GEOTECHNICAL ENGINEERING INVESTIGATION

on

Agua Fria River Channelization
Grade Control Structure
at Indian School Road Bridge
SLA Project No. AZ-MC-06

in

Phoenix, Arizona

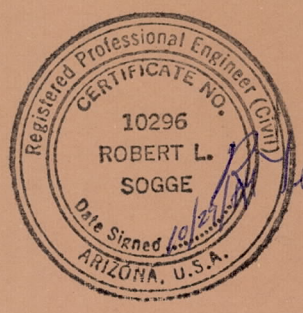
for

Simons, Li & Associates
120 W. Broadway, Suite 260
Tucson, Arizona 85702

524 N. 6th Ave.
Tucson, Arizona
85705
(602) 623-7774

DESERT EARTH ENGINEERING

October 29, 1984
84-208



consulting geotechnical engineers

October 29, 1984
84-208

Simons, Li & Associates
120 W. Broadway
Tucson, Arizona 85702

ATTN: John Lynch

RE: Geotechnical Engineering Report on Grade-Control Structure at Indian School Road Bridge and Agua Fria River

Gentlemen:

Desert Earth Engineering is pleased to submit this report covering design recommendations relating to foundation aspects on the above-captioned project. Our field investigation was conducted on September 12 and 13, 1984. Field testing results on selected samples obtained during the field investigation provide the basis for our engineering evaluation and our conclusions and recommendations.

The structure to be built on this site is a 1340-ft-long soil-cement grade control dike. Riverbed materials along the structure's alignment are sands, gravels, and cobbles. Strata with high cobble contents were not penetrable by our auger investigation and no borehole deeper than 25 ft was achieved. The upper ten feet is generally loose; for structures founded below this depth footings can be designed for a bearing capacity of 3500 pounds per square foot.

The soil-cement design for this structure will be covered in a separate report to be submitted upon completion of laboratory testing. This design will be based on strength and mix testing performed on samples taken from the alignment of the structure.

Our firm should be consulted if conditions encountered in the field are substantially different from those described in this report. This office, as part of our design function, should

Desert Earth Engineering
524 North Sixth Avenue
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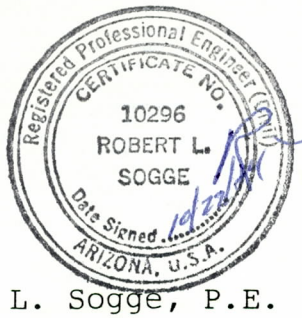
be engaged to observe soil conditions as they are uncovered during foundation and substructure installation in order to insure that the construction procedure is in accordance with the design recommendations. Such services are particularly necessary for monitoring the placement of engineered fill where required.

We wish to thank you for the pleasure of being associated with you on this project. If we can be of any further assistance, please call us.

Prepared and reviewed by:



R. L. Sogge, P.E.
Ralph Pattison

RLS/ajt
Copies: (2) Addressee
(1) Noel Borman
3555 Stanford Road
P.O. Box 1816
Ft. Collins, Colorado 80522

TABLE OF CONTENTS

SITE DESCRIPTION

Project Location: The project is located at the Indian School Road Bridge over the Agua Fria River approximately 11 miles west of I-17.

Topography: All boreholes were performed in a wide, flat river bottom, approximately 1600 ft wide.

Surface Water Drainage: River flow is to the south.

Vegetation Coverage: No substantial vegetation exists along the alignment of the structure.

PROPOSED DEVELOPMENT

Structure: A 1340-ft-long soil-cement grade control dike is to be built across the Agua Fria River 115 feet south of the Indian School Road bridge centerline.

Loads: Loads will not exceed 2700 pounds per square foot. This pressure is based on an assumed soil-cement density of 135 pounds per cubic foot and an assumed grade-control-structure height of twenty feet.

SCOPE OF WORK

The purpose of our work on this project is to conduct a field investigation and perform laboratory testing on the sampled soils in order to provide recommendations in report form for

design of the foundation system. The report includes a discussion of the most suitable foundation type, depth of foundation embedment, allowable soil bearing pressures, estimated settlement, collapse or expansion potentials, and recommendations on earthwork. Also included are discussions on site and foundation preparation and on surface and groundwater control.

FIELD INVESTIGATION

No. of Test Borings: 4
Location: See Site Plan Figure 1.
Date Drilled: September 12 and 13, 1984

A subsurface field investigation was conducted at the site using a Central Mining Equipment Model 55 drill rig, equipped with 6 5/8 inch OD, 3 1/4 inch ID hollow stem augers, to drill the bore holes. Soil sampling was achieved using a 2 inch OD, Split Spoon (SS) sampler, a 3 inch OD ring sampler, or bagged samples of auger cuttings.

The driving of the split spoon provides a measure of a soil's strength through Standard Penetration Test (SPT) blow count (N) values expressed in blows/ft. The disturbed samples provided can be used for moisture and soil property determinations. The ring sampler also yields penetration resistance data and provides "undisturbed" samples of cohesive fine grained soils for expansion or collapse tests. When blow counts are determined by the ring sampler using the same SPT

driving energy as for the split spoon, penetration resistances greater than the N-values will result due to its larger area. A penetrometer consisting of a 2 inch OD bull-nose sampler is also used to determine in-situ soil density. Penetration values from this device, expressed in blows/ft, also approximately correspond to split-spoon N values. The particular correspondence can be seen where both values were determined on the same soil strata. A blow count chart with density-consistency relations is presented in Appendix A.

Boring logs containing descriptions of the materials encountered in the subsurface investigation of the site are presented in Appendix A. A presentation of the penetration resistance values is also included on the boring logs. A soil profile for the project site is presented in Figure 2. This soil profile is a generalization of the subsurface soils found at each bore hole. It assumes that the overall soil conditions do not vary appreciably from those found at specific bore locations.

