GEOTECHNICAL DATA REPORT

REPLACE STRUCTURE B-425, OFF-SYSTEM BRIDGE

at PETRIFIED WASH

on SR 361

MINERAL COUNTY
February 2018

NEVADA DOT
GEOTECHNICAL ENGINEERING

STATE OF NEVADA

DEPARTMENT OF TRANSPORTATION

MATERIALS DIVISION

GEOTECHNICAL SECTION

GEOTECHNICAL DATA REPORT

REPLACE STRUCTURE B-425, OFF-SYSTEM BRIDGE at PETRIFIED WASH on SR 361

MINERAL COUNTY

February 2018

EA 74029

Prepared by: _____

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Table of Contents

APPENDICES:

INTRODUCTION

General

Presented herein is a summary of the Nevada Department of Transportation's (NDOT's) geotechnical investigation for the proposed replacement of structure B-425, an off-system bridge consisting of a double barrel concrete arch pipe; as well as, replacement of the adjacent single barrel concrete arch pipe culvert. The structures can be found between mile post 13.70 and 13.90 on SR 361, a two-lane highway, at Petrified Wash in Mineral County just south of Gabbs, Nevada. A Project Location Map is presented in Appendix A.

Purpose and Scope

A geotechnical investigation was conducted to determine subsurface soil conditions at the project site. The scope of work includes a geotechnical field investigation and a laboratory testing program. This report provides no specific geotechnical design recommendations for any structures, features, or locations found on this project.

PROJECT DESCRIPTION

Planned construction will consist of removing three 10 ft. by 10 ft. concrete arch pipes and replacing them with Reinforced Concrete Box (RCB) structures comparable in size. Current structures include a double barrel concrete arch box, on a skew, just south of a single barrel concrete arch box. A slight modification has been proposed for the alignment on the double barrel structure; however, the single barrel structure is planned to remain in its current configuration, normal to the roadway.

SUBSURFACE FIELD INVESTIGATION

The Geotechnical Section conducted a subsurface investigation at the aforementioned project location on January 9th and 10th, 2018. Field exploration consisted of auger drilling two 6-inch diameter borings, one boring just north of each structure, in the center of the northbound lane on SR 361. Approximate locations of the boreholes are plotted on the Boring Location Map located in Appendix A. Boring locations were obtained using a handheld Global Positioning System (GPS) and surface elevations were approximated from topographical data compiled by NDOT.

Drilling was conducted using a Diedrich D-120 drill rig equipped with hollow stem auger. Boring

logs of the subsurface conditions were recorded at the time of drilling. Representative soil samples at the double barrel location were obtained by alternating Standard Penetration Test (SPT) and California Modified Sampler (CMS) methods at 2.5 ft. intervals to a depth of 46.5 ft. Samples at the single barrel location were obtained using the SPT method exclusively, on 5 ft. intervals to a depth of 41.5 ft. All samplers were driven by a 140-lb automatic hammer, and the energy transfer from the automatic hammer into the drill rig string was calibrated at 86%. The uncorrected blow counts for both the SPT and CMS methods are reported on the boring logs located in Appendix B. Groundwater and bedrock were not encountered in either boring.

Boring logs and sample test results represent only the areas that were explored and may not fully characterize all soil types which may be encountered during construction. The maximum particle size recovered using the SPT and CMS samplers is 1-3/8 in. and 2-7/16 in., respectively; therefore, boring logs may not adequately represent the actual quantity or presence of gravels, cobbles, or boulders. Photographs of the project location are provided in Appendix A. Additionally, the boring log key and boring logs are provided in Appendix B.

LABORATORY ANALYSIS

Soil samples were returned to and tested at the NDOT Materials and Testing Laboratory in Carson City, Nevada. The testing program consisted of sieve analyses, Atterberg limits, and direct shear tests. Test results for each soil sample are attached in Appendix C.

