.34	-0.91	4	44	24.56	4	2	10.5	50.8
154.4	27.9	5.40	5.35	-0.93	4	44	24.63	4	2	10.5	50.8
155.6	28.2	5.40	5.36	-0.93	4	44	24.64	4	2	10.5	50.7

1 0 8.210000 10.80000

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Depth (ft) 33.5
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
34.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 4.115

Pile and Soil Model Total Capacity Rut (kips) 341.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.133	8138	0.010	0.000	0.85	0.0	0.050	0.100	3.40	3.1	11.4
2	0.133	8138	0.000	0.000	1.00	0.0	0.050	0.100	6.80	3.1	11.4
4	0.133	8138	0.000	0.000	1.00	11.0	0.050	0.100	13.60	3.1	11.4
5	0.133	8138	0.000	0.000	1.00	14.9	0.050	0.100	17.00	3.1	11.4
6	0.133	8138	0.000	0.000	1.00	16.7	0.050	0.100	20.40	3.1	11.4
7	0.133	8138	0.000	0.000	1.00	18.5	0.050	0.100	23.80	3.1	11.4
8	0.133	8138	0.000	0.000	1.00	7.6	0.050	0.100	27.20	3.1	11.4
9	0.133	8138	0.000	0.000	1.00	7.5	0.050	0.100	30.60	3.1	11.4
10	0.133	8138	0.000	0.000	1.00	8.2	0.050	0.100	34.00	3.1	11.5
Toe						257.0	0.150	0.100			

1.330 kips total unreduced pile weight (g= 32.17 ft/s2)
1.330 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
33.52	8.21	1.00	0.800

CLA-CR314-0.09 - B-1 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
341.6	128.8	7.12	7.10	-2.67	4	14	40.80	1	6	12.4	44.3
342.8	129.2	7.13	7.12	-2.70	4	14	40.89	1	6	12.5	44.3
344.0	130.0	7.14	7.12	-2.72	4	14	40.98	1	6	12.5	44.2
345.2	131.7	7.15	7.14	-2.74	4	14	41.01	1	6	12.5	44.2
346.4	133.3	7.16	7.15	-2.75	4	14	41.04	1	6	12.5	44.2
	1	0	8.210000		10.80000						

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CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 33.7
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
34.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 4.115

Pile and Soil Model Total Capacity Rut (kips) 344.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.133	8138	0.010	0.000	0.85	0.0	0.050	0.100	3.40	3.1	11.4
2	0.133	8138	0.000	0.000	1.00	0.0	0.050	0.100	6.80	3.1	11.4
4	0.133	8138	0.000	0.000	1.00	11.9	0.050	0.100	13.60	3.1	11.4
5	0.133	8138	0.000	0.000	1.00	15.0	0.050	0.100	17.00	3.1	11.4
6	0.133	8138	0.000	0.000	1.00	16.8	0.050	0.100	20.40	3.1	11.4
7	0.133	8138	0.000	0.000	1.00	18.5	0.050	0.100	23.80	3.1	11.4
8	0.133	8138	0.000	0.000	1.00	7.0	0.050	0.100	27.20	3.1	11.4
9	0.133	8138	0.000	0.000	1.00	7.6	0.050	0.100	30.60	3.1	11.4
10	0.133	8138	0.000	0.000	1.00	9.3	0.050	0.100	34.00	3.1	11.5
Toe						257.9	0.150	0.100			

1.330 kips total unreduced pile weight (g= 32.17 ft/s2)
1.330 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
33.74	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
344.0	131.6	7.13	7.12	-2.69	4	14	40.93	1	6	12.4	44.2
345.2	132.2	7.15	7.13	-2.72	4	14	40.99	1	6	12.5	44.2
346.5	134.3	7.16	7.14	-2.73	4	14	41.04	1	6	12.5	44.2
347.7	136.0	7.17	7.15	-2.74	4	14	41.07	1	6	12.5	44.1
348.9	136.7	7.18	7.16	-2.77	4	14	41.15	1	6	12.5	44.1
	1	0	8.210000		10.80000						

CLA-CR314-0.09 - B-1 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 34.0
Shaft Gain/Loss Factor 0.604 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
34.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 4.115

Pile and Soil Model Total Capacity Rut (kips) 346.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.133	8138	0.010	0.000	0.85	0.0	0.050	0.100	3.40	3.1	11.4
2	0.133	8138	0.000	0.000	1.00	0.0	0.050	0.100	6.80	3.1	11.4
3	0.133	8138	0.000	0.000	1.00	0.6	0.050	0.100	10.20	3.1	11.5
4	0.133	8138	0.000	0.000	1.00	12.4	0.050	0.100	13.60	3.1	11.4
5	0.133	8138	0.000	0.000	1.00	15.2	0.050	0.100	17.00	3.1	11.4
6	0.133	8138	0.000	0.000	1.00	17.0	0.050	0.100	20.40	3.1	11.4
7	0.133	8138	0.000	0.000	1.00	17.6	0.050	0.100	23.80	3.1	11.4
8	0.133	8138	0.000	0.000	1.00	7.1	0.050	0.100	27.20	3.1	11.4
9	0.133	8138	0.000	0.000	1.00	7.6	0.050	0.100	30.60	3.1	11.4
10	0.133	8138	0.000	0.000	1.00	10.5	0.050	0.100	34.00	3.1	11.5
Toe						259.0	0.150	0.100			

1.330 kips total unreduced pile weight (g= 32.17 ft/s2)
1.330 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
34.00	8.21	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
346.9	134.9	7.16	7.14	-2.64	4	14	41.08	1	6	12.5	44.2
348.2	136.7	7.17	7.15	-2.66	4	14	41.10	1	6	12.5	44.2
349.4	137.5	7.18	7.16	-2.68	4	14	41.19	1	6	12.5	44.1
350.6	139.3	7.19	7.17	-2.70	4	14	41.22	1	6	12.5	44.1
351.8	141.3	7.19	7.18	-2.72	4	14	41.24	1	6	12.5	44.1

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CTL Engineering Inc GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.604 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
11.8	147.1	5.8	141.3	29.9	29.471	-0.457	5.49	10.7
23.5	287.6	62.1	225.5	75.5	39.470	-3.811	6.76	12.2
23.5	124.9	62.2	62.6	21.4	23.499	-0.846	5.03	10.6
28.5	137.4	72.7	64.7	24.1	23.694	-1.093	5.17	10.5
33.5	150.7	84.4	66.4	27.5	24.349	-0.895	5.32	10.4
33.5	341.6	84.5	257.0	128.8	40.798	-2.673	7.12	12.4
33.7	344.0	86.1	257.9	131.6	40.929	-2.691	7.13	12.4
34.0	346.9	88.0	259.0	134.9	41.082	-2.644	7.16	12.5

Total Driving Time 23 minutes; Total No. of Blows 1104

G/L at Shaft and Toe: 0.637 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
11.8	147.1	5.8	141.3	29.9	29.471	-0.457	5.49	10.7
23.5	287.6	62.1	225.5	75.5	39.470	-3.811	6.76	12.2
23.5	124.9	62.2	62.6	21.4	23.502	-0.845	5.03	10.6
28.5	138.0	73.3	64.7	24.3	23.710	-1.085	5.18	10.5
33.5	151.9	85.6	66.4	27.7	24.373	-0.913	5.32	10.4
33.5	342.8	85.8	257.0	129.2	40.894	-2.699	7.13	12.5
33.7	345.2	87.3	257.9	132.2	40.991	-2.717	7.15	12.5
34.0	348.2	89.2	259.0	136.7	41.104	-2.661	7.17	12.5

Total Driving Time 23 minutes; Total No. of Blows 1106

CLA-CR314-0.09 - B-1 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.670 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
11.8	147.1	5.8	141.3	29.9	29.471	-0.457	5.49	10.7
23.5	287.6	62.1	225.5	75.5	39.470	-3.811	6.76	12.2
23.5	124.9	62.2	62.6	21.4	23.494	-0.846	5.03	10.6
28.5	138.5	73.8	64.7	24.4	23.717	-1.089	5.18	10.5
33.5	153.2	86.8	66.4	27.7	24.565	-0.914	5.38	10.5
33.5	344.0	87.0	257.0	130.0	40.976	-2.722	7.14	12.5
33.7	346.5	88.5	257.9	134.3	41.037	-2.728	7.16	12.5
34.0	349.4	90.4	259.0	137.5	41.193	-2.682	7.18	12.5

Total Driving Time 23 minutes; Total No. of Blows 1107

G/L at Shaft and Toe: 0.703 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
11.8	147.1	5.8	141.3	29.9	29.471	-0.457	5.49	10.7
23.5	287.6	62.1	225.5	75.5	39.470	-3.811	6.76	12.2
23.5	124.9	62.2	62.6	21.4	23.511	-0.844	5.03	10.6
28.5	139.1	74.4	64.7	24.5	23.746	-1.093	5.19	10.5
33.5	154.4	88.0	66.4	27.9	24.631	-0.933	5.40	10.5
33.5	345.2	88.2	257.0	131.7	41.008	-2.735	7.15	12.5
33.7	347.7	89.8	257.9	136.0	41.069	-2.742	7.17	12.5
34.0	350.6	91.6	259.0	139.3	41.219	-2.699	7.19	12.5

Total Driving Time 23 minutes; Total No. of Blows 1109

CLA-CR314-0.09 - B-1 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.736 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
11.8	147.1	5.8	141.3	29.9	29.471	-0.457	5.49	10.7
23.5	287.6	62.1	225.5	75.5	39.470	-3.811	6.76	12.2
23.5	124.9	62.2	62.6	21.4	23.495	-0.846	5.03	10.6
28.5	139.7	75.0	64.7	24.6	23.773	-1.100	5.20	10.5
33.5	155.6	89.2	66.4	28.2	24.635	-0.934	5.40	10.5
33.5	346.4	89.4	257.0	133.3	41.042	-2.752	7.16	12.5
33.7	348.9	91.0	257.9	136.7	41.152	-2.766	7.18	12.5
34.0	351.8	92.8	259.0	141.3	41.240	-2.716	7.19	12.5

Total Driving Time 23 minutes; Total No. of Blows 1112

Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
11.75	34.00	0.00	8.21	1.00	0.80	1.00	1.00
23.48	34.00	0.00	8.21	1.00	0.80	1.00	1.00
23.52	34.00	0.00	8.21	1.00	0.80	1.00	1.00
28.50	34.00	0.00	8.21	1.00	0.80	1.00	1.00
33.48	34.00	0.00	8.21	1.00	0.80	1.00	1.00
33.52	34.00	0.00	8.21	1.00	0.80	1.00	1.00
33.74	34.00	0.00	8.21	1.00	0.80	1.00	1.00
34.00	34.00	0.00	8.21	1.00	0.80	1.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.00	0.100	0.100	0.050	0.150	0.000	0.000	0.000
9.01	0.00	0.00	0.100	0.100	0.050	0.150	0.000	0.000	0.000
9.99	0.00	0.00	0.100	0.100	0.050	0.150	0.000	0.000	0.000
10.00	0.97	120.27	0.100	0.100	0.050	0.150	0.000	0.000	0.000
13.99	1.36	168.26	0.100	0.100	0.050	0.150	0.000	0.000	0.000
14.01	1.36	168.44	0.100	0.100	0.050	0.150	0.000	0.000	0.000
23.01	1.80	222.65	0.100	0.100	0.050	0.150	0.000	0.000	0.000
23.49	1.82	225.54	0.100	0.100	0.050	0.150	0.000	0.000	0.000
23.51	1.04	62.63	0.100	0.100	0.050	0.150	1.000	0.000	0.000
32.51	1.27	66.37	0.100	0.100	0.050	0.150	1.000	0.000	0.000
33.49	1.30	66.37	0.100	0.100	0.050	0.150	1.000	0.000	0.000
33.51	2.27	256.99	0.100	0.100	0.050	0.150	0.000	0.000	0.000
34.00	2.30	258.95	0.100	0.100	0.050	0.150	0.000	0.000	0.000