LABORATORY TESTING RESULTS

Grain Size Determination - Results in Appendix B.

Summary of Gradation and Plastic Index Tests

Boring No.	Depth (ft)	% Passing #200 Sieve	Liquid Limit	Plastic Index	USCS Symbol
B-1	10-11.5	6	NP	NP	SP
B-1	15-16.5	5	NP	NP	SP
B-1	20-21.5	6	NP	NP	SP

CONCLUSIONS AND RECOMMENDATIONS

The most important geotechnical feature of this site is the prevalence of cobbles in the subsurface soils along the dike alignment. These cobbles are especially common below a depth of ten feet although they exist in smaller percentages closer to the surface. The presence of these cobbles, and possibly some boulders, prevented any auger penetration beyond 25 ft, out of a target depth of 40 ft. A total of 14 attempts were made in 5 locations along the alignment. This impenetrable Sand Gravel Cobble (SGC) layer is a consistent commmon feature of the Phoenix area.

The remainder of the soil is composed of poorly-graded clean sands and gravels; clay and silt contents do not total more than 6 percent. The material is generally loose at depths of less than 10 feet, and then becomes denser with increasing depth.

Structures in the channel should be founded at least 10 feet below the river floor or three feet below the depth of maximum scour, whichever is greater. At these depths, footings can be designed for a bearing capacity of 3500 pounds per square foot.

A borehole investigation was performed in the spring of 1966 for the adjacent Indian School Road bridge. Information from this investigation confirms our findings. Examination of riverbed elevations extant in 1966 shows that a long-term bed degradation of about three feet has occurred in this channel.

Foundation

Foundation Type - Continous-wall foundations will be used to support this structure.

Supporting Foundations Soil - Structure footings will bear on a dense sand-gravel-cobble layer.

Allowable Bearing Capacity - 3500 psf at the specified footing depth. The bearing capacity varies with depth of embedment.

Minimum Footing Depth - 10 feet below existing grade or 3 ft below depth of maximum scour, whichever is greater. The footing depth is measured from the top of lowest adjacent grade to the bottom of the footing.

The allowable soil-bearing values specified may be increased one-third when considering wind or seismic forces either acting alone or when combined with vertical loads. The allowable bearing capacity may be increased one-fourth below the toes of retaining walls.

Approximate Total Settlement - Total settlement will be less than one inch.

Approximate Differential Settlement - Differential settlement will be less than one half of total settlement.

Collapse Potential - Collapse potential is negligible.

Swell Potential - Swell potential is negligible.

Lateral Foundation Pressures -

Active Sliding Pressure	35 pcf E.F.P.
Passive Resistance Pressure	300 pcf E.F.P.
Base Friction Coefficient (poured on grade)	$\tan 20^{o}$
Foundation Toe Pressures	Allowable x 1.25

E.F.P. = Equivalent Fluid Pressure

The pressure distribution behind a retaining wall depends on the deformation pattern of the wall. If wall movement is restrained near the top, pressures greater than the active condition, approaching K_o conditions, or 60 pcf E. F. P. are possible.

Passive and base friction resistance can be combined to resist sliding. A factor of safety of 1.5 should be used for sliding.

Site and Foundation Preparation

In view of the soils encountered, the following general procedure is recommended for preparation of the building site for support of foundation elements.

- Prepare the surface by stripping and removing all existing debris, vegetation, etc. from the project site.
- Excavate the length and width of the alignment to the required depth, using conventional earth moving equipment. If cobbles and boulders prevent efficient scraper operation, the use of front-end loaders may be required.
- Side Slopes may be formed as steeply as natural conditions allow, although slopes steeper than one-to-one are not recommended.
- Screen boulders and all cobbles larger than six inches from the excavated material and stockpile the remainder for use in the soil cement mix.
- Recompact all disturbed material at the bottom of the excavation before placement of soil-cement begins.

Summary of Compaction Requirements

Use	Min % Compaction*
Beneath foundation components and slabs-on-grade	
exposed in-situ subgrade soil	95%
engineered fill	95%
ABC (aggregate base course)	95%
Fill above footing bottom	90%

Beneath Roadways	95%
Beneath exterior slabs, pavements and pipelines	
exposed in-situ subgrade soil	90%
engineered fill	90%
ABC	95%

* These percentages are of Standard Proctor (ASTM D 698)

Surface Water and Groundwater Control

The material at this site is such that it will not be greatly affected by surface and subsurface groundwater. It is nevertheless recommended that surface water runoff be controlled to prevent ponding and infilitration into the foundation soil. The grade of the surface shall be sloped away from the structure as soon as backfill around the walls and footings are in place.

