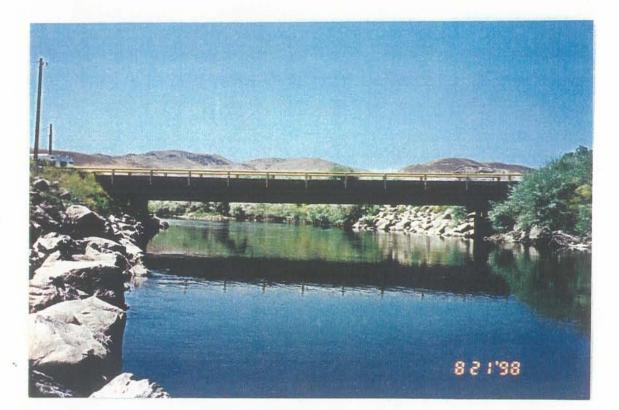
GEOTECHNICAL INVESTIGATION BRIDGE (B-2352) REPLACEMENT AT HAFED IN STOREY AND WASHOE COUNTIES

NOVEMBER 2, 2000





MATERIALS DIVISION

STATE OF NEVADA DEPARTMENT OF TRANSPORTATION MATERIALS DIVISION GEOTECHNICAL SECTION

GEOTECHNICAL INVESTIGATION REPORT

BRIDGE (B-2352) REPLACEMENT AT HAFED IN STOREY AND WASHOE COUNTIES

Project ID NO. 72423-1

NOVEMBER 2, 2000

Prepared by: _____

Hernan Perez, P.E. Staff III, Associate Engineer

Reviewed by: _____

Parviz Noori, P.E. Assistant Chief Materials Engineer - Geotechnical

Approved by: _____

Dean C. Weitzel, P.E. Chief Materials Engineer

TABLE OF CONTENTS

	Page 1	<u>No.</u>
1.0	INTRODUCTION	1
	1.1 General	1
	1.2 Project Description	2
2.0	FIELD EXPLORATION AND LABORATORY TESTING	2
	2.1 Field Exploration	
	2.2 Laboratory Testing	
3.0	SITE CONDITIONS	3
	3.1 Surface	
	3.2 Subsurface	
	3.3 Groundwater	
4.0	GEOLOGY AND SEISMICITY	4
	4.1 Local Geology	
	4.2 Seismicity	. 4
5.0	ENGINEERING ANALYSIS AND RECOMMENDATIONS	. 5
	5.1 Drilled Shaft Foundations	. 5
	5.2 Settlement	. 6
	5.3 Liquefaction Evaluation	. 6
	5.4 Lateral Resistance of Drilled Shafts	. 6
	5.5 Lateral Earth Pressures	. 7
	5.6 Drilled Shaft Construction Recommendations	
	5.7 Site Grading	. 8
	5.8 Drainage System	. 8
	5.9 Permanent Slopes and Temporary Excavations	. 9
REFE	ERENCES	10

TABLE OF CONTENTS (Continued)

Figure No.

Vicinity Map	1
Exploration Plan	
Site Seismic Response Spectra	
Drilled Shaft Ultimate Axial Capacity Without Scour	
Drilled Shaft Ultimate Axial Capacity With Scour	
Drilled Shaft Ultimate Uplift Capacity	6
Weephole Detail	7

APPENDIX A - BORING LOGS

Boring Logs	A-1
Key to Boring Logs	A-11

APPENDIX B - LABORATORY TEST RESULTS

Sieve Analysis	B-1
Chemical Analysis	B-9
Summary Sheets	B-10

1.0 INTRODUCTION

1.1 General

This report presents the results of our geotechnical investigation for the proposed single span bridge over the Truckee River near Hafed. The proposed bridge will be located south of Interstate 80 at the Mustang Road exit approximately 2 km east of Lockwood in Washoe and Storey Counties. A vicinity map including approximate location of the project is shown on Figure 1.

The exploration was conducted based on the alignment provided to us in the Fall of 1998. The proposed bridge was planned to be constructed approximately 25 meters upstream of the existing structure. However, now a new alignment has been selected and the proposed bridge will located approximately 30 meters downstream of the existing structure. An addendum to this geotechnical report will be issued after an additional exploration is conducted for the new alignment.

The purpose of this investigation was to explore and evaluate subsurface soil conditions and to provide design and construction recommendations for the proposed bridge foundation and roadway.

The scope of this investigation included the following:

- Subsurface exploration
- Laboratory testing
- Analysis of field and laboratory test data
- Site geology review
- Foundation design recommendations
- Construction recommendations

1.2 Project Description

The proposed project consists of construction of approximately 400 meters of two-lane roadway and a single span bridge approximately 48 meters in length over the Truckee river. Grading of existing topography will involve minor cuts north of the Truckee river and fills along the remaining length of the project. The existing bridge consists of a single span bridge approximately 35 meters in length which will be demolished once the new bridge is constructed.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

The field exploration was conducted on October 12 through 15, 1998, for the original alignment and consisted of 6 soil borings (MB-1 through MB-6) drilled at the locations shown on the Exploration Plan (see Figure 2). The purpose of the field exploration was to evaluate subsurface conditions and to provide geotechnical recommendations for the bridge foundation. The borings were drilled using a Mobile B-80 truck mounted drill rig equipped with solid auger and rotary wash equipment. Boring MB-2 and MB-3 were drilled using rotary wash. All other borings were drilled using a solid auger. Borings were drilled to depths ranging from 1.5 to 23.8 meters below the existing ground surface. The ground surface elevation at each boring location was determined from topographic maps of the area.

In situ testing and soil sampling were performed using the Standard Penetration Test (SPT). The SPT test is performed using a 35-mm inside diameter, 51-mm outside diameter split-spoon sampler. The sampler was first seated 150 mm and then driven an additional 300 mm with a 620 N (140-pound) hammer, free-falling through a distance of 760 mm (30 inches). The SPT provides a disturbed sample of the soil and an empirical indication (N-value) of the soil density. Representative soil samples were also obtained by bulk method. The soil samples were classified in accordance with the Unified Soil Classification System (ASTM D 2487).

2.2 Laboratory Testing

Representative soil samples from the borings were tested in the laboratory to determine their index properties. Tests performed included moisture content, unit weight, particle size analysis, and Atterberg limits. In addition, selected soil samples were tested for corrosion potential. Tests performed included chlorides, pH, sulfates, and electrical resistivity. Test results are presented in Appendix B.

3.0 SITE CONDITIONS

3.1 Surface

At the time of the exploration the proposed roadway alignment was undeveloped and partially covered with vegetation. The surface soils associated with the proposed roadway alignment consisted of dense sand with gravel and cobbles. The existing river banks at the bridge alignment are approximately 1H:2V (Horizontal:Vertical) with thick vegetation. Utility crossings include a telephone line, gas line and overhead power line along the proposed alignment. One or more power poles may have to be relocated from the area prior to construction of the bridge and roadway.

3.2 Subsurface

The subsurface soils encountered generally consisted of silty sand, and gravelly sand with cobbles and boulders to depths ranging from 5 to 6 meters. Below this layer, soils consisted of silty sand, gravelly sand, and poorly graded gravel with cobbles. Cobbles and boulders were encountered in varying amounts in borings MB-2 and MB-3. The boring logs in Appendix A should be reviewed for a more detailed description of the subsurface conditions encountered at the locations explored.

3.3 Groundwater

Groundwater was encountered in all borings except MB-1. The groundwater elevation varied from 1315.4 to 1317.2 meters. Seasonal fluctuation of the groundwater table should be expected due to variations in precipitation, groundwater withdrawal, and recharge.

4.0 GEOLOGY AND SEISMICITY

4.1 Local Geology

The site is located in an area of flood plain deposits. Based on a geologic map, the project site consists of Quaternary age alluvial-fan deposits of the Truckee River. These deposits consist of silt, sandy silt, silty sand, and gravelly sand with cobbles and boulders. The nearby mountains consist of Tertiary age basalt rock. Bedrock beneath the project is anticipated to be at a depth of more than 24 meters.

4.2 Seismicity

According to geologic maps, multiple fault traces are found in the surrounding area. Historical earthquake records indicate significant acceleration levels can be expected in the area. No faults are mapped to cross through the bridge site. Table 1 shows a list of faults in the area, expected earthquake magnitude, and distance from the proposed bridge.

Major Quaternary Faults	Earthquake Magnitude	Distance from Site
Eastern Reno Basin Fault Zone (ERBFZ)	6.9	10 km
Northern Virginia Range Fault (NVRF)	6.6	7 km
Olinghouse Fault Zone (OFZ)	7.1	5 km
Spanish Springs Peak Fault Zone (SSPFZ)	6.6	8 km

Table 1. Seismic Sources¹

¹ DePolo M. Craig, Anderson G. John, and Price G. Jonathan (1997).

Based on Division I-A, Seismic Design, of AASHTO Standard Specifications for Highway Bridges, Sixteenth Edition, 1996, the acceleration coefficient in rock at this site is 0.38g, with 10 percent probability of being exceeded in 50 years. Based on subsurface explorations and geologic maps of the area, bedrock was assumed to be more than 24 meters below the ground surface. For seismic design

purposes, a Soil Profile Type II and a Site Coefficient of 1.2 are recommended. Figure 3 shows the seismic response spectra for this site using both the AASHTO and UBC methods. The AASHTO (1996) response spectra is defined in Division I-A, Seismic Design. The UBC method of determining a site response spectra is defined in the Federal Highway Administration (FHWA) Geotechnical Earthquake Engineering Manual, Publication No. FHWA-HI-90-012. Figure 3 also shows the seismic design parameters for both methods.

5.0 ENGINEERING ANALYSIS AND RECOMMENDATIONS

5.1 Drilled Shaft Foundation

Both, shallow and deep foundation systems were considered for support of the bridge. Due to scour potential, drilled shafts are recommended for support of the bridge structure. The drilled shafts will derive their capacities from both skin friction and end bearing.

Figure 4 shows the ultimate downward capacity of a 1.5-m diameter drilled shaft versus the shaft tip elevation. This figure does not take scour into consideration. The downward capacity on Figure 4 needs to be divided by a safety factor to obtain the allowable downward capacity. Since no static load tests are proposed for this project, a safety factor of 2.75 is recommended for the static case with no scour.

Figure 5 shows the ultimate downward capacity of a 1.5-m diameter drilled shaft versus the shaft tip elevation including scour. The ultimate downward capacity on Figure 5 needs to be divided by a safety factor to obtain the allowable downward capacity. A safety factor of 1.1 is recommended for the static case with scour. A value of 6.2 meters below the channel bottom was used as depth of the potential scour in the foundation analysis.

The Ultimate Uplift capacity for a 1.5-m diameter drilled shaft was taken as 70 percent of the side friction capacity plus the weight of the concrete. Figure 6 shows the ultimate uplift capacity vs. shaft tip elevation for a 1.5-m diameter drilled shaft. The ultimate uplift capacity on Figure 6 needs to be divided by a safety factor to obtain the allowable uplift capacity. A safety factor of 1.1 is recommended

for the seismic or cyclic case with no scour.

Drilled shafts should be spaced at least 3 diameters on center. There will be no reduction in the downward capacities of the drilled shafts, due to group action, if the shafts are spaced as recommended.

5.2 Settlement

Settlement analysis for a 1.5-m diameter and 18-m long drilled shaft was conducted. A total settlement of 10 mm is predicted for a design load of 2500 kN. Differential settlement is estimated to be one-half of the total settlement. For a design load less than 2500 kN, the total settlement should be less than 10 mm.

5.3 Liquefaction Evaluation

A simplified liquefaction analysis evaluation was performed in accordance with the *Geotechnical Earthquake Engineering Reference Manual*, December 1998, Publication No. FHWA HI-99-012. The results of the analysis indicated that the factor of safety against initial liquefaction is greater than 1.1. Therefore, no liquefaction mitigation is required.

