FOR CONTRACT NO.: 05-445904

INFORMATIONAL HANDOUT

WATER QUALITY

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
Central Coast Region
CERTIFICAITON NO.34009WQ08

PERMITS

UNITED STATES ARMY CORPS OF ENGINEERS
NON-REPORTING NATIONWIDE 404 PERMIT

AGREEMENTS

CALIFORNIA DEPARTMENT OF FISH AND GAME
AGREEMENT NO.2009-0091-R4

MATERIALS INFORMATION

FOUNDATION REPORT, August 4, 2009
FINAL HYDRAULIC REPORT, May 17, 2007
FINAL SEISMIC DESIGN RECOMMNEDATION AND SOIL SPRINGS, August 3, 2009
FINAL FOUNDATION REPORT, Seismic Retrofit Analyses, April 30, 1997

TUNNEL SAFETY ORDERS

ROUTE: 05-SB/SLO-101-91.1,0.0/0.8

California Regional Water Quality Control Board
Central Coast Region

Linda S. Adams
Secretary for Environmental Protection

Internet Address: http://www.waterboards.ca.gov/centralcoast
895 Aerovista Place, Suite 101, San Luis Obispo, California 93401-7906
Phone (805) 549-3147 • FAX (805) 543-0397

Arnold Schwarzenegger
Governor

December 14, 2009

BY ELECTRONIC AND REGULAR MAIL

Karen Bewley
kbewley@dot.ca.gov
California Department of Transportation
(CalTrans, District 5)
50 Higuera Street
San Luis Obispo, Ca 93401

Dear Ms. Bewley:

WATER QUALITY CERTIFICATION NUMBER 34009WQ08 FOR SANTA MARIA BRIDGE WIDENING PROJECT, SAN LUIS OBISPO COUNTY

Thank you for the opportunity to review your June 26, 2009 application for water quality certification of the Santa Maria Bridge Widening Project. The application was completed on July 20, 2009. Thank you for submitting the additional information and clarification regarding the project's measures to protect water quality as we discussed during our phone conversations and e-mail exchanges from August 2009 through November 2009. The project appears to protect beneficial uses of State waters. We are issuing the enclosed Standard Letter of Certification.

At this time, we do not anticipate issuing additional requirements based on your application. Should new information come to our attention that indicates a water quality problem, we may require additional monitoring and reporting, issue Waste Discharge Requirements, or take other action.

Your Section 401 Water Quality Certification application and CEQA documents indicate that project activities may affect beneficial uses and water quality. The Water Board issues this certification to protect water quality and associated beneficial uses from project activities. We need reports to determine compliance with this certification. All technical and monitoring reports requested in this certification, or anytime after, are required per Section 13267 of the California Water Code.

Your failure to submit reports required by this certification, or your failure to submit a report of technical quality acceptable to the Executive Officer, may subject you to enforcement action per Section 13268 of the California Water Code. The Water Board will base enforcement actions on the date of certification. Any person affected by this Water Board action may petition the State Water Resources Control Board (State Board) to review this action in accordance with California Water Code Section 13320; and Title 23, California Code of Regulations, Sections 2050 and 3867-3869. The State Board, Office of Chief Counsel, PO Box 100, Sacramento, CA 95812, must receive the

petition within 30 days of the date of this certification. We will provide upon request copies of the law and regulations applicable to filing petitions.

If you have questions please contact **Tamara Presser at (805) 549-3334 or via email at Tpresser@waterboards.ca.gov**, or Phil Hammer at (805) 549-3882. Please mention the above certification number in all future correspondence pertaining to this project.

Sincerely,

for Roger W. Briggs
Executive Officer

Enclosure: Action on Request for CWA Section 401 Water Quality Certification

S:\Section 401 Certification\Certifications\San Luis Obispo\Santa Maria Bridge Widening\Santa Maria Bridge Widening_rev1.doc

cc: Enclosures with

Theresa Stevens
U.S. Army Corps of Engineers
Ventura Office
Regulatory Section
2151 Allesandro Drive, Suite 110
Ventura, CA 93001

401 Program Manager
State Water Resources Control Board
Division of Water Quality
Stateboard401@waterboards.ca.gov

California Department of Fish and Game
Lake and Streambed Alteration
1234 East Shaw Street
Fresno, CA 93710

R9-WTR8-Mailbox@epa.gov

Action on Request for
Clean Water Act Section 401 Water Quality Certification
for Discharge of Dredged and/or Fill Materials

PROJECT: Santa Maria Bridge Widening
APPLICANT: Karen Bewley
California Department of Transportation
50 Higurea Street
San Luis Obisopo, CA 93401

ACTION:
1. ■ Order for Standard Certification
2. ☐ Order for Technically-conditioned Certification
3. ☐ Order for Denial of Certification

STANDARD CONDITIONS:

1. This certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment per section 13330 of the California Water Code and section 3867 of Title 23 of the California Code of Regulations (23 CCR).

2. This certification action is not intended to apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license unless the pertinent certification application was filed per to 23 CCR subsection 3855(b) and the application specifically identified that a FERC license or amendment to a FERC license was being sought.

3. The validity of any non-denial certification action (Actions 1 and 2) shall be conditioned upon total payment of the fee required under 23 CCR section 3833, unless otherwise stated in writing by the certifying agency.

4. This certification is subject to the acquisition of all local, regional, state, and federal permits and approvals as required by law. Failure to meet any conditions contained herein or any the conditions contained in any other permit or approval issued by the State of California or any subdivision thereof may result in the revocation of this Certification and civil or criminal liability.

5. In the event of a violation or threatened violation of this certification, the violation or threatened violation shall be subject to any remedies, penalties, process or sanctions as provided for under state law. For purposes of Section 401(d) of the Clean Water Act, the applicability of any state law authorizing remedies, penalties,

process or sanctions for the violation or threatened violation constitutes a limitation necessary to assure compliance with the water quality standards and other pertinent requirements incorporated into this certification.

6. In response to a suspected violation of any condition of this certification, the Water Board may require the holder of any permit or license subject to this certification to furnish, under penalty of perjury, any technical or monitoring reports the Water Board deems appropriate, provided that the burden, including costs, of the reports shall have a reasonable relationship to the need for the reports and the benefits obtained from the reports.

7. The total fee for this project is **$39,471** which includes the $640 application fee. The remaining fee payable to the RWQCB is **$8,871.**

REGIONAL WATER QUALITY CONTROL BOARD CONTACT PERSON:
Tamara Presser
Central Coast Region, Region 3
(805) 549-3334
tpresser@waterboards.ca.gov
Please refer to the above certification number when corresponding with the Water Board concerning this project.

WATER QUALITY CERTIFICATION:
I hereby issue an order certifying that any discharge from the Santa Maria Bridge Widening project shall comply with the applicable provisions of sections 301 ("Effluent Limitations"), 302 ("Water Quality Related Effluent Limitations"), 303 ("Water Quality Standards and Implementation Plans"), 306 ("National Standards of Performance"), and 307 ("Toxic and Pretreatment Effluent Standards") of the Clean Water Act.

Except insofar as may be modified by any preceding conditions, all certification actions are contingent on (a) the discharge being limited and all proposed mitigation being completed in strict compliance with the applicant's project description and the attached Project Information Sheet, and (b) compliance with all applicable requirements of the Regional Water Quality Control Board's Water Quality Control Plan (Basin Plan).

for Roger W. Briggs
Executive Officer
Regional Water Quality Control Board

12/14/09
Date

Attachment 1

PROJECT INFORMATION

Application Date	Received: June 26, 2009 Completed: November 24, 2009
Applicant	Karen Bewley – California Department of Transportation (Caltrans, District 5)
Applicant Representatives	N/A
Project Name	Santa Maria Bridge Widening
Water Board Application Number	34009WQ08
Type of Project	Bridge Widening
Project Location	City of Santa Maria Longitude: 120. 43° W Latitude: 34.99° N
County	San Luis Obispo
Receiving Water(s)	Santa Maria River 312.00 Santa Maria Hydrologic Unit
Water Body Type	River
Designated Beneficial Uses	Municipal and Domestic Supply (MUN) Agricultural Supply (AGR) Industrial Service Supply (IND) Ground Water Recharge (GWR) Water Contact Recreation (REC-1) Non-Contact Recreation (REC-2) Wildlife Habitat (WILD) Cold Fresh Water Habitat (COLD) Warm Fresh Water Habitat (WARM) Migration of Aquatic Organisms (MIGR) Rare, Threatened or Endangered Species (RARE) Freshwater Replenishment (FRSH) Commercial and Sport Fishing (COMM)
Project Description (purpose/goal)	The purpose of the project is to relieve traffic congestion and improve both safety and operational efficiency of the stretch of U.S. Route 101 for local, regional and interregional travel, for present and future traffic demands. <u>The Central Coast Regional Water Quality Control Board (Water Board) understands that the project includes the following:</u> • Addition of a 12-foot northbound lane and a 12-foot southbound lane • Addition of a 12-foot Class I bicycle path • Connection of the two existing bridges and widening the

	newly connected structure by 20'-5" from the west side and 6'-6" from the east side.
Preliminary Water Quality Issues	The Water Board finds the project has the potential to cause sedimentation, siltation, and pollutant release to the named river. Erosion could be caused by the construction activities. Pollutants could be released from construction equipment (e.g., oil, gasoline, hydraulic fluid, and other liquid contaminants associated with earth-moving equipment) or from the concrete work associated with installation of the piers and abutments. The Water Board finds the project has the potential to adversely impact California red-legged frog and steelhead trout and their habitats.
Water Board Mitigation Requirements	<u>Mitigations that are required to comply with 401 Water Quality Certification include:</u> • All construction activities must be completed in accordance with the Caltrans Statewide Stormwater Management Plan (SWMP) and the project specific Stormwater Pollution Prevention Plan (SWPPP). • Caltrans or its contractor may conduct no work in jurisdictional waterways while water is present. • Caltrans must use silt fences and/or straw wattles around construction areas to control and eliminate erosion and sedimentation. • Erosion control measures shall be applied to all disturbed earth surfaces. • Seeding of entire slope with an approved grass seed mixture and placement of erosion control blankets over seeded areas shall be implemented for slope stabilization. • Any material stockpiled during construction shall be covered with plastic. • Sand bags shall be filled with clean gravel. • All construction vehicles and equipment used on site must be well maintained and checked daily for fuel and hydraulic fluid leaks or other problems that could result in spills of toxic materials. • The contractor must be required to have oil absorbent pads onsite in case a spill occurs. • All vehicle fueling must occur at least 100 feet away from waterways, and in the designated staging area. • Caltrans or its contractor must ensure that any dewatering discharges do not cause erosion, scour, or sedimentary

	deposits that would impact natural bedding materials. • During the rainy season (October 15 through May 15), the active disturbed soil area of the project site shall not be more than 5 acres. • There shall be no live stream diversions. • Caltrans or its contractor shall monitor the weather forecast on a daily basis and remove all mobile construction equipment from the streambed prior to all forecasted storms. • Caltrans or its contractor shall install appropriate best management practices between live stream flows and construction areas to prevent potential release of pollutants into a live stream. • No construction equipment shall cross a live stream. • Caltrans shall comply with mitigation measures described in the Mitigation and Monitoring Plan prepared by Caltrans on November 19, 2009. • After plant establishment, Caltrans shall remove all temporary irrigation system materials and equipment. • Water Board staff must be notified if mitigations as described in the 401 Water Quality Certification application for this project are altered by the imposition of subsequent permit conditions by any local, state or federal regulatory authority. Caltrans must inform Water Board staff of any modifications that interfere with compliance with this certification.
Area of Disturbance	Approximately 14.11 acres Streambed: 0.16 acres permanent, 13.95 acres temporary
Fill/Excavation Area	N/A
Dredge Volume	N/A
U.S. Army Corps of Engineers Permit No	Nationwide Permit 14 – Linear Transportation Projects
Federal Public Notice	Not applicable
Dept. of Fish and Game Streambed Alteration Agreement	Streambed Alteration Agreement is pending. Final, signed copy will be forwarded immediately upon execution.
Possible Listed Species	Steelhead trout, California red-legged frog
Status of CEQA Compliance	(Mitigated) Negative Declaration Lead Agency: Caltrans
Water Board Compensatory Mitigation Requirements	The project must include the following: • All areas of temporary streambed disturbance shall be mitigated by seeding and planting to return area to pre-construction conditions, in accordance with the November

	19, 2009 Mitigation and Monitoring Plan. • All areas of permanent streambed disturbance shall be mitigated by enhancing nearby portions of the streambed by planting, in accordance with the November 19, 2009 Mitigation and Monitoring Plan.
Total Project Fee	$39,471
Project Fee Provided	$30,600
Remaining Project Fee Due	$8,871
Additional Conditions	Contact Water Board staff when project begins to allow for a site visit. Submit a signed copy of the Department of Fish and Game's streambed alteration agreement to the Water Board immediately upon execution and prior to any discharge to waters of the State. Caltrans must conduct all construction activities in accordance with the Caltrans Statewide Stormwater Management Plan (SWMP). The Water Board requires visual monitoring and five reports for this project: • Visually inspect the site (at least one reach upstream and downstream of project) after completion of the project and for two subsequent rainy seasons to ensure that the new structures are not causing excessive erosion or other water quality problems. If the project does cause water quality problems, contact the Water Board staff member overseeing the project. Caltrans will be responsible for obtaining any additional permits necessary for implementing plans for restoration to prevent further water quality problems. • First Report: Within 30 days of project completion, submit a project completion report that contains a summary of daily activities, monitoring observations, and problems incurred and actions taken; include properly identified post-project photos. • Second, Third, Fourth, and Fifth Report: Submit annual reports complete with photos of revegetation efforts by December 31 of each monitoring year. Annual reports must quantify growth and progress of restoration and determine to what extent performance criteria have been met. All areas of the revegetation site shall be assessed for percent cover, general health and stature, and signs of

	reproduction. The report shall also include photographs of revegetation progress over time.

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
VENTURA FIELD OFFICE
2151 ALESSANDRO DRIVE, SUITE 110
VENTURA, CALIFORNIA 93001

December 14, 2009

REPLY TO
ATTENTION OF:

Regulatory Division

DEPARTMENT OF THE ARMY NATIONWIDE PERMIT AUTHORIZATION

Karen Bewley
Department of Transportation-District 5
50 Higuera Street
San Luis Obispo, California 93401

Dear Ms. Bewley:

This is in reply to your application (Caltrans Project No. 05-44590; Corps File No. SPL-2009-00499-TS) dated June 25, 2009, for a Department of the Army Permit to discharge fill onto waters of the U.S., in association with the Caltrans District 5 Santa Maria River Bridges Widening project on U.S. Highway 101. The proposed work would take place in the Santa Maria River within the City of Santa Maria, Santa Barbara County and San Luis Obispo County, California.

Based on the information you have provided, the Corps of Engineers has determined that your proposed activity complies with the enclosed terms and conditions of Nationwide Permit No. 14, as described in enclosure 1.

Specifically, you are authorized to:

1. Permanently impact 0.16 acre of waters of the United States for the purpose of widening the existing U.S. Highway 101 bridges across the Santa Maria River. Permanent impacts are associated with extension of the concrete bridge piers to support the widened bridge decks.
2. Temporarily impact approximately 13.95 acres of waters of the United States during construction activities associated with item one above.
3. Provide 1.082 acres of compensatory mitigation for permanent impacts to waters

of the United States. Compensatory mitigation would occur within the bed of the Santa Maria River and would be installed immediately following completion of construction activities. Compensatory mitigation would be installed and monitored for five (5) years in accordance with the Mitigation and Monitoring Plan (MMP) dated December 3, 2009.

4. Provide 13.95 acres of site restoration for temporary impacts to waters of the United States. Site restoration in the form of revegetation with native seed and weed control would occur within the bed of the Santa Maria River and would be installed immediately following completion of construction activities. Revegetation/seeding in temporarily impacted areas would be installed and monitored for five (5) years in accordance with the Mitigation and Monitoring Plan (MMP) dated December 3, 2009.

Furthermore, you must comply with the following non-discretionary Special Conditions:

Special Conditions:

1. The Permittee shall provide a copy of this permit to all Caltrans field staff, contractors, subcontractors, and equipment operators. Copies of this permit shall be readily available at the work site at all times during periods of active work, and shall be presented to any Corps personnel upon request.

2. The Permittee shall notify the Corps Regulatory Division project manager (Theresa Stevens, 805-585-2146-phone, 805-585-2154-fax; or Theresa.Stevens@usace.army.mil) at least 5 days in advance of work in waters of the United States. Notification in the form of electronic mail, telephone, facsimile or other direct communication is recommended.

3. Prior to initiation of construction in waters of the United States, the Permittee shall clearly mark the limits of the workspace with flagging or similar means to ensure mechanized equipment does not enter preserved waters of the U.S. and riparian wetland/habitat areas shown on the enclosed exhibits. Adverse impacts to waters of the U.S. beyond the Corps-approved construction footprint are not authorized. Such impacts could result in permit suspension and revocation, administrative, civil or criminal penalties, and/or substantial, additional, compensatory mitigation requirements.

4. Within 45 calendar days of completion of authorized work in waters of the U.S., the Permittee shall submit to the Corps Regulatory Division a post-project

implementation memo indicating the date authorized impacts to waters of the U.S. ceased.

5. Within 45 calendar days of complete installation of all mitigation, the Permittee shall submit to the Corps Regulatory Division two copies of a memo indicating the following:
   A) Date(s) all mitigation was installed and monitoring was initiated;
   B) Schedule for future mitigation monitoring, implementation and reporting pursuant to final, Corps-approved MMP;
   C) Summary of compliance status with each special condition of this permit (including any noncompliance previously occurred or currently occurring and corrective actions taken to achieve compliance);
   D) Color photographs taken at the project site before and after construction for those aspects directly associated with impacts to waters of the U.S.; and
   E) One copy of "as built" drawings for the entire project, including all mitigation sites (all sheets must be signed, dated, to-scale, and no larger than 11 x 17 inches).

6. This Corps permit does not authorize you to take any threatened or endangered species, in particular the California red legged frog (*Rana aurora draytonii*) and southern steelhead (*Oncorhynchus mykiss*), or adversely modify designated critical habitat. In order to legally take a listed species, you must have separate authorization under the Endangered Species Act (ESA) (e.g. ESA Section 10 permit, or a Biological Opinion (BO) under ESA Section 7, with "incidental take" provisions with which you must comply). The U.S. Fish and Wildlife Service BO (FWS File No. 1-8-06-F-23, dated August 23, 2006) contains mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" that is also specified in the BO. Your authorization under this Corps permit is conditional upon your compliance with all of the mandatory terms and conditions associated with incidental take of the attached BO, which terms and conditions are incorporated by reference in this permit. Failure to comply with the terms and conditions associated with incidental take of the BO, where a take of the listed species occurs, would constitute an unauthorized take, and it would also constitute non-compliance with your Corps permit.

7. Pursuant to 36 C.F.R. section 800.13, in the event of any discoveries during construction of either human remains, archeological deposits, or any other type of historic property, the Permittee shall notify the Corps' Regulatory and Archeology Staff within 24 hours (Regulatory: Theresa Stevens at 805-585-2146; Archaeology: Steve Dibble at 213-452-3849 or John Killeen at 213-452-3861). The Permittee shall immediately suspend all work in any area(s) where potential cultural resources are

discovered. The Permittee shall not resume construction in the area surrounding the potential cultural resources until the Corps Regulatory Division re-authorizes project construction, per 36 C.F.R. Section 800.13.

This letter of verification is valid through December 14, 2011. All nationwide permits expire on March 18, 2012. It is incumbent upon you to remain informed of changes to the nationwide permits. If the Corps of Engineers modifies, reissues, or revokes any nationwide permit at an earlier date, we will issue a public notice announcing the changes.

A nationwide permit does not grant any property rights or exclusive privileges. Also, it does not authorize any injury to the property or rights of others or authorize interference with any existing or proposed Federal project. Furthermore, it does not obviate the need to obtain other Federal, state, or local authorizations required by law.

Thank you for participating in our regulatory program. If you have any questions, please contact Theresa Stevens of my staff at 805-585-2146 or via e-mail at theresa.stevens@usace.army.mil.

Please be advised that you can now comment on your experience with Regulatory Division by accessing the Corps web-based customer survey form at: http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

Aaron O. Allen, Ph.D.
Chief, North Coast Branch
Regulatory Division

Enclosures Nationwide Permit General Conditions
Exhibits

LOS ANGELES DISTRICT
U.S. ARMY CORPS OF ENGINEERS

CERTIFICATION OF COMPLIANCE WITH
DEPARTMENT OF THE ARMY NATIONWIDE PERMIT

Permit Number: *SPL-2009-00499-TS*

Name of Permittee: *Department of Transportation-District 5*

Date of Issuance: *December 14, 2009*

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

U.S Army Corps of Engineers
Regulatory Division
Ventura Field Office
ATTN: SPL-2009-00499-TS
2151 Alessandro Drive, Suite 110
Ventura, CA 93001

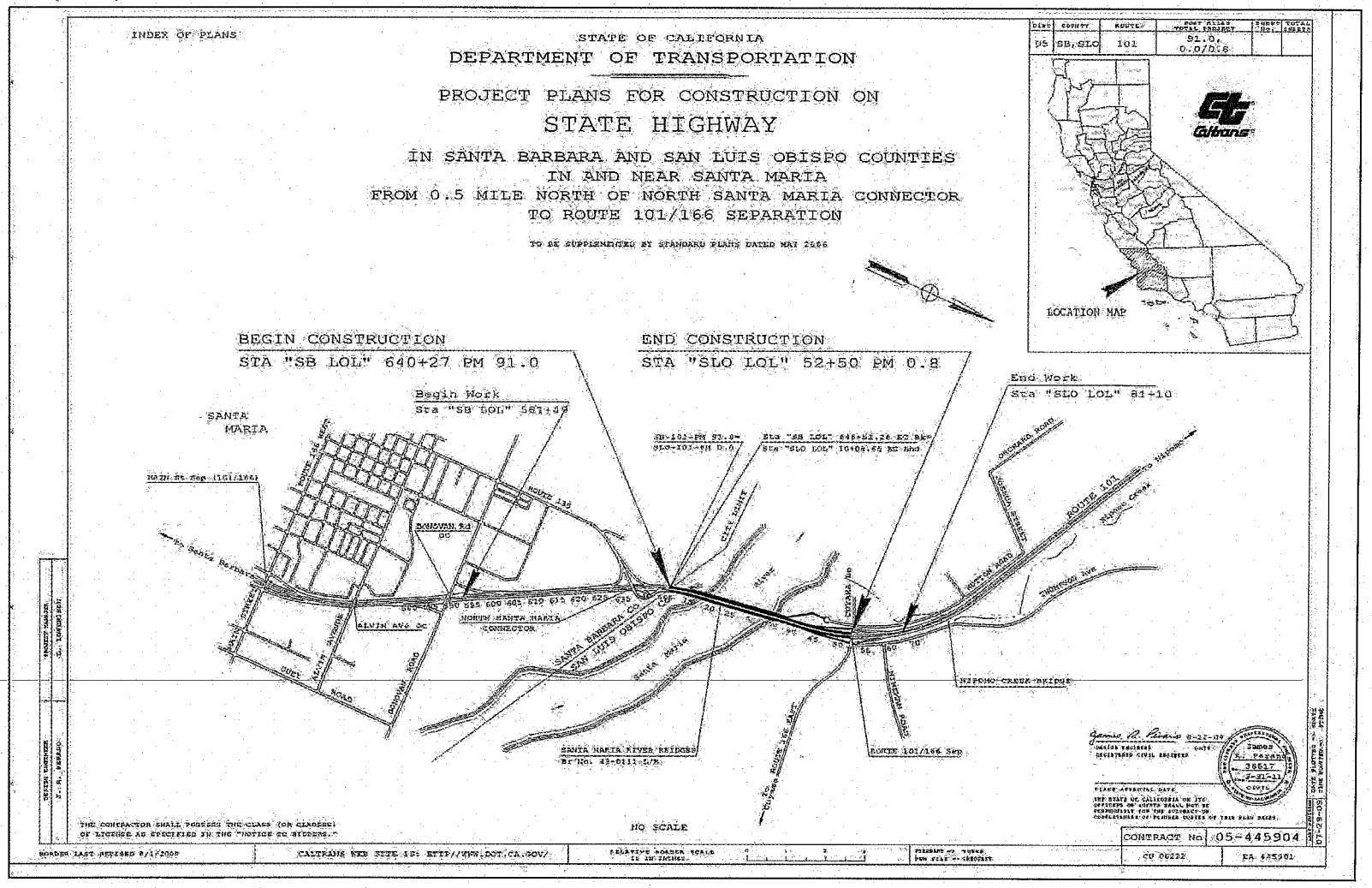
Please note that your permitted activity is subject to a compliance inspection by an Army Corps of Engineers representative. If you fail to comply with this nationwide permit you may be subject to permit suspension, modification, or revocation procedures as contained in 33 CFR 330.5 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit condition(s).

_____ _____

Signature of Permittee Date

Appendix A Project Location Map



DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SB/SLO	101			

REGISTERED CIVIL ENGINEER X DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Pete Norboe No. C57519 Exp. 12-31-2009 CIVIL STATE OF CALIFORNIA

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HYDROLOGIC SUMMARY

DRAINAGE AREA: x SQUARE MILES

	MAX DAILY RELEASE	ALLOWED BASE FLOOD	ORDINARY HIGHWATER ESTIMATE
FREQUENCY (YEARS)	50-yr	100-yr	N/A
EXISTING WATER SURFACE ELEV. (FEET)	55,500	74,000	N/A
DISCHARGE (CUBIC FEET PER SECOND)	209.1	210.1	N/A

FLOOD PLAIN DATA ARE BASED UPON INFORMATION AVAILABLE WHEN THE PLANS WERE PREPARED AND ARE SHOWN TO MEET FEDERAL REQUIREMENTS. THE ACCURACY OF SAID INFORMATION IS NOT WARRANTED BY THE STATE AND INTERESTED OR AFFECTED PARTIES SHOULD MAKE THEIR OWN INVESTIGATIONS.

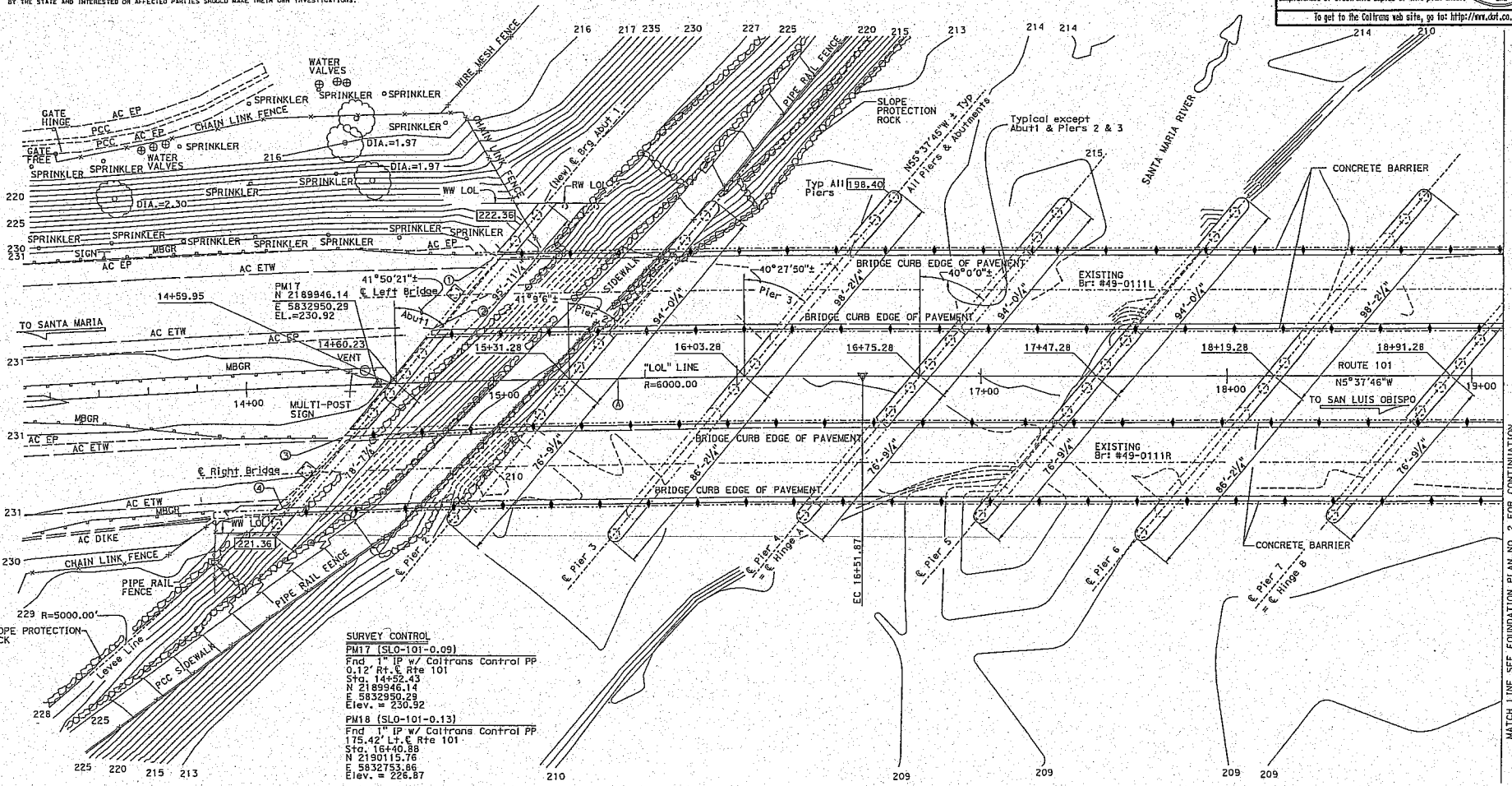
Bridge Location (Existing Br: #49-0111L)
① - 48.98 Lt. ℄ Exist Rte 101, Sta.15+0.78, Elev.=231.84 ±
② - 21.59 Lt. ℄ Exist Rte 101, Sta.14+76.11, Elev.=231.28±

Bridge Location (Existing Br: #49-0111R)
③ - 21.06 Rt. ℄ Exist Rte 101, Sta.14+37.80, Elev.=231.35 ±
④ - 48.64 Rt. ℄ Exist Rte 101, Sta.14+12.77, Elev.=230.81 ±

CURVE DATA

No.	R	Δ	T	L
(A)	6000.09	6°8'32"	321.92	643.22
(B)	5000.00	39°25'19"	1791.24	3440.21'

LEGEND:
48" Partially Filled Concrete Pipe Pile (New), (Existing Piles not Shown)
Denotes Bottom of Footing Elevation



SURVEY CONTROL

PM17 (SLO-101-0.09)
Fnd 1" IP w/ Caltrans Control PP
0.12' Rt. ℄ Rte 101
Sta. 14+52.43
N 2189946.14
E 5832950.29
Elev. = 230.92

PM18 (SLO-101-0.13)
Fnd 1" IP w/ Caltrans Control PP
175.42' Lt. ℄ Rte 101
Sta. 16+40.88
N 2190115.76
E 5832753.86
Elev. = 226.87

PRELIMINARY INVESTIGATION SECTION							
SCALE	VERT. DATUM NAVD 88	PHOTOGRAMMETRY AS OF: X					
1:20	HORZ. DATUM NAD 83	SURVEYED	BY DISTRICT	CHECKED	BY M. LICHA/ E. LOPEZ		
ALIGNMENT TIES	DISTR. TRAVERSE SHEET	DRAFTED	BY Y. ZHANG 04/2007	CHECKED	BY T. ZOLNIKOVA 04/2007		

STRUCTURES FOUNDATION PLAN SHEET (ENGLISH) (REV. 10/25/05)

	BY	CHECKED
DESIGN	Rosa Candiotti	Pete Norboe
DETAILS	Nania Helder	Pete Norboe
QUANTITIES	Rosa Candiotti	Pete Norboe

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 9

CU 05
EA 445901

FILE => 49-0111-a-fp101.dgn

BRIDGE NO. 49-0111
POST MILE SLO 0.0/0.4

SANTA MARIA RIVER BRIDGE (WIDEN)
FOUNDATION PLAN NO. 1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 12/31/08 12/31/08 12/31/08 12/31/08 4-14-09

SHEET 15 OF 129

USERNAME => dellott DATE PLOTTED => 07-MAY-2009 TIME PLOTTED => 14:16

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SB/SLO	101			

REGISTERED CIVIL ENGINEER X DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PETE NORBOE No. C57519 Exp.12-31-2009 CIVIL STATE OF CALIFORNIA

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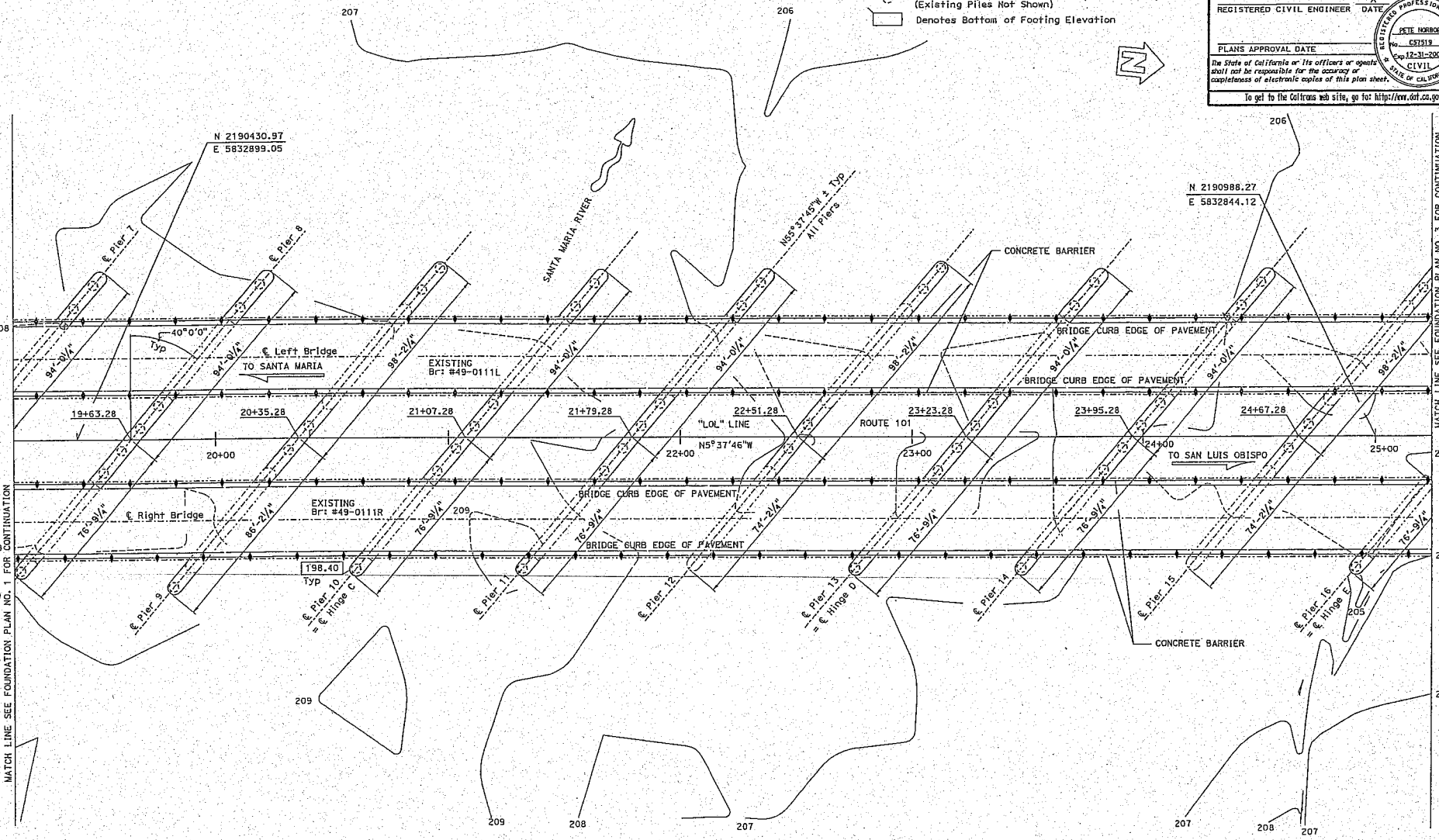
LEGEND:

48" Partially Filled Concrete Pipe Pile (New), (Existing Piles Not Shown)

Denotes Bottom of Footing Elevation



PRELIMINARY INVESTIGATION SECTION							
SCALE 1:20	VERT.DATUM NAVD 88	PHOTOGRAMMETRY AS OF: X					
	HORZ.DATUM NAD 83	SURVEYED	BY DISTRICT	CHECKED	BY M. LICHA/ E. LOPEZ		
ALIGNMENT TIES	DISTR.TRAVERSE SHEET	DRAFTED	BY Y. ZHANG 04/2007	CHECKED	BY T.ZOLNIKOVA 04/2007		

STRUCTURES FOUNDATION PLAN SHEET [ENGLISH] (REV. 10/23/05)

DESIGN	BY Rosa Candiotti	CHECKED Pete Norboe
DETAILS	BY Ronia Helder	CHECKED Pete Norboe
QUANTITIES	BY Rosa Candiotti	CHECKED Pete Norboe

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 9

CU 05 EA 445901

FILE => 49-0111-a-fp102.dgn

BRIDGE NO. 49-0111 POST MILE SLO 0.0/0.4

DISREGARD PRINTS BEARING EARLIER REVISION DATES 4-11-08

REVISION DATES

SHEET 16 OF 129

SANTA MARIA RIVER BRIDGE (WIDEN)

FOUNDATION PLAN NO. 2

USERNAME => delliott DATE PLOTTED => 07-MAY-2009 TIME PLOTTED => 14:16

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SB/SLO	101			

REGISTERED CIVIL ENGINEER X DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PETE NORBOE No. C57519 Exp 12-31-2009 CIVIL STATE OF CALIFORNIA

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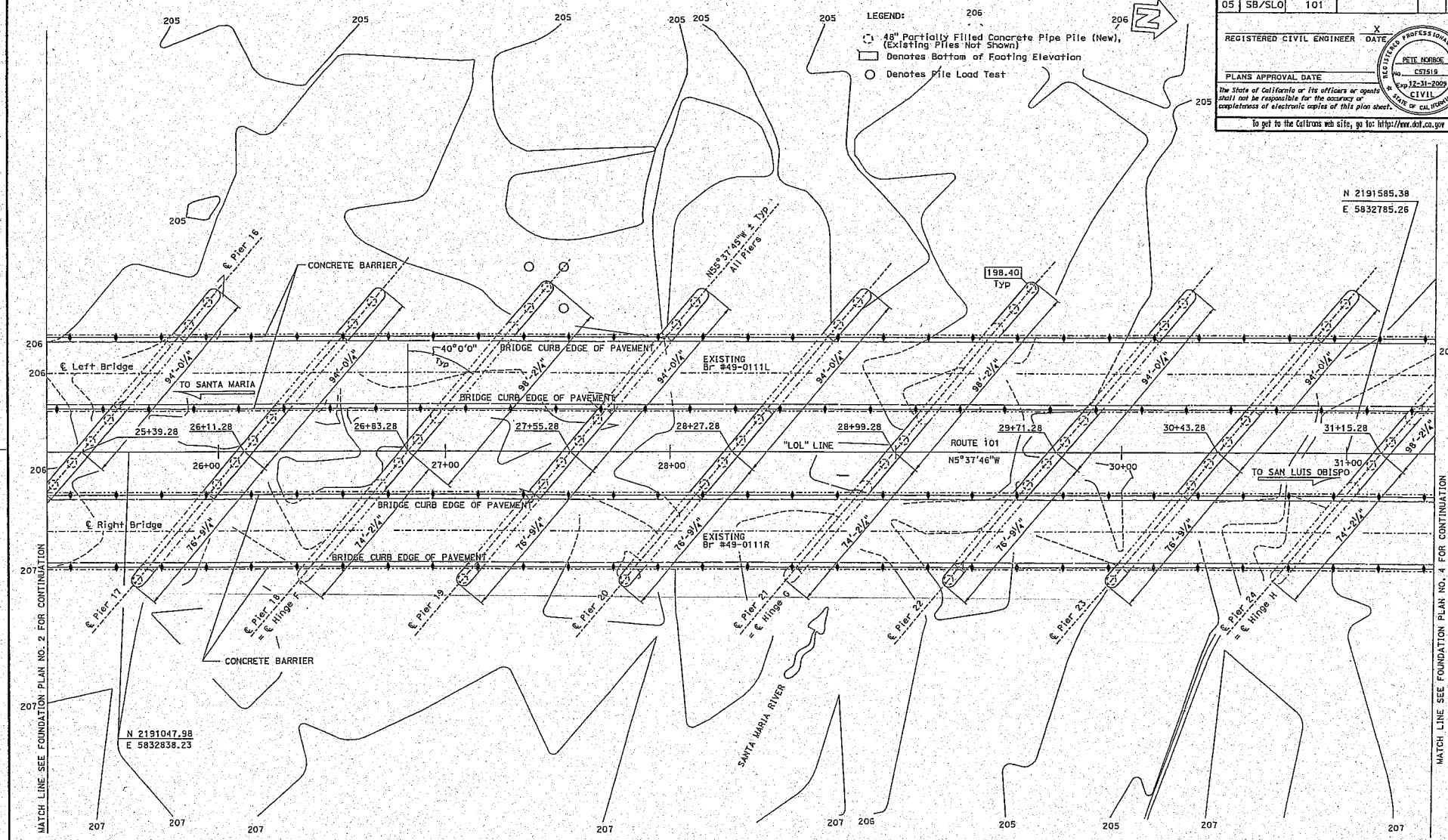

PRELIMINARY INVESTIGATION SECTION									
SCALE 1:20	VERT.DATUM NAVD 88	PHOTOGRAMMETRY AS OF: X				DESIGN	BY Rosa Candiotti	CHECKED Pete Norboe
	HORZ.DATUM NAD 83	SURVEYED	BY DISTRICT	CHECKED	BY N. LICHA/ E. LOPEZ	DETAILS	BY Ronla Helder	CHECKED Pete Norboe
ALIGNMENT TIES	DISTR.TRAVERSE SHEET	DRAFTED	BY Y. ZHANG 04/2007	CHECKED	BY T.ZOLNIKOVA 04/2007	QUANTITIES	BY Rosa Candiotti	CHECKED Pete Norboe

STRUCTURES FOUNDATION PLAN SHEET (ENGLISH) (REV. 10/23/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 9

CU 05
EA 445901

FILE => 49-0111-e-fp103.dgn

BRIDGE NO. 49-0111
POST MILE SLO 0.0/0.4

SANTA MARIA RIVER BRIDGE (WIDEN)
FOUNDATION PLAN NO. 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 11-14-2008 12-19-2008 3-24-2009 4-21-09 6-17-09

SHEET 17 OF 129

USERNAME => dellicit DATE PLOTTED => 07-MAY-2009 TIME PLOTTED => 14:16

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SB/SLO	101			

REGISTERED CIVIL ENGINEER X DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PETE NORBOE No. C57519 Exp. 12-31-2009 CIVIL STATE OF CALIFORNIA

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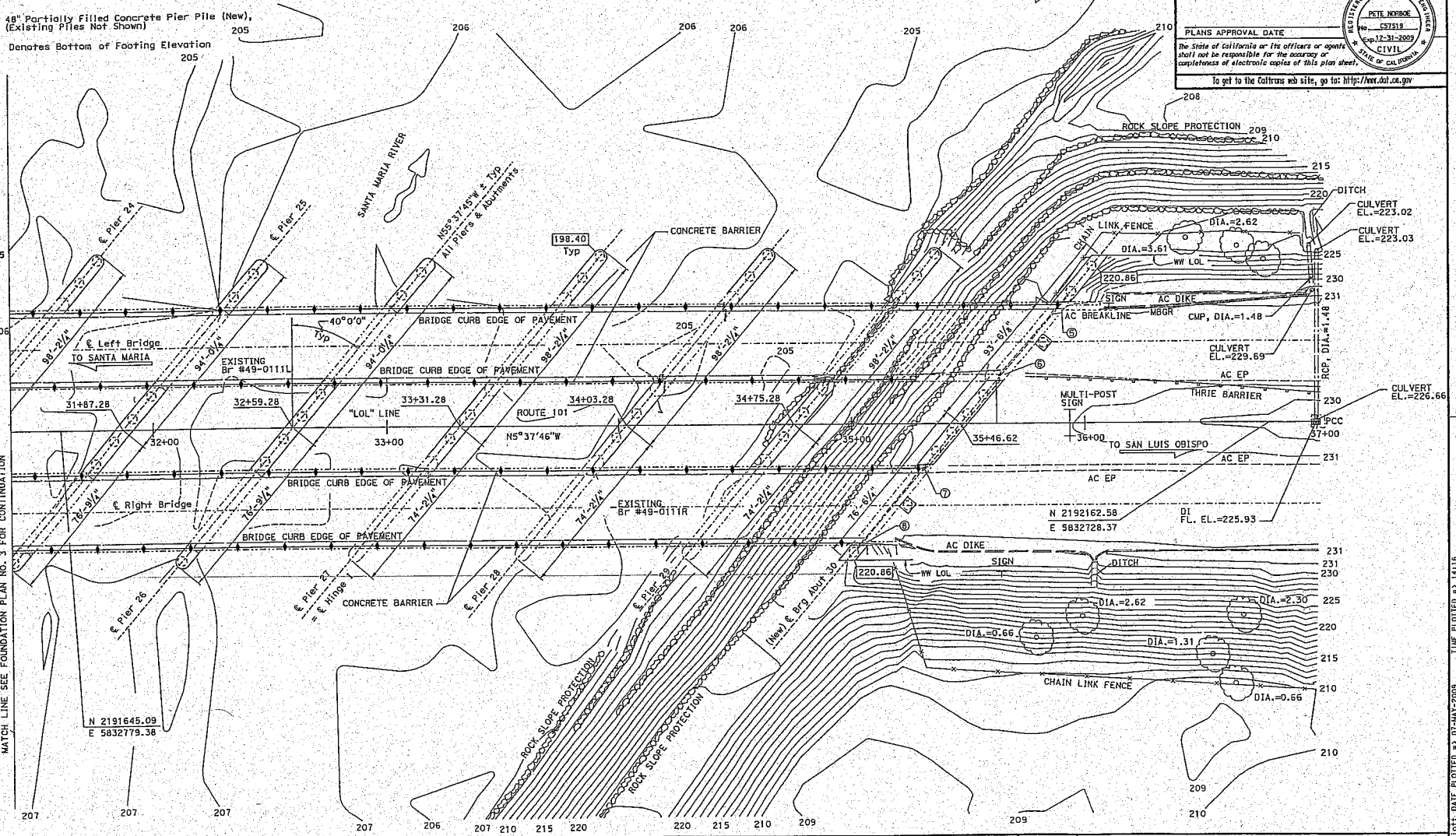
Bridge Location (Existing Br: #49-0111L)
Ⓔ - 48.91 Lt. ℄ Exist Rte 101, Sta.35+90.45, Elev.=230.94 ±
Ⓕ - 21.03 Lt. ℄ Exist Rte 101, Sta.35+66.25, Elev.=231.40 ±

Bridge Location (Existing Br: #49-0111R)
Ⓖ - 19.03 Rt. ℄ Exist Rte 101, Sta.35+31.59, Elev.=232.26 ±
Ⓗ - 50.76 Rt. ℄ Exist Rte 101, Sta.35+06.03, Elev.=231.84 ±

LEGEND:

48" Partially Filled Concrete Pier Pile (New), (Existing Piles Not Shown)

Denotes Bottom of Footing Elevation



PRELIMINARY INVESTIGATION SECTION							
SCALE 1:20	VERT.DATUM NAVD 88	PHOTOGRAMMETRY AS OF: X					
	HORZ.DATUM NAD 83	SURVEYED	BY DISTRICT	CHECKED	BY N. LICHA/ E. LOPEZ		
ALIGNMENT TIES DISTR.TRAVERSE SHEET		DRAFTED	BY Y. ZHANG 04/2007	CHECKED	BY T.ZOLNIKOVA 04/2007		

STRUCTURES FOUNDATION PLAN SHEET (ENGLISH) (REV. 10/25/05)

	BY	CHECKED
DESIGN	Rosa Candiotti	Pete Norboe
DETAILS	Ronia Helder	Pete Norboe
QUANTITIES	Rosa Candiotti	Pete Norboe

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH 9

CU 05
EA 445901

FILE => 49-0111-e-fp104.dgn

BRIDGE NO. 49-0111
POST MILE SLO 0.0/0.4

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 03-26-08 03-13-09 03-31-09 8-11-05

REVISION DATES

SHEET 18 OF 129

SANTA MARIA RIVER BRIDGE (WIDEN)
FOUNDATION PLAN NO. 4

USERNAME => gallott DATE PLOTTED => 07-MAY-2009 TIME PLOTTED => 14:16

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SB/SLO	101			

REGISTERED CIVIL ENGINEER X DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Pete Norboe No. C57519 Exp. 12-31-09 CIVIL STATE OF CALIFORNIA

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Legend:

- Denotes existing structures
- Denotes new structure
- Denotes limits of bridge removal

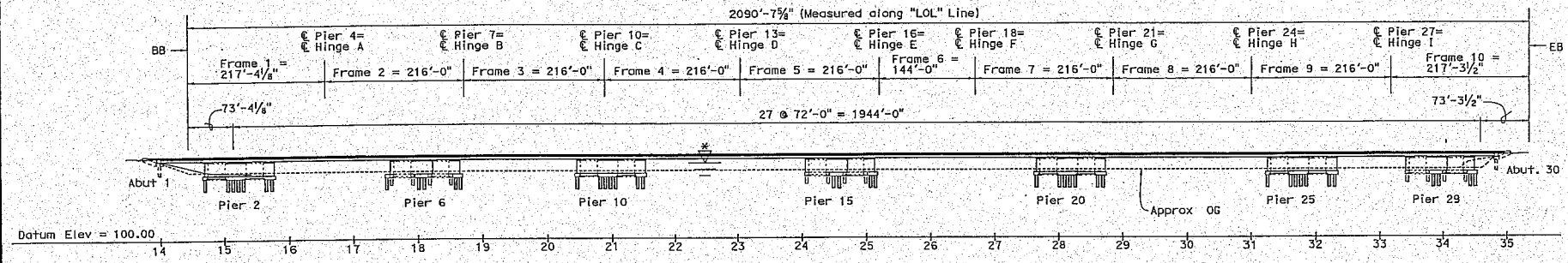
EVC Sta 14+57.70
Elev 232.40

Level

BVC Sta 35+47.78
Elev 232.40

PROFILE GRADE

NO SCALE



Notes:

1. For Index To Plans, Standard Plans list, and General Notes, see "INDEX TO PLANS" sheet.
2. Pile Data Table, see "PILE DATA" sheet.

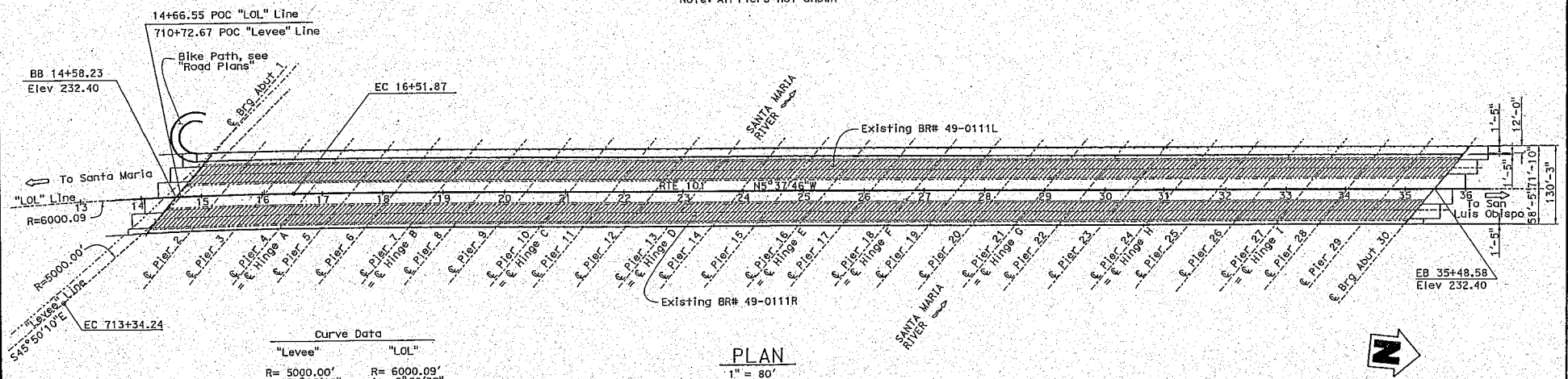
ELEVATION

1" =80'

Note: All Piers not shown

Notes:

* For Hydraulic Summary Table, see "FOUNDATION PLAN" sheets.



Curve Data

"Levee"	"LOL"
R= 5000.00'	R= 6000.09'
Δ= 39°25'19"	Δ= 6°08'32"
T= 1791.24'	T= 321.92'
L= 3440.21'	L= 643.22'

PLAN

1" = 80'

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

Gordon Donke DESIGN ENGINEER	DESIGN	BY Rosa Candiotti	CHECKED Pete Norboe	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
	DETAILS	BY D. Elliott	CHECKED Pete Norboe	LAYOUT BY D. Elliott	CHECKED Pete Norboe	
	QUANTITIES	BY Rosa Candiotti	CHECKED Pete Norboe	SPECIFICATIONS BY Todd Geerts	CHECKED Pete Norboe; PLANS AND SPECS COMPARED Todd Geerts	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH 9

CU 05
EA 445901

BRIDGE NO. 49-0111
POST MILE SLO 0.0/0.4

SANTA MARIA RIVER BRIDGE (WIDEN)
GENERAL PLAN NO. 1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 2-12-08 2-12-09 4-14-09

SHEET 1 OF 129

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

FILE => 49-0111-a-gp01.dgn

STRUCTURES DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 10/23/03)

STRUCTURES DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 07-24-08)

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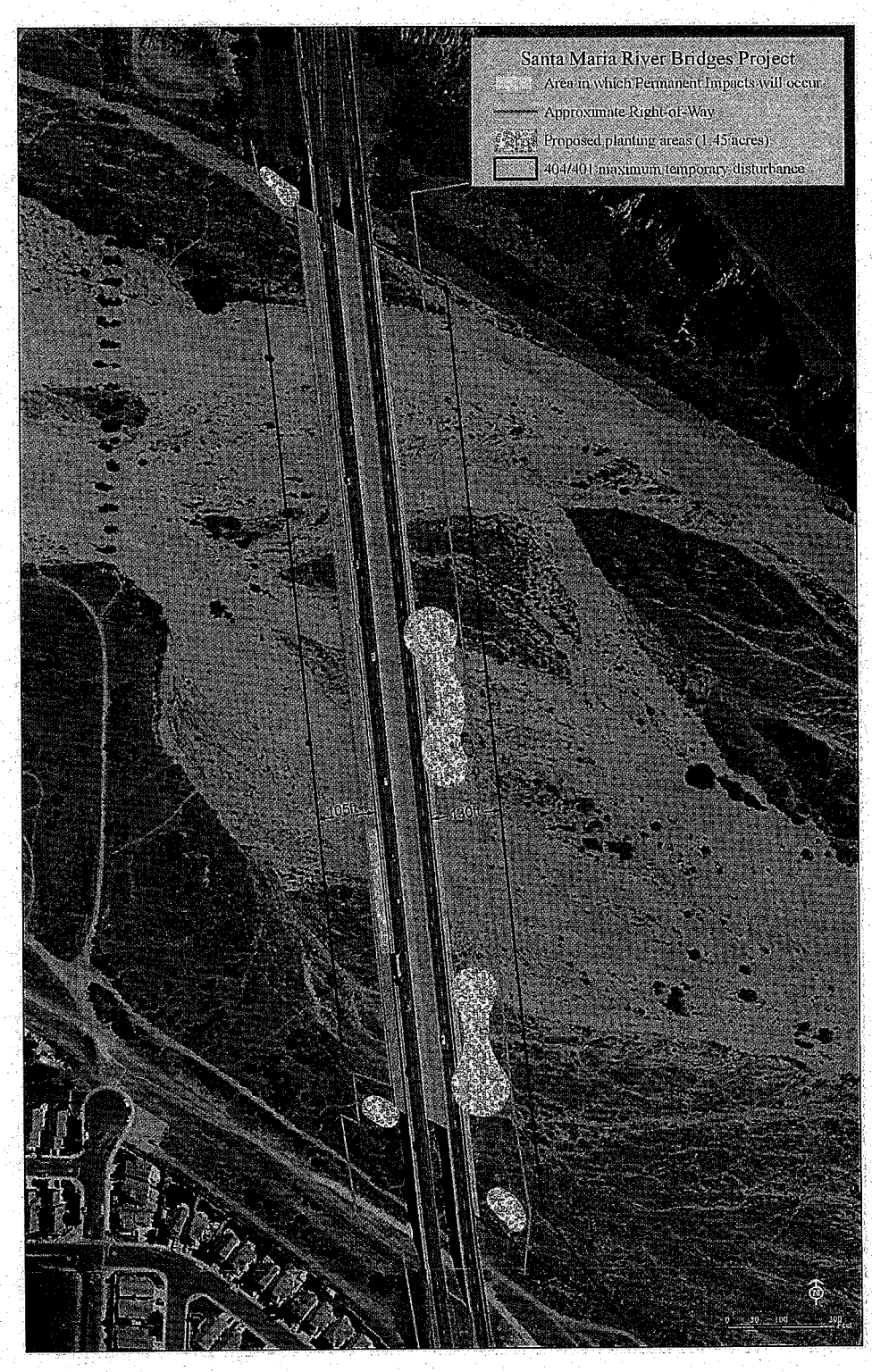
Appendix B Impact and Planting Map



Enclosure 1: NATIONWIDE PERMIT NUMBER 14 - TERMS AND CONDITIONS

1. Nationwide Permit 14 Terms:

Your activity is authorized under **Nationwide Permit Number 14**, subject to the following terms:

Linear Transportation Projects. Activities required for the construction, expansion, modification, or improvement of linear transportation projects (e.g., roads, highways, railways, trails, airport runways, and taxiways) in waters of the United States. For linear transportation projects in non-tidal waters, the discharge cannot cause the loss of greater than 1/2-acre of waters of the United States. For linear transportation projects in tidal waters, the discharge cannot cause the loss of greater than 1/3-acre of waters of the United States. Any stream channel modification, including bank stabilization, is limited to the minimum necessary to construct or protect the linear transportation project; such modifications must be in the immediate vicinity of the project.

This NWP also authorizes temporary structures, fills, and work necessary to construct the linear transportation project. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

This NWP cannot be used to authorize non-linear features commonly associated with transportation projects, such as vehicle maintenance or storage buildings, parking lots, train stations, or aircraft hangars.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if: (1) The loss of waters of the United States exceeds 1/10 acre; or (2) there is a discharge in a special aquatic site, including wetlands. (See general condition 27.) (Sections 10 and 404)

Note: Some discharges for the construction of farm roads or forest roads, or temporary roads for moving mining equipment, may qualify for an exemption under Section 404(f) of the Clean Water Act (see 33 CFR 323.4).

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as appropriate, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP.

2. Nationwide Permit General Conditions:
The following general conditions must be followed in order for any authorization by an NWP to be valid:

1. *Navigation*.

   (a) No activity may cause more than a minimal adverse effect on navigation.

   (b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.

   (c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. *Aquatic Life Movements*. No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. Culverts placed in streams must be installed to maintain low flow conditions.

3. *Spawning Areas.* Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. *Migratory Bird Breeding Areas*. Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. *Shellfish Beds.* No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48.

6. *Suitable Material.* No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

7. *Water Supply Intakes.* No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. *Adverse Effects From Impoundments*. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. *Management of Water Flows*. To the maximum extent practicable, the preconstruction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization and storm water management activities, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the preconstruction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. *Fills Within 100-Year Floodplains*. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. *Equipment*. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. *Soil Erosion and Sediment Controls*. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.

13. *Removal of Temporary Fills*. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. *Proper Maintenance*. Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety.

15. *Wild and Scenic Rivers.* No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service).

16. *Tribal Rights*. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

17. *Endangered Species*.

    (a) No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which ''may affect'' a listed species or critical habitat, unless Section 7 consultation addressing the effects of the proposed activity has been completed.

    (b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements.

(c) Non-federal permittees shall notify the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that may be affected by the proposed work or that utilize the designated critical habitat that may be affected by the proposed work. The district engineer will determine whether the proposed activity ''may affect'' or will have ''no effect'' to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the project, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification the proposed activities will have ''no effect'' on listed species or critical habitat, or until Section 7 consultation has been completed.

(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add speciesspecific regional endangered species conditions to the NWPs. (e) Authorization of an activity by a NWP does not authorize the ''take'' of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with ''incidental take'' provisions, etc.) from the U.S. FWS or the NMFS, both lethal and non-lethal ''takes'' of protected species are in violation of the ESA. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. FWS and NMFS or their world wide Web pages at *http://www.fws.gov/* and *http://www.noaa.gov/fisheries.html* respectively.

18. *Historic Properties*.

(a) In cases where the district engineer determines that the activity may affect properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of Section 106 of the National Historic Preservation Act. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the authorized activity may have the potential to cause effects to any historic properties listed, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the preconstruction notification must state which historic properties may be affected by the proposed work or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of or potential for the presence of historic resources can be sought from the State Historic Preservation Officer or Tribal Historic Preservation Officer, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted and these efforts, the district engineer shall determine whether the proposed activity has the potential to cause an effect on the historic properties. Where the non-Federal applicant has identified historic properties which the activity may have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects or that consultation under Section 106 of the NHPA has been completed.

(d) The district engineer will notify the prospective permittee within 45 days of receipt of a complete preconstruction notification whether NHPA Section 106 consultation is required. Section 106 consultation is not required when the Corps determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). If NHPA section 106 consultation is required and will occur, the district engineer will notify the non-Federal applicant that he or she cannot begin work until Section 106 consultation is completed.

(e) Prospective permittees should be aware that section 110k of the NHPA (16 U.S.C. 470h–2(k)) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the

ACHP and provide documentation specifying the circumstances, explaining the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

19. *Designated Critical Resource Waters*. Critical resource waters include: NOAA-designated marine sanctuaries, National Estuarine Research Reserves, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a state as having particular environmental or ecological significance and identified by the district engineer after notice and opportunity for public comment. The district engineer may also designate additional critical resource waters after notice and opportunity for comment.

    (a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, and 50 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

    (b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with general condition 27, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

20. *Mitigation*. The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that adverse effects on the aquatic environment are minimal:

    (a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

    (b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.

    (c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1⁄10 acre and require preconstruction notification, unless the district engineer determines in writing that some other form of mitigation would be more environmentally appropriate and provides a project-specific waiver of this requirement. For wetland losses of 1⁄10 acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in minimal adverse effects on the aquatic environment. Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, wetland restoration should be the first compensatory mitigation option considered.

    (d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation, such as stream restoration, to ensure that the activity results in minimal adverse effects on the aquatic environment.

    (e) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1⁄2 acre, it cannot be used to authorize any project resulting in the loss of greater than 1⁄2 acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that a project already meeting the established acreage limits also satisfies the minimal impact requirement associated with the NWPs.

    (f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the establishment, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, riparian areas may be the only compensatory mitigation required. Riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(g) Permittees may propose the use of mitigation banks, in-lieu fee arrangements or separate activity-specific compensatory mitigation. In all cases, the mitigation provisions will specify the party responsible for accomplishing and/or complying with the mitigation plan.

(h) Where certain functions and services of waters of the United States are permanently adversely affected, such as the conversion of a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse effects of the project to the minimal level.

21. *Water Quality*. Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA Section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

22. *Coastal Zone Management*. In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

23. *Regional and Case-By-Case Conditions*. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

24. *Use of Multiple Nationwide Permits*. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1⁄3-acre.

25. *Transfer of Nationwide Permit Verifications*. If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

''When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.''

_____ _____

(Transferee) (Date)

26. *Compliance Certification*. Each permittee who received an NWP verification from the Corps must submit a signed certification regarding the completed work and any required mitigation. The certification form must be forwarded by the Corps with the NWP verification letter and will include:

(a) A statement that the authorized work was done in accordance with the NWP authorization, including any general or specific conditions;

(b) A statement that any required mitigation was completed in accordance with the permit conditions; and

(c) The signature of the permittee certifying the completion of the work and mitigation.

27. *Pre-Construction Notification*.

(a) *Timing*. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, as a general rule, will request additional information necessary to

make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity:

(1) Until notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) If 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 17 that listed species or critical habitat might be affected or in the vicinity of the project, or to notify the Corps pursuant to general condition 18 that the activity may have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that is ''no effect'' on listed species or ''no potential to cause effects'' on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or Section 106 of the National Historic Preservation (see 33 CFR 330.4(g)) is completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee cannot begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) *Contents of Pre-Construction Notification*: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed project;

(3) A description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause; any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. The description should be sufficiently detailed to allow the district engineer to determine that the adverse effects of the project will be minimal and to determine the need for compensatory mitigation. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the project and when provided result in a quicker decision.);

(4) The PCN must include a delineation of special aquatic sites and other waters of the United States on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters of the United States, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many waters of the United States. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, where appropriate;

(5) If the proposed activity will result in the loss of greater than 1/10 acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan;

(6) If any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, for non-Federal applicants the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work. Federal applicants must provide documentation demonstrating compliance with the Endangered Species Act; and

(7) For an activity that may affect a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, for non-Federal applicants the PCN must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property. Federal applicants must provide documentation demonstrating compliance with Section 106 of the National Historic Preservation Act.

(c) *Form of Pre-Construction Notification*: The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is a PCN and must include all of the information required in paragraphs (b)(1) through (7) of this general condition. A letter containing the required information may also be used.

(d) *Agency Coordination*:

(1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the

project's adverse environmental effects to a minimal level.

(2) For all NWP 48 activities requiring pre-construction notification and for other NWP activities requiring preconstruction notification to the district engineer that result in the loss of greater than 1/2-acre of waters of the United States, the district engineer will immediately provide (e.g., via facsimile transmission, overnight mail, or other expeditious manner) a copy of the PCN to the appropriate Federal or state offices (U.S. FWS, state natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Office (THPO), and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will then have 10 calendar days from the date the material is transmitted to telephone or fax the district engineer notice that they intend to provide substantive, site-specific comments. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the preconstruction notification. The district engineer will fully consider agency comments received within the specified time frame, but will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each preconstruction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(3) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(4) Applicants are encouraged to provide the Corps multiple copies of pre-construction notifications to expedite agency coordination.

(5) For NWP 48 activities that require reporting, the district engineer will provide a copy of each report within 10 calendar days of receipt to the appropriate regional office of the NMFS.

(e) *District Engineer's Decision*: In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. If the proposed activity requires a PCN and will result in a loss of greater than 1/10 acre of wetlands, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for projects with smaller impacts. The district engineer will consider any proposed compensatory mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects to the aquatic environment of the proposed work are minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects on the aquatic environment are minimal, after considering mitigation, the district engineer will notify the permittee and include any conditions the district engineer deems necessary. The district engineer must approve any compensatory mitigation proposal before the permittee commences work. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure no more than minimal adverse effects on the aquatic environment. If the net adverse effects of the project on the aquatic environment (after consideration of the compensatory mitigation proposal) are determined by the district engineer to be minimal, the district engineer will provide a timely written response to the applicant. The response will state that the project can proceed under the terms and conditions of the NWP.

If the district engineer determines that the adverse effects of the proposed work are more than minimal, then the district engineer will notify the applicant either:

(1) That the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit;

(2) that the project is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level; or

(3) that the project is authorized under the NWP with specific modifications or conditions.

Where the district engineer determines that mitigation is required to ensure no more than minimal adverse effects occur to the aquatic environment, the activity will be authorized within the 45-day PCN period. The authorization will include the necessary conceptual or specific mitigation or a requirement that the applicant submit a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level. When mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan.

28. *Single and Complete Project.* The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

3. Regional Conditions for the Los Angeles District:

In accordance with General Condition Number 23, "Regional and Case-by-Case Conditions," the following Regional Conditions, as added by the Division Engineer, must be met in order for an authorization by any Nationwide to be valid:

1. For coastal watersheds from the southern reach of the Santa Monica Mountains in Los Angeles County to the San Luis Obispo County/Monterey County boundary, all road crossings must employ a bridge crossing design that ensures passage and/or spawning of steelhead (*Oncorhynchus mykiss*) is not hindered in any way. In these areas, bridge designs that span the stream or river, including designs for pier- or pile-supported spans, or designs based on use of a bottomless arch culvert simulating the natural stream bed (i.e., substrate and streamflow conditions in the culvert are similar to undisturbed stream bed channel conditions) shall be employed unless it can be demonstrated the stream or river does not support resources conducive to the recovery of federally listed anadromous salmonids, including migration of adults and smolts, or rearing and spawning. This proposal also excludes approach embankments into the channel unless they are determined to have no detectable effect on steelhead.

2. For the State of Arizona and the Mojave and Sonoran (Colorado) desert regions of California in Los Angeles District (generally north and east of the San Gabriel, San Bernardino, San Jacinto, and Santa Rosa mountain ranges, and south of Little Lake, Inyo County), no nationwide permit, except Nationwide Permits 1 (Aids to Navigation), 2 (Structures in Artificial Canals), 3 (Maintenance), 4 (Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities), 5 (Scientific Measurement Devices), 6 (Survey Activities), 9 (Structures in Fleeting and Anchorage Areas), 10 (Mooring Buoys), 11 (Temporary Recreational Structures), 20 (Oil Spill Cleanup), 22 (Removal of Vessels), 27 (Stream and Wetland Restoration Activities), 30 (Moist Soil Management for Wildlife), 31 (Maintenance of Existing Flood Control Projects), 32 (Completed Enforcement Actions), 35 (Maintenance Dredging of Existing Basins), 37 (Emergency Watershed Protection and Rehabilitation), 38 (Cleanup of Hazardous and Toxic Waste) and 47 (Pipeline Safety Program Designated Time Sensitive Inspections and Repairs), or other nationwide or regional general permits that specifically authorize maintenance of previously authorized structures or fill, can be used to authorize the discharge of dredged or fill material into a jurisdictional special aquatic site as defined at 40 CFR Part 230.40-45 (sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle-and-pool complexes).

3. For all projects proposed for authorization by nationwide or regional general permits where prior notification to the district engineer is required, applicants must provide color photographs or color photocopies of the project area taken from representative points documented on a site map. Pre-project photographs and the site map would be provided with the permit application. Photographs should represent conditions typical or indicative of the resources before impacts.

4. Notification pursuant to general condition 27 shall be required for projects in all special aquatic sites as defined at 40 CFR Part 230.40-45 (sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle-and-pool complexes), and in all perennial waterbodies in the State of Arizona and the Mojave and Sonoran (Colorado) desert regions of California in Los Angeles District (generally north and east of the San Gabriel, San Bernardino, San Jacinto, and Santa Rosa mountain ranges, and south of Little Lake, Inyo County), excluding the Colorado River from Davis Dam downstream to the north end of Topock and downstream of Imperial Dam (Federal Register dated March 12, 2007 (72 FR 11092) - regional conditions requiring notification do not apply to Nationwide Permit 47).

5. Notification pursuant to general condition 27 shall be required for projects in all areas designated as Essential Fish Habitat by the Pacific Fishery Management Council (i.e., all tidally influenced areas - Federal Register dated March 12, 2007 (72 FR 11092), regional conditions requiring notification do not apply to Nationwide Permit 47).

6. Notification pursuant to general condition 27 shall be required for projects in all watersheds in the Santa Monica Mountains in Los Angeles and Ventura counties bounded by Calleguas Creek on the west, by Highway 101 on the north and east, and by Sunset Boulevard and Pacific Ocean on the south (Federal Register dated March 12, 2007 (72 FR 11092) - regional conditions requiring notification do not apply to Nationwide Permit 47).

7. Individual permits shall be required for all discharges of fill material in jurisdictional vernal pools.

8. Individual permits shall be required in Murrieta Creek and Temecula Creek watersheds in Riverside County for new

permanent fills in perennial and intermittent watercourses otherwise authorized under NWPs 29, 39, 42 and 43, and in ephemeral watercourses for these NWPs for projects that impact greater than 0.1 acre of waters of the United States. In addition, when NWP 14 is used in conjunction with residential, commercial, or industrial developments the 0.1 acre limit would also apply.

9. Individual permits shall be required in San Luis Obispo Creek and Santa Rosa Creek in San Luis Obispo County for bank stabilization projects, and in Gaviota Creek, Mission Creek and Carpinteria Creek in Santa Barbara County for bank stabilization projects and grade control structures.

10. Notification pursuant to general condition 27 shall be required for projects in the Santa Clara River watershed in Los Angeles and Ventura counties, including but not limited to Aliso Canyon, Agua Dulce Canyon, Sand Canyon, Bouquet Canyon, Mint Canyon, South Fork of the Santa Clara River, San Francisquito Canyon, Castaic Creek, Piru Creek, Sespe Creek and the main-stem of the Santa Clara River (Federal Register dated March 12, 2007 (72 FR 11092) - regional conditions requiring notification do not apply to Nationwide Permit 47).

4. Further information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:
   ( ) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).
   (x) Section 404 of the Clean Water Act (33 U.S.C. 1344).
   ( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.
   (a) This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.
   (b) This permit does not grant any property rights or exclusive privileges.
   (c) This permit does not authorize any injury to the property or rights of others.
   (d) This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:
   (a) Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.
   (b) Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.
   (c) Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.
   (d) Design or construction deficiencies associated with the permitted work.
   (e) Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:
   (a) You fail to comply with the terms and conditions of this permit.
   (b) The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).
   (c) Significant new information surfaces which this office did not consider in reaching the original public interest decision.

   Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 330.5 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measure ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. This letter of verification is valid for a period not to exceed two years unless the nationwide permit is modified, reissued, revoked, or expires before that time.

7. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition H below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

8. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished with the terms and conditions of your permit.

AGREEMENT

California Fish and Game Code Section 1602
Stream Alteration Agreement No. 2009-0091-R4
California Department of Transportation
Santa Maria River – San Luis Obispo County
05-SLO-101 PM 0.0-0.8 EA 05-44590

Parties:

California Department of Fish and Game
Central Region
1234 East Shaw Avenue
Fresno, California 93710

California Department of Transportation
Karen Bewley
50 Higuera Street
San Luis Obispo, California 93401

WHEREAS:

1. Ms. Karen Bewley, representing the California Department of Transportation (referred to as "Caltrans") on June 29, 2009, notified ("Notification" No. 2009-0091-R4) the Department of Fish and Game ("Department") of their intent to divert or obstruct the natural flow of, or change the bed or banks of, or use materials from the Santa Maria River in San Luis Obispo County, waters over which the Department asserts jurisdiction pursuant to Division 2, Chapter 6 of the California Fish and Game Code.

2. Caltrans may not commence any activity that is subject to Fish and Game Code Sections 1600 et seq., until the Department has found that such Project shall not substantially adversely affect an existing fish or wildlife resource or until the Department's proposals, or the decisions of a panel of arbitrators, have been incorporated into such projects.

3. Fish and Game Code Sections 1600 et seq., make provisions for the negotiation of agreements regarding the delineation and definition of appropriate activities, Project modifications and/or specific measures necessary to protect fish and wildlife resources.

4. The Department has determined that without the protective features identified in this Agreement, the activities proposed in the Notification could substantially adversely affect fish and wildlife.

NOW THEREFORE, IT IS AGREED THAT:

1. The receipt of this document ("Agreement"), by Caltrans, satisfies the Department's requirement to notify Caltrans of the existence of an existing fish and wildlife resource that may be substantially adversely affected by the Project that is described in the Notification.

2. The contents of this Agreement constitute the Department's proposals as to measures necessary to protect fish and wildlife resources, and satisfy the Department's requirement to submit these proposals to Caltrans.

3. The signature of Caltrans' representative on this Agreement constitutes Caltrans' commitment to incorporate the Department's proposals into the Project that is described in the Notification.

4. This Agreement does not exempt Caltrans from complying with all other applicable local, State, and Federal law or other legal obligations.

5. This Agreement, alone, does not constitute or imply the approval or endorsement of a Project, or of specific Project features, by the Department, beyond the Department's limited scope of responsibility, established by Code Sections 1600 et seq. This Agreement does not therefore assure concurrence, by the Department, with the issuance of permits from this or any other agency. Independent review and recommendations shall be provided by the Department as appropriate on those projects where local, State, or Federal permits or environmental reports are required.

6. This Agreement does not authorize the "take" (defined in Fish and Game Code Section 86 as hunt, pursue, catch, capture, kill; or attempt to hunt, pursue, catch, capture, or kill) of State-listed threatened or endangered species. If the Operator, in the performance of the agreed work, discovers the presence of a listed species in the Project work area, work shall stop immediately. Caltrans shall not resume activities authorized by this Agreement until such time as valid "take" permits are obtained from the Department, pursuant to Fish and Game Code Sections 2081(a) and 2081(b), as appropriate.

7. To the extent that the Provisions of this Agreement provide for the diversion of water, they are agreed to with the understanding that Caltrans possesses the legal right to so divert such water.

8. To the extent that the Provisions of this Agreement provide for activities that require Caltrans to trespass on another owner's property, they are agreed to with the understanding that Caltrans possesses the legal right to so trespass.

9. To the extent that the Provisions of this Agreement provide for activities that are subject to the authority of other public agencies, said activities are agreed to with the understanding that all appropriate permits and authorizations shall be obtained prior to commencing agreed activities.

10. All Provisions of this Agreement remain in force throughout the term of the Agreement. Any Provision of the Agreement may be amended at any time, provided such amendment is agreed to in writing by both parties. Mutually approved amendments become part of the original Agreement and are subject to all previously negotiated Provisions. The Agreement may be terminated by either party, subject to 30 days written notification.

11. Caltrans shall provide a copy of the Agreement to the Project supervisors and all contractors and subcontractors. Copies of the Agreement shall be available at work sites during all periods of active work and shall be presented to Department personnel upon demand.

12. Caltrans agrees to provide the Department access to the Project site at any time to ensure compliance with the terms, conditions, and Provisions of this Agreement.

13. Caltrans and any contractor or subcontractor, working on activities covered by this Agreement, are jointly and separately liable for compliance with the Provisions of this Agreement. Any violation of the Provisions of this Agreement is cause to stop all work immediately until the problem is reconciled. Failure to comply with the Provisions and requirements of this Agreement may result in prosecution.

14. Caltrans assumes responsibility for the restoration of any fish and wildlife habitat which may be impaired or damaged either directly or, incidental to the Project, as a result of failure to properly implement or complete the mitigation features of this Agreement, or from activities which were not included in the Caltrans' Notification.

15. It is understood that the Department enters into this Agreement for purposes of establishing protective features for fish and wildlife, in the event that a Project is implemented. The decision to proceed with the Project is the sole responsibility of Caltrans, and is not required by this Agreement. It is agreed that all liability and/or incurred costs, related to or arising out of Caltrans' Project and the fish and wildlife protective conditions of this Agreement, remain the sole responsibility of Caltrans. Caltrans agrees to hold harmless and defend the Department against any related claim made by any party or parties for personal injury or other damage.

16. The terms, conditions, and Provisions contained herein constitute the limit of activities agreed to and resolved by this Agreement. The signing of this Agreement does not imply that Caltrans is precluded from doing other activities at the site. However, activities not specifically agreed to and resolved by this Agreement are subject to separate notification pursuant to Fish and Game Code Sections 1600 et seq.

California Environmental Quality Act (CEQA) Compliance: In approving this Agreement, the Department is independently required to assess the applicability of CEQA. The features of this Agreement shall be considered as part of the overall Project description. Caltrans' concurrence signature on this Agreement serves as confirmation to the Department that the activities that shall be conducted under the terms of this Agreement are consistent with the Project described in Notification No. 2009-0091-R4. Caltrans submitted a Mitigated Negative Declaration, approved on August 23, 2006, State Clearinghouse number 2006071039.

The Department, as a CEQA Responsible Agency, shall make findings and submit a Notice of Determination to the State Clearinghouse upon signing this Agreement.

This Agreement contains a Monitoring and Reporting Program (MRP), to incorporate monitoring and reporting requirements for the activities authorized in this Agreement.

Project Location: The work authorized by this Agreement will occur adjacent to the existing State Route (SR) 101 bridge (Br. No. 49-0111R&L) over the Santa Maria River at Post Mile (PM) 0.0-0.8 in Section 35 of Township 11 North, Range 34 West in San Luis Obispo County (**Figure 1**).

Project Description: Caltrans' Notification includes Fish and Game Notification Form FG2023 and supporting documents. The Notification comprises Caltrans' Project description, and it is used as the basis for establishing the protective Provisions that are included in this Agreement. Any changes or additions to the Project as described in the Notification shall require additional consultation and protective Provisions. The Department's concurrence with Caltrans' CEQA Determination is based upon Caltrans' commitment to full implementation of the Provisions of this Agreement. Caltrans has proposed the following scope of work. The bulleted items comprise the activities authorized by this Agreement.

- The existing Santa Maria Bridge would be widened to accommodate one additional 12-foot northbound lane, one additional 12-foot southbound lane, a 12-foot Class 1 bicycle path on the southbound side and 10-foot shoulders. The proposed widening will extend the width of the bridges from 68 feet to 130 feet and 10 inches, by filling the 36-foot median gap in between the existing bridges, and widening the structure 20 feet 5 inches to the west and 6 feet 5 inches to the east.

- Work will be done over the river channel when water is present, but no work will be done in the wetted portion of the channel.

- There will be approximately 12,474 square feet (0.29 acres) of permanent impacts to the Santa Maria River from pier and abutment extensions. A maximum of 660,816 square feet (15.17 acres) of temporary impacts will occur from construction activity. The substrate of the river at this location is primarily silt and sand, no cobble, gravel, pools, or riffles are present. The riparian vegetation is sparse and consists primarily of mulefat, arroyo willow, and coyote brush.

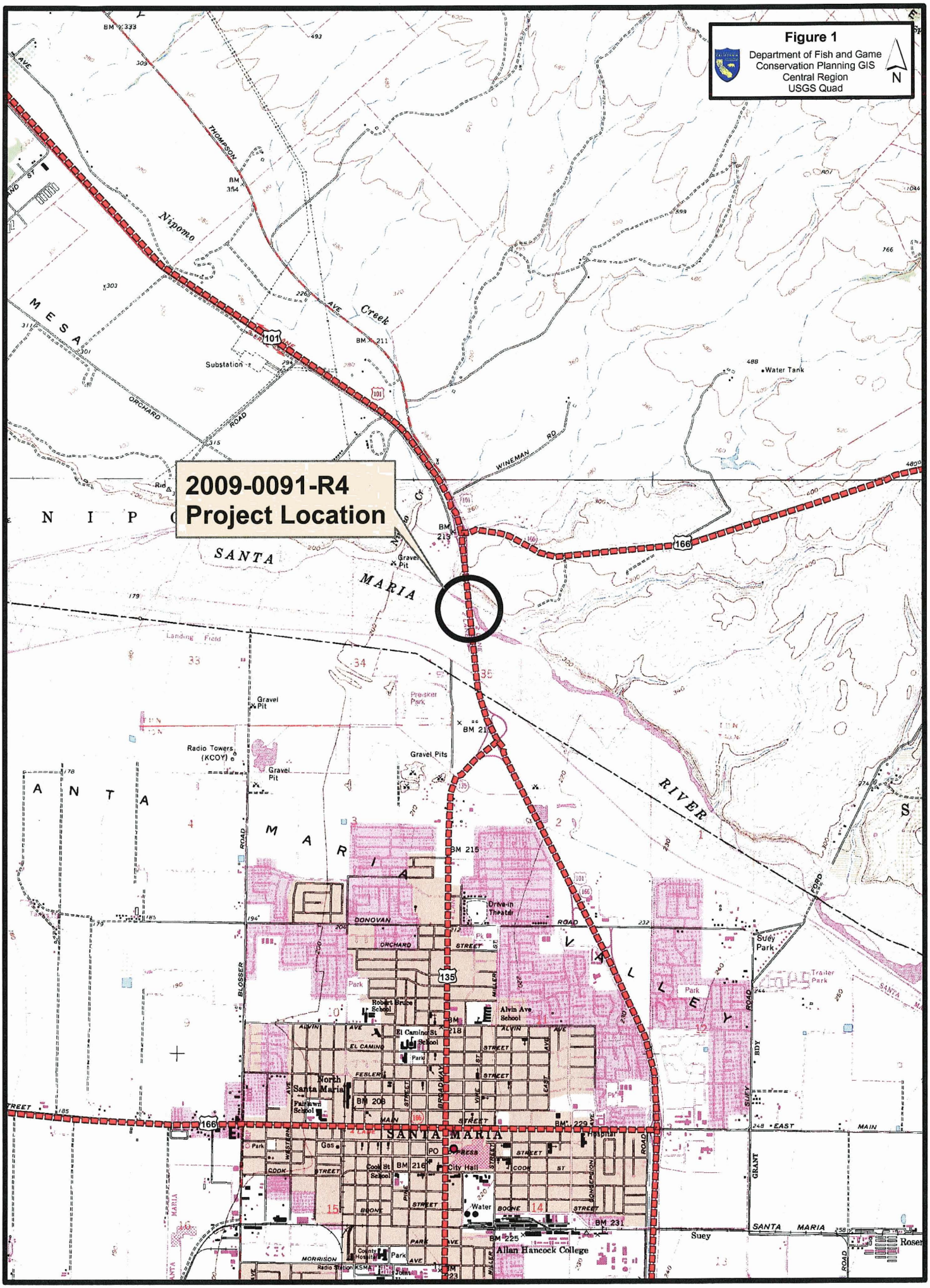


Figure 1
Department of Fish and Game
Conservation Planning GIS
Central Region
USGS Quad
N
2009-0091-R4
Project Location
Nipomo
Creek
MESA
SANTA
MARIA
RIVER
VALLEY
SANTA MARIA
North Santa Maria
Allan Hancock College
City Hall
Drive-in Theater
Radio Towers (KCOY)
Gravel Pit
Gravel Pits
Substation
Water Tank
Landing Field
Suey Park
Trailer Park
Robert Bruce School
Alvin Ave School
El Camino St School
Fairlawn School
Cook St School
County Hospital
Radio Station KSMA
Suey
Rosen
THOMPSON
ORCHARD ROAD
WINEMAN RD
DONOVAN
ORCHARD
BLOSSER
MILLER
ALVIN
EL CAMINO
FESLER
MAIN
COOK
BOONE
MORRISON
SUEY
GRANT
EAST MAIN
SANTA MARIA
166
101
135

Plant and Animal Species of Concern: This Agreement is intended to avoid, minimize, and mitigate adverse impacts to the fish and wildlife resources that occupy the area of the Santa Maria River, and the immediate adjacent riparian habitat. The protective measures described in this Agreement must be implemented in order to avoid impacts, within the area covered by this Agreement, to the following species:

California red-legged frog (*Rana aurora draytonii*), Federal Threatened
Steelhead (*Oncorhynchus mykiss irideus*), Federal Threatened
Western spadefoot (*Spea hammondii*), Species of Special Concern
Pallid bat (*Antrozous pallidus*), Species of Special Concern
Burrowing owl (*Athene cunicularia*), Species of Special Concern
Coast horned lizard (*Phrynosoma coronatum*), Species of Special Concern
Monarch butterfly (*Danaus plexippus*), California Natural Diversity Database (CNDDB) but not listed

California red-legged frogs (CRLF) are known to occur in the vicinity of the Project. Caltrans will be following 16 avoidance and minimization measures from the programmatic Biological Opinion issued for CRLF. A Caltrans 2005 survey did not find any CRLF tadpoles or egg masses in the Project area. According to the Caltrans Natural Environmental Study, steelhead trout are known to use this portion of the Santa Maria River. There were two (2) CNDDB records for Western spadefoot 3 miles to the west and downstream of the Project site in 1995. A small number of pallid bats were observed using the Santa Maria River Bridge as a night roost in 2000; however, they were not seen during 2005 surveys. No burrowing owls were seen during previous surveys, and very few ground squirrel burrows were observed. One Coast horned lizard was observed at the Project site in July 2001. There was a CNDDB record for Monarch butterflies winter roosting at Preisker Park to the southwest of the Project site. They do not roost in the Project footprint.

These species as well as the other birds, mammals, fish, reptiles, amphibians, invertebrates, and plants that comprise the local riparian ecosystem. Departmental files contain lists of species that could be subject to potential generated impacts from this Project if the following Provisions are not followed.

PROVISIONS:

General

1. The Notification, together with all supporting documents, is hereby incorporated into this Agreement to describe the location and features of the proposed Project. Caltrans agrees that all work shall be done as described in the Notification and supporting documents, incorporating all wildlife resource protection features, mitigation measures, and Provisions as described in this Agreement. Caltrans further agrees to notify the Department of any modifications that need to be made to the Project plans submitted to the Department. At the discretion of the Department, modifications may be deemed minor, requiring an amendment to this Agreement, or substantial requiring

the submission of a new notification application. If the latter is the case, this Agreement becomes null and void. Failure to notify the Department of changes to the original plans or subsequent amendments to this Agreement may result in the Department suspending or canceling this Agreement.

2. Before the start of construction/work activities covered under this Agreement, all workers shall have received training from Caltrans' staff, or approved alternate trainer, on the content of this Agreement, the resources at stake, and the legal consequences of non-compliance.

3. When known, prior to beginning work, Caltrans shall provide a construction/work schedule to the Department (fax to Laura Peterson-Diaz, Environmental Scientist, at (559) 243-4020). Please reference the Agreement number. Caltrans shall also notify the Department upon the completion of the activities covered by this Agreement.

4. Agreed activities within the bed, bank, or channel may commence any time after the Department has signed this Agreement. This Agreement shall remain in effect for five (5) years beginning on the date signed by the Department. If the Project is not completed prior to the expiration date defined above, Caltrans shall contact the Department to negotiate a new expiration date and any new requirements.

Flagging/Fencing

5. Within the riparian corridor, Caltrans shall identify the upstream and downstream limits of the minimum work area required, access routes, the Project footprint, plus all Environmentally Sensitive Areas (ESA). These boundaries shall be defined by the Caltrans' Project engineer and biologist, and flagged/fenced prior to the beginning of construction. These limits shall not extend beyond Caltrans' right-of-way and/or the construction easement, and shall be confined to the minimal area needed to accomplish the proposed work. Flagging/fencing shall be maintained in good repair for the duration of construction in the area under 1602 jurisdiction.

Wildlife

6. An approved biologist shall perform general wildlife surveys of the Project area (including access routes and storage areas) prior to Project construction start with special attention being paid to the sensitive species noted above and shall report any possible adverse affect to fish and wildlife resources not originally reported. If the survey shows presence of any wildlife species which could be impacted, Caltrans shall contact the Department and mitigation, specific to each incident, shall be developed. If any State- or Federal-listed threatened or endangered species are found within the proposed work area or could be impacted by the work proposed, a new Agreement and/or a 2081(b) State Incidental Take Permit may be necessary and a new CEQA analysis may need to be conducted, before work can begin.

7. If work is done between March 1 and September 1, then in order to protect nesting birds, an approved biologist shall survey for nesting activity in and adjacent to the defined "work area", before construction begins. If any nesting activity is observed, which could be disturbed by the proposed scope of work, Caltrans shall contact the Department and mitigation, specific to each incident, shall be developed.

8. Swallows: If Caltrans cannot avoid work on the bridges where there is the potential for disturbance of nesting swallows (February 15 through August 15), then prior to February 1, of each year, Caltrans shall remove all existing inactive nests which would be destroyed by the Project. Caltrans shall continue to discourage new nest building in places where they would be disturbed, using methods developed in consultation with the Caltrans District Biologist and the Department. Prior to nesting season, a swallow exclusion device, with visual warnings for the birds to prevent entanglement must be installed. Where disturbance shall occur, nesting must be discouraged throughout the nesting season.

9. Bats: Small numbers of pallid bats have used the Santa Maria River Bridge as a night roost in the past. No bats shall be directly disturbed without specific notice to and consultation with the Department. Pre-construction surveys by a qualified biologist shall be performed to determine if bat species are currently utilizing the bridge for roosting. If bats are using the existing bridge as a roosting site, exclusion of these bats shall take place a minimum of four (4) weeks prior to construction. If after four (4) weeks exclusion measures are unsuccessful and bat species still utilize the bridge for roosting, Caltrans shall contact the Department and mitigation shall be developed in consultation with the Department.

10. Steelhead Trout: No work shall take place in the wetted channel of the Santa Maria River which shall be treated as an ESA. Debris shields shall be put in place to prevent construction materials or tools from falling or rolling into the water. Debris shields may be silt fence, boards, or any temporary materials that would prevent construction materials and fine sediments from entering the river. These measures shall be inspected on a daily basis to ensure they are functioning properly to protect anadromous fish.

11. If any wildlife is encountered during the course of construction, said wildlife shall be allowed to leave the construction area unharmed.

Vegetation

12. For this Project, no riparian trees or shrubs with trunks greater than or equal to four (4) inches in diameter at breast height (DBH) will be removed. The riparian vegetation is sparse in the Project area and consists primarily of mulefat, arroyo willow, and coyote brush. Precautions shall be taken to avoid any unnecessary damage to any vegetation by people or equipment for the duration of the Project.

Vehicles

13. Construction vehicles and heavy equipment access to the stream banks and bed shall be limited to predetermined ingress and egress corridors and shall be restricted to the dry portions of the channel. All other areas adjacent to the work site shall be considered an ESA and shall remain off-limits to construction equipment.

Pollution

14. Caltrans and all contractors and subcontractors shall be subject to the pollution protective and other features of Department of Transportation Standard Specifications Section 7-1.01G and Fish and Game Code Sections 5650 and 12015. In addition, all Project-generated debris, building materials, and rubbish shall be removed from the river and from areas where such materials could be washed into it.

15. Staging and storage areas for equipment, materials, fuels, lubricants, and solvents shall be located more than 75 feet from the stream channel and banks. Any equipment or vehicles driven and/or operated within or adjacent to the stream shall be checked and maintained daily to prevent leaks of materials that, if introduced to water, could be deleterious to aquatic life. Stationary equipment such as cranes, drill rig, pile driver and similar equipment, located within or adjacent to the stream, shall be positioned over drip-pans.

16. If a spill should occur, cleanup shall begin immediately. The Department shall be notified as soon as possible by Caltrans and shall be consulted regarding further cleanup procedures.

17. All Project-generated debris, building materials, and rubbish shall be removed from the stream and from areas where such materials could be washed into the stream. Excavated materials shall not be stockpiled in a location where they could discharge into the channel without implementing management measures to prevent accidental discharge into the stream.

Erosion

18. All disturbed soils shall be stabilized to reduce erosion potential, both during and following construction. Erosion control Best Management Practices (BMPs) shall be applied to all disturbed areas.

Fill/Spoil

19. Rock, gravel, and/or other materials shall not be imported into or moved within the stream, except as otherwise addressed in this Agreement. Only on-site materials and clean imported fill shall be used to complete the Project.

20. Fill shall be limited to the minimal amount necessary to accomplish the agreed activities. Excess fill material shall be moved off-site at Project completion.

21. All cleared debris shall be removed from the normal high water areas of a stream or channel and shall not be redeposited within the flood plain. Spoil sites shall not be located within a stream or wetland, where spoil could be washed back into a stream, or where it covers aquatic or riparian vegetation.

Restoration

22. Excess material must be removed from the Project site, pursuant to Department of Transportation Standard Specifications Section 7-1.13.

23. Caltrans shall make the final contour of the site match the adjacent slope of the land and provide the appropriate surface water drainage. All areas subject to temporary ground disturbance, including storage and staging areas, temporary roads, pipeline corridors, etc., shall be recontoured, if necessary, and revegetated to promote restoration of the area.

24. All areas subject to ground disturbance on the bank shall be stabilized. Planting, seeding with native species, and mulching is conditionally acceptable. Where suitable vegetation cannot reasonably be expected to become established, non-erodible material shall be used for such stabilization. Any installation of non-erodible material, not included in the original Project description, shall be coordinated with the Department. Coordination may include the negotiation of additional Agreement Provisions for this activity.

MONITORING AND REPORTING PROGRAM (MRP):

PURPOSE

The purpose of the MRP is to ensure that the protective measures required by the Department are properly implemented, and to monitor the effectiveness of those measures.

OBLIGATIONS OF THE OPERATOR

Caltrans shall have primary responsibility for monitoring compliance with all protective measures included as "Provisions" in this Agreement. Protective measures must be implemented within the time periods indicated in the Agreement and the program described below.

Caltrans shall submit the following Reports to the Department:

- Verification of employee training (Provision 2).
- Construction/work schedule (Provision 3).
- Wildlife survey results (Provisions 6 and 9).
- A Final Project Report submitted within 30 days after the Project is completed. The final report shall summarize the Project construction, including any problems relating to the protective measures of this Agreement. "Before and After" photo documentation of the Project site shall be required.

In addition to the above monitoring and reporting requirements, the Department requires as part of this MRP that Caltrans:

- Immediately notify the Department in writing if monitoring reveals that any of the protective measures were not implemented during the period indicated in this program, or if it anticipates that measures will not be implemented within the time period specified.
- Immediately notify the Department if any of the protective measures are not providing the level of protection that is appropriate for the impact that is occurring, and recommendations, if any, for alternative protective measures.

VERIFICATION OF COMPLIANCE:

The Department shall verify compliance with protective measures to ensure the accuracy of Caltrans' monitoring and reporting efforts. The Department may, at its sole discretion, review relevant Project documents maintained by Caltrans, interview Caltrans' employees and agents, inspect the Project area, and take other actions to assess compliance with or effectiveness of protective measures for the Project.

CONCURRENCE:

APPROVED BY THE CALIFORNIA DEPARTMENT OF FISH AND GAME

on 11-25, 2009.

For Julie Means

Jeffrey R. Single, Ph.D.
Regional Manager
Central Region

ACKNOWLEDGMENT

The undersigned acknowledges receipt of this Agreement and, by signing, accepts and agrees to comply with all terms and conditions contained herein. The undersigned also acknowledges that adequate funding shall be made available to implement the measures required by this Agreement.

By: _____ Date: 11/23/2009

Karen Bewley
California Department of Transportation

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. GORDON DANKE
BRANCH CHIEF
Division of Engineering Services
Structural Design-Mail Station 9
Office of Bridge Design-Branch 9

Date: August 4, 2009

File: 05-SLO-101- PM 0.0/0.8
Santa Maria River Bridge (widen)
Br. No. 49-0111R/L
E.A. 05-445901

Attn: Pete Norboe

Rec'd 8/17/09

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services – MS 5
Office of Geotechnical Design – North

Subject: Foundation Report

Introduction

The Office of Geotechnical Design-North (OGD-N) has prepared the Foundation Report for the proposed median, west and east side widening of Santa Maria River Bridge (Br. No. 49-0111) located on Route 101 at PM 0.0/0.8, in San Luis Obispo County, California, near the City of Santa Maria. The bridge site is plotted on the Location Map (Figure 1).

The following foundation recommendations are based on the subsurface information gathered during a recent subsurface investigation (May 2008 through August 2008) along with a review of the previous foundation reports, As-Built records and Log of Test Borings (LOTB) for the existing bridge. With regards to the foundation recommendations provided in this report, elevations are based on the NAVD 88 vertical datum, and horizontal coordinates are based on the NAD83 horizontal datum, unless otherwise noted.

The following Department of Transportation, Caltrans records and resources were considered during the preparation of the Foundation Report:

- Structure Plan for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated February 17th, 25th, 26th, March 2nd, and April 29th of 2009.
- General Plans for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated March 14th and 29th of 2009.
- Foundation Plans for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated March 9th, 10th and 11th, April 14th and 29th of 2009.
- Abutment Details No. 6 for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated February 1, 2009.
- Final Hydraulics Report for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated May 17, 2007.
- Upstream Section for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated January 14, 2005.
- Bridge Inspection Report for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated January 14, 2005.

- As-Built General Plan (Earthquake Retrofit Project No. 812) for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated May 12, 1997.
- As-Built Abutment Details Plans (Earthquake Retrofit Project No. 812) for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated May 12, 1997.
- As-Built Abutment 1 and 30 Layout Plans (Earthquake Retrofit Project No. 812) for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated May 12, 1997.
- As-Built Foundation Location Plan 1 and 2 (Earthquake Retrofit Project No. 812) for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated May 12, 1997.
- As-Built Piers 3, 6, 9, 12, 15, 18, 21, 24, 27, 28, & 29 Plan (Earthquake Retrofit Project No. 812) for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated May 12, 1997.
- As-Built Piers 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20, 22, 23, 25, & 26 Plan (Earthquake Retrofit Project No. 812) for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated May 12, 1997.
- As-Built Pier Details 1, 2 and 3 Plans (Earthquake Retrofit Project No. 812) for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated May 12, 1997.
- As-Built Log of Test Borings No. 1, No. 2 and No. 3 (Earthquake Retrofit Project No. 812) for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated May 12, 1997.
- Final Foundation Report for the Seismic Retrofit Analysis of Santa Maria River Bridge (Br. No. 49-0111R/L) completed by Earth Mechanics, Inc. dated April 30, 1997.
- As-Built General Plan (Joint Seal Replacement) for the Santa Maria River Bridges (Br. No. 49-0111R/L) dated March 4, 1991.
- As-Built General Plan for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated August 15, 1960.
- As-Built Foundation Plan for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated August 15, 1960.
- As-Built Abutment Details 1 and 2 Plans for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated August 15, 1960.
- As-Built Abutment 1 and 30 Plans for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated August 15, 1960.
- As-Built Piers Plan for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated August 15, 1960.
- As-Built Pile Logs Sheets (four pages) for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated August 15, 1960.
- As-Built Log of Test Boring Sheet for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated August 15, 1960.
- As-Built Pile Details Sheet for Nine Santa Maria Structures dated August 15, 1960.
- Foundation Report for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated October 17, 1956.
- Foundation Review for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated November 14, 1956.
- Pile Driving Records for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated July through October 1961.

Project Description

The existing Santa Maria River Bridge (Br. No. 49-0111R/L) consists of two 29 span bridge structures. Both structures were built in 1962, each carrying two lanes of traffic. The existing right and left structures are approximately 2092.8 feet in length and a minimum of 34.0 feet in width. The existing structures are simple precast, prestressed "I" girders (5) on solid pier walls and open-end seat abutments. The existing structures are supported on 12-inch diameter Southern Pipe Cast-in-place-Alternative U, steel shells filled with concrete. The existing structures span the Santa Maria River that is bordered by levees to the north and south. Abutment 1 is located on the south levee and Abutment 30 is located on the north levee. In 1986, the existing structures were seismically upgraded with cable restrainers. This upgrade also included replacing the existing rocker bearings at the abutments with bearing pads and enlarging the existing abutment pedestals. The bridges were seismically retrofitted in 1997 by installing 48-inch diameter Cast-In-Drilled-Hole (CIDH) piles at Piers 3, 6, 9, 12, 15, 18, 21, 24, 27, 28, and 29. At the other piers, collar beams were added at the base of the pier walls.

The proposed widening will connect the existing bridges by filling the median gap (approx. 36 ft). Additionally, the structure will be widened 19 feet 10 inches on the west side and 6 feet 5 inches on the east side. The proposed widenings consist of precast, prestressed "I" girders supported on widened abutments and solid piers. All the abutment and pier widenings will be supported on 48-inch Cast-In-Steel-Shell (CISS) piles.

Site Geology and Subsurface Conditions

Regional Setting and Area Geology

The project site is located within the Coast Range geomorphic province, more specifically the Southern Coast Range. The Coast Ranges extend approximately 600 miles from the Oregon border to the Santa Ynez River. The Coast Ranges may be divided into two subprovinces: the ranges north of San Francisco Bay and the ranges from the San Francisco Bay south to Santa Barbara County (Norris, 1976). The Santa Maria River Valley is located in Santa Barbara County between the San Luis Range and The Casmalia Hills. The valley was formed by late Cenozoic uplift of the Coast Ranges, like many alluvial valleys along the California Coast (Norris, 1976).

Based on the "Geologic Map of the Santa Maria and Twitchell Dam quadrangles, Santa Barbara and San Luis Obispo Counties, California," prepared by T.W. Dibblee, 1994 (Dibblee Geological Foundation, Map DF-51), the project vicinity is underlain by four geologic units. The four units mapped are Surficial Sediments (Qg/Qa), Older Alluvium (Qoa), Orcutt formation (Qo), and Paso Robles formation (QTp). Descriptions of the geologic units mapped in this area (Figure 2) can be found in Dibblee and the US Geological Survey professional paper entitled "Geology and Paleontology of the Santa Maria District" (Woodring and Bramlette, 1950). The alluvium mapped in the Santa Maria area may be divided into two units. The upper unit consists of Surficial Sediments that are described as a mixture of sand and gravel deposited as stream channel deposits (Qg) and valley-floodplain alluvium (Qa). The lower unit, the Quaternary Older alluvium (Qoa) consists of dissected alluvial gravel, boulders, sand, and minor amounts of clay. The alluvium is considered to be Holocene in age and is approximately 50 feet in thickness

at the site. The alluvium rests unconformably on the Orcutt formation (Qo). The Orcutt formation is Pleistocene in age and consists of tan to rusty brown wind-deposited sand, and alluvial gravel. The Orcutt sand may be regarded as a terrace deposit. The thickness of the Orcutt formation in the Santa Maria district is between 50 and 100 feet. The Orcutt formation unconformably overlies the Paso Robles Formation. The Paso Robles formation (QTp) is considered to be Pliocene and Pleistocene in age and consists of crudely bedded, gray, weakly consolidated alluvial gravel, sand and clay. Sand and gravel are the principal constituents of the Paso Robles formation. Clay and fresh water limestone are minor, but the most characteristic constituents. Fresh water fossils are common in the limestone. Most of the Paso Robles formation is gray in color, except for the silty clay and silty sand in the upper part of the formation. These deposits are light brown. Limestone is mapped at the base of the formation (Woodring and Bramlette, 1950). The limestone is discontinuous and absent from many locations. The Paso Robles Formation has a maximum thickness of about 2,000 feet in the Santa Maria River Valley.

Field Investigation and Subsurface Conditions

The Office of Geotechnical Design-North conducted a subsurface investigation May through August of 2008.

The 2008 subsurface investigation consisted of thirty-nine mud rotary borings (Nos. R-08-001 through R-08-037, R-08-037A and R-08-038). The mud rotary borings were advanced using a self-casing wireline drilling method. The maximum depth reached by the 2008 subsurface investigation is approximately elevation 79.0 feet. Sampling was achieved in all borings by utilizing the Standard Penetration Test (SPT) sampler. Selected soil samples were tested in the Caltrans soils laboratory. A summary of the borings drilled during the subsurface investigation is included below in Table 1.

Table 1. The 2008 Subsurface Exploration Summary for Santa Maria River Bridge (Br. No. 49-0111R/L)

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency	Approx. Ground Surface Elevation (ft)	Boring Depth (ft)
R-08-001	5/22/08	CME750	CME Auto	1.27	228.8	143.0
R-08-002	5/30/08	CS1000	Diedrich Auto	1.33	208.1	117.2
R-08-003	5/29/08	CME750	CME Auto	1.27	208.5	121.5
R-08-004	6/1/08	CS1000	Diedrich Auto	1.33	208.7	123.0
R-08-005	6/2/08	CME750	CME Auto	1.27	209.0	110.0
R-08-006	6/2/08	CS1000	Diedrich Auto	1.33	212.5	112.2
R-08-007	6/4/08	CME750	CME Auto	1.27	212.9	111.5
R-08-008	6/4/08	CS1000	Diedrich Auto	1.33	212.8	112.0
R-08-009	6/11/08	CME750	CME Auto	1.27	207.4	121.5
R-08-010	6/12/08	CS1000	Diedrich Auto	1.33	205.8	122.0
R-08-011	6/18/08	CME750	CME Auto	1.27	207.0	80.5
R-08-012	6/19/08	CS1000	Diedrich Auto	1.33	206.8	112.3

Table 1. The 2008 Subsurface Exploration Summary for Santa Maria River Bridge (Br. No. 49-0111R/L) (Continued)

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency	Approx. Ground Surface Elevation (ft)	Boring Depth (ft)
R-08-013	6/21/08	B80	Safety	Unknown	212.2	102.5
R-08-014	6/22/08	CS1000	Diedrich Auto	1.33	208.4	112.3
R-08-015	6/23/08	B-80	Safety	Unknown	215.4	106.8
R-08-016	6/24/08	CS1000	Diedrich Auto	1.33	208.8	116.5
R-08-017	6/25/08	B-80	Safety	Unknown	230.9	151.8
R-08-018	7/2/08	CS1000	Diedrich Auto	1.33	208.9	121.5
R-08-019	7/9/08	CS1000	Diedrich Auto	1.33	207.9	122.0
R-08-020	7/10/08	CS1000	Diedrich Auto	1.33	207.8	122.0
R-08-021	7/11/08	CS1000	Diedrich Auto	1.33	206.4	122.0
R-08-022	7/12/08	CS1000	Diedrich Auto	1.33	206.4	122.0
R-08-023	7/14/08	CS1000	Diedrich Auto	1.33	206.4	122.0
R-08-024	7/15/08	CS1000	Diedrich Auto	1.33	206.9	121.2
R-08-025	7/18/08	CS1000	Diedrich Auto	1.33	207.4	122.0
R-08-026	7/20/08	CS1000	Diedrich Auto	1.33	205.9	122.5
R-08-027	7/23/08	CS1000	Diedrich Auto	1.33	205.8	122.5
R-08-028	7/24/08	CS1000	Diedrich Auto	1.33	206.2	122.0
R-08-029	7/26/08	CS1000	Diedrich Auto	1.33	205.2	122.5
R-08-030	7/28/08	CS1000	Diedrich Auto	1.33	206.5	103.5
R-08-031	7/31/08	CS1000	Diedrich Auto	1.33	206.0	120.5
R-08-032	8/6/08	CS1000	Diedrich Auto	1.33	204.9	120.5
R-08-033	8/6/08	CME750	CME Auto	1.27	203.8	122.0
R-08-034	8/13/08	CS1000	Diedrich Auto	1.33	202.3	120.5
R-08-035	8/13/08	CME750	CME Auto	1.27	202.9	111.5
R-08-036	8/20/08	CME750	CME Auto	1.27	206.8	107.0
R-08-037	8/21/08	CME750	CME Auto	1.27	207.6	57.5
R-08-037A	8/23/08	CS1000	Diedrich Auto	1.33	207.6	107.0
R-08-038	8/26/08	CME750	CME Auto	1.27	231.2	152.0

Note: Borings R-08-011 and R-08-037 were terminated at shallow depths due to a mechanical breakdown of the drill rig.

The soil encountered during the 2008 subsurface investigation generally consists of predominately granular soil with strata of cohesive soil. The granular soil consists of loose to very dense sand, silty sand, gravel, cobbles and some boulders. The cohesive soil consists of soft to hard sandy lean, sandy fat clay, clayey sand, lean clay with sand, fat/lean clay and silt. Some soil layers contain shells, shell fragments and wood fragments. Some soil layers have an organic odor and others have a sulfur odor. Some of the soil strata are weakly to strongly cemented below approximate elevation 168.0 in the area between Pier 27 and Abutment 30, and below approximate elevation 120.0 feet in the area between Pier 10 and Pier 26. Table 11 and 12 summarize the encountered subsurface conditions that may be of particular interest.

Near Abutment 1, approximately 18 feet of fill material was encountered in Boring R-08-001. The fill material generally consists of loose to very dense silty gravel with sand, poorly graded sand with silt and gravel, and silty sand. Below the fill material is approximately 114.0 feet of medium dense to very dense alternating layers of poorly graded sand with gravel, poorly graded sand, and silty sand. Hard cobbles (approximately 4 to 6 inches) were encountered within this material at approximate depths of 18 feet, 65 feet, and 112.5 feet. Underlying this material is

approximately 11 feet of hard sandy fat clay interbedded with layers of very dense silty sand and poorly graded sand with gravel. The maximum depth explored near Abutment 1 is 143 feet, an approximate elevation of 85.7 feet.

Near and at the existing Pier 2 through Pier 29 locations, the material encountered varies across the river channel as indicated by Borings R-08-002 through Borings R-08-016, R-08-018 through R-08-037, and R-08-037A. Generally the material encountered consists of approximately 25 feet to 35 feet of loose to medium dense poorly graded sand, poorly graded sand with gravel, poorly graded sand with silt and gravel, silty sand, and minor amounts of clayey sand. Scattered cobbles and boulders were found in this material. Table 11 includes the elevations at which the boulders were encountered. Most of this soil has been identified as being scourable and is susceptible to liquefaction. Underlying this material is approximately 10 feet of dense poorly graded sand, poorly graded sand with gravel, and poorly graded sand with silt. Below this material is approximately 10 feet to 30 feet of soft to hard lean clay, lean clay with sand, fat clay, sandy lean clay and loose clayey sand and silt. Below this material is approximately 30 feet to 50 feet of very dense silty sand, poorly graded sand with gravel, poorly graded sand with cobbles, and clayey sand. Some of the material has a sulfur or organic odor, and some contain shells, shell fragments or wood. Underlying this material is 5 feet to 10 feet of very dense weakly to strongly cemented silty sand and silt. Table 12 summarizes the elevations at which the cemented soils were encountered. The maximum depth explored within the channel near and at the pier locations is 123 feet, elevation 79.0 feet.

Near existing Abutment 30, approximately 22.5 feet of fill material was encountered in Boring R-08-017. The fill material generally consists of medium dense to dense poorly graded gravel with silt, clayey sand with gravel, and silty sand. Below the fill material is approximately 129.3 feet of medium dense to very dense poorly graded sand, poorly graded gravel with sand, silty sand, clayey sand and gravel. Hard cobbles (approximately 4 to 6 inches) are encountered within this material from the surface to an approximate elevation of 225.0 feet, from an approximate elevation of 192.0 feet to 180.5 feet, and from approximate elevation 107.5 feet to 79.0 feet. From an approximate elevation of 166.8 feet to elevation 79.0 feet, there are alternating layers of weakly to moderately cemented silty sand. The maximum depth explored near Abutment 30 is 151.8 feet, elevation 79.0 feet.

In addition to the 2008 subsurface investigation, the As-Built Log of Test Borings (LOTB) for Santa Maria River Bridge (Br. No. 49-0111R/L) was reviewed and considered during the preparation of the Foundation Report. According to the As-Built LOTB plans, a subsurface investigation was completed for the structure in May through June 1956, and in June 1996. The 1956 subsurface investigation included fifteen rotary (wet) sample borings (2.5 inch diameter). The 1960 As-Built LOTB shows the material encountered during the 1956 subsurface investigation is described generally as approximately 40 feet to 50 feet of loose to dense sand, sand with gravel or pebbles, silty sand, and silty sand with gravel or pebbles. Underlying this material is approximately 25 feet to 30 feet of loose and slightly compact sand with gravel, and interbeds of clayey silt and silty fine sand. Below this material is dense and very dense sand with gravel or pebbles to the maximum depth explored of 86.5 feet. The 1997 As-Built LOTB shows the 1996 subsurface investigation included three rotary (wet) sample borings (4.75 inch diameter) and one downhole PS Suspension Log. The LOTB shows the material encountered during the 1996 subsurface investigation generally consisted of approximately 35 feet to 90 feet

of loose to compact sand, sand with gravel, sand with gravel and cobbles, and sandy silt. Underlying this material was 10 feet to 50 feet of very loose to loose sandy silt and silty sand, and very soft to very stiff clayey silt and sandy silty clay. Below approximately elevation 100 feet, the material encountered has either a sulfur odor or an organic odor, and consisted of dense to very dense sand, sand with gravel and some cobbles, silty sand with gravel, and sand with shell fragments and cementation. Graywacke was reportedly encountered in boring B-1 at an approximate elevation of 43 feet and extended down to the bottom of the borehole at elevation 10 feet. Sandstone was encountered in boring B-2 at an approximate elevation of 60 feet and extended down to the bottom of the borehole at elevation of 54 feet. The PS Suspension Log is presented in the As-Built LOTB.

The elevations shown on the As-Built Log of Test Borings are based on the NGVD 1929 vertical datum. For subsurface data and boring locations, please refer to both the Log of Test Borings and the As-Built Log of Test Borings for detailed observations, information and conditions. These sheets will be forwarded once completed.

Ground Water

During the 2008 subsurface investigation, five boreholes were finished as open stand pipe piezometers. Ground water elevations were subsequently measured at boreholes R-08-006, R-08-009, R-08-017, R-08-026 and R-08-032 on August 21, 2008 and March 20, 2009. Ground water observations were not made at the remaining thirty-three borings. These borings were immediately backfilled upon the completion of drilling. Table 2 lists the elevations of the observed water levels on August 21, 2008 and March 20, 2009.

Table 2. Ground Water Measurement Data

Piezometer Location	Boring Number	Ground Water Elevation on 8/21/08 (ft)	Ground Water Elevation on 3/20/09 (ft)
Pier 4	R-08-006	120.8	117.2
Pier 14	R-08-009	136.4	137.0
Pier 20	R-08-026	131.5	134.0
Pier 25	R-08-032	137.9	137.8
Abutment 30	R-08-017	162.4	150.4

According to the 1960 As-Built LOTB, ground water was encountered during the 1956 subsurface investigation. Ground water was measured at an approximate elevation of 134.0 ft in Boring B-7 on June 1, 1956. According to the 1997 As-Built LOTB, ground water was encountered during the 1996 subsurface investigation. Ground water was measured at an approximate elevation of 189.8 ft in Boring B-3 on June 26, 1996, an approximate elevation of 196.6 ft in Boring B-1 on June 4 or 5, 1996, and at an approximate elevation of 191.5 ft in Boring B-2 on June 19, 1996.

Ground water elevations are subject to seasonal fluctuations and may occur at higher or lower elevations than those observed. Ground water elevations respond to rainfall patterns, ground water usage patterns and upstream stream flow regulation and diversions. For more details, please refer to the LOTB and As-Built LOTB sheets.

Scour and Liquefaction Evaluation

Scour

The Final Hydraulics Report for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated May 17, 2007, (2007 Final Hydraulics Report) was completed by the Office of Design and Technical Services, Structure Hydraulics Branch. According to this report, the scour potential was assessed in accordance with FHWA Technical Advisory T5140.23, "Evaluating Scour at Bridges", and with current Caltrans guidelines. The existing bridge was determined to not be "scour critical." The National Bridge Inspection Standards (NBIS) Item 113 code is 5, "Bridge Foundations determined to be stable for calculated scour conditions; scour within limits of piles." The potential local pier scour was calculated to be 15.0 feet. The recommended total scour elevation that all new foundation designs should consider is 180.5 ft. This includes the potential local pier scour and future degradation. According to this report, the Santa Maria River has been heavily mined upstream and downstream of the project location. The upstream mining results in an imbalance between the sediment supply and transport capacity, resulting in degradation at the bridge site. The downstream mining may cause a head cut that could migrate upstream to the bridge site. The 2007 Final Hydraulics report refers to a report completed in 1995 by Dr. Howard Chang on the effects of mining on the Santa Maria River. Dr. Chang's report indicates that the riverbed could possibly degrade to elevation 195.0 feet. Structure Hydraulics recommends placing the top of the footings at elevation 195.0 feet and that all foundations be designed assuming no ground support (lateral or vertical) above this elevation.

For further information, refer to the Final Hydraulics Report for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated May 17, 2007, completed by the Office of Structure Maintenance and Investigations, Structure Hydraulics and Hydrology Branch.

Corrosion Evaluation

Composite soil samples were collected from multiple borings drilled during the 2008 subsurface investigation. The Office of Testing and Technology Services, Corrosive Technology Branch tested the composite samples for corrosive potential. The Corrosion Technology Branch considers a site to be corrosive if one or more of the following conditions exist for the representative soil or water samples collected at the site: chloride concentration is 550 ppm or greater, sulfate concentration is 2000 ppm or greater, or the pH is 5.5 or less. The minimum resistivity serves only as an indicator parameter for the possible presence of soluble salts and is not used to define a site as being corrosive. It is the practice of the Corrosion Technology Branch that if the minimum resistivity of the sample is greater than 1000 ohm-cm, the sample is considered to be non-corrosive and testing to determine the sulfate and chloride content is not performed.

The results of the laboratory tests determined that the composite samples were considered to be non-corrosive at this site. Refer to Table 3 for specific test results.

Table 3. Corrosion Test Summary of the Composite Samples for Santa Maria River Bridge (Br. No. 49-0111R/L).

SIC Corrosion Number	Nearby Support Location	Boring Number	Sample Depth (ft)	pH	Minimum Resistivity (Ohm-Cm)	Chloride Content (PPM)	Sulfate Content (PPM)
C640299	Abutment 1	R-08-038	7.0-10.5	7.66	747	21	130
C640300	Abutment 1	R-08-038	77.0-80.5	8.41	4740	N/A	N/A
C653837	Pier 2	R-08-007	0.0-5.0	7.72	4104	N/A	N/A
C653838	Pier 2	R-08-007	27.0-30.5	8.19	4710	N/A	N/A
C653850	Pier 2	R-08-013	0.0-3.0	7.86	6463	N/A	N/A
C654051	Pier 2	R-08-013	42.5-46.0	8.18	5053	N/A	N/A
C653839	Pier 3	R-08-008	0.0-5.0	7.05	5244	N/A	N/A
C653840	Pier 3	R-08-008	42.0-45.5	8.12	4505	N/A	N/A
C653835	Pier 4	R-08-006	0.0-5.7	7.42	12540	N/A	N/A
C653836	Pier 4	R-08-006	38.0-39.0	8.31	6005	N/A	N/A
C654053	Pier 4	R-08-015	0.0-3.0	7.29	1476	N/A	N/A
C654054	Pier 4	R-08-015	32.5-36.0	8.51	4654	N/A	N/A
C653831	Pier 5	R-08-004	1.0-5.5	8.04	13500	N/A	N/A
C653832	Pier 5	R-08-004	28.0-31.5	8.64	8492	N/A	N/A
C653833	Pier 6	R-08-005	0.0-5.0	7.33	6559	N/A	N/A
C653834	Pier 6	R-08-005	65.0-66.5	8.12	7320	N/A	N/A
C653827	Pier 8	R-08-002	0.0-5.0	8.10	6583	N/A	N/A
C653828	Pier 8	R-08-002	32.2-35.7	9.00	6470	N/A	N/A
C653829	Pier 8	R-08-003	0.0-5.0	8.07	3902	N/A	N/A
C653830	Pier 8	R-08-003	41.5-45.0	8.68	5763	N/A	N/A
C654065	Pier 9	R-08-019	0.0-5.0	7.22	5980	N/A	N/A
C640262	Pier 9	R-08-019	55.5-67.0	8.61	6227	N/A	N/A
C654055	Pier 10	R-08-016	0.0-6.0	7.78	5348	N/A	N/A
C654052	Pier 11	R-08-014	27.3-30.8	8.07	6243	N/A	N/A
C653849	Pier 12	R-08-012	0.0-5.0	7.03	6005	N/A	N/A
C653847	Pier 13	R-08-011	0.0-5.0	7.52	7990	N/A	N/A
C653848	Pier 13	R-08-011	27.0-30.5	8.36	6005	N/A	N/A
C653841	Pier 14	R-08-009	1.0-1.5	7.79	19040	N/A	N/A
C653842	Pier 14	R-08-009	46.5-50.0	7.88	4293	N/A	N/A
C653844	Pier 14	R-08-010	32.5-35.5	8.29	6555	N/A	N/A
C653845	Pier 14	R-08-010	55.5-57.0	7.36	1656	N/A	N/A
C653846	Pier 14	R-08-010	0.0-5.0	7.58	9029	N/A	N/A
C654063	Pier 16	R-08-020	0.0-5.0	7.12	2657	N/A	N/A
C654058	Pier 16	R-08-020	62.0-65.5	7.48	1755	N/A	N/A
C654066	Pier 16	R-08-021	0.0-5.5	7.26	4086	N/A	N/A
C654060	Pier 16	R-08-021	57.0-60.5	7.21	1401	N/A	N/A
C654068	Pier 17	R-08-022	0.0-5.5	7.66	9786	N/A	N/A
C654067	Pier 17	R-08-022	42.5-45.5	7.69	4104	N/A	N/A
C654064	Pier 18	R-08-018	0.0-5.0	7.65	12678	N/A	N/A
C654059	Pier 18	R-08-018	36.5-40.0	8.04	5082	N/A	N/A

Table 3. Corrosion Test Summary of the Composite Samples for Santa Maria River Bridge (Br. No. 49-0111R/L). (Continued)

SIC Corrosion Number	Nearby Support Location	Boring Number	Sample Depth (ft)	pH	Minimum Resistivity (Ohm-Cm)	Chloride Content (PPM)	Sulfate Content (PPM)
C654069	Pier 18	R-08-023	0.0-5.0	7.39	7198	N/A	N/A
C654061	Pier 18	R-08-023	37.0-40.5	8.10	4418	N/A	N/A
C640263	Pier 19	R-08-024	0.0-5.5	7.53	6240	N/A	N/A
C640264	Pier 19	R-08-024	62.0-65.5	7.63	1580	N/A	N/A
C654070	Pier 20	R-08-025	0.0-5.5	7.29	11875	N/A	N/A
C654062	Pier 20	R-08-025	37.0-40.5	7.71	2685	N/A	N/A
C640265	Pier 20	R-08-026	0.0-5.0	7.66	9781	N/A	N/A
C640266	Pier 20	R-08-026	43.0-46.0	7.80	2332	N/A	N/A
C640267	Pier 21	R-08-027	0.0-5.0	7.56	10230	N/A	N/A
C640268	Pier 21	R-08-027	47.5-49.5	7.55	2806	N/A	N/A
C654071	Pier 22	R-08-028	0.0-5.0	7.52	7244	N/A	N/A
C654072	Pier 22	R-08-028	37.0-40.5	7.75	3220	N/A	N/A
C654073	Pier 22	R-08-029	0.0-6.0	8.29	14100	N/A	N/A
C654074	Pier 22	R-08-029	42.5-46.0	7.40	2285	N/A	N/A
C654075	Pier 23	R-08-030	65.5-67.0	7.68	806	19	482
C640269	Pier 24	R-08-031	0.0-5.0	7.67	15600	N/A	N/A
C640270	Pier 24	R-08-031	55.5-62.0	7.37	2673	N/A	N/A
C640271	Pier 25	R-08-032	0.0-5.5	8.13	22088	N/A	N/A
C640273	Pier 26	R-08-033	0.0-5.0	7.76	13008	N/A	N/A
C640274	Pier 26	R-08-033	26.0-27.0	7.32	2602	N/A	N/A
C640295	Pier 26	R-08-036	0.0-5.5	8.15	21015	N/A	N/A
C640296	Pier 26	R-08-036	45.5-52.0	7.49	2380	N/A	N/A
C640291	Pier 27	R-08-034	0.0-5.5	7.62	4266	N/A	N/A
C640292	Pier 27	R-08-034	40.5-47.0	7.33	1920	N/A	N/A
C640293	Pier 28	R-08-035	0.0-6.0	7.98	14190	N/A	N/A
C640294	Pier 28	R-08-035	57.0-60.0	8.02	3570	N/A	N/A
C640297	Pier 28	R-08-037	0.0-5.0	7.78	8719	N/A	N/A
C640298	Pier 28	R-08-037A	67.0-70.5	7.57	3386	N/A	N/A
C654056	Abutment 30	R-08-017	0.0-3.0	8.25	6786	N/A	N/A
C640261	Abutment 30	R-08-017	66.0-67.5	7.04	1220	N/A	N/A

Laboratory Testing

Laboratory testing was performed on selected samples of the subsurface materials obtained from the 2008 subsurface investigation. Tests were performed to determine the corrosion and engineering properties of the subsurface materials for use in the foundation analysis. In addition to the corrosion tests cited previously, the following tests were performed on selected samples: particle analysis (sieve and/or hydrometer) and Atterberg limits (liquid limit, plastic limit and plasticity index). All tests were performed in general accordance with American Society for Testing and Materials (ASTM) standards or California Test Methods (CTM).

Seismic Data and Evaluation

The Final Seismic Design Recommendations for this project have been provided in a separate report dated August 3rd, 2009 by Reza Mahallati of the OGD-N. Please contact Reza Mahallati at 916-227-1033 if there are any questions or if additional information is required.

Liquefaction

Earth Mechanics, Inc. completed an analysis for the potential of liquefaction at this site in 1996 and 1997. The investigation was based on the Caltrans 1996 subsurface investigation and the 1960 As-Built LOTBs. For the analysis, ground water was assumed to be at elevation 196.6 feet, near the base of the existing pier footings. Soils above elevation 196.6 feet were considered liquefiable should they be saturated at the time of the maximum credible earthquake. The 1996 and 1997 liquefaction analyses by EMI can be found in the Final Foundation Report by EMI (April 30, 1997). An analysis of the potential for liquefaction at this site was completed by Reza Mahallati (Seismic Specialist for OGD-N) and was based on the 2008 subsurface investigation. Mr. Mahallati's analysis is based on the assumption that the ground water elevation is 205.0 feet at all support locations. Table 4 provides a summary of the 2009 liquefaction analysis. The results of the 2009 liquefaction analyses are used in the design of the foundation for the widening of the Santa Maria River Bridge. The 2009 analyses are considered superior to preceeding studies because additional field and laboratory data were available.

Table 4. Potentially Liquefiable Layers at the New Proposed Support Locations for the widening of the Santa Maria River Bridge (Br. No. 49-0111R/L).

Support Location	Original Ground Elevation (ft)	Elevation of Potentially Liquefiable Layers (ft) Based on the 2008 Subsurface Investigation
Abutment 1	231	211 to 191
Pier 2	213	213 to 198 179 to 174
Pier 3	213	213 to 206 194 to 188
Pier 4	213	213 to 197 194 to 190
Pier 5	209	209 to 201 195 to 189
Pier 6	209	209 to 203 197 to 188 179 to 154
Pier 7	209	209 to 203 197 to 188 179 to 154

Table 4. Potentially Liquefiable Layers at the New Proposed Support Locations for the widening of the Santa Maria River Bridge (Br. No. 49-0111R/L). (Continued)

Support Location	Original Ground Elevation (ft)	Elevation of Potentially Liquefiable Layers (ft) Based on the 2008 Subsurface Investigation
Pier 8	208	208 to 190
Pier 9	208	208 to 188 176 to 171
Pier 10	208	208 to 188
Pier 11	208	208 to 191 166 to 157
Pier 12	208	208 to 198 188 to 185 174 to 164
Pier 13	207	167 to 162
Pier 14	206	206 to 196 190 to 183 166 to 161
Pier 15	206	206 to 196 190 to 183 166 to 161
Pier 16	206	206 to 183 171 to 165
Pier 17	206	189 to 184 169 to 163
Pier 18	206	206 to 176 171 to 166
Pier 19	207	207 to 176 172 to 162
Pier 20	206	206 to 175 169 to 164
Pier 21	206	199 to 184 166 to 160
Pier 22	205	205 to 187

Table 4. Potentially Liquefiable Layers at the New Proposed Support Locations for the widening of the Santa Maria River Bridge (Br. No. 49-0111R/L). (Continued)

Support Location	Original Ground Elevation (ft)	Elevation of Potentially Liquefiable Layers (ft) Based on the 2008 Subsurface Investigation
Pier 23	205	205 to 198 191 to 183
Pier 24	206	206 to 186
Pier 25	205	205 to 199
Pier 26	204	204 to 194
Pier 27	202	202 to 187 177 to 173
Pier 28	208	208 to 184
Pier 29	208	208 to 184
Abutment 30	231	201 to 185

As-Built Foundation Information

The As-Built records for the existing Santa Maria River Bridge (Br. No. 49-0111R/L) indicate that the bridge foundations consist of 12-inch diameter driven Southern Pipe Cast-in-place-Alternative U (steel shells filled with Class A concrete). The design load is 45 tons at all support locations. The Foundation Report dated October 17, 1956 recommended concrete (except cast-in-drill hole type) or pipe piles for all support locations with a design load of 45 tons per pile.

According to the Foundation Report dated October 17, 1956, a dense gravel layer was encountered between approximate elevations 165.0 feet and 180.0 feet. Since it was anticipated that the dense gravel could make driving the piles difficult, it was recommended that the Contractor be permitted to jet the piles to within five feet of the specified pile tip elevations. A Foundation Review completed on November 14, 1956, revised the recommended pile tip elevations for Piers 4 and 5 to elevation 165.0 feet from elevation 170.0 feet.

Summaries of the As-Built pile tip elevations for the existing left structure and right structure are provided in Tables 5 and 6, respectively.

Table 5. As-Built Pile Data for the Santa Maria River Left Bridge (Br. No. 49-0111L).