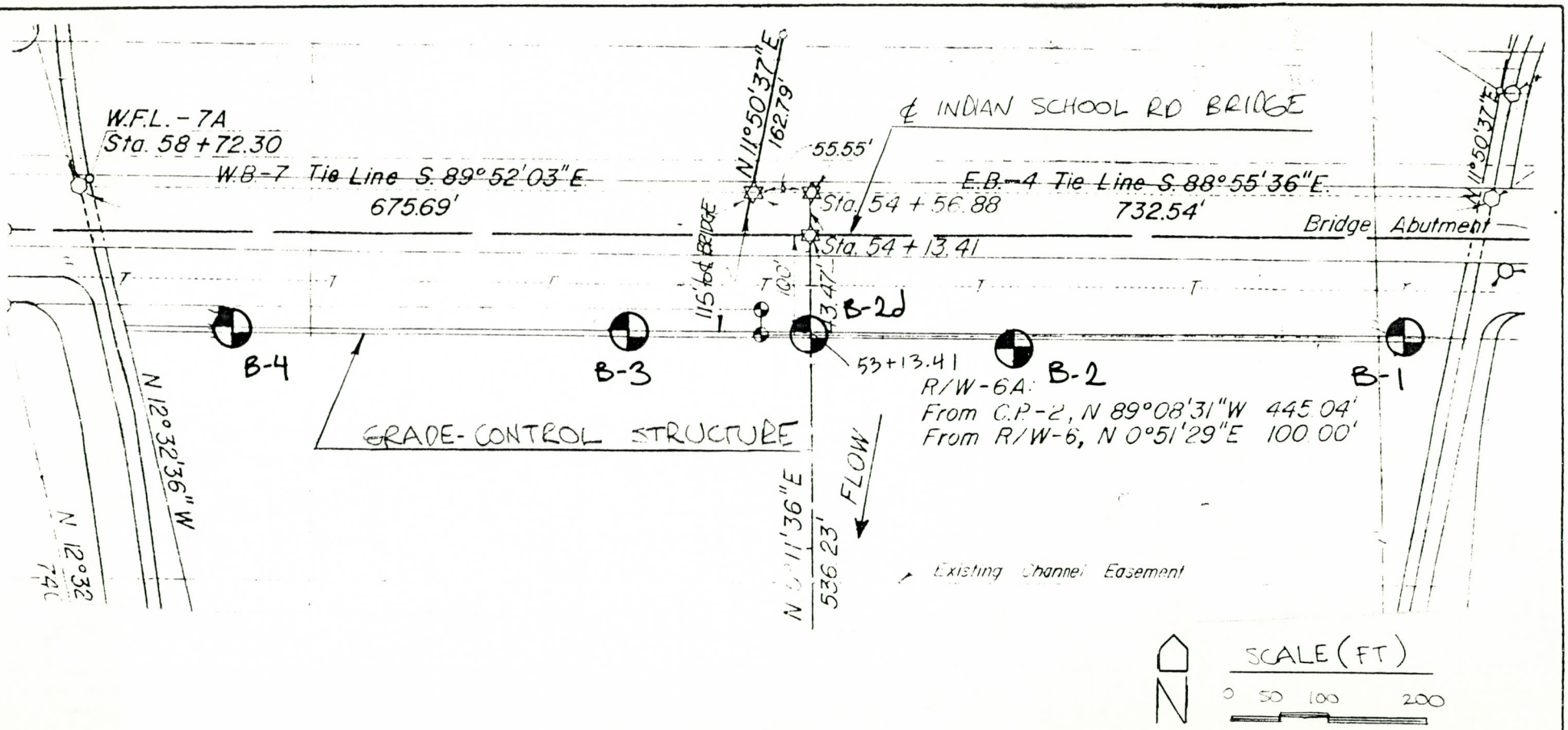
During the construction period water should not be allowed to enter any trenches for footings or other locations which will support structural components. If water softening of the soil occurs the softened soil should be removed.

LIMITATIONS

The field and laboratory testing relevant to this report was performed, unless otherwise noted, by Desert Earth Engineering. This work was performed in accordance with generally accepted engineering principles and practices.

This report assumes the subsurface conditions are as found in the test bore holes. If any conditions other than those assumed are encountered when making excavations, the owner or his representative should notify the Soil Engineer immediately so that supplementary recommendations can be made.

This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the applicable provisions of the recommendations contained herein are called to the attention of the Structural Engineers and incorporated into the plans. Also, it is assumed that the necessary steps are taken to see that the contractor and subcontractors carry out such provisions in the field.



