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FOUNDATION INVESTIGATION

Gerle Creek Bridge
Forest Road 14N34 at Gerle Creek
El Dorado County, California

County of El Dorado
Owner

2009-0152
39120-A4:015N:021W

December 2009

Taber
Since 1954

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El Dorado County, California

2009-0152

Introduction

We have completed a preliminary geologic/geotechnical review of the subject site and are providing preliminary geologic and foundation information for initial planning and type selection based on office review of preliminary bridge plans, referenced documents, field review, and exploration on October 27-29, 2009. Other limitations of this report are given in the attached General Conditions.

Project and Site Description

This project is understood to involve the construion of a new bridge over Gerle Creek to replace an unimproved stream crossing. We understand that three previous bridge crossings have been constructed and subsequently washed out at this location including:

- A log bridge with stone abutments was constructed in the 1920s,
- In 1944 a concrete bridge was built slightly upstream of the proposed bridge location (where concrete abutment wall remnants can currently be seen,) and
- A railroad flat car was placed as a bridge in the mid to late 1960s and was washed out in approximately 1980.

The proposed bridge site is located west of Johnny's Hill between Loon Lake and Hell Hole Reservoir, north of Ice House Road and Wentworth Springs Road on Forest Road 14N34. The site is approximately 1.4 miles south of the Placer County / El Dorado County line. Gerle creek runs northeast to southwest at the site and the proposed bridge crossing will trend northwest to southeast.

The proposed bridge location is at the downstream end of a long pool in the creek which is up to approximately 15 ft deep. The banks in the vicinity of the site consist of sand, gravel, cobbles and boulders up to 25 ft in diameter. We did not encounter boulders larger than 3 to 4 ft at the proposed abutment locations. The banks vary from 5 ft to 30 ft in height with slopes as steep as 1H:1V. The northwest bank at the proposed abutment location is approximately 5 ft high with slopes no steeper than 3H:1V.

However, north of the proposed northwest abutment, near the northwest abutment of the previous bridge, the bank is approximately 1H:1V and approximately 6 ft in height. This bank height and steepness is possibly due to grading associated with construction of the previous bridge. The southeast bank nearest the proposed southeast abutment is approximately 10 ft high with an approximate 2.5H:1V overall slope. However, some sections of the slope are as steep as 1H:1V. Banks are somewhat vegetated where they are flatter than 2H:1V and are generally not vegetated in steeper areas. Scattered large trees were found along the top of both banks.

The steep sections of the southeast bank of the creek appear to experience minor bank erosion during high water.

The proposed bridge is understood to be a single span structure approximately 120±ft in length and one lane wide, supported on concrete abutments. It is understood that final bridge type and dimensions have not been selected. Site topography and elevations were referenced to an untitled site plan provided by the El Dorado County Department of Transportation. This preliminary report will discuss geotechnical issues as they relate to preliminary design of the new bridge structure.

<u>Geologic Conditions</u>

The site is shown on published geologic mapping ("Geologic Map of The Chico Quadrangle, California" USGS, 1992 1:250,000) as underlain on the west side of the creek by Quaternary aged glacial till and moraines consisting of silt, sand, gravel, cobbles, and scattered boulders. The east side of the creek is shown to be underlain by Quaternary aged alluvium consisting of poorly sorted stream and basin deposits: clay to boulder in size.

No faults are indicated to pass through the project site on published mapping. The closest mapped fault is approximately 0.25 miles west of the project location and is un-named. Other faults are also mapped in the general vicinity of the site, including several unnamed faults striking generally north approximately 1-1.5 miles to the northeast of the site and another unnamed fault located approximately 2.25 miles east of the site. These faults are listed as not active during the Holocene by the California Geological Survey. The nearest active fault is the West Tahoe-Dollar Point fault located 16.5 miles to the east of the site.

Exploration and Testing

Information on the nature and distribution of subsurface materials and conditions for this foundation investigation was obtained by means of four sampled and logged test borings to maximum depth of 71.5±ft below ground surface (elev. 927±ft per untitled topographic site plan). The temporary bench mark established by the El Dorado County Department of Transportation is the top of the south corner of the northwest abutment for the previous bridge and is shown as having elevation 1000 on the provided site plan. Test borings were drilled with a track-mounted CME 55 drill rig. Drilling methods used to advance the borings included combinations of solid auger, concentrix air hammer and diamond core rotary drilling.

Samples of earth materials were obtained from the borings by means of 2.0-inch O.D. (1.4-inch I.D.) "standard penetration" (SPT) samplers lined with brass tubes to retain the samples. The sampler was advanced with standard 350 ft-lb striking force (per ASTM D1586) using an automatic-drop hammer system. Sampler penetration resistance was recorded to provide a field measure of soil consistency and can be correlated to soils strength and bearing characteristics.

The earth materials were field-classified and borings logged by a geologist on the bases of sampler penetration resistance, drill action, examination of samples and inspection of soil cuttings and rock cores. Groundwater observations were made in the borings during drilling. All borings were backfilled with soil cuttings at completion.

Portions of recovered drive-samples were retained in sealed containers for laboratory testing and reference. Moisture content-dry density, unconfined compressive strength, gradation, Atterberg limits and corrosivity screening (CTM 643, 417, and 422) tests were performed on selected drive samples in the laboratory to supplement field evaluation of earth materials parameters.

Where diamond coring was used, the recovered gravel, cobble and boulder material was logged as to percent recovery and bag samples were retained for reference.

The boring locations, elevations, details of borings and results of tests are shown on the "Log of Test Borings" drawings, Figure-1, Figure-2, and Appendix-A. Glen G. Wade was the field geologist for this project. All elevation measurements are based on elevations referenced from the topographic site plan provided by the El Dorado County Department of Transportation.

Earth Materials and Conditions

Three geotechnically important units exist at this location including an upper unit, a middle unit, and a lower unit. No apparent fills were observed in the proposed bridge abutment areas, but fill materials may exist at the site.

Upper Unit

The upper unit was encountered at each test boring location to approximately 3-10±ft depth in all test borings. As observed in the borings the upper unit consists of gravelly sand with cobbles, small boulders, and silt. The deposit is possibly a combination of creek sediment, colluvium from Johnny's Hill, and glacial materials. The unit is semicompact and "armors" the middle unit found below. Larger boulders were observed upstream of the bridge site and may exist within the abutment locations.

Middle Unit

The middle unit was encountered below the upper unit at 3-10±ft depth and extended to approximately 23±ft depth in boreholes B-1 and B-2 (elev. 976.5 and 975.5±ft, respectively). Middle unit material extended to approximately 31±ft depth in boreholes B-3 and B-4 (elev. 972.9 and 974.5±ft, respectively). Middle unit material consists of loose to semicompact brown and gray sand and silt.

Lower Unit

The lower unit material extends to the bottom of all borings. Lower unit material consists of compact to very dense brownish red and gray silty sandy gravel with cobbles.

Groundwater

Free groundwater levels were measured at 6.5±ft and 9.5±ft depths in boring B-1 and B-2 (elev. 990.0 and 992.0±ft, respectively). Free groundwater level in borings B-3 and B-4 were measured at 14.0±ft and 11.5±ft depths (elev. 989.9 and 994.0±ft, respectively).

Corrosivity

Corrosivity testing was performed on a bulk soil sample from the upper 5 ft of Boring B-1. Results of these tests indicate pH value of 5.82 (CTM 643); minimum resistivity value of 12,330 ohm-cm (CTM 643); chloride value of 8.1 ppm (CTM 422); and sulfate value of 13.2 ppm (CTM 417), respectively. These results indicate a "non-corrosive" soils environment for both concrete and steel (per Caltrans "Corrosion Guidelines", September 2003). Based on our limited testing it does not appear that special corrosion considerations are necessary at this site.

Seismic Conditions

The site is located approximately 16.5±miles (25.1±km) west of the trace of the West Tahoe - Dollar Point fault; the style of this fault is listed as normal (per Caltrans ARS Online site, http://dap3.dot.ca.gov/shake_stable). Based on available data, the site can be assigned a soils profile Type-D (per Table B.1, Caltrans "Seismic Design Criteria"

(SDC) Appendix B Rev. 8/2009). Caltrans structure design practice requires certain increases in SDC response curves due to fault proximity and type. Because the controlling fault is not within 25 km of the site, fault proximity adjustments are not required.

Based on the above information, structure design is recommended to be based on the following SDC parameters:

- Soil Type D
- Controlling Fault: West Tahoe – Dollar Point fault
- Maximum Magnitude: 7.0
- R_{rup}: 25.1 km

An ARS curve and seismic design parameters incorporating near field effects as generated by the Caltrans online tool can be found in Appendix-B.

Seismically induced liquefaction of Unit 2 soils is considered likely during moderate to strong ground shaking. This potential was evaluated using the Liquefy 2 computer program. Settlement on the order of 0.5 to 2 inches is considered possible at this site. Total settlement is strongly dependent on groundwater level at the time of the seismic event. Liquefaction can be expected to approximate elevation 978 and 970 in borings B-2 and B-3 respectively. Settlement of the ground surface in the area around the proposed abutments and down drag on pile foundations are considered likely.

Should there be important structural and/or economic considerations associated with more closely defining the above values or other site-seismicity characteristics, further study would be required.

Conclusions and Reccommendations

No over-riding geologic hazards (e.g., faulting, landslides, severe erosion, subsidence, etc.), are identified at this site. However, the sands found at approximately 15–20±ft below ground surface in all borings are considered potentially liquefiable.

Apparent scour was observed at the base of the bank on the southeast side of the creek. The scour area is immediately downstream of the southeastern abutment. This pattern of erosion appears consistent with high flow periods of Gerle Creek. It can be expected that high water events along Gerle Creek coincide with seasonal snow melt. The bank will possibly require protection from scour (say, rock slope protection).

H-piles driven vertically are technically feasible for abutment support but may have only minor penetration through the coarse surficial material, requiring significant excavation for removal of large boulders in the upper 5±ft. Piles should be easily driven through the middle unit soils. Bearing capacity is expected to be provided by lower unit soils via a combination of skin friction and end bearing. Anticipated hard driving conditions and the ability to cut or splice piles as necessary are the main advantages of using H-piles for these supports and are the reasons that H-piles are considered the most appropriate pile type for this location.

Alternatively, concrete Cast In Drilled Hole (CIDH) piles embedded into the dense to very dense Unit 3 soils could be utilized, but there may be some difficulty due to caving in upper unit soils likely requiring the use of casing. The loose, saturated deposits at the support locations would likely require "wet" construction and special inspection of CIDH piles.

H-piles

Potential hard driving would require the use of heavy sections and driving shoes / points on the H-piles. Design tip elevation for lateral loading would be controlled by the requirement for piling to penetrate into the dense to very dense lower unit soils.

Steel HP14x89 piling may be assigned allowable design (service) loading to 70 tons. All piling should be driven to or below minimum specified tip elevation and should have full design bearing per the Gates Formula at final penetration. H-piling with 70 ton design loads should be specified to penetrate to at least elev. 935±ft for both abutments. A Pile Data Table developed on this basis is as follows:

Table 1: Pile Data Table

Location	Type	Design Loading (service load) (kips)	Nominal Resistance		Design Tip Elevation (ref. elevation (ft))	Specified Tip Elevation
			Compression (kips)	Tension (kips)		
NW-Abut	HP14x89	140	280	0	935 (1)	935
SE-Abut	HP14x89	140	280	0	935(1)	935

Pile design tip elevation controlled by the following conditions: 1) axial compression; 2) axial tensile; 3) lateral;

Prior to driving piles, all boulders in the upper 5-ft should be removed or cored through prior driving of H-piles. Excavations to aid placement of H-piles should be backfilled with cement grout upon completion of driving. Pre-drilling or jetting as "driving aids" ("Standard Specifications" Section 49-1.05) should not be permitted below 20-ft depth at this site.

Consistent with current Caltrans practice, all piling should be driven to or below minimum specified tip elevation and have 3.5 times the design load (i.e., 490 kips) using the Gates formula at final penetration. The required "ultimate" driving resistance to be used with the Gates formula might be reduced based on "real" pile loading and a global safety factor of 3.5 (per FHWA criteria).

Assuming good equipment/driving techniques, relaxation of the minimum tip elevation for individual piles meeting effective "refusal" within 5 ft of specified tip elevation without consultation of this office would be considered acceptable. Pile "refusal" is defined here as two times required formula bearing in last 1.0 ft or three times required formula bearing in the last 3-inches.

