GEOTECHNICAL DATA REPORT

US50/SR439 RADIO TOWER LYON COUNTY, NEVADA

DECEMBER 2020





| NEVADA DEPARTMENT OF TRANSPORTATION | MATERIALS DIVISION | | GEOTECHNICAL SECTION | 1263 S STEWART ST, CARSON CITY, NEVADA 89712 |

STATE OF NEVADA DEPARTMENT OF TRANSPORTATION MATERIALS DIVISION GEOTECHNICAL SECTION

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US50/SR439 RADIO TOWER

LYON COUNTY. NEVADA

DECEMBER 2020

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Introduction

1.1 Project Description

The Nevada Department of Transportation (NDOT) plans to construct an 80-foot tall radio tower and associated hut at the intersection of U.S. Highway 50 (US 50) and State Route 439 (SR 439), west of Silver Springs. This geotechnical data report presents the information obtained from our geotechnical exploration for the proposed tower.

The project Vicinity Map and Exploration Map are shown in Appendix A on Figures A-1 and A-2, respectively.

1.2 Purpose and Scope of Work

The purpose of this investigation is to provide subsurface data for the project site from a geotechnical perspective, for the proposed tower foundation. The main objectives of the investigation were to characterize the subsurface materials, and document our findings in this report. The investigation was conducted in accordance with American Association of State Highway and Traffic Administration (AASHTO) and Federal Highway Administration (FHWA) guidelines.

The scope of our geotechnical investigation includes the following:

- A review of published geologic and geotechnical information pertaining to the site vicinity;
- A field exploration consisting of drilling one boring to a maximum depth of approximately 40 feet below ground surface (bgs) to obtain information about the subsurface conditions for the proposed tower foundation in the geotechnical data report;
- Performing geotechnical laboratory testing on select soil samples collected from the borings; and
- Preparation of this report.

2. Field Exploration and Laboratory Testing

2.1 Field Exploration

One boring was drilled on November 30, 2020 at the approximate location shown on the Exploration Map to a maximum depth of approximately 40 feet bgs. The boring was drilled utilizing a truck-mounted Diedrich D-120 drill rig equipped with six-inch diameter hollow stem augers. Samples were collected using Standard Penetration Test (SPT) samplers driven by an automatic hammer with a weight of 140 pounds and a drop of 30 inches.

The number of blows required to drive the sampler were recorded for each 6-inch interval of the 18-inch drive. The cumulative blow count for the bottom 12 inches of drive is presented in the boring logs. The blow counts presented in the logs are uncorrected and are shown as they were recorded in the field. Both the samples and drill cuttings were visually classified in the field based on the Unified Soil Classification System (USCS) in general accordance with ASTM D2488.

The subsurface conditions encountered are summarized in Section 3.2. Logs of the borings were prepared based on the field logging and the results of laboratory testing in general accordance with ASTM D2487. The boring logs are presented in Appendix B.

2.2 Geotechnical Laboratory Testing

Laboratory testing was conducted on select soil samples recovered during the field exploration. Tests conducted include the following:

- Method of Test Sieve Analysis of Coarse and Fine Aggregate (Nev. T206);
- Method of Test for Determining the Liquid Limit, Plastic Limit, and Plasticity Index of Soil (Nev. T210, T211, and T212);

Geotechnical laboratory test results are presented in Appendix C.

3. Site and Subsurface Conditions

3.1 Site Conditions

The site is located approximately 2½ miles west of the town of Silver Springs at the intersection of US 50 and SR 439 in Lyon County, Nevada. At the time of our exploration, the surrounding topography consisted of relatively flat undeveloped properties. The project limits consisted of a gravel surface, with a landscape statue to the south, near the roundabout intersection. Overhead utilities were observed to the north and west of the tower location, underground utilities were located within the project site for the purposes of this exploration.

3.2 Subsurface Conditions

3.2.1 General Geology and Faulting

The site is located within the Basin and Range geomorphic province, in Churchill Valley southwest of the Virginia Range and northeast of Churchill Butte. The site area is mapped as being comprised of Quaternary alluvium. The nearest active fault with historic movement (last 150 years) is the Olinghouse fault zone, located approximately 17 miles to the north. Other active faults nearby include the Rainbow Mountain fault zone located approximately 35 miles to the east.

3.2.2 Subsurface Materials

The results of our field exploration and laboratory analyses indicate approximately 8 inches of $\frac{3}{4}$ inch aggregate base fill. Beneath the aggregate base, native light brown silty SAND (SM) was encountered to the maximum depth explored, approximately 40 feet bgs.

3.2.3 Groundwater Conditions

Groundwater was not encountered during our exploration. Based on adjacent well logs, groundwater is anticipated to be deeper than 100 feet bgs.

4. References

American Association of State Highway and Transportation Officials (AASHTO), 2017, "LRFD Bridge Design Specifications, 8th Edition"

Kakata, K. John, et al, 1982, "Quaternary Fault Map of the Basin and Range and Rio Grande Rift Provinces, Western United States, Department of the Interior United States Geological Survey"

Loehr, Erik, et al, 2016, "FHWA NHI-16-072 Geotechnical Site Characterization"

Mayne, W. Paul, et al, 2002, "FHWA-NHI-01-031 Subsurface Investigation Manual"

Nevada Department of Transportation (NDOT), 2008, "Structures Manual"

Sabatini, P.J., et al, 2002, "FHWA-IF-02-034 Evaluation of Soil and Rock Properties"

Stewart, John H., and Carlson, John E., 1978, "Geologic map of Nevada, Nevada Bureau of Mines and Geology, scale 1:500,00."

