GEOTECHNICAL REPORT

SR 160 (BLUE DIAMOND ROAD)
U.P. RAILROAD GRADE SEPARATION
CLARK COUNTY
EA 72495
FEBRUARY 2004

NEVADA DOT
GEOTECHNICAL ENGINEERING

MATERIALS DIVISION

STATE OF NEVADA

DEPARTMENT OF TRANSPORTATION

MATERIALS DIVISION

GEOTECHNICAL SECTION

GEOTECHNICAL REPORT

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U. P. RAILROAD GRADE SEPARATION

EA 72495

February 2004

CLARK COUNTY, NEVADA

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INTRODUCTION

General

This report has been prepared for the proposed grade separation located at SR 160 (Blue Diamond Road), and the Union Pacific Railroad crossing in Clark County, Nevada. SR 160 runs approximately east-west at this location, and is currently one lane wide in each direction. The existing highway crosses the railroad tracks at grade. The proposed plan calls for construction of a grade separation, consisting of three additional lanes in each direction, crossing over the tracks. For a more detailed description, see the contract plans for this project. A site plan for the project is presented in Appendix A.

Photo 1. SR 160 (Blue Diamond Road): Looking West toward UPRR at-grade Crossing

Purpose and Scope

The purpose of this report is to present information regarding the subsurface soil conditions at the proposed project site. This report provides geotechnical design recommendations for the grade separation involved in this project, including, but not limited to retaining walls and new

bridge structures. The scope of this report consists primarily of geotechnical investigation, analysis, and recommendations for both design and construction. The investigation included gathering data from past field explorations and reports, in addition to information obtained from field reconnaissance, subsurface explorations, soil sampling, and analysis of field and laboratory testing data. This report includes boring logs and summaries of test results from the field investigations and the laboratory testing regimen. These may be found in appendices B and C, respectively.

PROJECT DESCRIPTION

State Route 160, currently conveys one lane of traffic in each direction at the Union Pacific Railroad crossing, 10 miles south-southwest of downtown Las Vegas, located approximately 2.8 miles west of I-15 at milepost 3.44. The existing road was originally constructed under Contract 656 in 1944, crossing the Union Pacific railroad tracks at grade. Proposed plans indicate the grade separation will be designed as dual, single span structures over the Union Pacific tracks, with each structure being approximately 150 feet in length, each conveying four lanes. The proposed design will necessitate construction of four retaining walls along both the north and south sides of the roadway, east and west of the railroad tracks. These retaining walls vary from around 1500 to 3000 feet in length, adding up to approximately 7800 feet in combined length, and reach heights up to 38 feet. A channel is proposed running parallel to the railroad tracks, passing as a box culvert beneath the retaining walls and retained fill of the west abutment.

Photo 2. SR 160 (Blue Diamond Road): Looking Northwest toward UPRR Crossing

GEOLOGIC CONDITIONS and SEISMICITY

The site is founded primarily in older alluvium of the Blue Diamond and Red Rock fans (Qoa).[1] These deposits are pink to brown fine pebble to small cobble gravel, with subordinate pebble-bearing sand. It is moderately to well consolidated to locally cemented due to petrocalcic carbonate deposits (caliche). Clasts are predominately limestone and dolomite with subordinate quartzite. This deposit has well-developed desert pavement, with surface clasts having slight to moderate desert varnish. The site is secondarily founded in intermittently active alluvium (Qai), and alluvium of active washes (Qa)[1]. These deposits are pink to pale-brown fine sand to pebble to cobble gravel, and are unconsolidated to moderately consolidated to locally cemented due to petrocalcic cementation. Clasts are predominately volcanic. Sand size sediment is mainly limestone and dolomite with subordinate quartz and feldspar; detrital gypsum occurs locally, and is an important component in these deposits. Large deposits of gypsum occur to the west-northwest of the project site, and are mined commercially 8 miles away.[2] No gypsum deposits were found during the investigation. This area lies at an elevation of approximately 2475 feet[3], and has not subsided to any measurable extent between 1963 and 1987[4]. The site slopes gently downward <2% to the east,[5] and groundwater exists at a depth of approximately 350 feet.[6]

There are numerous tectonic features surrounding the project site; among them are the Keystone Thrust located 13 miles to the west, and the Las Vegas Valley Shear Zone which lies about 23 miles to the northeast. Nearby faults include; the Sloan Fault 4 miles to the south, the Cottonwood Fault 13 miles to the west-southwest, and the Frenchman Mountain Fault 15 miles to the northeast of the site.[7] Of these faults, the Frenchman Mountain Fault is probably the most capable of producing a large (magnitude 6 or 7) earthquake[8]. The soil type for this project is Type II, as defined by AASHTO in Division IA – Seismic Design. The recommended acceleration coefficient (A) is 0.15g.

FIELD INVESTIGATION

The Nevada Department of Transportation (NDOT) Geotechnical Section conducted a subsurface investigation at the proposed project site in May and June of 2000. Subsurface soil conditions were explored by drilling seven boreholes (BD-1 through BD-7) to a maximum depth of 96.2 feet. The approximate locations of the boreholes are shown on the Borehole Locations sheet in Appendix A. Surface elevations were obtained for the borehole locations by surveying from known elevation points. Drilling was accomplished utilizing a Mobile B-80 drill rig equipped for soil sampling, using either bentonite drilling slurry for wet drilling, or eight inch (8") hollow stem auger. The on-site soil conditions were not suitable for using any sampler other than a Standard Penetration Test (SPT) sampler; therefore, all samples recovered were disturbed. Soil samples and standard penetration resistance values (N-Values) were obtained utilizing the SPT procedure as set forth in ASTM test number T 206. The uncorrected blow counts are shown on the boring logs in Appendix B. In addition, bulk samples were taken from auger cuttings. All soil samples were classified, both visually and using laboratory data, using the Unified Soil Classification System (USCS) described in ASTM test number D2487.

LABORATORY ANALYSIS

Laboratory analyses were performed on the samples collected from the seven boreholes. The testing program consisted of sieve analyses, Atterberg limits, and chemical analyses. Because of the high densities of the granular soils on-site, and the lack of any undisturbed or relatively undisturbed samples; no direct shear, triaxial shear, or consolidation tests were performed. The results of the testing program show that the soils consist primarily of very dense silty and clayey sands and gravels. Plasticity Indexes (PI) ranged from 3 to 11, with liquid limits between 21 and 31, indicating a variety of soil conditions. Further information is presented in the summaries of test results in Appendix C.

DISCUSSION

Borings from the field investigation identified the soils to be primarily very dense sandy gravels and gravelly sands, with occasional layers of silty and/or clayey sands and gravels with cobbles; no gypsum was encountered. Some caliche was encountered during line sampling for the proposed channel. No clearly defined subsurface stratification is apparent from this set of borings; subsurface soil conditions vary in each borehole. All drive samples taken during the field exploration showed the soils to be very dense, with field blow counts from 80 blows per foot, to refusal (50 blows - no progress). The southern side of the alignment showed the soils to be slightly more sandy than the northern side, which consisted of primarily gravel. Most of the sands were found in the top 15 feet. These soils are best suited for spread footings; deep foundations such as driven piles or drilled shafts are not recommended for this site due to high soil densities and presence of cobbles.

Information found in the Soil Parameter tables is calculated using the following methods. The at-rest earth pressure coefficient (K_0) is derived from the empirical formula: $K_0 = 1- \sin \varphi$. he static active earth pressure coefficient (K_a) is calculated using Coulombs analysis method. The static passive earth pressure coefficient (K_p) is calculated using the Log Spiral analysis method. The dynamic active earth pressure coefficient (K_{ae}) is calculated using the Mononobe-Okabe analysis method. The dynamic passive earth pressure coefficient (K_{pe}) is calculated using the Mononobe-Okabe analysis method. The structure - soil interface angle (δ) is taken as 0.6 φ. The Acceleration Coefficient (A), and Soil Profile Type are all obtained from AASHTO Standard Specifications for Highway Bridges, Division 1-A, Section 3. The horizontal Acceleration Coefficients (K_h) are obtained from AASHTO Standard Specifications for Highway Bridges, Division 1-A, Section 6. The vertical Acceleration Coefficient (K_v) is assumed to be zero.

RECOMMENDATIONS

Excavations and Earthwork

All excavation shall be performed in accordance with the NDOT Standard Specifications for Road and Bridge Construction (SSRBC). The contractor shall be responsible for all necessary shoring for any excavation. One of the primary geotechnical concerns for the construction of this project is the presence of very dense gravel deposits with cobbles, throughout the entire project area. All permanent slopes should be constructed to lie at a maximum of 2:1 (Horiz:Vert) slope. Estimates for construction excavation should be made based on using temporary 1:1 (Horiz:Vert) slopes.

Scarify all subgrade areas to a depth of six inches (6") and moisture condition to two to four percent (2-4%) above optimum moisture. Compact all scarified areas to the specified relative compaction.

Abutments

Spread footings are well suited to the dense, granular soils that exist throughout the project site, and are recommended to support the bridge abutments. The native soil provides an allowable bearing capacity (F.S.=3.0) for spread footings of eight kips per square foot (8 ksf), while embankment fills will provide an allowable bearing capacity (F.S.=3.0) of four kips per square foot (4 ksf). The bottoms of all spread footings founded in native soil should be a minimum of four feet wide, and at least four feet below the existing grade. Applied loads in the range of the allowable capacities given above should result in estimated total settlement of less than one inch (1 in.), and differential settlement of less than one half inch (½ in.) in native soils. This settlement should occur during construction, due to the granular nature of the native soils. The coefficient of friction for sliding should be 0.40. The following soil parameters and earth pressure coefficients in Table 1 may be used to design the abutment walls.

	Abutment/Wall Allowed to Displace	Abutment/Wall Restrained
ϕ_3 = soil friction angle	34º	34º
γ_3 = effective soil unit weight	120 pcf	120 pcf
δ_3 = structure - soil interface angle	20.4º	20.4º
K_h = Horizontal Acceleration Coefficient	0.075	0.075
K_v = Vertical Acceleration Coefficient	0	0
K_0 = At-Rest Earth Pressure Coefficient	0.441	0.441
K_a = Active Earth Pressure Coefficient (Coulomb)	0.255	0.255
K_p = Passive Earth Pressure Coefficient (Log Spiral)	7.11	7.11
K_{ae} = Dynamic Active Earth Pressure Coefficient (Mononobe-Okabe)	0.315	0.445
K_{pe} = Dynamic Passive Earth Pressure Coefficient (Mononobe-Okabe)	7.46	6.44

Table 1. SOIL PARAMETERS for GRANULAR BACKFILL

M.S.E. Walls

Mechanically Stabilized Earth (MSE) Walls are proposed to be located in each quadrant formed by State Route 160 (Blue Diamond Road), and the Union Pacific Railroad. Allowable soil bearing capacities for the retaining walls are calculated based on the FHWA Soils and Foundations Workshop Manual[9]. The allowable bearing capacity of the native soil is eight kips per square foot (8 ksf). Using a factor of safety of 2.0, the ultimate bearing capacity of the native soil is 16 kips per square foot (16 ksf). The coefficient of friction is 0.6. The strap lengths for the MSE walls should be 85% of the wall height, and not less than eight feet. The top of the leveling pads should be placed a minimum of three feet (3') below finish grade. The external (global) stability is the responsibility of NDOT and has been checked using procedures from the FHWA Mechanically Stabilized Earth Wall Design and Construction Manual[10]. The internal stability is the responsibility of the MSE wall supplier, and should be checked in accordance with AASHTO Section 5.8.4. Soil parameters and earth pressure coefficients used to design MSE walls may be found in Table 2.

