SPROUT ENGINEERS, INC.

1715 - 1725 "B" STREET • SPARKS, NEVADA
PHONE 355-9229 - 355-8303

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FOUNDATION INVESTIGATION

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
EMIGRANT SUMMIT INTERCHANGE
NUMBER I 889

SPROUT ENGINEERS, INC.

1715 - 1725 "B" STREET • SPARKS, NEVADA

PHONE 358-6931 · 358-6930

CIVIL ENGINEERING
ENGINEERING REPORTS
SURVEYING

FOUNDATION ENGINEERING
MATERIALS TESTING
CONCRETE DESIGN

Job No. 7454-T-63
December 19, 1963

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

Dear Mr. Wright:

SUBJECT: FOUNDATION INVESTIGATION -
EMIGRANT SUMMIT INTERCHANGE

We are submitting herewith the foundation report for the Emigrant Summit Interchange, Number I 889, crossing Interstate Highway 80.

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

We wish to thank you for this opportunity to prepare this report and wish to advise that we will be available for discussion or to answer any questions which may arise.

Respectfully submitted,

Eugene C. Sprout
Registered Civil
Engineer No. 933

Richard W. Arden
Registered Civil
Engineer No. 1643

RWA/pjg

FOUNDATION INVESTIGATION

STATE OF NEVADA

DEPARTMENT OF HIGHWAYS

Submitted herein are the results of a foundation investigation for the Emigrant Summit Interchange, Number I 889. The work was conducted during the second week of November, 1963, in accordance with an agreement between the Nevada State Department of Highways and Sprout Engineers, Inc.

In accordance with the agreement, a registered professional geological engineer or registered professional civil engineer, who is a principal member of the consulting firm, supervised the work at all times.

Scope:

The scope of the investigation consisted of the necessary drilling, sampling, field and laboratory testing to establish a safe and economical substructure design.

The results of the field investigation and laboratory tests, which form the basis for our recommendations, are included in this report.

Structural Considerations:

The Interchange consists of one (1) four-span, reinforced concrete structure to carry traffic over Interstate Highway 80.

Geologic and Soil Conditions:

The geology of the site consists of intricate volcanic lava flows and tuff. These volcanics have been traversed and eroded by water which has resulted in the ravine that runs east-west through the area. Subsequent to the erosion, a period of weathering and deposition followed. The weathering processes formed a thin mantle of clayey material over the site where Abutment No. 2 and Pier No. 3 are located. In the areas of Abutment No. 1 and Piers No. 1 and 2, the process of deposition has resulted in a strata of clayey sands and silts fifteen (15) to eighteen (18) feet thick being deposited over the volcanic tuff and lavas. Ground water was encountered at elevation 5674 $\pm$ at Borings 4, 5, and 6.

Discussion:

The conditions are such that, at Abutment No. 2 and Pier No. 3, the use of spread footings are feasible. At Abutment No. 1 and Piers No. 1 and 2, suitable foundation material for footing foundations was not encountered at economic excavation depths, thus, piles will be required at these locations.

In the areas of Abutment No. 1 and Pier No. 1, some small boulders were encountered during the drilling exploration. These boulders are interbedded with the clayey sands and silts

at these locations and may give a false end bearing resistance to piles driven in these areas. These piles should be driven to a minimum tip elevation specified on Plate 1, Tabular Summary of Foundation Recommendations. The soils surrounding these boulders are compressible, therefore, it is absolutely necessary that piles reach the specified minimum tip elevation.

The boulders, which probably rolled off the hill to the south, are erratic in distribution and may not be encountered during driving operations. It is necessary to base recommended pile types on the probability of encountering these buried boulders.

Consolidation tests indicate that the soil beneath Abutment No. 1 is compressible. The estimated settlement of this soil with a twenty-five (25) foot fill placed upon it is approximately eleven (11) inches. Calculations indicate that fifty per cent (50%) of the settlement will occur in a week and that ninety per cent (90%) will take place in twenty-five (25) days. Time-settlement relationships are shown on Plate 3.

Settlement studies also indicate that, by placing a five (5) foot surcharge on the fill, ninety per cent (90%) of consolidation will occur in approximately seventeen (17) days. This is only a reduction of one (1) week over the time-settlement anticipated without the surcharge. It does not appear economical to place a surcharge on the fill in the vicinity of Abutment No. 1.

