FINAL GEOTECHNICAL INVESTIGATION

U. S. HIGHWAY 95
PROJECT 1A WIDENING
RAINBOW BOULEVARD TO
CHEYENNE AVENUE

LAS VEGAS, NEVADA

JUNE 2000

prepared for

Sverdrup Civil Inc.
Las Vegas, Nevada

Black Eagle Consulting, Inc. - Geotechnical & Construction Services

June 16, 2000
Project No.: 0215-01-1

Mr. David Potter
Sverdrup Civil, Inc.
5450 West Sahara Avenue, Suite 150
Las Vegas, NV 89146

Black Eagle Consulting, Inc.

Re: U.S. 95 Widening Geotechnical Investigation

Dear Mr. Potter:

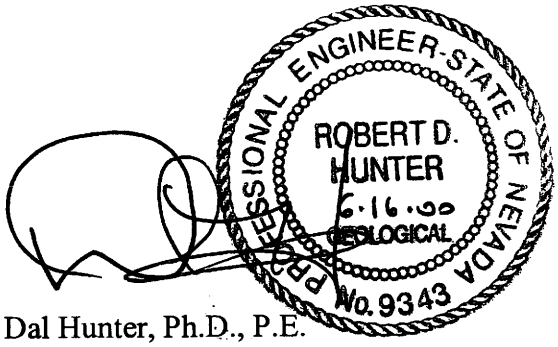
The following report presents the final results of our geotechnical investigation for widening of U.S. 95 between Rainbow Boulevard and Cheyenne Avenue. This report incorporates review comments from Sverdrup Civil and the Nevada Department of Transportation.

Soils encountered along the alignment are almost exclusively cemented granular materials exhibiting high standard penetration testing blowcounts, low plasticity, and a low percentage of fines. Subgrade strength along the mainline alignment was found to be high with R-Values ranging from 47 to 74. Localized lenses of weak caliche are present at depth, generally in the range of 300 to 450 millimeters in thickness. Very stiff clay soils were encountered along the northern segment of the proposed southbound sound walls at depths below one to two meters. All areas explored were suitable for standard spread footings or drilled shaft foundations for support of sound walls and/or retaining walls. Trench footings, if desired, will require aggressive excavation techniques.

We wish to thank you for the opportunity to provide our services and will be available to answer related questions.

Sincerely,

Black Eagle Consulting, Inc.



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U. S. HIGHWAY 95
PROJECT 1A WIDENING
RAINBOW BOULEVARD TO
CHEYENNE AVENUE

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SUMMARY OF RECOMMENDATIONS

General Information

Soils encountered along the alignment are almost exclusively cemented granular materials exhibiting high standard penetration testing blowcounts, low plasticity, and a low percentage of fines. Subgrade strength along the mainline alignment was found to be high with R-values ranging from 47 to 74. Localized lenses of weak caliche are present at depth, generally in the range of 300 to 450 millimeters in thickness. Very stiff clay soils were encountered along the northern segment of the proposed southbound noise barriers at depths below one to two meters. All areas explored were suitable for standard spread footings or drilled shaft foundations for support of noise barriers and/or retaining walls. Trench footings may be possible, but will require aggressive excavation techniques. The vast majority of the materials encountered will be suitable for *Borrow* or backfill.

Site Preparation

All vegetation should be stripped and grubbed from structural areas and removed from the site. A stripping depth of 25 mm is anticipated. Clearing and grubbing should be performed in accordance with section 201 of the Nevada Department of Transportation *Standard Specifications for Road And Bridge Construction* (*SSRBC*).

All areas to receive structural fill or structural loading should be densified to, at least, 90 percent relative compaction in accordance with *SSRBC* section 203.03.15. Where cemented soils are present, compaction is not practical or necessary. The surface of cemented soils should be cleaned of loose material prior to placement of fill, aggregate base or footing loads. In all cases, the final surface should be smooth, firm, and exhibit no signs of deflection.

If wet weather construction is anticipated, surface soils may be well above optimum moisture and impossible to compact. In most situations, stabilization should be possible by scarifying the top 300 mm of subgrade and allowing it to air dry to near-optimum moisture, prior to compaction. Where this procedure is ineffective or where construction schedules preclude delays, it will be necessary to remove the saturated soils. Areas of overexcavation for embankment fill should be backfilled with *borrow*, as per section 203 of the State of Nevada *Standard Specifications for Road and Bridge Construction (SSRBC)*. Areas of overexcavation for foundation fill should be backfilled with *granular* backfill as per Section 207 of *SSRBC*. All *Borrow* or *Granular Backfill* should be densified to at least 90 percent relative compaction.

Trenching and Excavation

Trenching on this site will be difficult due to the weak to moderate soil cementation, including zones of weak caliche. All of our exploration was performed with hollow-stem auger drilling techniques (refer to section on **Exploration**), indicating that no extremely hard caliche was encountered. Localized zones of harder caliche may be present between boring locations. Temporary trenches with near vertical side walls should be stable to a depth of approximately 1.5 meters. Excavations to greater depths will require shoring or laying back of sidewalls to maintain adequate stability. Regulations amended in Part 1926, Volume 54, Number 209 of the Federal Register (Table B-1, October 31, 1989) require that the temporary sidewall slopes be no greater than those presented in Table 1.

TABLE 1 - MAXIMUM ALLOWABLE TEMPORARY SLOPES	
Soil or Rock Type	**Maximum Allowable Slopes[1] for Deep Excavations less than 6 Meters Deep[2]**
Stable Rock	Vertical (90 degrees)
Type A[3]	4V:3H (53 degrees)
Type B	1V:1H (45 degrees)
Type C	2V:3H (34 degrees)
Notes:	
1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.	
2. Sloping or benching for excavations great than 6 meters deep shall be designed by a registered professional engineer.	
3. A short-term (open 24 hours or less) maximum allowable slope of 2V:1H (63 degrees) is allowed in excavation in type A soil that are 3.7 meters or less in depth. Short-term maximum allowable slopes for excavations greater than 3.7 meters in depth shall be 4V:3H (53 degrees).	

On the basis of our exploration, the U.S. 95 soils are predominately Type A. Any area in question should be specifically examined by the geological engineer during construction. All trenching should be performed and stabilized in accordance with local, state, and OSHA standards.

The majority of the materials encountered during our exploration were granular and would be suitable for backfill, except where *Granular Backfill* is required in accordance with section 207.02.02 of *SSRBC*. Backfill placement and compaction shall be in accordance with *SSRBC* sections 207.03.01, 207.03.02, and 207.03.03.

Directional Borings

It is our understanding that directional borings may be required for storm drains at mainline station 120+50 (0.91-meter diameter) and 129+50 (1.22-meter diameter). In both cases our borings indicate the presence of weakly to moderately cemented sands and gravels with localized zones of weak caliche. Since all of our exploration drilling was performed with a hollow stem auger (152-mm diameter), we anticipate that directional borings should be possible on this site. The drilling contractor needs to be familiar with the Las Vegas area and recognize that, while we drilled the borings with a hollow-stem auger, most of our sampling efforts either met with refusal or had very high standard penetration tests ("blowcounts").

Grading and Filling

Borrow and *Select Borrow* on this project should conform to the requirements of sections 203.02.04 and 203.02.05 of the *SSRBC*, respectively. The material should all pass a 75 mm sieve and must have a minimum R-value of 45. Native granular soils meeting these requirements will be suitable for use as *Borrow*, where available.

Fill materials in structural areas should be placed and compacted to at least 90 percent in accordance with *SSRBC* sections 203.03.12, 203.03.13, 203.03.14, and 203.03.15.

Subsidence and Shrinkage

Any granular cemented soils excavated and recompacted in structural fills should experience quantity shrinkage of approximately 5 to 10 percent. In other words, one cubic meter of excavated granular material will generate about 0.9 to 0.95 cubic meters of structural fill at 90 percent relative compaction.

Foundation Design

Spread Footings

Noise barriers and/or retaining walls on this project can readily be supported on cemented granular soils, compacted granular native soil or *Borrow*. Bearing capacity and settlement calculations were performed using AASHTO (1996) methodologies and are included as Appendix A. Continuous wall footings underlain by compacted, granular native soil or structural fill can be designed for a net maximum allowable bearing pressure of 192 kPa. The net allowable bearing pressure is that pressure at the base of the footing in excess of the adjacent overburden pressure. This allowable bearing value should be used for dead plus ordinary live loads. Ordinary live loads are defined as being that portion of the design live load which will be present during the majority of the life of the structure. Design live loads are those loads which are produced by the use and occupancy of the building, such as by moveable objects, including people or equipment, as well as snow loads. The bearing value of 192 kPa may be increased by one-third for total loads. Total loads are defined as the maximum load imposed by the required combinations of dead load, design live loads, snow loads, and wind or seismic loads.

Allowable bearing capacity for sound wall and retaining wall spread footings is limited by settlement. With the above allowable bearing pressure, total settlements of approximately 13 mm or less should be anticipated. Differential settlements along footings with similar loads, dimensions, and base elevations should not exceed two-thirds of the values provided above for total settlements. The majority of the anticipated settlement will occur during the construction period as the loads are applied.

Lateral loads, such as wind or seismic, may be resisted by passive soil pressure and friction on the bottom of the footing. The recommended coefficient of base friction is 0.45 and has been reduced by a factor of 1.5 on the ultimate soil strength. Design values for active and passive equivalent fluid pressures are 5.3 and 66.7 kN/m^3, respectively. Foundation fill should be backfilled with *granular backfill* as per Section 207, *SSRBC*. All exterior footings should be placed a minimum 300 mm below adjacent finish grade for frost protection.

If loose, soft, wet, or disturbed soils are encountered at the foundation subgrade, these soils should be removed to expose undisturbed material, and the resulting overexcavation backfilled with compacted *Granular Backfill*. The maximum depth of overexcavation required would be one meter The base of all excavations should be dry and free of loose soils at the time of concrete placement.

Drilled Shafts

It is our understanding that drilled shaft foundations are not necessary for this project, as currently designed. The following design criteria were developed for granular materials during an earlier draft of this report and are included for use in the event of a design change. Drilled shafts for noise barriers between borings WR-9 and WR-14 would require another design due to the presence of clay soils below a depth of 2 meters. Cemented soils and interbedded caliche layers will slow drilling operations but should be easily penetrated with a rock bit.

Numerous combinations of shaft diameter, length, and capacity are possible for sound and retaining wall foundations. Based on the preliminary loads provided, we have calculated the compressive uplift and axial capacity for a variety of drilled shaft configurations, presented in Tables 2A and 2B.

TABLE 2A - CAPACITY OF DRILLED SHAFT FOUNDATIONS IN kN - GRANULAR SOILS									
Length in Millimeters									
Diameter in Millimeters	2,500			3,000			3,500		
	Com-pression	Uplift	Lateral*	Com-pression	Uplift	Lateral*	Com-pression	Uplift	Lateral*
305	93	26	–	103	37	–	114	49	–
460	192	41	–	206	58	–	224	77	–
610	325	58	400	345	81	–	368	108	–
* Shear Load at Ground Line									

TABLE 2B – CAPACITY OF DRILLED SHAFT FOUNDATIONS IN kN – COHESIVE SOILS*			
Diameters in Millimeters	Length in Millimeters		
	3,500		
	Compression	Up Lift	Lateral**
305	265	171	–
460	318	233	–
610	423	367	400
* Area of Borings Wr–9 – Wr– 14 Only			** Shear Load at Ground Line

The axial capacities were calculated using the method provided by AASHTO (1996) for cohesionless soils. Since the soils are both granular and cohesive (weakly cemented), the calculation is conservative. Lateral capacity was calculated only for a 610-mm-diameter shaft, 2,500 mm in length. Because of the granular, cemented nature of the materials, the lateral capacity is quite high. The lateral capacity was determined for a 3 mm ground line deflection using the finite element method of Bowles (1996). If drilled shafts are selected, we will provide specific analysis for the actual shaft configuration(s) and lateral and moment loading. Design calculations for drilled shaft foundations are included as Appendix B.

High Mast Lighting

Foundations for this type of structure are dominated by lateral loads and best supported on a drilled shaft foundation. It is our understanding that the base plate configuration requires a minimum shaft diameter of 91 mm. The Brohms method (AASHTO, 1996; Brohms, 1966) was used to determine

the minimum shaft length. The length was increased by 20 percent as a factor of safety with the following results:

Table 3 – Design Parameters for High Mast Lighting Drilled Shaft Foundations			
Minimum Diameter	Minimum Length of Embedment	Depth to Maximum Moment	Maximum Moment
91 mm	4,400 mm	610 mm	455 kN - m @ 610 mm

Design calculations are presented in Appendix B.

Trench Footings

Trench footings could also provide adequate support for noise barriers. We are not aware of AASHTO design methods for trench footings so that the methodology of the California Department of Transportation (1990) was used (Appendix C). This method uses a simplified sheet pile analysis to calculate the allowable net horizontal lateral soil pressure. Our design values for the various noise barriers are presented below:

TABLE 2 - TRENCH FOOTING DESIGN PARAMETERS	
Noise Barrier Number	**Allowable Net Horizontal Lateral Soil Pressure in kN/m^3**
2, 3, 4, and 5 (level ground condition)	230
5 (1:6 downward slope to the east)	148
* Includes "R" factor of 0.753 and wall friction. No additional factor of safety has been applied.	

The bottom of trench footings should be cleaned of loose materials, to the extent practical, prior to pouring of concrete.

RETAINING STRUCTURES

Conventional Retaining Walls

The following recommendations are for backfill of conventional retaining walls with vertical back faces and various backfill slopes. Surcharge loads, including construction and traffic loads, should be added to the following values. Design calculations, in accordance with AASHTO (1996) methodology are included in Appendix D.

TABLE 4A - STATIC DESIGN VALUES FOR LATERAL EARTH PRESSURES AND COEFFICIENT OF FRICTION FOR RETAINING WALL BACKFILL*

STATIC CONDITIONS				
Top Slope (vert:horiz)	**Coefficient**			
	Active	**At Rest**	**Passive**	**Friction****
Flat	0.288	0.441	7.4	0.68
1:3	0.352	0.441	14.4	0.68
1:2	0.417	0.441	19.2	0.68
* Recommend use of unit weight of 20.4 kN/m^3 in calculation of lateral earth pressures.				
** Does not include safety factor.				

TABLE 4B - DYNAMIC DESIGN VALUES FOR LATERAL EARTH PRESSURES*

EARTHQUAKE CONDITIONS**		
Top Slope (vert:horiz)	**Coefficient**	
	Active	**Passive**
Flat	0.33	4.9
1:3	0.45	14
1:2	0.65	26
* Recommend use of unit weight of 20.4 kN/m^3 in calculation of lateral earth pressures.		
** Based on ground acceleration of 0.15 g with a 10 percent probability of exceedence in 50 years (AASHTO, 1996).		

Backfill behind retaining walls should be placed and compacted in accordance with sections 207.03.01 and 207.03.02 of *SSRBC*. The walls should be sufficiently drained with NDOT Type 2 Drain Backfill and weepholes to prevent build-up of hydrostatic pressure. Note that passive pressure in front of the wall should be neglected, unless the wall extends below the frost depth and/or utility trench excavation.

Soil Nail Wall, Lake Mead Boulevard

We understand that there is insufficient room for a cantilever retaining wall to widen the southbound outside lanes of U.S. 95 beneath Lake Mead Boulevard. A soil nail wall has been selected for this application, pending additional field exploration. Since this was not part of our original scope, no exploration was performed with the initial field work. We will use backhoe trenching to explore the existing 1:2 (vertical:horizontal) embankment slope at the wall location. The exploration will verify the constructability of soil nails and, following laboratory testing, provide final geotechnical design parameters.

For preliminary design purposes, the existing embankment can reasonably be assumed to be either *Borrow* or *Select Borrow* (*SSRBC*) with the following properties:

TABLE 5 - DESIGN CRITERIA FOR SOIL NAIL WALL		
Top Slope:	1:2 (vertical:horizontal)	
Surcharge:	Existing Structure Footing at 192 kPa, 3.35 meter from Front Face of Wall	
SOIL PARAMETERS		
	Embankment Fill	Native
ϕ	34 degrees	40 degrees
Cohesion	0.0 kPa	4.8 kPa
Unit Weight	20.4 kN/m^3	20.4 kN/m^3

Based on these parameters the following design requirements were determined:

TABLE 6 - DESIGN REQUIREMENTS FOR SOIL NAIL WALL	
Nail Spacing: 910 mm horz.; 1,220 mm vert.	Nail Diameter: 25.4 mm
Nail Length: 3,050 mm	Boring Diameter: 100 mm
Nail Angle: 20 degrees below horz.	Thickness of Structural Facing: 125 mm
Depth of Embedment: 610 mm (min)	Slope of Wall Face: Vertical
Minimum Distance of Bottom Nail Row Above Toe of Wall: 457 mm	Maximum distance of Bottom Nail Row Above Toe Nail of Wall: 686 mm

TABLE 6 - DESIGN REQUIREMENTS FOR SOIL NAIL WALL	
Maximum Distance of Top Nail Row Below Top of Wall: 915 mm	Minimum Distance of Top Nail Row Below Top of Wall: 457 mm
Ultimate Bond Stress - Backfill: 70 kN/m^2	Ultimate Bond Stress - native: 115 kN/m^2

The design was performed using the FHWA (1996) method, aided by the computer program SNAILZ, developed by the California Department of Transportation (1999). The design has included seismic loading of 0.08 based on a ground acceleration with a 10 percent probability of being exceeded in 50 years (AASHTO, 1996). Since this is a critical structure and aggressive (corrosive) soils can be expected, the nails should be encapsulated.

Slope Stability and Erosion Control

The exploration and testing program conducted during this investigation demonstrates that fill slopes up to 1:2 (vert:horiz) and cut slopes in native materials will be stable. Slope stability was verified using the program XSTABL (Appendix E). Slopes steeper than 1:3 will be subject to erosion unless drainage is prevented from washing over the slope or erosion protection is provided.

Dust potential at this site will be moderate during dry periods. Temporary (during construction) and permanent (after construction) erosion control will be required for all disturbed areas. The contractor shall prevent dust from being generated during construction in compliance with all applicable city, county, state, and federal regulations.

Site Drainage

Excellent surface drainage should be provided away from all improvements, including pavement edges and foundations. Subgrade on this project is moderately to highly moisture sensitive.

Curbs, Gutters, and Sidewalks

Any concrete slabs, such as curbs, gutters, or sidewalks, should be directly underlain by Type 2, Class B, aggregate base. The thickness of base material shall be 150 mm beneath curb and gutters and 100 mm beneath sidewalks. Aggregate base courses should be densified to at least 95 percent relative compaction.

Concrete

Type V cement should be used for all concrete work. Sulfate levels were found to vary with localized areas having very high concentrations. For the high levels of sulfate encountered, we recommend a minimum of 6.5 sacks of cement per cubic yard and a maximum water to cement ratio of 0.45. All concrete should be proportioned, mixed, placed, and cured in accordance with sections 501, 502, 508.03.01, .02, 0.3, and .04, 701, and 702 of *SSRBC*.

Corrosion Potential

The results of our corrosion testing program for native soils are presented in Appendix F.

INTRODUCTION

Presented herein are the results of the Black Eagle Consulting, Inc. geotechnical investigation, laboratory testing, and associated geotechnical design recommendations for the proposed widening of U. S. Highway 95, Project 1A in Las Vegas, Nevada. The improvements will extend between Rainbow Boulevard on the south and Cheyenne Avenue on the north. The preceding recommendations are based on surface and subsurface conditions encountered in our explorations, review of previous geotechnical reports, and on details of the proposed project as described in this report. The objectives of this study were to:

1. Determine general soil and caliche conditions pertaining to design and construction of the proposed highway improvements.

2. Provide recommendations for design and construction of the project, as related to these geotechnical conditions.

The area covered by this report is shown on Plate 1 - Plot Plan. Our investigation included field exploration, laboratory testing, and engineering analysis to determine the physical and mechanical properties of the various on-site materials. Results of our field exploration and testing programs are included in this report and form the basis for all conclusions and recommendations.

The services described above were conducted in accordance with the Black Eagle Consulting, Inc. Professional Geotechnical Agreement and the Sverdrup Subconsultant Agreement dated December 29, 1999.

PROJECT DESCRIPTION

The segment of U. S. 95 between Rainbow Boulevard and Cheyenne Avenue and Craig Road is to be widened to improve traffic flow and ease ingress and egress from the Rainbow Boulevard, Lake Mead Boulevard, and Cheyenne Avenue Interchanges. The following improvements are planned:

- Addition of northbound exit lane for Rainbow Boulevard (mainline station 88+40 to 93+80±).
- Addition of northbound entrance lane from westbound Rainbow Boulevard (mainline station 97+50 to 99+97).
- North and southbound mainline widening (mainline stations 100+14.630 to 138+10±).
- Addition of 1 to 2 southbound on-ramp lanes from westbound Lake Mead Boulevard (mainline stations 102+65 to 113+40±).
- Addition of 1 to 2 southbound on-ramp lanes from the eastbound Lake Mead Boulevard (mainline stations 102+60± to 113+20±).
- Addition of 1 to 2 southbound on-ramp lanes from eastbound Cheyenne Avenue (mainline stations 129+17± to 137+70±).
- Noise barrier walls along ramps on west side of U. S. 95 from Rainbow Boulevard to Smoke Ranch Road (minor interruptions).
- Noise barrier walls along ramps on east side of U. S. 95 from Washington (mainline station 96+80) to mainline station 102+50.

- Noise barrier walls along ramps on east side of U. S. 95 from Smoke Ranch Road (mainline station 121+60) to mainline station 133+70±.

- Utility relocation, as required.

SITE CONDITIONS

The areas proposed for widening and other improvements are all undeveloped and adjacent to existing ramps and freeway mainline. The mainline widening will be to the center, where the center median lies below the adjacent pavement and is drained by a small v-ditch. The areas of ramp widening and noise barriers traverse a variety of conditions, ranging from nearly level to steeply sloping. Vegetation throughout most of the alignment is very sparse, although landscaping is present in localized areas next to residential developments.

EXPLORATION

U. S. Highway 95, Project 1 A was explored in January 2000 by drilling a series of 60 test borings and two test pits. The borings along proposed wall alignments generally alternated between depths of 8.1 meters and 10.7 meters but ranged from1.68 to 11.13 meters. Borings along the mainline were advanced to a depth of 3.5 meters. The borings were drilled using 152-mm-outside-diameter (O.D.), 83-mm-inside-diameter (I.D.), augers and a truck-mounted Foremost B 4500 or B90 soils sampling drill rig. The locations of the test borings are shown on Plate 1 - Plot Plan. Boring WR-5 the 61st boring was inaccessible to the drill rig, due to a steep slope, and was not drilled.

In the borings, the native soils were sampled in-place every 0.6 to 1.5 meters by use of a standard, 51-mm O.D., split-spoon sampler driven by a standard 63.6 kg drive hammer with a 762 mm stroke. The number of blows to drive the sampler the final 300 mm of a 450 mm penetration (Standard Penetration Test - AASHTO T 206-87) into undisturbed soil is an indication of the density and consistency of the material. Pocket penetrometer testing was performed on various samples of fine grained soils in order to evaluate unconfined compressive strength.

An 89-mm O.D., split-spoon sampler (ASTM D 3550) was also used to sample soils where approximate in-place densities of subsurface materials were required. Sampling methods used were

similar to the SPT but also included the use of 64-mm-diameter, 150-mm- and 25-mm-long, brass sampling rings placed inside the split-spoon sampler. Because of the larger diameter of the sampler, blow counts are typically higher than those obtained with the SPT and should not be directly equated to SPT blow counts. The logs indicate the type of sampler used for each sample.

Due to the relatively small diameter of the samplers, the maximum particle size that could be obtained was approximately 90 mm. The final logs may not, therefore, adequately represent the actual quantity or presence of cobble or caliche fragments.

Exploration was performed with backhoe test pits on the existing west embankment slope at the Lake Mead Boulevard structure. Test Pits were used to observe and sample existing embankment fill materials for design of the soil nail wall. The site is inaccessible to a conventional soils sampling drill rig because of the existing 1:2 (Vertical:Horizontal) slope.

Material Classification

A geologist examined and classified all soils in the field in accordance with ASTM D 2488. During drilling, representative bulk samples were placed in sealed plastic bags and returned to our Sparks, Nevada, laboratory for testing. Additional soil classification was subsequently performed in accordance with ASTM 2487 (Unified Soil Classification System [USCS]) upon completion of laboratory testing as described below in the **Laboratory Testing** section. Logs of the test borings are presented as Plate 2 - Exploration Logs, and a USCS chart has been included as Plate 3 - Graphic Soils Classification Chart.

LABORATORY TESTING

All soils testing performed in the Black Eagle Consulting, Inc. soils laboratory for this project was conducted in accordance with the standards and methodologies described in AASHTO (1998) and NDOT (1999) standards.

Index Testing

Samples of each significant soil type were analyzed to determine their in situ moisture content (NDOT T 206 F), grain size distribution, and plasticity index (NDOT 210 E, 211 E, and 212 E). The results

of these tests are shown on Plate 4 - Index Test Results. Results of these tests were used to classify the soils according to ASTM D 2487 and to verify the field logs, which were then updated as appropriate. Classification in this manner provides an indication of the soil's mechanical properties and can be correlated with standard penetration testing and published charts (Bowles, 1996; NAVFAC, 1982) to evaluate bearing capacity, lateral earth pressures, and settlement potential.

Direct Shear Tests

Two direct shear tests (ASTM D 3080) were performed on representative samples of clayey sand obtained from 64-mm-diameter ring samples. Since these samples were driven and the split spoon sampler has a relatively thick wall, the samples are not entirely undisturbed. They do, however, represent in-place conditions better than a remolded sample would. Sampling by thin wall shelby tube was not possible anywhere on this project due to the very dense/hard, weakly cemented and, generally, gravelly nature of the soils. A third sample was remolded from existing fill in the area to be supported by the soil nail wall. The sample was scalped on a No. 4 sieve and remolded to 90 percent relative compaction, representing in-place conditions. Tests were run on saturated samples at various lateral pressures so as to plot the Mohr's Circle Envelope. Results of these tests are shown on Plate 5 - Direct Shear Test Results and aid in calculation of bearing capacities, friction factors, and lateral soil pressures.

R-Value Tests

Resistance value testing (NDOT T 115 C) was performed on seven representative samples of subgrade soil along the mainline. R-Value testing is a measure of subgrade strength and expansion potential and is used in design of flexible pavements. Results of the R-Value tests are shown on Plate 6.

Moisture-Density Curve

A moisture-density curve was determined for a sample of embankment fill collected at the site of the Lake Mead Soil Wall. A direct shear sample was remolded at 90 percent of the maximum dry density and optimum moisture content to evaluate soil strengths for the nails. The moisture-density curve is included as Plate 7.

Corrosion Potential Tests

Corrosion index property testing was performed on representative samples of site foundation soils. This included testing for pH, soil resistivity, soluble chloride and soluble sulfate, and redox potential. The results of the corrosion index property tests are shown in Appendix F. Corrosion testing was performed by Col•Tech Laboratories of Reno, Nevada.

GEOLOGIC AND GENERAL SOIL CONDITIONS

The alignment traverses the distal end of an alluvial fan sloping into Las Vegas Valley from mountains to the west. The materials are mapped by the Nevada Bureau of Mines and Geology (Matti, et al., 1987) as predominantly older alluvium of the Red Rock fan. The alignment crosses numerous narrow bands of younger, inactive, and intermittently active alluvial deposits between Rainbow Boulevard and Smoke Ranch Road. Between Cheyenne Avenue and Smoke Ranch Road, U.S. 95 lies primarily in intermittently active alluvial deposits and active alluvial zones.

The materials encountered in our borings were very uniform along most of the alignment. In general, these materials consist of a moderately cemented mixture of silts, sands, and gravels exhibiting low plasticity and SPT blowcounts in excess of 50. Grain size analysis generally showed between 10 and 30 percent fines (material passing the 0.074 mm sieve), with soils in the upper 3 to 4 meters generally coarser than deeper materials. Interbedded, weakly cemented, caliche layers, 0.3 to 0.5 meters thick, are common in the upper 4 meters. To the north, in the younger alluvium, the materials are slightly less cemented and, therefore, have slightly lower blowcounts in some areas. Borings WR-11 through WR-14 include interbedded hard clay layers, up to 3 meters thick, below a depth of about 2 meters. Some of the thinner layers of clay are expected to be moderately expansive, based on the measured index properties.

Ground water was not encountered to the depths explored and lies well below a depth which would affect construction.

GEOLOGIC HAZARDS

The project lies within Seismic Zone 2B, an area with some potential for earthquakes. There are no known faults or fissures crossing the alignment. A series of well-developed faults parallel the alignment 1.6 to 2.4 kilometers to the east. These faults are though to be of tectonic origin but may have additional movement associated with subsidence within the Las Vegas Valley (Bell and Price, 1991). This fault system appears to cut Holocene age deposits and are considered active (Bell and Price, 1999).

Liquefaction potential is negligible due to the types of materials present. Mapping by the U. S. Survey (1996) indicates that there is a 10 percent probability that a ground acceleration of 0.10 g to 0.15 g will be exceeded in 50 years at the S_B/S_C soils profile boundary. Materials encountered in our borings indicate that those boundary conditions are appropriate. For design purposes we recommend that an AASHTO Type II soil profile be used.

Other Geologic Hazards

A moderate potential for dust generation is present if grading is performed in dry weather. No other geologic hazards were identified.

ANTICIPATED CONSTRUCTION PROBLEMS

Some difficulty will be encountered in trenching due to the presence of moderately cemented sands and gravels.

STANDARD LIMITATION CLAUSE

This report has been prepared in accordance with generally accepted geotechnical practices. The analyses and recommendations submitted are based upon field exploration performed at the locations shown on Plate 1 - Plot Plan of this report. This report does not reflect soils variations that may become evident during the construction period, at which time re-evaluation of the recommendations may be necessary.

This report has been prepared to provide information allowing the engineer to design the project. In the event of changes in the design, or location of the project from the time of this report, recommendations should be reviewed and possibly modified by the geotechnical engineer. If the geotechnical engineer is not accorded the privilege of making this recommended review, he can assume no responsibility for misinterpretation or misapplication of his recommendations or their validity in the event changes have been made in the original design concept without his prior review. The geotechnical engineer makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of this agreement and included in this report.

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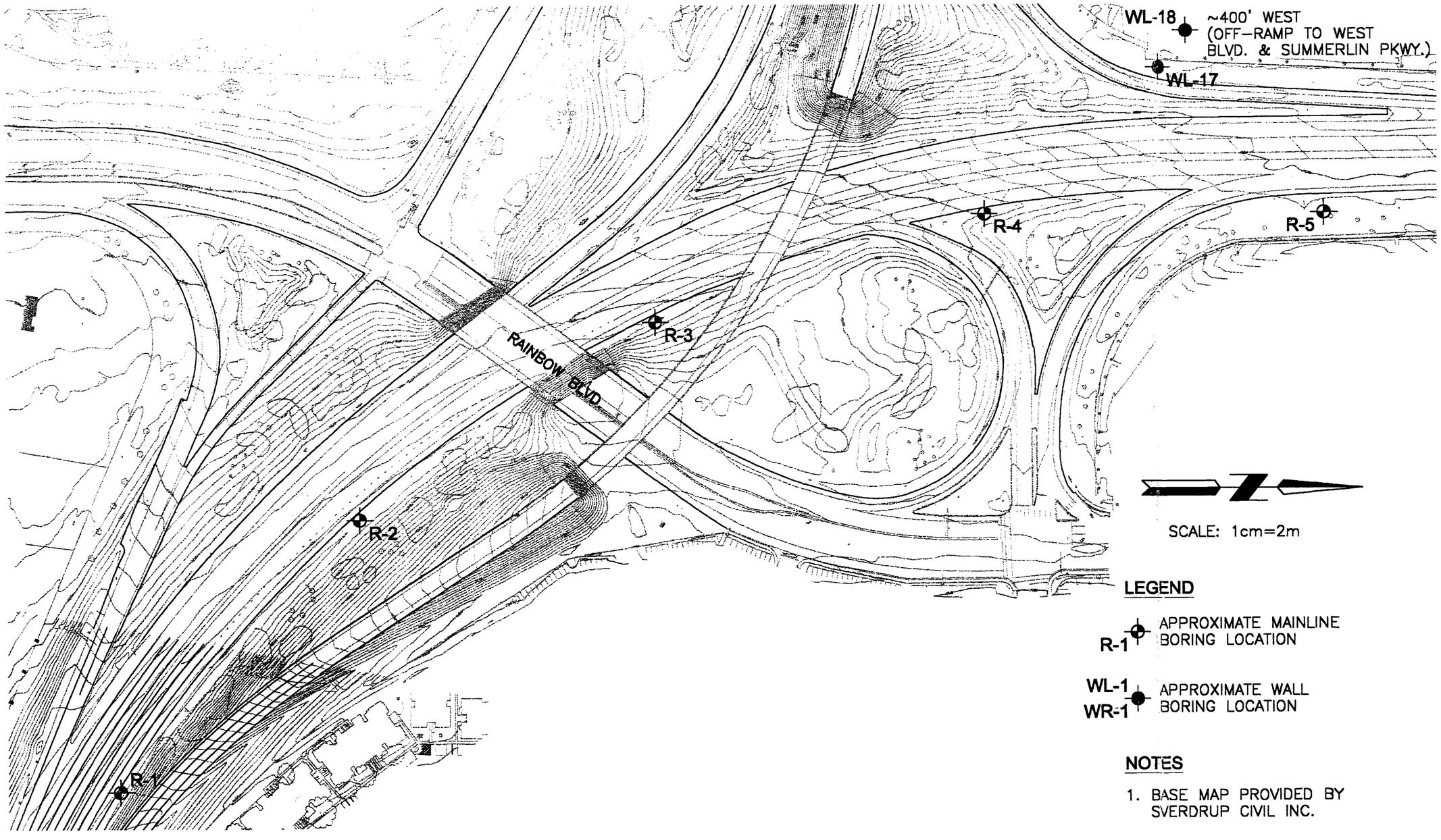
PLATES



SCALE: 1cm=2m

LEGEND

R-1 — APPROXIMATE MAINLINE BORING LOCATION

WL-1 / WR-1 — APPROXIMATE WALL BORING LOCATION

NOTES

1. BASE MAP PROVIDED BY SVERDRUP CIVIL INC.

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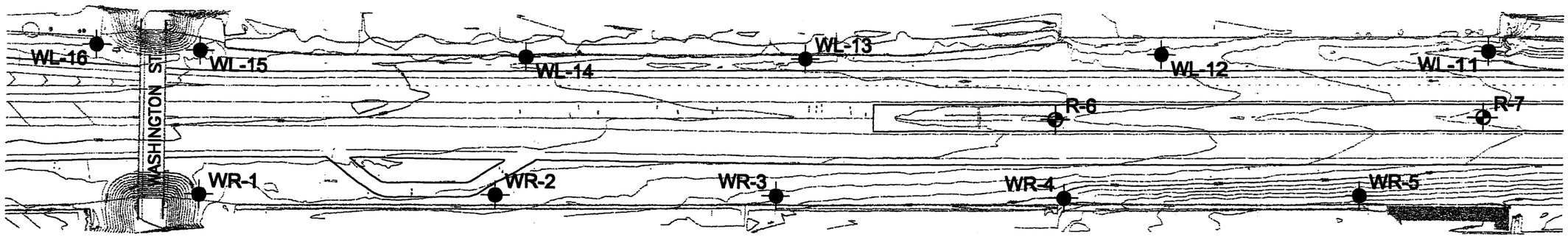
PLOT PLAN

U.S. 95 IMPROVEMENTS – PHASE 1
RAINBOW BLVD. TO CHEYENE AVE.
LAS VEGAS, NEVADA

Project No.
0215-01-1

Plate 1a

SCALE: 1cm=2m



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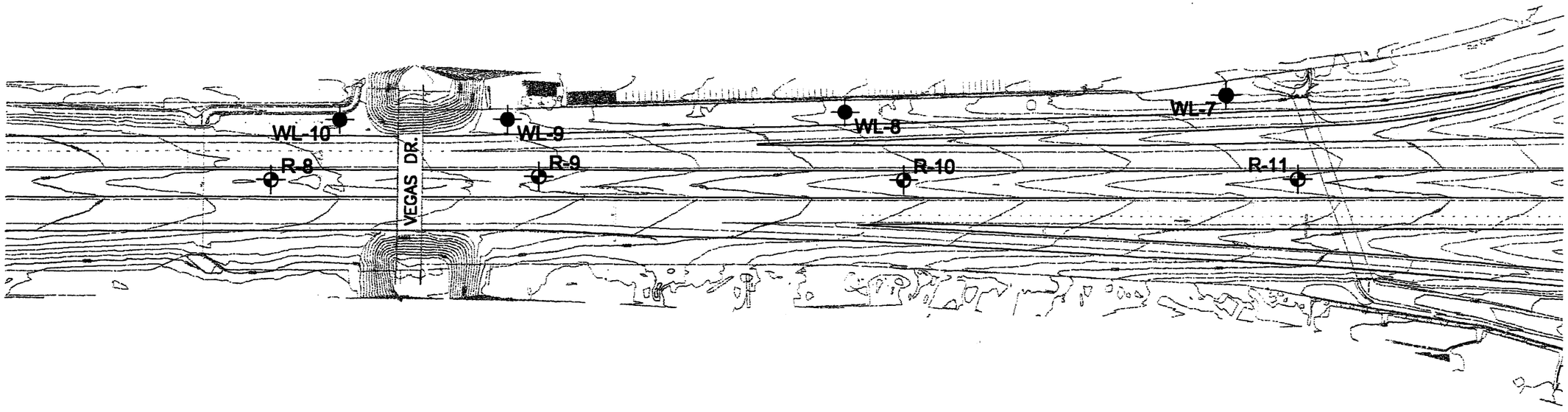
PLOT PLAN

U.S. 95 IMPROVEMENTS – PHASE 1
RAINBOW BLVD. TO CHEYENE AVE.
LAS VEGAS, NEVADA

Project No.
0215-01-1

Plate 1b

SCALE: 1cm=2m



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PLOT PLAN

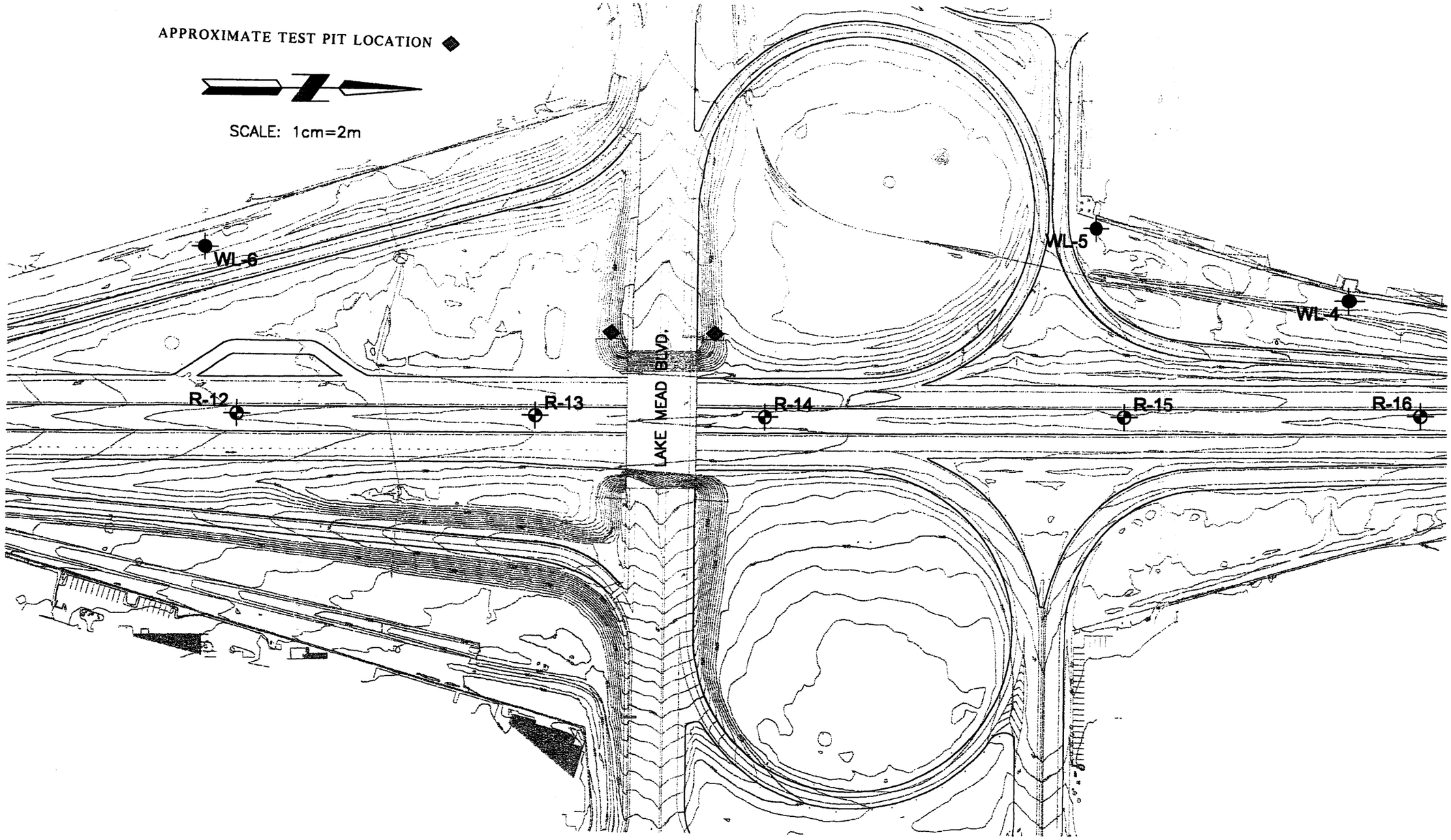
U.S. 95 IMPROVEMENTS – PHASE 1
RAINBOW BLVD. TO CHEYENE AVE.
LAS VEGAS, NEVADA

Project No.
0215-01-1

Plate 1c

APPROXIMATE TEST PIT LOCATION ◆

SCALE: 1cm=2m



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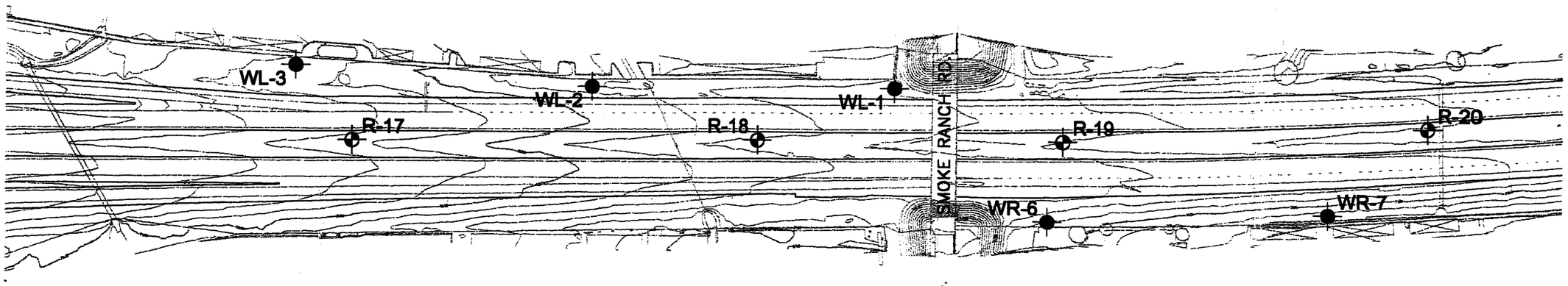
PLOT PLAN

U.S. 95 IMPROVEMENTS – PHASE 1
RAINBOW BLVD. TO CHEYENE AVE.
LAS VEGAS, NEVADA

Project No.
0215-01-1

Plate 1d

SCALE: 1cm=2m



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PLOT PLAN

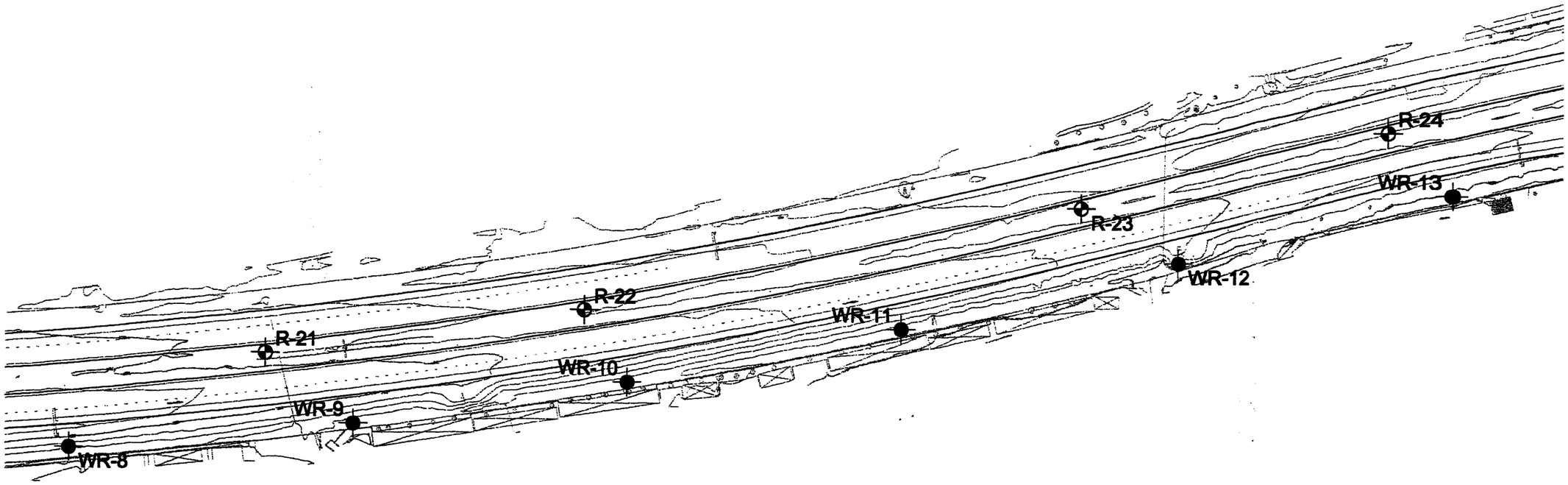
U.S. 95 IMPROVEMENTS – PHASE 1

LAS VEGAS, NEVADA

Project No.
0215-01-1

Plate 1e

SCALE: 1cm=2m



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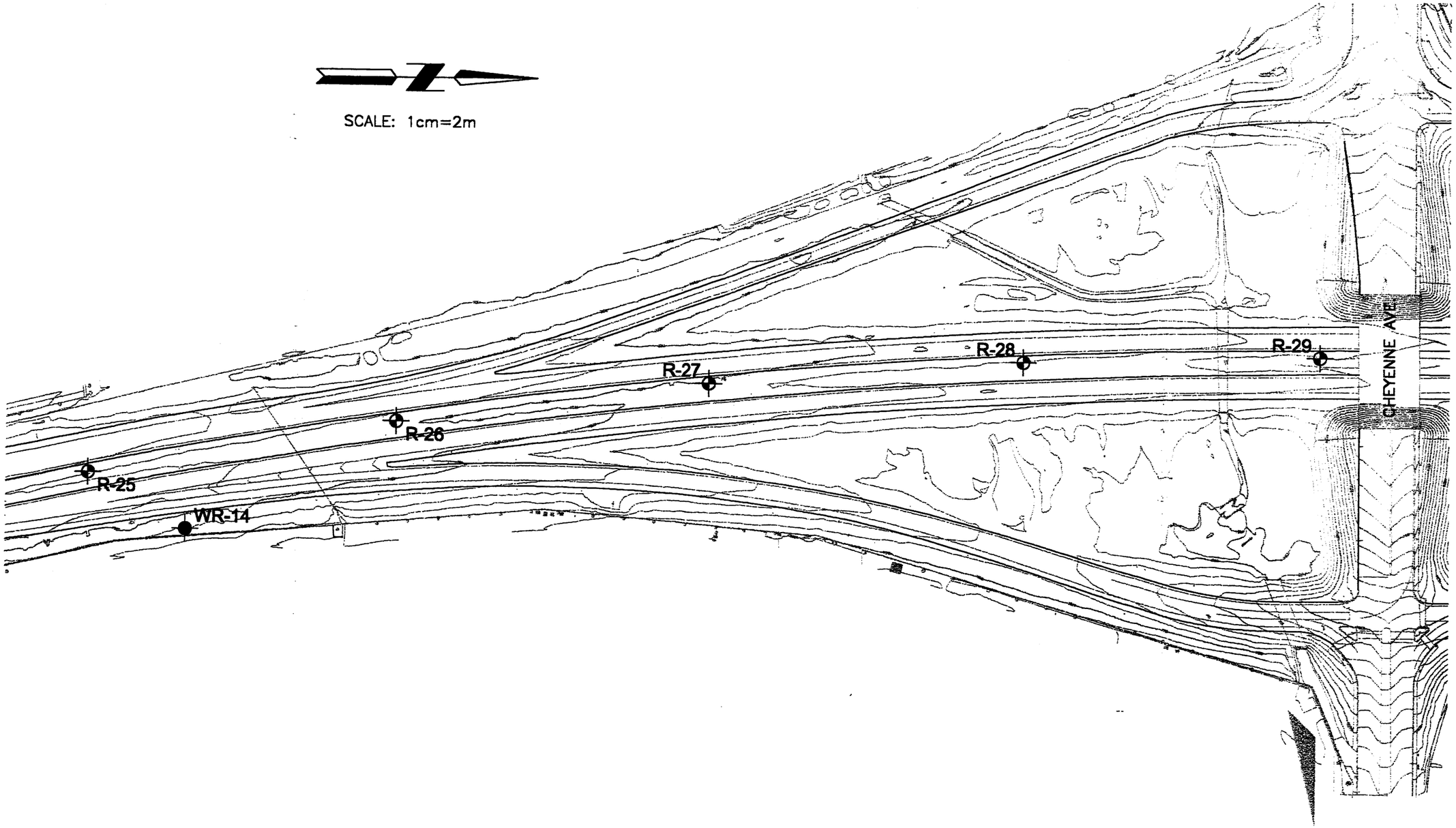
PLOT PLAN

U.S. 95 IMPROVEMENTS – PHASE 1
RAINBOW BLVD. TO CHEYENE AVE.
LAS VEGAS, NEVADA

Project No.
0215-01-1

Plate 1f

SCALE: 1cm=2m



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PLOT PLAN

U.S. 95 IMPROVEMENTS – PHASE 1
RAINBOW BLVD. TO CHEYENE AVE.
LAS VEGAS, NEVADA

Project No.
0215-01-1

Plate 1g

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/29/00
END DATE 1/29/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-01
E.A. # 0215-01-1
GROUND ELEV. 720.57 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/29/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							SM	**SILTY SAND with GRAVEL** light brown, dry to slightly moist, moderately to well cemented, with 14% very low plastic fines, 48% fine to coarse sand, 38% fine, subangular gravel to +12.5mm in diameter.	
	0.53	1A	SPT	44 50/50	50/50	75	MC, SA, PI			
									0.61	
719.57	1							SP SM	**POORLY GRADED SAND with SILT and GRAVEL** light grey to brown, dry to slightly moist, well cemented, with estimated 10-15% non-plastic to low plastic fines, 45-60% fine to coarse sand, 30-40% fine to coarse, angular to subangular gravel to +19mm in diameter.	
	1.52									
	1.64	1B	SPT	50/113	50/113	89				
718.57	2									
									2.44	
	2.74							SC	**CLAYEY SAND with GRAVEL** brown, slightly moist, well cemented, with estimated 25% low plastic fines, 45-55% fine to coarse sand, 20-30% fine, subangular gravel to +12.5mm in diameter.	
	2.90	1C	SPT	50/150	50/150	100			2.90	
717.57	3									
716.57	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/29/00
END DATE 1/29/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-02
E.A. # 0215-01-1
GROUND ELEV. 720.94 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/29/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30									
	0.36	2A	GRAB	50/50	50/50	50		GP	**POORLY GRADED GRAVEL with SAND** brown, dry to slightly moist, moderately to well cemented, with estimated 10% non-plastic to low plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to 25mm in diameter.	
									0.91	
719.94	1							SP SM	**POORLY GRADED SAND with SILT and GRAVEL** light brown, dry to slightly moist, well cemented with estimated 10-15% low plastic fines, 55-65% fine to coarse sand, 25-30% fine to coarse, angular to subangular gravel to +19mm in diameter.	
	1.22									
	1.33	2B	SPT	50/113	50/113	89			1.52	
718.94	2								Caliche at 5 feet.	
717.94	3									
716.94	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/29/00
END DATE 1/29/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-03
E.A. # 0215-01-1
GROUND ELEV. 722.48 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/29/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
								GP	**POORLY GRADED GRAVEL with SAND** grey, dry, loose, with estimated <5% non-plastic fines, 45% fine to coarse sand, 55% fine to coarse, subangular to subround gravel to +75mm in diameter.	
	0.15									
	0.30									
	0.43	3A	GRAB	50/125	50/125	0	MC, SA, PI, R			
721.48	1								**CLAYEY GRAVEL with SAND** light brown, dry to slightly moist, well cemented, with approximately 15% low plastic fines, 35% fine to coarse sand, 50% fine to coarse gravel to +25mm in diameter.	
	1.37									
	1.47	3B	SPT	50/100	50/100	50		GC		
720.48	2									
	2.74								2.74	
	2.83	3C	GRAB	50/88	50/88	40				
719.48	3									
718.48	4									

DOT .GPJ .GDT

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/29/00
END DATE 1/29/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-04
E.A. # 0215-01-1
GROUND ELEV. 725.91 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/29/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GM	**SILTY GRAVEL with SAND** brown, dry, well cemented, with estimated 5% non-plastic fines, 35% fine to coarse sand, 60% fine coarse, angular to subangular gravel to +37.5mm in diameter.	
	0.38	4A	SPT	50/75	50/75	67				
724.91	1									
	1.37								1.37	
	1.47	4B	SPT	50/100	50/100	100	MC, SA, PI	SM	**SILTY SAND with GRAVEL** brown, dry to slightly moist, well cemented, with approximately 16% very low plastic fines, 52% fine to coarse sand, 32% fine, angular to subangular gravel to +12.5mm in diameter.	
723.91	2									
	2.44									
	2.74							SP	**POORLY GRADED SAND with GRAVEL** light brown, slightly moist, well cemented, with estimated <5% non-plastic fines, 55-65% fine to coarse sand, 30-40% fine to coarse angular to subangular gravel to +19mm in diameter.	
	2.84	4C	SPT	50/100	50/100	75			2.83	
722.91	3									
721.91	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/29/00
END DATE 1/29/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-05
E.A. # 0215-01-1
GROUND ELEV. 731.05 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/29/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	BLOW COUNT Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30	5A	GRAB	50/25	50/25	0		GP	**POORLY GRADED GRAVEL with SAND** brown, dry, moderately to well cemented, with estimated 5% non-plastic to low plastic fines, 30-45% fine to coarse sand, 50-60% fine to coarse, angular to subangular gravel to +37.5mm in diameter.	
									0.91	
730.05	1								**POORLY GRADED SAND with SILT and GRAVEL** light brown, dry to slightly moist, well cemented, with estimated 5-10% nonplastic to low plastic fines, 50-55% fine to coarse sand, 40% fine to coarse, angular to subangular gravel to +25mm in diameter.	
	1.37	5B	GRAB	50/25	50/25	0		SP SM		
729.05	2									
									2.44	
	2.74							GM	**SILTY GRAVEL with SAND** light brown, slightly moist, well cemented, with 27% very low plastic fines, 36% fine to coarse sand, 37% fine to coarse, subangular gravel to +19mm in diameter.	
	2.84	5C	SPT	50/100	50/100	100	MC, SA, PI		2.83	
728.05	3									
727.05	4									

IV_DC ...J11.GF ...OT.GL ...30

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/27/00
END DATE 1/27/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-06
E.A. # 0215-01-1
GROUND ELEV. 727.18 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/27/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30								**CLAYEY SAND with GRAVEL** brown, dry to slightly moist, moderately to well cemented, with estimated 15-20% low plastic fines, 40-45% fine to coarse sand, 40% fine to coarse, subangular to subround gravel to +25mm in diameter.	
	0.51	6A	SPT	20 50/50	50/50	75				
726.18	1							SC		
	1.52									
	1.60	6B	SPT	50/75	50/75	67				
725.18	2									
									2.13	
								GC GM	**SILTY, CLAYEY GRAVEL with SAND** brown, slightly moist, well cemented, with estimated 15% non-plastic to low plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular gravel to +19mm in diameter.	
	2.74								2.74	
724.18	3	6C	SPT	28 32 29	61	83	MC, SA, PI	SM	**SILTY SAND with GRAVEL** brown, slightly moist, very dense/moderately cemented, with 12% non-plastic fines, 52% fine to coarse sand, 36% fine to coarse, subangular to subround gravel to +19mm in diameter.	
	3.20								3.20	
723.18	4									

EXPLORATION LOG

START DATE 1/27/00
END DATE 1/27/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-07
E.A. # 0215-01-1
GROUND ELEV. 726.17 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/27/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.00									
	0.10	7A	GRAB	50/100	50/100	0	MC, SA, PI, R	GP	0.06 **POORLY GRADED GRAVEL with SAND** grey, dry, loose, with estimated <5% non-plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular gravel to +25mm in diameter.	
725.17	1							GP GC	**POORLY GRADED GRAVEL with SAND and SILTY CLAY** brown, dry to slightly moist, moderately to well cemented, with approximately 10% low plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular gravel to +25mm in diameter.	
	1.22									
	1.52							SC	**CLAYEY SAND with GRAVEL** red brown, slightly moist, moderately cemented, with estimated 15% low to medium plastic fines, 45% fine to coarse sand, 40% fine to coarse, subangular to subround gravel to +38mm in diameter.	
	1.68	7B	SPT	50/150	50/150	50				
724.17	2									
	2.13									
	2.74							SP SC	**POORLY GRADED SAND with CLAY and GRAVEL** light brown to brown, slightly moist, moderately cemented, with estimated 5-10% low plastic fines, 60-65% fine to coarse sand, 30% fine to coarse gravel to +25mm in diameter.	
	2.92	7C	SPT	39 50/25	50/25	100				
	2.93									
723.17	3									
722.17	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/27/00
END DATE 1/27/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-08
E.A. # 0215-01-1
GROUND ELEV. 724.97 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/27/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.61								**POORLY GRADED GRAVEL with SAND** grey to brown, dry to slightly moist, weakly to moderately cemented, with estimated 5% non-plastic fines, 30-40% fine to coarse sand, 55-65% fine to coarse, subangular to subround gravel to +75mm in diameter. Unit contains approximately 5-10% cobbles at 0 to 0.61 meters.	
	0.86	8A	GRAB	29 50/100	50/100	0		GP		
723.97	1									
	1.52								1.52	
	1.70	8B	SPT	43 50/25	50/25	86	MC, SA, PI		**SILTY, CLAYEY SAND with GRAVEL** brown, slightly moist, well cemented, with 16% low plastic fines, 43% fine to coarse sand. 41% fine to coarse, subangular gravel to +19mm in diameter.	
722.97	2							SC SM		
	2.44								2.44	
	2.74							SP SM	**POORLY GRADED SAND with SILT and GRAVEL** brown, slightly moist, well cemented, with estimated 5-10% non-plastic to low plastic fines, 60-65% fine to coarse sand, 30% fine to coarse, angular to subangular gravel to +19mm in diameter.	
	2.82	8C	GRAB	50/75	50/75	0			2.83	
721.97	3									
720.97	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/27/00
END DATE 1/27/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-09
E.A. # 0215-01-1
GROUND ELEV. 723.80 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/27/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30									
	0.41	9A	GRAB	50/100	50/100	25		GP	**POORLY GRADED GRAVEL with SAND** grey to light brown, dry, well cemented, with estimated 5% non-plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +75mm in diameter. Minor cobbles at surface.	
722.80	1									
	1.37									
	1.52							SP SM	**POORLY GRADED SAND with SILT and GRAVEL** light brown, dry to slightly moist, moderately to well cemented, with estimated 5-10% non-plastic to low plastic fines, 60-65% fine to coarse sand, 30% fine to coarse, angular to subangular gravel to +12.5mm in diameter.	
	1.70	9B	SPT	25 50/25	50/25	57				
721.80	2									
	2.44									
	2.74							SC SM	**SILTY, CLAYEY SAND with GRAVEL** light brown, slightly moist, moderately to well cemented, with 13% low plastic fines, 45% fine to coarse sand, 42% fine, subangular gravel to +12.5mm in diameter.	
720.80	3 3.05	9C	SPT	42 50/150	50/150	83	MC, SA, PI			
	3.05									
719.80	4									

..._DOT ...1.GPJ ..._DOT.GDT ...

