GEOTECHNICAL INVESTIGATION

U.S. 95 WIDENING PROJECT
2C AND 2D RETAINING WALLS

CLARK COUNTY, NEVADA

NOVEMEBER 2002

Prepared for:

PBS&J

Black Eagle Consulting, Inc. - Geotechnical & Construction Services

Black Eagle Consulting, Inc.
Geotechnical & Construction Services

1345 Capital Boulevard, Suite A
Reno, Nevada 89502

Telephone: 775/359-6600
Facsimile: 775/359-7766

Email: mail@blackeagleconsulting.com

Mr. Mike McFall
PBS&J
901 North Green Valley Parkway, Suite 100
Henderson, NV 89014-6139

November 26, 2002
Project No.: 0324-01-3

RE: Project 2C and 2D Retaining Walls
Geotechnical Investigation

Dear Mr. McFall:

The following report presents our geotechnical investigation for the 23 retaining walls in Project 2C and 2D U.S. 95 Widening. All design recommendations are based on soil profiles and strength characteristics determined during our field exploration and laboratory testing programs, information in the 90 percent Design Submittal by BRG Engineering, and previous investigations.

Soils encountered along the alignment are dominated by high-strength, moderately-cemented, sandy gravels. The area explored is suitable for standard spread footings to support the retaining walls.

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.

Larry J. Johnson
President

PROFESSIONAL ENGINEER-STATE OF NEVADA
HAROLD E. BEESTON
GEOLOGICAL
11-26-02
No. 6647

Ex 12-31-02

Harold E. Beeston, P.E.
Special Projects Manager

Enclosure: Geotechnical Investigation

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLES

PLATES

APPENDICES

GEOTECHNICAL INVESTIGATION

U.S. 95 WIDENING PROJECT
PROJECT 2C AND 2D RETAINING WALLS

CLARK COUNTY, NEVADA

INTRODUCTION

Presented herein is a description of the Black Eagle Consulting, Inc. (BEC) geotechnical investigation for the proposed Project 2C and 2D retaining walls that are part of the U.S. 95 Widening Project in Las Vegas, Nevada. This report presents recommendations that would be associated with the retaining wall locations shown in 90 percent submittal plans dated April 29, 2002, by BRG Engineering. The investigation itself consisted of research of existing documents, including the recent BEC reports for the Rainbow Boulevard Bridge replacement, and the R6 and R7 Bridges, and the advancement of eight additional exploration borings, laboratory analysis, and geotechnical analysis. The objectives of this study were to:

1. Determine general soil conditions pertaining to the design and construction of the proposed retaining walls.

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

The services described herein were conducted in accordance with the Subcontract Addendum to PBS&J Sub-consultant Contract for *PBS&J Project 511300 with Black Eagle Consulting, Inc., with the short title, "U.S. 95 Project 2C and 2D Retaining Wall."*

PROJECT DESCRIPTION

It has been proposed to widen U.S. 95 to ten lanes in the vicinity of the Summerlin Parkway/Rainbow Boulevard/U.S. 95 Highway interchange. Twenty-three retaining walls, along with other facilities, will be constructed in the interchange to accomplish this goal. The Project 2C and 2D retaining walls (RW-1 through RW-23) characteristics are described below in Table 1.

Table 1 – Retaining Wall Characteristics

Name	Type	Length (m)	Maximum Height (m)	Minimum Height (m)	Foundation
RW-1	Cantilever	47	9.8	1.0	Spread Footing on Native Soils
RW-2	Cantilever	130	3.5	1.2	Spread Footing on Fill
RW-3	MSE	21	8.3	7.6	Footing Pad on Native Soils
RW-4	MSE	15	10.3	8.9	Footing Pad on Native Soils
RW-5	Soil Nail	38	2.4	1.4	Nails in Fill
RW-6A	Tieback/Soil Nail	50	5.4	1.1	Tiebacks and Nails in Fill
RW-6B	Cantilever	14	6.3	1.7	Spread Footing on Native Soils
RW-7	Tieback/Soil Nail	58	5.7	1.1	Tiebacks and Nails in Fill
RW-8	Cantilever	223	5.6	1.6	Spread Footing on Native Soils
RW-9	Cantilever	129	6.8	1.2	Spread Footing on Native Soils
RW-10	Cantilever	64	6.8	1.1	Spread Footing on Native Soils
RW-11	Cantilever	45	9.2	1.1	Spread Footing on Native Soils
RW-12	Cantilever	30	10.4	9.9	Spread Footing on Native Soils
RW-13	Cantilever	27	6.7	1.3	Spread Footing on Native Soils
RW-14	Cantilever	46	2.4	1.1	Spread Footing on Native Soils
RW-15	Cantilever	165	5.9	1.3	Spread Footing on Native Soils
RW-16	Tieback	67	5.8	0.8	Tiebacks in Native Soils
RW-17	Soil Nail	315	9.3	1.1	Nails in Fill
RW-18	Cantilever	103	2.4	1.1	Spread Footing on Native Soils
RW-19	Tieback	53	5.4	1.5	Tiebacks in Fill
RW-20	Cantilever	110	2.6	1.2	Spread Footing on Native Soils
RW-21	Cantilever	685	3.4	1.0?	Spread Footing on Native Soils
RW-22	Cantilever	145	3.5	2.0	Spread Footing on Native Soils
RW-23	Cantilever	94	3.8	1.7	Spread Footing on Native Soils

The Project 2C and 2D retaining wall sites extend along the U.S 95 from the Torrey Pines overpass on the east about 2,000 meters (m) to the Washington Avenue overpass on the northwest, along Summerlin Parkway about 200 meters west of the interchange, and along Rainbow Boulevard about 150 meters south of the interchange. Locations of the walls are shown in the Plot Plan in Plate 1

SITE CONDITIONS

Within the project area, there are several existing bridges that extend over U.S. 95, including the Summerlin Parkway Bridge, a steel-girder structure with seven spans and abutments; the 75-meter-long, two-span, post-tension, concrete box girder Rainbow Boulevard Bridge; the 60-meter-long, two-span, Washington Avenue Bridge that extends over U.S. 95 approximately 500 meters north of the Rainbow Bridge. The Washington Avenue Bridge consists of two parallel structures (the youngest structure was recently built to accommodate increased traffic flows), and the abutments for both structures have been placed on engineered fill.

The surface of the ground within the NDOT right-of-way, both within the main Rainbow interchange area and along the right-of-way shoulders north of the interchange, is covered mostly with sand, gravel, and low maintenance landscaping. The right-of-way east of the interchange, especially in the area of walls RW-21 and RW-23, narrows considerably where an existing retaining/sound wall separates the depressed northbound U.S. 95 traffic from private residences. Approximately 3 to 6 meters of open space, consisting of a sandy gravel soil with scattered weeds and refuse, are found between the wall and private property to the north. A 2-meter-high chain-link fence marks the actual NDOT boundary.

Various utilities, including storm drains and landscape irrigation lines associated with the right-of-way, are located throughout the project area. Communications lines and a gas pipeline, at an unknown depth, extending east-west beneath the Washington Avenue Bridge, are of specific concern.

EXPLORATION

Drilling

BEC explored the proposed retaining walls and new bridges at specific intervals in July 2001 to July 2002 by drilling a total of 42 hollow-stem auger borings to depths of up to 35 meters. The borings were drilled with 152-millimeter (-mm), outside-diameter (O.D.), 83-mm, inside-diameter (I.D.) augers. It should be noted that many of the borings utilized for the Project 2C and 2D retaining wall investigation were drilled during the exploration of the more extensive Rainbow/U.S. 95 interchange study and boring numbers are not in a continuous sequence. The existing fill, if any was identified, and native soil encountered in the borings were sampled in place every 600 mm by use of a standard, 51-mm, O.D., Split-Spoon Sampler driven with a standard 63.6-kilogram (-kg) drive hammer and a 762-mm stroke or an 89-mm O.D. Split-Spoon Sampler (ASTM D 3550).

Included in the analyses was evaluation of previously drilled borings located in close proximity to the proposed retaining walls. These included: Wallace, Inc., 1987, borings drilled for the design of the Summerlin Flyover that are adjacent to RW-2, RW-3, RW-6, and RW-7; NDOT, 1974, borings adjacent to RW-5 and

RW-19; and borings drilled by Terracon in 2000 for the Torrey Pines Bridge reconstruction that are adjacent to RW-21. The locations of all borings are shown on Plate 1.

Material Classification

An engineering geologist examined and classified all soils in the field. During drilling, representative bulk samples were placed in sealed plastic bags and returned to our Reno, 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 borings, including the previous borings, are presented in Appendix I (Boring Logs).

LABORATORY TESTING

All soils testing performed in the BEC soils laboratory have been conducted in accordance with the standards and methods described in American Association of State Highway Transportation Officials (AASHTO, 1998) and Nevada Department of Transportation (NDOT, 2000) standards.

Index Testing

Samples of each significant soil type were analyzed to determine their in-situ moisture content (NDOT T 206F), grain size distribution, and plasticity index (NDOT 210E, 211E, and 212E). The results of these tests are in Appendix II (Test Results). Results of these tests were used to classify the soils according to USCS and to verify the field logs, which were updated where 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

No direct shear tests were performed in this phase of exploration. Previous BEC testing for direct shear was performed on eleven samples of similar soils collected within the Rainbow interchange and reported in the Rainbow Bridge, R6, and R7 reports.