Cantilever Walls

The footing for concrete cast-in-place walls should be a minimum of two feet (2') wide, with the top of footing placed a minimum of two feet (2') below finish grade. Walls should be designed for a maximum bearing pressure of six kips per square foot (6 ksf) for native soil, and four kips per square foot (4 ksf) in fill. A coefficient of friction of 0.40 should be used for determining resistance to sliding. Applied loads in the range of the allowable capacities given above should result in estimated total settlement of less than one inch (1 in.), and differential settlement of less than one half inch (½ in.) in native soils. This settlement should occur during construction, due to the granular nature of the native soils. Settlement due to embankment loading should be negligible. Soil parameters and earth pressure coefficients used to design cantilever walls may be found in Table 1.

	Borrow and Retained Earth	**MSE Backfill**
ϕ_2 = soil friction angle	32º	34º
γ_2 = effective soil unit weight	120 pcf	120 pcf
δ_2 = structure - soil interface angle	19.2º	20.4º
K_h = Horizontal Acceleration Coefficient	0.075	0.075
K_v = Vertical Acceleration Coefficient	0	0
K_0 = At-Rest Earth Pressure Coefficient	0.470	0.441
K_a = Active Earth Pressure Coefficient (Coulomb)	0.276	0.255
K_p = Passive Earth Pressure Coefficient (Log Spiral)	6.14	7.11
K_{ae} = Dynamic Active Earth Pressure Coefficient (Mononobe-Okabe)	0.354	0.315
K_{pe} = Dynamic Passive Earth Pressure Coefficient (Mononobe-Okabe)	6.21	7.46

Table 2. SOIL PARAMETERS for MSE Walls

CONCRETE CHANNELS

A rectangular concrete channel is proposed for this project. This channel runs parallel to the railroad alignment. The allowable soil bearing capacity for the channel wall foundations is 4 ksf. Estimated quantities for excavation should be made on the basis of using temporary 1:1

(Vert:Horiz) slopes. Soil parameters and earth pressure coefficients used to design concrete channels may be found in Table 3.

ϕ_1 = soil friction angle	35º
γ_1 = effective soil unit weight	130 pcf
δ_1 = structure - soil interface angle	21º
K_h = Horizontal Acceleration Coefficient	0.075
K_v = Vertical Acceleration Coefficient	0
K_0 = At-Rest Earth Pressure Coefficient	0.426
K_a = Active Earth Pressure Coefficient (Coulomb)	0.245
K_p = Passive Earth Pressure Coefficient (Log Spiral)	8.27
K_{ae} = Dynamic Active Earth Pressure Coefficient (Mononobe-Okabe)	0.289
K_{pe} = Dynamic Passive Earth Pressure Coefficient (Mononobe-Okabe)	8.23

Table 3. SOIL PARAMETERS for NATIVE SOIL

REFERENCES

1. Las Vegas SW Quadrangle Geologic Map; Nevada Bureau of Mines and Geology, 1985, Map 3Bg.

2. Geology and Mineral Deposits of Clark County, Nevada, Bulletin 62, Nevada Bureau of Mines and Geology, 1965.

3. Las Vegas SW Folio Tinted Relief Map; Nevada Bureau of Mines and Geology, 1974.

4. Nevada Bureau of Mines and Geology NBMG Open File Report 93-4, Plate 4, Subsidence in Las Vegas Valley, 1980-91, 1993.

5. Las Vegas SW Folio Slope Map; Nevada Bureau of Mines and Geology, 1975.

6. Las Vegas SW Quadrangle Ground Water Map; Nevada Bureau of Mines and Geology, 1985, Map 3Bf.

7. Tectonic Map of Clark County, Nevada; Nevada Bureau of Mines, Bulletin 62, 1965; Plate 5.

8. dePolo, Craig; from Las Vegas Review Journal; Sunday, April 11, 1999.

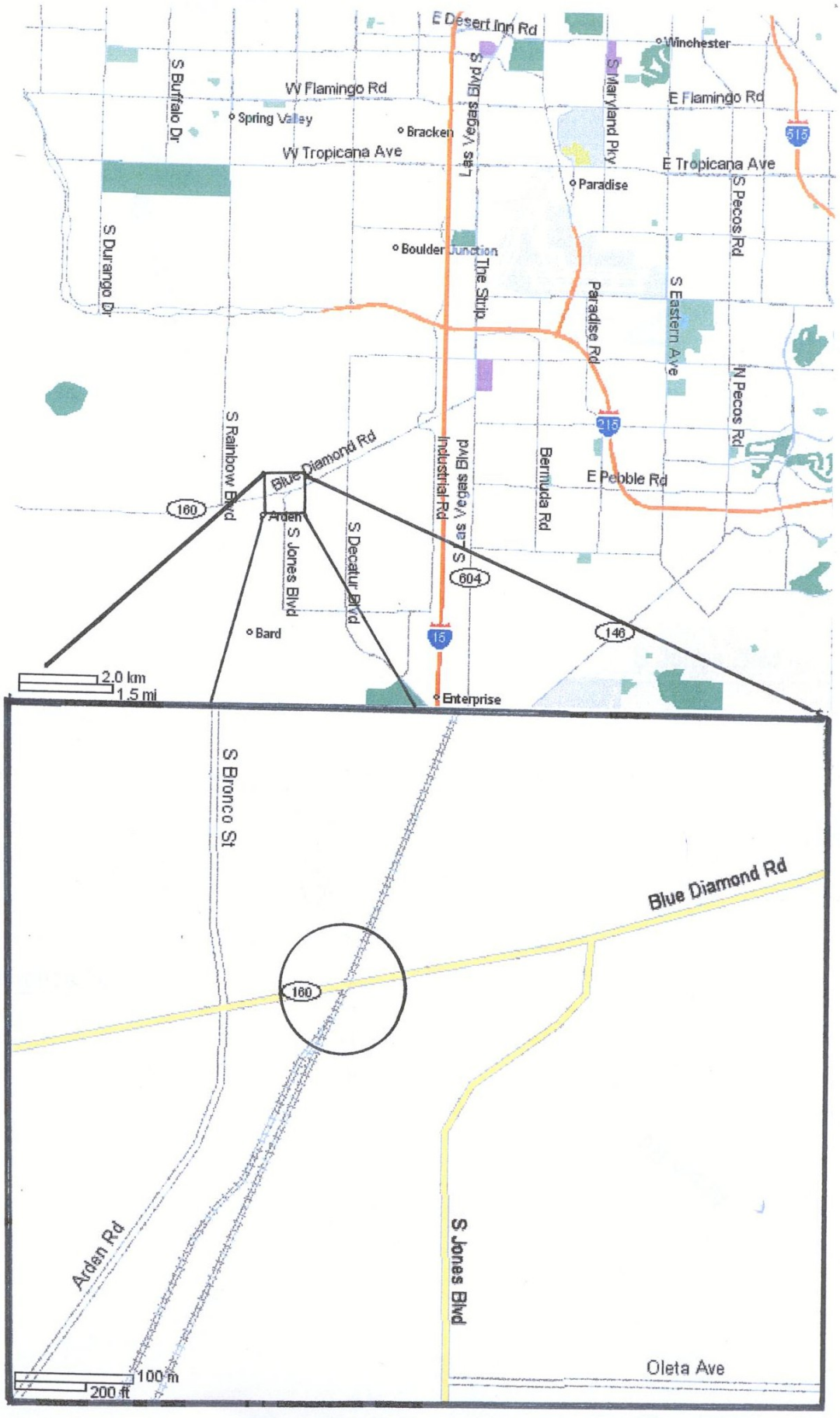
9. Soils and Foundations Workshop Manual, Figure 7-2; FHWA HI-88-009, National Highway Institute, revised July 1993.

10. Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Manual, FHWA-SA-96-071, reprinted September 1998.

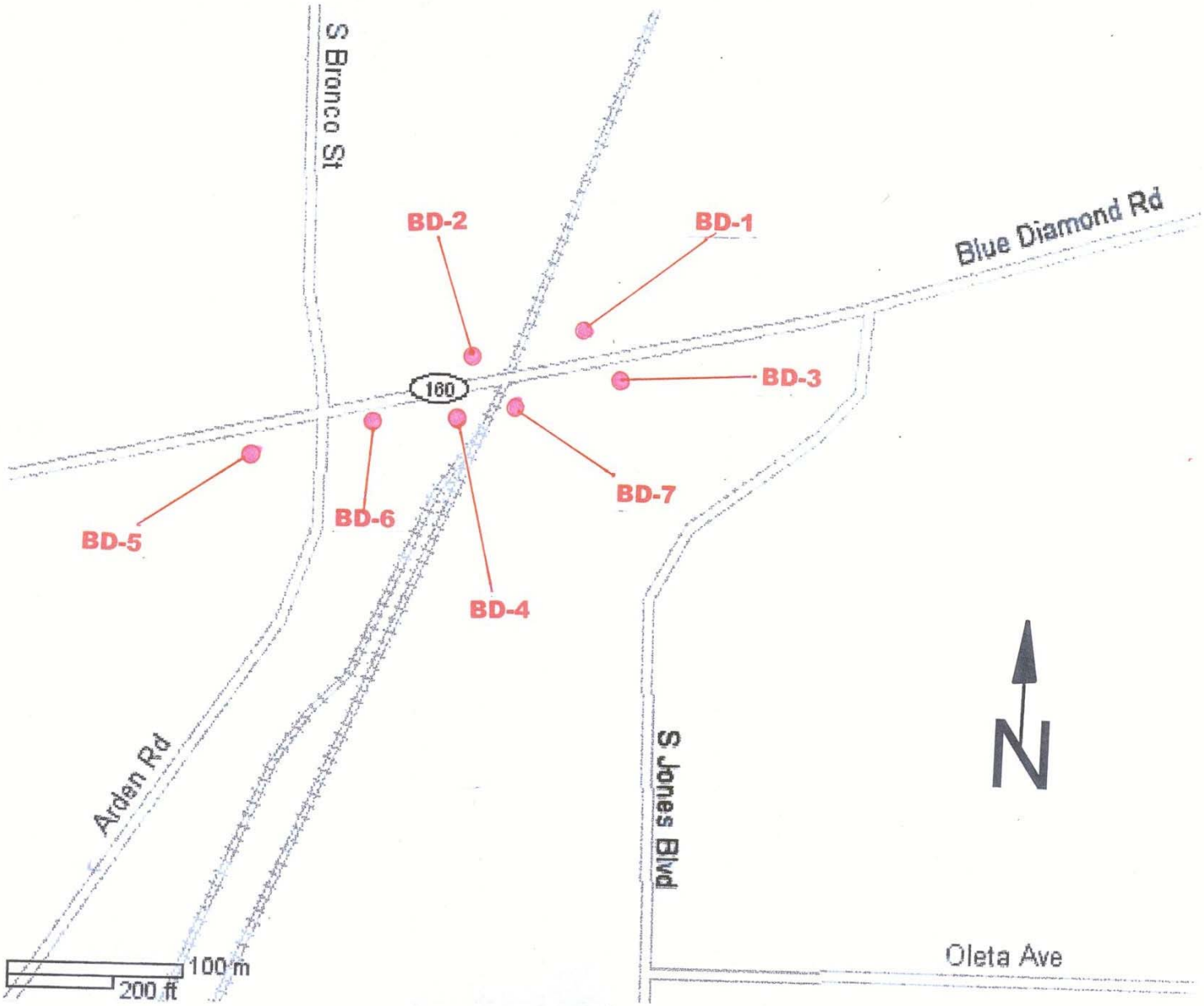
11. AASHTO Standard Specifications For Highway Bridges, sixteenth edition, 1996; with interims through 1999.