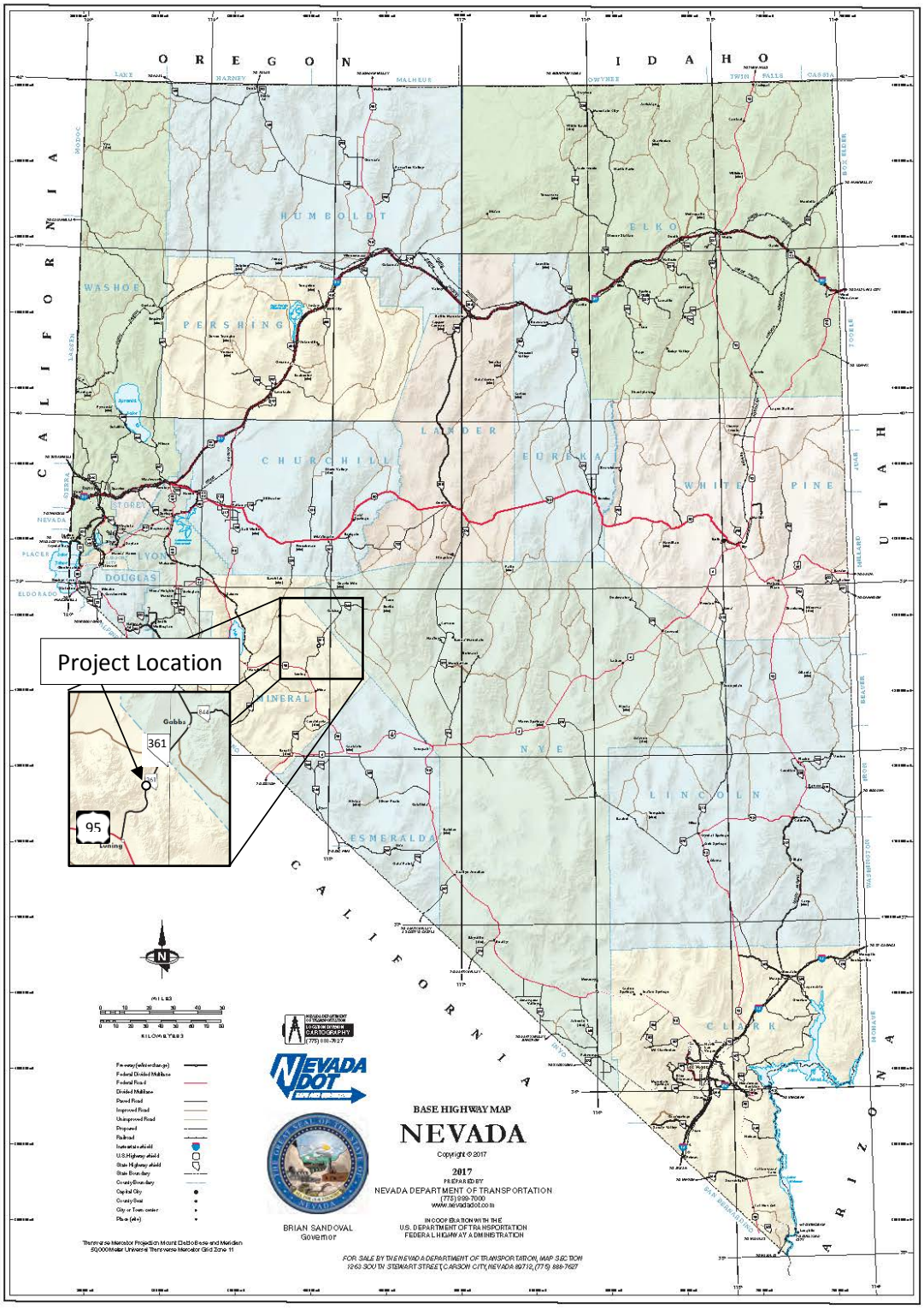
APPENDIX A

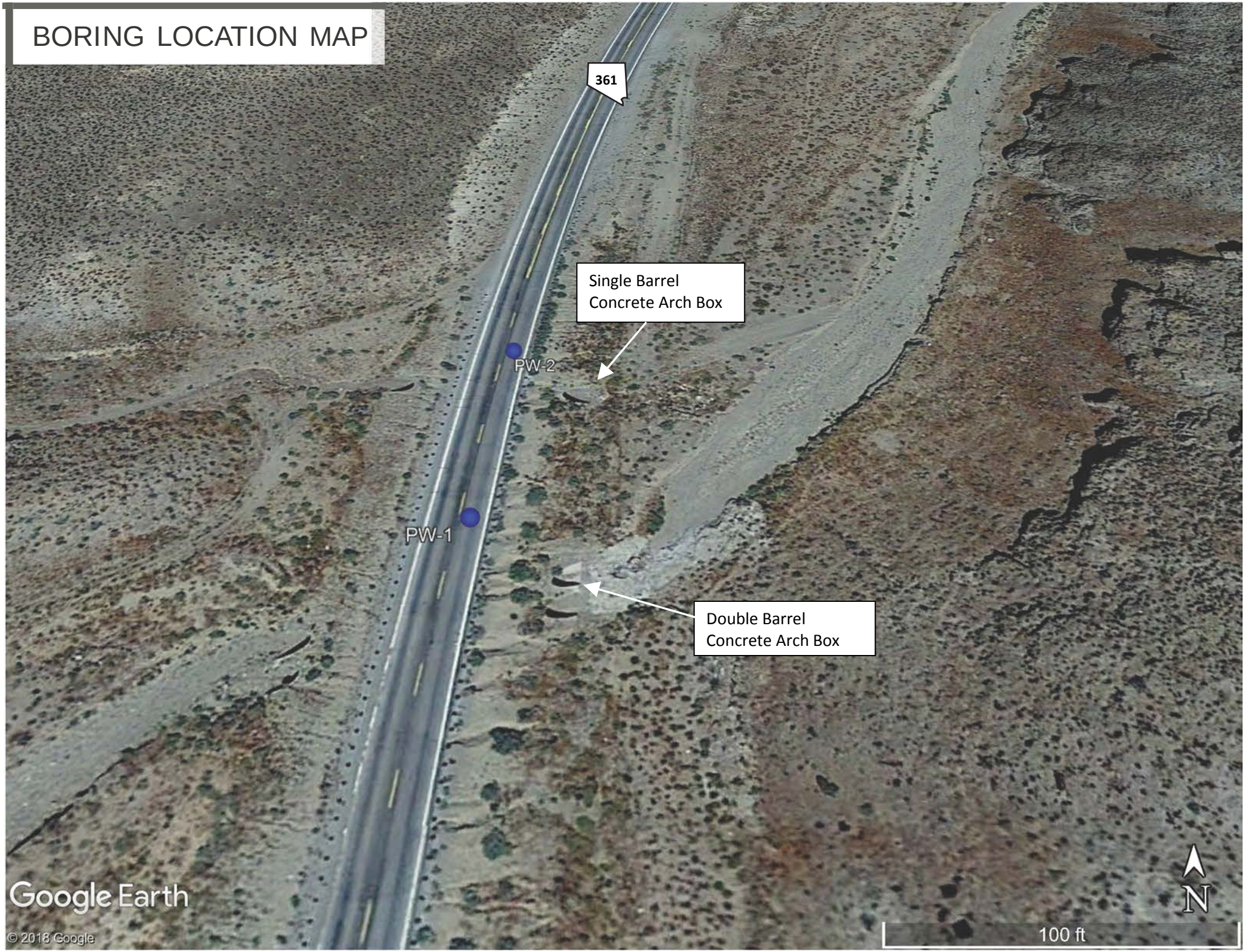
Project Location Map

Boring Location Map

Project Location Photographs

Project Location Map



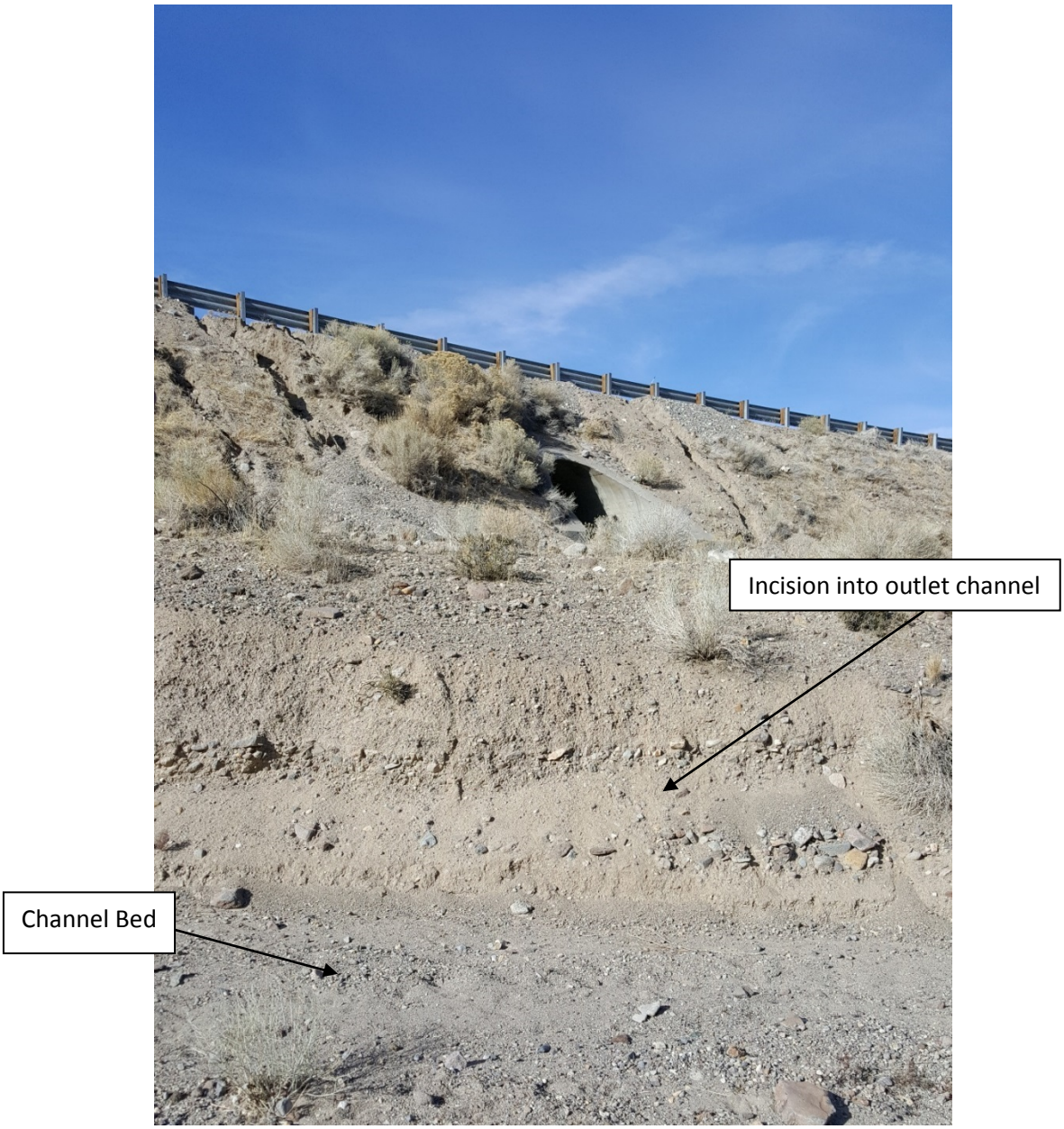

BORING LOCATION MAP
361
Single Barrel
Concrete Arch Box
PW-2
PW-1
Double Barrel
Concrete Arch Box
Google Earth
© 2018 Google
N
100 ft

Project Location Photographs

Photo looking south.

Double barrel concrete arch box. Photo looking west.

Northern barrel of double concrete arch box (left) and single barrel concrete arch box (right). Photo looking west.



Single barrel concrete arch box. Photo looking north-west.

APPENDIX B

Boring Log Key

Boring Logs

KEY TO EXPLORATION LOGS

PARTICLE SIZE LIMITS								
CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		FINE	MEDIUM	COARSE	FINE	COARSE		
.002 mm		#200	#40	#10	#4	¾ inch	3 inch	12 inch

USCS GROUP	TYPICAL SOIL DESCRIPTION
GW	Well graded gravels, gravel-sand mixtures, little or no fines
GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
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 sand-silt mixtures
SC	Clayey sands, poorly graded sand-clay mixtures
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
PT	Peat and other highly organic soils

MOISTURE CONDITION CRITERIA

Description	Criteria
Dry	Absence of moisture, dusty, dry to touch.
Moist	Damp, no visible free water.
Wet	Visible free water, usually below groundwater table.
∇ ▼	Groundwater Elevation Symbols

SOIL CEMENTATION CRITERIA

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Won't break or crumble w/finger pressure

STANDARD PENETRATION CLASSIFICATION*			
GRANULAR SOIL		CLAYEY SOIL	
BLOWS/FT	DENSITY	BLOWS/FT	CONSISTENCY
0 - 4	VERY LOOSE	0 - 1	VERY SOFT
5 – 10	LOOSE	2 - 4	SOFT
11 - 30	MEDIUM DENSE	5 - 8	MEDIUM STIFF
31 - 50	DENSE	9 - 15	STIFF
OVER 50	VERY DENSE	16 - 30	VERY STIFF
		31 - 60	HARD
		OVER 60	VERY HARD

*Standard Penetration Test (N) 140 lb hammer 30 inch free fall on 2 inch O.D. x 1.4 inch I.D. sampler.

Field Blow counts on California Modified Sampler (N_{CMS}) can be converted to $N_{SPT\ field}$ by:

$(N_{CMS\ field})(0.62) = N_{SPT\ field}$

Blow counts from Automatic Hammer can be converted to Standard SPT N_{60} by:

Rig #1627: $(N_{SPT\ field})(1.2) = N_{60}$

Rig #1082: $(N_{SPT\ field})(1.45) = N_{60}$

TEST ABBREVIATIONS

CD	CONSOLIDATED DRAINED	OC	ORGANIC CONTENT
CH	CHEMICAL (CORROSIVENESS)	C	CONSOLIDATION
CM	COMPACTION	PI	PLASTICITY INDEX
CU	CONSOLIDATED UNDRAINED	RQD	ROCK QUALITY DESIGNATION
D	DISPERSIVE SOILS	RV	R-VALUE
DS	DIRECT SHEAR	S	SIEVE ANALYSIS
E	EXPANSIVE SOIL	SL	SHRINKAGE LIMIT
G	SPECIFIC GRAVITY	U	UNCONFINED COMPRESSION
H	HYDROMETER	UU	UNCONSOLIDATED UNDRAINED
HC	HYDRO-COLLAPSE	UW	UNIT WEIGHT
K	PERMEABILITY	W	MOISTURE CONTENT

SOIL COLOR DESIGNATIONS ARE FROM THE MUNSELL SOIL/ROCK COLOR CHARTS.

EXAMPLE: (7.5 YR 5/3) BROWN

SAMPLER NOTATION

CMS	CALIF. MODIFIED SAMPLER[1]
CPT	CONE PENETRATION TEST
CS	CONTINUOUS SAMPLER[2]
PB	PITCHER BARREL
RC	ROCK CORE[3]
SH	SHELBY TUBE[4]
SPT	STANDARD PENETRATION TEST
TP	TEST PIT

1- I.D.= 2.421 inch

2- I.D.=3.228 inch with tube; 3.50 inch w/o tube

3- NXB I.D.= 1.875 inch

4- I.D.= 2.875 inch

Revised August 2010

EXPLORATION LOG

Materials Division
Geotechnical Section
1263 S. Stewart St
Carson City, NV 89712

START DATE 1/9/18
END DATE 1/9/18
JOB DESCRIPTION Replace Structure B-425
LOCATION SR 361 at Petrified Wash
BORING PW-1
E.A. # 74029
GROUND ELEV. 5594.00 (ft)
HAMMER DROP SYSTEM Auto. (ETR 86%)

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L" 826+95.0
OFFSET
ENGINEER Jensen
EQUIPMENT Diedrich D-120
OPERATOR Rigsby
DRILLING METHOD 6" HSA
BACKFILLED _____ DATE _____

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									ASPHALT 6"	
									AGGREGATE BASE 6"	
	2.5							SM		
	4.0	1	SPT	30 24 20	44		S,PI		**FILL: SILTY SAND WITH GRAVEL** Dense, dry to moist, brown, 0.3' orange, 0.2' red, -200=12.8%, sand=55.5%, gravel=31.7%	(1) Rock in sampler shoe
	5.0									
5589.0	5	2	CMS	13 12 11	23		S,PI		**FILL: SILTY SAND WITH GRAVEL** Medium dense, moist, brown	
	6.5									
									7.00	
	7.5							GP GC		
	9.0	3	SPT	10 20 16	36		S,PI		**FILL: POORLY GRADED GRAVEL WITH CLAY AND SAND** Dense, moist, brown and tan, -200=12.0%, sand=45.3%, gravel=42.7%	
									9.50	
	10.0									
5584.0	10	4	CMS	13 14 20	34		S,PI	SC SM	**FILL: SILTY, CLAYEY SAND WITH GRAVEL** Dense, moist, brown, -200=15.1%, sand=62.3%, gravel=22.6%	(4) Rock in sampler shoe
	11.5									
									12.00	
	12.5									
	14.0	5	SPT	11 37 49	86		S,PI	SM	**FILL: SILTY SAND WITH GRAVEL** Very dense, moist, brown, -200=13.0%, sand=57.6%, gravel=29.4%	Rod bouncing (center 9")
									14.50	
	15.0									
5579.0	15	6	CMS	12 16 18	34		S,PI,DS	SC SM	**FILL: SILTY, CLAYEY SAND WITH GRAVEL** Dense, moist, brown, subangular, Friction Angle (Residual) = 36 degrees, -200=13.6%, sand=66.5%, gravel=19.9%	(6) Rock in sampler shoe
	16.5									
									17.00	
	17.5									
	19.0	7	SPT	7 12 18	30		S,PI	SM	**FILL: SILTY SAND WITH GRAVEL** Medium dense, moist, brown, subrounded, -200=12.6%, sand=56.4%, gravel=31.0%	
									19.50	
	20.0									
5574.0	20	8	CMS	16 29 27	56		S,PI	SP SM	**FILL: POORLY GRADED SAND WITH SILT AND GRAVEL** Very dense, moist, brown, -200=10.7%, sand=50.2%, gravel=39.1%	
	21.5									
									22.00	
	22.5									
	24.0	9	SPT	14 15 19	34		S,PI	GP GM	**FILL: POORLY GRADED GRAVEL WITH SILT AND SAND** Dense, moist, brown, -200=9.8%, sand=44.9%, gravel=45.3%	(9) Rock in sampler shoe
									24.50	
	25.0									

