FOUNDATION INVESTIGATION

CRADLEBAUGH BRIDGE B-169 & CRADLEBAUGH SLOUGH B-170

STATE OF NEVADA - - DEPARTMENT OF HIGHWAYS

SPROUT ENGINEERS & ASSOCIATES INC.

RENO, NEVADA SEATTLE, WASHINGTON JACKSON, WYOMING

SPROUT ENGINEERS & ASSOCIATES INC.
CONSULTING ENGINEERS
950 INDUSTRIAL WAY, SPARKS (EAST RENO), NEVADA 89431 358-6931 (702)
RENO, NEVADA SEATTLE, WASHINGTON JACKSON, WYOMING

April 23, 1968
Job No. D-3021-F

Mr. John Bawden
State Highway Engineer
STATE OF NEVADA
Department of Highways
Carson City, Nevada (89701)

Re: Foundation Investigation
Cradlebaugh Bridges

Dear Mr. Bawden:

We are submitting herewith eight (8) copies of the Foundation Report for the proposed Cradlebaugh Bridge B-169 and Cradlebaugh Slough B-170.

The report represents the results of the field and laboratory investigation and gives recommendations for foundation design. All structures should be supported on pile foundations.

We wish to thank you for the opportunity to prepare this report. Please feel free to call on us for any discussion or to answer any questions which may arise.

Sincerely,

SPROUT ENGINEERS & ASSOCIATES, INC.

Richard W. Arden
Registered Civil Engineer No. 1643

Joe W. Howard
Registered Civil Engineer No. 2166

RWA:ca

FOUNDATION INVESTIGATION

CRADLEBAUGH BRIDGE B-169 & CRADLEBAUGH SLOUGH B-170

STATE OF NEVADA - - DEPARTMENT OF HIGHWAYS

Presented herein are the results of the foundation study that was conducted at the site of the proposed Cradlebaugh Bridge and Slough during the later part of February 1968. This investigation was conducted in accordance with an agreement between the State of Nevada, Department of Highways and Sprout Engineers & Associates, Inc. for the purpose of establishing the foundation designs for the proposed structrues.

SCOPE

The scope of the study consisted of field investigation, supported by laboratory testing, as required, to adequately determine the physical and mechanical properties of the soil with respect to bearing capacity, settlement and foundation conditions pertinent to the design of the project.

The results of the foundation investigation and laboratory testing - which form the basis of our recommendations are presented in this report.

SITE CONDITIONS

The Cradlebaugh Bridges are located approximately seven (7) miles south of Carson City on U. S. Highway 395. These bridges cross the Carson River and Slough and are very narrow. They will be replaced by new bridges which will be forty feet (40') wide. The existing structures

are supported on timber piling.

The surrounding area is relatively flat. The river channel is approximately ten feet (10') lower than the surrounding area.

GEOLOGICAL CONDITIONS

The site for the proposed structures is located in the Carson Valley, bounded by the Carson Range on the west and by the Pine Nut Mountain Range on the east.

The Carson Val ley lies between high, parallel, north-south trending mountain ranges and is characterized by wide alluvial fans sloping downward into a relatively flat basin. Occasional fault scarps are present in the alluvial fans near the mountain front. These scarps roughly parallel the range and do not extend into the alluvium of the valley floor.

The soils of the area are predominately derived from granitic intrusions formed during the Sierra Nevada Revolution. The soils encountered in the borings were largely very loose to dense, clean sands with lesser amounts of silty sand and sandy clay. The relative density of the sands varied throughout the depth of the boring - however, generally became denser with depth. A soft silty clay layer three feet (3') thick was encountered in Borings 1 and 2 at approximate elevation 4615. This clay layer was approximately one foot (1') thick in the remaining borings.

Bedding is present in the area drilled, the beds dip very slightly to the east. All contact observed were conformable.

Ground water was encountered in all borings at depths less than ten feet (10') placing the ground water table at a level very near the surface of the river at the time of measurement. Artesian water flow of approximately twenty (20) gallons per minute was encountered in Boring No. 2 after drilling through clay beds into sand at thirty-one feet (31').

