GEOTECHNICAL REPORT

WASHINGTON AVENUE
GRADE SEPARATION WIDENING
E.A. 72357

MAY 1999

NEVADA
DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

MATERIALS DIVISION

STATE OF NEVADA

DEPARTMENT OF TRANSPORTATION

MATERIALS DIVISION

GEOTECHNICAL SECTION

GEOTECHNICAL REPORT
WASHINGTON AVENUE
GRADE SEPARATION WIDENING

May, 1999

E.A. 72357

CLARK COUNTY, NEVADA

Prepared by: _____

Dana Boomhower, EIT

Geotechnical Designer

Reviewed by: _____

Parviz Noori, P.E.

Principal Geotechnical Engineer

Approved by: _____

Dean Weitzel, P.E.

Chief Materials Engineer

TABLE OF CONTENTS

APPENDICES

INTRODUCTION

General

This report has been prepared for the proposed widening of the Washington Avenue Grade Separation (H-1211) located at Washington Avenue and US-95 in Las Vegas, Nevada. Washington Avenue is currently two lanes wide as it passes over US-95 in the east-west direction. The proposed plan calls for construction of two additional lanes. A site plan for the project is presented in Appendix A (plate 1).

Purpose and Scope

The purpose of this report is to determine the subsurface conditions at the proposed project location, and augment the original foundation report of November 1977 (see Appendix B). In addition, the report provides geotechnical design and construction recommendations for the widening of the structure. The scope of this report consists primarily of investigation and analysis. The investigation includes gathering data from past field investigations, and design information from the existing structure. Additional information was obtained from recent subsurface investigation, soil sampling, and analysis of field and laboratory testing data. This report describes the subsurface soil conditions, provides recommendations regarding geotechnical properties of the soil strata, and includes boring logs and test results from the field investigation.

PROJECT DESCRIPTION

The existing Washington Avenue Grade Separation is a two span, continuous, post-tensioned concrete box girder built in 1977 under Contract 1761 (EA 70304). The structure is supported on open bridge abutments on each end, and a center pier, all founded on spread footings. The grade separation currently conveys two lanes of traffic over US 95, in the east-west direction. Preliminary proposed plans indicate the widening will be accomplished by constructing a similar structure adjacent to the existing one. This will increase the traffic capacity of Washington Avenue to four lanes as it crosses over US-95.

GEOLOGIC CONDITIONS and SEISMICITY

The site is founded in older alluvium of Red Rock fan deposits. These deposits are pink to brown pebble to small cobble gravel with subordinate pebble-bearing sand. Clasts are predominately limestone and dolomite with subordinate quartzite[1]. These quaternary deposits may contain locally cemented layers due to petrocalcic carbonate deposits (caliche). There are also active wash alluvium deposits which may occur in active stream channels throughout the area. These deposits consist of pink to pale brown fine sand to pebble to cobble gravel. Clasts found in these deposits are similar to those found in the Red Rock Fan deposits[1], predominately limestone and dolomite with subordinate quartzite. The site is located approximately 24 kilometers (≈15 miles) east of the La Madre fault and Keystone thrust fault.[2] These faults are no longer considered active. There is a

compaction fault scarp, designated scarp II, approximately 1 kilometer (≈0.6 miles) west of the site[3], as well as a small subsidence fault approximately 3 kilometers (≈1.8 miles) east of the site[4].

FIELD INVESTIGATION

On May 12th and 13th, 1998, the Nevada Department of Transportation Geotechnical Section conducted a subsurface investigation at the proposed project site. This exploration was a follow-up to the original foundation investigation and report of October and November 1977. Subsurface soil conditions were explored by drilling two boreholes (WAS-1, WAS-2) to a maximum depth of 13.7 meters (≈45.0 feet). The approximate locations of the boreholes are shown on the Borehole Location sheet (Appendix A, Plate 2). Drilling was accomplished with a Mobile B-80 drill rig equipped for soil sampling. Soil samples and standard penetration resistance values (N-Values) were obtained utilizing the Standard Penetration Test (SPT) procedure as set forth in ASTM test number T 206-87. Disturbed soil samples were obtained for visual soil classification and laboratory testing. All soil samples were classified using the Unified Soil Classification System (USCS).

Borehole WAS-1 is located approximately 19.2 meters (≈63.0 feet) left of station "W"8+55, approximately 4.6 meters (≈15.0 feet) north of the toe of the existing fill slope. Eight SPT's were conducted at 0.4 to 1.2 meters (≈1.5 to 4.0 feet) intervals within the upper 3.4 meters (≈11.0 feet), increasing to 3.0 meter (≈10.0 feet) intervals at greater depths, with the last test taken at a depth of 13.7 meters (≈45.0 feet). Due to lack of penetration of the sampler in very dense soil conditions

during SPT sampling, the sample recovery was low for each of the eight SPT's, with no recovery in three cases. Two bulk samples were collected for sieve analysis and Atterberg limits. These samples were taken at depths of 0.6 to 1.1 meters (≈2.0-3.5 feet) and 6.0 to 7.5 meters (≈20.0-25.0 feet).

Borehole WAS-2 is located approximately 18.3 meters (≈60.0 feet) left of station "W"11+00, approximately 7.5 meters (≈25.0 feet) north of the toe of the existing fill slope. Six SPT's were conducted at various depth intervals ranging from 0.4 to 0.6 meters (≈1.5 to 2.0 feet) within the upper 3.0 meters (≈10.0 feet), increasing to 3.0 meter (≈10.0 feet) intervals at greater depths. The last SPT was conducted at a depth of 8.7 meters (≈28.5 feet). Two bulk samples were also collected for laboratory testing, at depths of 0.9 to 1.4 meters (≈3.0-4.5 feet) and 2.7 to 3.0 meters (≈9.0-10.0 feet). The SPT's which were conducted below 2.0 meters (≈6.5 feet) indicated very dense soil conditions, with no retrieval beyond test B.

Drilling was hard in both boreholes throughout the entire depth. No groundwater was encountered in either of the boreholes. Soil cuttings brought up by the auger were very uniform. The drilling proceeded well, without any serious difficulties or problems. Copies of the boring logs and boring log key are presented in Appendix C. All samples were sent to the Nevada Department of Transportation materials laboratory for testing and/or storage.

LABORATORY ANALYSIS

Laboratory analyses were performed on six samples collected from the two boreholes. Five sieve analyses, three sets of Atterberg limits, and two moisture content tests were performed. The results of these analyses showed the soils to consist primarily of silty, clayey sands and gravels. None of the samples had Plasticity Indices (PI) greater than 5, and moisture contents varied from four to five percent (4% to 5%). Test results are found in Appendix D.

