Geotechnical Engineering
Construction Inspection
Materials Testing
Environmental

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October 1, 2017

DSA File No.: 19-41
DSA App No.: 03-114339
LEA No. 44 (Anaheim Lab)
MTGL Project No. 1047D35
MTGL Log No. 17-1391

Dan Holmquist, Facilities Project Manager
Glendale Unified School District
349 W. Magnolia Ave
Glendale, CA 91204

Subject: **NEW PEDESTRIAN BRIDGE DESIGN RECOMMENDATIONS**
Verdugo Woodlands Elementary School - Construction of 1-2-Story C.R. Building D, 3 Shade Structures (PC 02-112014), & Site Work
1751 North Verdugo Road, Glendale, CA

Reference: Ninyo and Moore, Geotechnical Evaluation, Verdugo Woodlands Elementary School, Glendale, CA, dated December 23, 2011, Project No. 208465001.

Dear Mr. Holmquist:

In accordance with your request, we have completed our geotechnical investigation for the proposed new pedestrian bridge at Verdugo Woodlands Elementary School. The purpose of our investigation is to provide additional geotechnical design parameters for the design and construction of the new bridge.

The scope of our Geotechnical services included the following:

- Review of geologic, seismic, ground water and geotechnical literature.
- Logging, sampling and backfilling of 2 exploratory borings drilled with an 8" hollow stem auger drill rig to maximum depth of 50 feet below existing grade.
- Laboratory testing of representative samples
- Geotechnical engineering review of data
- Preparation of this report summarizing our findings and presenting our conclusions and recommendations for the proposed construction.

Project Description

It is our understanding, based on our review of the conceptual site plan provided by NAC Architects, that a new pedestrian walkway bridge, approximately 8' wide and spanning over 100' across the existing Verdugo Wash drainage channel, is planned to be constructed to join the playground area and main campus of Verdugo Woodlands Elementary School.

Currently a new classroom building is being constructed on the main campus south of an existing pedestrian walkway bridge. According to the Project Structural Engineer, estimated loads for the new bridge are on the order of 100 kips for dead loads and 100 kips for live loads. Lateral loads are anticipated to be 35 kips on the foundation system due to seismic and wind loads.

Site Description

The project is located on the existing campus of Verdugo Woodlands Elementary School, located in the City of Glendale, County of Los Angeles, CA. The campus is bordered by Verdugo Road along the east, and residential properties along the north and south. The main campus and playground with temporary classrooms are divided by the existing concrete-lined Verdugo Wash drainage channel. The accompanying Boring Location Map (Figure 2) shows the approximate location of the site.

Topographically, the location of the proposed building is essentially planar, sloping gently to the south at about a 1 to 2 percent grade. Existing elevations within the proposed pedestrian bridge abutments are on order of 825 to 826 feet above sea level.

Subsurface Soil Conditions

In general, the site is underlain by artificial fills and native alluvial soils. The fills, where present, generally consists of a light brown silty fine to medium grained sand with gravels. The underlying alluvial soils generally consist of interbedded layers of coarse grained sands to silty sands with traces of gravel and cobbles. The alluvium is generally in a moist and dense condition.

Groundwater Conditions

According to the California Division of Mines and Geology (1998), historic high groundwater levels in the immediate site vicinity are shown to be on the order of 20 feet below surface elevations. At the time of our field investigation, groundwater was encountered in Boring 1 at a depth of 40 feet below existing ground surface at the time of drilling.

Laboratory Testing

Laboratory tests were performed on representative samples to verify the field classification of the recovered samples and to determine the geotechnical properties of the subsurface materials. All laboratory tests were performed in general conformance with ASTM or Caltrans Standard Test Methods. The results of our laboratory tests are presented in Appendix B of this report.

Conclusions

Based on the findings of our investigation, it is our opinion that the site is suitable for the proposed construction provided our recommendations are taken into consideration during design and construction. In addition, all other recommendations contained within the referenced project geotechnical investigation report by Ninyo & Moore, should be implemented except as modified in this report.

Earthquake Accelerations and Seismic Design Parameters

The USGS Seismic Design Maps application was used to calculate the CBC site specific design parameters as required by the 2016 California Building Code. Based upon the subsurface data, the site can be classified as Site Class D. The spectral acceleration values for 0.2 second and 1 second periods obtained from the computer program and in accordance with the 2016 California Building Code are tabulated below.

SEISMIC DESIGN PARAMETERS

Seismic Design Parameters	CBC Design Values
Site Class	D
Mapped Short Period (0.2 sec) Spectral Response Acceleration, S_S	2.848g
Mapped 1-Secion Spectral Response Acceleration, S_1	0.992g
Site Coefficient from Table 1613.5.3(1), F_a	1.0
Site Coefficient from Table 1613.5.3(2), F_v	1.5
MCE 0.2-Second Period Spectral Response Acceleration, S_{MS}	2.848g
MCE 1-Second Period Spectral Response Acceleration, S_{M1}	1.488g
Design Spectral Response Acceleration for Short Period, S_{DS}	1.899g
Design Spectral Response S_{D1}	0.992g

Conventional Foundations

The proposed pedestrian bridge may be supported by continuous footings having a minimum width of 18 inches and a minimum depth of 24 inches. The footing areas should be undercut, moistened, and compacted as necessary to produce soils compacted to a minimum of 90% relative compaction to a minimum depth of 2 feet below the bottom of the footings. Footing areas shall be defined as the area extending from the edge of the footing for a distance of 2 feet. Total settlement is estimated to be up to 1 inch with differential settlements on the order of ½ an inch across 40 feet.

Footings may be designed using an allowable bearing capacity of 2,500 pounds per square foot (psf). The allowable bearing capacity may be increased by one-third when considering loads of short duration such as wind or seismic forces. Nominal reinforcement consisting of two #5 bars placed within 3 inches of the top of footings and two #5 bars placed within 3 inches of the bottom of footings are recommended. However, the structural engineer may require heavier reinforcement.

Soil resistance developed against lateral structural movement may be obtained from a passive pressure value of 300 psf/ft to a maximum value of 3,000 psf. For sliding resistance, a friction coefficient of 0.35 may be used at the concrete and soil interface. The passive pressure and the friction of resistance may be combined without reduction. In addition, the lateral passive resistance is taken into account only if it is ensured that the soil against embedded structures will remain intact with time.

In order to prevent possible interference with the existing concrete lined drainage channel walls, a minimum horizontal setback distance of 15 feet from the edge of the channel is recommended for all footings.

Drilled Cast In Place Piles

Alternatively, the proposed pedestrian bridge may be supported on drilled cast in-place concrete pile foundations. Special care should be taken during construction to stabilize the sides of the CIDH piles, as required. Typical CIDH pile design and construction recommendations are applicable for this project.

The proposed bridge may be supported on 24-inch or 30-inch diameter CIDH piles. The bottom of the pile cap is assumed to be at a depth of three (3) feet. The allowable pile capacities are as follows.

ALLOWABLE AXIAL PILE CAPACITIES

CIDH Pile Diameter (in)	Design Pile Length (ft)	Allowable Vertical Capacity (kips)
24	15	50
	20	82
	25	120
	30	161
30	15	62
	20	103
	25	150
	30	201

A factor of safety of 2.0 for side friction was applied to compute the allowable capacities. No end bearing capacity is recommended. These capacities may be increased by one-third when considering seismic or short term, temporary loads. A minimum depth of 15 feet below the base of the pile cap is recommended for all piles.

For pile groups where support is being transferred to a group of piles, the pile spacing and efficiency reduction factors shall be in accordance with Figure 3. All piles shall be adequately reinforced and structurally tied into pile caps as recommended by the structural engineer.

The allowable lateral bearing pressure to be utilized for design purposes should be 300 psf/ft. The upper three feet of soil should be neglected for lateral resistance determination. The lateral bearing pressure may be increased for each additional foot of depth to a maximum value of 3,000 psf. For sliding resistance, a friction coefficient of 0.35 may be used at the concrete and soil interface.

The passive resistance of the pile cap and lateral capacity of the piles may be combined without reduction provided there is a center-to-center spacing of at least 3 pile widths in an orientation normal to the loading and center-to-center spacing of at least 8 pile widths in an orientation parallel to the loading direction. At a center-to-center spacing of three pile widths parallel to the direction of loading, the lateral capacity should be reduced by 50 percent. Interpolation may be used for center-to-center spacing between 3 and 8 pile widths.

If the piles are not adversely affected by a maximum ½" deflection at the ground surface due to short-term seismic lateral loads, the piles may be designed using lateral bearing pressures equal to two times the provided values.

In order to prevent possible interference with the existing concrete lined drainage channel foundations, a minimum horizontal distance of 15 feet from the edge of the channel is recommended for all piles.

Corrositivity

Soluble sulfate tests indicate that concrete at the subject site will have a negligle exposure to water soluble sulfate in the soil. Corrositivity testing consisting of soils reactivity (pH) and resistivity (ohms-cm) were also tested on representative soils. The test results indicate that the soils have a soil reactivity ranging from 6.6 to 6.9 and a resistivity ranging from 9,800 to 10,000 ohms-cm. A neutral or non-corrosive soil has a reactivity value ranging from 5.5 to 8.4. Generally, soils that could be considered corrosive to metal have resistivities less than 3,000 ohms. Those soils with resistivity values of less than 1000 ohms-cm can be considered extremely corrosive.

Based on our test results, it is our opinion that the underlying soils at the site have a low corrosion potential.

Closure

This report comprises a statement of professional opinion. That opinion is based on information and data obtained from a field investigation, laboratory testing of representative materials, and a geotechnical evaluation of the compiled data. This report does not constitute a guarantee or warranty of any type and none should be inferred.

We appreciate this opportunity to be of continued service to you. Should you have any questions regarding the information contained herein, please contact us at your earliest convenience.