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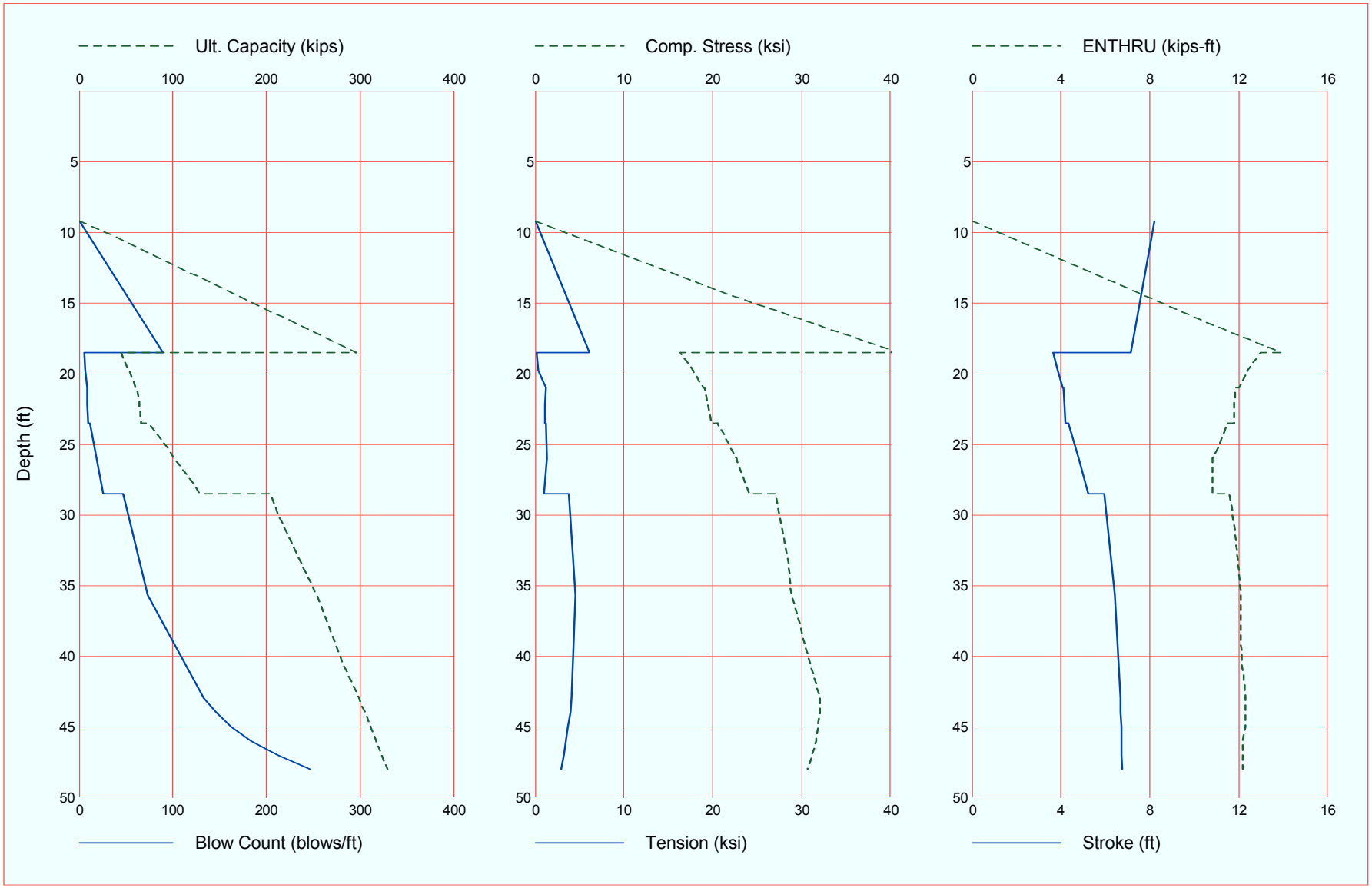
Mar 18 2014
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000



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Gain/Loss 1 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
9.2	0.0	0.0	0.0	0.0	0.000	0.000	8.21	0.0
18.5	296.4	33.9	262.5	89.4	40.952	-6.094	7.14	13.9
18.5	45.2	34.1	11.1	5.1	16.386	-0.167	3.63	13.0
19.8	52.9	41.8	11.1	6.8	17.769	-0.417	3.87	12.4
21.0	60.7	49.6	11.1	8.5	18.968	-1.230	4.09	12.0
21.0	61.7	49.7	12.0	8.8	19.065	-1.213	4.11	11.9
22.2	64.2	52.2	12.0	9.1	19.433	-1.135	4.15	11.8
23.5	66.8	54.8	12.0	9.5	19.790	-1.101	4.19	11.8
23.5	74.5	55.1	19.4	11.3	20.551	-1.212	4.35	11.5
26.0	101.8	82.3	19.4	18.5	22.629	-1.287	4.82	10.8
28.5	129.0	109.6	19.4	25.7	24.022	-1.019	5.24	10.8
28.5	204.2	109.9	94.3	47.4	27.020	-3.747	5.97	11.6
35.7	254.1	144.9	109.2	73.7	28.851	-4.571	6.41	12.1
43.0	299.1	186.3	112.8	133.6	32.036	-4.136	6.66	12.3
44.0	305.3	192.5	112.8	146.8	32.001	-3.973	6.69	12.3
45.0	311.4	198.6	112.8	162.2	31.876	-3.719	6.71	12.3
46.0	317.6	204.8	112.8	184.3	31.598	-3.421	6.73	12.2
47.0	323.8	211.0	112.8	211.8	31.253	-3.283	6.74	12.2
48.0	330.0	217.2	112.8	246.9	30.694	-2.982	6.76	12.2

Total Continuous Driving Time 57.00 minutes; Total Number of Blows 2629

GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.

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ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local non-axial stresses and prestress effects must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of building and other factors.

Input File: C:\2013\CLA B2.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2003.GW
Hammer File Version: 2003 (3/21/2012)

Input File Contents

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OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx
-100	0	4	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0.000

Pile g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	113.090	12.000	Pipe

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
1.700	227.000	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	CI	CoR	ROut
50.000	11.45	29000.0	492.000	3.141	0	0.850	0.010

Manufac	Hmr Name	HmrType	No Seg-s
DELMAG	D 15	1	5

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
3.30	120.00	11.81	10.80	8.21	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.81	21.27	11.81	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
13.30	109.60	123.90	0.002	0.002	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1250.00	0.00	0.00	0.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
8.2100	0.8000	1250.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.100	0.100	0.150	0.150	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000

Res. Distribution

Dpth	Rskn	Rtoe	Qs	Qt	Js	Jt	SU F	LimD	SU T
0.01	0.00	0.00	0.10	0.10	0.05	0.15	1.00	0.00	0.0
9.01	0.00	0.00	0.10	0.10	0.05	0.15	1.00	0.00	0.0
9.99	0.00	0.00	0.10	0.10	0.05	0.15	1.00	0.00	0.0
10.00	0.93	162.53	0.10	0.10	0.05	0.15	1.00	0.00	0.0
13.99	1.31	227.37	0.10	0.10	0.05	0.15	1.00	0.00	0.0
14.01	1.31	227.61	0.10	0.10	0.05	0.15	1.00	0.00	0.0
18.49	1.51	262.56	0.10	0.10	0.05	0.15	1.00	0.00	0.0
18.51	2.00	11.10	0.10	0.10	0.20	0.15	1.21	0.00	0.0
20.99	2.00	11.10	0.10	0.10	0.20	0.15	1.21	0.00	0.0
21.01	0.63	11.98	0.10	0.10	0.05	0.15	1.00	0.00	0.0
23.49	0.68	11.98	0.10	0.10	0.05	0.15	1.00	0.00	0.0
23.51	3.50	19.43	0.10	0.10	0.20	0.15	1.21	0.00	0.0
28.49	3.50	19.43	0.10	0.10	0.20	0.15	1.21	0.00	0.0
28.51	1.41	94.29	0.10	0.10	0.05	0.15	1.00	0.00	0.0
37.51	1.75	112.80	0.10	0.10	0.05	0.15	1.00	0.00	0.0
43.49	1.97	112.80	0.10	0.10	0.05	0.15	1.00	0.00	0.0
50.00	1.97	112.80	0.10	0.10	0.05	0.15	1.00	0.00	0.0

Gain/Loss factors: shaft and toe

1.00000	0.81300	0.83000	0.84700	0.86400
1.00000	1.00000	1.00000	1.00000	1.00000

Dpth	L	Wait	Strk	Pmx%	Eff.	Stff	CoR
9.25	0.00	0.00	0.000	0.000	0.000	0.000	0.000
18.48	0.00	0.00	0.000	0.000	0.000	0.000	0.000
18.52	0.00	0.00	0.000	0.000	0.000	0.000	0.000
19.75	0.00	0.00	0.000	0.000	0.000	0.000	0.000
20.98	0.00	0.00	0.000	0.000	0.000	0.000	0.000
21.02	0.00	0.00	0.000	0.000	0.000	0.000	0.000
22.25	0.00	0.00	0.000	0.000	0.000	0.000	0.000
23.48	0.00	0.00	0.000	0.000	0.000	0.000	0.000
23.52	0.00	0.00	0.000	0.000	0.000	0.000	0.000

```
   26.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   28.48      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   28.52      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   35.74      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   43.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   44.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   45.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   46.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   47.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
   48.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
    0.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
       1           0   8.210000       10.80000
```

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          GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
                                Version 2010
                               English Units

                 CLA-CR314-0.09 - B-2 : 10/16/2013 : re
                 ______________________________________

           Hammer Model:   D 15                 Made by:      DELMAG

           No.    Weight    Stiffn       CoR     C-Slk     Dampg
                    kips    k/inch                   ft    k/ft/s
             1     0.660
             2     0.660  132366.0     1.000    0.0100
             3     0.660  132366.0     1.000    0.0100
             4     0.660  132366.0     1.000    0.0100
             5     0.660  132366.0     1.000    0.0100
     Imp Block     0.810   70174.2     0.900    0.0100
     Helmet        1.700   60155.0     0.800    0.0100       5.3
     Combined Pile Top      8301.2