Earth Pressures

With use of standard Caltrans "Structure Backfill" materials and details, an active soil pressure of 36 pcf is considered appropriate for use in preliminary abutment wall design. Seismic loading will apply additional soil pressure to abutment walls. The resultant of incremental lateral soil pressure due to seismic loading will act at 0.6 times the wall height (above the base of the wall) and the magnitude of resultant may be calculated on the basis of an additional equivalent fluid pressure of 11 pcf. For seismic loading into abutments, passive soil resistance of up to 5.0 ksf is available – to be reduced for effective wall height less than 5.5 ft in accordance with Caltrans SDC (v.1.4).

Excavation Conditions

The upper unit soils should be capable of excavation using conventional heavy construction equipment. However, some large boulders may be encountered during excavation that may be difficult to remove. Wet excavation conditions and large volumes of seepage can be expected in excavations near the water elevations encountered in the borings. Temporary construction backslopes should be reviewed during construction in evaluation of stability and for possible supplemental support (e.g., local shoring in areas of soft/weak materials). It is expected that construction backslopes should be stable at configurations of 2H:1V or flatter. All excavations should conform to CalOSHA standards.

Roadway Earthwork

It is understood that the approach roadways will be unpaved and therefore pavement requirements were not part of the scope of services. It appears from field observations that roadway earthwork can be accomplished using typical earthmoving equipment. We note that while the materials found near the surface during our investigation are generally reported as semicompact to compact in nature, higher blow counts reported typically represent isolated cobbles and boulders. During construction some loose/soft subgrade may be encountered.

*   *   *   *   *   *

TABER CONSULTANTS

Glen G. Wade
Project Geologist

Reviewed by: Ronald E. Loutzenhiser
R.C.E. 64089

David A. Kitzmann
C.E.G. 2412

Attachments:		"Selected References"
		"General Conditions"
	Figure-1	"Vicinity Map"
	Figure-2	"Log of Test Boring"
		"Boring Legend"
	Appendix-A	"Laboratory Data"
	Appendix-B	"Seismic Data"

SELECTED REFERENCES

1. California Department of Transportation, "Caltrans Seismic Design Criteria (Ver. 1.4)", 2009.

2. California Division of Mines and Geology, "Geologic Map of the Chico Quadrangle", 1992, scale 1:250,000.

3. Jennings, Charles W. and Saucedu, George J., "Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions", 1994, scale 1:750,000

4. California Department of Transportation, "Standard Specifications", May 2006.

GENERAL CONDITIONS

The conclusions and recommendations of this study are professional opinion based upon the indicated project criteria and the limited data described herein. It is recognized there is potential for sufficient variation in subsurface conditions that modification of conclusions and recommendations might emerge from further, more detailed study.

This report is intended only for the purpose, site location and project description indicated and assumes design and construction in accordance with Caltrans practice.

As changes in appropriate standards, site conditions and technical knowledge cannot be adequately predicted, review of recommendations by this office for use after a period of two years is a condition of this report.

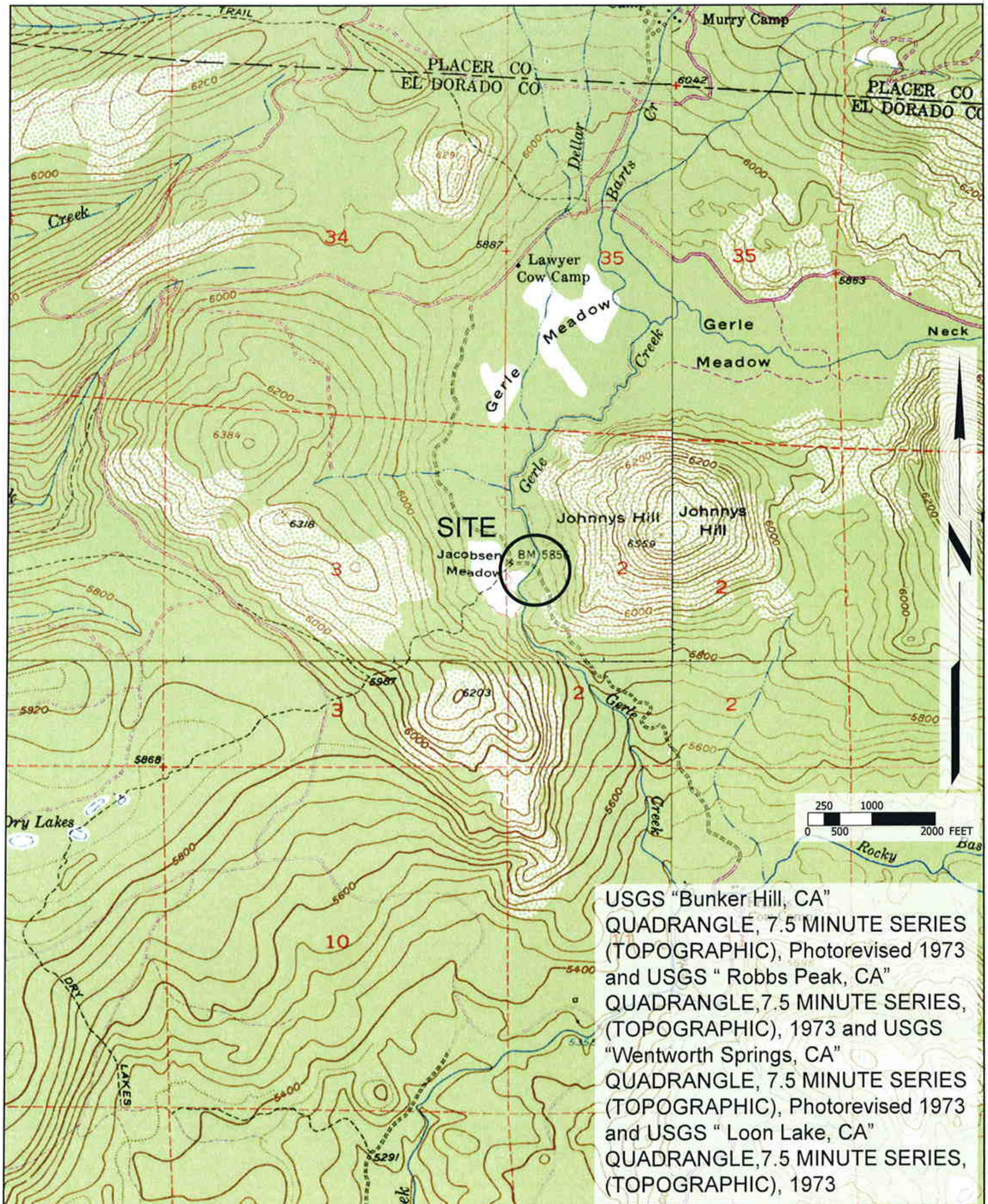
A review by this office of any foundation and/or grading plans and specifications or other work product insofar as they rely upon or implement the content of this report, together with the opportunity to make supplemental recommendations as indicated therefrom is considered an integral part of this study and a condition of recommendations.

Subsequently defined construction observation procedures and/or agencies are an element of work that may affect supplementary recommendations.

Should there be significant change in the project, or should earth materials or conditions different from those described in this report be encountered during construction, this office should be notified for evaluation and supplemental recommendations as necessary or appropriate.

Opinions and recommendations apply to current site conditions and those reasonably foreseeable for the described development--which includes appropriate operation and maintenance thereof. They cannot apply to site changes occurring, made, or induced, of which this office is not aware and has not had opportunity to evaluate.

The scope of this study specifically excluded sampling and/or testing for, or evaluation of the occurrence and distribution of, hazardous substances. No opinion is intended regarding the presence or distribution of any hazardous substances at this or nearby sites.



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VICINITY MAP

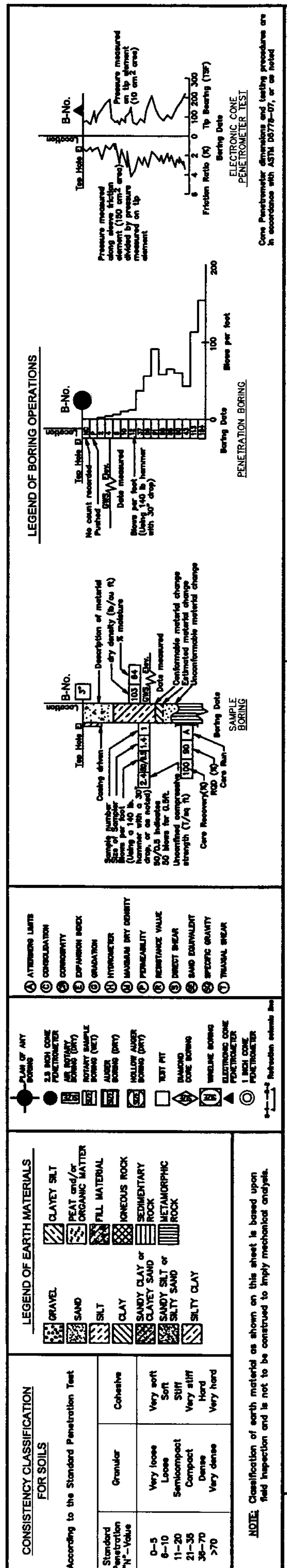
El Dorado County

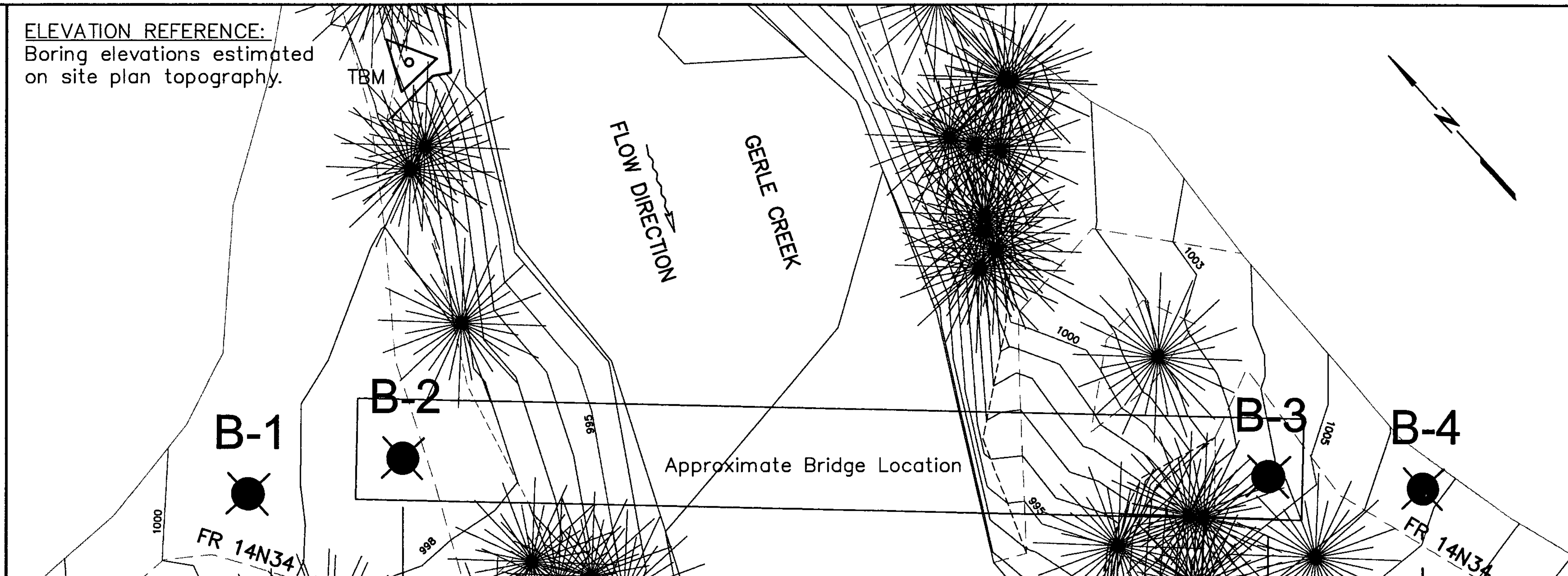
Gerle Creek Bridge
El Dorado County, California

