PROJECT REPORT

TO: ENVIRONMENTAL EVALUATION COMMITTEE

AGENDA DATE: February 27, 2020

FROM: PLANNING & DEVELOPMENT SERVICES

AGENDA TIME 1:30 PM/ No. 2

PROJECT TYPE: IS#19-0032; Lack Road Bridge Replacement SUPERVISORY DISTRICT #3

LOCATION: 6143 Lack Road APN: 020-150-031-001

Brawley, CA 92227 PARCEL SIZE: +/- 21.79 acres

GENERAL PLAN (existing) Agriculture GENERAL PLAN (proposed) N/A

ZONE (existing) A-3 (Heavy Agriculture) ZONE (proposed) N/A

GENERAL PLAN FINDINGS ☒ CONSISTENT ☐ INCONSISTENT ☐ MAY BE/FINDINGS

PLANNING COMMISSION DECISION: HEARING DATE: _____

☐ APPROVED ☐ DENIED ☐ OTHER

PLANNING DIRECTORS DECISION: HEARING DATE: _____

☐ APPROVED ☐ DENIED ☐ OTHER

ENVIROMENTAL EVALUATION COMMITTEE DECISION: HEARING DATE: 02/27/2020

INITIAL STUDY: 19-0032

☐ NEGATIVE DECLARATION ☐ MITIGATED NEG. DECLARATION ☐ EIR

DEPARTMENTAL REPORTS / APPROVALS:

PUBLIC WORKS	☒ NONE	☐ ATTACHED
AG	☒ NONE	☐ ATTACHED
APCD	☐ NONE	☒ ATTACHED
E.H.S.	☒ NONE	☐ ATTACHED
FIRE / OES	☒ NONE	☐ ATTACHED
SHERIFF.	☒ NONE	☐ ATTACHED
OTHER	Quechan, Campo Band of Mission Indians	

REQUESTED ACTION:

(See Attached)

Planning & Development Services
801 MAIN ST., EL CENTRO, CA 92243 442-265-1736
(Jim Minnick, Director)

☐ NEGATIVE DECLARATION
☐ MITIGATED NEGATIVE DECLARATION

Initial Study & Environmental Analysis
For:

(County Project Number 6421)
Lack Road Bridge Replacement Project

Prepared By:

COUNTY OF IMPERIAL
Planning & Development Services Department
801 Main Street
El Centro, CA 92243
(442) 265-1736
www.icpds.com

Environmental Intelligence, LLC
1590 South Coast Highway, Suite 17
Laguna Beach, CA 92651

February 2020

TABLE OF CONTENTS

EXHIBITS

APPENDICES

ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
AB	Assembly Bill
API	Area of Potential Impacts
AQMP	Air Quality Management Plan
BMP	Best Management Practice
BSA	Biological Study Area
BUOW	Burrowing Owl
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CAL FIRE	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFC	Chlorofluorocarbons
CFGC	California Fish and Game Code
CGP	Construction General Permit
CH_4	Methane
CHRIS	California Historical Resources Information System
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRRWQCB	Colorado River Regional Water Quality Control Board
dB	Decibel
dBA	A-Weighted Decibel
DPR	California Department of Parks and Recreation
DTSC	Department of Toxic Substances Control
EI	Environmental Intelligence, LLC
EIR	Environmental Impact Report
ESA	Environmentally Sensitive Area
FEMA	Federal Emergency Management Agency
FTA	Federal Transit Administration
GHG	Greenhouse Gas
GPS	Global Positioning System
HCP	Habitat Conservation Plan
HFC	Hydrofluorocarbon
ICAPCD	Imperial County Air Pollution Control District
ICFD	Imperial County Fire Department
ICPDS	Imperial County Planning & Development Services Department

ICSO	Imperial County Sheriff's Office
IID	Imperial Irrigation District
IS	Initial Study
Leq	Equivalent Noise Level
LRA	Local Responsibility Area
MM	Mitigation Measure
MND	Mitigated Negative Declaration
MPH	Miles per Hour
MSL	Mean Sea Level
N2O	Nitrous Oxide
NO2	Nitrogen Dioxide
NAAQS	National Ambient Air Quality Standards
NCCP	Natural Community Conservation Plan
ND	Negative Declaration
NF3	Nitrogen Trifluoride
NHD	National Hydrography Dataset
NPDES	National Pollutant Discharge Elimination System
NRHP	National Registrar of Historic Places
NWI	National Wetlands Inventory
O3	Ozone
OEHHA	Office of Environmental Health Hazard Assessment
OPR	California Governor's Office of Planning and Research
PFC	Perfluorocarbon
PM	Particulate Matter
PPV	Peak Particle Velocity
QI	Quaternary Lake Sediments
RACT SIP	Reasonable Available Control Technology State Implementation Plan
SCAG	Southern California Association of Governments
SCIC	South Coastal Information Center
SF6	Sulfur Hexafluoride
SIP	State Implementation Plan
SO2	Sulfur Dioxide
SR	State Route
SSAB	Salton Sea Air Basin
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	Toxic Air Contaminant
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	U.S. Geological Survey
VHFHSZ	Very High Fire Hazard Severity Zones

VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

SECTION 1
INTRODUCTION

A. PURPOSE

This document is a ☐ policy-level, ☒ project level Initial Study for evaluation of potential environmental impacts resulting with the proposed Lack Road Bridge Replacement Project (Refer to Exhibit 1, *Regional Vicinity*, & 2, *Project Location*).

B. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) REQUIREMENTS AND THE IMPERIAL COUNTY'S GUIDELINES FOR IMPLEMENTING CEQA

As defined by Section 15063 of the State California Environmental Quality Act (CEQA) Guidelines and Section 7 of the County's "CEQA Regulations Guidelines for the Implementation of CEQA, as amended", an **Initial Study** is prepared primarily to provide the Lead Agency with information to use as the basis for determining whether an Environmental Impact Report (EIR), Negative Declaration, or Mitigated Negative Declaration would be appropriate for providing the necessary environmental documentation and clearance for any proposed project.

☐ According to Section 15065, an **EIR** is deemed appropriate for a particular proposal if the following conditions occur:

- The proposal has the potential to substantially degrade quality of the environment.
- The proposal has the potential to achieve short-term environmental goals to the disadvantage of long-term environmental goals.
- The proposal has possible environmental effects that are individually limited but cumulatively considerable.
- The proposal could cause direct or indirect adverse effects on human beings.

☐ According to Section 15070(a), a **Negative Declaration** is deemed appropriate if the proposal would not result in any significant effect on the environment.

☐ According to Section 15070(b), a **Mitigated Negative Declaration** is deemed appropriate if it is determined that though a proposal could result in a significant effect, mitigation measures are available to reduce these significant effects to insignificant levels.

This Initial Study has determined that the proposed applications will not result in any potentially significant environmental impacts and therefore, a Negative Declaration is deemed as the appropriate document to provide necessary environmental evaluations and clearance as identified hereinafter.

This Initial Study and Negative Declaration are prepared in conformance with the California Environmental Quality Act of 1970, as amended (Public Resources Code, Section 21000 et. seq.); Section 15070 of the State & County of Imperial's Guidelines for Implementation of the California Environmental Quality Act of 1970, as amended (California Code of Regulations, Title 14, Chapter 3, Section 15000, et. seq.); applicable requirements of the County of Imperial; and the regulations, requirements, and procedures of any other responsible public agency or an agency with jurisdiction by law.

Pursuant to the County of Imperial Guidelines for Implementing CEQA, depending on the project scope, the County of Imperial Board of Supervisors, Planning Commission and/or Planning Director is designated the Lead Agency, in accordance with Section 15050 of the CEQA Guidelines. The Lead Agency is the public agency which has the

principal responsibility for approving the necessary environmental clearances and analyses for any project in the County.

C. INTENDED USES OF INITIAL STUDY AND NEGATIVE DECLARATION

This Initial Study and Negative Declaration are informational documents which are intended to inform County of Imperial decision makers, other responsible or interested agencies, and the general public of potential environmental effects of the proposed applications. The environmental review process has been established to enable public agencies to evaluate environmental consequences and to examine and implement methods of eliminating or reducing any potentially adverse impacts. While CEQA requires that consideration be given to avoiding environmental damage, the Lead Agency and other responsible public agencies must balance adverse environmental effects against other public objectives, including economic and social goals.

The Initial Study and Negative Declaration, prepared for the project will be circulated for a period of 20 days (*30-days if submitted to the State Clearinghouse for a project of area-wide significance*) for public and agency review and comments. At the conclusion, if comments are received, the County Planning & Development Services Department will prepare a document entitled "Responses to Comments" which will be forwarded to any commenting entity and be made part of the record within 10-days of any project consideration.

D. CONTENTS OF INITIAL STUDY & NEGATIVE DECLARATION

This Initial Study is organized to facilitate a basic understanding of the existing setting and environmental implications of the proposed applications.

SECTION 1

I. INTRODUCTION presents an introduction to the entire report. This section discusses the environmental process, scope of environmental review, and incorporation by reference documents.

SECTION 2

II. ENVIRONMENTAL CHECKLIST FORM contains the County's Environmental Checklist Form. The checklist form presents results of the environmental evaluation for the proposed applications and those issue areas that would have either a significant impact, potentially significant impact, or no impact.

PROJECT SUMMARY, LOCATION AND EVIRONMENTAL SETTINGS describes the proposed project entitlements and required applications. A description of discretionary approvals and permits required for project implementation is also included. It also identifies the location of the project and a general description of the surrounding environmental settings.

ENVIRONMENTAL ANALYSIS evaluates each response provided in the environmental checklist form. Each response checked in the checklist form is discussed and supported with sufficient data and analysis as necessary. As appropriate, each response discussion describes and identifies specific impacts anticipated with project implementation.

SECTION 3

III. MANDATORY FINDINGS presents Mandatory Findings of Significance in accordance with Section 15065 of the CEQA Guidelines.

IV. PERSONS AND ORGANIZATIONS CONSULTED identifies those persons consulted and involved in preparation of this Initial Study and Negative Declaration.

V. REFERENCES lists bibliographical materials used in preparation of this document.

VI. NEGATIVE DECLARATION – COUNTY OF IMPERIAL

VII. FINDINGS

SECTION 4

VIII. RESPONSE TO COMMENTS (IF ANY)

IX. MITIGATION MONITORING & REPORTING PROGRAM (MMRP) (IF ANY)

E. SCOPE OF ENVIRONMENTAL ANALYSIS

For evaluation of environmental impacts, each question from the Environmental Checklist Form is summarized and responses are provided according to the analysis undertaken as part of the Initial Study. Impacts and effects will be evaluated and quantified, when appropriate. To each question, there are four possible responses, including:

1. **No Impact:** A "No Impact" response is adequately supported if the impact simply does not apply to the proposed applications.

2. **Less Than Significant Impact:** The proposed applications will have the potential to impact the environment. These impacts, however, will be less than significant; no additional analysis is required.

3. **Less Than Significant With Mitigation Incorporated:** This applies where incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact".

4. **Potentially Significant Impact:** The proposed applications could have impacts that are considered significant. Additional analyses and possibly an EIR could be required to identify mitigation measures that could reduce these impacts to less than significant levels.

F. POLICY-LEVEL or PROJECT LEVEL ENVIRONMENTAL ANALYSIS

This Initial Study and Negative Declaration will be conducted under a ☐ policy-level, ☒ project level analysis. Regarding mitigation measures, it is not the intent of this document to "overlap" or restate conditions of approval that are commonly established for future known projects or the proposed applications. Additionally, those other standard requirements and regulations that any development must comply with, that are outside the County's jurisdiction, are also not considered mitigation measures and therefore, will not be identified in this document.

G. TIERED DOCUMENTS AND INCORPORATION BY REFERENCE

Information, findings, and conclusions contained in this document are based on incorporation by reference of tiered documentation, which are discussed in the following section.

1. Tiered Documents

As permitted in Section 15152(a) of the CEQA Guidelines, information and discussions from other documents can be included into this document. Tiering is defined as follows:

"Tiering refers to using the analysis of general matters contained in a broader EIR (such as the one prepared for a general plan or policy statement) with later EIRs and negative declarations on narrower projects;

incorporating by reference the general discussions from the broader EIR; and concentrating the later EIR or negative declaration solely on the issues specific to the later project."

Tiering also allows this document to comply with Section 15152(b) of the CEQA Guidelines, which discourages redundant analyses, as follows:

"Agencies are encouraged to tier the environmental analyses which they prepare for separate but related projects including the general plans, zoning changes, and development projects. This approach can eliminate repetitive discussion of the same issues and focus the later EIR or negative declaration on the actual issues ripe for decision at each level of environmental review. Tiering is appropriate when the sequence of analysis is from an EIR prepared for a general plan, policy or program to an EIR or negative declaration for another plan, policy, or program of lesser scope, or to a site-specific EIR or negative declaration."

Further, Section 15152(d) of the CEQA Guidelines states:

"Where an EIR has been prepared and certified for a program, plan, policy, or ordinance consistent with the requirements of this section, any lead agency for a later project pursuant to or consistent with the program, plan, policy, or ordinance should limit the EIR or negative declaration on the later project to effects which:

(1) Were not examined as significant effects on the environment in the prior EIR; or

(2) Are susceptible to substantial reduction or avoidance by the choice of specific revisions in the project, by the imposition of conditions, or other means."

2. Incorporation By Reference

Incorporation by reference is a procedure for reducing the size of EIRs/MND and is most appropriate for including long, descriptive, or technical materials that provide general background information, but do not contribute directly to the specific analysis of the project itself. This procedure is particularly useful when an EIR or Negative Declaration relies on a broadly-drafted EIR for its evaluation of cumulative impacts of related projects (*Las Virgenes Homeowners Federation v. County of Los Angeles* [1986, 177 Ca.3d 300]). If an EIR or Negative Declaration relies on information from a supporting study that is available to the public, the EIR or Negative Declaration cannot be deemed unsupported by evidence or analysis (*San Francisco Ecology Center v. City and County of San Francisco* [1975, 48 Ca.3d 584, 595]). This document incorporates by reference appropriate information from the "Final Environmental Impact Report and Environmental Assessment for the "County of Imperial General Plan EIR" prepared by Brian F. Mooney Associates in 1993 and updates.

When an EIR or Negative Declaration incorporates a document by reference, the incorporation must comply with Section 15150 of the CEQA Guidelines as follows:

- The incorporated document must be available to the public or be a matter of public record (CEQA Guidelines Section 15150[a]). The General Plan EIR and updates are available, along with this document, at the County of Imperial Planning & Development Services Department, 801 Main Street, El Centro, CA 92243 Ph. (442) 265-1736.

- This document must be available for inspection by the public at an office of the lead agency (CEQA Guidelines Section 15150[b]). These documents are available at the County of Imperial Planning & Development Services Department, 801 Main Street, El Centro, CA 92243 Ph. (442) 265-1736.

- These documents must summarize the portion of the document being incorporated by reference or briefly describe information that cannot be summarized. Furthermore, these documents must describe the

relationship between the incorporated information and the analysis in the tiered documents (CEQA Guidelines Section 15150[c]). As discussed above, the tiered EIRs address the entire project site and provide background and inventory information and data which apply to the project site. Incorporated information and/or data will be cited in the appropriate sections.

- These documents must include the State identification number of the incorporated documents (CEQA Guidelines Section 15150[d]). The State Clearinghouse Number for the County of Imperial General Plan EIR is SCH #93011023.

- The material to be incorporated in this document will include general background information (CEQA Guidelines Section 15150[f]). This has been previously discussed in this document.

SECTION 2

II. Environmental Checklist

1. **Project Title**: Imperial County Public Works Department Lack Road Bridge Replacement Project

2. **Lead Agency**: Imperial County Planning & Development Services Department (ICPDS)

3. **Contact person and phone number**: Mariela Moran, Planner II, (442)265-1736, ext. 1747

4. **Address**: 801 Main Street, El Centro CA, 92243

5. **E-mail**: marielamoran@co.imperial.ca.us

6. **Project location**: The proposed application, referred to herein as "the Proposed Project", is located approximately 5.8 miles northwest of the City of Westmorland where Lack Road crosses the New River at bridge No. 58C0101 in Imperial County, California (Exhibit 1, *Regional Vicinity*). The existing bridge is a seven (7) span, simply supported untreated DF stringers bridge with laminated timber decking and AC cover, supported by treated timber pile bents and pile bent abutments with timber seating walls that runs north and south over the New River. The existing bridge is approximately 106 feet in length and 27 feet wide. The approximate limits of the Proposed Project area would extend along Lack Road from approximately 300 feet south to 350 feet north of the New River. Lack Road is a north/south road that supports direct access from State Route (SR-) 86 to Imperial County Route S-30. The Proposed Project is located 0.3 mile south of Vail Road and 0.2 mile north of Foulds Road (Exhibit 2, *Project Location*).

7. **Project sponsor's name and address**: Imperial County Public Works Department, 155 S. 11th Street, El Centro, CA 92243

8. **General Plan designation**: The area surrounding the Proposed Project site is characterized as agricultural land uses. Lack Road is a farm to market road with two (2) traffic lanes, one (1) traveling in each direction. The Proposed Project is surrounded by land zoned as Heavy Agriculture (A-3) with a general plan designation of Agriculture (County of Imperial, 2019a, 2019b; Exhibits 3 and 4, *General Plan and Land Use Designation Map and Zoning Map*). The Proposed Project would construct a new improved bridge structure in place of the existing bridge where it crosses the New River. The Proposed Project is consistent with both the Imperial County General Plan's land use designation of the Proposed Project site and the County's Land Use Ordinance.

9. **Zoning**: See General Plan designation, above.

10. **Description of project**: Due to severe deterioration of some of the pile supports, the existing bridge has been closed to traffic (inactive) for over one (1) year. The County Public Works Department (Applicant) proposes to replace the existing seven (7) span timber bridge with a new precast concrete bridge designed to current American Association of State Highway and Transportation Officials (AASHTO) standards with California amendments (Exhibits 5 and 6, *Site Plan and Typical Section*). The proposed new bridge design would consist of a single-span bridge with four (4) precast/prestressed bulb-tee girders supported on two (2) abutments. The new bridge dimensions would be 35 feet and 6 inches wide by 125 feet long, with a structure depth of 7 feet and 0.875 inches. The selection of a precast bridge structure would eliminate the need for construction to take place within the New River.

The proposed roadway would remain a single travel lane in each direction, and geometry for the Proposed Project would be based on applicable County and AASHTO standards. The new bridge would be reconstructed in the same alignment with two (2) 12-foot-wide lanes designed for a 55 mile per hour (mph) vehicular speed. Shoulder widths would be 4 feet on the bridge, and would transition to the existing width at the roadway conform points. The new bridge would be designed to withstand a 100-year flood event.

The existing bridge would be removed without having to enter the New River as all construction activities were designed to take place from the river banks. It is estimated that the Proposed Project would be constructed over a nine (9)-month period beginning in March 2020 and concluding in November 2020.

11. **Surrounding land uses and setting**: Briefly describe the project's surroundings: The topography of the Proposed Project area is relatively flat with a gentle gradient downward to the northwest (Exhibit 7, *USGS Topographic Map*).

The elevation at the Proposed Project site is approximately 215 feet below Mean Sea Level (MSL). The New River flows beneath the existing bridge and the natural river's banks support limited wetland and riparian vegetation, which is primarily comprised of salt cedar (*Tamarix spp.*) and iodine bush (*Allenrolfea occidentalis*). Agricultural land surrounds the Proposed Project site with an Imperial Irrigation District (IID) culvert to the east that empties into the New River. Vail Road is located approximately 0.3 mile north of the Proposed Project site, while Foulds Road is located approximately 0.2 mile south of the Proposed Project site. The nearest sensitive receptors (residences) are approximately 1.1 miles south and 1.9 miles northeast of the Proposed Project.

12. **Other public agencies whose approval is required** (e.g., permits, financing approval, or participation agreement.): Planning Commission

13. **Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1?**

Note: Conducting consultation early in the CEQA process allows tribal governments, lead agencies, and project proponents to discuss the level of environmental review, identify and address potential adverse impacts to tribal cultural resources, and reduce the potential for delay and conflict in the environmental review process. (See Public Resources Code, Section 21080.3.2). Information may also be available from the California Native American Heritage Commission's Sacred Lands File per Public Resources Code, Section 5097.96 and the California Historical Resources Information System administered by the California Office of Historic Preservation. Please also note that Public Resources Code, Section 21082.3 (c) contains provisions specific to confidentiality.

The lead CEQA agency must begin the Assembly Bill (AB) 52 consultation process prior to the release of a ND, MND, or EIR. The AB 52 consultation process shall begin with the Lead Agency (ICPDS) providing written notification to California Native American Tribes who identify as being traditionally and culturally affiliated with the Proposed Project area. The written notification includes a brief description of the Proposed Project, including the location, the Lead Agency's contact information, and notification that the California Native American Tribe has 30 days to request consultation, per AB 52. Upon receipt of a written response from a California Native American Tribe requesting consultation, the Lead Agency and the California Native American Tribe(s) requesting consultation shall begin AB 52 consultation. AB 52 consultation notification letter was sent by the ICPDS on December 10, 2019. Response comment letters were received from the Quechan Indian Tribe (via email) on December 13, 2019, December 23, 2019 and February 2, 2020. The comments provided by the Quechan Indian Tribe have been acknowledged by the ICPDS and the Cultural Resources Survey Report (see Appendix D).

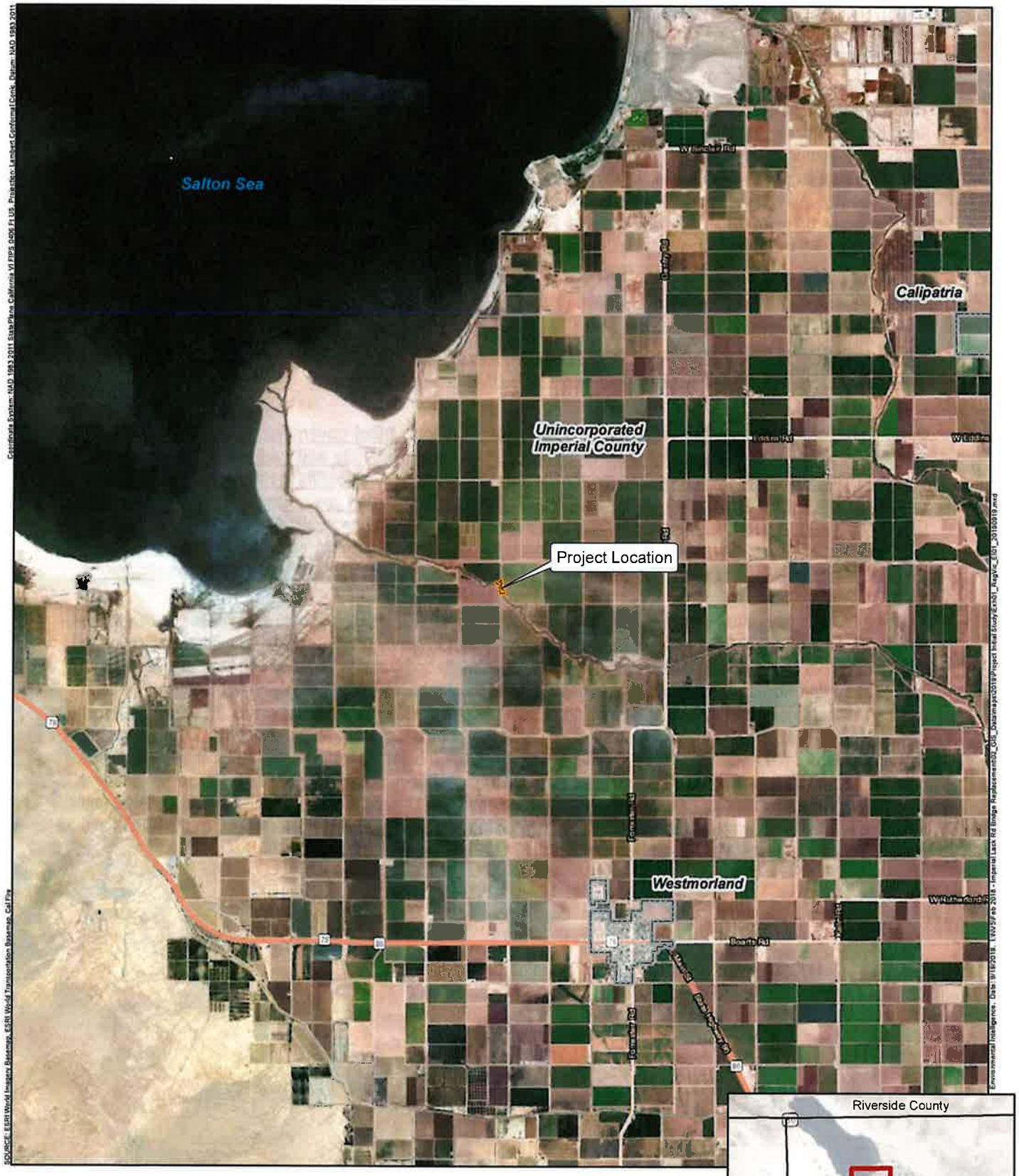


EXHIBIT 1: REGIONAL VICINITY

LACK ROAD BRIDGE REPLACEMENT | IMPERIAL COUNTY, CA

Proposed Project Site

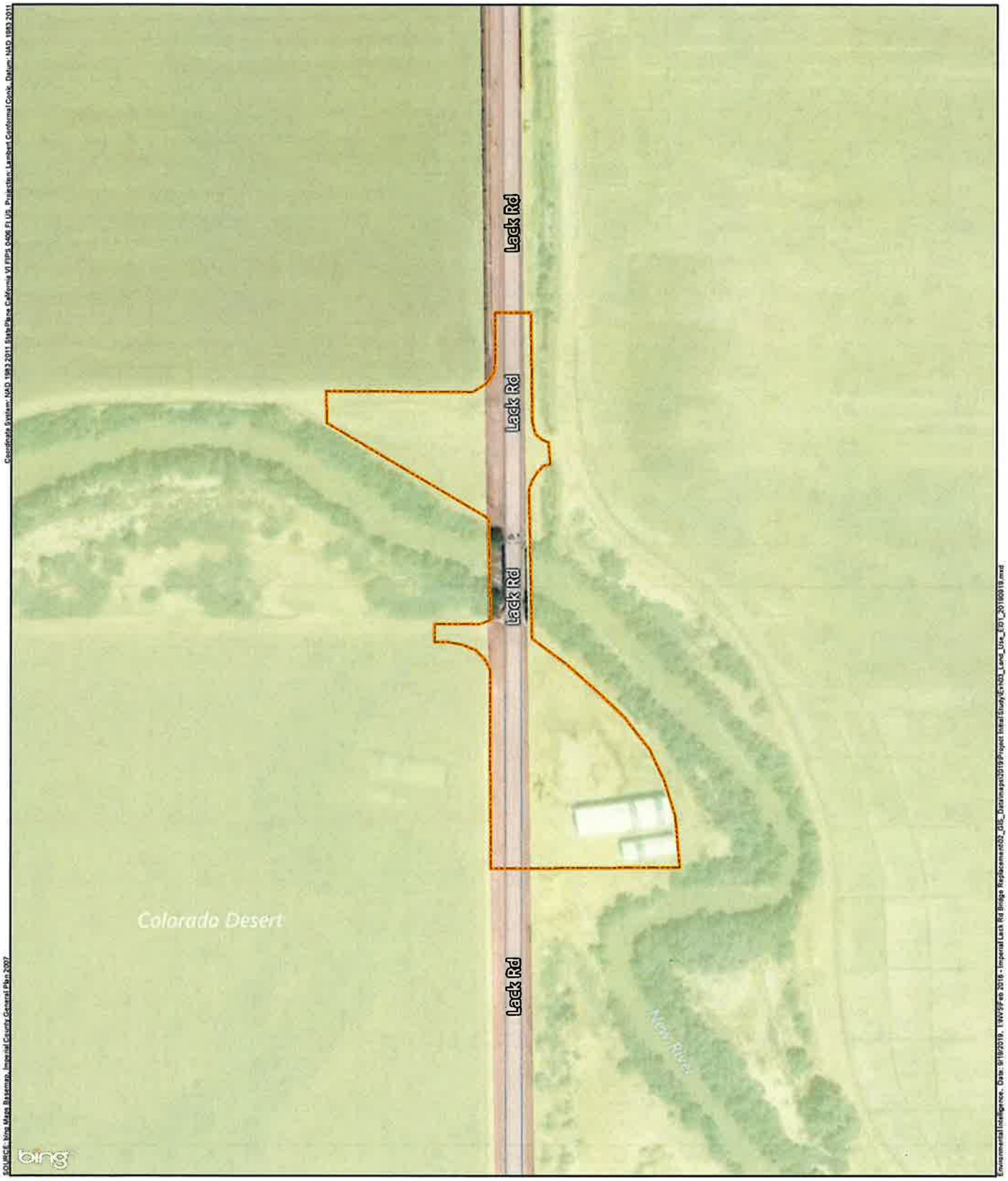
N
W
E
S

0 250 500 Feet

1:3,000 1 in = 250 feet

EXHIBIT 2: PROJECT LOCATION

LACK ROAD BRIDGE REPLACEMENT | IMPERIAL COUNTY, CA



Proposed Project Site

Land Use

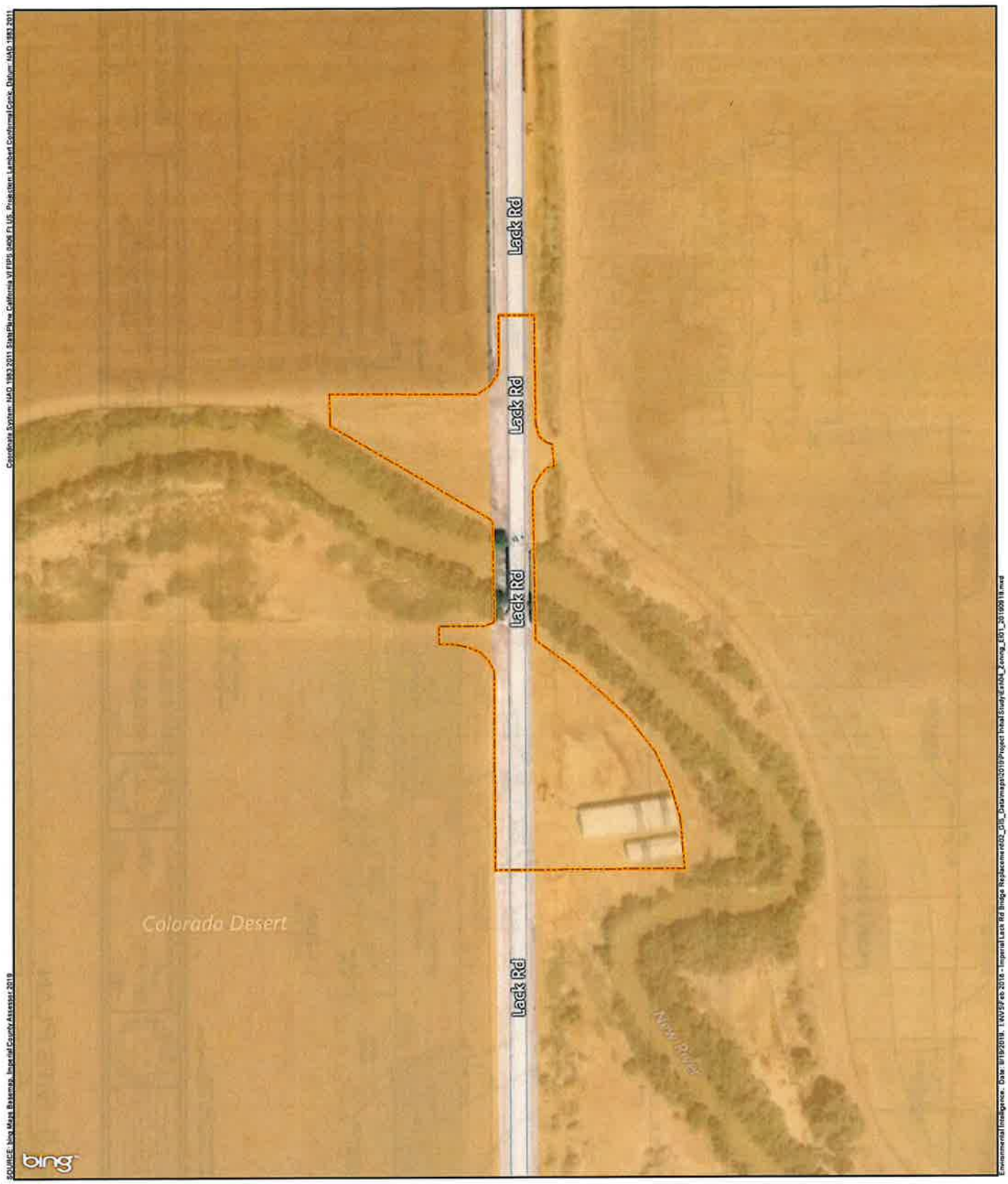
Agriculture

0 200 400 Feet

1:2,400 1 in = 200 feet

EXHIBIT 3: GENERAL PLAN AND LAND USE DESIGNATION MAP

LACK ROAD BRIDGE REPLACEMENT | IMPERIAL COUNTY, CA



Proposed Project Site

Zoning

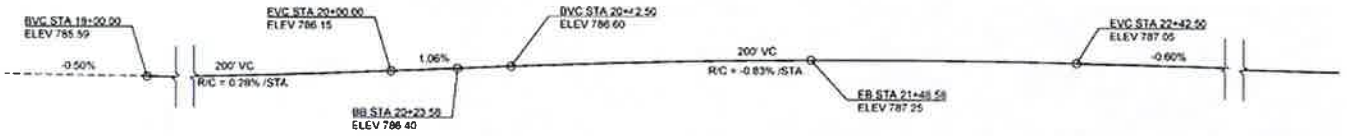
Heavy Agriculture

0 200 400 Feet

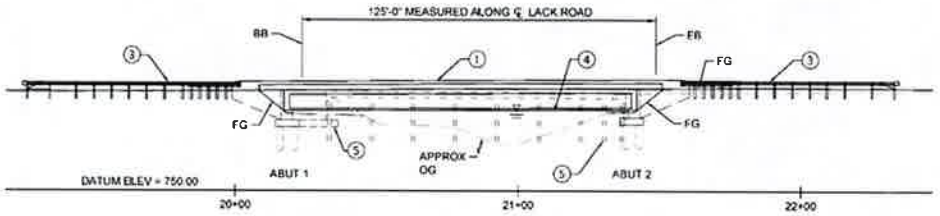
1:2,400 1 in = 200 feet

Exhibit 4: Zoning Map

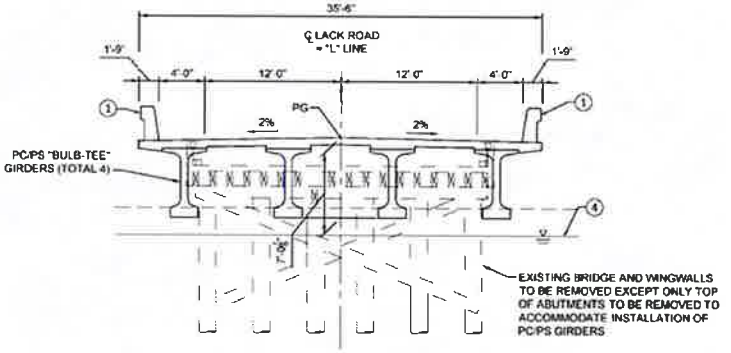
Lack Road Bridge Replacement | Imperial County, CA



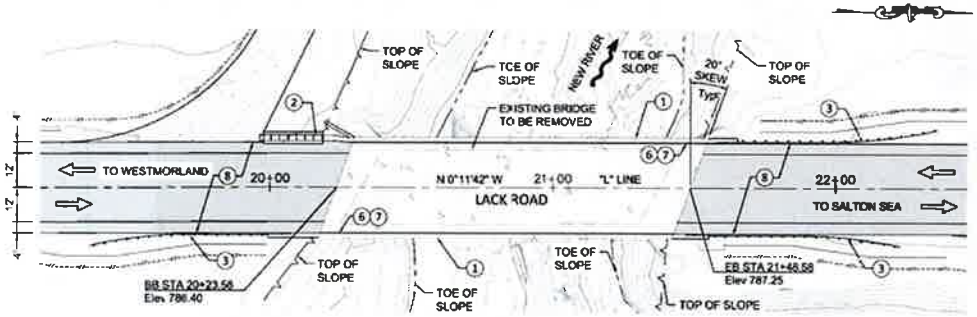
PROFILE GRADE
SCALE: 1"=20'



ELEVATION
SCALE: 1"=20'



TYPICAL SECTION
SCALE: 1"=5'



PLAN
SCALE: 1"=20'

LEGEND:

- INDICATES DIRECTION OF TRAFFIC
- INDICATES EXISTING BRIDGE
- INDICATES PROPOSED BRIDGE
- INDICATES DIRECTION OF FLOW

NOTES:

1. CONCRETE BARRIER (TYPE 836)
2. CRASH CUSHION, SEE ROADWAY PLANS
3. MIDWEST GUARDRAIL SYSTEM, SEE ROADWAY PLANS
4. Q100 WATER SURFACE ELEVATION = 778.40
5. EXISTING BRIDGE ABUTMENT REMAINS IN PLACE. CUT TOP PORTION TO AVOID NEW BRIDGE GIRDERS
6. PAINT BRIDGE NAME "LACK ROAD BRIDGE"
7. PAINT BRIDGE NUMBER "58C-0101"
8. AC PAVEMENT OVER AGGREGATE BASE, SEE "PLAN AND PROFILE" SHEET

GRAPHIC SCALE
0' 10' 20' 30' 40' 60' 80'
SCALE 1" = 20'

NOTES:
ANY UTILITIES LOCATED BY THE CONTRACTOR NOT SHOWN ON THESE PLANS SHALL BE PROTECTED IN PLACE OR REPLACED IN KIND IF DAMAGED BY THE CONTRACTOR

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
DANIEL SUN, P.E. NV5 — 40064 R.C.E. No. — 9/5/19 DATE — 12/30/19 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E. ROAD COMMISSIONER — 62028 R.C.E. No. — DATE — 9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

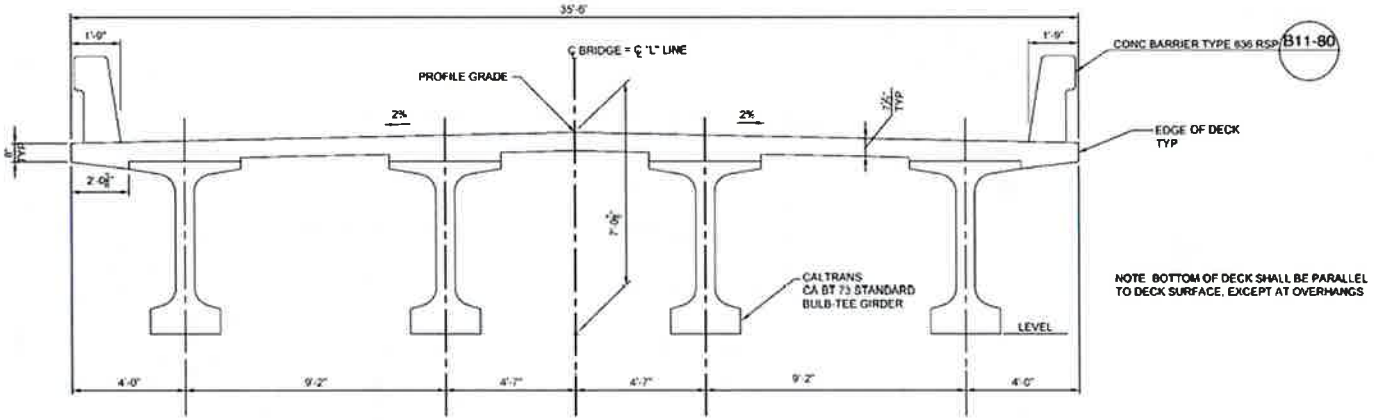
DATE 9/4/2019
DRWN SRO
CHKD AS SHOWN
APPVD CDS

LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

GENERAL PLAN
REFERENCE S 01
SHEET 5 OF 18

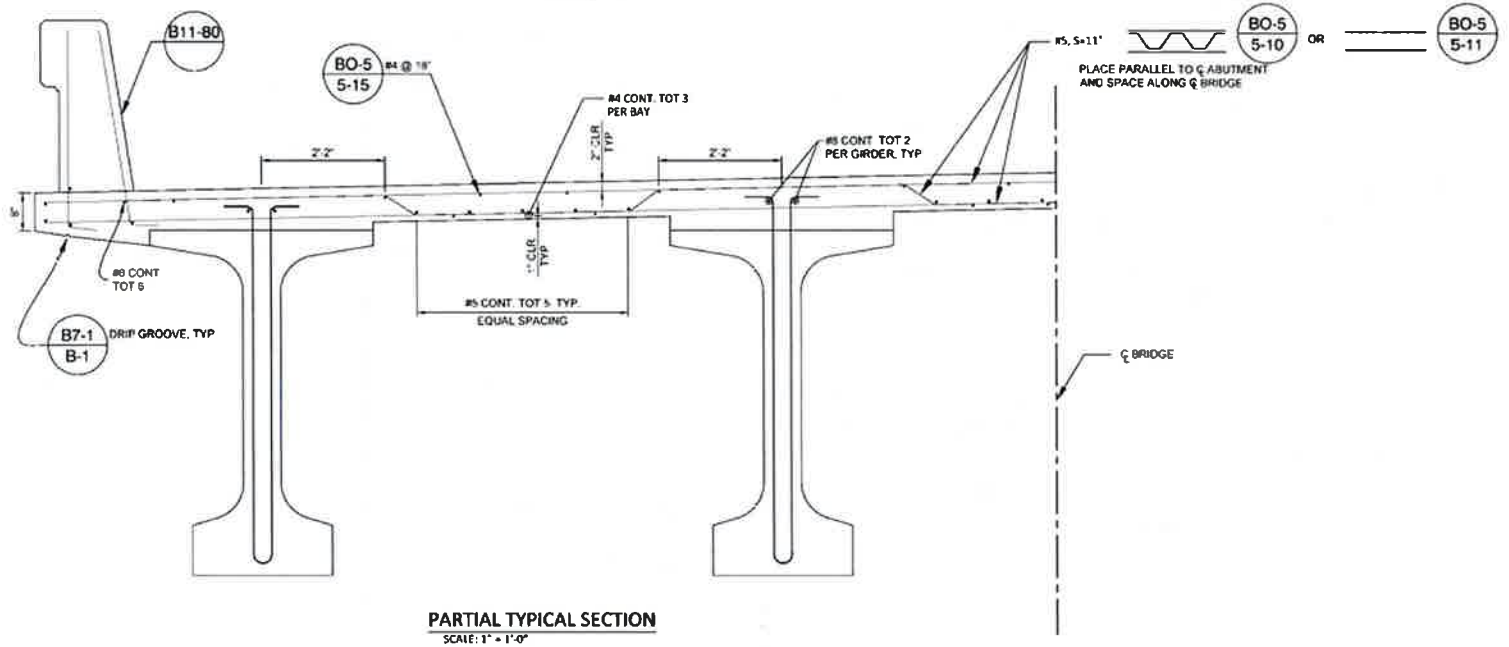
N:\18-0005439\Cad\Civil\31-Lack_Road_GP.dwg, Tab - 08-2019 10:19

Exhibit 5. Site Plan
Lack Road Bridge Replacement | Imperial County, CA



NOTE: BOTTOM OF DECK SHALL BE PARALLEL TO DECK SURFACE, EXCEPT AT OVERHANGS

TYPICAL SECTION
SCALE: ½" = 1'-0"



PARTIAL TYPICAL SECTION
SCALE: 1" = 1'-0"

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
DANIEL SUN, P.E.
NV5
40064 R.C.E. No.
9/9/19 DATE
12/30/19 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E.
ROAD COMMISSIONER
62026 R.C.E. No.
DATE
9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

9/9/2019
SRO
AS SHOWN
CDS

LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

TYPICAL SECTION

REFERENCE: S 08
SHEET 12 OF 18

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EXHIBIT 6. TYPICAL SECTION
LACK ROAD BRIDGE REPLACEMENT | IMPERIAL COUNTY, CA

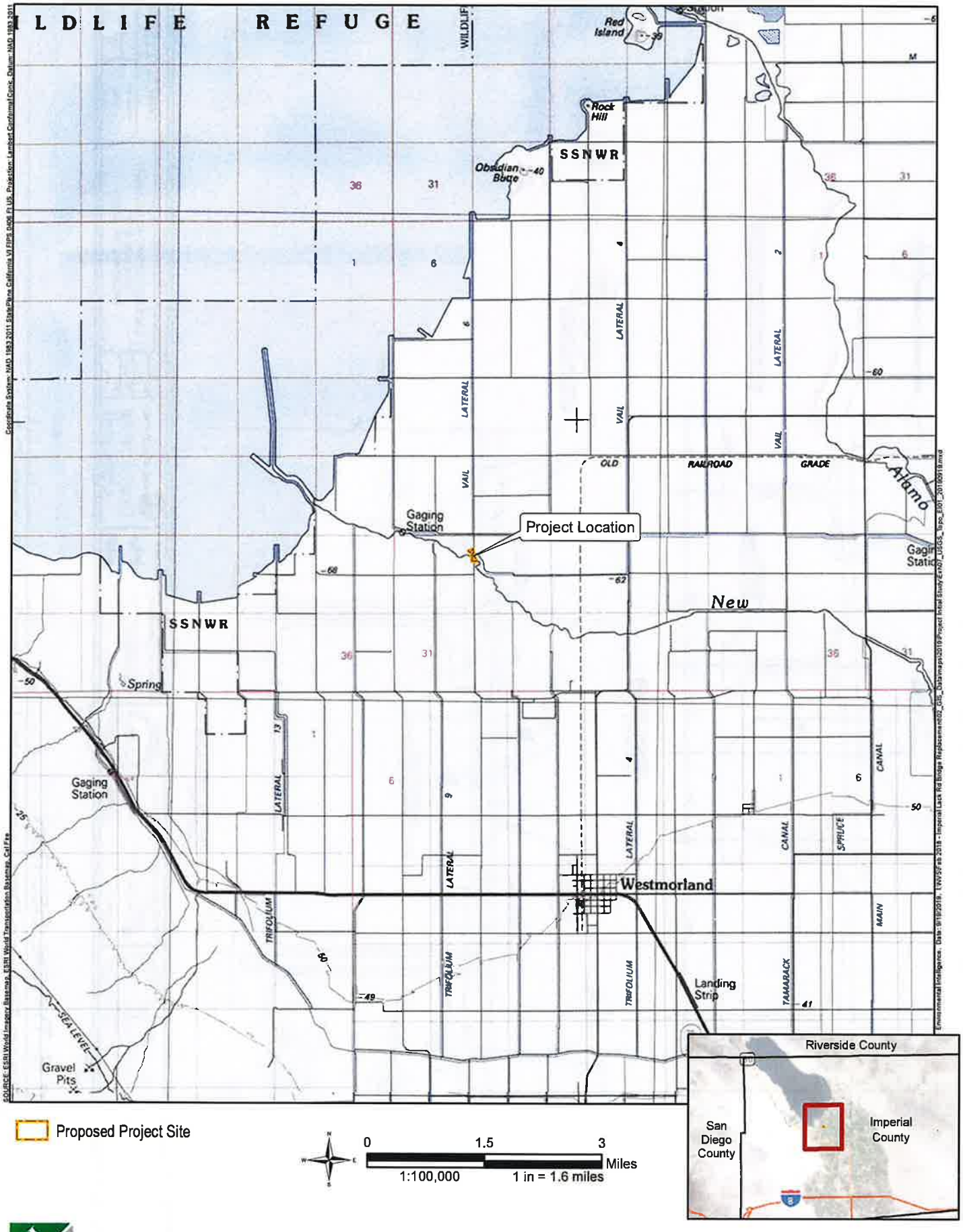

Exhibit 7: USGS Topographic Map

Lack Road Bridge Replacement | Imperial County, CA

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐	Aesthetics	☐	Agriculture and Forestry Resources	☐	Air Quality
☐	Biological Resources	☐	Cultural Resources	☐	Energy
☐	Geology /Soils	☐	Greenhouse Gas Emissions	☐	Hazards & Hazardous Materials
☐	Hydrology / Water Quality	☐	Land Use / Planning	☐	Mineral Resources
☐	Noise	☐	Population / Housing	☐	Public Services
☐	Recreation	☐	Transportation	☐	Tribal Cultural Resources
☐	Utilities/Service Systems	☐	Wildfire	☐	Mandatory Findings of Significance

ENVIRONMENTAL EVALUATION COMMITTEE (EEC) DETERMINATION

After Review of the Initial Study, the Environmental Evaluation Committee has:

☐ Found that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ Found that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ Found that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ Found that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ Found that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE DE MINIMIS IMPACT FINDING: ☐ Yes ☐ No

EEC VOTES	YES	NO	ABSENT
PUBLIC WORKS	☐	☐	☐
ENVIRONMENTAL HEALTH SVCS	☐	☐	☐
OFFICE EMERGENCY SERVICES	☐	☐	☐
APCD	☐	☐	☐
AG	☐	☐	☐
SHERIFF DEPARTMENT	☐	☐	☐
ICPDS	☐	☐	☐

Jim Minnick, Director of Planning/EEC Chairman Date:

PROJECT SUMMARY

A. Project Location:

The Proposed Project is located approximately 5.8 miles northwest of the City of Westmorland where Lack Road crosses the New River at bridge No. 58C0101 in Imperial County, California (Exhibit 1, *Regional Vicinity*). The existing bridge is a seven (7) span, simply supported untreated DF stringers bridge with laminated timber decking and AC cover, supported by treated timber pile bents and pile bent abutments with timber seating walls that runs north and south over the New River. The existing bridge is approximately 106 feet in length and 27 feet wide. The approximate limits of the Proposed Project area would extend along Lack Road from approximately 300 feet south to 350 feet north of the New River. Lack Road is a north/south road that supports direct access from State Route (SR-) 86 to Imperial County Route S-30. The Proposed Project is located 0.3 mile south of Vail Road and 0.2 mile north of Foulds Road (Exhibit 2, *Project Location*).

B. Project Summary:

Due to severe deterioration of some of the pile supports, the existing bridge has been closed to traffic (inactive) for over one (1) year. The County Public Works Department (Applicant) proposes to replace the existing seven (7) span timber bridge with a new precast concrete bridge designed to current American Association of State Highway and Transportation Officials (AASHTO) standards with California amendments (Exhibits 5 and 6, *Site Plan and Typical Section*). The proposed new bridge design would consist of a single-span bridge with four (4) precast/prestressed bulb-tee girders supported on two (2) abutments. The new bridge dimensions would be 35 feet and 6 inches wide by 125 feet long, with a structure depth of 7 feet and 0.875 inches. The selection of a precast bridge structure would eliminate the need for construction to take place within the New River.

The proposed roadway would remain a single travel lane in each direction, and geometry for the Proposed Project would be based on applicable County and AASHTO standards. The new bridge would be reconstructed in the same alignment with two (2) 12-foot-wide lanes designed for a 55 mile per hour (mph) vehicular speed. Shoulder widths would be 4 feet on the bridge, and would transition to the existing width at the roadway conform points. The new bridge would be designed to withstand a 100-year flood event.

The existing bridge would be removed without having to enter the New River as all construction activities were designed to take place from the river banks. It is estimated that the Proposed Project would be constructed over a nine (9)-month period beginning in March 2020 and concluding in November 2020.

C. Environmental Setting:

The topography of the Proposed Project area is relatively flat with a gentle gradient downward to the northwest (Exhibit 7, *USGS Topographic Map*). The elevation at the Proposed Project site is approximately 215 feet below Mean Sea Level (MSL). The New River flows beneath the existing bridge and the natural river's banks support limited wetland and riparian vegetation, which is primarily comprised of salt cedar (*Tamarix spp.*) and iodine bush (*Allenrolfea occidentalis*). Agricultural land surrounds the Proposed Project site with an Imperial Irrigation District (IID) culvert to the east that empties into the New River. Vail Road is located approximately 0.3 mile north of the Proposed Project site, while Foulds Road is located approximately 0.2 mile south of the Proposed Project site. The nearest sensitive receptors (residences) are approximately 1.1 miles south and 1.9 miles northeast of the Proposed Project.

D. Analysis:

The area surrounding the Proposed Project site is characterized as agricultural land uses. Lack Road is a farm to market road with two (2) traffic lanes, one (1) traveling in each direction. The Proposed Project is surrounded by land zoned as Heavy Agriculture (A-3) with a general plan designation of Agriculture (County of Imperial, 2019a, 2019b; Exhibits 3 and 4, *General Plan and Land Use Designation Map and Zoning Map*). The Proposed Project would construct a new improved bridge structure in place of the existing bridge where it crosses the New River. The Proposed Project is consistent with both the Imperial County General Plan's land use designation of the Proposed Project site and the County's Land Use Ordinance. Therefore, the adoption of the CEQA Initial Study for the Proposed Project would be consistent with applicable County and State ordinances and regulations.

E. General Plan Consistency:

In addition to the analysis stated above, the project is found to be consistent, with the adoption of CEQA Initial Study for the proposed Lack Road Bridge Replacement Project.

EVALUATION OF ENVIRONMENTAL IMPACTS:

1) A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

3) Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

4) "Negative Declaration: Less Than Significant With Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from "Earlier Analyses," as described in (5) below, may be cross-referenced).

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:

   a) Earlier Analysis Used. Identify and state where they are available for review.
   b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.
   c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

7) Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9) The explanation of each issue should identify:

   a) the significance criteria or threshold, if any, used to evaluate each question; and
   b) the mitigation measure identified, if any, to reduce the impact to less than significance

I. *AESTHETICS*

The Proposed Project consists of the replacement of the existing seven (7-) span timber bridge with a new precast concrete bridge within the same alignment as the existing bridge. The topography on the site is flat and primarily surrounded by disturbed agricultural land. The Proposed Project site is surrounded by land designated as Agriculture and zoned as A-3. The County's Zoning Code (Title 9, Chapter 9: A-3 [Heavy Agriculture]) provides the following description for the Heavy Agriculture land use district, and is provided below:

> **The purpose of the A-3 (Heavy Agriculture) [40 acres or larger typical] Zone is to designate areas that are suitable for agricultural land uses; to prevent the encroachment of incompatible uses onto and within agricultural lands; and to prohibit the premature conversion of such lands to non-agricultural uses. It is a land use that is to promote the heaviest of agricultural uses in the most suitable land areas of the County. Uses in the A-3 zoning designation are limited primarily to agricultural related uses and agricultural activities that are compatible with agricultural uses.**

The predominant land use in the vicinity of the Proposed Project is agricultural.

Four (4) highways within the County have the potential to be designated as a State Scenic Highway. The nearest eligible State Scenic Highway is SR-78 located approximately 4.3 miles south of the Proposed Project site (California Department of Transportation [Caltrans], 2018; County General Plan Circulation and Scenic Highways Element, 2008).

One of the goals of the County's General Plan is to protect and enhance the aesthetic character of the region. The County's natural scenic resources include deserts, sand dunes, mountains, and the Salton Sea. The nearest natural scenic resource is the Salton Sea, located approximately 2.2 miles northwest of the Proposed Project site.

Except as provided in Public Resources Code Section 21099, would the project:

a) Have a substantial adverse effect on a scenic vista or scenic highway? ☐ ☐ ☐ ☒

a) The Proposed Project would not interfere with or contain components that would adversely impact a scenic vista, area, or scenic corridor. The Proposed Project would be located on a site which does not contain any unique scenic qualities or characteristics. The Proposed Project would not adversely affect any scenic vista, spaces, corridors, or areas because the Proposed Project is consistent with the surrounding land uses and would not be visible from scenic vistas or major scenic corridors such as SR-78 (County General Plan Conservation and Open Space Element, 2016). Given the new bridge's depth of 7 feet and 0.875 inches, views of important visual resources such as views of the Salton Sea to the northwest will remain unaffected by the Proposed Project. Therefore, the Proposed Project would not be expected to have a substantial adverse effect on a scenic vista and there would be no impacts.

b) Substantially damage scenic resources, including, but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway? ☐ ☐ ☐ ☒

b) The Proposed Project is not located along a State Scenic Highway and there are no scenic trees, rock outcroppings, or historic buildings located at the Proposed Project site or in the surrounding area that would be damaged or impacted as a result of the Proposed Project. Therefore, no impact would occur as a result of the Proposed Project.

c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surrounding? (Public views are those that are experienced from publicly accessible vantage point.) If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality? ☐ ☐ ☒ ☐

c) The Proposed Project site is relatively flat and the proposed bridge replacement would occur within the existing roadway. The new bridge and construction related activities would be visible from public roadways and the surrounding agricultural lands. While the Proposed Project would minimally change the visual character in a non-urbanized area, the Proposed Project would replace an existing bridge that is so severely deteriorated that it resulted in inactivity (bridge closure) for over a year. Therefore, viewer sensitivity to the visual changes resulting from the new bridge would be minimal and instead contribute to a visual improvement of public views along the public roadways once the new bridge has been completed. As such, the Proposed Project would not significantly alter the existing viewshed and impacts would be less than significant.

d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area? ☐ ☐ ☒ ☐

d) The existing sources of light and glare in the Proposed Project area consist of vehicle lights (headlights and taillights) on the existing roadways and lighting associated with the surrounding agricultural uses. As a bridge replacement project, the Proposed Project's new bridge would not directly add any new light sources. As the existing bridge has been closed for over a year due to severe deterioration, the Proposed Project would generate additional traffic along Lack Road upon operation of the new bridge, which would increase light and glare from additional vehicular lights and indirectly add new light sources. However, the nearest residences are located 1.1 miles south and 1.9 miles northeast of the Proposed Project site. Due to these distances, these residences would not be adversely or significantly affected by the increase in light and glare from

additional vehicular lights from the new bridge. Therefore, potential lighting and glare impacts would to be less than significant.

Cumulative Impacts:

Implementation of the Proposed Project would not result in any significant cumulative impacts because development of the Proposed Project will not affect any scenic vista, spaces, corridors, or areas and is consistent with the surrounding land uses. Furthermore, the Proposed Project has been designed in accordance with applicable County and current AASHTO standards in order to not adversely impact day or nighttime views in the surrounding area. Therefore, the Proposed Project's cumulative contribution would be less than significant and potential cumulative impacts to aesthetics would not occur.

II. *AGRICULTURE AND FOREST RESOURCES*

In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. --Would the project:

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use? ☐ ☐ ☒ ☐

a) The California Department of Conservation's Important Farmland Maps were reviewed and the Proposed Project is located on land that is designated as Farmland of Statewide Importance. Farmland of Statewide Importance is similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture (California Department of Conservation, 2016a). Though the Proposed Project is located on land designated as Farmland of Statewide Importance, the Proposed Project consists of the replacement of an existing bridge with a new and improved bridge structure over the New River. The new bridge would be reconstructed in the same alignment as the existing bridge. As such, the Proposed Project would not require or result in any conversions or changes of farmland to non-agricultural uses as the existing use is a non-agricultural use. Therefore, less than significant impacts would occur.

b) Conflict with existing zoning for agricultural use, or a Williamson Act Contract? ☐ ☐ ☐ ☒

b) As discussed above, while the Proposed Project is surrounded by land designated as Agriculture and zoned A-3 (Heavy Agriculture), the Proposed Project is within the County's Right-of-Way and consists of the replacement of an existing bridge with a new and improved bridge structure to be reconstructed in the same alignment as the existing bridge over the New River. The County exited the California Department of Conservation's Land Conservation Act (Williamson Act) program by nonrenewing all contracts within the County, therefore no portion of the Proposed Project is enrolled in a Williamson Act Contract (California Department of Conservation, 2016b). As such, no impacts would occur related to conflicts with the existing zoning or a Williamson Act contract.

c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))? ☐ ☐ ☐ ☒

c) The Proposed Project would not be located on or within the vicinity of land zoned as forest land. The Proposed Project site is surrounded by land zoned as A-3 (Heavy Agriculture). The Proposed Project consists of the replacement of an existing bridge with a new and improved bridge structure reconstructed in the same alignment as the existing bridge over the New River. Therefore, the Proposed Project would not conflict with existing zoning for, or cause rezoning of forest land (as defined in Public Resources Code section 12220[g]), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104[g]). Therefore, no impacts would occur.

d) Result in the loss of forest land or conversion of forest land to non-forest use? ☐ ☐ ☐ ☒

d) The Proposed Project would not be located on or within the vicinity of forest land (as defined in California Public Resources Code Section 12220 [g]) and therefore, would not result in the loss of forest land or the conversion of forest land to non-forest use. No impact would occur.

e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use? ☐ ☐ ☒ ☐

e) The Proposed Project site is not located on or within the vicinity of forest land (California Public Resources Coded Section 12220 [g]) and, therefore, would not result in the conversion of forest land to non-forest use. The Proposed Project is surrounded by land designated as Agriculture and zoned A-3 (Heavy Agriculture). However, the Proposed Project would involve the replacement of an existing bridge with a new and improved bridge structure within the same alignment as the existing bridge. Therefore, the Proposed Project would not require or result in the conversion of Farmland to non-agricultural use (County of Imperial, 2019a, 2019b; California Department of Conservation, 2016a). Therefore, less than significant impacts would occur.

Cumulative Impacts:

Implementation of the Proposed Project would not result in any loss to agriculture and forestry resources; therefore, no cumulative impacts would occur.

III. *AIR QUALITY*

The Proposed Project is located in the Salton Sea Air Basin (SSAB) within the Imperial County Air Pollution Control District's (ICAPCD's) jurisdictional boundaries. The SSAB includes the Imperial Valley and the central part of Riverside County, including the Coachella Valley. The Imperial Valley is bordered by the Salton Sea to the north, the Anza-Borrego Desert State Park to the west, the Chocolate Mountains to the northeast, and the U.S./Mexican Border to the south. ICAPCD has jurisdiction over stationary sources of pollution and regulates air pollution for the Basin. Non-stationary sources are regulated by the California Air Resources Board (CARB). The ICAPCD has regional authority over the control of air pollution from all sources other than emissions from motor vehicles as well as regulatory control over all stationary sources of air contaminants. The ICAPCD has established significance thresholds to assist lead agencies in determining whether a proposed project may have a significant air quality impact and has provided guidance for project applicants in the 2007 Imperial County CEQA Air Quality Handbook (APCD, 2017).

Criteria Pollutants

Six (6) air pollutants have been identified by the U.S. Environmental Protection Agency (USEPA) and the CARB as being of concern both on a nationwide and statewide level: ozone (O_3); carbon monoxide (CO); nitrogen dioxide (NO_2); sulfur dioxide (SO_2); lead; and particulate matter (PM), which is subdivided into two (2) classes based on particle size: PM equal to or less than 10 micrometers in diameter (PM_{10}) and PM equal to or less than 2.5 micrometers in diameter ($PM_{2.5}$).

Air pollutant emissions also contribute to poor air quality when those emissions exceed significance thresholds, which can have adverse effects on human health. For instance, exposure to high concentrations of volatile organic compounds (VOCs) can interfere with oxygen uptake and ambient VOC concentrations are suspected to cause coughing, sneezing, headaches, weakness, laryngitis, and bronchitis. NO_2, as a potential irritant at atmospheric concentrations, can worsen respiratory diseases, such as asthma, over short periods of exposure, which causes respiratory symptoms including coughing, wheezing, or difficulty breathing. Longer periods of exposure to high concentrations of NO_2 can contribute to the development of asthma and potentially increase susceptibility to respiratory infections. CO in high concentrations reduces the amount of oxygen transported in the blood stream to critical organs like the heart and brain and, at very high levels, can lead to dizziness, confusion, unconsciousness, and death (USEPA, 2016). SO_2 can result in temporary breathing impairment in asthmatic children and adults engaged in active outdoor activities. Lastly, when inhaled into the deepest part of the lung, both PM_{10} and $PM_{2.5}$ cause health effects and, according to numerous scientific studies, have been linked to premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms such as irritation of the airways, coughing, or difficulty breathing (USEPA, 2018). These pollutants can cause potentially adverse health effects when they are emitted in significant amounts.

With the exception of $PM_{2.5}$, PM_{10}, and 8-hour O_3, the SSAB is in attainment or unclassified for all federal and State air pollutant standards. On November 13, 2009, the County was designated in nonattainment for 2006 24-hour $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS). However, the nonattainment designation was only for the urban area of the County. On April 10, 2014, the CARB approved the 2013 Amendments to Area Designations for California Ambient Air Quality Standards (CAAQS). Effective July 1, 2014, the City of Calexico was designated in nonattainment for State $PM_{2.5}$ standard, with the rest of the SSAB designated as in attainment.

The Imperial Valley is classified as nonattainment for federal and State PM_{10} standards. As a result, ICAPCD was required to develop a PM_{10} Attainment Plan. The final 2009 Imperial County State Implementation Plan (SIP) for PM_{10} was adopted by the ICAPCD on August 11, 2009.

ICAPCD was required to develop an 8-hour attainment plan for Ozone due to the County's moderate nonattainment status for 1997 federal 8-hour O_3 standards. On December 3, 2009 the USEPA determined the County had attained the 1997 8-hour NAAQS for O_3. However, because this determination does not constitute a redesignation to attainment under Section 107(d)(3) of the Clean Air Act (CAA), the designation status has remained moderate nonattainment for the 1997 8-hour O_3 standard. Nevertheless, ICAPCD is required to submit a modified air quality management plan (AQMP) to the USEPA for approval. Therefore, in order to meet the CAA requirements, the County submitted a 2009 8-hour O_3 AQMP and the Reasonable Available Control Technology State Implementation Plan (RACT SIP) for USEPA approval. Both the modified 2009 8-hour O_3 AQMP and RACT SIP were adopted by the ICAPCD on July 13, 2010. On

November 18, 2010, the CARB approved the County's modified 2009 8-hour O_3 AQMP.

Regional Conditions

Mountain peaks in the SSAB range from 3,000 to 11,000 feet in elevation, which prevents off-shore winds from flowing into Imperial County. Temperatures in the SSAB frequently exceed 100 degrees Fahrenheit (°F) during the summer and are generally over 70 °F in the winter. The SSAB averages between 3 and 7 inches of precipitation per year (CARB, 2011).

Sensitive Receptors

CARB has identified the following groups who are most likely to be affected by air pollution: children less than 14 years of age, the elderly over 65 years of age, athletes and people with cardiovascular and chronic respiratory diseases. Examples of land uses where substantial numbers of sensitive receptors are often found are residences, schools, daycare centers, playgrounds, and medical-related facilities (CARB, 2005). There are a few scattered residences on the surrounding agricultural land in the general vicinity of the Proposed Project. The nearest sensitive receptors to the Proposed Project are residences located approximately 1.1 miles south and 1.9 miles northeast of the Proposed Project. The closest school, Westmorland Elementary School is located approximately 4.7 miles southeast of the Proposed Project site (Google Earth, accessed 2019). It is estimated that the Proposed Project would be constructed over an approximate nine (9)-month period.

Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied upon to the following determinations. Would the Project:

a) Conflict with or obstruct implementation of the applicable air quality plan? ☐ ☒ ☐ ☐

a) As previously discussed, the SSAB has been designated as in attainment or unclassified for all federal and State pollutant standards with the exception of $PM_{2.5}$, PM_{10}, and 8-hour O_3. The 2009 Imperial County SIP for PM_{10}, modified 2009 8-hour O_3 AQMP, and RACT SIP set programs to comply with State and federal requirements for air quality standards. Air quality plans are based on population growth and vehicular miles traveled based on land uses established by local general plans. Therefore, the Proposed Project must demonstrate compliance with local land use plans, population projections, and applicable ICAPCD rules and regulations. The Proposed Project site is surrounded by land designated as Agriculture and zoned as A-3 (Heavy Agriculture). While the Proposed Project is surrounded by these lands, the Proposed Project consists of the replacement of an existing deteriorated bridge with a new and improved bridge structure to be reconstructed in the same alignment as the existing bridge over the New River. The Proposed Project would not alter the existing use of the Proposed Project site and, as such, be consistent with all applicable land use plans. Additionally, the Proposed Project does not include a residential component. As such, the Proposed Project would not alter the location, distribution, density, or growth of the human population in the area and would not exceed population projections.

Regarding short-term sources of emissions, the Proposed Project would generate fugitive dust emissions during ground disturbing activities during the construction phase. During operations, the Proposed Project's new bridge would add mobile emission sources (heavy equipment and vehicle traffic) to the Proposed Project vicinity that are currently emitted on other local roads on lengthy detours as the existing bridge has been closed for over a year. The Proposed Project would be required to comply with existing ICAPCD rules for the reduction of fugitive dust emissions. ICAPCD's Regulation VIII establishes these procedures. Compliance with this regulation is mandatory on all construction sites, regardless of size. However, because compliance with Regulation VIII is required for all projects, compliance with this regulation is mandatory and included as mitigation measures in this document. Therefore, compliance with this regulation and the ICAPCD's CEQA Handbook (MM-AQ-1 and MM-AQ-2) would ensure the Proposed Project would not conflict with or obstruct implementation of applicable air quality plans. Therefore, the Proposed Project would result in less than significant impacts with mitigation incorporated.

MM-AQ-1:
The Applicant shall comply with the requirements contained within ICAPCD Regulation VIII, which includes preparation of a Dust Control Plan for control of fugitive dust during construction, written notification to the Air District 10 days prior to the start of construction activities; and remit a list of equipment to be used during construction in Excel format (See Appendix E). The Dust Control Plan shall address construction and earthmoving activities. The Dust Control Plan shall include information regarding the dust suppressants that shall be applied and specific surface treatments and/or control measures to be utilized during construction. The Dust Control Plan shall be submitted to ICAPCD and ICPDS for review and approval prior to construction.

MM-AQ-2:
The Applicant shall comply with the required standard and enhanced mitigation measures contained in the ICAPCD CEQA Handbook, which include the following:

- **Standard Mitigation Measures for Construction Combustion Equipment**
  - **Use of alternative fueled or catalyst equipped diesel construction equipment, including all off-road and portable diesel-powered equipment;**
  - **Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to 5 minutes as a maximum;**
  - **Limit, to the extent feasible, the hours of operation of heavy-duty equipment and/or the amount of equipment in use; and**

- Replace fossil fueled equipment with electrically driven equivalents (provided they are not run via a portable generator set).

- **Enhanced Mitigation Measures for Construction Equipment**
  - Curtail construction during periods of high ambient pollutant concentrations; this may include ceasing of construction activity during the peak hour of vehicular traffic on adjacent roadways; and
  - Implement activity management (e.g. rescheduling activities to reduce short-term impacts).

b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard? ☐ ☒ ☐ ☐

b) The Proposed Project's impacts during both construction and operation could be cumulatively considerable as the SSAB is in attainment or unclassified for all federal and State pollutant standards with the exception of $PM_{2.5}$, PM_{10}, and 8-hour O_3. However, an individual project can emit these pollutants without significantly contributing to this cumulative impact depending on the magnitude of emissions. While the Proposed Project would generate emissions during the construction of the new bridge and could potentially result in a cumulatively considerable increase in the generation of pollutants, the Proposed Project would replace the existing bridge with a new and improved bridge structure within the same alignment as the existing bridge. Therefore, due to the small project footprint, construction impacts are expected to be minimal and temporary. Additionally, the Proposed Project would be required to comply with Regulation VII and the ICAPCD's CEQA Handbook (MM-AQ-1 and MM-AQ-2). As such, implementation of mitigation measures would ensure the Proposed Project's cumulative contribution during construction would be less than significant.

Emissions during operation of the Proposed Project could potentially result in a cumulatively considerable increase due to an increase in vehicular traffic (since the bridge is currently closed and seeing none). As commuters that currently utilize this stretch of Lack Road are required to exercise lengthy detours due to the closure of the existing bridge, the Proposed Project would improve passage for commuters. However, the Proposed Project's new bridge would increase mobile emission sources (heavy equipment and vehicle traffic) to the Proposed Project vicinity that have not been in the vicinity since the closure of the existing bridge over a year ago. Because the new bridge would be located on Lack Road, a Minor Collector road classified by the County, and only containing two (2) travel lanes, it is anticipated the new bridge would be used by the surrounding community's marginal number of commuters that either live or work along that stretch of Lack Road. As such, it is expected that the mobile emissions generated by the Proposed Project would not result in emissions that would exceed the ICAPCD's significance thresholds. Additionally, as the nearest sensitive receptors to the Proposed Project are residences located approximately 1.1 miles south and 1.9 miles northeast of the Proposed Project, the Proposed Project's emissions would not exceed the ICAPCD's significance thresholds at these sensitive receptors. Furthermore, like with the Proposed Project and as discussed in Response IIIa, above, cumulative projects would also be subject to mitigation pursuant to the ICAPCD rules and regulations (e.g., Regulation VIII) and the ICAPCD's CEQA Handbook. As the Proposed Project would be required to comply with Regulation VIII and the ICAPCD's CEQA Handbook (MM-AQ-1 and MM-AQ-2), the Proposed Project's contribution would be less than cumulatively considerable.

c) Expose sensitive receptors to substantial pollutants concentrations? ☐ ☒ ☐ ☐

c) In addition to the above listed criteria pollutants, toxic air contaminants (TACs) are another group of pollutants of concern. TACs are less pervasive in the urban atmosphere than criteria air pollutants, however they are linked to short-term (acute) and/or long-term (chronic or carcinogenic) adverse human health effects. There are hundreds of different types of TACs with varying degrees of toxicity. Sources of TACs include industrial processes such as petroleum refining and chrome plating operations, commercial operations such as gasoline stations and dry cleaners, and motor vehicle exhaust, to name a few. Cars and trucks release at least 40 different TACs. The most important of these TACs, in terms of health risk, are diesel particulates, benzene, formaldehyde, 1,3-butadiene, and acetaldehyde. Public exposure to TACs can result from emissions from normal operations as well as accidental releases. Health effects of TACs can include cancer, birth defects, neurological damage, and death. The Office of Environmental Health Hazard Assessment (OEHHA) developed a Guidance Manual for the Preparation of Health Risk Assessments. According to OEHHA methodology, health effects from carcinogenic TACs are usually described in terms of individual cancer risk, which is based on a 30-year lifetime exposure to TACs.

Construction

The greatest potential for TAC emissions would be related to diesel particulate emissions associated with heavy equipment operations during construction of the Proposed Project. As discussed above, health effects from TACs are usually described in terms of individual cancer risk, which is based on a 30-year lifetime exposure to TACs. Health effects are generally evaluated based on a lifetime, long-term exposure (i.e., 70 years). Given the relatively limited number of heavy-duty construction equipment and the short-term construction schedule, the Proposed Project would not result in a long-term substantial source of TAC emissions and corresponding individual cancer risk. Additionally, the nearest sensitive receptors are residences located approximately 1.1 miles south and 1.9 miles northeast of the Proposed Project site. Therefore, less than significant short-term toxic air contaminant impacts to sensitive receptors would occur during the construction phase of the Proposed Project.

Operation

The existing bridge has been closed to traffic for over one (1) year due to severe deterioration of some of the pile supports. As such, no existing traffic is generated at the Proposed Project site. Because agricultural operations surround the Proposed Project site, the Proposed Project would introduce heavy equipment and vehicular traffic along the new bridge and this section of Lack Road to the site during operation. While the Proposed Project's new bridge would generate heavy equipment and vehicular traffic, because the new bridge would be located on Lack Road, which is classified as a Minor Collector road by the County, and only contain two (2) travel lanes, it is anticipated the new bridge would be used by the surrounding community's marginal number of commuters that either live or work along that stretch of Lack Road. As such, it is anticipated the Proposed Project would not emit substantial pollutant concentrations. Additionally, as discussed in Response IIIa, above, the Applicant would comply with fugitive dust control measures during operation pursuant to ICAPCD's Regulation VIII (MM-AQ-1) and the ICAPCD CEQA Handbook (MM-AQ-2). Due to these factors and the distance to the nearest sensitive receptors (residences located approximately 1.1 miles south and 1.9 miles northeast of the Proposed Project site), impacts to sensitive receptors during operation would be less than significant with mitigation incorporated.

d) Result in other emissions (such as those leading to odors adversely affecting a substantial number of people? ☐ ☐ ☒ ☐

d) A significant impact would result if the Proposed Project would create objectionable odors during construction or operational activity. Potential sources that may emanate objectionable odors during construction activities include equipment exhaust, application of asphalt paints, and other exterior finishes. The objectionable odors that may be produced during the construction process are of short-term nature and the odor emissions are expected to cease upon the drying or hardening of the odor producing materials. Land uses, and industrial operations that are associated with odor complaints include agricultural uses, wastewater treatment plants, food processing plants, chemical plants, composting, refineries, landfills, dairies, and fiberglass molding. The Proposed Project, which consists of the replacement of an existing deteriorated bridge with a new bridge within the same alignment, would not include components that are typically associated with odor complaints. Additionally, the nearest sensitive receptors are residences located approximately 1.1 miles south and 1.9 miles northeast of the Proposed Project site. Due to the limited amounts of odor producing materials being utilized and the Proposed Project's distance from the nearest sensitive receptors, less than significant impacts related to odors affecting a substantial number of people would occur.

Cumulative Impacts:

Proposed Project implementation is not anticipated to exceed the construction or operational emissions threshold adopted by the ICAPCD. Compliance with the applicable ICAPCD's rules and regulations (including implementation of MM-AQ-1 and MM-AQ-2) would ensure that dust emissions are minimized during construction to further reduce short-term cumulative impacts. There is an existing regional cumulative impact associated with $PM_{2.5}$, PM_{10}, and 8-hour O_3 because the SSAB is in attainment or unclassified for all federal and State pollutant standards with the exception of these pollutants. However, an individual project can emit these pollutants without significantly contributing to this cumulative impact depending on the magnitude of emissions. Because emissions from the Proposed Project are expected to be less than significant, the Proposed Project's contribution to the cumulative air quality impact would also be less than significant. As discussed in Response IIIb, above, cumulative projects would also be subject to mitigation pursuant to the ICAPCD rules and regulations (e.g., Regulation VIII) and the ICAPCD's CEQA Handbook. Therefore, cumulative impacts would be less than significant.

IV. *BIOLOGICAL RESOURCES*

The County Public Works Department contracted Ms. Marie Barrett of Barrett's Biological Surveys to conduct a habitat assessment of the Proposed Project site. Prior to conducting the field survey, a desktop analysis was conducted. The desktop analysis included a literature review of potentially applicable regulatory requirements. Additionally, publicly available data was reviewed to determine if any special-status species or habitats occur (via recorded occurrences or habitat) or have the potential to occur within the vicinity of the Project. Resource records were obtained using the California Natural Diversity Database (CNDDB) for the Westmoreland E U.S. Geological Survey (USGS) 7.5-minute Topographic Quadrangle and the surrounding eight (8) quadrangles within the United States including Wiest, Iris, Niland, Obsidian Butte, Westmoreland W, Brawley NW, Brawley, and Alamorio. Ms. Barrett and Mr. Jacob Calanno conducted a pedestrian survey within and adjacent to the Biological Study Area (BSA) on July 25, 2019. The BSA is located within the Colorado Desert, which is a subdivision of the larger Sonoran Desert and covers approximately 7 million acres. The desert encompasses the County and includes parts of San Diego County, Riverside County, and a small part of San Bernardino County. The region experiences greater summer daytime temperatures (up to 120°F) than higher-elevation deserts and rarely experiences frost. In addition, the Colorado Desert experiences two (2) rainy seasons per year, usually in the winter and late summer in this portion. This area is within the agricultural portion that is irrigated by Colorado River water delivered through water conveyance structures maintained by the IID. The Proposed Project spans the New River which drains into the Salton Sea.

The purpose of the field survey was to identify if any sensitive or otherwise protected biological resources occur or have the potential to occur within the Proposed Project boundary and surrounding area. As discussed above, a desktop analysis and summary report were prepared by Barrett's Biological Surveys following the survey and are included as Appendix A (*Biological Assessment Report, 2019*). Discussions and determinations within this section are based on the results presented in Appendix A.

Would the project:

a)	Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☒	☐	☐

a) No federally or State threatened, endangered, candidate, or special-status species, or sensitive natural habitats were observed within the BSA. Within the nine (9) quadrangles searched as part of the desktop analysis for the Biological Assessment Report, four (4) botanical species and 36 wildlife species were listed. None of the special-status plant species were observed during the survey or would be expected to occur within the Proposed Project site. Nevertheless, the Biological Assessment Report recommended a preconstruction plant survey should be conducted by a qualified biologist (MM-BIO-1). Of the special-status wildlife species, burrowing owl (*Athene cunicularia*), a California Department of Fish and Wildlife (CDFW) Species of Special Concern and Yuma Ridgway's Rail (*Rallus obsoletus*), a federally endangered species, are both known to occur in the vicinity of the Proposed Project site (Appendix A). However, the Proposed Project's BSA did not have any sign of either species. There were no burrows located within the BSA. Additionally, no nesting birds or bats were observed during the pedestrian survey. Potential removal of salt cedar (*Tamarix spp.*), an invasive species, and iodine bush (*Allenrolfea occidentalis*), a native species, may be determined necessary to facilitate construction activities in the work area. This vegetation provides potentially suitable habitat for nesting birds. Therefore, it is recommended that vegetation removal occur outside the nesting season (general breeding and nesting bird season of February through August; MM-BIO-2). With implementation of MM-BIO-1 through MM-BIO-4, the Proposed Project's impacts to nesting birds during construction would be less than significant.

MM-BIO-1:

A preconstruction plant survey shall be conducted by a qualified biologist.

MM-BIO-2:

Nesting bird surveys by qualified biologists during nesting season (February through August); preferably time construction during non-nesting season (September through January). Time nesting surveys within 3-5 days prior to start of construction. Burrowing owl (BUOW) preconstruction survey within 14 days of start of construction.

MM-BIO-3:

Worker environmental awareness training for nesting birds and BUOW, which shall include the following aspects:

- **Biology and status of the BUOW;**
- **Protection measures designed to reduce potential impacts to the species, function of flagging designating authorized work areas;**
- **Reporting procedures to be used if a BUOW is encountered in the field; and driving procedures and techniques, for commuting, and driving on, to the Proposed Project site; and**
- **Identification of nesting birds and procedures to follow if nesting is suspected.**

MM-BIO-4:

Areas outside of the Proposed Project footprint shall be designated as an "Environmentally Sensitive Area" (ESA) on Proposed Project plans. No project-related activities shall take place within the ESA-designated areas.

b)	Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☐	☒	☐

b) Salt cedar and iodine bush were observed within the BSA during the pedestrian survey. No sensitive vegetation communities occur within or adjacent to the Proposed Project site (Appendix A). Effects on any riparian habitat would be expected to have a less than significant impact from implementation of the Proposed Project.

c)	Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☒	☐	☐

c) It is understood that Ms. Barrett did not conduct formal jurisdictional delineation surveys. However, riverine and freshwater emergent wetlands were found in the Proposed Project site (U.S. Fish and Wildlife Service [USFWS] National Wetlands

Inventory [NWI], 2019), as the New River is recognized as a jurisdictional water body by U.S. Army Corps of Engineers (USACE), Colorado River Regional Water Quality Control Board (CRRWQCB) and CDFW. Federal and State guidelines both follow a no net loss of wetlands. Therefore, the Proposed Project may require a Nationwide 404 permit from USACE under the Clean Water Act, a Streambed Alteration Agreement from CDFW under Section 1602 of the California Fish and Game Code (CFGC), and a 401 Water Quality Certification from CRRWQCB. However, the existing bridge would be removed without the need to be in the New River and all construction activities are anticipated to take place from the banks. Thus, construction of the Proposed Project would not impact any wetlands associated with the New River, the flow of the New River, or allow any fill into or out of the New River. The Proposed Project would have a temporary impact to the project area during construction; however, no permanent impacts are anticipated as a result of construction activities. Nevertheless, the Biological Report recommended consultation with USACE to obtain the required permit for working within a waterway that drains into waters of the United States and CDFW regarding a Streambed Alteration Agreement. Therefore, consultation with USACE, CDFW, and CRRWQCB is recommended for the Proposed Project to ensure the Proposed Project obtains applicable permits and complies with any mitigation measures from these agencies (MM-BIO-5). Implementation of mitigation measure MM-BIO-5 would reduce impacts to less than significant levels.

MM-BIO-5:

Once consultation with USACE, CRRWQCB, and CDFW has been conducted, the Applicant shall apply for and obtain any necessary permits and comply with any mitigation measures required by these agencies.

d) Interfere substantially with the movement of any resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites? ☐ ☐ ☒ ☐

d) The existing bridge over the New River has the potential to serve as a movement corridor for small and common wildlife species, such as rodents, reptiles, and small mammals. The closest alternative crossing points are at Gentry Road, approximately 2.5 miles southeast of the Proposed Project, and a small foot crossing, approximately 0.7 mile northwest of the Proposed Project. Although the existing bridge could serve as a wildlife corridor, particularly for nocturnal terrestrial species when traffic volume is assumed to be lower (lower collision risk), a new bridge would be constructed after removal of the existing bridge. This corridor would be unavailable for the duration of the Proposed Project's construction. While the terrestrial wildlife that use this corridor would be temporarily impacted, avian species and any fish species found in the New River would not be impacted. The flow of the New River would not be disrupted as a result of the Proposed Project as the removal of the existing bridge would be accomplished without the need to be in the New River and all anticipated construction activities would take place from the banks. Therefore, fish species such as common carp (*Cyprinus carpio*), channel catfish (*Ictalurus punctatus*), and Mozambique tilapia (*Oreochromis mossambicusa*) would not be impacted by the Proposed Project. A less than significant impact would result from the Proposed Project.

e) Conflict with any local policies or ordinance protecting biological resource, such as a tree preservation policy or ordinance? ☐ ☐ ☐ ☒

e) No local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance, apply to the Proposed Project site.

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan? ☐ ☐ ☐ ☒

f) The Proposed Project is not located within an area covered by an adopted Habitat Conservation Plan (HCP) or Natural Community Conservation Plan (NCCP).

Cumulative Impacts:

The Proposed Project site contains wetlands and jurisdictional waters of the U.S. and the State. The Proposed Project may trigger an application for waters permits to occur; however, implementation of the proposed mitigation measures identified below would mitigate the Proposed Project's cumulative biological resource impacts to below the level of significance.

V. *CULTURAL RESOURCES*

A cultural resources records search was conducted by Environmental Intelligence, LLC (EI) staff at the California Historical Resources Information System (CHRIS), South Coastal Information Center (SCIC) at San Diego State University on August 30, 2019. The records search identified all previously recorded cultural resources and cultural resource studies within the records search extent, which is defined as a ¼-mile radius around the Area of Potential Impacts (API). No previous cultural resource studies had been conducted within the API or within a ¼-mile radius. Additionally, no cultural resources had been previously recorded within the records search extent.

EI reviewed the Caltrans Historic Bridge Inventory for Local Agency Bridges to determine the potential historical significance of the Lack Road Bridge. The Caltrans Historic Bridge Inventory for Local Agency Bridges lists the Lack Road Bridge as bridge number 58C0101 - New River (Lack Road). It was constructed in 1940 and its location is listed as 4.2MI N/O SR-86. The bridge's historical significance is listed as a Category 5 (Bridge not eligible for National Registrar of Historic Places [NRHP]).

EI archaeologist Ms. Amber Lopez-Johnson (M.A.) conducted an intensive pedestrian survey of the API on September 26, 2019. The API was surveyed using transects spaced no greater than 15 meters apart. The archaeologist examined exposed ground surface for artifacts (e.g., flaked stone tools, tool-making debris, milling tools, ceramics, ecofacts [e.g., marine shell and bone], soil discoloration that might indicate the presence of a cultural midden, and features indicative of the former presence of structures or buildings [e.g., standing exterior walls, postholes, foundations] or historic debris [e.g., metal, glass, ceramics]). Ground disturbances such as burrows were visually inspected. EI used EOS Arrow GNSS 100 Series global positioning system (GPS) units with sub-meter accuracy and ArcGIS Collector Software to confirm all API footprints and record any geospatial data for newly or previously recorded resources. All new and previously recorded resources within the API were documented, photographed, and recorded on California Department of Parks and Recreation (DPR) 523 forms. No cultural material was identified within the API during the pedestrian survey. The API is located within an area that has been previously disturbed by ongoing agricultural activities. Based on the agricultural activities within the API, the potential for encountering subsurface cultural deposits within the API is considered low. The results of the records search and intensive pedestrian survey were documented in the Cultural Resources Survey Report, included as Appendix B (*Cultural Resources Survey Report, 2019 [Updated 2020]*).

Would the project:

a)	Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?	☐	☐	☒	☐

a) No historical resources have been documented within the Proposed Project area. Given the previous agricultural disturbance in the area, the potential to encounter historical resources within the Proposed Project area would be considered low. Therefore, less than significant impacts are expected.

b)	Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐

b) No archaeological resources have been previously recorded within the Proposed Project area. There is potential for archaeological resources to be found during excavation and grading. However, given the previously disturbed nature of the Proposed Project area, the potential to encounter archaeological resources within the Proposed Project area would be considered low. The ICPDS received a comment letter from the Campo Band of Mission Indians on December 19, 2019 (see Appendix D). Based on the information provided by the Campo Band of Mission Indians, the ICPDS is willing to implement MM-TCR-1 through MM-TCR-3 (see Section XVIII. Tribal Cultural Resources, below) for the Proposed Project. The Proposed Project would comply with these mitigation measures to avoid or reduce impacts to a tribal cultural resource to less than significant levels. Therefore, the Proposed Project would comply with these mitigation measures in order to not cause an adverse change in the significance of an archaeological resource and reduce impacts to less than significant levels.

c)	Disturb any human remains, including those interred outside of dedicated cemeteries?	☐	☒	☐	☐

c) No formal cemeteries are located within the Proposed Project area. Additionally, no known archaeological sites are located within the vicinity of the Proposed Project area, which could indicate the presence of human remains interred outside of dedicated cemeteries. Given the previously disturbed nature of the Proposed Project area, the potential to encounter human remains would be considered low. Nevertheless, based on the information provided by the Campo Band of Mission Indians comment letter (see Appendix D), the Proposed Project would implement MM-TCR-2 and MM-TCR-3 (see Section XVIII. Tribal Cultural Resources, below) to ensure impacts related to the disturbance of human remains, would be less than significant.

Cumulative Impacts:

Proposed Project implementation would not result in significant impacts to cultural resources. Therefore, the Proposed Project's contribution to a cumulative impact would not be considerable and potential cumulative impacts to cultural resources would be less than significant.

VI. *ENERGY*

Would the project:

a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation? ☐ ☐ ☐ ☒

a) The construction and operation of the Proposed Project would not require the creation of a new source of energy. The Proposed Project, as a bridge replacement project, would not have an electrical component as overhead lighting is not part of the design; therefore, no unnecessary consumption of energy is anticipated.

b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency? ☐ ☐ ☐ ☒

b) State and local agencies regulate the use and consumption of energy through various programs. As a result of the passage of AB 32 (California Global Warming Solutions Act of 2006), which seeks to reduce the effects of greenhouse gas (GHG) emissions, a majority of the State regulations are intended to reduce energy use and GHG emissions. The Proposed Project would be consistent with State regulations regarding GHG emissions (refer to Section 3.8 [GHG Emissions]). Energy consumption as part of the construction would be minimal and temporary. Additionally, no energy would be used during the operational life of the new bridge. As such, the Proposed Project would not conflict with or obstruct a State or local plan for renewable energy and energy efficiency. No impacts would occur.

Cumulative Impacts:

As identified above, the Proposed Project, as a bridge replacement project, would not unnecessarily consume energy resources or conflict with energy plans. As a result, no energy impacts would occur as a result of the Proposed Project, therefore the Proposed Project would not contribute to cumulative impacts.

VII. *GEOLOGY AND SOILS*

Would the project:

The County Public Works Department contracted NV5 to conduct a geotechnical study of the Proposed Project site and prepare a foundation report. The Draft Foundation Report prepared by NV5 is included as Appendix C (*Draft Foundation Report, 2019*). The purpose of the foundation report was to summarize the results of the geotechnical study and provide seismic and foundation design recommendations for the proposed replacement of the existing bridge. Discussions and determinations within this section are based on the results of the Draft Foundation Report.

Southern California is a seismically active region that contains several surface faults and fault zones considered active or potentially active, including the Newport-Inglewood, Whittier, San Andreas, San Jacinto, Malibu-Coast-Raymond, Chino, Elsinore, Palos Verdes, San Gabriel, and Sierra Madre-Santa Susana-Cucamonga faults.

a) Directly or indirectly cause potential substantial adverse effects, including risk of loss, injury, or death involving: ☐ ☒ ☐ ☐

1) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42? ☐ ☐ ☐ ☒

1) The most recent Alquist-Priolo Earthquake Fault Zoning Maps were reviewed and the Proposed Project site is not included within any Earthquake Fault Zones as created by the Alquist-Priolo Earthquake Fault Zoning Act. The Brawley Seismic Zone is located approximately 2 miles east of the Proposed Project. The Elmore Ranch Fault is the nearest known fault, located approximately 6 miles to the southwest of the Proposed Project site (California Department of Conservation, 2010). Given the distance of the Proposed Project from known faults and seismic zones, the Proposed Project would not be expected to expose people or structures to rupture as a result of a known earthquake fault. No impacts would occur.

2) Strong Seismic ground shaking? ☐ ☒ ☐ ☐

2) As discussed above, the Brawley Seismic Zone and the Elmore Ranch Fault are located approximately 2 miles east and 6 miles southwest, respectively. While no known faults or fault zones are located in close proximity to the Proposed Project site, risk of seismic activity is present due to the seismically active nature of the region. The Proposed Project would be designed using seismic recommendations in accordance with current Caltrans standards and engineering practices. Therefore, the Proposed Project's compliance with the current Caltrans standards (Bridge Design Practices

and Seismic Design Criteria) and AASHTO Bridge Design Specifications with California Amendments, as well as the recommended mitigation measures (MM-GS-1) would significantly reduce the potential for substantially adverse effects from strong seismic ground shaking. The Proposed Project would result in less than significant impacts with mitigation incorporated.

MM-GS-1:

The Applicant shall ensure all grading operations and construction are conducted in accordance with the Plans and Specifications and in conformance with the recommendations included in the Draft Foundation Report (Appendix C) and any subsequent geotechnical and soils report to be prepared by a licensed geotechnical engineer.

3) Seismic-related ground failure, including liquefaction and seiche/tsunami? ☐ ☒ ☐ ☐

3) Liquefaction occurs when unconsolidated, water-laden soils are shaken and lose cohesion, causing previously solid soils to behave temporarily as viscous liquids. It is most prevalent in areas of recently deposited silts or sands, and in areas with high groundwater levels. Liquefaction may lead to near-surface ground failure, such as ground settlement, lateral spread, and loss of foundation support. The Draft Foundation Report stated a subsurface exploration program encountered poorly to moderately consolidated alluvial clay and silty sands. A liquefaction assessment was completed by NV5 and the results of the liquefaction assessment were presented in the Draft Foundation Report (Appendix C). Due to the potential for liquefaction and associated seismic induced settlement, the proposed new bridge's pile design would need to accommodate potential downdrag forces. The design of the Proposed Project would comply with the current Caltrans standards (Bridge Design Practices and Seismic Design Criteria), AASHTO Bridge Design Specifications with California Amendments, and the recommendations in the Draft Foundation Report (see mitigation measure MM-GS-1), which would reduce impacts related to seismic ground failure and liquefaction to less than significant levels.

4) Landslides? ☐ ☐ ☒ ☐

4) The Proposed Project site is located in a flat area with no high or steep natural slopes. The Draft Foundation Report stated no indications of landslides or deep-seated instability were observed at the Proposed Project site during the geotechnical study (Appendix C). As such, the potential for landslides would be considered low. There would be no potential for the Proposed Project to expose people or structures to landslides. Less than significant impacts are expected.

b) Result in substantial soil erosion or the loss of topsoil? ☐ ☐ ☒ ☐

b) During construction, loss of topsoil and erosion could result from construction activities, including the operation of heavy machinery, grading activities, excavation, or wind or water erosion of stockpiled fill/excavated materials at staging areas. Erosion would be minimized through the implementation of best management practices (BMPs) such as limiting the amount of disturbed soil to the extent possible, preventing runoff from the site, and ensuring compliance with the Stormwater Pollution Prevention Plan (SWPPP; discussed in greater detail in the *Hydrology and Water Quality* section below). In addition, the Proposed Project site is relatively flat and experiences low levels of natural erosion (County of Imperial, n.d.). As such, with implementation of BMPs and compliance with the SWPPP, impacts related to soil erosion or the loss of top soil would be less than significant.

c) Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslides, lateral spreading, subsidence, liquefaction or collapse? ☐ ☒ ☐ ☐

c) The Draft Foundation Report identified the Proposed Project site as underlain with predominantly poorly to moderately consolidated alluvial materials consisting of lean clay with lenses of fat clay, silty sands and clayey sands. As discussed above, the potential for landslides is considered low. Lateral spreading occurs when there is widespread liquefaction and a gentle slope, or a free face toward which lateral spreading may occur. As discussed above, liquefaction impacts would be less than significant with mitigation incorporated (MM-GS-1). Additionally, the Draft Foundation Report stated the liquefiable layers are located below the elevation of the stream channel and abutment slope face. Furthermore, the piles for the existing bridge would not be removed from the New River, which the Draft Foundation Report assumes would provide some dissipation of additional lateral pressures resulting from an earthquake event. Thus, the Draft Foundation Report determined the potential for lateral spreading is considered low. Therefore, with incorporation of mitigation measure MM-GS-1, the Proposed Project would result in less than significant impacts.

d) Be located on expansive soil, as defined in the latest Uniform Building Code, creating substantial direct or indirect risk to life or property? ☐ ☒ ☐ ☐

d) As discussed above, the Proposed Project site is underlain with lean clay with lenses of fat clay, silty sands, and clayey sands. The geotechnical study tested two (2) samples of the near-surface clay soils, which indicated medium expansion

potential. As these materials are generally considered unsuitable for use as backfill for structure foundations, retaining walls, or pipe bedding, the foundation report recommended potential expansive soil properties should be verified at the completion of rough grading since site grading will redistribute on-site soils. Compliance with Caltrans standards (Bridge Design Practices and Seismic Design Criteria), AASHTO Bridge Design Specifications with California Amendment, recommendations from the Proposed Project's Draft Foundation Report (MM-GS-1), and mitigation measure MM-GS-2 included below would ensure that risks from expansive soil would be less than significant.

MM-GS-2:

Soils imported for on-site use shall preferably have very low to low expansion potential (based on UBC Standard 18-2 test procedures). Lots on which expansive soils may be exposed at grade shall be undercut 3 feet or more and capped with very low to low expansion potential fill. In the event expansive soils are present near the ground surface, special design and construction considerations shall be utilized in general accordance with the recommendations of the geotechnical consultant.

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water? ☐ ☐ ☐ ☒

e) The Proposed Project consists of a bridge replacement and there are no planned facilities that require a wastewater disposal system. Therefore, the Proposed Project would not include septic tanks or alternative wastewater disposal systems. No impact from septic tanks or alternative wastewater disposal systems as part of the Proposed Project would occur.

f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature? ☐ ☐ ☒ ☐

f) As shown on the California Division of Mines and Geology, 1:250,000 Geologic Map of the Salton Sea (Jennings, 1967), the Proposed Project area is underlain by Quaternary lake sediments (Ql), which have a high sensitivity for paleontological resources. However, given the previously disturbed nature of the Proposed Project area, the potential to encounter a paleontological resource would be considered low and potential impacts to paleontological resources would be less than significant.

Cumulative Impacts:

The development of cumulative projects in the area has the potential to impact geologic resources. However, geological impacts are site-specific and are expected to be minimal to none from a cumulative geological standpoint. Similar to the Proposed Project, any related projects' potential impacts related to geology and soils would be assess on a case-by-case basis. MM-GS-1 and MM-GS-2 would be implemented during the construction phase of the Proposed Project to reduce potential impacts. Therefore, with the implementation of mitigation measure, the Proposed Project's cumulative impacts related to geology and soils would be reduced to a less than significant level.

VIII. *GREENHOUSE GAS EMISSION*

Constituent gases of the Earth's atmosphere, called atmospheric GHGs, play a critical role in the Earth's radiation amount by trapping infrared radiation emitted from the Earth's surface, which otherwise would have escaped to space. Prominent GHGs contributing to this process include carbon dioxide (CO_2), methane (CH_4), ozone, water vapor, nitrous oxide (N_2O), and chlorofluorocarbons (CFCs). This phenomenon, known as the Greenhouse Effect, is responsible for maintaining a habitable climate. Anthropogenic (caused or produced by humans) emissions of these greenhouse gases in excess of natural ambient concentrations are responsible for the enhancement of the Greenhouse Effect and have led to a trend of unnatural warming of the Earth's natural climate, known as global warming or climate change. Emissions of gases that induce global warming are attributable to human activities associated with industrial/manufacturing, agriculture, utilities, transportation, and residential land uses. Transportation is responsible for 40 percent of the State's GHG emissions (CARB, 2019). Emissions of CO_2 and N_2O are byproducts of fossil fuel combustion. Methane, a potent GHG, results from off-gassing associated with agricultural practices and landfills. Sinks of CO_2, where CO_2 is stored outside of the atmosphere, include uptake by vegetation and dissolution into the ocean.

Assembly Bill 32 (Global Warming Solutions Act of 2006)

The Global Warming Solutions Act (commonly referred to as AB 32 requires a Statewide commitment and effort to reduce GHG emissions to 1990 levels by 2020 (25 percent below business as usual). To effectively implement the 2020 goal, AB 32 requires the CARB to develop appropriate regulations and to establish a mandatory reporting system to track and monitor GHG emission levels from stationary sources.

This bill is the first Statewide policy in the United States to mitigate GHG emissions and includes penalties for noncompliance. As with the goals and targets set by other GHG emissions–related actions taking place at the regional and international levels, AB 32 sets precedence in requiring an inventory and reduction of GHG emissions in the State.

Currently, six (6) GHGs are regulated by the federal and State government: CH_4, CO_2, hydrofluorocarbons (HFCs), N_2O, perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The CARB also includes nitrogen trifluoride (NF_3) in its inventory of monitored GHGs in California.

CEQA Guidelines

CEQA Guidelines require lead agencies to adopt GHG threshold of significance. When adopting these thresholds, the CEQA Guidelines allow lead agencies to consider thresholds of significance adopted or recommended by other public agencies, or recommended by experts, provided that the thresholds are supported by substantial evidence, and/or to develop their own significance threshold.

As discussed in Section III. *Air Quality*, above, the Proposed Project is located within the SSAB, which is under the jurisdiction of the ICAPCD. The County has not established formal quantitative or qualitative thresholds through a public rulemaking process, but CEQA permits the lead agency to establish a project-specific threshold of significance if backed by substantial evidence, until a formal threshold is approved.

Would the project:

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment? ☐ ☒ ☐ ☐

a) GHG emissions associated with the Proposed Project would primarily be associated with Project-related traffic. In addition, Project-related construction activities, energy consumption, water consumption, and solid waste generation would also contribute to the Proposed Project's overall generation of GHGs. As discussed above, the County has not established quantitative or qualitative thresholds. Significance of the Proposed Project's GHG impacts will be based on compliance with AB 32 (AB 32, 2006). AB 32 establishes goals for the statewide reduction of GHG emissions.

As discussed in the Section III. *Air Quality*, above, the Proposed Project would generate various emissions during construction and operation which include GHG emissions regulated under AB 32. The Proposed Project involves the replacement of an existing bridge with a new and improved bridge structure reconstructed in the same alignment as the existing bridge over the New River. Therefore, construction impacts are expected to be minimal and temporary. Nevertheless, mitigation measures MM-GHG-1 through MM-GHG-4 would be implemented to reduce Proposed Project impacts during construction to less than significant levels.

During operation, the Project-related traffic would generate GHG emissions. The existing bridge occupying the Proposed Project site has been closed for over a year. As such, commuters that currently live and work along this stretch of Lack Road are required to utilize lengthy detours due to this closure. With implementation of the Proposed Project, the Proposed Project would improve passage for these commuters but would add mobile emission sources to the Proposed Project vicinity, which could potentially increase GHG emissions. However, the effects of GHGs are global in nature. A project that shifts the location of a GHG-emitting activity (e.g., where vehicles drive) would result in no net change in global GHG emissions levels. Therefore, because the Proposed Project would simply recirculate traffic from other local roadways to the new improved bridge, the Proposed Project would result in less than significant impacts due to greenhouse gas emissions during operation.

MM-GHG-1:

The Applicant shall use alternative-fueled or catalyst equipped diesel construction equipment, including all off-road and portable diesel-powered equipment.

MM-GHG-2:

The Applicant shall minimize idling time by shutting off equipment when not in use or reducing the time of idling to a maximum of five (5) minutes.

MM-GHG-3:

The Applicant shall limit the hours of operation of heavy-duty equipment and/or the amount of equipment in use to the maximum extent feasible.

MM-GHG-4:

When the use of portable generators is not utilized, the Applicant shall replace fossil-fueled equipment with electrically-driven equivalents.

b) Conflict with an applicable plan or policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases? ☐ ☒ ☐ ☐

b) AB 32 is the primary plan, policy or regulation adopted in the State of California to reduce GHG emissions. The County has not adopted a climate action plan or policy. As discussed above, GHG impacts from the Proposed Project would be less than significant with implementation of mitigation measures MM-GHG-1 through MM-GHG-4.

Cumulative Impacts:

It is anticipated that Proposed Project-related cumulative impacts would not be significant because neither short-term (i.e., construction) emissions of GHGs nor operational GHG emissions are anticipated to exceed recommended significance thresholds. Furthermore, the contribution of Project-related GHG emissions to the cumulative impact of global climate change is considered less than significant because of the adoption of a new low carbon fuel standard and through increased fuel efficiency as mandated in AB 32 and related programs adopted by the State of California.

IX. *HAZARDS AND HAZARDOUS MATERIALS*

Would the project:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials? ☐ ☒ ☐ ☐

a) Construction of the Proposed Project would require the use and transport of chemicals and materials typically associated with precast concrete bridge structures, paving, and other chemicals associated with construction. The use of these materials would be temporary and limited to the immediate area of application during the construction phase. The use, transport, and disposal of these materials would be completed in a manner that is consistent with the State requirements and manufacturer's recommendations and would ensure that there would not be a significant hazard to the public or the environment.

The New River flows beneath the existing bridge, which is classified as a Class 4 waterway (Appendix C). During construction, the existing bridge would be removed. However, these activities would be conducted above the New River. All construction activities are anticipated to take place from the banks. While direct contact with the New River would not be necessary as part of the Proposed Project's construction activities, site grading would redistribute on-site soils that may need to be collected and disposed of. These soils may be contaminated from the New River. If these soils are contaminated, the temporary disturbance and potential disposal of these soils during grading may create a significant hazard to the public and environment. The Proposed Project would implement mitigation measures MM-AQ-1 and MM-HAZ-1 through MM-HAZ-6, including the preparation and implementation of a Contaminated Soil Management Plan, to minimize associated risks and ensure applicable statutory and regulatory standards and requirements are complied with in the event contaminated soils are encountered. Implementation of mitigation measures would ensure that potentially contaminated soils are identified, removed, and properly disposed of to prevent the creation of significant hazard to the public and the environment to the maximum extent feasible and reduce impacts to less than significant levels.

During operations, the Proposed Project's new bridge would not require the routine transport, use or disposal of hazardous materials. It is anticipated that hazardous materials would not be transported as a result of the new bridge or that materials requiring training, professional use, or transport to a designated hazardous disposal facility would not be frequently applied or used on the new bridge. Therefore, the Proposed Project would not cause a significant hazard to the public or environment during operation and impacts would be less than significant.

MM-HAZ-1:

Prior to construction activities, a soils investigation shall be conducted to determine the presence of contaminated soils on the Proposed Project site.

MM-HAZ-2:

A Contaminated Soil Management Plan shall be prepared and implemented during construction that contains procedures to be followed in the event that contaminated soils are encountered during construction of the Proposed Project. The Contaminated Soil Management Plan shall include procedures for the proper identification, removal, and disposal of contaminated soils.

MM-HAZ-3:

The Applicant shall contact the appropriate regulatory agencies identified in the Contaminated Soil Management Plan if contaminated soils are encountered.

MM-HAZ-4:

Sampling and analysis of soils known or suspected to be impacted by hazardous materials shall be conducted in accordance with the procedures detailed in the Contaminated Soil Management Plan.

MM-HAZ-5:

Procedures for the proper handling, storage, treatment, transport, and disposal of contaminated soil shall be conducted in consultation with the appropriate regulatory agencies and in compliance with applicable statutory and regulatory requirements.

MM-HAZ-6:

A Worker Health and Safety Plan shall be prepared and implemented prior to the start of construction activities. The Worker Health and Safety Plan shall identify the nature and extent of contaminants that may be encountered during construction, appropriate health and environmental protection measures and equipment, and emergency response procedures. The Worker Health and Safety Plan shall also include the following New River Health and Safety Considerations, which shall be adhered to prior to the start of and throughout construction activities:

- **The Proposed Project Contractor shall be advised that the New River flows beneath the Proposed Project site.**

- **As the New River is known to contain bacteria-laden foam that can blow over to nearby sites on windy days, precautions shall be identified and taken when working close to the New River on windy days (wind gusts in excess of 15 miles per hour).**
- **Construction workers shall be prohibited from drinking water from the New River.**
- **To assist in preparing for the risk associated with construction activities close to the New River, a model risk assessment is available on the Occupational Safety and Health Administration website (http:www.dir.ca.gov/dosh/).**

b) Create a significant hazard to the public or the environment through reasonable foreseeable upset and accident conditions involving the release of hazardous materials into the environment? ☐ ☒ ☐ ☐

b) As previously stated, construction of the Proposed Project would require the use of chemicals and materials typically associated with precast concrete bridge structures, paving, and other chemicals associated with construction. The use of these materials would be temporary and would be limited by the construction duration and location and in quantity. Additionally, they would be transported, used, and disposed of in a manner that is consistent with the State requirements and manufacturers recommendations and would not create a significant hazard to the public or environment. As discussed above, the New River is a polluted waterway that flows underneath the Proposed Project. As a result of the pollution in the New River, the soils on the Proposed Project site may be contaminated and, if contaminated, could create a significant hazard and release of hazardous materials into the environment during grading. Implementation of mitigation measures MM-AQ-1 and MM-HAZ-1 through MM-HAZ-6 would ensure that the Proposed Project would not release hazardous materials into the environment and create a significant hazard if contaminated soils are encountered.

The Proposed Project, as a bridge replacement project, would not involve the use of hazardous materials during operation. Thus, operation of the Proposed Project would not create a significant hazard to the public or environment through the accidental release of hazardous materials into the environment. Therefore, implementation of mitigation measures would reduce impacts related to hazardous materials to less than significant levels.

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school? ☐ ☐ ☒ ☐

c) The closest school, Westmorland Elementary School is located approximately 4.7 miles southeast of the Proposed Project site (Google Earth, accessed 2019). As previously noted in the responses to IXa and IXb above, while the Proposed Project may release hazardous materials into the environment with the disturbance of soil that may be contaminated by the polluted New River during construction, the Proposed Project would not emit hazardous emissions or handle hazardous materials within one-quarter mile of existing or proposed schools. As a result, the Proposed Project would not pose a risk to nearby schools and less than significant impacts would occur.

d) Be located on a site, which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment? ☐ ☒ ☐ ☐

d) A review of the Department of Toxic Substances Control's (DTSC's) and State Water Resources Control Board's (SWRCB's) databases (EnviroStor and Geotracker) were completed for the Proposed Project. The nearest cleanup site is located approximately 1.6 miles northeast of the Proposed Project. This cleanup site was deemed complete and the case was closed as of August 25, 1992 (SWRCB, 2019). The Proposed Project crosses the New River, which is a Class 4 contaminated waterway (Appendix C). The New River is included in the 2006 Clean Water Act Section 303 (d) list, which identifies waters that are too polluted or otherwise degraded to meet water quality standards set by states, territories, or authorized tribes. The New River conveys agricultural runoff from Mexicali and Imperial Valley, as well as contamination from urban runoff from Mexicali. The New River exhibits very poor water quality as it is known to transport community and industrial wastewater, raw and inadequately treated sewage, toxic industrial waste, garbage and other solid wastes, animal wastes, and occasionally geothermal wastewaters. As discussed above, direct contact with the New River would not be necessary as part of the Proposed Project's construction activities as these activities would take place from the banks. While direct contact with the New River would not be necessary as part of the Proposed Project's construction activities, soils on the Proposed Project site encountered during grading may be contaminated from the New River. If these soils are contaminated, a significant hazard to the public and environment may be created. The Proposed Project would implement mitigation measures MM-AQ-1 and MM-HAZ-1 through MM-HAZ-6 to minimize associated risks and ensure applicable statutory and regulatory standards and requirements are complied with in the event contaminated soils are encountered. With implementation of these mitigation measures, impacts related to the creation of a significant hazard to the public or environment would be reduced to less than significant levels.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area? ☐ ☐ ☐ ☒

e) The Proposed Project would not be located within an airport land use plan or within 2 miles of an airport and would not result in a safety hazard for people residing or working in the Proposed Project area. The nearest airport to the Proposed Project is the Cliff Hatfield Memorial Airport which is located approximately 7.2 miles northeast of the Proposed Project site.

f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan? ☐ ☐ ☒ ☐

f) The Proposed Project would be designed to applicable County and AASHTO standards and, as a result, provide adequate emergency access. The Proposed Project would not reduce the number of traffic lanes or create physical barriers along Lack Road. As the existing bridge has been closed to traffic for over one (1) year due to severe deterioration of some of the pile supports, implementation of the Proposed Project would improve all existing emergency access for adjacent properties and the surrounding community and reduce lengthy detours for all commuters that either live or work along that stretch of Lack Road. Therefore, implementation of the Proposed Project would not physically interfere or otherwise impair emergency response or emergency evacuation in the County.

g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires? ☐ ☐ ☐ ☒

g) There are no wildlands located adjacent to or within the vicinity of the Proposed Project. In addition, the California Department of Forestry and Fire Protection (CAL FIRE) maintains maps of recommended Very High Fire Hazard Severity Zones (VHFHSZs). According to the map prepared by CAL FIRE for the County, the Proposed Project is located within a Local Responsibility Area (LRA) classified as Unzoned, with the nearest VHFHSZ located approximately 25 miles northwest of the Proposed Project (CAL FIRE, 2007). The Proposed Project would not expose people or structures to the risk of loss, injury, or death as a result of wildland fires beyond existing conditions as a bridge replacement project outside a VHFHSZ. As such, neither people nor structures would be exposed to an anticipated significant risk or loss associated with wildland fires.

Cumulative Impacts:

The Proposed Project, as a bridge replacement project, does not pose a direct significant health threat either in the surrounding area or the County. The New River is a Class 4 contaminated waterway and flows underneath the Proposed Project site (Appendix C). As such, the Proposed Project may release hazardous materials into the environment with the disturbance of soil at the Proposed Project site during construction if the soils are contaminated by the polluted New River. However, potentially contaminated soil from the New River as a result of construction of the Proposed Project would be site specific and there is little cumulative relationship between potentially contaminated soils on the Proposed Project site and any related projects. As a result, less than significant cumulative impacts would occur.

X. *HYDROLOGY AND WATER QUALITY*

Would the project:

a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality? ☐ ☒ ☐ ☐

a) The Proposed Project would be completed in compliance with the established federal, State, and local water quality standards and these standards would apply to all related construction activities as well as storm water and waste discharge from the Proposed Project site during construction. A SWPPP is required for the Proposed Project, and coverage under the Statewide general National Pollutant Elimination System (NPDES) Permit (Construction General Permit [CGP], 2009-0009-DWQ [as amended by 2010-0014-DWQ and 2012-0006-DWQ] – General Permit No. CAS000002) is required. This coverage includes the preparation of a SWPPP prior to grading activities. The SWPPP would address:

- **Site Design BMPs;**
- **Routine structural and non-structural Source Control BMPs;**
- **Treatment Control BMPs, including consideration of a regional or watershed approach; and**
- **Inspection/Maintenance BMPs.**

The proposed grading activities that would occur in support of the Proposed Project would maintain the existing drainage pattern at the Proposed Project site.

The Draft Foundation Report (Appendix C) stated groundwater was encountered in exploratory borings at depths between approximately 18 and 19 feet below ground surface. Additionally, water elevation measurements were taken at the New River beneath the existing bridge at approximately 12 feet below the existing roadway. Per the County Health Department, the New River is polluted with both biological and chemical wastes and has been designated as a Class 4 contaminated waterway (Appendix C). As discussed above in Response IXd, the New River is included in the 2006 Clean Water Act Section 303 (d) list, which identifies waters that are too polluted or otherwise degraded to meet water quality standards set by states territories, or authorized tribes. The New River conveys agricultural runoff from Mexicali and Imperial Valley, as well as contamination from urban runoff from Mexicali. The New River exhibits very poor water quality as it is known to transport community and industrial wastewater, raw and inadequately treated sewage, toxic industrial waste, garbage and other solid wastes, animal wastes, and occasionally geothermal wastewaters. The Proposed Project, as a bridge replacement project, would not result in the discharge of pollutants into the already contaminated New River during operation. However, the grading phase of Proposed Project construction would require temporary disturbance of soils, which could potentially result in the degradation of water quality (surface and groundwater) if the soils are contaminated from the New River. Additionally, during grading and construction, pollutants including sediments, petroleum products, trash, concrete waste, sanitary waste, and chemicals may occur on-site which could also have detrimental effects on water quality. The Proposed Project would implement mitigation measures MM-WQ-1, MM-AQ-1 (see Section III, *Air Quality*, above), and MM-HAZ-1 through MM-HAZ-6 (see Section IX, *Hazards and Hazardous Materials*, above) to ensure impacts to water quality standards and surface and groundwater quality would be less than significant.

MM-WQ-1:

The Applicant shall implement and inspect BMPs. BMP implementation and maintenance for the SWPPP shall be verified through inspection, self-certification, survey or other effective measure by the Applicant, or authorized agent as approved by County Public Works Department. Records (maintenance, operations, inspections) of the BMPs will be made available to the County upon request.

b)	Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	☐	☒	☐	☐

b) As discussed above, the Draft Foundation Report (Appendix C) stated groundwater was encountered in exploratory borings at depths between approximately 18 and 19 feet below ground surface. Additionally, water elevation measurements were taken at the New River beneath the existing bridge at approximately 12 feet below the existing roadway. The existing bridge would be removed without the need to be in the New River. All construction activities are anticipated to take place from the banks. If temporary dewatering is necessary, the means and methods of any dewatering scheme shall be established by a local contractor and would require a permit and plan that complies with CRRWQCB regulations (MM-WQ-2). Minimal water use would be required for construction activities as part of the Proposed Project and would be limited to dust suppression. The water used for such activities would be obtained off-site and would not require the use of groundwater. Thus, the Proposed Project, as a bridge replacement project, is not expected to use any groundwater. Accordingly, with implementation of mitigation measure (MM-WQ-2), the Proposed Project would not substantially deplete groundwater supplies nor interfere substantially with groundwater recharge; therefore, impacts would be less than significant.

MM-WQ-2:

If temporary dewatering is necessary, the actual means and methods of any dewatering scheme shall be established by a contractor with local experience. Temporary dewatering shall require a permit and plan that complies with CRRWQCB regulations.

c)	Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:	☐	☒	☐	☐
	(i) result in substantial erosion or siltation on- or off-site;	☐	☐	☒	☐

(i) During Proposed Project construction, erosion could result from construction activities, including the operation of heavy machinery, grading activities, excavation, or wind or water erosion of stockpiled fill/excavated materials at staging areas. Erosion would be minimized through the implementation of BMPs such as limiting the amount of disturbed soil to the extent possible, preventing runoff from the site, and ensuring compliance with the SWPPP, discussed above. In addition, the Proposed Project site is relatively flat with low levels of natural erosion (County of Imperial, n.d.). As such, the Proposed Project would not result in substantial erosion or siltation on- or off-site with implementation of BMPs and compliance with the SWPPP. Therefore, impacts would be less than significant.

	(ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	☐	☐	☒	☐

(ii) The New River flows under the Proposed Project site. Water elevation measurements were taken at the New River beneath the existing bridge and were approximately 12 feet below the existing roadway. The Proposed Project includes the replacement of an existing bridge with a new bridge within the same alignment of the existing bridge. An IID culvert is located to the east of the Proposed Project site and empties into the New River. The Proposed Project would not result in alterations or relocation of the IID culvert. As such, the Proposed Project would not substantially increase the rate or amount of surface runoff that would result in flooding of the New River. Therefore, less than significant impacts would occur.

(iii) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or; ☐ ☒ ☐ ☐

(iii) The Proposed Project consists of the replacement of an existing bridge with a new bridge structure within the alignment of the existing bridge over the New River. As a bridge replacement project, no increase in runoff water is expected to result from the design of the Proposed Project. As discussed above, an IID culvert is located to the east of the Proposed Project site that empties into the New River. The Proposed Project would not be expected to result in alterations or relocation of the IID culvert. Therefore, the Proposed Project would not create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems. As discussed above, the Proposed Project would include grading during construction, which would disturb soils on-site. These soils may be contaminated from the New River, which could provide additional sources of polluted runoff. However, the Proposed Project would implement MM-WQ-1, MM-AQ-1 (see Section III, *Air Quality*, above), and MM-HAZ-1 through MM-HAZ-6 (see Section IX, *Hazards and Hazardous Materials*, above), which would reduce impacts related to the addition of polluted runoff sources to less than significant levels.

(iv) impede or redirect flood flows? ☐ ☐ ☒ ☐

(iv) The Proposed Project consists of the replacement of an existing bridge with a new bridge structure within the alignment of the existing bridge over the New River. Though the New River flows beneath the Proposed Project site, the existing bridge would be removed without the need to be in the New River. As all construction activities are anticipated to take place from the banks of the New River, the Proposed Project would not impede or redirect flood flows. Therefore, less than significant impacts would occur.

d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation? ☐ ☒ ☐ ☐

d) The Proposed Project is not within a tsunami zone (see Appendix C; California Department of Conservation, 2019). The Draft Foundation Report stated that though there have been no documented occurrences of seiches at the Salton Sea (located approximately 2.3 miles northwest of the Proposed Project site), it is likely that one (1) could occur due to the relatively shallow depth and seismic exposure. However, the Draft Foundation Report determined, given the Proposed Project site's distance to the Salton Sea and that the Proposed Project site is approximately 15 feet higher than the surface of the Salton Sea, the potential for seiches affecting the Proposed Project site is considered low.

The Proposed Project is located in Zone A, which is a special flood area and a 100-year flood hazard area by the Federal Emergency Management Agency (FEMA, 2008). The New River flows beneath the existing bridge within the Proposed Project site. As discussed above, the New River is polluted with both biological and chemical wastes and has been designated as a Class 4 contaminated waterway (Appendix C). Thus, should flooding of the New River occur, pollutants may be released. As discussed above, the existing bridge would be removed without the need to be in the New River. All Proposed Project construction activities are anticipated to take place from the banks. Nevertheless, while the release of pollutants would not be directly caused by Proposed Project, pollutants would indirectly be released from the polluted New River. Typical earthwork guidelines would be implemented for the Proposed Project, including taking precautions during site clearing, excavation, and grading to protect the Proposed Project site from flooding, ponding, or inundation (i.e., temporary provisions during the rainy season and pumps to remove water). In addition, the Proposed Project would implement BMPs, comply with the SWPPP, and comply with mitigation measures MM-AQ-1 (see Section III, *Air Quality*, above) and MM-HAZ-6 (see Section IX, *Hazards and Hazardous Materials*, above), which would reduce potential impacts to hydrology and water quality related to release of pollutants due to project inundation in a flood zone to less than significant levels.

e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan? ☐ ☒ ☐ ☐

e) As discussed, the increase in impervious surfaces posed by the Proposed Project would create and contribute to additional runoff. However, the Proposed Project is designed to include BMPs to capture and control the rate of runoff. Implementation of MM-WQ-1 would ensure that additional runoff water would not exceed the capacity of existing stormwater drainage systems or provide substantial additional sources of polluted runoff and therefore result in less than significant impacts.

Cumulative Impacts:

The Proposed Project could result in potential impacts related to water quality standards as a result of the Proposed Project's proximity to the polluted New River and the potential presence of contaminated soils on-site. Cumulative projects in the vicinity, individually and cumulatively, could potentially increase and contribute to the degradation of water quality, resulting in cumulative impacts to hydrology and surface water quality. However, as with the Proposed Project, each of the cumulative projects would also be subject to NPDES Permit requirements for both construction and operation. Projects would be required to develop a SWPPP and would be evaluated individually to determine appropriate BMPs to minimize water quality and hydrologic impacts. In addition, the County Public Works Department reviews all development projects on a case-by-case basis to ensure that sufficient local and regional drainage capacity is available. Furthermore, with implementation of mitigation measures discussed above, the Proposed Project's impacts to hydrology and water quality would be reduced to less than significant levels. Thus, the Proposed Project's contribution to cumulative impacts to hydrology and water quality would be less than significant.

XI. *LAND USE AND PLANNING*

Would the project:

The Proposed Project site is surrounded by land designated as Agriculture and zoned as A-3. The County's Zoning Code (Title 9, Chapter 9: A-3 [Heavy Agriculture]) provides the following description for the Heavy Agriculture land use district, and is provided below:

> **The purpose of the A-3 (Heavy Agriculture) [40 acres or larger typical] Zone is to designate areas that are suitable for agricultural land uses; to prevent the encroachment of incompatible uses onto and within agricultural lands; and to prohibit the premature conversion of such lands to non-agricultural uses. It is a land use that is to promote the heaviest of agricultural uses in the most suitable land areas of the County. Uses in the A-3 zoning designation are limited primarily to agricultural related uses and agricultural activities that are compatible with agricultural uses.**

The predominant land use in the vicinity of the Proposed Project is agricultural.

a) Physically divide an established community? ☐ ☐ ☐ ☒

a) The Proposed Project would be constructed within the same alignment as the existing bridge. The proposed use, design and scale would be consistent with the existing land use and development in the surrounding area. As the existing bridge has been closed for over a year due to severe deterioration, operation of a new and improved bridge as a result of the Proposed Project would improve all existing access to adjacent properties and the surrounding community and reduce lengthy detours for all commuters that either live or work along that stretch of Lack Road. The Proposed Project would not include any physical barriers or features that would divide an established community.

b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect? ☐ ☐ ☒ ☐

b) While the Proposed Project is surrounded by land designated as Agriculture and zoned A-3 (Heavy Agriculture), the Proposed Project consists of the replacement of an existing bridge with a new and improved bridge structure that would be reconstructed in the same alignment as the existing bridge over the New River. The Proposed Project would not alter the existing use of the Proposed Project site and, as such, be consistent with all applicable land use plans, policies, and regulations. The Proposed Project would be consistent with the goals and policies of the County General Plan, County Municipal Code, and related ordinances. As further discussed in Section IV. *Biological Resources*, above, the Proposed Project is not located within an area covered by an adopted HCP or NCCP. Therefore, less than significant impacts would occur.

Cumulative Impacts:

As indicated above, Proposed Project implementation is consistent with the existing land use on the Proposed Project site and compatible with the surrounding land uses in the Proposed Project environs. Therefore, implementation of the Proposed Project will not result in any cumulative land use impacts.

XII. *MINERAL RESOURCES*

Would the project:

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state? ☐ ☐ ☐ ☒

a) There are no locally-important mineral resources underlying the Proposed Project site (County General Plan, Conservation and Open Space Element, 2016). The Proposed Project would not contain elements that would remove, damage, or otherwise result in the loss of a known mineral resource. Therefore, the Proposed Project would not result in the loss of availability of

a known mineral resource.

b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan? ☐ ☐ ☐ ☒

b) There are no mineral recovery sites within or neighboring the Proposed Project area (County General Plan, Conservation and Open Space Element, 2016). Therefore, the Proposed Project would not result in the loss of a locally-important mineral resource recovery site.

Cumulative Impacts:

As identified above, the Proposed Project is not designated for mineral resources either by the State of California or the County and is not known to contain such resources. As a result, no mineral resources would be lost with site development and no cumulative impacts would occur.

XIII. *NOISE*

The County has established noise standards and noise limitations for construction-related activities. The County General Plan Noise Element states construction noise from a single piece of equipment or a combination of equipment, shall not exceed 75 dB L_{eq}, when averaged over an eight (8) hour period, and measured from the nearest sensitive receptor. Additionally, operation of construction equipment in the County is limited to the hours of 7 a.m. to 7 p.m., Monday through Friday, and 9 a.m. to 5 p.m. on Saturday with no commercial construction operations permitted on Sunday or holidays (County of Imperial, 2015).

The County has also established land use compatibility noise guidelines. The County General Plan Noise Element provides noise criteria for various land-use designations to determine land use compatibility (see Table 1, County Noise/Land Use Compatibility Guidelines).

TABLE 1: COUNTY NOISE/LAND USE COMPATIBILITY GUIDELINES

Land Use Category	Average-Daily Noise Level (dBA Community Noise Equivalent Level [CNEL])			
	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential	<60	60-70	70-75	>75
Transient Lodging-Motels, Hotels	<60	60-75	70-80	>80
Schools, Libraries, Churches, Hospitals, Nursing Homes	<60	60-70	70-80	>80
Auditoriums, Concert Halls, Amphitheaters	--	<70	--	>70
Sports Arena, Outdoor Spectator Sports	--	<70	70-75	>75
Playgrounds, Neighborhood Parks	<70	--	70-75	>75
Golf Courses, Riding Stables, Water Recreation, Cemeteries	<70	--	70-80	>80
Office Buildings, Business Commercial and Professional	<65	65-75	75-80	>80
Industrial, Manufacturing, Utilities, Agriculture	<70	70-75	75-80	>80

Source: County of Imperial, California, General Plan Noise Element, 2015.

Notes:

Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design.

Normally Unacceptable: New construction or development should be discouraged. If new construction or development does proceed a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. Clearly Unacceptable: New construction or development clearly should not be undertaken.

CNEL is a measure of cumulative noise exposure or the weighted average sound level over a 24-hour period. Many cities and counties use CNEL to apply more conservative evening hour corrections to a 24-hour noise level in order to account for noise sensitive time periods during the evening and night hours when sound appears louder.

The County General Plan Noise Element states a substantial increase in noise levels would be an increase of 5.0 dBA Community Noise Equivalent Level (CNEL) or greater where noise levels are less than the County's normally acceptable noise levels without project implementation. If the noise level without project implementation exceeds the County's normally acceptable noise levels, an increase of 3.0 dBA CNEL or greater would be considered a substantial increase.

The County Noise Abatement and Control Ordinance (Title 9 Division 7, 2017) provides property line noise limitations consistent with the County General Plan Noise Element. The one (1) hour average sound level limit for agricultural land uses is 70 dBA.

The County has also adopted a Right to Farm Ordinance (No.1031). The Right to Farm Ordinance requires a disclosure to land owners near agricultural land operations or areas zoned for agriculture. The disclosure advises land owners that discomfort and inconvenience from machinery and aircraft noise resulting from conforming and accepted agricultural operations as normal and necessary aspect of living in the agricultural areas of the County (County of Imperial, 2015).

Would the project result in:

a)	Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☒	☐	☐

a) Construction Noise

The Proposed Project would be expected to generate short-term noise associated with construction activities. The Proposed Project would be required to comply with the County General Plan Noise Element, which as discussed above requires construction activities to be completed between the hours of 7 a.m. to 7 p.m. Monday through Friday, and from 9 a.m. to 5 p.m. on Saturday with no commercial construction operations permitted on Sunday or holidays (County of Imperial, 2015). The USEPA has compiled data regarding the noise generated by typical construction activities (see Table 2, Typical Construction Activity Noise). As shown in Table 2, noise levels would be reduced with distance from construction activities, approximately 6 dBA per doubling distance. As a bridge replacement project, not all typical construction activities presented in Table 2 apply, however, at a minimum grading would be required during construction of the Proposed Project.

TABLE 2: TYPICAL CONSTRUCTION ACTIVITY NOISE

Construction Phase	Noise Levels at 50 Feet with Mufflers (dBA L_{eq})	Noise Levels at 100 Feet with Mufflers (dBA L_{eq})	Noise Levels at 200 Feet with Mufflers (dBA L_{eq})
Ground Clearing	82	76	70
Excavation, Grading	86	80	74
Foundations	77	71	65
Structural	83	77	71
Finishing	86	80	74

Source: United States Environmental Protection Agency, Noise from Construction Equipment and Operations, Building Equipment and Home Appliances, PB 206717, 1971.

Agricultural land surrounds the Proposed Project site. The nearest sensitive receptors are residences located approximately 1.1 miles south and 1.9 miles northeast of the Proposed Project. Based on the noise generated by typical construction activities shown in Table 2, above, and the fact that noise levels reduce approximately 6 dBA per doubling distance, noise experienced at the nearest sensitive receptors would not exceed the County's 75 dB L_{eq} threshold as a result of the Proposed Project's construction activities. Compliance with the County General Plan Noise Element and implementation of MM-NOISE-1 through MM-NOISE-3 would ensure that the Proposed Project's construction noise impacts would be less than significant.

Operational Noise

The existing bridge has been closed to traffic for over one (1) year due to severe deterioration of some of the pile supports. As such, noise generated from traffic does not currently exist at the Proposed Project site. The primary sources of noise in the Proposed Project area include vehicular traffic along the surrounding roadways (including Vail Road, located approximately 0.3 mile north of the Proposed Project site, and Foulds Road, located approximately 0.2 mile south of the Proposed Project site) and agricultural operations such as heavy equipment and vehicle use.

As discussed above, the County Noise Abatement and Control Ordinance (Title 9 Division 7, 2017) limits one (1) hour average sound in agricultural uses to 70 dBA. Additionally, as shown above in Table 1, the County's normally acceptable noise levels for agricultural land uses is less than 70 dBA CNEL. As discussed above, according to the County General Plan Noise Element, a substantial increase in noise levels would be an increase of 5.0 dBA CNEL or greater where noise levels are less than the County's normally acceptable noise levels without project implementation. If the noise level without project implementation exceeds the County's normally acceptable noise levels, an increase of 3.0 dBA CNEL or greater would be considered a substantial increase.

During operation, the Proposed Project's new bridge would generate traffic noise. Should the existing noise levels at the Proposed Project area be less than the County's normally acceptable noise levels for agricultural land uses (less than 70 dBA CNEL), than the Proposed Project would result in a substantial noise increase if the Proposed Project's traffic noise would generate approximately 73.2 dBA or more. Agricultural operations, which can typically include the use of heavy-duty equipment, could reach maximum noise levels of approximately 85 dBA at 50 feet. Should existing noise levels at the Proposed Project area be approximately 85 dBA and, therefore, exceed the County's normally acceptable noise levels, the Proposed Project would result in a substantial noise increase if the Proposed Project's traffic noise would generate

approximately 84.9 dBA or more.

Levels of highway traffic noise typically range from 70 to 80 dBA at a distance of 50 feet from the highway (United States Department of Transportation Federal Highway Administration, 2017). The Proposed Project's new bridge would generate traffic noise. However, because the new bridge would be located on Lack Road, a Minor Collector road classified by the County, and only contain two travel lanes, it is anticipated the new bridge would be used by the surrounding community's marginal number of commuters that either live or work along that stretch of Lack Road. As such, it is expected that the traffic noise generated by the Proposed Project would be substantially lower than the typical 70 to 80 dBA at a distance of 50 feet from a highway. Thus, the Proposed Project's traffic noise would be expected to generate less than 73.2 dBA and 84.9 dBA and, therefore, not result in a substantial noise increase in ambient noise in the vicinity of the Proposed Project.

Noise generated from heavily traveled roads typically attenuates at about 3 dBA per doubling distance. The nearest sensitive receptors are residences located approximately 1.1 miles south and 1.9 miles northeast of the Proposed Project. Due to the anticipated traffic noise generated by the Proposed Project and traffic noise attenuation, a substantial increase in ambient noise levels at these sensitive receptors would not occur. Therefore, impacts would be less than significant.

MM-NOISE-1:

In compliance with the County General Plan Noise Element, operation of construction equipment shall be limited to the hours of 7 a.m. to 7 p.m., Monday through Friday, and 9 a.m. to 5 p.m. on Saturday. No commercial construction operations shall be permitted on Sunday or holidays.

MM-NOISE-2:

Construction activities shall be operated in a manner that limits noise impacts on surrounding uses.

MM-NOISE-3:

Construction contractors shall equip all construction equipment with properly operating and maintained mufflers, consistent with the manufacturer's standards.

b) Generation of excessive groundborne vibration or groundborne noise levels? ☐ ☒ ☐ ☐

b) High levels of groundborne noise and groundborne vibration is generated during construction related activities such as excavation, large mechanical pile driving machines, or the use of heavy earthmoving equipment. According to the Federal Transit Administration (FTA), construction equipment could generate vibration velocities at a maximum of 0.089 peak particle velocity (PPV) from a large bulldozer (FTA, 2006). During operation, groundborne noise and groundborne vibration is generated by heavy-duty vehicular travel (e.g., refuse trucks, delivery trucks, and transit buses) on local roadways. Trucks and buses typically generate groundborne vibration velocity levels of around 63 VdB at 50 feet, and these levels could reach 72 VdB where trucks and buses pass over bumps in the road (FTA, 2006). Loaded trucks can result in a vibration level of approximately 0.076 PPV at a reference distance of 25 feet.

The most restrictive threshold for building damage is 0.12 PPV for historic buildings and buildings that are extremely susceptible to vibration damage (FTA, 2006). Regarding human annoyance resulting from groundborne vibration during construction, the FTA has established a vibration impact threshold of 80 VdB and above at residences and buildings where people normally sleep (FTA, 2006). The nearest building is approximately 1.1 miles south of the Proposed Project. The nearest sensitive receptors are residences located approximately 1.1 miles and 1.9 miles northeast of the Proposed Project. Due to distance, vibration generated by the Proposed Project during construction would not result in the generation of vibration in excess of vibration thresholds at the nearest building or the nearest noise sensitive receptors. Therefore, implementation of MM-NOISE-1 through MM-NOISE-3 would ensure that the Proposed Project's construction groundborne vibration impacts would be less than significant.

c) For a project located within the vicinity of a private airstrip or an airport land use plan or where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels? ☐ ☐ ☐ ☒

c) The Proposed Project would not be located within an airport land use plan or within 2 miles of an airport and would not result in a safety hazard for people residing or working in the Proposed Project area. The nearest airport to the Proposed Project is the Cliff Hatfield Memorial Airport which is located approximately 7.2 miles northeast of the Proposed Project site.

Cumulative Impacts:

Cumulative noise impacts could occur as a result of increased traffic volumes on local roadways due to future growth and increased development in the vicinity of the Proposed Project site. Cumulative traffic noise impacts are based on the difference between existing traffic volumes and future traffic volumes after build out of the project and in combination with related projects currently being proposed or built within the vicinity of the Proposed Project site. There are no other projects in the vicinity of the Proposed Project such that a meaningful contribution of traffic or noise would result in a cumulative effect such that noise levels would

substantially increase (a substantial increase in noise levels would be an increase of 5.0 dBA CNEL or greater where noise levels are less than the County's normally acceptable noise levels without project implementation. If the noise level without project implementation exceeds the County's normally acceptable noise levels, an increase of 3.0 dBA CNEL or greater would be considered a substantial increase). Cumulative impacts would be less than significant.

XIV. *POPULATION AND HOUSING*

Would the project:

a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and business) or indirectly (for example, through extension of roads or other infrastructure)? ☐ ☐ ☐ ☒

a) The Proposed Project would consist of the replacement of the severely deteriorated existing bridge with a new precast concrete bridge along Lack Road over the New River. No housing units are proposed. While the Proposed Project would provide a few temporary employment opportunities during construction, it is expected that these jobs would be filled by the workforce in the surrounding communities; therefore, no indirect population growth is anticipated. As a bridge replacement project, no growth inducing extensions of infrastructure, including roadways, are proposed as part of the Proposed Project. As such, the Proposed Project would be consistent with the grown and development in the area and would not induce population growth in the area, either directly or indirectly.

b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere? ☐ ☐ ☐ ☒

b) As a bridge replacement project, there are no housing facilities located on the Proposed Project site. While there are a few scattered residences on the surrounding agricultural land, no housing units would be removed as part of the Proposed Project. As such, there would be no displacement of any person or persons. The Proposed Project would not alter the location, distribution, density, or growth of the human population in the area. Therefore, the Proposed Project would not be expected to result in impacts to population and housing related to displacement of people or housing necessitating the construction of replacement housing.

Cumulative Impacts:

The Proposed Project is consistent with the County's General Plan. As a bridge replacement project, the Proposed Project would not contribute to cumulative effect as no housing and no displacement of people or housing are proposed. Therefore, the Proposed Project's cumulative contribution would not significantly impact population and housing.

XV. *PUBLIC SERVICES*

a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services: ☐ ☐ ☐ ☒

1) Fire Protection? ☐ ☐ ☐ ☒

1) The Proposed Project area is serviced by the Imperial County Fire Department (ICFD). The ICFD has eight (8) stations and six (6) contracting agencies providing fire protection services throughout the County (ICFD, 2019). The nearest fire station to the Proposed Project site is the Westmorland Volunteer Fire Station, located approximately 4.5 miles southeast of the Proposed Project site. The fire station currently operates with 22 volunteers and one part-time fire chief. It serves the areas within the City of Westmorland and the County (City of Westmorland, 2019). The Proposed Project would replace the severely deteriorated existing bridge along Lack Road over the New River with a new precast concrete bridge. The existing bridge would be removed without the need to be in the New River. The new bridge dimensions would be 35 feet and 6 inches wide by 125 feet long, with a structure depth of 7 feet and 0.875 inches. The Proposed Project's new bridge would be reconstructed at approximately the same alignment with two (2) 12-foot lanes designed to support a 55 mph vehicular speed. Shoulder widths would be 4 feet on the bridge, and would transition to the existing width at the roadway conform points. All construction activities are anticipated to take place from the banks. The existing bridge has been non-operational for over a year. As such, no traffic detour plan or temporary signage would be needed during construction. The Proposed Project would not include any other land uses and, therefore, would not induce population growth in the Proposed Project area necessitating the need for additional fire protection. The Proposed Project would comply with applicable requirements of

ICFD and construction plans would be subject to approval by ICFD. Therefore, the Proposed Project would not increase demand for fire protection services, nor degrade the quality of existing fire protection services.

2) Police Protection? ☐ ☐ ☐ ☒

2) The Imperial County Sheriff's Office (ICSO) provides law enforcement services in the County. The nearest ICSO station is located approximately 10.5 miles southeast of the Proposed Project. The Proposed Project would replace the severely deteriorated existing bridge along Lack Road over the New River with a new precast concrete bridge. As a bridge replacement project, the Proposed Project would not include any other land uses. The Proposed Project would therefore not induce population growth in the area. As a result, no additional police protection would be required. Therefore, the Proposed Project would not increase demand for police protection services, nor degrade the quality of existing police protection services.

3) Schools? ☐ ☐ ☐ ☒

3) The Proposed Project would not directly increase demand for public schools in the County. As a bridge replacement project, the Proposed Project would not generate employment that result in a substantial demand on school services. Furthermore, as discussed in Section XIV. *Population and Housing*, above, the Proposed Project would not directly or indirectly induce any population growth in the Proposed Project area. Therefore, the Proposed Project would not increase demand on schools.

4) Parks? ☐ ☐ ☐ ☒

4) The Parks and Recreation Division of the County Department of Public Works is dedicated to the improvement, repair, expansion, and implementation of parks and recreation through the County. The nearest County park is Red Hill Park, located approximately 7 miles northeast of the Proposed Project. As discussed in Section XIV. *Population and Housing*, above, the Proposed Project would not directly or indirectly induce any population growth in the Proposed Project area. Therefore, the Proposed Project, as a bridge replacement project, would not cause an increase in population that would create a need for additional parks. As a result, the Proposed Project would not increase demand for park facilities.

5) Other Public Facilities? ☐ ☐ ☐ ☒

5) The nearest public library, Imperial County Free Library, and post office are located approximately 7.8 miles east of the Proposed Project. As discussed in Section XIV. *Population and Housing*, above, the Proposed Project would not directly or indirectly induce any population growth in the Proposed Project area. No additional public facilities would be needed as a result of the Proposed Project. Therefore, the Proposed Project would not increase demand on other public facilities.

Cumulative Impacts:

The area in which the Proposed Project is located is currently supported by adequate public services, including fire protection, police protection, public school facilities, library, and park facilities. As a bridge replacement project, the Proposed Project would not substantially affect the existing level of public services provided in the area. Therefore, the Proposed Project's cumulative contribution to Public Services within the County would be considered less than significant.

XVI. *RECREATION*

The Parks and Recreation Division of the County Department of Public Works is dedicated to the improvement, repair, expansion, and implementation of parks and recreation through the County. The nearest County park is Red Hill Park, located approximately 7 miles northeast of the Proposed Project.

a) Would the project increase the use of the existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated? ☐ ☐ ☐ ☒

a) The Proposed Project would entail the replacement of an existing bridge with a new and improved bridge structure within the same alignment as the existing bridge over the New River. As such, the Proposed Project would not directly or indirectly induce population growth in the project area necessitating the increase in use of existing neighborhood and regional parks. Accordingly, no impacts related to increased use of existing neighborhood and regional parks would occur.

b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse effect on the environment? ☐ ☐ ☐ ☒

b) The Proposed Project is a bridge replacement project and, therefore, would not include or require the construction or expansion of recreational facilities. No impact would occur.

Cumulative Impacts:

The Proposed Project would not significantly increase the demand or wear for recreational facilities. Therefore, the Proposed Project would not contribute to cumulative adverse impacts to recreation facilities within the County.

XVII. *TRANSPORTATION*

Would the project:

a) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities? ☐ ☐ ☒ ☐

a) During the construction of the new bridge along the same alignment as the existing bridge, Proposed Project-related traffic would be temporary. Traffic during construction would include workers traveling to and from the Proposed Project site, trucks hauling construction materials to the Proposed Project site, and transporting material off-site. Though the Proposed Project would generate construction traffic on the local roadway network and along this section of Lack Road which currently experiences no traffic since the existing bridge has been closed for over a year, the construction traffic would be temporary and occurring throughout the day, generally during non-peak hours. As such, the construction traffic would not generate a substantial impact to the surrounding roadways. Therefore, construction traffic would not be expected to conflict with a program plan, ordinance or policy addressing the circulation system, and impacts would be less than significant.

The County General Plan's Circulation and Scenic Highways Element was adopted in 2008, prior to the closure of the existing bridge. The Circulation and Scenic Highways Element was prepared in conjunction with the Southern California Association of Governments (SCAG) Regional Transportation Plan, "Destination 2030," and other related transportation planning documents (County of Imperial, 2008). The Circulation and Scenic Highways Element included projected street segment configurations and volumes throughout the County, including for Lack Road, which is designated as a Minor Collector road. Thus, traffic along this section of Lack Road and over the bridge was anticipated and accommodated for in the Circulation and Scenic Highways Element. As the new bridge would be within the same alignment and have the same number of lanes (one [1] in each direction) as the existing bridge, operation of the Proposed Project is not anticipated to generate an increase in traffic beyond the traffic accommodated for in the County's General Plan. Therefore, the Proposed Project would not conflict with a program plan, ordinance or policy addressing the circulation system, and operational impacts would be less than significant.

b) Would the project conflict or be inconsistent with the CEQA Guidelines section 15064.3, subdivision (b)? ☐ ☐ ☒ ☐

b) CEQA Guidelines 15064.3 states vehicle miles traveled (VMT) is the most appropriate measure of transportation impacts. CEQA Guidelines 15064.3 subdivision (b) provides several criteria for analyzing transportation impacts, including analyzing a project's VMT qualitatively when lead agencies may not be able to quantitatively estimate VMT for a project type. The Proposed Project would replace an existing deteriorated bridge that has been closed for over a year with a new bridge within the alignment of the existing bridge. The new bridge would have the same number of lanes (one [1] in each direction) as the existing bridge. Though the Proposed Project would generate more vehicular traffic than existing vehicular traffic on the Proposed Project site, due to the closure of the bridge, implementation of the Proposed Project would improve vehicular traffic on adjacent properties and roads in the surrounding community as the Proposed Project would circulate the traffic as well as reduce lengthy detours for all commuters that either live or work along that stretch of Lack Road. Additionally, the Governor's Office of Planning and Research (OPR) has developed a Technical Advisory on Evaluating Transportation Impacts in CEQA, which states replacement projects designed to improve the condition of existing transportation assets, including bridges, would not likely lead to a substantial or measurable increase in vehicle travel and, therefore, generally should not require an induced travel analysis (OPR; 2018). Thus, the Proposed Project is anticipated to be consistent with CEQA Guidelines section 15064.3 subdivision (b) and impacts are expected to be less than significant.

c) Substantially increases hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)? ☐ ☐ ☒ ☐

c) The Proposed Project would consist of the replacement of an existing severely deteriorated bridge with a new bridge designed to applicable County and AASHTO standards. As such, the Proposed Project would not include a geometric design feature that would increase hazards or result in incompatible uses. As commuters currently that live and work along this stretch of Lack Road are required to utilize lengthy detours due to the closure of the existing bridge for over a year, the Proposed Project would improve passage for commuters. The Proposed Project would comply with the standards of Caltrans and ICFD. Additionally, the Proposed Project would utilize standards as set out in the California Manual on Uniform Traffic Control Devices for operational traffic control devices as appropriate and would further incorporate traffic control measures that are designed to ensure the safety of all road users. Therefore, the Proposed Project would result in less than significant

impacts related to hazardous design features or incompatible uses.

d) Result in inadequate emergency access? ☐ ☐ ☒ ☐

d) The Proposed Project would be designed to applicable County and AASHTO standards and, as a result, provide adequate emergency access. The Proposed Project would not reduce the number of traffic lanes or create physical barriers along Lack Road. As the existing bridge has been closed to traffic for over one (1) year due to severe deterioration of some of the pile supports, implementation of the Proposed Project would improve all existing emergency access for adjacent properties and the surrounding community and reduce lengthy detours for all commuters that either live or work along that stretch of Lack Road. Therefore, the Proposed Project would not include or create any physical barriers on roadways that would impede emergency access within the area or to the Proposed Project site.

Cumulative Impacts:

Proposed Project implementation is anticipated to contribute traffic along Lack Road. However, the Proposed Project would not generate an increase in traffic compared to the traffic generated on the existing bridge prior to its closure over a year ago or anticipated in the County's General Plan, as the Proposed Project's new bridge would be within the same alignment and have the same amount of lanes as the existing bridge. In addition, the Proposed Project would be design to applicable County and AASHTO standards. Furthermore, implementation of the Proposed Project would improve vehicular traffic on adjacent properties and roads in the surrounding community, as the Proposed Project would circulate the traffic as well as reduce lengthy detours for all commuters that either live or work along that stretch of Lack Road. Thus, as indicated in the preceding analysis, the Proposed Project's traffic impacts would be less than significant. Therefore, the Proposed Project's cumulative contribution would not result in significant cumulative transportation impacts.

XVIII. *TRIBAL CULTURAL RESOURCES*

a) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code Section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place or object with cultural value to a California Native American tribe, and that is: ☐ ☒ ☐ ☐

1. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as define in Public Resources Code Section 5020.1(k), or ☐ ☒ ☐ ☐

(i) Should it be determined that the Proposed Project requires a Notice of Preparation or a Notice of ND/MND, the Lead Agency would be required to conduct formal consultation with California Native American Tribes who identify as being traditionally and culturally affiliated with the Proposed Project area pursuant to AB 52 to determine potential impacts to tribal cultural resources as defined in Public Resources Code Section 21074. The CEQA Lead Agency must begin the AB 52 consultation process prior to the release of a ND, MND, or EIR. The AB 52 consultation process shall begin with the Lead Agency providing written notification to California Native American Tribes who identify as being traditionally and culturally affiliated with the Proposed Project area. The written notification would include a brief description of the Proposed Project, its location, the contact information for the ICPDS, the Lead Agency for the Proposed Project, and notification that the California Native American Tribe has 30 days to request consultation. AB 52 consultation notification letter was sent by the ICPDS on December 10, 2019. Response comment letters were received from the Quechan Indian Tribe (via email) on December 13, 2019, December 23, 2019 and February 7, 2020 (see Appendix D). A comment letter from Campo Band of Mission Indians was received on December 19, 2019 (see Appendix D). The comments provided by the Quechan Indian Tribe have been acknowledged by the ICPDS and the Cultural Resources Survey Report (Appendix B) has been updated accordingly. Based on the information provided by the Campo Band of Mission Indians, the ICPDS is willing to implement MM-TCR-1 through MM-TCR-3 for the Proposed Project to ensure impacts to tribal cultural resources would be avoided or reduced to less than significant levels.

MM-TCR-1:

During ground disturbing activities for the Proposed Project, a Kumeyaay cultural monitor from the Campo Band of Mission Indians shall be present to ensure Kumeyaay cultural resource are not overlooked.

MM-TCR-2:

During construction, should the Proposed Project disturb the cultural landscape or the ancestors of the Campo Band of Mission Indians, the Applicant and the ICPDS shall coordinate with the Campo Band of Mission Indians to determine the best course of action.

MM-TCR-3:

Should ancestral remains of the Campo Band of Mission Indians be disturbed during the construction of the Proposed Project, the Applicant and the ICPDS shall coordinate with the Campo Band of Mission Indians to provide financial compensation for the disturbance and displacement of those ancestral remains.

2.	A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth is subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American Tribe.	☐	☒	☐	☐

(ii) As discussed above, the ICPDS sent AB 52 consultation notification letters on December 10, 2019 and received response comment letters from the Quechan Indian Tribe (via email) on December 13, 2019, December 23, 2019 and February 7, 2020. A comment letter was received from the Campo Band of Mission Indians on December 19, 2019 (see Appendix D). The comments provided by the Quechan Indian Tribe have been acknowledged by the ICPDS and the Cultural Resources Survey Report (Appendix B) has been updated accordingly. Based on the information provided by the Campo Band of Mission Indians, the ICPDS is willing to implement MM-TCR-1 through MM-TCR-3, above, for the Proposed Project. The Proposed Project would comply with these mitigation measures to avoid or reduce impacts to tribal cultural resources to less than significant levels.

Cumulative Impacts:

Based on the response comment letters from the Campo Band of Mission Indians received by the ICPDS, implementation of MM-TCR-1 through MM-TCR-3, above, would avoid or reduce impacts to tribal cultural resources to less than significant levels. Similar to the Proposed Project, any related projects would be required to conduct AB 52 consultation and analyze and mitigate potential impacts to tribal cultural resources. Any related project sites that contain tribal cultural resources would be required to comply with site specific mitigation measures to avoid or reduce potential impacts. Therefore, cumulative impacts would be less than significant.

XIX. *UTILITIES AND SERVICE SYSTEMS*

Would the project:

a)	Require or result in the relocation or construction of new or expanded water, wastewater treatment or stormwater drainage, electric power, natural gas, or telecommunications facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐

a) The Proposed Project consists of the replacement of an existing bridge with a new and improved bridge structure within the same alignment as the existing bridge over the New River. Minimal water use would be required for construction activities as part of the Proposed Project. Construction water use would be limited to dust suppression. The water used for such activities would be obtained off-site and would not require any new water connections. An IID culvert is located to the east of the Proposed Project site that empties into the New River. The Proposed Project would not be expected to result in alterations or relocation of the IID culvert. As such, the Proposed Project would not cause for the relocation or construction of water or wastewater. Therefore, Proposed Project impacts associated with the relocation or construction of water or wastewater would be considered less than significant.

b)	Have sufficient water supplies available to serve the project from existing and reasonably foreseeable future development during normal, dry and multiple dry years?	☐	☐	☒	☐

b) As discussed in Response XIXa, above, water for the Proposed Project would be obtained off-site for construction activities limited to dust suppression. Water would be trucked in since the amount anticipated for dust suppression would not necessitate the need for new water facilities or expansion of existing water facilities. Therefore, less than significant impacts related to water supplies would occur.

c)	Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☒	☐

c) The Proposed Project would consist of the replacement of an existing bridge with a new and improved bridge structure within the same alignment as the existing bridge over the New River. Accordingly, the Proposed Project would not generate wastewater and there would be no change from existing conditions and no need for additional wastewater treatment during operation. During construction, sanitation waste and wastewater (i.e., human generated waste) would be disposed of at a local wastewater treatment plant in accordance with sanitation waste management practices. The Proposed Project would not hinder the local wastewater treatment provider's service capacity. Therefore, impacts associated with wastewater treatment capacity would be less than significant.

d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals? ☐ ☐ ☒ ☐

d) Implementation of the Proposed Project would generate an incremental increase in solid waste volumes requiring off-site disposal during construction activities including wood, metal, soil, and vegetation. Solid waste materials generated during the Proposed Project's construction would be collected, analyzed for contaminants, and characterized based on analytical results. All construction materials and debris would be removed from the area and recycled or properly disposed of off-site at County approved facilities (i.e., landfills). The County administers and operates nine (9) landfills. The Proposed Project would not generate a considerable increase in solid waste that would exceed the capacity of the 9 County operated landfills. Additionally, all work would be completed pursuant to applicable State, local, and County regulations and policies related to solid waste, including the County's Solid Waste Ordinance (Imperial County Municipal Code, Chapter 8.72 – Solid Waste Management). Compliance with all applicable State, local, and County regulations and policies would ensure impacts related to solid waste would be less than significant.

e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste? ☐ ☒ ☐ ☐

e) As discussed in XIXd, above, the Proposed Project would be required to comply with the County's Solid Waste Ordinance (Imperial County Municipal Code, Chapter 8.72 – Solid Waste Management). As a bridge replacement project, the Proposed Project would generate a limited amount of solid waste during construction activities. As a result, the Proposed Project would not generate a considerable increase in solid waste. However, solid waste generated by the Proposed Project during construction would include soil. While the material excavated for the Proposed Project would be collected, analyzed for contaminants and sent for recycling or disposed of off-site at a licensed waste facility, as discussed in Section IX, *Hazards and Hazardous Materials*, the Proposed Project may release hazardous materials into the environment with the disturbance of soil at the Proposed Project site during construction as the soil may be contaminated by the polluted New River, which the Proposed Project crosses. Site grading during construction of the Proposed Project would redistribute on-site soils that may need disposal. These soils may be contaminated from the New River. If these soils are contaminated, the temporary disturbance and potential disposal of these soils during grading may create a significant hazard to the public and environment. However, implementation of mitigation measures MM-AQ-1 and MM-HAZ-1 through MM-HAZ-6 would ensure that potentially contaminated soils are identified, removed, and properly disposed of to prevent the creation of significant hazard to the public and the environment to the maximum extent feasible and reduce impacts to less than significant levels.

Cumulative Impacts:

As a bridge replacement project, the Proposed Project would not require water use or generate solid waste during operation. During construction, the Proposed Project implementation would require minimal water use and generate solid waste. The Proposed Project would adhere to and be consistent with applicable State, local, and County regulations and policies. As discussed in Response XIXe, above, the Proposed Project would implement mitigation measures MM-AQ-1 and MM-HAZ-1 through MM-HAZ-6 should soils on-site be contaminated by the polluted New River and reduce impacts to less than significant levels. Thus, the Proposed Project's contribution to cumulative impacts to utilities would be less than significant.

XX. *WILDFIRE*

If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the Project:

a) Substantially impair an adopted emergency response plan or emergency evacuation plan? ☐ ☐ ☐ ☒

a) According to the map prepared by CAL FIRE for the County, the Proposed Project is located within an LRA classified as Unzoned, with the nearest VHFHSZ located approximately 25 miles northwest of the Proposed Project (CAL FIRE, 2007). The Proposed Project would be designed to applicable County and AASHTO standards and, as a result, provide adequate emergency access. The Proposed Project would not reduce the number of traffic lanes or create physical barriers along Lack Road. As the existing bridge has been closed to traffic for over one (1) year due to severe deterioration of some of the pile supports, implementation of the Proposed Project would improve all existing emergency access for adjacent properties and the surrounding community and reduce lengthy detours for all commuters that either live or work along that stretch of Lack Road. Therefore, implementation of the Proposed Project would not impair emergency response or emergency evacuation in

the County, but would actually improve it. Additionally, the Proposed Project would not include or create any physical barriers on roadways that would impede emergency access within the area or to the Proposed Project site. Therefore, no impacts would occur.

b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire? ☐ ☐ ☐ ☒

b) As discussed above, the Proposed Project is located within an LRA classified as Unzoned, not within a VHFHSZ. The nearest VHFHSZ is located approximately 25 miles northwest of the Proposed Project. The Proposed Project is a bridge replacement project, which would not contain project occupants. The nearest sensitive receptors are residences located approximately 1.1 miles south of the Proposed Project and approximately 1.9 miles northeast of the Proposed Project. Therefore, the Proposed Project would not expose project occupants to wildfire and no impacts would occur.

c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment? ☐ ☐ ☐ ☒

c) As a bridge replacement project, the Proposed Project would not require installation or maintenance of additional infrastructure that may exacerbate fire risk. Therefore, no impacts would occur.

d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes? ☐ ☐ ☐ ☒

d) The Proposed Project site is located in a flat area with no high or steep natural slopes. The Draft Foundation Report stated no indications of landslides or deep-seated instability were observed at the Proposed Project site during the geotechnical study (Appendix C). As such, the potential for landslides would be considered low. There would be no potential for the Proposed Project to expose people or structures to landslides. Therefore, the Proposed Project would not result in impacts related to the exposure of people or structures to significant risks as a result of runoff, post-fire slope instability or drainage changes. No impacts would occur.

Cumulative Impacts:

The Proposed Project would not result in impacts related to wildfire. The nearest VHFHSZ is located approximately 25 miles northwest of the Proposed Project. As a bridge replacement project, the Proposed Project would not substantially affect the potential for wildfire to occur in the Proposed Project area. Therefore, the Proposed Project would not contribute to significant cumulative impacts related to wildfire within the County.

Note: Authority cited: Sections 21083 and 21083.05, Public Resources Code. Reference: Section 65088.4, Gov. Code; Sections 21080(c), 21080.1, 21080.3, 21083, 21083.05, 21083.3, 21093, 21094, 21095, and 21151, Public Resources Code; Sundstrom v. County of Mendocino,(1988) 202 Cal.App.3d 296; Leonoff v. Monterey Board of Supervisors, (1990) 222 Cal.App.3d 1337; Eureka Citizens for Responsible Govt. v. City of Eureka (2007) 147 Cal.App.4th 357; Protect the Historic Amador Waterways v. Amador Water Agency (2004) 116 Cal.App.4th at 1109; San Franciscans Upholding the Downtown Plan v. City and County of San Francisco (2002) 102 Cal.App.4th 656.

Revised 2009- CEQA
Revised 2011- ICPDS
Revised 2016 – ICPDS
Revised 2017 – ICPDS
Revised 2019 – ICPDS

SECTION 3
III. MANDATORY FINDINGS OF SIGNIFICANCE

The following are Mandatory Findings of Significance in accordance with Section 15065 of the CEQA Guidelines.

a) **Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal, eliminate tribal cultural resources or eliminate important examples of the major periods of California history or prehistory?**

☐ ☒ ☐ ☐

As discussed in Section IV. *Biological Resources*, above, burrowing owl, a CDFW Species of Special Concern, and Yuma Ridgway's Rail, a federally endangered species, are both known to occur in the vicinity of the Proposed Project site. However, the Proposed Project's BSA did not have any sign of either species and no burrows were located within the BSA. Additionally, no nesting birds or bats were observed during the pedestrian survey. With removal of vegetation during construction that is suitable for nesting birds and since the Proposed Project is subject to the jurisdiction of USACE, CRRWQCB and the CDFW, implementation of MM-BIO-2 and MM-BIO-3 would ensure that potential impacts to biological resources would be below the level of significance.

As discussed in Section V. *Cultural Resources*, above, there are no known resources located within the API. Additionally, with regard to paleontological resources, though the Proposed Project area is underlain by Quaternary lake sediments (Ql), which have a high sensitivity for paleontological resources, the potential to encounter a paleontological resource would be considered low given the previously disturbed nature of the Proposed Project area. Therefore, less than significant impacts would occur with implementation of mitigation measures.

b) **Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)**

☐ ☒ ☐ ☐

Cumulative impacts associated with the Proposed Project are being considered in connection with the past, present, or reasonably foreseeable future projects in the area. As concluded in this analysis, the Proposed Project's incremental contribution to cumulative impacts related to aesthetics, agriculture and forestry resources, cultural resources, energy, land use/planning, mineral resources, population/housing, public services, recreation, transportation, utilities and service systems, and wildfire would be less than significant. Additionally, the Proposed Project would result in less than significant impacts with mitigation related to air quality, biological resources, cultural resources, geology and soils, greenhouse gases, hazards and hazardous materials, hydrology and water quality, noise, and tribal cultural resources. The mitigation measures that have been developed for the Proposed Project would assist in the assurance that cumulatively considerable contributions would result in less than significant impacts.

c) **Does the project have environmental effects, which will cause substantial adverse effects on human beings, either directly or indirectly?** ☐ ☒ ☐ ☐

Cumulative impacts associated with the Proposed Project are being considered in connection with the past, present, or reasonably foreseeable future projects in the area. As concluded in this analysis, the Proposed Project's incremental contribution to cumulative impacts related to aesthetics, agriculture and forestry resources, cultural resources, energy, land use/planning, mineral resources, population/housing, public services, recreation, transportation, utilities and service systems, and wildfire would be less than significant. Additionally, the Proposed Project would result in less than significant impacts with mitigation related to air quality, biological resources, geology and soils, greenhouse gases, hazards and hazardous materials, hydrology and water quality, noise, and tribal cultural resources. The mitigation measures that have been developed for the Proposed Project would assist in the assurance that cumulatively considerable contributions would result in less than significant impacts.

IV. PERSONS AND ORGANIZATIONS CONSULTED

This section identifies those persons who prepared or contributed to preparation of this document. This section is prepared in accordance with Section 15129 of the CEQA Guidelines.

- **COUNTY OF IMPERIAL**

V. Jim Minnick, Director of Planning & Development Services
VI. Michael Abraham, AICP, Assistant Director of Planning & Development Services
VII. Mariela Moran, Project Planner
VIII. Imperial County Air Pollution Control District
IX. Department of Public Works
X. Fire Department
XI. Ag Commissioner
XII. Environmental Health Services
XIII. Sheriff's Office

B. OTHER AGENCIES/ORGANIZATIONS

(i) Engineering Consultant
   a. NV5
      Jack Abcarius, P.E., Project Manager
      Hilary Brinegar, Environmental Project Manager

(ii) Environmental Consultants
   a. Environmental Intelligence, LLC
      Amariah Lebsock, Senior Project Manager
      Leanna Williams, Project Manager
      Rebecca Gilbert, Senior Archaeologist
      Michael Flores, Senior Biologist
      Robyn Walker, Technical Editor
   b. Barrett's Biological Surveys
      Marie Barrett, Biologist

(Written or oral comments received on the checklist prior to circulation)

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VI. MITIGATED NEGATIVE DECLARATION – County of Imperial

The following Mitigated Negative Declaration is being circulated for public review in accordance with the California Environmental Quality Act Section 21091 and 21092 of the Public Resources Code.

Project Name: Imperial County Public Works Department Lack Road Bridge Replacement Project

Project Applicant: Imperial County Public Works

Project Location: The Proposed Project is located approximately 5.8 miles northwest of the City of Westmorland where Lack Road crosses the New River at bridge No. 58C0101 in Imperial County, California (Exhibit 1, *Regional Vicinity*). The existing bridge is a seven (7) span, simply supported untreated DF stringers bridge with laminated timber decking and AC cover, supported by treated timber pile bents and pile bent abutments with timber seating walls that runs north and south over the New River. The existing bridge is approximately 106 feet in length and 27 feet wide. The approximate limits of the Proposed Project area would extend along Lack Road from approximately 300 feet south to 350 feet north of the New River. Lack Road is a north/south road that supports direct access from State Route (SR-) 86 to Imperial County Route S-30. The Proposed Project is located 0.3 mile south of Vail Road and 0.2 mile north of Foulds Road (Exhibit 2, *Project Location*).

Description of Project: Due to severe deterioration of some of the pile supports, the existing bridge has been closed to traffic (inactive) for over one (1) year. The County Public Works Department (Applicant) proposes to replace the existing seven (7) span timber bridge with a new precast concrete bridge designed to current American Association of State Highway and Transportation Officials (AASHTO) standards with California amendments (Exhibits 5 and 6, *Site Plan and Typical Section*). The proposed new bridge design would consist of a single-span bridge with four (4) precast/prestressed bulb-tee girders supported on two (2) abutments. The new bridge dimensions would be 35 feet and 6 inches wide by 125 feet long, with a structure depth of 7 feet and 0.875 inches. The selection of a precast bridge structure would eliminate the need for construction to take place within the New River.

The proposed roadway would remain a single travel lane in each direction, and geometry for the Proposed Project would be based on applicable County and AASHTO standards. The new bridge would be reconstructed in the same alignment with two (2) 12-foot-wide lanes designed for a 55 mile per hour (mph) vehicular speed. Shoulder widths would be 4 feet on the bridge, and would transition to the existing width at the roadway conform points. The new bridge would be designed to withstand a 100-year flood event.

The existing bridge would be removed without having to enter the New River as all construction activities were designed to take place from the river banks. It is estimated that the Proposed Project would be constructed over a nine (9)-month period beginning in March 2020 and concluding in November 2020.

VII. FINDINGS

This is to advise that the County of Imperial, acting as the lead agency, has conducted an Initial Study to determine if the project may have a significant effect on the environmental and is proposing this Mitigated Negative Declaration based upon the following findings:

☐ The Initial Study shows that there is no substantial evidence that the project may have a significant effect on the environment and a NEGATIVE DECLARATION will be prepared.

☐ The Initial Study identifies potentially significant effects but:

(1) Proposals made or agreed to by the applicant before this proposed Mitigated Negative Declaration was released for public review would avoid the effects or mitigate the effects to a point where clearly no significant effects would occur.

(2) There is no substantial evidence before the agency that the project may have a significant effect on the environment.

(3) Mitigation measures are required to ensure all potentially significant impacts are reduced to levels of insignificance.

A MITIGATED NEGATIVE DECLARATION will be prepared.

If adopted, the Mitigated Negative Declaration means that an Environmental Impact Report will not be required. Reasons to support this finding are included in the attached Initial Study. The project file and all related documents are available for review at the County of Imperial, Planning & Development Services Department, 801 Main Street, El Centro, CA 92243 (442) 265-1736.

NOTICE

The public is invited to comment on the proposed Negative Declaration during the review period.

Date of Determination Jim Minnick, Director of Planning & Development Services

The Applicant hereby acknowledges and accepts the results of the Environmental Evaluation Committee (EEC) and hereby agrees to implement all Mitigation Measures, if applicable, as outlined in the MMRP.

Applicant Signature Date

SECTION 4

VIII. RESPONSE TO COMMENTS

(ATTACH DOCUMENTS, IF ANY, HERE)

IX. MITIGATION MONITORING & REPORTING PROGRAM (MMRP)

(ATTACH DOCUMENTS, IF ANY, HERE)

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APPENDIX "A"

Natural Environment Study

(Minimal Impacts)

Lack Road Bridge (over New River) Improvement Project

Imperial County, California north of the City of Westmoreland and West of the City of Brawley

Lack Road Bridge No. 58C0101

August 2019

Prepared By and Certified as performed in accordance with established biological practices by:

Marie Barrett
Biologist
Barrett's Biological Surveys
Imperial County
(760) 352 4159

Date: 26 August 2019

Summary

This report presents the findings of general reconnaissance biological surveys of the project site. No special-status plant and two special-status wildlife species and migratory bird nesting have limited potential to occur within the Biological Study Area, therefore preconstruction surveys are recommended.

Table of Contents

1. Introduction

1.1 History

The project is located approximately 5.8 miles north of the city of Westmorland where Lack Road crosses the New River at bridge No. 58C0101 in Imperial County, California. The approximate limits of the project area will extend along Lack Road from approximately 300 feet south to 350 feet north of the New River. Due to severe deterioration of some of the pile supports, the existing bridge has been closed to traffic for well over a year now. The County proposes to replace the existing 7-span timber bridge with a new precast concrete bridge designed to current AASHTO standards with California amendments.

Project Purpose and Need

The proposed new bridge will be a single-span bridge with four precast/prestressed bulb-tee girders supported on two abutments. The new bridge dimensions will be 35 feet and 6 inches wide by 125 feet long, with a structure depth of 7 feet and 0.875 inches. The selection of a precast bridge structure eliminates the need for construction to take place within the New River.

The proposed roadway would remain one travel lane in each direction, and geometry for the project will be based on applicable Imperial County (County) and American Association of State Highway and Transportation Officials (AASHTO) standards. Lack Road Bridge will be reconstructed the same alignment with two 12-foot lanes designed for a 55-mile-per-hour (mph) vehicle speed. Shoulder widths will be four feet on the bridge and will transition to the existing width at the roadway conform points. The new bridge is designed to accommodate the 100-year flood event of the New River.

The existing bridge will be removed without the need to be in the New River. All operations are anticipated to take place from the banks. If the existing timber piles cannot be completely extracted, they will be cut-off above the current water surface elevation and left in place.

Lack Road is a farm to market roads. Lack Road is a north/south road that offers direct access from SR 86 to S30 which accesses Westmorland, Brawley and Calipatria for local commuters as well as farming and geothermal vehicles. Re-opening the structure to traffic will reduce the lengthy detour for all commuters that either live, or work along that stretch of Lack Road.