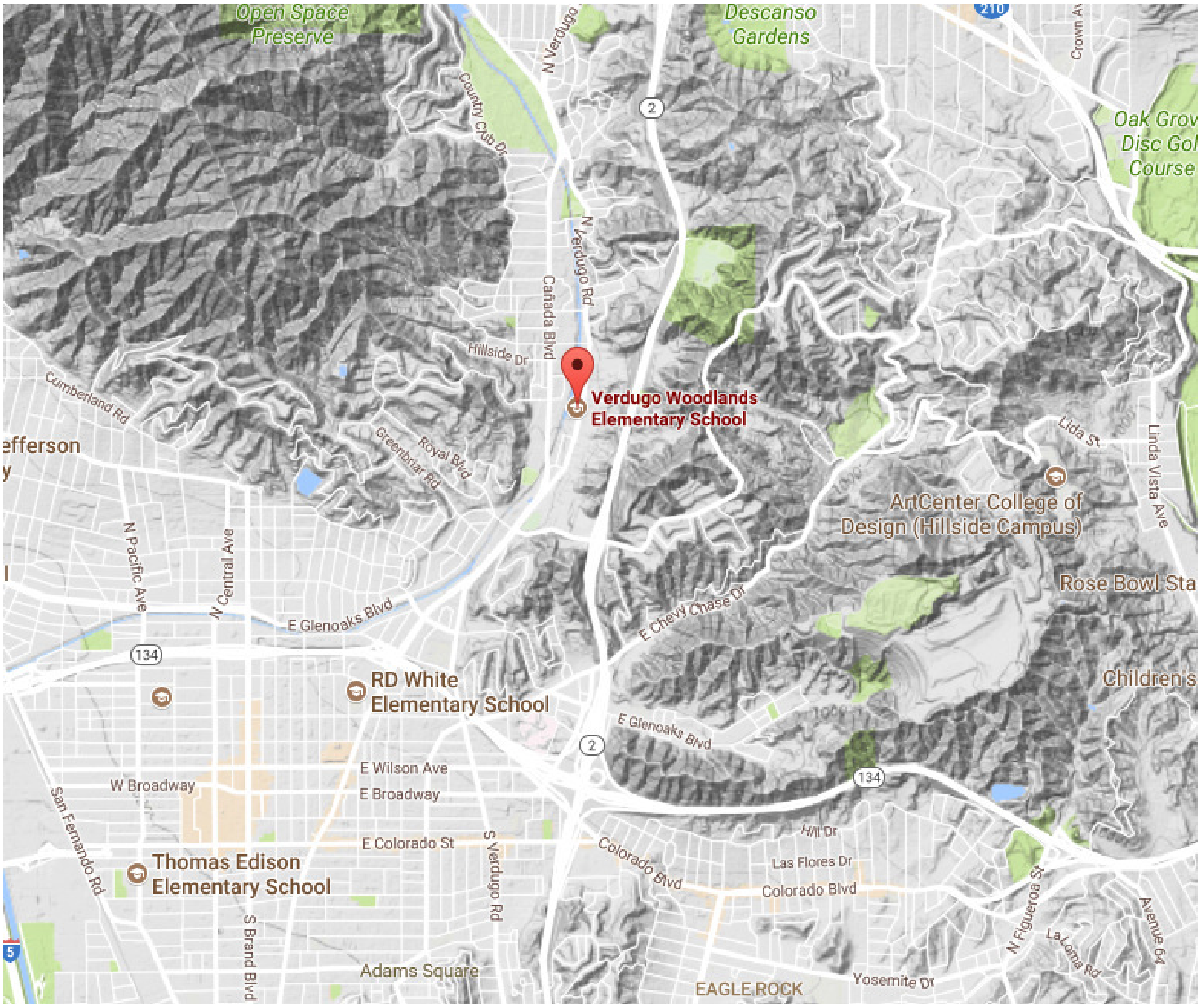
Respectfully Submitted,

MTG$_L$, Inc.

Isaac B. Chun, P.E., G.E.
Vice President | Engineering Manager

REGISTERED PROFESSIONAL ENGINEER
ISAAC B. CHUN
No. 2649
EXP. 12/31/17
GEOTECHNICAL
STATE OF CALIFORNIA

FIGURES

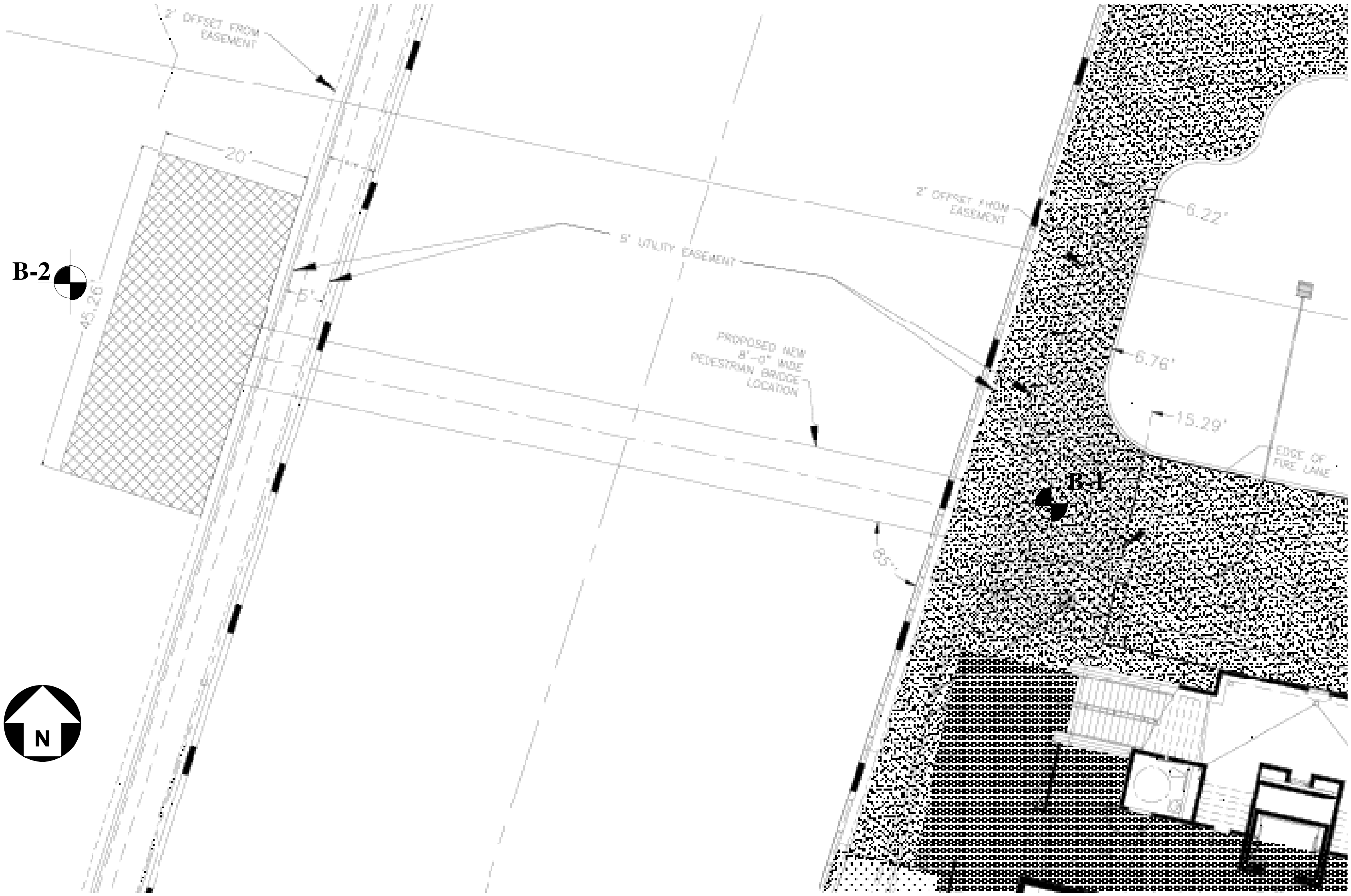


Base Map: Google Earth

SITE LOCATION MAP

Not to Scale

Figure 1



Base Map: NAC Architecture

B-N - Approximate Boring Location

BORING LOCATION MAP

Not to Scale

Figure 2

PILE GROUP

EFFICIENCY REDUCTION FACTORS

Spacing	2 Piles	4 Piles	6 Piles	9 Piles	12 Piles	16 Piles
1D	75%	50%	42%	33%	29%	25%
2D	85%	70%	66%	60%	58%	56%
3D	90%	80%	76%	73%	71%	69%
4D	93%	85%	82%	79%	78%	77%
5D	96%	87%	85%	83%	82%	81%
6D	100%	90%	88%	86%	85%	84%

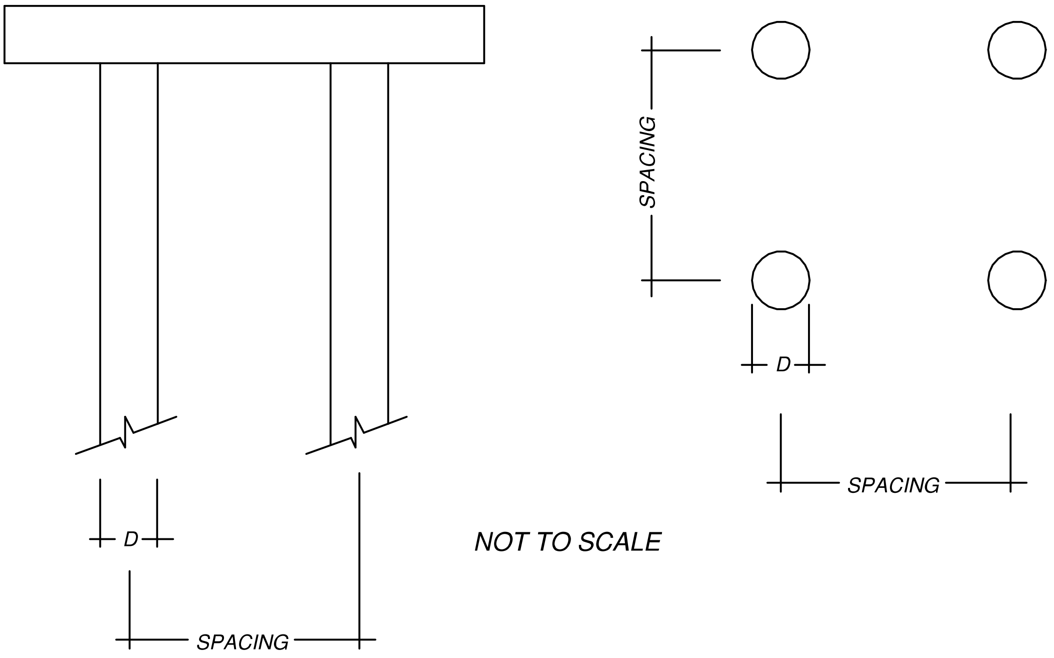


Figure 3

APPENDIX A

FIELD INVESTIGATION

APPENDIX A

FIELD EXPLORATION PROGRAM

The subsurface conditions for this Geotechnical Investigation were explored by excavating exploratory borings with an 8-inch hollow-stem-auger to a maximum depth of 50 feet below existing grade. All drive samples were obtained by SPT or California Tube Sampler. The approximate locations of the borings are shown on the Boring Location Plan (Figure 2). The field exploration was performed under the supervision of our Geotechnical Engineer who maintained a continuous log of the subsurface soils encountered and obtained samples for laboratory testing.