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E.A. # 74029
GROUND ELEV. 5594.00 (ft)
HAMMER DROP SYSTEM Auto. (ETR 86%)

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L" 826+95.0
OFFSET
ENGINEER Jensen
EQUIPMENT Diedrich D-120
OPERATOR Rigsby
DRILLING METHOD 6" HSA
BACKFILLED _____ DATE _____

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
		10	CMS	21 39 33	72		S,PI,DS	SM	**FILL: SILTY SAND** Very dense, Friction Angle (Residual) = 36 degrees, -200=41.60%, sand=46.1%, gravel=12.3%	Rod slightly bouncing (at 8")
	26.5									
	27.5								27.50	
		11	SPT	17 31 31	62		S,PI	SP SM	**FILL: POORLY GRADED SAND WITH SILT AND GRAVEL** Very dense, moist, brown, angular, -200=10.9%, sand=53.5%, gravel=35.6%	
	29.0								29.50	
5564.0	30 30.0									
		12	CMS	21 32 31	63		S,PI,DS		**WELL GRADED SAND WITH SILT AND GRAVEL** Very dense, moist, brown, Friction Angle = 39 degrees, -200=8.6%, sand=64.5%, gravel=26.9%	
	31.5									
	32.5									
		13	SPT	10 15 18	33		S,PI		**WELL GRADED SAND WITH SILT AND GRAVEL** Dense, moist, brown, subangular, -200=7.9%, sand=77.0%, gravel=15.1%	
	34.0									
5559.0	35 35.0							SW SM		
		14	CMS	20 37 51	88		S,PI		**WELL GRADED SAND WITH SILT AND GRAVEL** Very dense, moist, brown, -200=7.3%, sand=64.7%, gravel=28.0%	
	36.5									
	37.5									
		15	SPT	21 25 37	62		S,PI		**WELL GRADED SAND WITH SILT AND GRAVEL** Very dense, moist, brown, subangular, -200=9.3%, sand=52.3%, gravel=38.4%	
	39.0									
									39.50	
5554.0	40 40.0							GW GM	**WELL GRADED GRAVEL WITH SILT AND SAND** Very dense, moist, brown, Friction Angle (Residual) = 39 degrees, -200=6.9%, sand=40%, gravel=53.1%	
		16	CMS	23 32 32	64		S,PI,DS			
	41.5									
	42.5								42.00	
		17	SPT	17 23 22	45		S,PI	SW SM	**WELL GRADED SAND WITH SILT AND GRAVEL** Dense, moist, brown, subangular to subrounded, -200=9.1%, sand=54.2%, gravel=36.7%	
	44.0									
									44.50	
5549.0	45 45.0							GW GM	**WELL GRADED GRAVEL WITH SILT AND SAND** Very dense, moist, brown and gray, subangular to subrounded, -200=6.1%, sand=38.3%, gravel=55.6%	Rod bouncing (at 9")
		18	CMS	26 40 29	69		S,PI			
	46.5								46.50	
									B.O.H. No groundwater encoutered. Backfilled with drill cuttings.	

NDOT 74029_GABBS_RCB.GPJ NDOT 2017.11.09.GDT 2/12/18

EXPLORATION LOG

Materials Division
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1263 S. Stewart St
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START DATE 1/10/18
END DATE 1/10/18
JOB DESCRIPTION Replace Structure B-425
LOCATION SR 361 at Petrified Wash
BORING PW-2
E.A. # 74029
GROUND ELEV. 5590.00 (ft)
HAMMER DROP SYSTEM Auto. (ETR 86%)

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L" 827+85.0
OFFSET
ENGINEER Jensen
EQUIPMENT Diedrich D-120
OPERATOR Rigsby
DRILLING METHOD 6" HSA
BACKFILLED _____ DATE _____

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									ASPHALT 9"	
									1.33 **AGGREGATE BASE** 7"	
5585.0	5 5.0	19	SPT	16 20 16	36	87	S,PI	SP SM	**FILL: POORLY GRADED SAND WITH SILT AND GRAVEL** Dense, dry to moist, brown, -200=12.0%, sand=58.6%, gravel=29.4%	
	6.5								8.25	
5580.0	10 10.0	20	SPT	9 28 25	53	47	S,PI	SM	**FILL: SILTY SAND WITH GRAVEL** Very dense, moist, brown, -200=16.1%, sand=57.2%, gravel=26.7%	Rod slightly bouncing (at 13")
	11.5								13.25	
5575.0	15 15.0	21	SPT	11 11 11	22	50	S,PI	SC SM	**FILL: SILTY, CLAYEY SAND WITH GRAVEL** Medium dense, moist, brown, -200=19.4%, sand=53.8%, gravel=26.8%	
	16.5								18.25	
5570.0	20 20.0	22	SPT	4 5 5	10	60	S,PI	SM	**FILL: SILTY SAND WITH GRAVEL** Loose, moist, brown, -200=15.8%, sand=64.0%, gravel=20.2%	
	21.5									
	25.0									

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GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L" 827+85.0
OFFSET
ENGINEER Jensen
EQUIPMENT Diedrich D-120
OPERATOR Rigsby
DRILLING METHOD 6" HSA
BACKFILLED _____ DATE _____

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	26.5	23	SPT	47 50/2"		50	S,PI	SM	**FILL: SILTY SAND WITH GRAVEL** Very dense, moist, brown, -200=16.3%, sand=49.6%, gravel=34.1%	26'-30': 100 psi down pressure, (23) Fragmented rock in sampler shoe (extending 0.75" into sampler)
									27.00	
								GP	**FILL: GRAVEL** Very dense, brown	
5560.0	30 30.0								30.00	
		24	SPT	50/2"		17			**SAND WITH GRAVEL** Very dense, dry to moist, dark brown	100 psi down pressure, Rod bouncing
	31.5									
5555.0	35 35.0								No sample recovered	100 psi down pressure
		25	SPT	50/1.5"		0		SM		
	36.5									
5550.0	40 40.0									
		26	SPT	50/3"		20			**SILTY SAND WITH GRAVEL** Very dense, moist, dark brown, cemented	100 psi down pressure, (25) Rock in sampler shoe
	41.5								41.50	
									B.O.H. No groundwater encoutered. Backfilled with drill cuttings.	
5545.0	45									

APPENDIX C

Test Result Summary Sheets

Soil Particle Size Distribution Report Sheets (Gradation Curves)

Direct Shear Test Report Sheets

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 74029 **Job Description** Petrified Wash SR 361 RCB Replacement

Boring No. PW - 1 **Elevation (ft)** **Station** "L" 826 + 95 **Date** 1/9/2018

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg. (Peak)	C psi (Peak)	Φ deg. (Residual)	C psi (Residual)	
1	2.5 - 4.0	SPT	44	SM			12.8	23	20	3						
3	7.5 - 9.0	SPT	36	GP-GC			12.0	24	18	6						
4	10.5 - 11.5	CMS	34	SC-SM			15.1	21	17	4						
5	12.5 - 14.0	SPT	86	SM			13.0	22	19	3						
6_{mid}	15.5 - 16.0	CMS	34	SC-SM			13.6	22	18	4						
6_{top}	16.0 - 16.5	CMS			8.6	109.4					DS	36	3.5	36	2.0	
7	17.5 - 19.0	SPT	30	SM			12.6	21	19	2						
8	20.5 - 21.5	CMS	56	SP-SM			10.7	20	17	3						
9	22.5 - 24.0	SPT	34	GP-GM			9.8	21	19	2						
10_{mid}	25.5 - 26.0	CMS	72	SM			41.6	23	20	3						
10_{top}	26.0 - 26.5	CMS			8.0	110.7					DS	36	4.6	36	3.6	
11	27.5 - 29.0	SPT	62	SP-SM			10.9	20	17	3						

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT $N = (N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 74029 **Job Description** Petrified Wash SR 361 RCB Replacement

Boring No. PW - 1 **Elevation (ft)** **Station** "L" 826 + 95 **Date** 1/9/2018

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg. (Peak)	C psi (Peak)	Φ deg. (Residual)	C psi (Residual)	
12_{mid}	30.5 - 31.0	CMS	63	SW-SM			8.6	20	19	1						
12_{top}	31.0 - 31.5	CMS			6.3	104.0					DS	39	2.0	40	0.2	
13	32.5 - 34.0	SPT	33	SW-SM			7.9	18	NP	NP						
14	35.5 - 36.5	CMS	88	SW-SM			7.3	20	18	2						
15	37.5 - 39.0	SPT	62	SW-SM			9.3	19	17	2						
16_{mid}	40.5 - 41.0	CMS	64	GW-GM			6.9	21	19	2						
16_{top}	41.0 - 41.5	CMS			6.4	94.1					DS	39	1.7	39	2.1	
17	42.5 - 44.0	SPT	45	SW-SM			9.1	18	16	2						
18	45.5 - 46.5	CMS	69	GW-GM			6.1	22	19	3						

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
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Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
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CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT $N = (N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 74029 **Job Description** Petrified Wash SR 361 RCB Replacement

Boring No. PW - 2 **Elevation (ft)** **Station** "L" 827 + 85 **Date** 1/10/2018

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg. (Peak)	C psi (Peak)	Φ deg. (Residual)	C psi (Residual)	
19	5.0 - 6.5	SPT	36	SP-SM			12.0	20	18	2						
20	10.0 - 11.5	SPT	53	SM			16.1	21	18	3						
21	15.0 - 16.5	SPT	22	SC-SM			19.4	24	18	6						
22	20.0 - 20.5	SPT	10	SM			15.8	19	17	2						
23	25.0 - 26.5	SPT	R	SM			16.3	29	26	3						