DISCUSSION

Borings from the field investigation of October 1977 (EA 70304) identified the soils to be primarily silty sands and gravels, with some cementation, and occasional cobbles. The foundation report of November 1977 recommended the structure be founded on spread footings. Allowable bearing capacity for the abutment footings was given as 2 tons per square foot (2 tsf) (≈191 kPa) on approved fill compacted to 95%, or 6 tsf (≈575 kPa) if the footings were placed at, or deeper than 5 feet (≈1.5 meters) below original grade. Settlement was anticipated to be "negligible" and "of insignificant effect". Identification of soils obtained from the recent investigation are consistent with those determined previously (1977). The in situ soils were found to be very similar to soils originally obtained from this location. The SPT blow counts are very high, characterizing the soils as very dense.

RECOMMENDATIONS

The site conditions indicate that the in situ soils are competent to support the proposed structure on spread footings. The recommended bearing capacity of 2 tsf (≈191 kPa) on approved fill compacted to 95%, or 6 tsf (≈575 kPa) if the footings were placed at or deeper than 5 feet (≈1.5 meters) below original grade for the abutment footings from the foundation report of November 1977 is acceptable. It is our recommendation that the new foundation be designed in a similar fashion, so as to minimize any differential settlement between the two structures. However, the in situ soils can provide up to 10 tsf (≈958 kPa) for static analysis, and 20 tsf (≈1915 kPa) for seismic analysis. These figures are based on an ultimate bearing capacity of 30 tsf (≈2873 kPa), and using factors of safety 3.0 and 1.5 respectively. Similar design should also reduce possible problems that may be encountered due to differing responses during seismic events.

Four and six foot wide spread footings were evaluated for the approach fill embankment retaining walls. At an embedment depth of three feet in native ground, we recommend the allowable bearing capacities not to exceed 5.5 tsf (≈527 kPa), and 6.5 tsf (≈623 kPa) respectively.

The horizontal and vertical Acceleration Coefficients (A_h) and (A_v), Importance Classification (IC), Seismic Performance Factor (SPC), Soil Profile Type, and Site Coefficient (S), are all obtained from AASHTO Standard Specifications for Highway Bridges, Division 1-A, section 3. Earth pressure coefficients are calculated using Coulombs analysis method utilizing the Mononobe-Okabe equation for all cases (K_a, K_p, K_{ae}, and K_{pe}). Design parameters are found in the following table (see page 7).

Recommended Design Parameters for Footings and Walls

	0° Backslope (Piers)	2H:1V Backslope
φ = soil friction angle	38°	38°
δ = structure - soil interface angle	22°	22°
γ' = effective soil unit weight	19.6 kN/m^3 (125 pcf)	19.6 kN/m^3 (125 pcf)
Soil Profile Type (AASHTO)	II	II
K_a = Active Earth Pressure Coefficient (Coulomb)	0.22	0.32
K_p = Passive Earth Pressure Coefficient (Coulomb)	11.0	11.0
K_h = Horizontal Acceleration Coefficient	0.15	0.15
K_v = Vertical Acceleration Coefficient	0.00	0.00
K_{ae} = Dynamic Active Earth Pressure Coefficient (Mononobe-Okabe)	0.31	0.60
K_{pe} = Dynamic Passive Earth Pressure Coefficient (Mononobe-Okabe)	7.5	7.5
Coefficient of Base Friction (Sliding)	0.40	0.40

REFERENCES

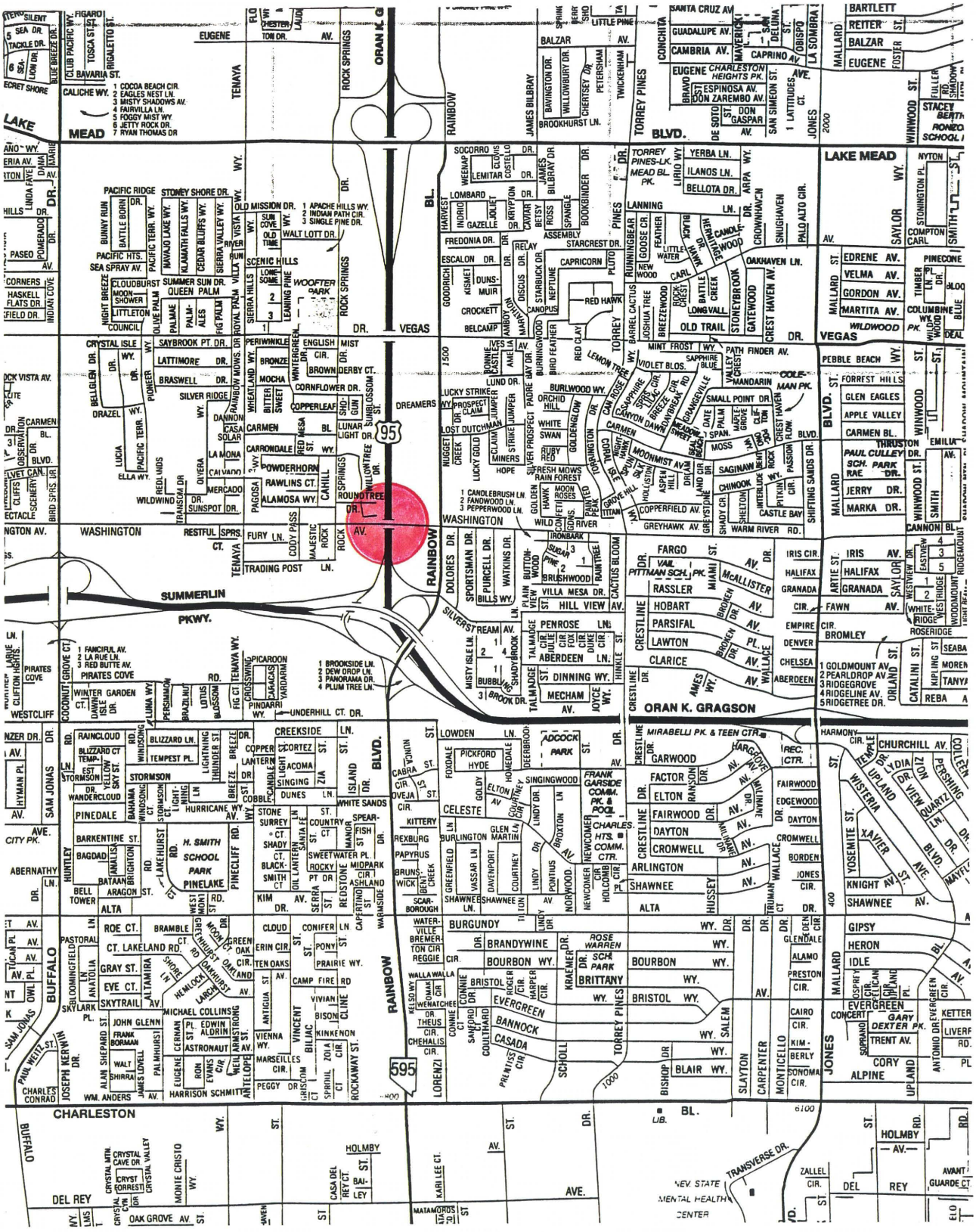
1.USGS Las Vegas NW 7½' Quadrangle Geologic Map, 1967