U.S. Geologic Survey, October 8, 2019, U.S. Seismic Design Maps, <u>https://earthquake.usgs.gov/ws/designmaps/</u>

5. Limitations

This report has been prepared by NDOT Geotechnical Section under the supervision of those whose signatures appear herein. The interpretation of data, findings, and recommendations presented in this report were developed from our geotechnical investigation.

If the proposed project is modified or relocated, or if the subsurface conditions found during construction differ from those described in this report, NDOT Geotechnical Section should be contacted immediately to assess the new information or changed conditions and determine if our recommendations need revision.

Appendix A Figures





Figure A-1 Vicinity MapLocation:Lyon County, NVProject Name:US50 Radio TowerEA Number:N/A





Location: Lyon County, NV Project Name: US50 Radio Tower EA Number: N/A

Appendix B Logs of Borings

KEY TO BORING LOGS

	PARTICLE SIZE LIMITS														
CLAY	SILT		SAND		GR	AVEL	COBBLES	BOULDERS							
		FINE	MEDIUM	COARSE	FINE	COARSE									
.00	2 mm #	200 \$	#40 #	10 #	4 ¾ iı	nch 3i	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
СН	Inorganic clays of high plasticity, fat clays
ОН	Organic clays of medium to high plasticity
CS	Claystone/Siltstone
PT	Peat and other highly organic soils

MOISTURE CONDITION CRITERIA

MOISTURE CONDIT	ION CRITERIA	SOIL CEMENTA	SOIL CEMENTATION CRITERIA								
<u>Description</u> Dry	<u>Criteria</u> Absence of moisture, dusty, dry to touch.	<u>Description</u> Weak	<u>Criteria</u> Crumbles or breaks with handling or little finger pressure.								
Moist	Damp, no visible free water.	Moderate	Crumbles or breaks with considerable finger pressure								
Wet	Visible free water, usually below groundwater table.	Strong	Won't break or crumble w/finger pressure								

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Groundwater Elevation Symbols

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									
	ation Test (N) 140 lb hammer on 2-inch O.D. x 1.4 inch I.D. sampler.	31 - 60 OVER 60	HARD VERY HARD									

Blow counts on Calif. Modified Sampler (N_{CMS}) can be converted to N_{SPT} by:

(NCMS)(0.62) = NSPT Blow counts from Automatic Hammer can be converted to Standard SPT $N_{\rm 60}$ by:

Rig # 1627: (N_{SPT})(1.2) =N₆₀ Rig # 1082: (NSPT)(1.45) =N60

TEST ABBREVIATIONS		SAMPLER NOTATION									
CD CONSOLIDATED DRAINED CH CHEMICAL (CORROSIVENESS) CM COMPACTION CU CONSOLIDATED UNDRAINED D DISPERSIVE SOILS DS DIRECT SHEAR E EXPANSIVE SOIL G SPECIFIC GRAVITY H HYDROMETER HC HYDRO-COLLAPSE K PERMEABILITY	O ORGANIC CONTENT OC CONSOLIDATION PI PLASTICITY INDEX RQD ROCK QUALITY DESIGNATION RV R-VALUE S SIEVE ANALYSIS SL SHRINKAGE LIMIT U UNCONFINED COMPRESSION UU UNCONSOLIDATED UNDRAINED UW UNIT WEIGHT W MOISTURE CONTENT	CMS CALIF. MODIFIED SAMPLER ¹ CPT CONE PENETRATION TEST CS CONTINUOUS SAMPLER ² CSS CALIFORNIA SPLIT SPOON P PUSHED (NOT DRIVEN) PB PITCHER BARREL RC ROCK CORE ³ SH SHELBY TUBE ⁴ SPT STANDARD PENETRATION TEST TP TEST PIT									
SOIL COLOR DESIGNATIONS ARE FROM THE MUNSELL SOIL COLOR CHART. 1- I.D.= 2.421 inch EXAMPLE: (7.5 YR 5/3) BROWN											

Revised June 2018

Γ							11/2	0/20			BOF	RING LO	OG				39.4008	SHEET 1 OF 2	
	TEVA	DA	S	START D	ATE	-		0/20	_							LATITUDE _	119.2682		
	UDOT			ND DAT		_			_ diaT	ower						LONGITUDE _	K. Jerms		
	SAFE AND CONN	ECTED		ROJEC		_										ENGINEER _	G. Prada		
	Materials Divis	ion		OCATIC	DN	-	N/A	1000	iiity,	INV						OPERATOR _		D-120 (1082)	
	Geotechnical Se	ection		.A. #		-	B-1					GR	OUNDW	ATER LE		DRILL RIG	6" HSA	D-120 (1062)	
	1263 S. Stewa			BORING		-	N/A					DATE	TIME	DEPTH ft	ELEV. ft		Automat		
	Carson City, NV	89712				v. n	40.2	,								HAMMER _		DATE 11/30/2020	
			T	OTAL D	EPTF											BACKFILLED _	100	DATE	
	ELEV. (ft) DEPTH (ft)	SAMPLE NO.	ТҮРЕ	BLOWS / 6"	Uncorrected N Value	Recovery (%)	% PASSING NO.4	% PASSING NO.200	LIQUID LIMIT	PLASTICITY INDEX	GRAPHIC LOG				IATEI SCRII	RIAL PTION		REMARKS	
											AB	8-Inche	es aggre	egate bas	se			_	
	-1 -2 -3 -4	1-1		5 3 3	6		82	14				Light b sand, t	rown sil	ty SAND e-to-med	(SM), t ium an	ïne-to-coarse gra gular gravel, dry,	ained loose		
			3 10 6	16		72	11	18	NP		Gravel	content							
		1-3		6 13 15	28		81	19				Becom	nes mois						
	+ 10 + 11	1-4		14 20 22	42		99	43	23	3		Fines	content i	increases	s, beco	mes dense			
7/20	- 12 - 13 - 14 - 15	1-5		17 30	68		98	33	26	7	SM	Becom	nes very	dense a	nd dry			Drill rate slowed 13' - 14'	
- LOG 2018.10.10.GDT 12/7	- 16 - 17 - 18 - 19			38						,		· · ·							
SPJ NDOT SMART	-20 -21 -22	1-6		14 24 22	46		77	12					o-coarse les dens		ılar gra	vel content increa	ases,		
SMART SOIL LOG US50 TOWERS.GPJ NDOT SMART LOG 2018.10.10.GDT 12/7/20	23 24 Standard Penetration							Aggre Base	gate		USC	S Silty							
SMAF	Test						60			Ŀ	LI								