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

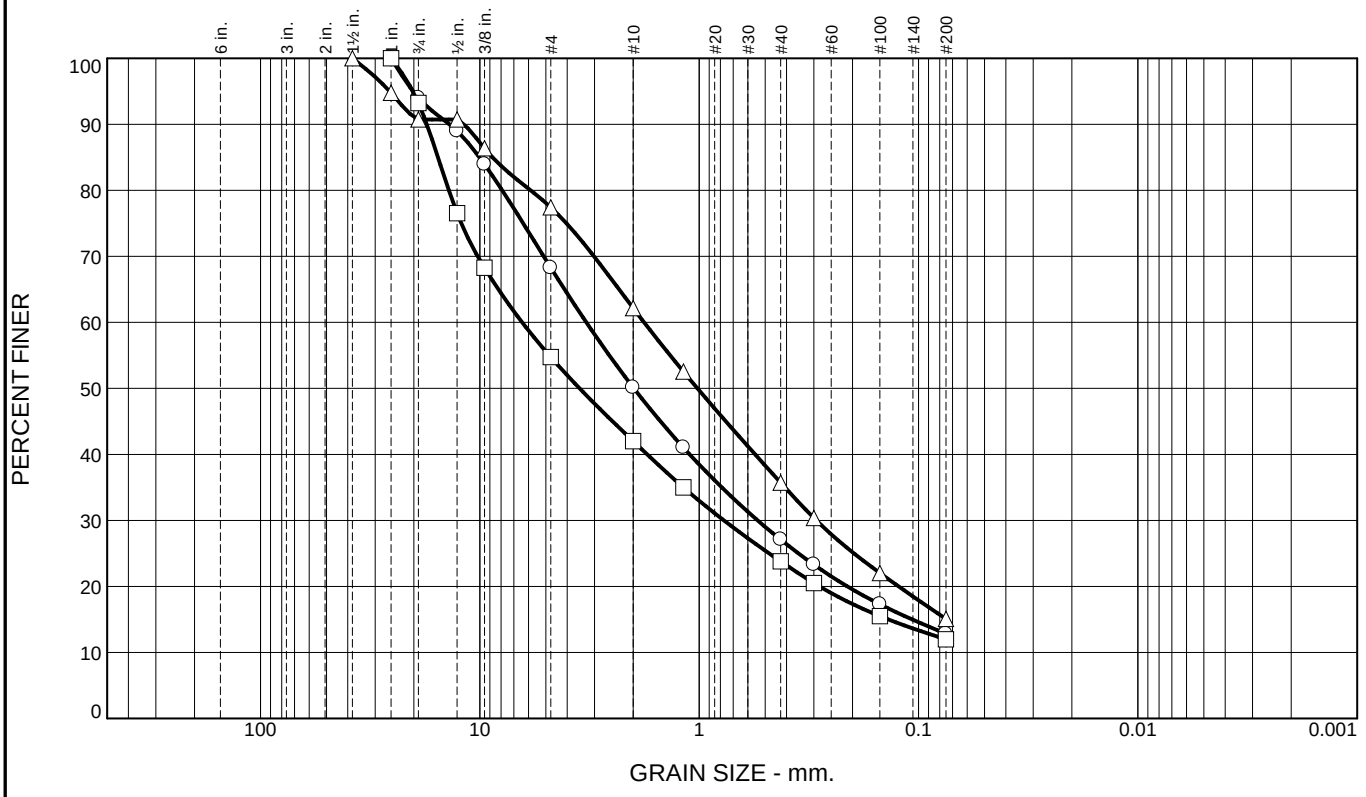
N = Field SPT $N = (N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	31.7	55.5	12.8		SM	A-1-a	20	23
□	0.0	45.3	42.7	12.0		GP-GC	A-1-a	18	24
△	0.0	22.6	62.3	15.1		SC-SM	A-1-b	17	21

SIEVE inches size	PERCENT FINER ○	□	△
1.5"			100.0
1"	100.0	100.0	94.8
3/4"	94.0	93.2	90.7
1/2"	89.0	76.5	90.7
3/8"	83.9	68.3	86.4
	GRAIN SIZE		
D_{60}	3.2697	6.4154	1.7833
D_{30}	0.5412	0.7715	0.2923
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	68.3	54.7	77.4
#10	50.1	42.0	62.2
#16	41.0	35.0	52.5
#40	27.1	23.8	35.7
#50	23.3	20.5	30.4
#100	17.3	15.5	22.0
#200	12.8	12.0	15.1

Material Description

○ silty sand with gravel

□ poorly graded gravel with clay and sand

△ silty, clayey sand with gravel

REMARKS:

○

□

△

○ Source of Sample: PW-1 Depth: 2.5' - 4.0' Sample Number: 1

□ Source of Sample: PW-1 Depth: 7.5' - 9.0' Sample Number: 3

△ Source of Sample: PW-1 Depth: 10.5' - 11.5' Sample Number: 4

NEVADA DEPARTMENT OF TRANSPORTATION

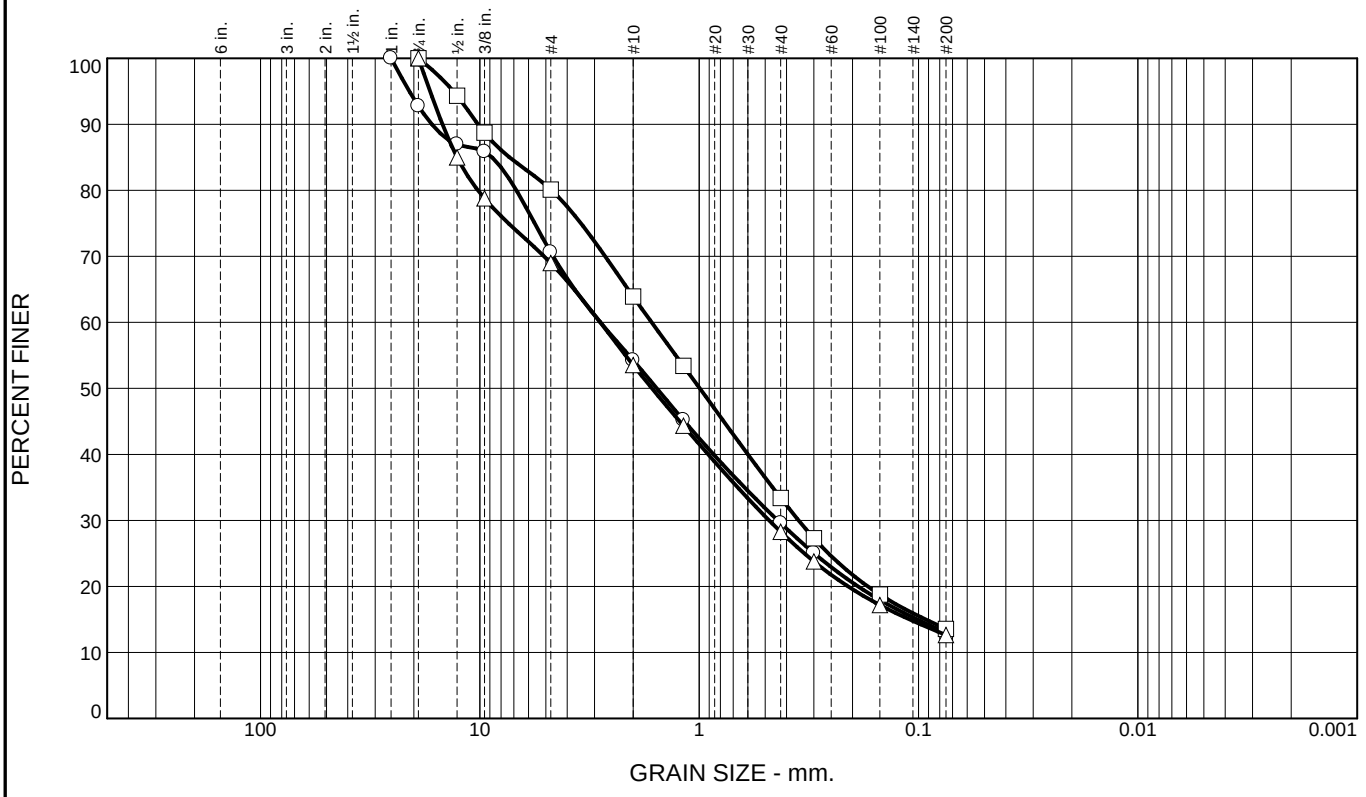
Client: S. Jensen

Project: Petrified Wash SR 361 RCB Replacement

Project No.: EA 74029

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	29.4	57.6	13.0		SM	A-1-b	19	22
□	0.0	19.9	66.5	13.6		SC-SM	A-1-b	18	22
△	0.0	31.0	56.4	12.6		SM	A-1-b	19	21

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		
3/4"	92.8	100.0	100.0
1/2"	87.0	94.3	85.0
3/8"	85.9	88.7	78.8
	GRAIN SIZE		
D_{60}	2.8206	1.6478	2.8250
D_{30}	0.4382	0.3523	0.4797
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	70.6	80.1	69.0
#10	54.3	63.9	53.5
#16	45.2	53.4	44.3
#40	29.6	33.4	28.3
#50	25.0	27.3	23.8
#100	17.9	18.8	17.2
#200	13.0	13.6	12.6

Material Description
○ silty sand with gravel
□ silty, clayey sand with gravel
△ silty sand with gravel

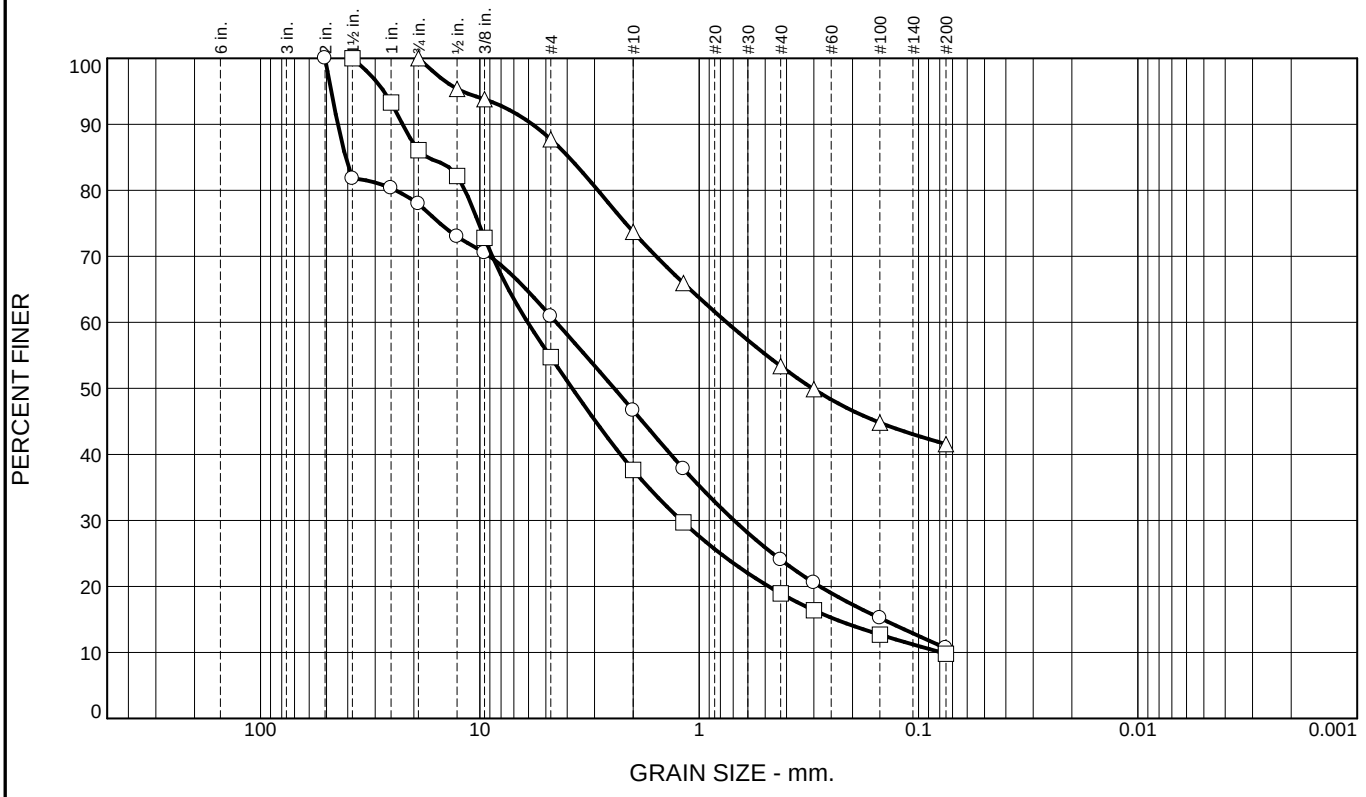
REMARKS:
○
□
△

○ Source of Sample: PW-1 Depth: 12.5' - 14.0' Sample Number: 5
□ Source of Sample: PW-1 Depth: 15.5' - 16.0' Sample Number: 6 Middle
△ Source of Sample: PW-1 Depth: 17.5' - 19.0' Sample Number: 7

