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*Civil Engineering*

FOUNDATION INVESTIGATION

SUN VALLEY GRADE SEPARATION
H-1091N and H-1091S

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

*Foundation Engineering*

*Engineering Reports*

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1715 - 1725 "B" STREET • SPARKS, NEVADA

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# FOUNDATION INVESTIGATION

## SUN VALLEY GRADE SEPARATION
## H-1091N and H-1091S

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

SPROUT ENGINEERS, INC.

950 INDUSTRIAL WAY • SPARKS, NEVADA

PHONE 358-6931 - 358-6930

CIVIL ENGINEERING
ENGINEERING REPORTS
SURVEYING

FOUNDATION ENGINEERING
MATERIALS TESTING
CONCRETE DESIGN

Job No. 8290-T-64
September 25, 1964

Mr. W. O. Wright
State Highway Engineer
State of Nevada
Department of Highways
Carson City, Nevada

Dear Mr. Wright:

FOUNDATION INVESTIGATION
SUN VALLEY GRADE SEPARATION

We are submitting herewith the Foundation Report for the Sun Valley Grade Separation, H-1091N and H-1091S.

The report presents the results of the study and recommendations for foundation design.

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

Respectfully submitted,

Eugene C. Sprout
Registered Civil
Engineer No. 993

Richard W. Arden
Registered Civil
Engineer No. 1643

FOUNDATION INVESTIGATION

STATE OF NEVADA DEPARTMENT OF HIGHWAYS

SUN VALLEY GRADE SEPARATION
H-1091N and H-1091S

Presented herein are the results of the Foundation Investigation for the Sun Valley Grade Separation, H-1091N and H-1091S.

This investigation was conducted in accordance with the agreement between the State of Nevada, Department of Highways and Sprout Engineers, Inc. for the purpose of establishing the foundation design for the above structure.

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

The results of the field exploration and laboratory tests, which form the basis of our recommendations, are presented in this report.

## Site Conditions

The Sun Valley Grade Separation is located at the proposed crossing of Kietzke Lane Extension and Sun Valley Drive. The name Sun Valley Drive has recently been changed to Clear Acre Lane. The structure will be located approximately one-half (½) mile north of Wedekind Road on Clear Acre Lane (Sun Valley Drive) in Washoe County northeast of Reno, Nevada.

The immediate area of the proposed structure is sparsely populated with estate-size lots. The ground is covered with low sagebrush and some range grasses. At Boring Nos. 2 and 3, three (3) feet of roadway fill was encountered. Under the roadway fill in these borings, and uppermost material in Boring Nos. 1 and 4, is ten (10) to fourteen (14) feet of slightly compact to compact, wet to moist, dark brown, fine sandy clay of high plasticity. The sandy clay is underlain by four (4) to twelve (12) feet of a dense, moist, brown gravel-sand-clay mixture. Under the gravel-sand-clay mixture a very dense, moist, brown sand-gravel mixture with decomposed rhyolite rock fragments was encountered. A small amount of clay binder was found in this lowermost material.

Water was not encountered in any of the borings, but the static water table was found to be one hundred (100) feet below the surface in a domestic well, seventy-five (75) feet east of Boring No. 4.

Geological Conditions

Topographically, the site for the proposed structure represents a natural drainage ravine, formed as a result of faulting. The ravine-fault trending southward is bounded on the east and west by rounded ridges within the range of 100 to 150 feet. The existing paved road leading to Sun Valley is built along the bottom of the ravine and rises to the north.

The soils encountered at the site are predominatly soft, wet, dark reddish-brown sandy clay to hard, moist, silty clay of residual nature. Quaternary-Tertiary rhyolite and basalt flows are stratigraphically beneath younger sediments, and in some areas pleistocene Lake Lahontan clays and sands are beneath younger sediments.

Structural Considerations

The proposed Sun Valley Grade Separation is to be one structure carrying four (4) lanes of traffic in the east-west direction. The structure will be built of reinforced concrete and will be of continuous span design. The structure will consist of one (1) center span with the two (2) end spans cantilevered out to the approach fills. The maximum elevation of the proposed footings is to be 4483.0± feet with sufficient cover so as to be below the frost zone. Approach fills are to be approximately fifteen (15) to twenty (20) feet high.

Foundation Discussion

The material encountered at the proposed footing elevation is a stiff, wet, dark brown fine sandy clay of high plasticity. This material is unsuitable for structure support by use of spread footings. The sandy clay becomes harder with depth, and could support large spread footings at a lower depth, but due to the uncertainty of the soil's becoming saturated at some future date

and allowing differential settlement of the piers, spread footings at this depth are not recommended.

The dense, clay-sand-gravel mixture found beneath the clay will provide good support for the structure by use of spread footings. This would place the footings ten (10) to fifteen (15) feet below the proposed footing elevation and may be economically unfeasible.

Timber piles could be used for support of the structure, but due to the existing high moisture content in the sandy clay and the possibility of the existing ground being subjected to wetting and drying cycles caused by storm runoff from the adjoining hills, timber piles are not recommended as an alternate support.

Pipe piles or H-Beam piles could be used for support of the structure. Piles should be driven to the minimum tip elevation as given in the Tabular Summary of Foundation Recommendations. Piles must bear on the very dense sand-gravel mixture with decomposed rhyolite rock fragments, and should be end-bearing piles only. If pipe piles are used, pre-drilling of the stiff to hard, fine sandy clay may be required to insure that the piles reach their minimum tip elevation without structural damage to the piles. Pile loading tests for driven piles are not required because of the good bearing qualities of the sand-gravel mixture.

Because pre-drilling for the pipe and H-Beam piles will be required, cast-in-drill-hole piles will be recommended for this

structure support. The cast-in-place concrete piles may be constructed with the normal precautions necessary for this type of support.

Special consideration should be given to slope protection and proper earth compaction of the two (2) high approach fills for the floating abutments.

Foundation Recommendations

1. All piers may be safely supported on cast-in-place concrete piles placed with the normal construction precautions associated with this type of pile. Cast-in-place concrete piles should bear at the tip elevation given in the Tabular Summary of Foundation Recommendations, Plate 1.

2. All piers may be safely supported on pipe or H-Piles of 45 tons per pile design load, driven in accordance with the recommendations set forth in the Tabular Summary Alternate Support Type, Plate 1 of this report.

3. Pipe piles should have a minimum gauge of "7" unless mandrel driven. Monotubes and Raymond Step-Taper Piles, if used, should have a minimum tip diameter of ten (10) inches and a minimum butt diameter of fifteen and one-

half (15½) inches. Pipe piles should be driven closed end, and the outside diameter of the closure plate should be the same as the outside diameter of the pile.

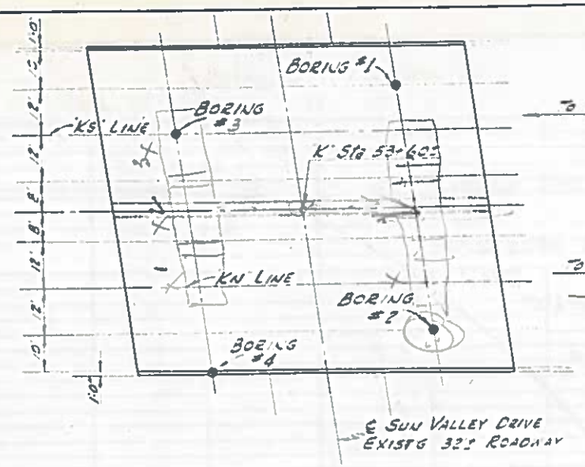
4. At least one load test should be conducted for cast-in-place piles. Pile load tests are not considered necessary for steel H or pipe piles, provided they achieve minimum design loads according to pile driving formulas.

5. A Tabular Summary of Foundation Recommendations is shown on Plate 1 of this report.

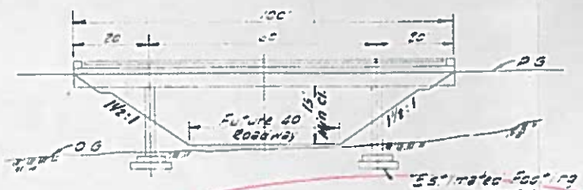
The following Plates and Appendices are attached and complete this report:

TABULAR SUMMARY OF FOUNDATION
RECOMMENDATIONS
FOR THE SUN VALLEY GRADE SEPARATION
STRUCTURE H-1091N and H-1091S

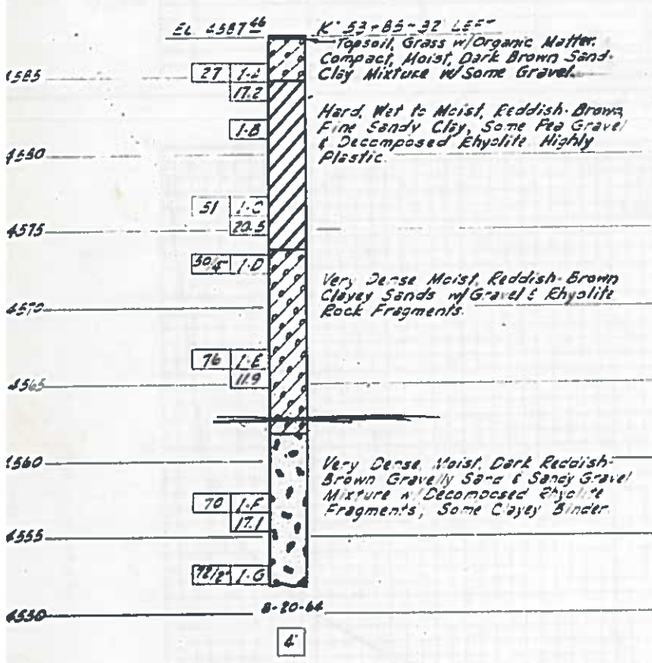
| Support | Support Station | Recommended Support Type | Base of Footing or Estimated Pile Tip Elevation | Safe Allowable Design Load | Alternate Support Type and Safe Allowable Design Load | Alternate Support Base of Footing or Pile Tip Elevation | Special Considerations |
|---|---|---|---|---|---|---|---|
| Pier No. 1 | "K" 53 + 30 H-1091S | 24" Cast-in Place Conc. Pile<br>16" Cast-in Place Conc. Pile | 4458.0<br>4446.0 | 45 ton per pile | 12 3/4 in. pipe piles 45 t/pile<br>10 BP 42 H-Pile 45 t/pile | 4563.0<br>4560.0 | [A] Cast-in-Place. Cast-in-dry drill hole after visual inspection |
| Pier No. 1 | "K" 53 + 30 H-1091N | 24" Cast-in Place Conc. Pile<br>16" Cast-in Place Conc. Pile | 4560.0<br>4548.0 | 45 ton per pile | 12 3/4 in. pipe piles 45 t/pile<br>10 BP 42 H-Pile 45 t/pile | 4566.0<br>4562.0 | [B] Driven Piles. Predrilling through stiff clay may be required for proper end bearing |
| Pier No. 2 | "K" 53 + 60 H-1091S H-1091N | 24" Cast-in Place Conc. Pile<br>16" Cast-in Place Conc. Pile | 4560.0<br>4548.0 | 45 ton per pile | 12 3/4 in. pipe piles 45 t/pile<br>10 BP 42 H-Pile 45 t/pile | 4566.0<br>4562.0 | |




LOCATION MAP




## BORING #1

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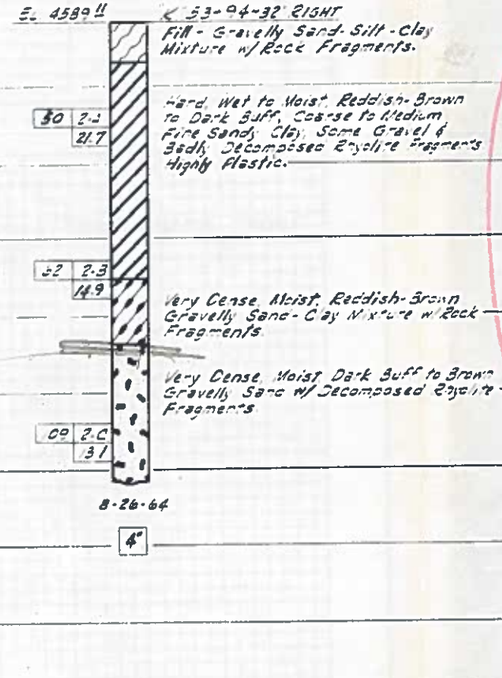


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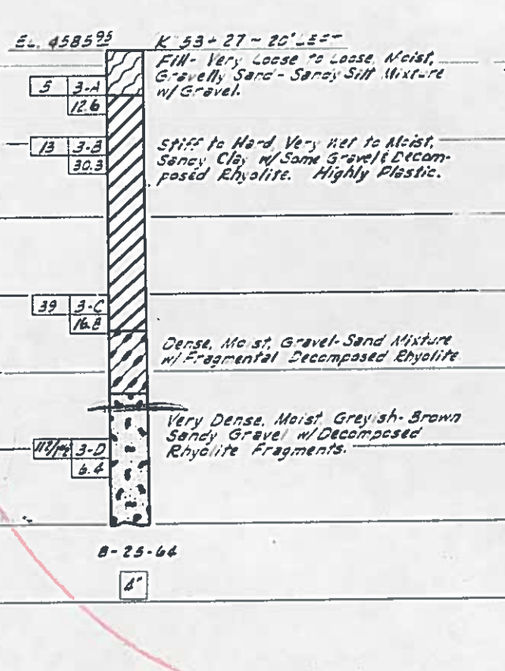


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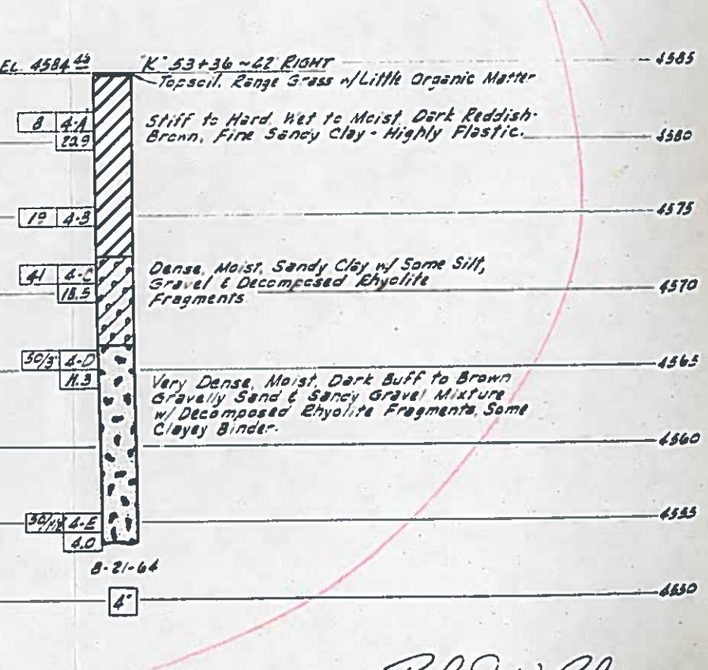
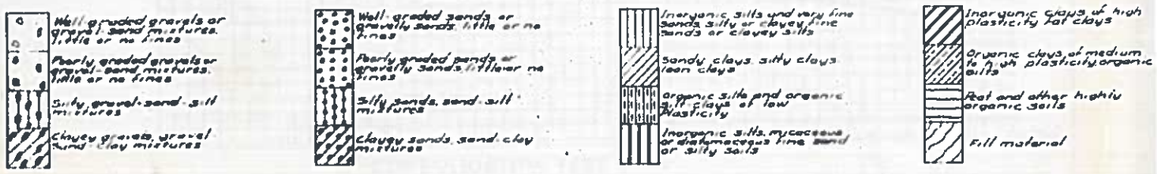



PROFILES

APPROVED Richard W. Anderson RE No 1643

## LEGEND OF SOILS

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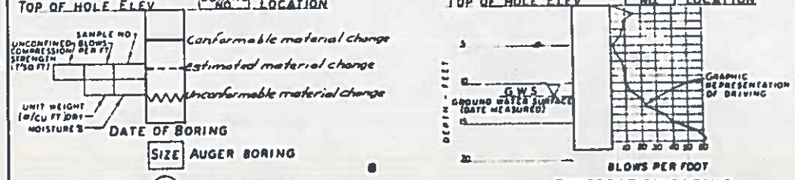



STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

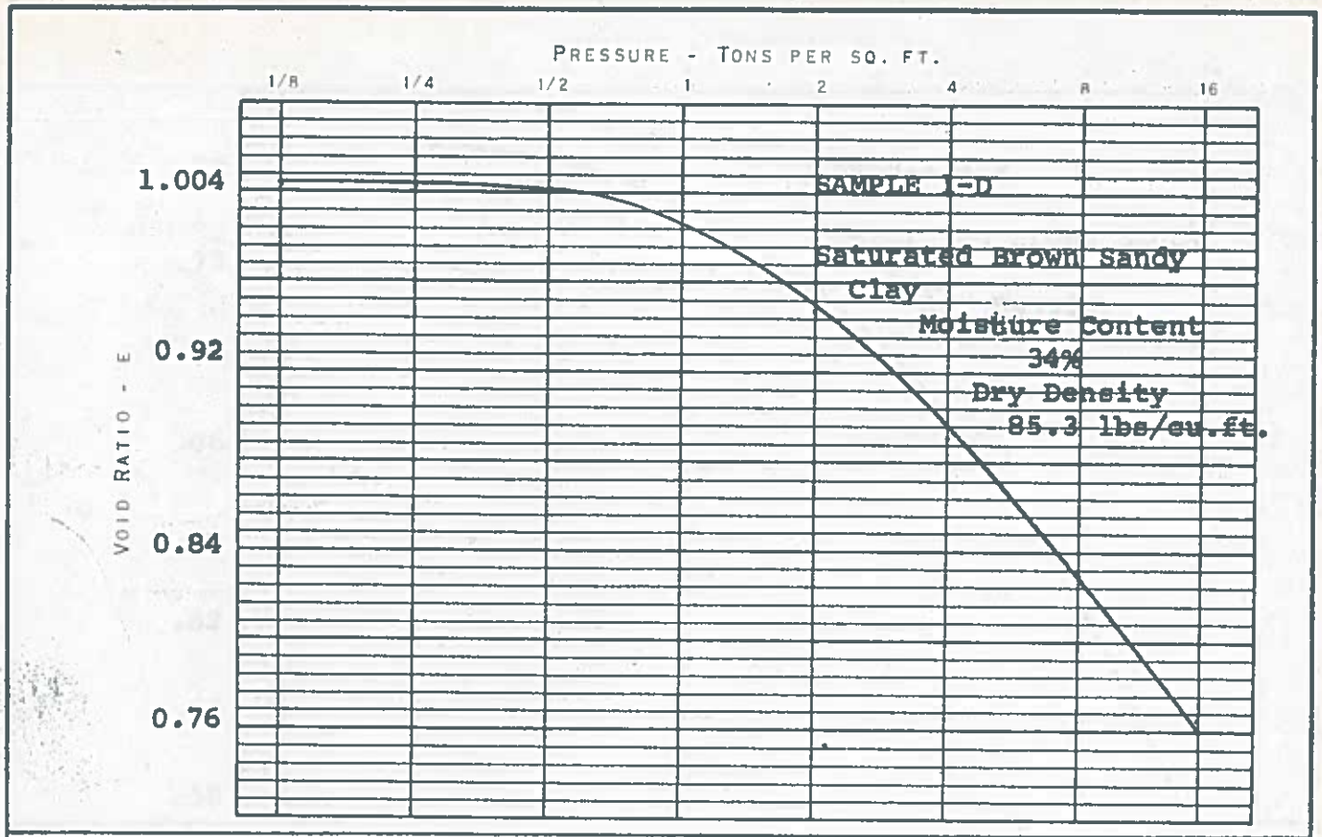
SUN VALLEY
GRADE SEPARATION
H-1091N & H-1091S

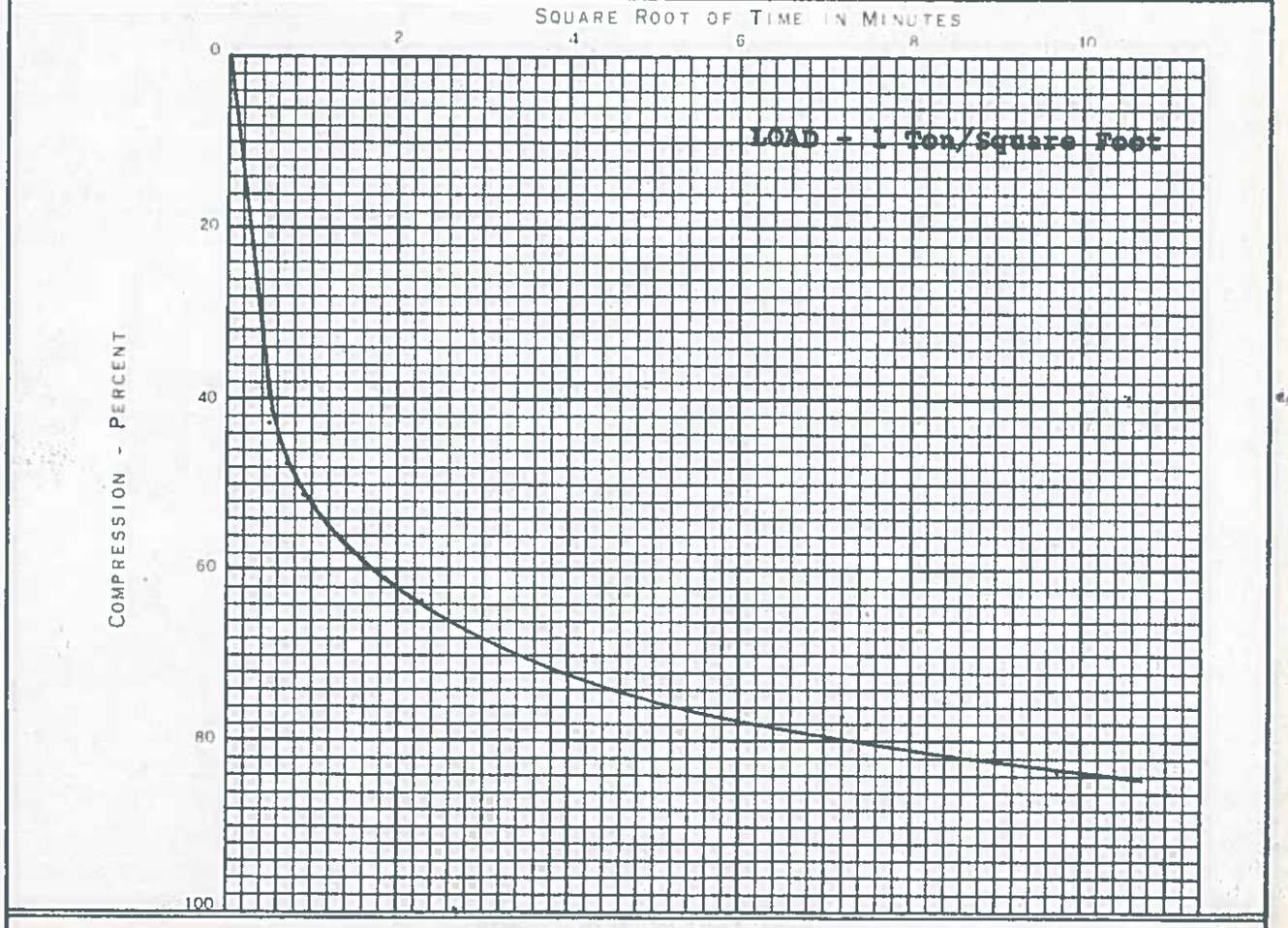
LOG OF TEST BORINGS

SPROUT ENGINEERS, INC.
950 INDUSTRIAL WAY
SPARKS, NEVADA

SEPT. 24, 1964
8290-T-64
JWH/LH

PLATE 2



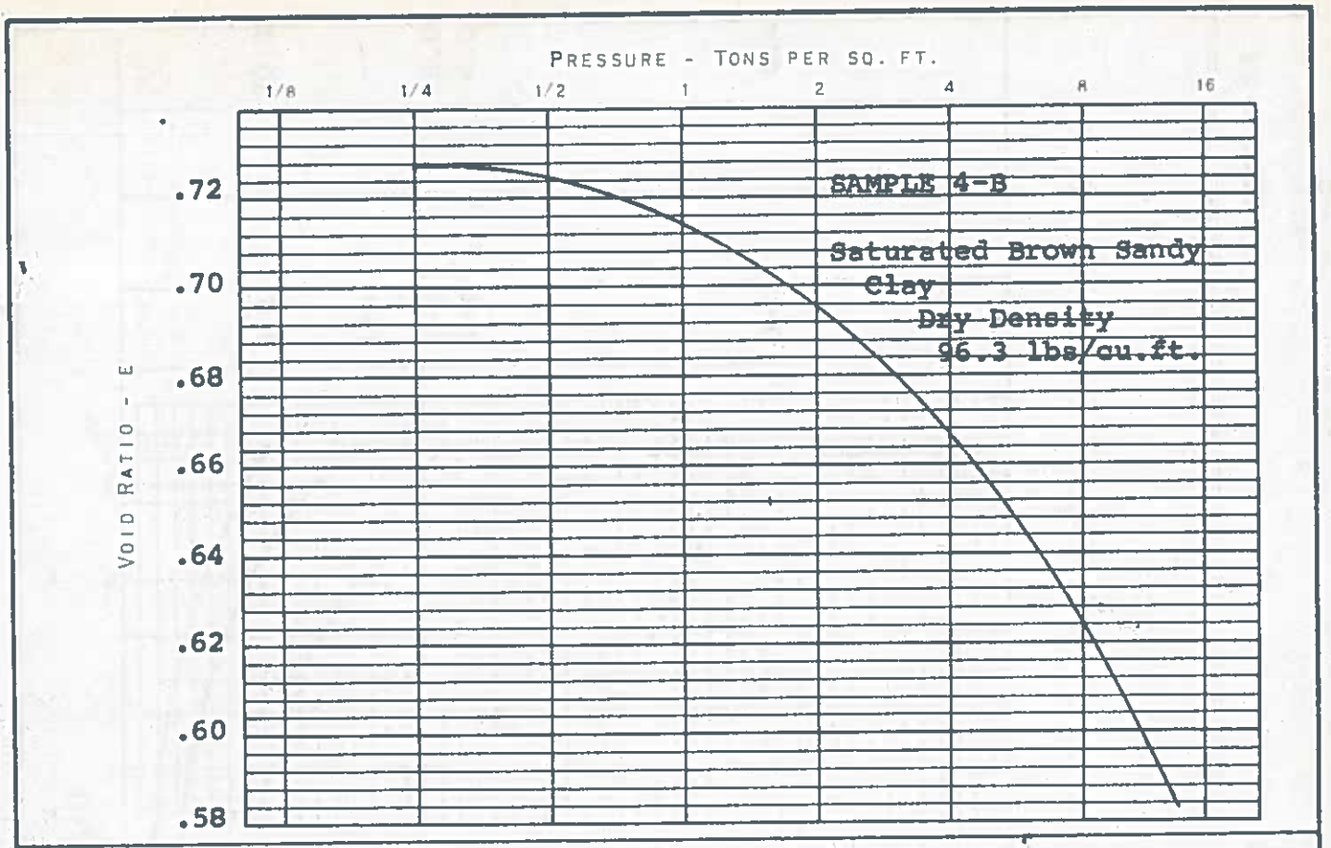



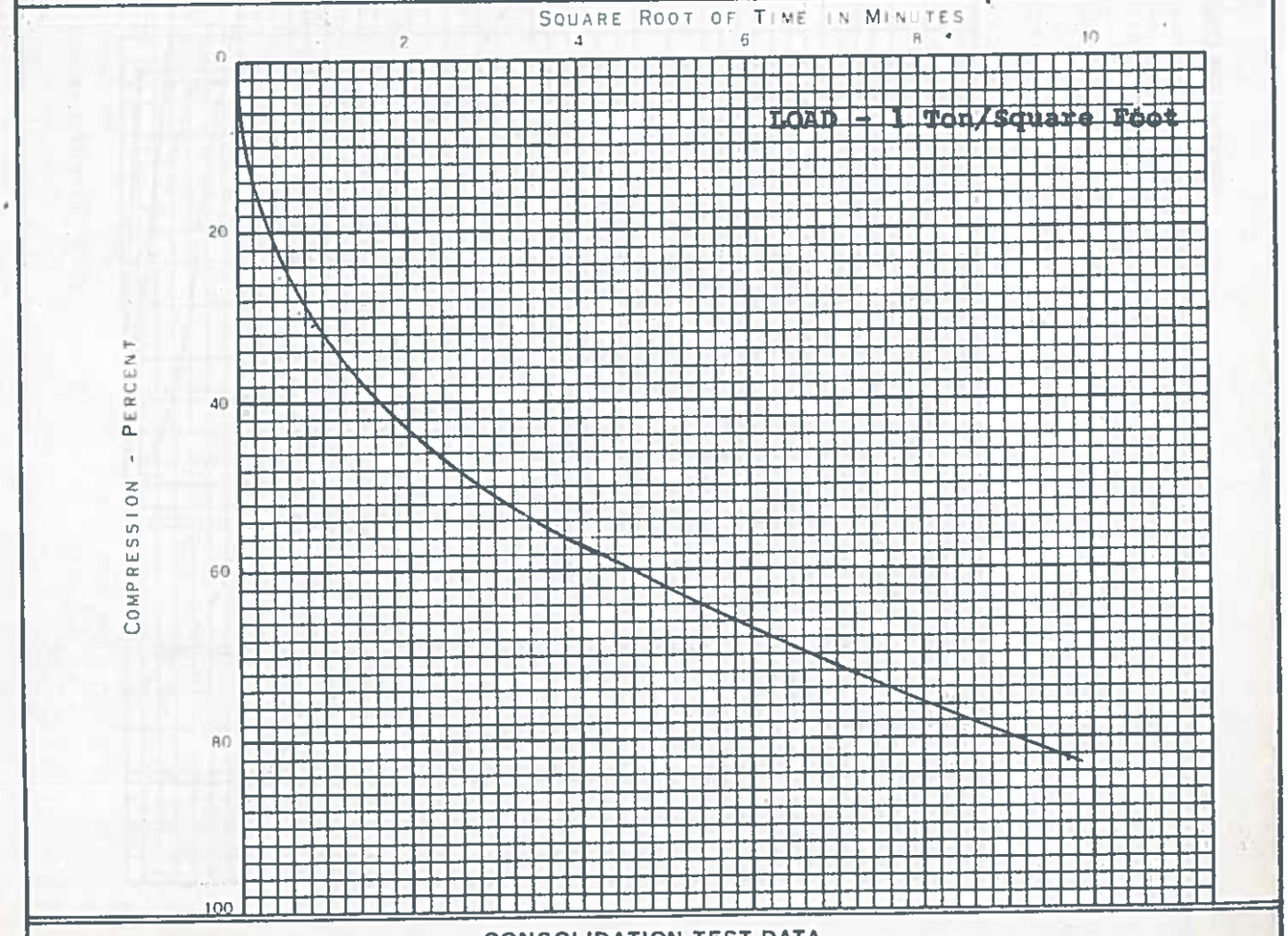

CONSOLIDATION TEST DATA

SPROUT ENGINEERS, INC.

FOUNDATION ENGINEERING

PLATE 3



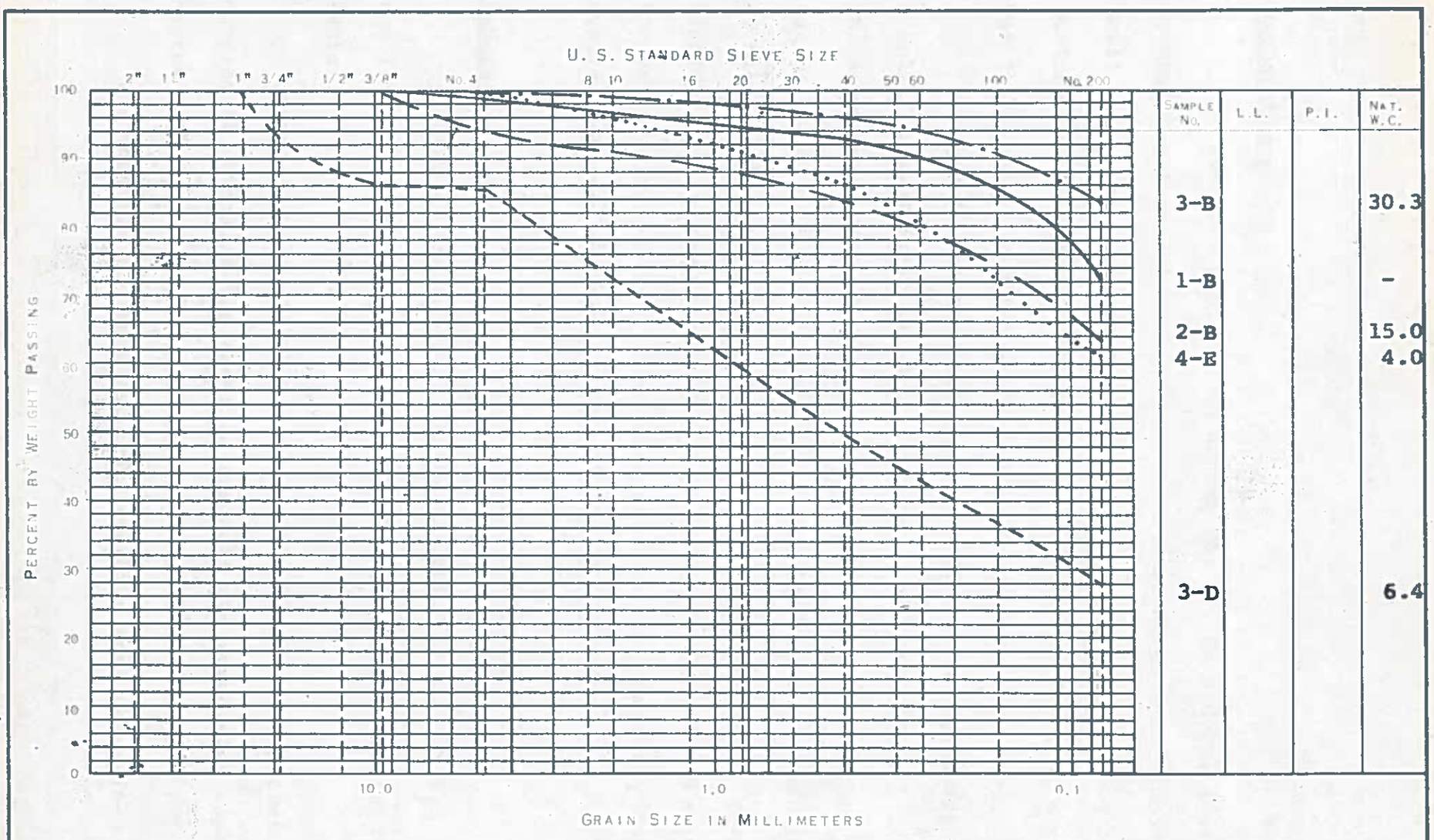




**CONSOLIDATION TEST DATA**

SPROUT ENGINEERS, INC.

FOUNDATION ENGINEERING

PLATE 4




**GRADATION CURVES**

**8290-T-64**

SPROUT ENGINEERS, INC.

MATERIAL TESTING

Plate 5

# APPENDIX I

## Explorations

The site was explored on August 20, 21, 25 and 26, 1964, by drilling four (4) test holes with a Test Borer Soil Sampling Drill Rig. The location of these holes is shown on the Log of Borings in the body of this report. The maximum depth of boring was thirty-six (36) feet below the surface.

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

## Laboratory Tests

Samples of the different soils encountered were tested in the laboratory as to grain-size distribution and plasticity characteristics.

Unconfined compression tests were performed on representative samples to determine the shearing strength and supporting capacities of the soil.

The moisture contents and dry densities were determined from

APPENDIX II

TEST RESULTS

Gradation

| Sample No. | Percent by Weight Passing No. 4 Sieve | Percent by Weight Passing No. 200 Sieve | Plastic Index |
|---|---|---|---|
| 1-A | 98.4 | 71.4 | 30 |
| 2-B | 94.7 | 63.2 | 30 |
| 3-B | 99.7 | 83.9 | 30 |
| 3-D | 79.9 | 28.1 | -- |
| 4-E | 100.0 | 61.6 | 40 |

Unconfined Compression Test

| Sample No. | Compressive Strength Lbs. per Sq. Ft. | Shearing Strength Lbs. per Sq. Ft. |
|---|---|---|
| 1-C | 31,900 | 15,970 |
| 3-C | 49,900 | 24,955 |
| 4-A | 11,885 | 5,940 |
| 4-C | 43,560 | 21,780 |