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/27/00
END DATE 1/27/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-10
E.A. # 0215-01-1
GROUND ELEV. 722.05 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/27/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	**POORLY GRADED GRAVEL with SAND** grey to light brown, dry, moderately to well cemented, with estimated 5% non-plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular gravel to +50mm in diameter.	
	0.38	10A	GRAB	50/75	50/75	0			0.30	
721.05	1							GM	**SILTY GRAVEL with SAND** light brown, dry, well cemented, with estimated 10-15% low plastic fines, 35-40% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +25mm in diameter.	
	1.52								1.52	
	1.70	10B	GRAB	25 50/25	50/25	0	MC, SA, PI		**POORLY GRADED GRAVEL with SILT and SAND** brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +25mm in diameter.	
720.05	2							GP GM		
	2.74	10C	GRAB			0			2.74	
719.05	3								Caliche at 2.7 meters.	
718.05	4									

EXPLORATION LOG

START DATE 1/27/00
END DATE 1/27/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-11
E.A. # 0215-01-1
GROUND ELEV. 720.45 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/27/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
								GP	0.06 **POORLY GRADED GRAVEL with SAND** grey, dry, loose, with estimated <5% non-plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +75mm in diameter. Minor surface cobbles are present.	
	0.30	11A	GRAB	50/0	50/0	0	MC, SA, PI, R			
								GP GC	**POORLY GRADED GRAVEL with CLAY and SAND** brown, slightly moist, well cemented, with approximately 10% low plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +19mm in diameter.	
719.45	1									
									1.22	
	1.52								**CLAYEY SAND with GRAVEL** brown, slightly moist, moderately cemented, with estimated 15% low plastic fines, 45% fine to coarse sand, 40% fine, angular to subangular gravel to +12.5mm in diameter.	
		11B	SPT	30 50/150	50/150	92				
	1.83							SC		
718.45	2									
									2.59	
	2.74								**CALICHE**	
									2.74	
		11C	SPT	32 50/113	50/113	95		SC	**CLAYEY SAND with GRAVEL** brown, slightly moist, moderately cemented, with estimated 25% low plastic fines, 50-55% fine to coarse sand, 20-25% fine to coarse, subangular gravel to +19mm in diameter.	
717.45	3 3.01								3.02	
716.45	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/27/00
END DATE 1/27/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-12
E.A. # 0215-01-1
GROUND ELEV. 718.81 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/27/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	**POORLY GRADED GRAVEL with SAND** grey to light brown, dry, weakly to moderately cemented, with estimated 5% non-plastic fines, 40% fine to coarse sand, 55% fine to coarse, subangular gravel to +19mm in diameter.	
	0.59	12A	SPT	22 50/125	50/125	72		SP	**POORLY GRADED SAND with GRAVEL** light brown, dry, moderately to well cemented, with estimated 5% non-plastic fines, 55-65% fine to coarse sand, 30-40% fine to coarse, angular to subangular gravel to +37.5mm in diameter.	
717.81	1								1.07 **CALICHE**	
									1.52	
716.81	2							SP SC	**POORLY GRADED SAND with CLAY and GRAVEL** brown, dry to slightly moist, well cemented, with estimated 5-10% low plastic fines, 60-65% fine to coarse sand, 30% fine, subangular gravel to +9.5mm in diameter.	
	2.74								2.44	
	2.97	12C	SPT	15 50/75	50/75	89	MC, SA, PI	SC	**CLAYEY SAND with GRAVEL** brown, slightly moist, moderately to well cemented, with 21% medium plastic fines, 51% fine to coarse sand, 28% fine, subround gravel to +9.5mm in diameter.	
715.81	3								2.97	
714.81	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/27/00
END DATE 1/27/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-13
E.A. # 0215-01-1
GROUND ELEV. 717.32 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/27/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	0.15 **POORLY GRADED GRAVEL with SILT and SAND** grey, dry, weakly cemented, with estimated 5-10% non-plastic to low plastic fines, 40-45% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +19mm in diameter.	
	0.38	13A	GRAB	50/75	50/75	0			**SILTY GRAVEL with SAND** brown, dry to slightly moist, well cemented, with estimated 15% non-plastic to low plastic fines, 30% fine to coarse sand, 55% fine to coarse, angular to subangular gravel to +37.5mm in diameter.	
716.32	1							GM		
	1.52								1.52	
	1.58	13B	GRAB	50/50	50/50	50			**CLAYEY SAND with GRAVEL** light brown to brown, slightly moist, well cemented, with estimated 15-20% low plastic fines, 50-55% fine to coarse sand, 30% fine to coarse, subangular gravel to +25mm in diameter.	
715.32	2							SC		
	2.74								2.74	
	2.87	13C	SPT	50/125	50/125	100	MC, SA, PI	SC	2.87 **CLAYEY SAND with GRAVEL** brown, slightly moist, moderately to well cemented, with 26% medium plastic fines, 52% fine to coarse sand, 22% fine, subround gravel to +12.5mm in diameter.	
714.32	3									
713.32	4									

EXPLORATION LOG

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-14
E.A. # 0215-01-1
GROUND ELEV. 716.69 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
								GP	0.15 **POORLY GRADED GRAVEL with SAND** grey, dry, moderately cemented, with estimated <5% non-plastic fines, 35-40% fine to coarse sand, 60% fine to coarse, subangular gravel to +25mm in diameter.	
	0.30									
	0.36	14A	GRAB	50/50	50/50	0				
								GP GM	**POORLY GRADED GRAVEL with SILT and SAND** light brown to brown, dry to slightly moist, well cemented, with estimated 5-10% non-plastic to low plastic fines, 30-45% fine to coarse sand, 50-60% fine to coarse, angular to subangular gravel to +37.5mm in diameter.	
715.69	1									
									1.22	
	1.52								**CLAYEY SAND with GRAVEL** light brown, slightly moist, well cemented, with approximately 20% low plastic fines, 50% fine to coarse sand, 30% fine to coarse, subangular gravel to +19mm in diameter.	
	1.62	14B	SPT	50/100	50/100	100	MC, SA, PI			
714.69	2							SC		
	2.74									
	2.82	14C	GRAB	50/75	50/75	0			2.82	
713.69	3									
712.69	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-15
E.A. # 0215-01-1
GROUND ELEV. 716.24 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	0.15 **POORLY GRADED GRAVEL with SAND** light brown to grey, dry, loose, with estimated <5% non-plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +75mm in diameter. Minor cobbles at surface.	
	0.41	15A	GRAB	50/75	50/75	33	MC, SA, PI, R			
715.24	1							GC GM	**SILTY, CLAYEY GRAVEL with SAND** brown, slightly moist, well cemented, with approximately 20% low plastic fines, 35% fine to coarse sand, 45% fine to coarse, subangular gravel to +19mm in diameter.	
									1.37	
	1.52								**CLAYEY SAND with GRAVEL** light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 55% fine to coarse sand, 30% fine to coarse, subangular gravel +19mm in diameter.	
	1.58	15B	GRAB	50/50	50/50	0				
714.24	2							SC		
									2.44	
	2.74							SC	**CLAYEY SAND with GRAVEL** light brown to brown, slightly moist, moderately cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine, subangular gravel to +12.5mm in diameter.	
	2.92	15C	SPT	34 50/25	50/25	86			2.93	
713.24	3									
712.24	4									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-16
E.A. # 0215-01-1
GROUND ELEV. 715.69 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
								GP	0.15 **POORLY GRADED GRAVEL with SAND** grey to brown, dry, weakly to moderately cemented, with estimated 5% non-plastic to low plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular gravel to +75mm in diameter. 5-10% cobbles at surface.	
	0.30 0.34	16A	GRAB	50/25	50/25	0				
								SM	**SILTY SAND with GRAVEL** brown to red brown, dry to slightly moist, with estimated 20-25% low plastic fines, 40% fine to coarse sand, 35-40% fine to coarse, subangular to subround gravel to +19mm in diameter.	
714.69	1									
	1.22								1.22	
	1.40	16B	SPT	43 50/25	50/25	86	MC, SA, PI		**SILTY SAND with GRAVEL** light brown, slightly moist, moderately to well cemented, with approximately 20% low plastic fines, 50% fine to coarse sand, 30% fine to coarse, subangular to subround gravel to +19mm in diameter.	
713.69	2							SM		
	2.74									
	2.82	16C	GRAB	50/75	50/75	0			2.82	
712.69	3									
711.69	4									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-17
E.A. # 0215-01-1
GROUND ELEV. 714.50 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	0.15 **POORLY GRADED GRAVEL with SAND** grey to brown, dry, weakly cemented, with estimated 5% non-plastic fines, 25-35% fine to coarse sand, 60-70% fine to coarse, subangular gravel to +37.5mm in diameter.	
	0.71	17A	SPT	19 36 50/100	50/100	69	MC, SA, PI	SM	**SILTY SAND with GRAVEL** brown, dry to slightly moist, moderately to well cemented, with 18% very low plastic fines, 45% fine to coarse sand, 37% fine to coarse, subangular gravel to +19mm in diameter.	
713.50	1									
	1.52								1.22	
	1.66	17B	SPT	50/138	50/138	95		SP SM	**POORLY GRADED SAND with SILT and GRAVEL** light brown, slightly moist, well cemented, with estimated 5-10% non-plastic to low plastic fines, 50-60% fine to coarse sand, 30-40% fine, subangular gravel to +12.5mm in diameter.	
712.50	2								2.13 **CALICHE**	
	2.74								2.44	
	2.80	17C	GRAB	50/50	50/50	0		SM	**SILTY SAND with GRAVEL** light brown to brown, slightly moist, well cemented, with estimated 15% non-plastic to low plastic fines, 50% fine to coarse sand, 35% fine to coarse, angular to subangular gravel to +19mm in diameter. 2.80	
711.50	3									
710.50	4									

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EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-18
E.A. # 0215-01-1
GROUND ELEV. 712.00 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30								**POORLY GRADED GRAVEL with SAND** grey to brown, dry to slightly moist, moderately to well cemented, with estimated 5% non-plastic fines, 35% fine to coarse sand, 60% fine to coarse, angular to subangular gravel to +75mm in diameter. Approximately 5% cobbles at surface.	
	0.41	18A	GRAB	50/100	50/100	0		GP		
711.00	1									
									1.22	
	1.52								**CLAYEY SAND with GRAVEL** brown to light brown, slightly moist, well cemented, with 17% low plastic fines, 46% fine to coarse sand, 37% fine to coarse, subangular gravel to +19mm in diameter.	
	1.58	18B	GRAB	50/50	50/50	0	MC, SA, PI	SC	1.68	
710.00	2									Auger Refusal at 1.68 meters (very hard caliche).
709.00	3									
708.00	4									

V_DO 11.GP ...JT.GL ...J0

EXPLORATION LOG

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-19
E.A. # 0215-01-1
GROUND ELEV. 711.82 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.00									
	0.14	19A	GRAB	50/138	50/138	55	MC, SA, PI, R	GP	**POORLY GRADED GRAVEL with SAND** grey, dry, loose, with estimated 10% non-plastic fines, 20% fine to coarse sand, 70% fine to coarse, subangular gravel to +50mm in diameter.	
									0.15	
								SC SM	**SILTY, CLAYEY SAND with GRAVEL** brown to light brown, dry to slightly moist, moderately to well cemented, with approximately 20% low plastic fines, 40% fine to coarse sand, 40% fine to coarse, subangular gravel to +19mm in diameter.	
710.82	1									
									1.22	
									CALICHE	With approximately 25% fine to coarse, subangular gravel to +19mm.
	1.52									
	1.60	19B	GRAB	50/75	50/75	0				
									1.83	
709.82	2								**CLAYEY SAND with GRAVEL** light brown to brown, slightly moist, well cemented, with estimated 15-20% low plastic fines, 50-60% fine to coarse, 25-30% fine to coarse, angular to subangular gravel to +19mm in diameter.	
								SC		
	2.74									
	2.82	19C	GRAB	50/75	50/75	0				
									2.82	
708.82	3									
707.82	4									

EXPLORATION LOG

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-20
E.A. # 0215-01-1
GROUND ELEV. 711.17 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	**POORLY GRADED GRAVEL with SAND** grey to light brown, dry, weakly cemented, with estimated <5% non-plastic fines, 20-25% fine to coarse sand, 75% fine to coarse, subangular gravel to +50mm in diameter.	
	0.76	20A	SPT	28 31 50	81	72	MC, SA, PI		0.15	
710.17	1							GP GC	**POORLY GRADED GRAVEL with CLAY and SAND** light brown to brown, dry to slightly moist, moderately to well cemented, with approximately 10% low plastic fines, 40% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +25mm in diameter.	
	1.52									
	1.60	20B	GRAB	50/75	50/75	0			1.68	
709.17	2								**CALICHE**	
	2.74								2.29	
	2.82	20C	SPT	50/75	50/75	98		SM	**SILTY SAND with GRAVEL** light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.	
708.17	3								2.82	
707.17	4									

EXPLORATION LOG

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-21
E.A. # 0215-01-1
GROUND ELEV. 710.75 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	0.15 **POORLY GRADED GRAVEL with SAND** grey to light brown, dry, weakly cemented, with estimated <5% non-plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular gravel to +75mm in diameter. Approximately 10% cobbles at surface.	
	0.60	21A	SPT	30 50/138	50/138	96			**SILTY SAND with GRAVEL** light brown to brown, dry to slightly moist, moderately to well cemented, with approximately 15% low plastic fines, 50% fine to coarse sand, 35% fine to caorse, subangular gravel to +19mm in diameter.	
709.75	1									
	1.52							SM		
	1.75	21B	SPT	43 50/75	50/75	89	MC, SA, PI			
708.75	2									
									2.29 **CALICHE** 2.44	
	2.74							SM	**SILTY SAND with GRAVEL** brown to light brown, slightly moist, well cemented, with estimated 15-20% low plastic fines, 40-50% fine to coarse sand, 30-40% fine to coarse,	
	2.82	21C	GRAB	50/75	50/75	66			2.82 subangular gravel to +25mm in diameter.	
707.75	3									
706.75	4									

EXPLORATION LOG

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-22
E.A. # 0215-01-1
GROUND ELEV. 710.12 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
								GP	0.15 **POORLY GRADED GRAVEL with SAND** grey to light brown, dry, weakly to moderately cemented, with estimated <5% non-plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular gravel to +75mm in diameter. Minor cobbles at surface.	
	0.30									
	0.38	22A	GRAB	50/75	50/75	0		SP SM	**POORLY GRADED SAND with SILT and GRAVEL** light brown to brown, dry to slightly moist, well cemented, with estimated, 5-10% low plastic fines, 30-35% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +37.5mm in diameter.	
									0.91	
709.12	1								**SILTY, CLAYEY SAND** brown to red brown, slightly moist, well cemented, with estimated 20-25% low plastic fines, 35-45% fine to coarse sand, 30-40% fine to coarse, subangular gravel to +19mm in diameter.	
	1.52									
	1.58	22B	GRAB	50/50	50/50	0		SC SM		
708.12	2									
									2.13	
								SP SC	**POORLY GRADED SAND with CLAY and GRAVEL** light brown, slightly moist, well cemented, with approximately 10% low to medium plastic fines, 50% fine to coarse sand, 40% fine, subangular gravel to +12.5mm in diameter.	
	2.74									
	2.89	22C	SPT	50/145	50/145	86	MC, SA, PI		2.90	
707.12	3									
706.12	4									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-23
E.A. # 0215-01-1
GROUND ELEV. 709.53 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
								GP	**POORLY GRADED GRAVEL with SAND** grey, dry, loose, with estimated <5% nonplastic fines, 30% fine to coarse sand, 70% fine to coarse, subangular gravel to +25mm in diameter.	
	0.30								0.15	
		23A	GRAB	33 46 40	86	44	MC, SA, PI, R	GP GC	**POORLY GRADED GRAVEL with SILTY CLAY and SAND** brown, slightly moist, moderately cemented, with approximately 10% low plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +25mm in diameter.	
	0.76									
708.53	1									
	1.52								1.22	
		23B	SPT	44 31 50/100	50/100	81		GC	**CLAYEY GRAVEL with SAND** brown, slightly moist, moderately to well cemented, with estimated 25-30% low to medium plastic fines, 30-35% fine to coarse sand, 40% fine to coarse, angular to subangular gravel to +25mm in diameter.	
	1.93									
707.53	2									
	2.74								2.29	
		23C	SPT	20 16 13	29	56		SC	**CLAYEY SAND** light brown, slightly moist, weakly cemented, with estimated 30% medium plastic fines, 60% fine to coarse sand, 10% fine, subangular gravel to +9.5mm in diameter.	
706.53	3									
	3.20								3.20	
705.53	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-24
E.A. # 0215-01-1
GROUND ELEV. 708.92 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	**POORLY GRADED GRAVEL with SAND** grey to brown, dry, moderately cemented, with estimated 5% non-plastic fines, 30% fine to coarse sand, 65% fine to coarse, subangular gravel to +50mm in diameter. Minor cobbles at surface. 0.15	
	0.40	24A	GRAB	50/25	50/25	0			**SILTY, CLAYEY SAND with GRAVEL** brown to red brown, dry to slightly moist, well cemented, with estimated 15-25% low plastic fines, 40-50% fine to coarse sand, 30-40% fine to coarse, angular to subround gravel to +25mm in diameter.	
707.92	1							SC SM		
	1.52									
	1.62	24B	SPT	50/100	50/100	75				
									1.68 **CALICHE** 1.83	
706.92	2								**CLAYEY SAND with GRAVEL** brown, moist, weakly cemented, with 30% low to medium plastic fines, 45% fine to coarse sand, 25% fine, subangular gravel to +12.5mm in diameter.	
	2.74							SC		
705.92	3	24C	SPT	9 7 9	16	61	MC, SA, PI			
	3.20								3.20	
704.92	4									

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EXPLORATION LOG

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-25
E.A. # 0215-01-1
GROUND ELEV. 708.44 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	**POORLY GRADED GRAVEL with SILT and SAND** grey to light brown, dry to slightly moist, weakly to moderately cemented, with estimated 5-10% non-plastic to low plastic fines, 30-35% fine to coarse sand, 60% fine to coarse, subangular gravel to +50mm in diameter.	
	0.76	25A	SPT	44 26 20	46	83	MC, SA, PI		**SILTY SAND with GRAVEL** brown to red brown, slightly moist, moderately to well cemented, with approximately 20% non-plastic to low plastic fines, 50% fine to coarse sand, 30% fine, subangular gravel to +12.5mm in diameter.	
707.44	1							SM		
	1.52									
	1.64	25B	SPT	50/113	50/113	67				
									1.83 **CALICHE**	
706.44	2								2.13 **CLAYEY SAND with GRAVEL** brown, slightly moist, moderately cemented, with estimated 30-40% medium plastic fines, 40-50% fine to coarse sand, 20% fine to coarse, subangular gravel to +25mm in diameter.	
	2.74							SC		
705.44	3	25C	SPT	24 26 19	45	89				
	3.20								3.20	
704.44	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-26
E.A. # 0215-01-1
GROUND ELEV. 707.95 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	**POORLY GRADED GRAVEL with SAND** grey to light brown, dry, weakly to moderately cemented, with estimated 5% non-plastic fines, 35-40% fine to coarse sand, 60% fine to coarse, subangular gravel to +37.5mm in diameter.	
	0.43	26A	GRAB	50/125	50/125	0				
								GC GM	**SILTY, CLAYEY GRAVEL with SAND** light brown, dry to slightly moist, moderately to well cemented, with estimated 10-15% low plastic fines, 35-40% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +25mm in diameter.	
706.95	1								0.91	
	1.52							SC SM	**SILTY, CLAYEY SAND with GRAVEL** brown, slightly moist, moderately cemented, with approximately 20% low plastic fines, 50% fine to coarse sand, 30% fine, subangular gravel to +12.5mm in diameter.	
	1.98	26B	SPT	28 31 31	62	78	MC, SA, PI			
705.95	2								2.13	
	2.74							SC	**CLAYEY SAND with GRAVEL** brown, slightly moist to moist, moderately to well cemented, with estimated 25% low to medium plastic fines, 50% fine to coarse sand, 25% fine, subangular gravel to +12.5mm in diameter.	
	2.98	26C	SPT	22 50/88	50/88	84				
704.95	3								2.99	
703.95	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-27
E.A. # 0215-01-1
GROUND ELEV. 707.56 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.00									
	0.10	27A	GRAB	50/100	50/100	0	MC, SA, PI, R	GP	**POORLY GRADED GRAVEL with SAND** brown to grey, dry, loose, with estimated 10% low plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +25mm in diameter.	
	0.15								**SILTY, CLAYEY GRAVEL with SAND** light brown, moist, well cemented, with approximately 12% low plastic fines, 40% fine to coarse sand, 48% fine to coarse, subangular gravel to +19mm in diameter.	
706.56	1							GC GM		
	1.37								**CLAYEY SAND** brown. moist, weakly to moderately cemented. with estimated 20% low plastic fines, 75% fine to medium sand, 5% fine, subangular gravel to +4.8mm in diameter.	
	1.52	27B	SPT	15 20 23	43	78		SC		
705.56	1.98 2									
	2.13								**CLAYEY SAND with GRAVEL** brown to light brown, slightly moist, well cemented, with estimated 15% low to medium plastic fines, 65% fine to coarse sand, 20% fine to coarse, subangular gravel to +25mm in diameter.	
	2.74							SC		
	2.90	27C	SPT	50/150	50/150	83				
									2.90	
704.56	3									
703.56	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-28
E.A. # 0215-01-1
GROUND ELEV. 707.13 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP GM	**POORLY GRADED GRAVEL with SILT and SAND** grey to brown, dry, moderately cemented, with estimated 5-10% non-plastic to low plastic fines, 40-45% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +37.5mm in diameter.	
	0.46	28A	GRAB	50/150	50/150	17			0.30	
706.13	1							GC GM	**SILTY, CLAYEY GRAVEL with SAND** brown to light brown, dry to slightly moist, moderately to well cemented, with estimated 10-20% low plastic fines, 35-40% fine to coarse sand, 40-50% fine to coarse, angular to subangular gravel to +25mm in diameter.	
	1.52								1.58	
	1.98	28B	SPT	27 15 17	32	89		SC	**CLAYEY SAND with GRAVEL** brown to light brown, slightly moist, moderately cemented, with estimated 25-30% low plastic fines, 50-55% fine to coarse sand, 20% fine, angular to subangular gravel to +9.5mm in diameter.	
705.13	2								2.13	
	2.74							SC	**CLAYEY SAND with GRAVEL** light brown, slightly moist, moderately cemented, with approximately 35% medium plastic fines, 50% fine to coarse sand, 15% fine, subangular gravel to +12.5mm in diameter.	
704.13	3	28C	SPT	19 12 22	34	89	MC, SA, PI			
	3.20								3.20	
703.13	4									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

START DATE 1/28/00
END DATE 1/28/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING R-29
E.A. # 0215-01-1
GROUND ELEV. 706.57 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/28/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GC GM	**SILTY, CLAYEY GRAVEL with SAND** grey to brown, dry to slightly moist, well cemented, with estimated 10-15% low plastic fines, 35-40% fine to coarse sand, 50% fine to coarse, subangular gravel to +37.5mm in diameter.	
	0.41	29A	GRAB	50/100	50/100	50				
705.57	1								0.91	
	1.52								**CLAYEY SAND with GRAVEL** brown, slightly moist to moist, weakly to moderately cemented, with approximately 30% medium plastic fines, 50% fine to coarse sand, 20% fine to coarse, subangular gravel to + 19mm in diameter.	
	1.98	29B	SPT	22 16 14	30	67	MC, SA, PI			
704.57	2							SC		
	2.74									
703.57	3	29C	SPT	7 16 22	38	83				
	3.20								3.20	
702.57	4									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/21/00
END DATE 1/21/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-01
E.A. # 0215-01-1
GROUND ELEV. 712.54 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/21/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30									
	0.61	A	GRAB	50/50	50/50		MC, SA, PI			
711.54	1							GC	**CLAYEY GRAVEL with SAND** brown, dry to slightly moist, well cemented, with approximately 15% low plastic fines, 30% fine to coarse sand, 55% fine to coarse, subround gravel to +19mm in diameter.	
	1.52									
	1.83	B	GRAB	50/13	50/13				1.52 **CALICHE**	
710.54	2									
									2.74	
709.54	3 3.05							SC SM	**SILTY, CLAYEY SAND with GRAVEL** light brown, slightly moist, moderately to well cemented, with approximately 15% low plastic fines, 45% fine to coarse sand, 40% fine to coarse, subangular gravel to +25mm in diameter.	
	3.18	C	SPT	50/125	50/125	80	MC, SA, PI		3.35	
708.54	4							GP GM	**POORLY GRADED GRAVEL with SILT and SAND** light brown, slightly moist, well cemented, with estimated 10% non-plastic to slightly plastic fines, 30% fine to coarse sand, 60% fine to coarse, angular to subangular gravel to +37.5mm in diameter.	
	4.57									
	4.88	D	GRAB	51/50	51/50				4.63	
707.54	5									
706.54	6									
705.54	7									
704.54	8									
703.54	9									
702.54	10									
701.54	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/21/00
END DATE 1/21/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-02
E.A. # 0215-01-1
GROUND ELEV. 713.30 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/21/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	0.15 **POORLY GRADED GRAVEL with SAND** grey to brown, dry, moderately to well cemented, with estimated 5% non-plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +50mm in diameter.	
	0.61	A	GRAB	50/75	50/75			GM		
712.30	1								0.91 **SILTY GRAVEL with SAND** brown, slightly moist, well cemented, with estimated 15% non-plastic fines, 35% fine to coarse sand, 40% fine to coarse, subround gravel to +25mm in diameter.	
	1.52 1.68	B	SPT	50/50	50/50	100	MC, SA, PI	SC		
711.30	2								1.68 **CLAYEY SAND with GRAVEL** light brown, slightly moist, well cemented, with approximately 25% low to medium plastic fines, 45% fine to coarse sand. 30% fine, subangular gravel to +12.5mm in diameter. **CALICHE**	
710.30	3 3.05							CL	2.44	
	3.35	C	GRAB	50/25	50/25				3.05 **SANDY/GRAVELLY LEAN CLAY** light brown, slightly moist, moderately cemented, with estimated 60% medium plastic fines, 20% fine to coarse sand, 20% fine. subangular to subround gravel to +12.5mm in diameter. **CALICHE**	
709.30	4								4.27	
	4.57 4.69	D	SPT	50/125	50/125	100		SC	**CLAYEY SAND with GRAVEL** light brown, slightly moist, moderately cemented, with estimated 25% low plastic fines, 60% fine to coarse sand, 15% fine. subangular to subround gravel to +9.5mm in diameter.	
708.30	5								4.72	
707.30	6 6.10							GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, moderately cemented, with estimated 15% low plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular gravel to +37.5mm in diameter.	
	6.55	E	SPT	26 24 25	49	66	MC, SA, PI		5.94 **CLAYEY SAND/SANDY LEAN CLAY** brown, moist, moderately cemented, with approximately 40% low plastic fines, 60% fine to medium sand, and trace fine to coarse, subangular gravel to +19mm in diameter. (Unit contains numerous interbeds of Sandy Lean Clay and Sandy Lean Clay with Gravel with estimated 45-50% low to medium plastic fines, 35-50% fine to coarse sand, and 0-20% fine to coarse, subangular gravel to +25mm in diameter.)	
706.30	7									
	7.62									
705.30	8 8.08	F	MC	28 30 50	80	100				
								SC		
704.30	9									
703.30	10									
	10.67									
702.30	11 11.13	H	SPT	18 15 20	35	66	MC, SA, PI		10.82	

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/21/00
END DATE 1/21/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-03
E.A. # 0215-01-1
GROUND ELEV. 714.82 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/21/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30								**POORLY GRADED GRAVEL with SILT and SAND** brown to light brown, dry to slightly moist, moderately to well cemented, with approximately 10% slightly plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +25mm in diameter.	
	0.43	A	SPT	50/125	50/125	60	MC, SA, PI			
713.82	1									
	1.52									
	1.83	B	GRAB	50/0	50/0					
712.82	2							GP GM		
711.82	3	3.05								
	3.35	C	GRAB	50/0	50/0					
710.82	4									
									4.27	
	4.57							SC	**CLAYEY SAND with GRAVEL** brown, slightly moist, moderately to well cemented, with approximately 15% medium plastic fines, 45% fine to coarse sand, 40% fine to coarse, subangular gravel to +19mm in diameter.	
	4.74	D	SPT	30 50/12.5	50/12.5	77	MC, SA, PI		4.72	
709.82	5									
708.82	6									
707.82	7									
706.82	8									
705.82	9									
704.82	10									
703.82	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/21/00
END DATE 1/21/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-04
E.A. # 0215-01-1
GROUND ELEV. 715.48 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/21/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	0.15 **POORLY GRADED GRAVEL with SAND** grey to brown, dry, non to weakly cemented, with estimated 0-5% non-plastic fines, 35-40% fine to coarse sand, 60% fine to coarse, subangular gravel to +25mm in diameter.	
	0.48	A	SPT	27 50/25	50/25	57	MC, SA, PI			
714.48	1							GP GM	**WELL GRADED GRAVEL with SILT and SAND** light brown, slightly moist, moderately to well cemented, with approximately 10% slightly plastic fines, 35% fine to coarse sand, 55% fine to coarse, subangular to subround gravel to +37.5mm in diameter.	
	1.52									
	1.83	B	GRAB	50/13	50/13					
713.48	2									
									2.74	
712.48	3 3.05							GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, with approximately 15% low plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular to subrounded gravel to +19mm in diameter.	
	3.35	C	SPT	40 50/125	50/125	55	MC, SA, PI			
711.48	4								4.27	
	4.57							SC	**CLAYEY SAND** olive to brown, moist, with approximately 40%-60% low to medium plastic fines, 40%-60% fine to medium sand, 5% fine, subrounded gravel to +9.5mm in diameter.	
710.48	5 5.03	D	MC	20 27 23	50	100	MC, SA, PI			
									5.49	
709.48	6 6.10							CH	**SANDY FAT CLAY** olive to brown, moist, with approximately 55% high plastic fines, 45% fine to medium sand, trace of fine gravel to +4.75mm in diameter.	
	6.55	E	SPT	12 10 17	27	83	MC, SA, PI			
708.48	7								7.16	
	7.62							CL	**SANDY LEAN CLAY** brown, moist, with approximately 60%-70% low to medium plastic fines and 30%-40% fine to medium sand.	
707.48	8 8.08	F	SPT	21 25 32	57	100	MC, SA, PI		7.92	
								SC	8.23 **CLAYEY SAND with GRAVEL** grey, moist, with approximately 30% low plastic fines, 55% fine to coarse sand, 15% fine to coarse, subangular gravel to +25mm in diameter.	
								GC	8.53 **CLAYEY GRAVEL with SAND** brown, slightly moist, with approximately 30% low to medium plastic fines, 30% fine to coarse sand, 40% fine, subangular gravel to +9.5mm in diameter.	
706.48	9 9.14									
	9.35	G	SPT	37 50/50	50/50	75		SC	**CLAYEY SAND with GRAVEL** brown to olive, moist, with approximately 20% low plastic fines, 60% fine to coarse sand, 20% fine, subangular gravel to +12.5mm in diameter.	
705.48	10									
	10.67									
704.48	11 11.13	H	SPT	11 20 20	40	100	MC, SA, PI		11.13	

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/21/00
END DATE 1/21/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-05
E.A. # 0215-01-1
GROUND ELEV. 718.02 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/21/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30								0.30 **CALICHE** light brown to grey, dry, hard, with gravel to +25mm in diameter.	
	0.51	A	SPT	30 50/50	50/50	75	MC, SA, PI			
717.02	1								**POORLY GRADED SAND with SILT and GRAVEL** light brown, dry to slightly moist, with approximately 10% slightly low plastic fines, 50% fine to coarse sand, 40% fine to coarse, subangular gravel to +25mm in diameter.	
	1.68	B	SPT	50/25	50/25	0		SP SM		
716.02	2									
715.02	3 3.05	C	GRAB	50/0	50/0	0	MC, SA, PI		2.90	
								GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, well cemented, with approximately 15% low plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular gravel to +19mm in diameter.	
714.02	4								4.27	
	4.57 4.65	D	GRAB	50/75	50/75	0		SP SC	4.65 **POORLY GRADED SAND with CLAY and GRAVEL** light brown, slightly moist, well cemented, with approximately 10% low plastic fines, 65%-70% fine to coarse sand, 20%-25% fine, subangular gravel to +12.5mm diameter.	
713.02	5									
712.02	6									
711.02	7									
710.02	8									
709.02	9									
708.02	10									
707.02	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/22/00
END DATE 1/22/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-06
E.A. # 0215-01-1
GROUND ELEV. 719.28 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/22/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GC	0.30 **CLAYEY GRAVEL with SAND** light brown, dry	
	0.42	A	SPT	50/112	50/112	44	MC, SA, PI	GP GM	0.43 **POORLY GRADED GRAVEL with SILT and SAND** light brown, slightly moist, well cemented, with approximately 10% slightly low plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +25mm in diameter.	
718.28	1									
	1.52	B	GRAB	50/13	50/13	0			1.52 **CALICHE** light brown to grey, very hard, with gravel to +19mm in diameter.	
717.28	2							GC	2.13 **CLAYEY GRAVEL with SAND** light brown, slightly moist, well cemented, with estimated 15% low plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular gravel to +19mm in diameter.	
716.28	3 3.05	C	GRAB	50/25	50/25	0	MC, SA, PI	SC	**CLAYEY SAND with GRAVEL** light brown, slightly moist, well cemented, with approximately 15% low plastic fines, 45% fine to coarse sand, 40% fine, subangular gravel to +12.5mm in diameter.	
									3.35	
715.28	4							SC	**CLAYEY SAND with GRAVEL** light brown, slightly moist, well cemented, with approximately 30% low to medium plastic fines, 40%-45% fine to coarse sand, 25%-30% fine to coarse, subangular to subrounded gravel to +19mm in diameter.	
	4.57 4.65	D	GRAB	50/75	50/75	0			4.27	
714.28	5							SC	**CLAYEY SAND with GRAVEL** light brown, slightly moist, well cemented, with approximately 15% non to low plastic fines, 55% fine to coarse sand, 30% fine, subangular gravel to +9.5mm in diameter.	
									5.49	
713.28	6 6.10							SC	**CLAYEY SAND** light brown, moist, well cemented, with approximately 30% medium plastic fines, 60% fine to coarse sand, 10% fine, subangular to subrounded gravel to +9.5mm in diameter.	
	6.24	E	SPT	50/137	50/137	100	MC, SA, PI			
712.28	7								7.01	
	7.62 7.70	F	SPT	50/75	50/75	100		GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, well cemented, with approximately 30% medium plastic fines, 30% fine to coarse sand, 40% fine to coarse, subangular to subrounded gravel to +37.5mm in diameter.	
711.28	8							SC	7.62 **CLAYEY SAND with GRAVEL** brown, slightly moist, well cemented, with approximately 15% low plastic fines, 45%-55% fine to coarse sand, 30%-40% fine to coarse, subangular to subrounded gravel to +19mm in diameter.	
									8.53	
710.28	9 9.14							SC	**CLAYEY SAND** brown, slightly moist, well cemented, with approximately 30% low to medium plastic fines, 60% fine to coarse sand, 10% fine to coarse, subangular gravel to +25mm in diameter.	
	9.22	G	SPT	50/75	50/75	100				
709.28	10								10.36	
	10.67 10.80	H	SPT	50/125	50/125	100	MC, SA, PI	SC	**CLAYEY SAND with GRAVEL** light brown, slightly moist, well cemented, with approximately 15% medium plastic fines, 45% fine to coarse sand, 40% fine, subangular gravel to +12.5mm in diameter.	
708.28	11								10.79	

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/22/00
END DATE 1/22/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-07
E.A. # 0215-01-1
GROUND ELEV. 720.04 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/22/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30 0.38	A	GRAB	50/75	50/75	0		GP GM	**POORLY GRADED GRAVEL with SILT and SAND** light brown to brown, dry, well cemented, with approximately 10% non to low plastic fines, 40% fine to coarse sand, 50% fine to coarse, subangular gravel to +75mm in diameter.	Minor surface cobbles.
719.04	1									
	0.91 1.52 1.60	B	GRAB	50/75	50/75	0	MC, SA, PI	GP GM	**POORLY GRADED GRAVEL with SILT and SAND** light brown, dry, well cemented, with approximately 10% non to low plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +19mm in diameter.	
718.04	2								1.60 1.68 **CALICHE** light brown to grey, extremely hard, with gravel to +19mm in diameter.	
717.04	3									
716.04	4									
715.04	5									
714.04	6									
713.04	7									
712.04	8									
711.04	9									
710.04	10									
709.04	11									

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EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/25/00
END DATE 1/25/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-08
E.A. # 0215-01-1
GROUND ELEV. 722.33 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/25/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30									
	0.46	A	SPT	50	50	100	MC, SA, PI	SM	**SILTY SAND with GRAVEL** brown to light brown, dry, with approximately 15% non plastic fines, 50% fine to coarse sand, 35% fine, subangular gravel to +12.5mm in diameter.	
721.33	1								1.22	
	1.52 1.66	B	GRAB	50/75	50/75	66		GP GC	**POORLY GRADED GRAVEL with CLAY and SAND** light brown, dry, well cemented with approximately 5%-10% low plastic fines, 40%-45% fine to coarse sand, 45%-50% fine to coarse, subangular gravel to +25mm in diameter.	
720.33	2								2.59	
719.33	3 3.05							GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, with approximately 15%-20% low to medium plastic fines, 30%-40% fine to coarse sand, 40%-50% fine to coarse, subangular to subrounded gravel to +25mm in diameter.	
	3.28	C	SPT	21 50/75	50/75	56				
718.33	4								3.96	
	4.57 4.65	D	SPT	50/75	50/75	100	MC, SA, PI	GM	**SILTY GRAVEL with SAND** light brown, slightly moist, well cemented, with approximately 15% non to low plastic fines, 40% fine to coarse sand, 45% fine to coarse, subangular to subrounded gravel to +19mm in diameter.	
717.33	5								5.49	
716.33	6 6.10							GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, with approximately 20% medium plastic fines, 35% fine to coarse sand, 45% fine to coarse, subangular gravel to +25mm in diameter.	
	6.25	E	SPT	50	50	100				
715.33	7								7.01	
	7.62 7.72	F	SPT	50/100	50/100	100	MC, SA, PI		7.16 **CALICHE** light brown to grey, very hard, with gravel to +19mm in diameter.	
714.33	8							SC SM	**SILTY, CLAYEY SAND with GRAVEL** light brown, slightly moist, well cemented, with approximately 15% low plastic fines, 50% fine to coarse sand, 35% fine, subangular gravel to +12.5mm in diameter.	
713.33	9 9.14	G	GRAB	50/0	50/0	0		GC	**CLAYEY GRAVEL with SAND** light brown, moist, well cemented, with approximately 15% low plastic fines, 40% fine to coarse sand, 45% fine to coarse, subangular gravel to +25mm in diameter.	
712.33	10								9.75	
	10.67 10.84	H	SPT	38 50/25	50/25	100	MC, SA, PI	SC	**CLAYEY SAND with GRAVEL** light brown, moist, with approximately 25% medium plastic fines, 50% fine to coarse sand, 25% fine, subangular gravel to +12.5mm in diameter.	
711.33	11								10.82	

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

START DATE 1/22/00
END DATE 1/22/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-09
E.A. # 0215-01-1
GROUND ELEV. 723.65 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/22/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GC GM	0.30 **SILTY, CLAYEY GRAVEL with SAND** light brown, dry, with approximately 10%-15% non to low plastic fines, 35%-40% fine to coarse sand, 50% fine to coarse, subangular gravel to +75mm in diameter.	
	0.45	A	SPT	50/137	50/137	91	MC, SA, PI			
722.65	1							GC		
	1.52								1.22 **CLAYEY GRAVEL with SAND** light brown, slightly moist, well cemented, with approximately 15% low plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular gravel to +37.5mm in diameter.	
	1.66	B	GRAB	50/137	50/137	0				
721.65	2							SC SM	**SILTY, CLAYEY SAND with GRAVEL** light brown, slightly moist, with approximately 15% slightly low plastic fines. 45% fine to coarse sand, 40% fine to coarse, subangular to subrounded gravel to +19mm in diameter.	
720.65	3 3.05									
	3.18	C	SPT	50/125	50/125	80	MC, SA, PI			
									3.35	
719.65	4							GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, well cemented, with approximately 25% low to medium plastic fines, 25% fine to coarse sand, 50% fine to coarse, subangular gravel to +19mm in diameter.	
	4.57 4.62	D	SPT	50/50	50/50	100				
718.65	5									
717.65	6 6.10								6.10	
		E	GRAB	50/0	50/0	0			**CALICHE** light brown, extremely hard.	Auger Refusal at 6.10 meters.
716.65	7									
715.65	8									
714.65	9									
713.65	10									
712.65	11									

nv_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/25/00
END DATE 1/25/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-10
E.A. # 0215-01-1
GROUND ELEV. 724.67 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/25/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30	A	SPT	50/25	50/25	100		GM	0.15 **SILTY GRAVEL with SAND** grey to light brown, dry, moderately cemented, with estimated 15% non-plastic to slightly plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular gravel to +25mm in diameter.	
723.67	1							SM	**SILTY SAND with GRAVEL** light brown, dry to slightly moist, well cemented, with approximately 15% slightly plastic fines, 45% fine to coarse sand, 40% fine, subround gravel to +12.5mm in diameter.	
	1.52	B	GRAB	50/50	50/50		MC, SA, PI			
722.67	2								2.13 **CALICHE**	
									2.44 **POORLY GRADED GRAVEL with CLAY and SAND** light brown, slightly moist, well cemented, with approximately 10% low plastic fines, 35% fine to coarse sand, 55% fine to coarse, subangular gravel to +19mm in diameter.	
721.67	3 3.05	C	SPT	50/75	50/75	100		GP GC	3.35 **CALICHE**	
720.67	4								3.96 **CLAYEY SAND with GRAVEL** light brown, slightly moist, well cemented, with approximately 20% medium plastic fines, 55% fine to coarse sand, 25% fine to coarse, subangular to subround gravel to +19mm in diameter.	
	4.57	D	GRAB	50/100	50/100					
719.67	5									
718.67	6 6.10	E	GRAB	50/50	50/50		MC, SA, PI			
717.67	7							SC		
	7.62	F	GRAB	50/75	50/75					
716.67	8									
715.67	9 9.14	G	SPT	50/100	50/100	75	MC, SA, PI			
									9.75 **CALICHE**	
714.67	10								10.06 **CLAYEY GRAVEL with SAND** light brown, slightly moist, well cemented, with estimated 15-20% low plastic fines, 35% fine to coarse sand, 45-50% fine to coarse, subangular gravel to +25mm in diameter.	
	10.97	H	SPT	50/25	50/25	0		GC	10.70	
713.67	11									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/24/00
END DATE 1/24/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-11
E.A. # 0215-01-1
GROUND ELEV. 725.77 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/24/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30			28				GP	0.15 **POORLY GRADED GRAVEL with SILT and SAND** grey to brown, dry to slightly moist, non to weakly cemented, with estimated 5-10% non-plastic fines, 35% fine to coarse sand, 55-60% fine to coarse. subangular to subround gravel to +50mm in diameter. Minor cobbles at surface.	
	0.69	A	SPT	38 50/75	50/75	80	MC, SA, PI	SC		
724.77	1								0.91 **CLAYEY SAND with GRAVEL** brown, slightly moist, moderately cemented, with approximately 30% low plastic fines, 45% fine to coarse sand, 25% fine, subangular to subround gravel to +12.5mm in diameter.	
	1.52							GC		
	1.83	B	GRAB	50/25	50/25					
723.77	2								2.13 **CLAYEY GRAVEL with SAND** brown, slightly moist, well cemented, with estimated 30% low to medium plastic fines. 30% fine to coarse sand, 40% fine to coarse, subangular to subround gravel to +37.5mm in diameter.	
722.77	3 3.05								2.44 **CALICHE**	
	3.35	C	GRAB	50/0	50/0		MC, SA, PI	GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, well cemented, with estimated 30% low plastic fines, 30% fine to coarse sand, 40% fine to coarse, subangular to subround gravel to +25mm in diameter.	
721.77	4 4.27									
	4.57	D	GRAB	50/25	50/25				4.60	
720.77	5									
719.77	6									
718.77	7									
717.77	8									
716.77	9									
715.77	10									
714.77	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