Subsurface conditions are summarized on the accompanying Logs of Borings. The logs contain factual information and interpretation of subsurface conditions between samples. The stratum indicated on these logs represents the approximate boundary between earth units and the transition may be gradual. The logs show subsurface conditions at the dates and locations indicated, and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend indicating the symbols and definitions used in this classification system and a legend defining the terms used in describing the relative compaction, consistency or firmness of the soil are attached in this appendix. Bag samples of the major earth units were obtained for laboratory inspection and testing, and the in-place density of the various strata encountered in the exploration was determined

The exploratory borings were located in the field by using cultural features depicted on a preliminary site plan provided by the client. Each location should be considered accurate only to the scale and detail of the plan utilized.

The exploratory borings were backfilled with native soil cuttings or cement slurry, compacted, and patched where appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM					
No. 200 U.S. Standard Sieve is the smallest particle visible	Coarse-grained soils >1/2 of materials is larger than #200 sieve	GRAVELS are more than half of coarse fraction larger than #4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
			Gravels with fines	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		SANDS are more than half of coarse fraction larger than #4 sieve	Clean Sands (less than 5% fines)	GM	Silty Gravels, poorly-graded gravel-sand-silt mixtures
			Sands with fines	GC	Clayey Gravels, poorly-graded gravel-sand-clay mixtures
	Fine-grained Soils >1/2 of materials is smaller than #200 sieve	SILTS AND CLAYS Liquid Limit Less than 50		SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly-graded sands, gravelly sands, little or no fines
				SM	Silty Sands, poorly-graded sands-gravel-clay mixtures
				SC	Clayey Sands, poorly-graded sand-gravel-silt mixtures
				ML	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
		SILTS AND CLAYS Liquid Limit Greater than 50		CL	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
				OL	Organic silts and clays of low plasticity
				MH	Inorganic silts, micaceous or diatomaceous fine sands or silts
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic silts and clays of medium to high plasticity
Highly Organic Soils				PT	Peat, humus swamp soils with high organic content

GRAIN SIZE				
Description		Sieve Size	Grain Size	Approximate Size
Boulders		>12”	>12”	Larger than basketball-sized
Cobbles		3”- 12”	3”- 12”	Fist-sized to basketball-sized
Gravel	Coarse	¾”- 3”	¾”- 3”	Thumb-sized
	Fine	#4 - ¾”	0.19” - 0.75”	Peat-sized to thumb-sized
Sand	Coarse	#10 - #4	0.079” - 0.19”	Rock salt-sized to pea-sized
	Medium	#40 - #10	0.017” - 0.079”	Sugar-sized to rock salt-sized
	Fine	#200 - #40	0.0029” - 0.017”	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029”	Flour-sized or smaller

SIZE PROPORTION
Trace – Less than 5%
Few – 5% to 10%
Little – 15% to 20%
Some – 30% to 45%
Mostly – 50% to 100%
MOISTURE CONTENT
Dry – Absence of moisture
Moist – Damp but not visible
Wet – Visible free water

CONSISTENCY FINE GRAINED SOILS			RELATIVE DENSITY COARSE GRAINED SOILS		
Apparent Density	**SPT (Blows/Foot)**	**Mod CA Sampler (Blows/Foot)**	**Apparent Density**	**SPT (Blows/Foot)**	**Mod CA Sampler (Blows/Foot)**
Very Soft	<2	<3	Very Loose	<4	<5
Soft	2-4	3-6	Loose	4-10	5-12
Firm	5-8	7-12	Medium Dense	11-30	13-35
Stiff	9-15	13-25	Dense	31-50	36-60
Very Stiff	16-30	26-50	Very Dense	>50	>60
Hard	>30	>50			

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Exploratory Boring Log

Boring No. B-1

Project: Verdugo Woodlands ES Bridge
Equipment: 8" H.S.A. Date: 9/9/17
Drive Wt: 140 lbs / Drop 30"
Logged by: IC Project No.: 1047D35

Sheet 1 of 2
Elevation: 825 ft
Latitude: 34.1738°
Longitude: -118.2272°

DESCRIPTION OF SUBSURFACE MATERIALS

This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log shows subsurface conditions at the date and location indicated, and may not be representative of the subsurface conditions at other locations and times

▨ - Bulk Sample ☒ - CA Sampler ◫ - SPT Sampler ▽ - Groundwater

Depth (ft.)	Graphic Symbol	U.S.C.S.	DESCRIPTION OF SUBSURFACE MATERIALS	Samples: Sample Type	Samples: Bulk Sample	Samples: Blows /Foot	Dry Density, (pcf)	Moisture Content %
		SM	ARTIFICIAL FILL (af) - Brown SILTY fine to medium grained SAND, moist, very dense					
		SM	Light brown SILTY fine to medium grained SAND with gravel, moist, medium dense	☒		50/5"		1.6
5		SM	ALLUVIUM (Qal) - Brown SILTY fine to coarse grained SAND with some gravel, moist, medium dense	☒	▨	12	104.6	10.8
10		SP	Yellow brown fine to coarse grained SAND, moist, medium dense	☒		30	114.0	2.3
15		SM/ SP	Gray brown SILTY fine to coarse grained SAND to SAND with gravel and some cobbles, moist, very dense	◫		81		3.5
			Increase in gravel and cobbles					
20		SM	Brown SILTY fine to medium grained SAND with some coarse grained sand particles, with gravel and cobbles up to 3 inches, moist, very dense	◫		60/6"		3.2
25		SM	Dark brown to reddish brown SILTY fine to medium grained SAND with trace of clay and gravels, moist, dense	◫		40		17.2

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▨ - Bulk Sample ☒ - CA Sampler ◫ - SPT Sampler ▽ - Groundwater

Depth (ft.)	Graphic Symbol	U.S.C.S.	DESCRIPTION OF SUBSURFACE MATERIALS	Samples: Sample Type	Samples: Bulk Sample	Samples: Blows /Foot	Dry Density, (pcf)	Moisture Content %
		SM	Dark brown to reddish brown SILTY fine to medium grained SAND with trace of clay and gravels, moist, dense	◫		40		17.2
30		SC	Dark brown CLAYEY fine to medium grained SAND with silt, moist, dense	◫		42		25.2
35		SP	Reddish brown fine to coarse grained SAND, moist, very dense	◫		60/4"		4.8
40		▽	Groundwater level at 40' after drilling (10:07 a.m.) Reddish brown fine to coarse grained SAND, very moist, very dense	◫		50/6"		14.6
			Groundwater encountered at 44' during drilling (9:31 a.m.)					
45		SW	Reddish brown fine to coarse grained SAND, saturated, dense, well graded	◫		44		24.4
		SW	Reddish brown fine to coarse grained SAND, saturated, dense, well graded					
				◫		43		15.0
50			End of boring at 50 feet. Groundwater encountered at 44' during drilling and measured at 40' after drilling. Boring backfilled with cement slurry on 9/9/17					

Geotechnical Engineering
Construction Inspection
Materials Testing
Environmental

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Exploratory Boring Log

Boring No. B-2

Project:	Verdugo Woodlands ES Bridge	Sheet 1 of 2	
Equipment:	8" H.S.A. Date: 9/9/17	Elevation:	826 ft
Drive Wt:	140 lbs / Drop 30"	Latitude:	34.1739°
Logged by:	IC Project No.: 1047D35	Longitude:	-118.2277°

DESCRIPTION OF SUBSURFACE MATERIALS

This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log shows subsurface conditions at the date and location indicated, and may not be representative of the subsurface conditions at other locations and times

▨ - Bulk Sample ☒ - CA Sampler ◫ - SPT Sampler ▽ - Groundwater

Depth (ft.)	U.S.C.S.	Description of Subsurface Materials	Samples: Sample Type	Samples: Bulk Sample	Samples: Blows /Foot	Dry Density, (pcf)	Moisture Content %
0	SM	8" Asphalt over native soils (Hand augered from 0-5 feet) ALLUVIUM (Qal) - Light brown SILTY fine to medium grained SAND with some gravels, dry					
5	SM	Brown SILTY fine to medium grained SAND with gravel, dry, medium dense	☒		20	108.9	1.6
10	SP	Yellow brown fine to coarse grained SAND with some silt and gravels, moist, very dense	☒	▨	77/ 11"		1.9
15	SM/ SP	Grayish brown SILTY fine to medium grained SAND to SAND, with some gravels, moist, very dense	◫		50/6"		3.0
20	SM	Brown SILTY fine to medium grained SAND with gravel, moist, very dense	◫		79/9"		2.5
		Increase in gravel content					
25		Brown SILTY fine to medium grained SAND with gravel, moist, very dense	◫		78/ 11"		2.0

Geotechnical Engineering
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Exploratory Boring Log

Boring No. B-2

Project: Verdugo Woodlands ES Bridge
Equipment: 8" H.S.A. Date: 9/9/17
Drive Wt: 140 lbs / Drop 30"
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Sheet 2 of 2
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▨ - Bulk Sample ☒ - CA Sampler ◫ - SPT Sampler ▽ - Groundwater

Depth (ft.)	Graphic Symbol	U.S.C.S.	Description of Subsurface Materials	Sample Type	Bulk Sample	Blows /Foot	Dry Density, (pcf)	Moisture Content %
		SM	Brown SILTY fine to medium grained SAND with gravel, moist, very dense	◫		78/ 11"		2.0
		SM	Brown SILTY fine to medium grained SAND with some coarse grained sand particles and gravels, moist, very dense	◫		50/6"		3.6
30			End of boring at 30 feet. No groundwater encountered during drilling. Boring backfilled with soil cuttings on 9/9/17.					
35								
40								
45								
50								

APPENDIX B

LABORATORY ANALYSIS

APPENDIX B

LABORATORY TESTING PROCEDURES

1. Classification

   Soils were classified visually, generally according to the Unified Soil Classification System. Classification tests were also completed on representative samples in accordance with ASTM C136/C117 for Grain Size. The test results are attached to this appendix.