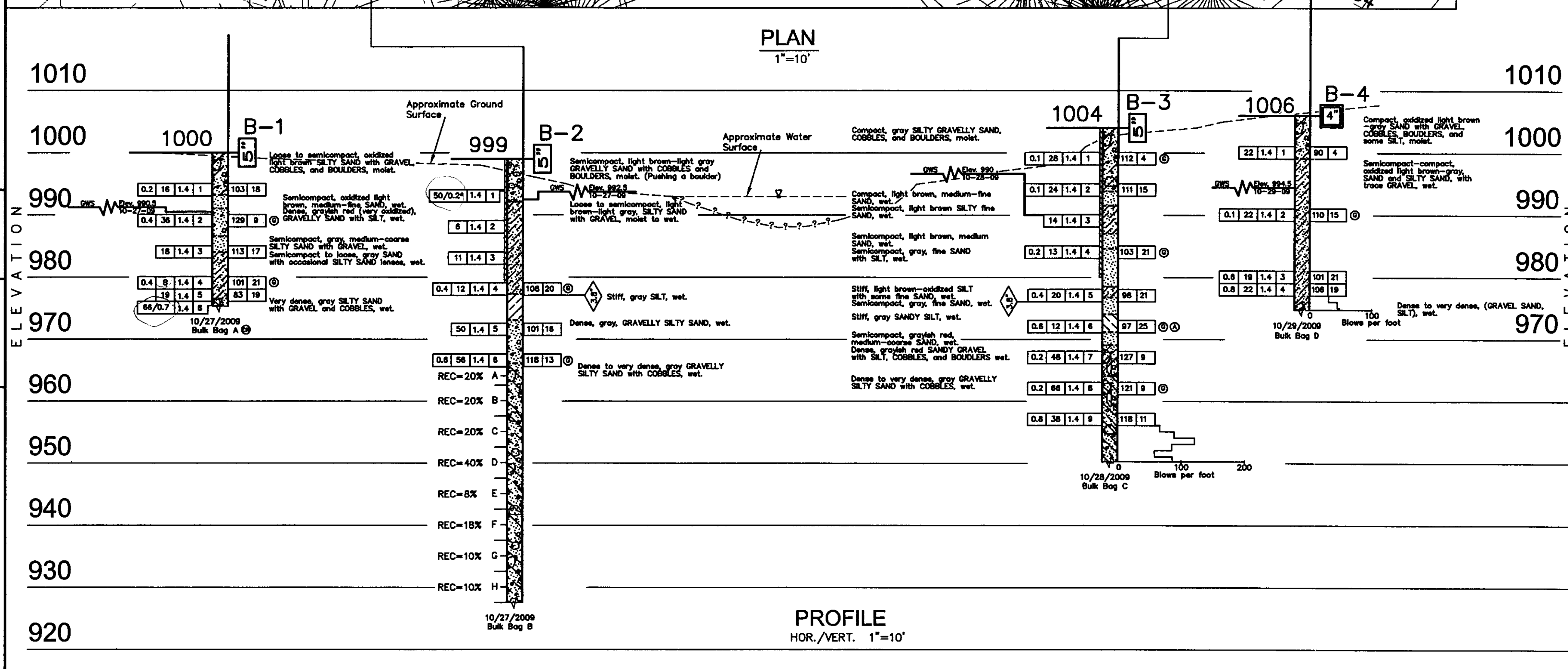
Project No.
2009-0152

December 2009

FIGURE-1







DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	C.R.			

CERTIFIED ENGINEERING GEOLOGIST

12/21/2009

PLANS APPROVAL DATE

REGISTERED GEOLOGIST DAVID A. KITZMANN No. 2412 EXP. 12-31-09 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

JOB No. 2009-0152

LOCATION: 39120-A4: 15N; 21W

NOTES:

1. Field classification of soils was in accordance with ASTM D 2488-00 "Description and Identification of Soils (Visual-Manual Procedure)" and the CALTRANS "Soil and Rock Logging, Classification, and Presentation Manual" (June 2007).

2. Standard Penetration tests were performed in accordance with ASTM D 1586-99 using a hammer operated with an automated drop system. Drill rods were 1 5/8-inch diameter "A"-rods; sampler was driven with brass liners.

3. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with ASTM D1586-99. Where less than 1 foot of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated.

4. Where indicated by an asterisk (*) the number of blows shown is for only that fraction of the initial 0.5 ft. "seating drive" interval penetrated.

5. REC = Core Recovery (percent).

6. Groundwater (GWS) elevations in the borings indicated on the Log of Test Boring Sheets reflect the fluid level in the borings on the specified date. If groundwater was not encountered it is indicated below the boring log.

7. Groundwater surface elevations are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.

8. Elevations are reported in feet.

9. Electronic media for plan view provided by El Dorado County Department of Transportation.

10. Channel profile inferred by Taber.

11. Groundline profile and water surface based on site plan topography.

DESIGN OVERSIGHT	DRAWN BY	M. Lattin/K. Kajiwara	Glen Wade FIELD INVESTIGATOR
SIGN OFF DATE	CHECKED BY	D. A. Kitzmann	DATE October 2009

PREPARED FOR
EL DORADO COUNTY
DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

BRIDGE NO.

POST MILE

GERLE CREEK BRIDGE

LOG OF TEST BORINGS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES 12/1/09

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

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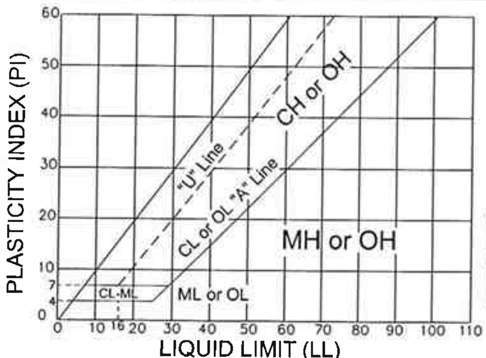
UNIFIED SOIL CLASSIFICATION SUMMARY

(ASTM D 2489-00)

Pt	OH	CH	MH	OL	CL	ML	SC	SM	SP	SW	GC	GM	GP	GW
Highly organic soils	Silts and clays Liquid limit 50 or more			Silts and clays Liquid limit less than 50			Sands with fines >15% fines		Clean sands ≤ 5% fines		Gravels with fines > 15% fines		Clean gravels ≤ 5% fines	
							Sands–50% or more of coarse fraction is smaller than No 4 Sieve				Gravels–more than 50% of coarse fraction is larger than No. 4 sieve			
Fine grained soils (50% or more is smaller than No. 200 sieve)							Coarse grained soils (More than 50% is larger than No. 200 sieve)							



LABORATORY CLASSIFICATION CRITERIA

GW and SW – Cu ≥ 4 for GW and 6 FOR SW; 1 ≤ Cc ≤ 3

GP and SP–Clean gravel or sand not meeting requirements for GW and SW.

GM and SM–Atterberg limits of fines below "A" line or P.I. less than 4.

GC and SC–Atterberg limits of fines above "A" line with P.I. greater than 7.

Fines (silt or clay)	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		
Sieve sizes	200	40	10	4	3/4"	3"	10"

Classification of earth materials shown on the test boring logs is based on field inspection and should not be construed to imply laboratory analysis unless so stated.

MATERIAL SYMBOLS

- Gravel
- Sand
- Silt
- Clay
- Sandy clay or clayey sand
- Sandy silt or silty sand
- Silty clay or clayey silt
- Peat and/or organic matter
- Fill material
- Igneous rock
- Sedimentary rock
- Metamorphic rock

CONSISTENCY CLASSIFICATION FOR SOILS

Standard Penetration "N"–Value*	Granular	Cohesive
0–5	Very loose	Very soft
6–10	Loose	Soft
11–20	Semicompact	Stiff
21–35	Compact	Very stiff
36–70	Dense	Hard
> 70	Very dense	Very hard

* According to the Standard Penetration Test (ASTM D 1586)

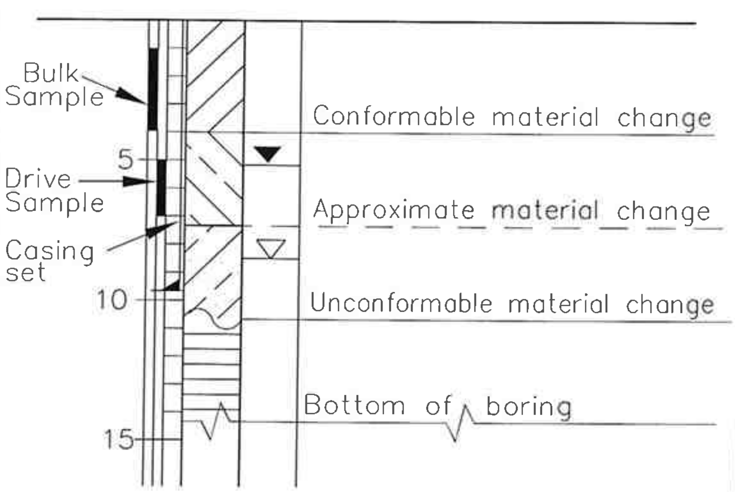
Blow count of 50/0.5 indicates 50 blows for 0.5 feet.

Where standard penetration test has not been performed, consistencies shown (in parenthesis) on logs are estimated.

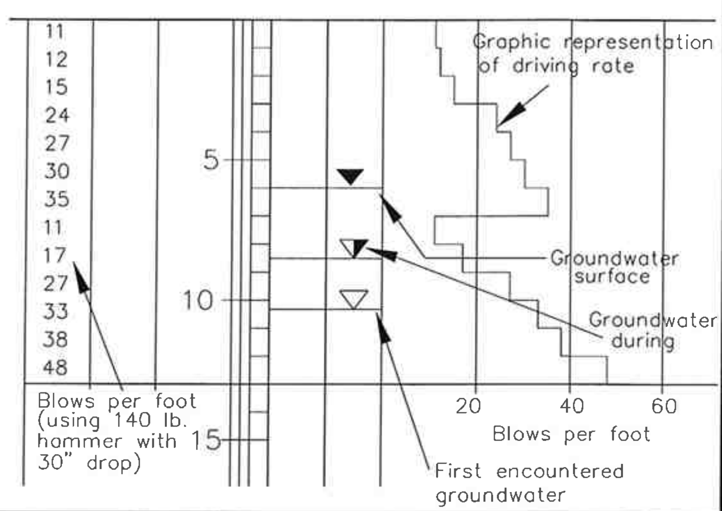
KEY TO "OTHER TESTS" LABORATORY

- A – Atterberg Limits
- C – Consolidation
- CR – Corrosivity
- E – Expansion Index
- G – Gradation
- H – Hydrometer
- M – Maximum Dry Density
- P – Permeability
- R – Resistance Value
- S – Direct Shear
- SE – Sand Equivalent
- SG – Specific Gravity
- T – Triaxial Shear

LEGEND OF BORING



LEGEND OF PENETRATION TEST



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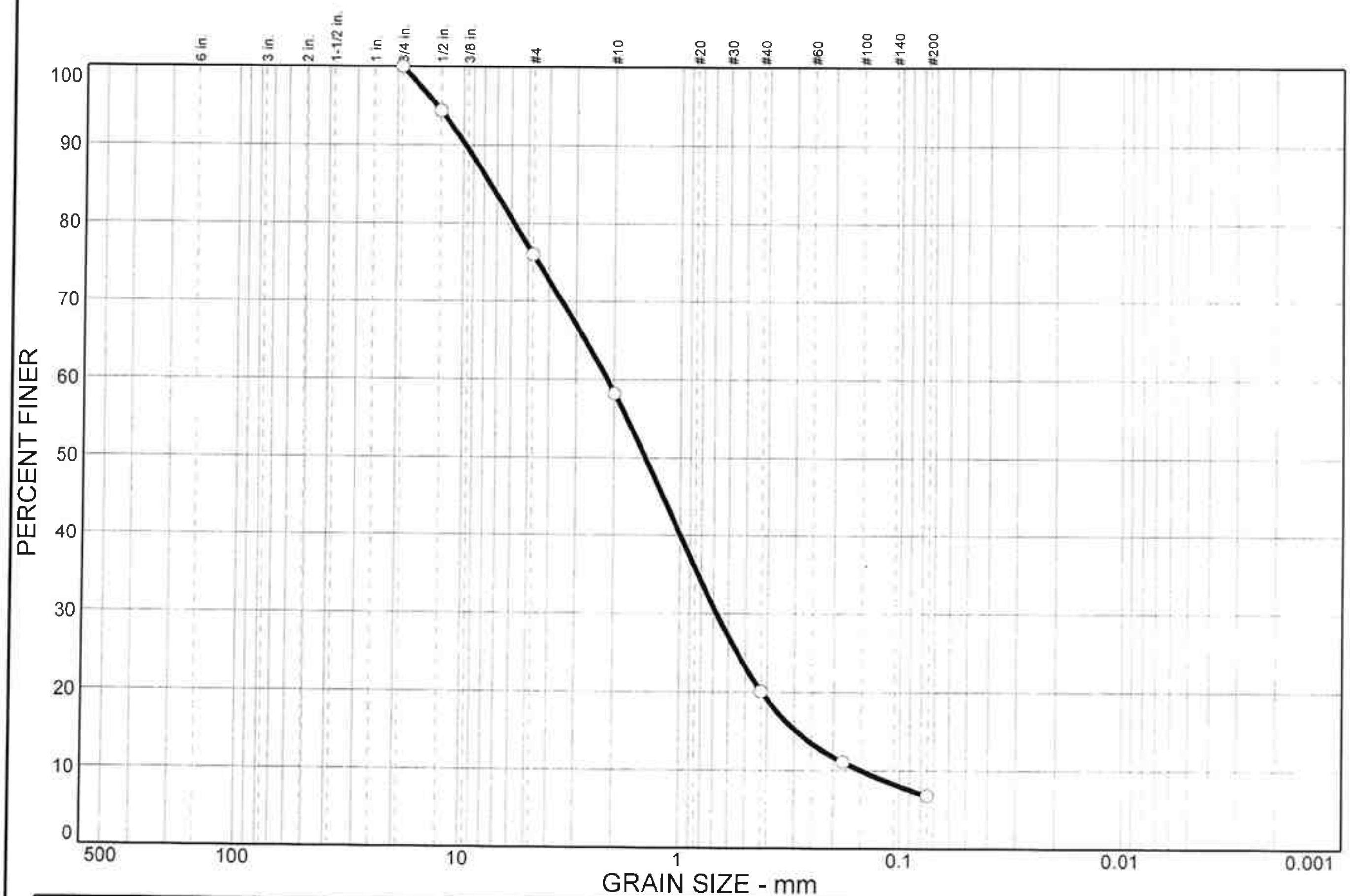
Appendix A:

Laboratory Data

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	24.0	17.8	38.1	13.3	6.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	94.4		
#4	76.0		
#10	58.2		
#40	20.1		
#80	11.1		
#200	6.8		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 7.48 D_{60}= 2.16 D_{50}= 1.45

D_{30}= 0.679 D_{15}= 0.292 D_{10}= 0.149

C_u= 14.50 C_c= 1.43

Classification

USCS= AASHTO=

Remarks

Total dry weight of sample tested =1,027 grams.