NEVADA DEPARTMENT OF TRANSPORTATION

Client: S. Jensen
Project: Petrified Wash SR 361 RCB Replacement
Project No.: EA 74029
Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	39.1	50.2	10.7		SP-SM	A-1-a	17	20
□	0.0	45.3	44.9	9.8		GP-GM	A-1-a	19	21
△	0.0	12.3	46.1	41.6		SM	A-4(0)	20	23

SIEVE inches size	PERCENT FINER ○	□	△
2"	100.0		
1.5"	81.8	100.0	
1"	80.3	93.3	
3/4"	78.0	86.1	100.0
1/2"	73.0	82.2	95.4
3/8"	70.5	72.8	93.8
	GRAIN SIZE		
D_{60}	4.4840	6.0521	0.7490
D_{30}	0.6933	1.2070	
D_{10}		0.0787	
	COEFFICIENTS		
C_c		3.06	
C_u		76.94	

SIEVE number size	PERCENT FINER ○	□	△
#4	60.9	54.7	87.7
#10	46.7	37.6	73.7
#16	37.8	29.7	66.0
#40	24.0	18.9	53.4
#50	20.6	16.4	49.9
#100	15.2	12.7	44.8
#200	10.7	9.8	41.6

Material Description

○ poorly graded sand with silt and gravel

□ poorly graded gravel with silt and sand

△ silty sand

REMARKS:

○

□

△

○ Source of Sample: PW-1 Depth: 20.5' - 21.5' Sample Number: 8

□ Source of Sample: PW-1 Depth: 22.5' - 24.0' Sample Number: 9

△ Source of Sample: PW-1 Depth: 25.5' - 26.0' Sample Number: 10 Middle

NEVADA DEPARTMENT OF TRANSPORTATION

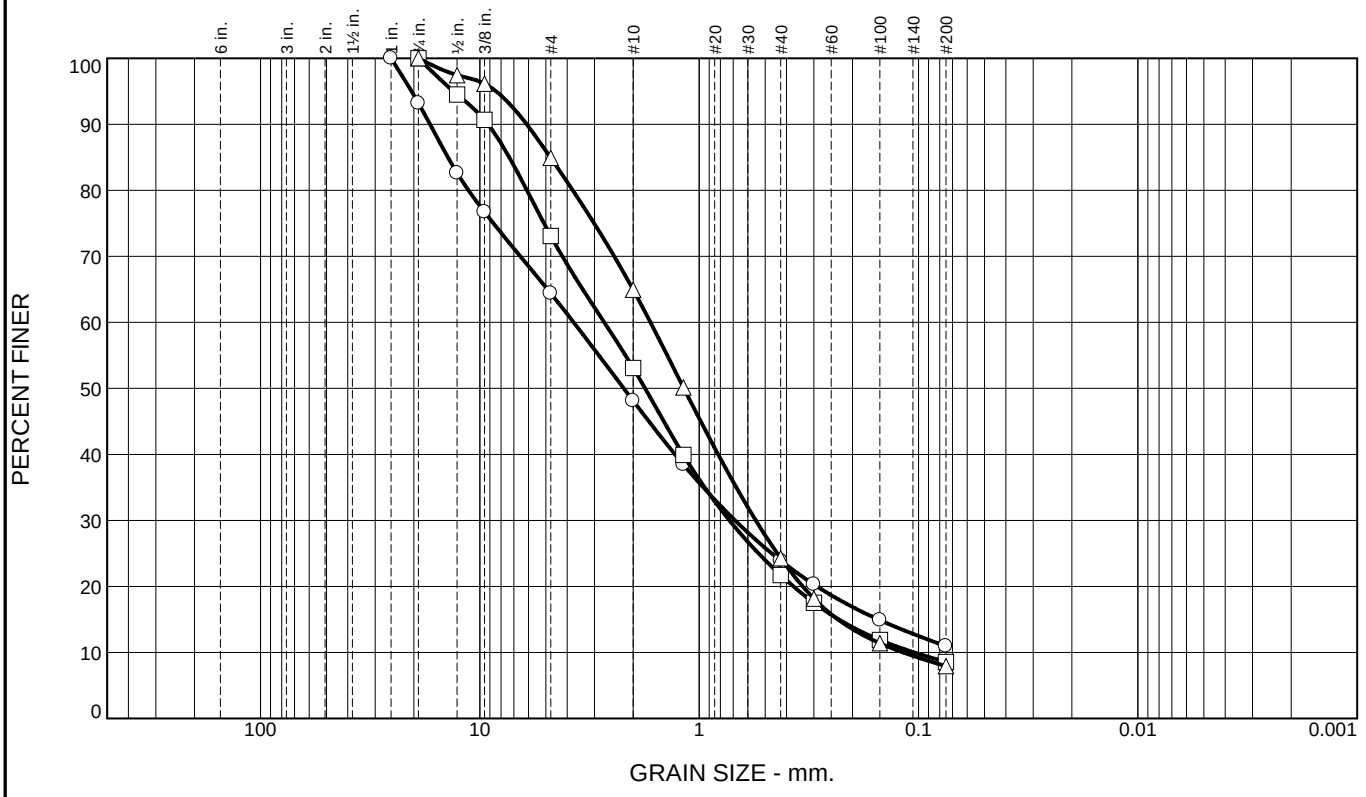
Client: S. Jensen

Project: Petrified Wash SR 361 RCB Replacement

Project No.: EA 74029

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	35.6	53.5	10.9		SP-SM	A-1-a	17	20
□	0.0	26.9	64.5	8.6		SW-SM	A-1-b	19	20
△	0.0	15.1	77.0	7.9		SW-SM	A-1-b	NP	18

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		
3/4"	93.2	100.0	100.0
1/2"	82.6	94.5	97.5
3/8"	76.7	90.7	96.2
GRAIN SIZE			
D_{60}	3.7371	2.7089	1.6681
D_{30}	0.6865	0.7280	0.5522
D_{10}		0.1045	0.1174
COEFFICIENTS			
C_c		1.87	1.56
C_u		25.92	14.21

SIEVE number size	PERCENT FINER ○	□	△
#4	64.4	73.1	84.9
#10	48.1	53.1	64.9
#16	38.5	39.9	50.1
#40	23.9	21.7	24.3
#50	20.3	17.5	18.2
#100	14.9	11.9	11.4
#200	10.9	8.6	7.9

Material Description
○ poorly graded sand with silt and gravel
□ well-graded sand with silt and gravel
△ well-graded sand with silt and gravel

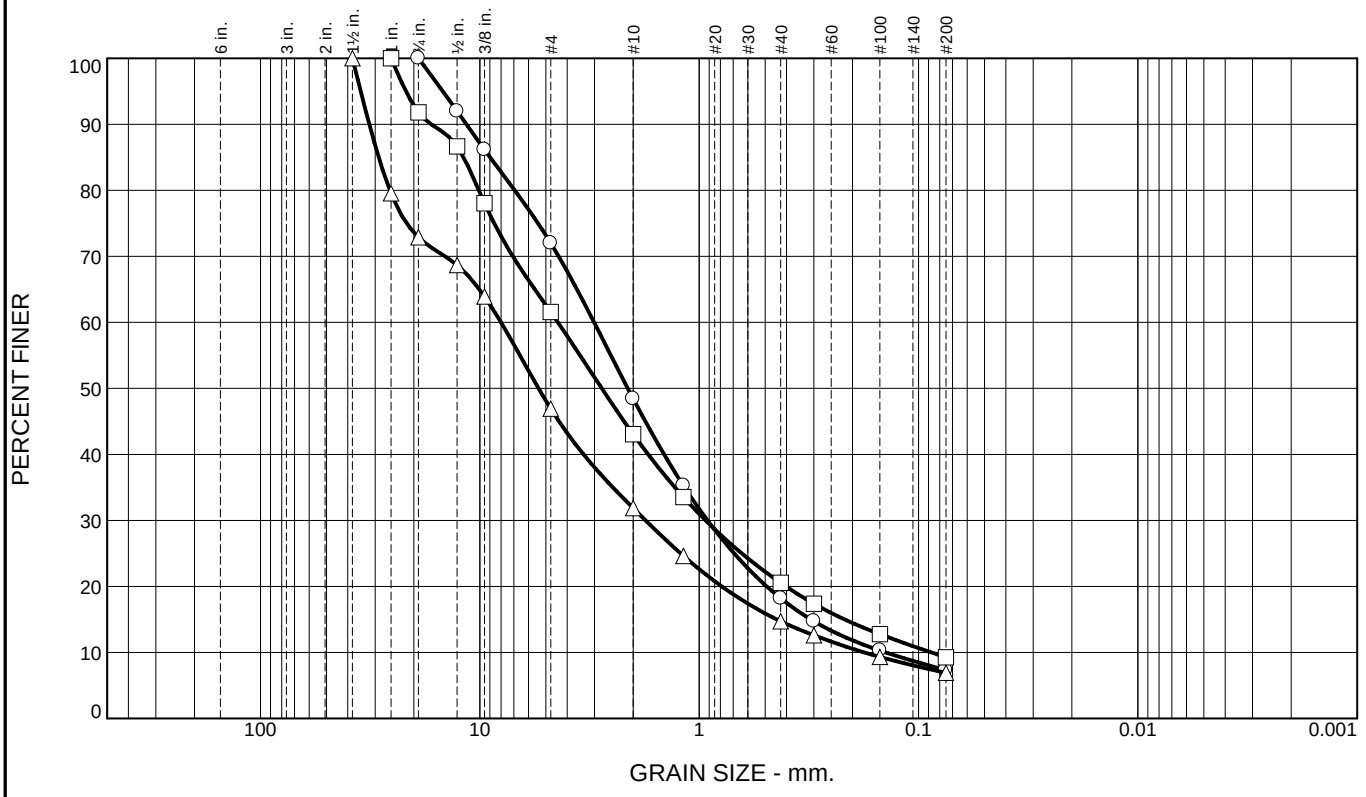
REMARKS:
○
□
△

○ Source of Sample: PW-1 Depth: 27.5' - 29.0' Sample Number: 11
□ Source of Sample: PW-1 Depth: 30.5' - 31.0' Sample Number: 12 Middle
△ Source of Sample: PW-1 Depth: 32.5' - 34.0' Sample Number: 13