2. Maximum Density

   Maximum density tests were performed on a representative bag sample of the near surface soils in accordance with ASTM D1557.

3. Direct Shear

   Direct Shear Tests were performed on in-place samples of site soils in accordance with ASTM D3080.

4. Expansion Index

   Expansion Index testing was completed in accordance with the standard test method ASTM D4829. Test results are presented below.

Sample Location	Expansion Index (EI)	Expansion Classification
B-1 @ 5-10 ft	0	Very Low

5. Corrosion

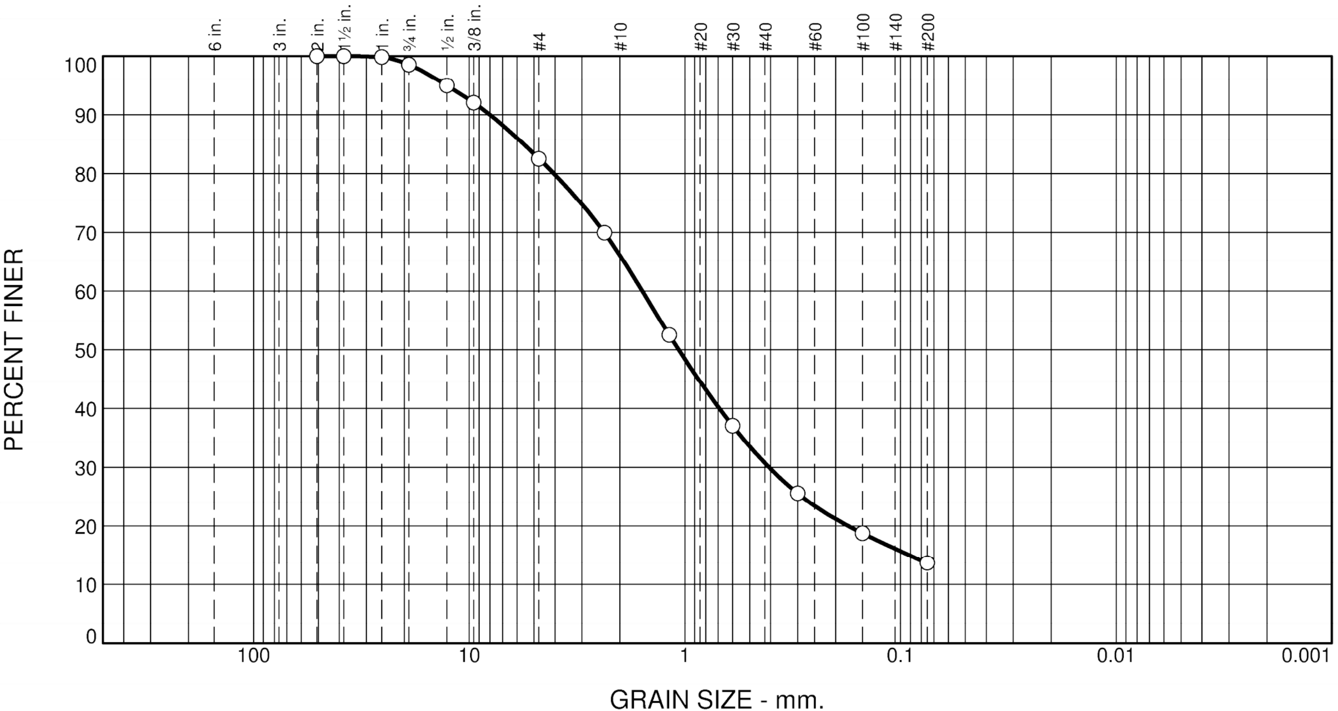
   Chemical testing was performed on representative samples to determine the corrosion potential of the onsite soils. Testing consisted of pH, chlorides (CTM 422), soluble sulfates (CTM 417), and resistivity (CTM 643).

6. Sand Equivalence

   The sand equivalence of representative soils was determined using the standard test methods of the American Society for Testing and Materials (ASTM D2419). Test results are presented below.

Sample Location	Sand Equivalence
B-1 @ 5-10 ft	36
B-2 @ 10-15 ft	43

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	1	16	17	35	17	14	

Test Results (ASTM C 136 & ASTM C 117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.0	100		
1.5	100		
1	100		
3/4	99		
1/2	95		
3/8	92		
#4	83		
#8	70		
#16	53		
#30	37		
#50	26		
#100	19		
#200	14		

* (no specification provided)

Material Description

(SM) SILTY SAND WITH GRAVEL

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= (SM) **AASHTO (M 145)=**

Coefficients

D_{90}= 8.0119	D_{85}= 5.5951	D_{60}= 1.5748
D_{50}= 1.0677	D_{30}= 0.4069	D_{15}= 0.0906
D_{10}=	C_u=	C_c=

Remarks

SAMPLED BY : I.C.

JOB # 1047D35

Date Received: **Date Tested:** 9-12-17

Tested By: RJS

Checked By: CF

Title: LAB MGR

Location: B1 @ 5-10

Sample Number: 985 **Depth:** 5-10

Date Sampled: 9-9-17

MTGL, Inc.

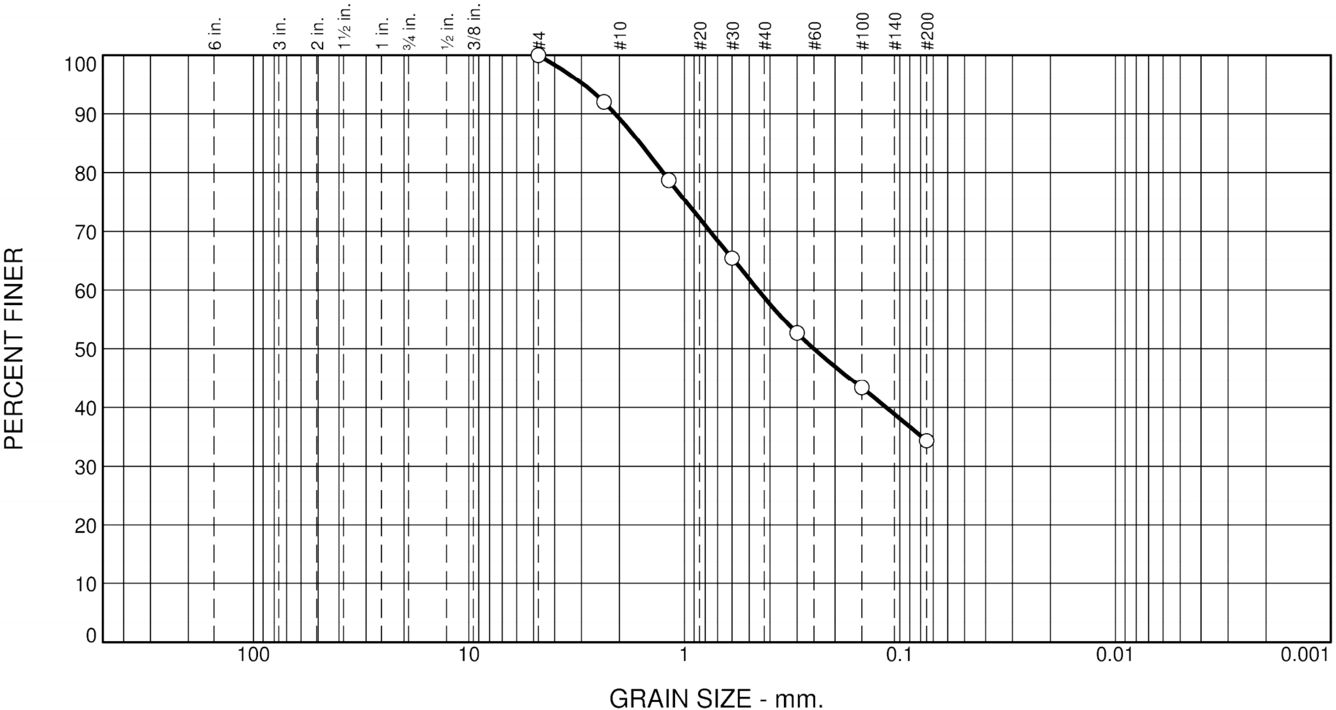
Anaheim, CA

Client: Glendale Unified School District

Project: Verdugo Woodlands Elementary School - New Pedestrian Bridge

Project No: 1047D35

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	11	30	25	34	

Test Results (ASTM C 136 & ASTM C 117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100		
#8	92		
#16	79		
#30	65		
#50	53		
#100	43		
#200	34		

* (no specification provided)

Material Description

SILTY SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= (SM) AASHTO (M 145)=

Coefficients

D_{90}= 2.0912 D_{85}= 1.6036 D_{60}= 0.4540
D_{50}= 0.2508 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