2. Bulletin 62, Plate 5; Tectonic Map of Clark County. USGS, 1965

3.Nevada Bureau of Mines and Geology, Bulletin 95, Plate 1, Subsidence in Las Vegas Valley, 1981

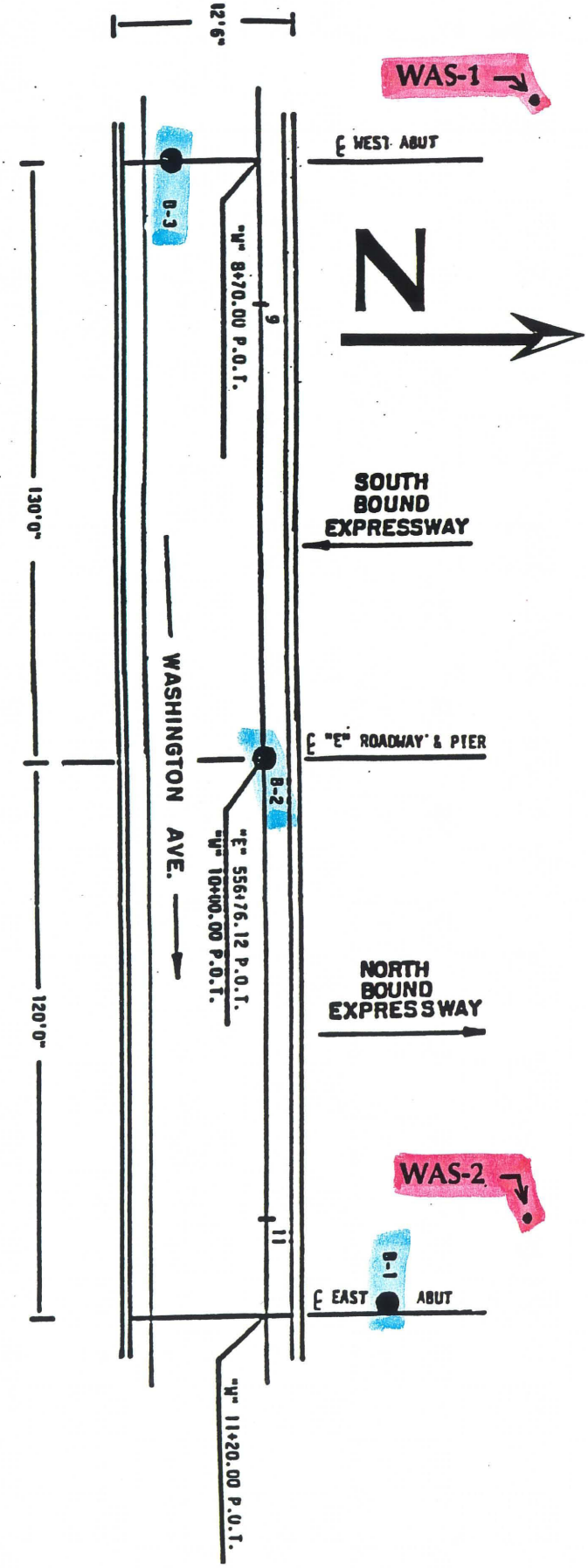
4.Nevada Bureau of Mines and Geology NBMG Open File Report 93-4, Plate 2, Subsidence in Las Vegas Valley, 1980-91, 1993

APPENDIX A



SITE PLAN

Plate 1



BOREHOLE LOCATION SHEET

Plate 2

APPENDIX B

15-11

NEVADA STATE HIGHWAY DEPARTMENT

FOUNDATION REPORT

WASHINGTON AVE. GRADE SEPARATION

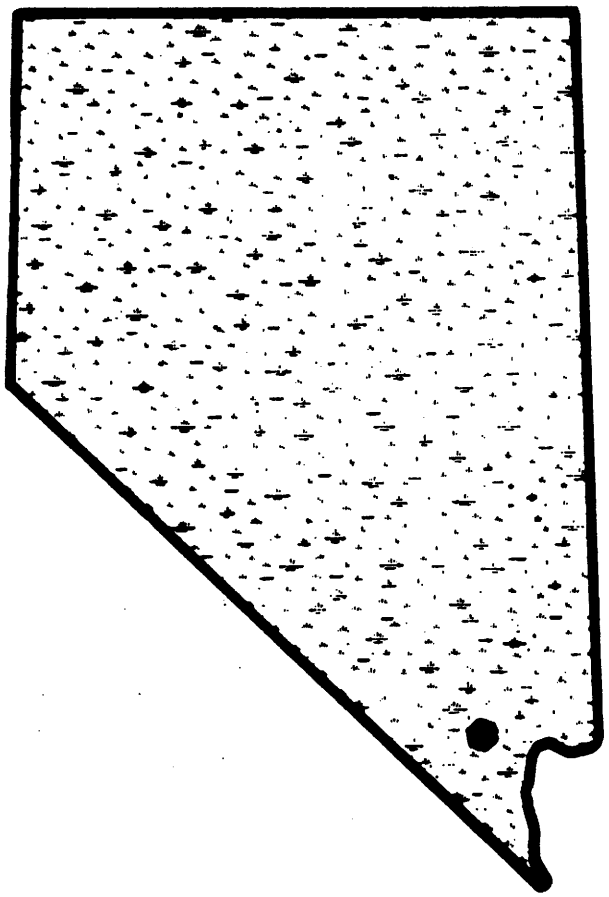
(H-1211)

U.S. 95 EXPRESSWAY

NOVEMBER 1977

E.A. NO. 70304

PROJECT NO. F-FF-RF-006-2(5)



ENGINEERING GEOLOGY & FOUNDATION SECTION

MATERIALS & TESTING DIVISION

WASHINGTON AVENUE GRADE SEPARATION

(H-1211)

AT U.S 95 EXPRESSWAY

November 1977

E. A. Number 70304

Project No. F-FF-RF-006-2(5)

Engineering Geology and Foundation Section

INTRODUCTION

A foundation study for the Washington Avenue Grade Separation on the U.S. 95 Expressway was conducted during the last week of October, 1977. The structure, H-1211, is located west of Las Vegas in what is to be a residential area and will carry primarily residential traffic. The study is based on three test borings of varying depths using 6 inch auger and incorporating the Standard Penetration Test.