HAMMER OPTIONS:
  Hammer File ID No.                  4  Hammer Type                 OE Diesel
  Stroke Option              FxdP-VarS  Stroke Convergence Crit.        0.010
  Fuel Pump Setting            Maximum

HAMMER DATA:
  Ram Weight          (kips)      3.30  Ram Length          (inch)    120.00
  Maximum Stroke        (ft)     10.80
  Rated Stroke          (ft)      8.21  Efficiency                     0.800

  Maximum Pressure     (psi)   1250.00  Actual Pressure      (psi)   1250.00
  Compression Exponent           1.350  Expansion Exponent              1.250
  Ram Diameter        (inch)     11.81
  Combustion Delay       (s)   0.00200  Ignition Duration      (s)   0.00200

          The Hammer Data Includes Estimated (NON-MEASURED) Quantities
          ____________________________________________________________


  HAMMER CUSHION                         PILE CUSHION
  Cross Sect. Area     (in2)    227.00  Cross Sect. Area     (in2)       0.00
  Elastic-Modulus      (ksi)     530.0  Elastic-Modulus      (ksi)        0.0
  Thickness           (inch)      2.00  Thickness           (inch)       0.00
  Coeff of Restitution              0.8  Coeff of Restitution              1.0
  RoundOut              (ft)       0.0  RoundOut              (ft)        0.0
  Stiffness        (kips/in)   60155.0  Stiffness        (kips/in)        0.0
```

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CLA-CR314-0.09 - B-2 : 10/16/2013 : re                              03/18/2014
CTL Engineering Inc                                       GRLWEAP Version 2010

 Depth                  (ft)       9.2
 Shaft Gain/Loss Factor         1.000  Toe Gain/Loss Factor           1.000

 PILE PROFILE:
 Toe Area             (in2)   113.090  Pile Type                       Pipe
 Pile Size           (inch)    12.000

  L b Top     Area    E-Mod  Spec Wt    Perim  C Index  Wave Sp      EA/c
       ft      in2      ksi   lb/ft3       ft              ft/s    k/ft/s
      0.0    11.45   29000.    492.0      3.1        0    16524.     20.1
     50.0    11.45   29000.    492.0      3.1        0    16524.     20.1

 Wave Travel Time 2L/c (ms)     6.052

        Pile and Soil Model            Total Capacity Rut  (kips)       0.0
No. Weight   Stiffn C-Slk T-Slk  CoR  Soil-S  Soil-D Quake  LbTop Perim    Area
      kips     k/in    ft    ft         kips    s/ft  inch     ft    ft     in2
  1  0.130     8301 0.010 0.000 0.85     0.0   0.000 0.100   3.33   3.1    11.4
  2  0.130     8301 0.000 0.000 1.00     0.0   0.000 0.100   6.67   3.1    11.4
 13  0.130     8301 0.000 0.000 1.00     0.0   0.050 0.100  43.33   3.1    11.4
 15  0.130     8301 0.000 0.000 1.00     0.0   0.050 0.100  50.00   3.1    11.4
Toe                                      0.0   0.150 0.100

     1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
     1.956 kips total reduced pile weight   (g= 32.17 ft/s2)

 PILE, SOIL, ANALYSIS OPTIONS:
 Uniform pile                           Pile Segments: Automatic
 No. of Slacks/Splices               0  Pile Damping           (%)         1
                                        Pile Damping Fact.(k/ft/s)     0.402
 Driveability Analysis
 Soil Damping Option             Smith
 Max No Analysis Iterations          0  Time Increment/Critical         160
 Output Time Interval                1  Analysis Time-Input   (ms)        0
 Output Level: Normal
 Gravity Mass, Pile, Hammer:   32.170    32.170    32.170
 Output Segment Generation: Automatic

    Depth    Stroke  Pressure    Efficy
       ft        ft     Ratio
     9.25      8.21      1.00     0.800


INITIAL STATIC ANALYSIS: Total Wt, Sum(R)     4.5     0.0
 Hammer+Pile Weight > Rult: Pile Runs


INITIAL STATIC ANALYSIS: Total Wt, Sum(R)     4.5     0.0
 Hammer+Pile Weight > Rult: Pile Runs


INITIAL STATIC ANALYSIS: Total Wt, Sum(R)     4.5     0.0
 Hammer+Pile Weight > Rult: Pile Runs


INITIAL STATIC ANALYSIS: Total Wt, Sum(R)     4.5     0.0
 Hammer+Pile Weight > Rult: Pile Runs


INITIAL STATIC ANALYSIS: Total Wt, Sum(R)     4.5     0.0
 Hammer+Pile Weight > Rult: Pile Runs
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CLA-CR314-0.09 - B-2 : 10/16/2013 : re                              03/18/2014
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    Rut   Bl Ct   Stroke (ft) Ten Str   i   t Comp Str   i   t ENTHRU   Bl Rt
   kips    b/ft   down     up     ksi              ksi         kip-ft   b/min
          1           0   8.210000       10.80000
```

CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 18.5
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 296.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
10	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	33.33	3.1	11.5
13	0.130	8301	0.000	0.000	1.00	5.8	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	13.1	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	15.0	0.050	0.100	50.00	3.1	11.4
Toe						262.5	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
18.48	8.21	1.00	0.800

CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
296.4	89.4	7.14	7.11	-6.09	9	19	40.95	15	5	13.9	44.2
296.4	89.4	7.14	7.11	-6.09	9	19	40.95	15	5	13.9	44.2
296.4	89.4	7.14	7.11	-6.09	9	19	40.95	15	5	13.9	44.2
296.4	89.4	7.14	7.11	-6.09	9	19	40.95	15	5	13.9	44.2
296.4	89.4	7.14	7.11	-6.09	9	19	40.95	15	5	13.9	44.2
	1		0	8.210000		10.80000					

CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 18.5
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 45.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
10	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	33.33	3.1	11.5
13	0.130	8301	0.000	0.000	1.00	6.0	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	13.1	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	15.1	0.051	0.100	50.00	3.1	11.4
Toe						11.1	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
18.52	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
45.2	5.1	3.63	3.61	-0.17	4	10	16.39	11	4	13.0	62.0
45.2	5.1	3.63	3.61	-0.16	4	10	16.39	11	4	13.0	62.0
45.2	5.1	3.63	3.61	-0.16	4	10	16.38	11	4	12.9	62.0
45.2	5.1	3.63	3.61	-0.16	4	10	16.39	11	4	12.9	62.0
45.2	5.1	3.63	3.61	-0.20	4	10	16.40	11	4	13.0	62.0

1 0 8.210000 10.80000

CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 19.8
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 52.9

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
10	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	33.33	3.1	11.5
13	0.130	8301	0.000	0.000	1.00	10.5	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	14.0	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	17.4	0.118	0.100	50.00	3.1	11.4
Toe						11.1	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
19.75	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
52.9	6.8	3.87	3.84	-0.42	13	50	17.77	12	4	12.4	59.9
51.5	6.6	3.84	3.81	-0.15	13	50	17.61	12	4	12.5	60.2
51.6	6.6	3.85	3.82	-0.18	13	50	17.63	12	4	12.5	60.1
51.7	6.7	3.85	3.82	-0.19	13	50	17.63	12	4	12.5	60.1
51.9	6.7	3.85	3.82	-0.22	13	50	17.62	12	4	12.4	60.1

1 0 8.210000 10.80000

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CLA-CR314-0.09 - B-2 : 10/16/2013 : re                              03/18/2014
CTL Engineering Inc                                       GRLWEAP Version 2010

 Depth                  (ft)      21.0
 Shaft Gain/Loss Factor          1.000  Toe Gain/Loss Factor           1.000

 PILE PROFILE:
 Toe Area              (in2)   113.090  Pile Type                       Pipe
 Pile Size            (inch)    12.000

  L b Top     Area    E-Mod  Spec Wt    Perim  C Index  Wave Sp      EA/c
       ft      in2      ksi   lb/ft3       ft               ft/s    k/ft/s
     0.0    11.45   29000.    492.0      3.1        0    16524.     20.1
    50.0    11.45   29000.    492.0      3.1        0    16524.     20.1

 Wave Travel Time 2L/c (ms)     6.052

        Pile and Soil Model            Total Capacity Rut  (kips)      60.7
No. Weight   Stiffn C-Slk T-Slk  CoR  Soil-S  Soil-D Quake  LbTop Perim    Area
      kips     k/in    ft    ft         kips    s/ft  inch     ft    ft     in2
  1  0.130     8301 0.010 0.000 0.85     0.0   0.000 0.100   3.33   3.1    11.4
  2  0.130     8301 0.000 0.000 1.00     0.0   0.000 0.100   6.67   3.1    11.4
  9  0.130     8301 0.000 0.000 1.00     0.0   0.050 0.100  30.00   3.1    11.5
 12  0.130     8301 0.000 0.000 1.00     3.0   0.050 0.100  40.00   3.1    11.4
 13  0.130     8301 0.000 0.000 1.00    12.4   0.050 0.100  43.33   3.1    11.4
 14  0.130     8301 0.000 0.000 1.00    14.6   0.050 0.100  46.67   3.1    11.4
 15  0.130     8301 0.000 0.000 1.00    19.6   0.169 0.100  50.00   3.1    11.4
Toe                                     11.1   0.150 0.100

     1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
     1.956 kips total reduced pile weight   (g= 32.17 ft/s2)


    Depth    Stroke  Pressure    Efficy
       ft        ft     Ratio
    20.98      8.21      1.00     0.800
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CLA-CR314-0.09 - B-2 : 10/16/2013 : re                              03/18/2014
CTL Engineering Inc                                       GRLWEAP Version 2010

    Rut   Bl Ct   Stroke (ft) Ten Str   i   t Comp Str   i   t ENTHRU   Bl Rt
   kips    b/ft   down      up     ksi               ksi          kip-ft   b/min
   60.7     8.5   4.09   4.06   -1.23  12  48    18.97  12   4   12.0    58.2
   57.8     7.9   4.02   3.98   -1.04  12  49    18.63  12   4   12.1    58.8
   58.0     8.0   4.02   3.99   -1.06  12  49    18.64  12   4   12.1    58.7
   58.3     8.0   4.03   4.00   -1.09  12  49    18.68  12   4   12.1    58.7
   58.5     8.1   4.04   4.01   -1.11  12  49    18.72  12   4   12.1    58.6
         1           0   8.210000       10.80000
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CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 21.0
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 61.7

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
9	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	30.00	3.1	11.5
12	0.130	8301	0.000	0.000	1.00	3.2	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	12.4	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	14.6	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	19.6	0.170	0.100	50.00	3.1	11.4
Toe						12.0	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
21.02	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
61.7	8.8	4.11	4.08	-1.21	12	48	19.06	12	4	11.9	58.1
58.8	8.1	4.04	4.01	-1.12	12	49	18.74	12	4	12.1	58.6
59.0	8.2	4.05	4.02	-1.14	12	49	18.77	12	4	12.1	58.5
59.3	8.2	4.05	4.02	-1.16	12	49	18.80	12	4	12.0	58.5
59.6	8.3	4.06	4.03	-1.18	12	49	18.84	12	4	12.1	58.4