SAMPLED BY: ISSAC C. JOB # 1047D35
F.M.=1.68

Date Received: 9-9-17 **Date Tested:** 9-12-17

Tested By: JM

Checked By: C

Title: LAB MGR

Location: B-1 @ 30
Sample Number: 985 **Depth:** 30

Date Sampled: 9-9-17

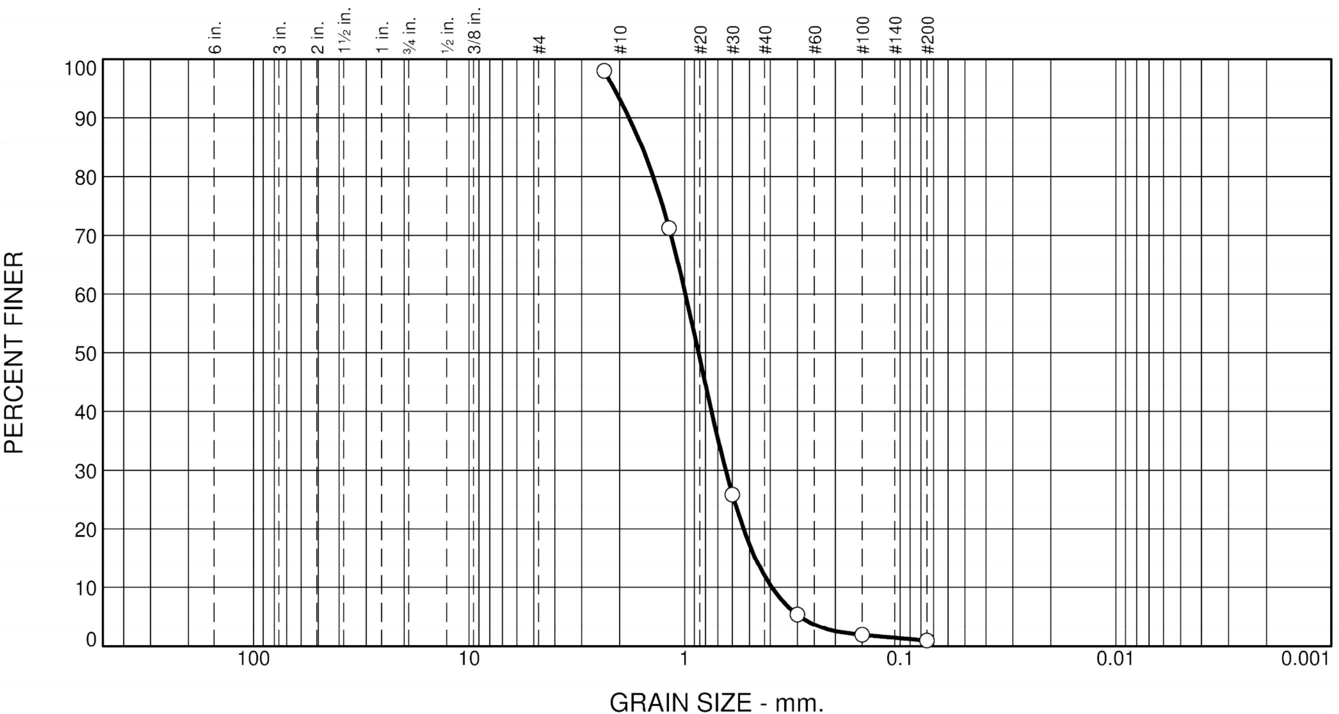
MTGL, Inc.

Anaheim, CA

Client: Glendale Unified School District
Project: Verdugo Woodlands Elementary School - New Pedestrian Bridge

Project No: 1047D35

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
				81	11	1	

Test Results (ASTM C 136 & ASTM C 117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#8	98		
#16	71		
#30	26		
#50	5		
#100	2		
#200	1.0		

* (no specification provided)

Material Description

WELL GRADED SAND WITH SILT

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= (SW-SM) **AASHTO (M 145)=**

Coefficients

D_{90}= 1.8088	D_{85}= 1.5734	D_{60}= 0.9919
D_{50}= 0.8619	D_{30}= 0.6439	D_{15}= 0.4691
D_{10}= 0.3936	C_u= 2.52	C_c= 1.06

Remarks

SAMPLED BY : ISSAC C
F.M.=2.97

Date Received: 9-9-17 **Date Tested:** 9-12-17
Tested By: JM
Checked By: CF
Title: LAB MGR

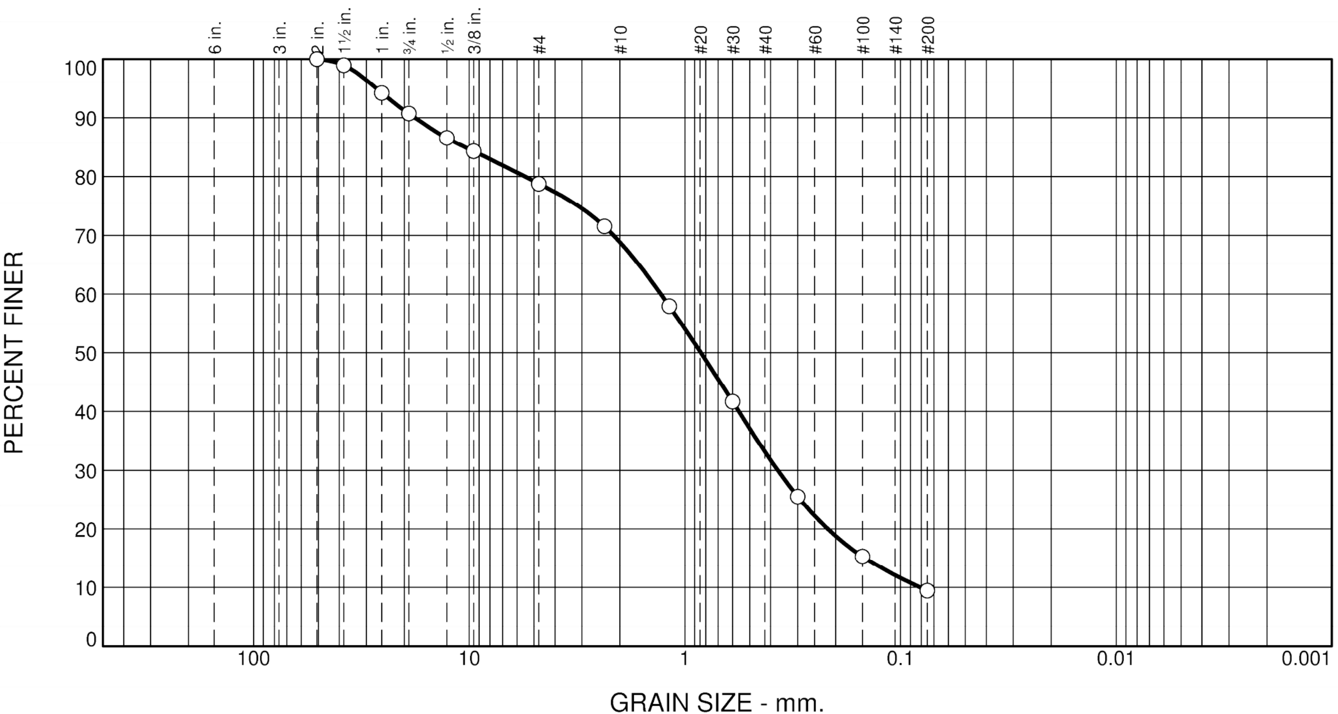
Location: B1 @ 45
Sample Number: 985 **Depth:** 45
Date Sampled: 9-9-17

MTGL, Inc.

Anaheim, CA

Client: Glendale Unified School District
Project: Verdugo Woodlands Elementary School - New Pedestrian Bridge
Project No: 1047D35

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	9	12	10	36	24	9	

Test Results (ASTM C 136 & ASTM C 117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2.0	100		
1.5	99		
1	94		
3/4	91		
1/2	87		
3/8	84		
#4	79		
#8	72		
#16	58		
#30	42		
#50	26		
#100	15		
#200	9.4		

* (no specification provided)

Material Description

WELL GRADED SAND WITH SILT AND GRAVEL

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= (SW-SM) **AASHTO (M 145)=**

Coefficients

D_{90}= 17.8887 D_{85}= 10.4723 D_{60}= 1.2930
D_{50}= 0.8427 D_{30}= 0.3705 D_{15}= 0.1458
D_{10}= 0.0809 C_u= 15.99 C_c= 1.31

Remarks

SAMPLED BY : ISSAC C
F.M.=3.35

Date Received: **Date Tested:** 9-12-17
Tested By: JM
Checked By: CF
Title: LAB MGR

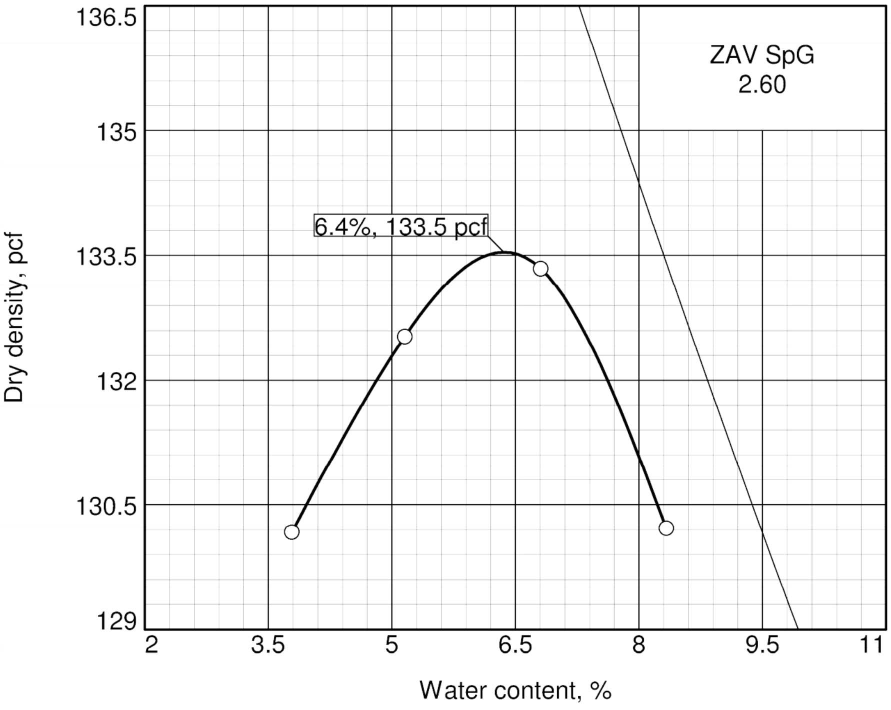
Location: B-2 @ 10-15
Sample Number: 985 **Depth:** 10-15
Date Sampled: 9-9-17

MTGL, Inc.