Corrosion Potential Tests

No corrosion potential tests were performed in this phase of exploration. Previous BEC testing for corrosion potential was performed on samples of similar soils. The tests for pH, soil resistivity, and soluble chloride and sulfate show that most of the soil in the interchange would not be corrosive to steel and concrete.

GEOLOGIC AND GENERAL SOIL CONDITIONS

The retaining wall sites are on soils that have been mapped by the Nevada Bureau of Mines and Geology (NBMG) (Matti, et al., 1987) as Older Alluvium of the Red Rock Fan (Pleistocene). According to the NBMG, the fan deposits consist of moderately well-consolidated and cemented, pebble to small cobble gravel with pebble-bearing sand. Previous drilling by NDOT for the overpass construction at Rainbow Boulevard (1974) and Washington Avenue (1977) encountered up to 60 feet of dense-to-very-dense, cemented sandy gravel. Drilling by BEC in 2001 and early 2002 within the US 95/Rainbow Boulevard interchange also encountered up to 30 meters of these same cemented sands and gravels. These logs are included in Appendix 1.

The native materials encountered in the main interchange and Washington Avenue, consist of very dense, moderately cemented, gravelly clayey sand and sandy gravel to depths of 7 to 30 meters. This highly competent native soil behaves very much like rock because of its cementation and density. These materials were consistent throughout the depth and lateral extent of exploration. The borings at the east end of Summerlin Parkway encountered dense clayey sand and sandy fat clay interbedded within the competent sand and gravel layers as high as 7 meters. These less competent units contained up to 55 percent medium to high plastic fines.

Variable depths of highway embankment were encountered in several of the borings. The embankment was dense-to-very-dense sand and gravel that is similar to the underlying native material. The embankment/native contact was often difficult to distinguish due to this similarity.

Ground water was not encountered during the exploration. It is, therefore, at a depth that would not affect construction.

GEOLOGIC AND SEISMIC HAZARDS

Seismicity

Much of the Western United States is a region of moderate to intense seismic activity related to movement of the crustal masses (plate tectonics). By far the most active region, outside of Alaska, centers on the San Andreas Fault system of western California. The particular area in Las Vegas, however, is not a highly active seismic area, but does have some potential for earthquakes. The AASHTO map in Division I-A of the *Standard Specifications for Highway Bridges* (1996) shows horizontal rock acceleration potential to be 0.15g for a 10 percent probability of exceeding it within 50 years in this area. For the purposes of this project, we recommend a design acceleration value of 0.15g to be used in accordance with NDOT design policy. The soils encountered during exploration have shear-wave velocities in excess of 600 meters per second. This is considered to be rock-like material for seismic evaluation purposes and is equivalent to the soil profile Type 1, as defined on page 399 of Division I-A of AASHTO *Seismic Design for Highway Bridges* (1996). However, conditions within the Las Vegas Valley are such that there is a strong potential for amplification of earthquake motion in the lower frequencies of less than three (3) hertz (Su, et al., 1996). Because of the unusual character of the Las Vegas Basin to amplify the lower frequencies and attenuate the higher frequencies, we recommend the use of a Soil Profile Type 2, which is more conservative than Type 1. This would give a Type 2 site coefficient of 1.2 for a seismic site coefficient of 0.18.

There is no potential for liquefaction at the site because the ground water is located at a depth below 30 meters.

Faults and Fissures

Area Quaternary faults have been mapped by the NBMG and are presented in the *Map of Faults and Earth Fissures in the Las Vegas Area* (DePolo and Bell, 2000). This map identifies traces of potential Quaternary age tectonic faults approximately 4 kilometers (km) west and 2 km east of the site, but there is no evidence of faulting through the site itself. Fissured areas are associated with the faults shown on this map. Fissures have been found approximately 4 km east of the site; however, there is no evidence of fissuring at the site.

Ground Subsidence

Regional land subsidence in the Las Vegas Valley related to ground water withdrawal has been monitored since 1935 (Bell and Price, 1993). A map included in that open-file report, titled *Subsidence in Las Vegas Valley 1963 Through 1986/87,* identifies three major Las Vegas subsidence centers located about 7 km north, 7 km east, and 8 km southeast of the site. The map also shows that subsidence of about 30 mm has occurred in the site vicinity between the years 1963 and 1987. This translates into a rough extrapolation of regional subsidence in the area of about 100 mm to the present day. Since this is a regional behavior and the actual settlement is slow (about 1 to 2 mm per year), there should not be any significant distress to the proposed retaining walls in the lifetime of the structures.

Dust Generation

A moderate potential for dust generation is present if grading is performed in dry weather. No other geological hazards have been identified.

RESULTS AND DISCUSSION

Retaining Wall Design

Project 2C and D will use conventional (cantilever), mechanically stabilized embankment (MSE), soil nail and tieback anchored retaining walls. The top-down constructed anchored walls will support native and/or pre-existing fill material. The cantilever and MSE walls will be backfilled with imported fill, or reworked native soil.

The native soil is very dense, weak to moderately cemented, alluvial sand and gravel. Table 2 provides the soil parameters for the native soil, pre-existing fill, and imported fill used in the soil pressure calculations. Where reworked native soil is used as backfill, after screening the plus-6-inch fraction, the material will have the same characteristics as the imported fill.

TABLE 2 – SOIL PARAMETERS TO USE FOR DESIGN

	Unit Weight (kN/m^3)	Phi Angle	Cohesion
Native Soil	20.4	40	0
Pre-existing and Imported Fill	19.6	34	0

The ground water table is at depth below the current exploration levels (> 30 meters in depth) and is not a factor in the design or construction of the retaining walls. A drainage system that includes a back face

drainage system and weep holes at the base of the wall should be used behind and along the toe of all of the walls to reduce any hydrostatic pressure that could result from surface infiltration.

Conventional Reinforced Concrete Cantilever Retaining Walls

Table 3 shows the recommended static and dynamic condition bearing and lateral soil pressure parameters for cantilever retaining wall design. The values are based on Mononobe-Okabe analyses, as referenced in Federal Highway Administration (FHWA, 1998); and, the calculations are included in Appendix III. The Table 3 recommendations are for both level and sloping backfill conditions.

TABLE 3 – CANTILEVER RETAINING WALL BEARING AND PRESSURE PARAMETERS

Name	Foundation	Allowable Bearing Pressure (Mpa)	Ultimate Bearing Pressure (Mpa)	Ultimate Base Sliding Coefficient	Backfill Pressure Coefficient* K_a	Backfill Pressure Coefficient* K_{ae}	Backfill Unit Weight kN/m^3
RW-1	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-2	Spread Footing Embankment	0.190	0.570	0.5	0.28 *0.42*	0.33 *0.58*	19.6
RW-6B	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-8	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-9	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-10	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-11	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-12	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-13	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-14	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-15	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-18	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6

TABLE 3 – CANTILEVER RETAINING WALL BEARING AND PRESSURE PARAMETERS

Name	Foundation	Allowable Bearing Pressure (Mpa)	Ultimate Bearing Pressure (Mpa)	Ultimate Base Sliding Coefficient	Backfill Pressure Coefficient* K_a	Backfill Pressure Coefficient* K_{ae}	Backfill Unit Weight kN/m^3
RW-20	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-21	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-22	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6
RW-23	Spread Footing on Native Soils	1.0	3.0	0.55	0.28 *0.42*	0.33 *0.58*	19.6

*Plain text is for level backfill, *Italicized text is for 1:2 (V:H) sloping backfill*

Backfill behind cantilever retaining walls should be compacted in accordance with NDOT standard specifications (2001). Care should be exercised when compacting backfill against retaining walls. To reduce temporary construction loads on the walls, heavy equipment should not be used for placing and compacting fill within a region as determined by a 2:1 (V:H) line drawn upward from the bottom of the wall, or within 1 meter of the wall, whichever is greater. We recommend that hand-operated compaction equipment be used to compact soils adjacent to walls. Areas to receive fill, or those areas located beneath proposed structural footings, should be cleared and grubbed as to NDOT specifications (NDOT, 2001).

MSE Retaining Walls

Table 4 shows the recommended static and dynamic condition bearing and lateral soil pressure parameters for MSE retaining wall design. The values are based on Mononobe-Okabe analyses, as referenced in Federal Highway Administration (FHWA, 1998); and, the calculations are included in Appendix III.

TABLE 4 – MSE RETAINING WALL BEARING AND PRESSURE PARAMETERS

Name	Foundation	Allowable Bearing Pressure (Mpa)	Ultimate Bearing Pressure (Mpa)	Ultimate Base Sliding Coefficient	Backfill Pressure Coefficient* K_a	Backfill Pressure Coefficient* K_{ae}	External Backfill Unit Weight kN/m^3
RW-3	Footing Pad on Native Soils	1.0	3.0	0.68	0.28 *0.37*	0.43 *0.89*	19.6
RW-4	Footing Pad on Native Soils	1.0	3.0	0.68	0.28 *0.37*	0.43 *0.89*	19.6

*Plain text is for level backfill, *Italicized text is for 1:2 (V:H) sloping back fill*

Backfill behind MSE walls should be compacted in accordance with NDOT Standard Specifications (2001). To reduce temporary construction loads on the walls, heavy equipment should not be used for placing and compacting fill within a region as determined by a 2:1 (V:H) line drawn upward from the bottom of the wall,

or within 1 meter of the wall, whichever is greater. We recommend that hand-operated compaction equipment be used to compact soils adjacent to walls. Areas to receive fill, or those areas located beneath proposed structural footings, should be cleared and grubbed as to NDOT Specifications (NDOT, 2001).