NEVADA DEPARTMENT OF TRANSPORTATION

Client: S. Jensen
Project: Petrified Wash SR 361 RCB Replacement
Project No.: EA 74029 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	28.0	64.7	7.3		SW-SM	A-1-a	18	20
□	0.0	38.4	52.3	9.3		SW-SM	A-1-a	17	19
△	0.0	53.1	40.0	6.9		GW-GM	A-1-a	19	21

SIEVE inches size	PERCENT FINER ○	□	△
1.5"			100.0
1"		100.0	79.6
3/4"	100.0	91.8	72.9
1/2"	92.0	86.7	68.7
3/8"	86.2	78.0	63.9
	GRAIN SIZE		
D_{60}	3.0135	4.4067	8.0084
D_{30}	0.9163	0.9348	1.7550
D_{10}	0.1411	0.0873	0.1767
	COEFFICIENTS		
C_c	1.97	2.27	2.18
C_u	21.35	50.50	45.32

SIEVE number size	PERCENT FINER ○	□	△
#4	72.0	61.6	46.9
#10	48.4	43.1	31.9
#16	35.3	33.5	24.6
#40	18.2	20.5	14.7
#50	14.7	17.4	12.6
#100	10.3	12.8	9.3
#200	7.3	9.3	6.9

Material Description
○ well-graded sand with silt and gravel
□ well-graded sand with silt and gravel
△ well-graded gravel with silt and sand

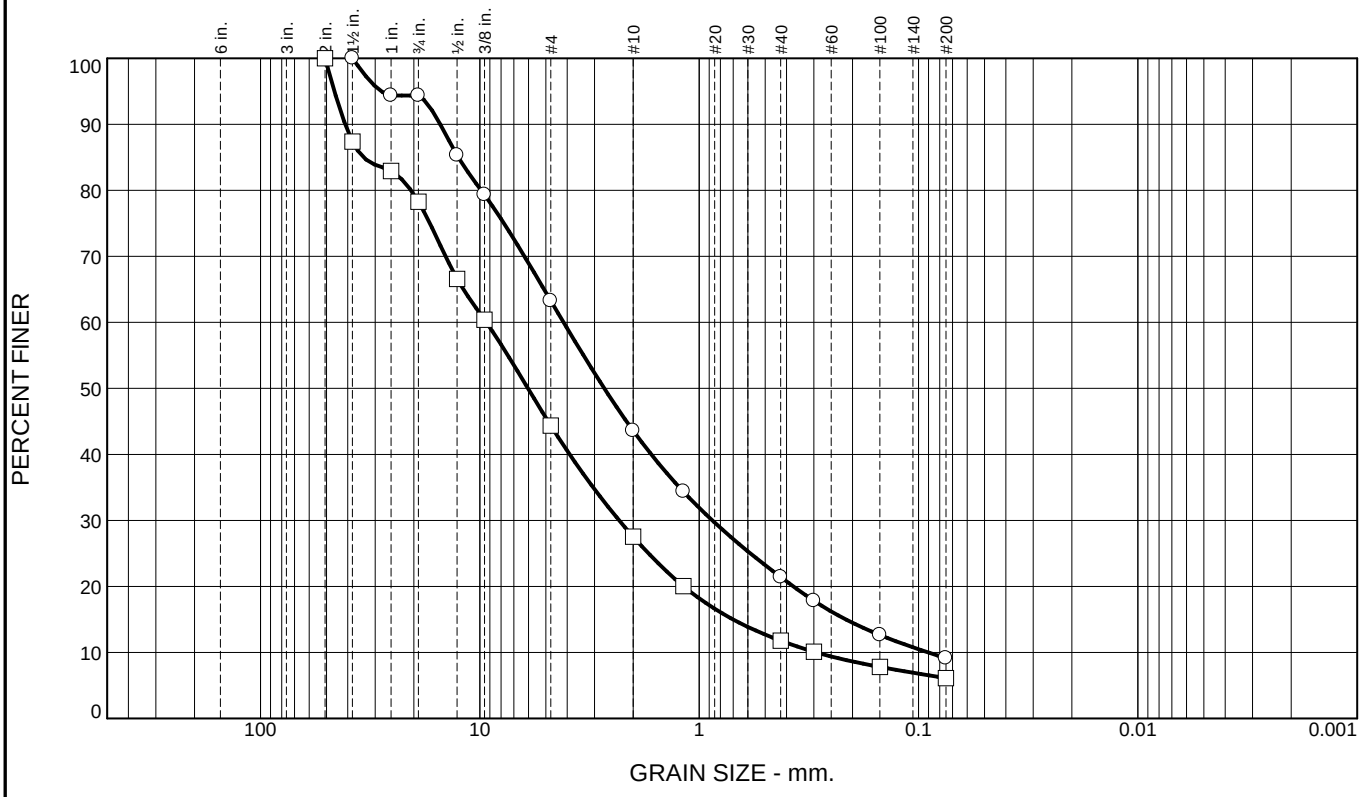
REMARKS:
○
□
△

○ Source of Sample: PW-1 Depth: 35.5' - 36.5' Sample Number: 14
□ Source of Sample: PW-1 Depth: 37.5' - 39.0' Sample Number: 15
△ Source of Sample: PW-1 Depth: 40.5' - 41.0' Sample Number: 16 Middle

NEVADA DEPARTMENT OF TRANSPORTATION

Client: S. Jensen
Project: Petrified Wash SR 361 RCB Replacement
Project No.: EA 74029 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	36.7	54.2	9.1		SW-SM	A-1-a	16	18
□	0.0	55.6	38.3	6.1		GW-GM	A-1-a	19	22

SIEVE inches size	○	□
2"		100.0
1.5"	100.0	87.4
1"	94.4	82.9
3/4"	94.4	78.3
1/2"	85.3	66.6
3/8"	79.3	60.4
	GRAIN SIZE	
D_{60}	4.1522	9.3432
D_{30}	0.8713	2.3165
D_{10}	0.0903	0.2923
	COEFFICIENTS	
C_c	2.02	1.96
C_u	45.98	31.96

SIEVE number size	○	□
#4	63.3	44.4
#10	43.6	27.5
#16	34.4	20.0
#40	21.4	11.8
#50	17.8	10.1
#100	12.6	7.8
#200	9.1	6.1

Material Description

○ well-graded sand with silt and gravel

□ well-graded gravel with silt and sand

REMARKS:

○

□

○ Source of Sample: PW-1 Depth: 42.5' - 44.0' Sample Number: 17

□ Source of Sample: PW-1 Depth: 45.5' - 46.5' Sample Number: 18

NEVADA DEPARTMENT OF TRANSPORTATION

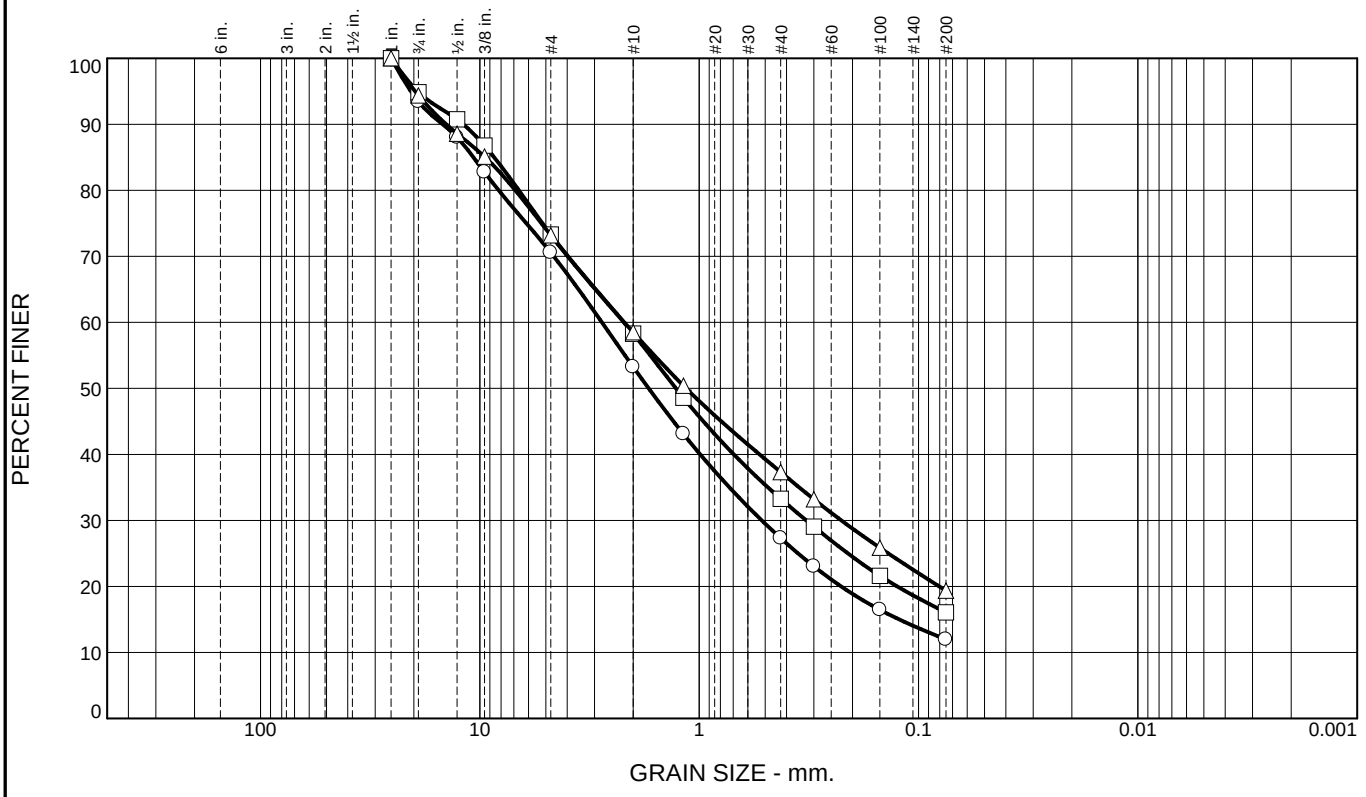
Client: S. Jensen

Project: Petrified Wash SR 361 RCB Replacement

Project No.: EA 74029

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	29.4	58.6	12.0		SP-SM	A-1-b	18	20
□	0.0	26.7	57.2	16.1		SM	A-1-b	18	21
△	0.0	26.8	53.8	19.4		SC-SM	A-1-b	18	24

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0	100.0	100.0
3/4"	93.4	94.9	94.4
1/2"	88.0	90.8	88.6
3/8"	82.7	86.8	85.1
GRAIN SIZE			
D_{60}	2.7758	2.2044	2.1954
D_{30}	0.5185	0.3249	0.2249
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	70.6	73.3	73.2
#10	53.3	58.3	58.5
#16	43.1	48.6	50.4
#40	27.3	33.3	37.3
#50	23.0	29.1	33.2
#100	16.5	21.6	25.9
#200	12.0	16.1	19.4

Material Description

○ poorly graded sand with silt and gravel

□ silty sand with gravel

△ silty, clayey sand with gravel

REMARKS:

○

□

△

○ Source of Sample: PW-2 Depth: 5.0' - 6.5' Sample Number: 19

□ Source of Sample: PW-2 Depth: 10.0' - 11.5' Sample Number: 20

△ Source of Sample: PW-2 Depth: 15.0' - 16.5' Sample Number: 21

NEVADA DEPARTMENT OF TRANSPORTATION

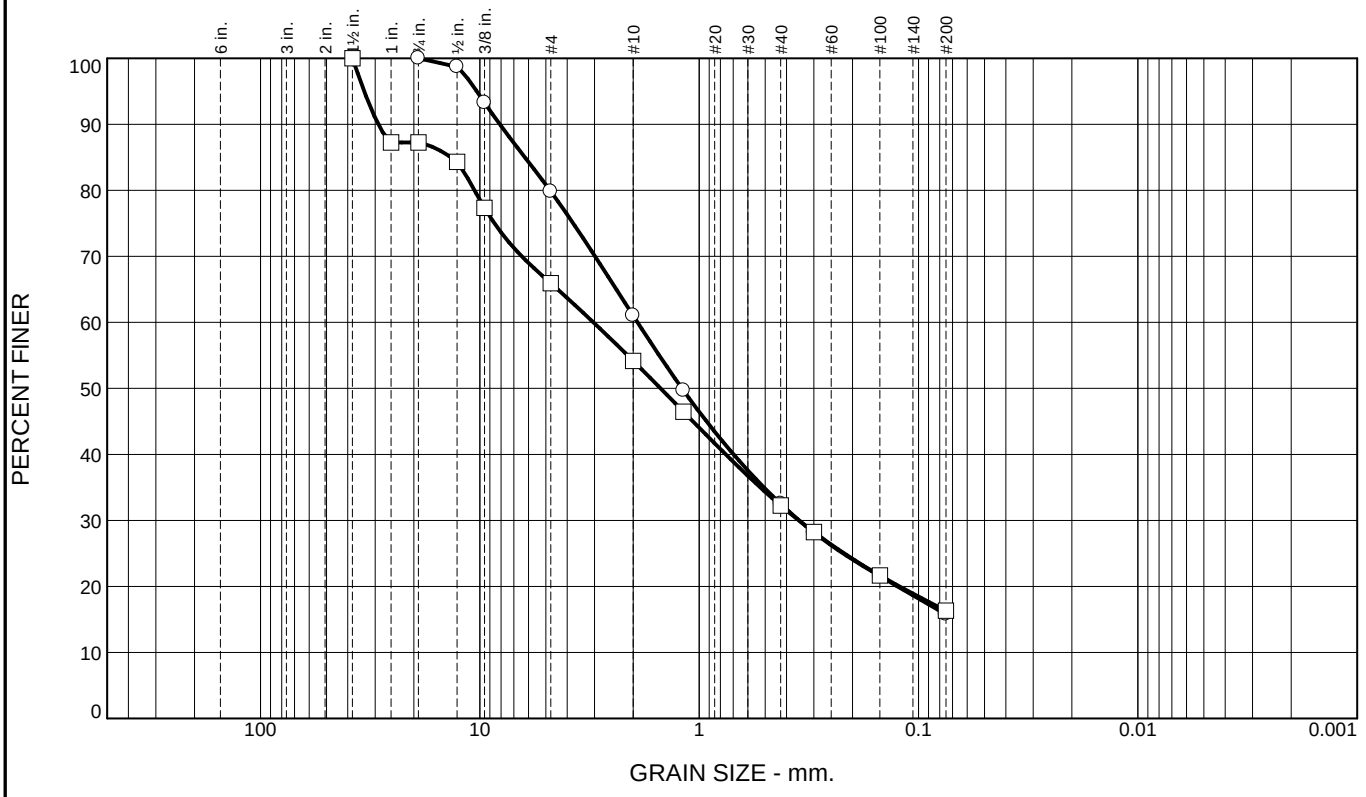
Client: S. Jensen

Project: Petrified Wash SR 361 RCB Replacement

Project No.: EA 74029

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	20.2	64.0	15.8		SM	A-1-b	17	19
□	0.0	34.1	49.6	16.3		SM	A-1-b	26	29

SIEVE inches size	○	□
1.5"		100.0
1"		87.3
3/4"	100.0	87.3
1/2"	98.7	84.3
3/8"	93.3	77.4
GRAIN SIZE		
D_{60}	1.9100	3.0357
D_{30}	0.3502	0.3516
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	○	□
#4	79.8	65.9
#10	61.0	54.2
#16	49.7	46.5
#40	32.5	32.3
#50	28.2	28.2
#100	21.6	21.7
#200	15.8	16.3

Material Description
○ silty sand with gravel

□ silty sand with gravel

REMARKS:
○

□

○ Source of Sample: PW-2 Depth: 20.0' - 20.5' Sample Number: 22

□ Source of Sample: PW-2 Depth: 25.0' - 26.5' Sample Number: 23

NEVADA DEPARTMENT OF TRANSPORTATION

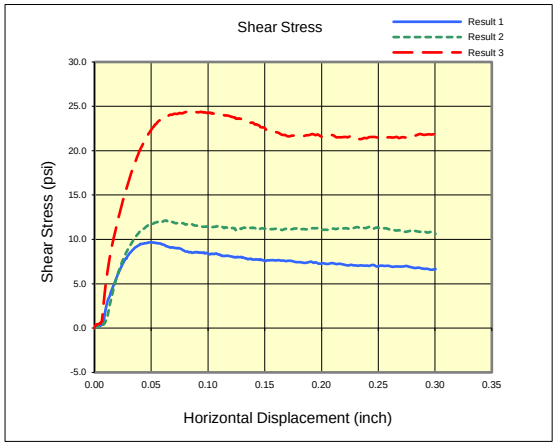
Client: S. Jensen

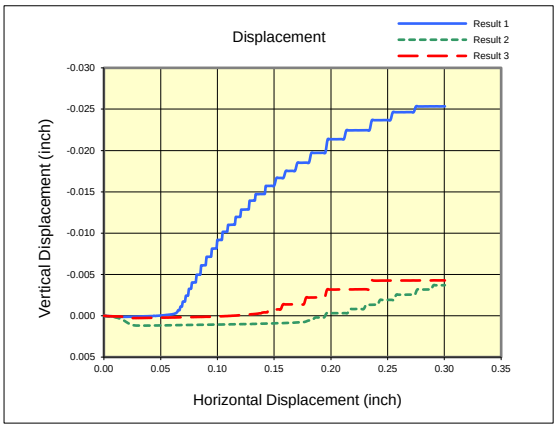
Project: Petrified Wash SR 361 RCB Replacement

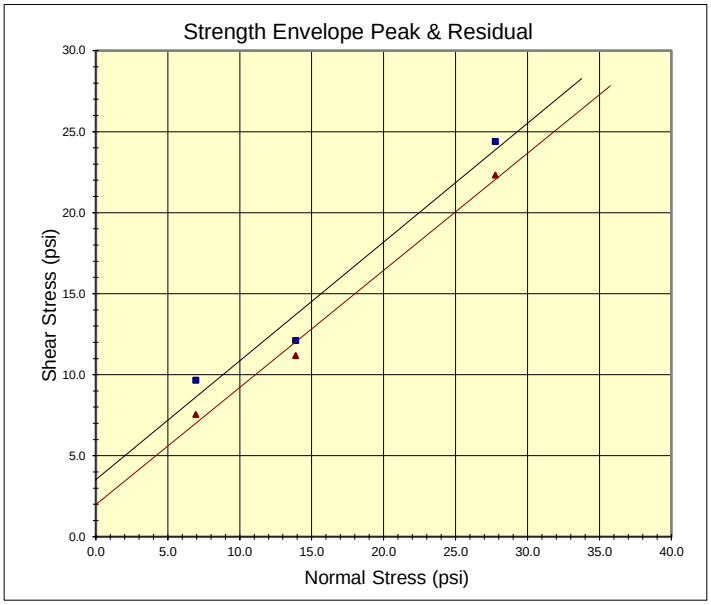
Project No.: EA 74029

Figure

DIRECT SHEAR TEST REPORT







Strength Parameters

	Peak		Residual
Friction Angle =	36	degrees	36
Cohesion =	3.53	psi	1.99

Project: FL-1-18 Boring: PW-1 Sample: 6Top

	Result 1	Result 2	Result 3
Specimen:	a	b	c
Date Tested	1/24/2018	1/24/2018	1/25/2018
Diameter (inch):	2.42	2.42	2.42
Height (inch):	1.00	1.00	1.00
Depth (ft):	16.25	16.25	16.25
Moisture (%)	9.2	8.9	8.9
Dry Unit Wt (pcf)	108.7	109.1	109.1
SHEAR			
Displacement Rate($^{in}/_{min}$)	0.0053	0.0056	0.0054
Normal Stress (psi)	6.95	13.88	27.76
Peak Shear Stress(psi)	9.67	12.12	24.40
Residual Shear Stress(psi)	7.6	11.2	22.3
Residual Point Picked @(in)	0.150	0.151	0.152
Time @ Peak Failure (min)	8.9	11.5	15.4

Specimen Comments

a Remolded sample(-#4) Shear @ 1,000 psf

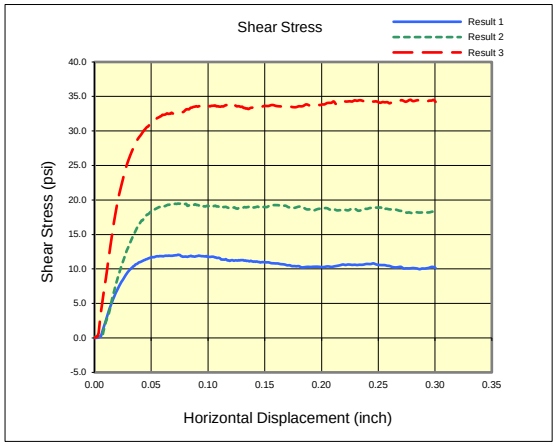
b Remolded sample(-#4) Shear @ 2,000 psf

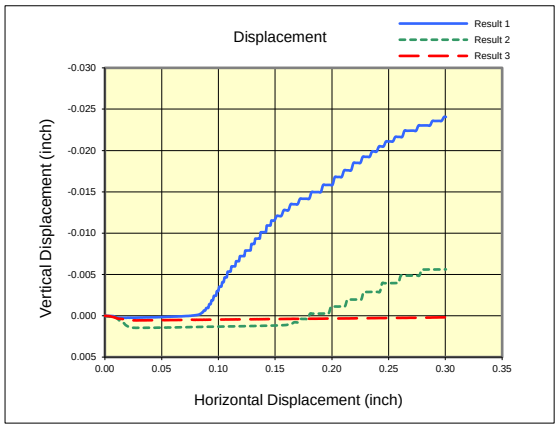
c Remolded sample(-#4) Shear @ 4,000 psf