12. Standard Specifications for Road and Bridge Construction, State of Nevada Department of Transportation, 2001.

APPENDIX A


E Desert Inn Rd
Winchester
S Buffalo Dr
W Flamingo Rd
E Flamingo Rd
Spring Valley
Bracken
Las Vegas Blvd S
S Maryland Pkwy
W Tropicana Ave
E Tropicana Ave
515
Paradise
S Pecos Rd
S Durango Dr
Boulder Junction
The Strip
Paradise Rd
S Eastern Ave
N Pecos Rd
S Rainbow Blvd
Blue Diamond Rd
215
E Pebble Rd
Industrial Rd
Las Vegas Blvd S
Bermuda Rd
160
Arden
S Jones Blvd
S Decatur Blvd
604
Bard
15
146
2.0 km
1.5 mi
Enterprise
S Bronco St
Blue Diamond Rd
160
Arden Rd
S Jones Blvd
Oleta Ave
100 m
200 ft

SITE MAP



BOREHOLE LOCATIONS

APPENDIX B

KEY TO BORING LOGS

PARTICLE SIZE LIMITS								
CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		FINE	MEDIUM	COARSE	FINE	COARSE		
.002 mm	#200	#40	#10	#4	3/4 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
GM	Silty gravels, poorly graded gravel-sand-silt mixtures
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
CS	Claystone/Siltstone
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.

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.

▽ ▼ **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
		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

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

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

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

$(N_{AUTOMATIC})(1.30) = N_{60}$

$(N_{SAFETY})(1.17) = N_{60}$

TEST ABBREVIATIONS

CD	CONSOLIDATED DRAINED	O	ORGANIC CONTENT
CH	CHEMICAL (CORROSIVENESS)	OC	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 COLOR CHART.
EXAMPLE: (7.5 YR 5/3) BROWN

SAMPLER NOTATION

CMS	CALIF. MODIFIED SAMPLER①
CPT	CONE PENETRATION
CS	CONTINUOUS SAMPLER②
CSS	CALIFORNIA SPLIT SPOON
P	PUSHED (NOT DRIVEN)
PB	PITCHER BARREL
RC	ROCK CORE③
SH	SHELBY TUBE④
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

LAST MODIFIED: October 11, 2006

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 5/2/00
END DATE 5/3/00
JOB DESCRIPTION SR 160 - PAHRUMP VALLEY ROAD
LOCATION SR 160 at UPRR Crossing
BORING BD-1
E.A. # 72495
GROUND ELEV. 2471.77 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"183+48
OFFSET 70.5' Right
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/15/00

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
									SANDY GRAVEL with COBBLES dry, light brown (7.5 YR 6/4)	
	2.00	A	SPT	20/0.25"	20/0.25"	0				(A) Refusal; No recovery.
	3.00								3.00	
	3.33	B	SPT	50/4"	50/4"	75		GW GC	WELL-GRADED GRAVEL with SILTY CLAY and SAND light brown to pink (7.5 YR 6/4 to 7.5 YR 7/4), very dense	(B) Very hard drilling to 6' @ 600 psi.
2466.8	5									
	6.00								6.00	
	7.29	C	SPT	30 39 50/3.5"	50/3.5"	81			WELL-GRADED GRAVEL with SILTY CLAY and SAND yellowish red (5 YR 5/6), very dense, with some cemented fines	
	8.00									
	8.33	D	SPT	50/4"	50/4"	0				
2461.8	10									
	13.00							GW GC		(E) Very hard drilling to 13'.
	13.25	E	SPT	50/3"	50/3"	33				
2456.8	15									
	18.00									
	18.21	F	SPT	50/2.5"	50/2.5"	0				(F) No recovery.
									19.00	
2451.8	20								WELL-GRADED GRAVEL with SILTY CLAY and SAND yellowish red (5 YR 5/6), very dense	
	23.00									
	23.21	G	SPT	50/2.5"	50/2.5"	20		GW GC		(G) Cuttings contain rock chips.
2446.8	25									End of Day 1 drilling @ 23.2'
	28.00									
	28.33	H	SPT	50/4"	50/4"	0				(H) No recovery.
									30.00	

NV_DOT BLUEDMND.GPJ NV_DOT.GDT 11/15/06

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BORING BD-1
E.A. # 72495
GROUND ELEV. 2471.77 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"183+48
OFFSET 70.5' Right
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/15/00

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
									SILTY CLAYEY SAND with GRAVEL light reddish brown to yellowish red (5 YR 6/4 to 5/6), very dense	Very hard drilling @ 30'.
	33.00							SC SM		
	33.33	I	SPT	75/4"	75/4"	50				
2436.8	35									
									36.00 — POORLY-GRADED GRAVEL with CLAY and SAND light reddish brown (5 YR 6/4), very dense	
	38.00									
	39.29	J	SPT	48 82 100/3.5"	100/3.5"	74				
2431.8	40									
	43.00									
	43.17	K	SPT	50/2"	50/2"	0				(K) No recovery.
2426.8	45									
										More clay in cuttings @ 46'.
	48.00							GP GC		
	48.21	L	SPT	50/2.5"	50/2.5"	0				
2421.8	50									
2416.8	55									
	58.00									
	58.17	M	SPT	50/2"	50/2"	0				(M) No recovery.
									60.00	

NV_DOT BLUEDMND.GPJ NV_DOT.GDT 11/15/06

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BORING BD-1
E.A. # 72495
GROUND ELEV. 2471.77 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"183+48
OFFSET 70.5' Right
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EQUIPMENT MOBILE B-80
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DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/15/00

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
									POORLY-GRADED GRAVEL with CLAY and SAND pinkish gray (5 YR 7/2), very dense	
2406.8	65							GP GC		
	68.00 68.13	N	SPT	50/1.5"	50/1.5"	0				(N) No recovery.
2401.8	70									
									74.00	
									SILTY CLAYEY SAND with GRAVEL yellowish red (5 YR 5/6), very dense	More clay in cuttings @ 74'. Slight color change to more yellowish @ 75'.
2396.8	75									
	78.00 78.17	O	SPT	50/2"	50/2"	0				(O) No recovery.
2391.8	80							SC SM		
2386.8	85									
	88.00 88.17	P	SPT	50/2"	50/2"	50				
									88.20 B.O.H.	

NV_DOT BLUEDMND.GPJ NV_DOT.GDT 11/15/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 5/4/00
END DATE 5/4/00
JOB DESCRIPTION SR 160 - PAHRUMP VALLEY ROAD
LOCATION SR 160 at UPRR Crossing
BORING BD-2
E.A. # 72495
GROUND ELEV. 2476.74 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"185+84
OFFSET 52.5' Right
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD 8" H.S.A.
BACKFILLED Yes DATE 5/4/00

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
									SANDY GRAVEL with COBBLES dry, light brown (7.5 YR 6/4)	
	2.00								2.00	
		A	BULK			100		GM	SILTY GRAVEL with SAND dry, light yellowish brown (10 YR 6/4), very dense	
	3.50									
	4.00								3.75	
		B	BULK			100			POORLY-GRADED GRAVEL with CLAY and SAND dry, light yellowish brown (10 YR 6/4)	
2471.7	5.00	C	SPT	50/0"	50/0"	0				(C) Refusal; No recovery.
	5.01									
	7.00							GP GC		
	8.00	D	BULK			100				
2466.7	10.00	E	SPT	50/2"	50/2"	0				(E) No recovery.
	10.17								11.00	
	12.00							GC GM	SILTY CLAYEY GRAVEL with SAND dry, light yellowish brown (10 YR 6/4), very dense	
		F	BULK			100				
	13.50								13.50	
								GP	POORLY-GRADED GRAVEL	
2461.7	15.00	G	SPT	50/1.5"	50/1.5"	0			15.10	(G) No recovery.
	15.13								B.O.H.	
2456.7	20									
2451.7	25									

NV_DOT BLUEDMND.GPJ NV_DOT.GDT 11/15/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 6/26/00
END DATE 6/26/00
JOB DESCRIPTION SR 160 - PAHRUMP VALLEY ROAD
LOCATION SR 160 at UPRR Crossing
BORING BD-3
E.A. # 72495
GROUND ELEV. 2471.83 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"182+95
OFFSET 46.0 Left
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR MARSHALL
DRILLING METHOD 8" H.S.A.
BACKFILLED Yes DATE 6/26/00

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
									SANDY GRAVEL with COBBLES dry, light brown (7.5 YR 6/4)	
	2.00								2.00	
	3.00	A	BULK			100			SILTY SAND with GRAVEL dry, reddish brown (5 YR 5/3), very dense	
	3.25	B	SPT	50/3"	50/3"	100				
		C	BULK			100				
2466.8	5 5.00	D	SPT	50/2"	50/2"	100				
	5.17									
	6.00							SM		
		E	BULK			100				More gravel @ 7'.
	8.00	G	SPT	50/1"	50/1"	0				(F) Probable slough.
	8.08									
2461.8	10									Gravel is finer @ 7.5'.
	11.00								10.50	
		H	BULK			100			POORLY-GRADED SAND with SILT and GRAVEL yellowish red (5 YR 5/6), very dense, with some cemented fines	
	13.00							SP SM		Gravel bed @ 13'.
	15.00									
2456.8	15 15.25	I	BULK	50/3"	50/3"	100			15.20	
									B.O.H.	
2451.8	20									
2446.8	25									

NV_DOT BLUEDMND.GPJ NV_DOT.GDT 11/15/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 6/27/00
END DATE 6/27/00
JOB DESCRIPTION SR 160 - PAHRUMP VALLEY ROAD
LOCATION SR 160 at UPRR Crossing
BORING BD-4
E.A. # 72495
GROUND ELEV. 2475.95 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"186+39
OFFSET 62.0 Left
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR MARSHALL
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/27/00