2. Study Methods

2.1 Regulatory Requirements

The primary regulations affecting biological resource impacts are discussed in this section. If construction of this project, or related activities associated with construction, impact federal- and/or state-listed species, the project may be subject to the California Endangered Species Act (CEPA) and the federal Endangered Species Act (ESA). If activities directly impact migratory birds or cause the destruction or abandonment of nests, the project would be subject to the

Migratory Bird Treaty Act. Additional regulations could also apply to the project. The following paragraphs provide a brief summary of the applicable provisions of these regulations.

2.1.1 Federal Endangered Species Act

The federal ESA provides protection for plants and animals listed as threatened or endangered by U.S. Wildlife and Forestry Service (USWFS) and the National Oceanic and Atmospheric Administration (NOAA) Marine Fisheries Service. Section 9 of the ESA (50 CFR 17.3) prohibits the take, possession, sale, or transport of any federal ESA-listed species. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, capture, collect, or attempt to engage in any such conduct" (16 U.S. Code [USC] Section 1532(19)). Federal regulation 50 CFR 17.3 further defines the term harm in the take definition to mean any act that actually kills or injures a federally listed species, including significant habitat modification or degradation. For plants, the federal ESA prohibits removing, possessing, maliciously damaging, or destroying any listed plant on areas under federal jurisdiction, and removing, cutting, digging up, damaging, or destroying any listed plant on non-federal land in knowing violation of state law (16 USC Section 1538(a)(2)(B)).

The federal ESA requires the federal government to designate critical habitat for any species listed under the federal ESA but also allows areas to be excluded from critical habitat (16 USC Section 1533(b)(2)). Critical habitat is a specific area(s) that is essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may also include specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

Section 7 of the federal ESA requires federal agencies to consult with USFWS and/or NOAA Marine Fisheries Service for any federal activity that may affect any federally listed species or its critical habitat. Informal consultation may precede, and obviate the need for formal consultation if USFWS and/or NOAA Marine Fisheries Service concur that the proposed agency action is not likely to adversely affect listed species. In the formal consultation process, USFWS and/or NOAA Marine Fisheries Service must issue a Biological Opinion as to the potential for effect to listed species. USFWS and/or NOAA Marine Fisheries Service may issue an incidental take permit, allowing take of the species that is incidental to an authorized activity, provided that the action will not jeopardize the continued existence of the species. Section 10(a) of the ESA provides for issuance of incidental take permits for private actions that have no federal involvement, through the development of a Habitat Conservation Plan (HCP).

2.1.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) provides protection for migratory birds. Conditions for permits to "take" migratory birds (as defined in the MBTA) are set forth in 50 CFR Part 13 [General Permit Procedures] and 50 CFR Part 21 [Migratory Bird Permits]). Unless expressly authorized in the regulations or by permit, activities such as hunting, pursuing, capturing, killing, selling, and shipping migratory birds are prohibited. The MBTA allows USFWS to issue permits to qualified applicants for certain types of activities. This protection extends to all migratory birds, parts, nests, and eggs. The full list of species protected under this act is found in 50 CFR 10.13.

2.1.3 California Endangered Species Act

The California Endangered Species Act (CESA) provides protection for candidate plants and animal species as well as those listed as threatened or endangered by CDFW. CESA prohibits the take of any such species unless authorized; however, California case law has not interpreted habitat destruction, alone, as included in the state's definition of take. Take is defined in Section 86 of the Fish and Game Code as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill" (Cal. Fish and Game Code §86). CDFW administers the act and authorizes take through Section 2081 agreements, Section 2080.1 consistency determinations (for species that are also listed under the federal ESA) or NCCPs.

2.1.4 Porter-Cologne Water Quality Control Act, as amended

This act is administered by the State Water Resource Control Board (SWRCB) to protect water quality and is an avenue to implement CA responsibilities under the federal Clean Water Act. This act regulates discharge of waste into a water resource.

2.1.5 Clean Water Act, 1972 (CWA 33 U.S.C. 1251 et seq.)

This act regulates discharges into waters of the U.S. Army Corp of Engineers (ACOE) is given the responsibility to implement programs to prevent pollution.

2.2 Studies Required

2.2.1 Literature Search

Prior to conducting field surveys, a review of pertinent literature, regulatory requirements, special-status species lists and recorded occurrences was conducted to determine if the proposed bridge repairs are within the range of sensitive resources such as state and/or federal listed threatened and/or endangered species. Available literature was reviewed including the California Natural Diversity Database (CNDDB) for the Westmoreland E U.S. Geological Survey (USGS) 7.5-minute Topographic Quadrangle and the surrounding eight quadrangles within the United States including Wiest, Iris, Niland, Obsidian Butte, Westmoreland W, Brawley NW, Brawley, Alamorio.

Survey Methodologies
Marie Barrett and Jacob Calanno performed the biological assessment surveys within and adjacent to the Biological Study Area (BSA).

All proposed impact areas within the BSA were visited on foot and any nests were evaluated for activity.

2.2.2 Personnel and Survey Dates

Marie Barrett and Jacob Calanno of Barrett's Biological Surveys performed the biological assessment survey on July 25, 2019 (85-88°F, clear, 3-4 mph between 0645-0800). Resumes are attached.

2.2.3 Limitations That May Influence Results

Due to a wet fall and winter, rain fall was sufficient to germinate seeds and therefore, botanical specimens were present.

This area is highly disturbed by vehicles during all seasons and typical damage was observed.

3. Results: Environmental Setting

3.1 Description of the Existing Biological and Physical Conditions

3.1.1 Biological Study Area (BSA)

This site is located within the Colorado Desert which is a subdivision of the larger Sonoran Desert and covers approximately 7 million acres. The desert encompasses Imperial County and includes parts of San Diego County, Riverside County, and a small part of San Bernardino County. This site is in Imperial County.

This desert lies at a relatively low elevation, below 1,000 feet, with the lowest point of the desert floor is 275 feet below sea level at the Salton Sea; northeast of the site. The highest peaks of the Peninsular Ranges which reach elevations of nearly 10,000 feet are to the west of the site.

The Colorado Desert's climate differs from other deserts. The region experiences greater summer daytime temperatures (up to 120°F) than higher-elevation deserts and rarely experiences frost. In addition, the Colorado Desert experiences two rainy seasons per year usually in the winter and late summer in this portion. This area is within the agricultural portion that is irrigated by Colorado River water delivered through water conveyance structures maintained by the Imperial Irrigation District (IID). This Lack Road Bridge spans the New River which drains into the Salton Sea

3.1.2 Physical Conditions

The original timber bridge has degraded requiring replacement. While the bridge is closed, traffic is rerouted via a five mile detour to bypass the closed bridge and access the nearest bridge over New River.

3.1.3 Biological Conditions in the Study Area

The top of the bridge is wooden and is not biologically sensitive. Underneath the bridge, over the New River, little flora or fauna were observed. No swallows were observed nesting beneath the bridge. Tables 1 and 2 (below) list species observations within the buffer zone of the site.

Table 1: Vegetation Found in Vicinity

Common Name	Scientific Name	Cal-IPC Rating*
Iodine bush	*Allenrolfea occidentalis*	
Saltcedar	*Tamarix spp.*	*Ca Noxious Weed* *Cal-IPC rating: High*

No vegetation was found that would be considered endangered, threatened or species of concern.

Table 2: Animals/Insects Found in Vicinity

Common Name	Scientific Name
Blackbird	*Turdus merula*
Canine tracks	*unknown*
Cottontail rabbit	*Sylvilagus audubonii*
Cabbage butterfly	*Pieris rapae*
Bees	*Aphis sp.*

No animals were found that would be considered endangered, threatened or species of concern.

3.1.4 Habitat Connectivity

The habitat is divided by Lack Road which runs from SR 78 to S30. Lack Road can be accessed by wildlife. This project will not change the existing connectivity.

3.2 Regional Species and Habitats/Natural Communities of Concern

3.2.1 Habitat/Natural Communities of Special Concern

There are no Habitat/Natural Communities of Special Concern found within the BSA.

3.2.2 Special-Status Plant Species

Appendix: Sensitive Botanical and Zoological Species (CNDDB/CNPS) Westmoreland E Quadrangle (Nine Quad Search) July 2019 (attached) listed 4 botanical species within the 9 Quadrangles searched. Of these, none would be expected within the site.

3.2.3 Special-Status Animal Species

Appendix: Sensitive Botanical and Zoological Species (CNDDB/CNPS) Westmoreland E Quadrangle (Nine Quad Search) July 2019 (attached) listed 36 zoological species within the 9 Quadrangles searched. Of these, two species Ridgeway's Rail (*Rallus obsoletus)* and Burrowing owl (*Athene cunicularia*) could be expected within the BSA.

4. Results: Biological Resources, Discussion of Impacts & Mitigation

4.1 Habitats/Natural Communities of Special Concern

There are no habitats/Natural Communities of Special Concern.

4.2 Special-Status Plant Species

No special-status plant species are expected as there is no habitat to support them.

4.2.1 Discussion of Plant Species

Survey Results
None observed within the BSA during survey.

Project Impacts
None are expected.

Avoidance and Minimization Efforts/Compensatory Mitigation
A preconstruction survey should be conducted by a qualified biologist.

4.3 Special-Status Animal Species

Ridgway Rail (Yuma clapper rail) is rated Federally as Endangered. It is a chickenlike marsh bird with a long, slightly drooping bill and an often upturned tail. Light brownish with dark streaks above. Rust-colored breast; bold, vertical gray and white bars on the flanks; white undertail coverts and lives in freshwater and brackish marshes. Prefers dense cattails, bulrushes, and other aquatic vegetation. Nests in riverine wetlands near upland, in shallow sites dominated by mature vegetation, often in the base of a shrub. Prefers denser cover in winter than in summer and is very shy. None observed or heard; Cattails found in a limited dense stand within Q lateral west of bridge replacement; no suitable habitat on site or in adjacent drains.

Burrowing Owl (*Athene cunicularia*) is considered a California Department of Fish and Wildlife: Species of Special Concern. They are small raptors that nest in burrows that have been borrowed from other species or by the raptor in open grassland areas and water conveyance structures in Imperial County. BUOW have adapted well in Imperial County using canals/drains/ditches to establish burrows and foraging for insects in agricultural fields. Owls/burrows not found on site or off site on IIDROW/field ditches. Observed in area over one mile outside of BSA

4.3.1 Discussion of Animal Species

Survey Results

BUOW or Ridgway Rail were not found within the BSA during the survey. No bulrushes, cattails were observed within the study area. BUOW were observed approximately one mile outside the survey area.

Project Impacts
No impacts are expected with avoidance and minimization efforts.

Avoidance and Minimization Efforts/Compensatory Mitigation
1. Nesting bird surveys by qualified biologists during nesting season (February through August); preferably time construction during non nesting season (September through January). Time nesting surveys within 3-5 days prior to start of construction. BUOW preconstruction survey within 14 days of start of construction.

2. Worker environmental awareness training for nesting birds and Burrowing Owl(BUOW) which will include the following aspects:

    - Biology and status of the BUOW;
    - Protection measures designed to reduce potential impacts to the species, function of flagging designating authorized work areas;
    - Reporting procedures to be used if a BUOW is encountered in the field; and driving procedures and techniques, for commuting, and driving on, to the project site
    - Identification of nesting birds and procedures to follow if nesting is suspected.

3. Areas outside of the project footprint will be designated as an "Environmentally Sensitive Area" (ESA) on project plans. No project-related activities will take place within the ESA-designated areas.

5. Conclusions & Regulatory Determination

5.1 Agency Coordination

Consultation should begin with U.S. Army Corps of Engineers Regulatory Division to obtain the required permit for working within a waterway that drains into waters of the United States.

California Department of Fish and Wildlife, Bermuda Dunes, should be contacted regarding a Streambed Alteration Permit.

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7. Appendix

Sensitive Botanical and Zoological Species (CNDDB/CNPS) Niland Quadrangle (Nine Quad Search) July, 2019

Biological Study Area Map

Photographs

Engineering Plans

Resumes

SENSITIVE BOTANICAL AND ZOOLOGICAL SPECIES (CNDDB/CNPS) SPECIES

APPENDIX A SENSITIVE BOTANICAL AND ZOOLOGICAL SPECIES (CNDDB/CNPS) Westmorland E Quadrangle (Nine Quad Search) July 2019				
BOTANICAL SPECIES	**STATUS[1]**	**DESCRIPTION OF SPECIES**	**HABITAT**	**OBSERVATION/ SITE POTENTIAL**
gravel milk-vetch *Astragalus sabulonum*	2B.2	Desert brush scrub	a dicot, is an annual herb that is native to California and is also found outside of California but is confined to western North America.	L No desert brush scrub habitat
Abrams' spurge *Euphorbia abramsiana*	2B.2	CNPS list: 2	Annual herbaceous blooms Sept/Nov. Common spurge in area has large purple spot and is prostrate; Abram's is not as colorful. Sonoran Desert Shrub	L No Sonoran desert scrub habitat
Glandular ditaxis *Ditaxis claryana*	CNPS: 2.2	Staminate flower: sepals 5, edges abutting in bud; petals 5; stamens 5–15, generally in 2 sets, some > others, filaments fused into a column, staminodes 0–3 at column tip	Sandy soils, Creosote Bush Scrub	L No Creosote brush scrub habitat

BOTANICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Munz's Cholla *Opuntia munzii*	CNDDB Ranks: G3, S1.2; CNPS: 1B.3	Shrub to tree-like, 6.4 - 12.8 feet (2-4 meters) tall, almost as wide. Main trunk 4-6 inches (10-15cm) thick. Stem succulent. Lower branches rather bare. Tubercles (small, wart-like projections) strongly raised, 3/8 - 5/8 inches (10-16mm) long, 2/8 inch (5-6mm) wide. Areoles (area bearing spines) with short, tan bristles, and 10-12 yellowish, somewhat equal spines, 3/8 - 5/8 inches (1-2cm) long. Flowers few. Petals yellowish-green, 5/8 - 6/8 inches (1.5-2cm) long. Fruit is dry. Seeds are somewhat rounded, 1/8 inch (3mm).	Dry, gravelly or sandy places. Creosote bush scrub. Elevation 480 - 1,920 feet (150-600 meters).	L No habitat

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Yellow Warbler *Dendroica petechia brewsteri*	CNDDB Rank: G5T3, S2; CDFW: SC	A Family of seed-eating, small to moderately large passerine birds that have strong, stubby beaks, which in some species can be quite large. They have a bouncing flight, alternating flapping with gliding on closed wings. Most sing well.	Yellow warblers in southern California breed in lowland and foothill riparian woodlands dominated by cottonwoods, alders, or willows and other small trees and shrubs typical of low, open-canopy riparian woodland (Garrett and Dunn 1981). During migration, they occur in lowland and foothill woodland habitats such as desert oases, riparian woodlands, oak woodlands, mixed deciduous-coniferous woodlands, suburban and urban gardens and parks, groves of exotic trees, farmyard windbreaks, and orchards (Small 1994).	L Sparse thickets
Crissal Thrasher *Toxostoma crissale*	CDFW Species of Special Concern	A large thrasher found in the Southwestern United. The bird grows to 32 cm (12.5 inches), and has a deeply	Dense vegetation along streams/washes in mesquite/willows/arrowweed	L

		curved bill. It can be found near water in dense underbrush, and in the low desert near canyon chaparral; seldom flies in the open.		None observed; scarce habitat
Black Skimmer *Rynchops niger*	Fed: - CDFW: SSC	A medium-sized to large waterbird with long red and black bill. Black back and cap.Underparts white with very short red legs.	Fairly common summer resident at the Salton Sea. Forages on small fishes and crustaceans in calm, shallow water. Roosts on sandy beaches or gravel bars	L No suitable habitat
Short-eared owl *Asio flammeus*	CDFW: SSC	Medium sized with light and dark brown mottled upperparts with dark-streaked, pale buff underparts. The head has large, round, pale buff facial disk with fine, brown tinges, black around eyes, and small ear tufts. Eyes are yellow and bill is black. Flight is erratic with flopping wing beats. Hunts day or night.	Found in fresh and saltwater swamplands, lowland meadows and irrigated alfalfa fields. Requires tall grass or cattail patches for nesting and cover. Nests on dry ground in depression concealed in vegetation.	L Irrigated alfalfa in vicinity could provide hunting area. No nesting areas on site

black storm-petrel *Oceanodroma melania*	CDFW: SSC Species of Special Concern	a small seabird of the storm petrel family Hydrobatidae. It is 23 cm in length, with a wingspan of 46–51 cm.	The species breeds colonially on islands off the southern California coast of the United States and off the Baja Peninsula and Gulf of California of Mexico. Nesting sites are usually in rock crevices, occasionally in small burrows in soft earth.	L No suitable habitat
black tern *Chlidonias niger*	SSC	As its name suggests, it has predominantly dark plumage.	generally found in or near inland water in Europe and North America.	L No habitat

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
California Black Rail *Laterallus jamaicensis coturniculus*	CDFW: Threatened	The smallest of all rails, the black rail is slate-colored, with a black bill, red eyes and a white-speckled back. The legs are moderately long and the toes are unwebbed. The sexes are similar.	Most commonly occurs in tidal emergent wetlands dominated by pickleweed or in brackish marshes with bulrushes in association with pickleweed. In freshwater, usually found in bulrushes, cattails, and saltgrass and in immediate vicinity of tidal sloughs. Typically occurs in the high wetland zones near upper limit of tidal flooding, not in low wetland areas with considerable annual or daily fluctuations in water levels. Nests are concealed in dense vegetation, often pickleweed, near upper limits of tidal flooding	L None observed; no habitat on site
Gila woodpecker *Melanerpes uropygialis*	CDFW: SSC	a medium-sized woodpecker	Found in the desert regions of the southwestern United States and western Mexico. In the U.S., they range through southeastern California, southern Nevada, Arizona, and New Mexico.	L No suitable habitat; no palm trees for nesting

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
American white pelican *Pelecanus erythrorhynchos*	CDFW: Unlisted	The American white pelican rivals the trumpeter swan, with a similar overall length, as the longest bird native to North America. Both very large and plump, it has an overall length of about 50–70 in (130–180 cm), courtesy of the huge beak which measures 11.3–15.2 in (290–390 mm) in males and 10.3–14.2 in (260–360 mm) in females. It has a wingspan of about 95–120 in (240–300 cm).	American white pelicans nest in colonies of several hundred pairs on islands in remote brackish and freshwater lakes of inland North America. The most northerly nesting colony can be found on islands in the rapids of the Slave River between Fort Fitzgerald, Alberta, and Fort Smith, Northwest Territories. About 10–20% of the population uses Gunnison Island in the Great Basin's Great Salt Lake as a nesting ground. The southernmost colonies are in southwestern Ontario and northeastern California.	L None observed; no habitat
California least tern *Sternula antillarum browni*	CDFW: SSC	Both the Californian subspecies and the nominate race of least tern are approximately 23 centimeters in length. Both have conspicuous black markings on their outermost primaries and fly over water with a distinctive hunchback appearance, with bills pointing slightly downward.	Wintering locations are actually unknown, but suspected to include the South American Pacific Coast. The California least tern arrives at its breeding grounds in late April.	L None observed; no habitat

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Northern harrier *Circus cyaneus hudsonius*	CDFW Species of Concern	The northern harrier is 41–52 cm (16–20 in) long with a 97–122 cm (38–48 in) wingspan.	It breeds throughout the northern parts of the northern hemisphere in Canada and the northernmost USA. While many taxonomic authorities split the northern harrier and the hen harrier into distinct species, others consider them conspecific.	L Irrigated alfalfa in vicinity could provide hunting area. No nesting areas on site
Le Conte's thrasher *Toxostoma lecontei*	CDFW: SC Species of Concern	Large, long-tailed songbird. Pale sandy gray all over. Long, down-curved bill. Dark tail. Pale reddish undertail.	Desert scrub, mesquite, tall riparian brush and, locally, chaparral.	L No habitat
Loggerhead shrike *Lanius ludovicianus*	CDFW: SC Species of Concern	It measures approximately 9 inches from bill to tail. The wing and tail length is about 3.82 and 3.87 inches long, respectively. It weighs on average 50 grams, with a range of 45-60 grams for a healthy adult shrike.	The bird requires an open habitat with an area to forage, elevated perches and nesting sites.	L No prey on site

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Gull-billed tern *Gelochelidon nilotica*	CDFW: SSC Species of Speical Concern	This is a fairly large and powerful tern, similar in size and general appearance to a Sandwich tern, but the short thick gull-like bill, broad wings, long legs and robust body are distinctive.	It breeds in warmer parts of the world in southern Europe, temperate and eastern Asia, both coasts of North America, eastern South America. This bird has a number of geographical races, differing mainly in size and minor plumage details.	L No habitat
Least Bell's vireo *Vireo bellii pusillus*	Fed: Endangered State: Endangered	Little brown bird	The Least Bell's Vireo, Vireo bellii pusillus, is one of four subspecies of Bell's Vireo recognized by the American Ornithologist's Union (AOU 1957). It is the western-most subspecies, breeding entirely within California and northern Baja California.	L No habitat
Least bittern *Lxobrychus exilis*	CDFW: SSC Species of Special Concern	The least bittern is one of the smallest herons in the world, with perhaps only the dwarf bittern and the black-backed bittern averaging smaller in length. It can measure from 28 to 36 cm (11 to 14 in) in length, and the wingspan ranges from 41 to 46 cm (16 to 18 in).	These birds nest in large marshes with dense vegetation from southern Canada to northern Argentina. The nest is a well-concealed platform built from cattails and other marsh vegetation. The female lays four or five eggs, in extreme cases from two to seven.	L No habitat

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Wood stork *Mycteria americana*	CDFW: SSC Species of SpecialConcern	The adult wood stork is a large bird which stands 83 to 115 cm (33–45 in) tall with a wingspan of 140 to 180 cm (55–71 in). The male typically weighs 2.5 to 3.3 kg (5.5–7.3 lb), with a mean weight of 2.7 kg (6.0 lb); the female weighs 2.0 to 2.8 kg (4.4–6.2 lb), with a mean weight of 2.42 kg (5.3 lb).	It is found in subtropical and tropical habitats in the Americas, including the Caribbean. In South America, it is resident, but in North America, it may disperse to as far as South America.	L No habitat
Southwestern willow flycatcher *Empidonax traillii extimus*	Fed: Endangered State: Endangered	Adults have brown-olive upperparts, darker on the wings and tail, with whitish underparts; they have an indistinct white eye ring, white wing bars and a small bill. The breast is washed with olive-gray. The upper part of the bill is gray; the lower part is orangish.	Their breeding habitat is deciduous thickets, especially willows and often near water, across the United States and southern Canada. They make a cup nest in a vertical fork in a shrub or tree.	L No habitat
Western snowy plover *Charadrius alexandrinus nivosus*	Fed: Threatened CDFAW: Species of Special Concern	A pale plover with a sand-colored dorsum, white venter, thin dark bill, dark or grayish feet and legs, and (in adults)	along Pacific coast north to Washington (most numerous from San Francisco Bay south), south to Oaxaca, and locally (but in larger numbers) inland	L No habitat

		a partial breast band and dark ear patch (females may lack the black areas in the plumage); immatures have light edges on dorsal body feathers, resulting in a scaly pattern	from Oregon and California (especially the San Joaquin Valley, Mojave Desert, and Salton Sea regions)	
ZOOLOGICAL SPECIES	**STATUS[1]**	**DESCRIPTION OF SPECIES**	**HABITAT**	**OBSERVATION/ SITE POTENTIAL**
Mountain plover *Charadrius montanus*	CDFW: SSC Species of Speical Concern	is a medium-sized ground bird in the plover family	it lives on level land. Unlike most plovers, it is usually not found near bodies of water or even on wet soil; it prefers dry habitat with short grass (usually due to grazing) and bare ground.	L Irrigated alfalfa in vicinity could provide forage area during winter if grazed or burned. No nesting areas on site
Willow Flycatcher *Empidonax traillii*	State: Endangered	Willow Flycatchers are brownish olive overall with a slight yellow wash to the belly. They have 2 whitish wingbars and a white throat that contrasts with the brownish olive breast.	Breeds in moist, shrubby areas, often with standing or running water. Winters in shrubby clearings and early successional growth.	L No habitat

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	CDFW: SSC Species of SpecpialConcern	Adults have a pointed bill. The adult male is mainly black with a yellow head and breast; they have a white wing patch sometimes only visible in flight. The adult female is mainly brown with a dull yellow throat and breast.	These birds forage in the marsh, in fields or on the ground; they sometimes catch insects in flight. They mainly eat seeds and insects. Outside the nesting period, they often feed in flocks, often with related species.	L No habitat; none observed
Sonoran Desert toad *Incillius alvarius*	CDFW: SSC	Smooth, typically olive-green/brown skin, cranial crests, and prominent, elongated glands on both sides of the back of the head and on the hind legs. Young toads have small dark, orange-tipped spots on the back. Larger tadpoles are gray or brown with a rounded tail tip, and grow to about 2.25".	Sonoran Desert scrub, semi-desert grasslands. May be found many miles from water, particularly during the summer monsoons. Most Sonoran Desert toads are found at night during the monsoon season, but they may emerge a month or more before the summer rains begin, particularly in areas of permanent water. Can be found in rodent burrows or underground retreats.	L None observed. No habitat present on site.

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Lowland leopard frog *Lithobates yavapaiensis*	Species of Special concern	Tan, gray-brown or light gray-green to green above; yellow below. Vague upper lip stripe, tuberculate skin. Dark network on rear of thighs; yellow groin color often extends onto rear of belly and underside of legs. Male will exhibit a swollen and darkened thumb base.	Find in desert grassland and in woodlands. Uses permanent water sources, stays near water. Breed Feb-April. Bullfrogs are predators	L No habitat

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Flat-tailed horned lizard *Phrynosoma mcallii*	CNDDB Rank: G3; S2 CDFW: SSC	A small (up to 87 mm or 3.4" from snout to vent), exceptionally flat and wide lizard with a long (for a horned lizard) broad, flat tail and a dark stripe running down the middle of the back.	Occupy a small range in the Sonoran Desert of southwestern California, southwestern Arizona, and extreme northern Mexico.	L No habitat
American Badger *Taxidea taxus*	CDFW: Species of Concern	Burrowing animals that feed on ground squirrels, rabbits, gophers and other small animals. Prefer grasslands, agricultural areas.	Found in drier open areas with friable soils	L None seen; no burrows observed with badger characteristics observed. Not expected because of farming activities
Yuma hispid cotton rat *Sigmodon hispidus eremicus*	CDFW: Species of Special Concern	Adult size is total length 202–340 mm (7.9–13 in); tail 87–122 mm (3.4-4.8 in), frequently broken or stubbed; hind foot 29–35 mm (1-1.3 in); ear 16–20 mm (0.6-0.9 in); mass 50-250 g (1.7-9 oz)	The southern edge of the S. hispidus distribution is likely near the Rio Grande, where it meets the northern distribution of S. toltecus (formerly S. h. toltecus). The northern extent of S. hispidus distribution is to the Platte River in Nebraska and from Arizona to Virginia.	L No habitat

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Colorado Desert fringe-toed lizard *Uma notata*	CDFW: SSC	A medium-sized, flat-bodied, smooth-skinned lizard	inhabits areas of loose sand. Sparsely-vegetated arid areas with fine wind-blown sand, including dunes, flats with sandy hummocks formed around the bases of vegetation, washes, and the banks of rivers. Needs fine, loose sand for burrowing.	L No habitat
coastal whiptail *Aspidoscelis tigris stejnegeri*	CDFW: SSC	A slim-bodied lizard with a long slender tail, a pointed snout, and large symmetrical head plates. Scales on the back are small and granular, and scales on the tail are keeled.	Found in a variety of ecosystems, primarily hot and dry open areas with sparse foliage - chaparral, woodland, and riparian areas.	L No habitat
Palm Springs pocket mouse	CDFG: SC	Small heteromyid rodent with length of about 110 to 151 mm and weight from 8 to 11 g. There are usually two small patches of lighter hairs at the base of the ear. There is no a tail-crest, and an unlobed antitragus in the outer ear.	Creosote scrub, desert scrub, and grasslands, with loosely packed or sandy soils with sparse tomoderately dense vegetative cover. P. I. bangsi occurs only in the Coachella Valley, where substantial agricultural and urban/suburban conversion of habitat, especially in the valley floor, has occurred over the last century. The species occurs only in native habitats.	L No habitat

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Desert Pupfish *Cyprinodon macularius*	CNDDB Rank: G1; S1 Federal: Endangered; Cal: Endangered	The body of the desert pupfish is thickened and markedly compressed laterally in adult males. The mouth is superior, highly protractile, armed with tricuspid teeth. The scales bear spine-like projections. The dorsal profile of the fish is smoothly rounded.	The pupfish occupies shallow waters of springs, small streams, and marshes.	L No drains located near Salton Sea near site
Razorback Sucker *Xyrauchen texanus*	Fed/CA: Endangered	One of the largest suckers in North America can grow to up to 13 pounds and lengths exceeding 3 feet. The razorback is brownish-green with a yellow to white-colored belly and has an abrupt, bony hump on its back shaped like an upside-down boat keel	Colorado River	L No habitat

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Pocketed free-tailed bat *Nyctinomops femorosaccus*	CNDDB Rank: G4, S2S3; CDFG: SC	A small fold, or "pocket" in the wing membrane of the free-tailed bat, near its knee, gives this bat its common name. Pocketed free-tailed bats have large ears and long wings, and fly rapidly, generally pursuing insects on the wing. They eat many kinds of insects, but seem to prefer small moths.	It occurs in the arid lowlands of the desert Southwest, and primarily roosts in crevices in rugged cliffs, slopes, and tall rocky outcrops.	L No habitat
Western Mastiff Bat *Eumops perotis californicus*	CNDDB Rank: G5T4, S3; CDFG: SC	Eumops perotis can be distinguished from all other North American molossid (free-tail) species based on size. With a forearm of 73-83 mm, it is North America's largest species.	In California, the E. perotis is most frequently encountered in broad open areas. Generally, this bat is found in a variety of habitats, from dry desert washes, flood plains, chaparral, oak woodland, open ponderosa pine forest, grassland, montane meadows, and agricultural areas.	L None observed under bridge

ZOOLOGICAL SPECIES	STATUS[1]	DESCRIPTION OF SPECIES	HABITAT	OBSERVATION/ SITE POTENTIAL
Pallid Bat *Antrozous pallidus*	Species of concern	Pallid bats have larger eyes than most other species of bats in North America and have pale, long, and wide ears; their fur is generally lightly colored. They have on average a total length of 92 to 135 mm (3.6 to 5.3 in).	They primarily sleep in rock crevices and buildings. Pallid bats are skilled at climbing and crawling.	L None observed under bridge
California Leaf-nosed Bat *Macrotus californicus*	Species of concern	The California leaf-nosed bat weighs between 12 and 20 grams, has a wingspan of over 30 centimeters and a body length of over 6 centimeters, and is brown in color. As its name implies, it has a triangular fleshy growth of skin, called a noseleaf, protruding above the nose.	Its natural habitat is hot deserts.	L No habitat

Special Status Species that Occur in Imperial County (USFWS)				
Common Name ***Scientific Name***	**Status[1]** **Federal/CDFW / CNPS**	**DESCRIPTION OF SPECIES**	**Habitat**	**Suitability Of Habitat In Survey Area**
Plants				
Peirson's milk-vetch *Astragalus magdalenae var. peirsonii*	T/E/1B	Silvery, short-lived perennial plant that is somewhat broom like in appearance. A member of the pea and bean family, it can grow to 2.5 feet tall and is notable among milkvetches for its greatly reduced leaves. Peirson´s milkvetch produces attractive, small purple flowers, generally in March or April, with 10 to 17 flowers per stalk. It yields inflated fruit similar to yellow-green pea pods with triangular beaks.	Desert dune habitats. In California, known from sand dunes in the Algodones Dunes system of Imperial County. Was known historically from Borrego Valley in San Diego County and at a site southwest of the Salton Sea in Imperial County	L No dune habitat

Common Name *Scientific Name*	Status[1] Federal/CDFG /CNPS	DESCRIPTION OF SPECIES	Habitat	Suitability Of Habitat In Survey Area
Birds				
California brown pelican *Pelecanus occidentalis* No longer endangered	Unlisted; CDFW Protected species	Large size and brown color. Adults weigh approximately 9 pounds, and have a wingspan of over 6 feet. They have long, dark bills with big pouches for catching and holding fish. Pelicans breed in nesting colonies on islands without mammal predators. Roosting and loafing sites provide important resting habitat for breeding and non-breeding birds.	Open water, estuaries, beaches; roosts on various structures, such as pilings, boat docks, breakwaters, and mudflats	L None observed. No open water

Common Name *Scientific Name*	Status[1] Federal/CDFG /CNPS	DESCRIPTION OF SPECIES	Habitat	Suitability Of Habitat In Survey Area
Southwestern willow *Empidonax tpllii extimus*	E/-/-	Small; usually a little less than 6 inches in length, including tail. Conspicuous light-colored wingbars. Lacks the conspicuous pale eye-ring of many similar *Empidonax* species. Overall, body brownish-olive to gray-green above. Throat whitish, breast pale olive, and belly yellowish. Bill relatively large; lower mandible completely pale. The breeding range of extimus includes Arizona and adjacent states.	At low elevations, breeds principally in dense willow, cottonwood, and tamarisk thickets and in woodlands, along streams and rivers. Migrants may occur more widely. Prefers riparian willow/cottonwood but will use salt cedar thickets	L No habitat

Common Name *Scientific Name*	Status[1] Federal/CDFG /CNPS	DESCRIPTION OF SPECIES	Habitat	Suitability Of Habitat In Survey Area
Mountain plover *Charadrius montanus*	FPT/SC/-	Medium-sized plover with pale brown upperparts, white underparts, and brown sides. Head has brown cap, white face, and dark eyestripe. Upperwings are brown with black edges and white bars; underwings are white. Tail is brown-black with white edges. Sexes are similar.	Avoids high and dense cover. Uses open grass plains, plowed fields with little vegetation, and open sagebrush areas. Likes to follow livestock grazing or burned off fields.	L Irrigated alfalfa in vicinity could provide forage area during winter if grazed or burned. No nesting areas on site
Black rail *Laterallus jamaicensis coturniculus*	-/T/-	The smallest of all rails, the black rail is slate-colored, with a black bill, red eyes and a white-speckled back. The legs are moderately long and the toes are unwebbed. The sexes are similar.	Most commonly occurs in tidal emergent wetlands dominated by pickleweed or in brackish marshes with bulrushes in association with pickleweed. In freshwater, usually found in bulrushes, cattails, and saltgrass and in immediate vicinity of tidal sloughs. Typically occurs in the high wetland zones near upper limit of tidal flooding, not in low wetland areas with considerable annual or daily fluctuations in water levels. Nests are concealed in dense vegetation, often pickleweed, near upper limits of tidal flooding	L None observed; no habitat

Common Name *Scientific Name*	Status[1] Federal/CDFG /CNPS	DESCRIPTION OF SPECIES	Habitat	Suitability Of Habitat In Survey Area
Raptors				
Peregrine Falcon *Falco peregrinus*	D/E/-	Large, powerful falcon; pointed winged falcon silhouette. Strong shallow wingbeats may dive at speeds up to 100 mph. Dark with dark hooded effect. Blue gray below with narrow bars Long-winged, long tailed hawk. Habitually flies low over open fields and marshes watching and listening for prey such as rodents and birds. (I observed Harrier with a white faced ibis as prey). Perches low or on ground. Low slow flight. Nests in reeds. Grey with black wingtips.	Most often found along coastlines or marshy habitats. Nest in cliffs and have been known to nest in tall buildings	L None observed; rare visitors to area outside of the Salton Sea. No waterfowl for prey or cliffs/tall buildings for nesting

Common Name *Scientific Name*	Status[1] Federal/CDFG /CNPS	DESCRIPTION OF SPECIES	Habitat	Suitability Of Habitat In Survey Area
Northern harrier *Circus cyaneus*	-/SC/-	Blue gray above pale reddish below; small size. Tip of tail squared off. Nesting occurs in dense tree stands which are cool, moist, well shaded and usually near water. Hunt in openings at the edges of woodlands and also brushy pastures.	Marshes, open fields. Nests in reeds	L Irrigated alfalfa in vicinity could provide hunting area. No nesting areas on site
Sharp-shinned Hawk *Accipiter striatus*	-/SC/-	Gray and white with black on shoulders and under bend of wing. Graceful flyer. Adults have bright red eyes. Medium size hawk; about 15 inches long and about 12 ounces. Males pale with rufous shoulders and thigh feathers. White tail washed with rufous. Wide head wings in shallow v when soaring.	Sharp-shinned hawks may appear in woodland habitats during winter and migration periods and are often common in southern California in the coastal lowlands and desert areas; winters in woodlands and other habitats except alpine, open prairie and bare desert	L Irrigated alfalfa in vicinity could provide hunting area. No nesting areas on site

Common Name *Scientific Name*	Status[1] Federal/CDFG /CNPS	DESCRIPTION OF SPECIES	Habitat	Suitability Of Habitat In Survey Area
White tailed Kite *Elanus leucurus*	/E/		Found in open country; like to perch on treetop. May be seen hovering prior to attack of a rodent.	L Irrigated alfalfa in vicinity could provide hunting area. No nesting areas on site
Ferruginous hawk *Buteo regalis*	/SC/		Found in arid to semiarid regions, as well as grasslands and agricultural areas in southwestern Canada, western United States, and northern Mexico.	L Irrigated alfalfa in vicinity could provide hunting area. No nesting areas on site
Mammals				
Bighorn sheep *Ovis canadensis*	E/E/-	Sheep have short hair which is light gray to grayish brown, except around their stomachs and rump, where it is creamy white. Their tails are about four inches long. Full-grown rams weigh between 180 and 240 pounds,	Desert Bighorn sheep occupy a variety of plant communities, ranging from mixed-grass hillsides, shrubs. Avoids dense vegetation	L None observed; no habitat

Common Name *Scientific Name*	Status[1] Federal/CDFG /CNPS	DESCRIPTION OF SPECIES	Habitat	Suitability Of Habitat In Survey Area
Jaguar *Panthera onca*	-/-/-	Typically yellow-brown with black spots, called rosettes, but they can also be black with black spots. They are nocturnal and have a keen sense of smell and hearing. Excellent swimmers, tree climbers, and move easily on the ground.	Occurs in tropical rainforests, arid scrub, and wet grasslands. Prefers dense forests or swamps with a ready supply of water	L None observed; no habitat

Common Name *Scientific Name*	Status[1] Federal/CDFG /CNPS	DESCRIPTION OF SPECIES	Habitat	Suitability Of Habitat In Survey Area
Reptiles and Amphibians				
Desert tortoise *Gopherus agassizii*	T/T/-	A herbivore that may attain a length of 9 to 15 inches in upper shell (carapace) length. The tortoise is able to live where ground temperature may exceed 140 degrees F because of its ability to dig underground burrows and escape the heat. At least 95% of its life is spent in burrows. Their shells are high-domed, and greenish-tan to dark brown in color. Desert tortoises can grow from 4–6"in height and weigh 8–15 lb (4–7 kg) when fully grown. The front limbs have heavy, claw-like scales and are flattened for digging. Back legs are more stumpy and elephantine	Dry, flat, and gravelly or sandy ground in desert shrub communities where annual and perennial grasses are abundant. Frequent habitats with a mix of shrubs, forbs, and grasses	L None observed; habitat not favorable

Common Name *Scientific Name*	Status[1] Federal/CDFG /CNPS	DESCRIPTION OF SPECIES	Habitat	Suitability Of Habitat In Survey Area
Flat-tailed horn lizard *Phrynosoma mcallii*	PT/-/-	Closely related to Desert horned lizard (scat indistinquishable); only found in Imperial, Riverside County,Ca and Yuma area, Az. Small round lizard with distinquishing round spots on back. Diet of ants; needs sandy soil, shade bushes to survive.	Desert washes/sandy areas with vegetative cover. Diet of ants	L No habitat; none observed
Fish				
Desert pupfish *Cyprinodon macularius*	E/E/-	Small, silvery-colored fish with 6 to 9 dark bands on its sides. Grows to a full average length of only 2.5 inches; develop quickly, sometimes reaching full maturity within 2 to 3 months. Although their average life span is 6 to 9 months, some survive more than one year. Pupfish have a short, scaled head with an upturned mouth.	Springs, seeps, and slow-moving streams in Salton Sink basin and backwaters and sloughs of the Colorado River	L None observed; no habitat; drains not adjacent to Salton Sea

Common Name *Scientific Name*	Status[1] Federal/CDFG /CNPS	DESCRIPTION OF SPECIES	Habitat	Suitability Of Habitat In Survey Area
Razorback Sucker *Xyrauchen texanus*	Fed/CA: Endangered	One of the largest suckers in North America can grow to up to 13 pounds and lengths exceeding 3 feet. The razorback is brownish-green with a yellow to white-colored belly and has an abrupt, bony hump on its back shaped like an upside-down boat keel	Colorado River	L None observed; no habitat

USFWS Birds of Conservation Concern					
Common Name	**Species Name**	**Habitat**	**Potential Onsite**	**Region 8 Imperial County**	**National Rating**
Bald Eagle	*Haliaeetus leucocephalus*	Nests on tall trees or on cliffs in forested areas near large bodies of water. Winters in coastal areas, along large rivers, and large unfrozen lakes.	Low Not expected. No tall trees; not observed in area	X	X
Swainson's Hawk	*Buteo swainsoni*	Breeds in open country such as grassland, shrubland, and agricultural areas. Usually migrates in large flocks often with Broad-winged Hawks. Winters in open grasslands and agricultural areas of Southern America.	L May migrate through. Not observed in area		X
Peregrine Falcon	*Falco peregrinus*	Inhabits open wetlands near cliffs for nesting. Also uses large cities and nests on buildings.	M No open wetlands or nesting area; could hunt in vicinity	X	X

Common Name	Species Name	Habitat	Potential Onsite	Region 8 Imperial County	Common Name
Black Rail	*Laterallus jamaicensis*	Nests in high portions of salt marshes, shallow freshwater marshes, wet meadows, and flooded grassy vegetation.	Low	X	X
			No salt or freshwater marshes; no vegetation		
Snowy Plover	*Chardrius alexandrinus*	Barren to sparsely vegetated sand beaches, dry salt flats in lagoons, dredge spoils deposited on beach or dune habitat, levees and flats at salt-evaporation ponds, river bars, along alkaline or sailne lakes, reservoirs, and ponds.	Low No habitat; not observed	X	X
Mountain Plover	*Charadrius montanus*	Breeds on open plains at moderate elevations. Winters in short-grass plains and fields, plowed fields, and sandy deserts.	Low Irrigated alfalfa in vicinity could provide forage area during winter if grazed or burned. No nesting areas on site	X	X
Black Oystercatcher	*Haematopus bachmani*	Rocky seacoasts and islands, less commonly sandy beaches.	Low No habitat; not observed	X	X

Common Name	Species Name	Habitat	Potential Onsite	Region 8 Imperial County	Common Name
Solitary Sandpiper	*Tringa solitaria*	Breeds in taiga, nesting in trees in deserted songbird nests. In migration and winter found along freshwater ponds, stream edges, temporary ponds, flooded ditches and fields, more commonly in wooded regions, less frequently on mudflats and open marshes.	Low No habitat; not observed		X
Lesser Yellowlegs	*Tringa flavipes*	Breeds in open boreal forest with scattered shallow wetlands. Winters in wide variety of shallow fresh and saltwater habitats.	Low No habitat; not observed		X
Upland Sandpiper	*Bartramia longicauda*	Native prairie and other dry grasslands, including airports and some croplands.	Low No habitat; not observed		X
Whimbrel	*Numenius phaeopus*	Breeds in various tundra habitat, from wet lowlands to dry heath. In migration, frequents various coastal and inland habitats, including fields and beaches. Winters in tidal flats and shorelines, occasionally visiting inland habitats.	Low Could use fields for foraging vicinity if planted to alfalfa or bermuda	X	X

Common Name	Species Name	Habitat	Potential Onsite	Region 8 Imperial County	Common Name
Long-billed Curlew	*Numenius americanus*	Nests in wet and dry uplands. In migration and winter found on wetlands, grain fields, lake and river shores, marshes, and beaches.	Low Could use fields for foraging in vicinity if planted to alfalfa or bermuda	X	X
Short-billed Dowitcher	*Limnodromus griseus*	Breeds in muskegs of taiga to timberline, and barely into subarctic tundra. Winters on coastal mud flats and brackish lagoons. In migration prefers saltwater tidal flats, beaches, and salt marshes. Also found in freshwater mud flats and flooded agricultural fields.	Medium Could use fields for foraging if planted to alfalfa or bermuda	X	X
Aleutian Tern	*Sterna aleutica*	Nest on flat vegetated islands on or near the coast. Vegetation includes dwarf-shrub tundra, grass and sedgemeadows, and coastal marsh. Migration and winter habitat not known, probably pelagic.	Low No habitat; not observed		X
Least Tern	*Sterna antillarum*	Seacoasts, beaches, bays, estuaries, lagoons, lakes and rivers, breeding on sandy or gravelly beaches and banks of rivers or lakes, rarely on flat rooftops of buildings.	Low No habitat; not observed		X

Common Name	Species Name	Habitat	Potential Onsite	Region 8 Imperial County	Common Name
Gull-billed Turn	*Sterna nilotica*	Breeds on gravelly or sandy beaches. Inters in salt marshes, estuaries, lagoons and plowed fields, along rivers, around lakes and in freshwater marshes.	Low No habitat; not observed		X
Black Skimmer	*Rynchops niger*	Breeds in large colonies on sandbars and beaches. Forages in shallow bays, inlets, and estuaries.	Low No habitat; not observed	X	X
Yellow-billed Cuckoo	*Coccyzus americanus*	Open woodlands with clearings, orchards, dense scrubby vegetation, mainly cottonwood, willow, and adler, often along water.	Low No habitat; not observed	X	X
Black Swift	*Cypseloides niger*	Nests on steep ledges on cliffs or canyons. Migrates and winters over coastal lowlands.	Low No habitat; no swifts observed in area	X	X
Costa's Hummingbird	*Calypte costae*	Primarily low deserts and arid brushy foothills, but also chaparral and coastal sage scrub closer to the coast. Often visits ornamental plantings and feeders in desert communities. In migration and winter frequents a wider variety of habitats, occasionally ranging into pine-oak woodlands.	Low No habitat; not observed – no feeders or nectar sources in area	X	X

Common Name	Species Name	Habitat	Potential Onsite	Region 8 Imperial County	Common Name
Calliope Hummingbird	*Stellula calliope*	Open montane forest, mountain meadows, and thickets of willow and alder. In migration and winter also in chaparral, oak and pine-oak woodlands, deserts, and gardens.	Low No habitat; not observed	X	X
Rufous Hummingbird	*Selasphorus rufus*	Breeds in a variety of forested habitats where flowers are found. Frequents montane meadows and just about anywhere else with flowers or feeders during migration. Winters primarily in pine and pine-oak forests in Mexico, but most birds wintering farther north are attracted either to flowers or feeders in gardens.	Low No habitat; not observed – no feeders or nectar in area.		X
Allen's Hummingbird	*Selasphorus sasin*	Breeds in coastal sage scrub, chaparral, and riparian corridors within coastal forests. In Mexico winters in forest edge and scrub clearings with flowers. The resident population on the mainland of southern California is largely restricted to suburban neighborhoods where feeders and flowers are plentiful.	Low No habitat; not observed. No feeders or nectar in area	X	X

Common Name	Species Name	Habitat	Potential Onsite	Region 8 Imperial County	Common Name
Lewis's Woodpecker	*Melanerpes lewis*	Breeds in open arid conifer, oak, and riparian woodlands: rare in coastal areas. Winters in breeding habitat, and oak savannas, orchards, and even in towns.	Low No habitat; not observed	X	X
Olive-sided Flycatcher	*Contopus cooperi*	Montane and northern coniferous forests, at forest edges and openings such as meadows, and at ponds and bags. Winters at forest edges and clearings where tall trees or snags are present.	Low No habitat; not observed	X	X
Willow Flycatcher	*Empidonax trailii*	Breeds in moist, shrubby areas, often with standing or running water. Winters in shrubby clearings and early successional growth.	Low No habitat; not observed	X	X
Loggerhead Shrike	*Lanius ludovicianus*	Open or brushy areas.	Low No habitat; not observed. No thickets or thorny trees available. Could pass through fields	X	X
Bell's Vireo	*Vireo bellii*	Dense, low, shrubby vegetation generally early successional stages in riparian areas, brushy fields, young second-growth forest or woodland, scrub oak, coastal chaparral, and mesquite brushlands, often near water in arid regions.	Low No habitat; not observed. No thickets available. Could pass through fields	X	X

Common Name	Species Name	Habitat	Potential Onsite	Region 8 Imperial County	Common Name
Black-chinned Sparrow	*Spizella atrogularis*	Arid brushland, commonly in tall and fairly dense sagebrush, and dry chaparral. Often in rocky, rugged country from sea level to around 8,900 ft (2700m).	Low No habitat; not observed	X	X
Tricolored Blackbird	*Agelaius tricolor*	Breeds in marsh vegetation, particulalry cattails, near grain fields, riparian scrublnd, and forests, but always near water. Dairies and feedlots also commonly used for foraging. Urban and suburban areas occasinoally utilized, particularly park lawns. Cultivated lands also suitable for foraging. Large night-time roosts form during nonbreeding season in cattail marshes near foraging grounds.	Low No habitat; not observed	X	X
Lawrence's Goldfinch	*Carduelis lawrencei*	Prefers dry interior foothills, mountain valleys, open woodlands, chaparral, and weedy fields. Often found near isolated water sources such as springs and cattle troughs.	Low No habitat; not observed	X	X

CNPS Species or Community Level	
G1 = Less than 6 viable element occurrences (EOs) OR less than 1,000 individuals OR less than 2,000 acres.	
G2 = 6-20 EOs OR 1,000-3,000 individuals OR 2,000-10,000 acres.	
G3 = 21-80 EOs OR 3,000-10,000 individuals OR 10,000-50,000 acres.	
G4 = Apparently secure; this rank is clearly lower than G3 but factors exist to cause some concern; i.e., there is some threat, or somewhat narrow habitat.	
G5 = Population or stand demonstrably secure to ineradicable due to being commonly found in the world.	
State Ranking	
The state rank (S-rank) is assigned much the same way as the global rank, except state ranks in California often also contain a threat designation attached to the S-rank.	The R-E-D Code contains information on Rarity, Endangerment, and Distribution, ranked as a 1, 2, or 3 for each value (as below). This code was originally known as the R-E-V-D Code (through the 3rd edition 1980), and the V (Vigor) was removed in the 4th edition (1984).
S1 = Less than 6 EOs OR less than 1,000 individuals OR less than 2,000 acres	**R - Rarity**
S1.1 = very threatened	1 – Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction is low at this time
S1.2 = threatened	2 – Distributed in a limited number of occurrences, occasionally more if each occurrence is small
S1.3 = no current threats known	3 – Distributed in one to several highly restricted occurrences, or present in such small numbers that it is seldom reported
S2 = 6-20 EOs OR 1,000-3,000 individuals OR 2,000-10,000 acres	**E - Endangerment**
S2.1 = very threatened	1 – Not very endangered in California
S2.2 = threatened	2 – Fairly endangered in California
S2.3 = no current threats known	3 – Seriously endangered in California
S3 = 21-80 EOs or 3,000-10,000 individuals OR 10,000-50,000 acres	**D - Distribution**
S3.1 = very threatened	1 – More or less widespread outside California
S3.2 = threatened	2 – Rare outside California
S3.3 = no current threats known	3 – Endemic to California
S4 = Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat. NO THREAT RANK.	
S5 = Demonstrably secure to ineradicable in California. NO THREAT RANK.	

Sources: CDFW/CNDDB 2019, California Wildlife 2018; CNPS 2019; USFWS, 2016	
State/CDFW:	[1]**Status: Federal:**
E = Listed as an endangered species; or previously known as "rare, fully protected"	E = Listed as an endangered species
T = Listed as a threatened species	T = Listed as a threatened species
SC = species of special concern (designation intended for use as a management tool and for information; species of special concern have no legal status (www.dfg.ca.gov/wildlife/species/ssc/birds.html))	C = Candidate for listing
CNPS (California Native Plant Society):	D = Delisted
1B = Rare, threatened, or endangered in California or elsewhere	PD = Proposed for delisting/PT = Proposed for threatened status
2= Plants rare, threatened, or endangered in Ca, but more common elsewhere	
3=Plants about which more information is needed	
Habitat Suitability Codes: H = Habitat is of high suitability for this species M = Habitat is of moderate suitability for this species L = Habitat is of low suitability for this species	

BIOLOGICAL RESOURCES MAP


Lack Road at New River Bridge
Agriculture
ID Drain
Lack Road
New River
Agriculture
Abandoned lot
Site
Agriculture
Hay Stack lot
Google Earth

ENGINEERING PLANS

COUNTY OF IMPERIAL

LACK ROAD BRIDGE REPLACEMENT OVER NEW RIVER, BR. NO. 58C-XXXX

COUNTY PROJECT NO. 6421

GENERAL NOTES

STREET IMPROVEMENT GENERAL NOTES

1. COUNTY ENCROACHMENT PERMIT CONDITIONS AND PROVISIONS SHALL TAKE PRECEDENCE OVER THE APPROVED PLANS AND SPECIFICATIONS FOR ANY CONFLICTS.
2. THE STRUCTURAL SECTION SHALL BE IN ACCORDANCE WITH IMPERIAL COUNTY STANDARDS (OR CALTRANS IF IN STATE R/W) AND AS APPROVED BY THE PUBLIC WORKS DIRECTOR (OR CALTRANS).
3. APPROVAL OF THESE IMPROVEMENT PLANS AS SHOWN DOES NOT CONSTITUTE APPROVAL OF ANY CONSTRUCTION OUTSIDE THE PROJECT BOUNDARY.
4. ALL UNDERGROUND UTILITIES WITHIN THE STREET RIGHT-OF-WAY SHALL BE CONSTRUCTED, CONNECTED AND TESTED PRIOR TO CONSTRUCTION OF BERM, CURB, CROSS GUTTER AND PAVING.
5. THE EXISTENCE AND LOCATION OF EXISTING UNDERGROUND FACILITIES SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS, TO THE BEST OF OUR KNOWLEDGE, THERE ARE NO OTHER EXISTING FACILITIES EXCEPT AS SHOWN ON THESE PLANS. HOWEVER, THE CONTRACTOR IS REQUIRED TO TAKE PRECAUTIONARY MEASURES TO PROTECT ANY EXISTING FACILITY SHOWN HEREON AND ANY OTHER THAT IS NOT OF RECORD OR NOT SHOWN ON THESE PLANS.
6. LOCATION AND ELEVATIONS OF IMPROVEMENTS TO BE MET BY WORK TO BE DONE SHALL BE CONFIRMED BY FIELD MEASUREMENTS PRIOR TO CONSTRUCTION OF NEW WORK. CONTRACTOR WILL MAKE EXPLORATORY EXCAVATIONS AND LOCATE EXISTING UNDERGROUND FACILITIES SUFFICIENTLY AHEAD OF CONSTRUCTION TO PERMIT REVISIONS TO PLANS IF REVISIONS ARE NECESSARY BECAUSE OF ACTUAL LOCATION OF EXISTING FACILITIES.
7. UTILITIES COORDINATION

   NO LESS THAN 3 WORKING DAYS PRIOR TO ANY EXCAVATION OR TRENCHING, EACH CONTRACTOR DOING SUCH WORK SHALL CONTACT THE FOLLOWING AGENCIES SO THAT EXISTING UNDERGROUND UTILITIES MAY BE LOCATED. THE AGENCY MAY REQUIRE AN INSPECTOR TO BE PRESENT.

1. IMPERIAL IRRIGATION DISTRICT (POWER)	(760) 339-9280
2. IMPERIAL IRRIGATION DISTRICT (WATER)	(760) 339-9283
3. AT&T	(800) 422-4133
4. SOUTHERN CALIFORNIA GAS CO.	811
5. THE CABLE COMPANY (SBC)	(760) 312-6512

   EXISTING UNDERGROUND UTILITIES

   BEFORE EXCAVATING FOR THIS CONTRACT, VERIFY LOCATION OF UNDERGROUND UTILITIES. THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THESE PLANS HAVE BEEN OBTAINED FROM AVAILABLE RECORDS ONLY AND MAY NOT REFLECT ALL EXISTING UTILITIES. LOCATION OF ALL EXISTING UTILITIES SHALL BE CONFIRMED BY FIELD MEASUREMENTS BY CONTRACTOR PRIOR TO CONSTRUCTION OF WORK.

   CONTRACTOR IS REQUIRED TO TAKE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN HEREON AND ANY OTHER EXISTING LINES NOT OF RECORD OR NOT SHOWN ON THESE PLANS.

   ACCURATE VERIFICATIONS AS TO SIZE, LOCATION AND DEPTH OF EXISTING UNDERGROUND SERVICES SHALL BE THE CONTRACTOR'S RESPONSIBILITY. THE CONTRACTOR SHALL NOTIFY THE SOUTHERN CALIFORNIA GAS COMPANY, AT&T, IMPERIAL IRRIGATION DISTRICT AND ANY OTHER AFFECTED UTILITY AGENCIES PRIOR TO STARTING HIS WORK NEAR SUCH UTILITY FACILITIES AND SHALL COORDINATE HIS WORK WITH UTILITY REPRESENTATIVES. FOR LOCATION OF UNDERGROUND UTILITIES AND APPURTENANCES, CONTACT "UNDERGROUND SERVICE ALERT" AT 811.
8. IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER TO CONTACT THE UTILITY AGENCIES, ADVISE THEM OF THE PROPOSED IMPROVEMENTS AND BEAR THE COST OF RELOCATIONS, IF NEEDED.
9. NO PAVING SHALL BE DONE UNTIL EXISTING POWER POLES ARE RELOCATED OUTSIDE THE AREAS TO BE PAVED.
10. PRIVATE ROAD IMPROVEMENTS SHOWN HEREON ARE FOR INFORMATION ONLY. COUNTY OFFICIALS SIGNATURE HEREON DOES NOT CONSTITUTE APPROVAL OR RESPONSIBILITY OF ANY KIND FOR THE DESIGN OR CONSTRUCTION OF THESE PRIVATE IMPROVEMENTS.
11. ALL SIGNS TO BE ALUMINUM WITH 3M HIGH INTENSITY TYPE REFLECTIVE FACE OR EQUIVALENT.
12. CONTRACTOR WILL BE RESPONSIBLE FOR THE REPLACEMENT OF ANY STRIPING, PAVEMENT MARKERS, OR LEGENDS OBLITERATED BY THE CONSTRUCTION OF THIS PROJECT.
13. THE CONTRACTOR SHALL DO ALL NEW STRIPING AND SANDBLASTING OF REDUNDANT STRIPING.
14. THE CONTRACTOR SHALL BE RESPONSIBLE TO SECURE AN ENCROACHMENT PERMIT FROM THE COUNTY OF IMPERIAL DEPARTMENT OF PUBLIC WORKS FOR ANY EXCAVATION OR CONSTRUCTION WITHIN COUNTY ROAD RIGHT-OF-WAY, FOR INSPECTIONS, 48 HOUR MINIMUM NOTICE IS REQUIRED, (760) 482-4462. ADDITIONALLY, UNDERGROUND SERVICE ALERT (USA) MUST BE CALLED TWO WORKING DAYS BEFORE THE CONTRACTOR MAY EXCAVATE. THEIR CONTACT NUMBER IS 811. ALL WORK AND MATERIALS ARE SUBJECT TO THE INSPECTION AND APPROVAL FROM THE COUNTY DEPARTMENT OF PUBLIC WORKS OR THEIR REPRESENTATIVE.
15. NO REVISIONS OF ANY KIND SHALL BE MADE TO THESE PLANS WITHOUT THE PRIOR WRITTEN APPROVAL OF BOTH THE COUNTY ENGINEER (OR HIS REPRESENTATIVE) AND THE ENGINEER OF RECORD. A REPRODUCIBLE AS-BUILT PLAN SET WILL BE PROVIDED TO THE PUBLIC WORKS DEPARTMENT AS A CONDITION OF SUBSTANTIAL CONSTRUCTION COMPLETION AND PRIOR TO ACCEPTANCE.
16. ALL WORK AND MATERIALS SHALL CONFORM TO THESE PLANS AND SPECIFICATIONS, THE IMPERIAL COUNTY DEPARTMENT OF PUBLIC WORKS STANDARDS AND ENCROACHMENT PERMIT CONDITIONS AND ANY REFERENCED STANDARDS AND SPECIFICATIONS OF THE AGENCIES REFERRED TO HEREIN. ALL WORK SHOWN OR INDICATED BY THESE PLANS SHALL BE COMPLETED IN ACCORDANCE WITH THE STANDARDS, POLICIES AND REGULATIONS OF IMPERIAL COUNTY. WHERE, OR IF, CONFLICTS OCCUR, THEN THE IMPERIAL COUNTY REQUIREMENTS SHALL GOVERN.
17. UNLESS SPECIFICALLY INDICATED OTHERWISE METHODS EMPLOYED AND MATERIAL USED IN THE CONSTRUCTION OF ALL OFFSITE IMPROVEMENTS SHALL CONFORM TO THE APPLICABLE PROVISIONS OF THE "STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS DATED 2018". ALL WORK IS SUBJECT TO INSPECTION AND APPROVAL AS REQUIRED.
18. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO OBTAIN AN EXCAVATION PERMIT FROM THE STATE OF CALIFORNIA DIVISION OF SAFETY AND TO ADHERE TO ALL PROVISIONS OF THE STATE CONSTRUCTION SAFETY ORDERS AND STANDARDS.
19. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN A GENERAL CONSTRUCTION ACTIVITY STORM WATER PERMIT FROM THE STATE WATER RESOURCES CONTROL BOARD DIVISION OF WATER QUALITY, CONTACT "STATE WATER RESOURCES CONTROL BOARD, DIVISION OF WATER QUALITY, ATTENTION: STORM WATER PERMIT UNIT, P.O. BOX 1977, SACRAMENTO, CALIFORNIA, 95812".
20. CONSTRUCTION PROJECTS DISTRUBING MORE THAN ONE ACRE MUST OBTAIN A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT. OWNER/DEVELOPERS ARE REQUIRED TO FILE A NOTICE OF INTENT (NOI) WITH THE STATE WATER RESOURCES CONTROL BOARD, PREPARE A STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND MONITORING PLAN FOR THE SITE.
21. EXISTING STORM DRAIN PIPES/CULVERTS WHETHER TO BE CONNECTED TO, EXTENDED, ADJUSTED, DRAINED TO, OR JUST IN PROJECT VICINITY SHALL BE REPAIRED AND/OR CLEANED TO MAKE THEM FUNCTIONAL AND ACCEPTABLE AS DIRECTED BY THE PUBLIC WORKS DIRECTOR.
22. TRAFFIC CONTROL SHALL BE IN ACCORDANCE WITH THE CURRENT MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AND THE CALIFORNIA SUPPLEMENT AS DIRECTED BY THE IMPERIAL COUNTY TRAFFIC ENGINEER.
23. ANY EXISTING SURVEY MONUMENTS OR COUNTY RECOGNIZED BENCHMARKS SHALL BE PROTECTED BY THE CONTRACTOR, SHOULD ANY SUCH MONUMENTS OR BENCHMARKS BE REMOVED, DAMAGED, OBLITERATED OR ALTERED BY THE CONTRACTOR'S OPERATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER RESETTING OF THE SAME AS PER THE SUBDIVISION MAP ACT, THE PROFESSIONAL LAND SURVEYORS ACT AND THE SATISFACTION OF THE COUNTY SURVEYOR/DIRECTOR OF PUBLIC WORKS. SUCH POINTS SHALL BE REFERENCED AND REPLACED WITH APPROPRIATE MONUMENTATION BY A LICENSED LAND SURVEYOR OR A REGISTERED CIVIL ENGINEER AUTHORIZED TO PRACTICE LAND SURVEYING. A CORNER RECORD OR RECORD OF SURVEY AS APPROPRIATE SHALL BE FILED BY THE LICENSED LAND SURVEYOR OR REGISTERED CIVIL ENGINEER.
24. DUST SHALL BE CONTROLLED BY THE CONTRACTOR IN ACCORDANCE WITH ALL IMPERIAL COUNTY AIR POLLUTION CONTROL DISTRICT (APCD) FUGITIVE DUST CONTROL RULES AND REGULATIONS AND SHALL COMPLY WITH THESE PERMITTING REQUIREMENTS, IF APPLICABLE.

ABBREVIATIONS

AB	AGGREGATE BASE	LF	LINEAR FEET
AC	ASPHALT CONCRETE	Lt	LEFT
BB	BEGINNING OF BRIDGE	LVC	LENGTH OF VERTICAL CURVE
BC	BEGIN HORIZONTAL CURVE	Max	MAXIMUM
BVC	BEGIN VERTICAL CURVE	Min	MINIMUM
℄	CENTERLINE	N	NORTH
Ctr	CENTER	No.	NUMBER
Dwg	DRAWING	OG	ORIGINAL GROUND
E	EAST	(P)	PROPOSED
(E)	EXISTING	PCC	PORTLAND CEMENT CONCRETE
EB	END OF BRIDGE	PG	PROFILE GRADE
EC	END HORIZONTAL CURVE	PVI	POINT OF VERTICAL INTERSECTION
Elev	ELEVATION	R	RADIUS
EP	EDGE OF PAVEMENT	RCP	REINFORCED CONCRETE PIPE
ETW	EDGE OF TRAVELED WAY	Rd	ROAD
EVC	END VERTICAL CURVE	Rt	RIGHT
FG	FINISH GRADE	R/W	RIGHT OF WAY
FO	FIBER OPTIC	S	SOUTH
GB	GRADE BREAK	Sta	STATION
Horiz	HORIZONTAL	Typ	TYPICAL
HP	HIGH POINT, HINGE POINT	Var	VARIES
ICDPW	IMPERIAL COUNTY DEPARTMENT OF PUBLIC WORKS	Vert	VERTICAL
		W	WEST
ID	IMPERIAL IRRIGATION DISTRICT	WS	WATER SURFACE

BENCHMARK

PROJECT BASIS OF BEARING:

THE BASIS OF BEARING IS THE CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD83, ZONE 6, BASED LOCALLY ON CONTROL STATION "DM0517". VERTICAL CONTROL IS BASED ON NAVD88.

PROJECT BENCHMARK:

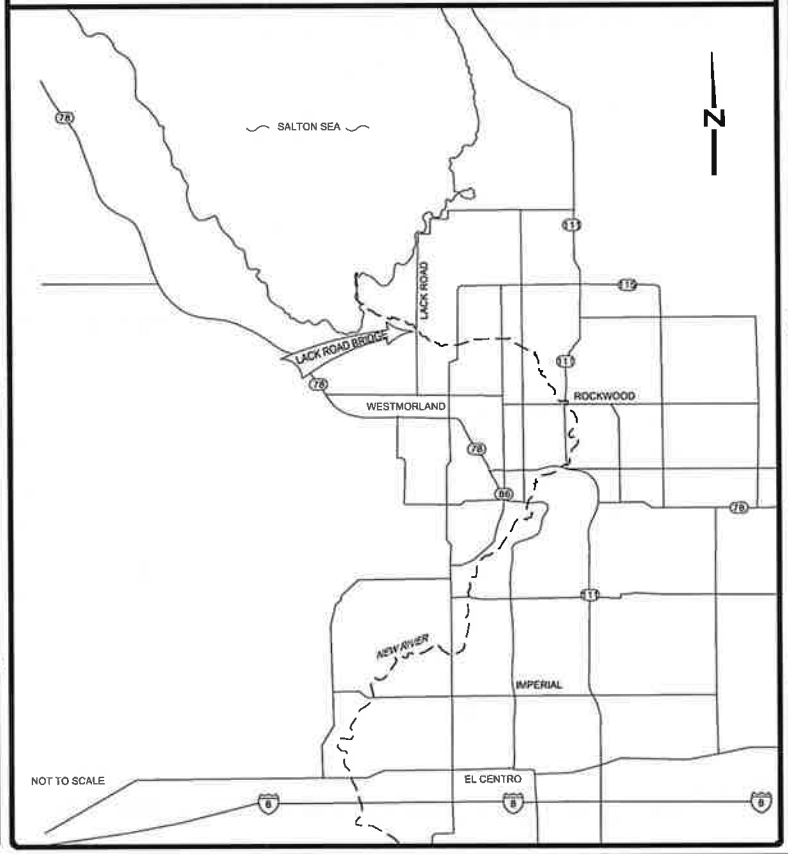
TOP OF BRASS DISK STAMPED "CO C 24 1971 CA-025" SET ON TOP OF NORTHEAST CORNER OF THE CONCRETE HEADWALL FOR THE SIPHON OF DELIVERY 180 RUNNING UNDER FOULDS ROAD, LOCATED AT THE SOUTHWEST QUADRANT OF THE INTERSECTION OF LACK ROAD AND FOULDS ROAD.

NATIONAL GEODETIC SURVEY DESIGNATION "CO C 24" AND PID "DW0517".

ELEVATION = -207.24 (NAVD 88)

EQUATION = ADD 208.91 FEET TO OBTAIN POSITIVE ELEVATION NUMBER VALUES = 788.67

VICINITY MAP



SYMBOLS

ITEM NO.	ITEM	SYMBOL
1	RIGHT OF WAY	
2	CENTERLINE/BASELINE	
3	(E) GAS LINE	
4	(E) OVERHEAD ELECTRICAL LINE	
5	(E) STORM DRAIN LINE	
6	ABANDON (E) UTILITY	
7	(E) EDGE OF PAVEMENT	
8	(P) EDGE OF PAVEMENT	
9	DAYLIGHT LINE	
10	COLD PLANE AC PAVEMENT	
11	ASPHALT CONCRETE PAVING	
12	ASPHALT CONCRETE (TYPE A)	
13	CLASS 2 AGGREGATE BASE	
14	CRASH CUSHION	
15	DIRECTION OF FLOW	
16	LINE AND CURVE NUMBER	1
17	CONTOURS - MAJOR	950
18	CONTOURS - MINOR	
19	CONTROL	△ N-17
20	SPOT ELEVATION	+ 951.44

SHEET INDEX

DIGALERT

CALL BEFORE YOU DIG — TWO WORKING DAYS BEFORE YOU DIG — TOLL FREE 811 — A PUBLIC SERVICE BY UNDERGROUND SERVICE ALERT

DECLARATION OF RESPONSIBLE CHARGE

I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT, THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE COUNTY OF IMPERIAL IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR THE PROJECT DESIGN.

NV5
15092 AVENUE OF SCIENCE, SUITE 200
SAN DIEGO, CA 92128

DATE

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:

PHILLIP REUSS, P.E.
NV5

82850
R.C.E. No.

9/6/19
DATE

9/30/20
REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:

JOHN A. GAY, P.E.
ROAD COMMISSIONER

62028
R.C.E. No.

DATE

9/30/19
REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

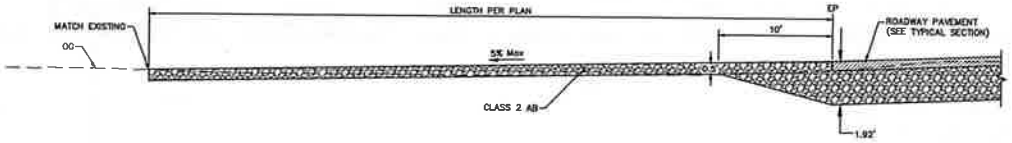
DATE	9/6/2019
DESIGNED	PAR
SCALE	AS SHOWN
DRAWN	JLA

LACK ROAD BRIDGE REPLACEMENT OVER NEW RIVER BRIDGE NO. 58C-XXXX

TITLE SHEET

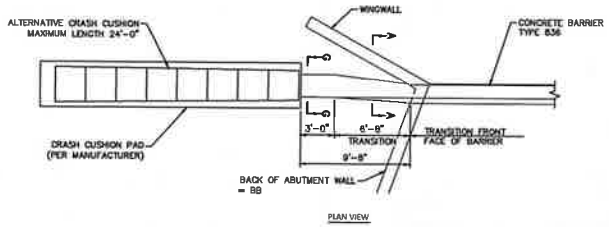
REFERENCE T-1

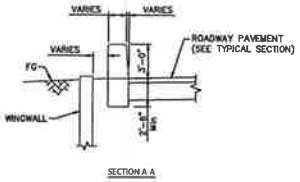
SHEET 1 OF 18

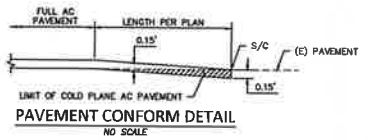


DRIVEWAY DETAIL
NO SCALE

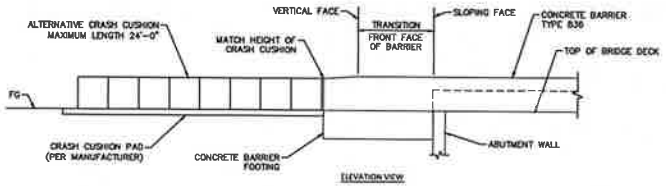
NOTES:
1. PARTIAL VIEW OF ALTERNATIVE CRASH CUSHION IS SHOWN FOR REFERENCE ONLY. FOR COMPLETE DETAILS, SEE MANUFACTURERS' PRODUCT MANUAL OF SELECTED CRASH CUSHION.
2. FOR ABUTMENT AND WINGWALL DETAILS, SEE BRIDGE PLANS.
3. FOR CONCRETE BARRIER DETAILS NOT SHOWN, SEE CALTRANS REVISED STANDARD PLAN RSP B11-79 AND RSP B11-80.

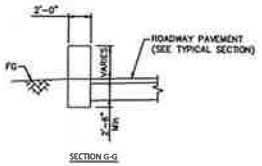






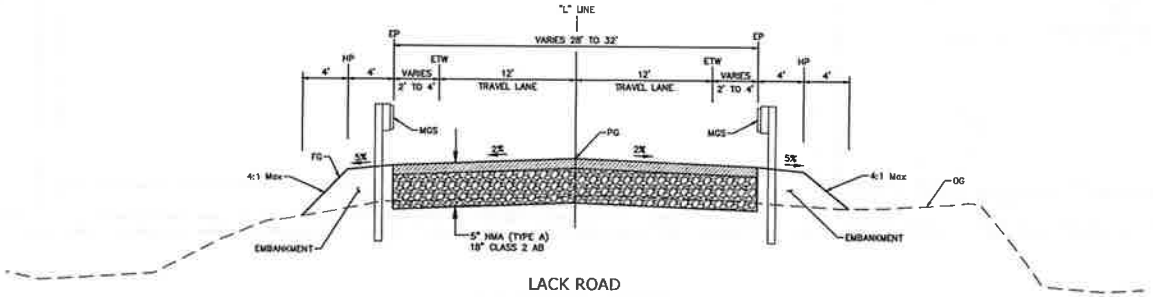
PAVEMENT CONFORM DETAIL
NO SCALE





CRASH CUSHION DETAIL
NO SCALE

NOTE:
FOR LOCATION OF MOS, SEE DRAWING PP-1.



LACK ROAD
"L" Sta 18+00.00 TO Sta 20+23.58 (BB)
"L" Sta 21+48.58 (EB) TO Sta 24+50.00

TYPICAL SECTION
NO SCALE

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
PHILLIP REUSS, P.E. NV5 — 82850 R.C.E. No. — 9/6/19 DATE — 9/30/20 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E. ROAD COMMISSIONER — 62028 R.C.E. No. — DATE — 9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

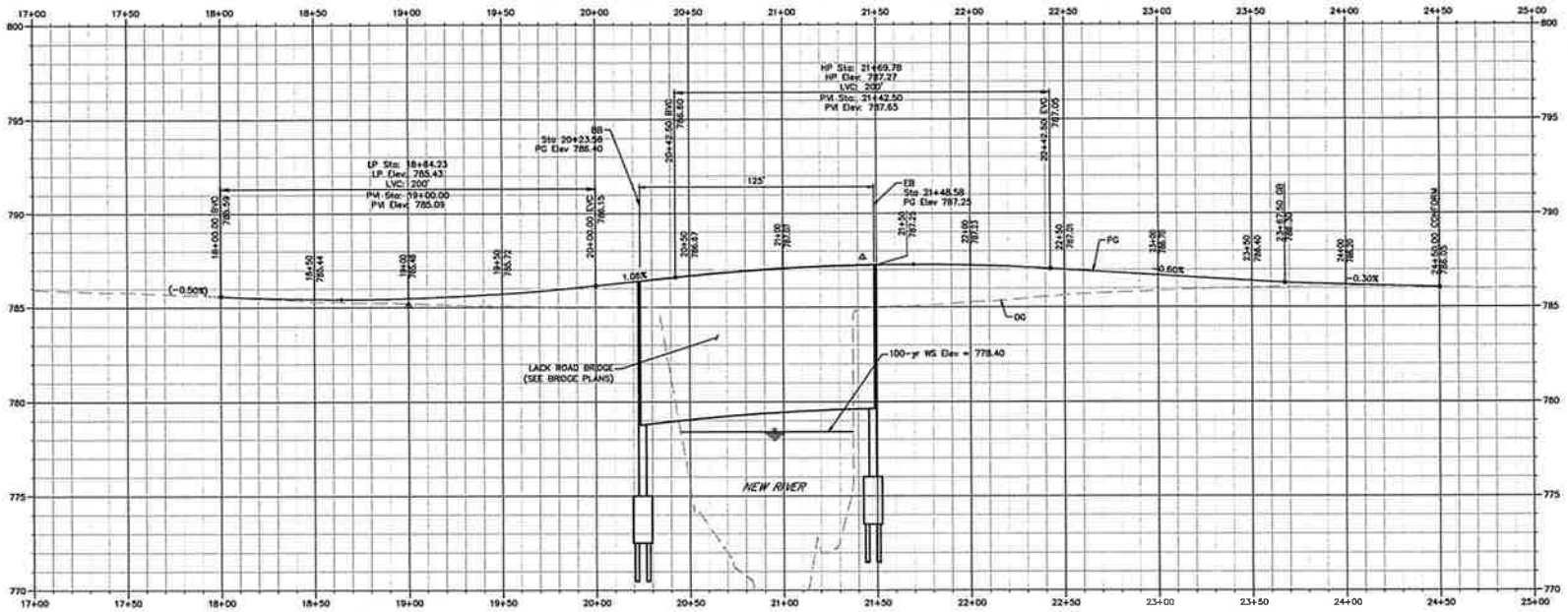
DATE: 9/6/2019
DRAWN: PAR
SCALE: AS SHOWN
CHECKED: JLA

LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

TYPICAL SECTION AND DETAILS

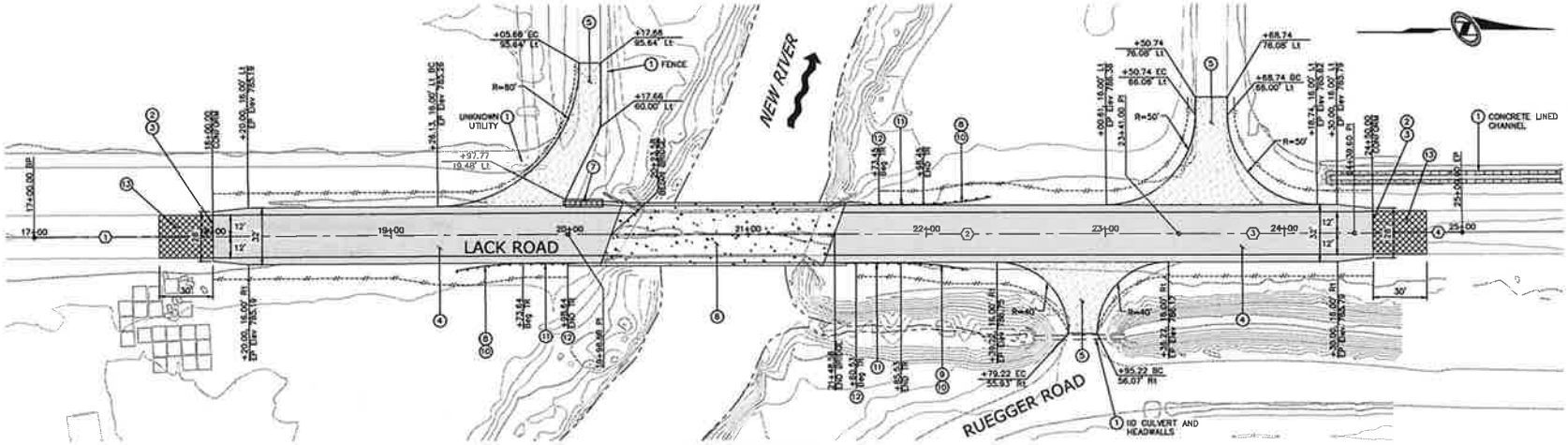
REFERENCE: X-1

SHEET 2 OF 18



LACK ROAD - PROFILE

SCALES: Horiz 1"=30'
Vert 1"=3'



LACK ROAD - PLAN

SCALE: 1"=30'

CONSTRUCTION NOTES

1. PROTECT IN PLACE.
2. SAWCUT EXISTING ASPHALT CONCRETE PAVEMENT.
3. MATCH EXISTING PAVEMENT. SEE ICCPW Dwg No. 453 FOR ADDITIONAL DETAILS.
4. NEW PAVEMENT SECTION PER TYPICAL SECTIONS. SEE ICDPW Dwg No. 440 FOR ADDITIONAL DETAILS.
5. GRADED DRIVEWAY. SEE DRAWING X-1 FOR DETAILS.
6. LACK ROAD BRIDGE. SEE BRIDGE PLANS.
7. ALTERNATIVE CRASH CUSHION. SEE CONSTRUCTION DETAIL ON DRAWING X-1.
8. MIDWEST GUARDRAIL SYSTEM FOR STRUCTURE APPROACH (TYPE 12B LAYOUT) PER CALTRANS STANDARD PLAN A77Q1.
9. MIDWEST GUARDRAIL SYSTEM FOR STRUCTURE DEPARTURE (TYPE 12BB LAYOUT) PER CALTRANS REVISED STANDARD PLAN A77Q4.
10. ALTERNATIVE FLARED TERMINAL SYSTEM. SEE SPECIAL PROVISIONS.
11. MIDWEST GUARDRAIL SYSTEM TRANSITION RAILING (TYPE WB-31) PER CALTRANS REVISED STANDARD PLAN A77U4.
12. MIDWEST GUARDRAIL SYSTEM CONNECTION TO BRIDGE RAILING PER CALTRANS STANDARD PLAN A77U1 AND A77U2.
13. COLD PLANE ASPHALT CONCRETE PAVEMENT. SEE DRAWING X-1 FOR DETAILS.

LINE DATA		
No.	BEARING	LENGTH
1	N0°28'33"W	298.88'
2	N0°11'42"W	342.12'
3	N0°18'50"W	98.60'
4	N0°40'08"W	60.40'

GRAPHIC SCALE
0' 30' 60' 90'
SCALE 1"= 30'

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
PHILLIP REUSS, P.E. NV5 — 82850 R.C.E. No.
9/6/19 DATE — 9/30/20 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY P.E. ROAD COMMISSIONER — 62028 R.C.E. No.
DATE — 9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

DATE 9/6/2019
DESIGN PAR
DRAWN AS SHOWN
CHECKED JLA

LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

PLAN AND PROFILE
LACK ROAD

REFERENCE PP-1

SHEET 3 OF 18

LEGEND

PAINTED TRAFFIC STRIPE PER CALTRANS STRIPING DETAILS; SEE STANDARD PLAN A20A THRU A20E.

EXISTING OBJECT MARKER

SURVEY CONTROL

SURVEY CONTROL DIAGRAM

BASIS OF COORDINATES

COORDINATES SHOWN HEREON ARE IN TERMS OF THE CALIFORNIA COORDINATE SYSTEM ZONE 6, NAD83, EPOC 2008.00, EXISTING FIRST ORDER GPS CONTROL POINTS FOUND AND USED TO CONSTRAIN NETWORK.

FIRST HORIZONTAL ORDER (NAD 83) REPEATER STATION IDENTIFIED AS "CRRS" "WESTMORLAND" LOCATED AT 7.7 MILES APPROXIMATELY NORTH AND ALONG STATE HIGHWAY 86 FROM THE CITY OF WESTMORLAND, THE STATION IS LOCATED IMMEDIATELY EAST OF THE NORTH BOUND LANE OF SAID STATE HIGHWAY 86 AND BY THE SOUTH CORNER OF THE EXISTING WATER RESERVOIR AND WAS USED FOR HORIZONTAL CALIBRATION, ACCORDING TO PUBLICATION FROM THE CALIFORNIA REAL TIME NETWORK (CRTN) AT SCRIPPS ORBIT AND PERMANENT ARRAY CENTER (SOPAC).

DESIGNATION – WESTMORLAND, CODE CRRS
NORTHING = 1989415.9770; EASTING = 6719424.2770

VERTICAL CONTROL

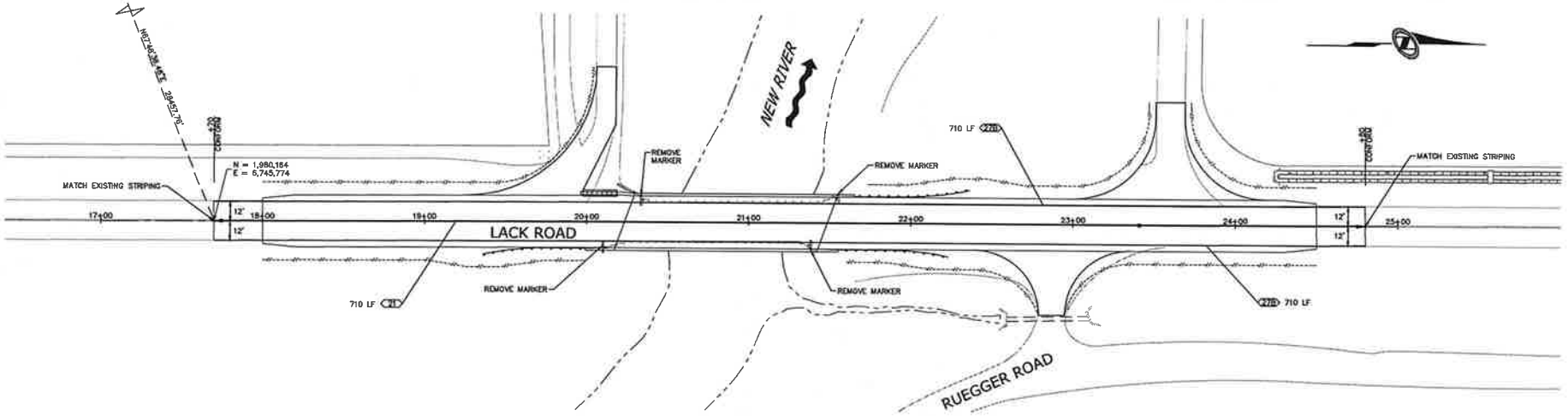
PROJECT BENCHMARK:

TOP OF BRASS DISK STAMPED "CO C 24 1971 CA-025" SET ON TOP OF NORTHEAST CORNER OF THE CONCRETE HEADWALL FOR THE SIPHON OF DELIVERY 180 RUNNING UNDER FOULDS ROAD, LOCATED AT THE SOUTHWEST QUADRANT OF THE INTERSECTION OF LACK ROAD AND FOULDS ROAD.

NATIONAL GEODETIC SURVEY DESIGNATION "CO C 24" AND PID "DW052",

ELEVATION = –207.24 (NAVD 88)

EQUATION = ADD 996.91 FEET TO OBTAIN POSITIVE ELEVATION NUMBER VALUES = 789.67



LACK ROAD - PLAN
SCALE: 1"=30'

GRAPHIC SCALE
0' 30' 60' 90'
SCALE 1"= 30'

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
PHILLIP REUSS, P.E.
NVS
9/9/19
DATE
82850
R.C.E. No.
9/30/20
REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E.
ROAD COMMISSIONER
DATE
62028
R.C.E. No.
9/30/19
REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

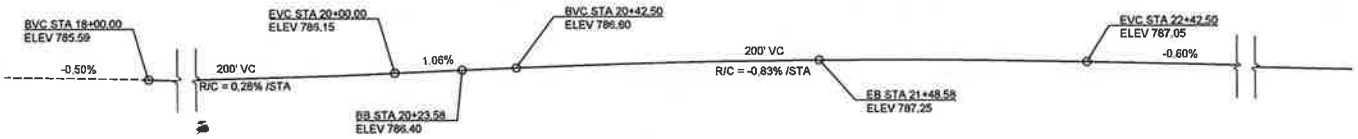
DATE 9/9/2019
DRAWN PAR
SCALE AS SHOWN
CHECKED JLA

LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

STRIPING PLAN
LACK ROAD

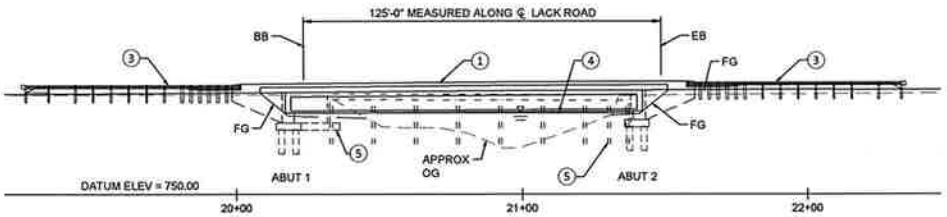
REFERENCE
PD-1

SHEET 4 OF 18



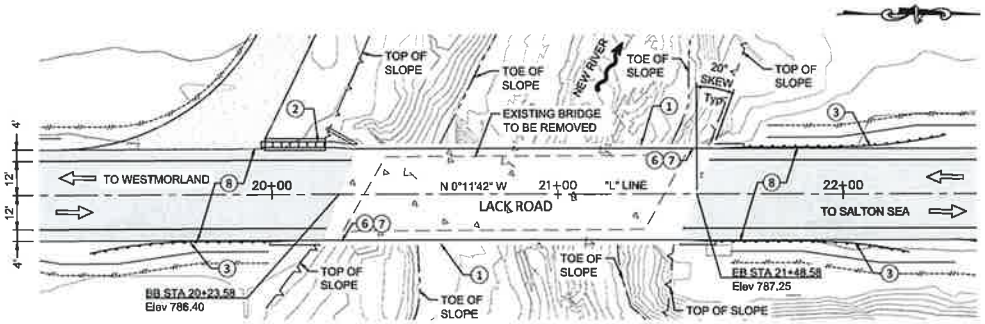
PROFILE GRADE

SCALE: 1"=20'



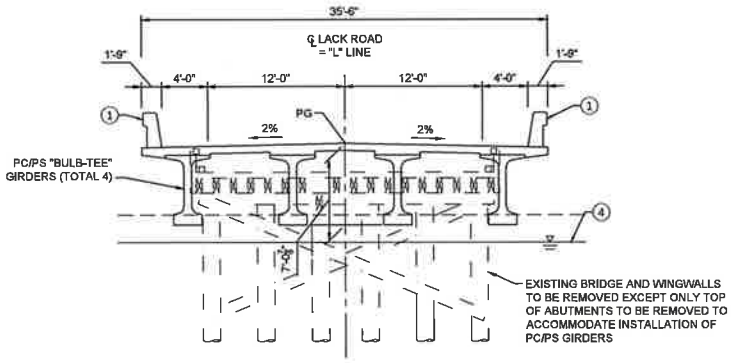
ELEVATION

SCALE: 1"=20'



PLAN

SCALE: 1"=20'



TYPICAL SECTION

SCALE: 1"=5'

LEGEND:

- INDICATES DIRECTION OF TRAFFIC
- INDICATES EXISTING BRIDGE
- INDICATES PROPOSED BRIDGE
- INDICATES DIRECTION OF FLOW

NOTES :

1. CONCRETE BARRIER (TYPE 836)
2. CRASH CUSHION, SEE ROADWAY PLANS
3. MIDWEST GUARDRAIL SYSTEM, SEE ROADWAY PLANS
4. Q100 WATER SURFACE ELEVATION = 778.40
5. EXISTING BRIDGE ABUTMENT REMAINS IN PLACE, CUT TOP PORTION TO AVOID NEW BRIDGE GIRDERS
6. PAINT BRIDGE NAME "LACK ROAD BRIDGE"
7. PAINT BRIDGE NUMBER "58C-0101"
8. AC PAVEMENT OVER AGGREGATE BASE, SEE "PLAN AND PROFILE" SHEET

NOTES :

ANY UTILITIES LOCATED BY THE CONTRACTOR NOT SHOWN ON THESE PLANS SHALL BE PROTECTED IN PLACE OR REPLACED IN KIND IF DAMAGED BY THE CONTRACTOR.

GRAPHIC SCALE
0' 10' 20' 30' 40' 60' 80'
SCALE 1"= 20'

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
DANIEL SUN, P.E. 40064 R.C.E. No.
NV5 9/6/19 DATE 12/30/19 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E. 62028 R.C.E. No.
ROAD COMMISSIONER DATE 9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

DATE 9/4/2019
DRAWN SRO
SCALE AS SHOWN
CHECKED CDS

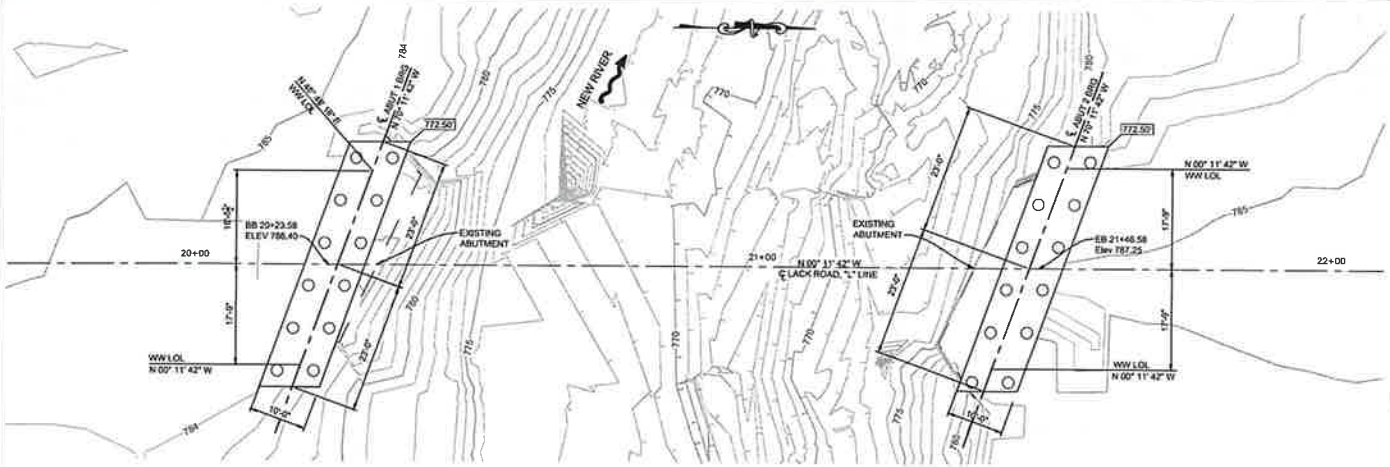
LACK ROAD BRIDGE REPLACEMENT OVER NEW RIVER BRIDGE NO. 58C-XXXX

GENERAL PLAN

REFERENCE S-01

SHEET 5 OF 18

N:\18-000034.39\Cadd\Civil\01-Lack_Road_GP.dwg, Sep-06-2019 10:19



PLAN

SCALE: 1"=10'-0"

GENERAL NOTES
LOAD AND RESISTANCE FACTOR DESIGN

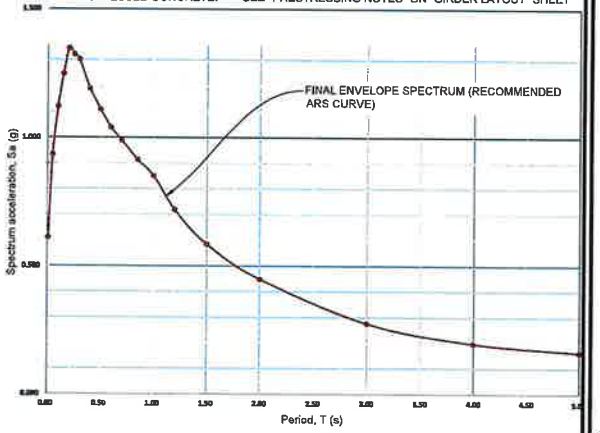
DESIGN:	AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 6TH EDITION AND THE CALTRANS AMENDMENTS, PREFACE DATED MARCH 10, 2015
SEISMIC DESIGN:	CALTRANS SEISMIC DESIGN CRITERIA (SDC), VERSION 2.0 DATED APRIL 2019
DEAD LOAD:	INCLUDES 35 PSF FOR FUTURE WEARING SURFACE.
LIVE LOAD:	HL93 AND PERMIT DESIGN LOAD

SEISMIC LOAD:

SOIL PROFILE: (VS30 = 985 ft/sec)
MAXIMUM MAGNITUDE: 7.7
PEAK GROUND ACCELERATION: 0.59g

REINFORCED CONCRETE: fy = 60 ksi
f'c = 4.0 ksi
n = 8

PRESTRESSED CONCRETE: SEE "PRESTRESSING NOTES" ON "GIRDER LAYOUT" SHEET



ARS CURVE

SITE SPECIFIC ACCELERATION RESPONSE SPECTRA CURVE

LEGEND:

- INDICATES EXISTING ABUTMENT
- INDICATES NEW BRIDGE
- INDICATES DIRECTION OF FLOW
- INDICATES BOTTOM OF FOOTING ELEVATION
- INDICATES CAST-IN DRILLED HOLE CONCRETE PILE

NOTES:

FOR SURVEY CONTROL AND BENCHMARK, SEE "STRIPING PLAN" SHEET PD-1.

HYDROLOGIC SUMMARY			
	DESIGN FLOOD	BASE FLOOD	OVER TOPPING FLOOD
FREQUENCY (YEARS)	100 YEAR	100 YEAR	>>> 500 YEAR
DISCHARGE (CUBIC FEET/SEC)	1550	1550	X
WATER SURFACE (ELEVATION AT BRIDGE)	778.7 ft	778.7 ft	X

* FEMA Q100 = 1200 CFS, WATER SURFACE ELEVATION = 777.9 FT
* IID MEASURED Q = 1550CFS MEASURED AT DOWNSTREAM STATION 5000FT FROM BRIDGE ON AUGUST 2ND, 2012

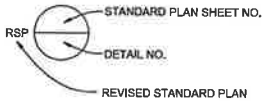
SCOUR DATA TABLE		
SUPPORT NO.	LONG TERM (DEGRADATION AND CONTRACTION) SCOUR ELEVATION (FT)	SHORT TERM (LOCAL) SCOUR DEPTH (FT)
ABUT 1	0.0	2.0
ABUT 4	0.0	2.0

PILE DATA TABLE					
LOCATION	PILE TYPE	NOMINAL RESISTANCE (KIPS)		DESIGN TIP ELEVATION (FT)	SPECIFIED TIP ELEVATION (FT)
		COMPRESSION	TENSION		
ABUT 1	CLASS 200 24" CIDH	400	0	681.5 (A), 713.5 (B), 686.5 (C)	681.5'
ABUT 2	CLASS 200 24" CIDH	400	0	681.5 (A), 728.0 (B), 688.0 (C)	681.5'

PILE DATA NOTES:
1. DESIGN TIP ELEVATIONS ARE CONTROLLED BY: (A) COMPRESSION, (B) LATERAL LOAD, (C) SETTLEMENT.
2. THE SPECIFIED TIP ELEVATION SHALL NOT BE RAISED ABOVE THE DESIGN TIP ELEVATIONS FOR TENSION, LATERAL, AND TOLERABLE SETTLEMENT.
3. THE NOMINAL DRIVING RESISTANCE REQUIRED IS EQUAL TO THE NOMINAL RESISTANCE NEEDED TO SUPPORT FACTORED LOAD PLUS DRIVING RESISTANCE FROM THE LIQUEFIABLE SOIL LAYER WHICH DOES NOT CONTRIBUTE TO THE DESIGN RESISTANCE.

CALTRANS STANDARD PLANS DATED APRIL 2018

	A3A	ABBREVIATIONS (SHEET 1 OF 3)
	A3B	ABBREVIATIONS (SHEET 2 OF 3)
	A3C	ABBREVIATIONS (SHEET 3 OF 3)
	A10A	LEGEND - LINES AND SYMBOLS (SHEET 1 OF 5)
	A10B	LEGEND - LINES AND SYMBOLS (SHEET 2 OF 5)
	A10C	LEGEND - LINES AND SYMBOLS (SHEET 3 OF 5)
	A10D	LEGEND - LINES AND SYMBOLS (SHEET 4 OF 5)
	A10E	LEGEND - LINES AND SYMBOLS (SHEET 5 OF 5)
	A62C	LIMITS OF PAYMENT FOR EXCAVATION AND BACKFILL BRIDGE
RSP	B0-1	BRIDGE DETAILS
	B0-3	BRIDGE DETAILS
	B0-5	BRIDGE DETAILS
	B0-13	BRIDGE DETAILS
	B2-3	24" CAST IN DRILLED HOLE CONCRETE PILE
	B6-21	JOINT SEALS (MAXIMUM MOVEMENT RATING = 2")
	B8-5	CAST-IN-PLACE POST TENSIONED GIRDER DETAILS
RSP	B11-79	CONCRETE BARRIER TYPE 836 DETAIL No 1
RSP	B11-80	CONCRETE BARRIER TYPE 836 DETAIL No 2



REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
DANIEL SUN, P.E. NV5 — 40064 R.C.E. No. — 9/6/19 DATE — 12/30/19 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E. ROAD COMMISSIONER — 62028 R.C.E. No. — DATE — 9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

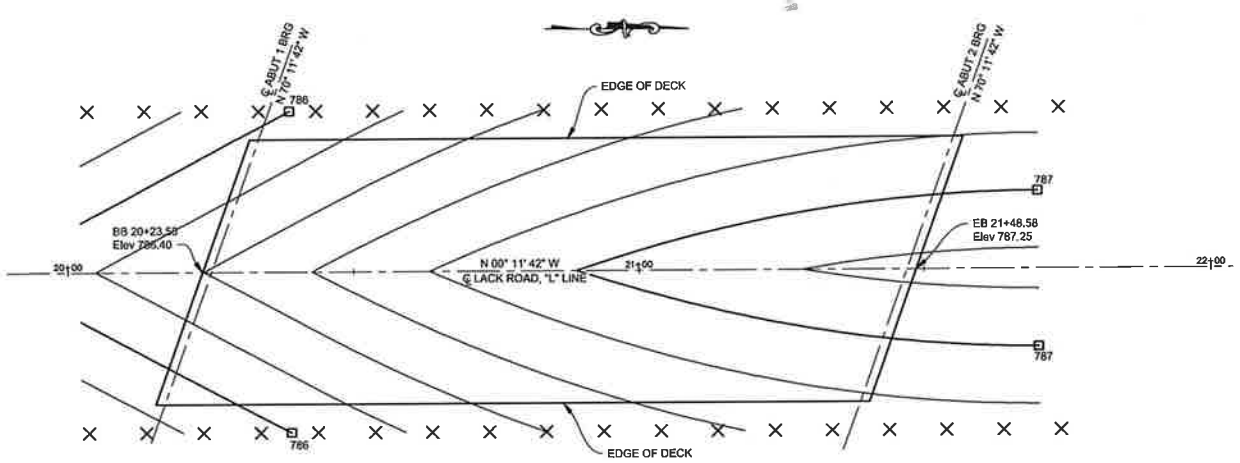
DATE 9/4/2019 | DRAWN SJD | SCALE AS SHOWN | CHECKED CDS

LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

FOUNDATION PLAN

REFERENCE S-02

SHEET 6 OF 18

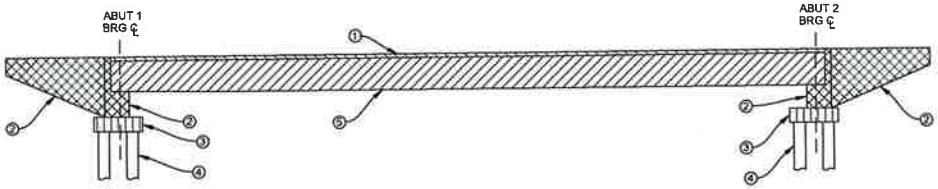


DECK CONTOURS

SCALE: 1"=10'

NOTES

1. CONTOUR INTERVALS = 0.20 FT.
2. CONTOURS DO NOT INCLUDE CAMBER
3. □ - INDICATES EVEN FOOT CONTOUR
4. × - INDICATES 10FT INTERVALS



① STRUCTURAL CONCRETE, BRIDGE (F'C = 4,500 PSI AT 28 DAYS)
② STRUCTURAL CONCRETE, BRIDGE (F'C = 4,000 PSI AT 28 DAYS)
③ STRUCTURAL CONCRETE, BRIDGE FOOTING (F'C = 4,000 PSI AT 28 DAYS)
④ STRUCTURAL CONCRETE, BRIDGE PILE (F'C = 4,000 PSI AT 28 DAYS)
⑤ STRUCTURAL CONCRETE, BRIDGE GIRDER (F'C = 6,500 PSI AT 28 DAYS)

CONCRETE TYPE LIMITS

SCALE: NTS

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PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

DATE 9/6/2019
DRAWN SRD
SCALE AS SHOWN
CHECKED CDS

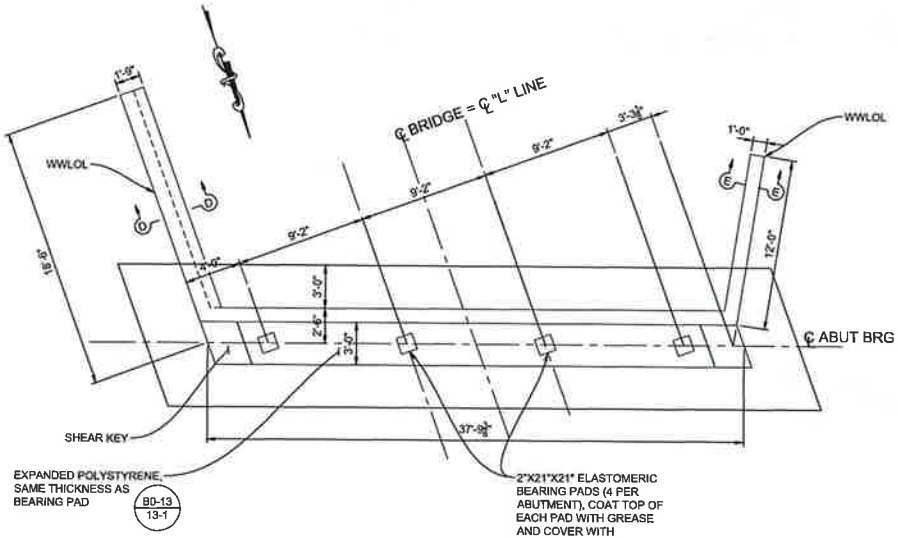
LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

DECK CONTOURS

REFERENCE S-03

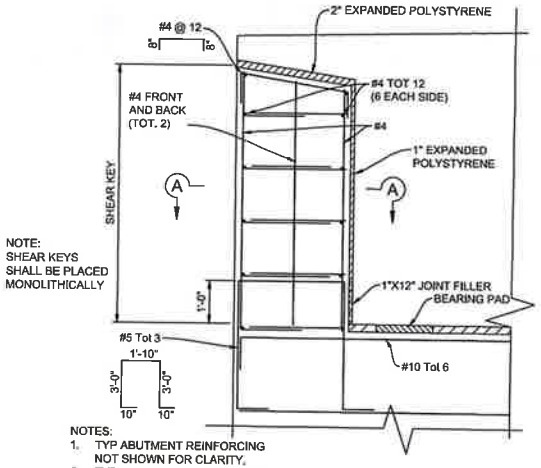
SHEET 7 OF 18

N:\18-0000439\Cadd\Civil\03-Lack_Deck_Contours.dwg Sep-06-2019 10:19



ABUTMENT 1 PLAN

SCALE: ¼" = 1'-0"

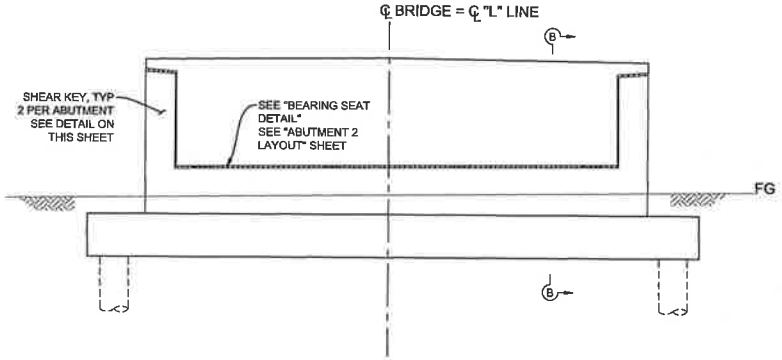


NOTE:
SHEAR KEYS SHALL BE PLACED MONOLITHICALLY

NOTES:
1. TYP ABUTMENT REINFORCING NOT SHOWN FOR CLARITY.
2. TYP ABUTMENT REINFORCING SHALL NOT EXTEND INTO SHEAR KEY.

TYPICAL SHEAR KEY

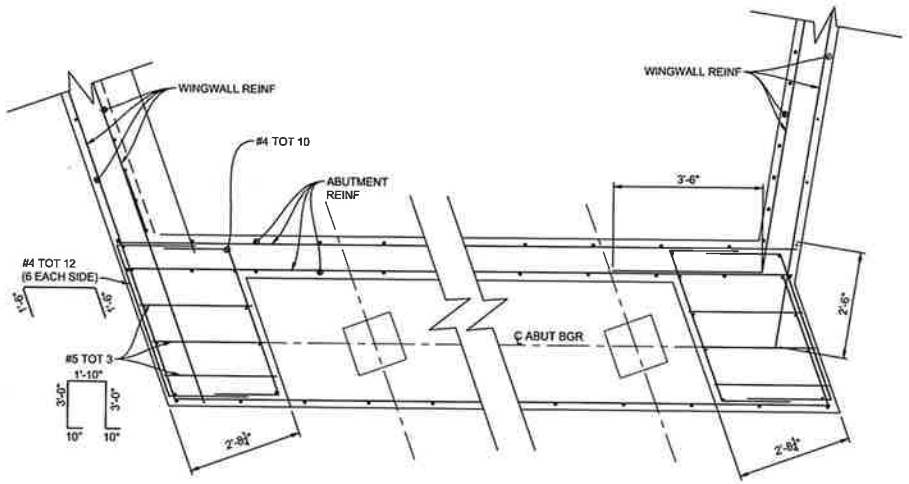
SCALE: ¾" = 1'-0"



ABUTMENT 1 ELEVATION

SCALE: ¼" = 1'-0"

NOTE:
FOR SECTION B-B, D-D AND E-E SEE "ABUTMENT DETAILS -1" SHEET



SECTION A-A

SCALE: ¾" = 1'-0"

REVISION	DATE	COMMENTS

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PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

DATE 9/4/2019
DRAWN SRD
SCALE AS SHOWN
CHECKED CDS

LACK ROAD BRIDGE REPLACEMENT OVER NEW RIVER
BRIDGE NO. 58C-XXXX

ABUTMENT 1 LAYOUT

REFERENCE S-04

SHEET 8 OF 18

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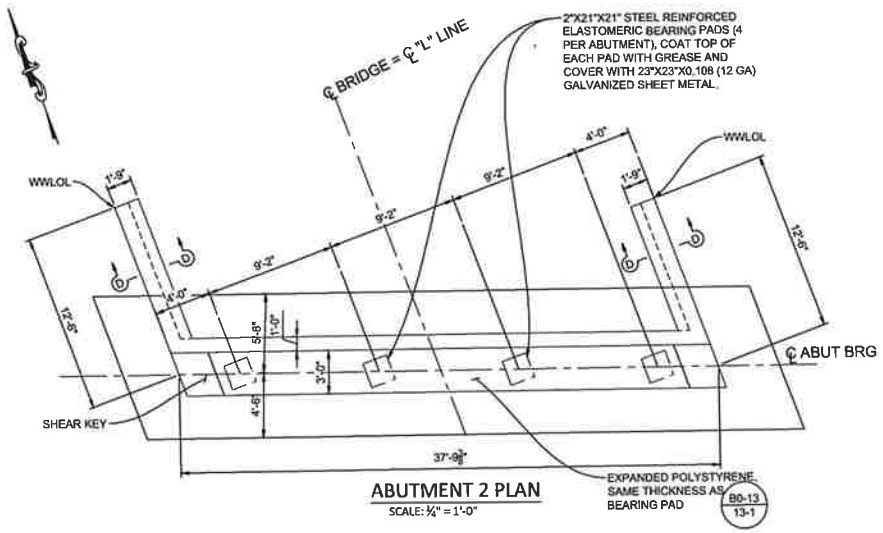
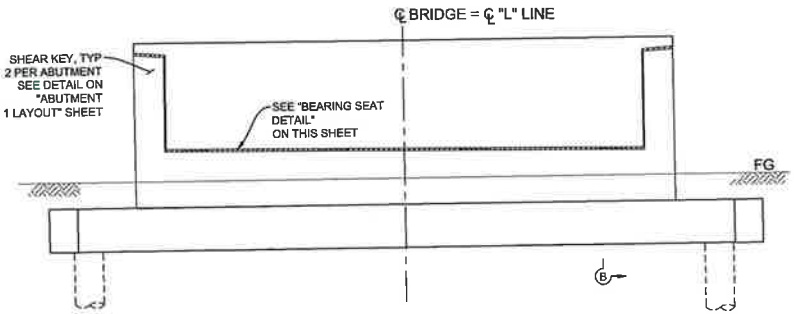


ABUTMENT 2 PLAN

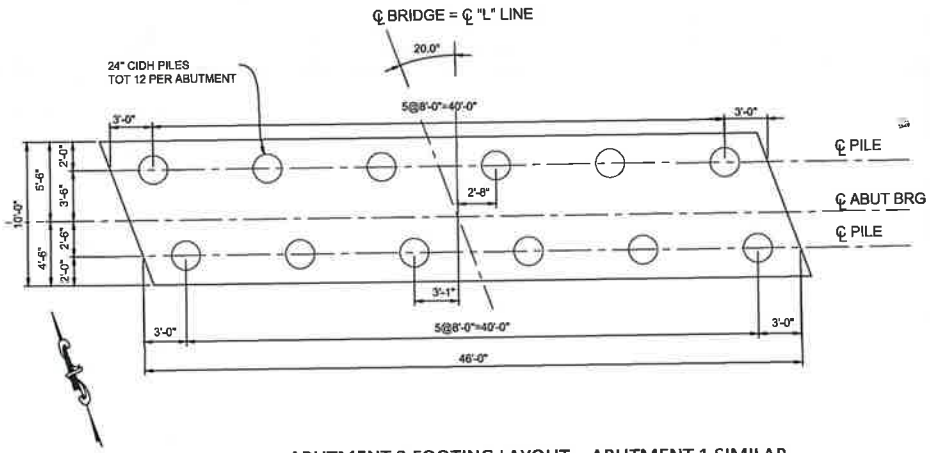
SCALE: ¼" = 1'-0"



ABUTMENT 2 ELEVATION

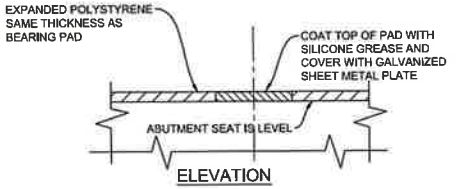
SCALE: ¼" = 1'-0"

NOTE:
FOR SECTION B-B AND D-D, SEE "ABUTMENT DETAILS -1" SHEET

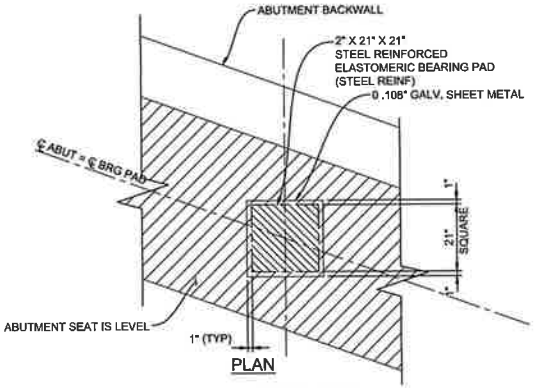


ABUTMENT 2 FOOTING LAYOUT - ABUTMENT 1 SIMILAR

SCALE: ¼" = 1'-0"



ELEVATION



PLAN

BEARING SEAT DETAIL

SCALE: 1" = 1'-0"

REVISION	DATE	COMMENTS

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DANIEL SUN, P.E.
NV5
40084 R.C.E. No.
9/6/19 DATE
12/30/19 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E.
ROAD COMMISSIONER
62028 R.C.E. No.
DATE
9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

DATE 9/4/2019
DESIGNED SHD
SCALE AS SHOWN
CHECKED CDS

LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

ABUTMENT 2 LAYOUT

REFERENCE S-05

SHEET 9 OF 18

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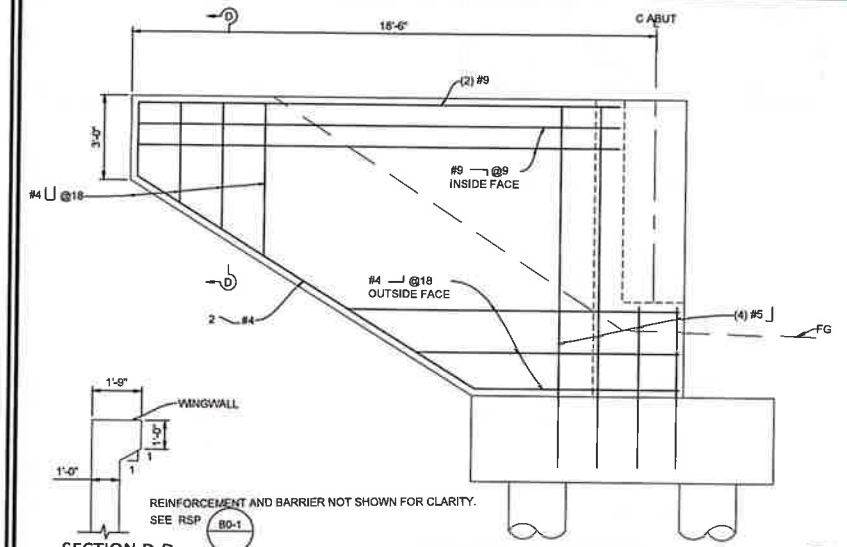
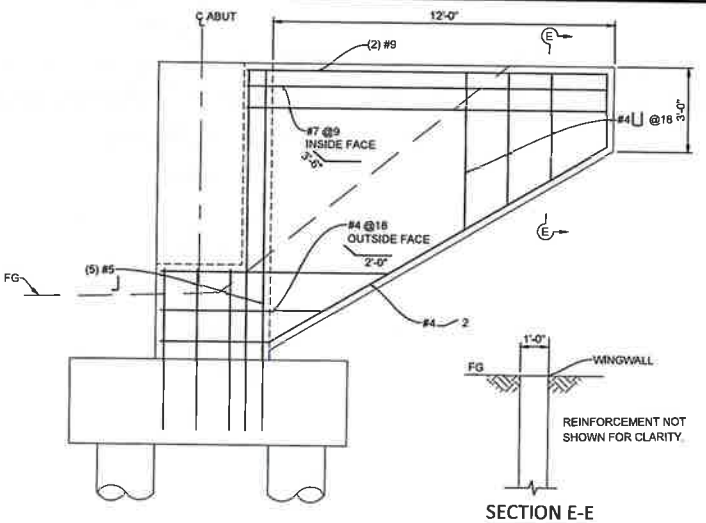


REINFORCEMENT AND BARRIER NOT SHOWN FOR CLARITY.
SEE RSP B0-1

SECTION D-D
SCALE: ½" = 1'-0"

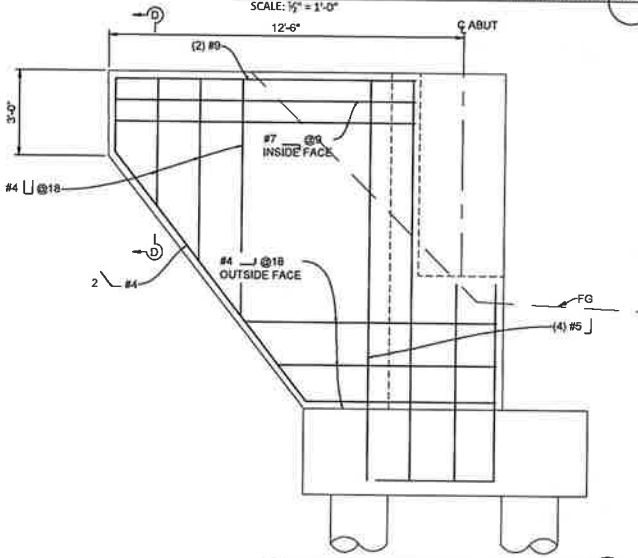
ABUTMENT 1 EAST WINGWALL ELEVATION B0-1
SCALE: ½" = 1'-0"



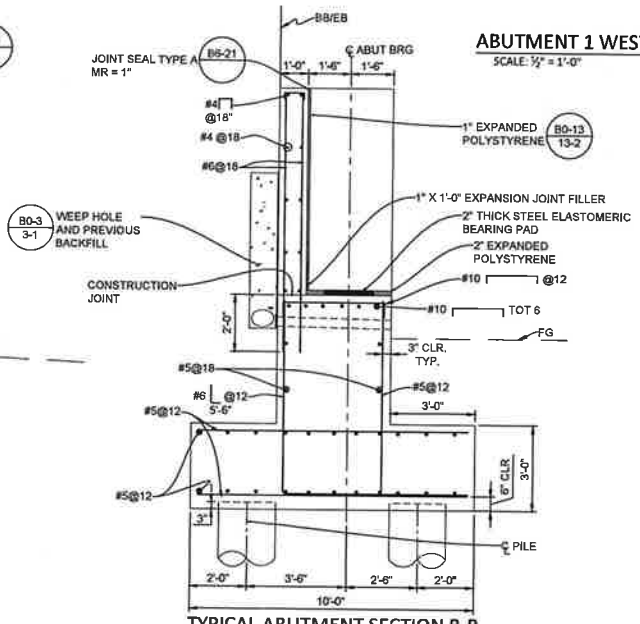
REINFORCEMENT NOT SHOWN FOR CLARITY.

SECTION E-E
SCALE: ½" = 1'-0"

ABUTMENT 1 WEST WINGWALL ELEVATION B0-1
SCALE: ½" = 1'-0"



ABUTMENT 2 WINGWALL ELEVATION B0-1
SCALE: ½" = 1'-0"



TYPICAL ABUTMENT SECTION B-B
SCALE: ½" = 1'-0"

NOTES:
1. ABUTMENT BACKWALL TO BE PLACED AFTER DECK CONSTRUCTION.
2. GIRDER TO BE FABRICATED FOR LEVEL BEARING

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
DANIEL SUN, P.E. NV5 — 40084 R.C.E. No. — 9/6/19 DATE — 12/30/19 REG. EXP.

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PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

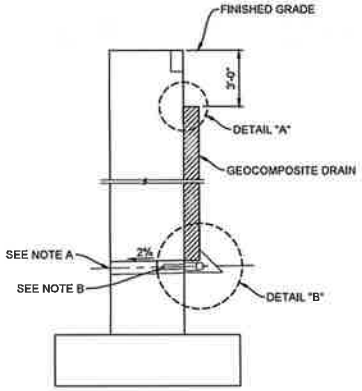
DATE 9/4/2019 | DRAWN SRD | SCALE AS SHOWN | CHECKED CDS

LACK ROAD BRIDGE REPLACEMENT OVER NEW RIVER BRIDGE NO. 58C-XXXX

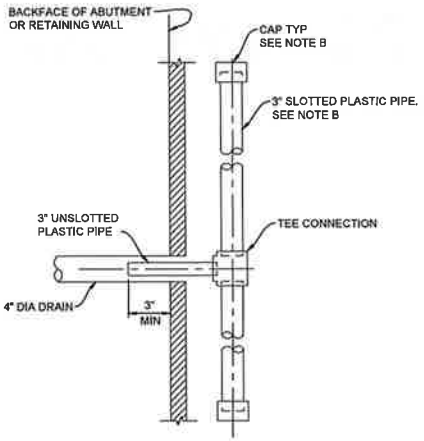
ABUTMENT DETAILS-1

REFERENCE S-06

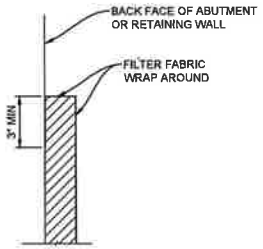
SHEET 10 OF 18



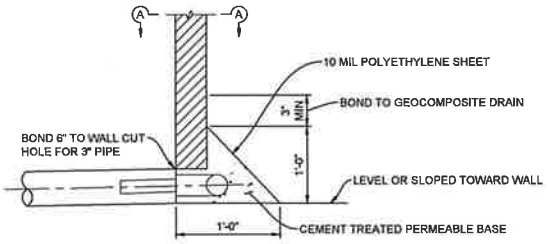
WALL SECTION
SCALE: NTS



SECTION A-A
SCALE: NTS



DETAIL A
SCALE: NTS



DETAIL B
SCALE: NTS

WEEP HOLE AND GEOCOMPOSITE DRAIN

ALTERNATIVE TO BRIDGE DETAIL B0-3 3-1

NOTES:

A. 4" DIA DRAINS AT INTERMEDIATE SAG POINTS AND AT 25' MAX. CENTER TO CENTER. EXPOSED WALL DRAINS SHALL BE LOCATED 4" ± ABOVE FINISHED GRADE.

B. GEOCOMPOSITE DRAIN, CEMENT TREATED PERMEABLE BASE, AND 3" DIA SLOTTED PLASTIC PIPE CONTINUOUS BEHIND RETAINING WALLS AND ABUTMENTS. CAP ENDS OF PIPE. PROVIDE "TEE" CONNECTION AT EACH 4" DIA DRAIN.

C. CONNECT THE LOW END OF PLASTIC PIPE TO THE MAIN OUTLET PIPE AS APPLICABLE.

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
DANIEL SUN, P.E. NVS — 40054 R.C.E. No. — 9/6/19 DATE — 12/30/19 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT APPROVED FOR CONSTRUCTION BY:
JOHN A. CAY, P.E. ROAD COMMISSIONER — 62028 R.C.E. No. — DATE — 9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

DATE 5/4/2019 | DRAWN SRD | SCALE AS SHOWN | CHECKED CDS

LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

ABUTMENT DETAILS-2

REFERENCE S-07

SHEET 11 OF 18

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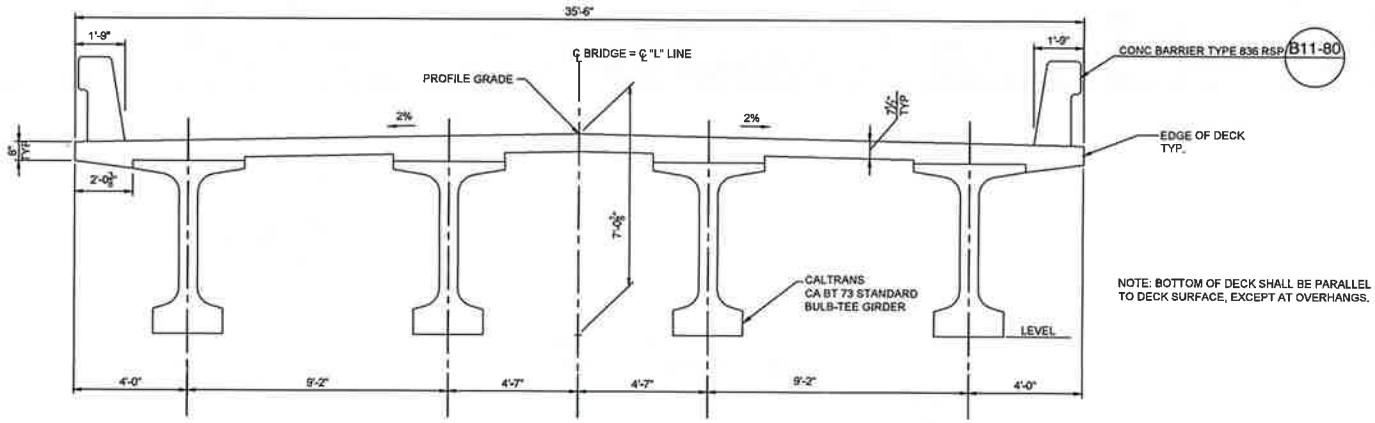
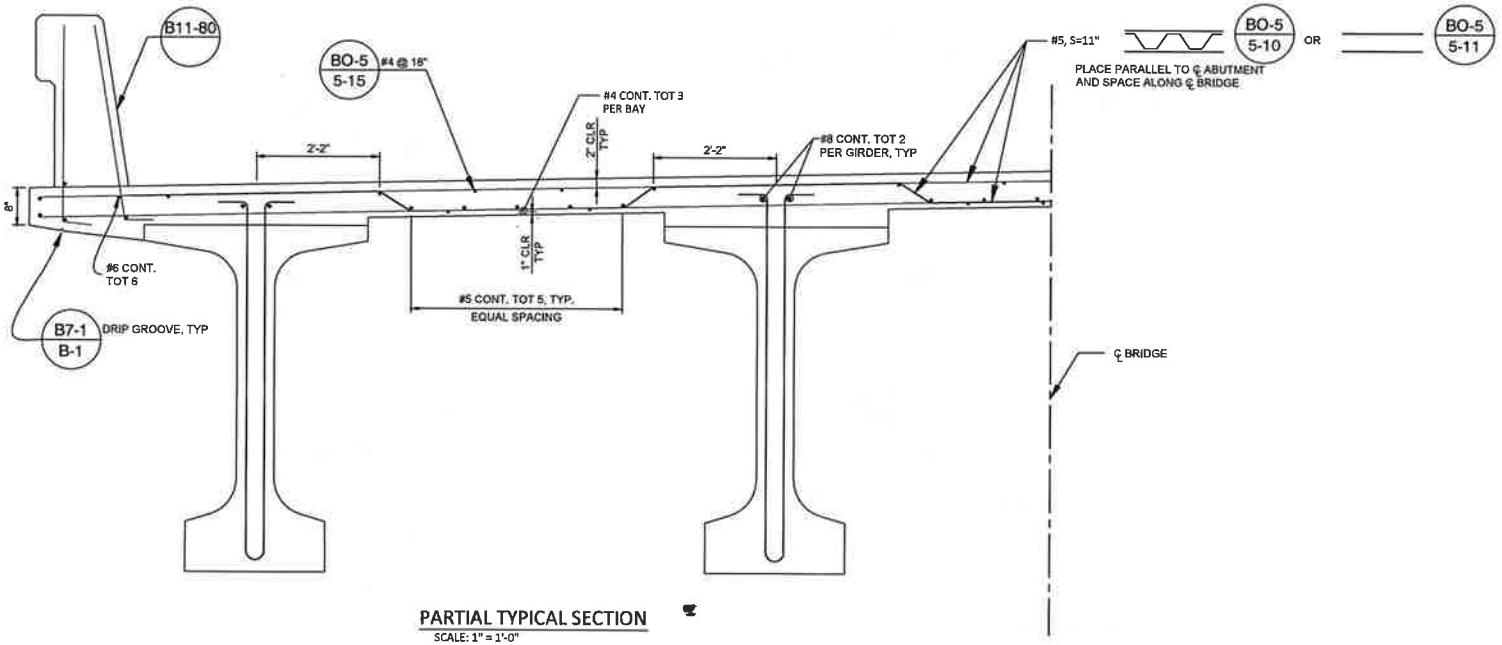


NOTE: BOTTOM OF DECK SHALL BE PARALLEL TO DECK SURFACE, EXCEPT AT OVERHANGS.

TYPICAL SECTION

SCALE: ½" = 1'-0"



PARTIAL TYPICAL SECTION

SCALE: 1" = 1'-0"

REVISION	DATE	COMMENTS

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ROAD COMMISSIONER — 63028 R.C.E. No. — DATE — 9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

DATE 9/4/2019
DRAWN SRD
SCALE AS SHOWN
CHECKED CDS

LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

TYPICAL SECTION

REFERENCE S-08

SHEET 12 OF 18

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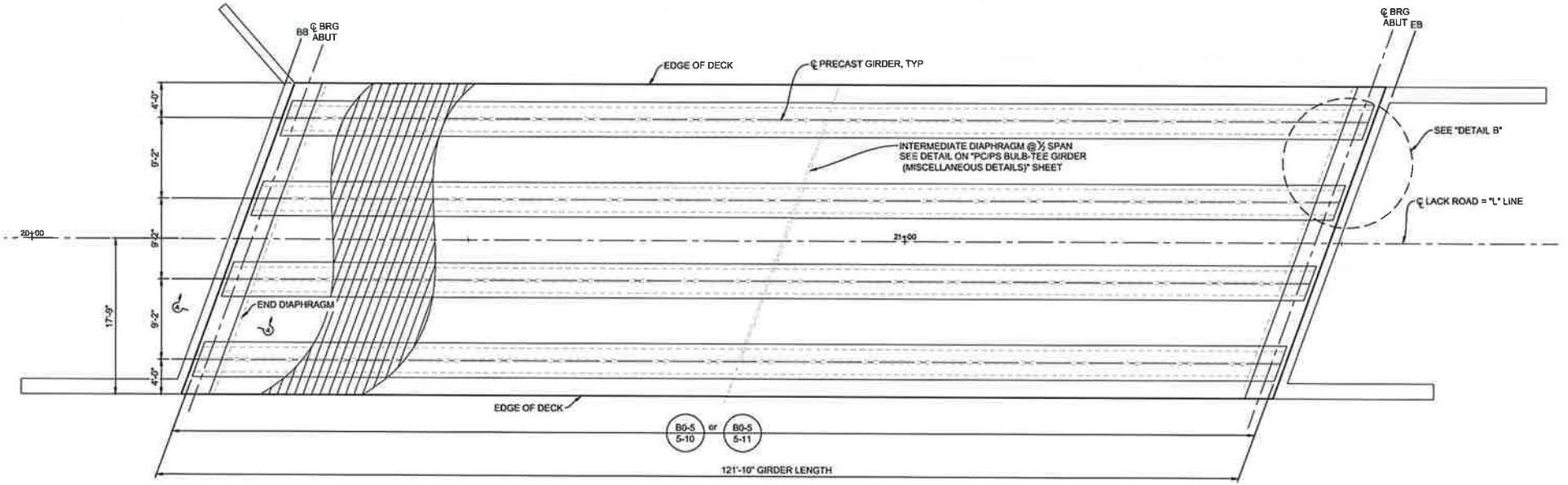
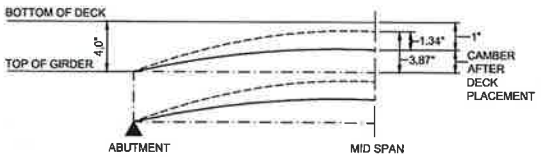


PLAN

SCALE: 3/16" = 1'-0"

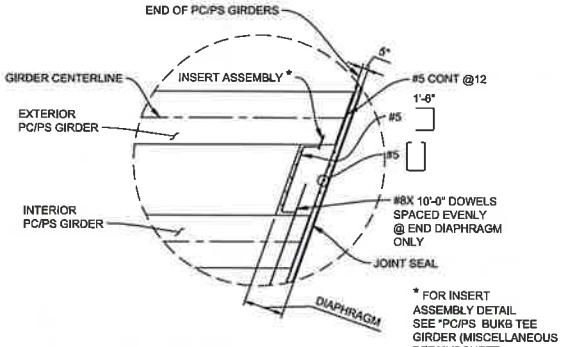


LEGEND:

- UN-DEFORMED SHAPE
- DEFORMED SHAPE (BEFORE DECK PLACEMENT)
- DEFORMED SHAPE (AFTER DECK PLACEMENT)

GIRDER HAUNCH THICKNESS

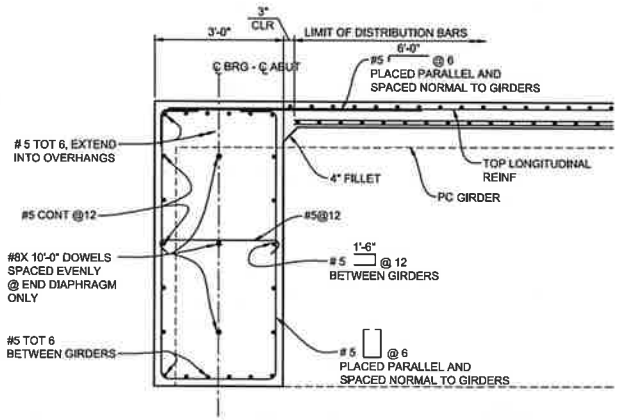
SCALE: NTS



* FOR INSERT ASSEMBLY DETAIL SEE "PC/PS BUKB TEE GIRDER (MISCELLANEOUS DETAIL)" SHEET

DETAIL B

SCALE: ¼" = 1'-0"



SECTION A-A

NOT TO SCALE

REVISION	DATE	COMMENTS

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DANIEL SUN, P.E. NV5 — 40064 R.C.E. No. — 9/6/19 DATE — 12/30/19 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E. ROAD COMMISSIONER — 62028 R.C.E. No. — DATE — 9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

DATE 9/4/2019
DRAWN SRD
SCALE AS SHOWN
CHECKED CDS

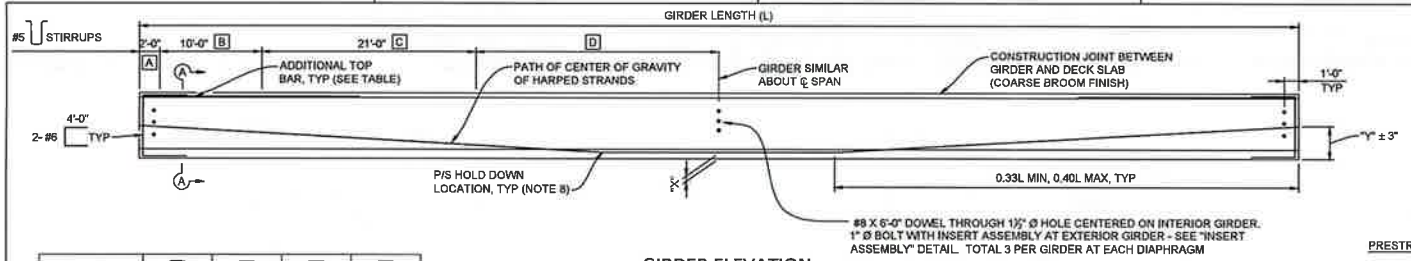
LACK ROAD BRIDGE REPLACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

GIRDER LAYOUT

REFERENCE S-09

SHEET 13 OF 18

N:\18-00004.39\Cadd\Civil\09-Lack_Road_Girder_Layout.dwg Sep-05-2019 10:20

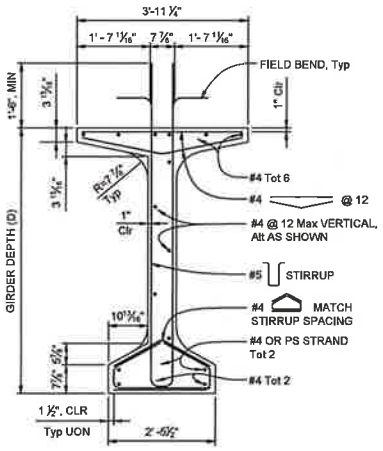


LOCATION	A	B	C	D
GIRDER ALL	#5 @ 3"	#5 @ 6"	#5 @ 12"	#5 @ 18"

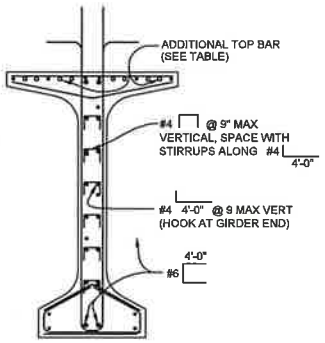
GIRDER ELEVATION

NOTE:
GIRDER ENDS TO BE CAST SUCH THAT A LEVEL SURFACE IS PROVIDED AT BEARING PADS

LOCATION	GIRDER LENGTH (L)	GIRDER DEPTH (D)	"X" (in)	JACKING FORCE (P) (kips)	As, Min (in^2)	"Y" (in)	CONCRETE STRENGTH (ksi) f'ci	CONCRETE STRENGTH (ksi) f'c	MIDSPAN DEAD LOAD DEFLECTION (in) DECK	MIDSPAN DEAD LOAD DEFLECTION (in) RAIL	ADDITIONAL TOP BAR (EACH END)
ALL	121'-10"	6'-0 7/8"	4	1640	9.24	35	6.0	6.5	2.77	0.50	8 # 4 x 15' Tot 8
			6	1690	9.78						

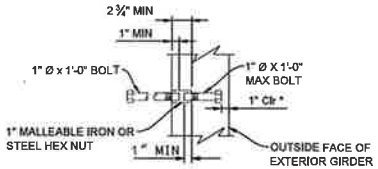


TYPICAL GIRDER SECTION



NOTE:
FOR DETAILS NOT SHOWN, SEE "TYPICAL GIRDER SECTION"

SECTION A-A

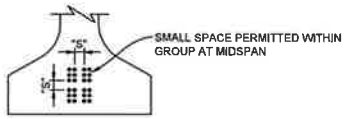


* DIMENSION MAY BE INCREASED WHEN INSERT ASSEMBLY IS USED AT END BLOCK

INSERT ASSEMBLY

PRESTRESSING NOTES:

1. THE JACKING FORCE (P) IS THE JACKING FORCE REQUIRED AT THE POINT OF CONTROL ALONG THE SPAN. THE JACKING FORCE DOES NOT INCLUDE ANY FABRICATION SPECIFIC LOSSES
2. THE MAXIMUM TENSILE STRESS IN THE PRESTRESSING STEEL UPON RELEASE SHALL NOT EXCEED 75% OF THESPECIFIED MINIMUM ULTIMATE TENSILE STRENGTH OF THE PRESTRESSING STEEL
3. THE MAXIMUM TEMPORARY TENSILE STRESS (JACKING STRESS) IN THE PRESTRESSING STEEL SHALL NOT EXCEED 80% OF THE SPECIFIED MINIMUM ULTIMATE TENSILE STRENGTH OF THE PRESTRESSING STEEL
4. CONCRETE STRENGTH:
   F'CI IS AT TIME OF INITIAL STRESSING
   F'C IS AT 28 DAYS
5. DEFLECTION COMPONENTS ARE INFORMATIONAL AND WILL BE USED TO SET SCREED LINE ELEVATIONS
6. SCREED LINE ELEVATIONS FOR DECK CONCRETE WILL BE DETERMINED BY THE ENGINEER
7. CONTRACTOR MAY INTERPOLATE "P" AND "X" VALUES BETWEEN THE LIMITS SHOWN, AS APPROVED BY THE ENGINEER
8. THERE SHALL BE A MINIMUM OF TWO HOLD DOWNS PER GIRDER FOR THE PRESTRESSING
9. PRESTRESSING STRAND SHALL BE 270 KSI LOW RELAXATION
10. AS, MIN IS THE MINIMUM AREA REQUIRED OF PRESTRESSING STEEL



CLEARANCES FOR PRETENSIONED STRANDS

NOTES:

1. Strands may be bundled in groups consisting of 3 vertically, 2 horizontally, and separated at the ends
2. The minimum distance "S" between groups or individual strands is 1-3/4" for 1/2" Ø strands and 2" for 0.6" Ø strands
3. "S" is measured between centers of adjacent strands
4. Approval by Engineer is required for deviation

NOTE:
For "WELDED WIRE REINFORCEMENT (WWR) ALTERNATIVE", see "PC/PS BULB-TEE GIRDER (MISCELLANEOUS DETAILS)" sheet

S-10

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	IMP	N/A		10	18

C. DANIEL SUN — REGISTERED CIVIL ENGINEER — 9/6/19 DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

STANDARD DRAWING
FILE no. xs8-010
APPROVAL DATE July 2014

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES

BRIDGE NO. 58C-XXXX
POST MILE X

LACK ROAD BRIDGE REPLACEMENT OVER NEW RIVER

PC/PS BULB-TEE GIRDER (HARPED STRANDS)

DS 050 214TA (ENGLISH STANDARD DRAWING "XS" BORDER REV. (02-03-11))

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: X
PROJECT NUMBER & PHASE: X
CONTRACT NO.: X

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — SHEET 10 OF 18

FILE => $REQUEST

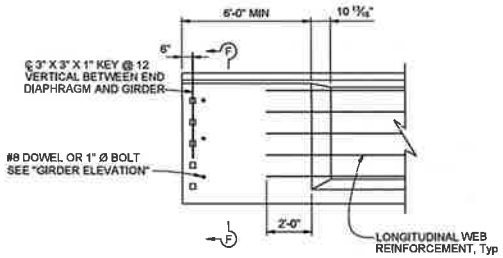
September 6, 2019 Jarod Egley

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	IMP	N/A		10	18

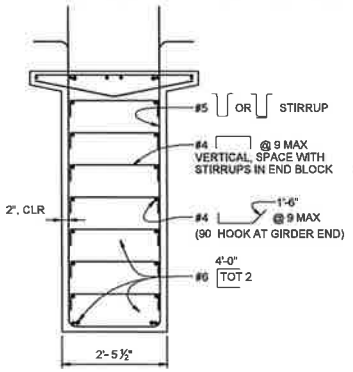
C. DANIEL SUN
REGISTERED CIVIL ENGINEER — DATE 9/6/19

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

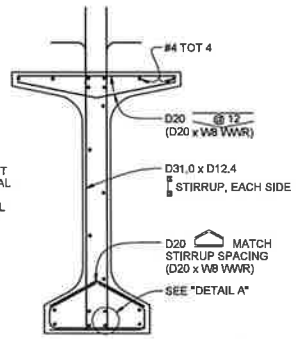


OPTIONAL END BLOCK - ELEVATION
SCALE: NTS



NOTE:
FOR DETAILS NOT SHOWN, SEE "TYPICAL GIRDER SECTION" DETAIL

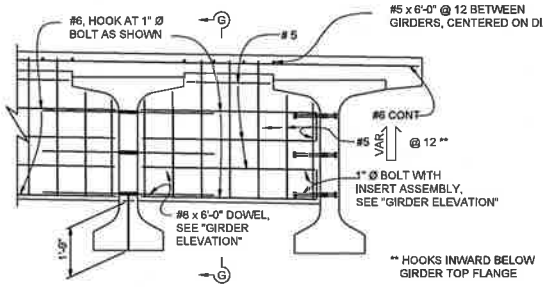
SECTION F-F
SCALE: NTS



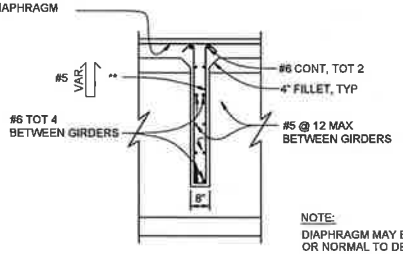
NOTE:
1. FOR DETAILS SHOWN BUT NOT NOTED, SEE "TYPICAL
2. GIRDER SECTION" DETAIL W8 WWR NOT SHOWN

WELDED WIRE REINFORCEMENT (WWR) ALTERNATIVE
SCALE: NTS

NOTE:
FOR "GIRDER ELEVATION" AND "TYPICAL GIRDER SECTION", SEE "PC/PS BULB-TEE GIRDER (DEBONDED STRANDS)" SHEET

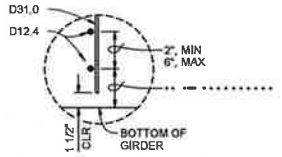


INTERMEDIATE DIAPHRAGM
SCALE: NTS



NOTE:
DIAPHRAGM MAY BE VERTICAL OR NORMAL TO DECK GRADE

SECTION G-G
SCALE: NTS



DETAIL A
SCALE: NTS

NOTE:
1. BOTTOM OF STIRRUP WWR DETAIL SHOWN, TOP SIMILAR
2. LONGITUDINAL WIRE AREA SHALL BE 40% OR GREATER OF VERTICA DEFORMED WIRE'S AREA

5-11

STANDARD DRAWING		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES	BRIDGE NO. 58C-XXXX	LACK ROAD BRIDGE REPLACEMENT OVER NEW RIVER
FILE NO. xs6-010	APPROVAL DATE July 2014			POST MILE X	PC/PS BULB-TEE GIRDER (MISCELLANEOUS DETAILS)

DS OSD 2147A (ENGLISH STANDARD DRAWING "XS" BORDER REV. (02-02-11))

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: X PROJECT NUMBER & PHASE: X CONTRACT NO.: X

FILE => REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES				SHEET	OF
				11	18

September 6, 2019 Jamal Egley

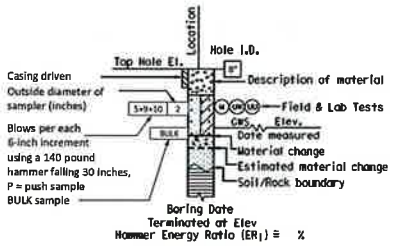
REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

CEMENTATION	
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

BOREHOLE IDENTIFICATION		
Symbol	Hole Type	Description
	A	Auger Boring
	R P	Rotary drilled boring Rotary percussion boring (air)
	R	Rotary drilled diamond core
	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
	O	Other
Note: Size in Inches.		

CONSISTENCY OF COHESIVE SOILS				
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

PLASTICITY OF FINE-GRAINED SOILS	
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



HOLLOW STEM AUGER

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
Chad Borden
2886 G.E. No.
8/30/19 DATE
6/30/21 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E. ROAD COMMISSIONER
62928 R.C.E. No.
DATE
9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

8/30/19
GC
AS SHOWN
CH

LOG OF TEST BORINGS-1
LACK ROAD BRIDGE REPACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

SOIL LEGEND

S-12

SHEET 16 OF 18

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
Carl Hanlin — 2886 G.E. No. — 8/30/19 DATE — 6/30/21 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E. ROAD COMMISSIONER — DATE
52028 R.C.E. No. — 9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

DATE 8/30/19 | DRAWN GC | CHECKED CH | SCALE AS SHOWN

LOG OF TEST BORINGS-2

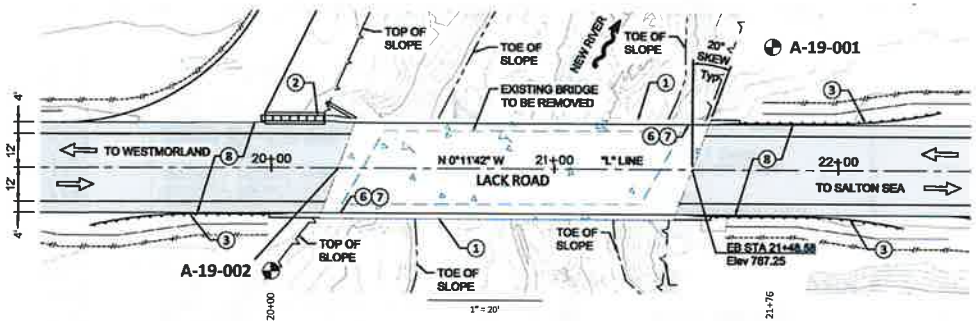
LACK ROAD BRIDGE REPACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

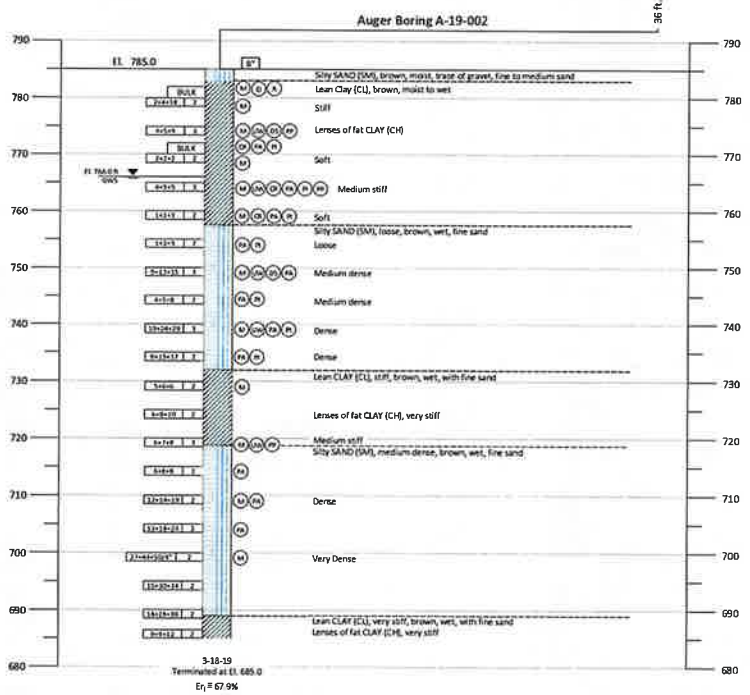
SOIL LEGEND

S-13

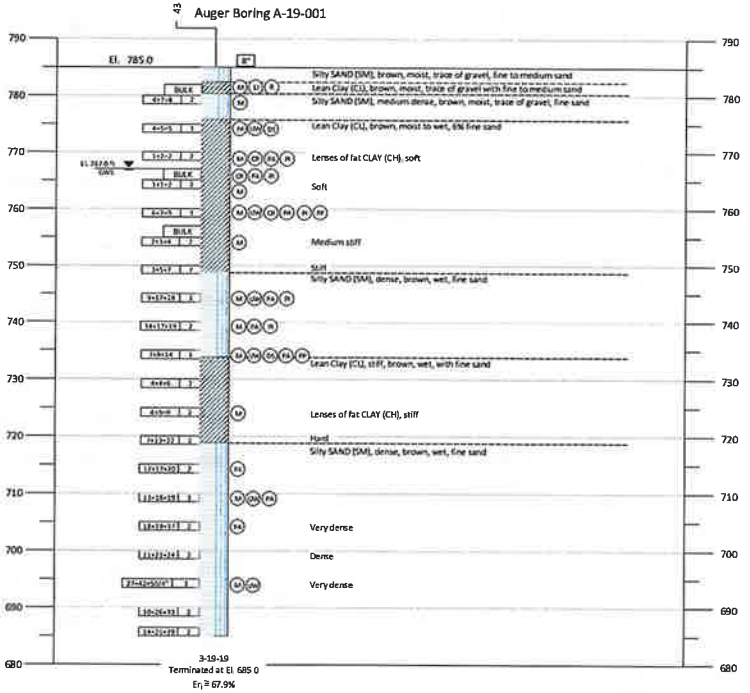
SHEET 17 OF 18

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)





PROFILE
Vertical Scale 1" = 10'



REVISION	DATE	COMMENTS

PREPARED UNDER THE DIRECT SUPERVISION OF:
Carl Henderson
8/30/19 DATE
2886 G.E. No.
6/30/21 REG. EXP.

COUNTY OF IMPERIAL PUBLIC WORKS DEPARTMENT
APPROVED FOR CONSTRUCTION BY:
JOHN A. GAY, P.E.
ROAD COMMISSIONER
DATE
62028 R.C.E. No.
9/30/19 REG. EXP.

PUBLIC WORKS DEPARTMENT
COUNTY OF IMPERIAL
EL CENTRO, CALIFORNIA

8/30/19 | GC | CH

LOG OF TEST BORINGS-3

LACK ROAD BRIDGE REPACEMENT
OVER NEW RIVER
BRIDGE NO. 58C-XXXX

LOG OF TEST BORINGS

S-14

SHT # 18 OF 18

PHOTOGRAPHS

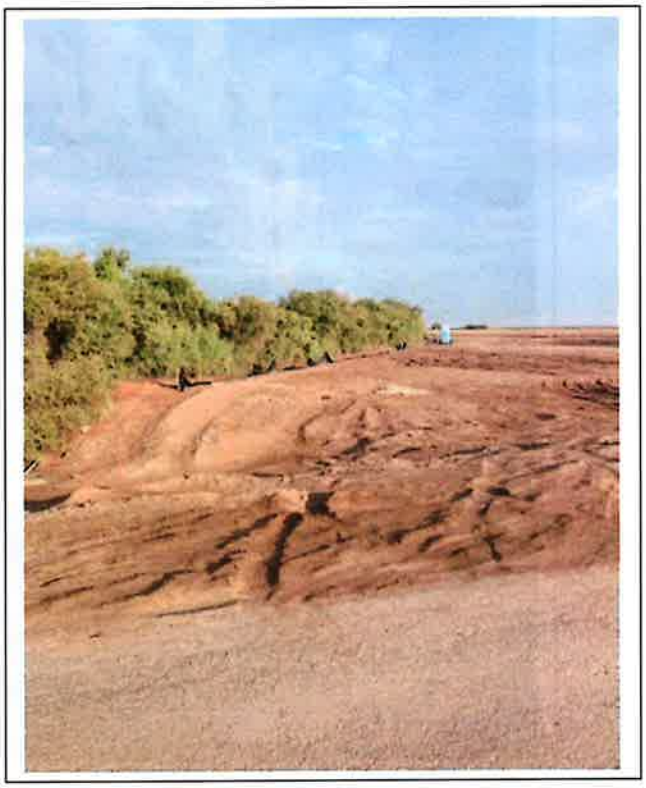
PHOTOGRAPHS

1. New River bridge on Lack Rd. looking north.

2. On Lack Road; west to the left is Sudan grass and to the right and salt cedar to the right.

3. South end of the New River bridge looking south on Lack Rd.

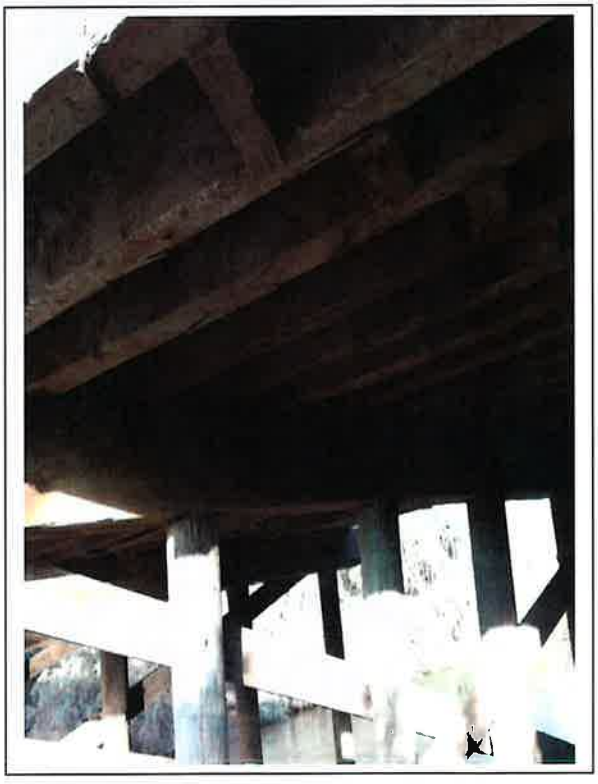
4. On Lack Rd. looking south across the New River Bridge.



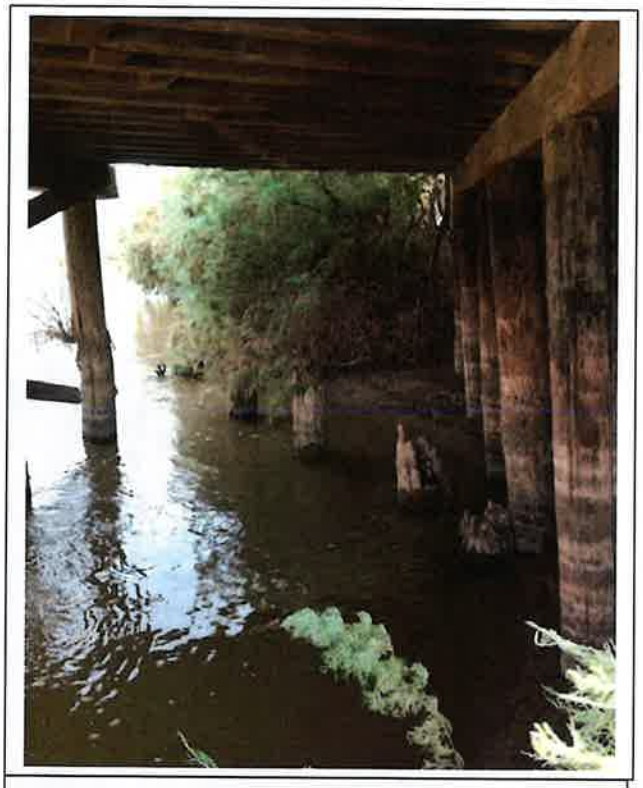
5. On north side of river on Lack Rd. looking west.

6. North side of river on Lack Rd. looking east.

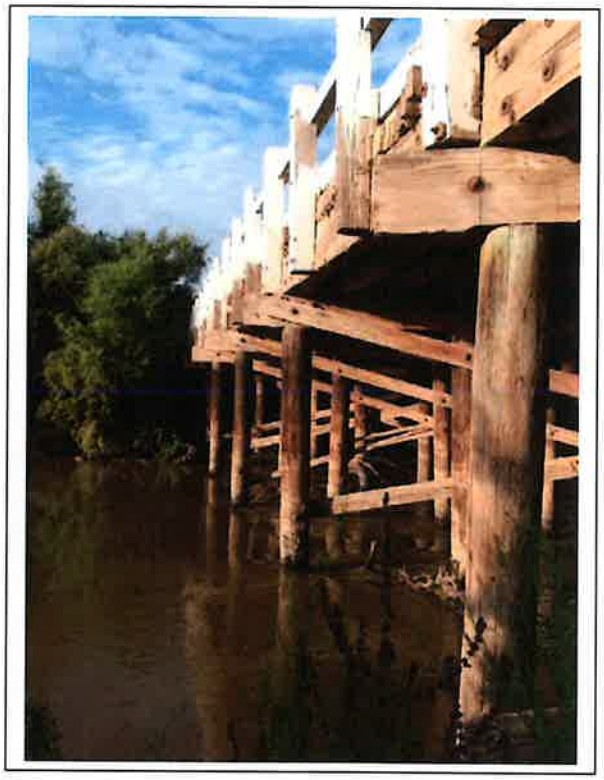
7. Under the bridge on the north bank no nesting birds or bats were observed.



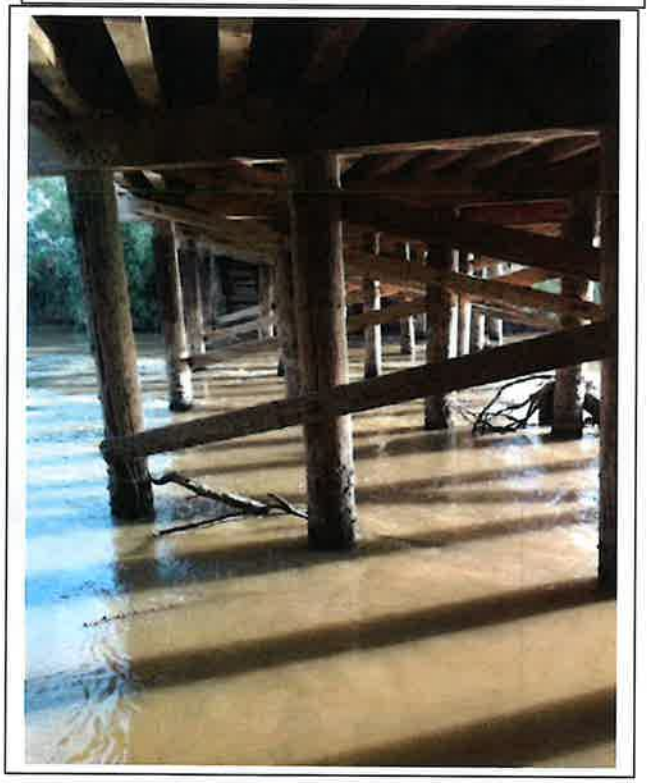
8. From the south Bank of the New River the picture taken is from the midsection of the bridge looking south, no nesting birds or bats were observed.



9. Under the New River Bridge on the east side looking west, no nesting birds or bats were observed.



10. From the north bank east side of New River Bridge looking south.



11. South bank looking at the north bank, no nesting birds or bats were observed.

12. East side of the New River Bridge looking west.

QUALIFICATIONS

MARIE S. BARRETT 2035 Forrester Road, El Centro, CA 92243 (760) 352 4159 mariebarrett@roadrunner.com

LICENSES/CERTIFICATES

Flat Tailed Horn Lizard Surveyor CDFG/BLM
Burrowing Owl Surveyor (CDFG/USFWS)
USFW Desert Tortoise Egg Handling Desert Tortoise Council Survey Techniques Workshop Certificate
BCI Bat Conservation and Management Workshop (Acoustic) Certificate
Southwestern Willow Flycatcher Workshop Kernville, CA 2010
CA Scientific Collection Permit 126/USFWS Salvage Permit MB52633B-1

CAREER HISTORY

Barrett's Biological Surveys, El Centro, California ***BIOLOGIST*** **3/95 -present**

Helped established protocol and perform Vegetative Baseline Studies and Biological Surveys for Mining Reclamation Plans in Imperial County. Have performed numerous (over 20,000 acres) surveys involving varied wildlife including burrowing owl, nesting birds and plant species and writing reports and biological assessments. Certified to perform Flat Tailed Horned Lizard Surveys; completed Desert Tortoise workshops; approved to handle desert tortoise (American Girl Mine/BLM project, 1/2013). Work closely with governmental agencies such as such as Bureau of Land Management, State Office of Mining Reclamation, California Department of Fish and Game. Written over ten Environmental Assessments for BLM, El Centro office. Over 150 days spent in field monitoring/surveying for FTHL; 98 days in field monitoring/surveying for desert tortoise and 32,000 acres surveyed for burrowing owl and nesting birds; 2 IID Burrowing owl surveys with AECOM (2011/12- 226 hrs). Wrote Imperial Irrigation District Artificial Burrow Installation Manual (2009). Over 25 active burrowing owl burrows passively relocated and 50 artificial burrows installed. Volunteered for desert tortoise work (20 hrs) with Dr. Jeff Lovich. Coachella Valley Projects: Torres-Martinez (Desert Cahuilla Composting Facility Biological Resource Technical Report/Surveys 60 acres, SR 86/Ave 84, 2013; Augustine Tribe (Solar Farm Biological Resource Technical Report/Surveys 10 acres, La Quinta,CA, 2010); Benitez Family Trust Therapeutic Community, Dillon and Cabazon Roads, 10 acres,2008); Chandri Group (Dairy Queen Chill/Grill Project, 1.5 acres, Date Palm Drive/I-10, La Quinta, CA, 2014). Blythe 8Minutenergy Mt. Signal Solar 5000 acres Preconstruction surveys/construction monitoring and BUOW Post construction monitoring; Biological report. 2010-2017
Black Mt. MetTower Installation: desert tortoise survey and monitoring approved by BLM, El Centro office
Salton City Burrtec Landfill FTHL monitoring/clearance 2010-2014 (42.5 hrs); Superior Redi Mix: FTHL surveys, Oat Pit Environmental Assessment for BLM, El Centro, 2009-14. (20 hours) SDG&E La Rosite Pole Replacement FTHL Monitoring 2012-2013(410 hrs); Imperial County Department of Public Works, FTHL surveys for Coyote Mine Environmental Assessment, BLM, El Centro, 2008. (10 hours) All American Aggregates, FTHL surveys, Boyd Road Mine Environmental Assessment, BLM El Centro, 2007. (9.5 hours) All American Aggregates, FTHL surveys, Wheeler Road Mine Environmental Assessment, BLM, El Centro, 2006. (8.5 hours); ValRock, FTHL surveys, Ocotillo ByPass Road Environmental Assessment, County of Imperial/BLM, El Centro, 2004. (7 hours). USFWS Authorized desert tortoise biologist: American Girl Mine and Mesquite Mine.

Citizens' Congressional Task Force on the New River, Brawley, Ca ***PROGRAM COORDINATOR*** **1/98 - present**

Assisted with design, construction, planting and monitoring of four constructed wetlands in Imperial County. Responsible for coordinating activities relating to student and public outreach education to promote the water quality opportunities of wetlands ponding systems on the New River.

Imperial Valley College, Imperial, California ***ENVIRONMENTAL MANAGEMENT PROJECT COORDINATOR*** **9/95-12/99**

Responsible for establishing an Environmental Technology curriculum, presenting public forums, short courses and certificate courses in hazardous materials and safety areas. In conjunction with Division Chairman, established a budget for 96-98 program and obtained funding of $131,000 based on 95-96 program performance. Established short courses that trained over 700 people in hazardous materials safety programs. Compiled a survey of employers, which provided direction for the program.

VOLUNTEER ORGANIZATIONS

CALIFORNIA NATIVE PLANT SOCIETY: Imperial Valley Coordinator, 2006-2016.
SALTON SEA INTERNATIONAL BIRD FESTIVAL: Coordinator: 2001-2010. Organize bird festival in the Imperial Valley that attracts over 300 birders.
COLORDO RIVER WATER QUALITY CONTROL BOARD: Board member Dec 05-Sept 06.
FRIENDS OF SONNY BONO NATIONAL WILDLIFE REFUGE: Board Chairman, May 2015- 16

EDUCATION

University of Arizona, Tucson, Arizona
Masters of Science Degree – AGRICULTURAL EDUCATION
Thesis: Survey and training protocol for documenting burrowing owls and habitat in Imperial County, California
California State Polytechnic College, Kellogg-Voorhis Campus, Pomona, California
Bachelor of Science Degree.- AGRICULTURAL BIOLOGY
Imperial Valley College, Imperial, California *Associate of Science Degree. AGRICULTURE*

Jacob Calanno
Post Office Box 458
Niland, California 92257
760-550-4214

SPECIALTIES: Environmental Remediation and Monitoring, Mechanical Process Applications, Field operations.

EDUCATION: Imperial Valley College, Imperial, Ca. - Municipal Water and Waste Water Treatment; Licensing pending.

COMPUTER SKILLS: Basic computer skills, Lab View for Engineers.

SPECIALIZED TRAINING: Environmental Review & Compliance for Natural Gas Facilities Seminar- June 5-7, 2012
Desert tortoise Surveying, Monitoring and Handling Techniques Certificate Nov. 5-6, 2012
Flat Tail Horn Lizard Training- June 20, 2012
40 Hour Hazwoper Feb. 8, 2013
CALIFORNIA OSHA TITLE-2011
Confine Space Training, 2005
Lockout/Tagout , 2005
Respirator Training, 2005
Operators Safety Training, 2005
Foreman Field Crew Supervisory and Operations Training, 2005

SUMMARY: Field Operations Crew Foreman/Operations Technician
I have 15 years' experience in the environmental remediation industry. My area of expertise is in remedial mechanical applications, equipment operations and maintenance programs. For the past 5 years I have been specifically working on construction, operation and maintenance for soil vapor direct and indirect fire extraction systems, applied to groundwater remediation projects. I have strong equipment application, organization and field crew tasking skills. I communicate well, ascertain direction and always work as a team player.

Training and hands on experience working in the field with endangered species; Desert Tortoise and the Flat Tail Horned Lizard, followed compliance policy and procedure when encountering endangered species. This training was received while working on specific projects such as:
USDOD, Navy Clean I Program, Salton Sea, Imperial, California; Barrett's Biological Surveys field work and monitoring.

WORK EXPERIENCE:

2013-18 Barrett's Biological Surveys
Project Salton City Burrtec Landfill: 320 acre FTHL clearance and provided FTHL training to construction crew/Nesting bird surveys (52 hrs)
Project Mesquite Mine: 30 acre desert tortoise clearance; fence installation monitoring (25 hrs)
Project: North Baja Bore Hole Project desert tortoise monitoring (12 hrs)
Project Oat Mine: FTHL monitoring (186 hrs)
Project CalTrans: FTHL monitoring (50 hrs)
Project Niland Wastewater Project BUOW/Biological surveys (5 days)
BLM, El Centro, CA office: Volunteer Bat Surveys with Pat Brown (20 hours)

APPENDIX "B"

Environmental
Intelligence, LLC

CULTURAL RESOURCES SURVEY REPORT FOR THE LACK ROAD BRIDGE REPLACEMENT, IMPERIAL COUNTY, CALIFORNIA

Prepared For:

Imperial County
Public Works Department
155 S. 11th Street
El Centro, California 92243

and

NV5 West, Inc.
15092 Avenue of Science, Suite 200
San Diego, CA 92128

Prepared By:

Rebecca Gilbert, M.A. and Amber Lopez-Johnson, M.A.
Environmental Intelligence, LLC.
177 E. Colorado Blvd., Suite 200
Pasadena, CA 91105

Date: November 6, 2019 (*Updated January 30, 2020)*

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EXHIBITS

EXECUTIVE SUMMARY

Purpose and Scope: Environmental Intelligence, LLC (EI) was retained by NV5 to conduct a Phase 1 cultural resources study for the Lack Road Bridge Replacement Project (Project), located in Imperial County, California. The Project is expected to require construction permits from Imperial County (County), and therefore, will be subject to compliance with the California Environmental Quality Act (CEQA).

The purpose of this study is to identify cultural resources within the Area of Potential Impacts (API) and to assess the Project's potential impacts on historical resources in compliance with CEQA. This report documents the results of a cultural resources records search and intensive pedestrian survey of the API. The API totals 3.27 acres.