5.4 Lateral Resistance of Drilled Shafts

In order to evaluate the lateral capacity of a drilled shaft, properties of the subsurface soils are required. The representative subsurface properties presented on Table 2 may be used to analyze the lateral capacity of a drilled shaft.

		Buoyant		Coefficient of
		Unit	Friction	Subgrade Reaction,
Elevation	Soil	Weight, γ'	Angle, ø	k (Static and Cyclic)
(meters)	Description	(kN/m ³)	Degrees	(kN/m ³)

Table 2 - Soil Parameters for Lateral Load Analysis	Table 2 -	· Soil	Parameters	for	Lateral	Load	Analysis
---	-----------	--------	------------	-----	---------	------	----------

1317.4 - 1311.0	Medium Dense Sand w/ Gravel	9.0	340	16,300
1311.0 -1304.0	Dense Gravelly Sand	9.8	36°	33,900
1304.0 - shaft tip	Dense Sand w/ gravel	9.0	35°	33,900

The loss of lateral capacity due to scour should be considered in the design. The lateral capacity of an individual shaft in a group is a function of its position in the group and the center-to-center shaft spacing. Per AASHTO, use a reduction factor to modify the p-y curve of an individual shaft based upon its position. For in-line (parallel) loading and center-to-center spacing of three diameters, use a reduction factor of 0.25. For normal loading and center-to-center spacing of three diameters, no reduction is necessary. For center-to-center spacing greater than three diameters, refer to Section 4.6.5.6.1.4 of AASHTO Standard Specifications for Highway Bridges, 1996.

5.5 Lateral Earth Pressures

Lateral earth pressures depend on the type of backfill material, in-place density, backfill slope, and wall geometry. The lateral pressure coefficients were computed for NDOT Granular Backfill using Coulomb equation (per AASHTO Standard Specifications for Highway Bridges, 1996). The lateral seismic active pressure coefficient (K_{AE}) and passive pressure coefficient (K_{PE}) were calculated using the Mononobe-Okabe equation.

In the absence of specific data for Granular Backfill, the lateral pressure coefficients were determined using an internal friction angle of 32 degrees, moist unit weight of 18.8 kN/m³, and level backfill.

A static active earth pressure coefficient (K_A) of 0.3 and a static passive pressure coefficient (K_P) of 3.0 may be used. For seismic design, an active earth pressure coefficient of 0.45 and a seismic passive earth pressure coefficient of 5.0 may be used. A coefficient of friction against sliding of 0.35 may be used. Any surcharge from adjacent loadings should be added to the above pressures using a factor of 0.3 for active conditions.

5.6 Drilled Shaft Construction Recommendations

Based on the subsurface exploration, cobbles and boulders are expected within the soil matrix in the top 5 to 6 meters overlying dense to very dense gravelly sand with cobbles. Although the boring logs do not show any boulders beyond 6 meters, large boulders may be present. Near the surface, 1.0 to 1.5 meter diameter boulders may be encountered. Therefore, hard drilling is expected and may require rock coring along with other heavy construction equipment.

Due to high ground water and cohesionless soils encountered, full depth temporary casing will be required to prevent sloughing and caving during drilling. In addition, use of drilling slurry may be needed. It is recommended that the contractor visit the site and review the boring logs in Appendix A.

5.7 Site Grading

Within construction limits, clearing and grubbing of existing vegetation and surface debris should be conducted according to Section 201 of NDOT Standard Specifications for Road and Bridge Construction (SSRBC), 1996 Edition. On average, removal of 150 mm of the top soil is recommended. Based on the subsurface exploration and laboratory test results, any soils that need to be excavated north of the river are suitable for use as Borrow.

5.8 Drainage System

A drainage system should be provided to prevent hydrostatic pressures that might develop by water trapped behind the abutment retaining walls. Drainage can be accomplished by providing weepholes along the face of the abutment walls.

Weepholes should be at least 102 mm in diameter and be placed at a maximum horizontal spacing of 4.5 meters approximately 75 mm \pm above the finished grade. The backside of the weepholes should be covered with a 150 mm-square aluminum or galvanized steel wire mesh hardware cloth with a minimum wire diameter of 0.75 mm. A minimum of 0.06 m³ of NDOT Type 2 Drain Backfill encapsulated in a

high strength filter fabric should be placed at each weephole. The filter fabric should meet or exceed the specifications shown on Figure 7.

5.9 Permanent Slopes and Temporary Excavations

In areas of fill, permanent slopes no steeper than 1.0V:2.0H (vertical:horizontal) are recommended. Temporary unsurcharged excavations on the existing fill should be no steeper than 1.5H:1V. Due to the granular nature of the soils, some sloughing of temporary slopes should be anticipated. However, it is the contractor's responsibility to determine the stable slope during construction in accordance with OSHA requirements. It is anticipated that excavations steeper than 1.0V:1.5H will require shoring. The contractor must meet all OSHA requirements for temporary excavation slopes and excavation shorings (Federal Register 29 Code of Federal Regulation, Part 1926) and Section 206 of NDOT Standard Specifications for Road and Highway Bridges.

REFERENCES

- 1. AASHTO, <u>Standard Specifications for Highway Bridges</u>, American Association of State Highway and Transportation Officials, Washington, D.C., Sixteenth Edition, 1996.
- 2. Bell John W., Bonham Harold F. Jr., <u>Nevada Bureau of Mines and Geology</u>, <u>Vista Quadrangle</u> <u>Geologic Map</u>, 1987.
- 3. Bonham Harold F., <u>Geologic Map of Washoe and Storey Counties</u>, Nevada Bureau of Mines, 1969.
- 4. Bowles, Joseph E. Bowles, Foundation Analysis and Design, fourth edition, 1988.
- 5. Das Braja M., <u>Principles of Foundation Engineering</u>, second edition, 1990.
- 6. DePolo, Craig M.; Anderson John G.; and Price Jonathan G., <u>Seismological Research Letters</u>, Volume 68, May/June, 1997.
- FHWA, Geotechnical Earthquake Engineering Reference Manual, December 1998, Publication No. FHWA HI-99-012
- 8. NAVFAC, <u>Design Manual 7.2</u>, Foundations and Earth Structures. Naval Facilities Engineering Command, May 1982.
- 9. Siddharthan Raj; Bell John W.; Anderson John G.; and DePolo, Craig M., <u>Peak Bedrock</u> <u>Acceleration for Reno-Carson City Region</u>. University of Nevada, Reno, Report No. 91-01, January 1991.
- 10. Transportation Research Board, <u>Manual for the Design of Bridge Foundations</u>. National Cooperative Highway Research Program Report No. 343, December 1991.

FIGURES

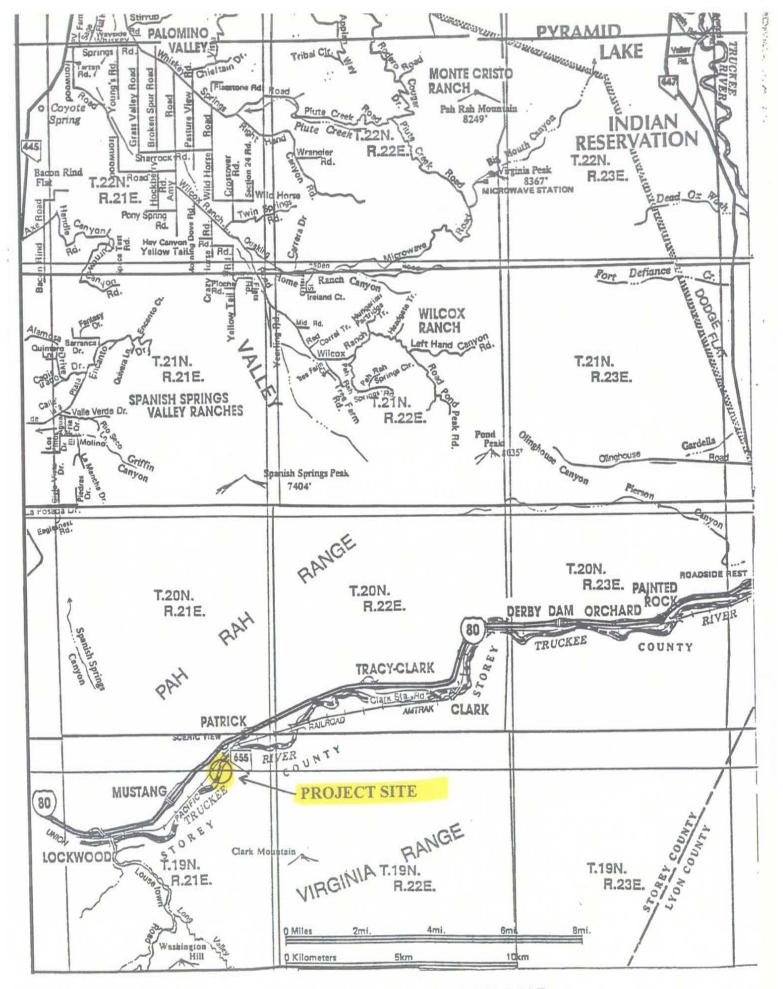
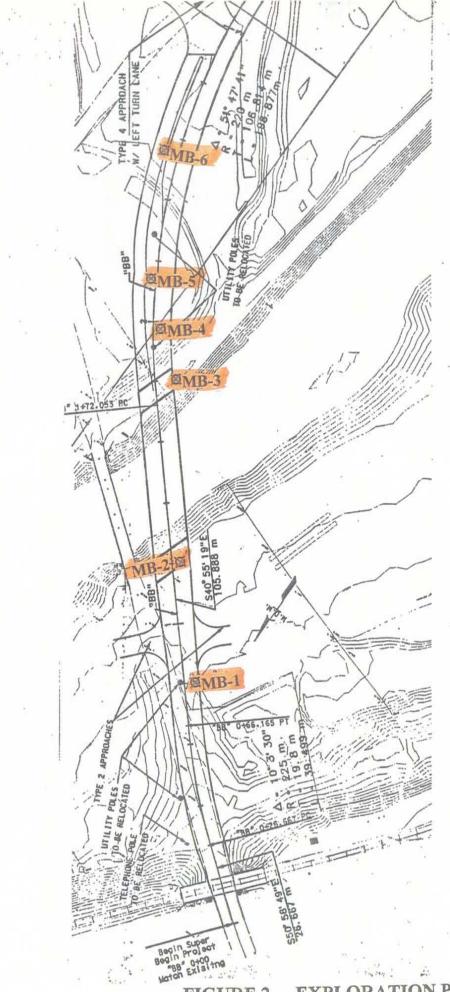
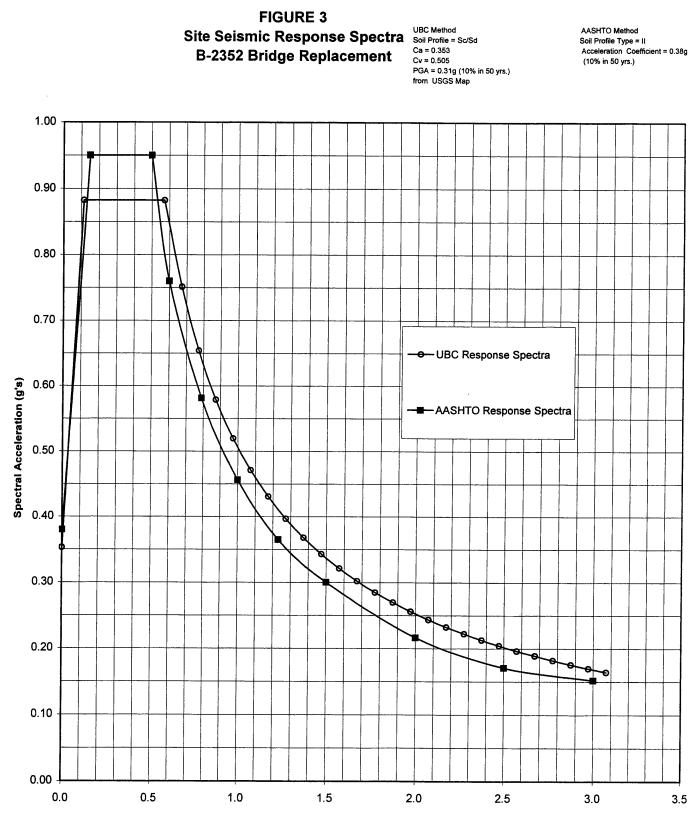