PROJECT DESCRIPTION

The proposed project consists of replacing the two (2) existing structures with new concrete bridges. Both structures will be forty feet (40') wide. The new Carson River Bridge will be six (6) span and two hundred seventy feet (270') long. The Slough structure will be three (3) span and fifty four feet (54') in length. The proposed grade of the new road will be raised approximately two and one-half feet (2-1/2')

DISCUSSION

The uppermost soil encountered in all borings is a loose silty sand material which would produce fairly large settlements under anticipated loads. This loose material extends to at least twelve feet (12') - thus eliminating the use of spread footings.

Pile foundations were analysed considering the three feet (3') of compressible material encountered near elvation 4615. This soft silty clay is underlying a very dense sand.

Pipe piles will achieve a design loading of 60 tons by the Pile Driving Formula in the dense sands at approximate elevation of 4620. This will place the tip above the silty clay layer. It is anticipated, that up to one and one-half inches (1-1/2") of settlement can be expected using a pipe pile which obtained bearing in the dense sands at elevation 4620.

To eliminate the settlement and overcome construction problems of penetrating the dense sand above the silty clay, a steel H-pile should be used. The estimated tip elevation for the H-pile will be between 4600 and 4615. Some difficulty may be encountered in driving on the southside of the river between elevation 4620 and 4615 due to the very dense sands. Abutment and wing walls should be designed using a fully saturated backfill condition due to the possibility of flooding in the area. The walls should be designed to sustain the active pressure which is an equivalent fluid pressure of eighty (80) pounds per cubic foot.

From the borings, it appears that the depth of scour is approximately elevation 4637. This will not present any problems for the piers; however, some special considerations should be given to the abutments.

FOUNDATION RECOMMENDATIONS

1. All piers and abutments should be supported by pile foundations. Piles should be driven in accordance with recommendations set

1. (continued)

forth in the Tabular Summary of Foundation Recommendations, Plate 1, of this report.

2. It is recommended that a BP10 - 42 Steel H-Pile be used at a design load of 60 tons per pile.

3. As an alternate a 12-3/4 inch OD pipe pile can be used at a design load of 45 tons; however, 1-1/2 inch settlement should be anticipated due to the soft silty clay layer.

4. Load tests, other than those conducted by Pile Drive Formula are not considered necessary.

5. Retaining walls should be designed using an equivalent fluid pressure of 80 pounds per cubic foot for the active condition.

The following plates and appendices are included and complete this report:

Plate 1	Tabular Summary of Foundation Recommendations
Plate 2	Log of Borings
Appendix I	Exploration and Laboratory Tests
A.	Shear Strength Diagram
B.	Test Results

TABULAR SUMMARY OF FOUNDATION RECOMMENDATIONS

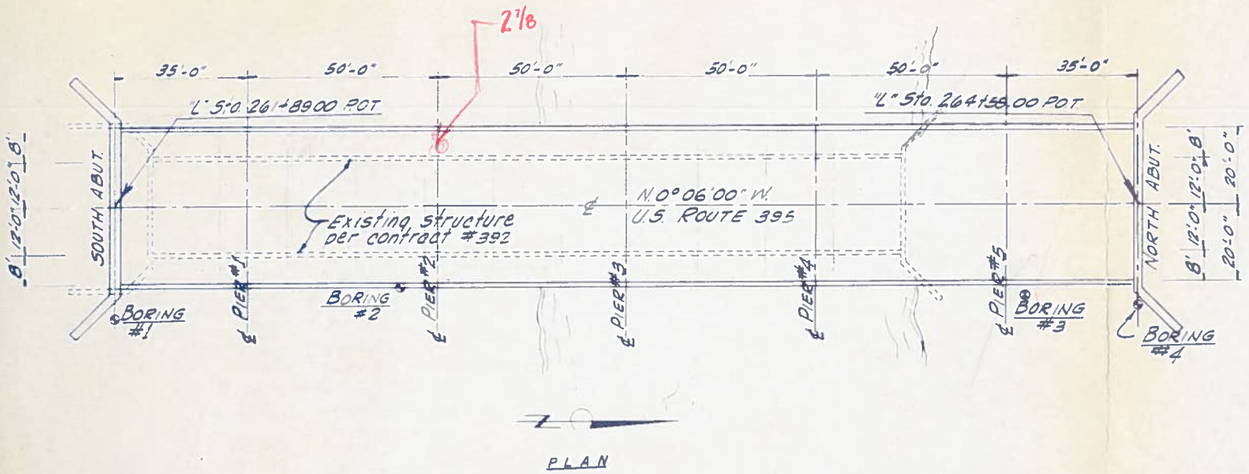
CRADLEBAUGH BRIDGE B-169

Support Station	Recommended Support Type	Estimated Pile Tip Elevation	Safe Allowable Design Load
261+89	BP10-42 Steel H-Pile	4600 4612	60 Ton
262+24	BP10-42 Steel H-Pile	4600	60 Ton
262+74	BP10-42 Steel H-Pile	4600	60 Ton
263+24	BP10-42 Steel H-Pile	4610	60 Ton
263+74	BP10-42 Steel H-Pile	4610	60 Ton
264+24	BP10-42 Steel H-Pile	4610	60 Ton
264+59	BP10-42 Steel H-Pile	4610	60 Ton

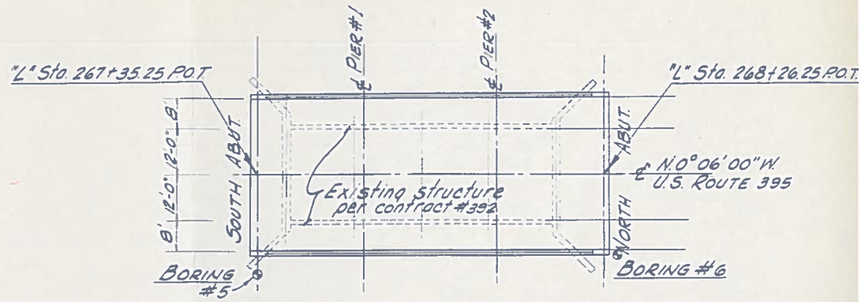
CRANDLEBAUGH BRIDGE B-170

267+35.25	BP10-42 Steel H-Pile	4612	60 Ton
267+63.25	BP10-42 Steel H-Pile	4612	60 Ton
267+98.25	BP10-42 Steel H-Pile	4612	60 Ton
268+26.25	BP10-42 Steel H-Pile	4612	60 Ton

FED. ROAD REG. NO.	STATE	PROJECT NO.	COUNTY	CONTROL SECTION	STATE ROUTE	SHEET NO.	TOTAL SHEETS
7	NEVADA						

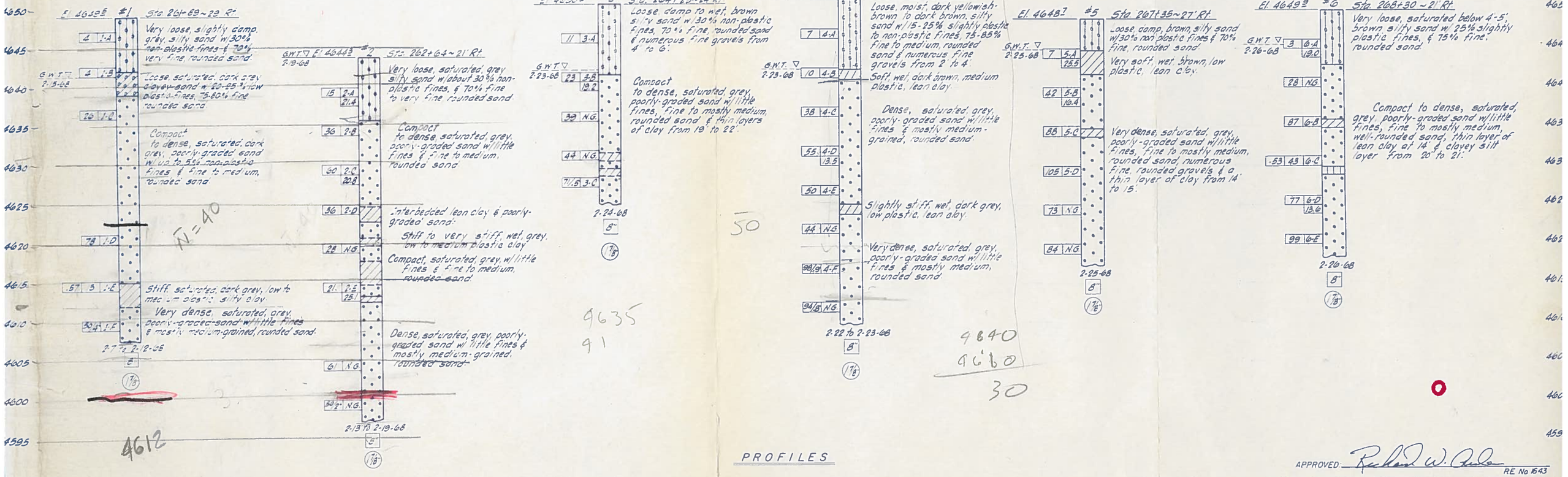


PLAN



PLAN

Leave exist'g. abutments & wings in place to save cost of removal plus the cost of constructing new wing walls or slope paving.



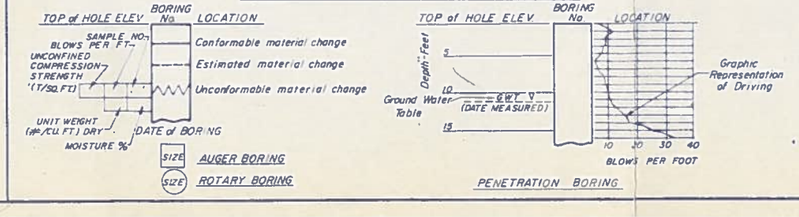
PROFILES

APPROVED: Richard W. Rule
RE No 1643

LEGEND OF SOILS

- Well-graded gravels or gravel-sand mixtures - Little or no fines.
- Poorly-graded gravels or gravel-sand mixtures - Little or no fines.
- Silty gravel-sand-silt mixtures.
- Clayey gravels, gravel-sand-clay mixtures.
- Well-graded sands or gravelly sands - Little or no fines.
- Poorly-graded sands or gravelly sands - Little or no fines.
- Silty sands, sand-silt mixtures.
- Clayey sands, sand-clay mixtures.
- Inorganic silts and very fine sands, silty or clayey fine sands or clayey silts.
- Sandy clays, silty clays, lean clays.
- Organic silts and organic silt-clays of low plasticity.
- Inorganic silts, micaceous or diatomaceous fine sand or silty soils.
- Inorganic clays of high plasticity, fat clays.
- Organic clays of medium to high plasticity, organic silts.
- Peat and other highly organic soils.
- Fill material.

LEGEND OF BORING OPERATION



STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CRADLEBAUGH BRIDGE B-169
&
CRADLEBAUGH SLOUGH B-170

LOG OF TEST BORINGS

SPROUT ENGINEERS, INC
950 INDUSTRIAL WAY
SPARKS, NEVADA

MARCH & 196
RWA/VP-LM
D-302

PLATE 2

APPENDIX I

APPENDIX I

EXPLORATION AND LABORATORY TESTS

EXPLORATIONS

The site was explored between February 7, 1968 and February 26, 1968 by drilling six (6) test holes with a Test Borer Soil Sampling Drill Rig. The location of these test holes are shown on the Log of Borings, Plate 2, of this report.

Samples of the various soils encountered were obtained with a Split Spoon Sampler (3" O.D. - 2-1/2" I.D. and 2" O.D. and 1-3/8" I.D.). The sampler was driven eighteen inches (18") into undisturbed soil using a 140 pound weight dropping thirty inches (30"). The number of blows required to drive the sampler twelve inches (12") was recorded and is shown on the Log of Borings.

Samples representing the various soils encountered were classified in the field by a Geologist. Samples of the soils encountered were taken to the laboratory for examination and testing.

LABORATORY TESTS

Samples of different soils encountered were tested in the Laboratory for grain-size distribution and plasticity characteristics.

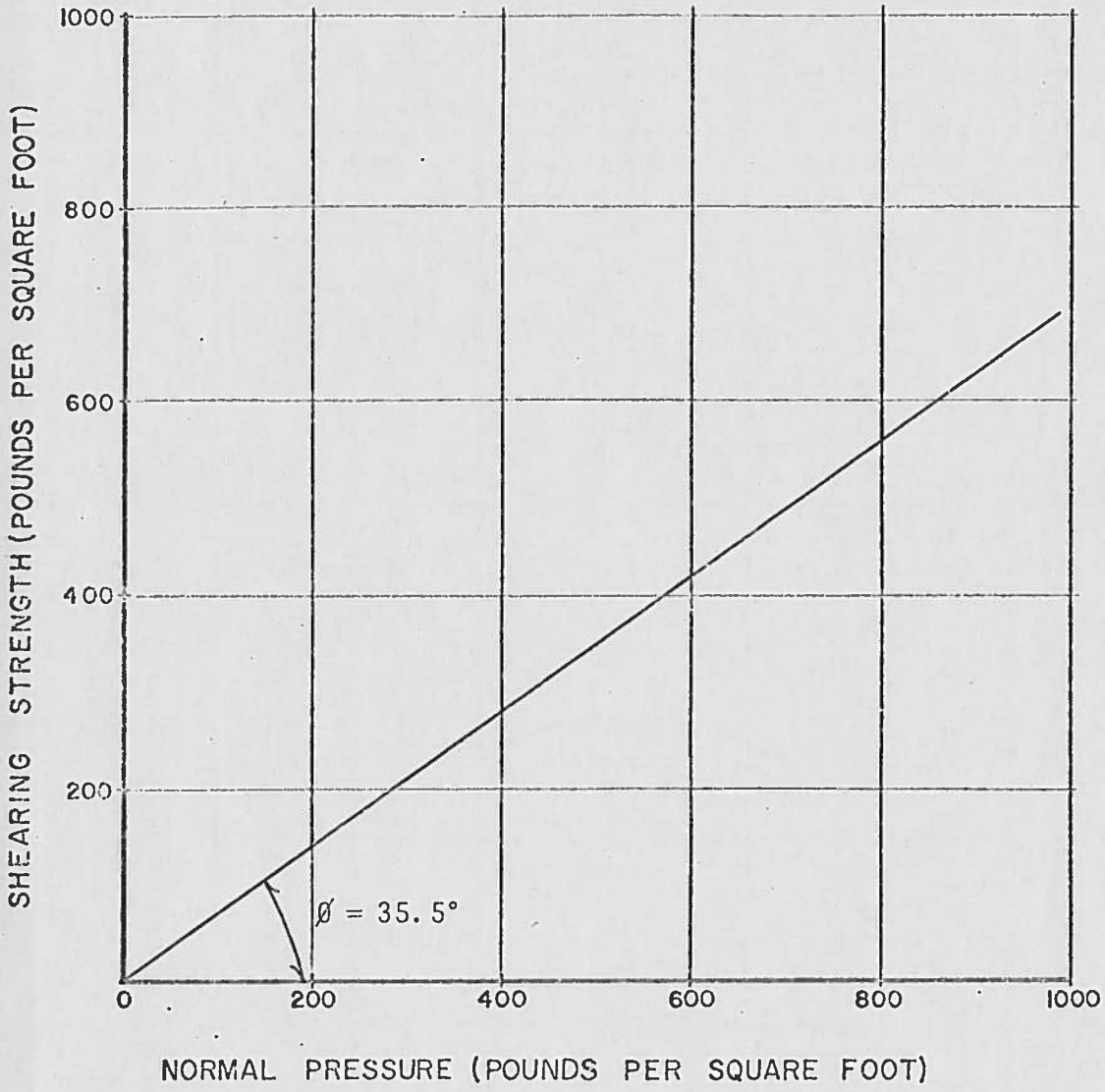
The moisture contents and dry densities were determined from core samples. These values were used with strength test and other data in calculations of bearing capacity and settlement.

Direct Shear Test was performed on a remolded sample. All tests were performed on saturated samples. These tests were performed with different normal loads. From these tests, the Mohr Strength Envelope can be plotted which gives the angle of internal friction and cohesive quality of the soil - thus resulting in the shearing strength of the native soil.

The Standard Penetration Tests were correlated with Strength Test and established empirical data in order to determine the relative density and supporting capabilities of the soil. The results of these tests are given in the report.

Consolidation, Swell and Unconfined Compression Tests were not performed on soil samples due to its granular nature. All settlements should take place during construction and differential settlements should not present any problems.

SHEAR STRENGTH DIAGRAM
DIRECT SHEAR TEST



Hole No. 4 - 15 feet to 20 feet
Sample Dry Density - 114 lbs. per cubic foot
In-Place Moisture - 16.5 Percent
Sample remolded and saturated.

CRADLEBAUGH BRIDGES
Nevada State Highway Department

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SPARKS, NEVADA (89431)

D-3021-F
FOUNDATION ENGINEERING
SOILS INVESTIGATION

PLATE A

TEST RESULTS

U. S. Standard Sieve Size / Sample Number	Percent by Weight Passing							
	1F	2A	2E	3B	4D	5A	5B	6A
No. 4		97		100	99		97	96
No. 10	100	96		99	95		87	94
No. 40	55	81	91	45	33	98	47	65
No. 200	4	12	76	4	4	89	7	26