Results: A cultural resources records search was conducted by staff at the South Coastal Information Center (SCIC) at San Diego State University on August 30, 2019. No previous cultural resource studies have been conducted within the API or within a ¼-mile radius. Additionally, no cultural resources have been previously recorded within the records search extent.

EI also reviewed the California Department of Transportation (Caltrans) Historic Bridge Inventory for Local Agency Bridges. The New River (Lack Rd) bridge (number 58C0101) was constructed in 1940 and the historical significance is listed as a Category 5 (Bridge not eligible for NRHP).

An intensive pedestrian survey of the API was conducted on September 26, 2019. No cultural resources were identified as a result of the survey efforts. As such, no impacts are expected to occur to historical resources as part of the Project.

Recommendations: As a result of the current survey, no cultural resources were identified within the API. As the Project is subject to compliance with CEQA, the County will be required to conduct Native American consultation pursuant to Assembly Bill (AB) 52. With the expectation of AB52 consultation by the County, no further work for cultural resources is recommended, unless the scope changes to include areas not reviewed as part of this study.

1.0 INTRODUCTION

Environmental Intelligence, LLC (EI) was retained by NV5 to conduct a Phase 1 cultural resources study for the Lack Road Bridge Replacement Project (Project), located in Imperial County, California. The Project is expected to require construction permits from Imperial County, and therefore, will be subject to compliance with the California Environmental Quality Act (CEQA). This report documents the results of the cultural resources records search and intensive pedestrian survey of the API for the Project.

1.1 Project Description and Location

Due to severe deterioration of some of the pile supports, the existing Lack Road bridge has been closed to traffic for over one (1) year. The County proposes to replace the existing seven-span timber bridge with a new precast concrete bridge designed to current American Association of State Highway and Transportation Officials (AASHTO) standards. The proposed new bridge would be a single-span bridge with four (4) precast/prestressed bulb-tee girders supported on two (2) abutments. The new bridge dimensions will be 35 feet and 6 inches wide by 125 feet long, with a structure depth of 7 feet and 0.875 inches. The selection of a precast bridge structure will eliminate the need for construction to take place within the New River.

The proposed roadway would remain one (1) travel lane in each direction, and geometry for the proposed Project would be based on applicable County and AASHTO standards. The proposed Project's new bridge would be reconstructed in the same alignment with two (2) 12-foot lanes designed for a 55-mile-per-hour (mph) vehicle speed. Shoulder widths would be 4 feet on the bridge, and would transition to the existing width at the roadway conform points. The new bridge is designed to accommodate the 100-year flood of the New River. The existing bridge will be removed.

The Project is located approximately 5.8 miles north of Westmorland, where Lack Road crosses the New River in Imperial County, California. Specifically, the Project is located in Sections 29 and 30 of Township 12 South, Range 13 East, SBBM, as shown on the Calipatria SW United States Geological Survey (USGS) 7.5-minute topographic quadrangle (Exhibit 1).

1.2 Area of Potential Impacts

The API for the Project is defined as the bridge replacement, graded driveways, and staging areas (Exhibit 2). The API totals 3.27 acres.

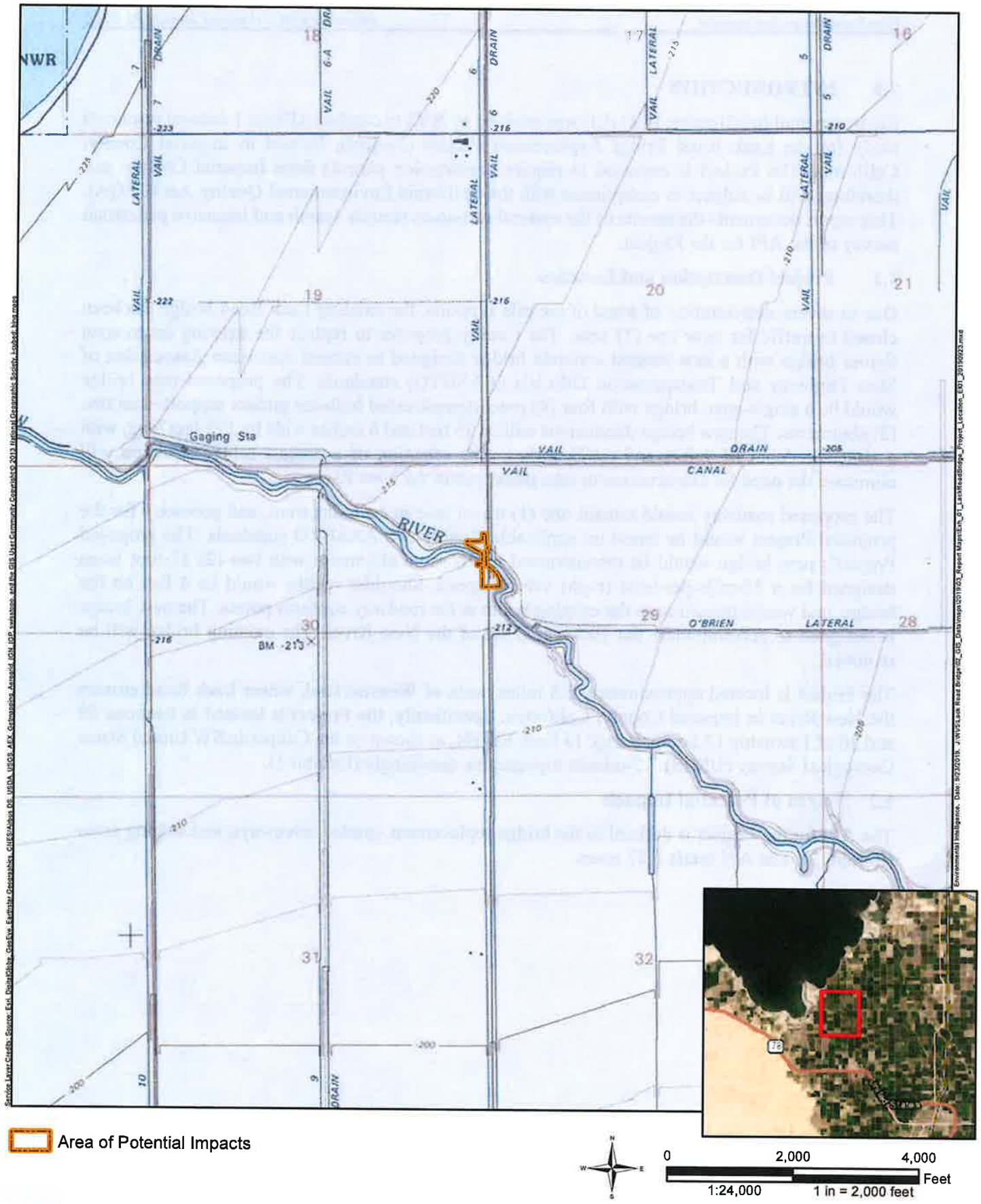

Exhibit 1: Project Location

Lack Bridge Road Replacement | Imperial County, CA

Exhibit 2: Area of Potential Impacts

Lack Road Bridge Replacement | Imperial County, CA

2.0 REGULATORY CONTEXT

2.1 State

2.1.1 California Environmental Quality Act

CEQA requires that a lead agency determine whether a project may have a significant effect on historical resources (Section 21084.1). If it can be demonstrated that a project will cause damage to a unique archaeological resource, the lead agency may require reasonable efforts be made to permit any or all of the resources to be preserved in place or left in an undisturbed state. To the extent that resources cannot be left undisturbed, mitigation measures are required (Section 21083.2[a], [b], and [c]).

Section 21083.2(g) defines a unique archaeological resource as an archaeological artifact, object, or site about which it can be clearly demonstrated that without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

1. Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information;
2. Has a special and particular quality such as being the oldest of its type or the best available example of its type; or
3. Is directly associated with a scientifically recognized important prehistoric or historic event or person.

2.1.2 California Register of Historical Resources

The California Register of Historical Resources (CRHR) was established in 1992 as a guide to be used by state and local agencies to identify California's historical resources and to identify what properties are to be protected from adverse change. A resource may be listed on the CRHR if it meets at least one of the following four criteria, which are directly modeled on NRHP criteria.

1. It is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.
2. It is associated with the lives of persons who are significant in our past.
3. It embodies the distinctive characteristics of a type, period, or method of construction; represents the work of a master; possesses high artistic values; or represents a significant and distinguishable entity whose components may lack individual distinction.
4. It has yielded, or may be likely to yield, information important in prehistory or history.

Resources must retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reason for their significance. A resource that has lost its historic character may still be eligible to the CRHR under Criterion 4 if it has the potential to yield scientifically important information.

2.1.3 Assembly Bill 52

Assembly Bill (AB) 52, signed by the California Governor in September of 2014, requires lead CEQA agencies to provide notice to tribes that are traditionally and culturally affiliated with the geographic area of a project only if they have requested to be notified of projects subject to AB 52. Consultation as defined under AB 52 includes, but is not limited to, discussing the type of environmental review necessary, the significance of tribal cultural resources (TCRs), the

significance of the project impacts on the TCRs, and alternatives and mitigation measures recommended by the tribe. Parties must consult in good faith and consultation is deemed concluded when (1) the parties agree to measures to avoid or reduce a significant impact on a TCR (if such a significant impact exists) or (2) when a party concludes that mutual agreement cannot be reached. Further, under AB 52, mitigation measures agreed upon during consultation must be included in the environmental document and, if no formal agreement on the appropriate mitigation has been established, mitigation measures that avoid or substantially lessen potential significant impacts should be implemented.

3.0 BACKGROUND INFORMATION

3.1 Environmental Setting

Located approximately 2.23 miles south of the Salton Sea, the Project area is situated within the southcentral extent of the Colorado Desert Province. On the eastern side of the province is the Imperial Valley consisting of the Colorado River running down to the Mexican border. West of the Colorado River and east of the Project area are the Chocolate Mountains, with the Algodones Dunes and the Cargo Muchacho Mountains to the southeast. The Chocolate Mountains and Cargo Muchacho Mountains are comprised of Proterozoic crystalline gneisses, anorthosites, and schists, with younger plutonic rocks in the Chocolate Mountains dating to 23 to 31 million years (early Miocene and to late Oligocene; Norris and Webb 1990).

The Colorado Desert is the warmest desert in California and is known as the "low desert" due to the long, deep valley making up the Salton Trough. The Salton Trough is 180 feet (58 m) below sea level (Schoenherr 1992). The Salton Sea began to fill around 1905 when an irrigation canal burst near the Mexican border, creating the New River that now flows into the Salton Sea from its southern end. Other major drainages flow into the Salton Sea from multiple directions; however, the New River and Alamo River account for most of the flow into the Salton Sea (Norris and Webb 1990). Both the New River and the Alamo River cross agricultural farmland and collect water from seepage and flooding from irrigation. The New River, per the Imperial County Health Department, is polluted with both biological and chemical wastes and has been designated as a Class 4 contaminated waterway.

The Colorado Desert is a subdivision of the larger Sonoran Desert located to the east. Vegetation is characterized by numerous cacti and trees of the legume family (*Fabaceae*), including the Smoke tree (*Psorothamnus spinosus*), a grayish, leafless legume, and Ocotillo (*Fouquieria splendens*), a large, stalk-like shrub with long, spiny, whip-like branches. The most common shrub of the lower slopes and flats of the Colorado Desert is Creosote bush (*Larrea tridentata*), with upper slopes occupied by a mixture of drought-deciduous shrubs and succulent plants that occur in the Cactus Scrub community (Schoenherr 1992).

Mammals in the Colorado Desert include desert bighorn sheep (*Ovis canadensis*), desert kit fox (*Vulpes macronis*), coyote (*Canis latrans*), western spotted skunk (*Ipilogale gracilis*), spotted bat (*Euderma maculatum*), black-tailed jackrabbit (*Lepus californicus*), ground squirrel (*Ammospermophilus leucurus*), and desert kangaroo rat (*Dipodomys deserti*). Birds in the region include eagles, hawks, owls, quail, white-winged dove, roadrunners, finches, warblers and orioles, with the Salton Sea providing habitat for a wide variety of waterfowl and shorebirds. Reptiles include several species of rattlesnakes.

3.2 Prehistoric Overview

California has been occupied for more than 12,000 years and several chronological sequences have been developed to study cultural change in California over the past 75 years (Bettinger and Taylor 1974; Moratto 1984; Wallace 1962; Warren 1984; Warren and Crabtree 1986).

The Colorado Desert region has its own unique natural and cultural history, but is also embedded in the large context of the Mojave Desert to the north, the Sonoran Desert to the east, and the mountains and coastlines of southern California and northern Baja California to the west and south (Schaefer and Laylander 2007).

3.2.1 PLEISTOCENE

Although pre-Clovis sites have been recorded elsewhere on the North American continent, there is no firm evidence of a pre-Clovis occupation within Southern California. The earliest documented occupation in Southern California is recorded from the Arlington Springs Woman skeleton from Santa Rosa Island, which produced radiocarbon dates of approximately 11,000 B.C (Glassow et al. 2007). Opposite Santa Rosa Island, on the mainland, site CA-SBA-1951 yielded a basal corner of a Clovis point that may indicate occupation of comparable age (Glassow et al. 2007).

The earliest cultural complex in the Mojave Desert that has been confidently identified is Clovis (ca. 10,000-8,000 B.C.; Sutton et al. 2007). The characteristic projectile points, consisting of large, lanceolate shaped bifaces with a fluted hafting technology, are exceedingly rare in the area. Isolated Clovis points have been found in the Mojave Desert, with concentrations reported around pluvial Lake China (Sutton et al. 2007). Based on the isolated nature of the finds consisting solely of lithic material, Clovis populations are typically viewed as consisting of small, mobile groups that employed a hunting and gathering subsistence strategy, with temporary camps located near permanent water sources such as pluvial lakes.

3.2.2 EARLY HOLOCENE

The early Holocene is marked by the Lake Mojave archaeological complex, which generally dates to between 8,000 and 6,000 B.C. and is typified by the projectile points of the Great Basin Stemmed Series (e.g., Lake Mojave, Silver Lake). In the Mojave Desert and southern Great Basin, stemmed archaeological assemblages have often been found near Pleistocene/Holocene transition lake beds and drainages. A number of articles have been written discussing whether early Holocene populations were specifically targeting lacustrine resources or whether seasonal resource populations located around water sources were of primary importance (e.g., Willig 1988). As Sutton et al. (2007) discuss, climate shifts, including the drying of the lake basins, would likely have caused increasing unpredictability in resource populations and locations, thereby causing high levels of residential mobility and the need for diversified subsistence strategies. Lithic assemblages consistent with the long-term curation and transport of material (abundant bifaces, unifaces, crescents, core tools and smaller amounts of ground stone tools) and more diversified archaeofaunal assemblages are indicative of a similar strategy.

3.2.3 MIDDLE HOLOCENE

The middle Holocene is marked by increasing aridity throughout the region. Woodland habitats receded to modern elevations during this time period and characteristic desert scrub communities, including creosote bush that expanded throughout the Mojave Desert by approximately 5,000 years ago (Spaulding 1991; West et al. 2007). The Pinto Complex is the primary cultural complex identified in the middle Holocene. Pinto Complex lithic assemblages show continuity from the Lake Mojave Complex in the use of similar material (i.e., material other than obsidian and cryptocrystalline silica [CCS]) and an emphasis on bifacial and unifacial core tools. The characteristic Pinto projectile points typically show high amounts of reworking and appear to have been used as thrusting spears (Sutton et al. 2007).

While large game was undoubtedly sought after, the change in suitable habitat for large artiodactyls likely played a major role in shifting settlement and subsistence patterns. Additionally, flat and shallow-basined millingstones and other ground stone implements increase notably within the period (Warren and Crabtree 1986), which is often viewed as a result of an increasing reliance

on hard seed exploitation. While Warren (1990) views this development as a result of increased subsistence strategy diversification brought on by environmental changes, Sutton et al. (2007) note that the Mojave Desert data demonstrates an emergence of heavy plant exploitation before the onset of middle Holocene aridity.

3.2.4 LATE HOLOCENE

The start of the late Holocene is marked by the Gypsum complex (2,000 B.C.-200 A.D.), which is characterized by smaller, dart-sized projectile points (e.g., Elko, Humboldt, and Gypsum series). The Gypsum complex emerged during a more mesic climate than the middle Holocene, and an increase in the abundance and diversity of lithic (knives, flake scrapers, large scraper planes, choppers) and ground stone (mortar and pestle) assemblages demonstrate an increasingly broad subsistence strategy. Increased evidence of ritual activity (split-twig figurines, petroglyphs quartz crystals) is present at locations such as Newberry Cave (Davis and Smith 1981; Warren and Crabtree 1986), and trade items from the coast suggest more contact between the regions.

Artifact assemblages from the Rose Springs Complex (ca. A.D. 200 to 1100) are characterized by Eastgate and Rose Springs projectile points, drills, pipes, bone awls, milling implements, marine shell, and large amounts of obsidian (Warren and Crabtree 1986). The large number of sites of this complex and the presence of more well-developed middens indicate a large increase in population size. This is likely due to the more productive environment, the introduction of a more effective hunting technology (the bow and arrow), or a combination of both (Sutton et al. 2007). Evidence from Anasazi agricultural populations is also present at archaeological sites in the eastern Mojave Desert at this time, including the area north of the Providence Mountains (Sutton et al. 2007).

The emergence of the Late Prehistoric cultural complexes coincides with the increasing aridity of the Medieval Climate Anomaly (MCA). Artifact assemblages are generally characterized by Desert series projectile points, buffware and brownware ceramics, steatite beads, a variety of milling implements, and an increase in the use of CCS over obsidian in tool production (Sutton et al. 2007). The development of regional interaction spheres within the Mojave Desert during this period may be viewed as forerunners to the known ethnographic groups (Warren 1984; Sutton et al. 2007).

3.3 Ethnographic Overview

The Project area falls within the traditional ethnographic territory of the Kumeyaay, Cahuilla, and Quechan tribes.

3.3.1 KUMEYAAY

The Kumeyaay, as they are preferred to be called, are also known as Southern Diegueño, Diegeño-Kamia, Ipai-Tipai, and Mission Indians (Pico 2019). The Kumeyaay consisted of self-governing clans that stretched from the coastal region to the Colorado River, north to Warner Springs Valley, and as far south as Ensenada. There were three main groups: the Tipai (Tie-Pie) occupied the northern area of present-day San Diego County, while the Ipai (ie-pie) occupied the southern area into Baja California, and the Kamei (cam-ie) gathered in the eastern part of San Diego County. They were a Yuman-speaking people and shared characteristics with neighboring tribes like the San Luiseño, Cupeño, and Cahuilla.

A dome-shaped hut called an e'waa [ee-wah'] approximately 15 to 20 feet in diameter provided shelter. It was constructed with sycamore and oak tree branches, tied with string made from yucca, and included an opening for smoke to escape during fires.

Acorns were a main staple in the Kumeyaay diet. Collected from oak trees, the acorns were then pounded into flour by mortar and pestle, rinsed to rid tannin acid, and prepared into a mush over a fire. Berries, nuts, seeds, roots, and bulbs were also gathered and eaten. The stalks from the mescal plant were gathered for food and as fiber to produce nets and sandals. The berries from the manzanita was made into a drink similar to "Kool-Aid" (Wilken 2012). The Kumeyaay also planted and grew crops like squash, beans, and corn, and gathered plants for medicinal purposes (Pico 2019; Wilken 2012). They also hunted different animals in the area including big game like antelope and mountain sheep, and trapped small animals like rabbits, birds, and quail. Local fish, as well as mollusks, shellfish, and seaweed were part of their diet too and nets and spears were used to fish in the ocean and rivers.

Clay collected from the river banks would be coiled and smoothed into utilitarian pottery for storing water or beans and nuts (King 2017). Fibers made from plants were twisted into string to make tightly knotted baskets, nets for fishing, sandals, and to construct shelter huts.

The Kumeyaay were first encountered in 1542 by European, Juan Rodriguez Cabrillo, and again in 1769 when the Spanish arrived (King 2017).

3.3.2 CAHUILLA

The Cahuilla's territory, located near the geographic center of Southern California, was bisected by a major travel trade route, the Cocopa-Maricopa Trail. The Colorado Desert separated the Cahuilla from the Mohave, Hachidoma, Ipai, and Tapai and the mountains, hills, and plains separated them from the Luiseño, Serrano, and Gabrielino (Bean 1978). Subsistence included hunting of large and small game animals, such as deer, antelope, mountain sheep, rabbits, squirrels, and ducks by the men. Women were responsible for the gathering of plant foods, with the most important being acorns (six varieties of oaks), mesquite and screw beans, pinon nuts, and the fleshy bulbs of various types of cacti (Bean 1978).

The Cahuilla were organized into political-ritual-corporates units (clans), composed of 3-10 lineages. The founding lineages often owned the office of ceremonial leader, the ceremonial house, and a ceremonial bundle, or *máyswut*. Cahuilla villages were usually situated in canyons or on alluvial fans near adequate sources of water or food material that offered protection from strong, prevailing winds. The lands surrounding the village were divided into tracts that were owned by clans, families, and individuals. Trail networks used for hunting, trading, and social interaction interconnected the villages. The villages were permanent, with movement out of them for a specific purpose such as hunting, gathering, trade, ritual, or social visiting. Buildings varied in size from small brush shelters to dome-shaped or rectangular house, 15-20 feet long depending on the needs of each individual family, along with village ceremonial houses (Bean 1978).

3.3.3 QUECHAN

Quechan are also known as the *Kwatsan* (which is derived from their creation myth and means "those who descended"), Yuma, or Yuman. Their settlements were centered to the east of the Project area along the confluence of the Gila and Colorado rivers in present-day Yuma, but their territory also stretched west into California and south into Baja California.

Quechan villages consisted of small family settlements located along the Colorado and Gila rivers. The households, or composite families, lived together and would move as a unit between seasonal settlements based on the continually changing floodplains of the rivers. The changing floodplains altered the locations of villages, camp sites, and horticultural plots, as the annual flooding eroded

some areas or buried others under silt. Possessions and houses of the dead were burned by the Quechan, which also contributed to their movement of villages over time (Bee 1983).

The Quechan were known for having a stable horticulture and gathering subsistence strategy. Large winter and spring settlements were located along the terraces above the Colorado River floodplains. In the spring when the waters receded from the floodplains, the Quechan would disperse into smaller, extended family camps near two to three-acre horticultural plots, where major crops included maize, squash, pumpkin, watermelon, and wheat (Bee 1983). After the fall harvest, the Quechan would return to the settlements on the terraces to escape the winter and spring floods from the Colorado River.

The Quechan were first encountered in 1540 by Hernando de Alarcón, followed Juan Oñate who visited the area in 1604. It is estimated that 4,000 Quechan people were living in their territory at the time of contact (Bee 1983).

3.4 Historic Overview

In California, the historic era is commonly divided into three periods: the Spanish or Mission period (1769–1822), the Mexican or Rancho period (1822–1848), and the American period (1848–present). These periods are described below, beginning with the earliest.

3.4.1 Spanish Period (1769-1822)

The earliest historic exploration of California was conducted by Juan Rodriguez Cabrillo in 1542, when contact was made with the Gabrielino on Santa Catalina Island. Contacts were amicable, and the Spanish were again received with hospitality during a return visit in 1602 by Sebastian Vizcaino (Bean and Smith 1978). While exploration of California continued throughout the 1700s, Spanish occupation and development of the region did not occur until over two centuries later, when Spain made the decision to colonize Alta California in an effort to prevent foreign invasion (Hoover et al. 2002). A series of 21 missions would eventually be established between San Diego and San Francisco, and they evolved into extensive operations containing churches, quarters for Indian laborers and soldiers, and a padre's residence. No missions were located in the vicinity of the Project area, the closest mission was located in present day San Diego. Spanish colonization was destructive to native populations of southern California. Besides infectious diseases, which severely decreased population rates of groups such as the Kumeyaay, the incorporation of young and healthy individuals into the Mission system had an undeniable impact on the cultural systems of native populations.

3.4.2 Mexican Period (1822-1848)

The Republic of Mexico was established in 1822, and Mexican rule brought significant changes from that of Spain. The missions were viewed as major economic forces by the Mexican government due to their vast landholdings. In 1834, the secularization of missions began and the mission properties were taken over by the state and sold to the highest bidders. Tracts of land, called *ranchos*, up to 1,000 acres in size were granted to citizens. These ranchos mark the first attempts to make specific identifications of land, and approximately 500 land grants were made during Mexican rule (Hoover et al. 2002). These land grants helped begin the proliferation of ranching throughout the region, as property owners often used their vast tracts of land for grazing cattle and sheep. No large tracts of land or ranchos were located near the Project area, as the eastern California deserts were still largely unoccupied.

3.4.3 AMERICAN PERIOD (1848-PRESENT)

The United States took possession of California after the signing of the Treaty of Guadalupe Hidalgo in 1848. The Land Act of 1851 established a Board of Land Commissioners to review land ownership and grants. While the 1848 treaty had bound the United States to honor the legitimate land claims of Mexican citizens, many of the original rancho owners eventually lost their land to the new government and rejected land claims reverted the property back to public domain. Americans had begun trickling into California after Jedediah Smith became the first American to lead an overland party into Spanish California during the Mexican Period. After the initial discovery of gold in Northern California in 1849, the rush west began in full swing and population increased as Americans began venturing west.

3.4.4 PROJECT AREA HISTORY

3.4.4.1 Imperial Valley

In 1781, gold in the Cargo Muchacho Mountains attracted settlers and miners into the area. Tumco became a well-known mining area by the 1900s and had a population of 2,000. The town's name is an acronym for The United Mining Company, now a ghost town with a few structures still standing. The value of gold resurged interest in the Tumco district and other parts of the Cargo Muchacho Mountains in the 1980s.

Besides mining for gold, the area became a destination to irrigate the desert. In 1859, Dr. O.M. Wozencraft was granted 1,600 square miles to irrigate a canal from the Colorado River to supply water for the agricultural farmlands and the settlers moving into the valley. By 1892, Mr. C.R. Rockwood was hired to irrigate the Sonoran Desert using water from the Colorado River, but took interest in Wozencraft's pending project in the Colorado Desert. Financing the project was slow, leading Rockwood to hire a successful Australian engineer, George Chaffey. Chaffey began dredging multiple areas in August of 1900. By 1905, 80 miles of main canals and 700 miles of distribution canals stretched over 67,000 irrigated acres (California Department of Fish and Wildlife [CDFW] 2019). The Southern Pacific Railway extended a rail line into the valley eventually connecting Niland to Imperial and then to Calexico. By 1919, a rail line connected El Centro to San Diego.

In 1907, Imperial County was formed to separate itself from San Diego County. The area has become one of the world's most productive agricultural regions producing year-round crops due to the warm climate and abundance of irrigated farmland. A few of the crops grown during winter months include lettuce, broccoli, and cauliflower.

4.0 METHODS

4.1 Records Search

A cultural resources records search was conducted by staff at the California Historical Resources Information System (CHRIS), South Coastal Information Center (SCIC) at San Diego State University on August 30, 2019. The records search identified all previously recorded cultural resources and cultural resource studies within the records search extent, which is defined as a ¼-mile radius around the API. The records search included a review of the NRHP, the CRHR, the California Points of Historical Interest list (CPHI), the California Historical Landmarks list, the Archaeological Determinations of Eligibility list, and the California State Historic Resources Inventory list. The records search also included a review of all historic USGS 7.5- and 15-minute quadrangle maps.

4.2 Caltrans Historic Bridge Inventory

EI reviewed the California Department of Transportation (Caltrans) Historic Bridge Inventory for Local Agency Bridges to determine the potential historical significance of the Lack Road Bridge.

4.3 Field Survey

EI archaeologist Amber Lopez-Johnson (M.A.) conducted an intensive pedestrian survey of the API on September 26, 2019. The API was surveyed using transects spaced no greater than 15 meters apart. The archaeologist examined exposed ground surface for artifacts (e.g., flaked stone tools, tool-making debris, milling tools, ceramics, ecofacts [e.g., marine shell and bone], soil discoloration that might indicate the presence of a cultural midden, and features indicative of the former presence of structures or buildings [e.g., standing exterior walls, postholes, foundations] or historic debris [e.g., metal, glass, ceramics]). Ground disturbances such as burrows were visually inspected. EI used EOS Arrow GNSS 100 Series GPS units with sub-meter accuracy and ArcGIS Collector Software to confirm all API footprints and record any geospatial data for newly or previously recorded resources. All new and previously recorded resources within the API were documented, photographed, and recorded on California Department of Parks and Recreation (DPR) 523 forms.

5.0 RESULTS

5.1 Records Search Results

No previous cultural resource studies have been conducted within the API or within a ¼-mile radius. Additionally, no cultural resources have been previously recorded within the records search extent.

5.2 Caltrans Historic Bridge Inventory Results

A review of the Caltrans Historic Bridge Inventory for Local Agency Bridges lists the Lack Road Bridge as bridge number 58C0101 - New River (Lack Rd). It was constructed in 1940 and its location is listed as 4.2MI N/O SR-86. The bridge's historical significance is listed as a Category 5 (Bridge not eligible for NRHP).

5.3 Field Survey Results

All portions of the API were accessible during the pedestrian survey (Exhibits 3-4). The API is located among agricultural fields and is bisected by the New River. Surface visibility was excellent (>90%), with most of the staging areas and graded driveways devoid of vegetation, though the soils were very wet and muddy from recent rains. Lack Road and the existing bridge are paved so no natural ground surface was visible at these locations.

No cultural material was identified within the API during the pedestrian survey. The API is located within an area that has been previously disturbed by agricultural activities, that are ongoing. Based on the agricultural activities within the API, the potential for encountering subsurface cultural deposits within the API is considered low.

EXHIBIT 3: OVERVIEW OF API/STAGING AREA, VIEW NORTHWEST.

EXHIBIT 4: OVERVIEW OF EXISTING BRIDGE, VIEW SOUTH.

6.0 SUMMARY AND MANAGEMENT RECOMMENDATIONS

As a result of the current survey, no cultural resources were identified within the API for the proposed Project. As the Project is subject to compliance with CEQA, the County will be required to conduct Native American consultation pursuant to AB 52. With the expectation of AB52 consultation by the County, no further work for cultural resources is recommended, unless the scope changes to include areas not reviewed as part of this study. In the event that cultural resources are discovered during ground-disturbing activities for the proposed Project, work must be halted until the resource can be evaluated by a qualified archaeologist. Further, should human remains be encountered, all work in the immediate vicinity must cease and the County Coroner must be immediately notified.

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APPENDIX "C"

FOUNDATION REPORT FOR LACK ROAD BRIDGE REPLACEMENT OVER NEW RIVER

June 7, 2019

Prepared For:

Imperial County Department of Public Works
155 S. 11th Street
El Centro, California 92243

Lack Road Bridge Over New River
Bridge No. 58C-101
Imperial County, CA

NV5 PROJECT No.: 227518-0000439

NV5 West, Inc.
15092 Avenue of Science, Suite 200
San Diego, CA 92128

Imperial County Department of Public Works
155 S. 11th Street
El Centro, California 92243

June 7, 2019
NV5 Project No: 227518-0000439

Attention: **Ms. Jenell Guerrero, MPA - Administrative Analyst II**

Subject: Foundation Report for Lack Road Bridge Replacement

Project: Lack Road Bridge Replacement Over New River
Bridge No. 58C-101
Imperial County, California

Dear Ms. Guerrero:

As requested, NV5 is pleased to present the results of the Foundation Report (FR) for design of the proposed replacement of the Lack Road Bridge Replacement Over New River (Bridge No. 58C-101). This study was conducted in conformance with NV5 West, Inc.'s (NV5) proposal dated February 21, 2018, submitted to NV5 Infrastructure.

NV5 appreciates the opportunity to be of service. Please do not hesitate to contact us if you have any questions or comments.

Respectfully submitted,

NV5 West, Inc.

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1.0 INTRODUCTION

This report presents results of NV5's foundation report for the proposed replacement of the Lack Road Bridge (Bridge No. 58C-101) located over New River in Imperial County, California. The approximate location of the project area is shown on *Figure 1, Site Location Map*.

The purpose of this report is to summarize the results of the recent geotechnical study conducted by the geotechnical group of NV5 West, Inc. and provide seismic and foundation design recommendations for the proposed replacement of the existing bridge structure. This report summarizes the data collected and presents findings, conclusions, and recommendations.

This foundation report was conducted in general conformance with NV5's proposal dated February 21, 2018 submitted to NV5 Infrastructure.

2.0 SCOPE OF WORK

NV5's scope of work for this project included the following tasks:

- Review of readily available background data, published geologic maps, topographic maps, seismic hazard maps and literature relevant to the subject site.
- Performing a site reconnaissance to observe the general surficial site conditions, check for accessibility, and select the exploratory boring locations.
- Coordinating with entities having an interest in the field exploration activities the drilling subcontractor (Baja Exploration), and Underground Service Alert (USA) for mark-out prior to site exploration.
- Conducting a subsurface investigation, which included the drilling, logging, and sampling of two (2) exploratory borings (A-19-001 and A-19-002) located within the project area to a maximum depth of approximately 100 feet below ground surface (bgs). Soil samples obtained from the borings were transported to NV5's in-house laboratory for observation and testing.
- Performing laboratory testing on selected representative bulk and relatively undisturbed soil samples obtained during the field exploration program to evaluate their pertinent geotechnical engineering properties.
- Performing an assessment of general seismic conditions and geotechnical hazards affecting the area and potential impacts on the subject project.
- Engineering evaluation of the data collected to develop geotechnical design parameters and recommendations for the design of the proposed construction.
- Preparation of this report.

This scope of this study did not include assessment for the presence of contaminants in the soils and groundwater. Our recommendations are based on the results of our field explorations, laboratory tests, engineering analyses, and our previous experience working on similar projects.

3.0 SITE AND PROJECT DESCRIPTION

The proposed replacement of the Lack Road Bridge over New River is located near Westmorland in Imperial County, California. The area in the immediate vicinity of the project limits is relatively flat with a gentle gradient downward to the northwest. The elevation at the project site is approximately 215 feet below mean sea level. The New River flows beneath Lack Road at the location of the bridge replacement (refer to *Figure 2, Boring Location Map*). The area surrounding the bridge consists predominantly of agricultural fields, and the natural river channel which is has limited wetland and riparian (mainly tamarisk) vegetation. All elevations referenced within this report are based on the World Geodetic System of 1984 (WGS84), unless otherwise noted.

Based on preliminary information provided by Imperial County Department of Public Works (dated January 18, 2018), it is understood that the proposed construction includes the replacement and widening of the existing bridge at Lack Road over the New River. The bridge was closed to all traffic by the County when they discovered a failed pile/column in August 2016. The existing bridge was constructed in 1940, is approximately 106 feet in length, 27 feet wide and is currently supported by treated timber pile bents and pile bent abutments with timber seating walls. Detailed site layout and construction plans had not been developed as of the date of this report.

4.0 EXCEPTIONS TO POLICIES AND PROCEDURES

The geotechnical investigation and preparation of this report generally conforms to current Caltrans design guidelines and practices presented listed in the References section of this report.

5.0 FIELD INVESTIGATION AND FIELD TESTING PROGRAM

Before starting NV5's field exploration program, Underground Service Alert was notified of the operations for underground utility marking at the locations of exploration. The subsurface conditions were explored on March 18th and 19th, 2018 by drilling, logging and sampling of two (2) exploratory borings (A-19-001 and A-19-002). The borings were drilled to a maximum depth (each) of about 100 feet bgs by Baja Exploration using a CME-95 truck mounted drill rig equipped with hollow-stem augers.

The borings were logged by an NV5 geologist. Representative samples of the soils encountered were obtained for visual soils classification and laboratory testing. The soil conditions encountered in the borings were visually examined, classified, and logged in general accordance with the Caltrans *Soil & Rock Logging, Classification, and Presentation Manual* (2010) and its associated errata (August 2018). The logs of the exploratory test borings are presented in *Appendix A, Boring Records*. The approximate locations of the exploratory borings are presented on *Figure 2, Boring Location Map*. Subsequent to logging and sampling, the borings were backfilled.

The bulk and relatively undisturbed drive samples of the soils encountered in the borings were tagged in the field and transported to NV5's laboratory for observation and testing. The drive samples were obtained using the California Modified Split Spoon and Standard Penetration Test (SPT) samplers, as described below. The CME-95 truck mounted drill rig's driving hammer was previously calibrated for SPT sampling and realized an average hammer efficiency ratio (ERi) of 67.9%).

California Modified Split Spoon Sampler

The split barrel drive sampler was driven with a 140-pound hammer allowed to drop freely 30 inches in general accordance with ASTM D1587. The number of blows for the last two of three 6-inch intervals were recorded during sampling and are presented in the logs of borings. The sampler has external and internal diameters of approximately 3.0 and 2.4 inches, respectively, and the inside of the sampler is lined with 1-inch-long brass rings. The relatively undisturbed soil samples within the rings were removed, sealed, and transported to the laboratory for observation and testing.

Standard Penetration Test (SPT) Sampler

A split barrel sampler was driven with a 140-pound hammer allowed to drop freely 30 inches in general accordance with ASTM D1586. The numbers of blows for the last two of three 6-inch intervals were recorded during sampling and are presented in the logs of borings (i.e., N-value). The sampler has external and internal diameters of 2.0 and 1.4 inches, respectively. The soil samples obtained in the interior of the barrel were measured, removed, sealed and transported to the laboratory for observation and testing.

6.0 LABORATORY TESTING PROGRAM

Laboratory testing was performed on selected representative bulk and relatively undisturbed soil samples obtained from the exploratory borings, to aid in the material classifications and to evaluate engineering properties of the materials encountered (see *Appendix B, Laboratory Test Results*). The following tests were performed:

- In-situ density and moisture content (ASTM D2937 and ASTM D2216);
- Particle size analyses (ASTM D6913, ASTM D2487 and ASTM D422);
- Atterberg Limits (ASTM 4318);
- Direct Shear (ASTM D3080);
- R-Value (ASTM D2844);
- Expansion Index (ASTM D4829); and
- Corrosivity test series including sulfate content, chloride content, pH-value, and resistivity (CTM 417, 422 and 643, respectively).

Testing was performed in general accordance with applicable ASTM standards and California Test Methods. A summary of the laboratory testing program and the laboratory test results are presented in *Appendix B, Laboratory Test Results*.

7.0 GEOLOGY

7.1 SITE GEOLOGY

The project site is located in Imperial County in the southern portion of the Salton Trough, a structural depression within the Colorado Desert geomorphic province. This province is generally a low-lying barren desert basin (in part about 230 feet below mean sea level) dominated by the Salton Sea. The province is a depressed block between active branches of the San Andreas fault system. The fault branches are buried by recent alluvial deposits. The dominant structural features related to the San Andreas fault system consist of northwest-trending faults and fault zones. The major northwest-trending fault zones include the San Jacinto fault, Imperial fault, the Superstition Hills fault, the Elsinore fault and the San Andreas fault. The Salton Trough has been inundated during the Quaternary by an ancient freshwater lake (Lake Cahuilla) which resulted in a sequence of lacustrine (lake) deposits consisting of interbedded sand, silt and clay. Remnants of the ancient shorelines of the extinct Lake Cahuilla remain prevalent in the Salton Trough.

7.2 SUBSURFACE CONDITIONS

Geologic materials encountered during the subsurface explorations consisted of natural deposits mapped as Quaternary-aged lake deposits known as the Cahuilla Beds (Ql) on published geologic maps. *Figure 3, Regional Geologic Map* presents the general distribution of geologic units in the site area. As encountered in the borings, the soils ranged from brown, dry to wet, soft to hard lean clay with lenses of fat clay, and loose to very dense silty sands and clayey sands. Detailed descriptions of the earth materials encountered are presented on the boring records in *Appendix A*.

7.3 GROUNDWATER

Groundwater was encountered in the exploratory borings at depths between approximately 18 and 19 feet bgs, as indicated in the following Table 1. Water elevation measurements were also taken at the New River beneath the existing bridge where it is approximately 12 feet below the roadway elevation. The New River, per the Imperial County Health Department, is polluted with both biological and chemical wastes and has been designated as a Class 4 contaminated waterway.

Table 1 - Depth to Groundwater as Measured in Each Boring

Boring Number	Depth to Groundwater
A-19-001	18 feet
A-19-002	19 feet

Groundwater levels may vary due to seasonal fluctuations and factors such as a substantial increase in surface water infiltration from landscape irrigation, agricultural activity, storage facility leaks or unusually heavy precipitation. There is uncertainty in the accuracy of short-term groundwater level measurements, particularly in fine-grained soil. The groundwater level, as reported herein, should not be interpreted to represent an accurate or permanent condition. Seasonal variations in the groundwater levels should be anticipated.

8.0 SCOUR EVALUATION

The proposed bridge structures span over the New River. The bridge inspection report prepared by Caltrans (dated December 13, 2017) indicates that soft near-surface soils have eroded away at one end of the bridge, reducing the effective embedment depth of the piles.

9.0 CORROSION EVALUATION

The corrosion potential of the on-site materials to steel and buried concrete was evaluated. Laboratory testing was performed on selected soil samples to evaluate pH, minimum resistivity, and chloride and soluble sulfate content. Table 2 below, presents the results of the corrosivity testing.

Table 2 - Corrosivity Test Results

Test Location	Depth (feet)	Material Type	pH	Minimum Resistivity (ohm-cm)	Water Soluble Sulfate Content (ppm)	Water Soluble Chloride Content (ppm)
A-19-001	15 - 26.5	Lean Clay	8.3	82	2700	6410
A-19-002	13 - 26.5	Lean Clay	8.2	93	2880	5340

General recommendations to address the corrosion potential of the on-site soils are provided below. If additional recommendations are desired, it is recommended that a corrosion specialist be consulted.

Caltrans Corrosion Guidelines dated March 2018 considers a site to be corrosive if one or more of the following conditions exist for the representative soil samples taken at the site:

> *Chloride concentration is 500 ppm or greater, sulfate concentration is 1500 ppm or greater, or the pH is 5.5 or less*

Based on experience and the Caltrans Corrosion Guidelines, the site soils are considered corrosive to steel and concrete foundation elements based on sulfate and chloride test results. As noted previously, the Salton Trough has been inundated during the Quaternary by an ancient freshwater lake (Lake Cahuilla) which resulted in a sequence of lacustrine (lake) deposits consisting of interbedded sand, silt and clay. Remnants of the ancient shorelines of the extinct Lake Cahuilla remain prevalent in the Salton Trough. These Cahuilla Beds also contain evaporite salt deposits that are high in chloride and sulfate minerals which can be extremely corrosive to steel and concrete. At a minimum, the use of Type V cement should be considered for use in for the foundations and substructures (Abutments). The use of epoxy coated reinforcement may also be considered for use. Additional concrete cover for reinforcement is also a consideration.

As indicated in the 2006 edition (second edition) of "Corrosion Basics - An Introduction," a general guideline for soil resistivity and corrosion-severity ratings is presented in Table 3 below.

Table 3 - Corrosivity Test Results

Soil Resistivity	Corrosivity
<1,000 ohm-cm	Extremely Corrosive
1,000 to 3,000 ohm-cm	Highly Corrosive
3,000 to 5,000 ohm-cm	Corrosive
5,000 to 10,000 ohm-cm	Moderately Corrosive
10,000 to 20,000 ohm-cm	Mildly Corrosive
>20,000 ohm-cm	Essentially Noncorrosive

Soil resistivity is not the only parameter affecting the risk of corrosion damage; and a high soil resistivity will not guarantee the absence of serious corrosion. For example, the American Water Works Association (AWWA) has developed a numerical soil-corrosivity scale, applicable to cast-iron alloys. The soil resistivity test results suggest the potential for soils to be extremely corrosive to ferrous pipes.

Any imported soils should be evaluated for corrosion characteristics if they will be in contact with buried or at-grade structures and appropriate mitigation measures should be included in the structure design. It is recommended that a corrosion specialist be contacted to determine mitigation measures for the proposed abutment and foundation construction.

10.0 SEISMIC DESIGN INFORMATION AND RECOMMENDATIONS

The principal seismic considerations for most facilities in southern California are damage caused by surface rupturing of fault traces, ground shaking, seismically induced ground settlement and liquefaction. Potential impacts to the project due to faulting, seismicity and other geologic hazards are discussed in the following sections.

10.1 FAULTING AND SEISMICITY

The project site is located in the seismically active region in Southern California, which is within the influence of several fault systems that are considered to be active or potentially active. *Figure 4, Regional Fault Map,* depicts the site in relation to known active faults in the region. Recommended seismic ground motion design parameters are provided in the Seismic Design Parameter Section of this report.

The *Caltrans Fault Database and ARS Online Report (V2.0)* prepared by T. Shantz (2012a) lists several known active faults, defined as active within the late Quaternary time (within the past 700,000 years) and capable of producing a maximum moment magnitude (MMax) earthquake of 6.0 or greater when evaluated deterministically. Using the bridge site location coordinates of: Latitude = 33.100001 degrees North, Longitude = 115.648826 degrees West, a list of five significant faults obtained from the Caltrans *ARS Online Tool* (V2.3.09) is summarized in Table 4 below.

Table 4 - Summary of Significant Faults Based on Caltrans ARS Online

Fault Name	Caltrans Fault ID No.	Maximum Moment Magnitude (M_{Max})	Slip Rate (mm/yr)	Fault Type	Approximate Site to Fault Distance R_{rup}/R_x (km)
Brawley (Seismic Zone) alt 2	388	6.5	23.0	Strike Slip	4.47/4.47
Elmore Ranch	392	6.6	1.0	Strike Slip	9.86/9.86
San Jacinto (Superstition Mountain)	402	7.7	6.0	Strike Slip	22.81/22.80
San Jacinto-Lone Tree fault	398	6.6	1.0	Strike Slip	10.56/8.22
San Andreas (Coachella) rev	372	7.9	10.6	Strike Slip	28.46/8.78

Notes: R_{rup} = Closest distance to fault rupture plane, R_x = Horizontal distance to the fault trace or surface projection of the top of rupture plane

10.2 SEISMIC DESIGN PARAMETERS

A preliminary bridge design ARS curve was developed following the Caltrans guidelines, namely, *Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations* (Caltrans, 2012a) and the *Seismic Design Criteria* (Caltrans, 2013), and the latest *ARS Online Tool (V2.3.09)*, which can be accessed at the link: http://dap3.dot.ca.gov/ARS_Online/.

Development of the bridge design ARS curve requires several input parameters, including site location coordinates (longitude and latitude), average shear wave velocity for the top 30 meters (100 feet) of soils (Vs30), and other site parameters, such as fault characteristics and site-to-fault distances.

Due to the lack of site specific geophysical or geotechnical data for the average shear wave velocity in the top 30 m (100 feet) of soils, VS30, the default value of 270 m/s was used in the *ARS Online Tool*, assuming a Type D soil for the site.

The current design approach incorporates the results of both deterministic and probabilistic seismic hazard analyses to produce the design response spectrum (ARS curve). The probabilistic base spectrum obtained from the ARS Online Tool has been checked to be within a 10% difference with the results from the USGS Unified Hazard seismic deaggregation analysis at the periods of 0.01s (PGA), 0.2s, 1.0 s and 2.0s as documented in the *Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations* (Caltrans, 2012a). The ARS calculation results show the probabilistic spectrum controls the design. The recommended design ARS curve is shown on *Figure 5, Recommended Bridge Design ARS Curve*. A summary of the computed deterministic and probabilistic acceleration response spectra, USGS seismic deaggregation spectrum, adjustment factors and final

envelope spectrum for the site is included in *Appendix C, ARS Curve Calculations*. Copies of the Caltrans ARS Online calculation outputs and the USGS Unified Hazard seismic deaggregation analyses are also included in Appendix C.

The values for the envelope of the spectral response based on ARS Online Version 2.3.09 (April 2017) are presented in the following Table 5. The spectral acceleration curve for the envelope is presented in Figure 5.

Table 5 - Spectral Envelope Values Based on Caltrans ARS Online (v2.3.09)

Period (sec)	S_A
0.01	0.611
0.05	0.934
0.1	1.121
0.15	1.248
0.2	1.346
0.25	1.322
0.3	1.303
0.4	1.190
0.5	1.110
0.6	1.040
0.7	0.990
0.85	0.914
1	0.851
1.2	0.719
1.5	0.585
2	0.449
3	0.277
4	0.197
5	0.162

10.3 SURFACE FAULT RUPTURE POTENTIAL

The project site is not located within an *Earthquake Fault Zone* delineated by the State of California for the hazard of fault surface rupture. The surface traces of known active or potentially active faults are not known to pass directly through the site. It should be noted that ground surface rupture due to a seismic event may occur in areas where no evidence of ground rupture had been previously noted. Based on the available geologic data, known active or potentially active faults with the potential for surface fault rupture are not known to exist beneath the site. Accordingly, the potential for surface rupture at the site due to faulting is considered low during the design life of the proposed structure.

10.4 SEISMIC SHAKING

The project site is located in southern California, which is considered a seismically active area, and as such, the seismic hazard most likely to impact the site is ground shaking resulting from an earthquake along one of the known active faults in the region. The seismic design of the project may be performed using seismic design recommendations in accordance with current building codes and engineering practices presented in section 11.0.

10.5 LIQUEFACTION AND SEISMICALLY-INDUCED SETTLEMENT

Liquefaction and dynamic settlement of soils can be caused by ground shaking during earthquakes. Dynamic settlement due to earthquake shaking can occur in both dry or unsaturated and saturated sands. Research and historical data indicate that loose, relatively clean granular soils are susceptible to liquefaction and dynamic settlement, whereas the stability of the majority of clayey silts, silty clays and clays is not adversely affected by ground shaking. Research through the California Department of Conservation indicate that the project area is not located within a designated Special Studies Zone.

Liquefaction is generally known to occur in saturated loose cohesionless soils at depths shallower than approximately 50 feet. The potential for liquefaction under the same conditions of ground shaking intensity and duration will decrease for sands that are more well-graded, irregular, gritty, coarser and denser. Also, a pronounced decrease in liquefaction potential will occur with the increase in fine-grained (i.e., silt and clay) content and plasticity of the soil. Idriss and Boulanger (2008) have suggested that soils with plasticity index of greater than 7 may be considered non-liquefiable. The potential consequences of liquefaction to engineered structures include loss of bearing capacity, buoyancy forces on underground structures (including pipelines), increased lateral earth pressures on retaining walls, and lateral spreading.

The subsurface exploration program encountered poorly (nearer to the surface) to moderately consolidated alluvial clay, and silty sands. A liquefaction assessment was completed in general accordance with the *California Geotechnical Manual, Liquefaction Evaluation, dated December 2014.* Excerpts from this manual (portions of page 4, 5, and 6) which provides guidance for quantitative liquefaction analysis is provided as follows.

4 Quantitative Liquefaction Analysis

Quantitative liquefaction analysis uses site-specific field and laboratory test data. Use the procedure of Youd, et al (2001): *Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils October, 2001* for quantitative liquefaction analysis. The procedure consists of the following general steps:

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1. Determine groundwater elevation. Use the ground water elevation measured during the field investigation. A higher elevation may be used if there is clear evidence for seasonal or long-term fluctuations. Do not combine liquefaction analysis with other extreme events, such as maximum scour and/or temporary or abnormally high groundwater levels. Combining extreme events results in conservative, costly, and unnecessary overdesign.
2. Determine which soil layers are to be evaluated for quantitative liquefaction analysis.
3. Correct SPT Blow Counts
4. Determine Cyclic Stress Ratio (CSR)
5. Determine Fines Content Correction
6. Calculate Cyclic Resistance Ratio $(CRR)_{7.5}$
7. Calculate the Magnitude Scaling Factor (MSF)
8. Calculate the Factor of Safety Against Liquefaction

Modifications or elaborations to Youd et al (2001) are as follows:

- Use Youd et al (2001) to depths of 50 feet; with caution to 70 feet; do not use below 70 feet.
- Extreme conditions below 70 feet (e.g.: loose fine sands without fines, thick layers, etc) require special analysis and consideration that is beyond the scope of this module.
- Use the Seed and Idriss formula (1997) found in Youd et al (2001) for the fines correction.
- Do not use the "Modified Chinese Criteria" as it is unconservative for determining if certain fine grained soils are liquefiable. Use the method in Bray and Sancio (2006) which states that fine grained soils will not liquefy (regardless of SPT blow count or CSR) if PI >12 or Wc < .85*LL
- Use the more conservative of the deterministic or probabilistic earthquake (5% probability of exceedance in 50 years or 975 year return period) to determine the PGA (a_{max}) and M_{Max}. (Youd uses the term a_{max} for PGA)
- For *deterministic* liquefaction seismic parameters run ARS Online to obtain the deterministic PGA and M_{Max}.
- For *probabilistic* liquefaction seismic parameters run ARS Online to obtain the PGA associated with a 975 year return period. Do a deaggregation using the 2008 USGS tool and use the larger of the M_{Median} or M_{Mode} value for M_{Max}. (Youd uses the term Mw for M_{Max})
- When the California minimum acceleration controls use the actual ground acceleration for liquefaction determination.
- Use a factor of safety against liquefaction of 1. (Soils with FS≥1 are not liquefiable.) Borderline cases where the factor of safety ranges between 0.95 and

1.05 may need further investigation depending on the consequences of liquefaction.

A peak ground acceleration (PGA) of 0.611g for geometric-mean MCE and earthquake moment magnitude of 6.5 based on the results of deaggregation analysis using the USGS online tools were used in liquefaction analysis. Groundwater levels at the time of drilling were also utilized in our analysis. Results of the liquefaction analysis are presented in *Appendix D, Liquefaction Analysis* and summarized in the following table. Project Elevation is assumed as the Site Elevation (about -215 feet elevation at the top of bridge) – 1,000 feet.

Table 6 – Summary of Liquefaction Analysis Results

Substructure	Estimated Base pf Pile Cap Project Elevation (feet)	Liquefiable Soil Layer Description	Estimated Top of Liquefiable Layer Project Elevation (feet)	Estimated Bottom of Liquefiable Layer Project Elevation (feet)	Estimated Liquefaction Settlement in layer (inches)	Estimated Cumulative Liquefaction Settlement at Top of Layer (inches)
Abutment 1	773.5	Silty Sand (SM) – Generally Medium	749	742	1.21	1.21 (1.59 inches when all of seismic settlement is included)
Abutment 2		Silty Sand (SM) - Generally Loose to Medium Dense	757.5	740.5	3.21	3,21 (3.58 inches when all of seismic settlement is included)

Seismic Settlement: Seismically-induced ground settlement can occur with or without liquefaction which results from densification of loose soils as a result of strong seismic ground shaking. Seismic settlement includes both settlement of liquefied soil layers and settlement of non-liquefied, unsaturated, loose sandy sediments. Total seismic settlement expected at the site is on the order of 1.59 inches for Abutment 1, and 3.58 inches for Abutment 2.

Lateral Spreading: Seismically-induced lateral spreading involves primarily lateral movement of earth materials due to ground shaking in conjunction with liquefaction. Lateral spreading can manifest as near-vertical cracks with predominantly horizontal movement of the soil mass involved towards an adjacent open slope face. Lateral spreading occurs when there is widespread liquefaction and a gentle slope, or a free face toward which lateral spreading may occur. Liquefiable layers as noted below are located below the elevation of the stream channel and abutment slope face. In addition it is noted that piles for the existing bridge will be left in place, which should provide some buttress/dissipation of additional lateral pressures that may result from an earthquake event. Therefore, the potential for lateral spreading is deemed to be low for this site.

10.6 LANDSLIDES AND SLOPE INSTABILITY

There are no high or steep natural slopes on or in close proximity to the project site. Based on the investigation, there appears to be no indications of landslides or deep-seated instability at the site. It is NV5's opinion that the potential damage to the planned facilities due to landsliding or slope instability is considered low.

10.7 SUBSIDENCE

The Imperial Valley is a region generally known for historic ground subsidence. The subsidence has been attributed to regional geologic processes and to fluid withdrawal associated with geothermal production. Most of the subsidence is tectonic in nature and the broad Salton Trough basin has been subsiding for at least the past 35 million years. Historic soil subsidence due to groundwater withdrawal associated with geothermal production has also been documented. The subsidence occurs when groundwater (near the surface or in a deep aquifer) is lowered past its historical level. This occurrence results in an increase of effective stress within a soil layer which typically translates into additional soil consolidation. Due to the depth of the reservoir, subsidence is not localized. Considering the distance to the geothermal production areas to the project site, and that ground subsidence in the Imperial Valley is occurring on a regional and not local level ground subsidence at the site is not expected to create significant differential settlement conditions. Therefore, potential for damaging localized differential settlement from fluid withdrawal subsidence is considered low.

10.8 TSUNAMIS, INUNDATION SEICHES, AND FLOODING

The site and surrounding areas are at an approximate elevation of 215 feet below mean sea level, the site is approximately 105 miles from the Gulf of California. Therefore, tsunamis (seismic sea waves) are not considered a hazard at the site.

There have been no documented occurrences of seiches at the Salton Sea, but given the relatively shallow depth and seismic exposure, it is likely that one could occur. It is noted that the elevation of the bridge site is approximately 15 feet higher than the surface of the Salton Sea, and given the distance to the to the Sea, the potential for a seiches affecting the project site are considered low.

10.9 EXPANSIVE SOILS

Improvements including foundations and slabs in contact with earth materials with a high potential for expansion can be expected to be subject to distress based on the potential for volume change associated with highly expansive soil. Soils such as these should not be relied upon for foundation bearing.

The project site is underlain predominantly by poorly to moderately consolidated alluvial materials consisting of lean clay with lenses of fat clay, silty sands and clayey sands. Two (2) tested samples of the near-surface clay soils indicate medium expansion potential with an Expansion Index (EI) of 71 to 89. These materials are generally considered unsuitable for use as backfill for structure foundations, retaining walls or pipe bedding. Since site grading will redistribute on-site soils, potential expansive soil properties should be verified at the completion of rough grading.

11.0 FOUNDATION RECOMMENDATIONS

Based on the results of the investigation, Cast-In-Drilled Hole (CIDH) piles are recommended for foundation support of the proposed Lack Road Bridge replacement. CISS piles are typically recommended to reduce the potential for construction difficulties due to caving of the loose sandy layers and to withstand the large lateral loads due to potential extreme events. However due to the extreme corrosion potential of subsurface soils and other cost considerations, CIDH piles are recommended provided that provisions for temporary shoring or drilling fluids are provided.

Shallow foundations are not recommended due to the presence of loose near-surface compressible soil. Detailed recommendations including vertical pile tip elevations, lateral capacity, estimated settlement, pile design and construction considerations, and embankment recommendations are provided in the following sections of the report.

11.1 VERTICAL DESIGN AND PILE TIP ELEVATIONS

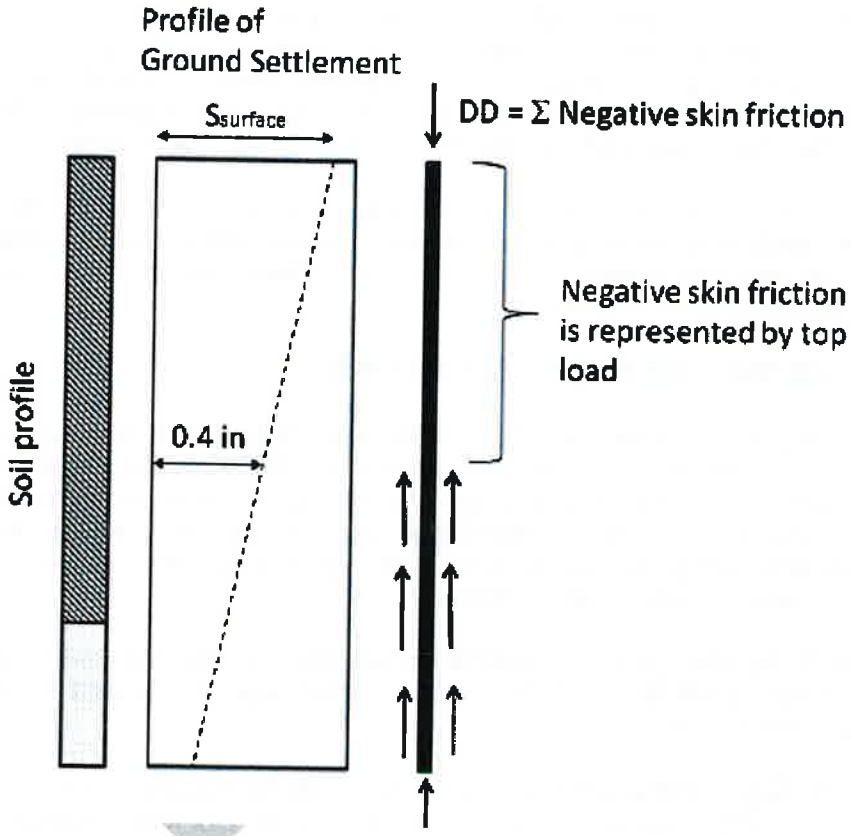
The ultimate axial capacity for 24-inch and 30-inch diameter CIDH piles in both compression and tension were computed using the static method of analysis with the computer program ALLPILE 7.0 by CIVILTECH, Inc. Both ultimate side resistance and end bearing were estimated in our analysis with results presented in *Appendix F, Axial Pile Resistance Analysis*. However it is suggested that end bearing be neglected in the design analysis because the movement associated with mobilizing the end bearing is typically beyond tolerable structural limits.

Due to the potential for liquefaction and associated seismic induced settlement, potential downdrag forces be accommodated in pile design. If the "AASHTO Explicit Approach" is used to estimate drag force, the following is recommended:

- For Abutment 1, no nominal axial pile resistance should be assumed for pile length above project elevation 742. Negative skin friction above Elevation 742 feet should be included as downdrag load (on top of pile) . The nominal geotechnical resistance available to resist the structural load plus the downdrag load is estimated by considering only the positive side resistance below project elevation 742.

- For Abutment 2, no nominal axial pile resistance should be assumed for pile length above project elevation 740.5. Negative skin friction above Elevation 740.5 feet should be included as downdrag load (on top of pile). The nominal geotechnical resistance available to resist the structural load plus the downdrag load is estimated by considering only the positive side resistance below project elevation 740.5.

The above downdrag assessment approach is conceptually shown in the following figure.



A Resistance Factor φ_{qs} = 0.7 should be multiplied by the side resistance presented in Appendix for Strength Limit State design. For the Extreme Event Limit State, a Resistance Factor φ = .0 should be used.

11.2 LATERAL PILE RESISTANCE

It is understood that the structural engineer will use the computer program LPILE to perform pushover analyses and determine the depth of fixity of the proposed CIDH piles. NV5 has estimated the relevant geotechnical input parameters for LPILE based on the current investigation. The recommended geotechnical input parameters for LPILE are presented in Table 7. It is noted per *Caltrans LRFD, Bridge Design Aids 12-2, dated May 2016* that the permissible horizontal loads for deep foundations at abutments is the load that results in a horizontal displacement of ¼ inch at the top or cut cut-off elevation of the pile/shaft. For comparison purposes the results of an analysis for 24-inch and 30-inch diameter CIDH piles, assuming a ¼ inch limiting deflection, is provided in *Appendix E, Lateral Pile Resistance Analysis*. It is important to note that the results of analysis is heavily dependent upon assume pile configuration, loading conditions, and reinforcement details.

Table 7 - Recommended Soil Parameters for LPILE – Abutment 1

Project Elevation (feet)	Soil Type	P-Y Model	Effective Unit Weight (pcf)	ϕ (deg)	C (psf)	K (psf)	ε_{50} (in/in)
772.5 to 749	CL	Soft Clay (Matlock)	58.7	-	300	Program Default	
749 to 734	SM	Sand (Reese, et.al)	63.5	34	-		
734 to 719	CL	Stiff Clay (w/o Free Water)	56.2	-	1,750		
719 to 705	SM	Sand (Reese, et al.)	65.5	35	-		
705 to 685	SM	Sand (Reese, et al.)	65.9	38	-		

Table 8 - Recommended Soil Parameters for LPILE – Abutment 2

Project Elevation (feet)	Soil Type	P-Y Model	Effective Unit Weight (pcf)	ϕ (deg)	C (psf)	K (psf)	ε_{50} (in/in)
773.5 to 757.5	CL	Soft Clay (Matlock)	60.4	-	500	Program Default	
757.5 to 743	SM	Soft Clay (Matlock) – due to this being a liquefiable layer. Residual Strength estimated using Seed/Harder curves	59.8	-	350		
743 to 732	SM	Sand (Reese, et.al)	66.8	34	-		
732 to 719	CL	Stiff Clay (w/o Free Water)	61.6		1,500		
719 to 705	SM	Sand (Reese, et al.)	61.6	33	-		
705 to 689	SM	Sand (Reese, et al.)	65.6	38	-		
689 to 685	CL	Stiff Clay (w/o Free Water)	62.6	-	2,000		

11.3 ESTIMATED SETTLEMENT

Settlement of the proposed bridge supported on CIDH piles in the manner recommended is estimated to be less than 0.5 inch. A detailed settlement analysis for deep foundations was beyond the scope of this study. NV5 would be pleased to perform a detailed settlement analysis on a case-by-case basis, if requested.

11.4 CIDH PILE DESIGN AND CONSTRUCTION CONSIDERATIONS

Caltrans standard specifications and special provisions for "Cast-in-Drill Hole (CIDH) Piling" should apply for construction of the CIDH piles. Groundwater is expected during pile construction. The design groundwater level is at 5 feet below the existing surface. However, at the time of construction, the groundwater elevation may be different due to seasonal fluctuations or other conditions.

Mineral slurry may be required to construct the CIDH piles in wet-hole conditions. Allowable slurries shall be approved by the Engineer. Temporary or permanent steel casing may be necessary for portions of CIDH piles within alluvium containing loose granular zones. The method for placing the permanent steel casing should be chosen by the contractor and approved by the Engineer so as to ensure that the casing provides a secure seal with the bedrock to prevent running, caving, or heaving of alluvial soils into the drilled shaft. There shall be no voids surrounding the casing. Due to the lateral and skin friction resistance demands on the CIDH piles, construction methods should be chosen that ensure the piles and casings are installed tightly within the native undisturbed material. In the event that permanent steel casing is utilized, no frictional resistance for the cased pile zones should be prescribed.

The contractor should anticipate variable drilling conditions within the bedrock and in very dense weathered materials. The contractor should also anticipate the need for soft and hard rock drilling techniques to extend the piles to the recommended depth. The amount of drilling difficulty experienced by the contractor should be expected to be variable within the methods used.

The estimated capacity of the piles relies on a concrete bond between the walls of the drilled shaft and the surrounding soil/rock. It is imperative that the borehole walls not be contaminated with drill cuttings or loose materials.

12.0 ADDITIONAL CONSIDERATIONS

12.1 GENERAL

Based on the results of field exploration, laboratory testing, and engineering evaluation and analyses, the proposed construction is considered geotechnically feasible, provided the recommendations contained herein are incorporated into the project plans and specifications and implemented during construction.

12.2 APPROACH FILL AND GENERAL EARTHWORK

Fill settlement issues at the abutments are not anticipated provided that the embankments are constructed and compacted according to Caltrans specifications. Site grading should be performed in accordance with the following recommendations and the *Typical Earthwork Guidelines* provided in *Appendix F*. In the event of conflict, the recommendations presented herein supersede those of *Appendix F*.

- Clearing and Grubbing: Prior to grading, the project area should be cleared of significant surface vegetation, demolition rubble, trash, pavement, debris, etc. Any buried organic debris or other unsuitable contaminated material encountered during subsequent excavation and grading work should also be removed. Removed material and debris should be properly disposed of offsite. Holes resulting from removal of buried obstruction which extend below finished site grades should be filled with properly compacted soils. Any utilities within the footprint of planned structural improvements should be appropriately abandoned.

- Site Grading: Areas to receive surface improvements or fill soils should be treated as follows:
  - Excavatability: Based on the subsurface exploration, it is anticipated that the on-site soils can be excavated by modern conventional heavy-duty excavating equipment in good operating condition.
  - Structural Fill Placement: The on-site clay soil may not be suitable for backfill of trenches or buried structures. The on-site sandy soils may be used for backfill provided they are free of any contaminated soil, debris, organic matter, or other deleterious materials. Areas to receive fill and/or surface improvements should be scarified to a minimum depth of 6 inches, brought to near-optimum moisture conditions, and compacted to at least 90 percent relative compaction, based on laboratory standard ASTM D1557. Fill soils should be brought to within 2 percent over optimum moisture content and compacted in uniform lifts to at least 90 percent relative compaction (ASTM D1557). Rocks with a maximum dimension greater than 4 inches should not be placed in the upper 3 feet of pad grade. The optimum lift thickness to produce a uniformly compacted fill will depend on the size and type of construction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in loose thickness. Placement and compaction of fill should be observed and tested by the geotechnical consultant.
  - Graded Slopes: Graded slopes should be constructed at a gradient of 2:1 (H:V) or flatter. To reduce the potential for surface runoff over slope faces, cut slopes should be provided with brow ditches and berms should be constructed at the top of fill slopes.
  - Paved Areas and Flatwork: The soils in proposed paved areas and flatwork should be excavated to a minimum depth of one (1) foot below the proposed subgrade elevation, moisture conditioned, and uniformly recompacted to at least 90 percent of the soils maximum dry density (based on ASTM D1557). This treatment should extend a horizontal distance of at least one (1) foot beyond the outside perimeter.
  - Import Soils: Import soils should be sampled and tested for suitability by NV5 prior to delivery to the site. Imported fill materials should consist of clean granular soils free from

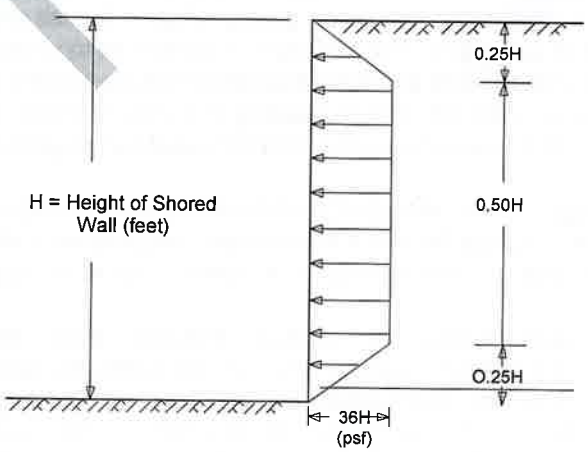
vegetation, debris, or rocks larger than 3 inches in maximum dimension. The Expansion Index value should not exceed a maximum of 20 (i.e., essentially non-expansive).

12.3 TEMPORARY EXCAVATIONS AND SHORING

Temporary, shallow excavations with vertical side slopes less than 4 feet high will generally be stable, although there is a potential for localized sloughing. In these soil types, vertical excavations greater than 4 feet high should not be attempted without proper shoring to prevent local instabilities. Stockpiled (excavated) materials should be placed no closer to the edge of a trench excavation than a distance defined by a line drawn upward from the bottom of the trench at an inclination of 1H:1V, but no closer than 4 feet. All trench excavations should be in accordance with Cal-OSHA regulations. For planning purposes, the native soil materials may be considered as Type C, as defined in the current Cal-OSHA soil classification.

Although not anticipated, in the event of possible applicability, temporary shoring may be accomplished by several methods including: hydraulic shores and trench plates; trench boxes; And soldier piles and lagging. For vertical excavations less than about 15 feet in height, cantilevered shoring may be used. Cantilevered shoring may also be used for deeper excavations; however, the total deflection at the top of the wall should not exceed one-inch. Therefore, shoring of excavations deeper than about 15 feet may need to be accomplished with the aid of tied back earth anchors. The excavation support system should be designed to resist lateral earth pressures of the soil and hydrostatic pressures. Preliminary design of cantilevered temporary shoring, a triangular distribution of lateral earth pressure may be used. It may be assumed that the subgrade soils, with a level surface behind the cantilevered shoring, will exert an equivalent fluid pressure of 37 pcf.

Tied-back or braced shoring should be designed to resist a trapezoidal distribution of lateral earth pressure. The recommended pressure distribution, for the case where the grade is level behind the shoring, is illustrated in the following diagram with the maximum pressure equal to 36H in psf, where H is the height of the shored wall in feet.



Any surcharge (live, including traffic, or dead load) located within a 1H:1V plane drawn upward from the base of the shored excavation should be added to the lateral earth pressures. The vertical loads imposed by existing structures, if any, should be determined by the structural engineer. The lateral

load contribution of a uniform surcharge load located across the 1:1 (H:V) zone behind the excavation may be calculated in accordance with *Figure 6, Lateral Surcharge Loads*. Lateral load contributions of surcharges located at a distance behind the shored wall should be provided by NV5 once the load configurations and layouts are known. As a minimum, a 2-ft equivalent soil surcharge is recommended to account for nominal construction loads.

The actual shoring design should be provided by a registered civil engineer in the State of California experienced in the design and construction of shoring under similar conditions. Once the final excavation and shoring plans are complete, the plans and the design should be reviewed by NV5 for conformance with the design intent and geotechnical recommendations. The shoring system should further satisfy requirements of Cal-OSHA.

12.4 DEWATERING

Groundwater was encountered at depths between approximately 18 to 19 feet below the existing ground surface. The groundwater table is subject to fluctuations in response to a number of factors. If necessary, the actual means and methods of any dewatering scheme should be established by a contractor with local experience. It is important to note that temporary dewatering, if necessary, will require a permit and plan that complies with RWQCB regulations. If excessive water is encountered, NV5 should be contacted to provide additional recommendations for temporary construction dewatering. Any cases of localized seepage or heavy precipitation should be monitored during construction. Based on the subsurface exploration the onsite soils maybe considered to be relatively permeable.

12.5 RETAINING WALLS

Retaining walls should be designed in accordance with the following recommendations and design parameters presented herein.

- Bearing Capacity - The proposed wall may be supported on continuous footings bearing on dense natural soils or properly compacted fill soils at a minimum depth of 18 inches beneath the lowest adjacent grade. At this depth, footings may be designed for an allowable soil-bearing pressure of 2,000 psf. This value may be increased by one-third for loads of short duration, such as wind or seismic forces.

- Lateral Earth Pressures - Based on laboratory test results and encountered soil conditions, the recommended lateral earth pressures for preliminary design of flexible retaining walls supported on shallow foundations are summarized in the following Table 7.

Table 7 - Recommended Lateral Earth Pressures

Parameter	Recommended Values				
	Level Backfill	5H:1V Slope	4H:1V Slope	3H:1V Slope	2H:1V Slope
Static Active Earth Pressure (P_a)	37H	43H	45H	49H	62H
Static At-Rest Earth Pressure (P_o)	60H	72H	75H	79H	87H
Seismic Earth Pressure (P_e)	23H	26H	27H	30H	38H
Coefficient of Friction (μ) for Lateral Resistance of Footing	0.35	N/A	N/A	N/A	N/A
Passive Earth Pressure (P_p) for Lateral Resistance of Footing	250H	N/A	N/A	N/A	N/A

Notes:

1. All values of height (H) are in feet (ft) and pressure (P) in pounds per square feet (psf).
2. Seismic earth pressure (P_e) is in addition to the static active or at-rest pressure, P_a and P_o which should be distributed as an inverted triangle along the wall height and the resultant of this pressure is an increment of force which should be applied to the back of the wall in the upper one-third (1/3) of the wall height and may also be applied as a reduction of force to the front of the wall in the upper one-third (1/3) of the footing depth.
3. The above pressure values do not include hydrostatic pressures that might be caused by groundwater or water trapped behind the structure.
4. The pressures listed in the table were based on the assumption that backfill soils will be compacted to 90 percent of maximum dry density (per ASTM D1557).
5. The coefficient of friction (μ) should be applied to dead normal (buoyant) loads when evaluating the sliding frictional resistance.
6. A resistance factor of 0.5 has been applied to the passive earth pressure and may be combined with the sliding frictional resistance using a resistance factor of 0.80. Neglect the upper 6 inches for passive pressure unless the surface is contained by a pavement or a slab. The passive earth pressure should not exceed a maximum value of 3,000 psf.
7. In addition to the above-mentioned pressures, retaining walls must be designed to resist horizontal pressures that may be generated by surcharge loads applied at the ground surface such as from uniform loads or vehicle loads. Figure 6 may be used to evaluate these surcharge loads.

- Drainage and Waterproofing - Retaining walls should be properly drained, and if desired, appropriately waterproofed. Adequate backfill drainage is essential to provide a free-drained backfill condition and to reduce the potential for the development of hydrostatic pressure buildup behind walls. Drainage behind the retaining walls may be provided with geosynthetic drainage composite such as TerraDrain, MiraDrain, or equivalent, placed continuously along the back of the wall and connected to a 4-inch-diameter perforated pipe. The pipe should be sloped at least 2 percent and surrounded by 3 cubic feet per foot of ¾-inch crushed rock wrapped in suitable non-woven filter fabric (Mirafi 140N or equivalent) or Caltrans Class 2 permeable granular filter materials without filter fabric. The crushed rock should meet the requirements defined in Section 200-1.2 of the latest edition of the Standard Specification for Public Works Construction (Greenbook). These drains should be connected to an adequate discharge system.

In lieu of a perforated drainage pipe and connection to an existing drainage system, weep holes or open vertical masonry joints may be provided in the lowest row of block exposed to the air to reduce the buildup of hydrostatic pressure behind the wall. Weep holes should be a minimum of three inches in diameter and provided at intervals of at least every six feet along the wall. Open vertical masonry joints should be provided at a minimum of 32-inch intervals. A continuous gravel fill, a minimum of one cubic foot per foot should be placed behind the weep holes or open masonry joints. The gravel should be wrapped in filter fabric (Mirafi 140N or equivalent). To prevent efflorescence at the face of the wall, the wall may also be appropriately waterproofed. Waterproofing treatments and alternative, suitable wall drainage products are available commercially. Design of waterproofing and its protection during construction should be addressed by the project design professional.

- Retaining Wall Backfill Compaction - Retaining wall backfill material should be non-expansive (E.I. of 20 or less) and free draining. Backfill should be brought to near-optimum moisture conditions and compacted by mechanical means to at least 90 percent relative compaction (ASTM D1557). Care should be taken when using compaction equipment in close proximity to retaining walls so that the walls are not damaged by excessive loading.

12.6 PAVEMENTS

Design of asphalt concrete pavement sections depends primarily on support characteristics (strength) of soil beneath the pavement section and on cumulative traffic loads within the service life of the pavement. Strength of the pavement subgrade is represented by R-value test data. R-value tests were performed on representative samples of the near-surface soil. The results yielded R-values ranging from 8 and 11. A summary of the test is included in *Appendix B*.

Traffic loads within service life of a pavement are represented by a Traffic Index (TI), which is calculated based on anticipated traffic loads and on the projected number of load repetitions during the design life of the pavement. The design TI value should be verified by the project Civil/Traffic Engineer prior to construction.

Preliminary pavement section recommendations were developed using a design R-value of 5 and traffic indices ranging from 6.0 to 12.0. The project Engineer should select the appropriate pavement section based on the anticipated traffic loads. NV5 can provide alternate sections based on other traffic loadings, if requested. Based on these design parameters, analysis in accordance with California Department of Transportation (Caltrans) Highway Design Manual, and assuming compliance with site preparation recommendations, NV5 recommends the flexible and rigid structural pavement sections presented in the following Table 8.

Table 8 - Flexible Asphalt Pavement Sections (Design R-value = 5)

Traffic Index (TI)	Pavement Section	
	AC(1) (inches)	AB(2) (inches)
6.0	4.0	13.0
8.0	5.0	18.0
10.0	6.0	24
12.0	7.5	30.0

(1) Asphaltic Concrete
(2) Crushed Aggregate Base (CAB), Green Book Section 200-2.2, compacted to at least 95% relative compaction (ASTM D1557);
Note: The upper 12 inches of subgrade soils should be compacted to at least 95% relative compaction (ASTM D1557).

Assuming that the near-surface on-site soils will be thoroughly mixed and compacted during grading operations, it is recommended that R-value testing be performed on representative soil samples after rough grading operations on the upper 2 feet to confirm applicability of the above pavement sections. If the paved areas are to be used during construction, or if the type and frequency of traffic is greater than assumed in the design, the pavement section should be re-evaluated for the anticipated traffic.

The upper 12 inches of subgrade soils should be compacted to a minimum dry density of 95 percent of the material's maximum dry density as determined by the ASTM D1557 test procedure. The aggregate base should conform to Class II aggregate base in accordance with Section 400.2.3 of the 2009 Regional Supplement to Greenbook Standard Specifications for Public Works Construction. The base course should also be compacted to a minimum dry density of 95 percent. Field and laboratory testing should be used to check compaction, aggregate gradation, and compacted thickness.

The asphalt pavement should be compacted to 95 percent of the unit weight as tested in accordance with the Hveem procedure (ASTM D1560). The maximum lift thickness should be 4.0 inches. The asphalt material shall conform to Type III, Class B2 or B3 of the Standard Specifications for Public Works Construction and the supplement. An approved mix design should be submitted 30 days prior to placement. The mix design should include proportions of materials, maximum density and required lay-down temperature range. Field and lab testing should be used to verify oil content, aggregate gradation, compaction, compacted thickness, and lay-down temperature.

Control joints are required for the Portland cement concrete pavement (rigid) at a maximum of 15 feet spacing each way and should be constructed immediately after concrete finishing.

The performance of pavements is highly dependent upon providing positive surface drainage away from the edge of the pavement. The ponding of water on or adjacent to pavement areas will likely cause failure of the subgrade and resultant pavement distress. Where planters are proposed, the

perimeter curb should extend at least 6 inches below the subgrade elevation of the adjacent pavement. In addition, experience indicates that even with these provisions, a saturated subgrade condition can develop as a result of increased irrigation, landscaping and surface runoff. A subdrain system should be considered along the perimeter of pavement subgrade areas to reduce the potential of this condition developing. The subdrain system should be designed to intercept irrigation water and surface runoff prior to entry into the pavement subgrade and carry the water to a suitable outlet.

13.0 DESIGN REVIEW AND CONSTRUCTION MONITORING

Geotechnical review of plans and specifications is of paramount importance in engineering practice. The poor performance of many pipelines has been attributed to inadequate geotechnical review of construction documents. Additionally, observation and testing of the backfill, subgrade and base will be important to the performance of the proposed improvements. The following sections present NV5's recommendations relative to the review of construction documents and the monitoring of construction activities.

13.1 PLANS AND SPECIFICATIONS

The design plans and specifications will be reviewed and approved by NV5 prior to construction, as the geotechnical recommendations may need to be re-evaluated in the light of the actual design configuration. This review is necessary to evaluate whether the recommendations contained in this report and future reports have been properly incorporated into the project plans and specifications.

13.2 CONSTRUCTION MONITORING

Site preparation, removal of unsuitable soils, assessment of imported fill materials, backfill placement, and other earthwork operations should be observed and tested. The substrata exposed during the construction may differ from that encountered in the test borings. Continuous observation by a representative of NV5 during construction allows for evaluation of the soil/rock conditions as they are encountered and allows the opportunity to recommend appropriate revisions where necessary.

14.0 LIMITATIONS

The recommendations and opinions expressed in this report are based on NV5's review of background documents and on information developed during this study. It should be noted that this study did not evaluate the possible presence of hazardous materials on any portion of the site. More detailed limitations of this geotechnical study are presented in the GBA's information bulletin in *Appendix G*.

Due to the limited nature of the field explorations, conditions not observed and described in this report may be present on the site. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation and laboratory testing can be performed upon request. It should be understood that conditions different from those anticipated in this report may be encountered during the proposed structure construction operations.

Site conditions, including ground-water level, can change with time as a result of natural processes or the activities of man at the subject site or at nearby sites. Changes to the applicable laws, regulations,

codes, and standards of practice may occur as a result of government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which NV5 has no control.

NV5's recommendations for this site are, to a high degree, dependent upon appropriate quality control of subgrade preparation, fill/backfill placement, etc. Accordingly, the recommendations are made contingent upon the opportunity for NV5 to observe grading operations and foundation excavations for the proposed construction. If parties other than NV5 are engaged to provide such services, such parties must be notified that they will be required to assume complete responsibility as the geotechnical engineer of record for the geotechnical phase of the project by concurring with the recommendations in this report and/or by providing alternative recommendations.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. NV5 should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

NV5 has endeavored to perform this study using the degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical professionals with experience in this area in similar soil/rock conditions. No other warranty, either expressed or implied, is made as to the conclusions and recommendations contained in this study.

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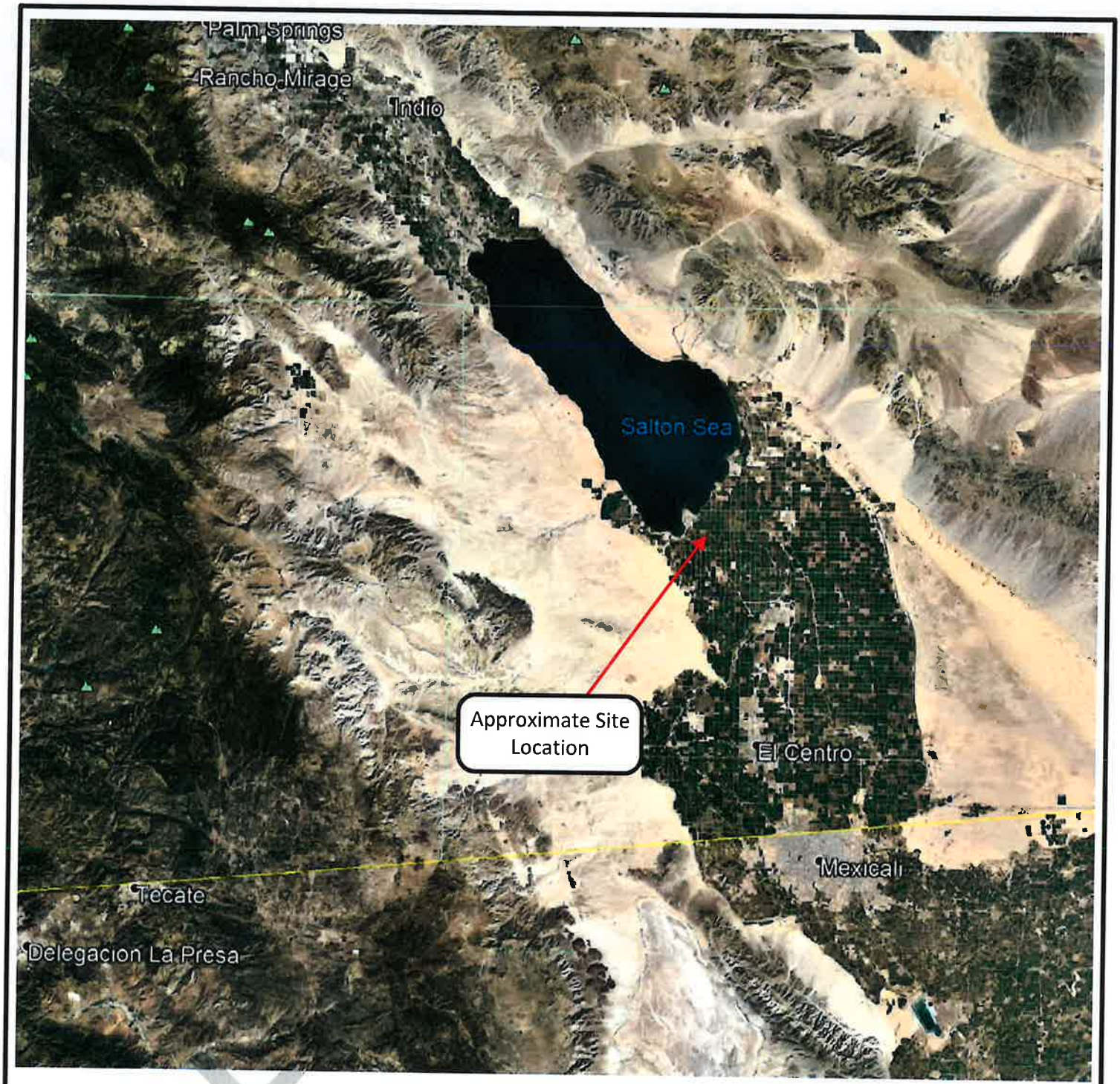
FIGURES



N

Reference: Google Earth 2019

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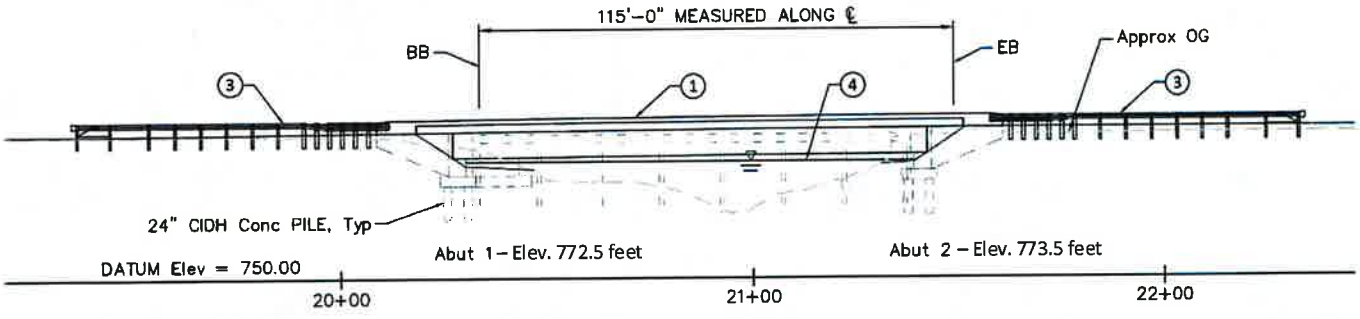
Project No: 227518-0000439
Drawn: SB
Date: April 2019

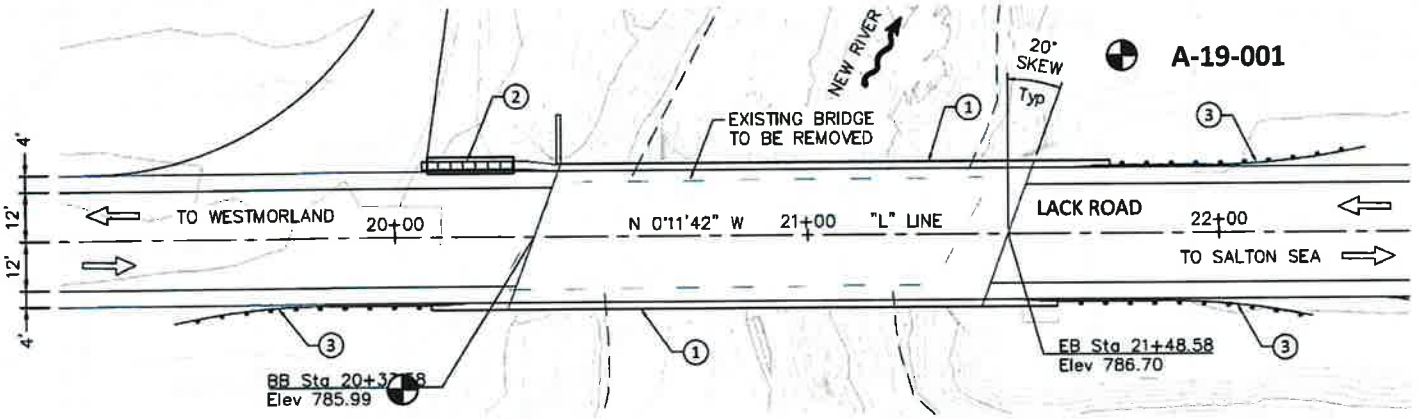
Site Location Map
Lack Road Bridge Replacement Over New River
Bridge No. 58C-101
Imperial County, CA

Figure 1



ELEVATION
SCALE: 1"=20'

GRAPHIC SCALE
0' 10' 20' 30' 40' 60' 80'
SCALE 1"= 20'



Note: Datum reflects addition of 1,000 feet to actual elevation

Legend:

A-19-002 ⊕ **Approximate location of geotechnical boring**

Reference: NV5, General Plan, Preliminary, Lack Road Bridge Replacement Over New River, Bridge No. 58C-101, dated June 4, 2019.

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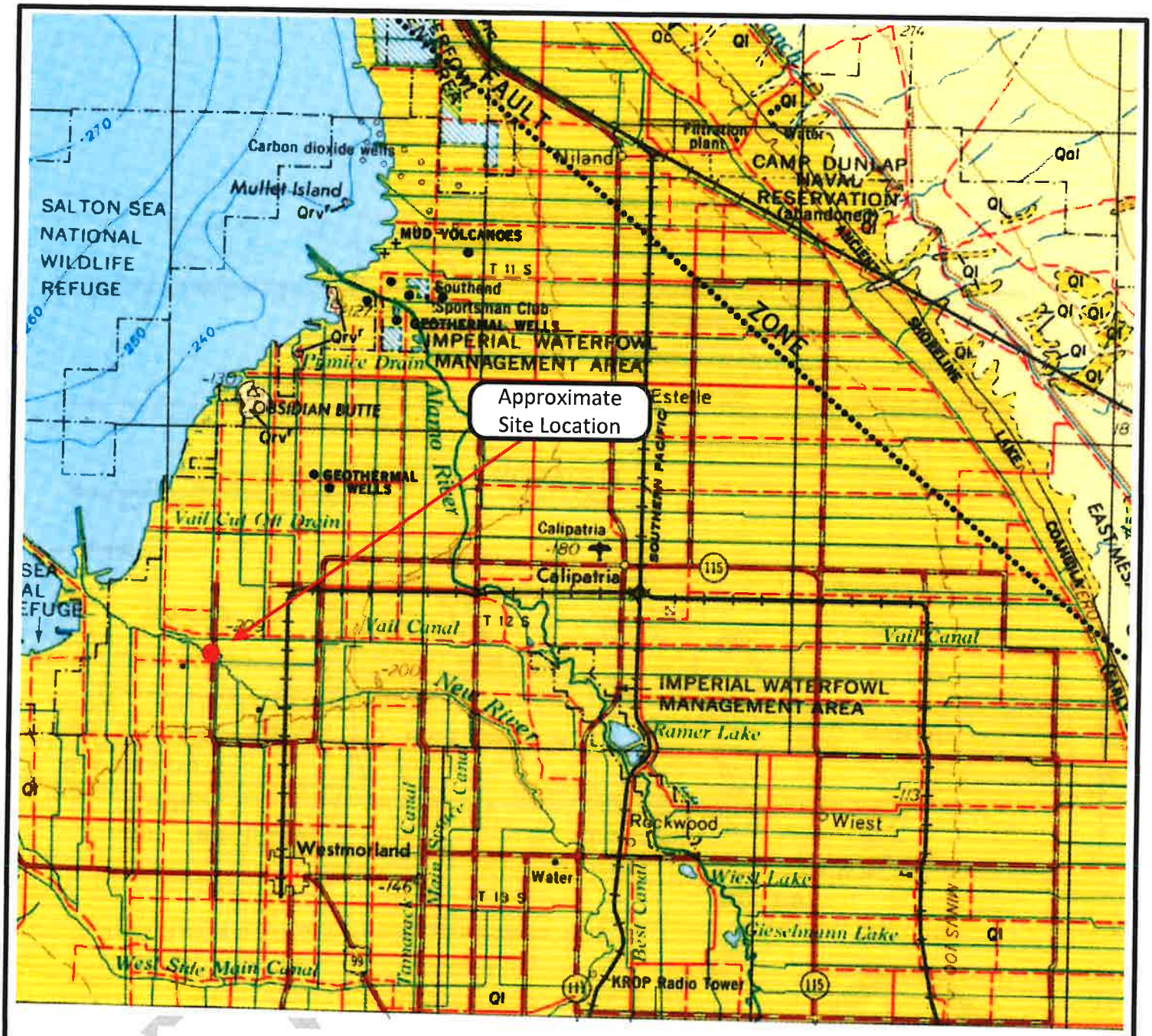
Boring Location Map
Lack Road Bridge Replacement Over New River
Bridge No. 58C-101
Imperial County, CA
Figure 2



DESCRIPTION OF MAP UNITS

Qal — **Alluvium**

Qrv — **Recent volcanic: Qrv^r —rhyolite; Qrv^a —andesite; Qrv^b —basalt; Qrv^p —pyroclastic rocks**

Ql — **Quaternary lake deposits**

0 2 4-miles

N

Reference: Jennings, C.W., 1967, Geologic Map California, Olaf P. Jenkins Edition, Salton Sea Edition: Department of Conservation, California Geological Survey, scale 1:250,000.

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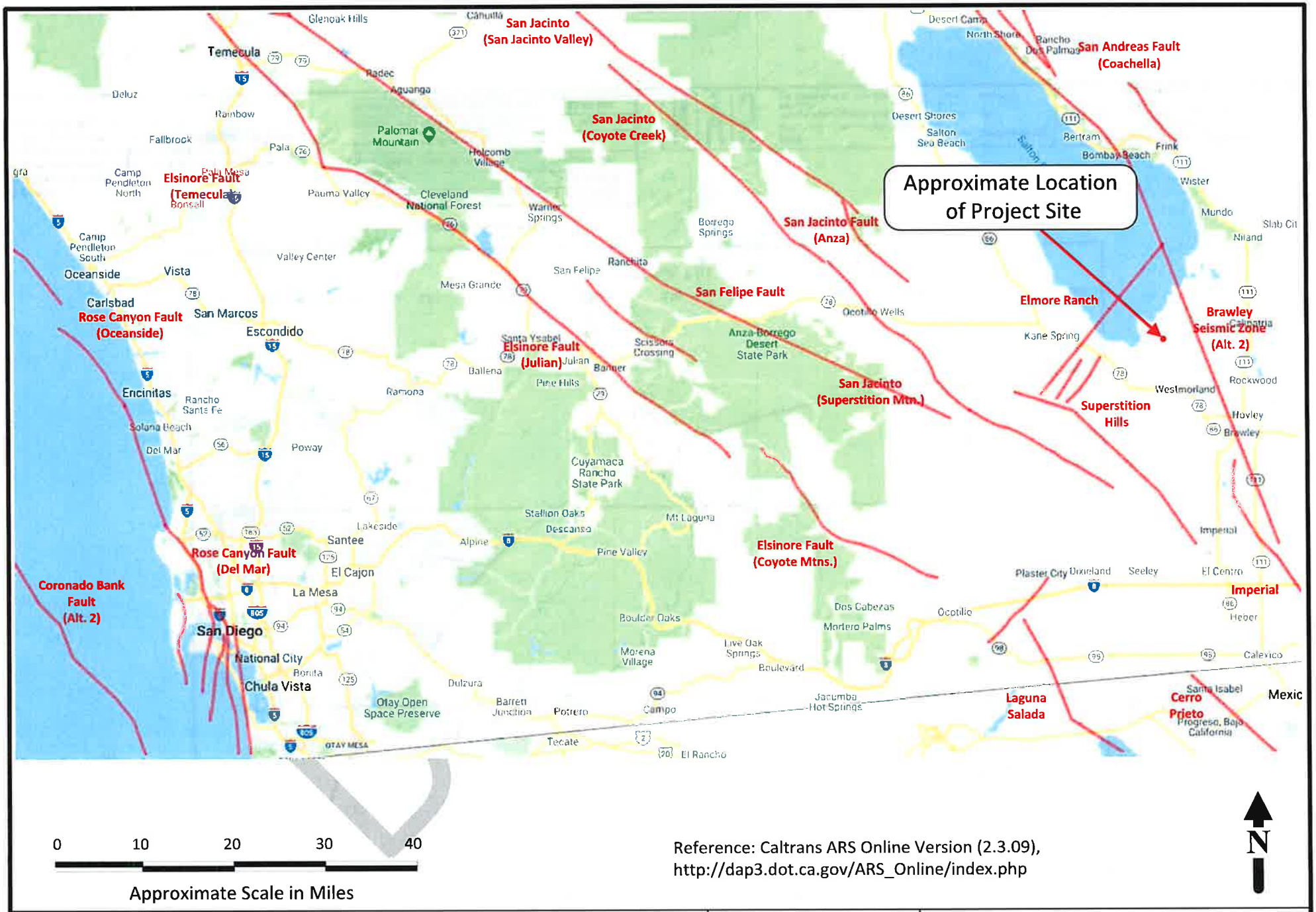
Date: April 2019

Regional Geologic Map
Lack Road Bridge Replacement Over New River
Bridge No. 58C-101
Imperial County, CA

Figure 3



Reference: Caltrans ARS Online Version (2.3.09),
http://dap3.dot.ca.gov/ARS_Online/index.php

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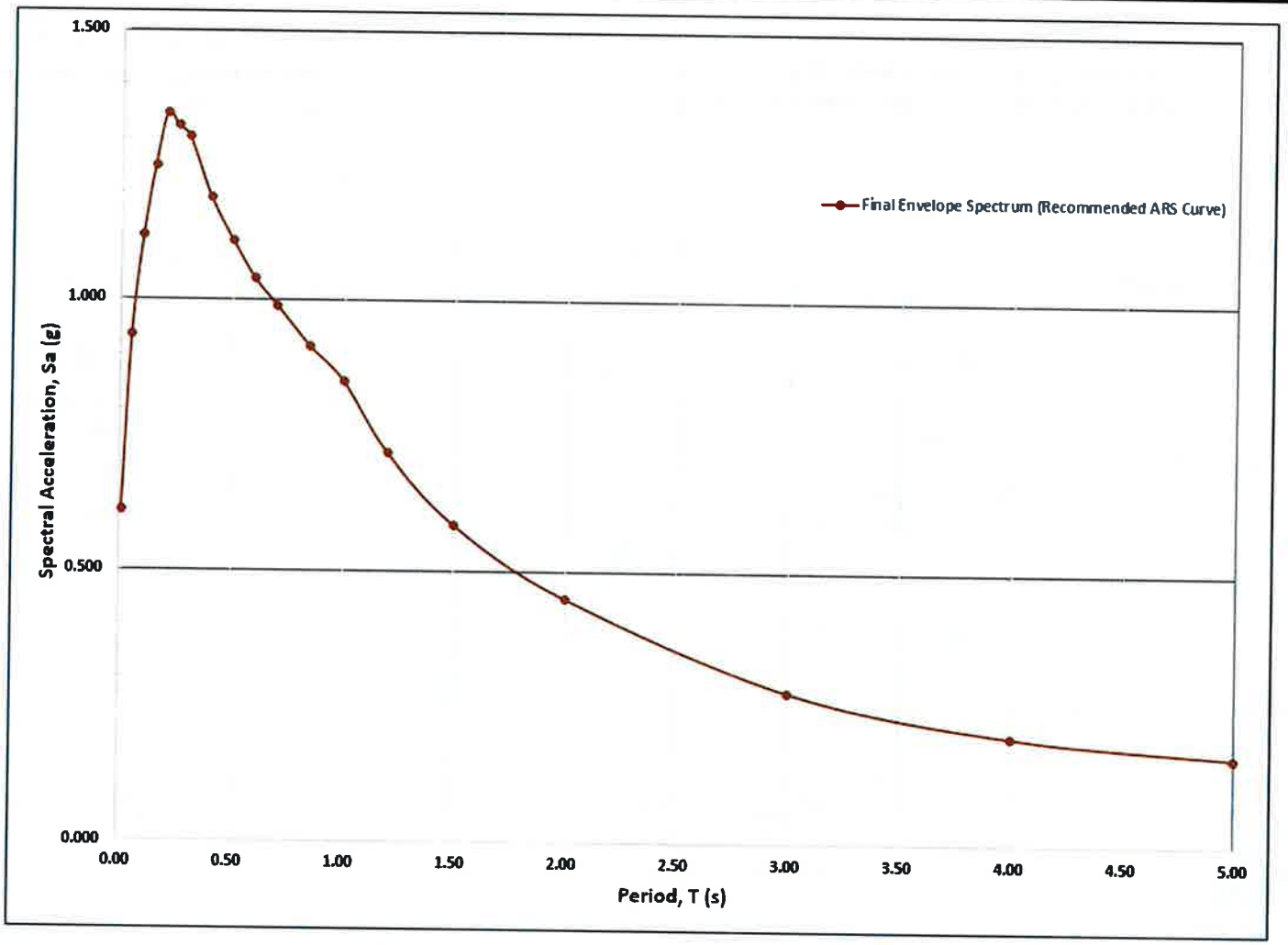
Project No: **227518-0000439**
Drawn: **SR**
Date: **May 2019**

Regional Fault Map

Lack Road Bridge Replacement Over New River
Bridge No. 58C-101
Imperial County, California

Figure 4



Project Site Information:

Latitude	33.100001
Longitude	-115.648826
Ave. Shear Wave Velocity, Vs_{30}	270 m/s
Depth to Vs = 1.0 km/s, $Z_{1.0}$ (m)	N/A
Depth to Vs = 2.5 km/s, Z2.5 (km)	N/A
Near-Fault Deaggregation Distance	11.62 km

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1. CalTrans ARS Online Tool (v2.3.09), 2017.
2. CalTrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, Nov. 2012.
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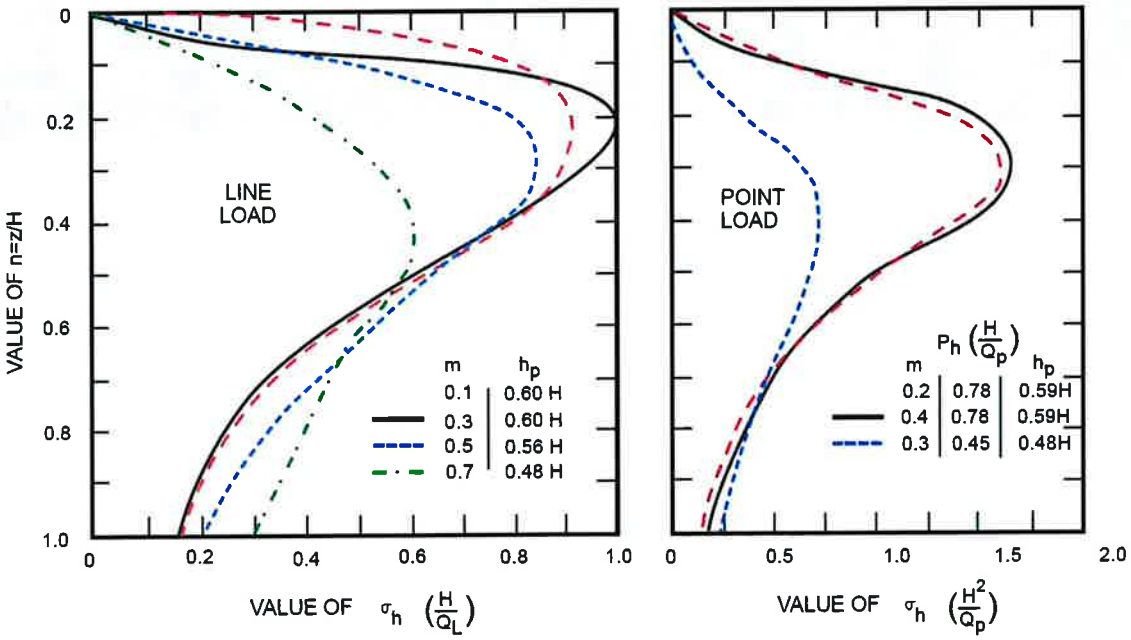
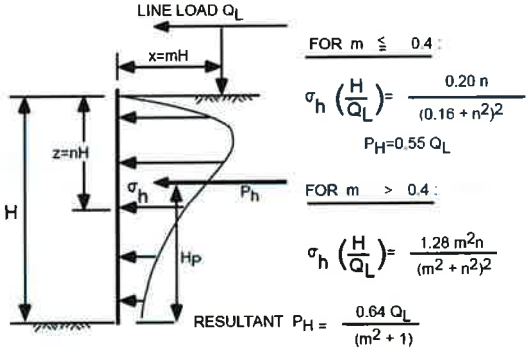
Date: May 2019

Recommended Bridge Design
ARS Curve
Lack Road Bridge Replacement Over New River
Bridge No. 58C-101
Imperial County, California Figure No. 5





FOR $m \leq 0.4$:

$$\sigma_h \left(\frac{H}{Q_L}\right) = \frac{0.20\,n}{(0.16 + n^2)^2}$$

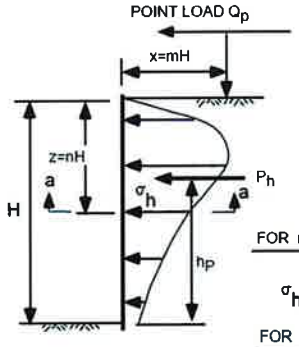
$P_H = 0.55\,Q_L$

FOR $m > 0.4$:

$$\sigma_h \left(\frac{H}{Q_L}\right) = \frac{1.28\,m^2 n}{(m^2 + n^2)^2}$$

RESULTANT $P_H = \frac{0.64\,Q_L}{(m^2 + 1)}$

PRESSURE FROM LINE LOAD Q_L
(BOUSSINESQ EQUATION MODIFIED BY EXPERIMENT)



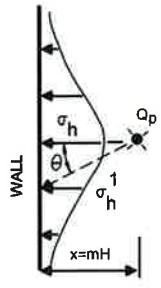
FOR $m \leq 0.4$:

$$\sigma_h \left(\frac{H^2}{Q_p}\right) = \frac{0.28\,n^2}{(0.16 + n^2)^3}$$

FOR $m > 0.4$:

$$\sigma_h \left(\frac{H^2}{Q_p}\right) = \frac{1.77\,m^2 n^2}{(m^2 + n^2)^3}$$

$$\sigma_h^1 = \sigma_h \cos 2(1.1\theta)$$



SECTION a ~a
PRESSURE FROM POINT LOAD Q_p
(BOUSSINESQ EQUATION MODIFIED BY EXPERIMENT)

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Drawn: **SB**
Date: **April 2019**

Lateral Surcharge Loads

Lack Road Bridge Replacement Over New River
Bridge No. 58C-101
Imperial County, California

Figure 6

APPENDIX A

Boring Records

Boring Records

To investigate the geotechnical subsurface soil and groundwater conditions at the project site, NV5 drilled two exploratory borings (A-19-001 through A-19-002) to approximately 100 feet below ground surface (bgs). The borings were drilled using an 8-inch diameter hollow-stem auger drilling technique to the maximum depth explored. Baja Exploration drilled and sampled the borings using a CME-95 truck-mounted drill rig which has been calibrated to an average hammer efficiency ratio (ERi) of 67.9%. All drilling, field testing and traffic control companies were subcontractors to NV5.

The boring locations are shown on Figure 2, Boring Location Map. The boring records are attached in this appendix.

All field explorations were supervised by an NV5 engineering geologist licensed in California and conducted in accordance with the requirements given in the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010). These Boring Records were prepared in general accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) and associated errata dated August 2018.

Soil samples were collected at 5-ft alternating depth intervals using Standard Penetration Test (SPT) sampler in accordance with ASTM D1586 and Modified California ring-lined split-barrel samplers in accordance with ASTM D3550. Bulk samples of near surface soils and every major change of soil stratigraphy will also be collected from auger cuttings and placed in sealed plastic bags.

SPT drive samples were obtained using a 2.0-inch outside diameter and 1.4-inch inside diameter split-spoon sampler without lining. The soils recovered from the SPT sampling were stored in sealed plastic bags to preserve the natural moisture content.

Modified California drive samples were collected with a 3.0-inch outside diameter 2.5-inch inside diameter split-barrel sampler and a 2.4-inch inside diameter cutting shoe. The sampler barrel consists of 18-inch long metal rings for sample collection and has an additional length of waste barrel. Stainless steel or brass liner rings for sample collection are 1-inch high, 2.4-inch inside diameter, and 2.5-inch outside diameter. Modified California drive samples were retained in the metal rings and placed in sealed plastic canisters to prevent loss of moisture.

At each sampling interval, the drive samplers were fitted onto a sampling rod, lowered to the bottom of the boring, and driven 18 inches or to refusal (50 blows per 6 inches) with a 140-lb free-falling hammer dropped from a height of 30 inches using an energy-calibrated hammer delivery system. Compared to the SPT, the California sampler provides less disturbed samples.

At the completion of the drilling and sampling, the boring was abandoned by backfilling the borehole with Bentonite grout.

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Name
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND and SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Name
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (ASTM D 1557)
CR	Corrosion, Sulfates, Chlorides (CTM 643-99; CTM 417-06; CTM 422-06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeablility (CTM 220-05)
PA	Particle Size Analysis (ASTM D422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301-00)
SE	Sand Equivalent (CTM 217-99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06) Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Mud Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (short-term)
- Static Water Level Reading (long-term)

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REPORT TITLE: **Boring Record**				HOLE ID: **A-19-001**
DIST	COUNTY: **IMP**	ROUTE	POSTMILE	EA
PROJECT OR BRIDGE NAME: **Lack Road Bridge Replacement Over New River**				
BRIDGE NUMBER: **58C-101**	PREPARED BY: **S. Burford**		DATE: **5/17/2019**	SHEET: **1 of 2**

CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	Pocket Penetrometer (tsf)	Torvane (tsf)	Field Approximation
Very Soft	<0.25	<0.25	<0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	0.25 - 0.50	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	0.50 - 1.0	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
S iff	1.0 - 2.0	1.0 - 2.0	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Ver Stiff	2.0 - 4.0	2.0 - 4.0	1.0 - 2.0	Readily indented by thumbnail
Hard	>4.0	>4.0	>2.0	Indented by humbna l with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60} - Value (blows / foot)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	>50

MOISTURE

Descriptor	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OF PROPORTION OF SOILS

Descriptor	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

NOTE: This legend sheet provides descriptions and associated criteria for required soil description components only. Refer to Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010), Section 2, for tables of additional soil description components and discussion of soil description and identification.

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REPORT TITLE				HOLE ID
Boring Record				**A-19-001**
DIST	COUNTY	ROUTE	POSTMILE	EA
	IMP			
PROJECT OR BRIDGE NAME				
Lack Road Bridge Replacement Over New River				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
58C-101	**S. Burford**	**5/17/2019**	**2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or East/North and Datum)	HOLE ID
S. Burford	**3/19/2019**	**3/19/2019**	**33.100095 N, -115.648916 W**	**A-19-001**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
Baja Exploration			**Northwest Side of Bridge**	**-215.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow Stem Auger			**CME-95**	**8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
SPT (1.4") CalMod (2.4")			**Automatic, Weight= 140 lbs/ Drop= 30"**	**67.9 %**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READING DURING DRILLING	AFTER DRILLING	TOTAL DEPTH OF BORING
Bentonite Cement Slurry			**18.0 ft on 3/19/2019**	**18.0 ft on 3/19/2019**	**100.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Type	Sample ID	Blows per 6 in.	Blows per foot	Recovery %	RQD %	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks (Other Tests)
	0		Silty SAND (SM): Brown; moist; trace of gravel, fine to medium sand												
-216	1														
	2		2.5 El. -217.5'												
-218	3		Lean CLAY (CL): Brown; moist; trace of gravel, fine to medium sand												
	4		4.5 El. -219.5'		B01	n/a	n/a	n/a	n/a	21.0					R EI M
-220	5		Silty SAND (SM): Medium dense; brown; moist; trace of gravel, fine sand												
	6				S01	4 8	15	n/a	n/a	9.3					M
-222	7														
	8														
-224	9		9.0 El. -224.0'												
	10		Lean CLAY (CL): Brown; moist; 6% fine sand												
-226	11				S02	4 5 5	10	n/a	n/a	26.0	97.3				DS
	12														
-228	13														
	14														
-230	15		Lenses of Fat Clay, soft												
	16				S03	1 2 2	4	n/a	n/a	27.2					PA PI CR
-232	17														M
	18														
-234	19				B02	n/a	n/a	n/a	n/a						PA PI CR
	20		Soft												
-236	21				S04	1 1 2	3	n/a	n/a	38.7					PA M PI CR
	22														
-238	23														
	24														
-240	25														
	26				S05	6 7 9	16	n/a	n/a	26.7	95.6	PP=0.25			PA M PI CR
-242	27														
	28														
-244	29				B03	n/a	n/a	n/a	n/a						
	30		Medium stiff												
-246	31				S06	2 3 4	7	n/a	n/a	30.6					M
	32														
-248	33														
	34		Stiff												
-250	35														
	36		36.0 El. -251.0'		S07	3 5 7	12	n/a	n/a						
-252	37		Silty SAND (SM): Dense; brown; moist; fine sand												
	38														
-254	39														
	40														

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REPORT TITLE				HOLE ID
Boring Record				**A-19-001**
DIST	COUNTY	ROUTE	POSTMILE	EA
	IMPERIAL			
PROJECT OR BRIDGE NAME				
Lack Road Bridge Replacement Over New River				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
58C-101	**S. Burford**	**5/17/2019**	**1 of 3**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or East/North and Datum)	HOLE ID
S. Burford	3/19/2019	3/19/2019	33.100095 N, -115.648916 W	A-19-001
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
Baja Exploration			Northwest Side of Bridge	-215.0 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow Stem Auger			CME-95	8 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
SPT (1.4") CalMod (2.4")			Automatic, Weight= 140 lbs/ Drop= 30"	67.9 %
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READING: DURING DRILLING 18.0 ft on 3/19/2019; AFTER DRILLING 18.0 ft on 3/19/2019	TOTAL DEPTH OF BORING
Bentonite Cement Slurry				100.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Type	Sample ID	Blows per 6 in.	Blows per foot	Recovery %	RQD %	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks (Other Tests)
	40														
-256	41		Silty SAND (SM): Dense; brown; moist; fine sand		S08	9 17 28	45	n/a	n/a	22.2	103.0				PA PI M
	4		Dense												
-258	43														
	44														
-260	45		Dense		S09	14 17 19	36	n/a	n/a	21.9					PA PI M
	46														
-262	47														
	48														
-264	49														
	50		Medium dense												
-266	51		51.0 El. -266.0' Lean CLAY (CL): Stiff; brown; moist; fine sand		S10	7 8 14	22	n/a	n/a	33.3	89.2	PP=1.75			PA DS(51-51.5')
	52														
-268	53														
	54														
-270	55				S11	4 4 6	10	n/a	n/a						
	56		Stiff												
-272	57														
	58														
-274	59														
	60		Lenses of Fat Clay, stiff		S12	4 5 9	14	n/a	n/a	30.9					M
-276	61														
	62														
-278	63														
	64		Hard												
-280	65				S13	7 13 22	35	n/a	n/a						
	66		66.0 El. -281.0' Silty SAND (SM): Dense; brown; moist; fine sand												
-282	67														
	68														
-284	69														
	70		Dense		S14	12 17 20	37	n/a	n/a						PA
-286	71														
	72														
-288	73														
	74														
-290	75				S15	13 18 19	37	n/a	n/a	22.4	104.5				PA M
	76														
-292	77														
	78														
-294	79														
	80														

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REPORT TITLE				HOLE ID
Boring Record				A-19-001
DIST	COUNTY	ROUTE	POSTMILE	EA
	IMPERIAL			
PROJECT OR BRIDGE NAME				
Lack Road Bridge Replacement Over New River				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
58C-101	S. Burford	5/17/2019	2 of 3	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or East/North and Datum)	HOLE ID
S. Burford	**3/19/2019**	**3/19/2019**	**33.100095 N, -115.648916 W**	**A-19-001**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
Baja Exploration			**Northwest Side of Bridge**	**-215.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow Stem Auger			**CME-95**	**8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
SPT (1.4") CalMod (2.4")			**Automatic, Weight= 140 lbs/ Drop= 30"**	**67.9 %**
BORE HOLE BACKFILL AND COMPLETION			GROUNDWATER READING DURING DRILLING / AFTER DRILLING	TOTAL DEPTH OF BORING
Bentonite Cement Slurry			**18.0 ft on 3/19/2019 / 18.0 ft on 3/19/2019**	**100.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Type	Sample ID	Blows per 6 in.	Blows per foot	Recovery %	RQD %	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks (Other Tests)
-296	80 / 81 / 8		Silty SAND (SM): Dense; brown; moist; fine sand Very dense	X	S16	18 19 37	56	n/a	n/a						PA
-298	83 / 84														
-300	85 / 86		Dense	X	S17	11 21 24	45	n/a	n/a						
-302	87 / 88														
-304	89 / 90		Very dense												
-306	91 / 92			■	S18	27 42 50/4"	92	n/a	n/a	22.3	104 9				M
-308	93 / 94														
-310	95 / 96		Very dense	X	S19	10 26 33	59	n/a	n/a						
-312	97 / 98														
-314	99		Very dense	X	S20	14 28 39	67	n/a	n/a						
	100		100.0 El. -315.0'												
-316	101 / 102		Bottom of Borehole at 100.0 feet. Groundwater encountered at 18' BGS. Refusal not encountered. Backfilled with bentonite cement slurry.												
-318	103 / 104														
-320	105 / 106														
-322	107 / 108														
-324	109 / 110														
-326	111 / 112														
-328	113 / 114														
-330	115 / 116														
-332	117 / 118														
-334	119 / 120														

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REPORT TITLE				HOLE ID
Boring Record				**A-19-001**
DIST	COUNTY	ROUTE	POSTMILE	EA
	IMPERIAL			
PROJECT OR BRIDGE NAME				
Lack Road Bridge Replacement Over New River				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
58C-101	**S. Burford**	**5/17/2019**	**3 of 3**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or East/North and Datum)	HOLE ID
S. Burford	3/18/2019	3/18/2019	33.099600 N, -115.648740 W	A-19-002
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
Baja Exploration			Southeast Side of Bridge	-215.0 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow Stem Auger			CME-95	8 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
SPT (1.4") CalMod (2.4")			Automatic, Weight= 140 lbs/ Drop= 30"	67.9 %
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READING: DURING DRILLING 19.0 ft on 3/18/2019; AFTER DRILLING 19.0 ft on 3/18/2019	TOTAL DEPTH OF BORING 100.0 ft
Bentonite Cement Slurry				

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Type	Sample ID	Blows per 6 in.	Blows per foot	Recovery %	RQD %	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks (Other Tests)
	0		Silty SAND (SM): Brown; moist; fine sand												
-256	41		Medium dense	X	S08	4 5 8	13	n/a	n/a						PA PI
	42														
-258	43														
	44														
-260	45		Dense	X	S09	19 24 29	53	n/a	n/a	20.1	107.6				PA PI M
	46														
-262	47														
	48														
-264	49														
	50		Dense	X	S10	9 15 17	32	n/a	n/a						PA PI
-266	51														
	52														
-268	53		53.0 El. -268.0' Lean CLAY (CL): Stiff; brown; moist; fine sand												
	54														
-270	55		Stiff	X	S11	5 6 6	12	n/a	n/a	30.7					M
	56														
-272	57														
	58														
-274	59														
	60		Lenses of Fat Clay, very stiff	X	S12	6 8 10	18	n/a	n/a						
-276	61														
	62														
-278	63														
	64														
-280	65		Medium stiff												
	66		66.3 El. -281.3'	X	S13	6 7 8	15	n/a	n/a	27.8	97.0	PP=0.5			M
-282	67		Silty SAND (SM): Medium dense; brown; moist; fine sand												
	68														
-284	69														
	70		Medium dense	X	S14	6 8 8	16	n/a	n/a						PA
-286	71														
	72														
-288	73														
	74														
-290	75		Dense	X	S15	12 14 19	33	n/a	n/a	22.9					PA M
	76														
-292	77														
	78														
-294	79														
	80		80.0 El. -295.0'												

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REPORT TITLE				HOLE ID
Boring Record				A-19-002
DIST	COUNTY	ROUTE	POSTMILE	EA
	IMPERIAL			
PROJECT OR BRIDGE NAME				
Lack Road Bridge Replacement Over New River				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
58C-101	S. Burford	5/17/2019	2 of 3	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or East/North and Datum)	HOLE ID
S. Burford	**3/18/2019**	**3/18/2019**	**33.099600 N, -115.648740 W**	**A-19-002**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Station, Offset, Line)	SURFACE ELEVATION
Baja Exploration			**Southeast Side of Bridge**	**-215.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow Stem Auger			**CME-95**	**8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
SPT (1.4") CalMod (2.4")			**Automatic, Weight= 140 lbs/ Drop= 30"**	**67.9 %**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READING DURING DRILLING / AFTER DRILLING	TOTAL DEPTH OF BORING
Bentonite Cement Slurry			**19.0 ft on 3/18/2019 / 19.0 ft on 3/18/2019**	**100.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Type	Sample ID	Blows per 6 in.	Blows per foot	Recovery %	RQD %	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks (Other Tests)
	80														
-296	81		Silty SAND (SM): Brown; moist; fine sand Dense	X	S16	12 18 24	42	n/a	n/a						PA
	82														
-298	83														
	84														
-300	85		Very dense												
	86			X	S17	27 44 50/4"	94	n/a	n/a	20.2					M
-302	87														
	88														
-304	89														
	90		Very dense												
-306	91			X	S18	15 30 34	64	n/a	n/a						
	92														
-308	93														
	94														
-310	95		Very dense												
	96		96.0 El. -311.0' Lean CLAY (CL): Very stiff; brown; moist; fine sand	X	S19	18 28 36	64	n/a	n/a						
-312	97														
	98		Lenses of Fat Clay, very stiff												
-314	99			X	S20	9 9 12	21	n/a	n/a						
	100		100.0 El. -315.0'												
-316	101		Bottom of Borehole at 100.0 feet. Groundwater encountered at 19' BGS. Refusal not encountered. Backfilled with bentonite cement slurry.												
	102														
-318	103														
	104														
-320	105														
	106														
-322	107														
	108														
-324	109														
	110														
-326	111														
	112														
-328	113														
	114														
-330	115														
	116														
-332	117														
	118														
-334	119														
	120														

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REPORT TITLE				HOLE ID
Boring Record				**A-19-002**
DIST	COUNTY	ROUTE	POSTMILE	EA
	IMPERIAL			
PROJECT OR BRIDGE NAME				
Lack Road Bridge Replacement Over New River				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
58C-101	**S. Burford**	**5/17/2019**	**3 of 3**	

LOGGED BY: **S. Burford**	BEGIN DATE: **3/18/2019**	COMPLETION DATE: **3/18/2019**	BOREHOLE LOCATION (Lat/Long or East/North and Datum): **33.099600 N, -115.648740 W**
DRILLING CONTRACTOR: **Baja Exploration**			BOREHOLE LOCATION (Station, Offset, Line): **Southeast Side of Bridge**
DRILLING METHOD: **Hollow Stem Auger**			DRILL RIG: **CME-95**
SAMPLER TYPE(S) AND SIZE(S) (ID): **SPT (1.4") CalMod (2.4")**			SPT HAMMER TYPE: **Automatic, Weight= 140 lbs/ Drop= 30"**
BOREHOLE BACKFILL AND COMPLETION: **Bentonite Cement Slurry**			GROUNDWATER READING: DURING DRILLING **19.0 ft on 3/18/2019**; AFTER DRILLING **19.0 ft on 3/18/2019**

HOLE ID	SURFACE ELEVATION	BOREHOLE DIAMETER	HAMMER EFFICIENCY, ERi	TOTAL DEPTH OF BORING
A-19-002	**-215.0 ft**	**8 in**	**67.9 %**	**100.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Type	Sample ID	Blows per 6 in.	Blows per foot	Recovery %	RQD %	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks (Other Tests)
	80		Silty SAND (SM): Brown; moist; fine sand	X	S16	12 18 24	42	n/a	n/a						PA
-296	81		Dense												
	82														
-298	83														
	84														
-300	85		Very dense	X	S17	27 44 50/4"	94	n/a	n/a	20.2					M
	86														
-302	87														
	88														
-304	89														
	90		Very dense	X	S18	15 30 34	64	n/a	n/a						
-306	91														
	92														
-308	93														
	94														
-310	95		Very dense	X	S19	18 28 36	64	n/a	n/a						
	96		96.0 El. -311.0'												
-312	97		Lean CLAY (CL): Very stiff; brown; moist; fine sand												
	98		Lenses of Fat Clay, very stiff												
-314	99			X	S20	9 9 12	21	n/a	n/a						
	100		100.0 El. -315.0'												
-316	101		Bottom of Borehole at 100.0 feet. Groundwater encountered at 19' BGS. Refusal not encountered. Backfilled with bentonite cement slurry.												
	102														
-318	103														
	104														
-320	105														
	106														
-322	107														
	108														
-324	109														
	110														
-326	111														
	112														
-328	113														
	114														
-330	115														
	116														
-332	117														
	118														
-334	119														
	120														

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REPORT TITLE: **Boring Record**				HOLE ID: **A-19-002**
DIST	COUNTY: **IMPERIAL**	ROUTE	POSTMILE	EA
PROJECT OR BRIDGE NAME: **Lack Road Bridge Replacement Over New River**				
BRIDGE NUMBER: **58C-101**	PREPARED BY: **S. Burford**	DATE: **5/17/2019**	SHEET: **3 of 3**	

APPENDIX B

Laboratory Test Results

SUMMARY OF LABORATORY TEST RESULTS

In-situ Moisture and Density Tests

The in-situ moisture contents and dry densities of selected samples obtained from the test borings were evaluated in general accordance with the latest version of D2216 and D2937 laboratory test methods. The method involves obtaining the moist weight of the sample and then drying the sample to obtain it's dry weight. The moisture content is calculated by taking the difference between the wet and dry weights, dividing it by the dry weight of the sample and expressing the result as a percentage. The results of the in-situ moisture content and density tests are presented in the following table and on the boring records in Appendix A.

RESULTS OF MOISTURE CONTENT AND DENSITY TESTS
(ASTM D2216 and ASTM D2937)

Sample Location	Moisture Content (percent)	Dry Density (pounds per cubic foot)
A-19-001 @ 3 - 5 feet	21.0	Not Tested
A-19-001 @ 5 - 6.5 feet	9.3	Not Tested
A-19-001 @ 11 – 11.5 feet	26.0	97.3
A-19-001 @ 15 - 16.5 feet	27.2	Not Tested
A-19-001 @ 20 - 21.5 feet	38.7	Not Tested
A-19-001 @ 25 – 26.5 feet	26.7	95.6
A-19-001 @ 30 – 31.5 feet	30.6	Not Tested
A-19-001 @ 40 - 41.5 feet	22.2	103.0
A-19-001 @ 45 - 46.5 feet	21.9	Not Tested
A-19-001 @ 51 – 51.5 feet	33.3	89.2
A-19-001 @ 60 - 61.5 feet	30.9	Not Tested
A-19-001 @ 75 - 76.5 feet	22.4	104.5
A-19-001 @ 90 - 91.5 feet	22.3	104.9
A-19-002 @ 3 - 5 feet	17.6	Not Tested
A-19-002 @ 5 - 6.5 feet	26.3	Not Tested
A-19-002 @ 11 – 11.5 feet	23.8	99.2
A-19-002 @ 15 - 16.5 feet	28.9	Not Tested
A-19-002 @ 20 - 21.5 feet	32.4	87.0
A-19-002 @ 25 - 26.5 feet	34.4	Not Tested
A-19-002 @ 36 – 36.5 feet	23.8	98.7
A-19-002 @ 45 - 46.5 feet	20.1	107.6

Sample Location	Moisture Content (percent)	Dry Density (pounds per cubic foot)
A-19-002 @ 55 - 56.5 feet	30.7	Not Tested
A-19-002 @ 65 - 66.5 feet	27.8	97.0
A-19-002 @ 75 - 76.5 feet	22.9	Not Tested
A-19-002 @ 85 - 86.5 feet	20.2	Not Tested

Classification

Soils were visually and texturally classified in general accordance with the Unified Soil Classification System (ASTM D2487). Soil classifications are indicated on the boring records presented in Appendix A.

Particle-size Distribution Tests

An evaluation of the grain-size distribution of selected soil samples was performed in general accordance with the latest version of ASTM D6913 (including -200 wash). These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System. Particle size distribution test results are presented on the laboratory test sheets attached in this appendix.

Atterberg Limits

Atterberg limits tests were performed in general accordance with ASTM D4318 on selected soil samples. These tests were useful in classification of the soils. Test results are attached in this appendix and summarized below.

RESULTS OF ATTERBERG LIMITS TESTS
(ASTM D4318)

Location	A-19-001 @ 15 - 26.5 ft	A-19-001 @ 40 - 51 ft	A-19-002 @ 13 - 26.5 ft	A-19-002 @ 30 - 51.5
Group Name	Lean CLAY (CL)	Non-Plastic	Lean CLAY (CL)	Non-Plastic
Liquid Limit	37	NR	40	NR
Plastic Limit	17	NR	16	NR
Plasticity Index	20	NR	24	NR

Direct Shear

Direct shear tests were performed on representative relatively undisturbed samples in general accordance with ASTM D3080 to evaluate the shear strength characteristics of the on-site materials. The test method consists of placing the soil sample in the direct shear device, applying a series of normal stresses, and then shearing the sample at the constant rate of shearing deformation. The shearing force and horizontal displacements are measured and recorded as the soil specimen is sheared. The shearing is continued well beyond the point of maximum stress until the stress reaches a constant or residual value. The results of the tests are presented in the following table and attached in this appendix.

RESULTS OF DIRECT SHEAR TESTS
(ASTM D3080)

Location	USCS Classification	Peak Friction (degrees)	Ultimate Friction (degrees)	Peak Cohesion (psf)	Ultimate Cohesion (psf)	Notes
A-19-001 @ 11 - 11.5 ft.	CL	30	29	0	0	Relatively undisturbed
A-19-001 @ 51 - 51.5 ft.	CL	21	21	610	597	Relatively undisturbed
A-19-002 @ 11 - 11.5 ft.	CL	18	21	970	640	Relatively undisturbed
A-19-002 @ 36 - 36.5 ft.	SM	35	29	273	358	Relatively undisturbed

Resistance "R" Values Tests

R-Value tests were performed on samples of the on-site soils. The tests were performed in general accordance with California Test Method 301/ ASTM D2844. The result of the tests are presented below and attached in this appendix.

RESULTS OF R-VALUE TESTS
(ASTM D2844 and CTM 301)

Location	A-19-001 @ 3 – 5 ft	A-19-02 @ 3 – 5 ft
"R" Value	8	11
Material Type	Lean CLAY (CL)	Lean CLAY (CL)

Expansion Index Tests

Expansion index tests were performed on samples of the on-site soils. The tests were performed in general accordance with ASTM D4829. The result of the tests are presented below and attached in this appendix.

RESULTS OF EXPANSION INDEX TESTS
(ASTM D4829)

Location	Material Type	Initial Moisture Content, %	Final Moisture Content, %	Dry Density, pcf	Initial Saturation, %	Expansion Index	Potential Expansion
A-19-001 @ 3 - 5 ft.	Lean CLAY (CL)	12.4	29.3	102.4	51.9	**89**	**MEDIUM**
A-19-002 @ 3 - 5 ft.	Lean CLAY (CL)	10.6	23.2	108.4	51.5	**71**	**MEDIUM**

Soil Corrosivity Tests

Water soluble sulfate & chloride, resistivity and pH tests were performed by Clarkson Laboratory and Supply Inc., in general accordance with California Test Methods 643, 417 and 422 to provide an indication of the degree of corrosivity of the subgrade soils at locations tested with regard to concrete and normal grade steel.

RESULTS OF CORROSIVITY TESTS
(CTM 417, CTM 422 and CTM 643)

Sample Location	A-19-001 @ 15 - 26.5 ft	A-19-002 @ 13 - 26.5 ft
pH	8.3	8.2
Minimum Resistivity (Ohm-cm)	82	93
Water Soluble Sulfates (ppm)	2700	2880
Water Soluble Chlorides (ppm)	6410	5340
Material Type	Lean CLAY (CL)	Lean CLAY (CL)

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Natural Moisture & Density Report

(ASTM D2216 & ASTM D2937)

Date:	April 16, 2019	Job Number:	227518-0000439.00
Client:	County of Imperial	Report Number:	7182
Address:	1002 State Street	Lab Number:	117939-117940, 117942-
	El Centro, CA 92243		117947, 117949, 117951-
Project:	Lack Road Bridge – Bridge No.58C-101		117954, 117957- 117959
Project Add:	Imperial County, CA		117962-117964
			117966-117967

Sampled By: Sean Burford
Date Sampled: 3/19/2019
Date Rcvd: 3/19/2019

Lab Number	117939	117940	117942	117943	117944
Exploration No.	A-19-001	A-19-001	A-19-001	A-19-001	A-19-001
Sample ID	A-19-001-B01-1	A-19-001-S01-1	A-19-001-S03-1	A-19-001-S04-1	A-19-001-S05-1
Depth, ft.	3-5	5-6.5	15-16.5	20-21.5	26-26.5
Moisture Content, %	21.0	9.3	27.2	38.7	26.7
Dry Density, pcf	-	-	-	-	95.6

Lab Number	117945	117946	117947	117949	117951
Exploration No.	A-19-001	A-19-001	A-19-001	A-19-001	A-19-001
Sample ID	A-19-001-S06-1	A-19-001-S08-1	A-19-001-S09-1	A-19-001-S12-1	A-19-001-S15-1
Depth, ft.	30-31.5	41-41.5	45-46.5	60-61.5	76-76.5
Moisture Content, %	30.6	22.2	21.9	30.9	22.4
Dry Density, pcf	-	103.0	-	-	104.5

Lab Number	117952	117953	117954	117957	117958
Exploration No.	A-19-001	A-19-002	A-19-002	A-19-002	A-19-002
Sample ID	A-19-001-S18-1	A-19-002-B01-1	A-19-002-S01-1	A-19-002-S03-1	A-19-002-S04-1
Depth, ft.	91-91.5	3-5	5-6.5	15-16.5	21-21.5
Moisture Content, %	22.3	17.6	26.3	28.9	32.4
Dry Density, pcf	104.9	-	-	-	87.0

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Natural Moisture & Density Report

(ASTM D2216 & ASTM D2937)

Lab Number	117959	117962	117963	117964	117966
Exploration No.	A-19-002	A-19-002	A-19-002	A-19-002	A-19-002
Sample ID	A-19-002-S05-1	A-19-002-S09-1	A-19-002-S11-1	A-19-002-S13-1	A-19-002-S15-1
Depth, ft.	25-26.5	46-46.5	55-56.5	66-66.5	75-76.5
Moisture Content, %	34.4	20.1	30.7	27.8	22.9
Dry Density, pcf	-	107.6	-	97.0	

Lab Number	117967				
Exploration No.	A-19-002				
Sample ID	A-19-002-S17-1				
Depth, ft.	85-86.5				
Moisture Content, %	20.2				
Dry Density, pcf	-				

Respectfully Submitted,
NV5 West, Inc.

Reviewed by: Carl Henderson

Carl Henderson, PhD, PE, GE
CQA Group Director (San Diego)

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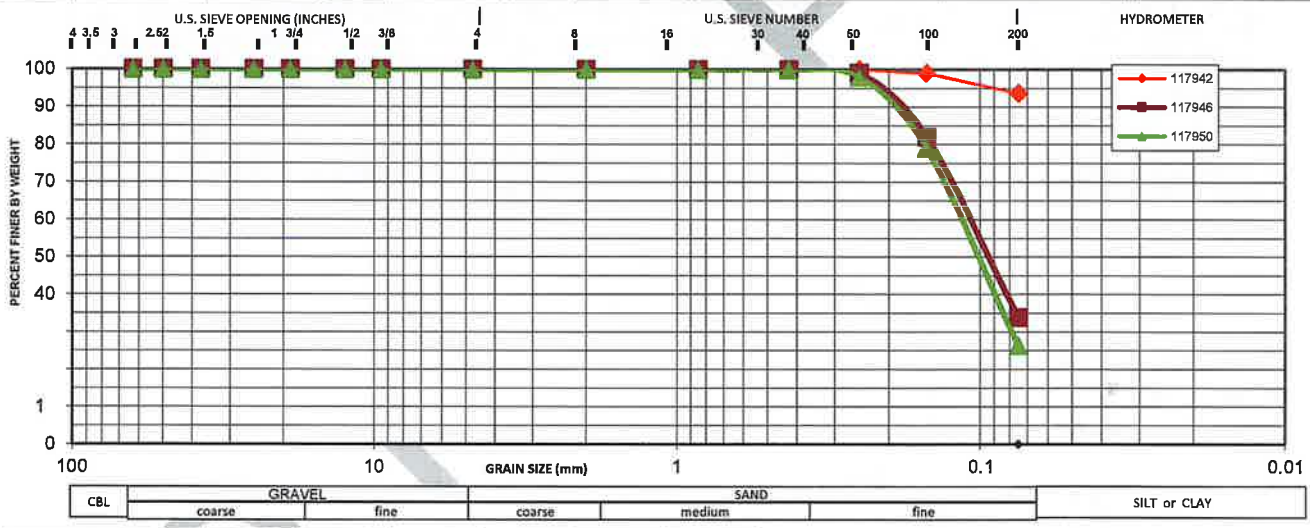
REPORT OF SIEVE ANALYSIS TEST

ASTM D6913 - Soil

a e:	Apr 6, 2019	Job Number:	227518-0000439.00
Client:	County of Imperial	Report Number:	7217
Address:	1002 State Street El Centro, CA 92243	Lab Number:	117942, 117946, 117950
Project :	Lack Road Bridge – Bridge No.58C-101		
Project Address:	Imperial County, CA		

	117942	117946	1179
Material	Lean CLAY (CL)	Silty SAND (SM)	Silty SAND (SM)
Color	Brown	Brown	Brown
Sample Location	A-19- 1 @ 15'-26.5'	A-19-001 @ 41'-51'	A-19-001 @ 70'-86.5'
Sample ID	A-19-0 1-S03,B02,S04,S05-1	A-19-001-S08,S09,S10-1	A-19-001-S14,S15,S16,S17-1
Date Sampled	3/19/2 19	3/19/2019	3/19/2019
Date Submitted	3/19/2019	3/19/2 19	3/19/2019
Sampled By	Sean Burford	Sean Burford	Sean Burford
Date Tested	3/28/2019	3/28/2 19	3/28/2019
Tested By	Darre Delgado	Darrel Delgado	Darrel Delgado



Sample ID:	117942	117946	117950			
Sieve Size			% Pa ng			
63mm (2 1/2")	100	100	100			
50mm (2")	100	100	100			
37.5mm (1 1/2")	100	100	100			
")	100	100	100			
/4")	100	100	100			
(1/2")	100	100	100			
3/8")	100	100	100			
(#4)	100	100	100			
0)	100	100	100			
#20)	100	100	100			
#40)	100	100	100			
#60)	100	99	98			
(#100)	99	82	79			
#200) washu	93.7	33.9	26.4			
s Modulus	0 0	0.2	0.			
Shape (sand & gravel)	N.R.	N.R.	Round			
Hardness (sand & gravel)	N.R.	H&D	N.R.			
c Gravity	2.65	2.65	2.65			
f Curvature (C_c)	N.R.	N.R.	N.R.			
f Uniformity (C_u)	N.R.	N.R.	N.R.			
l	0	0	0			
		66	74			
	93.7	33.9	26.4			
ass:	CL	SM	SM			

ardness: H&D = Hard & Durable; W&F = Weathered & Friable
ot Recorded; N/A: Not Available.

fully Submitted,
t, Inc.

Carl Henderson, PhD, PE ,GE
up Director (San Diego)

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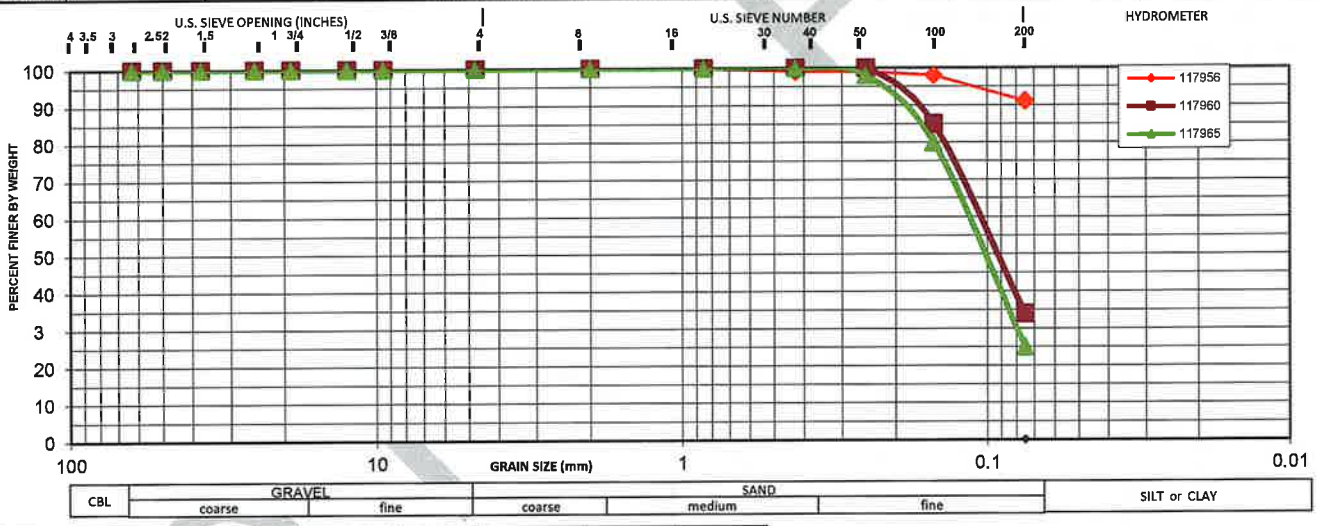
REPORT OF SIEVE ANALYSIS TEST

ASTM D6913 - Soil

a e:	April 16, 2019	Job Number:	227518-0000439.00
Client:	County of Imperial	Report Number:	7217
Address:	1002 State Street El Centro, CA 92243	Lab Number:	117956, 117960, 117965
Project :	Lack Road Bridge – Bridge No.58C-101		
Project Address:	Imp l County, CA		

	117956	117960	1179
Material	Lean CLAY (CL)	Silty SAND (SM)	Silty AND (SM)
Color	Brown	Brown	Brown
Sample Location	A-19-002 @ 13'-26.5'	A-19-002 @ 30'-51.5'	A-19-002 @ 70'-81.5'
Sample ID	A-19-0 2-B02,S03,S04,S05-1	A-19-002-S06,S07,S08,S09,S10-1	A-19-002-S14,S15,S16-1
Date Sampled	19	3/19/2019	3/19/2019
Date Submitted	3/19/2019	3/19/2019	3/19/2019
Sampled By	Sean Burford	Sean Burford	Sean Burford
Date Tested	3/28/2019	4/1/2019	4/1/2019
Tested By	Darre Delgado	Darre Delgado	Darrel Delgado



Sample ID:	117956	117960	117965			
Sieve Size	% Passing					
63mm (2 1/2")	100	100	100			
50mm (2")	100	100	100			
37.5mm (1 1/2")	100	100	100			
")	100	100	100			
/4")	100	100	100			
(1/2")	100	100	100			
3/8")	100	100	100			
(#4)	100	100	100			
0)	100	100	100			
#20)	100	100	100			
#40)	99	100	100			
#60)	99	100	98			
(#100)	98	85	80			
#200) washµ	91.1	33.9	25.0			
s Modulus	0 0	0.2	0.			
Shape (sand & gravel)	N.R.	N.R.	Round			
Hardness (sand & gravel)	N.R.	H&D	N.R.			
c Gravity	2.65	2.65	2.65			
f Curvature (C_c)	N.R.	N.R.	N.R.			
f Uniformity (C_u)	N.R.	N.R.	N.R.			
l	0	0	0			
		66	75			
	91.1	33.9	25.0			
ass:	CL	SM	SM			

ardness: H&D = Hard & Durable; W&F = Weathered & Friable
ot Recorded; N/A: Not Available.

fully Submitted,
t, Inc.

Carl Henderson, PhD, PE ,GE
up Director (San Diego)

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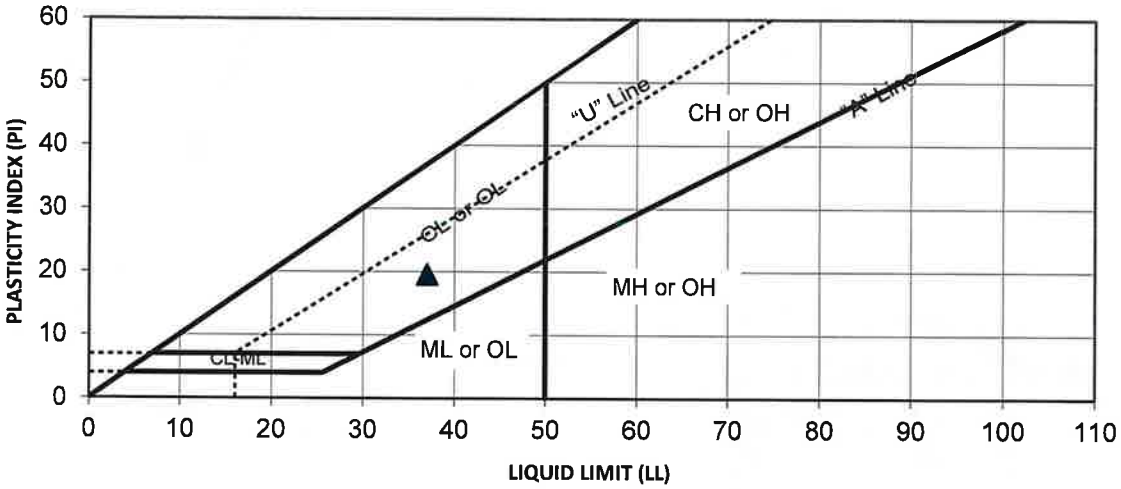
REPORT OF LIQUID LIMIT, PLASTIC LIMIT & PLASTICITY INDEX TESTS

(ASTM D4318)

a e:	April 16, 2019	Job Number:	227518-0000439.00
Client:	County of Imperial	Report Number:	7217
Address:	1002 State Street El Centro, CA 92243	Lab Number:	117942

Project:	Lack Road Bridge – Bridge No.58C-101
Project Address:	Imperial County, CA
Material:	Brown Lean CLAY (CL)
Location:	A-19-001 @ 15'-26.5' (Combined Sample)
Sample ID:	A-19-001-S03,B02,S04,S05-1
Date Sampled:	3/19/2019
Date Submitted:	3/19/2019
Sampled By:	Sean Burford
Date Tested:	4/3/2019



SUMMAR OF TEST RESULTS

SAMPLE ID	SOURCE /LOCATION DEPTH	%>#40	TEST RESULT			USCS	
			LL	PL	PI	Class	Group Name
117942	A-19-001 @ 15'-26.5' (Combined Sample)		**37**	**17**	**20**	CL	Lean CLAY

Reviewed By: Carl Henderson

Carl Henderson, PhD, PE, GE
CQA Group Director (San Diego)

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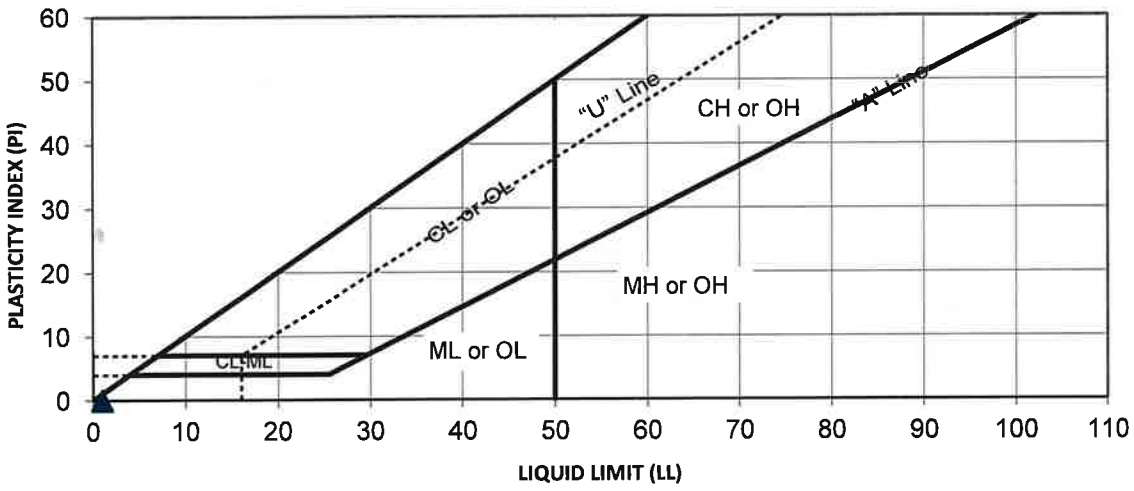
REPORT OF LIQUID LIMIT, PLASTIC LIMIT & PLASTICITY INDEX TESTS

(ASTM D4318)

a e:	April 16, 2019	Job Number:	227518-0000439.00
Client:	County of Imperial	Report Number:	7217
Address:	1002 State Street	Lab Number:	117946
	El Centro, CA 92243		

Project:	Lack Road Bridge – Bridge No.58C-101
Project Address:	Imperial County, CA
Material:	Brown Silty SAND (SM)
Location:	A-19-001 @ 41'-51' (Combined Sample)
Sample ID:	A-19-001-S08,S09,S10-1
Date Sampled:	3/19/2019
Date Submitted:	3/19/2019
Sampled By:	Sean Burford
Date Tested:	4/3/2019



SUMMAR OF TEST RESULTS

SAMPLE ID	SOURCE /LOCATION DEPTH	%>#40	TEST RESULT			USCS	
			LL	PL	PI	Class	Group Name
117946	A-19-001 @ 41'-51' (Combined Sample)		**NR**	**NR**	**NR**	-	Non-Plastic

Reviewed By: Carl Henderson

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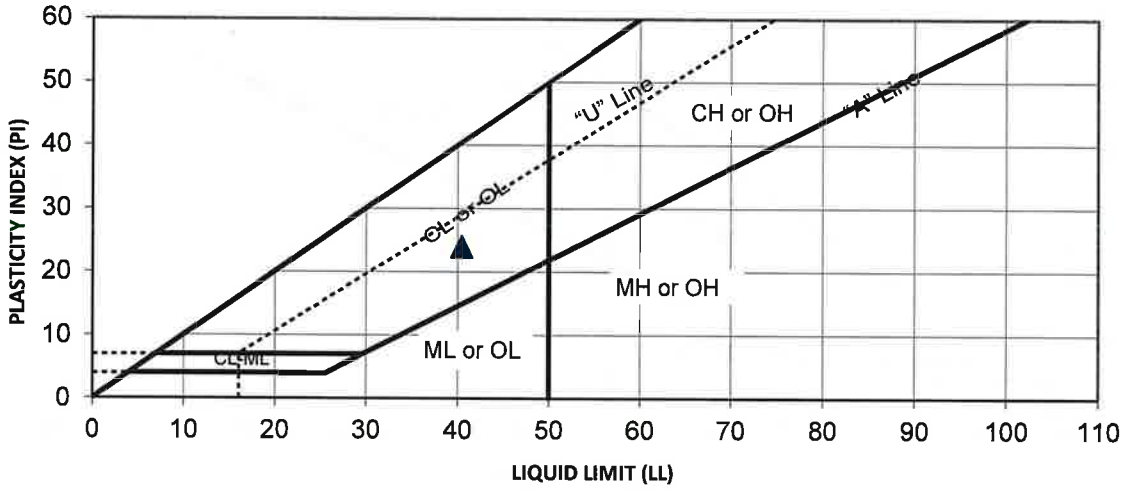
REPORT OF LIQUID LIMIT, PLASTIC LIMIT & PLASTICITY INDEX TESTS

(ASTM D4318)

D t :	April 16, 2019	Job Number:	227518-0000439.00
Client:	County of Imperial	Report Number:	7217
Address:	1002 State Street El Centro, CA 92243	Lab Number:	117956

Project:	Lack Road Bridge – Bridge No.58C-101
Project Address:	Imperial County, CA
Material:	Brown Lean CLAY (CL)
Location:	A-19-002 @ 13'-26.5' (Combined Sample)
Sample ID:	A-19-002-B02,S03,S04,S05-1
Date Sampled:	3/19/2019
Date Submitted:	3/19/2019
Sampled By:	Sean Burford
Date Tested:	4/2/2019



SUMMARY OF TEST RESULTS

SAMPLE ID	SOURCE /LOCATION DEPTH	%>#40	TEST RESULT			USCS	
			LL	PL	PI	Class	Group Name
117956	A-19-002 @ 13'-26.5' (Combined Sample)	1	**40**	**16**	**24**	CL	Lean CLAY

Reviewed By: Carl Henderson

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CQA Group Director (San Diego)

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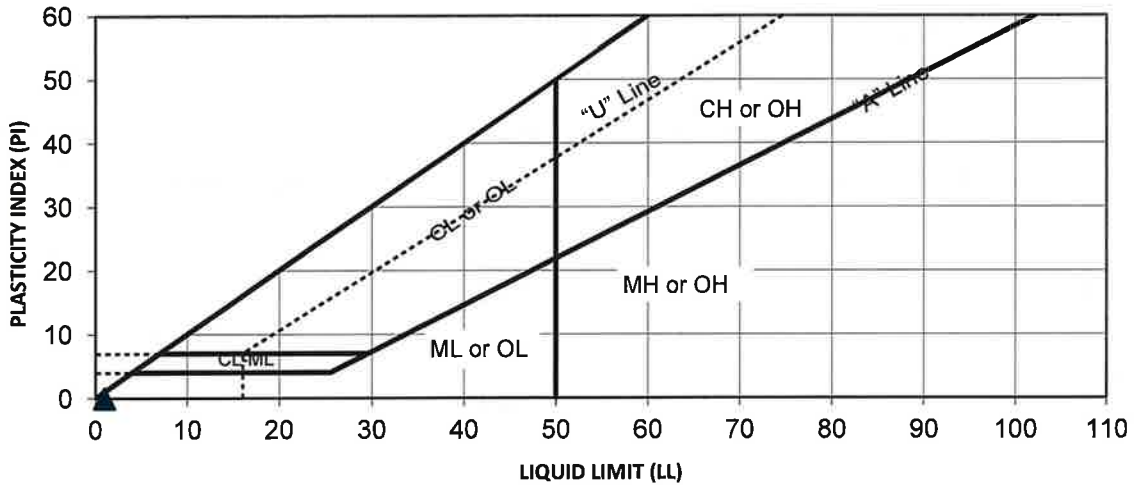
REPORT OF LIQUID LIMIT, PLASTIC LIMIT & PLASTICITY INDEX TESTS

(ASTM D4318)

D t :	April 16, 2019	Job Number:	227518-0000439.00
Client:	County of Imperial	Report Number:	7217
Address:	1002 State Street El Centro, CA 92243	Lab Number:	117960

Project:	Lack Road Bridge – Bridge No.58C-101
Project Address:	Imperial County, CA
Material:	Brown Silty SAND (SM)
Location:	A-19-002 @ 30'-51.5' (Combined Sample)
Sample ID:	A-19-002-S06,S07,S08,S09,S10-1
Date Sampled:	3/19/2019
Date Submitted:	3/19/2019
Sampled By:	Sean Burford
Date Tested:	4/3/2019



SUMMARY OF TEST RESULTS

SAMPLE ID	SOURCE /LOCATION DEPTH	%>#40	TEST RESULT			USCS	
			LL	PL	PI	Class	Group Name
117960	A-19-002 @ 30'-51.5' (Combined Sample)		**NR**	**NR**	**NR**	-	Non-Plastic

Reviewed By: Carl Henderson

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CQA Group Director (San Diego)

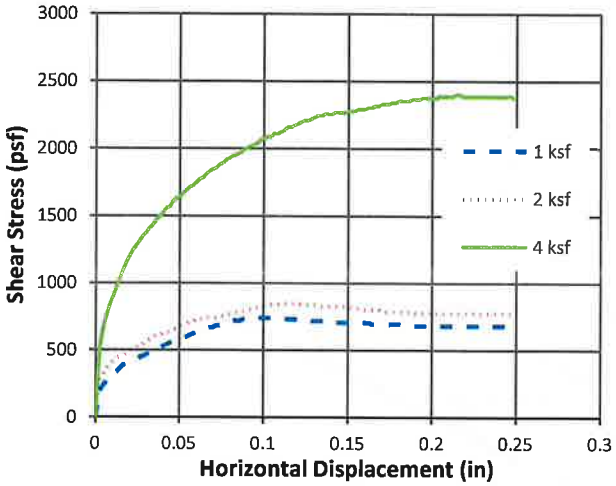
DIRECT SHEAR TEST (ASTM D3080)

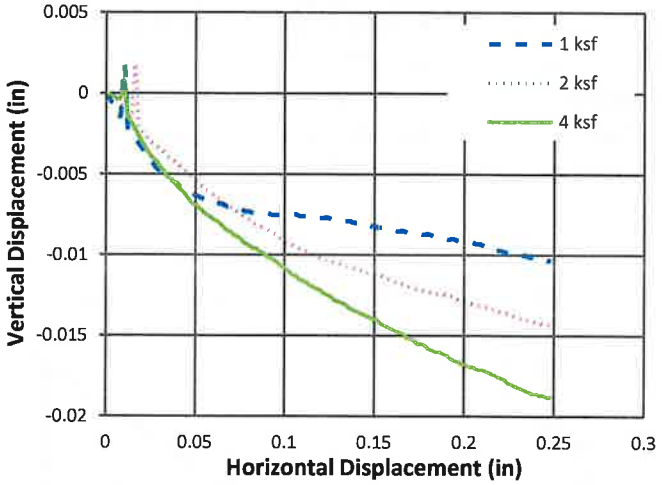
Project No.	227518-0000439.00	Date:	4/16/2019
Client:	County of Imperial	Report No.:	7217
Proj. Name:	Lack Road Bridge – Bridge No.58C-101	Lab No.:	117941
Location:	Imperial County, CA	Boring No. A-19-001	Date Rcvd: 3/19/2019
Sample date:	3/19/2019	Sample ID: A-19-001-S02-1	Sample Location: 11'-11.5' Test Date: 3/29/2019

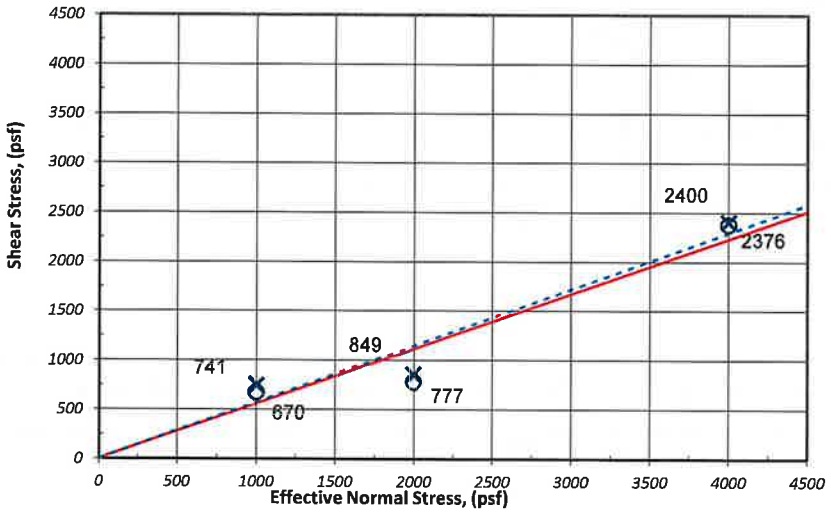
TEST DATA:

	Sample ID:	1 ksf	2 ksf	4 ksf
Initial	Water Content (%)	26.0	26.0	26.0
	Dry Density	98.5	96.4	97.1
	Saturation (%)	94.0	89.6	91.2
Final	Water Content (%)	27.3	27.9	25.9
	Dry Density	97.1	92.8	95.8
	Saturation (%)	95.5	88.4	88.0
Normal Stress (psf)				4000
Ultimate Shear Stress (psf)				76
Peak Shear Stress (psf)		741	84	00

Sample Type:	Relatively Undisturbed Sample
Description:	Lean CLAY (CL)
Color:	Brown
Tested By:	Chirag Padhiar







Peak Cohesion, C'(psf): **0**	Ultimate Cohesion, C'(psf): **0**
Peak Friction,Φ' (deg): **30**	Ultimate Friction,Φ' (deg): **29**

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Respectfully Submitted,
NV5 West, Inc.

Carl Henderson

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CQA Group Director (San Diego)

DIRECT SHEAR TEST (ASTM D3080)

r j c No.	227518-0000439.00		Date: 4/16/2019
Client:	County of Imperial		Report No.: 7217
Proj. Name:	Lack Road Bridge – Bridge No.58C-101		Lab No.: 117948
Location:	Imperial County, CA	Boring No. A-19-001	Date Rcvd: 3/19/2019
Sample date:	3/19/2019	Sample ID: A-19-001-S10-1	Sample Location: 51'-51.5' Test Date: 4/5/2019

TEST DATA:

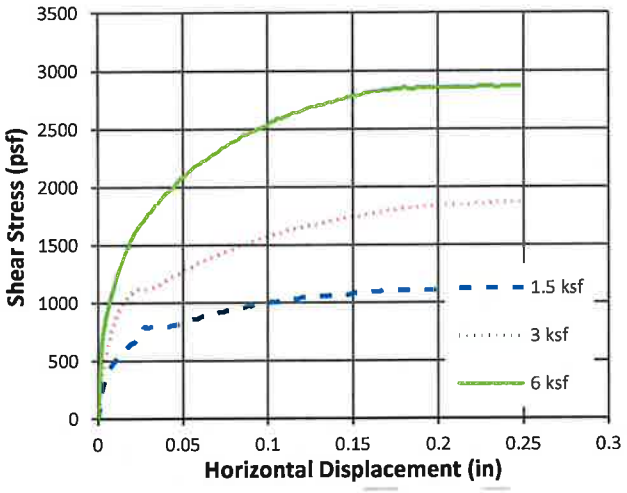
	Sample ID:	1.5 ksf	3 ksf	6 ksf
Initial	Water Content (%)	33.3	33.3	33.3
	Dry Density	89.1	89.1	89.4
	Saturation (%)	97.1	97.1	97.7
Final	Water Content (%)	30.0	27.6	26.2
	Dry Density	88.0	85.8	85.8
	Saturation (%)	85.3	74.7	70.8
Normal Stress (psf)				000
Ultimate Shear Stress (psf)				870
Peak Shear Stress (psf)		1110	18	870

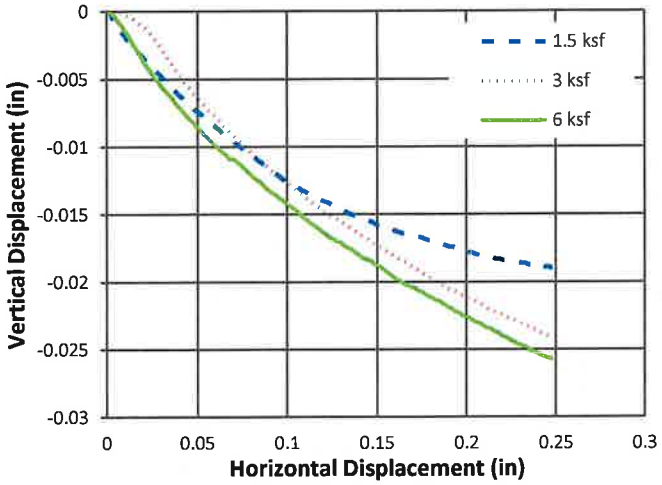
Sample Type: Relatively Undisturbed Sample

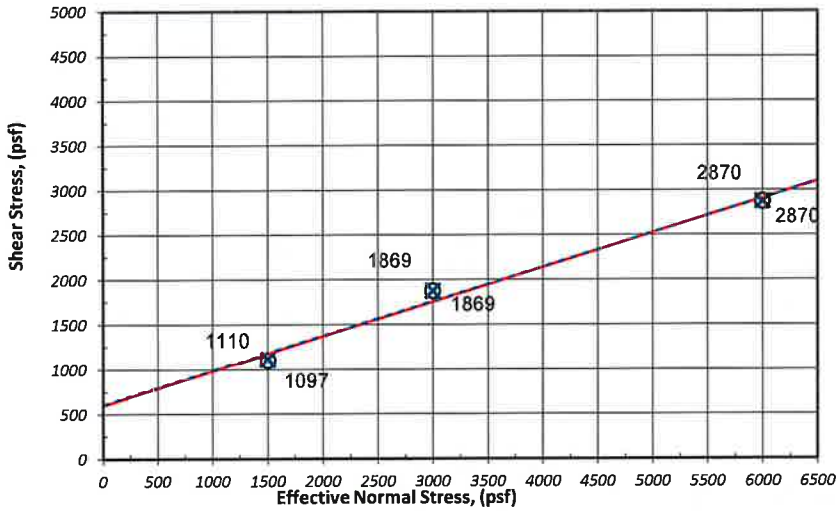
Description: Lean CLAY (CL)

Color: Brown

Tested By: Darrel Delgado







Linear (Ultimate Strength Envelope)

Linear (Peak Strength Envelope)

Peak y = 0.3829x + 609.5

Ultimate y = 0.3854x + 596.5

Peak Cohesion, C'(psf): **610**	Ultimate Cohesion, C'(psf): **597**
Peak Friction,Φ' (deg): **21**	Ultimate Friction,Φ' (deg): **21**

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San Diego CA 92128
p. 858 385 0500 f. 858 715 5810

Respectfully Submitted,

NV5 West, Inc.

Carl Henderson

Carl Henderson, PhD, PE, GE
CQA Group Director (San Diego)

DIRECT SHEAR TEST (ASTM D3080)

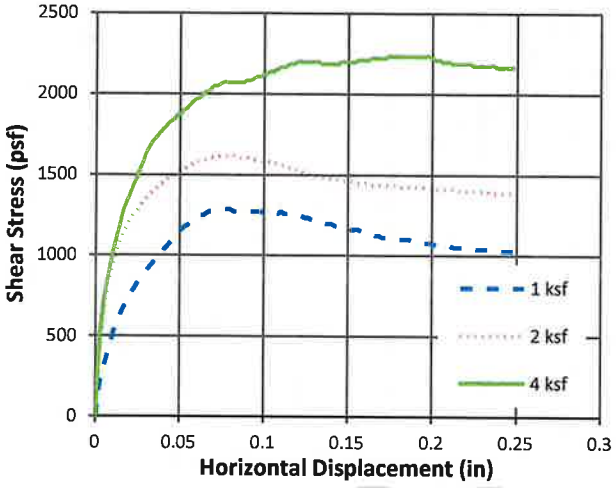
r j c No.	227518-0000439.00		
Client:	County of Imperial		
Proj. Name:	Lack Road Bridge – Bridge No.58C-101		
Location:	Imperial County, CA	Boring No.	A-19-002
Sample date:	3/19/2019	Sample Location:.	11'-11.5'
Sample ID:	A-19-002-S02-1		

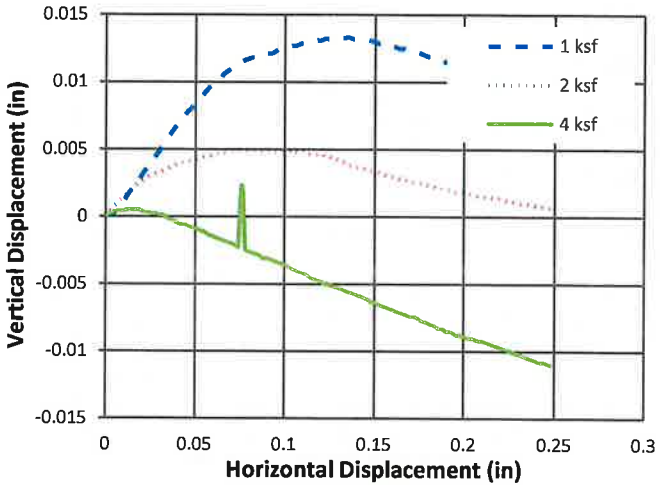
Date:	4/16/2019
Report No.:	7217
Lab No.:	117955
Date Rcvd:	3/19/2019
Test Date:	4/9/2019

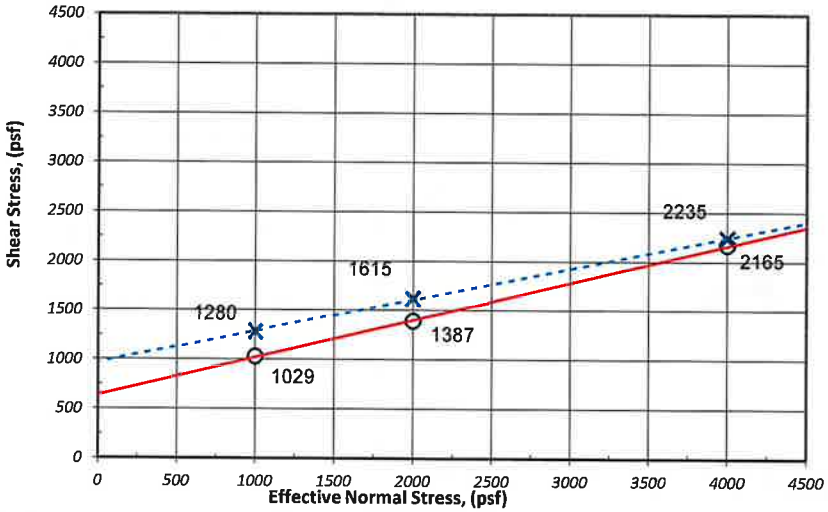
TEST DATA:

	Sample ID:	1 ksf	2 ksf	4 ksf
Initial	Water Content (%)	23.8	23.8	23.8
	Dry Density	99.4	100.1	98.0
	Saturation (%)	88.0	89.3	85.0
Final	Water Content (%)	27.8	27.0	26.1
	Dry Density	97.4	98.5	96.7
	Saturation (%)	98.1	97.6	90.6
Normal Stress (psf)				000
Ultimate Shear Stress (psf)				165
Peak Shear Stress (psf)		1280	16	235

Sample Type:	Relatively Undisturbed Sample
Description:	Lean CLAY (CL)
Color:	Brown
Tested By:	Darrel Delgado







Peak Cohesion, C'(psf): **970**	Ultimate Cohesion, C'(psf): **640**
Peak Friction,Φ' (deg): **18**	Ultimate Friction,Φ' (deg): **21**

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Respectfully Submitted,
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Carl Henderson

Carl Henderson, PhD, PE, GE
CQA Group Director (San Diego)

DIRECT SHEAR TEST (ASTM D3080)

r j c No.	227518-0000439.00			Date:	4/16/2019
Client:	County of Imperial			Report No.:	7217
Proj. Name:	Lack Road Bridge – Bridge No.58C-101			Lab No.:	117961
Location:	Imperial County, CA		Boring No. A-19-002	Date Rcvd:	3/19/2019
Sample date:	3/19/2019	Sample ID: A-19-002-S07-1	Sample Location: 36'-36.5'	Test Date:	4/11/2019

TEST DATA:

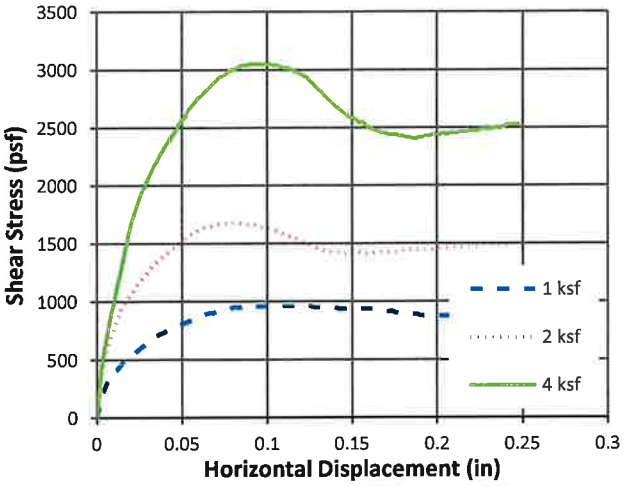
	Sample ID:	1 ksf	2 ksf	4 ksf
Initial	Water Content (%)	23.8	23.8	23.8
	Dry Density	99.9	96.9	99.3
	Saturation (%)	89.1	83.0	87.8
Final	Water Content (%)	22.5	25.1	25.0
	Dry Density	95.9	92.8	92.2
	Saturation (%)	76.7	79.5	78.1
Normal Stress (psf)				000
Ultimate Shear Stress (psf)				35
Peak Shear Stress (psf)		961	167	50

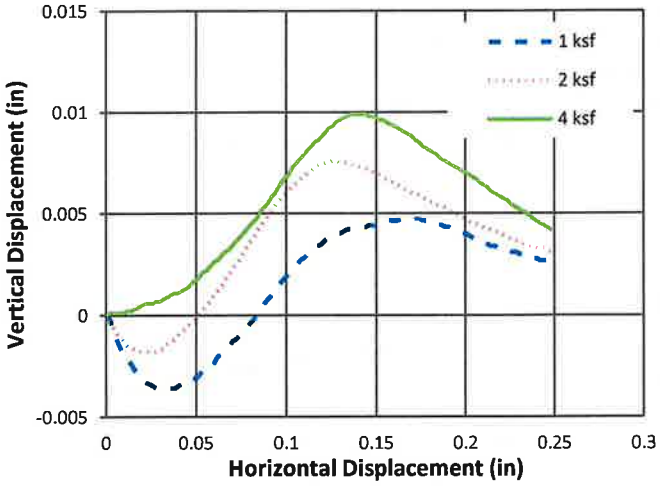
Sample Type: Relatively Undisturbed Sample

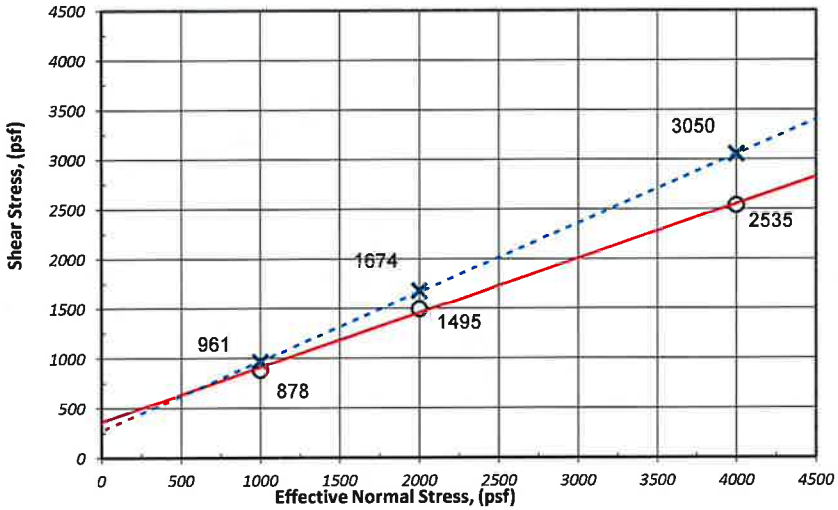
Description: Silty SAND (SM)

Color: Brown

Tested By: Darrel Delgado







Peak Cohesion, C'(psf): **273**	Ultimate Cohesion, C'(psf): **358**
Peak Friction,Φ' (deg): **35**	Ultimate Friction,Φ' (deg): **29**

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Respectfully Submitted,
NV5 West, Inc.

Carl Henderson, PhD, PE, GE
CQA Group Director (San Diego)

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RESISTANCE "R" VALUE TEST

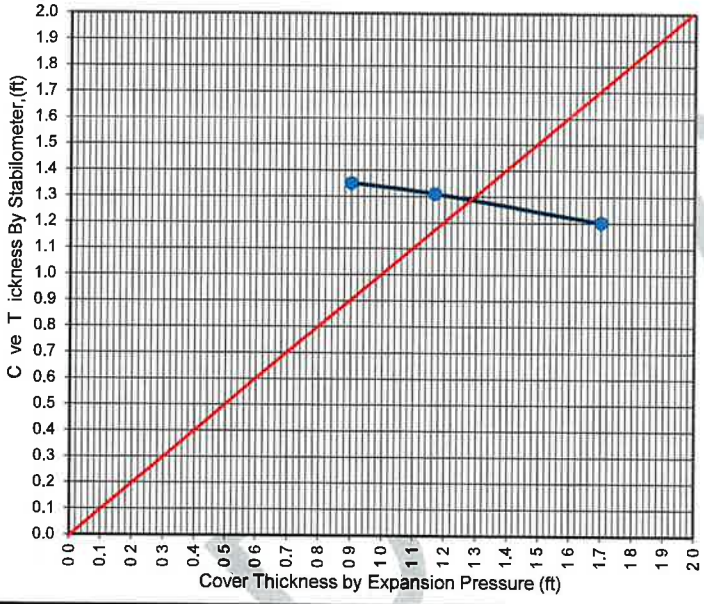
(CTM301 Caltrans / ASTM D2844)

Da e:	4/16/2019	Job Number:	227518-0000439.00
Client:	County of Imperial	Report Number:	7217
Address:	1002 State Street El Centro, CA 92243	Lab Number:	117939
Project :	Lack Road Bridge – Bridge No.58C-101		
Project Address :	Imperial County, CA		

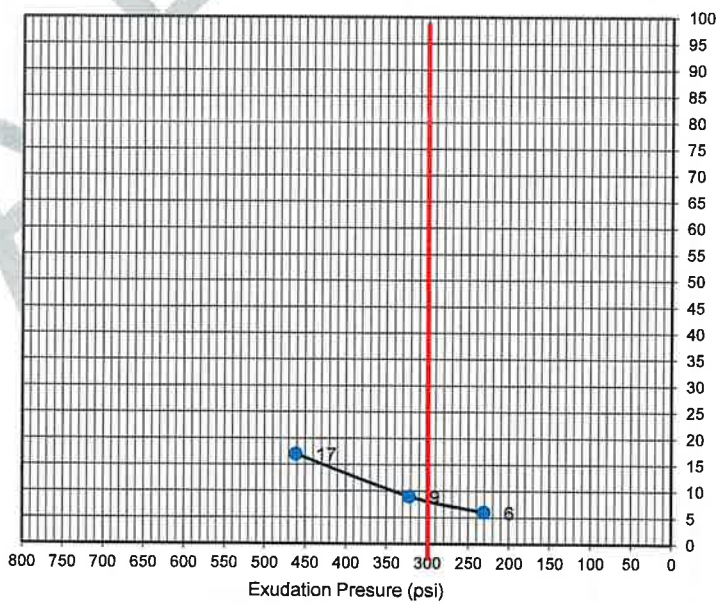
Material:	Brown Lean CLAY (CL)
Location:	A-19-001 @ 3'-5'
Sample ID:	A-19-001-B01-1
Sampled By:	Sean Burford
Date Sampled:	3/19/2019
Date Received:	19

Tested By: Noah Regalado

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



TEST SPECIMEN	A	B	C	D
COMP. FOOT PRESSURE, psi	220	150	110	
INITIAL MOISTURE %	11.3	11.3	11.3	
MOISTURE @ COMPACTION %	17.8	19.7	21.5	
DRY DENSITY, pcf	111.2	107.3	103.5	
EXUDATION PRESSURE, psi	462	322	231	
STABILOMETER VALUE 'R'	17	9	6	

R-VALUE BY EXUDATION	8
R-VALUE BY EXPANSION	10
R-VALUE AT EQUILIBRIUM	**8**

Respectfully Submitted,
NV5 West, Inc.

Reviewed By: Carl Henderson

Carl Henderson, PhD, PE, GE
CQA Group Director (San Diego)

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RESISTANCE "R" VALUE TEST

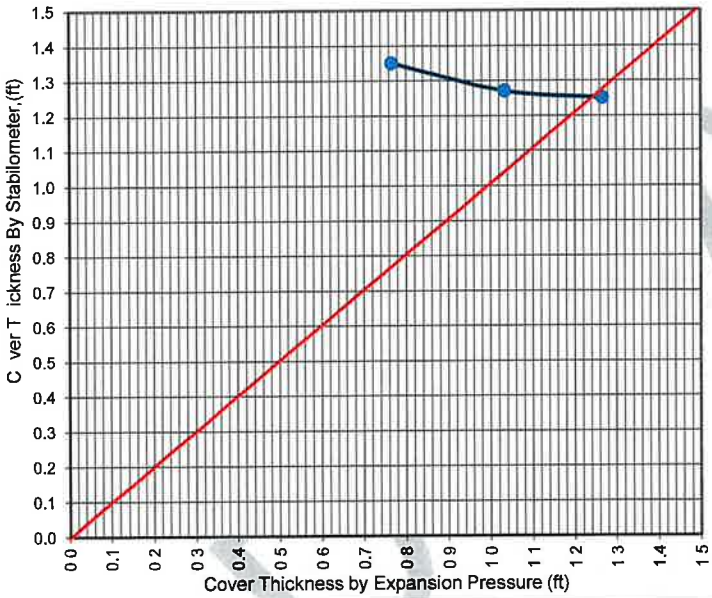
(CTM301 Caltrans / ASTM D2844)

Da e:	4/16/2019	Job Number:	227518-0000439.00
Client:	County of Imperial	Report Number:	7217
Address:	1002 State Street El Centro, CA 92243	Lab Number:	117953
Project :	Lack Road Bridge – Bridge No.58C-101		
Project Address :	Imperial County, CA		

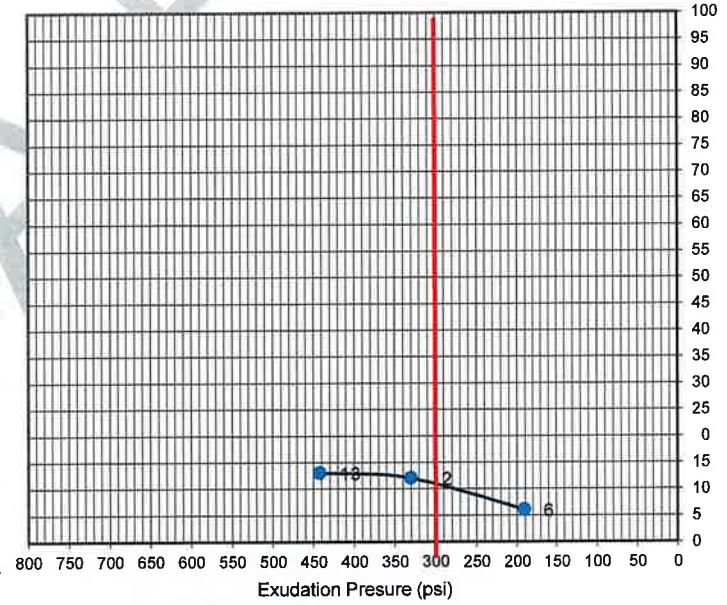
Material:	Brown Lean CLAY (CL)
Location:	A-19-002 @ 3'-5'
Sample ID:	A-19-002-B01-1
Sampled By:	Sean Burford
Date Sampled:	3/19/2019
Date Received:	19

Tested By: Noah Regalado

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



TEST SPECIMEN	A	B	C	D
COMP. FOOT PRESSURE, psi	190	130	90	
INITIAL MOISTURE %	6.6	6.6	6.6	
MOISTURE @ COMPACTION %	14.6	16.3	18.1	
DRY DENSITY, pcf	115.6	110.9	109.0	
EXUDATION PRESSURE, psi	443	330	191	
STABILOMETER VALUE 'R'	13	12	6	

R-VALUE BY EXUDATION	11
R-VALUE BY EXPANSION	12
R-VALUE AT EQUILIBRIUM	**11**

Respectfully Submitted,

NV5 West, Inc.

Reviewed By: Carl Henderson

Carl Henderson, PhD, PE, GE
CQA Group Director (San Diego)

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Expansion Index Test Report

(ASTM D4829)

Date:	April 16, 2019	Job Number:	227518-0000439.00
Client:	County of Imperial	Report Number:	7182
Address:	1002 State Street	Lab Number:	117939, 117953
	El Centro, CA 92243		
Project:	Lack Road Bridge – Bridge No.58C-101		
Project Add:	Imperial County, CA		

Sampled By:	Sean Burford
Date Sampled:	3/19/2019
Date Rcvd:	3/19/2019

Lab Number	117939	117953
Location	A-19-001 @ 3'-5'	A-19-002 @ 3'-5'
Sample ID	A-19-001-B01-1	A-19-002-B01-1
Material Type	Brown Lean Clay (CL)	Brown Lean Clay (CL)
Initial Moisture Content, %	12.4	10.6
Final Moisture Content, %	29.3	23.2
Dry Density, pcf	102.4	108.4
Initial Saturation, %	51.9	51.5
Expansion Index	**89**	**71**
Potential Expansion	**MEDIUM**	**MEDIUM**

Respectfully Submitted,
NV5 West, Inc.

Carl Henderson, PhD, PE, GE
CQA Group Director (San Diego)

L A B O R A T O R Y R E P O R T

Telephone (619) 425-1993 Fax 425-7917 Established 1928

C L A R K S O N L A B O R A T O R Y A N D S U P P L Y I N C.
350 Trousdale Dr. Chula Vista, Ca. 91910 www.clarksonlab.com
A N A L Y T I C A L A N D C O N S U L T I N G C H E M I S T S

Date: April 2, 2019
Purchase Order Number: 19-0505
Sales Order Number: 43806
Account Number: NV5-SD

To:

NV5 West Inc
15092 Avenue of Science #200
San Diego, CA 92128
Attention: Brittani Escobedo

Laboratory Number: SO7253-1 Customers Phone: 858-715-5800
Fax: 858-715-5810

Sample Designation:

One soil sample received on 03/29/19 at 12:45pm,
taken from Lack Road Bridge Job 439.0 marked as
Lab#117942 Report#7217 A-19-001 Depth 15-26.5.

Analysis By California Test 643, 1999, Department of Transportation Division of Construction, Method for Estimating the Service Life of Steel Culverts.

pH 8.3

Water Added (ml)	Resistivity (ohm-cm)
20	250
5	140
5	120
5	92
5	88
5	82
5	82
5	83
5	85

11 years to perforation for a 16 gauge metal culvert.
14 years to perforation for a 14 gauge metal culvert.
20 years to perforation for a 12 gauge metal culvert.
25 years to perforation for a 10 gauge metal culvert.
31 years to perforation for a 8 gauge metal culvert.

Water Soluble Sulfate Calif. Test 417 0.270% (2700ppm)

Water Soluble Chloride Calif. Test 422 0.641% (6410ppm)

Laura Torres
Laura Torres
LT/ilv

L A B O R A T O R Y R E P O R T

Telephone (619) 425-1993 Fax 425-7917 Established 1928

C L A R K S O N L A B O R A T O R Y A N D S U P P L Y I N C.
350 Trousdale Dr. Chula Vista, Ca. 91910 www.clarksonlab.com
A N A L Y T I C A L A N D C O N S U L T I N G C H E M I S T S

Date: April 2, 2019
Purchase Order Number: 19-0505
Sales Order Number: 43806
Account Number: NV5-SD

To:

NV5 West Inc
15092 Avenue of Science #200
San Diego, CA 92128
Attention: Brittani Escobedo

Laboratory Number: SO7253-2 Customers Phone: 858-715-5800
Fax: 858-715-5810

Sample Designation:

One soil sample received on 03/29/19 at 12:45pm,
taken from Lack Road Bridge Job 439.0 marked as
Lab#117956, Report#7217 A-19-002 Depth 13-26.5.

Analysis By California Test 643, 1999, Department of Transportation Division of Construction, Method for Estimating the Service Life of Steel Culverts.

pH 8.2

Water Added (ml)	Resistivity (ohm-cm)
30	120
5	100
5	100
5	96
5	96
5	93
5	93
5	94
5	95

12 years to perforation for a 16 gauge metal culvert.
15 years to perforation for a 14 gauge metal culvert.
21 years to perforation for a 12 gauge metal culvert.
27 years to perforation for a 10 gauge metal culvert.
32 years to perforation for a 8 gauge metal culvert.

Water Soluble Sulfate Calif. Test 417 0.288% (2880ppm)

Water Soluble Chloride Calif. Test 422 0.534% (5340ppm)

Laura Torres

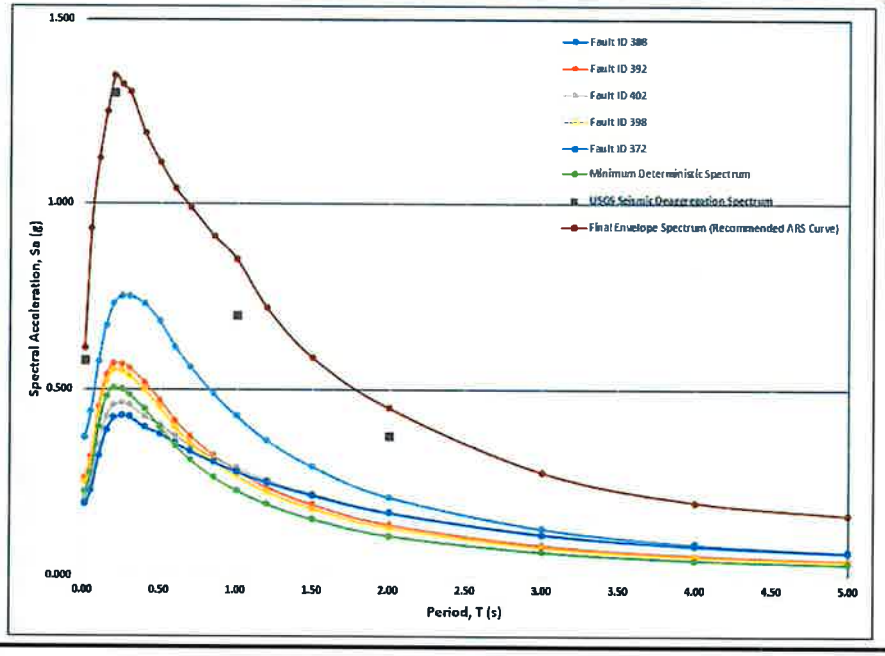
Laura Torres
LT/ilv

APPENDIX C

ARC Curve Calculations

Summary of Computed Acceleration Response Spectra

Period T (sec)	Fault ID 388 Brawley alt 2 (Seismic Zone) Mmax = 6.5 Deterministic Base Spectrum (g)	Fault ID 392 Elmore Ranch Mmax = 6.6 Deterministic Base Spectrum (g)	Fault ID 402 San Jacinto (Superstition Mtn.) Mmax = 7.7 Deterministic Base Spectrum (g)	Fault ID 398 San Jacinto Lone Tree fault Mmax = 6.6 Deterministic Base Spectrum (g)	Fault ID 372 San Andreas (Coachella) Mmax = 7.9 Deterministic Base Spectrum (g)	Minimum Deterministic Spectrum (g)	Probabalistic ARS Base Spectrum (g)	USGS Seismic Deaggregation Spectrum (g)	Basin Effect Adjustment Factor	Near-Fault Effect Adjustment Factor	Adjusted Probabalistic Spectrum (g)	Final Envelope Spectrum (g)
0.01	0.371	0.263	0.208	0.252	0.192	0.226	0.611	0.578	1.000	1.000	0.611	0.611
0.05	0.440	0.318	0.248	0.305	0.229	0.275	0.934		1.000	1.000	0.934	0.934
0.10	0.577	0.452	0.351	0.437	0.321	0.400	1.121		1.000	1.000	1.121	1.121
0.15	0.673	0.540	0.427	0.523	0.391	0.481	1.248		1.000	1.000	1.248	1.248
0.20	0.731	0.572	0.458	0.553	0.423	0.505	1.346	1.301	1.000	1.000	1.346	1.346
0.25	0.750	0.570	0.462	0.549	0.429	0.499	1.322		1.000	1.000	1.322	1.322
0.30	0.751	0.559	0.457	0.538	0.427	0.486	1.303		1.000	1.000	1.303	1.303
0.40	0.730	0.520	0.427	0.499	0.399	0.446	1.190		1.000	1.000	1.190	1.190
0.50	0.683	0.472	0.405	0.452	0.382	0.400	1.110		1.000	1.000	1.110	1.110
0.60	0.615	0.418	0.375	0.399	0.356	0.350	1.000		1.000	1.040	1.040	1.040
0.70	0.561	0.375	0.350	0.358	0.335	0.311	0.916		1.000	1.080	0.990	0.990
0.85	0.489	0.324	0.317	0.308	0.306	0.265	0.802		1.000	1.140	0.914	0.914
1.00	0.429	0.283	0.289	0.269	0.281	0.230	0.709	0.699	1.000	1.200	0.851	0.851
1.20	0.364	0.239	0.257	0.227	0.252	0.192	0.599		1.000	1.200	0.719	0.719
1.50	0.293	0.191	0.219	0.181	0.217	0.152	0.488		1.000	1.200	0.585	0.585
2.00	0.212	0.137	0.169	0.130	0.170	0.107	0.374	0.376	1.000	1.200	0.449	0.449
3.00	0.127	0.082	0.110	0.078	0.112	0.064	0.231		1.000	1.200	0.277	0.277
4.00	0.086	0.056	0.079	0.053	0.082	0.043	0.164		1.000	1.200	0.197	0.197
5.00	0.064	0.042	0.062	0.040	0.064	0.032	0.135		1.000	1.200	0.162	0.162



Project Site Information:

Latitude	33.100001
Longitude	-115.648826
Ave. Shear Wave Velocity, Vs_{30}	270 m/s
Depth to Vs = 1.0 km/s, $Z_{1.0}$ (m)	N/A
Depth to Vs = 2.5 km/s, Z2.5 (km)	N/A
Near-Fault Deaggregation Distance	11.62 km

References:

1. CalTrans ARS Online Tool (v2.3.09), 2017.

2. CalTrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, Nov. 2012.

3. USGS Unified Hazard Tool, Seismic Deaggregation, Dynamic Conterminous U.S. 2008 (v3.3.1).

NV5

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15092 Avenue of Science, Suite 200
San Diego, CA
Tel: (858) 385-0500, Fax: (858) 385-0400

Project No: 227518-0000439
Drawn: SR
Date: May 2019

Summary of Computed Acceleration Response Spectra
Lack Road Bridge
Imperial County, California

SITE DATA (ARS Online Version 2.3.09)

Shear Wave Velocity, *Vs30*:	270 m/s
Latitude:	33.100001
Longitude:	-115.648826
Depth to Vs = 1.0 km/s:	N/A
Depth to Vs = 2.5 km/s:	N/A

DETERMINISTIC

Brawley (Seismic Zone) alt 2

Fault ID:	388
Maximum Magnitude (MMax):	6.5
Fault Type:	SS
Fault Dip:	90 Deg
Dip Direction:	V
Bottom of Rupture Plane:	13.20 km
Top of Rupture Plane(Ztor):	0.00 km
Rrup	4.47 km
Rjb:	4.47 km
Rx:	4.47 km
Fnorm:	0
Frev:	0

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.371	1.000	1.000	0.371
0.05	0.440	1.000	1.000	0.440
0.1	0.577	1.000	1.000	0.577
0.15	0.673	1.000	1.000	0.673
0.2	0.731	1.000	1.000	0.731
0.25	0.750	1.000	1.000	0.750
0.3	0.751	1.000	1.000	0.751
0.4	0.730	1.000	1.000	0.730
0.5	0.683	1.000	1.000	0.683
0.6	0.615	1.000	1.040	0.640
0.7	0.561	1.000	1.080	0.606
0.85	0.489	1.000	1.140	0.557
1	0.429	1.000	1.200	0.515
1.2	0.364	1.000	1.200	0.437
1.5	0.293	1.000	1.200	0.351
2	0.212	1.000	1.200	0.254
3	0.127	1.000	1.200	0.152
4	0.086	1.000	1.200	0.104
5	0.064	1.000	1.200	0.077

Elmore Ranch

Fault ID:	392

Maximum Magnitude (MMax):	6.6
Fault Type:	SS
Fault Dip:	90 Deg
Dip Direction:	V
Bottom of Rupture Plane:	11.00 km
Top of Rupture Plane(Ztor):	0.00 km
Rrup	9.86 km
Rjb:	9.86 km
Rx:	9.86 km
Fnorm:	0
Frev:	0

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.263	1.000	1.000	0.263
0.05	0.318	1.000	1.000	0.318
0.1	0.452	1.000	1.000	0.452
0.15	0.540	1.000	1.000	0.540
0.2	0.572	1.000	1.000	0.572
0.25	0.570	1.000	1.000	0.570
0.3	0.559	1.000	1.000	0.559
0.4	0.520	1.000	1.000	0.520
0.5	0.472	1.000	1.000	0.472
0.6	0.418	1.000	1.040	0.435
0.7	0.375	1.000	1.080	0.405
0.85	0.324	1.000	1.140	0.369
1	0.283	1.000	1.200	0.339
1.2	0.239	1.000	1.200	0.286
1.5	0.191	1.000	1.200	0.229
2	0.137	1.000	1.200	0.164
3	0.082	1.000	1.200	0.098
4	0.056	1.000	1.200	0.067
5	0.042	1.000	1.200	0.050

San Jacinto (Superstition Mtn)

Fault ID:	402
Maximum Magnitude (MMax):	7.7
Fault Type:	SS
Fault Dip:	90 Deg
Dip Direction:	V
Bottom of Rupture Plane:	12.00 km
Top of Rupture Plane(Ztor):	0.00 km
Rrup	22.81 km
Rjb:	22.81 km
Rx:	22.80 km
Fnorm:	0
Frev:	0

Period	SA(Base	Basin	Near Fault	SA(Final

	Spectrum)	Factor	Factor(Applied)	Spectrum)
0.01	0.208	1.000	1.000	0.208
0.05	0.248	1.000	1.000	0.248
0.1	0.351	1.000	1.000	0.351
0.15	0.427	1.000	1.000	0.427
0.2	0.458	1.000	1.000	0.458
0.25	0.462	1.000	1.000	0.462
0.3	0.457	1.000	1.000	0.457
0.4	0.427	1.000	1.000	0.427
0.5	0.405	1.000	1.000	0.405
0.6	0.375	1.000	1.009	0.378
0.7	0.350	1.000	1.018	0.356
0.85	0.317	1.000	1.031	0.326
1	0.289	1.000	1.044	0.302
1.2	0.257	1.000	1.044	0.268
1.5	0.219	1.000	1.044	0.228
2	0.169	1.000	1.044	0.177
3	0.110	1.000	1.044	0.115
4	0.079	1.000	1.044	0.083
5	0.062	1.000	1.044	0.065

San Jacinto-Lone Tree fault

Fault ID:	398
Maximum Magnitude (MMax):	6.6
Fault Type:	SS
Fault Dip:	90 Deg
Dip Direction:	V
Bottom of Rupture Plane:	12.00 km
Top of Rupture Plane(Ztor):	0.00 km
Rrup	10.56 km
Rjb:	10.56 km
Rx:	8.22 km
Fnorm:	0
Frev:	0

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0 252	1 000	000	252
.05	0 305	1 000	000	305
.1	0 37	1 000	000	437
.15	0 523	1 000	000	523
.2	0 53	1 000	000	553
.25	0 549	1 000	000	549
.3	0 38	1 000	000	538
.4	0 99	1 000	000	499
.5	0 52	1 000	000	452
.6	0 99	1 000	040	415
.7	0 58	1 000	080	387
.85	0 308	1 000	140	351

1	0.269	1.000	1.200	0.323
1.2	0.227	1.000	1.200	0.272
1.5	0.181	1.000	1.200	0.217
2	0.130	1.000	1.200	0.156
3	0.078	1.000	1.200	0.093
4	0.053	1.000	1.200	0.064
5	0.040	1.000	1.200	0.048

San Andreas (Coachella) rev

Fault ID:	372
Maximum Magnitude (MMax):	7.9
Fault Type:	SS
Fault Dip:	90 Deg
Dip Direction:	V
Bottom of Rupture Plane:	10.60 km
Top of Rupture Plane(Ztor):	0.00 km
Rrup	28.46 km
Rjb:	28.46 km
Rx:	8.78 km
Fnorm:	0
Frev:	0

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.192	1.000	1.000	0.192
0.05	0.229	1.000	1.000	0.229
0.1	0.321	1.000	1.000	0.321
0.15	0.391	1.000	1.000	0.391
0.2	0.423	1.000	1.000	0.423
0.25	0.429	1.000	1.000	0.429
0.3	0.427	1.000	1.000	0.427
0.4	0.399	1.000	1.000	0.399
0.5	0.382	1.000	1.000	0.382
0.6	0.356	1.000	1.000	0.356
0.7	0.335	1.000	1.000	0.335
0.85	0.306	1.000	1.000	0.306
1	0.281	1.000	1.000	0.281
1.2	0.252	1.000	1.000	0.252
1.5	0.217	1.000	1.000	0.217
2	0.170	1.000	1.000	0.170
3	0.112	1.000	1.000	0.112
4	0.082	1.000	1.000	0.082
5	0.064	1.000	1.000	0.064

PROBABILISTIC

Probabilistic Model

USGS Seismic Hazard Map(2008) 975 Year Return Period

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.611	1.000	1.000	0.611
0.05	0.934	1.000	1.000	0.934
0.1	1.121	1.000	1.000	1.121
0.15	1.248	1.000	1.000	1.248
0.2	1.346	1.000	1.000	1.346
0.25	1.322	1.000	1.000	1.322
0.3	1.303	1.000	1.000	1.303
0.4	1.190	1.000	1.000	1.190
0.5	1.110	1.000	1.000	1.110
0.6	1.000	1.000	1.040	1.040
0.7	0.916	1.000	1.080	0.990
0.85	0.802	1.000	1.140	0.914
1	0.709	1.000	1.200	0.851
1.2	0.599	1.000	1.200	0.719
1.5	0.488	1.000	1.200	0.585
2	0.374	1.000	1.200	0.449
3	0.231	1.000	1.200	0.277
4	0.164	1.000	1.200	0.197
5	0.135	1.000	1.200	0.162

MINIMUM DETERMINISTIC SPECTRUM

Period	SA
0.01	0.226
0.05	0.275
0.1	0.400
0.15	0.481
0.2	0.505
0.25	0.499
0.3	0.486
0.4	0.446
0.5	0.400
0.6	0.350
0.7	0.311
0.85	0.265
1	0.230
1.2	0.192
1.5	0.152
2	0.107
3	0.064
4	0.043
5	0.032

Envelope Data

Period	SA
0.01	0.611
0.05	0.934
0.1	1.121
0.15	1.248
0.2	1.346
0.25	1.322
0.3	1.303
0.4	1.190
0.5	1.110
0.6	1.040
0.7	0.990
0.85	0.914
1	0.851
1.2	0.719
1.5	0.585
2	0.449
3	0.277
4	0.197
5	0.162

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

ease do ot use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2008 (v3.3

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

33.100001

Time Horizon

Return period in years

975

Longitude

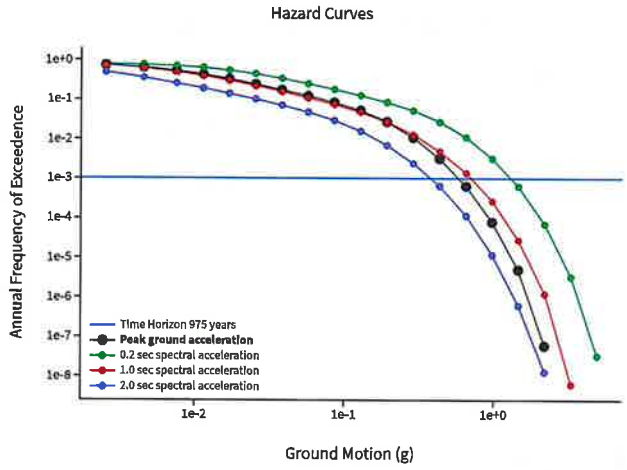
Decimal degrees, negative values for western longitudes

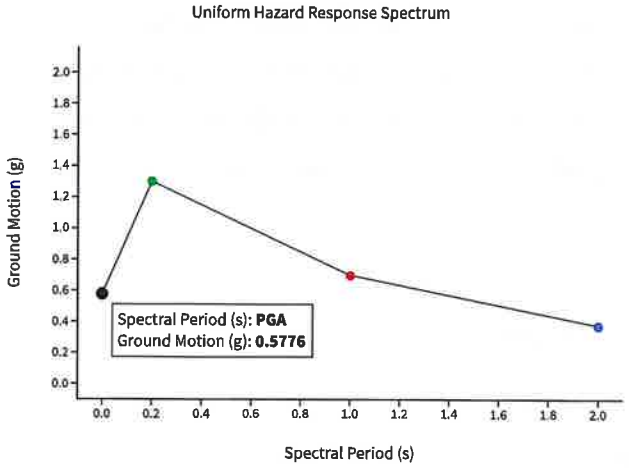
-115.648826

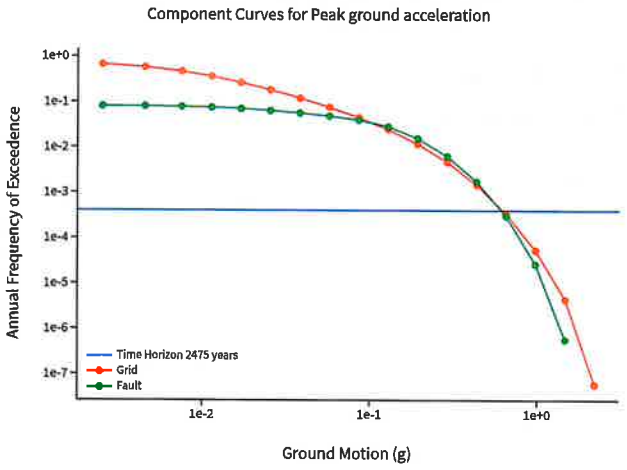
Site Class

259 m/s (Site class D)

Hazard Curve





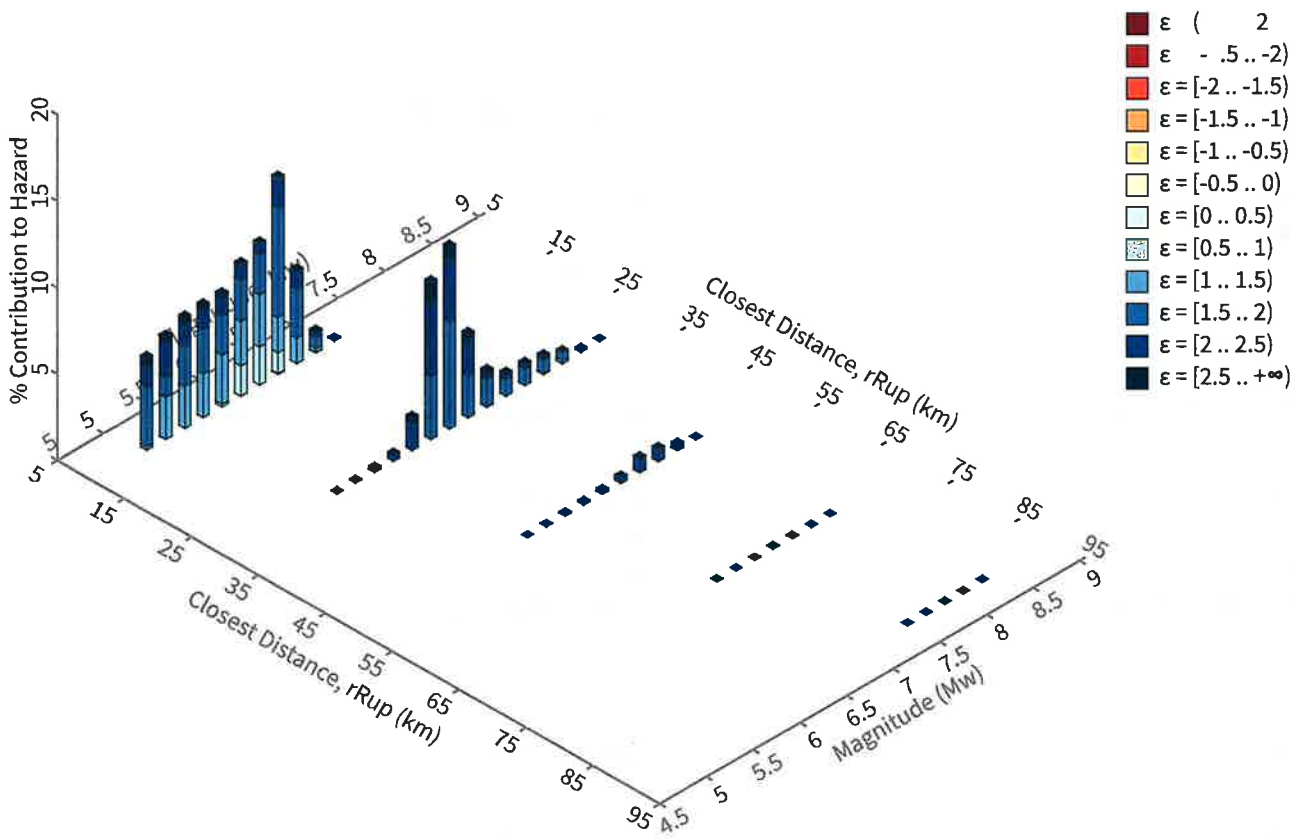


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 975 yrs
Exceedance rate: 0.001025641 yr^{-1}
PGA ground motion: 0.57759466 g

Recovered targets

Return period: 1177.6244 yrs
Exceedance rate: 0.0008491672 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.07 %

Mean (for all sources)

r: 15.3 km
m: 6.36
ε_0: 1.79 σ

Mode (largest r-m bin)

r: 11.62 km
m: 6.5
ε_0: 1.62 σ
Contribution: 11.35 %

Mode (largest ε_0 bin)

r: 12.26 km
m: 6.52
ε_0: 1.73 σ
Contribution: 6.33 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	T pe	r	m	ϵ_0	lon	lat	az	%
brawmap.in	Grid							35.63
PointSourceFixedStrike: -115.600, 33.100		6.53	5.69	1.47	115.600°W	33.100°N	89.99	13.60
PointSourceFixedStrike: -115.700, 33.100		6.66	5.69	1.48	115.700°W	33.100°N	270.01	9.01
PointSourceFixedStrike: -115.700, 33.200		8.94	6.00	1.66	115.700°W	33.200°N	336.82	3.58
PointSourceFixedStrike: -115.600, 33.000		8.89	5.99	1.65	115.600°W	33.000°N	157.73	3.20
PointSourceFixedStrike: -115.600, 33.200		10.85	5.94	1.85	115.600°W	33.200°N	22.22	2.52
PointSourceFixedStrike: -115.700, 33.000		10.98	5.94	1.87	115.700°W	33.000°N	203.23	1.08
bFault.ch	Fault							21.07
Imperial		21.39	6.90	2.03	115.553°W	32.926°N	155.14	12.38
Superstition Hills		17.24	6.70	2.01	115.802°W	33.008°N	234.54	4.38
Elmore Ranch		9.79	6.59	1.58	115.656°W	33.231°N	357.49	4.09
bFault.gr	Fault							12.08
Imperial		23.44	6.74	2.15	115.553°W	32.926°N	155.14	6.57
Superstition Hills		17.41	6.60	2.05	115.802°W	33.008°N	234.54	2.94
Elmore Ranch		9.95	6.55	1.58	115.656°W	33.231°N	357.49	2.52
aFault_aPriori_D2.1	Fault							7.44
aFault_MoBal	Fault							7.34
S. San Andreas : CO		28.43	6.96	2.14	115.712°W	33.350°N	348.10	2.91
impext.ch.in (opt)	Grid							3.75
PointSourceFinite: -115.649, 33.140		6.68	5.72	1.46	115.649°W	33.140°N	0.00	2.39
CAmap.21.ch.in (opt)	Grid							3.35
PointSourceFinite: -115.649, 33.140		6.88	5.69	1.30	115.649°W	33.140°N	0.00	2.01
CAmap.24.ch.in (opt)	Grid							3.35
PointSourceFinite: -115.649, 33.140		6.88	5.69	1.30	115.649°W	33.140°N	0.00	2.01
impext.gr.in (opt)	Grid							1.85
PointSourceFinite: -115.649, 33.140		6.68	5.72	1.46	115.649°W	33.140°N	0.00	1.19
CAmap.24.gr.in (opt)	Grid							1.64
PointSourceFinite: -115.649, 33.140		6.88	5.69	1.30	115.649°W	33.140°N	0.00	1.00
CAmap.21.gr.in (opt)	Grid							1.64
PointSourceFinite: -115.649, 33.140		6.88	5.69	1.30	115.649°W	33.140°N	0.00	1.00

U.S. Geological Survey Earthqu ke Hazards Program

Unified Hazard Tool

ease do ot use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2008 (v3.3

Spectral Period

0.2 sec spectral acceleration

Latitude

Decimal degrees

33.100001

Time Horizon

Return period in years

975

Longitude

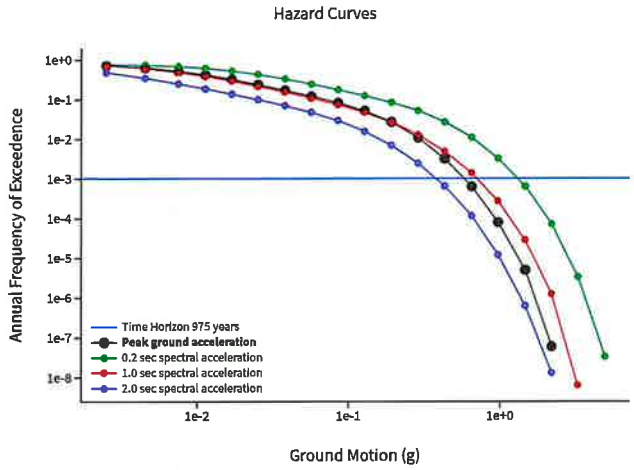
Decimal degrees, negative values for western longitudes

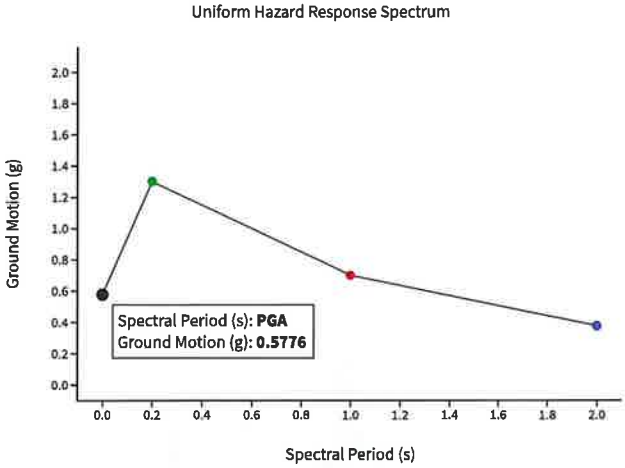
-115.648826

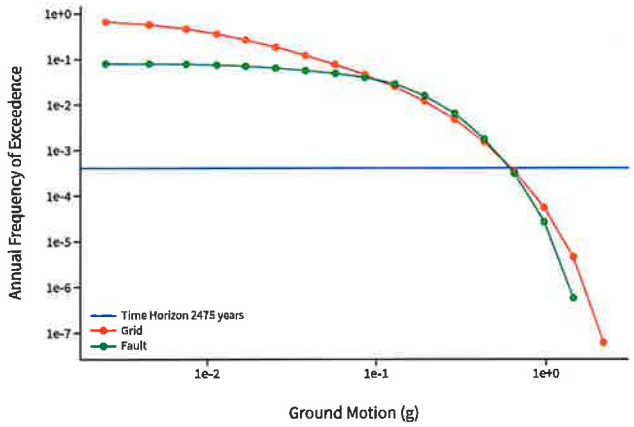
Site Class

259 m/s (Site class D)

Hazard Curve





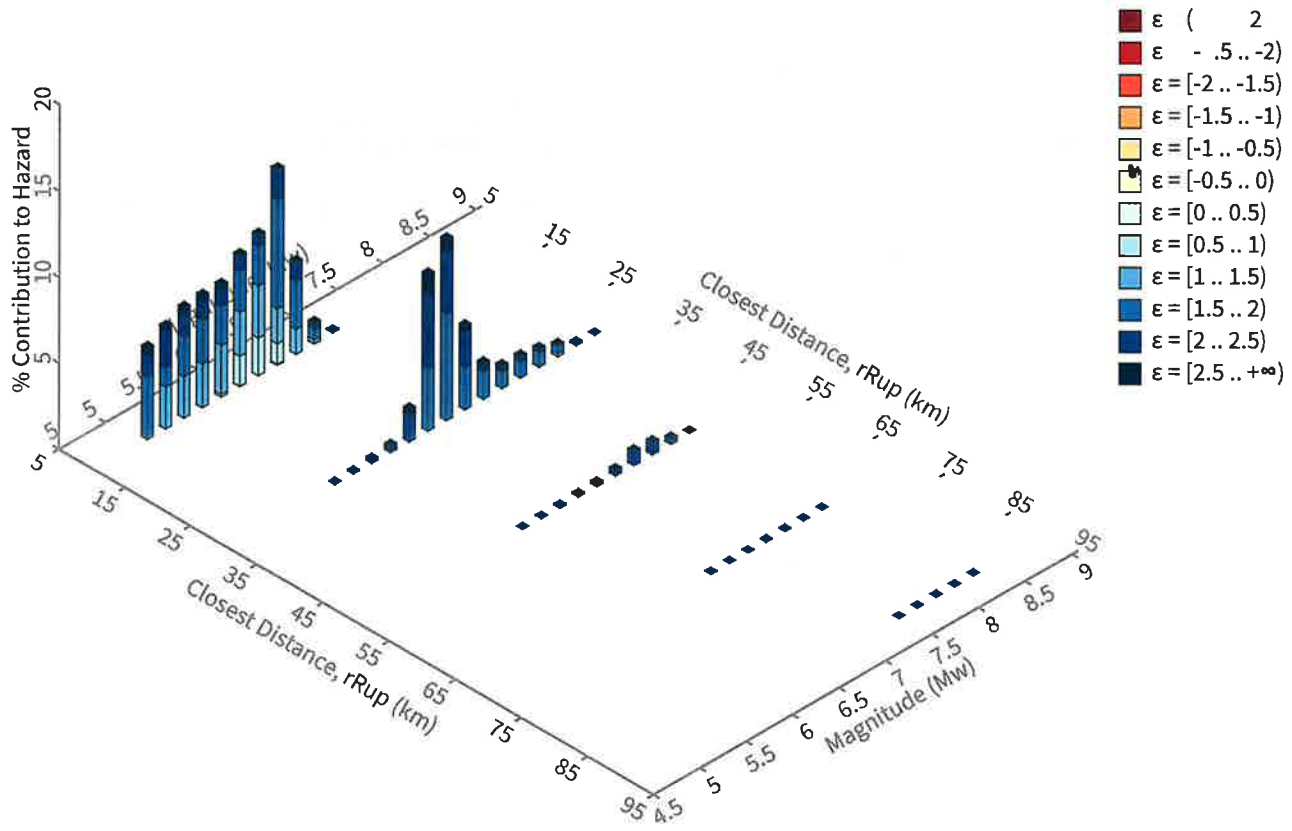


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 975 yrs
Exceedance rate: 0.001025641 yr^{-1}
0.2 s SA ground motion: 1 3006378 g

Recovered targets

Return period: 1161.1623 yrs
Exceedance rate: 0.00086120603 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.03 %

Mean (for all sources)

r: 15.82 km
m: 6 38
ε_0: 1.91 σ

Mode (largest r m bin)

r: 12.27 km
m: 6 5
ε_0: 1.66 σ
Contribution: 12.53 %

Mode (largest ε_0 bin)

r: 21.63 km
m: 6 91
ε_0: 1.89 σ
Contribution: 6.1 %

Discretization

r: min 0 0, max 1000 0, Δ 20 0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [2 5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [1 0 0 5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1 0 1 5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
brawmap.in	Grid							32.27
PointSourceFixedStrike: -115.600, 33.100		6.53	5.71	1.60	115.600°W	33.100°N	89.99	10.73
PointSourceFixedStrike: -115.700, 33.100		6.66	5.72	1.61	115.700°W	33.100°N	270.01	7.19
PointSourceFixedStrike: -115.700, 33.200		9.08	5.97	1.77	115.700°W	33.200°N	336.82	3.56
PointSourceFixedStrike: -115.600, 33.000		9.03	5.96	1.76	115.600°W	33.000°N	157.73	3.18
PointSourceFixedStrike: -115.600, 33.200		10.88	5.93	1.91	115.600°W	33.200°N	22.22	2.73
PointSourceFixedStrike: -115.700, 33.000		11.00	5.93	1.92	115.700°W	33.000°N	203.23	1.18
bFault.ch	Fault							24.61
Imperial		21.39	6.88	2.05	115.553°W	32.926°N	155.14	14.69
Superstition Hills		17.24	6.69	1.95	115.802°W	33.008°N	234.54	5.56
Elmore Ranch		9.79	6.59	1.56	115.656°W	33.231°N	357.49	4.25
bFault.gr	Fault							15.03
Imperial		23.53	6.73	2.15	115.553°W	32.926°N	155.14	8.63
Superstition Hills		17.39	6.60	1.99	115.802°W	33.008°N	234.54	3.78
Elmore Ranch		9.94	6.54	1.57	115.656°W	33.231°N	357.49	2.59
aFault_MoBal	Fault							6.90
S. San Andreas : CO		28.43	6.94	2.26	115.712°W	33.350°N	348.10	3.27
San Jacinto : SM		23.01	6.60	2.24	115.807°W	32.938°N	219.26	1.11
aFault_aPriori_D2.1	Fault							6.40
San Jacinto : B		29.55	6.74	2.32	115.943°W	33.001°N	248.20	1.16
impext.ch.in (opt)	Grid							3.67
PointSourceFinite: -115.649, 33.140		6.76	5.74	1.59	115.649°W	33.140°N	0.00	1.93
CAmap.21.ch.in (opt)	Grid							2.93
PointSourceFinite: -115.649, 33.140		6.90	5.72	1.48	115.649°W	33.140°N	0.00	1.43
CAmap.24.ch.in (opt)	Grid							2.93
PointSourceFinite: -115.649, 33.140		6.90	5.72	1.48	115.649°W	33.140°N	0.00	1.43
impext.gr.in (opt)	Grid							1.80
CAmap 24 gr in (opt)	Grid							1 42
CAmap.21.gr.in (opt)	Grid							1.42

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2008 (v3.3.

Spectral Period

1.0 sec spectral acceleration

Latitude

Decimal degrees

33.100001

Time Horizon

Return period in years

975

Longitude

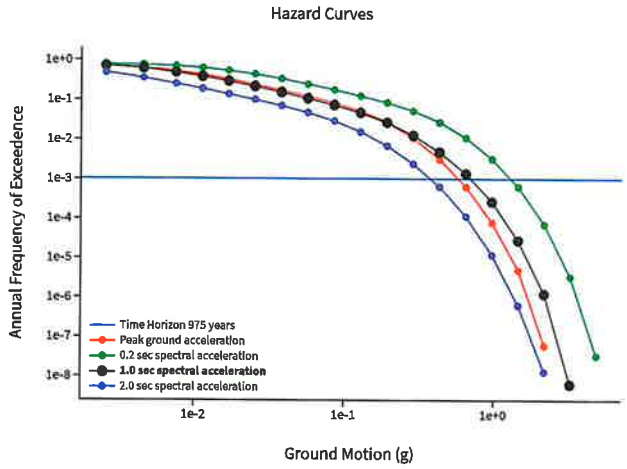
Decimal degrees, negative values for western longitudes

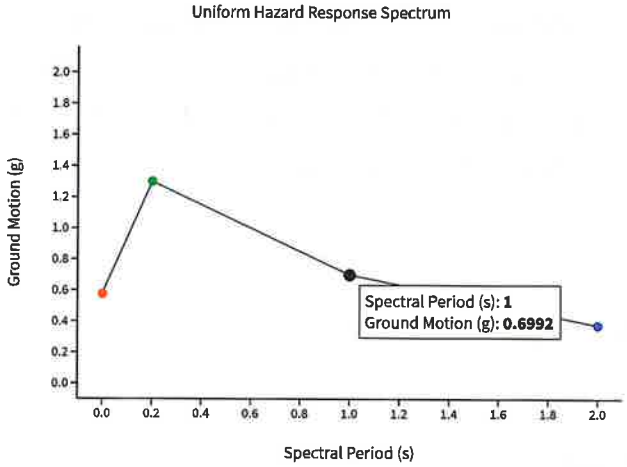
-115.648826

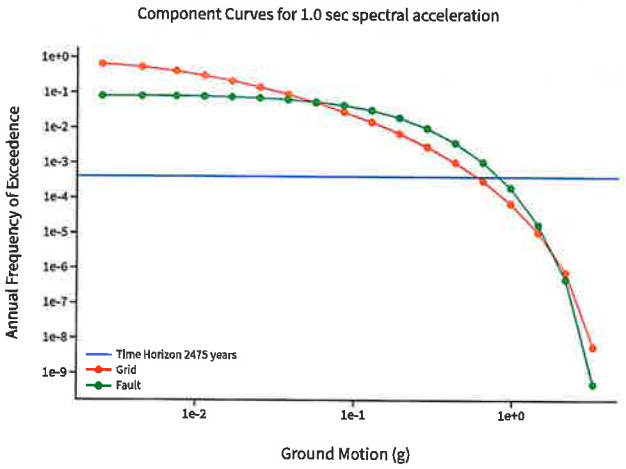
Site Class

259 m/s (Site class D)

Hazard Curve





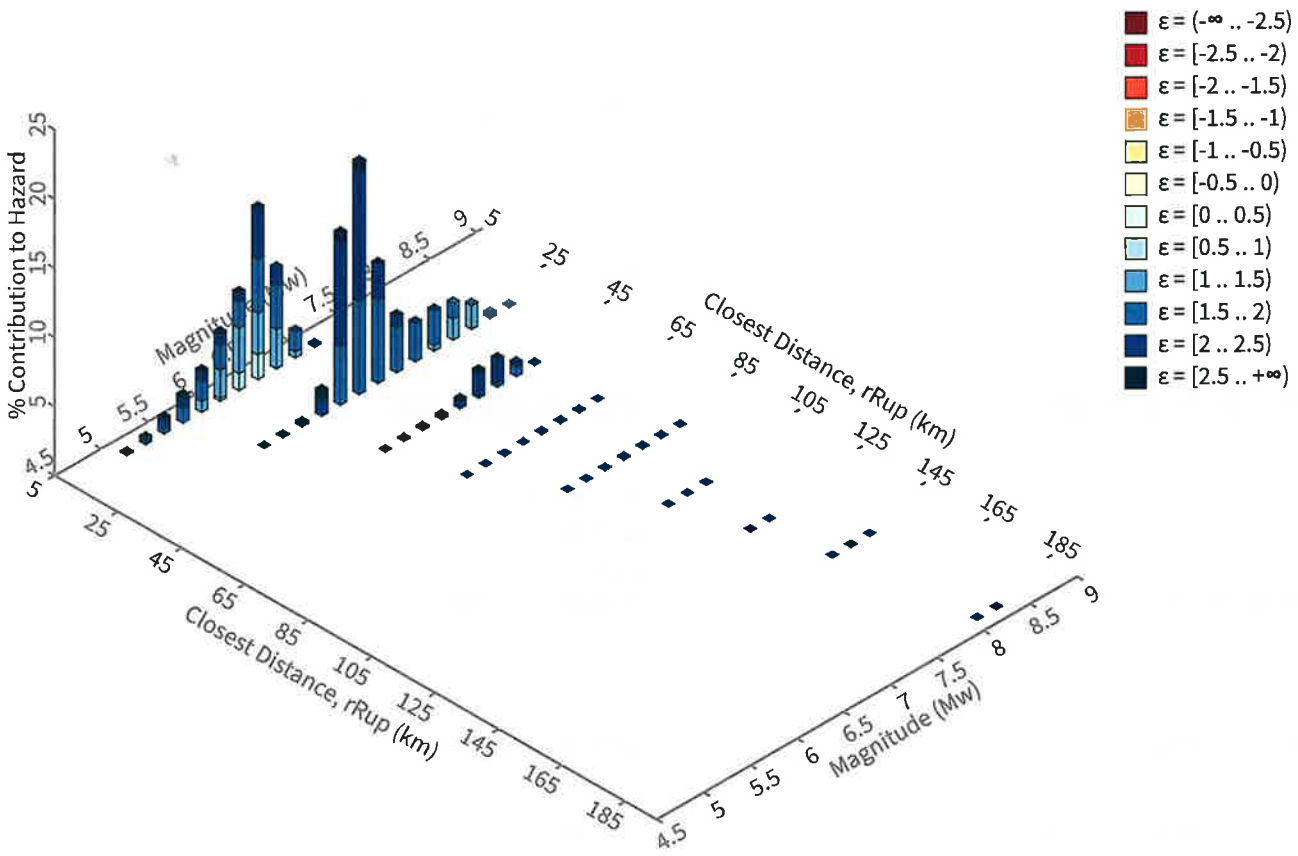


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 975 yrs
Exceedance rate: 0.001025641 yr^{-1}
1.0 s SA ground motion: 0.69915642 g

Recovered targets

Return period: 1114.6666 yrs
Exceedance rate: 0.00089712924 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.09 %

Mean (for all sources)

r: 20.43 km
m: 6.82
ε_0: 1.85 σ

Mode (largest r-m bin)

r: 23.17 km
m: 6.91
ε_0: 2.03 σ
Contribution: 16.72 %

Mode (largest ε_0 bin)

r: 23.87 km
m: 6.91
ε_0: 2.13 σ
Contribution: 9.39 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
bFault.ch	Fault							30.84
Imperial		21.39	6.91	1.97	115.553°W	32.926°N	155.14	19.47
Superstition Hills		17.24	6.72	1.92	115.802°W	33.008°N	234.54	5.90
Elmore Ranch		9.79	6.61	1.44	115.656°W	33.231°N	357.49	5.05
brawmap.in	Grid							15.95
PointSourceFixedStrike: -115.600, 33.100		6.52	6.02	1.52	115.600°W	33.100°N	89.99	5.28
PointSourceFixedStrike: -115.700, 33.100		6.65	6.02	1.53	115.700°W	33.100°N	270.01	3.50
PointSourceFixedStrike: -115.700, 33.200		7.73	6.23	1.46	115.700°W	33.200°N	336.82	2.12
PointSourceFixedStrike: -115.600, 33.000		7.68	6.23	1.46	115.600°W	33.000°N	157.73	1.90
PointSourceFixedStrike: -115.600, 33.200		10.28	6.21	1.75	115.600°W	33.200°N	22.22	1.22
bFault.gr	Fault							15.20
Imperial		23.12	6.75	2.14	115.553°W	32.926°N	155.14	8.75
Superstition Hills		17.40	6.61	2.03	115.802°W	33.008°N	234.54	3.45
Elmore Ranch		9.94	6.55	1.49	115.656°W	33.231°N	357.49	2.92
aFault_aPriori_D2.1	Fault							14.83
San Jacinto : CC+B+SM		23.01	7.33	1.74	115.807°W	32.938°N	219.26	1.82
San Jacinto : A+C		45.34	7.51	2.25	116.099°W	33.256°N	292.59	1.55
S. San Andreas : CO		28.43	7.00	2.18	115.712°W	33.350°N	348.10	1.41
S. San Andreas : SM+NSB+SSB+BG+CO		28.42	7.84	1.54	115.712°W	33.350°N	348.10	1.28
San Jacinto : B+SM		23.01	7.01	1.98	115.807°W	32.938°N	219.26	1.20
San Jacinto : B		29.55	6.79	2.34	115.943°W	33.001°N	248.20	1.16
San Jacinto : SBV+SJV+A+C		45.34	7.78	2.03	116.099°W	33.256°N	292.59	1.05
aFault_MoBal	Fault							14.00
S. San Andreas : CO		28.43	6.97	2.20	115.712°W	33.350°N	348.10	4.77
S. San Andreas : SM+NSB+SSB+BG+CO		28.42	7.84	1.53	115.712°W	33.350°N	348.10	1.02
aFault_unseg	Fault							1.96
S. San Andreas		34.77	8.00	1.54	115.712°W	33.350°N	348.10	1.11
impext.ch.in (opt)	Grid							1.84
PointSourceFinite: -115.649, 33.140		6.44	6.06	1.42	115.649°W	33.140°N	0.00	1.00
CAmap.21.ch.in (opt)	Grid							1.51
CAmap.24.ch.in (opt)	Grid							1.51

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2008 (v3.3

Spectral Period

2.0 sec spectral acceleration

Latitude

Decimal degrees

33.100001

Time Horizon

Return period in years

975

Longitude

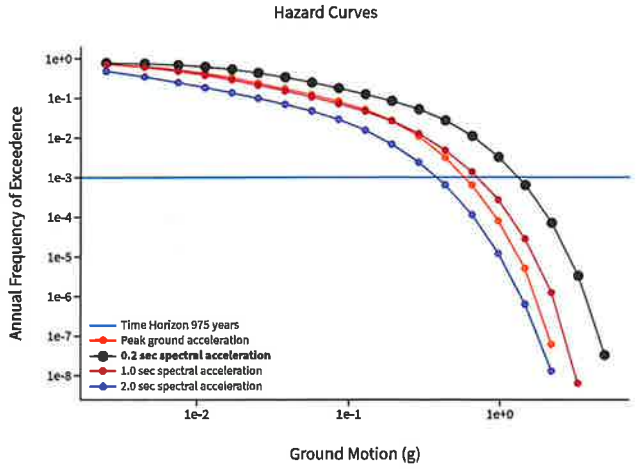
Decimal degrees, negative values for western longitudes

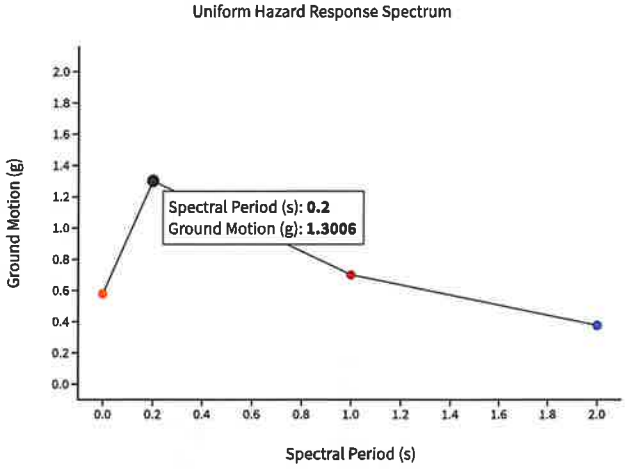
-115.648826

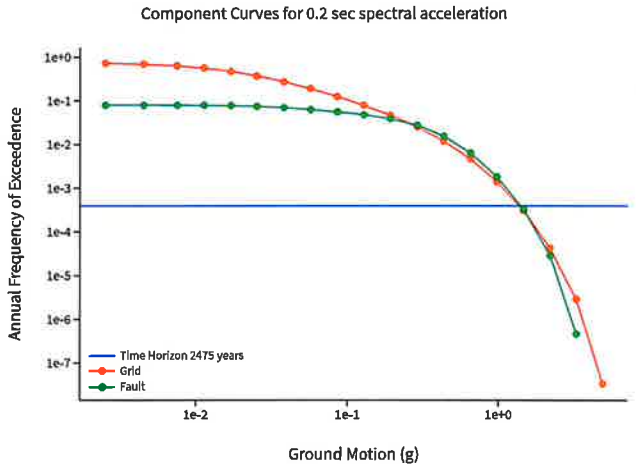
Site Class

259 m/s (Site class D)

Hazard Curve





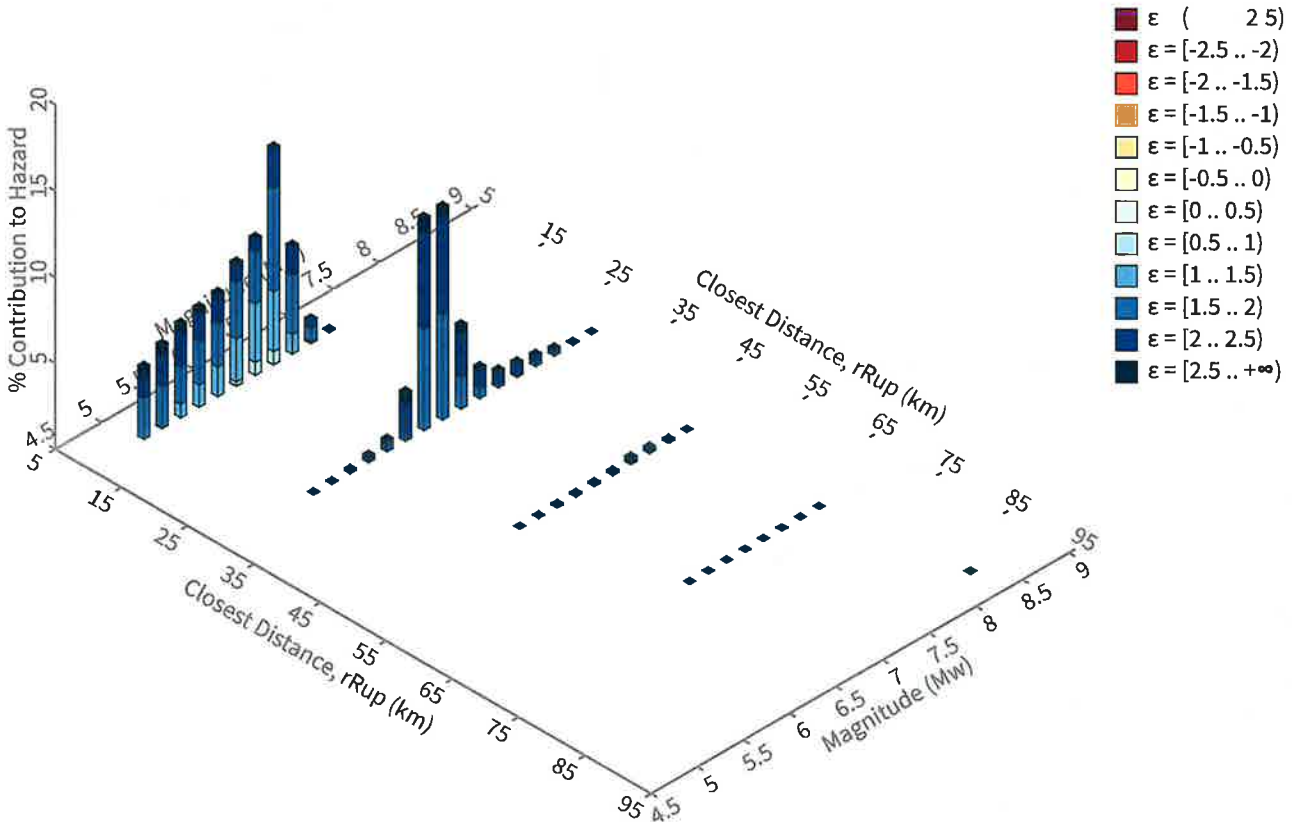


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 975 yrs
Exceedance rate: 0.001025641 yr^{-1}
2.0 s SA ground motion: 0.37603219 g

Recovered targets

Return period: 1085.0489 yrs
Exceedance rate: 0.00092161743 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.15 %

Mean (for all sources)

r: 24.27 km
m: 7.03
ε_0: 1.8 σ

Mode (largest r-m bin)

r: 23.18 km
m: 6.91
ε_0: 2.02 σ
Contribution: 17.01 %

Mode (largest ε_0 bin)

r: 24.15 km
m: 6.9
ε_0: 2.14 σ
Contribution: 8.4 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

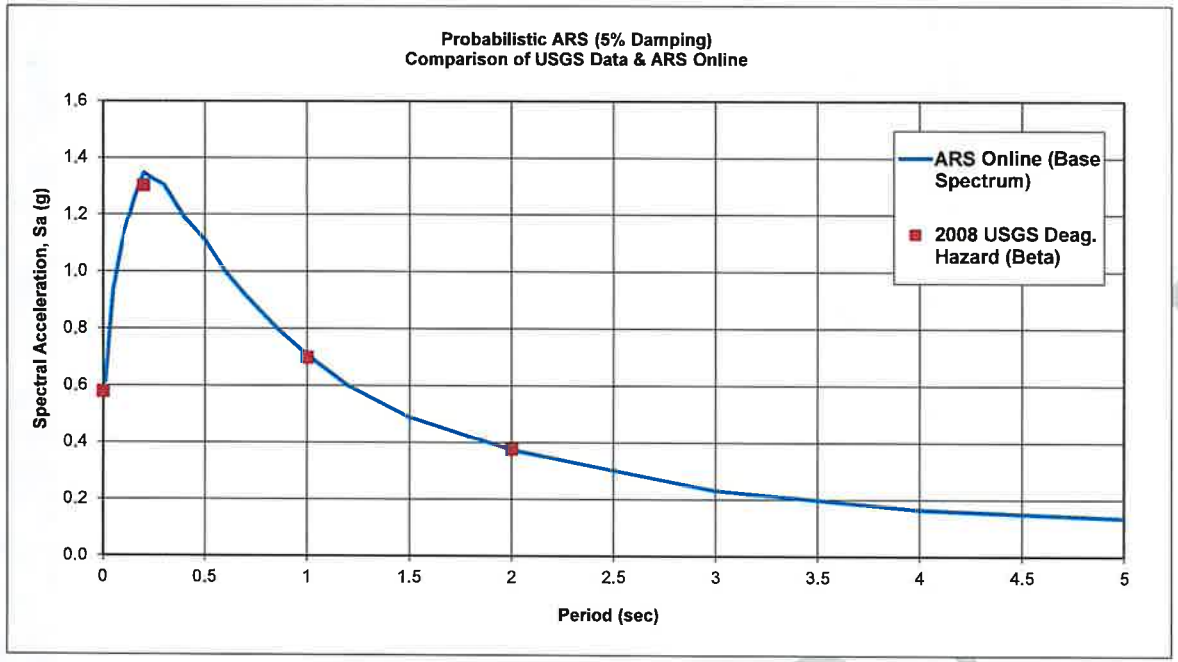
ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ϵ_0	lon	lat	az	%
bFault.ch	Fault							30.21
Imperial		21.39	6.93	1.94	115.553°W	32.926°N	155.14	19.77
Superstition Hills		17.24	6.73	1.94	115.802°W	33.008°N	234.54	5.29
Elmore Ranch		9.79	6.62	1.48	115.656°W	33.231°N	357.49	4.45
aFault_aPriori_D2.1	Fault							21.42
San Jacinto : A+C		45.34	7.52	2.03	116.099°W	33.256°N	292.59	2.72
San Jacinto : CC+B+SM		23.01	7.34	1.59	115.807°W	32.938°N	219.26	2.41
S. San Andreas : SM+NSB+SSB+BG+CO		28.42	7.84	1.23	115.712°W	33.350°N	348.10	2.12
San Jacinto : SBV+SJV+A+C		45.34	7.79	1.72	116.099°W	33.256°N	292.59	2.01
S. San Andreas : CO		28.43	7.01	2.12	115.712°W	33.350°N	348.10	1.57
S. San Andreas : NSB+SSB+BG+CO		28.42	7.64	1.47	115.712°W	33.350°N	348.10	1.37
San Jacinto : B+SM		23.01	7.03	1.92	115.807°W	32.938°N	219.26	1.32
S. San Andreas : BG+CO		28.42	7.39	1.75	115.712°W	33.350°N	348.10	1.31
S. San Andreas : SSB+BG+CO		28.42	7.54	1.58	115.712°W	33.350°N	348.10	1.09
San Jacinto : B		29.55	6.80	2.32	115.943°W	33.001°N	248.20	1.09
aFault_MoBal	Fault							19.26
S. San Andreas : CO		28.43	6.99	2.14	115.712°W	33.350°N	348.10	5.19
S. San Andreas : SM+NSB+SSB+BG+CO		28.42	7.84	1.22	115.712°W	33.350°N	348.10	1.70
San Jacinto : CC+B+SM		23.01	7.34	1.59	115.807°W	32.938°N	219.26	1.12
San Jacinto : A+C		45.34	7.52	2.03	116.099°W	33.256°N	292.59	1.01
bFault.gr	Fault							13.21
Imperial		23.05	6.77	2.15	115.553°W	32.926°N	155.14	7.81
Superstition Hills		17.40	6.61	2.09	115.802°W	33.008°N	234.54	2.80
Elmore Ranch		9.94	6.55	1.56	115.656°W	33.231°N	357.49	2.46
brawmap.in	Grid							8.84
PointSourceFixedStrike: -115.600, 33.100		6.52	6.14	1.60	115.600°W	33.100°N	89.99	2.78
PointSourceFixedStrike: -115.700, 33.100		6.65	6.15	1.61	115.700°W	33.100°N	270.01	1.84
PointSourceFixedStrike: -115.700, 33.200		7.35	6.29	1.52	115.700°W	33.200°N	336.82	1.34
PointSourceFixedStrike: -115.600, 33.000		7.30	6.29	1.51	115.600°W	33.000°N	157.73	1.20
aFault_unseg	Fault							3.26
S. San Andreas		37.69	8.00	1.22	115.712°W	33.350°N	348.10	2.06
impext.ch.in (opt)	Grid							1.09

Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data

- This spreadsheet facilitates a data check of the ARS Online base spectrum vs the USGS Data. This spreadsheet does not perform a deaggregation.
- Spectral acceleration points may be obtained from USGS Website at https://geohazards.usgs.gov/deaggint/2008/



Place ARS Online Probabilistic Data Here (Use 19 Period Data Option in ARS Online)				
T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.611	1	1	0.611
0.05	0.934	1	1	0.934
0.1	1.121	1	1	1.121
0.15	1.248	1	1	1.248
0.2	1.346	1	1	1.346
0.25	1.322	1	1	1.322
0.3	1.303	1	1	1.303
0.4	1.19	1	1	1.19
0.5	1.11	1	1	1.11
0.6	1	1	1.04	1.04
0.7	0.916	1	1.08	0.99
0.85	0.802	1	1.14	0.914
1	0.709	1	1.2	0.851
1.2	0.599	1	1.2	0.719
1.5	0.488	1	1.2	0.585
2	0.374	1	1.2	0.449
3	0.231	1	1.2	0.277
4	0.164	1	1.2	0.197
5	0.135	1	1.2	0.162

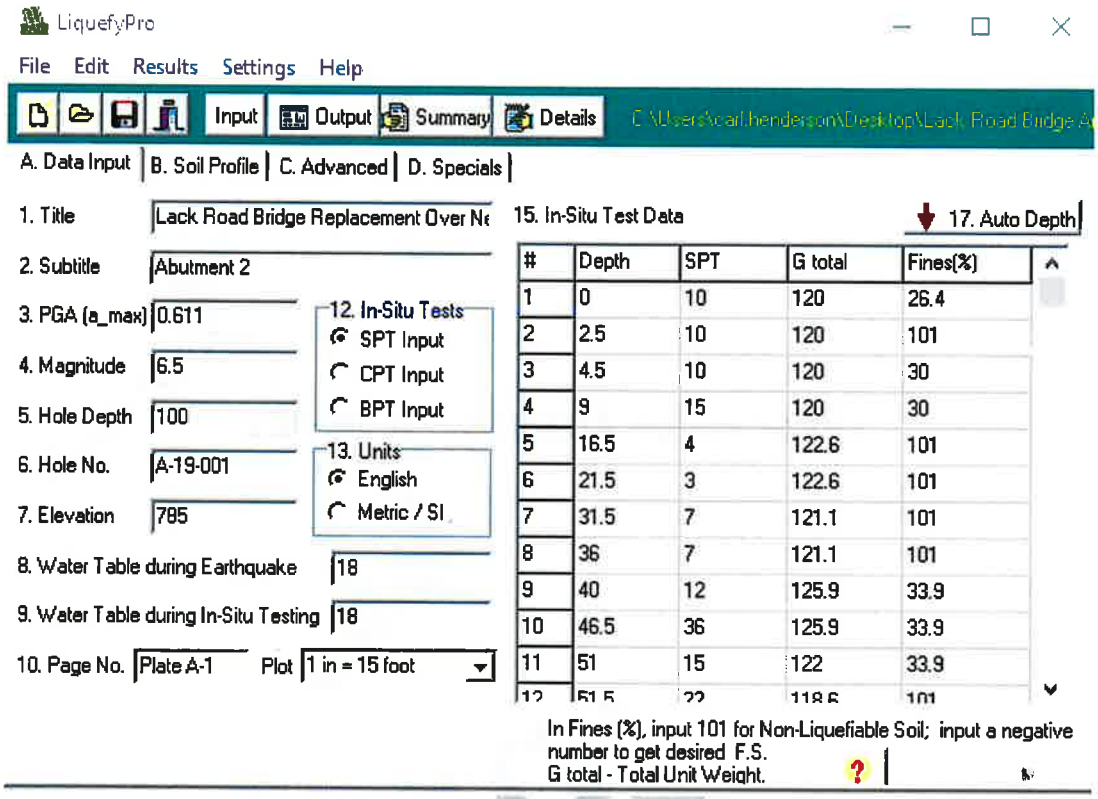
Input USGS Deaggregation Hazard Data for a Exceedance Probability of 5% in 50yr			
Period (sec)	INPUT USGS Deagg. Spec Accel	ARS Online Base Sa(g)	% Difference (bet. USGS & ARS Online)
0	0.5776	0.611	5.5%
0.2	1.3006	1.346	3.4%
1	0.6992	0.709	1.4%
2	0.376	0.374	0.5%

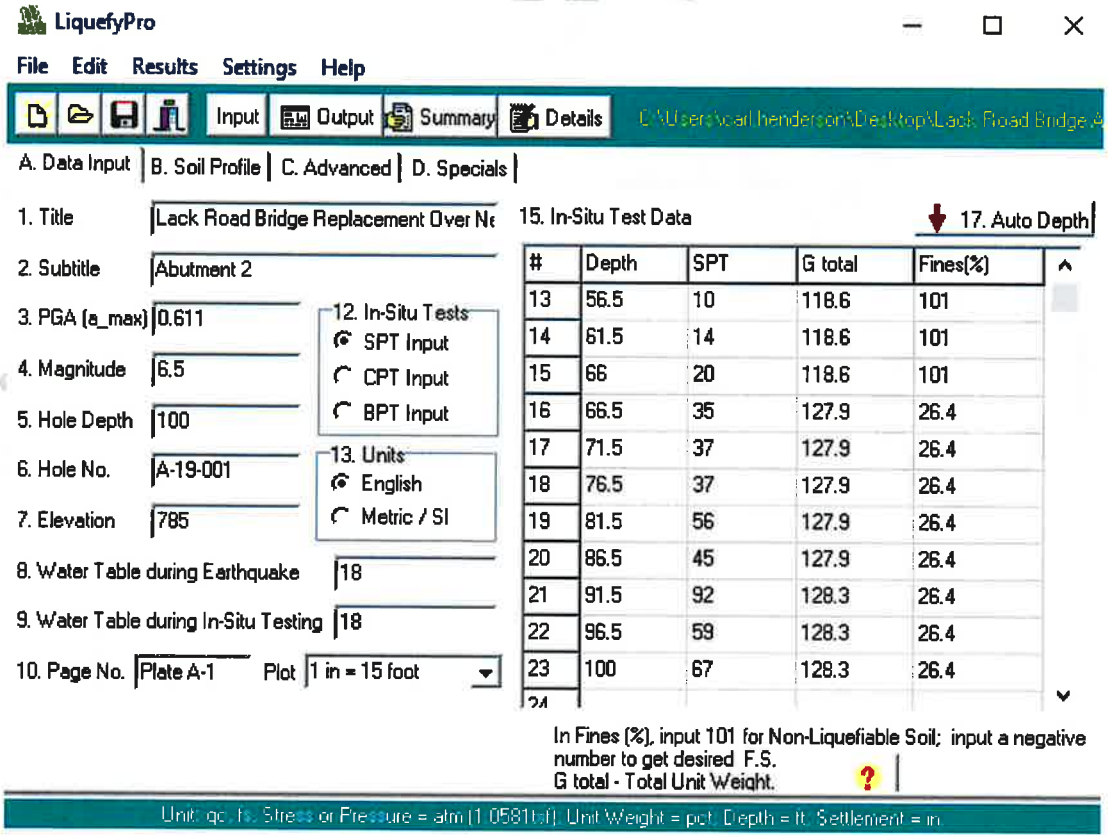
Max % Difference = 5.5%

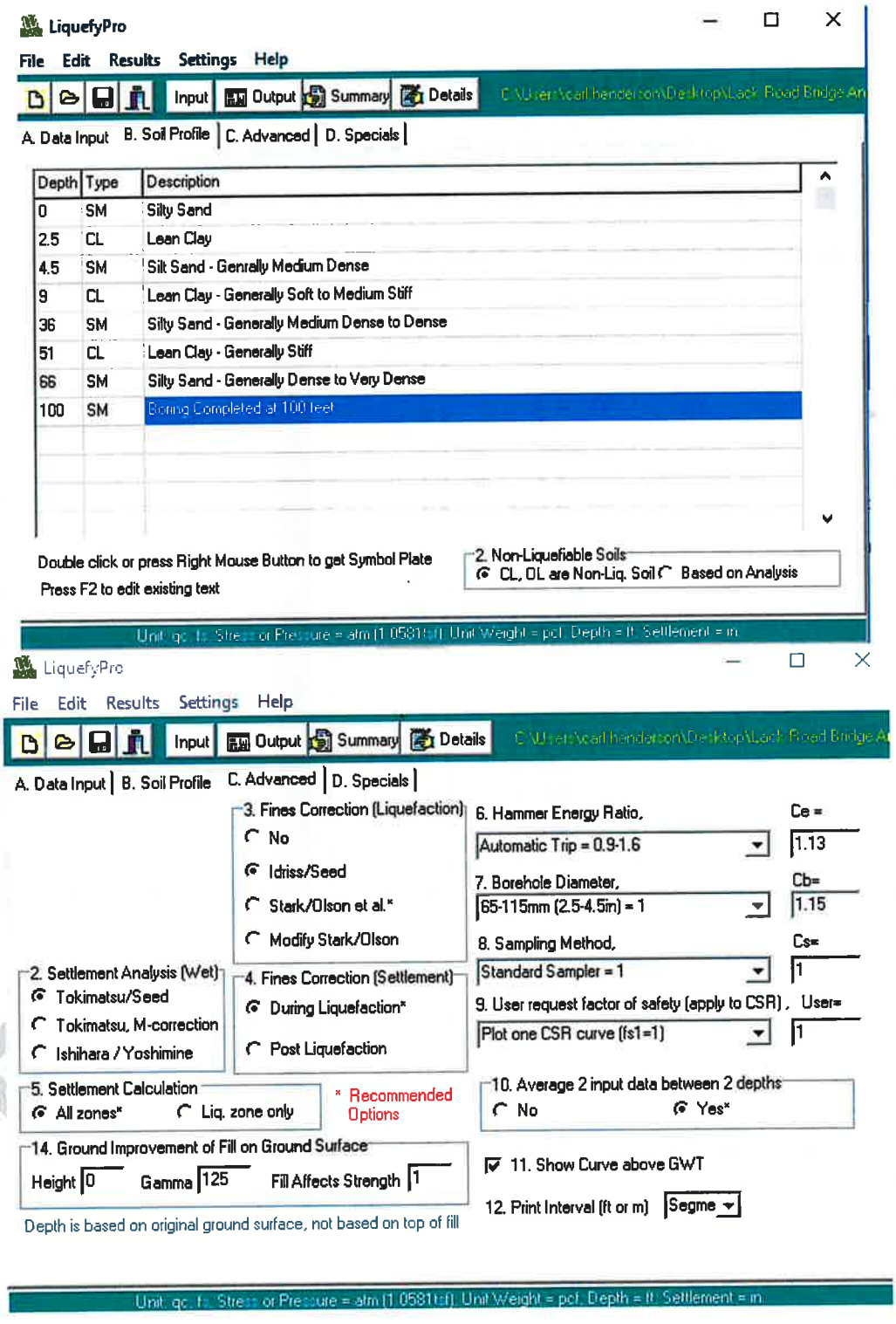
APPENDIX D

Liquefaction Analysis Results

Liquefaction Analysis – A-19-001


LiquefyPro
File Edit Results Settings Help
Input Output Summary Details
A. Data Input B. Soil Profile C. Advanced D. Specials
1. Title Lack Road Bridge Replacement Over Ne
2. Subtitle Abutment 2
3. PGA (a_max) 0.611
4. Magnitude 6.5
5. Hole Depth 100
6. Hole No. A-19-001
7. Elevation 785
12. In-Situ Tests
SPT Input
CPT Input
BPT Input
13. Units
English
Metric / SI
8. Water Table during Earthquake 18
9. Water Table during In-Situ Testing 18
10. Page No. Plate A-1 Plot 1 in = 15 foot
15. In-Situ Test Data
17. Auto Depth
Depth SPT G total Fines(%)
1 0 10 120 26.4
2 2.5 10 120 101
3 4.5 10 120 30
4 9 15 120 30
5 16.5 4 122.6 101
6 21.5 3 122.6 101
7 31.5 7 121.1 101
8 36 7 121.1 101
9 40 12 125.9 33.9
10 46.5 36 125.9 33.9
11 51 15 122 33.9
In Fines (%), input 101 for Non-Liquefiable Soil; input a negative number to get desired F.S.
G total - Total Unit Weight.


LiquefyPro
File Edit Results Settings Help
Input Output Summary Details
A. Data Input B. Soil Profile C. Advanced D. Specials
1. Title Lack Road Bridge Replacement Over Ne
2. Subtitle Abutment 2
3. PGA (a_max) 0.611
4. Magnitude 6.5
5. Hole Depth 100
6. Hole No. A-19-001
7. Elevation 785
12. In-Situ Tests
SPT Input
CPT Input
BPT Input
13. Units
English
Metric / SI
8. Water Table during Earthquake 18
9. Water Table during In-Situ Testing 18
10. Page No. Plate A-1 Plot 1 in = 15 foot
15. In-Situ Test Data
17. Auto Depth
Depth SPT G total Fines(%)
13 56.5 10 118.6 101
14 61.5 14 118.6 101
15 66 20 118.6 101
16 66.5 35 127.9 26.4
17 71.5 37 127.9 26.4
18 76.5 37 127.9 26.4
19 81.5 56 127.9 26.4
20 86.5 45 127.9 26.4
21 91.5 92 128.3 26.4
22 96.5 59 128.3 26.4
23 100 67 128.3 26.4
In Fines (%), input 101 for Non-Liquefiable Soil; input a negative number to get desired F.S.
G total - Total Unit Weight.
Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in


LiquefyPro
File Edit Results Settings Help
Input Output Summary Details
A. Data Input B. Soil Profile C. Advanced D. Specials
Depth Type Description
0 SM Silty Sand
2.5 CL Lean Clay
4.5 SM Silt Sand - Genrally Medium Dense
9 CL Lean Clay - Generally Soft to Medium Stiff
36 SM Silty Sand - Generally Medium Dense to Dense
51 CL Lean Clay - Generally Stiff
66 SM Silty Sand - Generally Dense to Very Dense
100 SM Boring Completed at 100 feet
Double click or press Right Mouse Button to get Symbol Plate
Press F2 to edit existing text
2. Non-Liquefiable Soils
CL, OL are Non-Liq. Soil
Based on Analysis
LiquefyPro
File Edit Results Settings Help
Input Output Summary Details
A. Data Input B. Soil Profile C. Advanced D. Specials
3. Fines Correction (Liquefaction)
No
Idriss/Seed
Stark/Olson et al.*
Modify Stark/Olson
6. Hammer Energy Ratio, Ce =
Automatic Trip = 0.9-1.6
1.13
7. Borehole Diameter, Cb=
65-115mm (2.5-4.5in) = 1
1.15
8. Sampling Method, Cs=
Standard Sampler = 1
1
9. User request factor of safety (apply to CSR), User=
Plot one CSR curve (fs1=1)
1
2. Settlement Analysis (Wet)
Tokimatsu/Seed
Tokimatsu, M-correction
Ishihara / Yoshimine
4. Fines Correction (Settlement)
During Liquefaction*
Post Liquefaction
5. Settlement Calculation
All zones*
Liq. zone only
* Recommended Options
10. Average 2 input data between 2 depths
No
Yes*
14. Ground Improvement of Fill on Ground Surface
Height 0 Gamma 125 Fill Affects Strength 1
Depth is based on original ground surface, not based on top of fill
11. Show Curve above GWT
12. Print Interval (ft or m) Segme

Viewform1

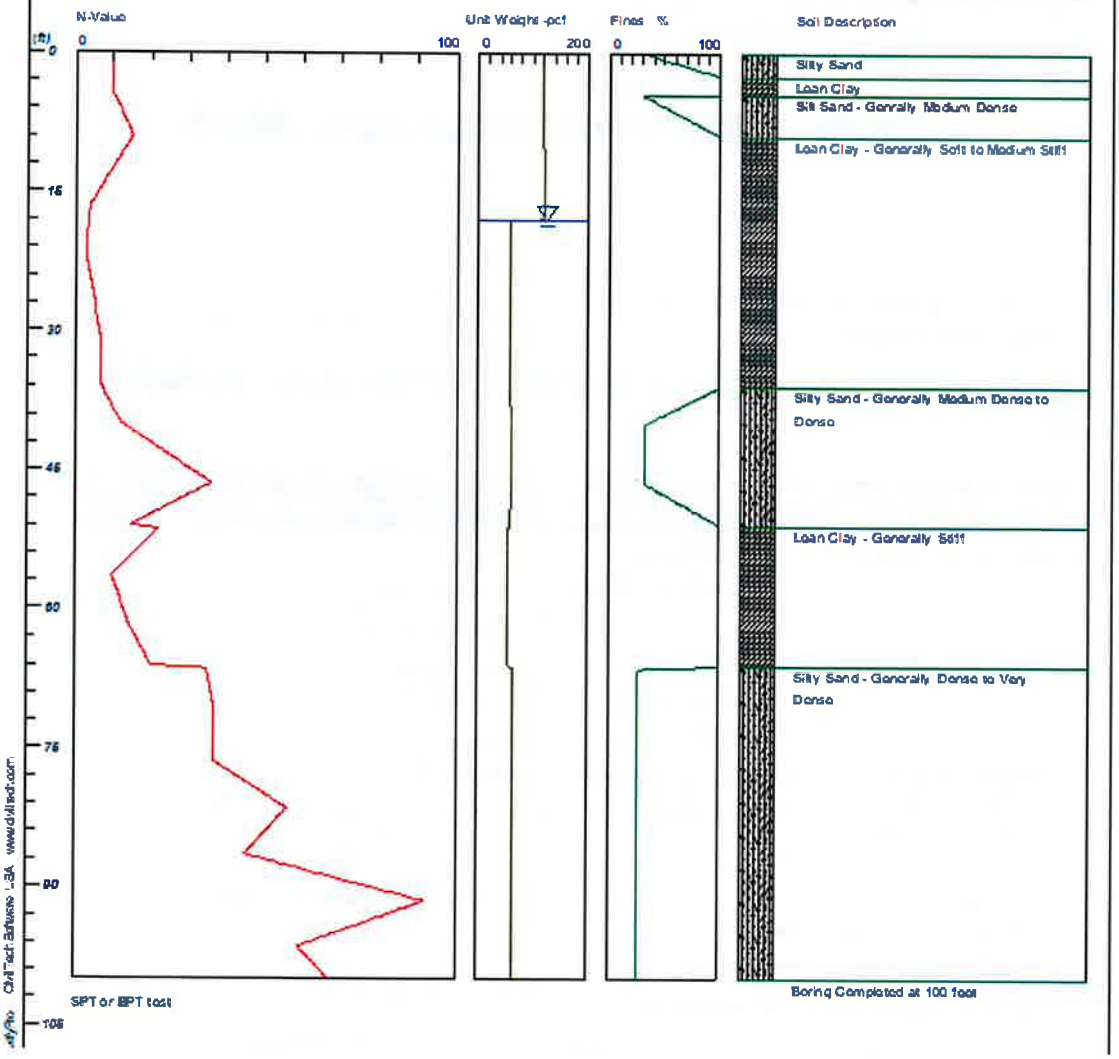
Page 1 of 1 1 Zoom % 80.0

LIQUEFACTION ANALYSIS

Lack Road Bridge Replacement Over New River

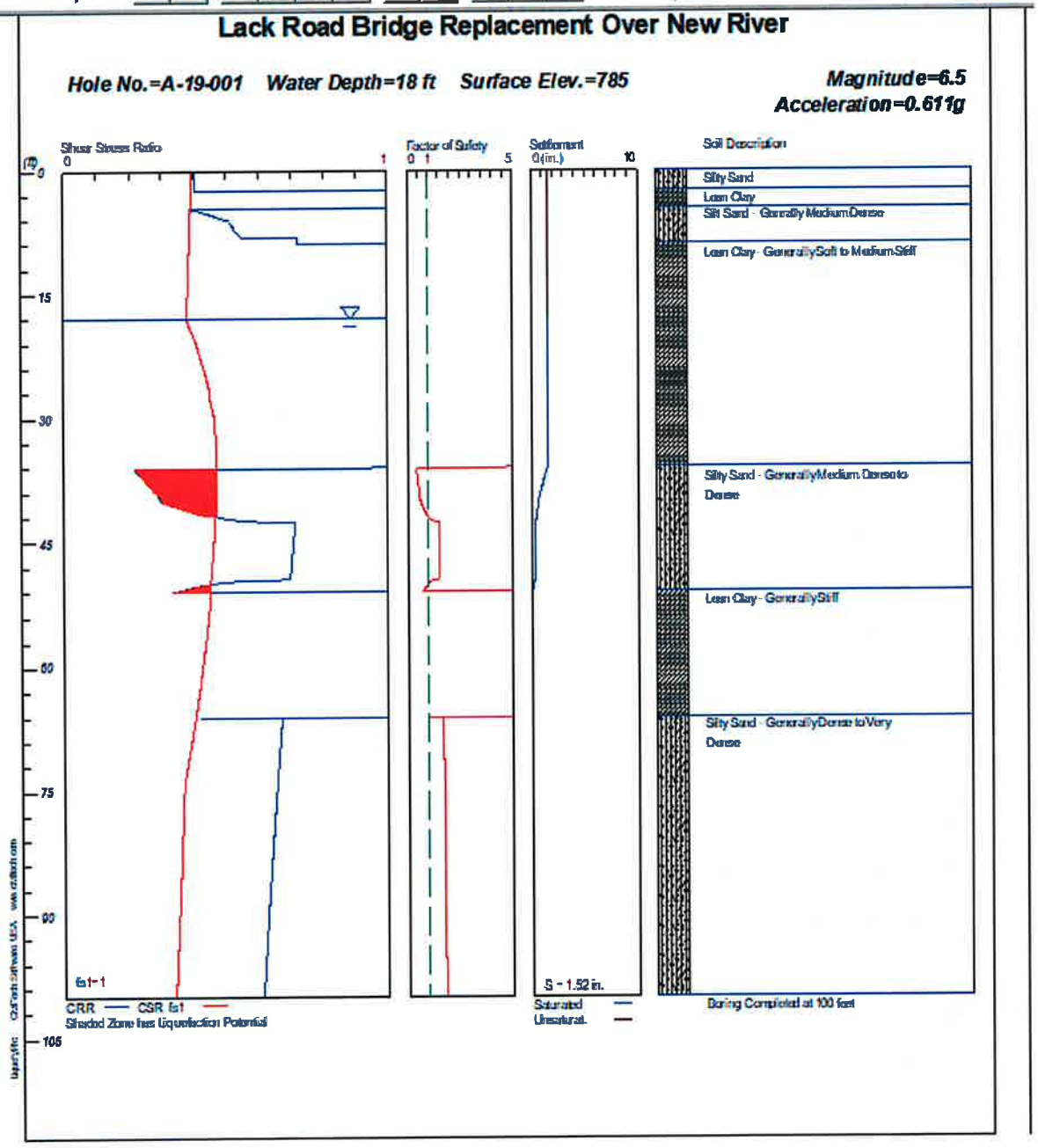
Hole No.=A-19-001 Water Depth=18 ft Surface Elev.=785

Magnitude=6.5
Acceleration=0.611g



Viewform1

Page 1 of 1 | 1 | Zoom % | 80.0



****

LIQUEFACTION ANALYSIS SUMMARY

www.civiltech.com

****

Font: Courier New, Regular, Size 8 is recommended for this report.

Licensed to , 6/6/2019 6:54:47 AM

Input File Name: C:\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix D - Liquefaction Analysis\A-19-001.liq

Title: Lack Road Bridge Replacement Over New River

Subtitle: Abutment 2

Surface Elev.=785

Hole No.=A-19-001

Depth of Hole= 100.00 ft

Water Table during Earthquake= 18.00 ft

Water Table during In-Situ Testing= 18.00 ft

Max. Acceleration= 0.61 g

Earthquake Magnitude= 6.50

Input Data:

Surface Elev.=785

Hole No.=A-19-001

Depth of Hole=100.00 ft

Water Table during Earthquake= 18.00 ft

Water Table during In-Situ Testing= 18.00 ft

Max. Acceleration=0.61 g

Earthquake Magnitude=6.50

No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.

2. Settlement Analysis Method: Tokimatsu/Seed

3. Fines Correction for Liquefaction: Idriss/Seed

4. Fine Correction for Settlement: During Liquefaction*

5. Settlement Calculation in: All zones*

6. Hammer Energy Ratio, Ce = 1.13

7. Borehole Diameter, Cb= 1.15

8. Sampling Method, Cs= 1

9. User request factor of safety (apply to CSR), User= 1

Plot one CSR curve (fs1=1)

10. Use Curve Smoothing: Yes*

* Recommended Options

In-Situ Test Data:

Depth	SPT	gamma	Fines
ft		pcf	%
0.00	10.00	120.00	30.00
2.50	10.00	120.00	NoLiq
4.50	10.00	120.00	30.00
9.00	15.00	120.00	NoLiq
16.50	4.00	122.60	NoLiq
21.50	3.00	122.60	NoLiq
31.50	7.00	121.10	NoLiq
36.00	7.00	121.10	NoLiq
40.00	12.00	125.90	33.90
46.50	36.00	125.90	33.90
51.00	15.00	122.00	NoLiq
51.50	22.00	118.60	NoLiq

56.50	10.00	118.60	NoLiq
61.50	14.00	118.60	NoLiq
66.00	20.00	118.60	NoLiq
66.50	35.00	127.90	26.40
71.50	37.00	127.90	26.40
76.50	37.00	127.90	26.40
81.50	56.00	127.90	26.40
86.50	45.00	127.90	26.40
91.50	92.00	128.30	26.40
96.50	59.00	128.30	26.40
100.00	67.00	128.30	26.40

Output Results:

Settlement of Saturated Sands=1.49 in.

Settlement of Unsaturated Sands=0.03 in.

Total Settlement of Saturated and Unsaturated Sands=1.52 in.

Differential Settlement=0.762 to 1.006 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.38	0.40	5.00	1.49	0.03	1.52
0.05	0.39	0.40	5.00	1.49	0.03	1.52
0.10	0.39	0.40	5.00	1.49	0.03	1.52
0.15	0.40	0.40	5.00	1.49	0.03	1.52
0.20	0.40	0.40	5.00	1.49	0.03	1.52
0.25	0.40	0.40	5.00	1.49	0.03	1.52
0.30	0.40	0.40	5.00	1.49	0.03	1.52
0.35	0.40	0.40	5.00	1.49	0.03	1.52
0.40	0.40	0.40	5.00	1.49	0.03	1.52

0.45	0.40	0.40	5.00	1.49	0.03	1.52
0.50	0.40	0.40	5.00	1.49	0.03	1.52
0.55	0.40	0.40	5.00	1.49	0.03	1.52
0.60	0.40	0.40	5.00	1.49	0.03	1.52
0.65	0.40	0.40	5.00	1.49	0.03	1.52
0.70	0.40	0.40	5.00	1.49	0.03	1.52
0.75	0.40	0.40	5.00	1.49	0.03	1.52
0.80	0.40	0.40	5.00	1.49	0.03	1.52
0.85	0.40	0.40	5.00	1.49	0.03	1.52
0.90	0.40	0.40	5.00	1.49	0.03	1.52
0.95	0.40	0.40	5.00	1.49	0.03	1.52
1.00	0.40	0.40	5.00	1.49	0.03	1.52
1.05	0.40	0.40	5.00	1.49	0.03	1.52
1.10	0.40	0.40	5.00	1.49	0.03	1.52
1.15	0.40	0.40	5.00	1.49	0.03	1.52
1.20	0.40	0.40	5.00	1.49	0.03	1.52
1.25	0.40	0.40	5.00	1.49	0.03	1.52
1.30	0.40	0.40	5.00	1.49	0.03	1.52
1.35	0.40	0.40	5.00	1.49	0.03	1.52
1.40	0.40	0.40	5.00	1.49	0.03	1.52
1.45	0.40	0.40	5.00	1.49	0.03	1.52
1.50	0.40	0.40	5.00	1.49	0.03	1.52
1.55	0.40	0.40	5.00	1.49	0.03	1.52
1.60	0.40	0.40	5.00	1.49	0.03	1.52
1.65	0.40	0.40	5.00	1.49	0.03	1.52
1.70	0.40	0.40	5.00	1.49	0.03	1.52
1.75	0.40	0.40	5.00	1.49	0.03	1.52
1.80	0.40	0.40	5.00	1.49	0.03	1.52
1.85	0.40	0.40	5.00	1.49	0.03	1.52
1.90	0.40	0.40	5.00	1.49	0.03	1.52
1.95	0.40	0.40	5.00	1.49	0.03	1.52

2.00	0.40	0.40	5.00	1.49	0.03	1.52
2.05	0.40	0.40	5.00	1.49	0.03	1.52
2.10	0.40	0.40	5.00	1.49	0.02	1.52
2.15	0.40	0.40	5.00	1.49	0.02	1.52
2.20	0.40	0.40	5.00	1.49	0.02	1.52
2.25	0.40	0.40	5.00	1.49	0.02	1.52
2.30	0.40	0.40	5.00	1.49	0.02	1.52
2.35	0.40	0.39	5.00	1.49	0.02	1.52
2.40	0.40	0.39	5.00	1.49	0.02	1.52
2.45	0.40	0.39	5.00	1.49	0.02	1.52
2.50	0.40	0.39	5.00	1.49	0.02	1.52
2.55	2.00	0.39	5.00	1.49	0.02	1.52
2.60	2.00	0.39	5.00	1.49	0.02	1.52
2.65	2.00	0.39	5.00	1.49	0.02	1.52
2.70	2.00	0.39	5.00	1.49	0.02	1.52
2.75	2.00	0.39	5.00	1.49	0.02	1.52
2.80	2.00	0.39	5.00	1.49	0.02	1.52
2.85	2.00	0.39	5.00	1.49	0.02	1.52
2.90	2.00	0.39	5.00	1.49	0.02	1.52
2.95	2.00	0.39	5.00	1.49	0.02	1.52
3.00	2.00	0.39	5.00	1.49	0.02	1.52
3.05	2.00	0.39	5.00	1.49	0.02	1.52
3.10	2.00	0.39	5.00	1.49	0.02	1.52
3.15	2.00	0.39	5.00	1.49	0.02	1.52
3.20	2.00	0.39	5.00	1.49	0.02	1.52
3.25	2.00	0.39	5.00	1.49	0.02	1.52
3.30	2.00	0.39	5.00	1.49	0.02	1.52
3.35	2.00	0.39	5.00	1.49	0.02	1.52
3.40	2.00	0.39	5.00	1.49	0.02	1.52
3.45	2.00	0.39	5.00	1.49	0.02	1.52
3.50	2.00	0.39	5.00	1.49	0.02	1.52

3.55	2.00	0.39	5.00	1.49	0.02	1.52
3.60	2.00	0.39	5.00	1.49	0.02	1.52
3.65	2.00	0.39	5.00	1.49	0.02	1.52
3.70	2.00	0.39	5.00	1.49	0.02	1.52
3.75	2.00	0.39	5.00	1.49	0.02	1.52
3.80	2.00	0.39	5.00	1.49	0.02	1.52
3.85	2.00	0.39	5.00	1.49	0.02	1.52
3.90	2.00	0.39	5.00	1.49	0.02	1.52
3.95	2.00	0.39	5.00	1.49	0.02	1.52
4.00	2.00	0.39	5.00	1.49	0.02	1.52
4.05	2.00	0.39	5.00	1.49	0.02	1.52
4.10	2.00	0.39	5.00	1.49	0.02	1.52
4.15	2.00	0.39	5.00	1.49	0.02	1.52
4.20	2.00	0.39	5.00	1.49	0.02	1.52
4.25	2.00	0.39	5.00	1.49	0.02	1.52
4.30	2.00	0.39	5.00	1.49	0.02	1.52
4.35	2.00	0.39	5.00	1.49	0.02	1.52
4.40	2.00	0.39	5.00	1.49	0.02	1.52
4.45	2.00	0.39	5.00	1.49	0.02	1.52
4.50	2.00	0.39	5.00	1.49	0.02	1.52
4.55	0.39	0.39	5.00	1.49	0.02	1.52
4.60	0.39	0.39	5.00	1.49	0.02	1.52
4.65	0.40	0.39	5.00	1.49	0.02	1.52
4.70	0.41	0.39	5.00	1.49	0.02	1.52
4.75	0.41	0.39	5.00	1.49	0.02	1.52
4.80	0.42	0.39	5.00	1.49	0.02	1.52
4.85	0.42	0.39	5.00	1.49	0.02	1.52
4.90	0.43	0.39	5.00	1.49	0.02	1.52
4.95	0.43	0.39	5.00	1.49	0.02	1.52
5.00	0.43	0.39	5.00	1.49	0.02	1.52
5.05	0.43	0.39	5.00	1.49	0.02	1.52

5.10	0.44	0.39	5.00	1.49	0.02	1.52
5.15	0.44	0.39	5.00	1.49	0.02	1.52
5.20	0.44	0.39	5.00	1.49	0.02	1.51
5.25	0.45	0.39	5.00	1.49	0.02	1.51
5.30	0.45	0.39	5.00	1.49	0.02	1.51
5.35	0.45	0.39	5.00	1.49	0.02	1.51
5.40	0.46	0.39	5.00	1.49	0.02	1.51
5.45	0.46	0.39	5.00	1.49	0.02	1.51
5.50	0.46	0.39	5.00	1.49	0.02	1.51
5.55	0.47	0.39	5.00	1.49	0.02	1.51
5.60	0.47	0.39	5.00	1.49	0.02	1.51
5.65	0.47	0.39	5.00	1.49	0.02	1.51
5.70	0.48	0.39	5.00	1.49	0.02	1.51
5.75	0.48	0.39	5.00	1.49	0.02	1.51
5.80	0.49	0.39	5.00	1.49	0.02	1.51
5.85	0.49	0.39	5.00	1.49	0.02	1.51
5.90	0.49	0.39	5.00	1.49	0.02	1.51
5.95	0.50	0.39	5.00	1.49	0.02	1.51
6.00	0.50	0.39	5.00	1.49	0.02	1.51
6.05	0.51	0.39	5.00	1.49	0.02	1.51
6.10	0.51	0.39	5.00	1.49	0.02	1.51
6.15	0.51	0.39	5.00	1.49	0.02	1.51
6.20	0.51	0.39	5.00	1.49	0.02	1.51
6.25	0.51	0.39	5.00	1.49	0.02	1.51
6.30	0.51	0.39	5.00	1.49	0.01	1.51
6.35	0.51	0.39	5.00	1.49	0.01	1.51
6.40	0.52	0.39	5.00	1.49	0.01	1.51
6.45	0.52	0.39	5.00	1.49	0.01	1.51
6.50	0.52	0.39	5.00	1.49	0.01	1.51
6.55	0.52	0.39	5.00	1.49	0.01	1.51
6.60	0.52	0.39	5.00	1.49	0.01	1.51

6.65	0.52	0.39	5.00	1.49	0.01	1.51
6.70	0.52	0.39	5.00	1.49	0.01	1.51
6.75	0.52	0.39	5.00	1.49	0.01	1.51
6.80	0.52	0.39	5.00	1.49	0.01	1.51
6.85	0.52	0.39	5.00	1.49	0.01	1.51
6.90	0.52	0.39	5.00	1.49	0.01	1.51
6.95	0.52	0.39	5.00	1.49	0.01	1.51
7.00	0.53	0.39	5.00	1.49	0.01	1.51
7.05	0.53	0.39	5.00	1.49	0.01	1.51
7.10	0.53	0.39	5.00	1.49	0.01	1.51
7.15	0.53	0.39	5.00	1.49	0.01	1.51
7.20	0.53	0.39	5.00	1.49	0.01	1.50
7.25	0.53	0.39	5.00	1.49	0.01	1.50
7.30	0.53	0.39	5.00	1.49	0.01	1.50
7.35	0.53	0.39	5.00	1.49	0.01	1.50
7.40	0.53	0.39	5.00	1.49	0.01	1.50
7.45	0.53	0.39	5.00	1.49	0.01	1.50
7.50	0.54	0.39	5.00	1.49	0.01	1.50
7.55	0.54	0.39	5.00	1.49	0.01	1.50
7.60	0.54	0.39	5.00	1.49	0.01	1.50
7.65	0.54	0.39	5.00	1.49	0.01	1.50
7.70	0.54	0.39	5.00	1.49	0.01	1.50
7.75	0.54	0.39	5.00	1.49	0.01	1.50
7.80	0.54	0.39	5.00	1.49	0.01	1.50
7.85	0.54	0.39	5.00	1.49	0.01	1.50
7.90	0.55	0.39	5.00	1.49	0.01	1.50
7.95	0.55	0.39	5.00	1.49	0.01	1.50
8.00	0.55	0.39	5.00	1.49	0.01	1.50
8.05	0.55	0.39	5.00	1.49	0.01	1.50
8.10	0.55	0.39	5.00	1.49	0.00	1.50
8.15	0.55	0.39	5.00	1.49	0.00	1.50

8.20	0.55	0.39	5.00	1.49	0.00	1.50
8.25	0.72	0.39	5.00	1.49	0.00	1.50
8.30	0.72	0.39	5.00	1.49	0.00	1.50
8.35	0.72	0.39	5.00	1.49	0.00	1.50
8.40	0.72	0.39	5.00	1.49	0.00	1.50
8.45	0.72	0.39	5.00	1.49	0.00	1.50
8.50	0.72	0.39	5.00	1.49	0.00	1.50
8.55	0.72	0.39	5.00	1.49	0.00	1.50
8.60	0.72	0.39	5.00	1.49	0.00	1.50
8.65	0.72	0.39	5.00	1.49	0.00	1.50
8.70	0.72	0.39	5.00	1.49	0.00	1.50
8.75	0.72	0.39	5.00	1.49	0.00	1.50
8.80	0.72	0.39	5.00	1.49	0.00	1.50
8.85	0.72	0.39	5.00	1.49	0.00	1.50
8.90	0.72	0.39	5.00	1.49	0.00	1.49
8.95	0.72	0.39	5.00	1.49	0.00	1.49
9.00	2.00	0.39	5.00	1.49	0.00	1.49
9.05	2.00	0.39	5.00	1.49	0.00	1.49
9.10	2.00	0.39	5.00	1.49	0.00	1.49
9.15	2.00	0.39	5.00	1.49	0.00	1.49
9.20	2.00	0.39	5.00	1.49	0.00	1.49
9.25	2.00	0.39	5.00	1.49	0.00	1.49
9.30	2.00	0.39	5.00	1.49	0.00	1.49
9.35	2.00	0.39	5.00	1.49	0.00	1.49
9.40	2.00	0.39	5.00	1.49	0.00	1.49
9.45	2.00	0.39	5.00	1.49	0.00	1.49
9.50	2.00	0.39	5.00	1.49	0.00	1.49
9.55	2.00	0.39	5.00	1.49	0.00	1.49
9.60	2.00	0.39	5.00	1.49	0.00	1.49
9.65	2.00	0.39	5.00	1.49	0.00	1.49
9.70	2.00	0.39	5.00	1.49	0.00	1.49

9.75	2.00	0.39	5.00	1.49	0.00	1.49
9.80	2.00	0.39	5.00	1.49	0.00	1.49
9.85	2.00	0.39	5.00	1.49	0.00	1.49
9.90	2.00	0.39	5.00	1.49	0.00	1.49
9.95	2.00	0.39	5.00	1.49	0.00	1.49
10.00	2.00	0.39	5.00	1.49	0.00	1.49
10.05	2.00	0.39	5.00	1.49	0.00	1.49
10.10	2.00	0.39	5.00	1.49	0.00	1.49
10.15	2.00	0.39	5.00	1.49	0.00	1.49
10.20	2.00	0.39	5.00	1.49	0.00	1.49
10.25	2.00	0.39	5.00	1.49	0.00	1.49
10.30	2.00	0.39	5.00	1.49	0.00	1.49
10.35	2.00	0.39	5.00	1.49	0.00	1.49
10.40	2.00	0.39	5.00	1.49	0.00	1.49
10.45	2.00	0.39	5.00	1.49	0.00	1.49
10.50	2.00	0.39	5.00	1.49	0.00	1.49
10.55	2.00	0.39	5.00	1.49	0.00	1.49
10.60	2.00	0.39	5.00	1.49	0.00	1.49
10.65	2.00	0.39	5.00	1.49	0.00	1.49
10.70	2.00	0.39	5.00	1.49	0.00	1.49
10.75	2.00	0.39	5.00	1.49	0.00	1.49
10.80	2.00	0.39	5.00	1.49	0.00	1.49
10.85	2.00	0.39	5.00	1.49	0.00	1.49
10.90	2.00	0.39	5.00	1.49	0.00	1.49
10.95	2.00	0.39	5.00	1.49	0.00	1.49
11.00	2.00	0.39	5.00	1.49	0.00	1.49
11.05	2.00	0.39	5.00	1.49	0.00	1.49
11.10	2.00	0.39	5.00	1.49	0.00	1.49
11.15	2.00	0.39	5.00	1.49	0.00	1.49
11.20	2.00	0.39	5.00	1.49	0.00	1.49
11.25	2.00	0.39	5.00	1.49	0.00	1.49

11.30	2.00	0.39	5.00	1.49	0.00	1.49
11.35	2.00	0.39	5.00	1.49	0.00	1.49
11.40	2.00	0.39	5.00	1.49	0.00	1.49
11.45	2.00	0.39	5.00	1.49	0.00	1.49
11.50	2.00	0.39	5.00	1.49	0.00	1.49
11.55	2.00	0.39	5.00	1.49	0.00	1.49
11.60	2.00	0.39	5.00	1.49	0.00	1.49
11.65	2.00	0.39	5.00	1.49	0.00	1.49
11.70	2.00	0.39	5.00	1.49	0.00	1.49
11.75	2.00	0.39	5.00	1.49	0.00	1.49
11.80	2.00	0.39	5.00	1.49	0.00	1.49
11.85	2.00	0.39	5.00	1.49	0.00	1.49
11.90	2.00	0.39	5.00	1.49	0.00	1.49
11.95	2.00	0.39	5.00	1.49	0.00	1.49
12.00	2.00	0.39	5.00	1.49	0.00	1.49
12.05	2.00	0.39	5.00	1.49	0.00	1.49
12.10	2.00	0.39	5.00	1.49	0.00	1.49
12.15	2.00	0.39	5.00	1.49	0.00	1.49
12.20	2.00	0.39	5.00	1.49	0.00	1.49
12.25	2.00	0.39	5.00	1.49	0.00	1.49
12.30	2.00	0.39	5.00	1.49	0.00	1.49
12.35	2.00	0.39	5.00	1.49	0.00	1.49
12.40	2.00	0.39	5.00	1.49	0.00	1.49
12.45	2.00	0.39	5.00	1.49	0.00	1.49
12.50	2.00	0.39	5.00	1.49	0.00	1.49
12.55	2.00	0.39	5.00	1.49	0.00	1.49
12.60	2.00	0.39	5.00	1.49	0.00	1.49
12.65	2.00	0.39	5.00	1.49	0.00	1.49
12.70	2.00	0.39	5.00	1.49	0.00	1.49
12.75	2.00	0.39	5.00	1.49	0.00	1.49
12.80	2.00	0.39	5.00	1.49	0.00	1.49

12.85	2.00	0.39	5.00	1.49	0.00	1.49
12.90	2.00	0.39	5.00	1.49	0.00	1.49
12.95	2.00	0.39	5.00	1.49	0.00	1.49
13.00	2.00	0.39	5.00	1.49	0.00	1.49
13.05	2.00	0.39	5.00	1.49	0.00	1.49
13.10	2.00	0.39	5.00	1.49	0.00	1.49
13.15	2.00	0.38	5.00	1.49	0.00	1.49
13.20	2.00	0.38	5.00	1.49	0.00	1.49
13.25	2.00	0.38	5.00	1.49	0.00	1.49
13.30	2.00	0.38	5.00	1.49	0.00	1.49
13.35	2.00	0.38	5.00	1.49	0.00	1.49
13.40	2.00	0.38	5.00	1.49	0.00	1.49
13.45	2.00	0.38	5.00	1.49	0.00	1.49
13.50	2.00	0.38	5.00	1.49	0.00	1.49
13.55	2.00	0.38	5.00	1.49	0.00	1.49
13.60	2.00	0.38	5.00	1.49	0.00	1.49
13.65	2.00	0.38	5.00	1.49	0.00	1.49
13.70	2.00	0.38	5.00	1.49	0.00	1.49
13.75	2.00	0.38	5.00	1.49	0.00	1.49
13.80	2.00	0.38	5.00	1.49	0.00	1.49
13.85	2.00	0.38	5.00	1.49	0.00	1.49
13.90	2.00	0.38	5.00	1.49	0.00	1.49
13.95	2.00	0.38	5.00	1.49	0.00	1.49
14.00	2.00	0.38	5.00	1.49	0.00	1.49
14.05	2.00	0.38	5.00	1.49	0.00	1.49
14.10	2.00	0.38	5.00	1.49	0.00	1.49
14.15	2.00	0.38	5.00	1.49	0.00	1.49
14.20	2.00	0.38	5.00	1.49	0.00	1.49
14.25	2.00	0.38	5.00	1.49	0.00	1.49
14.30	2.00	0.38	5.00	1.49	0.00	1.49
14.35	2.00	0.38	5.00	1.49	0.00	1.49

14.40	2.00	0.38	5.00	1.49	0.00	1.49
14.45	2.00	0.38	5.00	1.49	0.00	1.49
14.50	2.00	0.38	5.00	1.49	0.00	1.49
14.55	2.00	0.38	5.00	1.49	0.00	1.49
14.60	2.00	0.38	5.00	1.49	0.00	1.49
14.65	2.00	0.38	5.00	1.49	0.00	1.49
14.70	2.00	0.38	5.00	1.49	0.00	1.49
14.75	2.00	0.38	5.00	1.49	0.00	1.49
14.80	2.00	0.38	5.00	1.49	0.00	1.49
14.85	2.00	0.38	5.00	1.49	0.00	1.49
14.90	2.00	0.38	5.00	1.49	0.00	1.49
14.95	2.00	0.38	5.00	1.49	0.00	1.49
15.00	2.00	0.38	5.00	1.49	0.00	1.49
15.05	2.00	0.38	5.00	1.49	0.00	1.49
15.10	2.00	0.38	5.00	1.49	0.00	1.49
15.15	2.00	0.38	5.00	1.49	0.00	1.49
15.20	2.00	0.38	5.00	1.49	0.00	1.49
15.25	2.00	0.38	5.00	1.49	0.00	1.49
15.30	2.00	0.38	5.00	1.49	0.00	1.49
15.35	2.00	0.38	5.00	1.49	0.00	1.49
15.40	2.00	0.38	5.00	1.49	0.00	1.49
15.45	2.00	0.38	5.00	1.49	0.00	1.49
15.50	2.00	0.38	5.00	1.49	0.00	1.49
15.55	2.00	0.38	5.00	1.49	0.00	1.49
15.60	2.00	0.38	5.00	1.49	0.00	1.49
15.65	2.00	0.38	5.00	1.49	0.00	1.49
15.70	2.00	0.38	5.00	1.49	0.00	1.49
15.75	2.00	0.38	5.00	1.49	0.00	1.49
15.80	2.00	0.38	5.00	1.49	0.00	1.49
15.85	2.00	0.38	5.00	1.49	0.00	1.49
15.90	2.00	0.38	5.00	1.49	0.00	1.49

15.95	2.00	0.38	5.00	1.49	0.00	1.49
16.00	2.00	0.38	5.00	1.49	0.00	1.49
16.05	2.00	0.38	5.00	1.49	0.00	1.49
16.10	2.00	0.38	5.00	1.49	0.00	1.49
16.15	2.00	0.38	5.00	1.49	0.00	1.49
16.20	2.00	0.38	5.00	1.49	0.00	1.49
16.25	2.00	0.38	5.00	1.49	0.00	1.49
16.30	2.00	0.38	5.00	1.49	0.00	1.49
16.35	2.00	0.38	5.00	1.49	0.00	1.49
16.40	2.00	0.38	5.00	1.49	0.00	1.49
16.45	2.00	0.38	5.00	1.49	0.00	1.49
16.50	2.00	0.38	5.00	1.49	0.00	1.49
16.55	2.00	0.38	5.00	1.49	0.00	1.49
16.60	2.00	0.38	5.00	1.49	0.00	1.49
16.65	2.00	0.38	5.00	1.49	0.00	1.49
16.70	2.00	0.38	5.00	1.49	0.00	1.49
16.75	2.00	0.38	5.00	1.49	0.00	1.49
16.80	2.00	0.38	5.00	1.49	0.00	1.49
16.85	2.00	0.38	5.00	1.49	0.00	1.49
16.90	2.00	0.38	5.00	1.49	0.00	1.49
16.95	2.00	0.38	5.00	1.49	0.00	1.49
17.00	2.00	0.38	5.00	1.49	0.00	1.49
17.05	2.00	0.38	5.00	1.49	0.00	1.49
17.10	2.00	0.38	5.00	1.49	0.00	1.49
17.15	2.00	0.38	5.00	1.49	0.00	1.49
17.20	2.00	0.38	5.00	1.49	0.00	1.49
17.25	2.00	0.38	5.00	1.49	0.00	1.49
17.30	2.00	0.38	5.00	1.49	0.00	1.49
17.35	2.00	0.38	5.00	1.49	0.00	1.49
17.40	2.00	0.38	5.00	1.49	0.00	1.49
17.45	2.00	0.38	5.00	1.49	0.00	1.49

17.50	2.00	0.38	5.00	1.49	0.00	1.49
17.55	2.00	0.38	5.00	1.49	0.00	1.49
17.60	2.00	0.38	5.00	1.49	0.00	1.49
17.65	2.00	0.38	5.00	1.49	0.00	1.49
17.70	2.00	0.38	5.00	1.49	0.00	1.49
17.75	2.00	0.38	5.00	1.49	0.00	1.49
17.80	2.00	0.38	5.00	1.49	0.00	1.49
17.85	2.00	0.38	5.00	1.49	0.00	1.49
17.90	2.00	0.38	5.00	1.49	0.00	1.49
17.95	2.00	0.38	5.00	1.49	0.00	1.49
18.00	2.00	0.38	5.00	1.49	0.00	1.49
18.05	2.00	0.38	5.00	1.49	0.00	1.49
18.10	2.00	0.38	5.00	1.49	0.00	1.49
18.15	2.00	0.38	5.00	1.49	0.00	1.49
18.20	2.00	0.38	5.00	1.49	0.00	1.49
18.25	2.00	0.38	5.00	1.49	0.00	1.49
18.30	2.00	0.38	5.00	1.49	0.00	1.49
18.35	2.00	0.38	5.00	1.49	0.00	1.49
18.40	2.00	0.38	5.00	1.49	0.00	1.49
18.45	2.00	0.38	5.00	1.49	0.00	1.49
18.50	2.00	0.39	5.00	1.49	0.00	1.49
18.55	2.00	0.39	5.00	1.49	0.00	1.49
18.60	2.00	0.39	5.00	1.49	0.00	1.49
18.65	2.00	0.39	5.00	1.49	0.00	1.49
18.70	2.00	0.39	5.00	1.49	0.00	1.49
18.75	2.00	0.39	5.00	1.49	0.00	1.49
18.80	2.00	0.39	5.00	1.49	0.00	1.49
18.85	2.00	0.39	5.00	1.49	0.00	1.49
18.90	2.00	0.39	5.00	1.49	0.00	1.49
18.95	2.00	0.39	5.00	1.49	0.00	1.49
19.00	2.00	0.39	5.00	1.49	0.00	1.49

19.05	2.00	0.39	5.00	1.49	0.00	1.49
19.10	2.00	0.39	5.00	1.49	0.00	1.49
19.15	2.00	0.39	5.00	1.49	0.00	1.49
19.20	2.00	0.39	5.00	1.49	0.00	1.49
19.25	2.00	0.39	5.00	1.49	0.00	1.49
19.30	2.00	0.39	5.00	1.49	0.00	1.49
19.35	2.00	0.39	5.00	1.49	0.00	1.49
19.40	2.00	0.39	5.00	1.49	0.00	1.49
19.45	2.00	0.39	5.00	1.49	0.00	1.49
19.50	2.00	0.39	5.00	1.49	0.00	1.49
19.55	2.00	0.40	5.00	1.49	0.00	1.49
19.60	2.00	0.40	5.00	1.49	0.00	1.49
19.65	2.00	0.40	5.00	1.49	0.00	1.49
19.70	2.00	0.40	5.00	1.49	0.00	1.49
19.75	2.00	0.40	5.00	1.49	0.00	1.49
19.80	2.00	0.40	5.00	1.49	0.00	1.49
19.85	2.00	0.40	5.00	1.49	0.00	1.49
19.90	2.00	0.40	5.00	1.49	0.00	1.49
19.95	2.00	0.40	5.00	1.49	0.00	1.49
20.00	2.00	0.40	5.00	1.49	0.00	1.49
20.05	2.00	0.40	5.00	1.49	0.00	1.49
20.10	2.00	0.40	5.00	1.49	0.00	1.49
20.15	2.00	0.40	5.00	1.49	0.00	1.49
20.20	2.00	0.40	5.00	1.49	0.00	1.49
20.25	2.00	0.40	5.00	1.49	0.00	1.49
20.30	2.00	0.40	5.00	1.49	0.00	1.49
20.35	2.00	0.40	5.00	1.49	0.00	1.49
20.40	2.00	0.40	5.00	1.49	0.00	1.49
20.45	2.00	0.40	5.00	1.49	0.00	1.49
20.50	2.00	0.40	5.00	1.49	0.00	1.49
20.55	2.00	0.40	5.00	1.49	0.00	1.49

20.60	2.00	0.40	5.00	1.49	0.00	1.49
20.65	2.00	0.40	5.00	1.49	0.00	1.49
20.70	2.00	0.41	5.00	1.49	0.00	1.49
20.75	2.00	0.41	5.00	1.49	0.00	1.49
20.80	2.00	0.41	5.00	1.49	0.00	1.49
20.85	2.00	0.41	5.00	1.49	0.00	1.49
20.90	2.00	0.41	5.00	1.49	0.00	1.49
20.95	2.00	0.41	5.00	1.49	0.00	1.49
21.00	2.00	0.41	5.00	1.49	0.00	1.49
21.05	2.00	0.41	5.00	1.49	0.00	1.49
21.10	2.00	0.41	5.00	1.49	0.00	1.49
21.15	2.00	0.41	5.00	1.49	0.00	1.49
21.20	2.00	0.41	5.00	1.49	0.00	1.49
21.25	2.00	0.41	5.00	1.49	0.00	1.49
21.30	2.00	0.41	5.00	1.49	0.00	1.49
21.35	2.00	0.41	5.00	1.49	0.00	1.49
21.40	2.00	0.41	5.00	1.49	0.00	1.49
21.45	2.00	0.41	5.00	1.49	0.00	1.49
21.50	2.00	0.41	5.00	1.49	0.00	1.49
21.55	2.00	0.41	5.00	1.49	0.00	1.49
21.60	2.00	0.41	5.00	1.49	0.00	1.49
21.65	2.00	0.41	5.00	1.49	0.00	1.49
21.70	2.00	0.41	5.00	1.49	0.00	1.49
21.75	2.00	0.41	5.00	1.49	0.00	1.49
21.80	2.00	0.41	5.00	1.49	0.00	1.49
21.85	2.00	0.41	5.00	1.49	0.00	1.49
21.90	2.00	0.41	5.00	1.49	0.00	1.49
21.95	2.00	0.42	5.00	1.49	0.00	1.49
22.00	2.00	0.42	5.00	1.49	0.00	1.49
22.05	2.00	0.42	5.00	1.49	0.00	1.49
22.10	2.00	0.42	5.00	1.49	0.00	1.49

22.15	2.00	0.42	5.00	1.49	0.00	1.49
22.20	2.00	0.42	5.00	1.49	0.00	1.49
22.25	2.00	0.42	5.00	1.49	0.00	1.49
22.30	2.00	0.42	5.00	1.49	0.00	1.49
22.35	2.00	0.42	5.00	1.49	0.00	1.49
22.40	2.00	0.42	5.00	1.49	0.00	1.49
22.45	2.00	0.42	5.00	1.49	0.00	1.49
22.50	2.00	0.42	5.00	1.49	0.00	1.49
22.55	2.00	0.42	5.00	1.49	0.00	1.49
22.60	2.00	0.42	5.00	1.49	0.00	1.49
22.65	2.00	0.42	5.00	1.49	0.00	1.49
22.70	2.00	0.42	5.00	1.49	0.00	1.49
22.75	2.00	0.42	5.00	1.49	0.00	1.49
22.80	2.00	0.42	5.00	1.49	0.00	1.49
22.85	2.00	0.42	5.00	1.49	0.00	1.49
22.90	2.00	0.42	5.00	1.49	0.00	1.49
22.95	2.00	0.42	5.00	1.49	0.00	1.49
23.00	2.00	0.42	5.00	1.49	0.00	1.49
23.05	2.00	0.42	5.00	1.49	0.00	1.49
23.10	2.00	0.42	5.00	1.49	0.00	1.49
23.15	2.00	0.42	5.00	1.49	0.00	1.49
23.20	2.00	0.42	5.00	1.49	0.00	1.49
23.25	2.00	0.43	5.00	1.49	0.00	1.49
23.30	2.00	0.43	5.00	1.49	0.00	1.49
23.35	2.00	0.43	5.00	1.49	0.00	1.49
23.40	2.00	0.43	5.00	1.49	0.00	1.49
23.45	2.00	0.43	5.00	1.49	0.00	1.49
23.50	2.00	0.43	5.00	1.49	0.00	1.49
23.55	2.00	0.43	5.00	1.49	0.00	1.49
23.60	2.00	0.43	5.00	1.49	0.00	1.49
23.65	2.00	0.43	5.00	1.49	0.00	1.49

23.70	2.00	0.43	5.00	1.49	0.00	1.49
23.75	2.00	0.43	5.00	1.49	0.00	1.49
23.80	2.00	0.43	5.00	1.49	0.00	1.49
23.85	2.00	0.43	5.00	1.49	0.00	1.49
23.90	2.00	0.43	5.00	1.49	0.00	1.49
23.95	2.00	0.43	5.00	1.49	0.00	1.49
24.00	2.00	0.43	5.00	1.49	0.00	1.49
24.05	2.00	0.43	5.00	1.49	0.00	1.49
24.10	2.00	0.43	5.00	1.49	0.00	1.49
24.15	2.00	0.43	5.00	1.49	0.00	1.49
24.20	2.00	0.43	5.00	1.49	0.00	1.49
24.25	2.00	0.43	5.00	1.49	0.00	1.49
24.30	2.00	0.43	5.00	1.49	0.00	1.49
24.35	2.00	0.43	5.00	1.49	0.00	1.49
24.40	2.00	0.43	5.00	1.49	0.00	1.49
24.45	2.00	0.43	5.00	1.49	0.00	1.49
24.50	2.00	0.43	5.00	1.49	0.00	1.49
24.55	2.00	0.43	5.00	1.49	0.00	1.49
24.60	2.00	0.43	5.00	1.49	0.00	1.49
24.65	2.00	0.43	5.00	1.49	0.00	1.49
24.70	2.00	0.44	5.00	1.49	0.00	1.49
24.75	2.00	0.44	5.00	1.49	0.00	1.49
24.80	2.00	0.44	5.00	1.49	0.00	1.49
24.85	2.00	0.44	5.00	1.49	0.00	1.49
24.90	2.00	0.44	5.00	1.49	0.00	1.49
24.95	2.00	0.44	5.00	1.49	0.00	1.49
25.00	2.00	0.44	5.00	1.49	0.00	1.49
25.05	2.00	0.44	5.00	1.49	0.00	1.49
25.10	2.00	0.44	5.00	1.49	0.00	1.49
25.15	2.00	0.44	5.00	1.49	0.00	1.49
25.20	2.00	0.44	5.00	1.49	0.00	1.49

25.25	2.00	0.44	5.00	1.49	0.00	1.49
25.30	2.00	0.44	5.00	1.49	0.00	1.49
25.35	2.00	0.44	5.00	1.49	0.00	1.49
25.40	2.00	0.44	5.00	1.49	0.00	1.49
25.45	2.00	0.44	5.00	1.49	0.00	1.49
25.50	2.00	0.44	5.00	1.49	0.00	1.49
25.55	2.00	0.44	5.00	1.49	0.00	1.49
25.60	2.00	0.44	5.00	1.49	0.00	1.49
25.65	2.00	0.44	5.00	1.49	0.00	1.49
25.70	2.00	0.44	5.00	1.49	0.00	1.49
25.75	2.00	0.44	5.00	1.49	0.00	1.49
25.80	2.00	0.44	5.00	1.49	0.00	1.49
25.85	2.00	0.44	5.00	1.49	0.00	1.49
25.90	2.00	0.44	5.00	1.49	0.00	1.49
25.95	2.00	0.44	5.00	1.49	0.00	1.49
26.00	2.00	0.44	5.00	1.49	0.00	1.49
26.05	2.00	0.44	5.00	1.49	0.00	1.49
26.10	2.00	0.44	5.00	1.49	0.00	1.49
26.15	2.00	0.44	5.00	1.49	0.00	1.49
26.20	2.00	0.44	5.00	1.49	0.00	1.49
26.25	2.00	0.44	5.00	1.49	0.00	1.49
26.30	2.00	0.45	5.00	1.49	0.00	1.49
26.35	2.00	0.45	5.00	1.49	0.00	1.49
26.40	2.00	0.45	5.00	1.49	0.00	1.49
26.45	2.00	0.45	5.00	1.49	0.00	1.49
26.50	2.00	0.45	5.00	1.49	0.00	1.49
26.55	2.00	0.45	5.00	1.49	0.00	1.49
26.60	2.00	0.45	5.00	1.49	0.00	1.49
26.65	2.00	0.45	5.00	1.49	0.00	1.49
26.70	2.00	0.45	5.00	1.49	0.00	1.49
26.75	2.00	0.45	5.00	1.49	0.00	1.49

26.80	2.00	0.45	5.00	1.49	0.00	1.49
26.85	2.00	0.45	5.00	1.49	0.00	1.49
26.90	2.00	0.45	5.00	1.49	0.00	1.49
26.95	2.00	0.45	5.00	1.49	0.00	1.49
27.00	2.00	0.45	5.00	1.49	0.00	1.49
27.05	2.00	0.45	5.00	1.49	0.00	1.49
27.10	2.00	0.45	5.00	1.49	0.00	1.49
27.15	2.00	0.45	5.00	1.49	0.00	1.49
27.20	2.00	0.45	5.00	1.49	0.00	1.49
27.25	2.00	0.45	5.00	1.49	0.00	1.49
27.30	2.00	0.45	5.00	1.49	0.00	1.49
27.35	2.00	0.45	5.00	1.49	0.00	1.49
27.40	2.00	0.45	5.00	1.49	0.00	1.49
27.45	2.00	0.45	5.00	1.49	0.00	1.49
27.50	2.00	0.45	5.00	1.49	0.00	1.49
27.55	2.00	0.45	5.00	1.49	0.00	1.49
27.60	2.00	0.45	5.00	1.49	0.00	1.49
27.65	2.00	0.45	5.00	1.49	0.00	1.49
27.70	2.00	0.45	5.00	1.49	0.00	1.49
27.75	2.00	0.45	5.00	1.49	0.00	1.49
27.80	2.00	0.45	5.00	1.49	0.00	1.49
27.85	2.00	0.45	5.00	1.49	0.00	1.49
27.90	2.00	0.45	5.00	1.49	0.00	1.49
27.95	2.00	0.45	5.00	1.49	0.00	1.49
28.00	2.00	0.45	5.00	1.49	0.00	1.49
28.05	2.00	0.46	5.00	1.49	0.00	1.49
28.10	2.00	0.46	5.00	1.49	0.00	1.49
28.15	2.00	0.46	5.00	1.49	0.00	1.49
28.20	2.00	0.46	5.00	1.49	0.00	1.49
28.25	2.00	0.46	5.00	1.49	0.00	1.49
28.30	2.00	0.46	5.00	1.49	0.00	1.49

28.35	2.00	0.46	5.00	1.49	0.00	1.49
28.40	2.00	0.46	5.00	1.49	0.00	1.49
28.45	2.00	0.46	5.00	1.49	0.00	1.49
28.50	2.00	0.46	5.00	1.49	0.00	1.49
28.55	2.00	0.46	5.00	1.49	0.00	1.49
28.60	2.00	0.46	5.00	1.49	0.00	1.49
28.65	2.00	0.46	5.00	1.49	0.00	1.49
28.70	2.00	0.46	5.00	1.49	0.00	1.49
28.75	2.00	0.46	5.00	1.49	0.00	1.49
28.80	2.00	0.46	5.00	1.49	0.00	1.49
28.85	2.00	0.46	5.00	1.49	0.00	1.49
28.90	2.00	0.46	5.00	1.49	0.00	1.49
28.95	2.00	0.46	5.00	1.49	0.00	1.49
29.00	2.00	0.46	5.00	1.49	0.00	1.49
29.05	2.00	0.46	5.00	1.49	0.00	1.49
29.10	2.00	0.46	5.00	1.49	0.00	1.49
29.15	2.00	0.46	5.00	1.49	0.00	1.49
29.20	2.00	0.46	5.00	1.49	0.00	1.49
29.25	2.00	0.46	5.00	1.49	0.00	1.49
29.30	2.00	0.46	5.00	1.49	0.00	1.49
29.35	2.00	0.46	5.00	1.49	0.00	1.49
29.40	2.00	0.46	5.00	1.49	0.00	1.49
29.45	2.00	0.46	5.00	1.49	0.00	1.49
29.50	2.00	0.46	5.00	1.49	0.00	1.49
29.55	2.00	0.46	5.00	1.49	0.00	1.49
29.60	2.00	0.46	5.00	1.49	0.00	1.49
29.65	2.00	0.46	5.00	1.49	0.00	1.49
29.70	2.00	0.46	5.00	1.49	0.00	1.49
29.75	2.00	0.46	5.00	1.49	0.00	1.49
29.80	2.00	0.46	5.00	1.49	0.00	1.49
29.85	2.00	0.46	5.00	1.49	0.00	1.49

29.90	2.00	0.46	5.00	1.49	0.00	1.49
29.95	2.00	0.46	5.00	1.49	0.00	1.49
30.00	2.00	0.47	5.00	1.49	0.00	1.49
30.05	2.00	0.47	5.00	1.49	0.00	1.49
30.10	2.00	0.47	5.00	1.49	0.00	1.49
30.15	2.00	0.47	5.00	1.49	0.00	1.49
30.20	2.00	0.47	5.00	1.49	0.00	1.49
30.25	2.00	0.47	5.00	1.49	0.00	1.49
30.30	2.00	0.47	5.00	1.49	0.00	1.49
30.35	2.00	0.47	5.00	1.49	0.00	1.49
30.40	2.00	0.47	5.00	1.49	0.00	1.49
30.45	2.00	0.47	5.00	1.49	0.00	1.49
30.50	2.00	0.47	5.00	1.49	0.00	1.49
30.55	2.00	0.47	5.00	1.49	0.00	1.49
30.60	2.00	0.47	5.00	1.49	0.00	1.49
30.65	2.00	0.47	5.00	1.49	0.00	1.49
30.70	2.00	0.47	5.00	1.49	0.00	1.49
30.75	2.00	0.47	5.00	1.49	0.00	1.49
30.80	2.00	0.47	5.00	1.49	0.00	1.49
30.85	2.00	0.47	5.00	1.49	0.00	1.49
30.90	2.00	0.47	5.00	1.49	0.00	1.49
30.95	2.00	0.47	5.00	1.49	0.00	1.49
31.00	2.00	0.47	5.00	1.49	0.00	1.49
31.05	2.00	0.47	5.00	1.49	0.00	1.49
31.10	2.00	0.47	5.00	1.49	0.00	1.49
31.15	2.00	0.47	5.00	1.49	0.00	1.49
31.20	2.00	0.47	5.00	1.49	0.00	1.49
31.25	2.00	0.47	5.00	1.49	0.00	1.49
31.30	2.00	0.47	5.00	1.49	0.00	1.49
31.35	2.00	0.47	5.00	1.49	0.00	1.49
31.40	2.00	0.47	5.00	1.49	0.00	1.49

31.45	2.00	0.47	5.00	1.49	0.00	1.49
31.50	2.00	0.47	5.00	1.49	0.00	1.49
31.55	2.00	0.47	5.00	1.49	0.00	1.49
31.60	2.00	0.47	5.00	1.49	0.00	1.49
31.65	2.00	0.47	5.00	1.49	0.00	1.49
31.70	2.00	0.47	5.00	1.49	0.00	1.49
31.75	2.00	0.47	5.00	1.49	0.00	1.49
31.80	2.00	0.47	5.00	1.49	0.00	1.49
31.85	2.00	0.47	5.00	1.49	0.00	1.49
31.90	2.00	0.47	5.00	1.49	0.00	1.49
31.95	2.00	0.47	5.00	1.49	0.00	1.49
32.00	2.00	0.47	5.00	1.49	0.00	1.49
32.05	2.00	0.47	5.00	1.49	0.00	1.49
32.10	2.00	0.47	5.00	1.49	0.00	1.49
32.15	2.00	0.47	5.00	1.49	0.00	1.49
32.20	2.00	0.47	5.00	1.49	0.00	1.49
32.25	2.00	0.47	5.00	1.49	0.00	1.49
32.30	2.00	0.47	5.00	1.49	0.00	1.49
32.35	2.00	0.47	5.00	1.49	0.00	1.49
32.40	2.00	0.47	5.00	1.49	0.00	1.49
32.45	2.00	0.47	5.00	1.49	0.00	1.49
32.50	2.00	0.47	5.00	1.49	0.00	1.49
32.55	2.00	0.47	5.00	1.49	0.00	1.49
32.60	2.00	0.47	5.00	1.49	0.00	1.49
32.65	2.00	0.47	5.00	1.49	0.00	1.49
32.70	2.00	0.47	5.00	1.49	0.00	1.49
32.75	2.00	0.47	5.00	1.49	0.00	1.49
32.80	2.00	0.47	5.00	1.49	0.00	1.49
32.85	2.00	0.47	5.00	1.49	0.00	1.49
32.90	2.00	0.47	5.00	1.49	0.00	1.49
32.95	2.00	0.47	5.00	1.49	0.00	1.49

33.00	2.00	0.47	5.00	1.49	0.00	1.49
33.05	2.00	0.47	5.00	1.49	0.00	1.49
33.10	2.00	0.47	5.00	1.49	0.00	1.49
33.15	2.00	0.47	5.00	1.49	0.00	1.49
33.20	2.00	0.47	5.00	1.49	0.00	1.49
33.25	2.00	0.47	5.00	1.49	0.00	1.49
33.30	2.00	0.47	5.00	1.49	0.00	1.49
33.35	2.00	0.47	5.00	1.49	0.00	1.49
33.40	2.00	0.47	5.00	1.49	0.00	1.49
33.45	2.00	0.47	5.00	1.49	0.00	1.49
33.50	2.00	0.47	5.00	1.49	0.00	1.49
33.55	2.00	0.47	5.00	1.49	0.00	1.49
33.60	2.00	0.47	5.00	1.49	0.00	1.49
33.65	2.00	0.47	5.00	1.49	0.00	1.49
33.70	2.00	0.47	5.00	1.49	0.00	1.49
33.75	2.00	0.47	5.00	1.49	0.00	1.49
33.80	2.00	0.47	5.00	1.49	0.00	1.49
33.85	2.00	0.47	5.00	1.49	0.00	1.49
33.90	2.00	0.47	5.00	1.49	0.00	1.49
33.95	2.00	0.47	5.00	1.49	0.00	1.49
34.00	2.00	0.47	5.00	1.49	0.00	1.49
34.05	2.00	0.47	5.00	1.49	0.00	1.49
34.10	2.00	0.47	5.00	1.49	0.00	1.49
34.15	2.00	0.47	5.00	1.49	0.00	1.49
34.20	2.00	0.47	5.00	1.49	0.00	1.49
34.25	2.00	0.47	5.00	1.49	0.00	1.49
34.30	2.00	0.47	5.00	1.49	0.00	1.49
34.35	2.00	0.47	5.00	1.49	0.00	1.49
34.40	2.00	0.47	5.00	1.49	0.00	1.49
34.45	2.00	0.47	5.00	1.49	0.00	1.49
34.50	2.00	0.47	5.00	1.49	0.00	1.49

34.55	2.00	0.47	5.00	1.49	0.00	1.49
34.60	2.00	0.47	5.00	1.49	0.00	1.49
34.65	2.00	0.47	5.00	1.49	0.00	1.49
34.70	2.00	0.47	5.00	1.49	0.00	1.49
34.75	2.00	0.47	5.00	1.49	0.00	1.49
34.80	2.00	0.47	5.00	1.49	0.00	1.49
34.85	2.00	0.47	5.00	1.49	0.00	1.49
34.90	2.00	0.47	5.00	1.49	0.00	1.49
34.95	2.00	0.47	5.00	1.49	0.00	1.49
35.00	2.00	0.47	5.00	1.49	0.00	1.49
35.05	2.00	0.47	5.00	1.49	0.00	1.49
35.10	2.00	0.47	5.00	1.49	0.00	1.49
35.15	2.00	0.47	5.00	1.49	0.00	1.49
35.20	2.00	0.47	5.00	1.49	0.00	1.49
35.25	2.00	0.47	5.00	1.49	0.00	1.49
35.30	2.00	0.47	5.00	1.49	0.00	1.49
35.35	2.00	0.47	5.00	1.49	0.00	1.49
35.40	2.00	0.47	5.00	1.49	0.00	1.49
35.45	2.00	0.47	5.00	1.49	0.00	1.49
35.50	2.00	0.47	5.00	1.49	0.00	1.49
35.55	2.00	0.47	5.00	1.49	0.00	1.49
35.60	2.00	0.47	5.00	1.49	0.00	1.49
35.65	2.00	0.47	5.00	1.49	0.00	1.49
35.70	2.00	0.47	5.00	1.49	0.00	1.49
35.75	2.00	0.47	5.00	1.49	0.00	1.49
35.80	2.00	0.47	5.00	1.49	0.00	1.49
35.85	2.00	0.47	5.00	1.49	0.00	1.49
35.90	2.00	0.47	5.00	1.49	0.00	1.49
35.95	2.00	0.47	5.00	1.49	0.00	1.49
36.00	2.00	0.47	5.00	1.49	0.00	1.49
36.05	0.22	0.47	0.46*	1.49	0.00	1.49

36.10	0.22	0.47	0.46*	1.49	0.00	1.49
36.15	0.22	0.47	0.47*	1.48	0.00	1.48
36.20	0.22	0.47	0.47*	1.47	0.00	1.47
36.25	0.22	0.47	0.47*	1.46	0.00	1.46
36.30	0.22	0.47	0.48*	1.45	0.00	1.45
36.35	0.23	0.47	0.48*	1.44	0.00	1.44
36.40	0.23	0.47	0.48*	1.42	0.00	1.42
36.45	0.23	0.47	0.48*	1.41	0.00	1.41
36.50	0.23	0.47	0.48*	1.40	0.00	1.40
36.55	0.23	0.47	0.49*	1.39	0.00	1.39
36.60	0.23	0.47	0.49*	1.38	0.00	1.38
36.65	0.23	0.47	0.49*	1.37	0.00	1.37
36.70	0.23	0.47	0.49*	1.35	0.00	1.35
36.75	0.23	0.47	0.50*	1.34	0.00	1.34
36.80	0.24	0.47	0.50*	1.33	0.00	1.33
36.85	0.24	0.47	0.50*	1.32	0.00	1.32
36.90	0.24	0.47	0.50*	1.31	0.00	1.31
36.95	0.24	0.47	0.51*	1.30	0.00	1.30
37.00	0.24	0.47	0.51*	1.29	0.00	1.29
37.05	0.24	0.47	0.51*	1.27	0.00	1.27
37.10	0.24	0.47	0.51*	1.26	0.00	1.26
37.15	0.24	0.47	0.52*	1.25	0.00	1.25
37.20	0.24	0.47	0.52*	1.24	0.00	1.24
37.25	0.24	0.47	0.52*	1.23	0.00	1.23
37.30	0.25	0.47	0.52*	1.22	0.00	1.22
37.35	0.25	0.47	0.52*	1.21	0.00	1.21
37.40	0.25	0.47	0.53*	1.20	0.00	1.20
37.45	0.25	0.47	0.53*	1.19	0.00	1.19
37.50	0.25	0.47	0.53*	1.18	0.00	1.18
37.55	0.25	0.47	0.53*	1.16	0.00	1.16
37.60	0.25	0.47	0.54*	1.15	0.00	1.15

37.65	0.25	0.47	0.54*	1.14	0.00	1.14
37.70	0.25	0.47	0.54*	1.13	0.00	1.13
37.75	0.26	0.47	0.54*	1.12	0.00	1.12
37.80	0.26	0.47	0.55*	1.11	0.00	1.11
37.85	0.26	0.47	0.55*	1.10	0.00	1.10
37.90	0.26	0.47	0.55*	1.09	0.00	1.09
37.95	0.26	0.47	0.55*	1.08	0.00	1.08
38.00	0.26	0.47	0.55*	1.07	0.00	1.07
38.05	0.26	0.47	0.56*	1.06	0.00	1.06
38.10	0.26	0.47	0.56*	1.05	0.00	1.05
38.15	0.26	0.47	0.56*	1.04	0.00	1.04
38.20	0.27	0.47	0.56*	1.03	0.00	1.03
38.25	0.27	0.47	0.57*	1.02	0.00	1.02
38.30	0.27	0.47	0.57*	1.01	0.00	1.01
38.35	0.27	0.47	0.57*	0.99	0.00	0.99
38.40	0.27	0.47	0.57*	0.98	0.00	0.98
38.45	0.27	0.47	0.57*	0.97	0.00	0.97
38.50	0.27	0.47	0.58*	0.96	0.00	0.96
38.55	0.27	0.47	0.58*	0.95	0.00	0.95
38.60	0.27	0.47	0.58*	0.94	0.00	0.94
38.65	0.27	0.47	0.58*	0.93	0.00	0.93
38.70	0.28	0.47	0.59*	0.92	0.00	0.92
38.75	0.28	0.47	0.59*	0.91	0.00	0.91
38.80	0.28	0.47	0.59*	0.90	0.00	0.90
38.85	0.28	0.47	0.59*	0.89	0.00	0.89
38.90	0.28	0.47	0.60*	0.88	0.00	0.88
38.95	0.28	0.47	0.60*	0.87	0.00	0.87
39.00	0.28	0.47	0.60*	0.86	0.00	0.86
39.05	0.28	0.47	0.60*	0.85	0.00	0.85
39.10	0.28	0.47	0.60*	0.84	0.00	0.84
39.15	0.29	0.47	0.61*	0.83	0.00	0.83

39.20	0.29	0.47	0.61*	0.82	0.00	0.82
39.25	0.29	0.47	0.61*	0.81	0.00	0.81
39.30	0.29	0.47	0.61*	0.80	0.00	0.80
39.35	0.29	0.47	0.62*	0.79	0.00	0.79
39.40	0.29	0.47	0.62*	0.79	0.00	0.79
39.45	0.29	0.47	0.62*	0.78	0.00	0.78
39.50	0.29	0.47	0.62*	0.77	0.00	0.77
39.55	0.29	0.47	0.63*	0.76	0.00	0.76
39.60	0.29	0.47	0.63*	0.75	0.00	0.75
39.65	0.30	0.47	0.63*	0.74	0.00	0.74
39.70	0.30	0.47	0.63*	0.73	0.00	0.73
39.75	0.30	0.47	0.63*	0.72	0.00	0.72
39.80	0.30	0.47	0.64*	0.71	0.00	0.71
39.85	0.30	0.47	0.64*	0.70	0.00	0.70
39.90	0.30	0.47	0.64*	0.69	0.00	0.69
39.95	0.30	0.47	0.64*	0.68	0.00	0.68
40.00	0.30	0.47	0.64*	0.67	0.00	0.67
40.05	0.30	0.47	0.65*	0.66	0.00	0.66
40.10	0.31	0.47	0.65*	0.65	0.00	0.65
40.15	0.31	0.47	0.66*	0.64	0.00	0.64
40.20	0.31	0.47	0.67*	0.64	0.00	0.64
40.25	0.32	0.47	0.68*	0.63	0.00	0.63
40.30	0.32	0.47	0.68*	0.62	0.00	0.62
40.35	0.32	0.47	0.69*	0.61	0.00	0.61
40.40	0.33	0.47	0.70*	0.60	0.00	0.60
40.45	0.33	0.47	0.71*	0.59	0.00	0.59
40.50	0.33	0.47	0.71*	0.58	0.00	0.58
40.55	0.34	0.47	0.72*	0.58	0.00	0.58
40.60	0.34	0.47	0.73*	0.57	0.00	0.57
40.65	0.35	0.47	0.74*	0.56	0.00	0.56
40.70	0.35	0.47	0.75*	0.55	0.00	0.55

40.75	0.35	0.47	0.75*	0.54	0.00	0.54
40.80	0.36	0.47	0.76*	0.53	0.00	0.53
40.85	0.36	0.47	0.77*	0.53	0.00	0.53
40.90	0.37	0.47	0.78*	0.52	0.00	0.52
40.95	0.37	0.47	0.79*	0.51	0.00	0.51
41.00	0.37	0.47	0.80*	0.50	0.00	0.50
41.05	0.38	0.47	0.81*	0.50	0.00	0.50
41.10	0.38	0.47	0.82*	0.49	0.00	0.49
41.15	0.39	0.47	0.83*	0.48	0.00	0.48
41.20	0.39	0.47	0.84*	0.47	0.00	0.47
41.25	0.40	0.47	0.85*	0.47	0.00	0.47
41.30	0.40	0.47	0.86*	0.46	0.00	0.46
41.35	0.41	0.47	0.87*	0.45	0.00	0.45
41.40	0.41	0.47	0.88*	0.44	0.00	0.44
41.45	0.42	0.47	0.89*	0.44	0.00	0.44
41.50	0.42	0.47	0.90*	0.43	0.00	0.43
41.55	0.43	0.47	0.91*	0.42	0.00	0.42
41.60	0.43	0.47	0.92*	0.42	0.00	0.42
41.65	0.44	0.47	0.93*	0.41	0.00	0.41
41.70	0.44	0.47	0.95*	0.40	0.00	0.40
41.75	0.45	0.47	0.96*	0.40	0.00	0.40
41.80	0.46	0.47	0.97*	0.39	0.00	0.39
41.85	0.46	0.47	0.99*	0.38	0.00	0.38
41.90	0.47	0.47	1.00	0.38	0.00	0.38
41.95	0.47	0.47	1.02	0.37	0.00	0.37
42.00	0.48	0.47	1.03	0.37	0.00	0.37
42.05	0.49	0.47	1.05	0.36	0.00	0.36
42.10	0.50	0.47	1.07	0.35	0.00	0.35
42.15	0.51	0.47	1.08	0.35	0.00	0.35
42.20	0.52	0.47	1.10	0.34	0.00	0.34
42.25	0.53	0.47	1.13	0.34	0.00	0.34

42.30	0.54	0.47	1.15	0.33	0.00	0.33
42.35	0.55	0.47	1.18	0.33	0.00	0.33
42.40	0.57	0.47	1.21	0.32	0.00	0.32
42.45	0.59	0.47	1.26	0.32	0.00	0.32
42.50	0.62	0.47	1.33	0.31	0.00	0.31
42.55	0.69	0.47	1.48	0.31	0.00	0.31
42.60	0.71	0.47	1.52	0.30	0.00	0.30
42.65	0.71	0.47	1.52	0.30	0.00	0.30
42.70	0.71	0.47	1.52	0.30	0.00	0.30
42.75	0.71	0.47	1.52	0.29	0.00	0.29
42.80	0.71	0.47	1.52	0.29	0.00	0.29
42.85	0.71	0.47	1.52	0.29	0.00	0.29
42.90	0.71	0.47	1.52	0.28	0.00	0.28
42.95	0.71	0.47	1.52	0.28	0.00	0.28
43.00	0.71	0.47	1.52	0.28	0.00	0.28
43.05	0.71	0.47	1.52	0.27	0.00	0.27
43.10	0.71	0.47	1.52	0.27	0.00	0.27
43.15	0.71	0.47	1.53	0.27	0.00	0.27
43.20	0.71	0.47	1.53	0.27	0.00	0.27
43.25	0.71	0.47	1.53	0.26	0.00	0.26
43.30	0.71	0.47	1.53	0.26	0.00	0.26
43.35	0.71	0.47	1.53	0.26	0.00	0.26
43.40	0.71	0.47	1.53	0.26	0.00	0.26
43.45	0.71	0.47	1.53	0.26	0.00	0.26
43.50	0.71	0.47	1.53	0.26	0.00	0.26
43.55	0.71	0.47	1.53	0.26	0.00	0.26
43.60	0.71	0.47	1.53	0.26	0.00	0.26
43.65	0.71	0.47	1.53	0.26	0.00	0.26
43.70	0.71	0.47	1.53	0.26	0.00	0.26
43.75	0.71	0.46	1.53	0.25	0.00	0.25
43.80	0.71	0.46	1.53	0.25	0.00	0.25

43.85	0.71	0.46	1.53	0.25	0.00	0.25
43.90	0.71	0.46	1.53	0.25	0.00	0.25
43.95	0.71	0.46	1.53	0.25	0.00	0.25
44.00	0.71	0.46	1.53	0.25	0.00	0.25
44.05	0.71	0.46	1.53	0.25	0.00	0.25
44.10	0.71	0.46	1.53	0.25	0.00	0.25
44.15	0.71	0.46	1.53	0.25	0.00	0.25
44.20	0.71	0.46	1.53	0.25	0.00	0.25
44.25	0.71	0.46	1.53	0.25	0.00	0.25
44.30	0.71	0.46	1.53	0.25	0.00	0.25
44.35	0.71	0.46	1.53	0.25	0.00	0.25
44.40	0.71	0.46	1.53	0.25	0.00	0.25
44.45	0.71	0.46	1.53	0.25	0.00	0.25
44.50	0.71	0.46	1.53	0.25	0.00	0.25
44.55	0.71	0.46	1.53	0.25	0.00	0.25
44.60	0.71	0.46	1.53	0.25	0.00	0.25
44.65	0.71	0.46	1.53	0.25	0.00	0.25
44.70	0.71	0.46	1.53	0.25	0.00	0.25
44.75	0.71	0.46	1.53	0.25	0.00	0.25
44.80	0.71	0.46	1.53	0.25	0.00	0.25
44.85	0.71	0.46	1.53	0.25	0.00	0.25
44.90	0.71	0.46	1.53	0.25	0.00	0.25
44.95	0.71	0.46	1.53	0.25	0.00	0.25
45.00	0.71	0.46	1.53	0.25	0.00	0.25
45.05	0.71	0.46	1.53	0.25	0.00	0.25
45.10	0.71	0.46	1.53	0.25	0.00	0.25
45.15	0.71	0.46	1.53	0.25	0.00	0.25
45.20	0.71	0.46	1.53	0.25	0.00	0.25
45.25	0.71	0.46	1.53	0.25	0.00	0.25
45.30	0.71	0.46	1.53	0.25	0.00	0.25
45.35	0.71	0.46	1.53	0.25	0.00	0.25

45.40	0.71	0.46	1.53	0.25	0.00	0.25
45.45	0.71	0.46	1.53	0.25	0.00	0.25
45.50	0.71	0.46	1.53	0.25	0.00	0.25
45.55	0.71	0.46	1.53	0.25	0.00	0.25
45.60	0.71	0.46	1.53	0.25	0.00	0.25
45.65	0.71	0.46	1.53	0.25	0.00	0.25
45.70	0.71	0.46	1.53	0.25	0.00	0.25
45.75	0.70	0.46	1.53	0.25	0.00	0.25
45.80	0.70	0.46	1.53	0.25	0.00	0.25
45.85	0.70	0.46	1.53	0.25	0.00	0.25
45.90	0.70	0.46	1.53	0.25	0.00	0.25
45.95	0.70	0.46	1.53	0.25	0.00	0.25
46.00	0.70	0.46	1.53	0.25	0.00	0.25
46.05	0.70	0.46	1.53	0.25	0.00	0.25
46.10	0.70	0.46	1.53	0.25	0.00	0.25
46.15	0.70	0.46	1.53	0.25	0.00	0.25
46.20	0.70	0.46	1.53	0.25	0.00	0.25
46.25	0.70	0.46	1.53	0.25	0.00	0.25
46.30	0.70	0.46	1.53	0.25	0.00	0.25
46.35	0.70	0.46	1.53	0.25	0.00	0.25
46.40	0.70	0.46	1.53	0.25	0.00	0.25
46.45	0.70	0.46	1.53	0.25	0.00	0.25
46.50	0.70	0.46	1.53	0.25	0.00	0.25
46.55	0.70	0.46	1.53	0.25	0.00	0.25
46.60	0.70	0.46	1.53	0.25	0.00	0.25
46.65	0.70	0.46	1.53	0.25	0.00	0.25
46.70	0.70	0.46	1.53	0.25	0.00	0.25
46.75	0.70	0.46	1.53	0.25	0.00	0.25
46.80	0.70	0.46	1.53	0.25	0.00	0.25
46.85	0.70	0.46	1.53	0.25	0.00	0.25
46.90	0.70	0.46	1.53	0.25	0.00	0.25

46.95	0.70	0.46	1.53	0.25	0.00	0.25
47.00	0.70	0.46	1.53	0.25	0.00	0.25
47.05	0.70	0.46	1.53	0.25	0.00	0.25
47.10	0.70	0.46	1.53	0.25	0.00	0.25
47.15	0.70	0.46	1.53	0.25	0.00	0.25
47.20	0.70	0.46	1.53	0.25	0.00	0.25
47.25	0.70	0.46	1.53	0.25	0.00	0.25
47.30	0.70	0.46	1.53	0.25	0.00	0.25
47.35	0.70	0.46	1.53	0.25	0.00	0.25
47.40	0.70	0.46	1.53	0.25	0.00	0.25
47.45	0.70	0.46	1.53	0.25	0.00	0.25
47.50	0.70	0.46	1.53	0.25	0.00	0.25
47.55	0.70	0.46	1.53	0.25	0.00	0.25
47.60	0.70	0.46	1.53	0.25	0.00	0.25
47.65	0.70	0.46	1.53	0.25	0.00	0.25
47.70	0.70	0.46	1.53	0.25	0.00	0.25
47.75	0.70	0.46	1.53	0.25	0.00	0.25
47.80	0.70	0.46	1.53	0.25	0.00	0.25
47.85	0.70	0.46	1.53	0.25	0.00	0.25
47.90	0.70	0.46	1.53	0.25	0.00	0.25
47.95	0.70	0.46	1.53	0.25	0.00	0.25
48.00	0.70	0.46	1.53	0.25	0.00	0.25
48.05	0.70	0.46	1.53	0.25	0.00	0.25
48.10	0.70	0.46	1.53	0.25	0.00	0.25
48.15	0.70	0.46	1.53	0.25	0.00	0.25
48.20	0.70	0.46	1.53	0.25	0.00	0.25
48.25	0.70	0.46	1.53	0.25	0.00	0.25
48.30	0.70	0.46	1.53	0.25	0.00	0.25
48.35	0.70	0.46	1.53	0.25	0.00	0.25
48.40	0.70	0.46	1.53	0.25	0.00	0.25
48.45	0.70	0.46	1.53	0.25	0.00	0.25

48.50	0.70	0.46	1.53	0.25	0.00	0.25
48.55	0.70	0.46	1.53	0.25	0.00	0.25
48.60	0.70	0.46	1.53	0.25	0.00	0.25
48.65	0.70	0.46	1.53	0.25	0.00	0.25
48.70	0.70	0.46	1.53	0.25	0.00	0.25
48.75	0.70	0.46	1.53	0.25	0.00	0.25
48.80	0.70	0.46	1.53	0.25	0.00	0.25
48.85	0.70	0.46	1.54	0.24	0.00	0.24
48.90	0.70	0.45	1.54	0.24	0.00	0.24
48.95	0.70	0.45	1.54	0.24	0.00	0.24
49.00	0.70	0.45	1.54	0.24	0.00	0.24
49.05	0.70	0.45	1.54	0.24	0.00	0.24
49.10	0.70	0.45	1.54	0.24	0.00	0.24
49.15	0.70	0.45	1.54	0.23	0.00	0.23
49.20	0.70	0.45	1.54	0.23	0.00	0.23
49.25	0.70	0.45	1.54	0.23	0.00	0.23
49.30	0.70	0.45	1.54	0.22	0.00	0.22
49.35	0.70	0.45	1.54	0.22	0.00	0.22
49.40	0.70	0.45	1.54	0.22	0.00	0.22
49.45	0.63	0.45	1.38	0.21	0.00	0.21
49.50	0.58	0.45	1.28	0.21	0.00	0.21
49.55	0.55	0.45	1.21	0.20	0.00	0.20
49.60	0.53	0.45	1.17	0.20	0.00	0.20
49.65	0.52	0.45	1.14	0.19	0.00	0.19
49.70	0.50	0.45	1.11	0.19	0.00	0.19
49.75	0.49	0.45	1.08	0.18	0.00	0.18
49.80	0.48	0.45	1.06	0.18	0.00	0.18
49.85	0.47	0.45	1.04	0.17	0.00	0.17
49.90	0.46	0.45	1.02	0.17	0.00	0.17
49.95	0.45	0.45	1.00	0.16	0.00	0.16
50.00	0.44	0.45	0.98*	0.15	0.00	0.15

50.05	0.44	0.45	0.97*	0.15	0.00	0.15
50.10	0.43	0.45	0.95*	0.14	0.00	0.14
50.15	0.42	0.45	0.93*	0.14	0.00	0.14
50.20	0.42	0.45	0.92*	0.13	0.00	0.13
50.25	0.41	0.45	0.90*	0.12	0.00	0.12
50.30	0.40	0.45	0.89*	0.12	0.00	0.12
50.35	0.40	0.45	0.88*	0.11	0.00	0.11
50.40	0.39	0.45	0.86*	0.10	0.00	0.10
50.45	0.38	0.45	0.85*	0.09	0.00	0.09
50.50	0.38	0.45	0.84*	0.09	0.00	0.09
50.55	0.37	0.45	0.83*	0.08	0.00	0.08
50.60	0.37	0.45	0.81*	0.07	0.00	0.07
50.65	0.36	0.45	0.80*	0.06	0.00	0.06
50.70	0.36	0.45	0.79*	0.06	0.00	0.06
50.75	0.35	0.45	0.78*	0.05	0.00	0.05
50.80	0.35	0.45	0.77*	0.04	0.00	0.04
50.85	0.34	0.45	0.76*	0.03	0.00	0.03
50.90	0.34	0.45	0.75*	0.03	0.00	0.03
50.95	0.33	0.45	0.74*	0.02	0.00	0.02
51.00	0.33	0.45	0.73*	0.02	0.00	0.02
51.05	2.00	0.45	5.00	0.02	0.00	0.02
51.10	2.00	0.45	5.00	0.02	0.00	0.02
51.15	2.00	0.45	5.00	0.02	0.00	0.02
51.20	2.00	0.45	5.00	0.02	0.00	0.02
51.25	2.00	0.45	5.00	0.02	0.00	0.02
51.30	2.00	0.45	5.00	0.02	0.00	0.02
51.35	2.00	0.45	5.00	0.02	0.00	0.02
51.40	2.00	0.45	5.00	0.02	0.00	0.02
51.45	2.00	0.45	5.00	0.02	0.00	0.02
51.50	2.00	0.45	5.00	0.02	0.00	0.02
51.55	2.00	0.45	5.00	0.02	0.00	0.02

51.60	2.00	0.45	5.00	0.02	0.00	0.02
51.65	2.00	0.45	5.00	0.02	0.00	0.02
51.70	2.00	0.45	5.00	0.02	0.00	0.02
51.75	2.00	0.45	5.00	0.02	0.00	0.02
51.80	2.00	0.45	5.00	0.02	0.00	0.02
51.85	2.00	0.45	5.00	0.02	0.00	0.02
51.90	2.00	0.45	5.00	0.02	0.00	0.02
51.95	2.00	0.45	5.00	0.02	0.00	0.02
52.00	2.00	0.45	5.00	0.02	0.00	0.02
52.05	2.00	0.45	5.00	0.02	0.00	0.02
52.10	2.00	0.45	5.00	0.02	0.00	0.02
52.15	2.00	0.45	5.00	0.02	0.00	0.02
52.20	2.00	0.45	5.00	0.02	0.00	0.02
52.25	2.00	0.45	5.00	0.02	0.00	0.02
52.30	2.00	0.45	5.00	0.02	0.00	0.02
52.35	2.00	0.45	5.00	0.02	0.00	0.02
52.40	2.00	0.45	5.00	0.02	0.00	0.02
52.45	2.00	0.45	5.00	0.02	0.00	0.02
52.50	2.00	0.45	5.00	0.02	0.00	0.02
52.55	2.00	0.45	5.00	0.02	0.00	0.02
52.60	2.00	0.45	5.00	0.02	0.00	0.02
52.65	2.00	0.45	5.00	0.02	0.00	0.02
52.70	2.00	0.45	5.00	0.02	0.00	0.02
52.75	2.00	0.45	5.00	0.02	0.00	0.02
52.80	2.00	0.45	5.00	0.02	0.00	0.02
52.85	2.00	0.45	5.00	0.02	0.00	0.02
52.90	2.00	0.45	5.00	0.02	0.00	0.02
52.95	2.00	0.45	5.00	0.02	0.00	0.02
53.00	2.00	0.45	5.00	0.02	0.00	0.02
53.05	2.00	0.44	5.00	0.02	0.00	0.02
53.10	2.00	0.44	5.00	0.02	0.00	0.02

53.15	2.00	0.44	5.00	0.02	0.00	0.02
53.20	2.00	0.44	5.00	0.02	0.00	0.02
53.25	2.00	0.44	5.00	0.02	0.00	0.02
53.30	2.00	0.44	5.00	0.02	0.00	0.02
53.35	2.00	0.44	5.00	0.02	0.00	0.02
53.40	2.00	0.44	5.00	0.02	0.00	0.02
53.45	2.00	0.44	5.00	0.02	0.00	0.02
53.50	2.00	0.44	5.00	0.02	0.00	0.02
53.55	2.00	0.44	5.00	0.02	0.00	0.02
53.60	2.00	0.44	5.00	0.02	0.00	0.02
53.65	2.00	0.44	5.00	0.02	0.00	0.02
53.70	2.00	0.44	5.00	0.02	0.00	0.02
53.75	2.00	0.44	5.00	0.02	0.00	0.02
53.80	2.00	0.44	5.00	0.02	0.00	0.02
53.85	2.00	0.44	5.00	0.02	0.00	0.02
53.90	2.00	0.44	5.00	0.02	0.00	0.02
53.95	2.00	0.44	5.00	0.02	0.00	0.02
54.00	2.00	0.44	5.00	0.02	0.00	0.02
54.05	2.00	0.44	5.00	0.02	0.00	0.02
54.10	2.00	0.44	5.00	0.02	0.00	0.02
54.15	2.00	0.44	5.00	0.02	0.00	0.02
54.20	2.00	0.44	5.00	0.02	0.00	0.02
54.25	2.00	0.44	5.00	0.02	0.00	0.02
54.30	2.00	0.44	5.00	0.02	0.00	0.02
54.35	2.00	0.44	5.00	0.02	0.00	0.02
54.40	2.00	0.44	5.00	0.02	0.00	0.02
54.45	2.00	0.44	5.00	0.02	0.00	0.02
54.50	2.00	0.44	5.00	0.02	0.00	0.02
54.55	2.00	0.44	5.00	0.02	0.00	0.02
54.60	2.00	0.44	5.00	0.02	0.00	0.02
54.65	2.00	0.44	5.00	0.02	0.00	0.02

54.70	2.00	0.44	5.00	0.02	0.00	0.02
54.75	2.00	0.44	5.00	0.02	0.00	0.02
54.80	2.00	0.44	5.00	0.02	0.00	0.02
54.85	2.00	0.44	5.00	0.02	0.00	0.02
54.90	2.00	0.44	5.00	0.02	0.00	0.02
54.95	2.00	0.44	5.00	0.02	0.00	0.02
55.00	2.00	0.44	5.00	0.02	0.00	0.02
55.05	2.00	0.44	5.00	0.02	0.00	0.02
55.10	2.00	0.44	5.00	0.02	0.00	0.02
55.15	2.00	0.44	5.00	0.02	0.00	0.02
55.20	2.00	0.44	5.00	0.02	0.00	0.02
55.25	2.00	0.44	5.00	0.02	0.00	0.02
55.30	2.00	0.44	5.00	0.02	0.00	0.02
55.35	2.00	0.44	5.00	0.02	0.00	0.02
55.40	2.00	0.44	5.00	0.02	0.00	0.02
55.45	2.00	0.44	5.00	0.02	0.00	0.02
55.50	2.00	0.44	5.00	0.02	0.00	0.02
55.55	2.00	0.44	5.00	0.02	0.00	0.02
55.60	2.00	0.44	5.00	0.02	0.00	0.02
55.65	2.00	0.44	5.00	0.02	0.00	0.02
55.70	2.00	0.44	5.00	0.02	0.00	0.02
55.75	2.00	0.44	5.00	0.02	0.00	0.02
55.80	2.00	0.44	5.00	0.02	0.00	0.02
55.85	2.00	0.44	5.00	0.02	0.00	0.02
55.90	2.00	0.44	5.00	0.02	0.00	0.02
55.95	2.00	0.44	5.00	0.02	0.00	0.02
56.00	2.00	0.44	5.00	0.02	0.00	0.02
56.05	2.00	0.44	5.00	0.02	0.00	0.02
56.10	2.00	0.44	5.00	0.02	0.00	0.02
56.15	2.00	0.44	5.00	0.02	0.00	0.02
56.20	2.00	0.44	5.00	0.02	0.00	0.02

56.25	2.00	0.44	5.00	0.02	0.00	0.02
56.30	2.00	0.44	5.00	0.02	0.00	0.02
56.35	2.00	0.44	5.00	0.02	0.00	0.02
56.40	2.00	0.44	5.00	0.02	0.00	0.02
56.45	2.00	0.44	5.00	0.02	0.00	0.02
56.50	2.00	0.44	5.00	0.02	0.00	0.02
56.55	2.00	0.44	5.00	0.02	0.00	0.02
56.60	2.00	0.44	5.00	0.02	0.00	0.02
56.65	2.00	0.44	5.00	0.02	0.00	0.02
56.70	2.00	0.43	5.00	0.02	0.00	0.02
56.75	2.00	0.43	5.00	0.02	0.00	0.02
56.80	2.00	0.43	5.00	0.02	0.00	0.02
56.85	2.00	0.43	5.00	0.02	0.00	0.02
56.90	2.00	0.43	5.00	0.02	0.00	0.02
56.95	2.00	0.43	5.00	0.02	0.00	0.02
57.00	2.00	0.43	5.00	0.02	0.00	0.02
57.05	2.00	0.43	5.00	0.02	0.00	0.02
57.10	2.00	0.43	5.00	0.02	0.00	0.02
57.15	2.00	0.43	5.00	0.02	0.00	0.02
57.20	2.00	0.43	5.00	0.02	0.00	0.02
57.25	2.00	0.43	5.00	0.02	0.00	0.02
57.30	2.00	0.43	5.00	0.02	0.00	0.02
57.35	2.00	0.43	5.00	0.02	0.00	0.02
57.40	2.00	0.43	5.00	0.02	0.00	0.02
57.45	2.00	0.43	5.00	0.02	0.00	0.02
57.50	2.00	0.43	5.00	0.02	0.00	0.02
57.55	2.00	0.43	5.00	0.02	0.00	0.02
57.60	2.00	0.43	5.00	0.02	0.00	0.02
57.65	2.00	0.43	5.00	0.02	0.00	0.02
57.70	2.00	0.43	5.00	0.02	0.00	0.02
57.75	2.00	0.43	5.00	0.02	0.00	0.02

57.80	2.00	0.43	5.00	0.02	0.00	0.02
57.85	2.00	0.43	5.00	0.02	0.00	0.02
57.90	2.00	0.43	5.00	0.02	0.00	0.02
57.95	2.00	0.43	5.00	0.02	0.00	0.02
58.00	2.00	0.43	5.00	0.02	0.00	0.02
58.05	2.00	0.43	5.00	0.02	0.00	0.02
58.10	2.00	0.43	5.00	0.02	0.00	0.02
58.15	2.00	0.43	5.00	0.02	0.00	0.02
58.20	2.00	0.43	5.00	0.02	0.00	0.02
58.25	2.00	0.43	5.00	0.02	0.00	0.02
58.30	2.00	0.43	5.00	0.02	0.00	0.02
58.35	2.00	0.43	5.00	0.02	0.00	0.02
58.40	2.00	0.43	5.00	0.02	0.00	0.02
58.45	2.00	0.43	5.00	0.02	0.00	0.02
58.50	2.00	0.43	5.00	0.02	0.00	0.02
58.55	2.00	0.43	5.00	0.02	0.00	0.02
58.60	2.00	0.43	5.00	0.02	0.00	0.02
58.65	2.00	0.43	5.00	0.02	0.00	0.02
58.70	2.00	0.43	5.00	0.02	0.00	0.02
58.75	2.00	0.43	5.00	0.02	0.00	0.02
58.80	2.00	0.43	5.00	0.02	0.00	0.02
58.85	2.00	0.43	5.00	0.02	0.00	0.02
58.90	2.00	0.43	5.00	0.02	0.00	0.02
58.95	2.00	0.43	5.00	0.02	0.00	0.02
59.00	2.00	0.43	5.00	0.02	0.00	0.02
59.05	2.00	0.43	5.00	0.02	0.00	0.02
59.10	2.00	0.43	5.00	0.02	0.00	0.02
59.15	2.00	0.43	5.00	0.02	0.00	0.02
59.20	2.00	0.43	5.00	0.02	0.00	0.02
59.25	2.00	0.43	5.00	0.02	0.00	0.02
59.30	2.00	0.43	5.00	0.02	0.00	0.02

59.35	2.00	0.43	5.00	0.02	0.00	0.02
59.40	2.00	0.43	5.00	0.02	0.00	0.02
59.45	2.00	0.43	5.00	0.02	0.00	0.02
59.50	2.00	0.43	5.00	0.02	0.00	0.02
59.55	2.00	0.43	5.00	0.02	0.00	0.02
59.60	2.00	0.43	5.00	0.02	0.00	0.02
59.65	2.00	0.43	5.00	0.02	0.00	0.02
59.70	2.00	0.43	5.00	0.02	0.00	0.02
59.75	2.00	0.43	5.00	0.02	0.00	0.02
59.80	2.00	0.43	5.00	0.02	0.00	0.02
59.85	2.00	0.43	5.00	0.02	0.00	0.02
59.90	2.00	0.43	5.00	0.02	0.00	0.02
59.95	2.00	0.42	5.00	0.02	0.00	0.02
60.00	2.00	0.42	5.00	0.02	0.00	0.02
60.05	2.00	0.42	5.00	0.02	0.00	0.02
60.10	2.00	0.42	5.00	0.02	0.00	0.02
60.15	2.00	0.42	5.00	0.02	0.00	0.02
60.20	2.00	0.42	5.00	0.02	0.00	0.02
60.25	2.00	0.42	5.00	0.02	0.00	0.02
60.30	2.00	0.42	5.00	0.02	0.00	0.02
60.35	2.00	0.42	5.00	0.02	0.00	0.02
60.40	2.00	0.42	5.00	0.02	0.00	0.02
60.45	2.00	0.42	5.00	0.02	0.00	0.02
60.50	2.00	0.42	5.00	0.02	0.00	0.02
60.55	2.00	0.42	5.00	0.02	0.00	0.02
60.60	2.00	0.42	5.00	0.02	0.00	0.02
60.65	2.00	0.42	5.00	0.02	0.00	0.02
60.70	2.00	0.42	5.00	0.02	0.00	0.02
60.75	2.00	0.42	5.00	0.02	0.00	0.02
60.80	2.00	0.42	5.00	0.02	0.00	0.02
60.85	2.00	0.42	5.00	0.02	0.00	0.02

60.90	2.00	0.42	5.00	0.02	0.00	0.02
60.95	2.00	0.42	5.00	0.02	0.00	0.02
61.00	2.00	0.42	5.00	0.02	0.00	0.02
61.05	2.00	0.42	5.00	0.02	0.00	0.02
61.10	2.00	0.42	5.00	0.02	0.00	0.02
61.15	2.00	0.42	5.00	0.02	0.00	0.02
61.20	2.00	0.42	5.00	0.02	0.00	0.02
61.25	2.00	0.42	5.00	0.02	0.00	0.02
61.30	2.00	0.42	5.00	0.02	0.00	0.02
61.35	2.00	0.42	5.00	0.02	0.00	0.02
61.40	2.00	0.42	5.00	0.02	0.00	0.02
61.45	2.00	0.42	5.00	0.02	0.00	0.02
61.50	2.00	0.42	5.00	0.02	0.00	0.02
61.55	2.00	0.42	5.00	0.02	0.00	0.02
61.60	2.00	0.42	5.00	0.02	0.00	0.02
61.65	2.00	0.42	5.00	0.02	0.00	0.02
61.70	2.00	0.42	5.00	0.02	0.00	0.02
61.75	2.00	0.42	5.00	0.02	0.00	0.02
61.80	2.00	0.42	5.00	0.02	0.00	0.02
61.85	2.00	0.42	5.00	0.02	0.00	0.02
61.90	2.00	0.42	5.00	0.02	0.00	0.02
61.95	2.00	0.42	5.00	0.02	0.00	0.02
62.00	2.00	0.42	5.00	0.02	0.00	0.02
62.05	2.00	0.42	5.00	0.02	0.00	0.02
62.10	2.00	0.42	5.00	0.02	0.00	0.02
62.15	2.00	0.42	5.00	0.02	0.00	0.02
62.20	2.00	0.42	5.00	0.02	0.00	0.02
62.25	2.00	0.42	5.00	0.02	0.00	0.02
62.30	2.00	0.42	5.00	0.02	0.00	0.02
62.35	2.00	0.42	5.00	0.02	0.00	0.02
62.40	2.00	0.42	5.00	0.02	0.00	0.02

62.45	2.00	0.42	5.00	0.02	0.00	0.02
62.50	2.00	0.42	5.00	0.02	0.00	0.02
62.55	2.00	0.42	5.00	0.02	0.00	0.02
62.60	2.00	0.42	5.00	0.02	0.00	0.02
62.65	2.00	0.42	5.00	0.02	0.00	0.02
62.70	2.00	0.42	5.00	0.02	0.00	0.02
62.75	2.00	0.42	5.00	0.02	0.00	0.02
62.80	2.00	0.42	5.00	0.02	0.00	0.02
62.85	2.00	0.42	5.00	0.02	0.00	0.02
62.90	2.00	0.41	5.00	0.02	0.00	0.02
62.95	2.00	0.41	5.00	0.02	0.00	0.02
63.00	2.00	0.41	5.00	0.02	0.00	0.02
63.05	2.00	0.41	5.00	0.02	0.00	0.02
63.10	2.00	0.41	5.00	0.02	0.00	0.02
63.15	2.00	0.41	5.00	0.02	0.00	0.02
63.20	2.00	0.41	5.00	0.02	0.00	0.02
63.25	2.00	0.41	5.00	0.02	0.00	0.02
63.30	2.00	0.41	5.00	0.02	0.00	0.02
63.35	2.00	0.41	5.00	0.02	0.00	0.02
63.40	2.00	0.41	5.00	0.02	0.00	0.02
63.45	2.00	0.41	5.00	0.02	0.00	0.02
63.50	2.00	0.41	5.00	0.02	0.00	0.02
63.55	2.00	0.41	5.00	0.02	0.00	0.02
63.60	2.00	0.41	5.00	0.02	0.00	0.02
63.65	2.00	0.41	5.00	0.02	0.00	0.02
63.70	2.00	0.41	5.00	0.02	0.00	0.02
63.75	2.00	0.41	5.00	0.02	0.00	0.02
63.80	2.00	0.41	5.00	0.02	0.00	0.02
63.85	2.00	0.41	5.00	0.02	0.00	0.02
63.90	2.00	0.41	5.00	0.02	0.00	0.02
63.95	2.00	0.41	5.00	0.02	0.00	0.02

64.00	2.00	0.41	5.00	0.02	0.00	0.02
64.05	2.00	0.41	5.00	0.02	0.00	0.02
64.10	2.00	0.41	5.00	0.02	0.00	0.02
64.15	2.00	0.41	5.00	0.02	0.00	0.02
64.20	2.00	0.41	5.00	0.02	0.00	0.02
64.25	2.00	0.41	5.00	0.02	0.00	0.02
64.30	2.00	0.41	5.00	0.02	0.00	0.02
64.35	2.00	0.41	5.00	0.02	0.00	0.02
64.40	2.00	0.41	5.00	0.02	0.00	0.02
64.45	2.00	0.41	5.00	0.02	0.00	0.02
64.50	2.00	0.41	5.00	0.02	0.00	0.02
64.55	2.00	0.41	5.00	0.02	0.00	0.02
64.60	2.00	0.41	5.00	0.02	0.00	0.02
64.65	2.00	0.41	5.00	0.02	0.00	0.02
64.70	2.00	0.41	5.00	0.02	0.00	0.02
64.75	2.00	0.41	5.00	0.02	0.00	0.02
64.80	2.00	0.41	5.00	0.02	0.00	0.02
64.85	2.00	0.41	5.00	0.02	0.00	0.02
64.90	2.00	0.41	5.00	0.02	0.00	0.02
64.95	2.00	0.41	5.00	0.02	0.00	0.02
65.00	2.00	0.41	5.00	0.02	0.00	0.02
65.05	2.00	0.41	5.00	0.02	0.00	0.02
65.10	2.00	0.41	5.00	0.02	0.00	0.02
65.15	2.00	0.41	5.00	0.02	0.00	0.02
65.20	2.00	0.41	5.00	0.02	0.00	0.02
65.25	2.00	0.41	5.00	0.02	0.00	0.02
65.30	2.00	0.41	5.00	0.02	0.00	0.02
65.35	2.00	0.41	5.00	0.02	0.00	0.02
65.40	2.00	0.41	5.00	0.02	0.00	0.02
65.45	2.00	0.41	5.00	0.02	0.00	0.02
65.50	2.00	0.41	5.00	0.02	0.00	0.02

65.55	2.00	0.41	5.00	0.02	0.00	0.02
65.60	2.00	0.41	5.00	0.02	0.00	0.02
65.65	2.00	0.41	5.00	0.02	0.00	0.02
65.70	2.00	0.40	5.00	0.02	0.00	0.02
65.75	2.00	0.40	5.00	0.02	0.00	0.02
65.80	2.00	0.40	5.00	0.02	0.00	0.02
65.85	2.00	0.40	5.00	0.02	0.00	0.02
65.90	2.00	0.40	5.00	0.02	0.00	0.02
65.95	2.00	0.40	5.00	0.02	0.00	0.02
66.00	2.00	0.40	5.00	0.02	0.00	0.02
66.05	0.42	0.40	1.04	0.02	0.00	0.02
66.10	0.47	0.40	1.16	0.01	0.00	0.01
66.15	0.56	0.40	1.40	0.01	0.00	0.01
66.20	0.67	0.40	1.66	0.00	0.00	0.00
66.25	0.67	0.40	1.66	0.00	0.00	0.00
66.30	0.67	0.40	1.66	0.00	0.00	0.00
66.35	0.67	0.40	1.66	0.00	0.00	0.00
66.40	0.67	0.40	1.66	0.00	0.00	0.00
66.45	0.67	0.40	1.66	0.00	0.00	0.00
66.50	0.67	0.40	1.66	0.00	0.00	0.00
66.55	0.67	0.40	1.66	0.00	0.00	0.00
66.60	0.67	0.40	1.66	0.00	0.00	0.00
66.65	0.67	0.40	1.66	0.00	0.00	0.00
66.70	0.67	0.40	1.66	0.00	0.00	0.00
66.75	0.67	0.40	1.66	0.00	0.00	0.00
66.80	0.67	0.40	1.66	0.00	0.00	0.00
66.85	0.67	0.40	1.67	0.00	0.00	0.00
66.90	0.67	0.40	1.67	0.00	0.00	0.00
66.95	0.67	0.40	1.67	0.00	0.00	0.00
67.00	0.67	0.40	1.67	0.00	0.00	0.00
67.05	0.67	0.40	1.67	0.00	0.00	0.00

67.10	0.67	0.40	1.67	0.00	0.00	0.00
67.15	0.67	0.40	1.67	0.00	0.00	0.00
67.20	0.67	0.40	1.67	0.00	0.00	0.00
67.25	0.67	0.40	1.67	0.00	0.00	0.00
67.30	0.67	0.40	1.67	0.00	0.00	0.00
67.35	0.67	0.40	1.67	0.00	0.00	0.00
67.40	0.67	0.40	1.67	0.00	0.00	0.00
67.45	0.67	0.40	1.67	0.00	0.00	0.00
67.50	0.67	0.40	1.67	0.00	0.00	0.00
67.55	0.67	0.40	1.67	0.00	0.00	0.00
67.60	0.67	0.40	1.67	0.00	0.00	0.00
67.65	0.67	0.40	1.67	0.00	0.00	0.00
67.70	0.67	0.40	1.68	0.00	0.00	0.00
67.75	0.67	0.40	1.68	0.00	0.00	0.00
67.80	0.67	0.40	1.68	0.00	0.00	0.00
67.85	0.67	0.40	1.68	0.00	0.00	0.00
67.90	0.66	0.40	1.68	0.00	0.00	0.00
67.95	0.66	0.40	1.68	0.00	0.00	0.00
68.00	0.66	0.40	1.68	0.00	0.00	0.00
68.05	0.66	0.40	1.68	0.00	0.00	0.00
68.10	0.66	0.40	1.68	0.00	0.00	0.00
68.15	0.66	0.40	1.68	0.00	0.00	0.00
68.20	0.66	0.40	1.68	0.00	0.00	0.00
68.25	0.66	0.39	1.68	0.00	0.00	0.00
68.30	0.66	0.39	1.68	0.00	0.00	0.00
68.35	0.66	0.39	1.68	0.00	0.00	0.00
68.40	0.66	0.39	1.68	0.00	0.00	0.00
68.45	0.66	0.39	1.69	0.00	0.00	0.00
68.50	0.66	0.39	1.69	0.00	0.00	0.00
68.55	0.66	0.39	1.69	0.00	0.00	0.00
68.60	0.66	0.39	1.69	0.00	0.00	0.00

68.65	0.66	0.39	1.69	0.00	0.00	0.00
68.70	0.66	0.39	1.69	0.00	0.00	0.00
68.75	0.66	0.39	1.69	0.00	0.00	0.00
68.80	0.66	0.39	1.69	0.00	0.00	0.00
68.85	0.66	0.39	1.69	0.00	0.00	0.00
68.90	0.66	0.39	1.69	0.00	0.00	0.00
68.95	0.66	0.39	1.69	0.00	0.00	0.00
69.00	0.66	0.39	1.69	0.00	0.00	0.00
69.05	0.66	0.39	1.69	0.00	0.00	0.00
69.10	0.66	0.39	1.69	0.00	0.00	0.00
69.15	0.66	0.39	1.69	0.00	0.00	0.00
69.20	0.66	0.39	1.69	0.00	0.00	0.00
69.25	0.66	0.39	1.70	0.00	0.00	0.00
69.30	0.66	0.39	1.70	0.00	0.00	0.00
69.35	0.66	0.39	1.70	0.00	0.00	0.00
69.40	0.66	0.39	1.70	0.00	0.00	0.00
69.45	0.66	0.39	1.70	0.00	0.00	0.00
69.50	0.66	0.39	1.70	0.00	0.00	0.00
69.55	0.66	0.39	1.70	0.00	0.00	0.00
69.60	0.66	0.39	1.70	0.00	0.00	0.00
69.65	0.66	0.39	1.70	0.00	0.00	0.00
69.70	0.66	0.39	1.70	0.00	0.00	0.00
69.75	0.66	0.39	1.70	0.00	0.00	0.00
69.80	0.66	0.39	1.70	0.00	0.00	0.00
69.85	0.66	0.39	1.70	0.00	0.00	0.00
69.90	0.66	0.39	1.70	0.00	0.00	0.00
69.95	0.66	0.39	1.71	0.00	0.00	0.00
70.00	0.66	0.39	1.71	0.00	0.00	0.00
70.05	0.66	0.39	1.71	0.00	0.00	0.00
70.10	0.66	0.39	1.71	0.00	0.00	0.00
70.15	0.66	0.39	1.71	0.00	0.00	0.00

70.20	0.66	0.39	1.71	0.00	0.00	0.00
70.25	0.66	0.39	1.71	0.00	0.00	0.00
70.30	0.66	0.39	1.71	0.00	0.00	0.00
70.35	0.66	0.39	1.71	0.00	0.00	0.00
70.40	0.66	0.39	1.71	0.00	0.00	0.00
70.45	0.66	0.39	1.71	0.00	0.00	0.00
70.50	0.66	0.39	1.71	0.00	0.00	0.00
70.55	0.66	0.39	1.71	0.00	0.00	0.00
70.60	0.66	0.38	1.71	0.00	0.00	0.00
70.65	0.66	0.38	1.71	0.00	0.00	0.00
70.70	0.66	0.38	1.72	0.00	0.00	0.00
70.75	0.66	0.38	1.72	0.00	0.00	0.00
70.80	0.66	0.38	1.72	0.00	0.00	0.00
70.85	0.66	0.38	1.72	0.00	0.00	0.00
70.90	0.66	0.38	1.72	0.00	0.00	0.00
70.95	0.66	0.38	1.72	0.00	0.00	0.00
71.00	0.66	0.38	1.72	0.00	0.00	0.00
71.05	0.66	0.38	1.72	0.00	0.00	0.00
71.10	0.66	0.38	1.72	0.00	0.00	0.00
71.15	0.66	0.38	1.72	0.00	0.00	0.00
71.20	0.66	0.38	1.72	0.00	0.00	0.00
71.25	0.66	0.38	1.72	0.00	0.00	0.00
71.30	0.66	0.38	1.72	0.00	0.00	0.00
71.35	0.66	0.38	1.72	0.00	0.00	0.00
71.40	0.66	0.38	1.73	0.00	0.00	0.00
71.45	0.66	0.38	1.73	0.00	0.00	0.00
71.50	0.66	0.38	1.73	0.00	0.00	0.00
71.55	0.66	0.38	1.73	0.00	0.00	0.00
71.60	0.66	0.38	1.73	0.00	0.00	0.00
71.65	0.66	0.38	1.73	0.00	0.00	0.00
71.70	0.66	0.38	1.73	0.00	0.00	0.00

71.75	0.66	0.38	1.73	0.00	0.00	0.00
71.80	0.66	0.38	1.73	0.00	0.00	0.00
71.85	0.66	0.38	1.73	0.00	0.00	0.00
71.90	0.66	0.38	1.73	0.00	0.00	0.00
71.95	0.66	0.38	1.73	0.00	0.00	0.00
72.00	0.66	0.38	1.73	0.00	0.00	0.00
72.05	0.66	0.38	1.74	0.00	0.00	0.00
72.10	0.66	0.38	1.74	0.00	0.00	0.00
72.15	0.66	0.38	1.74	0.00	0.00	0.00
72.20	0.66	0.38	1.74	0.00	0.00	0.00
72.25	0.66	0.38	1.74	0.00	0.00	0.00
72.30	0.66	0.38	1.74	0.00	0.00	0.00
72.35	0.66	0.38	1.74	0.00	0.00	0.00
72.40	0.66	0.38	1.74	0.00	0.00	0.00
72.45	0.66	0.38	1.74	0.00	0.00	0.00
72.50	0.66	0.38	1.74	0.00	0.00	0.00
72.55	0.66	0.38	1.74	0.00	0.00	0.00
72.60	0.66	0.38	1.74	0.00	0.00	0.00
72.65	0.66	0.38	1.74	0.00	0.00	0.00
72.70	0.66	0.38	1.75	0.00	0.00	0.00
72.75	0.66	0.38	1.75	0.00	0.00	0.00
72.80	0.66	0.38	1.75	0.00	0.00	0.00
72.85	0.66	0.38	1.75	0.00	0.00	0.00
72.90	0.66	0.38	1.75	0.00	0.00	0.00
72.95	0.66	0.37	1.75	0.00	0.00	0.00
73.00	0.66	0.37	1.75	0.00	0.00	0.00
73.05	0.66	0.37	1.75	0.00	0.00	0.00
73.10	0.66	0.37	1.75	0.00	0.00	0.00
73.15	0.66	0.37	1.75	0.00	0.00	0.00
73.20	0.66	0.37	1.75	0.00	0.00	0.00
73.25	0.66	0.37	1.75	0.00	0.00	0.00

73.30	0.65	0.37	1.75	0.00	0.00	0.00
73.35	0.65	0.37	1.76	0.00	0.00	0.00
73.40	0.65	0.37	1.76	0.00	0.00	0.00
73.45	0.65	0.37	1.76	0.00	0.00	0.00
73.50	0.65	0.37	1.76	0.00	0.00	0.00
73.55	0.65	0.37	1.76	0.00	0.00	0.00
73.60	0.65	0.37	1.76	0.00	0.00	0.00
73.65	0.65	0.37	1.76	0.00	0.00	0.00
73.70	0.65	0.37	1.76	0.00	0.00	0.00
73.75	0.65	0.37	1.76	0.00	0.00	0.00
73.80	0.65	0.37	1.76	0.00	0.00	0.00
73.85	0.65	0.37	1.76	0.00	0.00	0.00
73.90	0.65	0.37	1.76	0.00	0.00	0.00
73.95	0.65	0.37	1.76	0.00	0.00	0.00
74.00	0.65	0.37	1.77	0.00	0.00	0.00
74.05	0.65	0.37	1.77	0.00	0.00	0.00
74.10	0.65	0.37	1.77	0.00	0.00	0.00
74.15	0.65	0.37	1.77	0.00	0.00	0.00
74.20	0.65	0.37	1.77	0.00	0.00	0.00
74.25	0.65	0.37	1.77	0.00	0.00	0.00
74.30	0.65	0.37	1.77	0.00	0.00	0.00
74.35	0.65	0.37	1.77	0.00	0.00	0.00
74.40	0.65	0.37	1.77	0.00	0.00	0.00
74.45	0.65	0.37	1.77	0.00	0.00	0.00
74.50	0.65	0.37	1.77	0.00	0.00	0.00
74.55	0.65	0.37	1.77	0.00	0.00	0.00
74.60	0.65	0.37	1.78	0.00	0.00	0.00
74.65	0.65	0.37	1.78	0.00	0.00	0.00
74.70	0.65	0.37	1.78	0.00	0.00	0.00
74.75	0.65	0.37	1.78	0.00	0.00	0.00
74.80	0.65	0.37	1.78	0.00	0.00	0.00

74.85	0.65	0.37	1.78	0.00	0.00	0.00
74.90	0.65	0.37	1.78	0.00	0.00	0.00
74.95	0.65	0.37	1.78	0.00	0.00	0.00
75.00	0.65	0.37	1.78	0.00	0.00	0.00
75.05	0.65	0.37	1.78	0.00	0.00	0.00
75.10	0.65	0.37	1.78	0.00	0.00	0.00
75.15	0.65	0.37	1.78	0.00	0.00	0.00
75.20	0.65	0.36	1.79	0.00	0.00	0.00
75.25	0.65	0.36	1.79	0.00	0.00	0.00
75.30	0.65	0.36	1.79	0.00	0.00	0.00
75.35	0.65	0.36	1.79	0.00	0.00	0.00
75.40	0.65	0.36	1.79	0.00	0.00	0.00
75.45	0.65	0.36	1.79	0.00	0.00	0.00
75.50	0.65	0.36	1.79	0.00	0.00	0.00
75.55	0.65	0.36	1.79	0.00	0.00	0.00
75.60	0.65	0.36	1.79	0.00	0.00	0.00
75.65	0.65	0.36	1.79	0.00	0.00	0.00
75.70	0.65	0.36	1.79	0.00	0.00	0.00
75.75	0.65	0.36	1.79	0.00	0.00	0.00
75.80	0.65	0.36	1.79	0.00	0.00	0.00
75.85	0.65	0.36	1.79	0.00	0.00	0.00
75.90	0.65	0.36	1.79	0.00	0.00	0.00
75.95	0.65	0.36	1.79	0.00	0.00	0.00
76.00	0.65	0.36	1.79	0.00	0.00	0.00
76.05	0.65	0.36	1.79	0.00	0.00	0.00
76.10	0.65	0.36	1.79	0.00	0.00	0.00
76.15	0.65	0.36	1.79	0.00	0.00	0.00
76.20	0.65	0.36	1.79	0.00	0.00	0.00
76.25	0.65	0.36	1.79	0.00	0.00	0.00
76.30	0.65	0.36	1.79	0.00	0.00	0.00
76.35	0.65	0.36	1.79	0.00	0.00	0.00

76.40	0.65	0.36	1.79	0.00	0.00	0.00
76.45	0.65	0.36	1.79	0.00	0.00	0.00
76.50	0.65	0.36	1.79	0.00	0.00	0.00
76.55	0.65	0.36	1.79	0.00	0.00	0.00
76.60	0.65	0.36	1.79	0.00	0.00	0.00
76.65	0.65	0.36	1.79	0.00	0.00	0.00
76.70	0.65	0.36	1.79	0.00	0.00	0.00
76.75	0.65	0.36	1.79	0.00	0.00	0.00
76.80	0.65	0.36	1.79	0.00	0.00	0.00
76.85	0.65	0.36	1.79	0.00	0.00	0.00
76.90	0.65	0.36	1.79	0.00	0.00	0.00
76.95	0.65	0.36	1.79	0.00	0.00	0.00
77.00	0.65	0.36	1.79	0.00	0.00	0.00
77.05	0.65	0.36	1.79	0.00	0.00	0.00
77.10	0.65	0.36	1.79	0.00	0.00	0.00
77.15	0.65	0.36	1.79	0.00	0.00	0.00
77.20	0.65	0.36	1.79	0.00	0.00	0.00
77.25	0.65	0.36	1.79	0.00	0.00	0.00
77.30	0.65	0.36	1.79	0.00	0.00	0.00
77.35	0.65	0.36	1.79	0.00	0.00	0.00
77.40	0.65	0.36	1.79	0.00	0.00	0.00
77.45	0.65	0.36	1.79	0.00	0.00	0.00
77.50	0.65	0.36	1.79	0.00	0.00	0.00
77.55	0.65	0.36	1.79	0.00	0.00	0.00
77.60	0.65	0.36	1.79	0.00	0.00	0.00
77.65	0.65	0.36	1.79	0.00	0.00	0.00
77.70	0.65	0.36	1.79	0.00	0.00	0.00
77.75	0.65	0.36	1.79	0.00	0.00	0.00
77.80	0.65	0.36	1.79	0.00	0.00	0.00
77.85	0.65	0.36	1.79	0.00	0.00	0.00
77.90	0.65	0.36	1.79	0.00	0.00	0.00

77.95	0.65	0.36	1.79	0.00	0.00	0.00
78.00	0.65	0.36	1.79	0.00	0.00	0.00
78.05	0.65	0.36	1.79	0.00	0.00	0.00
78.10	0.65	0.36	1.79	0.00	0.00	0.00
78.15	0.65	0.36	1.79	0.00	0.00	0.00
78.20	0.65	0.36	1.79	0.00	0.00	0.00
78.25	0.65	0.36	1.79	0.00	0.00	0.00
78.30	0.65	0.36	1.79	0.00	0.00	0.00
78.35	0.65	0.36	1.79	0.00	0.00	0.00
78.40	0.65	0.36	1.79	0.00	0.00	0.00
78.45	0.65	0.36	1.79	0.00	0.00	0.00
78.50	0.65	0.36	1.79	0.00	0.00	0.00
78.55	0.65	0.36	1.79	0.00	0.00	0.00
78.60	0.65	0.36	1.79	0.00	0.00	0.00
78.65	0.65	0.36	1.79	0.00	0.00	0.00
78.70	0.65	0.36	1.79	0.00	0.00	0.00
78.75	0.65	0.36	1.79	0.00	0.00	0.00
78.80	0.65	0.36	1.79	0.00	0.00	0.00
78.85	0.65	0.36	1.79	0.00	0.00	0.00
78.90	0.65	0.36	1.79	0.00	0.00	0.00
78.95	0.64	0.36	1.79	0.00	0.00	0.00
79.00	0.64	0.36	1.79	0.00	0.00	0.00
79.05	0.64	0.36	1.79	0.00	0.00	0.00
79.10	0.64	0.36	1.79	0.00	0.00	0.00
79.15	0.64	0.36	1.79	0.00	0.00	0.00
79.20	0.64	0.36	1.79	0.00	0.00	0.00
79.25	0.64	0.36	1.79	0.00	0.00	0.00
79.30	0.64	0.36	1.79	0.00	0.00	0.00
79.35	0.64	0.36	1.79	0.00	0.00	0.00
79.40	0.64	0.36	1.79	0.00	0.00	0.00
79.45	0.64	0.36	1.79	0.00	0.00	0.00

79.50	0.64	0.36	1.79	0.00	0.00	0.00
79.55	0.64	0.36	1.79	0.00	0.00	0.00
79.60	0.64	0.36	1.79	0.00	0.00	0.00
79.65	0.64	0.36	1.79	0.00	0.00	0.00
79.70	0.64	0.36	1.79	0.00	0.00	0.00
79.75	0.64	0.36	1.79	0.00	0.00	0.00
79.80	0.64	0.36	1.79	0.00	0.00	0.00
79.85	0.64	0.36	1.79	0.00	0.00	0.00
79.90	0.64	0.36	1.79	0.00	0.00	0.00
79.95	0.64	0.36	1.79	0.00	0.00	0.00
80.00	0.64	0.36	1.79	0.00	0.00	0.00
80.05	0.64	0.36	1.79	0.00	0.00	0.00
80.10	0.64	0.36	1.79	0.00	0.00	0.00
80.15	0.64	0.36	1.79	0.00	0.00	0.00
80.20	0.64	0.36	1.79	0.00	0.00	0.00
80.25	0.64	0.36	1.79	0.00	0.00	0.00
80.30	0.64	0.36	1.79	0.00	0.00	0.00
80.35	0.64	0.36	1.79	0.00	0.00	0.00
80.40	0.64	0.36	1.79	0.00	0.00	0.00
80.45	0.64	0.36	1.79	0.00	0.00	0.00
80.50	0.64	0.36	1.79	0.00	0.00	0.00
80.55	0.64	0.36	1.79	0.00	0.00	0.00
80.60	0.64	0.36	1.79	0.00	0.00	0.00
80.65	0.64	0.36	1.79	0.00	0.00	0.00
80.70	0.64	0.36	1.79	0.00	0.00	0.00
80.75	0.64	0.36	1.79	0.00	0.00	0.00
80.80	0.64	0.36	1.79	0.00	0.00	0.00
80.85	0.64	0.36	1.79	0.00	0.00	0.00
80.90	0.64	0.36	1.79	0.00	0.00	0.00
80.95	0.64	0.36	1.79	0.00	0.00	0.00
81.00	0.64	0.36	1.79	0.00	0.00	0.00

81.05	0.64	0.36	1.79	0.00	0.00	0.00
81.10	0.64	0.36	1.79	0.00	0.00	0.00
81.15	0.64	0.36	1.79	0.00	0.00	0.00
81.20	0.64	0.36	1.79	0.00	0.00	0.00
81.25	0.64	0.36	1.79	0.00	0.00	0.00
81.30	0.64	0.36	1.79	0.00	0.00	0.00
81.35	0.64	0.36	1.79	0.00	0.00	0.00
81.40	0.64	0.36	1.79	0.00	0.00	0.00
81.45	0.64	0.36	1.79	0.00	0.00	0.00
81.50	0.64	0.36	1.79	0.00	0.00	0.00
81.55	0.64	0.36	1.79	0.00	0.00	0.00
81.60	0.64	0.36	1.79	0.00	0.00	0.00
81.65	0.64	0.36	1.79	0.00	0.00	0.00
81.70	0.64	0.36	1.79	0.00	0.00	0.00
81.75	0.64	0.36	1.79	0.00	0.00	0.00
81.80	0.64	0.36	1.79	0.00	0.00	0.00
81.85	0.64	0.36	1.79	0.00	0.00	0.00
81.90	0.64	0.36	1.79	0.00	0.00	0.00
81.95	0.64	0.36	1.79	0.00	0.00	0.00
82.00	0.64	0.36	1.79	0.00	0.00	0.00
82.05	0.64	0.36	1.79	0.00	0.00	0.00
82.10	0.64	0.36	1.79	0.00	0.00	0.00
82.15	0.64	0.36	1.79	0.00	0.00	0.00
82.20	0.64	0.36	1.79	0.00	0.00	0.00
82.25	0.64	0.36	1.79	0.00	0.00	0.00
82.30	0.64	0.36	1.79	0.00	0.00	0.00
82.35	0.64	0.36	1.79	0.00	0.00	0.00
82.40	0.64	0.36	1.79	0.00	0.00	0.00
82.45	0.64	0.36	1.79	0.00	0.00	0.00
82.50	0.64	0.36	1.79	0.00	0.00	0.00
82.55	0.64	0.36	1.79	0.00	0.00	0.00

82.60	0.64	0.36	1.79	0.00	0.00	0.00
82.65	0.64	0.36	1.79	0.00	0.00	0.00
82.70	0.64	0.36	1.79	0.00	0.00	0.00
82.75	0.64	0.36	1.79	0.00	0.00	0.00
82.80	0.64	0.36	1.79	0.00	0.00	0.00
82.85	0.64	0.36	1.79	0.00	0.00	0.00
82.90	0.64	0.36	1.79	0.00	0.00	0.00
82.95	0.64	0.36	1.79	0.00	0.00	0.00
83.00	0.64	0.36	1.79	0.00	0.00	0.00
83.05	0.64	0.36	1.79	0.00	0.00	0.00
83.10	0.64	0.36	1.79	0.00	0.00	0.00
83.15	0.64	0.36	1.79	0.00	0.00	0.00
83.20	0.64	0.36	1.79	0.00	0.00	0.00
83.25	0.64	0.36	1.79	0.00	0.00	0.00
83.30	0.64	0.36	1.79	0.00	0.00	0.00
83.35	0.64	0.36	1.79	0.00	0.00	0.00
83.40	0.64	0.36	1.79	0.00	0.00	0.00
83.45	0.64	0.36	1.79	0.00	0.00	0.00
83.50	0.64	0.36	1.79	0.00	0.00	0.00
83.55	0.64	0.36	1.79	0.00	0.00	0.00
83.60	0.64	0.36	1.79	0.00	0.00	0.00
83.65	0.64	0.36	1.79	0.00	0.00	0.00
83.70	0.64	0.36	1.79	0.00	0.00	0.00
83.75	0.64	0.36	1.79	0.00	0.00	0.00
83.80	0.64	0.36	1.79	0.00	0.00	0.00
83.85	0.64	0.36	1.79	0.00	0.00	0.00
83.90	0.64	0.36	1.79	0.00	0.00	0.00
83.95	0.64	0.36	1.79	0.00	0.00	0.00
84.00	0.64	0.36	1.79	0.00	0.00	0.00
84.05	0.64	0.36	1.79	0.00	0.00	0.00
84.10	0.64	0.36	1.79	0.00	0.00	0.00

84.15	0.64	0.36	1.79	0.00	0.00	0.00
84.20	0.64	0.36	1.79	0.00	0.00	0.00
84.25	0.64	0.36	1.79	0.00	0.00	0.00
84.30	0.64	0.36	1.79	0.00	0.00	0.00
84.35	0.64	0.36	1.79	0.00	0.00	0.00
84.40	0.64	0.36	1.79	0.00	0.00	0.00
84.45	0.64	0.36	1.79	0.00	0.00	0.00
84.50	0.64	0.36	1.79	0.00	0.00	0.00
84.55	0.64	0.36	1.79	0.00	0.00	0.00
84.60	0.64	0.36	1.79	0.00	0.00	0.00
84.65	0.64	0.36	1.79	0.00	0.00	0.00
84.70	0.64	0.36	1.79	0.00	0.00	0.00
84.75	0.64	0.36	1.79	0.00	0.00	0.00
84.80	0.64	0.36	1.79	0.00	0.00	0.00
84.85	0.63	0.36	1.79	0.00	0.00	0.00
84.90	0.63	0.36	1.79	0.00	0.00	0.00
84.95	0.63	0.36	1.79	0.00	0.00	0.00
85.00	0.63	0.36	1.79	0.00	0.00	0.00
85.05	0.63	0.36	1.79	0.00	0.00	0.00
85.10	0.63	0.36	1.79	0.00	0.00	0.00
85.15	0.63	0.36	1.79	0.00	0.00	0.00
85.20	0.63	0.36	1.79	0.00	0.00	0.00
85.25	0.63	0.36	1.79	0.00	0.00	0.00
85.30	0.63	0.36	1.79	0.00	0.00	0.00
85.35	0.63	0.36	1.79	0.00	0.00	0.00
85.40	0.63	0.36	1.79	0.00	0.00	0.00
85.45	0.63	0.36	1.79	0.00	0.00	0.00
85.50	0.63	0.35	1.79	0.00	0.00	0.00
85.55	0.63	0.35	1.79	0.00	0.00	0.00
85.60	0.63	0.35	1.79	0.00	0.00	0.00
85.65	0.63	0.35	1.79	0.00	0.00	0.00

85.70	0.63	0.35	1.79	0.00	0.00	0.00
85.75	0.63	0.35	1.79	0.00	0.00	0.00
85.80	0.63	0.35	1.79	0.00	0.00	0.00
85.85	0.63	0.35	1.79	0.00	0.00	0.00
85.90	0.63	0.35	1.79	0.00	0.00	0.00
85.95	0.63	0.35	1.79	0.00	0.00	0.00
86.00	0.63	0.35	1.79	0.00	0.00	0.00
86.05	0.63	0.35	1.79	0.00	0.00	0.00
86.10	0.63	0.35	1.79	0.00	0.00	0.00
86.15	0.63	0.35	1.79	0.00	0.00	0.00
86.20	0.63	0.35	1.79	0.00	0.00	0.00
86.25	0.63	0.35	1.79	0.00	0.00	0.00
86.30	0.63	0.35	1.79	0.00	0.00	0.00
86.35	0.63	0.35	1.79	0.00	0.00	0.00
86.40	0.63	0.35	1.79	0.00	0.00	0.00
86.45	0.63	0.35	1.79	0.00	0.00	0.00
86.50	0.63	0.35	1.79	0.00	0.00	0.00
86.55	0.63	0.35	1.79	0.00	0.00	0.00
86.60	0.63	0.35	1.79	0.00	0.00	0.00
86.65	0.63	0.35	1.79	0.00	0.00	0.00
86.70	0.63	0.35	1.79	0.00	0.00	0.00
86.75	0.63	0.35	1.79	0.00	0.00	0.00
86.80	0.63	0.35	1.79	0.00	0.00	0.00
86.85	0.63	0.35	1.79	0.00	0.00	0.00
86.90	0.63	0.35	1.79	0.00	0.00	0.00
86.95	0.63	0.35	1.79	0.00	0.00	0.00
87.00	0.63	0.35	1.79	0.00	0.00	0.00
87.05	0.63	0.35	1.79	0.00	0.00	0.00
87.10	0.63	0.35	1.79	0.00	0.00	0.00
87.15	0.63	0.35	1.79	0.00	0.00	0.00
87.20	0.63	0.35	1.79	0.00	0.00	0.00

87.25	0.63	0.35	1.79	0.00	0.00	0.00
87.30	0.63	0.35	1.79	0.00	0.00	0.00
87.35	0.63	0.35	1.79	0.00	0.00	0.00
87.40	0.63	0.35	1.79	0.00	0.00	0.00
87.45	0.63	0.35	1.79	0.00	0.00	0.00
87.50	0.63	0.35	1.79	0.00	0.00	0.00
87.55	0.63	0.35	1.79	0.00	0.00	0.00
87.60	0.63	0.35	1.79	0.00	0.00	0.00
87.65	0.63	0.35	1.79	0.00	0.00	0.00
87.70	0.63	0.35	1.79	0.00	0.00	0.00
87.75	0.63	0.35	1.79	0.00	0.00	0.00
87.80	0.63	0.35	1.79	0.00	0.00	0.00
87.85	0.63	0.35	1.79	0.00	0.00	0.00
87.90	0.63	0.35	1.79	0.00	0.00	0.00
87.95	0.63	0.35	1.79	0.00	0.00	0.00
88.00	0.63	0.35	1.79	0.00	0.00	0.00
88.05	0.63	0.35	1.79	0.00	0.00	0.00
88.10	0.63	0.35	1.79	0.00	0.00	0.00
88.15	0.63	0.35	1.79	0.00	0.00	0.00
88.20	0.63	0.35	1.79	0.00	0.00	0.00
88.25	0.63	0.35	1.79	0.00	0.00	0.00
88.30	0.63	0.35	1.79	0.00	0.00	0.00
88.35	0.63	0.35	1.79	0.00	0.00	0.00
88.40	0.63	0.35	1.79	0.00	0.00	0.00
88.45	0.63	0.35	1.79	0.00	0.00	0.00
88.50	0.63	0.35	1.79	0.00	0.00	0.00
88.55	0.63	0.35	1.79	0.00	0.00	0.00
88.60	0.63	0.35	1.79	0.00	0.00	0.00
88.65	0.63	0.35	1.79	0.00	0.00	0.00
88.70	0.63	0.35	1.79	0.00	0.00	0.00
88.75	0.63	0.35	1.79	0.00	0.00	0.00

88.80	0.63	0.35	1.79	0.00	0.00	0.00
88.85	0.63	0.35	1.79	0.00	0.00	0.00
88.90	0.63	0.35	1.79	0.00	0.00	0.00
88.95	0.63	0.35	1.79	0.00	0.00	0.00
89.00	0.63	0.35	1.79	0.00	0.00	0.00
89.05	0.63	0.35	1.79	0.00	0.00	0.00
89.10	0.63	0.35	1.79	0.00	0.00	0.00
89.15	0.63	0.35	1.79	0.00	0.00	0.00
89.20	0.63	0.35	1.79	0.00	0.00	0.00
89.25	0.63	0.35	1.79	0.00	0.00	0.00
89.30	0.63	0.35	1.79	0.00	0.00	0.00
89.35	0.63	0.35	1.79	0.00	0.00	0.00
89.40	0.63	0.35	1.79	0.00	0.00	0.00
89.45	0.63	0.35	1.79	0.00	0.00	0.00
89.50	0.63	0.35	1.79	0.00	0.00	0.00
89.55	0.63	0.35	1.79	0.00	0.00	0.00
89.60	0.63	0.35	1.79	0.00	0.00	0.00
89.65	0.63	0.35	1.79	0.00	0.00	0.00
89.70	0.63	0.35	1.79	0.00	0.00	0.00
89.75	0.63	0.35	1.79	0.00	0.00	0.00
89.80	0.63	0.35	1.79	0.00	0.00	0.00
89.85	0.63	0.35	1.79	0.00	0.00	0.00
89.90	0.63	0.35	1.79	0.00	0.00	0.00
89.95	0.63	0.35	1.79	0.00	0.00	0.00
90.00	0.63	0.35	1.79	0.00	0.00	0.00
90.05	0.63	0.35	1.79	0.00	0.00	0.00
90.10	0.63	0.35	1.79	0.00	0.00	0.00
90.15	0.63	0.35	1.79	0.00	0.00	0.00
90.20	0.63	0.35	1.79	0.00	0.00	0.00
90.25	0.63	0.35	1.79	0.00	0.00	0.00
90.30	0.63	0.35	1.79	0.00	0.00	0.00

90.35	0.63	0.35	1.79	0.00	0.00	0.00
90.40	0.63	0.35	1.79	0.00	0.00	0.00
90.45	0.63	0.35	1.79	0.00	0.00	0.00
90.50	0.63	0.35	1.79	0.00	0.00	0.00
90.55	0.63	0.35	1.79	0.00	0.00	0.00
90.60	0.63	0.35	1.79	0.00	0.00	0.00
90.65	0.63	0.35	1.79	0.00	0.00	0.00
90.70	0.63	0.35	1.79	0.00	0.00	0.00
90.75	0.63	0.35	1.79	0.00	0.00	0.00
90.80	0.63	0.35	1.79	0.00	0.00	0.00
90.85	0.63	0.35	1.79	0.00	0.00	0.00
90.90	0.63	0.35	1.79	0.00	0.00	0.00
90.95	0.63	0.35	1.79	0.00	0.00	0.00
91.00	0.62	0.35	1.79	0.00	0.00	0.00
91.05	0.62	0.35	1.79	0.00	0.00	0.00
91.10	0.62	0.35	1.79	0.00	0.00	0.00
91.15	0.62	0.35	1.79	0.00	0.00	0.00
91.20	0.62	0.35	1.79	0.00	0.00	0.00
91.25	0.62	0.35	1.79	0.00	0.00	0.00
91.30	0.62	0.35	1.79	0.00	0.00	0.00
91.35	0.62	0.35	1.79	0.00	0.00	0.00
91.40	0.62	0.35	1.79	0.00	0.00	0.00
91.45	0.62	0.35	1.79	0.00	0.00	0.00
91.50	0.62	0.35	1.79	0.00	0.00	0.00
91.55	0.62	0.35	1.79	0.00	0.00	0.00
91.60	0.62	0.35	1.79	0.00	0.00	0.00
91.65	0.62	0.35	1.79	0.00	0.00	0.00
91.70	0.62	0.35	1.79	0.00	0.00	0.00
91.75	0.62	0.35	1.79	0.00	0.00	0.00
91.80	0.62	0.35	1.79	0.00	0.00	0.00
91.85	0.62	0.35	1.79	0.00	0.00	0.00

91.90	0.62	0.35	1.79	0.00	0.00	0.00
91.95	0.62	0.35	1.79	0.00	0.00	0.00
92.00	0.62	0.35	1.79	0.00	0.00	0.00
92.05	0.62	0.35	1.79	0.00	0.00	0.00
92.10	0.62	0.35	1.79	0.00	0.00	0.00
92.15	0.62	0.35	1.79	0.00	0.00	0.00
92.20	0.62	0.35	1.79	0.00	0.00	0.00
92.25	0.62	0.35	1.79	0.00	0.00	0.00
92.30	0.62	0.35	1.79	0.00	0.00	0.00
92.35	0.62	0.35	1.79	0.00	0.00	0.00
92.40	0.62	0.35	1.79	0.00	0.00	0.00
92.45	0.62	0.35	1.79	0.00	0.00	0.00
92.50	0.62	0.35	1.79	0.00	0.00	0.00
92.55	0.62	0.35	1.79	0.00	0.00	0.00
92.60	0.62	0.35	1.79	0.00	0.00	0.00
92.65	0.62	0.35	1.79	0.00	0.00	0.00
92.70	0.62	0.35	1.79	0.00	0.00	0.00
92.75	0.62	0.35	1.79	0.00	0.00	0.00
92.80	0.62	0.35	1.79	0.00	0.00	0.00
92.85	0.62	0.35	1.79	0.00	0.00	0.00
92.90	0.62	0.35	1.79	0.00	0.00	0.00
92.95	0.62	0.35	1.79	0.00	0.00	0.00
93.00	0.62	0.35	1.79	0.00	0.00	0.00
93.05	0.62	0.35	1.79	0.00	0.00	0.00
93.10	0.62	0.35	1.79	0.00	0.00	0.00
93.15	0.62	0.35	1.79	0.00	0.00	0.00
93.20	0.62	0.35	1.79	0.00	0.00	0.00
93.25	0.62	0.35	1.79	0.00	0.00	0.00
93.30	0.62	0.35	1.79	0.00	0.00	0.00
93.35	0.62	0.35	1.79	0.00	0.00	0.00
93.40	0.62	0.35	1.79	0.00	0.00	0.00

93.45	0.62	0.35	1.79	0.00	0.00	0.00
93.50	0.62	0.35	1.79	0.00	0.00	0.00
93.55	0.62	0.35	1.79	0.00	0.00	0.00
93.60	0.62	0.35	1.79	0.00	0.00	0.00
93.65	0.62	0.35	1.79	0.00	0.00	0.00
93.70	0.62	0.35	1.79	0.00	0.00	0.00
93.75	0.62	0.35	1.79	0.00	0.00	0.00
93.80	0.62	0.35	1.79	0.00	0.00	0.00
93.85	0.62	0.35	1.79	0.00	0.00	0.00
93.90	0.62	0.35	1.79	0.00	0.00	0.00
93.95	0.62	0.35	1.79	0.00	0.00	0.00
94.00	0.62	0.35	1.79	0.00	0.00	0.00
94.05	0.62	0.35	1.79	0.00	0.00	0.00
94.10	0.62	0.35	1.79	0.00	0.00	0.00
94.15	0.62	0.35	1.79	0.00	0.00	0.00
94.20	0.62	0.35	1.79	0.00	0.00	0.00
94.25	0.62	0.35	1.79	0.00	0.00	0.00
94.30	0.62	0.35	1.79	0.00	0.00	0.00
94.35	0.62	0.35	1.79	0.00	0.00	0.00
94.40	0.62	0.35	1.79	0.00	0.00	0.00
94.45	0.62	0.35	1.79	0.00	0.00	0.00
94.50	0.62	0.35	1.79	0.00	0.00	0.00
94.55	0.62	0.35	1.79	0.00	0.00	0.00
94.60	0.62	0.35	1.79	0.00	0.00	0.00
94.65	0.62	0.35	1.79	0.00	0.00	0.00
94.70	0.62	0.35	1.79	0.00	0.00	0.00
94.75	0.62	0.35	1.79	0.00	0.00	0.00
94.80	0.62	0.34	1.79	0.00	0.00	0.00
94.85	0.62	0.34	1.79	0.00	0.00	0.00
94.90	0.62	0.34	1.79	0.00	0.00	0.00
94.95	0.62	0.34	1.79	0.00	0.00	0.00

95.00	0.62	0.34	1.79	0.00	0.00	0.00
95.05	0.62	0.34	1.79	0.00	0.00	0.00
95.10	0.62	0.34	1.79	0.00	0.00	0.00
95.15	0.62	0.34	1.79	0.00	0.00	0.00
95.20	0.62	0.34	1.79	0.00	0.00	0.00
95.25	0.62	0.34	1.79	0.00	0.00	0.00
95.30	0.62	0.34	1.79	0.00	0.00	0.00
95.35	0.62	0.34	1.80	0.00	0.00	0.00
95.40	0.62	0.34	1.80	0.00	0.00	0.00
95.45	0.62	0.34	1.80	0.00	0.00	0.00
95.50	0.62	0.34	1.80	0.00	0.00	0.00
95.55	0.62	0.34	1.80	0.00	0.00	0.00
95.60	0.62	0.34	1.80	0.00	0.00	0.00
95.65	0.62	0.34	1.80	0.00	0.00	0.00
95.70	0.62	0.34	1.80	0.00	0.00	0.00
95.75	0.62	0.34	1.80	0.00	0.00	0.00
95.80	0.62	0.34	1.80	0.00	0.00	0.00
95.85	0.62	0.34	1.80	0.00	0.00	0.00
95.90	0.62	0.34	1.80	0.00	0.00	0.00
95.95	0.62	0.34	1.80	0.00	0.00	0.00
96.00	0.62	0.34	1.80	0.00	0.00	0.00
96.05	0.62	0.34	1.80	0.00	0.00	0.00
96.10	0.62	0.34	1.80	0.00	0.00	0.00
96.15	0.62	0.34	1.80	0.00	0.00	0.00
96.20	0.62	0.34	1.80	0.00	0.00	0.00
96.25	0.62	0.34	1.80	0.00	0.00	0.00
96.30	0.62	0.34	1.80	0.00	0.00	0.00
96.35	0.62	0.34	1.80	0.00	0.00	0.00
96.40	0.62	0.34	1.80	0.00	0.00	0.00
96.45	0.62	0.34	1.80	0.00	0.00	0.00
96.50	0.62	0.34	1.80	0.00	0.00	0.00

96.55	0.62	0.34	1.80	0.00	0.00	0.00
96.60	0.62	0.34	1.80	0.00	0.00	0.00
96.65	0.62	0.34	1.80	0.00	0.00	0.00
96.70	0.62	0.34	1.80	0.00	0.00	0.00
96.75	0.62	0.34	1.80	0.00	0.00	0.00
96.80	0.62	0.34	1.80	0.00	0.00	0.00
96.85	0.62	0.34	1.80	0.00	0.00	0.00
96.90	0.62	0.34	1.80	0.00	0.00	0.00
96.95	0.62	0.34	1.80	0.00	0.00	0.00
97.00	0.62	0.34	1.80	0.00	0.00	0.00
97.05	0.62	0.34	1.80	0.00	0.00	0.00
97.10	0.62	0.34	1.80	0.00	0.00	0.00
97.15	0.62	0.34	1.80	0.00	0.00	0.00
97.20	0.62	0.34	1.80	0.00	0.00	0.00
97.25	0.62	0.34	1.80	0.00	0.00	0.00
97.30	0.62	0.34	1.80	0.00	0.00	0.00
97.35	0.62	0.34	1.80	0.00	0.00	0.00
97.40	0.62	0.34	1.80	0.00	0.00	0.00
97.45	0.61	0.34	1.80	0.00	0.00	0.00
97.50	0.61	0.34	1.80	0.00	0.00	0.00
97.55	0.61	0.34	1.80	0.00	0.00	0.00
97.60	0.61	0.34	1.80	0.00	0.00	0.00
97.65	0.61	0.34	1.80	0.00	0.00	0.00
97.70	0.61	0.34	1.80	0.00	0.00	0.00
97.75	0.61	0.34	1.80	0.00	0.00	0.00
97.80	0.61	0.34	1.80	0.00	0.00	0.00
97.85	0.61	0.34	1.80	0.00	0.00	0.00
97.90	0.61	0.34	1.80	0.00	0.00	0.00
97.95	0.61	0.34	1.80	0.00	0.00	0.00
98.00	0.61	0.34	1.80	0.00	0.00	0.00
98.05	0.61	0.34	1.80	0.00	0.00	0.00

98.10	0.61	0.34	1.80	0.00	0.00	0.00
98.15	0.61	0.34	1.80	0.00	0.00	0.00
98.20	0.61	0.34	1.80	0.00	0.00	0.00
98.25	0.61	0.34	1.80	0.00	0.00	0.00
98.30	0.61	0.34	1.80	0.00	0.00	0.00
98.35	0.61	0.34	1.80	0.00	0.00	0.00
98.40	0.61	0.34	1.80	0.00	0.00	0.00
98.45	0.61	0.34	1.81	0.00	0.00	0.00
98.50	0.61	0.34	1.81	0.00	0.00	0.00
98.55	0.61	0.34	1.81	0.00	0.00	0.00
98.60	0.61	0.34	1.81	0.00	0.00	0.00
98.65	0.61	0.34	1.81	0.00	0.00	0.00
98.70	0.61	0.34	1.81	0.00	0.00	0.00
98.75	0.61	0.34	1.81	0.00	0.00	0.00
98.80	0.61	0.34	1.81	0.00	0.00	0.00
98.85	0.61	0.34	1.81	0.00	0.00	0.00
98.90	0.61	0.34	1.81	0.00	0.00	0.00
98.95	0.61	0.34	1.81	0.00	0.00	0.00
99.00	0.61	0.34	1.81	0.00	0.00	0.00
99.05	0.61	0.34	1.81	0.00	0.00	0.00
99.10	0.61	0.34	1.81	0.00	0.00	0.00
99.15	0.61	0.34	1.81	0.00	0.00	0.00
99.20	0.61	0.34	1.81	0.00	0.00	0.00
99.25	0.61	0.34	1.81	0.00	0.00	0.00
99.30	0.61	0.34	1.81	0.00	0.00	0.00
99.35	0.61	0.34	1.81	0.00	0.00	0.00
99.40	0.61	0.34	1.81	0.00	0.00	0.00
99.45	0.61	0.34	1.81	0.00	0.00	0.00
99.50	0.61	0.34	1.81	0.00	0.00	0.00
99.55	0.61	0.34	1.81	0.00	0.00	0.00
99.60	0.61	0.34	1.81	0.00	0.00	0.00

99.65	0.61	0.34	1.81	0.00	0.00	0.00
99.70	0.61	0.34	1.81	0.00	0.00	0.00
99.75	0.61	0.34	1.81	0.00	0.00	0.00
99.80	0.61	0.34	1.81	0.00	0.00	0.00
99.85	0.61	0.34	1.81	0.00	0.00	0.00
99.90	0.61	0.34	1.80	0.00	0.00	0.00
99.95	0.61	0.34	1.80	0.00	0.00	0.00
100.00	0.61	0.34	1.80	0.00	0.00	0.00

---

* F.S.<1, Liquefaction Potential Zone

(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

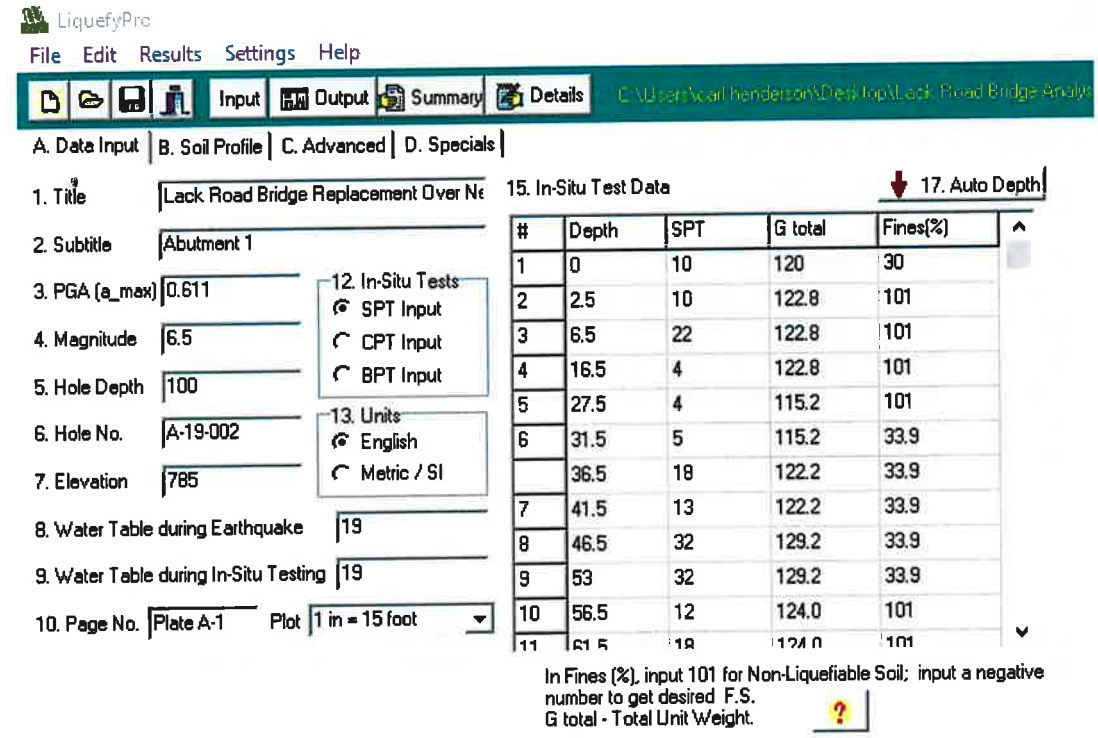
Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

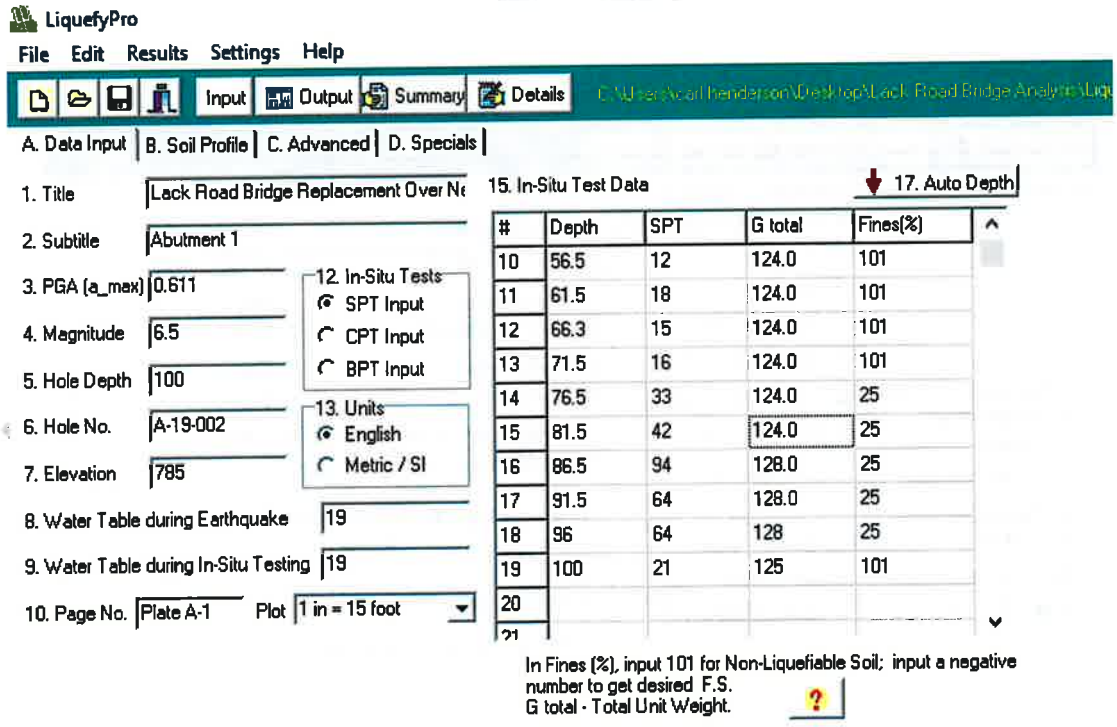
---

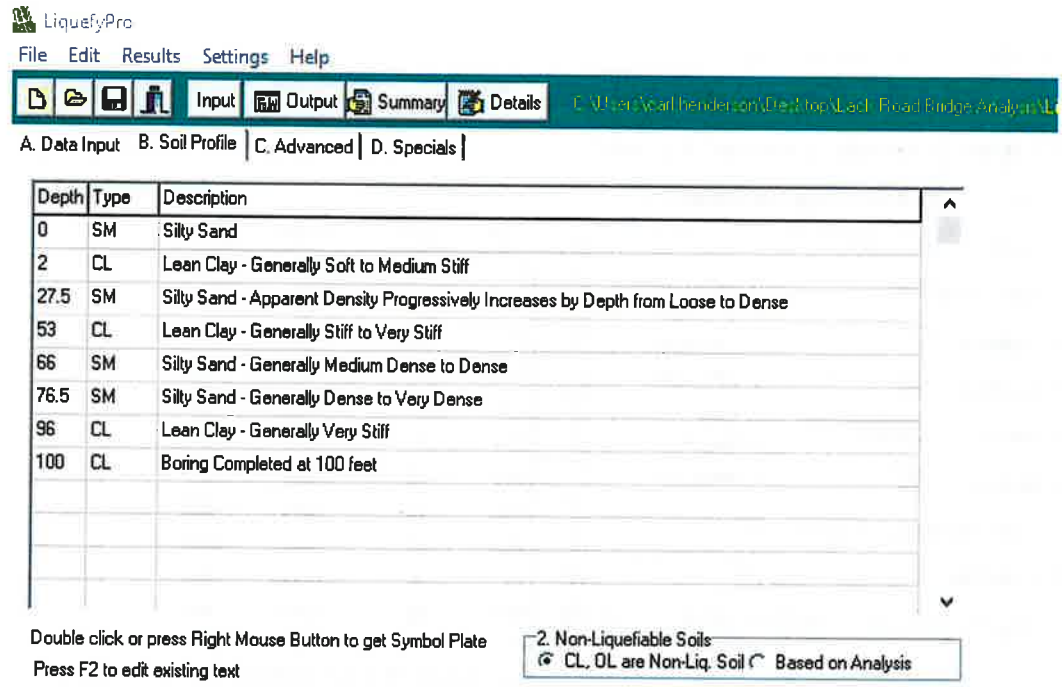
1 atm (atmosphere) = 1 tsf (ton/ft2)

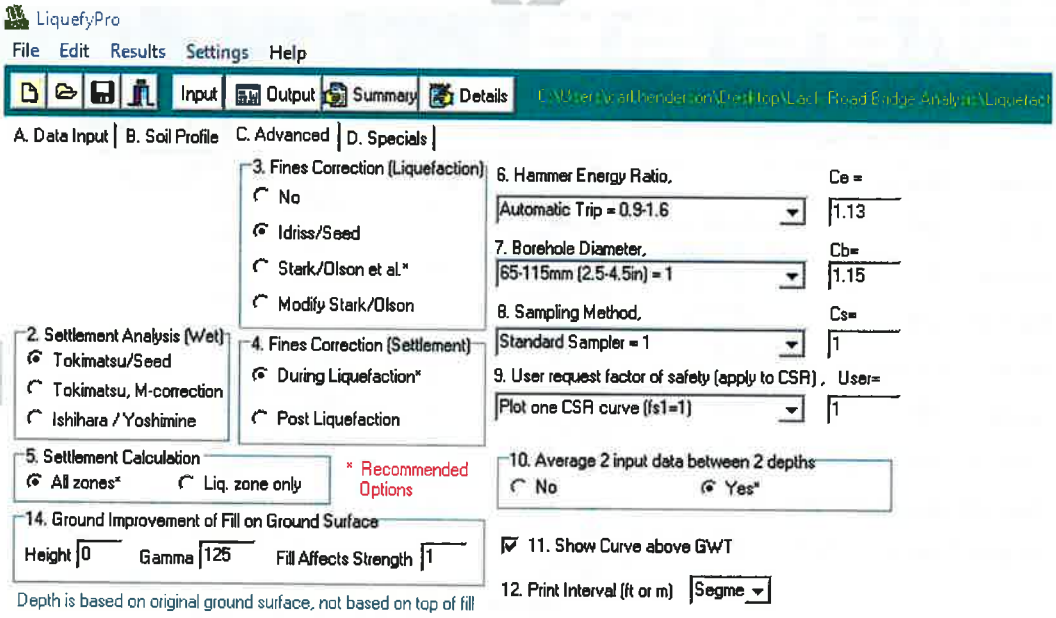
CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Liquefaction Analysis – A-19-002


LiquefyPro
File Edit Results Settings Help
Input Output Summary Details
A. Data Input B. Soil Profile C. Advanced D. Specials
1. Title Lack Road Bridge Replacement Over Ne
2. Subtitle Abutment 1
3. PGA (a_max) 0.611
4. Magnitude 6.5
5. Hole Depth 100
6. Hole No. A-19-002
7. Elevation 785
8. Water Table during Earthquake 19
9. Water Table during In-Situ Testing 19
10. Page No. Plate A-1
Plot 1 in = 15 foot
12. In-Situ Tests
SPT Input
CPT Input
BPT Input
13. Units
English
Metric / SI
15. In-Situ Test Data
17. Auto Depth
Depth SPT G total Fines(%)
1 0 10 120 30
2 2.5 10 122.8 101
3 6.5 22 122.8 101
4 16.5 4 122.8 101
5 27.5 4 115.2 101
6 31.5 5 115.2 33.9
36.5 18 122.2 33.9
7 41.5 13 122.2 33.9
8 46.5 32 129.2 33.9
9 53 32 129.2 33.9
10 56.5 12 124.0 101
In Fines (%), input 101 for Non-Liquefiable Soil; input a negative number to get desired F.S.
G total - Total Unit Weight.


LiquefyPro
File Edit Results Settings Help
Input Output Summary Details
A. Data Input B. Soil Profile C. Advanced D. Specials
1. Title Lack Road Bridge Replacement Over Ne
2. Subtitle Abutment 1
3. PGA (a_max) 0.611
4. Magnitude 6.5
5. Hole Depth 100
6. Hole No. A-19-002
7. Elevation 785
8. Water Table during Earthquake 19
9. Water Table during In-Situ Testing 19
10. Page No. Plate A-1
Plot 1 in = 15 foot
12. In-Situ Tests
SPT Input
CPT Input
BPT Input
13. Units
English
Metric / SI
15. In-Situ Test Data
17. Auto Depth
Depth SPT G total Fines(%)
10 56.5 12 124.0 101
11 61.5 18 124.0 101
12 66.3 15 124.0 101
13 71.5 16 124.0 101
14 76.5 33 124.0 25
15 81.5 42 124.0 25
16 86.5 94 128.0 25
17 91.5 64 128.0 25
18 96 64 128 25
19 100 21 125 101
20
In Fines (%), input 101 for Non-Liquefiable Soil; input a negative number to get desired F.S.
G total - Total Unit Weight.


LiquefyPro
File Edit Results Settings Help
Input Output Summary Details
A. Data Input B. Soil Profile C. Advanced D. Specials
Depth Type Description
0 SM Silty Sand
2 CL Lean Clay - Generally Soft to Medium Stiff
27.5 SM Silty Sand - Apparent Density Progressively Increases by Depth from Loose to Dense
53 CL Lean Clay - Generally Stiff to Very Stiff
66 SM Silty Sand - Generally Medium Dense to Dense
76.5 SM Silty Sand - Generally Dense to Very Dense
96 CL Lean Clay - Generally Very Stiff
100 CL Boring Completed at 100 feet
Double click or press Right Mouse Button to get Symbol Plate
Press F2 to edit existing text
2. Non-Liquefiable Soils
CL, OL are Non-Liq. Soil
Based on Analysis


LiquefyPro
File Edit Results Settings Help
Input Output Summary Details
A. Data Input B. Soil Profile C. Advanced D. Specials
3. Fines Correction (Liquefaction)
No
Idriss/Seed
Stark/Olson et al.*
Modify Stark/Olson
6. Hammer Energy Ratio, Ce =
Automatic Trip = 0.9-1.6
1.13
7. Borehole Diameter, Cb=
65-115mm (2.5-4.5in) = 1
1.15
8. Sampling Method, Cs=
Standard Sampler = 1
1
9. User request factor of safety (apply to CSR), User=
Plot one CSR curve (fs1=1)
1
2. Settlement Analysis (Wet)
Tokimatsu/Seed
Tokimatsu, M-correction
Ishihara / Yoshimine
4. Fines Correction (Settlement)
During Liquefaction*
Post Liquefaction
5. Settlement Calculation
All zones*
Liq. zone only
* Recommended Options
10. Average 2 input data between 2 depths
No
Yes*
14. Ground Improvement of Fill on Ground Surface
Height 0 Gamma 125 Fill Affects Strength 1
11. Show Curve above GWT
12. Print Interval (ft or m) Segme
Depth is based on original ground surface, not based on top of fill

Viewform1

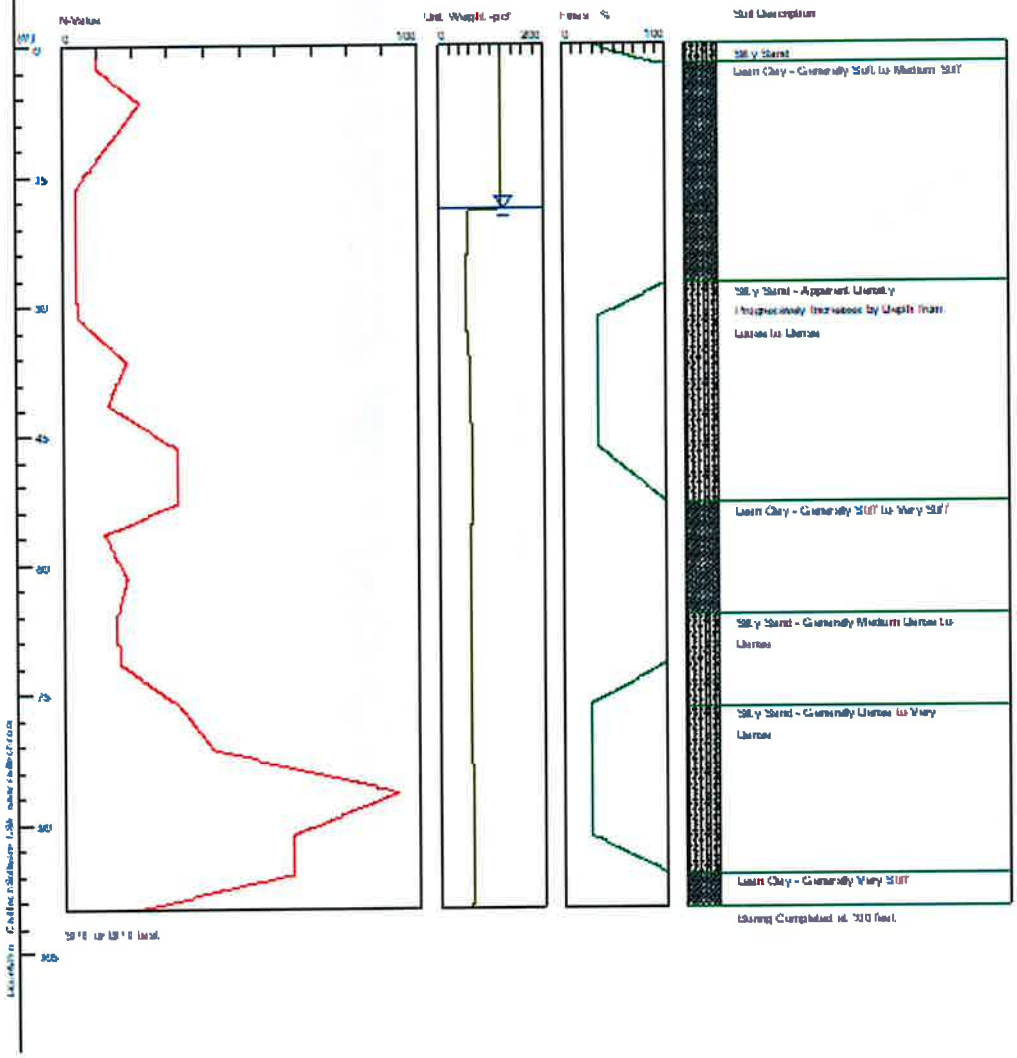
Page 1 of 1 | 1 | Zoom % | 70.0

LIQUEFACTION ANALYSIS

Lack Road Bridge Replacement Over New River

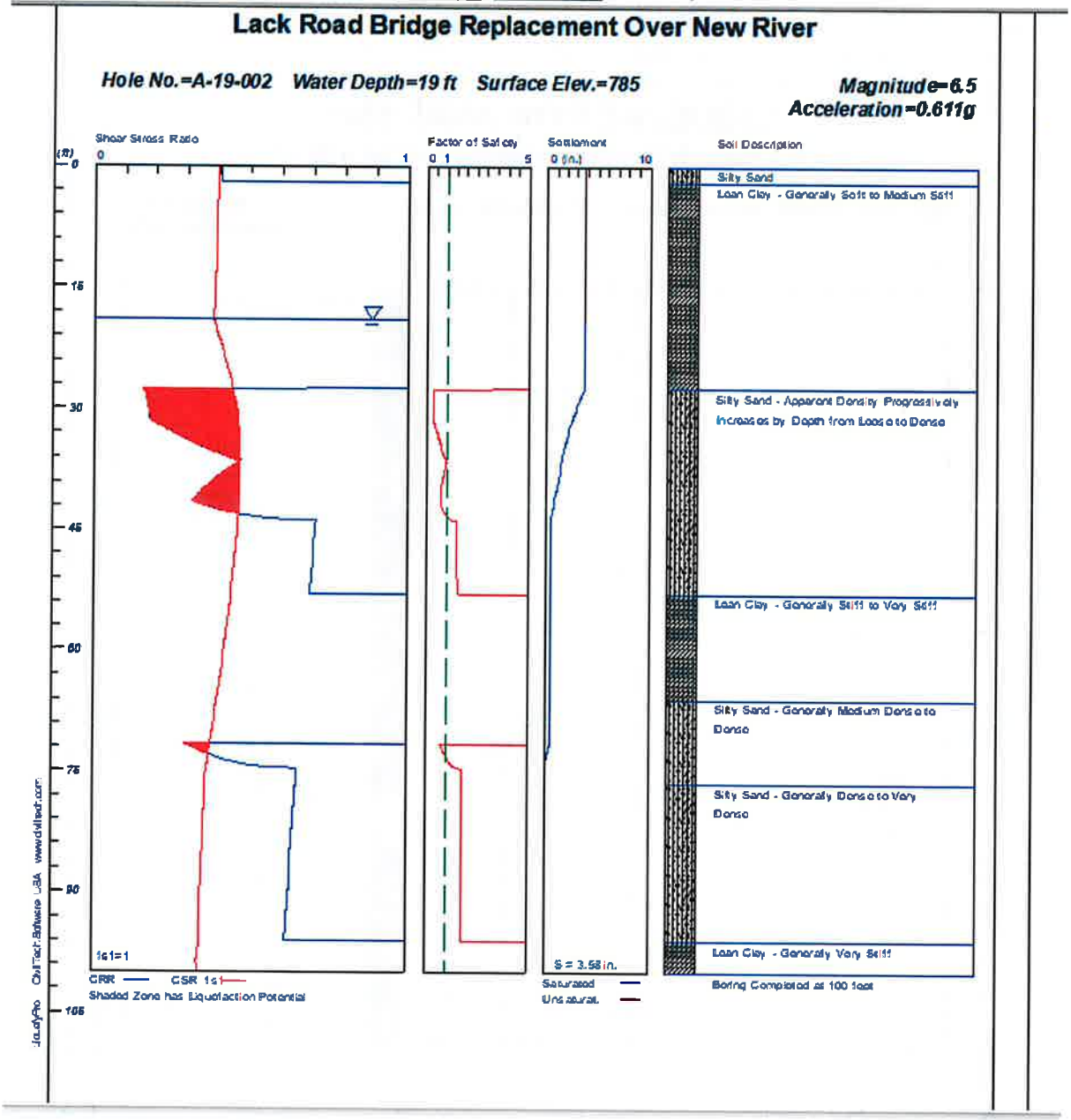
Hole No.=A-19-002 Water Depth=19 ft Surface Elev.=785

Magnitude=6.5
Acceleration=0.611g



Viewform1

Page 1 of 1 1 Zoom % 80.0



****

LIQUEFACTION ANALYSIS SUMMARY

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****

Font: Courier New, Regular, Size 8 is recommended for this report.

Licensed to , 6/6/2019 6:48:59 AM

Input File Name: C:\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix D - Liquefaction Analysis\A-19-002.liq

Title: Lack Road Bridge Replacement Over New River

Subtitle: Abutment 1

Surface Elev.=785

Hole No.=A-19-002

Depth of Hole= 100.00 ft

Water Table during Earthquake= 19.00 ft

Water Table during In-Situ Testing= 19.00 ft

Max. Acceleration= 0.61 g

Earthquake Magnitude= 6.50

Input Data:

Surface Elev.=785

Hole No.=A-19-002

Depth of Hole=100.00 ft

Water Table during Earthquake= 19.00 ft

Water Table during In-Situ Testing= 19.00 ft

Max. Acceleration=0.61 g

Earthquake Magnitude=6.50

No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu/Seed
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.13
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1

   Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	10.00	120.00	30.00
2.50	10.00	122.80	NoLiq
6.50	22.00	122.80	NoLiq
16.50	4.00	122.80	NoLiq
27.50	4.00	115.20	NoLiq
31.50	5.00	115.20	33.90
36.50	18.00	122.20	33.90
41.50	13.00	122.20	33.90
46.50	32.00	129.20	33.90
53.00	32.00	129.20	NoLiq
56.50	12.00	124.00	NoLiq
61.50	18.00	124.00	NoLiq

66.30	15.00	124.00	NoLiq
71.50	16.00	124.00	NoLiq
76.50	33.00	124.00	25.00
81.50	42.00	124.00	25.00
86.50	94.00	128.00	25.00
91.50	64.00	128.00	25.00
96.00	64.00	128.00	NoLiq
100.00	21.00	125.00	NoLiq

Output Results:

Settlement of Saturated Sands=3.58 in.

Settlement of Unsaturated Sands=0.00 in.

Total Settlement of Saturated and Unsaturated Sands=3.58 in.

Differential Settlement=1.792 to 2.366 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.38	0.40	5.00	3.58	0.00	3.58
0.05	0.39	0.40	5.00	3.58	0.00	3.58
0.10	0.39	0.40	5.00	3.58	0.00	3.58
0.15	0.40	0.40	5.00	3.58	0.00	3.58
0.20	0.40	0.40	5.00	3.58	0.00	3.58
0.25	0.40	0.40	5.00	3.58	0.00	3.58
0.30	0.40	0.40	5.00	3.58	0.00	3.58
0.35	0.40	0.40	5.00	3.58	0.00	3.58
0.40	0.40	0.40	5.00	3.58	0.00	3.58
0.45	0.40	0.40	5.00	3.58	0.00	3.58
0.50	0.40	0.40	5.00	3.58	0.00	3.58
0.55	0.40	0.40	5.00	3.58	0.00	3.58

0.60	0.40	0.40	5.00	3.58	0.00	3.58
0.65	0.40	0.40	5.00	3.58	0.00	3.58
0.70	0.40	0.40	5.00	3.58	0.00	3.58
0.75	0.40	0.40	5.00	3.58	0.00	3.58
0.80	0.40	0.40	5.00	3.58	0.00	3.58
0.85	0.40	0.40	5.00	3.58	0.00	3.58
0.90	0.40	0.40	5.00	3.58	0.00	3.58
0.95	0.40	0.40	5.00	3.58	0.00	3.58
1.00	0.40	0.40	5.00	3.58	0.00	3.58
1.05	0.40	0.40	5.00	3.58	0.00	3.58
1.10	0.40	0.40	5.00	3.58	0.00	3.58
1.15	0.40	0.40	5.00	3.58	0.00	3.58
1.20	0.40	0.40	5.00	3.58	0.00	3.58
1.25	0.40	0.40	5.00	3.58	0.00	3.58
1.30	0.40	0.40	5.00	3.58	0.00	3.58
1.35	0.40	0.40	5.00	3.58	0.00	3.58
1.40	0.40	0.40	5.00	3.58	0.00	3.58
1.45	0.40	0.40	5.00	3.58	0.00	3.58
1.50	0.40	0.40	5.00	3.58	0.00	3.58
1.55	0.40	0.40	5.00	3.58	0.00	3.58
1.60	0.40	0.40	5.00	3.58	0.00	3.58
1.65	0.40	0.40	5.00	3.58	0.00	3.58
1.70	0.40	0.40	5.00	3.58	0.00	3.58
1.75	0.40	0.40	5.00	3.58	0.00	3.58
1.80	0.40	0.40	5.00	3.58	0.00	3.58
1.85	0.40	0.40	5.00	3.58	0.00	3.58
1.90	0.40	0.40	5.00	3.58	0.00	3.58
1.95	0.40	0.40	5.00	3.58	0.00	3.58
2.00	0.40	0.40	5.00	3.58	0.00	3.58
2.05	2.00	0.40	5.00	3.58	0.00	3.58
2.10	2.00	0.40	5.00	3.58	0.00	3.58

2.15	2.00	0.40	5.00	3.58	0.00	3.58
2.20	2.00	0.40	5.00	3.58	0.00	3.58
2.25	2.00	0.40	5.00	3.58	0.00	3.58
2.30	2.00	0.40	5.00	3.58	0.00	3.58
2.35	2.00	0.39	5.00	3.58	0.00	3.58
2.40	2.00	0.39	5.00	3.58	0.00	3.58
2.45	2.00	0.39	5.00	3.58	0.00	3.58
2.50	2.00	0.39	5.00	3.58	0.00	3.58
2.55	2.00	0.39	5.00	3.58	0.00	3.58
2.60	2.00	0.39	5.00	3.58	0.00	3.58
2.65	2.00	0.39	5.00	3.58	0.00	3.58
2.70	2.00	0.39	5.00	3.58	0.00	3.58
2.75	2.00	0.39	5.00	3.58	0.00	3.58
2.80	2.00	0.39	5.00	3.58	0.00	3.58
2.85	2.00	0.39	5.00	3.58	0.00	3.58
2.90	2.00	0.39	5.00	3.58	0.00	3.58
2.95	2.00	0.39	5.00	3.58	0.00	3.58
3.00	2.00	0.39	5.00	3.58	0.00	3.58
3.05	2.00	0.39	5.00	3.58	0.00	3.58
3.10	2.00	0.39	5.00	3.58	0.00	3.58
3.15	2.00	0.39	5.00	3.58	0.00	3.58
3.20	2.00	0.39	5.00	3.58	0.00	3.58
3.25	2.00	0.39	5.00	3.58	0.00	3.58
3.30	2.00	0.39	5.00	3.58	0.00	3.58
3.35	2.00	0.39	5.00	3.58	0.00	3.58
3.40	2.00	0.39	5.00	3.58	0.00	3.58
3.45	2.00	0.39	5.00	3.58	0.00	3.58
3.50	2.00	0.39	5.00	3.58	0.00	3.58
3.55	2.00	0.39	5.00	3.58	0.00	3.58
3.60	2.00	0.39	5.00	3.58	0.00	3.58
3.65	2.00	0.39	5.00	3.58	0.00	3.58

3.70	2.00	0.39	5.00	3.58	0.00	3.58
3.75	2.00	0.39	5.00	3.58	0.00	3.58
3.80	2.00	0.39	5.00	3.58	0.00	3.58
3.85	2.00	0.39	5.00	3.58	0.00	3.58
3.90	2.00	0.39	5.00	3.58	0.00	3.58
3.95	2.00	0.39	5.00	3.58	0.00	3.58
4.00	2.00	0.39	5.00	3.58	0.00	3.58
4.05	2.00	0.39	5.00	3.58	0.00	3.58
4.10	2.00	0.39	5.00	3.58	0.00	3.58
4.15	2.00	0.39	5.00	3.58	0.00	3.58
4.20	2.00	0.39	5.00	3.58	0.00	3.58
4.25	2.00	0.39	5.00	3.58	0.00	3.58
4.30	2.00	0.39	5.00	3.58	0.00	3.58
4.35	2.00	0.39	5.00	3.58	0.00	3.58
4.40	2.00	0.39	5.00	3.58	0.00	3.58
4.45	2.00	0.39	5.00	3.58	0.00	3.58
4.50	2.00	0.39	5.00	3.58	0.00	3.58
4.55	2.00	0.39	5.00	3.58	0.00	3.58
4.60	2.00	0.39	5.00	3.58	0.00	3.58
4.65	2.00	0.39	5.00	3.58	0.00	3.58
4.70	2.00	0.39	5.00	3.58	0.00	3.58
4.75	2.00	0.39	5.00	3.58	0.00	3.58
4.80	2.00	0.39	5.00	3.58	0.00	3.58
4.85	2.00	0.39	5.00	3.58	0.00	3.58
4.90	2.00	0.39	5.00	3.58	0.00	3.58
4.95	2.00	0.39	5.00	3.58	0.00	3.58
5.00	2.00	0.39	5.00	3.58	0.00	3.58
5.05	2.00	0.39	5.00	3.58	0.00	3.58
5.10	2.00	0.39	5.00	3.58	0.00	3.58
5.15	2.00	0.39	5.00	3.58	0.00	3.58
5.20	2.00	0.39	5.00	3.58	0.00	3.58

5.25	2.00	0.39	5.00	3.58	0.00	3.58
5.30	2.00	0.39	5.00	3.58	0.00	3.58
5.35	2.00	0.39	5.00	3.58	0.00	3.58
5.40	2.00	0.39	5.00	3.58	0.00	3.58
5.45	2.00	0.39	5.00	3.58	0.00	3.58
5.50	2.00	0.39	5.00	3.58	0.00	3.58
5.55	2.00	0.39	5.00	3.58	0.00	3.58
5.60	2.00	0.39	5.00	3.58	0.00	3.58
5.65	2.00	0.39	5.00	3.58	0.00	3.58
5.70	2.00	0.39	5.00	3.58	0.00	3.58
5.75	2.00	0.39	5.00	3.58	0.00	3.58
5.80	2.00	0.39	5.00	3.58	0.00	3.58
5.85	2.00	0.39	5.00	3.58	0.00	3.58
5.90	2.00	0.39	5.00	3.58	0.00	3.58
5.95	2.00	0.39	5.00	3.58	0.00	3.58
6.00	2.00	0.39	5.00	3.58	0.00	3.58
6.05	2.00	0.39	5.00	3.58	0.00	3.58
6.10	2.00	0.39	5.00	3.58	0.00	3.58
6.15	2.00	0.39	5.00	3.58	0.00	3.58
6.20	2.00	0.39	5.00	3.58	0.00	3.58
6.25	2.00	0.39	5.00	3.58	0.00	3.58
6.30	2.00	0.39	5.00	3.58	0.00	3.58
6.35	2.00	0.39	5.00	3.58	0.00	3.58
6.40	2.00	0.39	5.00	3.58	0.00	3.58
6.45	2.00	0.39	5.00	3.58	0.00	3.58
6.50	2.00	0.39	5.00	3.58	0.00	3.58
6.55	2.00	0.39	5.00	3.58	0.00	3.58
6.60	2.00	0.39	5.00	3.58	0.00	3.58
6.65	2.00	0.39	5.00	3.58	0.00	3.58
6.70	2.00	0.39	5.00	3.58	0.00	3.58
6.75	2.00	0.39	5.00	3.58	0.00	3.58

6.80	2.00	0.39	5.00	3.58	0.00	3.58
6.85	2.00	0.39	5.00	3.58	0.00	3.58
6.90	2.00	0.39	5.00	3.58	0.00	3.58
6.95	2.00	0.39	5.00	3.58	0.00	3.58
7.00	2.00	0.39	5.00	3.58	0.00	3.58
7.05	2.00	0.39	5.00	3.58	0.00	3.58
7.10	2.00	0.39	5.00	3.58	0.00	3.58
7.15	2.00	0.39	5.00	3.58	0.00	3.58
7.20	2.00	0.39	5.00	3.58	0.00	3.58
7.25	2.00	0.39	5.00	3.58	0.00	3.58
7.30	2.00	0.39	5.00	3.58	0.00	3.58
7.35	2.00	0.39	5.00	3.58	0.00	3.58
7.40	2.00	0.39	5.00	3.58	0.00	3.58
7.45	2.00	0.39	5.00	3.58	0.00	3.58
7.50	2.00	0.39	5.00	3.58	0.00	3.58
7.55	2.00	0.39	5.00	3.58	0.00	3.58
7.60	2.00	0.39	5.00	3.58	0.00	3.58
7.65	2.00	0.39	5.00	3.58	0.00	3.58
7.70	2.00	0.39	5.00	3.58	0.00	3.58
7.75	2.00	0.39	5.00	3.58	0.00	3.58
7.80	2.00	0.39	5.00	3.58	0.00	3.58
7.85	2.00	0.39	5.00	3.58	0.00	3.58
7.90	2.00	0.39	5.00	3.58	0.00	3.58
7.95	2.00	0.39	5.00	3.58	0.00	3.58
8.00	2.00	0.39	5.00	3.58	0.00	3.58
8.05	2.00	0.39	5.00	3.58	0.00	3.58
8.10	2.00	0.39	5.00	3.58	0.00	3.58
8.15	2.00	0.39	5.00	3.58	0.00	3.58
8.20	2.00	0.39	5.00	3.58	0.00	3.58
8.25	2.00	0.39	5.00	3.58	0.00	3.58
8.30	2.00	0.39	5.00	3.58	0.00	3.58

8.35	2.00	0.39	5.00	3.58	0.00	3.58
8.40	2.00	0.39	5.00	3.58	0.00	3.58
8.45	2.00	0.39	5.00	3.58	0.00	3.58
8.50	2.00	0.39	5.00	3.58	0.00	3.58
8.55	2.00	0.39	5.00	3.58	0.00	3.58
8.60	2.00	0.39	5.00	3.58	0.00	3.58
8.65	2.00	0.39	5.00	3.58	0.00	3.58
8.70	2.00	0.39	5.00	3.58	0.00	3.58
8.75	2.00	0.39	5.00	3.58	0.00	3.58
8.80	2.00	0.39	5.00	3.58	0.00	3.58
8.85	2.00	0.39	5.00	3.58	0.00	3.58
8.90	2.00	0.39	5.00	3.58	0.00	3.58
8.95	2.00	0.39	5.00	3.58	0.00	3.58
9.00	2.00	0.39	5.00	3.58	0.00	3.58
9.05	2.00	0.39	5.00	3.58	0.00	3.58
9.10	2.00	0.39	5.00	3.58	0.00	3.58
9.15	2.00	0.39	5.00	3.58	0.00	3.58
9.20	2.00	0.39	5.00	3.58	0.00	3.58
9.25	2.00	0.39	5.00	3.58	0.00	3.58
9.30	2.00	0.39	5.00	3.58	0.00	3.58
9.35	2.00	0.39	5.00	3.58	0.00	3.58
9.40	2.00	0.39	5.00	3.58	0.00	3.58
9.45	2.00	0.39	5.00	3.58	0.00	3.58
9.50	2.00	0.39	5.00	3.58	0.00	3.58
9.55	2.00	0.39	5.00	3.58	0.00	3.58
9.60	2.00	0.39	5.00	3.58	0.00	3.58
9.65	2.00	0.39	5.00	3.58	0.00	3.58
9.70	2.00	0.39	5.00	3.58	0.00	3.58
9.75	2.00	0.39	5.00	3.58	0.00	3.58
9.80	2.00	0.39	5.00	3.58	0.00	3.58
9.85	2.00	0.39	5.00	3.58	0.00	3.58

9.90	2.00	0.39	5.00	3.58	0.00	3.58
9.95	2.00	0.39	5.00	3.58	0.00	3.58
10.00	2.00	0.39	5.00	3.58	0.00	3.58
10.05	2.00	0.39	5.00	3.58	0.00	3.58
10.10	2.00	0.39	5.00	3.58	0.00	3.58
10.15	2.00	0.39	5.00	3.58	0.00	3.58
10.20	2.00	0.39	5.00	3.58	0.00	3.58
10.25	2.00	0.39	5.00	3.58	0.00	3.58
10.30	2.00	0.39	5.00	3.58	0.00	3.58
10.35	2.00	0.39	5.00	3.58	0.00	3.58
10.40	2.00	0.39	5.00	3.58	0.00	3.58
10.45	2.00	0.39	5.00	3.58	0.00	3.58
10.50	2.00	0.39	5.00	3.58	0.00	3.58
10.55	2.00	0.39	5.00	3.58	0.00	3.58
10.60	2.00	0.39	5.00	3.58	0.00	3.58
10.65	2.00	0.39	5.00	3.58	0.00	3.58
10.70	2.00	0.39	5.00	3.58	0.00	3.58
10.75	2.00	0.39	5.00	3.58	0.00	3.58
10.80	2.00	0.39	5.00	3.58	0.00	3.58
10.85	2.00	0.39	5.00	3.58	0.00	3.58
10.90	2.00	0.39	5.00	3.58	0.00	3.58
10.95	2.00	0.39	5.00	3.58	0.00	3.58
11.00	2.00	0.39	5.00	3.58	0.00	3.58
11.05	2.00	0.39	5.00	3.58	0.00	3.58
11.10	2.00	0.39	5.00	3.58	0.00	3.58
11.15	2.00	0.39	5.00	3.58	0.00	3.58
11.20	2.00	0.39	5.00	3.58	0.00	3.58
11.25	2.00	0.39	5.00	3.58	0.00	3.58
11.30	2.00	0.39	5.00	3.58	0.00	3.58
11.35	2.00	0.39	5.00	3.58	0.00	3.58
11.40	2.00	0.39	5.00	3.58	0.00	3.58

11.45	2.00	0.39	5.00	3.58	0.00	3.58
11.50	2.00	0.39	5.00	3.58	0.00	3.58
11.55	2.00	0.39	5.00	3.58	0.00	3.58
11.60	2.00	0.39	5.00	3.58	0.00	3.58
11.65	2.00	0.39	5.00	3.58	0.00	3.58
11.70	2.00	0.39	5.00	3.58	0.00	3.58
11.75	2.00	0.39	5.00	3.58	0.00	3.58
11.80	2.00	0.39	5.00	3.58	0.00	3.58
11.85	2.00	0.39	5.00	3.58	0.00	3.58
11.90	2.00	0.39	5.00	3.58	0.00	3.58
11.95	2.00	0.39	5.00	3.58	0.00	3.58
12.00	2.00	0.39	5.00	3.58	0.00	3.58
12.05	2.00	0.39	5.00	3.58	0.00	3.58
12.10	2.00	0.39	5.00	3.58	0.00	3.58
12.15	2.00	0.39	5.00	3.58	0.00	3.58
12.20	2.00	0.39	5.00	3.58	0.00	3.58
12.25	2.00	0.39	5.00	3.58	0.00	3.58
12.30	2.00	0.39	5.00	3.58	0.00	3.58
12.35	2.00	0.39	5.00	3.58	0.00	3.58
12.40	2.00	0.39	5.00	3.58	0.00	3.58
12.45	2.00	0.39	5.00	3.58	0.00	3.58
12.50	2.00	0.39	5.00	3.58	0.00	3.58
12.55	2.00	0.39	5.00	3.58	0.00	3.58
12.60	2.00	0.39	5.00	3.58	0.00	3.58
12.65	2.00	0.39	5.00	3.58	0.00	3.58
12.70	2.00	0.39	5.00	3.58	0.00	3.58
12.75	2.00	0.39	5.00	3.58	0.00	3.58
12.80	2.00	0.39	5.00	3.58	0.00	3.58
12.85	2.00	0.39	5.00	3.58	0.00	3.58
12.90	2.00	0.39	5.00	3.58	0.00	3.58
12.95	2.00	0.39	5.00	3.58	0.00	3.58

13.00	2.00	0.39	5.00	3.58	0.00	3.58
13.05	2.00	0.39	5.00	3.58	0.00	3.58
13.10	2.00	0.39	5.00	3.58	0.00	3.58
13.15	2.00	0.38	5.00	3.58	0.00	3.58
13.20	2.00	0.38	5.00	3.58	0.00	3.58
13.25	2.00	0.38	5.00	3.58	0.00	3.58
13.30	2.00	0.38	5.00	3.58	0.00	3.58
13.35	2.00	0.38	5.00	3.58	0.00	3.58
13.40	2.00	0.38	5.00	3.58	0.00	3.58
13.45	2.00	0.38	5.00	3.58	0.00	3.58
13.50	2.00	0.38	5.00	3.58	0.00	3.58
13.55	2.00	0.38	5.00	3.58	0.00	3.58
13.60	2.00	0.38	5.00	3.58	0.00	3.58
13.65	2.00	0.38	5.00	3.58	0.00	3.58
13.70	2.00	0.38	5.00	3.58	0.00	3.58
13.75	2.00	0.38	5.00	3.58	0.00	3.58
13.80	2.00	0.38	5.00	3.58	0.00	3.58
13.85	2.00	0.38	5.00	3.58	0.00	3.58
13.90	2.00	0.38	5.00	3.58	0.00	3.58
13.95	2.00	0.38	5.00	3.58	0.00	3.58
14.00	2.00	0.38	5.00	3.58	0.00	3.58
14.05	2.00	0.38	5.00	3.58	0.00	3.58
14.10	2.00	0.38	5.00	3.58	0.00	3.58
14.15	2.00	0.38	5.00	3.58	0.00	3.58
14.20	2.00	0.38	5.00	3.58	0.00	3.58
14.25	2.00	0.38	5.00	3.58	0.00	3.58
14.30	2.00	0.38	5.00	3.58	0.00	3.58
14.35	2.00	0.38	5.00	3.58	0.00	3.58
14.40	2.00	0.38	5.00	3.58	0.00	3.58
14.45	2.00	0.38	5.00	3.58	0.00	3.58
14.50	2.00	0.38	5.00	3.58	0.00	3.58

14.55	2.00	0.38	5.00	3.58	0.00	3.58
14.60	2.00	0.38	5.00	3.58	0.00	3.58
14.65	2.00	0.38	5.00	3.58	0.00	3.58
14.70	2.00	0.38	5.00	3.58	0.00	3.58
14.75	2.00	0.38	5.00	3.58	0.00	3.58
14.80	2.00	0.38	5.00	3.58	0.00	3.58
14.85	2.00	0.38	5.00	3.58	0.00	3.58
14.90	2.00	0.38	5.00	3.58	0.00	3.58
14.95	2.00	0.38	5.00	3.58	0.00	3.58
15.00	2.00	0.38	5.00	3.58	0.00	3.58
15.05	2.00	0.38	5.00	3.58	0.00	3.58
15.10	2.00	0.38	5.00	3.58	0.00	3.58
15.15	2.00	0.38	5.00	3.58	0.00	3.58
15.20	2.00	0.38	5.00	3.58	0.00	3.58
15.25	2.00	0.38	5.00	3.58	0.00	3.58
15.30	2.00	0.38	5.00	3.58	0.00	3.58
15.35	2.00	0.38	5.00	3.58	0.00	3.58
15.40	2.00	0.38	5.00	3.58	0.00	3.58
15.45	2.00	0.38	5.00	3.58	0.00	3.58
15.50	2.00	0.38	5.00	3.58	0.00	3.58
15.55	2.00	0.38	5.00	3.58	0.00	3.58
15.60	2.00	0.38	5.00	3.58	0.00	3.58
15.65	2.00	0.38	5.00	3.58	0.00	3.58
15.70	2.00	0.38	5.00	3.58	0.00	3.58
15.75	2.00	0.38	5.00	3.58	0.00	3.58
15.80	2.00	0.38	5.00	3.58	0.00	3.58
15.85	2.00	0.38	5.00	3.58	0.00	3.58
15.90	2.00	0.38	5.00	3.58	0.00	3.58
15.95	2.00	0.38	5.00	3.58	0.00	3.58
16.00	2.00	0.38	5.00	3.58	0.00	3.58
16.05	2.00	0.38	5.00	3.58	0.00	3.58

16.10	2.00	0.38	5.00	3.58	0.00	3.58
16.15	2.00	0.38	5.00	3.58	0.00	3.58
16.20	2.00	0.38	5.00	3.58	0.00	3.58
16.25	2.00	0.38	5.00	3.58	0.00	3.58
16.30	2.00	0.38	5.00	3.58	0.00	3.58
16.35	2.00	0.38	5.00	3.58	0.00	3.58
16.40	2.00	0.38	5.00	3.58	0.00	3.58
16.45	2.00	0.38	5.00	3.58	0.00	3.58
16.50	2.00	0.38	5.00	3.58	0.00	3.58
16.55	2.00	0.38	5.00	3.58	0.00	3.58
16.60	2.00	0.38	5.00	3.58	0.00	3.58
16.65	2.00	0.38	5.00	3.58	0.00	3.58
16.70	2.00	0.38	5.00	3.58	0.00	3.58
16.75	2.00	0.38	5.00	3.58	0.00	3.58
16.80	2.00	0.38	5.00	3.58	0.00	3.58
16.85	2.00	0.38	5.00	3.58	0.00	3.58
16.90	2.00	0.38	5.00	3.58	0.00	3.58
16.95	2.00	0.38	5.00	3.58	0.00	3.58
17.00	2.00	0.38	5.00	3.58	0.00	3.58
17.05	2.00	0.38	5.00	3.58	0.00	3.58
17.10	2.00	0.38	5.00	3.58	0.00	3.58
17.15	2.00	0.38	5.00	3.58	0.00	3.58
17.20	2.00	0.38	5.00	3.58	0.00	3.58
17.25	2.00	0.38	5.00	3.58	0.00	3.58
17.30	2.00	0.38	5.00	3.58	0.00	3.58
17.35	2.00	0.38	5.00	3.58	0.00	3.58
17.40	2.00	0.38	5.00	3.58	0.00	3.58
17.45	2.00	0.38	5.00	3.58	0.00	3.58
17.50	2.00	0.38	5.00	3.58	0.00	3.58
17.55	2.00	0.38	5.00	3.58	0.00	3.58
17.60	2.00	0.38	5.00	3.58	0.00	3.58

17.65	2.00	0.38	5.00	3.58	0.00	3.58
17.70	2.00	0.38	5.00	3.58	0.00	3.58
17.75	2.00	0.38	5.00	3.58	0.00	3.58
17.80	2.00	0.38	5.00	3.58	0.00	3.58
17.85	2.00	0.38	5.00	3.58	0.00	3.58
17.90	2.00	0.38	5.00	3.58	0.00	3.58
17.95	2.00	0.38	5.00	3.58	0.00	3.58
18.00	2.00	0.38	5.00	3.58	0.00	3.58
18.05	2.00	0.38	5.00	3.58	0.00	3.58
18.10	2.00	0.38	5.00	3.58	0.00	3.58
18.15	2.00	0.38	5.00	3.58	0.00	3.58
18.20	2.00	0.38	5.00	3.58	0.00	3.58
18.25	2.00	0.38	5.00	3.58	0.00	3.58
18.30	2.00	0.38	5.00	3.58	0.00	3.58
18.35	2.00	0.38	5.00	3.58	0.00	3.58
18.40	2.00	0.38	5.00	3.58	0.00	3.58
18.45	2.00	0.38	5.00	3.58	0.00	3.58
18.50	2.00	0.38	5.00	3.58	0.00	3.58
18.55	2.00	0.38	5.00	3.58	0.00	3.58
18.60	2.00	0.38	5.00	3.58	0.00	3.58
18.65	2.00	0.38	5.00	3.58	0.00	3.58
18.70	2.00	0.38	5.00	3.58	0.00	3.58
18.75	2.00	0.38	5.00	3.58	0.00	3.58
18.80	2.00	0.38	5.00	3.58	0.00	3.58
18.85	2.00	0.38	5.00	3.58	0.00	3.58
18.90	2.00	0.38	5.00	3.58	0.00	3.58
18.95	2.00	0.38	5.00	3.58	0.00	3.58
19.00	2.00	0.38	5.00	3.58	0.00	3.58
19.05	2.00	0.38	5.00	3.58	0.00	3.58
19.10	2.00	0.38	5.00	3.58	0.00	3.58
19.15	2.00	0.38	5.00	3.58	0.00	3.58

19.20	2.00	0.38	5.00	3.58	0.00	3.58
19.25	2.00	0.38	5.00	3.58	0.00	3.58
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19.40	2.00	0.38	5.00	3.58	0.00	3.58
19.45	2.00	0.38	5.00	3.58	0.00	3.58
19.50	2.00	0.38	5.00	3.58	0.00	3.58
19.55	2.00	0.38	5.00	3.58	0.00	3.58
19.60	2.00	0.38	5.00	3.58	0.00	3.58
19.65	2.00	0.38	5.00	3.58	0.00	3.58
19.70	2.00	0.39	5.00	3.58	0.00	3.58
19.75	2.00	0.39	5.00	3.58	0.00	3.58
19.80	2.00	0.39	5.00	3.58	0.00	3.58
19.85	2.00	0.39	5.00	3.58	0.00	3.58
19.90	2.00	0.39	5.00	3.58	0.00	3.58
19.95	2.00	0.39	5.00	3.58	0.00	3.58
20.00	2.00	0.39	5.00	3.58	0.00	3.58
20.05	2.00	0.39	5.00	3.58	0.00	3.58
20.10	2.00	0.39	5.00	3.58	0.00	3.58
20.15	2.00	0.39	5.00	3.58	0.00	3.58
20.20	2.00	0.39	5.00	3.58	0.00	3.58
20.25	2.00	0.39	5.00	3.58	0.00	3.58
20.30	2.00	0.39	5.00	3.58	0.00	3.58
20.35	2.00	0.39	5.00	3.58	0.00	3.58
20.40	2.00	0.39	5.00	3.58	0.00	3.58
20.45	2.00	0.39	5.00	3.58	0.00	3.58
20.50	2.00	0.39	5.00	3.58	0.00	3.58
20.55	2.00	0.39	5.00	3.58	0.00	3.58
20.60	2.00	0.39	5.00	3.58	0.00	3.58
20.65	2.00	0.39	5.00	3.58	0.00	3.58
20.70	2.00	0.39	5.00	3.58	0.00	3.58

20.75	2.00	0.39	5.00	3.58	0.00	3.58
20.80	2.00	0.39	5.00	3.58	0.00	3.58
20.85	2.00	0.40	5.00	3.58	0.00	3.58
20.90	2.00	0.40	5.00	3.58	0.00	3.58
20.95	2.00	0.40	5.00	3.58	0.00	3.58
21.00	2.00	0.40	5.00	3.58	0.00	3.58
21.05	2.00	0.40	5.00	3.58	0.00	3.58
21.10	2.00	0.40	5.00	3.58	0.00	3.58
21.15	2.00	0.40	5.00	3.58	0.00	3.58
21.20	2.00	0.40	5.00	3.58	0.00	3.58
21.25	2.00	0.40	5.00	3.58	0.00	3.58
21.30	2.00	0.40	5.00	3.58	0.00	3.58
21.35	2.00	0.40	5.00	3.58	0.00	3.58
21.40	2.00	0.40	5.00	3.58	0.00	3.58
21.45	2.00	0.40	5.00	3.58	0.00	3.58
21.50	2.00	0.40	5.00	3.58	0.00	3.58
21.55	2.00	0.40	5.00	3.58	0.00	3.58
21.60	2.00	0.40	5.00	3.58	0.00	3.58
21.65	2.00	0.40	5.00	3.58	0.00	3.58
21.70	2.00	0.40	5.00	3.58	0.00	3.58
21.75	2.00	0.40	5.00	3.58	0.00	3.58
21.80	2.00	0.40	5.00	3.58	0.00	3.58
21.85	2.00	0.40	5.00	3.58	0.00	3.58
21.90	2.00	0.40	5.00	3.58	0.00	3.58
21.95	2.00	0.40	5.00	3.58	0.00	3.58
22.00	2.00	0.40	5.00	3.58	0.00	3.58
22.05	2.00	0.40	5.00	3.58	0.00	3.58
22.10	2.00	0.41	5.00	3.58	0.00	3.58
22.15	2.00	0.41	5.00	3.58	0.00	3.58
22.20	2.00	0.41	5.00	3.58	0.00	3.58
22.25	2.00	0.41	5.00	3.58	0.00	3.58

22.30	2.00	0.41	5.00	3.58	0.00	3.58
22.35	2.00	0.41	5.00	3.58	0.00	3.58
22.40	2.00	0.41	5.00	3.58	0.00	3.58
22.45	2.00	0.41	5.00	3.58	0.00	3.58
22.50	2.00	0.41	5.00	3.58	0.00	3.58
22.55	2.00	0.41	5.00	3.58	0.00	3.58
22.60	2.00	0.41	5.00	3.58	0.00	3.58
22.65	2.00	0.41	5.00	3.58	0.00	3.58
22.70	2.00	0.41	5.00	3.58	0.00	3.58
22.75	2.00	0.41	5.00	3.58	0.00	3.58
22.80	2.00	0.41	5.00	3.58	0.00	3.58
22.85	2.00	0.41	5.00	3.58	0.00	3.58
22.90	2.00	0.41	5.00	3.58	0.00	3.58
22.95	2.00	0.41	5.00	3.58	0.00	3.58
23.00	2.00	0.41	5.00	3.58	0.00	3.58
23.05	2.00	0.41	5.00	3.58	0.00	3.58
23.10	2.00	0.41	5.00	3.58	0.00	3.58
23.15	2.00	0.41	5.00	3.58	0.00	3.58
23.20	2.00	0.41	5.00	3.58	0.00	3.58
23.25	2.00	0.41	5.00	3.58	0.00	3.58
23.30	2.00	0.41	5.00	3.58	0.00	3.58
23.35	2.00	0.41	5.00	3.58	0.00	3.58
23.40	2.00	0.41	5.00	3.58	0.00	3.58
23.45	2.00	0.42	5.00	3.58	0.00	3.58
23.50	2.00	0.42	5.00	3.58	0.00	3.58
23.55	2.00	0.42	5.00	3.58	0.00	3.58
23.60	2.00	0.42	5.00	3.58	0.00	3.58
23.65	2.00	0.42	5.00	3.58	0.00	3.58
23.70	2.00	0.42	5.00	3.58	0.00	3.58
23.75	2.00	0.42	5.00	3.58	0.00	3.58
23.80	2.00	0.42	5.00	3.58	0.00	3.58

23.85	2.00	0.42	5.00	3.58	0.00	3.58
23.90	2.00	0.42	5.00	3.58	0.00	3.58
23.95	2.00	0.42	5.00	3.58	0.00	3.58
24.00	2.00	0.42	5.00	3.58	0.00	3.58
24.05	2.00	0.42	5.00	3.58	0.00	3.58
24.10	2.00	0.42	5.00	3.58	0.00	3.58
24.15	2.00	0.42	5.00	3.58	0.00	3.58
24.20	2.00	0.42	5.00	3.58	0.00	3.58
24.25	2.00	0.42	5.00	3.58	0.00	3.58
24.30	2.00	0.42	5.00	3.58	0.00	3.58
24.35	2.00	0.42	5.00	3.58	0.00	3.58
24.40	2.00	0.42	5.00	3.58	0.00	3.58
24.45	2.00	0.42	5.00	3.58	0.00	3.58
24.50	2.00	0.42	5.00	3.58	0.00	3.58
24.55	2.00	0.42	5.00	3.58	0.00	3.58
24.60	2.00	0.42	5.00	3.58	0.00	3.58
24.65	2.00	0.42	5.00	3.58	0.00	3.58
24.70	2.00	0.42	5.00	3.58	0.00	3.58
24.75	2.00	0.42	5.00	3.58	0.00	3.58
24.80	2.00	0.42	5.00	3.58	0.00	3.58
24.85	2.00	0.43	5.00	3.58	0.00	3.58
24.90	2.00	0.43	5.00	3.58	0.00	3.58
24.95	2.00	0.43	5.00	3.58	0.00	3.58
25.00	2.00	0.43	5.00	3.58	0.00	3.58
25.05	2.00	0.43	5.00	3.58	0.00	3.58
25.10	2.00	0.43	5.00	3.58	0.00	3.58
25.15	2.00	0.43	5.00	3.58	0.00	3.58
25.20	2.00	0.43	5.00	3.58	0.00	3.58
25.25	2.00	0.43	5.00	3.58	0.00	3.58
25.30	2.00	0.43	5.00	3.58	0.00	3.58
25.35	2.00	0.43	5.00	3.58	0.00	3.58

25.40	2.00	0.43	5.00	3.58	0.00	3.58
25.45	2.00	0.43	5.00	3.58	0.00	3.58
25.50	2.00	0.43	5.00	3.58	0.00	3.58
25.55	2.00	0.43	5.00	3.58	0.00	3.58
25.60	2.00	0.43	5.00	3.58	0.00	3.58
25.65	2.00	0.43	5.00	3.58	0.00	3.58
25.70	2.00	0.43	5.00	3.58	0.00	3.58
25.75	2.00	0.43	5.00	3.58	0.00	3.58
25.80	2.00	0.43	5.00	3.58	0.00	3.58
25.85	2.00	0.43	5.00	3.58	0.00	3.58
25.90	2.00	0.43	5.00	3.58	0.00	3.58
25.95	2.00	0.43	5.00	3.58	0.00	3.58
26.00	2.00	0.43	5.00	3.58	0.00	3.58
26.05	2.00	0.43	5.00	3.58	0.00	3.58
26.10	2.00	0.43	5.00	3.58	0.00	3.58
26.15	2.00	0.43	5.00	3.58	0.00	3.58
26.20	2.00	0.43	5.00	3.58	0.00	3.58
26.25	2.00	0.43	5.00	3.58	0.00	3.58
26.30	2.00	0.43	5.00	3.58	0.00	3.58
26.35	2.00	0.43	5.00	3.58	0.00	3.58
26.40	2.00	0.43	5.00	3.58	0.00	3.58
26.45	2.00	0.44	5.00	3.58	0.00	3.58
26.50	2.00	0.44	5.00	3.58	0.00	3.58
26.55	2.00	0.44	5.00	3.58	0.00	3.58
26.60	2.00	0.44	5.00	3.58	0.00	3.58
26.65	2.00	0.44	5.00	3.58	0.00	3.58
26.70	2.00	0.44	5.00	3.58	0.00	3.58
26.75	2.00	0.44	5.00	3.58	0.00	3.58
26.80	2.00	0.44	5.00	3.58	0.00	3.58
26.85	2.00	0.44	5.00	3.58	0.00	3.58
26.90	2.00	0.44	5.00	3.58	0.00	3.58

26.95	2.00	0.44	5.00	3.58	0.00	3.58
27.00	2.00	0.44	5.00	3.58	0.00	3.58
27.05	2.00	0.44	5.00	3.58	0.00	3.58
27.10	2.00	0.44	5.00	3.58	0.00	3.58
27.15	2.00	0.44	5.00	3.58	0.00	3.58
27.20	2.00	0.44	5.00	3.58	0.00	3.58
27.25	2.00	0.44	5.00	3.58	0.00	3.58
27.30	2.00	0.44	5.00	3.58	0.00	3.58
27.35	2.00	0.44	5.00	3.58	0.00	3.58
27.40	2.00	0.44	5.00	3.58	0.00	3.58
27.45	2.00	0.44	5.00	3.58	0.00	3.58
27.50	2.00	0.44	5.00	3.58	0.00	3.58
27.55	0.16	0.44	0.36*	3.58	0.00	3.58
27.60	0.16	0.44	0.36*	3.58	0.00	3.58
27.65	0.16	0.44	0.36*	3.56	0.00	3.56
27.70	0.16	0.44	0.36*	3.55	0.00	3.55
27.75	0.16	0.44	0.36*	3.53	0.00	3.53
27.80	0.16	0.44	0.36*	3.52	0.00	3.52
27.85	0.16	0.44	0.36*	3.50	0.00	3.50
27.90	0.16	0.44	0.37*	3.49	0.00	3.49
27.95	0.16	0.44	0.37*	3.47	0.00	3.47
28.00	0.17	0.44	0.37*	3.46	0.00	3.46
28.05	0.17	0.44	0.37*	3.44	0.00	3.44
28.10	0.17	0.45	0.37*	3.43	0.00	3.43
28.15	0.17	0.45	0.37*	3.41	0.00	3.41
28.20	0.17	0.45	0.37*	3.40	0.00	3.40
28.25	0.17	0.45	0.37*	3.38	0.00	3.38
28.30	0.17	0.45	0.37*	3.37	0.00	3.37
28.35	0.17	0.45	0.37*	3.35	0.00	3.35
28.40	0.17	0.45	0.37*	3.34	0.00	3.34
28.45	0.17	0.45	0.37*	3.32	0.00	3.32

28.50	0.17	0.45	0.37*	3.31	0.00	3.31
28.55	0.17	0.45	0.37*	3.30	0.00	3.30
28.60	0.17	0.45	0.37*	3.28	0.00	3.28
28.65	0.17	0.45	0.37*	3.27	0.00	3.27
28.70	0.17	0.45	0.37*	3.25	0.00	3.25
28.75	0.17	0.45	0.38*	3.24	0.00	3.24
28.80	0.17	0.45	0.38*	3.22	0.00	3.22
28.85	0.17	0.45	0.38*	3.21	0.00	3.21
28.90	0.17	0.45	0.38*	3.19	0.00	3.19
28.95	0.17	0.45	0.38*	3.18	0.00	3.18
29.00	0.17	0.45	0.38*	3.16	0.00	3.16
29.05	0.17	0.45	0.38*	3.15	0.00	3.15
29.10	0.17	0.45	0.38*	3.13	0.00	3.13
29.15	0.17	0.45	0.38*	3.12	0.00	3.12
29.20	0.17	0.45	0.38*	3.10	0.00	3.10
29.25	0.17	0.45	0.38*	3.09	0.00	3.09
29.30	0.17	0.45	0.38*	3.08	0.00	3.08
29.35	0.17	0.45	0.38*	3.06	0.00	3.06
29.40	0.17	0.45	0.38*	3.05	0.00	3.05
29.45	0.17	0.45	0.38*	3.03	0.00	3.03
29.50	0.17	0.45	0.38*	3.02	0.00	3.02
29.55	0.17	0.45	0.38*	3.00	0.00	3.00
29.60	0.17	0.45	0.38*	2.99	0.00	2.99
29.65	0.17	0.45	0.38*	2.97	0.00	2.97
29.70	0.17	0.45	0.38*	2.96	0.00	2.96
29.75	0.17	0.45	0.38*	2.94	0.00	2.94
29.80	0.17	0.45	0.38*	2.93	0.00	2.93
29.85	0.17	0.45	0.38*	2.92	0.00	2.92
29.90	0.17	0.45	0.38*	2.90	0.00	2.90
29.95	0.17	0.46	0.38*	2.89	0.00	2.89
30.00	0.17	0.46	0.38*	2.87	0.00	2.87

30.05	0.17	0.46	0.38*	2.86	0.00	2.86
30.10	0.17	0.46	0.38*	2.84	0.00	2.84
30.15	0.17	0.46	0.38*	2.83	0.00	2.83
30.20	0.17	0.46	0.38*	2.82	0.00	2.82
30.25	0.17	0.46	0.38*	2.80	0.00	2.80
30.30	0.17	0.46	0.38*	2.79	0.00	2.79
30.35	0.18	0.46	0.38*	2.77	0.00	2.77
30.40	0.18	0.46	0.38*	2.76	0.00	2.76
30.45	0.18	0.46	0.38*	2.74	0.00	2.74
30.50	0.18	0.46	0.39*	2.73	0.00	2.73
30.55	0.18	0.46	0.39*	2.72	0.00	2.72
30.60	0.18	0.46	0.39*	2.70	0.00	2.70
30.65	0.18	0.46	0.39*	2.69	0.00	2.69
30.70	0.18	0.46	0.39*	2.67	0.00	2.67
30.75	0.18	0.46	0.39*	2.66	0.00	2.66
30.80	0.18	0.46	0.39*	2.64	0.00	2.64
30.85	0.18	0.46	0.39*	2.63	0.00	2.63
30.90	0.18	0.46	0.39*	2.62	0.00	2.62
30.95	0.18	0.46	0.39*	2.60	0.00	2.60
31.00	0.18	0.46	0.39*	2.59	0.00	2.59
31.05	0.18	0.46	0.39*	2.57	0.00	2.57
31.10	0.18	0.46	0.39*	2.56	0.00	2.56
31.15	0.18	0.46	0.39*	2.55	0.00	2.55
31.20	0.18	0.46	0.39*	2.53	0.00	2.53
31.25	0.18	0.46	0.39*	2.52	0.00	2.52
31.30	0.18	0.46	0.39*	2.50	0.00	2.50
31.35	0.18	0.46	0.39*	2.49	0.00	2.49
31.40	0.18	0.46	0.39*	2.47	0.00	2.47
31.45	0.18	0.46	0.39*	2.46	0.00	2.46
31.50	0.18	0.46	0.39*	2.45	0.00	2.45
31.55	0.18	0.46	0.39*	2.43	0.00	2.43

31.60	0.18	0.46	0.40*	2.42	0.00	2.42
31.65	0.19	0.46	0.40*	2.40	0.00	2.40
31.70	0.19	0.46	0.41*	2.39	0.00	2.39
31.75	0.19	0.46	0.42*	2.38	0.00	2.38
31.80	0.19	0.46	0.42*	2.36	0.00	2.36
31.85	0.20	0.46	0.43*	2.35	0.00	2.35
31.90	0.20	0.46	0.43*	2.34	0.00	2.34
31.95	0.20	0.46	0.44*	2.32	0.00	2.32
32.00	0.20	0.46	0.44*	2.31	0.00	2.31
32.05	0.21	0.46	0.45*	2.30	0.00	2.30
32.10	0.21	0.46	0.45*	2.29	0.00	2.29
32.15	0.21	0.46	0.46*	2.27	0.00	2.27
32.20	0.21	0.46	0.46*	2.26	0.00	2.26
32.25	0.22	0.46	0.47*	2.25	0.00	2.25
32.30	0.22	0.46	0.48*	2.24	0.00	2.24
32.35	0.22	0.46	0.48*	2.23	0.00	2.23
32.40	0.22	0.46	0.49*	2.22	0.00	2.22
32.45	0.23	0.46	0.49*	2.20	0.00	2.20
32.50	0.23	0.46	0.50*	2.19	0.00	2.19
32.55	0.23	0.46	0.50*	2.18	0.00	2.18
32.60	0.23	0.46	0.51*	2.17	0.00	2.17
32.65	0.24	0.46	0.51*	2.16	0.00	2.16
32.70	0.24	0.46	0.52*	2.15	0.00	2.15
32.75	0.24	0.46	0.52*	2.13	0.00	2.13
32.80	0.24	0.46	0.53*	2.12	0.00	2.12
32.85	0.25	0.46	0.53*	2.11	0.00	2.11
32.90	0.25	0.46	0.54*	2.10	0.00	2.10
32.95	0.25	0.46	0.54*	2.09	0.00	2.09
33.00	0.25	0.46	0.55*	2.08	0.00	2.08
33.05	0.26	0.46	0.56*	2.07	0.00	2.07
33.10	0.26	0.46	0.56*	2.06	0.00	2.06

33.15	0.26	0.46	0.57*	2.05	0.00	2.05
33.20	0.26	0.46	0.57*	2.04	0.00	2.04
33.25	0.27	0.46	0.58*	2.03	0.00	2.03
33.30	0.27	0.46	0.58*	2.02	0.00	2.02
33.35	0.27	0.46	0.59*	2.01	0.00	2.01
33.40	0.27	0.46	0.59*	2.00	0.00	2.00
33.45	0.28	0.46	0.60*	1.99	0.00	1.99
33.50	0.28	0.46	0.60*	1.98	0.00	1.98
33.55	0.28	0.46	0.61*	1.97	0.00	1.97
33.60	0.28	0.46	0.61*	1.96	0.00	1.96
33.65	0.29	0.46	0.62*	1.95	0.00	1.95
33.70	0.29	0.46	0.62*	1.94	0.00	1.94
33.75	0.29	0.46	0.63*	1.93	0.00	1.93
33.80	0.29	0.46	0.63*	1.92	0.00	1.92
33.85	0.30	0.46	0.64*	1.91	0.00	1.91
33.90	0.30	0.46	0.65*	1.90	0.00	1.90
33.95	0.30	0.46	0.65*	1.89	0.00	1.89
34.00	0.30	0.46	0.66*	1.88	0.00	1.88
34.05	0.31	0.46	0.66*	1.87	0.00	1.87
34.10	0.31	0.46	0.67*	1.86	0.00	1.86
34.15	0.31	0.46	0.67*	1.85	0.00	1.85
34.20	0.31	0.46	0.68*	1.84	0.00	1.84
34.25	0.32	0.46	0.68*	1.83	0.00	1.83
34.30	0.32	0.46	0.69*	1.82	0.00	1.82
34.35	0.32	0.46	0.69*	1.82	0.00	1.82
34.40	0.32	0.46	0.70*	1.81	0.00	1.81
34.45	0.33	0.46	0.71*	1.80	0.00	1.80
34.50	0.33	0.46	0.71*	1.79	0.00	1.79
34.55	0.33	0.46	0.72*	1.78	0.00	1.78
34.60	0.33	0.46	0.72*	1.77	0.00	1.77
34.65	0.34	0.46	0.73*	1.76	0.00	1.76

34.70	0.34	0.46	0.74*	1.76	0.00	1.76
34.75	0.34	0.46	0.74*	1.75	0.00	1.75
34.80	0.35	0.46	0.75*	1.74	0.00	1.74
34.85	0.35	0.46	0.75*	1.73	0.00	1.73
34.90	0.35	0.46	0.76*	1.72	0.00	1.72
34.95	0.35	0.46	0.77*	1.71	0.00	1.71
35.00	0.36	0.46	0.77*	1.71	0.00	1.71
35.05	0.36	0.46	0.78*	1.70	0.00	1.70
35.10	0.36	0.46	0.78*	1.69	0.00	1.69
35.15	0.37	0.46	0.79*	1.68	0.00	1.68
35.20	0.37	0.46	0.80*	1.68	0.00	1.68
35.25	0.37	0.46	0.80*	1.67	0.00	1.67
35.30	0.38	0.46	0.81*	1.66	0.00	1.66
35.35	0.38	0.46	0.82*	1.65	0.00	1.65
35.40	0.38	0.46	0.82*	1.64	0.00	1.64
35.45	0.38	0.46	0.83*	1.64	0.00	1.64
35.50	0.39	0.46	0.84*	1.63	0.00	1.63
35.55	0.39	0.46	0.85*	1.62	0.00	1.62
35.60	0.39	0.46	0.85*	1.61	0.00	1.61
35.65	0.40	0.46	0.86*	1.61	0.00	1.61
35.70	0.40	0.46	0.87*	1.60	0.00	1.60
35.75	0.41	0.46	0.88*	1.59	0.00	1.59
35.80	0.41	0.46	0.88*	1.59	0.00	1.59
35.85	0.41	0.46	0.90*	1.58	0.00	1.58
35.90	0.42	0.46	0.90*	1.57	0.00	1.57
35.95	0.42	0.46	0.91*	1.57	0.00	1.57
36.00	0.43	0.46	0.92*	1.56	0.00	1.56
36.05	0.43	0.46	0.93*	1.55	0.00	1.55
36.10	0.43	0.46	0.94*	1.54	0.00	1.54
36.15	0.44	0.46	0.95*	1.54	0.00	1.54
36.20	0.44	0.46	0.95*	1.53	0.00	1.53

36.25	0.45	0.46	0.96*	1.52	0.00	1.52
36.30	0.45	0.46	0.97*	1.52	0.00	1.52
36.35	0.45	0.46	0.98*	1.51	0.00	1.51
36.40	0.46	0.46	0.99*	1.51	0.00	1.51
36.45	0.46	0.46	1.00	1.50	0.00	1.50
36.50	0.47	0.46	1.01	1.49	0.00	1.49
36.55	0.47	0.46	1.01	1.49	0.00	1.49
36.60	0.46	0.46	1.00	1.48	0.00	1.48
36.65	0.46	0.46	1.00*	1.47	0.00	1.47
36.70	0.46	0.46	0.99*	1.47	0.00	1.47
36.75	0.46	0.46	0.99*	1.46	0.00	1.46
36.80	0.45	0.46	0.98*	1.46	0.00	1.46
36.85	0.45	0.46	0.98*	1.45	0.00	1.45
36.90	0.45	0.46	0.97*	1.44	0.00	1.44
36.95	0.45	0.46	0.97*	1.44	0.00	1.44
37.00	0.45	0.46	0.96*	1.43	0.00	1.43
37.05	0.44	0.46	0.96*	1.42	0.00	1.42
37.10	0.44	0.46	0.95*	1.42	0.00	1.42
37.15	0.44	0.46	0.95*	1.41	0.00	1.41
37.20	0.44	0.46	0.95*	1.40	0.00	1.40
37.25	0.44	0.46	0.94*	1.40	0.00	1.40
37.30	0.43	0.46	0.94*	1.39	0.00	1.39
37.35	0.43	0.46	0.93*	1.38	0.00	1.38
37.40	0.43	0.46	0.93*	1.38	0.00	1.38
37.45	0.43	0.46	0.92*	1.37	0.00	1.37
37.50	0.43	0.46	0.92*	1.36	0.00	1.36
37.55	0.42	0.46	0.92*	1.36	0.00	1.36
37.60	0.42	0.46	0.91*	1.35	0.00	1.35
37.65	0.42	0.46	0.91*	1.34	0.00	1.34
37.70	0.42	0.46	0.90*	1.34	0.00	1.34
37.75	0.42	0.46	0.90*	1.33	0.00	1.33

37.80	0.42	0.46	0.90*	1.32	0.00	1.32
37.85	0.41	0.46	0.89*	1.32	0.00	1.32
37.90	0.41	0.46	0.89*	1.31	0.00	1.31
37.95	0.41	0.46	0.89*	1.30	0.00	1.30
38.00	0.41	0.46	0.88*	1.29	0.00	1.29
38.05	0.41	0.46	0.88*	1.29	0.00	1.29
38.10	0.41	0.46	0.87*	1.28	0.00	1.28
38.15	0.40	0.46	0.87*	1.27	0.00	1.27
38.20	0.40	0.46	0.87*	1.27	0.00	1.27
38.25	0.40	0.46	0.86*	1.26	0.00	1.26
38.30	0.40	0.46	0.86*	1.25	0.00	1.25
38.35	0.40	0.46	0.86*	1.24	0.00	1.24
38.40	0.40	0.46	0.85*	1.24	0.00	1.24
38.45	0.39	0.46	0.85*	1.23	0.00	1.23
38.50	0.39	0.46	0.85*	1.22	0.00	1.22
38.55	0.39	0.46	0.84*	1.22	0.00	1.22
38.60	0.39	0.46	0.84*	1.21	0.00	1.21
38.65	0.39	0.46	0.84*	1.20	0.00	1.20
38.70	0.39	0.46	0.83*	1.19	0.00	1.19
38.75	0.38	0.46	0.83*	1.19	0.00	1.19
38.80	0.38	0.46	0.83*	1.18	0.00	1.18
38.85	0.38	0.46	0.82*	1.17	0.00	1.17
38.90	0.38	0.46	0.82*	1.16	0.00	1.16
38.95	0.38	0.46	0.82*	1.16	0.00	1.16
39.00	0.38	0.46	0.81*	1.15	0.00	1.15
39.05	0.38	0.46	0.81*	1.14	0.00	1.14
39.10	0.37	0.46	0.81*	1.13	0.00	1.13
39.15	0.37	0.46	0.81*	1.13	0.00	1.13
39.20	0.37	0.46	0.80*	1.12	0.00	1.12
39.25	0.37	0.46	0.80*	1.11	0.00	1.11
39.30	0.37	0.46	0.80*	1.10	0.00	1.10

39.35	0.37	0.46	0.79*	1.09	0.00	1.09
39.40	0.37	0.46	0.79*	1.09	0.00	1.09
39.45	0.36	0.46	0.79*	1.08	0.00	1.08
39.50	0.36	0.46	0.78*	1.07	0.00	1.07
39.55	0.36	0.46	0.78*	1.06	0.00	1.06
39.60	0.36	0.46	0.78*	1.06	0.00	1.06
39.65	0.36	0.46	0.78*	1.05	0.00	1.05
39.70	0.36	0.46	0.77*	1.04	0.00	1.04
39.75	0.36	0.46	0.77*	1.03	0.00	1.03
39.80	0.35	0.46	0.77*	1.02	0.00	1.02
39.85	0.35	0.46	0.76*	1.02	0.00	1.02
39.90	0.35	0.46	0.76*	1.01	0.00	1.01
39.95	0.35	0.46	0.76*	1.00	0.00	1.00
40.00	0.35	0.46	0.76*	0.99	0.00	0.99
40.05	0.35	0.46	0.75*	0.98	0.00	0.98
40.10	0.35	0.46	0.75*	0.98	0.00	0.98
40.15	0.35	0.46	0.75*	0.97	0.00	0.97
40.20	0.34	0.46	0.75*	0.96	0.00	0.96
40.25	0.34	0.46	0.74*	0.95	0.00	0.95
40.30	0.34	0.46	0.74*	0.94	0.00	0.94
40.35	0.34	0.46	0.74*	0.93	0.00	0.93
40.40	0.34	0.46	0.73*	0.93	0.00	0.93
40.45	0.34	0.46	0.73*	0.92	0.00	0.92
40.50	0.34	0.46	0.73*	0.91	0.00	0.91
40.55	0.34	0.46	0.73*	0.90	0.00	0.90
40.60	0.33	0.46	0.72*	0.89	0.00	0.89
40.65	0.33	0.46	0.72*	0.88	0.00	0.88
40.70	0.33	0.46	0.72*	0.88	0.00	0.88
40.75	0.33	0.46	0.72*	0.87	0.00	0.87
40.80	0.33	0.46	0.71*	0.86	0.00	0.86
40.85	0.33	0.46	0.71*	0.85	0.00	0.85

40.90	0.33	0.46	0.71*	0.84	0.00	0.84
40.95	0.33	0.46	0.71*	0.83	0.00	0.83
41.00	0.33	0.46	0.70*	0.82	0.00	0.82
41.05	0.32	0.46	0.70*	0.82	0.00	0.82
41.10	0.32	0.46	0.70*	0.81	0.00	0.81
41.15	0.32	0.46	0.70*	0.80	0.00	0.80
41.20	0.32	0.46	0.69*	0.79	0.00	0.79
41.25	0.32	0.46	0.69*	0.78	0.00	0.78
41.30	0.32	0.46	0.69*	0.77	0.00	0.77
41.35	0.32	0.46	0.69*	0.76	0.00	0.76
41.40	0.32	0.46	0.68*	0.76	0.00	0.76
41.45	0.31	0.46	0.68*	0.75	0.00	0.75
41.50	0.31	0.46	0.68*	0.74	0.00	0.74
41.55	0.32	0.46	0.69*	0.73	0.00	0.73
41.60	0.32	0.46	0.70*	0.72	0.00	0.72
41.65	0.32	0.46	0.70*	0.71	0.00	0.71
41.70	0.33	0.46	0.71*	0.70	0.00	0.70
41.75	0.33	0.46	0.72*	0.69	0.00	0.69
41.80	0.34	0.46	0.73*	0.69	0.00	0.69
41.85	0.34	0.46	0.74*	0.68	0.00	0.68
41.90	0.34	0.46	0.74*	0.67	0.00	0.67
41.95	0.35	0.46	0.75*	0.66	0.00	0.66
42.00	0.35	0.46	0.76*	0.65	0.00	0.65
42.05	0.36	0.46	0.77*	0.64	0.00	0.64
42.10	0.36	0.46	0.78*	0.64	0.00	0.64
42.15	0.36	0.46	0.79*	0.63	0.00	0.63
42.20	0.37	0.46	0.80*	0.62	0.00	0.62
42.25	0.37	0.46	0.81*	0.61	0.00	0.61
42.30	0.38	0.46	0.82*	0.61	0.00	0.61
42.35	0.38	0.46	0.83*	0.60	0.00	0.60
42.40	0.38	0.46	0.84*	0.59	0.00	0.59

42.45	0.39	0.46	0.85*	0.58	0.00	0.58
42.50	0.39	0.46	0.86*	0.58	0.00	0.58
42.55	0.40	0.46	0.87*	0.57	0.00	0.57
42.60	0.40	0.46	0.88*	0.56	0.00	0.56
42.65	0.41	0.46	0.89*	0.55	0.00	0.55
42.70	0.41	0.46	0.90*	0.55	0.00	0.55
42.75	0.42	0.46	0.91*	0.54	0.00	0.54
42.80	0.42	0.46	0.92*	0.53	0.00	0.53
42.85	0.43	0.46	0.93*	0.53	0.00	0.53
42.90	0.44	0.46	0.95*	0.52	0.00	0.52
42.95	0.44	0.46	0.96*	0.51	0.00	0.51
43.00	0.45	0.46	0.97*	0.51	0.00	0.51
43.05	0.45	0.46	0.99*	0.50	0.00	0.50
43.10	0.46	0.46	1.00	0.50	0.00	0.50
43.15	0.47	0.46	1.02	0.49	0.00	0.49
43.20	0.47	0.46	1.03	0.48	0.00	0.48
43.25	0.48	0.46	1.05	0.48	0.00	0.48
43.30	0.49	0.46	1.06	0.47	0.00	0.47
43.35	0.50	0.46	1.08	0.47	0.00	0.47
43.40	0.51	0.46	1.10	0.46	0.00	0.46
43.45	0.52	0.46	1.12	0.45	0.00	0.45
43.50	0.53	0.46	1.15	0.45	0.00	0.45
43.55	0.54	0.46	1.17	0.44	0.00	0.44
43.60	0.55	0.46	1.20	0.44	0.00	0.44
43.65	0.57	0.46	1.24	0.43	0.00	0.43
43.70	0.60	0.46	1.30	0.43	0.00	0.43
43.75	0.64	0.46	1.39	0.42	0.00	0.42
43.80	0.71	0.46	1.54	0.42	0.00	0.42
43.85	0.71	0.46	1.54	0.42	0.00	0.42
43.90	0.71	0.46	1.54	0.41	0.00	0.41
43.95	0.71	0.46	1.54	0.41	0.00	0.41

44.00	0.71	0.46	1.54	0.40	0.00	0.40
44.05	0.71	0.46	1.54	0.40	0.00	0.40
44.10	0.71	0.46	1.54	0.40	0.00	0.40
44.15	0.71	0.46	1.54	0.39	0.00	0.39
44.20	0.71	0.46	1.54	0.39	0.00	0.39
44.25	0.71	0.46	1.54	0.39	0.00	0.39
44.30	0.71	0.46	1.54	0.39	0.00	0.39
44.35	0.71	0.46	1.54	0.38	0.00	0.38
44.40	0.71	0.46	1.54	0.38	0.00	0.38
44.45	0.71	0.46	1.54	0.38	0.00	0.38
44.50	0.71	0.46	1.54	0.38	0.00	0.38
44.55	0.71	0.46	1.54	0.38	0.00	0.38
44.60	0.71	0.46	1.54	0.38	0.00	0.38
44.65	0.71	0.46	1.54	0.38	0.00	0.38
44.70	0.71	0.46	1.54	0.37	0.00	0.37
44.75	0.71	0.46	1.55	0.37	0.00	0.37
44.80	0.71	0.46	1.55	0.37	0.00	0.37
44.85	0.71	0.46	1.55	0.37	0.00	0.37
44.90	0.71	0.46	1.55	0.37	0.00	0.37
44.95	0.71	0.46	1.55	0.37	0.00	0.37
45.00	0.71	0.46	1.55	0.37	0.00	0.37
45.05	0.71	0.46	1.55	0.37	0.00	0.37
45.10	0.71	0.46	1.55	0.37	0.00	0.37
45.15	0.71	0.46	1.55	0.37	0.00	0.37
45.20	0.71	0.46	1.55	0.37	0.00	0.37
45.25	0.71	0.46	1.55	0.37	0.00	0.37
45.30	0.71	0.46	1.55	0.37	0.00	0.37
45.35	0.71	0.46	1.55	0.37	0.00	0.37
45.40	0.71	0.46	1.55	0.37	0.00	0.37
45.45	0.71	0.46	1.55	0.37	0.00	0.37
45.50	0.71	0.46	1.55	0.37	0.00	0.37

45.55	0.71	0.46	1.55	0.37	0.00	0.37
45.60	0.70	0.46	1.55	0.37	0.00	0.37
45.65	0.70	0.46	1.55	0.37	0.00	0.37
45.70	0.70	0.46	1.55	0.37	0.00	0.37
45.75	0.70	0.46	1.55	0.37	0.00	0.37
45.80	0.70	0.46	1.55	0.37	0.00	0.37
45.85	0.70	0.46	1.55	0.37	0.00	0.37
45.90	0.70	0.46	1.55	0.37	0.00	0.37
45.95	0.70	0.46	1.55	0.37	0.00	0.37
46.00	0.70	0.46	1.55	0.37	0.00	0.37
46.05	0.70	0.46	1.55	0.37	0.00	0.37
46.10	0.70	0.46	1.55	0.37	0.00	0.37
46.15	0.70	0.45	1.55	0.37	0.00	0.37
46.20	0.70	0.45	1.55	0.37	0.00	0.37
46.25	0.70	0.45	1.55	0.37	0.00	0.37
46.30	0.70	0.45	1.55	0.37	0.00	0.37
46.35	0.70	0.45	1.55	0.37	0.00	0.37
46.40	0.70	0.45	1.55	0.37	0.00	0.37
46.45	0.70	0.45	1.55	0.37	0.00	0.37
46.50	0.70	0.45	1.55	0.37	0.00	0.37
46.55	0.70	0.45	1.55	0.37	0.00	0.37
46.60	0.70	0.45	1.55	0.37	0.00	0.37
46.65	0.70	0.45	1.55	0.37	0.00	0.37
46.70	0.70	0.45	1.55	0.37	0.00	0.37
46.75	0.70	0.45	1.55	0.37	0.00	0.37
46.80	0.70	0.45	1.55	0.37	0.00	0.37
46.85	0.70	0.45	1.55	0.37	0.00	0.37
46.90	0.70	0.45	1.55	0.37	0.00	0.37
46.95	0.70	0.45	1.55	0.37	0.00	0.37
47.00	0.70	0.45	1.55	0.37	0.00	0.37
47.05	0.70	0.45	1.55	0.37	0.00	0.37

47.10	0.70	0.45	1.55	0.37	0.00	0.37
47.15	0.70	0.45	1.55	0.37	0.00	0.37
47.20	0.70	0.45	1.55	0.37	0.00	0.37
47.25	0.70	0.45	1.55	0.37	0.00	0.37
47.30	0.70	0.45	1.55	0.37	0.00	0.37
47.35	0.70	0.45	1.55	0.37	0.00	0.37
47.40	0.70	0.45	1.55	0.37	0.00	0.37
47.45	0.70	0.45	1.55	0.37	0.00	0.37
47.50	0.70	0.45	1.55	0.37	0.00	0.37
47.55	0.70	0.45	1.55	0.37	0.00	0.37
47.60	0.70	0.45	1.55	0.37	0.00	0.37
47.65	0.70	0.45	1.55	0.37	0.00	0.37
47.70	0.70	0.45	1.55	0.37	0.00	0.37
47.75	0.70	0.45	1.55	0.37	0.00	0.37
47.80	0.70	0.45	1.55	0.37	0.00	0.37
47.85	0.70	0.45	1.55	0.37	0.00	0.37
47.90	0.70	0.45	1.55	0.37	0.00	0.37
47.95	0.70	0.45	1.55	0.37	0.00	0.37
48.00	0.70	0.45	1.55	0.37	0.00	0.37
48.05	0.70	0.45	1.55	0.37	0.00	0.37
48.10	0.70	0.45	1.55	0.37	0.00	0.37
48.15	0.70	0.45	1.55	0.37	0.00	0.37
48.20	0.70	0.45	1.55	0.37	0.00	0.37
48.25	0.70	0.45	1.55	0.37	0.00	0.37
48.30	0.70	0.45	1.55	0.37	0.00	0.37
48.35	0.70	0.45	1.55	0.37	0.00	0.37
48.40	0.70	0.45	1.55	0.37	0.00	0.37
48.45	0.70	0.45	1.55	0.37	0.00	0.37
48.50	0.70	0.45	1.55	0.37	0.00	0.37
48.55	0.70	0.45	1.55	0.37	0.00	0.37
48.60	0.70	0.45	1.55	0.37	0.00	0.37

48.65	0.70	0.45	1.55	0.37	0.00	0.37
48.70	0.70	0.45	1.55	0.37	0.00	0.37
48.75	0.70	0.45	1.55	0.37	0.00	0.37
48.80	0.70	0.45	1.55	0.37	0.00	0.37
48.85	0.70	0.45	1.55	0.37	0.00	0.37
48.90	0.70	0.45	1.55	0.37	0.00	0.37
48.95	0.70	0.45	1.55	0.37	0.00	0.37
49.00	0.70	0.45	1.55	0.37	0.00	0.37
49.05	0.70	0.45	1.55	0.37	0.00	0.37
49.10	0.70	0.45	1.55	0.37	0.00	0.37
49.15	0.70	0.45	1.55	0.37	0.00	0.37
49.20	0.70	0.45	1.55	0.37	0.00	0.37
49.25	0.70	0.45	1.55	0.37	0.00	0.37
49.30	0.70	0.45	1.55	0.37	0.00	0.37
49.35	0.70	0.45	1.55	0.37	0.00	0.37
49.40	0.70	0.45	1.55	0.37	0.00	0.37
49.45	0.70	0.45	1.56	0.37	0.00	0.37
49.50	0.70	0.45	1.56	0.37	0.00	0.37
49.55	0.70	0.45	1.56	0.37	0.00	0.37
49.60	0.70	0.45	1.56	0.37	0.00	0.37
49.65	0.70	0.45	1.56	0.37	0.00	0.37
49.70	0.70	0.45	1.56	0.37	0.00	0.37
49.75	0.70	0.45	1.56	0.37	0.00	0.37
49.80	0.70	0.45	1.56	0.37	0.00	0.37
49.85	0.70	0.45	1.56	0.37	0.00	0.37
49.90	0.70	0.45	1.56	0.37	0.00	0.37
49.95	0.70	0.45	1.56	0.37	0.00	0.37
50.00	0.70	0.45	1.56	0.37	0.00	0.37
50.05	0.70	0.45	1.56	0.37	0.00	0.37
50.10	0.70	0.45	1.56	0.37	0.00	0.37
50.15	0.69	0.45	1.56	0.37	0.00	0.37

50.20	0.69	0.45	1.56	0.37	0.00	0.37
50.25	0.69	0.45	1.56	0.37	0.00	0.37
50.30	0.69	0.45	1.56	0.37	0.00	0.37
50.35	0.69	0.45	1.56	0.37	0.00	0.37
50.40	0.69	0.45	1.56	0.37	0.00	0.37
50.45	0.69	0.45	1.56	0.37	0.00	0.37
50.50	0.69	0.45	1.56	0.37	0.00	0.37
50.55	0.69	0.45	1.56	0.37	0.00	0.37
50.60	0.69	0.45	1.56	0.37	0.00	0.37
50.65	0.69	0.44	1.56	0.37	0.00	0.37
50.70	0.69	0.44	1.56	0.37	0.00	0.37
50.75	0.69	0.44	1.56	0.37	0.00	0.37
50.80	0.69	0.44	1.56	0.37	0.00	0.37
50.85	0.69	0.44	1.56	0.37	0.00	0.37
50.90	0.69	0.44	1.56	0.37	0.00	0.37
50.95	0.69	0.44	1.56	0.37	0.00	0.37
51.00	0.69	0.44	1.56	0.37	0.00	0.37
51.05	0.69	0.44	1.56	0.37	0.00	0.37
51.10	0.69	0.44	1.56	0.37	0.00	0.37
51.15	0.69	0.44	1.56	0.37	0.00	0.37
51.20	0.69	0.44	1.56	0.37	0.00	0.37
51.25	0.69	0.44	1.56	0.37	0.00	0.37
51.30	0.69	0.44	1.56	0.37	0.00	0.37
51.35	0.69	0.44	1.56	0.37	0.00	0.37
51.40	0.69	0.44	1.56	0.37	0.00	0.37
51.45	0.69	0.44	1.56	0.37	0.00	0.37
51.50	0.69	0.44	1.56	0.37	0.00	0.37
51.55	0.69	0.44	1.56	0.37	0.00	0.37
51.60	0.69	0.44	1.56	0.37	0.00	0.37
51.65	0.69	0.44	1.56	0.37	0.00	0.37
51.70	0.69	0.44	1.56	0.37	0.00	0.37

51.75	0.69	0.44	1.56	0.37	0.00	0.37
51.80	0.69	0.44	1.56	0.37	0.00	0.37
51.85	0.69	0.44	1.56	0.37	0.00	0.37
51.90	0.69	0.44	1.56	0.37	0.00	0.37
51.95	0.69	0.44	1.57	0.37	0.00	0.37
52.00	0.69	0.44	1.57	0.37	0.00	0.37
52.05	0.69	0.44	1.57	0.37	0.00	0.37
52.10	0.69	0.44	1.57	0.37	0.00	0.37
52.15	0.69	0.44	1.57	0.37	0.00	0.37
52.20	0.69	0.44	1.57	0.37	0.00	0.37
52.25	0.69	0.44	1.57	0.37	0.00	0.37
52.30	0.69	0.44	1.57	0.37	0.00	0.37
52.35	0.69	0.44	1.57	0.37	0.00	0.37
52.40	0.69	0.44	1.57	0.37	0.00	0.37
52.45	0.69	0.44	1.57	0.37	0.00	0.37
52.50	0.69	0.44	1.57	0.37	0.00	0.37
52.55	0.69	0.44	1.57	0.37	0.00	0.37
52.60	0.69	0.44	1.57	0.37	0.00	0.37
52.65	0.69	0.44	1.57	0.37	0.00	0.37
52.70	0.69	0.44	1.57	0.37	0.00	0.37
52.75	0.69	0.44	1.57	0.37	0.00	0.37
52.80	0.69	0.44	1.57	0.37	0.00	0.37
52.85	0.69	0.44	1.57	0.37	0.00	0.37
52.90	0.69	0.44	1.57	0.37	0.00	0.37
52.95	0.69	0.44	1.57	0.37	0.00	0.37
53.00	0.69	0.44	1.57	0.37	0.00	0.37
53.05	2.00	0.44	5.00	0.37	0.00	0.37
53.10	2.00	0.44	5.00	0.37	0.00	0.37
53.15	2.00	0.44	5.00	0.37	0.00	0.37
53.20	2.00	0.44	5.00	0.37	0.00	0.37
53.25	2.00	0.44	5.00	0.37	0.00	0.37

53.30	2.00	0.44	5.00	0.37	0.00	0.37
53.35	2.00	0.44	5.00	0.37	0.00	0.37
53.40	2.00	0.44	5.00	0.37	0.00	0.37
53.45	2.00	0.44	5.00	0.37	0.00	0.37
53.50	2.00	0.44	5.00	0.37	0.00	0.37
53.55	2.00	0.44	5.00	0.37	0.00	0.37
53.60	2.00	0.44	5.00	0.37	0.00	0.37
53.65	2.00	0.44	5.00	0.37	0.00	0.37
53.70	2.00	0.44	5.00	0.37	0.00	0.37
53.75	2.00	0.44	5.00	0.37	0.00	0.37
53.80	2.00	0.44	5.00	0.37	0.00	0.37
53.85	2.00	0.44	5.00	0.37	0.00	0.37
53.90	2.00	0.44	5.00	0.37	0.00	0.37
53.95	2.00	0.44	5.00	0.37	0.00	0.37
54.00	2.00	0.44	5.00	0.37	0.00	0.37
54.05	2.00	0.44	5.00	0.37	0.00	0.37
54.10	2.00	0.44	5.00	0.37	0.00	0.37
54.15	2.00	0.44	5.00	0.37	0.00	0.37
54.20	2.00	0.44	5.00	0.37	0.00	0.37
54.25	2.00	0.44	5.00	0.37	0.00	0.37
54.30	2.00	0.44	5.00	0.37	0.00	0.37
54.35	2.00	0.43	5.00	0.37	0.00	0.37
54.40	2.00	0.43	5.00	0.37	0.00	0.37
54.45	2.00	0.43	5.00	0.37	0.00	0.37
54.50	2.00	0.43	5.00	0.37	0.00	0.37
54.55	2.00	0.43	5.00	0.37	0.00	0.37
54.60	2.00	0.43	5.00	0.37	0.00	0.37
54.65	2.00	0.43	5.00	0.37	0.00	0.37
54.70	2.00	0.43	5.00	0.37	0.00	0.37
54.75	2.00	0.43	5.00	0.37	0.00	0.37
54.80	2.00	0.43	5.00	0.37	0.00	0.37

54.85	2.00	0.43	5.00	0.37	0.00	0.37
54.90	2.00	0.43	5.00	0.37	0.00	0.37
54.95	2.00	0.43	5.00	0.37	0.00	0.37
55.00	2.00	0.43	5.00	0.37	0.00	0.37
55.05	2.00	0.43	5.00	0.37	0.00	0.37
55.10	2.00	0.43	5.00	0.37	0.00	0.37
55.15	2.00	0.43	5.00	0.37	0.00	0.37
55.20	2.00	0.43	5.00	0.37	0.00	0.37
55.25	2.00	0.43	5.00	0.37	0.00	0.37
55.30	2.00	0.43	5.00	0.37	0.00	0.37
55.35	2.00	0.43	5.00	0.37	0.00	0.37
55.40	2.00	0.43	5.00	0.37	0.00	0.37
55.45	2.00	0.43	5.00	0.37	0.00	0.37
55.50	2.00	0.43	5.00	0.37	0.00	0.37
55.55	2.00	0.43	5.00	0.37	0.00	0.37
55.60	2.00	0.43	5.00	0.37	0.00	0.37
55.65	2.00	0.43	5.00	0.37	0.00	0.37
55.70	2.00	0.43	5.00	0.37	0.00	0.37
55.75	2.00	0.43	5.00	0.37	0.00	0.37
55.80	2.00	0.43	5.00	0.37	0.00	0.37
55.85	2.00	0.43	5.00	0.37	0.00	0.37
55.90	2.00	0.43	5.00	0.37	0.00	0.37
55.95	2.00	0.43	5.00	0.37	0.00	0.37
56.00	2.00	0.43	5.00	0.37	0.00	0.37
56.05	2.00	0.43	5.00	0.37	0.00	0.37
56.10	2.00	0.43	5.00	0.37	0.00	0.37
56.15	2.00	0.43	5.00	0.37	0.00	0.37
56.20	2.00	0.43	5.00	0.37	0.00	0.37
56.25	2.00	0.43	5.00	0.37	0.00	0.37
56.30	2.00	0.43	5.00	0.37	0.00	0.37
56.35	2.00	0.43	5.00	0.37	0.00	0.37

56.40	2.00	0.43	5.00	0.37	0.00	0.37
56.45	2.00	0.43	5.00	0.37	0.00	0.37
56.50	2.00	0.43	5.00	0.37	0.00	0.37
56.55	2.00	0.43	5.00	0.37	0.00	0.37
56.60	2.00	0.43	5.00	0.37	0.00	0.37
56.65	2.00	0.43	5.00	0.37	0.00	0.37
56.70	2.00	0.43	5.00	0.37	0.00	0.37
56.75	2.00	0.43	5.00	0.37	0.00	0.37
56.80	2.00	0.43	5.00	0.37	0.00	0.37
56.85	2.00	0.43	5.00	0.37	0.00	0.37
56.90	2.00	0.43	5.00	0.37	0.00	0.37
56.95	2.00	0.43	5.00	0.37	0.00	0.37
57.00	2.00	0.43	5.00	0.37	0.00	0.37
57.05	2.00	0.43	5.00	0.37	0.00	0.37
57.10	2.00	0.43	5.00	0.37	0.00	0.37
57.15	2.00	0.43	5.00	0.37	0.00	0.37
57.20	2.00	0.43	5.00	0.37	0.00	0.37
57.25	2.00	0.43	5.00	0.37	0.00	0.37
57.30	2.00	0.43	5.00	0.37	0.00	0.37
57.35	2.00	0.43	5.00	0.37	0.00	0.37
57.40	2.00	0.43	5.00	0.37	0.00	0.37
57.45	2.00	0.43	5.00	0.37	0.00	0.37
57.50	2.00	0.43	5.00	0.37	0.00	0.37
57.55	2.00	0.43	5.00	0.37	0.00	0.37
57.60	2.00	0.43	5.00	0.37	0.00	0.37
57.65	2.00	0.43	5.00	0.37	0.00	0.37
57.70	2.00	0.43	5.00	0.37	0.00	0.37
57.75	2.00	0.42	5.00	0.37	0.00	0.37
57.80	2.00	0.42	5.00	0.37	0.00	0.37
57.85	2.00	0.42	5.00	0.37	0.00	0.37
57.90	2.00	0.42	5.00	0.37	0.00	0.37

57.95	2.00	0.42	5.00	0.37	0.00	0.37
58.00	2.00	0.42	5.00	0.37	0.00	0.37
58.05	2.00	0.42	5.00	0.37	0.00	0.37
58.10	2.00	0.42	5.00	0.37	0.00	0.37
58.15	2.00	0.42	5.00	0.37	0.00	0.37
58.20	2.00	0.42	5.00	0.37	0.00	0.37
58.25	2.00	0.42	5.00	0.37	0.00	0.37
58.30	2.00	0.42	5.00	0.37	0.00	0.37
58.35	2.00	0.42	5.00	0.37	0.00	0.37
58.40	2.00	0.42	5.00	0.37	0.00	0.37
58.45	2.00	0.42	5.00	0.37	0.00	0.37
58.50	2.00	0.42	5.00	0.37	0.00	0.37
58.55	2.00	0.42	5.00	0.37	0.00	0.37
58.60	2.00	0.42	5.00	0.37	0.00	0.37
58.65	2.00	0.42	5.00	0.37	0.00	0.37
58.70	2.00	0.42	5.00	0.37	0.00	0.37
58.75	2.00	0.42	5.00	0.37	0.00	0.37
58.80	2.00	0.42	5.00	0.37	0.00	0.37
58.85	2.00	0.42	5.00	0.37	0.00	0.37
58.90	2.00	0.42	5.00	0.37	0.00	0.37
58.95	2.00	0.42	5.00	0.37	0.00	0.37
59.00	2.00	0.42	5.00	0.37	0.00	0.37
59.05	2.00	0.42	5.00	0.37	0.00	0.37
59.10	2.00	0.42	5.00	0.37	0.00	0.37
59.15	2.00	0.42	5.00	0.37	0.00	0.37
59.20	2.00	0.42	5.00	0.37	0.00	0.37
59.25	2.00	0.42	5.00	0.37	0.00	0.37
59.30	2.00	0.42	5.00	0.37	0.00	0.37
59.35	2.00	0.42	5.00	0.37	0.00	0.37
59.40	2.00	0.42	5.00	0.37	0.00	0.37
59.45	2.00	0.42	5.00	0.37	0.00	0.37

59.50	2.00	0.42	5.00	0.37	0.00	0.37
59.55	2.00	0.42	5.00	0.37	0.00	0.37
59.60	2.00	0.42	5.00	0.37	0.00	0.37
59.65	2.00	0.42	5.00	0.37	0.00	0.37
59.70	2.00	0.42	5.00	0.37	0.00	0.37
59.75	2.00	0.42	5.00	0.37	0.00	0.37
59.80	2.00	0.42	5.00	0.37	0.00	0.37
59.85	2.00	0.42	5.00	0.37	0.00	0.37
59.90	2.00	0.42	5.00	0.37	0.00	0.37
59.95	2.00	0.42	5.00	0.37	0.00	0.37
60.00	2.00	0.42	5.00	0.37	0.00	0.37
60.05	2.00	0.42	5.00	0.37	0.00	0.37
60.10	2.00	0.42	5.00	0.37	0.00	0.37
60.15	2.00	0.42	5.00	0.37	0.00	0.37
60.20	2.00	0.42	5.00	0.37	0.00	0.37
60.25	2.00	0.42	5.00	0.37	0.00	0.37
60.30	2.00	0.42	5.00	0.37	0.00	0.37
60.35	2.00	0.42	5.00	0.37	0.00	0.37
60.40	2.00	0.42	5.00	0.37	0.00	0.37
60.45	2.00	0.42	5.00	0.37	0.00	0.37
60.50	2.00	0.42	5.00	0.37	0.00	0.37
60.55	2.00	0.42	5.00	0.37	0.00	0.37
60.60	2.00	0.42	5.00	0.37	0.00	0.37
60.65	2.00	0.42	5.00	0.37	0.00	0.37
60.70	2.00	0.42	5.00	0.37	0.00	0.37
60.75	2.00	0.42	5.00	0.37	0.00	0.37
60.80	2.00	0.42	5.00	0.37	0.00	0.37
60.85	2.00	0.41	5.00	0.37	0.00	0.37
60.90	2.00	0.41	5.00	0.37	0.00	0.37
60.95	2.00	0.41	5.00	0.37	0.00	0.37
61.00	2.00	0.41	5.00	0.37	0.00	0.37

61.05	2.00	0.41	5.00	0.37	0.00	0.37
61.10	2.00	0.41	5.00	0.37	0.00	0.37
61.15	2.00	0.41	5.00	0.37	0.00	0.37
61.20	2.00	0.41	5.00	0.37	0.00	0.37
61.25	2.00	0.41	5.00	0.37	0.00	0.37
61.30	2.00	0.41	5.00	0.37	0.00	0.37
61.35	2.00	0.41	5.00	0.37	0.00	0.37
61.40	2.00	0.41	5.00	0.37	0.00	0.37
61.45	2.00	0.41	5.00	0.37	0.00	0.37
61.50	2.00	0.41	5.00	0.37	0.00	0.37
61.55	2.00	0.41	5.00	0.37	0.00	0.37
61.60	2.00	0.41	5.00	0.37	0.00	0.37
61.65	2.00	0.41	5.00	0.37	0.00	0.37
61.70	2.00	0.41	5.00	0.37	0.00	0.37
61.75	2.00	0.41	5.00	0.37	0.00	0.37
61.80	2.00	0.41	5.00	0.37	0.00	0.37
61.85	2.00	0.41	5.00	0.37	0.00	0.37
61.90	2.00	0.41	5.00	0.37	0.00	0.37
61.95	2.00	0.41	5.00	0.37	0.00	0.37
62.00	2.00	0.41	5.00	0.37	0.00	0.37
62.05	2.00	0.41	5.00	0.37	0.00	0.37
62.10	2.00	0.41	5.00	0.37	0.00	0.37
62.15	2.00	0.41	5.00	0.37	0.00	0.37
62.20	2.00	0.41	5.00	0.37	0.00	0.37
62.25	2.00	0.41	5.00	0.37	0.00	0.37
62.30	2.00	0.41	5.00	0.37	0.00	0.37
62.35	2.00	0.41	5.00	0.37	0.00	0.37
62.40	2.00	0.41	5.00	0.37	0.00	0.37
62.45	2.00	0.41	5.00	0.37	0.00	0.37
62.50	2.00	0.41	5.00	0.37	0.00	0.37
62.55	2.00	0.41	5.00	0.37	0.00	0.37

62.60	2.00	0.41	5.00	0.37	0.00	0.37
62.65	2.00	0.41	5.00	0.37	0.00	0.37
62.70	2.00	0.41	5.00	0.37	0.00	0.37
62.75	2.00	0.41	5.00	0.37	0.00	0.37
62.80	2.00	0.41	5.00	0.37	0.00	0.37
62.85	2.00	0.41	5.00	0.37	0.00	0.37
62.90	2.00	0.41	5.00	0.37	0.00	0.37
62.95	2.00	0.41	5.00	0.37	0.00	0.37
63.00	2.00	0.41	5.00	0.37	0.00	0.37
63.05	2.00	0.41	5.00	0.37	0.00	0.37
63.10	2.00	0.41	5.00	0.37	0.00	0.37
63.15	2.00	0.41	5.00	0.37	0.00	0.37
63.20	2.00	0.41	5.00	0.37	0.00	0.37
63.25	2.00	0.41	5.00	0.37	0.00	0.37
63.30	2.00	0.41	5.00	0.37	0.00	0.37
63.35	2.00	0.41	5.00	0.37	0.00	0.37
63.40	2.00	0.41	5.00	0.37	0.00	0.37
63.45	2.00	0.41	5.00	0.37	0.00	0.37
63.50	2.00	0.41	5.00	0.37	0.00	0.37
63.55	2.00	0.41	5.00	0.37	0.00	0.37
63.60	2.00	0.41	5.00	0.37	0.00	0.37
63.65	2.00	0.41	5.00	0.37	0.00	0.37
63.70	2.00	0.41	5.00	0.37	0.00	0.37
63.75	2.00	0.40	5.00	0.37	0.00	0.37
63.80	2.00	0.40	5.00	0.37	0.00	0.37
63.85	2.00	0.40	5.00	0.37	0.00	0.37
63.90	2.00	0.40	5.00	0.37	0.00	0.37
63.95	2.00	0.40	5.00	0.37	0.00	0.37
64.00	2.00	0.40	5.00	0.37	0.00	0.37
64.05	2.00	0.40	5.00	0.37	0.00	0.37
64.10	2.00	0.40	5.00	0.37	0.00	0.37

64.15	2.00	0.40	5.00	0.37	0.00	0.37
64.20	2.00	0.40	5.00	0.37	0.00	0.37
64.25	2.00	0.40	5.00	0.37	0.00	0.37
64.30	2.00	0.40	5.00	0.37	0.00	0.37
64.35	2.00	0.40	5.00	0.37	0.00	0.37
64.40	2.00	0.40	5.00	0.37	0.00	0.37
64.45	2.00	0.40	5.00	0.37	0.00	0.37
64.50	2.00	0.40	5.00	0.37	0.00	0.37
64.55	2.00	0.40	5.00	0.37	0.00	0.37
64.60	2.00	0.40	5.00	0.37	0.00	0.37
64.65	2.00	0.40	5.00	0.37	0.00	0.37
64.70	2.00	0.40	5.00	0.37	0.00	0.37
64.75	2.00	0.40	5.00	0.37	0.00	0.37
64.80	2.00	0.40	5.00	0.37	0.00	0.37
64.85	2.00	0.40	5.00	0.37	0.00	0.37
64.90	2.00	0.40	5.00	0.37	0.00	0.37
64.95	2.00	0.40	5.00	0.37	0.00	0.37
65.00	2.00	0.40	5.00	0.37	0.00	0.37
65.05	2.00	0.40	5.00	0.37	0.00	0.37
65.10	2.00	0.40	5.00	0.37	0.00	0.37
65.15	2.00	0.40	5.00	0.37	0.00	0.37
65.20	2.00	0.40	5.00	0.37	0.00	0.37
65.25	2.00	0.40	5.00	0.37	0.00	0.37
65.30	2.00	0.40	5.00	0.37	0.00	0.37
65.35	2.00	0.40	5.00	0.37	0.00	0.37
65.40	2.00	0.40	5.00	0.37	0.00	0.37
65.45	2.00	0.40	5.00	0.37	0.00	0.37
65.50	2.00	0.40	5.00	0.37	0.00	0.37
65.55	2.00	0.40	5.00	0.37	0.00	0.37
65.60	2.00	0.40	5.00	0.37	0.00	0.37
65.65	2.00	0.40	5.00	0.37	0.00	0.37

65.70	2.00	0.40	5.00	0.37	0.00	0.37
65.75	2.00	0.40	5.00	0.37	0.00	0.37
65.80	2.00	0.40	5.00	0.37	0.00	0.37
65.85	2.00	0.40	5.00	0.37	0.00	0.37
65.90	2.00	0.40	5.00	0.37	0.00	0.37
65.95	2.00	0.40	5.00	0.37	0.00	0.37
66.00	2.00	0.40	5.00	0.37	0.00	0.37
66.05	2.00	0.40	5.00	0.37	0.00	0.37
66.10	2.00	0.40	5.00	0.37	0.00	0.37
66.15	2.00	0.40	5.00	0.37	0.00	0.37
66.20	2.00	0.40	5.00	0.37	0.00	0.37
66.25	2.00	0.40	5.00	0.37	0.00	0.37
66.30	2.00	0.40	5.00	0.37	0.00	0.37
66.35	2.00	0.40	5.00	0.37	0.00	0.37
66.40	2.00	0.40	5.00	0.37	0.00	0.37
66.45	2.00	0.39	5.00	0.37	0.00	0.37
66.50	2.00	0.39	5.00	0.37	0.00	0.37
66.55	2.00	0.39	5.00	0.37	0.00	0.37
66.60	2.00	0.39	5.00	0.37	0.00	0.37
66.65	2.00	0.39	5.00	0.37	0.00	0.37
66.70	2.00	0.39	5.00	0.37	0.00	0.37
66.75	2.00	0.39	5.00	0.37	0.00	0.37
66.80	2.00	0.39	5.00	0.37	0.00	0.37
66.85	2.00	0.39	5.00	0.37	0.00	0.37
66.90	2.00	0.39	5.00	0.37	0.00	0.37
66.95	2.00	0.39	5.00	0.37	0.00	0.37
67.00	2.00	0.39	5.00	0.37	0.00	0.37
67.05	2.00	0.39	5.00	0.37	0.00	0.37
67.10	2.00	0.39	5.00	0.37	0.00	0.37
67.15	2.00	0.39	5.00	0.37	0.00	0.37
67.20	2.00	0.39	5.00	0.37	0.00	0.37

67.25	2.00	0.39	5.00	0.37	0.00	0.37
67.30	2.00	0.39	5.00	0.37	0.00	0.37
67.35	2.00	0.39	5.00	0.37	0.00	0.37
67.40	2.00	0.39	5.00	0.37	0.00	0.37
67.45	2.00	0.39	5.00	0.37	0.00	0.37
67.50	2.00	0.39	5.00	0.37	0.00	0.37
67.55	2.00	0.39	5.00	0.37	0.00	0.37
67.60	2.00	0.39	5.00	0.37	0.00	0.37
67.65	2.00	0.39	5.00	0.37	0.00	0.37
67.70	2.00	0.39	5.00	0.37	0.00	0.37
67.75	2.00	0.39	5.00	0.37	0.00	0.37
67.80	2.00	0.39	5.00	0.37	0.00	0.37
67.85	2.00	0.39	5.00	0.37	0.00	0.37
67.90	2.00	0.39	5.00	0.37	0.00	0.37
67.95	2.00	0.39	5.00	0.37	0.00	0.37
68.00	2.00	0.39	5.00	0.37	0.00	0.37
68.05	2.00	0.39	5.00	0.37	0.00	0.37
68.10	2.00	0.39	5.00	0.37	0.00	0.37
68.15	2.00	0.39	5.00	0.37	0.00	0.37
68.20	2.00	0.39	5.00	0.37	0.00	0.37
68.25	2.00	0.39	5.00	0.37	0.00	0.37
68.30	2.00	0.39	5.00	0.37	0.00	0.37
68.35	2.00	0.39	5.00	0.37	0.00	0.37
68.40	2.00	0.39	5.00	0.37	0.00	0.37
68.45	2.00	0.39	5.00	0.37	0.00	0.37
68.50	2.00	0.39	5.00	0.37	0.00	0.37
68.55	2.00	0.39	5.00	0.37	0.00	0.37
68.60	2.00	0.39	5.00	0.37	0.00	0.37
68.65	2.00	0.39	5.00	0.37	0.00	0.37
68.70	2.00	0.39	5.00	0.37	0.00	0.37
68.75	2.00	0.39	5.00	0.37	0.00	0.37

68.80	2.00	0.39	5.00	0.37	0.00	0.37
68.85	2.00	0.39	5.00	0.37	0.00	0.37
68.90	2.00	0.39	5.00	0.37	0.00	0.37
68.95	2.00	0.39	5.00	0.37	0.00	0.37
69.00	2.00	0.39	5.00	0.37	0.00	0.37
69.05	2.00	0.38	5.00	0.37	0.00	0.37
69.10	2.00	0.38	5.00	0.37	0.00	0.37
69.15	2.00	0.38	5.00	0.37	0.00	0.37
69.20	2.00	0.38	5.00	0.37	0.00	0.37
69.25	2.00	0.38	5.00	0.37	0.00	0.37
69.30	2.00	0.38	5.00	0.37	0.00	0.37
69.35	2.00	0.38	5.00	0.37	0.00	0.37
69.40	2.00	0.38	5.00	0.37	0.00	0.37
69.45	2.00	0.38	5.00	0.37	0.00	0.37
69.50	2.00	0.38	5.00	0.37	0.00	0.37
69.55	2.00	0.38	5.00	0.37	0.00	0.37
69.60	2.00	0.38	5.00	0.37	0.00	0.37
69.65	2.00	0.38	5.00	0.37	0.00	0.37
69.70	2.00	0.38	5.00	0.37	0.00	0.37
69.75	2.00	0.38	5.00	0.37	0.00	0.37
69.80	2.00	0.38	5.00	0.37	0.00	0.37
69.85	2.00	0.38	5.00	0.37	0.00	0.37
69.90	2.00	0.38	5.00	0.37	0.00	0.37
69.95	2.00	0.38	5.00	0.37	0.00	0.37
70.00	2.00	0.38	5.00	0.37	0.00	0.37
70.05	2.00	0.38	5.00	0.37	0.00	0.37
70.10	2.00	0.38	5.00	0.37	0.00	0.37
70.15	2.00	0.38	5.00	0.37	0.00	0.37
70.20	2.00	0.38	5.00	0.37	0.00	0.37
70.25	2.00	0.38	5.00	0.37	0.00	0.37
70.30	2.00	0.38	5.00	0.37	0.00	0.37

70.35	2.00	0.38	5.00	0.37	0.00	0.37
70.40	2.00	0.38	5.00	0.37	0.00	0.37
70.45	2.00	0.38	5.00	0.37	0.00	0.37
70.50	2.00	0.38	5.00	0.37	0.00	0.37
70.55	2.00	0.38	5.00	0.37	0.00	0.37
70.60	2.00	0.38	5.00	0.37	0.00	0.37
70.65	2.00	0.38	5.00	0.37	0.00	0.37
70.70	2.00	0.38	5.00	0.37	0.00	0.37
70.75	2.00	0.38	5.00	0.37	0.00	0.37
70.80	2.00	0.38	5.00	0.37	0.00	0.37
70.85	2.00	0.38	5.00	0.37	0.00	0.37
70.90	2.00	0.38	5.00	0.37	0.00	0.37
70.95	2.00	0.38	5.00	0.37	0.00	0.37
71.00	2.00	0.38	5.00	0.37	0.00	0.37
71.05	2.00	0.38	5.00	0.37	0.00	0.37
71.10	2.00	0.38	5.00	0.37	0.00	0.37
71.15	2.00	0.38	5.00	0.37	0.00	0.37
71.20	2.00	0.38	5.00	0.37	0.00	0.37
71.25	2.00	0.38	5.00	0.37	0.00	0.37
71.30	2.00	0.38	5.00	0.37	0.00	0.37
71.35	2.00	0.38	5.00	0.37	0.00	0.37
71.40	2.00	0.38	5.00	0.37	0.00	0.37
71.45	2.00	0.38	5.00	0.37	0.00	0.37
71.50	2.00	0.38	5.00	0.37	0.00	0.37
71.55	0.29	0.38	0.78*	0.37	0.00	0.37
71.60	0.30	0.37	0.79*	0.37	0.00	0.37
71.65	0.30	0.37	0.79*	0.36	0.00	0.36
71.70	0.30	0.37	0.80*	0.35	0.00	0.35
71.75	0.30	0.37	0.81*	0.34	0.00	0.34
71.80	0.31	0.37	0.82*	0.33	0.00	0.33
71.85	0.31	0.37	0.82*	0.33	0.00	0.33

71.90	0.31	0.37	0.83*	0.32	0.00	0.32
71.95	0.31	0.37	0.84*	0.31	0.00	0.31
72.00	0.32	0.37	0.85*	0.30	0.00	0.30
72.05	0.32	0.37	0.85*	0.29	0.00	0.29
72.10	0.32	0.37	0.86*	0.29	0.00	0.29
72.15	0.32	0.37	0.87*	0.28	0.00	0.28
72.20	0.33	0.37	0.88*	0.27	0.00	0.27
72.25	0.33	0.37	0.88*	0.26	0.00	0.26
72.30	0.33	0.37	0.89*	0.26	0.00	0.26
72.35	0.33	0.37	0.90*	0.25	0.00	0.25
72.40	0.34	0.37	0.91*	0.24	0.00	0.24
72.45	0.34	0.37	0.92*	0.23	0.00	0.23
72.50	0.34	0.37	0.92*	0.23	0.00	0.23
72.55	0.35	0.37	0.93*	0.22	0.00	0.22
72.60	0.35	0.37	0.94*	0.21	0.00	0.21
72.65	0.35	0.37	0.95*	0.20	0.00	0.20
72.70	0.35	0.37	0.96*	0.20	0.00	0.20
72.75	0.36	0.37	0.97*	0.19	0.00	0.19
72.80	0.36	0.37	0.98*	0.18	0.00	0.18
72.85	0.36	0.37	0.99*	0.18	0.00	0.18
72.90	0.37	0.37	0.99*	0.17	0.00	0.17
72.95	0.37	0.37	1.00	0.16	0.00	0.16
73.00	0.37	0.37	1.01	0.16	0.00	0.16
73.05	0.38	0.37	1.02	0.15	0.00	0.15
73.10	0.38	0.37	1.03	0.14	0.00	0.14
73.15	0.38	0.37	1.04	0.14	0.00	0.14
73.20	0.39	0.37	1.05	0.13	0.00	0.13
73.25	0.39	0.37	1.06	0.12	0.00	0.12
73.30	0.40	0.37	1.08	0.12	0.00	0.12
73.35	0.40	0.37	1.09	0.11	0.00	0.11
73.40	0.40	0.37	1.10	0.10	0.00	0.10

73.45	0.41	0.37	1.11	0.10	0.00	0.10
73.50	0.41	0.37	1.12	0.09	0.00	0.09
73.55	0.42	0.37	1.13	0.09	0.00	0.09
73.60	0.42	0.37	1.15	0.08	0.00	0.08
73.65	0.42	0.37	1.16	0.08	0.00	0.08
73.70	0.43	0.37	1.17	0.07	0.00	0.07
73.75	0.43	0.37	1.19	0.07	0.00	0.07
73.80	0.44	0.37	1.20	0.06	0.00	0.06
73.85	0.44	0.37	1.21	0.06	0.00	0.06
73.90	0.45	0.37	1.23	0.05	0.00	0.05
73.95	0.45	0.37	1.24	0.05	0.00	0.05
74.00	0.46	0.36	1.26	0.04	0.00	0.04
74.05	0.47	0.36	1.28	0.04	0.00	0.04
74.10	0.47	0.36	1.30	0.04	0.00	0.04
74.15	0.48	0.36	1.32	0.03	0.00	0.03
74.20	0.49	0.36	1.34	0.03	0.00	0.03
74.25	0.50	0.36	1.36	0.03	0.00	0.03
74.30	0.51	0.36	1.39	0.02	0.00	0.02
74.35	0.52	0.36	1.43	0.02	0.00	0.02
74.40	0.53	0.36	1.47	0.02	0.00	0.02
74.45	0.55	0.36	1.52	0.02	0.00	0.02
74.50	0.58	0.36	1.60	0.01	0.00	0.01
74.55	0.63	0.36	1.74	0.01	0.00	0.01
74.60	0.65	0.36	1.79	0.01	0.00	0.01
74.65	0.65	0.36	1.79	0.01	0.00	0.01
74.70	0.65	0.36	1.79	0.01	0.00	0.01
74.75	0.65	0.36	1.80	0.01	0.00	0.01
74.80	0.65	0.36	1.80	0.01	0.00	0.01
74.85	0.65	0.36	1.80	0.01	0.00	0.01
74.90	0.65	0.36	1.80	0.01	0.00	0.01
74.95	0.65	0.36	1.80	0.00	0.00	0.00

75.00	0.65	0.36	1.80	0.00	0.00	0.00
75.05	0.65	0.36	1.80	0.00	0.00	0.00
75.10	0.65	0.36	1.80	0.00	0.00	0.00
75.15	0.65	0.36	1.80	0.00	0.00	0.00
75.20	0.65	0.36	1.80	0.00	0.00	0.00
75.25	0.65	0.36	1.80	0.00	0.00	0.00
75.30	0.65	0.36	1.80	0.00	0.00	0.00
75.35	0.65	0.36	1.81	0.00	0.00	0.00
75.40	0.65	0.36	1.81	0.00	0.00	0.00
75.45	0.65	0.36	1.81	0.00	0.00	0.00
75.50	0.65	0.36	1.81	0.00	0.00	0.00
75.55	0.65	0.36	1.81	0.00	0.00	0.00
75.60	0.65	0.36	1.81	0.00	0.00	0.00
75.65	0.65	0.36	1.81	0.00	0.00	0.00
75.70	0.65	0.36	1.81	0.00	0.00	0.00
75.75	0.65	0.36	1.81	0.00	0.00	0.00
75.80	0.65	0.36	1.81	0.00	0.00	0.00
75.85	0.65	0.36	1.81	0.00	0.00	0.00
75.90	0.65	0.36	1.81	0.00	0.00	0.00
75.95	0.65	0.36	1.81	0.00	0.00	0.00
76.00	0.65	0.36	1.81	0.00	0.00	0.00
76.05	0.65	0.36	1.81	0.00	0.00	0.00
76.10	0.65	0.36	1.81	0.00	0.00	0.00
76.15	0.65	0.36	1.81	0.00	0.00	0.00
76.20	0.65	0.36	1.81	0.00	0.00	0.00
76.25	0.65	0.36	1.81	0.00	0.00	0.00
76.30	0.65	0.36	1.81	0.00	0.00	0.00
76.35	0.65	0.36	1.81	0.00	0.00	0.00
76.40	0.65	0.36	1.81	0.00	0.00	0.00
76.45	0.65	0.36	1.81	0.00	0.00	0.00
76.50	0.65	0.36	1.81	0.00	0.00	0.00

76.55	0.65	0.36	1.81	0.00	0.00	0.00
76.60	0.65	0.36	1.81	0.00	0.00	0.00
76.65	0.65	0.36	1.81	0.00	0.00	0.00
76.70	0.65	0.36	1.81	0.00	0.00	0.00
76.75	0.65	0.36	1.81	0.00	0.00	0.00
76.80	0.65	0.36	1.81	0.00	0.00	0.00
76.85	0.65	0.36	1.80	0.00	0.00	0.00
76.90	0.65	0.36	1.80	0.00	0.00	0.00
76.95	0.65	0.36	1.80	0.00	0.00	0.00
77.00	0.65	0.36	1.80	0.00	0.00	0.00
77.05	0.65	0.36	1.80	0.00	0.00	0.00
77.10	0.65	0.36	1.80	0.00	0.00	0.00
77.15	0.65	0.36	1.80	0.00	0.00	0.00
77.20	0.65	0.36	1.80	0.00	0.00	0.00
77.25	0.65	0.36	1.80	0.00	0.00	0.00
77.30	0.65	0.36	1.80	0.00	0.00	0.00
77.35	0.65	0.36	1.80	0.00	0.00	0.00
77.40	0.65	0.36	1.80	0.00	0.00	0.00
77.45	0.65	0.36	1.80	0.00	0.00	0.00
77.50	0.64	0.36	1.80	0.00	0.00	0.00
77.55	0.64	0.36	1.80	0.00	0.00	0.00
77.60	0.64	0.36	1.80	0.00	0.00	0.00
77.65	0.64	0.36	1.80	0.00	0.00	0.00
77.70	0.64	0.36	1.80	0.00	0.00	0.00
77.75	0.64	0.36	1.80	0.00	0.00	0.00
77.80	0.64	0.36	1.80	0.00	0.00	0.00
77.85	0.64	0.36	1.80	0.00	0.00	0.00
77.90	0.64	0.36	1.80	0.00	0.00	0.00
77.95	0.64	0.36	1.80	0.00	0.00	0.00
78.00	0.64	0.36	1.80	0.00	0.00	0.00
78.05	0.64	0.36	1.80	0.00	0.00	0.00

78.10	0.64	0.36	1.80	0.00	0.00	0.00
78.15	0.64	0.36	1.80	0.00	0.00	0.00
78.20	0.64	0.36	1.80	0.00	0.00	0.00
78.25	0.64	0.36	1.80	0.00	0.00	0.00
78.30	0.64	0.36	1.80	0.00	0.00	0.00
78.35	0.64	0.36	1.80	0.00	0.00	0.00
78.40	0.64	0.36	1.80	0.00	0.00	0.00
78.45	0.64	0.36	1.80	0.00	0.00	0.00
78.50	0.64	0.36	1.80	0.00	0.00	0.00
78.55	0.64	0.36	1.80	0.00	0.00	0.00
78.60	0.64	0.36	1.80	0.00	0.00	0.00
78.65	0.64	0.36	1.80	0.00	0.00	0.00
78.70	0.64	0.36	1.80	0.00	0.00	0.00
78.75	0.64	0.36	1.80	0.00	0.00	0.00
78.80	0.64	0.36	1.80	0.00	0.00	0.00
78.85	0.64	0.36	1.80	0.00	0.00	0.00
78.90	0.64	0.36	1.80	0.00	0.00	0.00
78.95	0.64	0.36	1.80	0.00	0.00	0.00
79.00	0.64	0.36	1.80	0.00	0.00	0.00
79.05	0.64	0.36	1.80	0.00	0.00	0.00
79.10	0.64	0.36	1.80	0.00	0.00	0.00
79.15	0.64	0.36	1.80	0.00	0.00	0.00
79.20	0.64	0.36	1.80	0.00	0.00	0.00
79.25	0.64	0.36	1.80	0.00	0.00	0.00
79.30	0.64	0.36	1.80	0.00	0.00	0.00
79.35	0.64	0.36	1.80	0.00	0.00	0.00
79.40	0.64	0.36	1.80	0.00	0.00	0.00
79.45	0.64	0.36	1.80	0.00	0.00	0.00
79.50	0.64	0.36	1.80	0.00	0.00	0.00
79.55	0.64	0.36	1.80	0.00	0.00	0.00
79.60	0.64	0.36	1.80	0.00	0.00	0.00

79.65	0.64	0.36	1.80	0.00	0.00	0.00
79.70	0.64	0.36	1.80	0.00	0.00	0.00
79.75	0.64	0.36	1.80	0.00	0.00	0.00
79.80	0.64	0.36	1.80	0.00	0.00	0.00
79.85	0.64	0.36	1.80	0.00	0.00	0.00
79.90	0.64	0.36	1.80	0.00	0.00	0.00
79.95	0.64	0.36	1.80	0.00	0.00	0.00
80.00	0.64	0.36	1.80	0.00	0.00	0.00
80.05	0.64	0.36	1.80	0.00	0.00	0.00
80.10	0.64	0.36	1.80	0.00	0.00	0.00
80.15	0.64	0.36	1.80	0.00	0.00	0.00
80.20	0.64	0.36	1.80	0.00	0.00	0.00
80.25	0.64	0.36	1.80	0.00	0.00	0.00
80.30	0.64	0.36	1.80	0.00	0.00	0.00
80.35	0.64	0.36	1.80	0.00	0.00	0.00
80.40	0.64	0.36	1.80	0.00	0.00	0.00
80.45	0.64	0.36	1.80	0.00	0.00	0.00
80.50	0.64	0.36	1.80	0.00	0.00	0.00
80.55	0.64	0.36	1.80	0.00	0.00	0.00
80.60	0.64	0.36	1.80	0.00	0.00	0.00
80.65	0.64	0.36	1.80	0.00	0.00	0.00
80.70	0.64	0.36	1.80	0.00	0.00	0.00
80.75	0.64	0.36	1.80	0.00	0.00	0.00
80.80	0.64	0.36	1.80	0.00	0.00	0.00
80.85	0.64	0.36	1.80	0.00	0.00	0.00
80.90	0.64	0.36	1.80	0.00	0.00	0.00
80.95	0.64	0.36	1.80	0.00	0.00	0.00
81.00	0.64	0.36	1.80	0.00	0.00	0.00
81.05	0.64	0.35	1.80	0.00	0.00	0.00
81.10	0.64	0.35	1.80	0.00	0.00	0.00
81.15	0.64	0.35	1.80	0.00	0.00	0.00

81.20	0.64	0.35	1.80	0.00	0.00	0.00
81.25	0.64	0.35	1.80	0.00	0.00	0.00
81.30	0.64	0.35	1.80	0.00	0.00	0.00
81.35	0.64	0.35	1.80	0.00	0.00	0.00
81.40	0.64	0.35	1.80	0.00	0.00	0.00
81.45	0.64	0.35	1.80	0.00	0.00	0.00
81.50	0.64	0.35	1.80	0.00	0.00	0.00
81.55	0.64	0.35	1.80	0.00	0.00	0.00
81.60	0.64	0.35	1.80	0.00	0.00	0.00
81.65	0.64	0.35	1.80	0.00	0.00	0.00
81.70	0.64	0.35	1.80	0.00	0.00	0.00
81.75	0.64	0.35	1.80	0.00	0.00	0.00
81.80	0.64	0.35	1.80	0.00	0.00	0.00
81.85	0.64	0.35	1.80	0.00	0.00	0.00
81.90	0.64	0.35	1.80	0.00	0.00	0.00
81.95	0.64	0.35	1.80	0.00	0.00	0.00
82.00	0.64	0.35	1.80	0.00	0.00	0.00
82.05	0.64	0.35	1.80	0.00	0.00	0.00
82.10	0.64	0.35	1.80	0.00	0.00	0.00
82.15	0.64	0.35	1.80	0.00	0.00	0.00
82.20	0.64	0.35	1.80	0.00	0.00	0.00
82.25	0.64	0.35	1.80	0.00	0.00	0.00
82.30	0.64	0.35	1.80	0.00	0.00	0.00
82.35	0.64	0.35	1.80	0.00	0.00	0.00
82.40	0.64	0.35	1.80	0.00	0.00	0.00
82.45	0.64	0.35	1.80	0.00	0.00	0.00
82.50	0.64	0.35	1.80	0.00	0.00	0.00
82.55	0.64	0.35	1.80	0.00	0.00	0.00
82.60	0.64	0.35	1.80	0.00	0.00	0.00
82.65	0.64	0.35	1.80	0.00	0.00	0.00
82.70	0.64	0.35	1.80	0.00	0.00	0.00

82.75	0.64	0.35	1.80	0.00	0.00	0.00
82.80	0.64	0.35	1.80	0.00	0.00	0.00
82.85	0.64	0.35	1.80	0.00	0.00	0.00
82.90	0.64	0.35	1.80	0.00	0.00	0.00
82.95	0.64	0.35	1.80	0.00	0.00	0.00
83.00	0.64	0.35	1.80	0.00	0.00	0.00
83.05	0.64	0.35	1.80	0.00	0.00	0.00
83.10	0.64	0.35	1.80	0.00	0.00	0.00
83.15	0.64	0.35	1.80	0.00	0.00	0.00
83.20	0.64	0.35	1.80	0.00	0.00	0.00
83.25	0.64	0.35	1.80	0.00	0.00	0.00
83.30	0.64	0.35	1.80	0.00	0.00	0.00
83.35	0.64	0.35	1.80	0.00	0.00	0.00
83.40	0.64	0.35	1.80	0.00	0.00	0.00
83.45	0.64	0.35	1.80	0.00	0.00	0.00
83.50	0.64	0.35	1.80	0.00	0.00	0.00
83.55	0.64	0.35	1.80	0.00	0.00	0.00
83.60	0.64	0.35	1.80	0.00	0.00	0.00
83.65	0.64	0.35	1.80	0.00	0.00	0.00
83.70	0.64	0.35	1.80	0.00	0.00	0.00
83.75	0.63	0.35	1.80	0.00	0.00	0.00
83.80	0.63	0.35	1.80	0.00	0.00	0.00
83.85	0.63	0.35	1.80	0.00	0.00	0.00
83.90	0.63	0.35	1.80	0.00	0.00	0.00
83.95	0.63	0.35	1.80	0.00	0.00	0.00
84.00	0.63	0.35	1.80	0.00	0.00	0.00
84.05	0.63	0.35	1.80	0.00	0.00	0.00
84.10	0.63	0.35	1.80	0.00	0.00	0.00
84.15	0.63	0.35	1.80	0.00	0.00	0.00
84.20	0.63	0.35	1.80	0.00	0.00	0.00
84.25	0.63	0.35	1.80	0.00	0.00	0.00

84.30	0.63	0.35	1.80	0.00	0.00	0.00
84.35	0.63	0.35	1.80	0.00	0.00	0.00
84.40	0.63	0.35	1.80	0.00	0.00	0.00
84.45	0.63	0.35	1.80	0.00	0.00	0.00
84.50	0.63	0.35	1.80	0.00	0.00	0.00
84.55	0.63	0.35	1.80	0.00	0.00	0.00
84.60	0.63	0.35	1.80	0.00	0.00	0.00
84.65	0.63	0.35	1.80	0.00	0.00	0.00
84.70	0.63	0.35	1.80	0.00	0.00	0.00
84.75	0.63	0.35	1.80	0.00	0.00	0.00
84.80	0.63	0.35	1.80	0.00	0.00	0.00
84.85	0.63	0.35	1.80	0.00	0.00	0.00
84.90	0.63	0.35	1.80	0.00	0.00	0.00
84.95	0.63	0.35	1.80	0.00	0.00	0.00
85.00	0.63	0.35	1.80	0.00	0.00	0.00
85.05	0.63	0.35	1.80	0.00	0.00	0.00
85.10	0.63	0.35	1.80	0.00	0.00	0.00
85.15	0.63	0.35	1.80	0.00	0.00	0.00
85.20	0.63	0.35	1.80	0.00	0.00	0.00
85.25	0.63	0.35	1.80	0.00	0.00	0.00
85.30	0.63	0.35	1.80	0.00	0.00	0.00
85.35	0.63	0.35	1.80	0.00	0.00	0.00
85.40	0.63	0.35	1.80	0.00	0.00	0.00
85.45	0.63	0.35	1.80	0.00	0.00	0.00
85.50	0.63	0.35	1.80	0.00	0.00	0.00
85.55	0.63	0.35	1.80	0.00	0.00	0.00
85.60	0.63	0.35	1.80	0.00	0.00	0.00
85.65	0.63	0.35	1.80	0.00	0.00	0.00
85.70	0.63	0.35	1.80	0.00	0.00	0.00
85.75	0.63	0.35	1.80	0.00	0.00	0.00
85.80	0.63	0.35	1.80	0.00	0.00	0.00

85.85	0.63	0.35	1.80	0.00	0.00	0.00
85.90	0.63	0.35	1.80	0.00	0.00	0.00
85.95	0.63	0.35	1.80	0.00	0.00	0.00
86.00	0.63	0.35	1.80	0.00	0.00	0.00
86.05	0.63	0.35	1.80	0.00	0.00	0.00
86.10	0.63	0.35	1.80	0.00	0.00	0.00
86.15	0.63	0.35	1.80	0.00	0.00	0.00
86.20	0.63	0.35	1.80	0.00	0.00	0.00
86.25	0.63	0.35	1.80	0.00	0.00	0.00
86.30	0.63	0.35	1.80	0.00	0.00	0.00
86.35	0.63	0.35	1.80	0.00	0.00	0.00
86.40	0.63	0.35	1.80	0.00	0.00	0.00
86.45	0.63	0.35	1.80	0.00	0.00	0.00
86.50	0.63	0.35	1.80	0.00	0.00	0.00
86.55	0.63	0.35	1.80	0.00	0.00	0.00
86.60	0.63	0.35	1.80	0.00	0.00	0.00
86.65	0.63	0.35	1.80	0.00	0.00	0.00
86.70	0.63	0.35	1.80	0.00	0.00	0.00
86.75	0.63	0.35	1.80	0.00	0.00	0.00
86.80	0.63	0.35	1.80	0.00	0.00	0.00
86.85	0.63	0.35	1.80	0.00	0.00	0.00
86.90	0.63	0.35	1.80	0.00	0.00	0.00
86.95	0.63	0.35	1.80	0.00	0.00	0.00
87.00	0.63	0.35	1.80	0.00	0.00	0.00
87.05	0.63	0.35	1.80	0.00	0.00	0.00
87.10	0.63	0.35	1.80	0.00	0.00	0.00
87.15	0.63	0.35	1.80	0.00	0.00	0.00
87.20	0.63	0.35	1.80	0.00	0.00	0.00
87.25	0.63	0.35	1.80	0.00	0.00	0.00
87.30	0.63	0.35	1.80	0.00	0.00	0.00
87.35	0.63	0.35	1.80	0.00	0.00	0.00

87.40	0.63	0.35	1.80	0.00	0.00	0.00
87.45	0.63	0.35	1.80	0.00	0.00	0.00
87.50	0.63	0.35	1.80	0.00	0.00	0.00
87.55	0.63	0.35	1.80	0.00	0.00	0.00
87.60	0.63	0.35	1.80	0.00	0.00	0.00
87.65	0.63	0.35	1.80	0.00	0.00	0.00
87.70	0.63	0.35	1.80	0.00	0.00	0.00
87.75	0.63	0.35	1.80	0.00	0.00	0.00
87.80	0.63	0.35	1.80	0.00	0.00	0.00
87.85	0.63	0.35	1.80	0.00	0.00	0.00
87.90	0.63	0.35	1.80	0.00	0.00	0.00
87.95	0.63	0.35	1.80	0.00	0.00	0.00
88.00	0.63	0.35	1.80	0.00	0.00	0.00
88.05	0.63	0.35	1.80	0.00	0.00	0.00
88.10	0.63	0.35	1.80	0.00	0.00	0.00
88.15	0.63	0.35	1.80	0.00	0.00	0.00
88.20	0.63	0.35	1.80	0.00	0.00	0.00
88.25	0.63	0.35	1.80	0.00	0.00	0.00
88.30	0.63	0.35	1.80	0.00	0.00	0.00
88.35	0.63	0.35	1.80	0.00	0.00	0.00
88.40	0.63	0.35	1.80	0.00	0.00	0.00
88.45	0.63	0.35	1.80	0.00	0.00	0.00
88.50	0.63	0.35	1.80	0.00	0.00	0.00
88.55	0.63	0.35	1.80	0.00	0.00	0.00
88.60	0.63	0.35	1.80	0.00	0.00	0.00
88.65	0.63	0.35	1.80	0.00	0.00	0.00
88.70	0.63	0.35	1.80	0.00	0.00	0.00
88.75	0.63	0.35	1.80	0.00	0.00	0.00
88.80	0.63	0.35	1.80	0.00	0.00	0.00
88.85	0.63	0.35	1.80	0.00	0.00	0.00
88.90	0.63	0.35	1.80	0.00	0.00	0.00

88.95	0.63	0.35	1.80	0.00	0.00	0.00
89.00	0.63	0.35	1.80	0.00	0.00	0.00
89.05	0.63	0.35	1.80	0.00	0.00	0.00
89.10	0.63	0.35	1.80	0.00	0.00	0.00
89.15	0.63	0.35	1.80	0.00	0.00	0.00
89.20	0.63	0.35	1.80	0.00	0.00	0.00
89.25	0.63	0.35	1.80	0.00	0.00	0.00
89.30	0.63	0.35	1.80	0.00	0.00	0.00
89.35	0.63	0.35	1.80	0.00	0.00	0.00
89.40	0.63	0.35	1.80	0.00	0.00	0.00
89.45	0.63	0.35	1.80	0.00	0.00	0.00
89.50	0.63	0.35	1.80	0.00	0.00	0.00
89.55	0.63	0.35	1.80	0.00	0.00	0.00
89.60	0.63	0.35	1.80	0.00	0.00	0.00
89.65	0.63	0.35	1.80	0.00	0.00	0.00
89.70	0.63	0.35	1.80	0.00	0.00	0.00
89.75	0.63	0.35	1.80	0.00	0.00	0.00
89.80	0.63	0.35	1.80	0.00	0.00	0.00
89.85	0.63	0.35	1.80	0.00	0.00	0.00
89.90	0.63	0.35	1.80	0.00	0.00	0.00
89.95	0.62	0.35	1.80	0.00	0.00	0.00
90.00	0.62	0.35	1.80	0.00	0.00	0.00
90.05	0.62	0.35	1.80	0.00	0.00	0.00
90.10	0.62	0.35	1.80	0.00	0.00	0.00
90.15	0.62	0.35	1.80	0.00	0.00	0.00
90.20	0.62	0.35	1.80	0.00	0.00	0.00
90.25	0.62	0.35	1.80	0.00	0.00	0.00
90.30	0.62	0.35	1.80	0.00	0.00	0.00
90.35	0.62	0.35	1.80	0.00	0.00	0.00
90.40	0.62	0.35	1.80	0.00	0.00	0.00
90.45	0.62	0.35	1.80	0.00	0.00	0.00

90.50	0.62	0.35	1.80	0.00	0.00	0.00
90.55	0.62	0.35	1.80	0.00	0.00	0.00
90.60	0.62	0.35	1.80	0.00	0.00	0.00
90.65	0.62	0.35	1.80	0.00	0.00	0.00
90.70	0.62	0.35	1.80	0.00	0.00	0.00
90.75	0.62	0.35	1.80	0.00	0.00	0.00
90.80	0.62	0.35	1.80	0.00	0.00	0.00
90.85	0.62	0.35	1.80	0.00	0.00	0.00
90.90	0.62	0.35	1.80	0.00	0.00	0.00
90.95	0.62	0.35	1.80	0.00	0.00	0.00
91.00	0.62	0.35	1.80	0.00	0.00	0.00
91.05	0.62	0.35	1.80	0.00	0.00	0.00
91.10	0.62	0.35	1.80	0.00	0.00	0.00
91.15	0.62	0.35	1.80	0.00	0.00	0.00
91.20	0.62	0.35	1.80	0.00	0.00	0.00
91.25	0.62	0.35	1.80	0.00	0.00	0.00
91.30	0.62	0.35	1.80	0.00	0.00	0.00
91.35	0.62	0.35	1.80	0.00	0.00	0.00
91.40	0.62	0.35	1.80	0.00	0.00	0.00
91.45	0.62	0.35	1.80	0.00	0.00	0.00
91.50	0.62	0.35	1.80	0.00	0.00	0.00
91.55	0.62	0.35	1.80	0.00	0.00	0.00
91.60	0.62	0.35	1.80	0.00	0.00	0.00
91.65	0.62	0.35	1.80	0.00	0.00	0.00
91.70	0.62	0.35	1.80	0.00	0.00	0.00
91.75	0.62	0.35	1.80	0.00	0.00	0.00
91.80	0.62	0.34	1.80	0.00	0.00	0.00
91.85	0.62	0.34	1.80	0.00	0.00	0.00
91.90	0.62	0.34	1.80	0.00	0.00	0.00
91.95	0.62	0.34	1.80	0.00	0.00	0.00
92.00	0.62	0.34	1.80	0.00	0.00	0.00

92.05	0.62	0.34	1.80	0.00	0.00	0.00
92.10	0.62	0.34	1.80	0.00	0.00	0.00
92.15	0.62	0.34	1.80	0.00	0.00	0.00
92.20	0.62	0.34	1.80	0.00	0.00	0.00
92.25	0.62	0.34	1.80	0.00	0.00	0.00
92.30	0.62	0.34	1.80	0.00	0.00	0.00
92.35	0.62	0.34	1.80	0.00	0.00	0.00
92.40	0.62	0.34	1.80	0.00	0.00	0.00
92.45	0.62	0.34	1.80	0.00	0.00	0.00
92.50	0.62	0.34	1.80	0.00	0.00	0.00
92.55	0.62	0.34	1.80	0.00	0.00	0.00
92.60	0.62	0.34	1.80	0.00	0.00	0.00
92.65	0.62	0.34	1.80	0.00	0.00	0.00
92.70	0.62	0.34	1.80	0.00	0.00	0.00
92.75	0.62	0.34	1.80	0.00	0.00	0.00
92.80	0.62	0.34	1.80	0.00	0.00	0.00
92.85	0.62	0.34	1.80	0.00	0.00	0.00
92.90	0.62	0.34	1.80	0.00	0.00	0.00
92.95	0.62	0.34	1.80	0.00	0.00	0.00
93.00	0.62	0.34	1.80	0.00	0.00	0.00
93.05	0.62	0.34	1.80	0.00	0.00	0.00
93.10	0.62	0.34	1.80	0.00	0.00	0.00
93.15	0.62	0.34	1.80	0.00	0.00	0.00
93.20	0.62	0.34	1.80	0.00	0.00	0.00
93.25	0.62	0.34	1.80	0.00	0.00	0.00
93.30	0.62	0.34	1.80	0.00	0.00	0.00
93.35	0.62	0.34	1.80	0.00	0.00	0.00
93.40	0.62	0.34	1.81	0.00	0.00	0.00
93.45	0.62	0.34	1.81	0.00	0.00	0.00
93.50	0.62	0.34	1.81	0.00	0.00	0.00
93.55	0.62	0.34	1.81	0.00	0.00	0.00

93.60	0.62	0.34	1.81	0.00	0.00	0.00
93.65	0.62	0.34	1.81	0.00	0.00	0.00
93.70	0.62	0.34	1.81	0.00	0.00	0.00
93.75	0.62	0.34	1.81	0.00	0.00	0.00
93.80	0.62	0.34	1.81	0.00	0.00	0.00
93.85	0.62	0.34	1.81	0.00	0.00	0.00
93.90	0.62	0.34	1.81	0.00	0.00	0.00
93.95	0.62	0.34	1.81	0.00	0.00	0.00
94.00	0.62	0.34	1.81	0.00	0.00	0.00
94.05	0.62	0.34	1.81	0.00	0.00	0.00
94.10	0.62	0.34	1.81	0.00	0.00	0.00
94.15	0.62	0.34	1.81	0.00	0.00	0.00
94.20	0.62	0.34	1.81	0.00	0.00	0.00
94.25	0.62	0.34	1.81	0.00	0.00	0.00
94.30	0.62	0.34	1.81	0.00	0.00	0.00
94.35	0.62	0.34	1.81	0.00	0.00	0.00
94.40	0.62	0.34	1.81	0.00	0.00	0.00
94.45	0.62	0.34	1.81	0.00	0.00	0.00
94.50	0.62	0.34	1.81	0.00	0.00	0.00
94.55	0.62	0.34	1.81	0.00	0.00	0.00
94.60	0.62	0.34	1.81	0.00	0.00	0.00
94.65	0.62	0.34	1.81	0.00	0.00	0.00
94.70	0.62	0.34	1.81	0.00	0.00	0.00
94.75	0.62	0.34	1.81	0.00	0.00	0.00
94.80	0.62	0.34	1.81	0.00	0.00	0.00
94.85	0.62	0.34	1.81	0.00	0.00	0.00
94.90	0.62	0.34	1.81	0.00	0.00	0.00
94.95	0.62	0.34	1.81	0.00	0.00	0.00
95.00	0.62	0.34	1.81	0.00	0.00	0.00
95.05	0.62	0.34	1.81	0.00	0.00	0.00
95.10	0.62	0.34	1.81	0.00	0.00	0.00

95.15	0.62	0.34	1.81	0.00	0.00	0.00
95.20	0.62	0.34	1.81	0.00	0.00	0.00
95.25	0.62	0.34	1.81	0.00	0.00	0.00
95.30	0.62	0.34	1.81	0.00	0.00	0.00
95.35	0.62	0.34	1.81	0.00	0.00	0.00
95.40	0.62	0.34	1.81	0.00	0.00	0.00
95.45	0.62	0.34	1.81	0.00	0.00	0.00
95.50	0.62	0.34	1.81	0.00	0.00	0.00
95.55	0.62	0.34	1.81	0.00	0.00	0.00
95.60	0.62	0.34	1.81	0.00	0.00	0.00
95.65	0.62	0.34	1.81	0.00	0.00	0.00
95.70	0.62	0.34	1.81	0.00	0.00	0.00
95.75	0.62	0.34	1.81	0.00	0.00	0.00
95.80	0.62	0.34	1.81	0.00	0.00	0.00
95.85	0.62	0.34	1.81	0.00	0.00	0.00
95.90	0.62	0.34	1.81	0.00	0.00	0.00
95.95	0.62	0.34	1.81	0.00	0.00	0.00
96.00	2.00	0.34	5.00	0.00	0.00	0.00
96.05	2.00	0.34	5.00	0.00	0.00	0.00
96.10	2.00	0.34	5.00	0.00	0.00	0.00
96.15	2.00	0.34	5.00	0.00	0.00	0.00
96.20	2.00	0.34	5.00	0.00	0.00	0.00
96.25	2.00	0.34	5.00	0.00	0.00	0.00
96.30	2.00	0.34	5.00	0.00	0.00	0.00
96.35	2.00	0.34	5.00	0.00	0.00	0.00
96.40	2.00	0.34	5.00	0.00	0.00	0.00
96.45	2.00	0.34	5.00	0.00	0.00	0.00
96.50	2.00	0.34	5.00	0.00	0.00	0.00
96.55	2.00	0.34	5.00	0.00	0.00	0.00
96.60	2.00	0.34	5.00	0.00	0.00	0.00
96.65	2.00	0.34	5.00	0.00	0.00	0.00

96.70	2.00	0.34	5.00	0.00	0.00	0.00
96.75	2.00	0.34	5.00	0.00	0.00	0.00
96.80	2.00	0.34	5.00	0.00	0.00	0.00
96.85	2.00	0.34	5.00	0.00	0.00	0.00
96.90	2.00	0.34	5.00	0.00	0.00	0.00
96.95	2.00	0.34	5.00	0.00	0.00	0.00
97.00	2.00	0.34	5.00	0.00	0.00	0.00
97.05	2.00	0.34	5.00	0.00	0.00	0.00
97.10	2.00	0.34	5.00	0.00	0.00	0.00
97.15	2.00	0.34	5.00	0.00	0.00	0.00
97.20	2.00	0.34	5.00	0.00	0.00	0.00
97.25	2.00	0.34	5.00	0.00	0.00	0.00
97.30	2.00	0.34	5.00	0.00	0.00	0.00
97.35	2.00	0.34	5.00	0.00	0.00	0.00
97.40	2.00	0.34	5.00	0.00	0.00	0.00
97.45	2.00	0.34	5.00	0.00	0.00	0.00
97.50	2.00	0.34	5.00	0.00	0.00	0.00
97.55	2.00	0.34	5.00	0.00	0.00	0.00
97.60	2.00	0.34	5.00	0.00	0.00	0.00
97.65	2.00	0.34	5.00	0.00	0.00	0.00
97.70	2.00	0.34	5.00	0.00	0.00	0.00
97.75	2.00	0.34	5.00	0.00	0.00	0.00
97.80	2.00	0.34	5.00	0.00	0.00	0.00
97.85	2.00	0.34	5.00	0.00	0.00	0.00
97.90	2.00	0.34	5.00	0.00	0.00	0.00
97.95	2.00	0.34	5.00	0.00	0.00	0.00
98.00	2.00	0.34	5.00	0.00	0.00	0.00
98.05	2.00	0.34	5.00	0.00	0.00	0.00
98.10	2.00	0.34	5.00	0.00	0.00	0.00
98.15	2.00	0.34	5.00	0.00	0.00	0.00
98.20	2.00	0.34	5.00	0.00	0.00	0.00

98.25	2.00	0.34	5.00	0.00	0.00	0.00
98.30	2.00	0.34	5.00	0.00	0.00	0.00
98.35	2.00	0.34	5.00	0.00	0.00	0.00
98.40	2.00	0.34	5.00	0.00	0.00	0.00
98.45	2.00	0.34	5.00	0.00	0.00	0.00
98.50	2.00	0.34	5.00	0.00	0.00	0.00
98.55	2.00	0.34	5.00	0.00	0.00	0.00
98.60	2.00	0.34	5.00	0.00	0.00	0.00
98.65	2.00	0.34	5.00	0.00	0.00	0.00
98.70	2.00	0.34	5.00	0.00	0.00	0.00
98.75	2.00	0.34	5.00	0.00	0.00	0.00
98.80	2.00	0.34	5.00	0.00	0.00	0.00
98.85	2.00	0.34	5.00	0.00	0.00	0.00
98.90	2.00	0.34	5.00	0.00	0.00	0.00
98.95	2.00	0.34	5.00	0.00	0.00	0.00
99.00	2.00	0.34	5.00	0.00	0.00	0.00
99.05	2.00	0.34	5.00	0.00	0.00	0.00
99.10	2.00	0.34	5.00	0.00	0.00	0.00
99.15	2.00	0.34	5.00	0.00	0.00	0.00
99.20	2.00	0.34	5.00	0.00	0.00	0.00
99.25	2.00	0.34	5.00	0.00	0.00	0.00
99.30	2.00	0.34	5.00	0.00	0.00	0.00
99.35	2.00	0.34	5.00	0.00	0.00	0.00
99.40	2.00	0.34	5.00	0.00	0.00	0.00
99.45	2.00	0.34	5.00	0.00	0.00	0.00
99.50	2.00	0.34	5.00	0.00	0.00	0.00
99.55	2.00	0.34	5.00	0.00	0.00	0.00
99.60	2.00	0.34	5.00	0.00	0.00	0.00
99.65	2.00	0.34	5.00	0.00	0.00	0.00
99.70	2.00	0.34	5.00	0.00	0.00	0.00
99.75	2.00	0.34	5.00	0.00	0.00	0.00

99.80	2.00	0.34	5.00	0.00	0.00	0.00
99.85	2.00	0.34	5.00	0.00	0.00	0.00
99.90	2.00	0.34	5.00	0.00	0.00	0.00
99.95	2.00	0.34	5.00	0.00	0.00	0.00
100.00	2.00	0.34	5.00	0.00	0.00	0.00

---

* F.S.<1, Liquefaction Potential Zone

(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

---

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

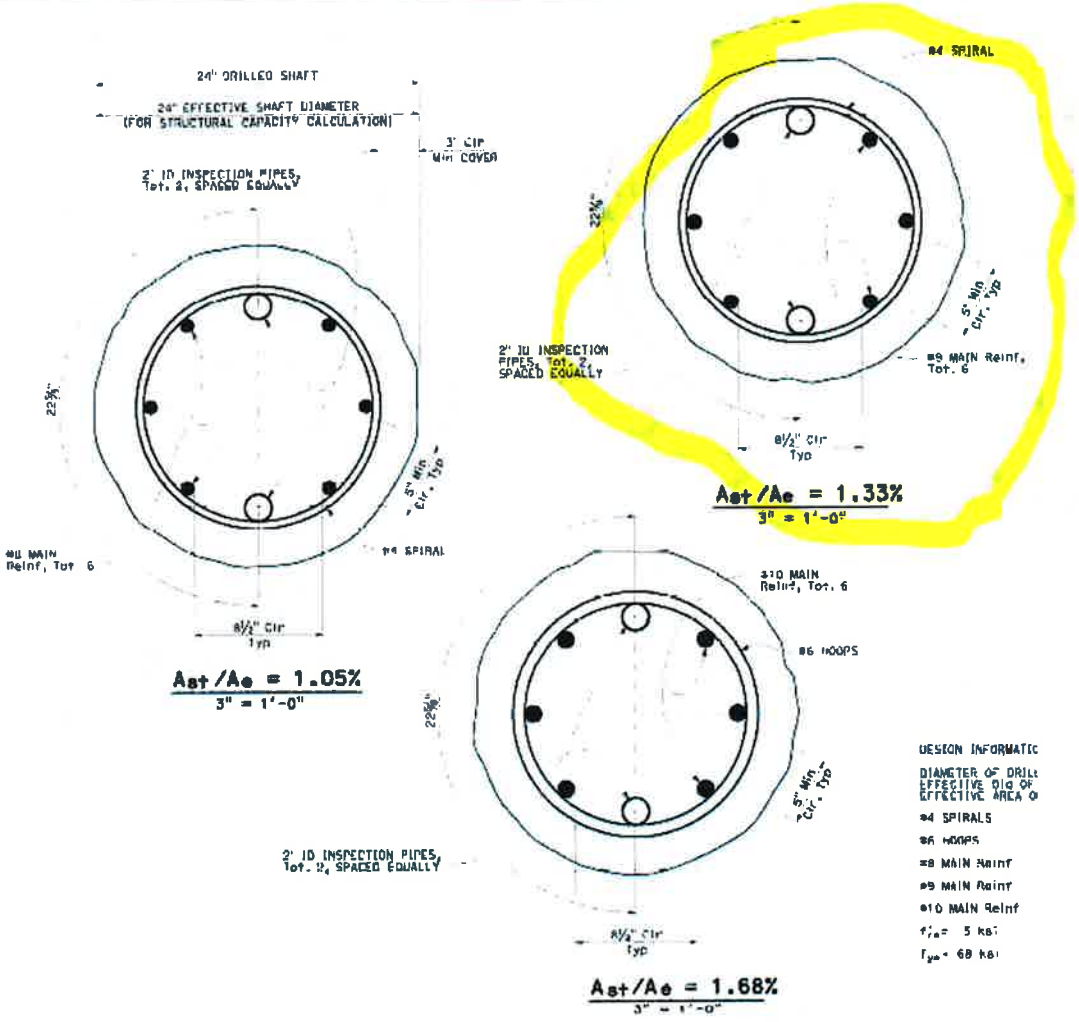
APPENDIX E

Lateral Resistance Analysis

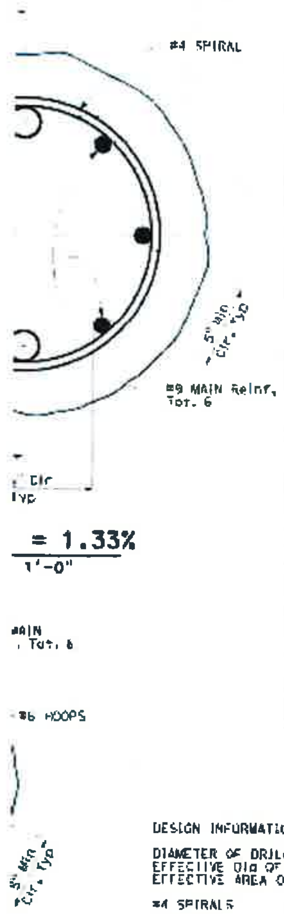
Boring A-19-001

Abutment #2

24-inch CIDH Pile


24" DRILLED SHAFT
24" EFFECTIVE SHAFT DIAMETER (FOR STRUCTURAL CAPACITY CALCULATION)
3" CLR MIN COVER
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
#4 SPIRAL
#8 MAIN Reinf, Tot. 6
8½" Clr Typ
3" Min. Clr. Typ
22½"
Ast /Ae = 1.05%
3" = 1'-0"
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
#9 MAIN Reinf, Tot. 6
Ast /Ae = 1.33%
3" = 1'-0"
#10 MAIN Reinf, Tot. 6
#6 HOOPS
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ae = 1.68%
3" = 1'-0"
DESIGN INFORMATIC
DIAMETER OF DRILL
EFFECTIVE DIA OF
EFFECTIVE AREA O
#4 SPIRALS
#6 HOOPS
#8 MAIN Reinf
#9 MAIN Reinf
#10 MAIN Reinf
f'ce = 5 ksi
fye = 60 ksi

ATTACHMENT A



STEEL ρ_s = A_{st}/A_e	UNFACTORED AXIAL LOAD (P_n)		SPIRALS SPACING C-C	HOOPS SPACING C-C	M_{nx} @ ε_c=0.003	M_p	ϕ_p	I_{cr}	$\phi_y/$	V_s
%	%	kips	in	in	kip-ft	kip-ft	rad/in	ft⁴	rad/in	kips
1.05% STEEL	0	0	6		236	224	0.001770	0.143	0.000224	55
		0	6		236	224	0.001770	0.143	0.000224	55
	5	95	6		294	273	0.002006	0.177	0.000221	55
		95	6		294	273	0.002006	0.177	0.000221	55
	10	189	6		344	318	0.001657	0.203	0.000225	55
		189	6		344	318	0.001657	0.203	0.000225	55
	15	284	6		390	358	0.001469	0.223	0.000231	55
		284	6		390	358	0.001469	0.223	0.000231	55
	20	378	6		414	392	0.001265	0.236	0.000238	55
		378	6		414	392	0.001265	0.236	0.000238	55
1.33% STEEL	0	0	6		287	274	0.001669	0.171	0.000230	55
		0	6		287	274	0.001669	0.171	0.000230	55
	5	98	6		345	323	0.001850	0.202	0.000230	55
		98	6		345	323	0.001850	0.202	0.000230	55
	10	196	6		385	366	0.001565	0.225	0.000234	55
		196	6		385	366	0.001565	0.225	0.000234	55
	15	294	6		420	403	0.001368	0.242	0.000239	55
		294	6		420	403	0.001368	0.242	0.000239	55
	20	392	6		453	434	0.001204	0.253	0.000246	55
		392	6		453	434	0.001204	0.253	0.000246	55
1.68% STEEL	0	0		6	345	326	0.001311	0.1983	0.000242	118
		0		6	346	326	0.001311	0.193	0.000242	118
	5	102		6	390	377	0.002795	0.22	0.000245	118
		102		6	390	377	0.002795	0.22	0.000245	119
	10	205		6	425	415	0.002552	0.239	0.000249	118
		205		6	425	415	0.002552	0.239	0.000249	119
	15	307		6	458	447	0.002271	0.253	0.000254	118
		307		6	458	447	0.002271	0.253	0.000254	119
	20	400		6	490	472	0.002054	0.261	0.000261	119
		404		6	490	472	0.002054	0.261	0.000261	118

DESIGN INFORMATION:

DIAMETER OF DRILLED SHAFT = 24"
EFFECTIVE Dia OF PILE (ϕ_{eff}) = 24"
EFFECTIVE AREA OF PILE (A_e) = 452 in²

#4 SPIRALS - DEFORMED ϕ = 0.56", A_b = 0.20 in²
#6 HOOPS - DEFORMED ϕ = 0.88", A_b = 0.44 in²
#8 MAIN Reinf - DEFORMED ϕ = 1.13", A_b = 0.79 in²
#9 MAIN Reinf - DEFORMED ϕ = 1.25", A_b = 1.00 in²
#10 MAIN Reinf - DEFORMED ϕ = 1.44", A_b = 1.27 in²

f'_{ce} = 5 ksi

f_{ye} = 68 ksi

NOTES:

- CLEARANCES SHOWN ARE TYPICAL
- CLEARANCES SHOWN ARE BASED ON DEFORMED REINFORCEMENT DIMENSIONS
- INSPECTION PIPES WILL NOT BE REQUIRED IF THE HOLE IS DRY OR DEWATERED WITHOUT THE USE OF TEMPORARY CASING TO CONTROL GROUND WATER

24" DIA CIDH PILE DETAILS WITHOUT CASING

Project Information

Enter information to identify this project

Project Name: Lack Road Bridge Replacement Over New River

Job Number: 227518-0000439

Client: Imperial County Department of Public Works

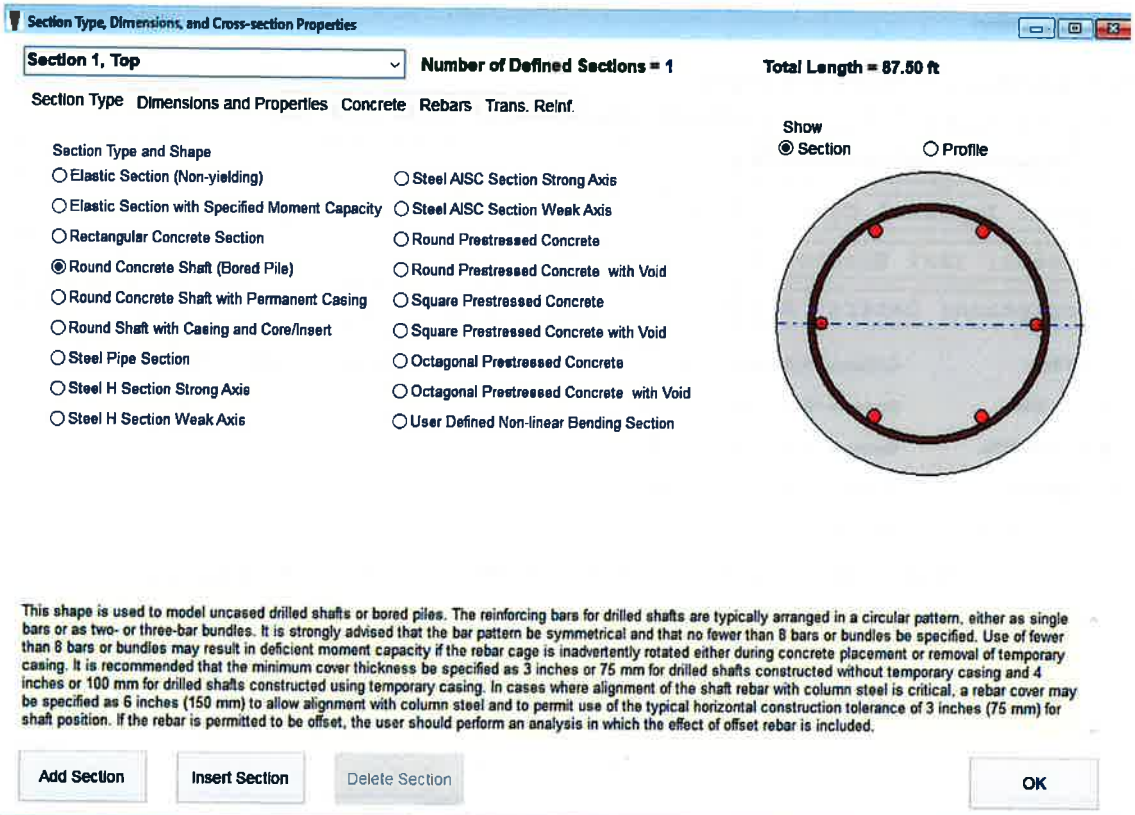
Engineer: Carl Henderson

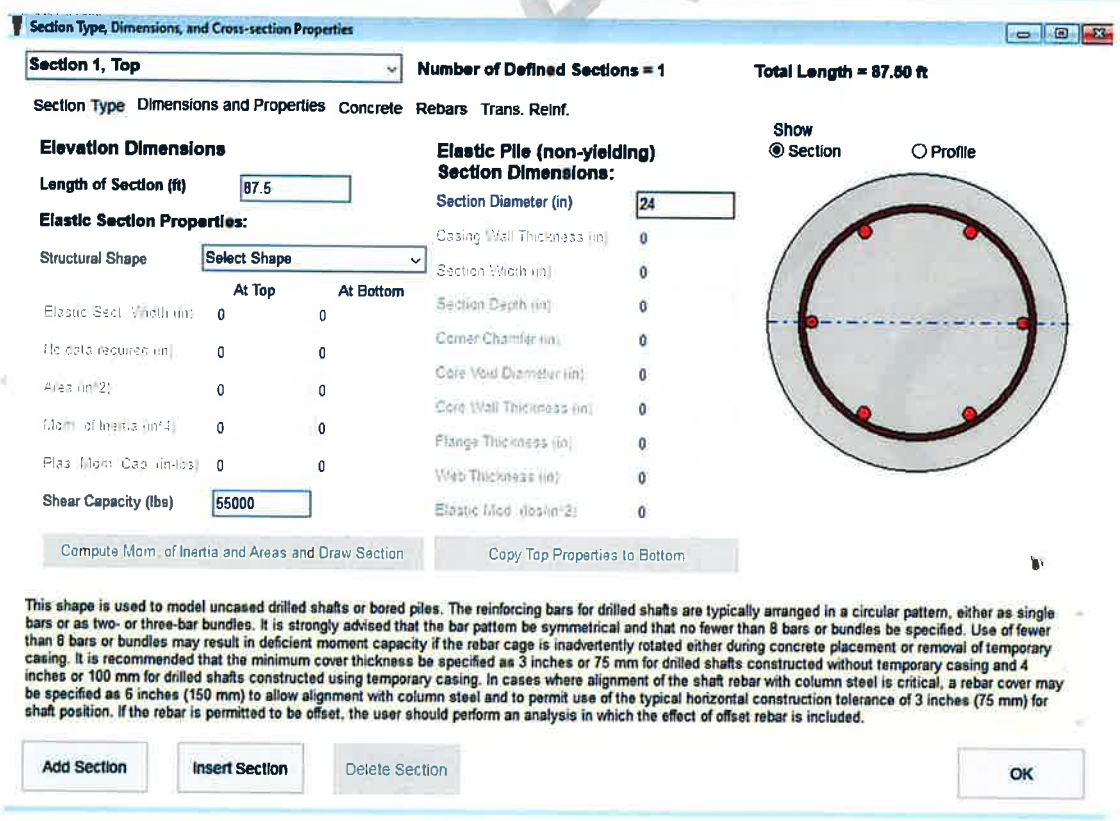
Description: Lateral Resistance - CIDH Concrete(24 inch);Boring A-19-01

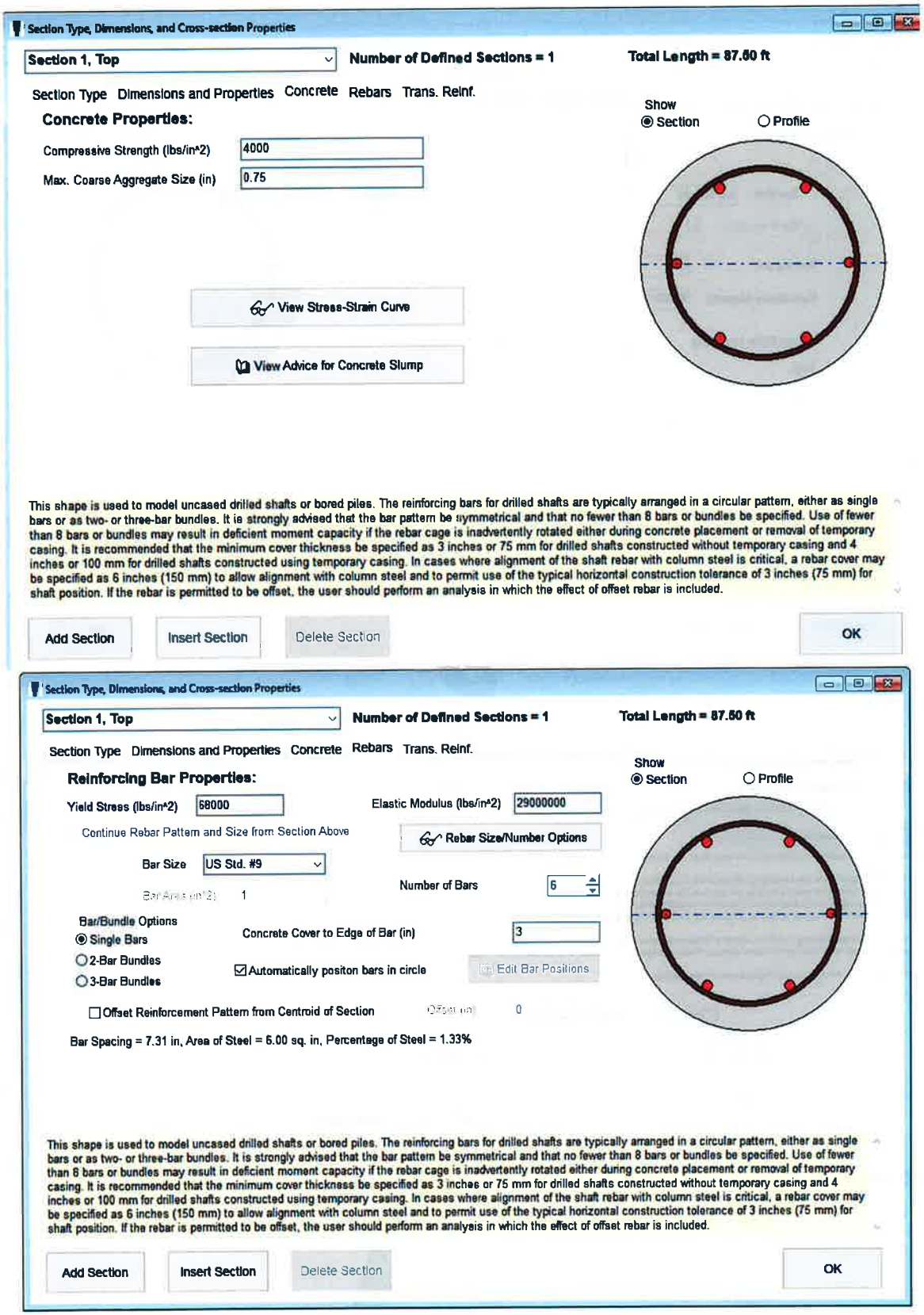
Path to Files:	C:\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix E - Lateral Pile Resistance Analysis
Input Data File:	Boring A-19-001 - 24 inch.lp10d
Output Report File:	Boring A-19-001 - 24 inch.lp10o
Plot Output File:	Boring A-19-001 - 24 inch.lp10p
Current Time and Date:	6/5/2019 7:01:34 PM

(Filenames, file paths, and date and time of program run are included in the output report.)

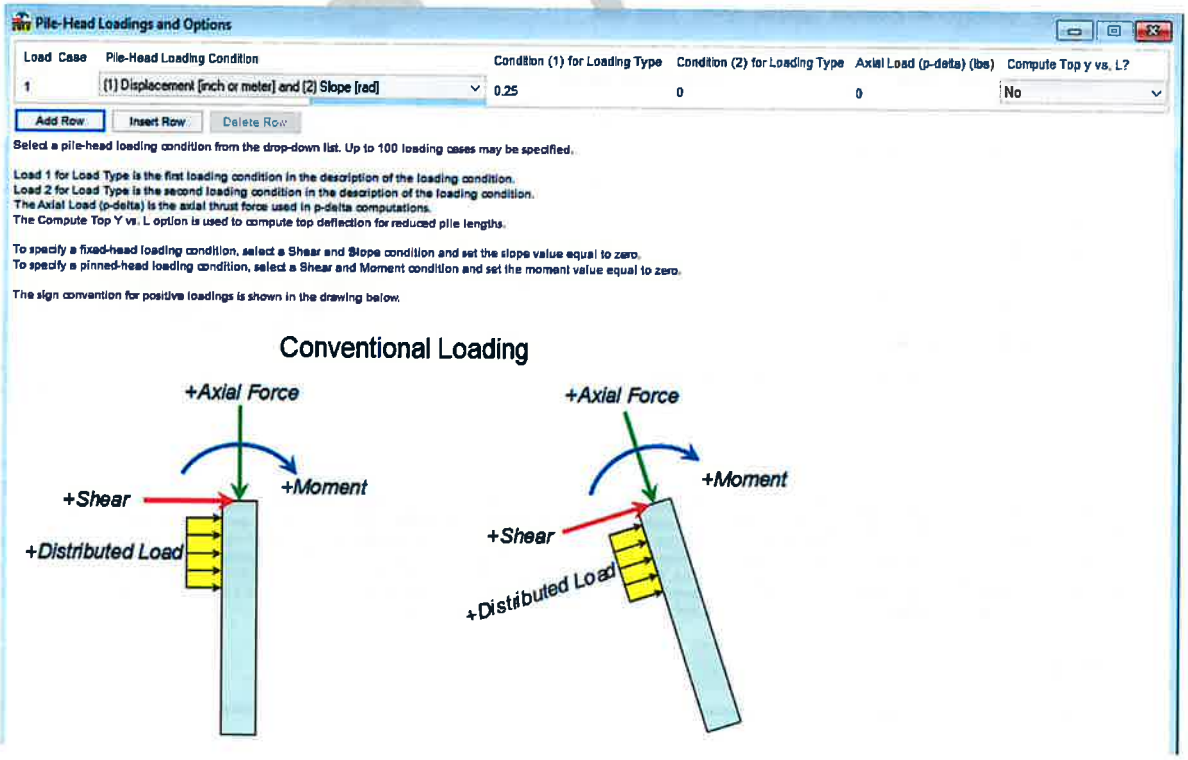
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Dimensions and Properties
Concrete
Rebars
Trans. Reinf.
Show
Section
Profile
Section Type and Shape
Elastic Section (Non-yielding)
Elastic Section with Specified Moment Capacity
Rectangular Concrete Section
Round Concrete Shaft (Bored Pile)
Round Concrete Shaft with Permanent Casing
Round Shaft with Casing and Core/Insert
Steel Pipe Section
Steel H Section Strong Axis
Steel H Section Weak Axis
Steel AISC Section Strong Axis
Steel AISC Section Weak Axis
Round Prestressed Concrete
Round Prestressed Concrete with Void
Square Prestressed Concrete
Square Prestressed Concrete with Void
Octagonal Prestressed Concrete
Octagonal Prestressed Concrete with Void
User Defined Non-linear Bending Section
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Dimensions and Properties
Concrete
Rebars
Trans. Reinf.
Elevation Dimensions
Length of Section (ft)
87.5
Elastic Section Properties:
Structural Shape
Select Shape
At Top
At Bottom
Shear Capacity (lbs)
55000
Elastic Pile (non-yielding) Section Dimensions:
Section Diameter (in)
24
Show
Section
Profile
Compute Mom. of Inertia and Areas and Draw Section
Copy Top Properties to Bottom
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Dimensions and Properties
Concrete
Rebars
Trans. Reinf.
Concrete Properties:
Compressive Strength (lbs/in^2)
4000
Max. Coarse Aggregate Size (in)
0.75
View Stress-Strain Curve
View Advice for Concrete Slump
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK
Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Dimensions and Properties
Concrete
Rebars
Trans. Reinf.
Reinforcing Bar Properties:
Yield Stress (lbs/in^2)
68000
Elastic Modulus (lbs/in^2)
29000000
Continue Rebar Pattern and Size from Section Above
Rebar Size/Number Options
Bar Size
US Std. #9
Number of Bars
6
1
Bar/Bundle Options
Single Bars
2-Bar Bundles
3-Bar Bundles
Concrete Cover to Edge of Bar (in)
3
Automatically positon bars in circle
Edit Bar Positions
Offset Reinforcement Pattern from Centroid of Section
0
Bar Spacing = 7.31 in, Area of Steel = 6.00 sq. in, Percentage of Steel = 1.33%
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Dimensions and Properties
Concrete
Rebars
Trans. Reinf.
Confined Section
Rebar Type
Spiral
Hoop
Bar Size
US Std. #4
Number of Bars
60
Bar Area (in^2)
0.2
Spacing (in)
6
Yield Stress (lbs/in^2)
68000
Use Strain Hardening
(For Longitudinal Reinforcement)
fu/fy
1.25
esh
0.0125
esu
0.09
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK

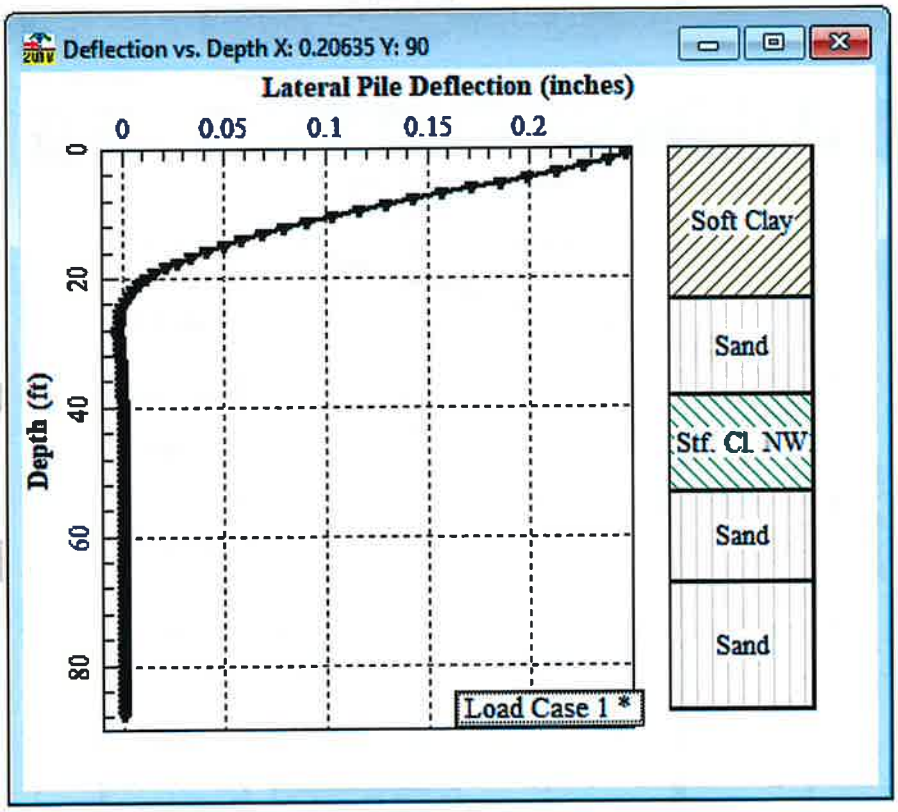

Pile-Head Loadings and Options
Load Case
Pile-Head Loading Condition
Condition (1) for Loading Type
Condition (2) for Loading Type
Axial Load (p-delta) (lbs)
Compute Top y vs. L?
1
(1) Displacement [inch or meter] and (2) Slope [rad]
0.25
0
0
No
Add Row
Insert Row
Delete Row
Select a pile-head loading condition from the drop-down list. Up to 100 loading cases may be specified.
Load 1 for Load Type is the first loading condition in the description of the loading condition.
Load 2 for Load Type is the second loading condition in the description of the loading condition.
The Axial Load (p-delta) is the axial thrust force used in p-delta computations.
The Compute Top Y vs. L option is used to compute top deflection for reduced pile lengths.
To specify a fixed-head loading condition, select a Shear and Slope condition and set the slope value equal to zero.
To specify a pinned-head loading condition, select a Shear and Moment condition and set the moment value equal to zero.
The sign convention for positive loadings is shown in the drawing below.
Conventional Loading
+Axial Force
+Moment
+Shear
+Distributed Load
+Axial Force
+Moment
+Shear
+Distributed Load

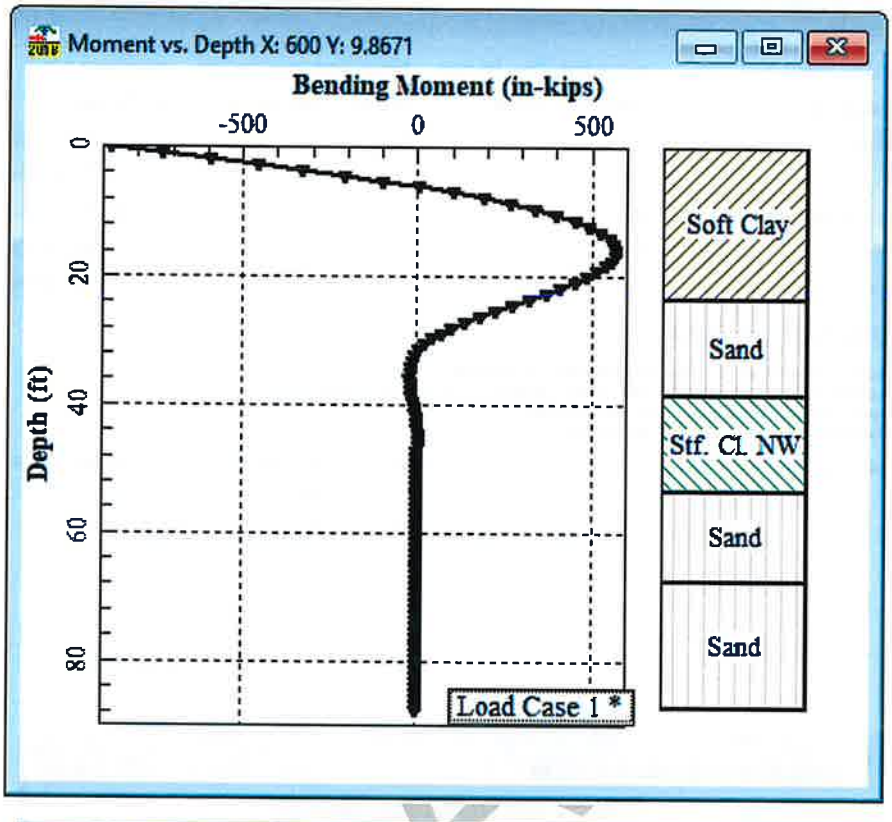
Soil Layers

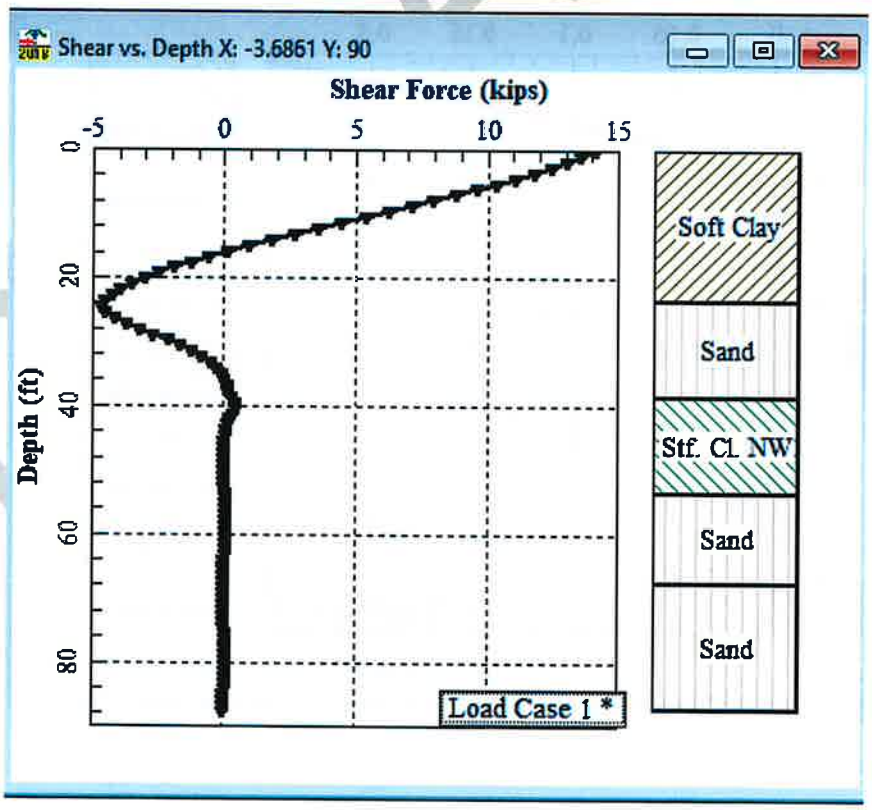
Layer	Select p-y Curve Type from Drop-down List	Vertical Depth Below Pile Head of Top of Soil Layer (ft)	Vertical Depth Below Pile Head of Bottom of Soil Layer (ft)	Press Button to Enter Soil Properties
1	Soft Clay (Matlock)	0	23.5	1: Soft Clay
2	Sand (Reese)	23.5	38.5	2: Sand (Reese, et al.)
3	Stiff Clay w/o Free Water (Reese)	38.5	53.5	3: Stiff Clay without Free Water
4	Sand (Reese)	53.5	67.5	4: Sand (Reese, et al.)
5	Sand (Reese)	67.5	87.5	5: Sand (Reese, et al.)

Add Row | Insert Row | Delete Row

All positive depth coordinates are defined as vertical distances below the pile-head.
If the pile-head is embedded below the ground surface, the top layer must extend from the ground surface (defined by a negative vertical depth) to some point below the pile head.
Select the p-y soil type using the drop-down list in the left table column.




Moment vs. Depth X: 600 Y: 9.8671
Bending Moment (in-kips)
-500
0
500
Depth (ft)
0
20
40
60
80
Soft Clay
Sand
Stf. Cl. NW
Sand
Sand
Load Case 1 *


Shear vs. Depth X: -3.6861 Y: 90
Shear Force (kips)
-5
0
5
10
15
Depth (ft)
0
20
40
60
80
Soft Clay
Sand
Stf. Cl. NW
Sand
Sand
Load Case 1 *

==========

LPile for Windows, Version 2018-10.002

Analysis of Individual Piles and Drilled Shafts

Subjected to Lateral Loading Using the p-y Method

==========

This copy of LPile is being used by:

Carl Henderson

NV5, Inc. - San Diego, CA

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is a violation of the software license agreement.

Files Used for Analysis

Path to file locations:

\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix E - Lateral Pile Resistance Analysis\

Name of input data file:

Boring A-19-001 - 24 inch.lp10

Name of output report file:

Boring A-19-001 - 24 inch.lp10

Name of plot output file:

Boring A-19-001 - 24 inch.lp10

Name of runtime message file:

Boring A-19-001 - 24 inch.lp10

Date and Time of Analysis

Date: June 5, 2019 Time: 19:09:16

Problem Title

Project Name: Lack Road Bridge Replacement Over New River

Job Number: 227518-0000439

Client: Imperial County Department of Public Works

Engineer: Carl Henderson

Description: Lateral Resistance - CIDH Concrete(24 inch);Boring A-19-01

Program Options and Settings

Computational Options:

- Use unfactored loads in computations (conventional analysis)

Engineering Units Used for Data Input and Computations:

- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

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

Loading Type and Number of Cycles of Loading:

- Static loading specified

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

Output Options:

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

Pile Structural Properties and Geometry

Number of pile sections defined = 1

Total length of pile = 87.500 ft

Depth of ground surface below top of pile = 0.0000 ft

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

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

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	24.0000
2	87.500	24.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile

Length of section = 87.500000 ft

Shaft Diameter = 24.000000 in

Shear capacity of section = 55000. lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees

= 0.000 radians

Pile Batter Angle = 0.000 degrees

= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 0.0000 ft

Distance from top of pile to bottom of layer = 23.500000 ft

Effective unit weight at top of layer = 58.700000 pcf

Effective unit weight at bottom of layer = 58.700000 pcf

Undrained cohesion at top of layer = 300.000000 psf

Undrained cohesion at bottom of layer = 300.000000 psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

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

Distance from top of pile to top of layer = 23.500000 ft

Distance from top of pile to bottom of layer = 38.500000 ft

Effective unit weight at top of layer = 63.500000 pcf

Effective unit weight at bottom of layer = 63.500000 pcf

Friction angle at top of layer = 34.000000 deg.

Friction angle at bottom of layer = 34.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer = 38.500000 ft

Distance from top of pile to bottom of layer = 53.500000 ft

Effective unit weight at top of layer = 56.200000 pcf

Effective unit weight at bottom of layer = 56.200000 pcf

Undrained cohesion at top of layer = 1750. psf

Undrained cohesion at bottom of layer = 1750. psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 53.500000 ft

Distance from top of pile to bottom of layer = 67.500000 ft

Effective unit weight at top of layer = 65.500000 pcf

Effective unit weight at bottom of layer = 65.500000 pcf

Friction angle at top of layer = 35.000000 deg.

Friction angle at bottom of layer = 35.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 67.500000 ft

Distance from top of pile to bottom of layer = 87.500000 ft

Effective unit weight at top of layer = 65.900000 pcf

Effective unit weight at bottom of layer = 65.900000 pcf

Friction angle at top of layer = 38.000000 deg.

Friction angle at bottom of layer = 38.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

(Depth of the lowest soil layer extends 0.000 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Soft Clay	0.00 23.5000	58.7000 58.7000	300.0000 300.0000	-- --	default default	-- --
2	Sand (Reese, et al.)	23.5000 38.5000	63.5000 63.5000	-- --	34.0000 34.0000	-- --	default default
3	Stiff Clay w/o Free Water	38.5000 53.5000	56.2000 56.2000	1750. 1750.	-- --	default default	-- --
4	Sand (Reese, et al.)	53.5000 67.5000	65.5000 65.5000	-- --	35.0000 35.0000	-- --	default default
5	Sand (Reese, et al.)	67.5000 87.5000	65.9000 65.9000	-- --	38.0000 38.0000	-- --	default default

---

Static Loading Type

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

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.250000 in	S = 0.0000 in/in	0.0000000	N.A.

V = shear force applied normal to pile axis

M = bending moment applied to pile head

y = lateral deflection normal to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).

Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

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

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section = 87.500000 ft

Shaft Diameter = 24.000000 in

Concrete Cover Thickness = 3.000000 in

Number of Reinforcing Bars = 6 bars

Yield Stress of Reinforcing Bars = 68000. psi

Modulus of Elasticity of Reinforcing Bars = 29000000. psi

Gross Area of Shaft = 452.389342 sq. in.

Total Area of Reinforcing Steel = 6.000000 sq. in.

Area Ratio of Steel Reinforcement = 1.33 percent

Edge-to-Edge Bar Spacing = 7.308000 in

Maximum Concrete Aggregate Size = 0.750000 in

Ratio of Bar Spacing to Aggregate Size = 9.74

Offset of Center of Rebar Cage from Center of Pile = 0.0000 in

Confined Section

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 1925.724 kips

Tensile Load for Cracking of Concrete = -205.732 kips

Nominal Axial Tensile Capacity = -408.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	8.436000	0.00000
2	1.128000	1.000000	4.218000	7.305790
3	1.128000	1.000000	-4.218000	7.305790
4	1.128000	1.000000	-8.436000	0.00000
5	1.128000	1.000000	-4.218000	-7.305790
6	1.128000	1.000000	4.218000	-7.305790

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

Minimum spacing between any two bars not equal to zero = 7.308 inches between bars 4 and 5.

Ratio of bar spacing to maximum aggregate size = 9.74

Concrete Properties:

Compressive Strength of Concrete = 4000. psi

Modulus of Elasticity of Concrete = 3604997. psi

Modulus of Rupture of Concrete = -474.341649 psi

Compression Strain at Peak Stress = 0.001886

Tensile Strain at Fracture of Concrete = -0.0001154

Maximum Coarse Aggregate Size = 0.750000 in

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

Number	Axial Thrust Force kips
1	0.000

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.

Y = stress in reinforcing steel has reached yield stress.

T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.

Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.

Position of neutral axis is measured from edge of compression side of pile.

Compressive stresses and strains are positive in sign.

Tensile stresses and strains are negative in sign.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conf Stress ksi	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000200	149.9781433	74989072.	12.0000155	0.00002400	-0.00002400	-0.0010177	0.1001357	0.6890409	
0.00000400	298.7624583	74690615.	12.0000156	0.00004800	-0.00004800	-0.0020352	0.1990021	1.3780818	
0.00000600	446.3529448	74392157.	12.0000157	0.00007200	-0.00007200	-0.0030527	0.2965992	2.0671227	
0.00000800	592.7496030	74093700.	12.0000157	0.00009600	-0.00009600	-0.0040700	0.3929269	2.7561637	
0.00001000	592.7496030	59274960.	6.2332537	0.00006233	-0.0001777	0.00000	0.2550722	-5.1175564	C
0.00001200	592.7496030	49395800.	6.2366937	0.00007484	-0.0002132	0.00000	0.3052466	-6.1398706	C
0.00001400	592.7496030	42339257.	6.2401470	0.00008736	-0.0002486	0.00000	0.3551390	-7.1617803	C
0.00001600	592.7496030	37046850.	6.2436135	0.00009990	-0.0002841	0.00000	0.4047487	-8.1832833	C
0.00001800	592.7496030	32930533.	6.2470935	0.0001124	-0.0003196	0.00000	0.4540748	-9.2043772	C
0.00002000	592.7496030	29637480.	6.2505870	0.0001250	-0.0003550	0.00000	0.5031164	-10.2250595	C
0.00002200	592.7496030	26943164.	6.2540941	0.0001376	-0.0003904	0.00000	0.5518727	-11.2453280	C
0.00002400	592.7496030	24697900.	6.2576149	0.0001502	-0.0004258	0.00000	0.6003429	-12.2651800	C
0.00002600	592.7496030	22798062.	6.2611496	0.0001628	-0.0004612	0.00000	0.6485261	-13.2846132	C
0.00002800	592.7496030	21169629.	6.2646982	0.0001754	-0.0004966	0.00000	0.6964214	-14.3036250	C
0.00003000	592.7496030	19758320.	6.2682609	0.0001880	-0.0005320	0.00000	0.7440279	-15.3222130	C
0.00003200	592.7496030	18523425.	6.2718377	0.0002007	-0.0005673	0.00000	0.7913448	-16.3403745	C

0.00003400	592.7496030	17433812.	6.2754289	0.0002134	-0.0006026	0.00000	0.8383711	-17.3581071 C
0.00003600	592.7496030	16465267.	6.2790345	0.0002260	-0.0006380	0.00000	0.8851059	-18.3754080 C
0.00003800	592.7496030	15598674.	6.2826546	0.0002387	-0.0006733	0.00000	0.9315484	-19.3922747 C
0.00004000	619.4931606	15487329.	6.2862893	0.0002515	-0.0007085	0.00000	0.9776976	-20.4087044 C
0.00004200	650.1062681	15478721.	6.2899388	0.0002642	-0.0007438	0.00000	1.0235526	-21.4246945 C
0.00004400	680.6836129	15470082.	6.2936032	0.0002769	-0.0007791	0.00000	1.0691124	-22.4402423 C
0.00004600	711.2250030	15461413.	6.2972826	0.0002897	-0.0008143	0.00000	1.1143761	-23.4553450 C
0.00004800	741.7302443	15452713.	6.3009771	0.0003024	-0.0008496	0.00000	1.1593428	-24.4699998 C
0.00005000	772.1991407	15443983.	6.3046870	0.0003152	-0.0008848	0.00000	1.2040115	-25.4842040 C
0.00005200	802.6314943	15435221.	6.3084122	0.0003280	-0.0009200	0.00000	1.2483812	-26.4979545 C
0.00005400	833.0271047	15426428.	6.3121529	0.0003409	-0.0009551	0.00000	1.2924510	-27.5112487 C
0.00005600	863.3857697	15417603.	6.3159093	0.0003537	-0.0009903	0.00000	1.3362198	-28.5240834 C
0.00005800	893.7072847	15408746.	6.3196814	0.0003665	-0.0010255	0.00000	1.3796867	-29.5364559 C
0.00006000	923.9914431	15399857.	6.3234695	0.0003794	-0.0010606	0.00000	1.4228506	-30.5483631 C
0.00006200	954.2380359	15390936.	6.3272737	0.0003923	-0.0010957	0.00000	1.4657105	-31.5598021 C
0.00006400	984.4468519	15381982.	6.3310940	0.0004052	-0.0011308	0.00000	1.5082655	-32.5707696 C
0.00006600	1015.	15372995.	6.3349307	0.0004181	-0.0011659	0.00000	1.5505145	-33.5812628 C
0.00006800	1045.	15363975.	6.3387839	0.0004310	-0.0012010	0.00000	1.5924564	-34.5912783 C
0.00007000	1075.	15354921.	6.3426537	0.0004440	-0.0012360	0.00000	1.6340902	-35.6008132 C

0.00007200	1105.	15345834.	6.3465403	0.0004570	-0.0012710	0.00000	1.6754148 -
36.6098641 C							
0.00007400	1135.	15336712.	6.3504438	0.0004699	-0.0013061	0.00000	1.7164291 -
37.6184279 C							
0.00007600	1165.	15327557.	6.3543644	0.0004829	-0.0013411	0.00000	1.7571321 -
38.6265012 C							
0.00007800	1195.	15318366.	6.3583022	0.0004959	-0.0013761	0.00000	1.7975227 -
39.6340808 C							
0.00008200	1255.	15299903.	6.3659839	0.0005220	-0.0014460	0.00000	1.8772997 -
41.6483301 C							
0.00008600	1314.	15281309.	6.3736641	0.0005481	-0.0015159	0.00000	1.9557911 -
43.6608014 C							
0.00009000	1374.	15262577.	6.3814108	0.0005743	-0.0015857	0.00000	2.0330043 -
45.6713175 C							
0.00009400	1433.	15243704.	6.3892252	0.0006006	-0.0016554	0.00000	2.1089304 -
47.6798519 C							
0.00009800	1492.	15224688.	6.3971084	0.0006269	-0.0017251	0.00000	2.1835601 -
49.6863775 C							
0.0001020	1551.	15205527.	6.4050619	0.0006533	-0.0017947	0.00000	2.2568839 -
51.6908667 C							
0.0001060	1610.	15186218.	6.4130867	0.0006798	-0.0018642	0.00000	2.3288925 -
53.6932911 C							
0.0001100	1668.	15166759.	6.4211843	0.0007063	-0.0019337	0.00000	2.3995758 -
55.6936216 C							
0.0001140	1727.	15147148.	6.4293561	0.0007329	-0.0020031	0.00000	2.4689240 -
57.6918283 C							
0.0001180	1785.	15127380.	6.4376035	0.0007596	-0.0020724	0.00000	2.5369267 -
59.6878806 C							
0.0001220	1843.	15107455.	6.4459278	0.0007864	-0.0021416	0.00000	2.6035738 -
61.6817471 C							
0.0001260	1901.	15087368.	6.4543306	0.0008132	-0.0022108	0.00000	2.6688543 -
63.6733955 C							
0.0001300	1959.	15067117.	6.4628135	0.0008402	-0.0022798	0.00000	2.7327576 -
65.6627927 C							
0.0001340	2016.	15046700.	6.4713780	0.0008672	-0.0023488	0.00000	2.7952725 -
67.6499047 C							
0.0001380	2074.	15026112.	6.4800257	0.0008942	-0.0024178	0.00000	2.8563875 -
68.0000000 CY							

0.0001420	2131.	15005350.	6.4887584	0.0009214	-0.0024866	0.00000	2.9160912 -
68.0000000 CY							
0.0001460	2188.	14984412.	6.4975777	0.0009486	-0.0025554	0.00000	2.9743716 -
68.0000000 CY							
0.0001500	2244.	14963294.	6.5064854	0.0009760	-0.0026240	0.00000	3.0312165 -
68.0000000 CY							
0.0001540	2301.	14941993.	6.5154834	0.0010034	-0.0026926	0.00000	3.0866134 -
68.0000000 CY							
0.0001580	2357.	14920504.	6.5245736	0.0010309	-0.0027611	0.00000	3.1405497 -
68.0000000 CY							
0.0001620	2414.	14898825.	6.5337579	0.0010585	-0.0028295	0.00000	3.1930123 -
68.0000000 CY							
0.0001660	2470.	14876951.	6.5430384	0.0010861	-0.0028979	0.00000	3.2439878 -
68.0000000 CY							
0.0001700	2525.	14854878.	6.5524172	0.0011139	-0.0029661	0.00000	3.2934624 -
68.0000000 CY							
0.0001740	2581.	14832603.	6.5618964	0.0011418	-0.0030342	0.00000	3.3414222 -
68.0000000 CY							
0.0001780	2635.	14805485.	6.5707289	0.0011696	-0.0031024	0.00000	3.3876313 -
68.0000000 CY							
0.0001820	2683.	14741307.	6.5735984	0.0011964	-0.0031716	0.00000	3.4305372 -
68.0000000 CY							
0.0001860	2719.	14617703.	6.5664909	0.0012214	-0.0032426	0.00000	3.4690569 -
68.0000000 CY							
0.0001900	2743.	14436291.	6.5492859	0.0012444	-0.0033156	0.00000	3.5032798 -
68.0000000 CY							
0.0001940	2759.	14221164.	6.5258794	0.0012660	-0.0033900	0.00000	3.5344248 -
68.0000000 CY							
0.0001980	2774.	14009254.	6.5027375	0.0012875	-0.0034645	0.00000	3.5643728 -
68.0000000 CY							
0.0002020	2789.	13805401.	6.4807391	0.0013091	-0.0035389	0.00000	3.5933873 -
68.0000000 CY							
0.0002060	2803.	13609134.	6.4598196	0.0013307	-0.0036133	0.00000	3.6214623 -
68.0000000 CY							
0.0002100	2818.	13420016.	6.4399198	0.0013524	-0.0036876	0.00000	3.6485919 -
68.0000000 CY							
0.0002140	2833.	13237643.	6.4209846	0.0013741	-0.0037619	0.00000	3.6747700 -
68.0000000 CY							

0.0002180	2847.	13061639.	6.4029633	0.0013958	-0.0038362	0.00000	3.6999904 -
68.0000000 CY							
0.0002220	2862.	12891659.	6.3858088	0.0014176	-0.0039104	0.00000	3.7242467 -
68.0000000 CY							
0.0002260	2876.	12727378.	6.3694773	0.0014395	-0.0039845	0.00000	3.7475327 -
68.0000000 CY							
0.0002300	2891.	12568375.	6.3535862	0.0014613	-0.0040587	0.00000	3.7697618 -
68.0000000 CY							
0.0002340	2905.	12414322.	6.3379422	0.0014831	-0.0041329	0.00000	3.7908994 -
68.0000000 CY							
0.0002380	2919.	12265149.	6.3230396	0.0015049	-0.0042071	0.00000	3.8110668 -
68.0000000 CY							
0.0002540	2975.	11712577.	6.2701918	0.0015926	-0.0045034	0.00000	3.8818947 -
68.0000000 CY							
0.0002700	3030.	11221045.	6.2268376	0.0016812	-0.0047988	0.00000	3.9366271 -
68.0000000 CY							
0.0002860	3083.	10780114.	6.1915423	0.0017708	-0.0050932	0.00000	3.9747691 -
68.0000000 CY							
0.0003020	3135.	10381541.	6.1631908	0.0018613	-0.0053867	0.00000	3.9957855 -
68.0000000 CY							
0.0003180	3186.	10018614.	6.1409649	0.0019528	-0.0056792	0.00000	3.9974180 -
68.0000000 CY							
0.0003340	3235.	9685782.	6.1242842	0.0020455	-0.0059705	0.00000	3.9980954 -
68.0000000 CY							
0.0003500	3283.	9378850.	6.1119838	0.0021392	-0.0062608	0.00000	3.9981031 -
68.0000000 CY							
0.0003660	3328.	9093458.	6.1033294	0.0022338	-0.0065502	0.00000	3.9974386 -
68.0000000 CY							
0.0003820	3368.	8816061.	6.0921625	0.0023272	-0.0068408	0.00000	3.9954947 -
68.0000000 CY							
0.0003980	3396.	8532256.	6.0702145	0.0024159	-0.0071361	0.00000	3.9986473
68.0000000 CY							
0.0004140	3412.	8240510.	6.0357469	0.0024988	-0.0074372	0.00000	3.9987525
68.0000000 CY							
0.0004300	3417.	7946549.	5.9910159	0.0025761	-0.0077439	0.00000	3.9940224
68.0000000 CY							
0.0004460	3419.	7666008.	5.9461724	0.0026520	-0.0080520	0.00000	3.9984544
68.0000000 CY							

0.0004620 68.0000000 CY	3421.	7403934.	5.9050089	0.0027281	-0.0083599	0.00000	3.9967885
0.0004780 68.0000000 CY	3422.	7158568.	5.8663683	0.0028041	-0.0086679	0.00000	3.9963131
0.0004940 68.0000000 CY	3423.	6928263.	5.8284564	0.0028793	-0.0089767	0.00000	3.9997546
0.0005100 68.0000000 CY	3423.	6712034.	5.7938333	0.0029549	-0.0092851	0.00000	3.9911636
0.0005260 68.0000000 CY	3424.	6508704.	5.7619981	0.0030308	-0.0095932	0.00000	3.9966313
0.0005420 68.0000000 CY	3424.	6317203.	5.7325695	0.0031071	-0.0099009	0.00000	3.9997478
0.0005580 68.0000000 CY	3424.	6136399.	5.7055814	0.0031837	-0.0102083	0.00000	3.9920981
0.0005740 68.0000000 CY	3424.	5965475.	5.6806677	0.0032607	-0.0105153	0.00000	3.9941643
0.0005900 68.0000000 CY	3424.	5803700.	5.6575201	0.0033379	-0.0108221	0.00000	3.9986123
0.0006060 68.0000000 CY	3424.	5650467.	5.6355248	0.0034151	-0.0111289	0.00000	3.9994553
0.0006220 68.0000000 CY	3424.	5505117.	5.6133141	0.0034915	-0.0114365	0.00000	3.9881580
0.0006380 68.0000000 CY	3424.	5367058.	5.5925248	0.0035680	-0.0117440	0.00000	3.9929624
0.0006540 68.0000000 CY	3424.	5235754.	5.5730592	0.0036448	-0.0120512	0.00000	3.9975660
0.0006700 68.0000000 CY	3424.	5110721.	5.5548293	0.0037217	-0.0123583	0.00000	3.9997879
0.0006860 68.0781955 CY	3424.	4991520.	5.5379478	0.0037990	-0.0126650	0.00000	3.9939172 -
0.0007020 68.3471142 CY	3424.	4877753.	5.5461614	0.0038934	-0.0129546	0.00000	3.9890114 -
0.0007180 68.6261436 CY	3424.	4769057.	5.5308184	0.0039711	-0.0132609	0.00000	3.9946253 -
0.0007340 68.8995630 CY	3424.	4665099.	5.5163748	0.0040490	-0.0135670	0.00000	3.9982679 -
0.0007500 69.1398603 CY	3424.	4565577.	5.5449909	0.0041587	-0.0138413	0.00000	3.9929544 -

0.0007660	3424.	4470213.	5.5315728	0.0042372	-0.0141468	0.00000	3.9834102	-
69.4028619 CY								
0.0007820	3424.	4378751.	5.5729707	0.0043581	-0.0144099	0.00000	3.9956941	-
69.6250747 CY								
0.0007980	3424.	4290956.	5.5598516	0.0044368	-0.0147152	0.00000	3.9986205	-
69.8786051 CY								
0.0008140	3424.	4206613.	5.6117214	0.0045679	-0.0149681	0.00000	3.9861077	-
70.0846555 CY								
0.0008300	3424.	4125522.	5.5989183	0.0046471	-0.0152729	0.00000	3.9817047	-
70.3291599 CY								
0.0008460	3424.	4047498.	5.6570973	0.0047859	-0.0155181	0.00000	3.9977790	-
70.5222203 CY								
0.0008620	3424.	3972370.	5.6458894	0.0048668	-0.0158212	0.00000	3.9995824	-
70.7572827 CY								
0.0008780	3424.	3899981.	5.6345047	0.0049471	-0.0161249	0.00000	3.9983119	-
70.9884286 CY								
0.0009740	3424.	3515588.	5.8085599	0.0056575	-0.0177185	0.00000	3.9917289	-
72.1336175 CY								
0.0010700	3424.	3200171.	5.9320456	0.0063473	-0.0193327	216719.	3.9987771	-
73.1894705 CY								
0.0011660	3424.	2936692.	5.9707509	0.0069619	-0.0210221	223166.	3.9884373	-
74.1954513 CY								
0.0012620	3424.	2713299.	6.1073980	0.0077075	-0.0225805	159488.	3.9918977	-
75.0428632 CY								

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003

or maximum developed moment if pile fails at smaller strains.

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

1	0.000	3423.399	0.00300000

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

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

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

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

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3423.	0.0000	2225.	14970468.
1	0.70	3423.	0.0000	2396.	14905475.
1	0.75	3423.	0.0000	2568.	14837946.

Layer No.	Top of Layer Below Pile Head ft	Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Equivalent Layer is Rock or Rock Layer Below	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	102667.
2	23.5000	11.4149	No	No	102667.	908781.
3	38.5000	39.1366	No	No	1011447.	472500.
4	53.5000	29.4243	No	No	1483947.	3140944.
5	67.5000	39.6115	Yes	No	4624891.	N.A.

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

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)

Displacement of pile head = 0.250000 inches

Rotation of pile head = 0.000E+00 radians

Axial load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-877121.	14095.	0.00	0.00	1.54E+10	-44.4612	933.6845	0.00
0.8750	0.2469	-731879.	13570.	-5.48E-04	0.00	1.54E+10	-50.0294	2128.	0.00
1.7500	0.2385	-592152.	13018.	-9.94E-04	0.00	1.58E+10	-55.1462	2428.	0.00
2.6250	0.2260	-458506.	12415.	-0.00122	0.00	7.44E+10	-59.7538	2776.	0.00
3.5000	0.2128	-331447.	11765.	-0.00128	0.00	7.46E+10	-64.0465	3160.	0.00
4.3750	0.1991	-211449.	11071.	-0.00132	0.00	7.48E+10	-68.0026	3585.	0.00
5.2500	0.1852	-98949.	10338.	-0.00134	0.00	7.50E+10	-71.6019	4060.	0.00
6.1250	0.1710	5658.	9570.	-0.00134	0.00	7.50E+10	-74.8256	4594.	0.00
7.0000	0.1569	102015.	8769.	-0.00134	0.00	7.50E+10	-77.6563	5196.	0.00
7.8750	0.1430	189810.	7941.	-0.00132	0.00	7.49E+10	-80.0777	5882.	0.00
8.7500	0.1293	268776.	7090.	-0.00128	0.00	7.47E+10	-82.0748	6667.	0.00
9.6250	0.1160	338694.	6220.	-0.00124	0.00	7.46E+10	-83.6339	7572.	0.00
10.5000	0.1032	399392.	5336.	-0.00119	0.00	7.45E+10	-84.7422	8624.	0.00
11.3750	0.09098	450746.	4443.	-0.00113	0.00	7.44E+10	-85.3883	9855.	0.00
12.2500	0.07945	492687.	3545.	-0.00106	0.00	7.43E+10	-85.5614	11308.	0.00
13.1250	0.06865	525194.	2648.	-9.91E-04	0.00	7.42E+10	-85.2515	13039.	0.00
14.0000	0.05863	548302.	1769.	-9.15E-04	0.00	7.42E+10	-82.2612	14732.	0.00
14.8750	0.04942	562341.	929.0691	-8.37E-04	0.00	7.41E+10	-77.7097	16509.	0.00
15.7500	0.04105	567812.	137.5777	-7.57E-04	0.00	7.41E+10	-73.0506	18683.	0.00
16.6250	0.03353	565230.	-604.4317	-6.77E-04	0.00	7.41E+10	-68.2845	21383.	0.00
17.5000	0.02685	555119.	-1296.	-5.97E-04	0.00	7.42E+10	-63.4084	24800.	0.00
18.3750	0.02099	538018.	-1935.	-5.20E-04	0.00	7.42E+10	-58.4141	29224.	0.00
19.2500	0.01593	514476.	-2522.	-4.45E-04	0.00	7.42E+10	-53.2848	35123.	0.00
20.1250	0.01163	485060.	-3053.	-3.75E-04	0.00	7.43E+10	-47.9884	43309.	0.00
21.0000	0.00806	450353.	-3528.	-3.09E-04	0.00	7.44E+10	-42.4631	55322.	0.00

21.8750	0.00515	410964.	-3943.	-2.48E-04	0.00	7.44E+10	-36.5823	74557.	0.00
22.7500	0.00285	367543.	-4293.	-1.93E-04	0.00	7.45E+10	-30.0465	110577.	0.00
23.6250	0.00110	320808.	-4574.	-1.45E-04	0.00	7.46E+10	-23.3582	223372.	0.00
24.5000	-1.83E-04	271499.	-4675.	-1.03E-04	0.00	7.47E+10	4.0409	231645.	0.00
25.3750	-0.00106	222634.	-4526.	-6.82E-05	0.00	7.48E+10	24.3056	239918.	0.00
26.2500	-0.00162	176450.	-4198.	-4.02E-05	0.00	7.49E+10	38.2006	248191.	0.00
27.1250	-0.00191	134477.	-3753.	-1.85E-05	0.00	7.50E+10	46.6222	256464.	0.00
28.0000	-0.00200	97644.	-3243.	-2.21E-06	0.00	7.50E+10	50.5201	264737.	0.00
28.8750	-0.00196	66381.	-2711.	9.28E-06	0.00	7.50E+10	50.8350	273010.	0.00
29.7500	-0.00181	40723.	-2189.	1.68E-05	0.00	7.50E+10	48.4588	281283.	0.00
30.6250	-0.00160	20407.	-1703.	2.11E-05	0.00	7.50E+10	44.2011	289556.	0.00
31.5000	-0.00137	4965.	-1267.	2.28E-05	0.00	7.50E+10	38.7677	297829.	0.00
32.3750	-0.00112	-6204.	-891.7280	2.27E-05	0.00	7.50E+10	32.7494	306102.	0.00
33.2500	-8.89E-04	-13761.	-580.0349	2.13E-05	0.00	7.50E+10	26.6207	314375.	0.00
34.1250	-6.75E-04	-18384.	-331.3672	1.91E-05	0.00	7.50E+10	20.7446	322648.	0.00
35.0000	-4.88E-04	-20720.	-141.6973	1.64E-05	0.00	7.50E+10	15.3830	330921.	0.00
35.8750	-3.32E-04	-21360.	-4.7041	1.34E-05	0.00	7.50E+10	10.7109	339194.	0.00
36.7500	-2.06E-04	-20819.	87.3926	1.05E-05	0.00	7.50E+10	6.8313	347467.	0.00
37.6250	-1.12E-04	-19525.	143.1628	7.64E-06	0.00	7.50E+10	3.7916	355740.	0.00
38.5000	-4.61E-05	-17813.	284.7365	5.02E-06	0.00	7.50E+10	23.1748	5278923.	0.00
39.3750	-6.47E-06	-13545.	423.4765	2.83E-06	0.00	7.50E+10	3.2518	5278923.	0.00
40.2500	1.32E-05	-8920.	405.5881	1.25E-06	0.00	7.50E+10	-6.6591	5278923.	0.00
41.1250	1.98E-05	-5028.	318.2482	2.77E-07	0.00	7.50E+10	-9.9771	5278923.	0.00
42.0000	1.91E-05	-2236.	215.5810	-2.32E-07	0.00	7.50E+10	-9.5786	5278923.	0.00
42.8750	1.50E-05	-500.7696	125.7764	-4.24E-07	0.00	7.50E+10	-7.5271	5278923.	0.00
43.7500	1.02E-05	404.9526	59.4559	-4.30E-07	0.00	7.50E+10	-5.1054	5278923.	0.00
44.6250	5.93E-06	747.8035	16.9913	-3.50E-07	0.00	7.50E+10	-2.9831	5278923.	0.00
45.5000	2.81E-06	761.7705	-6.0906	-2.44E-07	0.00	7.50E+10	-1.4135	5278923.	0.00
46.3750	8.09E-07	619.9008	-15.6479	-1.47E-07	0.00	7.50E+10	-0.4070	5278923.	0.00
47.2500	-2.81E-07	433.1637	-17.0424	-7.35E-08	0.00	7.50E+10	0.1414	5278923.	0.00
48.1250	-7.35E-07	262.0111	-14.3604	-2.49E-08	0.00	7.50E+10	0.3695	5278923.	0.00

49.0000	-8.04E-07	131.5957	-10.2996	2.68E-09	0.00	7.50E+10	0.4040	5278923.	0.00
49.8750	-6.79E-07	45.7186	-6.3876	1.51E-08	0.00	7.50E+10	0.3412	5278923.	0.00
50.7500	-4.87E-07	-2.5436	-3.3123	1.81E-08	0.00	7.50E+10	0.2446	5278923.	0.00
51.6250	-2.98E-07	-23.8395	-1.2413	1.63E-08	0.00	7.50E+10	0.1499	5278923.	0.00
52.5000	-1.45E-07	-28.6109	-0.07223	1.26E-08	0.00	7.50E+10	0.07280	5278923.	0.00
53.3750	-3.35E-08	-25.3564	0.3985	8.82E-09	0.00	7.50E+10	0.01686	5278923.	0.00
54.2500	4.05E-08	-20.2434	0.4751	5.63E-09	0.00	7.50E+10	-0.00225	585230.	0.00
55.1250	8.47E-08	-15.3789	0.4381	3.14E-09	0.00	7.50E+10	-0.00480	594669.	0.00
56.0000	1.06E-07	-11.0433	0.3808	1.29E-09	0.00	7.50E+10	-0.00612	604108.	0.00
56.8750	1.12E-07	-7.3818	0.3145	-4.70E-12	0.00	7.50E+10	-0.00653	613547.	0.00
57.7500	1.06E-07	-4.4397	0.2471	-8.32E-10	0.00	7.50E+10	-0.00630	622986.	0.00
58.6250	9.42E-08	-2.1923	0.1843	-1.30E-09	0.00	7.50E+10	-0.00567	632426.	0.00
59.5000	7.90E-08	-0.5703	0.1291	-1.49E-09	0.00	7.50E+10	-0.00483	641865.	0.00
60.3750	6.29E-08	0.5195	0.08331	-1.49E-09	0.00	7.50E+10	-0.00390	651304.	0.00
61.2500	4.76E-08	1.1791	0.04710	-1.37E-09	0.00	7.50E+10	-0.00300	660743.	0.00
62.1250	3.40E-08	1.5085	0.01997	-1.19E-09	0.00	7.50E+10	-0.00217	670182.	0.00
63.0000	2.27E-08	1.5984	8.59E-04	-9.69E-10	0.00	7.50E+10	-0.00147	679622.	0.00
63.8750	1.37E-08	1.5265	-0.01156	-7.50E-10	0.00	7.50E+10	-8.98E-04	689061.	0.00
64.7500	6.93E-09	1.3556	-0.01869	-5.48E-10	0.00	7.50E+10	-4.61E-04	698500.	0.00
65.6250	2.16E-09	1.1339	-0.02188	-3.74E-10	0.00	7.50E+10	-1.46E-04	707939.	0.00
66.5000	-9.31E-10	0.8962	-0.02231	-2.32E-10	0.00	7.50E+10	6.36E-05	717378.	0.00
67.3750	-2.71E-09	0.6654	-0.02099	-1.23E-10	0.00	7.50E+10	1.87E-04	726817.	0.00
68.2500	-3.51E-09	0.4553	-0.01820	-4.42E-11	0.00	7.50E+10	3.45E-04	1032209.	0.00
69.1250	-3.64E-09	0.2832	-0.01449	7.47E-12	0.00	7.50E+10	3.62E-04	1045443.	0.00
70.0000	-3.35E-09	0.1511	-0.01081	3.79E-11	0.00	7.50E+10	3.38E-04	1058676.	0.00
70.8750	-2.84E-09	0.05619	-0.00751	5.24E-11	0.00	7.50E+10	2.90E-04	1071909.	0.00
71.7500	-2.25E-09	-0.00672	-0.00477	5.58E-11	0.00	7.50E+10	2.33E-04	1085143.	0.00
72.6250	-1.67E-09	-0.04398	-0.00263	5.23E-11	0.00	7.50E+10	1.75E-04	1098376.	0.00
73.5000	-1.15E-09	-0.06198	-0.00107	4.49E-11	0.00	7.50E+10	1.22E-04	1111610.	0.00
74.3750	-7.27E-10	-0.06654	-2.48E-05	3.59E-11	0.00	7.50E+10	7.79E-05	1124843.	0.00
75.2500	-3.99E-10	-0.06250	6.11E-04	2.69E-11	0.00	7.50E+10	4.32E-05	1138077.	0.00

76.1250	-1.63E-10	-0.05370	9.32E-04	1.87E-11	0.00	7.50E+10	1.79E-05	1151310.	0.00
77.0000	-6.01E-12	-0.04293	0.00103	1.19E-11	0.00	7.50E+10	6.67E-07	1164544.	0.00
77.8750	8.79E-11	-0.03209	9.81E-04	6.70E-12	0.00	7.50E+10	-9.86E-06	1177777.	0.00
78.7500	1.35E-10	-0.02233	8.49E-04	2.89E-12	0.00	7.50E+10	-1.53E-05	1191010.	0.00
79.6250	1.49E-10	-0.01426	6.80E-04	0.00	0.00	7.50E+10	-1.70E-05	1204244.	0.00
80.5000	1.41E-10	-0.00806	5.04E-04	-1.24E-12	0.00	7.50E+10	-1.64E-05	1217477.	0.00
81.3750	1.23E-10	-0.00367	3.42E-04	-2.06E-12	0.00	7.50E+10	-1.44E-05	1230711.	0.00
82.2500	9.82E-11	-8.69E-04	2.06E-04	-2.38E-12	0.00	7.50E+10	-1.16E-05	1243944.	0.00
83.1250	7.26E-11	6.53E-04	9.92E-05	-2.39E-12	0.00	7.50E+10	-8.70E-06	1257178.	0.00
84.0000	4.80E-11	0.00122	2.31E-05	-2.26E-12	0.00	7.50E+10	-5.81E-06	1270411.	0.00
84.8750	2.52E-11	0.00114	-2.36E-05	-2.10E-12	0.00	7.50E+10	-3.08E-06	1283645.	0.00
85.7500	3.98E-12	7.20E-04	-4.23E-05	-1.97E-12	0.00	7.50E+10	-4.92E-07	1296878.	0.00
86.6250	-1.61E-11	2.49E-04	-3.43E-05	-1.90E-12	0.00	7.50E+10	2.01E-06	1310112.	0.00
87.5000	-3.59E-11	0.00	0.00	-1.88E-12	0.00	7.50E+10	4.52E-06	661672.	0.00

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

Output Summary for Load Case No. 1:

Pile-head deflection = 0.25000000 inches

Computed slope at pile head = 0.000000 radians

Maximum bending moment = -877121. inch-lbs

Maximum shear force = 14095. lbs

Depth of maximum bending moment = 0.000000 feet below pile head

Depth of maximum shear force = 0.000000 feet below pile head

Number of iterations = 15

Number of zero deflection points = 7

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs

Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians

Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.

Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs

Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type Pile-head	Load 1	Load Type Pile-head	Load 2	Axial Pile-head Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.2500	S, rad	0.00	0.00	0.2500	0.00	14095.	-877121.

Maximum pile-head deflection = 0.2500000000 inches

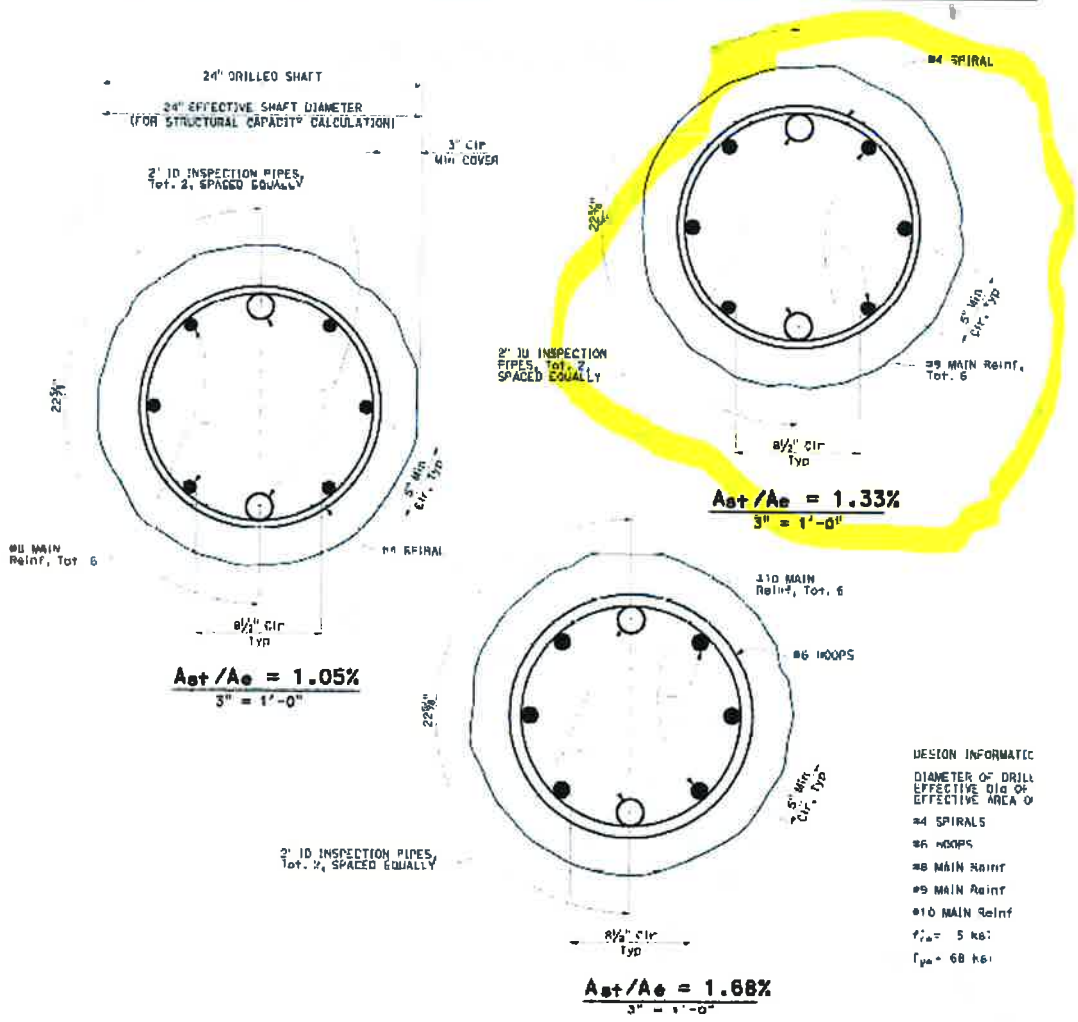
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.

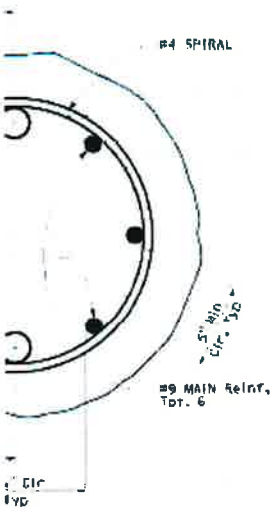
Boring A-19-002

Abutment #1

24-inch CIDH Pile


24" DRILLED SHAFT
24" EFFECTIVE SHAFT DIAMETER
(FOR STRUCTURAL CAPACITY CALCULATION)
3" CLR
MIN COVER
2" ID INSPECTION PIPES,
Tot. 2, SPACED EQUALLY
#4 SPIRAL
#8 MAIN
Reinf, Tot 6
8½" Clr
Typ
Ast /Ae = 1.05%
3" = 1'-0"
2" ID INSPECTION
PIPES, Tot. 2,
SPACED EQUALLY
#9 MAIN Reinf,
Tot. 6
8½" Clr
Typ
Ast /Ae = 1.33%
3" = 1'-0"
#10 MAIN
Reinf, Tot. 6
#6 HOOPS
2" ID INSPECTION PIPES,
Tot. 2, SPACED EQUALLY
8½" Clr
Typ
Ast/Ae = 1.68%
3" = 1'-0"
DESIGN INFORMATIC
DIAMETER OF DRILL
EFFECTIVE Dia OF
EFFECTIVE AREA O
#4 SPIRALS
#6 HOOPS
#8 MAIN Reinf
#9 MAIN Reinf
#10 MAIN Reinf
f'ce = 5 ksi
fye = 68 ksi

ATTACHMENT A



= 1.33%
1'-0"

STEEL $P_s = A_{st}/A_g$	UNFACTORED AXIAL LOAD (P_n)		SPIRALS SPACING C-C	HOOPS SPACING C-C	M_{nc} @ ε_c=0.003	M_p	ϕ_p	L_{cr}	ϕ_y/l	V_s
%	%	kips	in	in	kip-ft	kip-ft	rad/in	ft	rad/in	kips
1.00% STEEL	0	0	6		236	224	0.001770	0.143	0.000224	55
		0	6		236	224	0.001770	0.143	0.000224	55
	5	93	6		294	273	0.002006	0.177	0.000221	55
		93	6		294	273	0.002006	0.177	0.000221	55
	10	189	6		348	318	0.001857	0.203	0.000225	55
		189	6		348	318	0.001857	0.203	0.000225	55
	15	284	6		390	358	0.001469	0.223	0.000231	55
		284	6		390	358	0.001469	0.223	0.000231	55
	20	378	6		414	382	0.001265	0.236	0.000238	55
		378	6		414	382	0.001265	0.236	0.000238	55
1.33% STEEL	0	0	6		287	274	0.001669	0.171	0.000230	55
		0	6		287	274	0.001669	0.171	0.000230	55
	5	98	6		345	323	0.001850	0.202	0.000230	55
		98	6		345	323	0.001850	0.202	0.000230	55
	10	196	6		385	366	0.001565	0.225	0.000234	55
		196	6		385	366	0.001565	0.225	0.000234	55
	15	294	6		420	403	0.001368	0.242	0.000239	55
		294	6		420	403	0.001368	0.242	0.000239	55
	20	392	6		453	434	0.001204	0.253	0.000246	55
		392	6		453	434	0.001204	0.253	0.000246	55
1.00% STEEL	0	0		6	345	326	0.001311	0.1983	0.000242	118
		0		6	346	326	0.001311	0.143	0.000242	118
	5	102		6	390	377	0.002795	0.22	0.000245	118
		102		6	390	377	0.002795	0.22	0.000245	118
	10	205		6	425	415	0.002552	0.239	0.000249	118
		205		6	425	415	0.002552	0.239	0.000249	118
	15	307		6	456	447	0.002271	0.253	0.000254	118
		307		6	458	447	0.002271	0.253	0.000254	118
	20	409		6	490	472	0.002054	0.261	0.000261	118
		409		6	490	472	0.002054	0.261	0.000261	118

DESIGN INFORMATION:

DIAMETER OF DRILLED SHAFT = 24"
EFFECTIVE Dia OF PILE (D_{eff}) = 24"
EFFECTIVE AREA OF PILE (A_{ef}) = 452 in^2

#4 SPIRALS - DEFORMED ø = 0.56", A_b = 0.20 in^2
#6 HOOPS - DEFORMED ø = 0.88", A_b = 0.44 in^2
#8 MAIN Reinf - DEFORMED ø = 1.13", A_b = 0.79 in^2
#9 MAIN Reinf - DEFORMED ø = 1.26", A_b = 1.00 in^2
#10 MAIN Reinf - DEFORMED ø = 1.44", A_b = 1.27 in^2

f'_{ce} = 5 ksi
f_{ye} = 68 ksi

NOTES:

- CLEARANCES SHOWN ARE TYPICAL
- CLEARANCES SHOWN ARE BASED ON DEFORMED REINFORCEMENT DIMENSIONS
- INSPECTION PIPES WILL NOT BE REQUIRED IF THE HOLE IS DRY OR DEWATERED WITHOUT THE USE OF TEMPORARY CASING TO CONTROL GROUND WATER

24" DIA CIDH PILE DETAILS WITHOUT CASING

12-1.1

Project Information

Enter information to identify this project

Project Name: Lack Road Bridge Replacement Over New River

Job Number: 227518-0000439

Client: Imperial County Department of Public Works

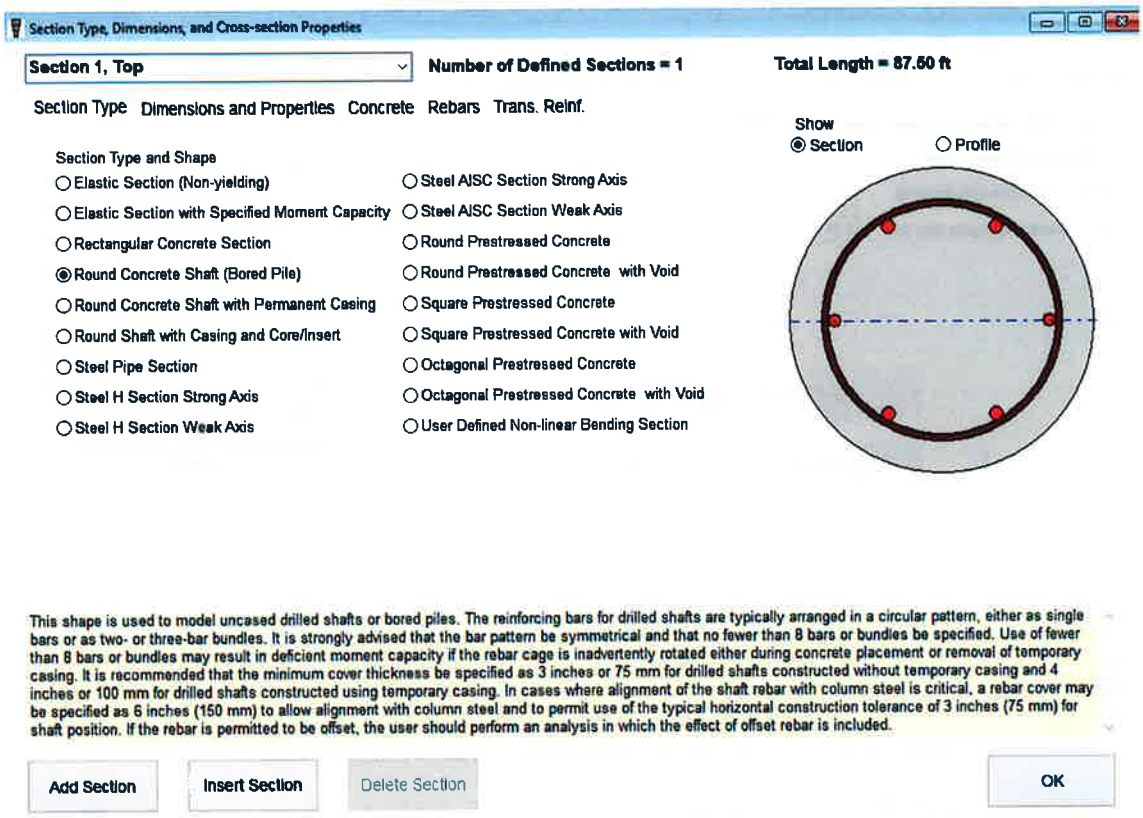
Engineer: Carl Henderson

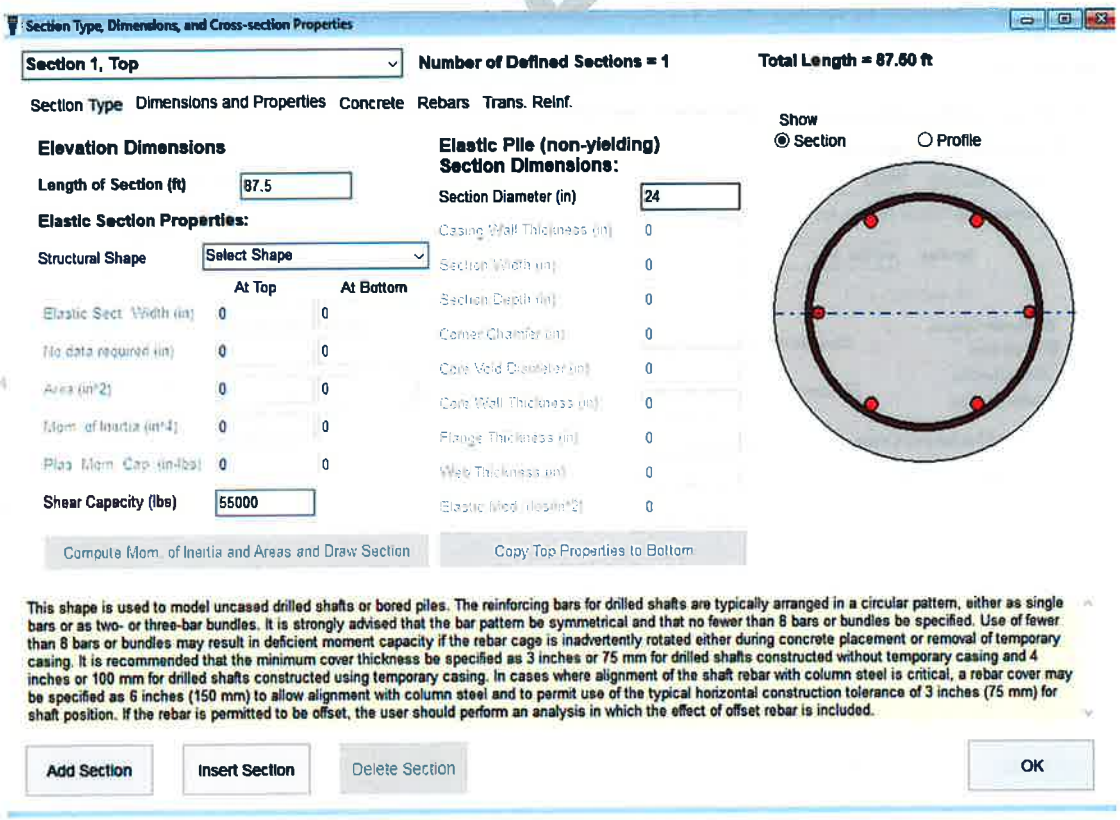
Description: Lateral Resistance - CIDH Concrete(24 inch);Boring A-19-02

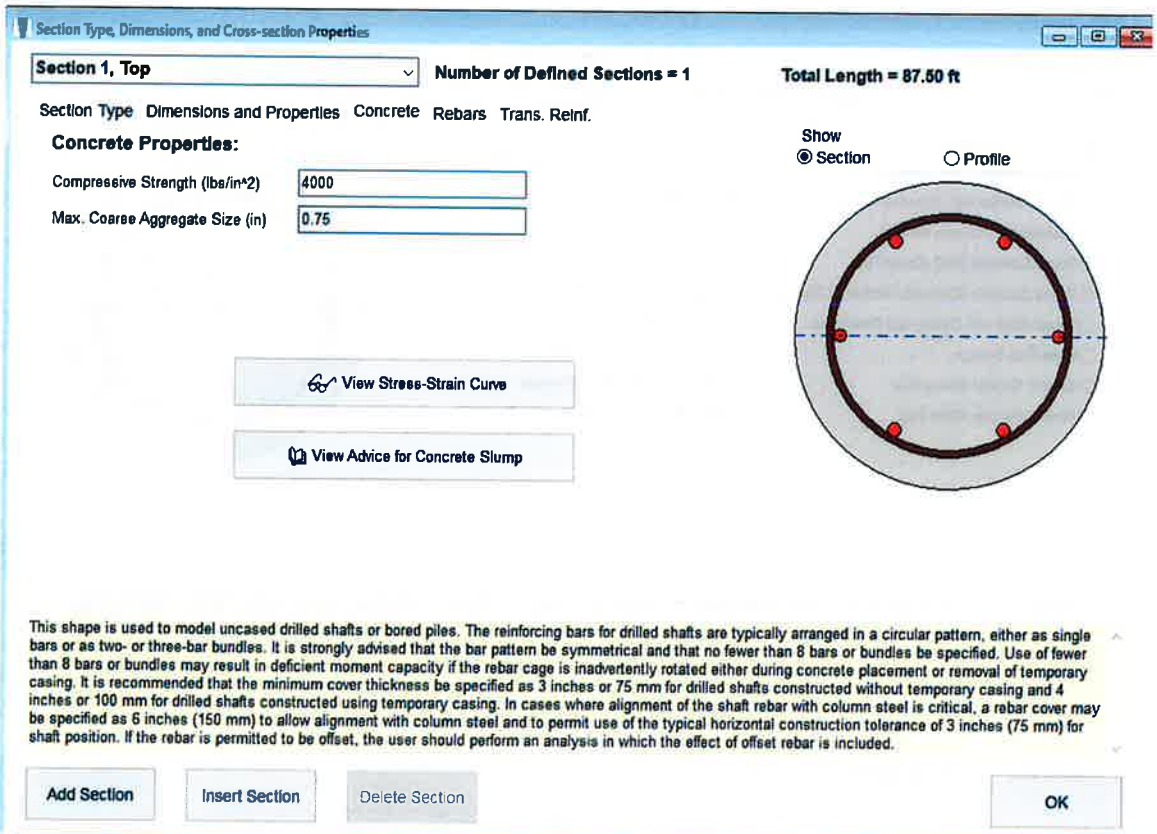
Path to Files:	C:\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix E - Lateral Pile Resistance Analysis
Input Data File:	Boring A-19-002 - 24 inch.lp10d
Output Report File:	Boring A-19-002 - 24 inch.lp10o
Plot Output File:	Boring A-19-002 - 24 inch.lp10p
Current Time and Date:	6/5/2019 7:47:09 PM

(Filenames, file paths, and date and time of program run are included in the output report.)

OK

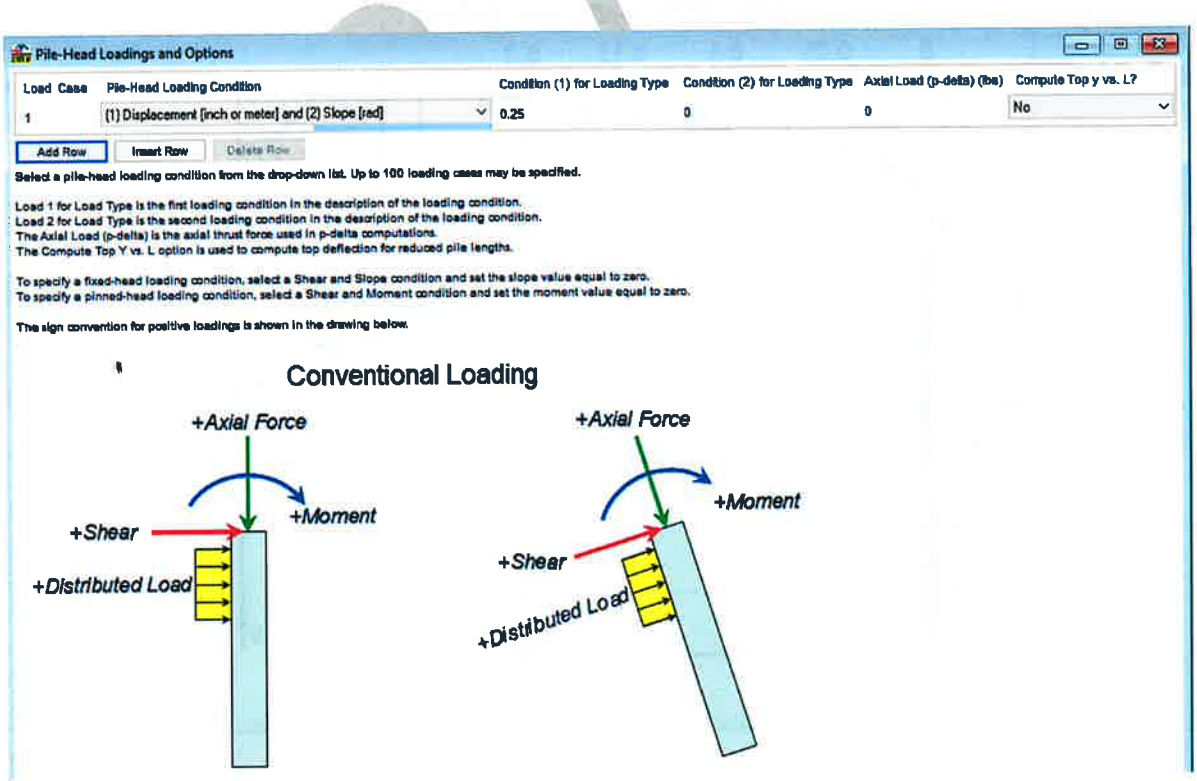

Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Dimensions and Properties
Concrete
Rebars
Trans. Reinf.
Show
Section
Profile
Section Type and Shape
Elastic Section (Non-yielding)
Elastic Section with Specified Moment Capacity
Rectangular Concrete Section
Round Concrete Shaft (Bored Pile)
Round Concrete Shaft with Permanent Casing
Round Shaft with Casing and Core/Insert
Steel Pipe Section
Steel H Section Strong Axis
Steel H Section Weak Axis
Steel AISC Section Strong Axis
Steel AISC Section Weak Axis
Round Prestressed Concrete
Round Prestressed Concrete with Void
Square Prestressed Concrete
Square Prestressed Concrete with Void
Octagonal Prestressed Concrete
Octagonal Prestressed Concrete with Void
User Defined Non-linear Bending Section
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Dimensions and Properties
Concrete
Rebars
Trans. Reinf.
Elevation Dimensions
Length of Section (ft)
87.5
Elastic Section Properties:
Structural Shape
Select Shape
At Top
At Bottom
Elastic Sect. Width (in)
No data required (in)
Area (in^2)
Mom. of Inertia (in^4)
Plas. Mom. Cap. (in-lbs)
Shear Capacity (lbs)
55000
Elastic Pile (non-yielding) Section Dimensions:
Section Diameter (in)
24
Casing Wall Thickness (in)
Section Width (in)
Section Depth (in)
Corner Chamfer (in)
Core Void Diameter (in)
Core Wall Thickness (in)
Flange Thickness (in)
Web Thickness (in)
Elastic Mod. (kip/in^2)
Compute Mom. of Inertia and Areas and Draw Section
Copy Top Properties to Bottom
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Dimensions and Properties
Concrete
Rebars
Trans. Reinf.
Concrete Properties:
Compressive Strength (lbs/in^2)
4000
Max. Coarse Aggregate Size (in)
0.75
View Stress-Strain Curve
View Advice for Concrete Slump
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Dimensions and Properties
Concrete
Rebars
Trans. Reinf.
Reinforcing Bar Properties:
Yield Stress (lbs/in^2)
68000
Elastic Modulus (lbs/in^2)
29000000
Continue Rebar Pattern and Size from Section Above
Rebar Size/Number Options
Bar Size
US Std. #9
Bar Area (in^2)
1
Number of Bars
6
Bar/Bundle Options
Single Bars
2-Bar Bundles
3-Bar Bundles
Concrete Cover to Edge of Bar (in)
3
Automatically positon bars in circle
Edit Bar Positions
Offset Reinforcement Pattern from Centroid of Section
0
Bar Spacing = 7.31 in, Area of Steel = 6.00 sq. in, Percentage of Steel = 1.33%
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Dimensions and Properties
Concrete
Rebars
Trans. Reinf.
Confined Section
Rebar Type
Spiral
Hoop
Bar Size
US Std. #4
Number of Bars
60
Bar Area (in^2)
0.2
Spacing (in)
6
Yield Stress (lbs/in^2)
68000
Use Strain Hardening
(For Longitudinal Reinforcement)
fu/fy
1.25
esh
0.0125
esu
0.09
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK

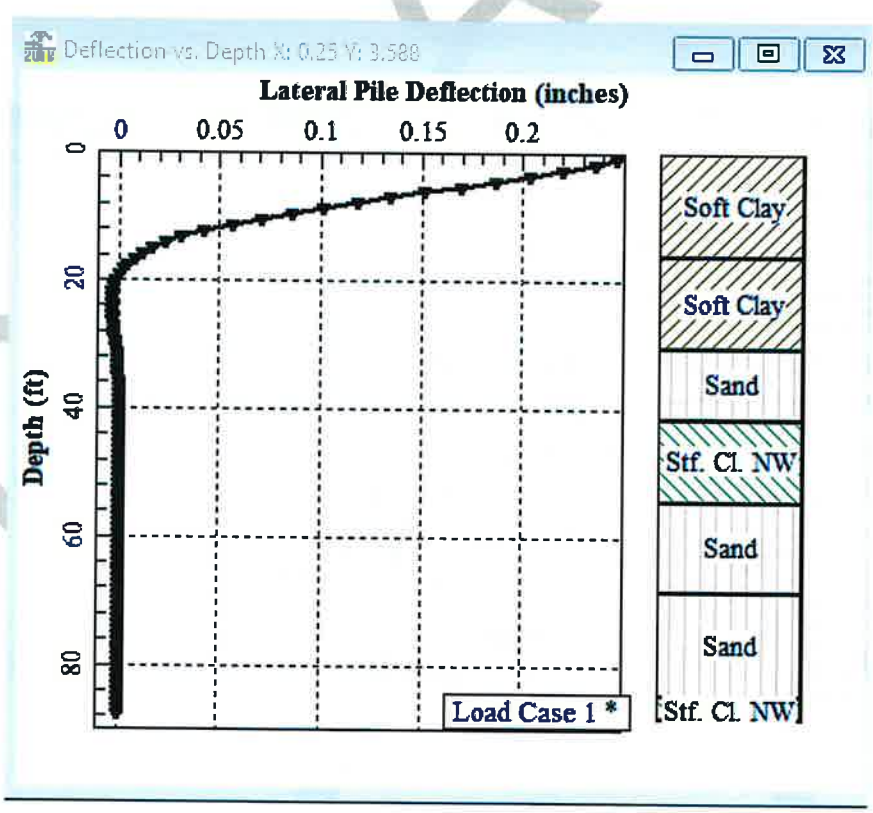

Pile-Head Loadings and Options
Load Case
Pile-Head Loading Condition
Condition (1) for Loading Type
Condition (2) for Loading Type
Axial Load (p-delta) (lbs)
Compute Top y vs. L?
1
(1) Displacement [inch or meter] and (2) Slope [rad]
0.25
0
0
No
Add Row
Insert Row
Delete Row
Select a pile-head loading condition from the drop-down list. Up to 100 loading cases may be specified.
Load 1 for Load Type is the first loading condition in the description of the loading condition.
Load 2 for Load Type is the second loading condition in the description of the loading condition.
The Axial Load (p-delta) is the axial thrust force used in p-delta computations.
The Compute Top Y vs. L option is used to compute top deflection for reduced pile lengths.
To specify a fixed-head loading condition, select a Shear and Slope condition and set the slope value equal to zero.
To specify a pinned-head loading condition, select a Shear and Moment condition and set the moment value equal to zero.
The sign convention for positive loadings is shown in the drawing below.
Conventional Loading
+Axial Force
+Moment
+Shear
+Distributed Load
+Axial Force
+Moment
+Shear
+Distributed Load

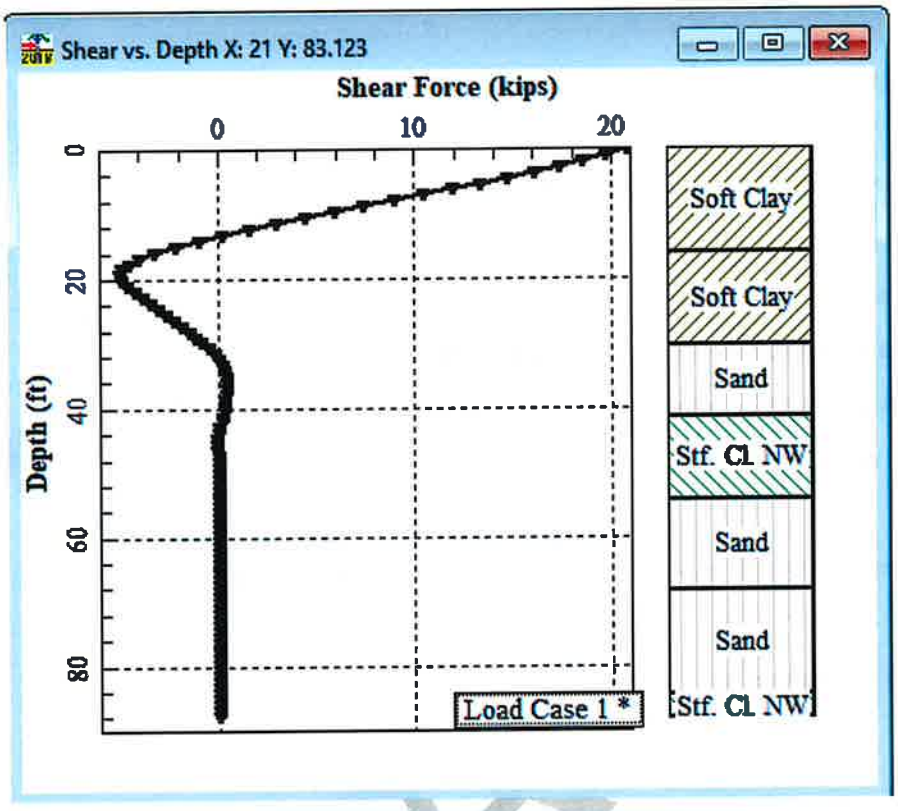
Soil Layers

Layer	Select p-y Curve Type from Drop-down List	Vertical Depth Below Pile Head of Top of Soil Layer (ft)	Vertical Depth Below Pile Head of Bottom of Soil Layer (ft)	Press Button to Enter Soil Properties
1	Soft Clay (Matlock)	0	16	1: Soft Clay
2	Soft Clay (Matlock)	16	30.5	2: Soft Clay
3	Sand (Reese)	30.5	41.5	3: Sand (Reese, et al.)
4	Stiff Clay w/o Free Water (Reese)	41.5	54.5	4: Stiff Clay without Free Water
5	Sand (Reese)	54.5	68.5	5: Sand (Reese, et al.)
6	Sand (Reese)	68.5	84.5	6: Sand (Reese, et al.)
7	Stiff Clay w/o Free Water (Reese)	84.5	88.5	7: Stiff Clay without Free Water

Add Row | Insert Row | Delete Row

All positive depth coordinates are defined as vertical distances below the pile-head.
If the pile-head is embedded below the ground surface, the top layer must extend from the ground surface (defined by a negative vertical depth) to some point below the pile head.
Select the p-y soil type using the drop-down list in the left table column.




Shear vs. Depth X: 21 Y: 83.123
Shear Force (kips)
0
10
20
Depth (ft)
0
20
40
60
80
Soft Clay
Soft Clay
Sand
Stf. Cl. NW
Sand
Sand
Stf. Cl. NW
Load Case 1 *

==========

LPile for Windows, Version 2018-10.002

Analysis of Individual Piles and Drilled Shafts

Subjected to Lateral Loading Using the p-y Method

==========

This copy of LPile is being used by:

Carl Henderson

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Files Used for Analysis

Path to file locations:

\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix E - Lateral Pile Resistance Analysis\

Name of input data file:

Boring A-19-002 - 24 inch.lp10

Name of output report file:

Boring A-19-002 - 24 inch.lp10

Name of plot output file:

Boring A-19-002 - 24 inch.lp10

Name of runtime message file:

Boring A-19-002 - 24 inch.lp10

Date and Time of Analysis

Date: June 5, 2019 Time: 19:46:32

Problem Title

Project Name: Lack Road Bridge Replacement Over New River

Job Number: 227518-0000439

Client: Imperial County Department of Public Works

Engineer: Carl Henderson

Description: Lateral Resistance - CIDH Concrete(24 inch);Boring A-19-02

Program Options and Settings

Computational Options:

- Use unfactored loads in computations (conventional analysis)

Engineering Units Used for Data Input and Computations:

- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

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

Loading Type and Number of Cycles of Loading:

- Static loading specified

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

Output Options:

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

Pile Structural Properties and Geometry

Number of pile sections defined = 1

Total length of pile = 87.500 ft

Depth of ground surface below top of pile = 0.0000 ft

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

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

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	24.0000
2	87.500	24.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile

Length of section = 87.500000 ft

Shaft Diameter = 24.000000 in

Shear capacity of section = 55000. lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees

= 0.000 radians

Pile Batter Angle = 0.000 degrees

= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 7 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 0.0000 ft

Distance from top of pile to bottom of layer = 16.000000 ft

Effective unit weight at top of layer = 60.400000 pcf

Effective unit weight at bottom of layer = 60.400000 pcf

Undrained cohesion at top of layer = 500.000000 psf

Undrained cohesion at bottom of layer = 500.000000 psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 16.000000 ft

Distance from top of pile to bottom of layer = 30.500000 ft

Effective unit weight at top of layer = 59.800000 pcf

Effective unit weight at bottom of layer = 59.800000 pcf

Undrained cohesion at top of layer = 350.000000 psf

Undrained cohesion at bottom of layer = 350.000000 psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 30.500000 ft

Distance from top of pile to bottom of layer = 41.500000 ft

Effective unit weight at top of layer = 66.800000 pcf

Effective unit weight at bottom of layer = 66.800000 pcf

Friction angle at top of layer = 34.000000 deg.

Friction angle at bottom of layer = 34.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer = 41.500000 ft

Distance from top of pile to bottom of layer = 54.500000 ft

Effective unit weight at top of layer = 61.600000 pcf

Effective unit weight at bottom of layer = 61.600000 pcf

Undrained cohesion at top of layer = 1500. psf

Undrained cohesion at bottom of layer = 1500. psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 54.500000 ft

Distance from top of pile to bottom of layer = 68.500000 ft

Effective unit weight at top of layer = 61.600000 pcf

Effective unit weight at bottom of layer = 61.600000 pcf

Friction angle at top of layer = 33.000000 deg.

Friction angle at bottom of layer = 33.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

Layer 6 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 68.500000 ft

Distance from top of pile to bottom of layer = 84.500000 ft

Effective unit weight at top of layer = 65.600000 pcf

Effective unit weight at bottom of layer = 65.600000 pcf

Friction angle at top of layer = 38.000000 deg.

Friction angle at bottom of layer = 38.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

Layer 7 is stiff clay without free water

Distance from top of pile to top of layer = 84.500000 ft

Distance from top of pile to bottom of layer = 88.500000 ft

Effective unit weight at top of layer = 62.600000 pcf

Effective unit weight at bottom of layer = 62.600000 pcf

Undrained cohesion at top of layer = 2000. psf

Undrained cohesion at bottom of layer = 2000. psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

(Depth of the lowest soil layer extends 1.000 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Soft Clay	0.00 16.0000	60.4000 60.4000	500.0000 500.0000	-- --	default default	-- --
2	Soft Clay	16.0000 30.5000	59.8000 59.8000	350.0000 350.0000	-- --	default default	-- --
3	Sand (Reese, et al.)	30.5000 41.5000	66.8000 66.8000	-- --	34.0000 34.0000	-- --	default default
4	Stiff Clay w/o Free Water	41.5000 54.5000	61.6000 61.6000	1500. 1500.	-- --	default default	-- --
5	Sand (Reese, et al.)	54.5000 68.5000	61.6000 61.6000	-- --	33.0000 33.0000	-- --	default default
6	Sand (Reese, et al.)	68.5000 84.5000	65.6000 65.6000	-- --	38.0000 38.0000	-- --	default default
7	Stiff Clay w/o Free Water	84.5000 88.5000	62.6000 62.6000	2000. 2000.	-- --	default default	-- --

---

Static Loading Type

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

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.250000 in	S = 0.0000 in/in	0.0000000	N.A.

V = shear force applied normal to pile axis

M = bending moment applied to pile head

y = lateral deflection normal to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).

Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

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

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section = 87.500000 ft

Shaft Diameter = 24.000000 in

Concrete Cover Thickness = 3.000000 in

Number of Reinforcing Bars = 6 bars

Yield Stress of Reinforcing Bars = 68000. psi

Modulus of Elasticity of Reinforcing Bars = 29000000. psi

Gross Area of Shaft = 452.389342 sq. in.

Total Area of Reinforcing Steel = 6.000000 sq. in.

Area Ratio of Steel Reinforcement = 1.33 percent

Edge-to-Edge Bar Spacing = 7.308000 in

Maximum Concrete Aggregate Size = 0.750000 in

Ratio of Bar Spacing to Aggregate Size = 9.74

Offset of Center of Rebar Cage from Center of Pile = 0.0000 in

Confined Section

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 1925.724 kips

Tensile Load for Cracking of Concrete = -205.732 kips

Nominal Axial Tensile Capacity = -408.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	8.436000	0.00000
2	1.128000	1.000000	4.218000	7.305790
3	1.128000	1.000000	-4.218000	7.305790
4	1.128000	1.000000	-8.436000	0.00000
5	1.128000	1.000000	-4.218000	-7.305790
6	1.128000	1.000000	4.218000	-7.305790

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

Minimum spacing between any two bars not equal to zero = 7.308 inches between bars 4 and 5.

Ratio of bar spacing to maximum aggregate size = 9.74

Concrete Properties:

Compressive Strength of Concrete = 4000. psi

Modulus of Elasticity of Concrete = 3604997. psi

Modulus of Rupture of Concrete = -474.341649 psi

Compression Strain at Peak Stress = 0.001886

Tensile Strain at Fracture of Concrete = -0.0001154

Maximum Coarse Aggregate Size = 0.750000 in

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

Number	Axial Thrust Force kips
1	0.000

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.

Y = stress in reinforcing steel has reached yield stress.

T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.

Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.

Position of neutral axis is measured from edge of compression side of pile.

Compressive stresses and strains are positive in sign.

Tensile stresses and strains are negative in sign.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conf Stress ksi	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000200	149.9781433	74989072.	12.0000155	0.00002400	-0.00002400	-0.0010177	0.1001357	0.6890409	
0.00000400	298.7624583	74690615.	12.0000156	0.00004800	-0.00004800	-0.0020352	0.1990021	1.3780818	
0.00000600	446.3529448	74392157.	12.0000157	0.00007200	-0.00007200	-0.0030527	0.2965992	2.0671227	
0.00000800	592.7496030	74093700.	12.0000157	0.00009600	-0.00009600	-0.0040700	0.3929269	2.7561637	
0.00001000	592.7496030	59274960.	6.2332537	0.00006233	-0.0001777	0.00000	0.2550722	-5.1175564	C
0.00001200	592.7496030	49395800.	6.2366937	0.00007484	-0.0002132	0.00000	0.3052466	-6.1398706	C
0.00001400	592.7496030	42339257.	6.2401470	0.00008736	-0.0002486	0.00000	0.3551390	-7.1617803	C
0.00001600	592.7496030	37046850.	6.2436135	0.00009990	-0.0002841	0.00000	0.4047487	-8.1832833	C
0.00001800	592.7496030	32930533.	6.2470935	0.0001124	-0.0003196	0.00000	0.4540748	-9.2043772	C
0.00002000	592.7496030	29637480.	6.2505870	0.0001250	-0.0003550	0.00000	0.5031164	-10.2250595	C
0.00002200	592.7496030	26943164.	6.2540941	0.0001376	-0.0003904	0.00000	0.5518727	-11.2453280	C
0.00002400	592.7496030	24697900.	6.2576149	0.0001502	-0.0004258	0.00000	0.6003429	-12.2651800	C
0.00002600	592.7496030	22798062.	6.2611496	0.0001628	-0.0004612	0.00000	0.6485261	-13.2846132	C
0.00002800	592.7496030	21169629.	6.2646982	0.0001754	-0.0004966	0.00000	0.6964214	-14.3036250	C
0.00003000	592.7496030	19758320.	6.2682609	0.0001880	-0.0005320	0.00000	0.7440279	-15.3222130	C
0.00003200	592.7496030	18523425.	6.2718377	0.0002007	-0.0005673	0.00000	0.7913448	-16.3403745	C

0.00003400	592.7496030	17433812.	6.2754289	0.0002134	-0.0006026	0.00000	0.8383711	-
17.3581071 C								
0.00003600	592.7496030	16465267.	6.2790345	0.0002260	-0.0006380	0.00000	0.8851059	-
18.3754080 C								
0.00003800	592.7496030	15598674.	6.2826546	0.0002387	-0.0006733	0.00000	0.9315484	-
19.3922747 C								
0.00004000	619.4931606	15487329.	6.2862893	0.0002515	-0.0007085	0.00000	0.9776976	-
20.4087044 C								
0.00004200	650.1062681	15478721.	6.2899388	0.0002642	-0.0007438	0.00000	1.0235526	-
21.4246945 C								
0.00004400	680.6836129	15470082.	6.2936032	0.0002769	-0.0007791	0.00000	1.0691124	-
22.4402423 C								
0.00004600	711.2250030	15461413.	6.2972826	0.0002897	-0.0008143	0.00000	1.1143761	-
23.4553450 C								
0.00004800	741.7302443	15452713.	6.3009771	0.0003024	-0.0008496	0.00000	1.1593428	-
24.4699998 C								
0.00005000	772.1991407	15443983.	6.3046870	0.0003152	-0.0008848	0.00000	1.2040115	-
25.4842040 C								
0.00005200	802.6314943	15435221.	6.3084122	0.0003280	-0.0009200	0.00000	1.2483812	-
26.4979545 C								
0.00005400	833.0271047	15426428.	6.3121529	0.0003409	-0.0009551	0.00000	1.2924510	-
27.5112487 C								
0.00005600	863.3857697	15417603.	6.3159093	0.0003537	-0.0009903	0.00000	1.3362198	-
28.5240834 C								
0.00005800	893.7072847	15408746.	6.3196814	0.0003665	-0.0010255	0.00000	1.3796867	-
29.5364559 C								
0.00006000	923.9914431	15399857.	6.3234695	0.0003794	-0.0010606	0.00000	1.4228506	-
30.5483631 C								
0.00006200	954.2380359	15390936.	6.3272737	0.0003923	-0.0010957	0.00000	1.4657105	-
31.5598021 C								
0.00006400	984.4468519	15381982.	6.3310940	0.0004052	-0.0011308	0.00000	1.5082655	-
32.5707696 C								
0.00006600	1015.	15372995.	6.3349307	0.0004181	-0.0011659	0.00000	1.5505145	-
33.5812628 C								
0.00006800	1045.	15363975.	6.3387839	0.0004310	-0.0012010	0.00000	1.5924564	-
34.5912783 C								
0.00007000	1075.	15354921.	6.3426537	0.0004440	-0.0012360	0.00000	1.6340902	-
35.6008132 C								

0.00007200	1105.	15345834.	6.3465403	0.0004570	-0.0012710	0.00000	1.6754148	-
36.6098641 C								
0.00007400	1135.	15336712.	6.3504438	0.0004699	-0.0013061	0.00000	1.7164291	-
37.6184279 C								
0.00007600	1165.	15327557.	6.3543644	0.0004829	-0.0013411	0.00000	1.7571321	-
38.6265012 C								
0.00007800	1195.	15318366.	6.3583022	0.0004959	-0.0013761	0.00000	1.7975227	-
39.6340808 C								
0.00008200	1255.	15299903.	6.3659839	0.0005220	-0.0014460	0.00000	1.8772997	-
41.6483301 C								
0.00008600	1314.	15281309.	6.3736641	0.0005481	-0.0015159	0.00000	1.9557911	-
43.6608014 C								
0.00009000	1374.	15262577.	6.3814108	0.0005743	-0.0015857	0.00000	2.0330043	-
45.6713175 C								
0.00009400	1433.	15243704.	6.3892252	0.0006006	-0.0016554	0.00000	2.1089304	-
47.6798519 C								
0.00009800	1492.	15224688.	6.3971084	0.0006269	-0.0017251	0.00000	2.1835601	-
49.6863775 C								
0.0001020	1551.	15205527.	6.4050619	0.0006533	-0.0017947	0.00000	2.2568839	-
51.6908667 C								
0.0001060	1610.	15186218.	6.4130867	0.0006798	-0.0018642	0.00000	2.3288925	-
53.6932911 C								
0.0001100	1668.	15166759.	6.4211843	0.0007063	-0.0019337	0.00000	2.3995758	-
55.6936216 C								
0.0001140	1727.	15147148.	6.4293561	0.0007329	-0.0020031	0.00000	2.4689240	-
57.6918283 C								
0.0001180	1785.	15127380.	6.4376035	0.0007596	-0.0020724	0.00000	2.5369267	-
59.6878806 C								
0.0001220	1843.	15107455.	6.4459278	0.0007864	-0.0021416	0.00000	2.6035738	-
61.6817471 C								
0.0001260	1901.	15087368.	6.4543306	0.0008132	-0.0022108	0.00000	2.6688543	-
63.6733955 C								
0.0001300	1959.	15067117.	6.4628135	0.0008402	-0.0022798	0.00000	2.7327576	-
65.6627927 C								
0.0001340	2016.	15046700.	6.4713780	0.0008672	-0.0023488	0.00000	2.7952725	-
67.6499047 C								
0.0001380	2074.	15026112.	6.4800257	0.0008942	-0.0024178	0.00000	2.8563875	-
68.0000000 CY								

0.0001420	2131.	15005350.	6.4887584	0.0009214	-0.0024866	0.00000	2.9160912	-
68.0000000 CY								
0.0001460	2188.	14984412.	6.4975777	0.0009486	-0.0025554	0.00000	2.9743716	-
68.0000000 CY								
0.0001500	2244.	14963294.	6.5064854	0.0009760	-0.0026240	0.00000	3.0312165	-
68.0000000 CY								
0.0001540	2301.	14941993.	6.5154834	0.0010034	-0.0026926	0.00000	3.0866134	-
68.0000000 CY								
0.0001580	2357.	14920504.	6.5245736	0.0010309	-0.0027611	0.00000	3.1405497	-
68.0000000 CY								
0.0001620	2414.	14898825.	6.5337579	0.0010585	-0.0028295	0.00000	3.1930123	-
68.0000000 CY								
0.0001660	2470.	14876951.	6.5430384	0.0010861	-0.0028979	0.00000	3.2439878	-
68.0000000 CY								
0.0001700	2525.	14854878.	6.5524172	0.0011139	-0.0029661	0.00000	3.2934624	-
68.0000000 CY								
0.0001740	2581.	14832603.	6.5618964	0.0011418	-0.0030342	0.00000	3.3414222	-
68.0000000 CY								
0.0001780	2635.	14805485.	6.5707289	0.0011696	-0.0031024	0.00000	3.3876313	-
68.0000000 CY								
0.0001820	2683.	14741307.	6.5735984	0.0011964	-0.0031716	0.00000	3.4305372	-
68.0000000 CY								
0.0001860	2719.	14617703.	6.5664909	0.0012214	-0.0032426	0.00000	3.4690569	-
68.0000000 CY								
0.0001900	2743.	14436291.	6.5492859	0.0012444	-0.0033156	0.00000	3.5032798	-
68.0000000 CY								
0.0001940	2759.	14221164.	6.5258794	0.0012660	-0.0033900	0.00000	3.5344248	-
68.0000000 CY								
0.0001980	2774.	14009254.	6.5027375	0.0012875	-0.0034645	0.00000	3.5643728	-
68.0000000 CY								
0.0002020	2789.	13805401.	6.4807391	0.0013091	-0.0035389	0.00000	3.5933873	-
68.0000000 CY								
0.0002060	2803.	13609134.	6.4598196	0.0013307	-0.0036133	0.00000	3.6214623	-
68.0000000 CY								
0.0002100	2818.	13420016.	6.4399198	0.0013524	-0.0036876	0.00000	3.6485919	-
68.0000000 CY								
0.0002140	2833.	13237643.	6.4209846	0.0013741	-0.0037619	0.00000	3.6747700	-
68.0000000 CY								

0.0002180	2847.	13061639.	6.4029633	0.0013958	-0.0038362	0.00000	3.6999904	-
68.0000000 CY								
0.0002220	2862.	12891659.	6.3858088	0.0014176	-0.0039104	0.00000	3.7242467	-
68.0000000 CY								
0.0002260	2876.	12727378.	6.3694773	0.0014395	-0.0039845	0.00000	3.7475327	-
68.0000000 CY								
0.0002300	2891.	12568375.	6.3535862	0.0014613	-0.0040587	0.00000	3.7697618	-
68.0000000 CY								
0.0002340	2905.	12414322.	6.3379422	0.0014831	-0.0041329	0.00000	3.7908994	-
68.0000000 CY								
0.0002380	2919.	12265149.	6.3230396	0.0015049	-0.0042071	0.00000	3.8110668	-
68.0000000 CY								
0.0002540	2975.	11712577.	6.2701918	0.0015926	-0.0045034	0.00000	3.8818947	-
68.0000000 CY								
0.0002700	3030.	11221045.	6.2268376	0.0016812	-0.0047988	0.00000	3.9366271	-
68.0000000 CY								
0.0002860	3083.	10780114.	6.1915423	0.0017708	-0.0050932	0.00000	3.9747691	-
68.0000000 CY								
0.0003020	3135.	10381541.	6.1631908	0.0018613	-0.0053867	0.00000	3.9957855	-
68.0000000 CY								
0.0003180	3186.	10018614.	6.1409649	0.0019528	-0.0056792	0.00000	3.9974180	-
68.0000000 CY								
0.0003340	3235.	9685782.	6.1242842	0.0020455	-0.0059705	0.00000	3.9980954	-
68.0000000 CY								
0.0003500	3283.	9378850.	6.1119838	0.0021392	-0.0062608	0.00000	3.9981031	-
68.0000000 CY								
0.0003660	3328.	9093458.	6.1033294	0.0022338	-0.0065502	0.00000	3.9974386	-
68.0000000 CY								
0.0003820	3368.	8816061.	6.0921625	0.0023272	-0.0068408	0.00000	3.9954947	-
68.0000000 CY								
0.0003980	3396.	8532256.	6.0702145	0.0024159	-0.0071361	0.00000	3.9986473	
68.0000000 CY								
0.0004140	3412.	8240510.	6.0357469	0.0024988	-0.0074372	0.00000	3.9987525	
68.0000000 CY								
0.0004300	3417.	7946549.	5.9910159	0.0025761	-0.0077439	0.00000	3.9940224	
68.0000000 CY								
0.0004460	3419.	7666008.	5.9461724	0.0026520	-0.0080520	0.00000	3.9984544	
68.0000000 CY								

0.0004620 68.0000000 CY	3421.	7403934.	5.9050089	0.0027281	-0.0083599	0.00000	3.9967885
0.0004780 68.0000000 CY	3422.	7158568.	5.8663683	0.0028041	-0.0086679	0.00000	3.9963131
0.0004940 68.0000000 CY	3423.	6928263.	5.8284564	0.0028793	-0.0089767	0.00000	3.9997546
0.0005100 68.0000000 CY	3423.	6712034.	5.7938333	0.0029549	-0.0092851	0.00000	3.9911636
0.0005260 68.0000000 CY	3424.	6508704.	5.7619981	0.0030308	-0.0095932	0.00000	3.9966313
0.0005420 68.0000000 CY	3424.	6317203.	5.7325695	0.0031071	-0.0099009	0.00000	3.9997478
0.0005580 68.0000000 CY	3424.	6136399.	5.7055814	0.0031837	-0.0102083	0.00000	3.9920981
0.0005740 68.0000000 CY	3424.	5965475.	5.6806677	0.0032607	-0.0105153	0.00000	3.9941643
0.0005900 68.0000000 CY	3424.	5803700.	5.6575201	0.0033379	-0.0108221	0.00000	3.9986123
0.0006060 68.0000000 CY	3424.	5650467.	5.6355248	0.0034151	-0.0111289	0.00000	3.9994553
0.0006220 68.0000000 CY	3424.	5505117.	5.6133141	0.0034915	-0.0114365	0.00000	3.9881580
0.0006380 68.0000000 CY	3424.	5367058.	5.5925248	0.0035680	-0.0117440	0.00000	3.9929624
0.0006540 68.0000000 CY	3424.	5235754.	5.5730592	0.0036448	-0.0120512	0.00000	3.9975660
0.0006700 68.0000000 CY	3424.	5110721.	5.5548293	0.0037217	-0.0123583	0.00000	3.9997879
0.0006860 68.0781955 CY	3424.	4991520.	5.5379478	0.0037990	-0.0126650	0.00000	3.9939172 -
0.0007020 68.3471142 CY	3424.	4877753.	5.5461614	0.0038934	-0.0129546	0.00000	3.9890114 -
0.0007180 68.6261436 CY	3424.	4769057.	5.5308184	0.0039711	-0.0132609	0.00000	3.9946253 -
0.0007340 68.8995630 CY	3424.	4665099.	5.5163748	0.0040490	-0.0135670	0.00000	3.9982679 -
0.0007500 69.1398603 CY	3424.	4565577.	5.5449909	0.0041587	-0.0138413	0.00000	3.9929544 -

0.0007660	3424.	4470213.	5.5315728	0.0042372	-0.0141468	0.00000	3.9834102 - 69.4028619 CY
0.0007820	3424.	4378751.	5.5729707	0.0043581	-0.0144099	0.00000	3.9956941 - 69.6250747 CY
0.0007980	3424.	4290956.	5.5598516	0.0044368	-0.0147152	0.00000	3.9986205 - 69.8786051 CY
0.0008140	3424.	4206613.	5.6117214	0.0045679	-0.0149681	0.00000	3.9861077 - 70.0846555 CY
0.0008300	3424.	4125522.	5.5989183	0.0046471	-0.0152729	0.00000	3.9817047 - 70.3291599 CY
0.0008460	3424.	4047498.	5.6570973	0.0047859	-0.0155181	0.00000	3.9977790 - 70.5222203 CY
0.0008620	3424.	3972370.	5.6458894	0.0048668	-0.0158212	0.00000	3.9995824 - 70.7572827 CY
0.0008780	3424.	3899981.	5.6345047	0.0049471	-0.0161249	0.00000	3.9983119 - 70.9884286 CY
0.0009740	3424.	3515588.	5.8085599	0.0056575	-0.0177185	0.00000	3.9917289 - 72.1336175 CY
0.0010700	3424.	3200171.	5.9320456	0.0063473	-0.0193327	216719.	3.9987771 - 73.1894705 CY
0.0011660	3424.	2936692.	5.9707509	0.0069619	-0.0210221	223166.	3.9884373 - 74.1954513 CY
0.0012620	3424.	2713299.	6.1073980	0.0077075	-0.0225805	159488.	3.9918977 - 75.0428632 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003

or maximum developed moment if pile fails at smaller strains.

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

1	0.000	3423.399	0.00300000

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

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

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

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

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	3423.	0.0000	2225.	14970468.
1	0.70	3423.	0.0000	2396.	14905475.
1	0.75	3423.	0.0000	2568.	14837946.

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	95394.
2	16.0000	19.8748	Yes	No	95394.	91415.
3	30.5000	14.2991	No	No	186809.	724831.
4	41.5000	40.6312	No	No	911640.	351000.
5	54.5000	29.0666	No	No	1262640.	2671102.
6	68.5000	37.2309	Yes	No	3933742.	7318055.
7	84.5000	319.6611	No	No	1.13E+07	N.A.

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

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)

Displacement of pile head = 0.250000 inches

Rotation of pile head = 0.000E+00 radians

Axial load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1125156.	20767.	0.00	0.00	1.53E+10	-93.3626	1961.	0.00
0.8750	0.2460	-912774.	19687.	-6.97E-04	0.00	1.53E+10	-102.8990	4393.	0.00
1.7500	0.2354	-711738.	18562.	-0.00125	0.00	1.55E+10	-111.2946	4965.	0.00
2.6250	0.2197	-522971.	17356.	-0.00153	0.00	7.42E+10	-118.4375	5661.	0.00
3.5000	0.2032	-347263.	16079.	-0.00159	0.00	7.46E+10	-124.8268	6450.	0.00
4.3750	0.1862	-185316.	14739.	-0.00163	0.00	7.49E+10	-130.4047	7352.	0.00
5.2500	0.1690	-37747.	13345.	-0.00164	0.00	7.50E+10	-135.1119	8394.	0.00
6.1250	0.1517	94927.	11906.	-0.00164	0.00	7.50E+10	-138.8847	9612.	0.00
7.0000	0.1346	212288.	10434.	-0.00162	0.00	7.48E+10	-141.6521	11054.	0.00
7.8750	0.1177	314032.	8937.	-0.00158	0.00	7.46E+10	-143.3315	12786.	0.00
8.7500	0.1013	399974.	7430.	-0.00153	0.00	7.45E+10	-143.8212	14904.	0.00
9.6250	0.08553	470060.	5924.	-0.00147	0.00	7.43E+10	-142.9892	17553.	0.00
10.5000	0.07044	524381.	4435.	-0.00140	0.00	7.42E+10	-140.6519	20965.	0.00
11.3750	0.05613	563195.	2980.	-0.00132	0.00	7.41E+10	-136.5366	25542.	0.00
12.2500	0.04265	586956.	1579.	-0.00120	0.00	3.52E+10	-130.2018	32051.	0.00
13.1250	0.03101	596362.	254.9336	-9.46E-04	0.00	1.93E+10	-122.0767	41330.	0.00
14.0000	0.02278	592310.	-988.0833	-6.66E-04	0.00	2.64E+10	-114.6884	52865.	0.00
14.8750	0.01702	575613.	-2158.	-5.08E-04	0.00	7.41E+10	-108.1884	66747.	0.00
15.7500	0.01211	546988.	-3253.	-4.28E-04	0.00	7.42E+10	-100.2781	86911.	0.00
16.6250	0.00802	507307.	-4039.	-3.54E-04	0.00	7.42E+10	-49.4410	64698.	0.00
17.5000	0.00469	462176.	-4515.	-2.85E-04	0.00	7.44E+10	-41.3245	92595.	0.00
18.3750	0.00203	412489.	-4896.	-2.24E-04	0.00	7.44E+10	-31.2826	161517.	0.00
19.2500	-7.91E-06	359352.	-5054.	-1.69E-04	0.00	7.45E+10	1.2431	1649489.	0.00

20.1250	-0.00152	306353.	-4898.	-1.22E-04	0.00	7.47E+10	28.3908	196387.	0.00
21.0000	-0.00258	256484.	-4572.	-8.27E-05	0.00	7.47E+10	33.8581	138029.	0.00
21.8750	-0.00325	210347.	-4202.	-4.99E-05	0.00	7.48E+10	36.6041	118079.	0.00
22.7500	-0.00362	168247.	-3810.	-2.34E-05	0.00	7.49E+10	37.9383	109910.	0.00
23.6250	-0.00375	130329.	-3410.	-2.48E-06	0.00	7.50E+10	38.3578	107512.	0.00
24.5000	-0.00368	96640.	-3008.	1.34E-05	0.00	7.50E+10	38.1173	108867.	0.00
25.3750	-0.00346	67153.	-2612.	2.49E-05	0.00	7.50E+10	37.3698	113260.	0.00
26.2500	-0.00315	41786.	-2226.	3.25E-05	0.00	7.50E+10	36.2172	120578.	0.00
27.1250	-0.00278	20413.	-1853.	3.69E-05	0.00	7.50E+10	34.7325	131101.	0.00
28.0000	-0.00238	2868.	-1498.	3.85E-05	0.00	7.50E+10	32.9708	145479.	0.00
28.8750	-0.00197	-11041.	-1162.	3.79E-05	0.00	7.50E+10	30.9757	164814.	0.00
29.7500	-0.00158	-21536.	-848.3491	3.56E-05	0.00	7.50E+10	28.7829	190874.	0.00
30.6250	-0.00122	-28857.	-519.8916	3.21E-05	0.00	7.50E+10	33.7805	289556.	0.00
31.5000	-9.09E-04	-32453.	-207.1814	2.78E-05	0.00	7.50E+10	25.7834	297829.	0.00
32.3750	-6.41E-04	-33207.	26.2480	2.32E-05	0.00	7.50E+10	18.6794	306102.	0.00
33.2500	-4.21E-04	-31902.	190.5404	1.87E-05	0.00	7.50E+10	12.6144	314375.	0.00
34.1250	-2.49E-04	-29206.	296.9018	1.44E-05	0.00	7.50E+10	7.6449	322648.	0.00
35.0000	-1.19E-04	-25667.	356.7608	1.05E-05	0.00	7.50E+10	3.7568	330921.	0.00
35.8750	-2.74E-05	-21714.	381.1229	7.23E-06	0.00	7.50E+10	0.8836	339194.	0.00
36.7500	3.26E-05	-17664.	380.1023	4.47E-06	0.00	7.50E+10	-1.0780	347467.	0.00
37.6250	6.65E-05	-13732.	362.6089	2.27E-06	0.00	7.50E+10	-2.2541	355740.	0.00
38.5000	8.03E-05	-10049.	336.1596	6.08E-07	0.00	7.50E+10	-2.7839	364013.	0.00
39.3750	7.93E-05	-6673.	306.7841	-5.63E-07	0.00	7.50E+10	-2.8115	372286.	0.00
40.2500	6.85E-05	-3606.	278.9935	-1.28E-06	0.00	7.50E+10	-2.4820	380560.	0.00
41.1250	5.24E-05	-813.7031	255.7832	-1.59E-06	0.00	7.50E+10	-1.9391	388833.	0.00
42.0000	3.50E-05	1765.	166.3107	-1.53E-06	0.00	7.50E+10	-15.1033	4524791.	0.00
42.8750	2.03E-05	2679.	41.0254	-1.21E-06	0.00	7.50E+10	-8.7605	4524791.	0.00
43.7500	9.55E-06	2627.	-26.5707	-8.43E-07	0.00	7.50E+10	-4.1149	4524791.	0.00
44.6250	2.63E-06	2121.	-54.1247	-5.10E-07	0.00	7.50E+10	-1.1335	4524791.	0.00
45.5000	-1.17E-06	1490.	-57.4279	-2.58E-07	0.00	7.50E+10	0.5043	4524791.	0.00
46.3750	-2.78E-06	914.8511	-48.4906	-8.93E-08	0.00	7.50E+10	1.1980	4524791.	0.00

47.2500	-3.04E-06	471.7413	-35.3122	7.81E-09	0.00	7.50E+10	1.3121	4524791.	0.00
48.1250	-2.62E-06	173.2959	-22.5046	5.30E-08	0.00	7.50E+10	1.1274	4524791.	0.00
49.0000	-1.93E-06	-0.8551	-12.2134	6.50E-08	0.00	7.50E+10	0.8328	4524791.	0.00
49.8750	-1.25E-06	-83.1865	-5.0123	5.92E-08	0.00	7.50E+10	0.5388	4524791.	0.00
50.7500	-6.90E-07	-106.1134	-0.6216	4.59E-08	0.00	7.50E+10	0.2975	4524791.	0.00
51.6250	-2.86E-07	-96.2403	1.5883	3.17E-08	0.00	7.50E+10	0.1234	4524791.	0.00
52.5000	-2.39E-08	-72.7595	2.2904	1.99E-08	0.00	7.50E+10	0.01032	4524791.	0.00
53.3750	1.32E-07	-48.1412	2.0470	1.14E-08	0.00	7.50E+10	-0.05669	4524791.	0.00
54.2500	2.16E-07	-29.7730	1.2601	5.98E-09	0.00	7.50E+10	-0.09320	4524791.	0.00
55.1250	2.57E-07	-21.6800	0.7129	2.38E-09	0.00	7.50E+10	-0.01102	449686.	0.00
56.0000	2.66E-07	-14.8015	0.5943	-1.72E-10	0.00	7.50E+10	-0.01159	456824.	0.00
56.8750	2.54E-07	-9.2003	0.4746	-1.85E-09	0.00	7.50E+10	-0.01121	463962.	0.00
57.7500	2.27E-07	-4.8345	0.3622	-2.84E-09	0.00	7.50E+10	-0.01020	471100.	0.00
58.6250	1.94E-07	-1.5935	0.2623	-3.29E-09	0.00	7.50E+10	-0.00884	478238.	0.00
59.5000	1.58E-07	0.6729	0.1774	-3.35E-09	0.00	7.50E+10	-0.00732	485376.	0.00
60.3750	1.24E-07	2.1321	0.1085	-3.15E-09	0.00	7.50E+10	-0.00580	492513.	0.00
61.2500	9.22E-08	2.9515	0.05501	-2.80E-09	0.00	7.50E+10	-0.00439	499651.	0.00
62.1250	6.50E-08	3.2872	0.01551	-2.36E-09	0.00	7.50E+10	-0.00314	506789.	0.00
63.0000	4.26E-08	3.2772	-0.01190	-1.90E-09	0.00	7.50E+10	-0.00209	513927.	0.00
63.8750	2.51E-08	3.0373	-0.02938	-1.46E-09	0.00	7.50E+10	-0.00124	521065.	0.00
64.7500	1.20E-08	2.6602	-0.03907	-1.06E-09	0.00	7.50E+10	-6.02E-04	528203.	0.00
65.6250	2.80E-09	2.2168	-0.04298	-7.19E-10	0.00	7.50E+10	-1.43E-04	535341.	0.00
66.5000	-3.12E-09	1.7576	-0.04289	-4.40E-10	0.00	7.50E+10	1.61E-04	542479.	0.00
67.3750	-6.45E-09	1.3161	-0.04027	-2.25E-10	0.00	7.50E+10	3.38E-04	549616.	0.00
68.2500	-7.84E-09	0.9119	-0.03631	-6.92E-11	0.00	7.50E+10	4.16E-04	556754.	0.00
69.1250	-7.90E-09	0.5535	-0.03000	3.34E-11	0.00	7.50E+10	7.87E-04	1045443.	0.00
70.0000	-7.14E-09	0.2819	-0.02209	9.19E-11	0.00	7.50E+10	7.20E-04	1058676.	0.00
70.8750	-5.97E-09	0.08964	-0.01511	1.18E-10	0.00	7.50E+10	6.09E-04	1071909.	0.00
71.7500	-4.67E-09	-0.03541	-0.00938	1.22E-10	0.00	7.50E+10	4.82E-04	1085143.	0.00
72.6250	-3.41E-09	-0.1073	-0.00497	1.12E-10	0.00	7.50E+10	3.57E-04	1098376.	0.00
73.5000	-2.32E-09	-0.1398	-0.00181	9.44E-11	0.00	7.50E+10	2.46E-04	1111610.	0.00

74.3750	-1.43E-09	-0.1452	2.87E-04	7.45E-11	0.00	7.50E+10	1.53E-04	1124843.	0.00
75.2500	-7.56E-10	-0.1338	0.00152	5.50E-11	0.00	7.50E+10	8.19E-05	1138077.	0.00
76.1250	-2.77E-10	-0.1133	0.00211	3.77E-11	0.00	7.50E+10	3.04E-05	1151310.	0.00
77.0000	3.52E-11	-0.08942	0.00225	2.35E-11	0.00	7.50E+10	-3.91E-06	1164544.	0.00
77.8750	2.16E-10	-0.06601	0.00210	1.26E-11	0.00	7.50E+10	-2.42E-05	1177777.	0.00
78.7500	3.00E-10	-0.04526	0.00180	4.79E-12	0.00	7.50E+10	-3.40E-05	1191010.	0.00
79.6250	3.17E-10	-0.02827	0.00143	0.00	0.00	7.50E+10	-3.63E-05	1204244.	0.00
80.5000	2.92E-10	-0.01527	0.00106	-3.40E-12	0.00	7.50E+10	-3.39E-05	1217477.	0.00
81.3750	2.45E-10	-0.00601	7.31E-04	-4.89E-12	0.00	7.50E+10	-2.87E-05	1230711.	0.00
82.2500	1.89E-10	8.02E-05	4.62E-04	-5.31E-12	0.00	7.50E+10	-2.24E-05	1243944.	0.00
83.1250	1.34E-10	0.00370	2.61E-04	-5.04E-12	0.00	7.50E+10	-1.60E-05	1257178.	0.00
84.0000	8.35E-11	0.00555	1.23E-04	-4.39E-12	0.00	7.50E+10	-1.01E-05	1270411.	0.00
84.8750	4.14E-11	0.00629	-6.55E-05	-3.57E-12	0.00	7.50E+10	-2.59E-05	6562500.	0.00
85.7500	8.62E-12	0.00418	-2.30E-04	-2.83E-12	0.00	7.50E+10	-5.39E-06	6562500.	0.00
86.6250	-1.80E-11	0.00147	-1.99E-04	-2.44E-12	0.00	7.50E+10	1.13E-05	6562500.	0.00
87.5000	-4.26E-11	0.00	0.00	-2.33E-12	0.00	7.50E+10	2.66E-05	3281250.	0.00

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

Output Summary for Load Case No. 1:

Pile-head deflection = 0.25000000 inches

Computed slope at pile head = 0.000000 radians

Maximum bending moment = -1125156. inch-lbs

Maximum shear force = 20767. lbs

Depth of maximum bending moment = 0.000000 feet below pile head

Depth of maximum shear force = 0.000000 feet below pile head

Number of iterations = 47

Number of zero deflection points = 7

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs

Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians

Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.

Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs

Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type	Pile-head Load 1	Load Type	Pile-head Load 2	Axial Pile-head Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.2500	S, rad	0.00	0.00	0.2500	0.00	20767.	-1125156.

Maximum pile-head deflection = 0.2500000000 inches

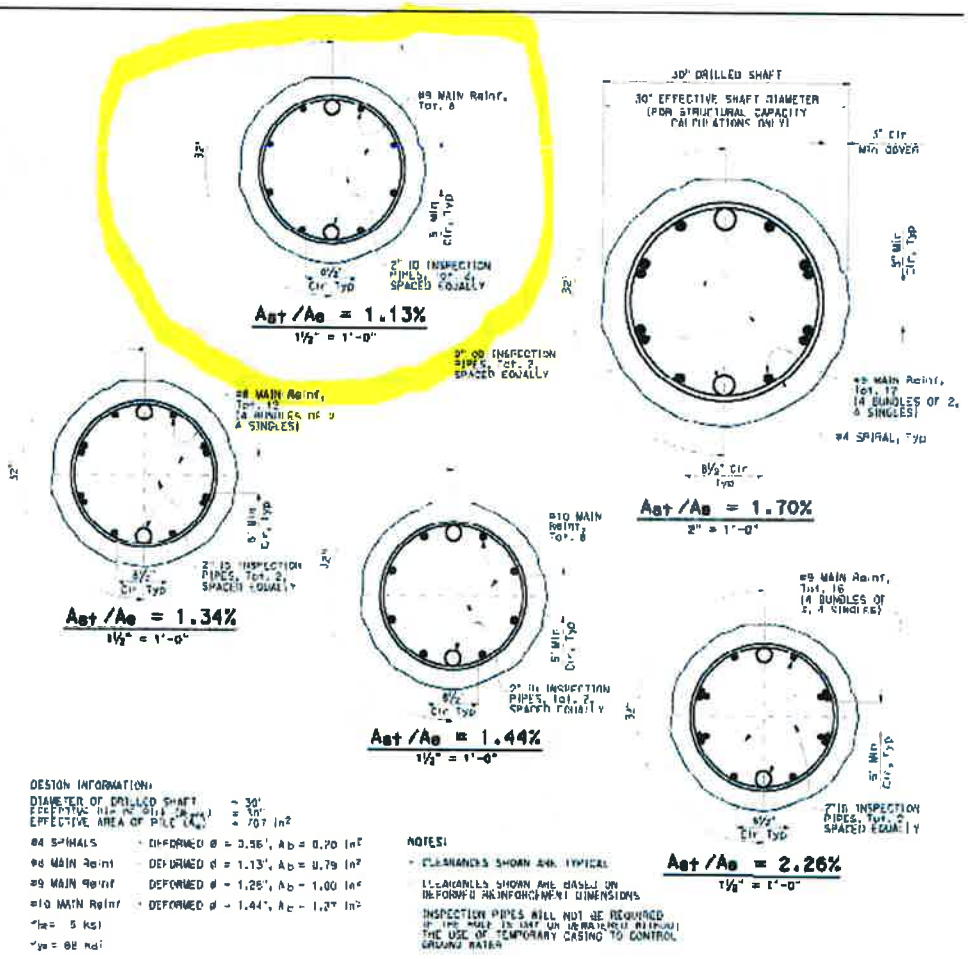
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.

Boring A-19-001

Abutment #2

30-inch CIDH Pile


#9 MAIN Reinf, Tot. 8
32"
5" Min Clr, Typ
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
8½" Clr Typ
Ast /Ag = 1.13%
1½" = 1'-0"
2" OD INSPECTION PIPES, Tot. 2 SPACED EQUALLY
#8 MAIN Reinf, Tot. 12 (4 BUNDLES OF 3 & SINGLES)
Ast /Ag = 1.34%
1½" = 1'-0"
#10 MAIN Reinf, Tot. 8
2" ID INSPECTION PIPES, Tot. 2 SPACED EQUALLY
Ast /Ag = 1.44%
1½" = 1'-0"
30" DRILLED SHAFT
30" EFFECTIVE SHAFT DIAMETER (FOR STRUCTURAL CAPACITY CALCULATIONS ONLY)
3" Clr Min COVER
#9 MAIN Reinf, Tot. 17 (4 BUNDLES OF 2, & SINGLES)
#4 SPIRAL, Typ
8½" Clr Typ
Ast /Ag = 1.70%
2" = 1'-0"
#9 MAIN Reinf, Tot. 16 (4 BUNDLES OF 2, & SINGLES)
2" ID INSPECTION PIPES, Tot. 2 SPACED EQUALLY
Ast /Ag = 2.26%
1½" = 1'-0"
DESIGN INFORMATION:
DIAMETER OF DRILLED SHAFT = 30"
EFFECTIVE DIA. OF SHAFT (Dsp) = 30"
EFFECTIVE AREA OF PILE (Ag) = 707 in²
#4 SPIRALS - DEFORMED ø = 0.56", Ab = 0.20 in²
#8 MAIN Reinf - DEFORMED ø = 1.13", Ab = 0.79 in²
#9 MAIN Reinf - DEFORMED ø = 1.28", Ab = 1.00 in²
#10 MAIN Reinf - DEFORMED ø = 1.44", Ab = 1.27 in²
f'c = 5 ksi
fy = 60 ksi
NOTES:
- CLEARANCES SHOWN ARE TYPICAL
CLEARANCES SHOWN ARE BASED ON DEFORMED REINFORCEMENT DIMENSIONS
INSPECTION PIPES WILL NOT BE REQUIRED IF THE HOLE IS DRY OR REMAINS DRY WITHOUT THE USE OF TEMPORARY CASING TO CONTROL GROUND WATER

ATTACHMENT A

STEEL A_s / A_{g1}/A_g %	UNFACTORED AXIAL LOAD (P_f) %	kips	SPIRALS SPACING C-C in	M_{nx} @ ϵ_c=0.003 kip-ft	M_p kip-ft	ϕ_p rad/in	I_{cr} in^4	θ_{yf} rad/in	Y_s kips
1.13% STEEL	0	0	6	500	494	0.001431	0.493	0.000176	74
		0	6	500	494	0.001431	0.493	0.000176	74
	5	149	6	613	591	0.001355	0.494	0.000172	74
		149	6	613	591	0.001355	0.494	0.000172	74
	10	299	6	714	684	0.001215	0.567	0.000173	74
		299	6	714	684	0.001215	0.567	0.000173	74
	15	448	6	790	767	0.001088	0.625	0.000176	74
		448	6	790	767	0.001088	0.625	0.000176	74
	20	597	6	862	841	0.000939	0.668	0.000181	74
		597	6	862	841	0.000939	0.668	0.000181	74
1.34% STEEL	0	0	6	577	569	0.001425	0.458	0.000178	74
		0	6	577	569	0.001425	0.458	0.000178	74
	5	153	6	685	662	0.001252	0.544	0.000175	74
		153	6	685	662	0.001252	0.544	0.000175	74
	10	307	6	779	750	0.001117	0.613	0.000175	74
		307	6	779	750	0.001117	0.613	0.000175	74
	15	460	6	858	829	0.001015	0.673	0.000171	74
		460	6	858	829	0.001015	0.673	0.000171	74
	20	613	6	932	902	0.000918	0.727	0.000183	74
		613	6	932	902	0.000918	0.727	0.000183	74
1.44% STEEL	0	0	6	611	602	0.001402	0.480	0.000180	74
		0	6	611	602	0.001402	0.480	0.000180	74
	5	155	6	725	698	0.001278	0.563	0.000178	74
		155	6	725	698	0.001278	0.563	0.000178	74
	10	310	6	808	788	0.001149	0.630	0.000180	74
		310	6	808	788	0.001149	0.630	0.000180	74
	15	466	6	882	870	0.001006	0.681	0.000183	74
		466	6	882	870	0.001006	0.681	0.000183	74
	20	621	6	952	941	0.000875	0.719	0.000188	74
		621	6	952	941	0.000875	0.719	0.000188	74
1.70% STEEL	0	0	6	701	695	0.001389	0.546	0.000183	74
		0	6	701	695	0.001389	0.546	0.000183	74
	5	160	6	807	786	0.001184	0.675	0.000180	74
		160	6	807	786	0.001184	0.675	0.000180	74
	10	320	6	893	870	0.001056	0.681	0.000182	74
		320	6	893	870	0.001056	0.681	0.000182	74
	15	481	6	968	948	0.000961	0.735	0.000185	74
		481	6	968	948	0.000961	0.735	0.000185	74
	20	641	6	1036	1018	0.000866	0.770	0.000190	74
		641	6	1036	1018	0.000866	0.770	0.000190	74
2.26% STEEL	0	0	6	888	880	0.001146	0.675	0.000187	74
		0	6	888	880	0.001146	0.675	0.000187	74
	5	171	6	979	970	0.001032	0.744	0.000181	74
		171	6	979	970	0.001032	0.744	0.000181	74
	10	342	6	1063	1054	0.000936	0.797	0.000190	74
		342	6	1063	1054	0.000936	0.797	0.000190	74
	15	513	6	1142	1130	0.000847	0.837	0.000194	74
		513	6	1142	1130	0.000847	0.837	0.000194	74
	20	684	6	1188	1197	0.000762	0.864	0.000199	74
		684	6	1188	1197	0.000762	0.864	0.000199	74

30" DIA CIDH PILE DETAILS
WITHOUT CASING

Project Information

Enter information to identify this project

Project Name: Lack Road Bridge Replacement Over New River

Job Number: 227518-0000439

Client: Imperial County Department of Public Works

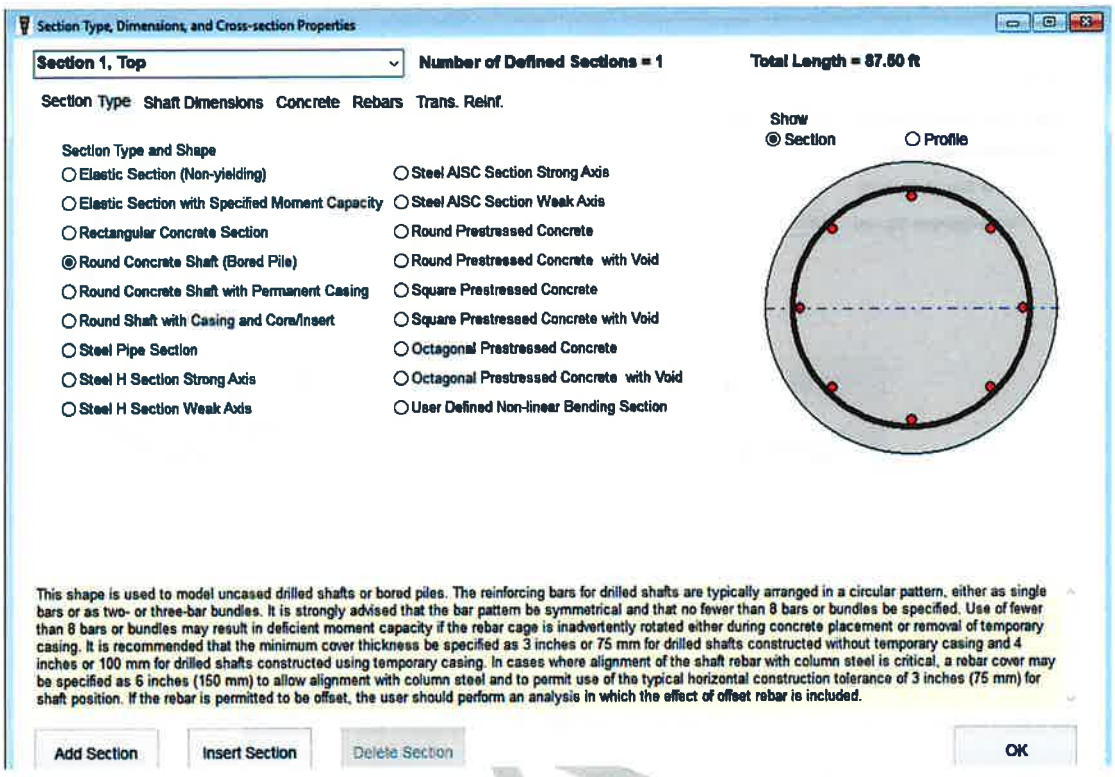
Engineer: Carl Henderson

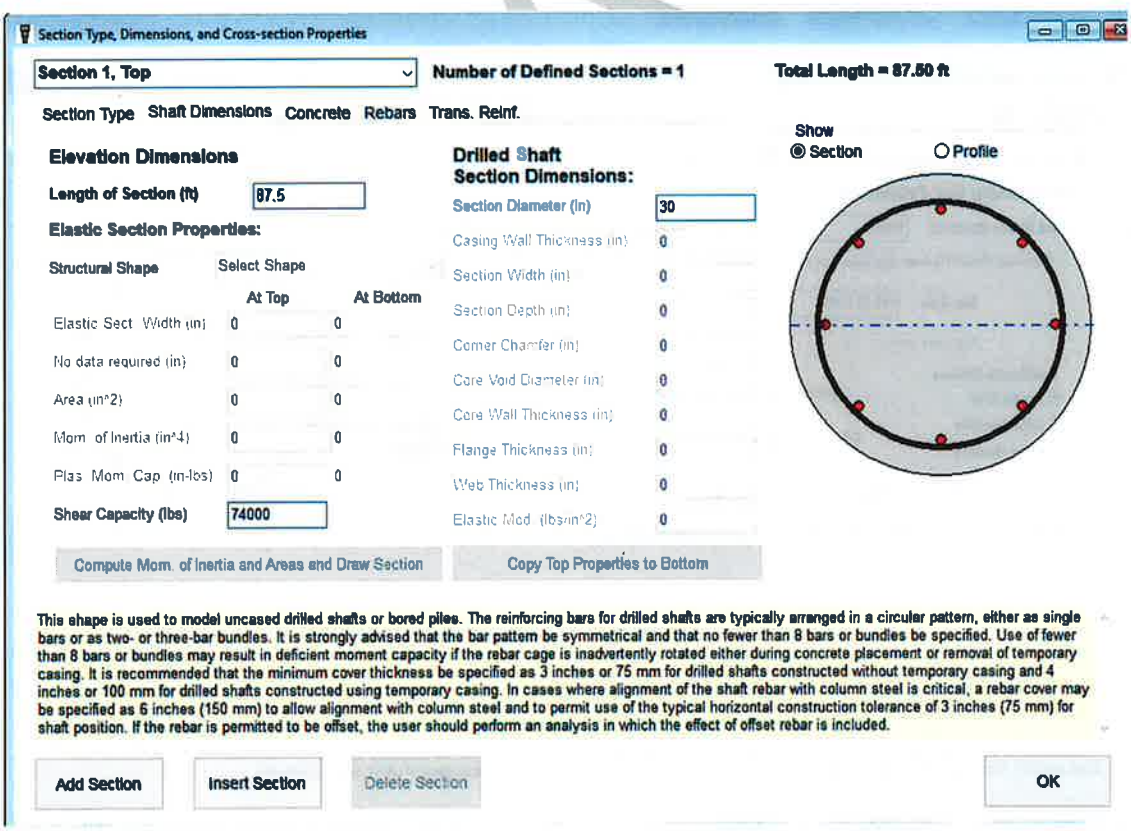
Description: Lateral Resistance - CIDH Concrete(30 inch);Boring A-19-01

Path to Files:	C:\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix E - Lateral Pile Resistance Analysis
Input Data File:	Boring A-19-001 - 30 inch.lp10d
Output Report File:	Boring A-19-001 - 30 inch.lp10o
Plot Output File:	Boring A-19-001 - 30 inch.lp10p
Current Time and Date:	6/5/2019 8:03:45 PM

(Filenames, file paths, and date and time of program run are included in the output report.)

OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Shaft Dimensions
Concrete
Rebars
Trans. Reinf.
Show
Section
Profile
Section Type and Shape
Elastic Section (Non-yielding)
Elastic Section with Specified Moment Capacity
Rectangular Concrete Section
Round Concrete Shaft (Bored Pile)
Round Concrete Shaft with Permanent Casing
Round Shaft with Casing and Core/Insert
Steel Pipe Section
Steel H Section Strong Axis
Steel H Section Weak Axis
Steel AISC Section Strong Axis
Steel AISC Section Weak Axis
Round Prestressed Concrete
Round Prestressed Concrete with Void
Square Prestressed Concrete
Square Prestressed Concrete with Void
Octagonal Prestressed Concrete
Octagonal Prestressed Concrete with Void
User Defined Non-linear Bending Section
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK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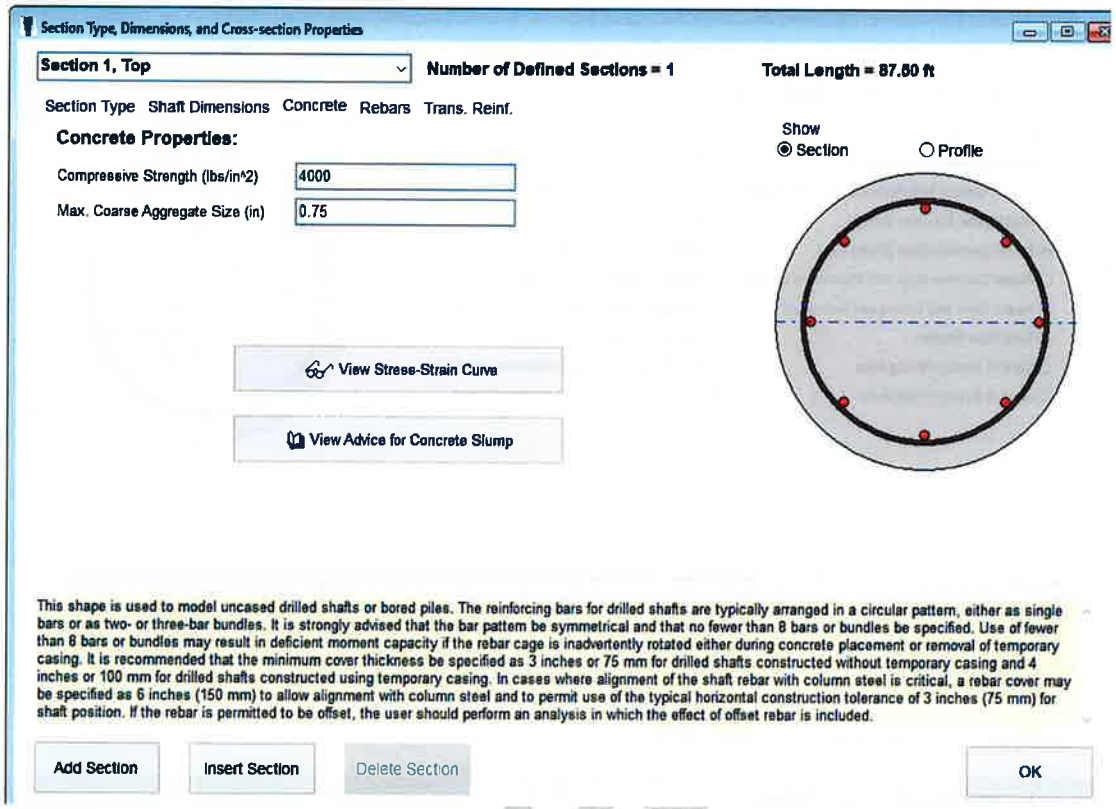
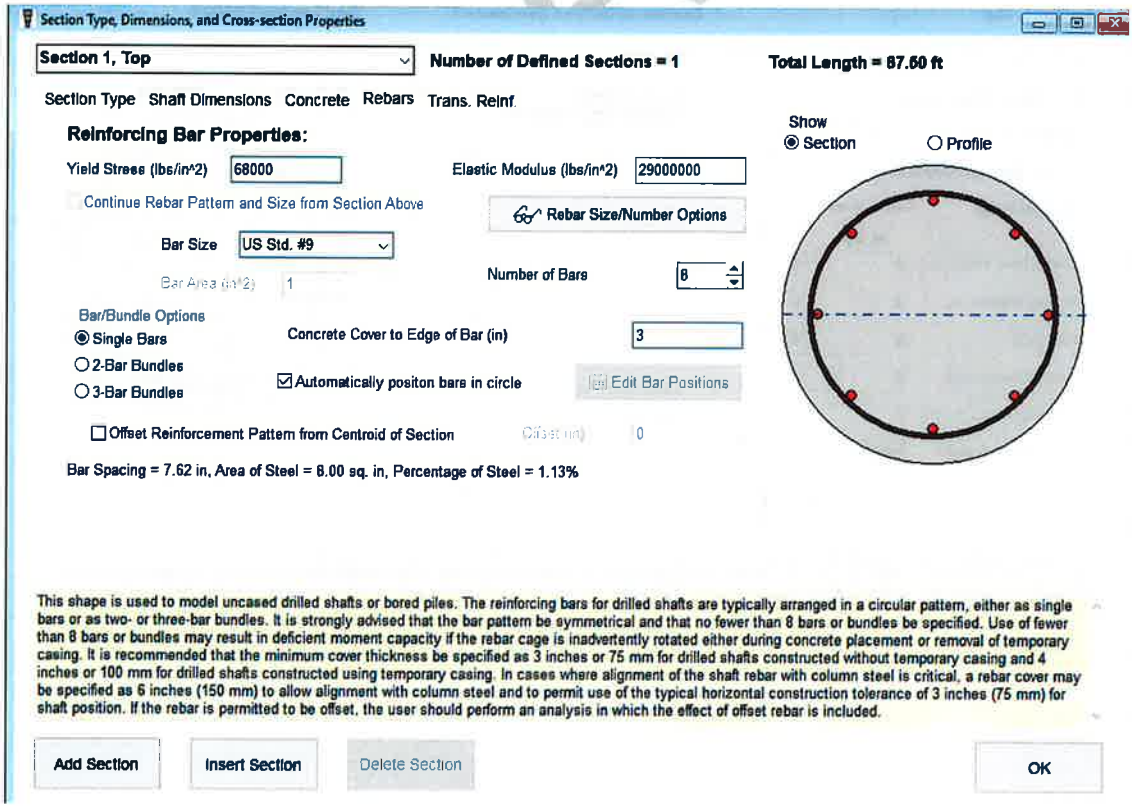
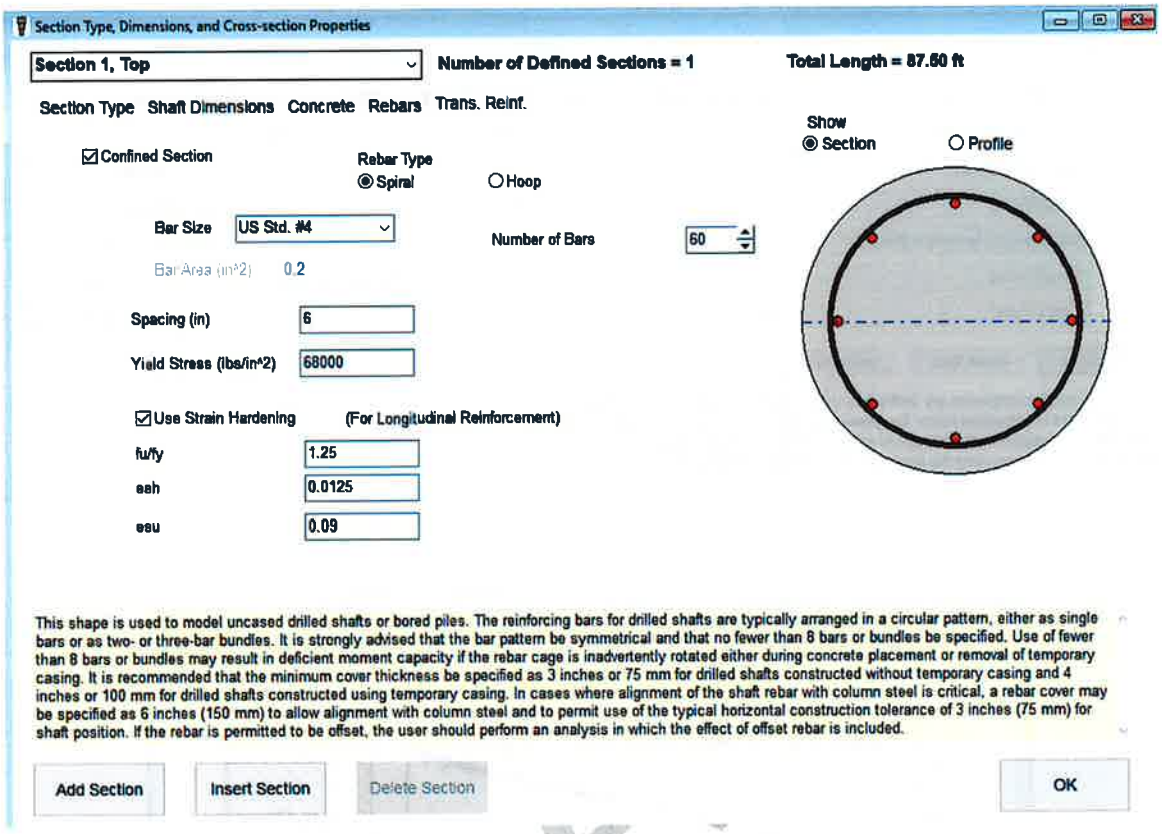
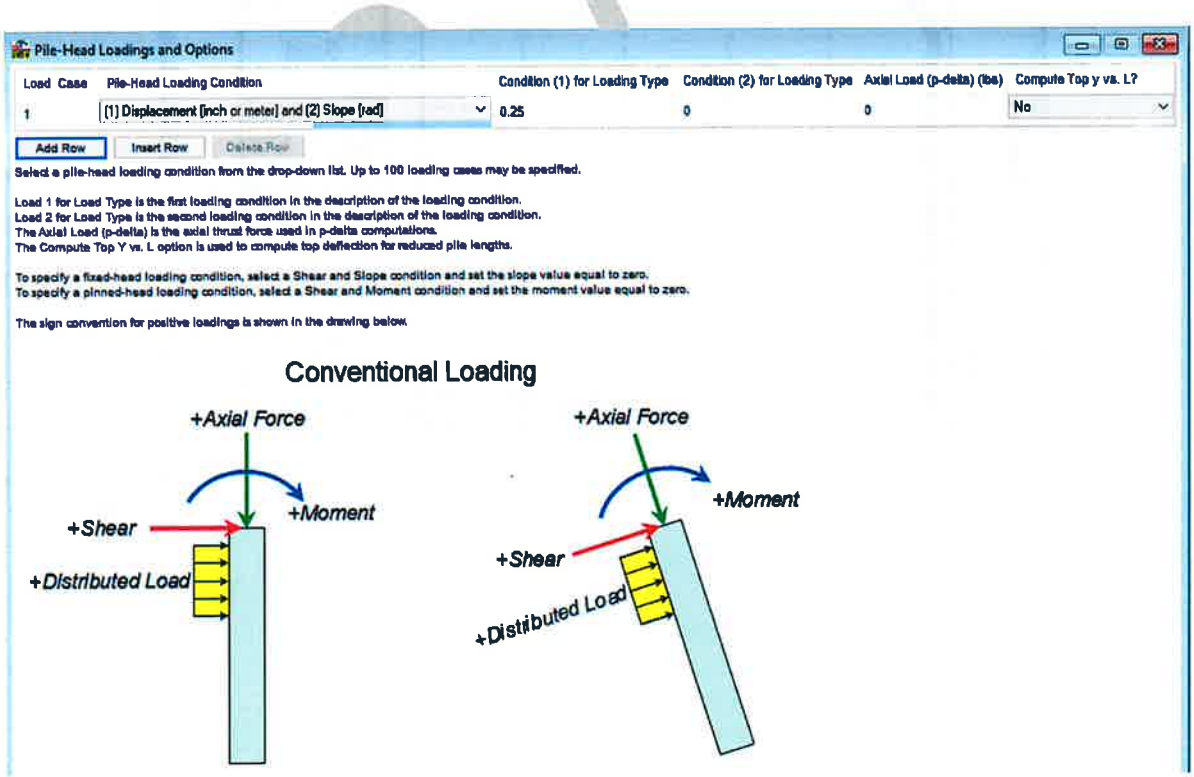
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Shaft Dimensions
Concrete
Rebars
Trans. Reinf.
Elevation Dimensions
Length of Section (ft)
87.5
Elastic Section Properties:
Structural Shape
Select Shape
At Top
At Bottom
Elastic Sect Width (in)
No data required (in)
Area (in^2)
Mom of Inertia (in^4)
Plas Mom Cap (in-lbs)
Shear Capacity (lbs)
74000
Drilled Shaft
Section Dimensions:
Section Diameter (in)
30
Casing Wall Thickness (in)
Section Width (in)
Section Depth (in)
Corner Chamfer (in)
Core Void Diameter (in)
Core Wall Thickness (in)
Flange Thickness (in)
Web Thickness (in)
Elastic Mod (lbs/in^2)
Compute Mom. of Inertia and Areas and Draw Section
Copy Top Properties to Bottom
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Shaft Dimensions
Concrete
Rebars
Trans. Reinf.
Concrete Properties:
Compressive Strength (lbs/in^2)
4000
Max. Coarse Aggregate Size (in)
0.75
View Stress-Strain Curve
View Advice for Concrete Slump
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Shaft Dimensions
Concrete
Rebars
Trans. Reinf.
Reinforcing Bar Properties:
Yield Stress (lbs/in^2)
68000
Elastic Modulus (lbs/in^2)
29000000
Continue Rebar Pattern and Size from Section Above
Rebar Size/Number Options
Bar Size
US Std. #9
Bar Area (in^2)
1
Number of Bars
8
Bar/Bundle Options
Single Bars
2-Bar Bundles
3-Bar Bundles
Concrete Cover to Edge of Bar (in)
3
Automatically positon bars in circle
Edit Bar Positions
Offset Reinforcement Pattern from Centroid of Section
Offset (in)
0
Bar Spacing = 7.62 in, Area of Steel = 8.00 sq. in, Percentage of Steel = 1.13%
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK


Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Shaft Dimensions
Concrete
Rebars
Trans. Reinf.
Confined Section
Rebar Type
Spiral
Hoop
Show
Section
Profile
Bar Size
US Std. #4
Number of Bars
60
Bar Area (in^2)
0.2
Spacing (in)
6
Yield Stress (lbs/in^2)
68000
Use Strain Hardening
(For Longitudinal Reinforcement)
fu/fy
1.25
esh
0.0125
esu
0.09
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK

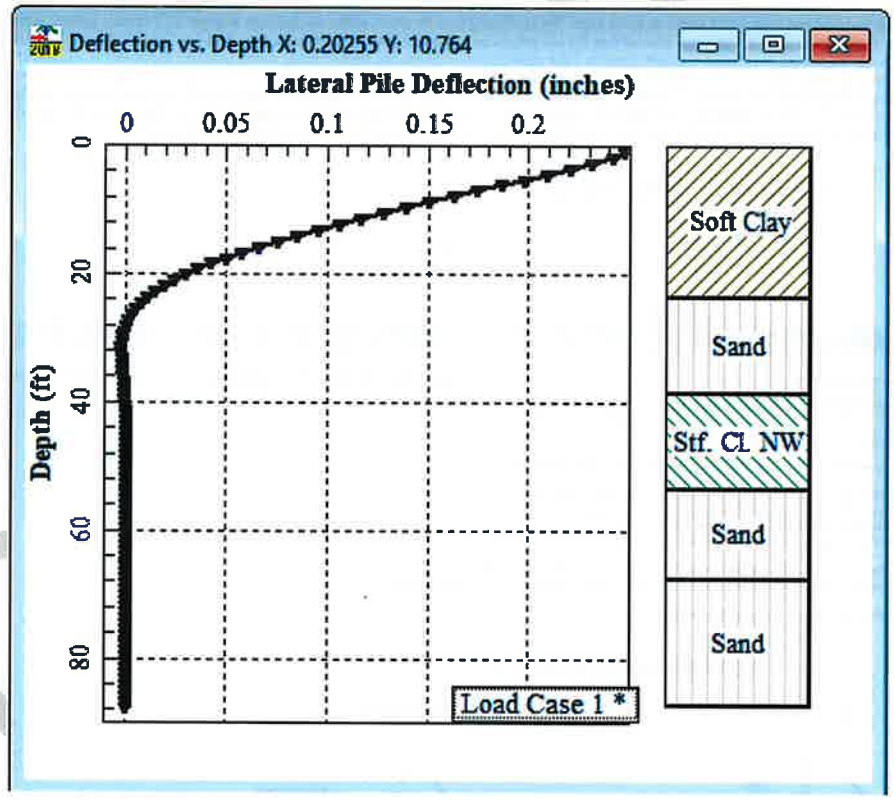

Pile-Head Loadings and Options
Load Case
Pile-Head Loading Condition
Condition (1) for Loading Type
Condition (2) for Loading Type
Axial Load (p-delta) (lbs)
Compute Top y vs. L?
1
(1) Displacement [inch or meter] and (2) Slope [rad]
0.25
0
0
No
Add Row
Insert Row
Delete Row
Select a pile-head loading condition from the drop-down list. Up to 100 loading cases may be specified.
Load 1 for Load Type is the first loading condition in the description of the loading condition.
Load 2 for Load Type is the second loading condition in the description of the loading condition.
The Axial Load (p-delta) is the axial thrust force used in p-delta computations.
The Compute Top Y vs. L option is used to compute top deflection for reduced pile lengths.
To specify a fixed-head loading condition, select a Shear and Slope condition and set the slope value equal to zero.
To specify a pinned-head loading condition, select a Shear and Moment condition and set the moment value equal to zero.
The sign convention for positive loadings is shown in the drawing below.
Conventional Loading
+Axial Force
+Moment
+Shear
+Distributed Load
+Axial Force
+Moment
+Shear
+Distributed Load

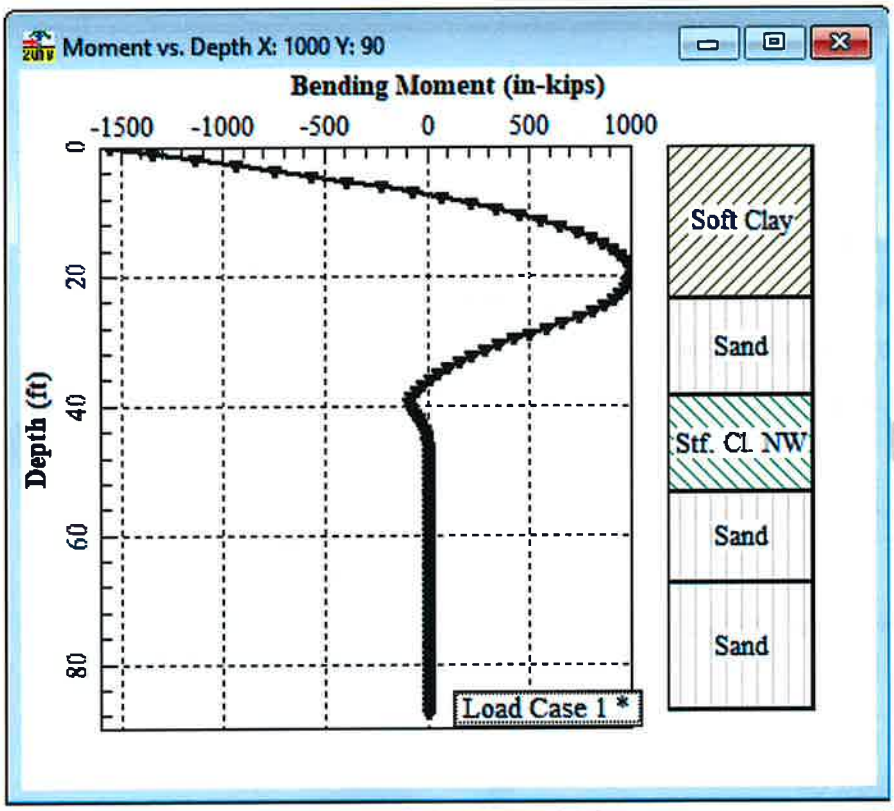
Soil Layers

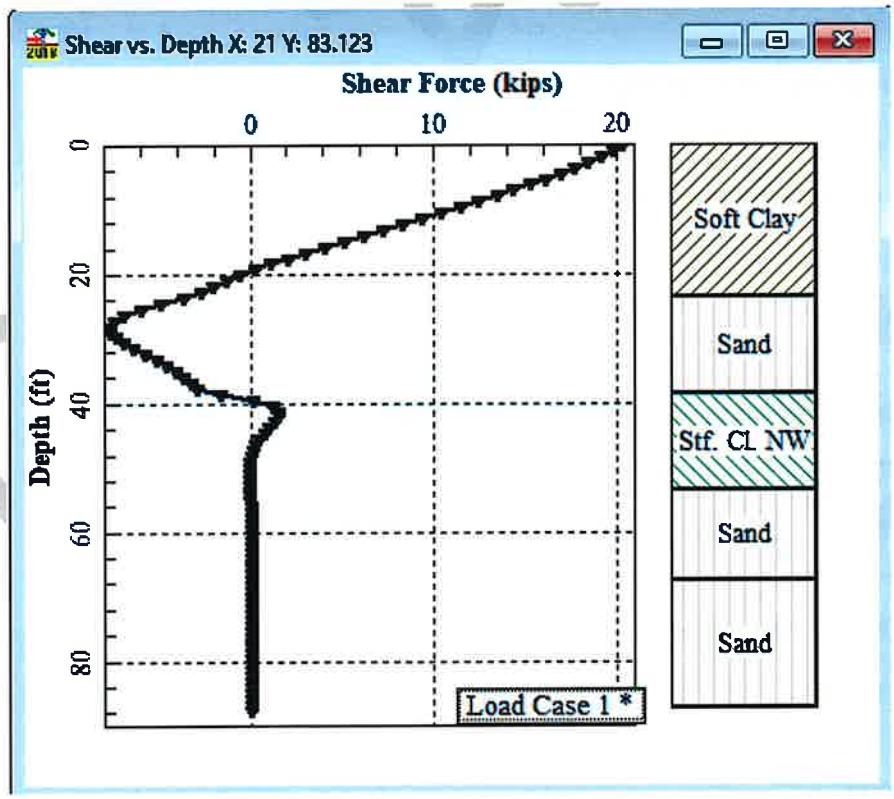
Layer	Select p-y Curve Type from Drop-down List	Vertical Depth Below Pile Head of Top of Soil Layer (ft)	Vertical Depth Below Pile Head of Bottom of Soil Layer (ft)	Press Button to Enter Soil Properties
1	Soft Clay (Matlock)	0	23.5	1: Soft Clay
2	Sand (Reese)	23.5	38.5	2: Sand (Reese, et al.)
3	Stiff Clay w/o Free Water (Reese)	38.5	53.5	3: Stiff Clay without Free Water
4	Sand (Reese)	53.5	67.5	4: Sand (Reese, et al.)
5	Sand (Reese)	67.5	87.5	5: Sand (Reese, et al.)

Add Row | Insert Row | Delete Row

All positive depth coordinates are defined as vertical distances below the pile-head.
If the pile-head is embedded below the ground surface, the top layer must extend from the ground surface (defined by a negative vertical depth) to some point below the pile head.
Select the p-y soil type using the drop-down list in the left table column.




Moment vs. Depth X: 1000 Y: 90
Bending Moment (in-kips)
-1500
-1000
-500
0
500
1000
Depth (ft)
0
20
40
60
80
Soft Clay
Sand
Stf. CL NW
Sand
Sand
Load Case 1 *


Shear vs. Depth X: 21 Y: 83.123
Shear Force (kips)
0
10
20
Depth (ft)
0
20
40
60
80
Soft Clay
Sand
Stf. CL NW
Sand
Sand
Load Case 1 *

==========

LPile for Windows, Version 2018-10.002

Analysis of Individual Piles and Drilled Shafts

Subjected to Lateral Loading Using the p-y Method

==========

This copy of LPile is being used by:

Carl Henderson

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Files Used for Analysis

Path to file locations:

\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix E - Lateral Pile Resistance Analysis\

Name of input data file:

Boring A-19-001 - 30 inch.lp10

Name of output report file:

Boring A-19-001 - 30 inch.lp10

Name of plot output file:

Boring A-19-001 - 30 inch.lp10

Name of runtime message file:

Boring A-19-001 - 30 inch.lp10

Date and Time of Analysis

Date: June 5, 2019 Time: 20:10:16

Problem Title

Project Name: Lack Road Bridge Replacement Over New River

Job Number: 227518-0000439

Client: Imperial County Department of Public Works

Engineer: Carl Henderson

Description: Lateral Resistance - CIDH Concrete(30 inch);Boring A-19-01

Program Options and Settings

Computational Options:

- Use unfactored loads in computations (conventional analysis)

Engineering Units Used for Data Input and Computations:

- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

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

Loading Type and Number of Cycles of Loading:

- Static loading specified

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

Output Options:

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

Pile Structural Properties and Geometry

Number of pile sections defined = 1

Total length of pile = 87.500 ft

Depth of ground surface below top of pile = 0.0000 ft

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

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

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	30.0000
2	87.500	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile

Length of section = 87.500000 ft

Shaft Diameter = 30.000000 in

Shear capacity of section = 74000. lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees

= 0.000 radians

Pile Batter Angle = 0.000 degrees

= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 0.0000 ft

Distance from top of pile to bottom of layer = 23.500000 ft

Effective unit weight at top of layer = 58.700000 pcf

Effective unit weight at bottom of layer = 58.700000 pcf

Undrained cohesion at top of layer = 300.000000 psf

Undrained cohesion at bottom of layer = 300.000000 psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

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

Distance from top of pile to top of layer = 23.500000 ft

Distance from top of pile to bottom of layer = 38.500000 ft

Effective unit weight at top of layer = 63.500000 pcf

Effective unit weight at bottom of layer = 63.500000 pcf

Friction angle at top of layer = 34.000000 deg.

Friction angle at bottom of layer = 34.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

Layer 3 is stiff clay without free water

Distance from top of pile to top of layer = 38.500000 ft

Distance from top of pile to bottom of layer = 53.500000 ft

Effective unit weight at top of layer = 56.200000 pcf

Effective unit weight at bottom of layer = 56.200000 pcf

Undrained cohesion at top of layer = 1750. psf

Undrained cohesion at bottom of layer = 1750. psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 53.500000 ft

Distance from top of pile to bottom of layer = 67.500000 ft

Effective unit weight at top of layer = 65.500000 pcf

Effective unit weight at bottom of layer = 65.500000 pcf

Friction angle at top of layer = 35.000000 deg.

Friction angle at bottom of layer = 35.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 67.500000 ft

Distance from top of pile to bottom of layer = 87.500000 ft

Effective unit weight at top of layer = 65.900000 pcf

Effective unit weight at bottom of layer = 65.900000 pcf

Friction angle at top of layer = 38.000000 deg.

Friction angle at bottom of layer = 38.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

(Depth of the lowest soil layer extends 0.000 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Soft Clay	0.00 23.5000	58.7000 58.7000	300.0000 300.0000	-- --	default default	-- --
2	Sand (Reese, et al.)	23.5000 38.5000	63.5000 63.5000	-- --	34.0000 34.0000	-- --	default default
3	Stiff Clay w/o Free Water	38.5000 53.5000	56.2000 56.2000	1750. 1750.	-- --	default default	-- --
4	Sand (Reese, et al.)	53.5000 67.5000	65.5000 65.5000	-- --	35.0000 35.0000	-- --	default default
5	Sand (Reese, et al.)	67.5000 87.5000	65.9000 65.9000	-- --	38.0000 38.0000	-- --	default default

---

Static Loading Type

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

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.250000 in	S = 0.0000 in/in	0.0000000	N.A.

V = shear force applied normal to pile axis

M = bending moment applied to pile head

y = lateral deflection normal to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).

Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

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

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section = 87.500000 ft

Shaft Diameter = 30.000000 in

Concrete Cover Thickness = 3.000000 in

Number of Reinforcing Bars = 8 bars

Yield Stress of Reinforcing Bars = 68000. psi

Modulus of Elasticity of Reinforcing Bars = 29000000. psi

Gross Area of Shaft = 706.858347 sq. in.

Total Area of Reinforcing Steel = 8.000000 sq. in.

Area Ratio of Steel Reinforcement = 1.13 percent

Edge-to-Edge Bar Spacing = 7.624735 in

Maximum Concrete Aggregate Size = 0.750000 in

Ratio of Bar Spacing to Aggregate Size = 10.17

Offset of Center of Rebar Cage from Center of Pile = 0.0000 in

Confined Section

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 2920.118 kips

Tensile Load for Cracking of Concrete = -317.428 kips

Nominal Axial Tensile Capacity = -544.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	11.436000	0.00000
2	1.128000	1.000000	8.086473	8.086473
3	1.128000	1.000000	0.00000	11.436000
4	1.128000	1.000000	-8.086473	8.086473
5	1.128000	1.000000	-11.436000	0.00000
6	1.128000	1.000000	-8.086473	-8.086473
7	1.128000	1.000000	0.00000	-11.436000
8	1.128000	1.000000	8.086473	-8.086473

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

Minimum spacing between any two bars not equal to zero = 7.625 inches between bars 1 and 2.

Ratio of bar spacing to maximum aggregate size = 10.17

Concrete Properties:

Compressive Strength of Concrete = 4000. psi

Modulus of Elasticity of Concrete = 3604997. psi

Modulus of Rupture of Concrete = -474.341649 psi

Compression Strain at Peak Stress = 0.001886

Tensile Strain at Fracture of Concrete = -0.0001154

Maximum Coarse Aggregate Size = 0.750000 in

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

Number	Axial Thrust Force kips
1	0.000

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.

Y = stress in reinforcing steel has reached yield stress.

T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.

Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.

Position of neutral axis is measured from edge of compression side of pile.

Compressive stresses and strains are positive in sign.

Tensile stresses and strains are negative in sign.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conf Stress ksi	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000200	365.8607984	182930399.	15.0000125	0.00003000	-0.00003000	-0.0012721	0.1249713	0.8613007	
0.00000400	728.0783216	182019580.	15.0000126	0.00006000	-0.00006000	-0.0025441	0.2479592	1.7226015	
0.00000600	1087.	181108762.	15.0000127	0.00009000	-0.00009000	-0.0038158	0.3689638	2.5839022	
0.00000800	1087.	135831571.	7.4425598	0.00005954	-0.0001805	0.00000	0.2436056	-5.1985261	C
0.00001000	1087.	108665257.	7.4475595	0.00007448	-0.0002255	0.00000	0.3035151	-6.4967077	C
0.00001200	1087.	90554381.	7.4525827	0.00008943	-0.0002706	0.00000	0.3630250	-7.7943012	C
0.00001400	1087.	77618041.	7.4576294	0.0001044	-0.0003156	0.00000	0.4221340	-9.0913025	C
0.00001600	1087.	67915786.	7.4627000	0.0001194	-0.0003606	0.00000	0.4808404	-10.3877072	C
0.00001800	1087.	60369587.	7.4677946	0.0001344	-0.0004056	0.00000	0.5391430	-11.6835112	C
0.00002000	1087.	54332628.	7.4729136	0.0001495	-0.0004505	0.00000	0.5970402	-12.9787101	C
0.00002200	1087.	49393299.	7.4780570	0.0001645	-0.0004955	0.00000	0.6545305	-14.2732996	C
0.00002400	1087.	45277190.	7.4832253	0.0001796	-0.0005404	0.00000	0.7116125	-15.5672752	C
0.00002600	1087.	41794330.	7.4884186	0.0001947	-0.0005853	0.00000	0.7682846	-16.8606324	C
0.00002800	1087.	38809020.	7.4936372	0.0002098	-0.0006302	0.00000	0.8245452	-18.1533666	C
0.00003000	1087.	36221752.	7.4988813	0.0002250	-0.0006750	0.00000	0.8803929	-19.4454733	C

0.00003200	1144.	35736003.	7.5041512	0.0002401	-0.0007199	0.00000	0.9358260	-
20.7369478 C								
0.00003400	1214.	35714613.	7.5094471	0.0002553	-0.0007647	0.00000	0.9908430	-
22.0277853 C								
0.00003600	1285.	35693132.	7.5147693	0.0002705	-0.0008095	0.00000	1.0454423	-
23.3179810 C								
0.00003800	1356.	35671558.	7.5201181	0.0002858	-0.0008542	0.00000	1.0996222	-
24.6075300 C								
0.00004000	1426.	35649891.	7.5254937	0.0003010	-0.0008990	0.00000	1.1533811	-
25.8964274 C								
0.00004200	1496.	35628131.	7.5308965	0.0003163	-0.0009437	0.00000	1.2067174	-
27.1846683 C								
0.00004400	1567.	35606275.	7.5363266	0.0003316	-0.0009884	0.00000	1.2596294	-
28.4722474 C								
0.00004600	1637.	35584324.	7.5417845	0.0003469	-0.0010331	0.00000	1.3121154	-
29.7591598 C								
0.00004800	1707.	35562276.	7.5472703	0.0003623	-0.0010777	0.00000	1.3641736	-
31.0454001 C								
0.00005000	1777.	35540130.	7.5527843	0.0003776	-0.0011224	0.00000	1.4158024	-
32.3309630 C								
0.00005200	1847.	35517886.	7.5583269	0.0003930	-0.0011670	0.00000	1.4670000	-
33.6158433 C								
0.00005400	1917.	35495542.	7.5638984	0.0004085	-0.0012115	0.00000	1.5177647	-
34.9000354 C								
0.00005600	1986.	35473097.	7.5694991	0.0004239	-0.0012561	0.00000	1.5680946	-
36.1835339 C								
0.00005800	2056.	35450551.	7.5751292	0.0004394	-0.0013006	0.00000	1.6179879	-
37.4663331 C								
0.00006000	2126.	35427903.	7.5807892	0.0004548	-0.0013452	0.00000	1.6674428	-
38.7484273 C								
0.00006200	2195.	35405151.	7.5864793	0.0004704	-0.0013896	0.00000	1.7164575	-
40.0298109 C								
0.00006400	2264.	35382294.	7.5921998	0.0004859	-0.0014341	0.00000	1.7650301	-
41.3104778 C								
0.00006600	2334.	35359332.	7.5979511	0.0005015	-0.0014785	0.00000	1.8131586	-
42.5904223 C								
0.00006800	2403.	35336262.	7.6037335	0.0005171	-0.0015229	0.00000	1.8608411	-
43.8696383 C								

0.00007000	2472.	35313085.	7.6095474	0.0005327	-0.0015673	0.00000	1.9080758 -
45.1481196 C							
0.00007200	2541.	35289799.	7.6153931	0.0005483	-0.0016117	0.00000	1.9548607 -
46.4258600 C							
0.00007400	2610.	35266403.	7.6212710	0.0005640	-0.0016560	0.00000	2.0011936 -
47.7028533 C							
0.00007600	2678.	35242895.	7.6271814	0.0005797	-0.0017003	0.00000	2.0470727 -
48.9790931 C							
0.00007800	2747.	35219275.	7.6331248	0.0005954	-0.0017446	0.00000	2.0924959 -
50.2545729 C							
0.00008200	2884.	35171696.	7.6451117	0.0006269	-0.0018331	0.00000	2.1819664 -
52.8032243 C							
0.00008600	3021.	35123711.	7.6569201	0.0006585	-0.0019215	0.00000	2.2695125 -
55.3495410 C							
0.00009000	3157.	35075312.	7.6686447	0.0006902	-0.0020098	0.00000	2.3551349 -
57.8933372 C							
0.00009400	3292.	35026451.	7.6804997	0.0007220	-0.0020980	0.00000	2.4388659 -
60.4340576 C							
0.00009800	3428.	34977118.	7.6924883	0.0007539	-0.0021861	0.00000	2.5206881 -
62.9716481 C							
0.0001020	3563.	34927303.	7.7046135	0.0007859	-0.0022741	0.00000	2.6005836 -
65.5060530 C							
0.0001060	3697.	34876996.	7.7168786	0.0008180	-0.0023620	0.00000	2.6785338 -
68.0000000 CY							
0.0001100	3831.	34826185.	7.7292870	0.0008502	-0.0024498	0.00000	2.7545200 -
68.0000000 CY							
0.0001140	3964.	34774859.	7.7418421	0.0008826	-0.0025374	0.00000	2.8285225 -
68.0000000 CY							
0.0001180	4097.	34723007.	7.7545476	0.0009150	-0.0026250	0.00000	2.9005216 -
68.0000000 CY							
0.0001220	4230.	34670615.	7.7674072	0.0009476	-0.0027124	0.00000	2.9704965 -
68.0000000 CY							
0.0001260	4351.	34534896.	7.7742259	0.0009796	-0.0028004	0.00000	3.0368014 -
68.0000000 CY							
0.0001300	4450.	34230190.	7.7681627	0.0010099	-0.0028901	0.00000	3.0976389 -
68.0000000 CY							
0.0001340	4541.	33887936.	7.7590277	0.0010397	-0.0029803	0.00000	3.1555955 -
68.0000000 CY							

0.0001380	4632.	33563132.	7.7511187	0.0010697	-0.0030703	0.00000	3.2118096	-
68.0000000 CY								
0.0001420	4722.	33254269.	7.7443433	0.0010997	-0.0031603	0.00000	3.2662650	-
68.0000000 CY								
0.0001460	4812.	32960004.	7.7386199	0.0011298	-0.0032502	0.00000	3.3189452	-
68.0000000 CY								
0.0001500	4898.	32650503.	7.7311928	0.0011597	-0.0033403	0.00000	3.3691558	-
68.0000000 CY								
0.0001540	4962.	32223153.	7.7121859	0.0011877	-0.0034323	0.00000	3.4144576	-
68.0000000 CY								
0.0001580	4999.	31636913.	7.6770703	0.0012130	-0.0035270	0.00000	3.4538529	-
68.0000000 CY								
0.0001620	5027.	31027991.	7.6383937	0.0012374	-0.0036226	0.00000	3.4905788	-
68.0000000 CY								
0.0001660	5054.	30446267.	7.6004273	0.0012617	-0.0037183	0.00000	3.5257470	-
68.0000000 CY								
0.0001700	5081.	29891157.	7.5645883	0.0012860	-0.0038140	0.00000	3.5597389	-
68.0000000 CY								
0.0001740	5109.	29360817.	7.5307337	0.0013103	-0.0039097	0.00000	3.5925462	-
68.0000000 CY								
0.0001780	5136.	28853570.	7.4987332	0.0013348	-0.0040052	0.00000	3.6241604	-
68.0000000 CY								
0.0001820	5163.	28367885.	7.4684682	0.0013593	-0.0041007	0.00000	3.6545726	-
68.0000000 CY								
0.0001860	5190.	27902362.	7.4398306	0.0013838	-0.0041962	0.00000	3.6837742	-
68.0000000 CY								
0.0001900	5217.	27455719.	7.4127211	0.0014084	-0.0042916	0.00000	3.7117561	-
68.0000000 CY								
0.0001940	5243.	27026782.	7.3870490	0.0014331	-0.0043869	0.00000	3.7385092	-
68.0000000 CY								
0.0001980	5270.	26614468.	7.3627308	0.0014578	-0.0044822	0.00000	3.7640241	-
68.0000000 CY								
0.0002020	5296.	26217370.	7.3390323	0.0014825	-0.0045775	0.00000	3.7881619	-
68.0000000 CY								
0.0002060	5322.	25834537.	7.3157941	0.0015071	-0.0046729	0.00000	3.8109102	-
68.0000000 CY								
0.0002100	5348.	25465631.	7.2937549	0.0015317	-0.0047683	0.00000	3.8324240	-
68.0000000 CY								

0.0002140	5374.	25109864.	7.2728516	0.0015564	-0.0048636	0.00000	3.8526933
68.0000000 CY							
0.0002180	5399.	24766505.	7.2530258	0.0015812	-0.0049588	0.00000	3.8717079
68.0000000 CY							
0.0002220	5425.	24434873.	7.2342233	0.0016060	-0.0050540	0.00000	3.8894573
68.0000000 CY							
0.0002260	5450.	24114340.	7.2163941	0.0016309	-0.0051491	0.00000	3.9059311
68.0000000 CY							
0.0002300	5475.	23804318.	7.1994914	0.0016559	-0.0052441	0.00000	3.9211184
68.0000000 CY							
0.0002340	5500.	23504259.	7.1834722	0.0016809	-0.0053391	0.00000	3.9350081
68.0000000 CY							
0.0002380	5525.	23213654.	7.1682960	0.0017061	-0.0054339	0.00000	3.9475889
68.0000000 CY							
0.0002540	5623.	22136674.	7.1153109	0.0018073	-0.0058127	0.00000	3.9845890
68.0000000 CY							
0.0002700	5718.	21177790.	7.0732358	0.0019098	-0.0061902	0.00000	3.9996752
68.0000000 CY							
0.0002860	5805.	20295938.	7.0348066	0.0020120	-0.0065680	0.00000	3.9999898
68.0000000 CY							
0.0003020	5855.	19386647.	6.9732568	0.0021059	-0.0069541	0.00000	3.9999473
68.0000000 CY							
0.0003180	5872.	18464254.	6.8926260	0.0021919	-0.0073481	0.00000	3.9990986
68.0000000 CY							
0.0003340	5882.	17611251.	6.8174051	0.0022770	-0.0077430	0.00000	3.9959315
68.0000000 CY							
0.0003500	5892.	16834041.	6.7512031	0.0023629	-0.0081371	0.00000	3.9986988
68.0000000 CY							
0.0003660	5900.	16119820.	6.6872110	0.0024475	-0.0085325	0.00000	3.9979549
68.0000000 CY							
0.0003820	5907.	15463980.	6.6301419	0.0025327	-0.0089273	0.00000	3.9949387
68.0000000 CY							
0.0003980	5914.	14859360.	6.5794263	0.0026186	-0.0093214	0.00000	3.9978473
68.0000000 CY							
0.0004140	5920.	14300419.	6.5340027	0.0027051	-0.0097149	0.00000	3.9963925
68.0000000 CY							
0.0004300	5926.	13781812.	6.4935223	0.0027922	-0.0101078	0.00000	3.9957401
68.0000000 CY							

0.0004460	5932.	13299718.	6.4569659	0.0028798	-0.0105002	0.00000	3.9998884
68.0000000 CY							
0.0004620	5936.	12849109.	6.4212412	0.0029666	-0.0108934	0.00000	3.9892564
68.0000000 CY							
0.0004780	5941.	12427908.	6.3880561	0.0030535	-0.0112865	0.00000	3.9969974
68.0000000 CY							
0.0004940	5945.	12033549.	6.3578227	0.0031408	-0.0116792	0.00000	3.9999695
68.0000000 CY							
0.0005100	5948.	11663166.	6.3307284	0.0032287	-0.0120713	0.00000	3.9868631
68.0000000 CY							
0.0005260	5952.	11314958.	6.3059733	0.0033169	-0.0124631	0.00000	3.9947358
68.0000000 CY							
0.0005420	5955.	10986995.	6.2833080	0.0034056	-0.0128544	0.00000	3.9992737 -
68.2568215 CY							
0.0005580	5958.	10677391.	6.2627794	0.0034946	-0.0132454	0.00000	3.9943377 -
68.6142988 CY							
0.0005740	5961.	10384615.	6.2442063	0.0035842	-0.0136358	0.00000	3.9863483 -
68.9624564 CY							
0.0005900	5963.	10107504.	6.2271222	0.0036740	-0.0140260	0.00000	3.9943697 -
69.3017802 CY							
0.0006060	5966.	9844862.	6.2114328	0.0037641	-0.0144159	0.00000	3.9989167 -
69.6325603 CY							
0.0006220	5971.	9599362.	6.1979490	0.0038551	-0.0148049	0.00000	3.9970048 -
69.9546162 CY							
0.0006380	5971.	9358626.	6.2148740	0.0039651	-0.0151749	0.00000	3.9831899 -
70.2537094 CY							
0.0006540	5971.	9129669.	6.2043996	0.0040577	-0.0155623	0.00000	3.9918978 -
70.5596923 CY							
0.0006700	5971.	8911647.	6.2447916	0.0041840	-0.0159160	0.00000	3.9997871 -
70.8325822 CY							
0.0006860	5971.	8703795.	6.2352134	0.0042774	-0.0163026	0.00000	3.9923545 -
71.1244500 CY							
0.0007020	5971.	8505418.	6.2910434	0.0044163	-0.0166437	0.00000	3.9881982 -
71.3760802 CY							
0.0007180	5971.	8315882.	6.2816400	0.0045102	-0.0170298	0.00000	3.9947167 -
71.6550383 CY							
0.0007340	5971.	8134609.	6.3499047	0.0046608	-0.0173592	0.00000	3.9930840 -
71.8877565 CY							

0.0007500	5971.	7961071.	6.3440593	0.0047580	-0.0177420	0.00000	3.9814163 - 72.1528388 CY
0.0007660	5971.	7794782.	6.4302503	0.0049256	-0.0180544	0.00000	3.9955380 - 72.3645535 CY
0.0007820	5971.	7635298.	6.4258518	0.0050250	-0.0184350	0.00000	3.9990961 - 72.6175874 CY
0.0007980	5971.	7482210.	6.5194460	0.0052025	-0.0187375	0.00000	3.9735552 - 72.8144524 CY
0.0008140	5971.	7335139.	6.5182900	0.0053059	-0.0191141	0.00000	3.9834632 - 73.0551934 CY
0.0008300	5971.	7193739.	6.5174131	0.0054095	-0.0194905	0.00000	3.9914284 - 73.2906734 CY
0.0008460	5971.	7057687.	6.6228339	0.0056029	-0.0197771	0.00000	3.9885417 - 73.4662113 CY
0.0008620	5971.	6926686.	6.6244490	0.0057103	-0.0201497	0.00000	3.9767041 - 73.6907232 CY
0.0008780	5971.	6800459.	6.7472796	0.0059241	-0.0204159	0.00000	3.9977377 - 73.8478165 CY
0.0009740	5971.	6130188.	6.9997482	0.0068178	-0.0224022	0.00000	3.9654547 - 74.9516944 CY
0.0010700	5971.	5580190.	7.2551920	0.0077631	-0.0243369	0.00000	3.9957181 - 75.9180299 CY

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003

or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	0.000	5937.922	0.00300000

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

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

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

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

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	5938.	0.0000	3860.	34815120.
1	0.70	5938.	0.0000	4157.	34699586.
1	0.75	5938.	0.0000	4453.	34216971.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or Rock Layer is Below	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	124505.
2	23.5000	11.6608	No	No	124505.	954836.
3	38.5000	35.9366	No	No	1079341.	590625.
4	53.5000	30.3196	No	No	1669966.	3337940.
5	67.5000	40.4228	Yes	No	5007906.	N.A.

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

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

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)

Displacement of pile head = 0.250000 inches

Rotation of pile head = 0.000E+00 radians

Axial load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1553879.	20409.	0.00	0.00	3.56E+10	-51.5926	1083.	0.00
0.8750	0.2476	-1342745.	19807.	-4.27E-04	0.00	3.56E+10	-57.3615	2433.	0.00
1.7500	0.2410	-1137935.	19176.	-7.92E-04	0.00	3.58E+10	-62.7322	2733.	0.00
2.6250	0.2310	-940041.	18492.	-9.86E-04	0.00	1.81E+11	-67.6450	3075.	0.00
3.5000	0.2203	-749605.	17757.	-0.00103	0.00	1.82E+11	-72.2983	3446.	0.00
4.3750	0.2092	-567140.	16975.	-0.00107	0.00	1.82E+11	-76.6749	3848.	0.00
5.2500	0.1978	-393128.	16149.	-0.00110	0.00	1.83E+11	-80.7584	4287.	0.00
6.1250	0.1861	-228021.	15281.	-0.00112	0.00	1.83E+11	-84.5336	4769.	0.00
7.0000	0.1743	-72232.	14375.	-0.00113	0.00	1.83E+11	-87.9859	5300.	0.00
7.8750	0.1625	73855.	13435.	-0.00113	0.00	1.83E+11	-91.1015	5888.	0.00
8.7500	0.1506	209899.	12464.	-0.00112	0.00	1.83E+11	-93.8672	6543.	0.00
9.6250	0.1390	335594.	11466.	-0.00110	0.00	1.83E+11	-96.2706	7274.	0.00
10.5000	0.1275	450675.	10444.	-0.00108	0.00	1.83E+11	-98.2997	8097.	0.00
11.3750	0.1163	554918.	9403.	-0.00105	0.00	1.82E+11	-99.9431	9026.	0.00
12.2500	0.1054	648143.	8347.	-0.00102	0.00	1.82E+11	-101.1899	10081.	0.00
13.1250	0.09491	730212.	7280.	-9.77E-04	0.00	1.82E+11	-102.0295	11288.	0.00
14.0000	0.08487	801032.	6207.	-9.33E-04	0.00	1.82E+11	-102.4516	12675.	0.00
14.8750	0.07532	860556.	5131.	-8.85E-04	0.00	1.82E+11	-102.4460	14282.	0.00
15.7500	0.06629	908786.	4071.	-8.34E-04	0.00	1.81E+11	-99.4415	15752.	0.00
16.6250	0.05781	946053.	3050.	-7.80E-04	0.00	1.81E+11	-95.0078	17257.	0.00
17.5000	0.04990	972844.	2077.	-7.25E-04	0.00	1.81E+11	-90.4651	19035.	0.00
18.3750	0.04259	989662.	1151.	-6.68E-04	0.00	1.81E+11	-85.8125	21156.	0.00
19.2500	0.03588	997020.	275.1912	-6.10E-04	0.00	1.81E+11	-81.0473	23718.	0.00
20.1250	0.02978	995441.	-550.1701	-5.53E-04	0.00	1.81E+11	-76.1644	26858.	0.00
21.0000	0.02428	985466.	-1324.	-4.95E-04	0.00	1.81E+11	-71.1554	30776.	0.00
21.8750	0.01938	967646.	-2044.	-4.39E-04	0.00	1.81E+11	-66.0069	35767.	0.00
22.7500	0.01507	942548.	-2709.	-3.83E-04	0.00	1.81E+11	-60.6984	42302.	0.00

23.6250	0.01133	910759.	-3682.	-3.30E-04	0.00	1.81E+11	-124.6904	115578.	0.00
24.5000	0.00814	865222.	-4905.	-2.78E-04	0.00	1.82E+11	-108.2431	139577.	0.00
25.3750	0.00548	807752.	-5979.	-2.30E-04	0.00	1.82E+11	-96.3451	184495.	0.00
26.2500	0.00331	739659.	-6896.	-1.85E-04	0.00	1.82E+11	-78.3238	248191.	0.00
27.1250	0.00159	662932.	-7512.	-1.45E-04	0.00	1.82E+11	-38.8864	256464.	0.00
28.0000	2.72E-04	581917.	-7752.	-1.09E-04	0.00	1.82E+11	-6.8552	264737.	0.00
28.8750	-6.96E-04	500146.	-7693.	-7.78E-05	0.00	1.82E+11	18.1033	273010.	0.00
29.7500	-0.00136	420371.	-7406.	-5.13E-05	0.00	1.83E+11	36.4906	281283.	0.00
30.6250	-0.00177	344620.	-6958.	-2.94E-05	0.00	1.83E+11	48.9315	289556.	0.00
31.5000	-0.00198	274263.	-6406.	-1.16E-05	0.00	1.83E+11	56.1307	297829.	0.00
32.3750	-0.00202	210094.	-5802.	2.29E-06	0.00	1.83E+11	58.8334	306102.	0.00
33.2500	-0.00193	152412.	-5190.	1.27E-05	0.00	1.83E+11	57.8068	314375.	0.00
34.1250	-0.00175	101103.	-4604.	2.00E-05	0.00	1.83E+11	53.8199	322648.	0.00
35.0000	-0.00151	55728.	-4071.	2.45E-05	0.00	1.83E+11	47.6301	330921.	0.00
35.8750	-0.00124	15604.	-3611.	2.65E-05	0.00	1.83E+11	39.9768	339194.	0.00
36.7500	-9.54E-04	-20113.	-3236.	2.64E-05	0.00	1.83E+11	31.5809	347467.	0.00
37.6250	-6.83E-04	-52348.	-2948.	2.43E-05	0.00	1.83E+11	23.1495	355740.	0.00
38.5000	-4.44E-04	-82031.	-1656.	2.05E-05	0.00	1.83E+11	223.1084	5278923.	0.00
39.3750	-2.54E-04	-87116.	185.3629	1.56E-05	0.00	1.83E+11	127.5513	5278923.	0.00
40.2500	-1.16E-04	-78138.	1162.	1.09E-05	0.00	1.83E+11	58.3906	5278923.	0.00
41.1250	-2.57E-05	-62723.	1536.	6.82E-06	0.00	1.83E+11	12.9061	5278923.	0.00
42.0000	2.70E-05	-45885.	1532.	3.70E-06	0.00	1.83E+11	-13.5731	5278923.	0.00
42.8750	5.20E-05	-30543.	1324.	1.51E-06	0.00	1.83E+11	-26.1490	5278923.	0.00
43.7500	5.86E-05	-18085.	1032.	1.10E-07	0.00	1.83E+11	-29.4702	5278923.	0.00
44.6250	5.43E-05	-8875.	733.7190	-6.64E-07	0.00	1.83E+11	-27.3117	5278923.	0.00
45.5000	4.47E-05	-2676.	472.3963	-9.95E-07	0.00	1.83E+11	-22.4641	5278923.	0.00
46.3750	3.34E-05	1045.	266.2311	-1.04E-06	0.00	1.83E+11	-16.8055	5278923.	0.00
47.2500	2.28E-05	2914.	117.8179	-9.28E-07	0.00	1.83E+11	-11.4637	5278923.	0.00
48.1250	1.39E-05	3520.	20.8576	-7.44E-07	0.00	1.83E+11	-7.0050	5278923.	0.00
49.0000	7.19E-06	3352.	-34.8851	-5.46E-07	0.00	1.83E+11	-3.6127	5278923.	0.00
49.8750	2.46E-06	2787.	-60.3421	-3.70E-07	0.00	1.83E+11	-1.2362	5278923.	0.00

50.7500	-5.88E-07	2085.	-65.2797	-2.30E-07	0.00	1.83E+11	0.2957	5278923.	0.00
51.6250	-2.38E-06	1416.	-57.4488	-1.30E-07	0.00	1.83E+11	1.1959	5278923.	0.00
52.5000	-3.32E-06	878.8505	-42.4192	-6.40E-08	0.00	1.83E+11	1.6669	5278923.	0.00
53.3750	-3.72E-06	525.3363	-23.8419	-2.37E-08	0.00	1.83E+11	1.8716	5278923.	0.00
54.2500	-3.81E-06	378.1706	-12.8999	2.22E-09	0.00	1.83E+11	0.2125	585230.	0.00
55.1250	-3.68E-06	254.4378	-10.6910	2.04E-08	0.00	1.83E+11	0.2082	594669.	0.00
56.0000	-3.39E-06	153.6586	-8.5754	3.21E-08	0.00	1.83E+11	0.1948	604108.	0.00
56.8750	-3.00E-06	74.3537	-6.6319	3.86E-08	0.00	1.83E+11	0.1754	613547.	0.00
57.7500	-2.57E-06	14.3897	-4.9090	4.12E-08	0.00	1.83E+11	0.1527	622986.	0.00
58.6250	-2.14E-06	-28.7360	-3.4313	4.08E-08	0.00	1.83E+11	0.1287	632426.	0.00
59.5000	-1.72E-06	-57.6685	-2.2041	3.83E-08	0.00	1.83E+11	0.1050	641865.	0.00
60.3750	-1.33E-06	-75.0226	-1.2186	3.45E-08	0.00	1.83E+11	0.08270	651304.	0.00
61.2500	-9.94E-07	-83.2587	-0.4560	2.99E-08	0.00	1.83E+11	0.06254	660743.	0.00
62.1250	-7.05E-07	-84.5996	0.1084	2.51E-08	0.00	1.83E+11	0.04497	670182.	0.00
63.0000	-4.66E-07	-80.9823	0.5030	2.04E-08	0.00	1.83E+11	0.03018	679622.	0.00
63.8750	-2.77E-07	-74.0376	0.7568	1.59E-08	0.00	1.83E+11	0.01817	689061.	0.00
64.7500	-1.32E-07	-65.0899	0.8983	1.19E-08	0.00	1.83E+11	0.00878	698500.	0.00
65.6250	-2.63E-08	-55.1743	0.9537	8.48E-09	0.00	1.83E+11	0.00178	707939.	0.00
66.5000	4.60E-08	-45.0628	0.9465	5.60E-09	0.00	1.83E+11	-0.00314	717378.	0.00
67.3750	9.12E-08	-35.2980	0.8968	3.29E-09	0.00	1.83E+11	-0.00632	726817.	0.00
68.2500	1.15E-07	-26.2295	0.8042	1.53E-09	0.00	1.83E+11	-0.01132	1032209.	0.00
69.1250	1.23E-07	-18.4092	0.6803	2.46E-10	0.00	1.83E+11	-0.01228	1045443.	0.00
70.0000	1.20E-07	-11.9425	0.5522	-6.25E-10	0.00	1.83E+11	-0.01213	1058676.	0.00
70.8750	1.10E-07	-6.8135	0.4294	-1.16E-09	0.00	1.83E+11	-0.01125	1071909.	0.00
71.7500	9.59E-08	-2.9246	0.3183	-1.44E-09	0.00	1.83E+11	-0.00991	1085143.	0.00
72.6250	7.99E-08	-0.1285	0.2224	-1.53E-09	0.00	1.83E+11	-0.00836	1098376.	0.00
73.5000	6.38E-08	1.7463	0.1431	-1.48E-09	0.00	1.83E+11	-0.00675	1111610.	0.00
74.3750	4.87E-08	2.8767	0.08026	-1.35E-09	0.00	1.83E+11	-0.00522	1124843.	0.00
75.2500	3.54E-08	3.4318	0.03272	-1.17E-09	0.00	1.83E+11	-0.00384	1138077.	0.00
76.1250	2.41E-08	3.5639	-0.00132	-9.69E-10	0.00	1.83E+11	-0.00265	1151310.	0.00
77.0000	1.50E-08	3.4041	-0.02397	-7.70E-10	0.00	1.83E+11	-0.00167	1164544.	0.00

77.8750	7.98E-09	3.0604	-0.03743	-5.84E-10	0.00	1.83E+11	-8.95E-04	1177777.	0.00
78.7500	2.77E-09	2.6180	-0.04378	-4.21E-10	0.00	1.83E+11	-3.15E-04	1191010.	0.00
79.6250	-8.58E-10	2.1410	-0.04492	-2.84E-10	0.00	1.83E+11	9.84E-05	1204244.	0.00
80.5000	-3.20E-09	1.6747	-0.04246	-1.75E-10	0.00	1.83E+11	3.71E-04	1217477.	0.00
81.3750	-4.53E-09	1.2494	-0.03772	-9.10E-11	0.00	1.83E+11	5.31E-04	1230711.	0.00
82.2500	-5.11E-09	0.8826	-0.03175	-2.98E-11	0.00	1.83E+11	6.05E-04	1243944.	0.00
83.1250	-5.16E-09	0.5826	-0.02533	1.22E-11	0.00	1.83E+11	6.17E-04	1257178.	0.00
84.0000	-4.85E-09	0.3506	-0.01901	3.90E-11	0.00	1.83E+11	5.87E-04	1270411.	0.00
84.8750	-4.34E-09	0.1834	-0.01314	5.43E-11	0.00	1.83E+11	5.30E-04	1283645.	0.00
85.7500	-3.71E-09	0.07462	-0.00795	6.18E-11	0.00	1.83E+11	4.58E-04	1296878.	0.00
86.6250	-3.04E-09	0.01640	-0.00355	6.44E-11	0.00	1.83E+11	3.79E-04	1310112.	0.00
87.5000	-2.36E-09	0.00	0.00	6.48E-11	0.00	1.83E+11	2.97E-04	661672.	0.00

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

Output Summary for Load Case No. 1:

Pile-head deflection = 0.25000000 inches

Computed slope at pile head = 0.000000 radians

Maximum bending moment = -1553879. inch-lbs

Maximum shear force = 20409. lbs

Depth of maximum bending moment = 0.000000 feet below pile head

Depth of maximum shear force = 0.000000 feet below pile head

Number of iterations = 14

Number of zero deflection points = 5

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs

Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians

Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.

Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs

Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type Pile-head	Load 1	Load Type Pile-head	Load 2	Axial Pile-head Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.2500	S, rad	0.00	0.00	0.2500	0.00	20409.	-1553879.

Maximum pile-head deflection = 0.2500000000 inches

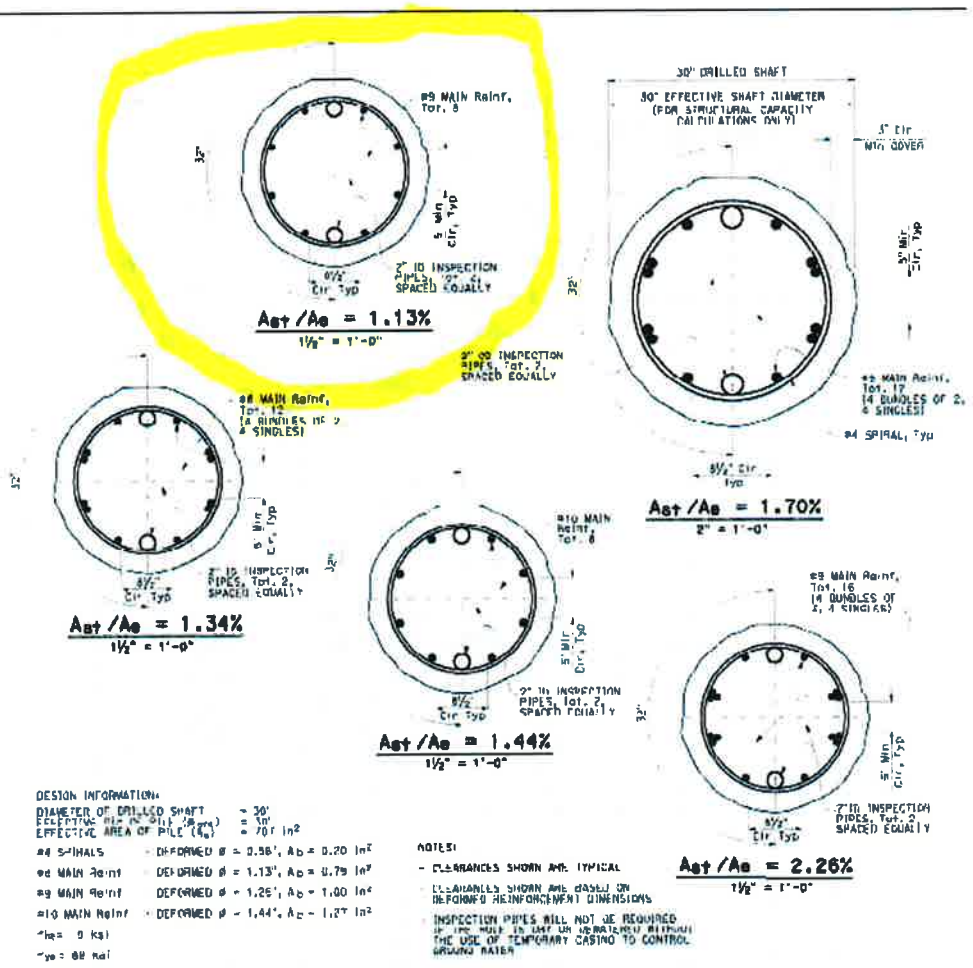
Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.

Boring A-19-002

Abutment #1

30-inch CIDH Pile


#9 MAIN Reinf, Tot. 8
32"
5" Min Cir. Typ
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
8½" Cir Typ
Ast /Ag = 1.13%
1½" = 1'-0"
30" DRILLED SHAFT
30" EFFECTIVE SHAFT DIAMETER (FOR STRUCTURAL CAPACITY CALCULATIONS ONLY)
3" Cir MIN COVER
#8 MAIN Reinf, Tot. 12 14 BUNDLES OF 2, & SINGLES!
#4 SPIRAL, Typ
8½" Cir Typ
Ast /Ag = 1.70%
2" = 1'-0"
#8 MAIN Reinf, Tot. 12 14 BUNDLES OF 2, & SINGLES!
5" Min Cir. Typ
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 1.34%
1½" = 1'-0"
#10 MAIN Reinf, Tot. 8
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 1.44%
1½" = 1'-0"
#9 MAIN Reinf, Tot. 16 14 BUNDLES OF 2, & SINGLES
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 2.26%
1½" = 1'-0"
DESIGN INFORMATION:
DIAMETER OF DRILLED SHAFT = 30'
EFFECTIVE DIA. OF DRILL SHAFT (Dg) = 30'
EFFECTIVE AREA OF PILE (Ag) = 707 in²
#4 S-IHALS - DEFORMED ø = 0.56", Ab = 0.20 in²
#8 MAIN Reinf - DEFORMED ø = 1.13", Ab = 0.79 in²
#9 MAIN Reinf - DEFORMED ø = 1.26", Ab = 1.00 in²
#10 MAIN Reinf - DEFORMED ø = 1.44", Ab = 1.27 in²
fc = 3 ksi
fy = 60 ksi
NOTES:
- CLEARANCES SHOWN ARE BASED ON DEFORMED REINFORCEMENT DIMENSIONS
- INSPECTION PIPES WILL NOT BE REQUIRED IF THE HOLE IS DRY OR MATERIAL WITHOUT THE USE OF TEMPORARY CASING TO CONTROL GROUND WATER

ATTACHMENT A

STEEL % A_{st}/A_g	UNFACTORED AXIAL LOAD (P_u)		SPIRALS SPACING C-C	M_{nc} @ ε_c=0.003	M_p	ϕ_p	I_{cr}	ϕ_{yi}	V_s
%	%	kips	in	kip-ft	kip-ft	rad/in	in^4	rad/in	kips
1.14% STEEL	0	0	6	500	494	0.001431	0.493	0.000176	74
		0	6	500	494	0.001491	0.493	0.000176	74
	5	149	6	613	591	0.001355	0.494	0.000172	74
		149	6	613	591	0.001355	0.494	0.000172	74
	10	299	6	714	684	0.001215	0.567	0.000173	74
		299	6	714	684	0.001215	0.567	0.000173	74
	14	448	6	790	767	0.001068	0.625	0.000176	74
		448	6	790	767	0.001068	0.625	0.000176	74
	20	597	6	862	841	0.000939	0.668	0.000181	74
		597	6	862	841	0.000939	0.668	0.000181	74
1.34% STEEL	0	0	6	577	563	0.001425	0.458	0.000178	74
		0	6	577	569	0.001425	0.458	0.000178	74
	5	153	6	685	662	0.001252	0.544	0.000175	74
		153	6	685	662	0.001252	0.544	0.000175	74
	10	307	6	779	750	0.001117	0.613	0.000175	74
		307	6	779	750	0.001117	0.613	0.000175	74
	15	460	6	858	829	0.001015	0.673	0.000177	74
		460	6	858	829	0.001015	0.673	0.000177	74
	20	614	6	932	902	0.000918	0.727	0.000183	74
		614	6	932	902	0.000918	0.727	0.000183	74
1.44% STEEL	0	0	6	611	602	0.001402	0.480	0.000180	74
		0	6	611	602	0.001402	0.480	0.000180	74
	5	155	6	723	698	0.001278	0.563	0.000178	74
		155	6	723	698	0.001278	0.563	0.000178	74
	10	310	6	808	788	0.001149	0.630	0.000180	74
		310	6	808	788	0.001149	0.630	0.000180	74
	15	466	6	882	870	0.001006	0.681	0.000183	74
		466	6	882	870	0.001006	0.681	0.000183	74
	20	621	6	952	941	0.000875	0.719	0.000188	74
		621	6	952	941	0.000875	0.719	0.000188	74
1.70% STEEL	0	0	6	701	695	0.001289	0.546	0.000183	74
		0	6	701	695	0.001289	0.546	0.000183	74
	5	160	6	807	786	0.001164	0.625	0.000180	74
		160	6	807	786	0.001164	0.625	0.000180	74
	10	320	6	890	870	0.001056	0.681	0.000182	74
		320	6	890	870	0.001056	0.681	0.000182	74
	15	481	6	968	948	0.000961	0.735	0.000185	74
		481	6	968	948	0.000961	0.735	0.000185	74
	20	641	6	1036	1018	0.000866	0.770	0.000190	74
		641	6	1036	1018	0.000866	0.770	0.000190	74
2.26% STEEL	0	0	6	888	880	0.001146	0.675	0.000187	74
		0	6	888	880	0.001146	0.675	0.000187	74
	5	171	6	979	970	0.001032	0.744	0.000187	74
		171	6	979	970	0.001032	0.744	0.000187	74
	10	342	6	1063	1054	0.000936	0.797	0.000190	74
		342	6	1063	1054	0.000936	0.797	0.000190	74
	15	513	6	1142	1130	0.000847	0.837	0.000194	74
		513	6	1142	1130	0.000847	0.837	0.000194	74
	20	684	6	1198	1187	0.000762	0.864	0.000199	74
		684	6	1198	1187	0.000762	0.864	0.000199	74

30" DIA CIDH PILE DETAILS
WITHOUT CASING

Project Information

Enter information to identify this project

Project Name: Lack Road Bridge Replacement Over New River

Job Number: 227518-0000439

Client: Imperial County Department of Public Works

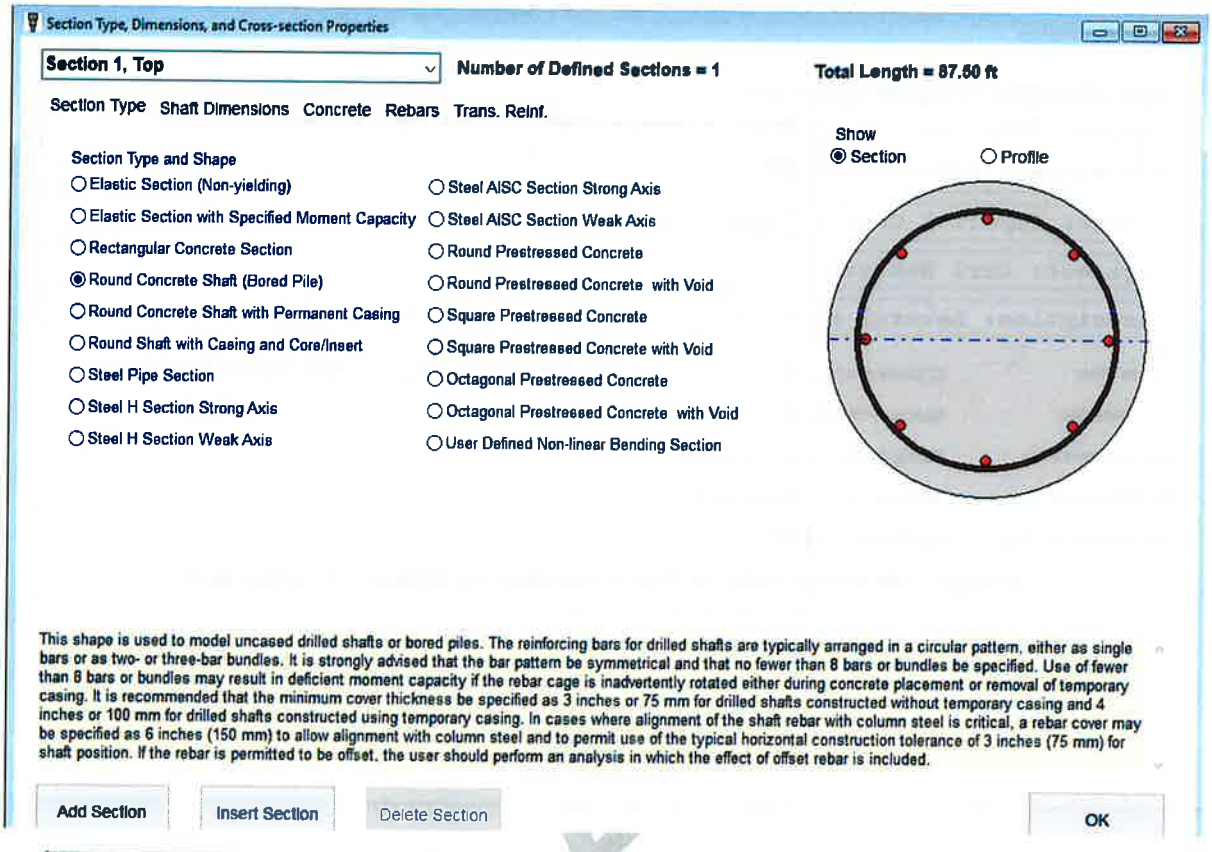
Engineer: Carl Henderson

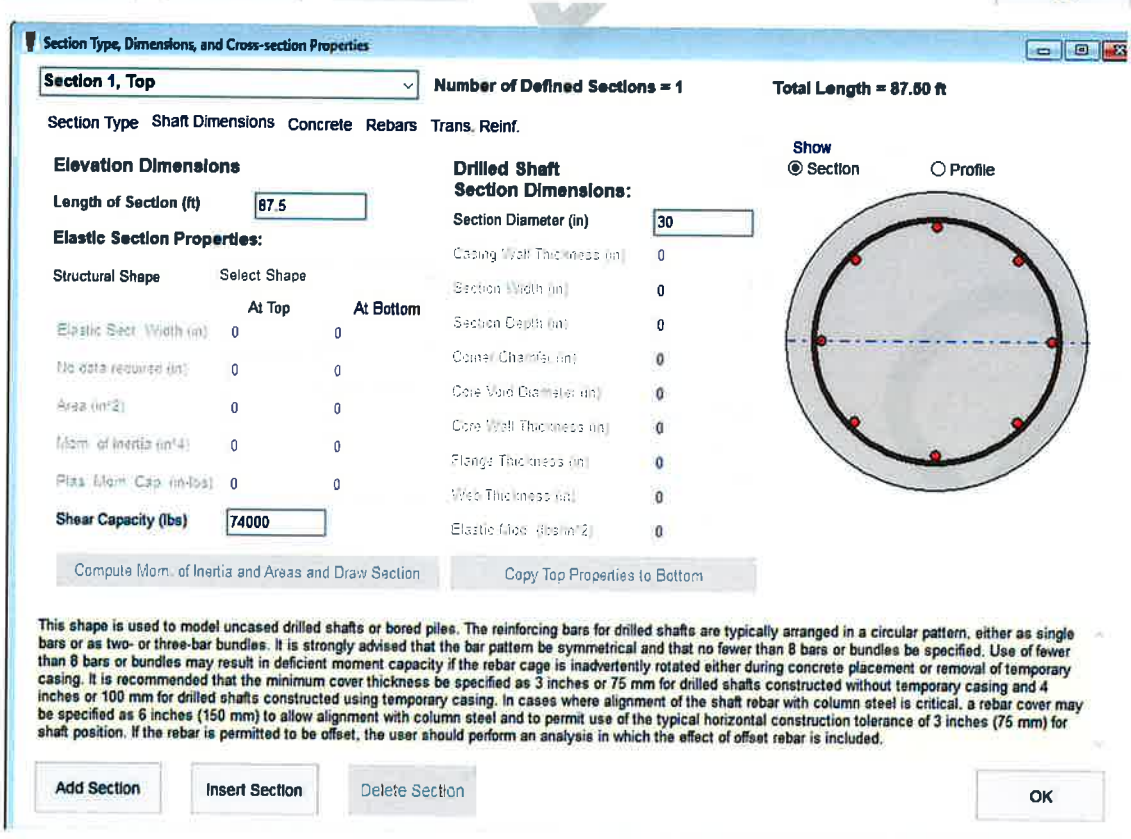
Description: Lateral Resistance - CIDH Concrete(30 inch);Boring A-19-02

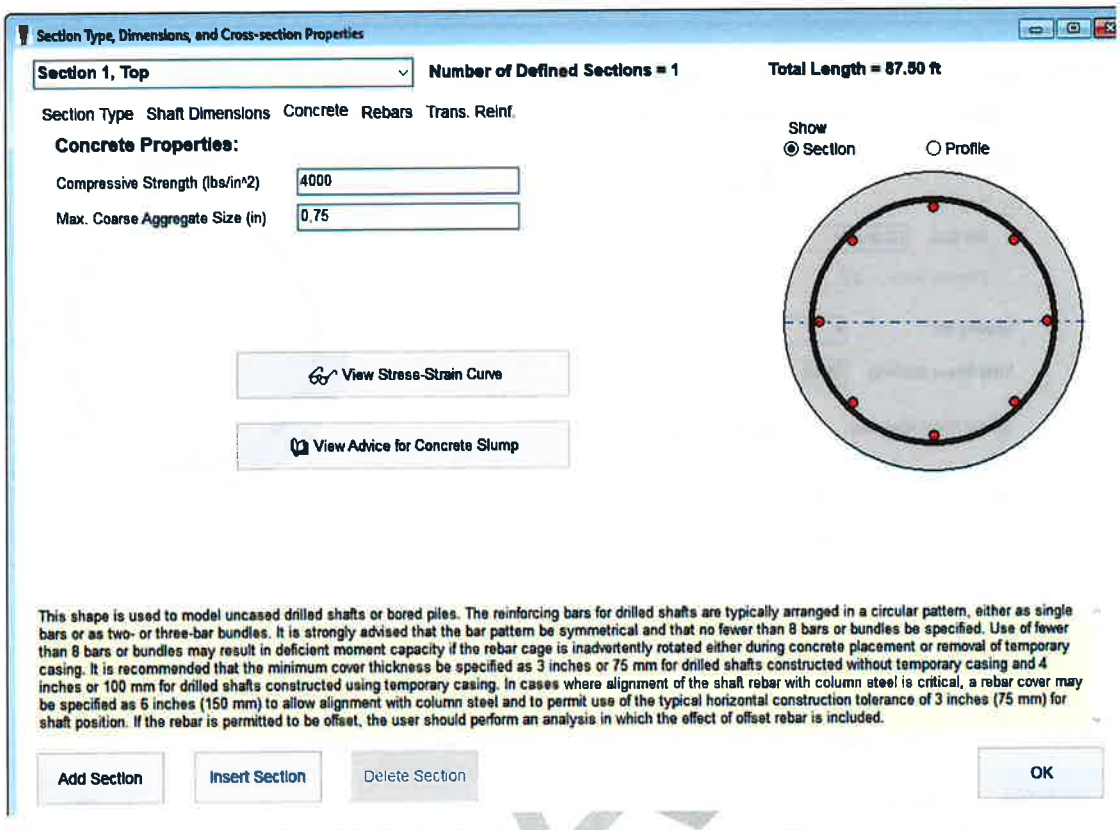
Path to Files:	C:\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix E - Lateral Pile Resistance Analysis
Input Data File:	Boring A-19-002 - 30 inch.lp10d
Output Report File:	Boring A-19-002 - 30 inch.lp10o
Plot Output File:	Boring A-19-002 - 30 inch.lp10p
Current Time and Date:	6/5/2019 8:31:20 PM

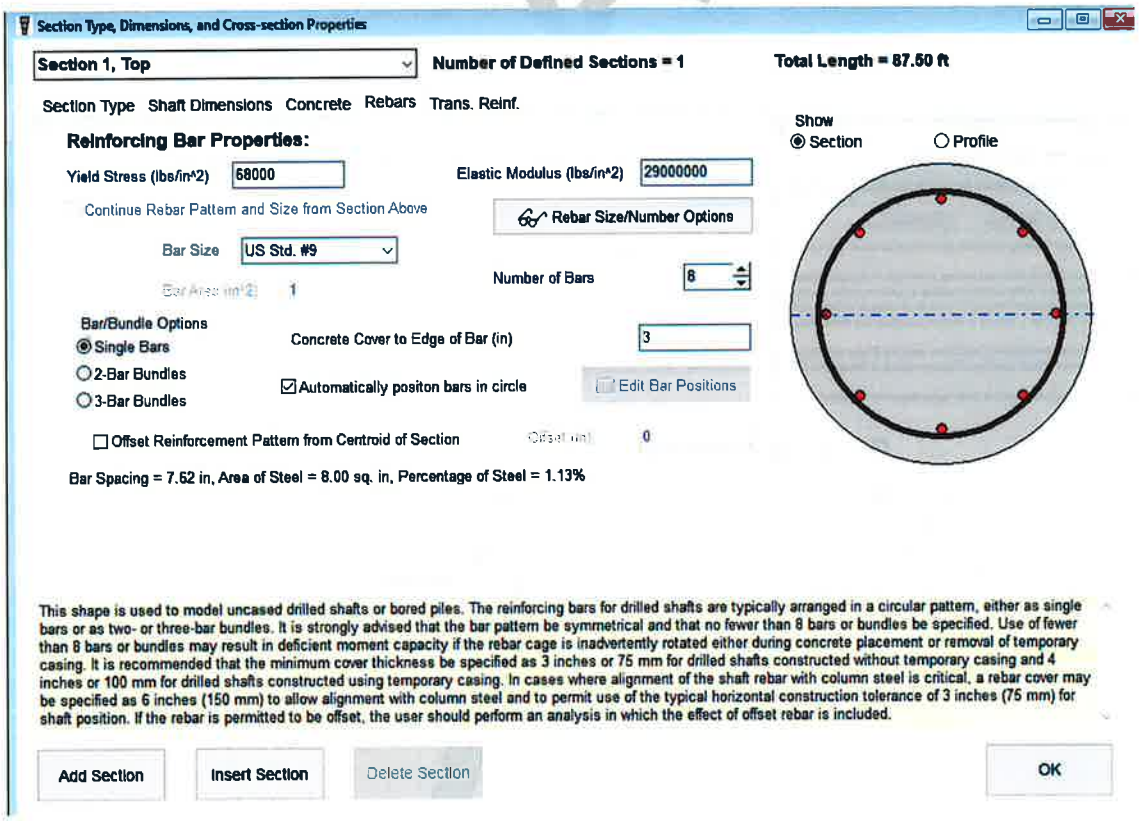
(Filenames, file paths, and date and time of program run are included in the output report.)

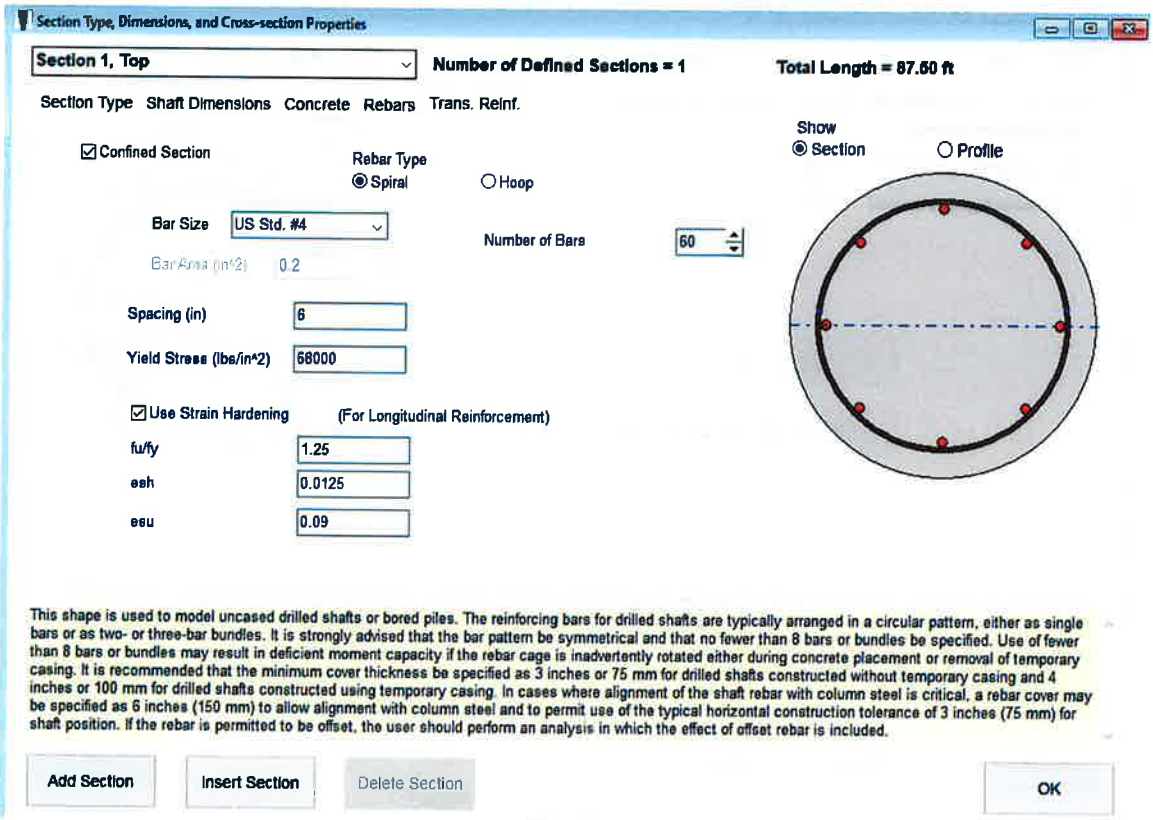
OK

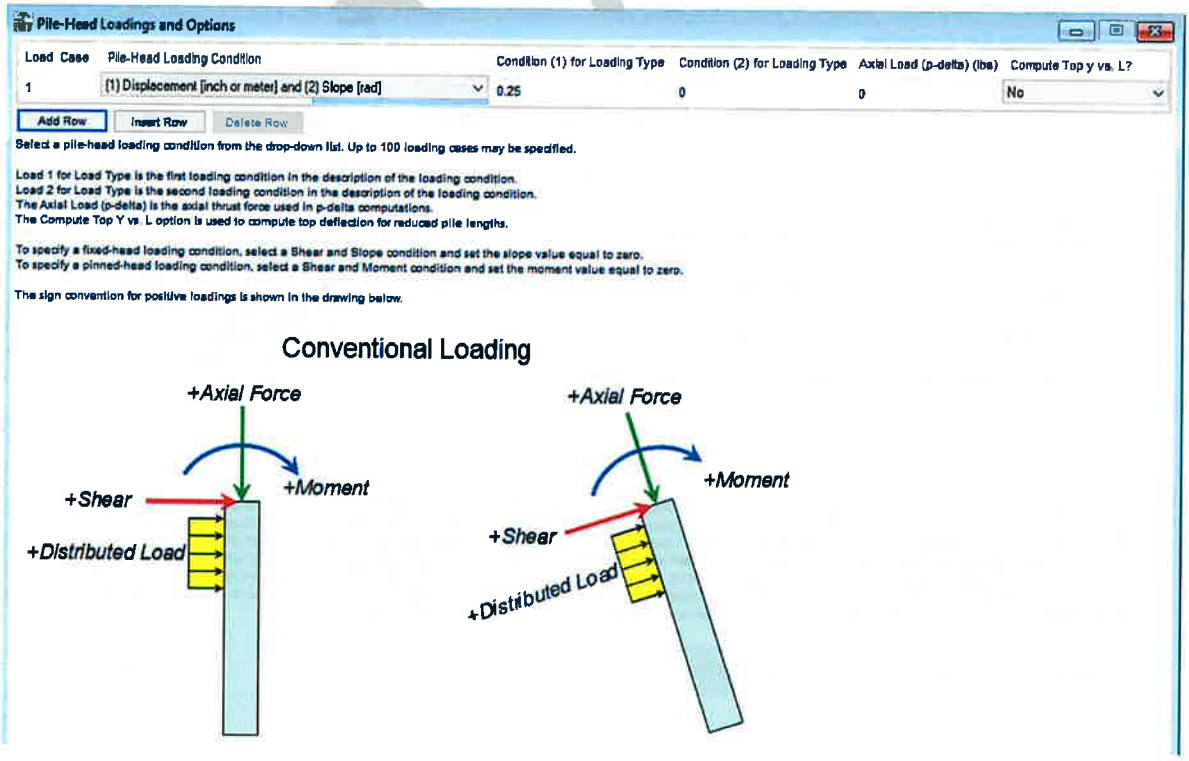

Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Shaft Dimensions
Concrete
Rebars
Trans. Reinf.
Show
Section
Profile
Section Type and Shape
Elastic Section (Non-yielding)
Elastic Section with Specified Moment Capacity
Rectangular Concrete Section
Round Concrete Shaft (Bored Pile)
Round Concrete Shaft with Permanent Casing
Round Shaft with Casing and Core/Insert
Steel Pipe Section
Steel H Section Strong Axis
Steel H Section Weak Axis
Steel AISC Section Strong Axis
Steel AISC Section Weak Axis
Round Prestressed Concrete
Round Prestressed Concrete with Void
Square Prestressed Concrete
Square Prestressed Concrete with Void
Octagonal Prestressed Concrete
Octagonal Prestressed Concrete with Void
User Defined Non-linear Bending Section
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK

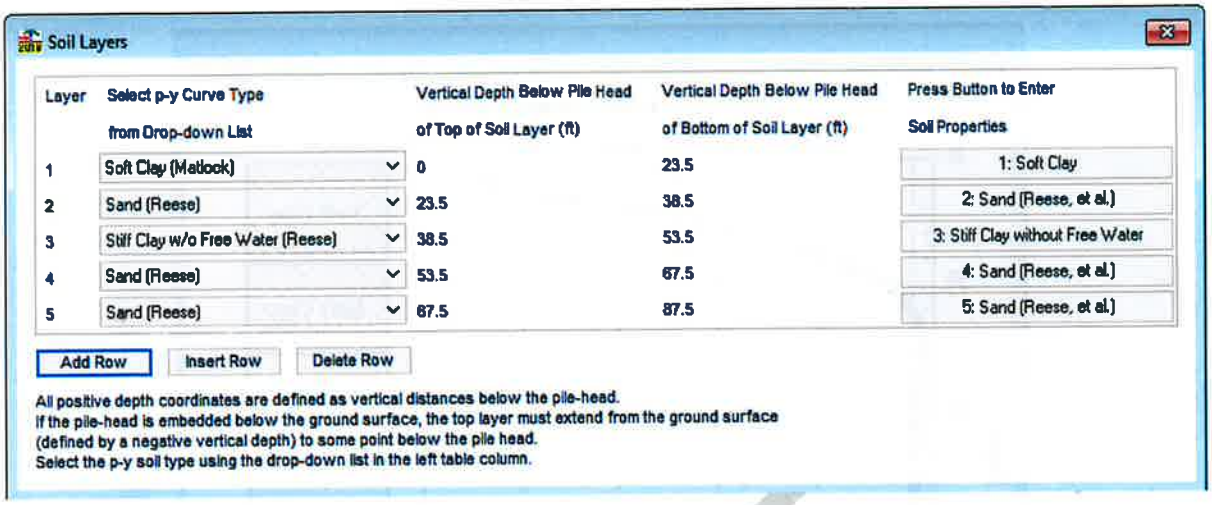

Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Shaft Dimensions
Concrete
Rebars
Trans. Reinf.
Elevation Dimensions
Length of Section (ft)
87.5
Elastic Section Properties:
Structural Shape
Select Shape
At Top
At Bottom
Elastic Sect. Width (in)
No data required (in)
Area (in^2)
Mom. of Inertia (in^4)
Plas. Mom. Cap. (in-lbs)
Shear Capacity (lbs)
74000
Drilled Shaft Section Dimensions:
Section Diameter (in)
30
Casing Wall Thickness (in)
Section Width (in)
Section Depth (in)
Corner Chamfer (in)
Core Void Diameter (in)
Core Wall Thickness (in)
Flange Thickness (in)
Web Thickness (in)
Elastic Mod. (ksi/in^2)
Compute Mom. of Inertia and Areas and Draw Section
Copy Top Properties to Bottom
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK

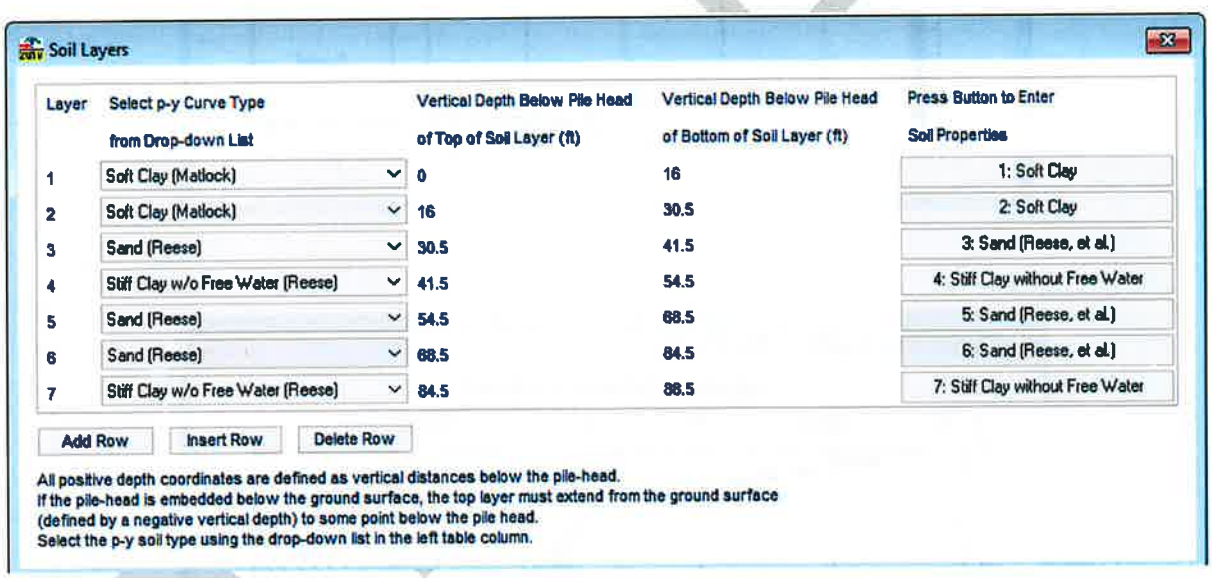

Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Shaft Dimensions
Concrete
Rebars
Trans. Reinf.
Concrete Properties:
Compressive Strength (lbs/in^2)
4000
Max. Coarse Aggregate Size (in)
0.75
View Stress-Strain Curve
View Advice for Concrete Slump
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK

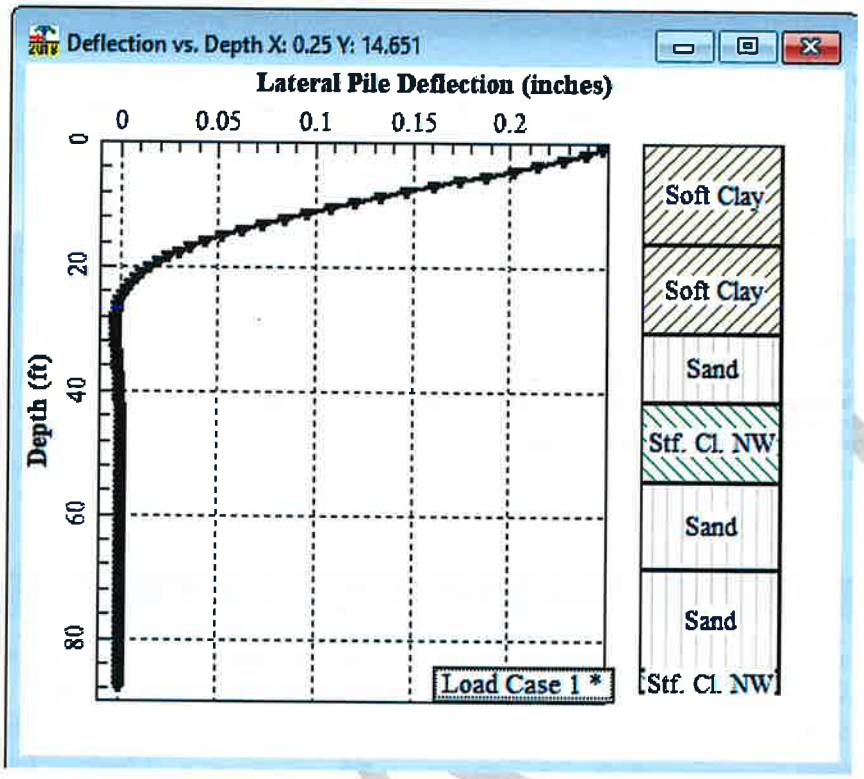

Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Shaft Dimensions
Concrete
Rebars
Trans. Reinf.
Reinforcing Bar Properties:
Yield Stress (lbs/in^2)
68000
Elastic Modulus (lbs/in^2)
29000000
Continue Rebar Pattern and Size from Section Above
Rebar Size/Number Options
Bar Size
US Std. #9
Number of Bars
8
Bar Area (in^2)
1
Bar/Bundle Options
Single Bars
2-Bar Bundles
3-Bar Bundles
Concrete Cover to Edge of Bar (in)
3
Automatically positon bars in circle
Edit Bar Positions
Offset Reinforcement Pattern from Centroid of Section
Offset (in)
0
Bar Spacing = 7.62 in, Area of Steel = 8.00 sq. in, Percentage of Steel = 1.13%
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK

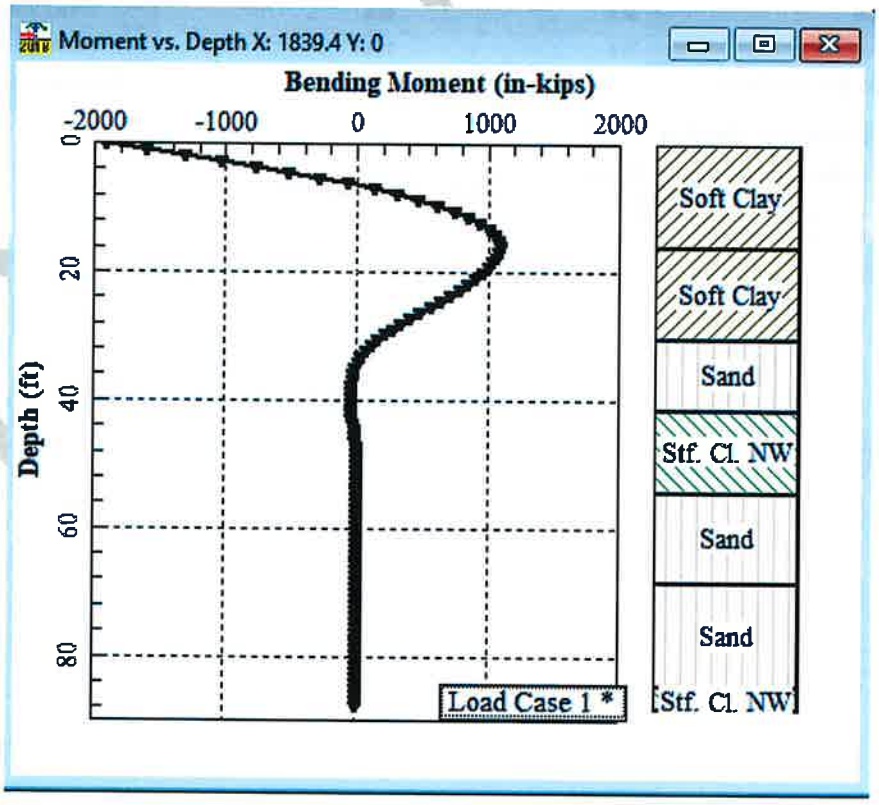

Section Type, Dimensions, and Cross-section Properties
Section 1, Top
Number of Defined Sections = 1
Total Length = 87.50 ft
Section Type
Shaft Dimensions
Concrete
Rebars
Trans. Reinf.
Confined Section
Rebar Type
Spiral
Hoop
Bar Size
US Std. #4
Number of Bars
60
Bar Area (in^2)
0.2
Spacing (in)
6
Yield Stress (lbs/in^2)
68000
Use Strain Hardening
(For Longitudinal Reinforcement)
fu/fy
1.25
esh
0.0125
esu
0.09
Show
Section
Profile
This shape is used to model uncased drilled shafts or bored piles. The reinforcing bars for drilled shafts are typically arranged in a circular pattern, either as single bars or as two- or three-bar bundles. It is strongly advised that the bar pattern be symmetrical and that no fewer than 8 bars or bundles be specified. Use of fewer than 8 bars or bundles may result in deficient moment capacity if the rebar cage is inadvertently rotated either during concrete placement or removal of temporary casing. It is recommended that the minimum cover thickness be specified as 3 inches or 75 mm for drilled shafts constructed without temporary casing and 4 inches or 100 mm for drilled shafts constructed using temporary casing. In cases where alignment of the shaft rebar with column steel is critical, a rebar cover may be specified as 6 inches (150 mm) to allow alignment with column steel and to permit use of the typical horizontal construction tolerance of 3 inches (75 mm) for shaft position. If the rebar is permitted to be offset, the user should perform an analysis in which the effect of offset rebar is included.
Add Section
Insert Section
Delete Section
OK

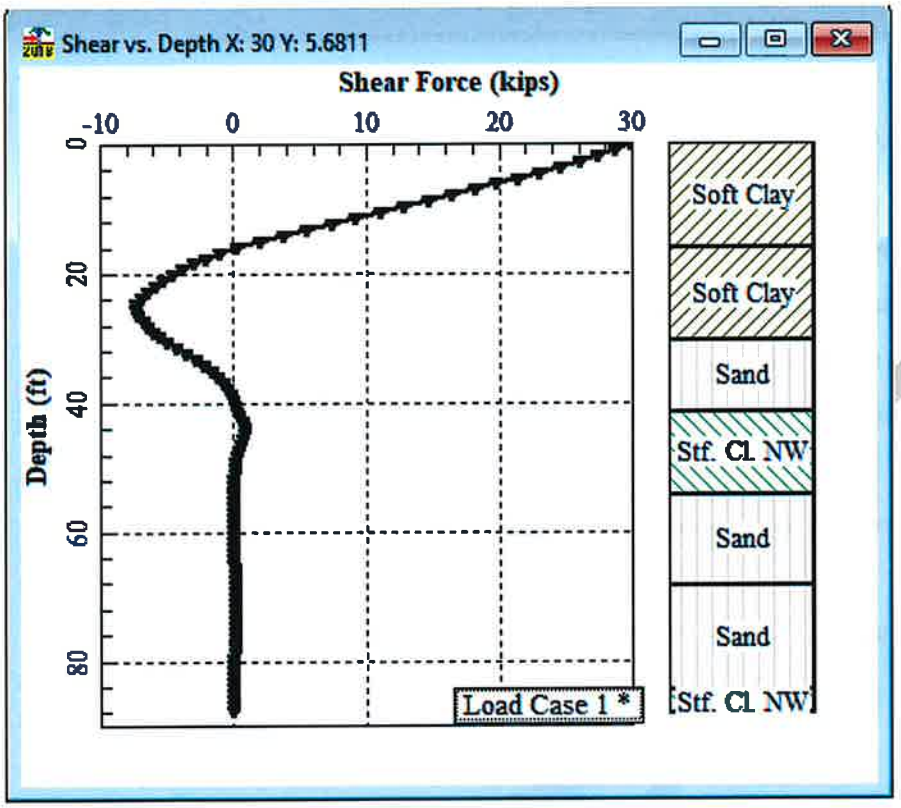

Pile-Head Loadings and Options
Load Case
Pile-Head Loading Condition
Condition (1) for Loading Type
Condition (2) for Loading Type
Axial Load (p-delta) (lbs)
Compute Top y vs. L?
1
(1) Displacement [inch or meter] and (2) Slope [rad]
0.25
0
0
No
Add Row
Insert Row
Delete Row
Select a pile-head loading condition from the drop-down list. Up to 100 loading cases may be specified.
Load 1 for Load Type is the first loading condition in the description of the loading condition.
Load 2 for Load Type is the second loading condition in the description of the loading condition.
The Axial Load (p-delta) is the axial thrust force used in p-delta computations.
The Compute Top Y vs. L option is used to compute top deflection for reduced pile lengths.
To specify a fixed-head loading condition, select a Shear and Slope condition and set the slope value equal to zero.
To specify a pinned-head loading condition, select a Shear and Moment condition and set the moment value equal to zero.
The sign convention for positive loadings is shown in the drawing below.
Conventional Loading
+Axial Force
+Moment
+Shear
+Distributed Load
+Axial Force
+Moment
+Shear
+Distributed Load


Soil Layers
Layer
Select p-y Curve Type from Drop-down List
Vertical Depth Below Pile Head of Top of Soil Layer (ft)
Vertical Depth Below Pile Head of Bottom of Soil Layer (ft)
Press Button to Enter Soil Properties
1 Soft Clay (Matlock) 0 23.5 1: Soft Clay
2 Sand (Reese) 23.5 38.5 2: Sand (Reese, et al.)
3 Stiff Clay w/o Free Water (Reese) 38.5 53.5 3: Stiff Clay without Free Water
4 Sand (Reese) 53.5 67.5 4: Sand (Reese, et al.)
5 Sand (Reese) 67.5 87.5 5: Sand (Reese, et al.)
Add Row
Insert Row
Delete Row
All positive depth coordinates are defined as vertical distances below the pile-head.
If the pile-head is embedded below the ground surface, the top layer must extend from the ground surface
(defined by a negative vertical depth) to some point below the pile head.
Select the p-y soil type using the drop-down list in the left table column.


Soil Layers
Layer
Select p-y Curve Type from Drop-down List
Vertical Depth Below Pile Head of Top of Soil Layer (ft)
Vertical Depth Below Pile Head of Bottom of Soil Layer (ft)
Press Button to Enter Soil Properties
1 Soft Clay (Matlock) 0 16 1: Soft Clay
2 Soft Clay (Matlock) 16 30.5 2: Soft Clay
3 Sand (Reese) 30.5 41.5 3: Sand (Reese, et al.)
4 Stiff Clay w/o Free Water (Reese) 41.5 54.5 4: Stiff Clay without Free Water
5 Sand (Reese) 54.5 68.5 5: Sand (Reese, et al.)
6 Sand (Reese) 68.5 84.5 6: Sand (Reese, et al.)
7 Stiff Clay w/o Free Water (Reese) 84.5 86.5 7: Stiff Clay without Free Water
Add Row
Insert Row
Delete Row
All positive depth coordinates are defined as vertical distances below the pile-head.
If the pile-head is embedded below the ground surface, the top layer must extend from the ground surface
(defined by a negative vertical depth) to some point below the pile head.
Select the p-y soil type using the drop-down list in the left table column.


Deflection vs. Depth X: 0.25 Y: 14.651
Lateral Pile Deflection (inches)
0
0.05
0.1
0.15
0.2
Depth (ft)
0
20
40
60
80
Load Case 1 *
Soft Clay
Soft Clay
Sand
Stf. Cl. NW
Sand
Sand
Stf. Cl. NW


Moment vs. Depth X: 1839.4 Y: 0
Bending Moment (in-kips)
-2000
-1000
0
1000
2000
Depth (ft)
0
20
40
60
80
Load Case 1 *
Soft Clay
Soft Clay
Sand
Stf. Cl. NW
Sand
Sand
Stf. Cl. NW


Shear vs. Depth X: 30 Y: 5.6811
Shear Force (kips)
-10
0
10
20
30
0
20
40
60
80
Depth (ft)
Load Case 1 *
Soft Clay
Soft Clay
Sand
Stf. Cl. NW
Sand
Sand
Stf. Cl. NW

==========

LPile for Windows, Version 2018-10.002

Analysis of Individual Piles and Drilled Shafts

Subjected to Lateral Loading Using the p-y Method

==========

This copy of LPile is being used by:

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Files Used for Analysis

Path to file locations:

\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix E - Lateral Pile Resistance Analysis\

Name of input data file:

Boring A-19-002 - 30 inch.lp10

Name of output report file:

Boring A-19-002 - 30 inch.lp10

Name of plot output file:

Boring A-19-002 - 30 inch.lp10

Name of runtime message file:

Boring A-19-002 - 30 inch.lp10

Date and Time of Analysis

Date: June 5, 2019 Time: 20:30:17

Problem Title

Project Name: Lack Road Bridge Replacement Over New River

Job Number: 227518-0000439

Client: Imperial County Department of Public Works

Engineer: Carl Henderson

Description: Lateral Resistance - CIDH Concrete(30 inch);Boring A-19-02

Program Options and Settings

Computational Options:

- Use unfactored loads in computations (conventional analysis)

Engineering Units Used for Data Input and Computations:

- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

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

Loading Type and Number of Cycles of Loading:

- Static loading specified

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

Output Options:

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

Pile Structural Properties and Geometry

Number of pile sections defined = 1

Total length of pile = 87.500 ft

Depth of ground surface below top of pile = 0.0000 ft

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

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

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	30.0000
2	87.500	30.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile

Length of section = 87.500000 ft

Shaft Diameter = 30.000000 in

Shear capacity of section = 55000. lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees

= 0.000 radians

Pile Batter Angle = 0.000 degrees

= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 7 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 0.0000 ft

Distance from top of pile to bottom of layer = 16.000000 ft

Effective unit weight at top of layer = 60.400000 pcf

Effective unit weight at bottom of layer = 60.400000 pcf

Undrained cohesion at top of layer = 500.000000 psf

Undrained cohesion at bottom of layer = 500.000000 psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

Layer 2 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer = 16.000000 ft

Distance from top of pile to bottom of layer = 30.500000 ft

Effective unit weight at top of layer = 59.800000 pcf

Effective unit weight at bottom of layer = 59.800000 pcf

Undrained cohesion at top of layer = 350.000000 psf

Undrained cohesion at bottom of layer = 350.000000 psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 30.500000 ft

Distance from top of pile to bottom of layer = 41.500000 ft

Effective unit weight at top of layer = 66.800000 pcf

Effective unit weight at bottom of layer = 66.800000 pcf

Friction angle at top of layer = 34.000000 deg.

Friction angle at bottom of layer = 34.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer = 41.500000 ft

Distance from top of pile to bottom of layer = 54.500000 ft

Effective unit weight at top of layer = 61.600000 pcf

Effective unit weight at bottom of layer = 61.600000 pcf

Undrained cohesion at top of layer = 1500. psf

Undrained cohesion at bottom of layer = 1500. psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 54.500000 ft

Distance from top of pile to bottom of layer = 68.500000 ft

Effective unit weight at top of layer = 61.600000 pcf

Effective unit weight at bottom of layer = 61.600000 pcf

Friction angle at top of layer = 33.000000 deg.

Friction angle at bottom of layer = 33.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

Layer 6 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 68.500000 ft

Distance from top of pile to bottom of layer = 84.500000 ft

Effective unit weight at top of layer = 65.600000 pcf

Effective unit weight at bottom of layer = 65.600000 pcf

Friction angle at top of layer = 38.000000 deg.

Friction angle at bottom of layer = 38.000000 deg.

Subgrade k at top of layer = 0.0000 pci

Subgrade k at bottom of layer = 0.0000 pci

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

Layer 7 is stiff clay without free water

Distance from top of pile to top of layer = 84.500000 ft

Distance from top of pile to bottom of layer = 88.500000 ft

Effective unit weight at top of layer = 62.600000 pcf

Effective unit weight at bottom of layer = 62.600000 pcf

Undrained cohesion at top of layer = 2000. psf

Undrained cohesion at bottom of layer = 2000. psf

Epsilon-50 at top of layer = 0.0000

Epsilon-50 at bottom of layer = 0.0000

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

(Depth of the lowest soil layer extends 1.000 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Layer Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci
1	Soft	0.00	60.4000	500.0000	--	default	--
	Clay	16.0000	60.4000	500.0000	--	default	--
2	Soft	16.0000	59.8000	350.0000	--	default	--
	Clay	30.5000	59.8000	350.0000	--	default	--
3	Sand	30.5000	66.8000	--	34.0000	--	default
	(Reese, et al.)	41.5000	66.8000	--	34.0000	--	default
4	Stiff Clay	41.5000	61.6000	1500.	--	default	--
	w/o Free Water	54.5000	61.6000	1500.	--	default	--
5	Sand	54.5000	61.6000	--	33.0000	--	default
	(Reese, et al.)	68.5000	61.6000	--	33.0000	--	default
6	Sand	68.5000	65.6000	--	38.0000	--	default
	(Reese, et al.)	84.5000	65.6000	--	38.0000	--	default
7	Stiff Clay	84.5000	62.6000	2000.	--	default	--
	w/o Free Water	88.5000	62.6000	2000.	--	default	--

Static Loading Type

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

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	5	y = 0.250000 in	S = 0.0000 in/in	0.0000000	N.A.

V = shear force applied normal to pile axis

M = bending moment applied to pile head

y = lateral deflection normal to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).

Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

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

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section = 87.500000 ft

Shaft Diameter = 30.000000 in

Concrete Cover Thickness = 3.000000 in

Number of Reinforcing Bars = 8 bars

Yield Stress of Reinforcing Bars = 68000. psi

Modulus of Elasticity of Reinforcing Bars = 29000000. psi

Gross Area of Shaft = 706.858347 sq. in.

Total Area of Reinforcing Steel = 8.000000 sq. in.

Area Ratio of Steel Reinforcement = 1.13 percent

Edge-to-Edge Bar Spacing = 7.624735 in

Maximum Concrete Aggregate Size = 0.750000 in

Ratio of Bar Spacing to Aggregate Size = 10.17

Offset of Center of Rebar Cage from Center of Pile = 0.0000 in

Confined Section

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 2920.118 kips

Tensile Load for Cracking of Concrete = -317.428 kips

Nominal Axial Tensile Capacity = -544.000 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.128000	1.000000	11.436000	0.00000
2	1.128000	1.000000	8.086473	8.086473
3	1.128000	1.000000	0.00000	11.436000
4	1.128000	1.000000	-8.086473	8.086473
5	1.128000	1.000000	-11.436000	0.00000
6	1.128000	1.000000	-8.086473	-8.086473
7	1.128000	1.000000	0.00000	-11.436000
8	1.128000	1.000000	8.086473	-8.086473

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

Minimum spacing between any two bars not equal to zero = 7.625 inches

between bars 1 and 2.

Ratio of bar spacing to maximum aggregate size = 10.17

Concrete Properties:

Compressive Strength of Concrete = 4000. psi

Modulus of Elasticity of Concrete = 3604997. psi

Modulus of Rupture of Concrete = -474.341649 psi

Compression Strain at Peak Stress = 0.001886

Tensile Strain at Fracture of Concrete = -0.0001154

Maximum Coarse Aggregate Size = 0.750000 in

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

Number	Axial Thrust Force kips
1	0.000

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.

Y = stress in reinforcing steel has reached yield stress.

T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.

Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.

Position of neutral axis is measured from edge of compression side of pile.

Compressive stresses and strains are positive in sign.

Tensile stresses and strains are negative in sign.

Axial Thrust Force = 0.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conf Stress ksi	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000200	365.8607984	182930399.	15.0000125	0.00003000	-0.00003000	-0.0012721	0.1249713	0.8613007	
0.00000400	728.0783216	182019580.	15.0000126	0.00006000	-0.00006000	-0.0025441	0.2479592	1.7226015	
0.00000600	1087.	181108762.	15.0000127	0.00009000	-0.00009000	-0.0038158	0.3689638	2.5839022	
0.00000800	1087.	135831571.	7.4425598	0.00005954	-0.0001805	0.00000	0.2436056	-5.1985261	C
0.00001000	1087.	108665257.	7.4475595	0.00007448	-0.0002255	0.00000	0.3035151	-6.4967077	C
0.00001200	1087.	90554381.	7.4525827	0.00008943	-0.0002706	0.00000	0.3630250	-7.7943012	C
0.00001400	1087.	77618041.	7.4576294	0.0001044	-0.0003156	0.00000	0.4221340	-9.0913025	C
0.00001600	1087.	67915786.	7.4627000	0.0001194	-0.0003606	0.00000	0.4808404	-10.3877072	C
0.00001800	1087.	60369587.	7.4677946	0.0001344	-0.0004056	0.00000	0.5391430	-11.6835112	C
0.00002000	1087.	54332628.	7.4729136	0.0001495	-0.0004505	0.00000	0.5970402	-12.9787101	C
0.00002200	1087.	49393299.	7.4780570	0.0001645	-0.0004955	0.00000	0.6545305	-14.2732996	C
0.00002400	1087.	45277190.	7.4832253	0.0001796	-0.0005404	0.00000	0.7116125	-15.5672752	C
0.00002600	1087.	41794330.	7.4884186	0.0001947	-0.0005853	0.00000	0.7682846	-16.8606324	C
0.00002800	1087.	38809020.	7.4936372	0.0002098	-0.0006302	0.00000	0.8245452	-18.1533666	C
0.00003000	1087.	36221752.	7.4988813	0.0002250	-0.0006750	0.00000	0.8803929	-19.4454733	C

0.00003200	1144.	35736003.	7.5041512	0.0002401	-0.0007199	0.00000	0.9358260 -
20.7369478 C							
0.00003400	1214.	35714613.	7.5094471	0.0002553	-0.0007647	0.00000	0.9908430 -
22.0277853 C							
0.00003600	1285.	35693132.	7.5147693	0.0002705	-0.0008095	0.00000	1.0454423 -
23.3179810 C							
0.00003800	1356.	35671558.	7.5201181	0.0002858	-0.0008542	0.00000	1.0996222 -
24.6075300 C							
0.00004000	1426.	35649891.	7.5254937	0.0003010	-0.0008990	0.00000	1.1533811 -
25.8964274 C							
0.00004200	1496.	35628131.	7.5308965	0.0003163	-0.0009437	0.00000	1.2067174 -
27.1846683 C							
0.00004400	1567.	35606275.	7.5363266	0.0003316	-0.0009884	0.00000	1.2596294 -
28.4722474 C							
0.00004600	1637.	35584324.	7.5417845	0.0003469	-0.0010331	0.00000	1.3121154 -
29.7591598 C							
0.00004800	1707.	35562276.	7.5472703	0.0003623	-0.0010777	0.00000	1.3641736 -
31.0454001 C							
0.00005000	1777.	35540130.	7.5527843	0.0003776	-0.0011224	0.00000	1.4158024 -
32.3309630 C							
0.00005200	1847.	35517886.	7.5583269	0.0003930	-0.0011670	0.00000	1.4670000 -
33.6158433 C							
0.00005400	1917.	35495542.	7.5638984	0.0004085	-0.0012115	0.00000	1.5177647 -
34.9000354 C							
0.00005600	1986.	35473097.	7.5694991	0.0004239	-0.0012561	0.00000	1.5680946 -
36.1835339 C							
0.00005800	2056.	35450551.	7.5751292	0.0004394	-0.0013006	0.00000	1.6179879 -
37.4663331 C							
0.00006000	2126.	35427903.	7.5807892	0.0004548	-0.0013452	0.00000	1.6674428 -
38.7484273 C							
0.00006200	2195.	35405151.	7.5864793	0.0004704	-0.0013896	0.00000	1.7164575 -
40.0298109 C							
0.00006400	2264.	35382294.	7.5921998	0.0004859	-0.0014341	0.00000	1.7650301 -
41.3104778 C							
0.00006600	2334.	35359332.	7.5979511	0.0005015	-0.0014785	0.00000	1.8131586 -
42.5904223 C							
0.00006800	2403.	35336262.	7.6037335	0.0005171	-0.0015229	0.00000	1.8608411 -
43.8696383 C							

0.00007000	2472.	35313085.	7.6095474	0.0005327	-0.0015673	0.00000	1.9080758	-
45.1481196 C								
0.00007200	2541.	35289799.	7.6153931	0.0005483	-0.0016117	0.00000	1.9548607	-
46.4258600 C								
0.00007400	2610.	35266403.	7.6212710	0.0005640	-0.0016560	0.00000	2.0011936	-
47.7028533 C								
0.00007600	2678.	35242895.	7.6271814	0.0005797	-0.0017003	0.00000	2.0470727	-
48.9790931 C								
0.00007800	2747.	35219275.	7.6331248	0.0005954	-0.0017446	0.00000	2.0924959	-
50.2545729 C								
0.00008200	2884.	35171696.	7.6451117	0.0006269	-0.0018331	0.00000	2.1819664	-
52.8032243 C								
0.00008600	3021.	35123711.	7.6569201	0.0006585	-0.0019215	0.00000	2.2695125	-
55.3495410 C								
0.00009000	3157.	35075312.	7.6686447	0.0006902	-0.0020098	0.00000	2.3551349	-
57.8933372 C								
0.00009400	3292.	35026451.	7.6804997	0.0007220	-0.0020980	0.00000	2.4388659	-
60.4340576 C								
0.00009800	3428.	34977118.	7.6924883	0.0007539	-0.0021861	0.00000	2.5206881	-
62.9716481 C								
0.0001020	3563.	34927303.	7.7046135	0.0007859	-0.0022741	0.00000	2.6005836	-
65.5060530 C								
0.0001060	3697.	34876996.	7.7168786	0.0008180	-0.0023620	0.00000	2.6785338	-
68.0000000 CY								
0.0001100	3831.	34826185.	7.7292870	0.0008502	-0.0024498	0.00000	2.7545200	-
68.0000000 CY								
0.0001140	3964.	34774859.	7.7418421	0.0008826	-0.0025374	0.00000	2.8285225	-
68.0000000 CY								
0.0001180	4097.	34723007.	7.7545476	0.0009150	-0.0026250	0.00000	2.9005216	-
68.0000000 CY								
0.0001220	4230.	34670615.	7.7674072	0.0009476	-0.0027124	0.00000	2.9704965	-
68.0000000 CY								
0.0001260	4351.	34534896.	7.7742259	0.0009796	-0.0028004	0.00000	3.0368014	-
68.0000000 CY								
0.0001300	4450.	34230190.	7.7681627	0.0010099	-0.0028901	0.00000	3.0976389	-
68.0000000 CY								
0.0001340	4541.	33887936.	7.7590277	0.0010397	-0.0029803	0.00000	3.1555955	-
68.0000000 CY								

0.0001380 68.0000000 CY	4632.	33563132.	7.7511187	0.0010697	-0.0030703	0.00000	3.2118096 -
0.0001420 68.0000000 CY	4722.	33254269.	7.7443433	0.0010997	-0.0031603	0.00000	3.2662650 -
0.0001460 68.0000000 CY	4812.	32960004.	7.7386199	0.0011298	-0.0032502	0.00000	3.3189452 -
0.0001500 68.0000000 CY	4898.	32650503.	7.7311928	0.0011597	-0.0033403	0.00000	3.3691558 -
0.0001540 68.0000000 CY	4962.	32223153.	7.7121859	0.0011877	-0.0034323	0.00000	3.4144576 -
0.0001580 68.0000000 CY	4999.	31636913.	7.6770703	0.0012130	-0.0035270	0.00000	3.4538529 -
0.0001620 68.0000000 CY	5027.	31027991.	7.6383937	0.0012374	-0.0036226	0.00000	3.4905788 -
0.0001660 68.0000000 CY	5054.	30446267.	7.6004273	0.0012617	-0.0037183	0.00000	3.5257470 -
0.0001700 68.0000000 CY	5081.	29891157.	7.5645883	0.0012860	-0.0038140	0.00000	3.5597389 -
0.0001740 68.0000000 CY	5109.	29360817.	7.5307337	0.0013103	-0.0039097	0.00000	3.5925462 -
0.0001780 68.0000000 CY	5136.	28853570.	7.4987332	0.0013348	-0.0040052	0.00000	3.6241604 -
0.0001820 68.0000000 CY	5163.	28367885.	7.4684682	0.0013593	-0.0041007	0.00000	3.6545726 -
0.0001860 68.0000000 CY	5190.	27902362.	7.4398306	0.0013838	-0.0041962	0.00000	3.6837742 -
0.0001900 68.0000000 CY	5217.	27455719.	7.4127211	0.0014084	-0.0042916	0.00000	3.7117561 -
0.0001940 68.0000000 CY	5243.	27026782.	7.3870490	0.0014331	-0.0043869	0.00000	3.7385092 -
0.0001980 68.0000000 CY	5270.	26614468.	7.3627308	0.0014578	-0.0044822	0.00000	3.7640241 -
0.0002020 68.0000000 CY	5296.	26217370.	7.3390323	0.0014825	-0.0045775	0.00000	3.7881619 -
0.0002060 68.0000000 CY	5322.	25834537.	7.3157941	0.0015071	-0.0046729	0.00000	3.8109102 -
0.0002100 68.0000000 CY	5348.	25465631.	7.2937549	0.0015317	-0.0047683	0.00000	3.8324240 -

0.0002140	5374.	25109864.	7.2728516	0.0015564	-0.0048636	0.00000	3.8526933	-
68.0000000 CY								
0.0002180	5399.	24766505.	7.2530258	0.0015812	-0.0049588	0.00000	3.8717079	-
68.0000000 CY								
0.0002220	5425.	24434873.	7.2342233	0.0016060	-0.0050540	0.00000	3.8894573	-
68.0000000 CY								
0.0002260	5450.	24114340.	7.2163941	0.0016309	-0.0051491	0.00000	3.9059311	-
68.0000000 CY								
0.0002300	5475.	23804318.	7.1994914	0.0016559	-0.0052441	0.00000	3.9211184	-
68.0000000 CY								
0.0002340	5500.	23504259.	7.1834722	0.0016809	-0.0053391	0.00000	3.9350081	-
68.0000000 CY								
0.0002380	5525.	23213654.	7.1682960	0.0017061	-0.0054339	0.00000	3.9475889	-
68.0000000 CY								
0.0002540	5623.	22136674.	7.1153109	0.0018073	-0.0058127	0.00000	3.9845890	-
68.0000000 CY								
0.0002700	5718.	21177790.	7.0732358	0.0019098	-0.0061902	0.00000	3.9996752	-
68.0000000 CY								
0.0002860	5805.	20295938.	7.0348066	0.0020120	-0.0065680	0.00000	3.9999898	-
68.0000000 CY								
0.0003020	5855.	19386647.	6.9732568	0.0021059	-0.0069541	0.00000	3.9999473	-
68.0000000 CY								
0.0003180	5872.	18464254.	6.8926260	0.0021919	-0.0073481	0.00000	3.9990986	-
68.0000000 CY								
0.0003340	5882.	17611251.	6.8174051	0.0022770	-0.0077430	0.00000	3.9959315	-
68.0000000 CY								
0.0003500	5892.	16834041.	6.7512031	0.0023629	-0.0081371	0.00000	3.9986988	-
68.0000000 CY								
0.0003660	5900.	16119820.	6.6872110	0.0024475	-0.0085325	0.00000	3.9979549	
68.0000000 CY								
0.0003820	5907.	15463980.	6.6301419	0.0025327	-0.0089273	0.00000	3.9949387	
68.0000000 CY								
0.0003980	5914.	14859360.	6.5794263	0.0026186	-0.0093214	0.00000	3.9978473	
68.0000000 CY								
0.0004140	5920.	14300419.	6.5340027	0.0027051	-0.0097149	0.00000	3.9963925	
68.0000000 CY								
0.0004300	5926.	13781812.	6.4935223	0.0027922	-0.0101078	0.00000	3.9957401	
68.0000000 CY								

0.0004460 68.0000000 CY	5932.	13299718.	6.4569659	0.0028798	-0.0105002	0.00000	3.9998884
0.0004620 68.0000000 CY	5936.	12849109.	6.4212412	0.0029666	-0.0108934	0.00000	3.9892564
0.0004780 68.0000000 CY	5941.	12427908.	6.3880561	0.0030535	-0.0112865	0.00000	3.9969974
0.0004940 68.0000000 CY	5945.	12033549.	6.3578227	0.0031408	-0.0116792	0.00000	3.9999695
0.0005100 68.0000000 CY	5948.	11663166.	6.3307284	0.0032287	-0.0120713	0.00000	3.9868631
0.0005260 68.0000000 CY	5952.	11314958.	6.3059733	0.0033169	-0.0124631	0.00000	3.9947358
0.0005420 68.2568215 CY	5955.	10986995.	6.2833080	0.0034056	-0.0128544	0.00000	3.9992737 -
0.0005580 68.6142988 CY	5958.	10677391.	6.2627794	0.0034946	-0.0132454	0.00000	3.9943377 -
0.0005740 68.9624564 CY	5961.	10384615.	6.2442063	0.0035842	-0.0136358	0.00000	3.9863483 -
0.0005900 69.3017802 CY	5963.	10107504.	6.2271222	0.0036740	-0.0140260	0.00000	3.9943697 -
0.0006060 69.6325603 CY	5966.	9844862.	6.2114328	0.0037641	-0.0144159	0.00000	3.9989167 -
0.0006220 69.9546162 CY	5971.	9599362.	6.1979490	0.0038551	-0.0148049	0.00000	3.9970048 -
0.0006380 70.2537094 CY	5971.	9358626.	6.2148740	0.0039651	-0.0151749	0.00000	3.9831899 -
0.0006540 70.5596923 CY	5971.	9129669.	6.2043996	0.0040577	-0.0155623	0.00000	3.9918978 -
0.0006700 70.8325822 CY	5971.	8911647.	6.2447916	0.0041840	-0.0159160	0.00000	3.9997871 -
0.0006860 71.1244500 CY	5971.	8703795.	6.2352134	0.0042774	-0.0163026	0.00000	3.9923545 -
0.0007020 71.3760802 CY	5971.	8505418.	6.2910434	0.0044163	-0.0166437	0.00000	3.9881982 -
0.0007180 71.6550383 CY	5971.	8315882.	6.2816400	0.0045102	-0.0170298	0.00000	3.9947167 -
0.0007340 71.8877565 CY	5971.	8134609.	6.3499047	0.0046608	-0.0173592	0.00000	3.9930840 -

0.0007500	5971.	7961071.	6.3440593	0.0047580	-0.0177420	0.00000	3.9814163	-
72.1528388 CY								
0.0007660	5971.	7794782.	6.4302503	0.0049256	-0.0180544	0.00000	3.9955380	-
72.3645535 CY								
0.0007820	5971.	7635298.	6.4258518	0.0050250	-0.0184350	0.00000	3.9990961	-
72.6175874 CY								
0.0007980	5971.	7482210.	6.5194460	0.0052025	-0.0187375	0.00000	3.9735552	-
72.8144524 CY								
0.0008140	5971.	7335139.	6.5182900	0.0053059	-0.0191141	0.00000	3.9834632	-
73.0551934 CY								
0.0008300	5971.	7193739.	6.5174131	0.0054095	-0.0194905	0.00000	3.9914284	-
73.2906734 CY								
0.0008460	5971.	7057687.	6.6228339	0.0056029	-0.0197771	0.00000	3.9885417	-
73.4662113 CY								
0.0008620	5971.	6926686.	6.6244490	0.0057103	-0.0201497	0.00000	3.9767041	-
73.6907232 CY								
0.0008780	5971.	6800459.	6.7472796	0.0059241	-0.0204159	0.00000	3.9977377	-
73.8478165 CY								
0.0009740	5971.	6130188.	6.9997482	0.0068178	-0.0224022	0.00000	3.9654547	-
74.9516944 CY								
0.0010700	5971.	5580190.	7.2551920	0.0077631	-0.0243369	0.00000	3.9957181	-
75.9180299 CY								

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003

or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	0.000	5937.922	0.00300000

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

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

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

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

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	5938.	0.0000	3860.	34815120.
1	0.70	5938.	0.0000	4157.	34699586.
1	0.75	5938.	0.0000	4453.	34216971.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or Rock Layer Below	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	111266.
2	16.0000	19.4971	Yes	No	111266.	114269.
3	30.5000	14.8186	No	No	225535.	779975.
4	41.5000	38.0828	No	No	1005510.	438750.
5	54.5000	30.1015	No	No	1444260.	2863508.
6	68.5000	38.1226	Yes	No	4307768.	7680178.
7	84.5000	275.0475	No	No	1.20E+07	N.A.

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

Computed Values of Pile Loading and Deflection

for Lateral Loading for Load Case Number 1

Pile-head conditions are Displacement and Pile-head Rotation (Loading Type 5)

Displacement of pile head = 0.250000 inches

Rotation of pile head = 0.000E+00 radians

Axial load on pile head = 0.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness in-lb^2	Soil Res. p lb/inch	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2500	-1916330.	29885.	0.00	0.00	3.55E+10	-108.3377	2275.	0.00
0.8750	0.2470	-1609040.	28646.	-5.21E-04	0.00	3.55E+10	-118.0025	5016.	0.00
1.7500	0.2391	-1314760.	27361.	-9.53E-04	0.00	3.57E+10	-126.7055	5565.	0.00
2.6250	0.2270	-1034449.	25991.	-0.00118	0.00	1.81E+11	-134.3583	6214.	0.00
3.5000	0.2143	-768951.	24543.	-0.00123	0.00	1.82E+11	-141.4417	6929.	0.00
4.3750	0.2012	-519048.	23024.	-0.00127	0.00	1.82E+11	-147.9215	7719.	0.00
5.2500	0.1878	-285452.	21440.	-0.00129	0.00	1.83E+11	-153.7649	8598.	0.00
6.1250	0.1742	-68809.	19798.	-0.00130	0.00	1.83E+11	-158.9401	9583.	0.00
7.0000	0.1605	130310.	18106.	-0.00130	0.00	1.83E+11	-163.4159	10691.	0.00
7.8750	0.1469	311413.	16370.	-0.00128	0.00	1.83E+11	-167.1609	11947.	0.00
8.7500	0.1335	474087.	14599.	-0.00126	0.00	1.83E+11	-170.1431	13380.	0.00
9.6250	0.1204	618002.	12801.	-0.00123	0.00	1.82E+11	-172.3292	15027.	0.00
10.5000	0.1077	742918.	10985.	-0.00119	0.00	1.82E+11	-173.6831	16935.	0.00
11.3750	0.09540	848686.	9159.	-0.00115	0.00	1.82E+11	-174.1638	19168.	0.00
12.2500	0.08364	935252.	7332.	-0.00109	0.00	1.81E+11	-173.7233	21810.	0.00
13.1250	0.07244	1002665.	5516.	-0.00104	0.00	1.81E+11	-172.3022	24975.	0.00
14.0000	0.06185	1051081.	3720.	-9.78E-04	0.00	1.81E+11	-169.8230	28830.	0.00
14.8750	0.05190	1080775.	1956.	-8.99E-04	0.00	1.16E+11	-166.1803	33620.	0.00
15.7500	0.04297	1092147.	234.3133	-7.75E-04	0.00	7.67E+10	-161.6679	39500.	0.00
16.6250	0.03562	1085695.	-1110.	-6.46E-04	0.00	1.04E+11	-94.2996	27798.	0.00
17.5000	0.02942	1068847.	-2069.	-5.60E-04	0.00	1.81E+11	-88.4751	31578.	0.00
18.3750	0.02387	1042245.	-2967.	-4.98E-04	0.00	1.81E+11	-82.5191	36300.	0.00
19.2500	0.01895	1006544.	-3801.	-4.39E-04	0.00	1.81E+11	-76.4133	42331.	0.00
20.1250	0.01465	962420.	-4571.	-3.82E-04	0.00	1.81E+11	-70.1266	50258.	0.00
21.0000	0.01093	910563.	-5273.	-3.28E-04	0.00	1.81E+11	-63.6057	61087.	0.00

21.8750	0.00777	851694.	-5905.	-2.77E-04	0.00	1.82E+11	-56.7555	76714.	0.00
22.7500	0.00512	786568.	-6462.	-2.29E-04	0.00	1.82E+11	-49.3907	101280.	0.00
23.6250	0.00295	715997.	-6937.	-1.86E-04	0.00	1.82E+11	-41.0913	146272.	0.00
24.5000	0.00121	640895.	-7313.	-1.47E-04	0.00	1.82E+11	-30.5417	264470.	0.00
25.3750	-1.37E-04	562426.	-7395.	-1.12E-04	0.00	1.82E+11	14.8445	1140797.	0.00
26.2500	-0.00115	485593.	-7160.	-8.21E-05	0.00	1.82E+11	30.0078	275020.	0.00
27.1250	-0.00186	412069.	-6817.	-5.63E-05	0.00	1.83E+11	35.2671	198947.	0.00
28.0000	-0.00233	342434.	-6433.	-3.47E-05	0.00	1.83E+11	37.9957	171348.	0.00
28.8750	-0.00259	276987.	-6026.	-1.69E-05	0.00	1.83E+11	39.3616	159637.	0.00
29.7500	-0.00268	215879.	-5611.	-2.73E-06	0.00	1.83E+11	39.8295	155892.	0.00
30.6250	-0.00265	159163.	-5018.	8.04E-06	0.00	1.83E+11	72.9758	289556.	0.00
31.5000	-0.00251	110493.	-4261.	1.58E-05	0.00	1.83E+11	71.3073	297829.	0.00
32.3750	-0.00232	69684.	-3532.	2.09E-05	0.00	1.83E+11	67.4889	306102.	0.00
33.2500	-0.00207	36316.	-2852.	2.40E-05	0.00	1.83E+11	62.0996	314375.	0.00
34.1250	-0.00181	9794.	-2234.	2.53E-05	0.00	1.83E+11	55.6581	322648.	0.00
35.0000	-0.00154	-10591.	-1686.	2.53E-05	0.00	1.83E+11	48.6164	330921.	0.00
35.8750	-0.00128	-25616.	-1214.	2.42E-05	0.00	1.83E+11	41.3575	339194.	0.00
36.7500	-0.00103	-36082.	-817.2093	2.25E-05	0.00	1.83E+11	34.1961	347467.	0.00
37.6250	-8.08E-04	-42778.	-493.9219	2.02E-05	0.00	1.83E+11	27.3824	355740.	0.00
38.5000	-6.09E-04	-46455.	-239.3482	1.77E-05	0.00	1.83E+11	21.1078	364013.	0.00
39.3750	-4.37E-04	-47804.	-47.0963	1.49E-05	0.00	1.83E+11	15.5116	372286.	0.00
40.2500	-2.95E-04	-47444.	90.4607	1.22E-05	0.00	1.83E+11	10.6897	380560.	0.00
41.1250	-1.81E-04	-45905.	181.7669	9.54E-06	0.00	1.83E+11	6.7020	388833.	0.00
42.0000	-9.47E-05	-43627.	431.1694	6.97E-06	0.00	1.83E+11	40.8033	4524791.	0.00
42.8750	-3.47E-05	-36850.	723.8601	4.66E-06	0.00	1.83E+11	14.9473	4524791.	0.00
43.7500	3.10E-06	-28425.	795.3089	2.78E-06	0.00	1.83E+11	-1.3380	4524791.	0.00
44.6250	2.38E-05	-20148.	734.5199	1.39E-06	0.00	1.83E+11	-10.2408	4524791.	0.00
45.5000	3.23E-05	-13001.	607.7248	4.38E-07	0.00	1.83E+11	-13.9106	4524791.	0.00
46.3750	3.30E-05	-7386.	460.1229	-1.47E-07	0.00	1.83E+11	-14.2040	4524791.	0.00
47.2500	2.92E-05	-3338.	319.5121	-4.55E-07	0.00	1.83E+11	-12.5790	4524791.	0.00
48.1250	2.34E-05	-676.5078	200.5149	-5.70E-07	0.00	1.83E+11	-10.0871	4524791.	0.00

49.0000	1.72E-05	872.8464	108.6052	-5.65E-07	0.00	1.83E+11	-7.4195	4524791.	0.00
49.8750	1.16E-05	1604.	43.5153	-4.93E-07	0.00	1.83E+11	-4.9786	4524791.	0.00
50.7500	6.86E-06	1787.	1.8677	-3.96E-07	0.00	1.83E+11	-2.9543	4524791.	0.00
51.6250	3.23E-06	1643.	-20.9611	-2.98E-07	0.00	1.83E+11	-1.3940	4524791.	0.00
52.5000	6.05E-07	1346.	-29.6481	-2.12E-07	0.00	1.83E+11	-0.2606	4524791.	0.00
53.3750	-1.21E-06	1021.	-28.2702	-1.44E-07	0.00	1.83E+11	0.5231	4524791.	0.00
54.2500	-2.42E-06	752.8110	-20.0551	-9.30E-08	0.00	1.83E+11	1.0417	4524791.	0.00
55.1250	-3.17E-06	599.6556	-13.8742	-5.42E-08	0.00	1.83E+11	0.1356	449686.	0.00
56.0000	-3.56E-06	461.4537	-12.3500	-2.37E-08	0.00	1.83E+11	0.1547	456824.	0.00
56.8750	-3.67E-06	340.3054	-10.6876	-7.28E-10	0.00	1.83E+11	0.1620	463962.	0.00
57.7500	-3.57E-06	237.0139	-8.9962	1.58E-08	0.00	1.83E+11	0.1602	471100.	0.00
58.6250	-3.33E-06	151.3846	-7.3582	2.70E-08	0.00	1.83E+11	0.1518	478238.	0.00
59.5000	-3.00E-06	82.4910	-5.8323	3.37E-08	0.00	1.83E+11	0.1389	485376.	0.00
60.3750	-2.63E-06	28.9065	-4.4568	3.69E-08	0.00	1.83E+11	0.1231	492513.	0.00
61.2500	-2.23E-06	-11.1024	-3.2535	3.74E-08	0.00	1.83E+11	0.1061	499651.	0.00
62.1250	-1.84E-06	-39.4171	-2.2305	3.60E-08	0.00	1.83E+11	0.08879	506789.	0.00
63.0000	-1.47E-06	-57.9428	-1.3856	3.32E-08	0.00	1.83E+11	0.07214	513927.	0.00
63.8750	-1.14E-06	-68.5149	-0.7090	2.95E-08	0.00	1.83E+11	0.05673	521065.	0.00
64.7500	-8.54E-07	-72.8326	-0.1857	2.55E-08	0.00	1.83E+11	0.04294	528203.	0.00
65.6250	-6.08E-07	-72.4157	0.2025	2.13E-08	0.00	1.83E+11	0.03101	535341.	0.00
66.5000	-4.06E-07	-68.5804	0.4754	1.73E-08	0.00	1.83E+11	0.02099	542479.	0.00
67.3750	-2.46E-07	-62.4314	0.6531	1.35E-08	0.00	1.83E+11	0.01286	549616.	0.00
68.2500	-1.23E-07	-54.8650	0.7547	1.01E-08	0.00	1.83E+11	0.00650	556754.	0.00
69.1250	-3.27E-08	-46.5817	0.8060	7.22E-09	0.00	1.83E+11	0.00326	1045443.	0.00
70.0000	2.91E-08	-37.9389	0.8077	4.80E-09	0.00	1.83E+11	-0.00293	1058676.	0.00
70.8750	6.80E-08	-29.6194	0.7559	2.86E-09	0.00	1.83E+11	-0.00695	1071909.	0.00
71.7500	8.91E-08	-22.0656	0.6710	1.38E-09	0.00	1.83E+11	-0.00921	1085143.	0.00
72.6250	9.70E-08	-15.5276	0.5694	2.98E-10	0.00	1.83E+11	-0.01014	1098376.	0.00
73.5000	9.54E-08	-10.1077	0.4631	-4.38E-10	0.00	1.83E+11	-0.01010	1111610.	0.00
74.3750	8.78E-08	-5.8014	0.3608	-8.94E-10	0.00	1.83E+11	-0.00940	1124843.	0.00
75.2500	7.66E-08	-2.5317	0.2678	-1.13E-09	0.00	1.83E+11	-0.00831	1138077.	0.00

76.1250	6.40E-08	-0.1777	0.1874	-1.21E-09	0.00	1.83E+11	-0.00701	1151310.	0.00
77.0000	5.12E-08	1.4031	0.1207	-1.18E-09	0.00	1.83E+11	-0.00568	1164544.	0.00
77.8750	3.93E-08	2.3580	0.06781	-1.07E-09	0.00	1.83E+11	-0.00440	1177777.	0.00
78.7500	2.88E-08	2.8272	0.02756	-9.19E-10	0.00	1.83E+11	-0.00326	1191010.	0.00
79.6250	2.00E-08	2.9367	-0.00159	-7.54E-10	0.00	1.83E+11	-0.00229	1204244.	0.00
80.5000	1.29E-08	2.7938	-0.02148	-5.89E-10	0.00	1.83E+11	-0.00150	1217477.	0.00
81.3750	7.59E-09	2.4856	-0.03402	-4.38E-10	0.00	1.83E+11	-8.89E-04	1230711.	0.00
82.2500	3.74E-09	2.0793	-0.04102	-3.07E-10	0.00	1.83E+11	-4.43E-04	1243944.	0.00
83.1250	1.14E-09	1.6242	-0.04406	-2.01E-10	0.00	1.83E+11	-1.37E-04	1257178.	0.00
84.0000	-4.72E-10	1.1540	-0.04448	-1.21E-10	0.00	1.83E+11	5.71E-05	1270411.	0.00
84.8750	-1.39E-09	0.6901	-0.03961	-6.79E-11	0.00	1.83E+11	8.71E-04	6562500.	0.00
85.7500	-1.90E-09	0.3222	-0.02881	-3.88E-11	0.00	1.83E+11	0.00119	6562500.	0.00
86.6250	-2.21E-09	0.08501	-0.01534	-2.71E-11	0.00	1.83E+11	0.00138	6562500.	0.00
87.5000	-2.47E-09	0.00	0.00	-2.47E-11	0.00	1.83E+11	0.00154	3281250.	0.00

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

Output Summary for Load Case No. 1:

Pile-head deflection = 0.25000000 inches

Computed slope at pile head = 0.000000 radians

Maximum bending moment = -1916330. inch-lbs

Maximum shear force = 29885. lbs

Depth of maximum bending moment = 0.000000 feet below pile head

Depth of maximum shear force = 0.000000 feet below pile head

Number of iterations = 48

Number of zero deflection points = 5

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs

Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians

Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.

Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs

Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Load 1	Load Type 2	Load 2	Axial Pile-head Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	y, in	0.2500	S, rad	0.00	0.00	0.2500	0.00	29885.	-1916330.

Maximum pile-head deflection = 0.2500000000 inches

Maximum pile-head rotation = 0.0000000000 radians = 0.000000 deg.

The analysis ended normally.

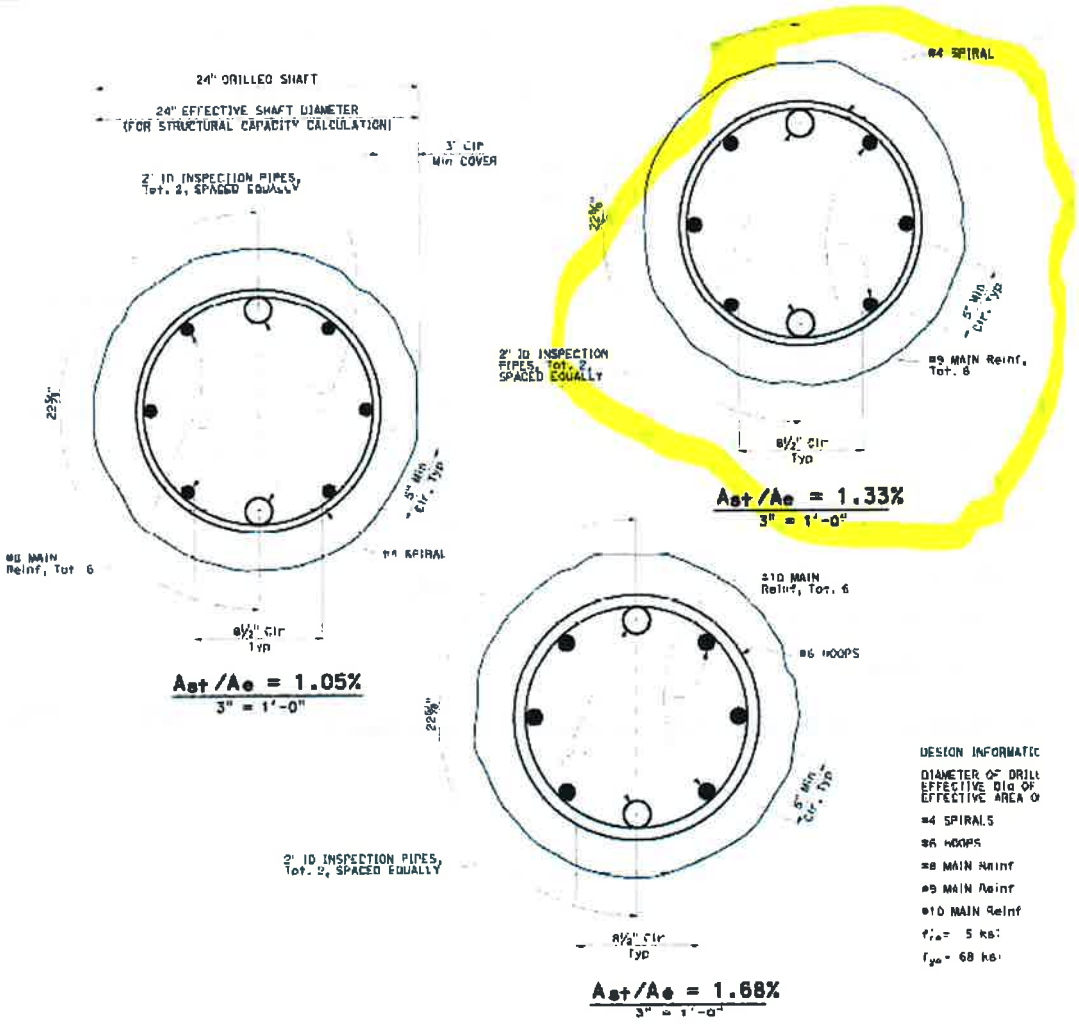
APPENDIX F

Axial Pile Resistance Analysis

Boring A-19-002

Abutment #1

24-inch CIDH Pile


24" DRILLED SHAFT
24" EFFECTIVE SHAFT DIAMETER
(FOR STRUCTURAL CAPACITY CALCULATION)
3" CLR
Min COVER
2" ID INSPECTION PIPES,
Tot. 2, SPACED EQUALLY
#4 SPIRAL
#9 MAIN Reinf,
Tot. 6
8½" Clr
Typ
Ast /Ae = 1.33%
3" = 1'-0"
#8 MAIN
Reinf, Tot 6
#4 SPIRAL
Ast /Ae = 1.05%
3" = 1'-0"
#10 MAIN
Reinf, Tot. 6
#6 HOOPS
2" ID INSPECTION PIPES,
Tot. 2, SPACED EQUALLY
Ast /Ae = 1.68%
3" = 1'-0"
DESIGN INFORMATIC
DIAMETER OF DRILL
EFFECTIVE Dia OF
EFFECTIVE AREA O
#4 SPIRALS
#6 HOOPS
#8 MAIN Reinf
#9 MAIN Reinf
#10 MAIN Reinf
f'ce = 5 ksi
fye = 60 ksi

File Edit Run Setup Help

Vertical | Lateral | Sample: List of Sample: (E-English, M-Metric)

A. Pile Type | B. Pile Profile | C. Pile Properties | D. Load and Group | E. Soil Properties | F. Advanced Page

1. Pile Type

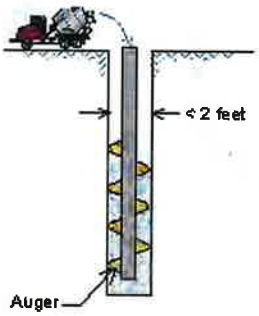
- (•) Drilled Pile (dia <=24 in. or 61 cm)
- ( ) Drilled Shaft (dia >24 in. or 61 cm)
- ( ) SHAFT (US. FHWA Methods)
- ( ) Driving Steel Pile (Open end)
- ( ) Driving Steel Pile (Closed end)
- ( ) Driving Concrete Pile
- ( ) Driving Tapered Pile (Timber Pile)
- ( ) Driving Jetted
- ( ) Micropile (MiniPile)
- ( ) Uplift Anchor
- ( ) Plate, Screw, and Helical
- ( ) Shallow Footing

Project Title 1:

Lack Road Bridge Replacement

Project Title 2:

Abutment 1; Boring A-19-002; 24-Inch CIDH



☑ Shown following text in Profile.

The text can be edited and saved.

Concrete poured into drilled hole.
Diameter is limited to 24in (61cm).

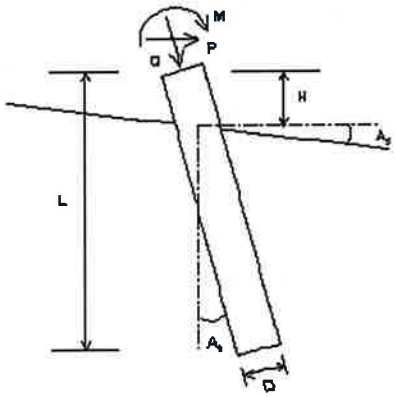
2. Units:

(•) English ( ) Metric

The parameters for all the types of piles are adjustable in Setup Page 3.

VERTICAL ANALYSIS

Figure 1



Drilled Pile (dia <=24 in. or 61 cm)

Loads:
Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

(with Load Factor)
Vertical Load, Q= 0.0 -kp

Profile:
Pile Length, L= 87.5 -ft
Top Height, H= -3 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0
Fixed Head Condition

Soil Data:

Depth -ft	Gamma -lb/ft3	Phi	C -kp/ft2	K -lb/in3	e50 or Dr %	Nspt
0	60.4	0.0	0.30	0	0.00	4
3	60.4	0.0	0.30	0	0.00	4
19	59.8	30	0.00	0	0.0	9
33.5	66.8	34	0.00	0	0	43
44.5	61.6	0.0	1.5	0	0	15
57.8	61.6	33	0.00	0	0	25
71.5	65.6	38	0.00	0	0	57
87.5	62.6	0.0	2	0	0	21
91.5	62.6	0.0	2	0	0	21

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/in2	Weight -kp/ft
0.0	24	452.4	75.4	16286.0	3000	0.471
87.5	24	452.4	75.4	16286.0	3000	0.471

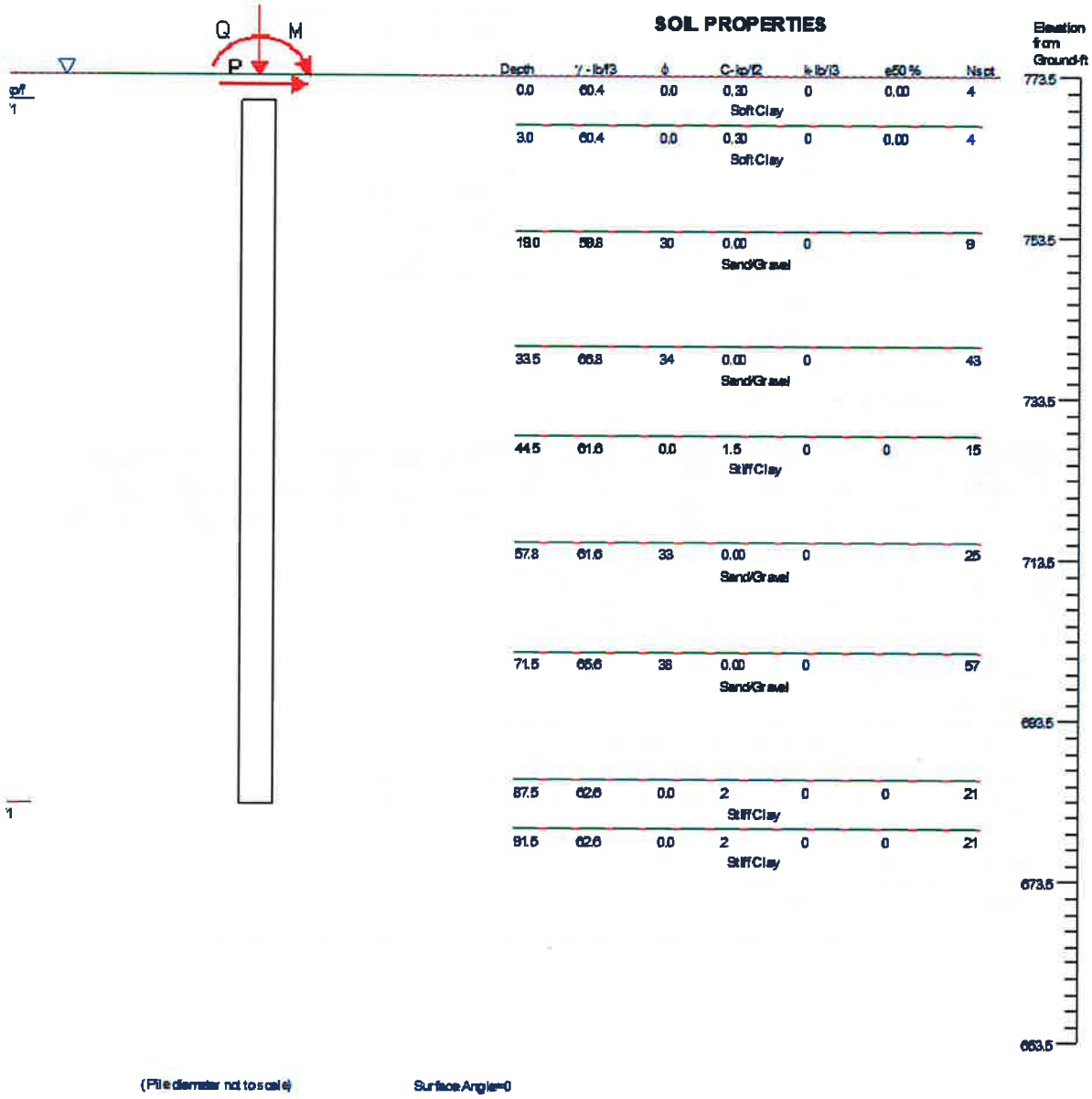
Vertical Capacity:
Weight above Ground= 0.00 Total Weight= 24.04-kp *Soil Weight is not included
Side Resistance (Down)= 468.857-kp Side Resistance (Up)= 349.918-kp
Tip Resistance (Down)= 56.550-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down) Qult= 525.407-kp Total Ultimate Capacity (Up)= 373.954-kp
Total Allowable Capacity (Down) Qallow= 525.407-kp Total Allowable Capacity (Up) Qallow= 373.954-kp
OK! Qallow > Q

Settlement Calculation:
At Q= 0.00-kp Settlement= 0.00000-in
At Xallow= 1.00-in Q= 427.79221-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

Concrete poured into drilled hole.
Diameter is limited to 24in (61cm).

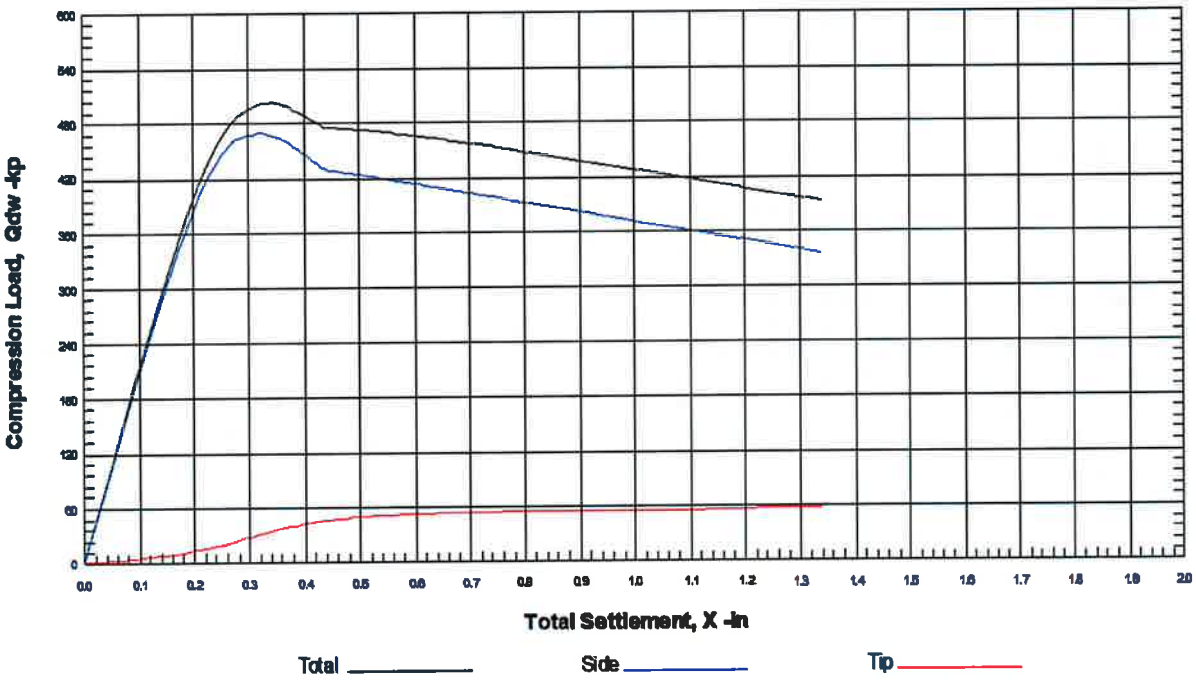
OUNDATION PROFILE & SOIL CONDITIONS



(Pile diameter not to scale) Surface Angle=0

Lack Road Bridge Replacement
Abutment 1; Boring A-19-002; 24-Inch CIDH **Figure 1**

Vertical Load vs. Total Settlement



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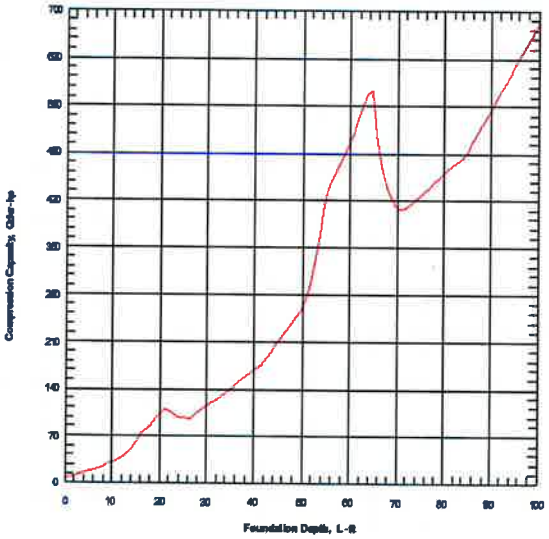
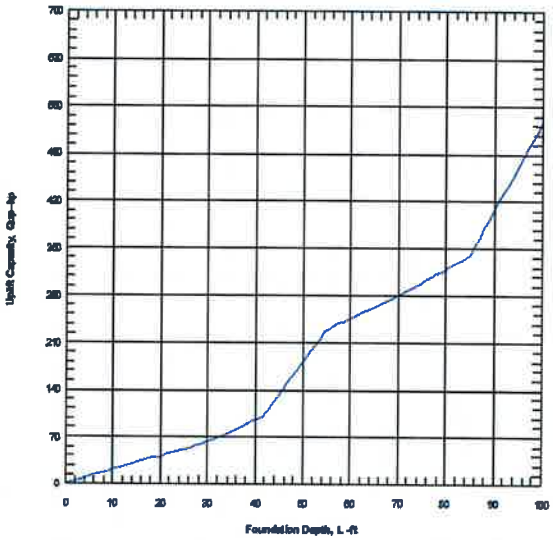
Lack Road Bridge Replacement
Abutment 1; Boring A-19-002; 24-Inch CIDH Figure 1

ULTIMATE CAPACITY vs FOUNDATION DEPTH





CivilTech Software

Lack Road Bridge Replacement
Abutment 1; Boring A-19-002; 24-Inch CIDH Figure 1

****

ALLPILE 7

VERTICAL ANALYSIS SUMMARY OUTPUT

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Date: 6/6/2019 File: C:\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix F - Axial Pile Resistance Analysis\Abutment 1\A-19-002 24-inch CIDH.alp 1.0

Title 1: Lack Road Bridge Replacement

Title 2: Abutment 1; Boring A-19-002; 24-Inch CIDH

ALLPILE INPUT DATA:

---

* Pile Type Page *

Unit: English

Concrete poured into drilled hole. Diameter is limited to 24in (61cm).

Pile Type: Drilled Pile (dia <=24 in. or 61 cm)

* Pile Profile *

Foundation Depth: 87.5 -ft

Top Height: -3 -ft

Slope Angle: 0

Pile Angle: 0

* Pile Properties *

Zs	Width	Area	Perim.	I	E	Weight	Mix*	Out	In	Other	Type
-ft	-in	-in2	-in	-in4	-kp/i2	-kp/f	%	Side	Side	Par.	

0.0	24	452.4	75.4	16286.0	3000	0.471	0.0	3	3	30	Concrete (rough)
87.5	24	452.4	75.4								Pile Tip

Note: Mix = % of Inside material/Outside material

Group Type: 0

Top Type: 5

Water Table: 0 -ft

Ground Elevation: 773.5 -ft

* Soil Properties *

Zs	Gamma	Phi	C	K	E50/Dr	Nspt	Type	Soil
-ft	-lb/f3	o	-kp/f2	-lb/i3	- %			
0.0	60.4	0.0	0.30	0	0.00	4	1	Soft Clay
3.0	60.4	0.0	0.30	0	0.00	4	1	Soft Clay
19.0	59.8	30	0.00	0	0.0	9	4	Sand/Gravel
33.5	66.8	34	0.00	0	0	43	4	Sand/Gravel
44.5	61.6	0.0	1.5	0	0	15	2	Stiff Clay
57.8	61.6	33	0.00	0	0	25	4	Sand/Gravel
71.5	65.6	38	0.00	0	0	57	4	Sand/Gravel
87.5	62.6	0.0	2	0	0	21	2	Stiff Clay
91.5	62.6	0.0	2	0	0	21	2	Stiff Clay

Surcharge Pressure on ground: 0 -kp/f2

ALLPILE ANALYSIS AND RESULTS:

TOTAL LOADS:

Vertical Load, Q: 0.0 -kp

Vertical Load with Load Factor, Q: 0.0 -kp

Vertical Load with Load factor and Pile Cap, Q= 0.0 -kp

Load Factor for Vertical Load and Torsion= 1.0

Vertical Loads Supported by Pile Cap: 0 %

Load Factor for Vertical Loads: 1.0

PILE PROFILE:

Pile Length, L= 87.5 -ft

Top Height, H= -3 -ft

Slope Angle, As= 0

Batter Angle, Ab= 0.00 Batter Factor, Kbat= 1.00

*To consider the influence of different soils below the pile tip, bearing stratum is defined from pile tip extending to 10 Diameter of pile, which is 20.0-ft (Input Page F, Item 3)

SINGLE PILE:

Kdown= 0.7 Kup= 0.4 Ka= 1.00

Single Pile Vertical Analysis:

Total Ultimate Capacity (Down)= 525.407-kp Total Ultimate Capacity (Up)= 373.954-kp

Total Allowable Capacity (Down)= 525.407-kp Total Allowable Capacity (Up)= 373.954-kp

Weight above Ground= 0.00 Total Weight= 24.04-kp *Soil Weight is not included

Side Resistance (Down)= 468.857-kp Side Resistance (Up)= 349.918-kp

Tip Resistance (Down)= 56.550-kp Tip Resistance (Up)= 0.000-kp

Negative Friction, Qneg= 0.000-kp, which has been subtracted from Total Ultimate Capacity (Down)

Negative friction does not affect Total Ultimate Capacity (Up)

At Work Load= 0.00-kp, Settlement= 0.00000-in

At Work Load= 0.00-kp, Secant Stiffness Kqx= 2502.52-kp/-in

At Allowable Settlement= 1.000000-in, Capacity= 427.79-kp

Work Load, 0.00-kp, OK with the Capacity at Allowable Settlement= 1.00000-in, Capacity= 427.79-kp

Work Load, 0.00-kp, OK with the Allowable Capacity (Down)= 525.41-kp

---

FACTOR OF SAFETY:

FSside	FStip	FSuplif	FSweight
1.0	1.0	1.0	1.0

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

1 1 1 1 1

Vertical Side and Tip Resistance vs. Total Settlement:

****

Xtop -in	Qside -kp	Qtip -kp	Qtotal -kp
0.001	1.8	0.0	1.8
0.090	188.7	4.5	193.2
0.125	255.4	6.6	262.0
0.153	308.0	8.7	316.7
0.177	349.2	10.6	359.9
0.197	381.1	12.5	393.6
0.214	405.4	14.3	419.7
0.228	423.6	16.1	439.7
0.241	437.2	17.8	455.0
0.252	447.1	19.4	466.5
0.261	454.2	20.9	475.1
0.270	459.3	22.4	481.7
0.279	462.8	23.8	486.6
0.287	465.2	25.1	490.4
0.294	466.8	26.4	493.3
0.301	467.9	27.7	495.6
0.308	468.5	28.9	497.4
0.315	468.8	30.0	498.8
0.322	468.9	31.1	500.0
0.328	468.7	32.2	500.8
0.335	468.2	33.2	501.4
0.341	467.5	34.1	501.6
0.347	466.5	35.0	501.6

0.353	465.3	35.9	501.2
0.359	463.8	36.8	500.5
0.364	462.0	37.6	499.6
0.370	460.0	38.3	498.3
0.376	457.7	39.1	496.8
0.381	455.3	39.8	495.1
0.386	452.8	40.4	493.2
0.391	450.3	41.1	491.3
0.397	447.7	41.7	489.4
0.402	445.2	42.3	487.5
0.407	442.8	42.8	485.6
0.413	440.5	43.3	483.8
0.418	438.2	43.8	482.0
0.423	435.9	44.3	480.2
0.428	433.4	44.8	478.2
0.433	430.4	45.2	475.6
0.439	429.8	45.7	475.5
0.445	429.2	46.1	475.3
0.451	428.7	46.4	475.1
0.457	428.1	46.8	474.9
0.462	427.5	47.2	474.6
0.468	426.9	47.5	474.4
0.474	426.3	47.8	474.1
0.480	425.7	48.1	473.9
0.486	425.2	48.4	473.6
0.492	424.6	48.7	473.3
0.497	424.0	48.9	472.9
0.503	423.4	49.2	472.6
0.509	422.8	49.4	472.3
0.515	422.3	49.7	471.9
0.520	421.7	49.9	471.6

0.526	421.1	50.1	471.2
0.532	420.5	50.3	470.8
0.537	419.9	50.5	470.4
0.543	419.3	50.7	470.0
0.549	418.8	50.9	469.6
0.555	418.2	51.0	469.2
0.560	417.6	51.2	468.8
0.566	417.0	51.4	468.4
0.572	416.4	51.5	468.0
0.577	415.9	51.7	467.5
0.583	415.3	51.8	467.1
0.589	414.7	51.9	466.6
0.594	414.1	52.1	466.2
0.600	413.5	52.2	465.7
0.606	413.0	52.3	465.3
0.611	412.4	52.4	464.8
0.617	411.8	52.6	464.3
0.623	411.2	52.7	463.9
0.628	410.6	52.8	463.4
0.634	410.0	52.9	462.9
0.640	409.5	53.0	462.4
0.645	408.9	53.1	462.0
0.651	408.3	53.2	461.5
0.657	407.7	53.3	461.0
0.662	407.1	53.3	460.5
0.668	406.6	53.4	460.0
0.673	406.0	53.5	459.5
0.679	405.4	53.6	459.0
0.685	404.8	53.7	458.5
0.690	404.2	53.8	458.0
0.696	403.6	53.8	457.5

0.702	403.1	53.9	457.0
0.707	402.5	54.0	456.5
0.713	401.9	54.0	456.0
0.718	401.3	54.1	455.4
0.724	400.7	54.2	454.9
0.730	400.2	54.2	454.4
0.735	399.6	54.3	453.9
0.741	399.0	54.4	453.4
0.747	398.4	54.4	452.8
0.780	394.9	54.8	449.7
0.892	383.3	55.5	438.8
1.004	371.7	55.8	427.4
1.115	360.0	55.8	415.9
1.227	348.4	56.1	404.5
1.338	336.8	56.5	393.3

Xtop - Total Vertical Settlement

Qside - Vertical Side Resistance (Down)

Qtip - Vertical Tip Resistance (Down)

Qtotal - Vertical Total Resistance (Ultimate)

Downward and Uplift Capacity vs Pile Length

The results are for single section pile. Multiple sections may not be correct!

****

Length -ft	Qtip -kp	Qside -kp	Q_dw -kp	Qd_alw -kp	Weight -kp	Qsid* -kp	Q_up -kp	Qu_alw -kp
0.00	6.85	0.00	6.9	6.85	0.00	0.00	0.00	0.00
1.01	7.12	1.89	9.0	9.02	0.28	1.89	2.17	2.17
2.02	7.41	3.79	11.2	11.21	0.55	3.79	4.35	4.35
3.03	7.77	5.69	13.5	13.47	0.83	5.69	6.53	6.53
4.04	8.23	7.61	15.8	15.83	1.11	7.61	8.72	8.72
5.05	8.80	9.52	18.3	18.31	1.39	9.52	10.91	10.91
6.06	9.41	11.40	20.8	20.81	1.66	11.40	13.06	13.06
7.07	10.14	13.31	23.5	23.46	1.94	13.31	15.26	15.26
8.08	10.99	15.19	26.2	26.18	2.22	15.19	17.41	17.41
9.09	11.95	17.13	29.1	29.08	2.50	17.13	19.63	19.63
10.10	13.03	19.00	32.0	32.03	2.77	19.00	21.78	21.78
11.11	14.29	20.90	35.2	35.19	3.05	20.90	23.94	23.94
12.12	15.72	22.85	38.6	38.57	3.33	22.85	26.18	26.18
13.13	18.97	24.74	43.7	43.71	3.61	24.74	28.35	28.35
14.14	25.29	26.61	51.9	51.90	3.88	26.61	30.50	30.50
15.15	34.08	28.52	62.6	62.60	4.16	28.52	32.69	32.69
16.16	44.89	30.46	75.3	75.35	4.43	30.31	34.74	34.74
17.17	48.81	32.80	81.6	81.61	4.71	31.67	36.39	36.39
18.18	52.95	35.31	88.3	88.26	5.00	33.11	38.10	38.10
19.19	57.33	37.87	95.2	95.20	5.27	34.58	39.85	39.85
20.20	61.96	40.59	102.6	102.55	5.55	36.12	41.66	41.66
21.21	66.87	43.44	110.3	110.31	5.83	37.76	43.59	43.59
22.22	60.33	46.35	106.7	106.68	6.10	39.39	45.49	45.49
23.23	51.85	49.37	101.2	101.22	6.37	41.12	47.50	47.50

24.24	45.51	52.64	98.1	98.15
25.25	40.64	55.96	96.6	96.60
26.26	36.97	59.30	96.3	96.26
27.27	39.22	62.85	102.1	102.07
28.28	40.46	66.56	107.0	107.02
29.29	41.59	70.29	111.9	111.88
30.30	42.60	74.27	116.9	116.87
31.31	43.34	78.71	122.1	122.05
32.32	43.91	83.48	127.4	127.39
33.33	44.34	88.41	132.7	132.75
34.34	44.62	93.52	138.1	138.14
35.35	44.92	98.77	143.7	143.69
36.36	45.32	104.19	149.5	149.51
37.37	45.53	109.71	155.2	155.24
38.38	45.46	115.35	160.8	160.81
39.39	45.36	120.92	166.3	166.28
40.40	45.28	126.51	171.8	171.79
41.41	45.22	132.17	177.4	177.39
42.42	45.60	141.33	186.9	186.92
43.43	46.00	150.44	196.4	196.44
44.44	46.43	160.00	206.4	206.42
45.45	46.83	169.69	216.5	216.53
46.46	47.29	179.36	226.6	226.64
47.47	47.71	188.91	236.6	236.61
48.48	48.11	198.06	246.2	246.17
49.49	48.96	207.56	256.5	256.52
50.51	55.05	217.17	272.2	272.22
51.52	68.48	226.74	295.2	295.21
52.53	87.32	236.53	323.9	323.85
53.54	115.48	245.97	361.5	361.45
54.55	158.94	255.35	414.3	414.29

6.66	43.05	49.71	49.71
6.94	44.92	51.86	51.86
7.21	46.77	53.98	53.98
7.49	48.86	56.35	56.35
7.77	51.00	58.77	58.77
8.04	53.08	61.12	61.12
8.33	55.38	63.71	63.71
8.60	57.92	66.52	66.52
8.88	60.63	69.50	69.50
9.15	63.40	72.55	72.55
9.42	66.32	75.74	75.74
9.70	69.35	79.05	79.05
9.98	72.41	82.39	82.39
10.26	75.57	85.83	85.83
10.54	78.84	89.38	89.38
10.82	82.00	92.82	92.82
11.10	85.22	96.32	96.32
11.38	88.47	99.85	99.85
11.66	97.38	109.04	109.04
11.92	106.42	118.34	118.34
12.21	115.85	128.06	128.06
12.50	125.60	138.09	138.09
12.76	135.40	148.16	148.16
13.04	144.96	158.01	158.01
13.31	154.02	167.32	167.32
13.60	163.39	176.99	176.99
13.89	173.04	186.92	186.92
14.15	182.61	196.76	196.76
14.44	192.60	207.04	207.04
14.70	201.97	216.67	216.67
14.97	211.41	226.37	226.37

55.56	180.12	261.81	441.9	441.94		15.26	216.06	231.32	231.32
56.57	189.75	267.61	457.4	457.36		15.52	219.84	235.37	235.37
57.58	199.25	273.08	472.3	472.33		15.82	222.93	238.75	238.75
58.59	209.87	278.31	488.2	488.17		16.09	225.74	241.82	241.82
59.60	220.32	283.53	503.8	503.84		16.38	228.70	245.08	245.08
60.61	232.17	288.75	520.9	520.92		16.65	231.52	248.17	248.17
61.62	244.58	294.37	538.9	538.95		16.91	234.95	251.86	251.86
62.63	258.59	299.87	558.5	558.47		17.21	237.97	255.18	255.18
63.64	272.45	304.84	577.3	577.29		17.48	240.54	258.02	258.02
64.65	271.77	310.45	582.2	582.22		17.74	243.99	261.73	261.73
65.66	195.43	316.12	511.5	511.54		18.05	247.55	265.59	265.59
66.67	146.39	321.78	468.2	468.17		18.31	250.98	269.29	269.29
67.68	114.11	326.73	440.8	440.84		18.58	253.41	271.98	271.98
68.69	91.71	332.58	424.3	424.29		18.88	257.01	275.89	275.89
69.70	74.21	338.54	412.8	412.75		19.15	259.95	279.09	279.09
70.71	61.95	344.77	406.7	406.72		19.41	263.60	283.01	283.01
71.72	57.82	351.58	409.4	409.40		19.68	267.55	287.23	287.23
72.73	57.66	357.36	415.0	415.02		19.99	270.53	290.52	290.52
73.74	57.63	364.16	421.8	421.79		20.25	274.43	294.68	294.68
74.75	57.44	370.05	427.5	427.49		20.52	277.79	298.31	298.31
75.76	57.38	377.09	434.5	434.48		20.79	282.55	303.34	303.34
76.77	57.31	383.37	440.7	440.68		21.10	285.57	306.67	306.67
77.78	57.23	390.55	447.8	447.78		21.36	290.39	311.76	311.76
78.79	57.12	396.12	453.2	453.25		21.63	292.83	314.46	314.46
79.80	57.03	402.62	459.6	459.65		21.90	296.56	318.45	318.45
80.81	56.92	409.68	466.6	466.60		22.21	301.40	323.61	323.61
81.82	56.81	415.78	472.6	472.59		22.48	304.74	327.22	327.22
82.83	56.71	421.98	478.7	478.69		22.75	308.25	330.99	330.99
83.84	56.61	427.91	484.5	484.52		23.02	311.58	334.59	334.59
84.85	56.55	435.70	492.3	492.25		23.28	316.76	340.05	340.05
85.86	56.55	448.55	505.1	505.10		23.60	329.92	353.52	353.52

86.87	56.55	461.27	517.8	517.82	23.87	342.24	366.11	366.11
87.88	56.55	473.82	530.4	530.37	24.14	355.06	379.19	379.19
88.89	56.55	486.30	542.8	542.85	24.40	367.19	391.60	391.60
89.90	56.55	499.06	555.6	555.61	24.67	380.58	405.25	405.25
90.91	56.55	512.84	569.4	569.39	24.99	394.41	419.40	419.40
91.92	56.55	525.61	582.2	582.16	25.26	406.99	432.26	432.26
92.93	56.55	537.30	593.9	593.85	25.53	418.02	443.55	443.55
93.94	56.55	549.03	605.6	605.58	25.80	430.18	455.98	455.98
94.95	56.55	562.85	619.4	619.40	26.07	444.42	470.49	470.49
95.96	56.55	574.76	631.3	631.31	26.34	455.80	482.14	482.14
96.97	56.55	588.11	644.7	644.66	26.66	469.32	495.98	495.98
97.98	56.55	600.76	657.3	657.31	26.93	482.09	509.02	509.02
98.99	56.55	612.89	669.4	669.44	27.20	493.82	521.02	521.02
100.00	56.55	626.70	683.2	683.25	27.47	508.69	536.16	536.16

FACTOR OF SAFETY:

FSside	FStip	FSup	FSweight
1.0	1.0	1.0	1.0

Note: Data can be selected, copied and pasted to Excel to create graphics

Length - Pile length, distance from pile top to tip (not from ground surface)

Qtip - Ultimate pile tip resistance

Qside - Ultimate pile side resistance

Q_dw - Ultimate pile downward resistance

Qd_alw - Allowable pile downward resistance

Weight - Weight of pile shaft

Qsid* - Ultimate pile side uplift resistance

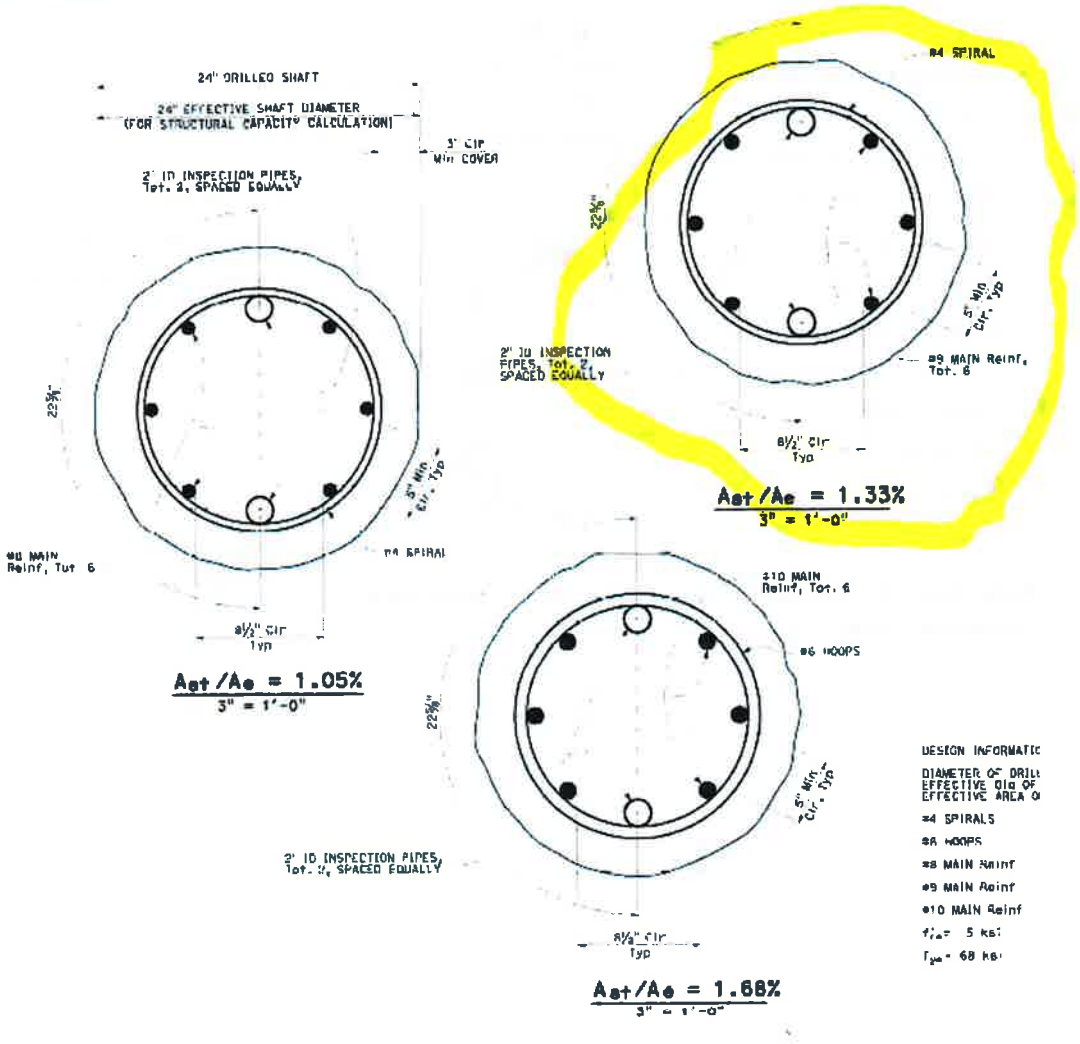
Q_up - Ultimate pile uplift resistance

Qu_alw - Allowable pile uplift resistance

Boring A-19-001

Abutment #2

24-inch CIDH Pile


24" DRILLED SHAFT
24" EFFECTIVE SHAFT DIAMETER
(FOR STRUCTURAL CAPACITY CALCULATION)
3" CLR
MIN COVER
2" ID INSPECTION PIPES,
Tot. 2, SPACED EQUALLY
22½"
#8 MAIN
Reinf, Tot 6
#4 SPIRAL
3" Min. Clr. Typ
8½" Clr
Typ
Ast /Ae = 1.05%
3" = 1'-0"
#4 SPIRAL
2" ID INSPECTION
PIPES, Tot. 2,
SPACED EQUALLY
#9 MAIN Reinf,
Tot. 6
Ast /Ae = 1.33%
3" = 1'-0"
#10 MAIN
Reinf, Tot. 6
#6 HOOPS
2" ID INSPECTION PIPES,
Tot. 2, SPACED EQUALLY
Ast /Ae = 1.68%
3" = 1'-0"
DESIGN INFORMATIC
DIAMETER OF DRILL
EFFECTIVE Dia OF
EFFECTIVE AREA O
#4 SPIRALS
#6 HOOPS
#8 MAIN Reinf
#9 MAIN Reinf
#10 MAIN Reinf
f'ce = 5 ksi
fye = 60 ksi

Allpile File name: A-19-001 24-inch CIDH.alp

File Edit Run Setup Help

Vertical | Lateral | K | Sample: List of Sample: (E-English, M-Metric)

A. Pile Type | B. Pile Profile | C. Pile Properties | D. Load and Group | E. Soil Properties | F. Advanced Page

1. Pile Type

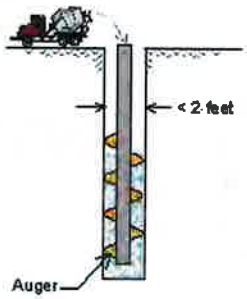
- (•) Drilled Pile (dia <=24 in. or 61 cm)
- ( ) Drilled Shaft (dia >24 in. or 61 cm)
- ( ) SHAFT (US. FHWA Methods)
- ( ) Driving Steel Pile (Open end)
- ( ) Driving Steel Pile (Closed end)
- ( ) Driving Concrete Pile
- ( ) Driving Tapered Pile (Timber Pile)
- ( ) Driving Jetted
- ( ) Micropile (MiniPile)
- ( ) Uplift Anchor
- ( ) Plate, Screw, and Helical
- ( ) Shallow Footing

Project Title 1:

Lack Road Bridge Replacement

Project Title 2:

Abutment 2; Boring A-19-001; 24-inch CIDH



☑ Shown following text in Profile.

The text can be edited and saved.

Concrete poured into drilled hole.
Diameter is limited to 24in (61cm).

2. Units:

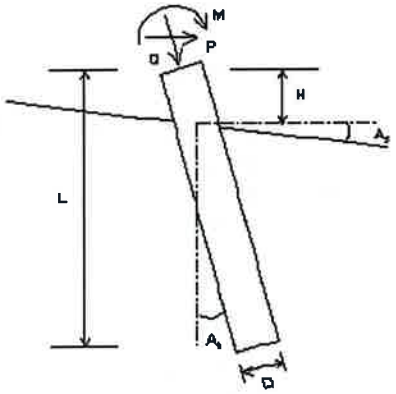
(•) English ( ) Metric

The parameters for all the types of piles are adjustable in Setup Page 3.

DefaultFilePath: C:\Allpile6\sample\

VERTICAL ANALYSIS

Figure 1



Drilled Pile (dia <=24 in. or 61 cm)

Loads:
Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

(with Load Factor)
Vertical Load, Q= 0.0 -kp

Profile:
Pile Length, L= 87.5 -ft
Top Height, H= -3 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0
Fixed Head Condition

Soil Data:

Depth -ft	Gamma -lb/ft3	Phi	C -kp/ft2	K -lb/in3	e50 or Dr %	Nspt
0	58.7	0.0	0.30	0.0	0.00	4
3	58.7	0.0	0.30	0.0	0.00	4
26.5	63.5	34	0.00	0.0	0.0	36
41.5	56.2	0.0	1.75	0	0	15
56.5	65.5	35	0.00	0	0	37
70.5	65.9	38	0.00	0	0	57
90.5	65.9	38	0.00	0	0	57

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/in2	Weight -kp/ft
0.0	24	452.4	75.4	16286.0	3000	0.471
87.5	24	452.4	75.4	16286.0	3000	0.471

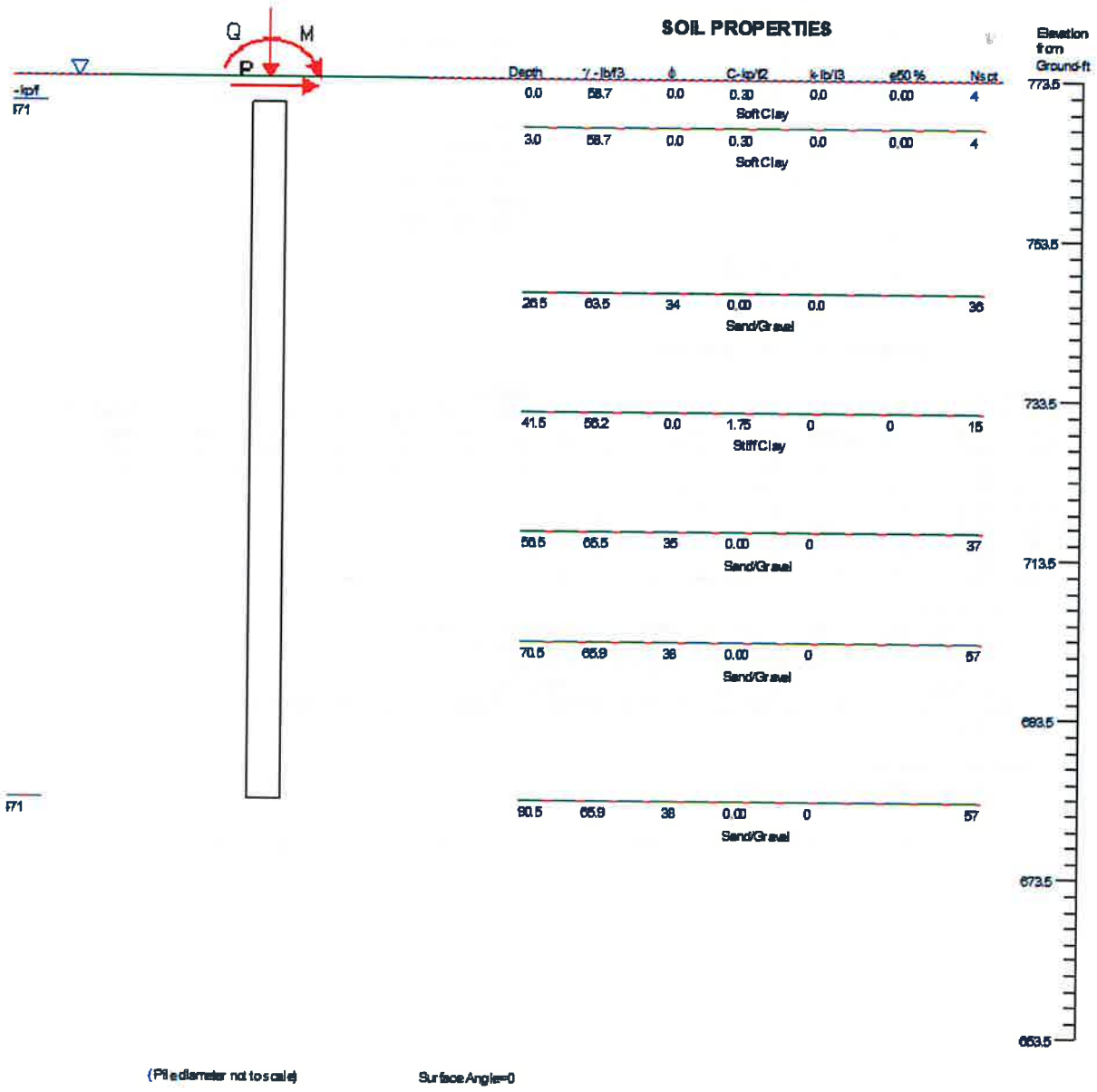
Vertical Capacity:
Weight above Ground= 0.00 Total Weight= 24.04-kp *Soil Weight is not included
Side Resistance (Down)= 481.122-kp Side Resistance (Up)= 364.909-kp
Tip Resistance (Down)= 349.394-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down) Qult= 830.516-kp Total Ultimate Capacity (Up)= 388.945-kp
Total Allowable Capacity (Down) Qallow= 830.516-kp Total Allowable Capacity (Up) Qallow= 388.945-kp
OK! Qallow > Q

Settlement Calculation:
At Q= 0.00-kp Settlement= 0.00000-in
At Xallow= 1.00-in Q= 613.21625-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

Concrete poured into drilled hole.
Diameter is limited to 24 in (61cm).

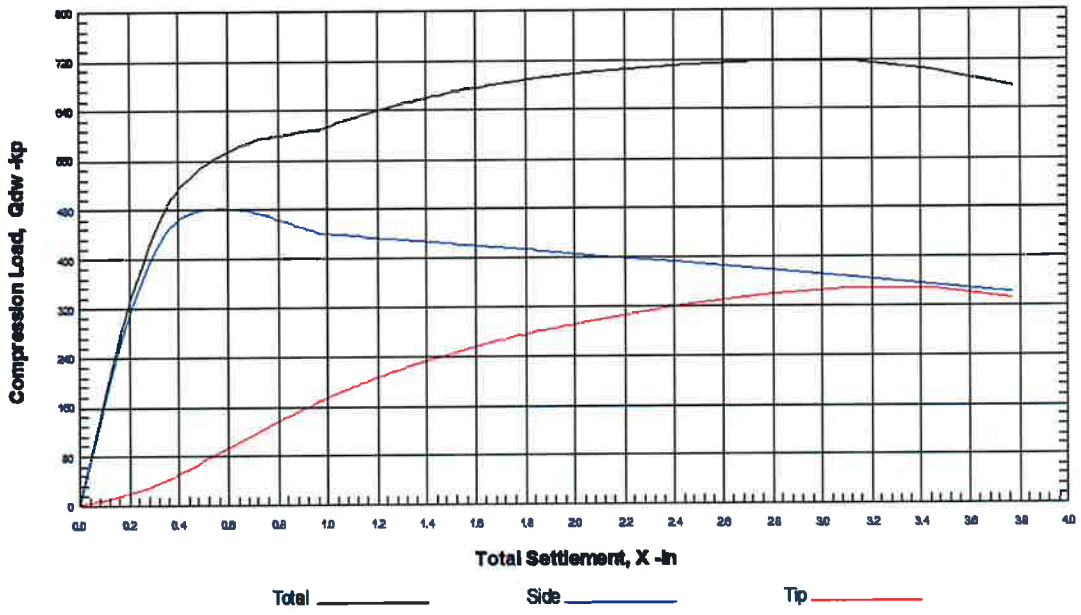
FOUNDATION PROFILE & SOIL CONDITIONS



(Pile diameter not to scale) Surface Angle=0

Lack Road Bridge Replacement
Abutment 2; Boring A-19-001; 24-Inch CIDH **Figure 1**

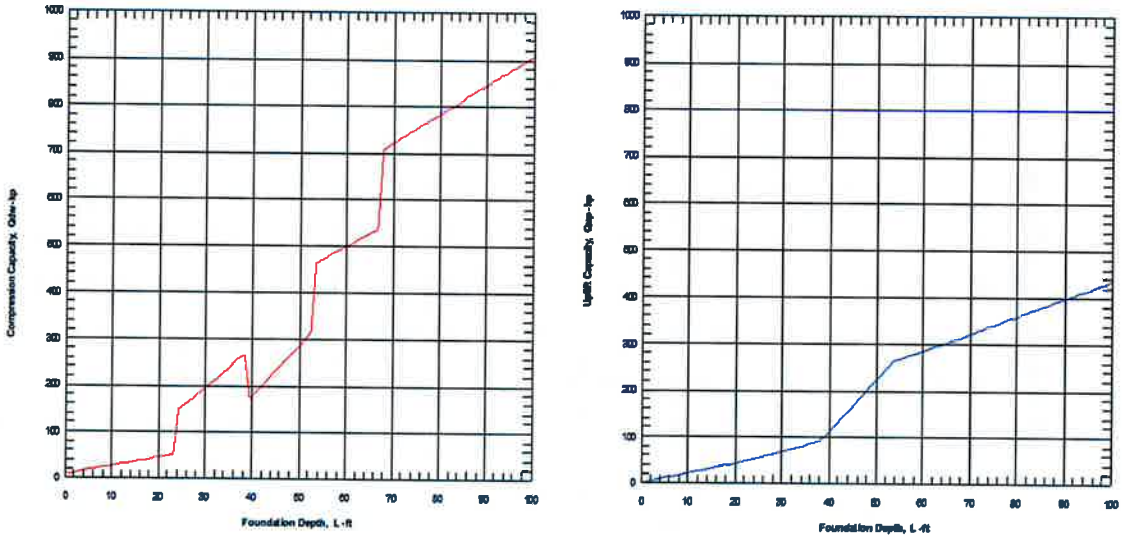
Vertical Load vs. Total Settlement



CivilTech Software

Lack Road Bridge Replacement
Abutment 2; Boring A-19-001; 24-Inch CIDH Figure 1

ULTIMATE CAPACITY vs FOUNDATION DEPTH



CivilTech Software

Lack Road Bridge Replacement
Abutment 2; Boring A-19-001; 24-Inch CIDH Figure 1

****

ALLPILE 7

VERTICAL ANALYSIS SUMMARY OUTPUT

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Date: 6/6/2019 File: \\cms1\project\PROJECTS\00,000's Projects\2019 Projects\227518-0000439.00 Lack Road Bridge - Bridge No. 58C-101\Report\Appendix F - Axial Pile Resistance Analysis\Abutment 2\A-19-001 24-inch CIDH.alp 1.0

Title 1: Lack Road Bridge Replacement

Title 2: Abutment 2; Boring A-19-001; 24-Inch CIDH

ALLPILE INPUT DATA:

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* Pile Type Page *

Unit: English

Concrete poured into drilled hole. Diameter is limited to 24in (61cm).

Pile Type: Drilled Pile (dia <=24 in. or 61 cm)

* Pile Profile *

Foundation Depth: 87.5 -ft

Top Height: -3 -ft

Slope Angle: 0

Pile Angle: 0

* Pile Properties *

Zs	Width	Area	Perim.	I	E	Weight	Mix*	Out	In	Other	Type
-ft	-in	-in2	-in	-in4	-kp/i2	-kp/f	%	Side	Side	Par.	

0.0	24	452.4	75.4	16286.0	3000	0.471	0.0	3	3	30	Concrete (rough)
87.5	24	452.4	75.4								Pile Tip

Note: Mix = % of Inside material/Outside material

Group Type: 0

Top Type: 5

Water Table: 0 -ft

Ground Elevation: 773.5 -ft

* Soil Properties *

Zs	Gamma	Phi	C	K	E50/Dr	Nspt	Type	Soil
-ft	-lb/f3	o	-kp/f2	-lb/i3	- %			
0.0	58.7	0.0	0.30	0.0	0.00	4	1	Soft Clay
3.0	58.7	0.0	0.30	0.0	0.00	4	1	Soft Clay
26.5	63.5	34	0.00	0.0	0.0	36	4	Sand/Gravel
41.5	56.2	0.0	1.75	0	0	15	2	Stiff Clay
56.5	65.5	35	0.00	0	0	37	4	Sand/Gravel
70.5	65.9	38	0.00	0	0	57	4	Sand/Gravel
90.5	65.9	38	0.00	0	0	57	4	Sand/Gravel

Surcharge Pressure on ground: 0 -kp/f2

Vertical Side and Tip Resistance vs. Total Settlement:

****

Xtop -in	Qside -kp	Qtip -kp	Qtotal -kp
0.001	1.7	0.5	2.2
0.120	195.5	9.9	205.4
0.168	264.2	14.7	278.9
0.210	318.4	19.4	337.8
0.247	360.6	24.1	384.8
0.281	393.1	28.9	422.0
0.311	417.8	33.6	451.4
0.339	436.2	38.3	474.6
0.365	449.9	43.0	492.9
0.389	459.8	47.7	507.5
0.413	466.9	52.3	519.2
0.435	471.8	57.0	528.8
0.457	475.3	61.6	536.9
0.478	477.6	66.2	543.8
0.499	479.2	70.7	549.9
0.520	480.2	75.2	555.4
0.541	480.8	79.7	560.5
0.561	481.1	84.1	565.2
0.581	481.1	88.6	569.7
0.601	480.9	92.9	573.8
0.622	480.4	97.3	577.7
0.641	479.7	101.5	581.2
0.661	478.6	105.8	584.4

0.681	477.3	110.0	587.3
0.700	475.7	114.1	589.8
0.719	473.8	118.2	592.0
0.739	471.6	122.3	593.9
0.758	469.2	126.3	595.5
0.777	466.7	130.3	596.9
0.795	464.1	134.2	598.2
0.814	461.4	138.0	599.4
0.833	458.7	141.8	600.6
0.852	456.2	145.6	601.8
0.870	453.7	149.3	603.0
0.889	451.4	152.9	604.3
0.908	449.1	156.5	605.6
0.927	446.7	160.1	606.8
0.945	444.2	163.6	607.7
0.963	441.1	167.0	608.1
0.983	440.3	170.4	610.8
1.002	439.7	173.7	613.5
1.021	439.1	177.0	616.2
1.040	438.5	180.3	618.8
1.059	437.9	183.4	621.4
1.078	437.3	186.6	623.9
1.097	436.7	189.7	626.3
1.116	436.1	192.7	628.8
1.135	435.5	195.7	631.1
1.154	434.9	198.6	633.4
1.173	434.3	201.5	635.7
1.192	433.6	204.3	637.9
1.211	433.0	207.1	640.1
1.229	432.4	209.8	642.2
1.248	431.8	212.5	644.3

1.267	431.2	215.1	646.3
1.285	430.6	217.7	648.3
1.304	430.0	220.2	650.2
1.323	429.4	222.7	652.1
1.341	428.8	225.2	653.9
1.360	428.2	227.6	655.7
1.378	427.5	230.0	657.5
1.396	426.9	232.3	659.2
1.415	426.3	234.6	660.9
1.433	425.7	236.8	662.5
1.452	425.1	239.0	664.1
1.470	424.5	241.2	665.7
1.488	423.9	243.3	667.2
1.506	423.3	245.4	668.7
1.525	422.7	247.5	670.1
1.543	422.1	249.5	671.5
1.561	421.4	251.5	672.9
1.579	420.8	253.4	674.2
1.597	420.2	255.3	675.6
1.615	419.6	257.2	676.8
1.633	419.0	259.1	678.1
1.651	418.4	260.9	679.3
1.669	417.8	262.7	680.5
1.687	417.2	264.4	681.6
1.705	416.6	266.2	682.7
1.723	416.0	267.9	683.8
1.741	415.4	269.6	684.9
1.759	414.7	271.2	686.0
1.777	414.1	272.8	687.0
1.795	413.5	274.5	688.0
1.813	412.9	276.0	689.0

1.831	412.3	277.6	689.9
1.848	411.7	279.1	690.8
1.866	411.1	280.6	691.7
1.884	410.5	282.1	692.6
1.902	409.9	283.6	693.5
1.920	409.3	285.1	694.3
1.937	408.6	286.5	695.1
1.955	408.0	287.9	696.0
1.973	407.4	289.3	696.7
2.079	403.8	297.4	701.1
2.429	391.6	320.6	712.2
2.776	379.4	338.9	718.2
3.117	367.2	349.4	716.6
3.448	355.0	347.9	702.9
3.769	342.8	332.3	675.1

Xtop - Total Vertical Settlement

Qside - Vertical Side Resistance (Down)

Qtip - Vertical Tip Resistance (Down)

Qtotal - Vertical Total Resistance (Ultimate)

Downward and Uplift Capacity vs Pile Length

The results are for single section pile. Multiple sections may not be correct!

****

Length -ft	Qtip -kp	Qside -kp	Q_dw -kp	Qd_alw -kp	Weight -kp	Qsid* -kp	Q_up -kp	Qu_alw -kp
0.00	7.71	0.00	7.7	7.71	0.00	0.00	0.00	0.00
1.01	7.98	1.89	9.9	9.87	0.28	1.89	2.17	2.17
2.02	8.14	3.79	11.9	11.94	0.55	3.79	4.35	4.35
3.03	8.26	5.69	14.0	13.95	0.83	5.69	6.53	6.53
4.04	8.36	7.61	16.0	15.97	1.11	7.61	8.72	8.72
5.05	8.48	9.52	18.0	18.00	1.39	9.52	10.91	10.91
6.06	8.48	11.40	19.9	19.88	1.66	11.40	13.06	13.06
7.07	8.48	13.31	21.8	21.80	1.94	13.31	15.26	15.26
8.08	8.48	15.19	23.7	23.68	2.22	15.19	17.41	17.41
9.09	8.48	17.13	25.6	25.61	2.50	17.13	19.63	19.63
10.10	8.48	19.00	27.5	27.49	2.77	19.00	21.78	21.78
11.11	8.48	20.90	29.4	29.38	3.05	20.90	23.94	23.94
12.12	8.48	22.85	31.3	31.33	3.33	22.85	26.18	26.18
13.13	8.48	24.74	33.2	33.22	3.61	24.74	28.35	28.35
14.14	8.48	26.61	35.1	35.10	3.88	26.61	30.50	30.50
15.15	8.48	28.52	37.0	37.01	4.16	28.52	32.69	32.69
16.16	8.48	30.40	38.9	38.88	4.43	30.40	34.84	34.84
17.17	8.48	32.31	40.8	40.79	4.71	32.31	37.02	37.02
18.18	8.48	34.25	42.7	42.73	5.00	34.25	39.24	39.24
19.19	8.48	36.13	44.6	44.61	5.27	36.13	41.40	41.40
20.20	8.48	38.04	46.5	46.52	5.55	38.04	43.59	43.59
21.21	8.48	39.97	48.5	48.45	5.83	39.97	45.80	45.80
22.22	8.48	41.83	50.3	50.31	6.10	41.83	47.93	47.93
23.23	8.48	43.70	52.2	52.18	6.37	43.70	50.07	50.07

24.24	102.14	46.89	149.0	149.03	6.66	45.80	52.47	52.47
25.25	106.22	50.59	156.8	156.81	6.94	47.94	54.88	54.88
26.26	110.33	54.45	164.8	164.78	7.21	50.07	57.27	57.27
27.27	114.41	58.50	172.9	172.91	7.49	52.40	59.89	59.89
28.28	118.50	62.71	181.2	181.21	7.77	54.82	62.60	62.60
29.29	122.58	66.94	189.5	189.52	8.04	57.23	65.27	65.27
30.30	126.66	71.43	198.1	198.09	8.33	59.85	68.18	68.18
31.31	130.76	76.03	206.8	206.78	8.60	62.44	71.04	71.04
32.32	134.84	80.75	215.6	215.59	8.88	65.13	74.00	74.00
33.33	138.94	85.69	224.6	224.64	9.15	67.91	77.06	77.06
34.34	143.01	90.61	233.6	233.63	9.42	70.76	80.19	80.19
35.35	147.12	95.89	243.0	243.00	9.70	73.73	83.43	83.43
36.36	151.21	101.25	252.5	252.45	9.98	76.78	86.76	86.76
37.37	153.65	106.67	260.3	260.32	10.26	79.91	90.17	90.17
38.38	153.67	112.19	265.9	265.86	10.54	83.07	93.60	93.60
39.39	49.48	122.47	172.0	171.96	10.82	92.93	103.75	103.75
40.40	49.48	133.38	182.9	182.86	11.10	103.80	114.90	114.90
41.41	49.48	144.61	194.1	194.09	11.38	115.04	126.42	126.42
42.42	49.48	155.96	205.4	205.44	11.66	126.62	138.28	138.28
43.43	49.48	167.09	216.6	216.57	11.92	137.66	149.59	149.59
44.44	49.48	177.98	227.5	227.46	12.21	148.45	160.66	160.66
45.45	49.48	189.11	238.6	238.59	12.50	159.54	172.03	172.03
46.46	49.48	200.15	249.6	249.63	12.76	170.72	183.48	183.48
47.47	49.48	211.23	260.7	260.71	13.04	181.61	194.65	194.65
48.48	49.48	222.15	271.6	271.64	13.31	192.54	205.85	205.85
49.49	49.48	233.51	283.0	282.99	13.60	203.95	217.54	217.54
50.51	49.48	244.29	293.8	293.78	13.89	214.74	228.63	228.63
51.52	49.48	255.86	305.3	305.34	14.15	226.45	240.60	240.60
52.53	49.48	267.03	316.5	316.51	14.44	237.72	252.16	252.16
53.54	186.37	277.78	464.1	464.15	14.70	248.15	262.86	262.86
54.55	185.92	283.53	469.5	469.45	14.97	251.58	266.55	266.55

55.56	185.91	289.50	475.4	475.40
56.57	186.37	295.30	481.7	481.66
57.58	186.09	301.01	487.1	487.10
58.59	186.35	306.10	492.5	492.45
59.60	185.86	312.38	498.2	498.24
60.61	185.93	318.07	504.0	504.00
61.62	185.85	323.48	509.3	509.33
62.63	186.33	329.29	515.6	515.62
63.64	186.07	335.33	521.4	521.41
64.65	186.39	340.10	526.5	526.49
65.66	185.95	346.30	532.3	532.25
66.67	186.11	351.70	537.8	537.81
67.68	349.63	356.87	706.5	706.50
68.69	349.64	364.60	714.2	714.24
69.70	349.51	370.47	720.0	719.98
70.71	349.13	376.71	725.8	725.84
71.72	350.10	382.89	733.0	732.99
72.73	349.45	389.34	738.8	738.79
73.74	350.08	395.93	746.0	746.02
74.75	349.17	401.12	750.3	750.30
75.76	349.68	407.98	757.7	757.67
76.77	349.98	414.69	764.7	764.67
77.78	350.17	421.15	771.3	771.32
78.79	350.25	426.63	776.9	776.88
79.80	350.22	433.02	783.2	783.24
80.81	350.09	439.58	789.7	789.68
81.82	349.86	445.78	795.6	795.64
82.83	349.39	451.55	800.9	800.95
83.84	348.94	457.53	806.5	806.48
84.85	350.01	464.44	814.4	814.45
85.86	349.36	470.71	820.1	820.08

15.26	255.17	270.43	270.43
15.52	258.52	274.05	274.05
15.82	261.97	277.79	277.79
16.09	264.23	280.32	280.32
16.38	268.49	284.88	284.88
16.65	271.58	288.23	288.23
16.91	274.57	291.48	291.48
17.21	277.84	295.05	295.05
17.48	281.72	299.20	299.20
17.74	283.56	301.31	301.31
18.05	287.56	305.61	305.61
18.31	290.32	308.63	308.63
18.58	293.00	311.58	311.58
18.88	298.46	317.34	317.34
19.15	301.36	320.51	320.51
19.41	305.24	324.65	324.65
19.68	308.23	327.91	327.91
19.99	312.28	332.27	332.27
20.25	316.28	336.53	336.53
20.52	318.71	339.23	339.23
20.79	322.67	343.45	343.45
21.10	326.76	347.86	347.86
21.36	330.57	351.93	351.93
21.63	333.01	354.64	354.64
21.90	336.71	358.61	358.61
22.21	340.62	362.84	362.84
22.48	344.17	366.65	366.65
22.75	347.59	370.33	370.33
23.02	350.95	373.97	373.97
23.28	354.83	378.11	378.11
23.60	358.46	382.06	382.06

86.87	350.15	477.09	827.2	827.23		23.87	362.12	385.99	385.99
87.88	349.31	483.80	833.1	833.11		24.14	366.67	390.81	390.81
88.89	350.06	489.61	839.7	839.67		24.40	368.96	393.36	393.36
89.90	348.89	495.78	844.7	844.68		24.67	373.32	397.99	397.99
90.91	349.49	502.74	852.2	852.22		24.99	377.23	402.23	402.23
91.92	349.88	508.90	858.8	858.78		25.26	380.67	405.93	405.93
92.93	350.33	515.49	865.8	865.82		25.53	384.18	409.71	409.71
93.94	348.79	520.28	869.1	869.07		25.80	386.79	412.59	412.59
94.95	348.95	526.16	875.1	875.10		26.07	389.99	416.06	416.06
95.96	349.17	532.56	881.7	881.74		26.34	393.31	419.65	419.65
96.97	349.19	539.89	889.1	889.08		26.66	398.42	425.08	425.08
97.98	349.27	546.09	895.4	895.37		26.93	401.59	428.52	428.52
98.99	349.15	551.88	901.0	901.02		27.20	404.66	431.86	431.86
100.00	348.95	557.47	906.4	906.43		27.47	407.60	435.07	435.07

FACTOR OF SAFETY:

FSside	FStip	FSup	FSweight
1.0	1.0	1.0	1.0

Note: Data can be selected, copied and pasted to Excel to create graphics

Length - Pile length, distance from pile top to tip (not from ground surface)

Qtip - Ultimate pile tip resistance

Qside - Ultimate pile side resistance

Q_dw - Ultimate pile downward resistance

Qd_alw - Allowable pile downward resistance

Weight - Weight of pile shaft

Qsid* - Ultimate pile side uplift resistance

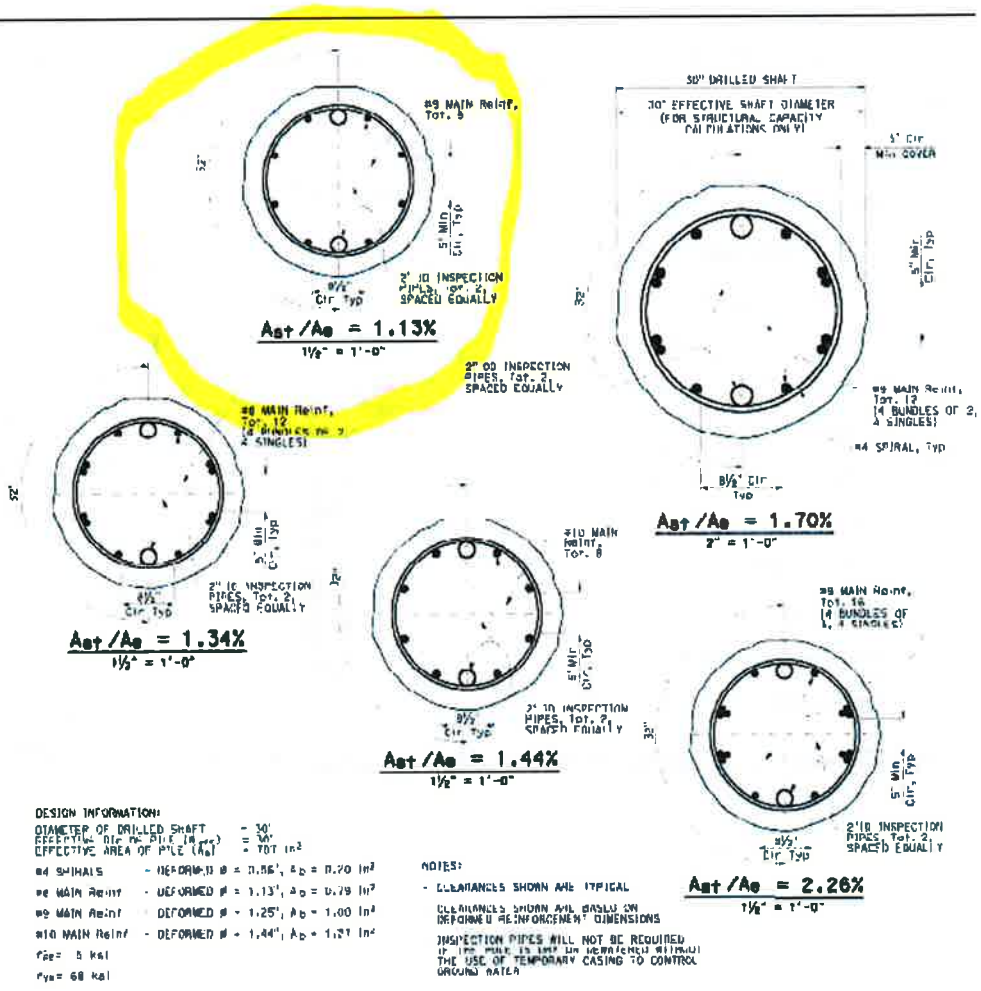
Q_up - Ultimate pile uplift resistance

Qu_alw - Allowable pile uplift resistance

Boring A-19-002

Abutment #1

30-inch CIDH Pile


#9 MAIN Reinf, Tot. 9
5" MIN Cir, Typ
8½" Cir Typ
3" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 1.13%
1½" = 1'-0"
30" DRILLED SHAFT
30" EFFECTIVE SHAFT DIAMETER (FOR STRUCTURAL CAPACITY CALCULATIONS ONLY)
3" Cir MIN COVER
5" Min Cir, Typ
#9 MAIN Reinf, Tot. 12 (4 BUNDLES OF 2, 4 SINGLES)
#4 SPIRAL, Typ
8½" Cir Typ
Ast /Ag = 1.70%
2" = 1'-0"
2" OD INSPECTION PIPES, Tot. 2, SPACED EQUALLY
#8 MAIN Reinf, Tot. 12 (4 BUNDLES OF 2, 4 SINGLES)
5" Min Cir, Typ
8½" Cir Typ
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 1.34%
1½" = 1'-0"
#10 MAIN Reinf, Tot. 8
5" Min Cir, Typ
8½" Cir Typ
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 1.44%
1½" = 1'-0"
#8 MAIN Reinf, Tot. 16 (4 BUNDLES OF 4, 4 SINGLES)
5" Min Cir, Typ
8½" Cir Typ
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 2.26%
1½" = 1'-0"
DESIGN INFORMATION:
DIAMETER OF DRILLED SHAFT = 30"
EFFECTIVE DIA OF PILE (Deff) = 30"
EFFECTIVE AREA OF PILE (Ag) = 707 in²
#4 SPIRALS - DEFORMED ϕ = 0.56", Ab = 0.20 in²
#8 MAIN Reinf - DEFORMED ϕ = 1.13", Ab = 0.79 in²
#9 MAIN Reinf - DEFORMED ϕ = 1.25", Ab = 1.00 in²
#10 MAIN Reinf - DEFORMED ϕ = 1.44", Ab = 1.27 in²
fce = 5 ksi
fya = 60 ksi
NOTES:
- CLEARANCES SHOWN ARE TYPICAL
CLEARANCES SHOWN ARE BASED ON DEFORMED REINFORCEMENT DIMENSIONS
INSPECTION PIPES WILL NOT BE REQUIRED IF THE HOLE IS DRY OF GROUNDWATER WITHOUT THE USE OF TEMPORARY CASING TO CONTROL GROUNDWATER

Allpile - file name: A-19-002 24-inch CIDH.alp

File Edit Run Setup Help

Vertical | Lateral | K | Sample: List of Sample: (E-English, M-Metric)

A. Pile Type | B. Pile Profile | C. Pile Properties | D. Load and Group | E. Soil Properties | F. Advanced Page

1. Pile Type

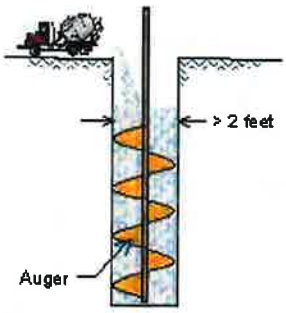
- ○ Drilled Pile (dia <=24 in. or 61 cm)
- ◉ Drilled Shaft (dia >24 in. or 61 cm)
- ○ SHAFT (US. FHWA Methods)
- ○ Driving Steel Pile (Open end)
- ○ Driving Steel Pile (Closed end)
- ○ Driving Concrete Pile
- ○ Driving Tapered Pile (Timber Pile)
- ○ Driving Jetted
- ○ Micropile (MiniPile)
- ○ Uplift Anchor
- ○ Plate, Screw, and Helical
- ○ Shallow Footing

Project Title 1:

Lack Road Bridge Replacement

Project Title 2:

Abutment 1; Boring A-19-002; 30-Inch CIDH



☑ Shown following text in Profile.

The text can be edited and saved.

Diameter more than 24in (61cm).
For bell section, select "Belled" in Diameter Variation (Pile Section Screen, Item 4).
Recommendation: 2 to 4 in Item 3 of Page F.

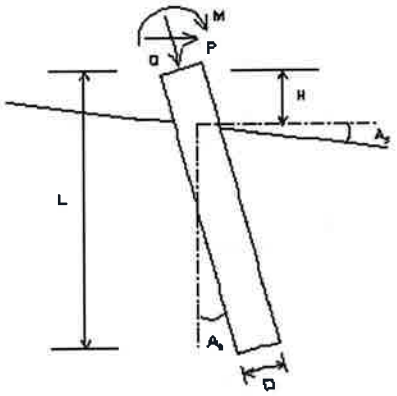
2. Units:

◉ English ○ Metric

The parameters for all the types of piles are adjustable in Setup Page 3.

VERTICAL ANALYSIS

Figure 1



Drilled Shaft (dia >24 in. or 61 cm)

Loads:
Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

(with Load Factor)
Vertical Load, Q= 0.0 -kp

Profile:
Pile Length, L= 87.5 -ft
Top Height, H= -3 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0
Fixed Head Condition

Soil Data:

Depth -ft	Gamma -lb/ft3	Phi	C -kp/ft2	K -lb/in3	e50 or Dr %	Nspt
0	60.4	0.0	0.30	0	0.00	4
3	60.4	0.0	0.30	0	0.00	4
19	59.8	30	0.00	0	0.0	9
33.5	66.8	34	0.00	0	0	43
44.5	61.6	0.0	1.5	0	0	15
57.8	61.6	33	0.00	0	0	25
71.5	65.6	38	0.00	0	0	57
87.5	62.6	0.0	2	0	0	21
91.5	62.6	0.0	2	0	0	21

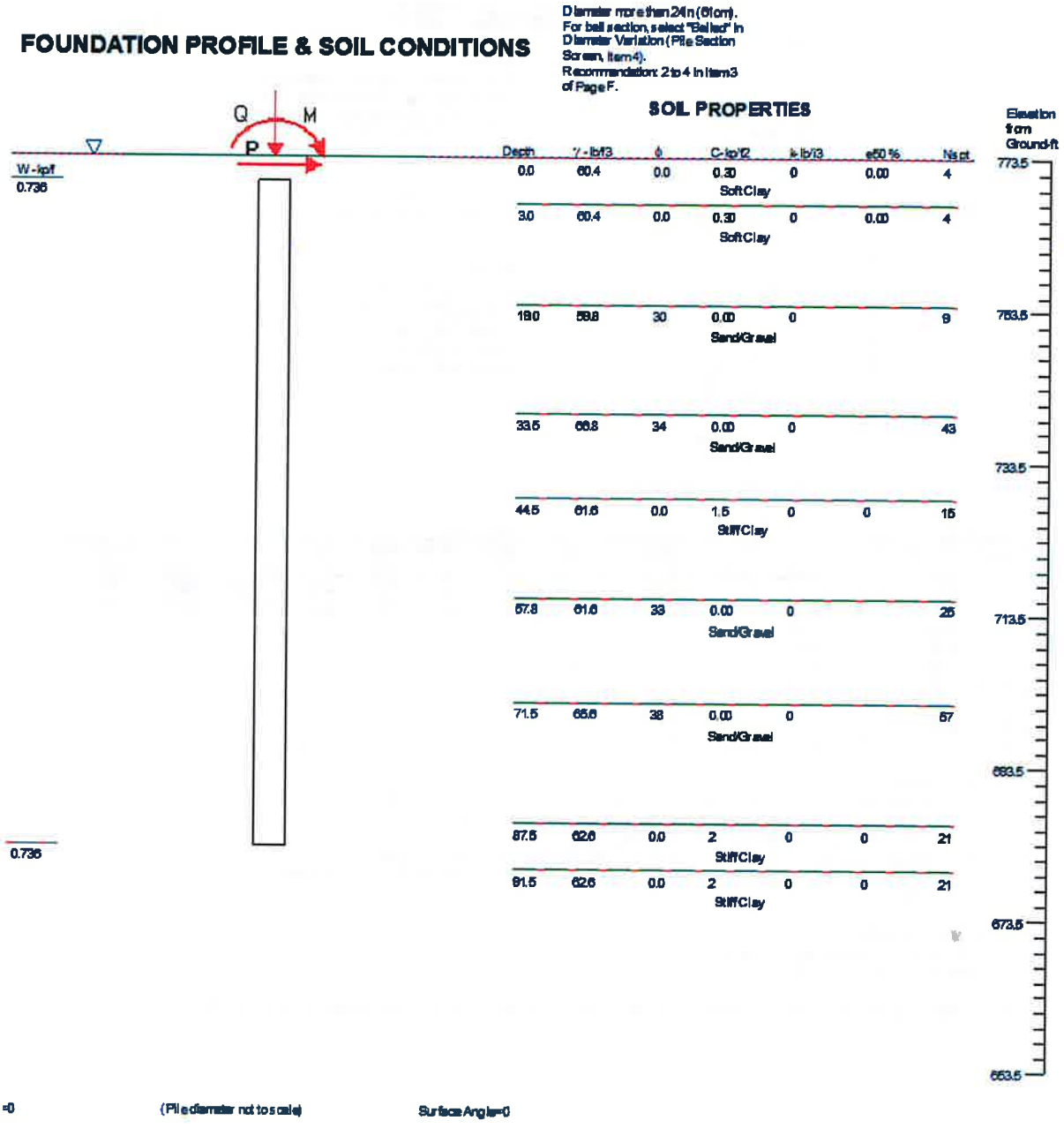
Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/i2	Weight -kp/f
0.0	30	706.9	94.2	39760.8	3000	0.736
87.5	30	706.9	94.2	39760.8	3000	0.736

Vertical Capacity:
Weight above Ground= 0.00 Total Weight= 37.56-kp *Soil Weight is not included
Side Resistance (Down)= 644.681-kp Side Resistance (Up)= 470.833-kp
Tip Resistance (Down)= 88.363-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down) Qult= 733.043-kp Total Ultimate Capacity (Up)= 508.394-kp
Total Allowable Capacity (Down) Qallow= 733.043-kp Total Allowable Capacity (Up) Qallow= 508.394-kp
OK! Qallow> Q

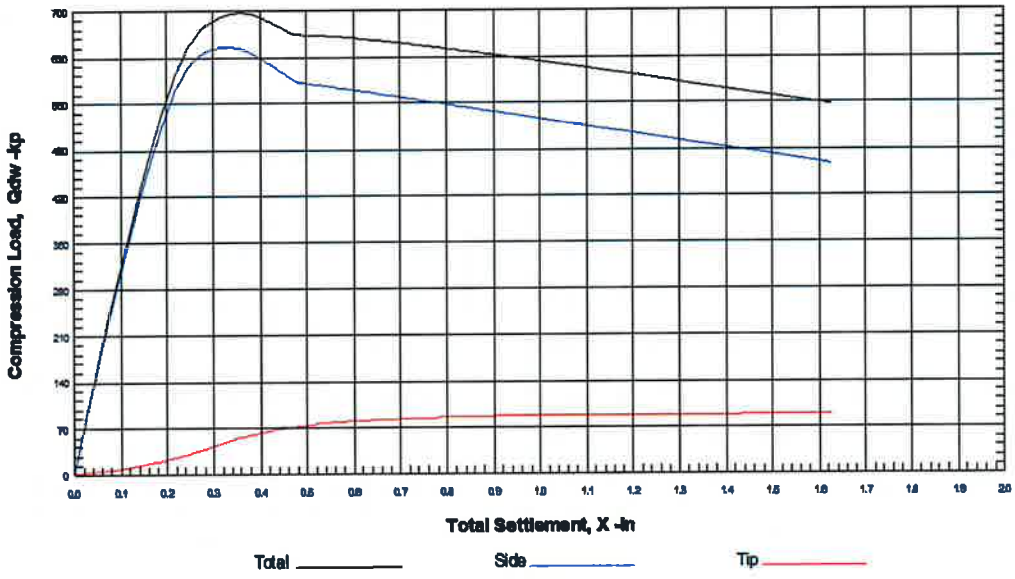
Settlement Calculation:
At Q= 0.00-kp Settlement= 0.00000-in
At Xallow= 1.00-in Q= 622.60736-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.



Lack Road Bridge Replacement
Abutment 1; Boring A-19-002; 30-Inch CIDH **Figure 1**

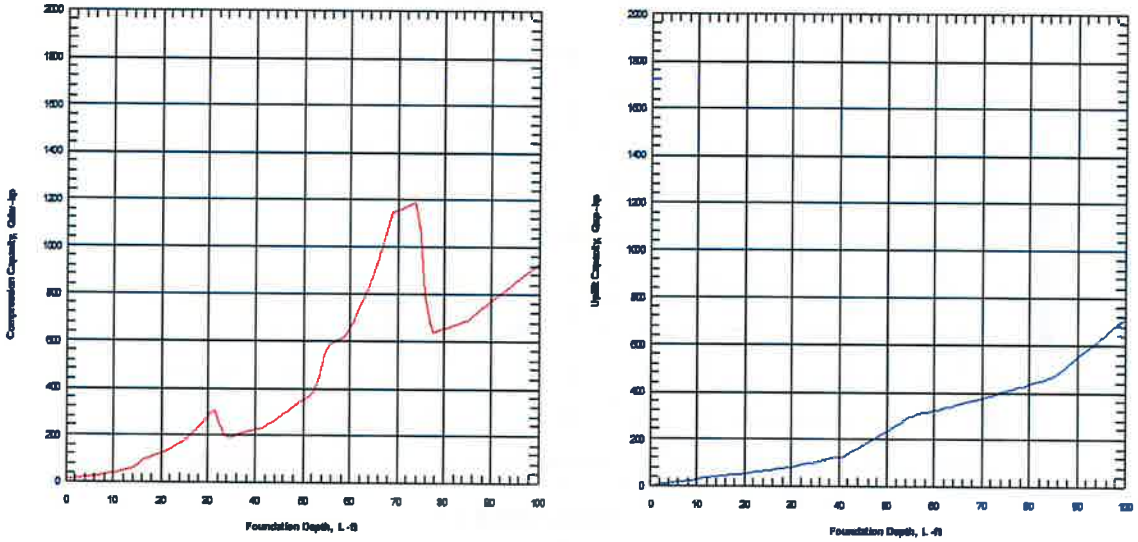
Vertical Load vs. Total Settlement



CivilTech Software

Lack Road Bridge Replacement
Abutment 1; Boring A-19-002; 30-Inch CIDFigure 1

ULTIMATE CAPACITY vs FOUNDATION DEPTH



CivilTech Software

Lack Road Bridge Replacement
Abutment 1; Boring A-19-002; 30-Inch CIDH

Figure 1

****

ALLPILE 7

VERTICAL ANALYSIS SUMMARY OUTPUT

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Date: 6/6/2019 File: C:\Users\carl.henderson\Desktop\Lack Road Bridge Analysis\Appendix F - Axial Pile Resistance Analysis\Abutment 1\A-19-002 30-inch CIDH.alp 1.0

Title 1: Lack Road Bridge Replacement

Title 2: Abutment 1; Boring A-19-002; 30-Inch CIDH

ALLPILE INPUT DATA:

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* Pile Type Page *

Unit: English

Diameter more than 24in (61cm). For bell section, select "Belled" in Diameter Variation (Pile Section Screen, Item 4). Recommendation: 2 to 4 in Item 3 of Page F.

Pile Type: Drilled Shaft (dia >24 in. or 61 cm)

* Pile Profile *

Foundation Depth: 87.5 -ft

Top Height: -3 -ft

Slope Angle: 0

Pile Angle: 0

* Pile Properties *

Zs	Width	Area	Perim.	I	E	Weight	Mix*	Out	In	Other	Type
-ft	-in	-in2	-in	-in4	-kp/i2	-kp/f	%	Side	Side	Par.	

0.0	30	706.9	94.2	39760.8	3000	0.736	0.0	3	3	30	Concrete (rough)
87.5	30	706.9	94.2								Pile Tip

Note: Mix = % of Inside material/Outside material

Group Type: 0

Top Type: 5

Water Table: 0 -ft

Ground Elevation: 773.5 -ft

* Soil Properties *

Zs	Gamma	Phi	C	K	E50/Dr	Nspt	Type	Soil
-ft	-lb/f3	o	-kp/f2	-lb/i3	- %			
0.0	60.4	0.0	0.30	0	0.00	4	1	Soft Clay
3.0	60.4	0.0	0.30	0	0.00	4	1	Soft Clay
19.0	59.8	30	0.00	0	0.0	9	4	Sand/Gravel
33.5	66.8	34	0.00	0	0	43	4	Sand/Gravel
44.5	61.6	0.0	1.5	0	0	15	2	Stiff Clay
57.8	61.6	33	0.00	0	0	25	4	Sand/Gravel
71.5	65.6	38	0.00	0	0	57	4	Sand/Gravel
87.5	62.6	0.0	2	0	0	21	2	Stiff Clay
91.5	62.6	0.0	2	0	0	21	2	Stiff Clay

Surcharge Pressure on ground: 0 -kp/f2

ALLPILE ANALYSIS AND RESULTS:

TOTAL LOADS:

Vertical Load, Q: 0.0 -kp

Vertical Load with Load Factor, Q: 0.0 -kp

Vertical Load with Load factor and Pile Cap, Q= 0.0 -kp

Load Factor for Vertical Load and Torsion= 1.0

Vertical Loads Supported by Pile Cap: 0 %

Load Factor for Vertical Loads: 1.0

PILE PROFILE:

Pile Length, L= 87.5 -ft

Top Height, H= -3 -ft

Slope Angle, As= 0

Batter Angle, Ab= 0.00 Batter Factor, Kbat= 1.00

*To consider the influence of different soils below the pile tip, bearing stratum is defined from pile tip extending to 4 Diameter of pile, which is 10.0-ft (Input Page F, Item 3)

SINGLE PILE:

Kdown= 0.7 Kup= 0.4 Ka= 1.00

Single Pile Vertical Analysis:

Total Ultimate Capacity (Down)= 733.043-kp Total Ultimate Capacity (Up)= 508.394-kp

Total Allowable Capacity (Down)= 733.043-kp Total Allowable Capacity (Up)= 508.394-kp

Weight above Ground= 0.00 Total Weight= 37.56-kp *Soil Weight is not included

Side Resistance (Down)= 644.681-kp Side Resistance (Up)= 470.833-kp

Tip Resistance (Down)= 88.363-kp Tip Resistance (Up)= 0.000-kp

Negative Friction, Qneg= 0.000-kp, which has been subtracted from Total Ultimate Capacity (Down)

Negative friction does not affect Total Ultimate Capacity (Up)

At Work Load= 0.00-kp, Settlement= 0.00000-in

At Work Load= 0.00-kp, Secant Stiffness Kqx= 3910.32-kp/-in

At Allowable Settlement= 1.000000-in, Capacity= 622.61-kp

Work Load, 0.00-kp, OK with the Capacity at Allowable Settlement= 1.00000-in, Capacity= 622.61-kp

Work Load, 0.00-kp, OK with the Allowable Capacity (Down)= 733.04-kp

---

FACTOR OF SAFETY:

FSside	FStip	FSuplif	FSweight
1.0	1.0	1.0	1.0

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

1	1	1	1	1

Vertical Side and Tip Resistance vs. Total Settlement:

****

Xtop -in	Qside -kp	Qtip -kp	Qtotal -kp
0.001	2.6	0.0	2.6
0.084	256.2	7.1	263.3
0.116	347.2	10.4	357.6
0.143	419.5	13.6	433.1
0.167	476.3	16.6	492.9
0.187	520.4	19.6	539.9
0.204	554.2	22.4	576.6
0.219	579.8	25.1	605.0
0.233	599.0	27.7	626.7
0.245	613.1	30.2	643.3
0.256	623.3	32.6	656.0
0.266	630.6	35.0	665.6
0.276	635.7	37.2	672.9
0.285	639.3	39.3	678.5
0.294	641.6	41.3	682.9
0.303	643.2	43.3	686.4
0.312	644.1	45.1	689.2
0.320	644.6	46.9	691.5
0.328	644.7	48.6	693.3
0.336	644.4	50.2	694.7
0.344	643.9	51.8	695.7
0.352	643.0	53.3	696.3
0.360	641.7	54.7	696.5

0.367	640.1	56.1	696.2
0.375	638.2	57.4	695.6
0.382	635.8	58.7	694.5
0.389	633.2	59.9	693.1
0.396	630.2	61.0	691.3
0.403	627.1	62.1	689.2
0.410	623.7	63.2	686.9
0.417	620.3	64.2	684.4
0.424	616.8	65.1	681.9
0.431	613.3	66.0	679.4
0.438	610.0	66.9	676.9
0.445	606.7	67.7	674.4
0.452	603.5	68.5	672.0
0.459	600.3	69.3	669.5
0.466	596.8	70.0	666.8
0.472	592.9	70.7	663.5
0.480	592.3	71.3	663.6
0.487	591.5	72.0	663.4
0.495	590.7	72.6	663.3
0.502	589.9	73.1	663.1
0.509	589.1	73.7	662.8
0.517	588.4	74.2	662.6
0.524	587.6	74.7	662.3
0.531	586.8	75.2	662.0
0.539	586.0	75.6	661.7
0.546	585.3	76.1	661.3
0.554	584.5	76.5	661.0
0.561	583.7	76.9	660.6
0.568	582.9	77.3	660.2
0.575	582.2	77.6	659.8
0.583	581.4	78.0	659.3

0.590	580.6	78.3	658.9
0.597	579.8	78.6	658.4
0.605	579.1	78.9	658.0
0.612	578.3	79.2	657.5
0.619	577.5	79.5	657.0
0.626	576.7	79.8	656.5
0.634	575.9	80.0	656.0
0.641	575.2	80.3	655.4
0.648	574.4	80.5	654.9
0.655	573.6	80.7	654.4
0.663	572.8	81.0	653.8
0.670	572.1	81.2	653.2
0.677	571.3	81.4	652.7
0.684	570.5	81.6	652.1
0.692	569.7	81.8	651.5
0.699	569.0	81.9	650.9
0.706	568.2	82.1	650.3
0.713	567.4	82.3	649.7
0.720	566.6	82.5	649.1
0.728	565.8	82.6	648.5
0.735	565.1	82.8	647.9
0.742	564.3	82.9	647.2
0.749	563.5	83.1	646.6
0.756	562.7	83.2	646.0
0.764	562.0	83.4	645.3
0.771	561.2	83.5	644.7
0.778	560.4	83.6	644.0
0.785	559.6	83.8	643.4
0.792	558.9	83.9	642.7
0.799	558.1	84.0	642.1
0.807	557.3	84.1	641.4

0.814	556.5	84.2	640.8
0.821	555.7	84.3	640.1
0.828	555.0	84.5	639.4
0.835	554.2	84.6	638.8
0.843	553.4	84.7	638.1
0.850	552.6	84.8	637.4
0.857	551.9	84.9	636.7
0.864	551.1	85.0	636.1
0.871	550.3	85.1	635.4
0.914	545.7	85.6	631.2
1.057	530.1	86.7	616.8
1.200	514.6	87.1	601.7
1.343	499.1	87.2	586.3
1.485	483.5	87.7	571.2
1.628	468.0	88.4	556.4

Xtop - Total Vertical Settlement

Qside - Vertical Side Resistance (Down)

Qtip - Vertical Tip Resistance (Down)

Qtotal - Vertical Total Resistance (Ultimate)

Downward and Uplift Capacity vs Pile Length

The results are for single section pile. Multiple sections may not be correct!

****

Length -ft	Qtip -kp	Qside -kp	Q_dw -kp	Qd_alw -kp	Weight -kp	Qsid* -kp	Q_up -kp	Qu_alw -kp
0.00	11.71	0.00	11.7	11.71	0.00	0.00	0.00	0.00
1.01	12.15	2.37	14.5	14.52	0.43	2.37	2.80	2.80
2.02	12.46	4.74	17.2	17.20	0.86	4.74	5.60	5.60
3.03	12.68	7.11	19.8	19.80	1.30	7.11	8.41	8.41
4.04	12.84	9.50	22.3	22.34	1.73	9.50	11.24	11.24
5.05	12.97	11.89	24.9	24.86	2.17	11.89	14.06	14.06
6.06	13.12	14.24	27.4	27.36	2.60	14.24	16.84	16.84
7.07	13.76	16.63	30.4	30.39	3.04	16.63	19.67	19.67
8.08	14.60	18.98	33.6	33.59	3.46	18.98	22.45	22.45
9.09	15.81	21.40	37.2	37.21	3.90	21.40	25.30	25.30
10.10	17.39	23.74	41.1	41.13	4.33	23.74	28.07	28.07
11.11	19.32	26.11	45.4	45.43	4.76	26.11	30.87	30.87
12.12	21.62	28.55	50.2	50.17	5.21	28.55	33.75	33.75
13.13	24.29	30.91	55.2	55.20	5.64	30.91	36.55	36.55
14.14	27.32	33.25	60.6	60.56	6.07	33.25	39.32	39.32
15.15	38.78	35.64	74.4	74.42	6.50	35.64	42.14	42.14
16.16	58.64	38.05	96.7	96.69	6.93	37.87	44.80	44.80
17.17	61.70	40.98	102.7	102.68	7.36	39.57	46.94	46.94
18.18	64.76	44.11	108.9	108.88	7.81	41.36	49.17	49.17
19.19	67.83	47.32	115.1	115.14	8.24	43.20	51.43	51.43
20.20	70.89	50.71	121.6	121.59	8.67	45.12	53.79	53.79
21.21	77.31	54.27	131.6	131.58	9.11	47.17	56.28	56.28
22.22	85.80	57.90	143.7	143.71	9.53	49.21	58.74	58.74
23.23	95.17	61.68	156.8	156.85	9.96	51.38	61.34	61.34

24.24	105.51	65.76	171.3	171.27
25.25	116.95	69.91	186.9	186.86
26.26	129.65	74.08	203.7	203.73
27.27	143.76	78.53	222.3	222.28
28.28	159.47	83.16	242.6	242.62
29.29	176.99	87.82	264.8	264.81
30.30	196.57	92.79	289.4	289.36
31.31	206.03	98.33	304.4	304.36
32.32	136.38	104.29	240.7	240.67
33.33	91.51	110.46	202.0	201.96
34.34	73.16	116.84	190.0	190.00
35.35	73.57	123.39	197.0	196.97
36.36	73.53	130.16	203.7	203.69
37.37	73.03	137.08	210.1	210.11
38.38	72.08	144.29	216.4	216.37
39.39	70.67	151.62	222.3	222.29
40.40	68.81	159.17	228.0	227.98
41.41	66.49	166.96	233.5	233.45
42.42	66.27	178.48	244.8	244.75
43.43	66.27	189.96	256.2	256.23
44.44	66.27	201.89	268.2	268.17
45.45	68.29	214.01	282.3	282.29
46.46	71.73	226.00	297.7	297.73
47.47	75.31	237.92	313.2	313.23
48.48	78.72	249.43	328.1	328.14
49.49	82.16	261.29	343.4	343.44
50.51	85.57	273.27	358.8	358.84
51.52	88.94	285.21	374.2	374.15
52.53	93.67	297.42	391.1	391.09
53.54	138.97	309.18	448.2	448.15
54.55	223.20	320.98	544.2	544.18

10.42	53.78	64.19	64.19
10.85	56.12	66.97	66.97
11.26	58.43	69.69	69.69
11.70	61.04	72.74	72.74
12.15	63.72	75.86	75.86
12.57	66.32	78.88	78.88
13.02	69.19	82.21	82.21
13.44	72.36	85.81	85.81
13.87	75.74	89.61	89.61
14.30	79.21	93.51	93.51
14.73	82.86	97.58	97.58
15.16	86.65	101.80	101.80
15.59	90.46	106.05	106.05
16.03	94.42	110.45	110.45
16.46	98.60	115.07	115.07
16.90	102.76	119.66	119.66
17.34	107.11	124.45	124.45
17.78	111.58	129.36	129.36
18.23	122.75	140.98	140.98
18.63	134.09	152.72	152.72
19.08	145.89	164.96	164.96
19.53	158.06	177.59	177.59
19.93	170.26	190.19	190.19
20.38	182.20	202.58	202.58
20.79	193.55	214.35	214.35
21.25	205.26	226.51	226.51
21.70	217.30	239.00	239.00
22.11	229.25	251.36	251.36
22.57	241.72	264.29	264.29
22.98	253.40	276.38	276.38
23.39	265.24	288.63	288.63

55.56	256.45	330.36	586.8	586.81
56.57	255.96	339.12	595.1	595.08
57.58	255.98	347.76	603.7	603.75
58.59	258.37	356.07	614.4	614.45
59.60	282.56	364.55	647.1	647.11
60.61	310.57	372.88	683.4	683.45
61.62	341.91	381.63	723.5	723.54
62.63	377.30	390.11	767.4	767.41
63.64	417.20	398.27	815.5	815.48
64.65	462.07	406.67	868.7	868.74
65.66	514.23	415.76	930.0	929.99
66.67	573.20	424.53	997.7	997.72
67.68	639.76	432.57	1072.3	1072.33
68.69	700.09	441.68	1141.8	1141.77
69.70	699.99	451.40	1151.4	1151.38
70.71	699.38	461.17	1160.5	1160.55
71.72	698.49	471.15	1169.6	1169.64
72.73	699.45	481.12	1180.6	1180.58
73.74	700.17	491.57	1191.7	1191.73
74.75	570.97	501.02	1072.0	1072.00
75.76	277.28	511.43	788.7	788.71
76.77	162.03	521.39	683.4	683.43
77.78	108.07	532.03	640.1	640.10
78.79	103.79	541.79	645.6	645.58
79.80	101.03	551.82	652.8	652.85
80.81	98.24	562.28	660.5	660.52
81.82	95.59	572.58	668.2	668.18
82.83	92.84	582.23	675.1	675.06
83.84	90.14	592.44	682.6	682.58
84.85	88.36	603.44	691.8	691.80
85.86	88.36	619.19	707.6	707.55

23.85	271.80	295.65	295.65
24.26	277.39	301.65	301.65
24.72	282.28	307.01	307.01
25.14	286.81	311.94	311.94
25.60	291.62	317.22	317.22
26.02	296.18	322.20	322.20
26.43	301.46	327.89	327.89
26.90	306.15	333.05	333.05
27.31	310.47	337.78	337.78
27.73	315.57	343.30	343.30
28.20	321.18	349.37	349.37
28.61	326.43	355.04	355.04
29.03	330.52	359.55	359.55
29.51	336.05	365.56	365.56
29.92	341.01	370.94	370.94
30.34	346.71	377.05	377.05
30.75	352.49	383.25	383.25
31.23	357.79	389.02	389.02
31.65	363.77	395.43	395.43
32.07	369.17	401.24	401.24
32.48	376.04	408.52	408.52
32.97	381.03	414.00	414.00
33.39	388.00	421.38	421.38
33.80	392.64	426.44	426.44
34.22	398.39	432.61	432.61
34.71	405.38	440.09	440.09
35.13	411.08	446.21	446.21
35.55	416.55	452.10	452.10
35.97	422.31	458.28	458.28
36.38	429.52	465.90	465.90
36.88	445.78	482.66	482.66

86.87	88.36	634.69	723.1	723.05		37.30	460.96	498.26	498.26
87.88	88.36	651.05	739.4	739.41		37.72	477.35	515.07	515.07
88.89	88.36	666.32	754.7	754.69		38.14	492.33	530.47	530.47
89.90	88.36	682.70	771.1	771.07		38.56	509.31	547.87	547.87
90.91	88.36	699.28	787.6	787.64		39.06	526.21	565.27	565.27
91.92	88.36	714.80	803.2	803.16		39.48	541.70	581.18	581.18
92.93	88.36	730.33	818.7	818.69		39.90	555.99	595.89	595.89
93.94	88.36	745.67	834.0	834.04		40.32	571.58	611.90	611.90
94.95	88.36	762.09	850.5	850.45		40.74	588.89	629.62	629.62
95.96	88.36	777.84	866.2	866.20		41.16	603.61	644.76	644.76
96.97	88.36	793.87	882.2	882.23		41.66	620.12	661.78	661.78
97.98	88.36	810.18	898.5	898.55		42.08	636.37	678.45	678.45
98.99	88.36	825.05	913.4	913.41		42.51	650.85	693.36	693.36
100.00	88.36	842.25	930.6	930.61		42.93	669.41	712.33	712.33

FACTOR OF SAFETY:

FSside	FStip	FSup	FSweight
1.0	1.0	1.0	1.0

Note: Data can be selected, copied and pasted to Excel to create graphics

Length - Pile length, distance from pile top to tip (not from ground surface)

Qtip - Ultimate pile tip resistance

Qside - Ultimate pile side resistance

Q_dw - Ultimate pile downward resistance

Qd_alw - Allowable pile downward resistance

Weight - Weight of pile shaft

Qsid* - Ultimate pile side uplift resistance

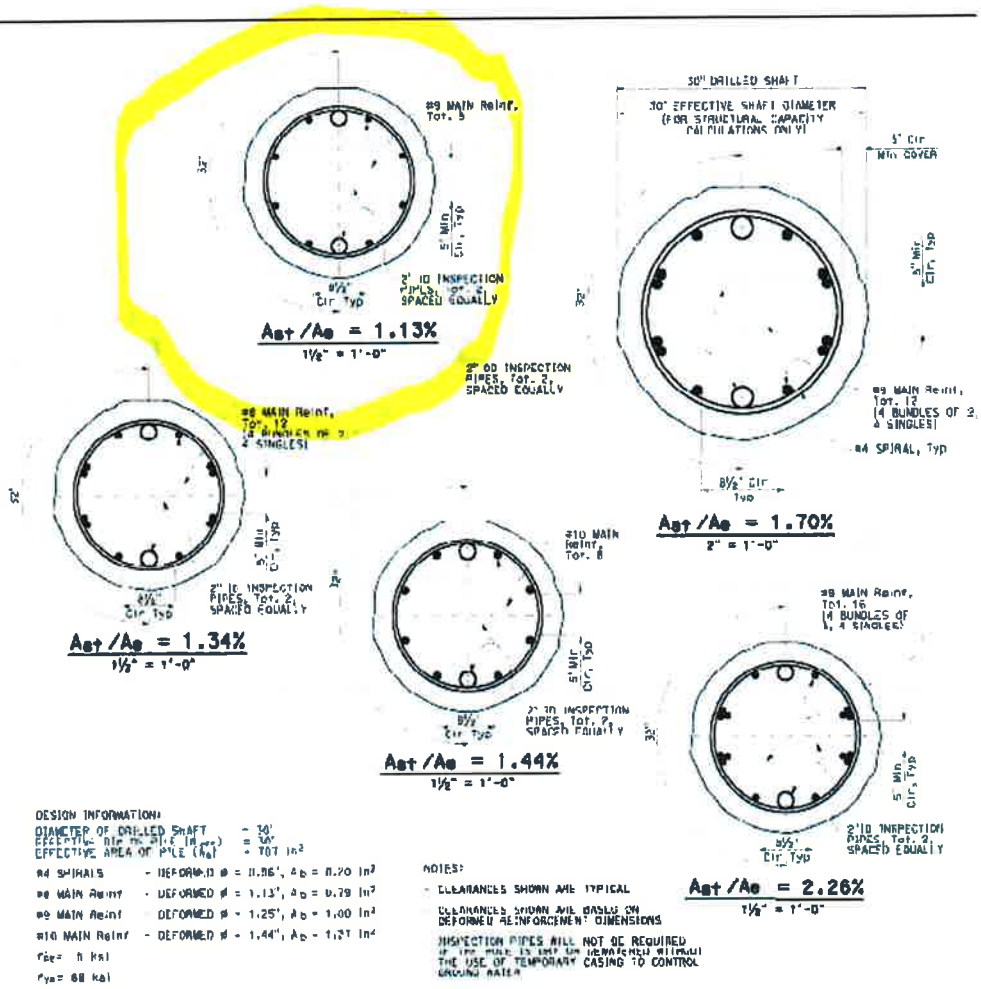
Q_up - Ultimate pile uplift resistance

Qu_alw - Allowable pile uplift resistance

Boring A-19-001

Abutment #2

30-inch CIDH Pile


#9 MAIN Reinf.
Tot. 9
3'
5" Min. Clr, Typ
8½" Clr Typ
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 1.13%
1½" = 1'-0"
#8 MAIN Reinf.
Tot. 12
(4 BUNDLES OF 2 & 4 SINGLES)
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 1.34%
1½" = 1'-0"
30" DRILLED SHAFT
30" EFFECTIVE SHAFT DIAMETER (FOR STRUCTURAL CAPACITY CALCULATIONS ONLY)
5" Clr Min COVER
5" Min. Clr, Typ
#9 MAIN Reinf, Tot. 12 (4 BUNDLES OF 2 & 4 SINGLES)
#4 SPIRAL, Typ
8½" Clr Typ
Ast /Ag = 1.70%
2" = 1'-0"
#10 MAIN Reinf, Tot. 8
5" Min. Clr, Typ
8½" Clr Typ
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 1.44%
1½" = 1'-0"
#8 MAIN Reinf, Tot. 15 (4 BUNDLES OF 3, 3 SINGLES)
5" Min. Clr, Typ
8½" Clr Typ
2" ID INSPECTION PIPES, Tot. 2, SPACED EQUALLY
Ast /Ag = 2.26%
1½" = 1'-0"
DESIGN INFORMATION:
DIAMETER OF DRILLED SHAFT = 30"
EFFECTIVE DIA OF PILE (Deff) = 30"
EFFECTIVE AREA OF PILE (Ag) = 707 in²
#4 SPIRALS - DEFORMED ø = 0.56", Ab = 0.20 in²
#8 MAIN Reinf - DEFORMED ø = 1.13", Ab = 0.79 in²
#9 MAIN Reinf - DEFORMED ø = 1.25", Ab = 1.00 in²
#10 MAIN Reinf - DEFORMED ø = 1.44", Ab = 1.27 in²
f'c= 4 ksi
fy= 60 ksi
NOTES:
- CLEARANCES SHOWN ARE TYPICAL
CLEARANCES SHOWN ARE BASED ON DEFORMED REINFORCEMENT DIMENSIONS
INSPECTION PIPES WILL NOT BE REQUIRED IF THE HOLE IS DRY OR DEWATERED WITHOUT THE USE OF TEMPORARY CASING TO CONTROL GROUND WATER

File Edit Run Setup Help

Vertical | Lateral | K | Sample: List of Sample: (E-English, M-Metric)

A. Pile Type | B. Pile Profile | C. Pile Properties | D. Load and Group | E. Soil Properties | F. Advanced Page

1. Pile Type

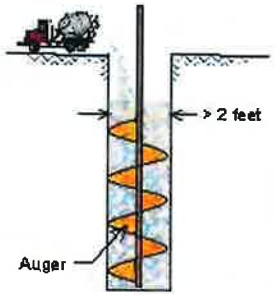
- ○ Drilled Pile (dia <=24 in. or 61 cm)
- ◉ Drilled Shaft (dia >24 in. or 61 cm)
- ○ SHAFT (US. FHWA Methods)
- ○ Driving Steel Pile (Open end)
- ○ Driving Steel Pile (Closed end)
- ○ Driving Concrete Pile
- ○ Driving Tapered Pile (Timber Pile)
- ○ Driving Jetted
- ○ Micropile (MiniPile)
- ○ Uplift Anchor
- ○ Plate, Screw, and Helical
- ○ Shallow Footing

Project Title 1:

Lack Road Bridge Replacement

Project Title 2:

Abutment 2; Boring A-19-001; 30-Inch CIDH



☑ Shown following text in Profile.

The text can be edited and saved.

Diameter more than 24in (61cm).
For bell section, select "Belled" in Diameter Variation (Pile Section Screen, Item 4).
Recommendation: 2 to 4 in Item 3 of Page F.

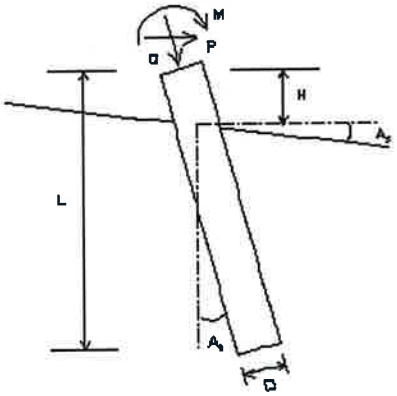
2. Units:

◉ English ○ Metric

The parameters for all the types of piles are adjustable in Setup Page 3.

VERTICAL ANALYSIS

Figure 1



Drilled Shaft (dia >24 in. or 61 cm)

Loads:
Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

(with Load Factor)
Vertical Load, Q= 0.0 -kp

Profile:
Pile Length, L= 87.5 -ft
Top Height, H= -3 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0
Fixed Head Condition

Soil Data:

Depth -ft	Gamma -lb/ft3	Phi	C -kp/ft2	K -lb/in3	e50 or Dr %	Nspt
0	58.7	0.0	0.30	0.0	0.00	4
3	58.7	0.0	0.30	0.0	0.00	4
26.5	63.5	34	0.00	0.0	0.0	36
41.5	56.2	0.0	1.75	0	0	15
56.5	65.5	35	0.00	0	0	37
70.5	65.9	38	0.00	0	0	57
90.5	65.9	38	0.00	0	0	57

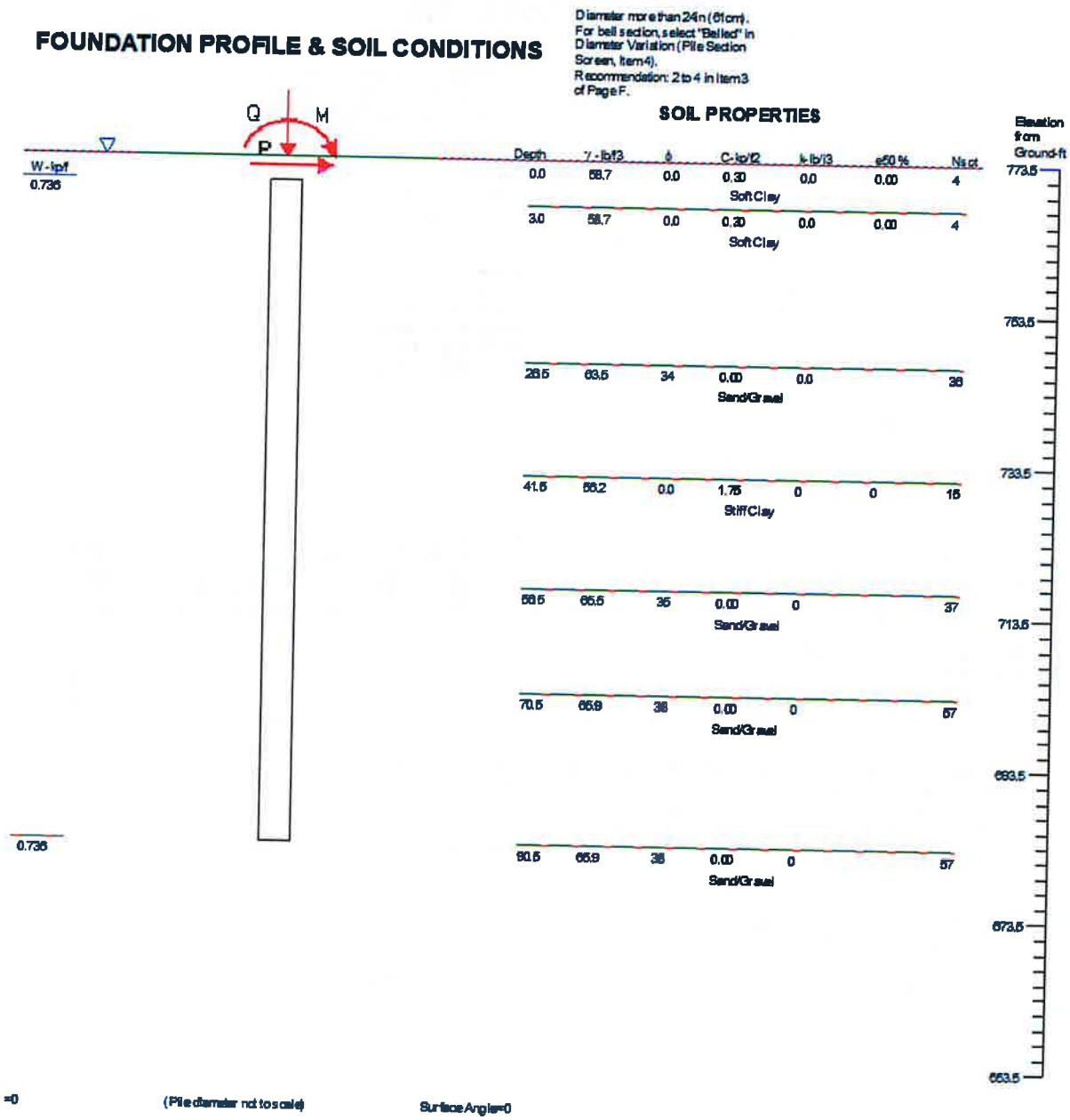
Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/in2	Weight -kp/ft
0.0	30	706.9	94.2	39760.8	3000	0.736
87.5	30	706.9	94.2	39760.8	3000	0.736

Vertical Capacity:
Weight above Ground= 0.00 Total Weight= 37.56-kp *Soil Weight is not included
Side Resistance (Down)= 681.476-kp Side Resistance (Up)= 490.408-kp
Tip Resistance (Down)= 675.588-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down) Qult= 1337.064-kp Total Ultimate Capacity (Up)= 527.969-kp
Total Allowable Capacity (Down) Qallow= 1337.064-kp Total Allowable Capacity (Up) Qallow= 527.969-kp
OK! Qallow > Q

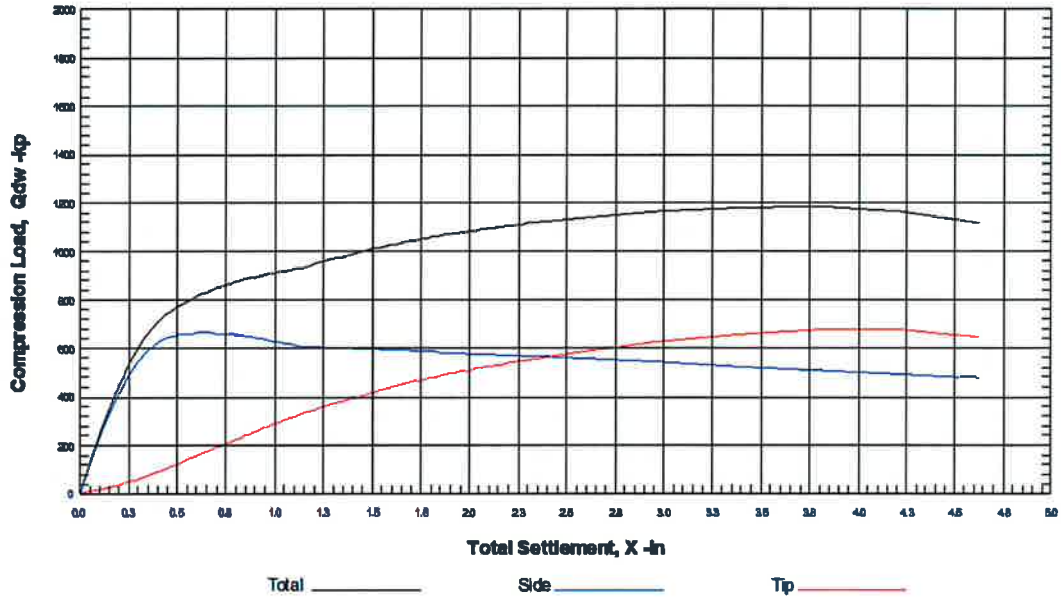
Settlement Calculation:
At Q= 0.00-kp Settlement= 0.00000-in
At Xallow= 1.00-in Q= 911.63080-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.



Lack Road Bridge Replacement
Abutment 2; Boring A-19-001; 30-Inch CIDH **Figure 1**

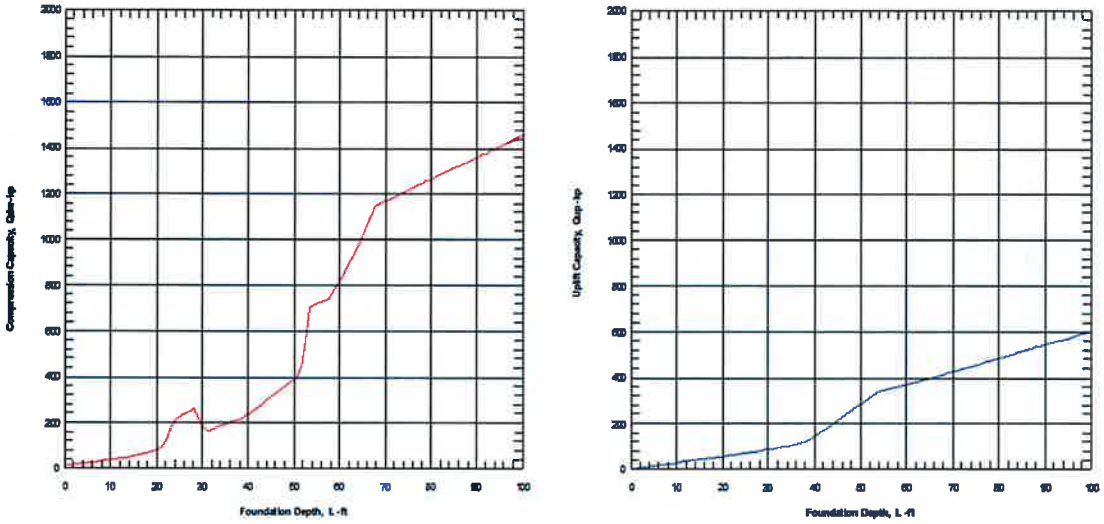
Vertical Load vs. Total Settlement



CivilTech Software

Lack Road Bridge Replacement
Abutment 2; Boring A-19-001; 30-Inch CIDH Figure 1

ULTIMATE CAPACITY vs FOUNDATION DEPTH



CivilTech Software

Lack Road Bridge Replacement
Abutment 2; Boring A-19-001; 30-Inch CIDH Figure 1

****

ALLPILE 7

VERTICAL ANALYSIS SUMMARY OUTPUT

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Date: 6/6/2019 File: \\cms1\project\PROJECTS\00,000's Projects\2019 Projects\227518-0000439.00 Lack Road Bridge - Bridge No. 58C-101\Report\Appendix F - Axial Pile Resistance Analysis\Abutment 2\A-19-001 30-inch CIDH.alp 1.0

Title 1: Lack Road Bridge Replacement

Title 2: Abutment 2; Boring A-19-001; 30-Inch CIDH

ALLPILE INPUT DATA:

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* Pile Type Page *

Unit: English

Diameter more than 24in (61cm). For bell section, select "Belled" in Diameter Variation (Pile Section Screen, Item 4). Recommendation: 2 to 4 in Item 3 of Page F.

Pile Type: Drilled Shaft (dia >24 in. or 61 cm)

* Pile Profile *

Foundation Depth: 87.5 -ft

Top Height: -3 -ft

Slope Angle: 0

Pile Angle: 0

* Pile Properties *

Zs	Width	Area	Perim.	I	E	Weight	Mix*	Out	In	Other	Type
-ft	-in	-in2	-in	-in4	-kp/i2	-kp/f	%	Side	Side	Par.	

0.0	30	706.9	94.2	39760.8	3000	0.736	0.0	3	3	30	Concrete (rough)
87.5	30	706.9	94.2								Pile Tip

Note: Mix = % of Inside material/Outside material

Group Type: 0

Top Type: 5

Water Table: 0 -ft

Ground Elevation: 773.5 -ft

* Soil Properties *

Zs	Gamma	Phi	C	K	E50/Dr	Nspt	Type	Soil
-ft	-lb/f3	o	-kp/f2	-lb/i3	- %			
0.0	58.7	0.0	0.30	0.0	0.00	4	1	Soft Clay
3.0	58.7	0.0	0.30	0.0	0.00	4	1	Soft Clay
26.5	63.5	34	0.00	0.0	0.0	36	4	Sand/Gravel
41.5	56.2	0.0	1.75	0	0	15	2	Stiff Clay
56.5	65.5	35	0.00	0	0	37	4	Sand/Gravel
70.5	65.9	38	0.00	0	0	57	4	Sand/Gravel
90.5	65.9	38	0.00	0	0	57	4	Sand/Gravel

Surcharge Pressure on ground: 0 -kp/f2

ALLPILE ANALYSIS AND RESULTS:

TOTAL LOADS:

Vertical Load, Q: 0.0 -kp

Vertical Load with Load Factor, Q: 0.0 -kp

Vertical Load with Load factor and Pile Cap, Q= 0.0 -kp

Load Factor for Vertical Load and Torsion= 1.0

Vertical Loads Supported by Pile Cap: 0 %

Load Factor for Vertical Loads: 1.0

PILE PROFILE:

Pile Length, L= 87.5 -ft

Top Height, H= -3 -ft

Slope Angle, As= 0

Batter Angle, Ab= 0.00 Batter Factor, Kbat= 1.00

*To consider the influence of different soils below the pile tip, bearing stratum is defined from pile tip extending to 4 Diameter of pile, which is 10.0-ft (Input Page F, Item 3)

SINGLE PILE:

Kdown= 0.7 Kup= 0.4 Ka= 1.00

Single Pile Vertical Analysis:

Total Ultimate Capacity (Down)= 1337.064-kp Total Ultimate Capacity (Up)= 527.969-kp

Total Allowable Capacity (Down)= 1337.064-kp Total Allowable Capacity (Up)= 527.969-kp

Weight above Ground= 0.00 Total Weight= 37.56-kp *Soil Weight is not included

Side Resistance (Down)= 661.476-kp Side Resistance (Up)= 490.408-kp

Tip Resistance (Down)= 675.588-kp Tip Resistance (Up)= 0.000-kp

Negative Friction, Qneg= 0.000-kp, which has been subtracted from Total Ultimate Capacity (Down)

Negative friction does not affect Total Ultimate Capacity (Up)

At Work Load= 0.00-kp, Settlement= 0.00000-in

At Work Load= 0.00-kp, Secant Stiffness Kqx= 3142.56-kp/-in

At Allowable Settlement= 1.000000-in, Capacity= 911.63-kp

Work Load, 0.00-kp, OK with the Capacity at Allowable Settlement= 1.00000-in, Capacity= 911.63-kp

Work Load, 0.00-kp, OK with the Allowable Capacity (Down)= 1337.06-kp

---

FACTOR OF SAFETY:

FSside	FStip	FSuplif	FSweight
1.0	1.0	1.0	1.0

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

1 1 1 1 1

Vertical Side and Tip Resistance vs. Total Settlement:

****

Xtop -in	Qside -kp	Qtip -kp	Qtotal -kp
0.001	2.5	0.9	3.4
0.119	265.2	19.2	284.4
0.169	359.0	28.4	387.4
0.213	433.3	37.5	470.8
0.253	491.5	46.7	538.2
0.290	536.5	55.8	592.3
0.324	570.9	65.0	635.9
0.356	596.9	74.1	670.9
0.387	616.1	83.2	699.3
0.416	630.3	92.2	722.5
0.444	640.5	101.2	741.7
0.471	647.7	110.2	757.8
0.498	652.7	119.1	771.8
0.524	656.2	127.9	784.1
0.550	658.5	136.7	795.3
0.575	660.0	145.4	805.5
0.601	661.0	154.1	815.1
0.626	661.4	162.7	824.1
0.651	661.5	171.2	832.7
0.676	661.2	179.7	840.9
0.701	660.6	188.0	848.6
0.726	659.6	196.3	855.9

0.750	658.3	204.5	862.8
0.775	656.6	212.6	869.2
0.799	654.5	220.7	875.1
0.823	652.0	228.6	880.6
0.847	649.2	236.5	885.6
0.871	646.1	244.2	890.3
0.895	642.7	251.9	894.6
0.919	639.2	259.4	898.6
0.942	635.6	266.9	902.5
0.966	632.0	274.2	906.2
0.990	628.5	281.5	910.0
1.013	625.1	288.7	913.7
1.037	621.8	295.7	917.5
1.060	618.5	302.7	921.2
1.084	615.2	309.5	924.8
1.107	611.7	316.3	928.0
1.130	607.5	323.0	930.5
1.154	606.8	329.5	936.3
1.178	606.0	336.0	941.9
1.202	605.2	342.3	947.5
1.226	604.4	348.6	952.9
1.249	603.5	354.7	958.3
1.273	602.7	360.8	963.5
1.297	601.9	366.7	968.6
1.320	601.1	372.6	973.7
1.344	600.3	378.3	978.6
1.367	599.5	384.0	983.4
1.391	598.7	389.5	988.2
1.414	597.9	395.0	992.8
1.437	597.0	400.4	997.4
1.461	596.2	405.6	1001.9

1.484	595.4	410.8	1006.2
1.507	594.6	415.9	1010.5
1.530	593.8	420.9	1014.7
1.554	593.0	425.8	1018.8
1.577	592.2	430.7	1022.8
1.600	591.3	435.4	1026.8
1.623	590.5	440.1	1030.6
1.646	589.7	444.7	1034.4
1.669	588.9	449.1	1038.1
1.691	588.1	453.6	1041.7
1.714	587.3	457.9	1045.2
1.737	586.5	462.2	1048.6
1.760	585.7	466.4	1052.0
1.783	584.8	470.5	1055.3
1.805	584.0	474.5	1058.5
1.828	583.2	478.5	1061.7
1.851	582.4	482.4	1064.8
1.873	581.6	486.2	1067.8
1.896	580.8	490.0	1070.8
1.918	580.0	493.7	1073.7
1.941	579.1	497.3	1076.5
1.963	578.3	500.9	1079.3
1.986	577.5	504.4	1082.0
2.008	576.7	507.9	1084.6
2.030	575.9	511.3	1087.2
2.053	575.1	514.7	1089.8
2.075	574.3	518.0	1092.2
2.097	573.5	521.2	1094.7
2.120	572.6	524.4	1097.1
2.142	571.8	527.6	1099.4
2.164	571.0	530.7	1101.7

2.186	570.2	533.7	1103.9
2.208	569.4	536.8	1106.2
2.231	568.6	539.7	1108.3
2.253	567.8	542.7	1110.4
2.275	566.9	545.5	1112.5
2.297	566.1	548.4	1114.5
2.319	565.3	551.2	1116.5
2.341	564.5	554.0	1118.5
2.363	563.7	556.7	1120.4
2.385	562.9	559.4	1122.3
2.517	558.0	575.0	1133.0
2.953	541.7	620.0	1161.8
3.384	525.5	655.2	1180.7
3.808	509.2	675.6	1184.8
4.221	493.0	672.8	1165.7
4.620	476.7	642.4	1119.1

Xtop - Total Vertical Settlement

Qside - Vertical Side Resistance (Down)

Qtip - Vertical Tip Resistance (Down)

Qtotal - Vertical Total Resistance (Ultimate)

Downward and Uplift Capacity vs Pile Length

The results are for single section pile. Multiple sections may not be correct!

****

Length -ft	Qtip -kp	Qside -kp	Q_dw -kp	Qd_alw -kp	Weight -kp	Qsid* -kp	Q_up -kp	Qu_alw -kp
0.00	11.71	0.00	11.7	11.71	0.00	0.00	0.00	0.00
1.01	12.15	2.37	14.5	14.52	0.43	2.37	2.80	2.80
2.02	12.46	4.74	17.2	17.20	0.86	4.74	5.60	5.60
3.03	12.68	7.11	19.8	19.80	1.30	7.11	8.41	8.41
4.04	12.84	9.50	22.3	22.34	1.73	9.50	11.24	11.24
5.05	12.97	11.89	24.9	24.86	2.17	11.89	14.06	14.06
6.06	13.11	14.24	27.3	27.35	2.60	14.24	16.84	16.84
7.07	13.25	16.63	29.9	29.89	3.04	16.63	19.67	19.67
8.08	13.25	18.98	32.2	32.24	3.46	18.98	22.45	22.45
9.09	13.25	21.40	34.7	34.65	3.90	21.40	25.30	25.30
10.10	13.25	23.74	37.0	37.00	4.33	23.74	28.07	28.07
11.11	13.25	26.11	39.4	39.36	4.76	26.11	30.87	30.87
12.12	13.25	28.55	41.8	41.80	5.21	28.55	33.75	33.75
13.13	13.25	30.91	44.2	44.16	5.64	30.91	36.55	36.55
14.14	14.56	33.25	47.8	47.81	6.07	33.25	39.32	39.32
15.15	16.95	35.64	52.6	52.58	6.50	35.64	42.14	42.14
16.16	19.73	37.98	57.7	57.71	6.93	37.98	44.91	44.91
17.17	22.92	40.36	63.3	63.28	7.36	40.36	47.73	47.73
18.18	26.50	42.79	69.3	69.29	7.81	42.79	50.59	50.59
19.19	30.49	45.14	75.6	75.63	8.24	45.14	53.38	53.38
20.20	34.87	47.52	82.4	82.39	8.67	47.52	56.19	56.19
21.21	43.49	49.93	93.4	93.42	9.11	49.94	59.05	59.05
22.22	72.82	52.26	125.1	125.08	9.53	52.26	61.79	61.79
23.23	130.28	54.59	184.9	184.87	9.96	54.60	64.56	64.56

24.24	159.61	58.58	218.2	218.19
25.25	165.98	63.20	229.2	229.18
26.26	172.39	68.03	240.4	240.43
27.27	178.78	73.09	251.9	251.87
28.28	185.16	78.34	263.5	263.51
29.29	125.99	83.63	209.6	209.62
30.30	86.64	89.23	175.9	175.87
31.31	71.02	94.98	166.0	166.00
32.32	73.22	100.88	174.1	174.10
33.33	75.00	107.06	182.1	182.07
34.34	76.34	113.21	189.5	189.55
35.35	77.26	119.79	197.0	197.05
36.36	77.73	126.49	204.2	204.22
37.37	77.78	133.28	211.1	211.06
38.38	77.39	140.33	217.7	217.72
39.39	77.32	153.23	230.6	230.55
40.40	77.32	166.88	244.2	244.19
41.41	77.32	180.88	258.2	258.20
42.42	77.32	195.05	272.4	272.37
43.43	77.32	208.96	286.3	286.28
44.44	79.25	222.57	301.8	301.82
45.45	81.70	236.49	318.2	318.19
46.46	84.53	250.27	334.8	334.80
47.47	87.39	264.12	351.5	351.51
48.48	89.92	277.77	367.7	367.70
49.49	92.51	291.94	384.4	384.45
50.51	95.07	305.42	400.5	400.49
51.52	127.50	319.86	447.4	447.36
52.53	202.32	333.82	536.1	536.13
53.54	360.16	347.24	707.4	707.40
54.55	359.90	356.20	716.1	716.10

10.42	57.22	67.64	67.64
10.85	59.89	70.74	70.74
11.26	62.55	73.81	73.81
11.70	65.46	77.17	77.17
12.15	68.49	80.64	80.64
12.57	71.50	84.07	84.07
13.02	74.77	87.79	87.79
13.44	78.01	91.45	91.45
13.87	81.36	95.23	95.23
14.30	84.84	99.14	99.14
14.73	88.41	103.13	103.13
15.16	92.11	107.27	107.27
15.59	95.93	111.52	111.52
16.03	99.84	115.87	115.87
16.46	103.88	120.34	120.34
16.90	116.23	133.13	133.13
17.34	129.81	147.16	147.16
17.78	143.84	161.63	161.63
18.23	158.30	176.53	176.53
18.63	172.11	190.74	190.74
19.08	185.59	204.67	204.67
19.53	199.45	218.97	218.97
19.93	213.41	233.34	233.34
20.38	227.02	247.40	247.40
20.79	240.68	261.47	261.47
21.25	254.91	276.16	276.16
21.70	268.41	290.11	290.11
22.11	283.02	305.13	305.13
22.57	297.10	319.67	319.67
22.98	310.15	333.12	333.12
23.39	315.43	338.82	338.82

55.56	360.31	365.29	725.6	725.59
56.57	359.70	374.08	733.8	733.78
57.58	361.22	382.95	744.2	744.17
58.59	384.42	391.11	775.5	775.53
59.60	408.10	400.62	808.7	808.71
60.61	434.63	409.44	844.1	844.07
61.62	462.94	417.97	880.9	880.91
62.63	493.24	426.80	920.0	920.04
63.64	525.66	435.97	961.6	961.63
64.65	560.51	443.57	1004.1	1004.08
65.66	599.10	453.26	1052.4	1052.36
66.67	640.68	461.74	1102.4	1102.43
67.68	677.11	470.00	1147.1	1147.11
68.69	676.92	481.33	1158.3	1158.25
69.70	676.70	490.68	1167.4	1167.38
70.71	676.05	500.25	1176.3	1176.30
71.72	675.53	509.34	1184.9	1184.88
72.73	676.26	519.66	1195.9	1195.93
73.74	676.78	529.64	1206.4	1206.42
74.75	675.34	538.09	1213.4	1213.43
75.76	675.55	548.42	1224.0	1223.96
76.77	675.63	558.37	1234.0	1234.00
77.78	675.49	568.07	1243.6	1243.56
78.79	677.23	577.47	1254.7	1254.69
79.80	676.68	587.11	1263.8	1263.79
80.81	675.92	596.94	1272.9	1272.86
81.82	677.10	607.13	1284.2	1284.24
82.83	675.75	616.01	1291.8	1291.75
83.84	676.57	625.99	1302.6	1302.55
84.85	677.23	636.12	1313.4	1313.35
85.86	675.75	645.50	1321.2	1321.25

23.85	320.85	344.70	344.70
24.26	325.92	350.18	350.18
24.72	331.22	355.94	355.94
25.14	335.08	360.22	360.22
25.60	341.35	366.95	366.95
26.02	346.19	372.21	372.21
26.43	350.94	377.37	377.37
26.90	355.92	382.82	382.82
27.31	361.69	389.00	389.00
27.73	364.93	392.66	392.66
28.20	371.05	399.25	399.25
28.61	375.48	404.10	404.10
29.03	379.87	408.89	408.89
29.51	387.63	417.14	417.14
29.92	392.41	422.33	422.33
30.34	398.26	428.59	428.59
30.75	402.78	433.54	433.54
31.23	409.15	440.38	440.38
31.65	415.12	446.78	446.78
32.07	419.29	451.35	451.35
32.48	425.23	457.72	457.72
32.97	431.25	464.22	464.22
33.39	436.94	470.32	470.32
33.80	441.45	475.26	475.26
34.22	447.03	481.25	481.25
34.71	452.84	487.55	487.55
35.13	458.67	493.80	493.80
35.55	463.89	499.44	499.44
35.97	469.54	505.50	505.50
36.38	475.24	511.62	511.62
36.88	480.65	517.53	517.53

86.87	675.86	654.90	1330.8	1330.76	37.30	486.05	523.35	523.35
87.88	675.99	665.68	1341.7	1341.67	37.72	493.09	530.80	530.80
88.89	676.27	674.57	1350.8	1350.84	38.14	496.89	535.03	535.03
89.90	675.87	684.74	1360.6	1360.62	38.56	503.74	542.29	542.29
90.91	675.82	694.74	1370.6	1370.56	39.06	509.37	548.43	548.43
91.92	675.41	703.71	1379.1	1379.12	39.48	514.39	553.87	553.87
92.93	677.17	714.59	1391.8	1391.76	39.90	520.29	560.19	560.19
93.94	676.45	723.43	1399.9	1399.88	40.32	525.18	565.49	565.49
94.95	675.57	731.99	1407.6	1407.56	40.74	529.88	570.62	570.62
95.96	677.26	742.68	1419.9	1419.94	41.16	535.57	576.73	576.73
96.97	676.08	752.74	1428.8	1428.83	41.66	542.46	584.12	584.12
97.98	677.53	763.20	1440.7	1440.74	42.08	547.98	590.06	590.06
98.99	676.06	771.62	1447.7	1447.68	42.51	552.50	595.00	595.00
100.00	677.04	781.42	1458.5	1458.46	42.93	557.77	600.70	600.70

FACTOR OF SAFETY:

FSside	FStip	FSup	FSweight
1.0	1.0	1.0	1.0

Note: Data can be selected, copied and pasted to Excel to create graphics

Length - Pile length, distance from pile top to tip (not from ground surface)

Qtip - Ultimate pile tip resistance

Qside - Ultimate pile side resistance

Q_dw - Ultimate pile downward resistance

Qd_alw - Allowable pile downward resistance

APPENDIX G

Typical Earthwork Guidelines

TYPICAL EARTHWORK GUIDELINES

1. GENERAL

These guidelines and the standard details attached hereto are presented as general procedures for earthwork construction for sites having slopes less than 10 feet high. They are to be utilized in conjunction with the project grading plans. These guidelines are considered a part of the geotechnical report, but are superseded by recommendations in the geotechnical report in the case of conflict. Evaluations performed by the consultant during the course of grading may result in new recommendations which could supersede these specifications and/or the recommendations of the geotechnical report. It is the responsibility of the contractor to read and understand these guidelines as well as the geotechnical report and project grading plans.

1.1. The contractor shall not vary from these guidelines without prior recommendations by the geotechnical consultant and the approval of the client or the client's authorized representative. Recommendations by the geotechnical consultant and/or client shall not be considered to preclude requirements for approval by the jurisdictional agency prior to the execution of any changes.

1.2. The contractor shall perform the grading operations in accordance with these specifications, and shall be responsible for the quality of the finished product notwithstanding the fact that grading work will be observed and tested by the geotechnical consultant.

1.3. It is the responsibility of the grading contractor to notify the geotechnical consultant and the jurisdictional agencies, as needed, prior to the start of work at the site and at any time that grading resumes after interruption. Each step of the grading operations shall be observed and documented by the geotechnical consultant and, where needed, reviewed by the appropriate jurisdictional agency prior to proceeding with subsequent work.

1.4. If, during the grading operations, geotechnical conditions are encountered which were not anticipated or described in the geotechnical report, the geotechnical consultant shall be notified immediately and additional recommendations, if applicable, may be provided.

1.5. An as-graded report shall be prepared by the geotechnical consultant and signed by a registered engineer and registered engineering geologist. The report documents the geotechnical consultants' observations, and field and laboratory test results, and provides conclusions regarding whether or not earthwork construction was performed in accordance with the geotechnical recommendations and the grading plans. Recommendations for foundation design, pavement design, subgrade treatment, etc., may also be included in the as-graded report.

1.6. For the purpose of evaluating quantities of materials excavated during grading and/or locating the limits of excavations, a licensed land surveyor or civil engineer shall be retained.

2. SITE PREPARATION

Site preparation shall be performed in accordance with the recommendations presented in the following sections.

2.1. The client, prior to any site preparation or grading, shall arrange and attend a pre-grading meeting between the grading contractor, the design engineer, the geotechnical consultant, and representatives of appropriate governing authorities, as well as any other involved parties. The parties shall be given two working days notice.

2.2. Clearing and grubbing shall consist of the substantial removal of vegetation, brush, grass, wood, stumps, trees, tree roots greater than 1/2-inch in diameter, and other deleterious materials from the areas to be graded. Clearing and grubbing shall extend to the outside of the proposed excavation and fill areas.

2.3. Demolition in the areas to be graded shall include removal of building structures, foundations, reservoirs, utilities (including underground pipelines, septic tanks, leach fields, seepage pits, cisterns, etc.), and other manmade surface and subsurface improvements, and the backfilling of mining shafts, tunnels and surface depressions. Demolition of utilities shall include capping or rerouting of pipelines at the project perimeter, and abandonment of wells in accordance with the requirements of the governing authorities and the recommendations of the geotechnical consultant at the time of demolition.

2.4. The debris generated during clearing, grubbing and/or demolition operations shall be removed from areas to be graded and disposed of off site at a legal dump site. Clearing, grubbing, and demolition operations shall be performed under the observation of the geotechnical consultant.

2.5. The ground surface beneath proposed fill areas shall be stripped of loose or unsuitable soil. These soils may be used as compacted fill provided they are generally free of organic or other deleterious materials and evaluated for use by the geotechnical consultant. The resulting surface shall be evaluated by the geotechnical consultant prior to proceeding. The cleared, natural ground surface shall be scarified to a depth of approximately 8 inches, moisture conditioned, and compacted in accordance with the specifications presented in Section 5 of these guidelines.

3. REMOVALS AND EXCAVATIONS

Removals and excavations shall be performed as recommended in the following sections.

3.1. Removals

3.1.1. Materials which are considered unsuitable shall be excavated under the observation of the geotechnical consultant in accordance with the recommendations contained herein. Unsuitable materials include, but may not be limited to, dry, loose, soft, wet, organic, compressible natural soils, fractured, weathered, soft bedrock, and undocumented or otherwise deleterious fill materials.

3.1.2. Materials deemed by the geotechnical consultant to be unsatisfactory due to moisture conditions shall be excavated in accordance with the recommendations of the geotechnical consultant, watered or dried as needed, and mixed to generally uniform moisture content in accordance with the specifications presented in Section 5 of this document.

3.2. Excavations

3.2.1. Temporary excavations no deeper than 4 feet in firm fill or natural materials may be made with vertical side slopes. To satisfy California Occupational Safety and Health Administration (CAL OSHA) requirements, any excavation deeper than 4 feet shall be shored or laid back at a 1:1 inclination or flatter, depending on material type, if construction workers are to enter the excavation.

4. COMPACTED FILL

Fill shall be constructed as specified below or by other methods recommended by the geotechnical consultant. Unless otherwise specified, fill soils shall be compacted to 90 percent relative compaction, as evaluated in accordance with ASTM Test Method D1557.

4.1. Prior to placement of compacted fill, the contractor shall request an evaluation of the exposed ground surface by the geotechnical consultant. Unless otherwise recommended, the exposed ground surface shall then be scarified to a depth of approximately 8 inches and watered or dried, as needed, to achieve a generally uniform moisture content at or near the optimum moisture content. The scarified materials shall then be compacted to 90 percent relative compaction. The evaluation of compaction by the geotechnical consultant shall not be considered to preclude any requirements for observation or approval by governing agencies. It is the contractor's responsibility to notify the geotechnical consultant and the appropriate governing agency when project areas are ready for observation, and to provide reasonable time for that review.

4.2. Excavated on-site materials which are in general compliance with the recommendations of the geotechnical consultant may be utilized as compacted fill provided they are generally free of organic or other deleterious materials and do not contain rock fragments greater than 6 inches in dimension. During grading, the contractor may encounter soil types other than those analyzed during the preliminary geotechnical study. The geotechnical consultant shall be consulted to evaluate the suitability of any such soils for use as compacted fill.

4.3. Where imported materials are to be used on site, the geotechnical consultant shall be notified three working days in advance of importation in order that it may sample and test the materials from the proposed borrow sites. No imported materials shall be delivered for use on site without prior sampling, testing, and evaluation by the geotechnical consultant.

4.4. Soils imported for on-site use shall preferably have very low to low expansion potential (based on UBC Standard 18-2 test procedures). Lots on which expansive soils may be exposed at grade shall be undercut 3 feet or more and capped with very low to low expansion potential fill. In the event expansive soils are present near the ground surface, special design and construction considerations shall be utilized in general accordance with the recommendations of the geotechnical consultant.

4.5. Fill materials shall be moisture conditioned to near optimum moisture content prior to placement. The optimum moisture content will vary with material type and other factors. Moisture conditioning of fill soils shall be generally uniform in the soil mass.

4.6. Prior to placement of additional compacted fill material following a delay in the grading operations, the exposed surface of previously compacted fill shall be prepared to receive fill. Preparation may include scarification, moisture conditioning, and recompaction.

4.7. Compacted fill shall be placed in horizontal lifts of approximately 8 inches in loose thickness. Prior to compaction, each lift shall be watered or dried as needed to achieve near optimum moisture condition, mixed, and then compacted by mechanical methods, using sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other appropriate compacting rollers, to the specified relative compaction. Successive lifts shall be treated in a like manner until the desired finished grades are achieved.

4.8. Fill shall be tested in the field by the geotechnical consultant for evaluation of general compliance with the recommended relative compaction and moisture conditions. Field density testing shall conform to ASTM D1556-00 (Sand Cone method), D2937-00 (Drive-Cylinder method), and/or D2922-96 and D3017-96 (Nuclear Gauge method). Generally, one test shall be provided for approximately every 2 vertical feet of fill placed, or for approximately every 1000 cubic yards of fill placed. In addition, on slope faces one or more tests shall be taken for approximately every 10,000 square feet of slope face and/or approximately every 10 vertical feet of slope height. Actual test intervals may vary as field conditions dictate. Fill found to be out of conformance with the grading recommendations shall be removed, moisture conditioned, and compacted or otherwise handled to accomplish general compliance with the grading recommendations.

4.9. The contractor shall assist the geotechnical consultant by excavating suitable test pits for removal evaluation and/or for testing of compacted fill.

4.10. At the request of the geotechnical consultant, the contractor shall "shut down" or restrict grading equipment from operating in the area being tested to provide adequate testing time and safety for the field technician.

4.11. The geotechnical consultant shall maintain a map with the approximate locations of field density tests. Unless the client provides for surveying of the test locations, the locations shown by the geotechnical consultant will be estimated. The geotechnical consultant shall not be held responsible for the accuracy of the horizontal or vertical locations or elevations.

4.12. Grading operations shall be performed under the observation of the geotechnical consultant. Testing and evaluation by the geotechnical consultant does not preclude the need for approval by or other requirements of the jurisdictional agencies.

4.13. Fill materials shall not be placed, spread or compacted during unfavorable weather conditions. When work is interrupted by heavy rains, the filling operation shall not be resumed until tests indicate that moisture content and density of the fill meet the project specifications. Regrading of the near-surface soil may be needed to achieve the specified moisture content and density.

4.14. Upon completion of grading and termination of observation by the geotechnical consultant, no further filling or excavating, including that planned for footings, foundations, retaining walls or other features, shall be performed without the involvement of the geotechnical consultant.

4.15. Fill placed in areas not previously viewed and evaluated by the geotechnical consultant may have to be removed and recompacted at the contractor's expense. The depth and extent of removal of the unobserved and undocumented fill will be decided based upon review of the field conditions by the geotechnical consultant.

4.16. Off-site fill shall be treated in the same manner as recommended in these specifications for on-site fills. Off-site fill subdrains temporarily terminated (up gradient) shall be surveyed for future locating and connection.

5. OVERSIZED MATERIAL

Oversized material shall be placed in accordance with the following recommendations.

5.1. During the course of grading operations, rocks or similar irreducible materials greater than 6 inches in dimension (oversized material) may be generated. These materials shall not be placed within the compacted fill unless placed in general accordance with the recommendations of the geotechnical consultant.

5.2. Where oversized rock (greater than 6 inches in dimension) or similar irreducible material is generated during grading, it is recommended, where practical, to waste such material off site, or on site in areas designated as "nonstructural rock disposal areas." Rock designated for disposal areas shall be placed with sufficient sandy soil to generally fill voids. The disposal area shall be capped with a 5-foot thickness of fill which is generally free of oversized material.

5.3. Rocks 6 inches in dimension and smaller may be utilized within the compacted fill, provided they are placed in such a manner that nesting of rock is not permitted. Fill shall be placed and compacted over and around the rock. The amount of rock greater than ¾-inch in dimension shall generally not exceed 40 percent of the total dry weight of the fill mass, unless the fill is specially designed and constructed as a "rock fill."

5.4. Rocks or similar irreducible materials greater than 6 inches but less than 4 feet in dimension generated during grading may be placed in windrows and capped with finer materials in accordance with the recommendations of the geotechnical consultant and the approval of the governing agencies. Selected native or imported granular soil (Sand Equivalent of 30 or higher) shall be placed and flooded over and around the windrowed rock such that voids are filled. Windrows of oversized materials shall be staggered so that successive windrows of oversized materials are not in the same vertical plane. Rocks greater than 4 feet in dimension shall be broken down to 4 feet or smaller before placement, or they shall be disposed of off site.

6. SLOPES

The following sections provide recommendations for cut and fill slopes.

6.1. Cut Slopes

6.1.1. The geotechnical consultant shall observe cut slopes during excavation. The geotechnical consultant shall be notified by the contractor prior to beginning slope excavations.

6.1.2. If, during the course of grading, adverse or potentially adverse geotechnical conditions are encountered in the slope which were not anticipated in the preliminary evaluation report, the geotechnical consultant shall evaluate the conditions and provide appropriate recommendations.

6.2. Fill Slopes

6.2.1. When placing fill on slopes steeper than 5:1 (horizontal:vertical), topsoil, slope wash, colluvium, and other materials deemed unsuitable shall be removed. Near-horizontal keys and near-vertical benches shall be excavated into sound bedrock or fine fill material, in accordance with the recommendation of the geotechnical consultant. Keying and benching shall be accomplished. Compacted fill shall not be placed in an area subsequent to keying and benching until the area has been observed by the geotechnical consultant. Where the natural gradient of a slope is less than 5:1, benching is generally not recommended. However, fill shall not be placed on compressible or otherwise unsuitable materials left on the slope face.

6.2.2. Within a single fill area where grading procedures dictate two or more separate fills, temporary slopes (false slopes) may be created. When placing fill adjacent to a temporary slope, benching shall be conducted in the manner described in Section 7.2. A 3-foot or higher near-vertical bench shall be excavated into the documented fill prior to placement of additional fill.

6.2.3. Unless otherwise recommended by the geotechnical consultant and accepted by the Building Official, permanent fill slopes shall not be steeper than 2:1 (horizontal:vertical). The height of a fill slope shall be evaluated by the geotechnical consultant.

6.2.4. Unless specifically recommended otherwise, compacted fill slopes shall be overbuilt and cut back to grade, exposing firm compacted fill. The actual amount of overbuilding may vary as field conditions dictate. If the desired results are not achieved, the existing slopes shall be overexcavated and reconstructed in accordance with the recommendations of the geotechnical consultant. The degree of overbuilding may be increased until the desired compacted slope face condition is achieved. Care shall be taken by the contractor to provide mechanical compaction as close to the outer edge of the overbuilt slope surface as practical.

6.2.5. If access restrictions, property line location, or other constraints limit overbuilding and cutting back of the slope face, an alternative method for compaction of the slope face may be attempted by conventional construction procedures including backrolling at intervals of 4 feet or less in vertical slope height, or as dictated by the capability of the available equipment, whichever is less. Fill slopes shall be backrolled utilizing a conventional sheepsfoot-type roller. Care shall be taken to maintain the specified moisture conditions and/or reestablish the same, as needed, prior to backrolling.

6.2.6. The placement, moisture conditioning and compaction of fill slope materials shall be done in accordance with the recommendations presented in Section 5 of these guidelines.

6.2.7. The contractor shall be ultimately responsible for placing and compacting the soil out to the slope face to obtain a relative compaction of 90 percent as evaluated by ASTM D1557 and a moisture content in accordance with Section 5. The geotechnical consultant shall perform field moisture and density tests at intervals of one test for approximately every 10,000 square feet of slope.

6.2.8. Backdrains shall be provided in fill as recommended by the geotechnical consultant.

6.3. Top-of-Slope Drainage

6.3.1. For pad areas above slopes, positive drainage shall be established away from the top of slope. This may be accomplished utilizing a berm and pad gradient of 2 percent or steeper at the top-of-slope areas. Site runoff shall not be permitted to flow over the tops of slopes.

6.3.2. Gunite-lined brow ditches shall be placed at the top of cut slopes to redirect surface runoff away from the slope face where drainage devices are not otherwise provided.

6.4. Slope Maintenance

6.4.1. In order to enhance surficial slope stability, slope planting shall be accomplished at the completion of grading. Slope plants shall consist of deep-rooting, variable root depth, drought-tolerant vegetation. Native vegetation is generally desirable. Plants native to semiarid and mid areas may also be appropriate. Large-leafed ice plant should not be used on slopes. A landscape architect shall be consulted regarding the actual types of plants and planting configuration to be used.

6.4.2. Irrigation pipes shall be anchored to slope faces and not placed in trenches excavated into slope faces. Slope irrigation shall be maintained at a level just sufficient to support plant growth. Property owners shall be made aware that over watering of slopes is detrimental to slope stability. Slopes shall be monitored regularly and broken sprinkler heads and/or pipes shall be repaired immediately.

6.4.3. Periodic observation of landscaped slope areas shall be planned and appropriate measures taken to enhance growth of landscape plants.

6.4.4. Graded swales at the top of slopes and terrace drains shall be installed and the property owners notified that the drains shall be periodically checked so that they may be kept clear. Damage to drainage improvements shall be repaired immediately. To reduce siltation, terrace drains shall be constructed at a gradient of 3 percent or steeper, in accordance with the recommendations of the project civil engineer.

6.4.5. If slope failures occur, the geotechnical consultant shall be contacted immediately for field review of site conditions and development of recommendations for evaluation and repair.

7. TRENCH BACKFILL

The following sections provide recommendations for backfilling of trenches.

7.1. Trench backfill shall consist of granular soils (bedding) extending from the trench bottom to 1 foot or more above the pipe. On-site or imported fill which has been evaluated by the geotechnical consultant may be used above the granular backfill. The cover soils directly in contact with the pipe shall be classified as having a very low expansion potential, in accordance with UBC Standard 18-2, and shall contain no rocks or chunks of hard soil larger than 3/4-inch in diameter.

7.2. Trench backfill shall, unless otherwise recommended, be compacted by mechanical means to 90 percent relative compaction as evaluated by ASTM D1557. Backfill soils shall be placed in loose lifts 8-inches thick or thinner, moisture conditioned, and compacted in accordance with the recommendations of Section 5 of these guidelines. The backfill shall be tested by the geotechnical consultant at vertical intervals of approximately 2 feet of backfill placed and at spacings along the trench of approximately 100 feet in the same lift.

7.3. Jetting of trench backfill materials is generally not a recommended method of densification, unless the on-site soils are sufficiently free-draining and provisions have been made for adequate dissipation of the water utilized in the jetting process.

7.4. If it is decided that jetting may be utilized, granular material with a sand equivalent greater than 30 shall be used for backfilling in the areas to be jetted. Jetting shall generally be considered for trenches 2 feet or narrower in width and 4 feet or shallower in depth. Following jetting operations, trench backfill shall be mechanically compacted to the specified compaction to finish grade.

7.5. Trench backfill which underlies the zone of influence of foundations shall be mechanically compacted to 90 percent or greater relative compaction, as evaluated by ASTM D1557-02. The zone of influence of the foundations is generally defined as the roughly triangular area within the limits of a 1:1 (horizontal:vertical) projection from the inner and outer edges of the foundation, projected down and out from both edges.

7.6. Trench backfill within slab areas shall be compacted by mechanical means to a relative compaction of 90 percent, as evaluated by ASTM D1557. For minor interior trenches, density testing may be omitted or spot testing may be performed, as deemed appropriate by the geotechnical consultant.

7.7. When compacting soil in close proximity to utilities, care shall be taken by the grading contractor so that mechanical methods used to compact the soils do not damage the utilities. If the utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, then the grading contractor may elect to use light mechanical compaction equipment or, with the approval of the geotechnical consultant, cover the conduit with clean granular material. These granular materials shall be jetted in place to the top of the conduit in accordance with the recommendations of Section 8.4 prior to initiating mechanical compaction procedures. Other methods of utility trench compaction may also be appropriate, upon review by the geotechnical consultant and the utility contractor, at the time of construction.

7.8. Clean granular backfill and/or bedding materials are not recommended for use in slope areas unless provisions are made for a drainage system to mitigate the potential for buildup of seepage forces or piping of backfill materials.

7.9. The contractor shall exercise the specified safety precautions, in accordance with OSHA Trench Safety Regulations, while conducting trenching operations. Such precautions include shoring or laying back trench excavations at 1:1 or flatter, depending on material type, for trenches in excess of 5 feet in depth. The geotechnical consultant is not responsible for the safety of trench operations or stability of the trenches.

8. DRAINAGE

The following sections provide recommendations pertaining to site drainage.

8.1. Roof, pad, and slope drainage shall be such that it is away from slopes and structures to suitable discharge areas by nonerodible devices (e.g., gutters, downspouts, concrete swales, etc.).

8.2. Positive drainage adjacent to structures shall be established and maintained. Positive drainage may be accomplished by providing drainage away from the foundations of the structure at a gradient of 2 percent or steeper for a distance of 5 feet or more outside the building perimeter, further maintained by a graded swale leading to an appropriate outlet, in accordance with the recommendations of the project civil engineer and/or landscape architect.

8.3. Surface drainage on the site shall be provided so that water is not permitted to pond. A gradient of 2 percent or steeper shall be maintained over the pad area and drainage patterns shall be established to remove water from the site to an appropriate outlet.

8.4. Care shall be taken by the contractor during grading to preserve any berms, drainage terraces, interceptor swales or other drainage devices of a permanent nature on or adjacent to the property. Drainage patterns established at the time of finish grading shall be maintained for the life of the project. Property owners shall be made very clearly aware that altering drainage patterns may be detrimental to slope stability and foundation performance.

9. SITE PROTECTION

The site shall be protected as outlined in the following sections.

9.1. Protection of the site during the period of grading shall be the responsibility of the contractor unless other provisions are made in writing and agreed upon among the concerned parties. Completion of a portion of the project shall not be considered to preclude that portion or adjacent areas from the need for site protection, until such time as the project is finished as agreed upon by the geotechnical consultant, the client, and the regulatory agency.

9.2. The contractor is responsible for the stability of temporary excavations. Recommendations by the geotechnical consultant pertaining to temporary excavations are made in consideration of stability of the finished project and, therefore, shall not be considered to preclude the responsibilities of the contractor. Recommendations by the geotechnical consultant shall also not be considered to preclude more restrictive requirements by the applicable regulatory agencies.

9.3. Precautions shall be taken during the performance of site clearing, excavation, and grading to protect the site from flooding, ponding, or inundation by surface runoff. Temporary provisions shall be made during the rainy season so that surface runoff is away from and off the working site. Where low areas cannot be avoided, pumps shall be provided to remove water as needed during periods of rainfall.

9.4. During periods of rainfall, plastic sheeting shall be used as needed to reduce the potential for unprotected slopes to become saturated. Where needed, the contractor shall install check dams, desilting basins, riprap, sandbags or other appropriate devices or methods to reduce erosion and provide recommended conditions during inclement weather.

9.5. During periods of rainfall, the geotechnical consultant shall be kept informed by the contractor of the nature of remedial or precautionary work being performed on site (e.g., pumping, placement of sandbags or plastic sheeting, other labor, dozing, etc.).

9.6. Following periods of rainfall, the contractor shall contact the geotechnical consultant and arrange a walk-over of the site in order to visually assess rain-related damage. The geotechnical consultant may also recommend excavation and testing in order to aid in the evaluation. At the request of the geotechnical consultant, the contractor shall make excavations in order to aid in evaluation of the extent of rain-related damage.

9.7. Rain or irrigation related damage shall be considered to include, but may not be limited to, erosion, silting, saturation, swelling, structural distress, and other adverse conditions noted by the geotechnical consultant. Soil adversely affected shall be classified as "Unsuitable Material" and shall be subject to overexcavation and replacement with compacted fill or to other remedial grading as recommended by the geotechnical consultant.

9.8. Relatively level areas where saturated soils and/or erosion gullies exist to depths greater than 1 foot shall be overexcavated to competent materials as evaluated by the geotechnical consultant. Where adverse conditions extend to less than 1 foot in depth, saturated and/or eroded materials may be processed in-place. Overexcavated or in-place processed materials shall be moisture conditioned and compacted in accordance with the recommendations provided in Section 5. If the desired results are not achieved, the affected materials shall be overexcavated, moisture conditioned, and compacted until the specifications are met.

9.9. Slope areas where saturated soil and/or erosion gullies exist to depths greater than 1 foot shall be overexcavated and replaced as compacted fill in accordance with the applicable specifications. Where adversely affected materials exist to depths of I foot or less below proposed finished grade, remedial grading by moisture conditioning in-place and compaction in accordance with the appropriate specifications may be attempted. If the desired results are not achieved, the affected materials shall be overexcavated, moisture conditioned, and compacted until the specifications are met. As conditions dictate, other slope repair procedures may also be recommended by the geotechnical consultant.

9.10. During construction, the contractor shall grade the site to provide positive drainage away from structures and to keep water from ponding adjacent to structures. Water shall not be allowed to damage adjacent properties. Positive drainage shall be maintained by the contractor until permanent drainage and erosion reducing devices are installed in accordance with project plans.

APPENDIX H

GBA - Important Information About This Geotechnical Report

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way□□□□□□□□□□□□□□ a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can □□□□□□□□□□□□□□□□□□□□□□□□□□□□□ construction project.

Geotechnical-Engineering Services Are Performed for □□□□□□□□□□□□□□□□□□□□□

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

NV5

Delivering Solutions
Improving Lives

APPENDIX "D"

Mariela Moran

From: Quechan Historic Preservation Officer <historicpreservation@quechantribe.com>
Sent: Friday, February 7, 2020 2:32 PM
To: Mariela Moran
Subject: RE: IS 19-0032 AB 52 Letter Quechan

Good afternoon Ms. Moran,
We have reviewed the new Cultural Resources Survey Report and find it satisfactory.

Jill

From: Mariela Moran [mailto:MarielaMoran@co.imperial.ca.us]
Sent: Wednesday, February 05, 2020 9:02 AM
To: Quechan Historic Preservation
Subject: RE: IS 19-0032 AB 52 Letter Quechan

Good morning Ms. McCormick,

Please find attached revised Cultural Resources Survey Report for the Lack Road Bridge Replacement. Let me know if you have any comments or questions.

Respectfully,

Mariela Moran

From: Quechan Historic Preservation <historicpreservation@quechantribe.com>
Sent: Friday, January 17, 2020 12:16 PM
To: Mariela Moran <MarielaMoran@co.imperial.ca.us>
Subject: RE: IS 19-0032 AB 52 Letter Quechan

Ms. Moran,
I reviewed your attached letter and presented it to the Cultural Committee and have come to the conclusion that the letter does not address our concerns. We still request that the cultural report be rewritten with a more comprehensive discussion of ALL of the Tribes with cultural affiliation to the area.

Jill

From: Mariela Moran [mailto:MarielaMoran@co.imperial.ca.us]
Sent: Thursday, January 16, 2020 10:59 AM
To: Quechan Historic Preservation Officer
Subject: FW: IS 19-0032 AB 52 Letter Quechan

From: Mariela Moran
Sent: Tuesday, January 14, 2020 9:36 AM

To: Quechan Historic Preservation Officer <historicpreservation@quechantribe.com>
Subject: RE: IS 19-0032 AB 52 Letter Quechan

Good morning Ms. Jill,

We received the attached letter from the Campo Band of Mission Indians, this letter will be incorporated in the proposed project Initial Study, please let me know if this action would address your comment below.

Very respectfully,

Mariela Moran

From: Quechan Historic Preservation Officer <historicpreservation@quechantribe.com>
Sent: Monday, December 23, 2019 11:53 AM
To: Mariela Moran <MarielaMoran@co.imperial.ca.us>
Cc: Jenell Guerrero <JenellGuerrero@co.imperial.ca.us>
Subject: RE: IS 19-0032 AB 52 Letter Quechan

Good afternoon Ms. Moran,
Thank you for providing the cultural resources report for this project. We have reviewed that report and would like to provide a few comments. The methodology of the survey appears to be sound, but we do take issue with the Cultural History section of the report.
The Cultural History section of the report only mentions the Kumeyaay, and lacks any mention of local Tribes and their connection to the project area. This section appears to be a generic, copy/paste version that lacks specifics germane to cultures of the project area. This lack of cultural context within the report is a means of disconnecting the local Tribal people from this landscape and is a disservice to the intent of Section 106 consultation. We suggest that in the future you employ contractors who are more familiar with the local Tribal cultures and the cultural history of this area.

From: Mariela Moran [mailto:MarielaMoran@co.imperial.ca.us]
Sent: Friday, December 13, 2019 4:17 PM
To: historicpreservation@quechantribe.com
Cc: Jenell Guerrero
Subject: RE: IS 19-0032 AB 52 Letter Quechan

Good afternoon Mr. Jill McCormick,

Please find attached Cultural Resources Survey Report for the Lack Road Bridge Replacement. Please let me know if you have any comments or questions.

Respectfully,

Mariela Moran

From: Quechan Historic Preservation Officer <historicpreservation@quechantribe.com>
Sent: Friday, December 13, 2019 12:21 PM
To: Mariela Moran <MarielaMoran@co.imperial.ca.us>
Subject: IS 19-0032 AB 52 Letter Quechan

Good afternoon Ms. Moran,
We have received the project notification for IS 19-0032. We would like to know if a Cultural Resources Survey has been done for this project. If a survey has been completed, we would like to have a copy of the report.

Thank you,
H. Jill McCormick, M.A.

Quechan Indian Tribe
Historic Preservation Officer
P.O. Box 1899
Yuma, AZ 85366-1899
Office: 760-572-2423
Cell: 928-261-0254
E-mail: historicpreservation@quechantribe.com

Campo Band of Mission Indians

Chairman Harry P. Cuero Jr.
Vice-Chairwoman Kerm Shipp
Secretary Mary Johnson
Treasurer Marcus Cuero
Committee Brian Connolly
Committee Steven M. Cuero
Committee Benjamin Dyche

December 19, 2019

Imperial County Planning & Development Services

801 Main Street

El Centro, CA 92243

To Whom it may Concern.

Subject: Lack Road Bridge over New River Replacement Project

After review of the Lack Road Bridge over New River Replacement Project, Campo Band of Mission Indians concludes this area has a rich history for the Kumeyaay people. There were many villages and ceremonial areas throughout the Kumeyaay territory. The Kumeyaay people have an oral history of the area as well as a Kumeyaay name, Matakal(Westmorland). The Kumeyaay religion and Kumeyaay stories talk about how the land of the Kumeyaay was different in the past than it is today. The Kumeyaay people would look to various natural features in the landscape to identify territory/surrounding. The are several natural features that are visible from that area.

Given the sensitivity of the Matakal (Westmorland) area, Campo Band of Mission Indians would like to request that cultural resources affected by the project be handled in a respectful manner. Campo Band of Mission Indians would also like to request that a Kumeyaay cultural monitor from Campo present for ground disturbing activities, to ensure Kumeyaay cultural resources are not overlooked. In addition to monitoring, Campo Band of Mission Indians would like to see some form of mitigation for the disturbing of our Cultural landscape and our ancestors. When different Structures are built, they disturb our cultural landscape. Also, when our ancestral remains are disturbed, and we take them back there is a lot that we do to take care of them. If our ancestral remains are disturbed, we would like to see some financial

mitigation for the project disturbing and displacing those ancestral remains. If you have questions or concerns, please feel free to contact Marcus Cuero at marcuscuero@campo-nsn.gov or by phone (619) 478-9046.

Sincerely,

Harry P. Cuero

Chairman

Campo Band of Mission Indians

APPENDIX "E"

150 SOUTH NINTH STREET
EL CENTRO, CA 92243-2850

TELEPHONE: (442) 265-1800
FAX: (442) 265-1799

AIR POLLUTION CONTROL DISTRICT

December 23, 2019

Jim Minnick, Director
Imperial County Planning & Development Services
801 Main Street
El Centro, CA 92243

SUBJECT: Initial Study 19-0032—Lack Road Bridge (New River) Replacement Project

Dear Mr. Minnick:

The Imperial County Air Pollution Control District ("Air District") would like to thank you for the opportunity to review and comment on Initial Study (IS) 19-0032 that will allow the removal of the existing Lack Road timber bridge spanning the New River and replace it with a pre-cast concrete bridge ("Project"). The planned Project will not require construction activities to take place in the New River. The Lack Road Bridge is located approximately 5.8 miles north of Westmoreland and 0.3 miles south of Vail Road.

Upon review, the Air District has noted that the Initial Study referenced in a November 27, 2019 letter from the Imperial County Department of Public Works is absent from the document submitted for Air District review. The Air District feels that the Project likely falls under Tier 1 classification for air quality impacts, but absent the aforementioned Initial Study, an unknown projected length of time for completion, and no identification of vehicles to be used in the construction fleet, air quality impacts cannot be properly assessed. Therefore, the Air District requests that the applicant adhere to mitigation measures contained in Chapter 7 of the Imperial County Air Pollution Control District California Environmental Quality Act (CEQA) Handbook (ed. 2017); adhere to the rules contained in the Air District's Regulation VIII including written notification to the Air District 10 days prior to the start of construction activities; and remit a list of equipment to be used during construction (in Excel format);

The Air District's Rules & Regulations can be found on its website (www.co.imperial.ca.us/AirPollution) under the "Planning" tab. Should the applicant have any questions, please contact our office at (442) 265-1800.

Respectfully,

Curtis Blondell

Curtis Blondell
APC Environmental Coordinator

Reviewed by,
Monica Soucier
APC Division Manager