Anaheim, CA

Client: Glendale Unified School District
Project: Verdugo Woodlands Elementary School - New Pedestrian Bridge
Project No: 1047D35

COMPACTION TEST REPORT



Curve No.
B-1 @ 5-10 ft

Test Specification:
ASTM D 1557-12 Method C Modified

Preparation Method MOIST
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 56
Mold Size 0.075 cu. ft.
Test Performed on Material Passing 3/4 in. **Sieve**

NM ______ **LL** ______ **PI** ______
Sp.G. (ASTM D 854) 2.6
%>3/4 in. ______ **%<No.200** ______
USCS ______ **AASHTO** ______
Date Sampled 9-9-17
Date Tested 9-12-17
Tested By JM

TESTING DATA

	1	2	3	4	5	6
WM + WS	11108.0	11253.0	11357.0	11311.0		
WM	6512.0	6512.0	6512.0	6512.0		
WW + T #1	361.7	385.3	412.6	310.8		
WD + T #1	348.5	366.4	386.3	286.9		
TARE #1	0.0	0.0	0.0	0.0		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	3.8	5.2	6.8	8.3		
DRY DENSITY	130.2	132.5	133.3	130.2		

TEST RESULTS

Maximum dry density = 133.5 pcf

Optimum moisture = 6.4 %

Material Description

Remarks:
SAMPLED BY : ISAAC C

Project No. 1047D35 **Client:** Glendale Unified School District
Project: Verdugo Woodlands Elementary School - New Pedestrian Bridge

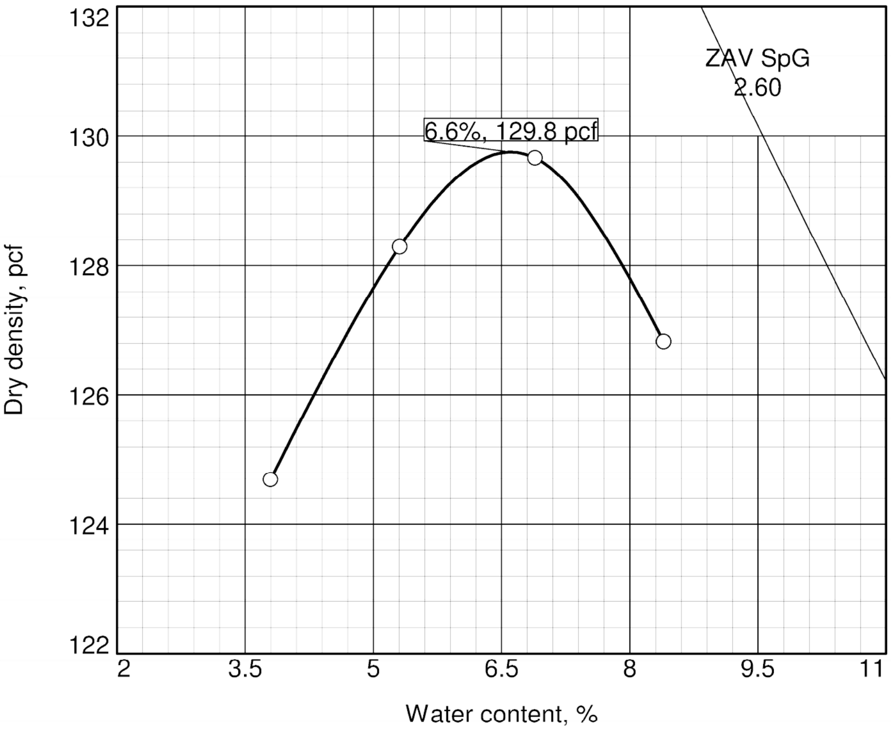
○ **Location:** B1 @ 5-10 **Depth:** 5-10 **Sample Number:** 985

MTGL, Inc.

Anaheim, CA

Checked by: CF
Title: LAB MGR

COMPACTION TEST REPORT



Curve No.
B-2 @ 10-15 ft

Test Specification:
ASTM D 1557-12 Method C Modified

Preparation Method MOIST
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 56
Mold Size 0.075 cu. ft.
Test Performed on Material Passing 3/4 in. **Sieve**

NM ______ **LL** ______ **PI** ______
Sp.G. (ASTM D 854) 2.6
%>3/4 in. ______ **%<No.200** ______
USCS ______ **AASHTO** ______
Date Sampled 9-9-17
Date Tested 9-12-17
Tested By JM

TESTING DATA

	1	2	3	4	5	6
WM + WS	10915.0	11108.0	11227.0	11189.0		
WM	6512.0	6512.0	6512.0	6512.0		
WW + T #1	486.5	422.6	347.5	322.7		
WD + T #1	468.7	401.3	325.1	297.7		
TARE #1	0.0	0.0	0.0	0.0		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	3.8	5.3	6.9	8.4		
DRY DENSITY	124.7	128.3	129.7	126.8		

TEST RESULTS

Maximum dry density = 129.8 pcf

Optimum moisture = 6.6 %

Material Description

Remarks:
SAMPLED BY: ISSAC C

Project No. 1047D35 **Client:** Glendale Unified School District
Project: Verdugo Woodlands Elementary School - New Pedestrian Bridge

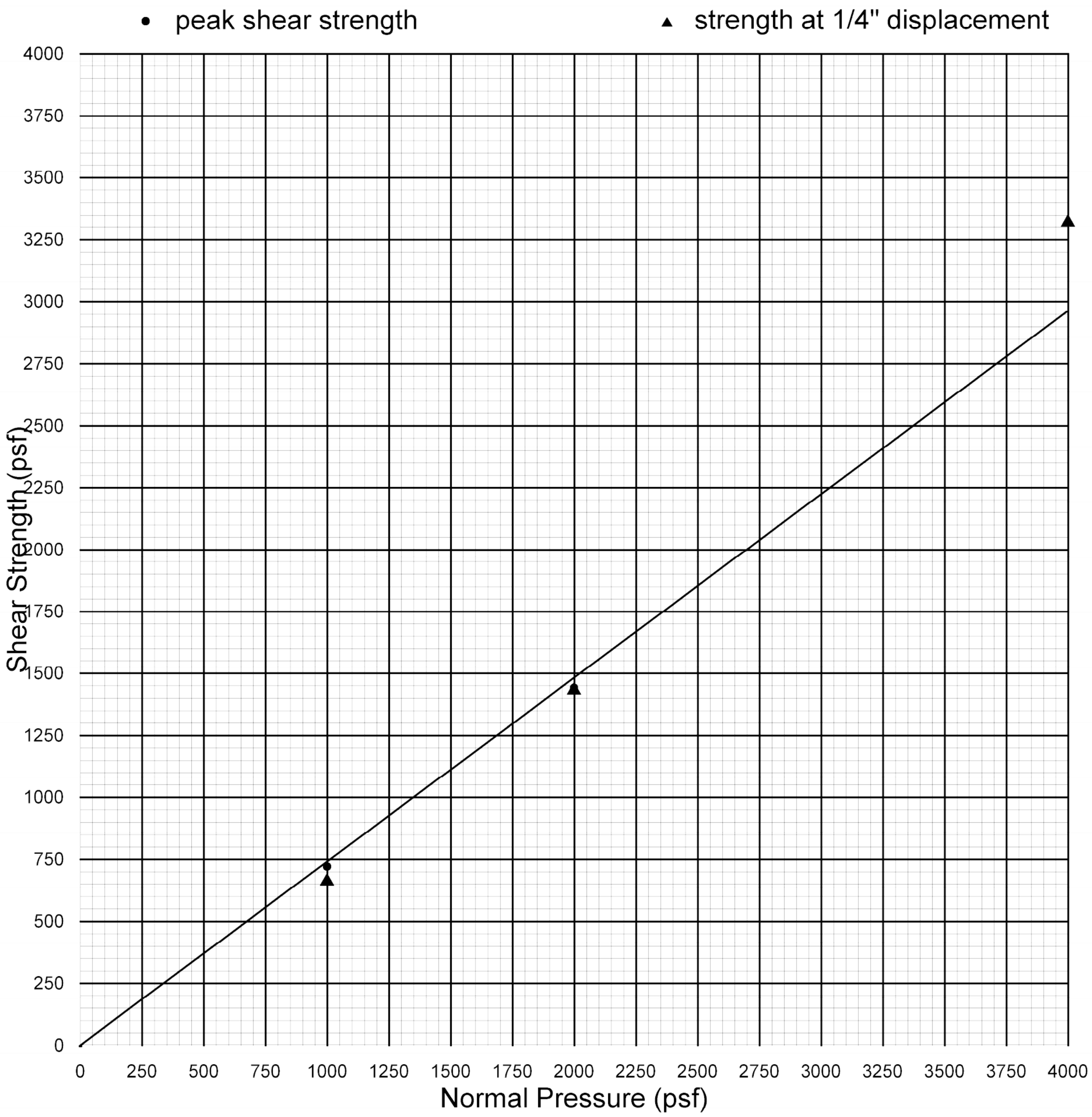
○ **Location:** B2 @ 10-15 **Depth:** 10-15 **Sample Number:** 985

MTGL, Inc.