Sample No.: 1/2
Location: Boring 1

Source of Sample:

Date: 11/19/2009
Elev./Depth: 10'-12'

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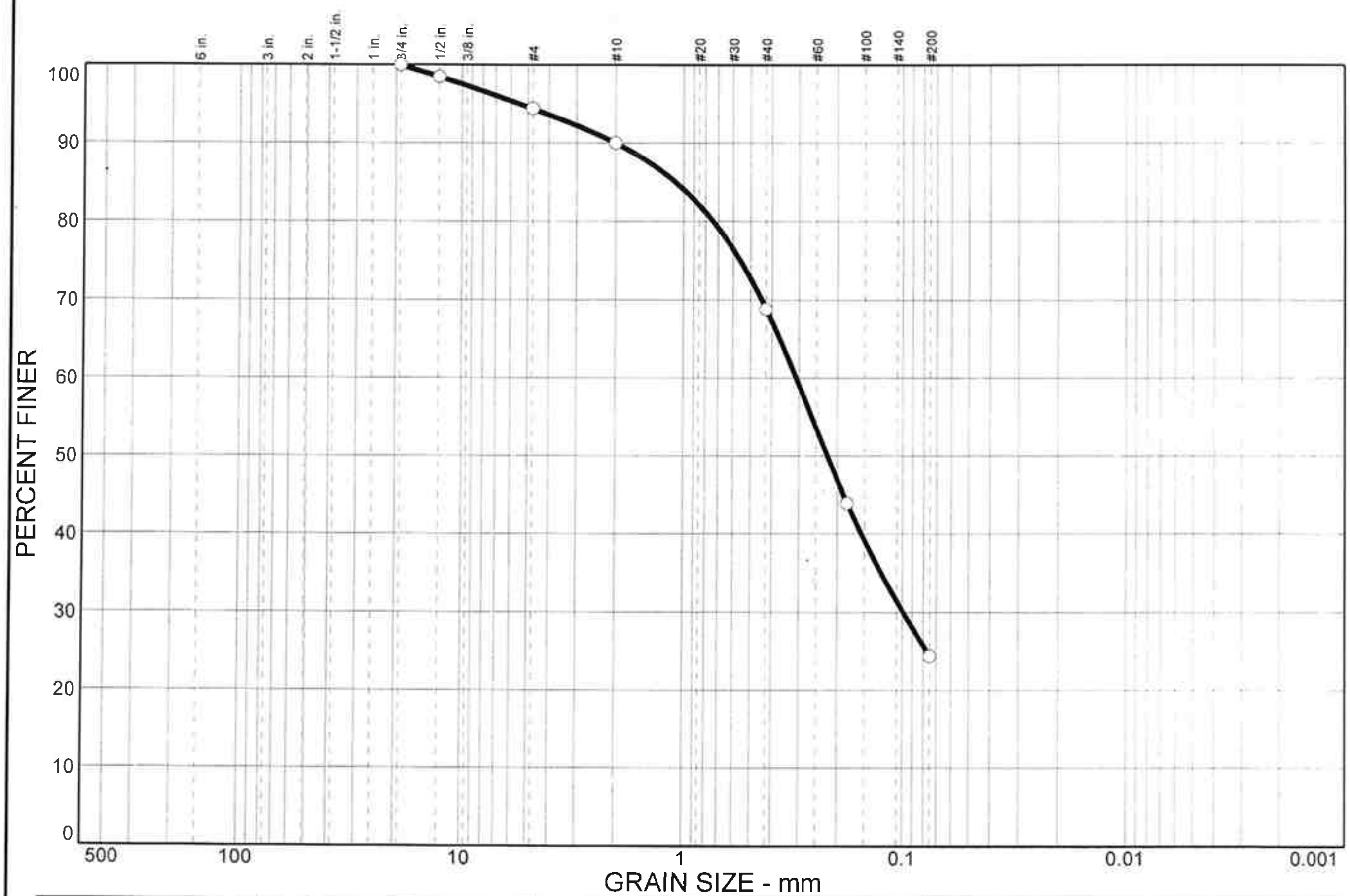
Client: El Dorado County DOT
Project: Gerle Creek Bridge
Project No: 2009-0152 **Figure** A-1

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	5.6	4.4	21.2	44.4	24.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	98.5		
#4	94.4		
#10	90.0		
#40	68.8		
#80	43.9		
#200	24.4		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 1.08 D_{60}= 0.310 D_{50}= 0.223
D_{30}= 0.0991 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Total dry weight of sample tested =730 grams.

Sample No.: 1/4 **Source of Sample:** **Date:** 11/19/2009
Location: Boring 1 **Elev./Depth:** 20'-22'

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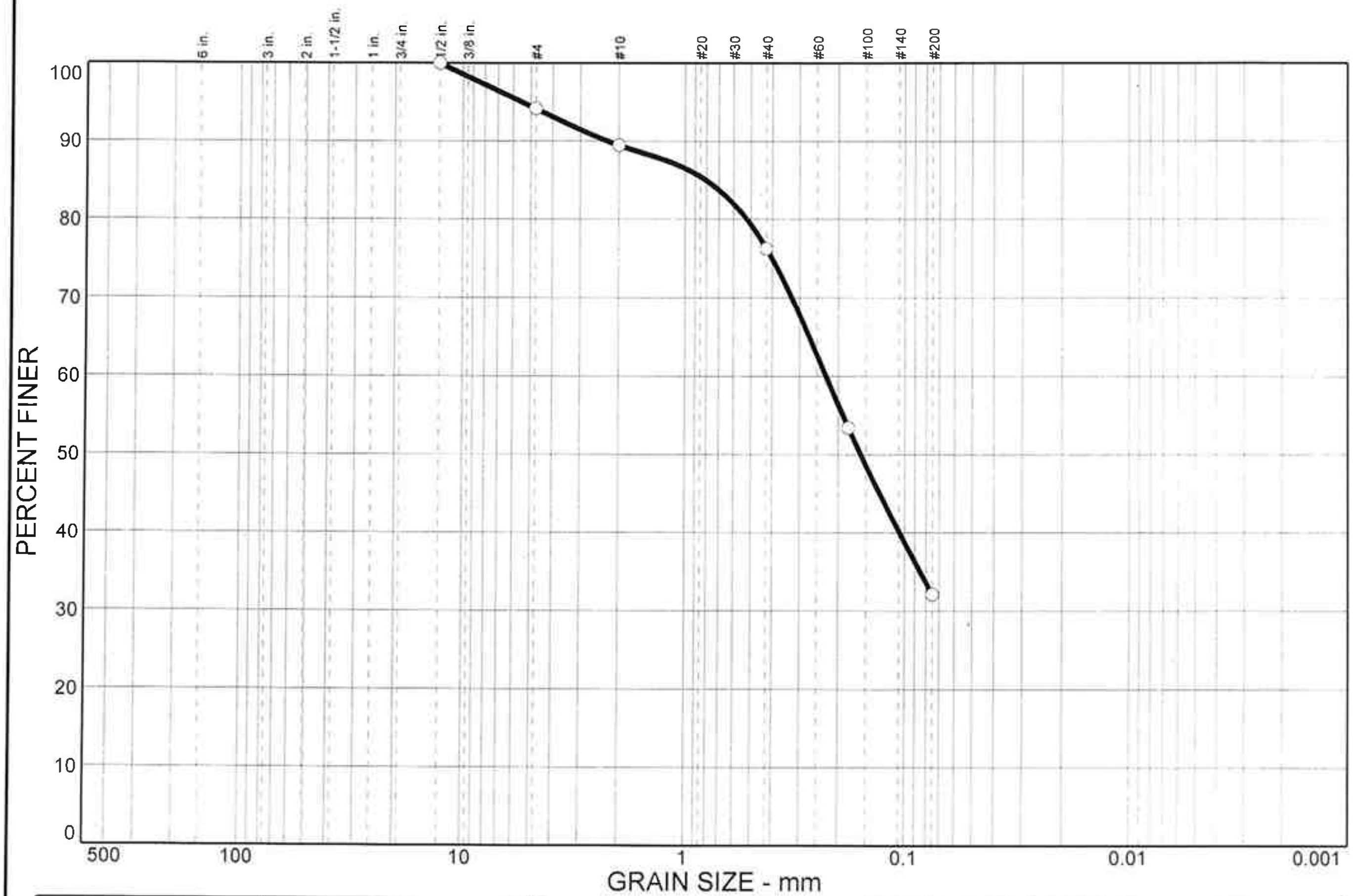
Since 1954

Client: El Dorado County DOT
Project: Gerle Creek Bridge

Project No: 2009-0152 **Figure** A-2

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	5.8	4.7	13.3	44.1	32.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	100.0		
#4	94.2		
#10	89.5		
#40	76.2		
#80	53.4		
#200	32.1		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.803 D_{60}= 0.228 D_{50}= 0.158
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

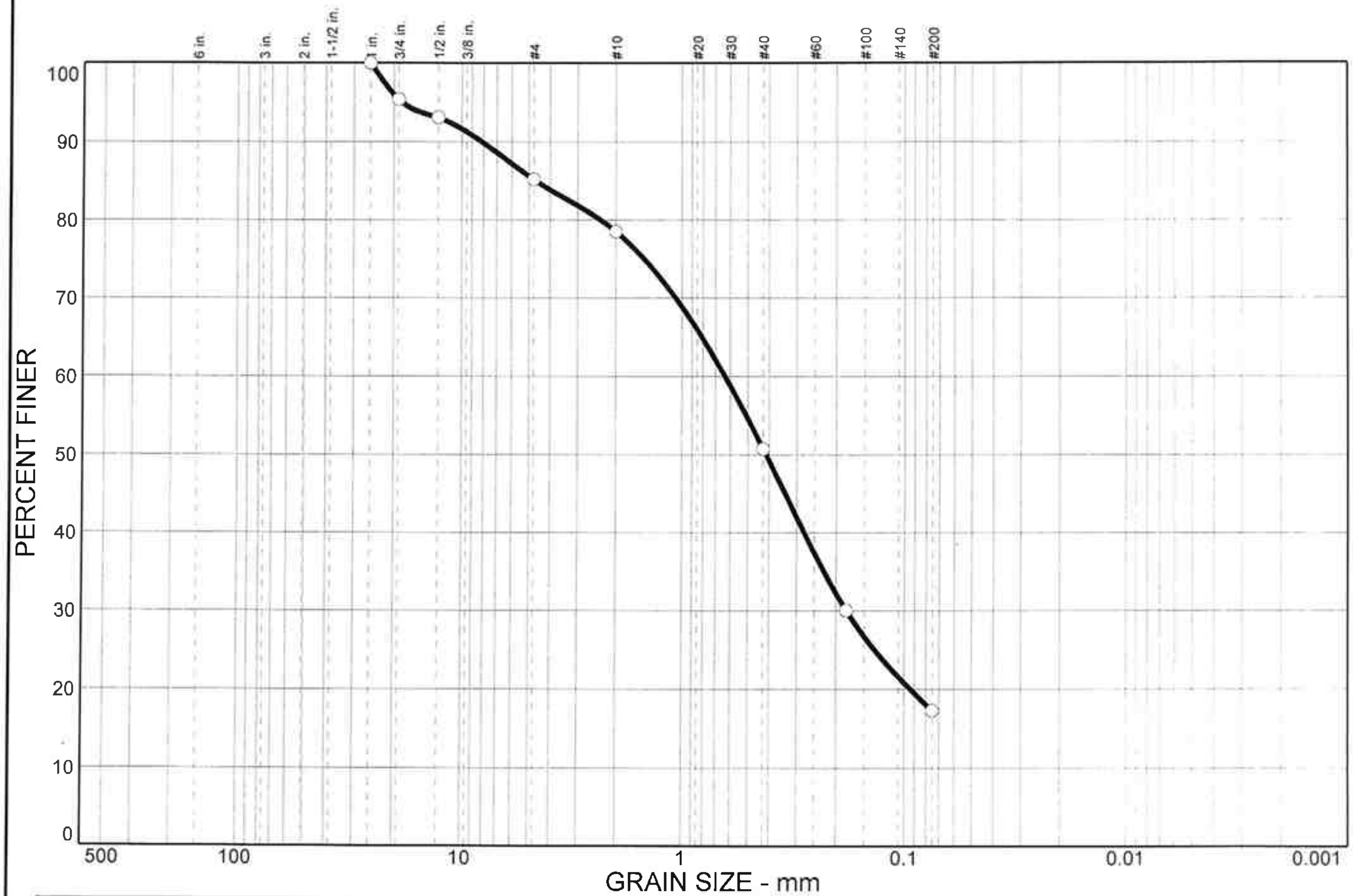
Total dry weight of sample tested =805 grams.