Support Location	Pile Type	Design Load [3] (tons)	Specified Pile Tip Elevation[3] (ft)	As-Built Maximum Pile Tip Elevation [2] (ft)	As-Built Average Pile Tip Elevation [2] (ft)	As-Built Minimum Pile Tip Elevation [2] (ft)
Abutment 1	Cast-In-Place Concrete Pile "Alt. U"	45	165.0	168.50	166.29	164.40
Pier 2	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	173.75	167.55	164.55
Pier 3	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	172.55	171.00	169.55
Pier 4	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	170.05	166.75	165.55
Pier 5	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	169.15	167.30	165.45
Pier 6	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	167.55	166.80	166.05
Pier 7	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	169.95	167.55	166.05
Pier 8	Cast-In-Place Concrete Pile "Alt. U"	45	165.0	165.85	164.90	163.45
Pier 9	Cast-In-Place Concrete Pile "Alt. U"	45	165.0	165.85	163.85	159.25
Pier 10	Cast-In-Place Concrete Pile "Alt. U"	45	165.0	166.55	164.45	161.05
Pier 11	Cast-In-Place Concrete Pile "Alt. U"	45	160.0	160.05	159.15	157.55
Pier 12	Cast-In-Place Concrete Pile "Alt. U"	45	155.0	155.85	154.80	154.15
Pier 13	Cast-In-Place Concrete Pile "Alt. U"	45	145.0	148.05	132.20	129.75
Pier 14	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	136.15	135.25	134.85
Pier 15	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	140.10	134.30	133.10
Pier 16	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	136.35	134.01	133.15
Pier 17	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	134.35	133.62	132.95
Pier 18	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	132.80	132.10	130.40
Pier 19	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	131.30	130.70	130.10

Table 5. As-Built Pile Data for the Santa Maria River Left Bridge (Br. No. 49-0111L). (Continued)

Support Location	Pile Type	Design Load (3) (tons)	Specified Pile Tip Elevation(3) (ft)	As-Built Maximum Pile Tip Elevation (2) (ft)	As-Built Average Pile Tip Elevation (2) (ft)	As-Built Minimum Pile Tip Elevation (2) (ft)
Pier 20	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	132.50	131.60	130.60
Pier 21	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	132.80	131.70	130.00
Pier 22	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	132.70	130.50	128.30
Pier 23	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	139.45	131.41	129.35
Pier 24	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	130.00	128.90	127.70
Pier 25	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	134.30	131.80	128.60
Pier 26	Cast-In-Place Concrete Pile "Alt. U"	45	155.0	154.10	149.20	143.50
Pier 27	Cast-In-Place Concrete Pile "Alt. U"	45	175.0	173.55	172.20	169.15
Pier 28	Cast-In-Place Concrete Pile "Alt. U"	45	175.0	176.35	174.85	172.25
Pier 29	Cast-In-Place Concrete Pile "Alt. U"	45	175.0	175.45	174.40	173.25
Abutment 30	Cast-In-Place Concrete Pile "Alt. U"	45	175.0	175.75	173.83	170.15

Notes:

1. *As-Built Elevations shown above are based on the NGVD29 vertical datum.*
2. *The "As-Built" Maximum, Average and Minimum Pile Tip Elevations were obtained from the Pile Log Sheet (dated 1961) and the Pile Driving Records (dated July through October 1961) for the Santa Maria River Left Bridge (Br. No. 49-0111L).*
3. *The Design Loads were derived from the Foundation Report (dated October 17, 1956) and the Pile Driving Records (dated September through October 1961) for the Santa Maria River Bridge (Br. No. 49-0111L/R).*
4. *The Specified Pile Tip Elevations were derived from the "As-Built" Abutment Details 2 plan sheet dated August 15, 1960.*

Table 6. As-Built Pile Data for the Santa Maria River Right Bridge (Br. No. 49-0111R).

Support Location	Pile Type	Design Load (3) (tons)	Specified Pile Tip Elevation(4) (ft)	As-Built Maximum Pile Tip Elevation (2) (ft)	As-Built Average Pile Tip Elevation (2) (ft)	As-Built Minimum Pile Tip Elevation (2) (ft)
Abutment 1	Cast-In-Place Concrete Pile "Alt. U"	45	165.0	171.00	166.20	164.10
Pier 2	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	172.90	169.66	168.60

Table 6. As-Built Pile Data for the Santa Maria River Right Bridge (Br. No. 49-0111R). (Continued)

Support Location	Pile Type	Design Load [3] (tons)	Specified Pile Tip Elevation[4] (ft)	As-Built Maximum Pile Tip Elevation [2] (ft)	As-Built Average Pile Tip Elevation [2] (ft)	As-Built Minimum Pile Tip Elevation [2] (ft)
Pier 3	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	173.25	170.70	169.65
Pier 4	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	172.15	170.30	168.25
Pier 5	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	171.45	169.80	168.75
Pier 6	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	169.55	169.00	167.85
Pier 7	Cast-In-Place Concrete Pile "Alt. U"	45	170.0	178.85	170.10	166.95
Pier 8	Cast-In-Place Concrete Pile "Alt. U"	45	165.0	165.45	164.60	163.75
Pier 9	Cast-In-Place Concrete Pile "Alt. U"	45	165.0	164.75	164.10	162.95
Pier 10	Cast-In-Place Concrete Pile "Alt. U"	45	165.0	165.65	164.40	158.35
Pier 11	Cast-In-Place Concrete Pile "Alt. U"	45	160.0	160.55	160.00	159.35
Pier 12	Cast-In-Place Concrete Pile "Alt. U"	45	155.0	159.25	156.20	152.95
Pier 13	Cast-In-Place Concrete Pile "Alt. U"	45	145.0	135.35	134.50	133.25
Pier 14	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	135.65	135.25	134.55
Pier 15	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	138.35	135.20	134.25
Pier 16	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	135.95	135.20	134.55
Pier 17	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	135.25	134.10	133.35
Pier 18	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	133.95	133.0	131.85
Pier 19	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	134.15	133.65	133.25
Pier 20	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	133.55	132.55	131.45

Table 6. As-Built Pile Data for the Santa Maria River Right Bridge (Br. No. 49-0111R). (Continued)

Support Location	Pile Type	Design Load (3) (tons)	Specified Pile Tip Elevation(4) (ft)	As-Built Maximum Pile Tip Elevation (2) (ft)	As-Built Average Pile Tip Elevation (2) (ft)	As-Built Minimum Pile Tip Elevation (2) (ft)
Pier 21	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	131.85	131.30	129.75
Pier 22	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	141.15	134.60	132.05
Pier 23	Cast-In-Place Concrete Pile "Alt. U"	45	130.0	138.55	133.65	130.05
Pier 24	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	138.85	134.55	132.75
Pier 25	Cast-In-Place Concrete Pile "Alt. U"	45	135.0	143.05	136.95	133.65
Pier 26	Cast-In-Place Concrete Pile "Alt. U"	45	155.0	157.45	151.20	146.65
Pier 27	Cast-In-Place Concrete Pile "Alt. U"	45	175.0	177.0	174.94	174.05
Pier 28	Cast-In-Place Concrete Pile "Alt. U"	45	175.0	179.05	175.80	174.30
Pier 29	Cast-In-Place Concrete Pile "Alt. U"	45	175.0	175.45	174.70	172.45
Abutment 30	Cast-In-Place Concrete Pile "Alt. U"	45	175.0	175.75	174.39	173.15

Notes:

1. *As-Built Elevations shown above are based on the NGVD29 vertical datum.*
2. *The "As-Built" Maximum, Average and Minimum Pile Tip Elevations were obtained from the Pile Log Sheet (dated 1961) for the Santa Maria River Right Bridge (Br. No. 49-0111R).*
3. *The Design Loads were derived from the Foundation Report (dated October 17, 1956) and the Pile Driving Records (dated July through October 1961) for the Santa Maria River Bridge (Br. No. 49-0111L/R).*
4. *The Specified Pile Tip Elevations were derived from the "As-Built" Abutment Details 2 plan sheet dated August 15, 1960.*

The 1997 seismic retrofit included installation of 48-inch Cast-In-Drilled-Hole (CIDH) piles at Piers 3, 6, 9, 12, 15, 18, 21, 24, 27, 28, and 29, and construction of new tie beams. At the other piers, collar beams were added at the base of the pier walls. The As-Built pile tip elevations for the seismic retrofit of the existing Santa Maria River Bridge (Br. No. 49-0111R/L) are listed below in Table 7. The information provided below was found on the Foundation Location Plan 2 sheet for the Bridge Across Santa Maria River (Earthquake Retrofit Project No. 812) dated May 12, 1997.

Table 7. As-Built Pile Data for the Seismic Retrofit of the Santa Maria River Bridges (Br. No. 49-0111R/L).

Location	Diameter (in)	Pile Type	Design Loading (Service) (kips)	Nominal Resistance		Cut-Off Elevation (ft)	Design Tip Elevation (ft)	Specified Tip Elevation (ft)
				Compression (kips)	Tension (kips)			
*Pier 3	48	CIDH	N/A	400	100	196.3	161.0 (1) & (2), 146.0 (3)	146.0
Pier 6	48	CIDH	N/A	470	130	196.3	161.0 (1) & (2)	161.0
Pier 9	48	CIDH	N/A	440	120	196.3	161.0 (1) & (2)	161.0
Pier 12	48	CIDH	N/A	270	110	196.3	161.0 (1) & (2)	161.0
Pier 15	48	CIDH	N/A	270	110	196.3	161.0 (1) & (2)	161.0
Pier 18	48	CIDH	N/A	440	120	196.3	161.0 (1) & (2)	161.0
Pier 21	48	CIDH	N/A	260	110	196.3	161.0 (1) & (2)	161.0
Pier 24	48	CIDH	N/A	330	120	196.3	161.0 (1) & (2)	161.0
Pier 27	48	CIDH	N/A	440	130	196.3	161.0 (1) & (2), 144.0 (3)	144.0
Pier 28 & 29	48	CIDH	N/A	450	130	196.3	161.0 (1) & (2), 142.0 (3)	142.0

Notes: Design Tip Elevations Controlled by the Following Demands:
(1) Lateral load under seismic demands.
(2) Tension and Compression load under seismic demands.
(3) Compression, scour potential to elevation 180.5 ft.
N/A: Not Applicable, Piles are designed for seismic loads only.
**Pier 3, Right Bridge-Right CIDH pile placed with 66.0 inch diameter to approx. elevation 161.0 ft and 48.0 inch to specified tip elevation.*

Foundation Recommendations

The proposed widening of the Santa Maria River Bridge (Br. No. 49-0111R/L), as indicated on the Structure Plan dated February 17th, 25th, 26th and March 2nd and April 29th of 2009, may be supported on 48 inch diameter Cast-In-Steel-Shell (CISS) piles at all support locations. The recommended minimum pile wall thickness is 0.75 inch. Six inch long driving shoes should be affixed to the tip of all the piles. The shoes should be fabricated from the same strength of steel as the NPS 48 X 0.75 pipe piles. The driving shoes should have a minimum thickness of 0.5 inches, increasing the pile wall thickness for the lowest six inches of the piles to 1.25 inches. They should be welded to the inside face of the pile, so that the outside diameter is uniform.

The nominal geotechnical resistances of the 48-inch diameter CISS piles were determined by utilizing the computer program APILE Plus, Version 4.0 for Windows (Ensoft, Inc., 2004). This program is based on the procedures recommended by the American Petroleum Institute (API, 1987) for the determination of the axial capacity of large diameter pipe piles. The nominal geotechnical resistances of the CISS piles at all support locations for the bridge widenings are based on combinations of side resistance and base resistance.

The proposed pile tip elevations were based on the cut-off elevation and factored loads provided by the Office of Bridge Design, Branch 9 dated February 17th 2009 for the piers and February 25, 2009 for the abutments. Refer to Table 8 for the Abutment Foundation Design Recommendations, Table 9 for the Pier Foundation Design Recommendations and Table 10 for the Pile Data Table.

Table 8. Abutment Foundation Design Recommendations for the Santa Maria River Bridge (Br. No. 49-0111R/L).

Abutment Foundations Design Recommendations									
Support Location	Pile Type	Cut-off Elevation (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
			Total	Permanent					
Abut. 1	CISS NPS 48 x 0.75	221.35 222.35	3600	2300	195	390	179 (a)	179	400
Abut. 30	CISS NPS 48 x 0.75	220.85	3600	2300	195	390	178 (a)	178	400

Notes:

1) *Design tip elevations are controlled by Compression.*
2) *Design tip elevations for settlement are not applicable to abutment supports because the existing piles are of a different type, size, length, and installation method from the proposed piles.*
3) *The Nominal Driving Resistance Required is equal to the nominal resistance needed to support the factored load plus driving resistance from the unsuitable penetrated soil layers (liquefiable and scourable) which do not contribute to the design resistance. Unsuitable soil layers are present at both abutment locations.*

Table 9. Pier Foundation Design Recommendations for the Santa Maria River Bridge (Br. No. 49-0111R/L).

Pier Foundations Design Recommendations											
Support Location	Pile Type	Cut-off Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.6)	Tension (φ=0.6)	Comp. (φ=1)	Tension (φ=1)			
Pier 2	CISS NPS 48 x 0.75	198.65	5100	1	900	100	900	75	132 (a-I) 160 (b-I) 145 (a-II) 168 (b-II)	132	2090
Pier 3	CISS NPS 48 x 0.75	198.65	5100	1	875	100	900	75	137 (a-I) 159 (b-I) 146 (a-II) 169 (b-II)	137	2100
Pier 4	CISS NPS 48 x 0.75	198.65	5100	1	825	100	900	75	136 (a-I) 159 (b-I) 145 (a-II) 169 (b-II)	136	2200
Pier 5	CISS NPS 48 x 0.75	198.65	5100	1	750	100	900	75	137 (a-I) 158 (b-I) 145 (a-II) 167 (b-II)	137	1730
Pier 6	CISS NPS 48 x 0.75	198.65	5100	1	900	100	900	75	127 (a-I) 157 (b-I) 132 (a-II) 167 (b-II)	127	1960
Pier 7	CISS NPS 48 x 0.75	198.65	5100	1	700	100	900	75	143 (a-I) 159 (b-I) 146 (a-II) 170 (b-II)	143	1750
Pier 8	CISS NPS 48 x 0.75	198.65	5100	1	700	100	900	75	141 (a-I) 159 (b-I) 146 (a-II) 170 (b-II)	141	1640
Pier 9	CISS NPS 48 x 0.75	198.65	5100	1	900	100	900	75	134 (a-I) 157 (b-I) 144 (a-II) 168 (b-II)	132	1840
Pier 10	CISS NPS 48 x 0.75	198.65	5100	1	700	100	900	75	139 (a-I) 157 (b-I) 143 (a-II) 168 (b-II)	139	1610
Pier 11	CISS NPS 48 x 0.75	198.65	5100	1	700	100	900	75	140 (a-I) 158 (b-I) 144 (a-II) 169 (b-II)	140	1470
Pier 12	CISS NPS 48 x 0.75	198.65	5100	1	500	100	900	75	148 (a-I) 155 (b-I) 143 (a-II) 165 (b-II)	143	1350

Table 9. Pier Foundation Design Recommendations for the Santa Maria River Bridge (Br. No. 49-0111R/L). (Continued)

Pier Foundations Design Recommendations											
Support Location	Pile Type	Cut-off Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.6)	Tension (φ=0.6)	Comp. (φ=1)	Tension (φ=1)			
Pier 13	CISS NPS 48 x 0.75	198.65	5100	1	500	100	900	75	145 (a-I) 159 (b-I) 134 (a-II) 171 (b-II)	134	1550
Pier 14	CISS NPS 48 x 0.75	198.65	5100	1	500	100	900	75	136 (a-I) 156 (b-I) 132 (a-II) 165 (b-II)	132	1350
Pier 15	CISS NPS 48 x 0.75	198.65	5100	1	400	100	900	75	136 (a-I) 155 (b-I) 133 (a-II) 165 (b-II)	133	1500
Pier 16	CISS NPS 48 x 0.75	198.65	5100	1	400	100	900	75	144 (a-I) 155 (b-I) 130 (a-II) 166 (b-II)	130	1600
Pier 17	CISS NPS 48 x 0.75	198.65	5100	1	400	100	900	75	142 (a-I) 158 (b-I) 131 (a-II) 167 (b-II)	131	1500
Pier 18	CISS NPS 48 x 0.75	198.65	5100	1	475	100	900	75	137 (a-I) 156 (b-I) 130 (a-II) 161 (b-II)	130	1420
Pier 19	CISS NPS 48 x 0.75	198.65	5100	1	475	100	900	75	141 (a-I) 157 (b-I) 131 (a-II) 162 (b-II)	131	1520
Pier 20	CISS NPS 48 x 0.75	198.65	5100	1	475	100	900	75	135 (a-I) 151 (b-I) 129 (a-II) 159 (b-II)	129	1500
Pier 21	CISS NPS 48 x 0.75	198.65	5100	1	475	100	900	75	136 (a-I) 154 (b-I) 128 (a-II) 165 (b-II)	128	1410
Pier 22	CISS NPS 48 x 0.75	198.65	5100	1	475	100	900	75	142 (a-I) 155 (b-I) 130 (a-II) 168 (b-II)	130	1500
Pier 23	CISS NPS 48 x 0.75	198.65	5100	1	475	100	900	75	150 (a-I) 158 (b-I) 130 (a-II) 166 (b-II)	130	1520
Pier 24	CISS NPS 48 x 0.75	198.65	5100	1	475	100	900	75	151 (a-I) 159 (b-I) 130 (a-II) 168 (b-II)	130	1800

Table 9. Pier Foundation Design Recommendations for the Santa Maria River Bridge (Br. No. 49-0111R/L). (Continued)

Pier Foundations Design Recommendations											
Support Location	Pile Type	Cut-off Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.6)	Tension (φ=0.6)	Comp. (φ=1)	Tension (φ=1)			
Pier 25	CISS NPS 48 x 0.75	198.65	5100	1	700	100	900	75	130 (a-I) 159 (b-I) 136 (a-II) 170 (b-II)	130	1420
Pier 26	CISS NPS 48 x 0.75	198.65	5100	1	700	100	900	75	132 (a-I) 155 (b-I) 137 (a-II) 168 (b-II)	132	1500
Pier 27	CISS NPS 48 x 0.75	198.65	5100	1	700	100	900	75	135 (a-I) 157 (b-I) 142 (a-II) 167 (b-II)	135	1340
Pier 28	CISS NPS 48 x 0.75	198.65	5100	1	700	100	900	75	136 (a-I) 156 (b-I) 141 (a-II) 166 (b-II)	136	1530
Pier 29	CISS NPS 48 x 0.75	198.65	5100	1	700	100	900	75	136 (a-I) 156 (b-I) 141 (a-II) 166 (b-II)	136	1530

Notes:

1) *Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (b-I) Tension (Strength Limit), (a-II) Compression (Extreme Event), and (b-II) Tension (Extreme Event), respectively.*
2) *Design Tip Elevations for settlement are not applicable to pier supports because the existing piles are of a different type, size, and length, and installation method from the proposed pile.*
3) *The specified tip elevation shall not be raised above the design tip elevations for Tension and Lateral Load.*
4) *The Nominal Driving Resistance Required is equal to the nominal resistance needed to support the factored load plus driving resistance from the unsuitable penetrated soil layers (liquefiable and scourable) which do not contribute to the design resistance. Unsuitable soil layers are present at all pier locations.*

Table 10. Pile Data Table for the Santa Maria River Bridge (Br. No. 49-0111R/L).

Pile Data Table						
Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abut. 1	CISS NPS 48 x 0.75	390	0	179 (a)	179	400
Pier 2	CISS NPS 48 x 0.75	1500	166	134 (a) 160 (b)	132	2090
Pier 3	CISS NPS 48 x 0.75	1460	166	137 (a) 159 (b)	137	2100
Pier 4	CISS NPS 48 x 0.75	1380	166	136 (a) 159 (b)	136	2200
Pier 5	CISS NPS 48 x 0.75	1250	166	137 (a) 158 (b)	137	1730
Pier 6	CISS NPS 48 x 0.75	1500	166	127 (a) 157 (b)	127	1960
Pier 7	CISS NPS 48 x 0.75	1170	166	143 (a) 159 (b)	143	1750
Pier 8	CISS NPS 48 x 0.75	1170	166	141 (a) 159 (b)	141	1640
Pier 9	CISS NPS 48 x 0.75	1500	166	132 (a) 157 (b)	132	1840
Pier 10	CISS NPS 48 x 0.75	1170	166	139 (a) 157 (b)	139	1610
Pier 11	CISS NPS 48 x 0.75	1170	166	140 (a) 158 (b)	140	1470
Pier 12	CISS NPS 48 x 0.75	900	166	143 (a) 155 (b)	143	1350
Pier 13	CISS NPS 48 x 0.75	900	166	134 (a) 159 (b)	134	1550
Pier 14	CISS NPS 48 x 0.75	900	166	132 (a) 156 (b)	132	1350
Pier 15	CISS NPS 48 x 0.75	900	166	133 (a) 155 (b)	133	1500
Pier 16	CISS NPS 48 x 0.75	900	166	130 (a) 155 (b)	130	1600
Pier 17	CISS NPS 48 x 0.75	900	166	132 (a) 158 (b)	131	1500
Pier 18	CISS NPS 48 x 0.75	900	166	130 (a) 156 (b)	130	1420
Pier 19	CISS NPS 48 x 0.75	900	166	131 (a) 157 (b)	131	1520
Pier 20	CISS NPS 48 x 0.75	900	166	129 (a) 151 (b)	129	1500
Pier 21	CISS NPS 48 x 0.75	900	166	128 (a) 154 (b)	128	1410
Pier 22	CISS NPS 48 x 0.75	900	166	130 (a) 155 (b)	130	1500
Pier 23	CISS NPS 48 x 0.75	900	166	130 (a) 158 (b)	130	1520
Pier 24	CISS NPS 48 x 0.75	900	166	130 (a) 159 (b)	130	1800

Table 10. Pile Data Table for the Santa Maria River Bridge (Br. No. 49-0111R/L). (Continued)

Pile Data Table						
Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Pier 25	CISS NPS 48 x 0.75	1170	166	130 (a) 159 (b)	130	1420
Pier 26	CISS NPS 48 x 0.75	1170	166	132 (a) 155 (b)	132	1500
Pier 27	CISS NPS 48 x 0.75	1170	166	135 (a) 157 (b)	135	1340
Pier 28	CISS NPS 48 x 0.75	1170	166	136 (a) 156 (b)	136	1530
Pier 29	CISS NPS 48 x 0.75	1170	166	136 (a) 156 (b)	136	1530
Abut. 30	CISS NPS 48 x 0.75	390	0	178 (a)	178	400

Notes:

1) *Design tip elevations for Abutments are controlled by Compression.*
2) *Design tip elevations for Bents are controlled by: (a) Compression, and (b) Tension.*
3) *Design tip elevations for settlement are not applicable to abutment and pier supports because the existing piles are of a different type, size, length, and installation method from the proposed pile.*
4) *The specified tip elevation shall not be raised above the design tip elevations for Tension and Lateral Load.*
5) *Unsuitable penetrated soil layers (liquefiable and scourable) which do not contribute to the design resistance are present at all pier locations.*

Retaining Wall Foundation at Abutment 1 Left

The following foundation recommendations are for the proposed Retaining Wall structure located at Abutment 1 Left as shown on Foundation Plan and Abutment Details No. 6 sheets dated April 14, 2009 and February 1, 2009, respectively. At these locations, it is recommended driven steel CISS NPS 24 x 0.5 piles be used to support the retaining wall. The specified pile tip elevations, shown below in Table 11 will provide piles with an ultimate geotechnical capacity that will meet the required nominal resistance in compression.

Table 11. Pile Data Table for the new proposed Abutment 1 Left Retaining Wall (Br. No. 49-0111R/L).

Location	Pile Type	Design Load kips	Nominal Resistance		Bottom of Footing Elevation ft	Design Pile Tip Elevation ft	Specified Pile Tip Elevation ft
			Compression kips	Tension kips			
Abutment 1 Left	CISS NPS 24 x 0.50	90	180	0	220.0 and above	176 (1)	176

Note: Design Pile Tip Elevation is controlled by the following demands: (1) *Compression*

WEAP Analysis

A WEAP analysis was performed for the soil conditions at Pier 4 left, utilizing the subsurface data of borehole R-08-015. Three pile driving systems were found to provide adequate driving characteristics for installation of the NPS 48 X 0.75 piles. These hammer systems are the Delmag 100-23, Menke MHU400 and the APE 100-13.

A252 Grade 3 steel was used in these analyses. Field driving stresses may exceed the A252 Grade 3 yield stress when unanticipated higher driving resistances are encountered, such as non-uniform loading at the pile tip or when subjecting piles to eccentric or uneven hammer blows. Therefore, maintaining proper pile and hammer alignment is essential during pile driving.

Pile Driving and Dynamic Pile Monitoring

For the purposes of pile installation and monitoring of piles for pile integrity and hammer system operation, this project is divided into three control zones. Prior to installing piles within a control zone, the contractor shall submit the details of the pile driving system, including a WEAP analysis, for the equipment that will be used for installation. The equipment shall be capable of installing the piles to the specified tip elevation at a reasonable rate of penetration, and within acceptable driving compressive stress limits. The submittal shall also address the details of whether the contractor proposes to employ center relief drilling and the procedure the contractor proposes to use. Multiple hammer system submittals may be made.

Each control zone has one or two controlling tests, as detailed in Table 11. The controlling test or controlling tests for each control zone shall be completed before any piles are driven within the specified control zone. All test piles and indicator piles installed within a control zone shall be dynamically monitored by Caltrans personnel, with the cooperation and assistance of the contractor. The dynamically monitored piles shall be provided with an additional 9 feet of length, which will remain as stick-up after the pile has been driven to the specified tip elevation. Pile length will be subsequently trimmed to the final required cutoff elevations.

Table 11. Control Zones and Controlling Tests

Control Zones	Controlling Tests
Pier 2 to Pier 10	Test Pile at Pier 18 Left **and** Pier 5 Middle
Pier 11 to Pier 20	Test Pile at Pier 18 Left
Pier 21 to Pier 29	Test Pile at Pier 18 Left **and** Indicator Pile at Pier 25 Middle

Dynamically monitored restrikes are required a minimum of 24 and 72 hours after the initial driving of the indicator or test pile. To facilitate the restrikes, pile driving operations shall be suspended 1.0 feet above the specified tip elevation at the completion of the initial pile driving operation, and 0.5 feet above the specified tip elevation at the completion of the 24 hour restrike,

as directed by the Engineer. The contractor shall provide high-energy hammer blows from the beginning of each pile restrike operation. For diesel hammers, the Contractor shall provide a hammer that has been warmed-up at another location prior to performing the restrike.

Pile acceptance criteria will be developed based on the data from the dynamic monitoring, a WEAP analysis, and the load tests. Bearing acceptance criteria curves will be provided by the Foundation Testing Branch of the Office of Geotechnical Support. Please coordinate with Brian Liebich from the Foundation Testing Branch for the performance of the dynamic monitoring and the development of the pile acceptance criteria. No production piles other than the indicator or test piles shall be driven until the pile acceptance criteria has been developed and provided to Structure Construction.

Pile Load Test

Both compression and tension static pile load tests are recommended at Pier 18 Left. The test pile should be the production pile that is located furthest from the centerline of the bridge. The reaction piles shall be dynamically monitored while they are being driven.

The pile load test at Pier 18 Left will require four reaction piles. A group of four NPS 48 X 0.75 piles are required to act as reaction piles. These reaction piles are to be driven to a specified tip elevation of 131.0 feet, with an estimated nominal driving resistance of 1400 kips. The reaction piles are to be dynamically monitored. The piles should be configured in the manner recommended by the Geotechnical Services Foundation Testing Branch. The load test apparatus provided by Caltrans will have a capacity of testing the pile to a 2000 kip compression and tensile load.

A tension static pile load test is recommended at Pier 5 Middle. The test pile and the two reaction piles will be production piles. The test pile and reaction piles shall all be dynamically monitored while being driven. The load test apparatus provided by Caltrans will have a capacity of testing the pile to a 2000 kip tensile load.

The soil that has moved into the test pile interiors during driving shall be removed to the specified depth of 29.0 feet from the cutoff shown on the plans prior to performing the static pile load tests. If soil was removed below this depth as part of the installation procedure, the soil should be replaced with a suitable cement slurry or concrete mix. The interior faces of the steel pile and the top of the natural soil infill should be prepared in the same manner as the zone to receive the structural concrete infill. The cement based backfill should be placed and adequately cured prior to performing the pile load tests.

All test and reaction piles subjected to tension loads during the static pile load tests shall be re-tapped with the approved pile driving hammer after the completion of the uplift load tests, and prior to configuring the pile heads to the cut-off elevations.

Please contact the Foundation Testing Branch for additional details and a review of the plans and specifications pertaining to the WEAP analysis, pile dynamic monitoring and the pile load tests.

General Notes to Designer

1. All support locations are to be plotted on the Log of Test Borings, in plan view, as stated in "Memo to Designers" 4-2. The plotting of support locations should be made prior to the foundation review.

2. If lateral demands exist on the support piles, the structural design engineer shall indicate on the plans, in the pile data table, the design pile tip elevations required to meet the lateral load demands. If the specified pile tip elevations given in the above pile data table are not adequate for lateral load demands; the Office of Geotechnical Design-North shall be contacted for further recommendations.

Construction Considerations

1. A 15-day fill delay period is recommended for the Abutment 1 and Abutment 30 locations. Piles may be driven at these support locations after the completions of the settlement periods.

2. Piles shall be driven in oversized drilled holes in conformance with the provisions in Section 49-1.06 "Predrilled Holes," of the Standard Specifications at the locations and to the corresponding bottom of hole elevations listed in the following table:

Bridge Name or Number	Location	Bent Number	Elevation of Bottom of Hole
Santa Maria River Bridge (Br. No. 49-0111R/L)	Abutment 1	-	210 feet
Santa Maria River Bridge (Br. No. 49-0111R/L)	Abutment 30	-	210 feet
Santa Maria River Bridge (Br. No. 49-0111R/L)	Abutment 1 Left Retaining Wall	-	190 feet

3. The oversized predrilled holes may be backfilled with grout instead of dry sand or pea gravel at locations that are considered to be within the levee. It may be necessary to consult with the Army Corps of Engineers on this matter.

4. For the outside widenings, the pile closest to the existing structure should be driven first. Pile driving should progress in a direction away from the existing structures.

5. Ground water was encountered during the subsurface investigation and should be considered at all phases of construction and pile installation. Ground water surface elevation is subject to seasonal fluctuations and release volumes from upstream dams. Ground water may occur higher or lower than indicated on the Log of Test Boring Sheets (LOTB) at the time of construction.

6. The CISS piles should be driven to the specified tip elevations with minimal interruptions in order to minimize an increase in the driving resistance due to soil setup.

7. At all pier locations, the geotechnical resistance of the CISS piles above the potential scour elevations for both the strength limit state and extreme event limit states, do not contribute to the pile resistance available to support the bridge. However, the Contractor's pile installation procedures will have to account for the resistance of the potentially scourable soil as reflected in the nominal driving resistances indicated in the Pile Data Table (Table 10). The Contractor's Driving System must be designed for the nominal driving resistances.

8. A vibratory hammer may not be used for installation of the piles at any of the support locations. Vibratory methods may cause settlement damage to the existing bridge structures.

9. As shown on the 2009 Logs of Test Borings, the objects listed in Table 12 were encountered by the exploratory drilling operations. These objects may have an effect on pile installations and footing excavations.

Table 12. Objects Encountered During 2008 Subsurface Investigation

Pier 2 Left	R-08-007	Boulder (RSP) encountered at elevations 200.9 feet and 198.9 feet
Pier 6 Right	R-08-005	Concrete debris encountered between elevations 202 feet and 204 feet
Pier 6 Right	R-08-005	Boulder (approx. 14 inches in dimension) encountered at elevation 137.5 feet
Pier 10 Right	R-08-018	Boulder (approx. 13 to 16 inches in dimension) encountered at elevation 129.9 feet
Pier 16 Right	R-08-020	Boulder encountered at elevations 180.4 feet and 177.9 feet
Pier 20 Right	R-08-025	Boulder (approx. 14 inches in dimension) encountered at elevation 200.4 feet and boulder (approx. 15 to 18 inches in dimension) encountered at elevation 90.85 feet
Pier 28 Middle	R-08-035	Boulder (approximately 14 inches in dimension) encountered at elevations 192 feet and 190 feet

10. Prior to pile installation at Piers 2 and 29, it will be necessary to remove portions of the existing RSP and the proposed cemented RSP not constructed as of this date. The theoretical limits of the RSP and cemented RSP will be shown on the plans. The actual lateral and vertical extent of the RSP and cemented RSP may be greater than is shown on the plans.

11. Soil strata containing as much as 40% soil particles larger than sand, and estimated to be cobbles up to 6 inches in dimension, were encountered by many of the boreholes. The locations and elevations of these soils are shown on the Logs of Test Borings.

12. The subsurface conditions shown in Table 13 are also noted on the Logs of Test Borings.

Table 13. Cemented Soils Encountered During 2008 Subsurface Investigation

Pier 26 Right	R-08-036	Weakly and moderately cemented silty sand encountered between elevations 140.5 feet and 144 feet
Pier 28 Right	R-08-037	Weakly and moderately cemented silty sand encountered between elevations 161 feet and 168 feet
Pier 28 Right	R-08-037A	Weakly cemented silty sand encountered between elevations 139.1 feet and 140.1 feet
Abutment 30	R-08-017	Weakly cemented silty sand encountered between elevations 155.0 feet and 168.0 feet

13. During construction of the 48-inch diameter drilled shafts for the seismic retrofit of the Santa Maria River Bridges in 1997, the Construction Contractor encountered objects at the locations shown in Table 14.

Table 14. Objects Encountered During 1997 Bridge Construction.

Pier 29	RSP boulder
Pier 3 Right	Boulder larger than 48 inches encountered 15 feet below original ground
Pier 12 Left	Boulder larger than 48 inches
Pier 12 Right	Boulder larger than 48 inches
Pier 15 Left	Man-made object (segment of corrugated metal pipe)
Pier 2 Left	RSP boulder

14. In addition to the objects and cemented soils noted above, dense to very dense soil was encountered at many of the support locations, as shown on the Logs of Test Borings. Depending upon the pile driving system selected by the contractor, hard and erratic driving conditions may be experienced due to this condition, and those noted above.

15. Center relief drilling thought the CISS piles may be employed by the contractor to assist pile installation. Center relief drilling shall not be allowed within five feet of the end of the pile. Equipment and methods selected by the contractor for removing soil from the piles shall not cause quick soil conditions. The contractor should also consider the necessity to field cut and field weld piles in order to facilitate center relief drilling operations.

16. Loose soil debris collects on top of the natural soil infill as a result of the operation to remove a portion of the soil infill and clean the interior face of the steel pile. This disturbed soil should be removed from the CISS piles prior to the placement of the steel reinforcement and structural concrete. Our Office recommends that the Structure Representative inspect the clean-out process of all piles before placing the steel reinforcement and concrete.

17. At the Engineer's option, if the retaining wall steel piles are driven to a depth that is within 5.0 feet of the specified tip and two times the required pile acceptance criteria is achieved, the pile tip elevation may be considered adequate and the excess pile length cut-off. Refer to the Caltrans Standard Specifications 49-1.08 (2006) for information concerning the pile acceptance criteria.

18. The Office of Geotechnical Design North should be invited to a pre-construction meeting.

Project Information

Standard special Provisions S5-280, "Project Information," discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the information handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

A. Log of Test Borings (Santa Maria River Bridge, Br. No. 49-0111R/L) dated May 1, 2009.

Data and Information included in the Information Handout provided to the bidders and Contractors are:

A. Foundation Report (Santa Maria River Bridge, Br. No. 49-0111R/L) dated August 4, 2009.
B. Seismic Report (Santa Maria River Bridge, Br. No. 49-0111R/L) dated August 3, 2009.

Data and information available for inspection at the District 5 Office:

A. None

Data and information available for inspection at the Transportation Laboratory:

A. As-Built Pile Logs Sheets (four pages) for the Bridges Across Santa Maria River (Br. No. 49-0111R/L) dated August 15, 1960.
B. Final Foundation Report, Seismic Retrofit Analyses, Bridges Across Santa Maria River Bridge No. 49-0111R/L, EMI, April 30, 1997.
C. Foundation Report for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated October 17, 1956.
D. Foundation Review for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated November 14, 1956.
E. Pile Driving Records for the Santa Maria River Bridge (Br. No. 49-0111R/L) dated July through October 1961.

The recommendations contained in this report are based on specific project information regarding design loads and structure locations that has been provided by the Office of Bridge Design North (OBDN). If any conceptual changes are made during final project design, the Office of Geotechnical Design - North, should review those changes to determine if the foundation recommendations provided in this report are still applicable. Any questions regarding the above recommendations should be directed to Jacqueline Martin (916) 227-1051 or Ron Richman (805) 549-3385, of the Office of Geotechnical Design-North.

Report by:

Jacqueline A. Martin

JACQUELINE A MARTIN
Engineering Geologist
Office of Geotechnical Design-North

Report by:

REGISTERED PROFESSIONAL ENGINEER
RONALD L. RICHMAN
No. CE039869
Exp. 12/31/2009
CIVIL ENGINEERING
STATE OF CALIFORNIA

RON RICHMAN, PE CE039869
Senior Materials and Research Engineer
Office of Geotechnical Design-North

cc: OGDN
GS File Room
Ron Richman
Reid Buell
Jacqueline Martin
R.E. Pending
Structure OE

REFERENCES

American Petroleum Institute (API), Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms-Working Stress Design (Pub. No. RP-2A-WSD), Twentieth Edition, July 1, 1993, p57-71.

Dupre, W.R., (1991), Quaternary geology of the southern California Coast Ranges. In R.B. Morrison, ed., Quaternary Nonglacial Geology: Conterminus U.S. Bolder, CO: Geological Society of America, The Geology of North America, Vol. K-2, p176-185.

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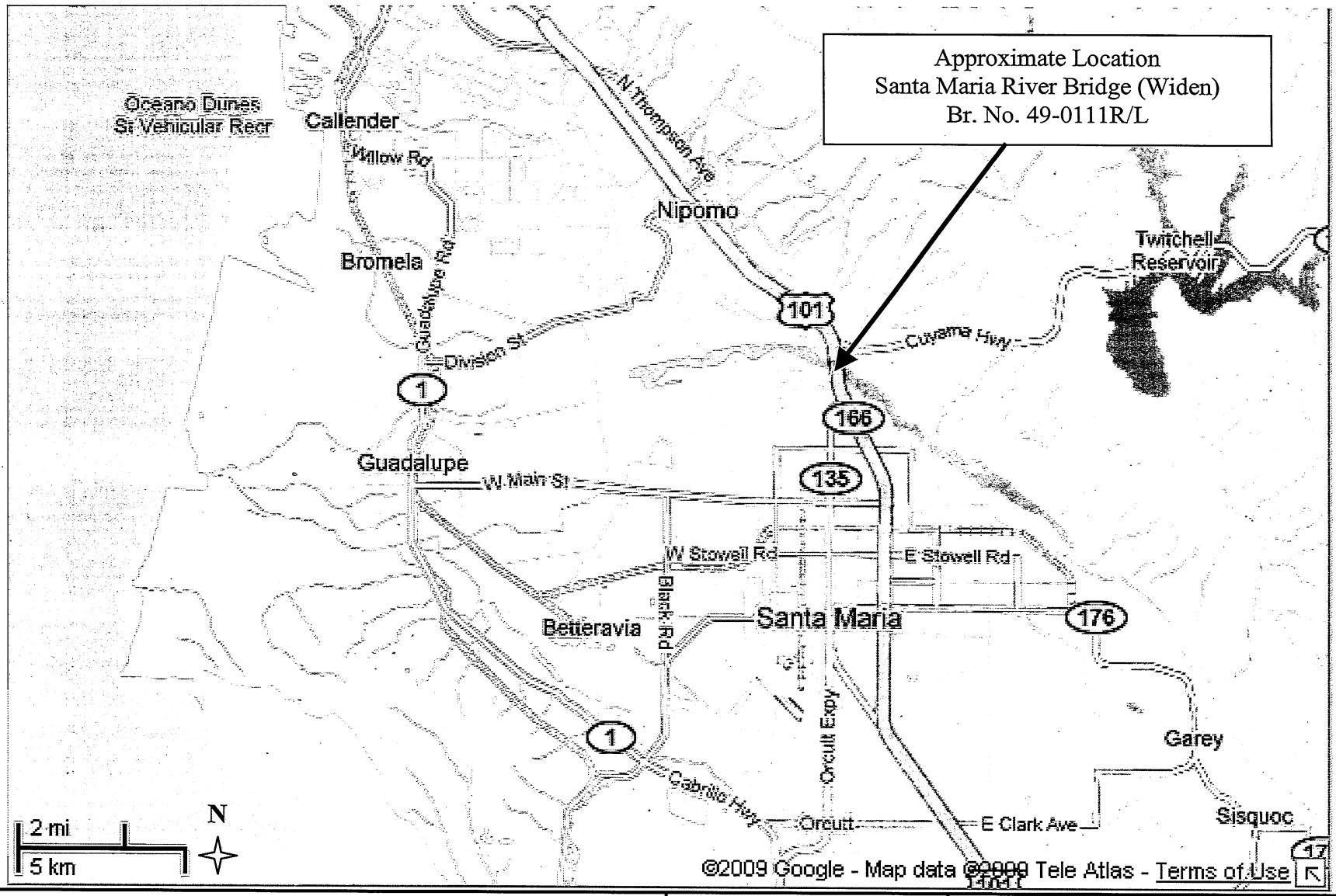
State of California, Department of Transportation (Caltrans):

- Standard Plans, May 2006
- Standard Specifications, May 2006
- Memo to Designers, Section 3-1, July 2008.
- Caltrans-Corrosion Guidelines, September 2003, Version 1.0.

Woodring, W.P. and Bramlette, M.N., (1950), Geology and Paleontology of the Santa Maria District, California, U.S. Geological Survey Professional Paper 222.

Worts, G. F., (1951), Geology and Ground-Water Resources of the Santa Maria Valley Area, California. Washington, DC: U.S. Geological Survey, U.S. Geological Survey Water Supply Paper 1000.



Caltrans

Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design – North

EA: 05-445901

August 4, 2009

Location Map

05-SLO-101 PM 0.0-0.8
Santa Maria River Bridge, Br. No. 49-0111R/L

Figure 1

Memorandum

To: Gordon Danke
Office of Structure Design
Design Branch 9

Date: May 17, 2007

File: 05-SLO-101-PM 0.19
EA 05-44590
Santa Maria River Bridge
49-0111 R/L

From: **Department of Transportation**
Hydraulic Engineering Branch

Subject: Final Hydraulic Report for the Santa Maria River Bridge

Attached for your records is the Hydrography report for the above referenced project. If you have any questions, please contact me at 227-0442.

Sincerely,

Neal Alie
Hydrology/Hydraulics Engineer

cc: Steve Ng

DIVISION OF STRUCTURES
Final Hydraulic Report

Santa Maria River Bridge

Located in San Luis Obispo

JOB:
Bridge No. 49-0111 R/L Bridge Widening

LOCATION:
05-SLO-101-PM 0.19

DATE:
May 2007

WRITTEN BY:
Neal Alie

REVIEWED BY:
Steve Ng

General

The Office of Structure Design is proposing to widen the existing Santa Maria River Bridge, Br. No. 49-0111 R/L from four lanes to six lanes. The new widened structure being proposed will match the existing I girder structure.

The existing Santa Maria River Bridge R/L, built in 1962, is a simple span precast prestressed I girder structure supported on solid piers and open end seated abutments on driven concrete piles. Both the right and left structures are 10.4 m (34.0 ft) wide and 638.0 m (2093.0 ft) long with 29 spans, spaced approximately 22.0 m (72.0 ft) apart. In 1997 the bridge was seismically retrofitted which included installing 1200 mm (4.0 ft) CIDH piles at piers 3, 6, 9, 12, 15, 18, 21, 24, 27, 28 and 29.

This report makes extensive reference to data and analysis found in the following: (1) Bridge Maintenance Reports, (2) Previous Hydraulics Study, October 3, 2000 (3) General as-builts, plans and profiles submitted by structures.

All elevations indicated in this report are referenced to the As-Built Datum dated August 15th, 1960.

Drainage Basin

The Santa Maria River located on the Central Coast of California is formed at the confluence of the Sisquoc and Cuyama River about 20 miles from the coast. The river defines part of the border between Santa Barbara and San Luis Obispo County and empties into the Pacific Ocean. There are no lakes or dams on the Santa Maria River, although a dam on the Cuyama River forms Twitchell Reservoir. Built by the Bureau of Reclamation, Twitchell Dam provides flood control and groundwater recharge. During much of the year the Santa Maria River has very little water, but it can sell greatly during a major storm event.

Discharge, Stage, Velocity and Waterway

The 50- year discharge was 1571.6 cms (55,500 cfs) and the 100-year discharge was 2095.0 cms (74,000 cfs).

The Hydraulic Program (BrEase) was used to perform a one-dimensional hydraulic analysis to calculate the water surface elevation and velocity at both the left and right bridge locations. The average velocity and the stage for the 50-year and 100-

year discharges at the upstream face of the bridge are given below. The results are based on a roughness coefficient of 0.035 and a gradient of 0.0033.

50-Year Discharge	1571.6 cms (55,500 cfs)
Velocity (50-year)	2.1 mps (6.9 fps)
Water Surface Elev.	63.7 m (209.1 ft)
Available Freeboard	4.5 m (14.9 ft)
100-year Discharge	2095.4 cms (74,000 cfs)
Velocity (100-year)	2.3 mps (7.6 fps)
Water Surface Elev.	64.0 m (210.1 ft)
Available Freeboard	4.2 m (13.9 ft)

There is more than adequate waterway for both the 50-year and 100-year events.

Streambed and Scour

According to the Bridge Maintenance records there has been a history of minor scour problems at the bridge site including footing exposure at several of the piers. There has also been a history of debris buildup at several of the pier noses.

The Santa Maria River has been heavily mined upstream and downstream throughout the years since it was built. The result of streambed mining upstream is an imbalance between the sediment supply and transport capacity causing degradation at the bridge site. The mining downstream can cause a head cut that could travel upstream to the bridge site. A report completed in 1995 by Dr. Howard Chang on the effects of mining on the Santa Maria River indicated that the riverbed could possibly degrade to elevation 59.4 m (195.0 ft).

In November 2001 the scour potential was assessed in accordance with FHWA Technical Advisory T5140.23, " Evaluating Scour at Bridges", and within current Caltrans guidelines. The existing bridge was determined to be not scouring critical. The NBIS Item 113 code is 5, "Bridge Foundations determined to be stable for calculated scour conditions; scour within limits of piles.

The potential local pier scour was calculated to be 4.57 m (15.0 ft) for existing condition. The total scour elevation that all new foundations should be designed too is at least 55.0 m (180.5 ft). This includes the potential local pier scour and future degradation. Structure Hydraulics recommends placing the top of the footings at

elevation 59.4 m (195.0 ft) and that all foundations be designed assuming no ground support (lateral or vertical) as a result of soil loss due to possible scour or lateral stream migration.

Drift

According to the Bridge Maintenance records there has been a history of debris piling up at the nose of a number of the piers, especially during major storm events. Photos taken by the Structure Hydraulics group during a field inspection in January 2005 indicate debris and vegetation growth at a number of the piers on the right bridge.

Bank Protection

There is rock slope protection at the roadway approach fills and appears to be in good condition.

HYDROLOGIC SUMMARY Br. No. 49-0111 R/L			
	Design Flood	Base Flood	Overtopping Flood/Flood of Record?
Frequency	50-yr	100-yr	N/A
Discharge	1571.6 cms (55,500 cfs)	2095.0 cms (74,000 cfs).	N/A
Water Surface Elevation at Bridge	63.7 m (209.1 ft)	64.0 m (210.1 ft)	N/A
Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.			

Santa Maria River Bridge
Bridge No. 49-0111R/L
05-SLO-101-PM 0.19
EA 05-44590

This report has been prepared under my direction as the professional engineer in responsible charge of the work, in accordance with the provisions of the professional Engineers Act of the State of California.

REGISTERED CIVIL ENGINEER (SIGNATURE)

REGISTRATION NUMBER: C056398 DATE: 5/17/07

REGISTERED PROFESSIONAL ENGINEER
NEAL ALI
No. C056398
Exp. 06/08
CIVIL
STATE OF CALIFORNIA

State of California
Department of Transportation

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. GORDON DANKE
Senior Bridge Engineer
Division of Structure Design MS 9
Office of Bridge Design Central
Bridge Design Branch 9

Date: August 3, 2009

File: 05-SLO-101
PM 0.0/0.8
05-445901
Santa Maria River
Bridge (widen)
Br. No. 49-0111 R/L

Attention: Mr. Pete Norboe

Rec'd 8/17/09

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5
OFFICE OF GEOTECHNICAL DESIGN - NORTH

Subject: Final Seismic Design Recommendations and Soil Springs

This report presents the final seismic design recommendations and soil springs for the above referenced project located on Route 101 in San Luis Obispo County, and is in response to your request. Please note the attached soil spring data were hand delivered on December 18th, 2008 meeting held in our office.

Seismicity

Based on the Caltrans California Seismic Hazard Map 1996, the controlling fault is the Santa Maria-Foxen Canyon (reverse including thrust) with a maximum credible earthquake moment magnitude of M_w=6.5, and is located about 1 kilometer south west of the site. The Peak Bedrock Acceleration, based on the above map is estimated to be 0.6g. The potential for surface rupture at the site due to fault movement is considered insignificant since there are no known faults projecting towards or passing directly through the project site.

A site specific Acceleration Response Spectral (ARS) curve using the measured shear wave velocity data were done by the Geotechnical Earthquake Engineering Section in a report entitled "Final Acceleration Response Spectrum for Santa Maria River Bridge (Bridge No. 49-0111 R/L)" dated August 8, 1996. The review of the subject report indicates that the previously developed seismic design criteria is still valid and may be

used to design the Santa Maria River Bridge. A copy of the report is attached in Appendix A.

Liquefaction Analyses

In order to verify the extend of the liquefaction potential at the bridge site, various soil samples during the subsurface exploration were collected and tested for their fine contents and the Atterberg Limits. The attached Appendix B exhibits the results of the liquefaction potential for the loose to compact granular materials. Please note that due to detailed study of the secondary hazards associated with ground motion, all previous related studies are superseded by this report. Furthermore, the analyses were done by assuming the water is sunning at the river bed.

Soil Springs

The soil springs, py curves for the propose 48-inch diameter Pipe Pile were generated using soil models included in the documentation for the computer program LPILE (Ensoft Inc., May 1997). Due to the existence of liquefiable layer, the p-values of the p-y curves in these layers were reduced.

Please note that group reduction factor (GRF) for p-y curves has not been imposed. GRF should be applied after the pile layout is finalized. A GRF of 0.4 should be applied for the pile center-to center spacing of 2D, where D is the pile diameter. A GRF of one should be used for the pile spacing of 5D or greater. Use linear interpolation for pile spacing between 2D and 5D. The plots and tabulated data for p-y curves are attached in Appendix B.

The axial resistance and end resistance (t-z and q-z curves) for the proposed pile foundations were generated using the procedures outlined in American Petroleum Institute Recommended Practice 2A-WSD (RP 2A-WSD) Twentieth Edition, July 1, 1993. Due to liquefiable layers, the axial and end resistances through these layers are zero.

The plots and tabulated data for t-z and q-z curves are attached in Appendices C and D respectively.

If you have any questions regarding the above recommendations, please call me at (916) 227-1033.

REZA MAHALLATI
Senior Materials and Research Engineer
Office of Geotechnical Design - North

REGISTERED PROFESSIONAL ENGINEER
REZA MAHALLATI
No. 49374
Exp. 9/30/10
CIVIL
STATE OF CALIFORNIA

Attachments
1- Appendix A – ARS Curve
2- Appendix B – Liquefiable Layers
3- Appendix C – p-y Curves
4- Appendix D – t-z Curves
5- Appendix E – q-z Curves

c: Jacqueline A. Martin (OGD-N)
GDN File

Appendix A

Recommended ARS Curve

WTC HERNAN

FAX

State of California

Business, Transportation and Housing Agency

Memorandum

Rec'd 8/21/96 @RBF

To : MR. R. BRENT LEMON

Date : August 8, 1996

File : 05-SLO-101-0.09
05-44440K

Santa Maria River
Bridge No. 49-0111 R/L

From : ~~DEPARTMENT OF TRANSPORTATION~~
ENGINEERING SERVICE CENTER
Office of Structural Foundations - MS #5
Structure Foundations Branch

Subject : Final Acceleration Response Spectrum for Santa Maria River Bridge (Bridge No. 49-0111 R/L)

This memo presents the final results of the site response analysis for the Santa Maria River Bridge (Bridge No. 49-0111 R/L).

On March 20, 1996, a preliminary site response analysis was sent to the Division of Structures. The depth to rock-like material and the shear wave velocities had been estimated at that time, and thus the results of the previous analysis were classified as preliminary.

On June 24, 1996 the Office of Structural Foundations received measured shear wave velocity data. These data were used in conjunction with Log of Test Borings to determine the final acceleration response spectrum (ARS). Figure 1 compares the recommended design ARS and the ARS due to the preliminary estimated and measured shear wave velocities. As indicated in Figure 1, the ARS generated from the measured shear wave velocities is considered to fall within the range of the previous recommended design curve. Therefore, previously recommended design ARS should be used as the final design ARS.

If you have any further questions please contact Mr. Jim Gutierrez at 227-7269 or Mr. Abbas Abghari at 227-6912.

JIM GUTIERREZ, PE
Associate Materials & Research Engineer
~~Geotechnical Earthquake~~ Engineering Section

ABBAS ABGHARI, Chief
Geotechnical Earthquake Engineering Section

cc: EL eivas

REGISTERED PROFESSIONAL ENGINEER
JIM GUTIERREZ
No. 0000
Exp. 12/31/98
CIVIL
STATE OF CALIFORNIA

Post-it® Fax Note 7671	Date	# of pages ▸ 2
To LINO CHEANG	From PAUL YOUNG	
Co./Dept.	Co	
Phone #	Phone # 855-3641	
Fax # 751-3928	Fax #	

Santa Maria River Bfidge (Bridge No. 44-0111L/R)

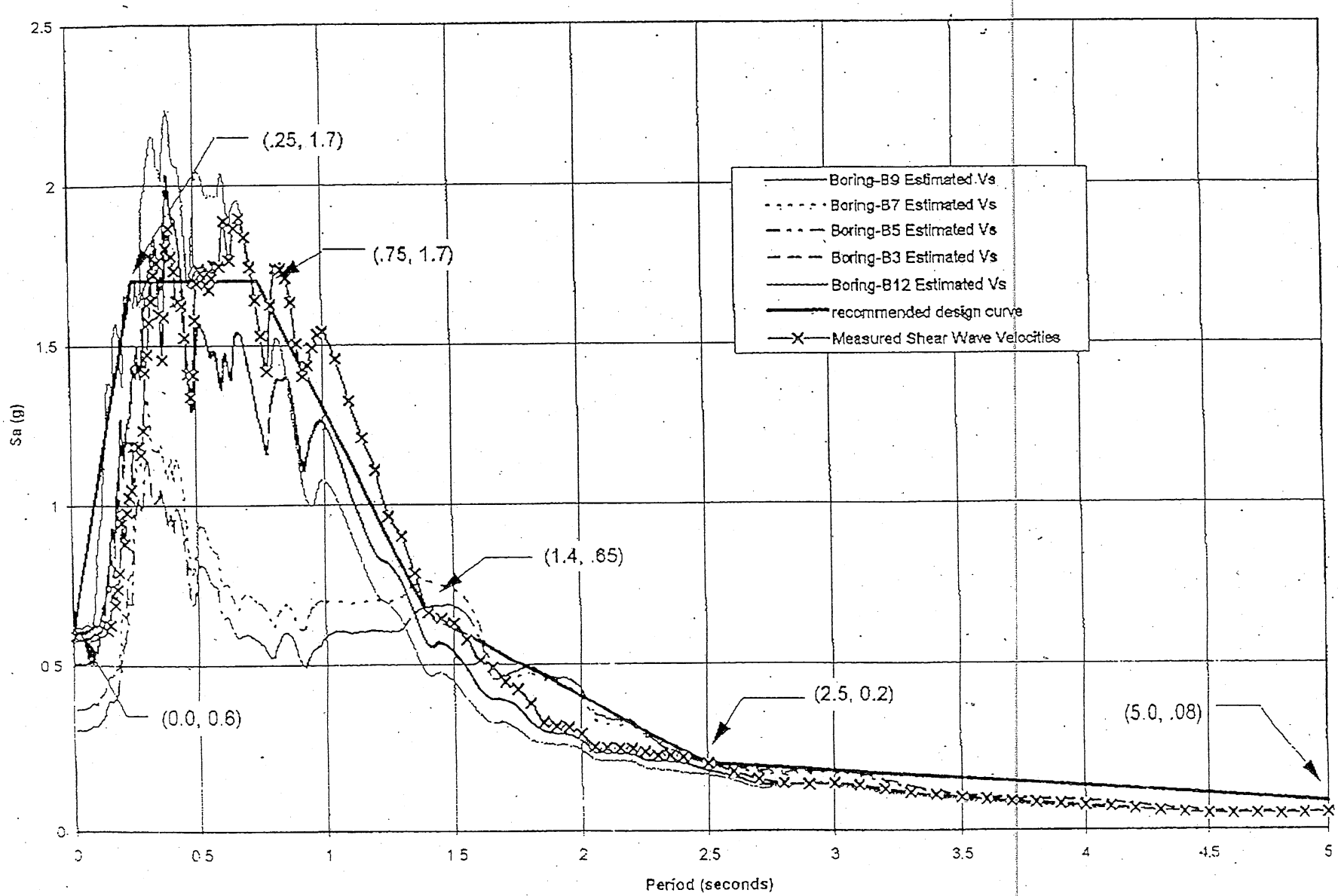


Figure 1,
Final Recommended Design ARS curve.

F-261 T-841 P-002 AUG 22 '96 11:01

Book

State of California

Business, Transportation and Housing Agency

Memorandum

Rec'd 6/17

To : MR. BRENT LEMON
Office of Structures External Liaison and Support
Design Branch "C"

Date : March 20, 1996

File : 05-SLO-101-0.09
05-414001

Santa Maria River Bridge
Bridge No. 49-0111R/L

From : **DEPARTMENT OF TRANSPORTATION**
ENGINEERING SERVICE CENTER
Office of Structural Foundations
Structure Foundations Branch

Subject : Preliminary Site Response Analysis

This memo presents the preliminary results of site response analysis of Santa Maria River Bridge (Bridge No. 49-0111R/L).

In accordance with CDMG's report in 1992 entitled, *Peak Acceleration from Maximum Credible Earthquake in California*, the Santa Maria River Fault with a maximum moment magnitude of 6.5 is the local fault. The Santa Maria River Fault is located approximately 1 km from the bridge site. The mean rock target spectrum was determined based on attenuation relationships developed by Geomatrix (1993). The Santa Cruz N-S record from the 1989 Loma Prieta Earthquake was modified to be spectrum compatible with the target spectrum at the site and then used as the outcropping rock motion (Figure 1).

Soil properties are determined based on As Built information. The depth to rock-like material (shear wave velocity of 2500 ft/s) is unknown. A depth of 150 to 200 feet to the rock-like material is assumed in this analysis.

The program SHAKE (1991) was used to conduct the site response analysis. Acceleration and displacement response spectra were calculated and are presented in Figure 2. In the same figure, the recommended design curve was superimposed over the earthquake responses to aid in design.

The 1956 boring data indicate the site is susceptible to liquefaction. Along the bridge site, two zones that have liquefaction potential were identified. Zone 1 consists of loose to compact sand with some shell or gravel. This zone starts at ground surface and goes to a depth of about 20 feet across the bridge site. Zone 2 is mainly composed of loose sand or silty sand at depths of 40 to 75 feet covering from Pier 10 through Pier 22. Liquefaction may cause a substantial reduction on soil lateral resistance and a full loss of soil axial capacity, coupled with additional soil forces imposing on pile foundations. Therefore, mitigation of liquefaction hazard for the highly liquefiable soil layers in two zones needs to be considered in retrofit design. As such, steel pipe piles of 24" or 36" in diameter are recommended for the pile foundation. Lateral soil resistance curves (p-y) may be generated using COM624. For liquefiable soil, it is recommended that p values generated from COM624 be multiplied by a reduction factor and y values kept the same. Reduction factors of 0.5 and 0.25 are recommended for Zone 1 and Zone 2, respectively. In addition, axial resistance should be set to zero for liquefiable soil.

Additional borings are scheduled in April by Dave Thomas and site specific analysis will be finalized when the soil data become available.

Bridge No. 49-0111 R/L

If you have any questions regarding this analysis, please contact James Chai at (916) 227-7179 or Abbas Abghari at (916) 227-7172.

JAMES (JIANZHONG) CHAI, P.E. C052137
Associate Materials & Research Engineer
Earthquake Engineering Section

ABBAS ABGHARI, Chief
Earthquake Engineering Section

Attachments

cc: ELeivas
DThomas

Santa Maria River Bridge (Bridge No.44-011 R/L)

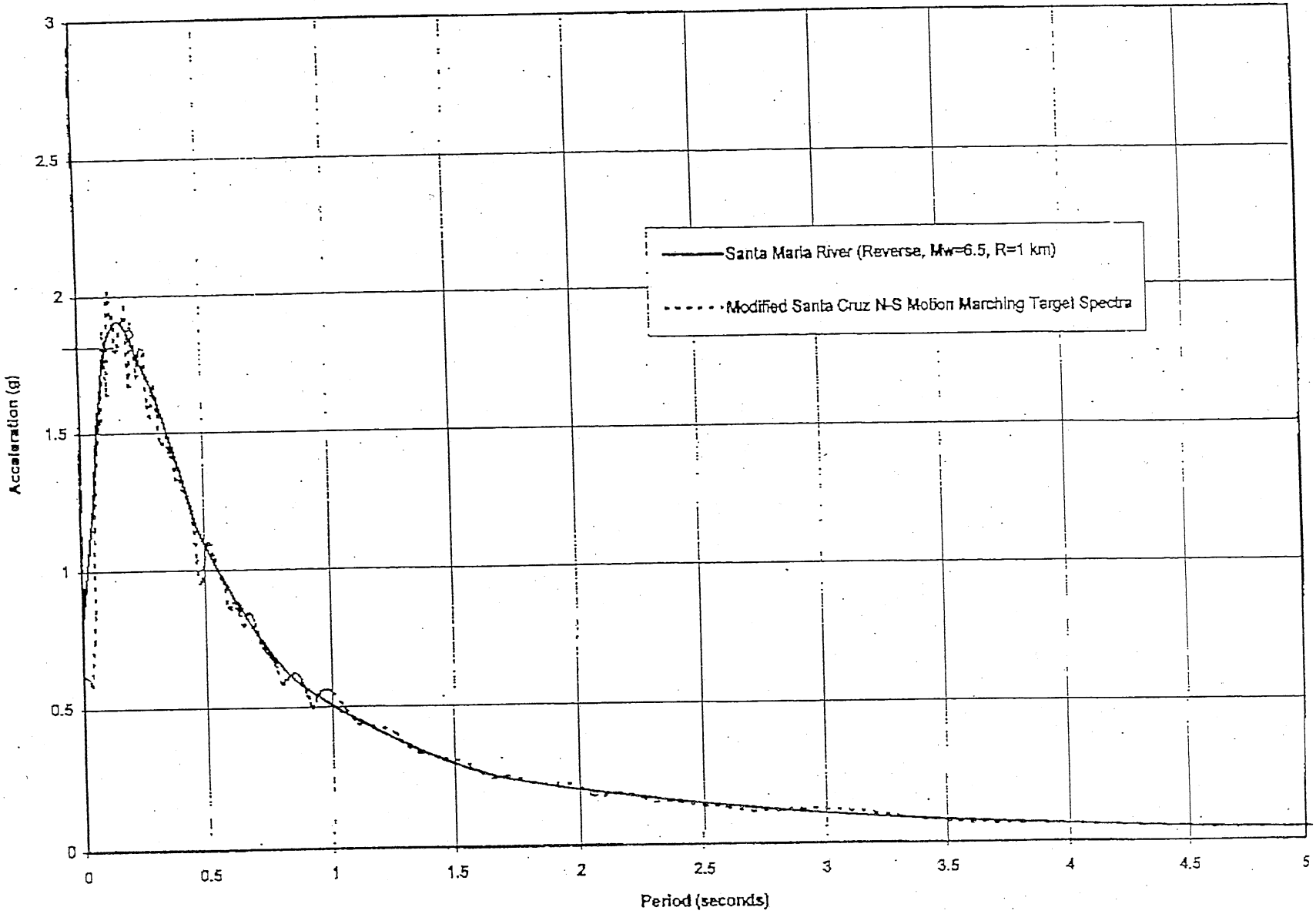


Figure 1 Target Spectra of Rock Input Motion

Snata Maria River Bridge (Bridge No. 44-011 R/L)

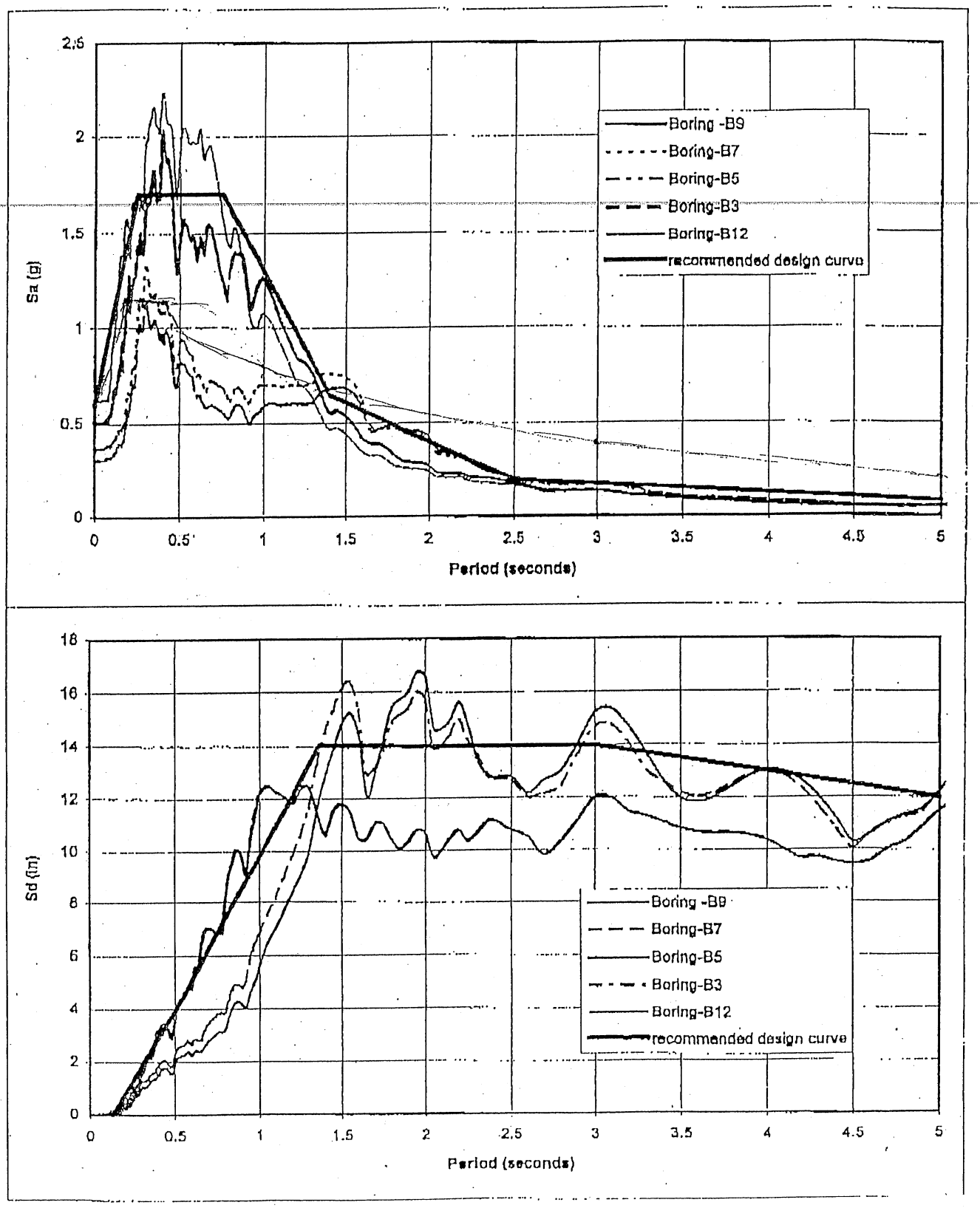


Figure 2 Acceleration Response Spectra at Ground Surface

Appendix B

Liquefaction Results

Santa Maria River Bridge (Widen)
Br. No. 49-0111 R/L
05-445901

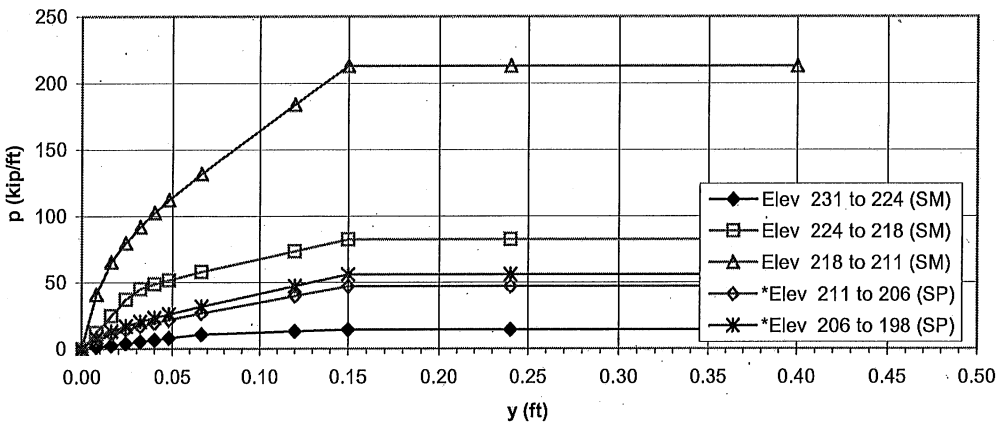
Support Location	Original Ground Elevation	Elevation of Liquefiable Layer (ft)
Abutment 1	231	211 to 191
Pier 2	213	213 to 198 and 179 to 174
Pier 3	213	213 to 206 and 194 to 188
Pier 4	213	213 to 197 and 194 to 190
Pier 5	209	209 to 201 and 195 to 189
Pier 6	209	209 to 203 and 197 to 188 and 179 to 154
Pier 7	209	209 to 203 and 197 to 188 and 179 to 154
Pier 8	208	208 to 190
Pier 9	208	208 to 188 and 176 to 171
Pier 10	208	208 to 188
Pier 11	208	208 to 191 and 166 to 157
Pier 12	208	208 to 198 and 188 to 185 and 174 to 164
Pier 13	207	167 to 162
Pier 14	206	206 to 196 and 190 to 183 and 166 to 161
Pier 15	206	206 to 196 and 190 to 183 and 166 to 161
Pier 16	206	206 to 183 and 171 to 165
Pier 17	206	189 to 184 and 169 to 163
Pier 18	206	206 to 176 and 171 to 166
Pier 19	207	207 to 176 and 172 to 162
Pier 20	206	206 to 175 and 169 to 164
Pier 21	206	199 to 184 and 166 to 160
Pier 22	205	205 to 187
Pier 23	205	205 to 198 and 191 to 183
Pier 24	206	206 to 186
Pier 25	205	205 to 199
Pier 26	204	204 to 194
Pier 27	202	202 to 187 and 177 to 173
Pier 28	208	208 to 184
Pier 29	208	208 to 184
Abutment 30	231	201 to 185

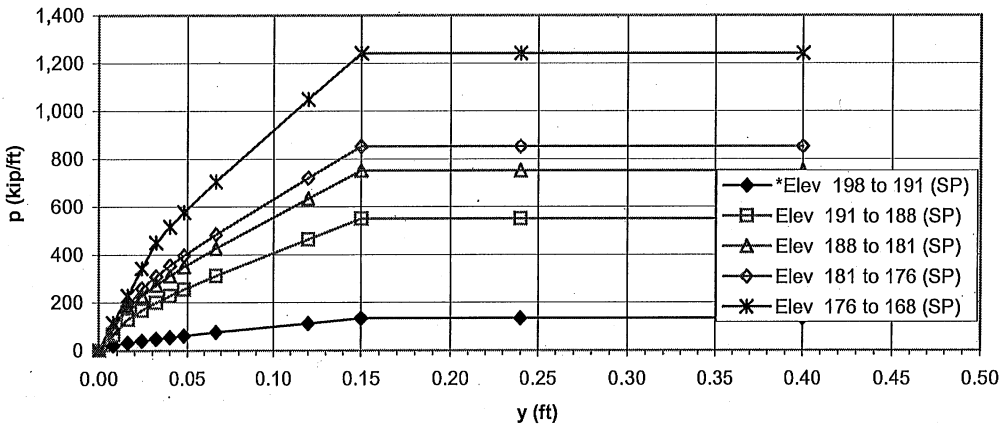
Appendix C

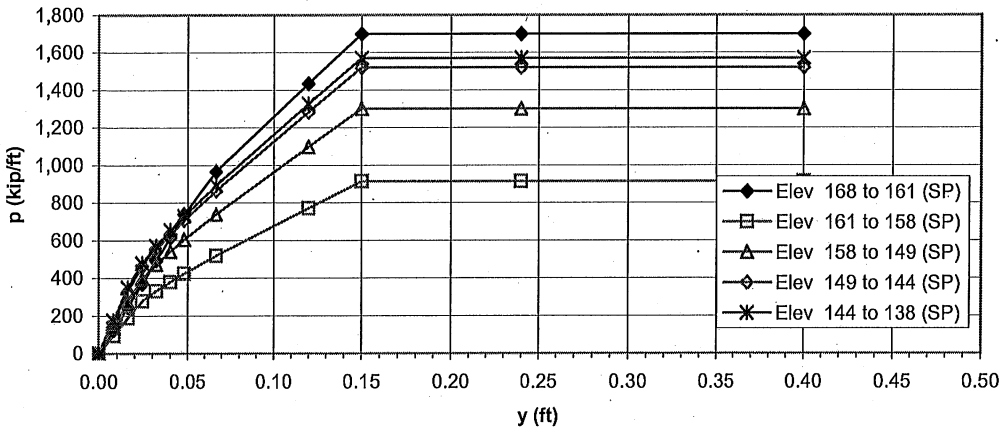
Lateral Resistance, p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Abut 1		O.G.	231.0	Pile	4' PP
Sta.		Cut-off	231.0	GWS	213.0







Post-Liquefaction

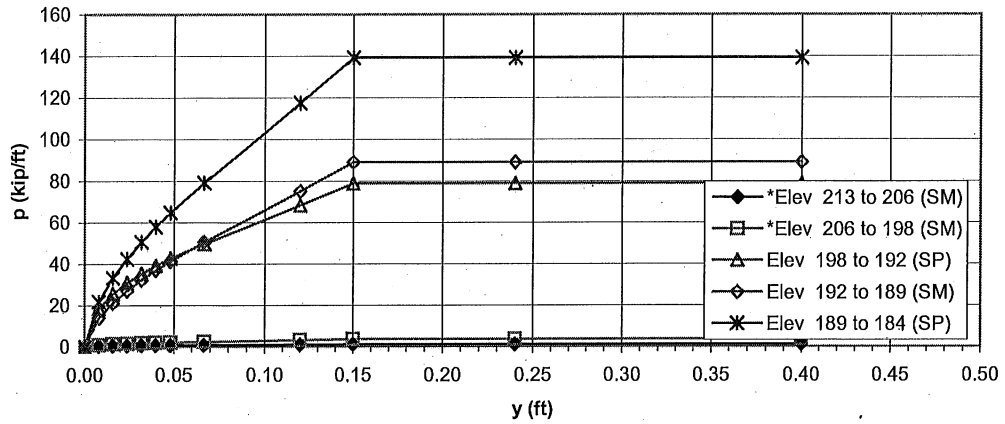
* - Liquefiable Layer

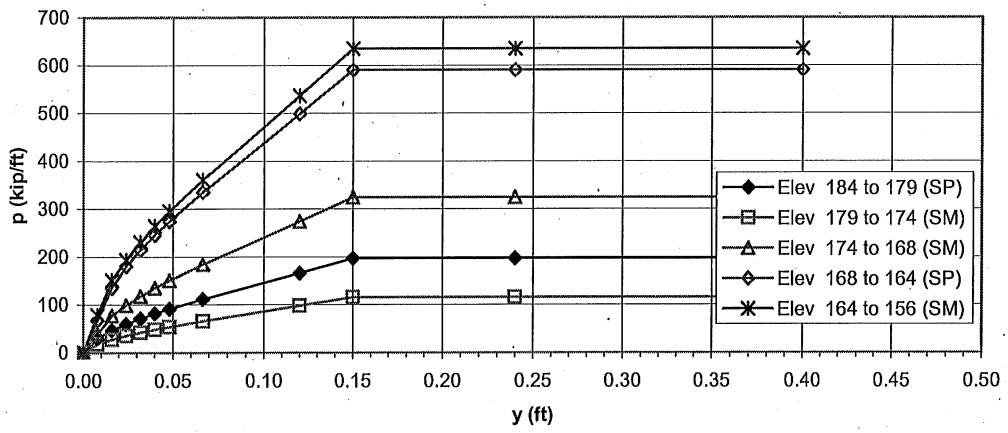
p-y Curves

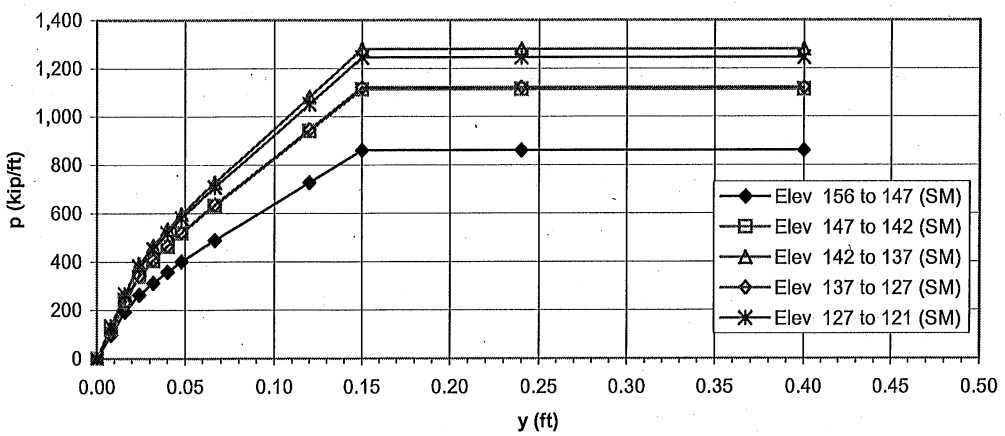
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 2

Sta.		O.G.	213.0	Pile	4'PP
		Cut-off	213.0	GWS	213.0







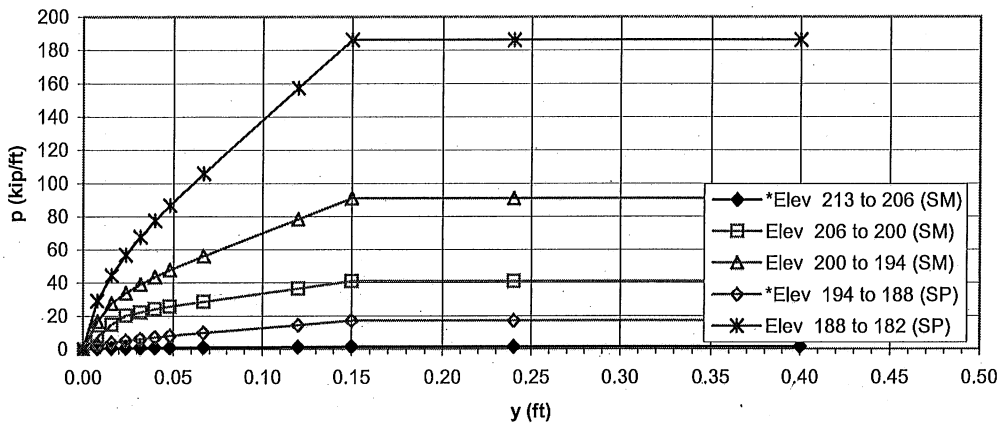
Post-Liquefaction

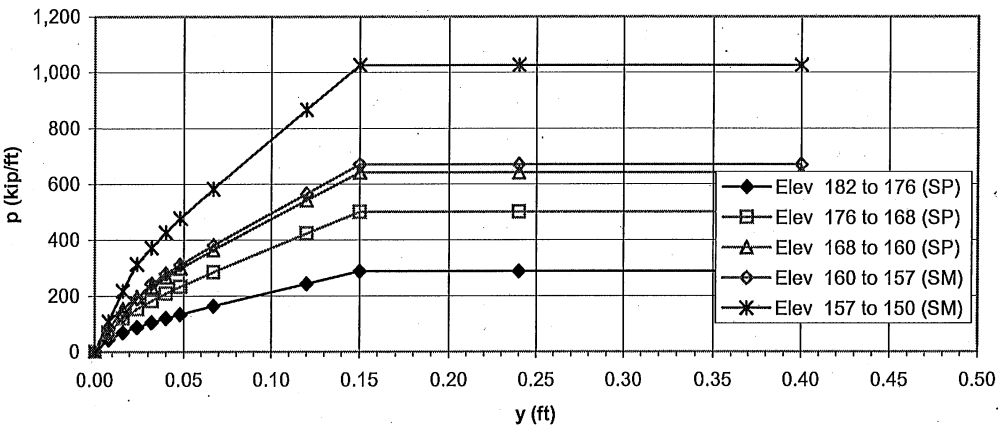
* - Liquefiable Layer

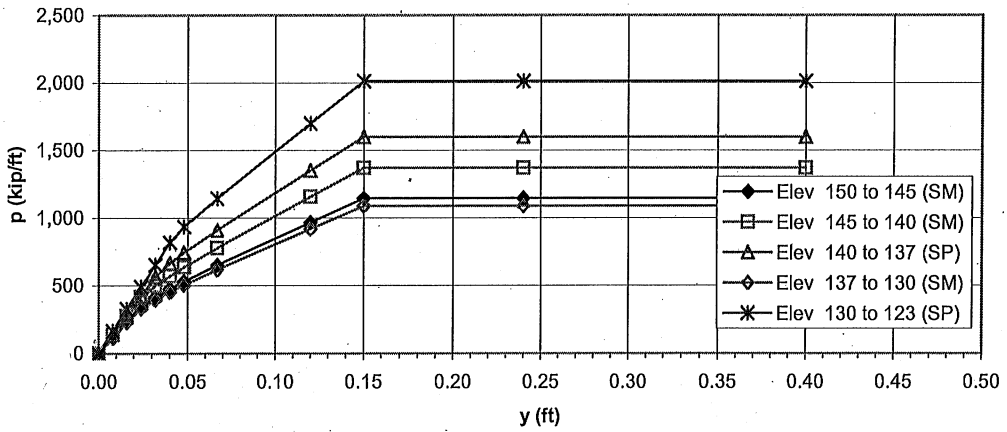
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 3		O.G.	213.0	Pile	4' PP
Sta.		Cut-off	213.0	GWS	213.0







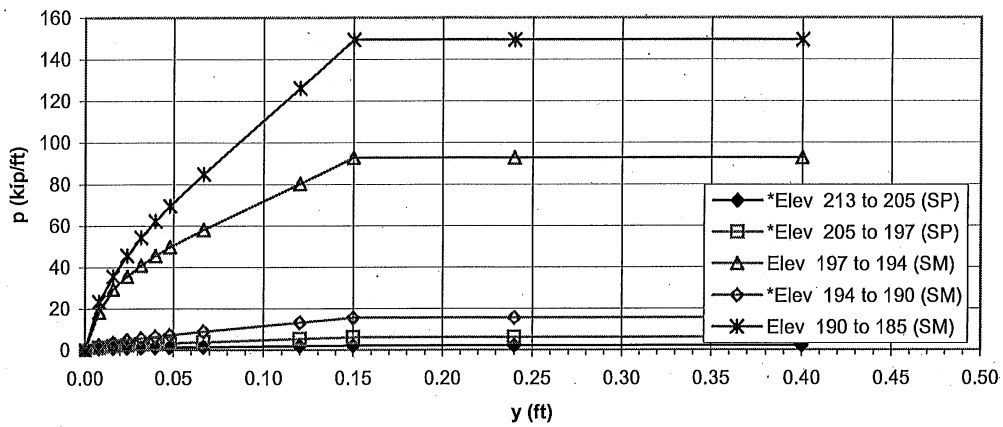
Post-Liquefaction

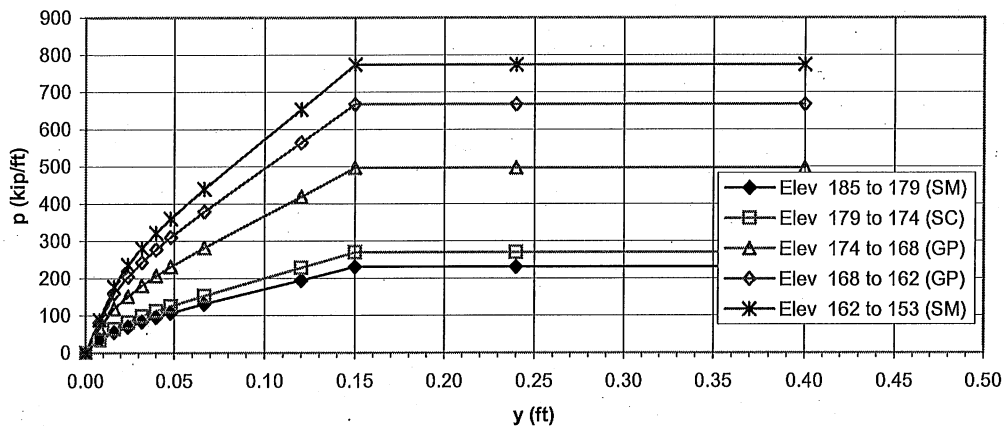
* - Liquefiable Layer

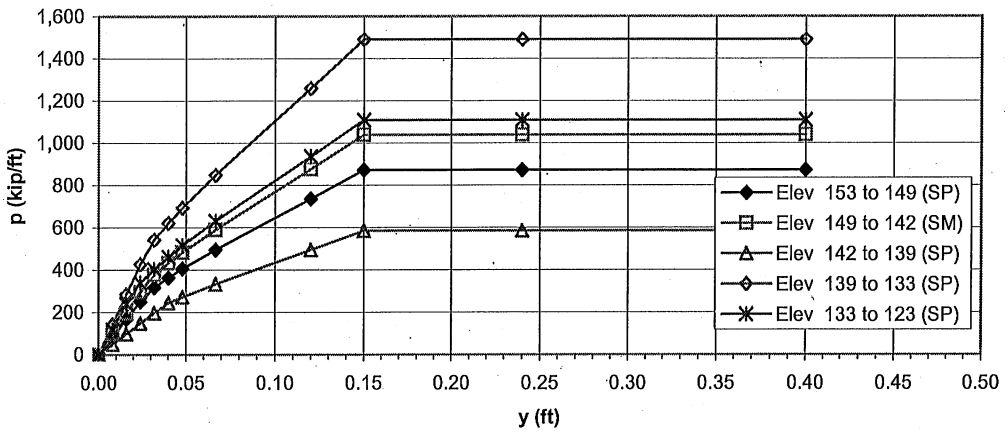
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 4		O.G.	213.0	Pile	4' PP
Sta.		Cut-off	213.0	GWS	213.0







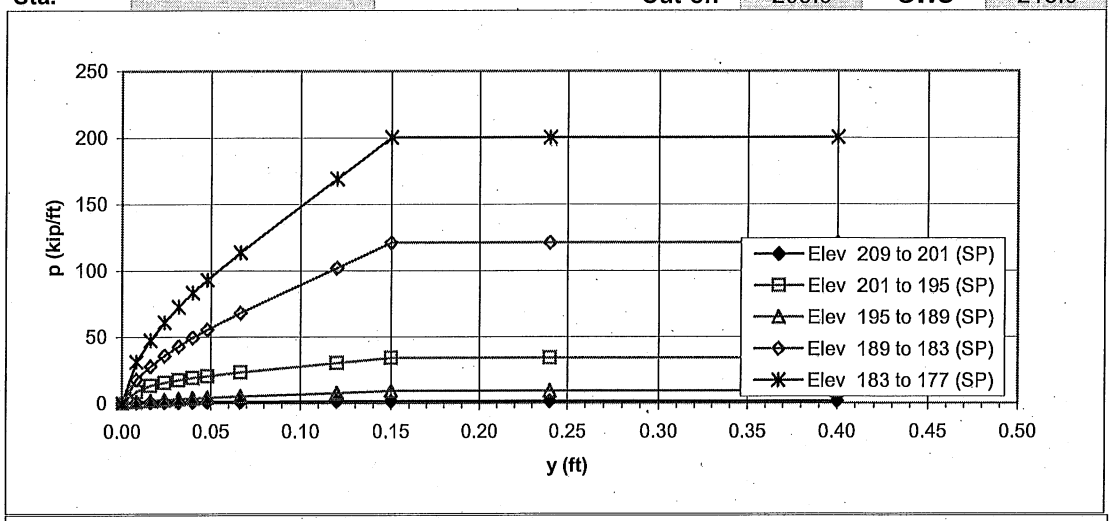
Post-Liquefaction

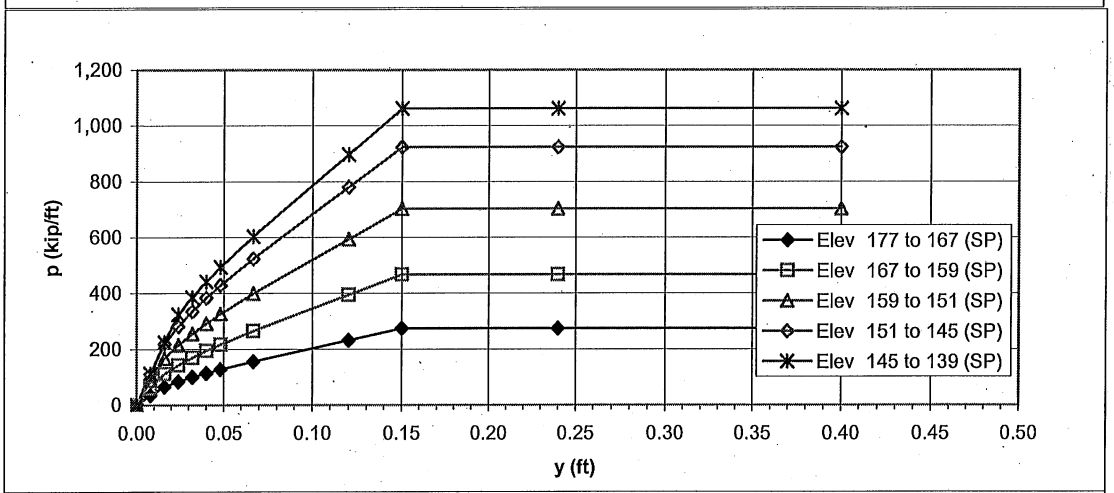
* - Liquefiable Layer

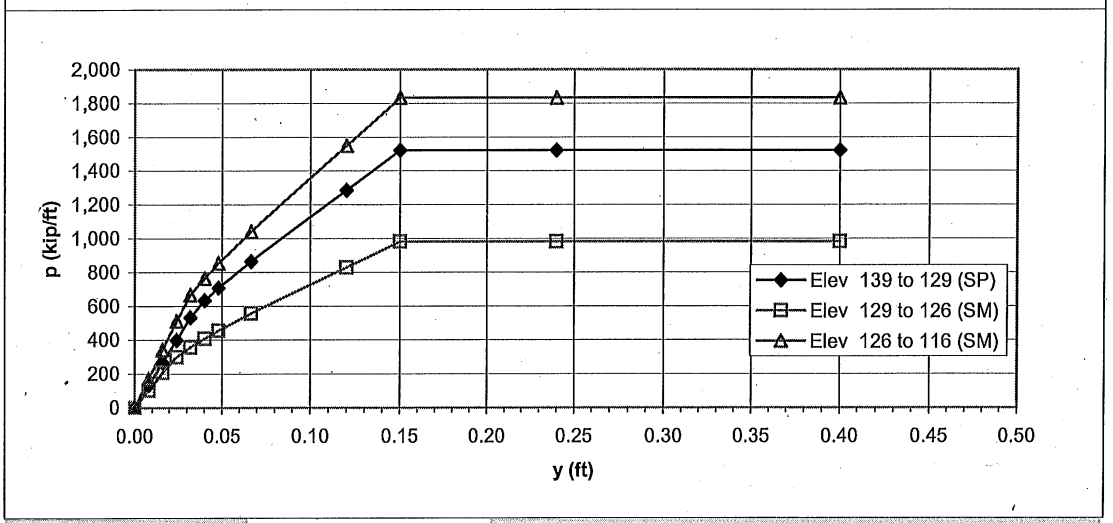
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 5		O.G.	209.0	Pile	4' PP
Sta.		Cut-off	209.0	GWS	213.0







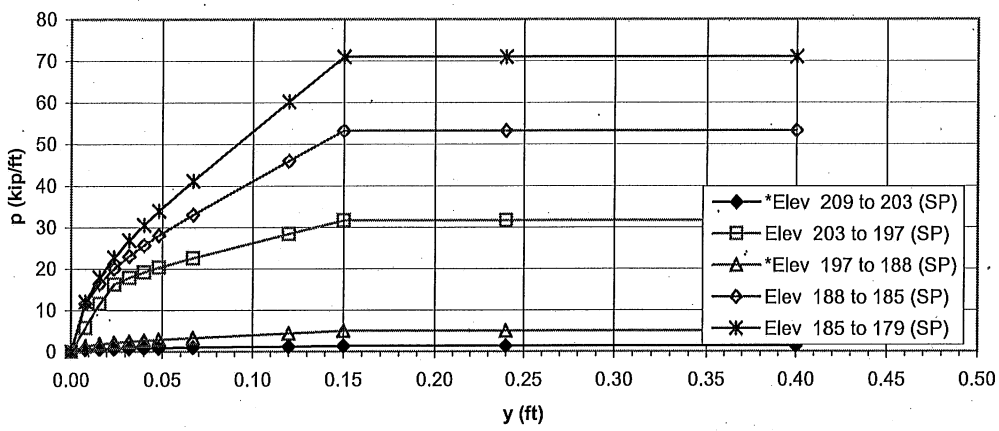
Post-Liquefaction

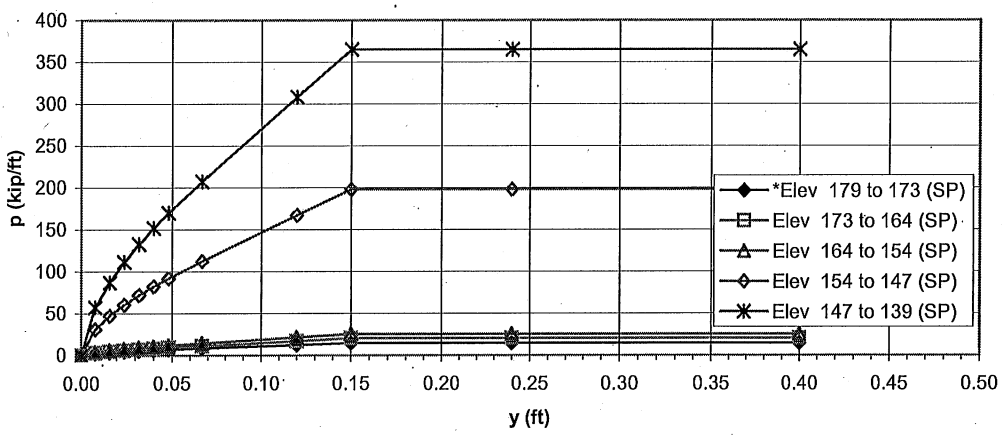
* - Liquefiable Layer

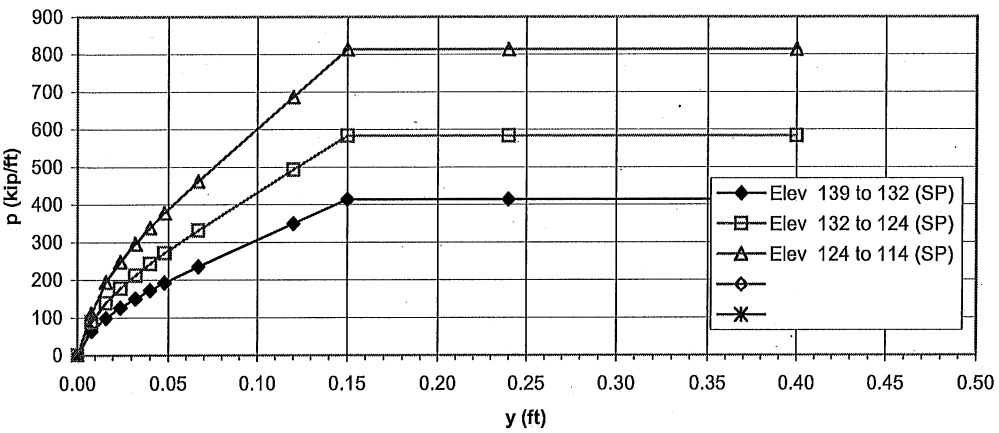
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 6		O.G.	209.0	Pile	4' PP
Sta.		Cut-off	209.0	GWS	213.0







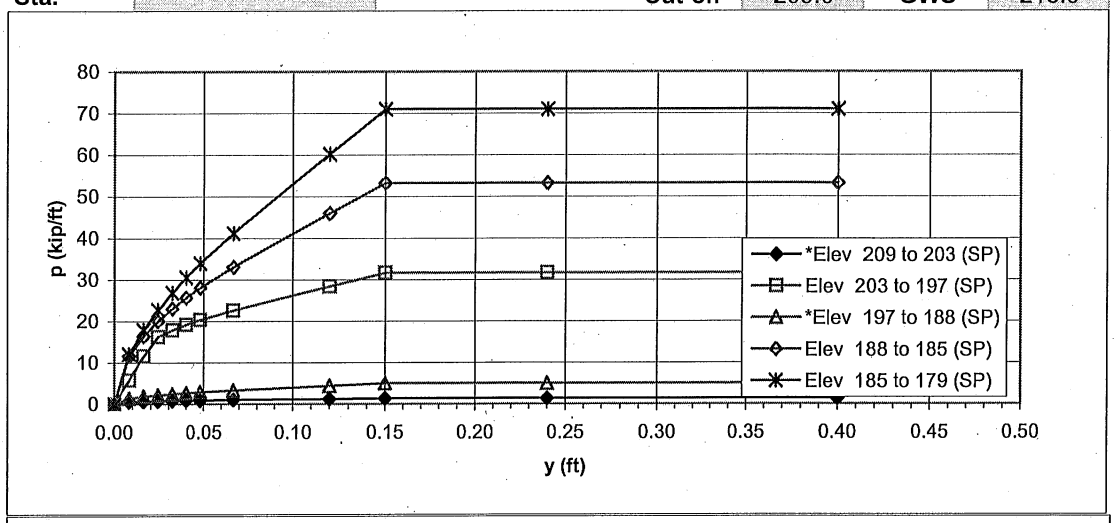
Post-Liquefaction

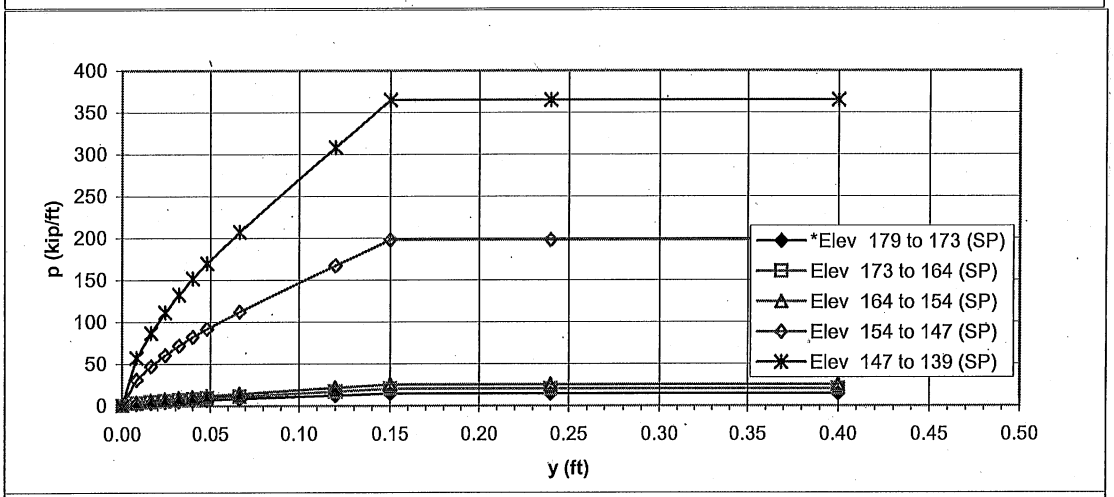
* - Liquefiable Layer

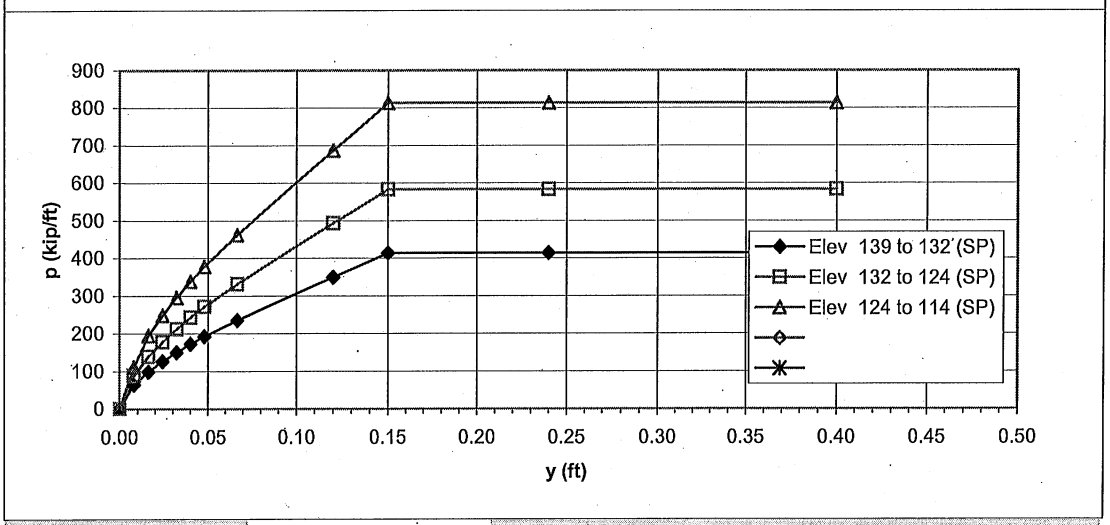
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 7		O.G.	209.0	Pile	4' PP
Sta.		Cut-off	209.0	GWS	213.0







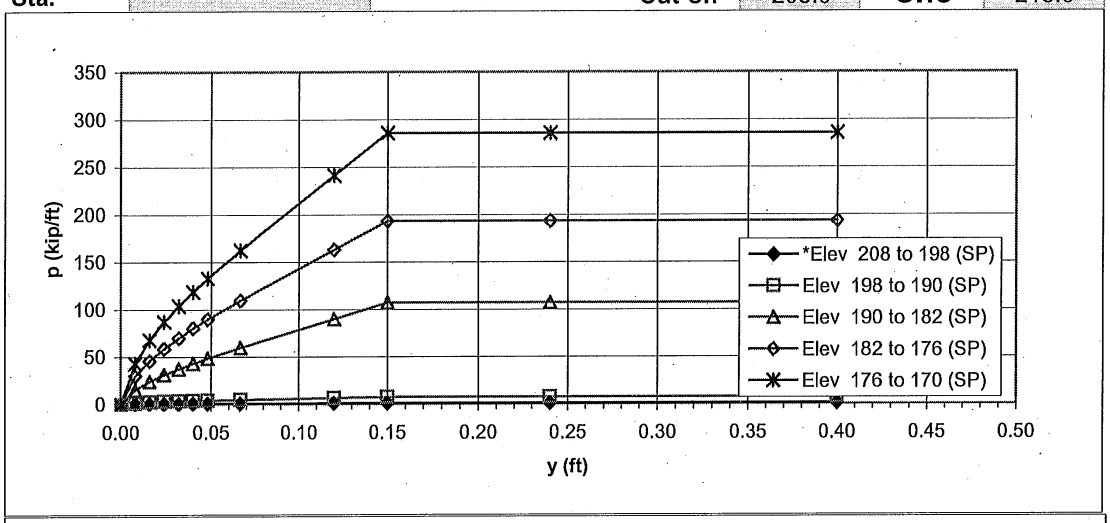
Post-Liquefaction

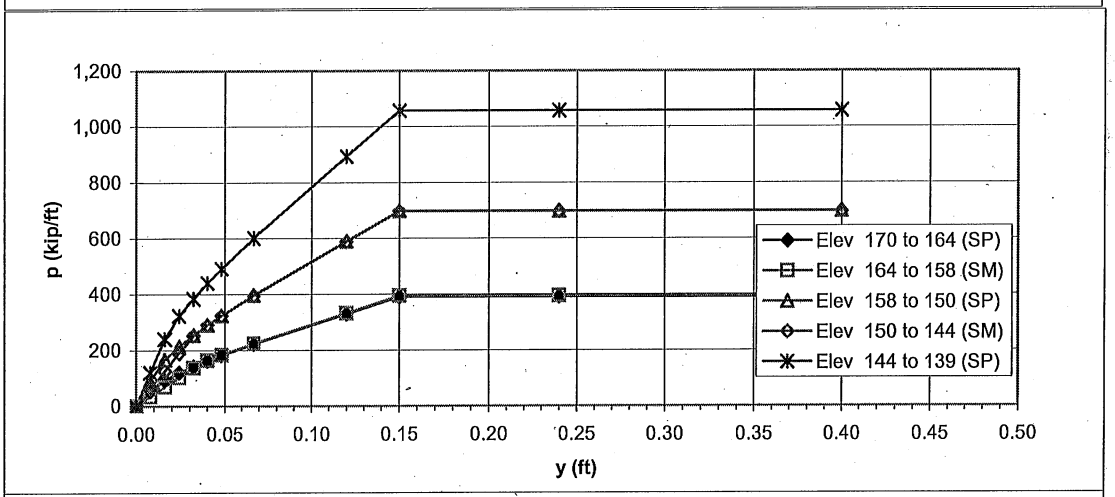
* - Liquefiable Layer

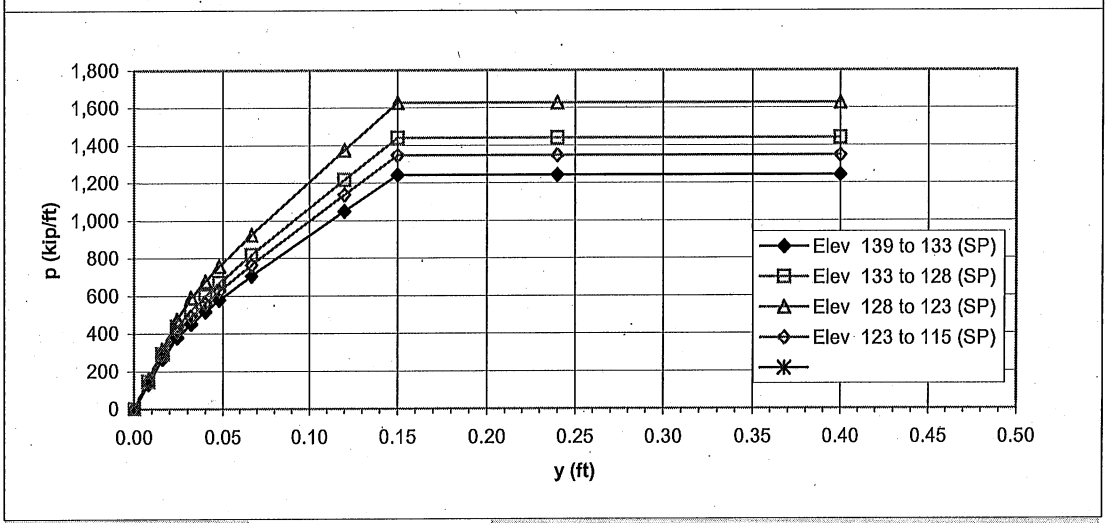
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 8		O.G.	208.0	Pile	4'PP
Sta.		Cut-off	205.0	GWS	213.0







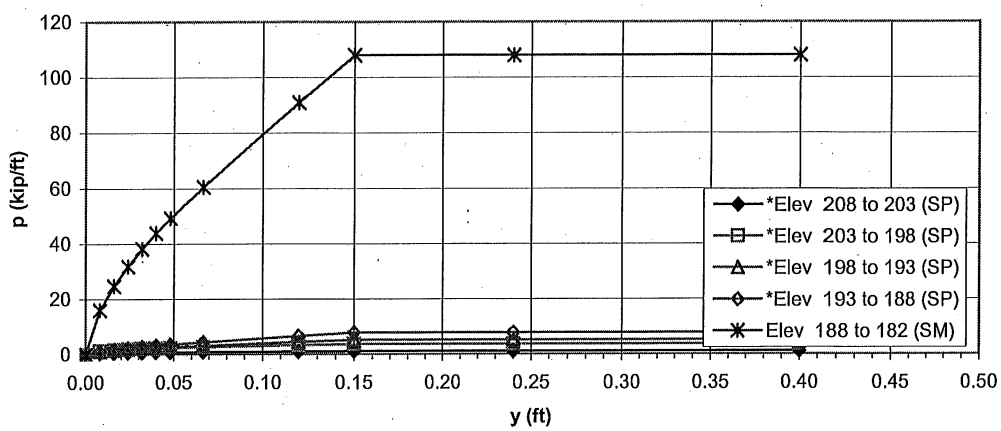
Post-Liquefaction

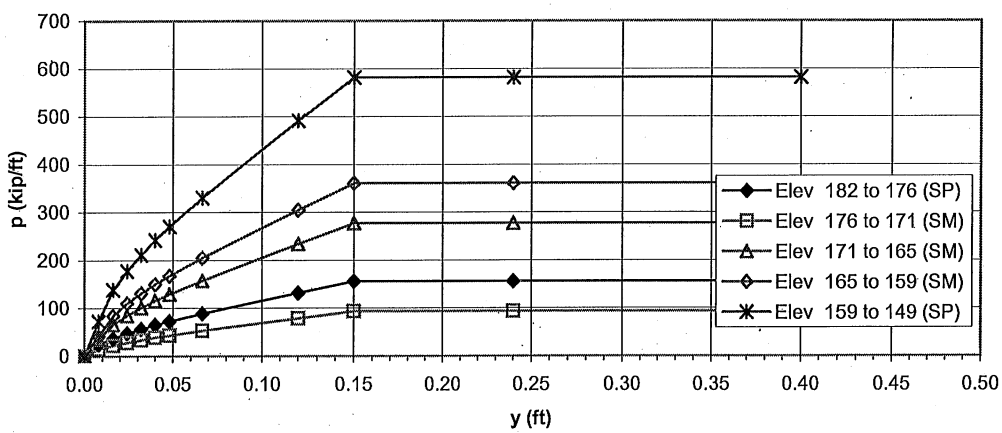
* - Liquefiable Layer

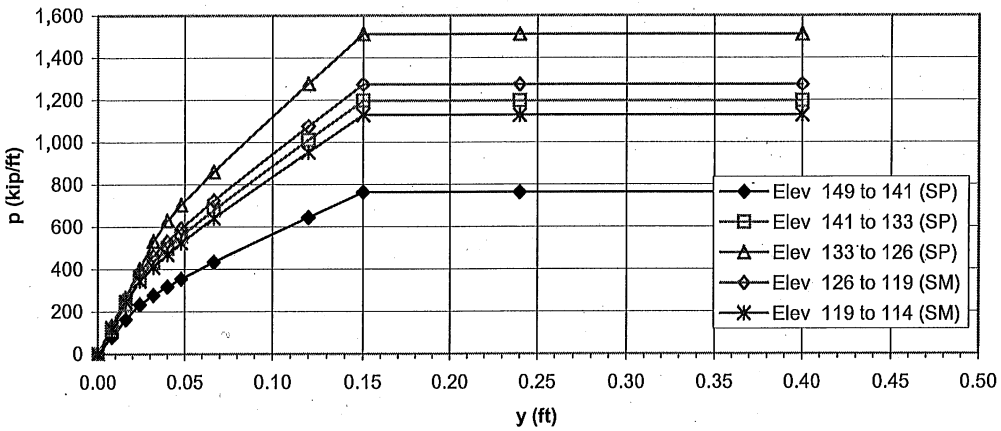
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 9		O.G.	208.0	Pile	4' PP
Sta.		Cut-off	208.0	GWS	213.0







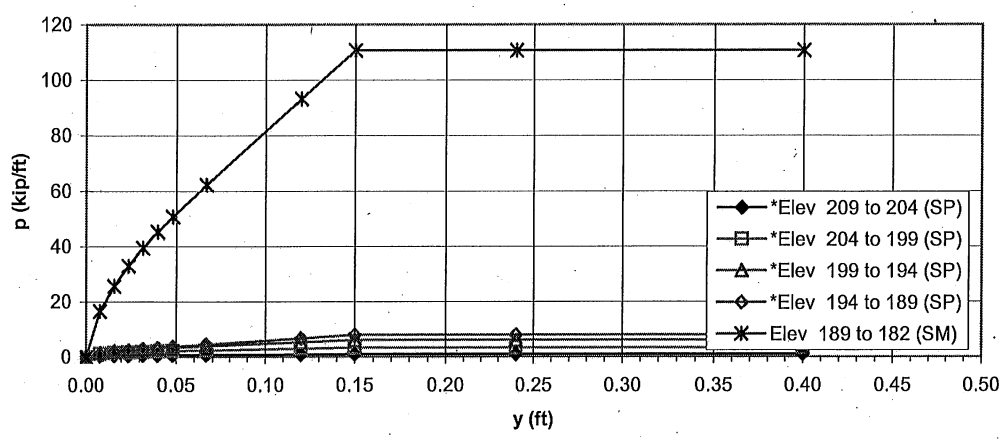
Post-Liquefaction

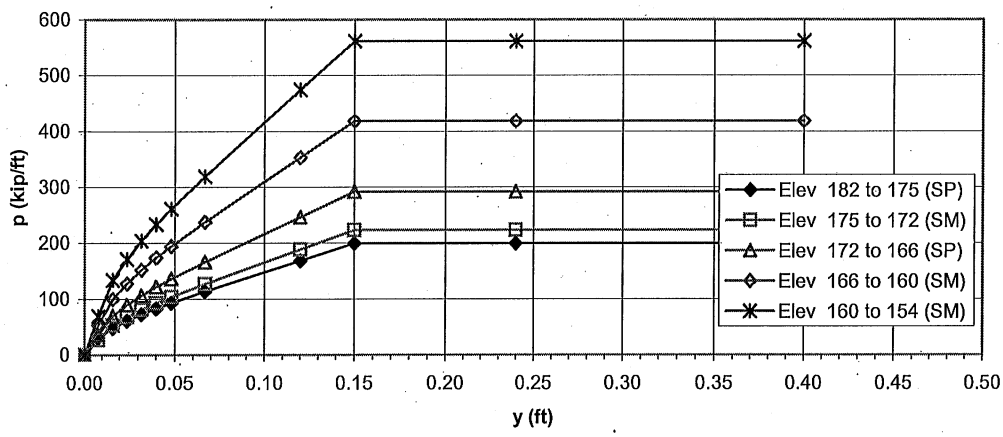
* - Liquefiable Layer

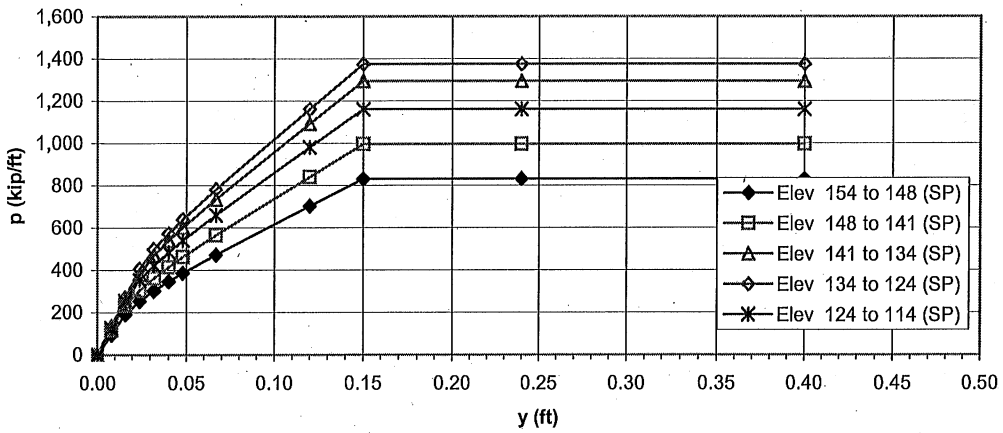
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 10		O.G.	209.0	Pile	4' PP
Sta.		Cut-off	209.0	GWS	213.0







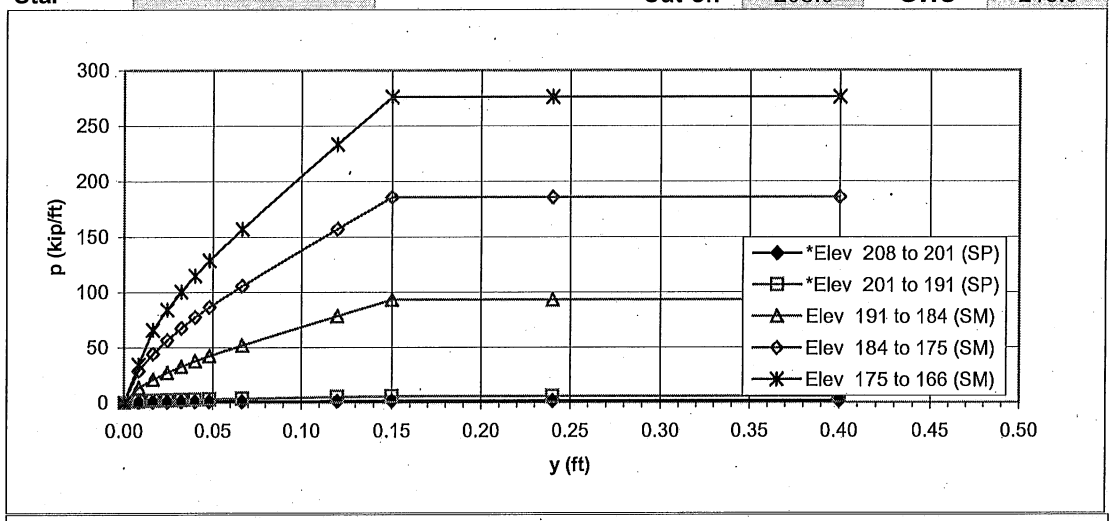
Post-Liquefaction

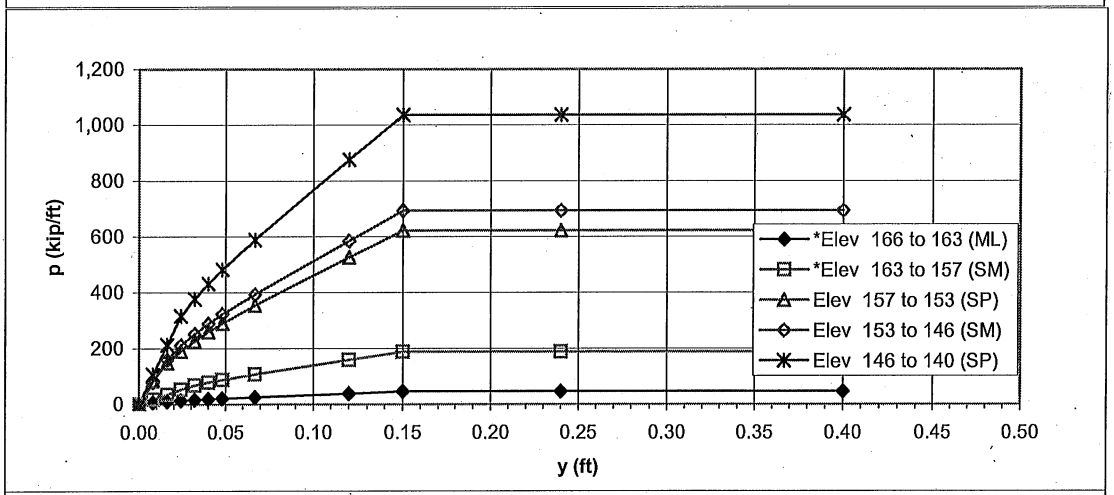
* - Liquefiable Layer

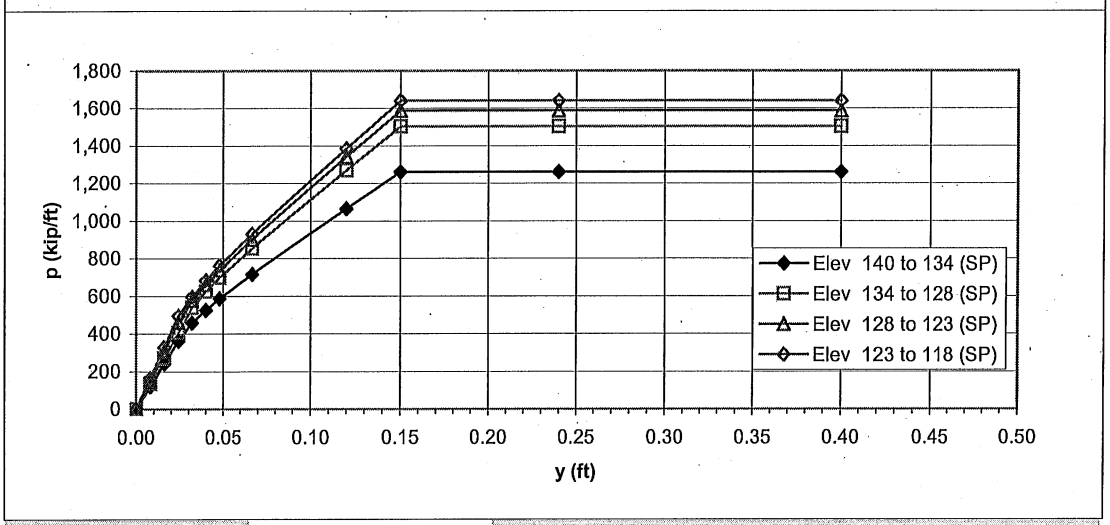
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 11		O.G.	208.0	Pile	4' PP
Sta.		Cut-off	208.0	GWS	213.0







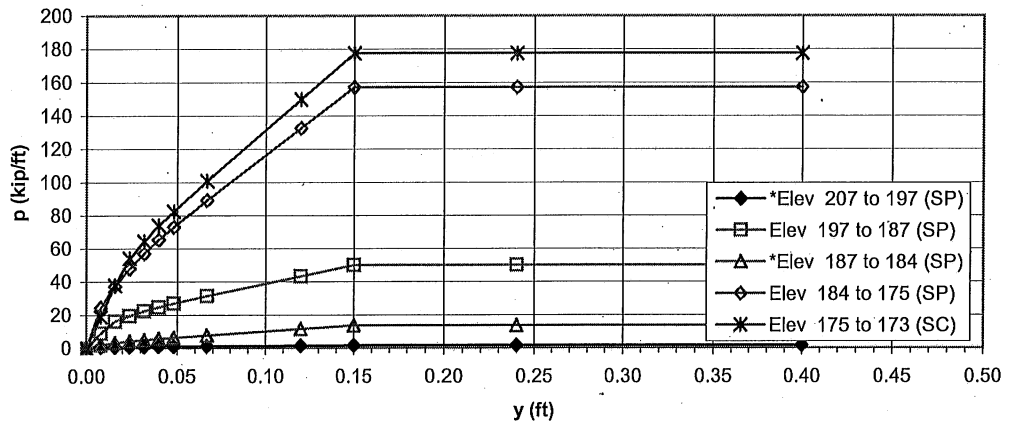
Post-Liquefaction

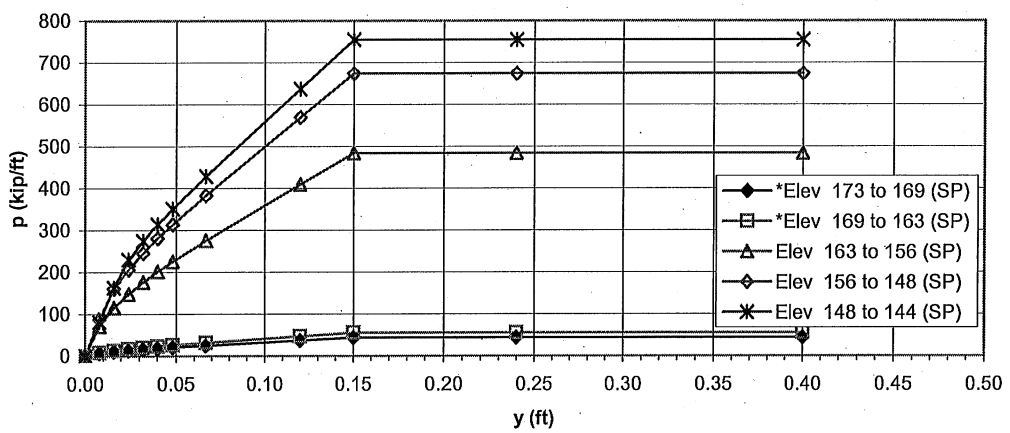
* - Liquefiable Layer

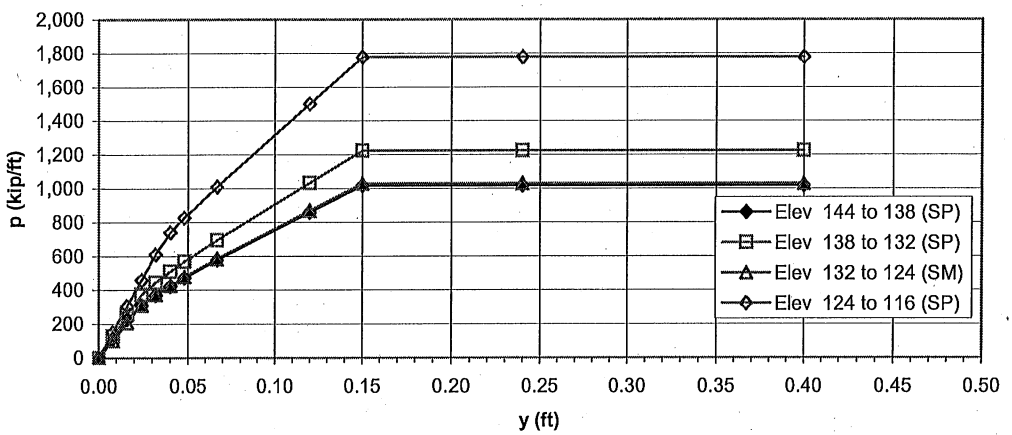
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 12		O.G.	207.0	Pile	4' PP
Sta.		Cut-off	207.0	GWS	213.0







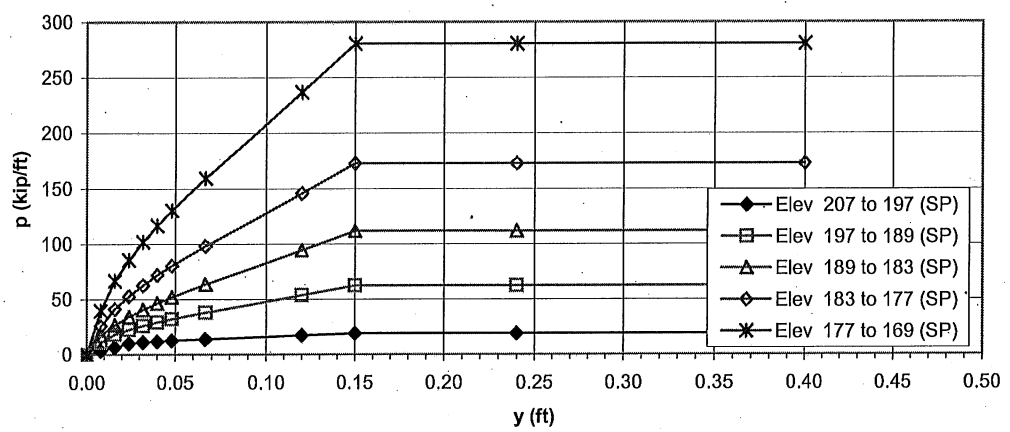
Post-Liquefaction

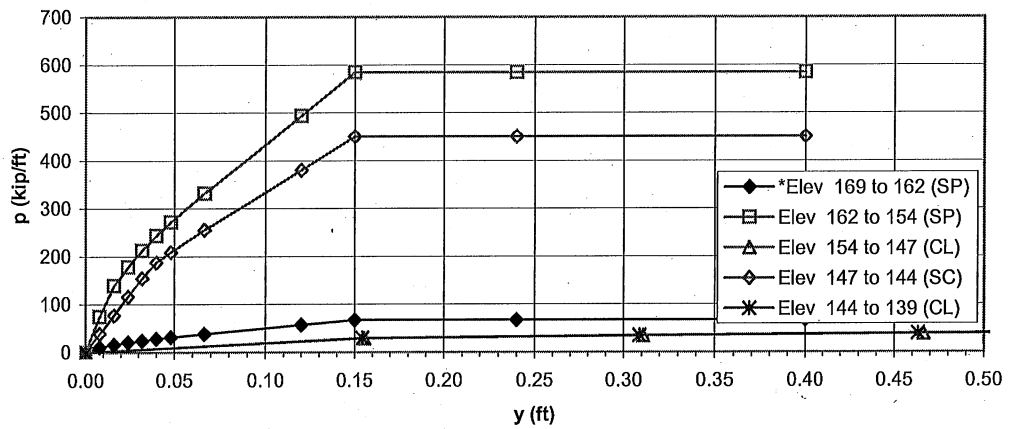
* - Liquefiable Layer

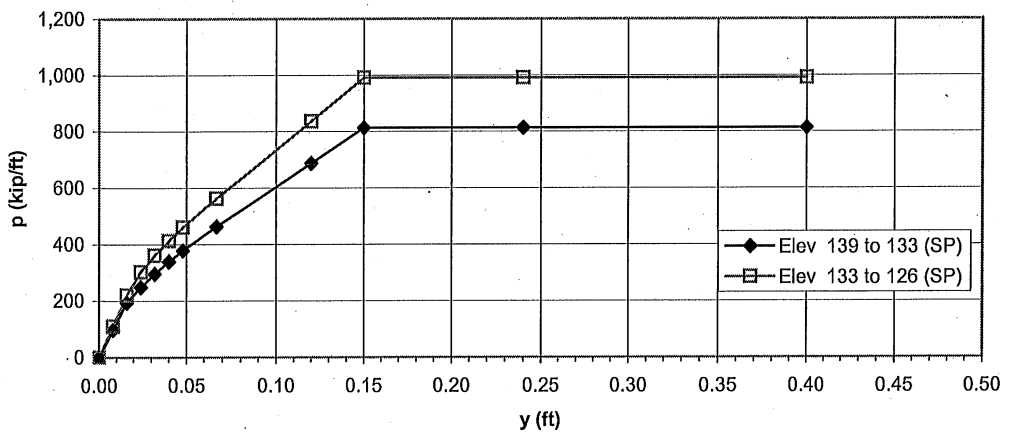
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 13		O.G.	207.0	Pile	4'PP
Sta.		Cut-off	207.0	GWS	213.0