Soil Nail Retaining Walls

Soil nail walls are flexible walls constructed from the top down in existing materials (both native soil and pre-existing fill) using reinforcing nails or bars placed at regular spaced intervals. A facing of shotcrete is typically applied to support face loadings during and after construction. Earth pressure is transferred from the wall face to the nails by the facing. The load transfer mechanism associated with soil nail walls is either frictional interaction between the nail and soil, or by the soil structure interaction between the soil and facing.

Table 5 shows the estimated ultimate bond stress shown in Table 8-6 (Munfakh, et al., 1998), and recommended static and dynamic parameters for soil nail retaining wall design based on Mononobe-Okabe analyses (FHWA, 1998). The calculations are included in Appendix III.

TABLE 5 – SOIL NAIL DESIGN AND PRESSURE PARAMETERS

Name	Foundation	Ultimate Bond Stress (kPa)	Phi Angle (degrees)	Cohesion (kPa)	Backfill Pressure Coefficient* K_a	Backfill Pressure Coefficient* K_{ae}	Embankment UnitWeight kN/m^3
RW-5	Nails in Fill	150	34	0*	0.28 *0.42*	0.33 *0.58*	19.6
RW-6A	Nails in Fill	150	34	0*	0.28 *0.42*	0.33 *0.58*	19.6
RW-7	Nails in Fill	150	34	0*	0.28 *0.42*	0.33 *0.58*	19.6
RW-17	Nails in Fill	150	34	0*	0.28 *0.42*	0.33 *0.58*	19.6

*Cohesion value to use for design. Actual existing material has enough cohesion for construction of soil nail walls

**Plain text is for level backfill, *Italics is for 1:2 (V:H) sloping back fill*

BRG Engineering will design (length, spacing, etc.) the soil nail walls. Verification and proof testing of nails should be performed. Pre-production verification tests on sacrificial test nails, as well as proof tests on production nails, should be performed at the locations specified by BRG Engineering. Verification and proof testing of nails should follow the criteria and loading schedules recommended by the FHWA (1994).

Wall excavation should follow the regulations set forth by OSHA for sidewall excavation. Nail encapsulation using double corrosion protection (epoxy coating and encapsulation) is recommended for permanent walls. A drain system is recommended to allow water to exit the facing through small drains along the lower edge of the wall. A 400-mm-wide drainage composite strip should be placed vertically on 1.2-meter spacing between

each column of soil nails. At the base of each drainage strip, a prefabricated drain grate should be placed to connect to a 75-mm-diameter PVC pipe, day-lighted out of the face of the wall at a 2 percent slope. A wall toe drain should be constructed to capture water flow from the drain strip drainage pipes. The toe drain may be either a concrete drainage swale or a drain trench.

Tieback Anchor Retaining Walls

The anchors in these walls will be designed to offset the surcharge loads from existing bridge abutment footings. Table 6 shows the estimated ultimate transfer load shown in Table 7-6 (Munfakh, et al., 1998), and recommended maximum static and dynamic lateral pressure parameters for tieback anchor retaining wall designs. Graphs of the lateral pressures are in Plate 2. Calculations are included in Appendix III.

TABLE 6 – TIEBACK ANCHOR DESIGN AND PRESSURE PARAMETERS

Name	Foundation	Ultimate Transfer Load (kN/m)	Phi Angle (degrees)	Cohesion (kPa)	Embankment Unit Weight kN/m^3	Maximum Static Lateral Pressure (kPa)	Maximum Dynamic Lateral Pressure (kPa)
RW-6A	Tiebacks in Fill	220	34	0*	19.6	62.6	87.1
RW-7	Tiebacks in Fill	220	34	0*	19.6	55.7	83.3
RW-16	Tiebacks in Native Soil	290	40	0*	20.4	45.2	66.1
RW-19	Tiebacks in Fill	220	34	0*	19.6	67.5	88.1

*Cohesion value to use for design. Actual existing material has enough cohesion for construction of tieback walls

Wall construction should follow the regulations set forth by OSHA for excavation sidewalls. Anchor design and construction should follow the specifications found in Appendix E of Publication No. FHWA-IF-99-015 titled *Geotechnical Engineering Circular N0. 4; Ground Anchors and Anchored Systems,* dated June 1999. These specifications include guidelines on the required corrosion protection and performance testing. Verification and proof testing of anchors should follow the criteria and loading schedules recommended by the Federal Highway Administration (FHWA, 1999).

RECOMMENDATION LIMITS

The above recommendations are based on the 90 percent information that BEC has submitted at this time. If the design and location of the retaining walls change, however, these recommendations are also subject to change.

STANDARD LIMITATION CLAUSE

This report has been prepared in accordance with generally accepted geotechnical practices. The analyses and recommendations submitted are based on field exploration performed at the locations shown on Plate 1 (Retaining Wall Plot Plan) and previous on-site investigations for existing structures. 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 these 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, expressed or implied, as to the professional recommendations provided under the terms of this agreement and included in this report.

REFERENCES

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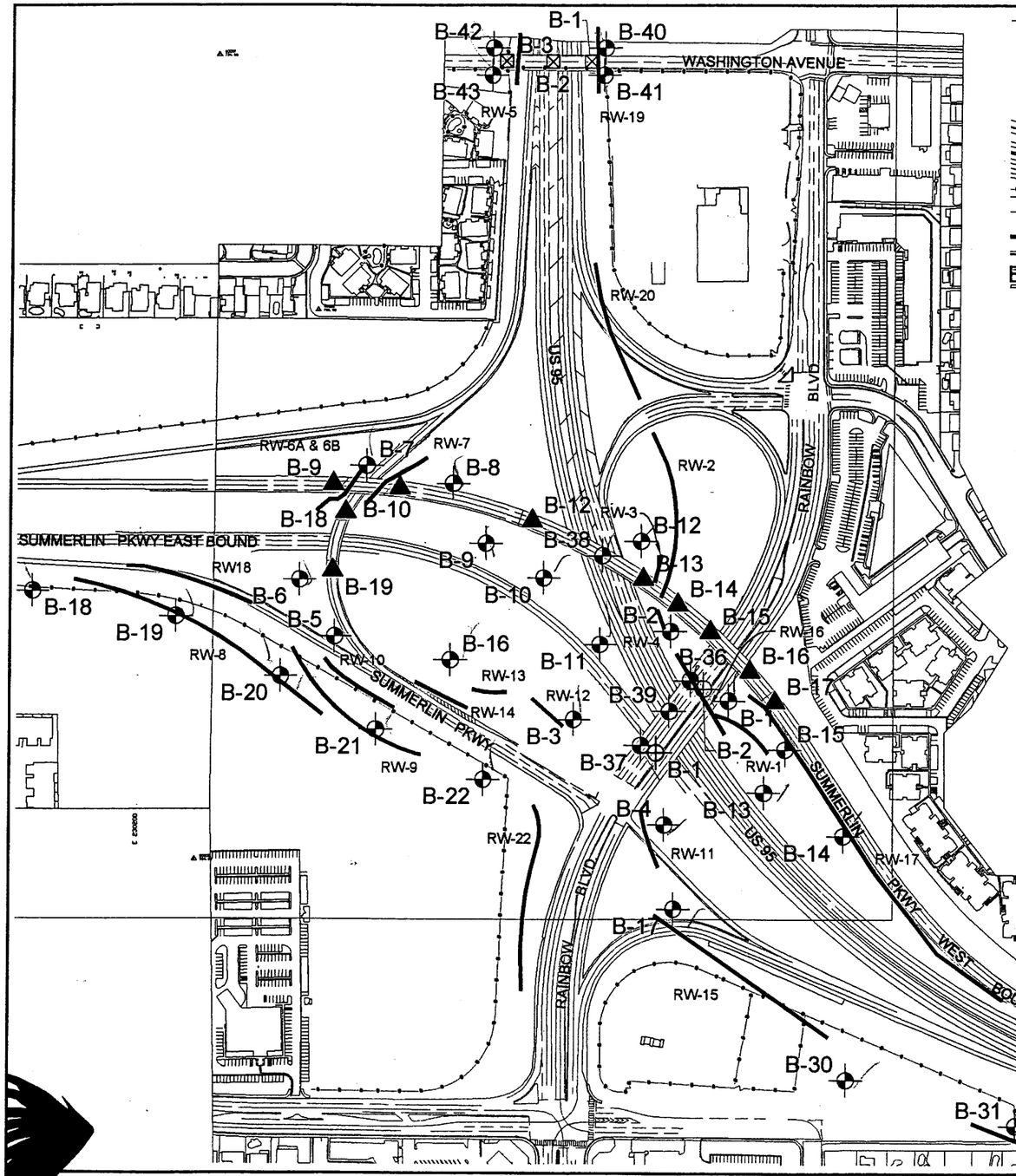
PLATES



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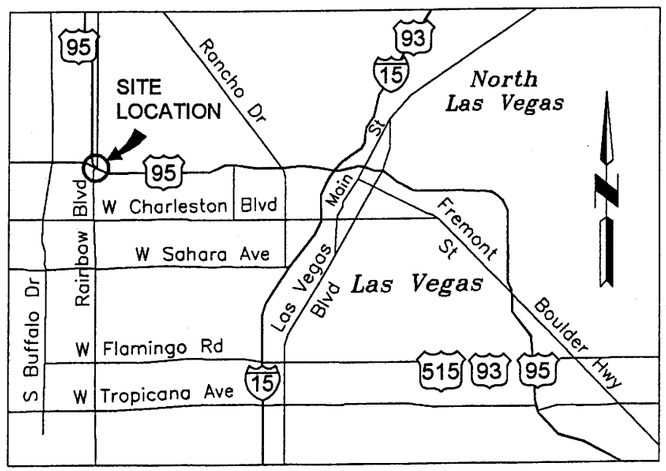
LEGEND

- B-1 ⊕ APPROXIMATE BORING LOCATION NDOT 1974 EXPLORATION
- B-1 ⊠ APPROXIMATE BORING LOCATION NDOT 1977 EXPLORATION
- B-9 ▲ APPROXIMATE BORING LOCATION G.C. WALLACE 1987 EXPLORATION
- B-1 ⊕ APPROXIMATE BORING LOCATION JULY 2001/2002 BEC EXPLORATION
- B-1 ⊙ APPROXIMATE BORING LOCATION OF TERRACON 2000 EXPLORATION

NOTES

1. BASE MAP PROVIDED BY PBS & J.



SITE LOCATION MAP

N.T.S.