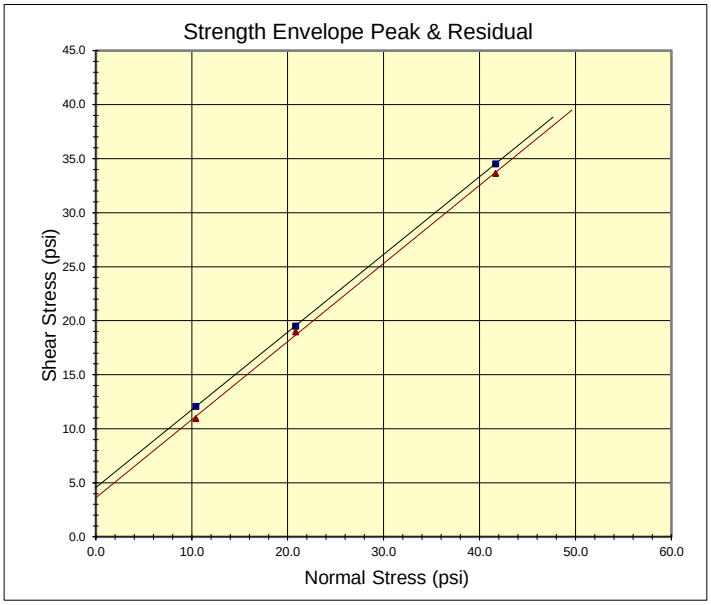
Geotechnical Section

NEVADA DOT

DIRECT SHEAR TEST REPORT







Strength Parameters

	Peak		Residual
Friction Angle =	36	degrees	36
Cohesion =	4.56	psi	3.62

Project: FL-1-18 Boring: PW-1 Sample: 10TOP

	Result 1	Result 2	Result 3
Specimen:	a	b	c
Date Tested	1/25/2018	1/26/2018	1/26/2018
Diameter (inch):	2.42	2.42	2.42
Height (inch):	1.00	1.00	1.00
Depth (ft):	26.25	26.25	26.25
Moisture (%)	9.1	9.0	8.9
Dry Unit Wt (pcf)	109.8	109.8	110.0
SHEAR			
Displacement Rate($^{in}/_{min}$)	0.0055	0.0054	0.0055
Normal Stress (psi)	10.41	20.83	41.65
Peak Shear Stress(psi)	12.06	19.52	34.53
Residual Shear Stress(psi)	10.9	19.0	33.6
Residual Point Picked @(in)	0.151	0.152	0.151
Time @ Peak Failure (min)	13.4	14.0	50.6

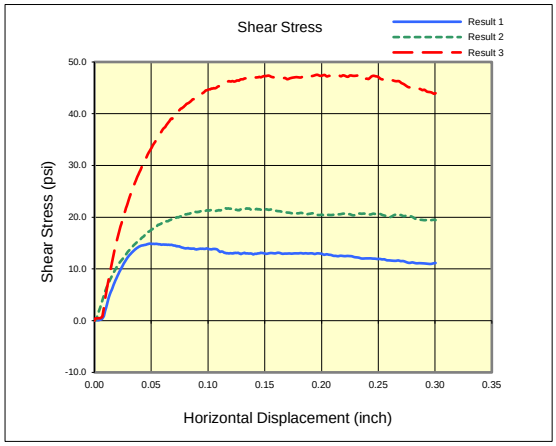
Specimen Comments

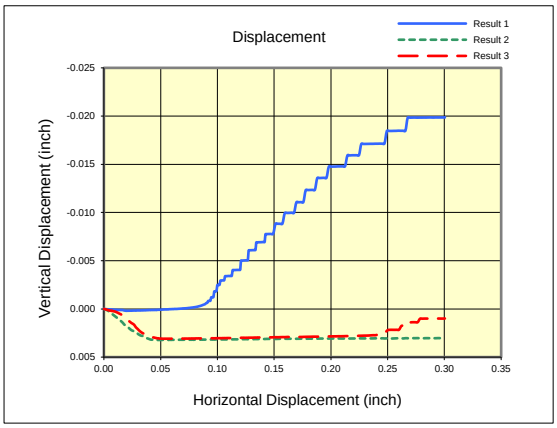
a Remolded sample(-#4) Shear @ 1,500 psf
b Remolded sample(-#4) Shear @ 3,000 psf
c Remolded sample(-#4) Shear @ 6,000 psf

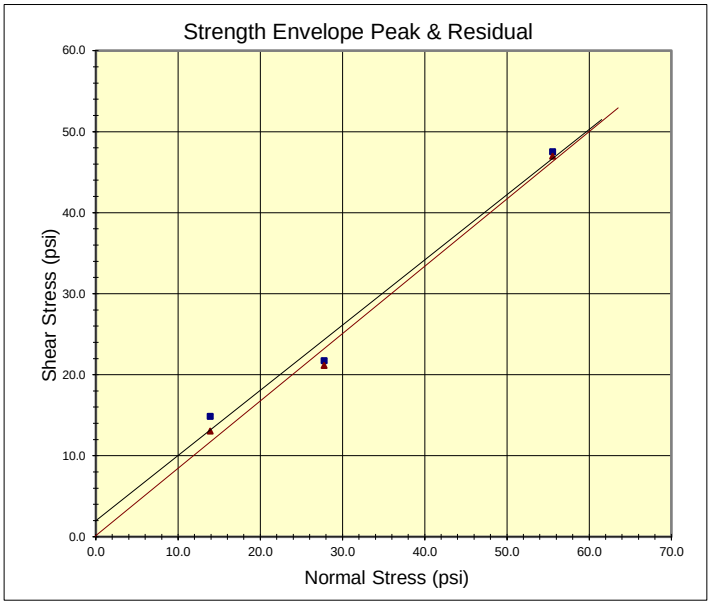
Geotechnical Section

NEVADA DOT

DIRECT SHEAR TEST REPORT







Strength Parameters

	Peak		Residual
Friction Angle =	39	degrees	40
Cohesion =	1.99	psi	0.15

Project: FL-1-18 Boring: PW-1 Sample: 12TOP

	Result 1	Result 2	Result 3
Specimen:	a	b	c
Date Tested	1/29/2018	1/29/2018	1/30/2018
Diameter (inch):	2.42	2.42	2.42
Height (inch):	1.00	1.00	1.00
Depth (ft):	31.25	31.25	31.25
Moisture (%)	7.5	7.3	7.5
Dry Unit Wt (pcf)	102.9	102.9	103.1
SHEAR			
Displacement Rate($^{in}/_{min}$)	0.0056	0.0056	0.0055
Normal Stress (psi)	13.89	27.77	55.53
Peak Shear Stress(psi)	14.89	21.73	47.53
Residual Shear Stress(psi)	13.1	21.1	47.0
Residual Point Picked @(in)	0.163	0.164	0.164
Time @ Peak Failure (min)	8.8	21.0	35.7

Specimen Comments

a Remolded sample(-#4) Shear @ 1,000 psf

b Remolded sample(-#4) Shear @ 2,000 psf

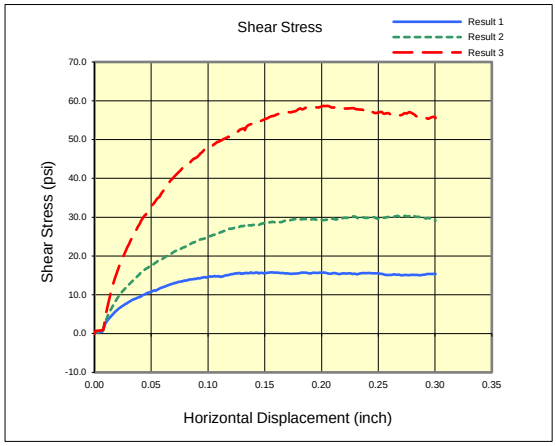
c Remolded sample(-#4) Shear @ 4,000 psf

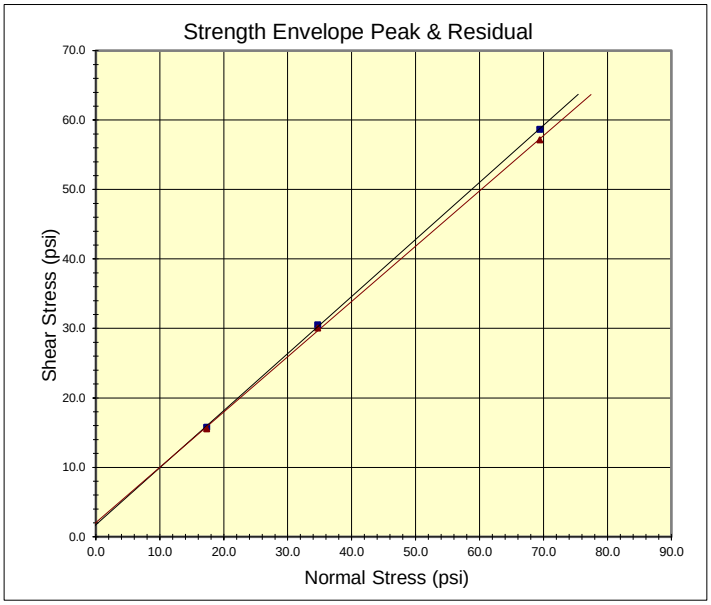
Geotechnical Section

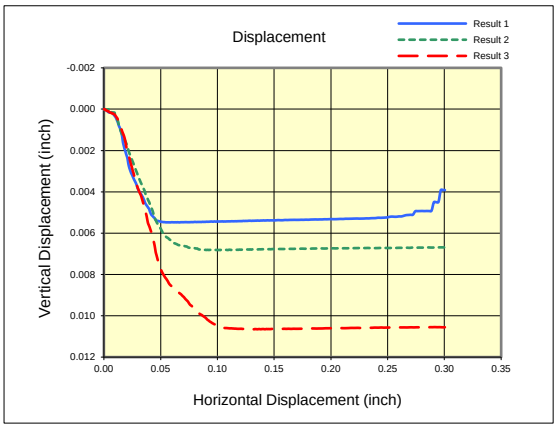
NEVADA DOT

DigiShear Report v4b __ DS PW-1-12Top

DIRECT SHEAR TEST REPORT







Strength Parameters

	Peak		Residual
Friction Angle =	39	degrees	39
Cohesion =	1.73	psi	2.05

Project: FL-1-18 Boring: PW-1 Sample: 16TOP

	Result 1	Result 2	Result 3
Specimen:	a	b	c
Date Tested	1/30/2018	1/31/2018	1/31/2018
Diameter (inch):	2.42	2.42	2.42
Height (inch):	1.00	1.00	1.00
Depth (ft):	41.25	41.25	41.25
Moisture (%)	7.3	7.3	7.3
Dry Unit Wt (pcf)	102.7	102.9	102.7
SHEAR			
Displacement Rate($^{in}/_{min}$)	0.0056	0.0055	0.0055
Normal Stress (psi)	17.33	34.70	69.43
Peak Shear Stress(psi)	15.79	30.52	58.69
Residual Shear Stress(psi)	15.6	30.1	57.2
Residual Point Picked @(in)	0.244	0.245	0.244
Time @ Peak Failure (min)	28.3	50.8	37.4

Specimen Comments

a Remolded sample(-#4) Shear @ 1,250 psf

b Remolded sample(-#4) Shear @ 2,500 psf

c Remolded sample(-#4) Shear @ 10,000 psf

Geotechnical Section

NEVADA DOT