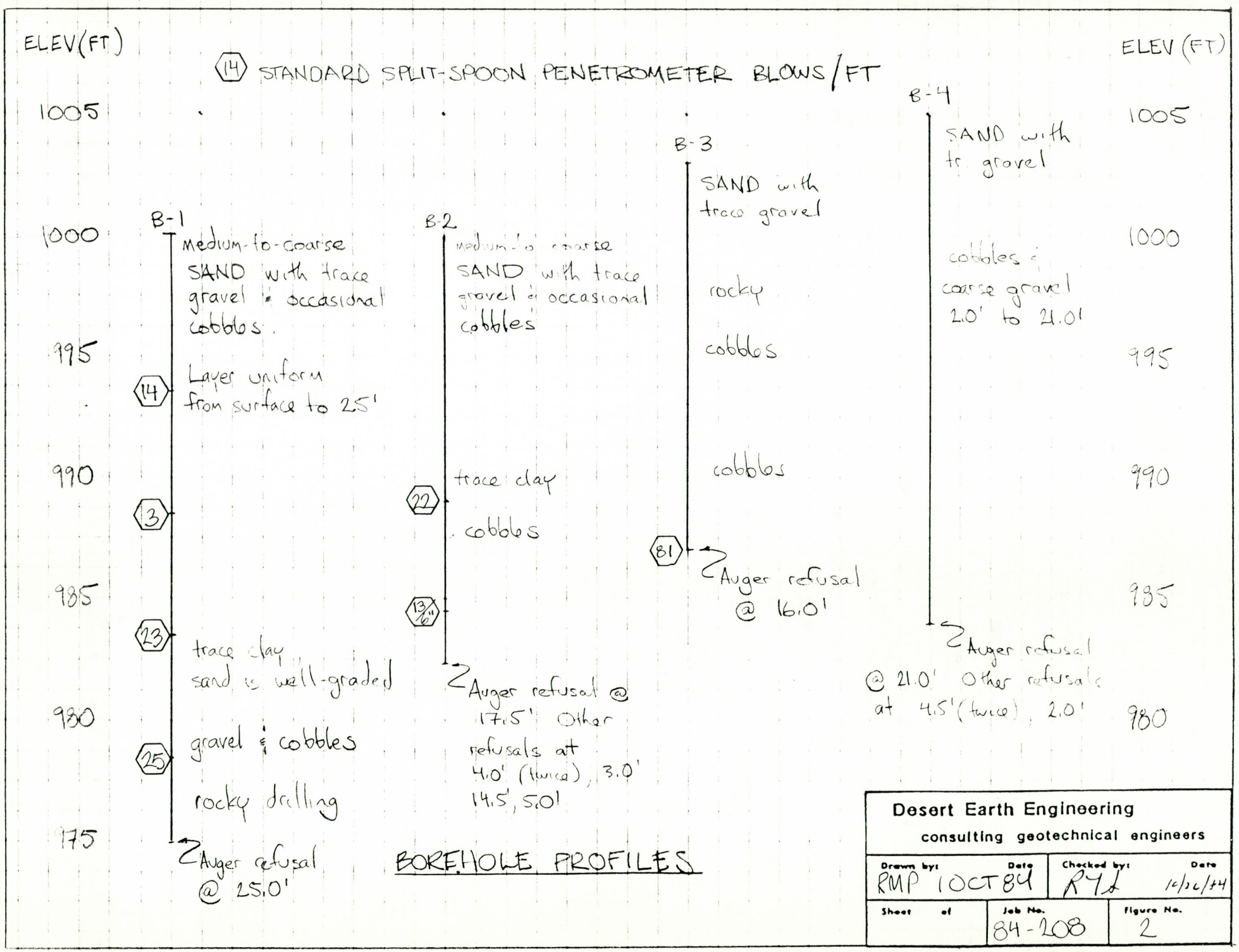
BOREHOLE LOCATIONS

GRADE-CONTROL STRUCTURE

INDIAN SCHOOL RD. & AGUA FRIA C

DRILLED SEPTEMBER 12 & 13, 1984

Desert Earth Engineering consulting geotechnical engineers		
Drawn by: RMP Date: 10CT 84	Checked by: RH Date: 10/26/84	
Sheet of	Job No. 84-208	Figure No. 1


ELEV(FT)
ELEV (FT)
(14) STANDARD SPLIT-SPOON PENETROMETER BLOWS/FT
1005
1000
995
990
985
980
975
B-1
Medium-to-coarse SAND with trace gravel & occasional cobbles.
(14) Layer uniform from surface to 25'
(3)
(23) trace clay
sand is well-graded
(25) gravel & cobbles
rocky drilling
Auger refusal @ 25.0'
B-2
medium-to-coarse SAND with trace gravel & occasional cobbles
trace clay
(22) cobbles
(13/6") cobbles
Auger refusal @ 17.5' Other refusals at 4.0' (twice), 3.0' 14.5', 5.0'
B-3
SAND with trace gravel
rocky
cobbles
cobbles
(81)
Auger refusal @ 16.0'
B-4
SAND with tr. gravel
cobbles & coarse gravel 2.0' to 21.0'
Auger refusal @ 21.0' Other refusals at 4.5' (twice), 2.0'
BOREHOLE PROFILES
Desert Earth Engineering
consulting geotechnical engineers
Drawn by: RMP Date 10CT84
Checked by: RTL Date 10/26/84
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Job No. 84-208
Figure No. 2

APPENDIX A

Soil Boring Logs

DRILLING, SAMPLING, AND FIELD TESTING EQUIPMENT

DRILLING: The drilling is performed using a Central Mining Equipment CME-55 drill rig capable of auger drilling, rotary wash drilling, and rock coring. Auger drilling is performed using 6 5/8" OD x 3 1/4" ID hollow-stem augers with carbide-tipped teeth. Rotary wash drilling employs a tricone gear bit and core drilling a diamond bit. These latter methods use high pressure water as a drilling fluid.

SAMPLING: Disturbed samples are achieved using a standard 2" OD x 1 3/8" ID split spoon sampler. The ID dimension is that of the inner brass liner. "Undisturbed" samples of cohesive fine-grained soils are obtained using a ring sampler of 3" OD x 2.416" ID. The series of 1" long, 2.416" ID brass rings in the sampler have a 2.5" OD and therefore readily fit into laboratory direct-shear and consolidation equipment.

In very soft cohesive soils, thin-walled Shelby tube samples can be taken. Rock cores are obtained from diamond-core drilling.

FIELD TESTING: An approximation of the soil's density and consistency, from which strength estimates can be made, is obtained using the penetration resistance to driving of the samplers. The Standard Penetration Test (SPT) N-value is the number of blows to drive a standard 2" OD x 1 3/8" ID split spoon sampler 1 ft. using a 140-pound weight dropping 30". Where driving resistance is difficult, blows/inches-driven values are presented.

A 3" OD ring sampler will generally have a larger blow count than will the split spoon sampler if the same driving energy is used for both.

Continuous-penetration resistance can be obtained using a 2" OD bull-nose penetrometer. When using the SPT driving energy the blow counts on a bull-nosed penetrometer are approximately equal to or greater than the N-value (blows/ft) resistance obtained.

METHOD OF SOIL CLASSIFICATION

GRAVEL (GP,GW)

SAND, SANDY (SP,SW,S)

SILT (ML,MH)

SILTY (M)

CLAY (CL,CH)

CLAYEY (C)

ORGANIC MATERIAL (OL,OH,PT)

WEATHERED TO DECOMPOSED BEDROCK

BEDROCK

CLASSIFICATION	U.S. Standard Sieve Size
BOULDERS	Above 12"
COBBLES	12" to 3"
GRAVEL	3" to No.4
Coarse	3"to3/4"
Fine	3/4"toNo.4
SAND	No.4toNo.200
Coarse	No.4toNo.10
Medium	No.10toNo.40
Fine	No.40toNo.200
SILT & CLAY	Below No.200