Black Eagle Consulting, Inc.
Geotechnical & Construction Services
1345 Capital Boulevard, Suite A
Reno, Nevada 89502-7140
Telephone: 775/359-6600
Facsimile: 775/359-7766

PBS & J

PLOT PLAN

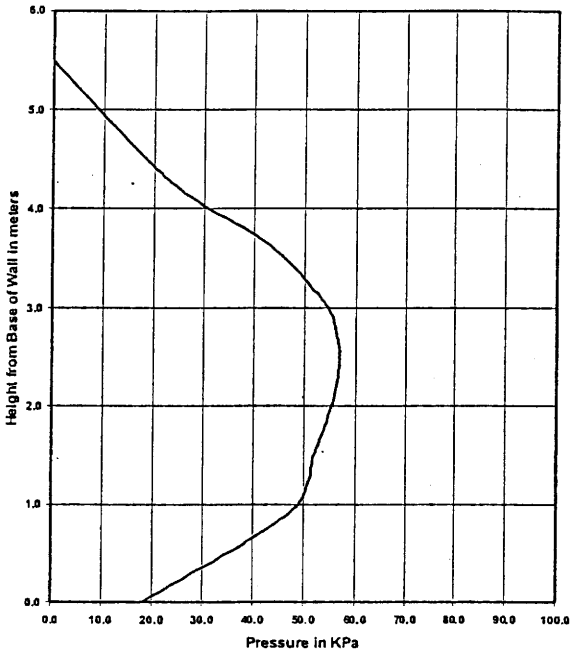
US95 PROJECT 2 C&D RETAINING WALL LOCATION

LAS VEGAS, NEVADA

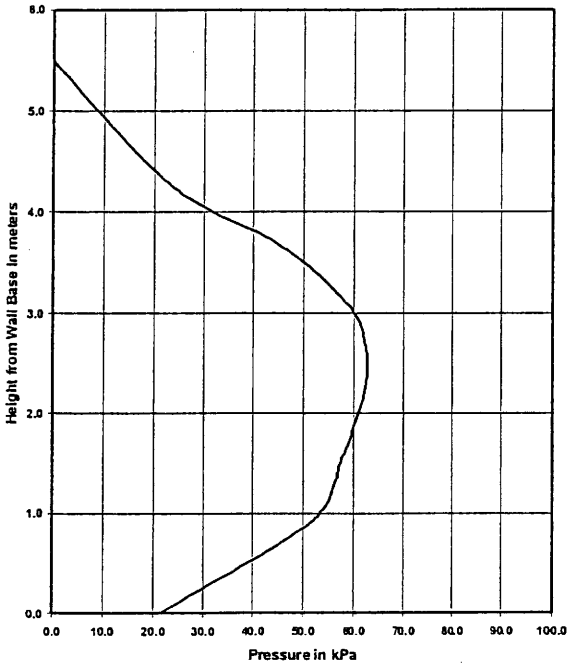
Project No.
0324-01-3

Plate 1

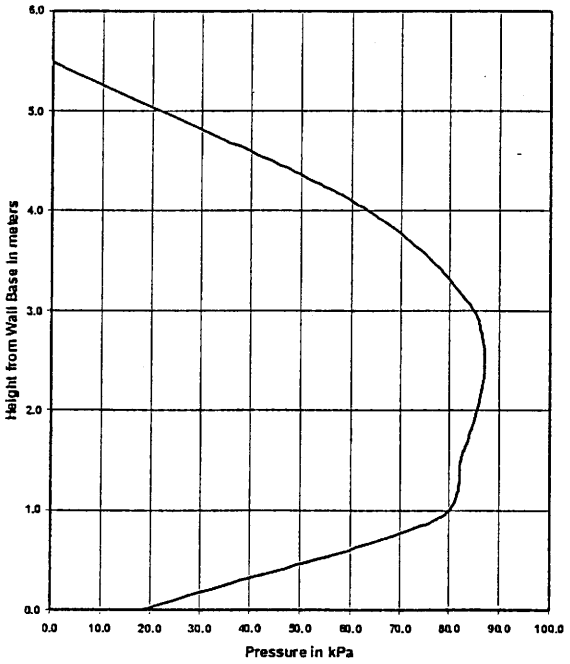
Lateral Pressure on RW-6
Dead Load Only



Lateral Pressure on RW-6
Dead Load + Live Load



Lateral Pressure on RW-6
Dead Load + Seismic Load

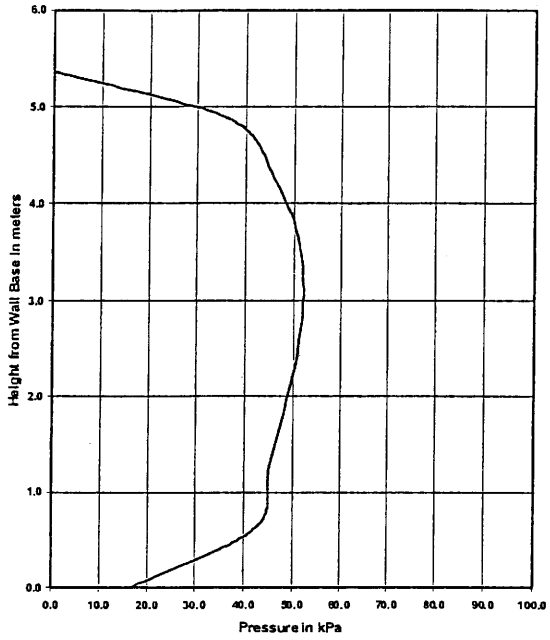


Black Eagle Consulting, Inc.
1345 Capital Boulevard, Suite A
Reno, Nevada 89502-7140
(775) 359-6600
FAX (775) 359-7766
E-mail: mail@blackeagleconsulting.com