							11/2	0/20			BOR	ING LO	CG				39.40083	SHEET 2 OF 2
	EVAL	DA				-		0/20	_								119.2682	
V	DOT TE AND CONNEC	TER				-			_ dio T	ower							K. Jermst	
JAP				ROJEC [.] OCATIC		-		n Cou								_ ENGINEER	G. Prada	· · · · · · · · · · · · · · · · · · ·
	ials Divisi			.A. #	21.1	_	N/A						DRILL RIG		D-120 (1082)			
	hnical Sec			ORING		-	B-1							ATER LE			6" HSA	· · · · ·
	S. Stewart City, NV 8) ELF	V. ft										Automatic	>	
Carson	UILY, INV 0	51 12		OTAL D			40.2									BACKFILLED _	Yes D	ATE 11/30/2020
							(7)	(1)	F	·								
(ft) (ft)	DEPTH (ft)	SAMPLE NO.	TYPE	BLOWS / 6"	Uncorrected N Value	Recovery (%)	% PASSING NO.4	% PASSING NO.200	LIQUID LIMIT	PLASTICITY INDEX	GRAPHIC LOG				IATE			REMARKS
Ξ	B	SAMP	F	BLOV	Unco N \	Rec	A PA	% PA NO	IQUI	SLAS	GRA			DE	SCRI	PTION		
	=			8								Fines	content	increases	s, grave	el content decreas	ses, sand	
-	26	1-7		12 19	31		99	36				becom	es fine-	grained				
-	-27																	
-	- 28																	
-	- 29																	
_	- 30			12								Becom	A VORV	dense	uravel c	ontent increases,	sand	
_	- 31	1-8		22	46		80	17	15	NP		becom	es fine-	to-coarse	graine	d	, Janu	
				24														
-	-32										SM							Rig chatter 32' - 34'
-	- 33																	34
-	- 34																	
		1-9		7 27	71		80	32				Fines	content	increases	6			
-	- 36	. 0		44														
-	- 37																	
-	- 38																	Dig chatter 20
	- 39																	Rig chatter 38' - 40'
-	-40	1-10		Refusal								Borina	termina	ated at 40	BGS.	groundwater not		
_	-41											encour	ntered		22,	0		
-	42																	
	-43																	
-	44																	
-	45																	
_	-46																	
-	- 47																	
-	48																	
-	-49																	
	-																	
Standa	ard						55	٨	act -]	S Silty						
Penetr Test								Aggre Base	yate		Sand	S Silty						

SMART SOIL LOG US50 TOWERS GPJ NDOT SMART LOG 2018.10.10.GDT 12/7/20

Appendix C Laboratory Test Results

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

D4 11-

441201 2020

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EA	Cont	:#
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Job Description US 50 RadioTower

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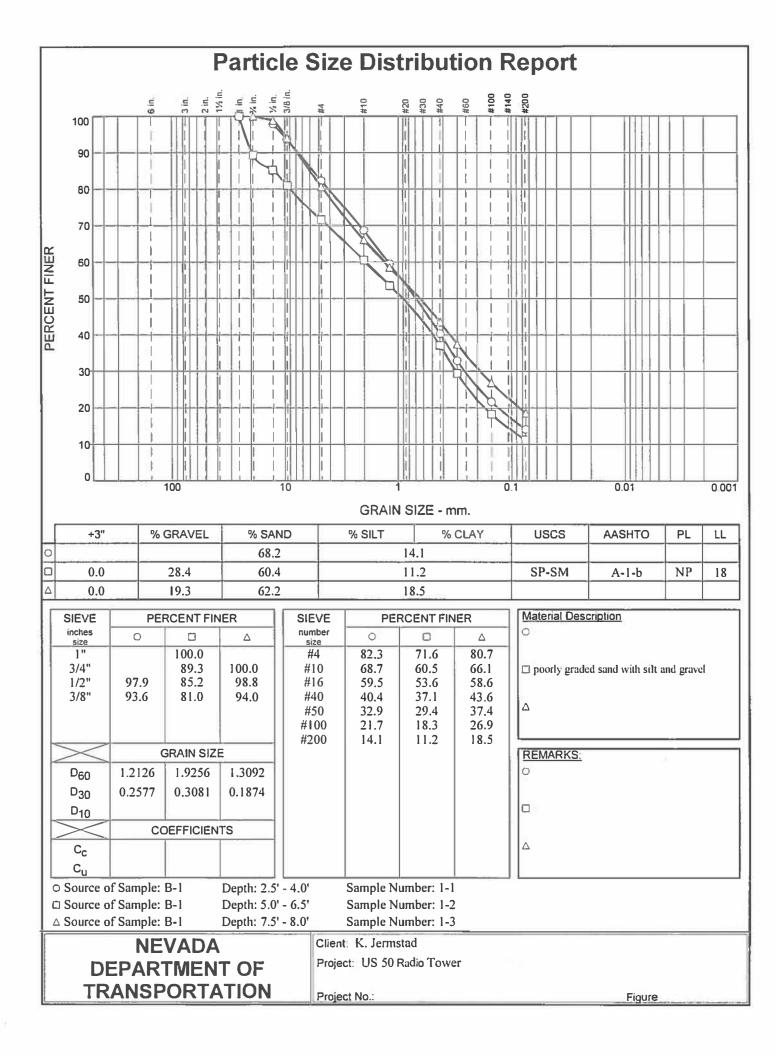
Boring N	o. B-1				Elevatio	on (ft)				Station						Date	11/30/ 2020
SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP- LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	Pi %	TEST TYPE	Ф deg.	ENGTH 1 C psi eak	ф deg.	C psi idual	-	COMMENTS
1-1	2.5 - 4.0	SPT					14.1										
1-2	5.0 - 6.5	SPT		SP-SM			11.2	18	NP	NP							
1-3	7.5 - 8.0	SPT					18.5										
1-4	10. 0- 11.5	SPT		SM			42.7	23	20	3							
1-5	15.0 - 16.5	SPT		SC-SM			33.4	26	19	7							
1-6	20.0 - 21.5	SPT					11.7										
1-7	25.0 - 25.5	SPT					36.3						×.				
1-8	31.0 - 31.5	SPT		SM			17.1	15	NP	NP							
1-9	35.0 - 36.5	SPT					31.5										