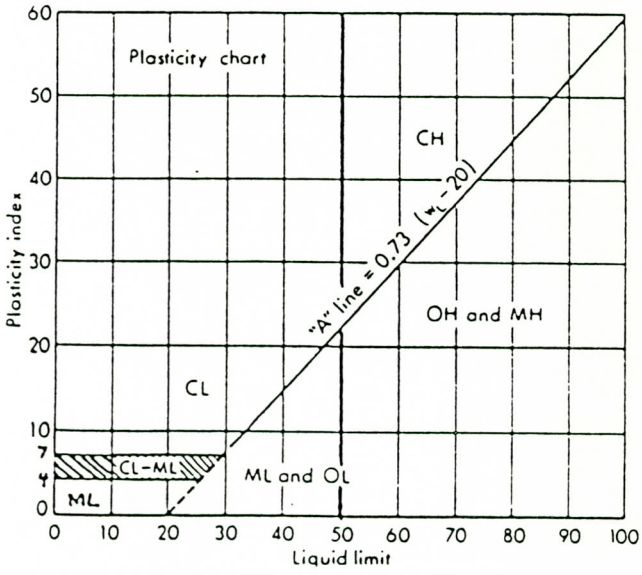
GRAIN SIZE CHART

Coarse Grained Scale
(50% retained on #200 sieve)

Adjective	%
with trace	1-12
with some	12-30
add "y" (ey)	> 30

P = poorly graded
W = well graded

Fine Grained Soils
(50% passing #200 sieve)



L = low compressibility
H = high compressibility

P.I.	Adjective	Silt (ML & MH)	Clay (CL & CH)	Organics (OL & OH)
< 1	non-plastic	--	--	--
1-10	slightly plastic	--	silty	--
10-20	medium plastic	clayey	silty to no adj.	silty
20-40	plastic	clayey	--	clayey
> 40	very plastic	clayey	--	--

BLOW COUNT - DENSITY RELATIONS

Cohesionless coarse-grained soils

Density	Nspt *
very loose	< 4
loose	4 - 10
medium dense	10 - 30
dense	30 - 50
very dense	> 50

Cohesive fine-grained soils

For cohesive fine-grained soils, design is usually governed by the moisture content, plasticity, consolidation, compressibility, or swell properties. Therefore, field penetrometer readings giving an indication of strength as characterized by the consistency or cohesion of a soil can be misleading and are not presented here.

The blows to drive a 3" OD x 2.42" I.D. ring sampler 1 ft will be greater than for a split spoon sampler if the same driving energy is used for both.

* Nspt is the Standard Penetration Test (SPT) blows/ft resistance using a 2" OD x 1 3/8 I.D. sampler (ASTM D1586).

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JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING

See Site Plan Figure #1

DRILLING METHOD & EQUIPMENT	BORING NO.
CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-1
	SHEET 1 OF 2
SAMPLING METHOD	ENGINEER
Split-spoon Penetrometer	RMP
	TIME 7:30
CASING DEPTH	DATE 12 Sept 84

DATUM ELEVATION 1000

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0			River Bottom
			1			(SP) brown M-C SAND w/trace gravel; moist subrounded to subangular, loose
			2			cobbles
			3			
			4			
			5			
SS	18/18	8/8/6	6			
			7			
			8			
			9			
			10			
SS	18/18	2/1/2	11			
			12			
			13			
			14			
			15			(SW-SC)trace clay, very slightly plastic, well graded,
SS	18/18	11/14/9	16			
			17			
			18			
			19			
			20			coarse, gravel & cobbles, rounded to subrounded

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LOCATION OF BORING

DRILLING METHOD & EQUIPMENT	BORING NO.
CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-1
	SHEET 2 of 2
SAMPLING METHOD	ENGINEER RMP
Split-spoon Penetrometer	TIME 9:15
	DATE 12 Sept 84
CASING DEPTH	

DATUM ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			20			(SP) brown medium SAND, moist, subrounded
SS	18/18	5/11/14	21			
			22			
			23			rocky drilling, cobbles
			24			rocky
			25			
			26			auger refusal @25.0'
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

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LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

SAMPLING METHOD: Split-spoon Penetrometer

CASING DEPTH:

BORING NO.: B-2

SHEET: 1 OF 1

ENGINEER: RMP

TIME: 1:30-2:30

DATE: 12 Sept 84

DATUM

ELEVATION 1000

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River bottom
			0			(SP) brown M-C SAND w/trace gravel, moist subangular, gap-graded
			1			
			2			occasional small cobbles
			3			
			4			
			5			split spoon refusal twice @ 5.0' - cobbles at bottom of hole
SS	0 / 0		6			coarse gravel - small cobbles in auger cuttings, rounded to subrounded
			7			
			8			
			9			
			10			(SP-SC) slight trace of clay
SS	11 / 10	7/15(5")	11			split spoon refusal after 11', rock
			12			cobbles
			13			cobbles & coarse gravel
			14			
			15			split spoon refusal after 6", rock
SS	6 / 0	13(6")	16			
			17			
			18			Auger refusal @ 17.5', rock
			19			
			20			

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LOCATION OF BORING

10 ft North of B-2

DRILLING METHOD & EQUIPMENT	BORING NO.
CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-2a
	SHEET 1 OF 1
SAMPLING METHOD	ENGINEER
Split-spoon Penetrometer	RMP
	TIME
CASING DEPTH	DATE
	12 Sept 84

DATUM ELEVATION 1000

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0			River Bottom
			1			(SW) brown SAND with trace gravel
			2			Occasional coarse gravel and cobbles
			3			
			4			Rocky
			5			Auger refusel @ 4.0 ft/ 2 times
			6			
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

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JOB NO.	CLIENT	LOCATION
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LOCATION OF BORING

30' NE of B-2

DRILLING METHOD & EQUIPMENT	BORING NO.
CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-2b
	SHEET 1 OF 1
SAMPLING METHOD	ENGINEER
Split-spoon Penetrometer	RMP
	TIME 2:50-3:30
CASING DEPTH	DATE 12 Sept 84