FIGURE 1 - VICINITY MAP



Approximate Boring Location

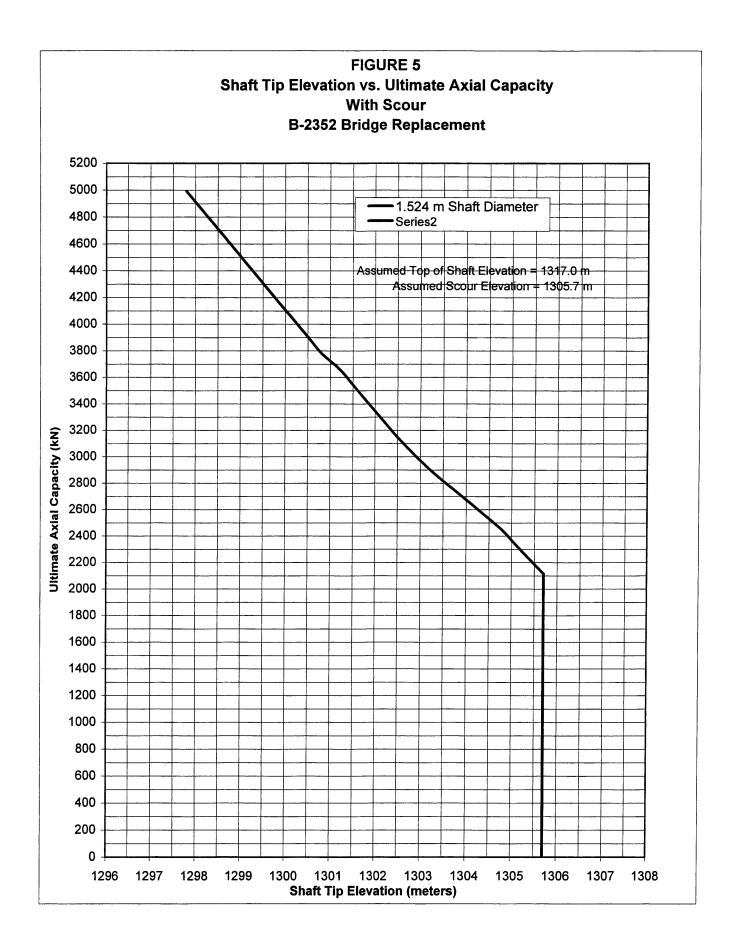
FIGURE 2 - EXPLORATION PLAN



Period, T (Seconds)

Without Scour **B-2352 Bridge Replacement** - 1.524 m diameter shaft Assumed Top of Shaft Elevation = 1317.0 m Ultimate Axial Capacity (kN) Shaft Tip Elevation (meters)

Figure 4 Shaft Tip Elevation vs. Ultimate Capacity



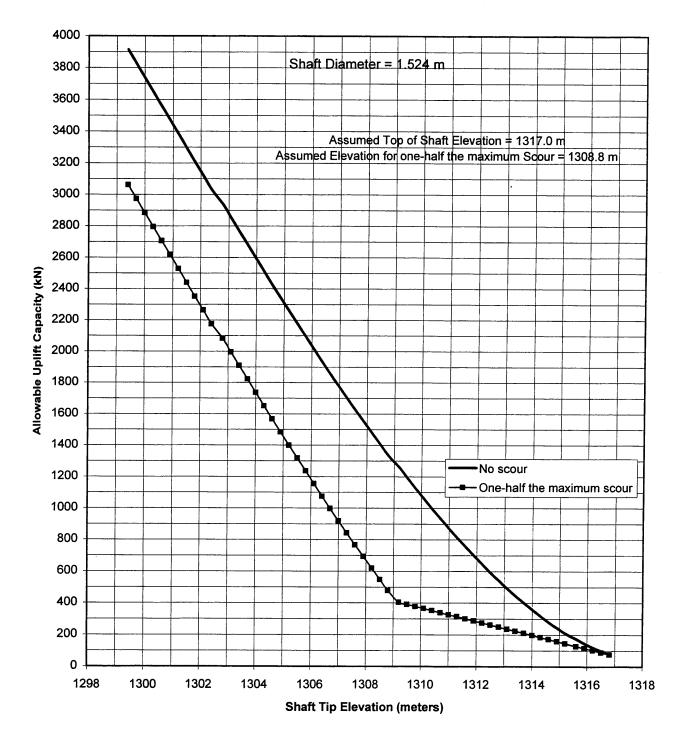
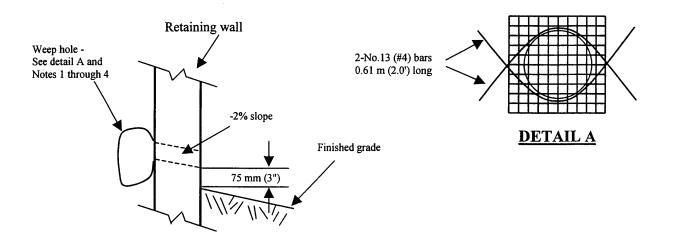


FIGURE 6 Shaft Tip Elevation vs. Allowable Uplift Capacity B-2352 Bridge Replacement

WEEP HOLE DETAIL



NOTES:

- 1. 50 mm (2") diameter drains with horizontal and vertical spacing of 4.5 m (15') \pm center to center. The bottom row must be located 75 mm (3") above finished grade.
- 2. 150 mm (6") square aluminum or galvanized steel wire mesh hardware cloth with a minimum wire diameter of 0.75 mm (0.03").
- 3. 0.06m³ (2 ft³) of NDOT Type 1 or 2 Drain Backfill, encapsulated in a geotextile fabric, securely tied. The geotextile fabric must:
 a) meet or exceed AASHTO Test Method M288 Class 2 strength requirements.
 b) have an AOS no greater than U.S. Sieve No. 40.
 c) have a permittivity of at least 0.5 sec⁻¹.
- 4. No direct payment will be made for the construction of weep holes.

APPENDIX A

BORING LOGS

						1()/15/99			EXPL	ORATIO	N LOG			
			4)/15/98	·					•		SHEET 1 OF 1
	DEPAI TRANS	rtment of Portatio	N		ND DATE		· · · · · · · · · · · · · · · · · · ·	kee River B	ridae E	Ponlacer	oont (P. 2	352)	STATION	BB 0+80	
					OB DESCR			River Near I		replacel		.552)	OFFSET	3 m Right H. Perez	
			\mathbf{n}		DCATION		B-1	NVCI INCAI I	laieu				ENGINEER	MOBILE	3-80
	Z				ORING								· EQUIPMENT OPERATOR	Pat Argal	
					A. #		423-1	·····		DATE		ELEVEL			
				G	ROUND EL	.EV13	19.70 ((III) Defetii					DRILLING		Solid Auger
	GEOTEC	HNICAL		H	AMMER DF		STEM	ballety	I		l		BACKFILLED	Yes D	ATE 10/15/98
	ELEV. (m)	DEPTH (m).00	SA NO.	MPLE TYPE	BLOW C 150 mm Increments	Last	Percent Recovid	LAB TESTS	USCS Group		МАТ	ERIAL DI	ESCRIPTION		REMARKS
		- 0.30		BULK	1		100	S			SM - Silty	sand with	gravel.		
		-							SM						
		F								0.61	GM - Silty	oravel with	sand and cobb	les	
	4040.0										<u></u> ,	, g.u. e			
	1318.8								GM						
		F								1.52					Auger refusal.
		-								1.02					
		F													
	1317.8	$\int_{-\infty}^{2}$													
		[
		-													
		\mathbf{F}								1					
	1316.8	-3													
		-													
		-													
	1315.8	+ 4													
		F													
			1												
		-													
	1314.8	-5													
		-													
		Ē I													
		F													
	1313.8	+6													
		-			-										
		-													
	1312.8	-7						•							
		F													
		-													
g		F													
1/02/0	1311.8 ·	-8													
5	1011.0	-													
1.G		F													
2		F													
Ň	1210 0	L.													
DO	1310.8	-9													
HAFE		F													
5		F													
NV_DOT HAFED.GPJ NV_DOT.GDT 11/02/00															

					START DAT	- 10	0/12/98			EXPLORATION LOG			
DEPA				=	IND DATE	L	0/13/98				•	DD 4 . 4 .	SHEET 1 OF 3
DEPA	PORT	ATIO	N		OB DESCR				sridae f	Replacement (B-2352)	STATION .	BB 1+20 5 m Righ	
					OCATION			River Near			OFFSET .	H. Perez	
			\backslash		ORING		B-2				ENGINEER .	MOBILE	
					.A. #		2423-1			GROUNDWATER LEVEL	OPERATOR	Pat Arga	
					ROUND EL		818.87 ((m)		DATE DEPTH m ELEV. m	DRILLING METHOD	Rotary W	
GEOTEC ENGIN	HNIC	AL VG	[IAMMER DI			Safety		10/15/98 3.70 1315.2	BACKFILLED	DATE 10/15/98	
ELEV. (m)		DEPTH SAMPLE BLOW COUNT (m) NO. TYPE 150 mm Last Percent LAB TESTS USCS (m) NO. TYPE Increments 300 mm Recovid Science										REMARKS	
	t^{\cdot}	<u></u>			Increments	1300 mm	Recovid			SP-SM - poorly sand	with silt and gray	vel.	
	[Cobbles and boulder	s within the soil n	natrix.	
ł	\mathbf{F}							l.					
İ	ŀ												
1317.9	<u>+</u> 1								SP				
	Ľ								SM				
	[
	Ļ												
1316.9	+2												
	ŀ	• • •	ŀ							2.40			
	<u> </u>	2.44			7				┣── '	2.40 <u>GM</u> - silty gravel with			
	Ľ	2.90	A	SPT	8	18	90	W, G, S, Ch	GM				
1315.9	-3	2.90			10					2.90 <u>SM</u> - silty sand with g	ravel Cobbies a	nd	
	F			1						boulders within the so	il matrix.		
	ŀ												
-	ŧ												
4244.0	Ľ,	3.96											
1314.9 -		4.16	В	CSS	21 1 15/50mm	5/50mn	1 45	W, UW, G, S Ch	SM				Sample refusai
	ŀ								JIN				
	-												Very hard
	-												drilling
1313.9 -	-5												
	[5.49								5 50			
	-	0.40			22			W, UW, G,		5.50 <u>GM</u> - silty gravel with s			
	╞	5.94	С	CSS	29 34	63	90	S, Ch	GM	5.90			
1312.9 -	-6				14					SM - Silty sand with g	avel.		
		6.40	D	SPT	32 38	70	90	W, G, S	SM	6.40			
										<u>GP</u> - poorly graded sa Cobbles within the soi	nd with gravel.		[
	F									Cobbles within the soi	I matrix.		
1311.9 -	-7												
	┝												
	F												
	Ľ												
1310.9 -	-8												
	-												
	\vdash	8.58											
	-		E	SPT	10/25mm1	3/25mm	-0						Sample refusal
4900 0									<u></u>				
1309.9 -	-9								GP				
	Ļ											1	
	ŀ												
	F												