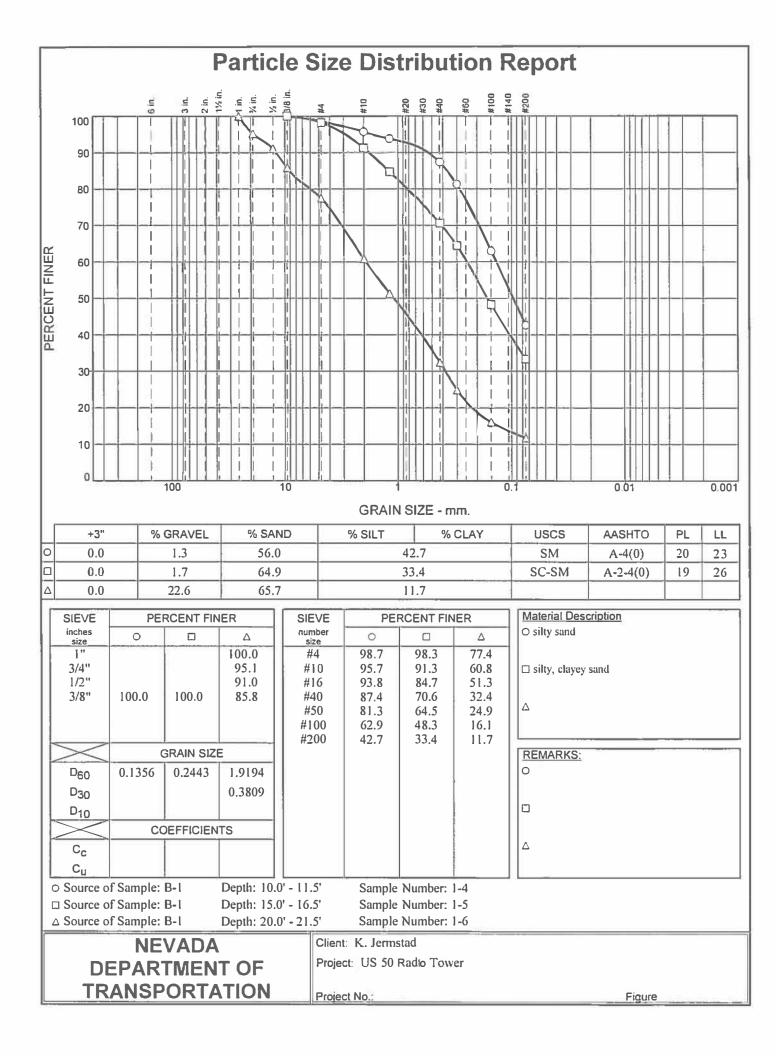
CMS = California Modified Sampler 2.42" ID SPT = Standard Penetralion 1.38" ID CS = Continuous Sample 3.23" ID RC = Rock Core PB = Pitcher Barrel CSS = Calif. Split Spoon 2.42" ID CPT = Cone Penetration Test TP = Test Pit P = Pushed, not driven R = Refusal Sh = Shelby Tube 2.87" ID $\label{eq:constraint} \begin{array}{l} U = Unconfined Compressive \\ UU = Unconsolidated Undrained \\ CD = Consolidated Drained \\ CU = Consolidated Undrained \\ DS = Direct Shear \\ \Phi = Friction \\ C = Cohesion \\ N = No. of blows per (t., sampler \\ \\ N = Field SPT \\ N = (N_{cm})(0.62) \end{array}$