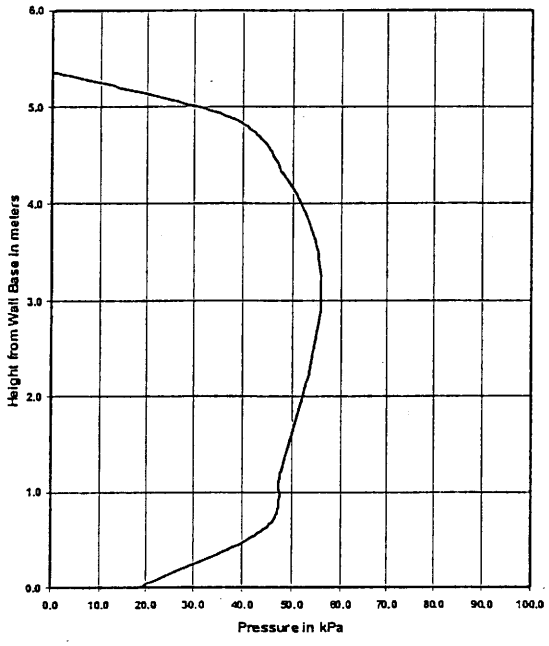
Lateral Pressure on RW-6

Plate 2a

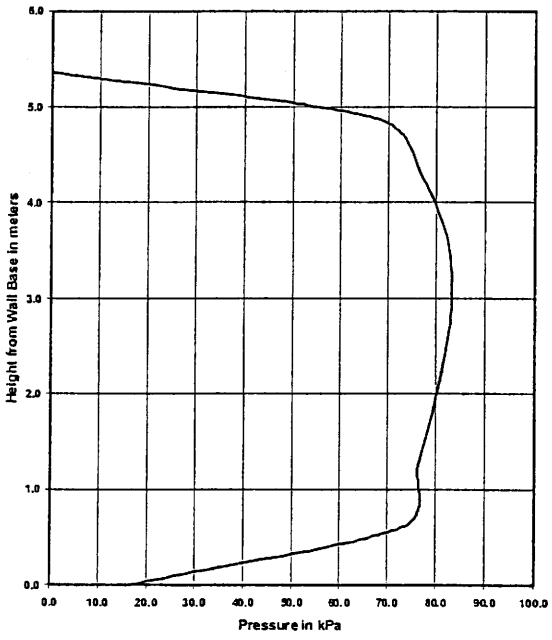
Lateral Pressure on RW-7
Dead Load Only



Lateral Pressure on RW-7
Dead Load + Live Load



Lateral Pressure on RW-7
Dead Load + Seismic Load

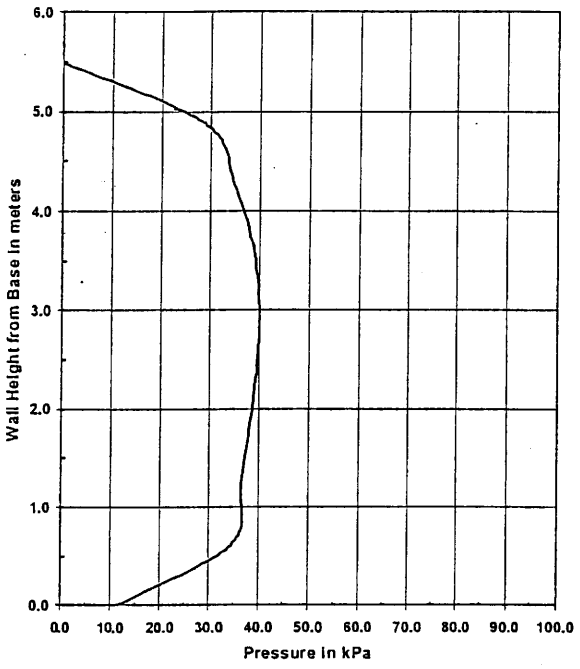


Black Eagle Consulting, Inc.
1345 Capital Boulevard, Suite A
Reno, Nevada 89502-7140
(775) 359-6600
FAX (775) 359-7766
E-mail: mail@blackeagleconsulting.com

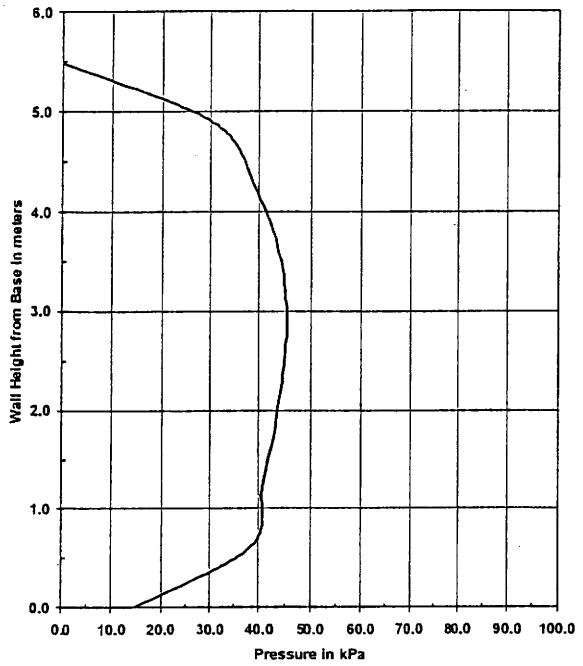
Lateral Pressure on RW-7

Plate 2b

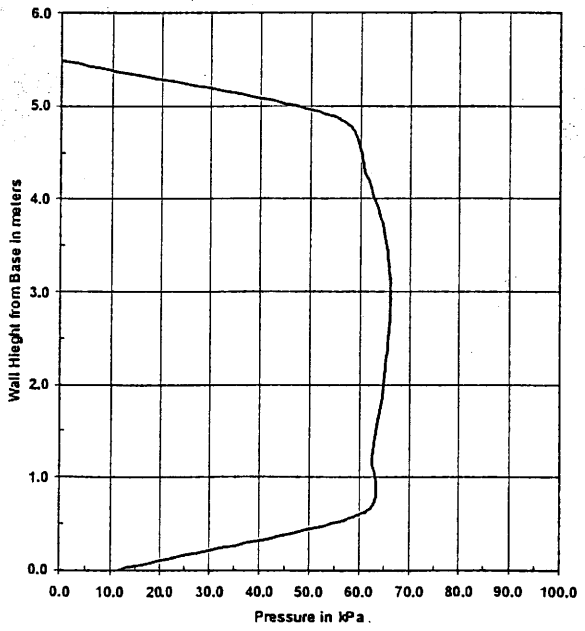
Lateral Pressure on RW-16
Dead Load Only



Lateral Pressure on RW-16
Dead Load+ Live Load



Lateral Pressure on RW-16
Dead Load + Seismic Load

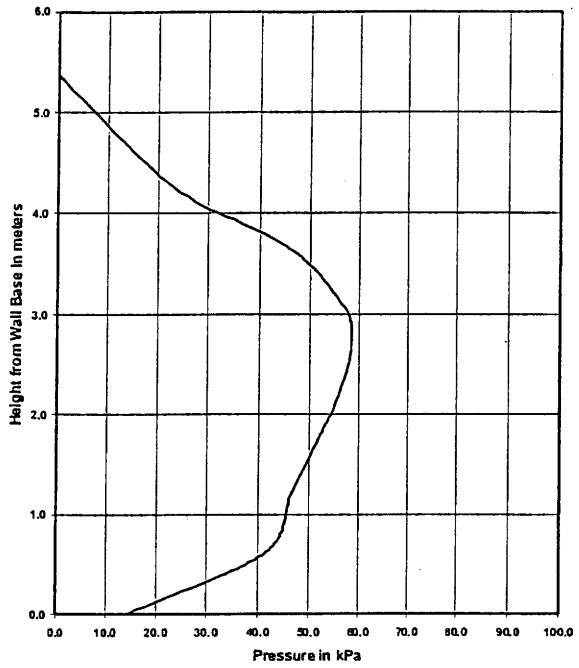


Black Eagle Consulting, Inc.
1345 Capital Boulevard, Suite A
Reno, Nevada 89502-7140
(775) 359-6600
FAX (775) 359-7766
E-mail: mail@blackeagleconsulting.com

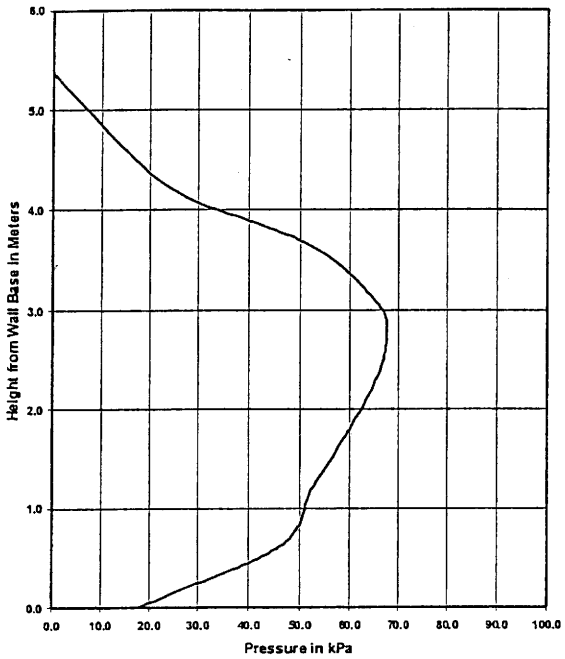
Lateral Pressure on RW-16

Plate 2c

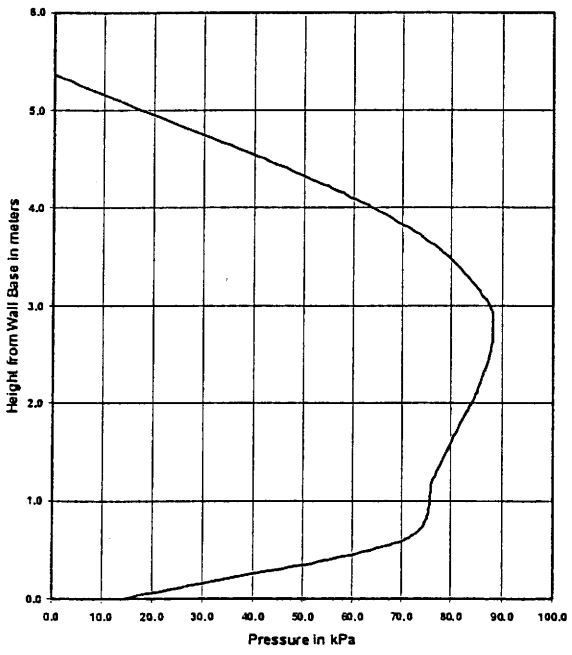
Lateral Pressure on RW-19
Dead Load Only



Lateral Pressure on RW-19
Dead Load + Live Load



Lateral Pressure on RW-19
Dead Load + Seismic Load



Black Eagle Consulting, Inc.
1345 Capital Boulevard, Suite A
Reno, Nevada 89502-7140
(775) 359-6600
FAX (775) 359-7766
E-mail: mail@blackeagleconsulting.com

Lateral Pressure on RW-19

Plate 2d

APPENDIX I

BORING LOGS

EXPLORATION LOG

START DATE 7/20/01
END DATE 7/20/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-01
E.A. # 0324-01-1
GROUND ELEV. 725.42 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 91+75 Q
OFFSET 50 RT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Cased DATE 7/20/2001