1						1()/12/98	<u> </u>		EXPL	ORATIO	N LOG			
	START DATE 10/12/98												•		SHEET 2 OF 3
	TRANSP	TMENT O	N		ND DATE			 kee River B	ridae I	Renlacer	nent (R_2	352)	STATION	BB 1+20 5 m Right	
					OB DESCR			River Near H		(opidooi		002/	OFFSET		
	4		\setminus		DCATION DRING		B-2						ENGINEER EQUIPMENT	H. Perez MOBILE I	3-80
					A.#		423-1			GROU	NDWATER		OPERATOR	Pat Argall	
		\sim					18.87 (m)	·	DATE	DEPTH m		DRILLING	Rotary Wa	ash
	GEOTECH	INICAL											METHOD		ATE 10/15/98
ŀ	ENGINE	<u> </u>	1 T 64	MPLE	BLOWC				 		L		DACKFILLED	U	
	ELEV. (m)	DEPTH (m)	NO.		460	Last	Percent Recov'd	LAB TESTS	USCS Group		MAT	ERIAL DI	ESCRIPTION		REMARKS
		-											······		
		F		[
		ŀ													
	4007.0	h		1											
	1307.9 -	+-11 -													
		-													
		11.5	<u>ه</u>		24				-GW	11.60	GW-GM -	well-grade	d gravel with silt	and	Sample resufal
	1306.9 -	- 	F	SPT	8/0mm	8/0mm	30	W, S	Gim		sand.			/	·
	1306.9 -	- 12 - 2.0	1	1		1			1		the soil m	iy graded g atrix.	ravel. Cobbles	Within	
		ŀ							GP						Very hard
		}						1							drilling
		-													
	1305.9 -	- 1313.11		SPT	26 3	30/50mn	n 40	S		<u> 13.11</u>	GP - noor	ly graded g	ravel. Cobbles		Sample refusal
		-		10.1	30/50mm			<u> </u>			the soil m	atrix.			Cumpio i cracui
		┝													
		F							GP						
	1304.9 -	- 14													
		-													
		F							·	14.63	GP - DOOR	ly graded g	ravel. Cobbles	within	1
	1202.0	- 15									the soil m	atrix.			
	1303.9 -	- 15													
		-							GP						
		┝													
	1302.9 -	- 16													
	1302.9 -									16.15	GP - poor		ravel. Cobbles v	within	
		F							l		the soil ma	atrix.			:
		╞		ł											
	1301.9 -	- 17							GP						
	1301.9 -	17.22	_	ļ						1					
		- 17.45	5 H	SPT	12 2 25/50mm	5/50mn	n 30	S							
٥		ŀ								17.68	GP noor	v graded -	ravel Cathles	within	
102/0	1300.9 -										GP - poor the soil ma	iy graded g atrix.	ravel. Cobbles v	will 1111	
E	1300.9 -	- "													
101		╞							GP						
2		ŀ			1										
Z	1200.0	L ₁₀	}												
50	1299.9 -								·	19.20					
HAFE		ŀ									GP - poor the soil ma	iy graded g atrix.	ravel. Cobbles v	within	
NV_DOT HAFED.GPJ NV_DOT.GDT 11/02/00		ŀ								1					
≩		ļ.													

					40)/12/98	. <u></u>		EXPL	ORATIO	N LOG			
		4	-		-)/13/98	· ·					•		SHEET 3 OF 3
TRANS	RTMENT OF				_		 kee River B	ridae F	Replacen	nent (B-2	352)	STATION	BB 1+20 5 m Right	
				B DESCRI			River Near I		(opidoon			OFFSET	H. Perez	
		\setminus		CATION		B-2						ENGINEER EQUIPMENT	MOBILE	3-80
				ORING		423-1			GROU	NDWATE		OPERATOR	Pat Argall	
				A. #			m)				ELEV. m	DRILLING	Rotary Wa	
GEOTE	UNICAL		G	ROUND EL	EV		afety		10/15/98		1315.2			ATE 10/15/98
ENGE	HNICAL			AMMER DR					L	l	L	BACKFILLED	D	ATE
ELEV. (m)	DEPTH (m)		MPLE TYPE	BLOW C 150 mm Increments	Last	Percent Recovid	LAB TESTS	USCS Group		MAT	ERIAL D	ESCRIPTION		REMARKS
	\mathbf{F}							GP						
1	<u>}</u>													Sample refusal
	20.78		SPT	10/25mm1	0/25mr			4	20.90					
1297.9	-21								20.30					Very hard
	\mathbf{F}					1								drilling
1	F													Lost slurry circulation
	Ľ					1								GIGUAUUII
1296.9	-22		l						1					
	+													
	ŀ	1												
	Ē													
1295.9	-23				1									
1	ł													
	ł		Į			1		ļ						
	Ľ							-						
1294.9			1											
	+								1					
1	ŀ													
	t				1									
1293.9	-25													
	\mathbf{F}								1					
	<u>}</u>													
	Į							1						
1292.9	I-26													
	$\mathbf{F}_{\mathbf{r}}$													
	ŀ				1									
	t	1												
1291.9	-27													
	+]						
	+													
3	ł													
1290.9	-28					}								
[]						1		1						
1289.9	\mathbf{F}													
ā. ≥	ł					1								
2 1289.9	-29													
	+			l										
HAFED	ŀ													
	F													
	L	1	1			1)		1					

ſ						- 10)/14/98	·		EXPL	ORATION	LOG			
	DEDAD	THENT O)/15/98	······ ·					•	DD 4 .75	SHEET 1 OF 3
		PORTATIO						ee River B	ridae f	Replacer	nent (B-235	52)	STATION _	BB 1+75 7 m Right	
					DB DESCRI			River Near I		(opidooi			OFFSET -	H. Perez	
	4		\mathbf{i}		OCATION		B-3	Aver rear i	laicu				ENGINEER _	MOBILE	3-80
					ORING					000			EQUIPMENT _	Pat Argall	
			/		A. #	_	2423-1			DATE	DEPTH m				
1			الملم		ROUND EL					10/15/98		1315.2	DRILLING	Rotary W	
L	GEOTEC ENGIN	HNICAL	1		AMMER DR		STEM	afety					BACKFILLED _	Yes D	ATE 10/15/98
	ELEV. (m)	DEPTH (m)		TYPE	BLOW C 150 mm Increments	Last	Percent Recovid	LAB TESTS	USCS Group				ESCRIPTION		REMARKS
		-		-		}			sw	0.30	<u>SW</u> - Well-g	graded sa	nd with gravel.		
		-			1				<u> </u>	+		graded sa	nd with cobbles.		
		F							sw						
		-								0.91					
	1317.8	+ 1									<u>SW</u> - Well-g bouiders.	graded sa	nd with cobbles a	Ind	
		E							SW						
		Ĺ							<u></u>	1.52			vel with sand, co	hhles	
		-									and boulder	naueu gra rs.	wei with Sand, Co	DDIC3	
	1316.8	-2							GW						
		-			}										
		2.4	4	+	4	<u> </u>				2.44	<u>CL</u> - Sandy	lean clay			
		F	A	SPT	4	9	100	S, W, PI, LL, PL	CL			ican ciay	•		
	1315.8	<u>- 2.9</u> -3		<u> </u>	5					2.90	GP - noorly	graded g	ravel with sand, o	obbles	
	1315.6	– 3		1							and boulder	graded gr IS.	aver with Sand, e	0000163	
		-		1											
	2	¥							l						
		F							l						
	1314.8	+ 4													
		F				Ì			GP						
		Ľ		}						}					
		Ĺ								}					
	1313.8 ·	- 5							{						Very hard
		-							ļ						drilling.
		- 5.4	<u> </u>	<u> </u>					L	5.49					Drilling rate: 75 mm/min
		┢	в	SPT	21 16	35	90	S, W	GW		GW-GM - W sand.	ell grade	d gravel with silt a	and	@ 300 psi
		5.9		<u> </u>	19				GM	5.94				· · ·	downward pressure.
	1312.8	6			ļ						<u>SM</u> - silty sa boulders.	and with g	ravel, cobbles an	d	pressure.
		[DUUIUEIS.				
		ŀ								1					
		\mathbf{F}		1											
	1311.8	-7													
		F	1						SM						
		ŀ													
зÌ		T			1					1					
Į	1310.8	F_8		}						1					Very hard
	1010.0	ļ		1											drilling.
키		8.5		1		l			l	8.53					Drilling rate: 50
3				t	25 23		<u> </u>		GP	+ -0.00	GP-GM - Po	orly grade	ed gravel with silt	and	mm/ min @ 300 psi
2]		8.9	C	SPT	23 18	41	90	S, W	GM	8.99	sand.		-		downward
5	1309.8	9-0.5	+	<u>†</u>				······		- 0.33	GP - poorly	graded gi	avel with sand an	nd	pressure.
		Į									cobbles.	·			
Ì		[GP						
3		F								1					
≥L		1													