Anaheim, CA

Checked by: CF
Title: LAB MGR

DIRECT SHEAR TEST - ASTM D-3080

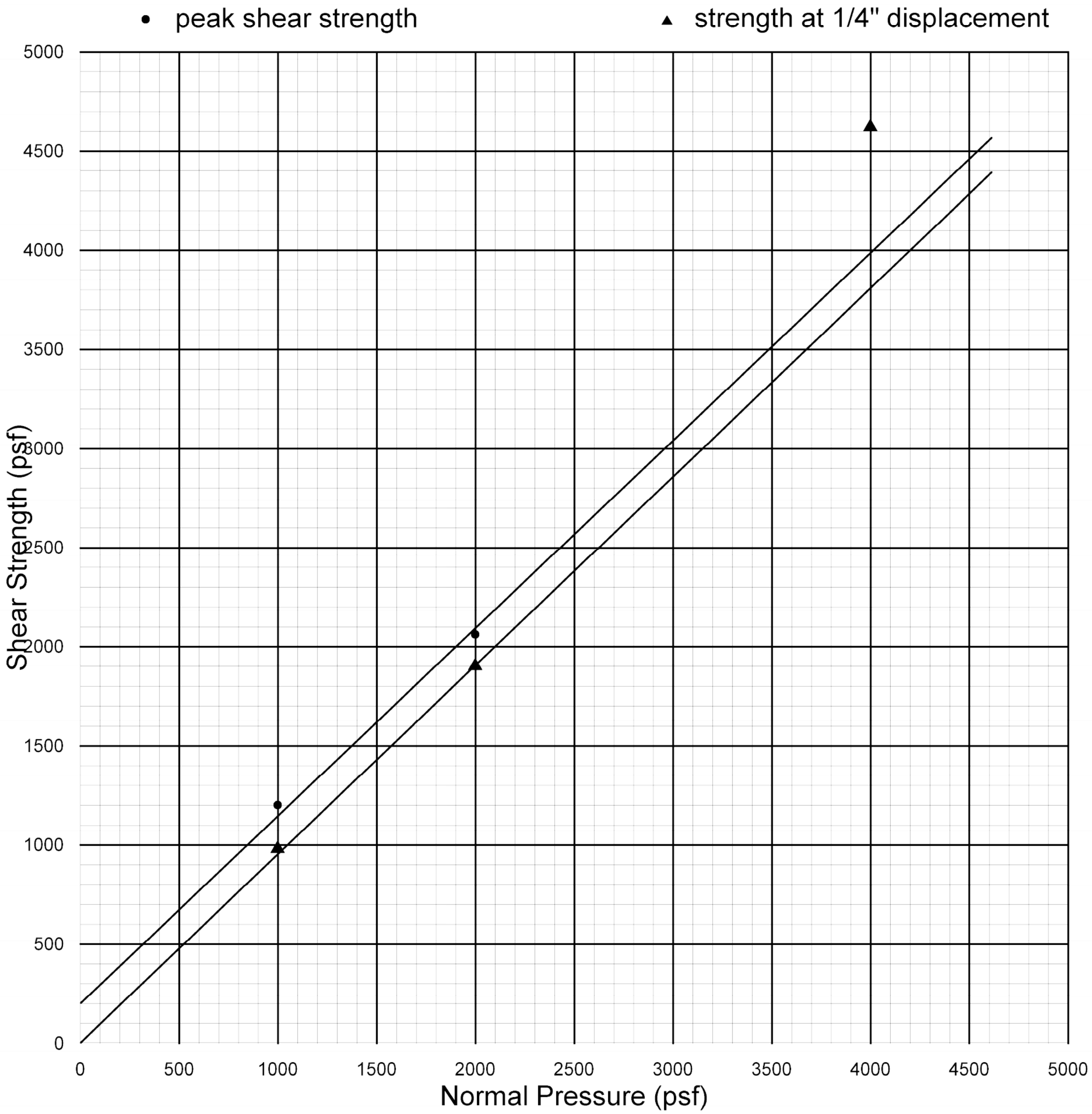


Strain Rate: 0.0084 in. / min.

Sample	**Type**	**Description**	**Dry Density (pcf)**	**Initial W.C. (%)**	**Final W.C. (%)**
B-1 @ 5'	Undisturbed & Saturated	F.M.Silty Sand	104.6	10.8	20.8

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	720 @ 0.0700"	660
2000	1440 @ 0.1255"	1430
4000	3320 @ 0.2500"	3320
	C = 0 psf	C = 0 psf
	ϕ = 36 deg.	ϕ = 36 deg.

DIRECT SHEAR TEST - ASTM D-3080



Strain Rate: 0.0084 in. / min.

Sample	**Type**	**Description**	**Dry Density (pcf)**	**Initial W.C. (%)**	**Final W.C. (%)**
B-1 @ 10'	Undisturbed & Saturated	F.C.Silty Sand w. F. Gravel	114.0	2.3	20.9

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	1200 @ 0.1550"	980
2000	2060 @ 0.1705"	1900
4000	4620 @ 0.2455"	4620
	C = 0 psf	C = 200 psf
	$\phi =$ 43.6 deg.	$\phi =$ 43.6 deg.

ANAHEIM TEST LAB, INC

3008 ORANGE AVENUE
SANTA ANA, CALIFORNIA 92707
PHONE (714) 549-7267

DATE: 09/12/17

MTGL, INC.
2992 LA PALMA AVE. #A
ANAHEIM, CA 92806

P.O. NO: Transmittal

LAB NO: C-0968 1-2

SPECIFICATION: CA-417/422/643

MATERIAL: Soil

PROJECT #: 1047D35

(Lab#985)
Verdugo Woodlands
Elementary School
1751 Verdugo Rd.
Glendale, CA
New Pedestrian Bridge

ANALYTICAL REPORT

CORROSION SERIES

SUMMARY OF DATA

	PH	SOLUBLE SULFATES per CA. 417 ppm	SOLUBLE CHLORIDES per CA. 422 ppm	MIN. RESISTIVITY per CA. 643 ohm-cm
1) B-1 @ 5’-10’ Brown Silty Fine to Coarse sand w/Gravel	6.9	141	55	10,000
2) B-2 @ 10’-15’ Brown Fine to Coarse Sand w/Gravel	6.6	115	48	9,800

RESPECTFULLY SUBMITTED

WES BRIDGER CHEMIST

MTG$_L$

Geotechnical Engineering
Construction Inspection
Materials Testing
Environmental

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Fax: 951.653.4666

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EMPIRE DISPATCH
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SAN DIEGO DISPATCH
888.844.5060

www.mtglinc.com

December 19, 2018

MTG$_L$ Project No.: 1047D35
MTG$_L$ Log No.: 18-3747
MTG$_L$ Branch: Anaheim
DSA File No.: 19-41
DSA Application No.: 03-119567
LEA No.: 44

Glendale Unified School District
349 West Magnolia Avenue
Glendale, California 91204

Attention: Mr. Dan Holmquist, Facilities Project Manager

Subject: **Report Update**
Verdugo Woodlands Elementary School Pedestrian Bridge
1751 North Verdugo Road
Glendale, Los Angeles County, California

Reference: MTG$_L$, Inc., "New Pedestrian Bridge Design Recommendations, Verdugo Woodlands Elementary School, 1751 North Verdugo Road, Glendale, CA", dated October 1, 2017, Project No. 1047D35, Log No. 17-1391

Introduction

In accordance with the request of NAC Architecture, MTG$_L$, Inc. has prepared this report to provide an Update to the referenced Geotechnical Investigation dated October 1, 2017 prepared for the subject site. As discussed in the referenced Geotechnical Investigation dated October 1 2017, plans were (and currently are) to construct a new pedestrian walkway bridge across the existing Verdugo Wash Drainage Channel to join the playground area and main campus of Verdugo Woodlands Elementary School located at 1751 North Verdugo Road, in the City of Glendale, Los Angeles County, California.

Project Review

The referenced report dated October 1, 2017 was prepared and signed by Isaac B. Chun, G. E. 2649, who was the DSA-approved Engineering Manager for the Anaheim office of MTG$_L$, Inc. at the time. Mr. Chun is no longer an employee of MTG$_L$, Inc. Bruce A. Hick, G. E. 2284, the signee for this report, is the new DSA-approved Engineering Manager for the Anaheim office of MTG$_L$, Inc. Mr. Hick will be acting as the responsible Geotechnical Engineer (GE) for this project.

Based upon information supplied by the project structural engineer, estimated loads for the new bridge are on the order of 100 kips for dead loads and 100 kips for liver loads. Lateral loads are anticipated on the foundation system due to seismic and wind loads.

Based upon consultations with project parties, the proposed new bridge is to be supported by 36-inch diameter drilled pier (cast-in-drilled-hole (CIDH)) foundations. Based upon preliminary design criteria, the minimum depth of embedment of the piles is 50 feet below the existing ground surface. Due to agency requirements (United States Army Corps of Engineers and Los Angeles County Flood Control), the upper 16 feet of the subgrade soils cannot be used for support of the CIDH foundations in order to prevent surcharging the flood channel walls. Casing will be installed to separate the pier concrete from the adjacent supporting soils.

Review and Conclusions

Based upon review of the referenced Geotechnical Investigation dated October 1, 2017, and current development plans, it is MTGL, Inc.'s opinion that the findings, conclusions, and recommendations contained within the referenced Geotechnical Investigation remain valid and should be followed and implemented during future project design and construction, except as amended in this report.

Recommendations

Foundation Design Parameters

Based upon review of the referenced Report dated October 1, 2017, the proposed pedestrian bridge may be founded on CIDH pier foundations. Seismic design parameters presented in the "Seismic Design Parameters" Table of the report (page 3) remain applicable for the design of the drilled pier foundations.

The piers should be a minimum of 36 inches in diameter and be embedded a minimum of 50 feet below the existing ground surface. As previously discussed, the upper 16 feet of the subgrade soils cannot be used for support of the CIDH foundations in order to prevent surcharging the flood channel walls. Casing should be installed to separate the pier concrete from the adjacent supporting soils. Allowable axial pile capacities were presented in the "Allowable Axial Pile Capacities" Table of the report (page 4). Interpolation may be provided for 36-inch diameter piers. As stated in the report, no end-bearing capacity is recommended.

Uplift capacity of the pier foundation may be considered equal to 60 percent of the allowable axial capacity between the pier and the surrounding soils (limited to below 16 feet from the existing ground surface), plus the weight of the pier foundation.

The allowable bearing capacity and the allowable resistance of the horizontal forces may be increased by 1/3 for wind, seismic, or other short-term loading.

Per the request of the project structural engineer, lateral capacity of a 36-inch diameter pile was conducted using the computerized "L-Pile" program. A maximum pile deflection of 0.25 inches was used in the analysis. The bending moment and shear forces for both "fixed head" and "free head" pile head conditions were prepared. It is incumbent upon the project structural engineer to determine which pile head condition is applicable. The lateral capacity analysis results are attached to this report.

Provided the piers are spaced a minimum of three diameters apart (measured from the butt), there is no reduction for pier group interaction. All piers shall be adequately reinforced and tied into pile caps as recommended by the structural engineer.

The indicated pier capacities are based upon the strength of the soils. The structural capacity of the pier itself should be verified by the structural engineer. Pier foundation reinforcement should be in accordance with applicable sections of the governing building code and/or requirements of the structural engineer.

Maximum settlement of pier foundations designed and constructed in accordance with the recommendations presented in this report are estimated to be on the order of ½ inch. Differential settlement between similarly loaded and adjacent foundations are expected to be a maximum of approximately ¼ inch across 40 feet, provided footings are founded on similar materials, and designed and constructed in accordance with the recommendations of this report. Settlement of all foundations is expected to occur rapidly and should be essentially complete shortly after initial application of the loads.

Soil Corrosion Potential and Type of Pier Concrete

Laboratory test results included in the referenced Report indicate that the subsurface soils have "negligible" soluble sulfate contents, low chloride contents, and a "low" corrosion potential to buried ferrous metal. Consequently, Type II/V cement with a maximum water-cement ratio of 0.50 and minimum compressive strength of 3,500 psi should be used for concrete in contact with onsite soils.

Construction Considerations

The site is suitable for drilling for CIDH pier foundations. Based upon review of the referenced Report, groundwater was encountered at a depth of approximately 40 feet below the existing ground surface. In addition, clean sands with gravel were encountered at various depths below the existing ground surface. The contractor should anticipate the need of appropriate measures (such as slurry, polymer or steel casing) to prevent caving, if it occurs, during drilling, reinforcement placement, and concrete placement.