DATUM ELEVATION 1000

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0			Brown SAND with trace gravel
			1			Occasional cobbles
			2			
			3			Auger refusel @ 3.0 ft/ moved 1.0' SW
			4			
			5			
			6			
			7			Cobbles
			8			
			9			
			10			Boulder @ 10.0 ft
			11			
			12			Cobbles, very rocky
			13			
			14			Auger refusal @ 14.0
			15			
			16			
			17			
			18			
			19			
			20			

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LOCATION OF BORING

See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT	BORING NO
CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-2d
	SHEET 1 OF 1
	ENGINEER RMP
SAMPLING METHOD	TIME
Split-spoon Penetrometer	6:30-6:45
	DATE
CASING DEPTH	13 Sept 84

DATUM ELEVATION 1002

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW) Brown SAND with trace gravel, moist subangular to subrounded, loose, well-graded
			1			
			2			Occasional cobbles
			3			
			4			Rocky
			5			
			6			Auger refusal @ 5.0 ft
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

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JOB NO	CLIENT	LOCATION
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LOCATION OF BORING

See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT	BORING NO.
CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-3
	SHEET 1 OF 1
SAMPLING METHOD	ENGINEER
Split-spoon Penetrometer	RMP
	TIME 6:45-7:20
CASING DEPTH	DATE 13 Sept 84

DATUM ELEVATION 1003

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
			0			River Bottom
			1			(SW) Brown SAND w/trace gravel, moist, loose subrounded to subangular, well-graded
			2			
			3			
			4			
			5			
			6			Rocky
			7			
			8			
			9			Occasional cobbles, rounded to subrounded
			10			
			11			
			12			
			13			Rocky, coarse gravel-and-cobble seam
			14			
			15			
SS	11/6	31/50/5"	16			Split spoon on a cobble final 6"
			17			Auger refusal @ 16.0'
			18			
			19			
			20			

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LOCATION OF BORING

See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT	BORING NO.
CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-4
	SHEET 1 OF
SAMPLING METHOD	ENGINEER
Split-spoon Penetrometer	RMP
	TIME 7:30-7:40
CASING DEPTH	DATE 13Sept 84

DATUM ELEVATION 1005

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW) Brown SAND w/trace gravel & occasional cobbles, loose, dry, well-graded
			1			
			2			
			3			
			4			Large cobble or boulder
			5			Auger refusal @ 4.5'/ moved 2' south refusal @ 4.5' again
			6			
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

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JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr.

LOCATION OF BORING

See Site Plan, Figure 1

DRILLING METHOD & EQUIPMENT	BORING NO.
CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers	B-4a
	SHEET 1 of 2
	ENGINEER RMP
SAMPLING METHOD	TIME
Split-spoon Penetrometer	7:40-
	DATE
CASING DEPTH	13 Sept 84

DATUM ELEVATION 1005

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			0			(SW-SC) Brown SAND w/trace gravel, moist, loose
			1			1" layers of varved clay
						occasional cobbles
			2			1st Auger refusal @ 2.0 ft
			3			
			4			
			5			
			6			
			7			Occasional cobbles
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

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JOB NO.	CLIENT	LOCATION
84-208	Simons, Li & Associates	Indian School & Aqua Fria Rvr

LOCATION OF BORING

DRILLING METHOD & EQUIPMENT: CME-55 Drill Rig equipped with 6 5/8" OD 3 1/4" ID hollow-stem continuous flight augers

BORING NO.: B-4a

SHEET: 2 OF 2

ENGINEER: RMP

SAMPLING METHOD: Split-spoon Penetrometer

TIME: 8:30

DATE: 13Sept 84

CASING DEPTH:

DATUM

ELEVATION 1005

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	BLOWS/6" SAMPLER	DEPTH IN FEET	BULL-NOSE BLOWS/FT	SOIL GRAPH	SURFACE CONDITIONS
						River Bottom
			20			Cobbles and coarse gravel
			21			
			22			Auger refusal @ 21.0 ft
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			0			

CHKD BY

DATE

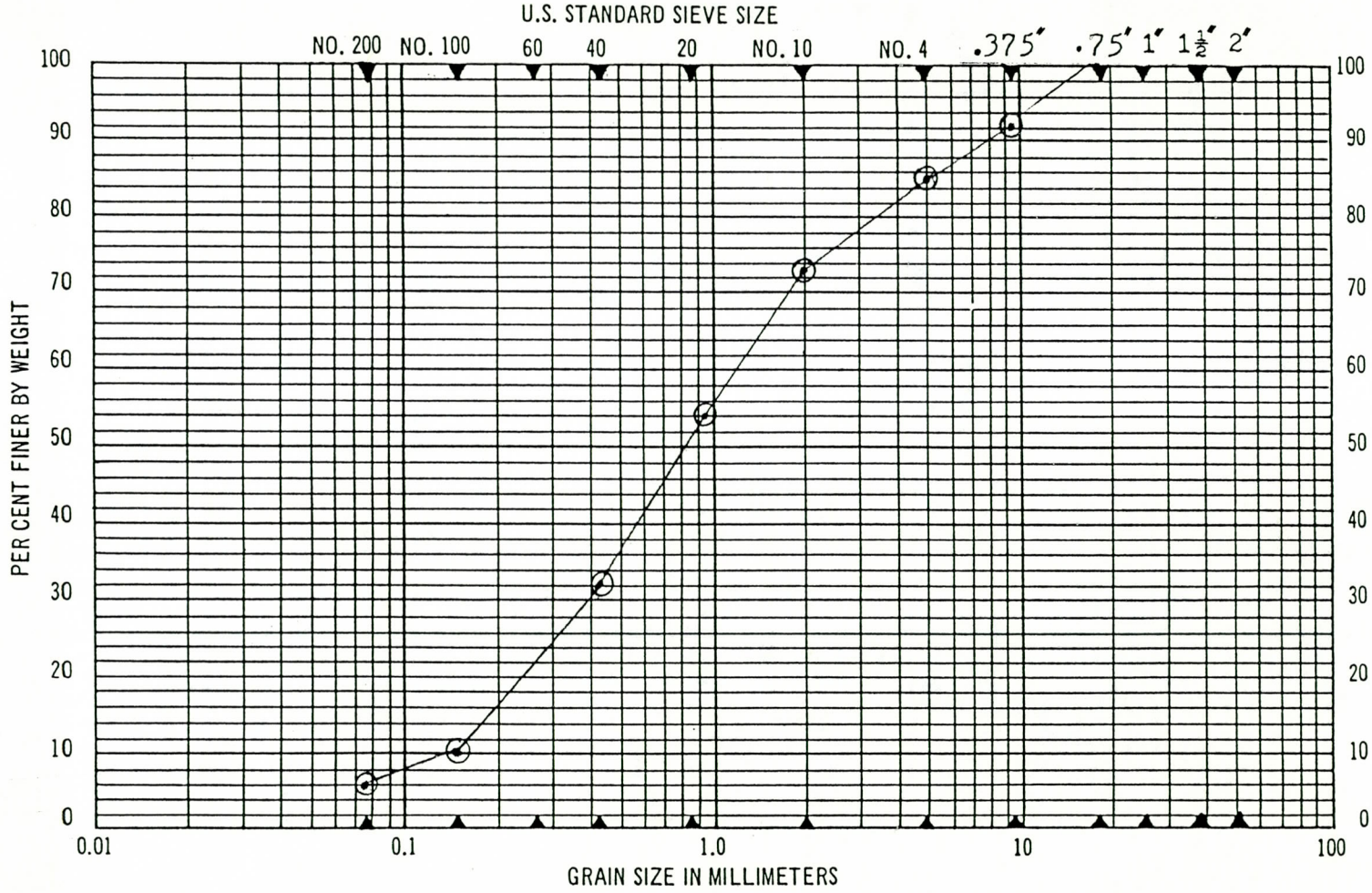
APPENDIX B

Laboratory Results

JOB NO. 84-208 BY TH DATE 5 Oct 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-1	10-11.5		(SP) SAND with some gravel

GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)



SILT OR CLAY	SAND			GRAVEL		*
	FINE	MEDIUM	COARSE	FINE	COARSE	

*COBBLES

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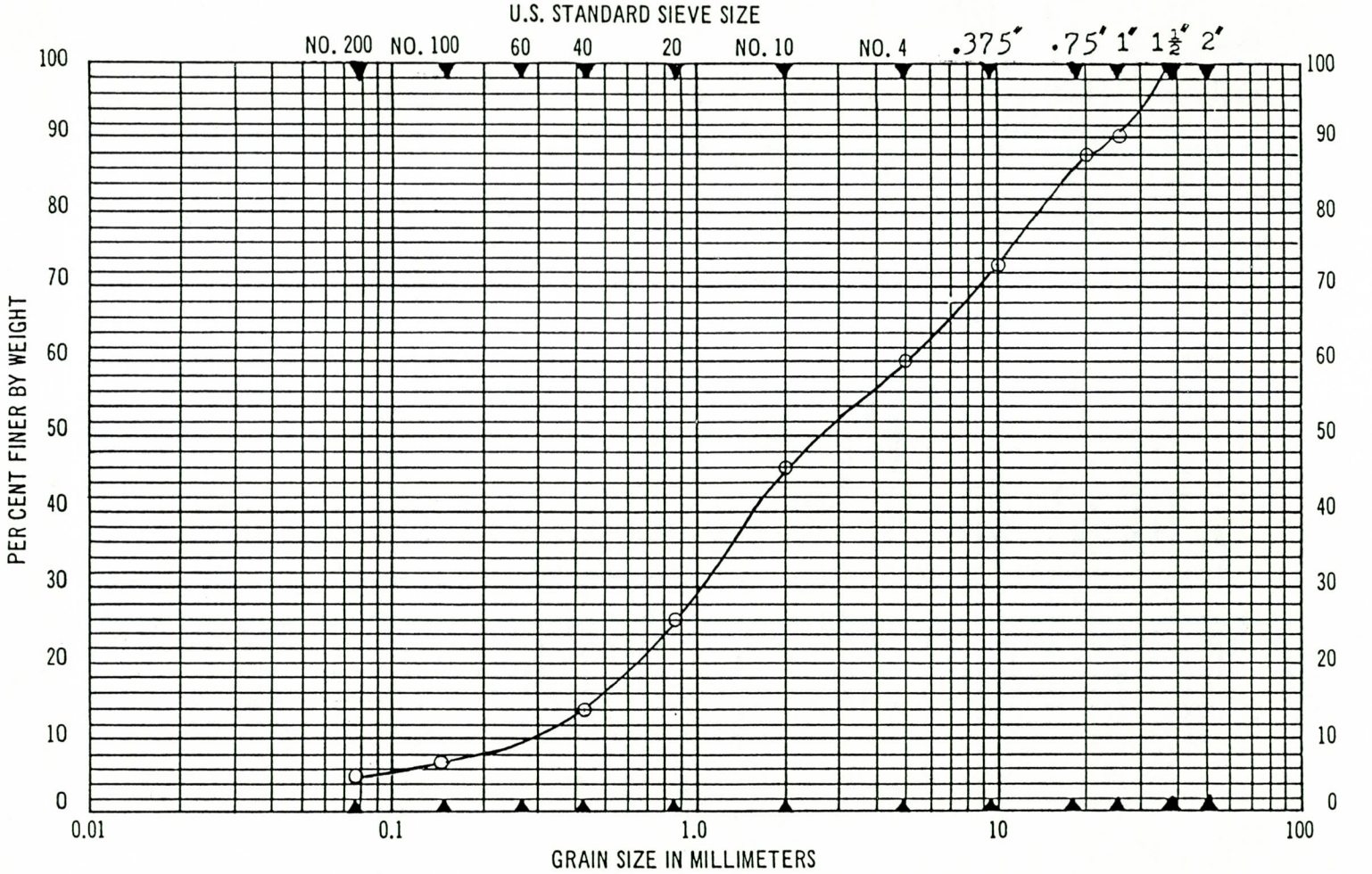
JOB NO. 84-208 BY RMP DATE 27 Sep 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-1	15-16.5		(SP) medium-to-coarse GRAVELLY SAND

GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)



SILT OR CLAY	SAND			GRAVEL		*
	FINE	MEDIUM	COARSE	FINE	COARSE	

*COBBLES

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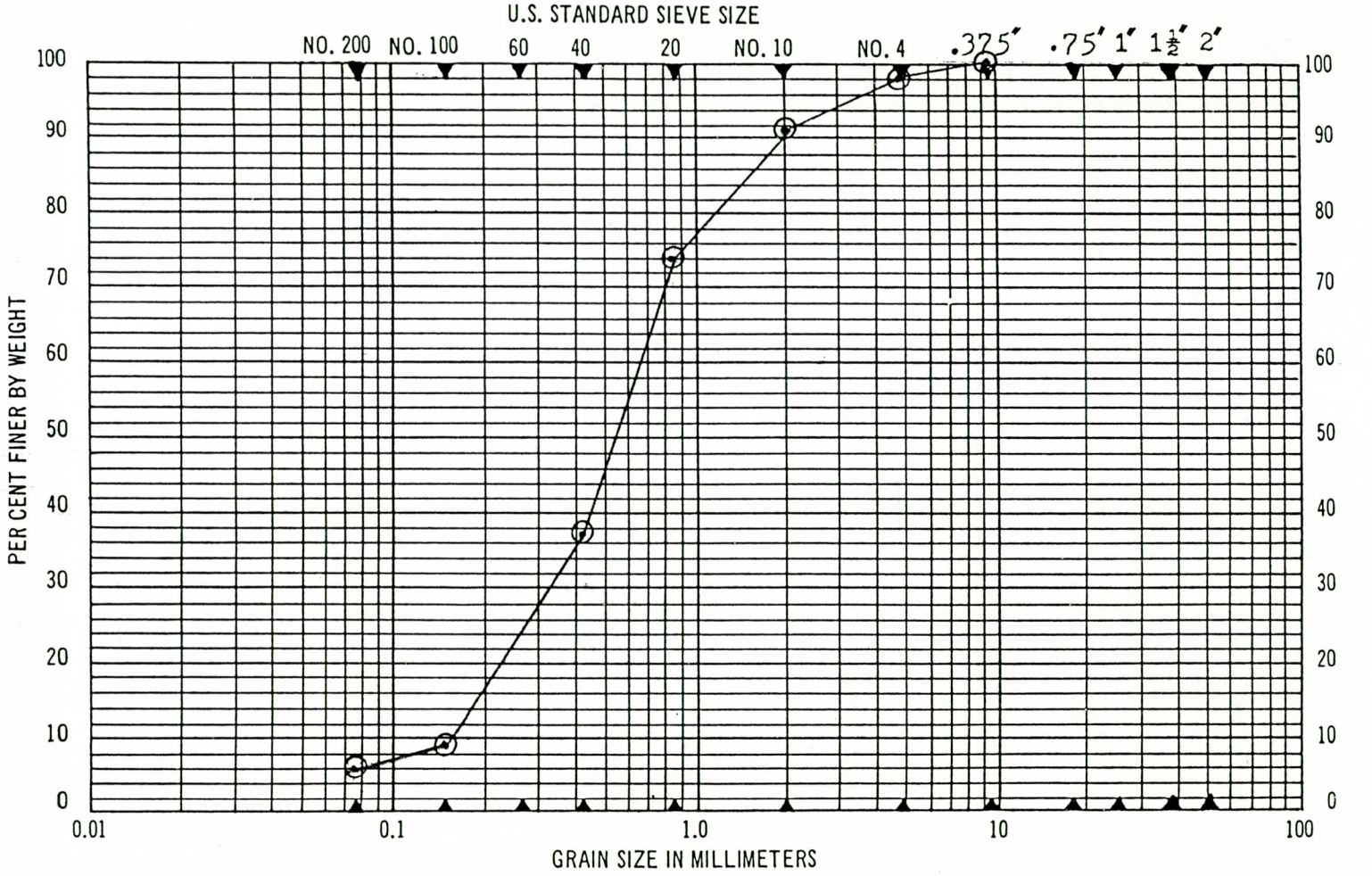
JOB NO. 84-208 BY TH DATE 8 Oct 84

KEY	BORING	DEPTH	ELEV.	SOIL CLASSIFICATION
	B-1	20-21.5		(SP) fine-to-medium SAND with trace silt

GRAIN-SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION SYSTEM)



SILT OR CLAY	SAND			GRAVEL		*
	FINE	MEDIUM	COARSE	FINE	COARSE	

*COBBLES

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APPENDIX C

Fill Specification

ENGINEERED FILL SPECIFICATION

The engineered fill material or aggregate base course (ABC) material composing such a fill should be thoroughly mixed for uniform consistency, be completely free of vegetation, roots, rubble, debris or other deleterious matter, and shall conform to the following specifications.

Gradation (ASTM D422) Sieve Size	% Passing by Weight Fill	ABC
6"	100	--
1 1/2"	--	100
#4	--	45-90
#200	50 Max	0-12
Plastic Index (ASTM D424)	12 Max	5 Max
Percent Expansion	1.0 Max	0.0
Abrasion	--	50 Max
Soluble Sulfates (%)	0.10 Max	0.10 Max

*Expansion shall be measured during saturation of a remolded sample compacted to 95% of Standard Proctor (ASTM D698) density at optimum moisture content which is subject to a load intensity of 1 PSI.