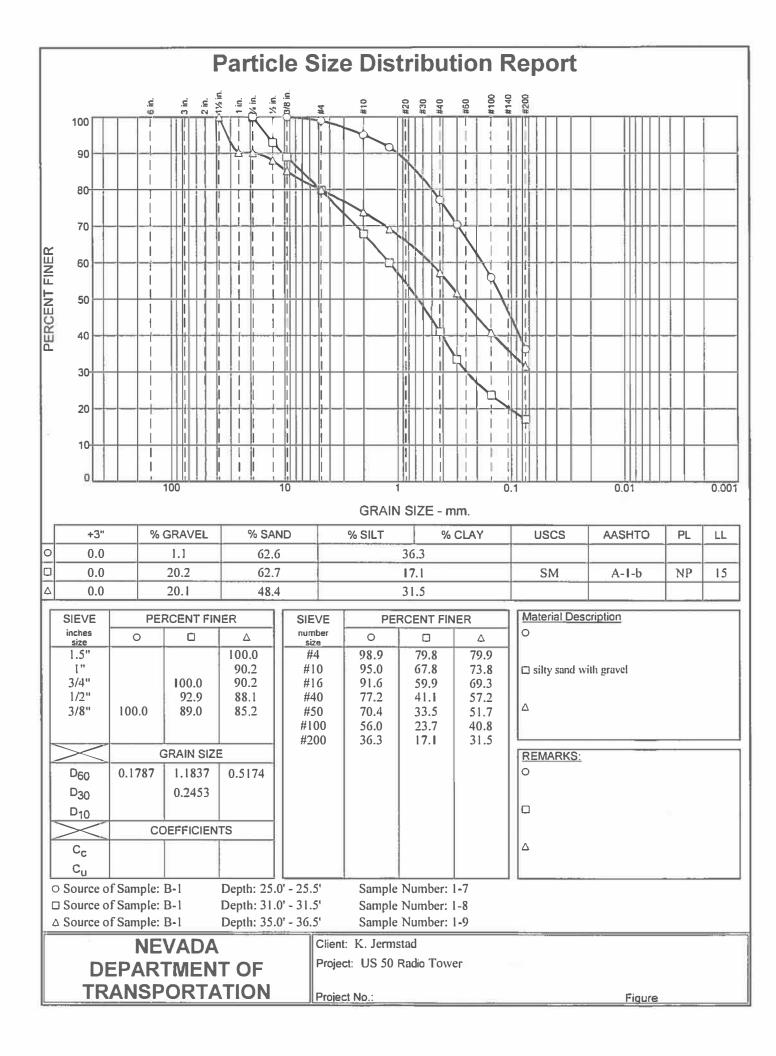
H = Hydrometer S = Sieve G = Specific Gravity PI = Plasticity Index LL = Liquid Limit PL = Plastic Limit NP = Non-Plastic OC = Consolidation Ch = Chemical RV = R - Value MD = Moisture Density

CM = Compaction E = Swelt/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

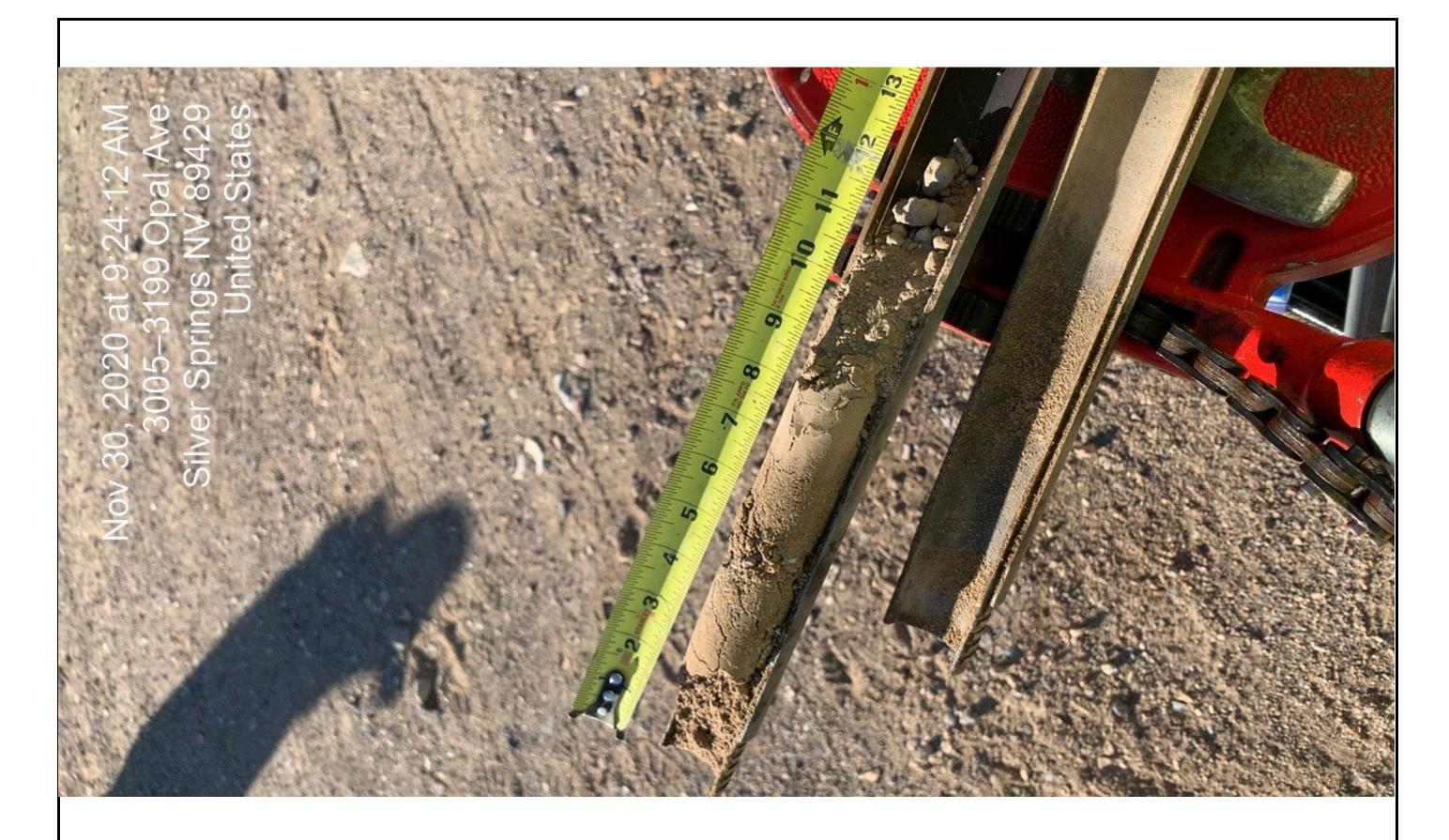
* = Average of subsamples







Appendix D Sample Photographs



JEVADA DOT

Figure D-1 Sample 1-1 (2.5'-4')Location:Lyon County, NVProject Name:US50 Radio TowerEA Number:N/A