The Washington Avenue Grade Separation, Structure H-1211, will be constructed on alluvial sands and gravels washed from the mountains to the west of the project. The gravels are comprised principally of carbonate rocks. As rain waters percolate downward through these gravels, calcium carbonate is dissolved from the rocks and precipitated in the voids. Consequently, much of this alluvium is partly cemented.

The cemented soil extends from within a couple of feet from the surface to past 64 feet deep (elevation 2327). The cemented condition varies from slight (comparatively soft) to extensive (very hard, but rippable) but is inconsistent with depth or horizontal extent. Very hard rock-like caliche was not encountered in any of the borings, nor was any natural ground water.

RECOMMENDATIONS

Examination of the soil composition indicates that spread footings is the most advantageous structure support method. Abutment footings may safely be placed in the approach embankment when designed for an allowable bearing capacity of 2 tons per square foot, if the embankment is constructed of structure backfill and compacted to a minimum of 95 percent of the maximum density as determined by Nevada Test Method No. T101, T102, or T103.

The bottom front edge of the footing should be a minimum of 5 feet horizontally from the face of the fill slope.

As an alternate, the west abutment may be placed at or below elevation 2386 and the east abutment at or below elevation 2382 for allowable design loads up to 6 tons per square foot.

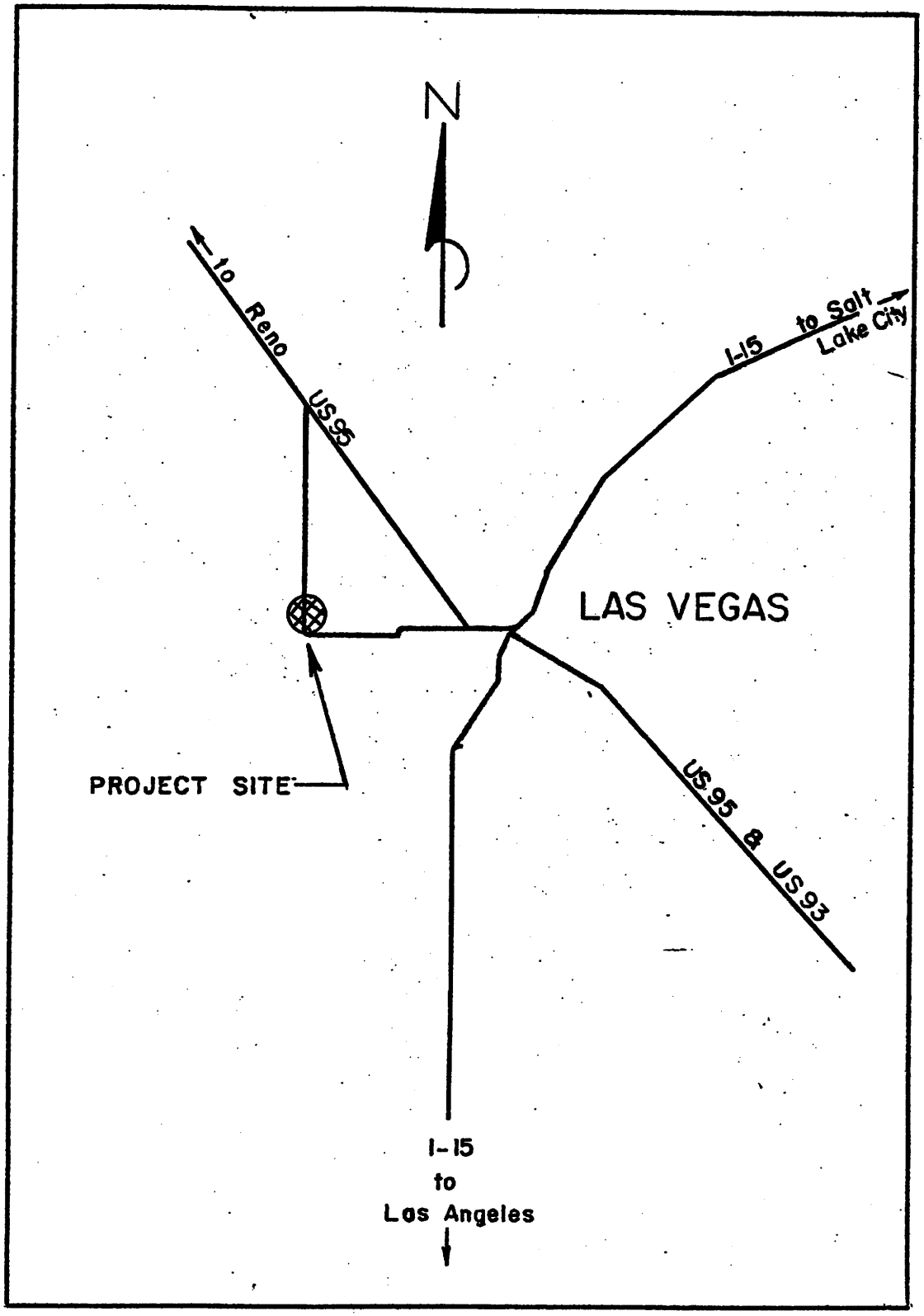
Pier footings may safely be placed at or below elevation 2384 using design loads up to and including 6 tons per square foot.

It is anticipated that the approach embankments will cause nominal settlements and will be of insignificant effect on the proposed type of superstructure (i.e., cast-in-place, post-tensioned, two-span box girder).