Sample No.: 2/4 **Source of Sample:** **Date:** 11/19/2009
Location: Boring 2 **Elev./Depth:** 20'-22'

Taber
Since 1954

Client: El Dorado County DOT
Project: Gerle Creek Bridge
Project No: 2009-0152 **Figure** A-3

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	4.6	10.2	6.7	27.8	33.4	17.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
.75 in.	95.4		
.5 in.	93.1		
#4	85.2		
#10	78.5		
#40	50.7		
#80	30.0		
#200	17.3		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 4.63 D_{60}= 0.635 D_{50}= 0.413
D_{30}= 0.180 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Total dry weight of sample tested =959 grams.

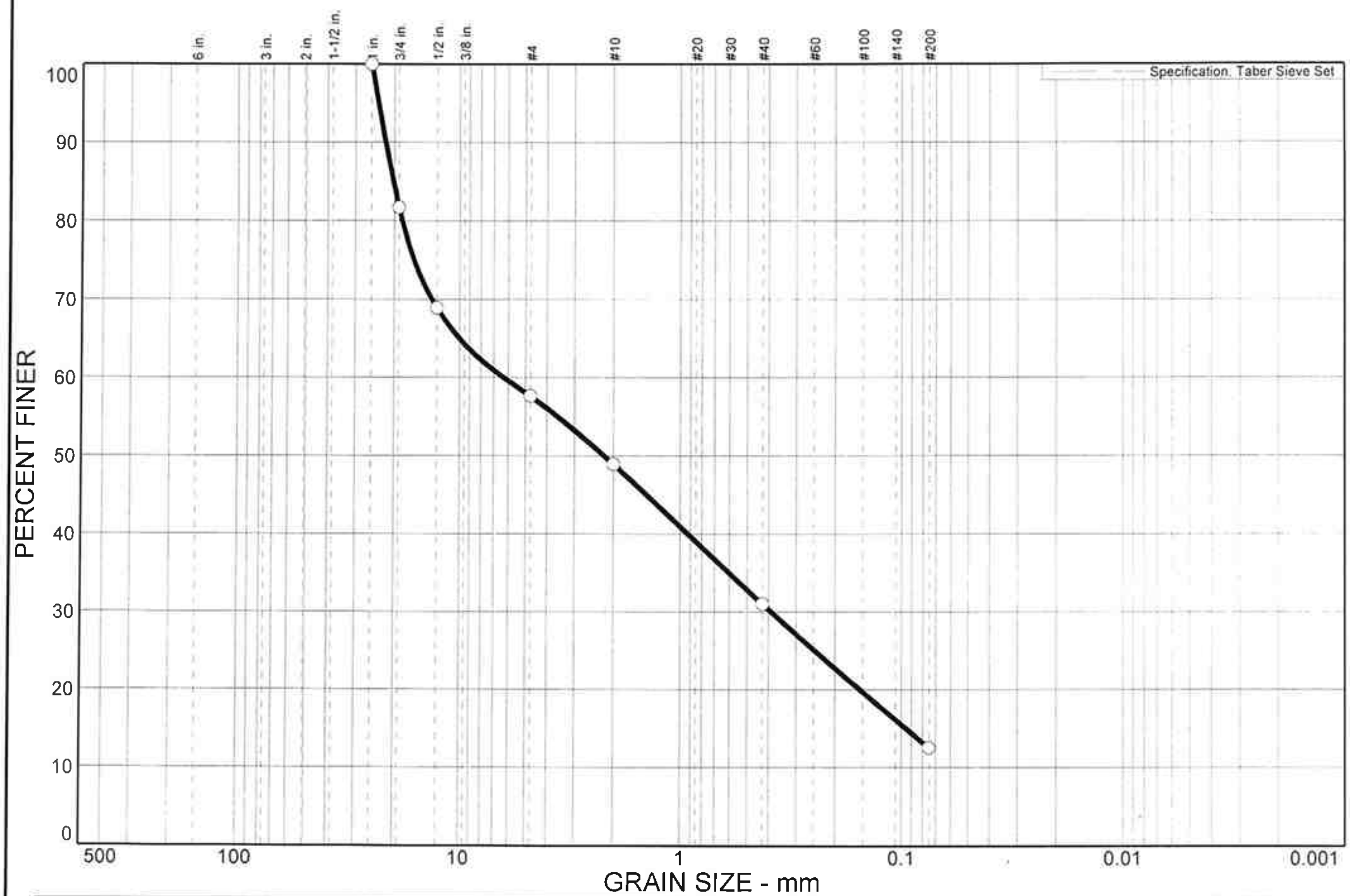
Sample No.: 2/6 **Source of Sample:** **Date:** 11/19/2009
Location: Boring 2 **Elev./Depth:** 31.5'-33.5'

Taber
Since 1954

Client: El Dorado County DOT
Project: Gerle Creek Bridge

Project No: 2009-0152 **Figure** A-4

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	18.3	24.1	8.7	17.9	18.5	12.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0	0.0 - 0.0	X
.75 in.	81.7	0.0 - 0.0	X
.5 in.	68.9	0.0 - 0.0	X
#4	57.6	0.0 - 0.0	X
#10	48.9	0.0 - 0.0	X
#40	31.0	0.0 - 0.0	X
#200	12.5	0 - 0	X

* Taber Sieve Set

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 20.2 D_{60}= 6.31 D_{50}= 2.21
D_{30}= 0.389 D_{15}= 0.0955 D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Total dry weight of sample tested =294 grams.

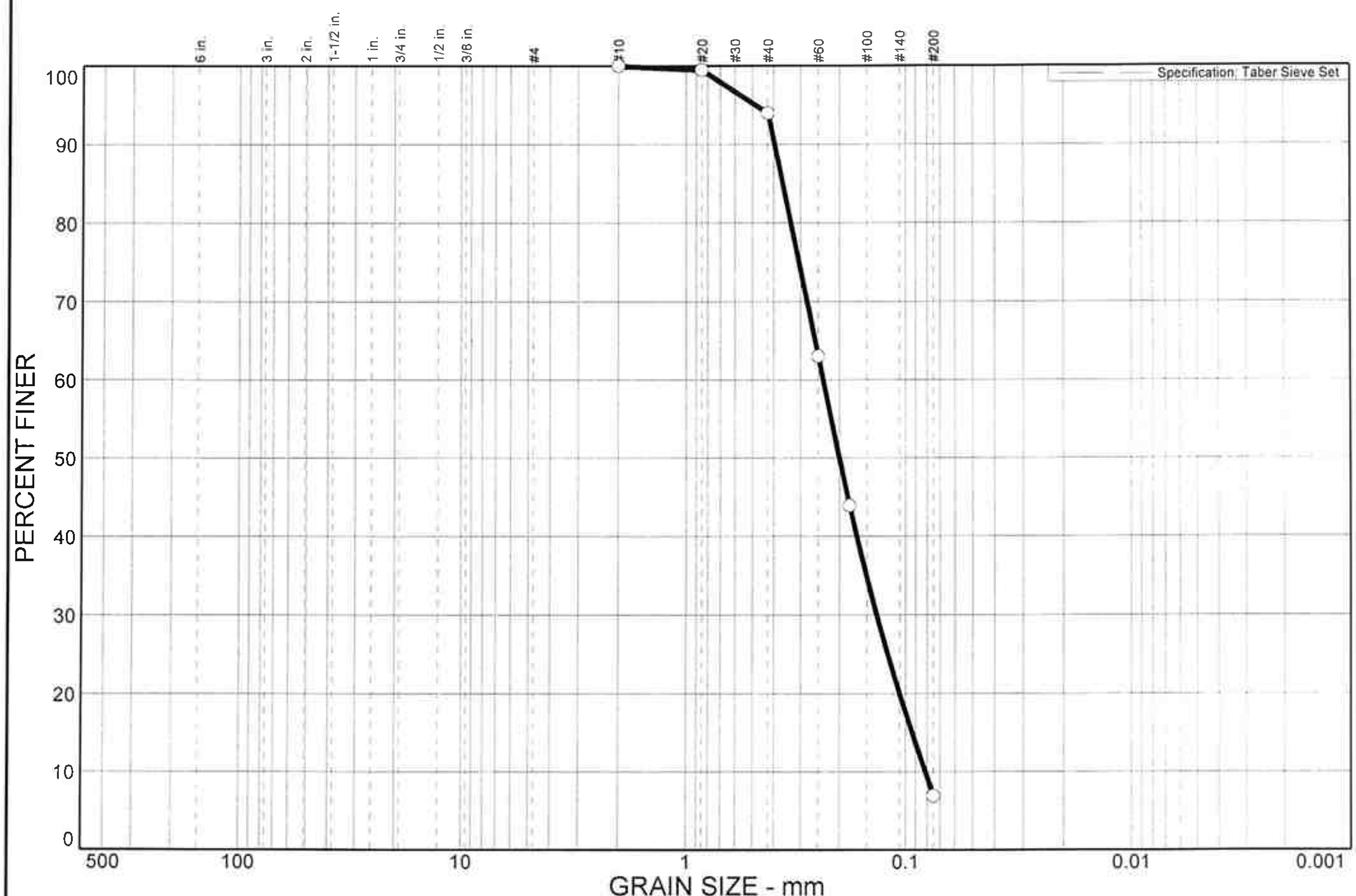
Sample No.: 3/1 **Source of Sample:** **Date:** 11/19/2009
Location: Boring 3 **Elev./Depth:** 4'-6'

Taber
Since 1954

Client: El Dorado County DOT
Project: Gerle Creek Bridge

Project No: 2009-0152 **Figure** A-5

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	6.0	87.1	6.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0	0.0 - 0.0	X
#20	99.5	0.0 - 0.0	X
#40	94.0	0.0 - 0.0	X
#60	63.0	0.0 - 0.0	X
#80	43.9	0.0 - 0.0	X
#200	6.9	0 - 0	X

* Taber Sieve Set

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.364 D_{60}= 0.238 D_{50}= 0.201
D_{30}= 0.136 D_{15}= 0.0935 D_{10}= 0.0817
C_u= 2.91 C_c= 0.95