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
								GM	**Silty Gravel with Sand** ; light grey brown, dry, very dense, with estimated 15-20% low plastic fines, 30-35% fine to coarse sand, 50-55% subangular limestone gravel to 3". 10-15% oversize to 6". Moderately cemented.	
724.42	0.61								**Poorly Graded Gravel with Clay and Sand** ; light brown grey, slightly moist, very dense, with 9% low to medium plastic fines, 35% fine to coarse sand, 56% subangular to subrounded limestone gravel to 2". Moderately cemented. All size fractions, including cement, are calcareous.	
	1									
	1.52	1A	MC	50/75	50/75	0				
	1.68									
		1A'	GRAB			50	SV, PI, Dens			
723.42	2 2.13								Lithology is based on auger cuttings which is likely biased toward a more coarse sample (the auger winnows out the fine material thereby increasing the apparent gravel content). Actual soil might be a cemented Silty Gravel with Sand or a Silty Sand with Gravel.	
722.42	3 3.05	1B	SPT	50/50	50/50	0				
	3.20									
		1B'	GRAB			50			Gravel becomes progressively finer and more subrounded down hole. Predominantly <1" at base of unit.	
	3.66									
721.42	4							GP GC		
	4.57	1C	MC	50/38	50/38	100				
720.42	5									
719.42	6 6.10	1D	SPT	50/25	50/25	0				
	6.25									
		1D'	GRAB			50	SV, PI, Dens			
	6.71									
718.42	7								7.32	
	7.62	1E	MC	50/75	50/75	100	SV, PI, Dens		**Clayey Sand with Gravel** ; light grey brown, slightly moist, very dense, with 19% low to medium plastic fines, 51% fine to coarse sand, 30% subrounded limestone gravel to 1". Moderate to well cemented. Gravel is sheared into sharp fragments during augering.	
717.42	8									
716.42	9 9.14	1F	SPT	50/25	50/25	50	SV, PI, Dens	SC	Samples 1F and 1G were combined for lab analysis.	

EXPLORATION LOG

START DATE 7/20/01
END DATE 7/20/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-01
E.A. # 0324-01-1
GROUND ELEV. 725.42 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 91+75 Q
OFFSET 50 RT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Cased DATE 7/20/2001

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
	10.67	1G	MC	50/75	50/75	100	SV, PI, Dens			
714.42	11									
									11.58	
									Silty, Clayey Gravel with Sand ; light brown grey, slightly moist, very dense, with 13% low plastic fines, 39% fine to coarse sand, 48% subangular limestone gravel to 1". Moderate to well cemented.	
713.42	12									
	12.19	1H	SPT	50/25	50/25	0	SV, PI, Dens			
	12.34									
	12.80	1H'	GRAB			50				
712.42	13							GC GM		
	13.72	1I	MC	50/25	50/25	0				
711.42	14									
									14.63	
									Clayey Sand with Gravel ; light brown, slightly moist, very dense, with 19% low plastic fines, 60% fine to coarse sand, 21% subrounded limestone gravel to 1". Moderately cemented.	
710.42	15									
	15.24	1J	SPT	50/100	50/100	100	SV, PI, Dens			
709.42	16								Samples 1J and 1K were combined for lab analysis.	
								SC		
	16.76	1K	MC	50/50	50/50	50	SV, PI, Dens			
708.42	17									
									17.83	
707.42	18								**Silty, Clayey Sand with Gravel** ; light brown grey, slightly moist, very dense, with 12% low plastic fines, 50% fine to coarse sand, 38% subrounded limestone gravel to 1.25". Moderately cemented.	
	18.29	1L	SPT	50/25	50/25	0				
	18.44									
	18.90	1L'	GRAB			50	SV, PI, Dens			
706.42	19							SC SM		
	19.81	1M	MC	50/75	50/75	67				

EXPLORATION LOG

START DATE 7/20/01
END DATE 7/20/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-01
E.A. # 0324-01-1
GROUND ELEV. 725.42 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 91+75 Q
OFFSET 50 RT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Cased DATE 7/20/2001

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
									20.42	
704.42	21								**Poorly Graded Gravel with Silt and Sand** ; light brown, slightly moist, very dense, with 11% low plastic fines, 44% fine to coarse sand, 45% subrounded limestone gravel to 1.5". Moderate to well cemented.	
	21.34	1N	SPT	50/12	50/12	0				
	21.49									
		1N'	GRAB			50	SV, PI, Dens			
	21.95									
703.42	22							GP GM		
	22.86	1O	MC	50/38	50/38	0				
702.42	23									
									23.77	
701.42	24								**Well Graded Gravel with Silty Clay and Sand** ; light brown grey, slightly moist, very dense, with 11% low plastic fines, 39% fine to coarse sand, 50% subangular limestone gravel to 1.25". Moderately cemented.	
	24.38	1P	SPT	50/38	50/38	0				
	24.54									
		1P'	GRAB			50	SV, PI, Dens			
	24.99							GW GC		
700.42	25									
	25.91	1Q	MC	50/50	50/50	0				
699.42	26									
									26.21	
698.42	27								**Clayey Sand with Gravel** ; light brown, slightly moist, very dense, with estimated 15-20% low to medium plastic fines, 45-50% fine to coarse sand, 30-35% subangular gravel to 0.75". Moderate to well cemented.	
	27.43	1R	SPT	50/50	50/50	100		SC		
697.42	28									
									28.35	
	28.96	1S	MC	50/88	50/88	0			**Well Graded Sand with Silt and Gravel** ; light brown, slightly moist, very dense, with 12% low to medium plastic fines, 60% fine to coarse sand, 28% subangular limestone gravel to 1".	
696.42	29 29.11									
		1S'	GRAB			50	SV, PI, Dens	SW SM		
	29.57									

EXPLORATION LOG

START DATE 7/20/01
END DATE 7/20/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-01
E.A. # 0324-01-1
GROUND ELEV. 725.42 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 91+75 Q
OFFSET 50 RT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Cased DATE 7/20/2001

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
	30.48	1T	SPT	50/12	50/12	0			30.48	
694.42	31									
693.42	32									
692.42	33									
691.42	34									
690.42	35									
689.42	36									
688.42	37									
687.42	38									
686.42	39									

...DOT ...GPJ ... ...GDT ...

EXPLORATION LOG

START DATE 7/21/01
END DATE 7/21/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-02
E.A. # 0324-01-1
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 92+61 Q
OFFSET 39 RT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 7/21/2001

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
								GM	**Silty Gravel with Sand** ; light grey brown, dry, very dense, with estimated 15-20% low plastic fines, 35-40% fine to coarse sand, 45-50% subangular limestone gravel to 3". 10-15% oversize to 6". Moderately cemented with weak caliche coating on cobbles.	
	0.61								**Well Graded Sand with Silt and Gravel** ; light grey brown, dry, very dense, with 10% low plastic fines, 47% fine to coarse sand, 43% subangular limestone gravel to 1.5". Moderate to well cemented. Gravel is sheared by the auger. Calcareous cement throughout hole.	
722.90	1									
	1.52 – 1.68	2A	MC	50/50	50/50	100		SW SM		
721.90	2 – 2.13	2A'	GRAB			50	SV, PI, Dens			
	2.44								**Clayey Gravel with Sand** ; light grey brown, dry, very dense, with 13% low to medium plastic fines, 42% fine to coarse sand, 45% subangular limestone gravel to 1.75". Moderately cemented.	
720.90	3 – 3.05 – 3.20	2B	SPT	50/100	50/100	50				
	3.66	2B'	GRAB			50	SV, PI, Dens	GC		
719.90	4									
	4.27								**Poorly Graded Gravel with Sand** ; light brown grey, dry, very dense, with 4% low plastic fines, 18% fine to coarse sand, 78% subrounded limestone gravel to 2.5". Moderate to well cemented.	
	4.57 – 4.72	2C	MC	50/25	50/25	0				
718.90	5 – 5.18	2C'	GRAB			50	SV, PI, Dens	GP		
	5.79								**Clayey Sand with Gravel** ; light brown, dry, very dense, with 18% medium plastic fines, 55% fine to coarse sand, 27% subrounded limestone gravel to 2". Moderate to well cemented.	
717.90	6 – 6.10 – 6.25	2D	SPT	50/75	50/75	0				
	6.71	2D'	GRAB			50	SV, PI, Dens			
716.90	7									
	7.62	2E	MC	50/50	50/50	100	SV, PI, Dens	SC		
715.90	8									
714.90	9 – 9.14	2F	SPT	50/12	50/12	0				
	9.75								**Clayey Sand with Gravel** ; light brown, dry,	

EXPLORATION LOG

START DATE 7/21/01
END DATE 7/21/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-02
E.A. # 0324-01-1
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 92+61 Q
OFFSET 39 RT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 7/21/2001

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
									very dense, with 14% medium plastic fines, 45% fine to coarse sand, 41% subangular limestone gravel to 1.5". Moderate to well cemented.	
	10.67	2G	MC	50/12	50/12	0				
	10.82									
712.90	11	2G'	GRAB			50	SV, PI, Dens	SC		
	11.28									
711.90	12									
	12.19	2H	SPT	50/38	50/38	0			12.19	
									Clayey Sand with Gravel ; light brown, dry, very dense, with 20% low to medium plastic fines, 54% fine to coarse sand, 26% subangular to subrounded limestone gravel to 1". Moderate to well cemented.	
710.90	13									
	13.72	2I	MC	50/75	50/75	100	SV, PI, Dens	SC		
709.90	14									
									14.63	
									Poorly Graded Gravel with Silty Clay and Sand ; light brown, dry, very dense, with 11% low plastic fines, 37% fine to coarse sand, 52% subangular limestone gravel to 1.5". Moderate to well cemented.	
708.90	15									
	15.24	2J	SPT	50/38	50/38	67		GP GC		
	15.39									
	15.85	2J'	GRAB			50	SV, PI, Dens			
707.90	16								16.15	
									Silty, Clayey Sand with Gravel ; light brown, slightly moist, very dense, with 21% low plastic fines, 59% fine to coarse sand, 20% subangular limestone gravel to 1". Moderate to well cemented.	
	16.76	2K	MC	50/63	50/63	100	SV, PI, Dens			
706.90	17									
705.90	18									
	18.29	2L	SPT	50/25	50/25	0				
704.90	19									
	19.81	2M	MC	50/50	50/50	75	SV, PI, Dens	SC SM		