START DATE 1/25/00
END DATE 1/25/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-12
E.A. # 0215-01-1
GROUND ELEV. 727.39 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/25/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GC GM	0.30 **SILTY, CLAYEY GRAVEL with SAND** brown, dry to slightly moist, weakly to moderately cemented, with estimated 15% low plastic fines, 30% fine to coarse sand, 55% fine to coarse, subangular gravel to +37.5mm in diameter.	
	0.76	A	SPT	38 24 36	60	67	MC, SA, PI	SC	1.22 **CLAYEY SAND with GRAVEL** brown, slightly moist, moderately cemented, with approximately 35% low plastic fines, 45% fine to coarse sand, 20% fine to coarse, subangular gravel to +19mm in diameter.	
726.39	1								**CLAYEY GRAVEL with SAND** brown, slightly moist, moderately to well cemented, with approximately 15% low plastic fines, 40% fine to coarse sand, 45% fine to coarse, subangular gravel to +25mm in diameter.	
	1.52 1.60	B	SPT	50/75	50/75	100				
725.39	2									
724.39	3 3.05 3.12	C	SPT	50/75	50/75	100				
723.39	4									
	4.57 4.78	D	SPT	20 50/50	50/50	0		GC		
722.39	5									
721.39	6 6.10									
	6.40	E	GRAB	50/125	50/125		MC, SA, PI			
720.39	7									
719.39	8								7.92 **CALICHE**	
									8.53 **POORLY GRADED GRAVEL with SILT and SAND** brown, slightly moist, well cemented, with approximately 10% slightly plastic fines, 40% fine to coarse sand, 50% fine to coarse, subangular gravel to +19mm in diameter.	
718.39	9 9.14									
	9.45	G	GRAB				MC, SA, PI	GP GM		
717.39	10									
									10.67	
716.39	11									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/25/00
END DATE 1/25/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-13
E.A. # 0215-01-1
GROUND ELEV. 727.74 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/25/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30 / 0.41	A	MC	50/100	50/100	100	MC, SA, PI			
									0.61 — **WELL GRADED GRAVEL with SILT, CLAY and SAND** grey to light brown, dry to slightly moist, moderately to well cemented, with approximately10% low plastic fines, 35% fine to coarse sand, 55% fine to coarse, subangular to subround gravel to +37.5mm in diameter. **CALICHE**	
726.74	1							GW GC		
	1.52 / 1.58	B	MC	50/50	50/50	0				
725.74	2									
									2.74 — **WELL GRADED GRAVEL with SILT and SAND** light brown, slightly moist, well cemented, with approximately 10% slightly plastic fines, 45% fine to coarse sand, 45% fine to coarse, subangular gravel to +19mm in diameter.	
724.74	3 3.05									
	3.35	C	GRAB	50/75	50/75		MC, SA, PI	GW GM		
723.74	4									
	4.57 / 4.67	D	MC	50/25	50/25	0			4.60	
722.74	5									
721.74	6									
720.74	7									
719.74	8									
718.74	9									
717.74	10									
716.74	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/25/00
END DATE 1/25/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-14
E.A. # 0215-01-1
GROUND ELEV. 728.64 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/25/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30								**POORLY GRADED GRAVEL with SILT and SAND** grey to brown, dry to slightly moist, moderately to well cemented, with approximately 10% non-plastic fines, 40% fine to coarse sand, 50% fine to coarse, subangular gravel to +37.5mm in diameter.	
	0.61	A	GRAB	50/100	50/100		MC, SA, PI			
727.64	1							GP GM		
	1.52									
	1.83	B	GRAB	50	50					
726.64	2									
									2.44	
									POORLY GRADED GRAVEL with SILT and SAND light brown, slightly moist, well cemented, with estimated 10% non-plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +19mm in diameter.	
725.64	3 3.05							GP GM		
	3.35	C	GRAB	50/25	50/25					
									3.66	
									CALICHE	
724.64	4								3.96	
	4.57								**SILTY, CLAYEY SAND with GRAVEL** light brown, slightly moist, well cemented, with approximately 15% low plastic fines, 50% fine to coarse sand, 35% fine to coarse, subangular gravel to +19mm in diameter.	
	4.88	D	GRAB	50	50		MC, SA, PI	SC SM		
723.64	5									
									5.79	
722.64	6 6.10								**SILTY GRAVEL with SAND** light brown, slightly moist, well cemented, with approximately 15% slightly plastic fines, 40% fine to coarse sand, 45% fine to coarse, subangular gravel to +19mm in diameter.	
	6.40	E	GRAB	50/25	50/25					
721.64	7									
	7.62									
	7.92	F	GRAB	50/50	50/50		MC, SA, PI	GM		
720.64	8									
719.64	9 9.14									
	9.45	G	GRAB	50/100	50/100					
									9.75	
718.64	10								**SILTY, CLAYEY SAND with GRAVEL** brown, slightly moist, well cemented, with approximately 15% low plastic fines, 60% fine to coarse sand, 25% fine, subangular gravel to +12.5mm in diameter.	
	10.36							SC SM		
	10.67	H	GRAB	50/0	50/0		MC, SA, PI		10.67	
717.64	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/25/00
END DATE 1/25/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-15
E.A. # 0215-01-1
GROUND ELEV. 729.75 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/25/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30									
	0.46	A	MC	50	50	67		SP SC		
728.75	1								0.91 **POORLY GRADED SAND with SILT, CLAY and GRAVEL** grey to brown, dry to slightly moist, moderately to well cemented, with estimated 5-10% low plastic fines, 50-60% fine to coarse sand, 30-40% fine to coarse, subangular to subround gravel to +25mm in diameter.	
	1.52									
	1.68	B	MC	50	50	67	MC, SA, PI	GW GC	**WELL GRADED GRAVEL with SILT, CLAY and SAND** brown to light brown, slightly moist, well cemented, with approximately 10% low plastic fines, 40% fine to coarse sand, 50% fine to coarse, subangular to subround gravel to +25mm in diameter.	
727.75	2									
									2.74	
726.75	3								3.05 **CALICHE**	
	3.05									
	3.20	C	GRAB	50/50	50/50		MC, SA, PI	GP GM	**POORLY GRADED GRAVEL with SILT and SAND** brown, slightly moist, well cemented, with approximately 10% slightly plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +37.5mm in diameter.	
725.75	4									
	4.57									
	4.63	D	GRAB	50/50	50/50				4.63	
724.75	5									
723.75	6									
722.75	7									
721.75	8									
720.75	9									
719.75	10									
718.75	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

START DATE 1/26/00
END DATE 1/26/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-16
E.A. # 0215-01-1
GROUND ELEV. 729.19 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/26/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP GM	**POORLY GRADED GRAVEL with SILT and SAND** light brown, dry to slightly moist, well cemented, with approximately 10% slightly plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +25mm in diameter.	
	0.61	A	GRAB	50/50	50/50		MC, SA, PI			
728.19	1								0.91	
	1.22								**CALICHE**	
	1.52									
	1.68	B	MC	50	50	100		GP GM	**POORLY GRADED GRAVEL with SILT and SAND** light brown, slightly moist, moderately to well cemented, with estimated 5% non-plastic to slightly plastic fines, 40% fine to coarse sand, 55% fine to coarse, angular to subangular gravel to +37.5mm in diameter.	
727.19	2									
726.19	3								3.20	
									CALICHE	
									3.66	
725.19	4							SP SM	**POORLY GRADED SAND with SILT and GRAVEL** brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 50% fine to coarse sand, 40% fine to coarse, subangular gravel to +19mm in diameter.	
	4.57									
	4.88	D	GRAB	50/100	50/100		MC, SA, PI			
724.19	5								5.18	
									CALICHE	
									5.79	
723.19	6	6.10								
	6.40	E	GRAB	50/50	50/50			GP GM	**POORLY GRADED GRAVEL with SILT and SAND** light brown, slightly moist, well cemented, with estimated 5-10% non-plastic to slightly plastic fines, 40-45% fine to coarse sand, 50% fine, subangular gravel to +12.5mm in diameter.	
722.19	7								7.01	
	7.62								**POORLY GRADED SAND with SILT and GRAVEL** brown, slightly moist, well cemented, with estimated 5-10% non-plastic to slightly plastic fines, 50-60% fine to coarse sand, 30-40% fine to coarse, subangular gravel to +19mm in diameter.	
	7.92	F	GRAB	50	50			SP SC		
721.19	8								8.53	
									POORLY GRADED GRAVEL with CLAY and SAND brown, slightly moist, well cemented, with approximately 10% low plastic fines, 40% fine to coarse sand, 50% fine to coarse, subangular gravel to +19mm in diameter.	
720.19	9	9.14								
	9.45	G	GRAB	50	50		MC, SA, PI	GP GC		
719.19	10								10.06	
									CLAYEY SAND with GRAVEL light brown, slightly moist, well cemented, with estimated 15% low plastic fines, 55% fine, subangular gravel to +12.5mm in diameter.	
	10.67	H	GRAB	50/100	50/100			SC		
	10.76								10.76	
718.19	11									

EXPLORATION LOG

START DATE 1/26/00
END DATE 1/26/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-17
E.A. # 0215-01-1
GROUND ELEV. 729.91 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/26/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP GM	**POORLY GRADED GRAVEL with SILT and SAND** grey to brown, dry to slightly moist, well cemented, with approximately 10% slightly plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +37.5mm in diameter.	
	0.61	A	GRAB	50/100	50/100		MC, SA, PI			
728.91	1									
	1.52									
	1.83	B	GRAB	50/100	50/100					
									1.83	
727.91	2								**CALICHE**	
									2.13	
								GP GM	**POORLY GRADED GRAVEL with SILT and SAND** brown, slightly moist, well cemented, with approximately 10% slightly plastic fines, 40% fine to coarse sand, 50% fine to coarse, subangular gravel to +19mm in diameter.	
726.91	3									
	3.05									
	3.35	C	GRAB	50/50	50/50		MC, SA, PI			
									3.35	
725.91	4							SP SM	**POORLY GRADED SAND with SILT and GRAVEL** brown, slightly moist, well cemented, with estimated 5-10% non-plastic to slightly plastic fines, 50-55% fine to coarse sand, 40% fine to coarse, subangular gravel to + 19mm in diameter.	
	4.57									
	4.66	D	GRAB	50/100	50/100				4.66	
724.91	5									
723.91	6									
722.91	7									
721.91	8									
720.91	9									
719.91	10									
718.91	11									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/26/00
END DATE 1/26/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WL-18
E.A. # 0215-01-1
GROUND ELEV. 729.50 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/26/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30									
	0.61	A	GRAB	50/100	50/100		MC, SA, PI	GP GM	**POORLY GRADED GRAVEL with SILT and SAND** grey to light brown, dry, moderately to well cemented, with approximately 10% low plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +19mm in diameter.	
728.50	1									
	1.52								1.22	
	1.83	B	GRAB	50	50				**POORLY GRADED GRAVEL with SILT and SAND** light brown, dry to slightly moist, moderately to well cemented, with approximately 10% non-plastic to slightly plastic fines, 40% fine to coarse sand, 50% fine to coarse, subangular gravel to +25mm in diameter.	
727.50	2									
726.50	3 3.05									
	3.35	C	GRAB	50	50			GP GM		
725.50	4									
	4.57									
	4.88	D	GRAB	50	50		MC, SA, PI			
724.50	5									
									5.49	
723.50	6 6.10								**POORLY GRADED GRAVEL with SAND** brown to light brown, slightly moist, moderately to well cemented with approximately 0-5% non-plastic fines, 40% fine to coarse sand, 55-60% fine to coarse, angular to subangular gravel to +25mm in diameter.	
	6.40	E	GRAB	50/125	50/125					
722.50	7									
	7.62									
	7.92	F	GRAB	50/125	50/125		MC, SA, PI	GP		
721.50	8									
720.50	9 9.14									
	9.45	G	GRAB	50/50	50/50					
719.50	10									
									10.06	
	10.67 10.73	H	GRAB	50/50	50/50		MC, SA, PI	SC	**CLAYEY SAND with GRAVEL** brown, moist, well cemented, with approximately 20% low plastic fines, 50% fine to coarse sand, 30% fine to coarse, subangular gravel to +19mm in diameter.	
718.50	11								10.73	

EXPLORATION LOG

START DATE 1/26/00
END DATE 1/26/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-01
E.A. # 0215-01-1
GROUND ELEV. 728.50 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/26/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30 / 0.41	A	GRAB	50/100	50/100	0	MC, SA, PI	GC GM	**SILTY, CLAYEY GRAVEL with SAND** light brown to brown, dry to slightly moist, well cemented, with approximately 15% low plastic fines, 25% fine to coarse sand, 60% fine to coarse, angular to subround gravel to +25mm in diameter.	
727.50	1									
	1.52 / 1.68	B	SPT	50/50	50/50	0				
726.50	2									
									2.44	
								GP GC	**POORLY GRADED GRAVEL with CLAY** light brown, slightly moist, well cemented, with approximately 10% low plastic fines, 30% fine to coarse sand, 60% fine to coarse, angular to subround gravel to +37.5mm in diameter.	
725.50	3.05 / 3.18	C	GRAB	50/50	50/50	0	MC, SA, PI		3.05 **CALICHE**	
									3.66	
724.50	4							GP GC	**POORLY GRADED GRAVEL with CLAY and SAND** light brown, slightly moist, well cemented with approximately 10% low plastic fines, 30% fine to coarse sand, 60% fine to coarse, angular to subround gravel to +37.5mm in diameter.	
	4.60 / 4.77	D	SPT	50/25	50/25	0			4.60	
723.50	5									
722.50	6									
721.50	7									
720.50	8									
719.50	9									
718.50	10									
717.50	11									

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EXPLORATION LOG

START DATE 1/26/00
END DATE 1/26/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-02
E.A. # 0215-01-1
GROUND ELEV. 728.00 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/26/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GP	0.15 **POORLY GRADED GRAVEL with SAND** grey to light brown, dry, weakly to moderately cemented, with estimated 5% non-plastic to slightly plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular gravel to +37.5mm in diameter.	
	0.41	A	MC	50/100	50/100	50				
727.00	1									
	1.52								**POORLY GRADED GRAVEL with CLAY and SAND** brown, dry to slightly moist, moderately to well cemented, with approximately 10% low plastic fines, 40% fine to coarse sand, 50% fine to coarse, subangular to subround gravel to +37.5mm in diameter.	
	1.68	B	MC	50	50	50	MC, SA, PI	GP GC		
726.00	2									
725.00	3									
	3.05									
	3.20	C	MC	50	50	0				
									3.35	
724.00	4								**POORLY GRADED GRAVEL with SILT, CLAY and SAND** brown. slightly moist. well cemented, with estimated 10% low plastic fines, 35% fine to coarse sand. 55% fine to coarse, angular to subangular gravel to +37.5mm in diameter.	
	4.57									
	4.72	D	GRAB	50	50	0	MC, SA, PI			
723.00	5							GP GC		
722.00	6									
	6.10									
	6.20	E	MC	50/100	50/100	0				
									6.71	
721.00	7								**POORLY GRADED GRAVEL with SILT, CLAY and SAND** brown. slightly moist, well cemented, with approximately 10% low plastic fines, 40% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +19mm in diameter.	
	7.62									
	7.67	F	GRAB	50/50	50/50	0	MC, SA, PI	GP GC		
720.00	8									
									8.53	
									CALICHE light brown, very hard.	
719.00	9									
	9.14								9.14	
	9.20	G	MC	50/50	50/50	0			**POORLY GRADED GRAVEL with SILT, CLAY and SAND** brown. slightly moist, well cemented, with approximately 10% low plastic fines, 45% fine to coarse sand, 45% fine, angular to subangular gravel to +12.5mm in diameter.	
718.00	10							GC GM		
	10.67									
	10.75	H	GRAB	50/50	50/50	0	MC, SA, PI		10.73	
717.00	11									

EXPLORATION LOG

START DATE 1/26/00
END DATE 1/26/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-03
E.A. # 0215-01-1
GROUND ELEV. 726.75 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/26/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
725.75	0.30 0.38	A	GRAB	50/75	50/75	0	MC, SA, PI	GP GM	**POORLY GRADED GRAVEL with SILT and SAND** brown, dry to slightly moist, well cemented, with approximately 10% low plastic fines, 40% fine to coarse sand, 50% fine to coarse, angular to subrounded gravel to +19mm in diameter.	
	1.07									
724.75	1.52 1.62	B	GRAB	50/100	50/100	0			**SILTY, CLAYEY GRAVEL with SAND** brown, slightly moist, well cemented, with approximately 10% low plastic fines, 40% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +25mm in diameter.	
723.75	3.05 3.12	C	GRAB	50/75	50/75	0	MC, SA, PI	GC GM		
722.75	4.57 4.62	D	GRAB	50/50	50/50	0				
	4.57									
721.75	5									
720.75	6									
719.75	7									
718.75	8									
717.75	9									
716.75	10									
715.75	11									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/26/00
END DATE 1/26/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-04
E.A. # 0215-01-1
GROUND ELEV. 726.42 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B90
OPERATOR J. Sorrells
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/26/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.00							GP	0.23 **POORLY GRADED GRAVEL with SAND** grey to brown, dry, moderately to well cemented, with estimated <5% non-plastic fines, 35-40% fine to coarse sand, 60% fine to coarse, subangular gravel to +37.5 mm in diameter.	
	0.38	A	GRAB	50/50	50/50	0	MC, SA, PI	SC SM		
725.42	1								1.22 **CLAYEY, SILTY SAND with GRAVEL** brown, dry to slightly moist, well cemented, with approximately 10% non-plastic fines, 40% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +19mm in diameter.	
	1.52	B	NR	50/50	50/50	0			**SILTY, CLAYEY GRAVEL with SAND** brown, slightly moist, well cemented, with approximately 10%-15% non to low plastic fines, 35%-40% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +12.5mm in diameter.	
724.42	2							GC GM		
723.42	3	C	GRAB	50/50	50/50	0				
722.42	4								3.96 **CALICHE** light brown to grey, hard, with gravel to +19mm in diameter.	
	4.57	D	GRAB	50/100	50/100	0	MC, SA, PI		4.57 **SILTY, CLAYEY GRAVEL with SAND** brown, slightly moist, well cemented, with approximately 10% low plastic fines, 35% fine to coarse sand, 55% fine to coarse, angular to subangular gravel to +37.5mm in diameter.	
721.42	5							GC GM		
720.42	6	E	GRAB	50/0	50/0	0				
719.42	7								7.01 **POORLY GRADED GRAVEL with CLAY and SAND** brown, slightly moist, well cemented, with approximately 10% low plastic fines, 40% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +19mm in diameter.	
	7.62	F	GRAB	50/100	50/100	0	MC, SA, PI	GP GC		
718.42	8									
	9.14								8.84 **SILTY, CLAYEY GRAVEL with SAND** brown, slightly moist, well cemented, with approximately 10% low plastic fines, 40% fine to coarse sand, 50% fine to coarse, angular to subangular gravel to +19mm in diameter.	
717.42	9	G	GRAB	50	50	0		GC GM		
716.42	10								10.06 **CLAYEY GRAVEL with SAND** brown, slightly moist, well cemented, with approximately 15% medium plastic fines, 50% fine to coarse sand, 35% fine, angular to subangular gravel to +12.5mm in diameter.	
	10.67	H	GRAB	50/125	50/125	0	MC, SA, PI	GC	10.67	
715.42	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/19/00
END DATE 1/19/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-06
E.A. # 0215-01-1
GROUND ELEV. 711.50 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/19/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30	A	SPT	50/25	50/25	0	MC, SA, PI			
	0.91							GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, well cemented, with approximately 20% medium plastic fines, 40% fine to coarse sand, 40% fine to coarse subangular to subrounded gravel to +25mm in diameter.	
710.50	1	A2	GRAB							
	1.52									
	1.65	B	MC	50/125	50/125	0				
709.50	2									
									2.29	
									CALICHE light brown to grey, hard, with gravel to +19mm in diameter.	
708.50	3 3.05									
	3.20	C	SPT	50	50	33				
									3.35	
707.50	4								**CLAYEY GRAVEL with SAND** light brown, slightly moist, well cemented, with approximately 25% low to medium plastic fines, 40% fine to coarse sand. 35% fine to coarse, subangular to subrounded gravel to +19mm in diameter. At approximately a depth of 13.5' there is a transition with approximately 15%-20% low plastic fines, 30%-40% fine to coarse sand, 50% fine to coarse subangular to subrounded gravel to a +25mm in diameter.	
	4.57	D	GRAB	50/125	50/125	0		GC		
706.50	5									
									5.79	
705.50	6 6.10									
	6.40	E	SPT	30 50	50	83	MC, SA, PI		**CLAYEY SAND with GRAVEL** light brown, slightly moist to moist, with approximately 40% high plastic fines, 40% fine to medium sand, 20% fine, subangular to subrounded gravel to +12.5mm in diameter. At approximately a depth of 6.7m there is a transition to a higher percent sand, with approximately 15% low to medium plastic fines, 65% fine to coarse sand, 20% fine to coarse, subangular gravel to +19mm in diameter.	
704.50	7									
	7.62							SC		
		F	SPT	23 40 40	80	66				
703.50	8 8.08									
									8.53	
									CALICHE light brown to grey, extremely well cemented, with gravel to +19mm in diameter.	
702.50	9 9.14	G	GRAB	50/125	50/125	0				
701.50	10 10.06								10.06	
	10.21	H	GRAB							
700.50	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

START DATE 1/18/00
END DATE 1/18/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-07
E.A. # 0215-01-1
GROUND ELEV. 710.53 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/18/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30									
	0.76	A	SPT	14 10 50	60	100	MC, SA, PI	SC	**CLAYEY SAND with GRAVEL** brown, slightly moist, with approximately 20% non-plastic fines, 40% fine to coarse sand, 40% fine to coarse, angular to subangular gravel to +19mm in diameter.	
709.53	1								0.91	
									CALICHE light brown to grey, hard, with gravel to +19mm in diameter.	
	1.37								1.37	
	1.52									
	1.73	B	MC	15 50	50	44			**CLAYEY GRAVEL with SAND** light brown, moist, with approximately 30% low plastic fines, 30% fine to coarse sand, 40% fine to coarse, subangular to subrounded gravel to +75mm in diameter.	
708.53	2									
707.53	3									
	3.05 3.10	C	SPT	50/50	50/50	0		GC		
	3.51									
706.53	4	C2	GRAB							
	4.57									
	4.70	D	SPT	50/125	50/125	0			4.70	
705.53	5									
704.53	6									
703.53	7									
702.53	8									
701.53	9									
700.53	10									
699.53	11									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/18/00
END DATE 1/18/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-08
E.A. # 0215-01-1
GROUND ELEV. 709.61 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/18/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30									
	0.60	A	SPT	16 54/137	54/137	64	MC, SA, PI	SC	**CLAYEY SAND with GRAVEL** brown, slightly moist, with approximately 20% low plastic fines, 30% fine to coarse sand, 50% fine to coarse, subangular to subrounded gravel to +19mm in diameter.	
708.61	1								0.84	
	1.52							GC	**CLAYEY GRAVEL with SAND / CLAYEY SAND with GRAVEL** light brown, slightly moist, with approximately 20% low to medium plastic fines, 40% fine to coarse sand, 40% fine to coarse, subrounded gravel to +25mm in diameter.	
	1.66	B	MC	50/137	50/137	30			1.37	
707.61	2								**CLAYEY SAND with GRAVEL** light brown, slightly moist, well cemented, with approximately 15% medium plastic fines, 45% fine to coarse sand, 40% fine to coarse subangular to subrounded gravel to +19mm in diameter.	
706.61	3 3.05	C	SPT	50/50	50/50	11	MC, SA, PI	SC		
705.61	4									
	4.57									
	4.72	D	SPT	50	50	33				
704.61	5								5.18	
								GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, with approximately 25% low plastic fines, 35% fine to coarse sand, 40% fine to coarse, subrounded gravel to +19mm in diameter.	
703.61	6 6.10								5.79	
	6.55	E	SPT	17 15 15	30	83		SC	**CLAYEY SAND with GRAVEL** light brown, slightly moist, with approximately 25% low plastic fines, 40% fine to coarse sand, 35% fine to coarse, angular to subangular gravel to +19mm in diameter.	
702.61	7									
	7.62								7.62	
701.61	8 8.08	F	SPT	20 22 32	54	83		CL	**CLAYEY SAND with GRAVEL / LEAN CLAY with SAND** light brown to brown, moist, with approximately 30%-60% low to medium plastic fines, 35%-55% fine to coarse sand, 10%-15% fine, angular to subangular gravel to +12.5mm in diameter.	
									8.53	
700.61	9 9.14								**LEAN CLAY with SAND** light brown, wet, with approximately 50%-60% medium plastic fines, 35%-40% fine to coarse sands, 5% fine, angular to subangular gravel to +4.75mm in diameter.	
	9.30	G	SPT	50	50	33				
699.61	10							CL		
	10.67									
	10.84	H	SPT	12 50/25	50/25	39				
698.61	11								11.13	

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EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/18/00
END DATE 1/18/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-09
E.A. # 0215-01-1
GROUND ELEV. 709.50 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/18/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30									
	0.76	A	SPT	19 12 20	32	100				
708.50	1							SC	**CLAYEY SAND with GRAVEL** light brown, slightly moist, with approximately 20% medium plastic fines, 50% fine to coarse sand, 30% fine, angular to subangular gravel to +12.5mm in diameter.	
	1.52									
	1.74	B	SPT	28 50/63	50/63	47	MC, SA, PI			
707.50	2									
									2.59	
								GC	2.90 **CLAYEY GRAVEL with SAND** light brown, slightly moist, with approximately 20% low plastic fines, 30% fine to coarse sand. 50% fine, subangular to subrounded gravel to +12.5mm in diameter	
706.50	3 3.05									
	3.51	C	SPT	17 22 22	44	100	MC, SA, PI	CL		
									3.81 **SANDY LEAN CLAY** light brown to brown, slightly moist, with approximately 55% medium plastic fines, 40% fine to coarse sand. 5% fine,subangular to subrounded gravel to +4.75mm in diameter.	
705.50	4									
	4.57							SC		
	5.03	D	SPT	16 33 25	58	83			**CLAYEY SAND with GRAVEL** brown, slightly moist, with approximately 25% low to medium plastic fines, 55% fine to coarse sand. 20% fine to coarse, subangular to subrounded gravel to +25mm in diameter.	
704.50	5								5.03	
703.50	6									
702.50	7									
701.50	8									
700.50	9									
699.50	10									
698.50	11									

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EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/20/00
END DATE 1/20/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-10
E.A. # 0215-01-1
GROUND ELEV. 708.33 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/20/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30	A	GRAB	50/75	50/75	0	MC, SA, PI	GM	0.30 **SILTY GRAVEL with SAND** brown, dry, with approximately 20% non-plastic fines, 30% fine to coarse sand, 50% fine to coarse, subangular to subrounded gravel to +75mm in diameter.	
707.33	1							SM	0.91 **SILTY SAND with GRAVEL** brown, dry, with approximately 20% non-plastic fines, 40% fine to coarse sand, 40% fine, subrounded gravel to +12.5mm in diameter.	
	1.52	B	SPT	50/50	50/50	11		SC	1.60 **CLAYEY SAND with GRAVEL / CLAYEY GRAVEL with SAND** light brown, slightly moist, with approximately 30% low to medium plastic fines, 40% fine to coarse sand, 30% fine, subrounded gravel to +12.5mm in diameter.	
706.33	2								1.98 **CALICHE** light brown to grey, extremely hard, with gravel to +12.5mm in diameter.	
705.33	3									
704.33	4									
703.33	5									
702.33	6									
701.33	7									
700.33	8									
699.33	9									
698.33	10									
697.33	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/20/00
END DATE 1/20/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-11
E.A. # 0215-01-1
GROUND ELEV. 708.25 (m)
HAMMER DROP SYSTEM Hydraulic

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/20/00

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GM	0.23 **SILTY GRAVEL with SAND** grey to brown, dry, with cobbles to +200mm in diameter.	
	0.59	A	SPT	15 50/125	50/125	82	MC, SA, PI	SM	**SILTY SAND with GRAVEL** brown, slightly moist, with approximately 20% non-plastic fines, 60% fine to coarse sand, 20% fine, subrounded gravel to +12.5mm in diameter.	
707.25	1									
	1.52									
	1.68	B	SPT	50	50	50			1.68	
706.25	2								2.04 **CALICHE** light brown to light grey, hard, with subrounded gravel to +25mm in diameter.	
									SANDY LEAN CLAY brown, slightly moist to moist, with approximately 50% low to medium plastic fines, 45% fine to coarse sand, 5% fine, subangular gravel to +9.5mm in diameter.	
705.25	3 3.05									
	3.35	C	GRAB			0		CL		
	3.66									
	3.96	D	MC	21 50	50	100	MC, SA, PI			
704.25	4								4.19	
	4.57							CL	4.50 **FAT CLAY with SAND** olive to light grey, moist, with approximately 80%-90% medium to high plastic fines and 10%-20% fine to medium sand.	
	4.72	E	SPT	50	50	100		CL	4.72 **SANDY LEAN CLAY** brown, moist, with approximately 50% low to medium plastic fines, 45% fine to coarse sand, 5% fine, subrounded gravel to +12.5mm in diameter.	
703.25	5									
702.25	6									
701.25	7									
700.25	8									
699.25	9									
698.25	10									
697.25	11									

EXPLORATION LOG

START DATE 1/20/00
END DATE 1/20/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-12
E.A. # 0215-01-1
GROUND ELEV. 708.75 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/20/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30 / 0.41	A	GRAB	50/100	50/100	0		GM	0.15 **SILTY GRAVEL with SAND** light brown to grey, dry	
707.75	1							SC	**CLAYEY SAND with GRAVEL** brown, slightly moist, well cemented, with approximately 20% low plastic fines, 50% fine to coarse sand, 30% fine to coarse, subrounded gravel to +19mm in diameter.	
	1.52 / 1.60	B	GRAB	50/75	50/75	0			1.07	
706.75	2							GC	**CLAYEY GRAVEL with SAND** light brown, slightly moist, well cemented, with approximately 30% low to medium plastic fines, 25% fine to coarse sand, 45% fine, subangular to subrounded gravel to +9.5mm in diameter.	
									1.98	
									2.21	
								CL	**CALICHE** light brown to grey, hard, with gravel to +9.5mm in diameter.	
705.75	3 3.05								2.90	
	3.51	C	MC	19 / 24 / 27	51	66		CL	**SANDY LEAN CLAY with GRAVEL** light brown, slightly moist, with approximately 40% low to medium plastic fines, 30% fine to coarse sand, 30% fine, subrounded gravel to +9.5mm in diameter.	
704.75	4								**LEAN CLAY with GRAVEL** olive to brown, moist, with approximately 70% low to medium fines, 10% fine to coarse sand, 20% fine, angular to subangular gravel to +9.5mm in diameter.	
	4.57								4.04	
		D	SPT	13 / 33 / 27	60	66		CL	**SANDY LEAN CLAY** light brown, moist, with approximately 60% low to medium plastic fines and 40% fine sands.	
703.75	5 5.03								4.72	
								SC	**CLAYEY SAND** light brown, moist, with approximately 40% low to medium plastic fines and 60% fine sands.	
									5.33	
								GC	**CLAYEY GRAVEL with SAND** light brown, moist, with approximately 30% low to medium plastic fines, 25% fine to coarse sand, 45% fine to coarse, subangular to subrounded gravel to +19mm in diameter.	
702.75	6 6.10								6.10	
	6.55	E	SPT	15 / 14 / 5	19	66		SC	6.40 **CLAYEY SAND with GRAVEL** brown, moist, with approximately 35% low to medium plastic fines, 45% fine to coarse sand, 20% fine to coarse, subangular gravel to +19mm in diameter.	
								CL	6.86 **SANDY LEAN CLAY** reddish brown, moist, with approximately 70% medium plastic fines and 30% fine sand.	
701.75	7								7.92 **SANDY LEAN CLAY with GRAVEL** brown, moist, with approximately 60% medium plastic, 20% fine to medium sand, 20% fine, subangular to subrounded gravel to +9.5mm in diameter.	
	7.62							CL		
700.75	8 8.08	F	SPT	29 / 24 / 50	74	56	MC, SA, PI			
									SANDY LEAN CLAY brown, moist, with approximately 50%-60% low to medium plastic fines, 35%-45% fine to medium sand, 5%-10% fine, subangular gravel to +9.5mm in diameter. At approximately 28' in depth the material is olive to brown, moist, with approximately 80% medium plastic fines, 15% fine to coarse sand, 5% fine, subangular to +4.75mm in diameter.	
699.75	9 9.14									
	9.60	G	SPT	10 / 28 / 32	60	83				
698.75	10								10.06 **CLAYEY SAND** light brown to olive, moist, with approximately 45% high plastic fines, 50% fine to coarse sand, 5% fine, subangular gravel to +4.75mm in diameter.	
	10.67							SC		
697.75	11 11.13	H	SPT	12 / 7 / 7	14	100			11.13	

EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/20/00
END DATE 1/20/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-13
E.A. # 0215-01-1
GROUND ELEV. 707.75 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/20/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GM	0.15 **SILTY GRAVEL** brown to grey, dry,	
	0.60	A	SPT	32 50/138	50/138	50	MC, SA, PI	SM	**SILTY SAND with GRAVEL** brown to light brown, dry to slightly moist, with approximately 20% non-plastic fines, 50% fine to coarse sand, 25% fine to coarse, subrounded gravel to +19mm in diameter.	
706.75	1							SM	0.76 **SILTY SAND / CLAYEY SAND** light brown, slightly moist, with approximately 25% low plastic fines, 65% fine to coarse sand, 10% fine to coarse, subangular to subrounded gravel to +19mm in diameter.	
	1.52								1.45	
	1.80	B	SPT	27 50/125	50/125	55		GC	1.98 **CLAYEY GRAVEL with SAND** light brown, slightly moist, with approximately 30% low plastic fines, 30% fine to coarse sand, 40% fine, subangular to subangular gravel to +9.5mm in diameter.	
705.75	2							CL	2.97 **GRAVELLY LEAN CLAY with SAND** light brown, slightly moist, with approximately 45% medium plastic fines, 25% fine to coarse sand, 30% fine, subrounded gravel to +9.5mm in diameter.	
704.75	3								3.51	
	3.05								3.96	
	3.35	C	SPT	22 50	50	66	MC, SA, PI	SC	**CLAYEY SAND with GRAVEL** light brown, slightly moist, with approximately 40% medium plastic fines, 40% fine to coarse sand, 20% fine, angular to subangular gravel to +12.5mm in diameter.	
703.75	4								**CALICHE** light brown to grey, hard, with gravel to +12.5mm in diameter.	
702.75	5									
701.75	6									
700.75	7									
699.75	8									
698.75	9									
697.75	10									
696.75	11									

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EXPLORATION LOG

SHEET 1 OF 1

START DATE 1/20/00
END DATE 1/20/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING WR-14
E.A. # 0215-01-1
GROUND ELEV. 707.24 (m)
HAMMER DROP SYSTEM Hydraulic

STATION
OFFSET
ENGINEER JRO
EQUIPMENT Foremost B4500
OPERATOR W. Dugas
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/20/00

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.30							GM	**SILTY GRAVEL** grey, dry	
	0.38	A	SPT	50/75	50/75	0				
								SC	**CLAYEY SAND with GRAVEL** brown to light brown, slightly moist, with approximately 20% low plastic fines, 60% fine to coarse sand, 20% fine, subangular gravel to +9.5mm in diameter.	
706.24	1								0.91	
								GC	**CLAYEY GRAVEL** light brown, slightly moist, with approximately 25% low plastic fines, 15% fine to coarse sand, 60% fine to coarse, subangular to subrounded gravel to +9.5mm in diameter.	
	1.52								1.30	
		B	SPT	15 17 29	46	66	MC, SA, PI	CL		
	1.98								1.98	
705.24	2								**SANDY LEAN CLAY with GRAVEL** brown, slightly moist, with approximately 35% low to medium plastic fines, 40% fine to medium sand, 25% fine to coarse, subangular gravel to +19mm in diameter.	
704.24	3 3.05							SC	**CLAYEY SAND with GRAVEL** light brown, moist, with approximately 35% medium plastic fines, 40% fine to coarse sand, 25% fine to coarse, subangular gravel to +19mm in diameter.	
		C	SPT	41 38 27	65	83	MC, SA, PI		3.66	
	3.51								**CALICHE** light brown to grey, hard, with gravel to +19mm in diameter.	
703.24	4								4.42	
	4.57									
		D	SPT	23 25 12	37	83		CL	**SANDY LEAN CLAY** light brown, moist, with approximately 60%-70% medium plastic fines, 20%-30% fine to coarse sand, 10% fine, subangular gravel to +4.75mm in diameter.	
702.24	5 5.03								4.88	
								GC	**CLAYEY GRAVEL with SAND** light brown, moist, moderately cemented, with estimated 30% low to medium plastic fines, 30% fine to coarse sand, 40% fine to coarse, subangular to subround gravel to +25mm in diameter.	
701.24	6 6.10								5.79	
		E	SPT	13 19 20	39	56	MC, SA, PI	CL	**SANDY LEAN CLAY** light brown, moist, with approximately 65% medium to high plastic fines, 20% fine to medium sand, 15% fine, subangular to subrounded gravel to +12.5mm in diameter.	
	6.55								6.55	
700.24	7									
699.24	8									
698.24	9									
697.24	10									
696.24	11									

NV_DOT 0215011.GPJ NV_DOT.GDT 6/14/00

EXPLORATION LOG

START DATE 4/13/00
END DATE 4/13/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING TP-01
E.A. # 0215-01-1
GROUND ELEV. 715.06 (m)
HAMMER DROP SYSTEM

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER CCM
EQUIPMENT Case 580 Super L
OPERATOR UKN
DRILLING METHOD
BACKFILLED Yes DATE 4/13/2000

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
714.06	1							GC GM	0-10 (Into Embankment): **POORLY GRADED GRAVEL with SILT and SAND** Moist, dense, light brown, with estimated 10% non-plastic fines, 40% fine to coarse sand, and 50% fine to coarse gravel to +3" in diameter. Unit contains estimated 30% by volume cobbles 3" to 10" in diameter.	
	1.52									
713.06	2	1	GRAB				Sv, Pl, W, Sh, P			
	2.13									
712.06	3								3.05	
711.06	4									
710.06	5									

EXPLORATION LOG

START DATE 4/13/00
END DATE 4/13/00
JOB DESCRIPTION U.S. 95 Widening Project
LOCATION Las Vegas, Nevada
BORING TP-02
E.A. # 0215-01-1
GROUND ELEV. 715.06 (m)
HAMMER DROP SYSTEM

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m

STATION
OFFSET
ENGINEER CCM
EQUIPMENT Case 580 Super L
OPERATOR UKN
DRILLING METHOD
BACKFILLED Yes DATE 4/13/2000

ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
714.06	1							GP GM	0-10 (Into Embankment): **POORLY GRADED GRAVEL with SILT and SAND** Moist, dense, light brown, with estimated 10% non-plastic fines, 40% fine to coarse sand, and 50% fine to coarse gravel to +3" in diameter. Unit contains estimated 30% by volume cobbles 3" to 10" in diameter.	
	1.52									
713.06	2	2A	GRAB				Sv, PI, W, Sh, P			
	2.13									
712.06	3								3.05	
711.06	4									
710.06	5									

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

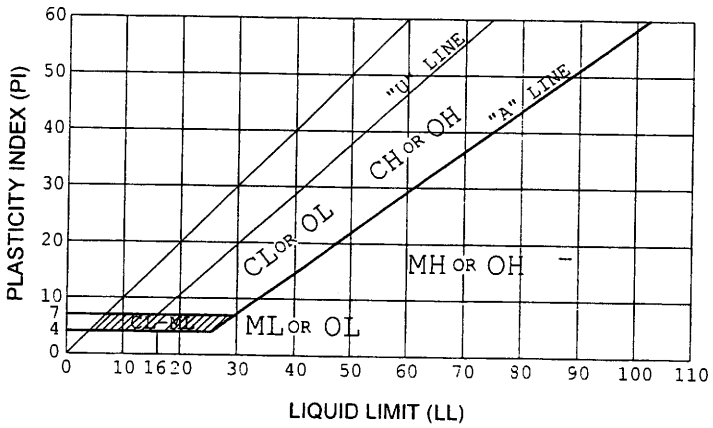
NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 2mm)
Sand	# 4 to #200 sieve (2mm to 0.074mm)
Silt or Clay	Passing #200 sieve (0.074mm)

RELATIVE DENSITY OF GRANULAR SOILS:

N-Blows/ft.	Relative Density
0-4	Very Loose
5-10	Loose
11-30	Medium Dense
31-50	Dense
greater than 50	Very Dense



PLASTICITY CHART

FOR CLASSIFICATION OF FINE-GRAINED SOILS AND FINE-GRAINED FRACTION OF COARSE-GRAINED SOILS

CONSISTENCY OF OF COHESIVE SOILS:

Unconfined Compressive Strength, psi	N-Blows/ft	Consistency
less than 500	0-1	Very Soft
500-1,000	2-4	Soft
1,000-2,000	5-8	Firm
2,000-4,000	9-15	Stiff
4,000-8,000	16-30	Very Stiff
8,000-16,000	31-60	Hard
greater than 16,000	greater than 60	Very Hard

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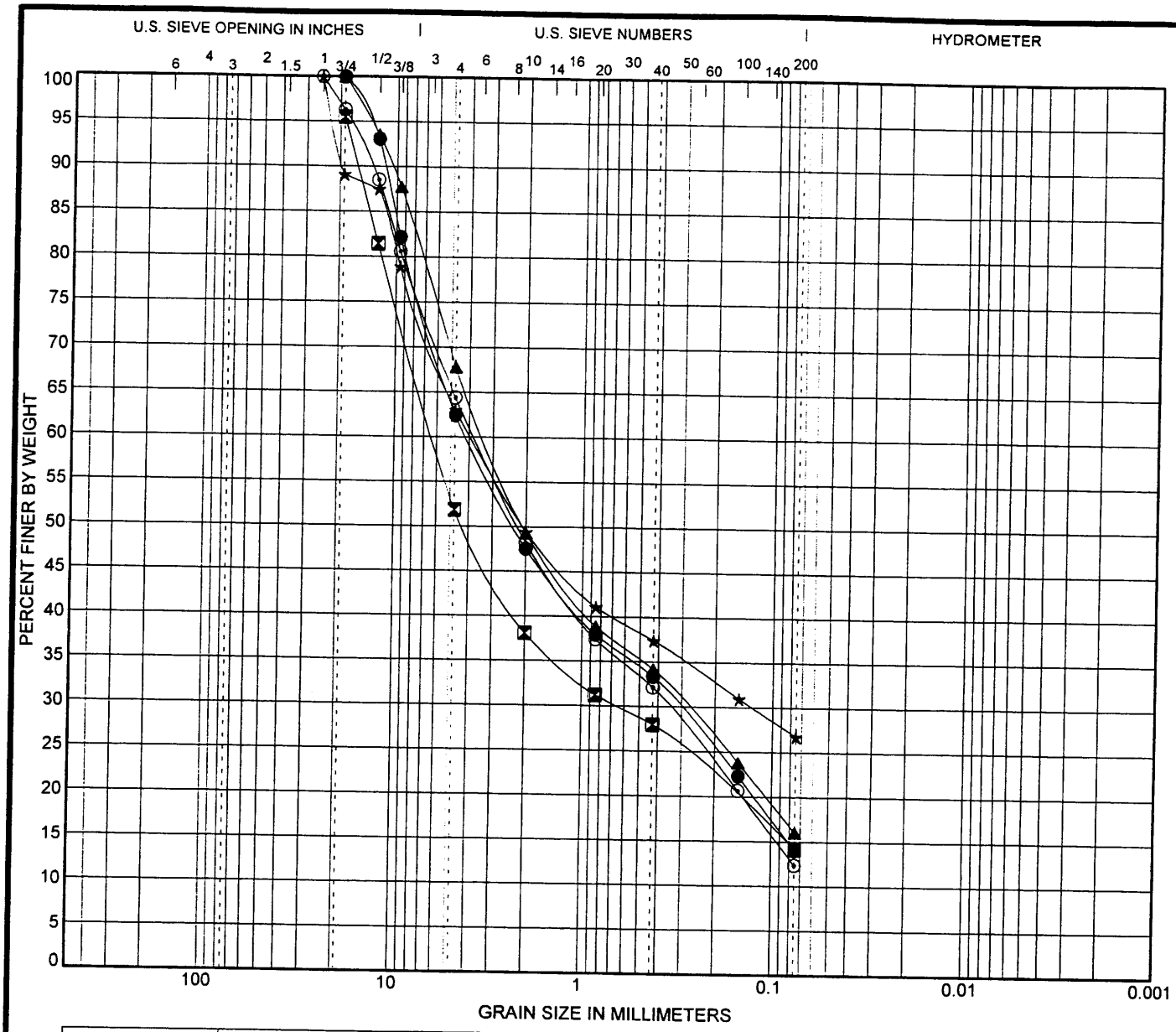
USCS Soil Classification

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	R-01	0.3	SILTY SAND with GRAVEL (SM)	16	15	1		
⊠	R-03	0.5	CLAYEY GRAVEL with SAND (GC)	27	17	10		
▲	R-04	1.4	SILTY SAND with GRAVEL (SM)	16	15	1		
★	R-05	1.4	SILTY GRAVEL with SAND (GM)	18	16	2		
⊙	R-06	2.7	SILTY SAND with GRAVEL (SM)	NP	NP	NP	0.53	60.99

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	R-01	0.3	19	4.117	0.309		1.2	37.5	48.4	14.0	
⊠	R-03	0.5	19	6.194	0.652		2.0	43.6	37.7	14.2	
▲	R-04	1.4	19	3.299	0.279		1.4	32.2	51.8	16.0	
★	R-05	1.4	25	3.92	0.128		1.6	37.0	36.2	26.8	
⊙	R-06	2.7	25	3.755	0.35		2.3	35.6	52.0	12.4	

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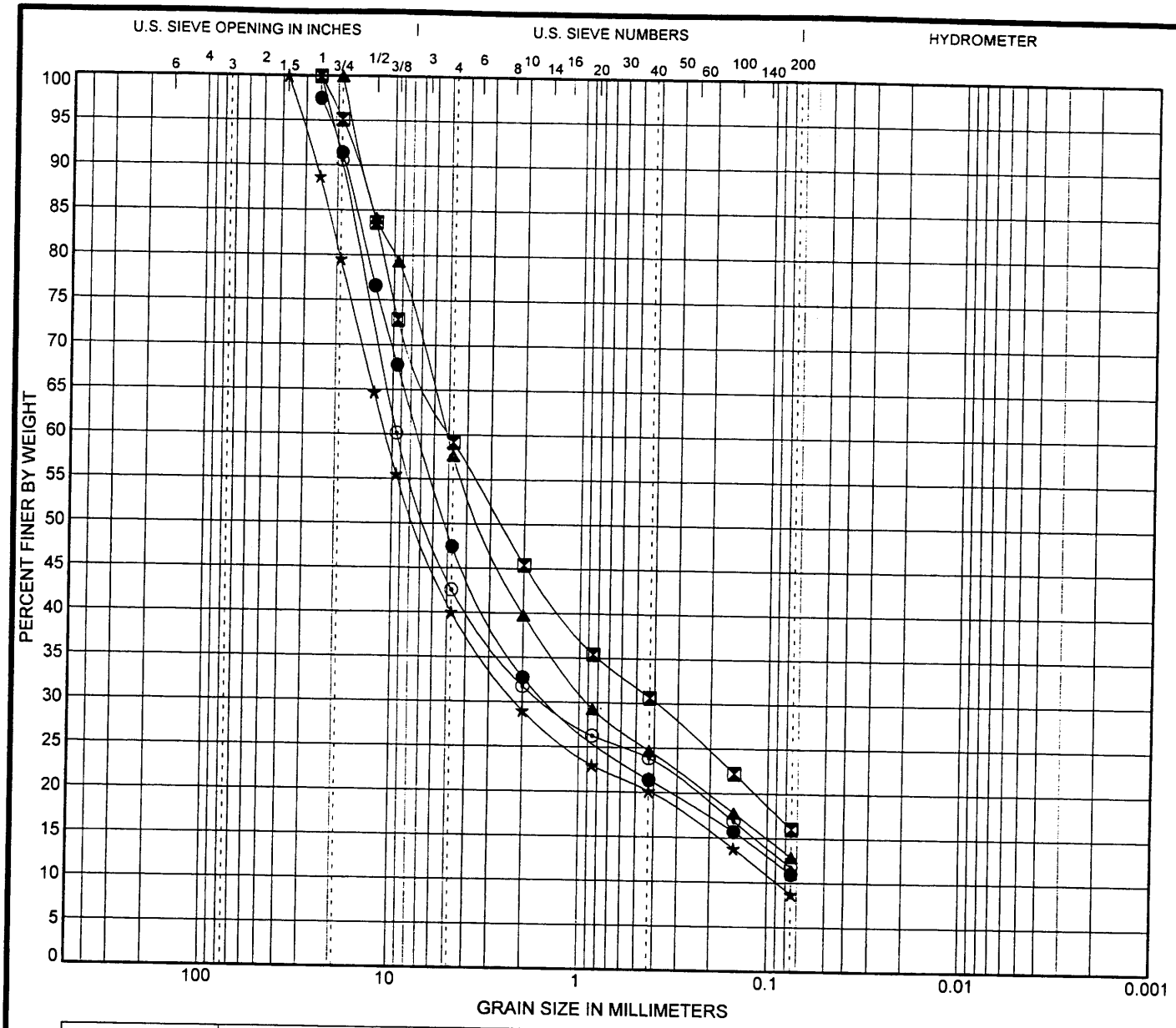
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4a

US GRAIN SIZE2 METRIC 0215011.GPJ US LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	R-07	0.5	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	19	15	4	3.99	112.44
⊠	R-08	1.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	19	15	4		
▲	R-09	2.7	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	20	15	5		
★	R-10	1.5	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	NP	NP	NP	4.83	122.26
⊙	R-11	0.5	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	29	19	10	4.16	160.67

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	R-07	0.5	25	7.281	1.371		1.9	50.1	36.5	11.0	
⊠	R-08	1.5	25	4.952	0.393		2.0	40.8	43.1	16.1	
▲	R-09	2.7	19	5.115	0.9		1.6	42.3	44.8	12.9	
★	R-10	1.5	37.5	10.853	2.158	0.089	1.6	60.0	31.3	8.8	
⊙	R-11	0.5	25	9.436	1.518		2.7	57.4	30.8	11.8	

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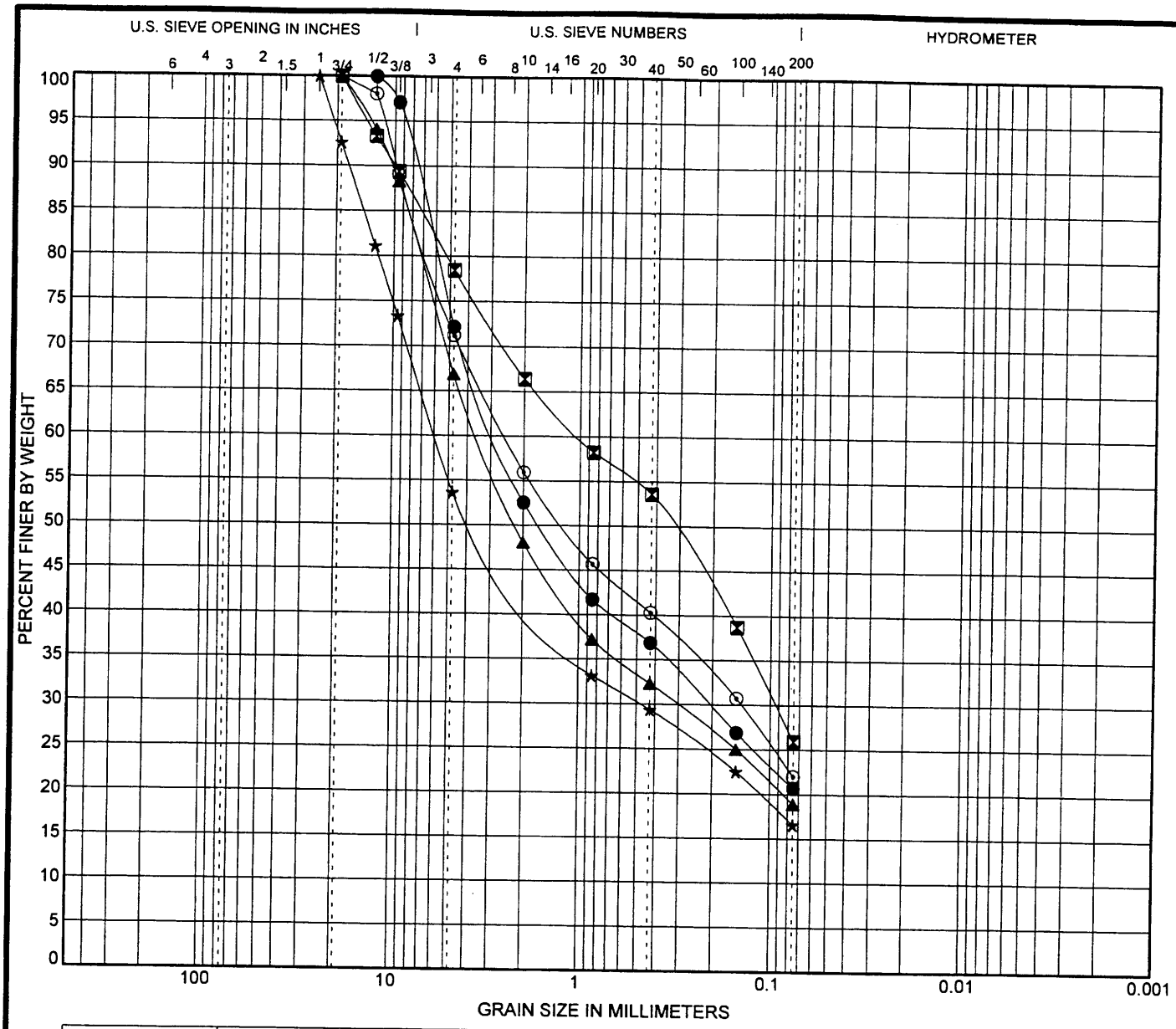
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4b

US GRAIN SIZE2 METRIC 0215011.GPJ US LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	R-12	2.7	CLAYEY SAND with GRAVEL (SC)	30	17	13		
⊠	R-13	2.7	CLAYEY SAND with GRAVEL (SC)	32	19	13		
▲	R-14	1.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	25	18	7		
★	R-15	0.5	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	21	15	6		
⊙	R-16	1.2	SILTY SAND with GRAVEL (SM)	17	14	3		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	R-12	2.7	12.5	2.775	0.207		3.2	27.8	51.5	20.7	
⊠	R-13	2.7	19	1.019	0.093		4.6	21.6	52.5	25.9	
▲	R-14	1.5	19	3.46	0.306		3.3	33.1	48.0	18.9	
★	R-15	0.5	25	5.937	0.475		2.1	46.3	37.1	16.6	
⊙	R-16	1.2	19	2.516	0.141		2.2	28.8	49.2	22.0	