Respectfully submitted,

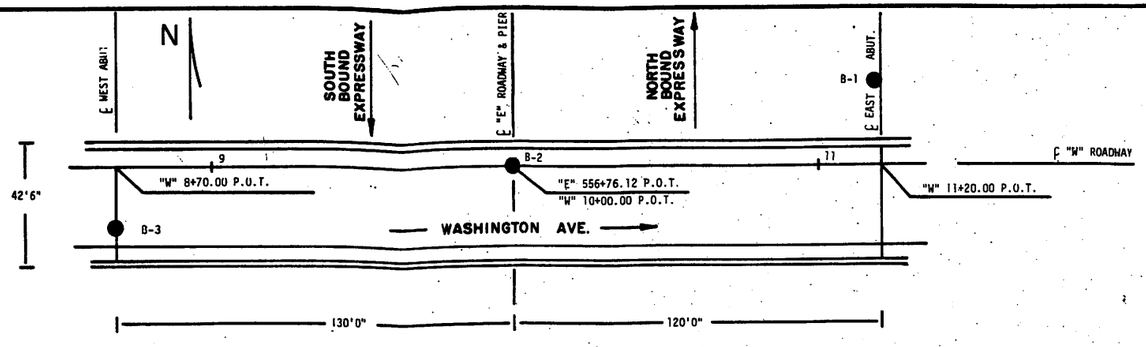
Carl M. Cavolick

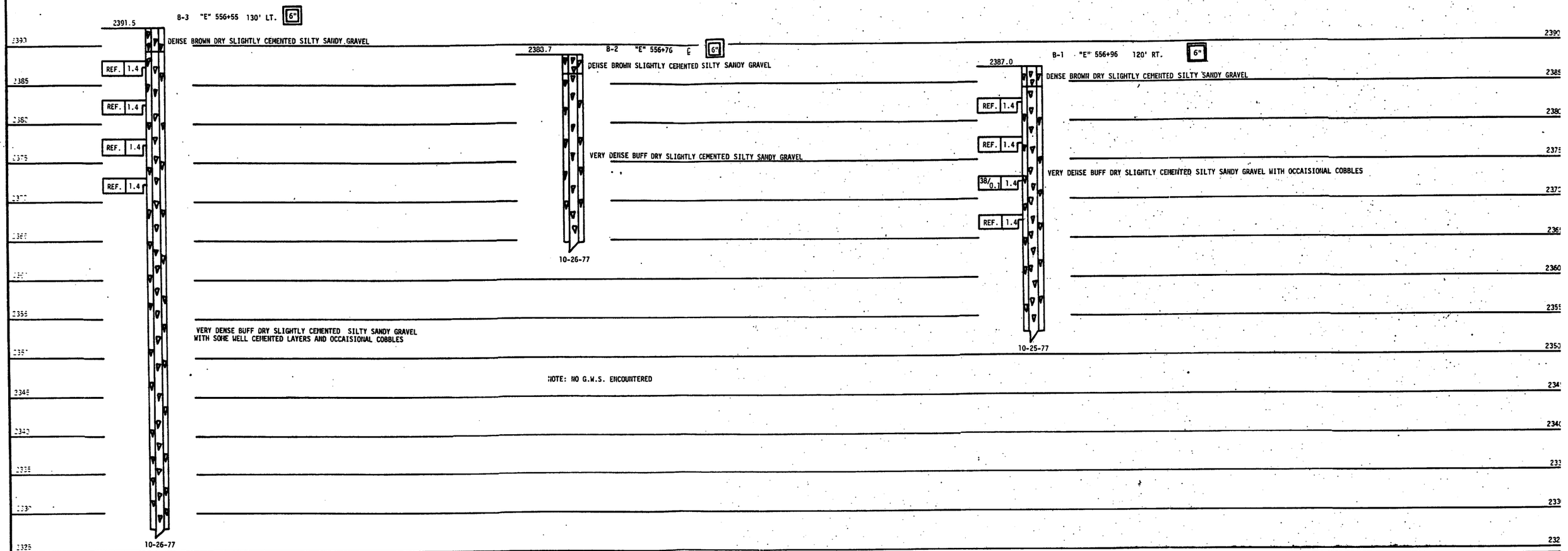
Carl M. Cavolick
Civil Engineer II


N
to Reno
US 95
I-15
to Salt Lake City
LAS VEGAS
PROJECT SITE
US 95 & US 93
I-15
to
Los Angeles

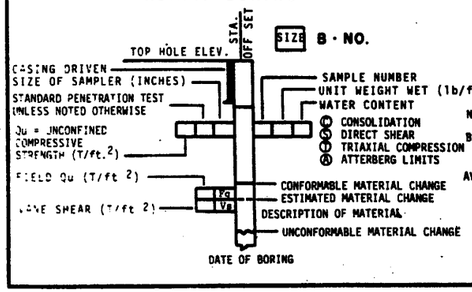
FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	F-FF-RF-006-2(5)	CLARK	

NOTE: FOUNDATION REPORT AVAILABLE FOR CONTRACTORS STUDY IN DISTRICT OFFICE AND MATERIALS & TESTING DIVISION ...

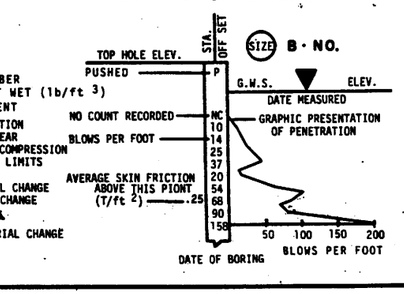




ROTARY BORING



PENETRATION BORING



- PLAN OF ANY BORING
- PENETROMETER (FLUSH-COUPLED)
- 2" CONE PENETROMETER
- SAMPLE BORING (DRY)
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- JET BORING
- DIAMOND CORE BORING
- TEST PIT

BIT SIZE: (O.D.) : "AX"=1-13/16", "BX"=2-9/32", "NX"=2-29/32"
CASING SIZES: (O.D.) : "BX"=2-7/8", "NX"=3-1/2"

THE UNIFIED SOIL CLASSIFICATION SYSTEM

MAJ. DIV.		LETTER	SYM.	DESCRIPTION
COARSE GRAINED MATERIAL	GRAVEL AND GRAVELLY SOIL	GW		WELL-GRADED GRAVEL OR GRAVEL-SAND MIXTURES. LITTLE OR NO FINES.
		GP		POORLY-GRADED GRAVEL OR GRAVEL-SAND MIXTURES. LITTLE OR NO FINES.
		GM		SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES.
		GC		CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURES.
	SAND AND SANDY SOIL	SW		WELL-GRADED SAND OR GRAVELLY SAND, LITTLE OR NO FINES.
		SP		POORLY-GRADED SAND OR GRAVELLY SAND, LITTLE OR NO FINES.
		SM		SILTY SAND, SAND-SILT MIXTURES.
		SC		CLAYEY SAND, SAND-CLAY MIXTURES.