Classification

USCS= AASHTO=

Remarks

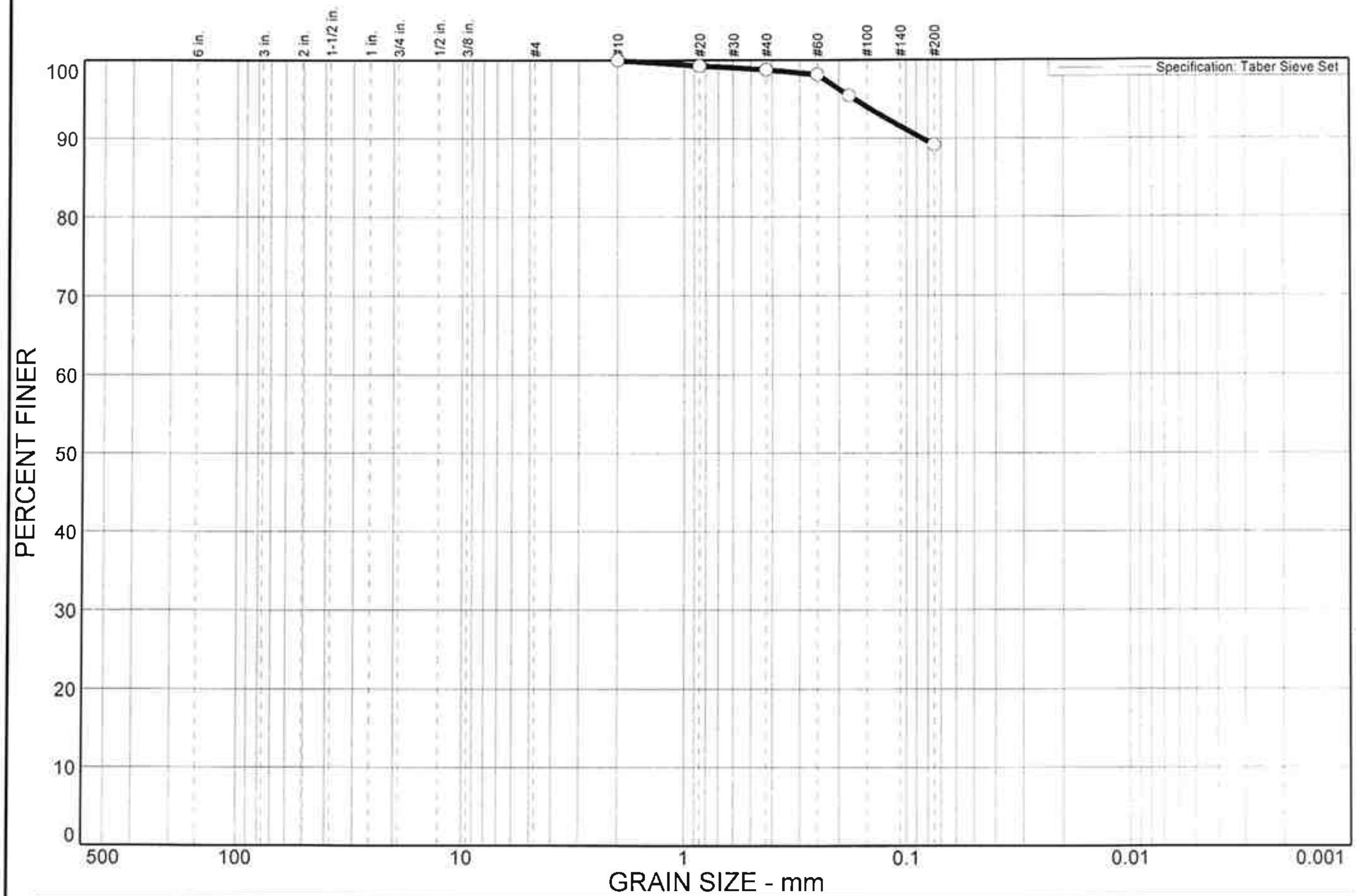
Total dry weight of sample tested = 815.7 grams

Sample No.: 3/4 **Source of Sample:** **Date:** 11/20/
Location: Boring 3 **Elev./Depth:** 19'-21'

Taber
Since 1954

Client: El Dorado County DOT
Project: Gerle Creek Bridge
Project No: 2009-0152 **Figure** A-6

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	1.2	9.6	89.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0	0.0 - 0.0	X
#20	99.3	0.0 - 0.0	X
#40	98.8	0.0 - 0.0	X
#60	98.2	0.0 - 0.0	X
#80	95.5	0.0 - 0.0	X
#200	89.2	0 - 0	X

* Taber Sieve Set

Material Description

Atterberg Limits

PL= 22 LL= 22 PI= 0

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

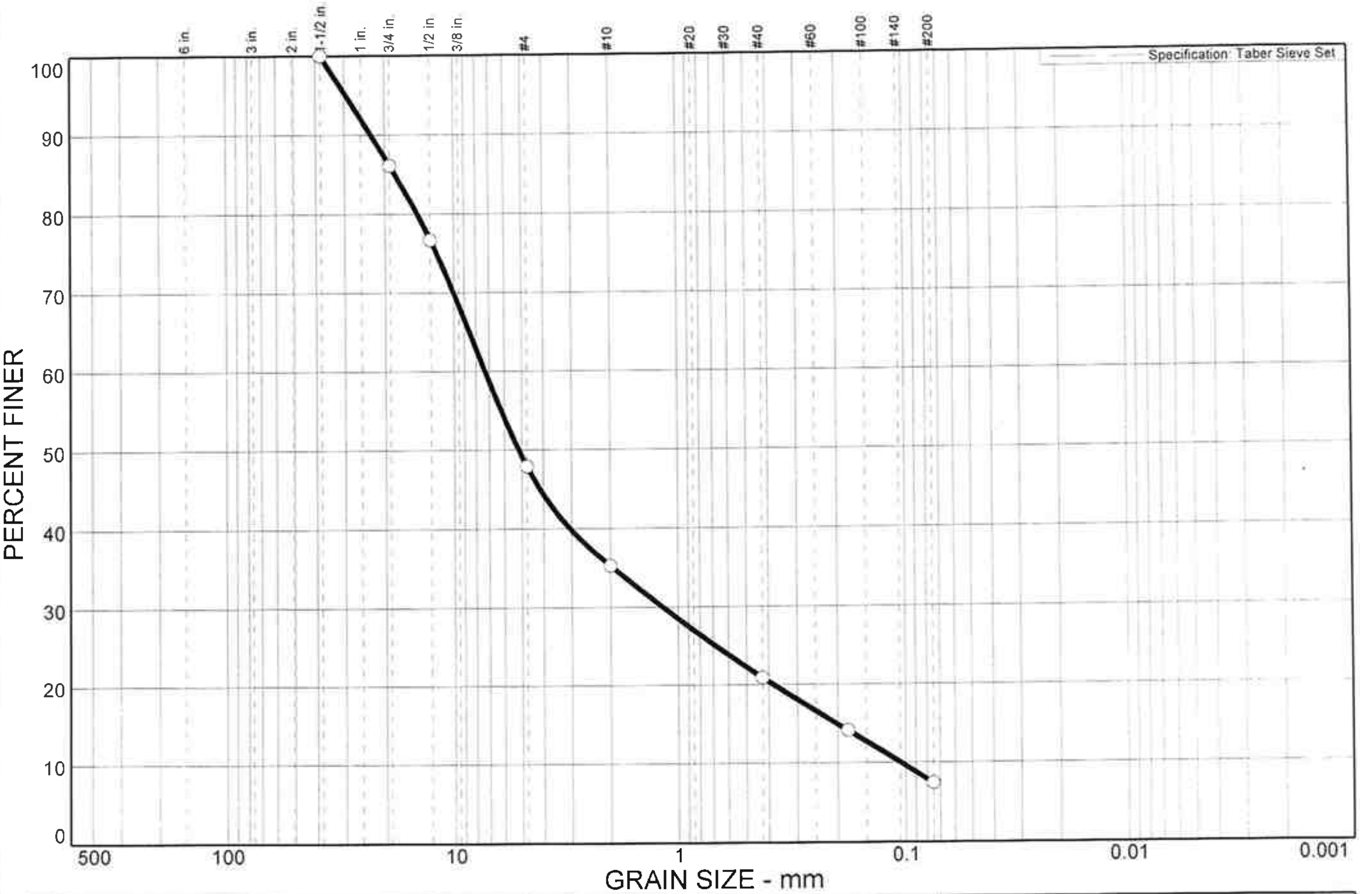
Total dry weight of sample tested = 486.2 grams

Sample No.: 3/6 **Source of Sample:** **Date:** 11/20/2009
Location: Boring 3 **Elev./Depth:** 31'-33'

Taber
Since 1954

Client: El Dorado County DOT
Project: Gerle Creek Bridge
Project No: 2009-0152 **Figure** A-7

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	13.9	38.2	12.6	14.4	13.5	7.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0	0.0 - 0.0	X
.75 in.	86.1	0.0 - 0.0	X
.5 in.	76.7	0.0 - 0.0	X
#4	47.9	0.0 - 0.0	X
#10	35.3	0.0 - 0.0	X
#40	20.9	0.0 - 0.0	X
#80	14.1	0.0 - 0.0	X
#200	7.4	0 - 0	X

* Taber Sieve Set

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 18.1 D_{60}= 7.31 D_{50}= 5.18
D_{30}= 1.17 D_{15}= 0.202 D_{10}= 0.105
C_u= 69.37 C_c= 1.77

Classification

USCS= AASHTO=

Remarks

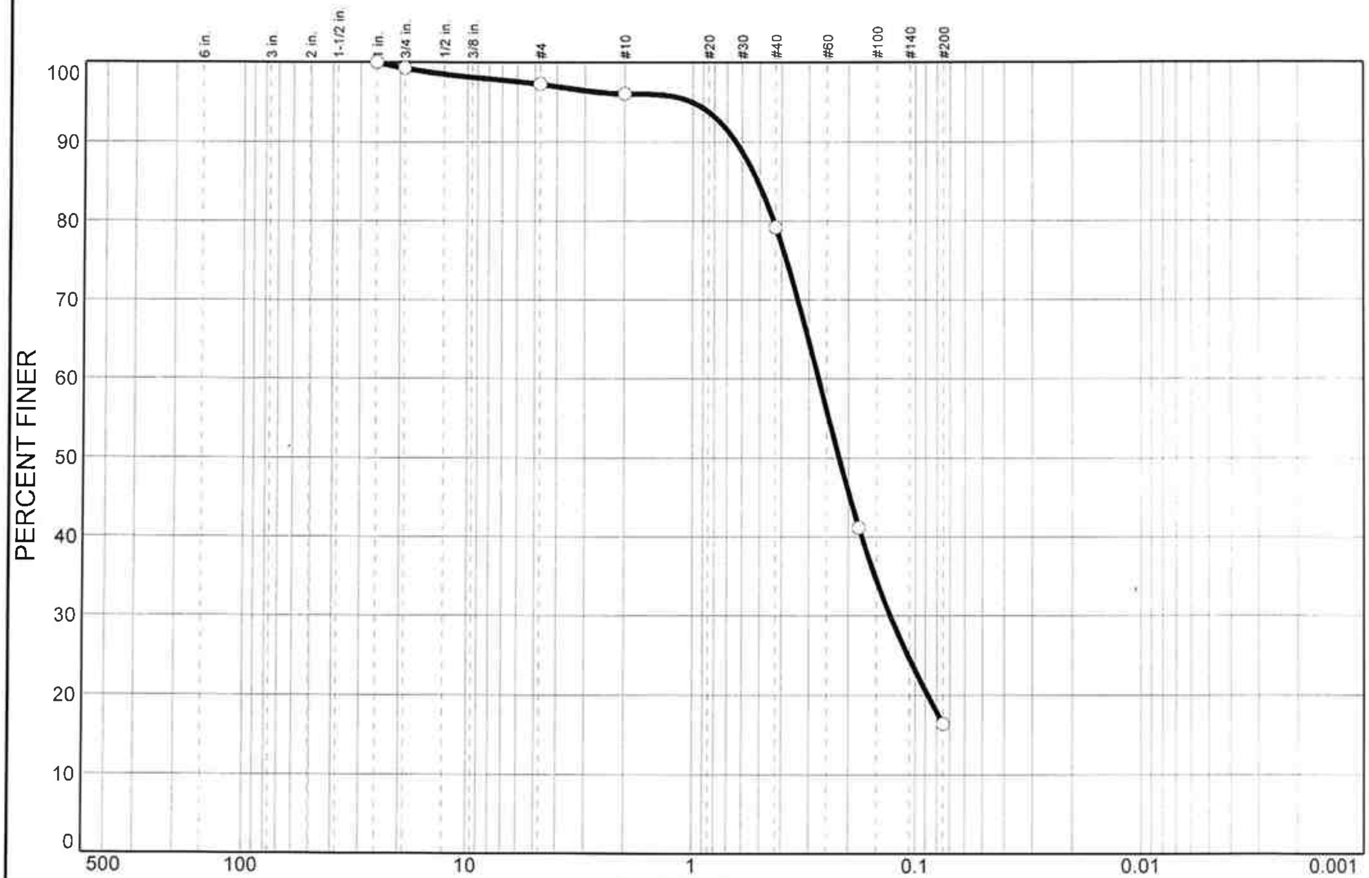
Total dry weight of sample tested =575 grams.