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CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
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Depth (ft) 22.2
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 64.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
9	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	30.00	3.1	11.5
12	0.130	8301	0.000	0.000	1.00	7.4	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	13.4	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	15.8	0.075	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	15.6	0.176	0.100	50.00	3.1	11.4
Toe						12.0	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
22.25	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
64.2	9.1	4.15	4.12	-1.13	12	47	19.43	12	4	11.8	57.8
61.3	8.5	4.08	4.05	-1.26	12	48	19.12	12	4	12.0	58.2
61.5	8.6	4.09	4.06	-1.25	12	48	19.15	12	4	12.0	58.2
61.8	8.6	4.10	4.07	-1.25	12	48	19.18	12	4	12.0	58.2
62.1	8.7	4.10	4.07	-1.24	12	48	19.19	12	4	12.0	58.1

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CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 23.5
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 66.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
8	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	26.67	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	0.4	0.050	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	11.5	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	14.2	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	18.1	0.135	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	10.5	0.126	0.100	50.00	3.1	11.4
Toe						12.0	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
23.48	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
66.8	9.5	4.19	4.16	-1.10	12	44	19.79	12	4	11.8	57.5
63.8	8.9	4.13	4.10	-1.15	12	47	19.44	12	4	11.8	57.9
64.1	9.0	4.13	4.11	-1.13	12	47	19.48	12	4	11.8	57.9
64.4	9.1	4.14	4.11	-1.12	12	47	19.50	12	4	11.8	57.8
64.6	9.1	4.14	4.12	-1.10	12	47	19.53	12	4	11.8	57.8

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CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
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Depth (ft) 23.5
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 74.5

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
8	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	26.67	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	0.6	0.050	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	11.6	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	14.2	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	18.2	0.137	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	10.5	0.125	0.100	50.00	3.1	11.4
Toe						19.4	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
23.52	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
74.5	11.3	4.35	4.34	-1.21	12	41	20.55	12	4	11.5	56.4
71.5	10.6	4.29	4.27	-1.12	12	42	20.26	12	4	11.6	56.8
71.8	10.7	4.30	4.28	-1.13	12	42	20.30	12	4	11.6	56.7
72.1	10.8	4.30	4.29	-1.13	12	42	20.32	12	4	11.6	56.7
72.3	10.8	4.31	4.29	-1.14	12	42	20.32	12	4	11.6	56.6

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Depth (ft) 26.0
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 101.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
8	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	26.67	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	8.9	0.050	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	13.7	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	16.6	0.097	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	13.9	0.163	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	29.2	0.191	0.100	50.00	3.1	11.4
Toe						19.4	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
26.00	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
101.8	18.5	4.82	4.84	-1.29	11	33	22.63	11	4	10.8	53.5
93.7	16.4	4.69	4.71	-1.12	11	35	22.10	11	4	10.9	54.2
94.4	16.5	4.70	4.72	-1.15	11	34	22.12	11	4	10.9	54.1
95.2	16.8	4.71	4.74	-1.16	11	34	22.19	11	4	10.8	54.0
95.9	16.9	4.73	4.75	-1.18	11	34	22.25	11	4	10.8	54.0

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Depth (ft) 28.5
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 129.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
7	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	23.33	3.1	11.5
10	0.130	8301	0.000	0.000	1.00	5.8	0.050	0.100	33.33	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	13.1	0.050	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	15.0	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	17.4	0.185	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	21.6	0.175	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	36.6	0.200	0.100	50.00	3.1	11.4
Toe						19.4	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
28.48	8.21	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
129.0	25.7	5.24	5.21	-1.02	10	28	24.02	10	4	10.8	51.4
115.9	22.5	5.05	5.06	-1.04	10	30	23.30	10	4	10.7	52.3
117.1	22.8	5.06	5.07	-1.03	10	30	23.37	10	4	10.7	52.2
118.3	22.9	5.13	5.08	-1.00	10	30	23.57	10	4	10.8	52.0
119.4	23.2	5.14	5.09	-0.99	10	30	23.64	10	4	10.8	51.9
	1		0	8.210000		10.80000					

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Depth (ft) 28.5
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 204.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
7	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	23.33	3.1	11.5
10	0.130	8301	0.000	0.000	1.00	6.0	0.050	0.100	33.33	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	13.1	0.050	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	15.1	0.051	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	17.3	0.185	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	22.0	0.176	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	36.5	0.200	0.100	50.00	3.1	11.4
Toe						94.3	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
28.52	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
204.2	47.4	5.97	5.97	-3.75	10	21	27.02	10	6	11.6	48.1
191.0	42.3	5.83	5.81	-3.15	10	22	26.08	10	4	11.4	48.7
192.2	42.8	5.84	5.83	-3.20	10	22	26.11	10	4	11.4	48.7
193.4	43.1	5.86	5.84	-3.26	10	22	26.18	10	4	11.5	48.6
194.6	43.6	5.87	5.86	-3.31	10	22	26.22	10	4	11.5	48.6

1 0 8.210000 10.80000

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CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 35.7
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 254.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
5	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	16.67	3.1	11.4
8	0.130	8301	0.000	0.000	1.00	7.9	0.050	0.100	26.67	3.1	11.5
9	0.130	8301	0.000	0.000	1.00	13.5	0.050	0.100	30.00	3.1	11.5
10	0.130	8301	0.000	0.000	1.00	16.1	0.083	0.100	33.33	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	15.0	0.171	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	26.9	0.187	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	32.9	0.188	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	15.6	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	16.9	0.050	0.100	50.00	3.1	11.4
Toe						109.2	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
35.74	8.21	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
254.1	73.7	6.41	6.41	-4.57	8	19	28.85	5	7	12.1	46.5
240.9	64.9	6.27	6.26	-4.02	8	19	27.59	5	7	11.8	47.1
242.1	65.6	6.28	6.27	-4.07	8	19	27.70	5	7	11.9	47.0
243.3	66.1	6.30	6.28	-4.13	8	19	27.86	5	7	11.9	47.0
244.5	67.2	6.30	6.30	-4.16	8	19	27.93	5	7	11.9	46.9
1		0	8.210000		10.80000						

CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 43.0
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 299.1

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.000	0.100	6.67	3.1	11.4
3	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	10.00	3.1	11.5
6	0.130	8301	0.000	0.000	1.00	10.1	0.050	0.100	20.00	3.1	11.5
7	0.130	8301	0.000	0.000	1.00	13.9	0.050	0.100	23.33	3.1	11.5
8	0.130	8301	0.000	0.000	1.00	17.3	0.114	0.100	26.67	3.1	11.5
9	0.130	8301	0.000	0.000	1.00	12.5	0.151	0.100	30.00	3.1	11.5
10	0.130	8301	0.000	0.000	1.00	32.2	0.195	0.100	33.33	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	29.1	0.173	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	15.8	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	17.2	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	18.5	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	19.8	0.050	0.100	50.00	3.1	11.4
Toe						112.8	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
43.00	8.21	1.00	0.800

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CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
299.1	133.6	6.66	6.69	-4.14	6	17	32.04	6	7	12.3	45.7
285.9	112.1	6.53	6.57	-3.86	6	18	30.85	6	7	12.1	46.1
287.1	113.5	6.54	6.58	-3.89	6	18	30.97	6	7	12.1	46.0
288.3	115.9	6.55	6.59	-3.91	6	18	31.06	6	7	12.1	46.0
289.5	117.6	6.56	6.61	-3.95	6	17	31.17	6	7	12.1	46.0
	1	0	8.210000		10.80000						

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CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 44.0
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 305.3

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	6.67	3.1	11.4
5	0.130	8301	0.000	0.000	1.00	2.0	0.050	0.100	16.67	3.1	11.4
6	0.130	8301	0.000	0.000	1.00	12.1	0.050	0.100	20.00	3.1	11.5
7	0.130	8301	0.000	0.000	1.00	14.5	0.050	0.100	23.33	3.1	11.5
8	0.130	8301	0.000	0.000	1.00	19.0	0.157	0.100	26.67	3.1	11.5
9	0.130	8301	0.000	0.000	1.00	12.7	0.139	0.100	30.00	3.1	11.5
10	0.130	8301	0.000	0.000	1.00	36.6	0.200	0.100	33.33	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	22.7	0.135	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	16.2	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	17.5	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	18.9	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	20.1	0.050	0.100	50.00	3.1	11.4
Toe						112.8	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
44.00	8.21	1.00	0.800

CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
305.3	146.8	6.69	6.71	-3.97	6	17	32.00	6	7	12.3	45.6
292.1	121.7	6.55	6.59	-3.71	6	17	30.87	6	7	12.1	46.0
293.3	125.2	6.56	6.61	-3.71	6	17	30.90	6	7	12.0	46.0
294.5	126.6	6.58	6.61	-3.75	6	17	31.05	6	7	12.1	45.9
295.7	128.5	6.59	6.62	-3.78	6	17	31.17	6	7	12.1	45.9
	1	0	8.210000		10.80000						

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Depth (ft) 45.0
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 311.4

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	6.67	3.1	11.4
5	0.130	8301	0.000	0.000	1.00	5.3	0.050	0.100	16.67	3.1	11.4
6	0.130	8301	0.000	0.000	1.00	13.0	0.050	0.100	20.00	3.1	11.5
7	0.130	8301	0.000	0.000	1.00	14.9	0.050	0.100	23.33	3.1	11.5
8	0.130	8301	0.000	0.000	1.00	17.8	0.182	0.100	26.67	3.1	11.5
9	0.130	8301	0.000	0.000	1.00	20.3	0.171	0.100	30.00	3.1	11.5
10	0.130	8301	0.000	0.000	1.00	36.6	0.200	0.100	33.33	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	16.4	0.066	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	16.6	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	17.9	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	19.2	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	20.4	0.050	0.100	50.00	3.1	11.4
Toe						112.8	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
45.00	8.21	1.00	0.800

CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
311.4	162.2	6.71	6.73	-3.72	6	17	31.88	6	7	12.3	45.5
298.2	133.6	6.57	6.62	-3.43	6	17	30.71	6	7	12.0	45.9
299.4	135.6	6.59	6.62	-3.46	6	17	30.83	6	7	12.1	45.9
300.6	137.7	6.60	6.63	-3.49	6	17	30.93	6	7	12.1	45.9
301.8	139.9	6.61	6.64	-3.52	6	17	31.05	6	7	12.1	45.8
	1	0	8.210000		10.80000						

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CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 46.0
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 317.6

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.000	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	6.67	3.1	11.4
5	0.130	8301	0.000	0.000	1.00	8.9	0.050	0.100	16.67	3.1	11.4
6	0.130	8301	0.000	0.000	1.00	13.7	0.050	0.100	20.00	3.1	11.5
7	0.130	8301	0.000	0.000	1.00	16.6	0.097	0.100	23.33	3.1	11.5
8	0.130	8301	0.000	0.000	1.00	13.9	0.163	0.100	26.67	3.1	11.5
9	0.130	8301	0.000	0.000	1.00	29.2	0.191	0.100	30.00	3.1	11.5
10	0.130	8301	0.000	0.000	1.00	31.2	0.182	0.100	33.33	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	15.7	0.050	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	17.0	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	18.3	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	19.6	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	20.6	0.050	0.100	50.00	3.1	11.4
Toe						112.8	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
46.00	8.21	1.00	0.800

CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
317.6	184.3	6.73	6.74	-3.42	5	16	31.60	6	7	12.2	45.5
304.4	149.8	6.60	6.64	-3.24	5	17	30.46	6	7	12.0	45.8
305.6	150.0	6.61	6.64	-3.28	5	17	30.65	6	7	12.1	45.8
306.8	152.8	6.63	6.65	-3.29	5	17	30.74	6	7	12.1	45.8
308.0	155.4	6.64	6.66	-3.31	5	17	30.85	6	7	12.1	45.7
	1	0	8.210000		10.80000						

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Depth (ft) 47.0
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 323.8

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.050	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	6.67	3.1	11.4
4	0.130	8301	0.000	0.000	1.00	1.0	0.050	0.100	13.33	3.1	11.4
5	0.130	8301	0.000	0.000	1.00	11.7	0.050	0.100	16.67	3.1	11.4
6	0.130	8301	0.000	0.000	1.00	14.3	0.050	0.100	20.00	3.1	11.5
7	0.130	8301	0.000	0.000	1.00	18.5	0.143	0.100	23.33	3.1	11.5
8	0.130	8301	0.000	0.000	1.00	11.2	0.130	0.100	26.67	3.1	11.5
9	0.130	8301	0.000	0.000	1.00	36.6	0.200	0.100	30.00	3.1	11.5
10	0.130	8301	0.000	0.000	1.00	24.8	0.150	0.100	33.33	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	16.1	0.050	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	17.4	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	18.7	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	20.0	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	20.6	0.050	0.100	50.00	3.1	11.4
Toe						112.8	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
47.00	8.21	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
323.8	211.8	6.74	6.76	-3.28	5	16	31.25	6	7	12.2	45.4
310.6	164.1	6.62	6.66	-3.12	5	17	30.25	6	7	12.1	45.8
311.8	170.1	6.63	6.67	-3.11	5	17	30.29	6	7	12.0	45.7
313.0	172.4	6.64	6.68	-3.14	5	17	30.42	6	7	12.1	45.7
314.2	175.1	6.65	6.68	-3.16	5	17	30.53	6	7	12.1	45.7
	1	0	8.210000		10.80000						

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CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 48.0
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 113.090 Pile Type Pipe
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	11.45	29000.	492.0	3.1	0	16524.	20.1
50.0	11.45	29000.	492.0	3.1	0	16524.	20.1

Wave Travel Time 2L/c (ms) 6.052

Pile and Soil Model Total Capacity Rut (kips) 330.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.130	8301	0.010	0.000	0.85	0.0	0.050	0.100	3.33	3.1	11.4
2	0.130	8301	0.000	0.000	1.00	0.0	0.050	0.100	6.67	3.1	11.4
4	0.130	8301	0.000	0.000	1.00	4.2	0.050	0.100	13.33	3.1	11.4
5	0.130	8301	0.000	0.000	1.00	12.7	0.050	0.100	16.67	3.1	11.4
6	0.130	8301	0.000	0.000	1.00	14.8	0.050	0.100	20.00	3.1	11.5
7	0.130	8301	0.000	0.000	1.00	18.7	0.176	0.100	23.33	3.1	11.5
8	0.130	8301	0.000	0.000	1.00	17.3	0.161	0.100	26.67	3.1	11.5
9	0.130	8301	0.000	0.000	1.00	36.6	0.200	0.100	30.00	3.1	11.5
10	0.130	8301	0.000	0.000	1.00	18.5	0.094	0.100	33.33	3.1	11.5
11	0.130	8301	0.000	0.000	1.00	16.5	0.050	0.100	36.67	3.1	11.4
12	0.130	8301	0.000	0.000	1.00	17.8	0.050	0.100	40.00	3.1	11.4
13	0.130	8301	0.000	0.000	1.00	19.1	0.050	0.100	43.33	3.1	11.4
14	0.130	8301	0.000	0.000	1.00	20.3	0.050	0.100	46.67	3.1	11.4
15	0.130	8301	0.000	0.000	1.00	20.6	0.050	0.100	50.00	3.1	11.4
Toe						112.8	0.150	0.100			

1.956 kips total unreduced pile weight (g= 32.17 ft/s2)
1.956 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Stroke ft	Pressure Ratio	Efficy
48.00	8.21	1.00	0.800

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Rut kips	Bl Ct b/ft	Stroke (ft) down	up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
330.0	246.9	6.76	6.77	-2.98	5	16	30.69	6	7	12.2	45.4
316.8	185.6	6.64	6.66	-2.80	5	16	29.72	6	7	12.0	45.8
318.0	193.1	6.65	6.68	-2.80	5	16	29.76	6	7	12.0	45.7
319.2	196.4	6.66	6.68	-2.82	5	16	29.88	6	7	12.0	45.7
320.4	200.0	6.67	6.69	-2.85	5	16	29.99	6	7	12.0	45.7

CLA-CR314-0.09 - B-2 : 10/16/2013 : re 03/18/2014
CTL Engineering Inc GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 1.000 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
9.2	0.0	0.0	0.0	0.0	0.000	0.000	8.21	0.0
18.5	296.4	33.9	262.5	89.4	40.952	-6.094	7.14	13.9
18.5	45.2	34.1	11.1	5.1	16.386	-0.167	3.63	13.0
19.8	52.9	41.8	11.1	6.8	17.769	-0.417	3.87	12.4
21.0	60.7	49.6	11.1	8.5	18.968	-1.230	4.09	12.0
21.0	61.7	49.7	12.0	8.8	19.065	-1.213	4.11	11.9
22.2	64.2	52.2	12.0	9.1	19.433	-1.135	4.15	11.8
23.5	66.8	54.8	12.0	9.5	19.790	-1.101	4.19	11.8
23.5	74.5	55.1	19.4	11.3	20.551	-1.212	4.35	11.5
26.0	101.8	82.3	19.4	18.5	22.629	-1.287	4.82	10.8
28.5	129.0	109.6	19.4	25.7	24.022	-1.019	5.24	10.8
28.5	204.2	109.9	94.3	47.4	27.020	-3.747	5.97	11.6
35.7	254.1	144.9	109.2	73.7	28.851	-4.571	6.41	12.1
43.0	299.1	186.3	112.8	133.6	32.036	-4.136	6.66	12.3
44.0	305.3	192.5	112.8	146.8	32.001	-3.973	6.69	12.3
45.0	311.4	198.6	112.8	162.2	31.876	-3.719	6.71	12.3
46.0	317.6	204.8	112.8	184.3	31.598	-3.421	6.73	12.2
47.0	323.8	211.0	112.8	211.8	31.253	-3.283	6.74	12.2
48.0	330.0	217.2	112.8	246.9	30.694	-2.982	6.76	12.2

Total Driving Time 57 minutes; Total No. of Blows 2629

G/L at Shaft and Toe: 0.813 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
9.2	0.0	0.0	0.0	0.0	0.000	0.000	10.80	0.0
18.5	296.4	33.9	262.5	89.4	40.952	-6.094	7.14	13.9
18.5	45.2	34.1	11.1	5.1	16.393	-0.160	3.63	13.0
19.8	51.5	40.4	11.1	6.6	17.606	-0.148	3.84	12.5
21.0	57.8	46.7	11.1	7.9	18.626	-1.039	4.02	12.1
21.0	58.8	46.8	12.0	8.1	18.740	-1.123	4.04	12.1
22.2	61.3	49.3	12.0	8.5	19.117	-1.256	4.08	12.0
23.5	63.8	51.9	12.0	8.9	19.440	-1.154	4.13	11.8
23.5	71.5	52.1	19.4	10.6	20.264	-1.118	4.29	11.6
26.0	93.7	74.3	19.4	16.4	22.099	-1.118	4.69	10.9
28.5	115.9	96.4	19.4	22.5	23.301	-1.044	5.05	10.7
28.5	191.0	96.7	94.3	42.3	26.076	-3.150	5.83	11.4
35.7	240.9	131.7	109.2	64.9	27.586	-4.018	6.27	11.8
43.0	285.9	173.1	112.8	112.1	30.846	-3.859	6.53	12.1
44.0	292.1	179.3	112.8	121.7	30.867	-3.712	6.55	12.1
45.0	298.2	185.4	112.8	133.6	30.710	-3.426	6.57	12.0
46.0	304.4	191.6	112.8	149.8	30.460	-3.240	6.60	12.0
47.0	310.6	197.8	112.8	164.1	30.253	-3.117	6.62	12.1
48.0	316.8	204.0	112.8	185.6	29.722	-2.802	6.64	12.0

Total Driving Time 49 minutes; Total No. of Blows 2282

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CTL Engineering Inc GRLWEAP Version 2010

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.830 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
9.2	0.0	0.0	0.0	0.0	0.000	0.000	10.80	0.0
18.5	296.4	33.9	262.5	89.4	40.952	-6.094	7.14	13.9
18.5	45.2	34.1	11.1	5.1	16.376	-0.165	3.63	12.9
19.8	51.6	40.5	11.1	6.6	17.631	-0.176	3.85	12.5
21.0	58.0	46.9	11.1	8.0	18.639	-1.063	4.02	12.1
21.0	59.0	47.1	12.0	8.2	18.768	-1.144	4.05	12.1
22.2	61.5	49.6	12.0	8.6	19.148	-1.253	4.09	12.0
23.5	64.1	52.1	12.0	9.0	19.476	-1.134	4.13	11.8
23.5	71.8	52.4	19.4	10.7	20.303	-1.126	4.30	11.6
26.0	94.4	75.0	19.4	16.5	22.124	-1.147	4.70	10.9
28.5	117.1	97.6	19.4	22.8	23.369	-1.025	5.06	10.7
28.5	192.2	97.9	94.3	42.8	26.110	-3.203	5.84	11.4
35.7	242.1	132.9	109.2	65.6	27.705	-4.066	6.28	11.9
43.0	287.1	174.3	112.8	113.5	30.969	-3.895	6.54	12.1
44.0	293.3	180.5	112.8	125.2	30.899	-3.706	6.56	12.0
45.0	299.4	186.6	112.8	135.6	30.827	-3.458	6.59	12.1
46.0	305.6	192.8	112.8	150.0	30.648	-3.278	6.61	12.1
47.0	311.8	199.0	112.8	170.1	30.289	-3.110	6.63	12.0
48.0	318.0	205.2	112.8	193.1	29.757	-2.797	6.65	12.0