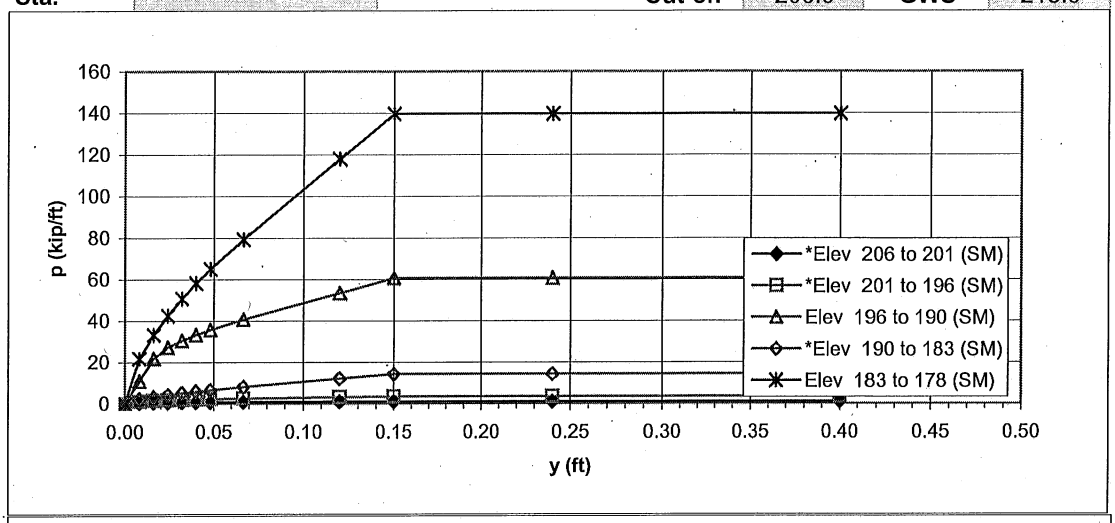
Post-Liquefaction

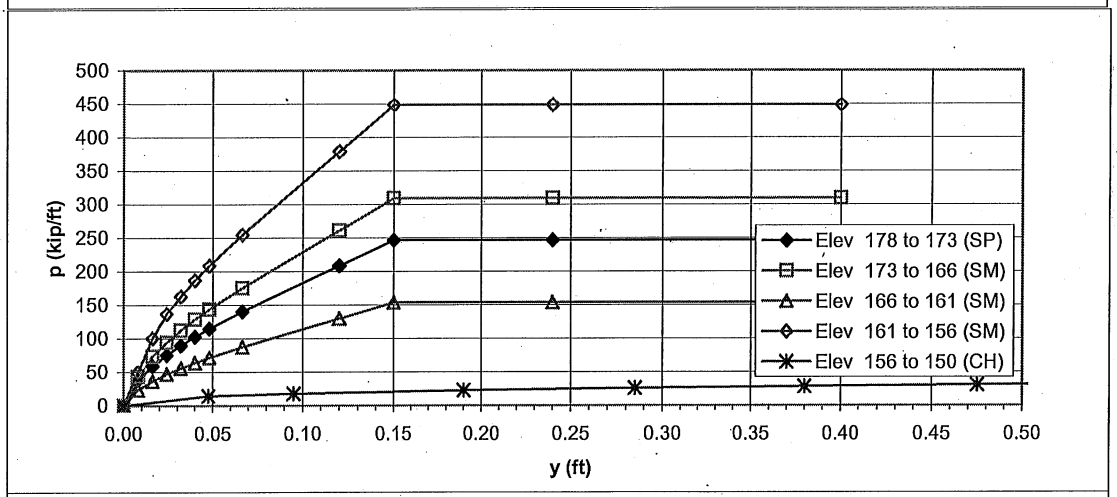
* - Liquefiable Layer

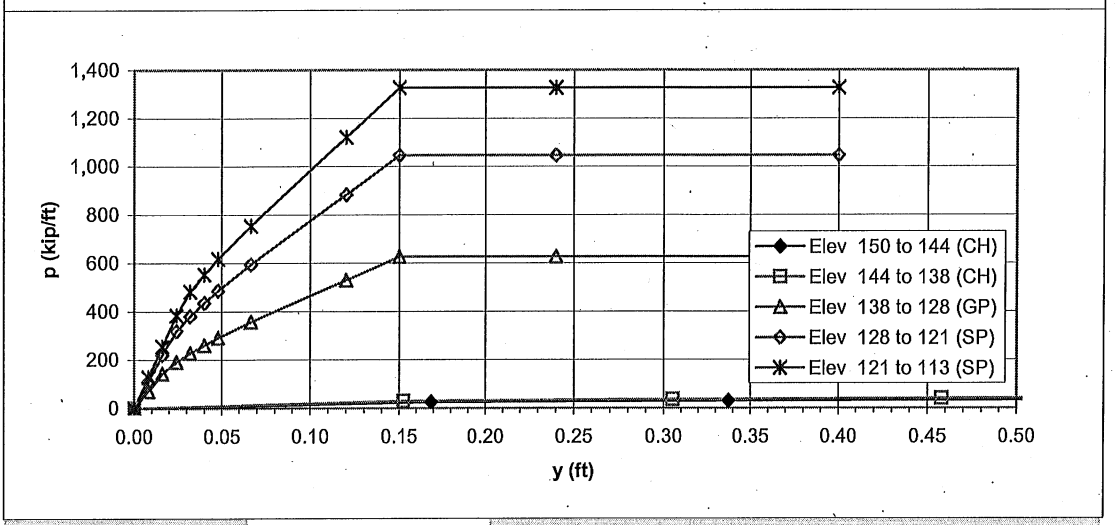
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 14		O.G.	206.0	Pile	4' PP
Sta.		Cut-off	206.0	GWS	213.0







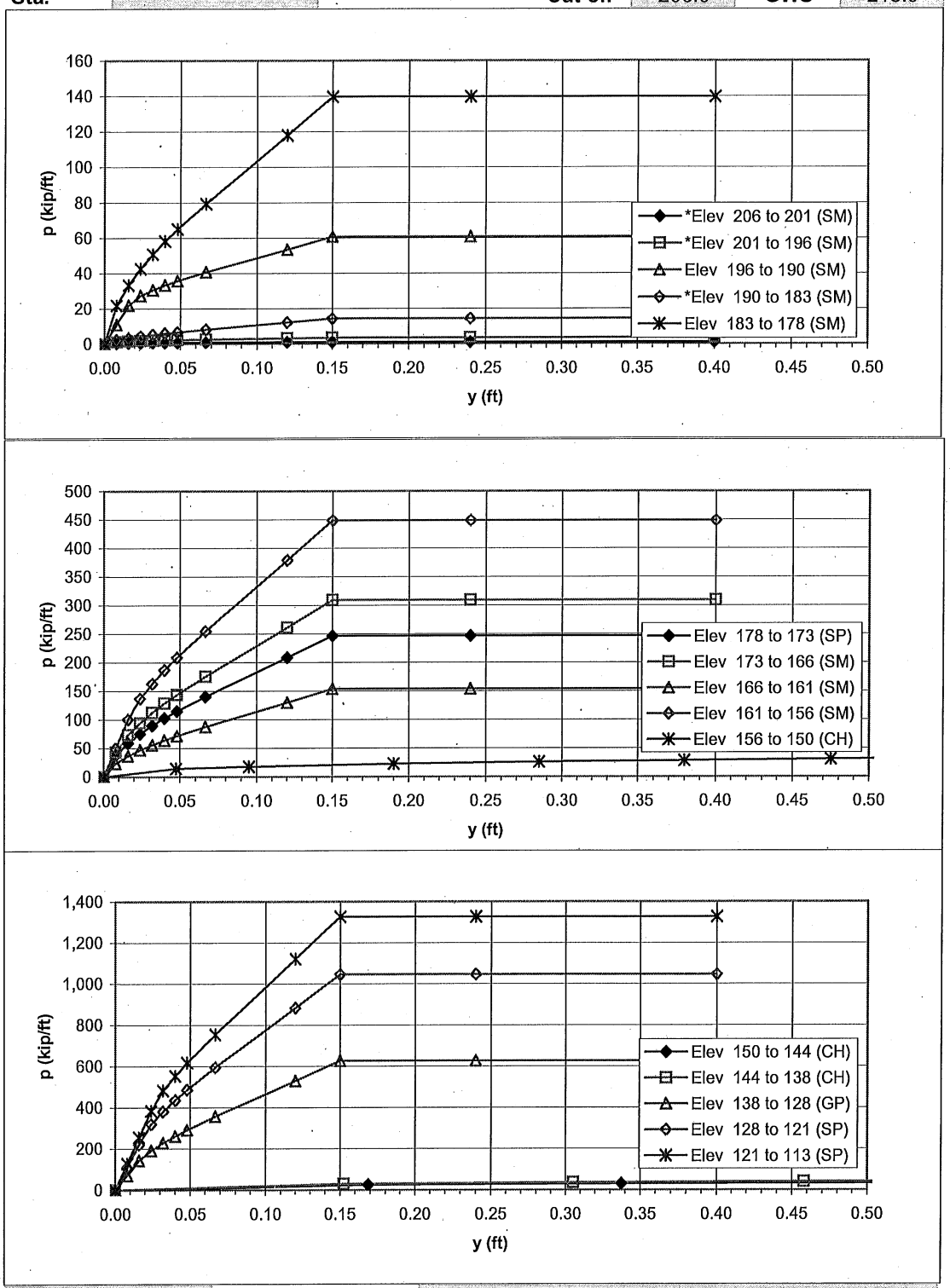
Post-Liquefaction

* - Liquefiable Layer

p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 15		O.G.	206.0	Pile	4' PP
Sta.		Cut-off	206.0	GWS	213.0



Post-Liquefaction

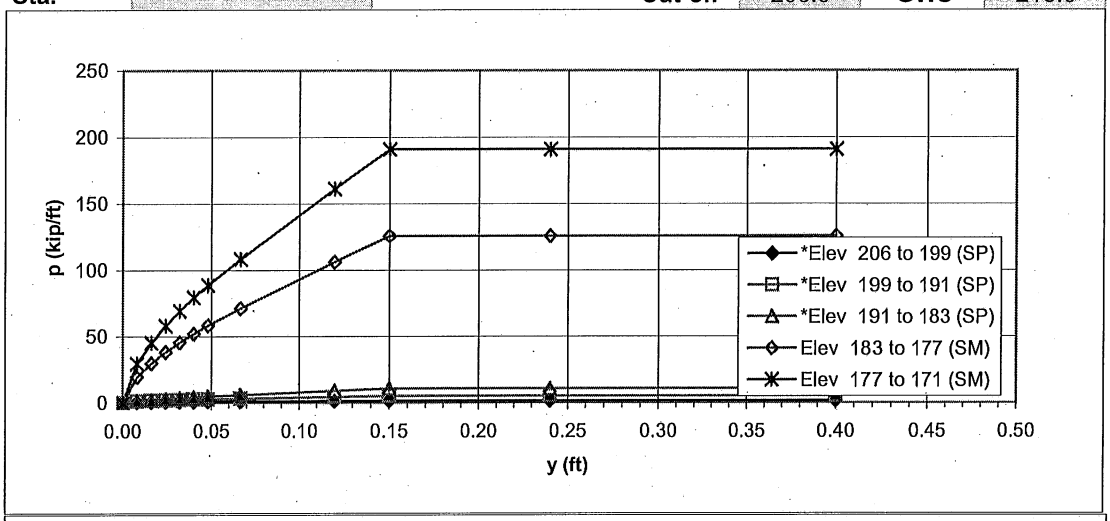
* - Liquefiable Layer

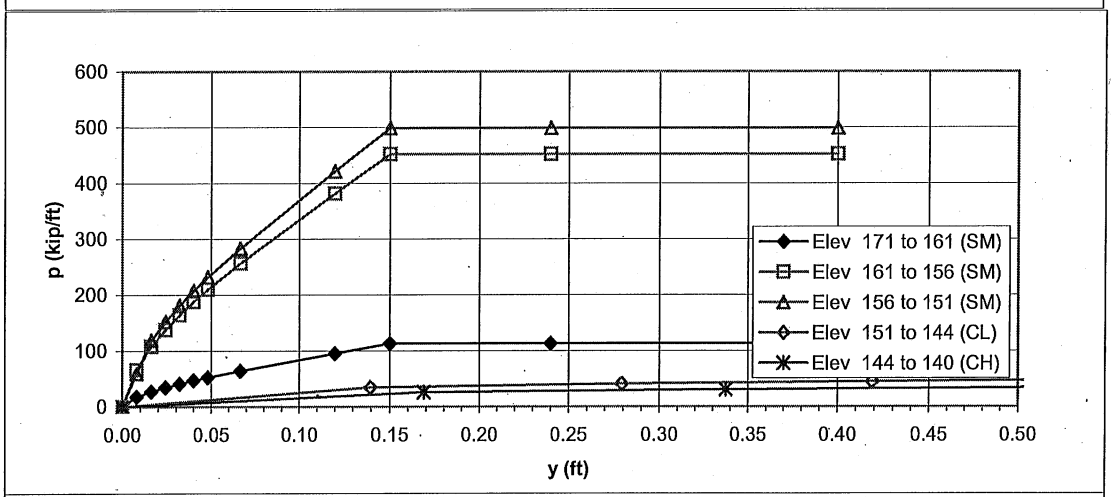
p-y Curves

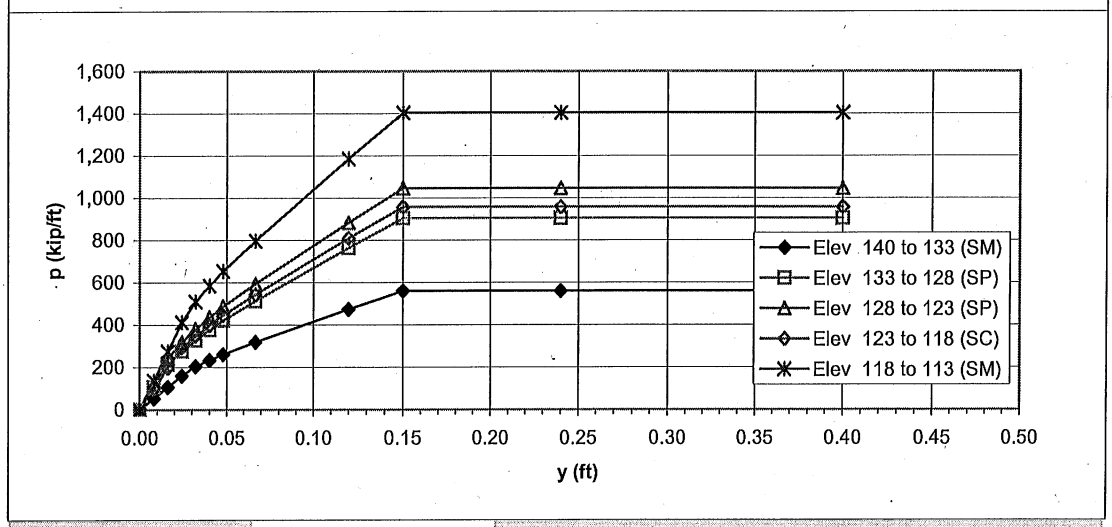
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 16

Sta.		O.G.	206.0	Pile	4' PP
		Cut-off	206.0	GWS	213.0







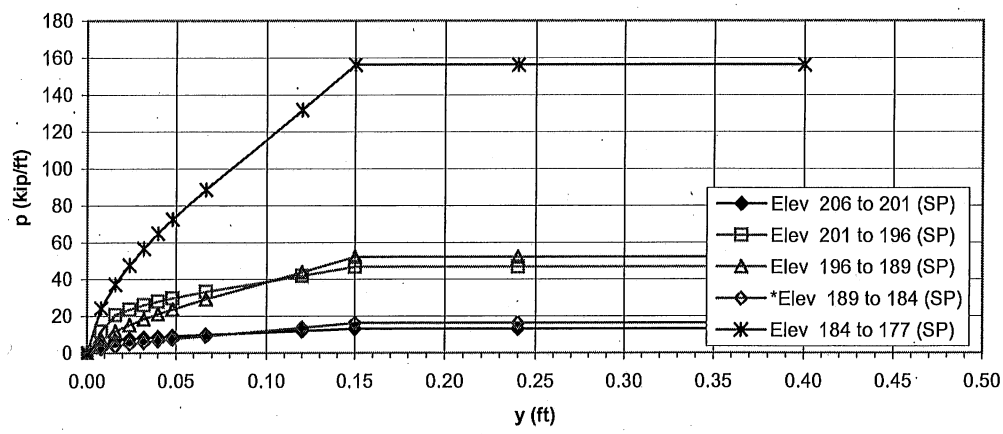
Post-Liquefaction

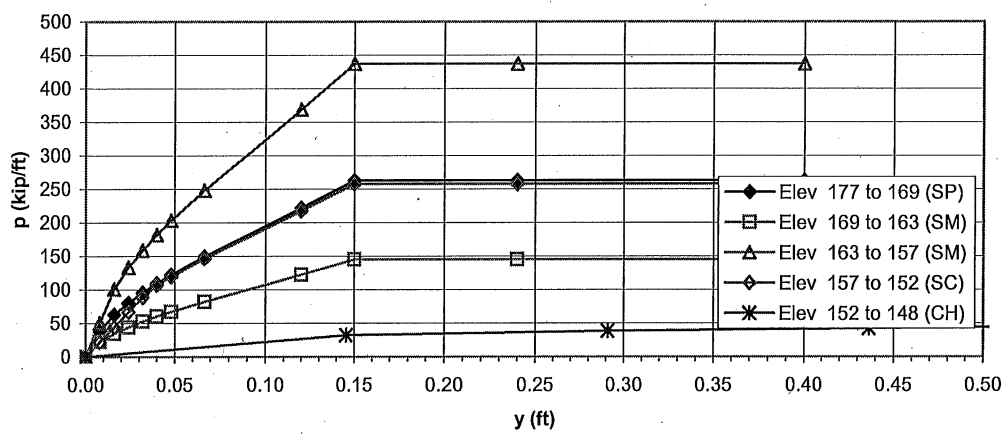
* - Liquefiable Layer

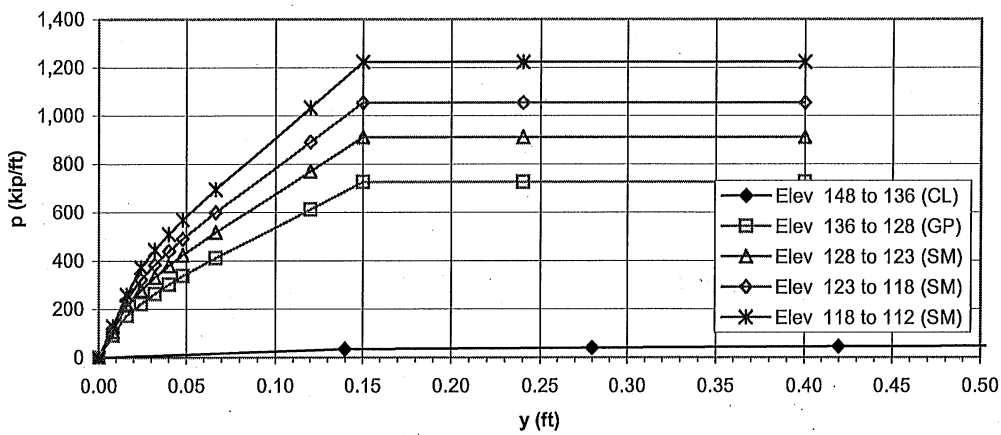
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 17		O.G.	206.0	Pile	4' PP
Sta.		Cut-off	206.0	GWS	213.0







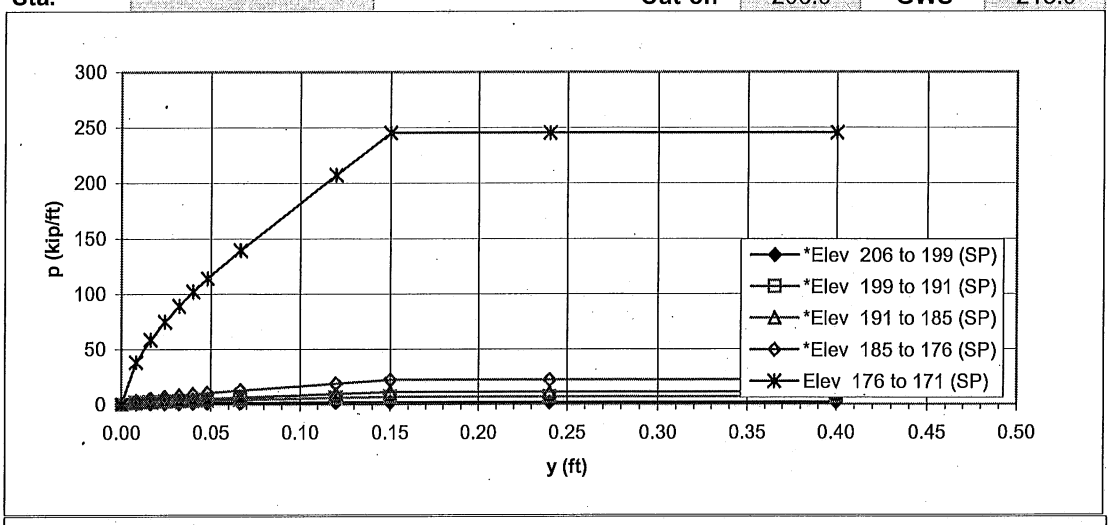
Post-Liquefaction

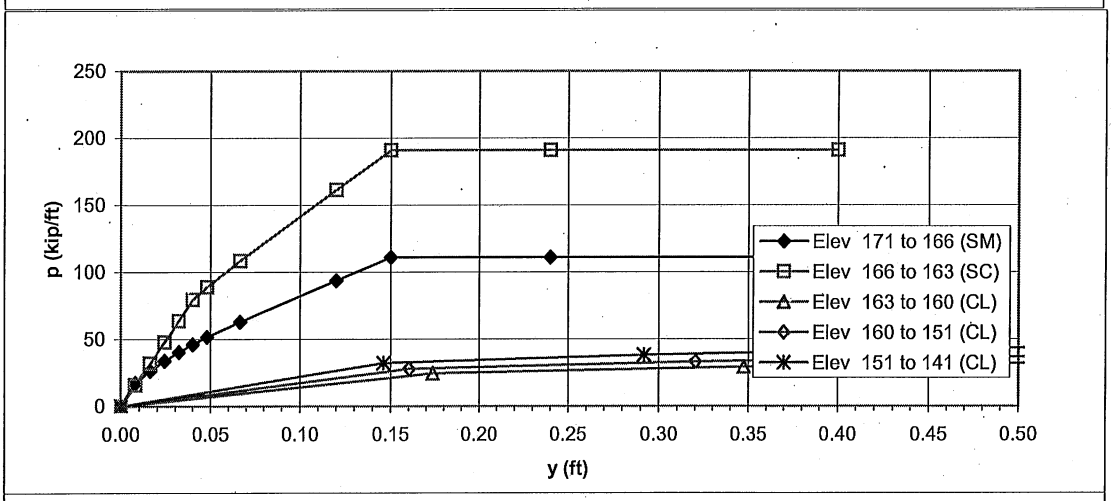
* - Liquefiable Layer

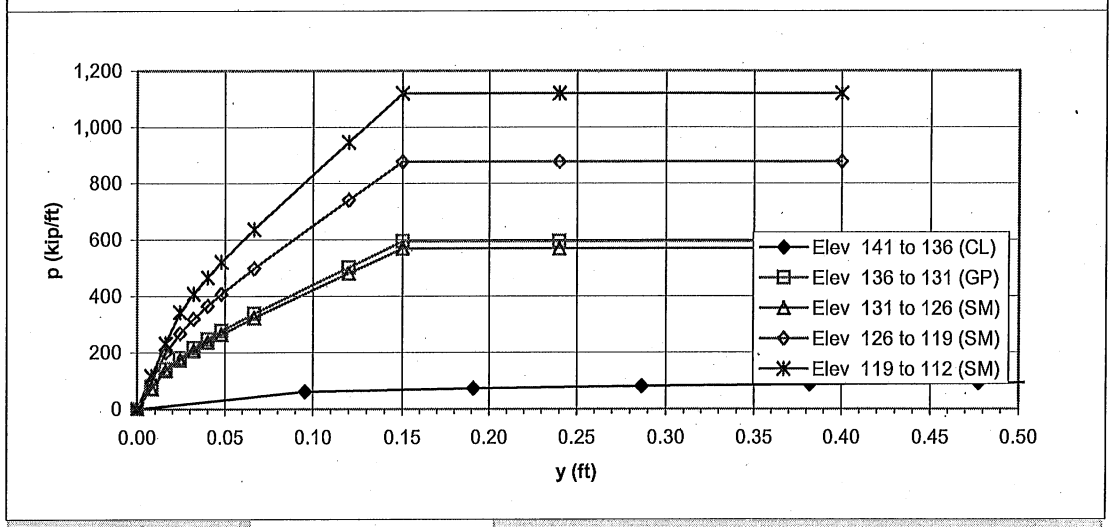
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 18		O.G.	206.0	Pile	4' PP
Sta.		Cut-off	206.0	GWS	213.0







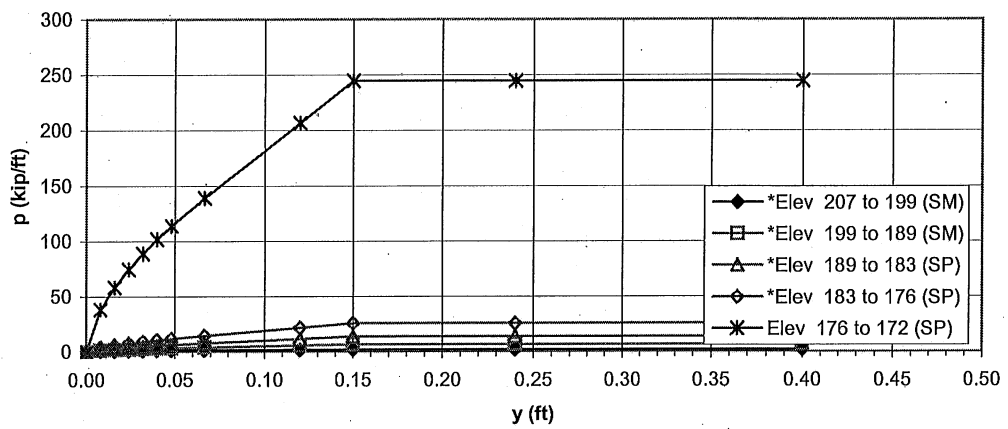
Post-Liquefaction

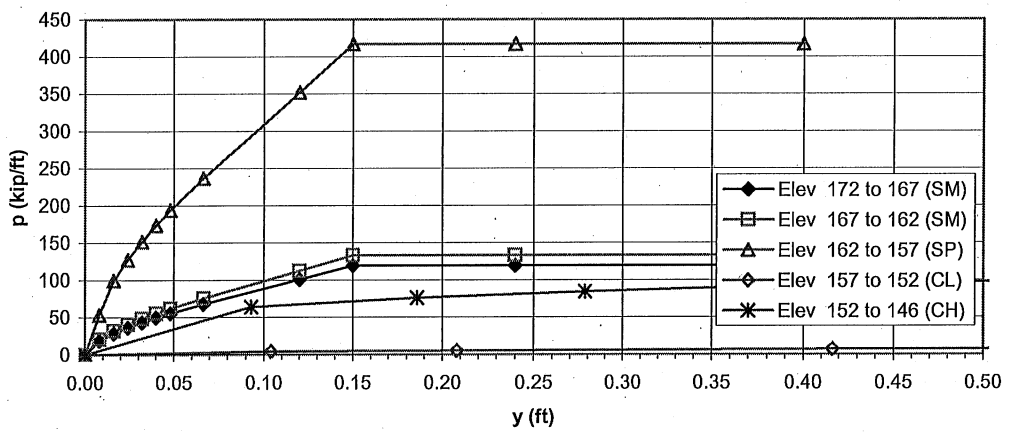
* - Liquefiable Layer

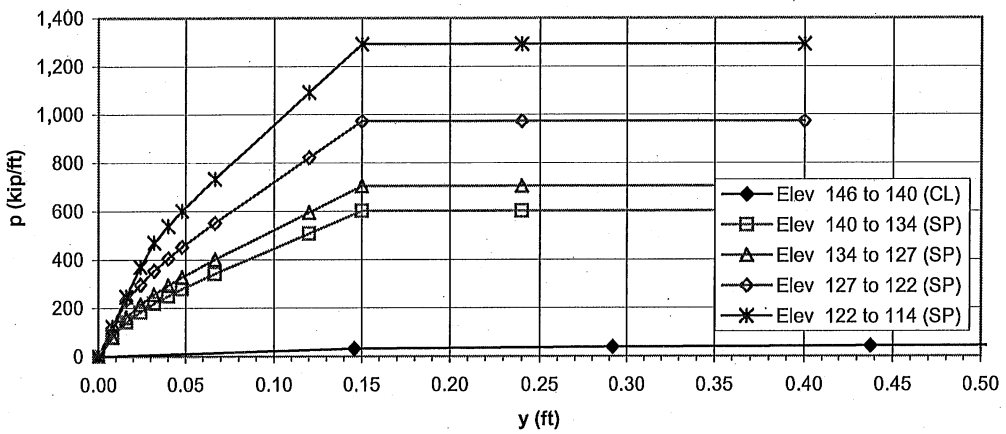
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 19		O.G.	207.0	Pile	4' PP
Sta.		Cut-off	207.0	GWS	213.0







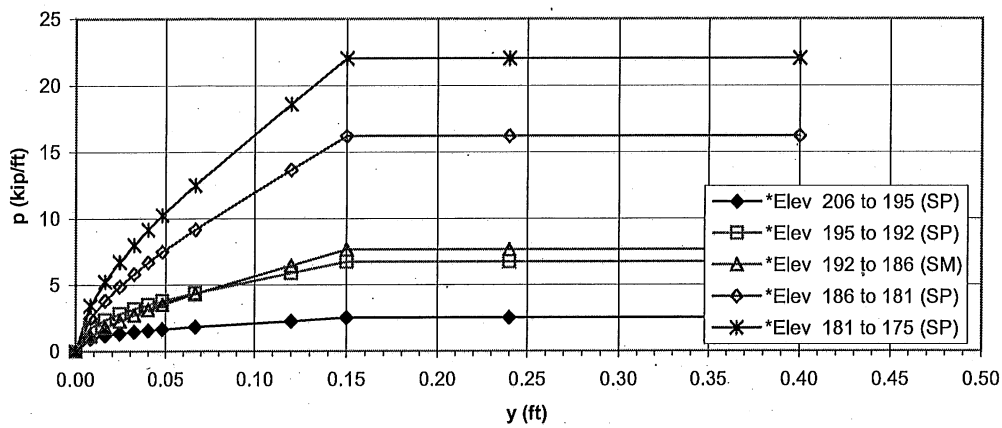
Post-Liquefaction

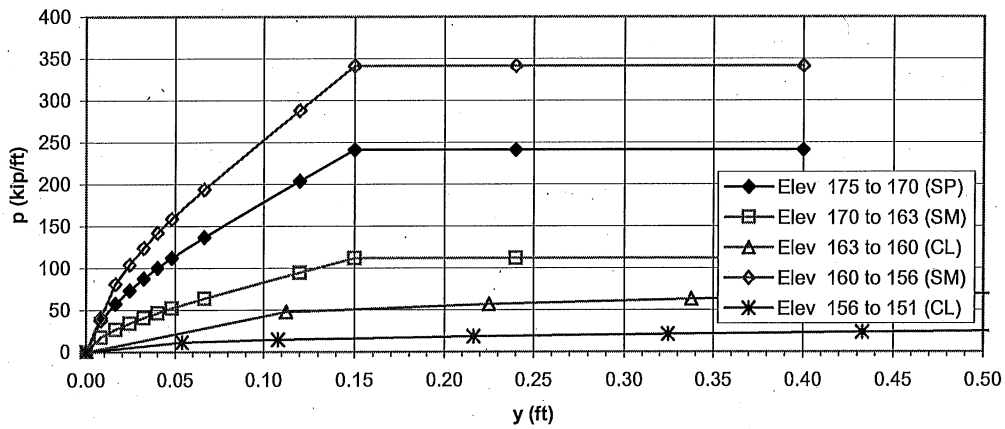
* - Liquefiable Layer

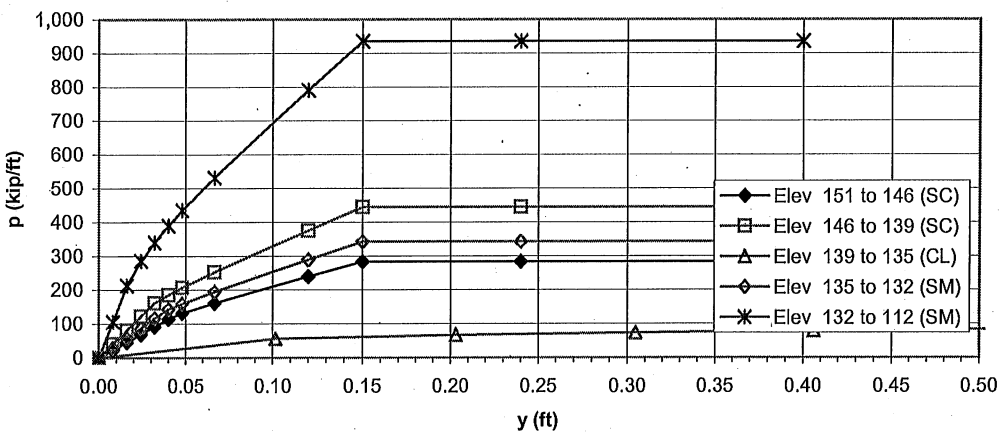
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 20		O.G.	206.0	Pile	4' PP
Sta.		Cut-off	206.0	GWS	213.0







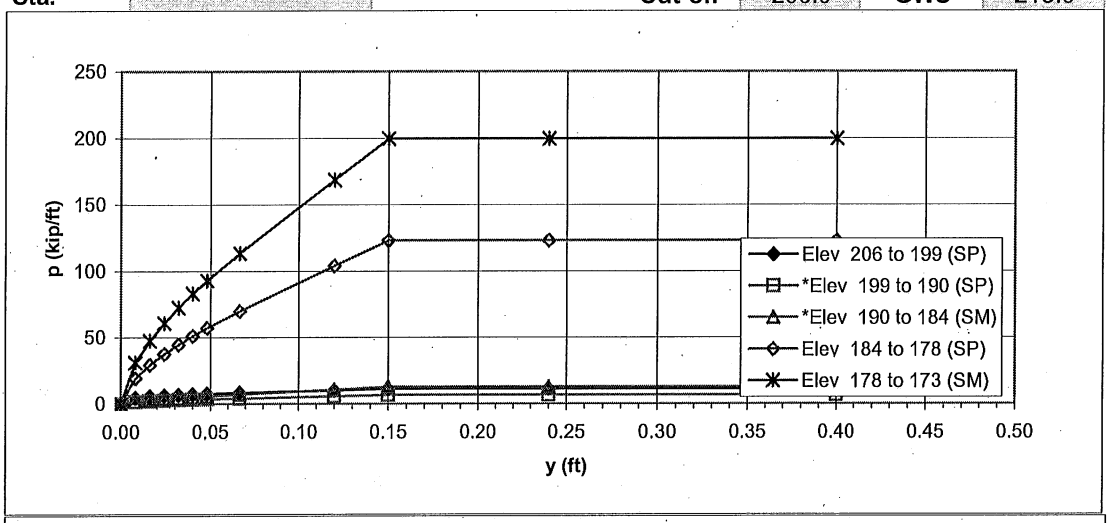
Post-Liquefaction

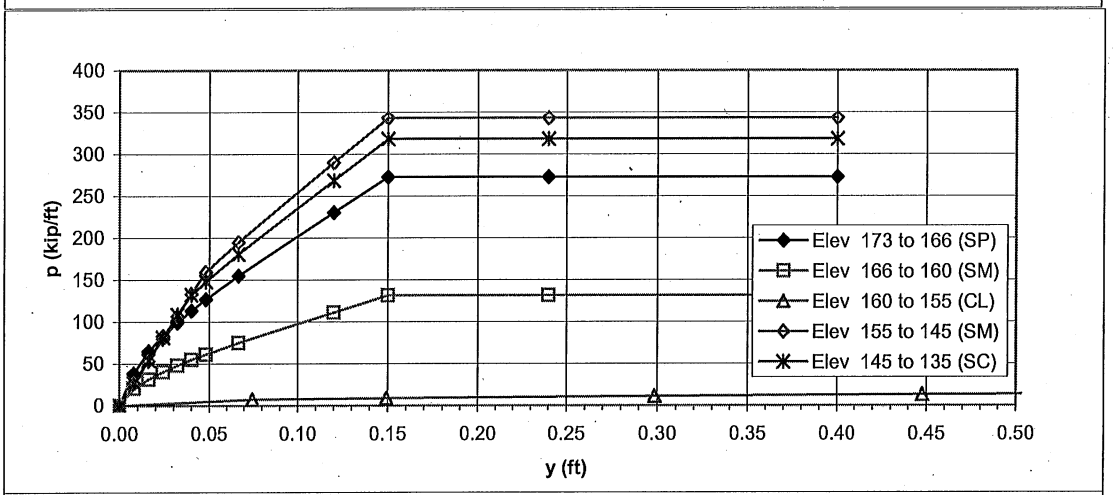
* - Liquefiable Layer

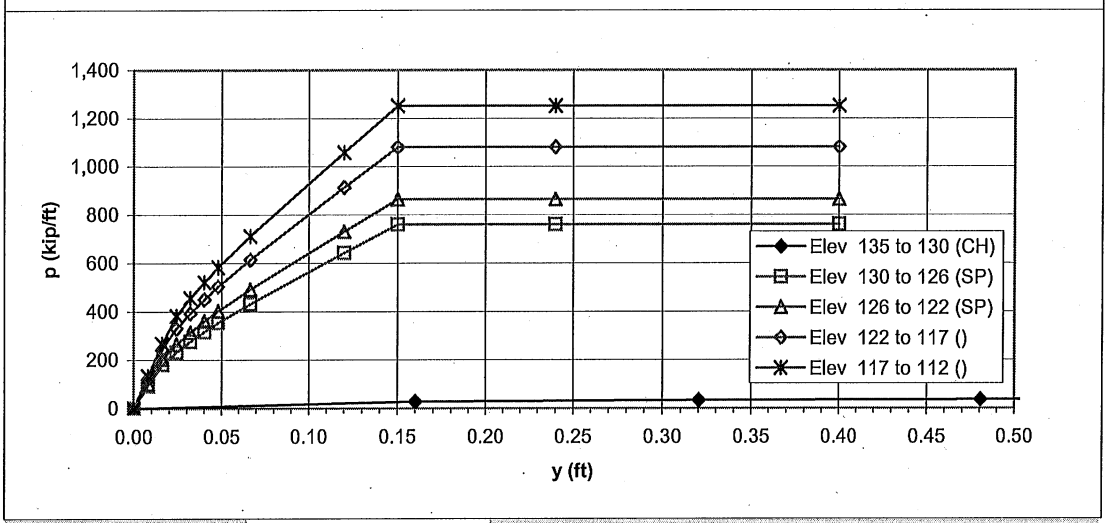
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 21		O.G.	206.0	Pile	4' PP
Sta.		Cut-off	206.0	GWS	213.0







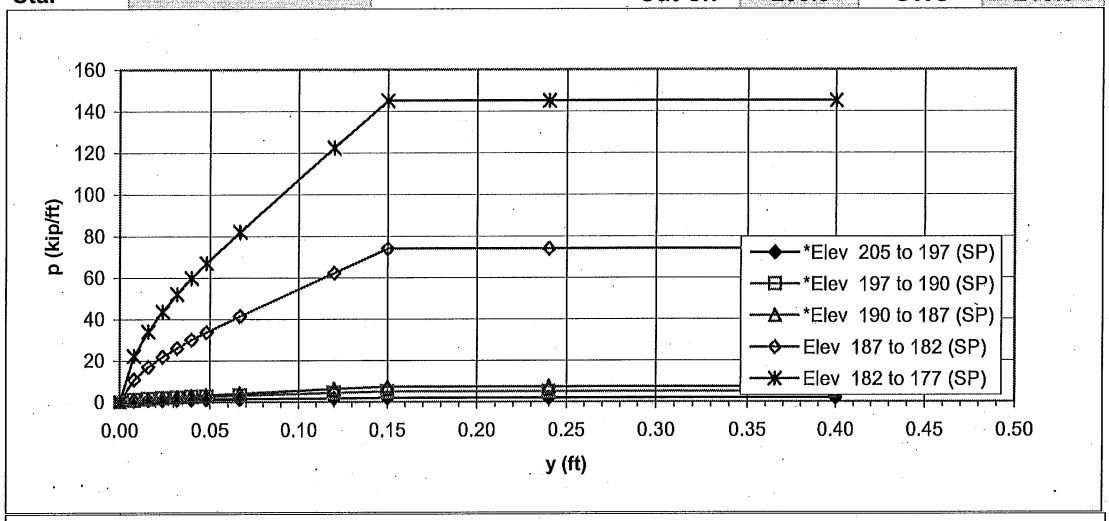
Post-Liquefaction

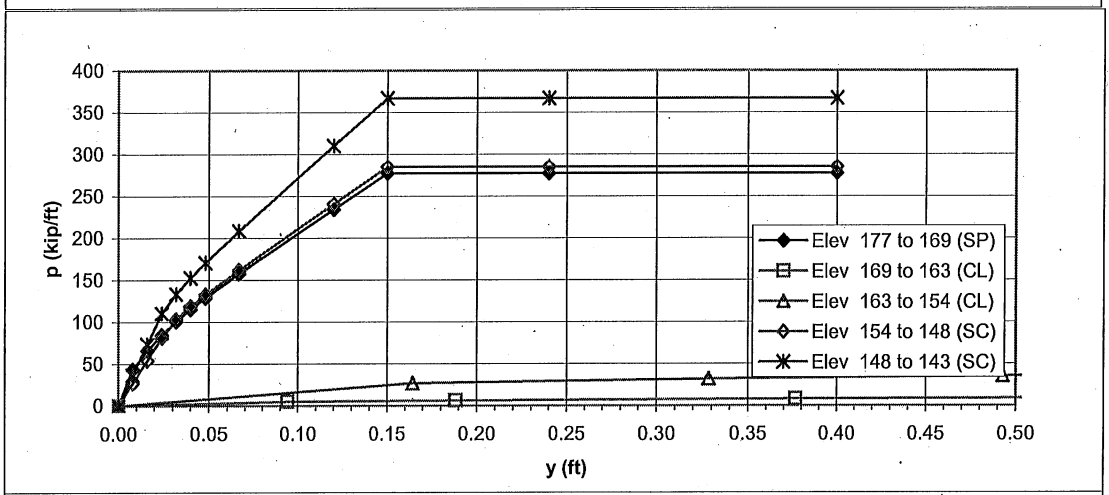
* - Liquefiable Layer

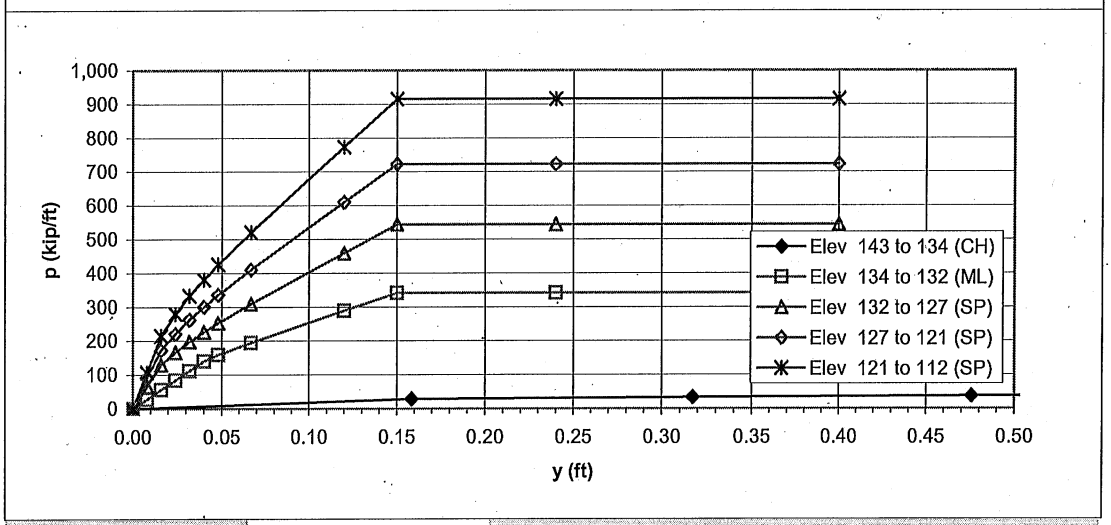
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 22		O.G.	205.0	Pile	4' PP
Sta.		Cut-off	205.0	GWS	213.0







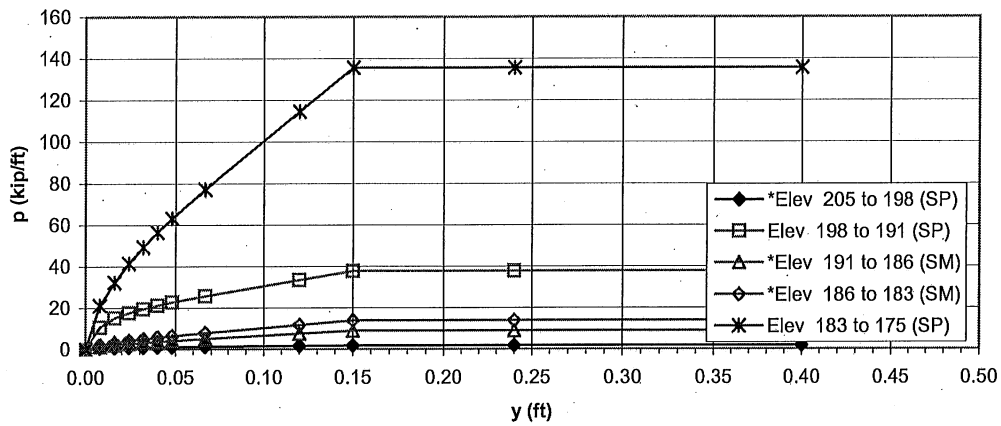
Post-Liquefaction

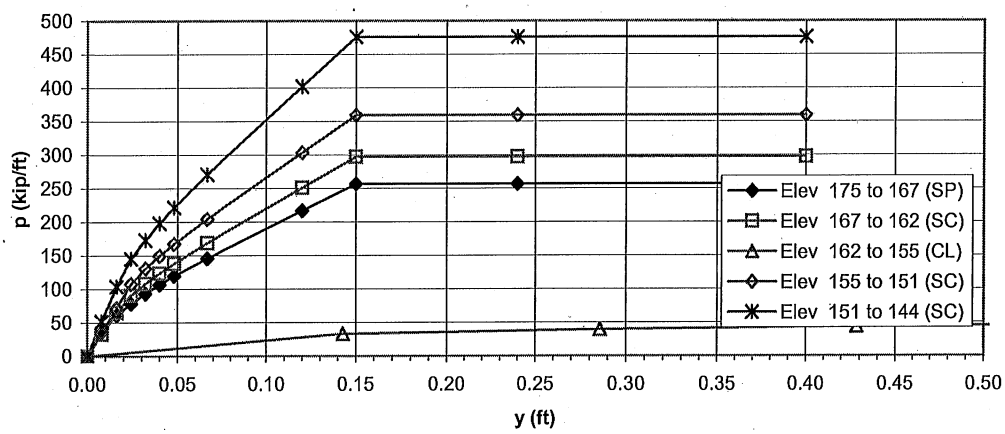
* - Liquefiable Layer

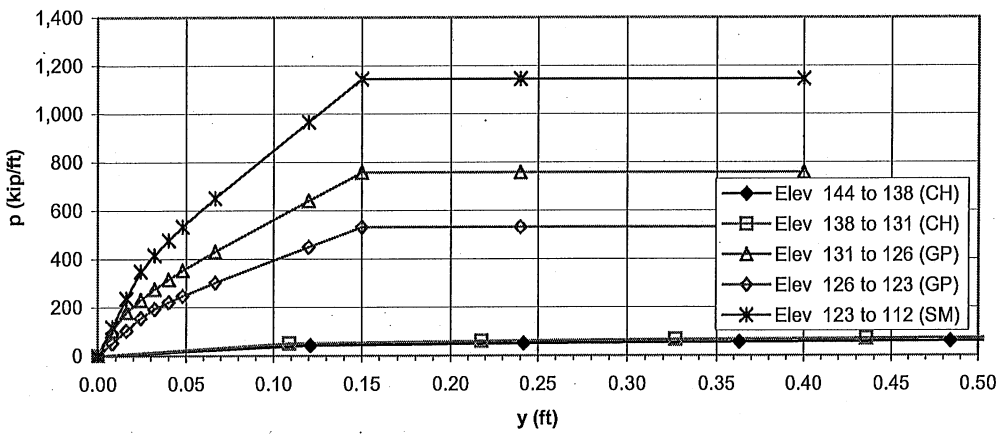
p-y Curves

Pier 23

Sta.		O.G.	205.0	Pile	4' PP
		Cut-off	205.0	GWS	213.0







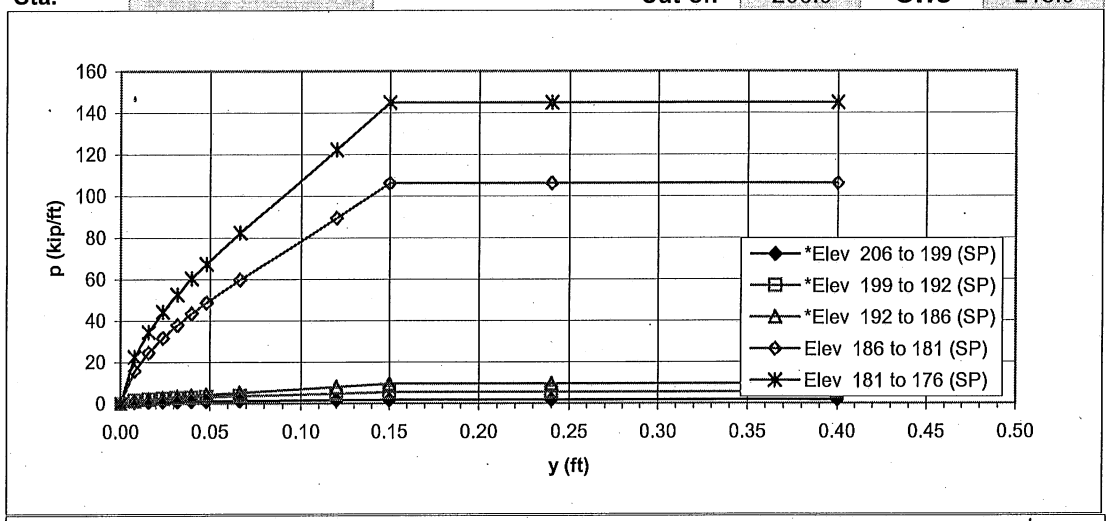
Post-Liquefaction

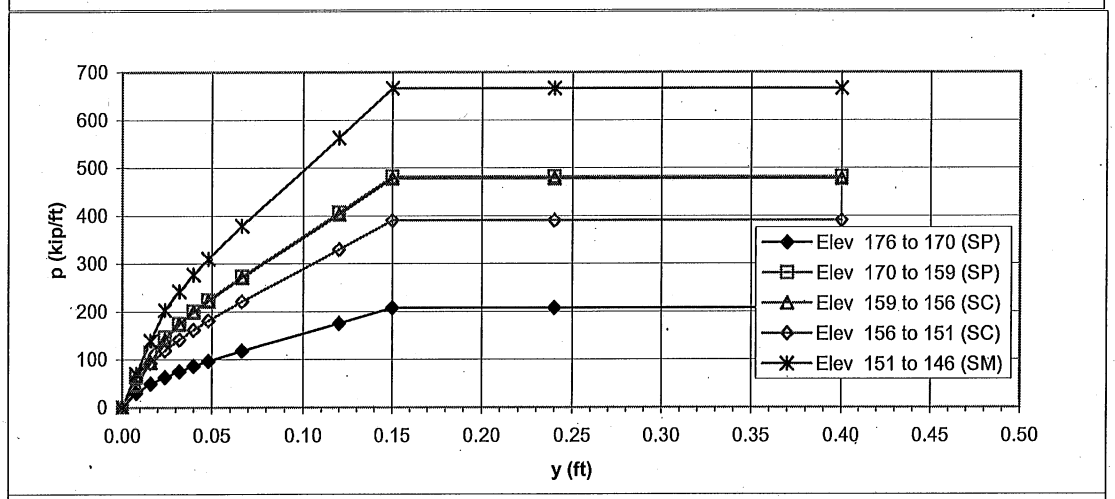
* - Liquefiable Layer

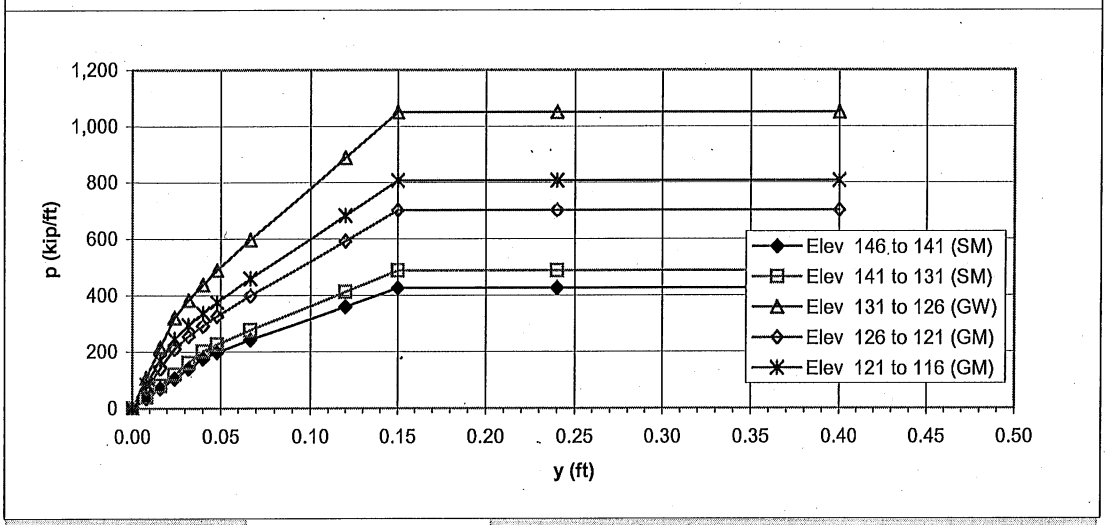
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 24		O.G.	206.0	Pile	4' PP
Sta.		Cut-off	206.0	GWS	213.0







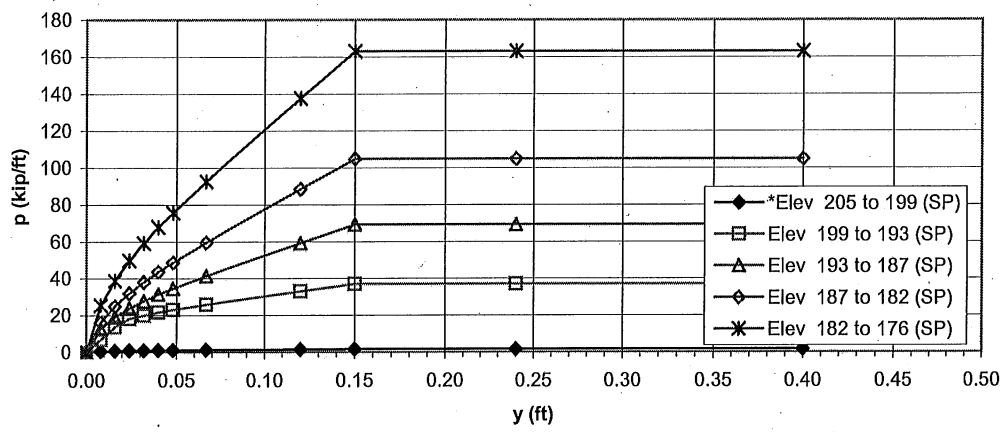
Post-Liquefaction

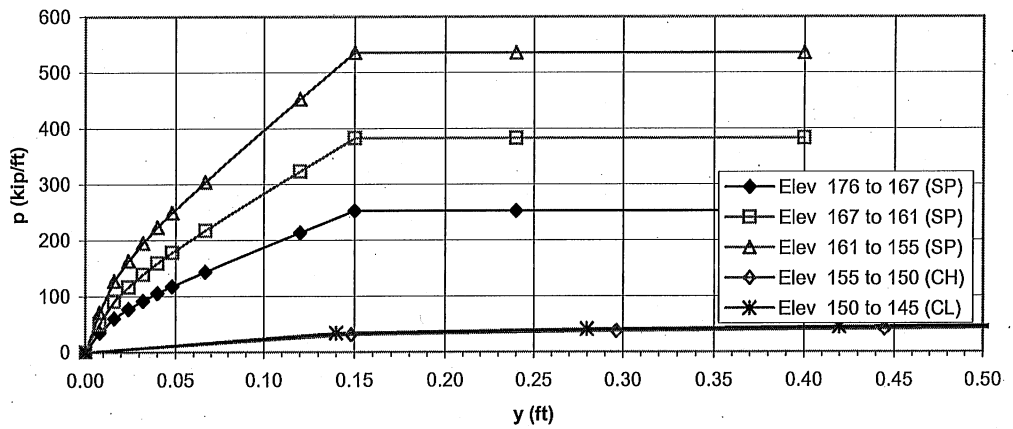
* - Liquefiable Layer

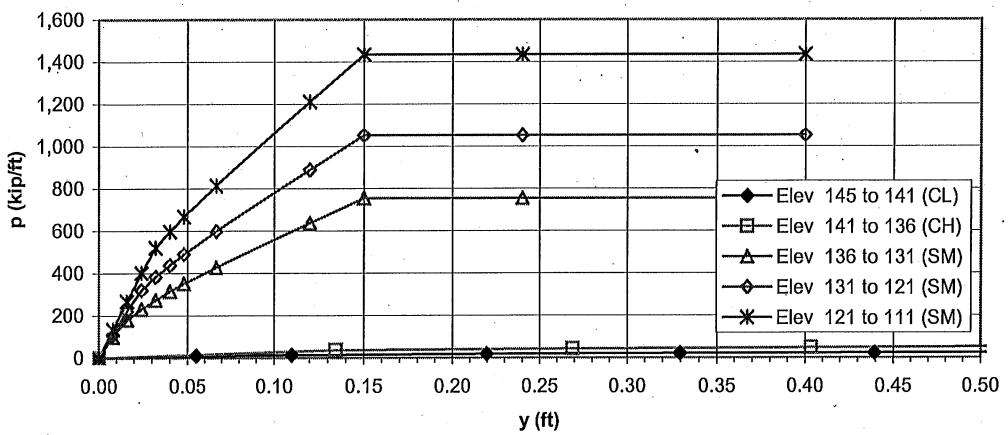
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 25		O.G.	205.0	Pile	4' PP
Sta.		Cut-off	205.0	GWS	213.0







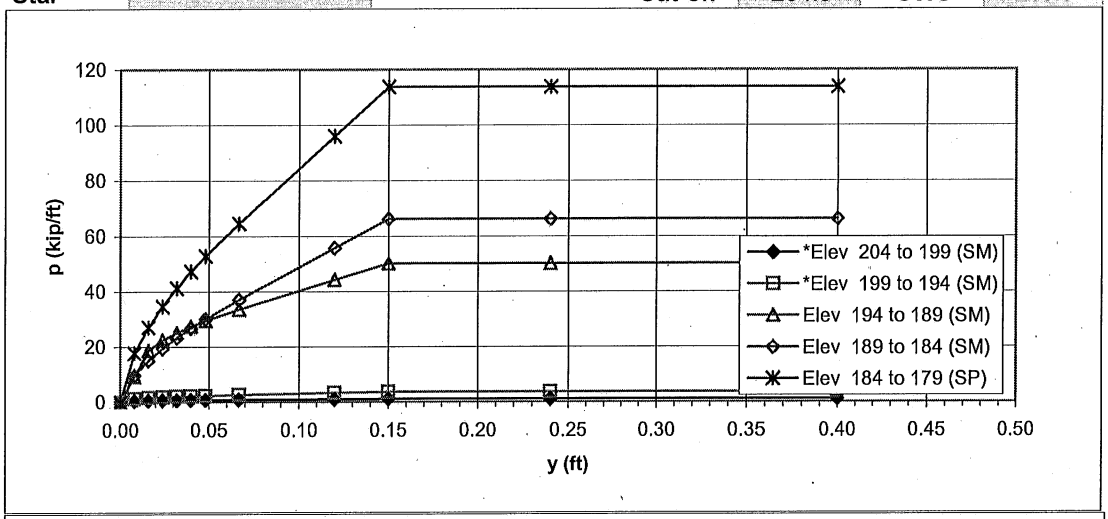
Post-Liquefaction

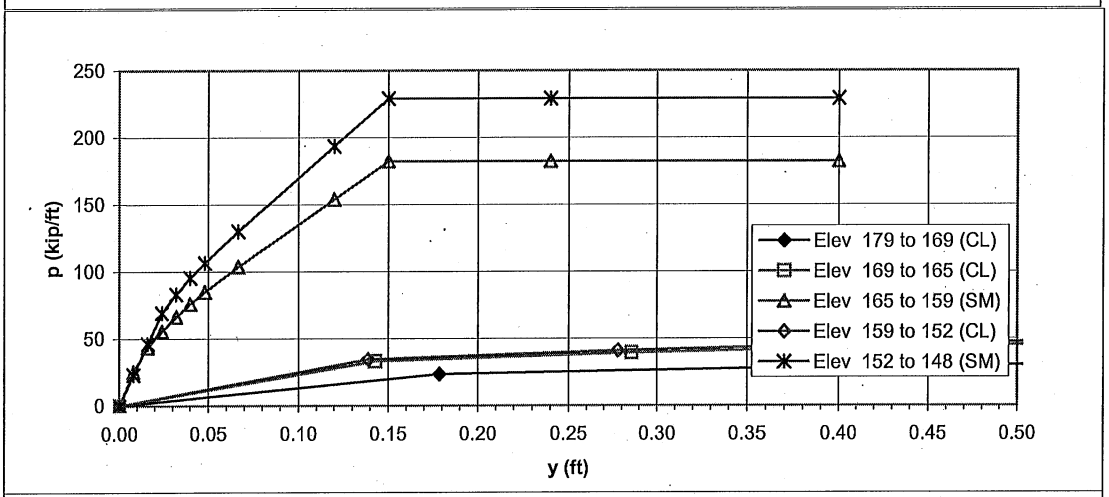
* - Liquefiable Layer

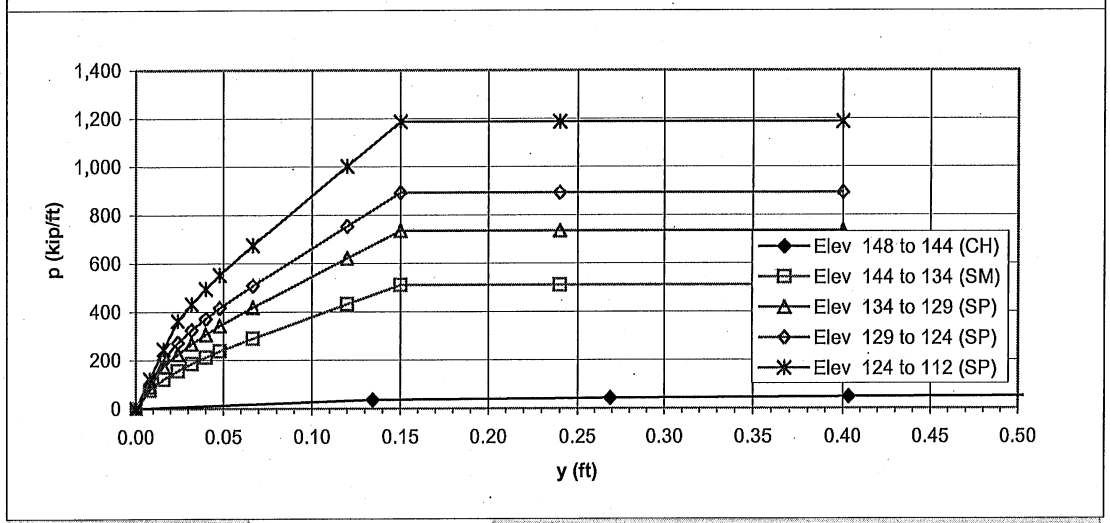
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 26		O.G.	204.0	Pile	4' PP
Sta.		Cut-off	204.0	GWS	213.0







Post-Liquefaction

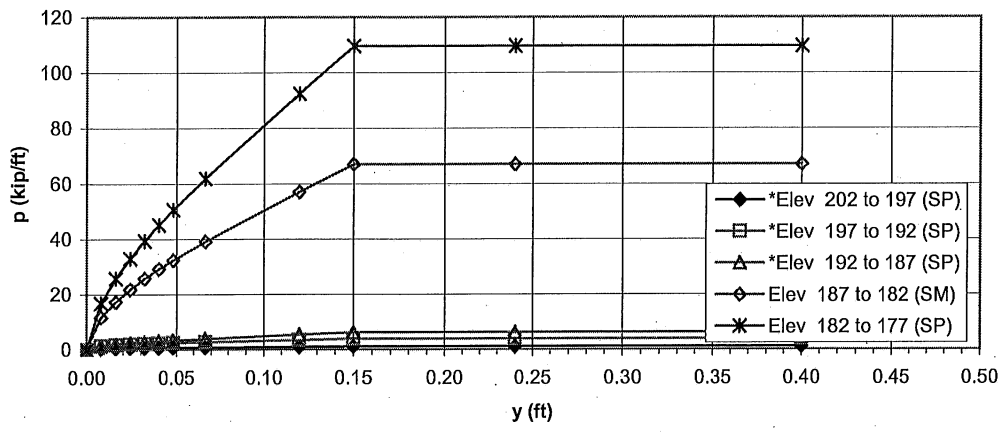
* - Liquefiable Layer

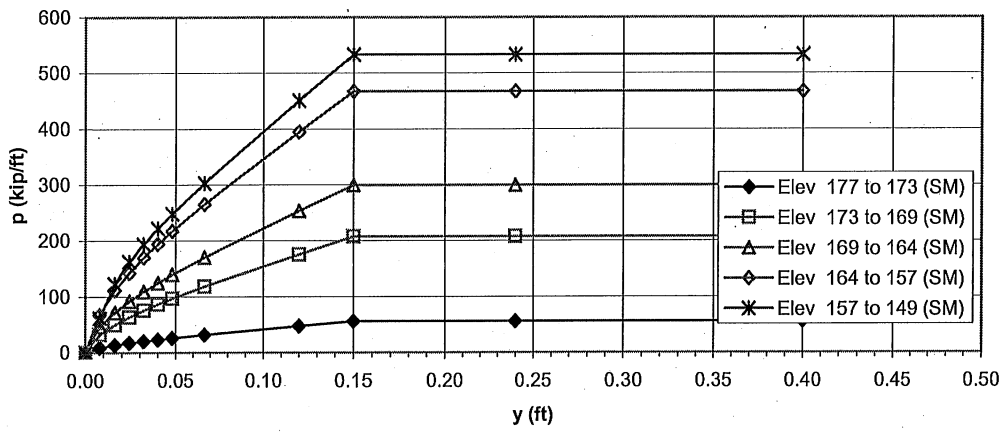
p-y Curves

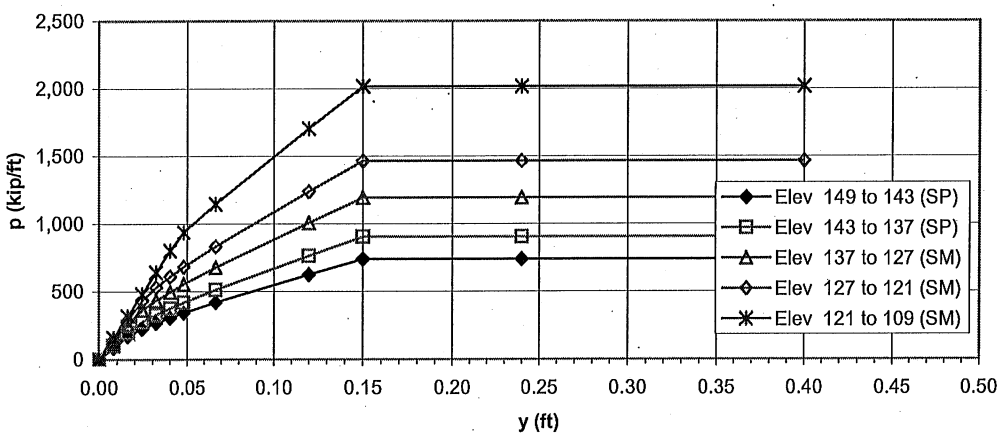
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 27
Sta.

O.G.	202.0	Pile	4' PP
Cut-off	202.0	GWS	213.0







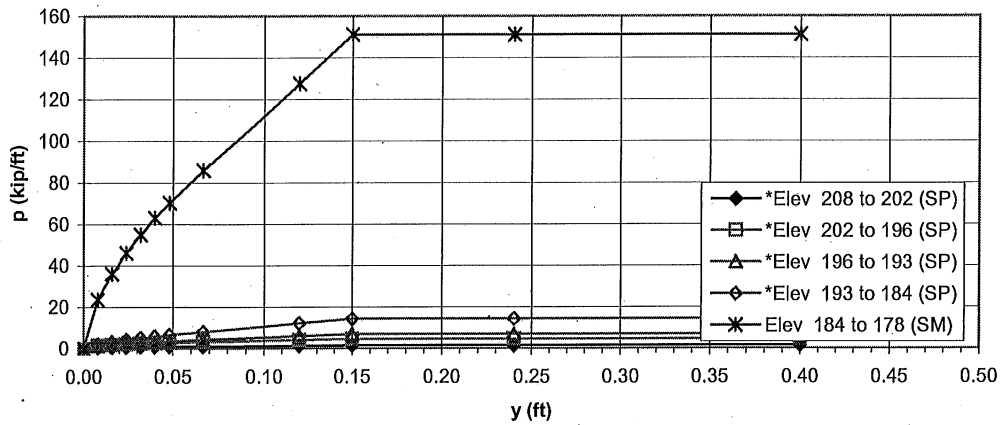
Post-Liquefaction

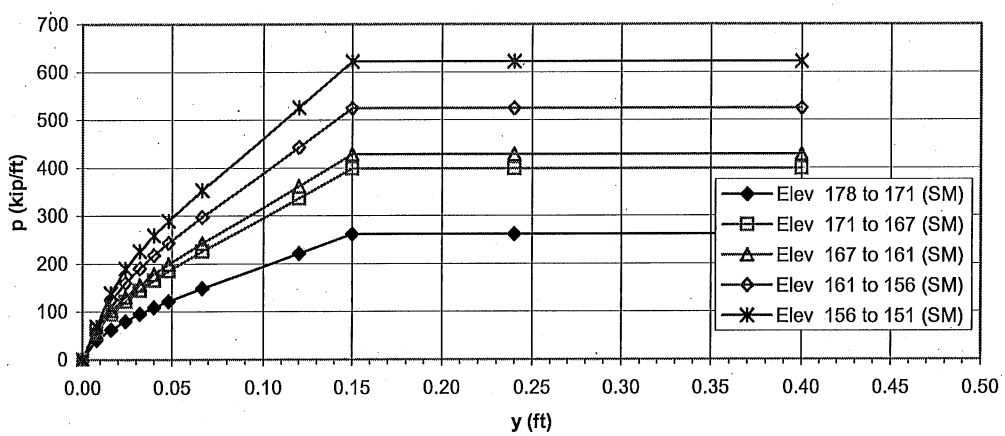
*** - Liquefiable Layer**

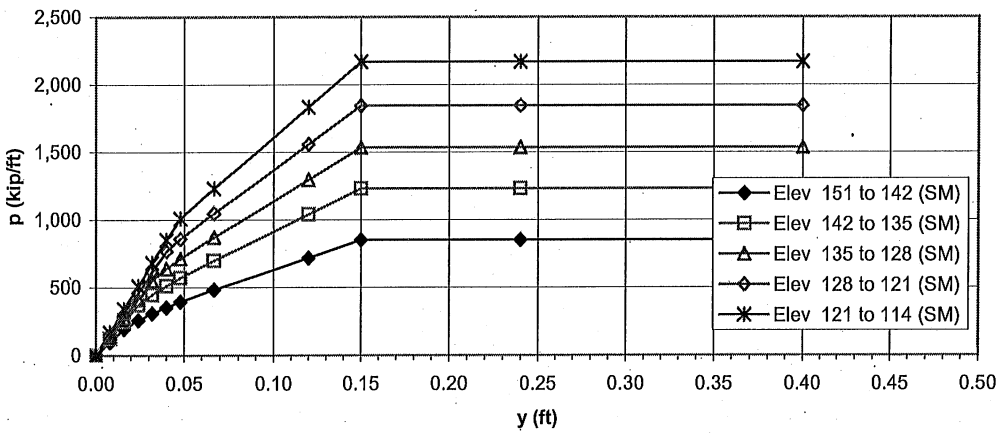
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 28		O.G.	208.0	Pile	4' PP
Sta.		Cut-off	208.0	GWS	213.0







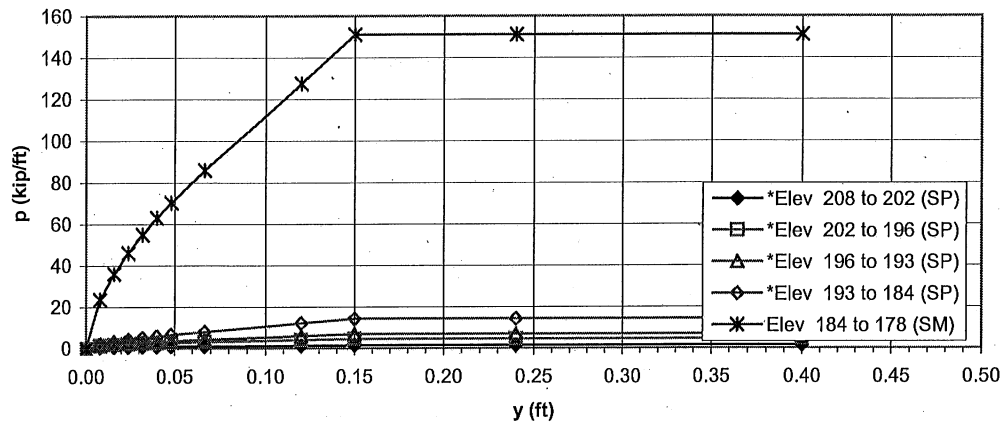
Post-Liquefaction

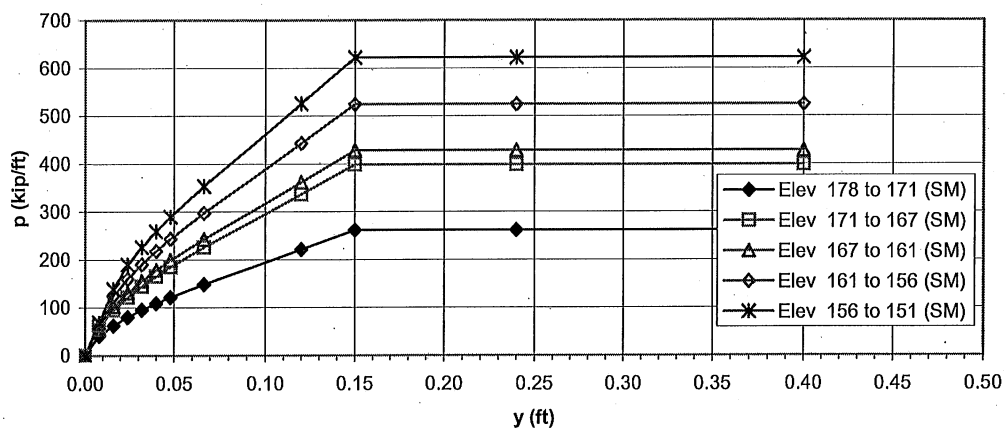
* - Liquefiable Layer

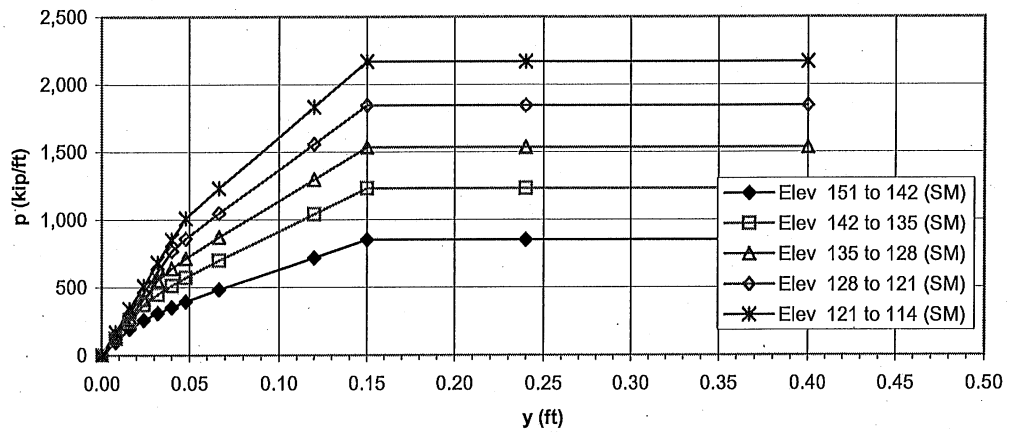
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 29		O.G.	208.0	Pile	4' PP
Sta.		Cut-off	208.0	GWS	213.0







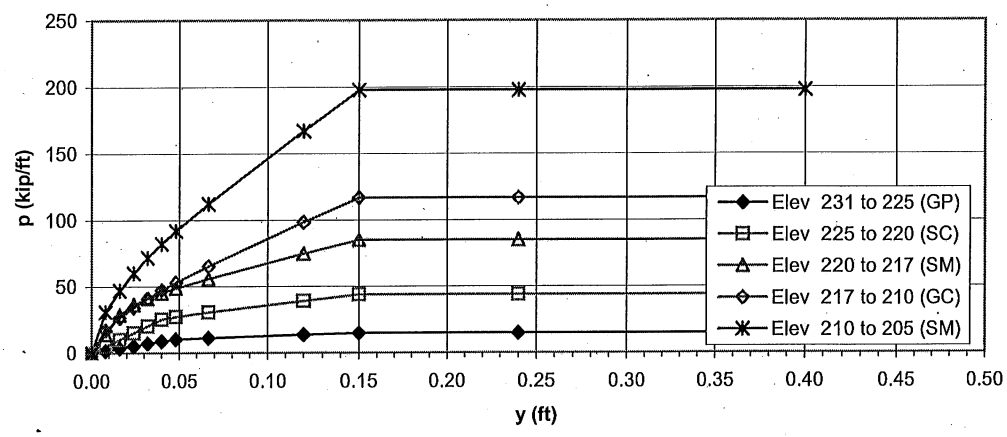
Post-Liquefaction

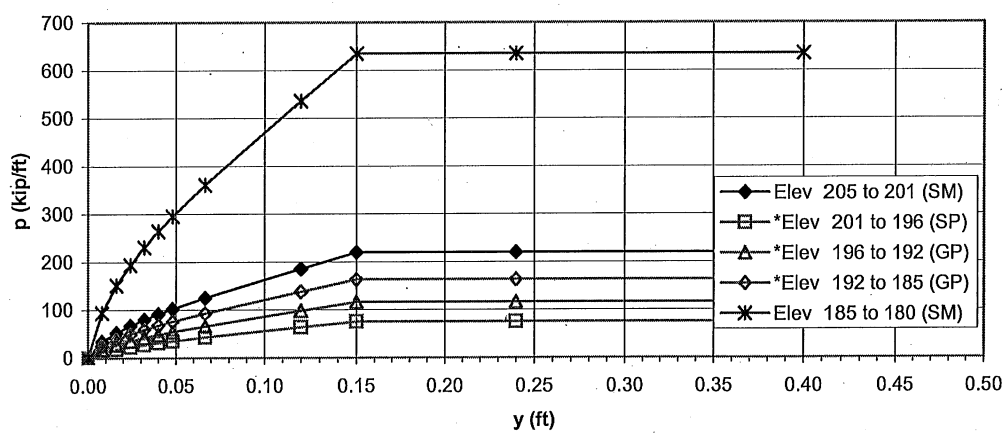
* - Liquefiable Layer

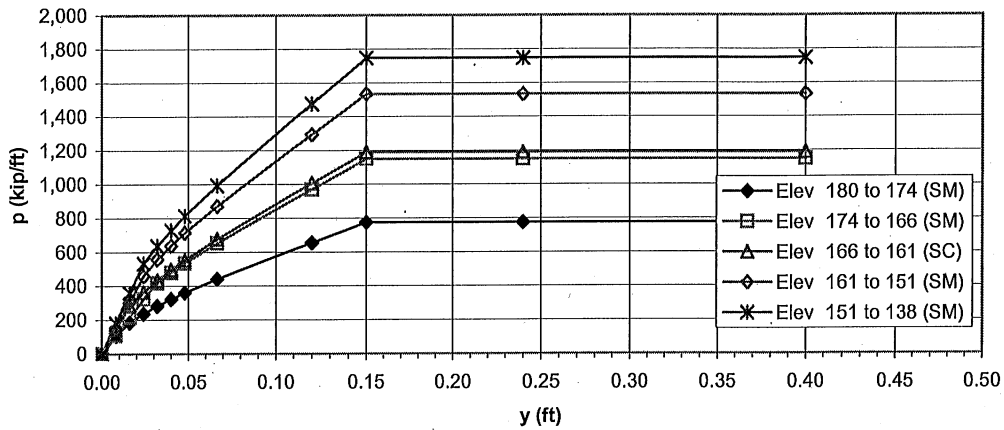
p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Abut 30		O.G.	231.0	Pile	4' PP
Sta.		Cut-off	231.0	GWS	213.0







* - Liquefiable Layer

p-y Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Abut 1
Sta.

O.G.	231	Pile	4' PP
Cut-off	231	GWS	213.0

y (ft)	Elev 231 to 224 (SM)	y (ft)	Elev 224 to 218 (SM)	y (ft)	Elev 218 to 211 (SM)	y (ft)	*Elev 211 to 206 (SP)	y (ft)	*Elev 206 to 198 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	1.4	0.008	12	0.008	41	0.008	7	0.008	9
0.02	2.7	0.016	25	0.016	66	0.016	11	0.016	13
0.02	4.1	0.024	37	0.024	80	0.024	14	0.024	17
0.03	5.5	0.032	45	0.032	92	0.032	17	0.032	20
0.04	6.9	0.040	49	0.040	103	0.040	20	0.040	23
0.05	8.2	0.048	52	0.048	112	0.048	22	0.048	26
0.07	10.9	0.067	58	0.067	132	0.067	27	0.067	32
0.12	13.3	0.120	74	0.120	184	0.120	40	0.120	48
0.15	14.6	0.150	82	0.150	213	0.150	47	0.150	56
0.24	14.6	0.240	82	0.240	213	0.240	47	0.240	56
0.40	14.6	0.400	82	0.400	213	0.400	47	0.400	56

y (ft)	*Elev 198 to 191 (SP)	y (ft)	Elev 191 to 188 (SP)	y (ft)	Elev 188 to 181 (SP)	y (ft)	Elev 181 to 176 (SP)	y (ft)	Elev 176 to 168 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	21	0.008	66	0.008	94	0.008	93	0.008	115
0.016	32	0.016	131	0.016	179	0.016	185	0.016	229
0.024	41	0.024	168	0.024	229	0.024	260	0.024	344
0.032	49	0.032	200	0.032	273	0.032	310	0.032	451
0.040	56	0.040	229	0.040	313	0.040	355	0.040	517
0.048	62	0.048	256	0.048	349	0.048	397	0.048	578
0.067	76	0.067	312	0.067	427	0.067	484	0.067	705
0.120	113	0.120	464	0.120	634	0.120	720	0.120	1,048
0.150	134	0.150	550	0.150	751	0.150	852	0.150	1,241
0.240	134	0.240	550	0.240	751	0.240	852	0.240	1,241
0.400	134	0.400	550	0.400	751	0.400	852	0.400	1,241

y (ft)	Elev 168 to 161 (SP)	y (ft)	Elev 161 to 158 (SP)	y (ft)	Elev 158 to 149 (SP)	y (ft)	Elev 149 to 144 (SP)	y (ft)	Elev 144 to 138 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	123	0.008	94	0.008	137	0.008	164	0.008	175
0.016	246	0.016	188	0.016	274	0.016	327	0.016	351
0.024	369	0.024	279	0.024	397	0.024	464	0.024	479
0.032	492	0.032	332	0.032	473	0.032	552	0.032	571
0.040	615	0.040	380	0.040	541	0.040	633	0.040	654
0.048	738	0.048	425	0.048	605	0.048	707	0.048	730
0.067	965	0.067	519	0.067	738	0.067	863	0.067	892
0.120	1,435	0.120	771	0.120	1,098	0.120	1,283	0.120	1,325
0.150	1,699	0.150	913	0.150	1,300	0.150	1,519	0.150	1,569
0.240	1,699	0.240	913	0.240	1,300	0.240	1,519	0.240	1,569
0.400	1,699	0.400	913	0.400	1,300	0.400	1,519	0.400	1,569

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 2
Sta.

O.G.	213	Pile	4'PP
Cut-off	213	GWS	213.0

y (ft)	*Elev 213 to 206 (SM)	y (ft)	*Elev 206 to 198 (SM)	y (ft)	Elev 198 to 192 (SP)	y (ft)	Elev 192 to 189 (SM)	y (ft)	Elev 189 to 184 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.5	0.008	1	0.008	19	0.008	14	0.008	22
0.02	0.6	0.016	1	0.016	26	0.016	21	0.016	33
0.02	0.7	0.024	2	0.024	31	0.024	27	0.024	43
0.03	0.7	0.032	2	0.032	35	0.032	32	0.032	51
0.04	0.8	0.040	2	0.040	39	0.040	37	0.040	58
0.05	0.8	0.048	2	0.048	43	0.048	41	0.048	65
0.07	0.9	0.067	2	0.067	50	0.067	51	0.067	79
0.12	1.1	0.120	3	0.120	68	0.120	75	0.120	118
0.15	1.2	0.150	4	0.150	79	0.150	89	0.150	139
0.24	1.2	0.240	4	0.240	79	0.240	89	0.240	139
0.40	1.2	0.400	4	0.400	79	0.400	89	0.400	139

y (ft)	Elev 184 to 179 (SP)	y (ft)	Elev 179 to 174 (SM)	y (ft)	Elev 174 to 168 (SM)	y (ft)	Elev 168 to 164 (SP)	y (ft)	Elev 164 to 156 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	30	0.008	18	0.008	40	0.008	68	0.008	79
0.016	47	0.016	28	0.016	77	0.016	135	0.016	151
0.024	60	0.024	35	0.024	99	0.024	180	0.024	194
0.032	72	0.032	42	0.032	118	0.032	215	0.032	231
0.040	82	0.040	48	0.040	135	0.040	246	0.040	264
0.048	92	0.048	54	0.048	151	0.048	275	0.048	295
0.067	112	0.067	66	0.067	184	0.067	335	0.067	361
0.120	166	0.120	98	0.120	274	0.120	498	0.120	536
0.150	197	0.150	116	0.150	324	0.150	590	0.150	635
0.240	197	0.240	116	0.240	324	0.240	590	0.240	635
0.400	197	0.400	116	0.400	324	0.400	590	0.400	635

y (ft)	Elev 156 to 147 (SM)	y (ft)	Elev 147 to 142 (SM)	y (ft)	Elev 142 to 137 (SM)	y (ft)	Elev 137 to 127 (SM)	y (ft)	Elev 127 to 121 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	97	0.008	122	0.008	133	0.008	115	0.008	133
0.016	194	0.016	244	0.016	266	0.016	230	0.016	266
0.024	263	0.024	340	0.024	391	0.024	342	0.024	380
0.032	313	0.032	405	0.032	465	0.032	407	0.032	453
0.040	358	0.040	464	0.040	533	0.040	467	0.040	519
0.048	401	0.048	518	0.048	595	0.048	521	0.048	579
0.067	489	0.067	632	0.067	727	0.067	636	0.067	707
0.120	727	0.120	940	0.120	1,080	0.120	946	0.120	1,052
0.150	861	0.150	1,113	0.150	1,279	0.150	1,120	0.150	1,245
0.240	861	0.240	1,113	0.240	1,279	0.240	1,120	0.240	1,245
0.400	861	0.400	1,113	0.400	1,279	0.400	1,120	0.400	1,245

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

p-y Data

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 3
Sta.

O.G. 213
Cut-off 213
Pile 4' PP
GWS 213.0

y (ft)	*Elev 213 to 206 (SM)	y (ft)	Elev 206 to 200 (SM)	y (ft)	Elev 200 to 194 (SM)	y (ft)	*Elev 194 to 188 (SP)	y (ft)	Elev 188 to 182 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.6	0.008	7	0.008	17	0.008	3	0.008	29
0.02	0.8	0.016	15	0.016	28	0.016	4	0.016	44
0.02	0.9	0.024	20	0.024	34	0.024	5	0.024	57
0.03	0.9	0.032	22	0.032	39	0.032	6	0.032	68
0.04	1.0	0.040	24	0.040	44	0.040	7	0.040	78
0.05	1.0	0.048	26	0.048	48	0.048	8	0.048	87
0.07	1.1	0.067	29	0.067	56	0.067	10	0.067	106
0.12	1.4	0.120	37	0.120	78	0.120	15	0.120	157
0.15	1.5	0.150	41	0.150	91	0.150	17	0.150	186
0.24	1.5	0.240	41	0.240	91	0.240	17	0.240	186
0.40	1.5	0.400	41	0.400	91	0.400	17	0.400	186

y (ft)	Elev 182 to 176 (SP)	y (ft)	Elev 176 to 168 (SP)	y (ft)	Elev 168 to 160 (SP)	y (ft)	Elev 160 to 157 (SM)	y (ft)	Elev 157 to 150 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	44	0.008	69	0.008	79	0.008	64	0.008	109
0.016	69	0.016	120	0.016	153	0.016	127	0.016	218
0.024	88	0.024	153	0.024	196	0.024	191	0.024	313
0.032	105	0.032	182	0.032	233	0.032	244	0.032	373
0.040	120	0.040	209	0.040	267	0.040	279	0.040	427
0.048	134	0.048	233	0.048	299	0.048	312	0.048	478
0.067	164	0.067	285	0.067	365	0.067	381	0.067	583
0.120	243	0.120	423	0.120	542	0.120	566	0.120	867
0.150	288	0.150	501	0.150	642	0.150	670	0.150	1,026
0.240	288	0.240	501	0.240	642	0.240	670	0.240	1,026
0.400	288	0.400	501	0.400	642	0.400	670	0.400	1,026

y (ft)	Elev 150 to 145 (SM)	y (ft)	Elev 145 to 140 (SM)	y (ft)	Elev 140 to 137 (SP)	y (ft)	Elev 137 to 130 (SM)	y (ft)	Elev 130 to 123 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	120	0.008	139	0.008	142	0.008	114	0.008	164
0.016	241	0.016	278	0.016	283	0.016	228	0.016	327
0.024	349	0.024	417	0.024	425	0.024	332	0.024	491
0.032	416	0.032	498	0.032	566	0.032	396	0.032	654
0.040	477	0.040	570	0.040	666	0.040	453	0.040	818
0.048	532	0.048	637	0.048	744	0.048	506	0.048	936
0.067	650	0.067	778	0.067	908	0.067	618	0.067	1,143
0.120	966	0.120	1,156	0.120	1,350	0.120	919	0.120	1,699
0.150	1,144	0.150	1,369	0.150	1,598	0.150	1,088	0.150	2,011
0.240	1,144	0.240	1,369	0.240	1,598	0.240	1,088	0.240	2,011
0.400	1,144	0.400	1,369	0.400	1,598	0.400	1,088	0.400	2,011

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 4

Sta.						O.G.	213	Pile	4' PP
						Cut-off	213	GWS	213.0

y (ft)	*Elev 213 to 205 (SP)	y (ft)	*Elev 205 to 197 (SP)	y (ft)	Elev 197 to 194 (SM)	y (ft)	*Elev 194 to 190 (SM)	y (ft)	Elev 190 to 185 (SM)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.9	0.008	1	0.008	18	0.008	2	0.008	23
0.02	1.1	0.016	2	0.016	29	0.016	4	0.016	36
0.02	1.2	0.024	2	0.024	36	0.024	5	0.024	46
0.03	1.3	0.032	3	0.032	41	0.032	6	0.032	54
0.04	1.4	0.040	3	0.040	46	0.040	7	0.040	62
0.05	1.4	0.048	3	0.048	50	0.048	7	0.048	70
0.07	1.6	0.067	4	0.067	58	0.067	9	0.067	85
0.12	1.9	0.120	5	0.120	80	0.120	13	0.120	126
0.15	2.1	0.150	6	0.150	93	0.150	16	0.150	149
0.24	2.1	0.240	6	0.240	93	0.240	16	0.240	149
0.40	2.1	0.400	6	0.400	93	0.400	16	0.400	149

y (ft)	Elev 185 to 179 (SM)	y (ft)	Elev 179 to 174 (SC)	y (ft)	Elev 174 to 168 (GP)	y (ft)	Elev 168 to 162 (GP)	y (ft)	Elev 162 to 153 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	36	0.008	34	0.008	68	0.008	82	0.008	89
0.016	55	0.016	64	0.016	118	0.016	159	0.016	177
0.024	70	0.024	82	0.024	152	0.024	204	0.024	236
0.032	84	0.032	98	0.032	181	0.032	243	0.032	281
0.040	96	0.040	113	0.040	207	0.040	278	0.040	322
0.048	107	0.048	126	0.048	231	0.048	311	0.048	360
0.067	131	0.067	153	0.067	282	0.067	379	0.067	440
0.120	195	0.120	228	0.120	419	0.120	564	0.120	653
0.150	231	0.150	270	0.150	496	0.150	668	0.150	774
0.240	231	0.240	270	0.240	496	0.240	668	0.240	774
0.400	231	0.400	270	0.400	496	0.400	668	0.400	774

y (ft)	Elev 153 to 149 (SP)	y (ft)	Elev 149 to 142 (SM)	y (ft)	Elev 142 to 139 (SP)	y (ft)	Elev 139 to 133 (SP)	y (ft)	Elev 133 to 123 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	84	0.008	99	0.008	49	0.008	142	0.008	120
0.016	167	0.016	197	0.016	98	0.016	284	0.016	239
0.024	251	0.024	296	0.024	148	0.024	426	0.024	338
0.032	317	0.032	377	0.032	197	0.032	542	0.032	403
0.040	363	0.040	432	0.040	244	0.040	621	0.040	462
0.048	405	0.048	483	0.048	272	0.048	693	0.048	516
0.067	495	0.067	590	0.067	332	0.067	847	0.067	630
0.120	736	0.120	876	0.120	494	0.120	1,259	0.120	936
0.150	871	0.150	1,038	0.150	585	0.150	1,490	0.150	1,109
0.240	871	0.240	1,038	0.240	585	0.240	1,490	0.240	1,109
0.400	871	0.400	1,038	0.400	585	0.400	1,490	0.400	1,109

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 5
Sta.

O.G.	209	Pile	4' PP
Cut-off	209	GWS	213.0

y (ft)	Elev 209 to 201 (SP)	y (ft)	Elev 201 to 195 (SP)	y (ft)	Elev 195 to 189 (SP)	y (ft)	Elev 189 to 183 (SP)	y (ft)	Elev 183 to 177 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.7	0.008	9	0.008	1	0.008	18	0.008	31
0.02	0.9	0.016	14	0.016	2	0.016	28	0.016	48
0.02	1.0	0.024	16	0.024	3	0.024	36	0.024	61
0.03	1.1	0.032	18	0.032	3	0.032	43	0.032	73
0.04	1.1	0.040	19	0.040	4	0.040	50	0.040	83
0.05	1.2	0.048	21	0.048	4	0.048	56	0.048	93
0.07	1.3	0.067	23	0.067	5	0.067	68	0.067	114
0.12	1.6	0.120	30	0.120	8	0.120	102	0.120	169
0.15	1.8	0.150	34	0.150	9	0.150	121	0.150	200
0.24	1.8	0.240	34	0.240	9	0.240	121	0.240	200
0.40	1.8	0.400	34	0.400	9	0.400	121	0.400	200

y (ft)	Elev 177 to 167 (SP)	y (ft)	Elev 167 to 159 (SP)	y (ft)	Elev 159 to 151 (SP)	y (ft)	Elev 151 to 145 (SP)	y (ft)	Elev 145 to 139 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	35	0.008	60	0.008	89	0.008	110	0.008	113
0.016	66	0.016	112	0.016	168	0.016	219	0.016	225
0.024	84	0.024	143	0.024	214	0.024	282	0.024	324
0.032	100	0.032	170	0.032	255	0.032	336	0.032	386
0.040	114	0.040	195	0.040	292	0.040	384	0.040	442
0.048	128	0.048	217	0.048	327	0.048	429	0.048	494
0.067	156	0.067	266	0.067	399	0.067	524	0.067	603
0.120	232	0.120	395	0.120	593	0.120	779	0.120	896
0.150	275	0.150	467	0.150	702	0.150	923	0.150	1,061
0.240	275	0.240	467	0.240	702	0.240	923	0.240	1,061
0.400	275	0.400	467	0.400	702	0.400	923	0.400	1,061

y (ft)	Elev 139 to 129 (SP)	y (ft)	Elev 129 to 126 (SM)	y (ft)	Elev 126 to 116 (SM)				
0.000	0	0.000	0	0.000	0				
0.008	133	0.008	104	0.008	171				
0.016	267	0.016	207	0.016	342				
0.024	400	0.024	300	0.024	512				
0.032	533	0.032	357	0.032	666				
0.040	633	0.040	409	0.040	763				
0.048	708	0.048	457	0.048	852				
0.067	864	0.067	558	0.067	1,041				
0.120	1,284	0.120	829	0.120	1,547				
0.150	1,521	0.150	982	0.150	1,832				
0.240	1,521	0.240	982	0.240	1,832				
0.400	1,521	0.400	982	0.400	1,832				

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 6
Sta.

O.G.	209	Pile	4' PP
Cut-off	209	GWS	213.0

y (ft)	*Elev 209 to 203 (SP)	y (ft)	Elev 203 to 197 (SP)	y (ft)	*Elev 197 to 188 (SP)	y (ft)	Elev 188 to 185 (SP)	y (ft)	Elev 185 to 179 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.6	0.008	6	0.008	1	0.008	12	0.008	12
0.02	0.7	0.016	12	0.016	2	0.016	16	0.016	18
0.02	0.8	0.024	16	0.024	2	0.024	20	0.024	23
0.03	0.9	0.032	18	0.032	2	0.032	23	0.032	27
0.04	0.9	0.040	19	0.040	3	0.040	26	0.040	31
0.05	1.0	0.048	20	0.048	3	0.048	28	0.048	34
0.07	1.0	0.067	23	0.067	3	0.067	33	0.067	41
0.12	1.3	0.120	28	0.120	4	0.120	46	0.120	60
0.15	1.4	0.150	32	0.150	5	0.150	53	0.150	71
0.24	1.4	0.240	32	0.240	5	0.240	53	0.240	71
0.40	1.4	0.400	32	0.400	5	0.400	53	0.400	71

y (ft)	*Elev 179 to 173 (SP)	y (ft)	Elev 173 to 164 (SP)	y (ft)	Elev 164 to 154 (SP)	y (ft)	Elev 154 to 147 (SP)	y (ft)	Elev 147 to 139 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	2	0.008	3	0.008	4	0.008	31	0.008	57
0.016	3	0.016	5	0.016	6	0.016	47	0.016	87
0.024	4	0.024	6	0.024	8	0.024	60	0.024	111
0.032	5	0.032	7	0.032	9	0.032	72	0.032	133
0.040	6	0.040	8	0.040	11	0.040	82	0.040	152
0.048	7	0.048	9	0.048	12	0.048	92	0.048	170
0.067	8	0.067	11	0.067	14	0.067	112	0.067	207
0.120	12	0.120	17	0.120	21	0.120	167	0.120	308
0.150	15	0.150	20	0.150	25	0.150	198	0.150	365
0.240	15	0.240	20	0.240	25	0.240	198	0.240	365
0.400	15	0.400	20	0.400	25	0.400	198	0.400	365

y (ft)	Elev 139 to 132 (SP)	y (ft)	Elev 132 to 124 (SP)	y (ft)	Elev 124 to 114 (SP)
0.000	0	0.000	0	0.000	0
0.008	65	0.008	88	0.008	111
0.016	99	0.016	139	0.016	194
0.024	126	0.024	178	0.024	248
0.032	151	0.032	212	0.032	296
0.040	172	0.040	243	0.040	339
0.048	193	0.048	271	0.048	378
0.067	235	0.067	332	0.067	462
0.120	350	0.120	493	0.120	687
0.150	414	0.150	583	0.150	813
0.240	414	0.240	583	0.240	813
0.400	414	0.400	583	0.400	813

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 7
Sta.

O.G.	209	Pile	4' PP
Cut-off	209	GWS	213.0

y (ft)	*Elev 209 to 203 (SP)	y (ft)	Elev 203 to 197 (SP)	y (ft)	*Elev 197 to 188 (SP)	y (ft)	Elev 188 to 185 (SP)	y (ft)	Elev 185 to 179 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.6	0.008	6	0.008	1	0.008	12	0.008	12
0.02	0.7	0.016	12	0.016	2	0.016	16	0.016	18
0.02	0.8	0.024	16	0.024	2	0.024	20	0.024	23
0.03	0.9	0.032	18	0.032	2	0.032	23	0.032	27
0.04	0.9	0.040	19	0.040	3	0.040	26	0.040	31
0.05	1.0	0.048	20	0.048	3	0.048	28	0.048	34
0.07	1.0	0.067	23	0.067	3	0.067	33	0.067	41
0.12	1.3	0.120	28	0.120	4	0.120	46	0.120	60
0.15	1.4	0.150	32	0.150	5	0.150	53	0.150	71
0.24	1.4	0.240	32	0.240	5	0.240	53	0.240	71
0.40	1.4	0.400	32	0.400	5	0.400	53	0.400	71

y (ft)	*Elev 179 to 173 (SP)	y (ft)	Elev 173 to 164 (SP)	y (ft)	Elev 164 to 154 (SP)	y (ft)	Elev 154 to 147 (SP)	y (ft)	Elev 147 to 139 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	2	0.008	3	0.008	4	0.008	31	0.008	57
0.016	3	0.016	5	0.016	6	0.016	47	0.016	87
0.024	4	0.024	6	0.024	8	0.024	60	0.024	111
0.032	5	0.032	7	0.032	9	0.032	72	0.032	133
0.040	6	0.040	8	0.040	11	0.040	82	0.040	152
0.048	7	0.048	9	0.048	12	0.048	92	0.048	170
0.067	8	0.067	11	0.067	14	0.067	112	0.067	207
0.120	12	0.120	17	0.120	21	0.120	167	0.120	308
0.150	15	0.150	20	0.150	25	0.150	198	0.150	365
0.240	15	0.240	20	0.240	25	0.240	198	0.240	365
0.400	15	0.400	20	0.400	25	0.400	198	0.400	365

y (ft)	Elev 139 to 132 (SP)	y (ft)	Elev 132 to 124 (SP)	y (ft)	Elev 124 to 114 (SP)
0.000	0	0.000	0	0.000	0
0.008	65	0.008	88	0.008	111
0.016	99	0.016	139	0.016	194
0.024	126	0.024	178	0.024	248
0.032	151	0.032	212	0.032	296
0.040	172	0.040	243	0.040	339
0.048	193	0.048	271	0.048	378
0.067	235	0.067	332	0.067	462
0.120	350	0.120	493	0.120	687
0.150	414	0.150	583	0.150	813
0.240	414	0.240	583	0.240	813
0.400	414	0.400	583	0.400	813

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 8
Sta.

O.G.	208	Pile	4'PP
Cut-off	205	GWS	213.0

y (ft)	*Elev 208 to 198 (SP)	y (ft)	Elev 198 to 190 (SP)	y (ft)	Elev 190 to 182 (SP)	y (ft)	Elev 182 to 176 (SP)	y (ft)	Elev 176 to 170 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.5	0.008	1	0.008	16	0.008	30	0.008	43
0.02	0.7	0.016	3	0.016	24	0.016	46	0.016	68
0.02	0.7	0.024	3	0.024	31	0.024	59	0.024	87
0.03	0.8	0.032	4	0.032	38	0.032	70	0.032	104
0.04	0.9	0.040	4	0.040	43	0.040	81	0.040	119
0.05	0.9	0.048	4	0.048	49	0.048	90	0.048	133
0.07	1.0	0.067	5	0.067	60	0.067	110	0.067	162
0.12	1.2	0.120	7	0.120	90	0.120	163	0.120	241
0.15	1.4	0.150	8	0.150	107	0.150	193	0.150	286
0.24	1.4	0.240	8	0.240	107	0.240	193	0.240	286
0.40	1.4	0.400	8	0.400	107	0.400	193	0.400	286

y (ft)	Elev 170 to 164 (SP)	y (ft)	Elev 164 to 158 (SM)	y (ft)	Elev 158 to 150 (SP)	y (ft)	Elev 150 to 144 (SM)	y (ft)	Elev 144 to 139 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	53	0.008	34	0.008	88	0.008	63	0.008	120
0.016	93	0.016	69	0.016	166	0.016	126	0.016	239
0.024	119	0.024	103	0.024	213	0.024	189	0.024	323
0.032	142	0.032	138	0.032	254	0.032	253	0.032	385
0.040	163	0.040	164	0.040	291	0.040	290	0.040	440
0.048	182	0.048	183	0.048	325	0.048	324	0.048	492
0.067	222	0.067	224	0.067	396	0.067	396	0.067	601
0.120	330	0.120	333	0.120	589	0.120	589	0.120	893
0.150	391	0.150	394	0.150	698	0.150	697	0.150	1,057
0.240	391	0.240	394	0.240	698	0.240	697	0.240	1,057
0.400	391	0.400	394	0.400	698	0.400	697	0.400	1,057

y (ft)	Elev 139 to 133 (SP)	y (ft)	Elev 133 to 128 (SP)	y (ft)	Elev 128 to 123 (SP)	y (ft)	Elev 123 to 115 (SP)		
0.000	0	0.000	0	0.000	0	0.000	0		
0.008	133	0.008	146	0.008	158	0.008	143		
0.016	266	0.016	292	0.016	316	0.016	286		
0.024	379	0.024	438	0.024	474	0.024	411		
0.032	452	0.032	523	0.032	592	0.032	490		
0.040	518	0.040	599	0.040	678	0.040	561		
0.048	578	0.048	670	0.048	757	0.048	627		
0.067	706	0.067	818	0.067	924	0.067	765		
0.120	1,049	0.120	1,215	0.120	1,374	0.120	1,137		
0.150	1,243	0.150	1,439	0.150	1,627	0.150	1,346		
0.240	1,243	0.240	1,439	0.240	1,627	0.240	1,346		
0.400	1,243	0.400	1,439	0.400	1,627	0.400	1,346		

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 9
Sta.

O.G.	208	Pile	4' PP
Cut-off	208	GWS	213.0

y (ft)	*Elev 208 to 203 (SP)	y (ft)	*Elev 203 to 198 (SP)	y (ft)	*Elev 198 to 193 (SP)	y (ft)	*Elev 193 to 188 (SP)	y (ft)	Elev 188 to 182 (SM)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.5	0.008	1	0.008	1	0.008	1	0.008	16
0.02	0.6	0.016	2	0.016	2	0.016	2	0.016	25
0.02	0.7	0.024	2	0.024	2	0.024	2	0.024	32
0.03	0.7	0.032	2	0.032	2	0.032	3	0.032	38
0.04	0.8	0.040	2	0.040	2	0.040	3	0.040	44
0.05	0.8	0.048	2	0.048	3	0.048	4	0.048	49
0.07	0.9	0.067	3	0.067	3	0.067	4	0.067	61
0.12	1.1	0.120	3	0.120	4	0.120	7	0.120	91
0.15	1.2	0.150	4	0.150	5	0.150	8	0.150	108
0.24	1.2	0.240	4	0.240	5	0.240	8	0.240	108
0.40	1.2	0.400	4	0.400	5	0.400	8	0.400	108

y (ft)	Elev 182 to 176 (SP)	y (ft)	Elev 176 to 171 (SM)	y (ft)	Elev 171 to 165 (SM)	y (ft)	Elev 165 to 159 (SM)	y (ft)	Elev 159 to 149 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	24	0.008	15	0.008	36	0.008	42	0.008	73
0.016	37	0.016	22	0.016	66	0.016	84	0.016	139
0.024	48	0.024	28	0.024	85	0.024	110	0.024	178
0.032	57	0.032	34	0.032	101	0.032	131	0.032	212
0.040	65	0.040	39	0.040	115	0.040	150	0.040	242
0.048	73	0.048	43	0.048	129	0.048	168	0.048	271
0.067	89	0.067	53	0.067	158	0.067	205	0.067	331
0.120	132	0.120	79	0.120	234	0.120	305	0.120	491
0.150	156	0.150	93	0.150	277	0.150	361	0.150	582
0.240	156	0.240	93	0.240	277	0.240	361	0.240	582
0.400	156	0.400	93	0.400	277	0.400	361	0.400	582

y (ft)	Elev 149 to 141 (SP)	y (ft)	Elev 141 to 133 (SP)	y (ft)	Elev 133 to 126 (SP)	y (ft)	Elev 126 to 119 (SM)	y (ft)	Elev 119 to 114 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	82	0.008	117	0.008	133	0.008	132	0.008	124
0.016	163	0.016	233	0.016	266	0.016	264	0.016	248
0.024	233	0.024	350	0.024	400	0.024	389	0.024	345
0.032	277	0.032	435	0.032	533	0.032	463	0.032	410
0.040	318	0.040	498	0.040	630	0.040	530	0.040	470
0.048	355	0.048	557	0.048	703	0.048	592	0.048	525
0.067	433	0.067	680	0.067	859	0.067	723	0.067	641
0.120	644	0.120	1,010	0.120	1,277	0.120	1,075	0.120	953
0.150	763	0.150	1,196	0.150	1,511	0.150	1,273	0.150	1,129
0.240	763	0.240	1,196	0.240	1,511	0.240	1,273	0.240	1,129
0.400	763	0.400	1,196	0.400	1,511	0.400	1,273	0.400	1,129

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

p-y Data

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 10
Sta.

						O.G.	209	Pile	4' PP
						Cut-off	209	GWS	213.0
y (ft)	*Elev 209 to 204 (SP)	y (ft)	*Elev 204 to 199 (SP)	y (ft)	*Elev 199 to 194 (SP)	y (ft)	*Elev 194 to 189 (SP)	y (ft)	Elev 189 to 182 (SM)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.5	0.008	1	0.008	1	0.008	1	0.008	17
0.02	0.6	0.016	2	0.016	2	0.016	2	0.016	26
0.02	0.6	0.024	2	0.024	2	0.024	2	0.024	33
0.03	0.7	0.032	2	0.032	3	0.032	3	0.032	39
0.04	0.7	0.040	2	0.040	3	0.040	3	0.040	45
0.05	0.7	0.048	2	0.048	3	0.048	4	0.048	51
0.07	0.8	0.067	2	0.067	4	0.067	5	0.067	62
0.12	1.0	0.120	3	0.120	5	0.120	7	0.120	93
0.15	1.1	0.150	3	0.150	6	0.150	8	0.150	111
0.24	1.1	0.240	3	0.240	6	0.240	8	0.240	111
0.40	1.1	0.400	3	0.400	6	0.400	8	0.400	111

y (ft)	Elev 182 to 175 (SP)	y (ft)	Elev 175 to 172 (SM)	y (ft)	Elev 172 to 166 (SP)	y (ft)	Elev 166 to 160 (SM)	y (ft)	Elev 160 to 154 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	31	0.008	27	0.008	36	0.008	53	0.008	69
0.016	48	0.016	53	0.016	70	0.016	100	0.016	134
0.024	61	0.024	68	0.024	89	0.024	128	0.024	171
0.032	73	0.032	81	0.032	106	0.032	152	0.032	204
0.040	83	0.040	93	0.040	122	0.040	174	0.040	234
0.048	93	0.048	104	0.048	136	0.048	195	0.048	261
0.067	113	0.067	127	0.067	166	0.067	238	0.067	319
0.120	169	0.120	189	0.120	247	0.120	353	0.120	474
0.150	200	0.150	223	0.150	292	0.150	418	0.150	561
0.240	200	0.240	223	0.240	292	0.240	418	0.240	561
0.400	200	0.400	223	0.400	292	0.400	418	0.400	561

y (ft)	Elev 154 to 148 (SP)	y (ft)	Elev 148 to 141 (SP)	y (ft)	Elev 141 to 134 (SP)	y (ft)	Elev 134 to 124 (SP)	y (ft)	Elev 124 to 114 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	95	0.008	116	0.008	127	0.008	135	0.008	127
0.016	190	0.016	232	0.016	253	0.016	270	0.016	255
0.024	254	0.024	304	0.024	380	0.024	405	0.024	354
0.032	302	0.032	362	0.032	470	0.032	500	0.032	422
0.040	346	0.040	414	0.040	538	0.040	572	0.040	483
0.048	387	0.048	463	0.048	601	0.048	640	0.048	540
0.067	472	0.067	565	0.067	734	0.067	781	0.067	660
0.120	702	0.120	840	0.120	1,092	0.120	1,161	0.120	980
0.150	831	0.150	995	0.150	1,293	0.150	1,375	0.150	1,161
0.240	831	0.240	995	0.240	1,293	0.240	1,375	0.240	1,161
0.400	831	0.400	995	0.400	1,293	0.400	1,375	0.400	1,161

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 11
Sta.

						O.G.	208	Pile	4' PP
						Cut-off	208	GWS	213.0

y (ft)	*Elev 208 to 201 (SP)	y (ft)	*Elev 201 to 191 (SP)	y (ft)	Elev 191 to 184 (SM)	y (ft)	Elev 184 to 175 (SM)	y (ft)	Elev 175 to 166 (SM)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.7	0.008	1	0.008	14	0.008	29	0.008	35
0.02	0.8	0.016	2	0.016	21	0.016	44	0.016	66
0.02	0.9	0.024	2	0.024	27	0.024	57	0.024	84
0.03	1.0	0.032	3	0.032	33	0.032	68	0.032	100
0.04	1.1	0.040	3	0.040	38	0.040	77	0.040	115
0.05	1.1	0.048	3	0.048	42	0.048	87	0.048	129
0.07	1.3	0.067	4	0.067	52	0.067	106	0.067	157
0.12	1.5	0.120	5	0.120	78	0.120	157	0.120	233
0.15	1.7	0.150	6	0.150	93	0.150	186	0.150	276
0.24	1.7	0.240	6	0.240	93	0.240	186	0.240	276
0.40	1.7	0.400	6	0.400	93	0.400	186	0.400	276

y (ft)	*Elev 166 to 163 (ML)	y (ft)	*Elev 163 to 157 (SM)	y (ft)	Elev 157 to 153 (SP)	y (ft)	Elev 153 to 146 (SM)	y (ft)	Elev 146 to 140 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	7	0.008	18	0.008	85	0.008	79	0.008	106
0.016	11	0.016	35	0.016	149	0.016	159	0.016	213
0.024	14	0.024	53	0.024	190	0.024	212	0.024	316
0.032	17	0.032	68	0.032	226	0.032	252	0.032	377
0.040	19	0.040	78	0.040	259	0.040	289	0.040	432
0.048	21	0.048	87	0.048	290	0.048	323	0.048	482
0.067	26	0.067	107	0.067	354	0.067	394	0.067	589
0.120	39	0.120	159	0.120	526	0.120	585	0.120	875
0.150	46	0.150	188	0.150	622	0.150	693	0.150	1,036
0.240	46	0.240	188	0.240	622	0.240	693	0.240	1,036
0.400	46	0.400	188	0.400	622	0.400	693	0.400	1,036

y (ft)	Elev 140 to 134 (SP)	y (ft)	Elev 134 to 128 (SP)	y (ft)	Elev 128 to 123 (SP)	y (ft)	Elev 123 to 118 (SP)		
0.000	0	0.000	0	0.000	0	0.000	0		
0.008	121	0.008	135	0.008	154	0.008	165		
0.016	241	0.016	270	0.016	307	0.016	330		
0.024	362	0.024	405	0.024	461	0.024	495		
0.032	459	0.032	540	0.032	577	0.032	596		
0.040	525	0.040	626	0.040	661	0.040	683		
0.048	587	0.048	699	0.048	739	0.048	763		
0.067	717	0.067	854	0.067	902	0.067	932		
0.120	1,065	0.120	1,269	0.120	1,341	0.120	1,385		
0.150	1,261	0.150	1,502	0.150	1,588	0.150	1,640		
0.240	1,261	0.240	1,502	0.240	1,588	0.240	1,640		
0.400	1,261	0.400	1,502	0.400	1,588	0.400	1,640		

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 12
Sta.

O.G.	207	Pile	4' PP
Cut-off	207	GWS	213.0

y (ft)	*Elev 207 to 197 (SP)	y (ft)	Elev 197 to 187 (SP)	y (ft)	*Elev 187 to 184 (SP)	y (ft)	Elev 184 to 175 (SP)	y (ft)	Elev 175 to 173 (SC)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.7	0.008	9	0.008	2	0.008	25	0.008	19
0.02	0.9	0.016	16	0.016	3	0.016	37	0.016	38
0.02	1.0	0.024	20	0.024	4	0.024	48	0.024	54
0.03	1.1	0.032	22	0.032	5	0.032	57	0.032	65
0.04	1.1	0.040	25	0.040	6	0.040	65	0.040	74
0.05	1.2	0.048	27	0.048	6	0.048	73	0.048	83
0.07	1.3	0.067	32	0.067	8	0.067	89	0.067	101
0.12	1.6	0.120	43	0.120	12	0.120	133	0.120	150
0.15	1.8	0.150	50	0.150	14	0.150	157	0.150	177
0.24	1.8	0.240	50	0.240	14	0.240	157	0.240	177
0.40	1.8	0.400	50	0.400	14	0.400	157	0.400	177

y (ft)	*Elev 173 to 169 (SP)	y (ft)	*Elev 169 to 163 (SP)	y (ft)	Elev 163 to 156 (SP)	y (ft)	Elev 156 to 148 (SP)	y (ft)	Elev 148 to 144 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	7	0.008	9	0.008	71	0.008	88	0.008	82
0.016	10	0.016	13	0.016	116	0.016	161	0.016	163
0.024	13	0.024	17	0.024	148	0.024	206	0.024	230
0.032	16	0.032	20	0.032	176	0.032	245	0.032	274
0.040	18	0.040	23	0.040	202	0.040	281	0.040	314
0.048	20	0.048	26	0.048	225	0.048	314	0.048	351
0.067	25	0.067	32	0.067	275	0.067	383	0.067	429
0.120	37	0.120	47	0.120	409	0.120	569	0.120	637
0.150	44	0.150	55	0.150	484	0.150	674	0.150	754
0.240	44	0.240	55	0.240	484	0.240	674	0.240	754
0.400	44	0.400	55	0.400	484	0.400	674	0.400	754

y (ft)	Elev 144 to 138 (SP)	y (ft)	Elev 138 to 132 (SP)	y (ft)	Elev 132 to 124 (SM)	y (ft)	Elev 124 to 116 (SP)		
0.000	0	0.000	0	0.000	0	0.000	0		
0.008	114	0.008	128	0.008	104	0.008	153		
0.016	228	0.016	256	0.016	208	0.016	306		
0.024	311	0.024	373	0.024	312	0.024	459		
0.032	370	0.032	445	0.032	374	0.032	612		
0.040	424	0.040	509	0.040	428	0.040	740		
0.048	474	0.048	569	0.048	479	0.048	827		
0.067	578	0.067	695	0.067	584	0.067	1,010		
0.120	860	0.120	1,033	0.120	869	0.120	1,501		
0.150	1,018	0.150	1,223	0.150	1,029	0.150	1,777		
0.240	1,018	0.240	1,223	0.240	1,029	0.240	1,777		
0.400	1,018	0.400	1,223	0.400	1,029	0.400	1,777		

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 16
Sta.

O.G.	206	Pile	4' PP
Cut-off	206	GWS	213.0

y (ft)	*Elev 206 to 199 (SP)	y (ft)	*Elev 199 to 191 (SP)	y (ft)	*Elev 191 to 183 (SP)	y (ft)	Elev 183 to 177 (SM)	y (ft)	Elev 177 to 171 (SM)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.7	0.008	1	0.008	2	0.008	20	0.008	30
0.02	0.8	0.016	2	0.016	3	0.016	30	0.016	46
0.02	0.9	0.024	2	0.024	3	0.024	38	0.024	58
0.03	1.0	0.032	3	0.032	4	0.032	46	0.032	69
0.04	1.1	0.040	3	0.040	4	0.040	52	0.040	80
0.05	1.1	0.048	3	0.048	5	0.048	59	0.048	89
0.07	1.2	0.067	3	0.067	6	0.067	71	0.067	108
0.12	1.5	0.120	5	0.120	9	0.120	106	0.120	161
0.15	1.7	0.150	5	0.150	11	0.150	126	0.150	191
0.24	1.7	0.240	5	0.240	11	0.240	126	0.240	191
0.40	1.7	0.400	5	0.400	11	0.400	126	0.400	191

y (ft)	Elev 171 to 161 (SM)	y (ft)	Elev 161 to 156 (SM)	y (ft)	Elev 156 to 151 (SM)	y (ft)	Elev 151 to 144 (CL)	y (ft)	Elev 144 to 140 (CH)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	18	0.008	66	0.008	60	0.140	34	0.169	26
0.016	27	0.016	108	0.016	119	0.279	41	0.338	31
0.024	34	0.024	138	0.024	152	0.419	45	0.506	34
0.032	41	0.032	164	0.032	181	0.559	49	0.675	36
0.040	47	0.040	188	0.040	208	0.698	51	0.844	38
0.048	53	0.048	210	0.048	232	0.838	54	1.013	40
0.067	64	0.067	257	0.067	283	1.117	58	1.350	43
0.120	95	0.120	381	0.120	421	1.396	58	1.688	43
0.150	113	0.150	452	0.150	499	1.676	58	2.025	43
0.240	113	0.240	452	0.240	499	1.955	58	2.363	43
0.400	113	0.400	452	0.400	499	2.234	58	2.700	43

y (ft)	Elev 140 to 133 (SM)	y (ft)	Elev 133 to 128 (SP)	y (ft)	Elev 128 to 123 (SP)	y (ft)	Elev 123 to 118 (SC)	y (ft)	Elev 118 to 113 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	53	0.008	107	0.008	121	0.008	99	0.008	137
0.016	107	0.016	214	0.016	242	0.016	199	0.016	275
0.024	160	0.024	276	0.024	319	0.024	292	0.024	412
0.032	204	0.032	329	0.032	380	0.032	348	0.032	510
0.040	233	0.040	377	0.040	435	0.040	399	0.040	585
0.048	261	0.048	421	0.048	486	0.048	446	0.048	653
0.067	318	0.067	514	0.067	594	0.067	544	0.067	797
0.120	473	0.120	764	0.120	883	0.120	809	0.120	1,185
0.150	561	0.150	904	0.150	1,045	0.150	958	0.150	1,403
0.240	561	0.240	904	0.240	1,045	0.240	958	0.240	1,403
0.400	561	0.400	904	0.400	1,045	0.400	958	0.400	1,403

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

p-y Data

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 17
Sta.

O.G.	206	Pile	4' PP
Cut-off	206	GWS	213.0

y (ft)	Elev 206 to 201 (SP)	y (ft)	Elev 201 to 196 (SP)	y (ft)	Elev 196 to 189 (SP)	y (ft)	*Elev 189 to 184 (SP)	y (ft)	Elev 184 to 177 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	4.0	0.008	12	0.008	8	0.008	3	0.008	24
0.02	7.0	0.016	21	0.016	12	0.016	4	0.016	37
0.02	7.7	0.024	24	0.024	15	0.024	5	0.024	48
0.03	8.3	0.032	26	0.032	18	0.032	6	0.032	57
0.04	8.8	0.040	28	0.040	21	0.040	7	0.040	65
0.05	9.2	0.048	30	0.048	24	0.048	8	0.048	73
0.07	10.0	0.067	33	0.067	29	0.067	9	0.067	89
0.12	12.1	0.120	42	0.120	44	0.120	14	0.120	132
0.15	13.2	0.150	47	0.150	52	0.150	16	0.150	156
0.24	13.2	0.240	47	0.240	52	0.240	16	0.240	156
0.40	13.2	0.400	47	0.400	52	0.400	16	0.400	156

y (ft)	Elev 177 to 169 (SP)	y (ft)	Elev 169 to 163 (SM)	y (ft)	Elev 163 to 157 (SM)	y (ft)	Elev 157 to 152 (SC)	y (ft)	Elev 152 to 148 (CH)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	39	0.008	23	0.008	51	0.008	22	0.145	32
0.016	63	0.016	35	0.016	101	0.016	44	0.291	38
0.024	80	0.024	44	0.024	133	0.024	67	0.436	42
0.032	96	0.032	53	0.032	159	0.032	89	0.582	46
0.040	110	0.040	60	0.040	182	0.040	107	0.727	48
0.048	122	0.048	67	0.048	203	0.048	120	0.873	50
0.067	149	0.067	82	0.067	248	0.067	146	1.164	54
0.120	222	0.120	123	0.120	369	0.120	218	1.455	54
0.150	263	0.150	145	0.150	437	0.150	258	1.746	54
0.240	263	0.240	145	0.240	437	0.240	258	2.037	54
0.400	263	0.400	145	0.400	437	0.400	258	2.328	54

y (ft)	Elev 148 to 136 (CL)	y (ft)	Elev 136 to 128 (GP)	y (ft)	Elev 128 to 123 (SM)	y (ft)	Elev 123 to 118 (SM)	y (ft)	Elev 118 to 112 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.140	34	0.008	92	0.008	108	0.008	119	0.008	130
0.280	41	0.016	173	0.016	217	0.016	237	0.016	260
0.420	45	0.024	221	0.024	278	0.024	322	0.024	373
0.560	48	0.032	264	0.032	331	0.032	383	0.032	445
0.700	51	0.040	302	0.040	379	0.040	439	0.040	509
0.839	54	0.048	337	0.048	424	0.048	491	0.048	569
1.119	58	0.067	412	0.067	517	0.067	599	0.067	695
1.399	58	0.120	612	0.120	769	0.120	891	0.120	1,032
1.679	58	0.150	725	0.150	911	0.150	1,055	0.150	1,222
1.959	58	0.240	725	0.240	911	0.240	1,055	0.240	1,222
2.239	58	0.400	725	0.400	911	0.400	1,055	0.400	1,222

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 18
Sta.

O.G.	206	Pile	4' PP
Cut-off	206	GWS	213.0

y (ft)	*Elev 206 to 199 (SP)	y (ft)	*Elev 199 to 191 (SP)	y (ft)	*Elev 191 to 185 (SP)	y (ft)	*Elev 185 to 176 (SP)	y (ft)	Elev 176 to 171 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.9	0.008	2	0.008	2	0.008	3	0.008	38
0.02	1.1	0.016	2	0.016	3	0.016	5	0.016	59
0.02	1.2	0.024	3	0.024	3	0.024	7	0.024	75
0.03	1.3	0.032	3	0.032	4	0.032	8	0.032	89
0.04	1.4	0.040	4	0.040	5	0.040	9	0.040	102
0.05	1.5	0.048	4	0.048	5	0.048	10	0.048	114
0.07	1.6	0.067	4	0.067	6	0.067	13	0.067	140
0.12	1.9	0.120	6	0.120	10	0.120	19	0.120	207
0.15	2.1	0.150	7	0.150	11	0.150	22	0.150	246
0.24	2.1	0.240	7	0.240	11	0.240	22	0.240	246
0.40	2.1	0.400	7	0.400	11	0.400	22	0.400	246

y (ft)	Elev 171 to 166 (SM)	y (ft)	Elev 166 to 163 (SC)	y (ft)	Elev 163 to 160 (CL)	y (ft)	Elev 160 to 151 (CL)	y (ft)	Elev 151 to 141 (CL)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	17	0.008	16	0.174	25	0.160	28	0.146	32
0.016	26	0.016	32	0.347	29	0.320	33	0.292	38
0.024	34	0.024	48	0.521	32	0.481	37	0.438	42
0.032	40	0.032	64	0.695	35	0.641	39	0.584	45
0.040	46	0.040	80	0.869	37	0.801	42	0.730	48
0.048	52	0.048	89	1.042	38	0.961	44	0.876	50
0.067	63	0.067	108	1.390	41	1.281	47	1.167	54
0.120	94	0.120	161	1.737	41	1.602	47	1.459	54
0.150	111	0.150	191	2.085	41	1.922	47	1.751	54
0.240	111	0.240	191	2.432	41	2.243	47	2.043	54
0.400	111	0.400	191	2.779	41	2.563	47	2.335	54

y (ft)	Elev 141 to 136 (CL)	y (ft)	Elev 136 to 131 (GP)	y (ft)	Elev 131 to 126 (SM)	y (ft)	Elev 126 to 119 (SM)	y (ft)	Elev 119 to 112 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.096	62	0.008	73	0.008	72	0.008	100	0.008	116
0.191	73	0.016	142	0.016	136	0.016	200	0.016	232
0.287	81	0.024	181	0.024	174	0.024	268	0.024	342
0.382	87	0.032	216	0.032	207	0.032	319	0.032	407
0.478	92	0.040	248	0.040	237	0.040	365	0.040	467
0.573	96	0.048	277	0.048	265	0.048	408	0.048	521
0.764	104	0.067	338	0.067	323	0.067	498	0.067	636
0.955	104	0.120	502	0.120	481	0.120	741	0.120	946
1.146	104	0.150	594	0.150	569	0.150	877	0.150	1,120
1.337	104	0.240	594	0.240	569	0.240	877	0.240	1,120
1.528	104	0.400	594	0.400	569	0.400	877	0.400	1,120

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 19
Sta.

O.G. 207
Cut-off 207
Pile 4' PP
GWS 213.0

y (ft)	*Elev 207 to 199 (SM)	y (ft)	*Elev 199 to 189 (SM)	y (ft)	*Elev 189 to 183 (SP)	y (ft)	*Elev 183 to 176 (SP)	y (ft)	Elev 176 to 172 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.8	0.008	1	0.008	2	0.008	4	0.008	38
0.02	1.0	0.016	2	0.016	3	0.016	6	0.016	58
0.02	1.1	0.024	2	0.024	4	0.024	8	0.024	75
0.03	1.2	0.032	3	0.032	5	0.032	9	0.032	89
0.04	1.3	0.040	3	0.040	6	0.040	11	0.040	102
0.05	1.4	0.048	3	0.048	6	0.048	12	0.048	114
0.07	1.5	0.067	4	0.067	8	0.067	15	0.067	139
0.12	1.9	0.120	6	0.120	12	0.120	22	0.120	207
0.15	2.1	0.150	7	0.150	14	0.150	26	0.150	245
0.24	2.1	0.240	7	0.240	14	0.240	26	0.240	245
0.40	2.1	0.400	7	0.400	14	0.400	26	0.400	245

y (ft)	Elev 172 to 167 (SM)	y (ft)	Elev 167 to 162 (SM)	y (ft)	Elev 162 to 157 (SP)	y (ft)	Elev 157 to 152 (CL)	y (ft)	Elev 152 to 146 (CH)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	19	0.008	21	0.008	53	0.104	4	0.093	64
0.016	28	0.016	32	0.016	99	0.208	5	0.186	76
0.024	36	0.024	41	0.024	127	0.416	7	0.279	85
0.032	43	0.032	49	0.032	151	0.625	8	0.372	91
0.040	50	0.040	56	0.040	173	0.833	9	0.464	96
0.048	55	0.048	62	0.048	194	1.041	9	0.557	101
0.067	68	0.067	76	0.067	237	1.249	10	0.743	108
0.120	101	0.120	113	0.120	352	1.457	10	0.929	108
0.150	119	0.150	133	0.150	417	1.666	11	1.115	108
0.240	119	0.240	133	0.240	417	3.123	11	1.301	108
0.400	119	0.400	133	0.400	417	5.205	11	1.486	108

y (ft)	Elev 146 to 140 (CL)	y (ft)	Elev 140 to 134 (SP)	y (ft)	Elev 134 to 127 (SP)	y (ft)	Elev 127 to 122 (SP)	y (ft)	Elev 122 to 114 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.146	32	0.008	82	0.008	81	0.008	118	0.008	124
0.292	38	0.016	143	0.016	161	0.016	232	0.016	247
0.438	42	0.024	184	0.024	215	0.024	297	0.024	371
0.584	45	0.032	219	0.032	256	0.032	354	0.032	470
0.730	48	0.040	250	0.040	293	0.040	405	0.040	538
0.876	50	0.048	280	0.048	328	0.048	452	0.048	601
1.167	54	0.067	342	0.067	400	0.067	552	0.067	734
1.459	54	0.120	508	0.120	595	0.120	821	0.120	1,091
1.751	54	0.150	601	0.150	705	0.150	972	0.150	1,292
2.043	54	0.240	601	0.240	705	0.240	972	0.240	1,292
2.335	54	0.400	601	0.400	705	0.400	972	0.400	1,292

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 20
Sta.