Sample No.: 3/8 **Source of Sample:** **Date:** 11/19/2009
Location: Boring 3 **Elev./Depth:** 41'-43'

Taber Since 1954

Client: El Dorado County DOT
Project: Gerle Creek Bridge
Project No: 2009-0152 **Figure** A-8

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.7	2.0	1.2	16.9	62.8	16.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
.75 in.	99.3		
#4	97.3		
#10	96.1		
#40	79.2		
#80	41.2		
#200	16.4		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.512 D_{60}= 0.273 D_{50}= 0.221

D_{30}= 0.130 D_{15}= D_{10}=

C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Total dry weight of sample tested =846 grams.

Sample No.: 4/2
Location: Boring 4

Source of Sample:

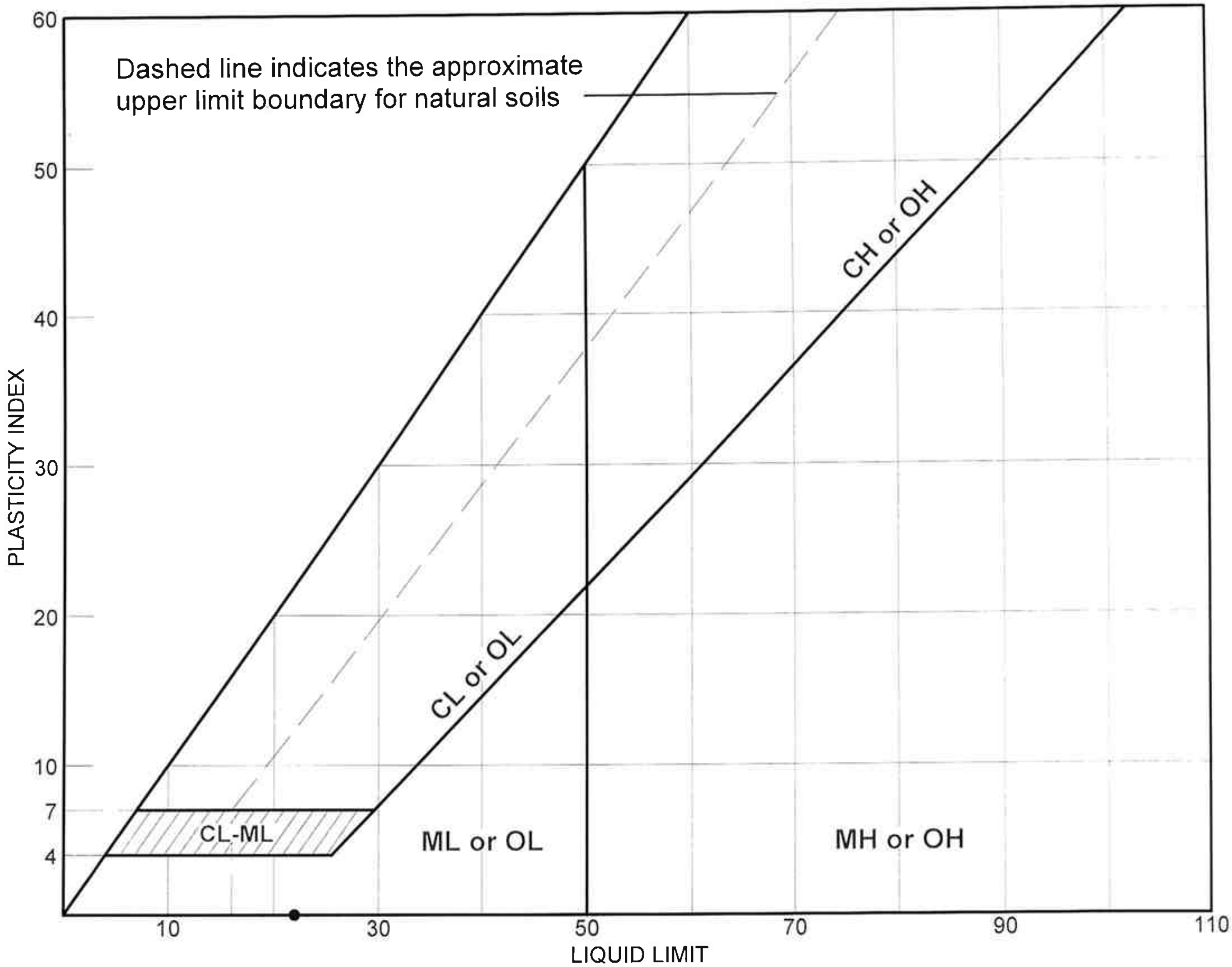
Date: 11/19/2009
Elev./Depth: 15'-17'

Taber
Since 1954

Client: El Dorado County DOT
Project: Gerle Creek Bridge

Project No: 2009-0152 **Figure** A-9

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●		3/6	31'-33'		22	22	0	

Taber
Since 1954

Client: El Dorado County DOT
Project: Gerle Creek Bridge

Project No.: 2009-0152 **Figure** A-10

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/20/2009
Date Submitted 11/17/2009

To: Ralph Fisher
Taber Consultants
3911 West Capital Avenue
W. Sacramento, CA 95691-2116

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009/0152 Site ID : BULK 1A.
Thank you for your business.

* For future reference to this analysis please use SUN # 57060-115545.

EVALUATION FOR SOIL CORROSION

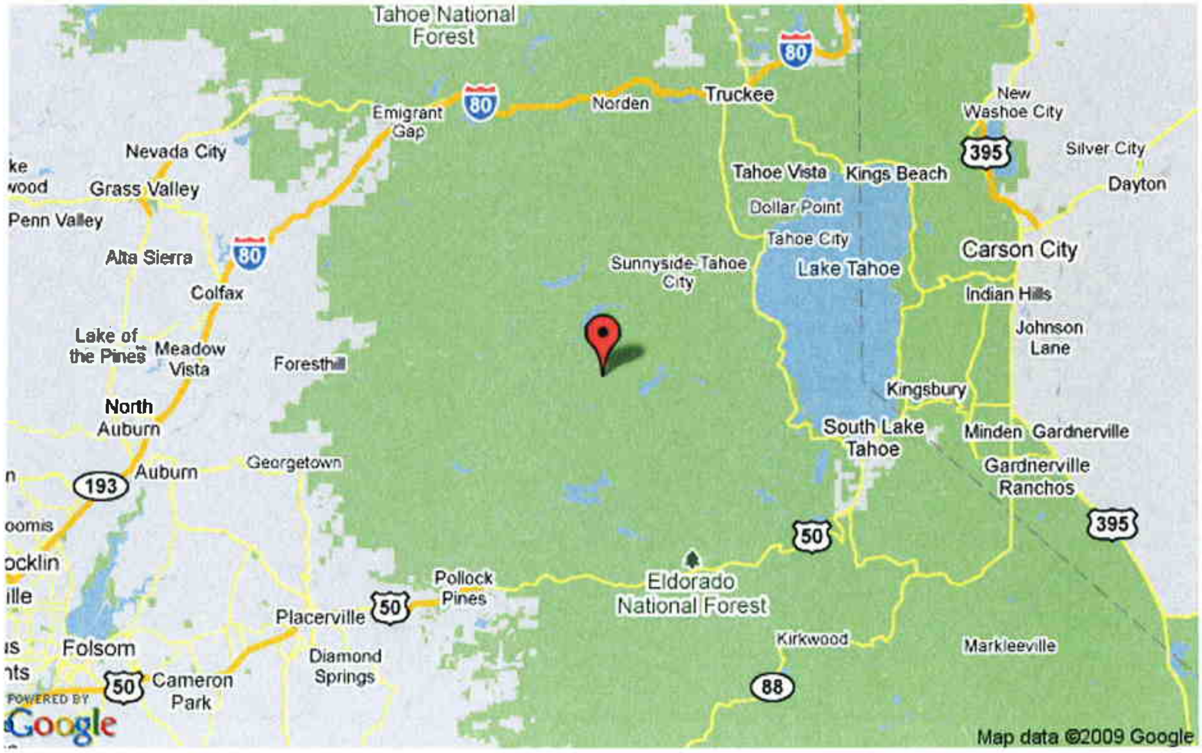
Soil pH	5.82		
Minimum Resistivity	12.33	ohm-cm (x1000)	
Chloride	8.1 ppm	00.00081	%
Sulfate	13.2 ppm	00.00132	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

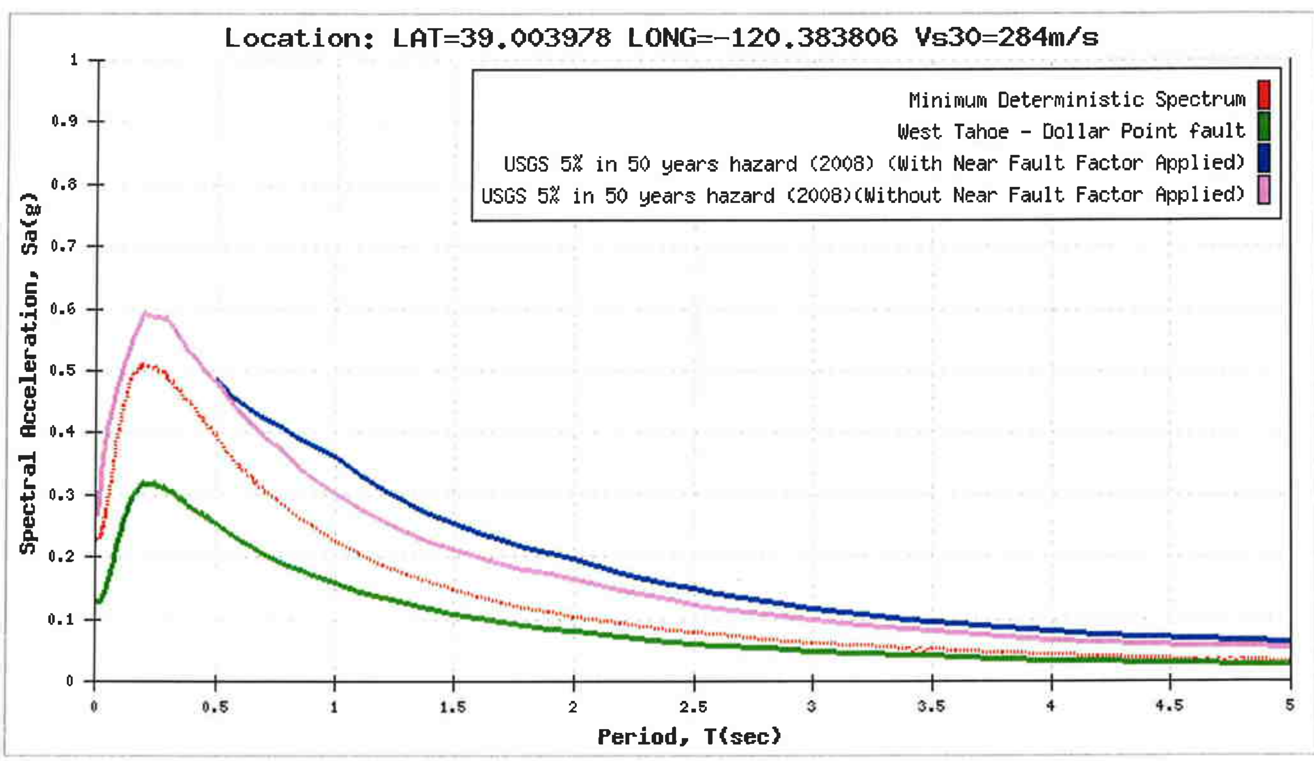
Appendix B:

Seismic Data

SELECT SITE LOCATION



CALCULATED SPECTRA



SITE DATA

Shear Wave Velocity, Vs_{30}:	284 m/s
Latitude:	39.003978
Longitude:	-120.383806
Depth to Vs = 1.0 km/s:	323 m
Depth to Vs = 2.5 km/s:	2.00 km

DETERMINISTIC

West Tahoe - Dollar Point fault

Fault ID:	84
Maximum Magnitude (MMax):	7
Fault Type:	N
Fault Dip:	60 Deg
Dip Direction:	e
Bottom of Rupture Plane:	13.00 km
Top of Rupture Plane(Ztor):	0.00 km
Rrup	25.11 km
Rjb:	25.11 km
Rx:	25.10 km
Fnorm:	1
Frev:	0

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Not Applied)	SA(Final Spectrum)
0.01	0.128	1.000	1.000	0.128
0.02	0.129	1.000	1.000	0.129
0.022	0.130	1.000	1.000	0.130
0.025	0.132	1.000	1.000	0.132
0.029	0.134	1.000	1.000	0.134
0.03	0.135	1.000	1.000	0.135
0.032	0.137	1.000	1.000	0.137
0.035	0.140	1.000	1.000	0.140
0.036	0.141	1.000	1.000	0.141
0.04	0.145	1.000	1.000	0.145
0.042	0.147	1.000	1.000	0.147
0.044	0.150	1.000	1.000	0.150
0.045	0.151	1.000	1.000	0.151
0.046	0.152	1.000	1.000	0.152
0.048	0.154	1.000	1.000	0.154
0.05	0.156	1.000	1.000	0.156
0.055	0.164	1.000	1.000	0.164
0.06	0.171	1.000	1.000	0.171
0.065	0.179	1.000	1.000	0.179
0.067	0.182	1.000	1.000	0.182