Recommendations:

1. A bearing value of three and one-half (3½) tons per square foot can be used for spread footings at Pier No. 3 and Abutment No. 2.

2. Piles are recommended at Abutment No. 1 and Piers No. 1 and 2. It is recommended that a 10 B.P. 42 pound steel H pile be driven to a design load of forty-five (45) tons per pile. The piles used for Abutment No. 1 and Pier No. 1 should have the lower two (2) feet of each pile reinforced by welding a one-quarter (1/4) inch plate to the inside of the webs to eliminate the possibility of web and flange separation during hard driving if boulders are encountered.

3. Piles should be driven through holes made through the approach fill at Abutment No. 1. Care should be taken that rocky material is not incorporated in those portions of the fill through which piles are to be driven.

4. Load tests are not considered necessary if piles are driven to the specified minimum tip elevations as recommended in the Tabular Summary of Foundation Recommendations, Plate 1.

5. At least twenty-five (25), and preferably thirty (30), days should elapse between the placing of the fill and the construction of Abutment No. 1 blocks. This waiting period will eliminate the settlement of fill away from the base of the blocks which will be supported by piles.

6. Due to the erratic nature of the intermixed volcanic lava and tuff at Abutment No. 2 and Pier No. 3, it is recommended that a principal design engineer from the Bridge Division and the consultant inspect these areas after excavation and prior to placement of spread footings.

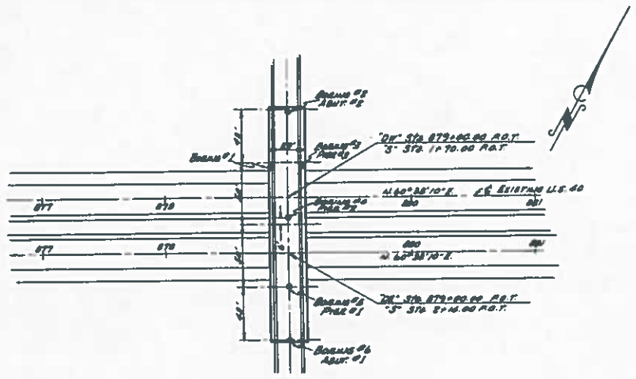
The following plates and appendixes are attached and complete this report:

Plate 1	Tabular Summary of Foundation Recommendations
Plate 2	Log of Borings
Plate 3	Time-Settlement Curve
Appendix I	Exploration and Laboratory Tests
Appendix II	Test Results

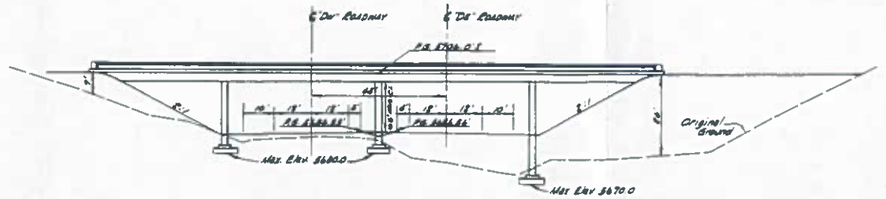
TABULAR SUMMARY OF FOUNDATION RECOMMENDATIONS
FOR THE
EMIGRANT SUMMIT INTERCHANGE

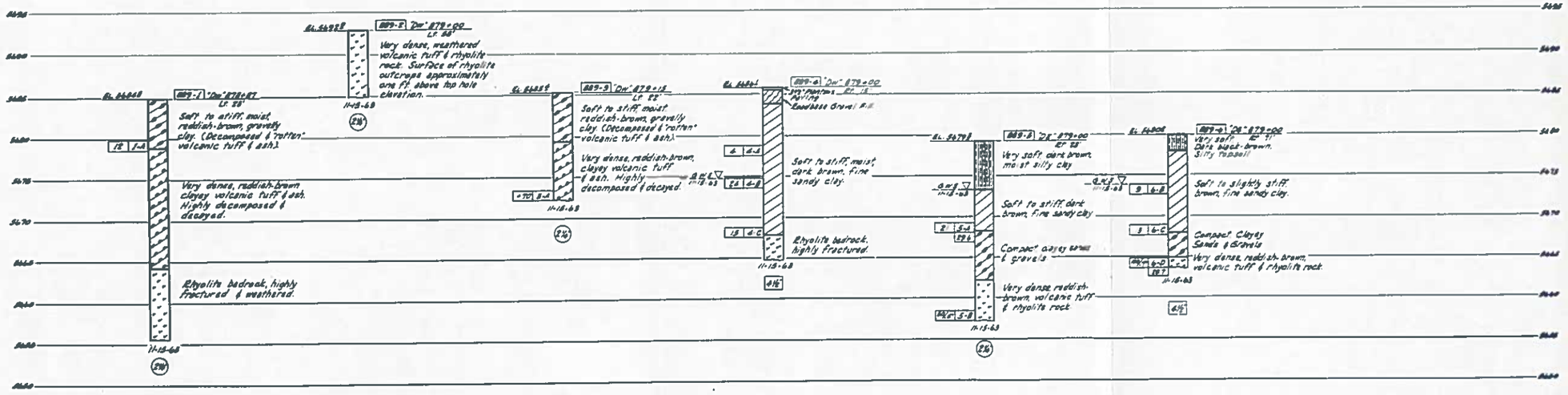
SUPPORT DESIGNATION	SUPPORT STATION	RECOMMENDED SUPPORT TYPE	SAFE ALLOWABLE DESIGN LOAD	ESTIMATED PILE TIP PENETRATION OR SPREAD FOOTING BLOCK ELEVATION	ALTERNATE SUPPORT TYPE	ESTIMATED TIP PENETRATION FOR ALTERNATE SUPPORT	SPECIAL CONSIDERATIONS
Abutment No. ①2 South	"DE" 879+00 Rt. 71 ft.	10 B.P. 42-H Pile with reinforced tip	45 T/Pile	5664.0	None		Drive Through Hole Made in Fill & to Minimum Tip Elevation of 5665.0
Pier No. ①3	"DE" 879+00 Rt. 28 ft.	10 B.P. 42-H Pile with reinforced tip	45 T/Pile	5661.0	None		Drive to Minimum Tip Elevation of 5662.0
Pier No. ②2	"DW" 879+00 Rt. 22 ft.	10 B.P. 42-H Pile	45 T/Pile	5667.0	None		Drive to Minimum Tip Elevation of 5668.0
Pier No. ③1	"DW" 879+00 Lt. 28 ft.	Spread Footing	3½ T/sq. ft.	5678.0	10 B.P. 42-H Pile at 45 T/Pile	5675.0	Inspection by Consultant if Footings Used
Abutment No. ②1 North	"DW" 879+00 Lt. 78 ft.	Spread Footing	3½ T/sq. ft.	5694.0	10 B.P. 42-H Pile at 45 T/Pile	5694.0	Inspection by Consultant if Footings Used

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



LOCATION MAP





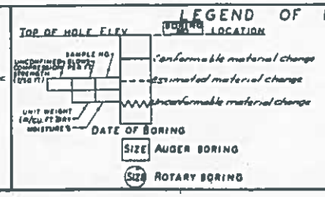
PROFILES

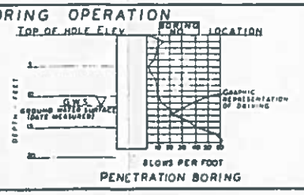
Approved: Richard W. Ahlo
R.E. Jan 19-64

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 with slight plasticity
Sandy clays, silty clays, lean clays
Organic silts and organic silty 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





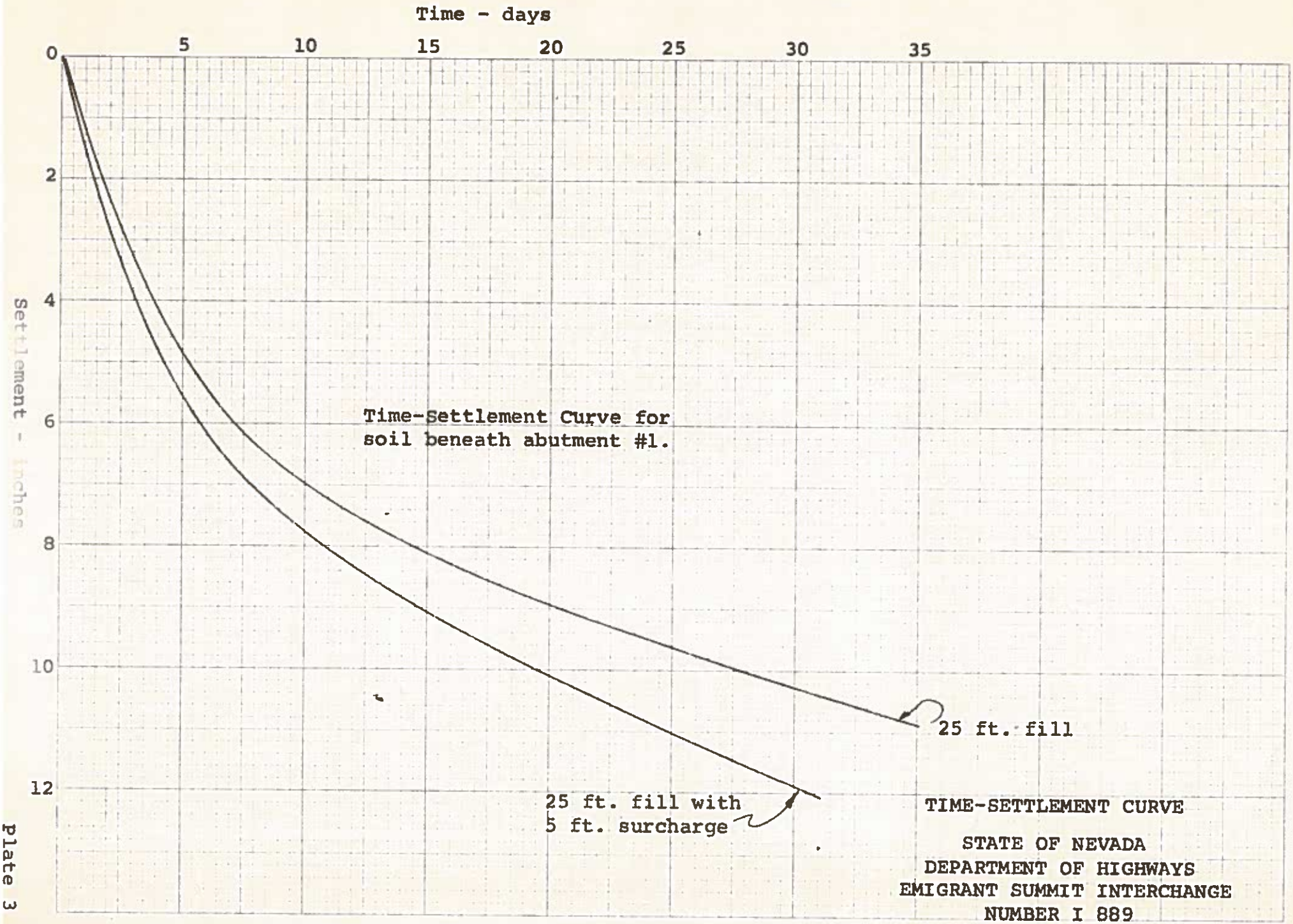
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

EMIGRANT SUMMIT INTERCHANGE
I-889

LOG OF TEST BORINGS

SPROUT ENGINEERS, INC.
1715 "B" STREET
SPARKS, NEVADA

DEC. 12, 1963
Job 7164-3-63



TIME-SETTLEMENT CURVE

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
EMIGRANT SUMMIT INTERCHANGE
NUMBER I 889

Plate 3

APPENDIX I

APPENDIX I

EXPLORATIONS

The site was explored on November 11 - 15, 1963, by drilling six (6) 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 twenty-nine (29) feet below the surface.

Samples of various soils encountered were obtained with a 3 Inch Thin Walled Shelby Tube and a Split Spoon Sampler (2" O.D. - 1 3/8" I.D.). The Split Spoon 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 were taken for examination and testing in our laboratory.

LABORATORY TESTS

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

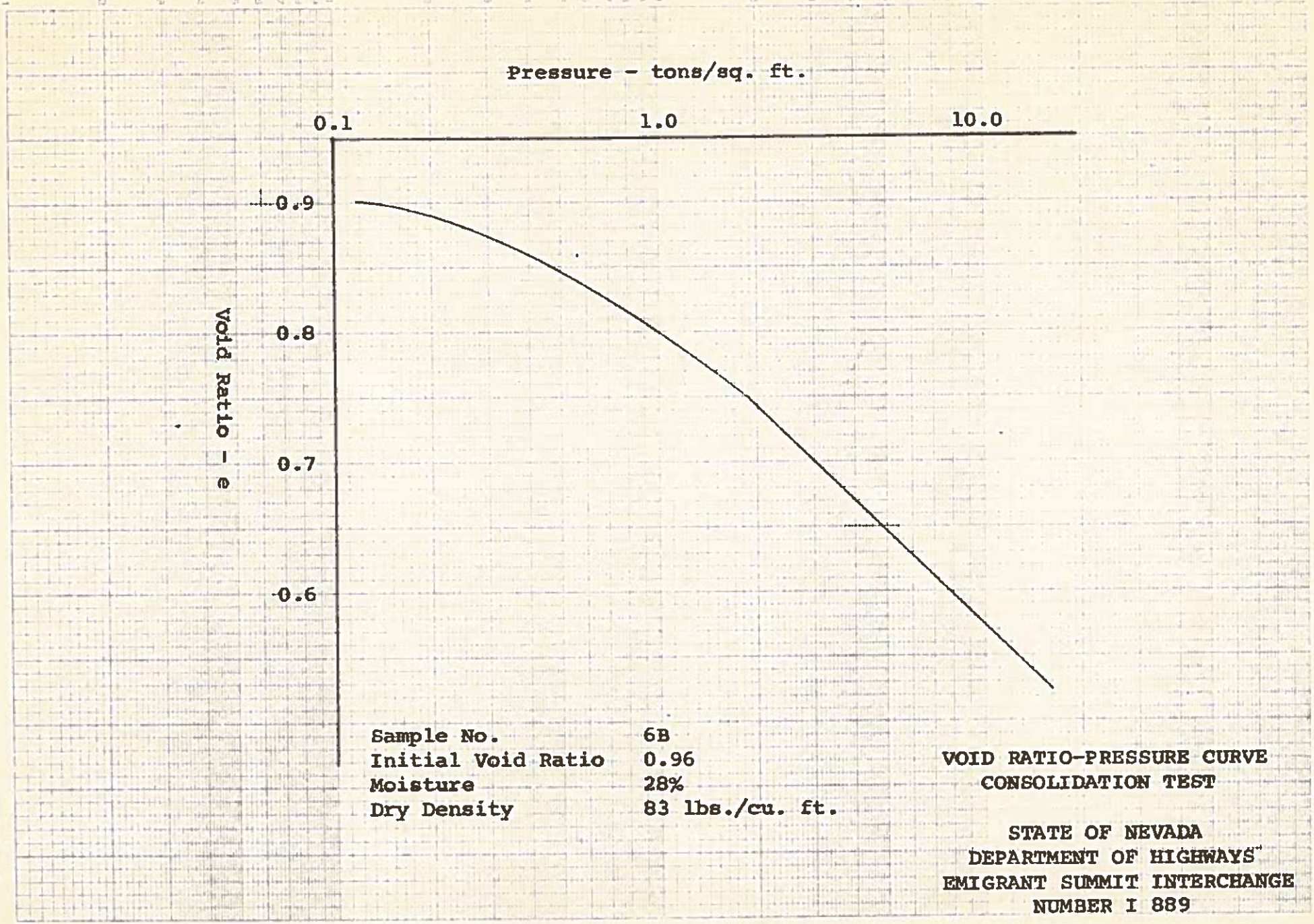
Unconfined compression tests were performed on representative samples to determine the shearing strength and supporting capacities of the soils.

The moisture contents and dry densities were determined from core samples. These values were used with strength tests and other data in calculations of bearing capacity and settlement. The results of these tests are shown in the Log of Borings.

A consolidation test was performed on a representative undisturbed sample in a saturated condition. The data obtained from this test was used to plot time-consolidation and pressure-consolidation curves. Engineering analysis of these curves permits estimation of probable settlement and rate of settlement under applied loads. The curves, representing data from these tests, are included in the report.

The standard penetration tests were correlated with strength tests and settlement studies along with established empirical data in order to determine the supporting capacities of the soils.

APPENDIX II

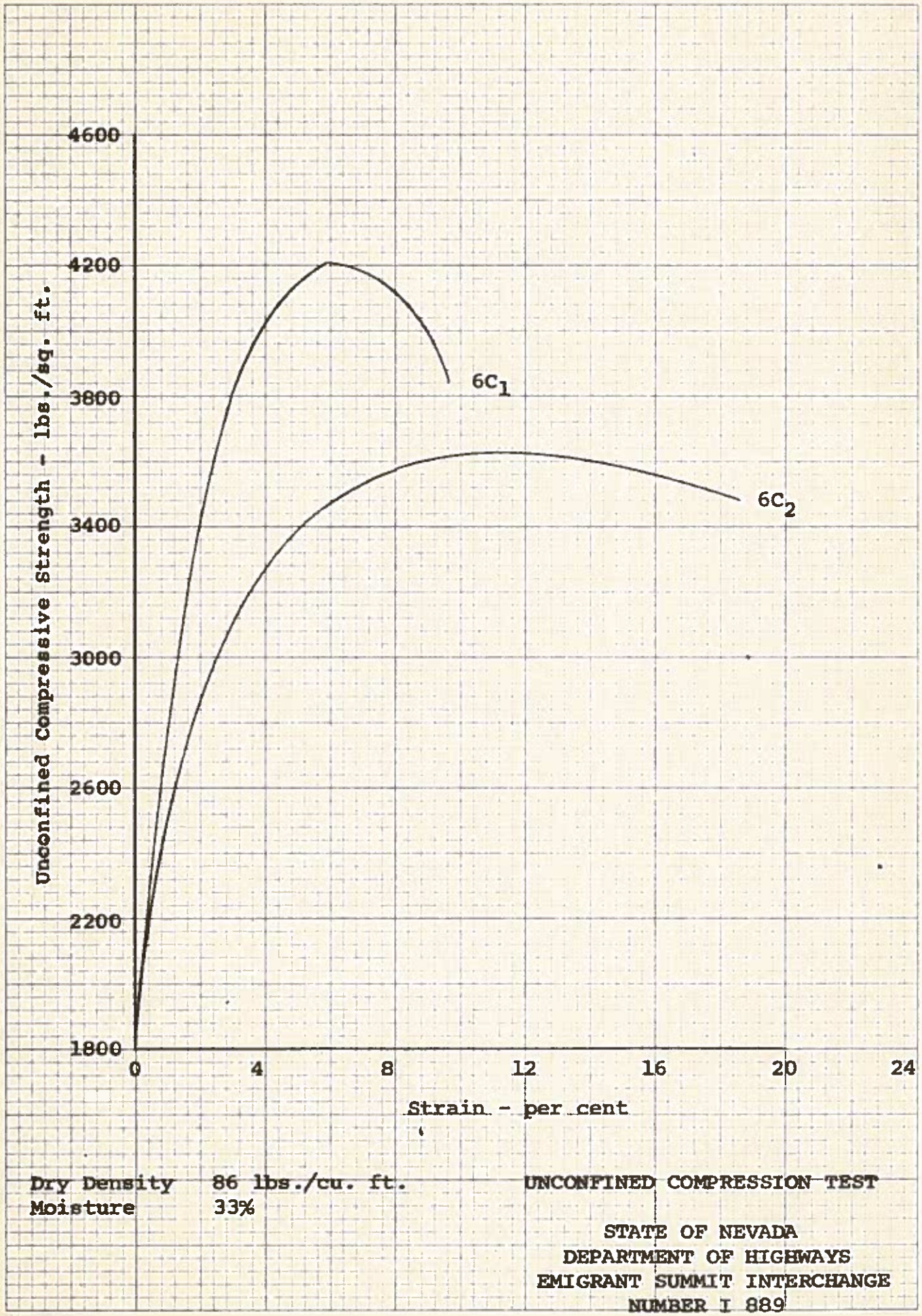


Sample No.	6B
Initial Void Ratio	0.96
Moisture	28%
Dry Density	83 lbs./cu. ft.

VOID RATIO-PRESSURE CURVE
CONSOLIDATION TEST

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
EMIGRANT SUMMIT INTERCHANGE
NUMBER I 889

Plate 4

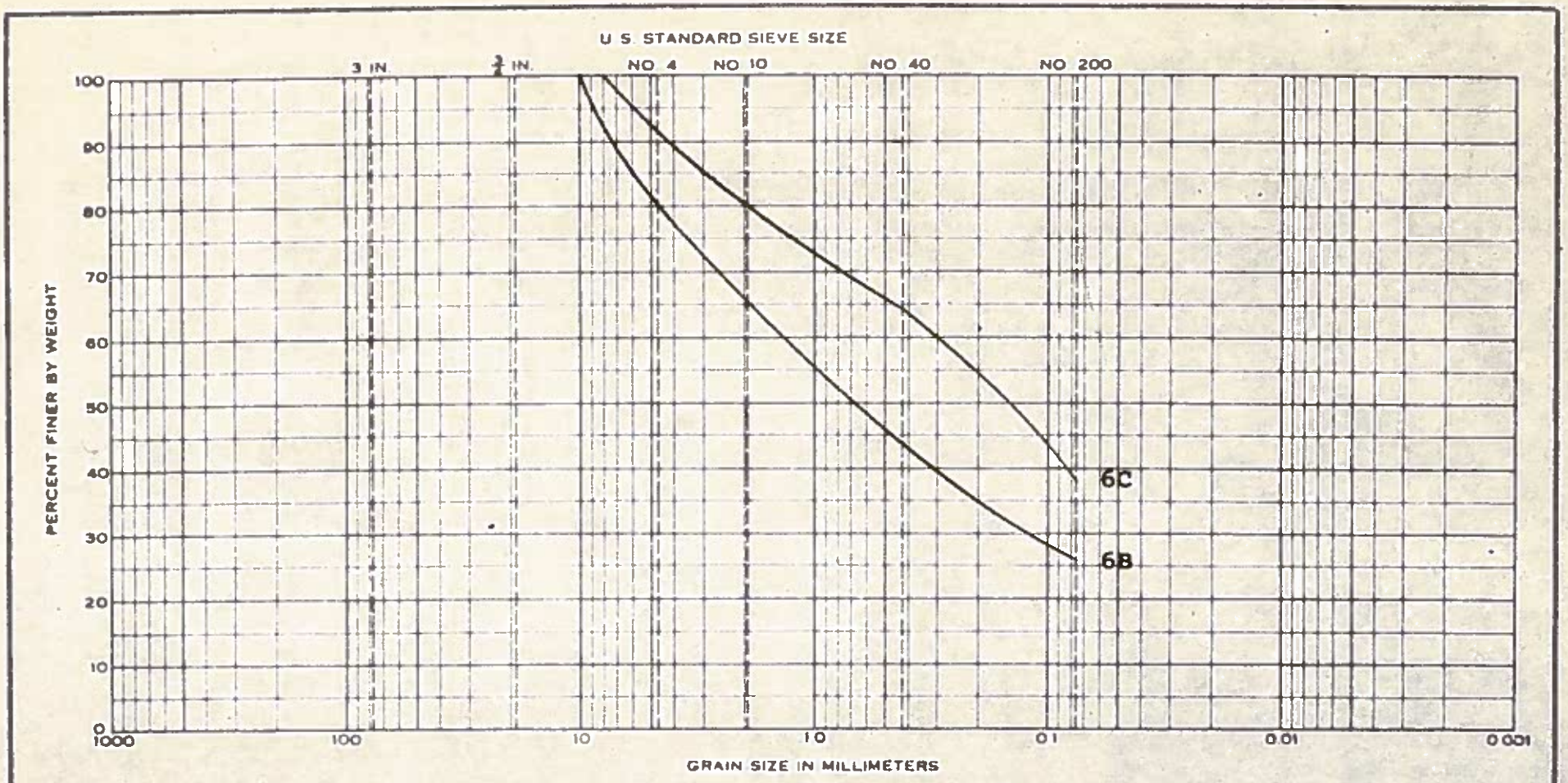


Dry Density 86 lbs./cu. ft.
Moisture 33%

UNCONFINED COMPRESSION TEST

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
EMIGRANT SUMMIT INTERCHANGE
NUMBER I 889

Plate 5



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
6B	5674	Sandy Silt		35	21	14
6C	5668	Sandy Silt		37	24	13

GRADATION CURVES

Project EMIGRANT SUMMIT
#I 889
Area
Boring No. 6
Date

Plate 6