FTART DATE L01/499 EXPLORATION LOG SHEET 2 OF INDEXT 101/990 STATON MODEL STATON STATON STATON STATON STATON STATON STATON MODEL STATON				-	**************************************		014 410-			EXPLO	RATIO	NIOG				
Bit DATE LD 1300 BIT 175 Image: Deb DATE LD Cartion Truckee River Near Hafed OFFSET OFFSET Truckee River Near Hafed BORNO MB-3 Counton			Щ					<u> </u>					•		SHEET 2 0)F 3
LOCATION Truckee River Near Hafed Diver Instant MD-1 BORING MB-3 BORING MB-3 BORING MOBILE B-30 BORING MB-3 GROUNDWATER LEVEL DOPERATOR MOBILE B-30 GROUND ELEV 1318.81 (m) DATE DOPERATOR PEAL Argall GROUND ELEV 1318.81 (m) DATE DOPERATOR PEAL Argall GROUND ELEV 1318.81 (m) DATE DOPERATOR PEAL Argall GROUND ELEV 1318.81 (m) DATE DATE DOPERATOR PEAL Argall GROUND ELEV 104 (m) DATE DATE DOPERATOR PEAL Argall GROUND Y Samedia DATE DATE DOPERATOR PEAL Argall 102.8 D SPT 18 990 S, W GP MATERIAL DESCRIPTION REMARKS 1307.8 11 GP GP 10.05 GP Poorty graded gravel with satt and mark 1307.8 11.8 GP GP 13.11 SM - Billy sand with gravel.	TRA	ARTMENT NSPORTAT	ION						Deidaa				STATION	BB 1+7		
BORING MB-3 T2423-1 GROUNDWATER LEVEL GROUNDWATER LEVEL GROUNDWATER LEVEL BOUNDELEV. 1318.81 (m) DEDICE 520 Control LEV DEDICE 520 Control LEVEL DEDICE 520 ContreVEL DEDICE 520						-					ent (B-23	352)	OFFSET			
EX.8 72423-1 GROUNDELEV GROUNDWATER LEVE. Control of the control of								NIVEI INEAI	naleu							
OTTE: DEPTH In ELEV. II Matter DROP SYSTEM. Safety DATE: DEPTH IN ELEV. II Matter DROP SYSTEM. Safety DATE: DEPTH IN ELEV. II Matter DROP SYSTEM. Safety DATE: DEPTH IN ELEV. II Matter DROP SYSTEM. Safety DATE: DEPTH IN ELEV. II Matter DROP SYSTEM. Safety Matter Sacarce Colling Matter Sacarce Colspan= Poorty graded gravel with salt and Too Sacarce Matter Sacarce Colspan= Poorty graded gravel with sand 1306.8 Fort 22 Sacarce Colspan= Poorty graded gravel with sand 1306.8 Fort 22<			\mathbf{V}													
DESCRIBUTION HAMMER DROP SYSTEM Safety 10/15/988 3.85 13/15.2 MEHTOD COUNT Vision ELEX DEPTH MOUPPE 10 MOU CUUNT LAB TESTS USCS MATERIAL DESCRIPTION REMARKS 10.52 0.52 D SPT 18 mm 3.80 90 S. W OP 10.62 Provide 10.75/988 Poorty graded gravel with sitt and 10.52 10.52 0.57 18 3.8 90 S. W OP 10.65 OP TO COMPT graded gravel with sitt and 10.52 1307.8 11 0 0 S. UV, W OP 11.58 GP - Doorly graded gravel with sitt and 10.52 1306.8 13/2.04 E CSS 25 100 S. UV, W GP Sand. 12.04 Sand. 13.11								(m)								
BLCX DEPTH SAMARE ORCP SYSTEM Jatery Image: Constraints and provide the second sec	GEOT	ECHNICAL								10/15/98			METHOD			
Image: Construct and Source and	ENG	INEERING					STEM_	Salety					BACKFILLED	Yes	DATE	}
1005 D SPT 18 20 39 90 5, W GP GM 10.05 10.52 POOTY graded gravel with sitt and 10.52 1307.8 11 1 20 90 5, W GP 10.55 20.07/9 graded gravel with sitt and 10.52 50 50 100 5, UW, W GP 11.56 GP-GM Poorty graded gravel with sitt and 12.04 11.50 1306.8 12.28 E CSS 28 55 100 S, UW, W GP 11.50 GP-GM Poorty graded gravel with sitt and 12.04 12.04 50 50 50 100 S, UW, W GP 13.11 SM SM 13.65 GP 13.56 GP 13.56 GP 13.56 GP 50 50 SV SM 13.65 GP 13.65 GP 13.56 GP 13.56 GP 13.56 GP 13.56 GP			нг		150 mn	n Last	Percent	LAB TESTS	USCS		MATE		SCRIPTION		REMARKS	
10.52 D 20 D 0.0		- 10.			18											
1307.8 -11 GP 1307.8 -11 GP 11.69 -11 1308.8 -122.04 E 1308.8 -122.04 E 1308.8 -122.04 C 1308.8 -133.11		- 10.				- 39	90	S, W		l Sa	and.		•			
Instruction Image: Construction of the second		Ĺ							T -		P - poorly	graded gr	avel with sand.		-	
1306.8 11.58 11.58 11.58 1306.8 122.04 E CSS 28 55 100 S. UW, W, GP 12.04 1306.8 122.04 Interview Interview Interview Interview Interview 1305.8 130.3 Interview Interview Interview Interview Interview 1305.8 130.3 Interview Interview Interview Interview Interview 1305.8 Interview Interview Interview Interview Interview Interview 1305.8 Interview Interview Interview Interview Interview 1305.8 Interview Interview Interview Interview Interview 1304.8 Interview Interview Interview Interview Interview 1303.8 Inter	1307.8	1 - 11														j
1306.8 E CSS 28 27 55 100 S, UW, W, G, Ch GP GM GP 12.04 GP-GM - Poorly graded gravel with silt and sand. 1306.8		F							GP							
1306.8 E CSS 28 27 55 100 S, UW, W, G, Ch GP GM GP 12.04 GP-GM - Poorly graded gravel with silt and sand. 1306.8		+ 11.6	58													
1306.8 192.04 200 27 33 100 G, Ch GM 12.04 sand. 1306.8					48		1	SINWW			-GM - P	ooriv grade	d gravel with si		_	
1305.8 -13/3.11 -13/3.11 -13/3.11 1305.8 -13/3.11 -13.11 1305.8 F SPT 22 1305.8 -13/3.11 -13.11 1304.8 -14 -14 1303.8 -14 1303.8 -15 1302.8 -16 1301.8 -17	1306.8	L 1212.0		CSS		55	100	G, Ch		sa	nd.	sony grade	a graver with Si			
1305.8 -131.3.11 -13.11 -13.11 -136.8 F SPT 22 59 92 S. W SM 1304.8 -14 -14 -14 -13.56 -13.56 1304.8 -14 -14 -14 -14 1303.8 -15 -15 -15 1302.8 -16 -16 -16 1301.8 -17 -16 -17		-				1	·		†		- poorly	graded gra	avel with sand.		-	
1305.8 1313.11 13.11 13.11 13.56 F SPT 22 59 92 S, W SM SM - silty sand with gravel. 1304.8 14 13.56 GP - poorly graded gravel with sand and cobbles. GP - poorly graded gravel with sand and cobbles. 1303.8 15 1302.8 16 GP GP 1301.8 17 I I I GP	_	\mathbf{F}										- •				
1304.8 -14 -13.56 -13.11 SM - silty sand with gravel. 1304.8 -14 -14 -14 -14 1302.8 -15 -15 -15 1302.8 -16 1301.8 -17		t							GP							
1304.8 -14 -13.56 -13.11 SM - silty sand with gravel. 1304.8 -14 -14 -14 -14 1302.8 -15 -15 -15 1302.8 -16 1301.8 -17	1305.8	F 1313 1														
Isos F SPT 22 59 92 S, W SM Isos		-	T		22	+			╡─╴			and with an			-	
1304.8 -14 1303.8 -15 1302.8 -16 1301.8 -17		13.5	F 6	SPT	22	59	92	S, W	SM		i - siity se	and with gra	avel.			
1304.8 14 	2	1	1	1						13.56 GP	- poorly	graded gra	vel with sand a		-	
1303.8 - 15 	1304.8	L 14								cot	bles.	g g.u	inor mar sand a			
1302.8 - 16 		-						1								
1302.8 - 16 		F	1													
1302.8 - 16 		F														
1302.8 - 16 	1303.8	L 15														
GP		+														
GP		F														
GP		Ē														
GP	1302.8	L 16														
		-														
	4	F							GP							
		F					1									
	1301.8	Ĺ,														
1300.8 - 18 $1299.8 - 19$ $1299.8 - 19$ 19.20 $19.35 - G SPT 40 40 0$ $GP - poorly graded gravel with sand and cobbles.$ 19.66 $GP - poorly graded gravel with sand and M No recovery.$		↓ ″														
1300.8 - 18 + 18 + 19 + 19.20 + 19.2		ŀ														
1300.8 - 18 - 18 - 18 - 18 - 19 - 19 - 19 - 1	2	F														
1299.8 - 19 $1299.8 - 19$ 19.20 $19.35 G SPT 40 40 0$ $GP - poorly graded gravel with sand and cobbles.$ 19.66 $GP - poorly graded gravel with sand and$ $Or recovery.$	1300 8 -	L_10														
$1299.8 - 19 \\ 19.20 \\ 19.35 G SPT 40 40 0 \\ \hline 19.35 G SPT 40 40 0 \\ \hline 19.35 G SPT 40 40 0 \\ \hline 19.66 \\ GP - poorly graded gravel with sand and cobbles. \\ 19.66 \\ GP - poorly graded gravel with sand and \\ \hline GP - poorly graded gravel with sand and \\ \hline SP - poorly graded gravel with sand$	- 1300.0 -	- 10														
1299.8 -19 -10	5	-														
1299.8 19 19 19.20 1	ă >	 														
Image: Section of the section of t	2													-		
19.35 G SPT 40 0 Image: Second structure Image: S	2 1299.0	19.20								19.20						
Image: Contract of the second seco	HAF	19.35	G	SPT	40	40	0		GP	<u>GP</u> -	poorly g	raded grave	el with sand and	a		
GP - poorly graded gravel with sand and	<u>s</u>	-							Gr	19.66						
										<u>GP</u> -	poorly g	raded grave	el with sand and	1 I		

ſ						10	/14/98			EXPL	ORATIO	N LOG			
			41				/15/98						•	004.75	SHEET 3 OF 3
	TRANSP	IMENT OF ORTATION			ID DATE				ridae I	Ponlacer	nent (B-2	252)	STATION	BB 1+75 7 m Right	
					B DESCRI	PTION Tr		River Near H		Cplacel			OFFSET	H. Perez	
	6		\setminus		CATION		B-3	aver rear r	laicu				ENGINEER	MOBILE	3-80
					ORING		423-1			GROU	NDWATE		OPERATOR	Pat Argall	
					A.#		18.81 (m)				ELEV.	DRILLING	Rotary Wa	
	GEOTECH	DUCAL	الملام		ROUND EL					10/15/98		1315.2			ATE 10/15/98
	GEOTECH	ERING			MMER DR		STEM	alety		L	L		BACKFILLED	D	ATE
ſ	ELEV. (m)	DEPTH (m)	SAI NO.	MPLE TYPE	BLOW C 150 mm Increments	Last	Percent Recov/d	LAB TESTS	USCS		MAT	ERIAL D	ESCRIPTION		REMARKS
T			1		moremento		I COOT G			-	cobbles.				
		-													
		\vdash							GP						
		-													
	1297.8 -	-21													
		Γ													
		21.64							1	21.64					
		ŀ									<u>GP</u> - pool cobbles.	rly graded g	ravel with sand	and	Coring was stopped due to
	1296.8 -	-22		CORE			15		GP	00.05	00000.000				equipment
		- 22.25							1	22.25	GP - poor	rlv araded a	ravel with sand a	and	difficulties.
		[cobbles.				
		Ļ													
	1295.8 -	-23							GP						
		F													
		-													Very hard
		[ļ	23.77					drilling.
	1294.8 -	-24													Drilling rate: 75 mm/min
		╞													@ 300 psi
		F													downward pressure.
		Ľ													•
	1293.8 -	-25							1						
		-													
		F													
		ŀ													
	1292.8 -	-26													
	1292.0	- 20													
		╞													
		┝								1					
	1204 0	L				}									
	1291.8 -	-27				1									
		F]						
		┝													
020		<u>ا</u>													
린	1290.8 -	-28													
9		ŀ													
8		┝													
≧]		F													
9	1289.8 -	-29			}										
FE		[}						
NV_DOT HAFED.GPJ NV_DOT.GDT 11/02/00		-	1												
5		┝													
źΙ		1	1	1	1	1	1		1						

	17A		s		= 10)/15/99	<u>.</u>		EXPL	ORATIO	N LOG	<u> </u>		SHEET 1 OF 1
DEDAS				ND DATE)/15/98						•	BB 1+98	SHEET 1 UF 1
TRANS	PORTATION	•		DB DESCR			kee River B	ridae F	Replacer	nent (B-2	352)	STATION	2 m Right	
							River Near H					OFFSET	H. Perez	
		\setminus		DCATION		B-4						ENGINEER	MOBILE E	3-80
				DRING		2423-1			GROU			OPERATOR	Pat Argall	
				A.#			·····			NDWATER				
0.000		الللم		ROUND EL		816.98 (كالت المعارية المراجعين المترج المتعاد المحد الأواجع		10/15/98		1315.5	DRILLING METHOD		Solid Auger
GEOTEC ENGIN	EERING			AMMER DF			barety		L	I	l	BACKFILLED	Yes D	ATE 10/15/98
ELEV. (m)	DEPTH (m0.00	SA NO.	MPLE TYPE	BLOW C 150 mm Increments	Last	Percent Recovid	LAB TESTS	USCS Group				ESCRIPTION		REMARKS
[F				ļ					SM - Silty	sand, light	brown, moist.		
	╞	A	BULK			100	S, RV	SM						
	ł						-,							
	0.91	ļ	i		ļ	ļ		ļ	0.91			<u> </u>		
1316.0	t'		1		İ					SP-SM - F gravel, lig	Poorly grad ht brown, v	ed sand with silt vet.	and	
,	Ţ	в	BULK			100	S, RV	SP SM		3				
	ŧ]		SM						
	1.83	<u> </u>	<u> </u>			<u> </u>		<u> </u>	1.83					
1315.0	-2									sand, light	roony grad t brown, we	led gravel with si et.	it and	
	F	С	BULK			100	S, RV	GP GM						
	[
	2.74								2.74					
1314.0	-3													
	F		1											
	F													i
	Ē							l						
1313.0	L ₄													
	F							[
	-													
	-													
1212.0														
1312.0 -	L, I													
]	-													
	-													
	\mathbf{F}													
1311.0 -	-6													
	F													
1310.0 -	-7													
	F							l	1					
1														
								l	1					
1309.0 -	-8													
l	F]	1					
ł	F													
ł									1					
1308.0 -	- 9													
1300.0	-													
	-								1					
	-													
1	F													