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
									SANDY GRAVEL with COBBLES dry, light brown (7.5 YR 6/4)	
	3.00								3.00	
	3.00	A	SPT	20/0"	20/0"	0			SILTY CLAYEY SAND with GRAVEL light reddish brown (5 YR 6/4), some cobbles, very dense	(A) Sampler ringing/bouncing during driving; Refusal.
								SC SM		
2471.0	5									Hard drilling @ 4'.
									6.00	
									POORLY-GRADED GRAVEL with SAND damp, reddish brown (5 YR 5/3), very dense	
	8.00									
	8.25	B	SPT	50/3"	50/3"	0				600 psi down pressure @ 8.3'.
2466.0	10									Soft zone from 9.5 'to 11'.
								GP		
	13.00									
	13.25	C	SPT	50/3"	50/3"	0				
2461.0	15									Very little fines in cuttings 15' to 16'.
									16.50	
									CLAYEY GRAVEL with SAND damp, reddish brown (5 YR 5/3), very dense	
	18.00									Clay in cuttings @ 17'.
	18.29	D	SPT	50/3.5"	50/3.5"	100				
2456.0	20									
								GC		
	23.00									400 psi down pressure @ 22'.
	23.25	E	SPT	50/3"	50/3"	0				
2451.0	25									
									26.00	
									POORLY-GRADED GRAVEL with CLAY and SAND light reddish brown (5 YR 6/4), very dense	
	28.00									
	28.50	F	SPT	80	80	67				

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 6/27/00
END DATE 6/27/00
JOB DESCRIPTION SR 160 - PAHRUMP VALLEY ROAD
LOCATION SR 160 at UPRR Crossing
BORING BD-4
E.A. # 72495
GROUND ELEV. 2475.95 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"186+39
OFFSET 62.0 Left
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR MARSHALL
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/27/00

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
								GP GC		Clay in cuttings from 30' to 33'.
2441.0	35									
	38.00 / 38.25	G	SPT	50/3"	50/3"	0				
2436.0	40									
	42.00								POORLY-GRADED GRAVEL with SILTand SAND light reddish brown (5 YR 6/4), very dense	
2431.0	45									
	48.00 / 48.25	H	SPT	50/3"	50/3"	50				
2426.0	50									Clay in cuttings from 51' to 52'.
2421.0	55							GP GM		
	58.00 / 58.25	I	SPT	50/3"	50/3"	0				

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 6/27/00
END DATE 6/27/00
JOB DESCRIPTION SR 160 - PAHRUMP VALLEY ROAD
LOCATION SR 160 at UPRR Crossing
BORING BD-4
E.A. # 72495
GROUND ELEV. 2475.95 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"186+39
OFFSET 62.0 Left
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR MARSHALL
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/27/00

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
2411.0	65									
	68.00 / 68.25	J	SPT	50/3"	50/3"	0				
2406.0	70								70.00 POORLY-GRADED GRAVEL with SILTand SAND light reddish brown (5 YR 6/4), very dense	Hard drilling. 650 psi down pressure from 72' to 74'.
2401.0	75									
	78.00 / 78.17	K	SPT	50/2"	50/2"	0				
2396.0	80							GP GM		Hard drilling from 81' to 91'.
2391.0	85									
	88.00 / 88.21	L	SPT	50/2.5"	50/2.5"	80				

NV_DOT BLUEDMND.GPJ NV_DOT.GDT 11/15/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 6/27/00
END DATE 6/27/00
JOB DESCRIPTION SR 160 - PAHRUMP VALLEY ROAD
LOCATION SR 160 at UPRR Crossing
BORING BD-4
E.A. # 72495
GROUND ELEV. 2475.95 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"186+39
OFFSET 62.0 Left
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR MARSHALL
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/27/00

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
										Minor clay lens @ 93'.
2381.0	95									
	96.00 96.17	M	SPT	50/2"	50/2"	0			96.20 B.O.H.	
2376.0	100									
2371.0	105									
2366.0	110									
2361.0	115									

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 6/28/00
END DATE 6/28/00
JOB DESCRIPTION SR 160 - PAHRUMP VALLEY ROAD
LOCATION SR 160 at UPRR Crossing
BORING BD-5
E.A. # 72495
GROUND ELEV. 2481.25 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"190+63
OFFSET 49.0 Left
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR MARSHALL
DRILLING METHOD 8" H.S.A.
BACKFILLED Yes DATE 6/28/00

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
	1.00								SANDY GRAVEL with COBBLES dry, light brown (7.5 YR 6/4)	
		A	BULK			100			2.00	
	3.00	B	SPT	50/1.5"	50/1.5"	100			SILTY CLAYEY SAND with GRAVEL dry, with cobbles, reddish brown (5 YR 5/3), very dense	(B) Probable slough.
	3.12	C	BULK			100		SC SM		
2476.3	5 5.00 5.01	D	SPT	50/0"	50/0"	0				(D) Refusal; No recovery. Very hard drilling @ 6'.
									7.00	
	8.00 8.08	E	SPT	50/1"	50/1"	100			SILTY SAND with GRAVEL dry, light reddish brown (5 YR 6/4), very dense	(E) Probable slough.
		F	BULK			100				
2471.3	10 10.00 10.08	G	SPT	50/1"	50/1"	0		SM		
	12.00 12.12	H	SPT	50/1.5"	50/1.5"	0				
									14.00	
	15.00							SP SC	POORLY-GRADED SAND with SILTY CLAY and GRAVEL reddish brown (5 YR 5/3), very dense	
2466.3	15 15.12	I	SPT	50/1.5"	50/1.5"	100			15.10 B.O.H.	
2461.3	20									
2456.3	25									

NV_DOT BLUEDMND.GPJ NV_DOT.GDT 11/15/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 6/28/00
END DATE 6/28/00
JOB DESCRIPTION SR 160 - PAHRUMP VALLEY ROAD
LOCATION SR 160 at UPRR Crossing
BORING BD-6
E.A. # 72495
GROUND ELEV. 2478.93 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"188+07
OFFSET 36.0 Left
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR MARSHALL
DRILLING METHOD 8" H.S.A.
BACKFILLED Yes DATE 6/28/00

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
									SANDY GRAVEL with COBBLES dry, light brown (7.5 YR 6/4)	
	2.00									
	3.00								SILTY CLAYEY SAND with GRAVEL dry, with cobbles, reddish brown (5 YR 5/3), very dense	
	3.58	A	SPT	60	50/1"	100		SC SM		
		B	BULK	50/1"		100				
2473.9	5 5.00									
	5.33	C	SPT	50/4"	50/4"	100				
									SILTY SAND with GRAVEL dry, light reddish brown (5 YR 6/4), very dense	
	8.00							SM		
	8.08	D	SPT	50/1"	50/1"	0				
									9.50	
2468.9	10 10.00								WELL-GRADED SAND with SILT and GRAVEL dry, light reddish brown (5 YR 6/3), very dense	
	10.17	E	SPT	50/2"	50/2"	100				
	11.00									Gravel layer @ 11'.
		F	BULK			100		SW SM		
	13.00									
	13.08	G	SPT	50/1"	50/1"	0				
2463.9	15 15.00									
	15.17	H	SPT	50/2"	50/2"	0				
									15.10	
									B.O.H.	
2458.9	20									
2453.9	25									

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 6/28/00
END DATE 6/28/00
JOB DESCRIPTION SR 160 - PAHRUMP VALLEY ROAD
LOCATION SR 160 at UPRR Crossing
BORING BD-7
E.A. # 72495
GROUND ELEV. 2473.25 (ft)
HAMMER DROP SYSTEM SAFETY

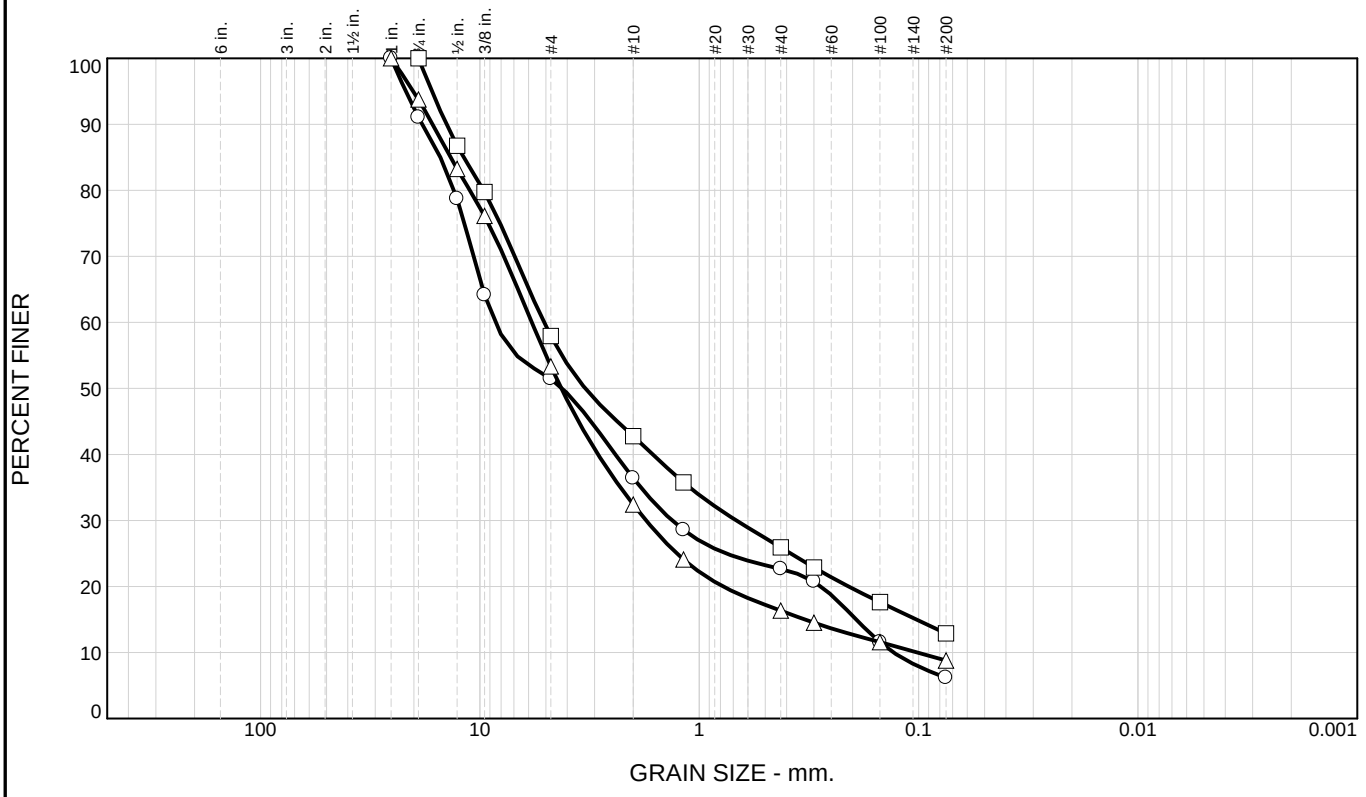
GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "PE"185+18
OFFSET 62.0 Left
ENGINEER BOOMHOWER
EQUIPMENT MOBILE B-80
OPERATOR MARSHALL
DRILLING METHOD 8" H.S.A.
BACKFILLED Yes DATE 6/28/00