O.G.	206	Pile	4' PP
Cut-off	206	GWS	213.0

y (ft)	*Elev 206 to 195 (SP)	y (ft)	*Elev 195 to 192 (SP)	y (ft)	*Elev 192 to 186 (SM)	y (ft)	*Elev 186 to 181 (SP)	y (ft)	*Elev 181 to 175 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	1.0	0.008	2	0.008	1	0.008	2	0.008	3
0.02	1.2	0.016	2	0.016	2	0.016	4	0.016	5
0.02	1.4	0.024	3	0.024	2	0.024	5	0.024	7
0.03	1.5	0.032	3	0.032	3	0.032	6	0.032	8
0.04	1.6	0.040	4	0.040	3	0.040	7	0.040	9
0.05	1.7	0.048	4	0.048	4	0.048	7	0.048	10
0.07	1.8	0.067	4	0.067	4	0.067	9	0.067	13
0.12	2.3	0.120	6	0.120	6	0.120	14	0.120	19
0.15	2.5	0.150	7	0.150	8	0.150	16	0.150	22
0.24	2.5	0.240	7	0.240	8	0.240	16	0.240	22
0.40	2.5	0.400	7	0.400	8	0.400	16	0.400	22

y (ft)	Elev 175 to 170 (SP)	y (ft)	Elev 170 to 163 (SM)	y (ft)	Elev 163 to 160 (CL)	y (ft)	Elev 160 to 156 (SM)	y (ft)	Elev 156 to 151 (CL)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	38	0.008	18	0.113	48	0.008	41	0.054	12
0.016	58	0.016	27	0.225	57	0.016	81	0.108	15
0.024	74	0.024	34	0.338	63	0.024	104	0.216	19
0.032	88	0.032	41	0.450	68	0.032	124	0.325	21
0.040	100	0.040	47	0.563	72	0.040	142	0.433	23
0.048	112	0.048	52	0.675	75	0.048	159	0.541	25
0.067	137	0.067	64	0.901	80	0.067	194	0.649	27
0.120	204	0.120	95	1.126	80	0.120	288	0.757	28
0.150	241	0.150	112	1.351	80	0.150	341	0.866	29
0.240	241	0.240	112	1.576	80	0.240	341	1.623	29
0.400	241	0.400	112	1.801	80	0.400	341	2.705	29

y (ft)	Elev 151 to 146 (SC)	y (ft)	Elev 146 to 139 (SC)	y (ft)	Elev 139 to 135 (CL)	y (ft)	Elev 135 to 132 (SM)	y (ft)	Elev 132 to 112 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	23	0.008	41	0.102	56	0.008	29	0.008	106
0.016	46	0.016	81	0.203	67	0.016	58	0.016	213
0.024	69	0.024	122	0.305	74	0.024	87	0.024	285
0.032	92	0.032	162	0.406	79	0.032	116	0.032	340
0.040	115	0.040	185	0.508	84	0.040	143	0.040	389
0.048	132	0.048	207	0.609	88	0.048	160	0.048	435
0.067	161	0.067	253	0.812	94	0.067	195	0.067	531
0.120	239	0.120	375	1.015	94	0.120	290	0.120	790
0.150	283	0.150	445	1.218	94	0.150	343	0.150	935
0.240	283	0.240	445	1.421	94	0.240	343	0.240	935
0.400	283	0.400	445	1.624	94	0.400	343	0.400	935

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 21
Sta.

O.G.	206	Pile	4' PP
Cut-off	206	GWS	213.0

y (ft)	Elev 206 to 199 (SP)	y (ft)	*Elev 199 to 190 (SP)	y (ft)	*Elev 190 to 184 (SM)	y (ft)	Elev 184 to 178 (SP)	y (ft)	Elev 178 to 173 (SM)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	4.7	0.008	2	0.008	2	0.008	19	0.008	31
0.02	5.7	0.016	2	0.016	3	0.016	29	0.016	48
0.02	6.4	0.024	3	0.024	4	0.024	38	0.024	61
0.03	6.9	0.032	3	0.032	5	0.032	45	0.032	73
0.04	7.3	0.040	3	0.040	5	0.040	51	0.040	83
0.05	7.7	0.048	4	0.048	6	0.048	57	0.048	93
0.07	8.4	0.067	4	0.067	7	0.067	70	0.067	113
0.12	10.3	0.120	6	0.120	11	0.120	104	0.120	169
0.15	11.3	0.150	7	0.150	13	0.150	123	0.150	200
0.24	11.3	0.240	7	0.240	13	0.240	123	0.240	200
0.40	11.3	0.400	7	0.400	13	0.400	123	0.400	200

y (ft)	Elev 173 to 166 (SP)	y (ft)	Elev 166 to 160 (SM)	y (ft)	Elev 160 to 155 (CL)	y (ft)	Elev 155 to 145 (SM)	y (ft)	Elev 145 to 135 (SC)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	38	0.008	21	0.075	7	0.008	27	0.008	27
0.016	65	0.016	31	0.149	9	0.016	53	0.016	54
0.024	83	0.024	40	0.299	11	0.024	80	0.024	81
0.032	99	0.032	48	0.448	13	0.032	107	0.032	109
0.040	114	0.040	55	0.597	14	0.040	134	0.040	132
0.048	127	0.048	61	0.746	15	0.048	160	0.048	148
0.067	155	0.067	75	0.896	16	0.067	195	0.067	181
0.120	230	0.120	111	1.045	17	0.120	290	0.120	269
0.150	273	0.150	132	1.194	18	0.150	343	0.150	318
0.240	273	0.240	132	2.239	18	0.240	343	0.240	318
0.400	273	0.400	132	3.731	18	0.400	343	0.400	318

y (ft)	Elev 135 to 130 (CH)	y (ft)	Elev 130 to 126 (SP)	y (ft)	Elev 126 to 122 (SP)	y (ft)	Elev 122 to 117 ()	y (ft)	Elev 117 to 112 ()
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.160	28	0.008	94	0.008	102	0.008	122	0.008	134
0.320	33	0.016	181	0.016	203	0.016	244	0.016	268
0.481	37	0.024	232	0.024	264	0.024	330	0.024	382
0.641	39	0.032	277	0.032	314	0.032	393	0.032	455
0.801	42	0.040	317	0.040	360	0.040	450	0.040	521
0.961	44	0.048	354	0.048	402	0.048	503	0.048	583
1.281	47	0.067	432	0.067	491	0.067	614	0.067	711
1.602	47	0.120	642	0.120	730	0.120	913	0.120	1,057
1.922	47	0.150	760	0.150	865	0.150	1,081	0.150	1,252
2.243	47	0.240	760	0.240	865	0.240	1,081	0.240	1,252
2.563	47	0.400	760	0.400	865	0.400	1,081	0.400	1,252

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 22
Sta.

O.G.	205	Pile	4' PP
Cut-off	205	GWS	213.0

y (ft)	*Elev 205 to 197 (SP)	y (ft)	*Elev 197 to 190 (SP)	y (ft)	*Elev 190 to 187 (SP)	y (ft)	Elev 187 to 182 (SP)	y (ft)	Elev 182 to 177 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.8	0.008	1	0.008	1	0.008	11	0.008	22
0.02	1.0	0.016	2	0.016	2	0.016	17	0.016	34
0.02	1.1	0.024	2	0.024	2	0.024	22	0.024	44
0.03	1.2	0.032	2	0.032	3	0.032	26	0.032	52
0.04	1.3	0.040	3	0.040	3	0.040	30	0.040	60
0.05	1.4	0.048	3	0.048	3	0.048	34	0.048	67
0.07	1.5	0.067	3	0.067	4	0.067	42	0.067	82
0.12	1.9	0.120	4	0.120	6	0.120	62	0.120	122
0.15	2.1	0.150	5	0.150	7	0.150	74	0.150	145
0.24	2.1	0.240	5	0.240	7	0.240	74	0.240	145
0.40	2.1	0.400	5	0.400	7	0.400	74	0.400	145

y (ft)	Elev 177 to 169 (SP)	y (ft)	Elev 169 to 163 (CL)	y (ft)	Elev 163 to 154 (CL)	y (ft)	Elev 154 to 148 (SC)	y (ft)	Elev 148 to 143 (SC)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	43	0.094	5	0.164	27	0.008	27	0.008	37
0.016	66	0.188	6	0.329	32	0.016	54	0.016	73
0.024	85	0.377	8	0.493	35	0.024	81	0.024	110
0.032	101	0.565	9	0.657	38	0.032	104	0.032	133
0.040	115	0.753	10	0.822	40	0.040	119	0.040	153
0.048	129	0.942	11	0.986	42	0.048	133	0.048	171
0.067	158	1.130	11	1.315	45	0.067	162	0.067	208
0.120	234	1.318	12	1.643	45	0.120	241	0.120	310
0.150	277	1.506	13	1.972	45	0.150	285	0.150	367
0.240	277	2.825	13	2.301	45	0.240	285	0.240	367
0.400	277	4.708	13	2.629	45	0.400	285	0.400	367

y (ft)	Elev 143 to 134 (CH)	y (ft)	Elev 134 to 132 (ML)	y (ft)	Elev 132 to 127 (SP)	y (ft)	Elev 127 to 121 (SP)	y (ft)	Elev 121 to 112 (SP)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.159	28	0.008	28	0.008	66	0.008	93	0.008	107
0.317	34	0.016	56	0.016	130	0.016	172	0.016	214
0.476	37	0.024	84	0.024	166	0.024	221	0.024	279
0.634	40	0.032	112	0.032	198	0.032	263	0.032	333
0.793	42	0.040	140	0.040	226	0.040	301	0.040	381
0.952	44	0.048	159	0.048	253	0.048	336	0.048	426
1.269	48	0.067	194	0.067	309	0.067	410	0.067	520
1.586	48	0.120	289	0.120	459	0.120	610	0.120	773
1.903	48	0.150	342	0.150	543	0.150	722	0.150	915
2.220	48	0.240	342	0.240	543	0.240	722	0.240	915
2.538	48	0.400	342	0.400	543	0.400	722	0.400	915

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

p-y Data

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 23
Sta.

O.G.	205	Pile	4' PP
Cut-off	205	GWS	213.0

y (ft)	*Elev 205 to 198 (SP)	y (ft)	Elev 198 to 191 (SP)	y (ft)	*Elev 191 to 186 (SM)	y (ft)	*Elev 186 to 183 (SM)	y (ft)	Elev 183 to 175 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.8	0.008	11	0.008	1	0.008	2	0.008	21
0.02	0.9	0.016	15	0.016	2	0.016	3	0.016	32
0.02	1.0	0.024	18	0.024	3	0.024	4	0.024	41
0.03	1.1	0.032	20	0.032	3	0.032	5	0.032	49
0.04	1.2	0.040	21	0.040	4	0.040	6	0.040	57
0.05	1.2	0.048	23	0.048	4	0.048	7	0.048	63
0.07	1.4	0.067	26	0.067	5	0.067	8	0.067	77
0.12	1.6	0.120	33	0.120	8	0.120	12	0.120	115
0.15	1.8	0.150	38	0.150	9	0.150	14	0.150	136
0.24	1.8	0.240	38	0.240	9	0.240	14	0.240	136
0.40	1.8	0.400	38	0.400	9	0.400	14	0.400	136

y (ft)	Elev 175 to 167 (SP)	y (ft)	Elev 167 to 162 (SC)	y (ft)	Elev 162 to 155 (CL)	y (ft)	Elev 155 to 151 (SC)	y (ft)	Elev 151 to 144 (SC)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	40	0.008	32	0.143	33	0.008	36	0.008	52
0.016	61	0.016	65	0.286	39	0.016	72	0.016	104
0.024	78	0.024	91	0.429	44	0.024	108	0.024	145
0.032	93	0.032	108	0.571	47	0.032	131	0.032	173
0.040	107	0.040	124	0.714	50	0.040	150	0.040	198
0.048	119	0.048	138	0.857	52	0.048	167	0.048	221
0.067	146	0.067	169	1.143	56	0.067	204	0.067	270
0.120	217	0.120	251	1.428	56	0.120	303	0.120	402
0.150	257	0.150	297	1.714	56	0.150	359	0.150	476
0.240	257	0.240	297	2.000	56	0.240	359	0.240	476
0.400	257	0.400	297	2.285	56	0.400	359	0.400	476

y (ft)	Elev 144 to 138 (CH)	y (ft)	Elev 138 to 131 (CH)	y (ft)	Elev 131 to 126 (GP)	y (ft)	Elev 126 to 123 (GP)	y (ft)	Elev 123 to 112 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.121	43	0.109	50	0.008	104	0.008	52	0.008	118
0.242	51	0.218	60	0.016	181	0.016	104	0.016	236
0.363	56	0.327	66	0.024	231	0.024	157	0.024	349
0.484	61	0.436	71	0.032	275	0.032	193	0.032	416
0.605	64	0.545	75	0.040	315	0.040	221	0.040	477
0.726	67	0.653	79	0.048	352	0.048	247	0.048	532
0.968	72	0.871	85	0.067	430	0.067	302	0.067	650
1.210	72	1.089	85	0.120	639	0.120	449	0.120	966
1.452	72	1.307	85	0.150	757	0.150	532	0.150	1,144
1.695	72	1.525	85	0.240	757	0.240	532	0.240	1,144
1.937	72	1.743	85	0.400	757	0.400	532	0.400	1,144

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 24
Sta.

O.G. 206
Cut-off 206

Pile 4" PP
GWS 213.0

y (ft)	*Elev 206 to 199 (SP)	y (ft)	*Elev 199 to 192 (SP)	y (ft)	*Elev 192 to 186 (SP)	y (ft)	Elev 186 to 181 (SP)	y (ft)	Elev 181 to 176 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.7	0.008	2	0.008	1	0.008	16	0.008	23
0.02	0.9	0.016	2	0.016	2	0.016	25	0.016	35
0.02	1.0	0.024	2	0.024	3	0.024	32	0.024	44
0.03	1.1	0.032	3	0.032	3	0.032	38	0.032	53
0.04	1.2	0.040	3	0.040	4	0.040	44	0.040	60
0.05	1.2	0.048	3	0.048	4	0.048	49	0.048	67
0.07	1.3	0.067	4	0.067	5	0.067	60	0.067	82
0.12	1.6	0.120	5	0.120	8	0.120	90	0.120	122
0.15	1.8	0.150	6	0.150	10	0.150	106	0.150	145
0.24	1.8	0.240	6	0.240	10	0.240	106	0.240	145
0.40	1.8	0.400	6	0.400	10	0.400	106	0.400	145

y (ft)	Elev 176 to 170 (SP)	y (ft)	Elev 170 to 159 (SP)	y (ft)	Elev 159 to 156 (SC)	y (ft)	Elev 156 to 151 (SC)	y (ft)	Elev 151 to 146 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	30	0.008	64	0.008	47	0.008	61	0.008	70
0.016	50	0.016	115	0.016	94	0.016	93	0.016	140
0.024	63	0.024	147	0.024	141	0.024	119	0.024	204
0.032	76	0.032	175	0.032	174	0.032	142	0.032	242
0.040	87	0.040	200	0.040	199	0.040	163	0.040	278
0.048	97	0.048	224	0.048	222	0.048	182	0.048	310
0.067	118	0.067	274	0.067	271	0.067	222	0.067	379
0.120	176	0.120	407	0.120	403	0.120	330	0.120	563
0.150	208	0.150	481	0.150	478	0.150	390	0.150	667
0.240	208	0.240	481	0.240	478	0.240	390	0.240	667
0.400	208	0.400	481	0.400	478	0.400	390	0.400	667

y (ft)	Elev 146 to 141 (SM)	y (ft)	Elev 141 to 131 (SM)	y (ft)	Elev 131 to 126 (GW)	y (ft)	Elev 126 to 121 (GM)	y (ft)	Elev 121 to 116 (GM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	35	0.008	40	0.008	108	0.008	70	0.008	85
0.016	70	0.016	80	0.016	215	0.016	140	0.016	170
0.024	106	0.024	121	0.024	321	0.024	211	0.024	247
0.032	141	0.032	161	0.032	382	0.032	255	0.032	294
0.040	176	0.040	201	0.040	438	0.040	292	0.040	336
0.048	198	0.048	227	0.048	489	0.048	326	0.048	376
0.067	242	0.067	277	0.067	597	0.067	399	0.067	459
0.120	360	0.120	412	0.120	887	0.120	592	0.120	682
0.150	426	0.150	488	0.150	1,051	0.150	701	0.150	808
0.240	426	0.240	488	0.240	1,051	0.240	701	0.240	808
0.400	426	0.400	488	0.400	1,051	0.400	701	0.400	808

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

p-y Data

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 25
Sta.

O.G.	205	Pile	4' PP
Cut-off	205	GWS	213.0

y (ft)	*Elev 205 to 199 (SP)	y (ft)	Elev 199 to 193 (SP)	y (ft)	Elev 193 to 187 (SP)	y (ft)	Elev 187 to 182 (SP)	y (ft)	Elev 182 to 176 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.8	0.008	7	0.008	13	0.008	16	0.008	26
0.02	0.9	0.016	14	0.016	19	0.016	25	0.016	39
0.02	1.0	0.024	18	0.024	24	0.024	32	0.024	50
0.03	1.1	0.032	20	0.032	28	0.032	38	0.032	59
0.04	1.2	0.040	22	0.040	31	0.040	44	0.040	68
0.05	1.2	0.048	23	0.048	35	0.048	49	0.048	76
0.07	1.4	0.067	26	0.067	41	0.067	60	0.067	93
0.12	1.6	0.120	33	0.120	59	0.120	89	0.120	138
0.15	1.8	0.150	37	0.150	69	0.150	105	0.150	163
0.24	1.8	0.240	37	0.240	69	0.240	105	0.240	163
0.40	1.8	0.400	37	0.400	69	0.400	105	0.400	163

y (ft)	Elev 176 to 167 (SP)	y (ft)	Elev 167 to 161 (SP)	y (ft)	Elev 161 to 155 (SP)	y (ft)	Elev 155 to 150 (CH)	y (ft)	Elev 150 to 145 (CL)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	35	0.008	51	0.008	71	0.148	31	0.140	34
0.016	60	0.016	91	0.016	128	0.296	37	0.280	41
0.024	77	0.024	117	0.024	163	0.445	41	0.420	45
0.032	92	0.032	139	0.032	195	0.593	44	0.560	48
0.040	105	0.040	159	0.040	223	0.741	47	0.700	51
0.048	118	0.048	178	0.048	249	0.889	49	0.839	54
0.067	144	0.067	217	0.067	304	1.186	53	1.119	58
0.120	214	0.120	323	0.120	452	1.482	53	1.399	58
0.150	253	0.150	383	0.150	536	1.779	53	1.679	58
0.240	253	0.240	383	0.240	536	2.075	53	1.959	58
0.400	253	0.400	383	0.400	536	2.372	53	2.239	58

y (ft)	Elev 145 to 141 (CL)	y (ft)	Elev 141 to 136 (CH)	y (ft)	Elev 136 to 131 (SM)	y (ft)	Elev 131 to 121 (SM)	y (ft)	Elev 121 to 111 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.055	11	0.134	36	0.008	99	0.008	110	0.008	134
0.110	14	0.269	43	0.016	180	0.016	221	0.016	267
0.220	18	0.403	48	0.024	230	0.024	321	0.024	401
0.330	21	0.538	51	0.032	274	0.032	383	0.032	521
0.440	23	0.672	54	0.040	314	0.040	438	0.040	597
0.549	25	0.807	57	0.048	351	0.048	490	0.048	667
0.659	26	1.076	61	0.067	428	0.067	598	0.067	814
0.769	28	1.345	61	0.120	636	0.120	889	0.120	1,211
0.879	29	1.614	61	0.150	753	0.150	1,052	0.150	1,433
1.648	29	1.883	61	0.240	753	0.240	1,052	0.240	1,433
2.747	29	2.152	61	0.400	753	0.400	1,052	0.400	1,433

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 27
Sta.

O.G.	202	Pile	4' PP
Cut-off	202	GWS	213.0

y (ft)	*Elev 202 to 197 (SP)	y (ft)	*Elev 197 to 192 (SP)	y (ft)	*Elev 192 to 187 (SP)	y (ft)	Elev 187 to 182 (SM)	y (ft)	Elev 182 to 177 (SP)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.5	0.008	1	0.008	1	0.008	12	0.008	17
0.02	0.6	0.016	2	0.016	2	0.016	17	0.016	26
0.02	0.7	0.024	2	0.024	2	0.024	22	0.024	33
0.03	0.7	0.032	2	0.032	3	0.032	26	0.032	39
0.04	0.8	0.040	2	0.040	3	0.040	29	0.040	45
0.05	0.8	0.048	3	0.048	3	0.048	32	0.048	51
0.07	0.9	0.067	3	0.067	4	0.067	39	0.067	62
0.12	1.0	0.120	4	0.120	5	0.120	57	0.120	92
0.15	1.1	0.150	4	0.150	6	0.150	67	0.150	110
0.24	1.1	0.240	4	0.240	6	0.240	67	0.240	110
0.40	1.1	0.400	4	0.400	6	0.400	67	0.400	110

y (ft)	Elev 177 to 173 (SM)	y (ft)	Elev 173 to 169 (SM)	y (ft)	Elev 169 to 164 (SM)	y (ft)	Elev 164 to 157 (SM)	y (ft)	Elev 157 to 149 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	9	0.008	33	0.008	47	0.008	67	0.008	62
0.016	13	0.016	50	0.016	72	0.016	111	0.016	123
0.024	17	0.024	63	0.024	91	0.024	143	0.024	163
0.032	20	0.032	76	0.032	109	0.032	170	0.032	194
0.040	23	0.040	87	0.040	125	0.040	195	0.040	222
0.048	26	0.048	97	0.048	139	0.048	217	0.048	248
0.067	32	0.067	118	0.067	170	0.067	265	0.067	303
0.120	47	0.120	175	0.120	253	0.120	395	0.120	450
0.150	56	0.150	208	0.150	300	0.150	467	0.150	533
0.240	56	0.240	208	0.240	300	0.240	467	0.240	533
0.400	56	0.400	208	0.400	300	0.400	467	0.400	533

y (ft)	Elev 149 to 143 (SP)	y (ft)	Elev 143 to 137 (SP)	y (ft)	Elev 137 to 127 (SM)	y (ft)	Elev 127 to 121 (SM)	y (ft)	Elev 121 to 109 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	86	0.008	99	0.008	126	0.008	144	0.008	160
0.016	172	0.016	198	0.016	253	0.016	288	0.016	321
0.024	226	0.024	276	0.024	364	0.024	432	0.024	481
0.032	269	0.032	329	0.032	434	0.032	533	0.032	641
0.040	308	0.040	377	0.040	497	0.040	610	0.040	802
0.048	344	0.048	421	0.048	555	0.048	682	0.048	938
0.067	420	0.067	514	0.067	677	0.067	833	0.067	1,146
0.120	624	0.120	764	0.120	1,007	0.120	1,238	0.120	1,703
0.150	739	0.150	905	0.150	1,192	0.150	1,466	0.150	2,017
0.240	739	0.240	905	0.240	1,192	0.240	1,466	0.240	2,017
0.400	739	0.400	905	0.400	1,192	0.400	1,466	0.400	2,017

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 28
Sta.

O.G.	208	Pile	4" PP
Cut-off	208	GWS	213.0

y (ft)	*Elev 208 to 202 (SP)	y (ft)	*Elev 202 to 196 (SP)	y (ft)	*Elev 196 to 193 (SP)	y (ft)	*Elev 193 to 184 (SP)	y (ft)	Elev 184 to 178 (SM)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.6	0.008	1	0.008	1	0.008	2	0.008	24
0.02	0.8	0.016	2	0.016	2	0.016	3	0.016	36
0.02	0.9	0.024	2	0.024	3	0.024	4	0.024	46
0.03	0.9	0.032	2	0.032	3	0.032	5	0.032	55
0.04	1.0	0.040	3	0.040	3	0.040	6	0.040	63
0.05	1.0	0.048	3	0.048	4	0.048	7	0.048	70
0.07	1.1	0.067	3	0.067	4	0.067	8	0.067	86
0.12	1.4	0.120	4	0.120	6	0.120	12	0.120	128
0.15	1.5	0.150	5	0.150	7	0.150	14	0.150	151
0.24	1.5	0.240	5	0.240	7	0.240	14	0.240	151
0.40	1.5	0.400	5	0.400	7	0.400	14	0.400	151

y (ft)	Elev 178 to 171 (SM)	y (ft)	Elev 171 to 167 (SM)	y (ft)	Elev 167 to 161 (SM)	y (ft)	Elev 161 to 156 (SM)	y (ft)	Elev 156 to 151 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	41	0.008	62	0.008	56	0.008	62	0.008	69
0.016	63	0.016	95	0.016	102	0.016	124	0.016	138
0.024	80	0.024	122	0.024	131	0.024	160	0.024	190
0.032	95	0.032	145	0.032	156	0.032	191	0.032	226
0.040	109	0.040	166	0.040	178	0.040	218	0.040	259
0.048	122	0.048	185	0.048	199	0.048	244	0.048	290
0.067	149	0.067	226	0.067	243	0.067	298	0.067	354
0.120	221	0.120	336	0.120	361	0.120	443	0.120	525
0.150	262	0.150	398	0.150	428	0.150	524	0.150	622
0.240	262	0.240	398	0.240	428	0.240	524	0.240	622
0.400	262	0.400	398	0.400	428	0.400	524	0.400	622

y (ft)	Elev 151 to 142 (SM)	y (ft)	Elev 142 to 135 (SM)	y (ft)	Elev 135 to 128 (SM)	y (ft)	Elev 128 to 121 (SM)	y (ft)	Elev 121 to 114 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	98	0.008	124	0.008	138	0.008	154	0.008	170
0.016	195	0.016	248	0.016	276	0.016	308	0.016	341
0.024	260	0.024	371	0.024	413	0.024	461	0.024	511
0.032	309	0.032	448	0.032	551	0.032	615	0.032	682
0.040	354	0.040	513	0.040	639	0.040	768	0.040	852
0.048	396	0.048	573	0.048	714	0.048	858	0.048	1,009
0.067	483	0.067	699	0.067	872	0.067	1,048	0.067	1,232
0.120	718	0.120	1,040	0.120	1,296	0.120	1,558	0.120	1,831
0.150	850	0.150	1,231	0.150	1,534	0.150	1,845	0.150	2,168
0.240	850	0.240	1,231	0.240	1,534	0.240	1,845	0.240	2,168
0.400	850	0.400	1,231	0.400	1,534	0.400	1,845	0.400	2,168

Note: p (kip/ft) Post-Liquefaction *- Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 29
Sta.

						O.G.	208	Pile	4" PP
						Cut-off	208	GWS	213.0

y (ft)	*Elev 208 to 202 (SP)	y (ft)	*Elev 202 to 196 (SP)	y (ft)	*Elev 196 to 193 (SP)	y (ft)	*Elev 193 to 184 (SP)	y (ft)	Elev 184 to 178 (SM)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	0.6	0.008	1	0.008	1	0.008	2	0.008	24
0.02	0.8	0.016	2	0.016	2	0.016	3	0.016	36
0.02	0.9	0.024	2	0.024	3	0.024	4	0.024	46
0.03	0.9	0.032	2	0.032	3	0.032	5	0.032	55
0.04	1.0	0.040	3	0.040	3	0.040	6	0.040	63
0.05	1.0	0.048	3	0.048	4	0.048	7	0.048	70
0.07	1.1	0.067	3	0.067	4	0.067	8	0.067	86
0.12	1.4	0.120	4	0.120	6	0.120	12	0.120	128
0.15	1.5	0.150	5	0.150	7	0.150	14	0.150	151
0.24	1.5	0.240	5	0.240	7	0.240	14	0.240	151
0.40	1.5	0.400	5	0.400	7	0.400	14	0.400	151

y (ft)	Elev 178 to 171 (SM)	y (ft)	Elev 171 to 167 (SM)	y (ft)	Elev 167 to 161 (SM)	y (ft)	Elev 161 to 156 (SM)	y (ft)	Elev 156 to 151 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	41	0.008	62	0.008	56	0.008	62	0.008	69
0.016	63	0.016	95	0.016	102	0.016	124	0.016	138
0.024	80	0.024	122	0.024	131	0.024	160	0.024	190
0.032	95	0.032	145	0.032	156	0.032	191	0.032	226
0.040	109	0.040	166	0.040	178	0.040	218	0.040	259
0.048	122	0.048	185	0.048	199	0.048	244	0.048	290
0.067	149	0.067	226	0.067	243	0.067	298	0.067	354
0.120	221	0.120	336	0.120	361	0.120	443	0.120	525
0.150	262	0.150	398	0.150	428	0.150	524	0.150	622
0.240	262	0.240	398	0.240	428	0.240	524	0.240	622
0.400	262	0.400	398	0.400	428	0.400	524	0.400	622

y (ft)	Elev 151 to 142 (SM)	y (ft)	Elev 142 to 135 (SM)	y (ft)	Elev 135 to 128 (SM)	y (ft)	Elev 128 to 121 (SM)	y (ft)	Elev 121 to 114 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	98	0.008	124	0.008	138	0.008	154	0.008	170
0.016	195	0.016	248	0.016	276	0.016	308	0.016	341
0.024	260	0.024	371	0.024	413	0.024	461	0.024	511
0.032	309	0.032	448	0.032	551	0.032	615	0.032	682
0.040	354	0.040	513	0.040	639	0.040	768	0.040	852
0.048	396	0.048	573	0.048	714	0.048	858	0.048	1,009
0.067	483	0.067	699	0.067	872	0.067	1,048	0.067	1,232
0.120	718	0.120	1,040	0.120	1,296	0.120	1,558	0.120	1,831
0.150	850	0.150	1,231	0.150	1,534	0.150	1,845	0.150	2,168
0.240	850	0.240	1,231	0.240	1,534	0.240	1,845	0.240	2,168
0.400	850	0.400	1,231	0.400	1,534	0.400	1,845	0.400	2,168

Note: p (kip/ft) Post-Liquefaction * - Liquefiable Layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Abut 30
Sta.

O.G.	231	Pile	4' PP
Cut-off	231	GWS	213.0

y (ft)	Elev 231 to 225 (GP)	y (ft)	Elev 225 to 220 (SC)	y (ft)	Elev 220 to 217 (SM)	y (ft)	Elev 217 to 210 (GC)	y (ft)	Elev 210 to 205 (SM)
0.00	0.0	0.000	0	0.000	0	0.000	0	0.000	0
0.01	1.8	0.008	5	0.008	14	0.008	17	0.008	31
0.02	3.6	0.016	10	0.016	29	0.016	27	0.016	47
0.02	5.4	0.024	15	0.024	37	0.024	34	0.024	60
0.03	7.2	0.032	20	0.032	41	0.032	41	0.032	72
0.04	9.0	0.040	25	0.040	45	0.040	47	0.040	82
0.05	10.4	0.048	27	0.048	49	0.048	53	0.048	92
0.07	11.3	0.067	31	0.067	56	0.067	65	0.067	112
0.12	13.7	0.120	39	0.120	75	0.120	98	0.120	167
0.15	15.0	0.150	44	0.150	85	0.150	117	0.150	198
0.24	15.0	0.240	44	0.240	85	0.240	117	0.240	198
0.40	15.0	0.400	44	0.400	85	0.400	117	0.400	198

y (ft)	Elev 205 to 201 (SM)	y (ft)	*Elev 201 to 196 (SP)	y (ft)	*Elev 196 to 192 (GP)	y (ft)	*Elev 192 to 185 (GP)	y (ft)	Elev 185 to 180 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	34	0.008	12	0.008	18	0.008	26	0.008	94
0.016	53	0.016	18	0.016	28	0.016	39	0.016	151
0.024	67	0.024	23	0.024	36	0.024	50	0.024	194
0.032	80	0.032	27	0.032	42	0.032	59	0.032	231
0.040	92	0.040	31	0.040	49	0.040	68	0.040	264
0.048	102	0.048	35	0.048	54	0.048	76	0.048	295
0.067	125	0.067	43	0.067	66	0.067	93	0.067	361
0.120	186	0.120	64	0.120	98	0.120	138	0.120	536
0.150	220	0.150	75	0.150	117	0.150	163	0.150	635
0.240	220	0.240	75	0.240	117	0.240	163	0.240	635
0.400	220	0.400	75	0.400	117	0.400	163	0.400	635

y (ft)	Elev 180 to 174 (SM)	y (ft)	Elev 174 to 166 (SM)	y (ft)	Elev 166 to 161 (SC)	y (ft)	Elev 161 to 151 (SM)	y (ft)	Elev 151 to 138 (SM)
0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
0.008	107	0.008	108	0.008	144	0.008	153	0.008	180
0.016	185	0.016	216	0.016	284	0.016	306	0.016	361
0.024	237	0.024	324	0.024	363	0.024	458	0.024	533
0.032	282	0.032	418	0.032	433	0.032	557	0.032	635
0.040	323	0.040	478	0.040	496	0.040	638	0.040	728
0.048	361	0.048	535	0.048	554	0.048	713	0.048	813
0.067	441	0.067	653	0.067	676	0.067	871	0.067	993
0.120	655	0.120	970	0.120	1,005	0.120	1,294	0.120	1,475
0.150	775	0.150	1,149	0.150	1,190	0.150	1,533	0.150	1,747
0.240	775	0.240	1,149	0.240	1,190	0.240	1,533	0.240	1,747
0.400	775	0.400	1,149	0.400	1,190	0.400	1,533	0.400	1,747

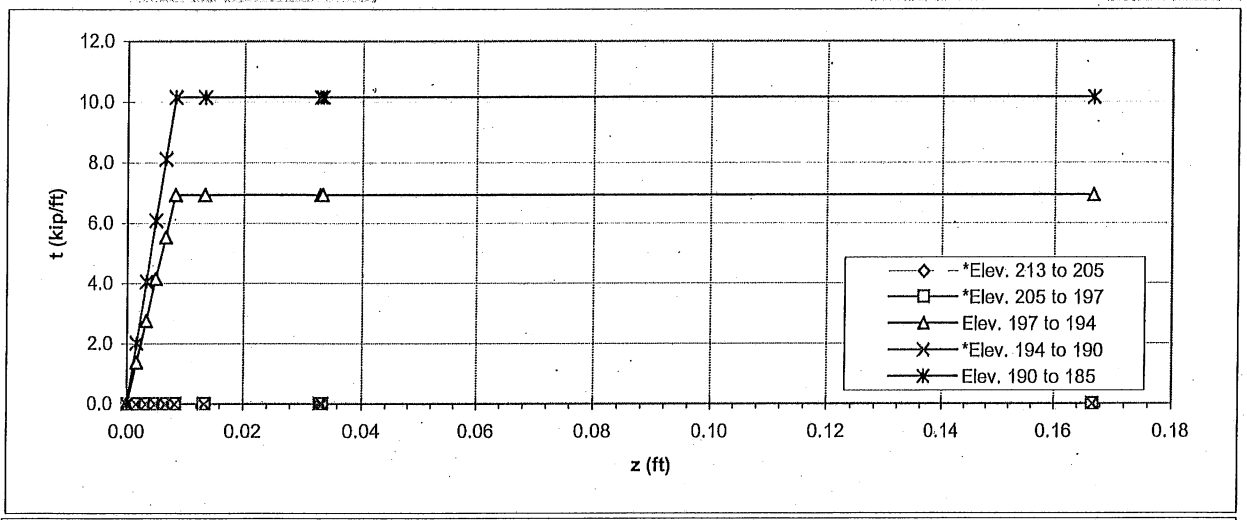
Note: p (kip/ft) * = Liquefiable Layer

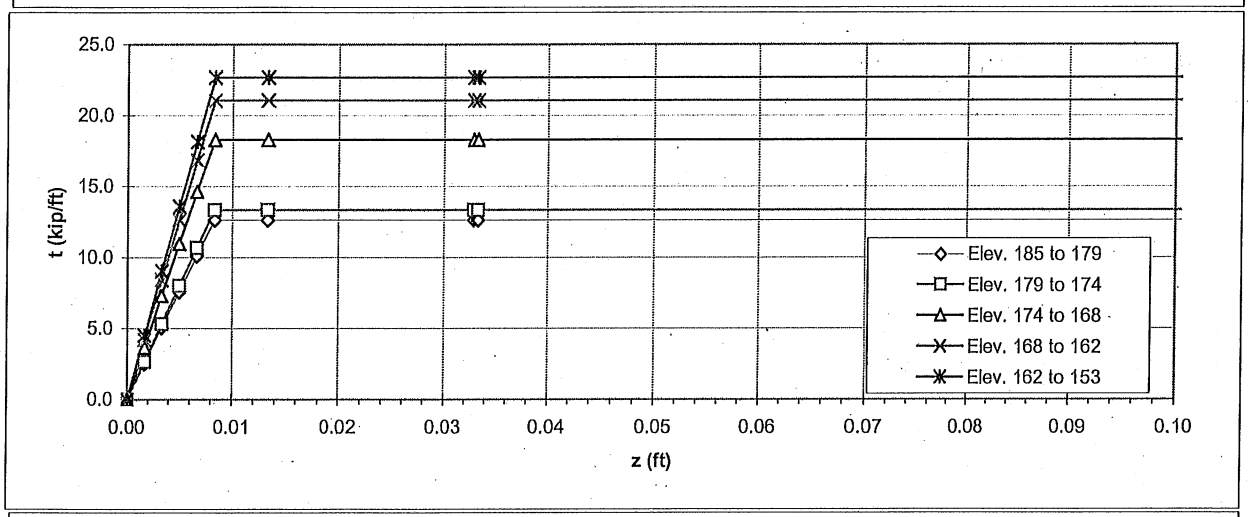
p-y Data

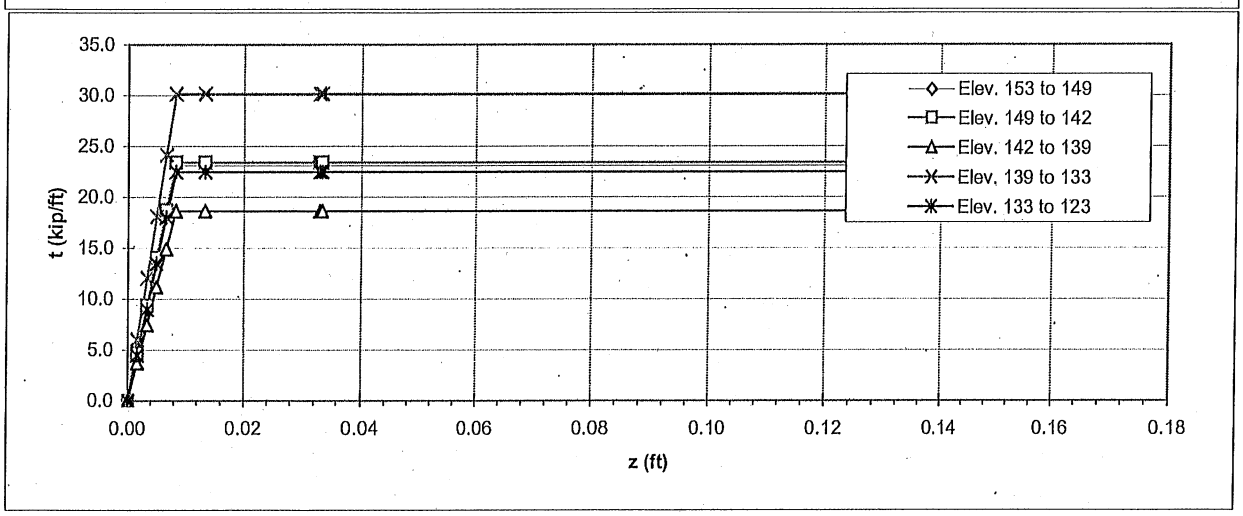
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 4
Sta.

O. G. Elev.	213.0	Pile	4" PP
Cut off Elev.	213.0	GWS	213.0







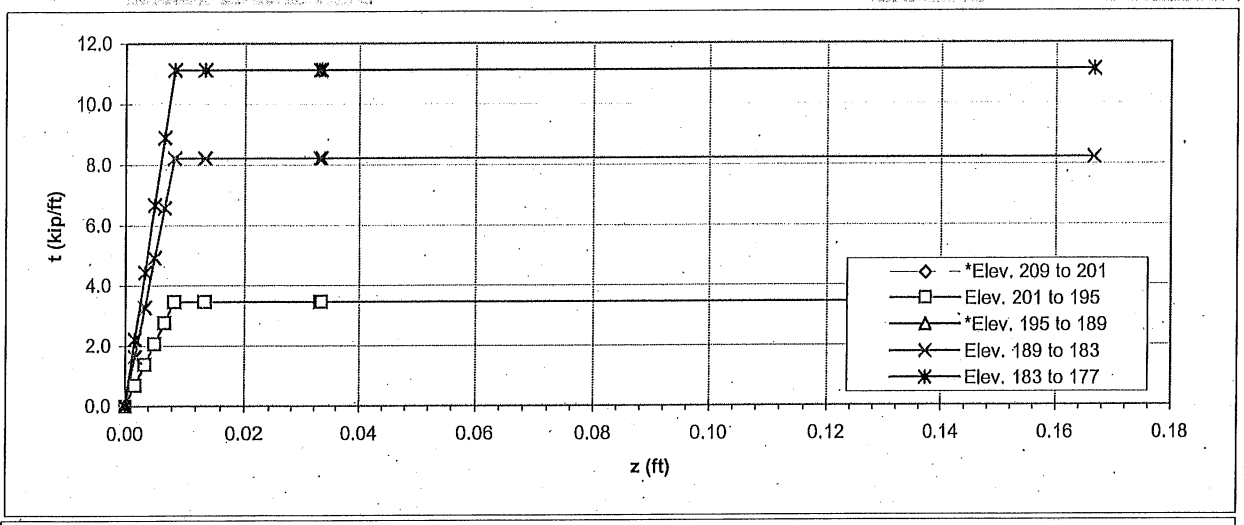
*-Liquefiable layer

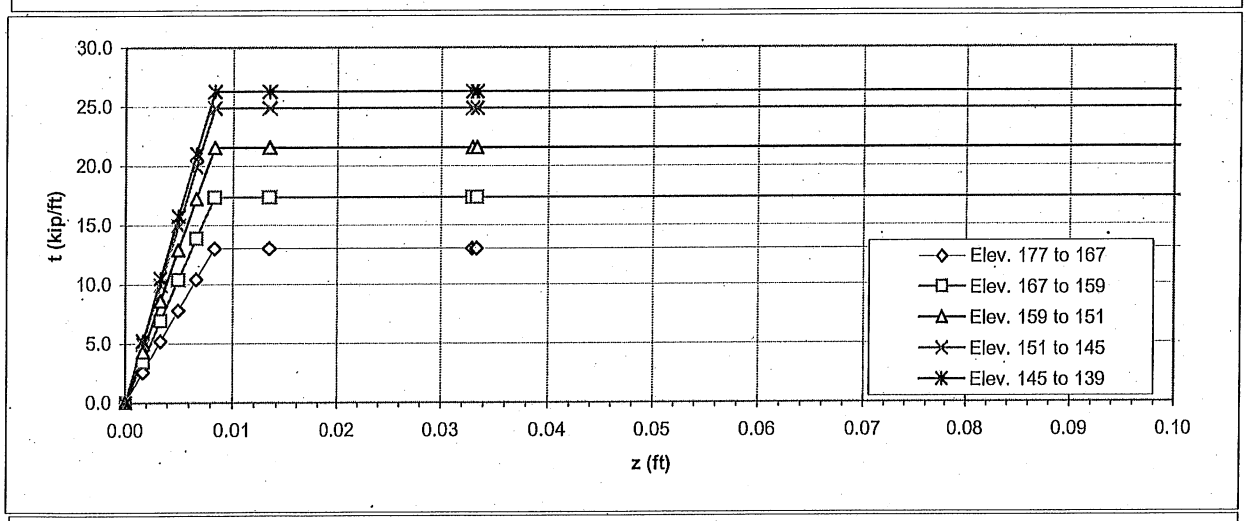
t-z Curves

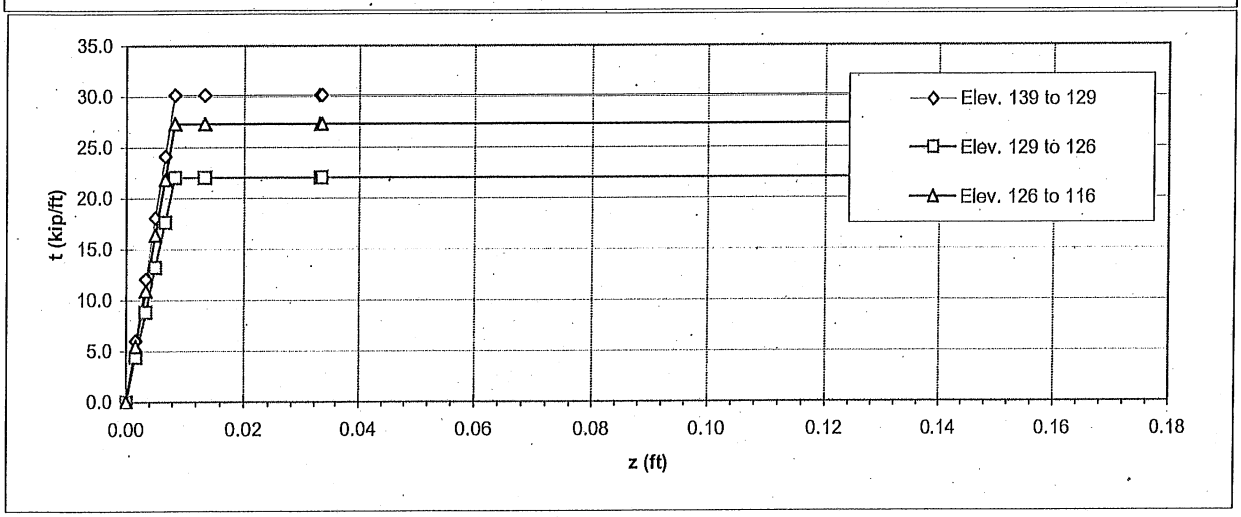
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 5
Sta.

O. G. Elev.	209.0	Pile	4" PP
Cut off Elev.	209.0	GWS	213.0







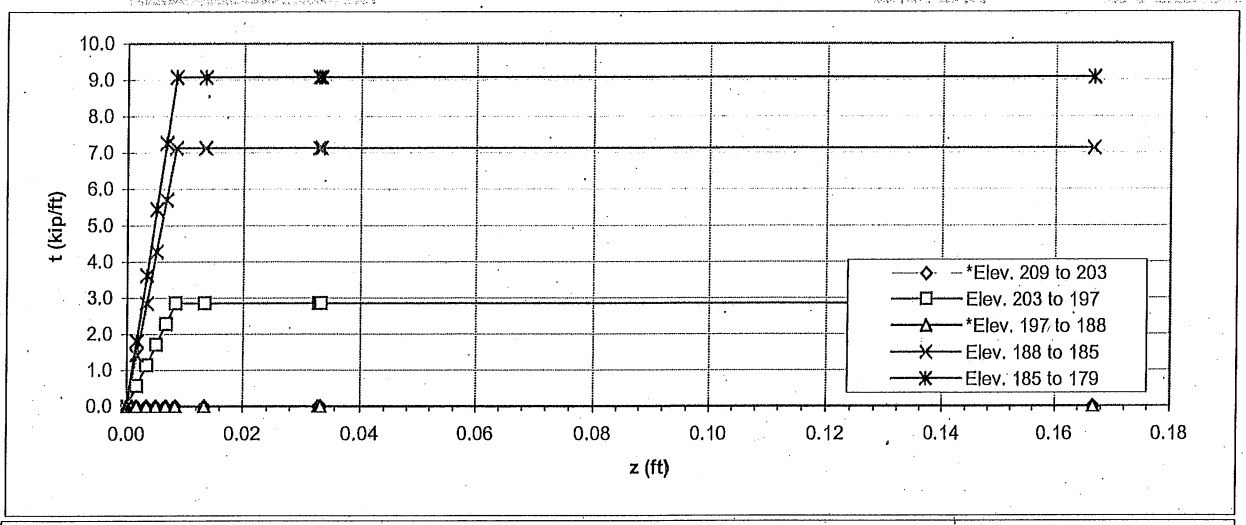
*-Liquefiable layer

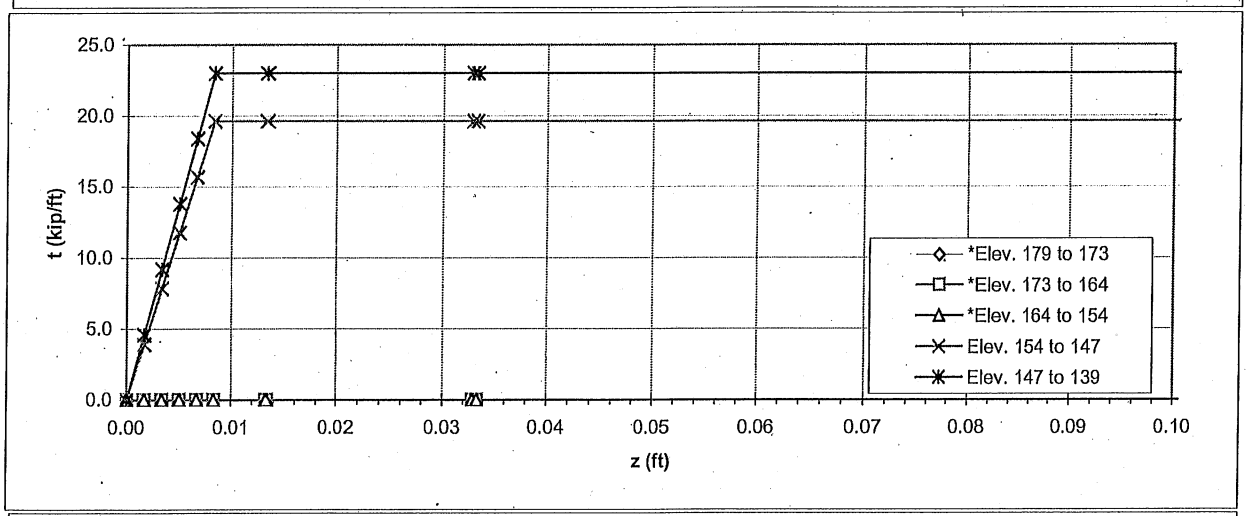
t-z Curves

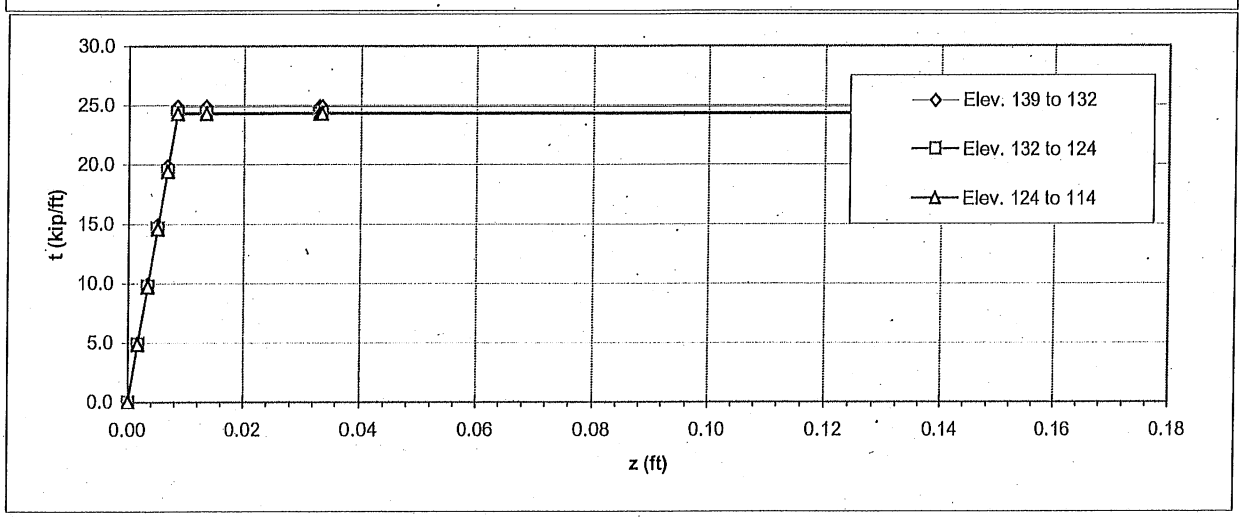
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 6
Sta.

O. G. Elev.	209.0	**Pile**	4" PP
Cut off Elev.	209.0	**GWS**	209.0







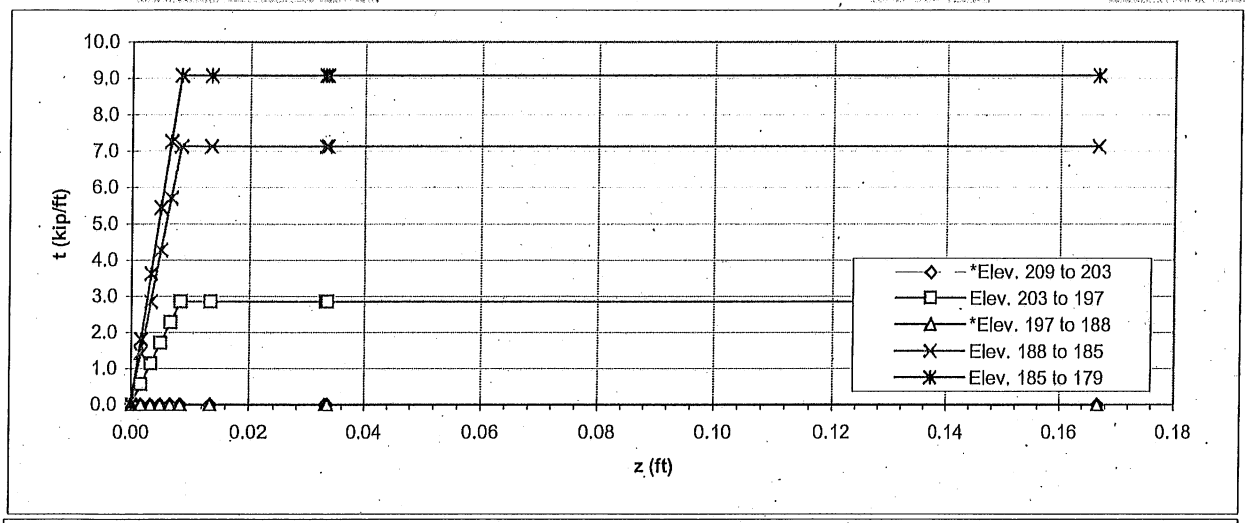
*-Liquefiable layer

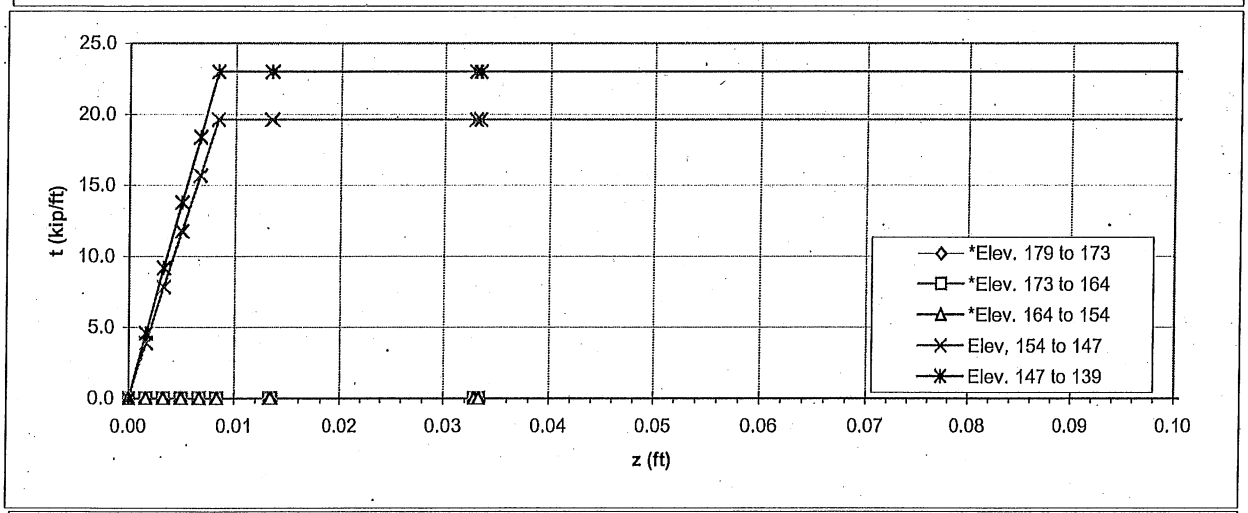
t-z Curves

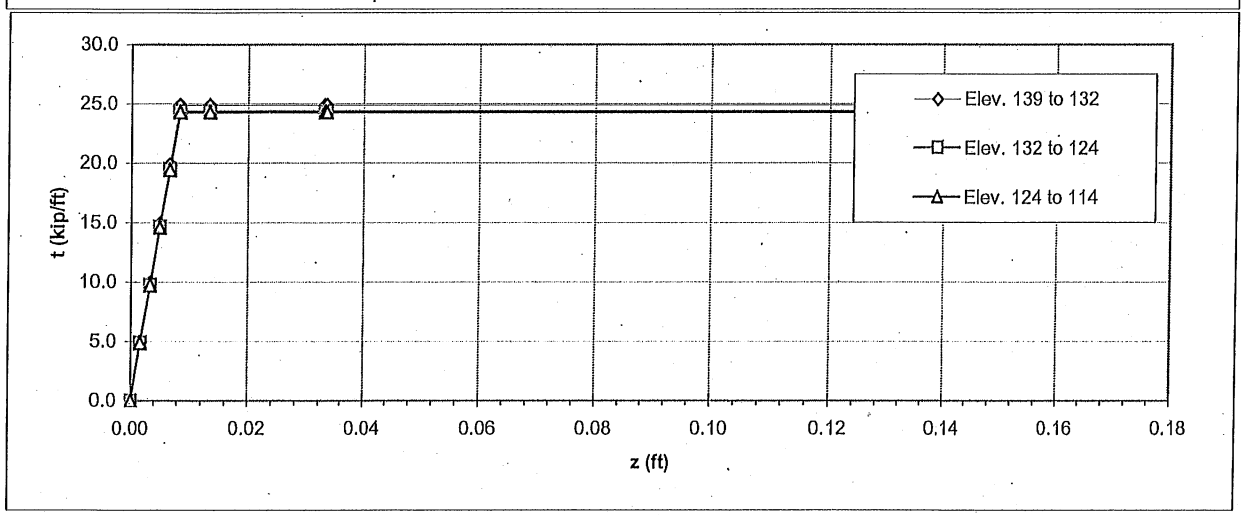
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 7
Sta.

O. G. Elev.	209.0	**Pile**	4" PP
Cut off Elev.	209.0	**GWS**	213.0







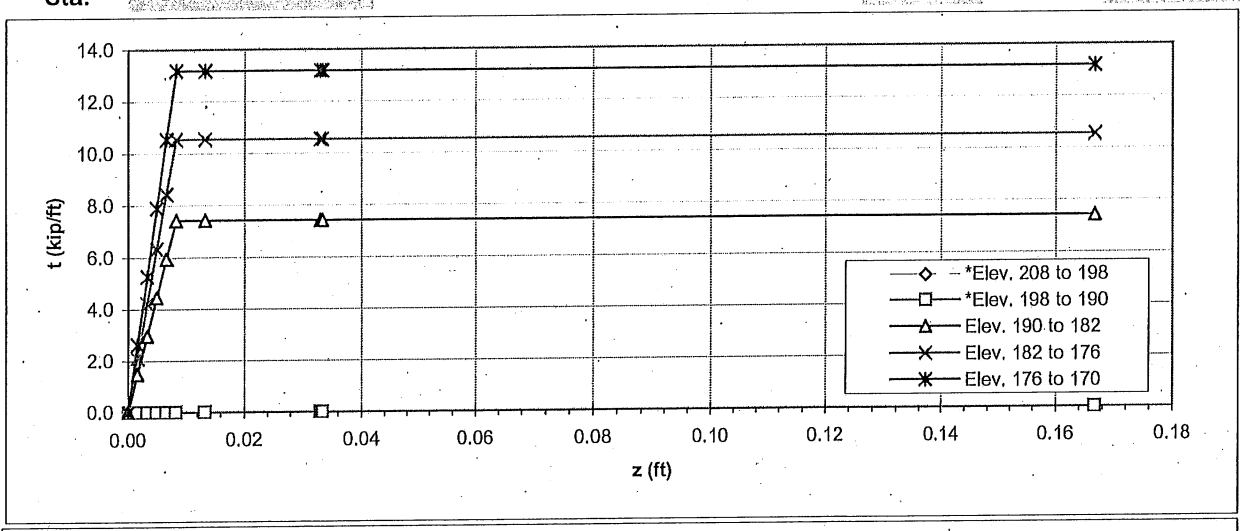
*-Liquefiable layer

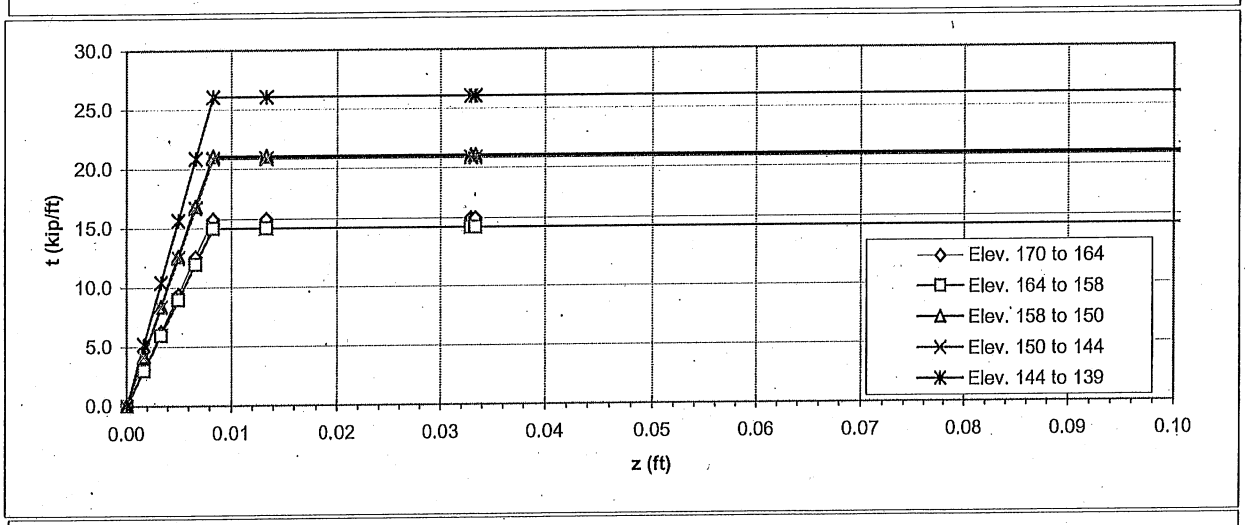
t-z Curves

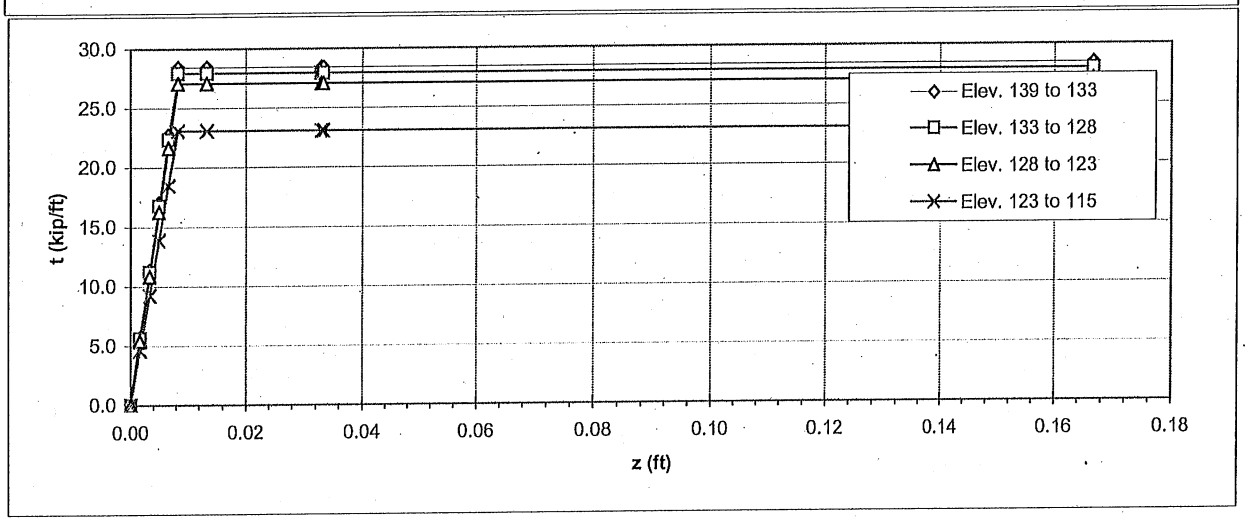
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 8
Sta.

O. G. Elev.	208.0	Pile	4" PP
Cut off Elev.	208.0	GWS	213.0







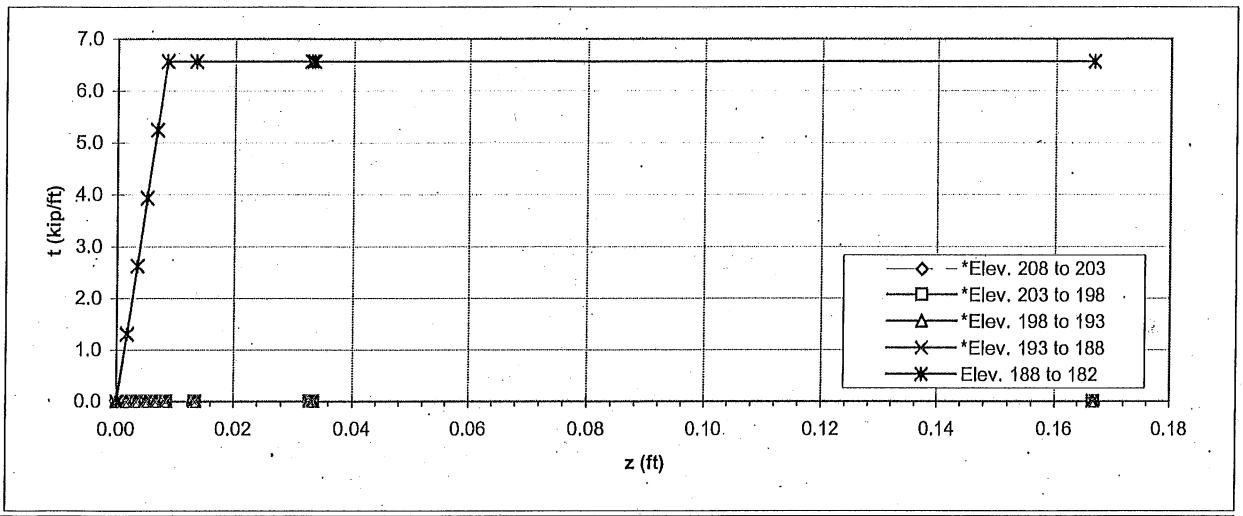
*-Liquefiable layer

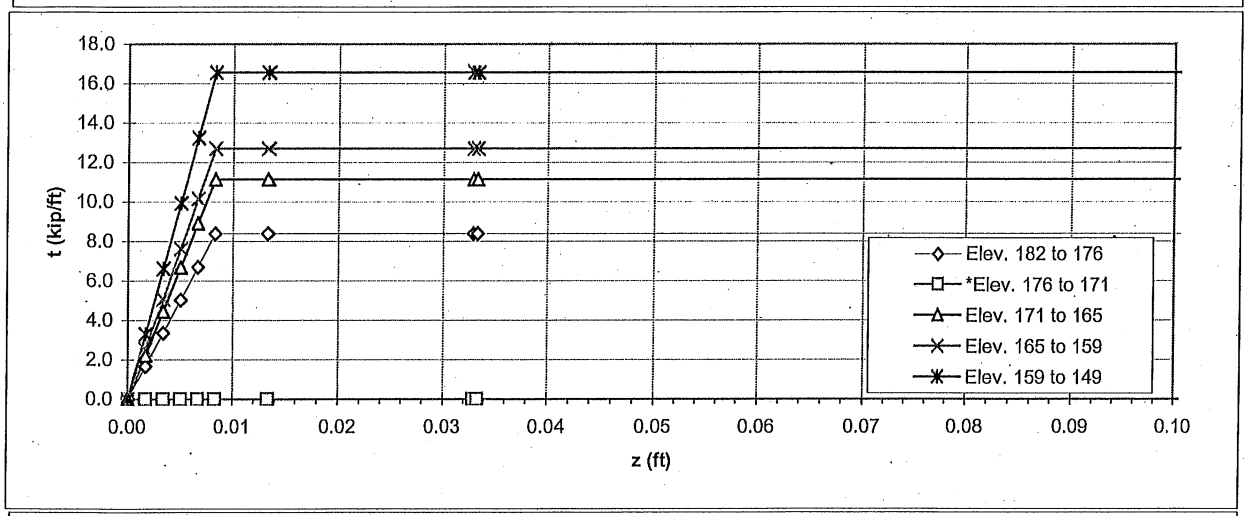
t-z Curves

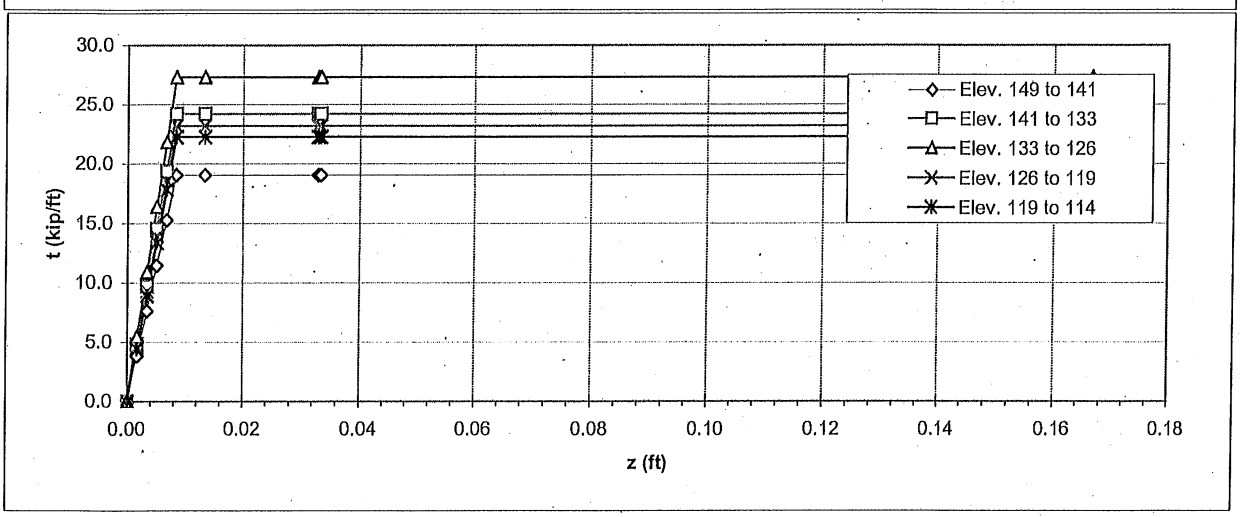
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 9
Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0







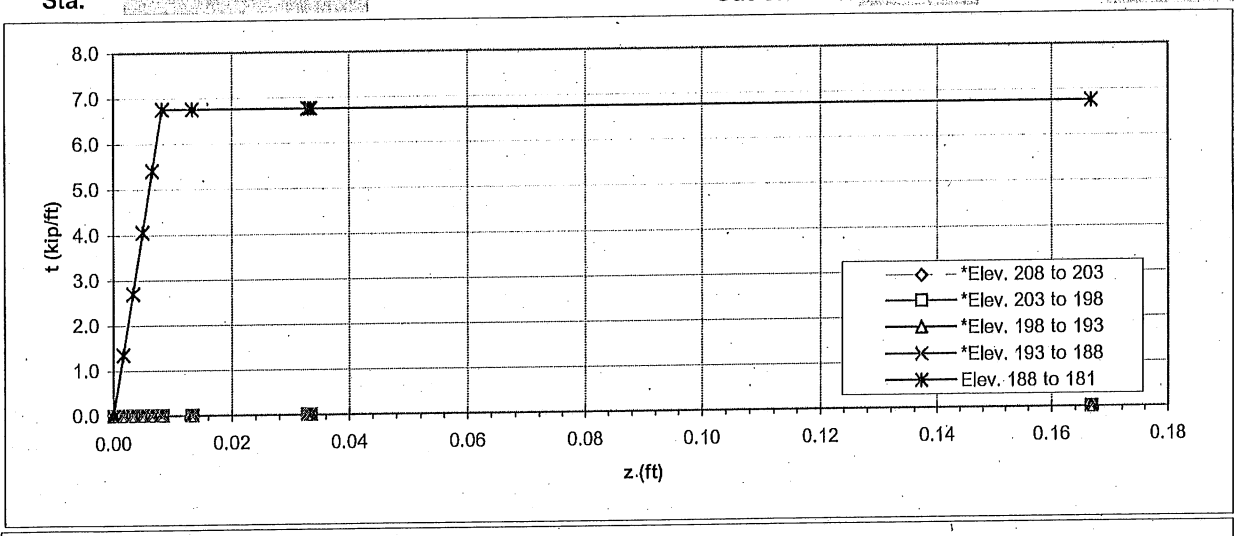
*-Liquefiable layer

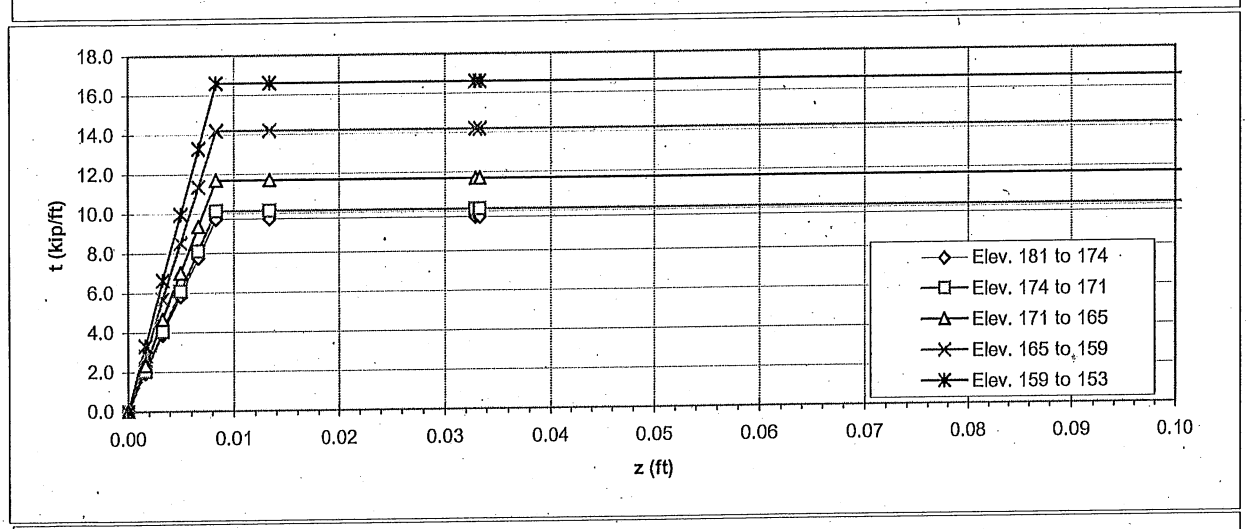
t-z Curves

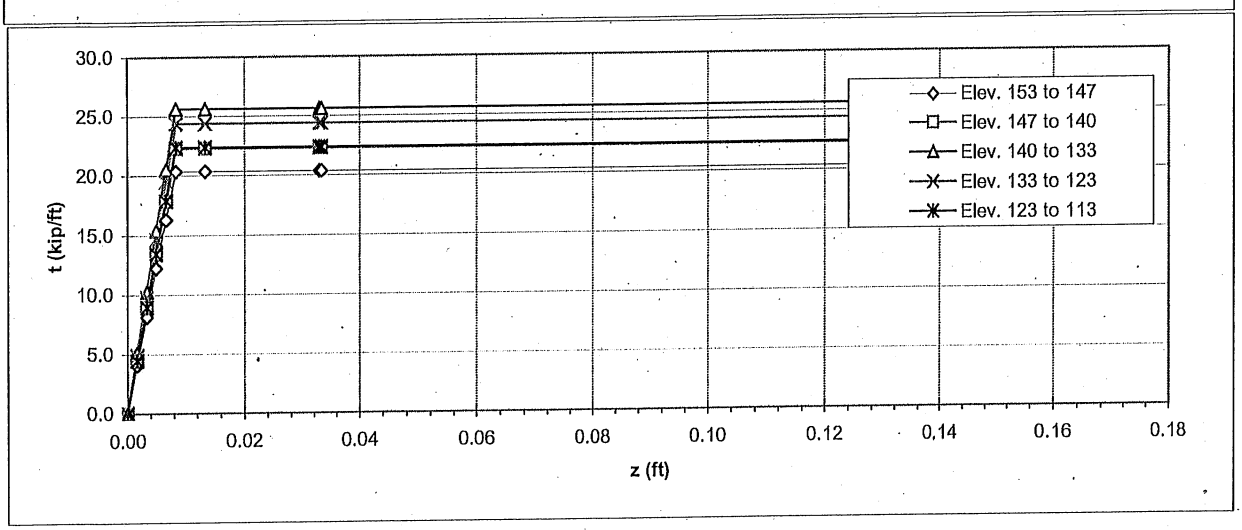
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 10
Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0







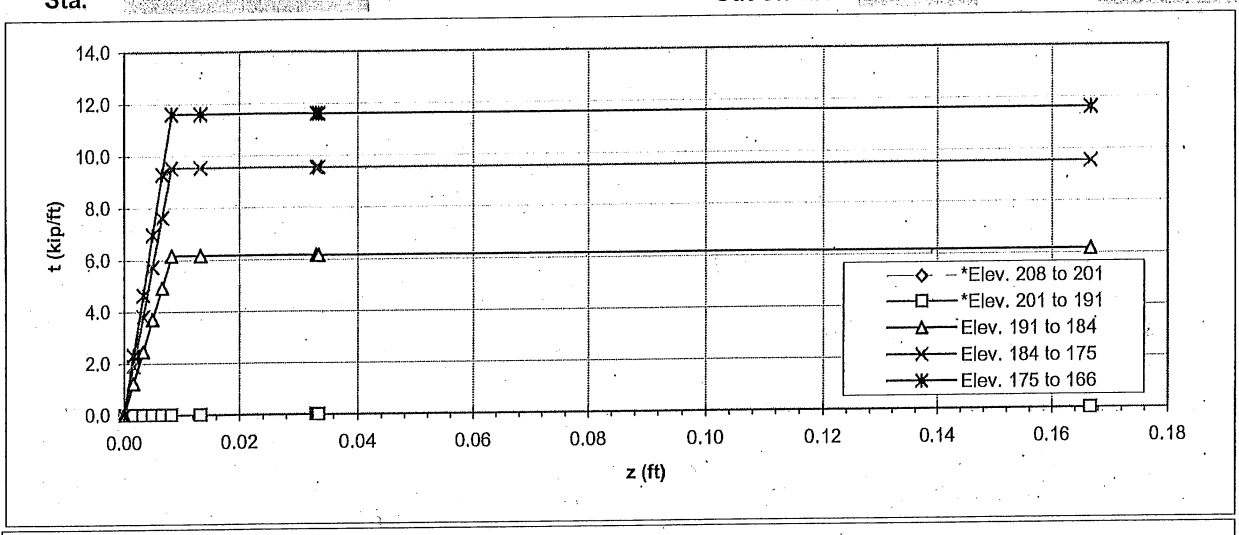
*-Liquefiable layer

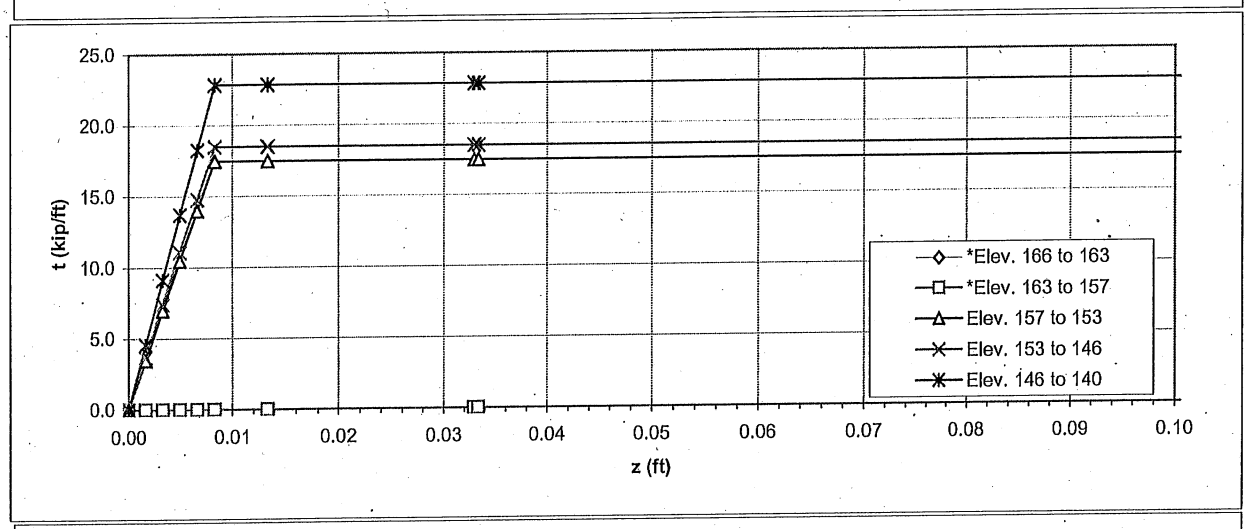
t-z Curves

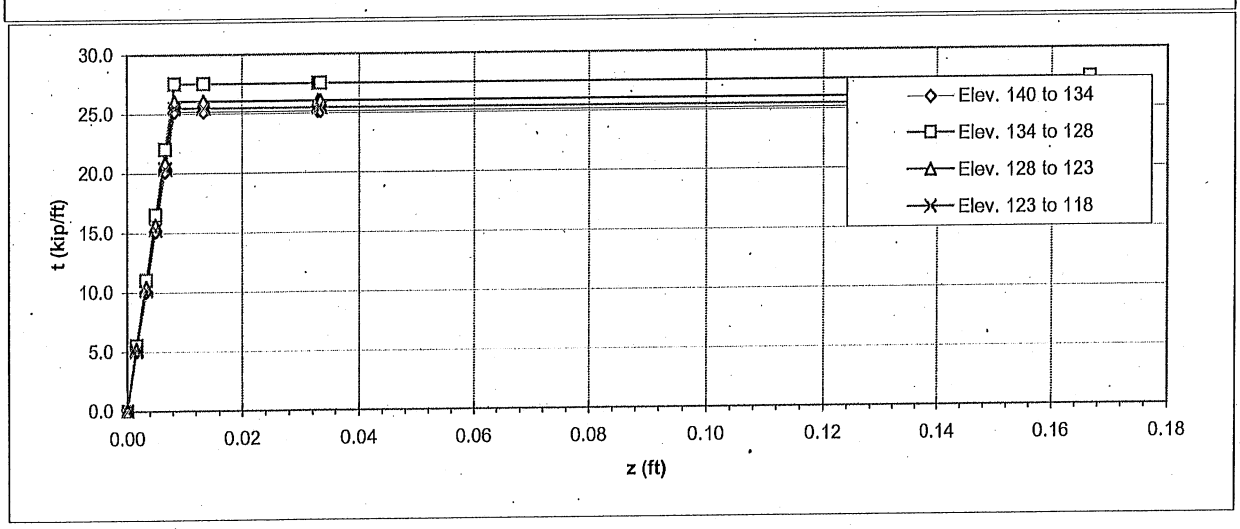
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 11
Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0







*-Liquefiable layer

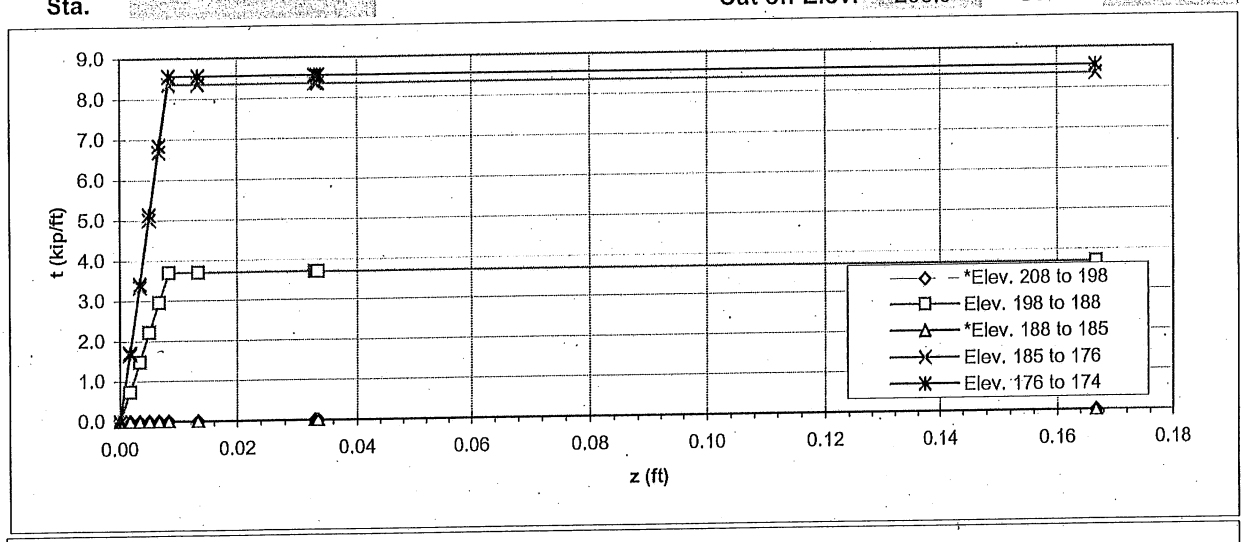
t-z Curves

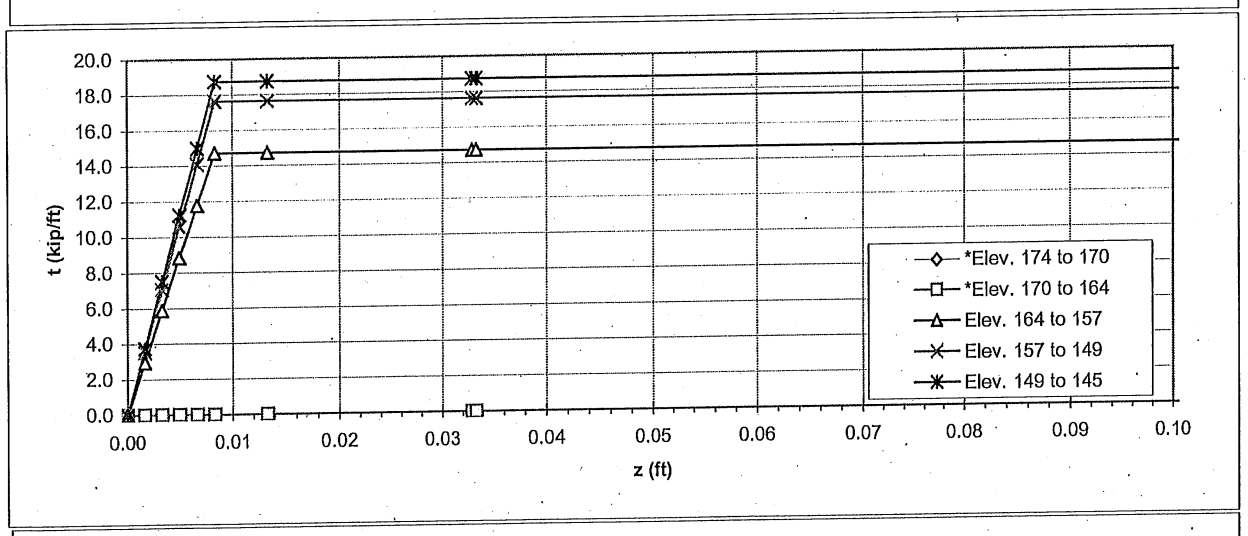
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

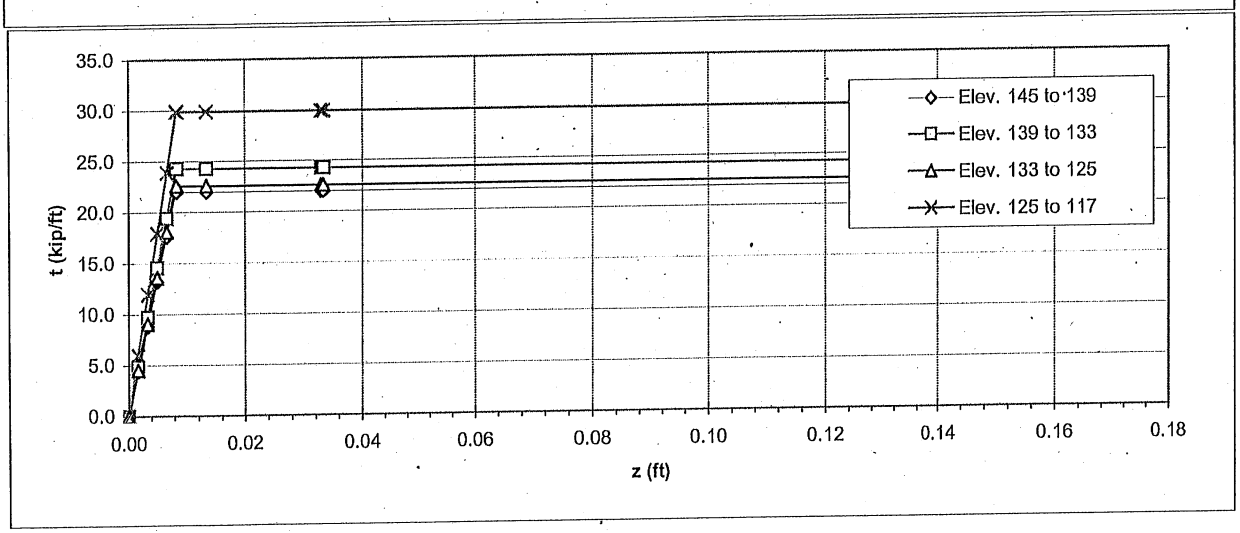
Pier 12

Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0







*-Liquefiable layer

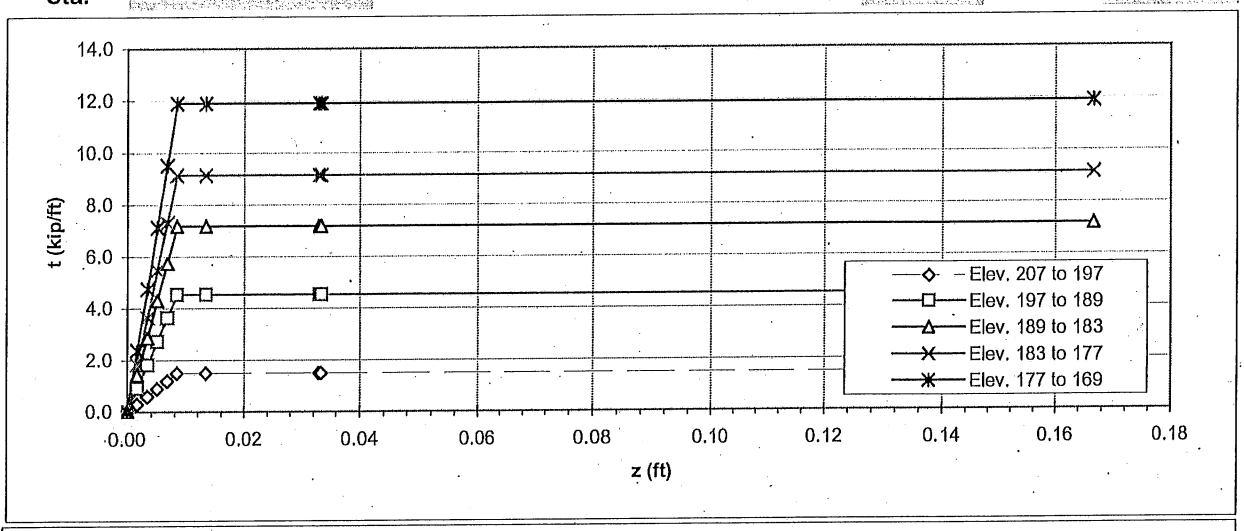
t-z Curves

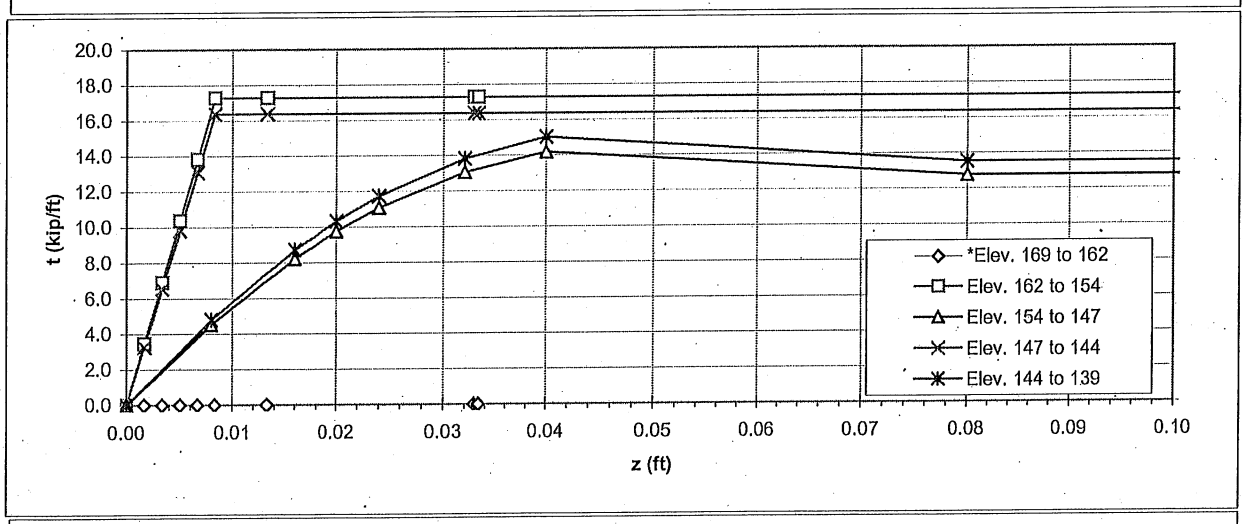
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

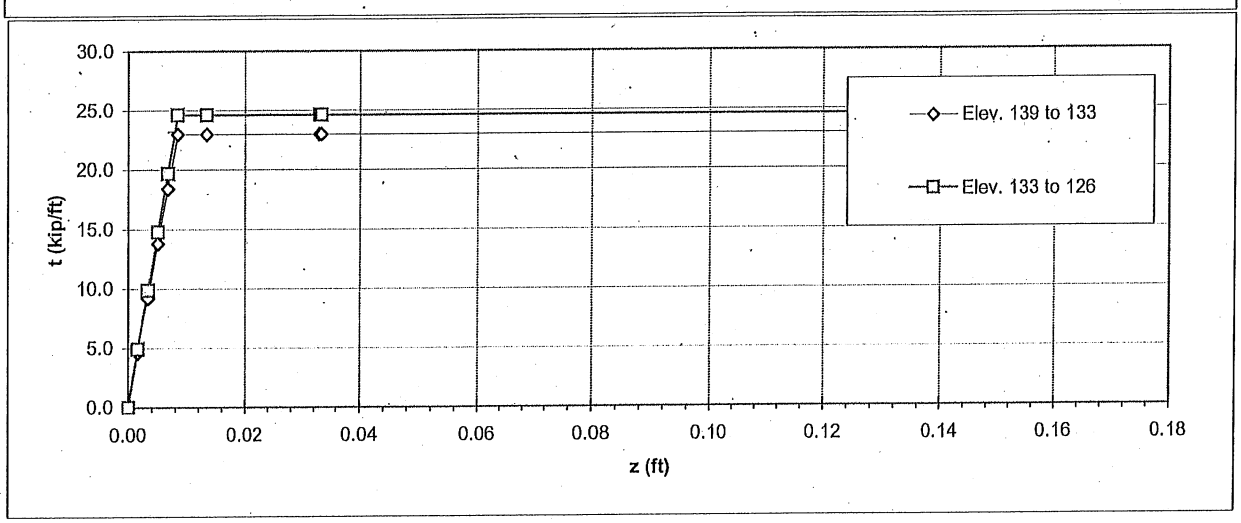
Pier 13

Sta.

O. G. Elev.	207.0	Pile	4' PP
Cut off Elev.	207.0	GWS	213.0







*-Liquefiable layer

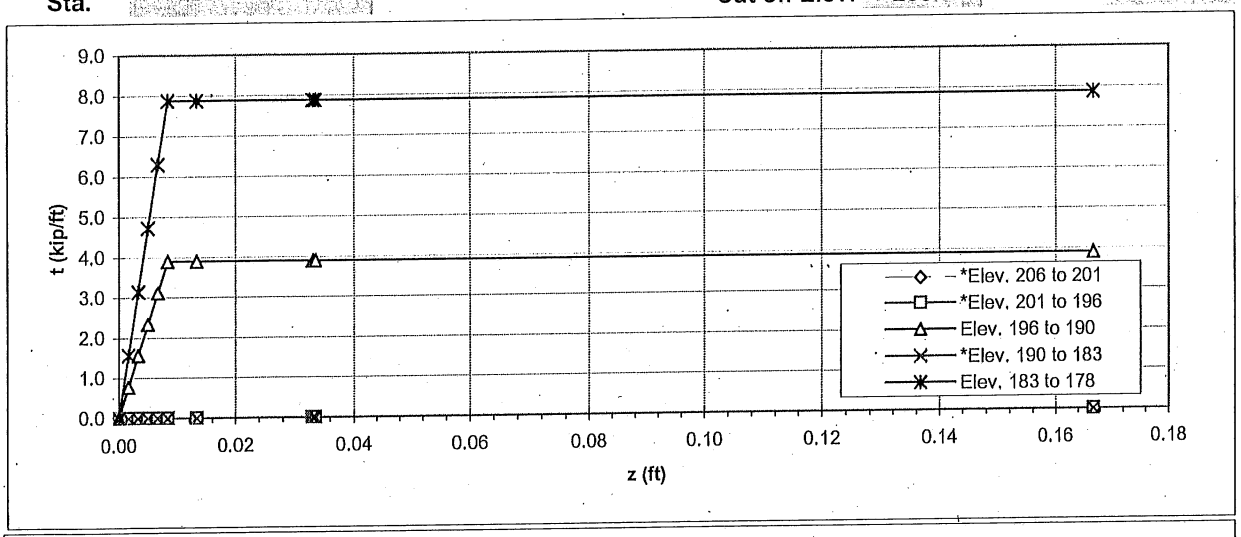
t-z Curves

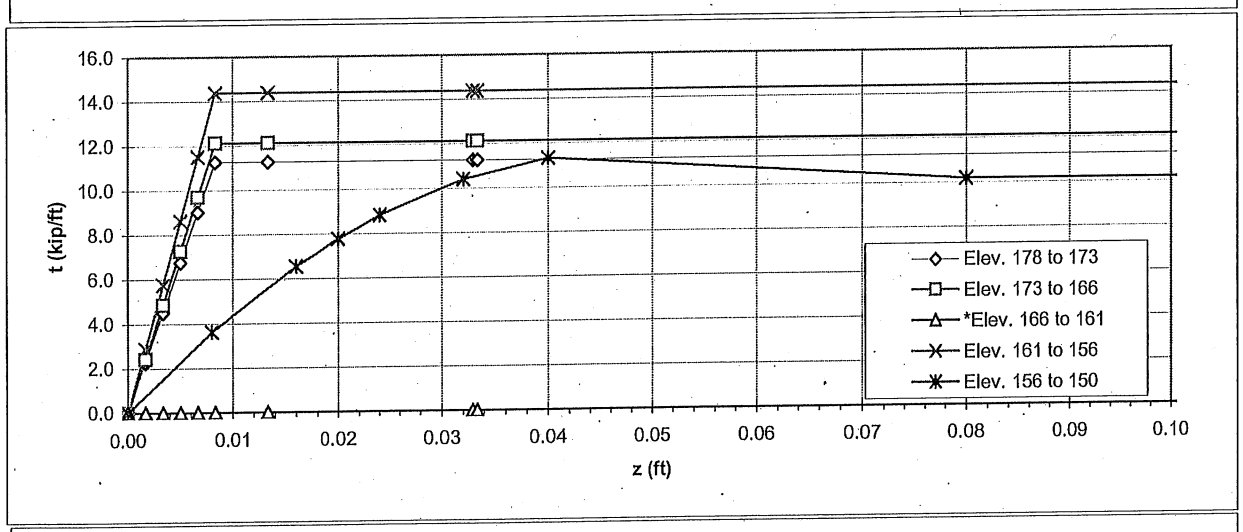
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

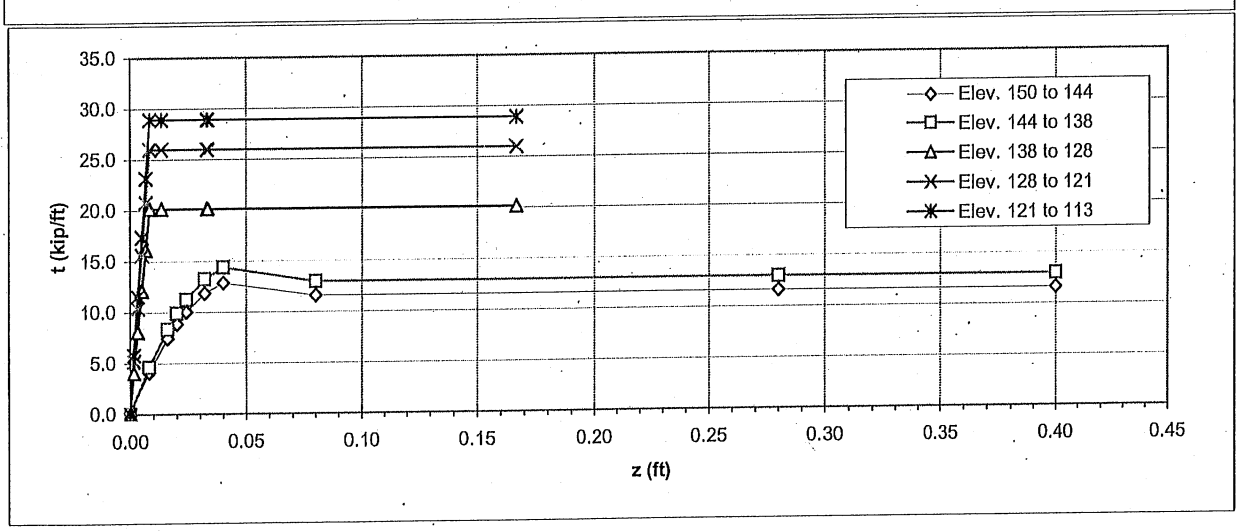
Pier 14

Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0







*-Liquefiable layer

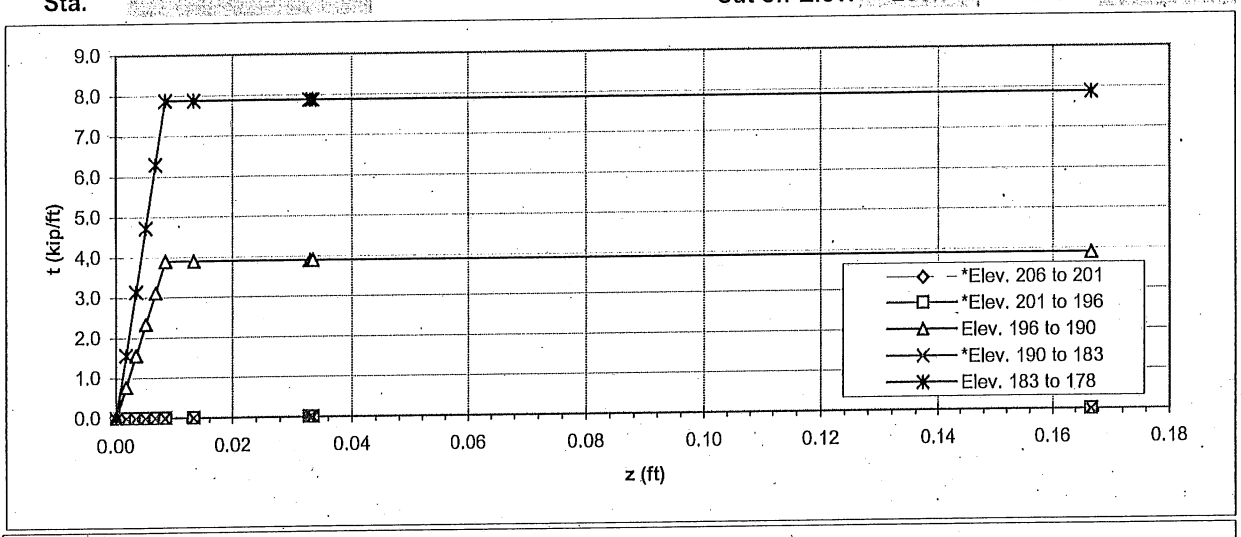
t-z Curves

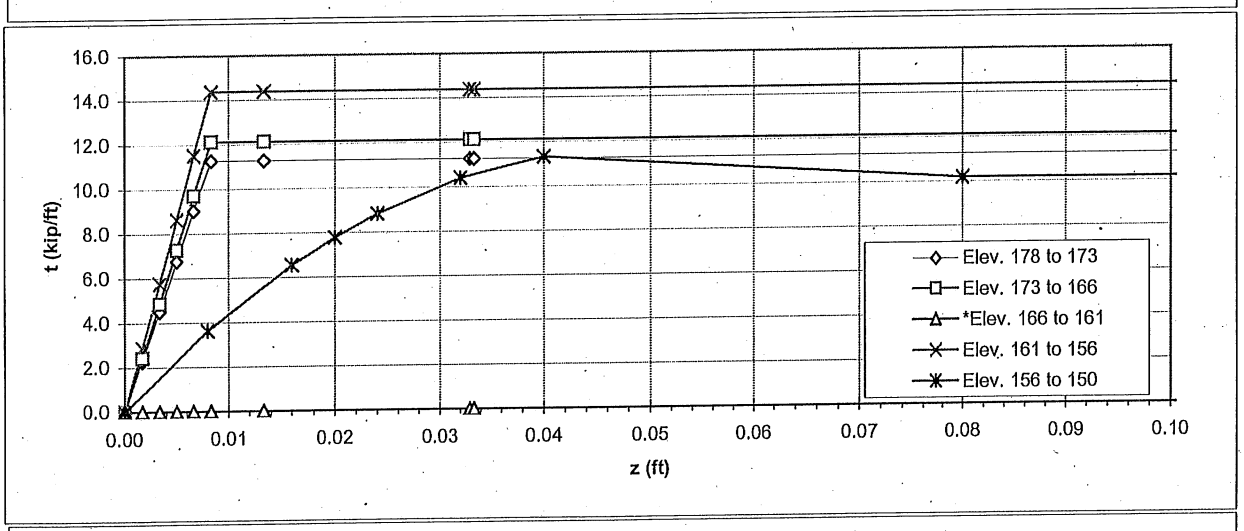
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

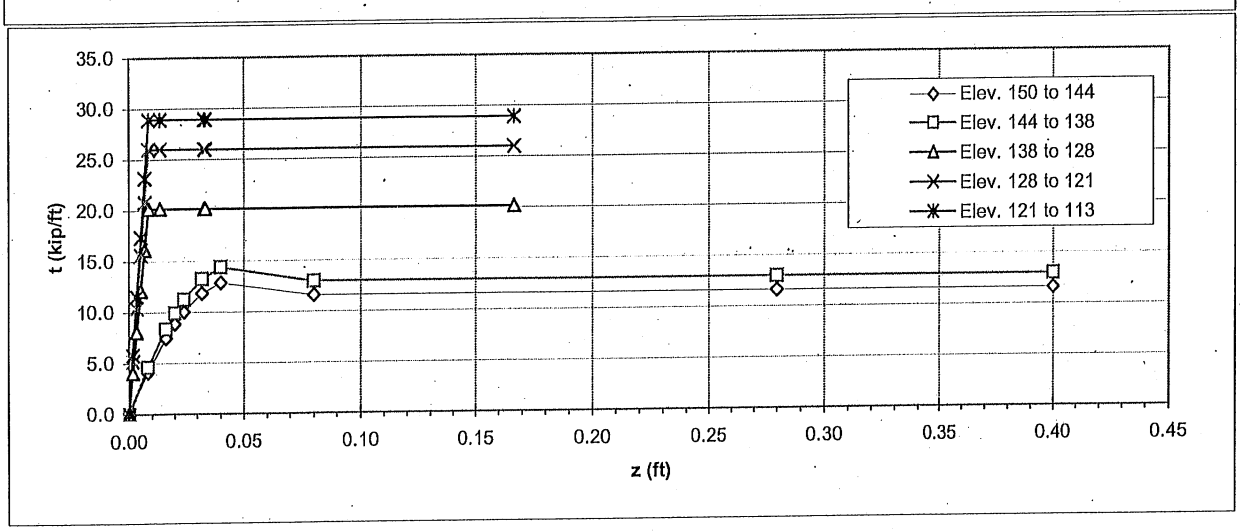
Pier 15

Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0







*-Liquefiable layer

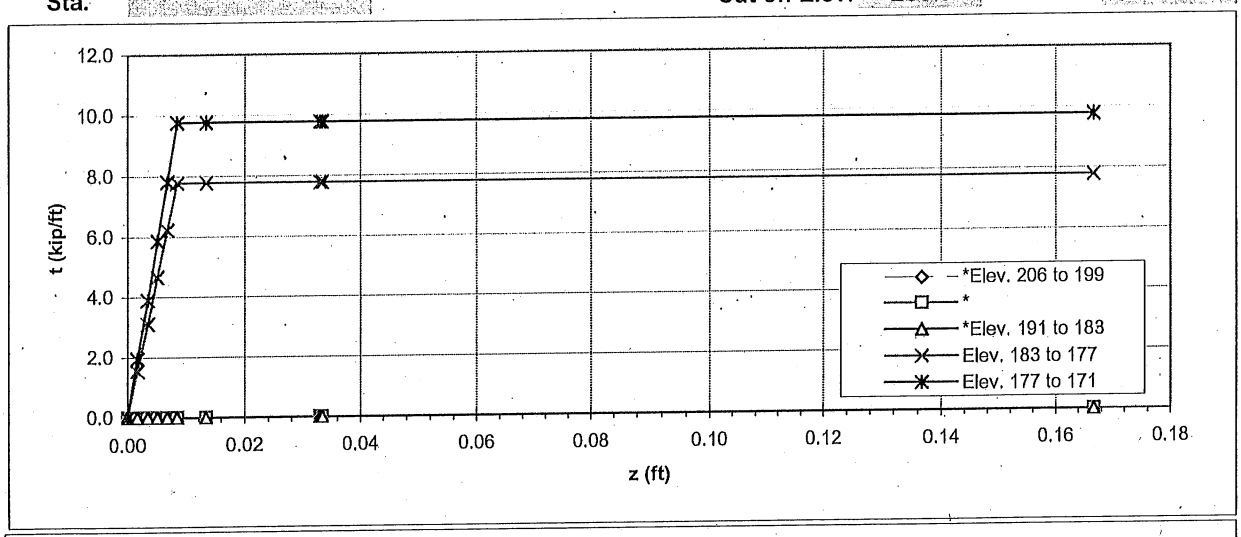
t-z Curves

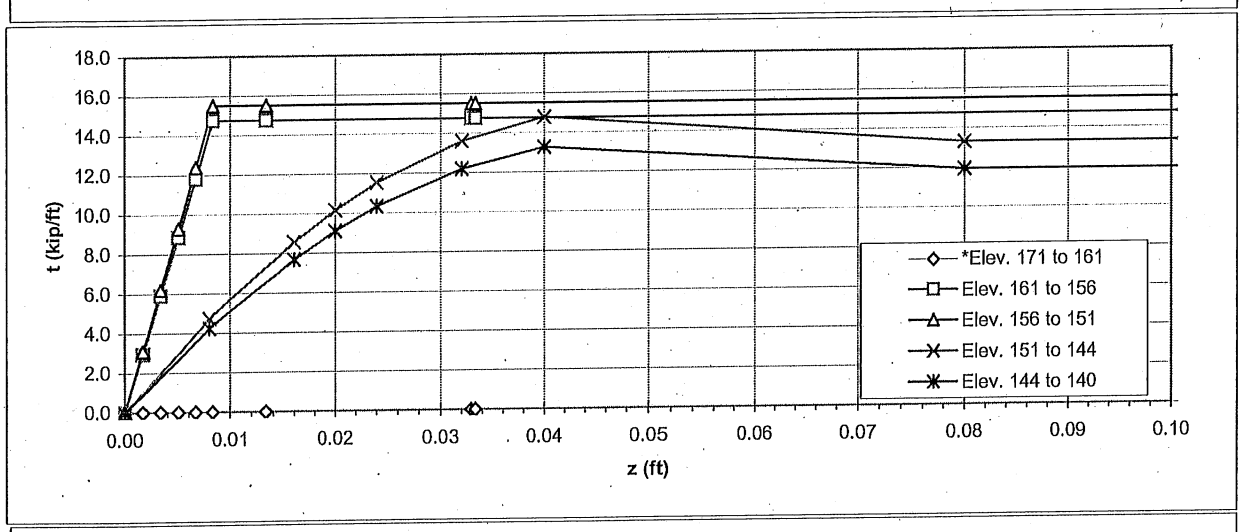
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

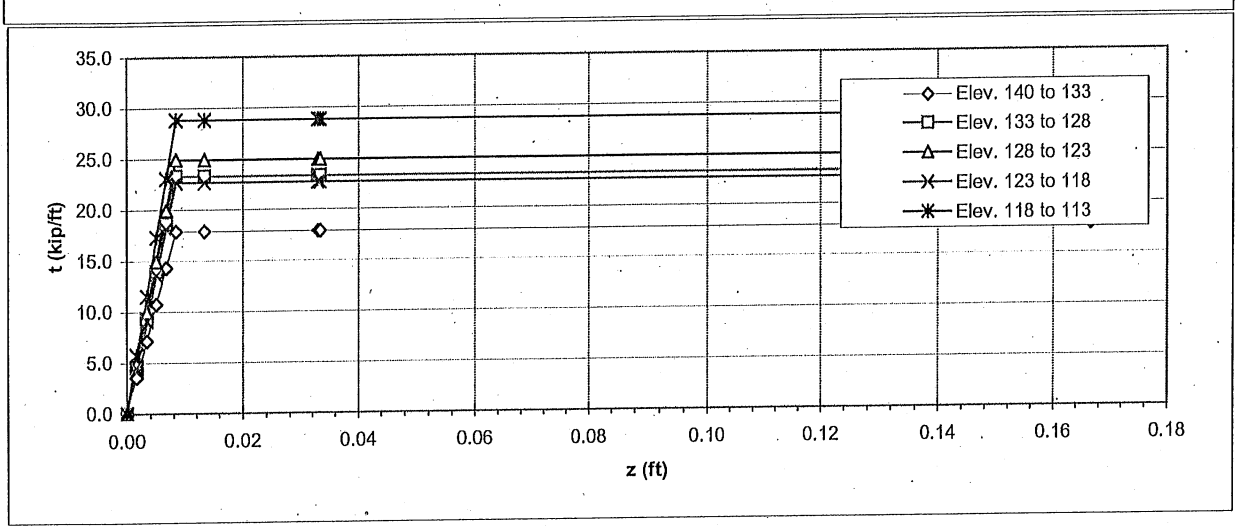
Pier 16

Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0







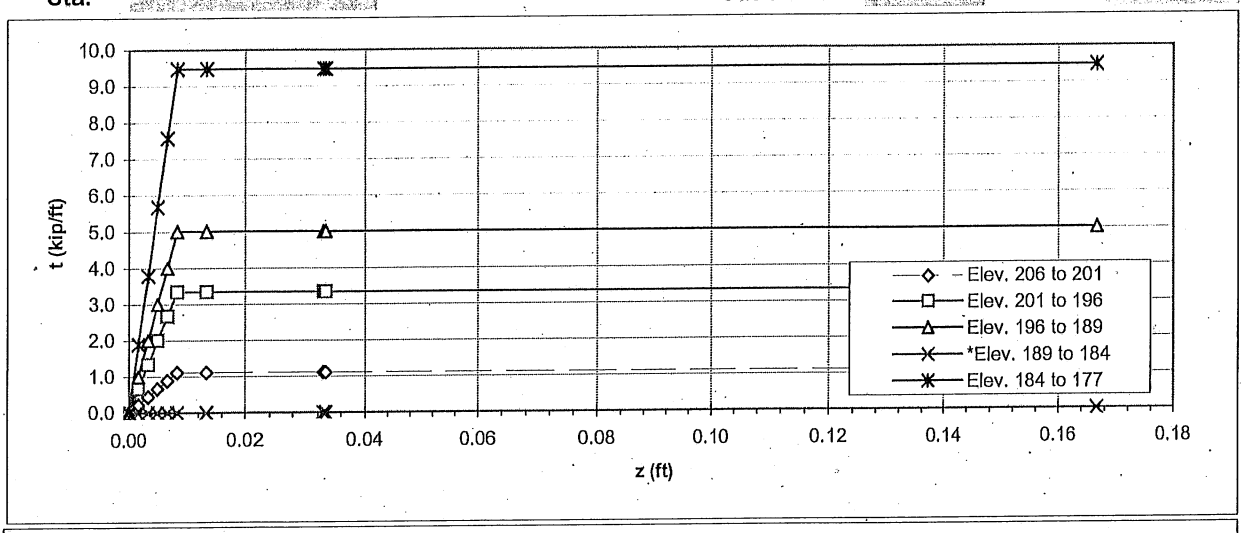
*-Liquefiable layer

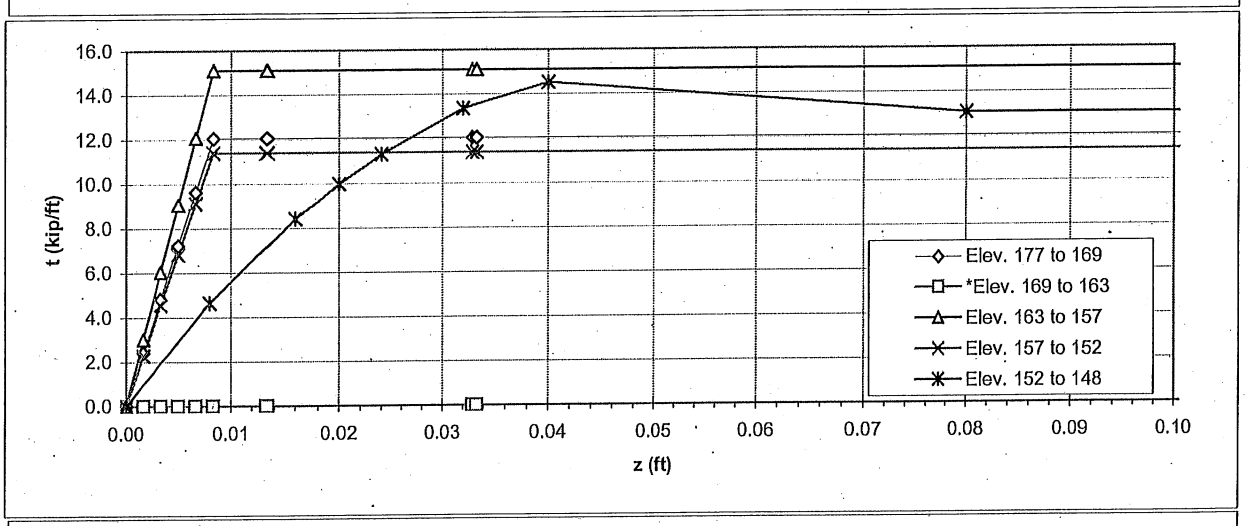
t-z Curves

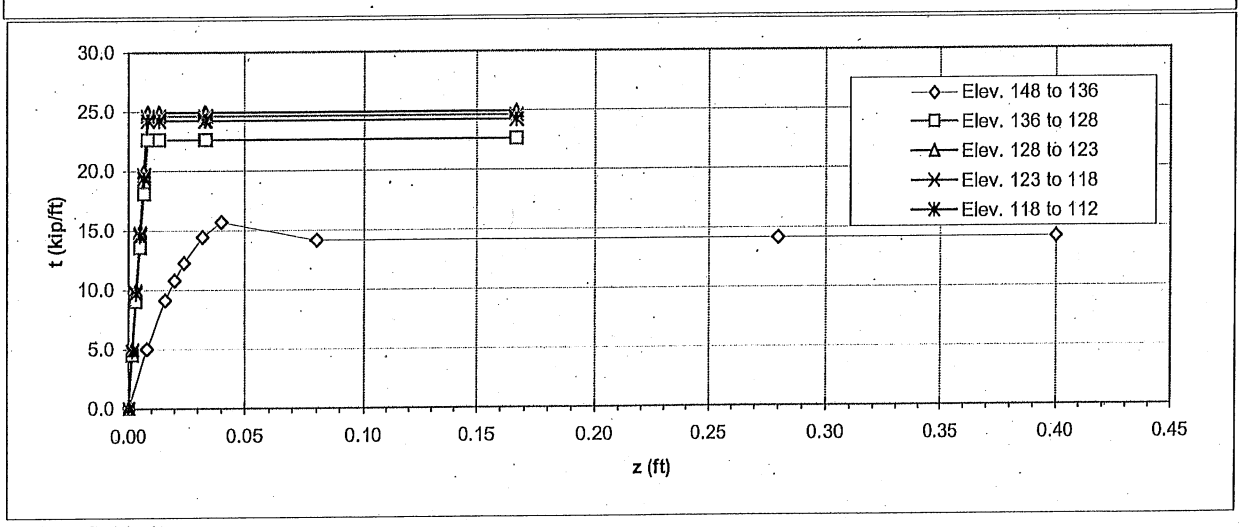
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 17
Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0







*-Liquefiable layer

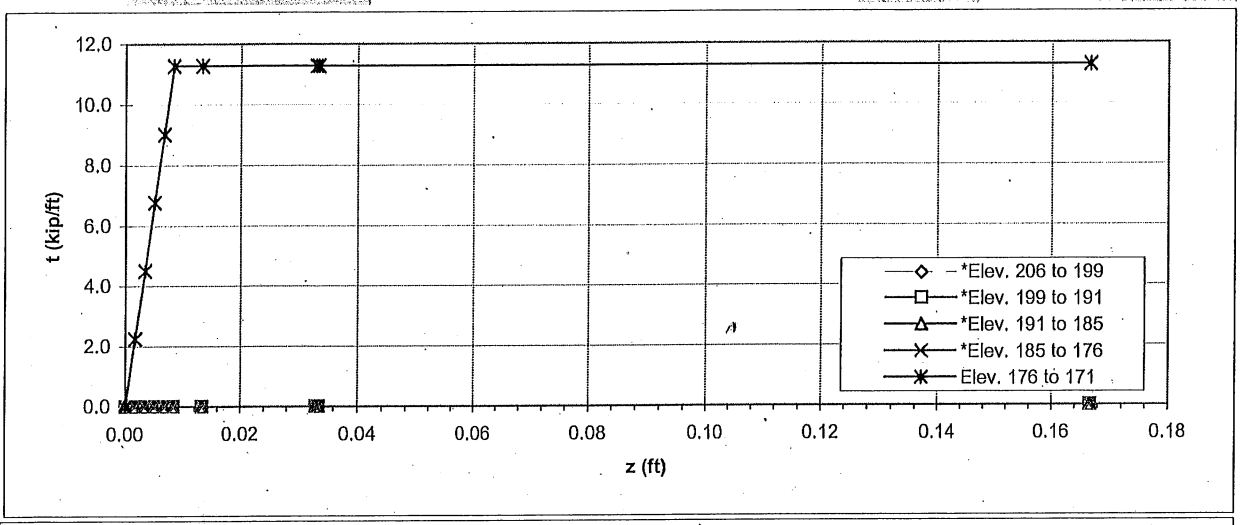
t-z Curves

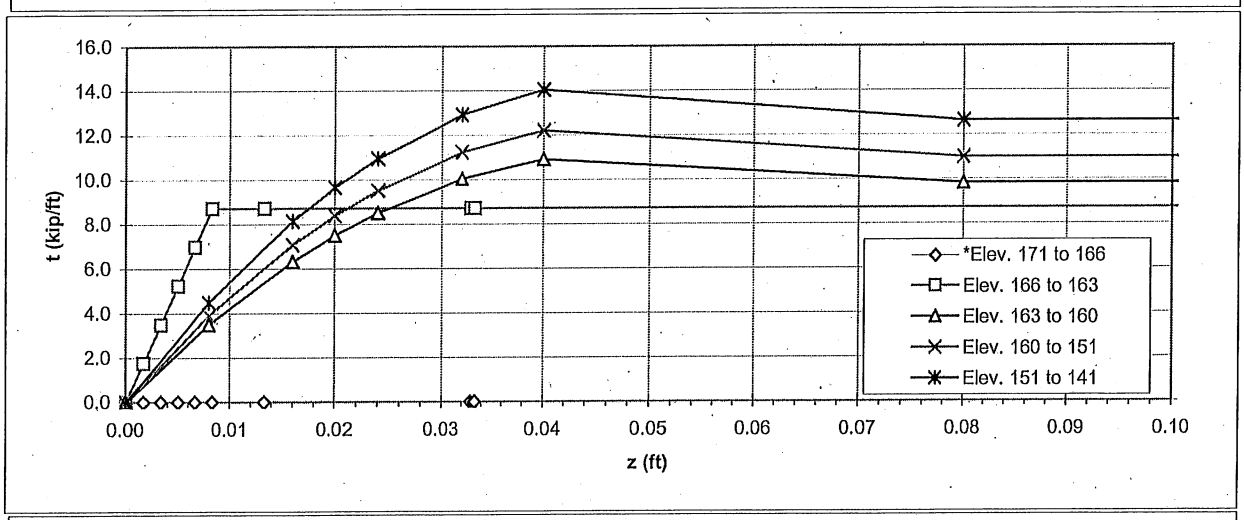
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

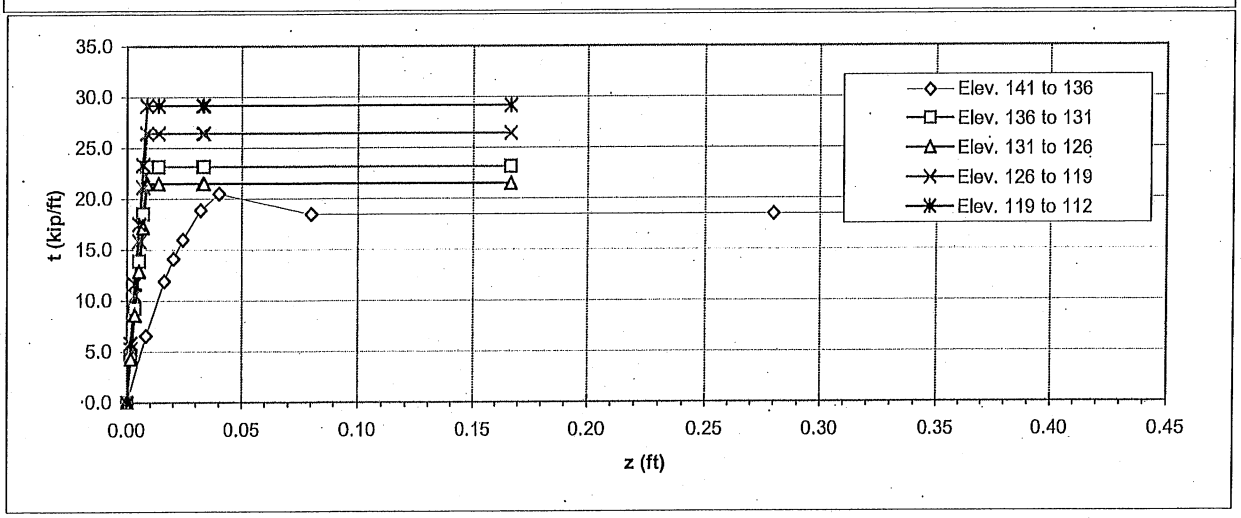
Pier 18

Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0







*-Liquefiable layer

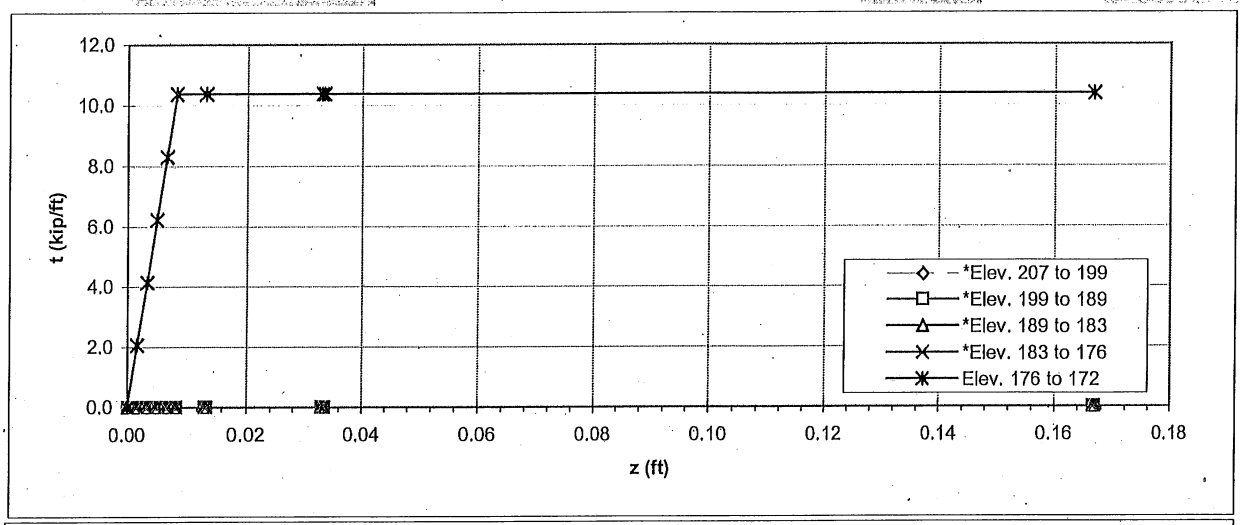
t-z Curves

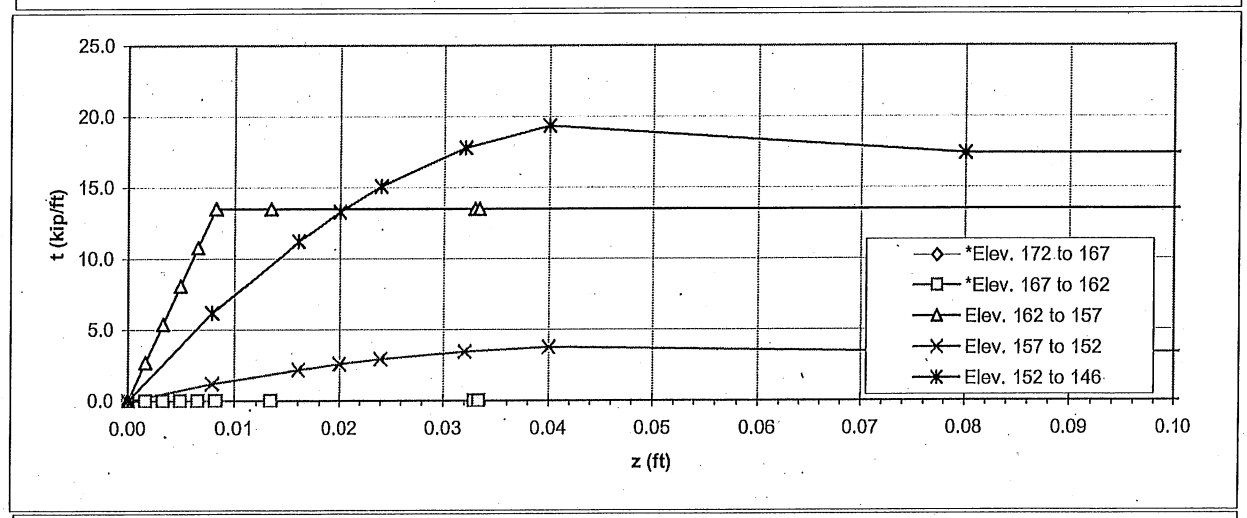
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

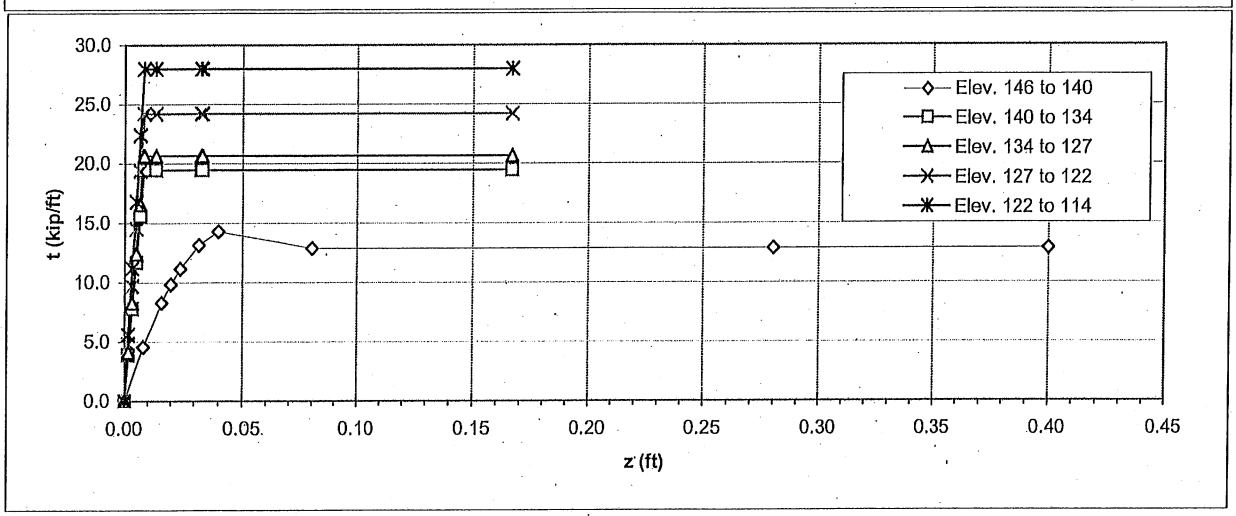
Pier 19

Sta.

O. G. Elev.	207.0	Pile	4' PP
Cut off Elev.	207.0	GWS	213.0







*-Liquefiable layer

t-z Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 23

Sta.

O. G. Elev. 205.0
Cut off Elev. 205.0

Pile 4' PP
GWS 213.0

z (ft)	*Elev. 205 to 198	z (ft)	Elev. 198 to 191	z (ft)	*Elev. 191 to 186	z (ft)	*Elev. 186 to 183	z (ft)	Elev. 183 to 175
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.8	0.00	0.0	0.00	0.0	0.00	1.9
0.00	0.0	0.00	1.6	0.00	0.0	0.00	0.0	0.00	3.8
0.01	0.0	0.01	2.4	0.01	0.0	0.01	0.0	0.01	5.7
0.01	0.0	0.01	3.3	0.01	0.0	0.01	0.0	0.01	7.6
0.01	0.0	0.01	4.1	0.01	0.0	0.01	0.0	0.01	9.4
0.01	0.0	0.01	4.1	0.01	0.0	0.01	0.0	0.01	9.4
0.03	0.0	0.03	4.1	0.03	0.0	0.03	0.0	0.03	9.4
0.03	0.0	0.03	4.1	0.03	0.0	0.03	0.0	0.03	9.4
0.17	0.0	0.17	4.1	0.17	0.0	0.17	0.0	0.17	9.4

z (ft)	Elev. 175 to 167	z (ft)	Elev. 167 to 162	z (ft)	Elev. 162 to 155	z (ft)	Elev. 155 to 151	z (ft)	Elev. 151 to 144
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.7	0.00	2.8	0.01	4.3	0.00	3.3	0.00	3.9
0.00	5.3	0.00	5.6	0.02	7.8	0.00	6.7	0.00	7.7
0.01	8.0	0.01	8.4	0.02	9.3	0.01	10.0	0.01	11.6
0.01	10.7	0.01	11.1	0.02	10.5	0.01	13.3	0.01	15.5
0.01	13.3	0.01	13.9	0.03	12.4	0.01	16.7	0.01	19.3
0.01	13.3	0.01	13.9	0.04	13.5	0.01	16.7	0.01	19.3
0.03	13.3	0.03	13.9	0.08	12.2	0.03	16.7	0.03	19.3
0.03	13.3	0.03	13.9	0.28	12.2	0.03	16.7	0.03	19.3
0.17	13.3	0.17	13.9	0.40	12.2	0.17	16.7	0.17	19.3

z (ft)	Elev. 144 to 138	z (ft)	Elev. 138 to 131	z (ft)	Elev. 131 to 126	z (ft)	Elev. 126 to 123	z (ft)	Elev. 123 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.01	5.7	0.01	6.4	0.00	5.6	0.00	4.2	0.00	6.0
0.02	10.2	0.02	11.6	0.00	11.3	0.00	8.3	0.00	12.1
0.02	12.1	0.02	13.8	0.01	16.9	0.01	12.5	0.01	18.1
0.02	13.8	0.02	15.6	0.01	22.5	0.01	16.7	0.01	24.1
0.03	16.2	0.03	18.4	0.01	28.1	0.01	20.8	0.01	30.2
0.04	17.7	0.04	20.0	0.01	28.1	0.01	20.8	0.01	30.2
0.08	15.9	0.08	18.0	0.03	28.1	0.03	20.8	0.03	30.2
0.28	15.9	0.28	18.0	0.03	28.1	0.03	20.8	0.03	30.2
0.40	15.9	0.40	18.0	0.17	28.1	0.17	20.8	0.17	30.2

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 24

Sta.

O. G. Elev. 206.0
Cut off Elev. 206.0

Pile 4' PP
GWS 213.0

z (ft)	*Elev. 206 to 199	z (ft)	*Elev. 199 to 192	z (ft)	*Elev. 192 to 186	z (ft)	Elev. 186 to 181	z (ft)	Elev. 181 to 176
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.0	0.00	1.6	0.00	1.9
0.00	0.0	0.00	0.0	0.00	0.0	0.00	3.2	0.00	3.9
0.01	0.0	0.01	0.0	0.01	0.0	0.01	4.8	0.01	5.8
0.01	0.0	0.01	0.0	0.01	0.0	0.01	6.5	0.01	7.8
0.01	0.0	0.01	0.0	0.01	0.0	0.01	8.1	0.01	9.7
0.01	0.0	0.01	0.0	0.01	0.0	0.01	8.1	0.01	9.7
0.03	0.0	0.03	0.0	0.03	0.0	0.03	8.1	0.03	9.7
0.03	0.0	0.03	0.0	0.03	0.0	0.03	8.1	0.03	9.7
0.17	0.0	0.17	0.0	0.17	0.0	0.17	8.1	0.17	9.7

z (ft)	Elev. 176 to 170	z (ft)	Elev. 170 to 159	z (ft)	Elev. 159 to 156	z (ft)	Elev. 156 to 151	z (ft)	Elev. 151 to 146
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.3	0.00	3.6	0.00	3.4	0.00	3.1	0.00	4.1
0.00	4.7	0.00	7.2	0.00	6.8	0.00	6.1	0.00	8.2
0.01	7.0	0.01	10.7	0.01	10.2	0.01	9.2	0.01	12.2
0.01	9.4	0.01	14.3	0.01	13.6	0.01	12.2	0.01	16.3
0.01	11.7	0.01	17.9	0.01	17.0	0.01	15.3	0.01	20.4
0.01	11.7	0.01	17.9	0.01	17.0	0.01	15.3	0.01	20.4
0.03	11.7	0.03	17.9	0.03	17.0	0.03	15.3	0.03	20.4
0.03	11.7	0.03	17.9	0.03	17.0	0.03	15.3	0.03	20.4
0.17	11.7	0.17	17.9	0.17	17.0	0.17	15.3	0.17	20.4

z (ft)	Elev. 146 to 141	z (ft)	Elev. 141 to 131	z (ft)	Elev. 131 to 126	z (ft)	Elev. 126 to 121	z (ft)	Elev. 121 to 116
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	3.4	0.00	3.7	0.00	4.8	0.00	4.2	0.00	4.3
0.00	6.7	0.00	7.3	0.00	9.5	0.00	8.4	0.00	8.6
0.01	10.1	0.01	11.0	0.01	14.3	0.01	12.6	0.01	12.9
0.01	13.5	0.01	14.7	0.01	19.0	0.01	16.8	0.01	17.3
0.01	16.9	0.01	18.3	0.01	23.8	0.01	21.0	0.01	21.6
0.01	16.9	0.01	18.3	0.01	23.8	0.01	21.0	0.01	21.6
0.03	16.9	0.03	18.3	0.03	23.8	0.03	21.0	0.03	21.6
0.03	16.9	0.03	18.3	0.03	23.8	0.03	21.0	0.03	21.6
0.17	16.9	0.17	18.3	0.17	23.8	0.17	21.0	0.17	21.6

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 25

Sta.

O. G. Elev. 205.0
Cut off Elev. 205.0
Pile 4' PP
GWS 213.0

z (ft)	*Elev. 205 to 199	z (ft)	Elev. 199 to 193	z (ft)	Elev. 193 to 187	z (ft)	Elev. 187 to 182	z (ft)	Elev. 182 to 176
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.6	0.00	1.2	0.00	1.6	0.00	2.1
0.00	0.0	0.00	1.3	0.00	2.3	0.00	3.3	0.00	4.2
0.01	0.0	0.01	1.9	0.01	3.5	0.01	4.9	0.01	6.3
0.01	0.0	0.01	2.5	0.01	4.6	0.01	6.5	0.01	8.4
0.01	0.0	0.01	3.2	0.01	5.8	0.01	8.1	0.01	10.4
0.01	0.0	0.01	3.2	0.01	5.8	0.01	8.1	0.01	10.4
0.03	0.0	0.03	3.2	0.03	5.8	0.03	8.1	0.03	10.4
0.03	0.0	0.03	3.2	0.03	5.8	0.03	8.1	0.03	10.4
0.17	0.0	0.17	3.2	0.17	5.8	0.17	8.1	0.17	10.4

z (ft)	Elev. 176 to 167	z (ft)	Elev. 167 to 161	z (ft)	Elev. 161 to 155	z (ft)	Elev. 155 to 150	z (ft)	Elev. 150 to 145
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.6	0.00	3.3	0.00	3.9	0.01	4.6	0.01	5.0
0.00	5.3	0.00	6.5	0.00	7.8	0.02	8.4	0.02	9.0
0.01	7.9	0.01	9.8	0.01	11.7	0.02	9.9	0.02	10.7
0.01	10.5	0.01	13.1	0.01	15.6	0.02	11.3	0.02	12.2
0.01	13.1	0.01	16.3	0.01	19.6	0.03	13.3	0.03	14.3
0.01	13.1	0.01	16.3	0.01	19.6	0.04	14.4	0.04	15.6
0.03	13.1	0.03	16.3	0.03	19.6	0.08	13.0	0.08	14.0
0.03	13.1	0.03	16.3	0.03	19.6	0.28	13.0	0.28	14.0
0.17	13.1	0.17	16.3	0.17	19.6	0.40	13.0	0.40	14.0

z (ft)	Elev. 145 to 141	z (ft)	Elev. 141 to 136	z (ft)	Elev. 136 to 131	z (ft)	Elev. 131 to 121	z (ft)	Elev. 121 to 111
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.01	3.2	0.01	5.4	0.00	5.6	0.00	6.0	0.00	6.0
0.02	5.8	0.02	9.8	0.00	11.2	0.00	12.1	0.00	12.1
0.02	6.9	0.02	11.6	0.01	16.7	0.01	18.1	0.01	18.1
0.02	7.8	0.02	13.2	0.01	22.3	0.01	24.1	0.01	24.1
0.03	9.2	0.03	15.5	0.01	27.9	0.01	30.2	0.01	30.2
0.04	10.1	0.04	16.9	0.01	27.9	0.01	30.2	0.01	30.2
0.08	9.0	0.08	15.2	0.03	27.9	0.03	30.2	0.03	30.2
0.28	9.0	0.28	15.2	0.03	27.9	0.03	30.2	0.03	30.2
0.40	9.0	0.40	15.2	0.17	27.9	0.17	30.2	0.17	30.2

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 26

Sta.

O. G. Elev. 204.0
Cut off Elev. 204.0
Pile 4' PP
GWS 213.0

z (ft)	*Elev. 204 to 199	z (ft)	*Elev. 199 to 194	z (ft)	Elev. 194 to 189	z (ft)	Elev. 189 to 184	z (ft)	Elev. 184 to 179
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.8	0.00	1.1	0.00	1.6
0.00	0.0	0.00	0.0	0.00	1.5	0.00	2.2	0.00	3.2
0.01	0.0	0.01	0.0	0.01	2.3	0.01	3.3	0.01	4.7
0.01	0.0	0.01	0.0	0.01	3.0	0.01	4.4	0.01	6.3
0.01	0.0	0.01	0.0	0.01	3.8	0.01	5.5	0.01	7.9
0.01	0.0	0.01	0.0	0.01	3.8	0.01	5.5	0.01	7.9
0.03	0.0	0.03	0.0	0.03	3.8	0.03	5.5	0.03	7.9
0.03	0.0	0.03	0.0	0.03	3.8	0.03	5.5	0.03	7.9
0.17	0.0	0.17	0.0	0.17	3.8	0.17	5.5	0.17	7.9

z (ft)	Elev. 179 to 169	z (ft)	Elev. 169 to 165	z (ft)	Elev. 165 to 159	z (ft)	Elev. 159 to 152	z (ft)	Elev. 152 to 148
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.01	2.8	0.01	3.6	0.00	2.4	0.01	4.1	0.00	2.7
0.02	5.0	0.02	6.5	0.00	4.7	0.02	7.5	0.00	5.3
0.02	5.9	0.02	7.6	0.01	7.1	0.02	8.9	0.01	8.0
0.02	6.7	0.02	8.7	0.01	9.5	0.02	10.1	0.01	10.6
0.03	7.9	0.03	10.2	0.01	11.8	0.03	11.9	0.01	13.3
0.04	8.6	0.04	11.1	0.01	11.8	0.04	12.9	0.01	13.3
0.08	7.8	0.08	10.0	0.03	11.8	0.08	11.6	0.03	13.3
0.28	7.8	0.28	10.0	0.03	11.8	0.28	11.6	0.03	13.3
0.40	7.8	0.40	10.0	0.17	11.8	0.40	11.6	0.17	13.3

z (ft)	Elev. 148 to 144	z (ft)	Elev. 144 to 134	z (ft)	Elev. 134 to 129	z (ft)	Elev. 129 to 124	z (ft)	Elev. 124 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.01	4.6	0.00	4.4	0.00	5.2	0.00	5.6	0.00	6.0
0.02	8.3	0.00	8.8	0.00	10.3	0.00	11.2	0.00	12.1
0.02	9.8	0.01	13.2	0.01	15.5	0.01	16.8	0.01	18.1
0.02	11.2	0.01	17.6	0.01	20.6	0.01	22.4	0.01	24.1
0.03	13.2	0.01	22.0	0.01	25.8	0.01	28.0	0.01	30.2
0.04	14.3	0.01	22.0	0.01	25.8	0.01	28.0	0.01	30.2
0.08	12.9	0.03	22.0	0.03	25.8	0.03	28.0	0.03	30.2
0.28	12.9	0.03	22.0	0.03	25.8	0.03	28.0	0.03	30.2
0.40	12.9	0.17	22.0	0.17	25.8	0.17	28.0	0.17	30.2

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 27

Sta.

O. G. Elev. 202.0
Cut off Elev. 202.0
Pile 4' PP
GWS 213.0

z (ft)	*Elev. 202 to 197	z (ft)	*Elev. 197 to 192	z (ft)	*Elev. 192 to 187	z (ft)	Elev. 187 to 182	z (ft)	Elev. 182 to 177
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.0	0.00	1.1	0.00	1.6
0.00	0.0	0.00	0.0	0.00	0.0	0.00	2.3	0.00	3.2
0.01	0.0	0.01	0.0	0.01	0.0	0.01	3.4	0.01	4.8
0.01	0.0	0.01	0.0	0.01	0.0	0.01	4.5	0.01	6.5
0.01	0.0	0.01	0.0	0.01	0.0	0.01	5.7	0.01	8.1
0.01	0.0	0.01	0.0	0.01	0.0	0.01	5.7	0.01	8.1
0.03	0.0	0.03	0.0	0.03	0.0	0.03	5.7	0.03	8.1
0.03	0.0	0.03	0.0	0.03	0.0	0.03	5.7	0.03	8.1
0.17	0.0	0.17	0.0	0.17	0.0	0.17	5.7	0.17	8.1

z (ft)	*Elev. 177 to 173	z (ft)	Elev. 173 to 169	z (ft)	Elev. 169 to 164	z (ft)	Elev. 164 to 157	z (ft)	Elev. 157 to 149
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	2.3	0.00	2.8	0.00	3.5	0.00	3.7
0.00	0.0	0.00	4.6	0.00	5.6	0.00	6.9	0.00	7.4
0.01	0.0	0.01	6.8	0.01	8.3	0.01	10.4	0.01	11.1
0.01	0.0	0.01	9.1	0.01	11.1	0.01	13.9	0.01	14.8
0.01	0.0	0.01	11.4	0.01	13.9	0.01	17.3	0.01	18.5
0.01	0.0	0.01	11.4	0.01	13.9	0.01	17.3	0.01	18.5
0.03	0.0	0.03	11.4	0.03	13.9	0.03	17.3	0.03	18.5
0.03	0.0	0.03	11.4	0.03	13.9	0.03	17.3	0.03	18.5
0.17	0.0	0.17	11.4	0.17	13.9	0.17	17.3	0.17	18.5

z (ft)	Elev. 149 to 143	z (ft)	Elev. 143 to 137	z (ft)	Elev. 137 to 127	z (ft)	Elev. 127 to 121	z (ft)	Elev. 121 to 109
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	4.4	0.00	4.9	0.00	5.5	0.00	5.2	0.00	6.0
0.00	8.8	0.00	9.8	0.00	11.0	0.00	10.5	0.00	12.1
0.01	13.2	0.01	14.7	0.01	16.5	0.01	15.7	0.01	18.1
0.01	17.6	0.01	19.6	0.01	22.0	0.01	20.9	0.01	24.1
0.01	22.0	0.01	24.4	0.01	27.5	0.01	26.2	0.01	30.2
0.01	22.0	0.01	24.4	0.01	27.5	0.01	26.2	0.01	30.2
0.03	22.0	0.03	24.4	0.03	27.5	0.03	26.2	0.03	30.2
0.03	22.0	0.03	24.4	0.03	27.5	0.03	26.2	0.03	30.2
0.17	22.0	0.17	24.4	0.17	27.5	0.17	26.2	0.17	30.2

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 28

Sta.

O. G. Elev. 208.0
Cut off Elev. 208.0
Pile 4' PP
GWS 213.0

z (ft)	*Elev. 208 to 202	z (ft)	*Elev. 202 to 196	z (ft)	*Elev. 196 to 193	z (ft)	*Elev. 193 to 184	z (ft)	Elev. 184 to 178
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	1.9
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	3.7
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	5.6
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	7.4
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	9.3
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	9.3
0.03	0.0	0.03	0.0	0.03	0.0	0.03	0.0	0.03	9.3
0.03	0.0	0.03	0.0	0.03	0.0	0.03	0.0	0.03	9.3
0.17	0.0	0.17	0.0	0.17	0.0	0.17	0.0	0.17	9.3

z (ft)	Elev. 178 to 171	z (ft)	Elev. 171 to 167	z (ft)	Elev. 167 to 161	z (ft)	Elev. 161 to 156	z (ft)	Elev. 156 to 151
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.5	0.00	3.1	0.00	3.3	0.00	3.6	0.00	4.0
0.00	5.1	0.00	6.3	0.00	6.5	0.00	7.3	0.00	7.9
0.01	7.6	0.01	9.4	0.01	9.8	0.01	10.9	0.01	11.9
0.01	10.1	0.01	12.6	0.01	13.1	0.01	14.5	0.01	15.8
0.01	12.6	0.01	15.7	0.01	16.4	0.01	18.1	0.01	19.8
0.01	12.6	0.01	15.7	0.01	16.4	0.01	18.1	0.01	19.8
0.03	12.6	0.03	15.7	0.03	16.4	0.03	18.1	0.03	19.8
0.03	12.6	0.03	15.7	0.03	16.4	0.03	18.1	0.03	19.8
0.17	12.6	0.17	15.7	0.17	16.4	0.17	18.1	0.17	19.8

z (ft)	Elev. 151 to 142	z (ft)	Elev. 142 to 135	z (ft)	Elev. 135 to 128	z (ft)	Elev. 128 to 121	z (ft)	Elev. 121 to 114
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	4.7	0.00	5.7	0.00	6.0	0.00	6.0	0.00	6.0
0.00	9.3	0.00	11.4	0.00	12.1	0.00	12.1	0.00	12.1
0.01	14.0	0.01	17.1	0.01	18.1	0.01	18.1	0.01	18.1
0.01	18.7	0.01	22.7	0.01	24.1	0.01	24.1	0.01	24.1
0.01	23.3	0.01	28.4	0.01	30.2	0.01	30.2	0.01	30.2
0.01	23.3	0.01	28.4	0.01	30.2	0.01	30.2	0.01	30.2
0.03	23.3	0.03	28.4	0.03	30.2	0.03	30.2	0.03	30.2
0.03	23.3	0.03	28.4	0.03	30.2	0.03	30.2	0.03	30.2
0.17	23.3	0.17	28.4	0.17	30.2	0.17	30.2	0.17	30.2

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 29

Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0

z (ft)	*Elev. 208 to 202	z (ft)	*Elev. 202 to 196	z (ft)	*Elev. 196 to 193	z (ft)	*Elev. 193 to 184	z (ft)	Elev. 184 to 178
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	1.9
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	3.7
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	5.6
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	7.4
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	9.3
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	9.3
0.03	0.0	0.03	0.0	0.03	0.0	0.03	0.0	0.03	9.3
0.03	0.0	0.03	0.0	0.03	0.0	0.03	0.0	0.03	9.3
0.17	0.0	0.17	0.0	0.17	0.0	0.17	0.0	0.17	9.3

z (ft)	Elev. 178 to 171	z (ft)	Elev. 171 to 167	z (ft)	Elev. 167 to 161	z (ft)	Elev. 161 to 156	z (ft)	Elev. 156 to 151
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.5	0.00	3.1	0.00	3.3	0.00	3.6	0.00	4.0
0.00	5.1	0.00	6.3	0.00	6.5	0.00	7.3	0.00	7.9
0.01	7.6	0.01	9.4	0.01	9.8	0.01	10.9	0.01	11.9
0.01	10.1	0.01	12.6	0.01	13.1	0.01	14.5	0.01	15.8
0.01	12.6	0.01	15.7	0.01	16.4	0.01	18.1	0.01	19.8
0.01	12.6	0.01	15.7	0.01	16.4	0.01	18.1	0.01	19.8
0.03	12.6	0.03	15.7	0.03	16.4	0.03	18.1	0.03	19.8
0.03	12.6	0.03	15.7	0.03	16.4	0.03	18.1	0.03	19.8
0.17	12.6	0.17	15.7	0.17	16.4	0.17	18.1	0.17	19.8

z (ft)	Elev. 151 to 142	z (ft)	Elev. 142 to 135	z (ft)	Elev. 135 to 128	z (ft)	Elev. 128 to 121	z (ft)	Elev. 121 to 114
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	4.7	0.00	5.7	0.00	6.0	0.00	6.0	0.00	6.0
0.00	9.3	0.00	11.4	0.00	12.1	0.00	12.1	0.00	12.1
0.01	14.0	0.01	17.1	0.01	18.1	0.01	18.1	0.01	18.1
0.01	18.7	0.01	22.7	0.01	24.1	0.01	24.1	0.01	24.1
0.01	23.3	0.01	28.4	0.01	30.2	0.01	30.2	0.01	30.2
0.01	23.3	0.01	28.4	0.01	30.2	0.01	30.2	0.01	30.2
0.03	23.3	0.03	28.4	0.03	30.2	0.03	30.2	0.03	30.2
0.03	23.3	0.03	28.4	0.03	30.2	0.03	30.2	0.03	30.2
0.17	23.3	0.17	28.4	0.17	30.2	0.17	30.2	0.17	30.2

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Abut 30

Sta.

O. G. Elev. 231.0
Cut off Elev. 231.0

Pile 4' PP
GWS 213.0

z (ft)	Elev. 231 to 225	z (ft)	Elev. 225 to 220	z (ft)	Elev. 220 to 217	z (ft)	Elev. 217 to 210	z (ft)	Elev. 210 to 205
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.3	0.00	0.9	0.00	1.4	0.00	1.9	0.00	2.9
0.00	0.6	0.00	1.7	0.00	2.9	0.00	3.7	0.00	5.7
0.01	0.9	0.01	2.6	0.01	4.3	0.01	5.6	0.01	8.6
0.01	1.2	0.01	3.4	0.01	5.7	0.01	7.5	0.01	11.4
0.01	1.5	0.01	4.3	0.01	7.2	0.01	9.4	0.01	14.3
0.01	1.5	0.01	4.3	0.01	7.2	0.01	9.4	0.01	14.3
0.03	1.5	0.03	4.3	0.03	7.2	0.03	9.4	0.03	14.3
0.03	1.5	0.03	4.3	0.03	7.2	0.03	9.4	0.03	14.3
0.17	1.5	0.17	4.3	0.17	7.2	0.17	9.4	0.17	14.3

z (ft)	Elev. 205 to 201	z (ft)	*Elev. 201 to 196	z (ft)	*Elev. 196 to 192	z (ft)	*Elev. 192 to 185	z (ft)	Elev. 185 to 180
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.8	0.00	0.0	0.00	0.0	0.00	0.0	0.00	4.4
0.00	5.7	0.00	0.0	0.00	0.0	0.00	0.0	0.00	8.7
0.01	8.5	0.01	0.0	0.01	0.0	0.01	0.0	0.01	13.1
0.01	11.4	0.01	0.0	0.01	0.0	0.01	0.0	0.01	17.4
0.01	14.2	0.01	0.0	0.01	0.0	0.01	0.0	0.01	21.8
0.01	14.2	0.01	0.0	0.01	0.0	0.01	0.0	0.01	21.8
0.03	14.2	0.03	0.0	0.03	0.0	0.03	0.0	0.03	21.8
0.03	14.2	0.03	0.0	0.03	0.0	0.03	0.0	0.03	21.8
0.17	14.2	0.17	0.0	0.17	0.0	0.17	0.0	0.17	21.8

z (ft)	Elev. 180 to 174	z (ft)	Elev. 174 to 166	z (ft)	Elev. 166 to 161	z (ft)	Elev. 161 to 151	z (ft)	Elev. 151 to 138
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	4.7	0.00	5.8	0.00	4.6	0.00	4.9	0.00	4.8
0.00	9.5	0.00	11.6	0.00	9.2	0.00	9.7	0.00	9.5
0.01	14.2	0.01	17.5	0.01	13.8	0.01	14.6	0.01	14.3
0.01	18.9	0.01	23.3	0.01	18.4	0.01	19.5	0.01	19.1
0.01	23.7	0.01	29.1	0.01	22.9	0.01	24.4	0.01	23.8
0.01	23.7	0.01	29.1	0.01	22.9	0.01	24.4	0.01	23.8
0.03	23.7	0.03	29.1	0.03	22.9	0.03	24.4	0.03	23.8
0.03	23.7	0.03	29.1	0.03	22.9	0.03	24.4	0.03	23.8
0.17	23.7	0.17	29.1	0.17	22.9	0.17	24.4	0.17	23.8

Note - t (kip/ft)
*-Liquefiable layer

Appendix E

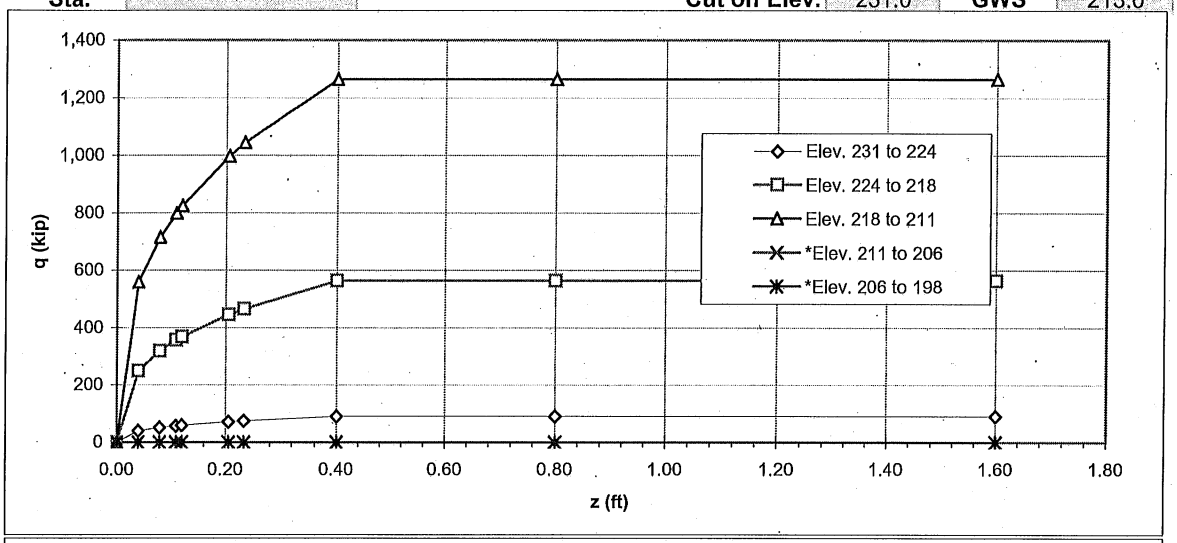
Tip Resistance, q-z Curves

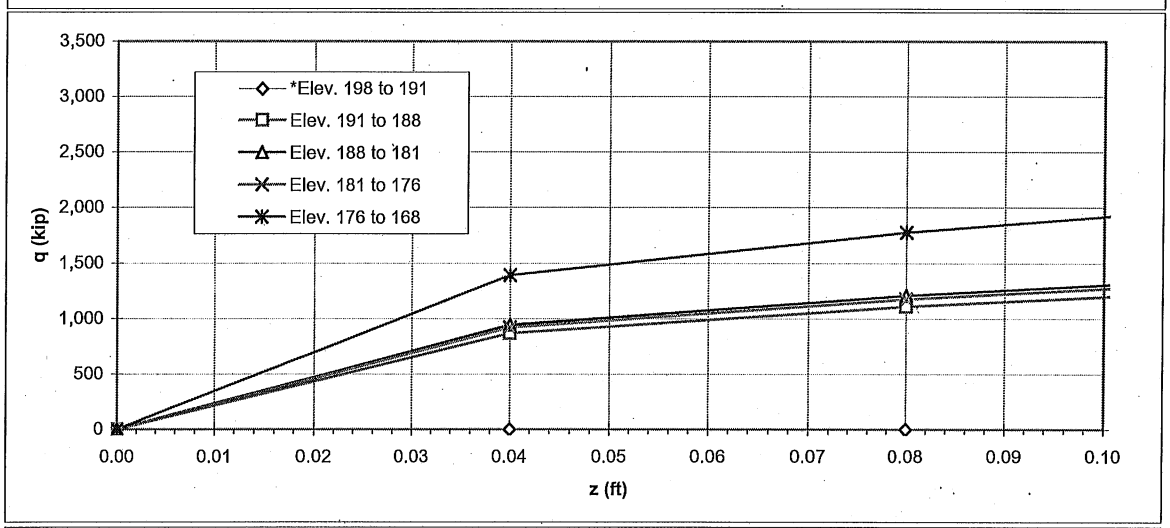
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

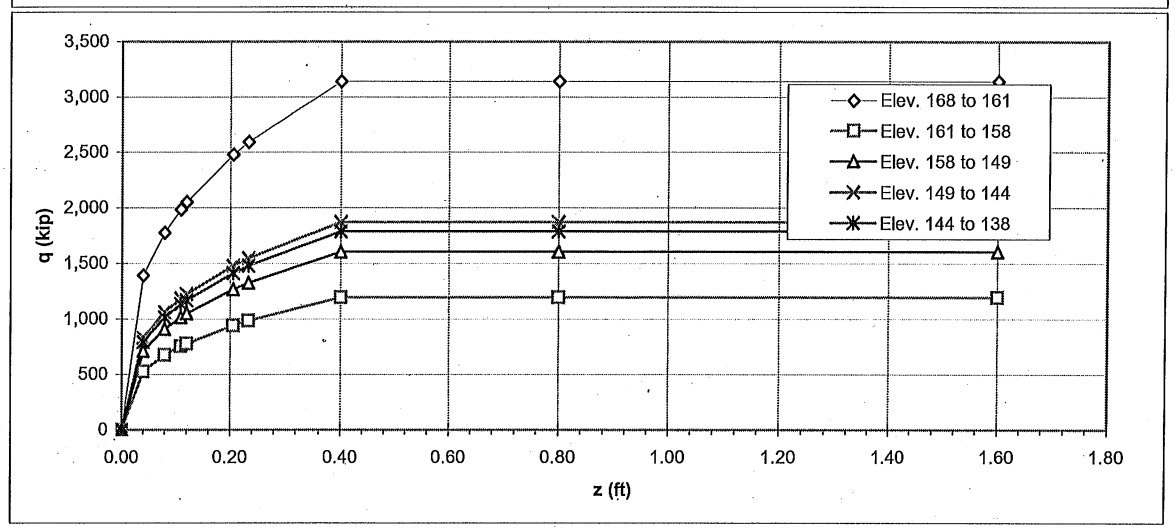
Abut 1

Sta.

O. G. Elev.	231.0	**Pile**	**4" PP**
Cut off Elev.	231.0	**GWS**	213.0







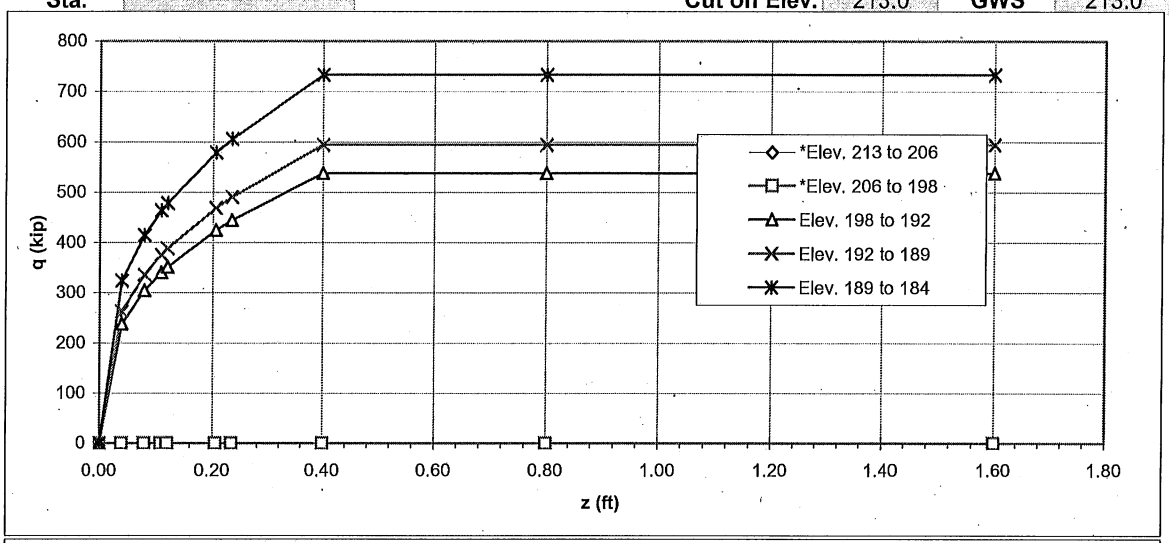
*-Liquefiable layer

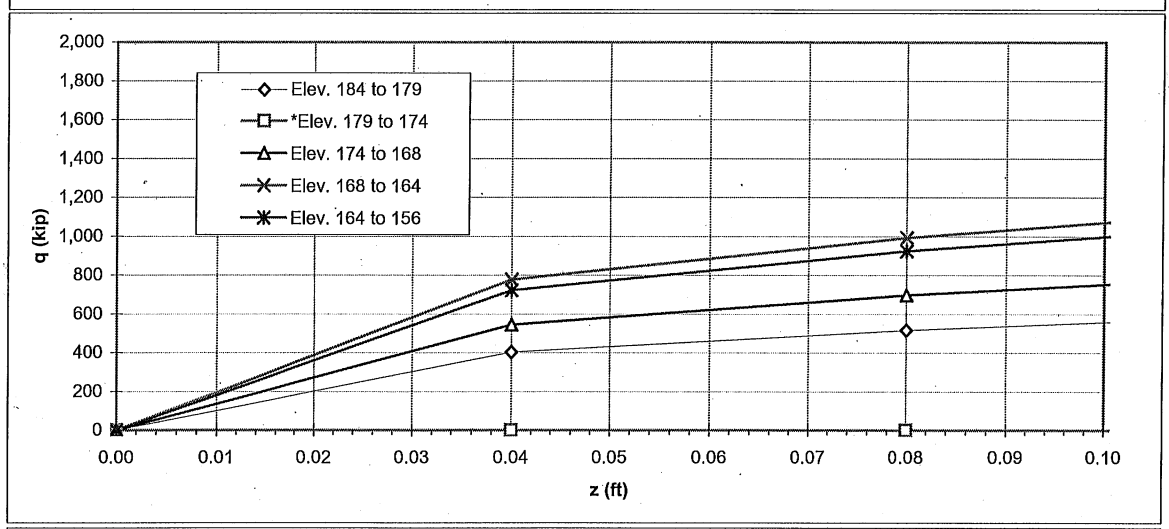
q-z Curves

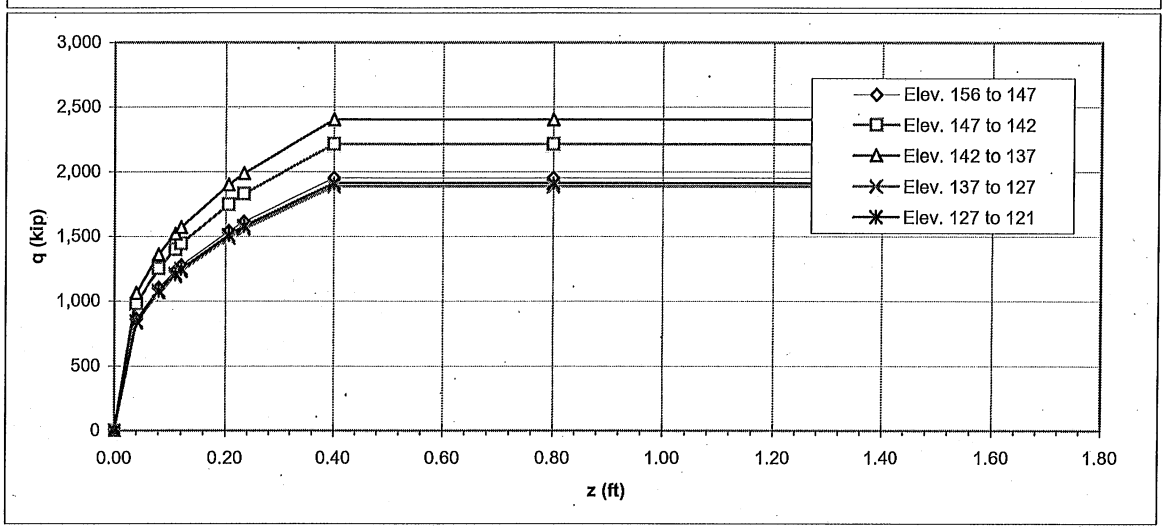
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 2

Sta.		**O. G. Elev.**	213.0	**Pile**	4" PP
		Cut off Elev.	213.0	**GWS**	213.0







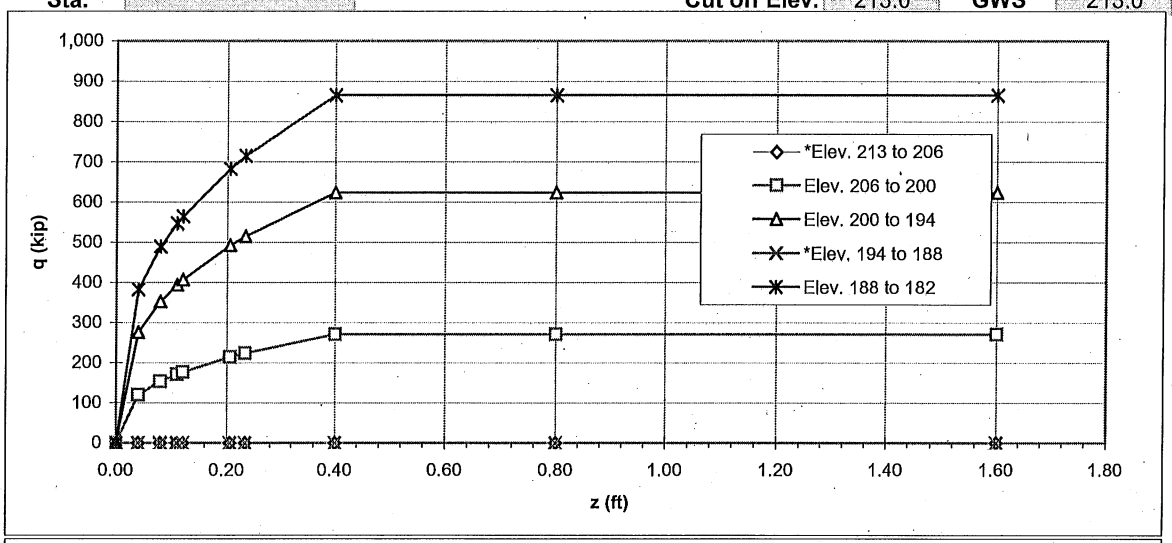
*-Liquefiable layer

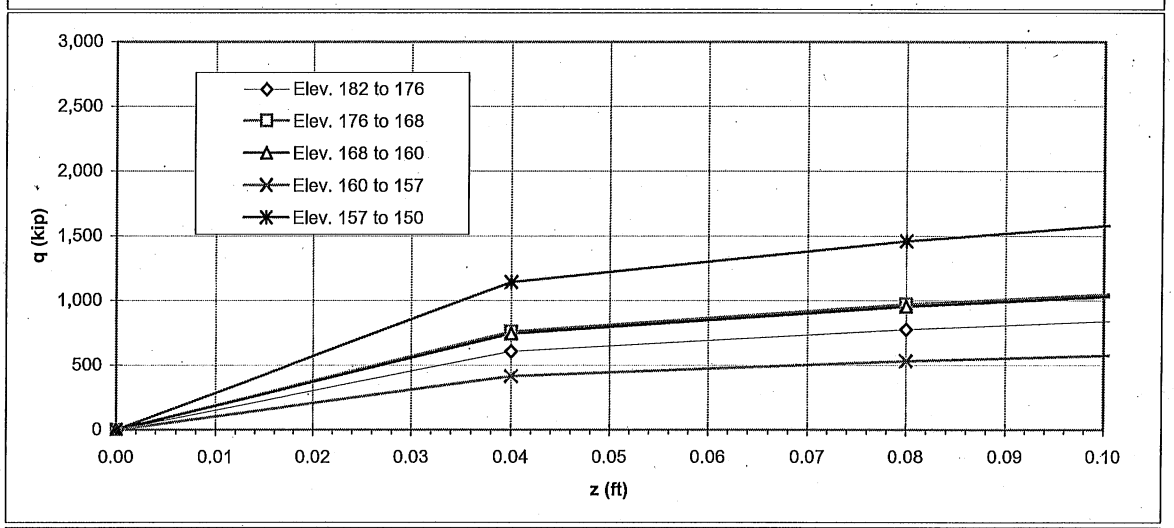
q-z Curves

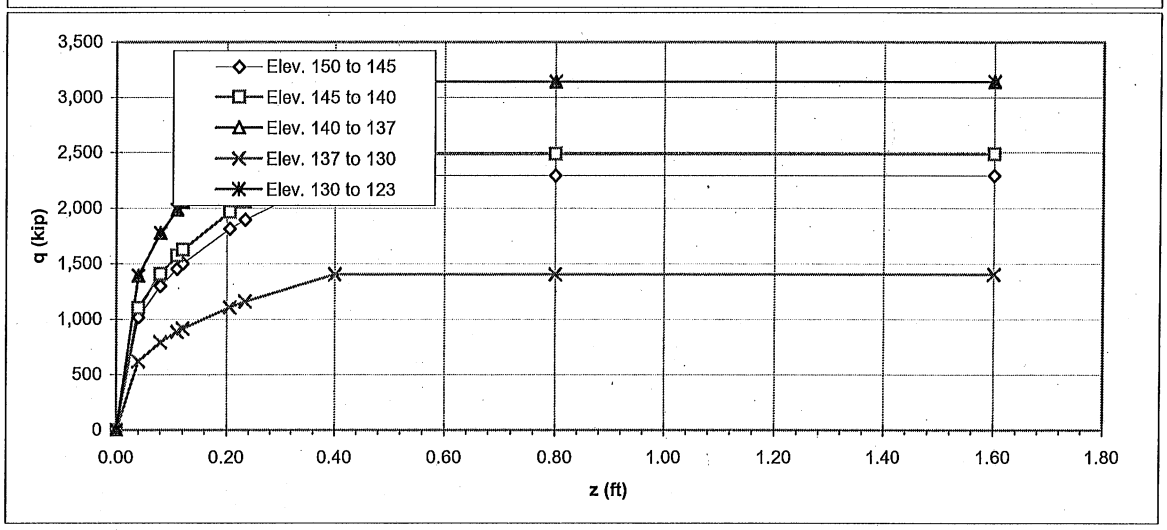
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 3

Sta.		**O. G. Elev.**	213.0	**Pile**	4" PP
		Cut off Elev.	213.0	**GWS**	213.0







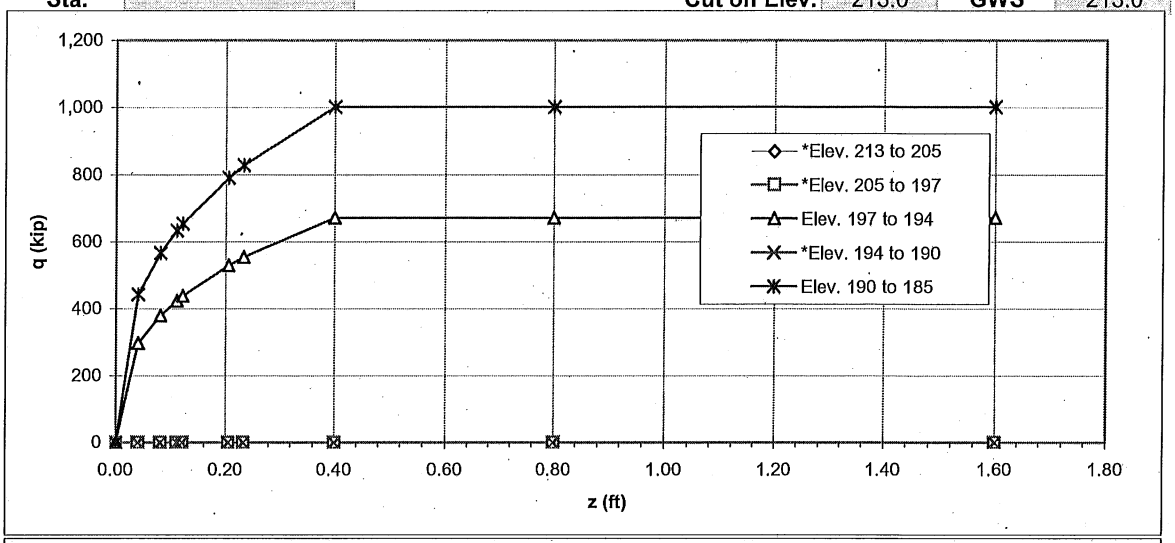
*-Liquefiable layer

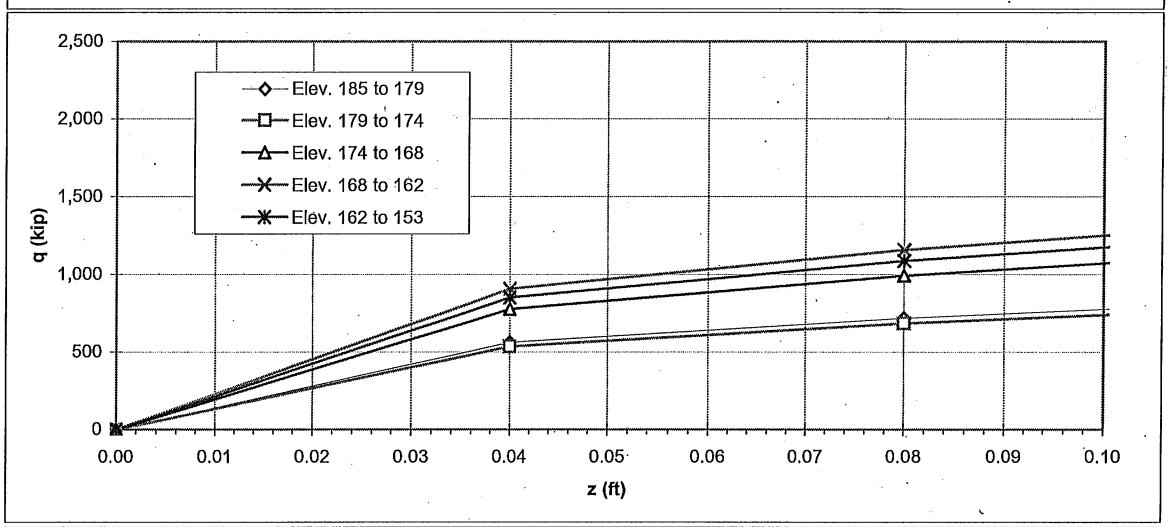
q-z Curves

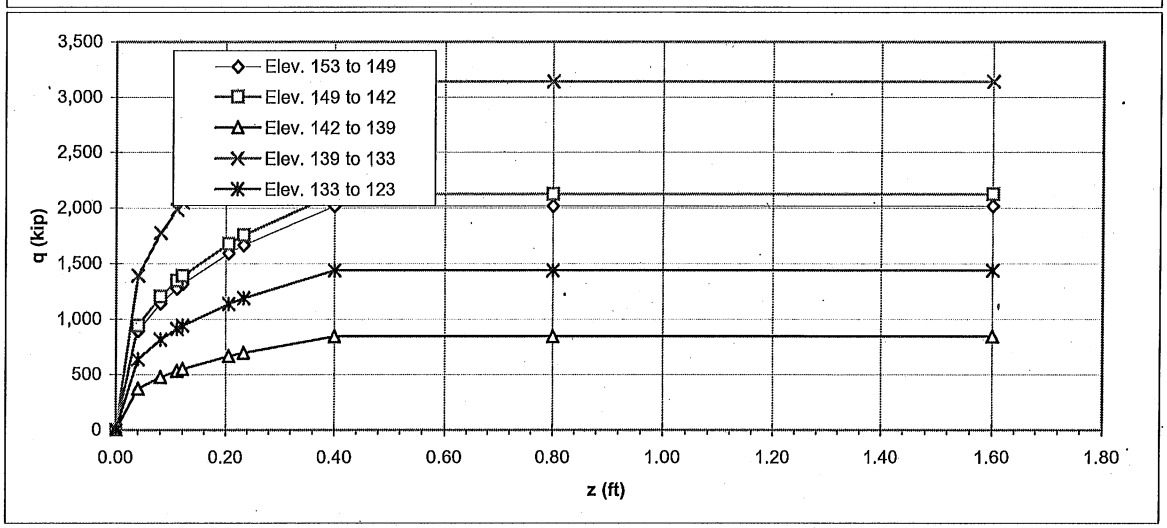
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 4

Sta.		**O. G. Elev.**	213.0	**Pile**	**4" PP**
		Cut off Elev.	213.0	**GWS**	213.0







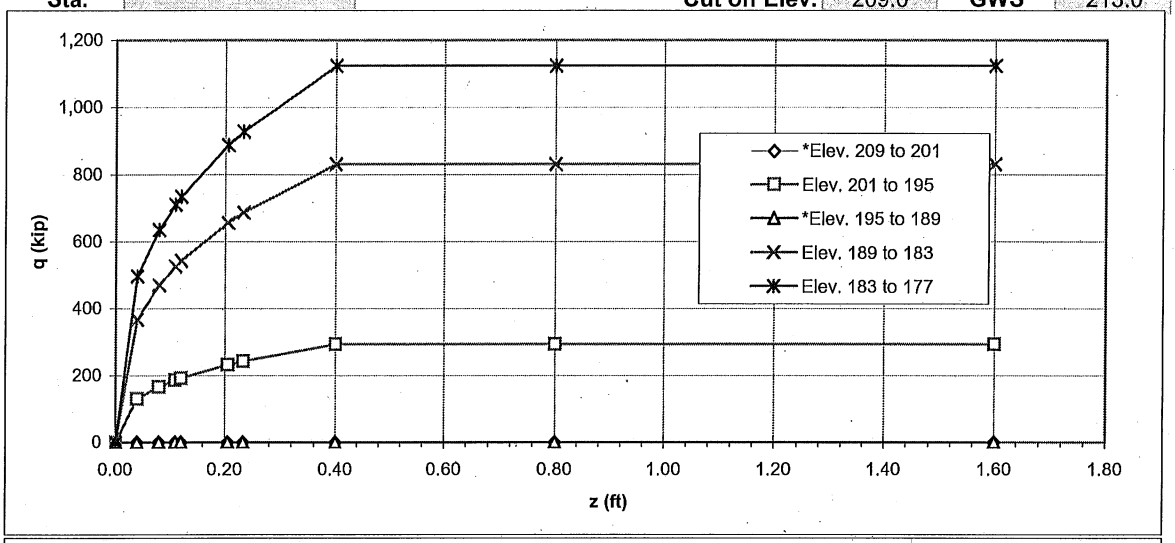
*-Liquefiable layer

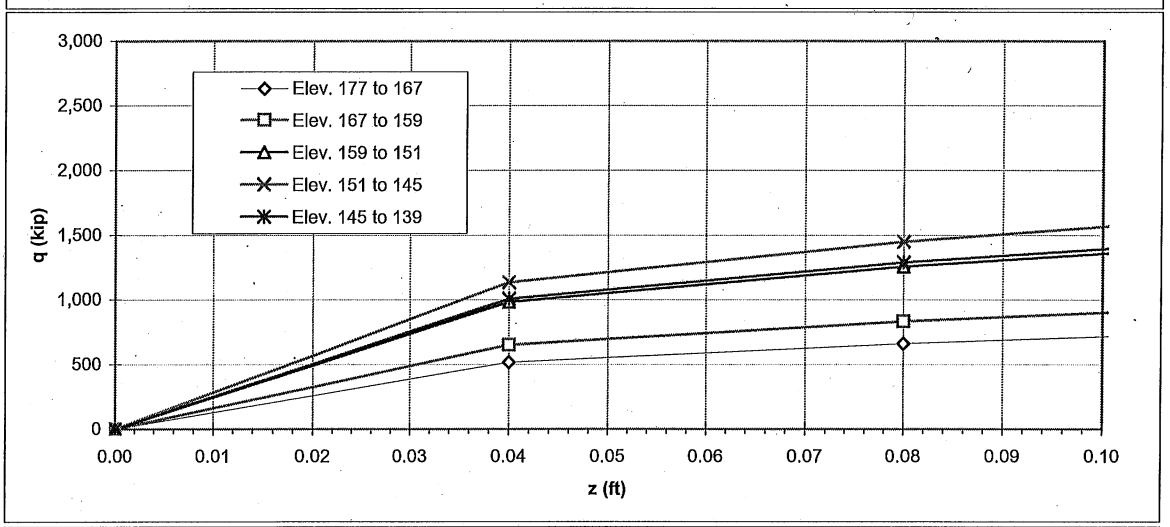
q-z Curves

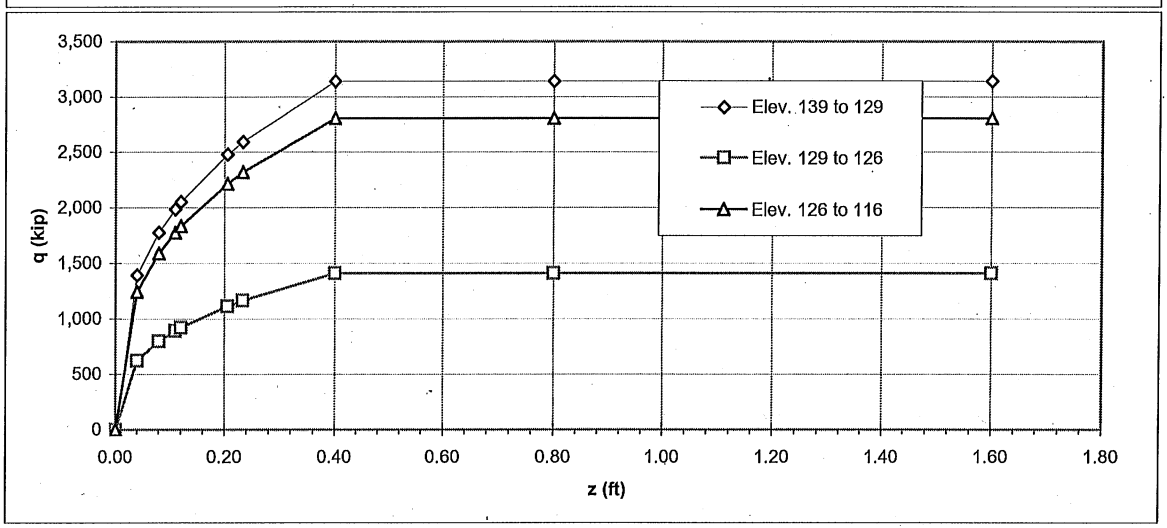
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 5

Sta.		**O. G. Elev.**	209.0	**Pile**	**4" PP**
		Cut off Elev.	209.0	**GWS**	213.0







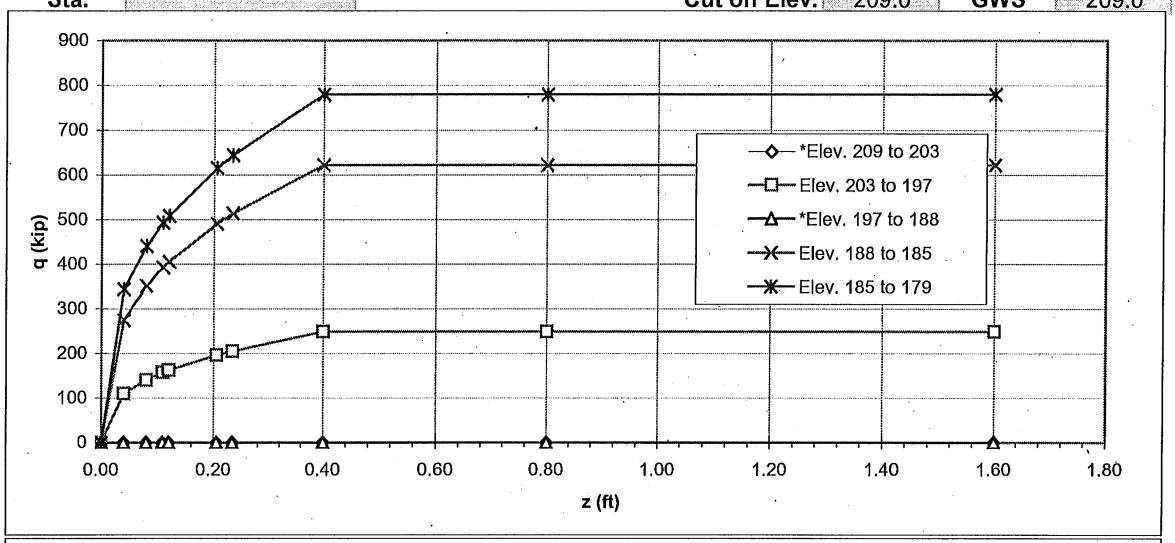
*-Liquefiable layer

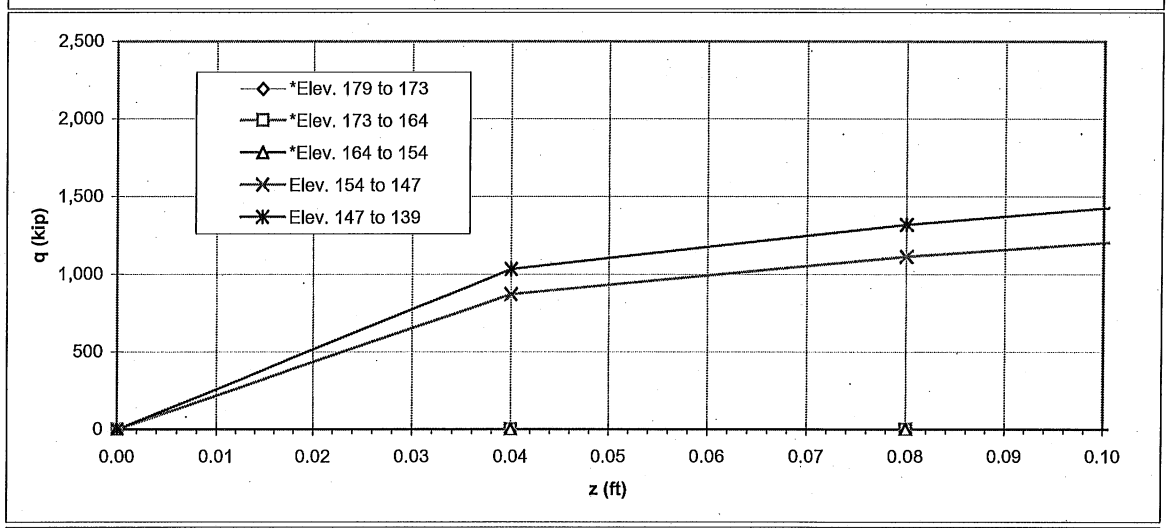
q-z Curves

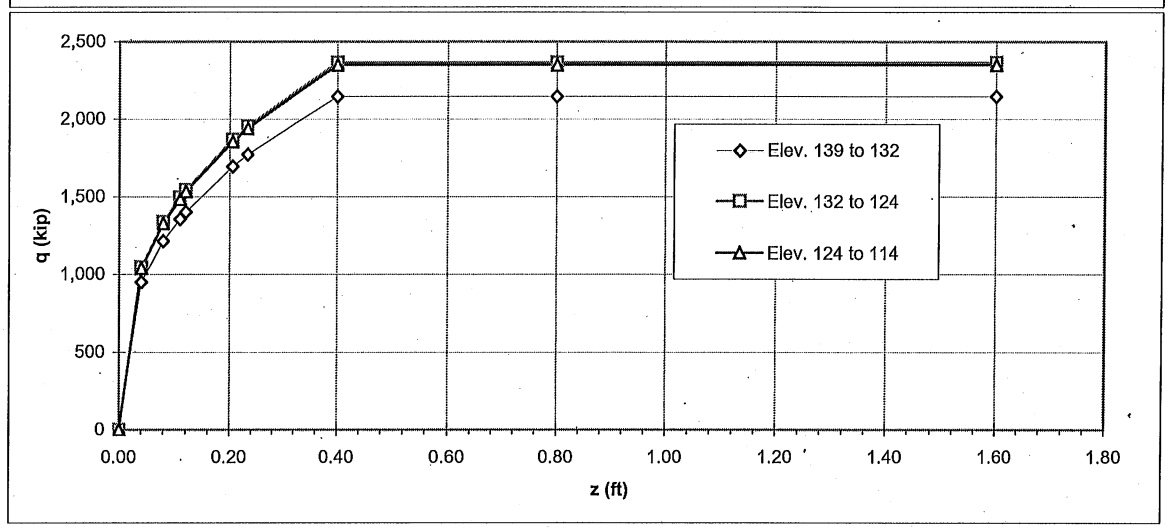
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 6

Sta.		**O. G. Elev.**	209.0	**Pile**	**4" PP**
		Cut off Elev.	209.0	**GWS**	209.0







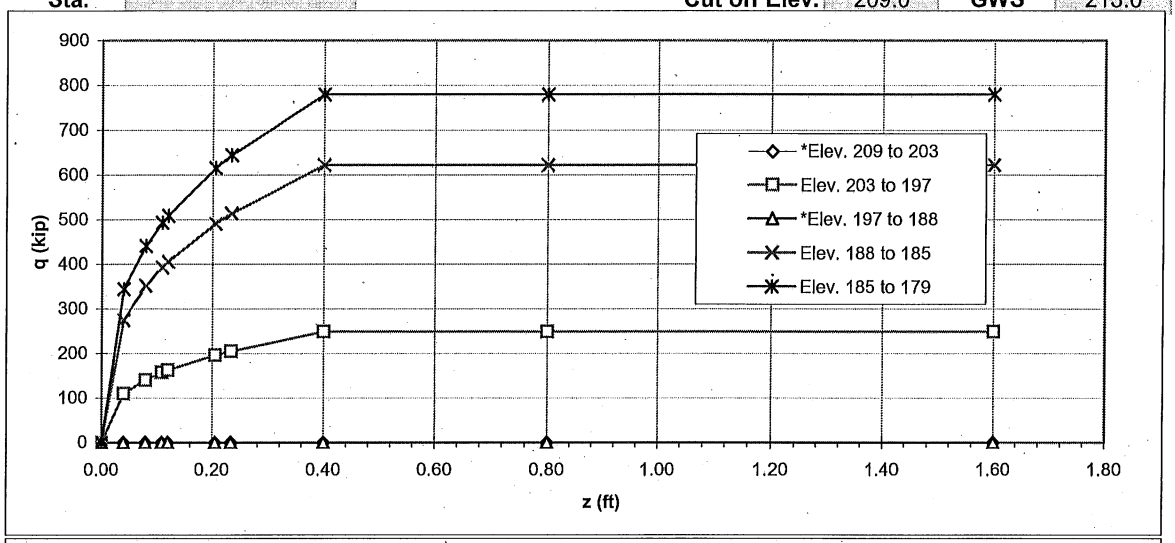
*-Liquefiable layer

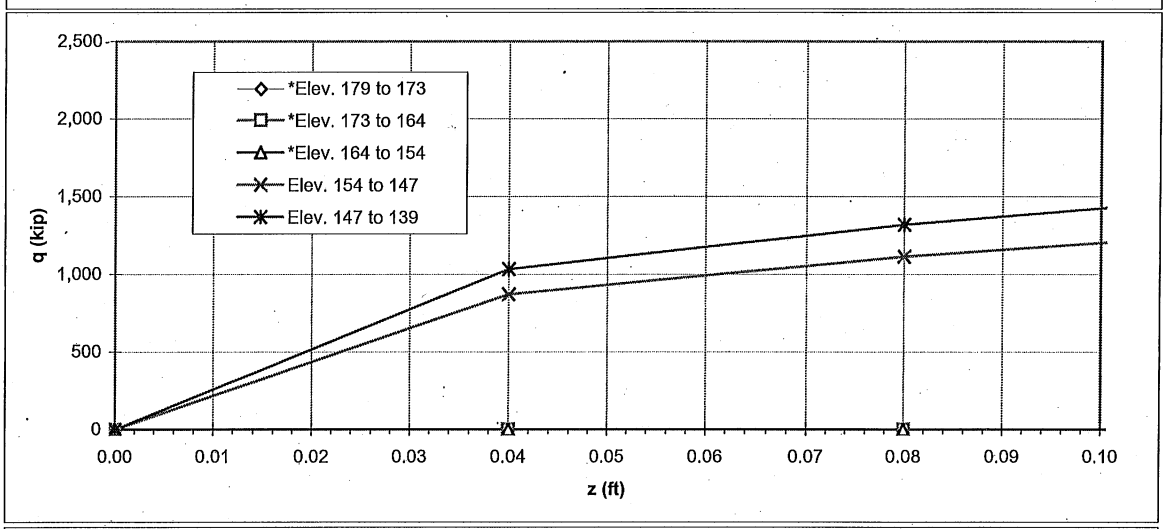
q-z Curves

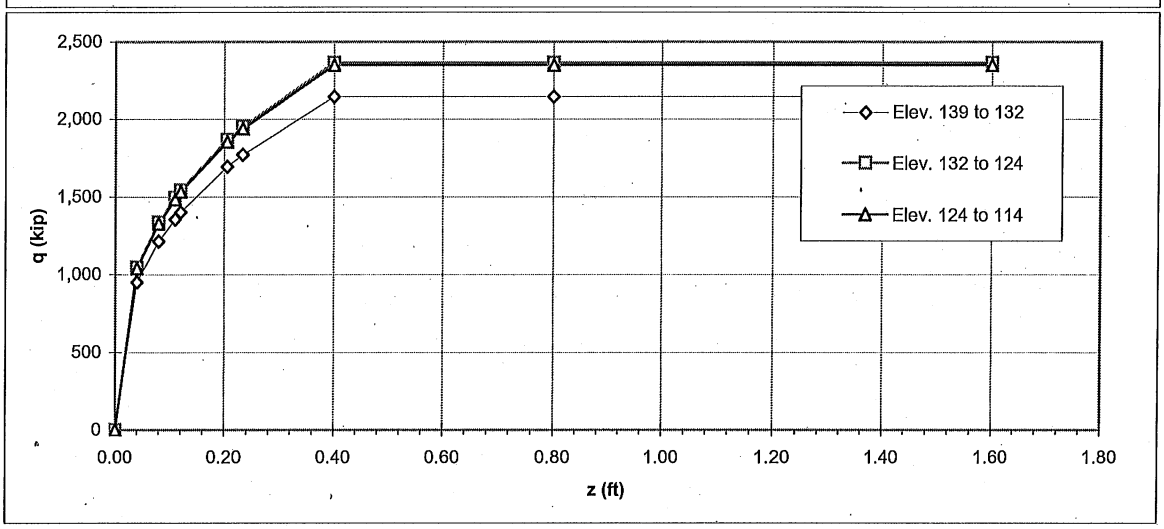
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 7

Sta.		**O. G. Elev.**	209.0	**Pile**	**4" PP**
		Cut off Elev.	209.0	**GWS**	213.0







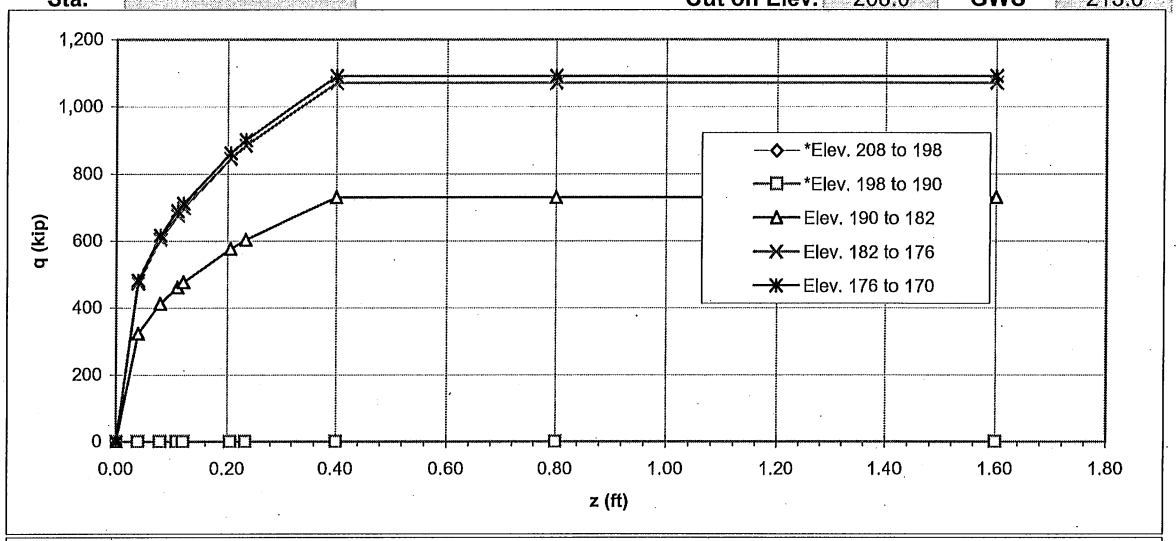
*-Liquefiable layer

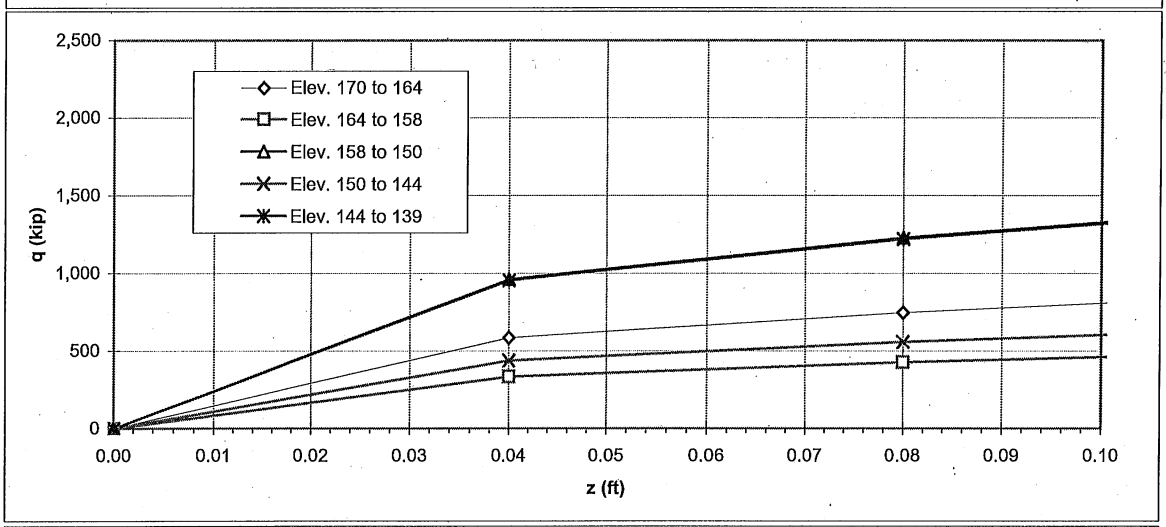
q-z Curves

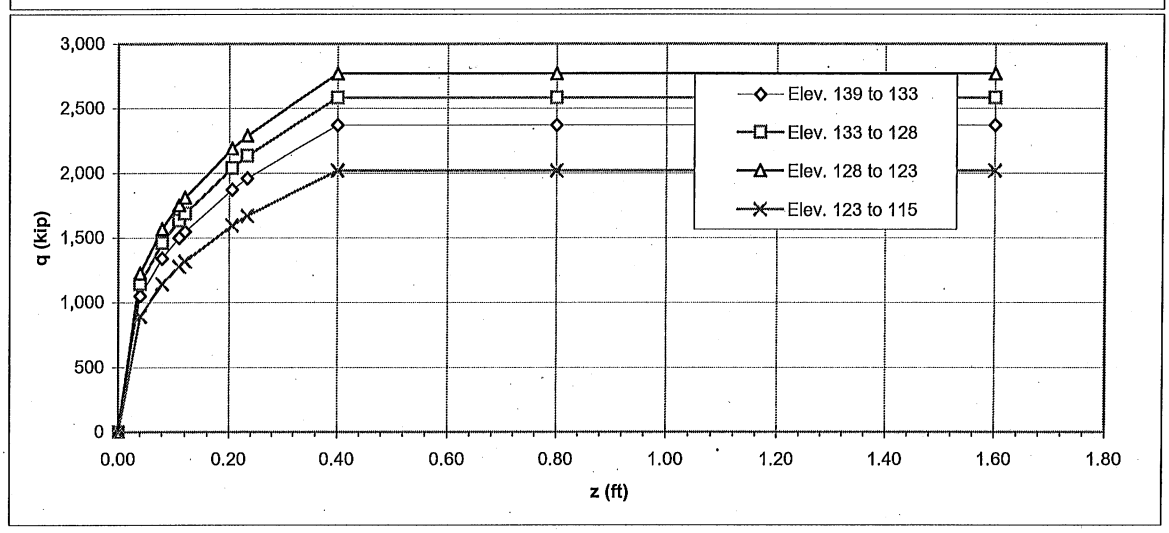
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 8
Sta.

O. G. Elev.	208.0	**Pile**	**4" PP**
Cut off Elev.	208.0	**GWS**	213.0







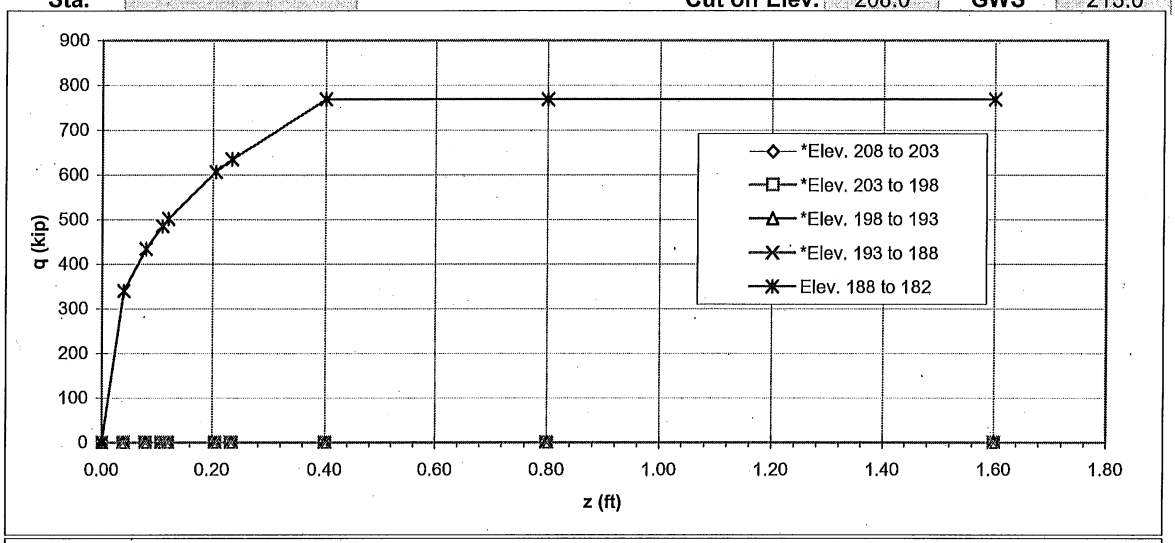
*-Liquefiable layer

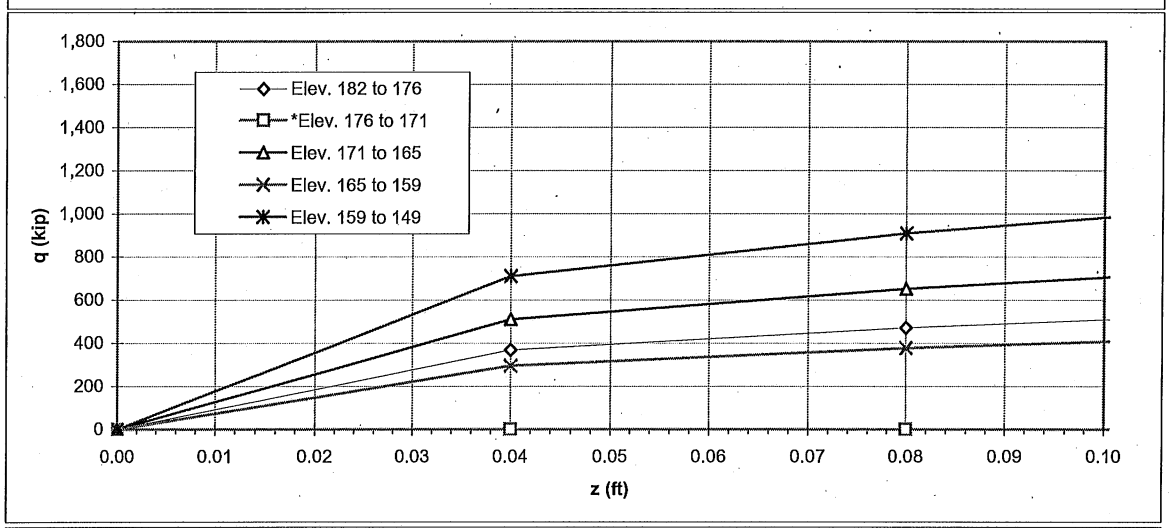
q-z Curves

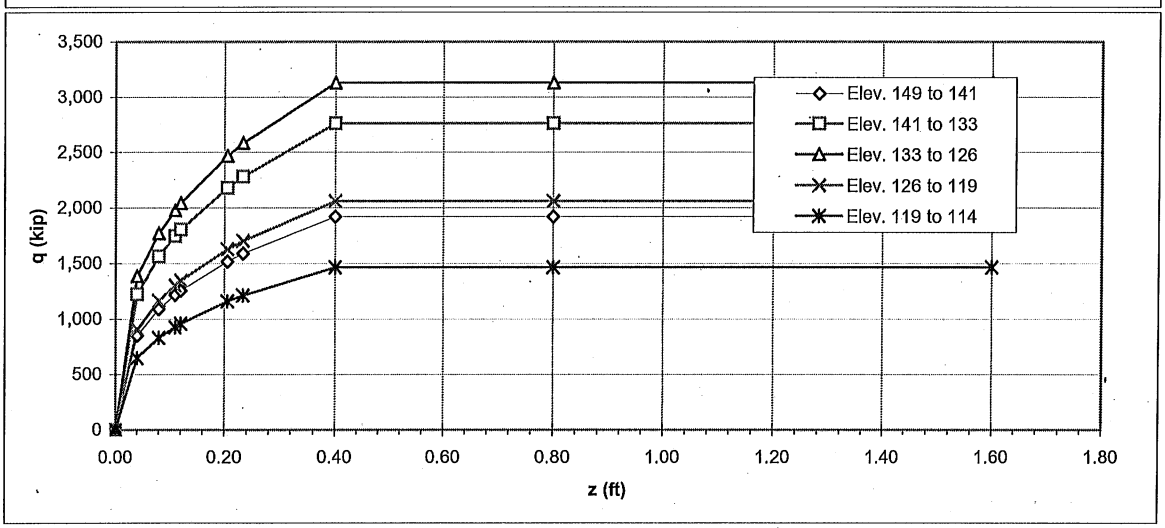
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 9

Sta.		**O. G. Elev.**	208.0	**Pile**	**4' PP**
		Cut off Elev.	208.0	**GWS**	213.0







*-Liquefiable layer

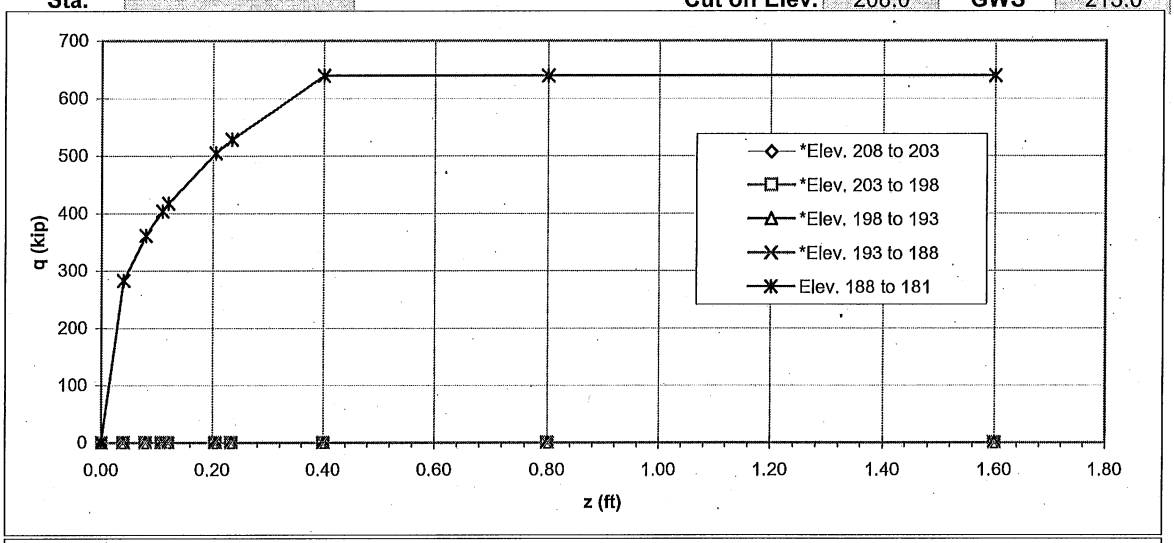
q-z Curves

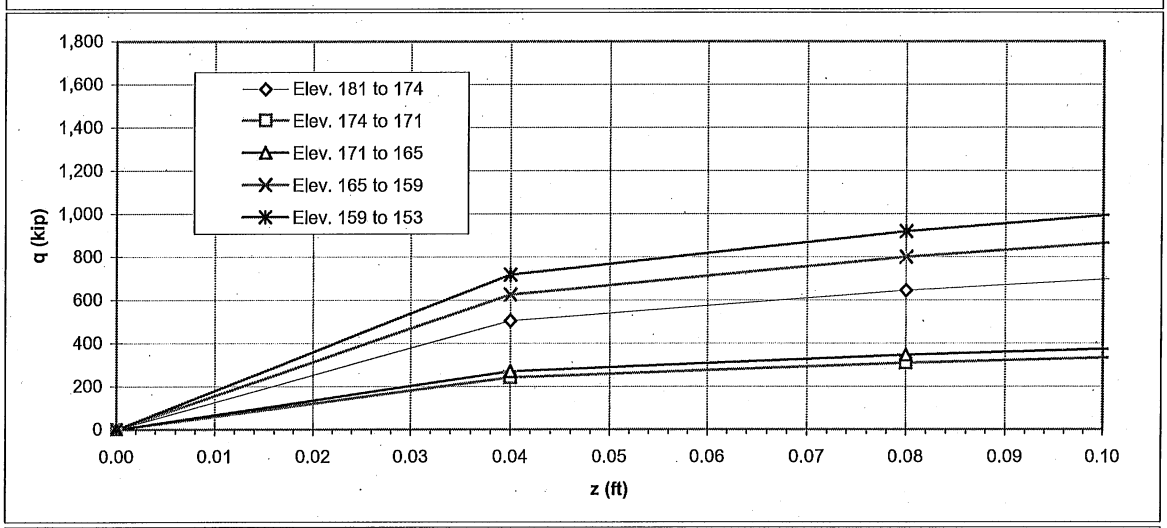
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

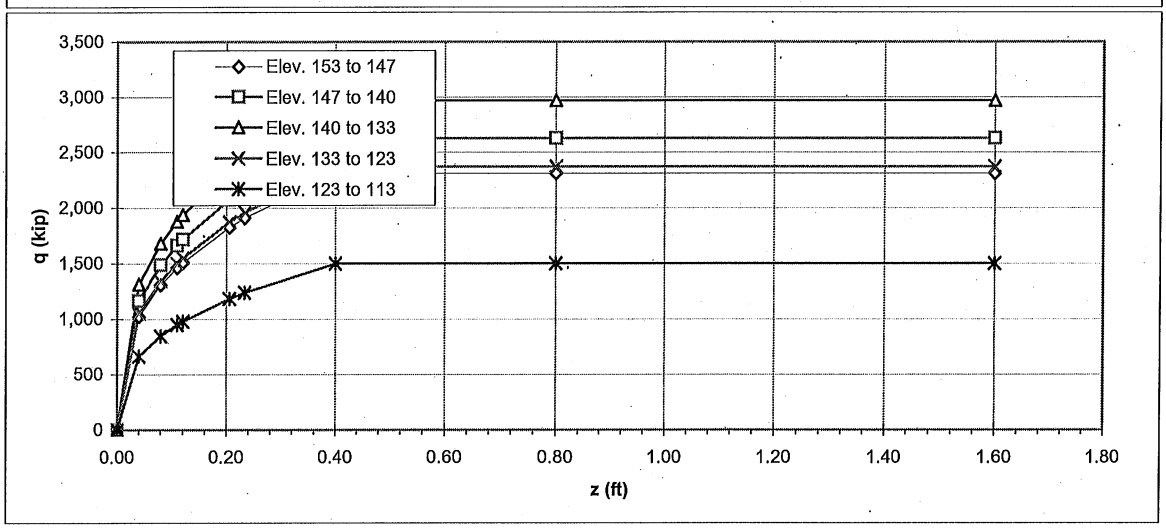
Pier 10

Sta.

O. G. Elev.	208.0	**Pile**	**4' PP**
Cut off Elev.	208.0	**GWS**	213.0







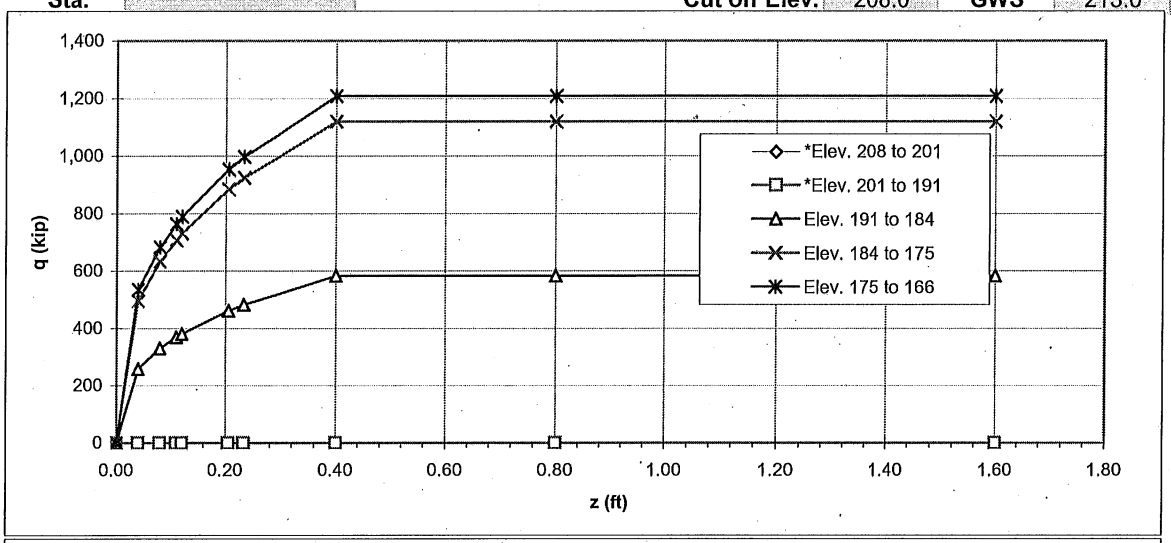
*-Liquefiable layer

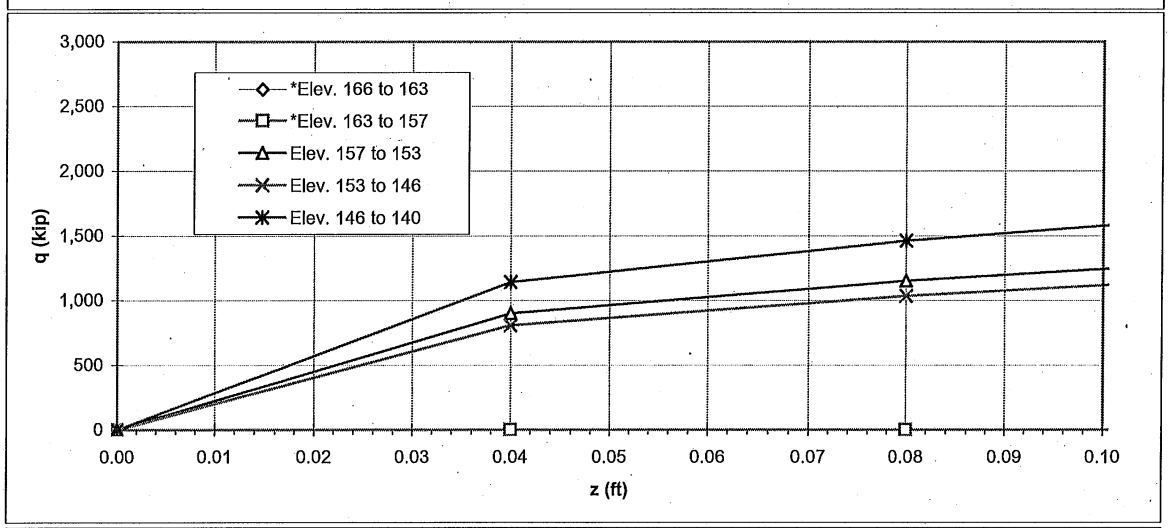
q-z Curves

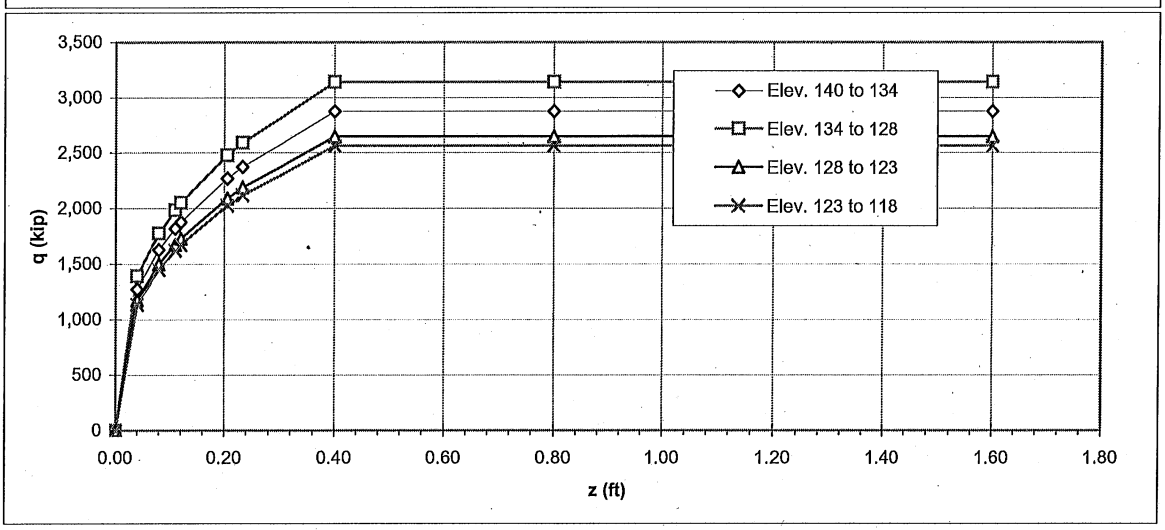
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 11

Sta.		**O. G. Elev.**	208.0	**Pile**	4' PP
		Cut off Elev.	208.0	**GWS**	213.0







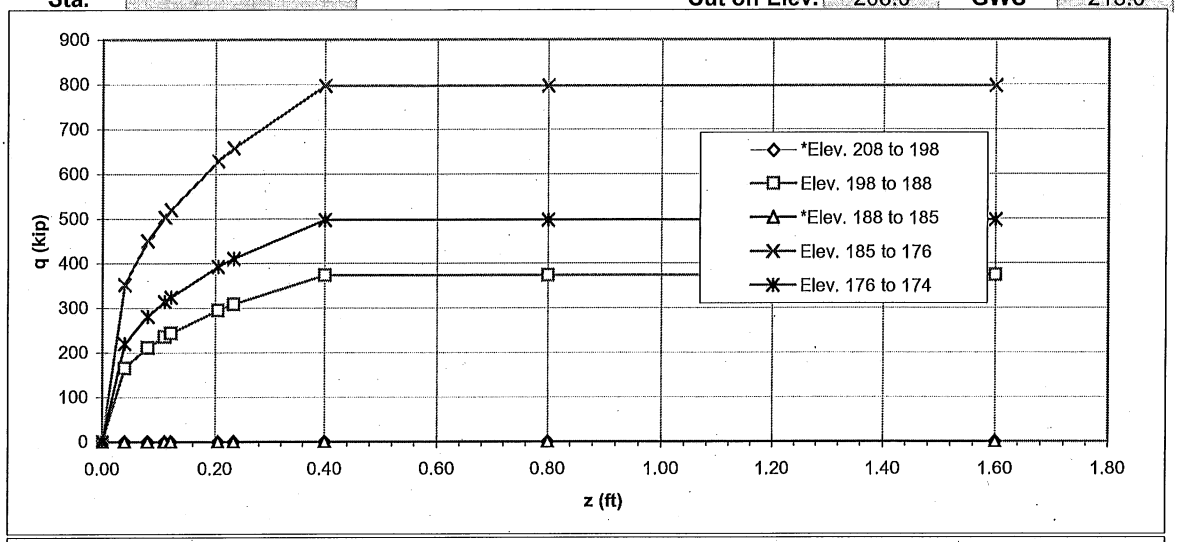
*-Liquefiable layer

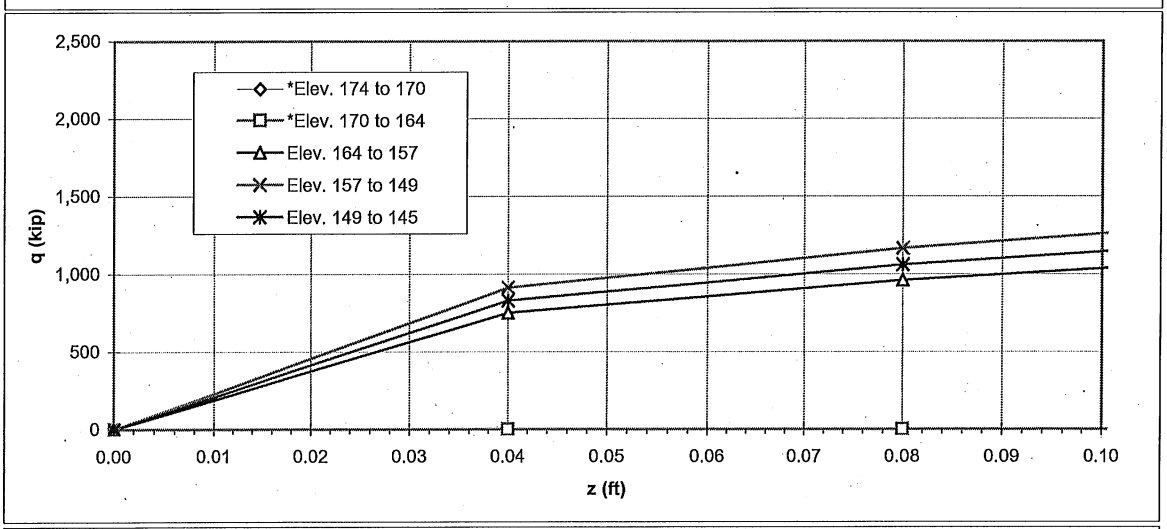
q-z Curves

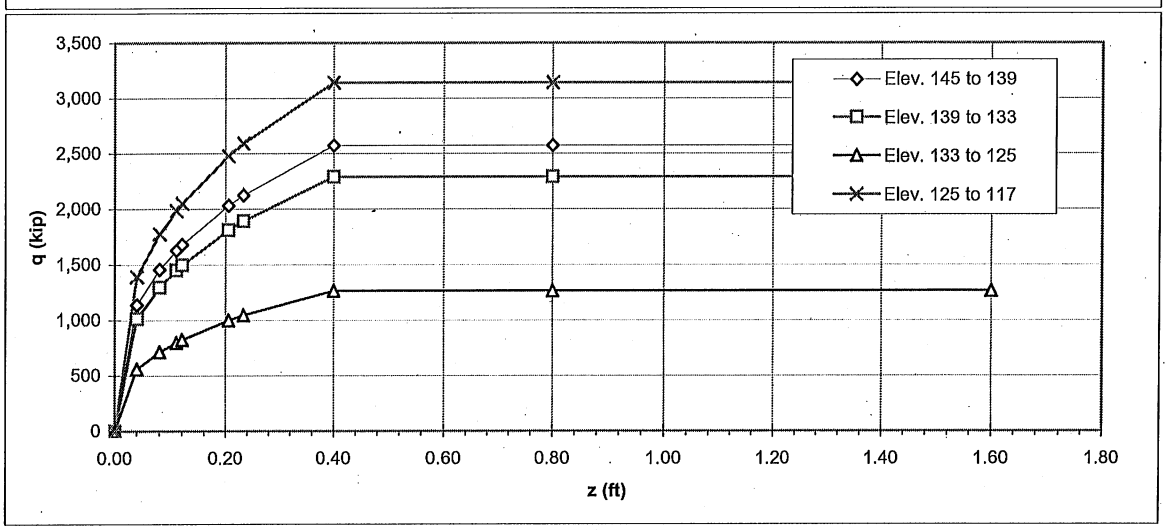
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 12

Sta.		**O. G. Elev.**	208.0	**Pile**	**4' PP**
		Cut off Elev.	208.0	**GWS**	213.0







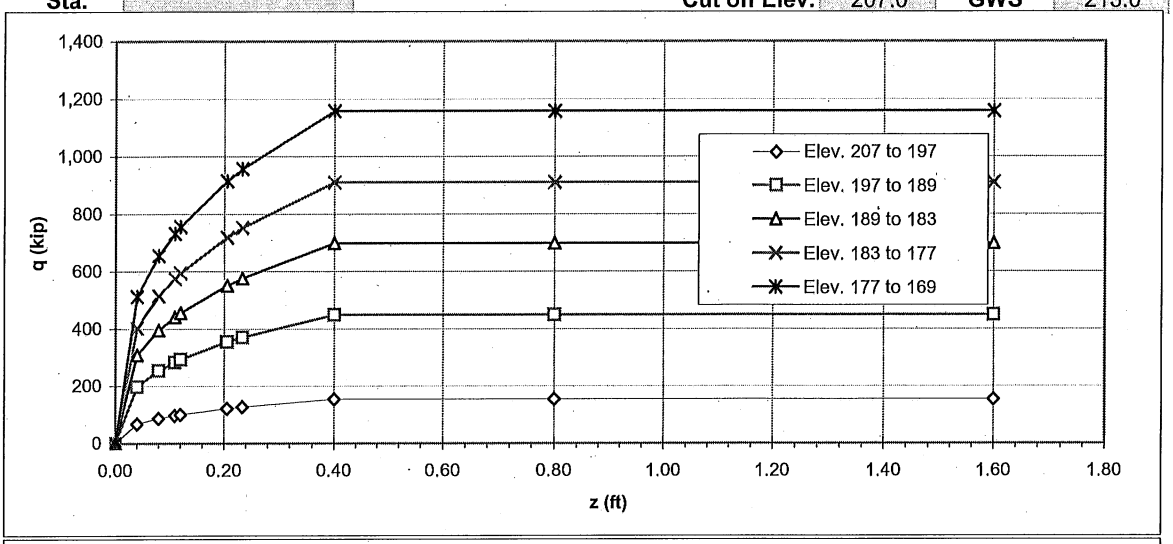
*-Liquefiable layer

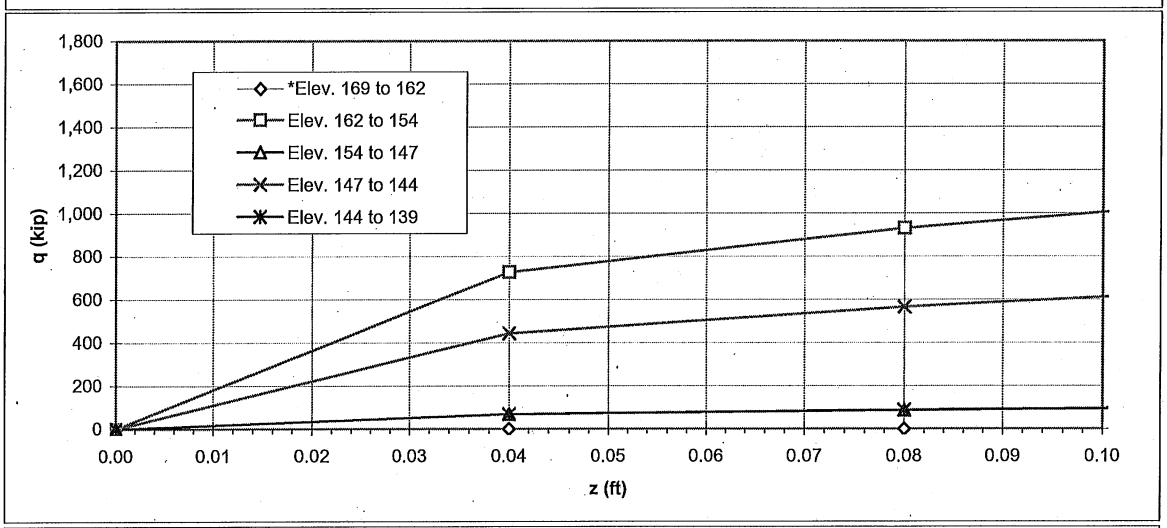
q-z Curves

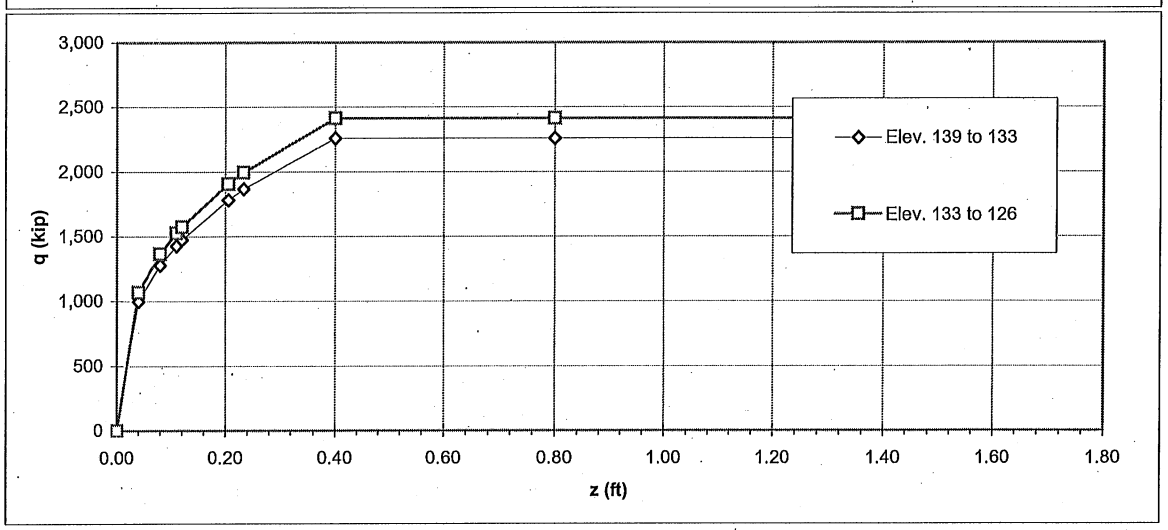
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 13

Sta.		**O. G. Elev.**	207.0	**Pile**	4' PP
		Cut off Elev.	207.0	**GWS**	213.0







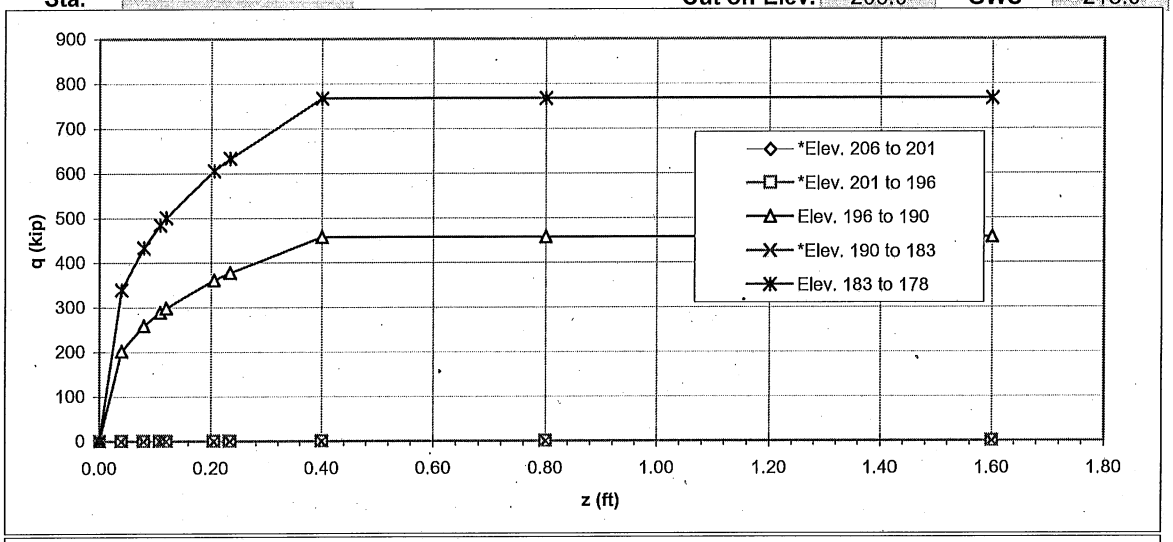
*-Liquefiable layer

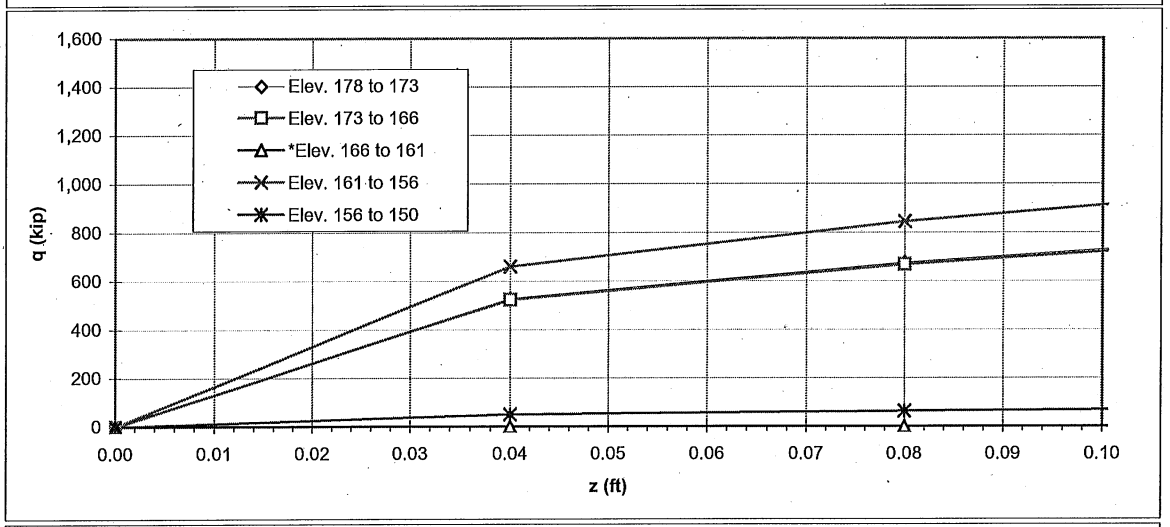
q-z Curves

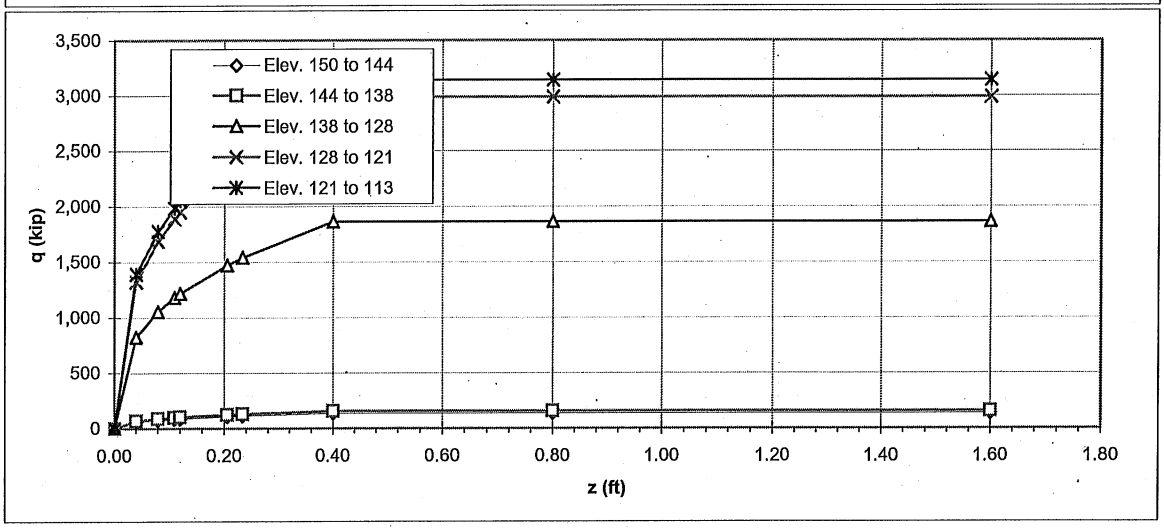
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 14

Sta.		**O. G. Elev.**	206.0	**Pile**	**4' PP**
		Cut off Elev.	206.0	**GWS**	213.0







*-Liquefiable layer

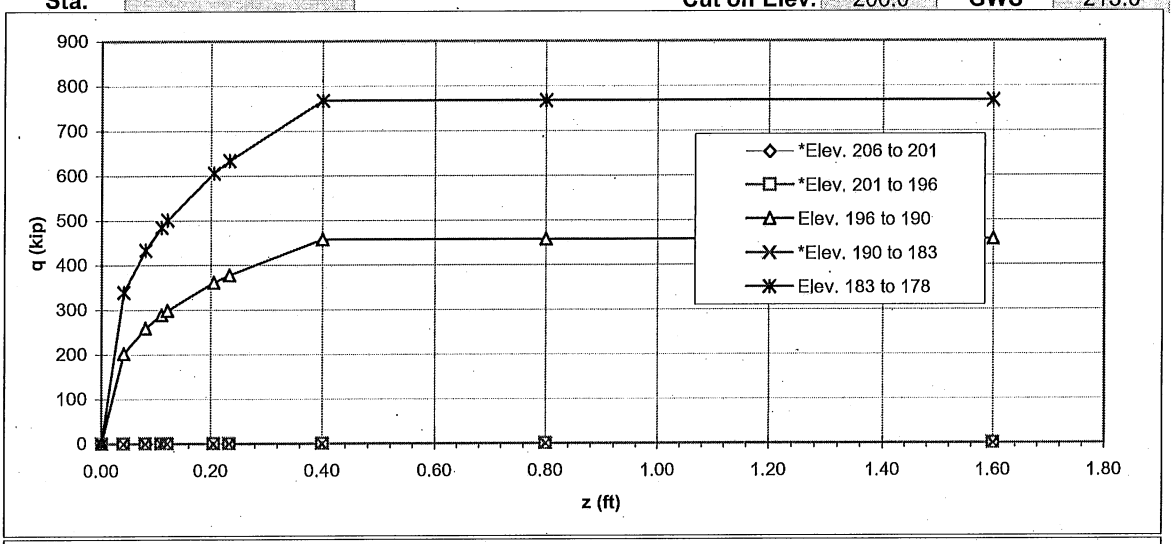
q-z Curves

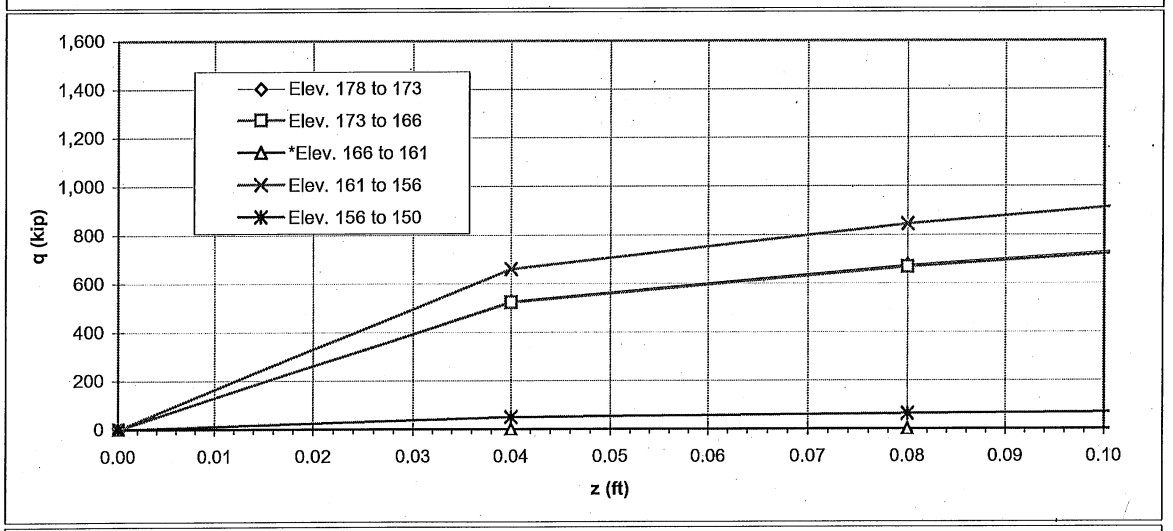
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

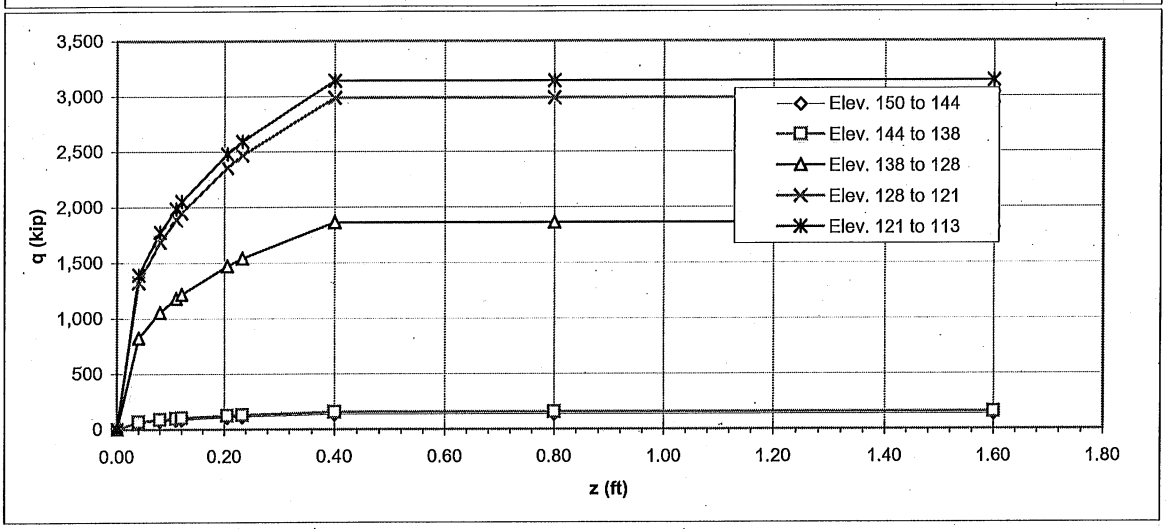
Pier 15

Sta.

O. G. Elev.	206.0	**Pile**	**4' PP**
Cut off Elev.	206.0	**GWS**	213.0







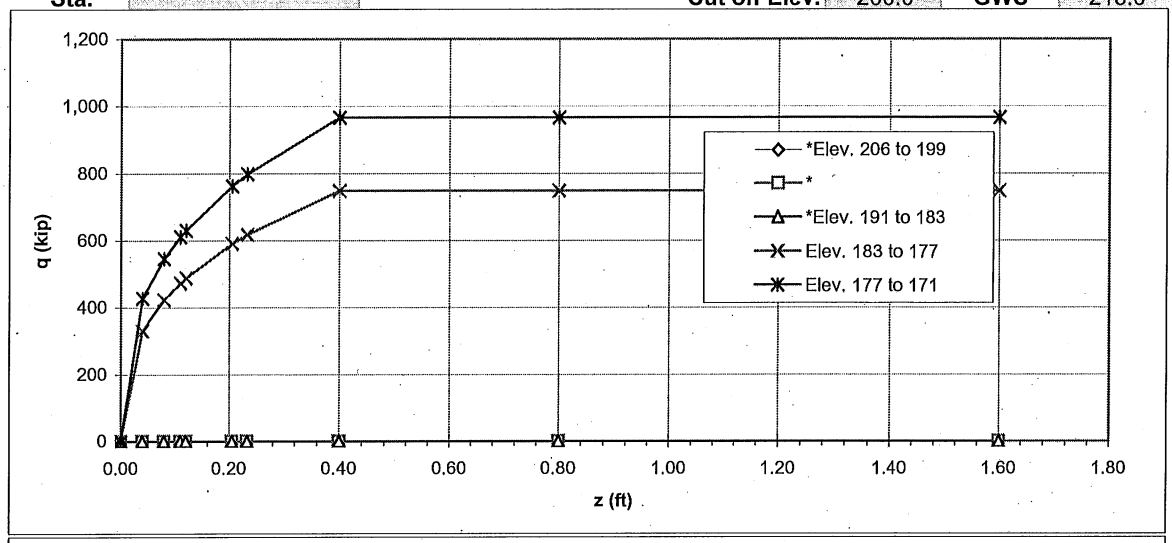
*-Liquefiable layer

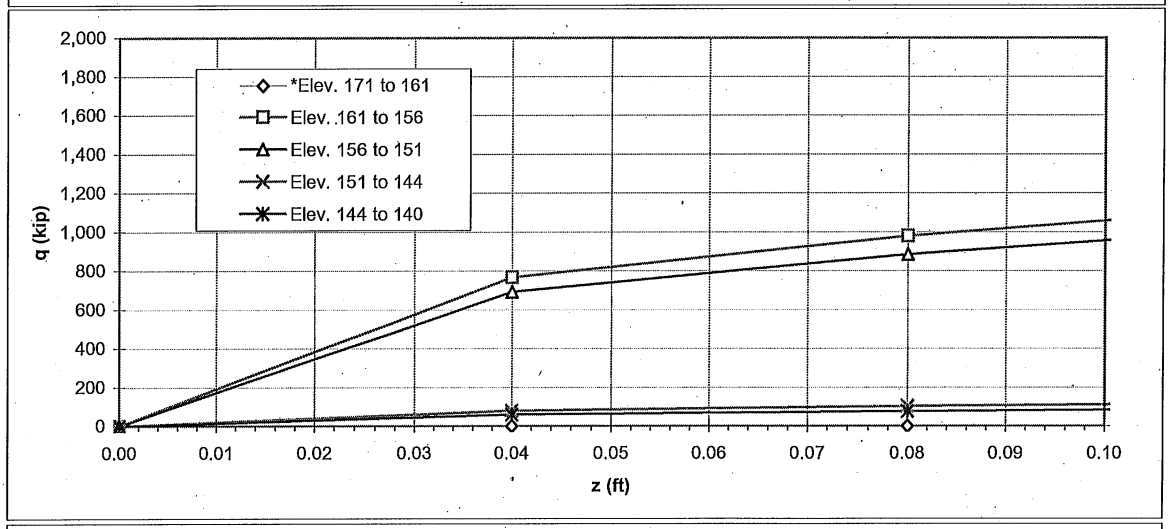
q-z Curves

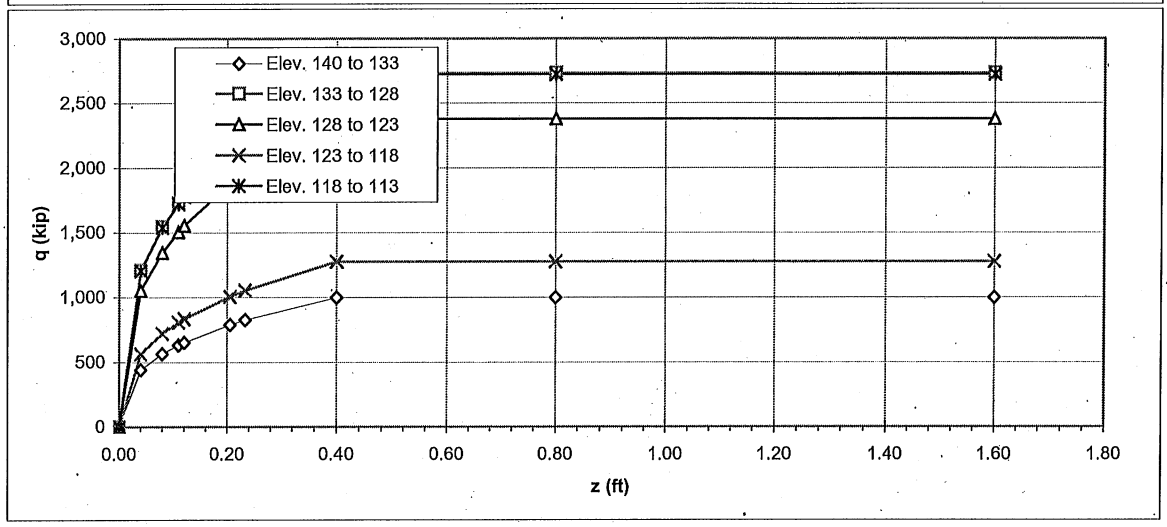
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 16

Sta.		**O. G. Elev.**	206.0	**Pile**	4' PP
		Cut off Elev.	206.0	**GWS**	213.0







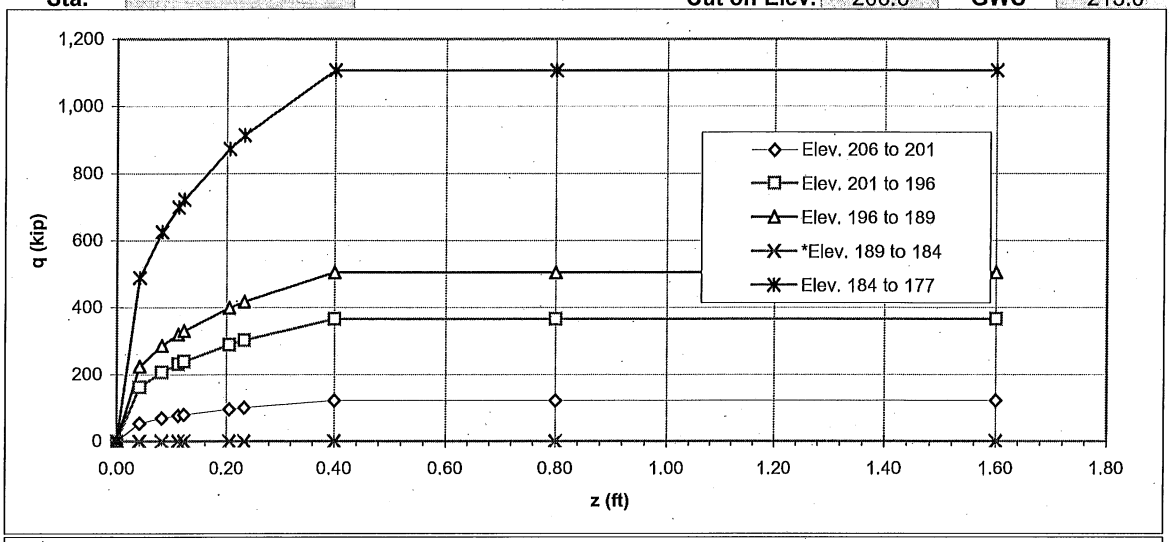
*-Liquefiable layer

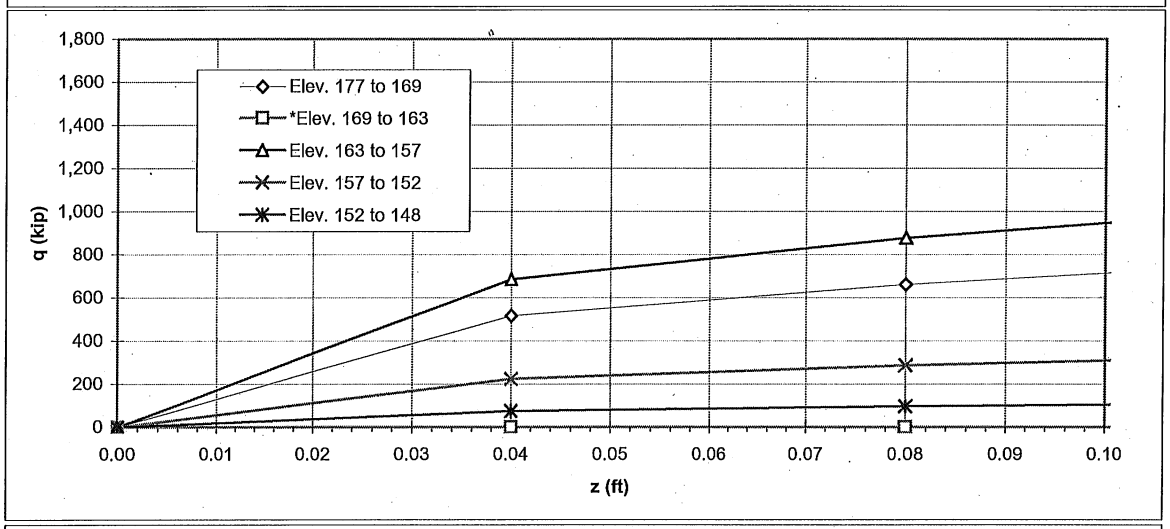
q-z Curves

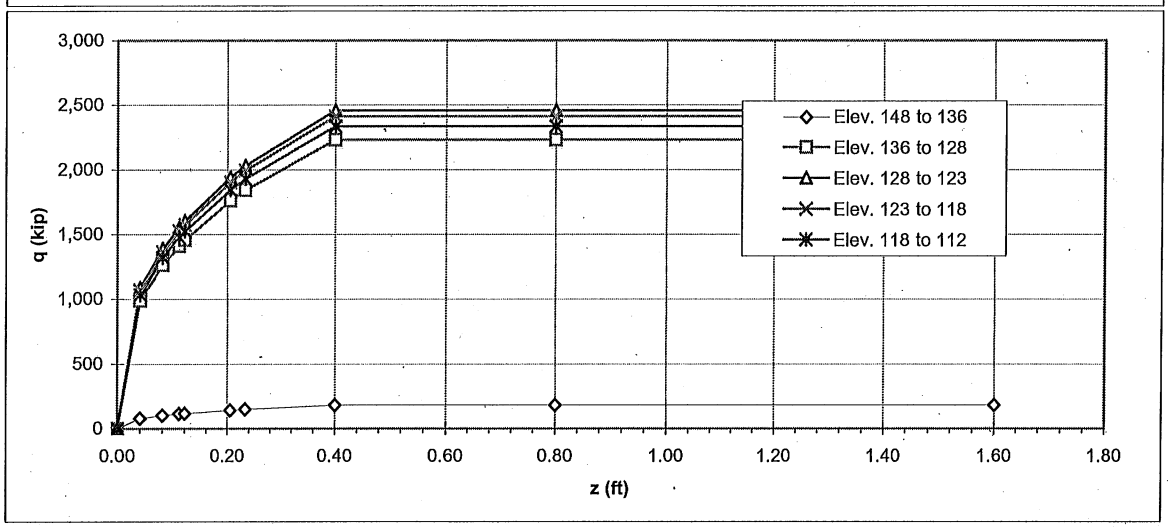
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 17

Sta.		**O. G. Elev.**	206.0
		Cut off Elev.	206.0
Pile	4' PP		
GWS	213.0		







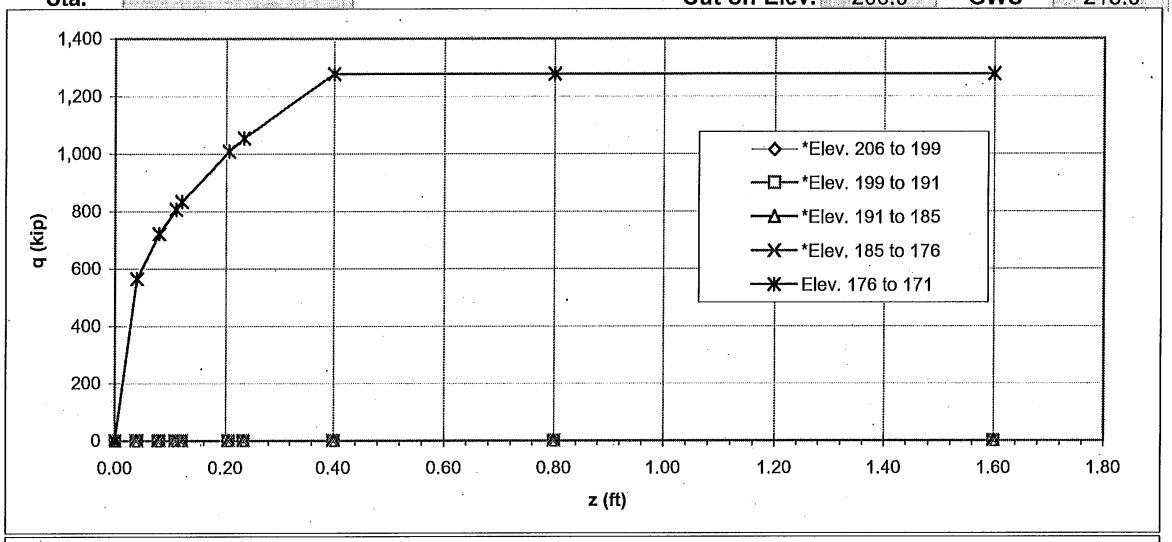
*-Liquefiable layer

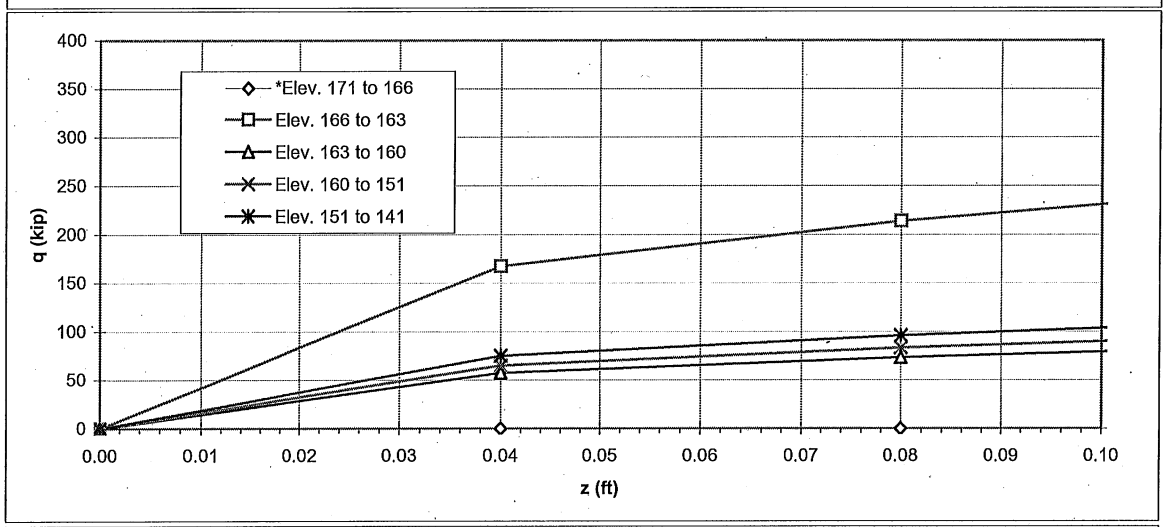
q-z Curves

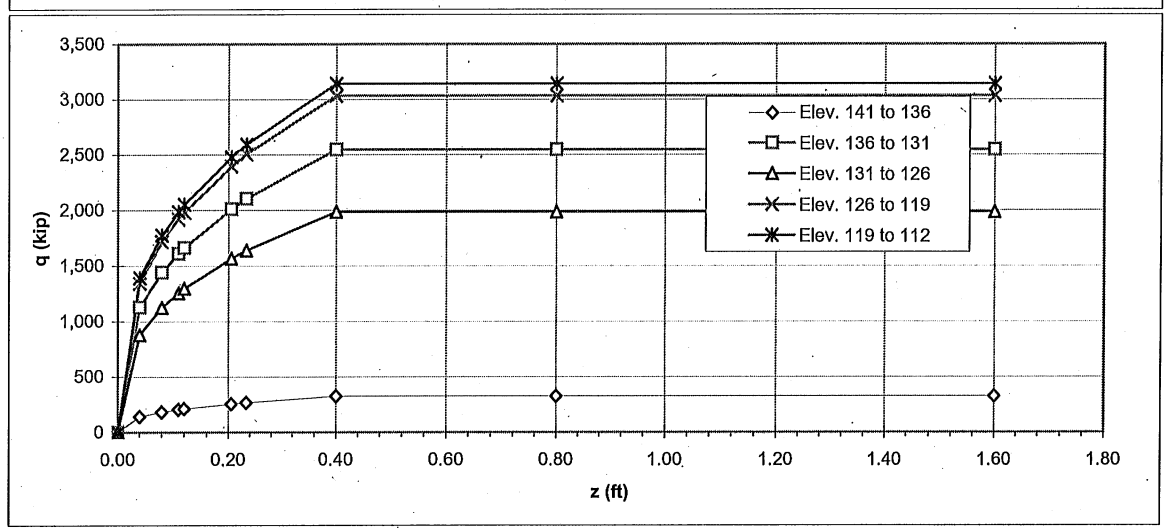
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 18

Sta.		**O. G. Elev.**	206.0	**Pile**	**4' PP**
		Cut off Elev.	206.0	**GWS**	213.0







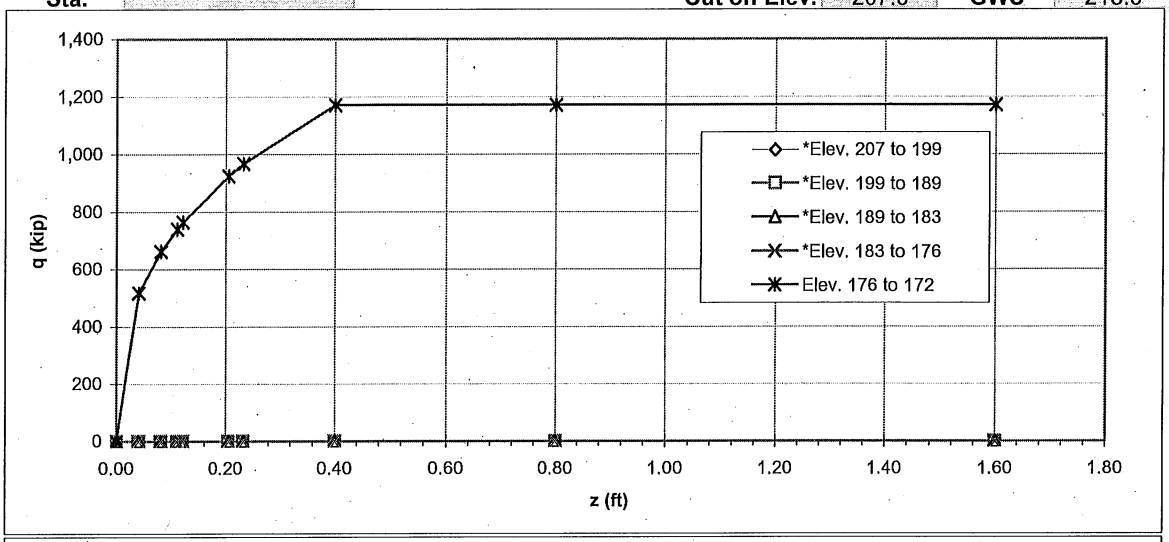
*-Liquefiable layer

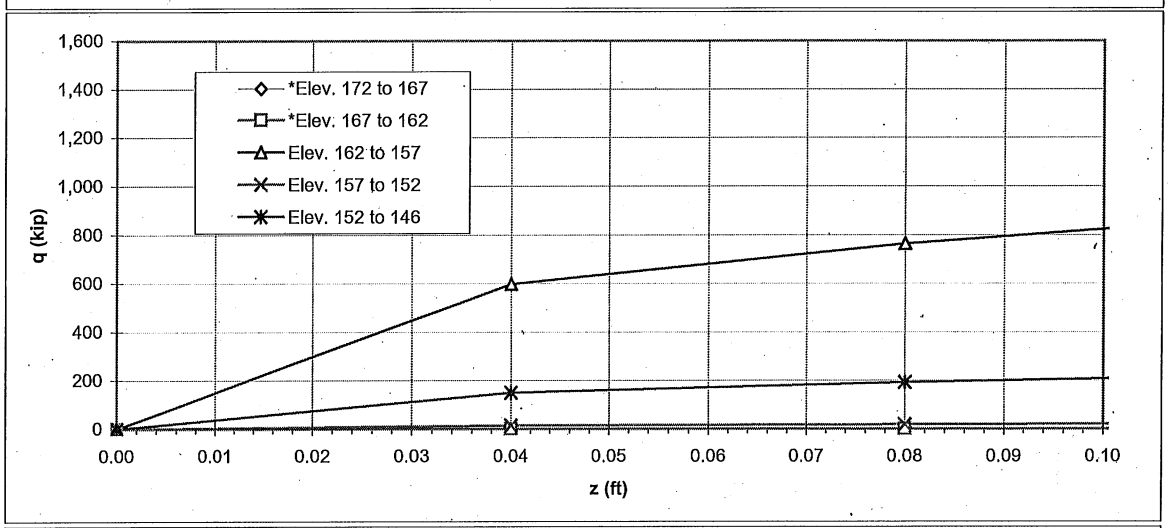
q-z Curves

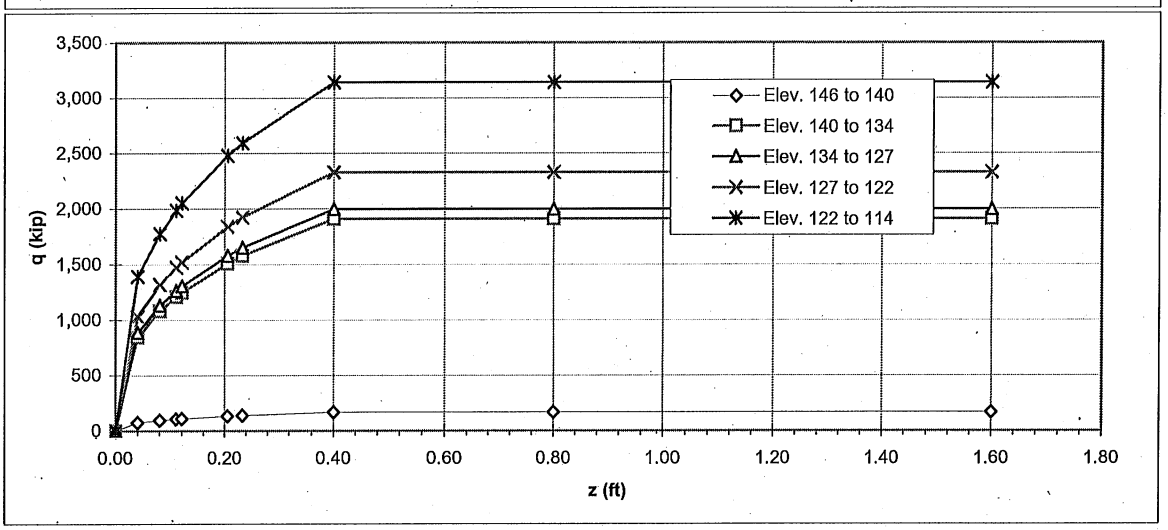
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 19

Sta.		**O. G. Elev.**	207.0	**Pile**	4' PP
		Cut off Elev.	207.0	**GWS**	213.0







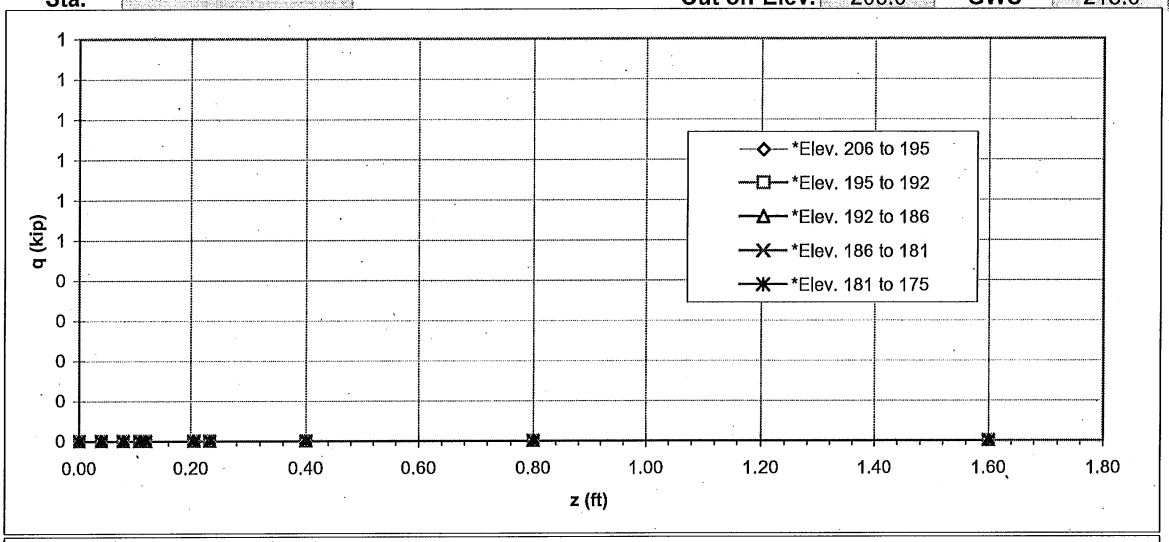
*-Liquefiable layer

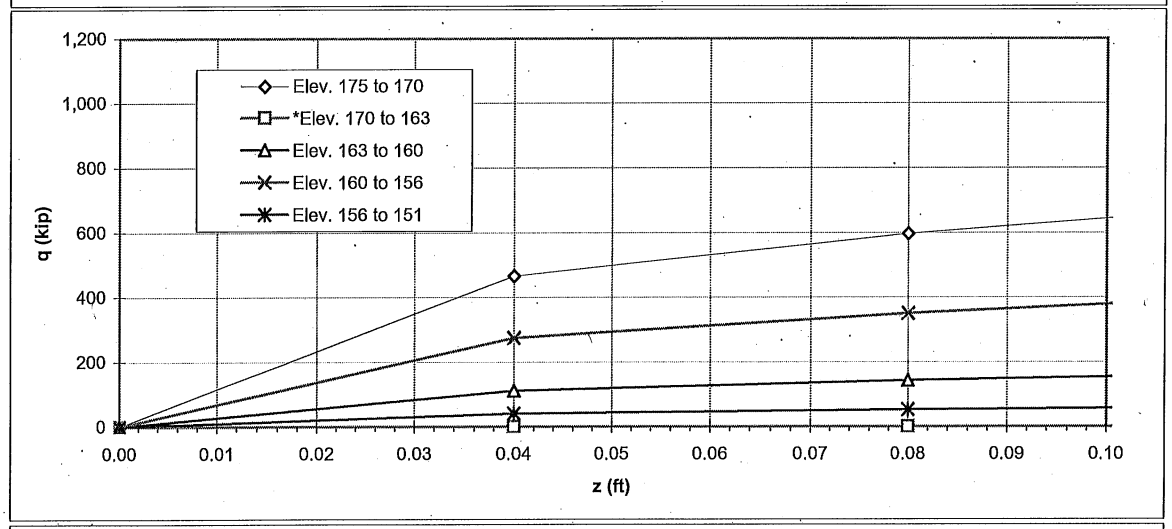
q-z Curves

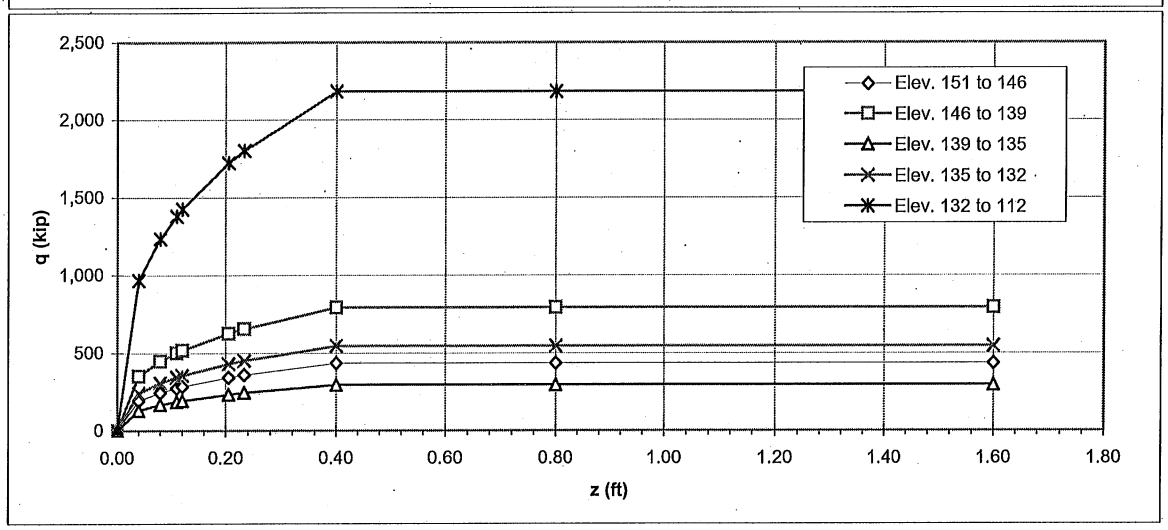
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 20

Sta.		**O. G. Elev.**	206.0	**Pile**	4' PP
		Cut off Elev.	206.0	**GWS**	213.0







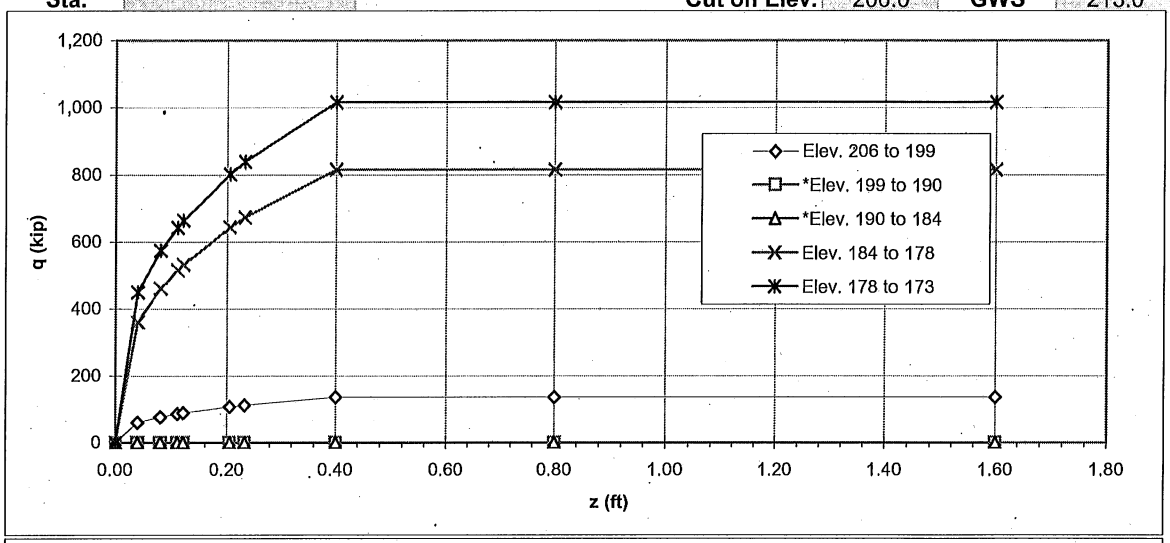
*-Liquefiable layer

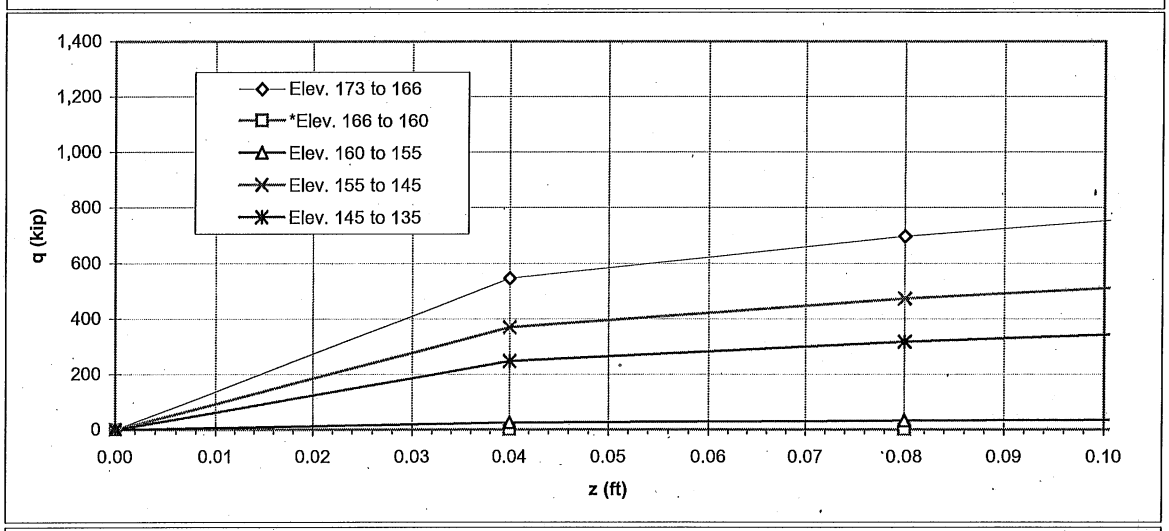
q-z Curves

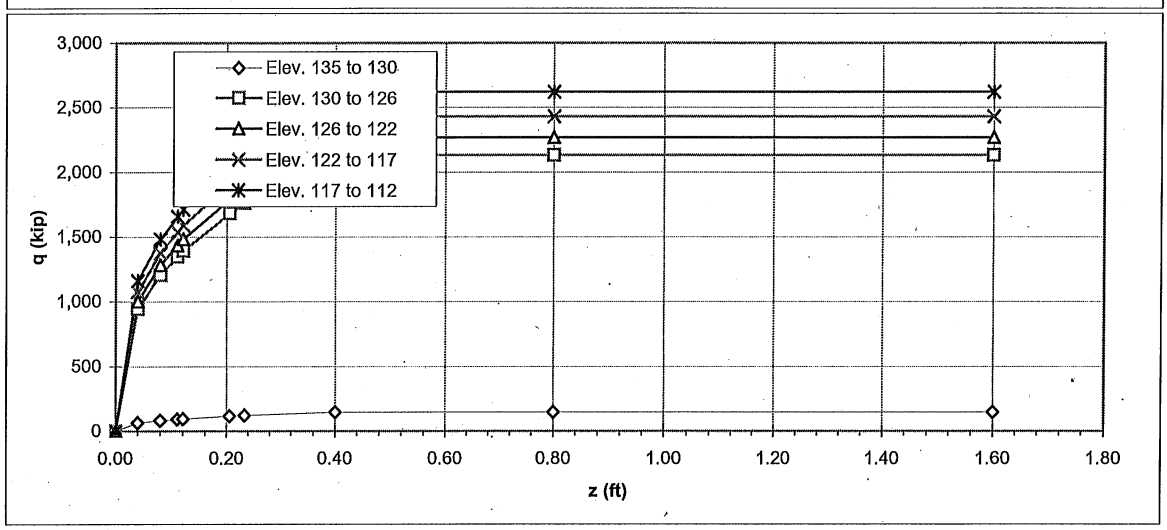
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 21

Sta.		**O. G. Elev.**	206.0	**Pile**	4' PP
		Cut off Elev.	206.0	**GWS**	213.0







*-Liquefiable layer

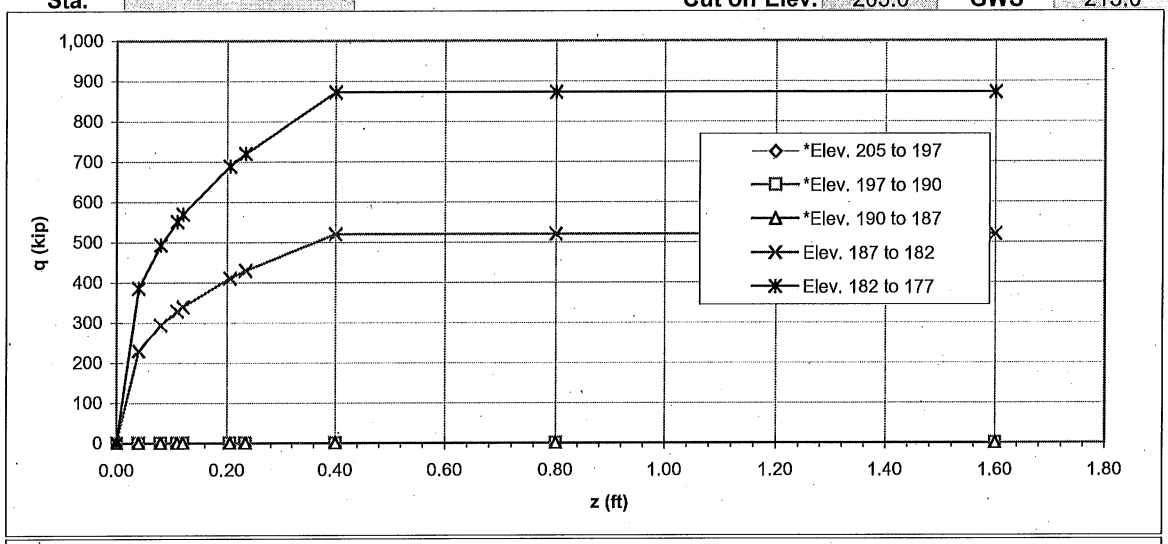
q-z Curves

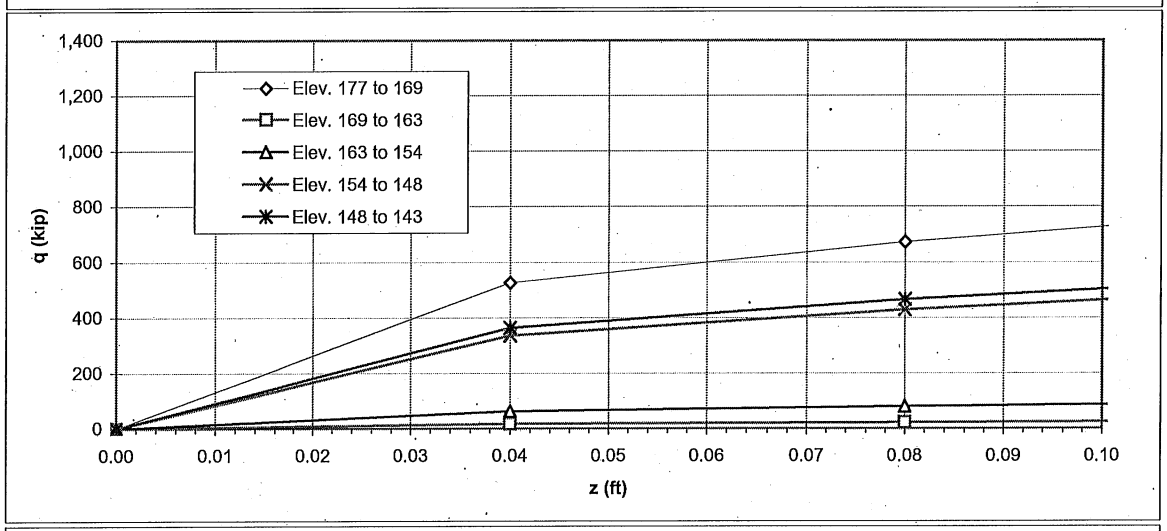
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

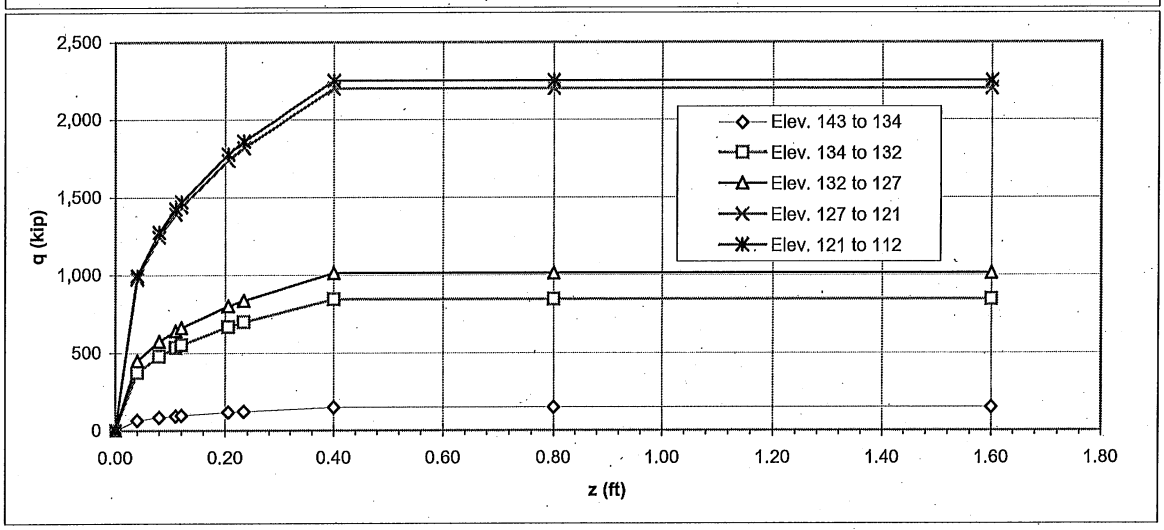
Pier 22

Sta.

O. G. Elev.	205.0	**Pile**	4' PP
Cut off Elev.	205.0	**GWS**	213.0







*-Liquefiable layer

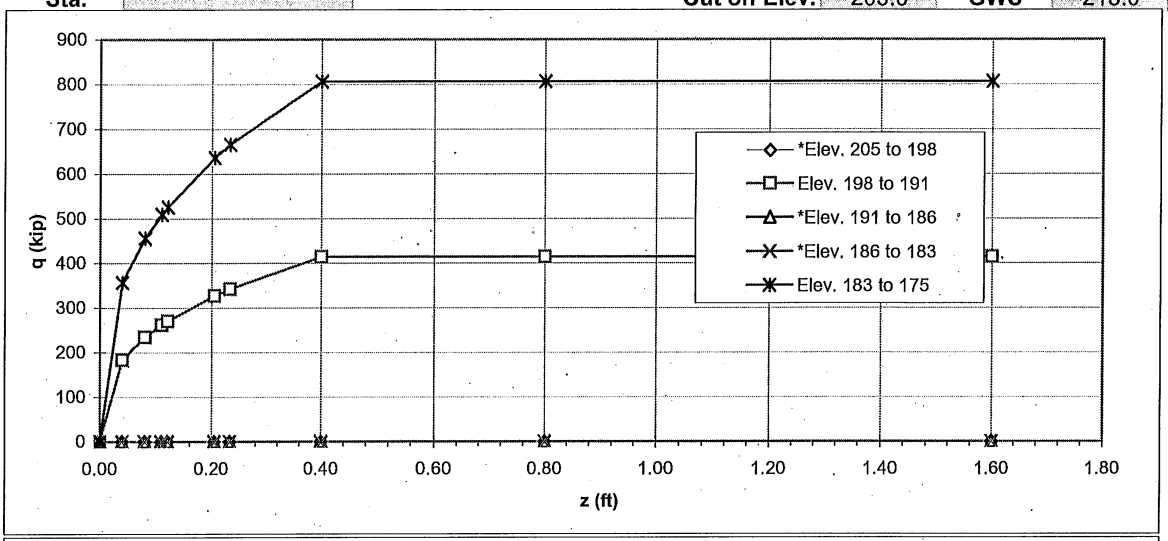
q-z Curves

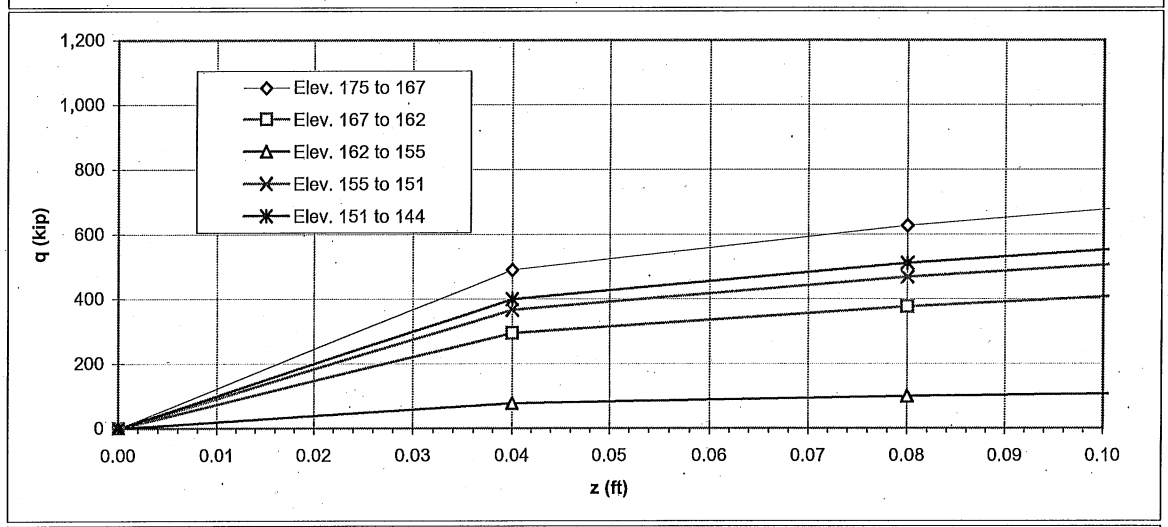
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

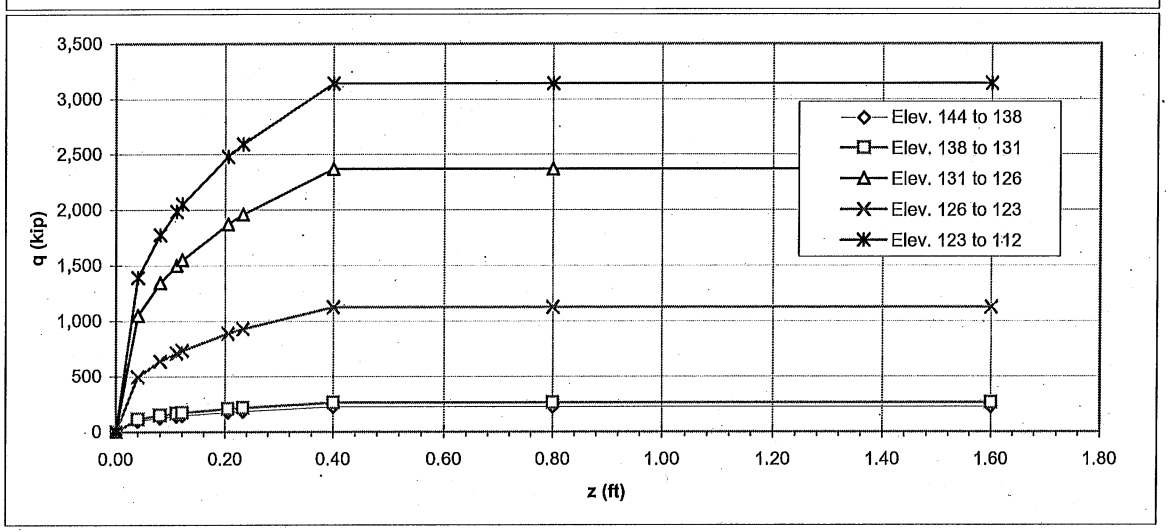
Pier 23

Sta.

O. G. Elev.	205.0	**Pile**	**4' PP**
Cut off Elev.	205.0	**GWS**	213.0







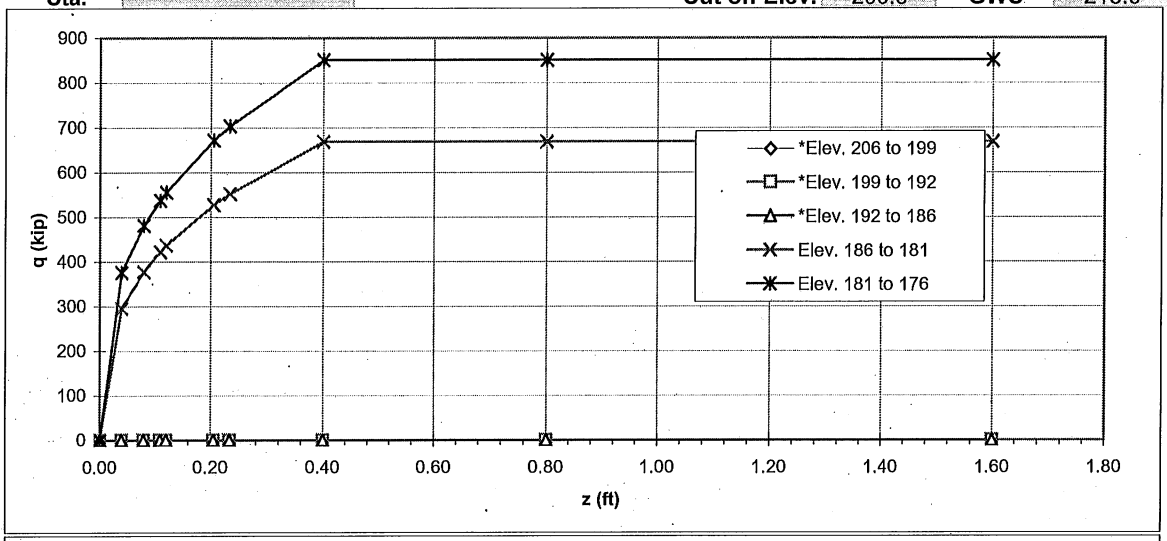
*-Liquefiable layer

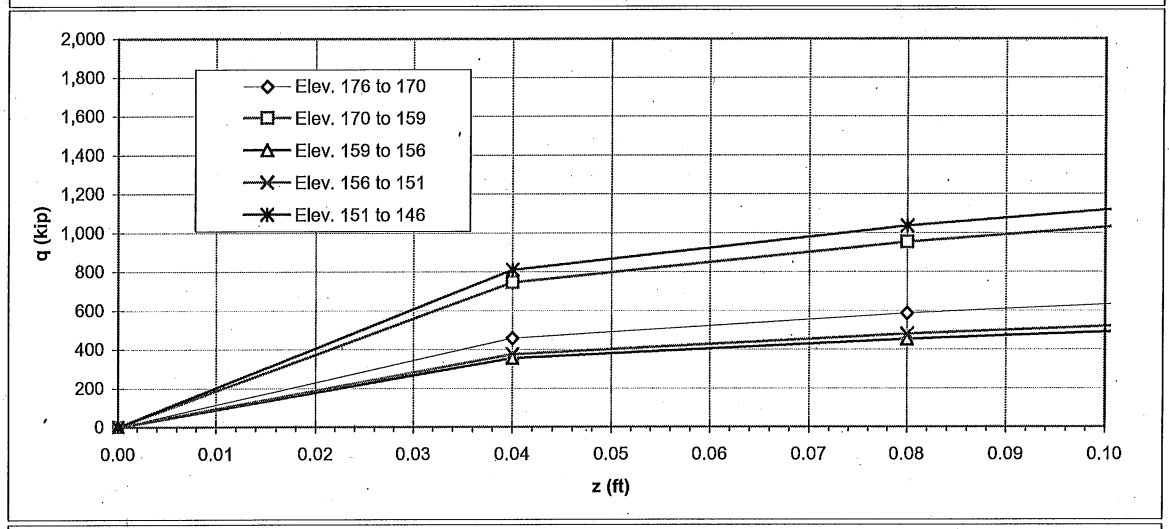
q-z Curves

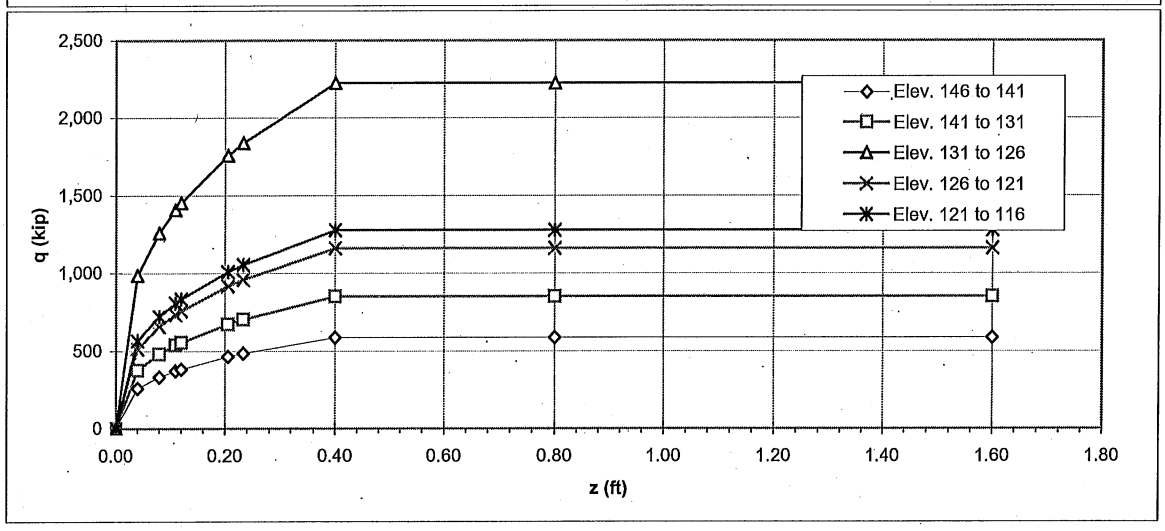
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 24

Sta.		**O. G. Elev.**	206.0
		Cut off Elev.	206.0
Pile	4' PP		
GWS	213.0		







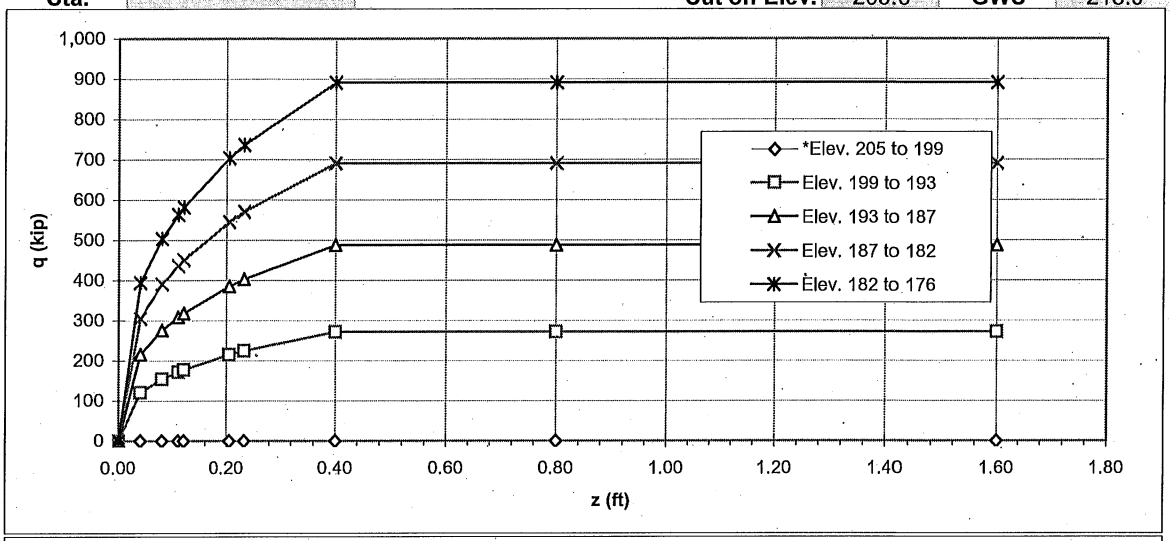
*-Liquefiable layer

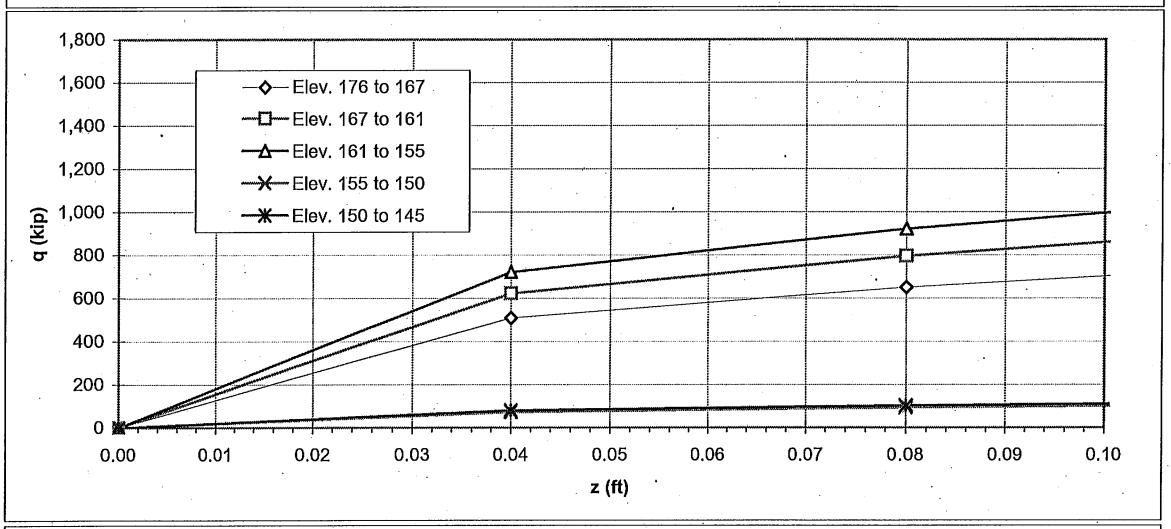
q-z Curves

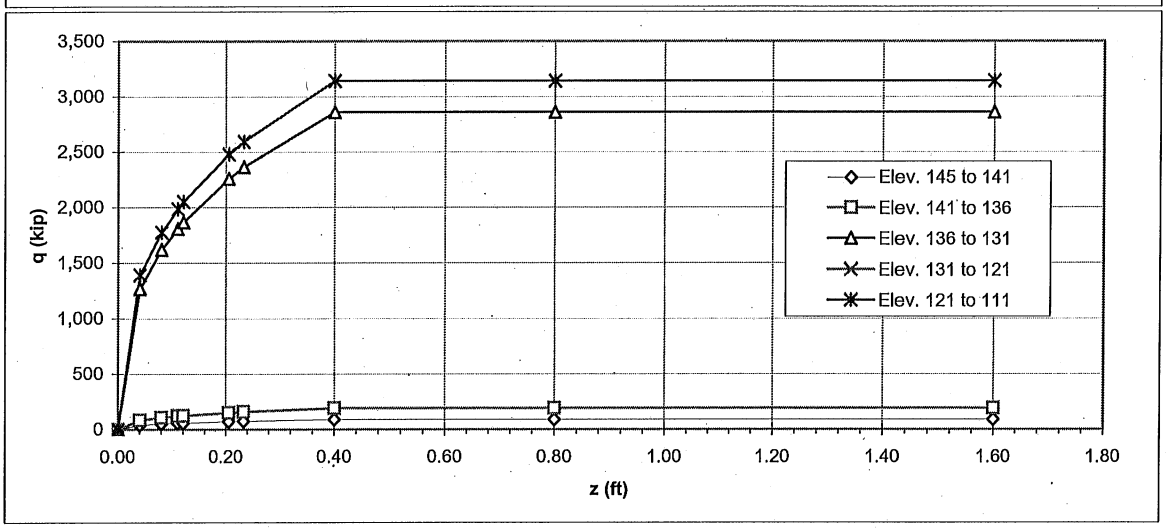
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 25

Sta.		**O. G. Elev.**	205.0	**Pile**	**4' PP**
		Cut off Elev.	205.0	**GWS**	213.0







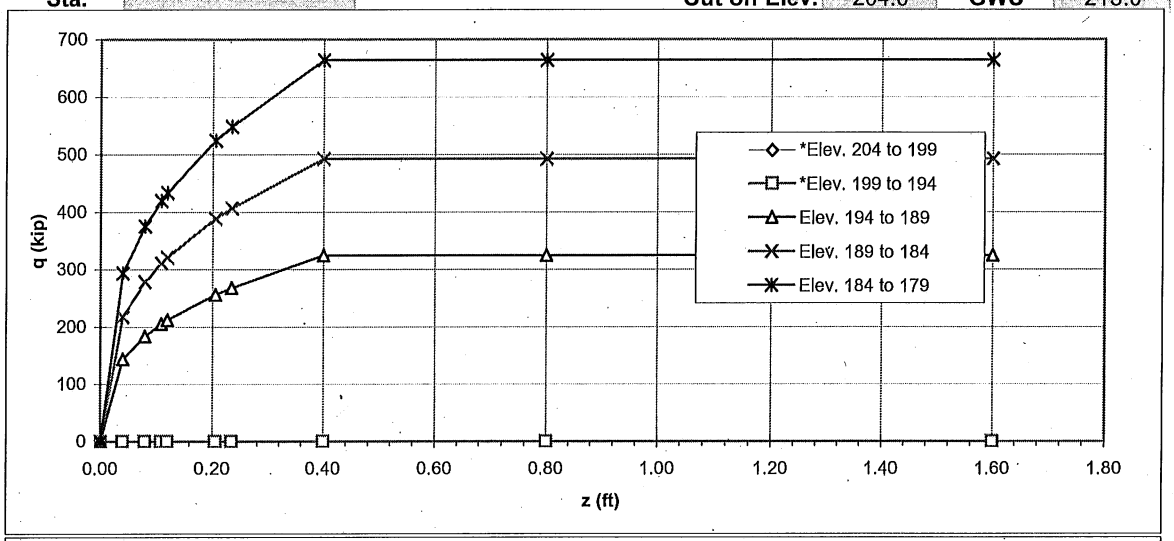
*-Liquefiable layer

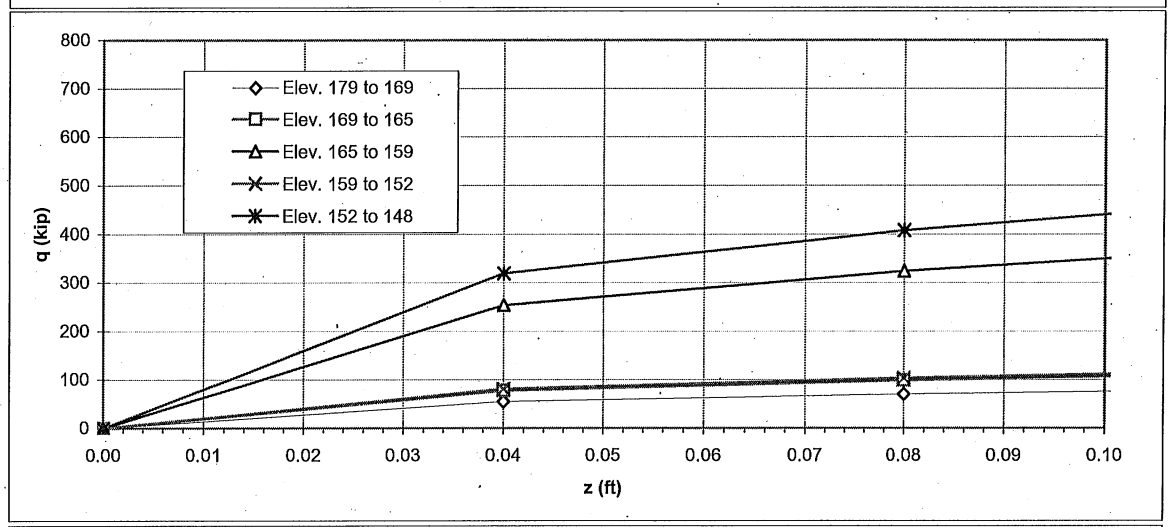
q-z Curves

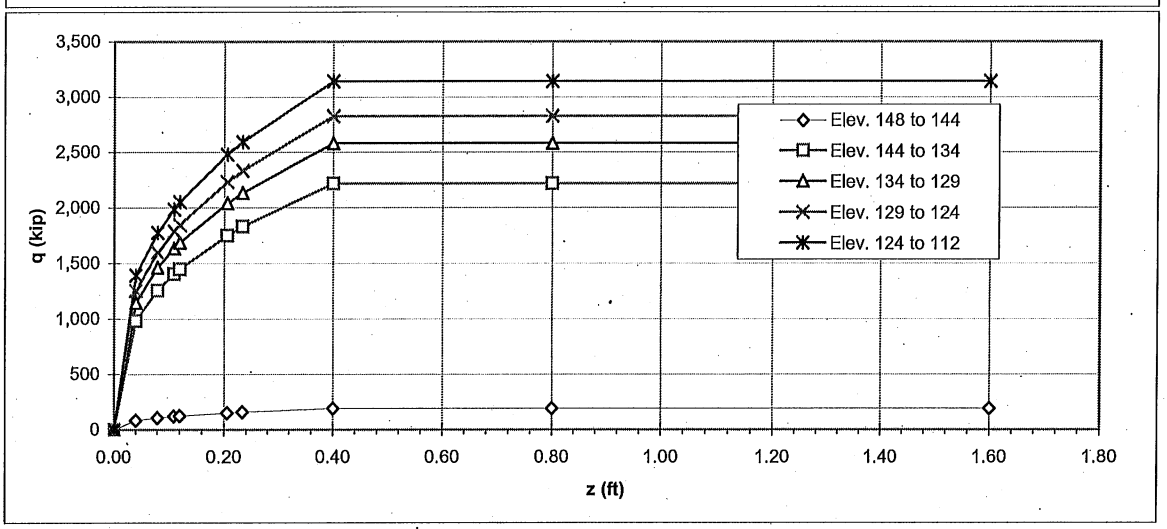
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 26

Sta.		**O. G. Elev.**	204.0	**Pile**	**4' PP**
		Cut off Elev.	204.0	**GWS**	213.0







*-Liquefiable layer

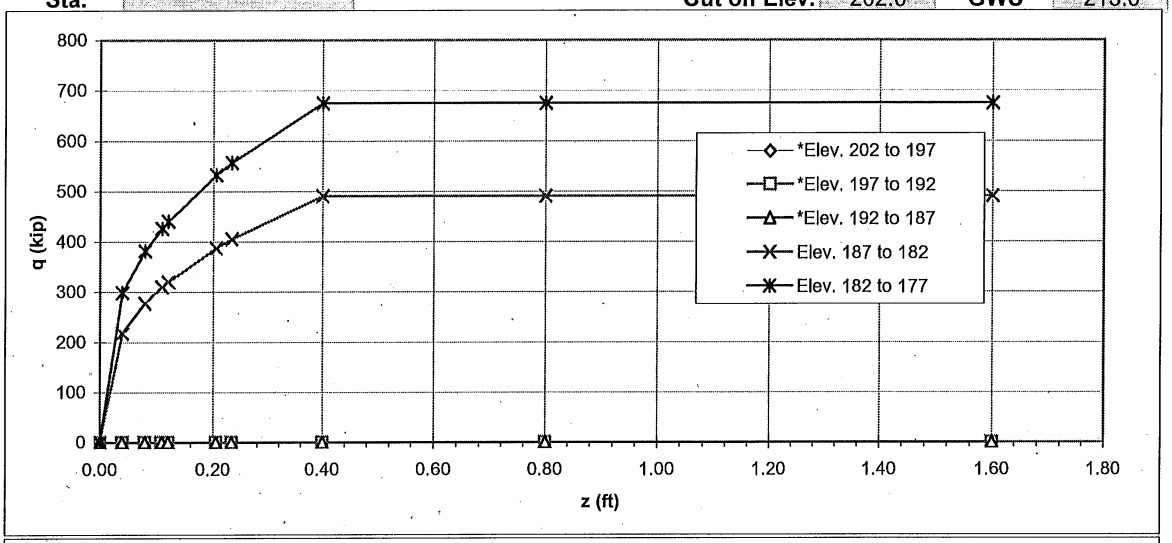
q-z Curves

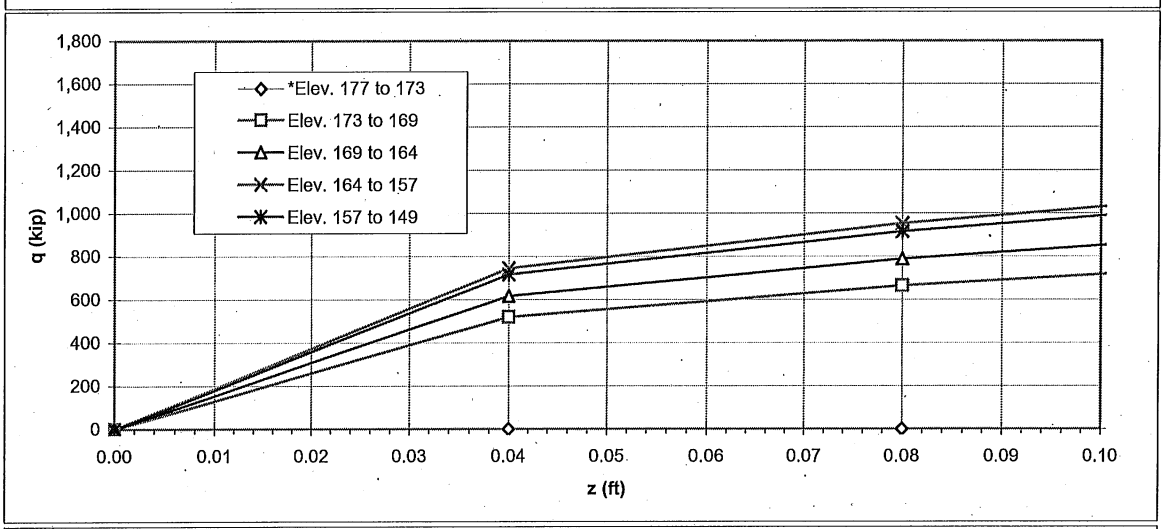
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

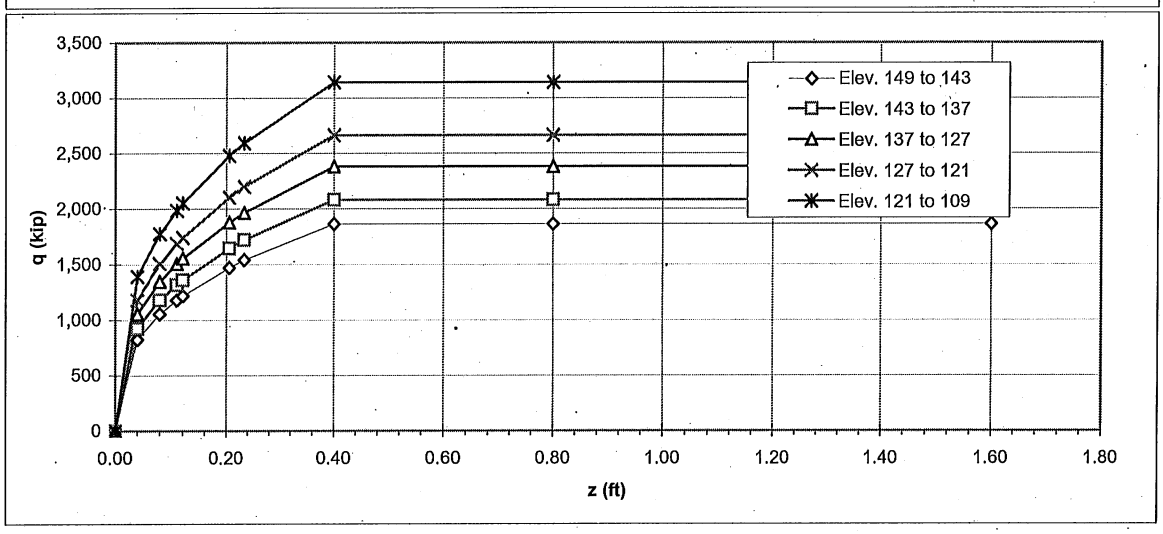
Pier 27

Sta.

O. G. Elev.	202.0	**Pile**	**4' PP**
Cut off Elev.	202.0	**GWS**	213.0







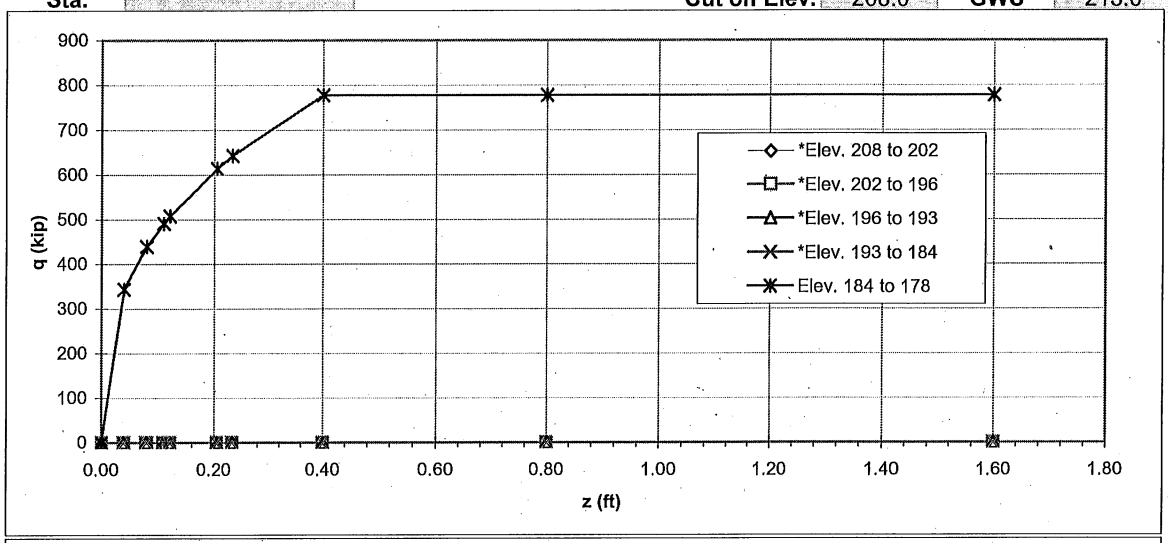
*-Liquefiable layer

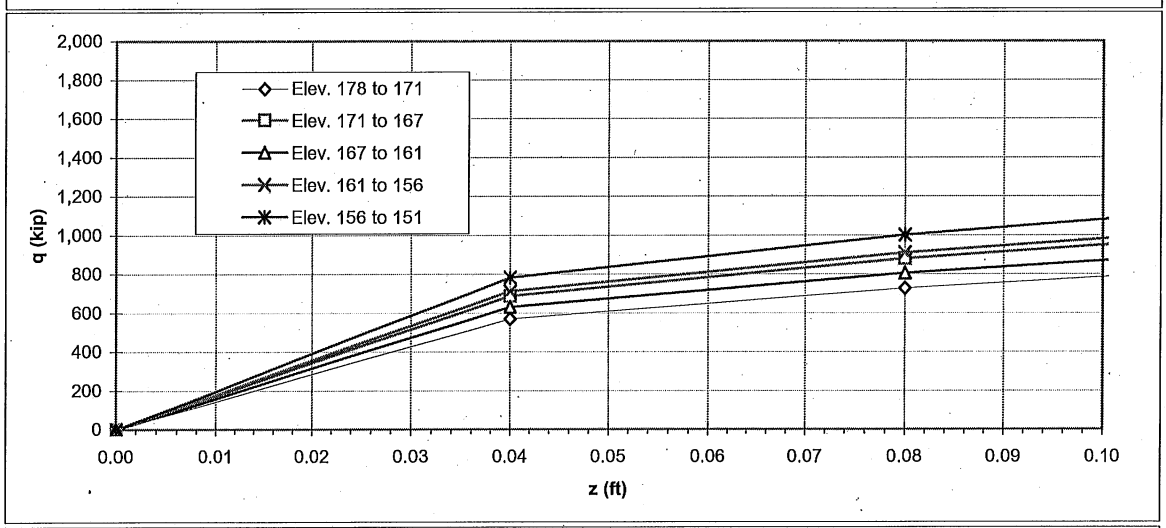
q-z Curves

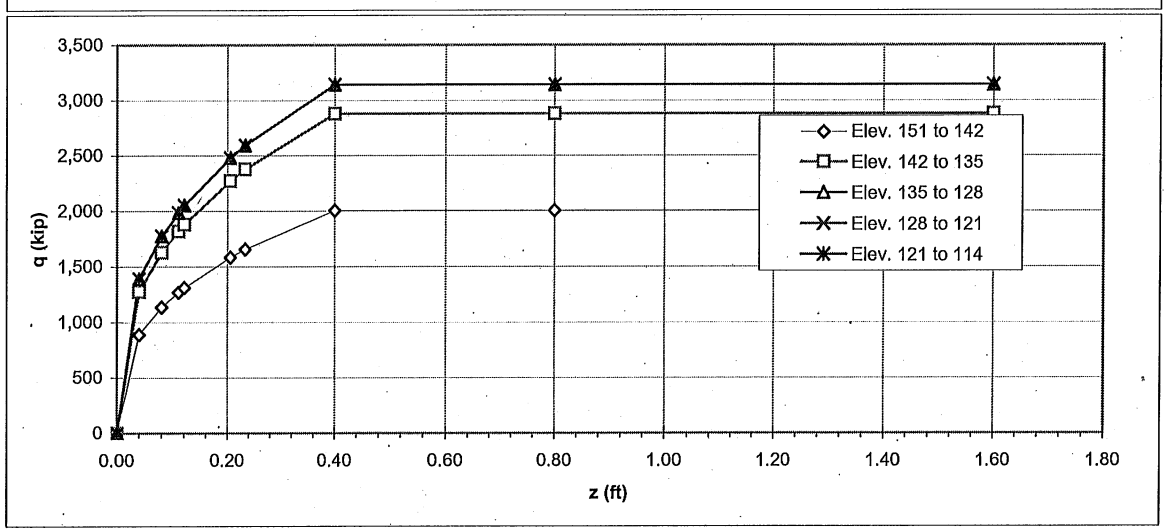
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 28

Sta.		**O. G. Elev.**	208.0	**Pile**	4' PP
		Cut off Elev.	208.0	**GWS**	213.0







*-Liquefiable layer

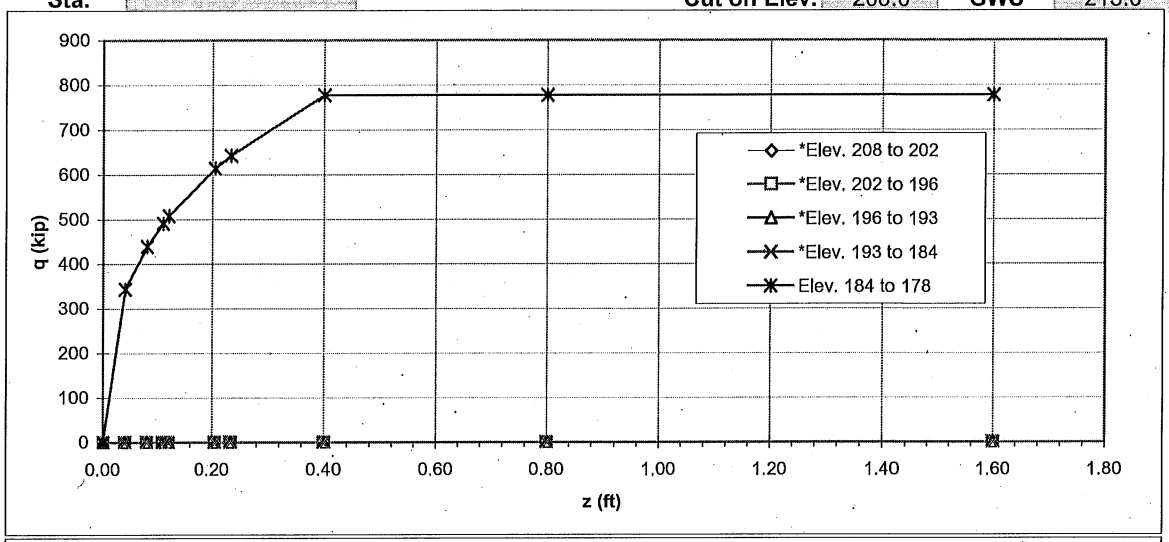
q-z Curves

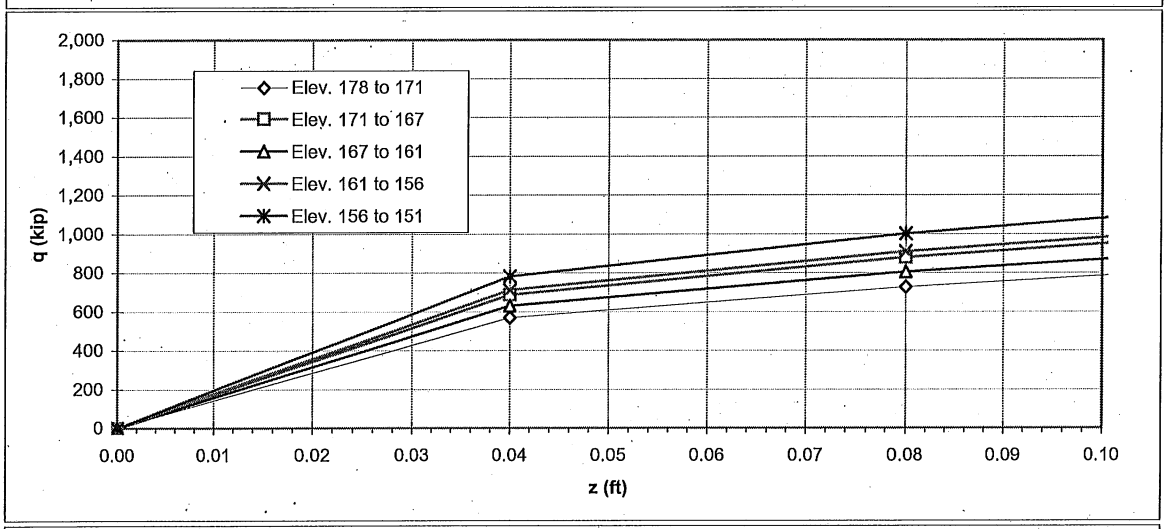
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

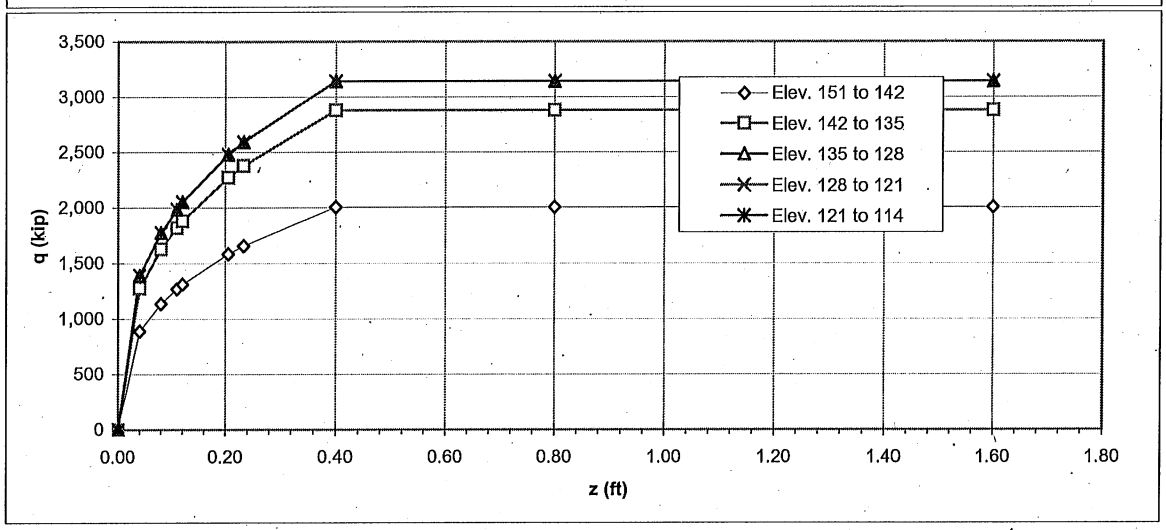
Pier 29

Sta.

O. G. Elev.	208.0	**Pile**	**4' PP**
Cut off Elev.	208.0	**GWS**	213.0







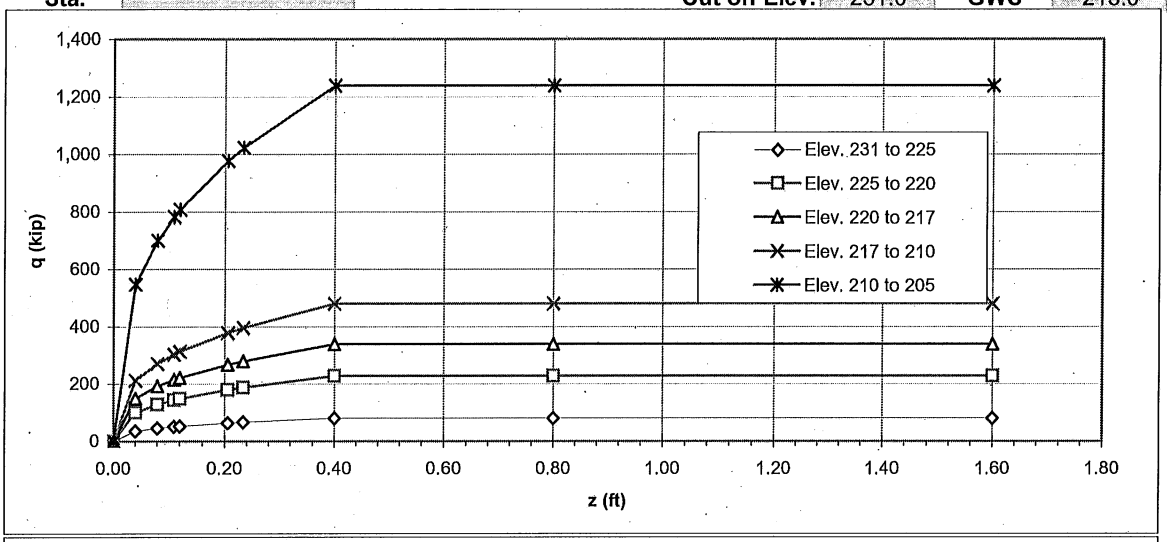
*-Liquefiable layer

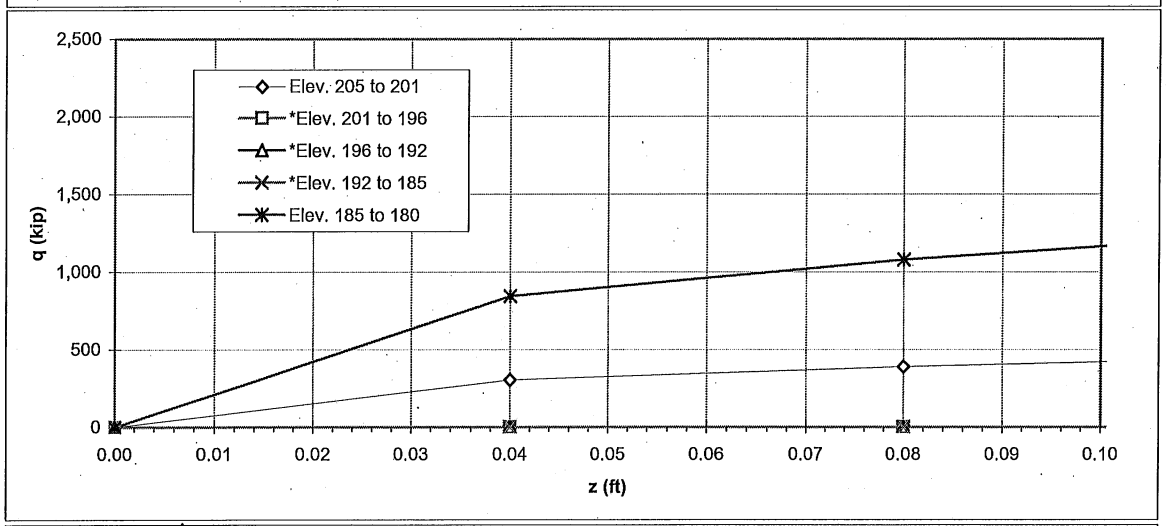
q-z Curves

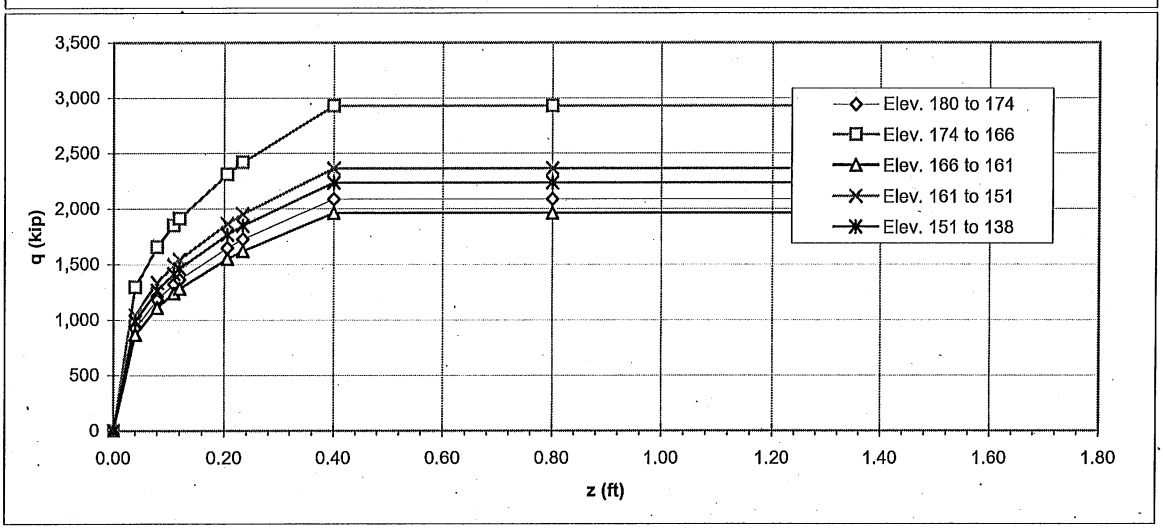
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Abut 30

Sta.		**O. G. Elev.**	231.0	**Pile**	4' PP
		Cut off Elev.	231.0	**GWS**	213.0







*-Liquefiable layer

q-z Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Abut 1

Sta.

O. G. Elev.	231.0	Pile	4" PP
Cut off Elev.	231.0	GWS	213.0

z (ft)	Elev. 231 to 224	z (ft)	Elev. 224 to 218	z (ft)	Elev. 218 to 211	z (ft)	*Elev. 211 to 206	z (ft)	*Elev. 206 to 198
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	40.3	0.04	249.9	0.04	559.7	0.04	0.0	0.04	0.0
0.08	51.5	0.08	319.4	0.08	715.3	0.08	0.0	0.08	0.0
0.11	57.5	0.11	357.1	0.11	799.7	0.11	0.0	0.11	0.0
0.12	59.4	0.12	368.7	0.12	825.7	0.12	0.0	0.12	0.0
0.21	71.8	0.21	445.8	0.21	998.4	0.21	0.0	0.21	0.0
0.23	75.2	0.23	466.5	0.23	1,044.7	0.23	0.0	0.23	0.0
0.40	91.0	0.40	564.6	0.40	1,264.6	0.40	0.0	0.40	0.0
0.80	91.0	0.80	564.6	0.80	1,264.6	0.80	0.0	0.80	0.0
1.60	91.0	1.60	564.6	1.60	1,264.6	1.60	0.0	1.60	0.0

z (ft)	*Elev. 198 to 191	z (ft)	Elev. 191 to 188	z (ft)	Elev. 188 to 181	z (ft)	Elev. 181 to 176	z (ft)	Elev. 176 to 168
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	867.3	0.04	945.2	0.04	920.3	0.04	1,390.4
0.08	0.0	0.08	1,108.5	0.08	1,208.1	0.08	1,176.2	0.08	1,777.1
0.11	0.0	0.11	1,239.2	0.11	1,350.5	0.11	1,314.9	0.11	1,986.6
0.12	0.0	0.12	1,279.6	0.12	1,394.6	0.12	1,357.8	0.12	2,051.4
0.21	0.0	0.21	1,547.2	0.21	1,686.2	0.21	1,641.8	0.21	2,480.5
0.23	0.0	0.23	1,618.9	0.23	1,764.3	0.23	1,717.8	0.23	2,595.4
0.40	0.0	0.40	1,959.6	0.40	2,135.7	0.40	2,079.3	0.40	3,141.6
0.80	0.0	0.80	1,959.6	0.80	2,135.7	0.80	2,079.3	0.80	3,141.6
1.60	0.0	1.60	1,959.6	1.60	2,135.7	1.60	2,079.3	1.60	3,141.6

z (ft)	Elev. 168 to 161	z (ft)	Elev. 161 to 158	z (ft)	Elev. 158 to 149	z (ft)	Elev. 149 to 144	z (ft)	Elev. 144 to 138
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	1,390.4	0.04	527.8	0.04	710.2	0.04	828.5	0.04	791.9
0.08	1,777.1	0.08	674.6	0.08	907.7	0.08	1,059.0	0.08	1,012.1
0.11	1,986.6	0.11	754.1	0.11	1,014.7	0.11	1,183.8	0.11	1,131.4
0.12	2,051.4	0.12	778.7	0.12	1,047.8	0.12	1,222.4	0.12	1,168.3
0.21	2,480.5	0.21	941.6	0.21	1,266.9	0.21	1,478.1	0.21	1,412.7
0.23	2,595.4	0.23	985.2	0.23	1,325.6	0.23	1,546.5	0.23	1,478.1
0.40	3,141.6	0.40	1,192.6	0.40	1,604.6	0.40	1,872.0	0.40	1,789.3
0.80	3,141.6	0.80	1,192.6	0.80	1,604.6	0.80	1,872.0	0.80	1,789.3
1.60	3,141.6	1.60	1,192.6	1.60	1,604.6	1.60	1,872.0	1.60	1,789.3

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 2

Sta.

O. G. Elev. 213.0
Cut off Elev. 213.0

Pile 4" PP
GWS 213.0

z (ft)	*Elev. 213 to 206	z (ft)	*Elev. 206 to 198	z (ft)	Elev. 198 to 192	z (ft)	Elev. 192 to 189	z (ft)	Elev. 189 to 184
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	238.1	0.04	263.1	0.04	324.6
0.08	0.0	0.08	0.0	0.08	304.4	0.08	336.3	0.08	414.8
0.11	0.0	0.11	0.0	0.11	340.2	0.11	375.9	0.11	463.7
0.12	0.0	0.12	0.0	0.12	351.3	0.12	388.2	0.12	478.9
0.21	0.0	0.21	0.0	0.21	424.8	0.21	469.4	0.21	579.0
0.23	0.0	0.23	0.0	0.23	444.5	0.23	491.1	0.23	605.8
0.40	0.0	0.40	0.0	0.40	538.1	0.40	594.5	0.40	733.3
0.80	0.0	0.80	0.0	0.80	538.1	0.80	594.5	0.80	733.3
1.60	0.0	1.60	0.0	1.60	538.1	1.60	594.5	1.60	733.3

z (ft)	Elev. 184 to 179	z (ft)	*Elev. 179 to 174	z (ft)	Elev. 174 to 168	z (ft)	Elev. 168 to 164	z (ft)	Elev. 164 to 156
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	403.9	0.04	0.0	0.04	545.2	0.04	775.9	0.04	722.7
0.08	516.3	0.08	0.0	0.08	696.8	0.08	991.7	0.08	923.7
0.11	577.1	0.11	0.0	0.11	778.9	0.11	1,108.6	0.11	1,032.6
0.12	595.9	0.12	0.0	0.12	804.3	0.12	1,144.8	0.12	1,066.3
0.21	720.6	0.21	0.0	0.21	972.5	0.21	1,384.2	0.21	1,289.3
0.23	754.0	0.23	0.0	0.23	1,017.6	0.23	1,448.4	0.23	1,349.0
0.40	912.6	0.40	0.0	0.40	1,231.8	0.40	1,753.2	0.40	1,632.9
0.80	912.6	0.80	0.0	0.80	1,231.8	0.80	1,753.2	0.80	1,632.9
1.60	912.6	1.60	0.0	1.60	1,231.8	1.60	1,753.2	1.60	1,632.9

z (ft)	Elev. 156 to 147	z (ft)	Elev. 147 to 142	z (ft)	Elev. 142 to 137	z (ft)	Elev. 137 to 127	z (ft)	Elev. 127 to 121
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	863.8	0.04	980.0	0.04	1,064.2	0.04	834.9	0.04	845.8
0.08	1,104.0	0.08	1,252.5	0.08	1,360.1	0.08	1,067.1	0.08	1,081.0
0.11	1,234.2	0.11	1,400.2	0.11	1,520.4	0.11	1,192.9	0.11	1,208.4
0.12	1,274.4	0.12	1,445.9	0.12	1,570.0	0.12	1,231.8	0.12	1,247.8
0.21	1,541.0	0.21	1,748.3	0.21	1,898.4	0.21	1,489.4	0.21	1,508.8
0.23	1,612.4	0.23	1,829.2	0.23	1,986.3	0.23	1,558.4	0.23	1,578.7
0.40	1,951.7	0.40	2,214.2	0.40	2,404.4	0.40	1,886.4	0.40	1,911.0
0.80	1,951.7	0.80	2,214.2	0.80	2,404.4	0.80	1,886.4	0.80	1,911.0
1.60	1,951.7	1.60	2,214.2	1.60	2,404.4	1.60	1,886.4	1.60	1,911.0

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 3

Sta.

O. G. Elev. 213.0
Cut off Elev. 213.0
Pile 4" PP
GWS 213.0

z (ft)	*Elev. 213 to 206	z (ft)	Elev. 206 to 200	z (ft)	Elev. 200 to 194	z (ft)	*Elev. 194 to 188	z (ft)	Elev. 188 to 182
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	120.0	0.04	276.0	0.04	0.0	0.04	383.1
0.08	0.0	0.08	153.4	0.08	352.8	0.08	0.0	0.08	489.6
0.11	0.0	0.11	171.4	0.11	394.4	0.11	0.0	0.11	547.3
0.12	0.0	0.12	177.0	0.12	407.3	0.12	0.0	0.12	565.1
0.21	0.0	0.21	214.1	0.21	492.4	0.21	0.0	0.21	683.3
0.23	0.0	0.23	224.0	0.23	515.3	0.23	0.0	0.23	715.0
0.40	0.0	0.40	271.1	0.40	623.7	0.40	0.0	0.40	865.5
0.80	0.0	0.80	271.1	0.80	623.7	0.80	0.0	0.80	865.5
1.60	0.0	1.60	271.1	1.60	623.7	1.60	0.0	1.60	865.5

z (ft)	Elev. 182 to 176	z (ft)	Elev. 176 to 168	z (ft)	Elev. 168 to 160	z (ft)	Elev. 160 to 157	z (ft)	Elev. 157 to 150
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	607.7	0.04	758.7	0.04	745.1	0.04	416.9	0.04	1,142.3
0.08	776.7	0.08	969.7	0.08	952.3	0.08	532.8	0.08	1,459.9
0.11	868.2	0.11	1,084.0	0.11	1,064.6	0.11	595.6	0.11	1,632.0
0.12	896.5	0.12	1,119.4	0.12	1,099.3	0.12	615.1	0.12	1,685.3
0.21	1,084.0	0.21	1,353.5	0.21	1,329.2	0.21	743.7	0.21	2,037.7
0.23	1,134.3	0.23	1,416.2	0.23	1,390.8	0.23	778.1	0.23	2,132.1
0.40	1,373.0	0.40	1,714.3	0.40	1,683.5	0.40	941.9	0.40	2,580.9
0.80	1,373.0	0.80	1,714.3	0.80	1,683.5	0.80	941.9	0.80	2,580.9
1.60	1,373.0	1.60	1,714.3	1.60	1,683.5	1.60	941.9	1.60	2,580.9

z (ft)	Elev. 150 to 145	z (ft)	Elev. 145 to 140	z (ft)	Elev. 140 to 137	z (ft)	Elev. 137 to 130	z (ft)	Elev. 130 to 123
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	1,016.2	0.04	1,101.3	0.04	1,390.4	0.04	620.5	0.04	1,390.4
0.08	1,298.8	0.08	1,407.5	0.08	1,777.1	0.08	793.1	0.08	1,777.1
0.11	1,451.9	0.11	1,573.5	0.11	1,986.6	0.11	886.6	0.11	1,986.6
0.12	1,499.2	0.12	1,624.8	0.12	2,051.4	0.12	915.5	0.12	2,051.4
0.21	1,812.8	0.21	1,964.6	0.21	2,480.5	0.21	1,107.0	0.21	2,480.5
0.23	1,896.8	0.23	2,055.6	0.23	2,595.4	0.23	1,158.3	0.23	2,595.4
0.40	2,296.0	0.40	2,488.2	0.40	3,141.6	0.40	1,402.1	0.40	3,141.6
0.80	2,296.0	0.80	2,488.2	0.80	3,141.6	0.80	1,402.1	0.80	3,141.6
1.60	2,296.0	1.60	2,488.2	1.60	3,141.6	1.60	1,402.1	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 4

Sta.

O. G. Elev. 213.0
Cut off Elev. 213.0

Pile 4" PP
GWS 213.0

z (ft)	*Elev. 213 to 205	z (ft)	*Elev. 205 to 197	z (ft)	Elev. 197 to 194	z (ft)	*Elev. 194 to 190	z (ft)	Elev. 190 to 185
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	297.2	0.04	0.0	0.04	443.7
0.08	0.0	0.08	0.0	0.08	379.9	0.08	0.0	0.08	567.0
0.11	0.0	0.11	0.0	0.11	424.7	0.11	0.0	0.11	633.9
0.12	0.0	0.12	0.0	0.12	438.5	0.12	0.0	0.12	654.6
0.21	0.0	0.21	0.0	0.21	530.2	0.21	0.0	0.21	791.5
0.23	0.0	0.23	0.0	0.23	554.8	0.23	0.0	0.23	828.1
0.40	0.0	0.40	0.0	0.40	671.5	0.40	0.0	0.40	1,002.4
0.80	0.0	0.80	0.0	0.80	671.5	0.80	0.0	0.80	1,002.4
1.60	0.0	1.60	0.0	1.60	671.5	1.60	0.0	1.60	1,002.4

z (ft)	Elev. 185 to 179	z (ft)	Elev. 179 to 174	z (ft)	Elev. 174 to 168	z (ft)	Elev. 168 to 162	z (ft)	Elev. 162 to 153
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	562.4	0.04	535.6	0.04	776.6	0.04	906.1	0.04	850.3
0.08	718.7	0.08	684.5	0.08	992.6	0.08	1,158.1	0.08	1,086.8
0.11	803.5	0.11	765.2	0.11	1,109.6	0.11	1,294.6	0.11	1,214.9
0.12	829.7	0.12	790.2	0.12	1,145.8	0.12	1,336.9	0.12	1,254.6
0.21	1,003.2	0.21	955.5	0.21	1,385.5	0.21	1,616.5	0.21	1,517.0
0.23	1,049.7	0.23	999.7	0.23	1,449.7	0.23	1,691.3	0.23	1,587.2
0.40	1,270.6	0.40	1,210.1	0.40	1,754.8	0.40	2,047.3	0.40	1,921.3
0.80	1,270.6	0.80	1,210.1	0.80	1,754.8	0.80	2,047.3	0.80	1,921.3
1.60	1,270.6	1.60	1,210.1	1.60	1,754.8	1.60	2,047.3	1.60	1,921.3

z (ft)	Elev. 153 to 149	z (ft)	Elev. 149 to 142	z (ft)	Elev. 142 to 139	z (ft)	Elev. 139 to 133	z (ft)	Elev. 133 to 123
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	892.6	0.04	940.7	0.04	373.2	0.04	1,390.4	0.04	636.9
0.08	1,140.9	0.08	1,202.3	0.08	477.0	0.08	1,777.1	0.08	814.0
0.11	1,275.4	0.11	1,344.1	0.11	533.2	0.11	1,986.6	0.11	910.0
0.12	1,317.0	0.12	1,387.9	0.12	550.6	0.12	2,051.4	0.12	939.7
0.21	1,592.4	0.21	1,678.2	0.21	665.8	0.21	2,480.5	0.21	1,136.2
0.23	1,666.2	0.23	1,755.9	0.23	696.6	0.23	2,595.4	0.23	1,188.8
0.40	2,016.9	0.40	2,125.5	0.40	843.2	0.40	3,141.6	0.40	1,439.0
0.80	2,016.9	0.80	2,125.5	0.80	843.2	0.80	3,141.6	0.80	1,439.0
1.60	2,016.9	1.60	2,125.5	1.60	843.2	1.60	3,141.6	1.60	1,439.0

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 5

Sta.

O. G. Elev. 209.0
Cut off Elev. 209.0
Pile 4" PP
GWS 213.0

z (ft)	*Elev. 209 to 201	z (ft)	Elev. 201 to 195	z (ft)	*Elev. 195 to 189	z (ft)	Elev. 189 to 183	z (ft)	Elev. 183 to 177
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	130.1	0.04	0.0	0.04	368.1	0.04	497.5
0.08	0.0	0.08	166.3	0.08	0.0	0.08	470.4	0.08	635.9
0.11	0.0	0.11	185.9	0.11	0.0	0.11	525.9	0.11	710.9
0.12	0.0	0.12	192.0	0.12	0.0	0.12	543.0	0.12	734.1
0.21	0.0	0.21	232.2	0.21	0.0	0.21	656.6	0.21	887.6
0.23	0.0	0.23	242.9	0.23	0.0	0.23	687.0	0.23	928.7
0.40	0.0	0.40	294.0	0.40	0.0	0.40	831.6	0.40	1,124.2
0.80	0.0	0.80	294.0	0.80	0.0	0.80	831.6	0.80	1,124.2
1.60	0.0	1.60	294.0	1.60	0.0	1.60	831.6	1.60	1,124.2

z (ft)	Elev. 177 to 167	z (ft)	Elev. 167 to 159	z (ft)	Elev. 159 to 151	z (ft)	Elev. 151 to 145	z (ft)	Elev. 145 to 139
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	519.0	0.04	653.0	0.04	983.6	0.04	1,134.6	0.04	1,008.1
0.08	663.3	0.08	834.6	0.08	1,257.1	0.08	1,450.1	0.08	1,288.4
0.11	741.5	0.11	933.0	0.11	1,405.3	0.11	1,621.1	0.11	1,440.3
0.12	765.7	0.12	963.4	0.12	1,451.1	0.12	1,674.0	0.12	1,487.3
0.21	925.9	0.21	1,164.9	0.21	1,754.6	0.21	2,024.1	0.21	1,798.3
0.23	968.8	0.23	1,218.9	0.23	1,835.9	0.23	2,117.8	0.23	1,881.6
0.40	1,172.7	0.40	1,475.4	0.40	2,222.3	0.40	2,563.6	0.40	2,277.6
0.80	1,172.7	0.80	1,475.4	0.80	2,222.3	0.80	2,563.6	0.80	2,277.6
1.60	1,172.7	1.60	1,475.4	1.60	2,222.3	1.60	2,563.6	1.60	2,277.6

z (ft)	Elev. 139 to 129	z (ft)	Elev. 129 to 126	z (ft)	Elev. 126 to 116
0.00	0.0	0.00	0.0	0.00	0.0
0.04	1,390.4	0.04	623.6	0.04	1,242.9
0.08	1,777.1	0.08	797.0	0.08	1,588.5
0.11	1,986.6	0.11	890.9	0.11	1,775.8
0.12	2,051.4	0.12	920.0	0.12	1,833.7
0.21	2,480.5	0.21	1,112.4	0.21	2,217.2
0.23	2,595.4	0.23	1,163.9	0.23	2,319.9
0.40	3,141.6	0.40	1,408.9	0.40	2,808.2
0.80	3,141.6	0.80	1,408.9	0.80	2,808.2
1.60	3,141.6	1.60	1,408.9	1.60	2,808.2

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 6

Sta.

O. G. Elev.	209.0	Pile	4" PP
Cut off Elev.	209.0	GWS	209.0

z (ft)	*Elev. 209 to 203	z (ft)	Elev. 203 to 197	z (ft)	*Elev. 197 to 188	z (ft)	Elev. 188 to 185	z (ft)	Elev. 185 to 179
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	110.1	0.04	0.0	0.04	275.3	0.04	345.2
0.08	0.0	0.08	140.7	0.08	0.0	0.08	351.9	0.08	441.2
0.11	0.0	0.11	157.3	0.11	0.0	0.11	393.4	0.11	493.2
0.12	0.0	0.12	162.5	0.12	0.0	0.12	406.2	0.12	509.3
0.21	0.0	0.21	196.5	0.21	0.0	0.21	491.2	0.21	615.8
0.23	0.0	0.23	205.6	0.23	0.0	0.23	513.9	0.23	644.3
0.40	0.0	0.40	248.8	0.40	0.0	0.40	622.1	0.40	780.0
0.80	0.0	0.80	248.8	0.80	0.0	0.80	622.1	0.80	780.0
1.60	0.0	1.60	248.8	1.60	0.0	1.60	622.1	1.60	780.0

z (ft)	*Elev. 179 to 173	z (ft)	*Elev. 173 to 164	z (ft)	*Elev. 164 to 154	z (ft)	Elev. 154 to 147	z (ft)	Elev. 147 to 139
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	870.9	0.04	1,032.8
0.08	0.0	0.08	0.0	0.08	0.0	0.08	1,113.1	0.08	1,320.0
0.11	0.0	0.11	0.0	0.11	0.0	0.11	1,244.4	0.11	1,475.6
0.12	0.0	0.12	0.0	0.12	0.0	0.12	1,285.0	0.12	1,523.7
0.21	0.0	0.21	0.0	0.21	0.0	0.21	1,553.7	0.21	1,842.4
0.23	0.0	0.23	0.0	0.23	0.0	0.23	1,625.7	0.23	1,927.8
0.40	0.0	0.40	0.0	0.40	0.0	0.40	1,967.8	0.40	2,333.5
0.80	0.0	0.80	0.0	0.80	0.0	0.80	1,967.8	0.80	2,333.5
1.60	0.0	1.60	0.0	1.60	0.0	1.60	1,967.8	1.60	2,333.5

z (ft)	Elev. 139 to 132	z (ft)	Elev. 132 to 124	z (ft)	Elev. 124 to 114
0.00	0.0	0.00	0.0	0.00	0.0
0.04	949.7	0.04	1,046.5	0.04	1,039.8
0.08	1,213.9	0.08	1,337.6	0.08	1,329.0
0.11	1,357.0	0.11	1,495.3	0.11	1,485.7
0.12	1,401.2	0.12	1,544.0	0.12	1,534.1
0.21	1,694.3	0.21	1,867.0	0.21	1,855.0
0.23	1,772.8	0.23	1,953.5	0.23	1,940.9
0.40	2,145.9	0.40	2,364.6	0.40	2,349.4
0.80	2,145.9	0.80	2,364.6	0.80	2,349.4
1.60	2,145.9	1.60	2,364.6	1.60	2,349.4

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 7

Sta.

O. G. Elev.	209.0	Pile	4" PP
Cut off Elev.	209.0	GWS	213.0

z (ft)	*Elev. 209 to 203	z (ft)	Elev. 203 to 197	z (ft)	*Elev. 197 to 188	z (ft)	Elev. 188 to 185	z (ft)	Elev. 185 to 179
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	110.1	0.04	0.0	0.04	275.3	0.04	345.2
0.08	0.0	0.08	140.7	0.08	0.0	0.08	351.9	0.08	441.2
0.11	0.0	0.11	157.3	0.11	0.0	0.11	393.4	0.11	493.2
0.12	0.0	0.12	162.5	0.12	0.0	0.12	406.2	0.12	509.3
0.21	0.0	0.21	196.5	0.21	0.0	0.21	491.2	0.21	615.8
0.23	0.0	0.23	205.6	0.23	0.0	0.23	513.9	0.23	644.3
0.40	0.0	0.40	248.8	0.40	0.0	0.40	622.1	0.40	780.0
0.80	0.0	0.80	248.8	0.80	0.0	0.80	622.1	0.80	780.0
1.60	0.0	1.60	248.8	1.60	0.0	1.60	622.1	1.60	780.0

z (ft)	*Elev. 179 to 173	z (ft)	*Elev. 173 to 164	z (ft)	*Elev. 164 to 154	z (ft)	Elev. 154 to 147	z (ft)	Elev. 147 to 139
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	870.9	0.04	1,032.8
0.08	0.0	0.08	0.0	0.08	0.0	0.08	1,113.1	0.08	1,320.0
0.11	0.0	0.11	0.0	0.11	0.0	0.11	1,244.4	0.11	1,475.6
0.12	0.0	0.12	0.0	0.12	0.0	0.12	1,285.0	0.12	1,523.7
0.21	0.0	0.21	0.0	0.21	0.0	0.21	1,553.7	0.21	1,842.4
0.23	0.0	0.23	0.0	0.23	0.0	0.23	1,625.7	0.23	1,927.8
0.40	0.0	0.40	0.0	0.40	0.0	0.40	1,967.8	0.40	2,333.5
0.80	0.0	0.80	0.0	0.80	0.0	0.80	1,967.8	0.80	2,333.5
1.60	0.0	1.60	0.0	1.60	0.0	1.60	1,967.8	1.60	2,333.5

z (ft)	Elev. 139 to 132	z (ft)	Elev. 132 to 124	z (ft)	Elev. 124 to 114
0.00	0.0	0.00	0.0	0.00	0.0
0.04	949.7	0.04	1,046.5	0.04	1,039.8
0.08	1,213.9	0.08	1,337.6	0.08	1,329.0
0.11	1,357.0	0.11	1,495.3	0.11	1,485.7
0.12	1,401.2	0.12	1,544.0	0.12	1,534.1
0.21	1,694.3	0.21	1,867.0	0.21	1,855.0
0.23	1,772.8	0.23	1,953.5	0.23	1,940.9
0.40	2,145.9	0.40	2,364.6	0.40	2,349.4
0.80	2,145.9	0.80	2,364.6	0.80	2,349.4
1.60	2,145.9	1.60	2,364.6	1.60	2,349.4

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 8

Sta.

						O. G. Elev.	208.0	Pile	4" PP
						Cut off Elev.	208.0	GWS	213.0
z (ft)	*Elev. 208 to 198	z (ft)	*Elev. 198 to 190	z (ft)	Elev. 190 to 182	z (ft)	Elev. 182 to 176	z (ft)	Elev. 176 to 170
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	323.2	0.04	474.3	0.04	483.0
0.08	0.0	0.08	0.0	0.08	413.1	0.08	606.2	0.08	617.4
0.11	0.0	0.11	0.0	0.11	461.8	0.11	677.7	0.11	690.1
0.12	0.0	0.12	0.0	0.12	476.9	0.12	699.8	0.12	712.6
0.21	0.0	0.21	0.0	0.21	576.7	0.21	846.1	0.21	861.7
0.23	0.0	0.23	0.0	0.23	603.4	0.23	885.3	0.23	901.6
0.40	0.0	0.40	0.0	0.40	730.4	0.40	1,071.7	0.40	1,091.4
0.80	0.0	0.80	0.0	0.80	730.4	0.80	1,071.7	0.80	1,091.4
1.60	0.0	1.60	0.0	1.60	730.4	1.60	1,071.7	1.60	1,091.4

z (ft)	Elev. 170 to 164	z (ft)	Elev. 164 to 158	z (ft)	Elev. 158 to 150	z (ft)	Elev. 150 to 144	z (ft)	Elev. 144 to 139
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	585.1	0.04	333.9	0.04	961.5	0.04	437.5	0.04	954.8
0.08	747.8	0.08	426.7	0.08	1,228.9	0.08	559.1	0.08	1,220.3
0.11	836.0	0.11	477.1	0.11	1,373.7	0.11	625.0	0.11	1,364.2
0.12	863.3	0.12	492.6	0.12	1,418.5	0.12	645.4	0.12	1,408.7
0.21	1,043.8	0.21	595.6	0.21	1,715.2	0.21	780.4	0.21	1,703.3
0.23	1,092.2	0.23	623.2	0.23	1,794.7	0.23	816.6	0.23	1,782.2
0.40	1,322.0	0.40	754.4	0.40	2,172.4	0.40	988.4	0.40	2,157.3
0.80	1,322.0	0.80	754.4	0.80	2,172.4	0.80	988.4	0.80	2,157.3
1.60	1,322.0	1.60	754.4	1.60	2,172.4	1.60	988.4	1.60	2,157.3

z (ft)	Elev. 139 to 133	z (ft)	Elev. 133 to 128	z (ft)	Elev. 128 to 123	z (ft)	Elev. 123 to 115		
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0		
0.04	1,049.6	0.04	1,143.3	0.04	1,226.6	0.04	894.0		
0.08	1,341.5	0.08	1,461.2	0.08	1,567.7	0.08	1,142.6		
0.11	1,499.6	0.11	1,633.5	0.11	1,752.5	0.11	1,277.3		
0.12	1,548.5	0.12	1,686.7	0.12	1,809.7	0.12	1,319.0		
0.21	1,872.4	0.21	2,039.5	0.21	2,188.2	0.21	1,594.9		
0.23	1,959.1	0.23	2,134.0	0.23	2,289.5	0.23	1,668.8		
0.40	2,371.4	0.40	2,583.1	0.40	2,771.4	0.40	2,020.0		
0.80	2,371.4	0.80	2,583.1	0.80	2,771.4	0.80	2,020.0		
1.60	2,371.4	1.60	2,583.1	1.60	2,771.4	1.60	2,020.0		

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 9

Sta.

O. G. Elev. 208.0
Cut off Elev. 208.0
Pile 4" PP
GWS 213.0

z (ft)	*Elev. 208 to 203	z (ft)	*Elev. 203 to 198	z (ft)	*Elev. 198 to 193	z (ft)	*Elev. 193 to 188	z (ft)	Elev. 188 to 182
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	0.0	0.04	340.3
0.08	0.0	0.08	0.0	0.08	0.0	0.08	0.0	0.08	435.0
0.11	0.0	0.11	0.0	0.11	0.0	0.11	0.0	0.11	486.2
0.12	0.0	0.12	0.0	0.12	0.0	0.12	0.0	0.12	502.1
0.21	0.0	0.21	0.0	0.21	0.0	0.21	0.0	0.21	607.1
0.23	0.0	0.23	0.0	0.23	0.0	0.23	0.0	0.23	635.2
0.40	0.0	0.40	0.0	0.40	0.0	0.40	0.0	0.40	768.9
0.80	0.0	0.80	0.0	0.80	0.0	0.80	0.0	0.80	768.9
1.60	0.0	1.60	0.0	1.60	0.0	1.60	0.0	1.60	768.9

z (ft)	Elev. 182 to 176	z (ft)	*Elev. 176 to 171	z (ft)	Elev. 171 to 165	z (ft)	Elev. 165 to 159	z (ft)	Elev. 159 to 149
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	369.4	0.04	0.0	0.04	511.3	0.04	295.6	0.04	711.7
0.08	472.2	0.08	0.0	0.08	653.5	0.08	377.8	0.08	909.7
0.11	527.9	0.11	0.0	0.11	730.5	0.11	422.4	0.11	1,016.9
0.12	545.1	0.12	0.0	0.12	754.4	0.12	436.2	0.12	1,050.1
0.21	659.1	0.21	0.0	0.21	912.1	0.21	527.4	0.21	1,269.7
0.23	689.6	0.23	0.0	0.23	954.4	0.23	551.8	0.23	1,328.5
0.40	834.7	0.40	0.0	0.40	1,155.3	0.40	668.0	0.40	1,608.1
0.80	834.7	0.80	0.0	0.80	1,155.3	0.80	668.0	0.80	1,608.1
1.60	834.7	1.60	0.0	1.60	1,155.3	1.60	668.0	1.60	1,608.1

z (ft)	Elev. 149 to 141	z (ft)	Elev. 141 to 133	z (ft)	Elev. 133 to 126	z (ft)	Elev. 126 to 119	z (ft)	Elev. 119 to 114
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	851.2	0.04	1,223.1	0.04	1,384.9	0.04	911.9	0.04	648.9
0.08	1,087.9	0.08	1,563.2	0.08	1,770.1	0.08	1,165.5	0.08	829.3
0.11	1,216.1	0.11	1,747.5	0.11	1,978.8	0.11	1,302.9	0.11	927.1
0.12	1,255.8	0.12	1,804.5	0.12	2,043.3	0.12	1,345.4	0.12	957.3
0.21	1,518.5	0.21	2,181.9	0.21	2,470.6	0.21	1,626.8	0.21	1,157.5
0.23	1,588.8	0.23	2,283.0	0.23	2,585.1	0.23	1,702.1	0.23	1,211.2
0.40	1,923.2	0.40	2,763.5	0.40	3,129.2	0.40	2,060.4	0.40	1,466.1
0.80	1,923.2	0.80	2,763.5	0.80	3,129.2	0.80	2,060.4	0.80	1,466.1
1.60	1,923.2	1.60	2,763.5	1.60	3,129.2	1.60	2,060.4	1.60	1,466.1

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 10

Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0

z (ft)	*Elev. 208 to 203	z (ft)	*Elev. 203 to 198	z (ft)	*Elev. 198 to 193	z (ft)	*Elev. 193 to 188	z (ft)	Elev. 188 to 181
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	0.0	0.04	283.1
0.08	0.0	0.08	0.0	0.08	0.0	0.08	0.0	0.08	361.8
0.11	0.0	0.11	0.0	0.11	0.0	0.11	0.0	0.11	404.5
0.12	0.0	0.12	0.0	0.12	0.0	0.12	0.0	0.12	417.7
0.21	0.0	0.21	0.0	0.21	0.0	0.21	0.0	0.21	505.1
0.23	0.0	0.23	0.0	0.23	0.0	0.23	0.0	0.23	528.4
0.40	0.0	0.40	0.0	0.40	0.0	0.40	0.0	0.40	639.7
0.80	0.0	0.80	0.0	0.80	0.0	0.80	0.0	0.80	639.7
1.60	0.0	1.60	0.0	1.60	0.0	1.60	0.0	1.60	639.7

z (ft)	Elev. 181 to 174	z (ft)	Elev. 174 to 171	z (ft)	Elev. 171 to 165	z (ft)	Elev. 165 to 159	z (ft)	Elev. 159 to 153
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	504.9	0.04	241.5	0.04	270.6	0.04	626.3	0.04	719.1
0.08	645.4	0.08	308.6	0.08	345.9	0.08	800.4	0.08	919.1
0.11	721.4	0.11	345.0	0.11	386.7	0.11	894.8	0.11	1,027.5
0.12	745.0	0.12	356.3	0.12	399.3	0.12	924.0	0.12	1,061.0
0.21	900.8	0.21	430.8	0.21	482.8	0.21	1,117.2	0.21	1,282.9
0.23	942.5	0.23	450.7	0.23	505.2	0.23	1,169.0	0.23	1,342.3
0.40	1,140.9	0.40	545.6	0.40	611.5	0.40	1,415.0	0.40	1,624.9
0.80	1,140.9	0.80	545.6	0.80	611.5	0.80	1,415.0	0.80	1,624.9
1.60	1,140.9	1.60	545.6	1.60	611.5	1.60	1,415.0	1.60	1,624.9

z (ft)	Elev. 153 to 147	z (ft)	Elev. 147 to 140	z (ft)	Elev. 140 to 133	z (ft)	Elev. 133 to 123	z (ft)	Elev. 123 to 113
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	1,023.3	0.04	1,163.5	0.04	1,314.6	0.04	1,050.5	0.04	663.5
0.08	1,307.8	0.08	1,487.1	0.08	1,680.2	0.08	1,342.6	0.08	848.0
0.11	1,462.0	0.11	1,662.4	0.11	1,878.3	0.11	1,500.9	0.11	948.0
0.12	1,509.7	0.12	1,716.7	0.12	1,939.5	0.12	1,549.9	0.12	978.9
0.21	1,825.5	0.21	2,075.7	0.21	2,345.2	0.21	1,874.0	0.21	1,183.6
0.23	1,910.0	0.23	2,171.8	0.23	2,453.8	0.23	1,960.8	0.23	1,238.5
0.40	2,312.0	0.40	2,628.9	0.40	2,970.3	0.40	2,373.5	0.40	1,499.1
0.80	2,312.0	0.80	2,628.9	0.80	2,970.3	0.80	2,373.5	0.80	1,499.1
1.60	2,312.0	1.60	2,628.9	1.60	2,970.3	1.60	2,373.5	1.60	1,499.1

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 11

Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0

z (ft)	*Elev. 208 to 201	z (ft)	*Elev. 201 to 191	z (ft)	Elev. 191 to 184	z (ft)	Elev. 184 to 175	z (ft)	Elev. 175 to 166
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	258.5	0.04	495.7	0.04	534.9
0.08	0.0	0.08	0.0	0.08	330.4	0.08	633.6	0.08	683.7
0.11	0.0	0.11	0.0	0.11	369.3	0.11	708.3	0.11	764.3
0.12	0.0	0.12	0.0	0.12	381.3	0.12	731.4	0.12	789.2
0.21	0.0	0.21	0.0	0.21	461.1	0.21	884.3	0.21	954.2
0.23	0.0	0.23	0.0	0.23	482.5	0.23	925.3	0.23	998.4
0.40	0.0	0.40	0.0	0.40	584.0	0.40	1,120.1	0.40	1,208.6
0.80	0.0	0.80	0.0	0.80	584.0	0.80	1,120.1	0.80	1,208.6
1.60	0.0	1.60	0.0	1.60	584.0	1.60	1,120.1	1.60	1,208.6

z (ft)	*Elev. 166 to 163	z (ft)	*Elev. 163 to 157	z (ft)	Elev. 157 to 153	z (ft)	Elev. 153 to 146	z (ft)	Elev. 146 to 140
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	901.4	0.04	809.4	0.04	1,143.7
0.08	0.0	0.08	0.0	0.08	1,152.1	0.08	1,034.5	0.08	1,461.8
0.11	0.0	0.11	0.0	0.11	1,287.9	0.11	1,156.5	0.11	1,634.2
0.12	0.0	0.12	0.0	0.12	1,330.0	0.12	1,194.2	0.12	1,687.4
0.21	0.0	0.21	0.0	0.21	1,608.1	0.21	1,444.0	0.21	2,040.4
0.23	0.0	0.23	0.0	0.23	1,682.6	0.23	1,510.9	0.23	2,134.9
0.40	0.0	0.40	0.0	0.40	2,036.7	0.40	1,828.9	0.40	2,584.2
0.80	0.0	0.80	0.0	0.80	2,036.7	0.80	1,828.9	0.80	2,584.2
1.60	0.0	1.60	0.0	1.60	2,036.7	1.60	1,828.9	1.60	2,584.2

z (ft)	Elev. 140 to 134	z (ft)	Elev. 134 to 128	z (ft)	Elev. 128 to 123	z (ft)	Elev. 123 to 118		
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0		
0.04	1,273.2	0.04	1,390.4	0.04	1,172.3	0.04	1,135.4		
0.08	1,627.3	0.08	1,777.1	0.08	1,498.4	0.08	1,451.2		
0.11	1,819.2	0.11	1,986.6	0.11	1,675.0	0.11	1,622.3		
0.12	1,878.5	0.12	2,051.4	0.12	1,729.6	0.12	1,675.2		
0.21	2,271.4	0.21	2,480.5	0.21	2,091.4	0.21	2,025.6		
0.23	2,376.6	0.23	2,595.4	0.23	2,188.3	0.23	2,119.4		
0.40	2,876.8	0.40	3,141.6	0.40	2,648.8	0.40	2,565.5		
0.80	2,876.8	0.80	3,141.6	0.80	2,648.8	0.80	2,565.5		
1.60	2,876.8	1.60	3,141.6	1.60	2,648.8	1.60	2,565.5		

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 12

Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0

z (ft)	*Elev. 208 to 198	z (ft)	Elev. 198 to 188	z (ft)	*Elev. 188 to 185	z (ft)	Elev. 185 to 176	z (ft)	Elev. 176 to 174
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	165.4	0.04	0.0	0.04	352.7	0.04	220.3
0.08	0.0	0.08	211.3	0.08	0.0	0.08	450.8	0.08	281.6
0.11	0.0	0.11	236.2	0.11	0.0	0.11	503.9	0.11	314.8
0.12	0.0	0.12	244.0	0.12	0.0	0.12	520.4	0.12	325.1
0.21	0.0	0.21	295.0	0.21	0.0	0.21	629.2	0.21	393.1
0.23	0.0	0.23	308.6	0.23	0.0	0.23	658.4	0.23	411.3
0.40	0.0	0.40	373.6	0.40	0.0	0.40	796.9	0.40	497.8
0.80	0.0	0.80	373.6	0.80	0.0	0.80	796.9	0.80	497.8
1.60	0.0	1.60	373.6	1.60	0.0	1.60	796.9	1.60	497.8

z (ft)	*Elev. 174 to 170	z (ft)	*Elev. 170 to 164	z (ft)	Elev. 164 to 157	z (ft)	Elev. 157 to 149	z (ft)	Elev. 149 to 145
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	751.1	0.04	912.9	0.04	829.3
0.08	0.0	0.08	0.0	0.08	959.9	0.08	1,166.8	0.08	1,059.9
0.11	0.0	0.11	0.0	0.11	1,073.1	0.11	1,304.3	0.11	1,184.8
0.12	0.0	0.12	0.0	0.12	1,108.1	0.12	1,346.9	0.12	1,223.5
0.21	0.0	0.21	0.0	0.21	1,339.9	0.21	1,628.6	0.21	1,479.3
0.23	0.0	0.23	0.0	0.23	1,401.9	0.23	1,704.0	0.23	1,547.9
0.40	0.0	0.40	0.0	0.40	1,697.0	0.40	2,062.7	0.40	1,873.6
0.80	0.0	0.80	0.0	0.80	1,697.0	0.80	2,062.7	0.80	1,873.6
1.60	0.0	1.60	0.0	1.60	1,697.0	1.60	2,062.7	1.60	1,873.6

z (ft)	Elev. 145 to 139	z (ft)	Elev. 139 to 133	z (ft)	Elev. 133 to 125	z (ft)	Elev. 125 to 117		
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0		
0.04	1,138.6	0.04	1,014.5	0.04	559.3	0.04	1,390.4		
0.08	1,455.3	0.08	1,296.6	0.08	714.8	0.08	1,777.1		
0.11	1,626.9	0.11	1,449.5	0.11	799.1	0.11	1,986.6		
0.12	1,679.9	0.12	1,496.8	0.12	825.1	0.12	2,051.4		
0.21	2,031.3	0.21	1,809.8	0.21	997.7	0.21	2,480.5		
0.23	2,125.4	0.23	1,893.6	0.23	1,043.9	0.23	2,595.4		
0.40	2,572.7	0.40	2,292.2	0.40	1,263.6	0.40	3,141.6		
0.80	2,572.7	0.80	2,292.2	0.80	1,263.6	0.80	3,141.6		
1.60	2,572.7	1.60	2,292.2	1.60	1,263.6	1.60	3,141.6		

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 13

Sta.

O. G. Elev.	207.0	Pile	4' PP
Cut off Elev.	207.0	GWS	213.0

z (ft)	Elev. 207 to 197	z (ft)	Elev. 197 to 189	z (ft)	Elev. 189 to 183	z (ft)	Elev. 183 to 177	z (ft)	Elev. 177 to 169
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	68.4	0.04	198.7	0.04	309.2	0.04	403.0	0.04	512.8
0.08	87.5	0.08	254.0	0.08	395.2	0.08	515.1	0.08	655.4
0.11	97.8	0.11	283.9	0.11	441.8	0.11	575.9	0.11	732.6
0.12	101.0	0.12	293.2	0.12	456.2	0.12	594.6	0.12	756.5
0.21	122.1	0.21	354.5	0.21	551.6	0.21	719.0	0.21	914.7
0.23	127.7	0.23	370.9	0.23	577.1	0.23	752.3	0.23	957.1
0.40	154.6	0.40	449.0	0.40	698.6	0.40	910.7	0.40	1,158.6
0.80	154.6	0.80	449.0	0.80	698.6	0.80	910.7	0.80	1,158.6
1.60	154.6	1.60	449.0	1.60	698.6	1.60	910.7	1.60	1,158.6

z (ft)	*Elev. 169 to 162	z (ft)	Elev. 162 to 154	z (ft)	Elev. 154 to 147	z (ft)	Elev. 147 to 144	z (ft)	Elev. 144 to 139
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	727.8	0.04	68.1	0.04	442.9	0.04	68.8
0.08	0.0	0.08	930.3	0.08	87.1	0.08	566.1	0.08	88.0
0.11	0.0	0.11	1,039.9	0.11	97.3	0.11	632.9	0.11	98.3
0.12	0.0	0.12	1,073.8	0.12	100.5	0.12	653.5	0.12	101.5
0.21	0.0	0.21	1,298.4	0.21	121.5	0.21	790.2	0.21	122.8
0.23	0.0	0.23	1,358.6	0.23	127.2	0.23	826.8	0.23	128.5
0.40	0.0	0.40	1,644.5	0.40	153.9	0.40	1,000.8	0.40	155.5
0.80	0.0	0.80	1,644.5	0.80	153.9	0.80	1,000.8	0.80	155.5
1.60	0.0	1.60	1,644.5	1.60	153.9	1.60	1,000.8	1.60	155.5

z (ft)	Elev. 139 to 133	z (ft)	Elev. 133 to 126
0.00	0.0	0.00	0.0
0.04	999.5	0.04	1,068.2
0.08	1,277.5	0.08	1,365.3
0.11	1,428.1	0.11	1,526.2
0.12	1,474.6	0.12	1,576.0
0.21	1,783.1	0.21	1,905.6
0.23	1,865.7	0.23	1,993.9
0.40	2,258.3	0.40	2,413.5
0.80	2,258.3	0.80	2,413.5
1.60	2,258.3	1.60	2,413.5

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 14

Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0

z (ft)	*Elev. 206 to 201	z (ft)	*Elev. 201 to 196	z (ft)	Elev. 196 to 190	z (ft)	*Elev. 190 to 183	z (ft)	Elev. 183 to 178
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	202.5	0.04	0.0	0.04	339.6
0.08	0.0	0.08	0.0	0.08	258.9	0.08	0.0	0.08	434.1
0.11	0.0	0.11	0.0	0.11	289.4	0.11	0.0	0.11	485.3
0.12	0.0	0.12	0.0	0.12	298.8	0.12	0.0	0.12	501.1
0.21	0.0	0.21	0.0	0.21	361.3	0.21	0.0	0.21	605.9
0.23	0.0	0.23	0.0	0.23	378.0	0.23	0.0	0.23	634.0
0.40	0.0	0.40	0.0	0.40	457.6	0.40	0.0	0.40	767.4
0.80	0.0	0.80	0.0	0.80	457.6	0.80	0.0	0.80	767.4
1.60	0.0	1.60	0.0	1.60	457.6	1.60	0.0	1.60	767.4

z (ft)	Elev. 178 to 173	z (ft)	Elev. 173 to 166	z (ft)	*Elev. 166 to 161	z (ft)	Elev. 161 to 156	z (ft)	Elev. 156 to 150
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	528.7	0.04	522.5	0.04	0.0	0.04	660.4	0.04	50.1
0.08	675.8	0.08	667.9	0.08	0.0	0.08	844.1	0.08	64.0
0.11	755.5	0.11	746.6	0.11	0.0	0.11	943.6	0.11	71.5
0.12	780.1	0.12	770.9	0.12	0.0	0.12	974.3	0.12	73.9
0.21	943.2	0.21	932.2	0.21	0.0	0.21	1,178.1	0.21	89.3
0.23	986.9	0.23	975.4	0.23	0.0	0.23	1,232.7	0.23	93.4
0.40	1,194.7	0.40	1,180.6	0.40	0.0	0.40	1,492.1	0.40	113.1
0.80	1,194.7	0.80	1,180.6	0.80	0.0	0.80	1,492.1	0.80	113.1
1.60	1,194.7	1.60	1,180.6	1.60	0.0	1.60	1,492.1	1.60	113.1

z (ft)	Elev. 150 to 144	z (ft)	Elev. 144 to 138	z (ft)	Elev. 138 to 128	z (ft)	Elev. 128 to 121	z (ft)	Elev. 121 to 113
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	60.1	0.04	70.1	0.04	825.0	0.04	1,322.4	0.04	1,390.4
0.08	76.8	0.08	89.6	0.08	1,054.4	0.08	1,690.1	0.08	1,777.1
0.11	85.8	0.11	100.1	0.11	1,178.8	0.11	1,889.4	0.11	1,986.6
0.12	88.6	0.12	103.4	0.12	1,217.2	0.12	1,951.0	0.12	2,051.4
0.21	107.2	0.21	125.0	0.21	1,471.8	0.21	2,359.0	0.21	2,480.5
0.23	112.1	0.23	130.8	0.23	1,539.9	0.23	2,468.3	0.23	2,595.4
0.40	135.7	0.40	158.3	0.40	1,864.1	0.40	2,987.8	0.40	3,141.6
0.80	135.7	0.80	158.3	0.80	1,864.1	0.80	2,987.8	0.80	3,141.6
1.60	135.7	1.60	158.3	1.60	1,864.1	1.60	2,987.8	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 15

Sta.

O. G. Elev. 206.0
Cut off Elev. 206.0
Pile 4' PP
GWS 213.0

z (ft)	*Elev. 206 to 201	z (ft)	*Elev. 201 to 196	z (ft)	Elev. 196 to 190	z (ft)	*Elev. 190 to 183	z (ft)	Elev. 183 to 178
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	202.5	0.04	0.0	0.04	339.6
0.08	0.0	0.08	0.0	0.08	258.9	0.08	0.0	0.08	434.1
0.11	0.0	0.11	0.0	0.11	289.4	0.11	0.0	0.11	485.3
0.12	0.0	0.12	0.0	0.12	298.8	0.12	0.0	0.12	501.1
0.21	0.0	0.21	0.0	0.21	361.3	0.21	0.0	0.21	605.9
0.23	0.0	0.23	0.0	0.23	378.0	0.23	0.0	0.23	634.0
0.40	0.0	0.40	0.0	0.40	457.6	0.40	0.0	0.40	767.4
0.80	0.0	0.80	0.0	0.80	457.6	0.80	0.0	0.80	767.4
1.60	0.0	1.60	0.0	1.60	457.6	1.60	0.0	1.60	767.4

z (ft)	Elev. 178 to 173	z (ft)	Elev. 173 to 166	z (ft)	*Elev. 166 to 161	z (ft)	Elev. 161 to 156	z (ft)	Elev. 156 to 150
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	528.7	0.04	522.5	0.04	0.0	0.04	660.4	0.04	50.1
0.08	675.8	0.08	667.9	0.08	0.0	0.08	844.1	0.08	64.0
0.11	755.5	0.11	746.6	0.11	0.0	0.11	943.6	0.11	71.5
0.12	780.1	0.12	770.9	0.12	0.0	0.12	974.3	0.12	73.9
0.21	943.2	0.21	932.2	0.21	0.0	0.21	1,178.1	0.21	89.3
0.23	986.9	0.23	975.4	0.23	0.0	0.23	1,232.7	0.23	93.4
0.40	1,194.7	0.40	1,180.6	0.40	0.0	0.40	1,492.1	0.40	113.1
0.80	1,194.7	0.80	1,180.6	0.80	0.0	0.80	1,492.1	0.80	113.1
1.60	1,194.7	1.60	1,180.6	1.60	0.0	1.60	1,492.1	1.60	113.1

z (ft)	Elev. 150 to 144	z (ft)	Elev. 144 to 138	z (ft)	Elev. 138 to 128	z (ft)	Elev. 128 to 121	z (ft)	Elev. 121 to 113
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	60.1	0.04	70.1	0.04	825.0	0.04	1,322.4	0.04	1,390.4
0.08	76.8	0.08	89.6	0.08	1,054.4	0.08	1,690.1	0.08	1,777.1
0.11	85.8	0.11	100.1	0.11	1,178.8	0.11	1,889.4	0.11	1,986.6
0.12	88.6	0.12	103.4	0.12	1,217.2	0.12	1,951.0	0.12	2,051.4
0.21	107.2	0.21	125.0	0.21	1,471.8	0.21	2,359.0	0.21	2,480.5
0.23	112.1	0.23	130.8	0.23	1,539.9	0.23	2,468.3	0.23	2,595.4
0.40	135.7	0.40	158.3	0.40	1,864.1	0.40	2,987.8	0.40	3,141.6
0.80	135.7	0.80	158.3	0.80	1,864.1	0.80	2,987.8	0.80	3,141.6
1.60	135.7	1.60	158.3	1.60	1,864.1	1.60	2,987.8	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 16

Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0

z (ft)	*Elev. 206 to 199	z (ft)	*	z (ft)	*Elev. 191 to 183	z (ft)	Elev. 183 to 177	z (ft)	Elev. 177 to 171
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	331.3	0.04	427.7
0.08	0.0	0.08	0.0	0.08	0.0	0.08	423.4	0.08	546.7
0.11	0.0	0.11	0.0	0.11	0.0	0.11	473.3	0.11	611.1
0.12	0.0	0.12	0.0	0.12	0.0	0.12	488.8	0.12	631.0
0.21	0.0	0.21	0.0	0.21	0.0	0.21	591.0	0.21	763.0
0.23	0.0	0.23	0.0	0.23	0.0	0.23	618.4	0.23	798.4
0.40	0.0	0.40	0.0	0.40	0.0	0.40	748.5	0.40	966.4
0.80	0.0	0.80	0.0	0.80	0.0	0.80	748.5	0.80	966.4
1.60	0.0	1.60	0.0	1.60	0.0	1.60	748.5	1.60	966.4

z (ft)	*Elev. 171 to 161	z (ft)	Elev. 161 to 156	z (ft)	Elev. 156 to 151	z (ft)	Elev. 151 to 144	z (ft)	Elev. 144 to 140
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	766.6	0.04	692.7	0.04	80.3	0.04	60.1
0.08	0.0	0.08	979.7	0.08	885.4	0.08	102.7	0.08	76.8
0.11	0.0	0.11	1,095.2	0.11	989.7	0.11	114.8	0.11	85.8
0.12	0.0	0.12	1,131.0	0.12	1,022.0	0.12	118.5	0.12	88.6
0.21	0.0	0.21	1,367.5	0.21	1,235.8	0.21	143.3	0.21	107.2
0.23	0.0	0.23	1,430.9	0.23	1,293.0	0.23	150.0	0.23	112.1
0.40	0.0	0.40	1,732.0	0.40	1,565.2	0.40	181.5	0.40	135.7
0.80	0.0	0.80	1,732.0	0.80	1,565.2	0.80	181.5	0.80	135.7
1.60	0.0	1.60	1,732.0	1.60	1,565.2	1.60	181.5	1.60	135.7

z (ft)	Elev. 140 to 133	z (ft)	Elev. 133 to 128	z (ft)	Elev. 128 to 123	z (ft)	Elev. 123 to 118	z (ft)	Elev. 118 to 113
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	442.1	0.04	1,209.2	0.04	1,053.1	0.04	564.4	0.04	1,205.1
0.08	565.1	0.08	1,545.4	0.08	1,346.0	0.08	721.4	0.08	1,540.2
0.11	631.7	0.11	1,727.6	0.11	1,504.7	0.11	806.4	0.11	1,721.8
0.12	652.3	0.12	1,784.0	0.12	1,553.8	0.12	832.7	0.12	1,777.9
0.21	788.7	0.21	2,157.1	0.21	1,878.7	0.21	1,006.9	0.21	2,149.8
0.23	825.2	0.23	2,257.0	0.23	1,965.8	0.23	1,053.5	0.23	2,249.3
0.40	998.9	0.40	2,732.0	0.40	2,379.5	0.40	1,275.3	0.40	2,722.8
0.80	998.9	0.80	2,732.0	0.80	2,379.5	0.80	1,275.3	0.80	2,722.8
1.60	998.9	1.60	2,732.0	1.60	2,379.5	1.60	1,275.3	1.60	2,722.8

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 17

Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0

z (ft)	Elev. 206 to 201	z (ft)	Elev. 201 to 196	z (ft)	Elev. 196 to 189	z (ft)	*Elev. 189 to 184	z (ft)	Elev. 184 to 177
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	53.9	0.04	161.8	0.04	223.6	0.04	0.0	0.04	489.9
0.08	69.0	0.08	206.9	0.08	285.8	0.08	0.0	0.08	626.1
0.11	77.1	0.11	231.2	0.11	319.5	0.11	0.0	0.11	699.9
0.12	79.6	0.12	238.8	0.12	330.0	0.12	0.0	0.12	722.7
0.21	96.2	0.21	288.7	0.21	399.0	0.21	0.0	0.21	873.9
0.23	100.7	0.23	302.1	0.23	417.5	0.23	0.0	0.23	914.4
0.40	121.9	0.40	365.7	0.40	505.3	0.40	0.0	0.40	1,106.8
0.80	121.9	0.80	365.7	0.80	505.3	0.80	0.0	0.80	1,106.8
1.60	121.9	1.60	365.7	1.60	505.3	1.60	0.0	1.60	1,106.8

z (ft)	Elev. 177 to 169	z (ft)	*Elev. 169 to 163	z (ft)	Elev. 163 to 157	z (ft)	Elev. 157 to 152	z (ft)	Elev. 152 to 148
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	517.4	0.04	0.0	0.04	685.6	0.04	224.2	0.04	75.4
0.08	661.3	0.08	0.0	0.08	876.3	0.08	286.5	0.08	96.4
0.11	739.2	0.11	0.0	0.11	979.6	0.11	320.3	0.11	107.8
0.12	763.3	0.12	0.0	0.12	1,011.5	0.12	330.7	0.12	111.3
0.21	923.0	0.21	0.0	0.21	1,223.1	0.21	399.9	0.21	134.6
0.23	965.7	0.23	0.0	0.23	1,279.7	0.23	418.4	0.23	140.8
0.40	1,169.0	0.40	0.0	0.40	1,549.1	0.40	506.5	0.40	170.4
0.80	1,169.0	0.80	0.0	0.80	1,549.1	0.80	506.5	0.80	170.4
1.60	1,169.0	1.60	0.0	1.60	1,549.1	1.60	506.5	1.60	170.4

z (ft)	Elev. 148 to 136	z (ft)	Elev. 136 to 128	z (ft)	Elev. 128 to 123	z (ft)	Elev. 123 to 118	z (ft)	Elev. 118 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	80.1	0.04	987.5	0.04	1,088.4	0.04	1,067.8	0.04	1,033.4
0.08	102.4	0.08	1,262.1	0.08	1,391.1	0.08	1,364.8	0.08	1,320.8
0.11	114.4	0.11	1,410.9	0.11	1,555.1	0.11	1,525.7	0.11	1,476.6
0.12	118.2	0.12	1,456.9	0.12	1,605.8	0.12	1,575.4	0.12	1,524.7
0.21	142.9	0.21	1,761.6	0.21	1,941.6	0.21	1,904.9	0.21	1,843.6
0.23	149.5	0.23	1,843.2	0.23	2,031.6	0.23	1,993.2	0.23	1,929.0
0.40	181.0	0.40	2,231.1	0.40	2,459.1	0.40	2,412.7	0.40	2,335.0
0.80	181.0	0.80	2,231.1	0.80	2,459.1	0.80	2,412.7	0.80	2,335.0
1.60	181.0	1.60	2,231.1	1.60	2,459.1	1.60	2,412.7	1.60	2,335.0

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 18

Sta.