MAJ. DIV.		LETTER	SYM.	DESCRIPTION
FINE GRAINED MATERIAL	SILTS AND CLAYS LL.=<50	ML		INORGANIC SILT AND VERY FINE SAND, ROCK FLOUR, SILTY OR CLAYEY FINE SAND OR CLAYEY SILTS WITH SLIGHT PLASTICITY.
		CL		INORGANIC CLAY OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAY, SANDY CLAY SILTY CLAY, LEAN CLAY
		OL		ORGANIC SILT AND ORGANIC SILTY-CLAY OF LOW PLASTICITY
	SILTS AND CLAYS LL.=> 50	MH		INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILT.
		CH		INORGANIC CLAY OF HIGH PLASTICITY, FAT CLAY.
		OH		ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILT.
		PT		PEAT AND OTHER HIGHLY ORGANIC SOILS.

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 - 24	MEDIUM DENSE	5 - 8	MEDIUM STIFF
25 - 50	DENSE	9 - 15	STIFF
OVER 50	VERY DENSE	16 - 30	VERY STIFF
		31 - 60	HARD
* STANDARD PENETRATION TEST(N) 140 lb. HAMMER, 30" FREE FALL ON 2" O.D. X 1 3/8" I.D. SAMPLER		OVER 60	VERY HARD

DWN. R.R.R.
CHK. Ome
DATE: 11-22-77

NEVADA HIGHWAY DEPARTMENT MATERIALS AND TESTING DIVISION
FOUNDATIONS AND ENGINEERING GEOLOGY SECTION

WASHINGTON AV. G.S. — L.V. EXPRESSWAY
H - 1211

DWG. NO. 1
E.A. 7030

APPENDIX C

KEY TO BORING LOGS

PARTICLE SIZE LIMITS								
CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		FINE	MEDIUM	COARSE	FINE	COARSE		
.002 mm		#200	#40	#10	#4	19 mm	75 mm	300 mm

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
CE	Caliche
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 Symbol

SOIL CEMENTATION CRITERIA

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

STANDARD PENETRATION CLASSIFICATION*

GRANULAR SOIL		CLAYEY SOIL	
BLOWS/0.3m	DENSITY	BLOWS/0.3m	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) 63.5 Kg hammer 760mm free fall on 50.8mm O.D. x 35mm 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:
$(N_{AUTOMATIC})(1.25) = N_{60}$
$(N_{SAFETY})(1.17) = N_{60}$

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

SAMPLER NOTATION

CMS	CALIF. MODIFIED SAMPLER①
CPT	CONE PENETRATION
CS	CONTINUOUS SAMPLER②
CSS	CALIFORNIA SPLIT SPOON①
P	PUSHED (NOT DRIVEN)
PB	PITCHER BARREL
RC	ROCK CORE③
SH	SHELBY TUBE④
SPT	STANDARD PENETRATION TEST
TP	TEST PIT

①- I.D.= 61.5mm
②- I.D.=82mm with tube; 88.9mm w/o tube
③- N XW
④- I.D.= 73mm

LAST MODIFIED: May 18, 1999

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 5/12/98
END DATE: 5/12/98
JOB DESCRIPTION: WASHINGTON AVENUE WIDENING
LOCATION: @ US 95
BORING: WAS-1
E.A. #: 72357
GROUND ELEV.: 728.47 m
HAMMER DROP SYSTEM: SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.

STATION: "W"8+55
OFFSET: 63' Left
ENGINEER: BOOMHOWER
EQUIPMENT: MOBILE DRILL B-80
OPERATOR: WHITED/ALTAMIRANO
DRILLING METHOD: HOLLOW STEM AUGER
BACKFILLED: YES DATE: 5/12/98

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm increments	BLOW COUNT Last 300mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									WELL-GRADED GRAVEL with SILTY CLAY and SAND dry, pink to very pale brown	
							PI,S	GW-GC		Bulk sample 1 0.6m-1.1m
727.5	1.07	A	SPT	25/1"		100				Very hard drilling
	1.10									
	1.49									300 psi down pressure
	1.52	B	SPT	25/2.5"		100			**SILTY CLAYEY SAND with GRAVEL** dry, pinkish gray	
	1.58									
726.5	2.13	C	SPT	50/2.25"		100				Very hard drilling
	2.19									
725.5								GW-GM		
	3.35	D	SPT	25/2"		0				
	3.41									
724.5										
	4.54									
	4.57	E	SPT	25/3"		100			**SILTY CLAYEY SAND with GRAVEL** dry to damp, pinkish gray	No recovery (E)
	4.66									
723.5										
722.5								SC-SM	Occasional interbeds of gravel throughout	
									Material is consistently the same throughout drilling	
							PI,S			Bulk sample 2 6.1m-7.6m
721.5										
	7.59									
	7.62	F	SPT	25/2.5"		100			**NOTE:** First 1"-2" of each sample is probably slough. Almost all progress during sampling occurs during first 1-3 blows	
	7.68									
720.5										
719.5										

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 5/12/98
END DATE: 5/12/98
JOB DESCRIPTION: WASHINGTON AVENUE WIDENING
LOCATION: @ US 95
BORING: WAS-1
E.A. #: 72357
GROUND ELEV.: 728.47 m
HAMMER DROP SYSTEM: SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.

STATION: "W"8+55
OFFSET: 63' Left
ENGINEER: BOOMHOWER
EQUIPMENT: MOBILE DRILL B-80
OPERATOR: WHITED/ALTAMIRANO
DRILLING METHOD: HOLLOW STEM AUGER
BACKFILLED: YES DATE: 5/12/98

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
~~718.5~~									**SILTY CLAYEY SAND with GRAVEL** dry to damp, pinkish gray	
	10.67									
	10.73	G	SPT	25/2"		0		SC-SM		No recovery (G)
717.5										
716.5										
715.5										
	13.72									
	13.75	H	SPT	25/1"		0			13.75	No recovery (H)
714.5									**B.O.H.** No groundwater was encountered.	
713.5										
712.5										
711.5										
710.5										
709.5										

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE: 5/13/98
END DATE: 5/13/98
JOB DESCRIPTION: WASHINGTON AVENUE WIDENING
LOCATION: @ US 95
BORING: WAS-2
E.A. #: 72357
GROUND ELEV.: 726.95 m
HAMMER DROP SYSTEM: SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH	ELEV.