DEPA	WA RTMENT OF	D)/15/99)/15/98	••••••••••••••••••••••••••••••••••••••		EXPL	ORATIO	N LOG		BB 2+10	SHEET 1 OF 1
TRANS	RTMENT OF			B DESCRI	PTION	Truc	kee River B	ridge f	Replacer	nent (B-2	2352)	STATION OFFSET	1 m Left	
				OCATION		uckee F	River Near I	lafed				ENGINEER	H. Perez	
A			в	ORING	_M	B-5				<u> </u>		EQUIPMENT	MOBILE E	3-80
		/		A. #		423-1				NDWATE		OPERATOR	Pat Argall	
			G	ROUND EL	EV. 13	816.74 (m)		DATE 10/15/98		ELEV. m	DRILLING METHOD		olid Auger
GEOTEC	CHINICAL		H	AMMER DF	OP SYS	STEM _S	Safety			2.10	1014.0	BACKFILLED	Yes D	ATE 10/15/98
ELEV. (m)	DEPTH (m0).00		MPLE TYPE	BLOW C 150 mm Increments	Last	Percent Recovid	LAB TESTS	USCS Group				ESCRIPTION		REMARKS
	+							1		SM - Silty	/ sand, light	brown, moist.		
	F	A	BULK		[100	S, RV	SM						
	È													
1315.7	<u> </u>				 			┥	0.91	SM - Silty	sand with	gravel, light brow	m. wet.	
	+										,	J		
	F	B	BULK			100	S, RV	SM						
	1.83								1.83					
1314.7								1						
	Ŧ	C	BULK			100	S, RV							
	\mathbf{F}	Ŭ					0,10							
	2.74		ļ					ļ	2.74					
1313.7	-3													
	+				1									
	-				ļ									
	Ľ				ļ									
1312.7	4 .								1					
	-													
	F													
	E				ļ		l							
1311.7	-5													
	-				ł									
	ŀ				l									
	Ľ				l	ļ								
1310.7	- 6				{									
	-													
	F				ļ									
	Ľ													
1309.7	+7													
	\mathbf{F}								}					
	ł													
в	Ľ		1											
1308.7 1308.7 1307.7 1307.7	- 8						}							
10	╞			1										
01.6	ŀ							1						
≏ ≩	Ľ			l										
2 1307.7	₽													
0.0	F													
¥	ł						ł							
5	1													
≩	T i]								

ſ						10	/15/98			EXPLORATION LOG			
	DEDAE	<u>1'/:/</u>				-	/15/98				•		SHEET 1 OF 1
	TRANS	PORTATIO			ND DATE			ee River B	ridae P	Replacement (B-2352)	STATION _	BB 2+56	
					DB DESCRI			River Near H		(epiacement (D-2352)	OFFSET _	5 m Left	
	-1		\setminus	1000	DCATION		B-6	liver near r	laleu		ENGINEER _	H. Perez MOBILE B	80
				1000	ORING	1000	423-1				EQUIPMENT	Pat Argall	-00
				22.00	A. #					GROUNDWATER LEVEL	OPERATOR _		
	-				ROUND EL		16.89 (10/15/98 1.83 1315.1	DRILLING METHOD	150 mm S	the second second second second second second second second second second second second second second second s
	GEOTEC	HNICAL		H/	AMMER DR	ROP SYS	STEM_S	atety			BACKFILLED _	Yes DA	TE 10/15/1998
	ELEV. (m)	DEPTH (m).00		MPLE TYPE	BLOW C 150 mm Increments	OUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DE	SCRIPTION		REMARKS
		-								SM - Silty sand, light	brown, moist.		
		-	A	BULK			100	S, RV	SM				
		- 0.91								0.91		1	5
	1315.9	-1								SM - Silty sand with s	some gravel, light	brown,	
		F	в	BUIL			100	0.01		wet.			
		Ľ	В	BULK			100	S, RV	SM				
		1.83								1.83			
	1314.9	-2								GP-GM - Poorly grad	ed gravel with silf	and	
		-	c	BULK			100	S, RV	GP	sand, light brown, we	t.		22
		F		DOLK	1		100	5, KV	GM				
		2.74								2.74			
	1313.9	<u>_</u> 3											
	1010.0	-						1					
		-											
1		-											
		-											
	1312.9	-4										1	
		Ē											
		E											
		-											
	1311.9	-5											
		-											
		F											
		Ľ											
	1310.9	-6											
		-											
		-											
		-											
	1000 0	F _											
	1309.9	7											
		-									5		
		-											
26/00		F											
10/2	1308.9	8											
GDT		Ľ											
DOT		[
Ž		-											
GPJ	1307.9	-9											
ED		+											
HAI		-											
NV_DOT HAFED GPJ NV_DOT GDT 10/26/00		[×			
₹													
													A-10

TO BORING LOGS

			PARTI	CLE SIZE	LIMIT	S		
CLAY	SILT		SAND		GR/	AVEL	COBBLES	BOULDERS
· .		FINE	MEDIUM	COARSE	FINE	COARSE		
.002	; mm #:	200 #4	10 #	10 #4	19	7	5 mm 3	00 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
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 CO	INDITION CRITERIA	SOIL CEMENT	TATION CRITERIA
Description	<u>Criteria</u>	Description	<u>Criteria</u>
Dry	Absence of moisture, dusty,	Weak	Crumbles or breaks with handling or little
	dry to touch.		finger pressure.
Moist	Damp, no visible free water.	Moderate	Crumbles or breaks with considerable
Wet	Visible free water, usually below		finger pressure.
	groundwater table.	Strong	Won't break or crumble w/finger pressure



D

Е

G

Ħ

ĸ

Groundwater Elevation Symbols

ST	ANDARD PENETRATION CL	ASSIFICATIO	N*
GR	ANULAR SOIL	CLAY	EY 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
*Standard Penetr	ation Test (N) 63.5 Kg hammer	31 - 60	HARD
760mm free fall o	on 50.8mm O.D. x 35mm I.D. sampler.	OVER 60	VERY HARD

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 N₆₀ by: $(N_{AUTOMATIC})(1.25) = N_{60}$ $(N_{SAFETY})(1.17) = N_{60}$

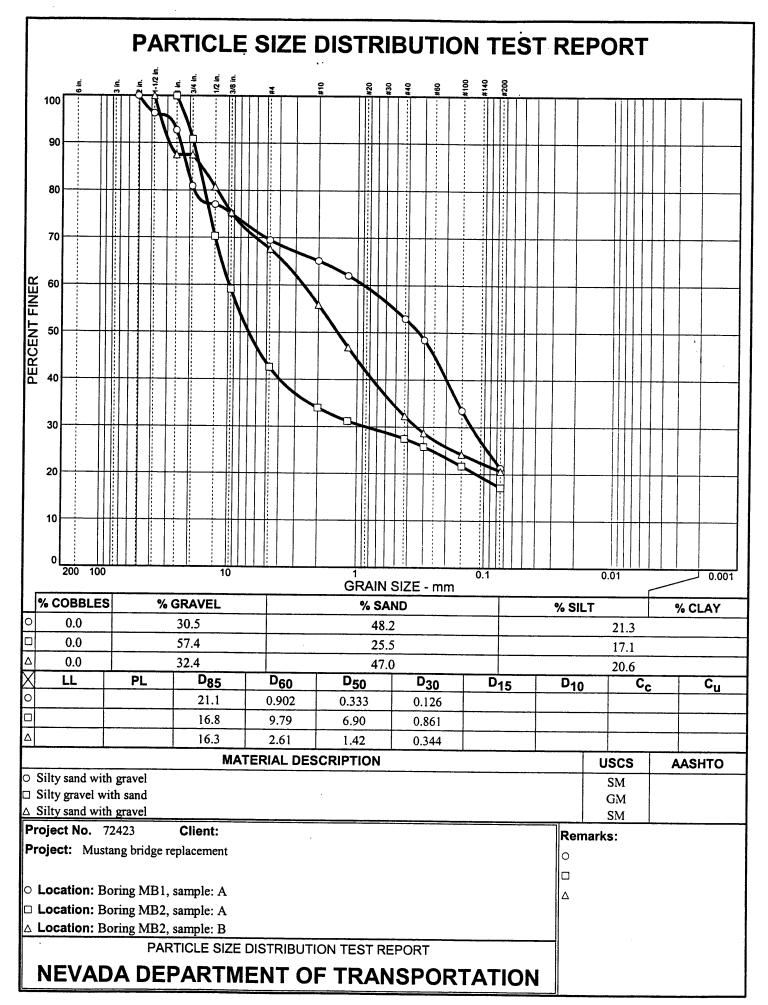
SAMPLER NOTATION **TEST ABBREVIATIONS** CALIF. MODIFIED SAMPLER 0 CONSOLIDATED DRAINED ORGANIC CONTENT CMS CD 0 CPT CONE PENETRATION CH CHEMICAL (CORROSIVENESS) OC CONSOLIDATION CONTINUOUS SAMPLER PLASTICITY INDEX CS CM COMPACTION PI CALIFORNIA SPLIT SPOON[®] CU CONSOLIDATED UNDRAINED RQD **ROCK QUALITY DESIGNATION** CSS PUSHED (NOT DRIVEN) RV **R-VALUE** P **DISPERSIVE SOILS** DIRECT SHEAR S SIEVE ANALYSIS PB PITCHER BARREL DS ROCK CORE RC **EXPANSIVE SOIL** SL SHRINKAGE LIMIT SHELBY TUBE® UNCONFINED COMPRESSION SH SPECIFIC GRAVITY U STANDARD PENETRATION TEST HYDROMETER UNCONSOLIDATED UNDRAINED SPT υυ TEST PIT UNIT WEIGHT TP HC **HYDRO-COLLAPSE** UW W **MOISTURE CONTENT** PERMEABILITY 1. I.D.= 61.5 mm 2- I.D.=82 mm with tube; 88.9mm w/o tube

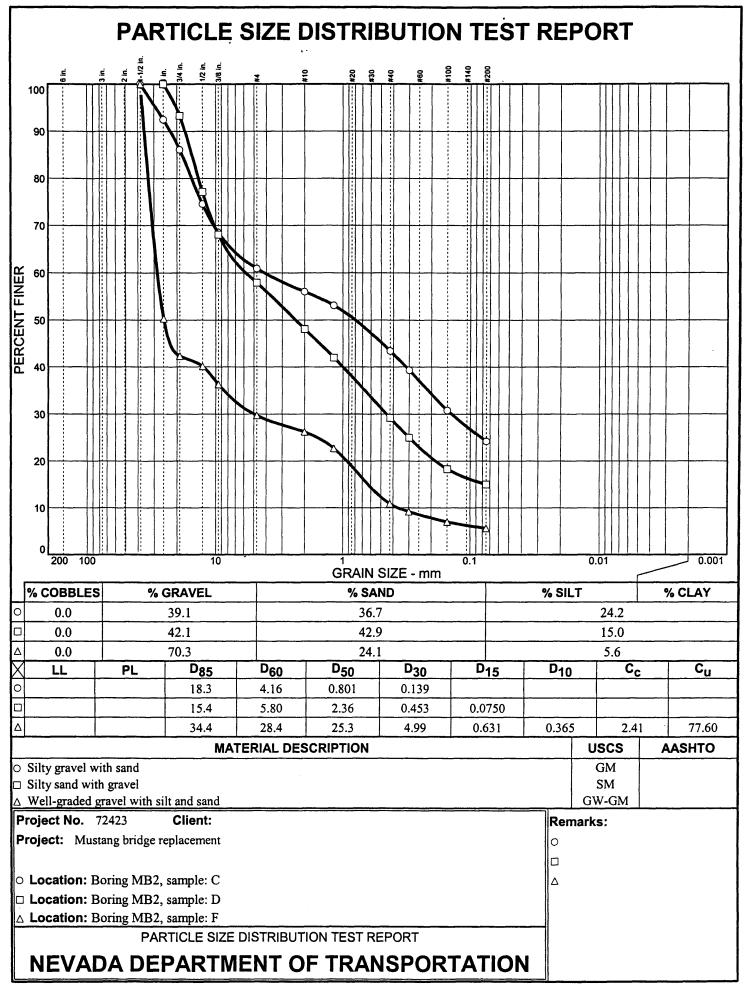
SOIL COLOR DESIGNATIONS ARE FROM THE MUNSELL SOIL COLOR CHART. 3- NXB I.D.= 47.625mm EXAMPLE: (7.5 YR 5/3) BROWN 4- I.D.= 73mm

