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MEMORANDUM

TO: ALL CONSULTANTS
ALL BRIDGE DESIGNERS

FROM: PAUL FOSSIER, P.E. 
BRIDGE DESIGN ENGINEER ADMINISTRATOR
STEPHEN MEUNIER, P.E. 
PAVEMENT AND GEOTECHNICAL ENGINEER ADMINISTRATOR

SUBJECT: BRIDGE DESIGN TECHNICAL MEMORANDUM NO. 32 REV. NO. 1
(BDTM.32.1)
PILE AND DRILLED SHAFT DATA TABLES AND GEOTECHNICAL NOTES

DATE: JUNE 26, 2013

Revision No. 1 Summary:

The pile and drilled shaft data tables have been updated and new test/indicator pile and test drilled shaft data tables have been created. An example has been incorporated. Typical example notes for piles and drilled shafts and a Pile and Drilled Shaft Length Diagram have been created. All revisions are shown in bold.

BDTM.32.1

Effective immediately for all projects prior to 95% final plan stage (as of April 15, 2011), the attached **Production Pile Data Table, Test Pile Data Table, Indicator Pile Data Table, Production Drilled Shaft Data Table, and/or Test Drilled Shaft Data Table, related typical example notes for piles and drilled shafts, and the Pile and Drilled Shaft Length Diagram** must be included in the contract plans as directed by the Geotechnical Engineer of Record. The **typical example notes and the diagram** should be included on the same plan sheet as the data tables. The attached tables shall replace the "pile load information" table on page 6(6) of DOTD's LRFD Bridge Design Manual (Version 2008.1).

All geotechnical information, such as notes, data tables, diagrams, boring sheets, and all geotechnical related details, shall be shown on separate plan sheets from bridge/structural details. All geotechnical plan sheets shall be assembled together in consecutive order and shall be stamped by the Geotechnical Engineer of Record. In lieu of showing the pile length in bridge general plans as has been done historically, reference should be made to the geotechnical plan sheets for the information.

Where design and loading conditions do not warrant the use of some columns in the tables, they should be filled in with a dash “-” as shown. The columns shall not be altered or deleted.

To provide additional clarification to some of the column headings on the attached tables, the following terms have been described and shown on the attached Pile and Drilled Shaft Length Diagram:

- **Maximum Cutoff/Top Elevation:** The top elevation of the highest pile or drilled shaft in each respective bent.
- **Plan Tip Elevation:** The plan bottom elevation of the pile or drilled shaft that corresponds to the pile or drilled shaft for which the Maximum Cutoff/Top Elevation is provided.
- **Plan Length:** The difference between the provided Maximum Cutoff/Top Elevation and Plan Tip Elevation.
- **Order Length:** The fabricated length of the piles. Where a test pile is not required, this will usually be the Plan Length. Where a test pile is required, this length will be determined at the completion of the test pile program. This information is to be completed by the Field Project Engineer.
- **As-Built Tip Elevation:** This information is to be completed by the Field Project Engineer.
- **Required Nominal Resistance:** The minimum capacity the contractor is required to achieve for each pile or drilled shaft. The appropriate column corresponding to whether or not preboring to the scour elevation was performed should be used as the required nominal resistance.
- **Bottom of Casing Elevation (Test Pile):** The required bottom elevation to which the test pile casing shall be driven. The soil inside the casing shall be excavated to the same elevation prior to driving the test pile.
- **Bottom of Permanent Casing Elevation (Drilled Shaft):** The required bottom elevation of permanent casing that shall be installed prior to drilling the shaft.