0.07	0.187	1.000	1.000	0.187
0.075	0.194	1.000	1.000	0.194
0.08	0.202	1.000	1.000	0.202
0.085	0.211	1.000	1.000	0.211
0.09	0.219	1.000	1.000	0.219
0.095	0.227	1.000	1.000	0.227
0.1	0.235	1.000	1.000	0.235
0.11	0.249	1.000	1.000	0.249
0.12	0.262	1.000	1.000	0.262
0.13	0.274	1.000	1.000	0.274
0.133	0.277	1.000	1.000	0.277
0.14	0.285	1.000	1.000	0.285
0.15	0.294	1.000	1.000	0.294
0.16	0.300	1.000	1.000	0.300
0.17	0.305	1.000	1.000	0.305
0.18	0.310	1.000	1.000	0.310
0.19	0.314	1.000	1.000	0.314
0.2	0.317	1.000	1.000	0.317
0.22	0.317	1.000	1.000	0.317
0.24	0.316	1.000	1.000	0.316
0.25	0.315	1.000	1.000	0.315
0.26	0.314	1.000	1.000	0.314
0.28	0.311	1.000	1.000	0.311
0.29	0.309	1.000	1.000	0.309
0.3	0.307	1.000	1.000	0.307
0.32	0.302	1.000	1.000	0.302
0.34	0.296	1.000	1.000	0.296
0.35	0.293	1.000	1.000	0.293
0.36	0.290	1.000	1.000	0.290
0.38	0.285	1.000	1.000	0.285
0.4	0.279	1.000	1.000	0.279
0.42	0.274	1.000	1.000	0.274
0.44	0.269	1.000	1.000	0.269
0.45	0.266	1.000	1.000	0.266
0.46	0.264	1.000	1.000	0.264
0.48	0.259	1.000	1.000	0.259
0.5	0.254	1.000	1.000	0.254
0.55	0.239	1.000	1.000	0.239
0.6	0.227	1.000	1.000	0.227
0.65	0.215	1.000	1.000	0.215
0.667	0.212	1.000	1.000	0.212
0.7	0.205	1.000	1.000	0.205
0.75	0.196	1.000	1.000	0.196
0.8	0.187	1.000	1.000	0.187
0.85	0.178	1.000	1.000	0.178
0.9	0.171	1.000	1.000	0.171
0.95	0.164	1.000	1.000	0.164
1	0.157	1.000	1.000	0.157
1.1	0.145	1.000	1.000	0.145
1.2	0.134	1.000	1.000	0.134

1.3	0.125	1.000	1.000	0.125
1.4	0.117	1.000	1.000	0.117
1.5	0.109	1.000	1.000	0.109
1.6	0.102	1.000	1.000	0.102
1.7	0.095	1.000	1.000	0.095
1.8	0.089	1.000	1.000	0.089
1.9	0.084	1.000	1.000	0.084
2	0.079	1.000	1.000	0.079
2.2	0.071	1.000	1.000	0.071
2.4	0.064	1.000	1.000	0.064
2.5	0.061	1.000	1.000	0.061
2.6	0.058	1.000	1.000	0.058
2.8	0.053	1.000	1.000	0.053
3	0.049	1.000	1.000	0.049
3.2	0.045	1.000	1.000	0.045
3.4	0.042	1.000	1.000	0.042
3.5	0.041	1.000	1.000	0.041
3.6	0.039	1.000	1.000	0.039
3.8	0.037	1.000	1.000	0.037
4	0.034	1.000	1.000	0.034
4.2	0.032	1.000	1.000	0.032
4.4	0.031	1.000	1.000	0.031
4.6	0.029	1.000	1.000	0.029
4.8	0.028	1.000	1.000	0.028
5	0.026	1.000	1.000	0.026

PROBABILISTIC

Probabilistic Model
USGS Seismic Hazard Map(2008) 975 Year Return Period

Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Not Applied)	SA(Final Spectrum)
0.01	0.268	1.000	1.000	0.268
0.02	0.320	1.000	1.000	0.320
0.022	0.328	1.000	1.000	0.328
0.025	0.339	1.000	1.000	0.339
0.029	0.352	1.000	1.000	0.352
0.03	0.355	1.000	1.000	0.355
0.032	0.361	1.000	1.000	0.361
0.035	0.370	1.000	1.000	0.370
0.036	0.372	1.000	1.000	0.372
0.04	0.382	1.000	1.000	0.382
0.042	0.387	1.000	1.000	0.387
0.044	0.392	1.000	1.000	0.392
0.045	0.394	1.000	1.000	0.394
0.046	0.396	1.000	1.000	0.396
0.048	0.401	1.000	1.000	0.401
0.05	0.405	1.000	1.000	0.405

0.055	0.415	1.000	1.000	0.415
0.06	0.425	1.000	1.000	0.425
0.065	0.433	1.000	1.000	0.433
0.067	0.437	1.000	1.000	0.437
0.07	0.442	1.000	1.000	0.442
0.075	0.450	1.000	1.000	0.450
0.08	0.457	1.000	1.000	0.457
0.085	0.464	1.000	1.000	0.464
0.09	0.471	1.000	1.000	0.471
0.095	0.478	1.000	1.000	0.478
0.1	0.484	1.000	1.000	0.484
0.11	0.498	1.000	1.000	0.498
0.12	0.511	1.000	1.000	0.511
0.13	0.523	1.000	1.000	0.523
0.133	0.526	1.000	1.000	0.526
0.14	0.534	1.000	1.000	0.534
0.15	0.545	1.000	1.000	0.545
0.16	0.556	1.000	1.000	0.556
0.17	0.565	1.000	1.000	0.565
0.18	0.575	1.000	1.000	0.575
0.19	0.584	1.000	1.000	0.584
0.2	0.593	1.000	1.000	0.593
0.22	0.590	1.000	1.000	0.590
0.24	0.588	1.000	1.000	0.588
0.25	0.587	1.000	1.000	0.587
0.26	0.586	1.000	1.000	0.586
0.28	0.584	1.000	1.000	0.584
0.29	0.583	1.000	1.000	0.583
0.3	0.582	1.000	1.000	0.582
0.32	0.568	1.000	1.000	0.568
0.34	0.556	1.000	1.000	0.556
0.35	0.550	1.000	1.000	0.550
0.36	0.544	1.000	1.000	0.544
0.38	0.533	1.000	1.000	0.533
0.4	0.523	1.000	1.000	0.523
0.42	0.513	1.000	1.000	0.513
0.44	0.505	1.000	1.000	0.505
0.45	0.500	1.000	1.000	0.500
0.46	0.496	1.000	1.000	0.496
0.48	0.489	1.000	1.000	0.489
0.5	0.481	1.000	1.000	0.481
0.55	0.454	1.000	1.020	0.454
0.6	0.431	1.000	1.040	0.431
0.65	0.410	1.000	1.060	0.410
0.667	0.404	1.000	1.067	0.404
0.7	0.392	1.000	1.080	0.392
0.75	0.376	1.000	1.100	0.376
0.8	0.358	1.000	1.120	0.358
0.85	0.342	1.000	1.140	0.342
0.9	0.327	1.000	1.160	0.327

0.95	0.314	1.000	1.180	0.314
1	0.302	1.000	1.200	0.302
1.1	0.278	1.000	1.200	0.278
1.2	0.258	1.000	1.200	0.258
1.3	0.240	1.000	1.200	0.240
1.4	0.225	1.000	1.200	0.225
1.5	0.212	1.000	1.200	0.212
1.6	0.200	1.000	1.200	0.200
1.7	0.190	1.000	1.200	0.190
1.8	0.181	1.000	1.200	0.181
1.9	0.172	1.000	1.200	0.172
2	0.165	1.000	1.200	0.165
2.2	0.146	1.000	1.200	0.146
2.4	0.131	1.000	1.200	0.131
2.5	0.124	1.000	1.200	0.124
2.6	0.118	1.000	1.200	0.118
2.8	0.107	1.000	1.200	0.107
3	0.098	1.000	1.200	0.098
3.2	0.090	1.000	1.200	0.090
3.4	0.083	1.000	1.200	0.083
3.5	0.080	1.000	1.200	0.080
3.6	0.077	1.000	1.200	0.077
3.8	0.071	1.000	1.200	0.071
4	0.067	1.000	1.200	0.067
4.2	0.063	1.000	1.200	0.063
4.4	0.061	1.000	1.200	0.061
4.6	0.058	1.000	1.200	0.058
4.8	0.056	1.000	1.200	0.056
5	0.054	1.000	1.200	0.054

MINIMUM DETERMINISTIC SPECTRUM

Period	SA
0.01	0.227
0.02	0.230
0.022	0.232
0.025	0.235
0.029	0.240
0.03	0.241
0.032	0.244
0.035	0.250
0.036	0.251
0.04	0.258
0.042	0.262
0.044	0.266
0.045	0.268
0.046	0.269

0.048	0.273
0.05	0.277
0.055	0.290
0.06	0.303
0.065	0.316
0.067	0.321
0.07	0.328
0.075	0.341
0.08	0.354
0.085	0.367
0.09	0.380
0.095	0.392
0.1	0.404
0.11	0.424
0.12	0.443
0.13	0.459
0.133	0.463
0.14	0.473
0.15	0.486
0.16	0.493
0.17	0.498
0.18	0.503
0.19	0.507
0.2	0.510
0.22	0.507
0.24	0.504
0.25	0.502
0.26	0.499
0.28	0.493
0.29	0.490
0.3	0.487
0.32	0.479
0.34	0.470
0.35	0.466
0.36	0.462
0.38	0.453
0.4	0.445
0.42	0.434
0.44	0.424
0.45	0.419
0.46	0.414
0.48	0.405
0.5	0.396
0.55	0.369
0.6	0.345
0.65	0.325
0.667	0.318
0.7	0.306
0.75	0.290
0.8	0.274

0.85	0.260
0.9	0.247
0.95	0.235
1	0.224
1.1	0.204
1.2	0.187
1.3	0.172
1.4	0.159
1.5	0.147
1.6	0.136
1.7	0.126
1.8	0.118
1.9	0.110
2	0.103
2.2	0.091
2.4	0.082
2.5	0.077
2.6	0.074
2.8	0.067
3	0.061
3.2	0.056
3.4	0.052
3.5	0.050
3.6	0.048
3.8	0.044
4	0.041
4.2	0.039
4.4	0.037
4.6	0.034
4.8	0.033
5	0.031

Envelope Data

Period	**SA**
0.01	0.268
0.02	0.320
0.022	0.328
0.025	0.339
0.029	0.352
0.03	0.355
0.032	0.361
0.035	0.370
0.036	0.372
0.04	0.382
0.042	0.387
0.044	0.392
0.045	0.394
0.046	0.396
0.048	0.401

0.05	0.405
0.055	0.415
0.06	0.425
0.065	0.433
0.067	0.437
0.07	0.442
0.075	0.450
0.08	0.457
0.085	0.464
0.09	0.471
0.095	0.478
0.1	0.484
0.11	0.498
0.12	0.511
0.13	0.523
0.133	0.526
0.14	0.534
0.15	0.545
0.16	0.556
0.17	0.565
0.18	0.575
0.19	0.584
0.2	0.593
0.22	0.590
0.24	0.588
0.25	0.587
0.26	0.586
0.28	0.584
0.29	0.583
0.3	0.582
0.32	0.568
0.34	0.556
0.35	0.550
0.36	0.544
0.38	0.533
0.4	0.523
0.42	0.513
0.44	0.505
0.45	0.500
0.46	0.496
0.48	0.489
0.5	0.481
0.55	0.454
0.6	0.431
0.65	0.410
0.667	0.404
0.7	0.392
0.75	0.376
0.8	0.358
0.85	0.342

0.9	0.327
0.95	0.314
1	0.302
1.1	0.278
1.2	0.258
1.3	0.240
1.4	0.225
1.5	0.212
1.6	0.200
1.7	0.190
1.8	0.181
1.9	0.172
2	0.165
2.2	0.146
2.4	0.131
2.5	0.124
2.6	0.118
2.8	0.107
3	0.098
3.2	0.090
3.4	0.083
3.5	0.080
3.6	0.077
3.8	0.071
4	0.067
4.2	0.063
4.4	0.061
4.6	0.058
4.8	0.056
5	0.054