Tevada Dot

Figure D-2 Sample 1-2 (5'-7.5')Location:Lyon County, NVProject Name:US50 Radio TowerEA Number:N/A



1263 South Stewart Street Carson City, Nevada 89712 Phone: (775) 888-7440 Fax: (775) 888-7201

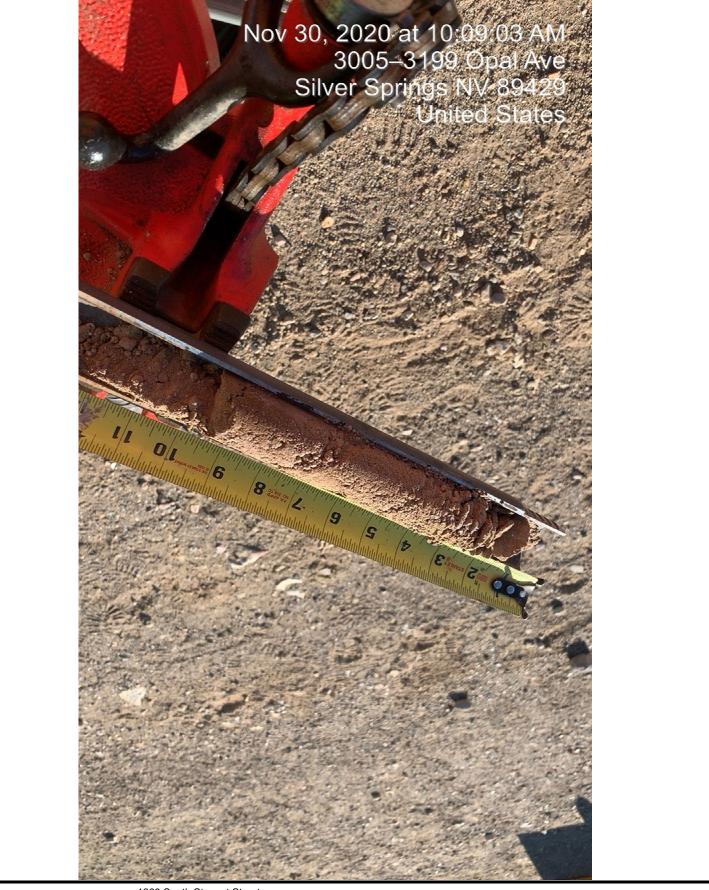
Figure D-3 Sample 1-3 (7.5'-9')Location:Lyon County, NVProject Name:US50 Radio TowerEA Number:N/A



TEVADA DOT

30, 2020 at 9:53:35 AM 3005–3199 Opal Ave Silver Springs NV 89429 United States

Figure D-4 Sample 1-4 (10'-11.5')Location:Lyon County, NVProject Name:US50 Radio TowerEA Number:N/A



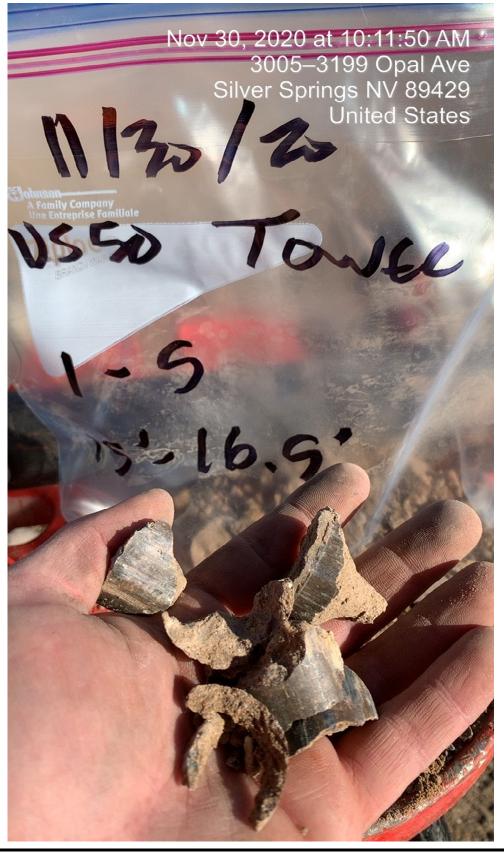




Figure D-5 Sample 1-5 (15'-16.5')Location:Lyon County, NVProject Name:US50 Radio TowerEA Number:N/A



JEVA DOT DA

Figure D-6 Sample 1-6 (20'-21.5')Location:Lyon County, NVProject Name:US50 Radio TowerEA Number:N/A