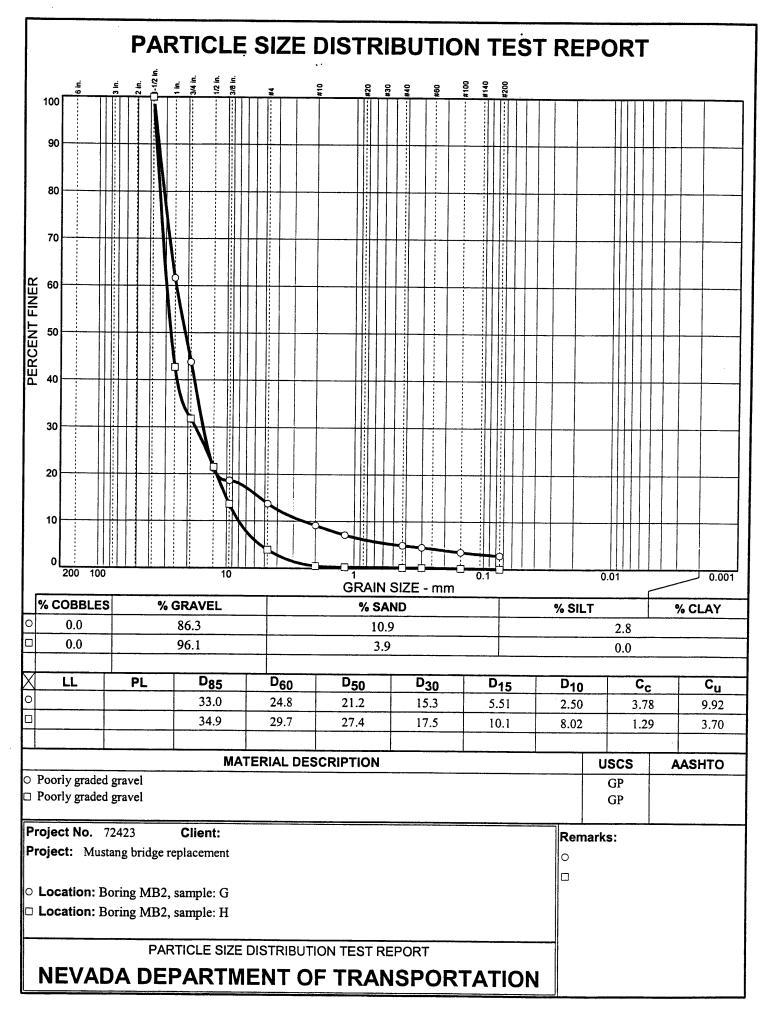
LAST MODIFIED: March 1, 2000

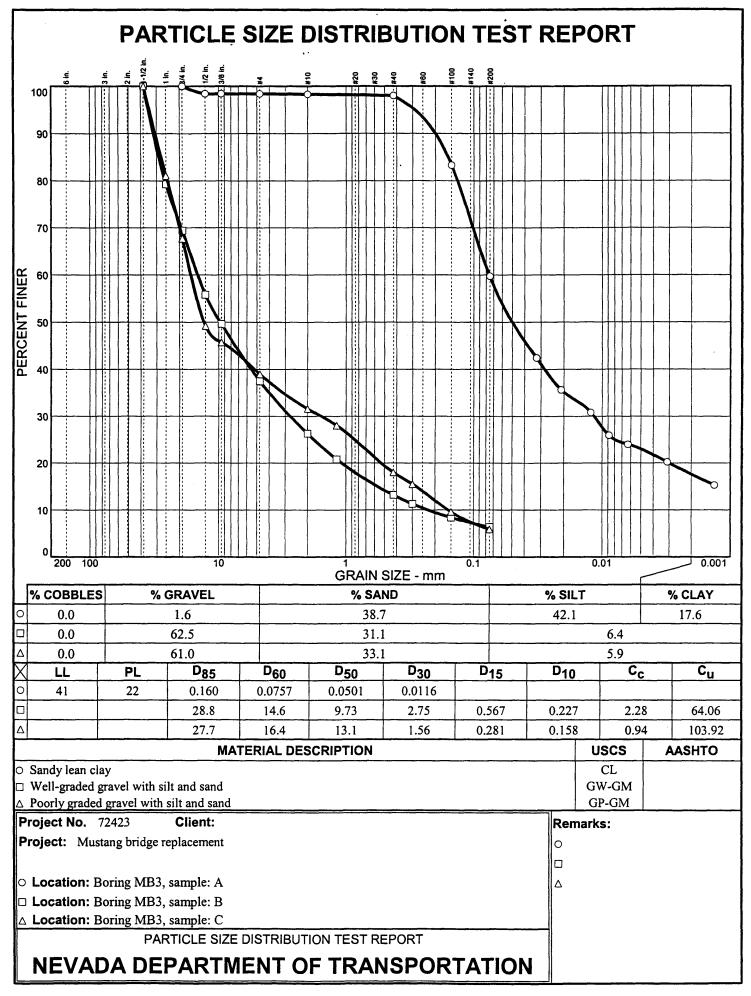
APPENDIX B

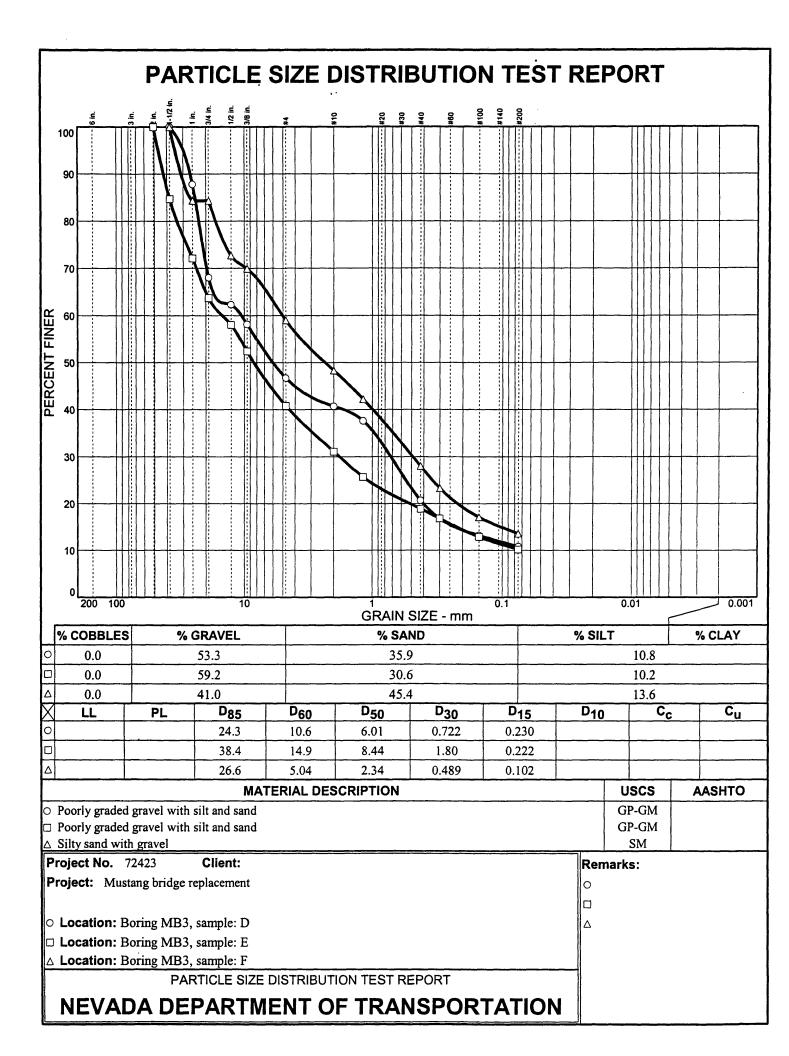
LABORATORY TEST RESULTS

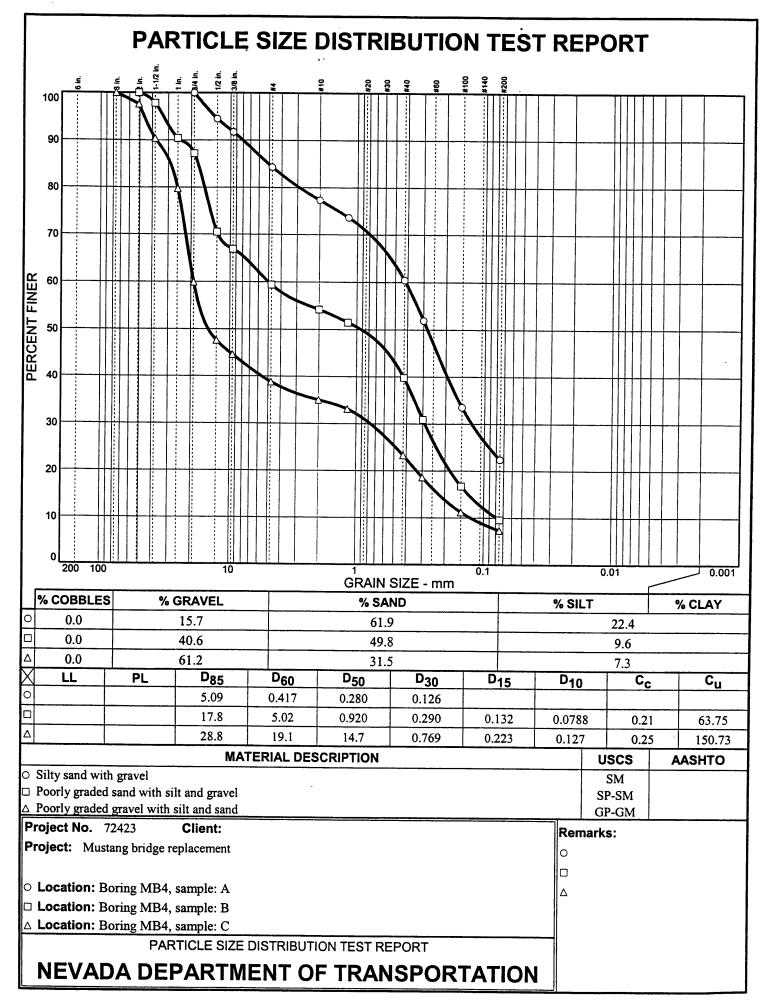


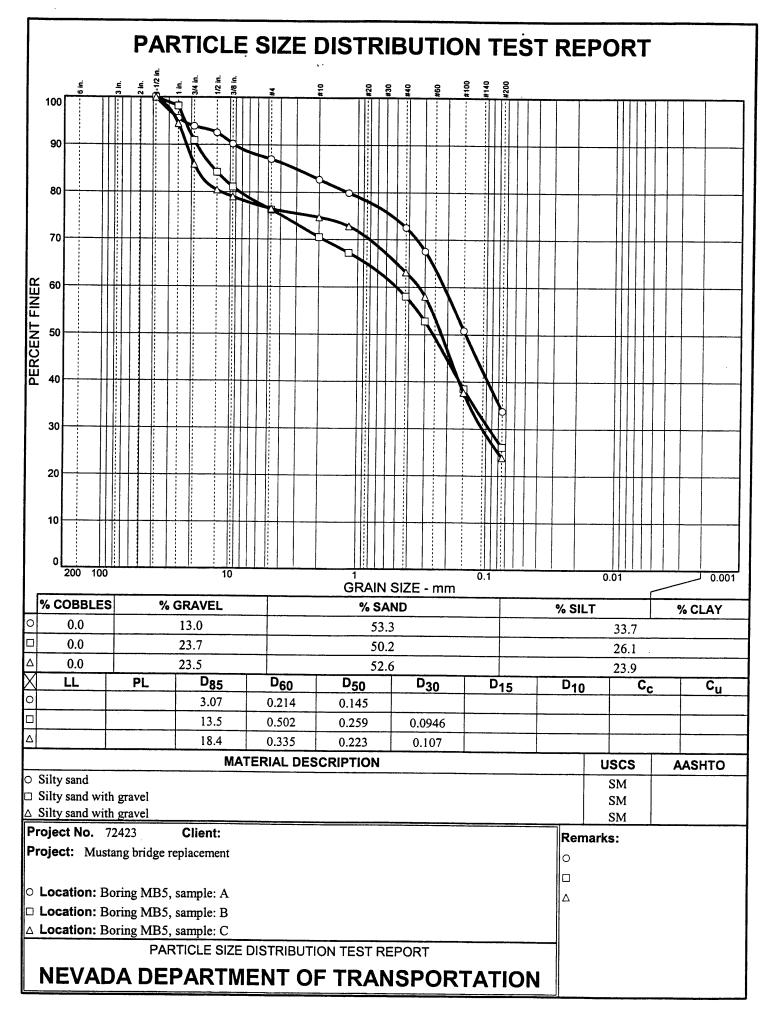


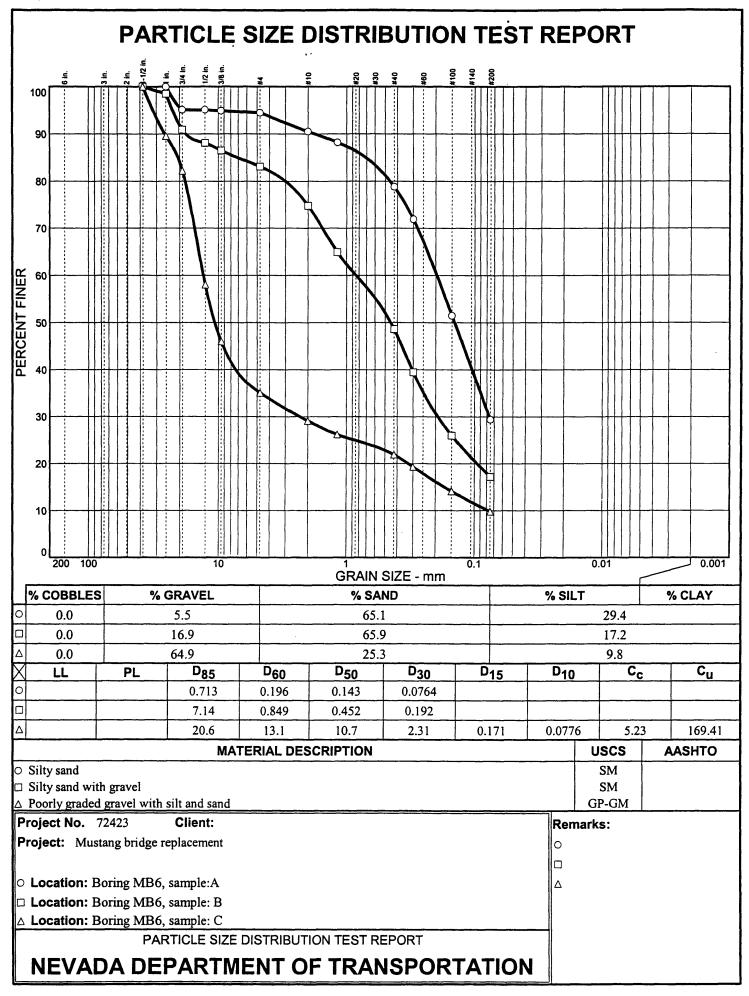












Summary Table

Project Description: Truckee River Bridge Replacement at Hafed **E.A. No.:** 72423-1

¹ Boring No.	Sample I.D.	² Depth (meters)	R-Value	Chlorides (PPM)	Sulfates (PPM)	pН	Resistivity (Ohm-cm)
	Α	0 - 0.9	72	70	0	8.1	3937
MB-4	В	0.9 - 1.8	76	60	0	8.0	4926
	С	1.8 - 2.7	78	60	0	8.1	5051
	Α	0 - 0.91	44	140	0	8.0	1425
MB-5	В	0.9 - 1.8	51	110	0	8.1	2353
	С	1.8 - 2.7	32	60	0	7.8	4032
	Α	0 - 0.9	70	70	0	8.0	3236
MB- 6	В	0.9 - 1.8	68	60	0	7.8	6410

Table 1. R-Value and Electrochemical Test Results

¹ See attached map for boring location.

² Measured from the ground surface.

72423 E.A. No.

N.D.O.T. GEOTECHNICAL SECTION

SUMMARY OF TEST RESULTS

Job Description Mustang bridge replacement

Elevation (m) See boring logs

Station See boring logs

Γ			<u> </u>	1		—					1	1.	<u> </u>
	OTHERS			Chem	Chem								
rest	C	KN/m ²											
IGTH	e e	deg.]											
STRENGTH TEST	TEST	TYPE (
	PÌ T	% T											
┢	PL	%											
┢	LL 1	%											
%		#200	21.3	17.1	20.6	24.2	15.0	5.6	2.8	0.0			
WET		KN/m ³			21.41	21.96							
	%M			17.2	15.0	19.5	13.6	8.0	4.2	3.0			
SOIL	GROUP		SM	GM	SM	MQ	SM	GW-GM	GР	GР			
z	BLOWS	per .3m		18	15\2"	63	20	8\0"	30\2"	25\3"			
SAMP-		TYPE	bulk	SPT	CSS	CSS	SPT	SPT	SPT	SPT			
SAMPLE	DEPTH	(m)	030	2.43 - 2.90	3.96 - 4.15	5.49 - 5.64	5.94 - 6.40	11.58 - 11.73	13.10 - 13.29	17.22 - 17.47			
SAMPLE	NO.		MB1-A	MB2-A	MB2-B	MB2-C	MB2-D	MB2-F	MB2-G	MB2-H			

SPT - Standard Penetration 35mm ID CS - Continuous Sample 82mm ID RC - Rock Core

PB - Pitcher Barrel

CSS - Calif. Split Spoon 61.5mm ID

TP - Test Pit

P = Pushed, not driven

G = Specific Gravity Pi - Plasticity Index **OC - Consolidation** NP - Non-Plastic PL - Plastic Limit LL - Liquid Limit Ch - Chemical RV - R · Value S - Sieve N - (Ncss)(0.62) N - No. of blows per 0.3m, sampler CU - Consolidated Undrained driven under 64kg mass CD - Consolidated Drained dropped 760mm. DS - Direct Shear φ - Friction C - Cohesion N - Field SPT

CM - Compaction

H - Hydrometer

UU - Unconsolidated Undrained U - Unconfined Compressive

E - Swell/Pressure on Expansive Soils

SL – Shrinkage Limit

UW - Unit Weight

W - Moisture Content

K - Permeability

0 - Organic Content

D - Dispersive

X – X-Ray Defraction

ROD - Rock Quality Designation

CPT - Cone Penetration Test

R - Refusal

Boring No. MB1 & MB2

72423 E.A. No.

Boring No. MB3

N.D.O.T. GEOTECHNICAL SECTION

Job Description Mustang bridge replacement

SUMMARY OF TEST RESULTS

Elevation (m) See boring logs

Station See boring logs

					.						_	 	
	OTHERS				-		G, Chem		No recoverv	3 5" recoverv	(monto)		
STRENGTH TEST	ပ	KN/m ²											
NGTH	9	deg.											
STRE	TEST												
	Id	%	19										
	PL	%	22										
	LL	%	4										
%	PASS	-	51.1	6.4	5.9	10.8	10.2	13.6					
WET	ΝŪ	KN/m ³					20.44						
	%M		30.2	12.4	9.6	15.6	13.7	15.2					
SOIL	GROUP		ML	GW-GM	GP-GM	GP-GM	GP-GM	SM					
z	BLOWS	TYPE per .3m	6	35	41	39	55	59	40\5"				
SAMP-	LER	TYPE	SPT	SPT	SPT	SPT	CSS	SPT	SPT	RC			
SAMPLE	DEPTH	(m)	2.43 - 2.90	5.49 - 5.94	8.53 - 8.99	10.06 - 10.52	11.58 - 12.04	13.11 - 13.56	19.0 - 19.34	21.64 - 22.25			
SAMPLE	NO.		MB3-A	MB3-B	MB3-C	MB3-D	MB3-E	MB3-F	MB3-G	MB3-H			

SH = Shelby Tube 73mm ID

SPT - Standard Penetration 35mm ID

UU - Unconsolidated Undrained U - Unconfined Compressive

CU - Consolidated Undrained

DS - Direct Shear φ - Friction C - Cohesion

CD - Consolidated Drained

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

dropped 760mm. N - Field SPT

N - No. of blows per 0.3m, sampler

driven under 64kg mass

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

CM - Compaction

E - Swell/Pressure on Expansive Soils

SL – Shrinkage Limit

UW – Unit Weight

W - Moisture Content

K - Permeability

0 - Organic Content

D - Dispersive

ROD - Rock Quality Designation

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

72423 E.A. No. MB4, MB5, & MB6

Boring No.

Job Description Mustang bridge replacement

N.D.O.T. GEOTECHNICAL SECTION

SUMMARY OF TEST RESULTS

See boring logs Elevation (m)

Station See boring logs

SAMPLE	SAMPLE	SAMP-	z	SOIL		WET	%	┢		S	STRENGTH TEST	THT:	EST	
NO.	DEPTH	LER	BLOWS	\mathbf{O}	%M	M	PASS				ST φ	the second value of the se	C C	OTHERS
	(m)	TYPE	per .3m			KN/m ³	#200	%	% %		TYPE de		KN/m ²	
MB4-A	091	bulk		SM			22.4							RV= 72
MB4-B	.91 - 1.83	bulk		SP-SM			9.6							RV= 76
MB4-C	1.83 - 2.74	bulk		GP-GM			7.3							RV= 78
MB5-A	091	bulk		SM			33.7							RV= 44
MB5-B	.91 - 1.83	bulk		SM			26.1							RV= 51
MB5-C	1.83 - 2.74	bulk		SM			23.9							RV= 32
MB6-A	091	bulk		SM			29.4							
MB6-B	.91 - 1.83	bulk		SM			17.2							RV= 70
MB6-C	1.83 - 2.74	bulk		GP-GM			9.8							RV= 60
														•
													1	

U - Unconfined Compressive DS - Direct Shear φ - Friction C - Cohesion SPT - Standard Penetration 35mm ID CSS - Calif. Split Spoon 61.5mm ID CS - Continuous Sample 82mm ID CPT - Cone Penetration Test SH - Shelby Tube 73mm ID P – Pushed, not driven PB - Pitcher Barrel RC - Rock Core TP - Test Pit R - Refusal

G - Specific Gravity PI - Plasticity Index OC - Consolidation PL - Plastic Limit NP - Non-Plastic LL – Liquid Limit Ch - Chemical RV - R · Value H = Hydrometer S = Sieve N - (Ncss)(0.62) N = No. of blows per 0.3m, sampler UU - Unconsolidated Undrained CU - Consolidated Undrained driven under 64kg mass CD - Consolidated Drained dropped 760mm.

E - Swell/Pressure on Expansive Soils CM - Compaction

SL - Shrinkage Limit

UW - Unit Weight

W - Moisture Content

K - Permeability

0 - Organic Content

D – Dispersive ROD – Rock Quality Designation

B-12

N - Field SPT