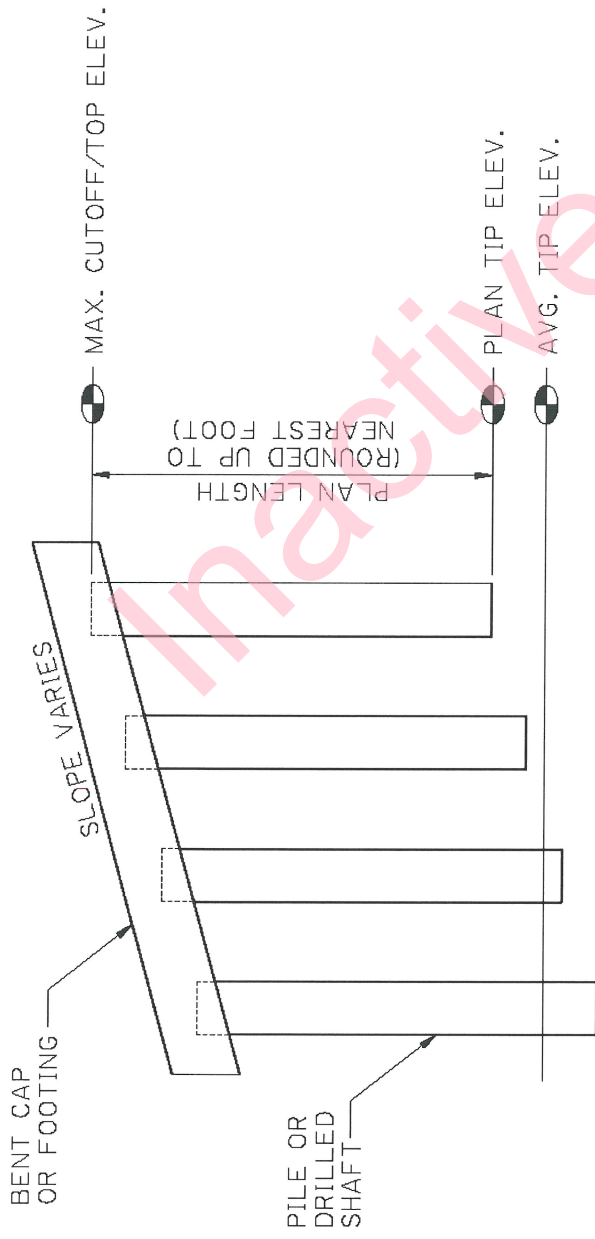
This technical memorandum is posted on the Bridge Design Website under Technical Memoranda.
http://www.dotd.la.gov/highways/project_devel/design/home.asp?ID=BRIDGE

Please contact Ms. Zhengzheng “Jenny” Fu (225-379-1321, zhengzheng.fu@la.gov) if you have questions or comments.

PF/zzf/pv

Cc: Richard Savoie (Chief Engineer)
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District Administrators (02, 03, 04, 05, 07, 08, 58, 61, 62)

Inactive



PILE AND DRILLED SHAFT LENGTH DIAGRAM

Production Pile Data Table

Bent No.	Station	No. of Piles per Bent	Pile Type & Size	Monitor Pile Required (Y or N)	Load (Tons)						Soil Resistance Factor (Φ)				Plan Length (ft)	Plan Tip EL (ft)	Order Length (ft)	As-Built Tip EL (ft)			Required Nominal Resistance (Tons)				
					Service		Strength		Extreme		Service	Strength		Extreme				Max. Cutoff EL (ft)	Max.	Min.	Avg.	Without Preboring	Preboring to Scour Depth		
					Permanent Load	Transient Load	Compression	Tension	Compression	Tension		Compression	Tension												
1	100+00	5	24" Sq. Solid PPC	Y	60	59	179	179	179	-	-	1	0.7	1	-	172	90	82				520	440		
2	200+00	10	30" Sq. Voided PPC	N	60	59	179	-	-	-	-	1	0.7	-	-	172	90	82				375	350		

Test Pile Data Table						
Test Pile No.	Station	Location	Pile Type & Size	Tip EL (ft)	Bottom of Casing EL (ft)	Test Load (Tons)
1	122+00	50' RT CL	24" sq. voided PCC	90	149	600

Indicator Pile Data Table					
Indicator Pile No.	Station	Location	Pile Type & Size	Tip EL (ft)	Bottom of Casing EL (ft)
1	122+00	50' RT CL	24" sq. voided PCC	90	-