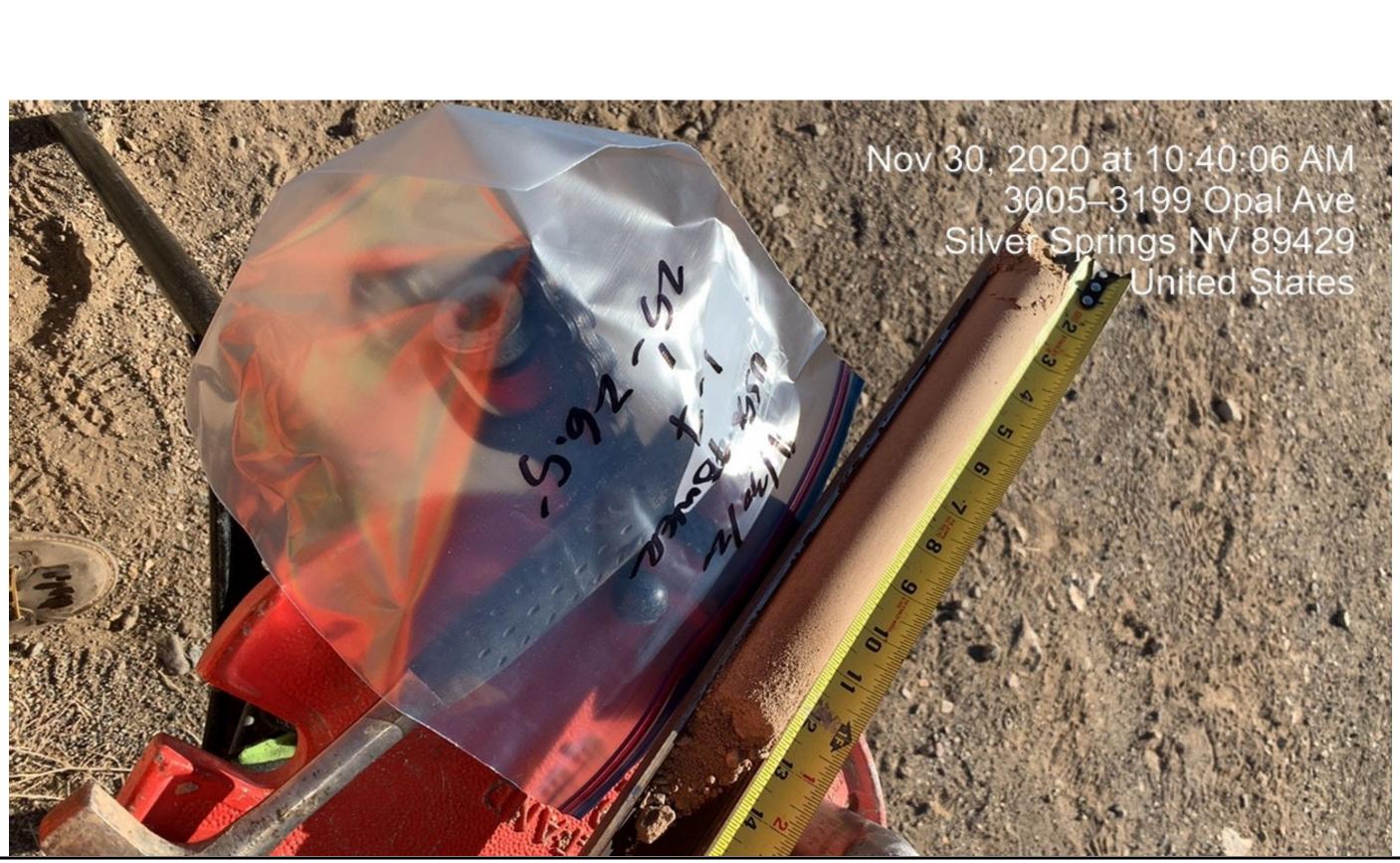
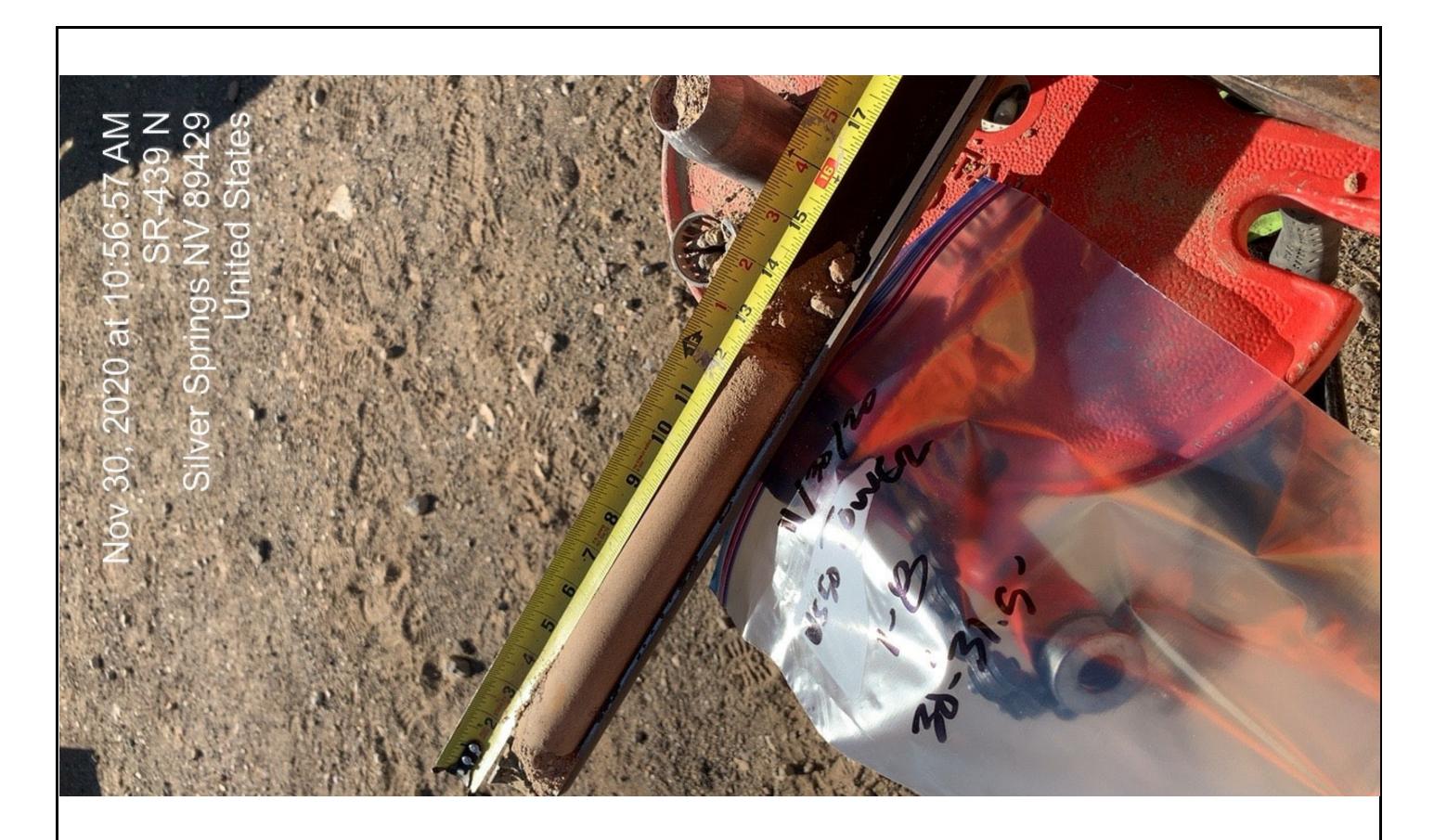