STATION: "W"11+00
OFFSET: 60' Left
ENGINEER: BOOMHOWER
EQUIPMENT: MOBILE DRILL B-80
OPERATOR: WHITED/ALTAMIRANO
DRILLING METHOD: HOLLOW STEM AUGER
BACKFILLED: YES DATE: 5/13/98

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm increments	BLOW COUNT Last 300mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
								GC-GM	**SILTY CLAYEY GRAVEL with SAND** damp, light brown	
	0.91								0.91	
725.9		A	SPT	13-14-11	25	61	PI,S,W		**SILTY CLAYEY SAND with GRAVEL** damp, light brown	Bulk sample 1 0.9m-1.4m
	1.37									
	1.52									
		B	SPT	11-14-11	25	78	S,W	SC-SM		
724.9	1.98									
										Gravel bed
	2.44									
	2.50	C	SPT	25/2"		0				No recovery (C)
									2.74	
							S		**SILTY CLAYEY GRAVEL with SAND** damp, light brown	Bulk sample 2 2.7m-3.1m
723.9	3.05									
	3.08	D	SPT	25/1"		0				No recovery (D)
722.9										
721.9										
								GC-GM		
720.9	6.10									
	6.19	E	SPT	25/3.5"		0			**NOTE:** First 1"-2" of each sample driven (samples C-F) is probably slough. Almost all progress during sampling occurs in the first 1-3 blows.	No recovery (E)
719.9										
718.9										
	8.69								8.72	
	8.72	F	SPT	25/1"		0			**B.O.H.**	No recovery (F)
717.9									No groundwater was encountered.	

APPENDIX D

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

E.A. No. 72357 **Job Description** Washington Avenue Widening

Boring No. WAS 1 **Elevation (m)** 728.5 **Station** "W" 8+55 19.2m Lt

SAMPLE NO.	SAMPLE DEPTH (m)	SAMP-LER TYPE	N BLOWS per .3m	SOIL GROUP	W%	WET UW KN/m³	% PASS #200	LL %	PL %	PI %	STRENGTH TEST			OTHERS
											TEST TYPE	φ deg.	C KN/m²	
1 - Bulk 1	.61 - 1.1	bulk		GW-GC			10.7	22	17	5				
1 - Bulk 2	6.1 - 7.6	bulk		SC-SM			14.1	23	18	5				

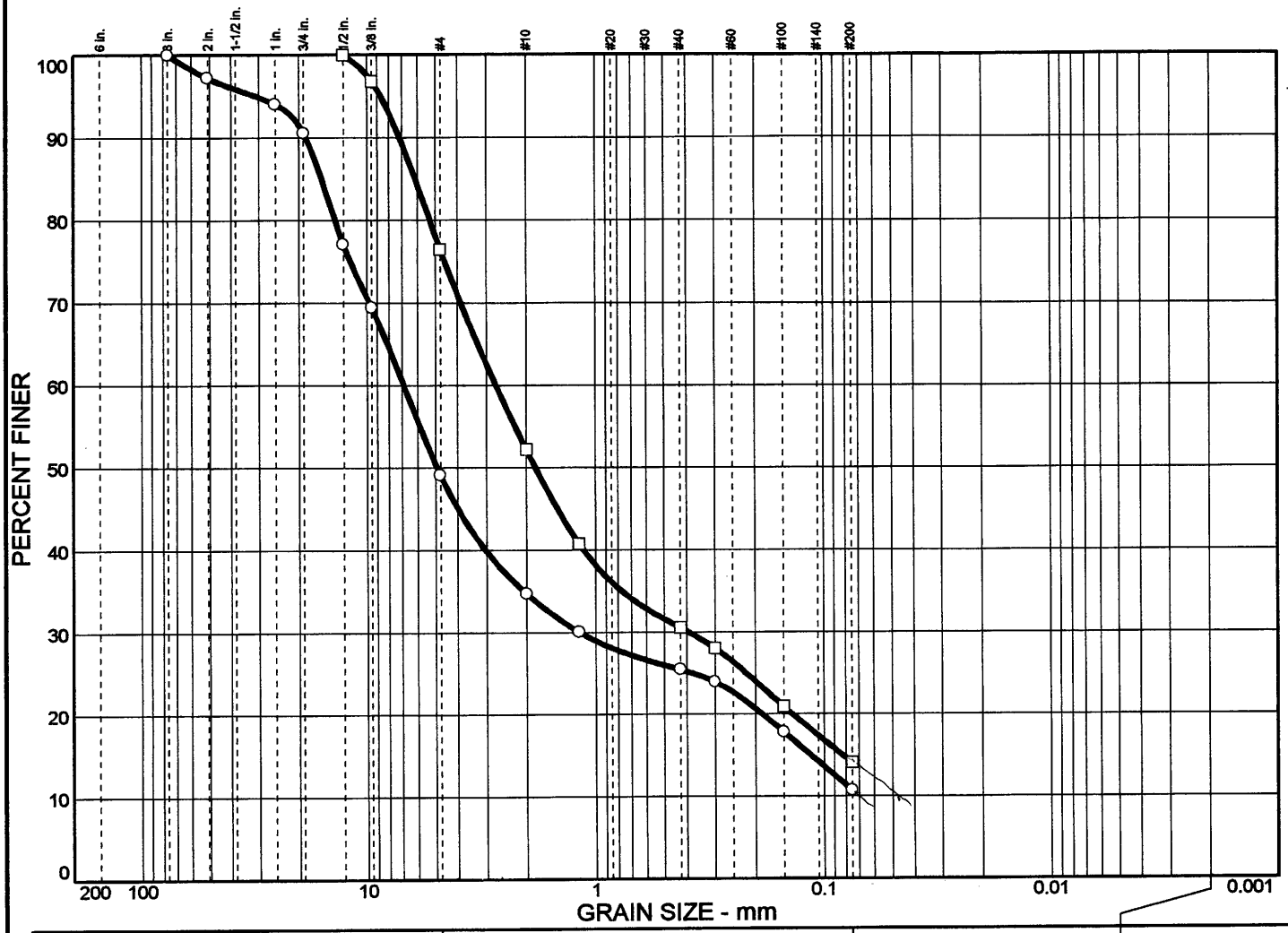
SPT = Standard Penetration 35mm ID
CS = Continuous Sample 82mm ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 61.5mm ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
φ = Friction
C = Cohesion
N = No. of blows per 0.3m, sampler driven under 64kg mass dropped 760mm.
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

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

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	50.9	38.4	10.7	
□	0.0	23.6	62.3	14.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	22	17	15.9	6.89	4.92	1.18	0.114			
□	23	18	6.13	2.72	1.83	0.394	0.0825			