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
									SANDY GRAVEL with COBBLES dry, pale yellow (2.5 YR 8/2)	Hard drilling @ 2'.
	2.50	A	SPT	50/1"	50/1"	0				
	2.58								3.00	
		B	BULK			100			SILTY SAND with GRAVEL dry, with cobbles, light reddish brown (5 YR 6/3), very dense	
	4.50									
	4.75	C	SPT	50/3"	50/3"	67				
2468.3	5									
	7.50									
	7.67	D	SPT	50/2"	50/2"	100		SM		
	9.50									
	9.54	E	SPT	50/.5"	50/.5"	0				
2463.3	10									
	11.00									
		F	BULK			100				
	12.00									
	12.08	G	SPT	50/1"	50/1"	0				
									14.00	
	15.00							GP	POORLY-GRADED GRAVEL with SAND dry, reddish brown (5 YR 5/3), very dense	
2458.3	15									
	15.33	H	SPT	50/4"	50/4"	100			15.30 B.O.H.	
2453.3	20									
2448.3	25									

APPENDIX C

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	48.5	45.3	6.2		GW-GC			
□	0.0	42.1	45.0	12.9		SC-SM			
△	0.0	46.7	44.5	8.8		GP-GC			

SIEVE inches size	PERCENT FINER ○	□	△
1	100.0		100.0
3/4	91.0	100.0	93.8
1/2	78.7	86.8	83.2
3/8	64.1	79.7	76.1
	GRAIN SIZE		
D_{60}	8.5399	5.1038	5.7992
D_{30}	1.3303	0.6774	1.7488
D_{10}	0.1300		0.1013
	COEFFICIENTS		
C_c	1.59		5.21
C_u	65.68		57.25

SIEVE number size	PERCENT FINER ○	□	△
#4	51.5	57.9	53.3
#10	36.4	42.8	32.4
#16	28.6	35.8	24.1
#40	22.6	25.9	16.3
#50	20.7	22.9	14.5
#100	11.6	17.6	11.6
#200	6.2	12.9	8.8

Material Description

○ Well-graded gravel with silty clay and sand

□ Silty clayey sand with gravel

△ Poorly graded gravel with clay and sand

REMARKS:

○

□

△

○ Location: Boring BD1, sample: b Depth: 0.9m Sample Number: b

□ Location: Boring BD1, sample: i Depth: 10.0m Sample Number: i

△ Location: Boring BD1, sample: j Depth: 11.6m Sample Number: j

NEVADA DEPARTMENT OF TRANSPORTATION

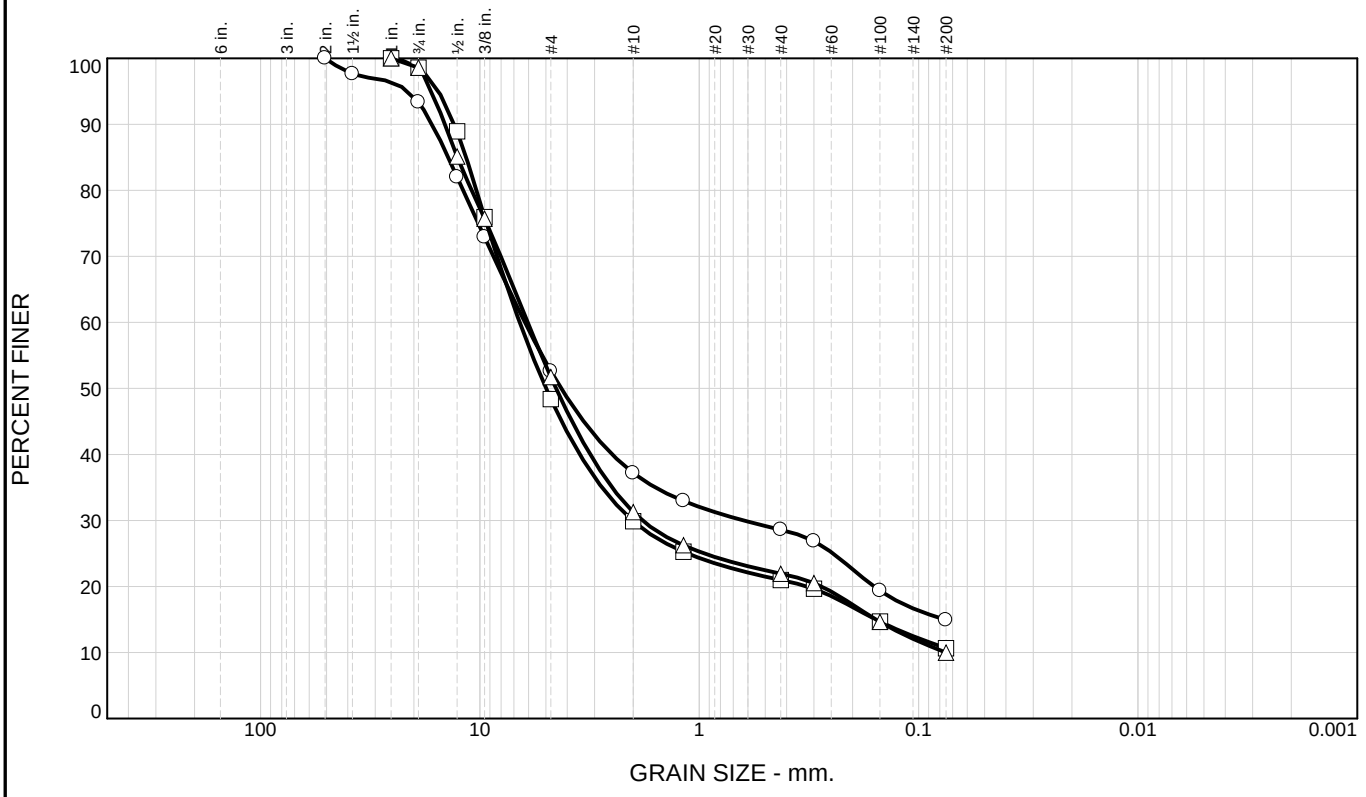
Client:

Project: Blue Diamond Interchange

Project No.: 72495

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	47.4	37.7	14.9		GM	A-1-a	18	21
□	0.0	51.6	37.8	10.6		GP-GC		16	21
△	0.0	48.3	41.7	10.0		GP-GC		16	20

SIEVE inches size	PERCENT FINER ○	□	△
2	100.0		
1.5	97.6		
1		100.0	100.0
3/4	93.3	98.6	98.6
1/2	82.0	88.9	85.1
3/8	72.9	75.9	75.7
	GRAIN SIZE		
D_{60}	6.2388	6.5918	6.0563
D_{30}	0.6262	2.0186	1.8180
D_{10}			0.0753
	COEFFICIENTS		
C_c			7.25
C_u			80.46

SIEVE number size	PERCENT FINER ○	□	△
#4	52.6	48.4	51.7
#10	37.2	29.9	31.3
#16	33.0	25.3	26.2
#40	28.6	21.0	21.9
#50	26.9	19.7	20.5
#100	19.4	14.7	14.6
#200	14.9	10.6	10.0

Material Description

○

□

△Poorly graded gravel with silty clay and sand

REMARKS:

○

□

△

○Location: Boring BD2, sample: a Depth: 0.6m Sample Number: a

□Location: Boring BD2, sample: b Depth: 1.2m Sample Number: b

△Location: Boring BD2, sample: d Depth: 2.1m Sample Number: d

NEVADA DEPARTMENT OF TRANSPORTATION

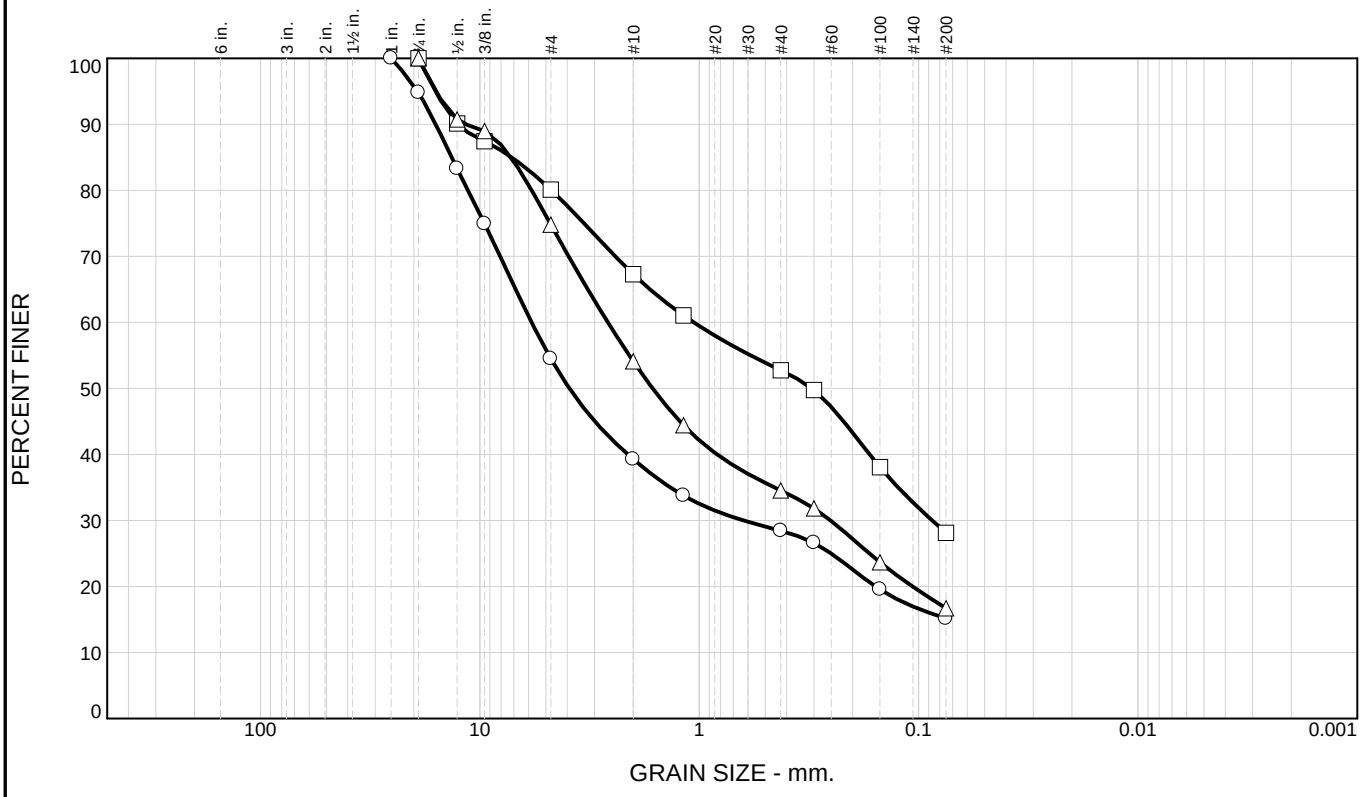
Client:

Project: Blue Diamond Interchange

Project No.: 72495

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	45.5	39.3	15.2		GC-GM	A-1-a	19	24
□	0.0	19.9	52.0	28.1		SM			
△	0.0	25.2	58.1	16.7		SM			

SIEVE inches size	PERCENT FINER ○	□	△
1	100.0		
3/4	94.8	100.0	100.0
1/2	83.3	90.1	90.7
3/8	74.9	87.4	89.0
GRAIN SIZE			
D_{60}	5.8121	1.0598	2.6110
D_{30}	0.6269	0.0866	0.2520
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	54.5	80.1	74.8
#10	39.3	67.3	54.1
#16	33.8	61.1	44.4
#40	28.4	52.7	34.5
#50	26.6	49.8	31.8
#100	19.6	38.1	23.7
#200	15.2	28.1	16.7