THE FOLLOWING NOTES APPLY IF THERE IS A TEST PILE AND MONITOR PILES

- 1 **PILES:** ALL PILE REQUIREMENTS INCLUDING SIZE, TYPE, LOCATION, AND MAXIMUM DESIGN LOAD SHALL BE AS DESCRIBED IN THE CONTRACT DOCUMENTS. THE MINIMUM PILE TIP ELEVATION WILL BE THE PLAN TIP ELEVATION AS SHOWN IN THE PRODUCTION PILE DATA TABLE, UNLESS OTHERWISE NOTED OR OTHERWISE DIRECTED BY THE GEOTECHNICAL ENGINEER. PILE ORDER LENGTHS WILL BE PROVIDED AFTER COMPLETION OF TEST PILE LOAD TESTING AND EVALUTION.
- 2 **PILE DRIVING EQUIPMENT APPROVAL:** ALL PILE DRIVING EQUIPMENT SHALL BE APPROVED USING THE WAVE EQUATION HAMMER APPROVAL METHOD IN ACCORDANCE WITH ARTICLE 804.05(C)(2) OF THE LOUISIANA STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES.
- 3 **DYNAMIC MONITORING:** PILE DRIVING ANALYZER (PDA) MONITORING WILL BE REQUIRED AT EACH TEST PILE, INDICATOR PILE, MONITOR PILE, AND AS DIRECTED BY THE GEOTECHNICAL ENGINEER. ALL COSTS AND DELAYS ASSOCIATED WITH PDA MONITORING SHALL BE INCLUDED UNDER ITEM NO. 804-17-00100, DYNAMIC MONITORING.
- 4 **MONITOR PILES:** THE FIRST PLUMB PILE DRIVEN AT EACH BENT INDICATED ON THE PRODUCTION PILE DATA TABLE SHALL BE MONITORED WITH THE PILE DRIVING ANALYZER (PDA). AT THE DIRECTION OF THE GEOTECHNICAL ENGINEER, A ONE DAY RESTRIKE MAY BE REQUIRED AT EACH MONITOR PILE.
- 5 **PILE CAPACITY VERIFICATION:** SHALL BE BASED ON DRIVING CRITERIA ESTABLISHED FROM PILE DATA AND WAVE EQUATION ANALYSIS.
- 6 **REQUIRED NOMINAL RESISTANCE:** REQUIRED NOMINAL RESISTANCE "WITHOUT PREBORING" SHALL BE USED TO VERIFY PILE CAPACITY IF NO PREBORING IS PERFORMED. IF PREBORING TO THE SCOUR ELEVATION IS PERFORMED, THE REQUIRED NOMINAL RESISTANCE "PREBORING TO SCOUR" SHALL BE USED FOR PILE CAPACITY VERIFICATION.

THE FOLLOWING NOTES APPLY IF THERE IS NO TEST PILE, BUT THERE ARE MONITOR PILES

- 1 **PILES:** ALL PILE REQUIREMENTS INCLUDING SIZE, TYPE, LOCATION, AND MAXIMUM DESIGN LOAD SHALL BE AS DESCRIBED IN THE CONTRACT DOCUMENTS. THE MINIMUM PILE TIP ELEVATION WILL BE THE PLAN TIP ELEVATION AS SHOWN IN THE PRODUCTION PILE DATA TABLE, UNLESS OTHERWISE NOTED OR OTHERWISE DIRECTED BY THE GEOTECHNICAL ENGINEER. PLAN LENGTHS PROVIDED IN THE PRODUCTION PILE DATA TABLE ARE ORDER LENGTHS.
- 2 **PILE DRIVING EQUIPMENT APPROVAL:** ALL PILE DRIVING EQUIPMENT SHALL BE APPROVED USING THE WAVE EQUATION HAMMER APPROVAL METHOD IN ACCORDANCE WITH ARTICLE 804.05(C)(2) OF THE LOUISIANA STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES.
- 3 **DYNAMIC MONITORING:** PILE DRIVING ANALYZER (PDA) MONITORING WILL BE REQUIRED AT EACH TEST PILE, INDICATOR PILE, MONITOR PILE, AND AS DIRECTED BY THE ENGINEER. ALL COSTS AND DELAYS ASSOCIATED WITH PDA MONITORING SHALL BE INCLUDED UNDER ITEM NO. 804-17-00100, DYNAMIC MONITORING.
- 4 **MONITOR PILES:** THE FIRST PLUMB PILE DRIVEN AT EACH BENT INDICATED ON THE PRODUCTION PILE DATA TABLE SHALL BE MONITORED WITH THE PILE DRIVING ANALYZER (PDA). AT THE DIRECTION OF THE GEOTECHNICAL ENGINEER, A ONE DAY RESTRIKE MAY BE REQUIRED AT EACH MONITOR PILE.
- 5 **PILE CAPACITY VERIFICATION:** SHALL BE BASED ON DRIVING CRITERIA ESTABLISHED FROM PILE DATA AND WAVE EQUATION ANALYSIS.
- 6 **REQUIRED NOMINAL RESISTANCE:** REQUIRED NOMINAL RESISTANCE "WITHOUT PREBORING" SHALL BE USED TO VERIFY PILE CAPACITY IF NO PREBORING IS PERFORMED. IF PREBORING TO THE SCOUR ELEVATION IS PERFORMED, THE REQUIRED NOMINAL RESISTANCE "PREBORING TO SCOUR" SHALL BE USED FOR PILE CAPACITY VERIFICATION.

THE FOLLOWING NOTES APPLY IF THERE IS NO TEST/INDICATOR PILES OR NO MONITOR PILES

- 1 **PILES:** ALL PILE REQUIREMENTS INCLUDING SIZE, TYPE, LOCATION, AND MAXIMUM DESIGN LOAD SHALL BE AS DESCRIBED IN THE CONTRACT DOCUMENTS. THE MINIMUM PILE TIP ELEVATION WILL BE THE PLAN TIP ELEVATION AS SHOWN IN THE PRODUCTION PILE DATA TABLE, UNLESS OTHERWISE NOTED OR OTHERWISE DIRECTED BY THE GEOTECHNICAL ENGINEER. PLAN LENGTHS PROVIDED IN THE PRODUCTION PILE DATA TABLE ARE ORDER LENGTHS.
- 2 **PILE DRIVING EQUIPMENT APPROVAL:** ALL PILE DRIVING EQUIPMENT SHALL BE APPROVED USING THE WAVE EQUATION HAMMER APPROVAL METHOD IN ACCORDANCE WITH ARTICLE 804.05(C)(2) OF THE LOUISIANA STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES.

- 3 **PILE CAPACITY VERIFICATION:** SHALL BE BASED ON THE MODIFIED GATES DYNAMIC FORMULA:

ENGLISH DYNAMIC FORMULA:

$$R = \frac{(1.75\sqrt{E_r} \log(10N_b)) - 100}{2}$$

R = Pile Bearing Capacity (Tons)
*E_r = Manufacturer's Rated Energy at the field
observed ram stroke (foot – pounds)*
N_b = Number of Hammer Blows/Inch

METRIC DYNAMIC FORMULA:

$$R = (7\sqrt{E_r} \log(10N_b)) - 550$$

R = Pile Bearing Capacity (kiloNewton)
*E_r = Manufacturer's Rated Energy at the field
observed ram stroke (Joules)*
N_b = Number of Hammer Blows/25 mm

- 4 **REQUIRED NOMINAL RESISTANCE:** REQUIRED NOMINAL RESISTANCE "WITHOUT PREBORING" SHALL BE USED TO VERIFY PILE CAPACITY IF NO PREBORING IS PERFORMED. IF PREBORING TO THE SCOUR ELEVATION IS PERFORMED, THE REQUIRED NOMINAL RESISTANCE "PREBORING TO SCOUR" SHALL BE USED FOR PILE CAPACITY VERIFICATION.