Total Driving Time 50 minutes; Total No. of Blows 2311

G/L at Shaft and Toe: 0.847 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
9.2	0.0	0.0	0.0	0.0	0.000	0.000	10.80	0.0
18.5	296.4	33.9	262.5	89.4	40.952	-6.094	7.14	13.9
18.5	45.2	34.1	11.1	5.1	16.391	-0.157	3.63	12.9
19.8	51.7	40.6	11.1	6.7	17.628	-0.193	3.85	12.5
21.0	58.3	47.2	11.1	8.0	18.684	-1.090	4.03	12.1
21.0	59.3	47.3	12.0	8.2	18.803	-1.159	4.05	12.0
22.2	61.8	49.8	12.0	8.6	19.181	-1.247	4.10	12.0
23.5	64.4	52.4	12.0	9.1	19.501	-1.116	4.14	11.8
23.5	72.1	52.6	19.4	10.8	20.321	-1.133	4.30	11.6
26.0	95.2	75.7	19.4	16.8	22.194	-1.161	4.71	10.8
28.5	118.3	98.8	19.4	22.9	23.573	-1.003	5.13	10.8
28.5	193.4	99.1	94.3	43.1	26.178	-3.264	5.86	11.5
35.7	243.3	134.1	109.2	66.1	27.860	-4.126	6.30	11.9
43.0	288.3	175.5	112.8	115.9	31.057	-3.914	6.55	12.1
44.0	294.5	181.7	112.8	126.6	31.050	-3.747	6.58	12.1
45.0	300.6	187.8	112.8	137.7	30.933	-3.492	6.60	12.1
46.0	306.8	194.0	112.8	152.8	30.736	-3.288	6.63	12.1
47.0	313.0	200.2	112.8	172.4	30.422	-3.137	6.64	12.1
48.0	319.2	206.4	112.8	196.4	29.877	-2.821	6.66	12.0

Total Driving Time 50 minutes; Total No. of Blows 2336

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.864 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	Bl Ct bl/ft	Com Str ksi	Ten Str ksi	Stroke ft	ENTHRU kip-ft
9.2	0.0	0.0	0.0	0.0	0.000	0.000	10.80	0.0
18.5	296.4	33.9	262.5	89.4	40.952	-6.094	7.14	13.9
18.5	45.2	34.1	11.1	5.1	16.399	-0.203	3.63	13.0
19.8	51.9	40.8	11.1	6.7	17.624	-0.223	3.85	12.4
21.0	58.5	47.4	11.1	8.1	18.722	-1.112	4.04	12.1
21.0	59.6	47.6	12.0	8.3	18.840	-1.180	4.06	12.1
22.2	62.1	50.1	12.0	8.7	19.190	-1.235	4.10	12.0
23.5	64.6	52.7	12.0	9.1	19.533	-1.097	4.14	11.8
23.5	72.3	52.9	19.4	10.8	20.321	-1.140	4.31	11.6
26.0	95.9	76.5	19.4	16.9	22.254	-1.182	4.73	10.8
28.5	119.4	100.0	19.4	23.2	23.644	-0.987	5.14	10.8
28.5	194.6	100.3	94.3	43.6	26.220	-3.311	5.87	11.5
35.7	244.5	135.3	109.2	67.2	27.933	-4.162	6.30	11.9
43.0	289.5	176.7	112.8	117.6	31.175	-3.948	6.56	12.1
44.0	295.7	182.9	112.8	128.5	31.166	-3.778	6.59	12.1
45.0	301.8	189.0	112.8	139.9	31.054	-3.520	6.61	12.1
46.0	308.0	195.2	112.8	155.4	30.855	-3.306	6.64	12.1
47.0	314.2	201.4	112.8	175.1	30.527	-3.159	6.65	12.1
48.0	320.4	207.6	112.8	200.0	29.990	-2.845	6.67	12.0

Total Driving Time 51 minutes; Total No. of Blows 2366

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Table of Depths Analyzed with Driving System Modifiers

Depth ft	Temp. Length ft	Wait Time hr	Equivalent Stroke ft	Pressure Ratio	Efficy.	Stiffn. Factor	Cushion CoR
9.25	50.00	0.00	8.21	1.00	0.80	1.00	1.00
18.48	50.00	0.00	8.21	1.00	0.80	1.00	1.00
18.52	50.00	0.00	8.21	1.00	0.80	1.00	1.00
19.75	50.00	0.00	8.21	1.00	0.80	1.00	1.00
20.98	50.00	0.00	8.21	1.00	0.80	1.00	1.00
21.02	50.00	0.00	8.21	1.00	0.80	1.00	1.00
22.25	50.00	0.00	8.21	1.00	0.80	1.00	1.00
23.48	50.00	0.00	8.21	1.00	0.80	1.00	1.00
23.52	50.00	0.00	8.21	1.00	0.80	1.00	1.00
26.00	50.00	0.00	8.21	1.00	0.80	1.00	1.00
28.48	50.00	0.00	8.21	1.00	0.80	1.00	1.00
28.52	50.00	0.00	8.21	1.00	0.80	1.00	1.00
35.74	50.00	0.00	8.21	1.00	0.80	1.00	1.00
43.00	50.00	0.00	8.21	1.00	0.80	1.00	1.00
44.00	50.00	0.00	8.21	1.00	0.80	1.00	1.00
45.00	50.00	0.00	8.21	1.00	0.80	1.00	1.00
46.00	50.00	0.00	8.21	1.00	0.80	1.00	1.00
47.00	50.00	0.00	8.21	1.00	0.80	1.00	1.00
48.00	50.00	0.00	8.21	1.00	0.80	1.00	1.00

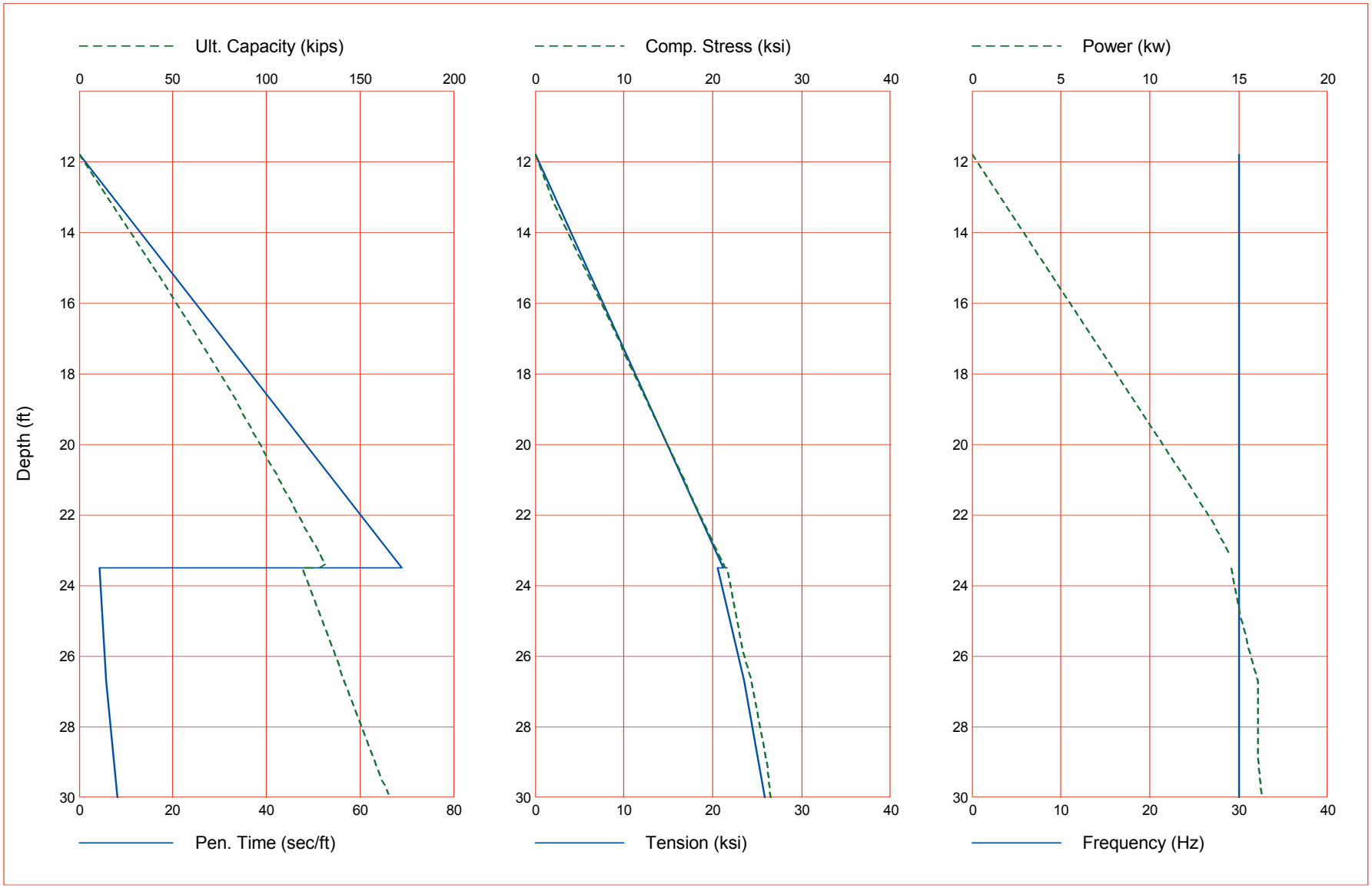
Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.00	0.100	0.100	0.050	0.150	0.000	0.000	0.000
9.01	0.00	0.00	0.100	0.100	0.050	0.150	0.000	0.000	0.000
9.99	0.00	0.00	0.100	0.100	0.050	0.150	0.000	0.000	0.000
10.00	0.93	162.53	0.100	0.100	0.050	0.150	0.000	0.000	0.000
13.99	1.31	227.37	0.100	0.100	0.050	0.150	0.000	0.000	0.000
14.01	1.31	227.61	0.100	0.100	0.050	0.150	0.000	0.000	0.000
18.49	1.51	262.56	0.100	0.100	0.050	0.150	0.000	0.000	0.000
18.51	2.00	11.10	0.100	0.100	0.200	0.150	1.000	0.000	0.000
20.99	2.00	11.10	0.100	0.100	0.200	0.150	1.000	0.000	0.000
21.01	0.63	11.98	0.100	0.100	0.050	0.150	0.000	0.000	0.000
23.49	0.68	11.98	0.100	0.100	0.050	0.150	0.000	0.000	0.000
23.51	3.50	19.43	0.100	0.100	0.200	0.150	1.000	0.000	0.000
28.49	3.50	19.43	0.100	0.100	0.200	0.150	1.000	0.000	0.000
28.51	1.41	94.29	0.100	0.100	0.050	0.150	0.000	0.000	0.000
37.51	1.75	112.80	0.100	0.100	0.050	0.150	0.000	0.000	0.000
43.49	1.97	112.80	0.100	0.100	0.050	0.150	0.000	0.000	0.000
50.00	1.97	112.80	0.100	0.100	0.050	0.150	0.000	0.000	0.000

CTL Engineering Inc
CLA-CR314-0.09 - Sheet Pile

Mar 07 2014
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000



CTL Engineering Inc
CLA-CR314-0.09 - Sheet Pile

Mar 07 2014
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 1.000 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Penetration Time sec/ft	Comp. Stress ksi	Tension Stress ksi	Frequency Hz	Power kw
11.8	0.0	0.0	0.0	0.0	0.000	0.000	30.0	0.0
23.5	132.2	113.3	18.8	68.9	21.389	-21.217	30.0	14.9
23.5	119.0	113.7	5.3	4.3	21.553	-20.572	30.0	14.6
26.7	141.6	136.2	5.4	5.7	24.347	-23.519	30.0	16.1
30.0	166.2	160.6	5.5	8.2	26.494	-25.859	30.0	16.3

GRLWEAP - Version 2010
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins and Associates, Inc.) with cooperation from Pile Dynamics, Inc.
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ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local non-axial stresses and prestress effects must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of building and other factors.

Input File: J:\DEPT5\13 PROJECTS\13050157COL-CEC-CLA-CR314-0.09-BRIDGE 1204 \DESIGN\135157SH.GWW
Hammer File: C:\ProgramData\PDI\GRLWEAP\2010\Resource\HAMMER2003.GW
Hammer File Version: 2003 (3/21/2012)

Input File Contents

```
    CLA-CR314-0.09 - Sheet Pile
 OUT OSG HAM STR FUL PEL  N SPL N-U P-D %SK ISM  0 PHI RSA ITR H-D MXT     DEx
-100   0 776   0   0   0  0   0   0   1   0   0  0   0   0   0   0   0   0.000
    Pile g  Hammer g  Toe Area Pile Size           Pile Type
    32.170    32.170     9.560     0.000          Sheet Pile
      W Cp      A Cp      E Cp      T Cp       CoR      ROut      StCp
     0.800     0.000       0.0     0.000     0.000     0.010       0.0
      A Cu      E Cu      T Cu       CoR      ROut      StCu
     0.000       0.0     0.000     0.000     0.000       0.0
      LPle      APle      EPle      WPle      Peri        CI       CoR      ROut
    30.000      9.56   29000.0   492.000     6.430         0     0.850     0.010
 Manufac  Hmr Name  HmrType No Seg-s
 APE      50E            4        2
    Ecc Wt     Ecc R   MaxFreq    Efficy    Power
     0.233     1.270      30.0     1.000    194.0
  Top Mass  Bot Mass            Stiffness
     0.500     3.000     0.000      12.0       0.0       0.0
    Frequ.    Effic.                       T-Start                        F-Line
   30.0000    0.8000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
       Qs        Qt        Js        Jt        Qx        Jx      Rati      Dept
     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
  Research Soil Model: Atoe, Plug,  Gap, Q-fac
     0.000     0.000     0.000     0.000
  Research Soil Model: RD-skn: m, d, toe: m, d
     0.000     0.000     0.000     0.000
  Res. Distribution
    Dpth    Rskn      Rtoe      Qs      Qt      Js      Jt   SU F    LimD   SU T
    0.01    0.00      0.00    0.10    0.10    0.05    0.15   1.00    0.00    0.0
    9.01    0.00      0.00    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   11.99    0.00      0.00    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   12.00    1.17     12.04    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   13.99    1.36     14.04    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   14.01    1.36     14.05    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   23.01    1.80     18.57    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   23.49    1.82     18.81    0.10    0.10    0.05    0.15   1.00    0.00    0.0
   23.51    1.04      5.29    0.10    0.10    0.05    0.15   1.49    0.00    0.0
   30.00    1.21      5.52    0.10    0.10    0.05    0.15   1.49    0.00    0.0
  Gain/Loss factors: shaft and toe
   1.00000   0.63700   0.67000   0.70300   0.73600
   1.00000   1.00000   1.00000   1.00000   1.00000
      Dpth         L      Wait      Freq      Pmx%      Eff.      Stff       CoR
     11.75      0.00      0.00     0.000     0.000     0.000     0.000     0.000
     23.48      0.00      0.00     0.000     0.000     0.000     0.000     0.000
     23.52      0.00      0.00     0.000     0.000     0.000     0.000     0.000
     26.74      0.00      0.00     0.000     0.000     0.000     0.000     0.000
     30.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
      0.00      0.00      0.00     0.000     0.000     0.000     0.000     0.000
         4            0  0.0000000E+00  0.0000000E+00
```

GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2010
English Units

CLA-CR314-0.09 - Sheet Pile

Hammer Model: 50E Made by: APE

No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.500				
Bottom+Clamp	3.800	12.0	1.000	0.0100	3.0

Top Weight	(kips)	0.50	Bottom Weight+Clamp	(kips)	3.80
Connect. Stiffness	(k/in)	12.00	Connect. Dashpot	(k/ft/s)	3.0
Eccenter Moment	(kips-ft)	0.296			
Maximum Frequency	(1/s)	30.00	Actual Target Frequ.	(1/s)	30.00
Efficiency		0.8000	Rated Power	(kW)	194.0
Line Pull	(kips)	0.0000	Start-Up Time	(s)	0.000

CLA-CR314-0.09 - Sheet Pile 03/07/2014
CTL Engineering Inc GRLWEAP Version 2010

Depth (ft) 11.8
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 9.560 Pile Type Sheet Pile
Pile Size (inch) 0.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	9.56	29000.	492.0	6.4	0	16524.	16.8
30.0	9.56	29000.	492.0	6.4	0	16524.	16.8

Wave Travel Time 2L/c (ms) 3.631

Pile and Soil Model Total Capacity Rut (kips) 0.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.109	6931	0.010	0.000	0.85	0.0	0.000	0.100	3.33	6.4	9.6
2	0.109	6931	0.000	0.000	1.00	0.0	0.000	0.100	6.67	6.4	9.6
6	0.109	6931	0.000	0.000	1.00	0.0	0.050	0.100	20.00	6.4	9.6
9	0.109	6931	0.000	0.000	1.00	0.0	0.050	0.100	30.00	6.4	9.6
Toe						0.0	0.150	0.100			

0.980 kips total unreduced pile weight (g= 32.17 ft/s2)
0.980 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:
Uniform pile Pile Segments: Automatic
No. of Slacks/Splices 0 Pile Damping (%) 1
Pile Damping Fact.(k/ft/s) 0.336

Driveability Analysis
Soil Damping Option Smith
Max No Analysis Iterations 0 Time Increment/Critical 160
Output Time Interval 6 Analysis Time-Input (ms) 0
Output Level: Normal
Gravity Mass, Pile, Hammer: 32.170 32.170 32.170
Output Segment Generation: Automatic

Depth ft	Frequ. 1/s	Efficy
11.750	30.000	0.800

Downward load greater than or equal to resistance

Cent.F: 0. Top F 0. kips; Ratio 0.000 Red.Facs: 0.800 0.000 Frq 0.0 Hz

Downward load greater than or equal to resistance

Cent.F: 0. Top F 0. kips; Ratio 0.000 Red.Facs: 0.800 0.000 Frq 0.0 Hz

Downward load greater than or equal to resistance

Cent.F: 0. Top F 0. kips; Ratio 0.000 Red.Facs: 0.800 0.000 Frq 0.0 Hz

Downward load greater than or equal to resistance

Cent.F: 0. Top F 0. kips; Ratio 0.000 Red.Facs: 0.800 0.000 Frq 0.0 Hz

Downward load greater than or equal to resistance

Cent.F: 0. Top F 0. kips; Ratio 0.000 Red.Facs: 0.800 0.000 Frq 0.0 Hz

Rut kips	Pen.Time s/ft	Freq 1/s	Ten Str ksi	i	t CompStr ksi	i	t Power kW
4		0	0.0000000E+00		0.0000000E+00		

Depth (ft) 23.5
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 9.560 Pile Type Sheet Pile
Pile Size (inch) 0.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	9.56	29000.	492.0	6.4	0	16524.	16.8
30.0	9.56	29000.	492.0	6.4	0	16524.	16.8

Wave Travel Time 2L/c (ms) 3.631

Pile and Soil Model Total Capacity Rut (kips) 132.2

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.109	6931	0.010	0.000	0.85	0.0	0.000	0.100	3.33	6.4	9.6
2	0.109	6931	0.000	0.000	1.00	0.0	0.050	0.100	6.67	6.4	9.6
6	0.109	6931	0.000	0.000	1.00	11.8	0.050	0.100	20.00	6.4	9.6
7	0.109	6931	0.000	0.000	1.00	30.3	0.050	0.100	23.33	6.4	9.6
8	0.109	6931	0.000	0.000	1.00	33.9	0.050	0.100	26.67	6.4	9.6
9	0.109	6931	0.000	0.000	1.00	37.3	0.050	0.100	30.00	6.4	9.6
Toe						18.8	0.150	0.100			

0.980 kips total unreduced pile weight (g= 32.17 ft/s2)
0.980 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Frequ. 1/s	Efficy
23.480	30.000	0.800

Cent.F: 145. Top F 204. kips; Ratio 1.401 Red.Facs: 0.800 0.556 Frq 30.0 Hz

Cent.F: 145. Top F 204. kips; Ratio 1.401 Red.Facs: 0.800 0.556 Frq 30.0 Hz

Cent.F: 145. Top F 204. kips; Ratio 1.401 Red.Facs: 0.800 0.556 Frq 30.0 Hz

Cent.F: 145. Top F 204. kips; Ratio 1.401 Red.Facs: 0.800 0.556 Frq 30.0 Hz

Cent.F: 145. Top F 204. kips; Ratio 1.401 Red.Facs: 0.800 0.556 Frq 30.0 Hz

CLA-CR314-0.09 - Sheet Pile 03/07/2014
CTL Engineering Inc GRLWEAP Version 2010

Rut kips	Pen.Time s/ft	Freq 1/s	Ten Str ksi	i	t	CompStr ksi	i	t	Power kW
132.2	68.940	30.000	-21.22	21463		21.39	21479		14.9
132.2	68.940	30.000	-21.22	21463		21.39	21479		14.9
132.2	68.940	30.000	-21.22	21463		21.39	21479		14.9
132.2	68.940	30.000	-21.22	21463		21.39	21479		14.9
132.2	68.940	30.000	-21.22	21463		21.39	21479		14.9
4		0	0.0000000E+00	0.0000000E+00					

Depth (ft) 23.5
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 9.560 Pile Type Sheet Pile
Pile Size (inch) 0.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	9.56	29000.	492.0	6.4	0	16524.	16.8
30.0	9.56	29000.	492.0	6.4	0	16524.	16.8

Wave Travel Time 2L/c (ms) 3.631

Pile and Soil Model Total Capacity Rut (kips) 119.0

No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.109	6931	0.010	0.000	0.85	0.0	0.000	0.100	3.33	6.4	9.6
2	0.109	6931	0.000	0.000	1.00	0.0	0.050	0.100	6.67	6.4	9.6
6	0.109	6931	0.000	0.000	1.00	12.2	0.050	0.100	20.00	6.4	9.6
7	0.109	6931	0.000	0.000	1.00	30.4	0.050	0.100	23.33	6.4	9.6
8	0.109	6931	0.000	0.000	1.00	33.9	0.050	0.100	26.67	6.4	9.6
9	0.109	6931	0.000	0.000	1.00	37.3	0.050	0.100	30.00	6.4	9.6
Toe						5.3	0.150	0.100			

0.980 kips total unreduced pile weight (g= 32.17 ft/s2)
0.980 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Frequ. 1/s	Efficy
23.520	30.000	0.800

Cent.F: 146. Top F 205. kips; Ratio 1.411 Red.Facs: 0.800 0.557 Frq 30.0 Hz

Cent.F: 146. Top F 205. kips; Ratio 1.410 Red.Facs: 0.800 0.557 Frq 30.0 Hz

Cent.F: 146. Top F 205. kips; Ratio 1.410 Red.Facs: 0.800 0.557 Frq 30.0 Hz

Cent.F: 146. Top F 205. kips; Ratio 1.410 Red.Facs: 0.800 0.557 Frq 30.0 Hz

Cent.F: 146. Top F 205. kips; Ratio 1.411 Red.Facs: 0.800 0.557 Frq 30.0 Hz

Rut kips	Pen.Time s/ft	Freq 1/s	Ten Str ksi	i	t	CompStr ksi	i	t	Power kW
119.0	4.280	30.000	-20.57	21429		21.55	21312		14.6
118.9	4.276	30.000	-20.56	21463		21.55	21312		14.6
119.0	4.276	30.000	-20.56	21463		21.55	21312		14.6
119.0	4.276	30.000	-20.57	21463		21.55	21346		14.6
119.0	4.277	30.000	-20.57	21463		21.55	21312		14.6
4		0	0.0000000E+00	0.0000000E+00					

Depth (ft) 26.7
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 9.560 Pile Type Sheet Pile
Pile Size (inch) 0.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	9.56	29000.	492.0	6.4	0	16524.	16.8
30.0	9.56	29000.	492.0	6.4	0	16524.	16.8

Wave Travel Time 2L/c (ms) 3.631

Total Capacity Rut (kips) 141.6

No.	Pile and Soil Model Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.109	6931	0.010	0.000	0.85	0.0	0.050	0.100	3.33	6.4	9.6
2	0.109	6931	0.000	0.000	1.00	0.0	0.050	0.100	6.67	6.4	9.6
5	0.109	6931	0.000	0.000	1.00	11.2	0.050	0.100	16.67	6.4	9.6
6	0.109	6931	0.000	0.000	1.00	30.2	0.050	0.100	20.00	6.4	9.6
7	0.109	6931	0.000	0.000	1.00	33.8	0.050	0.100	23.33	6.4	9.6
8	0.109	6931	0.000	0.000	1.00	37.3	0.050	0.100	26.67	6.4	9.6
9	0.109	6931	0.000	0.000	1.00	23.7	0.050	0.100	30.00	6.4	9.6
Toe						5.4	0.150	0.100			

0.980 kips total unreduced pile weight (g= 32.17 ft/s2)
0.980 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Frequ. 1/s	Efficy
26.740	30.000	0.800

Cent.F: 144. Top F 231. kips; Ratio 1.605 Red.Facs: 0.800 0.551 Frq 30.0 Hz

Cent.F: 145. Top F 223. kips; Ratio 1.542 Red.Facs: 0.800 0.553 Frq 30.0 Hz

Cent.F: 144. Top F 224. kips; Ratio 1.548 Red.Facs: 0.800 0.553 Frq 30.0 Hz

Cent.F: 144. Top F 224. kips; Ratio 1.554 Red.Facs: 0.800 0.552 Frq 30.0 Hz

Cent.F: 144. Top F 225. kips; Ratio 1.560 Red.Facs: 0.800 0.552 Frq 30.0 Hz

Rut kips	Pen.Time s/ft	Freq 1/s	Ten Str ksi	i	t	CompStr ksi	i	t	Power kW
141.6	5.664	30.000	-23.52	21329		24.35	21311		16.1
133.4	4.981	30.000	-22.54	21429		23.45	21345		15.6
134.1	5.040	30.000	-22.63	21429		23.53	21445		15.6
134.9	5.098	30.000	-22.72	21295		23.61	21478		15.7
135.6	5.158	30.000	-22.81	21295		23.70	21345		15.7
4		0	0.0000000E+00	0.0000000E+00					

Depth (ft) 30.0
Shaft Gain/Loss Factor 1.000 Toe Gain/Loss Factor 1.000

PILE PROFILE:
Toe Area (in2) 9.560 Pile Type Sheet Pile
Pile Size (inch) 0.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	C Index	Wave Sp ft/s	EA/c k/ft/s
0.0	9.56	29000.	492.0	6.4	0	16524.	16.8
30.0	9.56	29000.	492.0	6.4	0	16524.	16.8

Wave Travel Time 2L/c (ms) 3.631

Total Capacity Rut (kips) 166.2

No.	Pile and Soil Model Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.109	6931	0.010	0.000	0.85	0.0	0.050	0.100	3.33	6.4	9.6
2	0.109	6931	0.000	0.000	1.00	0.0	0.050	0.100	6.67	6.4	9.6
4	0.109	6931	0.000	0.000	1.00	10.6	0.050	0.100	13.33	6.4	9.6
5	0.109	6931	0.000	0.000	1.00	30.2	0.050	0.100	16.67	6.4	9.6
6	0.109	6931	0.000	0.000	1.00	33.7	0.050	0.100	20.00	6.4	9.6
7	0.109	6931	0.000	0.000	1.00	37.2	0.050	0.100	23.33	6.4	9.6
8	0.109	6931	0.000	0.000	1.00	24.0	0.050	0.100	26.67	6.4	9.6
9	0.109	6931	0.000	0.000	1.00	25.0	0.050	0.100	30.00	6.4	9.6
Toe						5.5	0.150	0.100			

0.980 kips total unreduced pile weight (g= 32.17 ft/s2)
0.980 kips total reduced pile weight (g= 32.17 ft/s2)

Depth ft	Frequ. 1/s	Efficy
30.000	30.000	0.800

Cent.F: 143. Top F 252. kips; Ratio 1.760 Red.Facs: 0.800 0.547 Frq 30.0 Hz

Cent.F: 144. Top F 239. kips; Ratio 1.661 Red.Facs: 0.800 0.550 Frq 30.0 Hz

Cent.F: 144. Top F 240. kips; Ratio 1.670 Red.Facs: 0.800 0.550 Frq 30.0 Hz

Cent.F: 144. Top F 242. kips; Ratio 1.681 Red.Facs: 0.800 0.550 Frq 30.0 Hz

Cent.F: 144. Top F 243. kips; Ratio 1.691 Red.Facs: 0.800 0.549 Frq 30.0 Hz

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Rut kips	Pen.Time s/ft	Freq 1/s	Ten Str ksi	i	t	CompStr ksi	i	t	Power kW
166.2	8.170	30.000	-25.86	31461		26.49	31477		16.3
149.1	5.919	30.000	-24.30	21461		25.09	21311		15.9
150.6	6.072	30.000	-24.44	21294		25.23	21311		16.0
152.2	6.242	30.000	-24.59	21294		25.36	21477		16.0
153.7	6.409	30.000	-24.74	21461		25.50	21311		16.1

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 1.000 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	PenTime s/ft	CompStr ksi	Ten Str ksi	Power kW
11.8	0.0	0.0	0.0	0.0	0.000	0.000	0.0
23.5	132.2	113.3	18.8	68.9	21.389	-21.217	14.9
23.5	119.0	113.7	5.3	4.3	21.553	-20.572	14.6
26.7	141.6	136.2	5.4	5.7	24.347	-23.519	16.1
30.0	166.2	160.6	5.5	8.2	26.494	-25.859	16.3

Total Driving Time 7 minutes

G/L at Shaft and Toe: 0.637 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	PenTime s/ft	CompStr ksi	Ten Str ksi	Power kW
11.8	0.0	0.0	0.0	0.0	0.000	0.000	0.0
23.5	132.2	113.3	18.8	68.9	21.389	-21.217	14.9
23.5	118.9	113.7	5.3	4.3	21.546	-20.564	14.6
26.7	133.4	128.0	5.4	5.0	23.449	-22.539	15.6
30.0	149.1	143.5	5.5	5.9	25.092	-24.296	15.9

Total Driving Time 7 minutes

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SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.670 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	PenTime s/ft	CompStr ksi	Ten Str ksi	Power kW
11.8	0.0	0.0	0.0	0.0	0.000	0.000	0.0
23.5	132.2	113.3	18.8	68.9	21.389	-21.217	14.9
23.5	119.0	113.7	5.3	4.3	21.547	-20.565	14.6
26.7	134.1	128.7	5.4	5.0	23.534	-22.627	15.6
30.0	150.6	145.1	5.5	6.1	25.228	-24.436	16.0

Total Driving Time 7 minutes

G/L at Shaft and Toe: 0.703 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	PenTime s/ft	CompStr ksi	Ten Str ksi	Power kW
11.8	0.0	0.0	0.0	0.0	0.000	0.000	0.0
23.5	132.2	113.3	18.8	68.9	21.389	-21.217	14.9
23.5	119.0	113.7	5.3	4.3	21.548	-20.566	14.6
26.7	134.9	129.5	5.4	5.1	23.615	-22.716	15.7
30.0	152.2	146.7	5.5	6.2	25.363	-24.585	16.0

Total Driving Time 7 minutes

SUMMARY OVER DEPTHS

G/L at Shaft and Toe: 0.736 1.000

Depth ft	Rut kips	Frictn kips	End Bg kips	PenTime s/ft	CompStr ksi	Ten Str ksi	Power kW
11.8	0.0	0.0	0.0	0.0	0.000	0.000	0.0
23.5	132.2	113.3	18.8	68.9	21.389	-21.217	14.9
23.5	119.0	113.7	5.3	4.3	21.548	-20.567	14.6
26.7	135.6	130.2	5.4	5.2	23.698	-22.813	15.7
30.0	153.7	148.2	5.5	6.4	25.500	-24.741	16.1

Total Driving Time 7 minutes

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Table of Depths Analyzed with Driving System Modifiers

Depth ft	Length ft	Wait Time hr	Frequ. l/s	Efficiency
11.75	30.00	0.00	30.00	1.00
23.48	30.00	0.00	30.00	1.00
23.52	30.00	0.00	30.00	1.00
26.74	30.00	0.00	30.00	1.00
30.00	30.00	0.00	30.00	1.00

Soil Layer Resistance Values

Depth ft	Shaft Res. k/ft2	End Bearing kips	Shaft Quake inch	Toe Quake inch	Shaft Damping s/ft	Toe Damping s/ft	Soil Setup Normlzd	Limit Distance ft	Setup Time hrs
0.01	0.00	0.00	0.100	0.100	0.050	0.150	0.000	0.000	0.000
9.01	0.00	0.00	0.100	0.100	0.050	0.150	0.000	0.000	0.000
11.99	0.00	0.00	0.100	0.100	0.050	0.150	0.000	0.000	0.000
12.00	1.17	12.04	0.100	0.100	0.050	0.150	0.000	0.000	0.000
13.99	1.36	14.04	0.100	0.100	0.050	0.150	0.000	0.000	0.000
14.01	1.36	14.05	0.100	0.100	0.050	0.150	0.000	0.000	0.000
23.01	1.80	18.57	0.100	0.100	0.050	0.150	0.000	0.000	0.000
23.49	1.82	18.81	0.100	0.100	0.050	0.150	0.000	0.000	0.000
23.51	1.04	5.29	0.100	0.100	0.050	0.150	1.000	0.000	0.000
30.00	1.21	5.52	0.100	0.100	0.050	0.150	1.000	0.000	0.000