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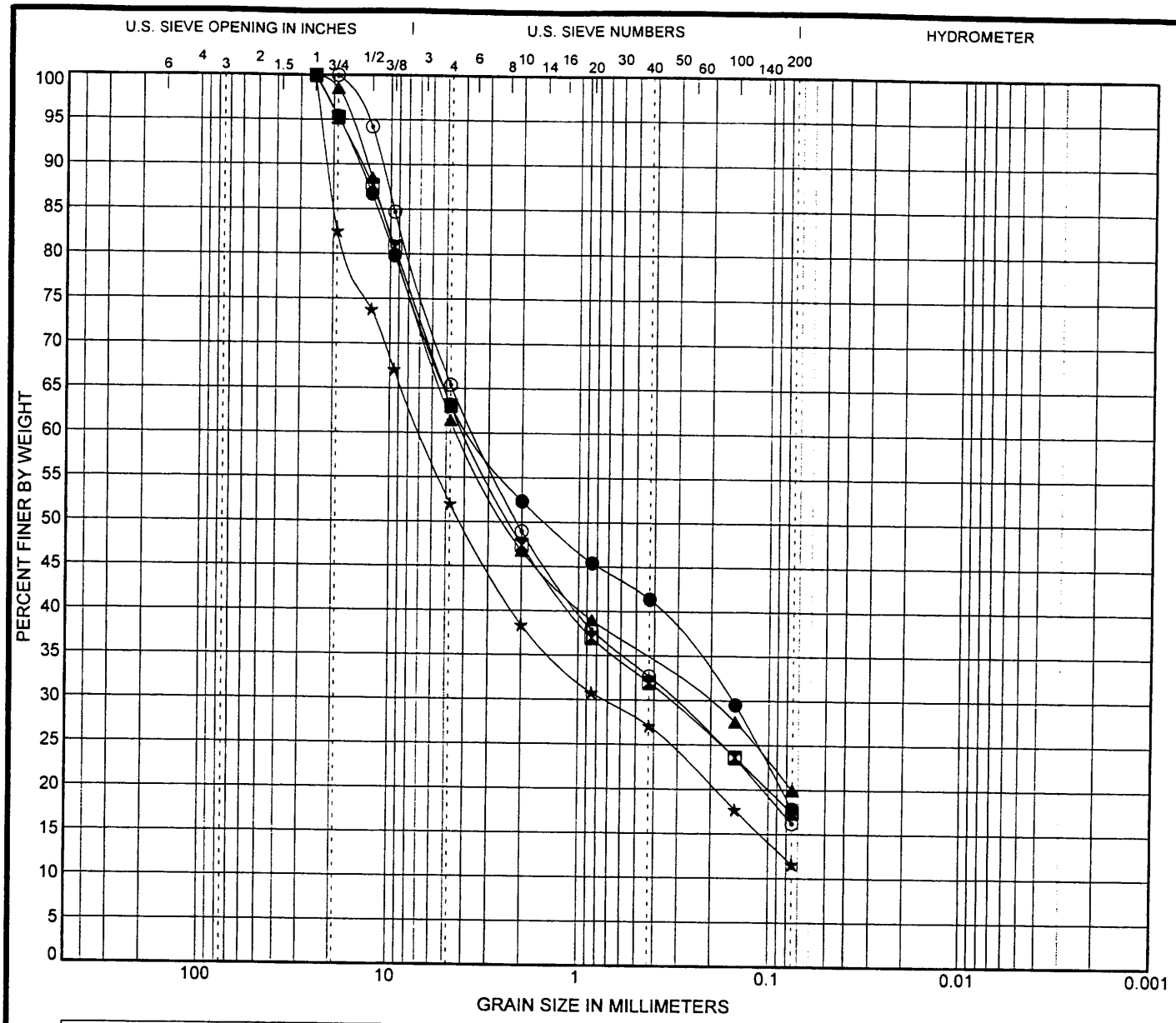
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4c



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	R-17	0.3	SILTY SAND with GRAVEL (SM)	17	16	1		
⊠	R-18	1.5	SILTY SAND with GRAVEL (SM)	17	14	3		
▲	R-19	0.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	20	14	6		
★	R-20	0.3	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	24	17	7	1.25	110.07
⊙	R-21	1.5	SILTY SAND with GRAVEL (SM)	20	17	3		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	R-17	0.3	25	3.686	0.156		3.9	36.8	45.3	17.8	
⊠	R-18	1.5	25	4.009	0.332		2.6	36.9	45.6	17.4	
▲	R-19	0.5	25	4.359	0.215		2.8	38.5	41.5	20.0	
★	R-20	0.3	25	6.848	0.73		2.5	48.0	40.4	11.6	
⊙	R-21	1.5	19	3.576	0.313		2.4	34.6	49.2	16.2	

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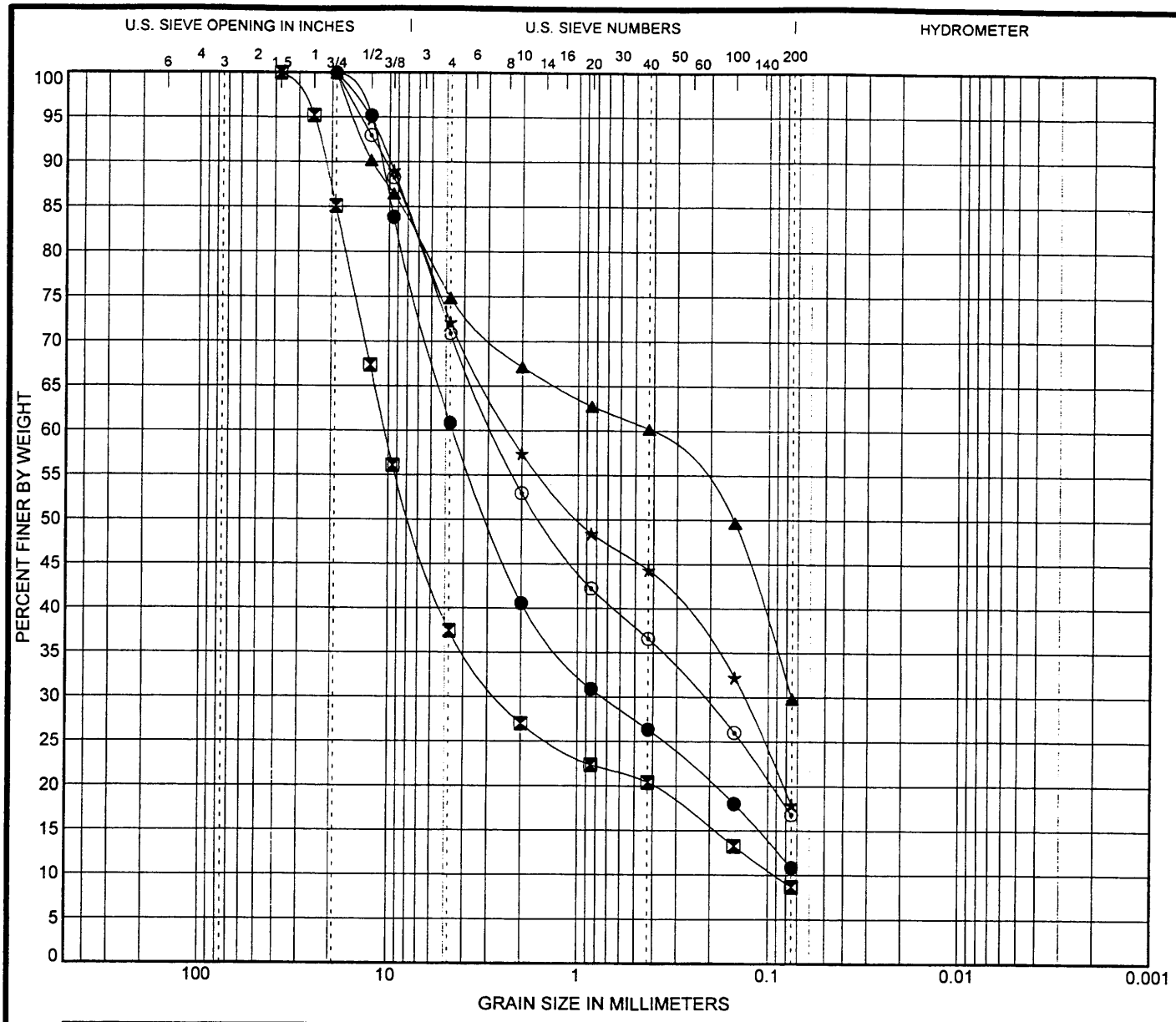
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4d

US GRAIN SIZE2 METRIC 0215011.GPJ US LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	R-22	2.7	WELL-GRADED SAND with CLAY and GRAVEL (SW-SC)	30	19	11	1.74	66.38
⊠	R-23	0.5	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	25	18	7	6.89	114.64
▲	R-24	2.7	CLAYEY SAND with GRAVEL (SC)	37	17	20		
★	R-25	0.3	SILTY SAND with GRAVEL (SM)	NP	NP	NP		
⊙	R-26	1.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	22	17	5		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	R-22	2.7	19	4.576	0.74		3.3	39.1	50.0	10.9	
⊠	R-23	0.5	37.5	10.436	2.558	0.091	2.2	62.5	28.7	8.7	
▲	R-24	2.7	19	0.416	0.075		16.7	25.1	45.0	29.9	
★	R-25	0.3	19	2.324	0.134		3.3	27.8	54.2	18.0	
⊙	R-26	1.5	19	2.805	0.222		3.4	29.1	54.1	16.8	

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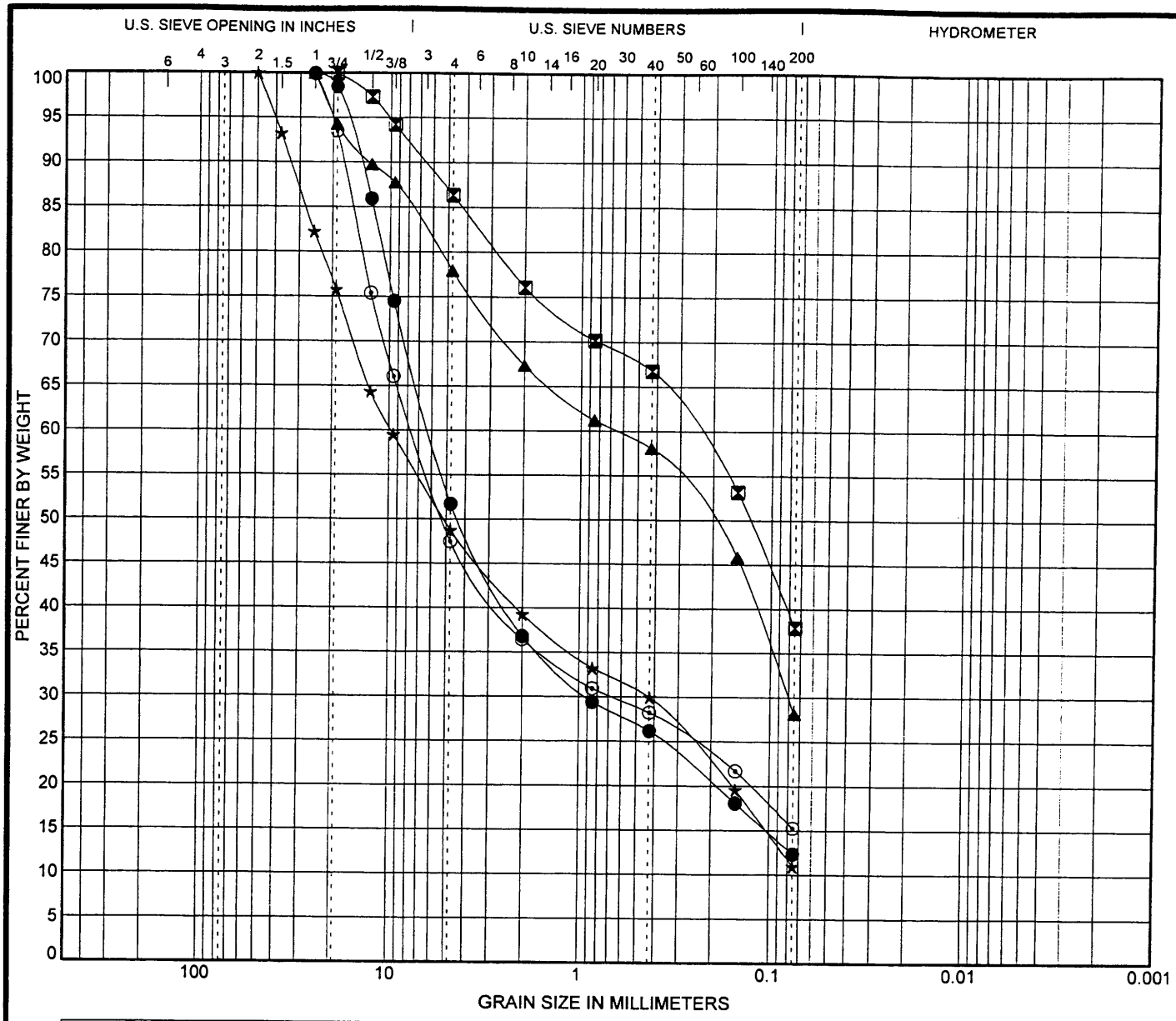
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4e



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	R-27	0.5	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	22	16	6	2.41	108.74
⊠	R-28	2.7	CLAYEY SAND (SC)	37	17	20		
▲	R-29	1.5	CLAYEY SAND with GRAVEL (SC)	22	13	9		
★	TP-01	1.5	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	NP	NP	NP	0.27	140.87
⊙	WL-01	0.3	CLAYEY GRAVEL with SAND (GC)	24	16	8		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	R-27	0.5	25	6.107	0.909		2.6	48.3	39.4	12.4	
⊠	R-28	2.7	19	0.252			8.7	13.6	48.5	37.9	
▲	R-29	1.5	25	0.646	0.081		5.2	22.1	49.8	28.2	
★	TP-01	1.5	50	9.74	0.428		3.5	51.2	37.8	11.0	
⊙	WL-01	0.3	25	7.574	0.668		2.9	52.5	32.2	15.3	

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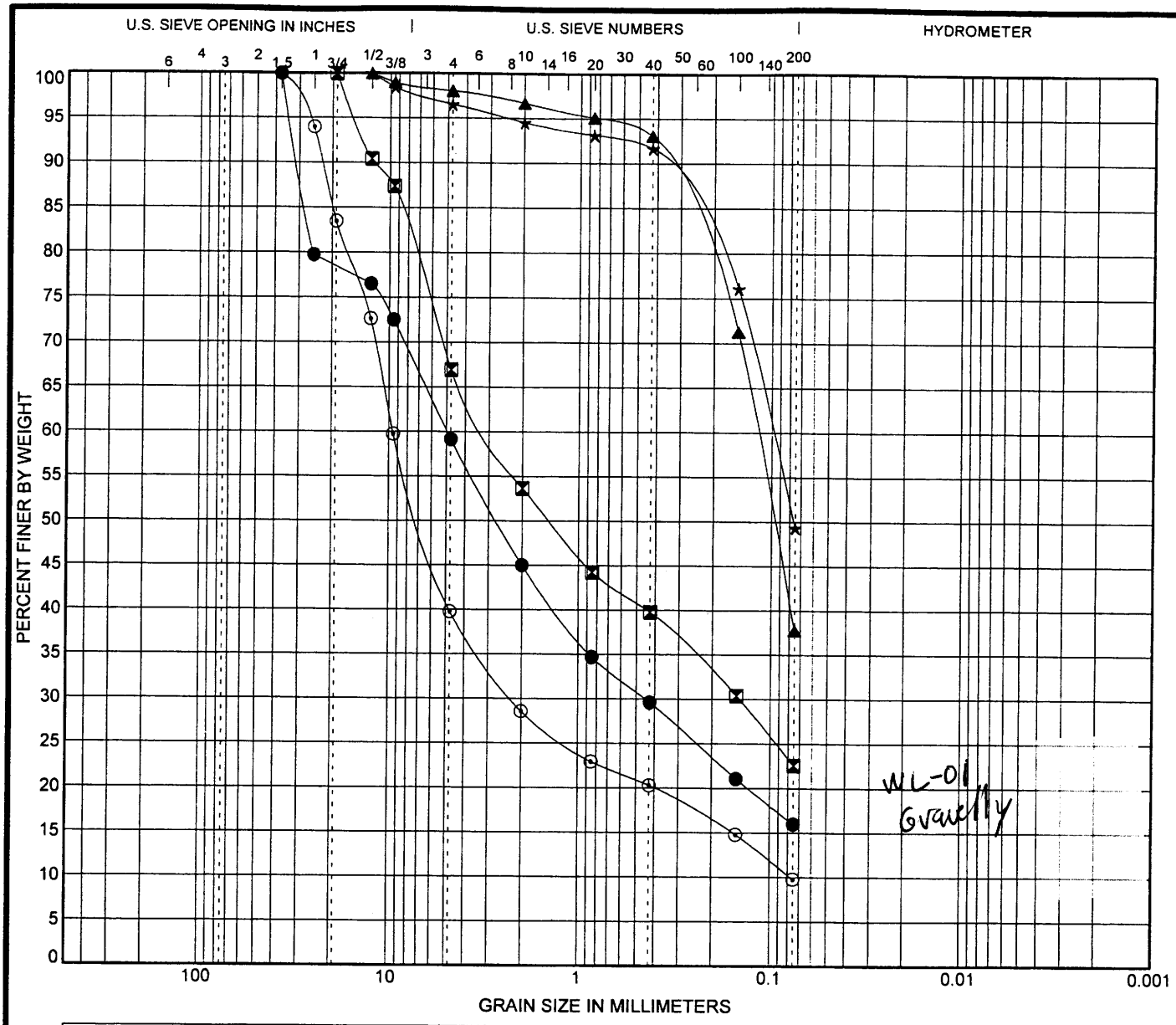
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4f



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WL-01	3.0	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	22	15	7		
⊠	WL-02	1.5	CLAYEY SAND with GRAVEL (SC)	38	21	17		
▲	WL-02	6.1	CLAYEY SAND (SC)	46	19	27		
★	WL-02	10.7	CLAYEY SAND (SC)	32	16	16		
⊙	WL-03	0.3	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	18	16	2	6.78	124.08

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WL-01	3.0	37.5	4.954	0.447		1.8	40.8	43.2	16.0	
⊠	WL-02	1.5	19	3.017	0.145		5.8	33.0	44.4	22.6	
▲	WL-02	6.1	12.5	0.119			14.2	1.9	60.3	37.8	
★	WL-02	10.7	12.5	0.099			19.8	3.4	47.2	49.4	
⊙	WL-03	0.3	37.5	9.548	2.233	0.077	1.7	60.2	30.0	9.8	

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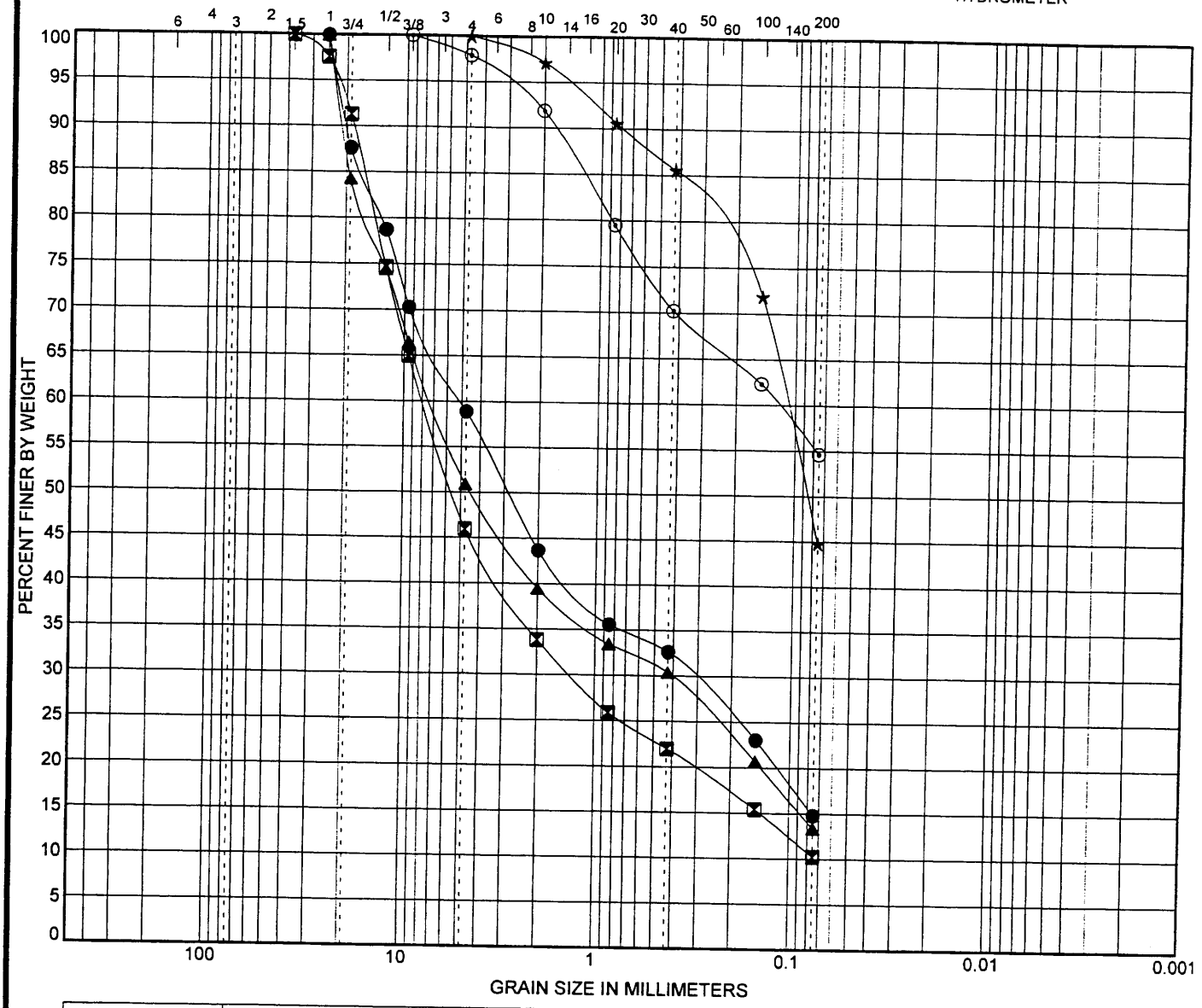
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4g



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WL-03	4.6	CLAYEY SAND with GRAVEL (SC)	37	20	17		
⊠	WL-04	0.3	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	19	17	2	3.06	109.58
▲	WL-04	3.0	CLAYEY GRAVEL with SAND (GC)	29	19	10		
★	WL-04	4.6	CLAYEY SAND (SC)	40	22	18		
⊙	WL-04	6.1	SANDY FAT CLAY (CH)	63	24	39		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WL-03	4.6	25	5.074	0.319		4.0	41.1	44.1	14.8	
⊠	WL-04	0.3	37.5	7.913	1.322		1.8	54.0	35.7	10.3	
▲	WL-04	3.0	25	7.12	0.407		1.6	49.1	37.5	13.4	
★	WL-04	4.6	4.75	0.111			13.1	0.0	55.2	44.8	
⊙	WL-04	6.1	9.5	0.121			23.3	2.1	43.3	54.6	

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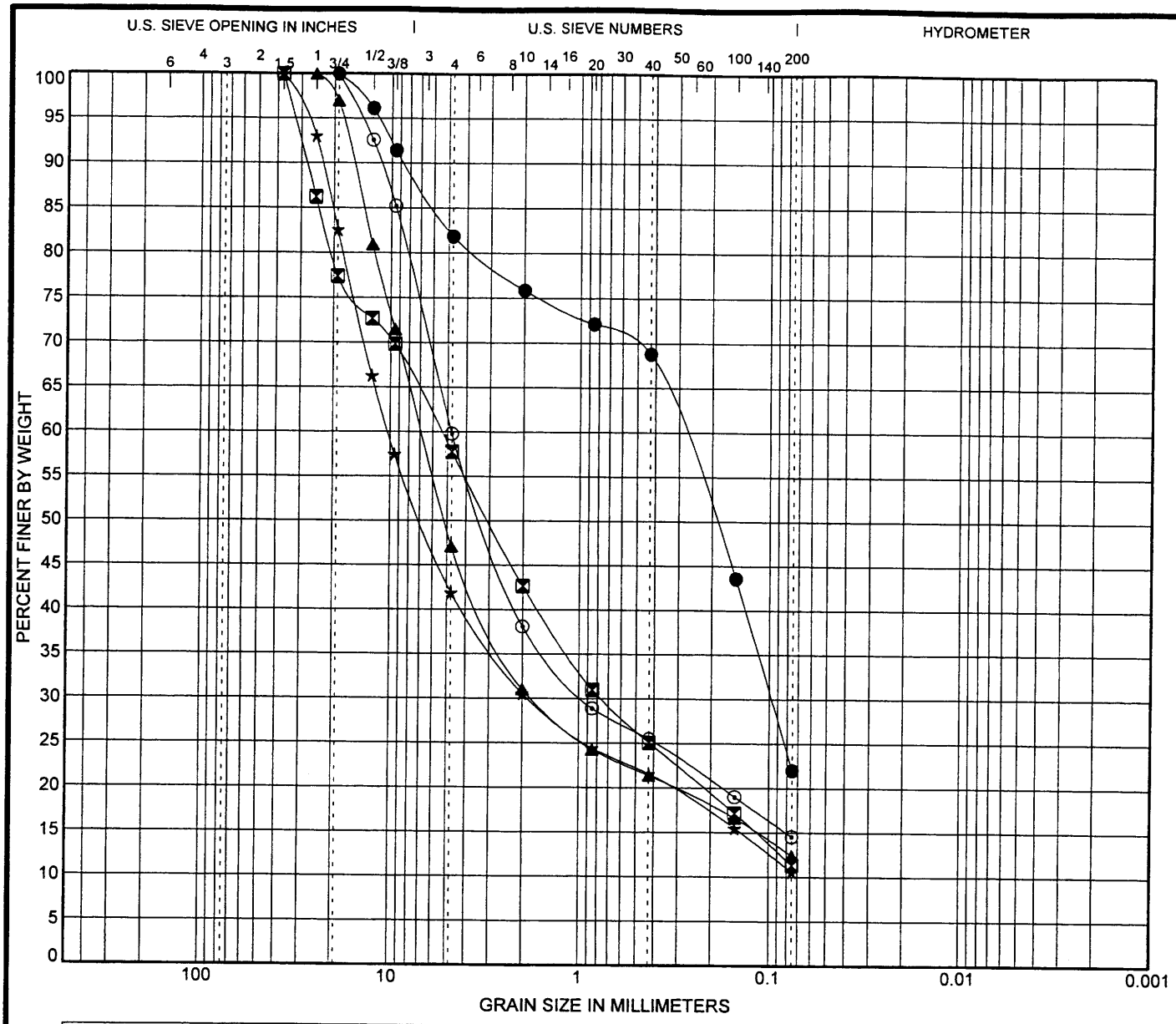
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4h

US GRAIN SIZE2 METRIC 0215011.GPJ US LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	WL-04	10.7	CLAYEY SAND with GRAVEL (SC)	68	28	40		
⊠	WL-05	0.3	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	20	17	3	1.66	84.68
▲	WL-05	3.0	CLAYEY GRAVEL with SAND (GC)	26	18	8	8.95	136.72
★	WL-06	0.3	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	18	16	2	4.85	149.69
⊙	WL-06	3.0	CLAYEY SAND with GRAVEL (SC)	19	10	9		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WL-04	10.7	19	0.295	0.097		15.1	18.1	59.8	22.0	
⊠	WL-05	0.3	37.5	5.398	0.755		1.0	42.2	46.4	11.4	
▲	WL-05	3.0	25	6.853	1.754		2.0	52.9	34.7	12.4	
★	WL-06	0.3	37.5	10.271	1.848		2.7	58.1	31.3	10.6	
⊙	WL-06	3.0	19	4.775	0.94		1.5	40.2	45.2	14.6	

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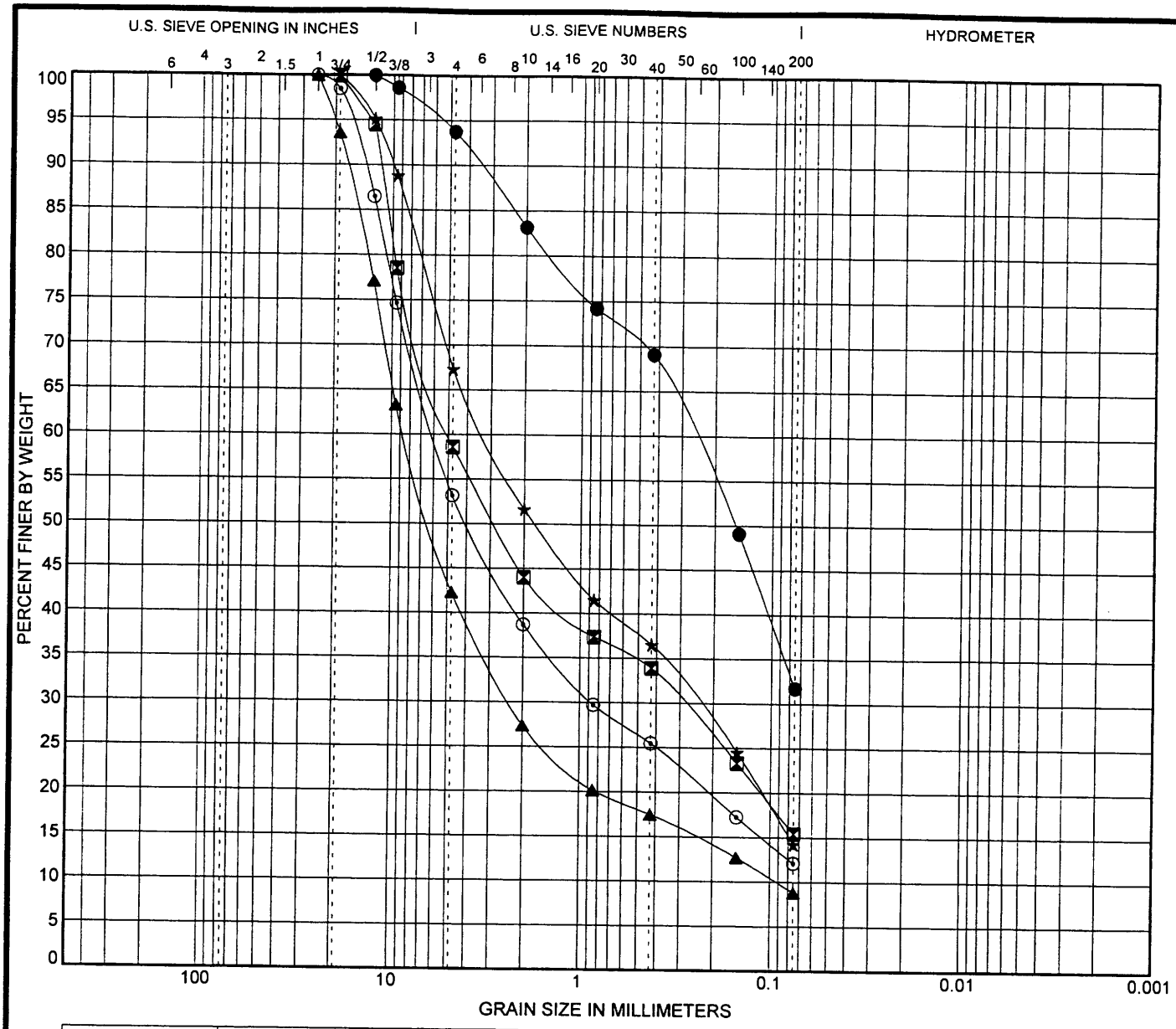
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4i

US_GRAIN_SIZE2_METRIC_0215011.GPJ US_LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WL-06	6.1	CLAYEY SAND (SC)	40	21	19		
⊠	WL-06	10.7	CLAYEY SAND with GRAVEL (SC)	37	20	17		
▲	WL-07	1.5	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	18	17	1	6.93	92.46
★	WL-08	0.3	SILTY SAND with GRAVEL (SM)	NP	NP	NP		
⊙	WL-08	4.6	SILTY GRAVEL with SAND (GM)	19	17	2	2.27	105.09

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WL-06	6.1	12.5	0.264			11.0	6.2	62.0	31.8	
⊠	WL-06	10.7	19	4.984	0.289		3.6	41.4	43.2	15.4	
▲	WL-07	1.5	25	8.513	2.33	0.092	1.0	57.7	33.4	8.9	
★	WL-08	0.3	19	3.165	0.241		0.6	32.6	53.1	14.3	
⊙	WL-08	4.6	25	5.922	0.871		2.1	46.8	41.0	12.1	

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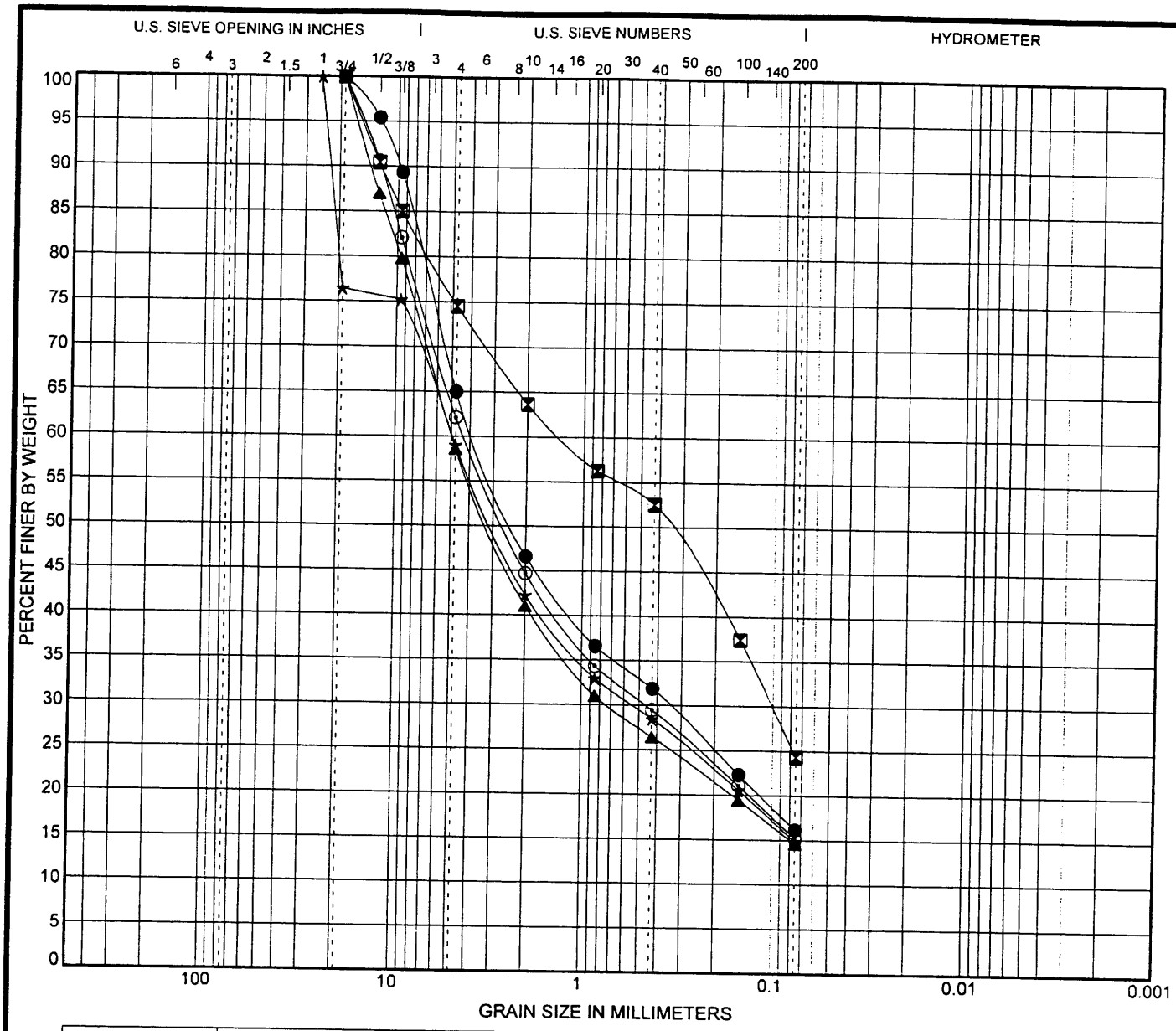
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4j

US_GRAIN_SIZE2_METRIC_0215011.GPJ_US_LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WL-08	7.6	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	25	18	7		
⊠	WL-08	10.7	CLAYEY SAND with GRAVEL (SC)	45	21	24		
▲	WL-09	1.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	19	15	4		
★	WL-09	3.0	SILTY SAND with GRAVEL (SM)	21	18	3		
⊙	WL-10	1.5	SILTY SAND with GRAVEL (SM)	17	16	1		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WL-08	7.6	19	3.75	0.347		3.9	35.0	48.8	16.2	
⊠	WL-08	10.7	19	1.306	0.101		9.4	25.5	50.2	24.3	
▲	WL-09	1.5	19	4.969	0.73		1.8	41.4	44.0	14.6	
★	WL-09	3.0	25	4.949	0.538		1.9	41.0	44.2	14.9	
⊙	WL-10	1.5	19	4.273	0.458		1.7	37.9	46.9	15.2	

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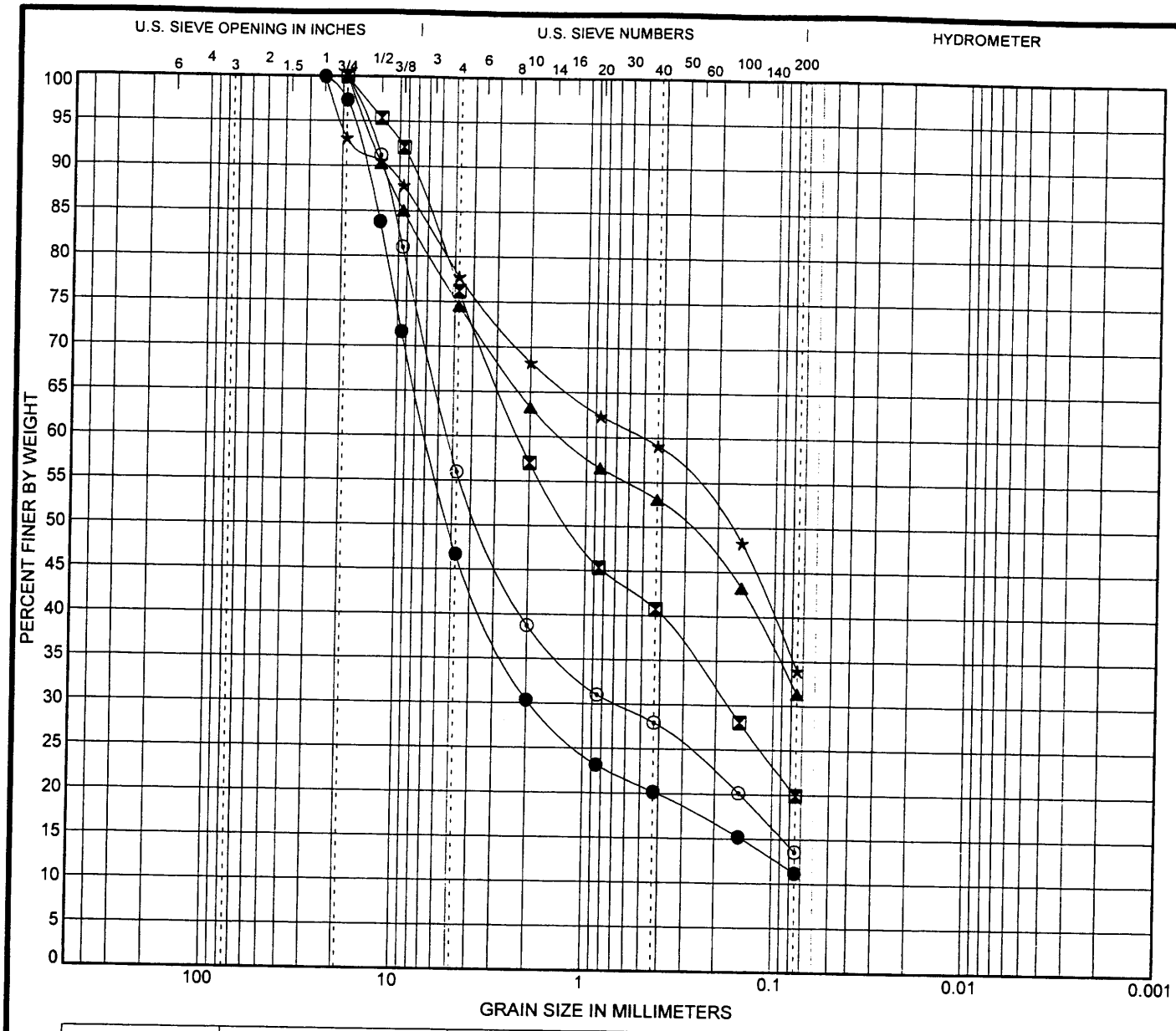
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4k

US GRAIN SIZE2 METRIC 0215011.GPJ US_LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WL-10	3.0	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	27	17	10	8.78	113.40
⊠	WL-10	9.1	CLAYEY SAND with GRAVEL (SC)	40	24	16		
▲	WL-11	0.3	CLAYEY SAND with GRAVEL (SC)	23	14	9		
★	WL-12	0.3	CLAYEY SAND with GRAVEL (SC)	26	14	12		
⊙	WL-12	6.1	CLAYEY GRAVEL with SAND (GC)	27	19	8		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WL-10	3.0	25	6.872	1.912		2.1	53.3	35.5	11.2	
⊠	WL-10	9.1	19	2.282	0.175		5.3	23.8	56.3	19.9	
▲	WL-11	0.3	19	1.315			7.0	25.4	43.2	31.4	
★	WL-12	0.3	25	0.511			7.9	22.2	43.8	34.0	
⊙	WL-12	6.1	19	5.311	0.672		3.0	44.0	42.4	13.6	

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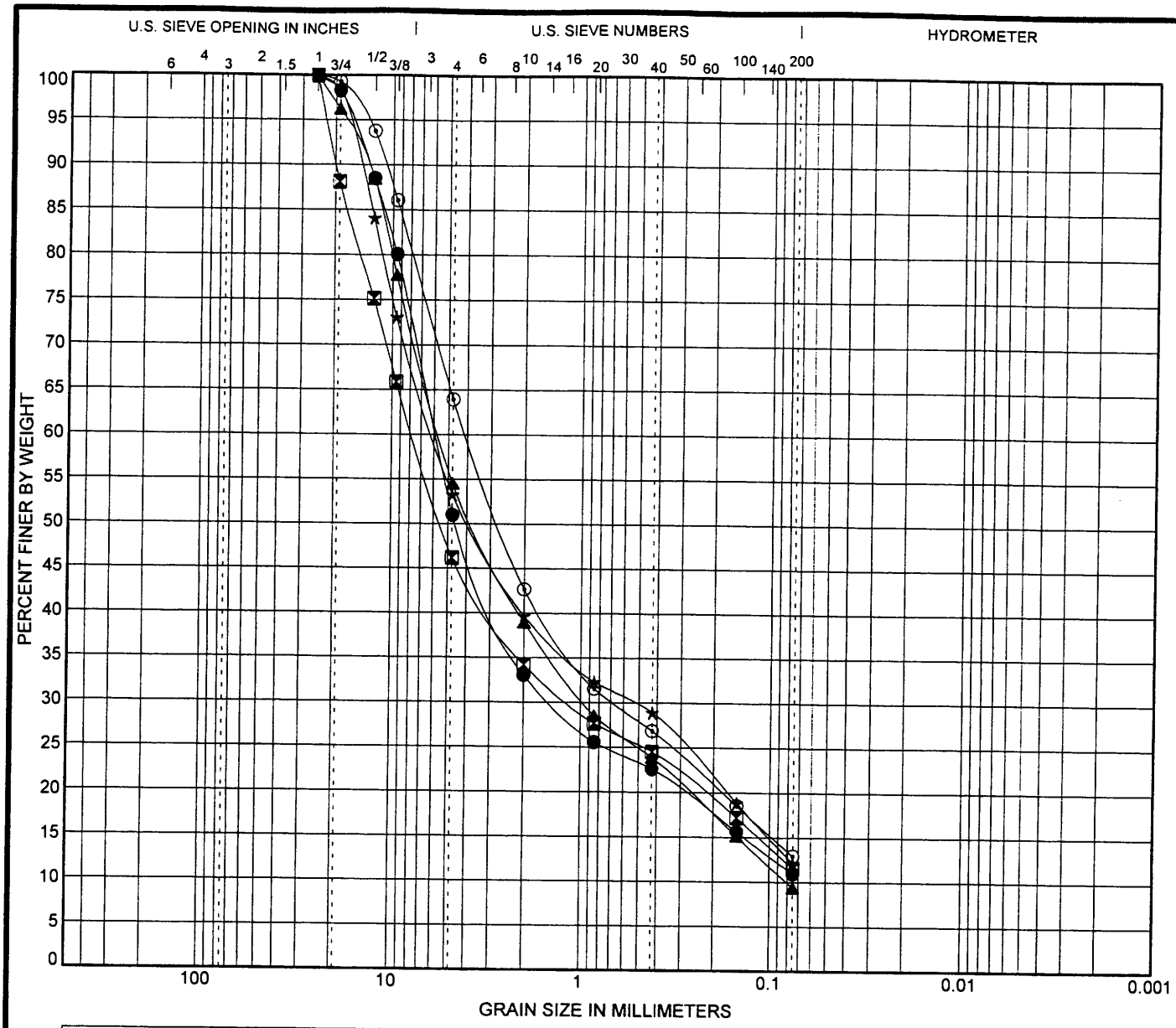
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4l

US GRAIN SIZE2 METRIC 0215011.GPJ US LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WL-12	9.1	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	18	16	2	5.20	90.83
⊠	WL-13	0.3	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	20	16	4	2.78	124.99
▲	WL-13	3.0	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	20	18	2	2.03	69.57
★	WL-14	0.3	SILTY GRAVEL with SAND (GM)	16	16	NP	0.78	100.42
⊙	WL-14	4.6	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	20	16	4		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WL-12	9.1	25	5.884	1.408		2.0	49.0	40.0	11.0	
⊠	WL-13	0.3	25	7.719	1.151		2.1	53.8	34.6	11.6	
▲	WL-13	3.0	25	5.587	0.955	0.08	2.3	45.4	45.1	9.4	
★	WL-14	0.3	25	6.003	0.528		2.1	46.7	41.1	12.2	
⊙	WL-14	4.6	25	4.043	0.675		2.3	36.0	51.0	12.9	

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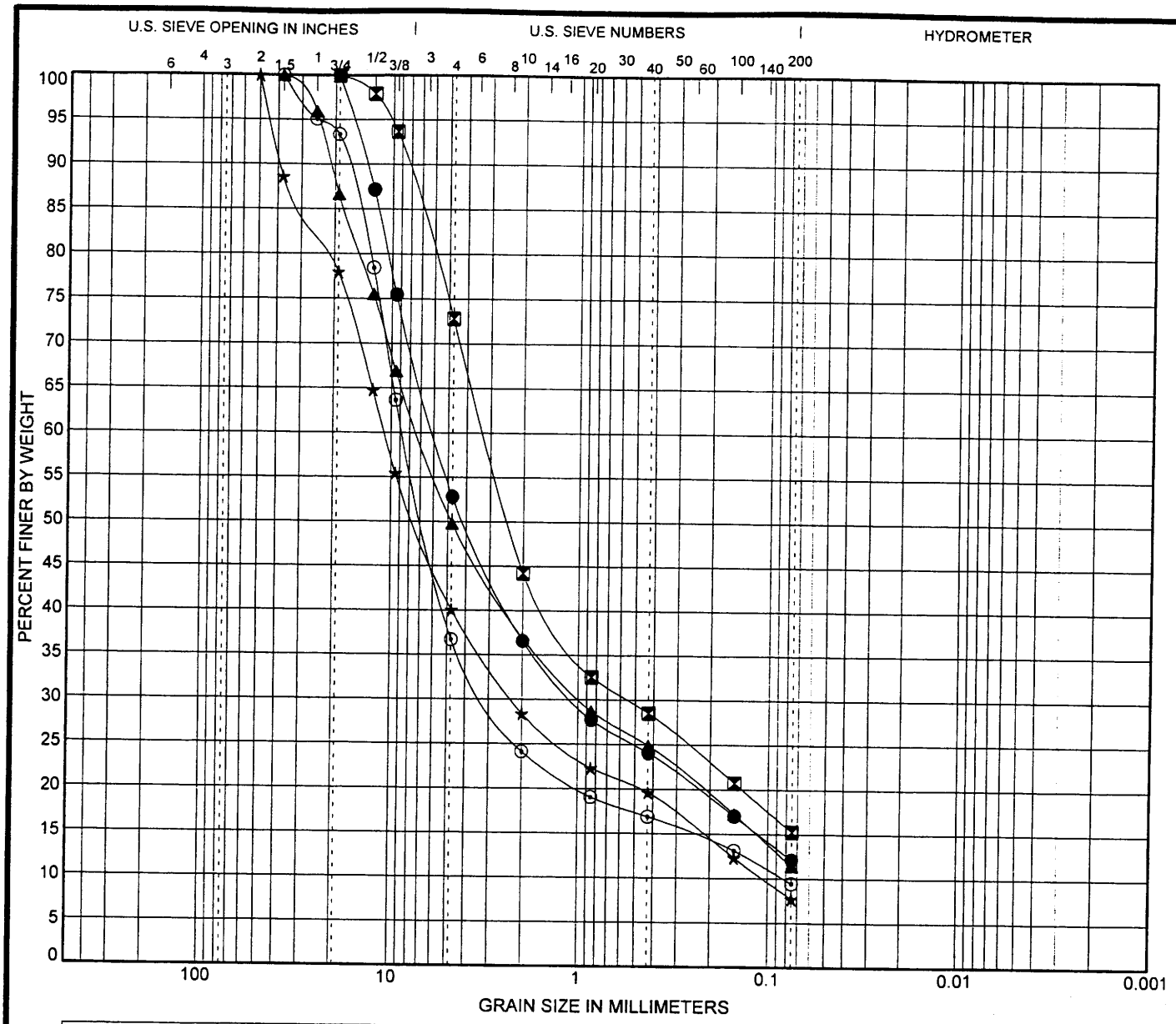
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WL-14	7.6	SILTY GRAVEL with SAND (GM)	20	17	3	3.39	106.60
⊠	WL-14	10.7	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	22	16	6		
▲	WL-15	1.5	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	21	17	4	2.07	113.41
★	WL-15	3.0	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	21	19	2	4.45	103.40
⊙	WL-16	0.6	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	17	16	1	12.51	104.32

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WL-14	7.6	19	5.914	1.055		1.9	47.2	40.7	12.1	
⊠	WL-14	10.7	19	3.222	0.547		2.6	27.2	57.5	15.3	
▲	WL-15	1.5	37.5	7.178	0.971		2.4	50.2	38.4	11.4	
★	WL-15	3.0	50	10.853	2.252	0.105	2.4	59.9	32.3	7.8	
⊙	WL-16	0.6	37.5	8.644	2.994	0.083	1.7	63.3	27.2	9.5	

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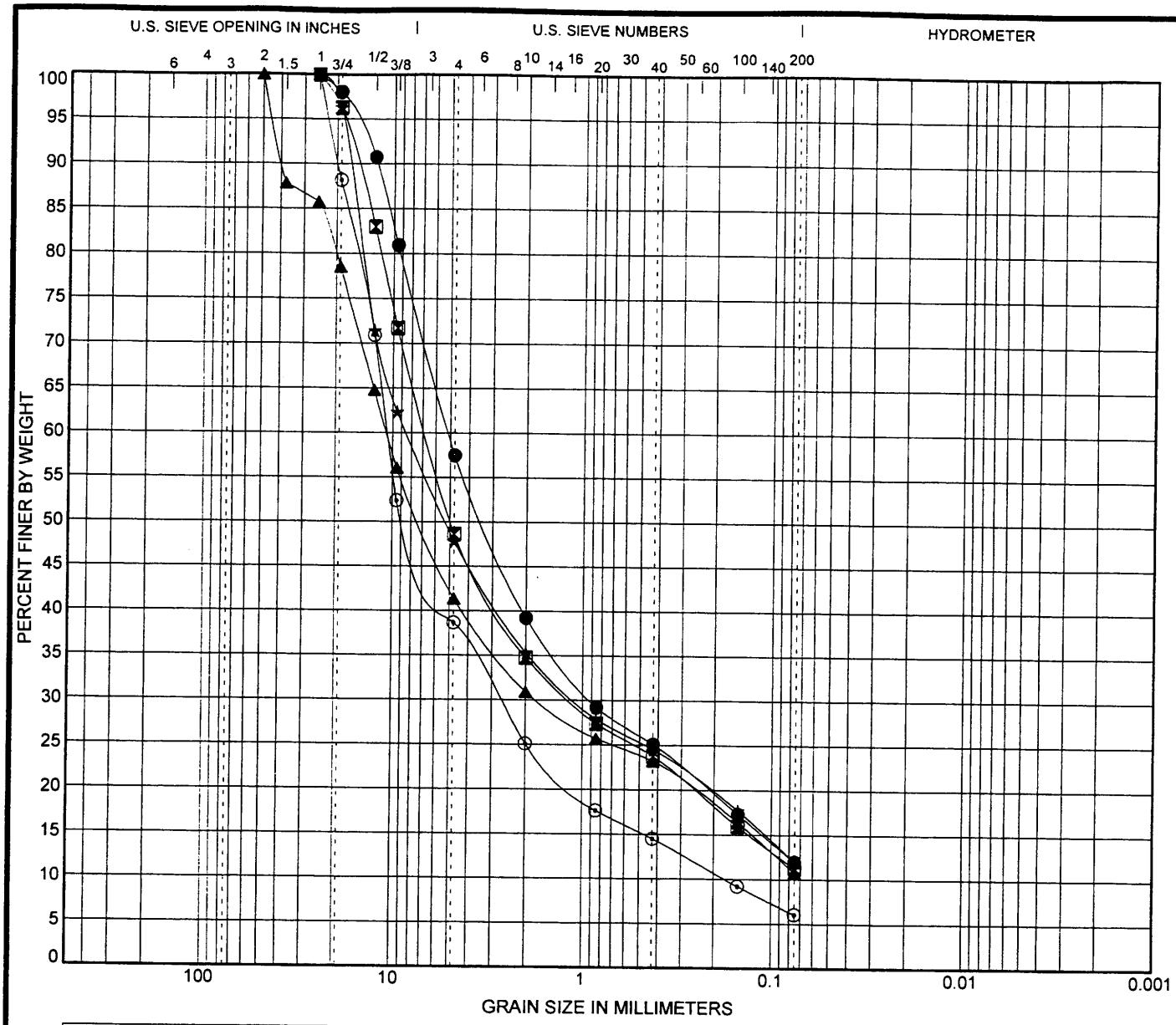
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4n

US GRAIN SIZE2 METRIC 0215011.GPJ US LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WL-16	4.6	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	NP	NP	NP	2.78	88.30
⊠	WL-16	9.1	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	19	15	4	3.19	108.01
▲	WL-17	0.6	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	17	16	1	4.05	158.13
★	WL-17	3.0	SILTY GRAVEL with SAND (GM)	18	16	2	2.35	144.11
⊙	WL-18	0.6	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	25	19	6	4.03	61.03

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WL-16	4.6	25	5.113	0.908		2.3	42.5	45.5	12.0	
⊠	WL-16	9.1	25	6.676	1.148		2.3	51.3	37.4	11.3	
▲	WL-17	0.6	50	10.748	1.721		3.1	58.6	30.6	10.8	
★	WL-17	3.0	25	8.48	1.082		2.5	52.2	35.8	12.0	
⊙	WL-18	0.6	25	10.632	2.734	0.174	0.9	61.3	32.6	6.1	

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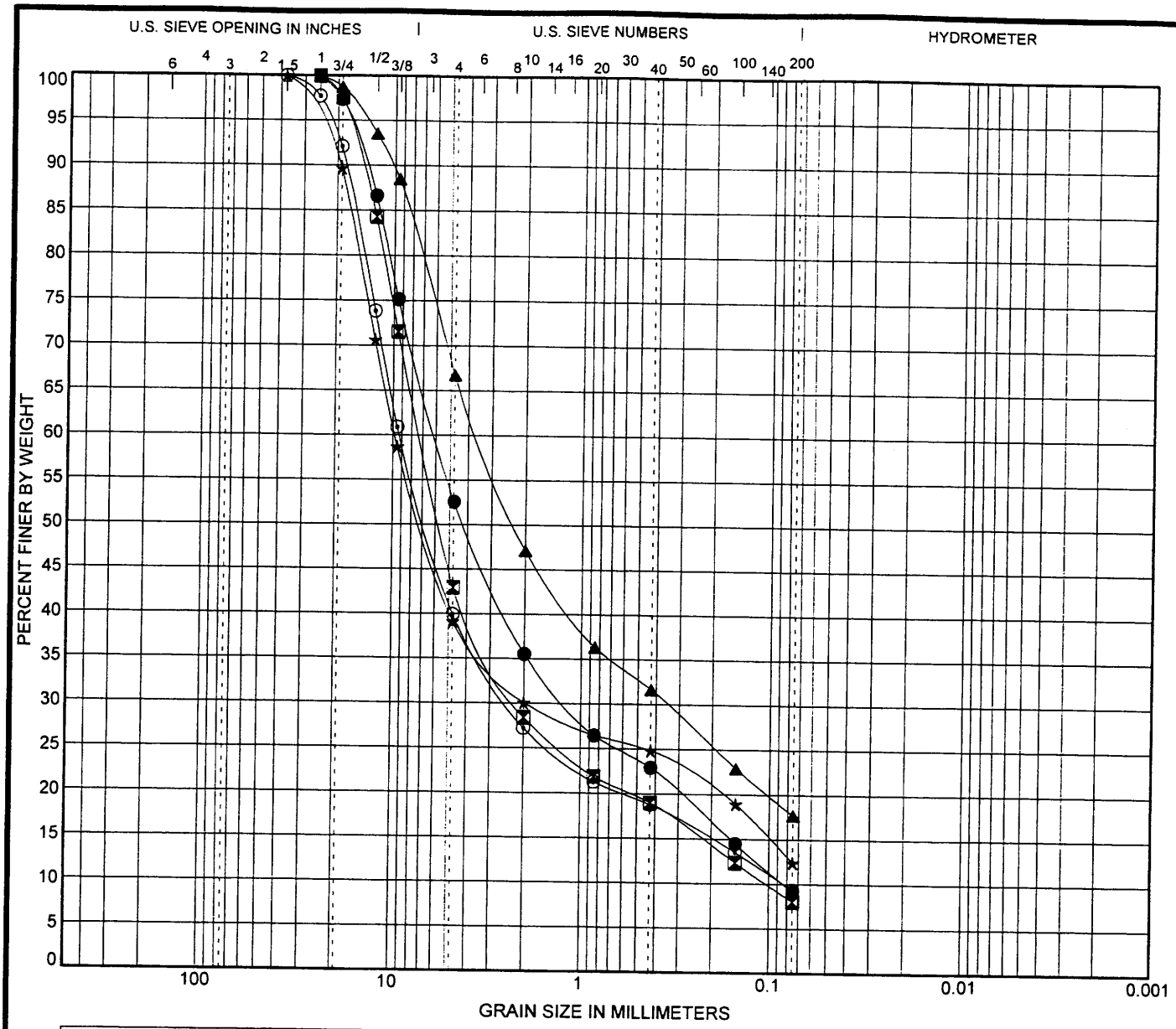
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4o



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WL-18	4.6	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	NP	NP	NP	2.82	71.41
⊠	WL-18	7.6	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	NP	NP	NP	6.57	70.26
▲	WL-18	10.7	SILTY SAND with GRAVEL (SM)	19	16	3		
★	WR-01	0.3	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	23	16	7	6.79	169.14
⊙	WR-01	3.0	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	21	17	4	7.62	110.97

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WL-18	4.6	25	5.963	1.185	0.083	1.2	47.4	43.4	9.2	
⊠	WL-18	7.6	25	7.176	2.194	0.102	0.8	57.0	34.9	8.1	
▲	WL-18	10.7	25	3.528	0.349		2.1	33.2	49.0	17.7	
★	WR-01	0.3	37.5	9.782	1.96		2.5	60.9	26.7	12.4	
⊙	WR-01	3.0	37.5	9.216	2.415	0.083	1.5	60.1	30.6	9.4	

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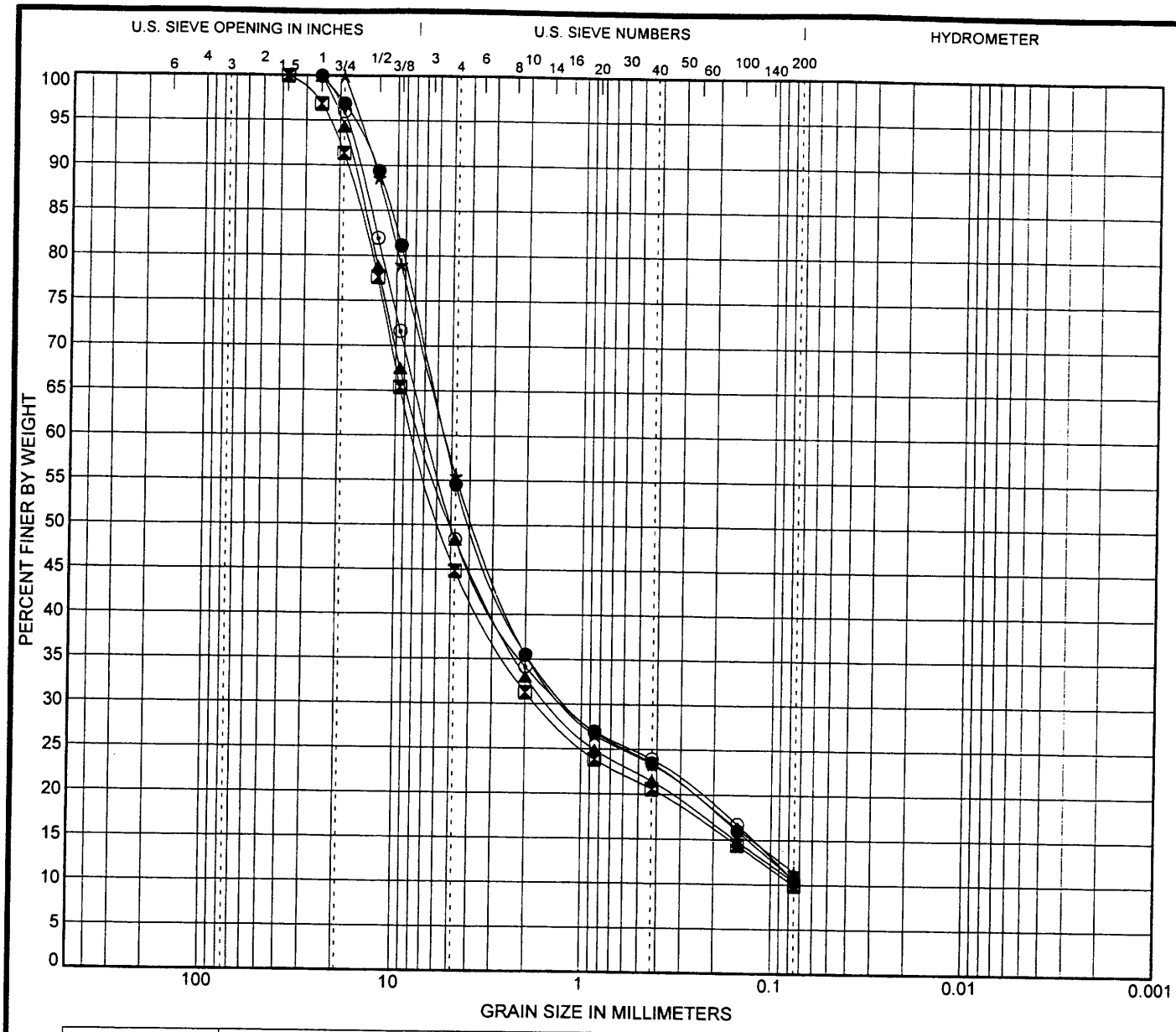
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4p



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WR-02	1.5	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	23	17	6	3.54	78.89
⊠	WR-02	4.6	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	24	17	7	4.96	104.58
▲	WR-02	7.6	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	23	16	7	4.16	103.44
★	WR-02	10.7	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	22	17	5	4.23	89.09
⊙	WR-03	0.3	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	18	16	2	3.13	94.90

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WR-02	1.5	25	5.473	1.159		2.2	45.4	44.0	10.6	
⊠	WR-02	4.6	37.5	7.913	1.724	0.076	2.1	55.1	34.9	9.9	
▲	WR-02	7.6	25	7.236	1.451		2.1	51.6	37.9	10.4	
★	WR-02	10.7	19	5.426	1.183		2.5	44.5	44.0	11.4	
⊙	WR-03	0.3	25	6.712	1.219		2.0	51.6	37.9	10.5	

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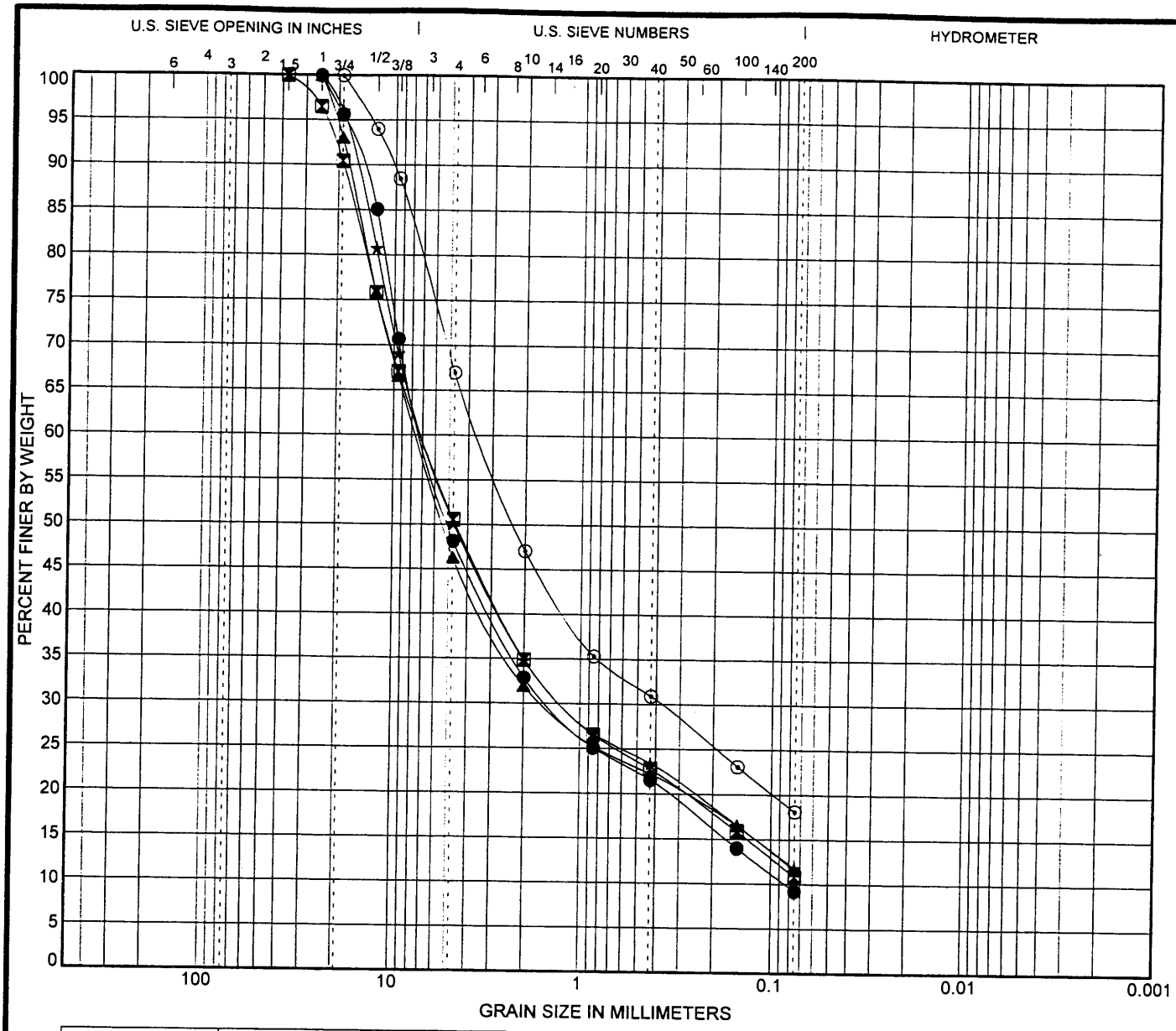
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4q



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WR-03	3.0	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	18	17	1	3.71	81.78
⊠	WR-04	0.3	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	16	16	NP	3.11	105.79
▲	WR-04	4.6	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	32	18	14	5.37	126.84
★	WR-04	7.6	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	23	17	6	3.69	118.15
⊙	WR-04	10.7	CLAYEY SAND with GRAVEL (SC)	45	22	23		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WR-03	3.0	25	6.836	1.457	0.084	1.8	51.8	38.9	9.3	
⊠	WR-04	0.3	37.5	7.056	1.211		1.7	49.4	39.7	10.9	
▲	WR-04	4.6	25	7.582	1.56		2.4	53.7	34.7	11.6	
★	WR-04	7.6	25	6.812	1.203		2.2	49.9	38.3	11.8	
⊙	WR-04	10.7	19	3.506	0.377		4.5	33.0	48.9	18.1	

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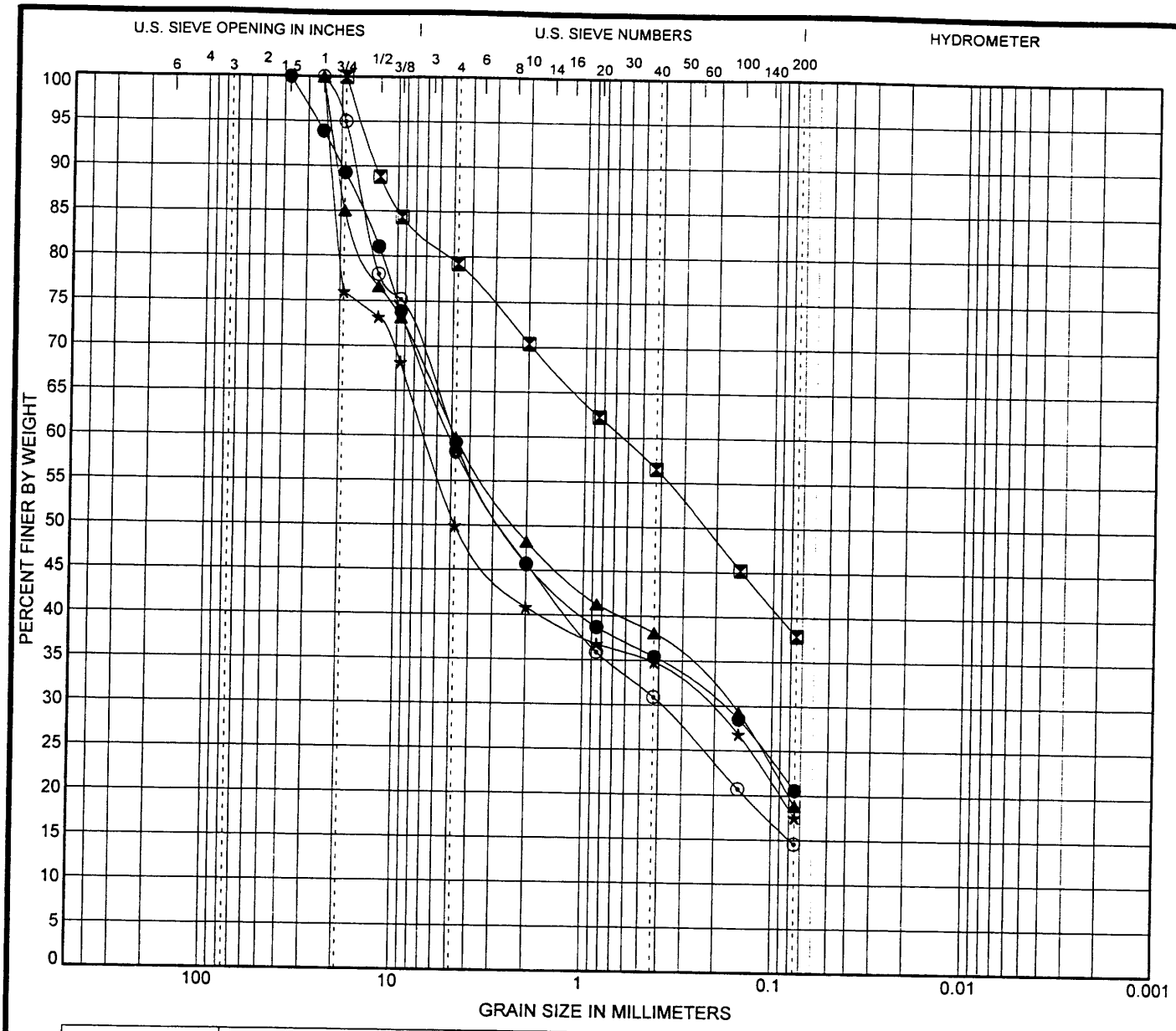
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4r

US GRAIN SIZE2 METRIC 0215011.GPJ US LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WR-06	0.3	CLAYEY GRAVEL with SAND (GC)	45	25	20		
⊠	WR-06	6.1	CLAYEY SAND with GRAVEL (SC)	52	24	28		
▲	WR-07	0.0	CLAYEY SAND with GRAVEL (SC)	26	18	8		
★	WR-08	0.3	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	25	18	7		
⊙	WR-08	3.0	CLAYEY SAND with GRAVEL (SC)	36	22	14		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WR-06	0.3	37.5	5.126	0.187		6.4	41.7	37.7	20.6	
⊠	WR-06	6.1	19	0.643			10.4	20.8	41.3	37.9	
▲	WR-07	0.0	25	4.804	0.163		4.1	40.2	40.9	18.9	
★	WR-08	0.3	25	6.956	0.226		5.8	50.0	32.4	17.6	
⊙	WR-08	3.0	25	4.895	0.387		4.1	40.7	44.7	14.6	

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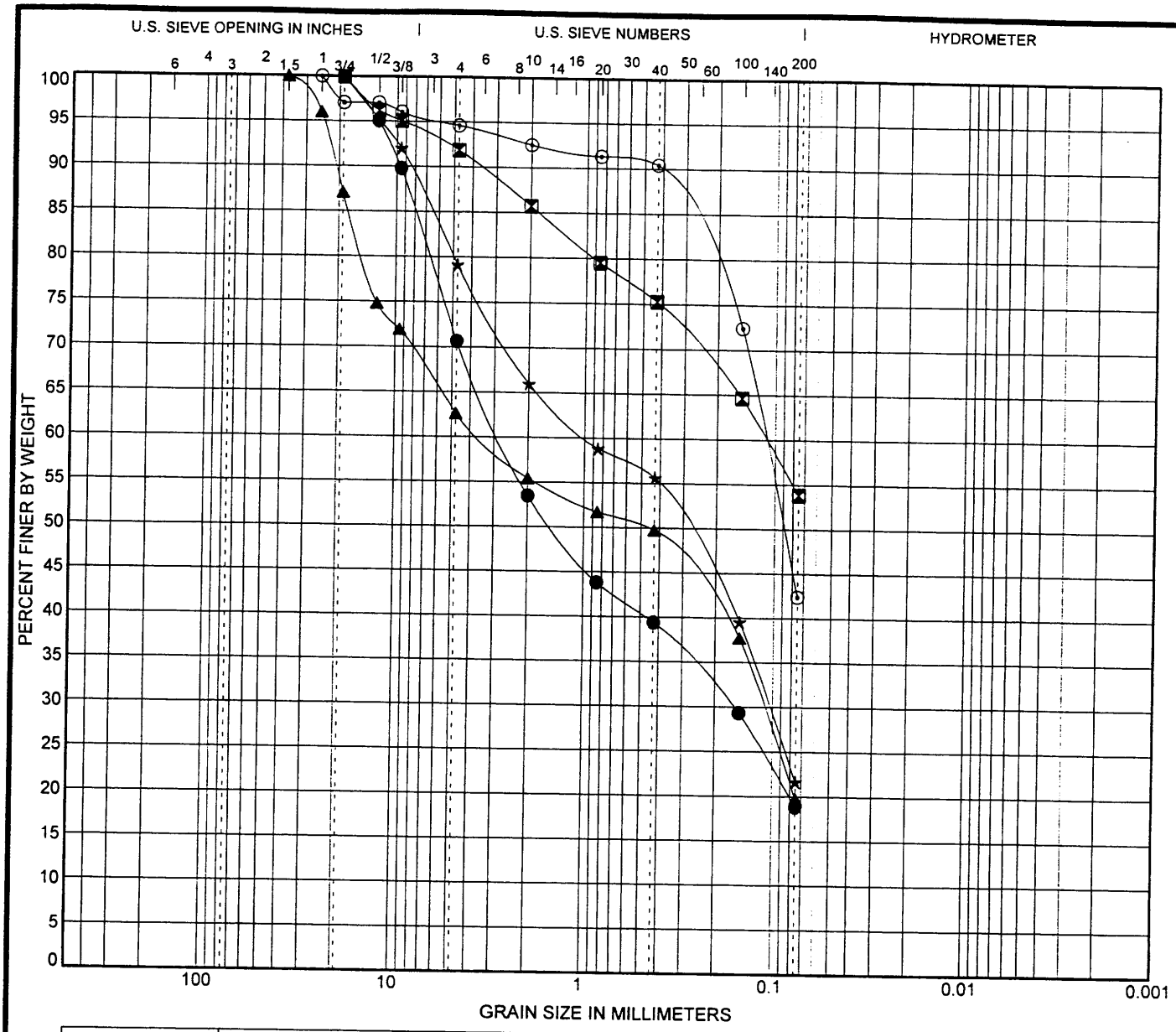
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4s

US GRAIN SIZE2 METRIC 0215011.GPJ US_LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WR-09	1.5	CLAYEY SAND with GRAVEL (SC)	34	21	13		
⊠	WR-09	3.0	SANDY LEAN CLAY (CL)	37	21	16		
▲	WR-10	0.3	SILTY SAND with GRAVEL (SM)	17	18	NP		
★	WR-11	0.3	SILTY SAND with GRAVEL (SM)	16	16	NP		
⊙	WR-11	3.7	CLAYEY SAND (SC)	34	12	22		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WR-09	1.5	19	2.774	0.16		3.7	29.3	51.8	18.9	
⊠	WR-09	3.0	19	0.111			11.9	8.1	38.0	53.9	
▲	WR-10	0.3	37.5	3.46	0.111		3.2	37.4	42.9	19.8	
★	WR-11	0.3	19	0.975	0.103		4.6	20.8	57.5	21.7	
⊙	WR-11	3.7	25	0.113			11.1	5.4	52.2	42.4	

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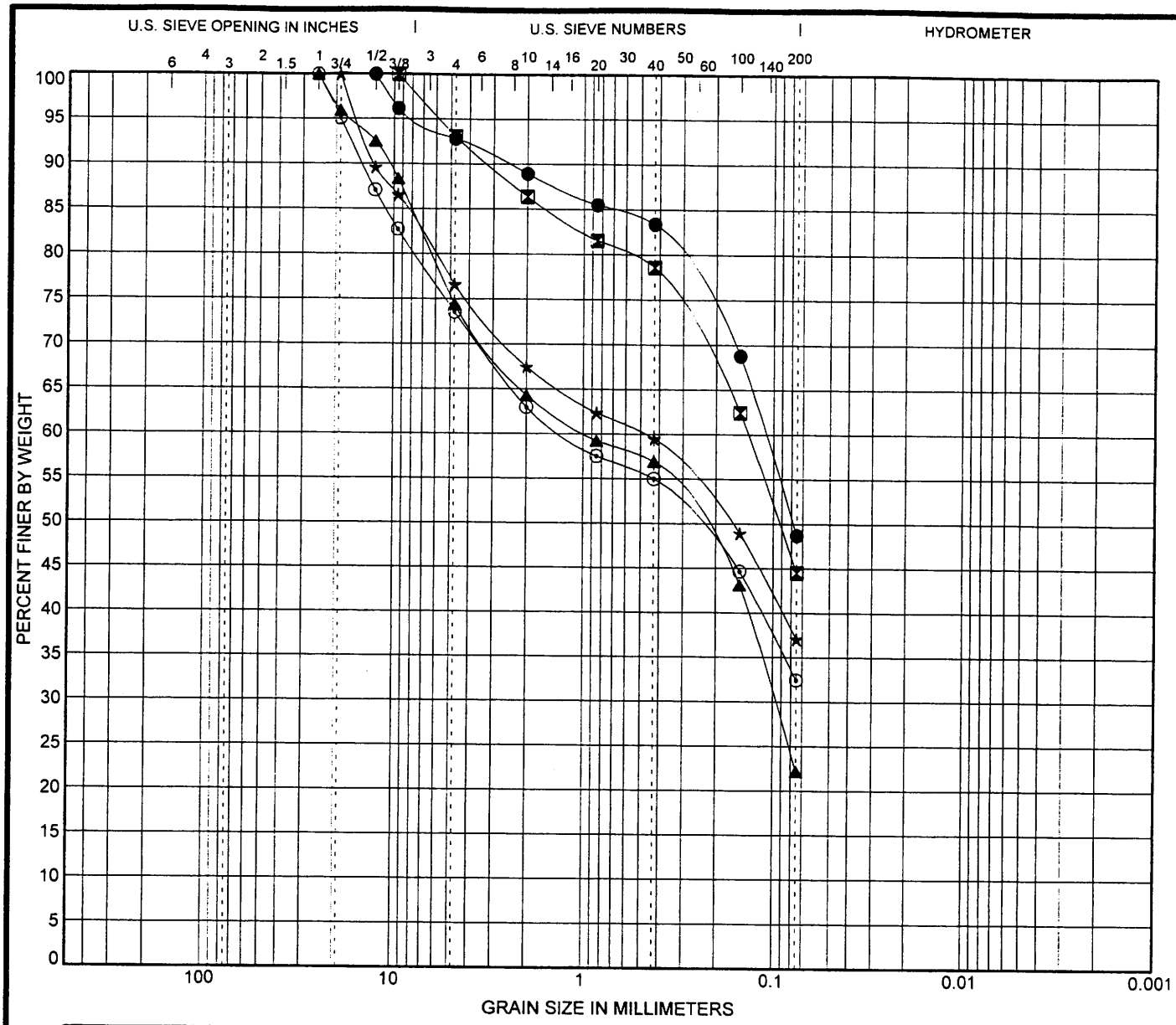
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4t

US GRAIN SIZE2 METRIC 0215011.GPJ US LAB.GDT 6/16/00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	WR-12	7.6	CLAYEY SAND (SC)	25	15	10		
⊠	WR-12	10.7	CLAYEY SAND (SC)	56	26	30		
▲	WR-13	0.3	SILTY SAND with GRAVEL (SM)	16	16	NP		
★	WR-13	3.0	CLAYEY SAND with GRAVEL (SC)	39	21	18		
⊙	WR-14	1.5	CLAYEY SAND with GRAVEL (SC)	26	15	11		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	WR-12	7.6	12.5	0.111			9.5	7.1	44.1	48.7	
⊠	WR-12	10.7	9.5	0.136			16.0	6.9	48.6	44.5	
▲	WR-13	0.3	25	0.961	0.097		2.7	25.5	52.3	22.2	
★	WR-13	3.0	19	0.476			9.0	23.4	39.5	37.1	
⊙	WR-14	1.5	25	1.251			7.0	26.4	41.1	32.5	

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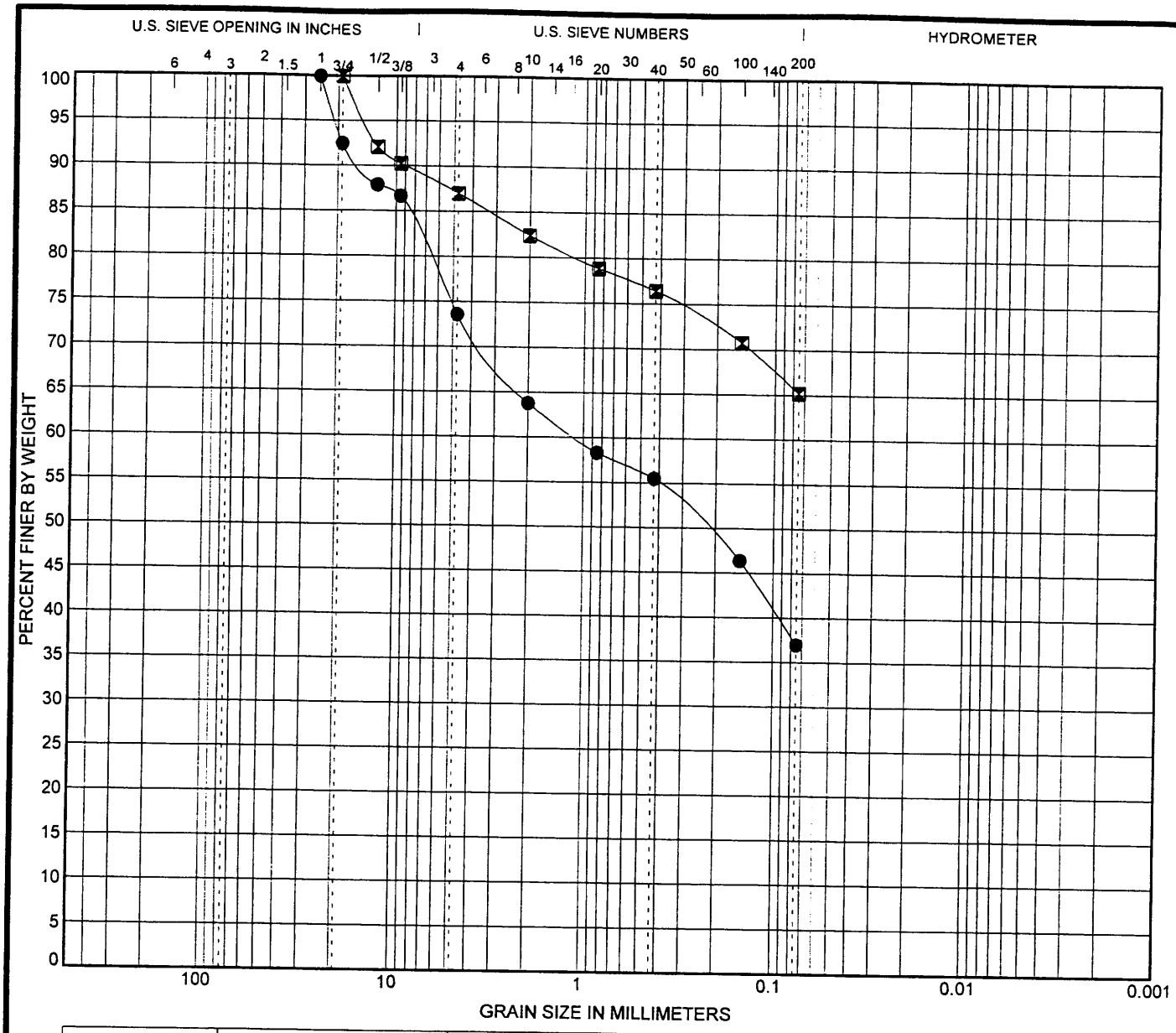
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4u



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: Sample Depth in meters.

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● WR-14	3.0	CLAYEY SAND with GRAVEL (SC)	54	27	27		
⊠ WR-14	6.1	SANDY LEAN CLAY (CL)	48	21	27		

Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
● WR-14	3.0	25	1.102			11.3	26.4	36.6	37.0	
⊠ WR-14	6.1	19				13.3	13.0	21.8	65.2	

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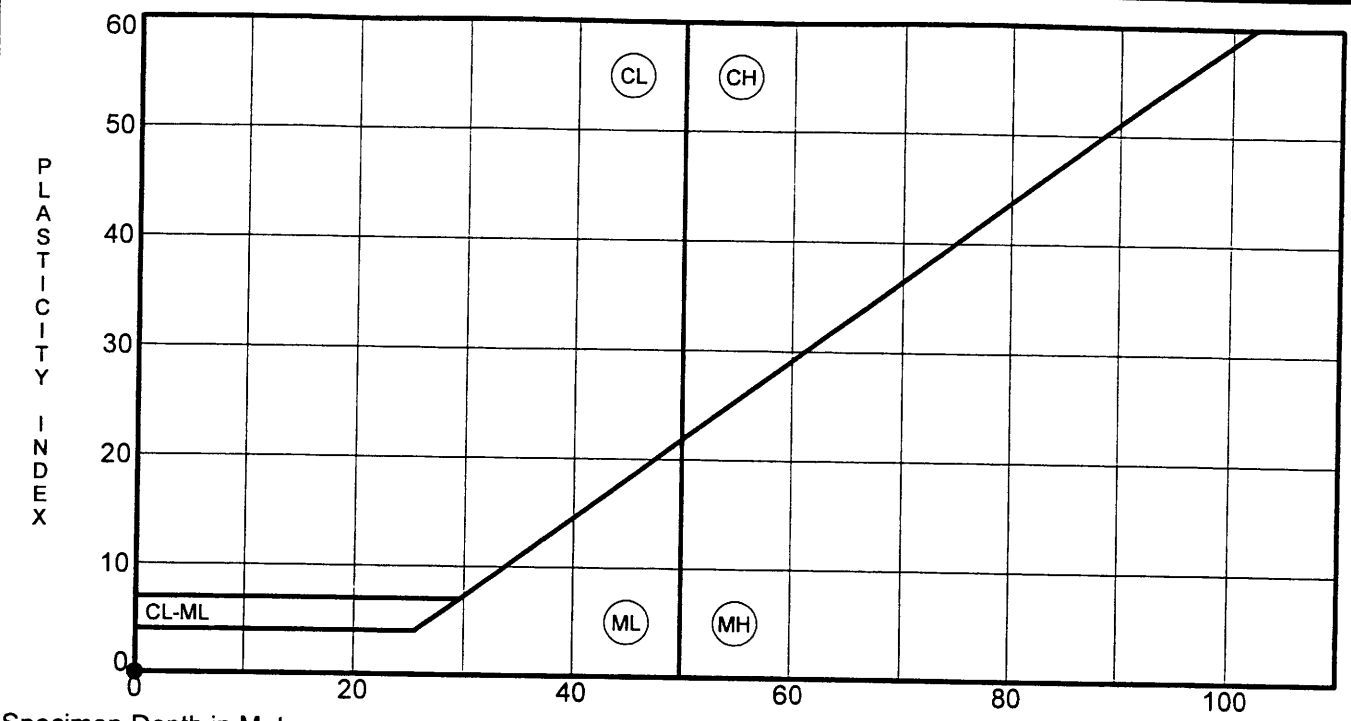
GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4v

US GRAIN SIZE2 METRIC 0215011.GPJ US LAB.GDT 6/16/00



Specimen Depth in Meters.

	Specimen Identification		LL	PL	PI	Fines	Classification
●	TP-01	1.5	NP	NP	NP	11	POORLY GRADED GRAVEL with SILT and SAND GP-GM

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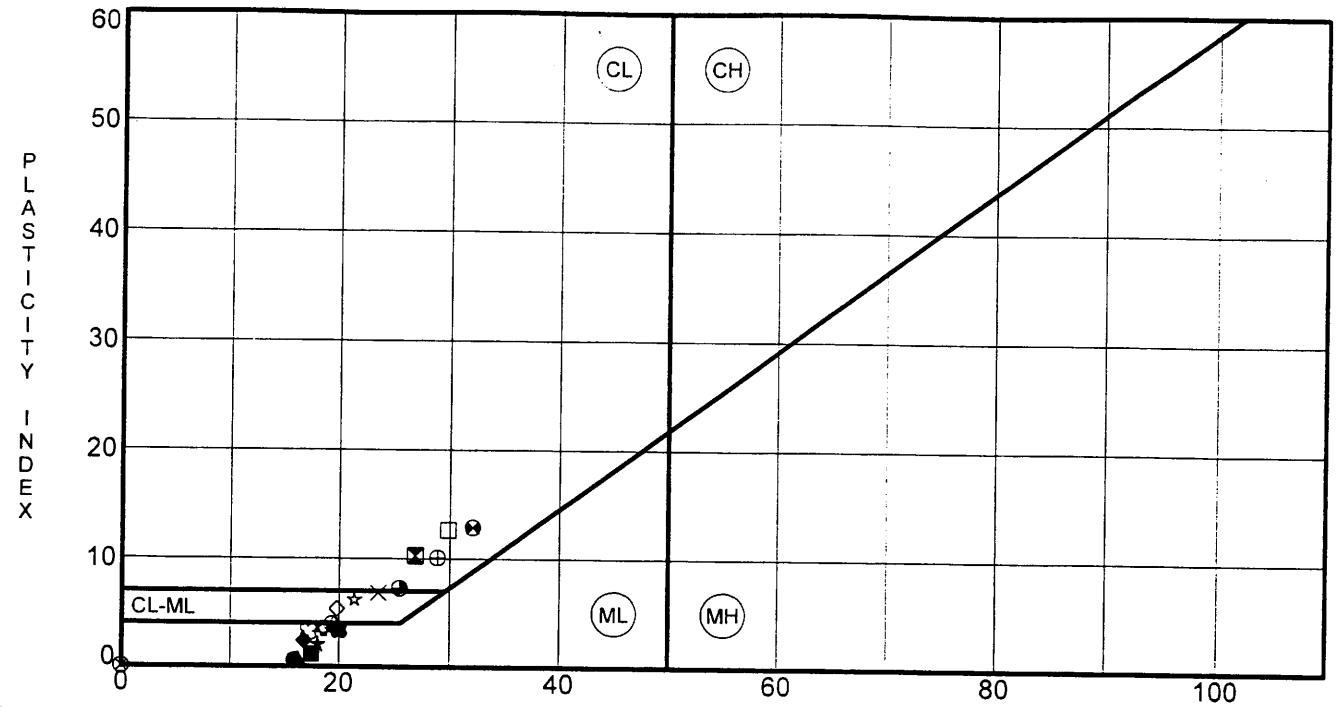
ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4w



Specimen Depth in Meters.

Specimen Identification			LL	PL	PI	Fines	Classification
●	R-01	0.3	16	15	1	14	SILTY SAND with GRAVEL SM
⊠	R-03	0.5	27	17	10	14	CLAYEY GRAVEL with SAND GC
▲	R-04	1.4	16	15	1	16	SILTY SAND with GRAVEL SM
★	R-05	1.4	18	16	2	27	SILTY GRAVEL with SAND GM
⊙	R-06	2.7	NP	NP	NP	12	SILTY SAND with GRAVEL SM
✿	R-07	0.5	19	15	4	11	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC
○	R-08	1.5	19	15	4	16	SILTY, CLAYEY SAND with GRAVEL SC-SM
△	R-09	2.7	20	15	5	13	SILTY, CLAYEY SAND with GRAVEL SC-SM
⊗	R-10	1.5	NP	NP	NP	9	POORLY GRADED GRAVEL with SILT and SAND GP-GM
⊕	R-11	0.5	29	19	10	12	POORLY GRADED GRAVEL with CLAY and SAND GP-GC
□	R-12	2.7	30	17	13	21	CLAYEY SAND with GRAVEL SC
⊗	R-13	2.7	32	19	13	26	CLAYEY SAND with GRAVEL SC
◒	R-14	1.5	25	18	7	19	SILTY, CLAYEY SAND with GRAVEL SC-SM
☆	R-15	0.5	21	15	6	17	SILTY, CLAYEY GRAVEL with SAND GC-GM
⊠	R-16	1.2	17	14	3	22	SILTY SAND with GRAVEL SM
■	R-17	0.3	17	16	1	18	SILTY SAND with GRAVEL SM
◆	R-18	1.5	17	14	3	17	SILTY SAND with GRAVEL SM
◇	R-19	0.5	20	14	6	20	SILTY, CLAYEY SAND with GRAVEL SC-SM
×	R-20	0.3	24	17	7	12	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC
✖	R-21	1.5	20	17	3	16	SILTY SAND with GRAVEL SM

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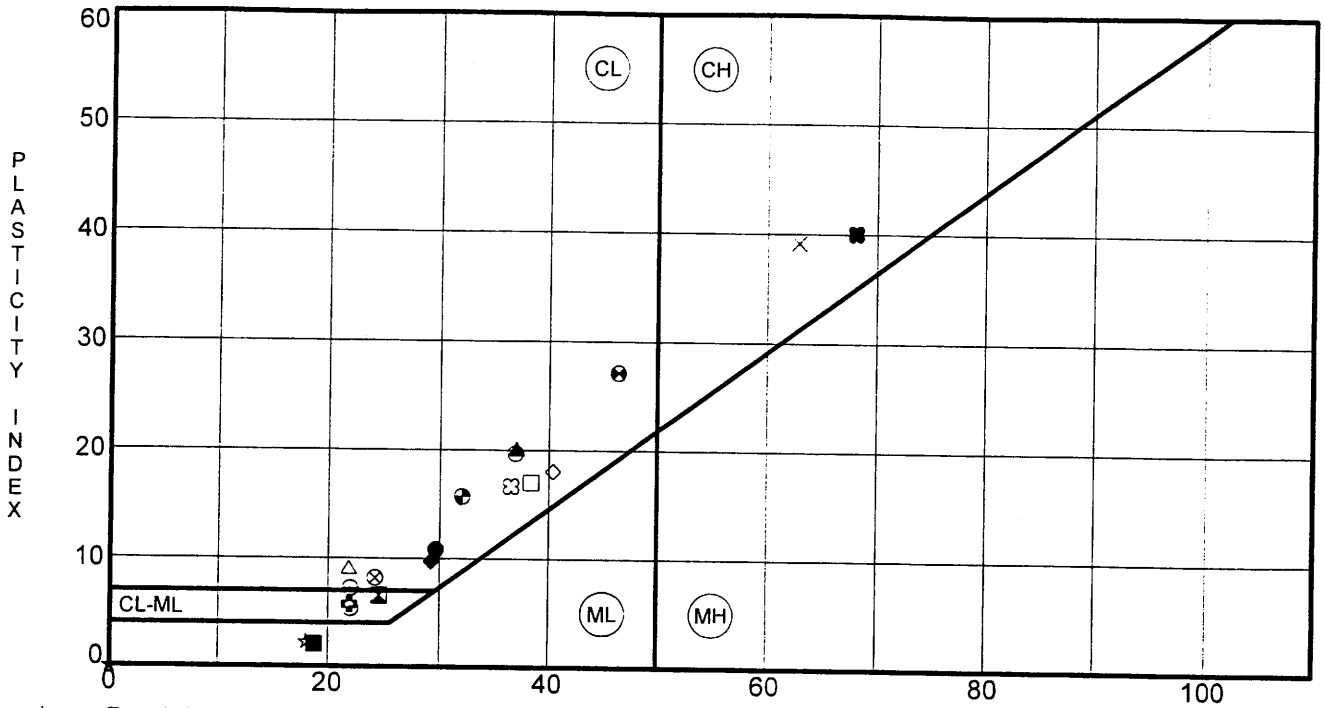
ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4x



Specimen Depth in Meters.

Specimen Identification			LL	PL	PI	Fines	Classification
●	R-22	2.7	30	19	11	11	WELL-GRADED SAND with CLAY and GRAVEL SW-SC
⊠	R-23	0.5	25	18	7	9	POORLY GRADED GRAVEL with SILTY CLAY and SAND GP-GC
▲	R-24	2.7	37	17	20	30	CLAYEY SAND with GRAVEL SC
★	R-25	0.3	NP	NP	NP	18	SILTY SAND with GRAVEL SM
⊙	R-26	1.5	22	17	5	17	SILTY, CLAYEY SAND with GRAVEL SC-SM
✿	R-27	0.5	22	16	6	12	SILTY, CLAYEY GRAVEL with SAND GC-GM
○	R-28	2.7	37	17	20	38	CLAYEY SAND SC
△	R-29	1.5	22	13	9	28	CLAYEY SAND with GRAVEL SC
⊗	WL-01	0.3	24	16	8	15	CLAYEY GRAVEL with SAND GC
⊕	WL-01	3.0	22	15	7	16	SILTY, CLAYEY SAND with GRAVEL SC-SM
□	WL-02	1.5	38	21	17	23	CLAYEY SAND with GRAVEL SC
◍	WL-02	6.1	46	19	27	38	CLAYEY SAND SC
◕	WL-02	10.7	32	16	16	49	CLAYEY SAND SC
☆	WL-03	0.3	18	16	2	10	POORLY GRADED GRAVEL with SILT and SAND GP-GM
⊠	WL-03	4.6	37	20	17	15	CLAYEY SAND with GRAVEL SC
■	WL-04	0.3	19	17	2	10	WELL-GRADED GRAVEL with SILT and SAND GW-GM
◆	WL-04	3.0	29	19	10	13	CLAYEY GRAVEL with SAND GC
◇	WL-04	4.6	40	22	18	45	CLAYEY SAND SC
×	WL-04	6.1	63	24	39	55	SANDY FAT CLAY CH
✖	WL-04	10.7	68	28	40	22	CLAYEY SAND with GRAVEL SC

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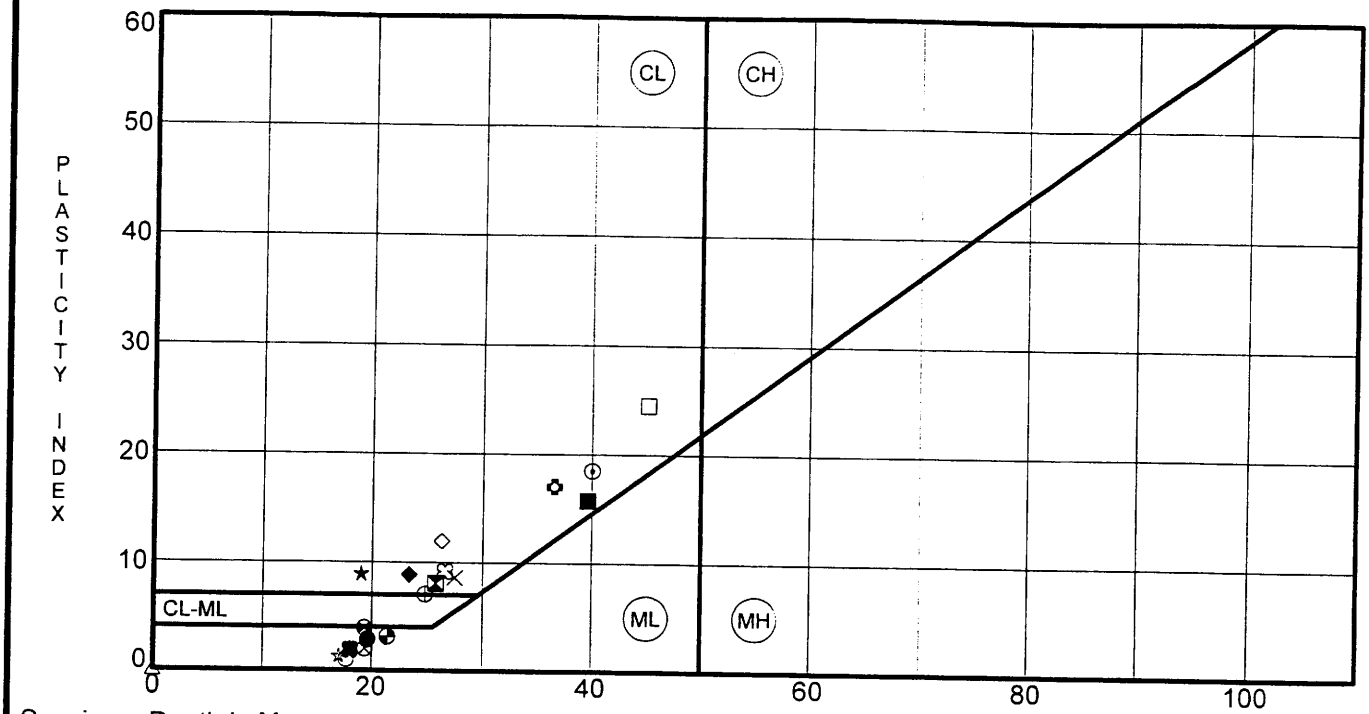
ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4y



Specimen Depth in Meters.

Specimen Identification			LL	PL	PI	Fines	Classification
●	WL-05	0.3	20	17	3	11	WELL-GRADED SAND with SILT and GRAVEL SW-SM
⧓	WL-05	3.0	26	18	8	12	CLAYEY GRAVEL with SAND GC
▲	WL-06	0.3	18	16	2	11	POORLY GRADED GRAVEL with SILT and SAND GP-GM
★	WL-06	3.0	19	10	9	15	CLAYEY SAND with GRAVEL SC
⊙	WL-06	6.1	40	21	19	32	CLAYEY SAND SC
✿	WL-06	10.7	37	20	17	15	CLAYEY SAND with GRAVEL SC
○	WL-07	1.5	18	17	1	9	POORLY GRADED GRAVEL with SILT and SAND GP-GM
△	WL-08	0.3	NP	NP	NP	14	SILTY SAND with GRAVEL SM
⊗	WL-08	4.6	19	17	2	12	SILTY GRAVEL with SAND GM
⊖	WL-08	7.6	25	18	7	16	SILTY, CLAYEY SAND with GRAVEL SC-SM
□	WL-08	10.7	45	21	24	24	CLAYEY SAND with GRAVEL SC
◓	WL-09	1.5	19	15	4	15	SILTY, CLAYEY SAND with GRAVEL SC-SM
◔	WL-09	3.0	21	18	3	15	SILTY SAND with GRAVEL SM
☆	WL-10	1.5	17	16	1	15	SILTY SAND with GRAVEL SM
⊠	WL-10	3.0	27	17	10	11	POORLY GRADED GRAVEL with CLAY and SAND GP-GC
■	WL-10	9.1	40	24	16	20	CLAYEY SAND with GRAVEL SC
◆	WL-11	0.3	23	14	9	31	CLAYEY SAND with GRAVEL SC
◇	WL-12	0.3	26	14	12	34	CLAYEY SAND with GRAVEL SC
╳	WL-12	6.1	27	19	8	14	CLAYEY GRAVEL with SAND GC
✖	WL-12	9.1	18	16	2	11	POORLY GRADED GRAVEL with SILT and SAND GP-GM

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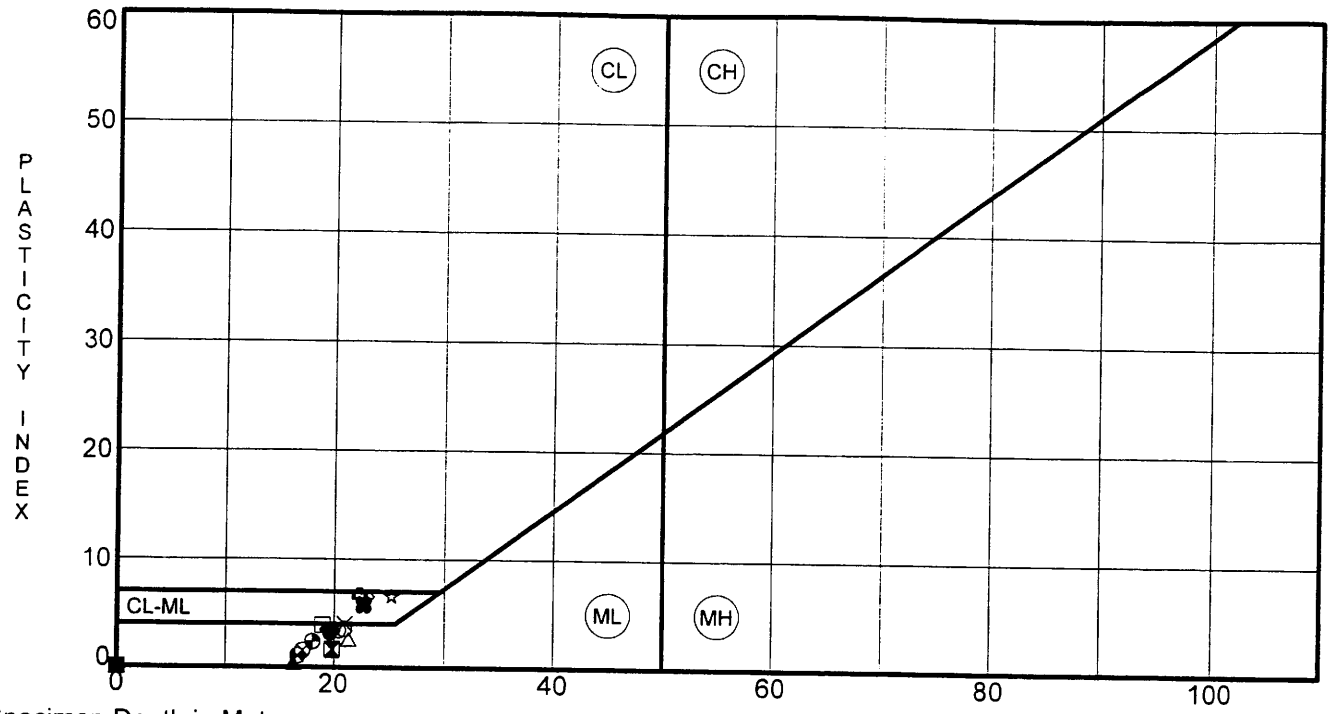
ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4z



Specimen Depth in Meters.

	Specimen Identification		LL	PL	PI	Fines	Classification
●	WL-13	0.3	20	16	4	12	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC
⊠	WL-13	3.0	20	18	2	9	WELL-GRADED GRAVEL with SILT and SAND GW-GM
▲	WL-14	0.3	16	16	NP	12	SILTY GRAVEL with SAND GM
★	WL-14	4.6	20	16	4	13	SILTY, CLAYEY SAND with GRAVEL SC-SM
⊙	WL-14	7.6	20	17	3	12	SILTY GRAVEL with SAND GM
✿	WL-14	10.7	22	16	6	15	SILTY, CLAYEY SAND with GRAVEL SC-SM
○	WL-15	1.5	21	17	4	11	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC
△	WL-15	3.0	21	19	2	8	POORLY GRADED GRAVEL with SILT and SAND GP-GM
⊗	WL-16	0.6	17	16	1	9	POORLY GRADED GRAVEL with SILT and SAND GP-GM
⊕	WL-16	4.6	NP	NP	NP	12	WELL-GRADED SAND with SILT and GRAVEL SW-SM
□	WL-16	9.1	19	15	4	11	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC
⊖	WL-17	0.6	17	16	1	11	POORLY GRADED GRAVEL with SILT and SAND GP-GM
◒	WL-17	3.0	18	16	2	12	SILTY GRAVEL with SAND GM
☆	WL-18	0.6	25	19	6	6	POORLY GRADED GRAVEL with SILTY CLAY and SAND GP-GC
⊠	WL-18	4.6	NP	NP	NP	9	WELL-GRADED GRAVEL with SILT and SAND GW-GM
■	WL-18	7.6	NP	NP	NP	8	POORLY GRADED GRAVEL with SILT and SAND GP-GM
◆	WL-18	10.7	19	16	3	18	SILTY SAND with GRAVEL SM
◇	WR-01	0.3	23	16	7	12	SILTY, CLAYEY GRAVEL with SAND GC-GM
×	WR-01	3.0	21	17	4	9	POORLY GRADED GRAVEL with SILTY CLAY and SAND GP-GC
✖	WR-02	1.5	23	17	6	11	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC

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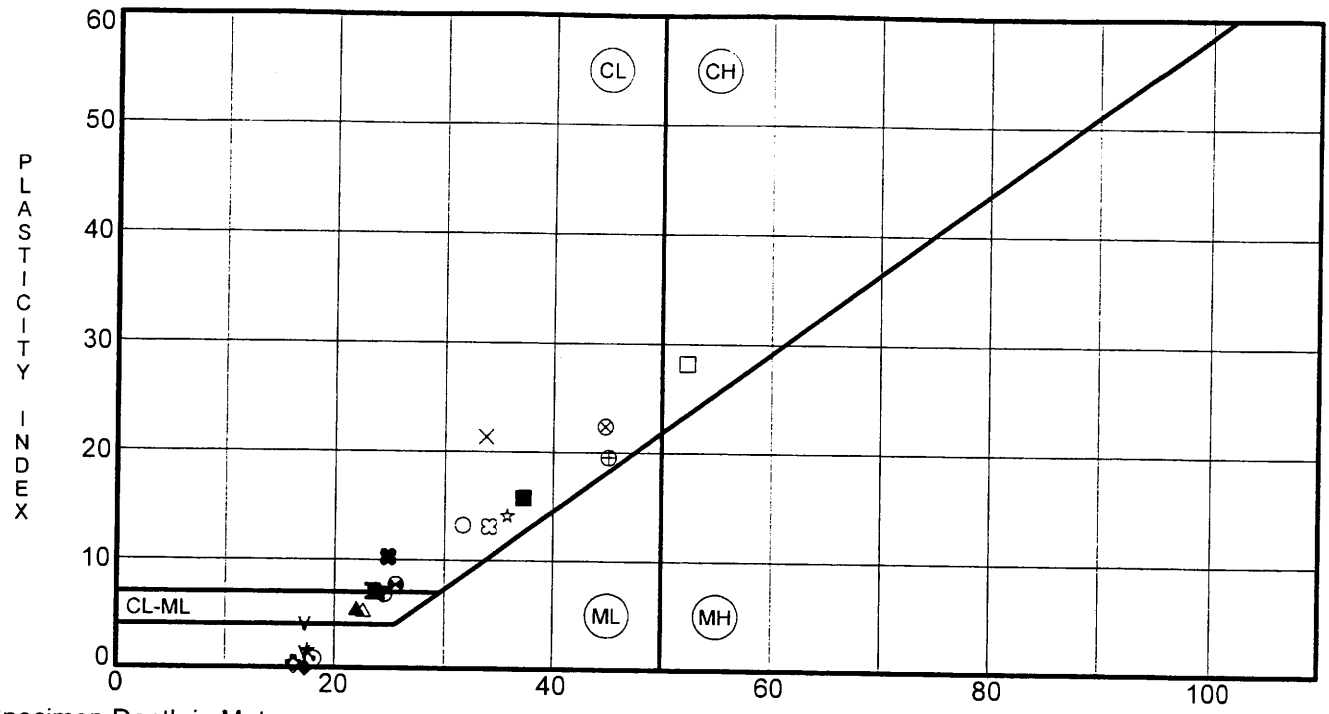
ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4aa



Specimen Depth in Meters.

Specimen Identification			LL	PL	PI	Fines	Classification
●	WR-02	4.6	24	17	7	10	POORLY GRADED GRAVEL with SILTY CLAY and SAND GP-GC
⊠	WR-02	7.6	23	16	7	10	POORLY GRADED GRAVEL with SILTY CLAY and SAND GP-GC
▲	WR-02	10.7	22	17	5	11	POORLY GRADED GRAVEL with SILTY CLAY and SAND GP-GC
★	WR-03	0.3	18	16	2	11	WELL-GRADED GRAVEL with SILT and SAND GW-GM
⊙	WR-03	3.0	18	17	1	9	WELL-GRADED GRAVEL with SILT and SAND GW-GM
✿	WR-04	0.3	16	16	NP	11	WELL-GRADED GRAVEL with SILT and SAND GW-GM
○	WR-04	4.6	32	18	14	12	POORLY GRADED GRAVEL with CLAY and SAND GP-GC
△	WR-04	7.6	23	17	6	12	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC
⊗	WR-04	10.7	45	22	23	18	CLAYEY SAND with GRAVEL SC
⊕	WR-06	0.3	45	25	20	21	CLAYEY GRAVEL with SAND GC
□	WR-06	6.1	52	24	28	38	CLAYEY SAND with GRAVEL SC
⊖	WR-07	0.0	26	18	8	19	CLAYEY SAND with GRAVEL SC
◒	WR-08	0.3	25	18	7	18	SILTY, CLAYEY GRAVEL with SAND GC-GM
☆	WR-08	3.0	36	22	14	15	CLAYEY SAND with GRAVEL SC
⊠	WR-09	1.5	34	21	13	19	CLAYEY SAND with GRAVEL SC
■	WR-09	3.0	37	21	16	54	SANDY LEAN CLAY CL
◆	WR-10	0.3	17	18	NP	20	SILTY SAND with GRAVEL SM
◇	WR-11	0.3	16	16	NP	22	SILTY SAND with GRAVEL SM
×	WR-11	3.7	34	12	22	42	CLAYEY SAND SC
✖	WR-12	7.6	25	15	10	49	CLAYEY SAND SC

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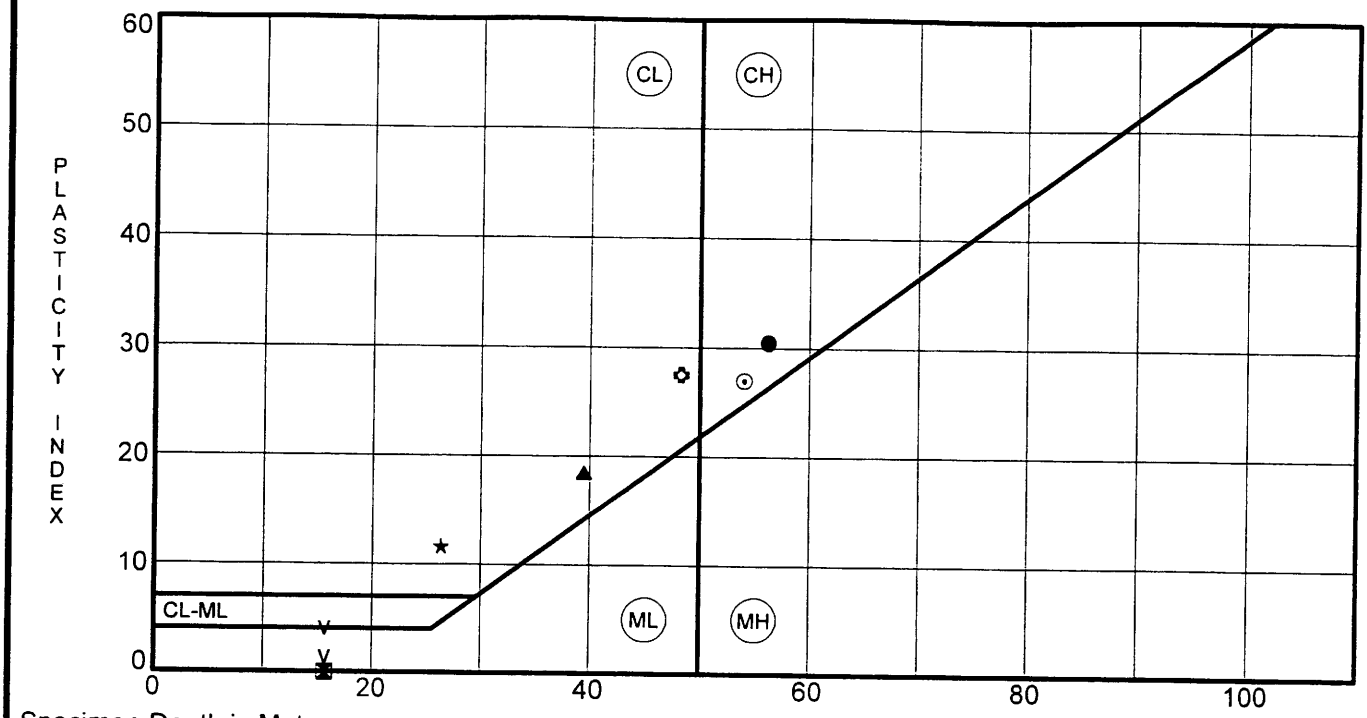
ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4ab



Specimen Depth in Meters.

	Specimen Identification		LL	PL	PI	Fines	Classification
●	WR-12	10.7	56	26	30	45	CLAYEY SAND SC
⊠	WR-13	0.3	16	16	NP	22	SILTY SAND with GRAVEL SM
▲	WR-13	3.0	39	21	18	37	CLAYEY SAND with GRAVEL SC
★	WR-14	1.5	26	15	11	32	CLAYEY SAND with GRAVEL SC
⊙	WR-14	3.0	54	27	27	37	CLAYEY SAND with GRAVEL SC
✿	WR-14	6.1	48	21	27	65	SANDY LEAN CLAY CL

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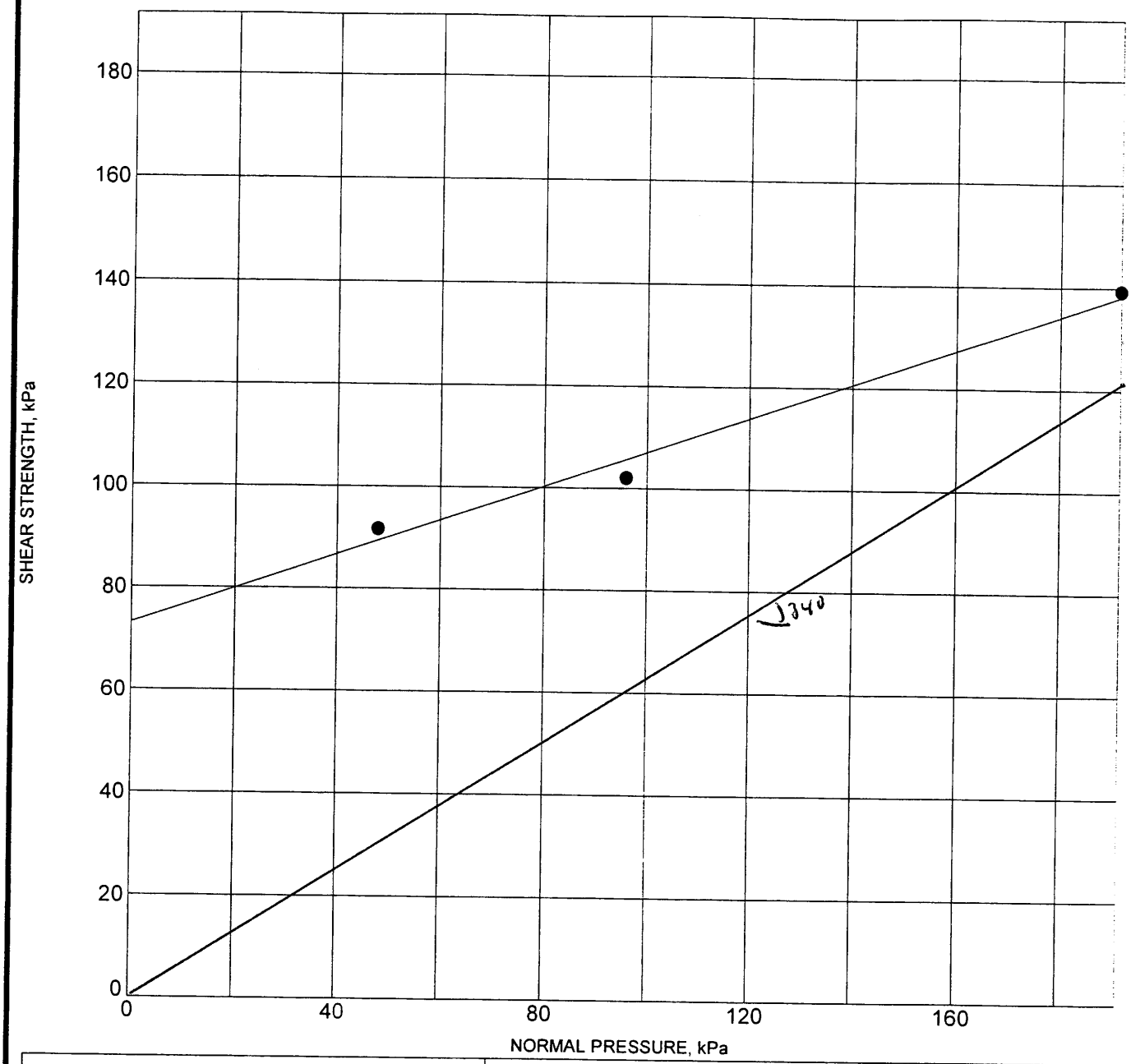
ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4ac



Source: WL-04 [4.6]				Classification: CLAYEY SAND (SC)		
LL = 40	PL = 22	PI = 18	Gs = NT	Test Unit: Carol-Warner 2001D, 2.41" Round		
Specimen Type: Undisturbed				Condition: Inundated	**Before Test**	**After Test**
Diameter (mm): 61.47		Height (mm): 25.40		Water Content, w(%)	13.1	
Rate of Shearing (mm/min)		0.76		Dry Density (kg/m^3)	1586.7	
Cohesion, c (kPa)		73.2		Wet Density (kg/m^3)	1794.2	
Friction Angle, phi (deg)		19		Test Method: AASHTO T236		
Remarks:						

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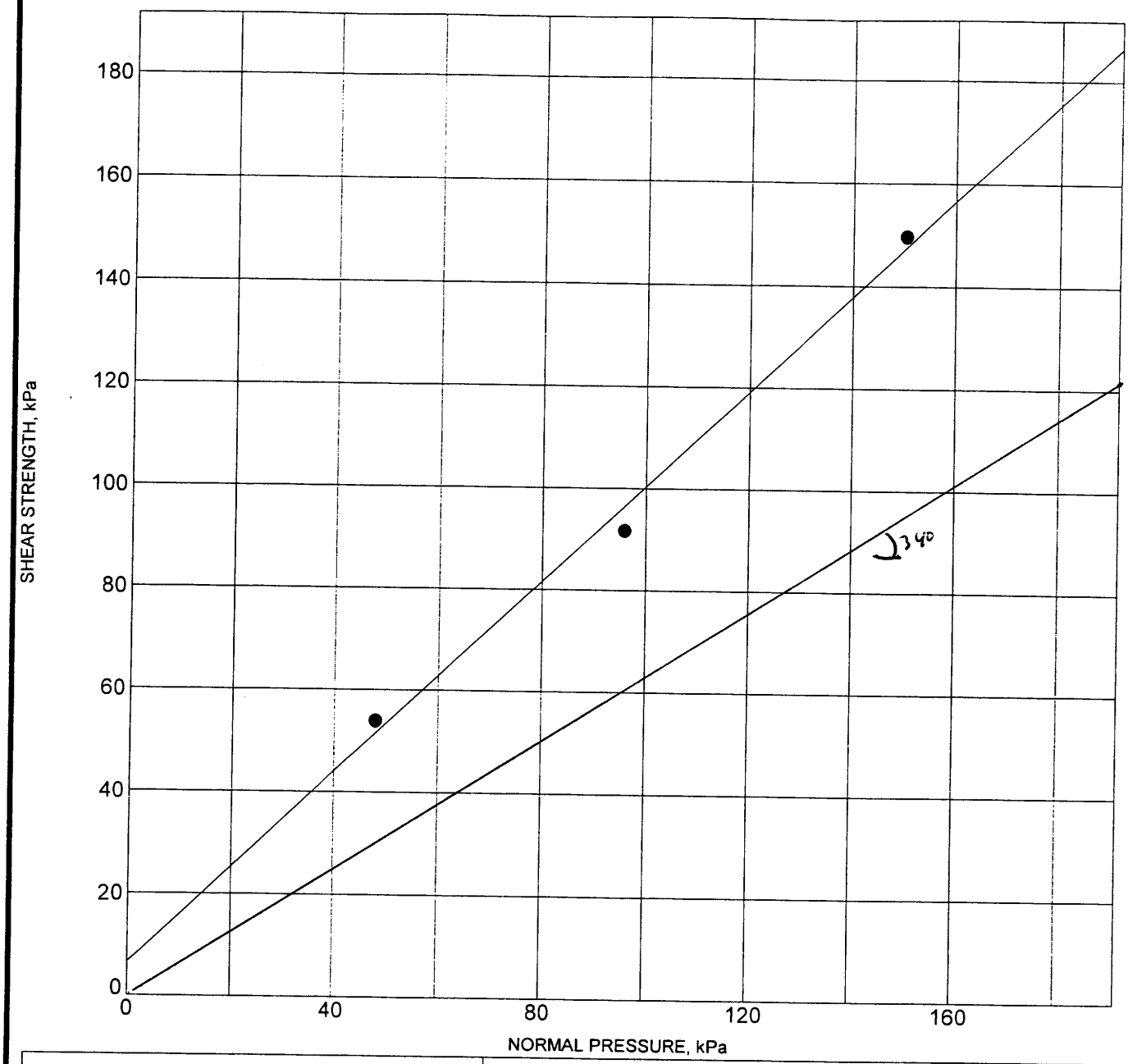
DIRECT SHEAR TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 5a



Source: WR-11 [3.7]				Classification: CLAYEY SAND (SC)		
LL = 34	PL = 12	PI = 21	Gs = NT	Test Unit: Carol-Warner 2001D, 2.41" Round		
Specimen Type: Undisturbed				Condition: Inundated	**Before Test**	**After Test**
Diameter (mm): 61.47		Height (mm): 25.40		Water Content, w(%)	11.1	
Rate of Shearing (mm/min)		0.51		Dry Density (kg/m^3)	1766.1	
Cohesion, c (kPa)		6.6		Wet Density (kg/m^3)	1962.2	
Friction Angle, phi (deg)		43		Test Method: AASHTO T236		
Remarks:						

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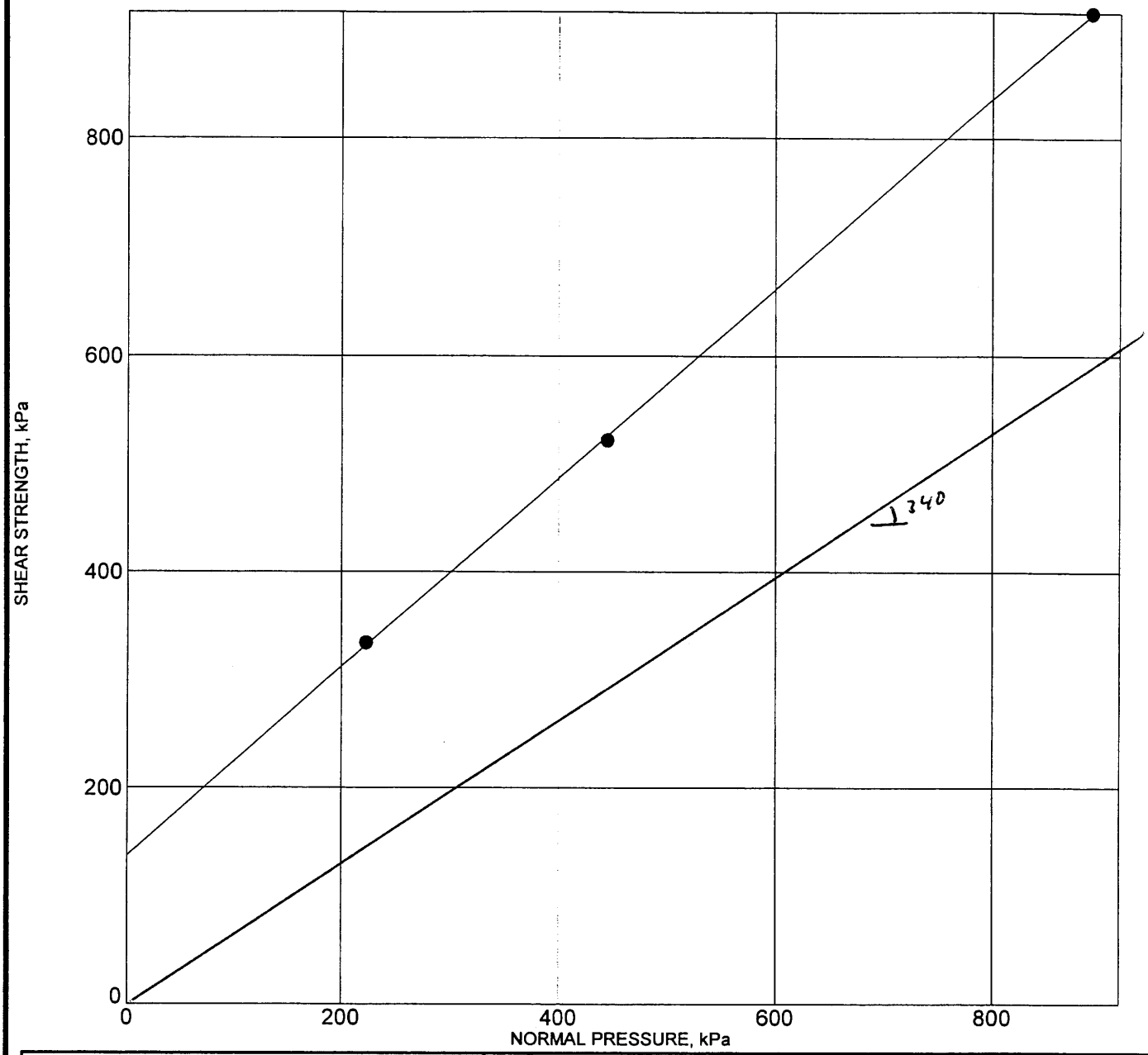
DIRECT SHEAR TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 5b



Source: TP-01 [1.52m]					Test Number	1	2	3
USCS: POORLY GRADED GRAVEL with SILT and SAND (GP-GM)				Initial	Water Content, w (%)	8.3	8.3	8.3
LL = 0	PL = 0	PI = 0	Gs = NT		Void Ratio, e	---	---	---
Test Unit: Carol-Warner 2001D, 2.42" Round					Saturation, S (%)	---	---	---
Sample Type: Remolded					Dry Density, γ_d (kg/m^3)	1896.1	1896.1	1896.1
Sample Condition: Conditioned					Wet Density, γ (kg/m^3)	2053.5	2053.5	2053.5
Test Method: ASTM D3080				Final	Water Content, w (%)	7.5	7.2	7.4
Diameter (mm): 61.47		Height (mm): 25.40			Void Ratio, e	---	---	---
Shearing Rate (mm/min): 1.02					Saturation, S (%)	---	---	---
Cohesion, c (kPa): 137.5					Dry Density, γ_d (kg/m^3)	1835.7	1835.7	1891.7
Friction Angle, phi (°): 41					Wet Density, γ (kg/m^3)	1973.4	2016.7	2031.1
Notes:								

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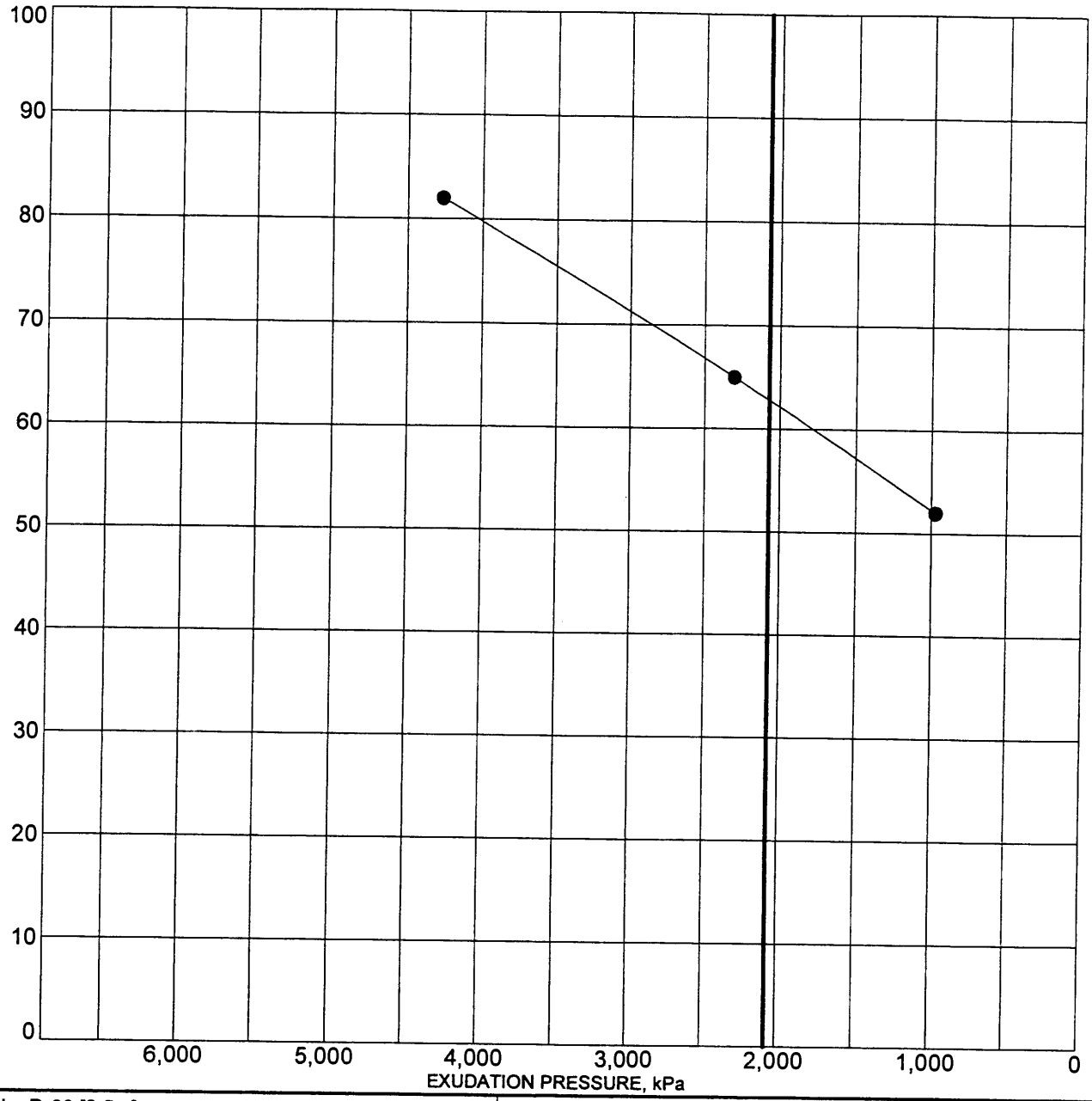
DIRECT SHEAR TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 5c



Sample: R-03 [0.5m]			Description:			
USCS: CLAYEY GRAVEL with SAND (GC)						
LL = 27	PL = 17	PI = 10	Test Number	1	2	3
Lab Log Number:	871		Sample Height (mm)	58.4	59.2	59.9
Date Tested:	2/7/2000		Water Content, w (%)	6.3	6.5	6.8
Compactor Unit:	Cox & Sons CS-1000		Dry Density, (kg/m^3)	2273.0	2269.8	2234.5
Stabilometer Unit:	ELE AP-490A		Wet Density, (kg/m^3)	2417.1	2417.1	2386.7
Test Method:	AASHTO T190		Exudation Pressure (kPa)	4267.4	2302.6	972.1
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value:	**63**		Corrected R Value, R	82	65	52
Notes:						

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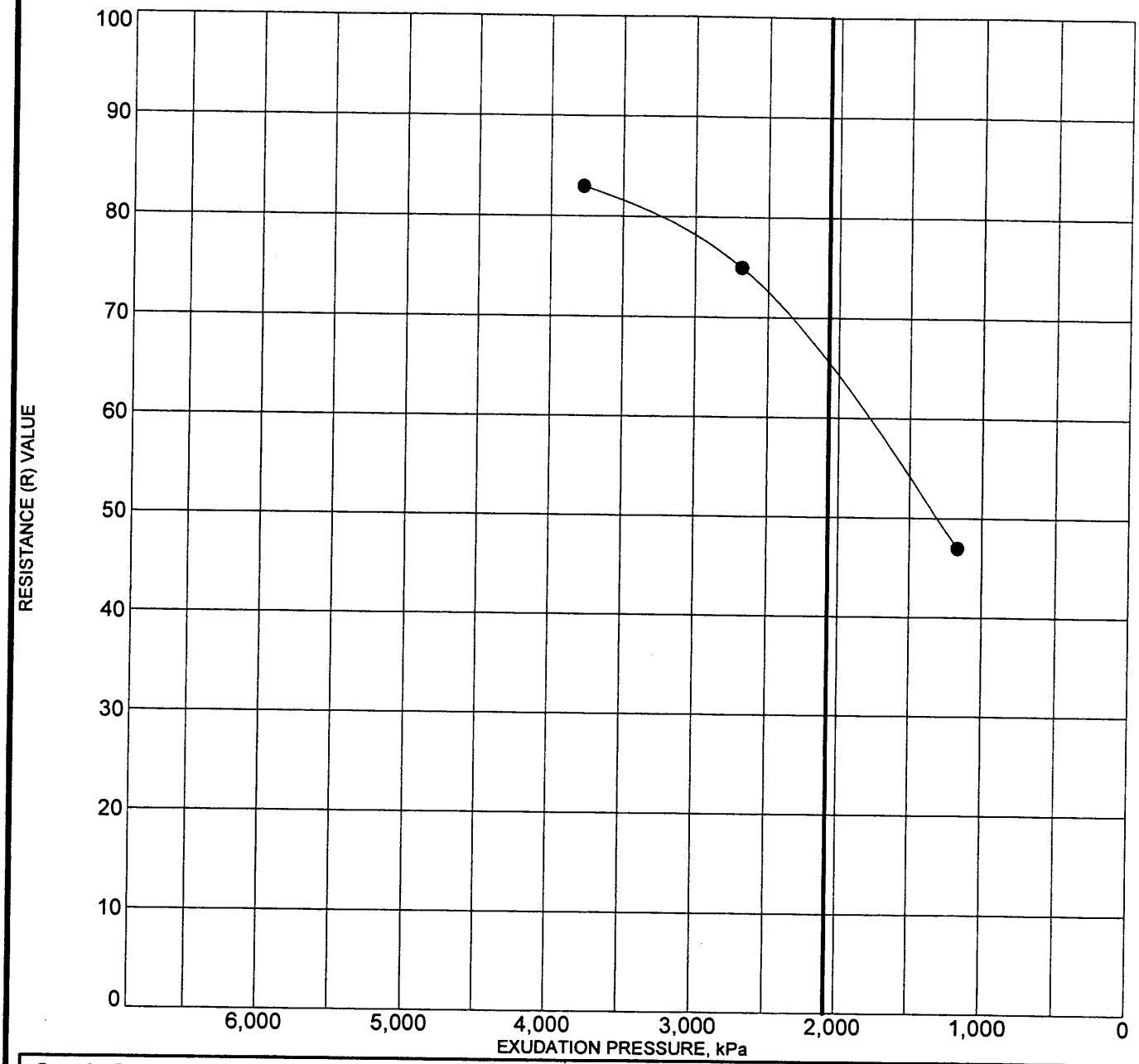
RESISTANCE (R) VALUE TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 6a



Sample: R-07 [0.5m]			Description:			
USCS: WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)						
LL = 19	PL = 15	PI = 4	Test Number	1	2	3
Lab Log Number:	871		Sample Height (mm)	61.7	60.7	62.0
Date Tested:	2/8/2000		Water Content, w (%)	7.0	6.5	6.1
Compactor Unit:	Cox & Sons CS-1000		Dry Density, (kg/m^3)	2295.4	2316.2	2325.8
Stabilometer Unit:	ELE AP-490A		Wet Density, (kg/m^3)	2455.6	2466.8	2466.8
Test Method:	AASHTO T190		Exudation Pressure (kPa)	1165.1	2681.8	3771.0
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value:	**64**		Corrected R Value, R	47	75	83
Notes:						

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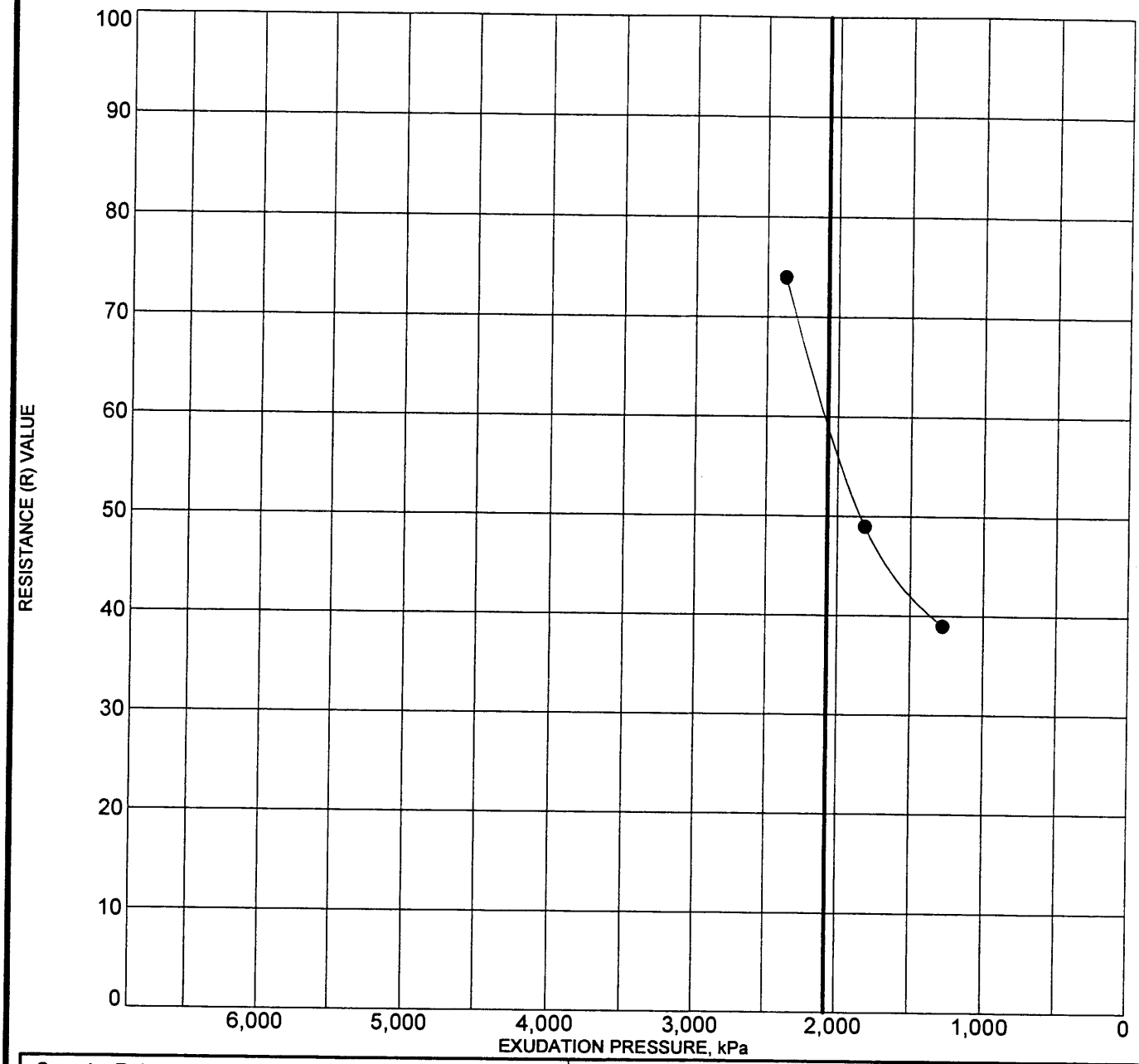
RESISTANCE (R) VALUE TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 6b



Sample: R-11 [0.5m]			Description:			
USCS: POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)						
LL = 29	PL = 19	PI = 10	Test Number	1	2	3
Lab Log Number:	871		Sample Height (mm)	64.8	64.5	63.8
Date Tested:	2/9/2000		Water Content, w (%)	8.1	7.6	7.0
Compactor Unit:	Cox & Sons CS-1000		Dry Density, (kg/m^3)	2205.7	2231.3	2256.9
Stabilometer Unit:	ELE AP-490A		Wet Density, (kg/m^3)	2383.5	2401.1	2415.5
Test Method:	AASHTO T190		Exudation Pressure (kPa)	1275.4	1813.1	2371.5
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value:	**60**		Corrected R Value, R	39	49	74
Notes:						

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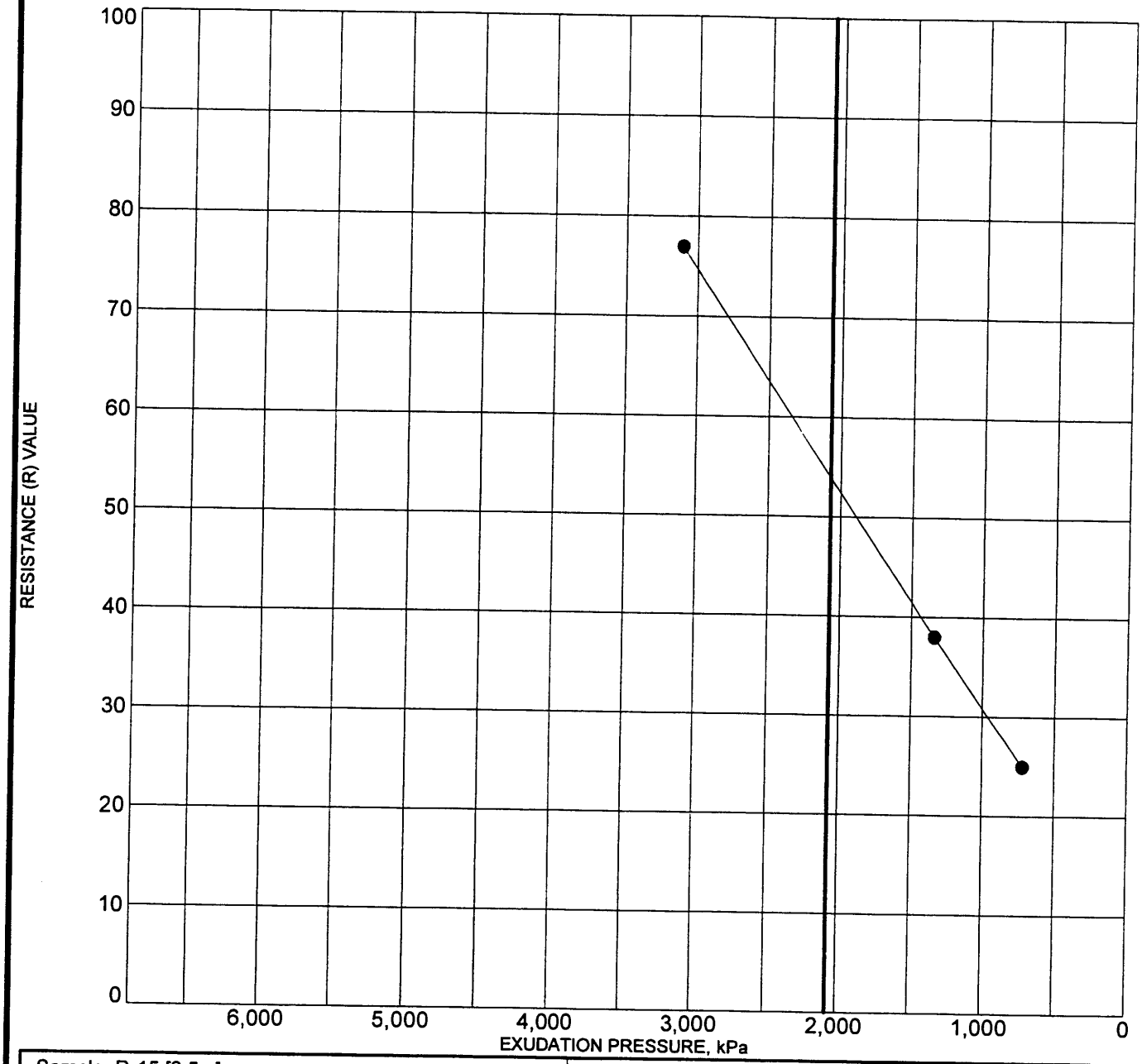
RESISTANCE (R) VALUE TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 6c



Sample: R-15 [0.5m]			Description:			
USCS: SILTY, CLAYEY GRAVEL with SAND (GC-GM)						
LL = 21	PL = 15	PI = 6	Test Number	1	2	3
Lab Log Number:	871		Sample Height (mm)	59.7	60.2	60.7
Date Tested:	2/8/2000		Water Content, w (%)	7.2	8.0	8.8
Compactor Unit:	Cox & Sons CS-1000		Dry Density, (kg/m^3)	2260.1	2221.7	2197.7
Stabilometer Unit:	ELE AP-490A		Wet Density, (kg/m^3)	2423.5	2399.5	2391.5
Test Method:	AASHTO T190		Exudation Pressure (kPa)	3102.3	1337.4	723.9
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value:	**54**		Corrected R Value, R	77	38	25
Notes:						

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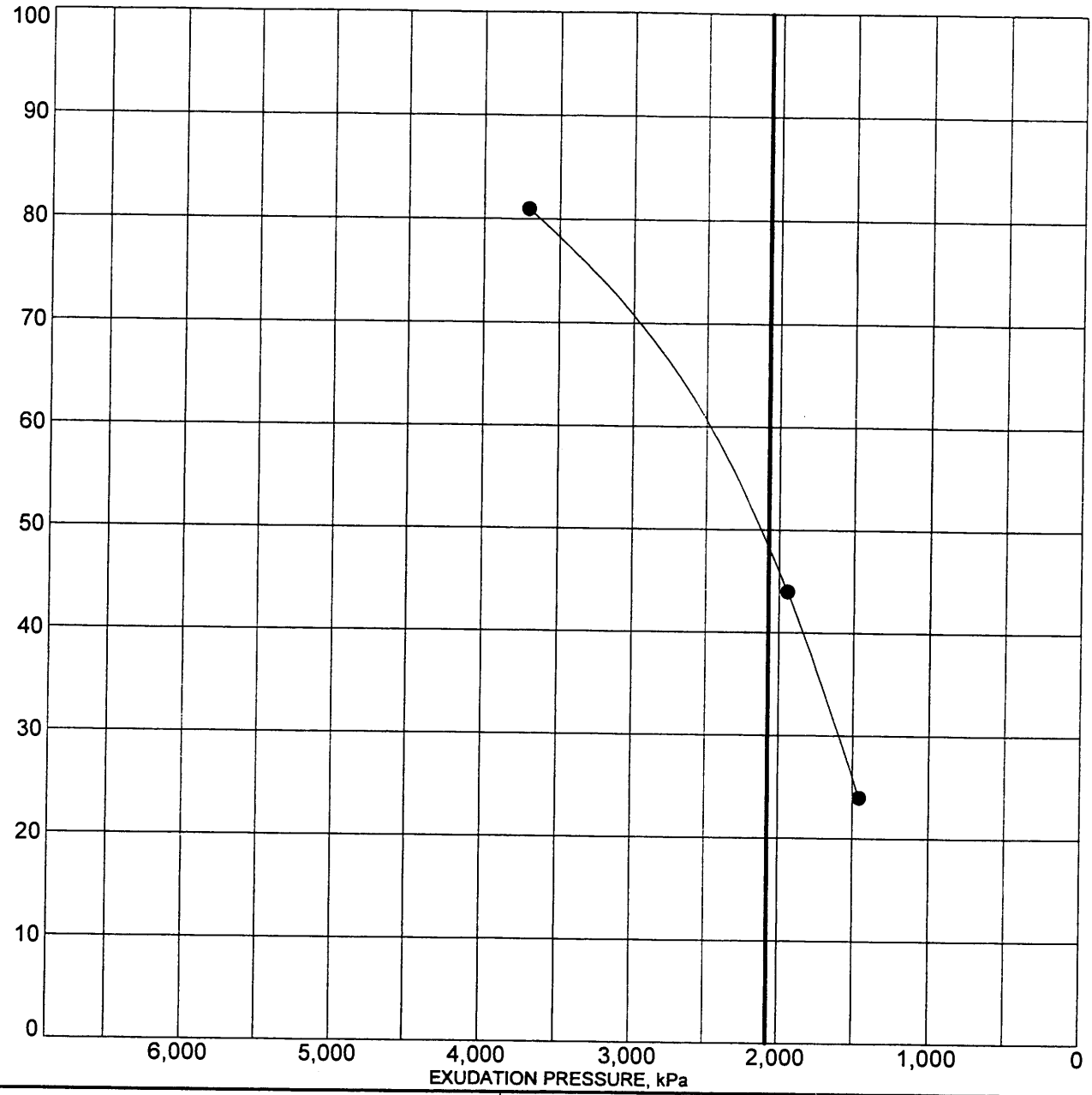
RESISTANCE (R) VALUE TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 6d



Sample: R-19 [0.5m]			Description:			
USCS: SILTY, CLAYEY SAND with GRAVEL (SC-SM)						
LL = 20	PL = 14	PI = 6	Test Number	1	2	3
Lab Log Number:	871		Sample Height (mm)	64.5	64.5	64.0
Date Tested:	2/13/2000		Water Content, w (%)	8.1	7.4	7.2
Compactor Unit:	Cox & Sons CS-1000		Dry Density, (kg/m^3)	2212.1	2220.1	2232.9
Stabilometer Unit:	ELE AP-490A		Wet Density, (kg/m^3)	2391.5	2385.1	2393.1
Test Method:	AASHTO T190		Exudation Pressure (kPa)	1454.6	1944.1	3702.1
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value:	**47**		Corrected R Value, R	24	44	81
Notes:						

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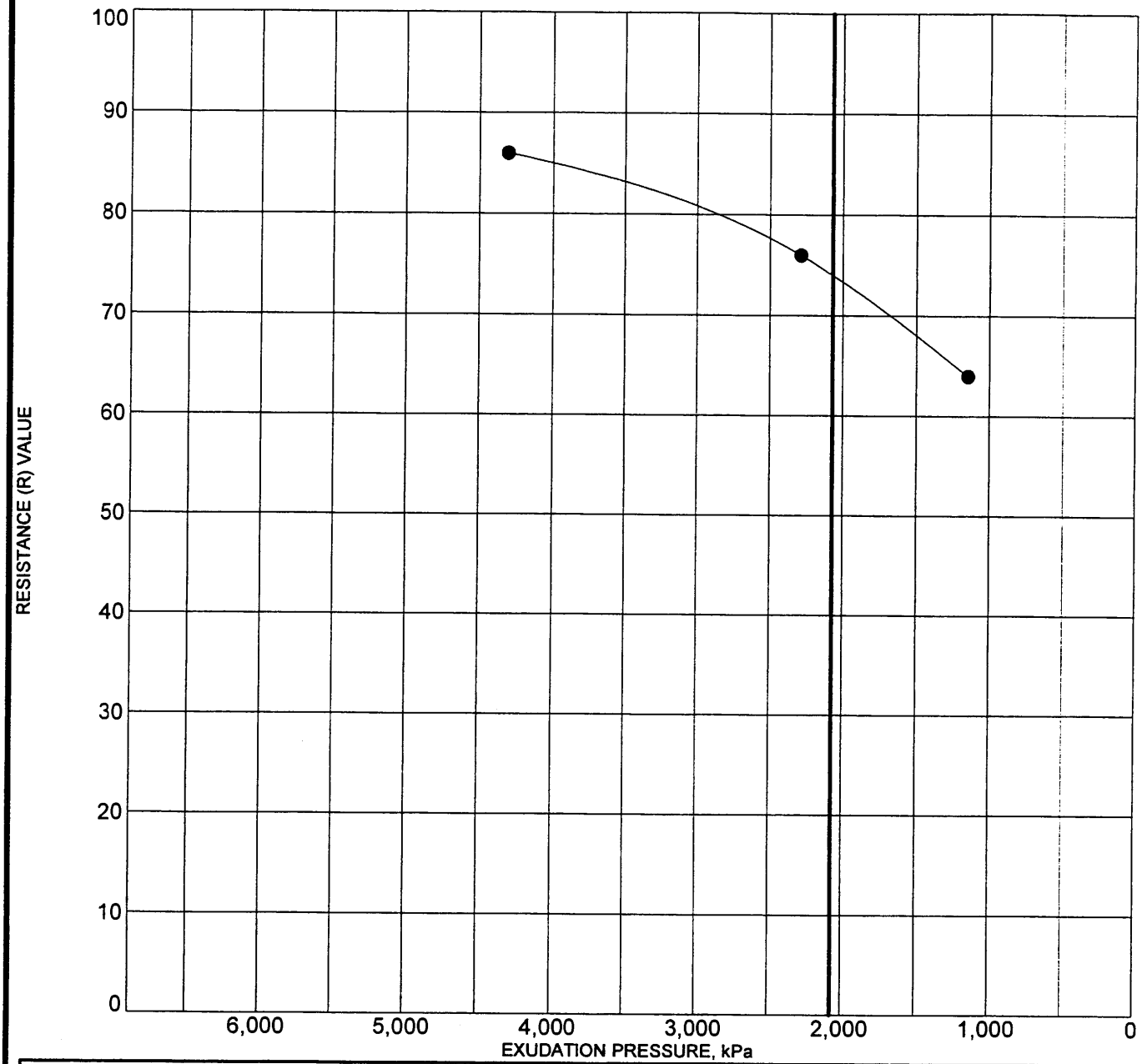
RESISTANCE (R) VALUE TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 6e



Sample: R-23 [0.5m]			Description:			
USCS: POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)						
LL = 25	PL = 18	PI = 7	Test Number	1	2	3
Lab Log Number:	871		Sample Height (mm)	63.8	64.3	64.0
Date Tested:	2/13/2000		Water Content, w (%)	6.3	6.6	7.0
Compactor Unit:	Cox & Sons CS-1000		Dry Density, (kg/m^3)	2264.9	2232.9	2228.1
Stabilometer Unit:	ELE AP-490A		Wet Density, (kg/m^3)	2407.5	2380.3	2383.5
Test Method:	AASHTO T190		Exudation Pressure (kPa)	4308.8	2288.8	1144.4
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value:	**74**		Corrected R Value, R	86	76	64
Notes:						

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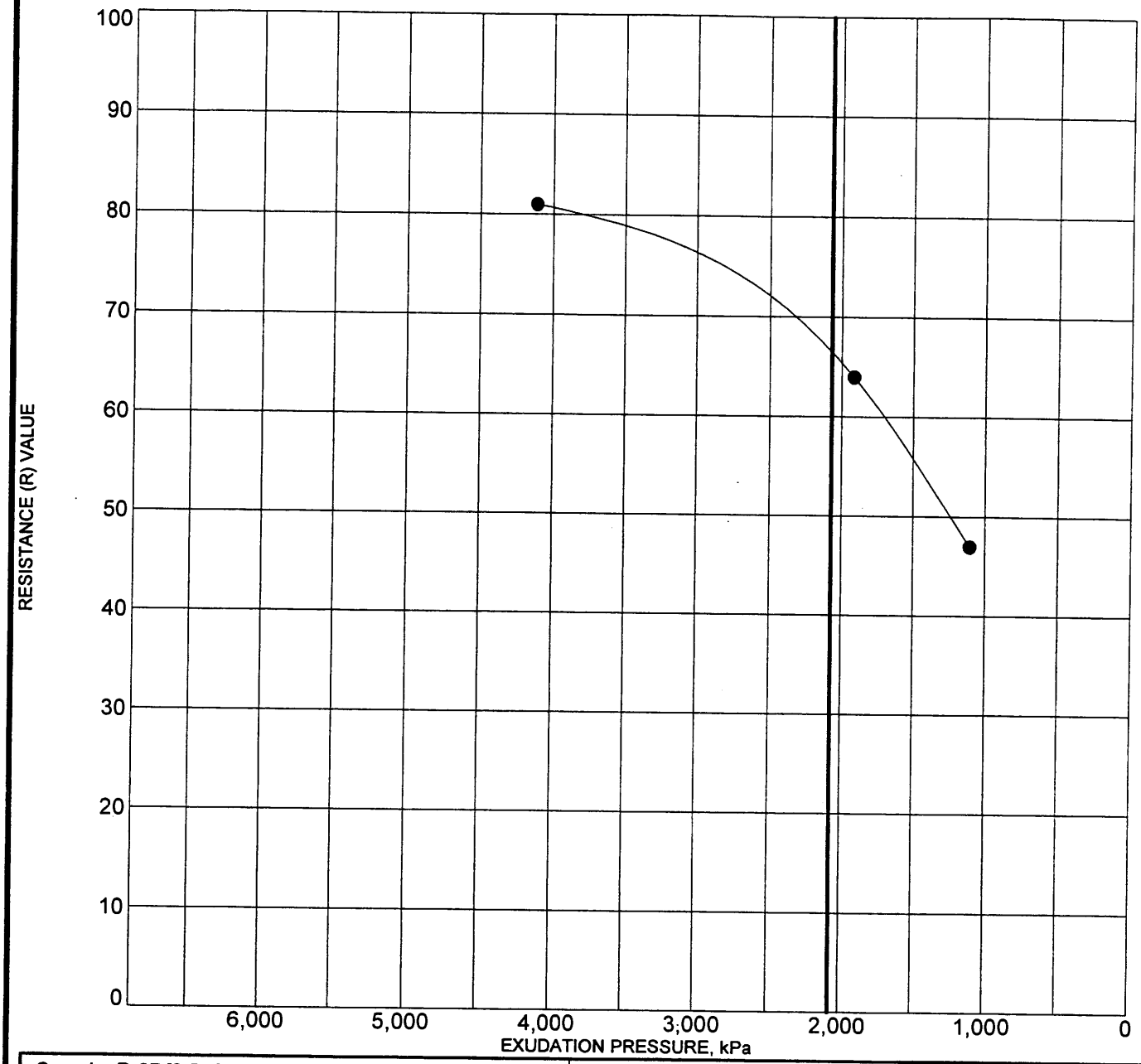
RESISTANCE (R) VALUE TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 6f



Sample: R-27 [0.5m]			Description:			
USCS: SILTY, CLAYEY GRAVEL with SAND (GC-GM)						
LL = 22	PL = 16	PI = 6	Test Number	1	2	3
Lab Log Number:	871		Sample Height (mm)	61.5	59.9	61.2
Date Tested:	2/12/2000		Water Content, w (%)	7.2	6.8	6.0
Compactor Unit:	Cox & Sons CS-1000		Dry Density, (kg/m^3)	2269.8	2295.4	2301.8
Stabilometer Unit:	ELE AP-490A		Wet Density, (kg/m^3)	2433.1	2450.8	2439.5
Test Method:	AASHTO T190		Exudation Pressure (kPa)	1103.0	1916.5	4115.7
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value:	**65**		Corrected R Value, R	47	64	81
Notes:						

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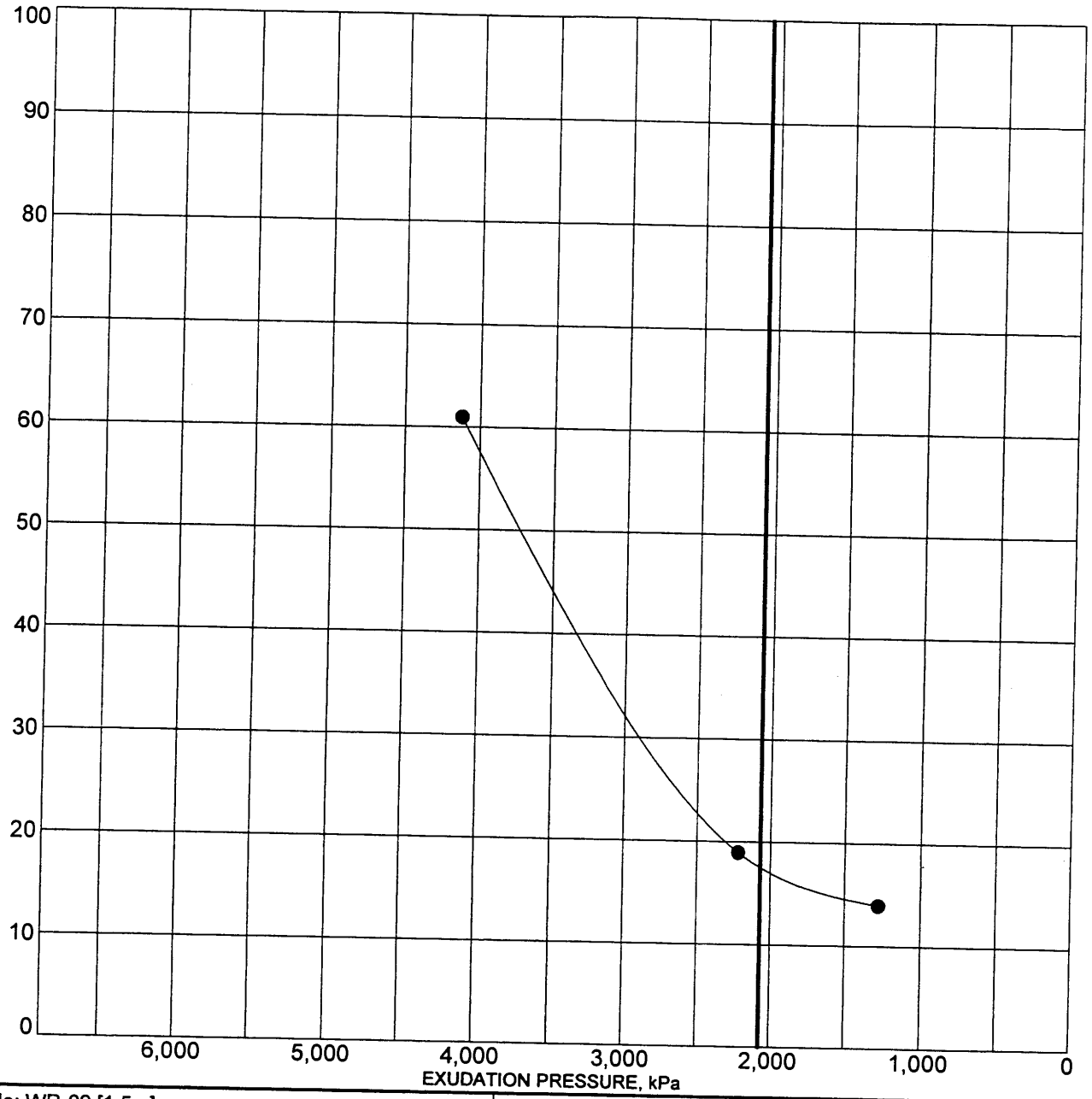
RESISTANCE (R) VALUE TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 6g



Sample: WR-09 [1.5m]			Description:			
USCS: CLAYEY SAND with GRAVEL (SC)						
LL = 34	PL = 21	PI = 13	Test Number	1	2	3
Lab Log Number:	871		Sample Height (mm)	60.2	60.7	60.7
Date Tested:	2/13/2000		Water Content, w (%)	10.6	9.6	9.0
Compactor Unit:	Cox & Sons CS-1000		Dry Density, (kg/m^3)	2032.7	2069.5	2074.3
Stabilometer Unit:	ELE AP-490A		Wet Density, (kg/m^3)	2248.9	2269.8	2261.7
Test Method:	AASHTO T190		Exudation Pressure (kPa)	1275.4	2219.9	4122.6
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value:	**18**		Corrected R Value, R	14	19	61
Notes:						

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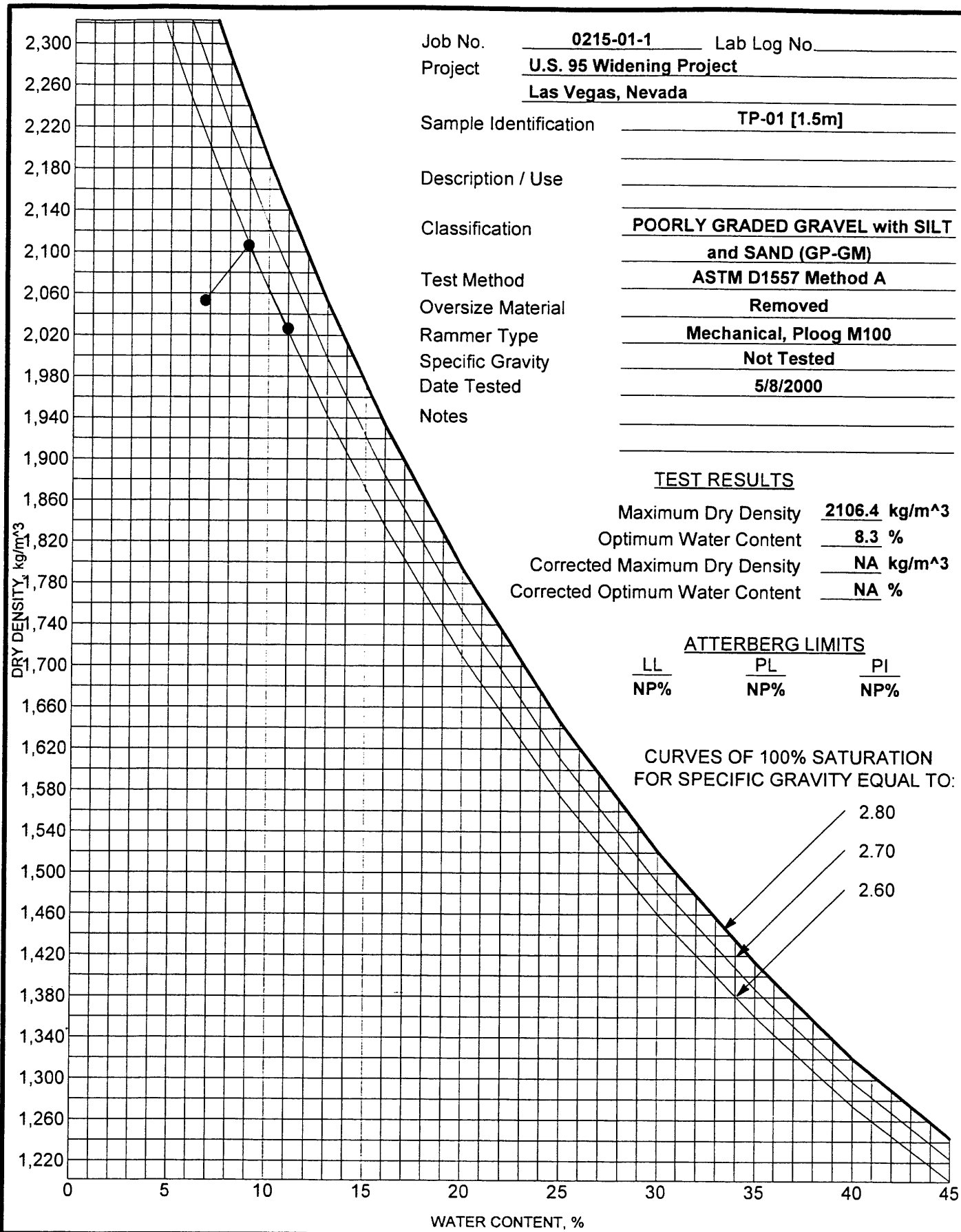
RESISTANCE (R) VALUE TEST

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 6h



Job No. 0215-01-1 Lab Log No.

Project U.S. 95 Widening Project
Las Vegas, Nevada

Sample Identification TP-01 [1.5m]

Description / Use

Classification POORLY GRADED GRAVEL with SILT and SAND (GP-GM)

Test Method ASTM D1557 Method A

Oversize Material Removed

Rammer Type Mechanical, Ploog M100

Specific Gravity Not Tested

Date Tested 5/8/2000

Notes

TEST RESULTS

Maximum Dry Density	2106.4 kg/m^3
Optimum Water Content	8.3 %
Corrected Maximum Dry Density	NA kg/m^3
Corrected Optimum Water Content	NA %

ATTERBERG LIMITS

LL	PL	PI
NP%	NP%	NP%

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MOISTURE-DENSITY RELATIONSHIP

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 7

US COMPACTION3 METRIC 0215011.GPJ US_LAB.GDT 6/16/00

APPENDIX A -

DESIGN CALCULATIONS FOR SPREAD FOOTING FOUNDATIONS

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-21-00
Page: 1 of 1

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1

CALCULATION OF BEARING CAPACITY USING THE VESIC METHOD
Depth to Groundwater >B

1.) References:
a.) AASHTO, 1996: *Standard Specifications for Highway Bridges*, 16th ed.
b.) Bowles,J.E., 1996: *Foundation Analysis and Design*, 5th ed.

2.) Variables: Note that additional factors can be added for inclined loads and/or inclined base.

$c := 0.0 \cdot \frac{lb}{ft^2}$ $\phi := 34 \cdot deg$ $\gamma_{eff} := 130 \cdot \frac{lb}{ft^3}$ $L := 40 \cdot ft$ $B := 7.25 \cdot ft$ $D := 1.0 \cdot ft$

3.) Calculate Bearing Capacity Factors: $N_q := e^{\pi \cdot \tan(\phi)} \cdot \tan\left(45 \cdot deg + \frac{\phi}{2}\right)^2$

$N_c := (N_q - 1) \cdot \cot(\phi)$ $N_\gamma := 2 \cdot (N_q + 1) \cdot \tan(\phi)$

$N_c = 42.164$ $N_q = 29.44$ $N_\gamma = 41.064$

4.) Calcuate Shape Factors:

$S_c := 1 + \left(\frac{B}{L}\right) \cdot \left(\frac{N_q}{N_c}\right)$ $S_q := 1 + \left(\frac{B}{L}\right) \cdot \tan(\phi)$ $S_\gamma := 1 - 0.4 \cdot \left(\frac{B}{L}\right)$

$S_c = 1.127$ $S_q = 1.122$ $S_\gamma = 0.928$

5.) Calculate Ultimate Bearing Capacity, q_{ult}:

$kip := 1000 \cdot lb$

$q_{ult} := (c \cdot N_c \cdot S_c) + (0.5 \cdot \gamma_{eff} \cdot B \cdot N_\gamma \cdot S_\gamma) + \gamma_{eff} \cdot D \cdot N_q \cdot S_q$ $kPa := 47.88026 \cdot \frac{kip}{ft^2}$

6.) Calculate Allowable Bearing Pressure, q_{allow}, at Appropriate Safety Factor, SF

$SF := 3.0$ $q_{allow} := \frac{q_{ult}}{SF}$ $q_{allow} = 7.414\,ft^{-2}\,kip$ $q_{allow} = 0.155\,kPa$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-24-00
Page: 1 of 1

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1 Cohesive Soil (sample WL-4 @ 4.75 m

CALCULATION OF BEARING CAPACITY USING THE VESIC METHOD
Depth to Groundwater >B

1.) References:
a.) AASHTO, 1996: *Standard Specifications for Highway Bridges,* 16th ed.
b.) Bowles,J.E., 1996: *Foundation Analysis and Design,* 5th ed.

2.) Variables: Note that additional factors can be added for inclined loads and/or inclined base.

$c := 3546 \cdot \frac{lb}{ft^2}$ $\phi := 19 \cdot deg$ $\gamma_{eff} := 114 \cdot \frac{lb}{ft^3}$ $L := 40 \cdot ft$ $B := 7.25 \cdot ft$ $D := 1.0 \cdot ft$

3.) Calculate Bearing Capacity Factors: $N_q := e^{\pi \cdot \tan(\phi)} \cdot \tan\left(45 \cdot deg + \frac{\phi}{2}\right)^2$

$N_c := (N_q - 1) \cdot \cot(\phi)$ $N_\gamma := 2 \cdot (N_q + 1) \cdot \tan(\phi)$

$N_c = 13.934$ $N_q = 5.798$ $N_\gamma = 4.681$

4.) Calcuate Shape Factors:

$S_c := 1 + \left(\frac{B}{L}\right) \cdot \left(\frac{N_q}{N_c}\right)$ $S_q := 1 + \left(\frac{B}{L}\right) \cdot \tan(\phi)$ $S_\gamma := 1 - 0.4 \cdot \left(\frac{B}{L}\right)$

$S_c = 1.075$ $S_q = 1.062$ $S_\gamma = 0.928$

5.) Calculate Ultimate Bearing Capacity, q_{ult}: $kip := 1000 \cdot lb$

$q_{ult} := (c \cdot N_c \cdot S_c) + (0.5 \cdot \gamma_{eff} \cdot B \cdot N_\gamma \cdot S_\gamma) + \gamma_{eff} \cdot D \cdot N_q \cdot S_q$ $kPa := 47.88026 \cdot \frac{kip}{ft^2}$

6.) Calculate Allowable Bearing Pressure, q_{allow}, at Appropriate Safety Factor, SF

$SF := 3.0$ $q_{allow} := \frac{q_{ult}}{SF}$ $q_{allow} = 18.544\, ft^{-2} kip$ $q_{allow} = 0.387\, kPa$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-21-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION OF IMMEDIATE SETTLEMENT ON GRANULAR SOILS

REFERENCE: Bowles, J.E., 1996, *Foundation Analysis and Design*, 5th edition

Calculation of Immediate Settlement on sandy soils beneath soil cement embankment

Variables:

$B := 5.4 \cdot ft \quad L := 54 \cdot ft \quad N_{stp} := 57 \quad H := 30 \cdot ft \quad \mu := .35 \quad I_F := .85 \quad kip := 1000 \cdot lb$

$L' := \frac{L}{2} \quad B' := \frac{B}{2} \quad M := \frac{L'}{B'} \quad N := \frac{H}{B'} \quad q_o := 4.25 \cdot \frac{kip}{ft^2}$

$E_s := 10 \cdot (N_{stp} + 15) \cdot \frac{kip}{ft^2} \qquad E_s \cdot \frac{ft^2}{kip} = 720$

Calculations:

Results:

$$I_1 := \frac{1}{\pi} \cdot \left[M \cdot \ln\left[\frac{\left(1 + \sqrt{M^2 + 1}\right) \cdot \sqrt{M^2 + N^2}}{M \cdot \left(1 + \sqrt{M^2 + N^2 + 1}\right)} \right] + \ln\left[\frac{\left(M + \sqrt{M^2 + 1}\right) \cdot \sqrt{1 + N^2}}{M + \sqrt{M^2 + N^2 + 1}} \right] \right] \qquad I_1 = 0.803$$

$$I_2 := \frac{N}{2 \cdot \pi} \cdot \operatorname{atan}\left(\frac{M}{N \cdot \sqrt{M^2 + N^2 + 1}} \right) \qquad I_2 = 0.106$$

$$I_s := I_1 + \left(\frac{1 - 2 \cdot \mu}{1 - \mu} \right) \cdot I_2 \qquad I_s = 0.852$$

$$\Delta H := q_o \cdot B' \cdot \left(\frac{1 - \mu^2}{E_s} \right) \cdot \left[I_1 + \left[\left(\frac{1 - 2 \cdot \mu}{1 - \mu} \right) \cdot I_2 \right] \right] \cdot I_F \cdot 4 \qquad \Delta H = 0.486\,in$$

$\Delta H = 12.344\,mm$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 6-14-00

Project Name: US 95 1A Soundwall and/or Retaining Wall Footings
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

LATERAL PRESSURES for FOOTINGS or SMALL RETAINING WALLS

VARIABLES:

$$\gamma := 18.86 \cdot \frac{kg}{m^3} \qquad \phi := 34 \cdot deg$$

At-Rest Condition: $A_r := (1 - \sin(\phi)) \cdot \gamma$

$A_r = 8.314\,kg\,m^{-3}$

Active Condition: $A := \frac{1 - \sin(\phi)}{1 + \sin(\phi)} \cdot \gamma$

$A = 5.332\,kg\,m^{-3}$

Passive Condition: $P := \frac{1 + \sin(\phi)}{1 - \sin(\phi)} \cdot \gamma$

$P = 66.71\,kg\,m^{-3}$

Coefficient of Friction: $\mu := \tan(\phi)$ $\mu = 0.675$

$\mu_{sf} := .67 \cdot \mu$

$\mu_{sf} = 0.452$

APPENDIX B -

DESIGN CALCULATIONS FOR DRILLED SHAFT FOUNDATIONS

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

Design Conditions:

1.) Length = 8.2 ft
2.) Diameter = 1.0 ft

Design Calcuations-Compression

Side Resistance

z = depth below ground surface

$kip := 1000 \cdot lbf$

$z := \left(\frac{2 + 8.2}{2}\right)$ ft

$\gamma := 130 \cdot \frac{lbf}{ft^3}$

$kN := \frac{kip}{4.448222}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z^{.5}$

diameter $D := 1.0 \cdot ft$

$\sigma'_z := z \cdot \gamma \cdot ft$

length of embedment $L := (8.2 - 2) \cdot ft$

eq. 11.11 Ref. 2 $f_{sz} := \beta \cdot \sigma'_z$

but $f_{sz} := if\left(f_{sz} \geq 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{sz}\right)$

$f_{sz} = 0.792 \frac{kip}{ft^2}$

Shaft side friction = $Q_s := f_{sz} \cdot \pi \cdot D \cdot L$

$Q_s = 15.434\,kip$

$Q_s = 68.652\,kN$

End Bearing

Uncorrected SPT Values $N_{spt} := 50$

from Table 4.6.5.1.4A
page 83; Ref. 1 $q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$

End Bearing eq 11.14, Ref.2
Cb = correction factor for D > 50" $C_d := \frac{4.17ft}{D}$ $C_d := if\left(C_d \geq 1.00, 1.00, C_d\right)$

$C_d = 1$ $Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$

$Q_b = 47.124\,kip$ $Q_b = 209.618\,kN$

$Q_{ult} := Q_s + Q_b$

$Q_{ult} = 62.558\,kip$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$ $Q_{ult} = 278.27\,kN$

and to have low settlement $Q_a \leq Q_s$

$Q_a = 20.853\,kip$ $Q_a = 92.757\,kN$

Design Calculations-Uplift

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$W_{shaft} = 0.682\,kip$

$Q_{au} = 5.826\,kip$

$Q_{au} = 25.917\,kN$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

Design Conditions:

1.) Length = 9.84 ft
2.) Diameter = 1.0 ft

Design Calcuations-Compression

Side Resistance

z = depth below ground surface

$kip := 1000 \cdot lbf$

$z := \left(\frac{2 + 9.84}{2}\right)$ ft $\quad \gamma := 130 \cdot \frac{lbf}{ft^3}$ $\quad kN := \frac{kip}{4.448222}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z^{.5}$ $\quad$ diameter $D := 1.0 \cdot ft$

$\sigma'_z := z \cdot \gamma \cdot ft$ $\quad$ length of embedment $L := (9.84 - 2) \cdot ft$

eq. 11.11 Ref. 2 $f_{sz} := \beta \cdot \sigma'_z$ $\quad$ but $f_{sz} := if\left(f_{sz} \geq 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{sz}\right)$

$f_{sz} = 0.902 \frac{kip}{ft^2}$ $\quad$ Shaft side friction = $Q_S := f_{sz} \cdot \pi \cdot D \cdot L$

$Q_S = 22.207\,kip$ $\quad Q_S = 98.78\,kN$

End Bearing

Uncorrected SPT Values $N_{spt} := 50$

from Table 4.6.5.1.4A
page 83; Ref. 1 $q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$

End Bearing eq 11.14, Ref.2
Cb = correction factor for D > 50" $C_d := \frac{4.17ft}{D}$ $C_d := if\left(C_d \geq 1.00, 1.00, C_d\right)$

$C_d = 1$ $Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$

$Q_b = 47.124\,kip$ $Q_b = 209.618\,kN$

$Q_{ult} := Q_s + Q_b$

$Q_{ult} = 69.331\,kip$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$ $Q_{ult} = 308.398\,kN$

and to have low settlement $Q_a \leq Q_s$

$Q_a = 23.11\,kip$ $Q_a = 102.799\,kN$

Design Calculations-Uplift

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$Q_{au} = 8.264\,kip$

$W_{shaft} = 0.862\,kip$

$Q_{au} = 36.761\,kN$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

Design Conditions:

1.) Length = 11.48 ft
2.) Diameter = 1.0 ft

Design Calcuations-Compression

Side Resistance

z = depth below ground surface

$z := \left(\frac{2 + 11.48}{2}\right)$ ft

$\gamma := 130 \cdot \frac{lbf}{ft^3}$

$kip := 1000 \cdot lbf$

$kN := \frac{kip}{4.448222}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z^{.5}$

diameter $D := 1.0 \cdot ft$

$\sigma'_z := z \cdot \gamma \cdot ft$

length of embedment $L := (11.48 - 2) \cdot ft$

eq. 11.11 Ref. 2 $f_{sz} := \beta \cdot \sigma'_z$

but $f_{sz} := if\left(f_{sz} \geq 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{sz}\right)$

$f_{sz} = 1.007 \frac{kip}{ft^2}$

Shaft side friction = $Q_S := f_{sz} \cdot \pi \cdot D \cdot L$

$Q_S = 29.997\,kip$

$Q_S = 133.433\,kN$

End Bearing

Uncorrected SPT Values $N_{spt} := 50$

from Table 4.6.5.1.4A
page 83; Ref. 1 $q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$

End Bearing eq 11.14, Ref.2
Cb = correction factor for D > 50" $C_d := \frac{4.17ft}{D}$ $C_d := if\left(C_d \geq 1.00, 1.00, C_d\right)$

$C_d = 1$ $Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$

$Q_b = 47.124\,kip$ $Q_b = 209.618\,kN$

$Q_{ult} := Q_s + Q_b$

$Q_{ult} = 77.121\,kip$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$ $Q_{ult} = 343.051\,kN$

and to have low settlement $Q_a \leq Q_s$

$Q_a = 25.707\,kip$ $Q_a = 114.35\,kN$

Design Calculations-Uplift

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$W_{shaft} = 1.042\,kip$

$Q_{au} = 11.041\,kip$

$Q_{au} = 49.115\,kN$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

Design Conditions:

1.) Length = 8.2 ft
2.) Diameter = 1.5 ft

Design Calcuations-Compression

Side Resistance

z = depth below ground surface

$kip := 1000 \cdot lbf$

$z := \left(\frac{2 + 8.2}{2}\right)$ ft

$\gamma := 130 \cdot \frac{lbf}{ft^3}$

$kN := \frac{kip}{4.448222}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z^{.5}$

diameter $D := 1.5 \cdot ft$

$\sigma'_z := z \cdot \gamma \cdot ft$

length of embedment $L := (8.2 - 2) \cdot ft$

eq. 11.11 Ref. 2 $f_{sz} := \beta \cdot \sigma'_z$

but $f_{sz} := if\left(f_{sz} \geq 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{sz}\right)$

$f_{sz} = 0.792 \frac{kip}{ft^2}$

Shaft side friction = $Q_s := f_{sz} \cdot \pi \cdot D \cdot L$

$Q_s = 23.151\,kip$

$Q_s = 102.979\,kN$

End Bearing

Uncorrected SPT Values $N_{spt} := 50$

from Table 4.6.5.1.4A
page 83; Ref. 1 $q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$

End Bearing eq 11.14, Ref.2
Cb = correction factor for D > 50" $C_d := \frac{4.17ft}{D}$ $C_d := if\left(C_d \geq 1.00, 1.00, C_d\right)$

$C_d = 1$ $Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$

$Q_b = 106.029\,kip$ $Q_b = 471.639\,kN$

$Q_{ult} := Q_s + Q_b$

$Q_{ult} = 129.179\,kip$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$ $Q_{ult} = 574.618\,kN$

and to have low settlement $Q_a \leq Q_s$

$Q_a = 43.06\,kip$ $Q_a = 191.539\,kN$

Design Calculations-Uplift

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$W_{shaft} = 1.534\,kip$

$Q_{au} = 9.251\,kip$

$Q_{au} = 41.149\,kN$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

Design Conditions:

1.) Length = 9.84 ft
2.) Diameter = 1.5 ft

Design Calcuations-Compression

Side Resistance

z = depth below ground surface

$kip := 1000 \cdot lbf$

$z := \left(\frac{2 + 9.84}{2}\right)$ ft

$\gamma := 130 \cdot \frac{lbf}{ft^3}$

$kN := \frac{kip}{4.448222}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z^{.5}$

diameter $D := 1.5 \cdot ft$

$\sigma'_z := z \cdot \gamma \cdot ft$

length of embedment $L := (9.84 - 2) \cdot ft$

eq. 11.11 Ref. 2 $f_{sz} := \beta \cdot \sigma'_z$

but $f_{sz} := if\left(f_{sz} \geq 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{sz}\right)$

$f_{sz} = 0.902 \frac{kip}{ft^2}$

Shaft side friction = $Q_S := f_{sz} \cdot \pi \cdot D \cdot L$

$Q_S = 33.31\,kip$

$Q_S = 148.171\,kN$

End Bearing

Uncorrected SPT Values $N_{spt} := 50$

from Table 4.6.5.1.4A
page 83; Ref. 1 $q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$

End Bearing eq 11.14, Ref.2
Cb = correction factor for D > 50" $C_d := \frac{4.17ft}{D}$ $C_d := if\left(C_d \geq 1.00, 1.00, C_d\right)$

$C_d = 1$ $Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$

$Q_b = 106.029\,kip$ $Q_b = 471.639\,kN$

$Q_{ult} := Q_s + Q_b$

$Q_{ult} = 139.339\,kip$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$ $Q_{ult} = 619.81\,kN$

and to have low settlement $Q_a \leq Q_s$

$Q_a = 46.446\,kip$ $Q_a = 206.603\,kN$

Design Calculations-Uplift

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$W_{shaft} = 1.94\,kip$

$Q_{au} = 13.043\,kip$

$Q_{au} = 58.018\,kN$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Sheet 1 of 2
Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

Design Conditions:

1.) Length = 11.48 ft
2.) Diameter = 1.5 ft

Design Calcuations-Compression

Side Resistance

z = depth below ground surface

$kip := 1000 \cdot lbf$

$z := \left(\frac{2 + 11.48}{2}\right)$ ft

$\gamma := 130 \cdot \frac{lbf}{ft^3}$

$kN := \frac{kip}{4.448222}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z^{.5}$

diameter $D := 1.5 \cdot ft$

$\sigma'_z := z \cdot \gamma \cdot ft$

length of embedment $L := (11.48 - 2) \cdot ft$

eq. 11.11 Ref. 2 $f_{sz} := \beta \cdot \sigma'_z$

but $f_{sz} := if\left(f_{sz} \geq 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{sz}\right)$

$f_{sz} = 1.007 \frac{kip}{ft^2}$

Shaft side friction = $Q_S := f_{sz} \cdot \pi \cdot D \cdot L$

$Q_S = 44.996\,kip$

$Q_S = 200.15\,kN$

End Bearing

Uncorrected SPT Values $N_{spt} := 50$

from Table 4.6.5.1.4A
page 83; Ref. 1 $q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$

End Bearing eq 11.14, Ref.2
Cb = correction factor for D > 50" $C_d := \frac{4.17ft}{D}$ $C_d := if(C_d \geq 1.00, 1.00, C_d)$

$C_d = 1$ $Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$

$Q_b = 106.029\,kip$ $Q_b = 471.639\,kN$

$Q_{ult} := Q_s + Q_b$

$Q_{ult} = 151.024\,kip$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$ $Q_{ult} = 671.789\,kN$

and to have low settlement $Q_a \leq Q_s$

$Q_a = 50.341\,kip$ $Q_a = 223.93\,kN$

Design Calculations-Uplift

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$W_{shaft} = 2.345\,kip$

$Q_{au} = 17.344\,kip$

$Q_{au} = 77.149\,kN$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

Design Conditions:

1.) Length = 8.2 ft
2.) Diameter = 2.0 ft

Design Calcuations-Compression

Side Resistance

z = depth below ground surface

$z := \left(\frac{2 + 8.2}{2}\right)$ ft

$\gamma := 130 \cdot \frac{lbf}{ft^3}$

$kip := 1000 \cdot lbf$

$kN := \frac{kip}{4.448222}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z^{.5}$

diameter $D := 2.0 \cdot ft$

$\sigma'_z := z \cdot \gamma \cdot ft$

length of embedment $L := (8.2 - 2) \cdot ft$

eq. 11.11 Ref. 2 $f_{sz} := \beta \cdot \sigma'_z$

but $f_{sz} := if\left(f_{sz} \geq 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{sz}\right)$

$f_{sz} = 0.792 \frac{kip}{ft^2}$

Shaft side friction = $Q_S := f_{sz} \cdot \pi \cdot D \cdot L$

$Q_S = 30.867\,kip$

$Q_S = 137.305\,kN$

End Bearing

Uncorrected SPT Values $N_{spt} := 50$

from Table 4.6.5.1.4A
page 83; Ref. 1 $q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$

End Bearing eq 11.14, Ref.2
Cb = correction factor for D > 50" $C_d := \frac{4.17ft}{D}$ $C_d := if\left(C_d \geq 1.00, 1.00, C_d\right)$

$C_d = 1$ $Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$

$Q_b = 188.496\,kip$ $Q_b = 838.47\,kN$

$Q_{ult} := Q_s + Q_b$

$Q_{ult} = 219.363\,kip$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$ $Q_{ult} = 975.775\,kN$

and to have low settlement $Q_a \leq Q_s$

$Q_a = 73.121\,kip$ $Q_a = 325.258\,kN$

Design Calculations-Uplift

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$Q_{au} = 13.016\,kip$

$W_{shaft} = 2.727\,kip$

$Q_{au} = 57.898\,kN$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

Design Conditions:

1.) Length = 9.84 ft
2.) Diameter = 2.0 ft

Design Calcuations-Compression

Side Resistance

z = depth below ground surface

$kip := 1000 \cdot lbf$

$z := \left(\frac{2 + 9.84}{2}\right)$ ft $\quad \gamma := 130 \cdot \frac{lbf}{ft^3}$ $\quad kN := \frac{kip}{4.448222}$

Eq.11.13 $\beta := 1.5 - 0.135 \cdot z^{.5}$ Ref. 2

diameter $D := 2.0 \cdot ft$

$\sigma'z := z \cdot \gamma \cdot ft$

length of embedment $L := (9.84 - 2) \cdot ft$

eq. 11.11 $f_{sz} := \beta \cdot \sigma'z$ Ref. 2

but $f_{sz} := if\left(f_{sz} \geq 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{sz}\right)$

$f_{sz} = 0.902 \frac{kip}{ft^2}$

Shaft side friction = $Q_S := f_{sz} \cdot \pi \cdot D \cdot L$

$Q_S = 44.413\,kip$ $\quad Q_S = 197.561\,kN$

End Bearing

Uncorrected SPT Values $N_{spt} := 50$

from Table 4.6.5.1.4A
page 83; Ref. 1 $q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$

End Bearing eq 11.14, Ref.2
Cb = correction factor for D > 50" $C_d := \frac{4.17ft}{D}$ $C_d := if\left(C_d \geq 1.00, 1.00, C_d\right)$

$C_d = 1$ $Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$

$Q_b = 188.496\,kip$ $Q_b = 838.47\,kN$

$Q_{ult} := Q_s + Q_b$

$Q_{ult} = 232.909\,kip$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$ $Q_{ult} = 1.036 \times 10^3\,kN$

and to have low settlement $Q_a \leq Q_s$

$Q_a = 77.636\,kip$ $Q_a = 345.344\,kN$

Design Calculations-Uplift

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$W_{shaft} = 3.448\,kip$

$Q_{au} = 18.253\,kip$

$Q_{au} = 81.192\,kN$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

Design Conditions:

1.) Length = 11.48 ft
2.) Diameter = 2.0 ft

Design Calcuations-Compression

Side Resistance

z = depth below ground surface

$kip := 1000 \cdot lbf$

$z := \left(\frac{2 + 11.48}{2}\right)$ ft

$\gamma := 130 \cdot \frac{lbf}{ft^3}$

$kN := \frac{kip}{4.448222}$

Eq.11.13 $\beta := 1.5 - 0.135 \cdot z^{.5}$

Ref. 2

diameter $D := 2.0 \cdot ft$

$\sigma'_z := z \cdot \gamma \cdot ft$

length of embedment $L := (11.48 - 2) \cdot ft$

eq. 11.11 $f_{sz} := \beta \cdot \sigma'_z$

Ref. 2

but $f_{sz} := if\left(f_{sz} \geq 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{sz}\right)$

$f_{sz} = 1.007 \frac{kip}{ft^2}$

Shaft side friction = $Q_S := f_{sz} \cdot \pi \cdot D \cdot L$

$Q_S = 59.994\,kip$

$Q_S = 266.867\,kN$

End Bearing

Uncorrected SPT Values $N_{spt} := 50$

from Table 4.6.5.1.4A
page 83; Ref. 1 $q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$

End Bearing eq 11.14, Ref.2
Cb = correction factor for D > 50" $C_d := \frac{4.17ft}{D}$ $C_d := if\left(C_d \geq 1.00, 1.00, C_d\right)$

$C_d = 1$ $Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$

$Q_b = 188.496\,kip$ $Q_b = 838.47\,kN$

$Q_{ult} := Q_s + Q_b$

$Q_{ult} = 248.49\,kip$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$ $Q_{ult} = 1.105 \times 10^3\,kN$

and to have low settlement $Q_a \leq Q_s$

$Q_a = 82.83\,kip$ $Q_a = 368.446\,kN$

Design Calculations-Uplift

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$W_{shaft} = 4.17\,kip$

$Q_{au} = 24.168\,kip$

$Q_{au} = 107.503\,kN$

BLACK EAGLE CONSULTING Inc.
Geotechnical and Construction Services

Date: 6-13-00

Project Name: US 95 Project 1B WR-9 to WR-14
Project Number: 0215-01-1
Calculated By: pap Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in MIXED SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042
3. Geotechnical Investigation, Black Eagle Consulting, Inc

Design Conditions for 2 Strata:

1.) Exclude top 5 feet due to disturbance and lateral loads
2.) Shaft Diameter = 1.5 ft; Shaft Length= 11.5 ft
3.) Based on Black Eagle Consulting Boring No. WR-11 (worst case)
4.) GWT = > 35 feet
5.) Layer 1: 0-6.7' granular Layer 2: 6.7-15.5' cohesive

Calculation of Overburden Pressure for Correction of SPT N Values to Aid in Selection of Undrained Strength of Cohesive Soil Layers

$L_{o1} := 6.7 \cdot ft$ $L_{o2} := 15.5 \cdot ft$

$\gamma_{o1} := 130 \cdot \frac{lb}{ft^3}$ $\gamma_{o2} := 110 \cdot \frac{lb}{ft^3}$

$\gamma_w := 62.4 \cdot \frac{lb}{ft^3}$ $N_{stp} := 50$ at depth of interest

$D_j := 13 \cdot ft$ (Depth of Interest)

$\sigma'_j := \left(L_{o1} \cdot \gamma_{o1} + L_{o2} \cdot \gamma_{o2}\right)$

$\sigma'_j = 2.576 \times 10^3 \, lb \, ft^{-2}$

$N_C := \left(\frac{2000 \cdot lb \cdot ft^{-2}}{\sigma'_j}\right)^{.5} \cdot N_{stp}$ $N_C = 44.057$

DESIGN CALCULATIONS
Shaft Resistance in Compression

Note: Set c_u = 0 for Granular (g) soils; L= 0 for Cohesive Soils

Shaft Resistance for Granular Condition z = mid point of strata
Layer No. 1 Silty Sand with Gravel; Caliche

Midpoint of Interval: $z_1 := \left(\frac{6.7 + 5}{2}\right)$ $\gamma_1 := 130 \cdot \frac{lb}{ft^3}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z_1^{.5}$ diameter $D := 1.5ft$

$\beta = 1.173$

$\sigma'_{z1} := z_1 \cdot \gamma_1$ Length of embedment: $L_1 := (6.7 - 5) \cdot ft$

Eq. 11.11 Ref. 2 $f_{sz1} := \beta \cdot \sigma'_{z1} \cdot ft$ but $f_{sz1} := if\left(f_{sz1} \geq 4000 \cdot \frac{lb}{ft^2}, 4000 \cdot \frac{lb}{ft^2}, f_{sz1}\right)$

$f_{sz1} = 892.43 \frac{lb}{ft^2}$

Shaft Resistance
Layer 1
Granular Condition $S_{1g} := f_{sz1} \cdot \pi \cdot D \cdot L_1$

$S_{1g} = 7.149 \times 10^3 \, lb$

Shaft Resistance for Cohesive Condition

Layer No. 2 Sandy Lean Clay

$c_{u2} := 8000 \cdot \frac{lb}{ft^2}$

Interval: 6.7 to 11.5 feet

$L_{2c} := 11.5 \cdot ft - 6.7 \cdot ft$

$L_{2c} = 4.8\,ft$

Area of Interval

$A := D \cdot \pi \cdot L_{2c}$

$A = 22.619\,ft^2$

From Table 11.1, Ref. 2, $\alpha := 0.55$

$\alpha_{cu2} := \alpha \cdot c_{u2}$

$\alpha_{cu2} := if\left(\alpha_{cu2} \geq 5500 \cdot lb \cdot ft^{-2}, 5500 \cdot lb \cdot ft^{-2}, \alpha_{cu2}\right)$

$\alpha_{cu2} = 4.4 \times 10^3\,lb\,ft^{-2}$

Shaft Resistance, layer 2 Cohesive Condition: $S_{2c} := A \cdot c_{u2} \cdot \alpha$

$S_{2c} = 9.953 \times 10^4\,lb$

Total Shaft Resistance: $Q_s := \left(S_{1g} + S_{2c}\right)$

$kip := 1000 \cdot lb$

$kN := \frac{kip}{4.448222}$

$Q_s = 1.067 \times 10^5\,lb$

$Q_s = 106.675\,kip$

$Q_s = 474.514\,kN$

DESIGN CALCULATIONS
End Bearing

Cohesive Soil

Equation 11.4, Ref. 2: Length of Shaft : $L_S := 11.5 \cdot ft$

$C_{ub'} := 8000 \cdot lb$

$N_C := 6.0 \cdot \left[1 + \left(0.2 \cdot \frac{L_S}{D}\right)\right]$ $N_C := if\left(N_C \geq 9.00, 9.00, N_C\right)$

$Q_{bc} := N_C \cdot C_{ub'}$ $Q_{bc} = 7.2 \times 10^4\, lb$

$Q_{bc} := if\left(Q_{bc} \geq 80000 \cdot lb, 80000 \cdot lb, Q_{bc}\right)$

$Q_{ult} := Q_s + Q_{bc}$ $Q_{ult} = 178.675\, kip$ $Q_{ult} = 794.786\, kN$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$

and to have low settlement $Q_a \leq Q_s$ $Q_a = 59.558\, kip$

$Q_a = 264.929\, kN$

DESIGN CALCULATIONS
Uplift

$L := 11.5 \cdot ft$

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$Q_{au} = 38.403\, kip$ $Q_{au} = 170.827\, kN$

$W_{shaft} = 2.845\, kip$

BLACK EAGLE CONSULTING Inc.
Geotechnical and Construction Services

Date: 6-13-00

Project Name: US 95 Project 1B WR-9 to WR-14
Project Number: 0215-01-1
Calculated By: pap Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in MIXED SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042
3. Geotechnical Investigation, Black Eagle Consulting, Inc

Design Conditions for 2 Strata:

1.) Exclude top 5 feet due to disturbance and lateral loads
2.) Shaft Diameter = 2.0 ft; Shaft Length= 11.5 ft
3.) Based on Black Eagle Consulting Boring No. WR-11 (worst case)
4.) GWT = > 35 feet
5.) Layer 1: 0-6.7' granular Layer 2: 6.7-15.5' cohesive

Calculation of Overburden Pressure for Correction of SPT N Values to Aid in Selection of Undrained Strength of Cohesive Soil Layers

$L_{o1} := 6.7 \cdot ft$ $L_{o2} := 15.5 \cdot ft$

$\gamma_{o1} := 130 \cdot \frac{lb}{ft^3}$ $\gamma_{o2} := 110 \cdot \frac{lb}{ft^3}$

$\gamma_w := 62.4 \cdot \frac{lb}{ft^3}$ $N_{stp} := 50$ at depth of interest

$D_i := 13 \cdot ft$ (Depth of Interest)

$\sigma'_i := \left(L_{o1} \cdot \gamma_{o1} + L_{o2} \cdot \gamma_{o2}\right)$

$\sigma'_i = 2.576 \times 10^3 \, lb ft^{-2}$

$N_C := \left(\frac{2000 \cdot lb \cdot ft^{-2}}{\sigma'_i}\right)^{.5} \cdot N_{stp}$ $\quad N_C = 44.057$

DESIGN CALCULATIONS
Shaft Resistance in Compression

Note: Set $c_u = 0$ for Granular (g) soils; L= 0 for Cohesive Soils

Shaft Resistance for Granular Condition z = mid point of strata
Layer No. 1 Silty Sand with Gravel; Caliche

Midpoint of Interval: $z_1 := \left(\frac{6.7 + 5}{2}\right)$ $\quad \gamma_1 := 130 \cdot \frac{lb}{ft^3}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z_1^{.5}$ $\quad$ diameter $D := 2.0ft$

$\beta = 1.173$

$\sigma'_{z1} := z_1 \cdot \gamma_1$ $\quad$ Length of embedment: $L_1 := (6.7 - 5) \cdot ft$

Eq. 11.11 Ref. 2 $f_{sz1} := \beta \cdot \sigma'_{z1} \cdot ft$ but $f_{sz1} := if\left(f_{sz1} \geq 4000 \cdot \frac{lb}{ft^2}, 4000 \cdot \frac{lb}{ft^2}, f_{sz1}\right)$

$f_{sz1} = 892.43 \frac{lb}{ft^2}$

Shaft Resistance
Layer 1
Granular Condition $S_{1g} := f_{sz1} \cdot \pi \cdot D \cdot L_1$

$S_{1g} = 9.532 \times 10^3 \, lb$

Shaft Resistance for Cohesive Condition

Layer No. 2 Sandy Lean Clay

$c_{u2} := 8000 \cdot \frac{lb}{ft^2}$

Interval: 6.7 to 11.5 feet

$L_{2c} := 11.5 \cdot ft - 6.7 \cdot ft$

$L_{2c} = 4.8\,ft$

Area of Interval

$A := D \cdot \pi \cdot L_{2c}$

$A = 30.159\,ft^2$

From Table 11.1, Ref. 2, $\alpha := 0.55$

$\alpha_{cu2} := \alpha \cdot c_{u2}$

$\alpha_{cu2} := if\left(\alpha_{cu2} \geq 5500 \cdot lb \cdot ft^{-2}, 5500 \cdot lb \cdot ft^{-2}, \alpha_{cu2}\right)$

$\alpha_{cu2} = 4.4 \times 10^3\,lb\,ft^{-2}$

Shaft Resistance, layer 2 Cohesive Condition: $S_{2c} := A \cdot c_{u2} \cdot \alpha$

$S_{2c} = 1.327 \times 10^5\,lb$

Total Shaft Resistance: $Q_s := \left(S_{1g} + S_{2c}\right)$

$kip := 1000 \cdot lb$

$kN := \frac{kip}{4.448222}$

$Q_s = 1.422 \times 10^5\,lb$

$Q_s = 142.233\,kip$

$Q_s = 632.685\,kN$

DESIGN CALCULATIONS
End Bearing

Cohesive Soil

Equation 11.4, Ref. 2: Length of Shaft : $L_s := 11.5 \cdot ft$

$C_{ub'} := 8000 \cdot lb$

$N_c := 6.0 \cdot \left[1 + \left(0.2 \cdot \frac{L_s}{D}\right)\right]$ $N_c := if\left(N_c \geq 9.00, 9.00, N_c\right)$

$Q_{bc} := N_c \cdot C_{ub'}$ $Q_{bc} = 7.2 \times 10^4\, lb$

$Q_{bc} := if\left(Q_{bc} \geq 80000 \cdot lb, 80000 \cdot lb, Q_{bc}\right)$

$Q_{ult} := Q_s + Q_{bc}$ $Q_{ult} = 214.233\, kip$ $Q_{ult} = 952.957\, kN$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$

and to have low settlement $Q_a \leq Q_s$ $Q_a = 71.411\, kip$

$Q_a = 317.652\, kN$

DESIGN CALCULATIONS
Uplift

$L := 11.5 \cdot ft$

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$Q_{au} = 52.469\, kip$ $Q_{au} = 233.394\, kN$

$W_{shaft} = 5.058\, kip$

BLACK EAGLE CONSULTING Inc. Sheet 1 of 8
Geotechnical and Construction Services Date: 6-13-00

Project Name: US 95 Project 1B WR-9 to WR-14
Project Number: 0215-01-1
Calculated By: pap Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in MIXED SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042
3. Geotechnical Investigation, Black Eagle Consulting, Inc

Design Conditions for 2 Strata:

1.) Exclude top 5 feet due to disturbance and lateral loads
2.) Shaft Diameter = 3.0 ft; Shaft Length= 11.5 ft
3.) Based on Black Eagle Consulting Boring No. WR-11 (worst case)
4.) GWT = > 35 feet
5.) Layer 1: 0-6.7' granular Layer 2: 6.7-15.5' cohesive

Calculation of Overburden Pressure for Correction of SPT N Values to Aid in Selection of Undrained Strength of Cohesive Soil Layers

$L_{o1} := 6.7 \cdot ft$ $L_{o2} := 15.5 \cdot ft$

$\gamma_{o1} := 130 \cdot \frac{lb}{ft^3}$ $\gamma_{o2} := 110 \cdot \frac{lb}{ft^3}$

$\gamma_w := 62.4 \cdot \frac{lb}{ft^3}$ $N_{stp} := 50$ at depth of interest

$D_i := 13 \cdot ft$ (Depth of Interest)

$\sigma'_i := \left(L_{o1} \cdot \gamma_{o1} + L_{o2} \cdot \gamma_{o2}\right)$

$$\sigma'_i = 2.576 \times 10^{3}\, lb\, ft^{-2}$$

$$N_C := \left(\frac{2000 \cdot lb \cdot ft^{-2}}{\sigma'_i}\right)^{.5} \cdot N_{stp} \qquad N_C = 44.057$$

DESIGN CALCULATIONS
Shaft Resistance in Compression

Note: Set c_u = 0 for Granular (g) soils; L= 0 for Cohesive Soils

Shaft Resistance for Granular Condition z = mid point of strata
Layer No. 1 Silty Sand with Gravel; Caliche

Midpoint of Interval: $z_1 := \left(\frac{6.7 + 5}{2}\right)$ $\qquad \gamma_1 := 130 \cdot \frac{lb}{ft^3}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z_1^{.5}$ $\qquad$ diameter $D := 3.0ft$

$\beta = 1.173$

$\sigma'_{z1} := z_1 \cdot \gamma_1$ $\qquad$ Length of embedment: $L_1 := (6.7 - 5) \cdot ft$

Eq. 11.11 Ref. 2 $f_{sz1} := \beta \cdot \sigma'_{z1} \cdot ft$ but $f_{sz1} := if\left(f_{sz1} \geq 4000 \cdot \frac{lb}{ft^2}, 4000 \cdot \frac{lb}{ft^2}, f_{sz1}\right)$

$f_{sz1} = 892.43 \frac{lb}{ft^2}$

Shaft Resistance
Layer 1
Granular Condition $S_{1g} := f_{sz1} \cdot \pi \cdot D \cdot L_1$

$S_{1g} = 1.43 \times 10^{4}\, lb$

Shaft Resistance for Cohesive Condition

Layer No. 2 Sandy Lean Clay

$c_{u2} := 8000 \cdot \frac{lb}{ft^2}$

Interval: 6.7 to 11.5 feet

$L_{2c} := 11.5 \cdot ft - 6.7 \cdot ft$

$L_{2c} = 4.8\,ft$

Area of Interval

$A := D \cdot \pi \cdot L_{2c}$

$A = 45.239\,ft^2$

From Table 11.1, Ref. 2, $\alpha := 0.55$

$\alpha_{cu2} := \alpha \cdot c_{u2}$

$\alpha_{cu2} := if\left(\alpha_{cu2} \geq 5500 \cdot lb \cdot ft^{-2}, 5500 \cdot lb \cdot ft^{-2}, \alpha_{cu2}\right)$

$\alpha_{cu2} = 4.4 \times 10^3\,lb\,ft^{-2}$

Shaft Resistance, layer 2 Cohesive Condition: $S_{2c} := A \cdot c_{u2} \cdot \alpha$

$S_{2c} = 1.991 \times 10^5\,lb$

Total Shaft Resistance: $Q_s := \left(S_{1g} + S_{2c}\right)$

$kip := 1000 \cdot lb$

$kN := \frac{kip}{4.448222}$

$Q_s = 2.133 \times 10^5\,lb$

$Q_s = 213.35\,kip$

$Q_s = 949.028\,kN$

DESIGN CALCULATIONS
End Bearing

Cohesive Soil

Equation 11.4, Ref. 2: Length of Shaft : $L_s := 11.5 \cdot ft$

$C_{ub'} := 8000 \cdot lb$

$N_c := 6.0 \cdot \left[1 + \left(0.2 \cdot \frac{L_s}{D}\right)\right]$ $N_c := if\left(N_c \geq 9.00, 9.00, N_c\right)$

$Q_{bc} := N_c \cdot C_{ub'}$ $Q_{bc} = 7.2 \times 10^4 lb$

$Q_{bc} := if\left(Q_{bc} \geq 80000 \cdot lb, 80000 \cdot lb, Q_{bc}\right)$

$Q_{ult} := Q_s + Q_{bc}$ $Q_{ult} = 285.35\,kip$ $Q_{ult} = 1.269 \times 10^3 kN$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$

and to have low settlement $Q_a \leq Q_s$ $Q_a = 95.117\,kip$

$Q_a = 423.1\,kN$

DESIGN CALCULATIONS
Uplift

$L := 11.5 \cdot ft$

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$W_{shaft} = 11.38\,kip$ $Q_{au} = 82.497\,kip$ $Q_{au} = 366.965\,kN$

US 95 2 ft dia x 8 ft long drilled shaft

++++++++++++++++ THIS OUTPUT FOR DATA FILE: US95.DTA

SOLUTION FOR LATERALLY LOADED PILE--ITYPE = 1 ++++++++++

NO OF NP = 20 NO OF ELEMENTS, NM = 9 NO OF NON-ZERO P, NNZP = 1
NO OF LOAD CASES, NLC = 4 NO OF CYCLES NCYC = 3
NODE SOIL STARTS JTSOIL = 2
NONLINEAR (IF > 0) = 1 NO OF BOUNDARY CONDIT NZX = 0
MODULUS KCODE = 3 LIST BAND IF > 0 = 0
IMET (SI > 0) = 0

MEMNO	NP1	NP2	NP3	NP4	LENGTH	WIDTH	INERTIA,FT**4
1	1	2	3	4	2.000	2.000	.78500E+00
2	3	4	5	6	2.000	2.000	.78500E+00
3	5	6	7	8	2.000	2.000	.78500E+00
4	7	8	9	10	2.000	2.000	.78500E+00
5	9	10	11	12	2.000	2.000	.78500E+00
6	11	12	13	14	2.000	2.000	.78500E+00
7	13	14	15	16	2.000	2.000	.78500E+00
8	15	16	17	18	2.000	2.000	.78500E+00
9	17	18	19	20	2.000	2.000	.78500E+00

THE INITIAL INPUT P-MATRIX ENTRIES

NP	LC	P(NP,LC)
2	1	70.000
2	2	80.000
2	3	90.000
2	4	95.000

THE ORIGINAL P-MATRIX WHEN NONLIN > 0 ++++++

1	.00	70.00
2	.00	.00
3	.00	.00
4	.00	.00
5	.00	.00
6	.00	.00
7	.00	.00
8	.00	.00
9	.00	.00
10	.00	.00

MOD OF ELASTICITY E = 466900. KSF

GROUND NODE REDUCTION FACTORS FOR PILES, FAC1,FAC2 = -1.00 1.00

THE NODE SOIL MODULUS, SPRINGS AND MAX DEFL:

NODE	SOIL MODULUS	SPRING,K/FT	MAX DEFL,FT
1	.0	.0	.0500
2	1545.0	4691.3	.0400
3	3947.0	14850.0	.0300
4	4942.0	19614.0	.0200
5	5706.0	22743.3	.0100
6	6349.0	25345.3	.0100
7	6916.0	27628.0	.0100
8	7429.0	29688.0	.0100
9	7900.0	31578.7	.0100
10	8339.0	16385.3	.0100

BASE SUM OF NODE SPRINGS = 192524.0 K/FT NO ADJUSTMENTS
* = NODE SPRINGS HAND COMPUTED AND INPUT

MEMBER MOMENTS, NODE REACTIONS, DEFLECTIONS, SOIL PRESSURE, AND LAST USED P-MATRIX FOR LC = 1

MEMNO	MOMENTS--NEAR END 1ST, K-FT		NODE	SPG FORCE, KIPS	ROT, RADS	DEFL, FT	SOIL Q, KSF	P-, K-FT	P-, KIPS
1	.000	140.000	1	.00	-.00322	.01455	.00	.00	70.00
2	-140.000	201.580	2	39.21	-.00284	.00836	12.91	.00	.00
3	-201.580	157.680	3	52.74	-.00191	.00355	14.02	.00	.00
4	-157.680	84.232	4	14.77	-.00093	.00075	3.72	.00	.00
5	-84.232	27.975	5	-8.60	-.00027	-.00038	2.16	.00	.00
6	-27.975	.031	6	-14.16	.00004	-.00056	3.55	.00	.00
7	-.031	-6.784	7	-10.56	.00011	-.00038	2.64	.00	.00
8	6.784	-3.658	8	-4.97	.00010	-.00017	1.24	.00	.00

9	3.658	.000	9	-.27	.00007	-.00001	.07	.00	.00
			10	1.83	.00006	.00011	.93	.00	.00

SUM SPRING FORCES = 70.00 VS SUM APPLIED FORCES = 70.00 KIPS

(*) = SOIL DISPLACEMENT > XMAX SO SPRING FORCE AND Q = XMAX*VALUE ++++++++++++
NOTE THAT P-MATRIX ABOVE INCLUDES ANY EFFECTS FROM X > XMAX ON LAST CYCLE ++++++++++

MEMBER MOMENTS, NODE REACTIONS, DEFLECTIONS, SOIL PRESSURE, AND LAST USED P-MATRIX FOR LC = 2

MEMNO	MOMENTS--NEAR END 1ST, K-FT		NODE	SPG FORCE, KIPS	ROT, RADS	DEFL, FT	SOIL Q, KSF	P-, K-FT	P-, KIPS
1	.000	160.000	1	.00	-.00368	.01663	.00	.00	80.00
2	-160.000	230.377	2	44.81	-.00325	.00955	14.76	.00	.00
3	-230.377	180.206	3	60.27	-.00218	.00406	16.02	.00	.00
4	-180.206	96.265	4	16.88	-.00106	.00086	4.25	.00	.00
5	-96.265	31.971	5	-9.82	-.00031	-.00043	2.46	.00	.00
6	-31.971	.036	6	-16.18	.00004	-.00064	4.05	.00	.00
7	-.036	-7.753	7	-12.07	.00013	-.00044	3.02	.00	.00
8	7.753	-4.180	8	-5.68	.00011	-.00019	1.42	.00	.00
9	4.180	.000	9	-.30	.00008	-.00001	.08	.00	.00
			10	2.09	.00006	.00013	1.06	.00	.00

SUM SPRING FORCES = 80.00 VS SUM APPLIED FORCES = 80.00 KIPS

(*) = SOIL DISPLACEMENT > XMAX SO SPRING FORCE AND Q = XMAX*VALUE ++++++++++++
NOTE THAT P-MATRIX ABOVE INCLUDES ANY EFFECTS FROM X > XMAX ON LAST CYCLE ++++++++++

MEMBER MOMENTS, NODE REACTIONS, DEFLECTIONS, SOIL PRESSURE, AND LAST USED P-MATRIX FOR LC = 3

MEMNO	MOMENTS--NEAR END 1ST, K-FT		NODE	SPG FORCE, KIPS	ROT, RADS	DEFL, FT	SOIL Q, KSF	P-, K-FT	P-, KIPS
1	.000	180.000	1	.00	-.00414	.01871	.00	.00	90.00
2	-180.000	259.174	2	50.41	-.00365	.01075	16.60	.00	.00
3	-259.174	202.732	3	67.81	-.00245	.00457	18.02	.00	.00
4	-202.732	108.299	4	19.00	-.00119	.00097	4.79	.00	.00
5	-108.299	35.968	5	-11.05	-.00035	-.00049	2.77	.00	.00
6	-35.968	.040	6	-18.20	.00005	-.00072	4.56	.00	.00
7	-.040	-8.722	7	-13.58	.00015	-.00049	3.40	.00	.00
8	8.722	-4.703	8	-6.39	.00012	-.00022	1.60	.00	.00
9	4.703	.000	9	-.34	.00009	-.00001	.09	.00	.00
			10	2.35	.00007	.00014	1.20	.00	.00

SUM SPRING FORCES = 90.00 VS SUM APPLIED FORCES = 90.00 KIPS

(*) = SOIL DISPLACEMENT > XMAX SO SPRING FORCE AND Q = XMAX*VALUE ++++++++++++
NOTE THAT P-MATRIX ABOVE INCLUDES ANY EFFECTS FROM X > XMAX ON LAST CYCLE ++++++++++

MEMBER MOMENTS, NODE REACTIONS, DEFLECTIONS, SOIL PRESSURE, AND LAST USED P-MATRIX FOR LC = 4

MEMNO	MOMENTS--NEAR END 1ST, K-FT		NODE	SPG FORCE, KIPS	ROT, RADS	DEFL, FT	SOIL Q, KSF	P-, K-FT	P-, KIPS
1	.000	190.000	1	.00	-.00437	.01975	.00	.00	95.00
2	-190.000	273.573	2	53.21	-.00386	.01134	17.52	.00	.00
3	-273.573	213.995	3	71.58	-.00259	.00482	19.02	.00	.00
4	-213.995	114.315	4	20.05	-.00126	.00102	5.05	.00	.00
5	-114.315	37.966	5	-11.67	-.00037	-.00051	2.93	.00	.00
6	-37.966	.042	6	-19.21	.00005	-.00076	4.81	.00	.00
7	-.042	-9.207	7	-14.34	.00015	-.00052	3.59	.00	.00
8	9.207	-4.964	8	-6.75	.00013	-.00023	1.69	.00	.00
9	4.964	.000	9	-.36	.00009	-.00001	.09	.00	.00
			10	2.48	.00008	.00015	1.26	.00	.00

SUM SPRING FORCES = 95.00 VS SUM APPLIED FORCES = 95.00 KIPS

(*) = SOIL DISPLACEMENT > XMAX SO SPRING FORCE AND Q = XMAX*VALUE ++++++++++++
NOTE THAT P-MATRIX ABOVE INCLUDES ANY EFFECTS FROM X > XMAX ON LAST CYCLE ++++++++++

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 5-1-00

Project Name: US 95 High Mast Lighting Foundations
Project Number: 215-01-1
Calculated By: DH Checked By: mcd

CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

Design Conditions:

1.) Length = 14.3 ft
2.) Diameter = 3.0 ft

Design Calcuations-Compression

Side Resistance

z = depth below ground surface

$kip := 1000 \cdot lbf$

$z := \left(\frac{2 + 14.3}{2}\right)$ ft

$\gamma := 130 \cdot \frac{lbf}{ft^3}$

$kN := \frac{kip}{4.448222}$

Eq.11.13 Ref. 2 $\beta := 1.5 - 0.135 \cdot z^{.5}$

diameter $D := 3.0 \cdot ft$

$\sigma'_z := z \cdot \gamma \cdot ft$

length of embedment $L := (14.3 - 2) \cdot ft$

eq. 11.11 Ref. 2 $f_{sz} := \beta \cdot \sigma'_z$

but $f_{sz} := if\left(f_{sz} \geq 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{sz}\right)$

$f_{sz} = 1.181 \frac{kip}{ft^2}$

Shaft side friction = $Q_S := f_{sz} \cdot \pi \cdot D \cdot L$

$Q_S = 136.898\,kip$

$Q_S = 608.951\,kN$

End Bearing

Uncorrected SPT Values $N_{spt} := 50$

from Table 4.6.5.1.4A
page 83; Ref. 1 $q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$

End Bearing eq 11.14, Ref.2
Cb = correction factor for D > 50" $C_d := \frac{4.17ft}{D}$ $C_d := if\left(C_d \geq 1.00, 1.00, C_d\right)$

$C_d = 1$ $Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$

$Q_b = 424.115\,kip$ $Q_b = 1.887 \times 10^3\,kN$

$Q_{ult} := Q_s + Q_b$

$Q_{ult} = 561.013\,kip$

with safety factor $SF := 3$ $Q_a := \frac{Q_{ult}}{SF}$ $Q_{ult} = 2.496 \times 10^3\,kN$

and to have low settlement $Q_a \leq Q_s$

$Q_a = 187.004\,kip$ $Q_a = 831.836\,kN$

Design Calculations-Uplift

$W_{shaft} := \pi\left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$ $Q_{au} := \frac{Q_s}{3} + W_{shaft}$

$W_{shaft} = 12.172\,kip$

$Q_{au} = 57.805\,kip$

$Q_{au} = 257.128\,kN$

BLACK EAGLE CONSULTING
Project Name: U.S 95 High Mast Lighting
Project Number: 215-01-1
Calculated By: DH; Checked By: mcd

Sheet: 1 of 2
Date: 5-1-00

DESIGN OF LATERALLY LOADED DRILLED SHAFT USING THE BROMS METHOD COHESSIONLESS SOILS

References:

1.) AASHTO, 1996: *Standard Specifications for Highway Bridges*, 16th edition

2.) Broms, B.B., 1964: *Design of Laterally Loaded Piles*, Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics and Foundation Division, Vol. 91, No. SM-3

Variables:

Q = Horizontal Load at Top of Shaft in kips: $Q := 0.0$

Moment at Top of Shaft in kip-ft: $M := 335.0$

a = Depth of Unsuitable Soil, 2' min: $a := 2.0$

γ = Effective Unit Weight of Soil in kcf: $\gamma := .130$

ϕ = Angle of Internal Friction: $\phi := 38deg$

L = Depth of Embedment in feet: **find**

D = Diameter of Shaft in feet: $D := 3.0$

Kp = Coefficient of Rankine passive earth pressure:

$$K_p := \frac{1 + \sin(\phi \cdot deg)}{1 - \sin(\phi \cdot deg)}$$

$K_p = 1.023$

For Granular Soils:

Initial estimate of L to start iteration: $L := 10$

$$L := root\left[L^3 - 2 \cdot Q \cdot \frac{(a + L)}{\gamma \cdot K_p \cdot D} - \frac{2M}{\gamma \cdot K_p \cdot D}, L\right]$$

$L = 11.885$ feet

Add 20% safety factor to length:

$$L_D := L \cdot 1.2$$

$$L_D = 14.262 \text{ feet}$$

Location of Maximum Moment-below top of shaft in feet:

$$Y_m := \left[\frac{2 \cdot Q}{\left(3 \cdot \gamma \cdot K_p \cdot D\right)}\right]^{.5} + a$$

$$Y_m = 2 \quad \text{feet}$$

Maximum Moment: $$M_{max} := M + Q \cdot a + Q \cdot Y_m - \frac{Q \cdot Y_m}{3}$$

$$M_{max} = 335 \quad \text{kip} - \text{ft}$$

APPENDIX C -

DESIGN CALCULATIONS FOR TRENCH FOOTINGS

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 3-20-00
Sheet 1 of 2

Project Name: SVERDRUP-US 95
Project Number: 215-01-1

Lateral Soil Pressure for Trench Footings by The Sheet Pile Procedure

References:

1.) California Department of Transportation, 1990, *Lateral Soil Pressure by the Sheet Pile Procedure:* Bridge Design Aids, p. 16-2 to 16-8

2.) NAVFAC (Naval Facilities Engineering Command), 1982, *Foundations and Earth Structures;* Design Manual 7.2.

Surface Slope Condition: Level (Noise walls 2,3,4 and east side of 5)

Variables:

$\phi := 40deg$ angle of shearing resistance

$\delta := -\frac{2}{3}\cdot\phi$ wall friction angle $\cos(\delta) = 0.894$

$\beta := 0.0deg$ slope angle

$\gamma := 130\cdot\frac{lbf}{ft^3}$ effective unit weight of soil

Find:

P_p = passive soil pressure

P_a = active soil pressure

K_p = coefficient of passive pressure

K_a = coefficient of active pressure

R = reduction factor for K_p

Q = allowable net horizontal ultimate lateral soil pressure

Calculations:

$\frac{\beta}{\phi} = 0$ $\frac{\delta}{\phi} = -0.667$

$R := .753$ (Interpolated From Figure 1 of Reference 1 or Figure 6 of Reference 2)

$K_a := .22$ (From Figure 1 of Reference 1 or Figure 6 of Reference 2)

$K_p := 17$ (From Figure 1 of Reference 1 or Figure 6 of Reference 2)

1.) Find Passive Pressure, Corrected to the Horizontal:

$P_p := R \cdot K_p \cdot \gamma \cdot \cos(\delta)$ $P_p = 1487 \frac{lbf}{ft^3}$

2.) Find Active Pressure, Corrected to the Horizontal:

$P_a := K_a \cdot \gamma \cdot \cos(\delta)$ $P_a = 25.6 \frac{lbf}{ft^3}$

3.) Determine Allowable Net Horizontal Ultimate Lateral Soil Pressure:

$Q := P_p - P_a$ $Q = 1462 \frac{lbf}{ft^3}$

$kN := 1000N$

$Q = 230 \frac{kN}{m^3}$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 3-20-00
Sheet 1 of 2

Project Name: SVERDRUP-US 95
Project Number: 215-01-1

Lateral Soil Pressure for Trench Footings by The Sheet Pile Procedure

References:

1.) California Department of Transportation, 1990, *Lateral Soil Pressure by the Sheet Pile Procedure:* Bridge Design Aids, p. 16-2 to 16-8

2.) NAVFAC (Naval Facilities Engineering Command), 1982, *Foundations and Earth Structures;* Design Manual 7.2.

Surface Slope Condition: 6:1 (west side of noise wall 5)

Variables:

$\phi := 40\text{deg}$ angle of shearing resistance

$\delta := -\frac{2}{3}\cdot\phi$ wall friction angle $\cos(\delta) = 0.894$

$\beta := -9.5\text{deg}$ slope angle (6:1 H:V downward slope on the west side)

$\gamma := 130\cdot\frac{\text{lbf}}{\text{ft}^3}$ effective unit weight of soil

Find:

P_p = passive soil pressure

P_a = active soil pressure

K_p = coefficient of passive pressure

K_a = coefficient of active pressure

R = reduction factor for K_p

Q = allowable net horizontal ultimate lateral soil pressure

Calculations:

$\frac{\beta}{\phi} = -0.238$ $\frac{\delta}{\phi} = -0.667$

$R := .753$ (Interpolated From Figure 1 of Reference 1 or Figure 6 of Reference 2)

$K_a := .16$ (From Figure 1 of Reference 1 or Figure 6 of Reference 2)

$K_p := 11$ (From Figure 1 of Reference 1 or Figure 6 of Reference 2)

1.) Find Passive Pressure, Corrected to the Horizontal:

$$P_p := R \cdot K_p \cdot \gamma \cdot \cos(\delta) \qquad P_p = 962 \frac{lbf}{ft^3}$$

2.) Find Active Pressure, Corrected to the Horizontal:

$$P_a := K_a \cdot \gamma \cdot \cos(\delta) \qquad P_a = 18.6 \frac{lbf}{ft^3}$$

3.) Determine Allowable Net Horizontal Ultimate Lateral Soil Pressure:

$$Q := P_p - P_a \qquad Q = 944 \frac{lbf}{ft^3}$$

$kN := 1000N$

$$Q = 148 \frac{kN}{m^3}$$

APPENDIX D -

LATERAL EARTH PRESSURES FOR RETAINING WALLS

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-21-2000

Project Name: US 95: Retaining Walls
Project Number: 0215-01-1
Calculated By: DH Checked By: mcd

CALCLUATION OF COEFFICIENT FOR PASSIVE PRESSURE

1.) References:
a.) AASHTO, 1996: *Standard Specifications for Highway Bridges,* 16th ed

2.) Design Parameters:

$\phi := 34deg$ $\beta_0 := 0.0deg$

$\beta := 22deg$ $\beta_3 := 18.4deg$

$\delta := -22deg$ $\beta_2 := 26.6deg$

$\frac{\delta}{\phi} = -0.647$

Interpolate Rf from Fig. 5.5.2E of reference:

For Flat Slope:

$\frac{\beta_0}{\phi} = 0$

$R_1 := .752 + (.836 - .752)\cdot.7$ $R_1 = 0.811$

$R_2 := .682 + (.783 - .682)\cdot.7$ $R_2 = 0.753$

$R_f := (R_1 - R_2)\cdot.8 + .753$

$R_f = 0.799$

For 3:1 Slope: $\frac{\beta_3}{\phi} = 0.541$

For 2:1 Slope: $\frac{\beta_2}{\phi} = 0.782$

From Fig. 5.5.2E of reference:

$K_{pflat} := 9.2\cdot R_f$ $K_{pflat} = 7.355$

$K_{p3} := 18\cdot R_f$ $K_{p3} = 14.391$

$K_{p2} := 24\cdot R_f$ $K_{p2} = 19.188$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-21-2000

Project Name: US 95: Retaining Walls - 3:1 Backfill slope, i.
Project Number: 0215-01-1
Calculated By: DH Checked By: mcd

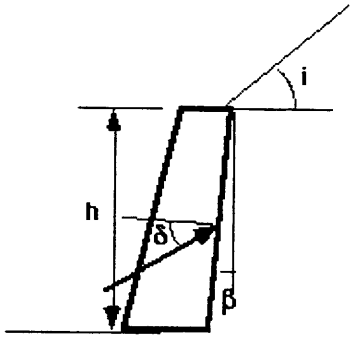
COULOMB ANALYSIS ACTIVE COEFFICIENT for SLOPING BACKFILL

References:

AASHTO- 1996STANDARD
SPECIFICATIONS FOR
HIGHWAY BRIDGES sec 5.5

$\phi := 34 \cdot deg$

$\beta := 0 \cdot deg$ $i := 18.4 deg$



Calculate Ka for static conditions (Assumes $\delta = 0$; i.e, does not include wall friction):

$$K_a(\phi, i, \beta) \equiv \frac{\cos(\phi - \beta)^2}{\left(\cos(\beta)^2 \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^2\right]}$$

$K_a := K_a(\phi, i, \beta)$ $K_a = 0.352$

AT REST CONDITION:

$K_o := 1 - \sin(\phi)$

$K_o = 0.441$

COEFFICIENT OF FRICTION,μ:

Static Conditions: $\mu := \tan(\phi)$ $\mu = 0.675$

With Safety Factor: $\mu_{sf} := .667 \cdot \mu$

$\mu_{sf} = 0.45$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-21-2000

Project Name: US 95: Retaining Walls - 2:1 Backfill slope, i.
Project Number: 0215-01-1
Calculated By: DH Checked By: mcd

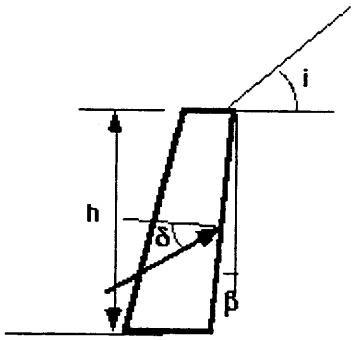
COULOMB ANALYSIS ACTIVE COEFFICIENT for SLOPING BACKFILL

References:

AASHTO- 1996STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES sec 5.5

$\phi := 34 \cdot deg$

$\beta := 0 \cdot deg$ $i := 26.6 deg$



Calculate Ka for static conditions (Assumes δ = 0; i.e, does not include wall friction):

$$K_a(\phi, i, \beta) \equiv \frac{\cos(\phi - \beta)^2}{\left(\cos(\beta)^2 \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^2\right]}$$

$K_a := K_a(\phi, i, \beta)$ $K_a = 0.417$

AT REST CONDITION:

$K_o := 1 - \sin(\phi)$

$K_o = 0.441$

COEFFICIENT OF FRICTION,μ:

Static Conditions: $\mu := \tan(\phi)$ $\mu = 0.675$

With Safety Factor: $\mu_{sf} := .667 \cdot \mu$

$\mu_{sf} = 0.45$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 2-21-2000

Project Name: US 95: Retaining Walls - Flat Backfill.
Project Number: 0215-01-1
Calculated By: DH Checked By: mcd

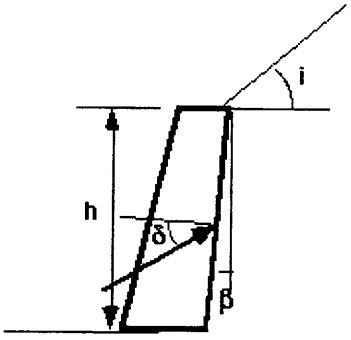
COULOMB ANALYSIS ACTIVE COEFFICIENT for SLOPING BACKFILL

References:

AASHTO- 1996STANDARD
SPECIFICATIONS FOR
HIGHWAY BRIDGES sec 5.5

$\phi := 34 \cdot deg$

$\beta := 0 \cdot deg$ $\quad i := 0.0 deg$



Calculate Ka for static conditions (Assumes $\delta = 0$; i.e, does not include wall friction):

$$K_a(\phi, i, \beta) \equiv \frac{\cos(\phi - \beta)^2}{\left(\cos(\beta)^2 \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^2\right]}$$

$K_a := K_a(\phi, i, \beta)$ $\quad K_a = 0.283$

AT REST CONDITION:

$K_o := 1 - \sin(\phi)$

$K_o = 0.441$

COEFFICIENT OF FRICTION,μ:

Static Conditions: $\quad \mu := \tan(\phi) \quad \mu = 0.675$

With Safety Factor: $\quad \mu_{sf} := .667 \cdot \mu$

$\mu_{sf} = 0.45$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 4-5-2000

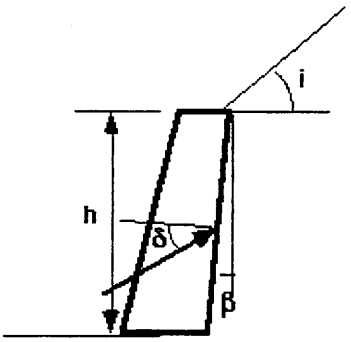
Project Name: U.S.95: Retaining Walls - Flat Backfill.
Project Number: 0215-01-1
Calculated By: DH Checked By: mcd

MONONOBE- OKABE ANALYSIS

References:
Federal Highway Administration,1981:
Seismic Design Guidelines for Highway Bridges,
Final Report No. FHWAIRD-81/081.

AASHTO- 1997 Interim Revisions to the
STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES sec 5.8.9

Federal Highway Administration,1998:
Geotechnical Earthquake Engineering,
Publication No. FHWA HI-99-012.



From AASHTO seismic map k_h = 0.08 g
for 10% probability in 50 years.

$A := 0.08$ $A_m := [(1.45 - A) \cdot A]$ $A_m = 0.11$

$k_h := A_m$ $k_v := 0$

$\phi := 34 \cdot deg$

$\delta := \frac{\phi}{3}$ $\delta = 11.333\,deg$ (may approach 0 during earthquake; $\phi/3$ is conservative))

$\beta := 0 \cdot deg$ $i := 0.0deg$

$\theta := atan\left(\frac{k_h}{1 - k_v}\right)$ $\theta = 6.255\,deg$

$$K_{ae} := \frac{\cos(\phi - \theta - \beta)^2}{\cos(\theta)\cdot\cos(\beta)^2\cdot\cos(\delta + \beta + \theta)\cdot\left(1 + \sqrt{\frac{\sin(\phi + \delta)\cdot\sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta)\cdot\cos(i - \beta)}}\right)^2}$$

$$K_{pe} := \frac{\cos(\phi - \theta + \beta)^2}{\cos(\theta)\cdot\cos(\beta)^2\cdot\cos(\delta - \beta + \theta)\cdot\left(1 - \sqrt{\frac{\sin(\phi + \delta)\cdot\sin(\phi - \theta + i)}{\cos(\delta - \beta + \theta)\cdot\cos(i - \beta)}}\right)^2}$$

$K_{ae} = 0.327$

$K_{pe} = 4.902$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Sheet 1 of 2
Date: 4-5-2000

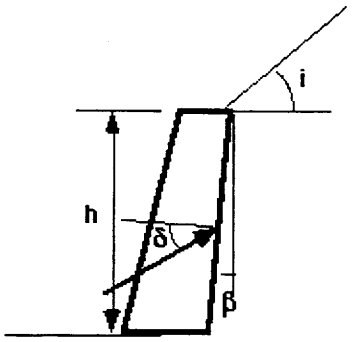
Project Name: U.S.95: Retaining Walls - 3:1 Sloped Backfill.
Project Number: 0215-01-1
Calculated By: DH Checked By: mcd

MONONOBE- OKABE ANALYSIS

References:
Federal Highway Administration,1981:
Seismic Design Guidelines for Highway Bridges,
Final Report No. FHWAIRD-81/081.

AASHTO- 1997 Interim Revisions to the
STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES sec 5.8.9

Federal Highway Administration,1998:
Geotechnical Earthquake Engineering,
Publication No. FHWA HI-99-012.



From AASHTO seismic map k_h = 0.08 g
for 10% probability in 50 years.

$A := 0.08$ $A_m := [(1.45 - A) \cdot A]$ $A_m = 0.11$

$k_h := A_m$ $k_v := 0$

$\phi := 34 \cdot deg$

$\delta := \frac{\phi}{3}$ $\delta = 11.333\,deg$ (may approach 0 during earthquake; $\phi/3$ is conservative))

$\beta := 0 \cdot deg$ $i := 18.4deg$

$\theta := atan\left(\frac{k_h}{1 - k_v}\right)$ $\theta = 6.255\,deg$

$$K_{ae} := \frac{\cos(\phi - \theta - \beta)^2}{\cos(\theta)\cdot\cos(\beta)^2\cdot\cos(\delta + \beta + \theta)\cdot\left(1 + \sqrt{\frac{\sin(\phi + \delta)\cdot\sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta)\cdot\cos(i - \beta)}}\right)^2}$$

$$K_{pe} := \frac{\cos(\phi - \theta + \beta)^2}{\cos(\theta)\cdot\cos(\beta)^2\cdot\cos(\delta - \beta + \theta)\cdot\left(1 - \sqrt{\frac{\sin(\phi + \delta)\cdot\sin(\phi - \theta + i)}{\cos(\delta - \beta + \theta)\cdot\cos(i - \beta)}}\right)^2}$$

$K_{ae} = 0.449$

$K_{pe} = 13.547$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 4-5-2000

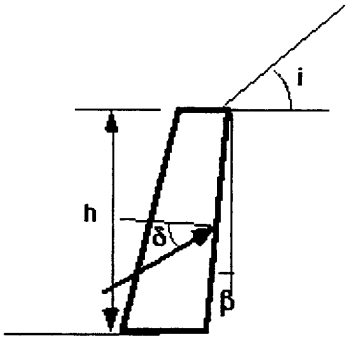
Project Name: U.S.95: Retaining Walls - 2:1 Sloped Backfill.
Project Number: 0215-01-1
Calculated By: DH Checked By: mcd

MONONOBE- OKABE ANALYSIS

References:
Federal Highway Administration,1981:
Seismic Design Guidelines for Highway Bridges,
Final Report No. FHWAIRD-81/081.

AASHTO- 1997 Interim Revisions to the
STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES sec 5.8.9

Federal Highway Administration,1998:
Geotechnical Earthquake Engineering,
Publication No. FHWA HI-99-012.



From AASHTO seismic map k_h = 0.08 g
for 10% probability in 50 years.

$A := 0.08$ $A_m := [(1.45 - A) \cdot A]$ $A_m = 0.11$

$k_h := A_m$ $k_v := 0$

$\phi := 34 \cdot deg$

$\delta := \frac{\phi}{3}$ $\delta = 11.333\,deg$ (may approach 0 during earthquake; $\phi/3$ is conservative))

$\beta := 0 \cdot deg$ $i := 26.6deg$

$\theta := atan\left(\frac{k_h}{1 - k_v}\right)$ $\theta = 6.255\,deg$

$$K_{ae} := \frac{\cos(\phi - \theta - \beta)^2}{\cos(\theta)\cdot\cos(\beta)^2\cdot\cos(\delta + \beta + \theta)\cdot\left(1 + \sqrt{\frac{\sin(\phi + \delta)\cdot\sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta)\cdot\cos(i - \beta)}}\right)^2}$$

$$K_{pe} := \frac{\cos(\phi - \theta + \beta)^2}{\cos(\theta)\cdot\cos(\beta)^2\cdot\cos(\delta - \beta + \theta)\cdot\left(1 - \sqrt{\frac{\sin(\phi + \delta)\cdot\sin(\phi - \theta + i)}{\cos(\delta - \beta + \theta)\cdot\cos(i - \beta)}}\right)^2}$$

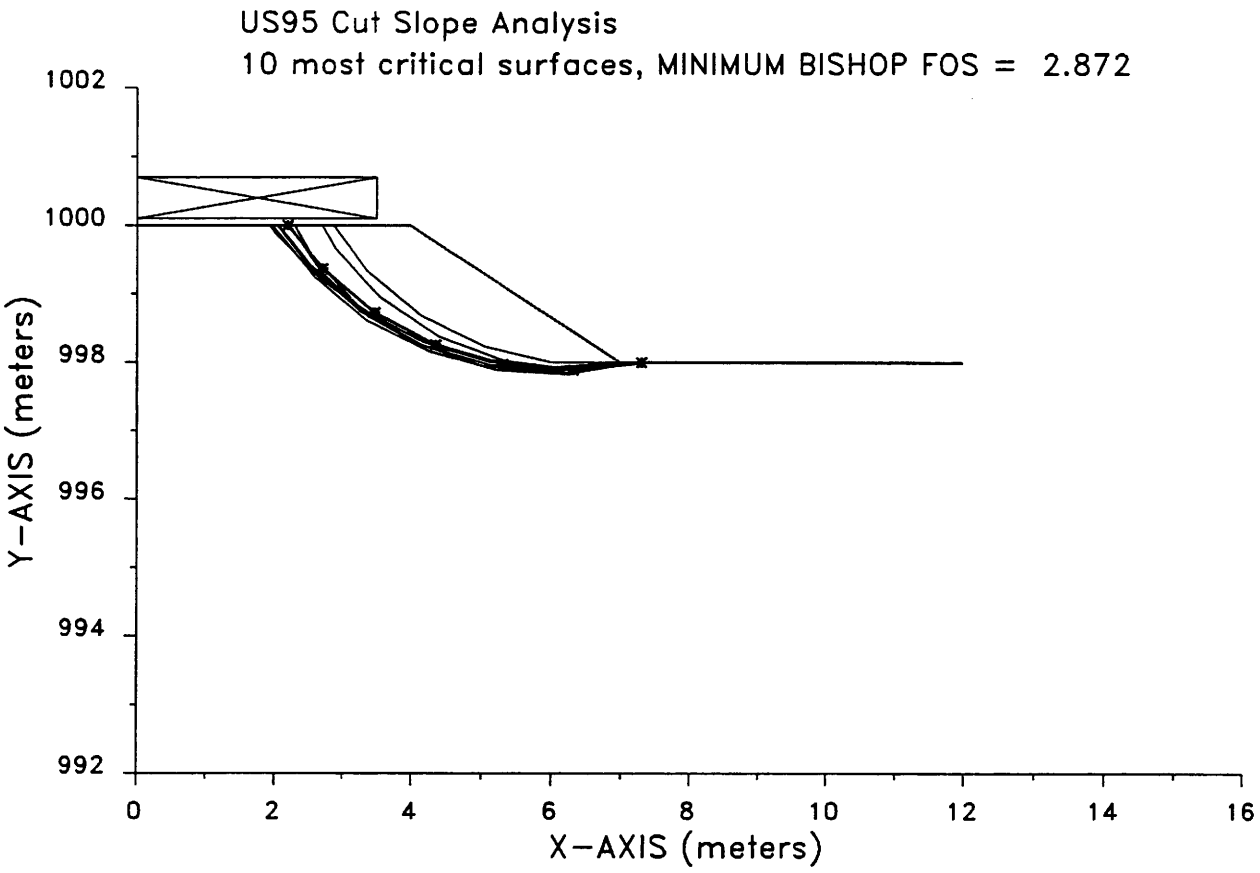
$K_{ae} = 0.648$

$K_{pe} = 26.505$

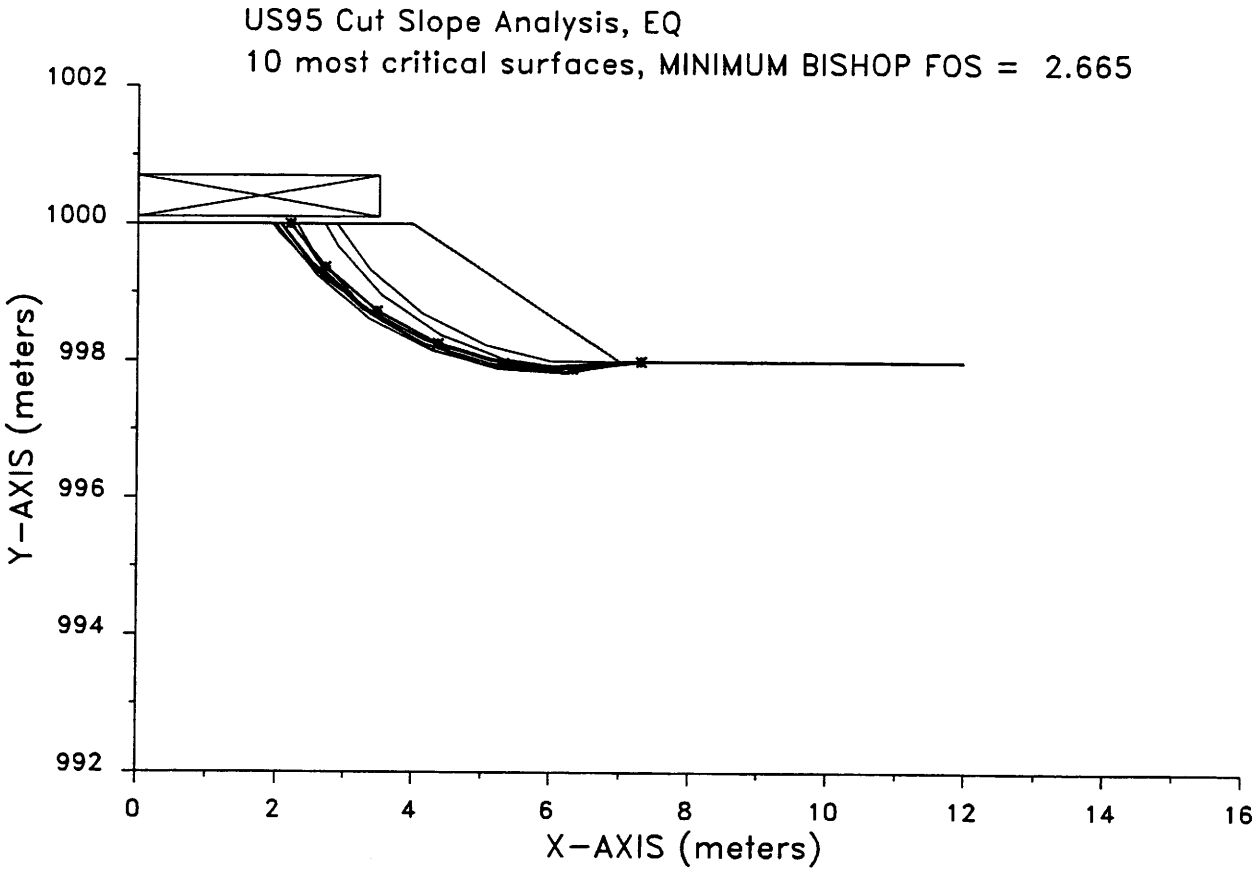
APPENDIX E -

SLOPE STABILITY CALCULATIONS

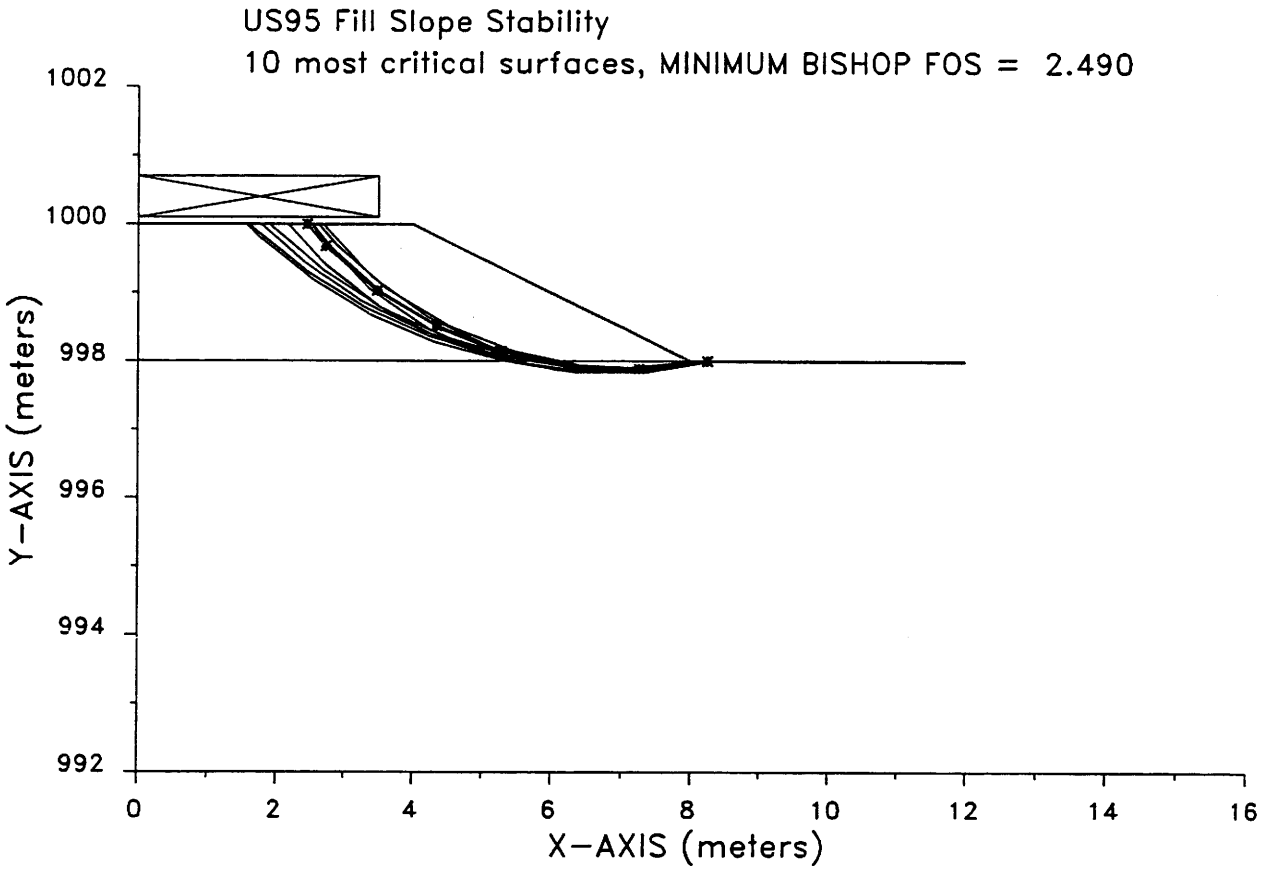
US95-C1 4-28-** 15:11



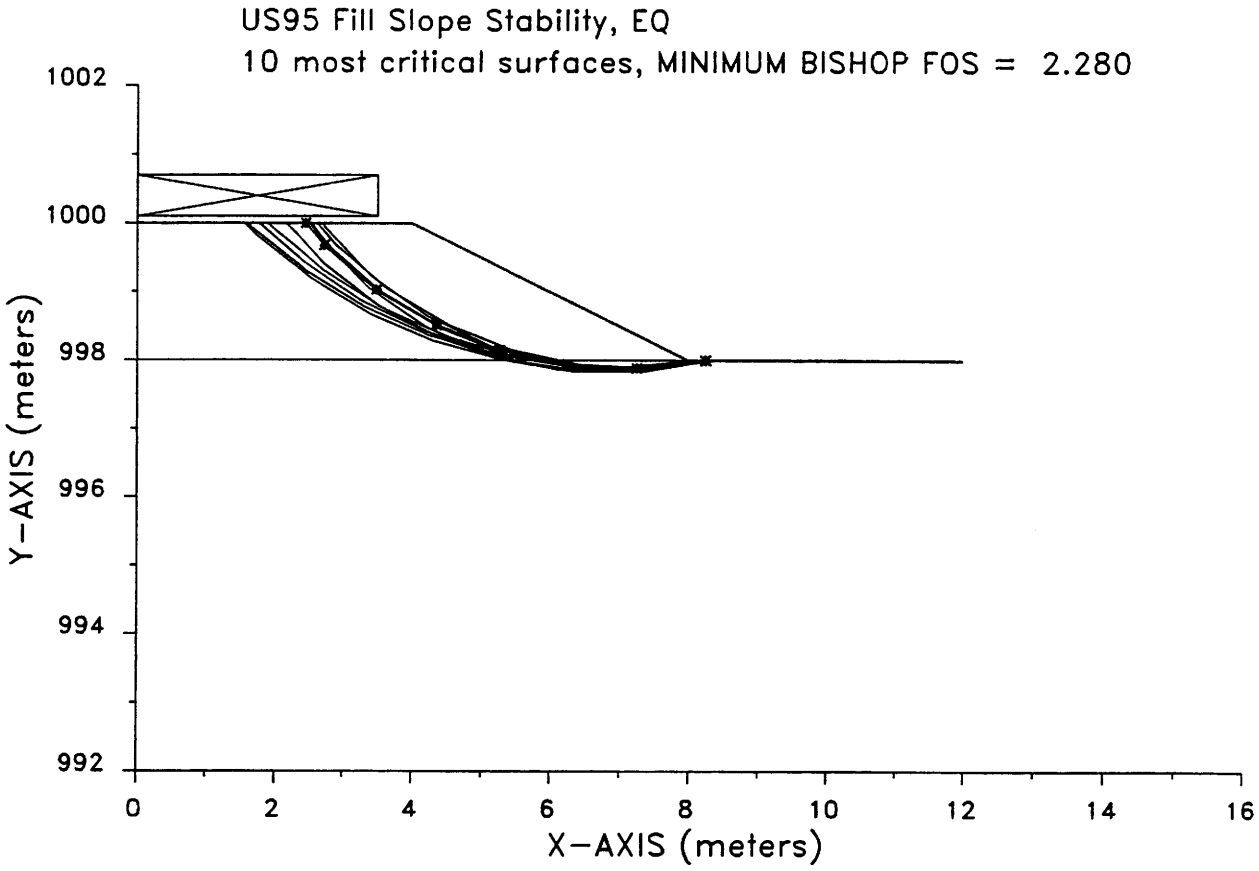
US95-C2 4-28-** 15:12



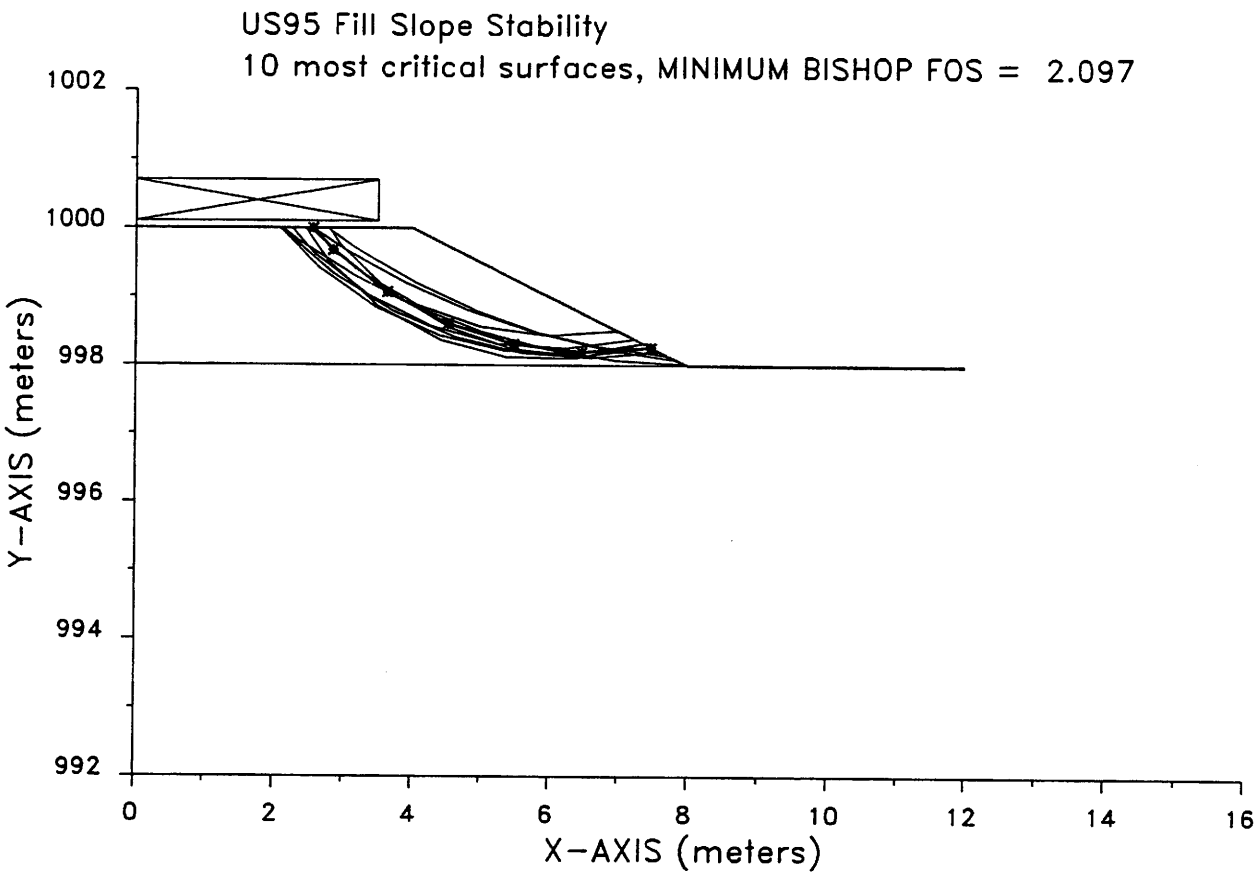
US95-F1 4-28-** 15:12



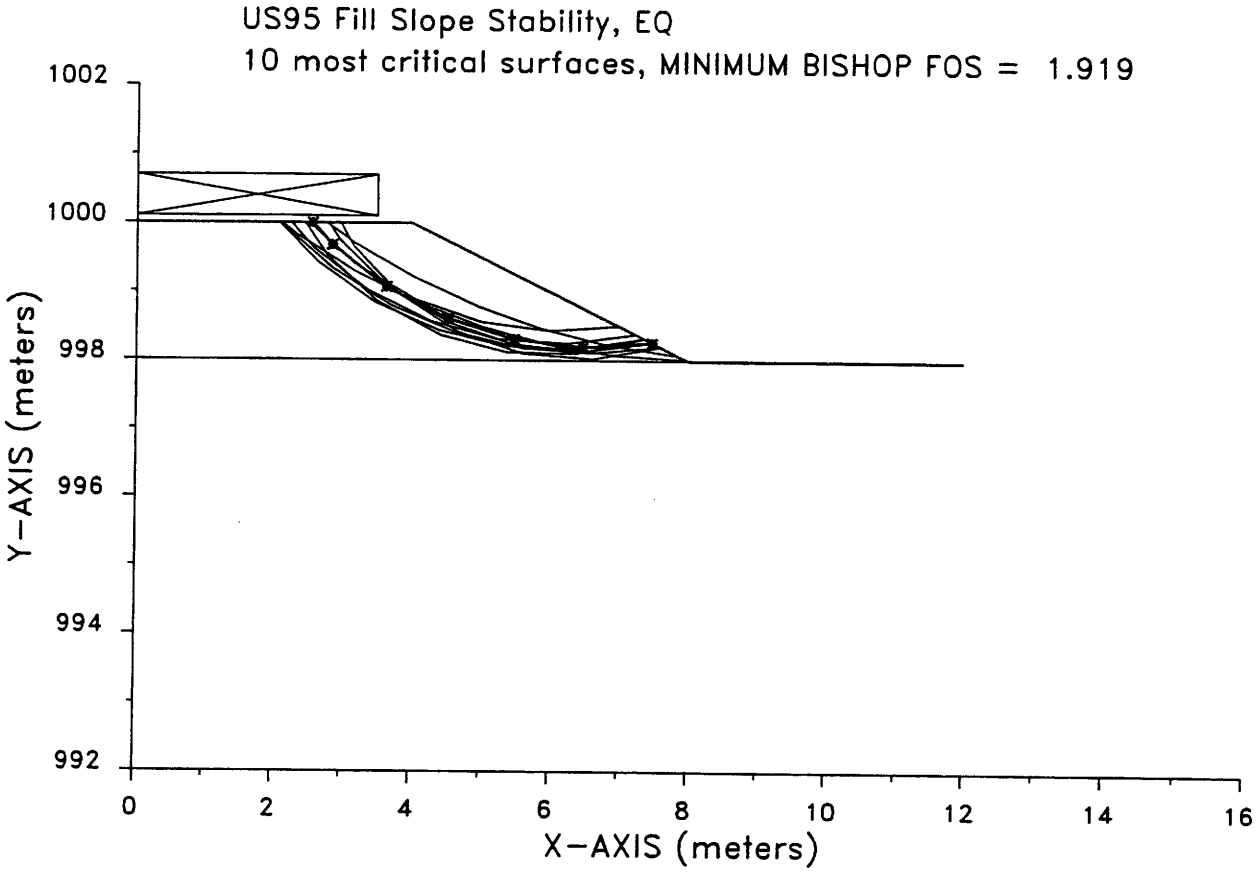
US95-F2 4-28-** 15:12



US95-F3 4-28-** 15:13



US95-F4 4-28-** 15:13



APPENDIX F -

CORROSION TESTING PROGRAM RESULTS

COL•TECH EnviroLabs

CLIENT: Mr. Dal Hunter
BLA001 Black Eagle Consulting, Inc.
1380 Greg Street Suite 218
Sparks NV 89431

DATE: February 25, 2000
INVOICE NUMBER: P0085
PROJECT NUMBER: 215-01-1
LABORATORY NUMBER: P045-05

REPORT OF ANALYSIS

SAMPLE ID:	Chloride (mg/Kg)	pH (SI)	Resistivity (ohm-cm)	Redox Potential (mV)	Sulfate (mg/Kg)
WR - 1B	4.70	7.71	20300	195	22.1
WR - 12A	7.96	7.87	19500	180	16.9
WL - 2A	8.67	7.54	14000	205	141
WL - 6B	45.0	7.57	5100	210	258
WL - 12B	7.60	7.87	10500	200	53.2
WL - 16B	5.54	8.28	14400	205	12.6
DATE OF ANALYSIS & ANALYTICAL METHODS					
DATES:	2-18-00	2-16-00	2-23-00	2-23-00	2-18-00
METHODS:	SM 4500 Cl^- F	SM 4500 - H^+ - B	DOT	-----	SM 4500 - SO_4^{-2} B

Wayne M. Colwell
Director of Laboratory Services