THE FOLLOWING NOTE IS OPTIONAL DEPENDING ON SITE CONDITIONS

PREBORING AND/OR JETTING: PREBORING AND/OR JETTING MAY BE NECESSARY TO FACILITATE PILE INSTALLATION. PREAPPROVAL FROM THE FIELD PROJECT ENGINEER AND THE GEOTECHNICAL ENGINEER IS REQUIRED PRIOR TO ANY PREBORING AND/OR JETTING OPERATION. ALL PREBORING AND/OR JETTING SHALL BE IN ACCORDANCE WITH ARTICLES 804.08(A) AND 804.08(B) AS APPROPRIATE.

THE FOLLOWING NOTES ARE REQUIRED IF A TEST SHAFT IS USED

DRILLED SHAFTS: ALL DRILLED SHAFT REQUIREMENTS INCLUDING SIZE, TYPE, LOCATION, AND MAXIMUM DESIGN LOAD SHALL BE AS DESCRIBED IN THE CONTRACT DOCUMENTS. THE MINIMUM SHAFT TIP ELEVATION WILL BE THE PLAN TIP ELEVATION AS SHOWN IN PRODUCTION DRILLED SHAFT DATA TABLE, UNLESS OTHERWISE NOTED OR OTHERWISE DIRECTED BY THE GEOTECHNICAL ENGINEER. PLAN LENGTHS PROVIDED IN THE PRODUCTION DRILLED SHAFT DATA TABLE ARE FOR ESTIMATION PURPOSES ONLY. FINAL SHAFT LENGTHS WILL BE DETERMINED AFTER THE COMPLETION OF TEST SHAFT LOAD TESTING AND EVALUATION. THE DRILLED SHAFTS SHALL CONFORM TO THE DETAILS SHOWN IN THE PLANS AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. CROSSHOLE SONIC LOGGING IS TO BE PERFORMED ON EACH SHAFT, EXCLUDING WINGWALL SHAFTS. THE CONTRACTOR SHALL REMOVE ALL EXCAVATED MATERIAL, SLURRY, AND EXCESS CONCRETE FROM THE SITE AND DISPOSE OF IT PROPERLY. THE DRILLED SHAFT CONTRACTOR SHALL SUPPLY ALL CONCRETE AND REINFORCING STEEL FOR THE DRILLED SHAFTS.

TEST DRILLED SHAFTS: ALL TEST SHAFT REQUIREMENTS INCLUDING SIZE, TYPE, LOCATION, AND MAXIMUM LOADING SHALL BE AS DESCRIBED IN THE CONTRACT DOCUMENTS.

THE FOLLOWING NOTES ARE REQUIRED IF NO TEST SHAFT IS USED

DRILLED SHAFTS: ALL DRILLED SHAFT REQUIREMENTS INCLUDING SIZE, TYPE, LOCATION, AND MAXIMUM DESIGN LOAD SHALL BE AS DESCRIBED IN THE CONTRACT DOCUMENTS. THE MINIMUM SHAFT TIP ELEVATION WILL BE THE PLAN TIP ELEVATION AS SHOWN IN THE PRODUCTION DRILLED SHAFT DATA TABLE, UNLESS OTHERWISE NOTED OR OTHERWISE DIRECTED BY THE GEOTECHNICAL ENGINEER. PLAN LENGTHS PROVIDED IN THE PRODUCTION DRILLED SHAFT DATA TABLE ARE FINAL SHAFT LENGTHS. DRILLED SHAFTS SHALL CONFORM TO THE DETAILS SHOWN IN THE PLANS AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. CROSSHOLE SONIC LOGGING IS TO BE PERFORMED ON EACH SHAFT, EXCLUDING WINGWALL SHAFTS. THE CONTRACTOR SHALL REMOVE ALL EXCAVATED MATERIAL, SLURRY, AND EXCESS CONCRETE FROM THE SITE AND DISPOSE OF IT PROPERLY. THE DRILLED SHAFT CONTRACTOR SHALL SUPPLY ALL CONCRETE AND REINFORCING STEEL FOR THE DRILLED SHAFTS.

TRIAL DRILLED SHAFTS: ALL TRIAL SHAFT REQUIREMENTS INCLUDING SIZE, TYPE, AND LOCATION SHALL BE AS DESCRIBED IN THE CONTRACT DOCUMENTS.