MATERIAL DESCRIPTION	USCS	AASHTO
○ Well graded gravel with silty clay and sand	GW-GC	
□ Silty, clayey sand with gravel	SC-SM	

Project No. 72357 **Client:**

Project: Washington Avenue Widening

○ **Location:** Boring WAS1, sample: Bulk 1

□ **Location:** Boring WAS1, sample: Bulk 2

Remarks:

○

□

PARTICLE SIZE DISTRIBUTION TEST REPORT

NEVADA DEPARTMENT OF TRANSPORTATION

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

E.A. No. 72357 **Job Description** Washington Avenue Widening

Boring No. WAS 2 **Elevation (m)** 726.9 **Station** "W" 11+00 18.2m Lt

SAMPLE NO.	SAMPLE DEPTH (m)	SAMP-LER TYPE	N BLOWS per .3m	SOIL GROUP	W%	WET UW KN/m³	% PASS #200	LL %	PL %	PI %	STRENGTH TEST			OTHERS
											TEST TYPE	φ deg.	C KN/m²	
2 - A	.91 - 1.4	SPT		GC-GM	4.4			24	19	5				
2 - B	1.5 - 2.0	SPT		GC-GM	4.3		13.8							
2 - Bulk 1	.91 - 1.4	bulk		SC-SM			17.3							
2 - Bulk 2	2.7 - 3.1	bulk		GC-GM			18.4							

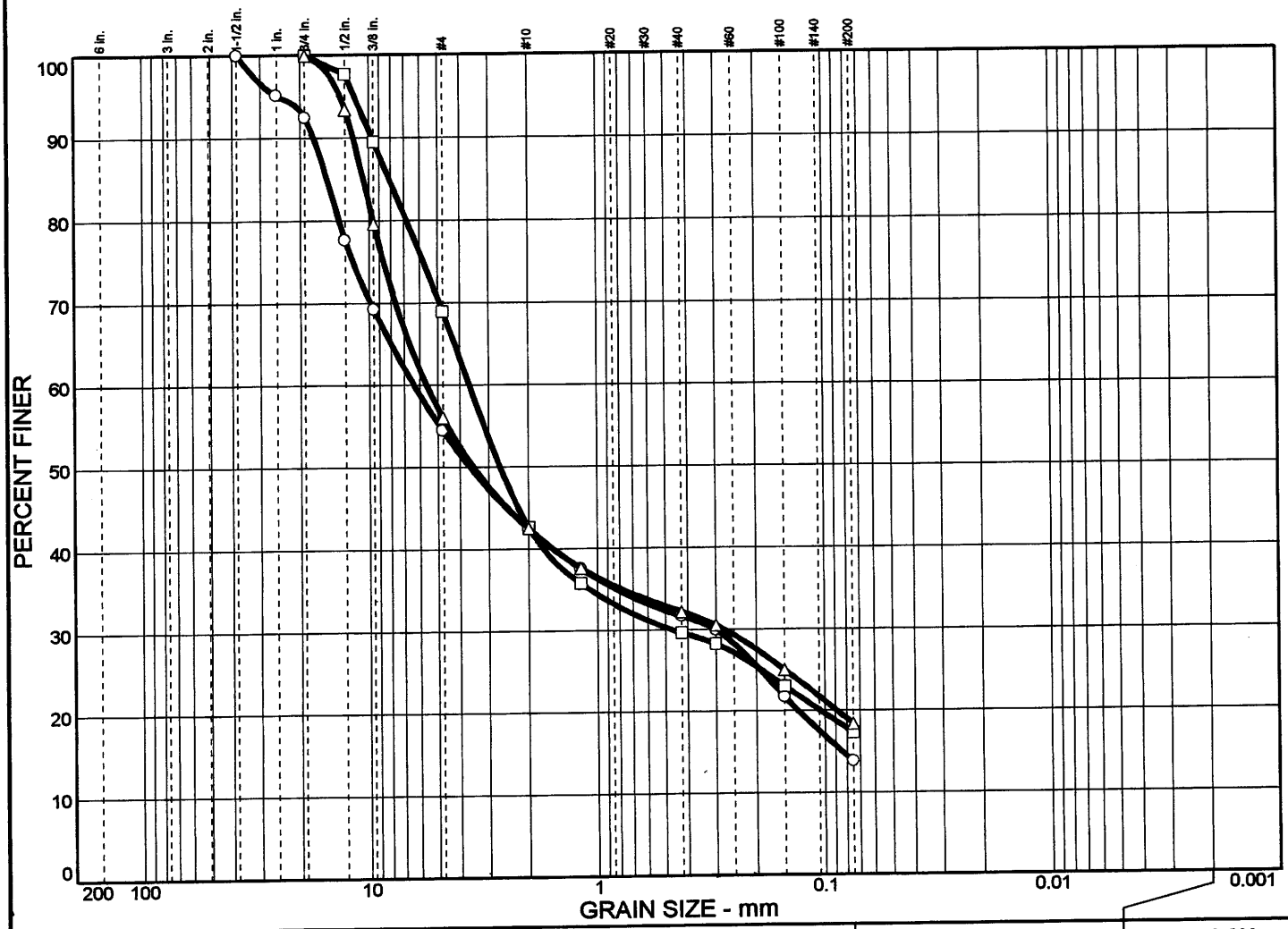
SH = Shelby Tube 73mm ID
SPT = Standard Penetration 35mm ID
CS = Continuous Sample 82mm ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 61.5mm ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
φ = Friction
C = Cohesion
N = No. of blows per 0.3m, sampler driven under 64kg mass dropped 760mm.
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

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

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	45.6	40.6	13.8	
□	0.0	31.1	51.6	17.3	
△	0.0	44.0	37.6	18.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	24	19	15.3	6.36	3.63	0.304	0.0839			
□			8.13	3.64	2.67	0.470				
△			10.6	5.60	3.49	0.277				

MATERIAL DESCRIPTION	USCS	AASHTO
○ Silty clayey gravel with sand	GC-GM	
□ Silty clayey sand with gravel	SC-SM	
△ Silty clayey gravel with sand	GC-GM	

Project No. 72357 **Client:**

Project: Washington Avenue Widening

○ **Location:** Boring WAS2, sample: B

□ **Location:** Boring WAS2, sample Bulk 1

△ **Location:** Boring WAS2, sample Bulk 2

Remarks:

○

□

△

PARTICLE SIZE DISTRIBUTION TEST REPORT

NEVADA DEPARTMENT OF TRANSPORTATION