O. G. Elev. 206.0
Cut off Elev. 206.0

Pile 4' PP
GWS 213.0

z (ft)	*Elev. 206 to 199	z (ft)	*Elev. 199 to 191	z (ft)	*Elev. 191 to 185	z (ft)	*Elev. 185 to 176	z (ft)	Elev. 176 to 171
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	0.0	0.04	565.4
0.08	0.0	0.08	0.0	0.08	0.0	0.08	0.0	0.08	722.6
0.11	0.0	0.11	0.0	0.11	0.0	0.11	0.0	0.11	807.8
0.12	0.0	0.12	0.0	0.12	0.0	0.12	0.0	0.12	834.1
0.21	0.0	0.21	0.0	0.21	0.0	0.21	0.0	0.21	1,008.6
0.23	0.0	0.23	0.0	0.23	0.0	0.23	0.0	0.23	1,055.3
0.40	0.0	0.40	0.0	0.40	0.0	0.40	0.0	0.40	1,277.4
0.80	0.0	0.80	0.0	0.80	0.0	0.80	0.0	0.80	1,277.4
1.60	0.0	1.60	0.0	1.60	0.0	1.60	0.0	1.60	1,277.4

z (ft)	*Elev. 171 to 166	z (ft)	Elev. 166 to 163	z (ft)	Elev. 163 to 160	z (ft)	Elev. 160 to 151	z (ft)	Elev. 151 to 141
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	167.3	0.04	57.5	0.04	65.1	0.04	75.1
0.08	0.0	0.08	213.8	0.08	73.4	0.08	83.2	0.08	96.0
0.11	0.0	0.11	239.1	0.11	82.1	0.11	93.0	0.11	107.3
0.12	0.0	0.12	246.9	0.12	84.8	0.12	96.0	0.12	110.8
0.21	0.0	0.21	298.5	0.21	102.5	0.21	116.1	0.21	133.9
0.23	0.0	0.23	312.3	0.23	107.2	0.23	121.5	0.23	140.1
0.40	0.0	0.40	378.0	0.40	129.8	0.40	147.0	0.40	169.6
0.80	0.0	0.80	378.0	0.80	129.8	0.80	147.0	0.80	169.6
1.60	0.0	1.60	378.0	1.60	129.8	1.60	147.0	1.60	169.6

z (ft)	Elev. 141 to 136	z (ft)	Elev. 136 to 131	z (ft)	Elev. 131 to 126	z (ft)	Elev. 126 to 119	z (ft)	Elev. 119 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	143.9	0.04	1,127.8	0.04	878.5	0.04	1,343.4	0.04	1,390.4
0.08	183.9	0.08	1,441.5	0.08	1,122.9	0.08	1,717.0	0.08	1,777.1
0.11	205.6	0.11	1,611.4	0.11	1,255.2	0.11	1,919.4	0.11	1,986.6
0.12	212.3	0.12	1,664.0	0.12	1,296.2	0.12	1,982.0	0.12	2,051.4
0.21	256.7	0.21	2,012.0	0.21	1,567.3	0.21	2,396.6	0.21	2,480.5
0.23	268.6	0.23	2,105.2	0.23	1,639.9	0.23	2,507.6	0.23	2,595.4
0.40	325.2	0.40	2,548.3	0.40	1,985.0	0.40	3,035.4	0.40	3,141.6
0.80	325.2	0.80	2,548.3	0.80	1,985.0	0.80	3,035.4	0.80	3,141.6
1.60	325.2	1.60	2,548.3	1.60	1,985.0	1.60	3,035.4	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 19

Sta.

O. G. Elev.	207.0	Pile	4' PP
Cut off Elev.	207.0	GWS	213.0

z (ft)	*Elev. 207 to 199	z (ft)	*Elev. 199 to 189	z (ft)	*Elev. 189 to 183	z (ft)	*Elev. 183 to 176	z (ft)	Elev. 176 to 172
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	0.0	0.04	518.5
0.08	0.0	0.08	0.0	0.08	0.0	0.08	0.0	0.08	662.7
0.11	0.0	0.11	0.0	0.11	0.0	0.11	0.0	0.11	740.9
0.12	0.0	0.12	0.0	0.12	0.0	0.12	0.0	0.12	765.0
0.21	0.0	0.21	0.0	0.21	0.0	0.21	0.0	0.21	925.0
0.23	0.0	0.23	0.0	0.23	0.0	0.23	0.0	0.23	967.9
0.40	0.0	0.40	0.0	0.40	0.0	0.40	0.0	0.40	1,171.6
0.80	0.0	0.80	0.0	0.80	0.0	0.80	0.0	0.80	1,171.6
1.60	0.0	1.60	0.0	1.60	0.0	1.60	0.0	1.60	1,171.6

z (ft)	*Elev. 172 to 167	z (ft)	*Elev. 167 to 162	z (ft)	Elev. 162 to 157	z (ft)	Elev. 157 to 152	z (ft)	Elev. 152 to 146
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	596.9	0.04	15.0	0.04	150.2
0.08	0.0	0.08	0.0	0.08	762.9	0.08	19.2	0.08	191.9
0.11	0.0	0.11	0.0	0.11	852.8	0.11	21.5	0.11	214.6
0.12	0.0	0.12	0.0	0.12	880.7	0.12	22.2	0.12	221.6
0.21	0.0	0.21	0.0	0.21	1,064.9	0.21	26.8	0.21	267.9
0.23	0.0	0.23	0.0	0.23	1,114.2	0.23	28.0	0.23	280.3
0.40	0.0	0.40	0.0	0.40	1,348.7	0.40	33.9	0.40	339.3
0.80	0.0	0.80	0.0	0.80	1,348.7	0.80	33.9	0.80	339.3
1.60	0.0	1.60	0.0	1.60	1,348.7	1.60	33.9	1.60	339.3

z (ft)	Elev. 146 to 140	z (ft)	Elev. 140 to 134	z (ft)	Elev. 134 to 127	z (ft)	Elev. 127 to 122	z (ft)	Elev. 122 to 114
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	75.1	0.04	845.2	0.04	884.1	0.04	1,031.0	0.04	1,390.4
0.08	96.0	0.08	1,080.3	0.08	1,130.0	0.08	1,317.8	0.08	1,777.1
0.11	107.3	0.11	1,207.6	0.11	1,263.2	0.11	1,473.1	0.11	1,986.6
0.12	110.8	0.12	1,247.0	0.12	1,304.4	0.12	1,521.2	0.12	2,051.4
0.21	133.9	0.21	1,507.9	0.21	1,577.2	0.21	1,839.3	0.21	2,480.5
0.23	140.1	0.23	1,577.7	0.23	1,650.3	0.23	1,924.5	0.23	2,595.4
0.40	169.6	0.40	1,909.8	0.40	1,997.6	0.40	2,329.6	0.40	3,141.6
0.80	169.6	0.80	1,909.8	0.80	1,997.6	0.80	2,329.6	0.80	3,141.6
1.60	169.6	1.60	1,909.8	1.60	1,997.6	1.60	2,329.6	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 20

Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0

z (ft)	*Elev. 206 to 195	z (ft)	*Elev. 195 to 192	z (ft)	*Elev. 192 to 186	z (ft)	*Elev. 186 to 181	z (ft)	*Elev. 181 to 175
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	0.0	0.04	0.0
0.08	0.0	0.08	0.0	0.08	0.0	0.08	0.0	0.08	0.0
0.11	0.0	0.11	0.0	0.11	0.0	0.11	0.0	0.11	0.0
0.12	0.0	0.12	0.0	0.12	0.0	0.12	0.0	0.12	0.0
0.21	0.0	0.21	0.0	0.21	0.0	0.21	0.0	0.21	0.0
0.23	0.0	0.23	0.0	0.23	0.0	0.23	0.0	0.23	0.0
0.40	0.0	0.40	0.0	0.40	0.0	0.40	0.0	0.40	0.0
0.80	0.0	0.80	0.0	0.80	0.0	0.80	0.0	0.80	0.0
1.60	0.0	1.60	0.0	1.60	0.0	1.60	0.0	1.60	0.0

z (ft)	Elev. 175 to 170	z (ft)	*Elev. 170 to 163	z (ft)	Elev. 163 to 160	z (ft)	Elev. 160 to 156	z (ft)	Elev. 156 to 151
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	466.4	0.04	0.0	0.04	111.8	0.04	274.5	0.04	41.0
0.08	596.1	0.08	0.0	0.08	142.9	0.08	350.9	0.08	52.4
0.11	666.3	0.11	0.0	0.11	159.8	0.11	392.2	0.11	58.6
0.12	688.1	0.12	0.0	0.12	165.0	0.12	405.0	0.12	60.5
0.21	832.0	0.21	0.0	0.21	199.5	0.21	489.7	0.21	73.1
0.23	870.5	0.23	0.0	0.23	208.7	0.23	512.4	0.23	76.5
0.40	1,053.7	0.40	0.0	0.40	252.7	0.40	620.3	0.40	92.6
0.80	1,053.7	0.80	0.0	0.80	252.7	0.80	620.3	0.80	92.6
1.60	1,053.7	1.60	0.0	1.60	252.7	1.60	620.3	1.60	92.6

z (ft)	Elev. 151 to 146	z (ft)	Elev. 146 to 139	z (ft)	Elev. 139 to 135	z (ft)	Elev. 135 to 132	z (ft)	Elev. 132 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	192.7	0.04	350.6	0.04	131.0	0.04	241.3	0.04	966.6
0.08	246.3	0.08	448.1	0.08	167.5	0.08	308.5	0.08	1,235.4
0.11	275.3	0.11	500.9	0.11	187.2	0.11	344.8	0.11	1,381.1
0.12	284.3	0.12	517.2	0.12	193.3	0.12	356.1	0.12	1,426.1
0.21	343.7	0.21	625.4	0.21	233.8	0.21	430.5	0.21	1,724.4
0.23	359.6	0.23	654.4	0.23	244.6	0.23	450.5	0.23	1,804.3
0.40	435.3	0.40	792.1	0.40	296.1	0.40	545.3	0.40	2,184.0
0.80	435.3	0.80	792.1	0.80	296.1	0.80	545.3	0.80	2,184.0
1.60	435.3	1.60	792.1	1.60	296.1	1.60	545.3	1.60	2,184.0

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 21

Sta.

O. G. Elev. 206.0
Cut off Elev. 206.0

Pile 4' PP
GWS 213.0

z (ft)	Elev. 206 to 199	z (ft)	*Elev. 199 to 190	z (ft)	*Elev. 190 to 184	z (ft)	Elev. 184 to 178	z (ft)	Elev. 178 to 173
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	60.3	0.04	0.0	0.04	0.0	0.04	361.2	0.04	450.0
0.08	77.1	0.08	0.0	0.08	0.0	0.08	461.7	0.08	575.1
0.11	86.2	0.11	0.0	0.11	0.0	0.11	516.1	0.11	642.9
0.12	89.0	0.12	0.0	0.12	0.0	0.12	533.0	0.12	663.9
0.21	107.6	0.21	0.0	0.21	0.0	0.21	644.4	0.21	802.7
0.23	112.6	0.23	0.0	0.23	0.0	0.23	674.3	0.23	839.9
0.40	136.3	0.40	0.0	0.40	0.0	0.40	816.2	0.40	1,016.7
0.80	136.3	0.80	0.0	0.80	0.0	0.80	816.2	0.80	1,016.7
1.60	136.3	1.60	0.0	1.60	0.0	1.60	816.2	1.60	1,016.7

z (ft)	Elev. 173 to 166	z (ft)	*Elev. 166 to 160	z (ft)	Elev. 160 to 155	z (ft)	Elev. 155 to 145	z (ft)	Elev. 145 to 135
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	545.5	0.04	0.0	0.04	25.0	0.04	369.5	0.04	247.8
0.08	697.3	0.08	0.0	0.08	32.0	0.08	472.3	0.08	316.7
0.11	779.4	0.11	0.0	0.11	35.8	0.11	528.0	0.11	354.1
0.12	804.9	0.12	0.0	0.12	36.9	0.12	545.2	0.12	365.6
0.21	973.2	0.21	0.0	0.21	44.6	0.21	659.3	0.21	442.1
0.23	1,018.3	0.23	0.0	0.23	46.7	0.23	689.8	0.23	462.6
0.40	1,232.6	0.40	0.0	0.40	56.5	0.40	835.0	0.40	559.9
0.80	1,232.6	0.80	0.0	0.80	56.5	0.80	835.0	0.80	559.9
1.60	1,232.6	1.60	0.0	1.60	56.5	1.60	835.0	1.60	559.9

z (ft)	Elev. 135 to 130	z (ft)	Elev. 130 to 126	z (ft)	Elev. 126 to 122	z (ft)	Elev. 122 to 117	z (ft)	Elev. 117 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	65.1	0.04	943.4	0.04	1,004.1	0.04	1,076.4	0.04	1,160.2
0.08	83.2	0.08	1,205.8	0.08	1,283.3	0.08	1,375.8	0.08	1,482.8
0.11	93.0	0.11	1,347.9	0.11	1,434.6	0.11	1,538.0	0.11	1,657.6
0.12	96.0	0.12	1,391.9	0.12	1,481.4	0.12	1,588.1	0.12	1,711.7
0.21	116.1	0.21	1,683.0	0.21	1,791.2	0.21	1,920.3	0.21	2,069.7
0.23	121.5	0.23	1,761.0	0.23	1,874.2	0.23	2,009.2	0.23	2,165.6
0.40	147.0	0.40	2,131.6	0.40	2,268.6	0.40	2,432.1	0.40	2,621.4
0.80	147.0	0.80	2,131.6	0.80	2,268.6	0.80	2,432.1	0.80	2,621.4
1.60	147.0	1.60	2,131.6	1.60	2,268.6	1.60	2,432.1	1.60	2,621.4

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 22

Sta.

O. G. Elev.	205.0	Pile	4' PP
Cut off Elev.	205.0	GWS	213.0

z (ft)	*Elev. 205 to 197	z (ft)	*Elev. 197 to 190	z (ft)	*Elev. 190 to 187	z (ft)	Elev. 187 to 182	z (ft)	Elev. 182 to 177
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	230.4	0.04	386.3
0.08	0.0	0.08	0.0	0.08	0.0	0.08	294.5	0.08	493.8
0.11	0.0	0.11	0.0	0.11	0.0	0.11	329.2	0.11	552.0
0.12	0.0	0.12	0.0	0.12	0.0	0.12	339.9	0.12	570.0
0.21	0.0	0.21	0.0	0.21	0.0	0.21	411.0	0.21	689.2
0.23	0.0	0.23	0.0	0.23	0.0	0.23	430.0	0.23	721.1
0.40	0.0	0.40	0.0	0.40	0.0	0.40	520.6	0.40	872.9
0.80	0.0	0.80	0.0	0.80	0.0	0.80	520.6	0.80	872.9
1.60	0.0	1.60	0.0	1.60	0.0	1.60	520.6	1.60	872.9

z (ft)	Elev. 177 to 169	z (ft)	Elev. 169 to 163	z (ft)	Elev. 163 to 154	z (ft)	Elev. 154 to 148	z (ft)	Elev. 148 to 143
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	526.6	0.04	17.5	0.04	62.6	0.04	335.7	0.04	364.1
0.08	673.1	0.08	22.4	0.08	80.0	0.08	429.0	0.08	465.4
0.11	752.4	0.11	25.0	0.11	89.4	0.11	479.6	0.11	520.3
0.12	777.0	0.12	25.8	0.12	92.3	0.12	495.2	0.12	537.2
0.21	939.5	0.21	31.3	0.21	111.6	0.21	598.8	0.21	649.6
0.23	983.0	0.23	32.7	0.23	116.8	0.23	626.5	0.23	679.7
0.40	1,189.9	0.40	39.6	0.40	141.4	0.40	758.4	0.40	822.8
0.80	1,189.9	0.80	39.6	0.80	141.4	0.80	758.4	0.80	822.8
1.60	1,189.9	1.60	39.6	1.60	141.4	1.60	758.4	1.60	822.8

z (ft)	Elev. 143 to 134	z (ft)	Elev. 134 to 132	z (ft)	Elev. 132 to 127	z (ft)	Elev. 127 to 121	z (ft)	Elev. 121 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	66.1	0.04	373.9	0.04	448.4	0.04	975.0	0.04	996.8
0.08	84.4	0.08	477.8	0.08	573.0	0.08	1,246.2	0.08	1,274.0
0.11	94.4	0.11	534.2	0.11	640.6	0.11	1,393.1	0.11	1,424.2
0.12	97.5	0.12	551.6	0.12	661.5	0.12	1,438.6	0.12	1,470.6
0.21	117.9	0.21	667.0	0.21	799.8	0.21	1,739.4	0.21	1,778.2
0.23	123.3	0.23	697.9	0.23	836.9	0.23	1,820.0	0.23	1,860.6
0.40	149.3	0.40	844.7	0.40	1,013.0	0.40	2,203.1	0.40	2,252.2
0.80	149.3	0.80	844.7	0.80	1,013.0	0.80	2,203.1	0.80	2,252.2
1.60	149.3	1.60	844.7	1.60	1,013.0	1.60	2,203.1	1.60	2,252.2

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 23

Sta.

O. G. Elev.	205.0	Pile	4' PP
Cut off Elev.	205.0	GWS	213.0

z (ft)	*Elev. 205 to 198	z (ft)	Elev. 198 to 191	z (ft)	*Elev. 191 to 186	z (ft)	*Elev. 186 to 183	z (ft)	Elev. 183 to 175
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	183.6	0.04	0.0	0.04	0.0	0.04	357.0
0.08	0.0	0.08	234.7	0.08	0.0	0.08	0.0	0.08	456.2
0.11	0.0	0.11	262.4	0.11	0.0	0.11	0.0	0.11	510.0
0.12	0.0	0.12	270.9	0.12	0.0	0.12	0.0	0.12	526.7
0.21	0.0	0.21	327.6	0.21	0.0	0.21	0.0	0.21	636.8
0.23	0.0	0.23	342.8	0.23	0.0	0.23	0.0	0.23	666.3
0.40	0.0	0.40	414.9	0.40	0.0	0.40	0.0	0.40	806.5
0.80	0.0	0.80	414.9	0.80	0.0	0.80	0.0	0.80	806.5
1.60	0.0	1.60	414.9	1.60	0.0	1.60	0.0	1.60	806.5

z (ft)	Elev. 175 to 167	z (ft)	Elev. 167 to 162	z (ft)	Elev. 162 to 155	z (ft)	Elev. 155 to 151	z (ft)	Elev. 151 to 144
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	490.0	0.04	294.5	0.04	77.6	0.04	366.1	0.04	399.4
0.08	626.2	0.08	376.4	0.08	99.2	0.08	467.9	0.08	510.4
0.11	700.1	0.11	420.8	0.11	110.9	0.11	523.1	0.11	570.6
0.12	722.9	0.12	434.5	0.12	114.5	0.12	540.1	0.12	589.2
0.21	874.1	0.21	525.4	0.21	138.4	0.21	653.1	0.21	712.4
0.23	914.6	0.23	549.8	0.23	144.8	0.23	683.4	0.23	745.4
0.40	1,107.1	0.40	665.5	0.40	175.3	0.40	827.2	0.40	902.3
0.80	1,107.1	0.80	665.5	0.80	175.3	0.80	827.2	0.80	902.3
1.60	1,107.1	1.60	665.5	1.60	175.3	1.60	827.2	1.60	902.3

z (ft)	Elev. 144 to 138	z (ft)	Elev. 138 to 131	z (ft)	Elev. 131 to 126	z (ft)	Elev. 126 to 123	z (ft)	Elev. 123 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	100.1	0.04	117.6	0.04	1,049.2	0.04	497.9	0.04	1,390.4
0.08	127.9	0.08	150.3	0.08	1,340.9	0.08	636.3	0.08	1,777.1
0.11	143.0	0.11	168.1	0.11	1,499.0	0.11	711.4	0.11	1,986.6
0.12	147.6	0.12	173.5	0.12	1,547.9	0.12	734.6	0.12	2,051.4
0.21	178.5	0.21	209.8	0.21	1,871.7	0.21	888.2	0.21	2,480.5
0.23	186.8	0.23	219.6	0.23	1,958.4	0.23	929.3	0.23	2,595.4
0.40	226.1	0.40	265.8	0.40	2,370.5	0.40	1,124.9	0.40	3,141.6
0.80	226.1	0.80	265.8	0.80	2,370.5	0.80	1,124.9	0.80	3,141.6
1.60	226.1	1.60	265.8	1.60	2,370.5	1.60	1,124.9	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 24

Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0

z (ft)	*Elev. 206 to 199	z (ft)	*Elev. 199 to 192	z (ft)	*Elev. 192 to 186	z (ft)	Elev. 186 to 181	z (ft)	Elev. 181 to 176
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	296.0	0.04	376.7
0.08	0.0	0.08	0.0	0.08	0.0	0.08	378.3	0.08	481.4
0.11	0.0	0.11	0.0	0.11	0.0	0.11	423.0	0.11	538.2
0.12	0.0	0.12	0.0	0.12	0.0	0.12	436.7	0.12	555.7
0.21	0.0	0.21	0.0	0.21	0.0	0.21	528.1	0.21	672.0
0.23	0.0	0.23	0.0	0.23	0.0	0.23	552.6	0.23	703.1
0.40	0.0	0.40	0.0	0.40	0.0	0.40	668.9	0.40	851.1
0.80	0.0	0.80	0.0	0.80	0.0	0.80	668.9	0.80	851.1
1.60	0.0	1.60	0.0	1.60	0.0	1.60	668.9	1.60	851.1

z (ft)	Elev. 176 to 170	z (ft)	Elev. 170 to 159	z (ft)	Elev. 159 to 156	z (ft)	Elev. 156 to 151	z (ft)	Elev. 151 to 146
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	458.0	0.04	745.9	0.04	355.1	0.04	375.9	0.04	809.7
0.08	585.3	0.08	953.3	0.08	453.9	0.08	480.5	0.08	1,034.9
0.11	654.3	0.11	1,065.7	0.11	507.4	0.11	537.1	0.11	1,156.9
0.12	675.7	0.12	1,100.5	0.12	523.9	0.12	554.6	0.12	1,194.6
0.21	817.0	0.21	1,330.6	0.21	633.5	0.21	670.6	0.21	1,444.5
0.23	854.8	0.23	1,392.3	0.23	662.8	0.23	701.7	0.23	1,511.4
0.40	1,034.7	0.40	1,685.3	0.40	802.3	0.40	849.4	0.40	1,829.5
0.80	1,034.7	0.80	1,685.3	0.80	802.3	0.80	849.4	0.80	1,829.5
1.60	1,034.7	1.60	1,685.3	1.60	802.3	1.60	849.4	1.60	1,829.5

z (ft)	Elev. 146 to 141	z (ft)	Elev. 141 to 131	z (ft)	Elev. 131 to 126	z (ft)	Elev. 126 to 121	z (ft)	Elev. 121 to 116
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	259.9	0.04	376.6	0.04	985.0	0.04	513.8	0.04	565.0
0.08	332.2	0.08	481.4	0.08	1,258.9	0.08	656.7	0.08	722.2
0.11	371.4	0.11	538.1	0.11	1,407.3	0.11	734.1	0.11	807.3
0.12	383.5	0.12	555.6	0.12	1,453.2	0.12	758.1	0.12	833.6
0.21	463.7	0.21	671.9	0.21	1,757.2	0.21	916.6	0.21	1,008.0
0.23	485.2	0.23	703.0	0.23	1,838.5	0.23	959.1	0.23	1,054.7
0.40	587.3	0.40	850.9	0.40	2,225.5	0.40	1,160.9	0.40	1,276.6
0.80	587.3	0.80	850.9	0.80	2,225.5	0.80	1,160.9	0.80	1,276.6
1.60	587.3	1.60	850.9	1.60	2,225.5	1.60	1,160.9	1.60	1,276.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 25

Sta.

O. G. Elev.	205.0	Pile	4' PP
Cut off Elev.	205.0	GWS	213.0

z (ft)	*Elev. 205 to 199	z (ft)	Elev. 199 to 193	z (ft)	Elev. 193 to 187	z (ft)	Elev. 187 to 182	z (ft)	Elev. 182 to 176
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	120.5	0.04	215.9	0.04	305.8	0.04	394.6
0.08	0.0	0.08	154.0	0.08	276.0	0.08	390.9	0.08	504.3
0.11	0.0	0.11	172.2	0.11	308.5	0.11	436.9	0.11	563.8
0.12	0.0	0.12	177.8	0.12	318.6	0.12	451.2	0.12	582.2
0.21	0.0	0.21	215.0	0.21	385.2	0.21	545.6	0.21	703.9
0.23	0.0	0.23	224.9	0.23	403.1	0.23	570.8	0.23	736.6
0.40	0.0	0.40	272.3	0.40	487.9	0.40	691.0	0.40	891.6
0.80	0.0	0.80	272.3	0.80	487.9	0.80	691.0	0.80	891.6
1.60	0.0	1.60	272.3	1.60	487.9	1.60	691.0	1.60	891.6

z (ft)	Elev. 176 to 167	z (ft)	Elev. 167 to 161	z (ft)	Elev. 161 to 155	z (ft)	Elev. 155 to 150	z (ft)	Elev. 150 to 145
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	509.5	0.04	623.1	0.04	721.5	0.04	73.3	0.04	80.1
0.08	651.2	0.08	796.4	0.08	922.1	0.08	93.7	0.08	102.4
0.11	727.9	0.11	890.3	0.11	1,030.8	0.11	104.7	0.11	114.4
0.12	751.7	0.12	919.3	0.12	1,064.4	0.12	108.1	0.12	118.2
0.21	908.9	0.21	1,111.6	0.21	1,287.0	0.21	130.7	0.21	142.9
0.23	951.0	0.23	1,163.1	0.23	1,346.7	0.23	136.8	0.23	149.5
0.40	1,151.1	0.40	1,407.9	0.40	1,630.1	0.40	165.6	0.40	181.0
0.80	1,151.1	0.80	1,407.9	0.80	1,630.1	0.80	165.6	0.80	181.0
1.60	1,151.1	1.60	1,407.9	1.60	1,630.1	1.60	165.6	1.60	181.0

z (ft)	Elev. 145 to 141	z (ft)	Elev. 141 to 136	z (ft)	Elev. 136 to 131	z (ft)	Elev. 131 to 121	z (ft)	Elev. 121 to 111
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	40.0	0.04	85.1	0.04	1,266.0	0.04	1,390.4	0.04	1,390.4
0.08	51.2	0.08	108.8	0.08	1,618.1	0.08	1,777.1	0.08	1,777.1
0.11	57.2	0.11	121.6	0.11	1,808.9	0.11	1,986.6	0.11	1,986.6
0.12	59.1	0.12	125.5	0.12	1,867.9	0.12	2,051.4	0.12	2,051.4
0.21	71.4	0.21	151.8	0.21	2,258.6	0.21	2,480.5	0.21	2,480.5
0.23	74.7	0.23	158.8	0.23	2,363.2	0.23	2,595.4	0.23	2,595.4
0.40	90.5	0.40	192.3	0.40	2,860.6	0.40	3,141.6	0.40	3,141.6
0.80	90.5	0.80	192.3	0.80	2,860.6	0.80	3,141.6	0.80	3,141.6
1.60	90.5	1.60	192.3	1.60	2,860.6	1.60	3,141.6	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 26

Sta.

O. G. Elev.	204.0	Pile	4' PP
Cut off Elev.	204.0	GWS	213.0

z (ft)	*Elev. 204 to 199	z (ft)	*Elev. 199 to 194	z (ft)	Elev. 194 to 189	z (ft)	Elev. 189 to 184	z (ft)	Elev. 184 to 179
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	143.8	0.04	218.0	0.04	294.0
0.08	0.0	0.08	0.0	0.08	183.7	0.08	278.6	0.08	375.8
0.11	0.0	0.11	0.0	0.11	205.4	0.11	311.5	0.11	420.1
0.12	0.0	0.12	0.0	0.12	212.1	0.12	321.6	0.12	433.8
0.21	0.0	0.21	0.0	0.21	256.5	0.21	388.9	0.21	524.6
0.23	0.0	0.23	0.0	0.23	268.3	0.23	406.9	0.23	548.9
0.40	0.0	0.40	0.0	0.40	324.8	0.40	492.6	0.40	664.4
0.80	0.0	0.80	0.0	0.80	324.8	0.80	492.6	0.80	664.4
1.60	0.0	1.60	0.0	1.60	324.8	1.60	492.6	1.60	664.4

z (ft)	Elev. 179 to 169	z (ft)	Elev. 169 to 165	z (ft)	Elev. 165 to 159	z (ft)	Elev. 159 to 152	z (ft)	Elev. 152 to 148
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	55.1	0.04	77.6	0.04	253.3	0.04	80.9	0.04	319.1
0.08	70.4	0.08	99.2	0.08	323.8	0.08	103.4	0.08	407.8
0.11	78.7	0.11	110.9	0.11	362.0	0.11	115.6	0.11	455.9
0.12	81.2	0.12	114.5	0.12	373.8	0.12	119.4	0.12	470.7
0.21	98.2	0.21	138.4	0.21	451.9	0.21	144.4	0.21	569.2
0.23	102.8	0.23	144.8	0.23	472.9	0.23	151.1	0.23	595.5
0.40	124.4	0.40	175.3	0.40	572.4	0.40	182.9	0.40	720.9
0.80	124.4	0.80	175.3	0.80	572.4	0.80	182.9	0.80	720.9
1.60	124.4	1.60	175.3	1.60	572.4	1.60	182.9	1.60	720.9

z (ft)	Elev. 148 to 144	z (ft)	Elev. 144 to 134	z (ft)	Elev. 134 to 129	z (ft)	Elev. 129 to 124	z (ft)	Elev. 124 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	85.1	0.04	981.6	0.04	1,143.5	0.04	1,251.4	0.04	1,390.4
0.08	108.8	0.08	1,254.6	0.08	1,461.4	0.08	1,599.4	0.08	1,777.1
0.11	121.6	0.11	1,402.5	0.11	1,633.7	0.11	1,787.9	0.11	1,986.6
0.12	125.5	0.12	1,448.2	0.12	1,687.0	0.12	1,846.2	0.12	2,051.4
0.21	151.8	0.21	1,751.1	0.21	2,039.9	0.21	2,232.3	0.21	2,480.5
0.23	158.8	0.23	1,832.3	0.23	2,134.3	0.23	2,335.7	0.23	2,595.4
0.40	192.3	0.40	2,217.9	0.40	2,583.6	0.40	2,827.3	0.40	3,141.6
0.80	192.3	0.80	2,217.9	0.80	2,583.6	0.80	2,827.3	0.80	3,141.6
1.60	192.3	1.60	2,217.9	1.60	2,583.6	1.60	2,827.3	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 27

Sta.

O. G. Elev.	202.0	Pile	4' PP
Cut off Elev.	202.0	GWS	213.0

z (ft)	*Elev. 202 to 197	z (ft)	*Elev. 197 to 192	z (ft)	*Elev. 192 to 187	z (ft)	Elev. 187 to 182	z (ft)	Elev. 182 to 177
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	217.3	0.04	298.7
0.08	0.0	0.08	0.0	0.08	0.0	0.08	277.8	0.08	381.8
0.11	0.0	0.11	0.0	0.11	0.0	0.11	310.5	0.11	426.8
0.12	0.0	0.12	0.0	0.12	0.0	0.12	320.6	0.12	440.7
0.21	0.0	0.21	0.0	0.21	0.0	0.21	387.7	0.21	532.9
0.23	0.0	0.23	0.0	0.23	0.0	0.23	405.6	0.23	557.6
0.40	0.0	0.40	0.0	0.40	0.0	0.40	491.0	0.40	674.9
0.80	0.0	0.80	0.0	0.80	0.0	0.80	491.0	0.80	674.9
1.60	0.0	1.60	0.0	1.60	0.0	1.60	491.0	1.60	674.9

z (ft)	*Elev. 177 to 173	z (ft)	Elev. 173 to 169	z (ft)	Elev. 169 to 164	z (ft)	Elev. 164 to 157	z (ft)	Elev. 157 to 149
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	519.5	0.04	616.6	0.04	746.1	0.04	716.5
0.08	0.0	0.08	664.0	0.08	788.1	0.08	953.6	0.08	915.8
0.11	0.0	0.11	742.3	0.11	881.0	0.11	1,066.0	0.11	1,023.8
0.12	0.0	0.12	766.5	0.12	909.8	0.12	1,100.8	0.12	1,057.1
0.21	0.0	0.21	926.8	0.21	1,100.0	0.21	1,331.0	0.21	1,278.2
0.23	0.0	0.23	969.7	0.23	1,151.0	0.23	1,392.7	0.23	1,337.5
0.40	0.0	0.40	1,173.8	0.40	1,393.2	0.40	1,685.8	0.40	1,618.9
0.80	0.0	0.80	1,173.8	0.80	1,393.2	0.80	1,685.8	0.80	1,618.9
1.60	0.0	1.60	1,173.8	1.60	1,393.2	1.60	1,685.8	1.60	1,618.9

z (ft)	Elev. 149 to 143	z (ft)	Elev. 143 to 137	z (ft)	Elev. 137 to 127	z (ft)	Elev. 127 to 121	z (ft)	Elev. 121 to 109
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	824.7	0.04	921.9	0.04	1,053.6	0.04	1,179.5	0.04	1,390.4
0.08	1,054.1	0.08	1,178.3	0.08	1,346.6	0.08	1,507.5	0.08	1,777.1
0.11	1,178.3	0.11	1,317.3	0.11	1,505.3	0.11	1,685.3	0.11	1,986.6
0.12	1,216.8	0.12	1,360.2	0.12	1,554.4	0.12	1,740.2	0.12	2,051.4
0.21	1,471.3	0.21	1,644.7	0.21	1,879.5	0.21	2,104.2	0.21	2,480.5
0.23	1,539.4	0.23	1,720.9	0.23	1,966.5	0.23	2,201.7	0.23	2,595.4
0.40	1,863.4	0.40	2,083.1	0.40	2,380.4	0.40	2,665.1	0.40	3,141.6
0.80	1,863.4	0.80	2,083.1	0.80	2,380.4	0.80	2,665.1	0.80	3,141.6
1.60	1,863.4	1.60	2,083.1	1.60	2,380.4	1.60	2,665.1	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 28

Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0

z (ft)	*Elev. 208 to 202	z (ft)	*Elev. 202 to 196	z (ft)	*Elev. 196 to 193	z (ft)	*Elev. 193 to 184	z (ft)	Elev. 184 to 178
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	0.0	0.04	344.3
0.08	0.0	0.08	0.0	0.08	0.0	0.08	0.0	0.08	440.1
0.11	0.0	0.11	0.0	0.11	0.0	0.11	0.0	0.11	491.9
0.12	0.0	0.12	0.0	0.12	0.0	0.12	0.0	0.12	508.0
0.21	0.0	0.21	0.0	0.21	0.0	0.21	0.0	0.21	614.2
0.23	0.0	0.23	0.0	0.23	0.0	0.23	0.0	0.23	642.7
0.40	0.0	0.40	0.0	0.40	0.0	0.40	0.0	0.40	777.9
0.80	0.0	0.80	0.0	0.80	0.0	0.80	0.0	0.80	777.9
1.60	0.0	1.60	0.0	1.60	0.0	1.60	0.0	1.60	777.9

z (ft)	Elev. 178 to 171	z (ft)	Elev. 171 to 167	z (ft)	Elev. 167 to 161	z (ft)	Elev. 161 to 156	z (ft)	Elev. 156 to 151
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	568.9	0.04	687.6	0.04	630.1	0.04	711.5	0.04	782.5
0.08	727.2	0.08	878.8	0.08	805.3	0.08	909.3	0.08	1,000.1
0.11	812.9	0.11	982.5	0.11	900.2	0.11	1,016.5	0.11	1,118.1
0.12	839.4	0.12	1,014.5	0.12	929.6	0.12	1,049.7	0.12	1,154.5
0.21	1,014.9	0.21	1,226.7	0.21	1,124.0	0.21	1,269.2	0.21	1,396.0
0.23	1,062.0	0.23	1,283.5	0.23	1,176.0	0.23	1,328.0	0.23	1,460.6
0.40	1,285.5	0.40	1,553.6	0.40	1,423.6	0.40	1,607.5	0.40	1,768.1
0.80	1,285.5	0.80	1,553.6	0.80	1,423.6	0.80	1,607.5	0.80	1,768.1
1.60	1,285.5	1.60	1,553.6	1.60	1,423.6	1.60	1,607.5	1.60	1,768.1

z (ft)	Elev. 151 to 142	z (ft)	Elev. 142 to 135	z (ft)	Elev. 135 to 128	z (ft)	Elev. 128 to 121	z (ft)	Elev. 121 to 114
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	888.2	0.04	1,274.1	0.04	1,390.4	0.04	1,390.4	0.04	1,390.4
0.08	1,135.2	0.08	1,628.4	0.08	1,777.1	0.08	1,777.1	0.08	1,777.1
0.11	1,269.1	0.11	1,820.4	0.11	1,986.6	0.11	1,986.6	0.11	1,986.6
0.12	1,310.4	0.12	1,879.7	0.12	2,051.4	0.12	2,051.4	0.12	2,051.4
0.21	1,584.5	0.21	2,272.9	0.21	2,480.5	0.21	2,480.5	0.21	2,480.5
0.23	1,657.9	0.23	2,378.1	0.23	2,595.4	0.23	2,595.4	0.23	2,595.4
0.40	2,006.9	0.40	2,878.7	0.40	3,141.6	0.40	3,141.6	0.40	3,141.6
0.80	2,006.9	0.80	2,878.7	0.80	3,141.6	0.80	3,141.6	0.80	3,141.6
1.60	2,006.9	1.60	2,878.7	1.60	3,141.6	1.60	3,141.6	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 29

Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0

z (ft)	*Elev. 208 to 202	z (ft)	*Elev. 202 to 196	z (ft)	*Elev. 196 to 193	z (ft)	*Elev. 193 to 184	z (ft)	Elev. 184 to 178
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	0.0	0.04	0.0	0.04	0.0	0.04	0.0	0.04	344.3
0.08	0.0	0.08	0.0	0.08	0.0	0.08	0.0	0.08	440.1
0.11	0.0	0.11	0.0	0.11	0.0	0.11	0.0	0.11	491.9
0.12	0.0	0.12	0.0	0.12	0.0	0.12	0.0	0.12	508.0
0.21	0.0	0.21	0.0	0.21	0.0	0.21	0.0	0.21	614.2
0.23	0.0	0.23	0.0	0.23	0.0	0.23	0.0	0.23	642.7
0.40	0.0	0.40	0.0	0.40	0.0	0.40	0.0	0.40	777.9
0.80	0.0	0.80	0.0	0.80	0.0	0.80	0.0	0.80	777.9
1.60	0.0	1.60	0.0	1.60	0.0	1.60	0.0	1.60	777.9

z (ft)	Elev. 178 to 171	z (ft)	Elev. 171 to 167	z (ft)	Elev. 167 to 161	z (ft)	Elev. 161 to 156	z (ft)	Elev. 156 to 151
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	568.9	0.04	687.6	0.04	630.1	0.04	711.5	0.04	782.5
0.08	727.2	0.08	878.8	0.08	805.3	0.08	909.3	0.08	1,000.1
0.11	812.9	0.11	982.5	0.11	900.2	0.11	1,016.5	0.11	1,118.1
0.12	839.4	0.12	1,014.5	0.12	929.6	0.12	1,049.7	0.12	1,154.5
0.21	1,014.9	0.21	1,226.7	0.21	1,124.0	0.21	1,269.2	0.21	1,396.0
0.23	1,062.0	0.23	1,283.5	0.23	1,176.0	0.23	1,328.0	0.23	1,460.6
0.40	1,285.5	0.40	1,553.6	0.40	1,423.6	0.40	1,607.5	0.40	1,768.1
0.80	1,285.5	0.80	1,553.6	0.80	1,423.6	0.80	1,607.5	0.80	1,768.1
1.60	1,285.5	1.60	1,553.6	1.60	1,423.6	1.60	1,607.5	1.60	1,768.1

z (ft)	Elev. 151 to 142	z (ft)	Elev. 142 to 135	z (ft)	Elev. 135 to 128	z (ft)	Elev. 128 to 121	z (ft)	Elev. 121 to 114
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	888.2	0.04	1,274.1	0.04	1,390.4	0.04	1,390.4	0.04	1,390.4
0.08	1,135.2	0.08	1,628.4	0.08	1,777.1	0.08	1,777.1	0.08	1,777.1
0.11	1,269.1	0.11	1,820.4	0.11	1,986.6	0.11	1,986.6	0.11	1,986.6
0.12	1,310.4	0.12	1,879.7	0.12	2,051.4	0.12	2,051.4	0.12	2,051.4
0.21	1,584.5	0.21	2,272.9	0.21	2,480.5	0.21	2,480.5	0.21	2,480.5
0.23	1,657.9	0.23	2,378.1	0.23	2,595.4	0.23	2,595.4	0.23	2,595.4
0.40	2,006.9	0.40	2,878.7	0.40	3,141.6	0.40	3,141.6	0.40	3,141.6
0.80	2,006.9	0.80	2,878.7	0.80	3,141.6	0.80	3,141.6	0.80	3,141.6
1.60	2,006.9	1.60	2,878.7	1.60	3,141.6	1.60	3,141.6	1.60	3,141.6

Note - q (kip)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Abut 30

Sta.

O. G. Elev.	231.0	Pile	4" PP
Cut off Elev.	231.0	GWS	213.0

z (ft)	Elev. 231 to 225	z (ft)	Elev. 225 to 220	z (ft)	Elev. 220 to 217	z (ft)	Elev. 217 to 210	z (ft)	Elev. 210 to 205
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	35.7	0.04	101.1	0.04	150.3	0.04	212.4	0.04	548.2
0.08	45.6	0.08	129.2	0.08	192.1	0.08	271.5	0.08	700.6
0.11	51.0	0.11	144.4	0.11	214.7	0.11	303.5	0.11	783.2
0.12	52.7	0.12	149.1	0.12	221.7	0.12	313.4	0.12	808.7
0.21	63.7	0.21	180.3	0.21	268.1	0.21	379.0	0.21	977.9
0.23	66.6	0.23	188.6	0.23	280.5	0.23	396.5	0.23	1,023.2
0.40	80.7	0.40	228.3	0.40	339.6	0.40	480.0	0.40	1,238.5
0.80	80.7	0.80	228.3	0.80	339.6	0.80	480.0	0.80	1,238.5
1.60	80.7	1.60	228.3	1.60	339.6	1.60	480.0	1.60	1,238.5

z (ft)	Elev. 205 to 201	z (ft)	*Elev. 201 to 196	z (ft)	*Elev. 196 to 192	z (ft)	*Elev. 192 to 185	z (ft)	Elev. 185 to 180
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	304.8	0.04	0.0	0.04	0.0	0.04	0.0	0.04	843.7
0.08	389.5	0.08	0.0	0.08	0.0	0.08	0.0	0.08	1,078.3
0.11	435.5	0.11	0.0	0.11	0.0	0.11	0.0	0.11	1,205.5
0.12	449.7	0.12	0.0	0.12	0.0	0.12	0.0	0.12	1,244.8
0.21	543.7	0.21	0.0	0.21	0.0	0.21	0.0	0.21	1,505.1
0.23	568.9	0.23	0.0	0.23	0.0	0.23	0.0	0.23	1,574.9
0.40	688.6	0.40	0.0	0.40	0.0	0.40	0.0	0.40	1,906.3
0.80	688.6	0.80	0.0	0.80	0.0	0.80	0.0	0.80	1,906.3
1.60	688.6	1.60	0.0	1.60	0.0	1.60	0.0	1.60	1,906.3

z (ft)	Elev. 180 to 174	z (ft)	Elev. 174 to 166	z (ft)	Elev. 166 to 161	z (ft)	Elev. 161 to 151	z (ft)	Elev. 151 to 138
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.04	924.6	0.04	1,296.7	0.04	868.0	0.04	1,046.3	0.04	990.2
0.08	1,181.7	0.08	1,657.3	0.08	1,109.4	0.08	1,337.3	0.08	1,265.6
0.11	1,321.0	0.11	1,852.6	0.11	1,240.1	0.11	1,495.0	0.11	1,414.8
0.12	1,364.1	0.12	1,913.0	0.12	1,280.6	0.12	1,543.7	0.12	1,460.9
0.21	1,649.4	0.21	2,313.2	0.21	1,548.4	0.21	1,866.6	0.21	1,766.5
0.23	1,725.8	0.23	2,420.3	0.23	1,620.2	0.23	1,953.1	0.23	1,848.3
0.40	2,089.0	0.40	2,929.7	0.40	1,961.1	0.40	2,364.1	0.40	2,237.3
0.80	2,089.0	0.80	2,929.7	0.80	1,961.1	0.80	2,364.1	0.80	2,237.3
1.60	2,089.0	1.60	2,929.7	1.60	1,961.1	1.60	2,364.1	1.60	2,237.3

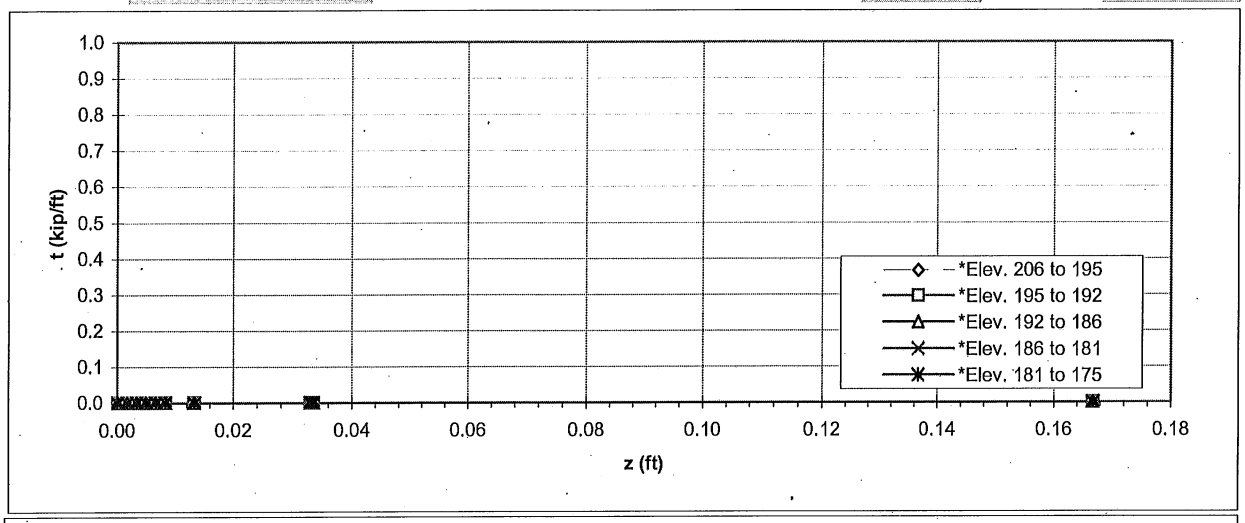
Note - q (kip)
*-Liquefiable layer

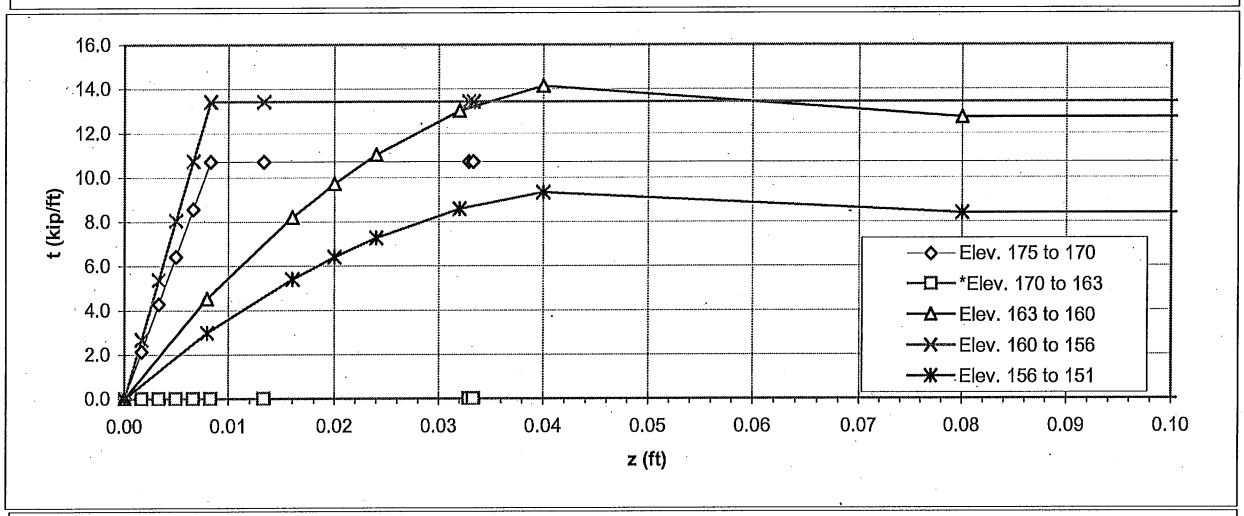
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

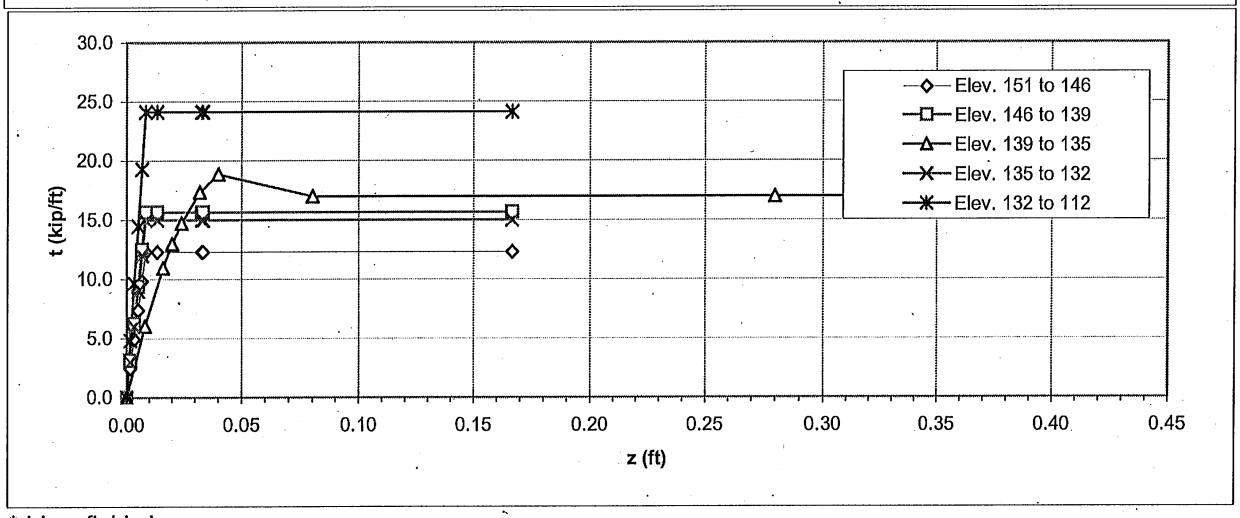
Pier 20

Sta.

O. G. Elev.	206.0	**Pile**	4' PP
Cut off Elev.	206.0	**GWS**	213.0







*-Liquefiable layer

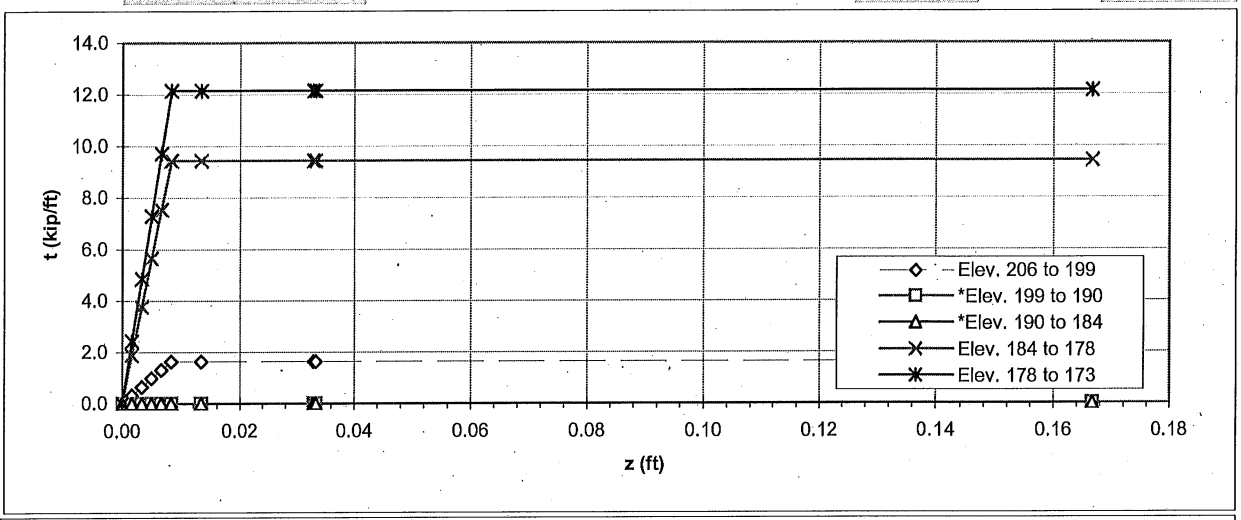
t-z Curves

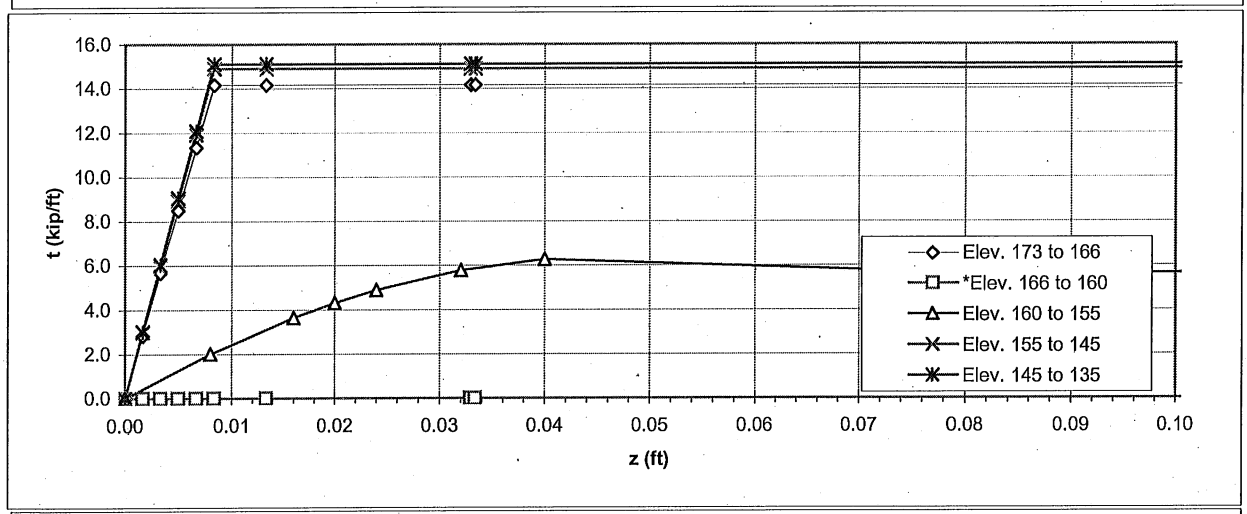
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

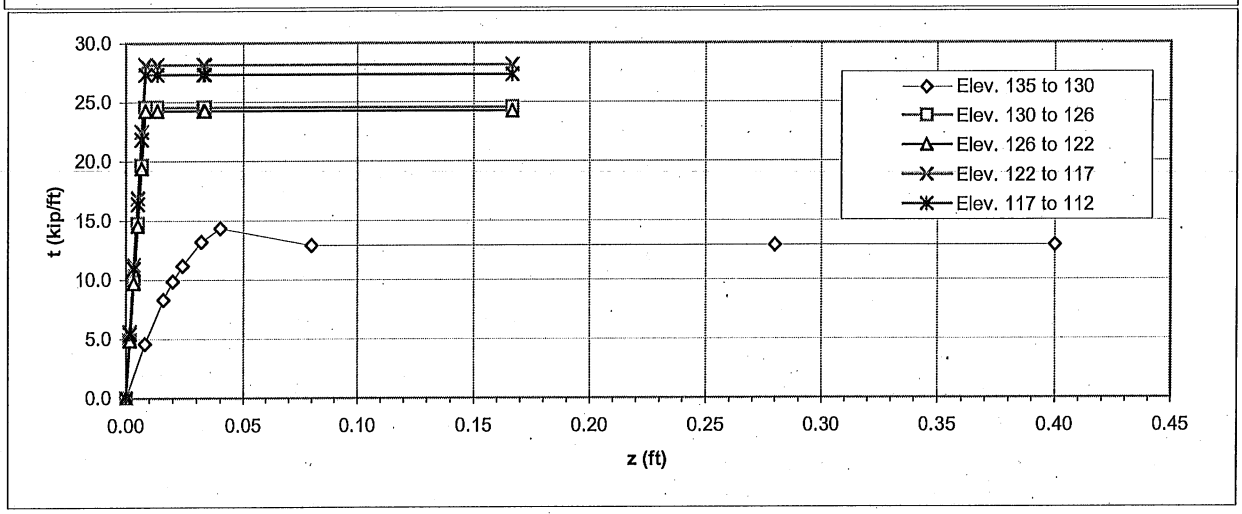
Pier 21

Sta.

O. G. Elev.	206.0	**Pile**	4' PP
Cut off Elev.	206.0	**GWS**	213.0







*-Liquefiable layer

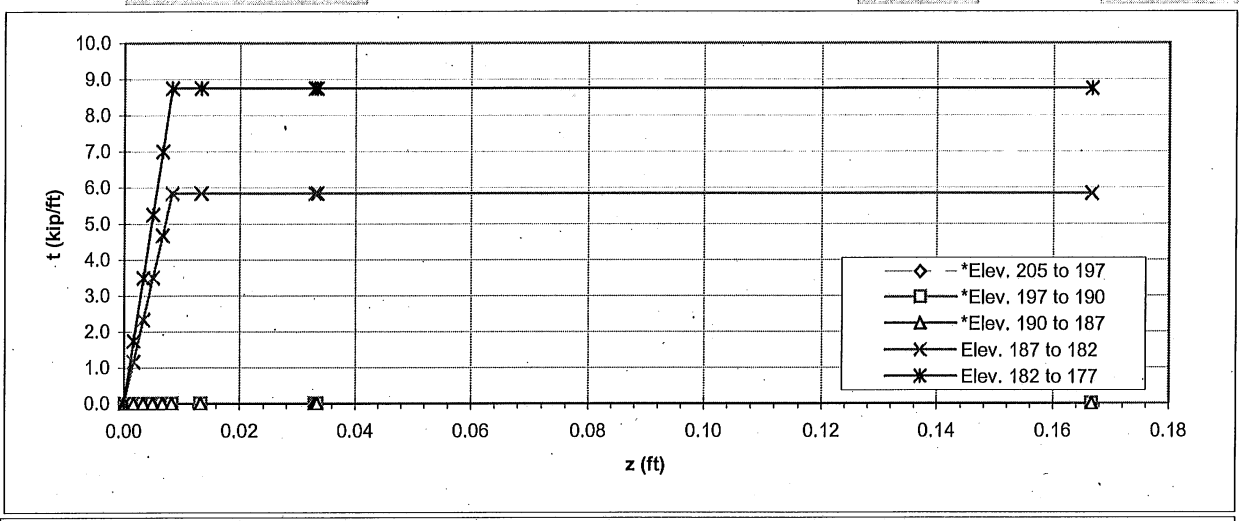
t-z Curves

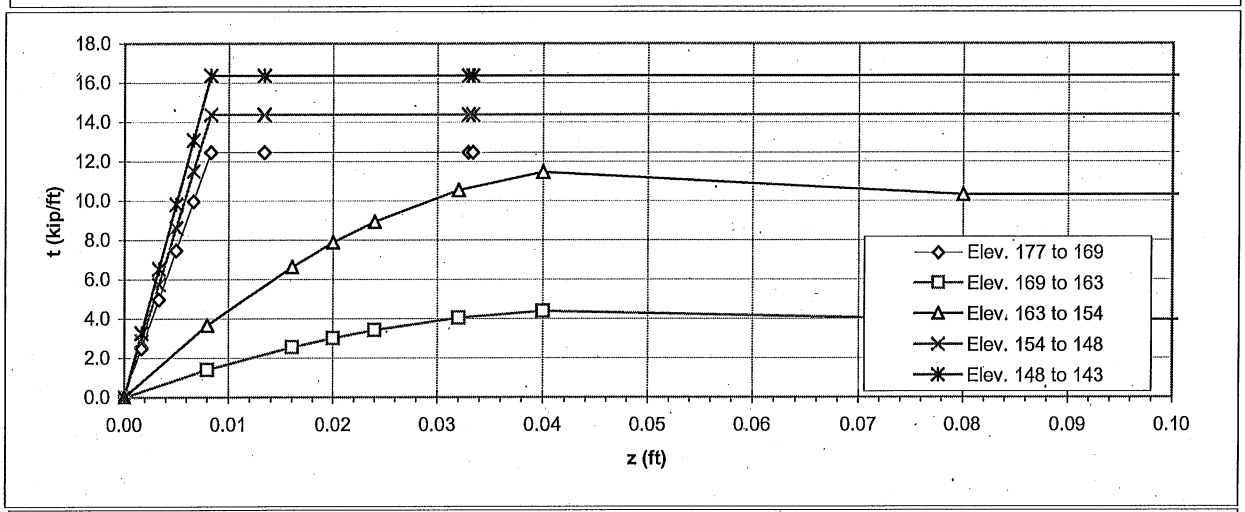
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

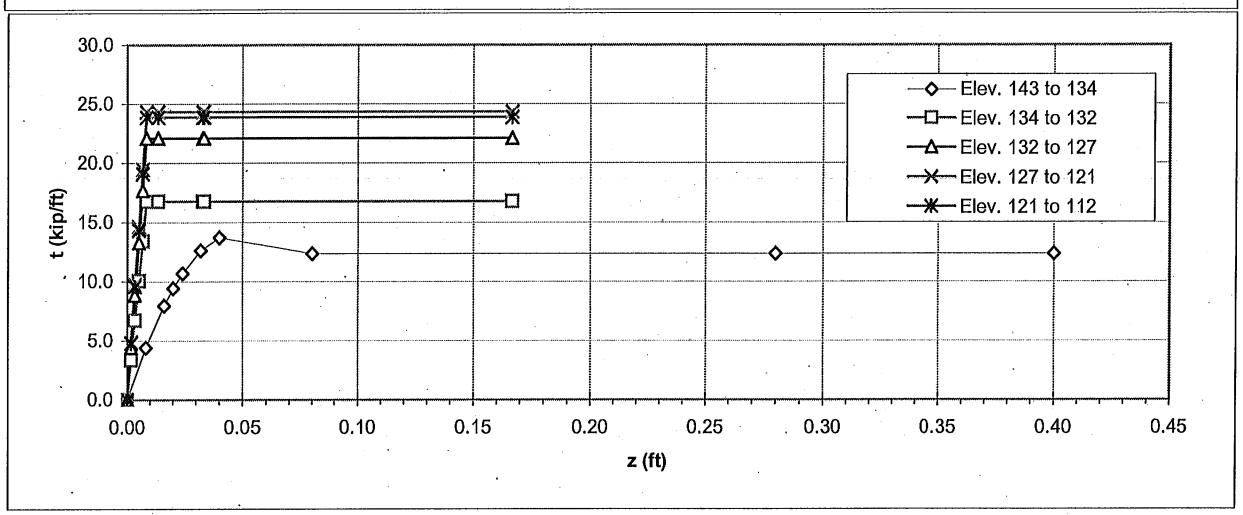
Pier 22

Sta.

O. G. Elev.	205.0	**Pile**	4' PP
Cut off Elev.	205.0	**GWS**	213.0







*-Liquefiable layer

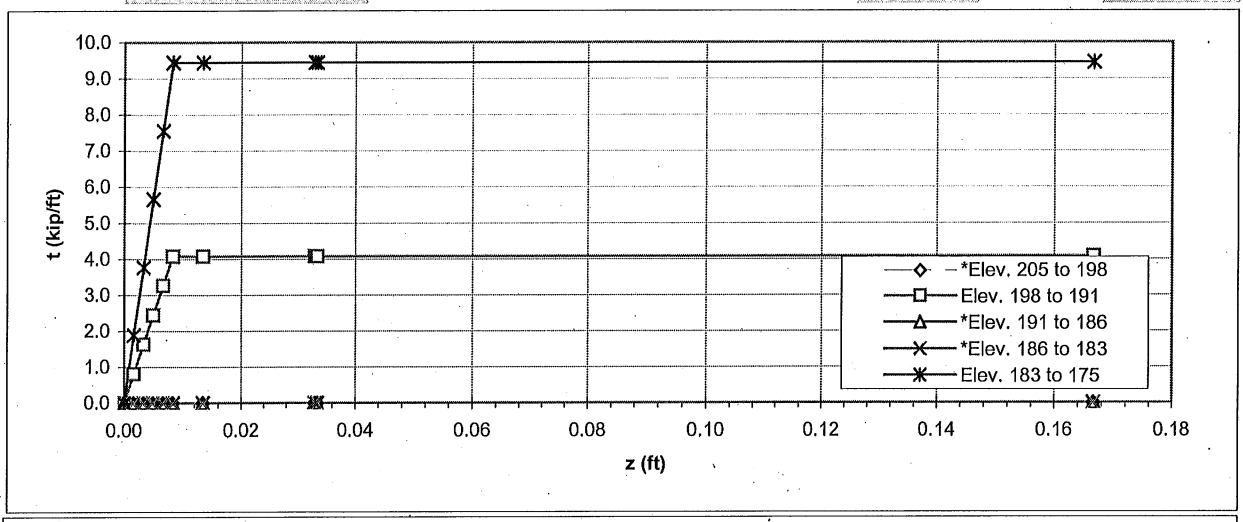
t-z Curves

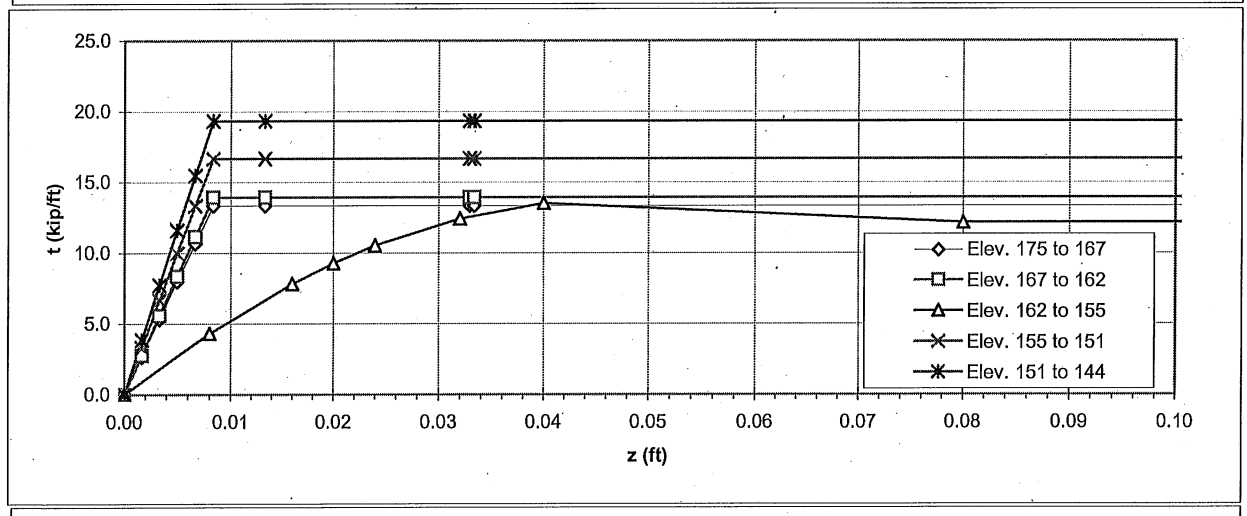
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

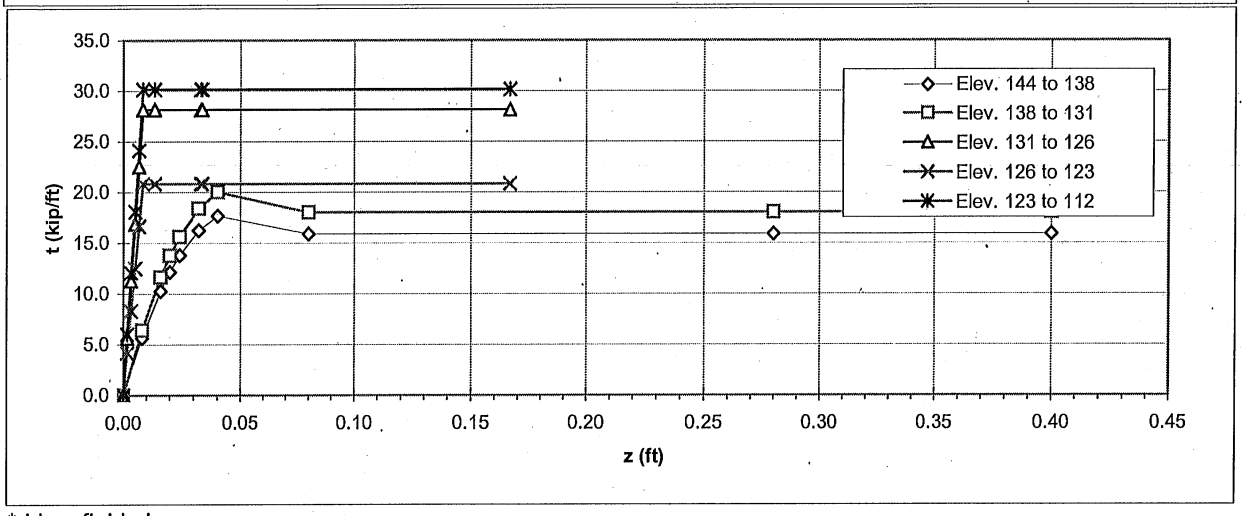
Pier 23

Sta.

O. G. Elev.	205.0	**Pile**	4' PP
Cut off Elev.	205.0	**GWS**	213.0







*-Liquefiable layer

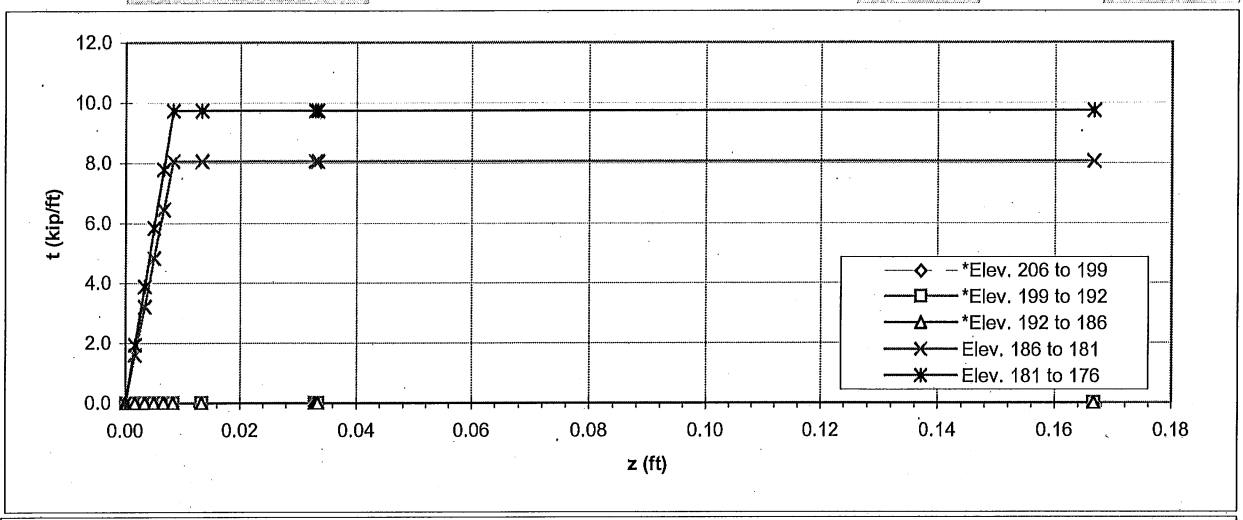
t-z Curves

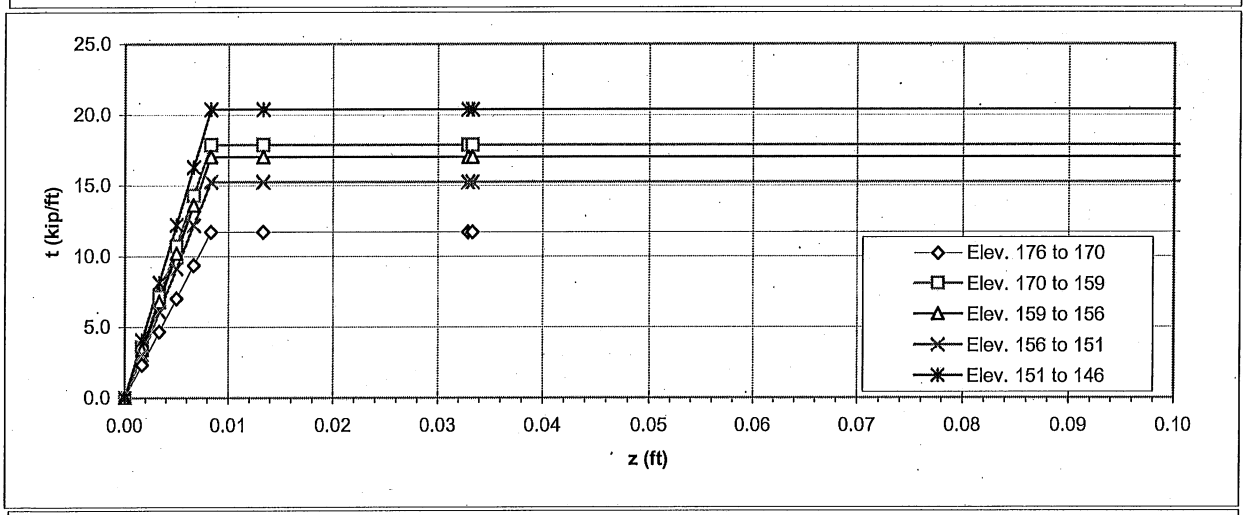
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

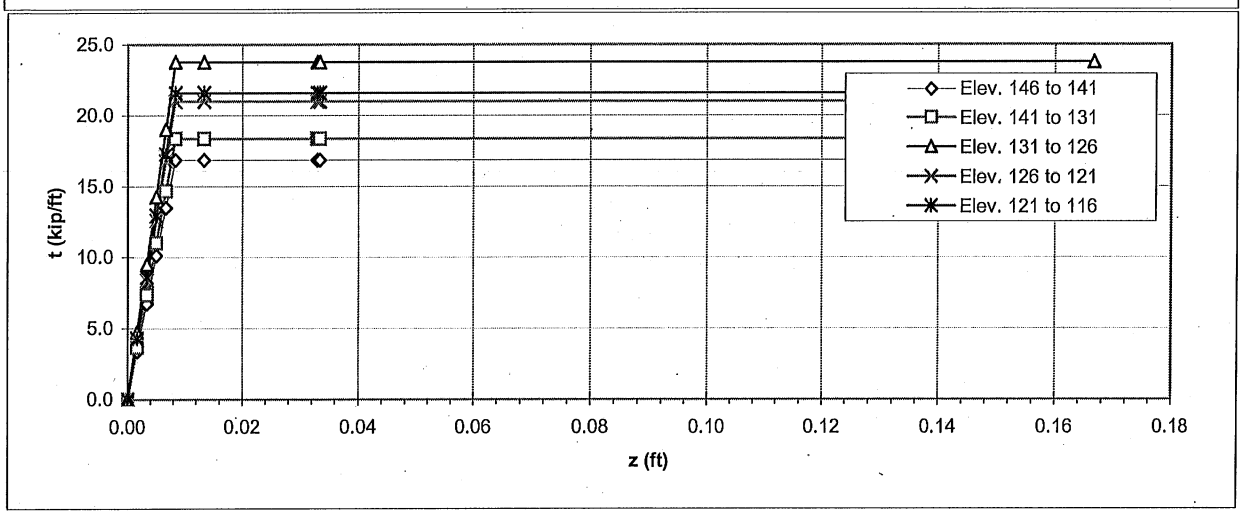
Pier 24

Sta.

O. G. Elev.	206.0	**Pile**	4' PP
Cut off Elev.	206.0	**GWS**	213.0







*-Liquefiable layer

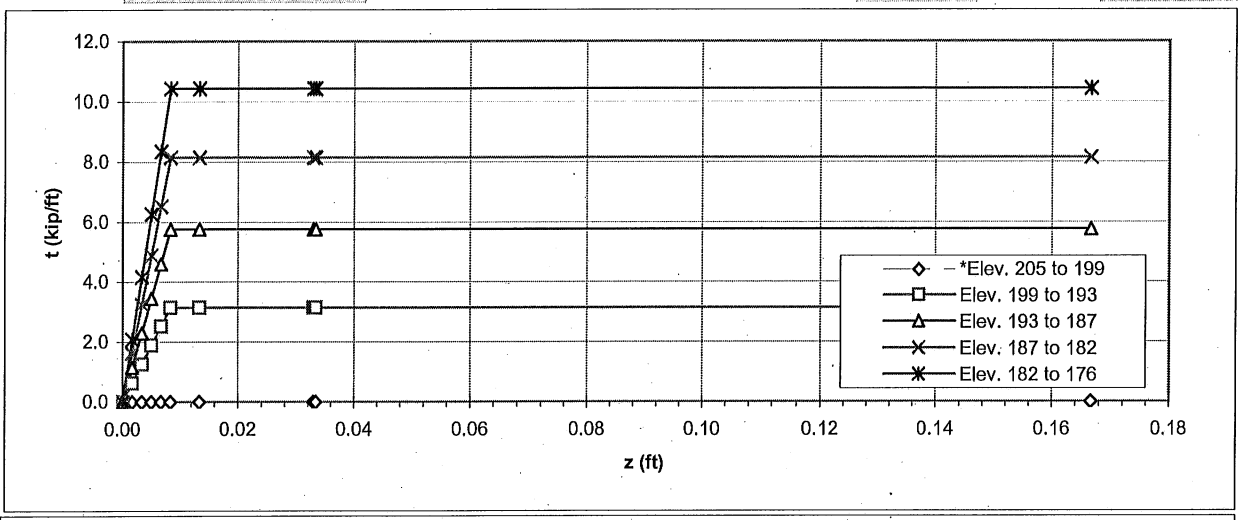
t-z Curves

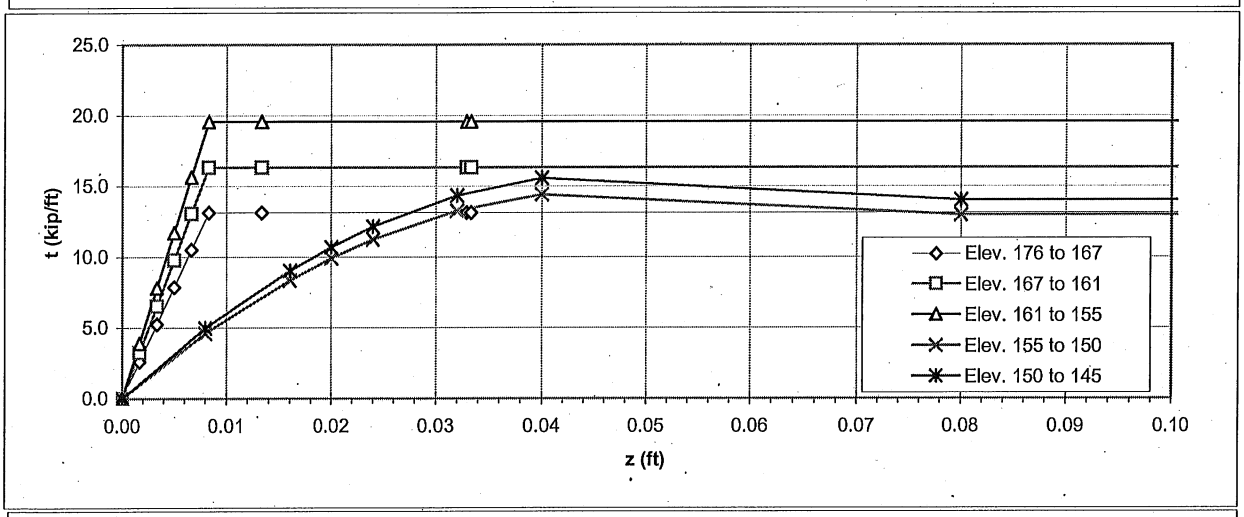
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

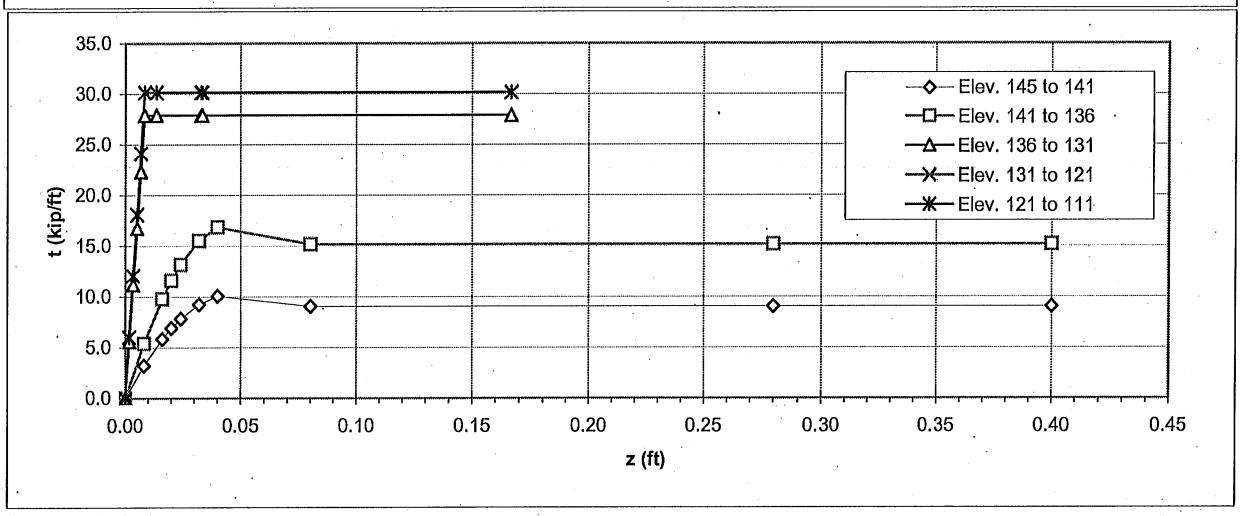
Pier 25

Sta.

O. G. Elev.	205.0	**Pile**	4' PP
Cut off Elev.	205.0	**GWS**	213.0







*-Liquefiable layer

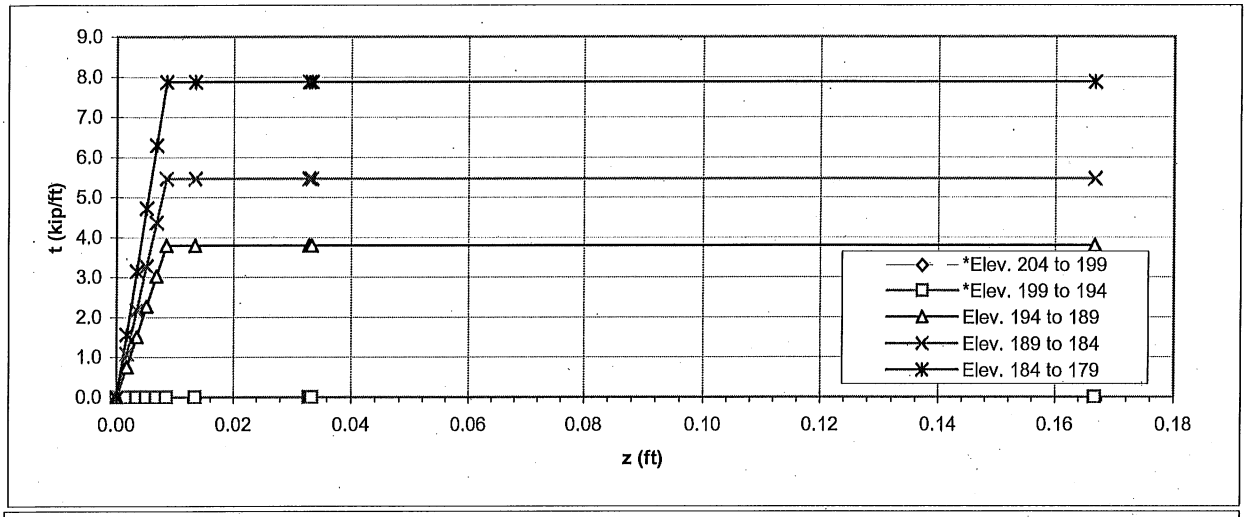
t-z Curves

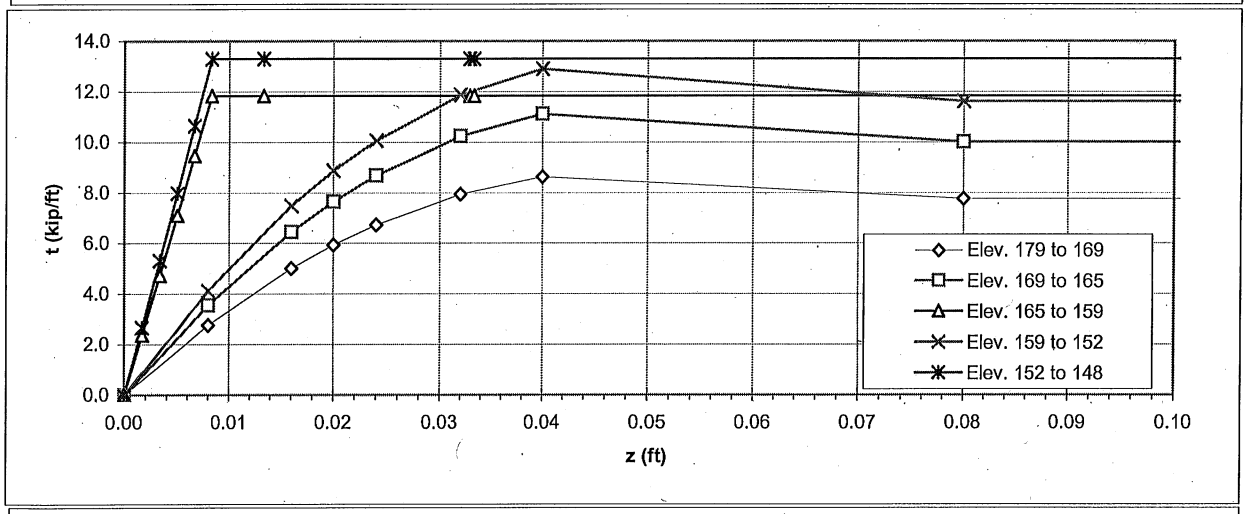
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

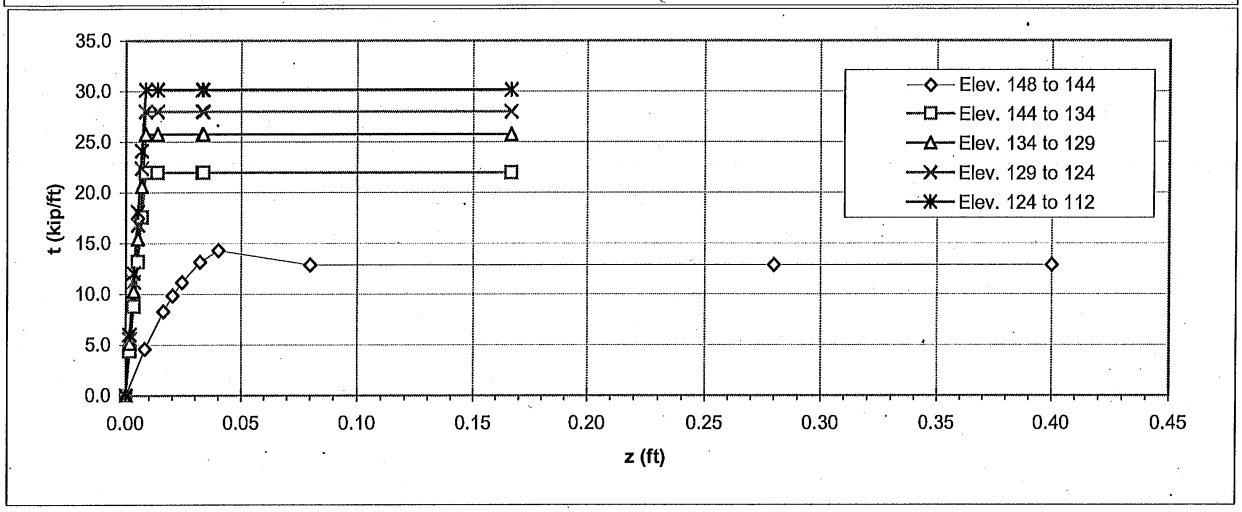
Pier 26

Sta.

O. G. Elev.	204.0	**Pile**	4' PP
Cut off Elev.	204.0	**GWS**	213.0







*-Liquefiable layer

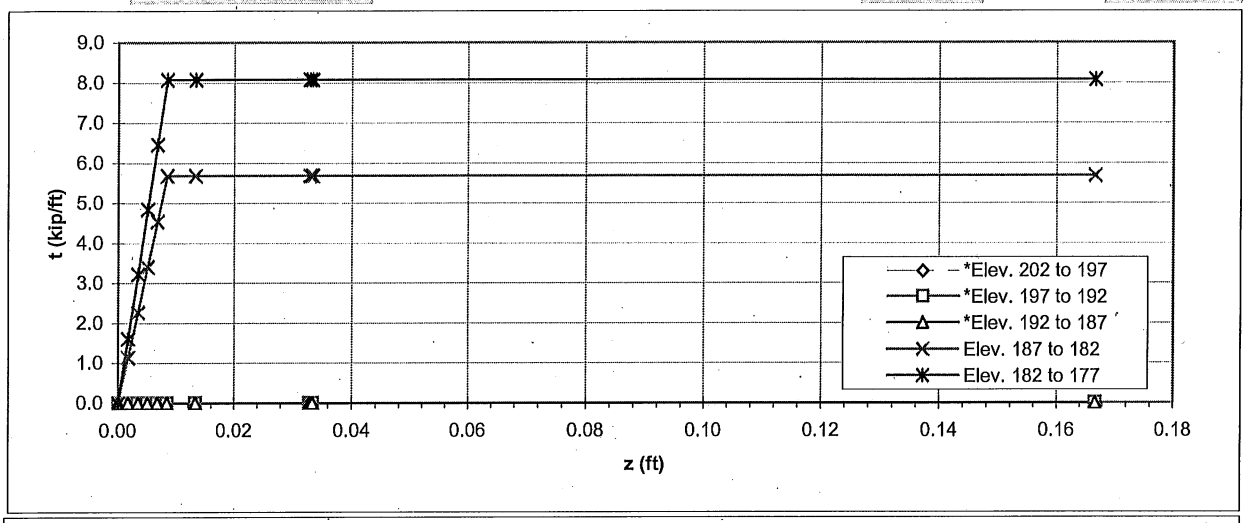
t-z Curves

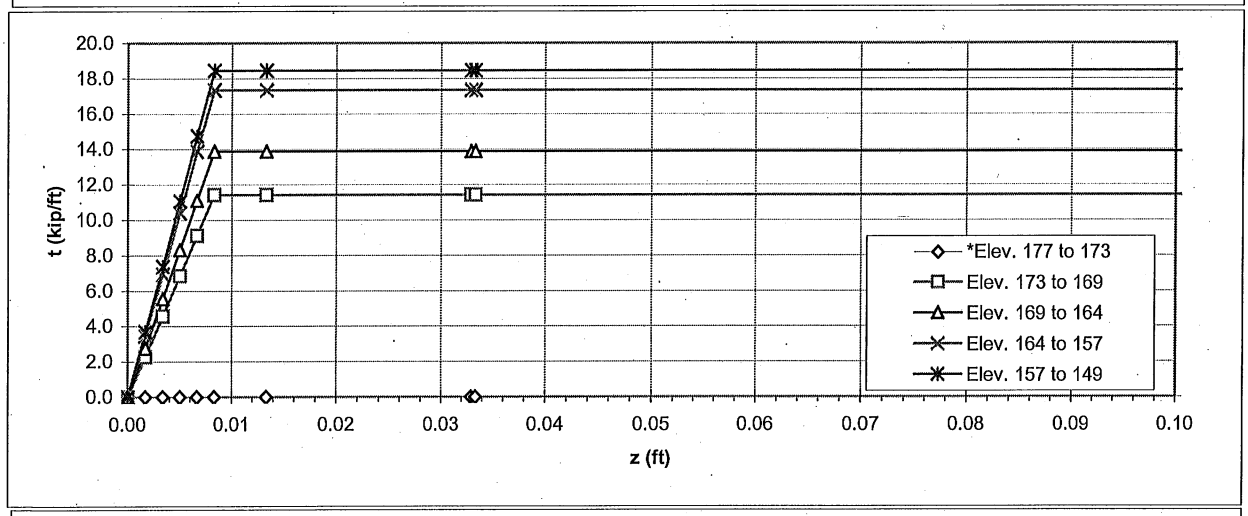
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

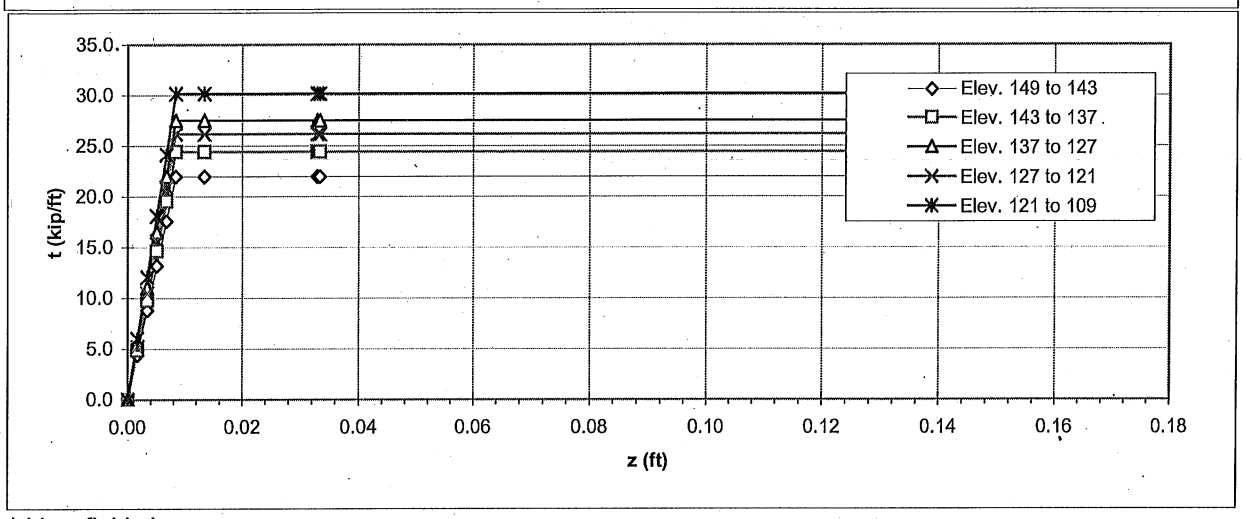
Pier 27

Sta.

O. G. Elev.	202.0	**Pile**	4' PP
Cut off Elev.	202.0	**GWS**	213.0







*-Liquefiable layer

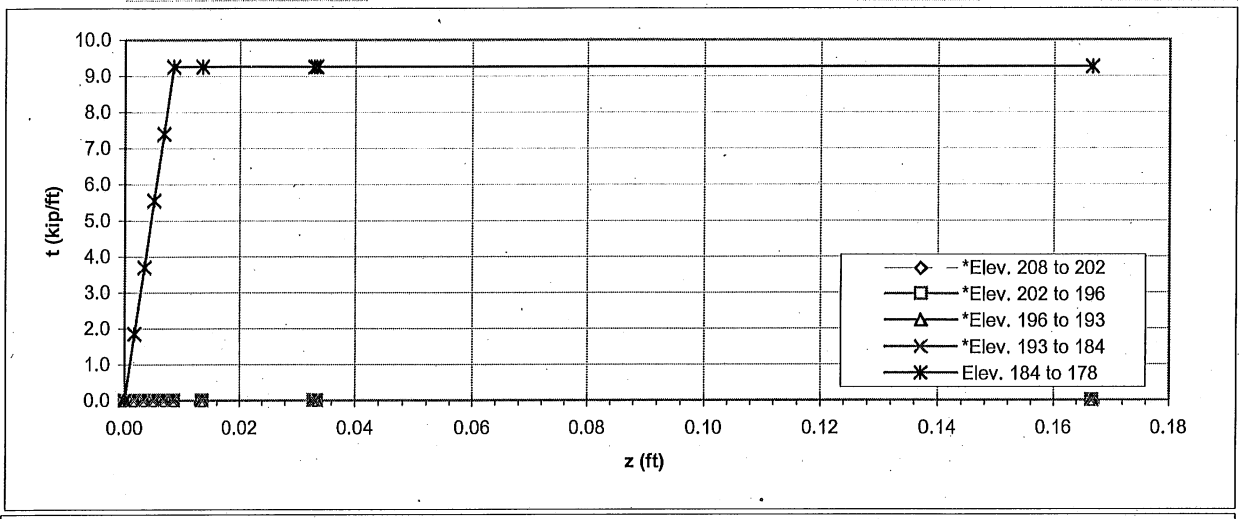
t-z Curves

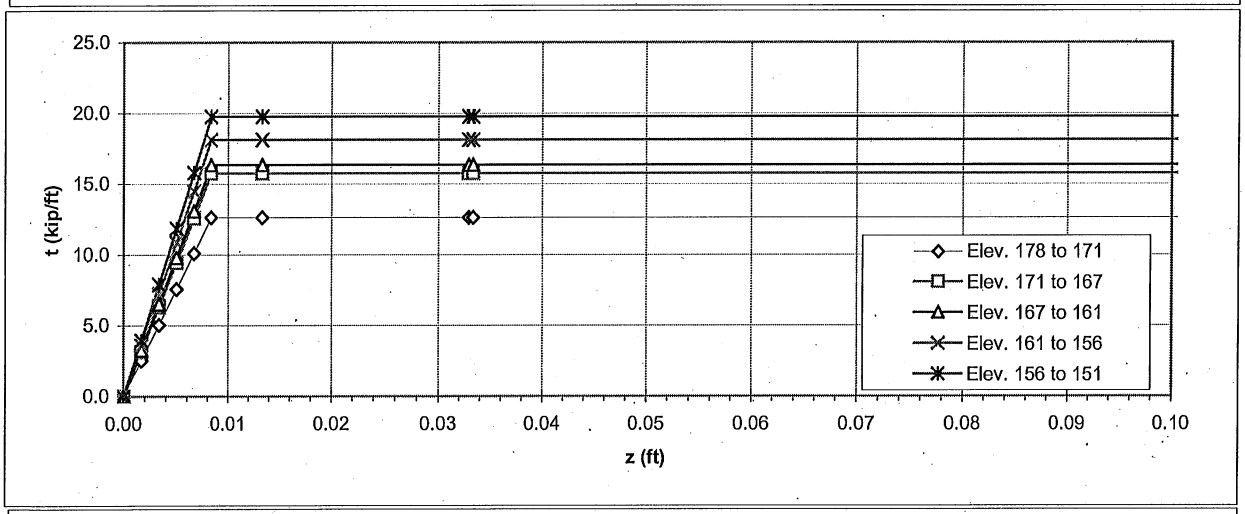
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

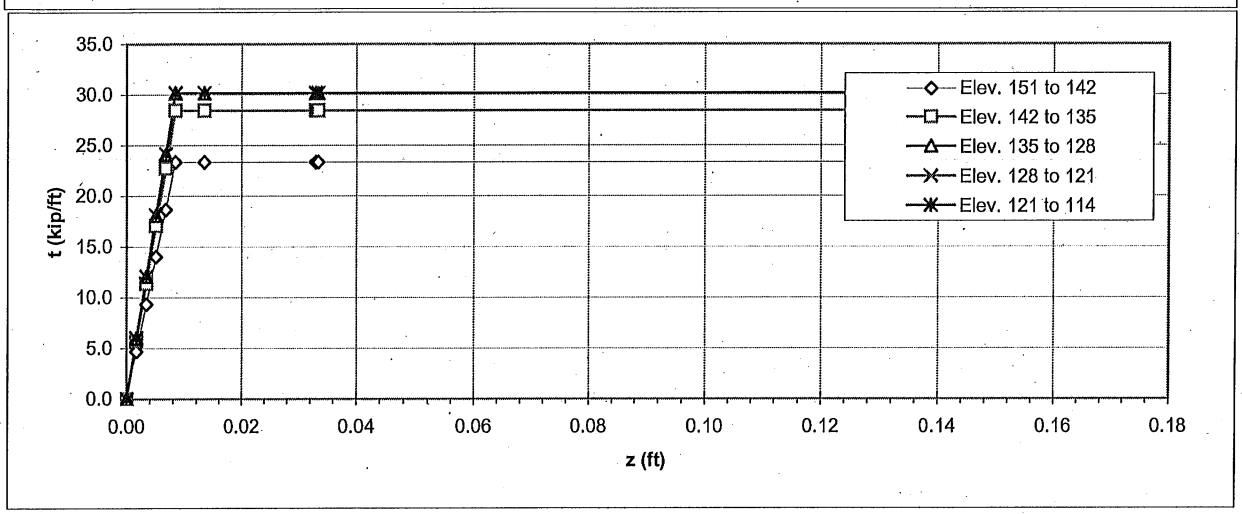
Pier 28

Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0







*-Liquefiable layer

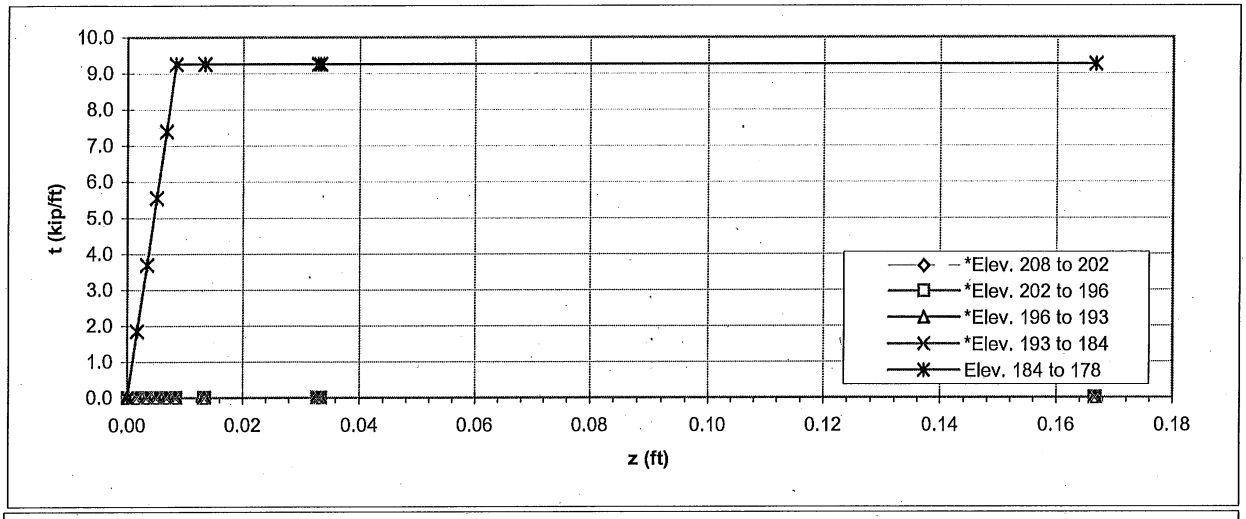
t-z Curves

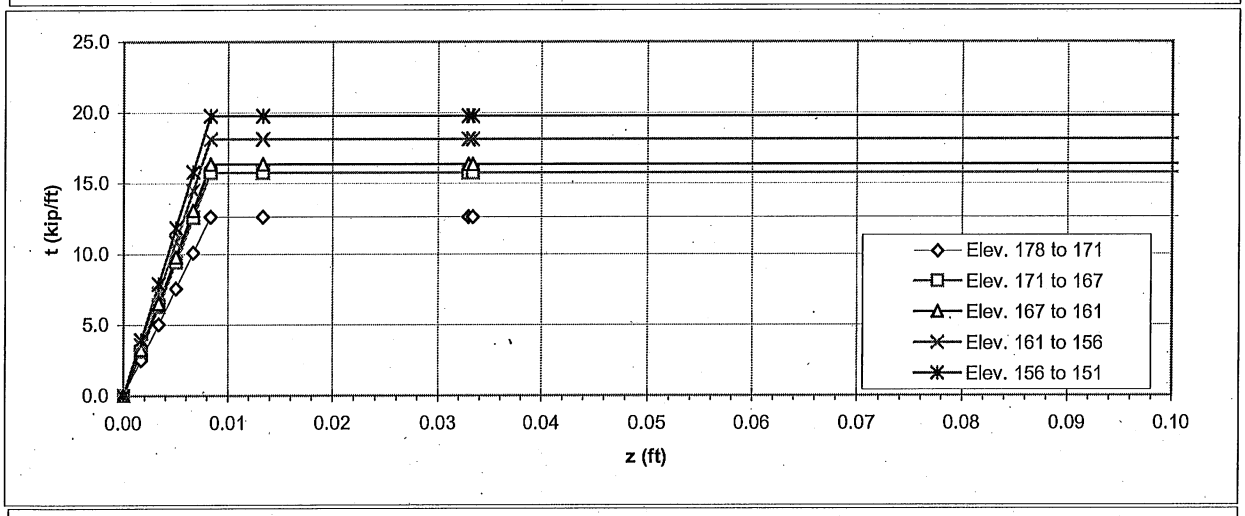
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

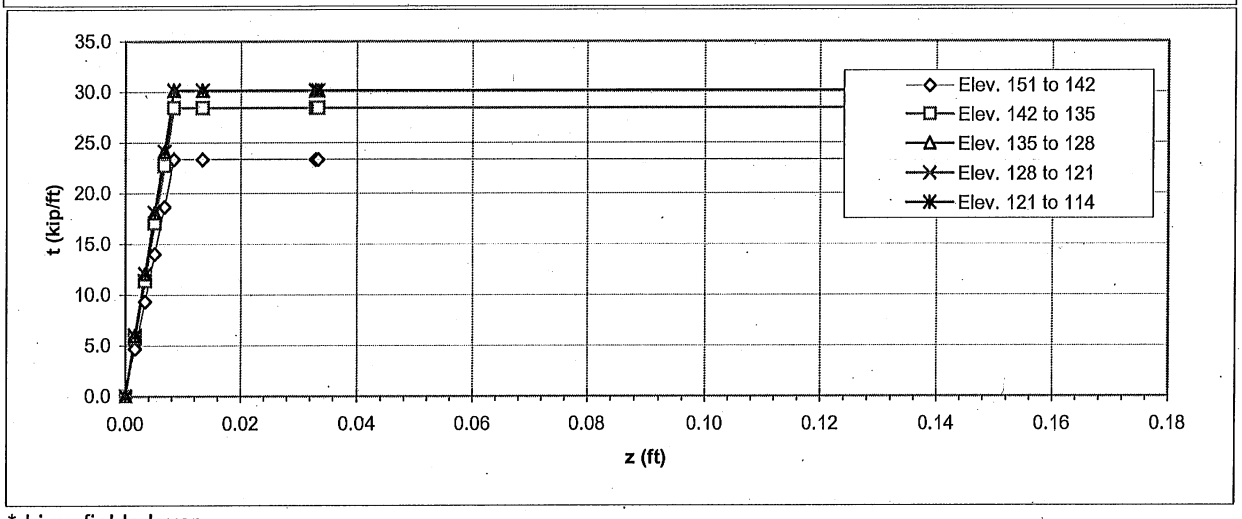
Pier 29

Sta.

O. G. Elev.	208.0	**Pile**	4' PP
Cut off Elev.	208.0	**GWS**	213.0







*-Liquefiable layer

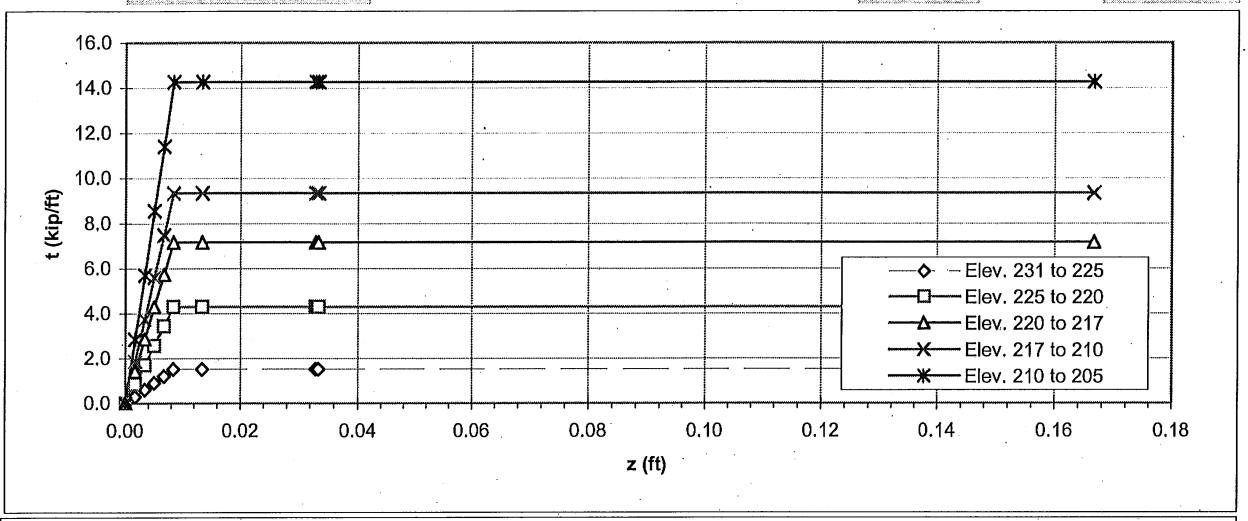
t-z Curves

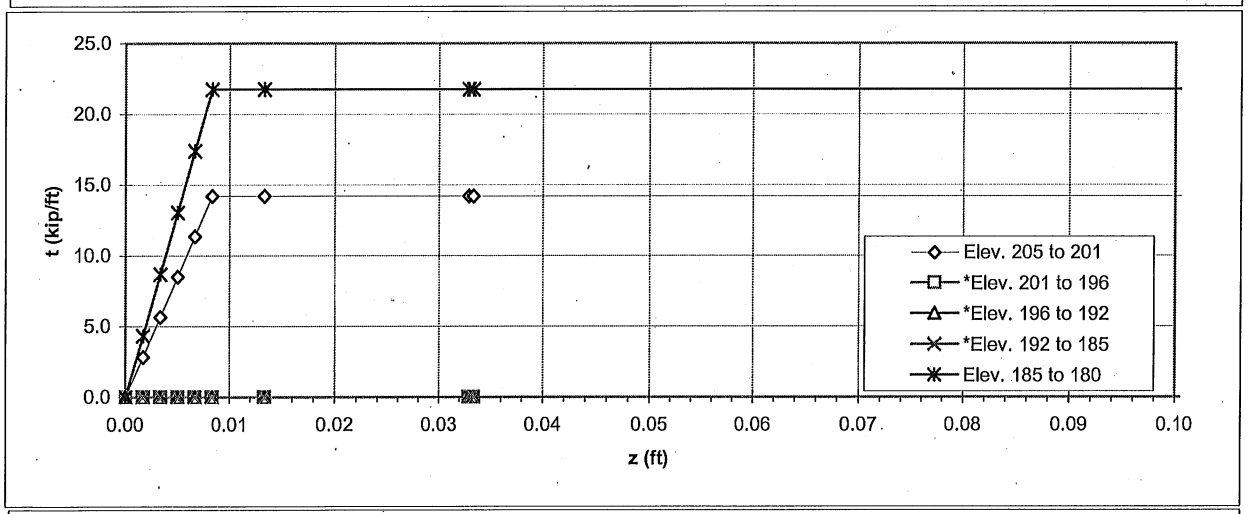
Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

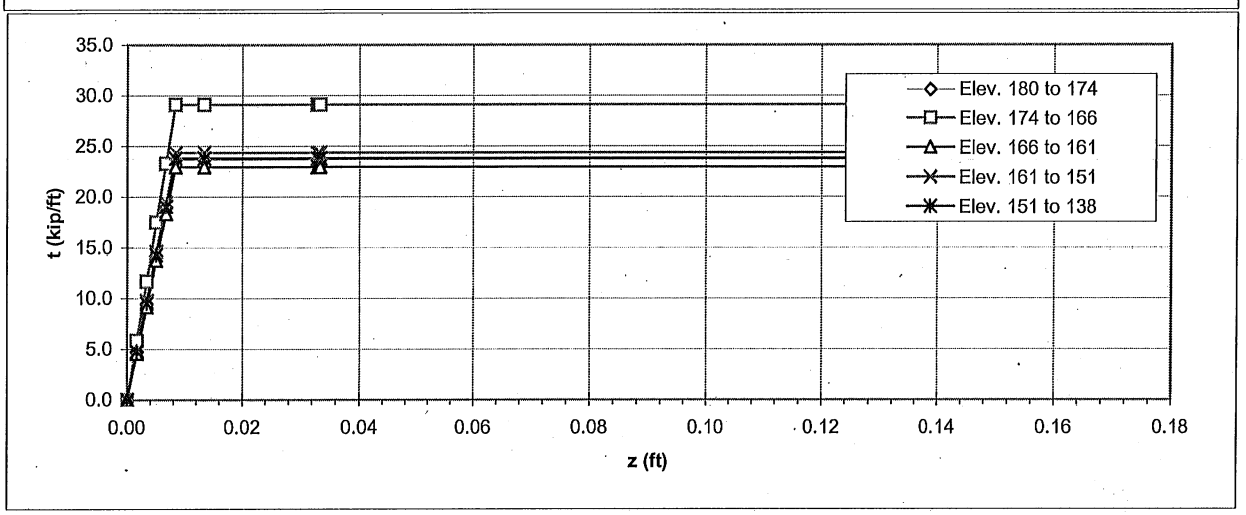
Abut 30

Sta.

O. G. Elev.	231.0	Pile	4' PP
Cut off Elev.	231.0	GWS	213.0







*-Liquefiable layer

t-z Curves

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Abut 1

Sta.

O. G. Elev. 231.0
Cut off Elev. 231.0

Pile 4" PP
GWS 213.0

z (ft)	Elev. 231 to 224	z (ft)	Elev. 224 to 218	z (ft)	Elev. 218 to 211	z (ft)	*Elev. 211 to 206	z (ft)	*Elev. 206 to 198
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.3	0.00	1.3	0.00	2.5	0.00	0.0	0.00	0.0
0.00	0.6	0.00	2.6	0.00	5.0	0.00	0.0	0.00	0.0
0.01	1.0	0.01	3.9	0.01	7.5	0.01	0.0	0.01	0.0
0.01	1.3	0.01	5.3	0.01	10.0	0.01	0.0	0.01	0.0
0.01	1.6	0.01	6.6	0.01	12.5	0.01	0.0	0.01	0.0
0.01	1.6	0.01	6.6	0.01	12.5	0.01	0.0	0.01	0.0
0.03	1.6	0.03	6.6	0.03	12.5	0.03	0.0	0.03	0.0
0.03	1.6	0.03	6.6	0.03	12.5	0.03	0.0	0.03	0.0
0.17	1.6	0.17	6.6	0.17	12.5	0.17	0.0	0.17	0.0

z (ft)	*Elev. 198 to 191	z (ft)	Elev. 191 to 188	z (ft)	Elev. 188 to 181	z (ft)	Elev. 181 to 176	z (ft)	Elev. 176 to 168
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	4.4	0.00	5.0	0.00	4.7	0.00	6.0
0.00	0.0	0.00	8.8	0.00	10.1	0.00	9.3	0.00	12.1
0.01	0.0	0.01	13.1	0.01	15.1	0.01	14.0	0.01	18.1
0.01	0.0	0.01	17.5	0.01	20.1	0.01	18.6	0.01	24.1
0.01	0.0	0.01	21.9	0.01	25.1	0.01	23.3	0.01	30.2
0.01	0.0	0.01	21.9	0.01	25.1	0.01	23.3	0.01	30.2
0.03	0.0	0.03	21.9	0.03	25.1	0.03	23.3	0.03	30.2
0.03	0.0	0.03	21.9	0.03	25.1	0.03	23.3	0.03	30.2
0.17	0.0	0.17	21.9	0.17	25.1	0.17	23.3	0.17	30.2

z (ft)	Elev. 168 to 161	z (ft)	Elev. 161 to 158	z (ft)	Elev. 158 to 149	z (ft)	Elev. 149 to 144	z (ft)	Elev. 144 to 138
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	6.0	0.00	4.2	0.00	4.5	0.00	4.5	0.00	4.5
0.00	12.1	0.00	8.5	0.00	9.0	0.00	9.1	0.00	9.1
0.01	18.1	0.01	12.7	0.01	13.4	0.01	13.6	0.01	13.6
0.01	24.1	0.01	16.9	0.01	17.9	0.01	18.2	0.01	18.1
0.01	30.2	0.01	21.1	0.01	22.4	0.01	22.7	0.01	22.7
0.01	30.2	0.01	21.1	0.01	22.4	0.01	22.7	0.01	22.7
0.03	30.2	0.03	21.1	0.03	22.4	0.03	22.7	0.03	22.7
0.03	30.2	0.03	21.1	0.03	22.4	0.03	22.7	0.03	22.7
0.17	30.2	0.17	21.1	0.17	22.4	0.17	22.7	0.17	22.7

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 2

Sta.

O. G. Elev. 213.0
Cut off Elev. 213.0

Pile 4" PP
GWS 213.0

z (ft)	*Elev. 213 to 206	z (ft)	*Elev. 206 to 198	z (ft)	Elev. 198 to 192	z (ft)	Elev. 192 to 189	z (ft)	Elev. 189 to 184
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	1.2	0.00	1.3	0.00	1.7
0.00	0.0	0.00	0.0	0.00	2.3	0.00	2.6	0.00	3.5
0.01	0.0	0.01	0.0	0.01	3.5	0.01	4.0	0.01	5.2
0.01	0.0	0.01	0.0	0.01	4.7	0.01	5.3	0.01	6.9
0.01	0.0	0.01	0.0	0.01	5.9	0.01	6.6	0.01	8.6
0.01	0.0	0.01	0.0	0.01	5.9	0.01	6.6	0.01	8.6
0.03	0.0	0.03	0.0	0.03	5.9	0.03	6.6	0.03	8.6
0.03	0.0	0.03	0.0	0.03	5.9	0.03	6.6	0.03	8.6
0.17	0.0	0.17	0.0	0.17	5.9	0.17	6.6	0.17	8.6

z (ft)	Elev. 184 to 179	z (ft)	*Elev. 179 to 174	z (ft)	Elev. 174 to 168	z (ft)	Elev. 168 to 164	z (ft)	Elev. 164 to 156
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.1	0.00	0.0	0.00	2.7	0.00	3.8	0.00	3.9
0.00	4.2	0.00	0.0	0.00	5.5	0.00	7.6	0.00	7.8
0.01	6.3	0.01	0.0	0.01	8.2	0.01	11.3	0.01	11.7
0.01	8.5	0.01	0.0	0.01	10.9	0.01	15.1	0.01	15.6
0.01	10.6	0.01	0.0	0.01	13.6	0.01	18.9	0.01	19.5
0.01	10.6	0.01	0.0	0.01	13.6	0.01	18.9	0.01	19.5
0.03	10.6	0.03	0.0	0.03	13.6	0.03	18.9	0.03	19.5
0.03	10.6	0.03	0.0	0.03	13.6	0.03	18.9	0.03	19.5
0.17	10.6	0.17	0.0	0.17	13.6	0.17	18.9	0.17	19.5

z (ft)	Elev. 156 to 147	z (ft)	Elev. 147 to 142	z (ft)	Elev. 142 to 137	z (ft)	Elev. 137 to 127	z (ft)	Elev. 127 to 121
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	4.6	0.00	5.3	0.00	5.5	0.00	4.6	0.00	4.6
0.00	9.2	0.00	10.6	0.00	11.0	0.00	9.1	0.00	9.1
0.01	13.8	0.01	15.9	0.01	16.5	0.01	13.7	0.01	13.7
0.01	18.4	0.01	21.2	0.01	22.0	0.01	18.2	0.01	18.3
0.01	23.0	0.01	26.5	0.01	27.5	0.01	22.8	0.01	22.8
0.01	23.0	0.01	26.5	0.01	27.5	0.01	22.8	0.01	22.8
0.03	23.0	0.03	26.5	0.03	27.5	0.03	22.8	0.03	22.8
0.03	23.0	0.03	26.5	0.03	27.5	0.03	22.8	0.03	22.8
0.17	23.0	0.17	26.5	0.17	27.5	0.17	22.8	0.17	22.8

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 3

Sta.

O. G. Elev. 213.0
Cut off Elev. 213.0

Pile 4" PP
GWS 213.0

z (ft)	*Elev. 213 to 206	z (ft)	Elev. 206 to 200	z (ft)	Elev. 200 to 194	z (ft)	*Elev. 194 to 188	z (ft)	Elev. 188 to 182
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.6	0.00	1.3	0.00	0.0	0.00	2.1
0.00	0.0	0.00	1.3	0.00	2.5	0.00	0.0	0.00	4.1
0.01	0.0	0.01	1.9	0.01	3.8	0.01	0.0	0.01	6.2
0.01	0.0	0.01	2.6	0.01	5.0	0.01	0.0	0.01	8.3
0.01	0.0	0.01	3.2	0.01	6.3	0.01	0.0	0.01	10.4
0.01	0.0	0.01	3.2	0.01	6.3	0.01	0.0	0.01	10.4
0.03	0.0	0.03	3.2	0.03	6.3	0.03	0.0	0.03	10.4
0.03	0.0	0.03	3.2	0.03	6.3	0.03	0.0	0.03	10.4
0.17	0.0	0.17	3.2	0.17	6.3	0.17	0.0	0.17	10.4

z (ft)	Elev. 182 to 176	z (ft)	Elev. 176 to 168	z (ft)	Elev. 168 to 160	z (ft)	Elev. 160 to 157	z (ft)	Elev. 157 to 150
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.7	0.00	3.8	0.00	4.0	0.00	4.1	0.00	5.2
0.00	5.3	0.00	7.6	0.00	8.1	0.00	8.2	0.00	10.3
0.01	8.0	0.01	11.3	0.01	12.1	0.01	12.3	0.01	15.5
0.01	10.6	0.01	15.1	0.01	16.2	0.01	16.4	0.01	20.7
0.01	13.3	0.01	18.9	0.01	20.2	0.01	20.5	0.01	25.8
0.01	13.3	0.01	18.9	0.01	20.2	0.01	20.5	0.01	25.8
0.03	13.3	0.03	18.9	0.03	20.2	0.03	20.5	0.03	25.8
0.03	13.3	0.03	18.9	0.03	20.2	0.03	20.5	0.03	25.8
0.17	13.3	0.17	18.9	0.17	20.2	0.17	20.5	0.17	25.8

z (ft)	Elev. 150 to 145	z (ft)	Elev. 145 to 140	z (ft)	Elev. 140 to 137	z (ft)	Elev. 137 to 130	z (ft)	Elev. 130 to 123
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	5.5	0.00	6.0	0.00	6.0	0.00	4.5	0.00	6.0
0.00	10.9	0.00	12.0	0.00	12.1	0.00	9.0	0.00	12.1
0.01	16.4	0.01	18.0	0.01	18.1	0.01	13.5	0.01	18.1
0.01	21.9	0.01	24.0	0.01	24.1	0.01	18.0	0.01	24.1
0.01	27.3	0.01	30.0	0.01	30.2	0.01	22.5	0.01	30.2
0.01	27.3	0.01	30.0	0.01	30.2	0.01	22.5	0.01	30.2
0.03	27.3	0.03	30.0	0.03	30.2	0.03	22.5	0.03	30.2
0.03	27.3	0.03	30.0	0.03	30.2	0.03	22.5	0.03	30.2
0.17	27.3	0.17	30.0	0.17	30.2	0.17	22.5	0.17	30.2

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 4

Sta.

O. G. Elev. 213.0
Cut off Elev. 213.0

Pile 4" PP
GWS 213.0

z (ft)	*Elev. 213 to 205	z (ft)	*Elev. 205 to 197	z (ft)	Elev. 197 to 194	z (ft)	*Elev. 194 to 190	z (ft)	Elev. 190 to 185
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	1.4	0.00	0.0	0.00	2.0
0.00	0.0	0.00	0.0	0.00	2.8	0.00	0.0	0.00	4.1
0.01	0.0	0.01	0.0	0.01	4.2	0.01	0.0	0.01	6.1
0.01	0.0	0.01	0.0	0.01	5.6	0.01	0.0	0.01	8.1
0.01	0.0	0.01	0.0	0.01	6.9	0.01	0.0	0.01	10.2
0.01	0.0	0.01	0.0	0.01	6.9	0.01	0.0	0.01	10.2
0.03	0.0	0.03	0.0	0.03	6.9	0.03	0.0	0.03	10.2
0.03	0.0	0.03	0.0	0.03	6.9	0.03	0.0	0.03	10.2
0.17	0.0	0.17	0.0	0.17	6.9	0.17	0.0	0.17	10.2

z (ft)	Elev. 185 to 179	z (ft)	Elev. 179 to 174	z (ft)	Elev. 174 to 168	z (ft)	Elev. 168 to 162	z (ft)	Elev. 162 to 153
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.5	0.00	2.7	0.00	3.7	0.00	4.2	0.00	4.5
0.00	5.1	0.00	5.3	0.00	7.3	0.00	8.4	0.00	9.1
0.01	7.6	0.01	8.0	0.01	11.0	0.01	12.6	0.01	13.6
0.01	10.1	0.01	10.7	0.01	14.6	0.01	16.9	0.01	18.1
0.01	12.6	0.01	13.3	0.01	18.3	0.01	21.1	0.01	22.7
0.01	12.6	0.01	13.3	0.01	18.3	0.01	21.1	0.01	22.7
0.03	12.6	0.03	13.3	0.03	18.3	0.03	21.1	0.03	22.7
0.03	12.6	0.03	13.3	0.03	18.3	0.03	21.1	0.03	22.7
0.17	12.6	0.17	13.3	0.17	18.3	0.17	21.1	0.17	22.7

z (ft)	Elev. 153 to 149	z (ft)	Elev. 149 to 142	z (ft)	Elev. 142 to 139	z (ft)	Elev. 139 to 133	z (ft)	Elev. 133 to 123
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	4.6	0.00	4.7	0.00	3.7	0.00	6.0	0.00	4.5
0.00	9.2	0.00	9.4	0.00	7.5	0.00	12.1	0.00	9.0
0.01	13.9	0.01	14.0	0.01	11.2	0.01	18.1	0.01	13.5
0.01	18.5	0.01	18.7	0.01	14.9	0.01	24.1	0.01	18.0
0.01	23.1	0.01	23.4	0.01	18.6	0.01	30.2	0.01	22.5
0.01	23.1	0.01	23.4	0.01	18.6	0.01	30.2	0.01	22.5
0.03	23.1	0.03	23.4	0.03	18.6	0.03	30.2	0.03	22.5
0.03	23.1	0.03	23.4	0.03	18.6	0.03	30.2	0.03	22.5
0.17	23.1	0.17	23.4	0.17	18.6	0.17	30.2	0.17	22.5

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 5

Sta.

O. G. Elev. 209.0
Cut off Elev. 209.0
Pile 4" PP
GWS 213.0

z (ft)	*Elev. 209 to 201	z (ft)	Elev. 201 to 195	z (ft)	*Elev. 195 to 189	z (ft)	Elev. 189 to 183	z (ft)	Elev. 183 to 177
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.7	0.00	0.0	0.00	1.6	0.00	2.2
0.00	0.0	0.00	1.4	0.00	0.0	0.00	3.3	0.00	4.5
0.00	0.0	0.01	2.1	0.00	0.0	0.01	4.9	0.01	6.7
0.00	0.0	0.01	2.8	0.00	0.0	0.01	6.6	0.01	8.9
0.00	0.0	0.01	3.5	0.00	0.0	0.01	8.2	0.01	11.1
0.00	0.0	0.01	3.5	0.00	0.0	0.01	8.2	0.01	11.1
0.00	0.0	0.03	3.5	0.00	0.0	0.03	8.2	0.03	11.1
0.00	0.0	0.03	3.5	0.00	0.0	0.03	8.2	0.03	11.1
0.00	0.0	0.17	3.5	0.00	0.0	0.17	8.2	0.17	11.1

z (ft)	Elev. 177 to 167	z (ft)	Elev. 167 to 159	z (ft)	Elev. 159 to 151	z (ft)	Elev. 151 to 145	z (ft)	Elev. 145 to 139
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.6	0.00	3.5	0.00	4.3	0.00	5.0	0.00	5.3
0.00	5.2	0.00	6.9	0.00	8.6	0.00	10.0	0.00	10.5
0.01	7.8	0.01	10.4	0.01	12.9	0.01	14.9	0.01	15.8
0.01	10.4	0.01	13.9	0.01	17.2	0.01	19.9	0.01	21.0
0.01	13.0	0.01	17.4	0.01	21.6	0.01	24.9	0.01	26.3
0.01	13.0	0.01	17.4	0.01	21.6	0.01	24.9	0.01	26.3
0.03	13.0	0.03	17.4	0.03	21.6	0.03	24.9	0.03	26.3
0.03	13.0	0.03	17.4	0.03	21.6	0.03	24.9	0.03	26.3
0.17	13.0	0.17	17.4	0.17	21.6	0.17	24.9	0.17	26.3

z (ft)	Elev. 139 to 129	z (ft)	Elev. 129 to 126	z (ft)	Elev. 126 to 116
0.00	0.0	0.00	0.0	0.00	0.0
0.00	6.0	0.00	4.4	0.00	5.5
0.00	12.1	0.00	8.8	0.00	10.9
0.01	18.1	0.01	13.2	0.01	16.4
0.01	24.1	0.01	17.6	0.01	21.9
0.01	30.2	0.01	22.0	0.01	27.3
0.01	30.2	0.01	22.0	0.01	27.3
0.03	30.2	0.03	22.0	0.03	27.3
0.03	30.2	0.03	22.0	0.03	27.3
0.17	30.2	0.17	22.0	0.17	27.3

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 6

Sta.

O. G. Elev. 209.0
Cut off Elev. 209.0
Pile 4" PP
GWS 209.0

z (ft)	*Elev. 209 to 203	z (ft)	Elev. 203 to 197	z (ft)	*Elev. 197 to 188	z (ft)	Elev. 188 to 185	z (ft)	Elev. 185 to 179
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.6	0.00	0.0	0.00	1.4	0.00	1.8
0.00	0.0	0.00	1.1	0.00	0.0	0.00	2.9	0.00	3.6
0.01	0.0	0.01	1.7	0.01	0.0	0.01	4.3	0.01	5.5
0.01	0.0	0.01	2.3	0.01	0.0	0.01	5.7	0.01	7.3
0.01	0.0	0.01	2.9	0.01	0.0	0.01	7.1	0.01	9.1
0.01	0.0	0.01	2.9	0.01	0.0	0.01	7.1	0.01	9.1
0.03	0.0	0.03	2.9	0.03	0.0	0.03	7.1	0.03	9.1
0.03	0.0	0.03	2.9	0.03	0.0	0.03	7.1	0.03	9.1
0.17	0.0	0.17	2.9	0.17	0.0	0.17	7.1	0.17	9.1

z (ft)	*Elev. 179 to 173	z (ft)	*Elev. 173 to 164	z (ft)	*Elev. 164 to 154	z (ft)	Elev. 154 to 147	z (ft)	Elev. 147 to 139
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.0	0.00	3.9	0.00	4.6
0.00	0.0	0.00	0.0	0.00	0.0	0.00	7.8	0.00	9.2
0.01	0.0	0.01	0.0	0.01	0.0	0.01	11.8	0.01	13.8
0.01	0.0	0.01	0.0	0.01	0.0	0.01	15.7	0.01	18.4
0.01	0.0	0.01	0.0	0.01	0.0	0.01	19.6	0.01	23.0
0.01	0.0	0.01	0.0	0.01	0.0	0.01	19.6	0.01	23.0
0.03	0.0	0.03	0.0	0.03	0.0	0.03	19.6	0.03	23.0
0.03	0.0	0.03	0.0	0.03	0.0	0.03	19.6	0.03	23.0
0.17	0.0	0.17	0.0	0.17	0.0	0.17	19.6	0.17	23.0

z (ft)	Elev. 139 to 132	z (ft)	Elev. 132 to 124	z (ft)	Elev. 124 to 114
0.00	0.0	0.00	0.0	0.00	0.0
0.00	5.0	0.00	4.9	0.00	4.9
0.00	10.0	0.00	9.7	0.00	9.7
0.01	14.9	0.01	14.6	0.01	14.6
0.01	19.9	0.01	19.5	0.01	19.4
0.01	24.9	0.01	24.4	0.01	24.3
0.01	24.9	0.01	24.4	0.01	24.3
0.03	24.9	0.03	24.4	0.03	24.3
0.03	24.9	0.03	24.4	0.03	24.3
0.17	24.9	0.17	24.4	0.17	24.3

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 7

Sta.

O. G. Elev. 209.0
Cut off Elev. 209.0
Pile 4" PP
GWS 213.0

z (ft)	*Elev. 209 to 203	z (ft)	Elev. 203 to 197	z (ft)	*Elev. 197 to 188	z (ft)	Elev. 188 to 185	z (ft)	Elev. 185 to 179
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.6	0.00	0.0	0.00	1.4	0.00	1.8
0.00	0.0	0.00	1.1	0.00	0.0	0.00	2.9	0.00	3.6
0.01	0.0	0.01	1.7	0.01	0.0	0.01	4.3	0.01	5.5
0.01	0.0	0.01	2.3	0.01	0.0	0.01	5.7	0.01	7.3
0.01	0.0	0.01	2.9	0.01	0.0	0.01	7.1	0.01	9.1
0.01	0.0	0.01	2.9	0.01	0.0	0.01	7.1	0.01	9.1
0.03	0.0	0.03	2.9	0.03	0.0	0.03	7.1	0.03	9.1
0.03	0.0	0.03	2.9	0.03	0.0	0.03	7.1	0.03	9.1
0.17	0.0	0.17	2.9	0.17	0.0	0.17	7.1	0.17	9.1

z (ft)	*Elev. 179 to 173	z (ft)	*Elev. 173 to 164	z (ft)	*Elev. 164 to 154	z (ft)	Elev. 154 to 147	z (ft)	Elev. 147 to 139
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.0	0.00	3.9	0.00	4.6
0.00	0.0	0.00	0.0	0.00	0.0	0.00	7.8	0.00	9.2
0.01	0.0	0.01	0.0	0.01	0.0	0.01	11.8	0.01	13.8
0.01	0.0	0.01	0.0	0.01	0.0	0.01	15.7	0.01	18.4
0.01	0.0	0.01	0.0	0.01	0.0	0.01	19.6	0.01	23.0
0.01	0.0	0.01	0.0	0.01	0.0	0.01	19.6	0.01	23.0
0.03	0.0	0.03	0.0	0.03	0.0	0.03	19.6	0.03	23.0
0.03	0.0	0.03	0.0	0.03	0.0	0.03	19.6	0.03	23.0
0.17	0.0	0.17	0.0	0.17	0.0	0.17	19.6	0.17	23.0

z (ft)	Elev. 139 to 132	z (ft)	Elev. 132 to 124	z (ft)	Elev. 124 to 114
0.00	0.0	0.00	0.0	0.00	0.0
0.00	5.0	0.00	4.9	0.00	4.9
0.00	10.0	0.00	9.7	0.00	9.7
0.01	14.9	0.01	14.6	0.01	14.6
0.01	19.9	0.01	19.5	0.01	19.4
0.01	24.9	0.01	24.4	0.01	24.3
0.01	24.9	0.01	24.4	0.01	24.3
0.03	24.9	0.03	24.4	0.03	24.3
0.03	24.9	0.03	24.4	0.03	24.3
0.17	24.9	0.17	24.4	0.17	24.3

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 11

Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0

z (ft)	*Elev. 208 to 201	z (ft)	*Elev. 201 to 191	z (ft)	Elev. 191 to 184	z (ft)	Elev. 184 to 175	z (ft)	Elev. 175 to 166
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	1.2	0.00	1.9	0.00	2.3
0.00	0.0	0.00	0.0	0.00	2.5	0.00	3.8	0.00	4.7
0.01	0.0	0.01	0.0	0.01	3.7	0.01	5.7	0.01	7.0
0.01	0.0	0.01	0.0	0.01	4.9	0.01	7.6	0.01	9.3
0.01	0.0	0.01	0.0	0.01	6.2	0.01	9.6	0.01	11.6
0.01	0.0	0.01	0.0	0.01	6.2	0.01	9.6	0.01	11.6
0.03	0.0	0.03	0.0	0.03	6.2	0.03	9.6	0.03	11.6
0.03	0.0	0.03	0.0	0.03	6.2	0.03	9.6	0.03	11.6
0.17	0.0	0.17	0.0	0.17	6.2	0.17	9.6	0.17	11.6

z (ft)	*Elev. 166 to 163	z (ft)	*Elev. 163 to 157	z (ft)	Elev. 157 to 153	z (ft)	Elev. 153 to 146	z (ft)	Elev. 146 to 140
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	3.5	0.00	3.7	0.00	4.6
0.00	0.0	0.00	0.0	0.00	7.0	0.00	7.4	0.00	9.1
0.01	0.0	0.01	0.0	0.01	10.5	0.01	11.1	0.01	13.7
0.01	0.0	0.01	0.0	0.01	14.0	0.01	14.8	0.01	18.3
0.01	0.0	0.01	0.0	0.01	17.5	0.01	18.5	0.01	22.8
0.01	0.0	0.01	0.0	0.01	17.5	0.01	18.5	0.01	22.8
0.03	0.0	0.03	0.0	0.03	17.5	0.03	18.5	0.03	22.8
0.03	0.0	0.03	0.0	0.03	17.5	0.03	18.5	0.03	22.8
0.17	0.0	0.17	0.0	0.17	17.5	0.17	18.5	0.17	22.8

z (ft)	Elev. 140 to 134	z (ft)	Elev. 134 to 128	z (ft)	Elev. 128 to 123	z (ft)	Elev. 123 to 118		
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0		
0.00	5.0	0.00	5.5	0.00	5.2	0.00	5.1		
0.00	10.1	0.00	11.0	0.00	10.4	0.00	10.2		
0.01	15.1	0.01	16.5	0.01	15.6	0.01	15.3		
0.01	20.2	0.01	22.0	0.01	20.8	0.01	20.4		
0.01	25.2	0.01	27.5	0.01	26.1	0.01	25.5		
0.01	25.2	0.01	27.5	0.01	26.1	0.01	25.5		
0.03	25.2	0.03	27.5	0.03	26.1	0.03	25.5		
0.03	25.2	0.03	27.5	0.03	26.1	0.03	25.5		
0.17	25.2	0.17	27.5	0.17	26.1	0.17	25.5		

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 12

Sta.

O. G. Elev.	208.0	Pile	4' PP
Cut off Elev.	208.0	GWS	213.0

z (ft)	*Elev. 208 to 198	z (ft)	Elev. 198 to 188	z (ft)	*Elev. 188 to 185	z (ft)	Elev. 185 to 176	z (ft)	Elev. 176 to 174
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.7	0.00	0.0	0.00	1.7	0.00	1.7
0.00	0.0	0.00	1.5	0.00	0.0	0.00	3.3	0.00	3.4
0.01	0.0	0.01	2.2	0.01	0.0	0.01	5.0	0.01	5.1
0.01	0.0	0.01	3.0	0.01	0.0	0.01	6.7	0.01	6.8
0.01	0.0	0.01	3.7	0.01	0.0	0.01	8.4	0.01	8.6
0.01	0.0	0.01	3.7	0.01	0.0	0.01	8.4	0.01	8.6
0.03	0.0	0.03	3.7	0.03	0.0	0.03	8.4	0.03	8.6
0.03	0.0	0.03	3.7	0.03	0.0	0.03	8.4	0.03	8.6
0.17	0.0	0.17	3.7	0.17	0.0	0.17	8.4	0.17	8.6

z (ft)	*Elev. 174 to 170	z (ft)	*Elev. 170 to 164	z (ft)	Elev. 164 to 157	z (ft)	Elev. 157 to 149	z (ft)	Elev. 149 to 145
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	2.9	0.00	3.5	0.00	3.7
0.00	0.0	0.00	0.0	0.00	5.9	0.00	7.1	0.00	7.5
0.01	0.0	0.01	0.0	0.01	8.8	0.01	10.6	0.01	11.2
0.01	0.0	0.01	0.0	0.01	11.8	0.01	14.1	0.01	15.0
0.01	0.0	0.01	0.0	0.01	14.7	0.01	17.6	0.01	18.7
0.01	0.0	0.01	0.0	0.01	14.7	0.01	17.6	0.01	18.7
0.03	0.0	0.03	0.0	0.03	14.7	0.03	17.6	0.03	18.7
0.03	0.0	0.03	0.0	0.03	14.7	0.03	17.6	0.03	18.7
0.17	0.0	0.17	0.0	0.17	14.7	0.17	17.6	0.17	18.7

z (ft)	Elev. 145 to 139	z (ft)	Elev. 139 to 133	z (ft)	Elev. 133 to 125	z (ft)	Elev. 125 to 117		
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0		
0.00	4.4	0.00	4.9	0.00	4.5	0.00	6.0		
0.00	8.8	0.00	9.7	0.00	9.0	0.00	11.9		
0.01	13.2	0.01	14.6	0.01	13.6	0.01	17.9		
0.01	17.6	0.01	19.4	0.01	18.1	0.01	23.9		
0.01	22.0	0.01	24.3	0.01	22.6	0.01	29.9		
0.01	22.0	0.01	24.3	0.01	22.6	0.01	29.9		
0.03	22.0	0.03	24.3	0.03	22.6	0.03	29.9		
0.03	22.0	0.03	24.3	0.03	22.6	0.03	29.9		
0.17	22.0	0.17	24.3	0.17	22.6	0.17	29.9		

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 13

Sta.

O. G. Elev. 207.0
Cut off Elev. 207.0

Pile 4' PP
GWS 213.0

z (ft)	Elev. 207 to 197	z (ft)	Elev. 197 to 189	z (ft)	Elev. 189 to 183	z (ft)	Elev. 183 to 177	z (ft)	Elev. 177 to 169
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.3	0.00	0.9	0.00	1.4	0.00	1.8	0.00	2.4
0.00	0.6	0.00	1.8	0.00	2.9	0.00	3.7	0.00	4.8
0.01	0.9	0.01	2.7	0.01	4.3	0.01	5.5	0.01	7.1
0.01	1.2	0.01	3.6	0.01	5.8	0.01	7.3	0.01	9.5
0.01	1.5	0.01	4.5	0.01	7.2	0.01	9.1	0.01	11.9
0.01	1.5	0.01	4.5	0.01	7.2	0.01	9.1	0.01	11.9
0.03	1.5	0.03	4.5	0.03	7.2	0.03	9.1	0.03	11.9
0.03	1.5	0.03	4.5	0.03	7.2	0.03	9.1	0.03	11.9
0.17	1.5	0.17	4.5	0.17	7.2	0.17	9.1	0.17	11.9

z (ft)	*Elev. 169 to 162	z (ft)	Elev. 162 to 154	z (ft)	Elev. 154 to 147	z (ft)	Elev. 147 to 144	z (ft)	Elev. 144 to 139
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	3.5	0.01	4.5	0.00	3.3	0.01	4.8
0.00	0.0	0.00	6.9	0.02	8.2	0.00	6.6	0.02	8.7
0.01	0.0	0.01	10.4	0.02	9.8	0.01	9.8	0.02	10.3
0.01	0.0	0.01	13.8	0.02	11.1	0.01	13.1	0.02	11.7
0.01	0.0	0.01	17.3	0.03	13.1	0.01	16.4	0.03	13.8
0.01	0.0	0.01	17.3	0.04	14.2	0.01	16.4	0.04	15.0
0.03	0.0	0.03	17.3	0.08	12.8	0.03	16.4	0.08	13.5
0.03	0.0	0.03	17.3	0.28	12.8	0.03	16.4	0.28	13.5
0.17	0.0	0.17	17.3	0.40	12.8	0.17	16.4	0.40	13.5

z (ft)	Elev. 139 to 133	z (ft)	Elev. 133 to 126
0.00	0.0	0.00	0.0
0.00	4.6	0.00	4.9
0.00	9.2	0.00	9.8
0.01	13.8	0.01	14.8
0.01	18.4	0.01	19.7
0.01	23.0	0.01	24.6
0.01	23.0	0.01	24.6
0.03	23.0	0.03	24.6
0.03	23.0	0.03	24.6
0.17	23.0	0.17	24.6

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 14

Sta.

O. G. Elev. 206.0
Cut off Elev. 206.0

Pile 4' PP
GWS 213.0

z (ft)	*Elev. 206 to 201	z (ft)	*Elev. 201 to 196	z (ft)	Elev. 196 to 190	z (ft)	*Elev. 190 to 183	z (ft)	Elev. 183 to 178
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.8	0.00	0.0	0.00	1.6
0.00	0.0	0.00	0.0	0.00	1.6	0.00	0.0	0.00	3.2
0.01	0.0	0.01	0.0	0.01	2.3	0.01	0.0	0.01	4.7
0.01	0.0	0.01	0.0	0.01	3.1	0.01	0.0	0.01	6.3
0.01	0.0	0.01	0.0	0.01	3.9	0.01	0.0	0.01	7.9
0.01	0.0	0.01	0.0	0.01	3.9	0.01	0.0	0.01	7.9
0.03	0.0	0.03	0.0	0.03	3.9	0.03	0.0	0.03	7.9
0.03	0.0	0.03	0.0	0.03	3.9	0.03	0.0	0.03	7.9
0.17	0.0	0.17	0.0	0.17	3.9	0.17	0.0	0.17	7.9

z (ft)	Elev. 178 to 173	z (ft)	Elev. 173 to 166	z (ft)	*Elev. 166 to 161	z (ft)	Elev. 161 to 156	z (ft)	Elev. 156 to 150
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.3	0.00	2.4	0.00	0.0	0.00	2.9	0.01	3.6
0.00	4.5	0.00	4.9	0.00	0.0	0.00	5.8	0.02	6.6
0.01	6.8	0.01	7.3	0.01	0.0	0.01	8.6	0.02	7.8
0.01	9.0	0.01	9.7	0.01	0.0	0.01	11.5	0.02	8.8
0.01	11.3	0.01	12.1	0.01	0.0	0.01	14.4	0.03	10.4
0.01	11.3	0.01	12.1	0.01	0.0	0.01	14.4	0.04	11.3
0.03	11.3	0.03	12.1	0.03	0.0	0.03	14.4	0.08	10.2
0.03	11.3	0.03	12.1	0.03	0.0	0.03	14.4	0.28	10.2
0.17	11.3	0.17	12.1	0.17	0.0	0.17	14.4	0.40	10.2

z (ft)	Elev. 150 to 144	z (ft)	Elev. 144 to 138	z (ft)	Elev. 138 to 128	z (ft)	Elev. 128 to 121	z (ft)	Elev. 121 to 113
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.01	4.1	0.01	4.6	0.00	4.0	0.00	5.2	0.00	5.8
0.02	7.5	0.02	8.4	0.00	8.1	0.00	10.4	0.00	11.6
0.02	8.8	0.02	9.9	0.01	12.1	0.01	15.6	0.01	17.4
0.02	10.0	0.02	11.2	0.01	16.1	0.01	20.8	0.01	23.1
0.03	11.8	0.03	13.3	0.01	20.1	0.01	26.0	0.01	28.9
0.04	12.9	0.04	14.4	0.01	20.1	0.01	26.0	0.01	28.9
0.08	11.6	0.08	13.0	0.03	20.1	0.03	26.0	0.03	28.9
0.28	11.6	0.28	13.0	0.03	20.1	0.03	26.0	0.03	28.9
0.40	11.6	0.40	13.0	0.17	20.1	0.17	26.0	0.17	28.9

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 15

Sta.

O. G. Elev.	206.0	Pile	4' PP
Cut off Elev.	206.0	GWS	213.0

z (ft)	*Elev. 206 to 201	z (ft)	*Elev. 201 to 196	z (ft)	Elev. 196 to 190	z (ft)	*Elev. 190 to 183	z (ft)	Elev. 183 to 178
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.8	0.00	0.0	0.00	1.6
0.00	0.0	0.00	0.0	0.00	1.6	0.00	0.0	0.00	3.2
0.01	0.0	0.01	0.0	0.01	2.3	0.01	0.0	0.01	4.7
0.01	0.0	0.01	0.0	0.01	3.1	0.01	0.0	0.01	6.3
0.01	0.0	0.01	0.0	0.01	3.9	0.01	0.0	0.01	7.9
0.01	0.0	0.01	0.0	0.01	3.9	0.01	0.0	0.01	7.9
0.03	0.0	0.03	0.0	0.03	3.9	0.03	0.0	0.03	7.9
0.03	0.0	0.03	0.0	0.03	3.9	0.03	0.0	0.03	7.9
0.17	0.0	0.17	0.0	0.17	3.9	0.17	0.0	0.17	7.9

z (ft)	Elev. 178 to 173	z (ft)	Elev. 173 to 166	z (ft)	*Elev. 166 to 161	z (ft)	Elev. 161 to 156	z (ft)	Elev. 156 to 150
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.3	0.00	2.4	0.00	0.0	0.00	2.9	0.01	3.6
0.00	4.5	0.00	4.9	0.00	0.0	0.00	5.8	0.02	6.6
0.01	6.8	0.01	7.3	0.01	0.0	0.01	8.6	0.02	7.8
0.01	9.0	0.01	9.7	0.01	0.0	0.01	11.5	0.02	8.8
0.01	11.3	0.01	12.1	0.01	0.0	0.01	14.4	0.03	10.4
0.01	11.3	0.01	12.1	0.01	0.0	0.01	14.4	0.04	11.3
0.03	11.3	0.03	12.1	0.03	0.0	0.03	14.4	0.08	10.2
0.03	11.3	0.03	12.1	0.03	0.0	0.03	14.4	0.28	10.2
0.17	11.3	0.17	12.1	0.17	0.0	0.17	14.4	0.40	10.2

z (ft)	Elev. 150 to 144	z (ft)	Elev. 144 to 138	z (ft)	Elev. 138 to 128	z (ft)	Elev. 128 to 121	z (ft)	Elev. 121 to 113
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.01	4.1	0.01	4.6	0.00	4.0	0.00	5.2	0.00	5.8
0.02	7.5	0.02	8.4	0.00	8.1	0.00	10.4	0.00	11.6
0.02	8.8	0.02	9.9	0.01	12.1	0.01	15.6	0.01	17.4
0.02	10.0	0.02	11.2	0.01	16.1	0.01	20.8	0.01	23.1
0.03	11.8	0.03	13.3	0.01	20.1	0.01	26.0	0.01	28.9
0.04	12.9	0.04	14.4	0.01	20.1	0.01	26.0	0.01	28.9
0.08	11.6	0.08	13.0	0.03	20.1	0.03	26.0	0.03	28.9
0.28	11.6	0.28	13.0	0.03	20.1	0.03	26.0	0.03	28.9
0.40	11.6	0.40	13.0	0.17	20.1	0.17	26.0	0.17	28.9

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 19

Sta.

O. G. Elev. 207.0
Cut off Elev. 207.0
Pile 4' PP
GWS 213.0

z (ft)	*Elev. 207 to 199	z (ft)	*Elev. 199 to 189	z (ft)	*Elev. 189 to 183	z (ft)	*Elev. 183 to 176	z (ft)	Elev. 176 to 172
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	2.1
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	4.2
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	6.2
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	8.3
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	10.4
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	10.4
0.03	0.0	0.03	0.0	0.03	0.0	0.03	0.0	0.03	10.4
0.03	0.0	0.03	0.0	0.03	0.0	0.03	0.0	0.03	10.4
0.17	0.0	0.17	0.0	0.17	0.0	0.17	0.0	0.17	10.4

z (ft)	*Elev. 172 to 167	z (ft)	*Elev. 167 to 162	z (ft)	Elev. 162 to 157	z (ft)	Elev. 157 to 152	z (ft)	Elev. 152 to 146
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	2.7	0.01	1.2	0.01	6.2
0.00	0.0	0.00	0.0	0.00	5.4	0.02	2.2	0.02	11.2
0.01	0.0	0.01	0.0	0.01	8.1	0.02	2.6	0.02	13.3
0.01	0.0	0.01	0.0	0.01	10.8	0.02	2.9	0.02	15.1
0.01	0.0	0.01	0.0	0.01	13.5	0.03	3.5	0.03	17.8
0.01	0.0	0.01	0.0	0.01	13.5	0.04	3.8	0.04	19.3
0.03	0.0	0.03	0.0	0.03	13.5	0.08	3.4	0.08	17.4
0.03	0.0	0.03	0.0	0.03	13.5	0.28	3.4	0.28	17.4
0.17	0.0	0.17	0.0	0.17	13.5	0.40	3.4	0.40	17.4

z (ft)	Elev. 146 to 140	z (ft)	Elev. 140 to 134	z (ft)	Elev. 134 to 127	z (ft)	Elev. 127 to 122	z (ft)	Elev. 122 to 114
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.01	4.6	0.00	3.9	0.00	4.1	0.00	4.8	0.00	5.6
0.02	8.3	0.00	7.8	0.00	8.3	0.00	9.7	0.00	11.2
0.02	9.8	0.01	11.7	0.01	12.4	0.01	14.5	0.01	16.8
0.02	11.1	0.01	15.6	0.01	16.5	0.01	19.4	0.01	22.4
0.03	13.1	0.01	19.5	0.01	20.7	0.01	24.2	0.01	28.0
0.04	14.3	0.01	19.5	0.01	20.7	0.01	24.2	0.01	28.0
0.08	12.9	0.03	19.5	0.03	20.7	0.03	24.2	0.03	28.0
0.28	12.9	0.03	19.5	0.03	20.7	0.03	24.2	0.03	28.0
0.40	12.9	0.17	19.5	0.17	20.7	0.17	24.2	0.17	28.0

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 20

Sta.		O. G. Elev.	206.0	Pile	4' PP
		Cut off Elev.	206.0	GWS	213.0

z (ft)	*Elev. 206 to 195	z (ft)	*Elev. 195 to 192	z (ft)	*Elev. 192 to 186	z (ft)	*Elev. 186 to 181	z (ft)	*Elev. 181 to 175
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0
0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0	0.01	0.0
0.03	0.0	0.03	0.0	0.03	0.0	0.03	0.0	0.03	0.0
0.03	0.0	0.03	0.0	0.03	0.0	0.03	0.0	0.03	0.0
0.17	0.0	0.17	0.0	0.17	0.0	0.17	0.0	0.17	0.0

z (ft)	Elev. 175 to 170	z (ft)	*Elev. 170 to 163	z (ft)	Elev. 163 to 160	z (ft)	Elev. 160 to 156	z (ft)	Elev. 156 to 151
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.1	0.00	0.0	0.01	4.5	0.00	2.7	0.01	3.0
0.00	4.3	0.00	0.0	0.02	8.2	0.00	5.4	0.02	5.4
0.01	6.4	0.01	0.0	0.02	9.7	0.01	8.1	0.02	6.4
0.01	8.6	0.01	0.0	0.02	11.0	0.01	10.7	0.02	7.3
0.01	10.7	0.01	0.0	0.03	13.0	0.01	13.4	0.03	8.6
0.01	10.7	0.01	0.0	0.04	14.1	0.01	13.4	0.04	9.3
0.03	10.7	0.03	0.0	0.08	12.7	0.03	13.4	0.08	8.4
0.03	10.7	0.03	0.0	0.28	12.7	0.03	13.4	0.28	8.4
0.17	10.7	0.17	0.0	0.40	12.7	0.17	13.4	0.40	8.4

z (ft)	Elev. 151 to 146	z (ft)	Elev. 146 to 139	z (ft)	Elev. 139 to 135	z (ft)	Elev. 135 to 132	z (ft)	Elev. 132 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.5	0.00	3.1	0.01	6.0	0.00	3.0	0.00	4.8
0.00	4.9	0.00	6.3	0.02	10.9	0.00	6.0	0.00	9.7
0.01	7.4	0.01	9.4	0.02	13.0	0.01	9.0	0.01	14.5
0.01	9.8	0.01	12.5	0.02	14.7	0.01	12.0	0.01	19.3
0.01	12.3	0.01	15.6	0.03	17.3	0.01	15.0	0.01	24.1
0.01	12.3	0.01	15.6	0.04	18.9	0.01	15.0	0.01	24.1
0.03	12.3	0.03	15.6	0.08	17.0	0.03	15.0	0.03	24.1
0.03	12.3	0.03	15.6	0.28	17.0	0.03	15.0	0.03	24.1
0.17	12.3	0.17	15.6	0.40	17.0	0.17	15.0	0.17	24.1

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 21

Sta.

O. G. Elev. 206.0 | Pile 4' PP
Cut off Elev. 206.0 | GWS 213.0

z (ft)	Elev. 206 to 199	z (ft)	*Elev. 199 to 190	z (ft)	*Elev. 190 to 184	z (ft)	Elev. 184 to 178	z (ft)	Elev. 178 to 173
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.3	0.00	0.0	0.00	0.0	0.00	1.9	0.00	2.4
0.00	0.7	0.00	0.0	0.00	0.0	0.00	3.8	0.00	4.9
0.01	1.0	0.01	0.0	0.01	0.0	0.01	5.7	0.01	7.3
0.01	1.3	0.01	0.0	0.01	0.0	0.01	7.5	0.01	9.7
0.01	1.6	0.01	0.0	0.01	0.0	0.01	9.4	0.01	12.1
0.01	1.6	0.01	0.0	0.01	0.0	0.01	9.4	0.01	12.1
0.03	1.6	0.03	0.0	0.03	0.0	0.03	9.4	0.03	12.1
0.03	1.6	0.03	0.0	0.03	0.0	0.03	9.4	0.03	12.1
0.17	1.6	0.17	0.0	0.17	0.0	0.17	9.4	0.17	12.1

z (ft)	Elev. 173 to 166	z (ft)	*Elev. 166 to 160	z (ft)	Elev. 160 to 155	z (ft)	Elev. 155 to 145	z (ft)	Elev. 145 to 135
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.8	0.00	0.0	0.01	2.0	0.00	3.0	0.00	3.0
0.00	5.7	0.00	0.0	0.02	3.6	0.00	6.0	0.00	6.0
0.01	8.5	0.01	0.0	0.02	4.3	0.01	8.9	0.01	9.1
0.01	11.3	0.01	0.0	0.02	4.9	0.01	11.9	0.01	12.1
0.01	14.2	0.01	0.0	0.03	5.8	0.01	14.9	0.01	15.1
0.01	14.2	0.01	0.0	0.04	6.3	0.01	14.9	0.01	15.1
0.03	14.2	0.03	0.0	0.08	5.7	0.03	14.9	0.03	15.1
0.03	14.2	0.03	0.0	0.28	5.7	0.03	14.9	0.03	15.1
0.17	14.2	0.17	0.0	0.40	5.7	0.17	14.9	0.17	15.1

z (ft)	Elev. 135 to 130	z (ft)	Elev. 130 to 126	z (ft)	Elev. 126 to 122	z (ft)	Elev. 122 to 117	z (ft)	Elev. 117 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.01	4.6	0.00	4.9	0.00	4.9	0.00	5.6	0.00	5.5
0.02	8.3	0.00	9.8	0.00	9.7	0.00	11.3	0.00	10.9
0.02	9.9	0.01	14.7	0.01	14.6	0.01	16.9	0.01	16.4
0.02	11.2	0.01	19.7	0.01	19.4	0.01	22.5	0.01	21.9
0.03	13.2	0.01	24.6	0.01	24.3	0.01	28.2	0.01	27.3
0.04	14.3	0.01	24.6	0.01	24.3	0.01	28.2	0.01	27.3
0.08	12.9	0.03	24.6	0.03	24.3	0.03	28.2	0.03	27.3
0.28	12.9	0.03	24.6	0.03	24.3	0.03	28.2	0.03	27.3
0.40	12.9	0.17	24.6	0.17	24.3	0.17	28.2	0.17	27.3

Note - t (kip/ft)
*-Liquefiable layer

Santa Maria River Bridge (Widen)
Br. No. 49-0111
05-445901

Pier 22

Sta.

O. G. Elev. 205.0
Cut off Elev. 205.0

Pile 4' PP
GWS 213.0

z (ft)	*Elev. 205 to 197	z (ft)	*Elev. 197 to 190	z (ft)	*Elev. 190 to 187	z (ft)	Elev. 187 to 182	z (ft)	Elev. 182 to 177
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	0.0	0.00	0.0	0.00	0.0	0.00	1.2	0.00	1.8
0.00	0.0	0.00	0.0	0.00	0.0	0.00	2.3	0.00	3.5
0.01	0.0	0.01	0.0	0.01	0.0	0.01	3.5	0.01	5.3
0.01	0.0	0.01	0.0	0.01	0.0	0.01	4.7	0.01	7.0
0.01	0.0	0.01	0.0	0.01	0.0	0.01	5.8	0.01	8.8
0.01	0.0	0.01	0.0	0.01	0.0	0.01	5.8	0.01	8.8
0.03	0.0	0.03	0.0	0.03	0.0	0.03	5.8	0.03	8.8
0.03	0.0	0.03	0.0	0.03	0.0	0.03	5.8	0.03	8.8
0.17	0.0	0.17	0.0	0.17	0.0	0.17	5.8	0.17	8.8

z (ft)	Elev. 177 to 169	z (ft)	Elev. 169 to 163	z (ft)	Elev. 163 to 154	z (ft)	Elev. 154 to 148	z (ft)	Elev. 148 to 143
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.00	2.5	0.01	1.4	0.01	3.7	0.00	2.9	0.00	3.3
0.00	5.0	0.02	2.6	0.02	6.6	0.00	5.8	0.00	6.5
0.01	7.5	0.02	3.0	0.02	7.9	0.01	8.6	0.01	9.8
0.01	10.0	0.02	3.4	0.02	8.9	0.01	11.5	0.01	13.1
0.01	12.5	0.03	4.0	0.03	10.5	0.01	14.4	0.01	16.4
0.01	12.5	0.04	4.4	0.04	11.5	0.01	14.4	0.01	16.4
0.03	12.5	0.08	4.0	0.08	10.3	0.03	14.4	0.03	16.4
0.03	12.5	0.28	4.0	0.28	10.3	0.03	14.4	0.03	16.4
0.17	12.5	0.40	4.0	0.40	10.3	0.17	14.4	0.17	16.4

z (ft)	Elev. 143 to 134	z (ft)	Elev. 134 to 132	z (ft)	Elev. 132 to 127	z (ft)	Elev. 127 to 121	z (ft)	Elev. 121 to 112
0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
0.01	4.4	0.00	3.4	0.00	4.4	0.00	4.9	0.00	4.8
0.02	7.9	0.00	6.7	0.00	8.8	0.00	9.7	0.00	9.5
0.02	9.4	0.01	10.1	0.01	13.3	0.01	14.6	0.01	14.3
0.02	10.7	0.01	13.4	0.01	17.7	0.01	19.5	0.01	19.1
0.03	12.6	0.01	16.8	0.01	22.1	0.01	24.3	0.01	23.9
0.04	13.7	0.01	16.8	0.01	22.1	0.01	24.3	0.01	23.9
0.08	12.3	0.03	16.8	0.03	22.1	0.03	24.3	0.03	23.9
0.28	12.3	0.03	16.8	0.03	22.1	0.03	24.3	0.03	23.9
0.40	12.3	0.17	16.8	0.17	22.1	0.17	24.3	0.17	23.9

Note - t (kip/ft)
*-Liquefiable layer

FINAL FOUNDATION REPORT
Seismic Retrofit Analyses
Bridges Across Santa Maria River
Bridge No. 49-0111 R/L

EMI Project No. 95-158
Date: April 30, 1997

EARTH MECHANICS, INC.

Geotechnical and Earthquake Engineering

Earth Mechanics, Inc.

Geotechnical & Earthquake Engineering

April 30, 1997

EMI Project No. 95-158

RBF and Associates
14725 Alton Parkway
Irvine, California 92718

Attention: Mr. Paul Young

Subject: Final Geotechnical Report, Seismic Retrofit of Bridges Across Santa Maria River (Bridge No. 49-0111R/L)

Dear Mr. Young:

Earth Mechanics, Inc. (EMI) completed a geotechnical report dated September 5, 1996 containing the foundation recommendations for the as-built (seismic) analysis of the subject structure. A copy of that report is included in Attachment I. The purpose of the seismic analysis is to identify the vulnerability of the bridge foundations under earthquake loading and recommend preliminary foundation retrofit strategies. After the as-built analysis, RBF recommends foundation retrofit at Piers 3, 6, 9, 12, 15, 18, 21, 24 and 27 through 29. The retrofit consists of the addition of new piles. This retrofit strategy was approved at a meeting in Caltrans on September 19, 1996. Two retrofit pile types were considered: HP 10x42 and 4-foot diameter CIDH piles. The 4-foot diameter CIDH piles were selected for final PS&E.

On November 18, 1996, EMI submitted a final foundation report providing recommendations for the 4-foot diameter drilled shafts. This report was reviewed by Caltrans. Caltrans prepared 2 review sheet: one from Ms. Clare Singleton of the Geotechnical Earthquake Engineering Section and the second review sheet by Mr. Reza Mahallati of Translab. EMI prepared written responses to these review comments which were approved by Caltrans. A copy of the responses are included in Attachment II.

This final report replaces the November 18, 1996 final report and incorporates the responses to Caltrans review comments of Attachment II.

Causative Fault

The causative fault for this bridge is the Santa Maria fault, located about 1 km from the site (see Attachment I). The Santa Maria fault has been renamed to Santa Maria River - Foxen Canyon fault in the 1995 version of the California Seismic Hazard Map by L. Mualchin.

17660 Newhope Street, Suite E, Fountain Valley, California 92708 Tel: (714) 751-3826 Fax: (714) 751-3928

Existing Pile Capacity

The existing pile capacity was provided in the September 5, 1996 geotechnical report. The capacity values were documented in a table showing support locations and ultimate compressive and tensile capacities under non-liquefied and liquefied soil conditions. Translab reviewer requested that the pile type, design load and footing bottom and as-built pile-tip elevations be included in this table. The revised pile data table for the existing pile is included in Attachment III.

Degradation and Local Scour Potential

In the as-built analyses, recent measurements of the river bed elevations and a long-term degradation elevation recommended by Caltrans in a March 6, 1996 memorandum were used to determine foundation capacity and stiffness characteristics. Recent measured river bed elevations were reported to be between +205 and 196 feet. The long-term degraded elevation was reported to be +195 feet. However, modification of the pier foundations to accommodate the proposed retrofit strategy will affect the above scour depths.

Based on the retrofitted configuration of the piers and additional scour analyses performed by Caltrans, the following scour information was provided to us for our retrofit pile design:

Degradation Scour El. (ft)	Local Scour El. (ft)	Condition
+195	+180.5	With Foundation Retrofit
+195	+182	Without Foundation Retrofit
+195	+183	As-Built Condition

In addition to the above scour data, the following criteria were used to include the effects of scour in the foundation design:

(1) For seismic design: use degradation scour and neglect local scour
(2) For service design: use local scour depth

Pile Design

Axial Capacity for Seismic Design, 4-foot Diameter CIDH Piles. Ultimate axial compressive and uplift capacities were computed for the 4-foot diameter CIDH piles for a scour elevation of +195 feet. The results are presented in Table 1.

Axial Pile Capacity for Static Design, Existing Piles and 4-foot Diameter CIDH Piles. The stability of the non-retrofitted and retrofitted footings must also be checked using scour elevation of +182 and +180.5 feet, respectively. The ultimate pile capacities for the existing and retrofit piles for the above scour elevations are presented in Tables 2 and 3. The results of Table 2 were also used for the as-built condition which shows a scour elevation of +183 feet.

CIDH Pile-Head Stiffness. Pile-head stiffness for the CIDH piles were computed for two boundary conditions: (1) zero pile-head rotation and (2) free pile-head condition. The stiffness coefficients are presented in Tables 4 and 5, respectively. The pile-head stiffness coefficients for a special case where the pile top was braced laterally and a rotation of 0.005 radians was applied at the pile top are presented in Table 6.

Drilled Shaft Construction Considerations

The as-built LOTB shows a measured ground water elevation of +134 feet which is about 70 feet below the original ground surface. Recent soil borings by Caltrans conducted in June, 1996 show ground water elevations varying from +196.6 to 189.8 feet. As a result of the recent measurements and this structure being a river crossing, we should assume that ground water will be encountered during construction of the proposed 4-foot diameter drilled shafts. A slurry-displacement method of construction would be needed. In addition, presence of fine to coarse grained sand with gravel is reported on the LOTB. This material (when saturated) has a high potential for caving. Therefore, casing may be required. The casing must be pulled as the concrete is being poured while always maintaining at least a 5-foot head of concrete inside the casing.

As a standard Caltrans practice for "wet" construction, PVC tubings must be installed within the reinforcement cage for gamma-ray testing.

Sincerely,
EARTH MECHANICS, INC.

Lino Cheang, RCE 41401
Project manager
LCC:lc

REGISTERED PROFESSIONAL ENGINEER
LINO C. CHEANG
No. C41401
Exp. 9-30-99
CIVIL
STATE OF CALIFORNIA

TABLE 1. PILE DATA TABLE, 48" DIA. CIDH PILES (Scour Elevation = +195 ft)

Location	Dia.	Design Loading (Service)	Nominal Resistance (k)		Cut-off El. (ft)	Design Tip El. (ft)	Spec. Tip El.(ft)	Liquefiable Layer El. (ft)
			Compr.	Tension				
Pier 3	48"	N/A	740 (730)	245 (240)	+196.3	+146.0 (1), (2), (3), (4) & (5)	+146.0	+196 to +190 +176 to +171
Pier 6	48"	N/A	470	130	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	None
Pier 9	48"	N/A	440 (400)	120 (110)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +186 +171 to +166
Pier 12	48"	N/A	270 (200)	110 (100)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +187 +165 to +161
Pier 15	48"	N/A	270 (200)	110 (100)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +185 +165 to +161
Pier 18	48"	N/A	440 (190)	120 (100)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +185 +170 to +161
Pier 21	48"	N/A	260 (185)	110 (90)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +182 +167 to +161
Pier 24	48"	N/A	330 (325)	120 (110)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +191 +179 to +174
Pier 27	48"	N/A	810 (770)	290 (270)	+196.3	+144.0 (1), (2), (3), (4) & (5)	+144.0	+196 to +174
Piers 28 & 29	48"	N/A	860 (850)	310 (300)	+196.3	+142.0 (1), (2), (3), (4) & (5)	+142.0	+189 to +179

Notes: (1) Capacity values enclosed in brackets are for liquefied soil conditions, all others are for non-liquefied soil condition.
(2) Design tip elevation is controlled by the following demands:
(1) Compression; (2) Tension; (3) Lateral; (4) Scour to Elev. +195 feet; (5) Soil Liquefaction.
N/A = not applicable

Existing Pier Cast-in-Place Con. Alt. 4

TABLE 2. ULT. PILE COMPRESSIVE CAPACITY, NON-RETROFITTED FOOTINGS
As-Built Scour Elevation of +183' and Pier Retrofit Scour Elevation of +182'

static condition - does not include capacity loss for liquefaction (extreme limit state)

Pier Location	Existing Piles Compr. Capacity (kips)
2	100
4,5 and 7	98
8 and 10	102
11	127
13 and 14	203
16 and 17	194
19 and 20	199
22 and 23	199
25	208
26	135

TABLE 3. ULT. PILE COMPRESSIVE CAPACITY, RETROFITTED FOOTINGS
Scour Elevation of +180.5 Feet

Pier Location	Existing Piles Compr. Capacity (kips)	4' Diameter CIDH Piles	
		Compr. Cap. (kips)	Length (ft)
3	63	434	50
6	87	209	35
9	113	201	35
12	142	108	35
15	169	108	35
18	176	103	35
21	172	106	35
24	184	139	35
27	53	480	52
28 and 29	47	525	54

TABLE 4. PILE-HEAD STIFFNESSES FOR 48" CIDH PILE ZERO PILE-HEAD ROTATION CONDITION

Pier	Lateral Deflection (in)	Lateral Stiffness, K_δ (E5 lb/in)	Rocking Stiffness, K_θ (E9 lb-in/rad)	Coupled Stiffness, $K_{\delta\theta}$ (E7 lb)
3 & 24	1	5.03 (3.82)	7.12 (6.39)	4.92 (4.24)
	3	2.95 (1.52)	6.08 (4.05)	3.51 (2.05)
6	1	4.82	6.94	4.72
	3	2.80	5.93	3.36
9, 12,15, 18 & 21	1	4.40 (3.56)	6.83 (6.53)	4.51 (4.03)
	3	2.69 (2.20)	5.91 (5.60)	3.32 (2.93)
27	1	3.56 (1.72)	6.20 (5.10)	3.80 (2.42)
	3	2.23 (1.46)	5.51 (4.89)	2.89 (2.22)
28 & 29	1	4.95 (3.06)	7.05 (6.61)	4.76 (3.90)
	3	2.55 (2.07)	6.07 (6.01)	3.36 (3.17)

Note: Stiffness values enclosed in brackets are for liquefied soil conditions, all others are for non-liquefied soil conditions.

TABLE 5. PILE-HEAD STIFFNESSES FOR 48" CIDH PILE FREE PILE-HEAD CONDITION

Pier	Lateral Deflection (in)	Lateral Stiffness, K_δ (E5 lb/in)
3 & 24	1	1.89 (1.01)
	2	0.987 (0.969)
6	1	1.88
	2	1.32
9, 12, 15, 18 & 21	1	1.60 (1.19)
	2	0.987 (0.969)
27	1	1.40 (0.572)
	2	1.02 (0.519)
28 & 29	1	2.21 (0.836)
	2	1.34 (0.641)

Note: Stiffness values enclosed in brackets are for liquefied soil conditions, all others are for non-liquefied soil condition.

TABLE 6. PILE-HEAD STIFFNESSES FOR 48" CIDH PILE FOR APPLIED PILE-HEAD ROTATION OF 0.005 RADIANS

Pier	Lateral Stiffness, K_δ (E5 lb/in)	Rocking Stiffness, K_θ (E9 lb-in/rad)	Coupled Stiffness, $K_{\delta\theta}$ (E7 lb)
3 & 24	8.18 (6.46)	8.04 (7.55)	6.56 (5.92)
6	9.14	8.03	6.75
9, 12, 15, 18 & 21	6.39 (4.48)	7.49 (7.03)	5.60 (4.70)
27	5.30 (1.74)	6.73 (5.12)	4.70 (2.44)
28 & 29	9.19 (3.50)	7.90 (6.35)	6.43 (4.22)

Note: Stiffness values enclosed in brackets are for liquefied soil conditions, all others are for non-liquefied soil conditions.

ATTACHMENT I

LETTER REPORT DATED SEPTEMBER 5, 1996

Earth Mechanics, Inc.

Geotechnical & Earthquake Engineering

September 5, 1996

EMI Project No. 95-158

RBF and Associates
14725 Alton Parkway
Irvine, California 92718

Attention: Mr. Paul Young

Subject: Foundation Capacities and Stiffnesses for Seismic Analysis and Retrofit of Bridges Across Santa Maria River (Bridge No. 49-111R/L)

Dear Mr. Young:

This letter report summarizes the geotechnical parameters recommended for seismic analysis of the subject bridge.

Bridge Configuration and Foundation Type

This bridge consists of right and left structures which has 29 spans supported on seat-type abutments and 28 piers. All abutments and piers are founded on piles. According to the As-Built Plans, the pile type is Cast-In-Place (CIP) concrete, Alternative "U", with a design (service) load of 45 tons. Three sheets of Pile Logs showing minimum, average and maximum pile penetration elevations are also included in the As-Built Plans.

General Subsurface Conditions

A Log-of-Test-Borings sheet included with the As-Built Plans shows the subsurface soil data obtained from 15 rotary borings drilled in May and June 1956. The deepest boring reached a depth of 86.5 feet at Elevation +120 feet. The elevation of the ground surface at the boring locations varied from Elevations +213 to +205 feet. The groundwater at the time of drilling was encountered near Elevation +134 feet, about 72 feet below the original ground surface.

The idealized soil profile at each support location, represented by 6 soil units, is presented in Table 1. This site is mainly underlain by silty sand and sand with silt, pebble and gravel. Clayey silt also appears locally. Embankment fills (Soil Unit 1) were placed at the abutments. Loose to slightly compact silty sand and sand appear both at shallow (Soil Unit 2) and deeper depths (Soil Unit 4). Compact sand (Soil Unit 3) exists between Soil Units 2 and 4. Slightly compact to compact clayey silt (Soil Unit 5) underlies Soil Unit 4 in some areas. A dense to very dense sand (Soil Unit 6) layer was the last stratum encountered in the soil exploration.

17660 Newhope Street, Suite E, Fountain Valley, California 92708 Tel: (714) 751-3826 Fax: (714) 751-3928

TABLE 1. IDEALIZED SOIL PROFILE AT EACH SUPPORT LOCATION

Location	Soil Unit 1	Soil Unit 2	Soil Unit 3	Soil Unit 4	Soil Unit 5	Soil Unit 6
Abutment 1	El. +223' to El. +212'	El. +212' to El +190'	El. +190' to El +173'	El. +173' to El. +167'	Not Encountered	below El. +167'
Piers 2 & 3	Not Encountered	El. +200' to El +190'	El. +190' to El +173"	El. +173' to El +171"	Not Encountered	below El. +171'
Piers 4 to 7	Not Encountered	Not Encountered	El. +200' to El. +170'	Not Encountered	Not Encountered	below El.+170'
Piers 8 to 10	Not Encountered	El. +198' to El +186'	El. +186' to El +171"	El. +171' to El +166"	Not Encountered	below El. +166'
Piers 11 & 12	Not Encountered	El. +198' to El. +187'	El. +187' to El. +165'	El. +165' to El. +160'	Not Encountered	below El.+160'
Piers 13 to 15	Not Encountered	El. +198' to El. +185'	El. +185' to El. +165'	El. +165' to El. +136'	Not Encountered	below El.+136'
Piers 16 to 18	Not Encountered	El. +198' to El. +185'	El. +185' to El. +170'	El. +170' to El. +134'	Not Encountered	below El.+134'
Piers 19 to 21	Not Encountered	El. +196.5' to El. +191'	El. +191' to El. +179' & El. +174' to El. +158'	El. +179' to El. +174' & El. +158' to El. +148'	El. +148' to El. +130'	below El.+130'
Piers 22 & 23	Not Encountered	El. +196.5' to El. +193'	El. +193' to El. +189' & El. +184' to El. +168'	El. +189' to El. +184' & El. +168' to El. +143'	El. +143' to El. +130' 158?	below El.+130'
Pier 24	Not Encountered	El. +196.5' to El. +191'	El. +193' to El. +179' & El. +174' to El. +158'	El. +179' to El. +174' & El. +178' to El. +148'	El. +148' to El. +130'	below El.+130'
Pier 25	Not Encountered	El. +196' to El. +189'	El. +189' to El. +158'	Not Encountered	El. +158' to El. +136'	below El.+136'
Piers 26 & 27	Not Encountered	El. +196.5' to El. +176'	El. +176' to El. +150'	Not Encountered	Not Encountered	below El.+150'
Piers 28 & 29	Not Encountered	Not Encountered	El. +196.5' to El. +189'	El. +189' to El. +179'	Not Encountered	below El.+179'
Abutment 30	El. +220' to El. +206'	Not Encountered	El. +206' to El. +181'	Not Encountered	Not Encountered	below El.+181'

*Soil units 2 and 4 are liquefiable.

Seismic Parameters

A study was conducted by Caltrans Structure Foundations Branch to address the issues of site specific acceleration response spectra and liquefaction potential. The findings of this study were presented in a memorandum dated March 20, 1996 and updated in another memorandum dated August 8, 1996. We have reviewed these memorandums which are included in Appendix A. The following recommendations are based on the memorandums and our review.

Maximum Credible Earthquake. The causative fault is the Santa Maria River fault located about 1 km from the site. This fault is capable of generating a Magnitude 6.5 event. The peak bedrock acceleration is 0.56g according to the attenuation relationship published by Mualchin and Jones (1992). This peak bedrock acceleration should be rounded upward to 0.6g in accordance with Caltrans Bridge Design Specifications (BDS), Commentary 3-3.

ARS Curve. The site specific acceleration response spectrum presented in the Caltrans memorandum dated August 8, 1996 is recommended.

Liquefaction Potential. The loose and slightly compact silty sand at both shallow and deep depths (Soil Units 2 and 4 as shown in Table 1) is potentially liquefiable under the maximum credible earthquake.

Design Soil Strengths

The design strength parameters under non-liquefied and liquefied soil conditions are presented in Table 2. The residual strengths of the liquefiable soils were obtained using correlation with Standard Penetration Test (SPT) blowcounts published by Seed and Harder (1990).

TABLE 2. DESIGN SOIL STRENGTHS

Soil Unit	Soil Type	Non-Liquefied			Liquefied	
		Total Unit Weight, γ	Friction Angle, ϕ	Cohesion, c	Total Unit Weight, γ	Residual Strength, S_{ur}
1	fill	120 pcf	32 °	0	120 pcf	non-liquefiable
2	shallow silty sand and sand	115 pcf	30 °	0	90 pcf	0.5 ksf
3	sand	120 pcf	35 °	0	120 pcf	non-liquefiable
4	deep silty sand and sand	115 pcf	28 °	0	90 pcf	0.3 ksf
5	clayey silt	115 pcf	0	0.7 ksf	115 pcf	non-liquefiable
6	sand	125 pcf	38 °	0	125 pcf	non-liquefiable

Fluctuation of River Bed Elevation

River bed scouring is occurring at this bridge site. The most recent measurements of ground surface elevations documented in a Caltrans memorandum dated March 4, 1996 indicate the river bed varies from Elevations +205 to +196 feet. This memorandum also reported that the long-term degradation of the river bed is anticipated to be at Elevation +195 feet.

In accordance with Caltrans BDS, Section 4.4.2.2, one-half of the anticipated scour depth should be used for seismic design. In our calculations, we have the option to use the original ground surface shown on the LOTB or the most recent measurements presented in the Caltrans memorandum dated March 4, 1996 to determine the total scour depth. We elected to use the most recent measurements because it is more conservative in the determination of foundation capacity.

Foundation Capacity

As-built average pile-tip elevations were used in the evaluation of pile capacities. Calculations of axial pile capacity were performed using the methods presented in NAVFAC Design Manual with some minor modifications. Lateral pile response was analyzed using the computer program BMCOL 76 (Matlock et al., 1981).

Axial Pile Capacity. Table 3 lists the parameters used in our calculations of axial pile capacity for non-liquefied and liquefied soil conditions. The bearing capacity factor, N_q, for end bearing resistance is 100 for pile lengths less than 40 feet and 50 for pile lengths greater than 40 feet. Using the shear strengths of Table 2 , the parameters of Table 3 and the above bearing capacity factors, the resulting ultimate axial pile capacity is presented in Table 4. The ultimate compressive capacity at Piers 3, 12 and 27 through 29 for the non-liquefied case is less than 2 times the service load capacity because of the reduction in the soil overburden pressure due to scouring.

TABLE 3. PARAMETERS USED IN AXIAL PILE CAPACITY CALCULATIONS

Non-Liquefied				Liquefied
Soil-Pile Friction Angle, δ (°)	Earth Pressure Coeff.		Adhesion "α" Factor	Adhesion "α" Factor
	Compr., K_{HC}	Tension, K_{HT}		
ϕ - 5	0.8	0.6	0.85	0.95 for S_{ur} = 0.5 ksf 1.05 for S_{ur} = 0.3 ksf

TABLE 4. ULTIMATE AXIAL PILE CAPACITY IN KIPS

Location	Non-liquefied		Liquefied	
	Compression	Tension	Compression	Tension
Abutment 1	266	100	205	84
Pier 2	188	32	158	28
Pier 3	158	23	129	21
Piers 4 to 7	189	32	189	32
Piers 8 to 10	190	32	149	29
Pier 11	219	40	176	35
Pier 12	166	54	137	46
Piers 13 to 15	270	100	168	64
Piers 16 to 18	260	94	149	57
Piers 19 to 21	260	96	173	69
Piers 22 & 23	252	93	188	73
Pier 24	265	103	237	91
Pier 25	254	103	251	100
Pier 26	191	65	157	57
Pier 27	121	15	77	13
Piers 28 & 29	119	14	94	12
Abutment 30	195	68	195	68

Note: The above capacities are based on soil resistance only and may be limited by the strength of the pile materials and pile-head connection details.

Lateral Pile Capacity. The analyses were performed for a vertical pile with a free-head condition. Table 5 lists the parameters used to derive nonlinear soil response (p-y) curves used for the analyses. The soil response curves for non-liquefied case were computed using Reese et al. (1974) criteria for sands. The liquefied materials were modeled as soils with undrained residual strengths as shown in Table 2 and the p-y criteria by Matlock (1970). The relationship of pile-head shear and maximum moment versus pile-head deflection for non-liquefied and liquefied cases are presented in Figures

1 and 2, respectively. The maximum moment occurs at a depth of about 5 and 7 feet below the pile top for the non-liquefied and the liquefied cases, respectively.

TABLE 5. PARAMETERS USED IN LATERAL PILE CAPACITY CALCULATIONS

Non-liquefied Sandy Soils		Liquefied Soils	
Friction Angle, ϕ	Variation of Subgrade Modulus with Depth, k (pci)	J-Factor	Strain ε_{50}
28°	10	0.5	0.01
30°	30		
32°	50		
35°	80		
38°	140		

Lateral Resistance at Abutments. Lateral loads can be resisted by a combination of pile resistance and passive soil pressure. The lateral pile capacity has been presented in Figures 1 and 2.

For longitudinal loading towards the approach embankments, a maximum soil pressure of 7.7 ksf can be used for retained wall heights equal to or greater than 8 feet. For wall heights less than 8 feet, the earlier version of Caltrans Memo 20-4 suggested to reduce the maximum pressure by the square root of wall height to 8 feet, but the current version of Caltrans Memo 20-4 suggests reduction of the maximum soil pressure by the square of the ratio of wall height to 8 feet. Classical lateral earth pressure theory for frictional soils suggests a linear increase of soil pressure (proportional to overburden pressure) with depth, therefore, we recommend a linear relationship for the reduction (i.e., the maximum soil pressure should be reduced by the ratio of the wall height to 8 feet for a wall shorter than 8 feet).

The capacity of the wingwalls will contribute to the lateral translational resistance under transverse loading. Based on the as-built plans, each abutment has 2 interior and 2 exterior wingwalls. The resistance of each interior wingwall is estimated to be about 50 kips. At Abutment 1, the lateral resistance of the western and eastern wingwall is estimated to be 140 kips and 350 kips, respectively. At Abutment 30, the interior wingwall resistance is also 50 kips and the exterior western and eastern wingwall resistances are 170 and 250 kips, respectively. The above recommended values are based on soil resistance only; these values should be compared to the structural capacity of the wingwall and the smaller value used for design.

Passive Resistance of Pile Caps at Piers. Under horizontal longitudinal and transverse earthquake loadings, the embedded pile caps will develop passive soil resistance. This passive soil resistance should be added to the pile group lateral resistance to determine the total lateral sliding capacity of the pier foundations. The recommended uniformly distributed passive earth pressure is presented in Table 6.

TABLE 6. PASSIVE SOIL PRESSURE AGAINST PILE CAPS/EMBEDDED PIER WALLS

Location	Uniform Passive Earth Pressure (ksf)	
	Non-liquefied	Liquefied
Piers 2 & 3	0.6	0.5
Piers 4 to 7	0.8	Not Liquefiable, use 0.8
Piers 8 to 24	0.3	neglect
Piers 25 to 29	neglect	neglect

Abutment Stiffness

The abutment endwall for the left and right bridge is joined by a continuous pile cap. The abutment stiffness consists of contributions from the pile group and the abutment endwall. However, the continuous pile cap was assumed to be separated at the centerline of the "LO" Line because only one-half (left or right) of the bridge was modeled in the structural response analyses. The pile-group stiffness coefficients for abutments are presented in Table 7. The pile group stiffness for Abutment 30 under non-liquefied and liquefied conditions are the same.

TABLE 7. PILE GROUP STIFFNESS OF ABUTMENTS

Direction of Loading	Non-liquefied		Liquefied	
	Abut 1	Abut 30	Abut 1	Abut 30
Translation in X-Direction (k/ft)	6.02E+03	5.48E+03	5.66E+03	Same as in Non-liquefied Case
Translation in Y-Direction (k/ft)	1.94E+05	2.33E+05	1.92E+05	
Translation in Z-Direction (k/ft)	1.18E+04	1.24E+04	1.13E+04	
Rotation about X-Axis (k-ft/rad)	4.02E+05	4.83E+05	3.97E+05	
Rotation about Y-Axis (k-ft/rad)	5.97E+06	6.39E+06	5.75E+06	
Rotation about Z-Axis (k-ft/rad)	1.04E+08	1.19E+08	1.02E+08	
Note: See Figure 3 for coordinate system.				

Abutment Endwall Stiffness. The initial endwall stiffness can be calculated by multiplying the maximum passive soil pressure by the wall area in contact with soil and dividing the product by the total displacement (gap opening plus soil yield displacement). A soil yield displacement of 2 percent of the wall height is proposed. A procedure to determine the maximum passive soil pressure has been described earlier.

Foundation Stiffness for Piers

The foundation stiffness for the piers includes the contribution from the pile-group and embedded pile-cap and pier wall. Tables 8 through 10 present the stiffness coefficients for the non-liquefied condition. Stiffness coefficients for the liquefied case are presented in Tables 11 through 13. These stiffnesses should be lumped at the centroid of the pile cap.

TABLE 8. FOUNDATION STIFFNESS OF PIERS 2 TO 11: NON-LIQUEFIED CASE

Direction of Loading	Piers 2 & 3	Piers 4 to 7	Piers 8 to 11
Translation in X-Direction (k/ft)	6.84E+03	7.76E+03	4.73E+03
Translation in Y-Direction (k/ft)	3.00E+05	3.00E+05	2.82E+05
Translation in Z-Direction (k/ft)	7.92E+03	9.20E+03	5.27E+03
Rotation about X-Axis (k-ft/rad)	6.75E+05	6.75E+05	6.34E+05
Rotation about Y-Axis (k-ft/rad)	1.11E+06	1.25E+06	7.74E+05
Rotation about Z-Axis (k-ft/rad)	4.94E+07	4.94E+07	4.64E+07
Note: See Figure 3 for coordinate system.			

TABLE 9. FOUNDATION STIFFNESS OF PIERS 12 TO 24: NON-LIQUEFIED CASE

Direction of Loading	Pier 12	Piers 13, 14 & 16 to 24	Pier 15
Translation in X-Direction (k/ft)	4.73E+03	4.73E+03	5.89E+03
Translation in Y-Direction (k/ft)	2.40E+05	1.92E+05	2.40E+05
Translation in Z-Direction (k/ft)	5.27E+03	5.27E+03	6.43E+03
Rotation about X-Axis (k-ft/rad)	5.40E+05	4.32E+05	5.40E+05
Rotation about Y-Axis (k-ft/rad)	7.74E+05	7.74E+05	9.45E+05
Rotation about Z-Axis (k-ft/rad)	3.95E+07	3.16E+07	3.86E+07
Note: See Figure 3 for coordinate system.			

TABLE 10. FOUNDATION STIFFNESS OF PIERS 25 TO 29: NON-LIQUEFIED CASE

Direction of Loading	Piers 25 & 26	Pier 27	Piers 28 & 29
Translation in X-Direction (k/ft)	3.82E+03	3.82E+03	4.10E+03
Translation in Y-Direction (k/ft)	1.92E+05	1.54E+05	2.56E+05
Translation in Z-Direction (k/ft)	3.82E+03	3.82E+03	4.10E+03
Rotation about X-Axis (k-ft/rad)	4.32E+05	3.46E+05	5.76E+05
Rotation about Y-Axis (k-ft/rad)	6.38E+05	6.38E+05	6.83E+05
Rotation about Z-Axis (k-ft/rad)	3.16E+07	2.53E+07	4.21E+07
Note: See Figure 3 for coordinate system.			

TABLE 11. FOUNDATION STIFFNESS OF PIERS 2 TO 11: LIQUEFIED CASE

Direction of Loading	Piers 2 & 3	Piers 4 to 7	Piers 8 to 11
Translation in X-Direction (k/ft)	3.57E+03	Same as in Non-liquefied Case	2.32E+03
Translation in Y-Direction (k/ft)	2.74E+05		2.55E+05
Translation in Z-Direction (k/ft)	4.47E+03		2.32E+03
Rotation about X-Axis (k-ft/rad)	6.17E+05		5.74E+05
Rotation about Y-Axis (k-ft/rad)	5.71E+05		3.87E+05
Rotation about Z-Axis (k-ft/rad)	4.51E+07		4.20E+07
Note: See Figure 3 for coordinate system.			

TABLE 12. FOUNDATION STIFFNESS OF PIERS 12 TO 24: LIQUEFIED CASE

Direction of Loading	Pier 12	Piers 13, 14 & 16 to 24	Pier 15
Translation in X-Direction (k/ft)	2.32E+03	2.32E+03	2.90E+03
Translation in Y-Direction (k/ft)	2.26E+05	1.73E+05	2.22E+05
Translation in Z-Direction (k/ft)	2.32E+03	2.32E+03	2.90E+03
Rotation about X-Axis (k-ft/rad)	5.08E+05	3.88E+05	5.00E+05
Rotation about Y-Axis (k-ft/rad)	3.87E+05	3.87E+05	4.73E+05
Rotation about Z-Axis (k-ft/rad)	3.72E+07	2.84E+07	3.57E+07
Note: See Figure 3 for coordinate system.			

TABLE 13. FOUNDATION STIFFNESS OF PIERS 25 TO 29: LIQUEFIED CASE

Direction of Loading	Piers 25 & 26	Pier 27	Piers 28 & 29
Translation in X-Direction (k/ft)	2.13E+03	2.13E+03	4.05E+03
Translation in Y-Direction (k/ft)	1.75E+05	1.28E+05	2.33E+05
Translation in Z-Direction (k/ft)	2.13E+03	2.13E+03	4.05E+03
Rotation about X-Axis (k-ft/rad)	3.94E+05	2.88E+05	5.24E+05
Rotation about Y-Axis (k-ft/rad)	3.55E+05	3.55E+05	6.75E+05
Rotation about Z-Axis (k-ft/rad)	2.88E+07	2.11E+07	3.83E+07
Note: See Figure 3 for coordinate system.			

Wingwalls. The soil backfill-wingwall stiffness for horizontal transverse loading (X-Direction in Figure 3) is estimated to be 4,500 kips per foot.

Please contact us if you have any questions regarding this letter report.

Sincerely,
EARTH MECHANICS, INC.

Lino Cheang, RCE 41401
Project Manager
Encl.
LCC:sv

REGISTERED PROFESSIONAL ENGINEER
LINO C. CHEANG
No. C41401
Exp. 9-30-99
CIVIL
STATE OF CALIFORNIA

References

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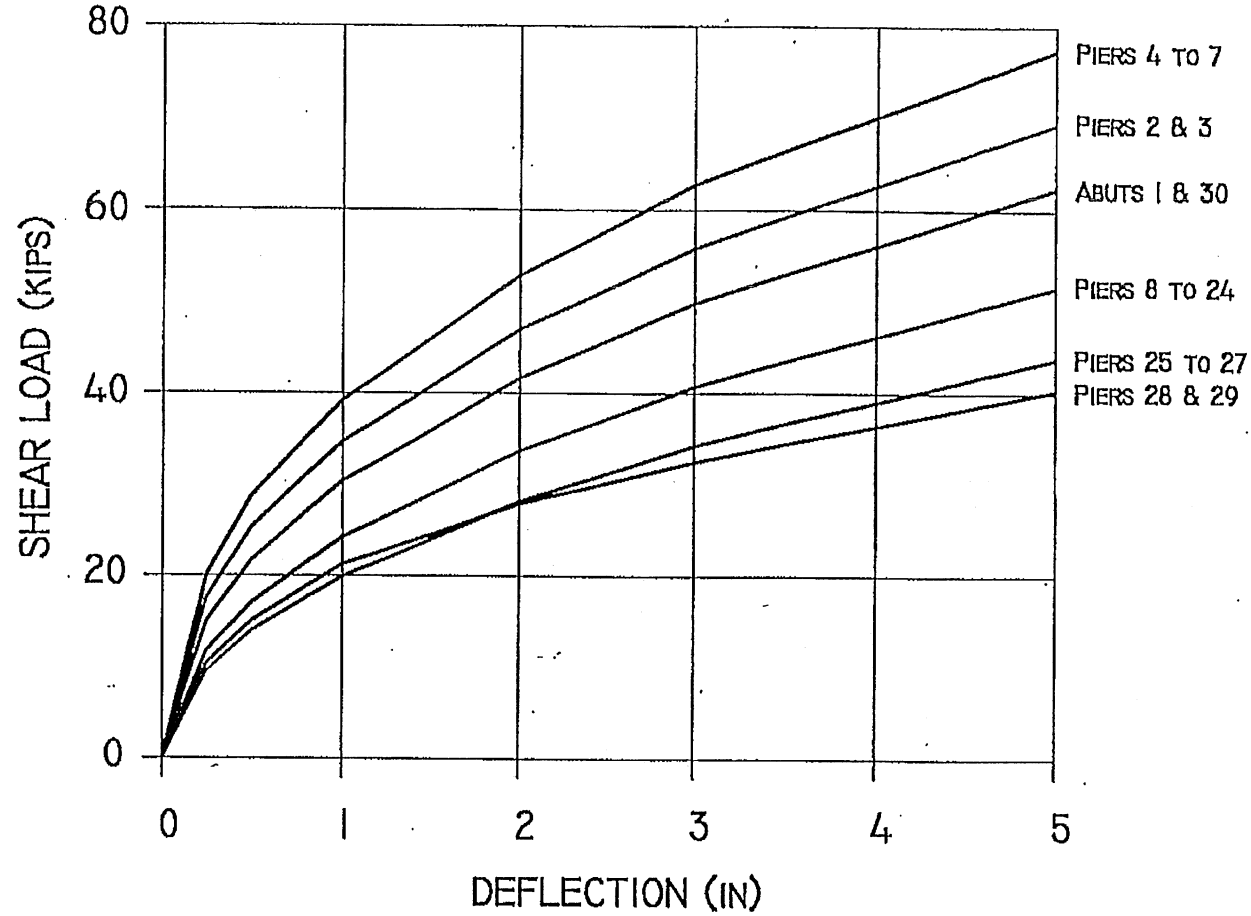
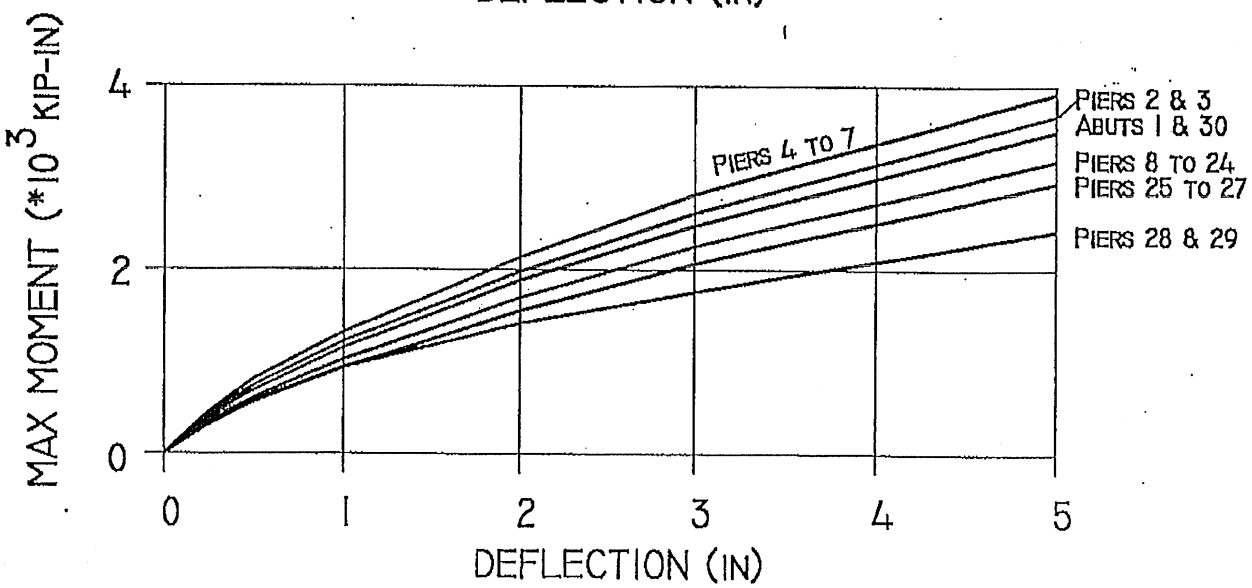
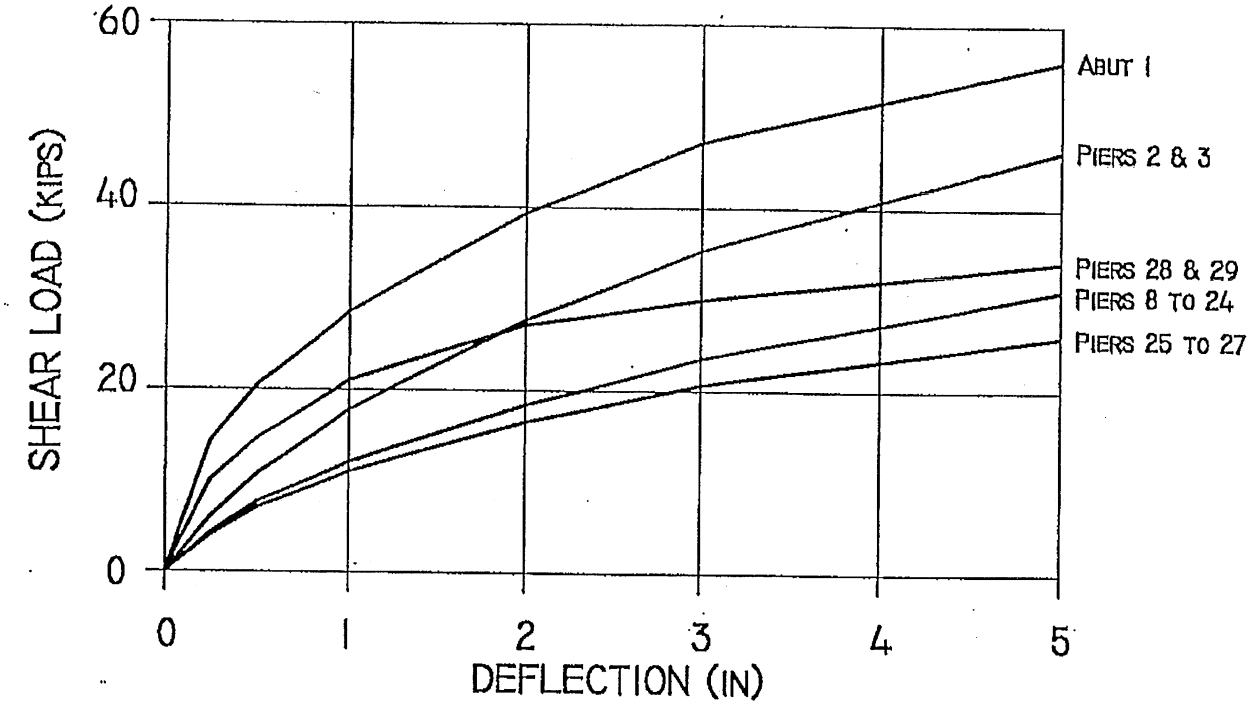
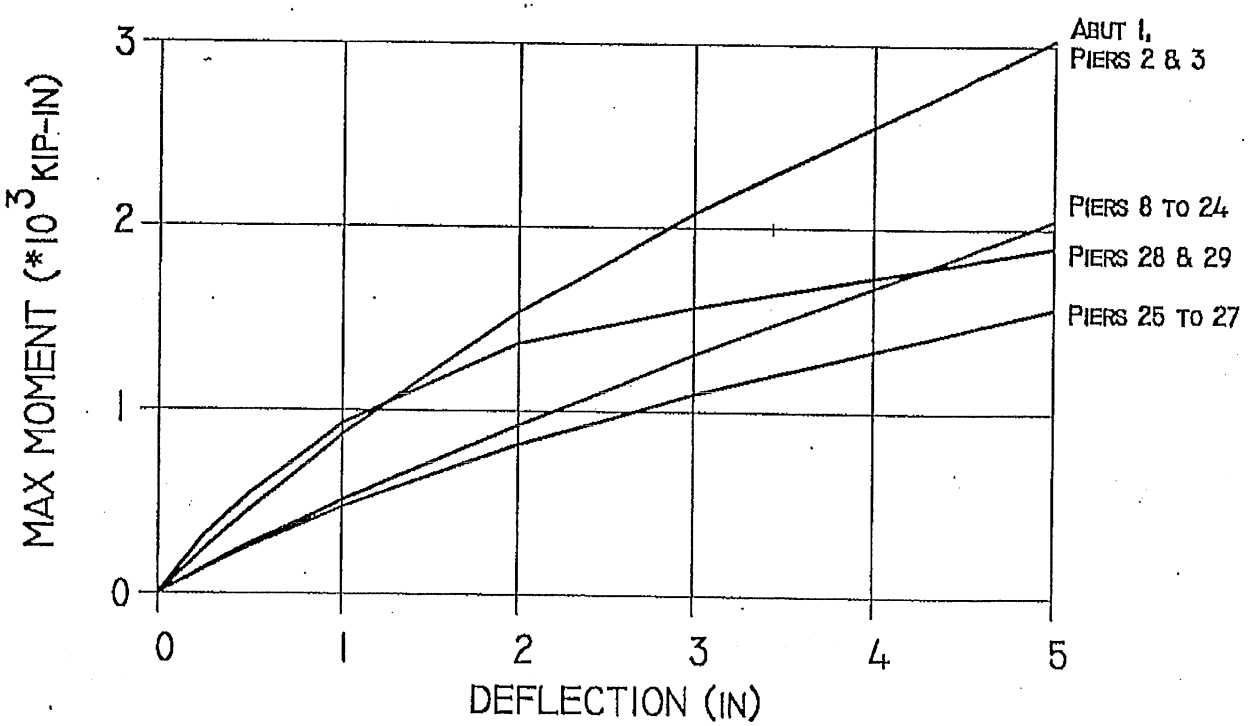
Seed, H.B., Harder, L.F., 1990, "SPT-Based Analysis of Cyclic Pore Pressure Generation and Undrained Residual Strength," Proceedings, H. Bolton Seed Memorial Symposium, Vol. 2, BiTech Publishers, p. 351-376.





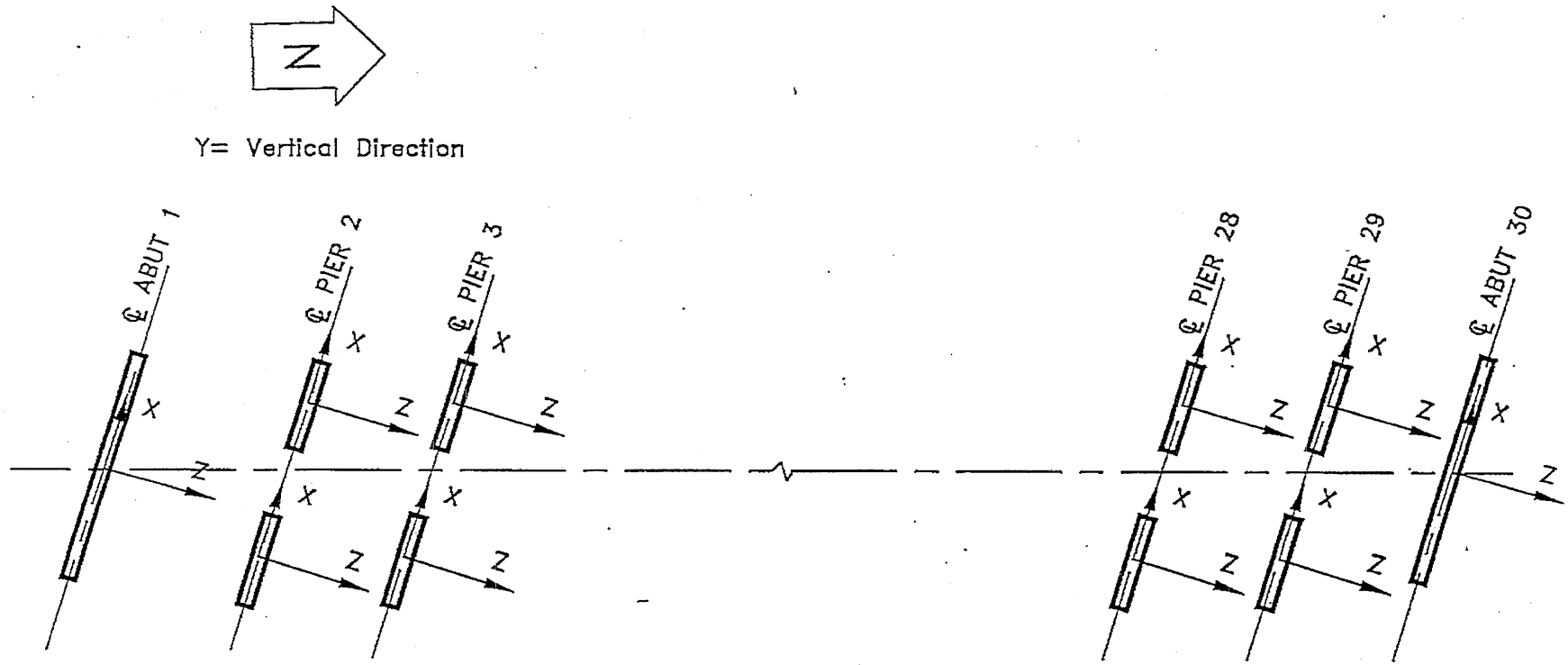
BRIDGES ACROSS SANTA MARIA RIVER	LATERAL PILE SOLUTIONS FOR SEISMIC DESIGN NON-LIQUEFIED CASE PILE TYPE: CAST-IN-PLACE CONC. (ALT. "U") FIGURE 1
Earth Mechanics, Inc. Geotechnical & Earthquake Engineering	Project No. 95-158 Date: 7-24-96





NOTE: SUPPORT LOCATIONS NOT INCLUDED IN THIS FIGURE ARE NOT AFFECTED BY SOIL LIQUEFACTION.

BRIDGES ACROSS SANTA MARIA RIVER	LATERAL PILE SOLUTIONS FOR SEISMIC DESIGN LIQUEFIED CASE PILE TYPE: CAST-IN-PLACE CONC. (ALT. "U") FIGURE 2
Earth Mechanics, Inc. Geotechnical & Earthquake Engineering	Project No. 95-158 Date: 7-23-96



NO SCALE

Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	BRIDGES ACROSS SANTA MARIA RIVER	COORDINATE SYSTEM FOR FOUNDATION STIFFNESS
	Project No. 95-158 / Date: 7-23-96	Figure 3

Memorandum

To: Mickey Horn, Chief
Office of Structure

Date: September 12, 1996
File No: SR# 812

From: Lino Cheang, Earth Mechanics, Inc.

Subject: PRELIMINARY SEISMIC, GEOLOGIC, AND FOUNDATION INFORMATION
Bridge Across Santa Maria River (Bridge No. 49-111R/L)

Geologic Data

Based on Log of Test Borings dated May and June, 1956

GWS Elev. +134 feet in May and June, 1956

Earthquake Data

Fault: Santa Maria River Fault
Distance to Site from Fault: 0.6 miles
Horizontal Bedrock Acceleration (max): 0.56 g

Moment Magnitude: 6.5

Depth to Bedrock-Like Materials (Shear-Wave Velocity > 2500 ft/sec):
0 - 10, 10 - 80, 80 - 150 or >150

Liquefaction Potential: Low ___ Med. ___ High x

"As-Built" Foundation

Piles		Spread Footings	
Pile Type(s)	Cast-In-Place Concrete (Alt. "U")	Footings at	None
Design Load	45 tons	Not Applicable	
Estimated Ultimate Compression Load for Retrofit Design		See attached table	
Estimated Ultimate Uplift Load for Retrofit Design		See attached table	
Estimated Ultimate Bearing Capacity for Retrofit Design		Not Applicable	

Scour Potential N/A ___ Yes x No ___

Remarks

The attached ultimate axial capacities are based on liquefied soil resistance and may be reduced by the strength of the pile materials and pile-head connection details.

Additional Drilling Required: Yes ___ No x

Prepared by: Lino Cheang, RCE 41401

REGISTERED PROFESSIONAL ENGINEER
LINO C. CHEANG
No. C41401
Exp. 9-30-99
CIVIL
STATE OF CALIFORNIA

Date: September 12, 1996

APPENDIX A

CALTRANS Memorandum Dated March 20, 1996 and August 8, 1996

Book

Business, Transportation and Housing Agency

State of California

Memorandum

Rec'd 6/17

To : MR. BRENT LEMON
Office of Structures External Liaison and Support
Design Branch "C"

Date : March 20, 1996

File : 05-SLO-101-0.09
05-414001

Santa Maria River Bridge
Bridge No. 49-0111R/L

From : DEPARTMENT OF TRANSPORTATION
ENGINEERING SERVICE CENTER
Office of Structural Foundations
Structure Foundations Branch

Subject : Preliminary Site Response Analysis

This memo presents the preliminary results of site response analysis of Santa Maria River Bridge (Bridge No. 49-0111R/L).

In accordance with CDMG's report in 1992 entitled, *Peak Acceleration from Maximum Credible Earthquake in California*, the Santa Maria River Fault with a maximum moment magnitude of 6.5 is the local fault. The Santa Maria River Fault is located approximately 1 km from the bridge site. The mean rock target spectrum was determined based on attenuation relationships developed by Geomatrix (1993). The Santa Cruz N-S record from the 1989 Loma Prieta Earthquake was modified to be spectrum compatible with the target spectrum at the site and then used as the outcropping rock motion (Figure 1).

Soil properties are determined based on As Built information. The depth to rock-like material (shear wave velocity of 2500 ft/s) is unknown. A depth of 150 to 200 feet to the rock-like material is assumed in this analysis.

The program SHAKE (1991) was used to conduct the site response analysis. Acceleration and displacement response spectra were calculated and are presented in Figure 2. In the same figure, the recommended design curve was superimposed over the earthquake responses to aid in design.

The 1956 boring data indicate the site is susceptible to liquefaction. Along the bridge site, two zones that have liquefaction potential were identified. Zone 1 consists of loose to compact sand with some shell or gravel. This zone starts at ground surface and goes to a depth of about 20 feet across the bridge site. Zone 2 is mainly composed of loose sand or silty sand at depths of 40 to 75 feet covering from Pier 10 through Pier 22. Liquefaction may cause a substantial reduction on soil lateral resistance and a full loss of soil axial capacity, coupled with additional soil forces imposing on pile foundations. Therefore, mitigation of liquefaction hazard for the highly liquefiable soil layers in two zones needs to be considered in retrofit design. As such, steel pipe piles of 24" or 36" in diameter are recommended for the pile foundation. Lateral soil resistance curves (p-y) may be generated using COM624. For liquefiable soil, it is recommended that p values generated from COM624 be multiplied by a reduction factor and y values kept the same. Reduction factors of 0.5 and 0.25 are recommended for Zone 1 and Zone 2, respectively. In addition, axial resistance should be set to zero for liquefiable soil.

Additional borings are scheduled in April by Dave Thomas and site specific analysis will be finalized when the soil data become available.

Bridge No. 49-0111 R/L

Mr. Brent Lemon
March 20, 1996
Page 2

If you have any questions regarding this analysis, please contact James Chai at (916) 227-7179 or Abbas Abghari at (916) 227-7172.

JAMES (JIANZHONG) CHAI, P.E. C052137
Associate Materials & Research Engineer
Earthquake Engineering Section

ABBAS ABGHARI, Chief
Earthquake Engineering Section

Attachments

cc: ELeivas
DThomas

Santa Maria River Bridge (Bridge No.44-011 R/L)

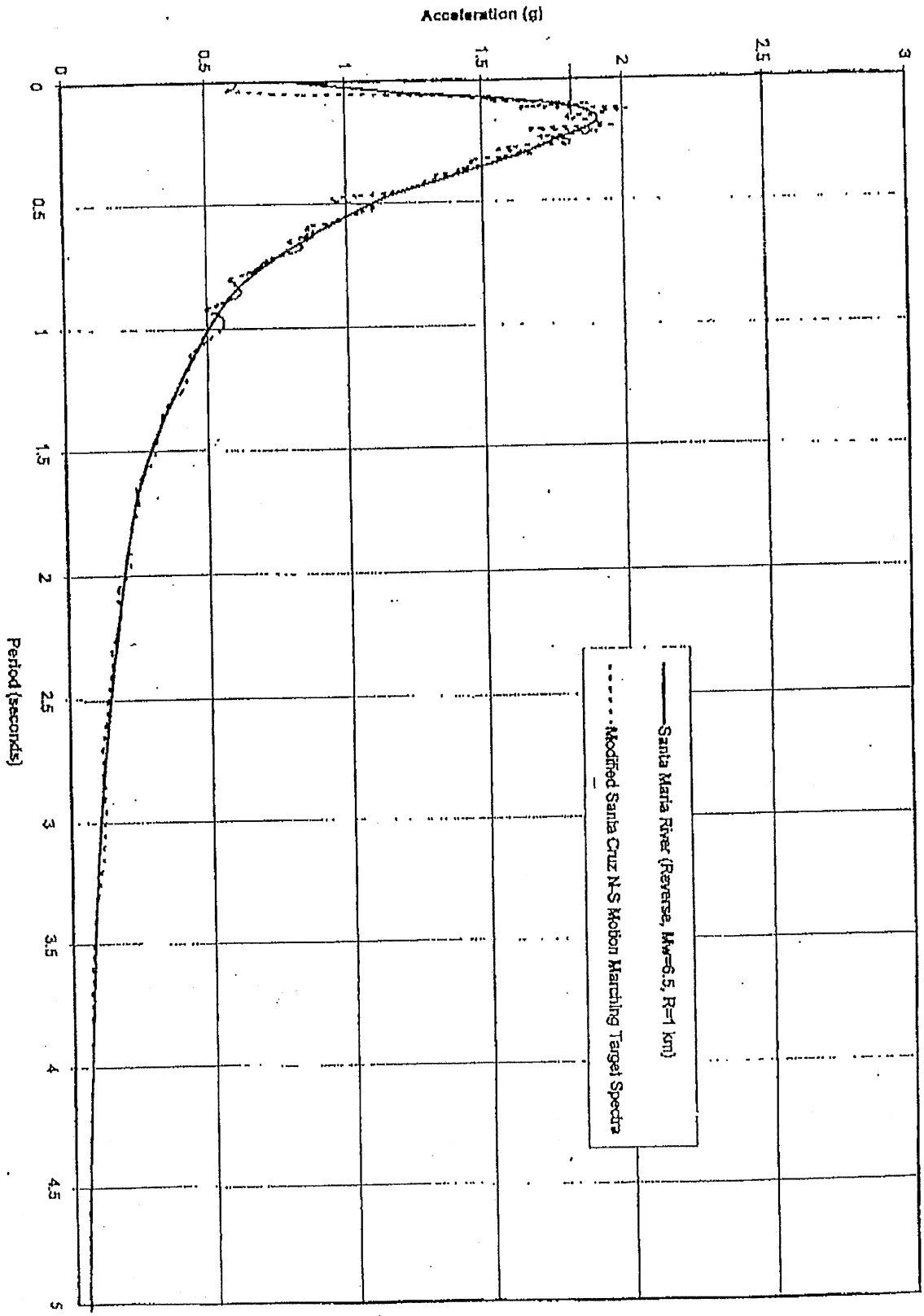


Figure 1 Target Spectra of Rock Input Motion

Snata Maria River Bridge (Bridge No. 44-011 R/L)

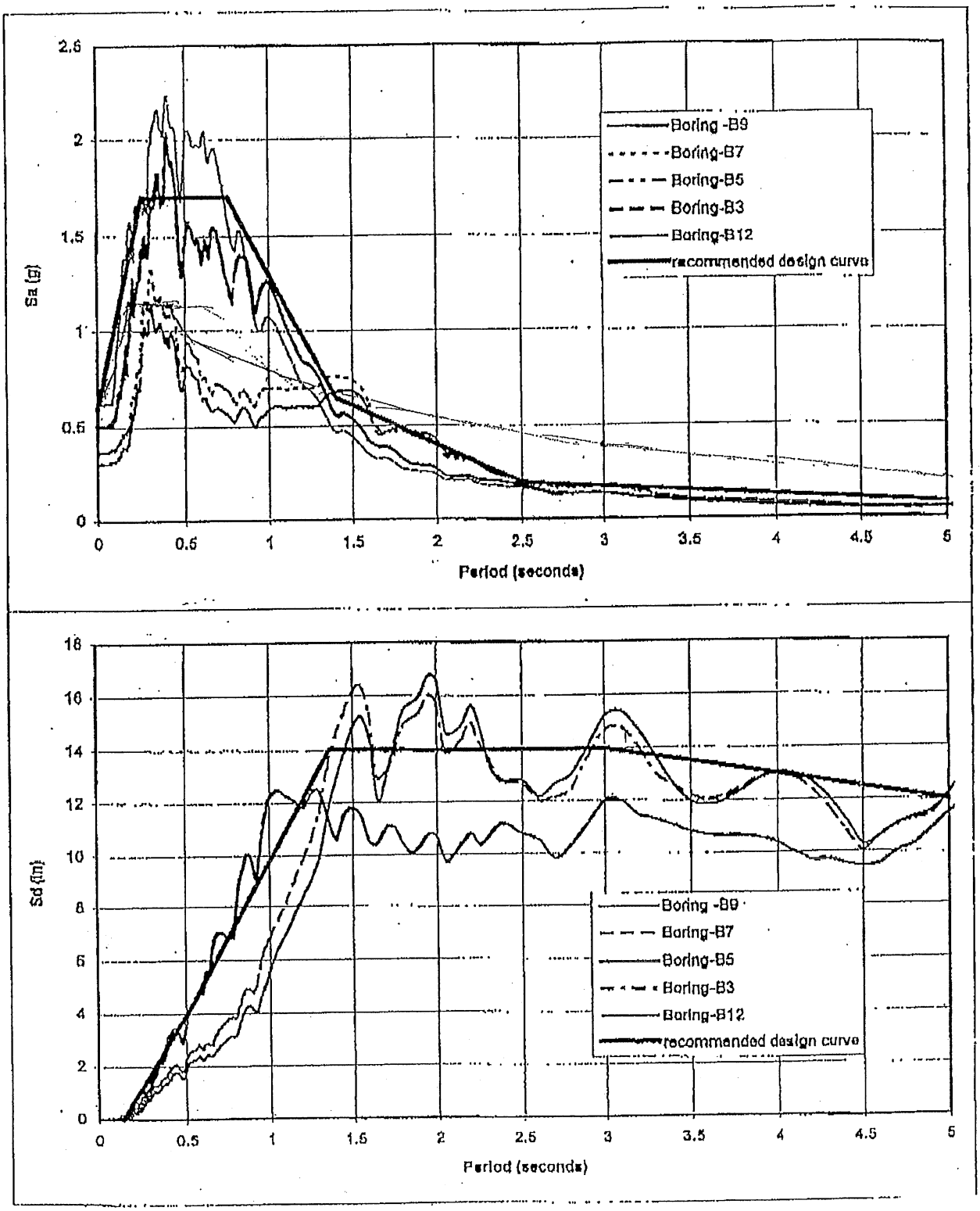


Figure 2 Acceleration Response Spectra at Ground Surface

WTC HERNAN

FAX

State of California

Business, Transportation and Housing Agency

Memorandum

Rec'd 8/21/96 @RBF

To : MR. R. BRENT LEMON

Date : August 8, 1996

File : 05-SLO-101-0.09
05-44440K

Santa Maria River
Bridge No. 49-0111 R/L

From : **DEPARTMENT OF TRANSPORTATION**
ENGINEERING SERVICE CENTER
Office of Structural Foundations - MS #5
Structure Foundations Branch

Subject : Final Acceleration Response Spectrum for Santa Maria River Bridge (Bridge No. 49-0111 R/L)

This memo presents the final results of the site response analysis for the Santa Maria River Bridge (Bridge No. 49-0111 R/L).

On March 20, 1996, a preliminary site response analysis was sent to the Division of Structures. The depth to rock-like material and the shear wave velocities had been estimated at that time, and thus the results of the previous analysis were classified as preliminary.

On June 24, 1996 the Office of Structural Foundations received measured shear wave velocity data.. These data were used in conjunction with Log of Test Borings to determine the final acceleration response spectrum (ARS). Figure 1 compares the recommended design ARS and the ARS due to the preliminary estimated and measured shear wave velocities. As indicated in Figure 1, the ARS generated from the measured shear wave velocities is considered to fall within the range of the previous recommended design curve. Therefore, previously recommended design ARS should be used as the final design ARS.

If you have any further questions please contact Mr. Jim Gutierrez at 227-7269 or Mr. Abbas Abghari at 227-6912.

JIM GUTIERREZ, PE
Associate Materials & Research Engineer
~~Geotechnical Earthquake~~ Engineering Section

ABBAS ABGHARI, Chief
Geotechnical Earthquake Engineering Section

cc: ELeivas

REGISTERED PROFESSIONAL ENGINEER
JIM GUTIERREZ
No. 20021
Exp. 12/31/98
CIVIL
STATE OF CALIFORNIA

Post-it® Fax Note 7671	Date	# of pages ▸ 2
To LINO CHANG	From PAUL YOUNG	
Co./Dept.	Co	
Phone #	Phone # 855-3641	
Fax # 751-3928	Fax #	

Santa Maria River Bridge (Bridge No. 44-0111L/R)

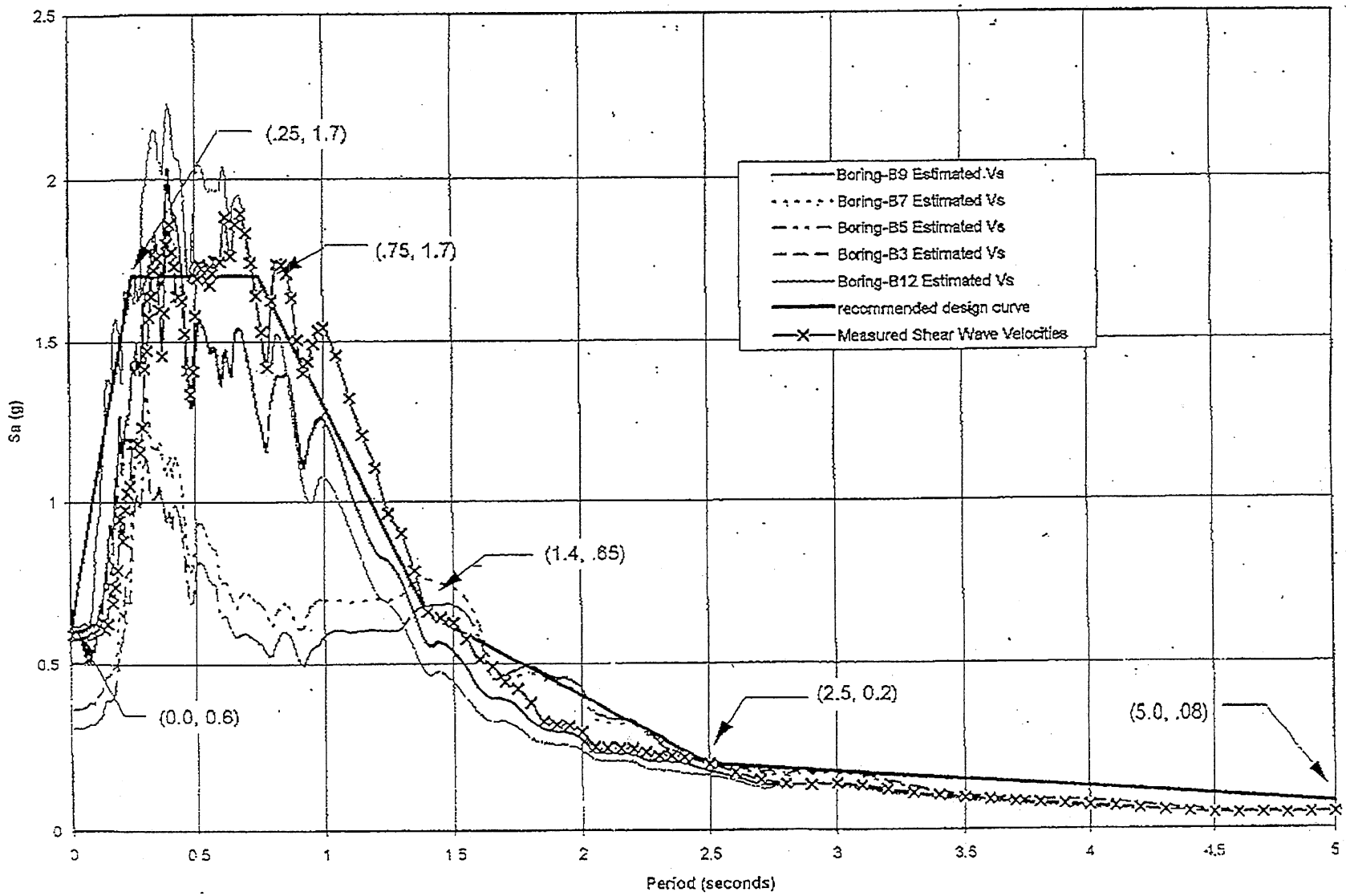


Figure 1,
Final Recommended Design ARS curve.

F-261 T-841 P-002 AUG 22 '96 11:01

ATTACHMENT II

RESPONSE TO CALTRANS REVIEW COMMENTS

Earth Mechanics, Inc.

Geotechnical & Earthquake Engineering

April 24, 1997

RBF and Associates
14725 Alton Parkway
Irvine, California 92718

Attention: Mr. Paul Young

Subject: Response to Caltrans Foundation Review Dated April 21, 1997
Santa Maria River Bridge, Bridge No. 49-0111L/R
EA# 05-444431

Dear Mr. Young:

We have received a faxed copy of the subject Caltrans Foundation Review sheet. A copy of this review sheet is included as Attachment 1. In addition to preparing the response, you have requested us to clarify and include additional foundation information to support your retrofit design calculations.

Clarification and Addition

(1) The table at the bottom of Page 1 of the foundation report dated November 18, 1996 will be revised as follows:

Degradation Scour El. (ft)	Local Scour El. (ft)	Condition
+195	+177	With Foundation Retrofit
+195	+181	Without Foundation Retrofit

(2) Table 1 on Page 3 of the foundation report dated November 18, 1996 is based on a scour elevation of +195 feet. The Caltrans ½-scour depth criteria was not used in the calculations, the scour elevation was used as the ground surface.

Response to Foundation Review Comments

Our response to review comments by Ms. Clare Singleton of the Geotechnical Earthquake Engineering Section is included as Attachment 2.

17660 Newhope Street, Suite E, Fountain Valley, California 92708 Tel: (714) 751-3826 Fax: (714) 751-3928

Project Plans

(1) See response prepared by RBF.

(2) RBF will correct Pile Data Table on Foundation Plan 2.
RBF will shown the actual axial demand based on structural analysis.
Service load capacity in Pile Data Table is not applicable (see our response under "Foundation Report", Item 5).

Log of Test Borings

(1) and (2) See response prepared by RBF.

Foundation Report

(1) We will comply.

(2) See response prepared by RBF.

(3) See response prepared by RBF.

(4) We will insert the following writeup in an addendum report:

"Drilled Shaft Construction Considerations

The as-built LOTB shows a measured ground water elevation of +134 feet which is about 70 feet below the original ground surface. Recent soil borings by Caltrans conducted in June, 1996 show ground water elevations varying from +196.6 to 189.8 feet. As a result of the recent measurements and this structure being a river crossing, we should assume that ground water will be encountered during construction of the proposed 4-foot diameter drilled shafts. A slurry-displacement method of construction would be needed. In addition, presence of fine to coarse grained sand with gravel is reported on the LOTB. This material (when saturated) has a high potential for caving. Therefore, casing may be required. The casing must be pulled as the concrete is being poured while always maintaining at least a 5-foot head of concrete inside the casing.

As a standard Caltrans practice for "wet" construction, PVC tubings must be installed within the reinforcement cage for gamma-ray testing."

(5) Table 1 in the foundation report dated November 18, 1996 will be revised as follows:

Location	Dia.	Design Loading (Service)	Nominal Resistance (k)		Cut-off El.	Design Tip El.	Spec. Tip El.	Liquefiable Layer El.
			Compr.	Tension				
Pier 3	48"	N/A	400 (385)	100	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +190 +176 to +171
Pier 6	48"	N/A	470	130	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	None
Pier 9	48"	N/A	440 (400)	120 (110)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +186 +171 to +166
Pier 12	48"	N/A	270 (200)	110 (100)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +187 +165 to +161
Pier 15	48"	N/A	270 (200)	110 (100)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +185 +165 to +161
Pier 18	48"	N/A	440 (190)	120 (100)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +185 +170 to +161
Pier 21	48"	N/A	260 (185)	110 (90)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +182 +167 to +161
Pier 24	48"	N/A	330 (325)	120 (110)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +191 +179 to +174
Pier 27	48"	N/A	440 (350)	130 (110)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+196 to +174
Piers 28 & 29	48"	N/A	450 (410)	130 (125)	+196.3	+161.0 (1), (2), (3), (4) & (5)	+161.0	+189 to +179

Notes: (1) Capacity values enclosed in brackets are for liquefied soil conditions, all others are for non-liquefied soil condition.
(2) Design tip elevation is controlled by the following demands:
(1) Compression; (2) Tension; (3) Lateral; (4) Scour to Elev. +195 feet; (5) Soil Liquefaction.
N/A = not applicable

(6) See response prepared by RBF.

(7) This Caltrans request is for the existing piles, we will comply.

Sincerely,
EARTH MECHANICS, INC.

REGISTERED PROFESSIONAL ENGINEER
LINO C. CHEANG
No. C41401
Exp. 9-30-99
CIVIL
STATE OF CALIFORNIA

Lino Cheang, RCE 41401
Project Manager
Encl.
LCC/lcc

ATTACHMENT 1

Caltrans Foundation Review Sheet Dated April 21, 1997

FOUNDATION REVIEW

ENGINEERING SERVICE CENTER
OFFICE OF STRUCTURAL FOUNDATIONS

TO: TOM HALLENBECK
Project Design Branch "C"

Attention: Greg Wong

DATE: April 21, 1997

FILE: 05-SLO-101-0.19
District County Route Post Mile

FDN REPORT BY: Earth Mechanics, Inc DTD: 11/18/96 Bridges Across Santa Maria Rivers
Structure Name

GENERAL PLAN DTD: No Date FDN PLAN DTD: 11/15/96 05-444411 (EA Number) 49-0111 L/R (Bridge Number)

Submittal (*Check One*): ☒ 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ Other ____

Comments pertaining to current submittal:

Please see memo dated April 10, 1997 for comments made by Clare Singleton from Geotechnical Earthquake Engineering Section.

Project Plans

1-The seismic loading under the General Notes on the foundation Plan 1 must be deleted. The "Site Specific Response Spectra" has been done and it is presented in the project plan.

2-The Pile Data table on Foundation Plan 2 is incorrect. The table must specify the design tip elevation for each loading demand. (i.e. the tip elevation for compression, and tension) The pile data notes that the specified tip elevation is controlled by axial demand under lateral loads. Please see "MTD" 3-1 for typical examples of how the pile data must be formatted.

The nominal resistance in compression and tension as listed in the table are the same loads as shown in the foundation report. Why? The loads in the pile data table must be the actual demands on these piles based on structural analysis. Please comment.

Furthermore, the nominal resistance in compression has exceeded 2x the design service load at some of the support locations.

Per our analysis, these piles are not adequate to handle the additional loads. Please submit your calculations along with the soil strength parameters. The piles should also be structurally analyzed to verify their integrity. Please comment.

Log of Test Borings (LOTB)

→ 1-The "As-Built" LOTB with the driving records must be included.

2-The additional Caltrans LOTB must be added.

Foundation Report

1-The "Santa Maria River" fault is renamed to "Santa Maria River - Foxen Canyon." This revision is shown in the Caltrans California Seismic Hazard Map 1995 by Lalliana Muelchin, December 1995. Please update the report.

REGISTERED PROFESSIONAL ENGINEER
REZA MAHALLATI
No. 49374
Exp. 9/30/99
CIVIL
STATE OF CALIFORNIA

Approval (*Check One*):
- ☐ (C1) Approved as submitted
- ☐ (C2) Approved subject to EFPB verification of comments being adequately addressed
- ☒ (C3) Not approved (resubmittal to SFB required)
- ☐ (C4) Package submitted not complete

Division of Structures
Externally Financed Projects Branch

Reza Mahallati
Engineering Service Center
Office of Structural Foundations

cc: OSF (Sacramento) DOS Specifications and Estimates Section (All Reviews) DOS R.E. Pending File

FOUNDATION REVIEW

ENGINEERING SERVICE CENTER
OFFICE OF STRUCTURAL FOUNDATIONS

TO: TOM HALLENBECK
Project Design Section "C"

Attention Greg Wong

DATE: April 21, 1997

FILE: 05-SLO-101-0.19
District County Route Post Mile

Bridges Across Santa Maria Rivers
Structure Name

05-444411
EA Number

49-0111 L/R
Bridge Number

2-The local scour elevation and the degradation scour elevation as shown on the first page of the foundation report dated 11/18/96, must elaborate more on the locations of these scour: Is it assumed that the scour elevation is constant for a bridge that is almost 2100 feet long? Please comment.
3-On page 2 of the report dated 11/18/96, the local scour is neglected for seismic design. Bridge Design Specification states in Section 4.4.2.2, "Scour Protection," that 1/2 of the maximum anticipated scour is assumed to have occurred when designing for earthquake loading. Please redo the pile analysis.
4-The constructibility of these CIDH piles must be discussed in the foundation report.
5-Table 1 on page 3 must be revised to show the pile tip elevation and not the length, it must also list the design service load, if any, and design tip elevations for compression and tension demands.
The Pile Data Table on the Foundation Plan 2 lists these piles to have 100 tons of design loading. As previously stated, the compression demands on these piles have exceeded 2x the design service loads. Geotechnically, these piles are not adequate. Structurally, they must also be analyzed to verify their integrity.
6-Our pile capacity analysis was based on 1/2 inch settlement. Piles will provide more capacity if larger movements are allowed in retrofit scheme. How much movements are allowed? Please comment.
7-Table 4 on page 6 must be revised to list the pile type, unit, and design tip elevations for compression and tension demands.

ATTACHMENT 2

Response to Review Comments Prepared by Clare Singleton

Earth Mechanics, Inc.

Geotechnical & Earthquake Engineering

April 23, 1997

RBF and Associates
14725 Alton Parkway
Irvine, California 92718

Attention: Mr. Paul Young

Subject: Response to Caltrans Review Comments Documented in a Caltrans Memorandum Dated April 10, 1997, Santa Maria River Bridge, Bridge No. 49-0111L/R EA# 05-444431

Dear Mr. Young:

We received a faxed copy of the subject Caltrans memorandum. A copy this memorandum is attached. There are two major review comments:

(1) Geotechnical report did not include most recent LOTB drilled in June, 1996. Designer should review the new boring data to verify or re-evaluate the design parameters used for analyses.

We agree and we have reviewed the new boring data. We have the following comments and conclusions after our review:

- To facilitate our calculations, the ground surface elevations shown in Table 1 (Idealized Soil Profiles) are based on the "one-half" scour depth criteria used by Caltrans for seismic design. The "one-half scour depth" is defined as the difference between ground surface measurements and the scour elevation of +195 feet, both documented in a Caltrans memorandum dated March 4, 1996. Therefore, the ground surface elevations on Table 1 do not match the elevations on the as-built LOTB and the recent boring data.

- Our calculations are based on scour elevations of +195 and +181 feet for seismic and service loading conditions, respectively, therefore, any discrepancies on soil stratigraphy and properties above these scour elevations will have no impact on our recommendations.

- The borings shown on the as-built LOTB terminate near the as-built pile tip elevations which are generally near Elevation +160 feet for Abutments 1 through Piers 12, Piers 26 through 29 and Abutment 30, and Elevation +130 feet for Piers 13 through 25. Therefore, comparison of soil stratigraphy below the above elevations with the recent soil borings is not possible.

17660 Newhope Street, Suite E, Fountain Valley, California 92708 Tel: (714) 751-3826 Fax: (714) 751-3928

- The idealized soil profiles presented in Table 1 were developed based on 15 soil borings shown on the as-built LOTB. Even though there are simplifications and some local variation of soil stratigraphy is expected, it is an accurate representation of the general subsurface conditions along the bridge alignment. We would not recommend changing our recommendations based on subsurface data collected from 3 recent soil borings until a comparison shows large discrepancies. We have compared the recent soil borings with the idealized soil profiles of Table 1 and large discrepancies are not evident as discussed below:

Recent Boring B-3 at Station 19+00 Near Pier 7. The comparison shows good correlation between the recent boring and subsurface conditions near Pier 7 except the thickness of Soil Unit 3 is much greater in the recent boring. However, this difference has little impact on the foundation recommendations.

Idealized Soil Stratigraphy	Elevation	
	Recent Boring B-3	@ Pier 7
Loose to slightly compact silty sand and sand (Soil Unit 2 in Foundation Report)	+213' to +200'	Not Encountered
Compact sand (Soil Unit 3)	+200' to +120'	+200' to +170'
Loose to slightly compact silty sand and sand (Soil Unit 4)	Not Encountered	Not Encountered
Slightly compact to compact clayey silt (Soil Unit 5)	Not Encountered	Not Encountered
Dense to very dense sand (Soil Unit 6)	+120' to +110'	Below +170'

Recent Boring B-1 at Station 25+00 Near Pier 16. The comparison below shows good correlation between the recent boring and subsurface conditions near Pier 16.

Idealized Soil Stratigraphy	Elevation	
	Recent Boring B-1	@ Pier 16
Loose to slightly compact silty sand and sand (Soil Unit 2 in Foundation Report)	+203' to +185'	+198' to +185'
Compact sand (Soil Unit 3)	+185' to +180'	+185' to +170'
Loose to slightly compact silty sand and sand (Soil Unit 4)	+180' to +132'	+170' to +134'
Slightly compact to compact clayey silt (Soil Unit 5)	Not Encountered	Not Encountered
Dense to very dense sand (Soil Unit 6)	+132' to +120'	Below +134'

Recent Boring B-2 at Station 29+70 Near Pier 22. The following comparison shows different

contacts for Soil Units 4 and 5. According to the log of the recent Boring B-2, the fines content (% Passing #200 Sieve) between Elevation 145 and 130 feet exceeds 30%. Classification of soils within these elevations as SAND (as shown on the boring log) is questionable. Correction of the soil classification within these elevations will result in an improved correlation with the as-built LOTB data.

Idealized Soil Stratigraphy	Elevation	
	Recent Boring B-2	@ Pier 22
Loose to slightly compact silty sand and sand (Soil Unit 2 in Foundation Report)	+198.5' to +180'	+196.5' to +193'
Compact sand (Soil Unit 3)	+180' to +165'	+193' to +189' +184' to +168'
Loose to slightly compact silty sand and sand (Soil Unit 4)	+155' to +130'	+189' to +184' +168' to +143'
Slightly compact to compact clayey silt (Soil Unit 5)	+165' to +155'	+143 to +130'
Dense to very dense sand (Soil Unit 6)	+130' to +125'	Below +130'

(2) *The report states recorded ground water table at time of drilling in May and June, 1956 was about 60 to 70 feet below the ground surface. A higher water table must have been assumed for scour and liquefaction considerations. This assumption should be addressed briefly in the report.*

All foundation stiffness and capacity calculations assume the ground water table to be at the river bottom.

Sincerely,
EARTH MECHANICS, INC.

REGISTERED PROFESSIONAL ENGINEER
LINO C. CHEANG
No. C41401
Exp. 9-30-99
CIVIL
STATE OF CALIFORNIA

Lino Cheang, RCE 41401
Project Manager
Encl.
LCC/lcc

State of California

Business, Transportation and Housing Agency

Memorandum

To: MR. GREG WONG
Office of Structure External Liaison & Support
Branch "C"

Date: April 10, 1997

File: 05-SLO-101-0.19
05-444411
Seismic Retrofit

Santa Maria River Bridge
Bridge No. 49-0111L/R

From: **DEPARTMENT OF TRANSPORTATION**
ENGINEERING SERVICE CENTER
Office of Structural Foundations - MS #5
Structure Foundations Branch

Subject: Review of Seismic Retrofit Analysis

Your recent request for review of the Final Foundation Report, Seismic Retrofit Analyses for the Bridge Across Santa Maria River (Br. No. 49-0111R/L) dated November 18, 1996 has been forwarded to our section by Mark DeSalvatore. This final report, as prepared by Lino Cheang of Earth Mechanics, Incorporated and the preliminary plans provided, have been reviewed.

On April 8,1997, our office received a copy of the latest Log of Test Borings (LOTB) drilled in June of 1996 and compared it with the general subsurface conditions in this final report. The report does not include this most recent LOTB and inconsistencies are apparent between the new boring data and the "Idealized Soil Profile" in Table 1 of the September 5, 1996 letter report included in the final report appendix. It is recommend that these logs be reviewed by the designer to verify or reevaluate the design parameters used for analyses.

Furthermore, watershed assumptions were not stated in the report. The report does state that the recorded ground water table at the time of the May and June 1956 drilling was near elevation +134 feet which is about 60 to 70 feet below the ground surface. A higher water table must have been assumed for scour and shallower liquefaction considerations and these assumptions should be addressed briefly in the report. Furthermore, incorporation of the latest LOTB will indicate a much higher water table which may be used as supporting evidence.

If you have any questions, please call Clare Singleton at 227-7059 or Abbas Abghari at 227-7172.

E. C. Singleton

E. C. SINGLETON
Associate Materials & Research Engineer
Geotechnical Earthquake Engineering Section

A. Abghari

ABBAS ABGHARI, Chief
Geotechnical Earthquake Engineering Section

cc: ELeivas - SFB
MDeSalvatore - GSB

ROBERT BEIN, WILLIAM FROST & ASSOCIATES

PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS

MEMORANDUM

To: Tom Ostrom JN 33184

From: Hernan Montoya, S.E.

Date: April 8, 1997

Subject: Caltrans SR No. 812 - Foundation Review Comments
Bridges Across Santa Maria River (Br. No. 49-0111L/R)

REPLY TO FOUNDATION REVIEW COMMENTS:

Project Plans:

1. The information shown for Seismic Loading under the General Notes on the Foundation Plan 1 is accurate and consistent with what has been shown and approved for all other seismic retrofit projects within our contract. Depth of Alluvium is greater than 150' with an estimated PGA of .60g. Site Specific Response Spectra Curve included on this sheet was used in lieu of Curve "D" which is no longer recommended for new designs.

2. Pile Data Table complies with Memo to Designers 3-1 for CIDH concrete piles. Footnotes are used for Class 70 & 100, Steel HP and Cast-in-Steel-Shell piles. RBF was directed to remove footnotes from Pile Data Table after the first submittal. However, to comply with the request of the foundation reviewer, pile design footnotes were added to the Pile Data Table. Please see enclosed Foundation Location Plan 2.

   Nominal Resistance values shown in the Pile Data Table are the maximum ultimate values which the new 35' long CIDH piles are able to resist and are expected to experience at a given time (under MCE). The foundation is expected to displace and rock due to transverse loads. The foundation stiffnesses were relaxed in the dynamic models from full elastic, down to pseudo-elastic behavior, "plunging" up and down when reaching these ultimate values. The 260 to 450 kip for compression and 100 to 130 kips tension correspond to ultimate capacity and thus, maximum seismic demand when the CIDH piles "plunge" up and down under non-liquefied conditions (liquefied conditions with lower compression and tension values may also occur). The structure was checked for both conditions, with the liquefied condition being more critical for displacements, stability, etc., and the non-liquefied condition being more critical for

force and ductility demands. Not all CIDH pile group stiffnesses were relaxed or iterated down to the same value. For simplicity of construction, a typical pile length of CIDH pile was selected, CIDH capacities were calculated for each bent based on this typical length and foundation stiffnesses for each pier were relaxed to converge to these capacities. Because of the varying soil conditions for the different bents, ultimate capacities are different for the same length of pile.

The new CIDH piles do not have a sustained service load. There are no load demands on the CIDH piles until a seismic event occurs. Therefore, the values to be listed under the Design (Service Load column on the New CIDH Pile Data table) should be zero or N.A.

Service and ultimate capacities used in this retrofit design were furnished by EMI. Please refer to the geotechnical report. New CIDH design as well existing pile capacity verification were performed by RBF. Please refer to pages 600-612 of the structural calculations for new CIDH design, pages 626-631 for the dead plus live load check under local scour, and pages 37-41 for the existing pile capacity calculations.

Log of Test Borings (LOTB)

1. Driving records not to be included according to telephone conversation with Mr. Tom Ostrom on April 23, 1997.

2. The additional Caltrans LOTB were added on 3/31/97.

Foundation Report

1. See reply by EMI.

2. Scour calculations were based on input by Caltrans Hydrology/Hydraulics. See memorandum by Cathy Avila dated October 24, 1996.

Estimated channel bed degradation:	Elevation 195'
Estimated local scour without foundation retrofit:	Approx. 12' (Elev. 183')
Estimated local scour with foundation retrofit:	Approx. 19' (Elev. 176')

3. Local scour was not and should not be used for seismic retrofit design (please refer to Memorandum by Eldon R. Davidson dated October 26, 1995). As-built pile ultimate capacities for retrofit design were calculated using half scour between existing grade and Elevation 195', in accordance with BDS. New CIDH pile capacities for retrofit design were calculated using a degraded channel bed at Elevation 195'.

4. See reply by EMI.

5. See reply by EMI. Pile Data Table has been revised as requested. Please see enclosed Foundation Location Plan 2.

6. CIDH piles are not designed to maintain a vertical deflection of less than ½" during the maximum credible earthquake. Larger vertical deflections are allowed to occur in order to maintain the transverse period, transverse deflections, force and ductility demands within reasonable levels.

7. See reply by EMI.

For further information please refer to the Reply to Foundation Review Comments by EMI. Please do not hesitate to contact us should you have any further questions or comments regarding this retrofit design.

Thanks!

5					

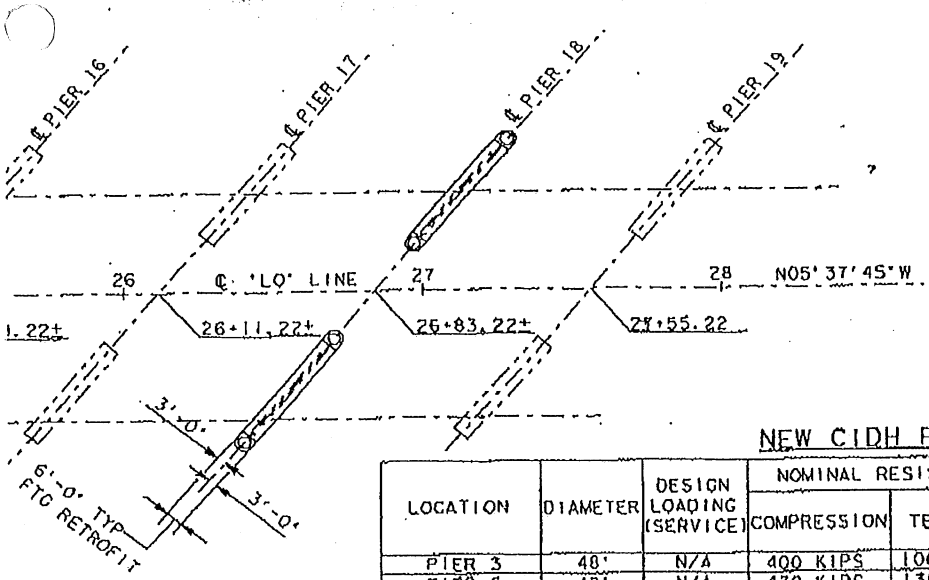
REGISTERED ENGINEER - CIVIL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HERNAN MONTOYA NO. C36919 EXP. 6/30/00 CIVIL STATE OF CALIFORNIA

ROBERT BEIN, WILLIAM FROST AND ASSOCIATES
14725 ALTON PARKWAY
IRVINE, CA. 92718

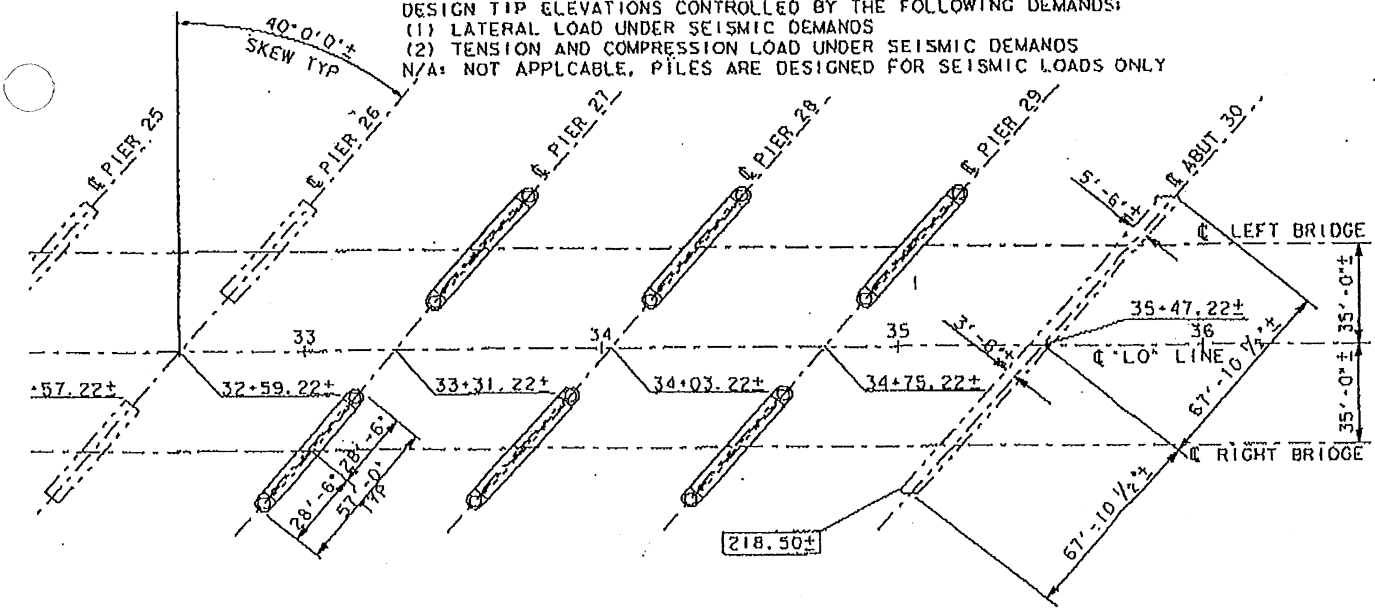
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET



NEW CIDH PILE DATA

LOCATION	DIAMETER	DESIGN LOADING (SERVICE)	NOMINAL RESISTANCE		CUT-OFF ELEV	DESIGN TIP ELEV	SPECIFIED TIP ELEV
			COMPRESSION	TENSION			
PIER 3	48"	N/A	400 KIPS	100 KIPS	196.3	161.0 (1)&(2)	161.0
PIER 6	48"	N/A	470 KIPS	130 KIPS	196.3	161.0 (1)&(2)	161.0
PIER 9	48"	N/A	440 KIPS	120 KIPS	196.3	161.0 (1)&(2)	161.0
PIER 12	48"	N/A	270 KIPS	110 KIPS	196.3	161.0 (1)&(2)	161.0
PIER 15	48"	N/A	270 KIPS	110 KIPS	196.3	161.0 (1)&(2)	161.0
PIER 18	48"	N/A	440 KIPS	120 KIPS	196.3	161.0 (1)&(2)	161.0
PIER 21	48"	N/A	260 KIPS	110 KIPS	196.3	161.0 (1)&(2)	161.0
PIER 24	48"	N/A	330 KIPS	120 KIPS	196.3	161.0 (1)&(2)	161.0
PIER 27	48"	N/A	440 KIPS	130 KIPS	196.3	161.0 (1)&(2)	161.0
PIER 28 & 29	48"	N/A	450 KIPS	130 KIPS	196.3	161.0 (1)&(2)	161.0

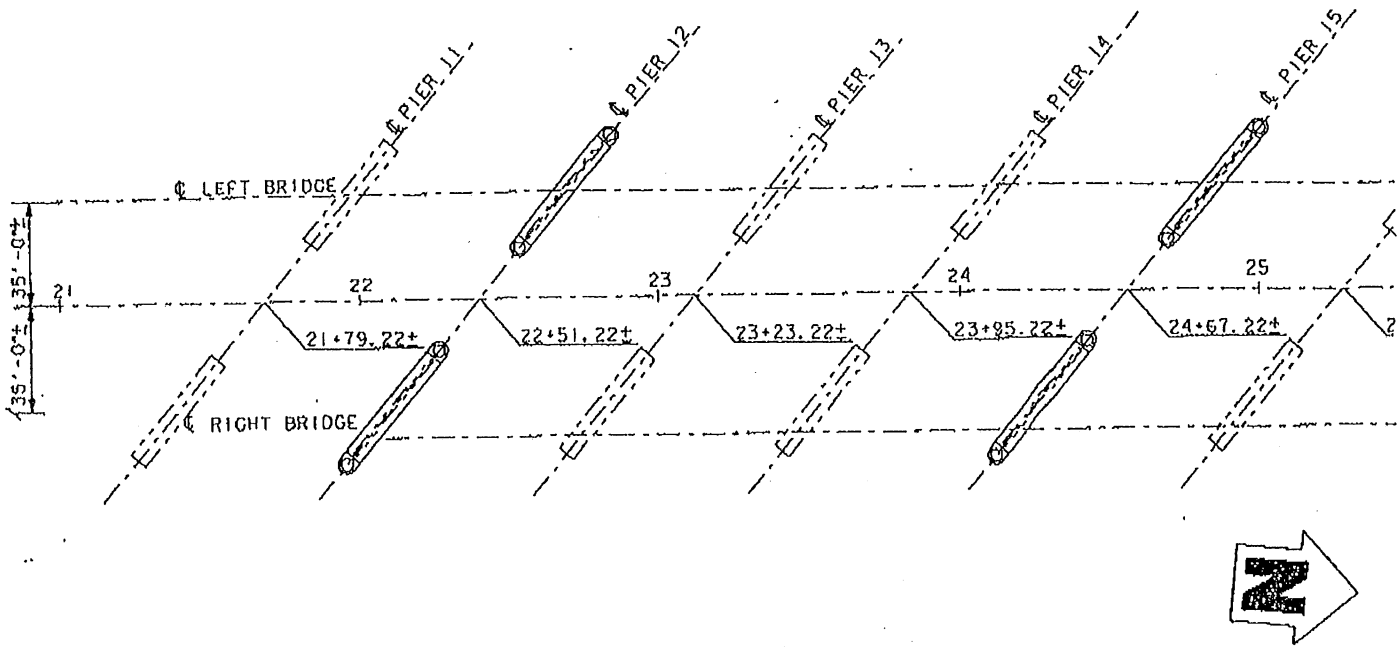
DESIGN TIP ELEVATIONS CONTROLLED BY THE FOLLOWING DEMANDS:
(1) LATERAL LOAD UNDER SEISMIC DEMANDS
(2) TENSION AND COMPRESSION LOAD UNDER SEISMIC DEMANDS
N/A: NOT APPLICABLE, PILES ARE DESIGNED FOR SEISMIC LOADS ONLY

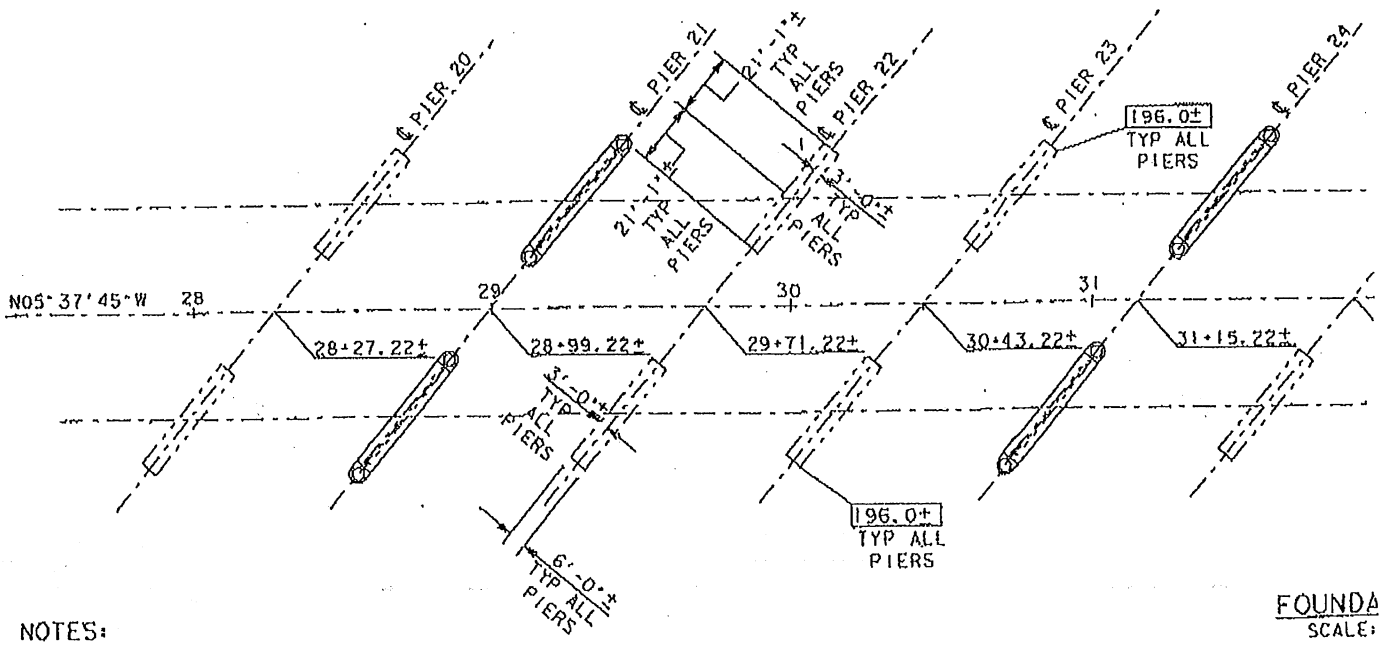


ON PLAN
= 30'

PREPARED FOR THE 'ATE OF CALIFORNIA PARTMENT OF TRANSPORTATION	P. YOUNG PROJECT ENGINEER	BRIDGE NO. 49-0111L/R POST MILE 0.19	EARTHQUAKE RETROFIT PROJECT NO. 812 BRIDGES ACROSS SANTA MARIA RIVER FOUNDATION LOCATION PLAN 2
	CU 06233 EA 444431	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES (PRELIMINARY STAGES ONLY) SHEET 3 OF 18

812A-03.DGN





FOUNDA
SCALE:

NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.
2. SEE ROAD PLANS FOR EXIST UTILITY LOCATIONS.

DESIGN OVERSIGHT THOMAS A. OSTROM		DESIGN	BY W. ACEVEDO/H. MONTOYA	CHECKED	G. RENDE
SIGNOFF DATE		DETAILS	BY J. SALDANA	CHECKED	H. MONTOYA
		QUANTITIES	BY J. SALDANA	CHECKED	R. ROLLINS

ATTACHMENT III

AS-BUILT PILE DATA TABLE

TABLE 4. ULTIMATE AXIAL PILE CAPACITY IN KIPS

Location	Pile Type	Design Load (tons)	Footing Bottom El. (ft)	As-Built Avg. Pile-Tip El. (ft)	Non-liquefied, Kip		Liquefied	
					Compr.	Tension	Compr.	Tension
Abutment 1	12" Dia. Steel Shell Filled with Conc. (Alt. "U")	45	220.25	166.20	266	100	205	84
Pier 2		45	196.25	167.55	188	32	158	28
Pier 3		45	196.25	171.00	158	23	129	21
Pier 4		45	196.25	166.75	189	32	189	32
Pier 5		45	196.25	167.30	189	32	189	32
Pier 6		45	196.25	166.80	189	32	189	32
Pier 7		45	196.25	167.50	189	32	189	32
Pier 8		45	196.25	164.90	190	32	149	29
Pier 9		45	196.25	163.85	190	32	149	29
Pier 10		45	196.25	164.45	190	32	149	29
Pier 11		45	196.25	159.13	219	40	176	35
Pier 12		45	196.25	154.80	166	54	137	46
Pier 13		45	196.25	132.20	270	100	168	64
Pier 14		45	196.25	133.25	270	100	168	64
Pier 15		45	196.25	134.30	270	100	168	64
Piers 16 to 18		45	196.25	132.10	260	94	149	57
Pier 19		45	196.25	130.80	260	96	173	69
Pier 20		45	196.25	131.60	260	96	173	69
Pier 21		45	196.25	131.70	260	96	173	69
Piers 22 & 23		45	196.25	130.50	252	93	188	73
Pier 24		45	196.25	128.90	265	103	237	91
Pier 25		45	196.25	131.80	254	103	251	100
Pier 26		45	196.25	149.20	191	65	157	57
Pier 27		45	196.25	172.20	121	15	77	13
Pier 28		45	196.25	174.85	119	14	94	12
Pier 29		45	196.25	174.40	119	14	94	12
Abutment 30		45	196.25	175.00	195	68	195	68

Note: The above capacities are based on soil resistance only and may be limited by the strength of the pile materials and pile-head connection details.

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Van Nuys Office R5D2

Underground Classification

C105-079-09T

Santa Maria River Bridge (WIDEN) - California Department of Transportation

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of **50 Higuera St., San Luis Obispo, CA 93401-5415**

(MAILING ADDRESS)

at **Within the Santa Maria Riverbed, approximately 0.25 miles north of the 101/135 Broadway St. interchange, San Luis Obispo County**

(LOCATION)

has been classified as *****NON GASSY*****

(CLASSIFICATION)

as required by the California Labor Code Section 7955.

The Division shall be notified if sufficient quantities of flammable gas or vapors have been encountered underground. Classifications are based on the California Labor Code Part 9, Tunnel Safety Orders and Mine Safety Orders.

178 Cast In Drilled Hole Piles, each approximately 48" in diameter and ranging in depths from 26' to 84' in depth to be excavated within the Santa Maria Riverbed, approximately 0.25 miles north of the 101/135 Broadway St. interchange, San Luis Obispo County.

Date June 23, 2009

Tony Serpas

Tony Serpas
(Senior Engineer)