EXPLORATION LOG

START DATE 7/21/01
END DATE 7/21/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-02
E.A. # 0324-01-1
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

STATION 92+61 Q
OFFSET 39 RT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 7/21/2001

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

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
									Samples 2M and 2O were combined for lab analysis.	
702.90	21									
	21.34	2N	SPT	50/25	50/25	0				
701.90	22									
	22.86	2O	MC	50/38	50/38	67	SV, PI, Dens		22.86	
700.90	23									
699.90	24									
698.90	25									
697.90	26									
696.90	27									
695.90	28									
694.90	29									

EXPLORATION LOG

START DATE 7/21/01
END DATE 7/21/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-03
E.A. # 0324-01-1
GROUND ELEV. 728.47 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 92+26 Q
OFFSET 65 LT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 7/21/2001

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
727.47	0							GM	**Silty Gravel with Sand** ; light grey brown, dry, very dense, with estimated 15-20% low plastic fines, 35-40% fine to coarse sand, 45-50% subangular limestone gravel to 3". 5-10% oversize to 5". Moderately cemented with weak caliche coating on cobbles.	
	0.61									
	1								**Silty Clayey Sand with Gravel** ; light grey brown, dry, very dense, with 15% low plastic fines, 47% fine to coarse sand, 38% subangular limestone gravel to 2". Moderate to well cemented. Gravel is sheared by the auger. Calcareous cement throughout hole.	
	1.52	3A	MC	50/50	50/50	0				
	1.68									
726.47	2	3A'	GRAB			50	SV, PI, Dens			
	2.13							SC SM		
725.47	3									
	3.05	3B	SPT	50/38	50/38	0				
	3.20									
	3.66	3B'	GRAB			50	SV, PI, Dens			
724.47	3.96									
	4								**Well Graded Gravel with Silt and Sand** ; light brown grey, dry, very dense, with 12% low plastic fines, 42% fine to coarse sand, 46% subangular to subrounded limestone gravel to 1.75". Moderate to well cemented.	
	4.57	3C	MC	50/88	50/88	60	SV, PI, Dens	GW GM		
723.47	5									
	5.49									
									Silty Sand with Gravel ; light grey brown, dry, very dense, with 13% low plastic fines, 49% fine to coarse sand, 38% subangular limestone gravel to 2.5". Moderately cemented.	
722.47	6									
	6.10	3D	SPT	50/25	50/25	100				
	6.25									
	6.71	3D'	GRAB			50	SV, PI, Dens			
721.47	7							SM		
	7.62	3E	MC	50/75	50/75	0				
720.47	8									
	8.84									
									Silty, Clayey Sand with Gravel ; light brown, dry, very dense, with 15% low plastic fines, 52% fine to coarse sand, 33% subangular to subrounded limestone gravel to 1". Moderate to well cemented.	
719.47	9									
	9.14	3F	SPT	50/25	50/25	100				
	9.30									
	9.75	3F'	GRAB			50	SV, PI, Dens			

EXPLORATION LOG

START DATE 7/21/01
END DATE 7/21/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-03
E.A. # 0324-01-1
GROUND ELEV. 728.47 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 92+26 Q
OFFSET 65 LT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 7/21/2001

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
	10.67	3G	MC	50/62	50/62	60				
717.47	11							SC SM		
716.47	12									
	12.19 – 12.34	3H	SPT	50/25	50/25	0				
	12.80	3H'	GRAB			50	SV, PI, Dens			
715.47	13									
	13.11								**Clayey Sand** ; light brown, slightly moist, very dense, with 28% low to medium plastic fines, 64% fine to coarse sand, 8% subangular to subrounded limestone gravel to 1". Moderate to well cemented.	
	13.72	3I	MC	50/50	50/50	100	SV, PI, Dens	SC		
714.47	14									
	14.63								**Silty Sand with Gravel** ; light brown, slightly moist, very dense, with 15% low plastic fines, 52% fine to coarse sand, 33% subangular limestone gravel to 1". Moderate to well cemented.	
713.47	15									
	15.24 – 15.39	3J	SPT	50/62	50/62	0				
	15.85	3J'	GRAB			50	SV, PI, Dens			
712.47	16							SM		
	16.76	3K	MC	50/25	50/25	0				
711.47	17									
	17.37								**Clayey Sand with Gravel** ; light brown, slightly moist, very dense, with estimated 15-20% medium plastic fines, 45-50% fine to coarse sand, 35-40% subangular limestone gravel to 1". Moderate to well cemented.	
710.47	18									
	18.29 – 18.44	3L	SPT	50/25	50/25	0				
	18.90	3L'	GRAB			50				
709.47	19									
	19.81	3M	MC	50/38	50/38	0				

EXPLORATION LOG

START DATE 7/21/01
END DATE 7/21/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-03
E.A. # 0324-01-1
GROUND ELEV. 728.47 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 92+26 Q
OFFSET 65 LT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 7/21/2001

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
								SC		
707.47	21									
	21.34	3N	SPT	50/38	50/38	0				
	21.49									
		3N'	GRAB			50				
	21.95									
706.47	22									
	22.86	3O	MC	50/62	50/62	0			22.86	
705.47	23									
704.47	24									
703.47	25									
702.47	26									
701.47	27									
700.47	28									
699.47	29									

EXPLORATION LOG

START DATE 7/21/01
END DATE 7/21/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-04
E.A. # 0324-01-1
GROUND ELEV. 725.12 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 91+30 Q
OFFSET 35 LT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 7/21/2001

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
724.12	0							GM	**Silty Gravel with Sand** ; light grey brown, dry, very dense, with estimated 15-20% low plastic fines, 35-40% fine to coarse sand, 45-50% subangular limestone gravel to 3". 5-10% oversize to 5". Moderately cemented with weak caliche coating on cobbles.	
	0.91									
	1							SP SM	**Poorly Graded Sand with Silt and Gravel** ; light grey brown, dry, very dense, with 10% low plastic fines, 49% fine to coarse sand, 41% subangular limestone gravel to 2". Moderate to well cemented. Gravel is sheared by the auger. Calcareous cement throughout hole.	
	1.52	4A	MC	50/50	50/50	100				
	1.68	4A'	GRAB			50	SV, PI, Dens			
723.12	2									
	2.13									
	2.44									
722.12	3								**Well Graded Gravel with Silt and Sand** ; light grey brown, dry, very dense, with 10% low plastic fines, 43% fine to coarse sand, 48% subangular limestone gravel to 2". Moderate to well cemented.	
	3.05	4B	SPT	50/25	50/25	0				
	3.20	4B'	GRAB			50	SV, PI, Dens			
	3.66							GW GM		
721.12	4									
	4.57	4C	MC	50/25	50/25	0				
720.12	5									
	5.18									
719.12	6								**Silty Gravel with Sand** ; light brown grey, dry, very dense, with estimated 15-20% low plastic fines, 35-40% fine to coarse sand, 45-50% subangular to subrounded limestone gravel to 1". Moderately cemented.	
	6.10	4D	SPT	50/62	50/62	0				
	6.25	4D'	GRAB			50		GM		
	6.71									
718.12	7									
	7.32									
	7.62	4E	MC	50/50	50/50	100	SV, PI, Dens		**Clayey Sand with Gravel** ; light brown, dry, very dense, with 19% medium plastic fines, 51% fine to coarse sand, 30% subangular limestone gravel to 1". Moderate to well cemented.	
717.12	8									
716.12	9									
	9.14	4F	SPT	50/62	50/62	60	SV, PI, Dens		Samples 4F and 4H were combined for the lab analysis.	

DOT .GPJ .GDT ...12

EXPLORATION LOG

START DATE 7/21/01
END DATE 7/21/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-04
E.A. # 0324-01-1
GROUND ELEV. 725.12 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 91+30 Q
OFFSET 35 LT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 7/21/2001

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
								SC		
	10.67	4G	MC	50/25	50/25	0				
714.12	11									
713.12	12									
	12.19	4H	SPT	50/100	50/100	75	SV, PI, Dens			
									12.80	
712.12	13								**Clayey Sand with Gravel** ; light brown, slightly moist, very dense, with estimated 20-25% low to medium plastic fines, 45-50% fine to coarse sand, 25-30% subangular limestone gravel to 1". Moderate to well cemented.	
	13.72	4I	MC	50/88	50/88	0				
711.12	14									
710.12	15									
	15.24	4J	SPT	50/62	50/62	100				
								SC		
709.12	16									
	16.76	4K	MC	50/62	50/62	0				
708.12	17									
707.12	18									
	18.29	4L	SPT	50/50	50/50	0				
									18.90	
706.12	19								**Clayey Gravel with Sand** ; light brown, slightly moist, very dense, with estimated 15-20% low to medium plastic fines, 35-40% fine to coarse sand, 45-50% subangular to subrounded gravel to 1.25". Moderate to well cemented. Lithology based on auger cuttings.	
	19.81	4M	MC	50/75	50/75	0				

...DOT (...).GPJ ...GDT ...