Figure D-7 Sample 1-7 (25'-26.5')Location:Lyon County, NVProject Name:US50 Radio TowerEA Number:N/A



JEVADA DOT

Figure D-8 Sample 1-8 (30'-31.5')Location:Lyon County, NVProject Name:US50 Radio TowerEA Number:N/A

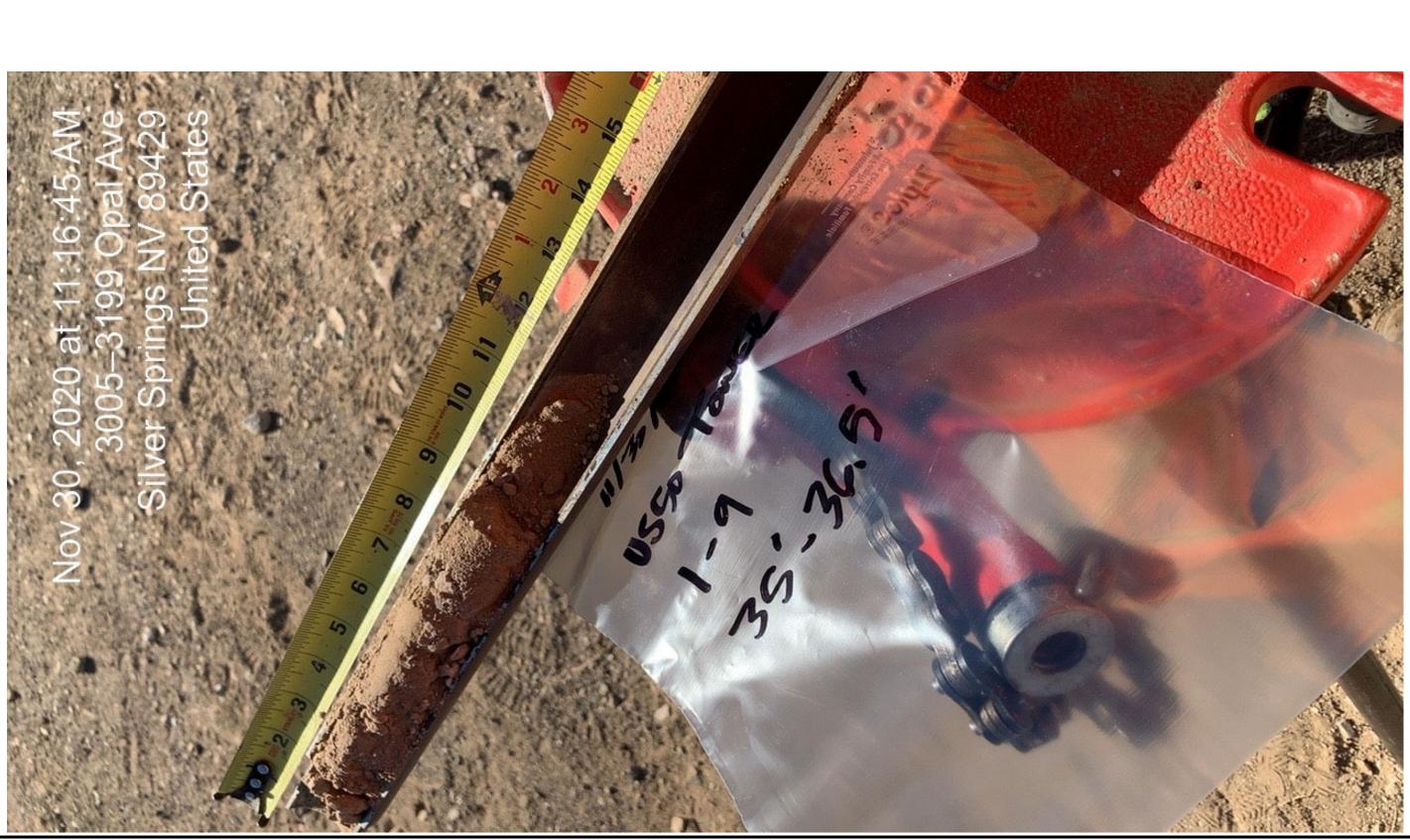




Figure D-9 Sample 1-9 (35'-36.5')Location:Lyon County, NVProject Name:US50 Radio TowerEA Number:N/A

NEVADA DEPARTMENT OF TRANSPORTATION

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