The adequacy of CIDH piers will depend heavily on construction methods and procedures. Large zones of disturbance around CIDH piers can lead to lower skin friction due to excessive stress relief around the length of the piers. The piers should be constructed by qualified contractors experienced in this type of construction and be monitored on a full-time basis during construction by the geotechnical consultant. Piers should be constructed within two (2) percent of plumb.

All piers should have concrete placed on the day of drilling: no pier hole should be kept open overnight. The concrete for the CIDH piers should be placed using a down-hole tremie to limit the concrete from striking the sides of the drilled shafts. Once concrete pumping has begun, a minimum head of five (5) feet of concrete above the bottom of the tremie should be maintained throughout the concrete placement. If steel casing is used, the casing must be removed slowly with the minimum concrete head maintained to prevent caving and necking of the pier. The pier concrete mix used must be capable of disseminating around the reinforcing bars and in contact with the soils without arching during extraction of the casing.

Closure

This report is intended to be made a part of, and incorporated with, the referenced report dated October 1, 2017. All other findings, conclusions, and recommendations contained within the referenced report, except as amended in this report, remain valid and should be implemented during design and construction.

MTG$_L$, Inc. appreciates this opportunity to be of continued service to you on this project. Should you have any questions regarding the information contained herein, please contact us at your earliest convenience.

Respectfully Submitted,
MTG$_L$, Inc.

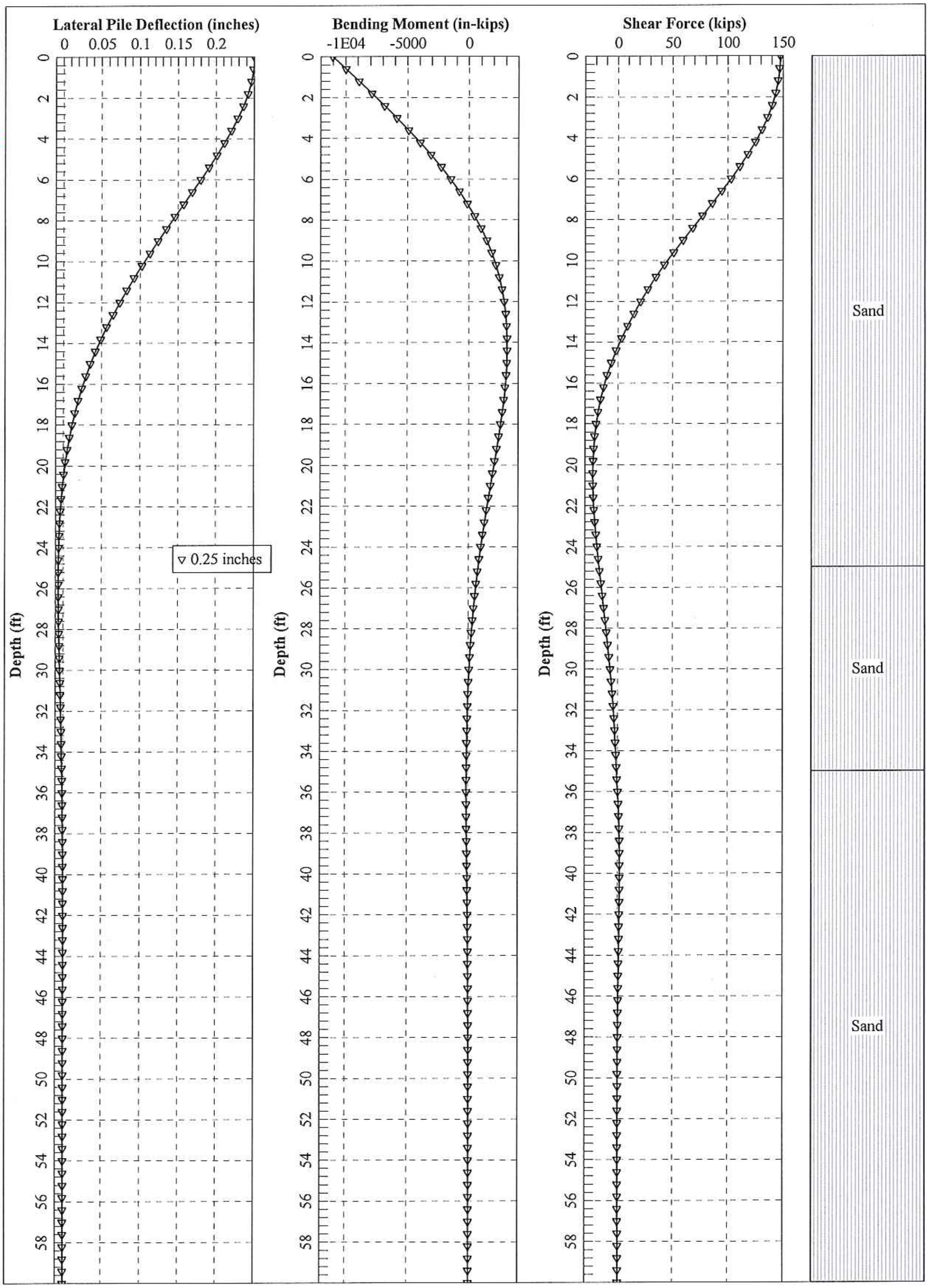
REGISTERED PROFESSIONAL ENGINEER
BRUCE A. HICK
No. GE2284
Exp. 12/31/18
GEOTECHNICAL
STATE OF CALIFORNIA

Bruce A. Hick, P.E., G.E.
Vice President | Engineering Manager

Attachments: "L"-Pile Analysis

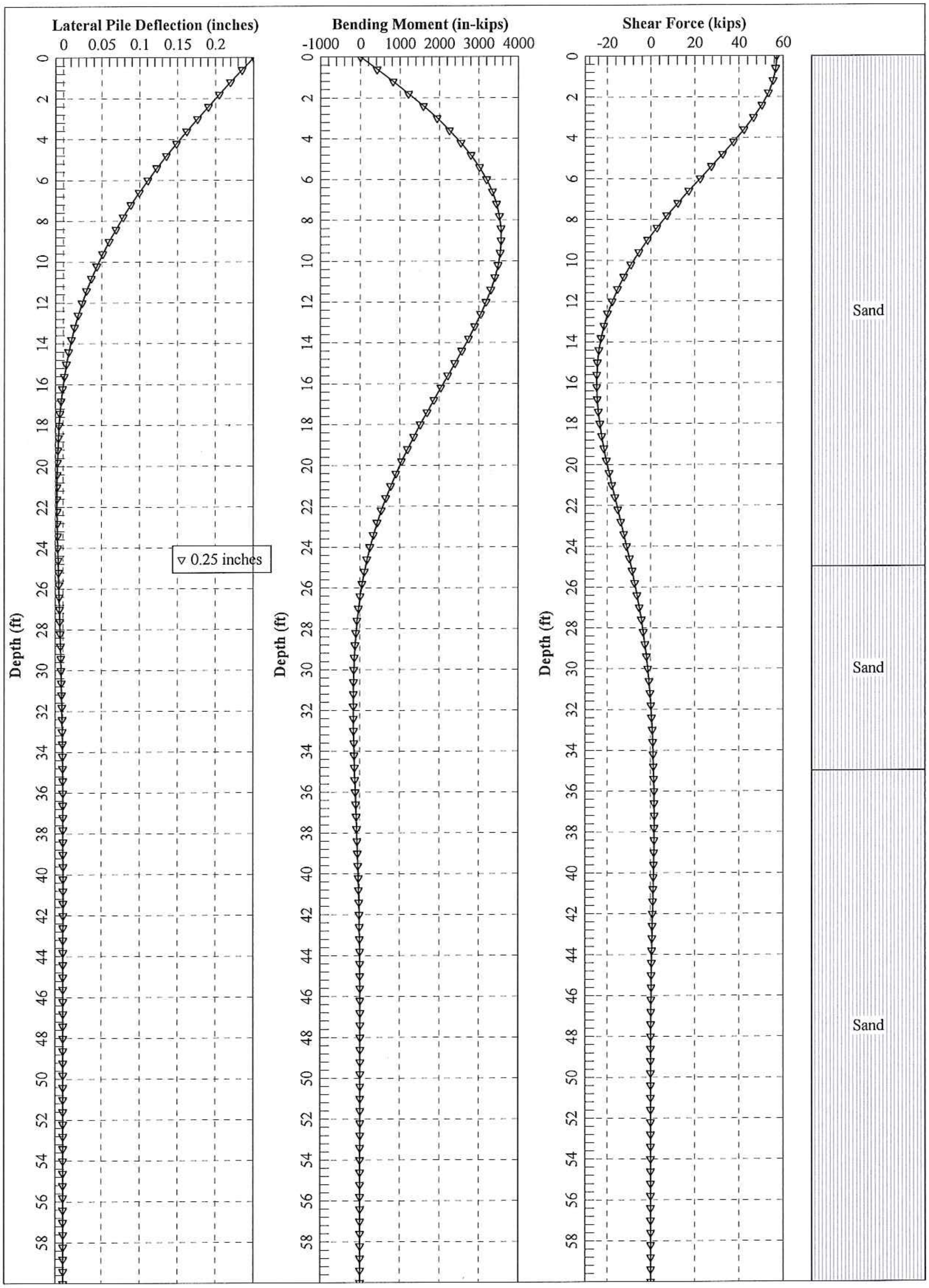
FIXED HEAD - UNFACTORED LATERAL CAPACITIES

16 FEET
BELOW
GROUND
SURFACE



FREE HEAD - UNFACTORED LATERAL CAPACITIES

16 FEET
BELOW
GROUND
SURFACE



Lateral Pile Capacity - 36 inches Diameter

Pile Location	Pile Head Condition	Pile Head Deflection (in)	Single Lateral Load per pile (kips)	M_{max} (kips-in)	Depth to M_{max} (ft)	Minimum Pile Embedment Depth (ft)[2]
Abutment, Borings B-1, Boring B-2	Fixed Head	0.25	150	11,000	0	50
	Free Head	0.25	57	3,500	9	50

NOTES: 1. Lateral capacities are unfactored. A minimum FS=2 should be used for ASD.
2. Depth "0" on charts and herein is at 16 feet below ground surface (bottom channel)