Material Description
○ Silty clayey gravel with sand
□ Silty sand with gravel
△ Silty sand with gravel

REMARKS:
○
□
△

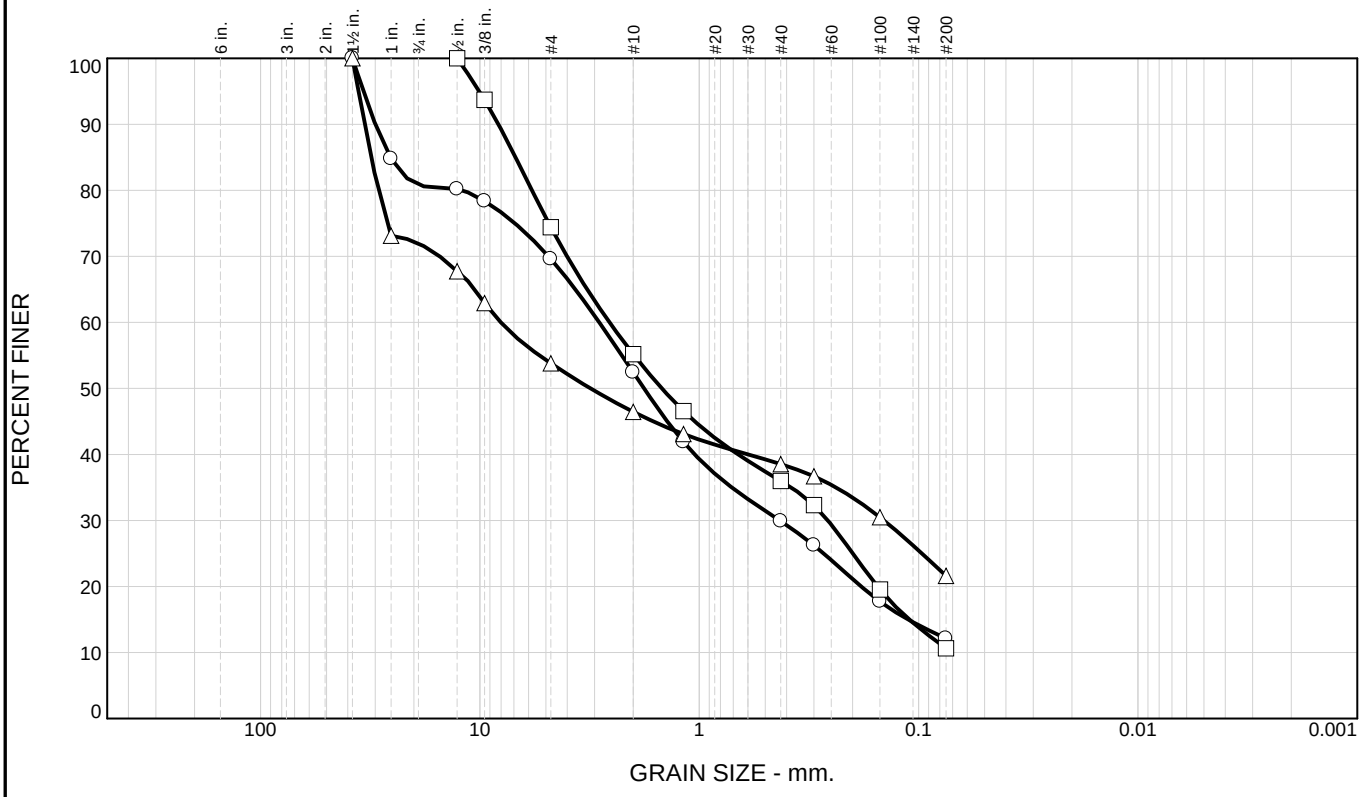
○ Location: Boring BD2, sample: f Depth: 3.7m Sample Number: f
□ Location: Boring BD3, sample: b Depth: 0.91m Sample Number: b
△ Location: Boring BD3, sample: d Depth: 1.52m Sample Number: d

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: Blue Diamond Interchange
Project No.: 72495

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	30.4	57.5	12.1		SM			
□	0.0	25.6	63.8	10.6		SP-SM			
△	0.0	46.2	32.2	21.6		GC			

SIEVE inches size	PERCENT FINER ○	□	△
1.5	100.0		100.0
1	84.8		73.1
1/2	80.2	100.0	67.7
3/8	78.4	93.7	62.9
	GRAIN SIZE		
D_{60}	2.8572	2.5665	8.0315
D_{30}	0.4293	0.2590	0.1438
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	69.6	74.4	53.8
#10	52.4	55.2	46.5
#16	41.9	46.6	43.1
#40	29.9	36.0	38.5
#50	26.2	32.3	36.7
#100	17.7	19.5	30.5
#200	12.1	10.6	21.6

Material Description

○ Silty sand with gravel

□ Poorly graded sand with silt and gravel

△ Clayey gravel with sand

REMARKS:

○

□

△

○ Location: Boring BD3, sample: f Depth: 2.44m Sample Number: f

□ Location: Boring BD3, sample: i Depth: 4.57m Sample Number: i

△ Location: Boring BD4, sample: d Depth: 5.49m Sample Number: d

NEVADA DEPARTMENT OF TRANSPORTATION

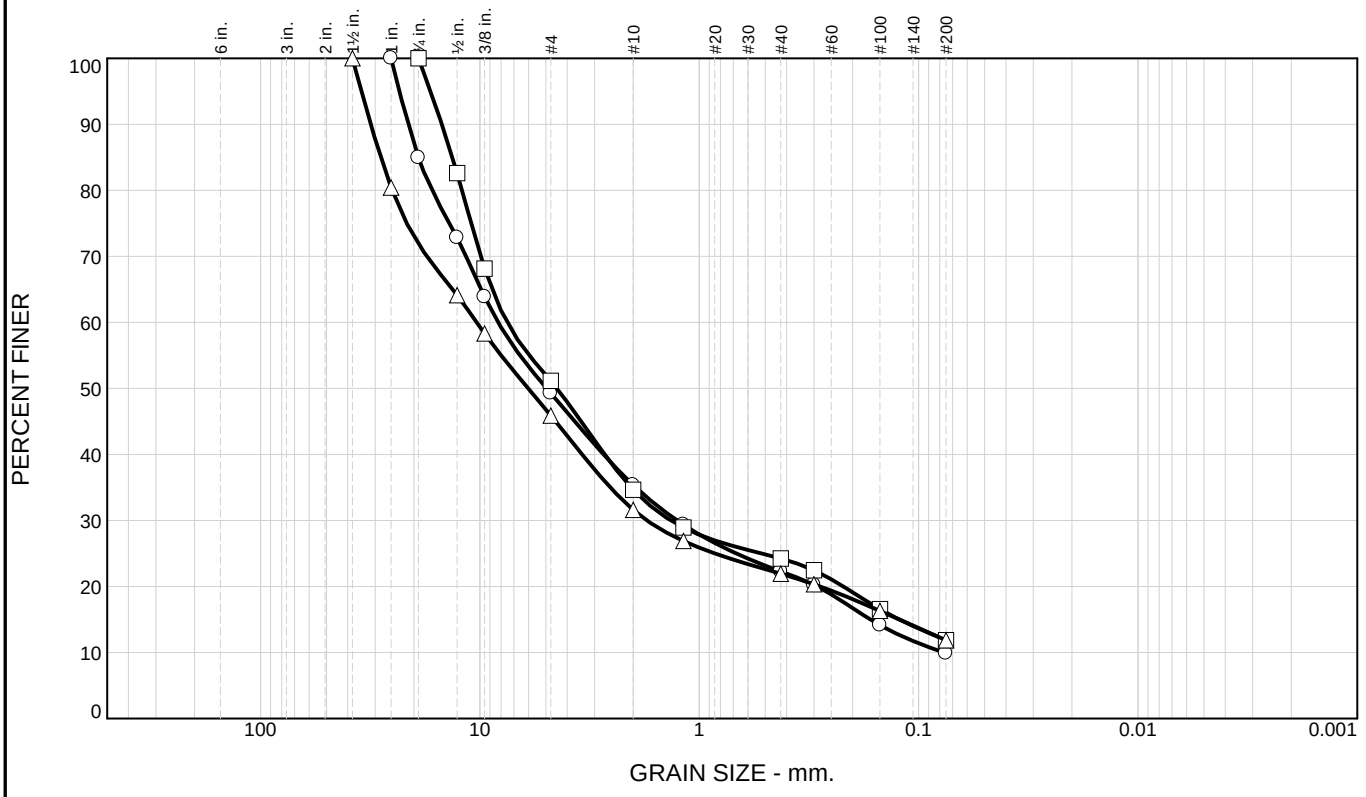
Client:

Project: Blue Diamond Interchange

Project No.: 72495

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	50.7	39.4	9.9		GP-GC			
□	0.0	48.9	39.2	11.9		GP-GM			
△	0.0	54.1	34.1	11.8		GP-GM			

SIEVE inches size	PERCENT FINER ○	□	△
1.5			100.0
1	100.0		80.4
3/4	85.0	100.0	
1/2	72.8	82.6	64.1
3/8	63.9	68.1	58.3
	GRAIN SIZE		
D_{60}	8.2630	7.5216	10.3487
D_{30}	1.2626	1.3481	1.7346
D_{10}	0.0768		
	COEFFICIENTS		
C_c	2.51		
C_u	107.56		

SIEVE number size	PERCENT FINER ○	□	△
#4	49.3	51.1	45.9
#10	35.4	34.6	31.6
#16	29.3	28.9	26.9
#40	22.3	24.2	21.9
#50	20.3	22.5	20.3
#100	14.1	16.6	16.3
#200	9.9	11.9	11.8

Material Description

○ Poorly-graded gravel with clay and sand

□ Poorly graded gravel with silt and sand

△ Poorly graded gravel with silt and sand

REMARKS:

○

□

△

○ Location: Boring BD4, sample: f Depth: 8.53m Sample Number: f

□ Location: Boring BD4, sample: h Depth: 14.63m Sample Number: h

△ Location: Boring BD4, sample: l Depth: 26.83m Sample Number: l

NEVADA DEPARTMENT OF TRANSPORTATION

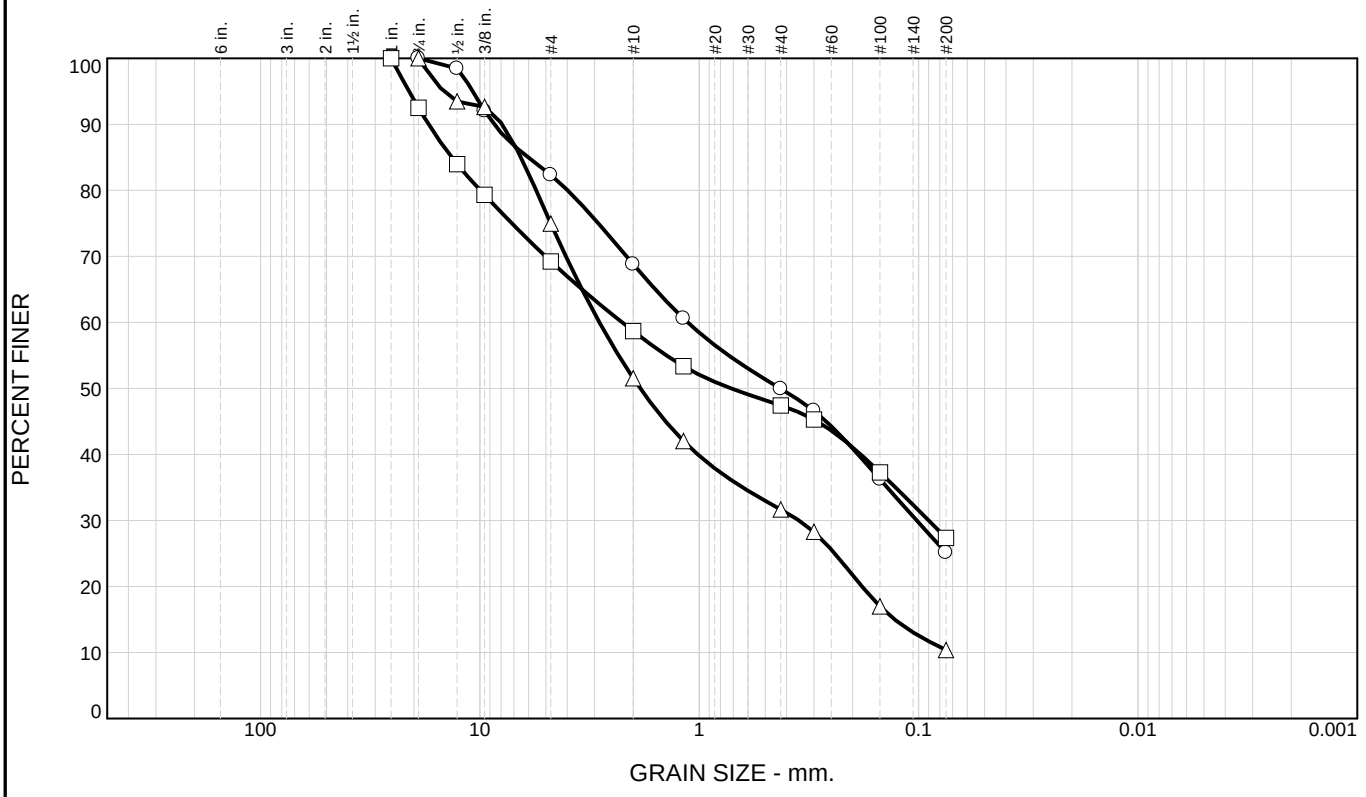
Client:

Project: Blue Diamond Interchange

Project No.: 72495

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	17.7	57.2	25.1		SC-SM		16	21
□	0.0	30.8	41.8	27.4		SM			
△	0.0	25.0	64.6	10.4		SP-SC			

SIEVE inches size	PERCENT FINER ○	□	△
1		100.0	
3/4	100.0	92.5	100.0
1/2	98.5	84.0	93.5
3/8	92.0	79.3	92.6
GRAIN SIZE			
D_{60}	1.1291	2.2471	2.8522
D_{30}	0.1019	0.0899	0.3507
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	82.3	69.2	75.0
#10	68.8	58.7	51.5
#16	60.6	53.4	42.0
#40	49.9	47.4	31.7
#50	46.6	45.3	28.3
#100	36.2	37.3	17.0
#200	25.1	27.4	10.4

Material Description

○ Silty, clayey sand with gravel

□ Silty sand with gravel

△ Poorly graded sand with silty clay and gravel

REMARKS:

○

□

△

○ Location: Boring BD5, sample: b Depth: 0.91m Sample Number: b

□ Location: Boring BD5, sample: e Depth: 2.44m Sample Number: e

△ Location: Boring BD5, sample: i Depth: 4.57m Sample Number: i

NEVADA DEPARTMENT OF TRANSPORTATION

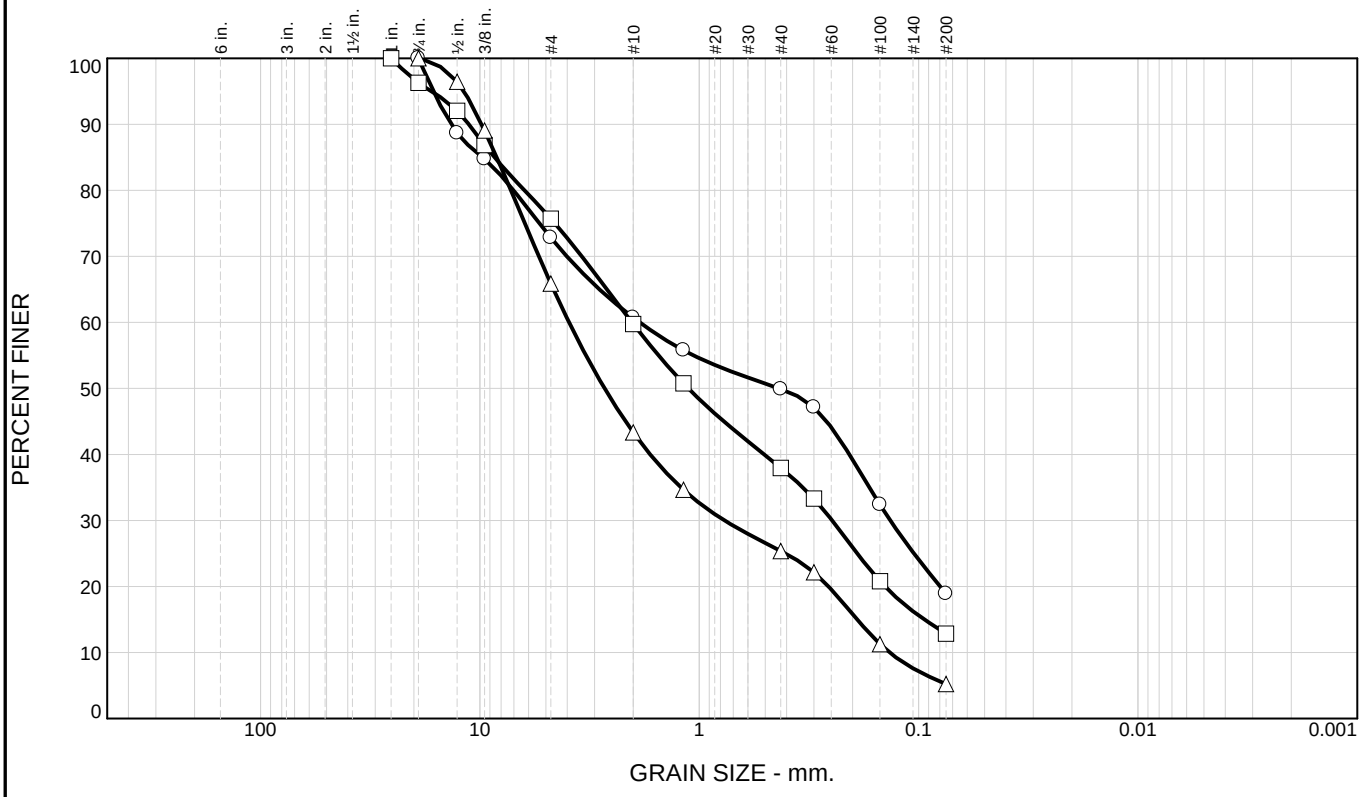
Client:

Project: Blue Diamond Interchange

Project No.: 72495

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	27.2	53.9	18.9		SC-SM		17	22
□	0.0	24.3	62.9	12.8		SM			
△	0.0	34.1	60.7	5.2		SW-SM			

SIEVE inches size	PERCENT FINER ○	□	△
1		100.0	
3/4	100.0	96.3	100.0
1/2	88.7	92.1	96.5
3/8	84.8	86.9	89.1
GRAIN SIZE			
D_{60}	1.8688	2.0273	3.9249
D_{30}	0.1347	0.2477	0.7670
D_{10}			0.1357
COEFFICIENTS			
C_c			1.10
C_u			28.92

SIEVE number size	PERCENT FINER ○	□	△
#4	72.8	75.7	65.9
#10	60.7	59.7	43.3
#16	55.8	50.8	34.6
#40	49.9	38.0	25.4
#50	47.1	33.3	22.2
#100	32.4	20.8	11.3
#200	18.9	12.8	5.2

Material Description

○ Silty, clayey sand with gravel

□ Silty sand with gravel

△ Well-graded sand with silt and gravel

REMARKS:

○

□

△

○ Location: Boring BD6, sample: a Depth: 0.91m Sample Number: a

□ Location: Boring BD6, sample: c Depth: 1.52m Sample Number: c

△ Location: Boring BD6, sample: e Depth: 3.05m Sample Number: e

NEVADA DEPARTMENT OF TRANSPORTATION

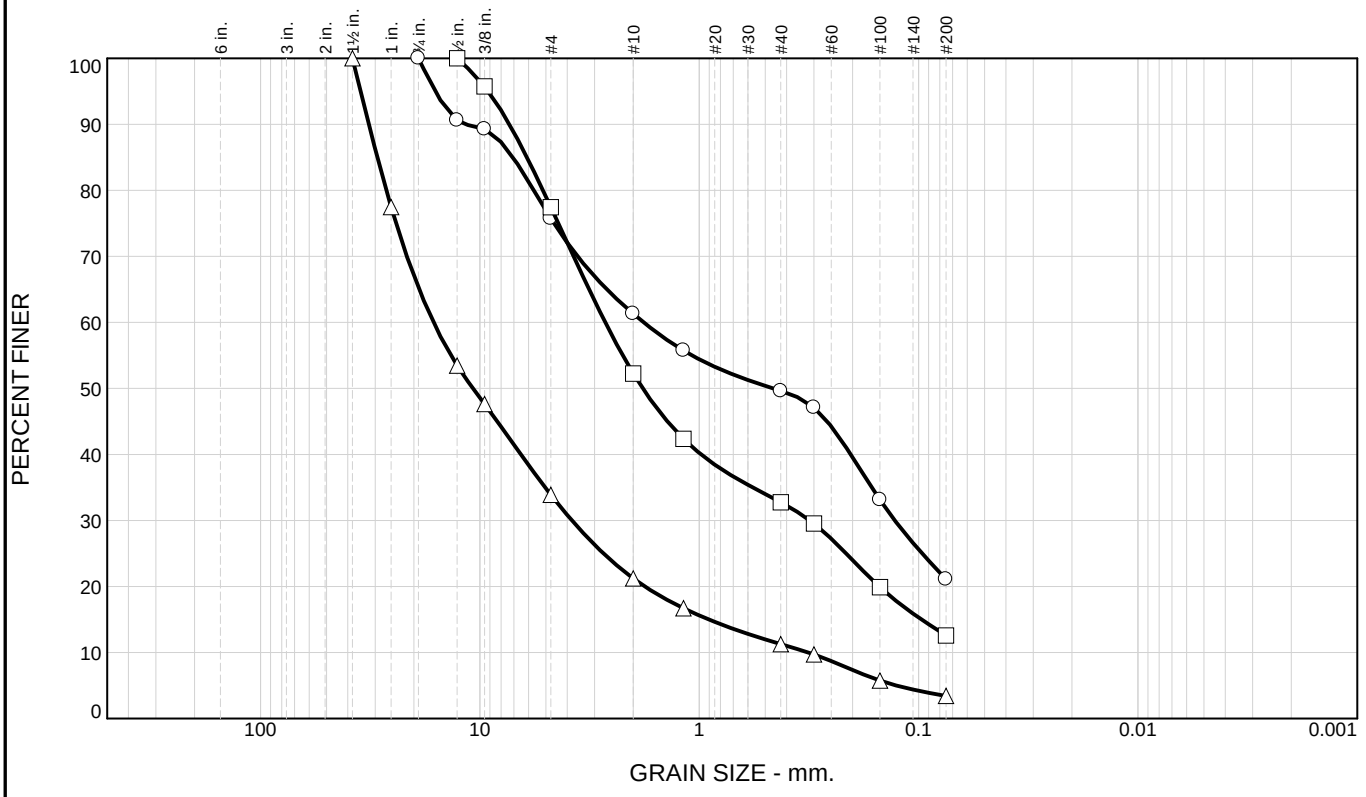
Client:

Project: Blue Diamond Interchange

Project No.: 72495

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	24.3	54.6	21.1		SM			
□	0.0	22.5	64.9	12.6		SM			
△	0.0	66.1	30.5	3.4		GP			

SIEVE inches size	PERCENT FINER ○	□	△
1.5			100.0
1			77.5
3/4	100.0		
1/2	90.6	100.0	53.5
3/8	89.3	95.7	47.6
	GRAIN SIZE		
D_{60}	1.7925	2.6837	16.2738
D_{30}	0.1284	0.3127	3.8071
D_{10}			0.3180
	COEFFICIENTS		
C_c			2.80
C_u			51.17

SIEVE number size	PERCENT FINER ○	□	△
#4	75.7	77.5	33.9
#10	61.3	52.3	21.2
#16	55.7	42.4	16.7
#40	49.6	32.8	11.3
#50	47.1	29.5	9.7
#100	33.1	19.9	5.7
#200	21.1	12.6	3.4

Material Description
○ Silty sand with gravel

□ Silty sand with gravel

△ Poorly-graded gravel with sand

REMARKS:
○

□

△

○ Location: Boring BD7, sample: c Depth: 1.37m Sample Number: c
□ Location: Boring BD7, sample: d Depth: 2.29m Sample Number: d
△ Location: Boring BD7, sample: h Depth: 4.57m Sample Number: h

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: Blue Diamond Interchange
Project No.: 72495

Figure

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

EA/Cont # 72495 **Job Description** S.R. 160 (Blue Diamond) @ U.P.R.R. Crossing

Boring No. BD1 **Elevation (ft)** 2471.77 **Station** "PE" 183+48 70.5' Rt.

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					OTHERS
											TEST TYPE	Φ deg. (Peak)	C psf (Peak)	Φ deg. (Residual)	C psf (Residual)	
A	2.0 - 3.0	SPT														
B	3.0 - 3.3	SPT		GW-GC			6.2									
C	6.0 - 7.4	SPT						31	20	11						
D	8.0 - 8.3	SPT														
E	13.0 - 13.3	SPT														
F	18.0 - 18.2	SPT														
G	23.0 - 23.2	SPT														
H	28.0 - 28.3	SPT														
I	33.0 - 33.3	SPT		SC-SM			12.9									
J	38.0 - 39.3	SPT		GP-GC			8.8									
K	43.0 - 43.2	SPT														
L	48.0 - 48.2	SPT														

CMS = California Modified Sampler 2.375" ID
SPT = Standard Penetration 1.375" ID
CS = Continuous Sample 3.25" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.375" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.875" 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

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

EA/Cont # 72495 **Job Description** S.R. 160 (Blue Diamond) @ U.P.R.R. Crossing

Boring No. BD1 **Elevation (ft)** 2471.77 **Station** "PE" 183+48 70.5' Rt.

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					OTHERS
											TEST TYPE	Φ deg. (Peak)	C psf (Peak)	Φ deg. (Residual)	C psf (Residual)	
M	58.0 - 58.2	SPT														
N	68.0 - 68.1	SPT														
O	78.0 - 78.2	SPT														
P	88.0 - 88.2	SPT														

CMS = California Modified Sampler 2.375" ID
SPT = Standard Penetration 1.375" ID
CS = Continuous Sample 3.25" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.375" ID
CPT = Cone Penetration Test
TP = Test Pit
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Sh = Shelby Tube 2.875" 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

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

EA/Cont # 72495 **Job Description** S.R. 160 (Blue Diamond) @ U.P.R.R. Crossing

Boring No. BD2 **Elevation (ft)** 2476.74 **Station** "PE" 185+84 52.5' Rt.

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					OTHERS
											TEST TYPE	Φ deg. (Peak)	C psf (Peak)	Φ deg. (Residual)	C psf (Residual)	
A	2.0 - 3.5	bulk		GM			14.9	21	18	3						Ch, Apparent Gravity = 2.56
B	4.0 - 5.0	bulk		GP-GC			10.6	21	16	5						Ch
C	5.0 - 5.0	SPT														
D	7.0 - 8.0	bulk		GP-GC			10.0	20	16	4						G = 2.473 (+#4) 2.638 (-#4)
E	10.0 - 10.2	SPT														
F	12.0 - 13.5	bulk		GC-GM			15.2	24	19	5						Ch
G	15.0 - 15.1	SPT														

CMS = California Modified Sampler 2.375" ID
SPT = Standard Penetration 1.375" ID
CS = Continuous Sample 3.25" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.375" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.875" 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
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W = Moisture Content
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O = Organic Content
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RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

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

EA/Cont # 72495 **Job Description** S.R. 160 (Blue Diamond) @ U.P.R.R. Crossing

Boring No. BD3 **Elevation (ft)** 2471.83 **Station** "PE" 182+95 46.0' Lt.

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					OTHERS
											TEST TYPE	Φ deg.	C psf	Φ deg.	C psf	
												Peak		Residual		
A	0.0 - 3.0	bulk														
B	3.0 - 3.3	SPT		SM			28.1									
C	3.3 - 5.0	bulk														
D	5.0 - 5.2	SPT		SM			16.7									
E	6.0 - 8.0	bulk														
F	8.0 - 8.2	SPT		SM			12.1									
G	10.0 - 10.1	SPT														
H	11.0 - 13.0	bulk														
I	15.0 - 15.3	SPT		SP-SM			10.6									

CMS = California Modified Sampler 2.375" ID
SPT = Standard Penetration 1.375" ID
CS = Continuous Sample 3.25" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.375" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.875" 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

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

EA/Cont # 72495 **Job Description** S.R. 160 (Blue Diamond) @ U.P.R.R. Crossing

Boring No. BD4 **Elevation (ft)** 2475.95 **Station** "PE" 186+39 62.0' Lt.

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					OTHERS
											TEST TYPE	Φ deg.	C psf	Φ deg.	C psf	
												Peak		Residual		
A	3.0 - 3.0	SPT														
B	8.0 - 8.3	SPT														
C	13.0 - 13.2	SPT														
D	18.0 - 18.3	SPT		GC			21.6									
R	23.0 - 23.3	SPT														
F	28.0 - 28.5	SPT		GP-GC			9.9									
G	38.0 - 38.3	SPT														
H	48.0 - 48.3	SPT		GP-GM			11.9									
I	58.0 - 58.3	SPT														
J	68.0 - 68.3	SPT														
K	78.0 - 78.2	SPT														
L	88.0 - 88.2	SPT		GP-GM			11.9									

CMS = California Modified Sampler 2.375" ID
SPT = Standard Penetration 1.375" ID
CS = Continuous Sample 3.25" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.375" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.875" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
$\bar{\Phi}$ = 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

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

EA/Cont # 72495 **Job Description** S.R. 160 (Blue Diamond) @ U.P.R.R. Crossing

Boring No. BD4 **Elevation (ft)** 2475.95 **Station** "PE" 186+39 62.0' Lt.

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					OTHERS
											TEST TYPE	Φ deg.	C psf	Φ deg.	C psf	
												Peak		Residual		
M	96.0 - 96.2	SPT														

CMS = California Modified Sampler 2.375" ID
SPT = Standard Penetration 1.375" ID
CS = Continuous Sample 3.25" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.375" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.875" 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

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

EA/Cont # 72495 **Job Description** S.R. 160 (Blue Diamond) @ U.P.R.R. Crossing

Boring No. BD5 **Elevation (ft)** 2481.25 **Station** "PE" 190+63 49.0' Lt.

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					OTHERS
											TEST TYPE	Φ deg.	C psf	Φ deg.	C psf	
												Peak		Residual		
A	1.0 - 3.0	bulk														
B	9.0 - 3.1	SPT		SC-SM			25.1	21	16	5						
C	3.1 - 5.0	bulk														
D	5.0 - 5.0	SPT														
E	8.0 - 8.1	SPT		SM			27.4									
F	8.1 - 10.0	bulk														
G	10.0 - 10.1	SPT														
H	12.0 - 12.1	SPT														
I	15.0 - 15.1	bulk		SP-SC			10.4									

CMS = California Modified Sampler 2.375" ID
SPT = Standard Penetration 1.375" ID
CS = Continuous Sample 3.25" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.375" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.875" 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

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

EA/Cont # 72495 **Job Description** S.R. 160 (Blue Diamond) @ U.P.R.R. Crossing

Boring No. BD6 **Elevation (ft)** 2478.93 **Station** "PE" 188+07 36.0' Lt.

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					OTHERS
											TEST TYPE	Φ deg.	C psf	Φ deg.	C psf	
												Peak		Residual		
A	3.0 - 3.6	SPT		SC-SM				18.9	22	17	5					
B	3.6 - 5.0	bulk														
C	5.0 - 5.3	SPT		SM				12.9								
D	8.0 - 8.1	SPT														
E	10.0 - 10.2	SPT		SW-SM				5.2								
F	11.0 - 13.0	bulk														
G	13.0 - 13.1	SPT														
H	15.0 - 15.2	SPT														

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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
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X = X-Ray Defraction
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SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 72495 **Job Description** S.R. 160 (Blue Diamond) @ U.P.R.R. Crossing

Boring No. BD7 **Elevation (ft)** 2473.25 **Station** "PE" 185+18 62.0' Lt.

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					OTHERS
											TEST TYPE	Φ deg. (Peak)	C psf (Peak)	Φ deg. (Residual)	C psf (Residual)	
A	2.5 - 2.6	SPT														
B	2.6 - 4.5	bulk														
C	4.5 - 4.7	SPT		SM			21.1									
D	7.5 - 7.7	SPT		SM			12.6									
E	9.5 - 9.6	SPT														
F	11.0 - 12.0	bulk														
G	12.0 - 12.1	SPT														
H	15.0 - 15.3	SPT		GP			3.4									

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CSS = Calif. Split Spoon 2.375" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
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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
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D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential