GEOTECHNICAL EXPLORATION
PROPOSED GRADE SEPARATIONS
U.S. HIGHWAY 95 AT
LONE MOUNTAIN RD. & ALEXANDER RD.
LAS VEGAS, NEVADA

for: G.C. Wallace, Inc.

Project No. 4129J001

March 10, 1989

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INTRODUCTION

This report presents the results of a geotechnical exploration performed for the proposed grade separations along U.S. Highway 95 at Lone Mountain Road and Alexander Road in Las Vegas, Nevada. The two intersections are shown on Plate No. 1, entitled Plot Plan.

The exploration included obtaining information on existing conditions, performing laboratory testing and engineering analyses, providing recommendations for use in design of foundations and retaining walls, and providing grading guidelines. Approximate locations of our field explorations are shown on Plate No. 1. Results of the field explorations and laboratory tests are presented in the Appendix.

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. No other warranty, express or implied, is made. This report has been prepared for G.C. Wallace, Inc. to be used as an aid in the design of the proposed project. This report is not a bidding document, and any contractor reviewing this report must draw his own conclusions regarding specific construction techniques to be used on this project.

PROPOSED CONSTRUCTION

Grade separations are planned along U.S. Highway 95 (Oran K. Gragson Highway) at Lone Mountain Road and Alexander Road. The grade separations will consist of earthen ramps to reinforced concrete bridge structures spanning U.S. Highway 95. Each bridge will have two piers at its center and abutments at each side. It is planned to support the piers on square spread-type foundations and the abutments on continuous spread-type foundations. Preliminary load information provided by the Department of Transportation indicates that each pier will impose approxiately 1500 kips.

SUBSURFACE EXPLORATION AND TESTING PROGRAMS

The subsurface exploration program consisted of drilling 10 borings to depths ranging from 10 to 30 feet below existing grade. Samples were obtained to aid in material classification and for laboratory testing. Laboratory tests included moisture-density determinations, direct shear tests, consolidation tests and chemical tests. A more detailed discussion of the subsurface exploration and testing programs is presented in the Appendix.

SITE CONDITIONS

Surface

The areas of the planned grade separations are existing intersections. U.S. Highway 95 had two paved travel lanes in

each direction separated by an unpaved median. Lone Mountain Road and Alexander Road had one paved travel lane in each direction. There was a sparse growth of vegetation in the undeveloped areas. Site drainage was generally by sheetflow to the east.

Subsurface

Soils encountered at the two grade separation locations were similar. There was from 1/2 to 5 feet of fill encountered at the surface in 9 of 10 explorations. The fill consisted of sandy gravel, gravelly sand, clayey sand and silty sand. There could be deeper and/or poorer quality fill beyond exploration locations.

Natural soils generally consisted of firm to moderately hard silty clay and sandy clay with some medium dense to dense clayey sand. Test results indicate that onsite soils are only somewhat expansive. Moderately hard to hard caliche was encountered in 3 explorations. The claiche was first encountered at depths ranging from 12 to 28 1/2 feet below existing grade. Water was not encountered within the depths explored.

GEOLOGIC DISCUSSION

The planned grade separations are located in the west-central portion of the Las Vegas Valley. This location places the site in an area underlain by thick alluvial deposits (hundreds of feet) of which the surface materials generally

consist of fine-grained soils, with the materials being irregularly cemented.

Inspection of the ground surface indicated no readily discernible evidence suggestive of recent faulting. The nearest mapped compaction fault to either intersection is about 1/2 mile to the east.[1] Compaction faults are generally accepted as a phenomena resulting from deep-seated, differential consolidation of alluvial materials with dissimilar grain size and compressibility characteristics. Since the subject grade separations are west of the most westerly compaction faults in the Valley, there should be no effect on the projects due to potential fault movements.

The subject site is located within zone 2B as defined by the Uniform Building Code 1988 edition on Figure 2, entitled Seismic Zone Map of the United States. Numerous seismic events, most of which were a probable result of underground blasting at the Nevada Test Site (about 90 miles north of Las Vegas), have been felt in and around the Las Vegas area. There is a noticeable lack of earthquakes which have epicenters in the Southern Nevada area and are directly attributable to deep-seated tectonic movement. A few events recorded in the Henderson area and in Lincoln County registered between 5.0 and 6.0 Richter magnitude. Most of the recorded events in the area range between 4.0 and 4.9.

1- Bell, John W., 1981, Subsidence in Las Vegas Valley, Nevada Bureau of Mines and Geology, Bulletin 95

RECOMMENDATIONS

General

As can be noted by the exploration logs, subsurface conditions varied. However, most onsite materials will provide satisfactory support for the planned construction.

Foundations

Planned bridges, wing walls and retaining walls may be supported by spread-type foundations established on undisturbed dense or stiff natural soils and/or properly compacted fill. Foundations should be at least 24 inches wide and should be established at least 24 inches below the lowest adjacent final compacted subgrade or top of paving. Foundations may be designed to impose a maximum dead- plus live-load pressure of 4500 pounds per square foot. The bearing value is a net bearing value and the weight of the foundation may be ignored. A one-third increase in the bearing value may be used for wind or seismic loads.

Settlement

Based on subsurface conditions encountered and data provided, it is our opinion that if structures are supported as recommended, settlement should be within acceptable limits. We can provide estimates of structure settlements when foundation designs are finalized.

Compacted fill embankments for ramps will cause settlement. Natural soils encountered consisted primarily of nonsaturated fine-grained soils. We estimate that approximately 60 percent of the settlement due to the placement of the fill will take place during placement. The remainder of the settlement will occur over a period of time. We recommend that the compacted fills be placed as far ahead of structure construction as possible. Placement of the asphaltic paving on the ramps should be at the end of construction.

Lateral Loads

Lateral loads may be resisted by soil friction and by the passive resistance of the soils. A coefficient of friction of 0.30 may be used between foundations and the supporting clay soils. The passive resistance of natural soils or properly compacted fill may be assumed to be equal to the pressure developed by a fluid with a density of 300 pounds per cubic foot. A one-third increase in the passive value may be used for wind or seismic loads. The passive resistance and the frictional resistance of the soils may be combined without reduction in determining the total lateral resistance.

Active Pressure

Cantilevered walls with level earth backfill may be designed to resist an active earth pressure equal to 30 pounds per cubic foot. Any surcharge from adjacent loadings should be

added to this pressure using a factor of 0.3. Drainage should be provided behind the walls to prevent hydrostatic pressure buildup. Walls should be waterproofed or at least dampproofed. It is important that all backfill be properly placed and compacted. Backfill should be mechanically compacted in layers; flooding should not be permitted. Care should be taken when placing backfill so as not to damage the walls. Backfills should be inspected and tested during placement.

Excavations and Slopes

Onsite soils can be excavated using conventional equipment. Cemented deposits were encountered at depths greater than 12 feet in 3 of 10 explorations. Based on data obtained from our explorations, we do not anticipate that cemented deposits will be encountered during construction. If cemented deposits are encountered, contractors should satisfy themselves as to the hardness of deposits and construction procedures and equipment required.

Excavations should not be expected to stand vertically with safety. Excavations should be sloped back or shored. Unshored excavations should be sloped back at least 1:1. Slopes may need to be flattened based on conditions exposed during construction. Traffic and any surcharge loads should be kept back at least ten feet from the top of excavations. Exposed slopes should be kept moist (but not saturated) during construction. Berms should be constructed adjacent to the tops

of excavations to help prevent surface water from entering the excavations or eroding the slope surfaces.

Permanent slopes should be constructed no steeper than 1 1/2:1 (horizontal to vertical). Fill materials shall be generally placed on a horizontal plane unless otherwise accepted by the Geotechnical Engineer. Fill placement near the tops of slopes shall be properly controlled in such a manner that loose soils are not allowed to slough over or onto the slope surface. Slope surfaces should be properly compacted or overfilled and trimmed back. Berms or other drainage devices should be constructed at the tops of slopes. Consideration should be given to protecting the surface of completed slopes to prevent erosion.

Grading

All vegetation, debris, existing uncontrolled fill soils and loose or disturbed natural soils should be removed from within the planned roadways, improvement areas, and areas to receive structural fill. Removal of materials should extend at least five feet beyond planned improvements, if practicable. The term uncontrolled fill refers to any existing fill that was not properly placed, inspected or tested.

After performing required excavations, the exposed soils should be carefully inspected and any remaining unsuitable deposits should be removed. Exposed soils should then be

scarified to a depth of six inches, moistened as necessary, and compacted to at least 90 percent of the maximum density obtainable by the ASTM D1557 method. After compacting the upper soils, all required fill should be placed in loose lifts not over eight inches in thickness. As mentioned in detail later in this section, we recommend that all embankment fill and backfill consist of imported granular material. Materials should be compacted to at least 95 percent. Moisture content of the soils at the time of compaction should be at or near optimum.

Fill materials shall be generally placed on a horizontal plane unless otherwise accepted. Fill placement near the tops of slopes should be properly controlled in such a manner that loose soils are not allowed to slough over or onto the slope surface. Slope surfaces should either be overfilled and trimmed back or slope rolled to provide a properly compacted surface.

Onsite soils are predominantly fine-grained clay soils. We recommend that excavated clay soils not be used for embankment fill or backfill. We recommend that embankment fill and backfill consist of select imported materials. Imported materials should be predominantly granular and nonexpansive and have 100 percent passing the 3 inch sieve and less than 10 percent passing the No. 200 sieve. Imported material should be approved prior to importing.

Paving

Subgrade for the areas to be paved should be properly prepared as outlined in the Grading section prior to placing any asphalt or base materials. Proper drainage of paved areas should be provided to prevent water from entering beneath the pavement and to minimize water flow over pavement surfaces. This will increase the life of the paving and help avoid possible premature failure.

We have been informed that the Department of Transportation will be establishing the paving criteria for the approaches to the bridge. The asphalt and base course materials should be placed and compacted to Department of Transportation standards. Testing and inspection should be performed during asphalt and base course placement.

Corrosivity

Test results indicate that onsite soils possess low to moderate concentrations of sulfate considered to be corrosive to metal and concrete. However, we recommend that Type V or equivalent sulfate resistant cement be utilized in all concrete in contact with onsite soils. Consideration should be given to providing protection to buried metal pipes or use of non-metallic pipe where permitted by local building codes.

Other Services

It is recommended that the Geotechnical Engineer be provided the opportunity for a general review of final design plans and specifications in order that recommendations may be reviewed for applicability. Excavations should be inspected to observe materials present. Field and laboratory testing of materials should be performed to determine whether applicable requirements have been met.

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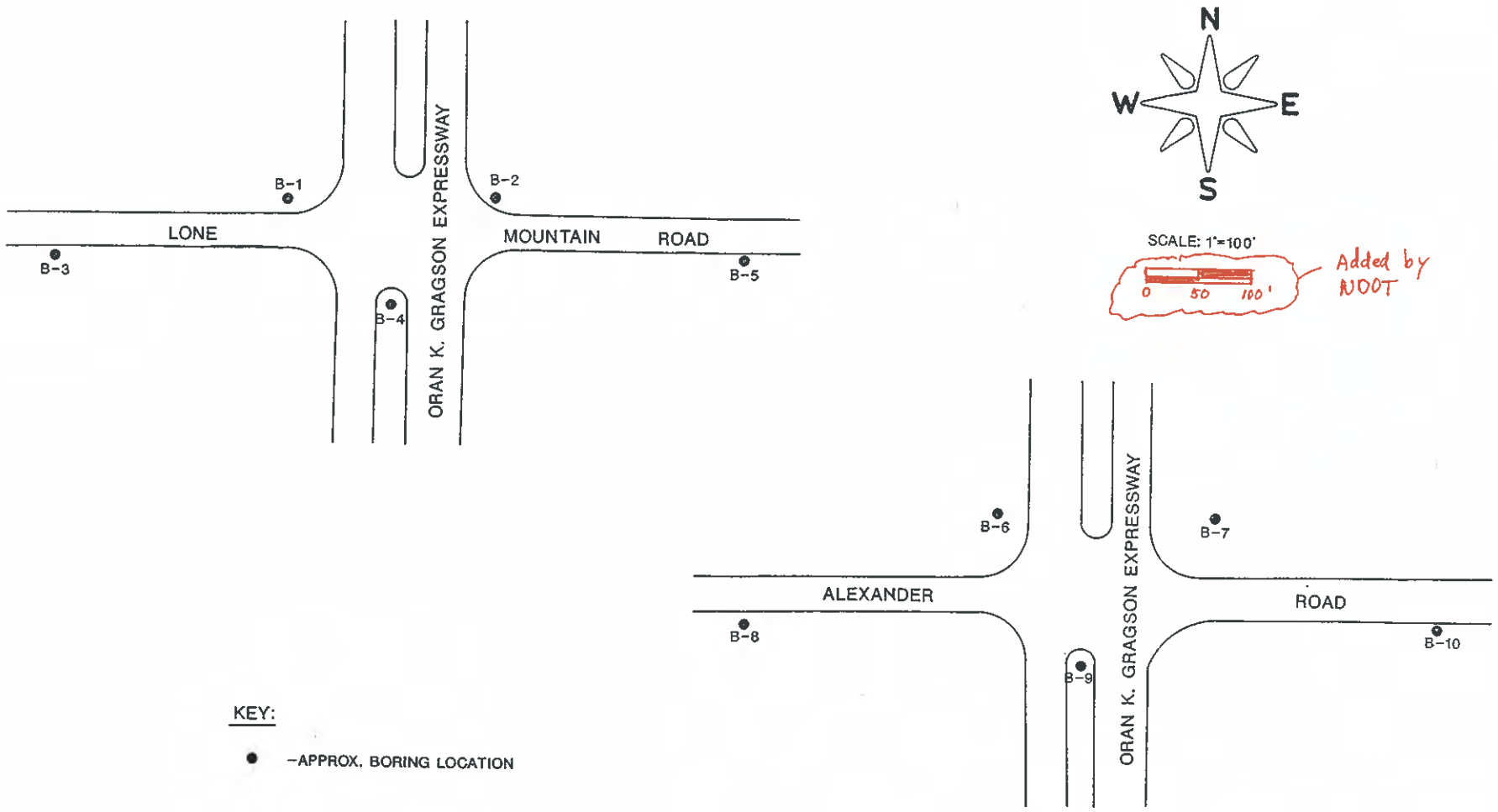

WESTERN TECHNOLOGIES INC.		PLOT PLAN	
BY: TPA	DATE: 3-9-89	PROJECT NO.: 4129J001	PLATE: 1

APPENDIX

APPENDIX

Subsurface Explorations

The subsurface conditions at the two grade separations were explored by drilling a total of 10 borings to depths ranging from 10 to 30 feet below existing grade. Borings were drilled using a rotary-air drill rig (Midway 13M) and an auger drill rig (Mobil B40L).

Soils encountered were logged during drilling and samples were obtained to aid in classification and for laboratory testing. Logs of the borings are presented on Plates A-1 through A-10. The number of blows required to drive the sampler 12 inches is shown to the left on the boring logs. Soils are classified in accordance with the Unified Soil Classification System. An explanation of material classifications used in the report is presented on Plate B.

Laboratory Tests

Field moisture content and dry density determinations were performed on representative samples. Test results are presented on the left of the boring logs.

Direct shear tests were performed on samples to determine the strength of the soils. Tests were performed at field moisture contents and at various surcharge pressures. Test results are presented on Plate C.

Consolidation tests were performed on representative samples to illustrate the compressibility of onsite soils. Water was added during testing to illustrate the influence of moisture on compressibility. Plates D-1 and D-2 present the test results.

Expansion tests were performed on representative samples. Tests were performed from and air-dried moisture content to a near saturated moisture content using a 60 psf surcharge load. Test results are as follow:

SAMPLE	EXPANSION (%)
Boring No. 3 @ 3 ft.	1.4
Boring No. 6 @ 4 ft.	1.2
Boring No. 10 @ 3 ft.	2.2
Boring No. 10 @ 8 ft.	4.2

Chemical tests were performed on samples to determine the percentage of sulfate and sodium sulfate. Tests were performed by Atlas Chemical Testing Laboratories, Inc. Test results are presented on Plate E.

DATE DRILLED: 2-14-89 BORING NO. 1 ELEVATION:

LOCATION: See Plate No. 1

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLES SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0					FILL	FILL - SANDY GRAVEL -lt. brown w/cobbles	sl. moist	
					CL	SANDY CLAY -w/caliche gravel, lt. brown		
5				54		w/some caliche gravel		
						SILTY CLAY -w/some caliche gravel, lt. brown	moist	stiff
	19.2	103	C	13		w/caliche gravel, brown	very moist	
10								
						SANDY CLAY -w/caliche gravel, brn.	moist	
	16.2	114		22		SILTY CLAY -w/caliche gravel, brn.		
15						w/sand, some caliche gravel, lt. brown		
	10.9			36				
20						Bottom at 20 feet		
25								
30								

*OTHER TESTS: C-CONSOLIDATION, A-ATTERBERG, S-SHEAR G-GRAIN SIZE, E-EXPANSION, CH-CHEMICAL

** USING 370 LB. DRIVING WEIGHT AND 2.50 INCH (I.D.) DIAMETER SAMPLER

NOTES: Water not encountered

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

BY: LLM APPROV: _____

WESTERN TECHNOLOGIES INC.

PROJECT NO. 4129J001

BORING LOG AND TEST SUMMARY

PLATE A-1

DATE DRILLED: 2-14-89 BORING NO. 2 ELEVATION:

LOCATION: See Plate No. 1

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLES SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0						FILL FILL - GRAVELLY SAND -lt. brown		
					SC	CLAYEY SAND -w/caliche gravel, brown	sl. moist	m.dense
					CL	SANDY CLAY -w/some caliche gravel, lt. brown		
				10		SILTY CLAY -w/some caliche gravel, lt. brown	moist	stiff
5						brown		
				18		SANDY CLAY -w/some caliche gravel, lt. brown	sl. moist	v. stiff
10						SILTY CLAY -w/caliche gravel, brown	moist	stiff
				50/3"		CALICHE -lt. brown	d.-sl.m.	hard
					CL	SILTY CLAY -w/some caliche gravel, lt. brown	sl. moist	very stiff
15						CALICHE -lt. brown		m.h.-h.
			C	57	CL	SILTY CLAY -w/sand and caliche gravel, brown		very stiff
20						Bottom at 20 feet		
25								
30								

*OTHER TESTS: C-CONSOLIDATION, A-ATTERBERG, S-SHEAR G-GRAIN SIZE, E-EXPANSION, CH-CHEMICAL

** USING 370 LB. DRIVING WEIGHT AND 250 INCH (I.D.) DIAMETER SAMPLER

NOTES: Water not encountered

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

BY: 2AM APPROV: _____

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WESTERN TECHNOLOGIES INC.

PROJECT NO. 4129J001

BORING LOG AND TEST SUMMARY

PLATE A-2

DATE DRILLED: 2-14-89 BORING NO. 3 ELEVATION:

LOCATION: See Plate No. 1

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLES SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0						FILL FILL - GRAVELLY SAND -lt. brown	sl. moist	
						CL SILTY CLAY -w/caliche gravel, lt. brown		stiff
	15.1	123		50			moist	s.-v.s.
5						w/some caliche gravel, lt. brown		
	8.8			37		w/caliche gravel		stiff
10						Bottom at 10 feet		
15								
20								
25								
30								

*OTHER TESTS: C-CONSOLIDATION, A-ATTERBERG, S-SHEAR
G-GRAIN SIZE, E-EXPANSION, CH-CHEMICAL

** USING 370 LB. DRIVING WEIGHT AND 2.50 INCH (I.D.) DIAMETER SAMPLER

NOTES: Water not encountered

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

BY: JLM APPROV: _____

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WESTERN TECHNOLOGIES INC.

PROJECT NO. 4129J001

BORING LOG AND TEST SUMMARY

PLATE A-3

DATE DRILLED: 2-14-89 BORING NO. 4 ELEVATION:

LOCATION: See Plate No. 1

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLES SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0					FILL	FILL - SANDY GRAVEL -lt. brown	sl. moist	
5	11.1	123	S(2)	36	SC	CLAYEY SAND -w/gravel, brown w/caliche gravel, lt. brown		dense m. dense
					CL	SANDY CLAY -w/caliche gravel, lt.brn.	moist	stiff
						SILTY CLAY -w/caliche gravel, lt. brown		
10				7			very moist	firm soft f.-stiff
							moist	stiff to v. stiff
15	14.1	110	S(2)	12			very moist	firm to stiff
						partially cemented	moist	stiff
						no cementation	sl.moist	v.s.-m.h.
20	13.2	108	S(2)	65/9½"		w/some caliche gravel partially cemented	moist	stiff
							sl.m.-m.	v. stiff v.s.-m.h.
						SANDY CLAY -w/some caliche gravel, lt. brown	sl. moist	stiff
25	8.2			12				
						SILTY CLAY -w/some caliche gravel, lt. brown	moist	
30			S(2)			CALICHE -lt. brown w/small uncemented layers	dry to sl.moist	m.h.-h. hard m.h.-h.

*OTHER TESTS: C-CONSOLIDATION, A-ATTERBERG, S-SHEAR G-GRAIN SIZE, E-EXPANSION, CH-CHEMICAL

** USING 370 LB. DRIVING WEIGHT AND 2.50 INCH (I.D.) DIAMETER SAMPLER

NOTES: Water not encountered

Bottom at 30 feet

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

BY: YLM APPROV: _____

WESTERN TECHNOLOGIES INC.

PROJECT NO. 4129.T001

BORING LOG AND TEST SUMMARY

PLATE A-4

DATE DRILLED: 2-14-89
LOCATION: See Plate No. 1

BORING NO. 5

ELEVATION:

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLES	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0						FILL	FILL - GRAVELLY SAND -lt. brown		
						CL	SANDY CLAY -w/trace gravel, lt. brown w/some caliche gravel	sl. moist	f.-stiff firm
	17.7	88		8					
5							SILTY CLAY -w/caliche gravel and sand, brown w/some caliche gravel	moist	stiff
	18.5	98		9					
10							Bottom at 10 feet		
15									
20									
25									
30									

*OTHER TESTS: C-CONSOLIDATION, A-ATTERBERG, S-SHEAR
G-GRAIN SIZE, E-EXPANSION, CH-CHEMICAL

** USING 370 LB. DRIVING WEIGHT AND 2.50 INCH (I.D.) DIAMETER SAMPLER

NOTES: Water not encountered

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

BY: SLM APPROV: _____

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WESTERN TECHNOLOGIES INC.

PROJECT NO. 4129J001

BORING LOG AND TEST SUMMARY

PLATE A-5

DATE DRILLED: 2-14-89 BORING NO. 6 ELEVATION:

LOCATION: See Plate No. 1

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLES	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0						FILL	FILL -2 inches gravel over GRAVELLY SAND w/ cobbles, brown	moist	
						CL	SILTY CLAY -w/trace gravel, lt. brown		firm to stiff
5	18.3	124		11			brown	moist to very moist	
							w/some caliche gravel, lt. brown	sl.moist	stiff
10	9.5	122		15				moist to v. moist	
							brown	very moist	firm to stiff
							SANDY CLAY -w/some caliche gravel, brown	sl. moist to moist	stiff
15	14.9	123	C	43			SILTY CLAY -w/some caliche gravel, brown		very stiff
							SANDY CLAY -w/caliche gravel, lt. brown partially cemented w/some caliche gravel, brown w/trace caliche gravel, rust brn.	sl. moist	v.s.-m.h
20				73				moist	very stiff
							Bottom at 20 feet		
25									
30									

*OTHER TESTS: C-CONSOLIDATION, A-ATTERBERG, S-SHEAR G-GRAIN SIZE, E-EXPANSION, CH-CHEMICAL

** USING 140 LB. DRIVING WEIGHT AND 2.50 INCH (I.D.) DIAMETER SAMPLER

NOTES: Water not encountered

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

BY: LA APPROV: _____

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WESTERN TECHNOLOGIES INC.

PROJECT NO. 4129J001

BORING LOG AND TEST SUMMARY

PLATE A-6

DATE DRILLED: 2-14-89 BORING NO. 7 ELEVATION:

LOCATION: See Plate No. 1

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLES SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0					FILL	FILL - SANDY GRAVEL -lt. brown	sl.moist	
						FILL - CLAYEY SAND -w/some gr., brown w/trace gravel	moist	
	10.1	109		16	CL	SANDY CLAY -w/trace gravel, brown	m.-v.m.	stiff
						SILTY CLAY -w/some caliche gravel, lt. brown	moist	
5							moist to very moist	firm to stiff
	8.1	120		58		lt. brown		
						w/sand, brown	moist	stiff to v. stiff
10							moist to very moist	stiff
	14.3	106		43		w/caliche gravel		
						CALICHE -lt. brown	sl.moist	v.stiff m.hard
					CL	SILTY CLAY -w/caliche gravel, brown small cemented layers	moist	stiff to v. stiff
15						SANDY CLAY -w/caliche gravel, partially cemented, brown	sl.	very stiff to mod. hard
				50/5"		w/small cemented layers	moist	
						SILTY CLAY -w/some cal. gr.,lt.brn.		v.stiff
20						Bottom at 20 feet		
25								
30								

*OTHER TESTS: C-CONSOLIDATION, A-ATTERBERG, S-SHEAR
G-GRAIN SIZE, E-EXPANSION, CH-CHEMICAL

** USING 140 LB. DRIVING WEIGHT AND 2.5 INCH (I.D.) DIAMETER SAMPLER

NOTES: Water not encountered

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

BY: 24 APPROV: _____

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WESTERN TECHNOLOGIES INC.

PROJECT NO. 4129J001

BORING LOG AND TEST SUMMARY

PLATE A-7

DATE DRILLED: 2-14-89

LOCATION: See Plate No. 1

BORING NO. 8

ELEVATION:

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLES SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0	13.3	105		26	CL	SANDY CLAY -w/caliche gravel, brown w/some caliche gravel	sl. moist	stiff
5						SILTY CLAY -w/caliche gravel, lt. brown	moist sl.m.-m.	
						SANDY CLAY -w/trace gravel, brown	sl. moist	
				27		SILTY CLAY -w/caliche gravel and sand, lt. brown		
10						Bottom at 10 feet		
15								
20								
25								
30								

*OTHER TESTS: C-CONSOLIDATION, A-ATTERBERG, S-SHEAR G-GRAIN SIZE, E-EXPANSION, CH-CHEMICAL

** USING 370 LB. DRIVING WEIGHT AND 2.50 INCH (I.D.) DIAMETER SAMPLER

NOTES: Water not encountered

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

BY: JA APPROV: _____

GSI3

WESTERN TECHNOLOGIES INC.

PROJECT NO. 4129J001

BORING LOG AND TEST SUMMARY

PLATE A-8

DATE DRILLED: 2-14-89 BORING NO. 9 ELEVATION:

LOCATION: See Plate No. 1

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLES SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0						FILL FILL - SANDY GRAVEL -w/an occasional cobble, lt. brown	sl.moist	
						FILL - GRAVELLY SAND -w/cobbles, reddish brown brown		
5					CL	SANDY CLAY -w/trace gravel, brown		
	13.2	110	S(2)	29		SILTY CLAY -w/some caliche gravel, brown	moist	stiff
						SANDY CLAY -w/some caliche gravel, brown		
10						SILTY CLAY -w/caliche gravel, some sand, brown		
	14.5	109	S	28		w/trace sand, lt. brown	sl. moist	stiff to v. stiff
						brown	moist	stiff
15						lt. brown	sl.moist	s.-v.s.
	7.2	117	S	68		SANDY CLAY -w/caliche gravel, trace gravel, brown lt. brown	moist	
						SILTY CLAY -w/some caliche gravel, lt. brown	sl. moist	very stiff
20							moist	
	7.9	115	S	67		SANDY CLAY -lt. brown		
						SILTY CLAY -w/trace gravel, lt. brown	sl.	stiff to very stiff
25	12.8	103	S(2)	55			moist	
								very stiff
30						Bottom at 30 feet		

*OTHER TESTS: C-CONSOLIDATION, A-ATTERBERG, S-SHEAR G-GRAIN SIZE, E-EXPANSION, CH-CHEMICAL

** USING 140 LB. DRIVING WEIGHT AND 2.50 INCH (I.D.) DIAMETER SAMPLER

NOTES: Water not encountered

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

BY: YAL APPROV: _____

GSI3

WESTERN TECHNOLOGIES INC.

PROJECT NO. 4129T001

BORING LOG AND TEST SUMMARY

PLATE A-9

DATE DRILLED: 2-14-89

LOCATION: See Plate No. 1

BORING NO. 10

ELEVATION:

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLES	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0							FILL FILL - SILTY SAND -w/gravel, an occasional cobble, reddish brown	moist	
						CL	SILTY CLAY -w/trace caliche gravel, lt. brown	sl.moist to moist	firm
	18.1	111		9			brown	moist	
5							w/some caliche gravel, lt. brown	sl.	stiff
	7.9	107		28			w/caliche gravel, lt. gray w/some caliche gravel, lt. brown	moist	stiff to v. stiff
10							Bottom at 10 feet		
15									
20									
25									
30									

*OTHER TESTS: C-CONSOLIDATION, A-ATTERBERG, S-SHEAR
G-GRAIN SIZE, E-EXPANSION, CH-CHEMICAL

** USING 140 LB. DRIVING WEIGHT AND 2.50 INCH (I.D.) DIAMETER SAMPLER

NOTES: Water not encountered

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

BY: 5 APPROV: _____

GSI3

WESTERN TECHNOLOGIES INC.

PROJECT NO. 4129J001

BORING LOG AND TEST SUMMARY

PLATE A-10

COARSE-GRAINED SOILS

LESS THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size
GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	
GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% FINES	
GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% FINES	
SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size
SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	
SM	SILTY SANDS, SAND-SILT MIXTURES, MORE THAN 12% FINES	
SC	CLAYEY SANDS, SAND-CLAY MIXTURES, MORE THAN 12% FINES	

NOTE:
Coarse-grained soils receive dual symbols if they contain 5 to 12% fines (e.g. SW-SM, GP-GC, etc.)

FINE-GRAINED SOILS

MORE THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	SILTS AND CLAYS Liquid limit less than 50
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
OL	ORGANIC SILTS OR ORGANIC SILTY-CLAYS OF LOW PLASTICITY	
MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit more than 50
CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
PT	PEAT, MUCK, AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

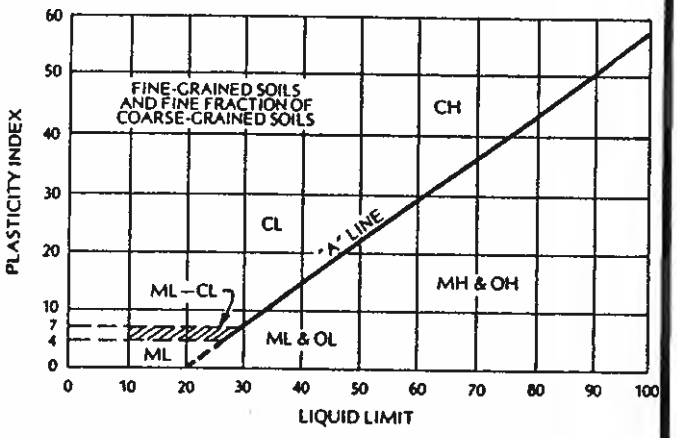
NOTE:
Fine-grained soils receive dual symbols if their limits plot in the hatched zone on the Plasticity Chart (ML-CL)

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	ABOVE 12 in
COBBLES	3 in. to 12 in
GRAVEL	No. 4 to 3 in.
Coarse	¾ in. to 3 in.
Fine	No. 4 to ¾ in.
SAND	No. 200 to No 4
Coarse	No. 10 to No. 4
Medium	No. 40 to No. 10
Fine	No. 200 to No. 40
*FINES (Silt or Clay)	BELOW No. 200

NOTE:
Only sizes smaller than three inches are used to classify soils.

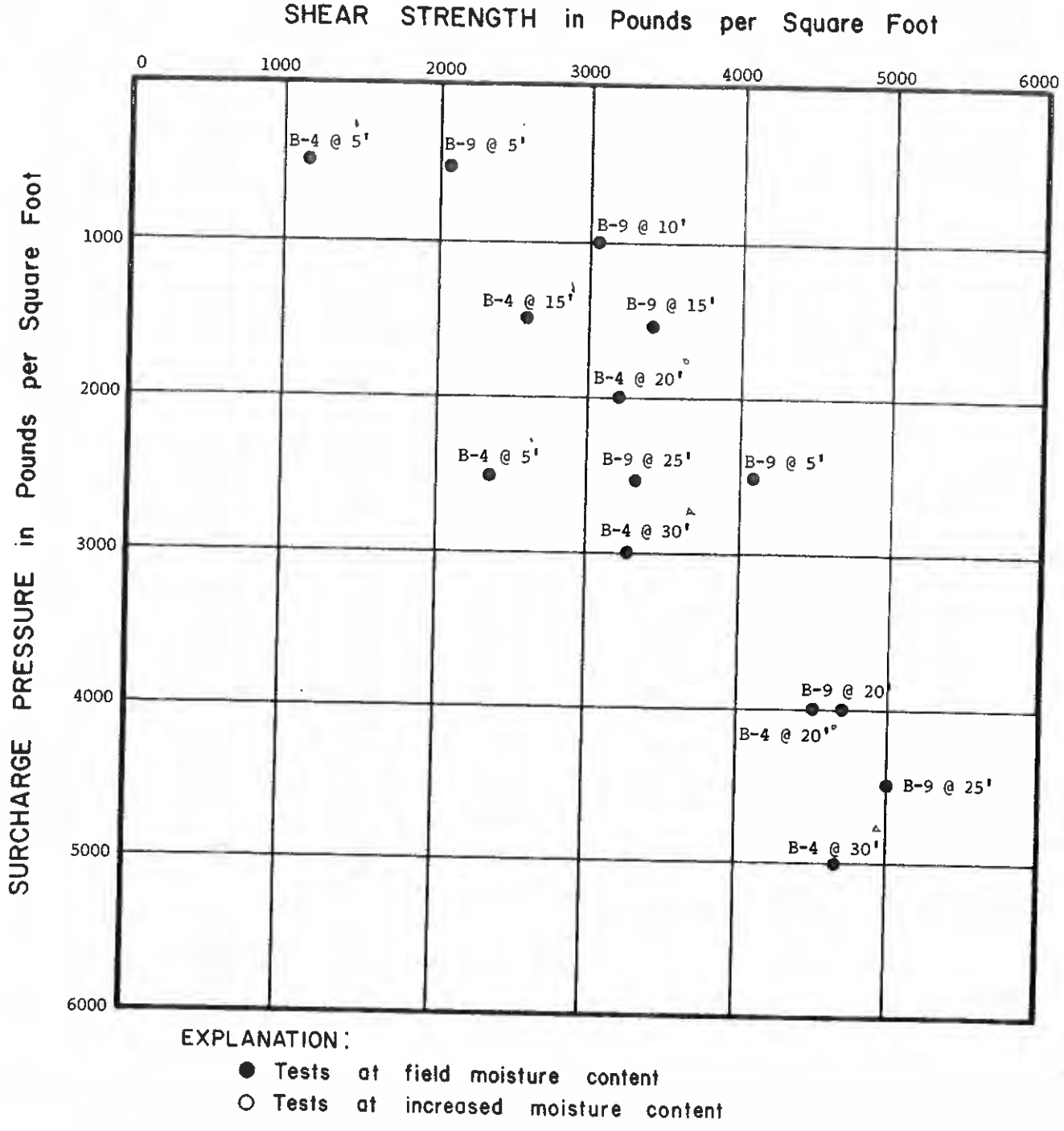
PLASTICITY CHART



WESTERN TECHNOLOGIES INC.

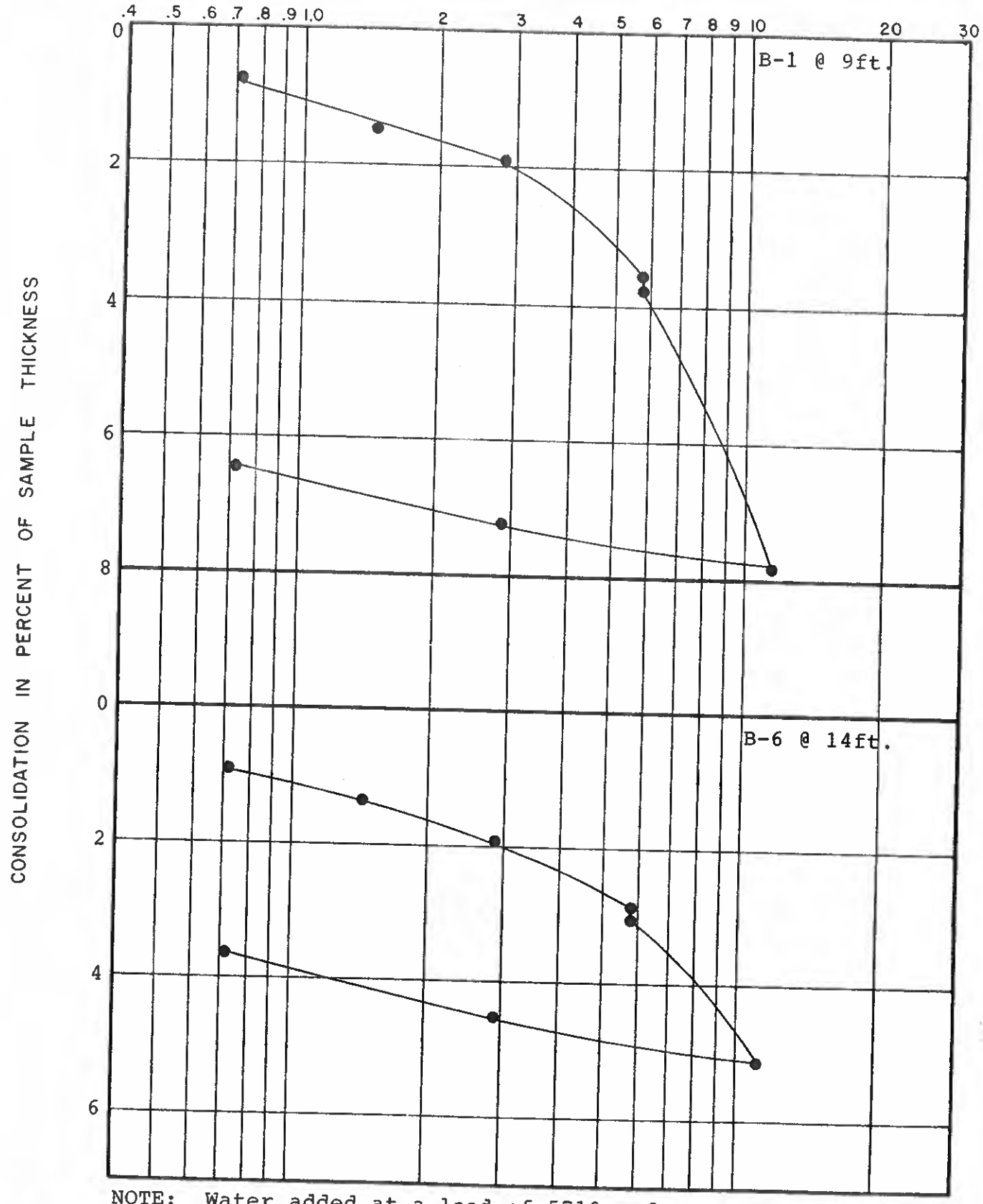
EXPLANATION OF MATERIAL CLASSIFICATIONS

PLATE B



WESTERN TECHNOLOGIES INC.	DIRECT SHEAR TEST DATA	PLATE C
PROJECT NO. 4129J001		

LOAD IN KIPS PER SQUARE FOOT



CONSOLIDATION IN PERCENT OF SAMPLE THICKNESS

NOTE: Water added at a load of 5710 psf.

WESTERN TECHNOLOGIES INC.

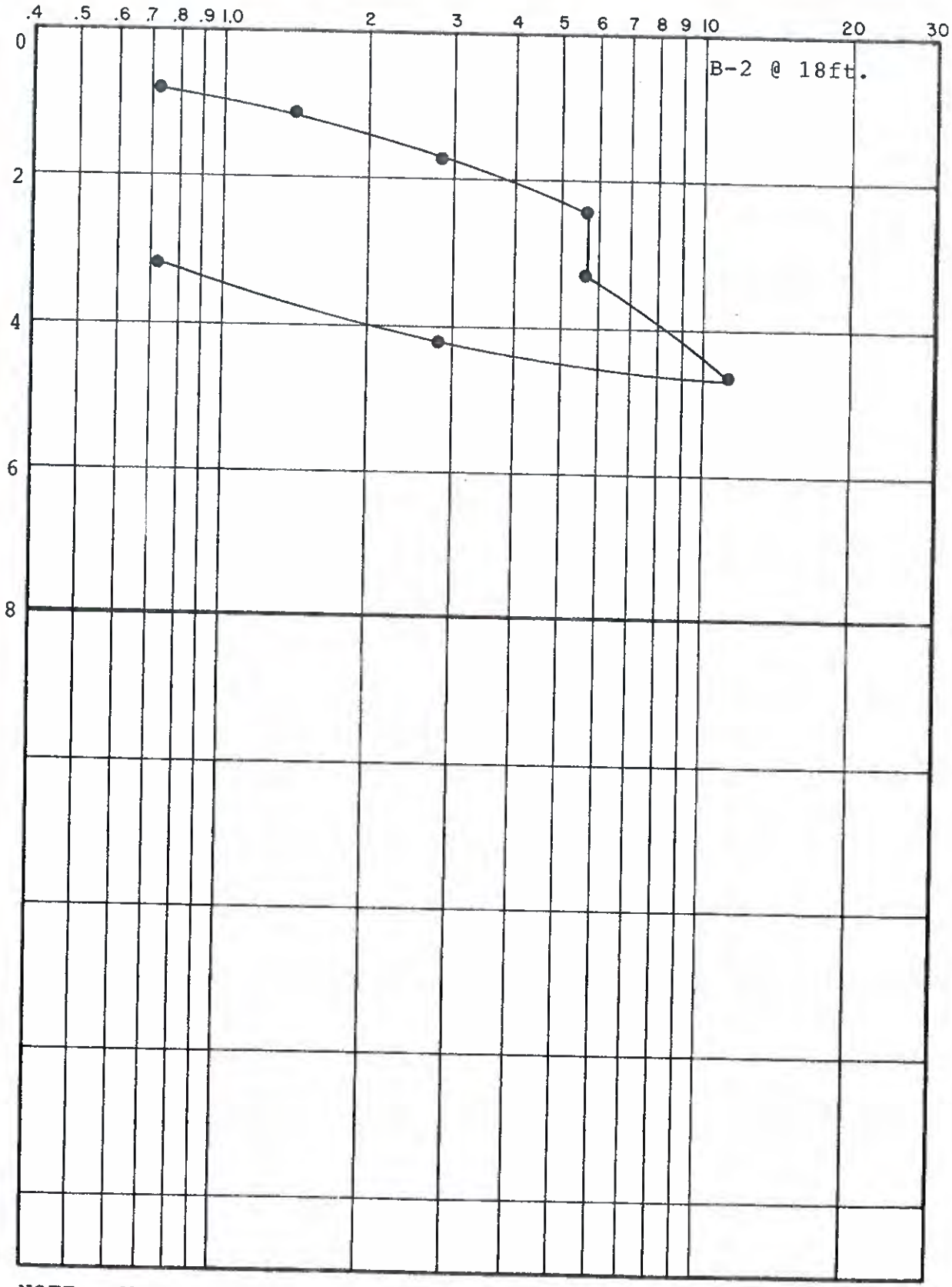
PROJECT NO. 4129J001

CONSOLIDATION TEST DATA

PLATE D-1

GSI9

LOAD IN KIPS PER SQUARE FOOT



CONSOLIDATION IN PERCENT OF SAMPLE THICKNESS

NOTE: Water added at a load of 5710 psf.

WESTERN TECHNOLOGIES INC.	CONSOLIDATION TEST DATA	PLATE D-2
PROJECT NO. 4129J001		

GS19

Atlas Chemical Testing Laboratories, Inc.

2765 SO. HIGHLAND DR., SUITE 211 • (702) 735-6171 • LAS VEGAS, NEVADA 89109

CHEMICAL
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TESTING MATERIALS

ACT LAB NO: 2367

DATE: 2/22/89

PROJECT NO: 4129J001

ANALYZED BY: Daniel C. Fischer

CHEMICAL TESTS
ASTM D-516

Sample No.	Location	Sample Depth (Feet)	Percent Sodium	Percent Sulfate	Total Available Water Soluble Sodium Sulfate Percent
	B-1	4	0.01	0.02	0.02
	B-8	2	0.05	0.10	0.15
	B-3	2	0.02	0.03	0.05
	B-9	10	0.06	0.13	0.19
	B-4	10	0.03	0.33	0.09
	B-10	3	0.08	0.83	0.24