EXPLORATION LOG

START DATE 7/21/01
END DATE 7/21/01
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-04
E.A. # 0324-01-1
GROUND ELEV. 725.12 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
7/21/01	NE	

STATION 91+30 Q
OFFSET 35 LT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 7/21/2001

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
704.12	21							GC		
	21.34	4N	SPT	50/62	50/62	60				
703.12	22									
	22.86	4O	MC	50/38	50/38	0			22.86	
702.12	23									
701.12	24									
700.12	25									
699.12	26									
698.12	27									
697.12	28									
696.12	29									

NV_DOT 0324011.GPJ Nv_DOT.GDT 5/29/2002

EXPLORATION LOG

START DATE 11/8/01
END DATE 11/8/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-5
E.A. # 0324-01-2
GROUND ELEV. 730.61 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/8/01	NE	

STATION 14+40 R
OFFSET 27 LT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/8/2001

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
729.61	1 1.07	A	SPT	50/25	50/25	5		GP GM	**POORLY GRADED GRAVEL with SILT and SAND** light brown, dry, very dense, with 6% nonplastic fines, 29% fine to coarse sand and 65% fine to coarse subangular gravel to 2". Cobbles to 4" comprise an estimated 20% of the unit mass.	Previously reported as boring B-A.
	1.22									
	1.68	A'	GRAB			50	PI, SI, MC			
728.61	2									Poor sample return on SPT and MC samples
									2.13	
	2.59	B	MC	75/50	75/50	11			**POORLY GRADED GRAVEL with SILT and SAND** light brown, slightly moist, very dense, with 10-20% nonplastic fines, 30% fine to coarse sand and 50-55% fine to coarse subrounded gravel to 1/2". Trace cobbles to 5" sheared by auger. Moderate calcareous cementation.	
	2.74									
727.61	3 3.20	B'	GRAB			50	PI, SI, MC, SH, CHEM			
726.61	4 4.11	C	ST	50/25	50/25	1				
	4.27									
	4.72	C'	GRAB			50	PI, SI, MC			
725.61	5							GP GC		
	5.64	D	MC	75/25	75/25	5				
	5.79									
724.61	6 6.25	D'	GRAB			50	PI, SI, MC			
723.61	7 7.16	E	ST	50/25	50/25	5				
722.61	8								8.23	
	8.69	F	MC	75/40	75/40	10			**SILTY, CLAYEY SAND with GRAVEL** light brown, slightly moist, very dense, with 2% nonplastic fines, 46% fine to coarse sand and 42% fine to coarse subrounded gravel to 3". Cobbles to 4" comprise and estimated 10% of the unit mass.	
721.61	9									

EXPLORATION LOG

START DATE 11/8/01
END DATE 11/8/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-5
E.A. # 0324-01-2
GROUND ELEV. 730.61 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/8/01	NE	

STATION 14+40 R
OFFSET 27 LT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/8/2001

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
	10.21	G	SPT	50/50	50/50	11				
719.61	11							SC SM		
	11.73	H	MC	75/50	75/50	11				
	11.89									
718.61	12	H'	GRAB			50	PI, SI, MC			
	12.34									
717.61	13									
716.61	14									
									14.33	
	14.78	I	MC	75/50	75/50	11			**POORLY GRADED GRAVEL with SILT and SAND** tan, slightly moist, very dense, with 10-20% nonplastic fines, 30% fine to coarse sand and 50-55% fine to coarse subrounded gravel to 1/2". Trace cobbles to 4".	
715.61	15									
714.61	16									
713.61	17									
	17.83	J	SPT	50/125	50/125	28				
712.61	18							GP GC		
711.61	19									

EXPLORATION LOG

START DATE 11/8/01
END DATE 11/8/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-5
E.A. # 0324-01-2
GROUND ELEV. 730.61 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/8/01	NE	

STATION 14+40 R
OFFSET 27 LT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/8/2001

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
	20.88	K	MC	75/25	75/25	5				
709.61	21									
708.61	22									
	22.40	L	MC	75/50	75/50	11				
									22.86	
707.61	23									
706.61	24									
705.61	25									
704.61	26									
703.61	27									
702.61	28									
701.61	29									

DOT ..... 2.GPJ ..... T.GDT 2002

EXPLORATION LOG

START DATE 11/8/01
END DATE 11/8/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-6
E.A. # 0324-01-2
GROUND ELEV. 726.95 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/8/01	NE	

STATION 14+50 R
OFFSET 15 LT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/8/2001

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	0.30 **POORLY GRADED GRAVEL with SILT and SAND** grey-brown, dry, medium dense, with estimated 90% fine to coarse gravel, 10% coarse sand and 90% fine to coarse subrounded gravel. Cobbles to 4" comprise an estimated 20% of the unit mass. Loose weak cementation gravels at surface.	Previously reported as boring B-B.
725.95	1 1.07	A	SPT	50/25	50/25	5		GW GM	**WELL GRADED GRAVEL with SILT and SAND** light brown, dry to slightly moist, very dense, with 10% nonplastic fines, 41% fine to coarse sand and 49% fine to coarse subrounded gravel to 2".	
	1.22									
	1.68	A'	GRAB			50	PI, SI, MC,			
									1.92	
724.95	2								**POORLY GRADED GRAVEL with SILT and SAND** tan, moist, very dense with 2% nonplastic fines, 42% fine to coarse sand and 47% fine subrounded gravel to 1-1/2".	
	2.59	B	MC	75/25	75/25	5		GW GM		
	2.74									
723.95	3 3.20	B'	GRAB			50	PI, SI, MC, SH, CHEM			
									3.66	
722.95	4 4.11	C	SPT	50/25	50/25	5		GW GM	**WELL GRADED GRAVEL with SILT and SAND** light brown, dry to slightly moist, very dense with 10% nonplastic to very low plasticity fines, 41% fine to coarse sand and 49% fine to coarse subrounded gravel to 2".	
	4.27									
	4.72	C'	GRAB			50	PI, SI, MC,			
									4.97	
721.95	5								**POORLY GRADED GRAVEL with SILTY CLAY and SAND** light brown, dry, very dense, with 11% nonplastic to very low plasticity fine, 52% fine to coarse gravel and 36% coarse sand and 52% fine to coarse subrounded limestone gravel to 3". Cobbles to 4" comprise an estimated 20% of the unit mass.	
	5.64	D	MC	75/25	75/25	5				
	5.79									
720.95	6 6.25	D'	GRAB			50	PI, SI, MC,	GP GC		
719.95	7 7.16	E	SPT	50/25	50/25	5				
									7.59	
718.95	8								**SILTY GRAVEL with SAND** light brown, dry to slightly moist, very dense, with 13% nonplastic fines, 42% fine to coarse sand and 45% fine to coarse subrounded limestone gravel to 3".	
	8.69	F	MC	75/25	75/25	5				
717.95	9									

DOT ... 2.GPJ ... T.GDT ... 2002

EXPLORATION LOG

START DATE 11/8/01
END DATE 11/8/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-6
E.A. # 0324-01-2
GROUND ELEV. 726.95 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/8/01	NE	

STATION 14+50 R
OFFSET 15 LT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/8/2001

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
	10.21	G	SPT	50/60	50/60	12		GM		
715.95	11									
	11.73	H	MC	75/0	75/0	0				
	11.89									
714.95	12	H'	GRAB			50	PI, SI, MC,			
	12.34									
713.95	13									
									13.17 **WELL GRADED GRAVEL with SILT and SAND** tan, dry to slightly moist, very dense, with estimated 10% nonplastic fines, 40% fine to coarse sand and 50% fine to coarse subrounded gravel to 2".	
712.95	14									
	14.78	I	SPT	50/25	50/25	5				
711.95	15									
710.95	16									
709.95	17									
	17.83	J	MC	75/50	75/50	11		GP GM		
708.95	18									
707.95	19									

DOT ....2.GPJ ....T.GDT 002

EXPLORATION LOG

START DATE 11/8/01
END DATE 11/8/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-6
E.A. # 0324-01-2
GROUND ELEV. 726.95 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/8/01	NE	

STATION 14+50 R
OFFSET 15 LT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/8/2001

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
	20.88	K	SPT	50/50	50/50	11				
705.95	21									
704.95	22									
	22.40	L	MC	75/25	75/25	5				
									22.86	
703.95	23									
702.95	24									
701.95	25									
700.95	26									
699.95	27									
698.95	28									
697.95	29									

DOT_2.GPJ _F.GDT 002

EXPLORATION LOG

START DATE 11/9/01
END DATE 11/9/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-7
E.A. # 0324-01-2
GROUND ELEV. 733.04 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/9/01	NE	

STATION 14+50 R
OFFSET 90 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/9/2001

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
									WELL GRADED GRAVEL with SILTY CLAY and SAND tan, slightly moist, very dense, with 11% nonplastic to low plasticity fines, 42% fine to coarse sand and 47% fine subrounded gravel to 1-1/2". Moderate calcareous cementation.	Previously reported as boring B-C.
732.04	1 1.07	A	SPT	50/25	50/25	5		GW GC		
	1.22									
	1.68	A'	GRAB			50	PI, SI, MC, SH, CHEM			
731.04	2									
									2.29	
	2.59	B	MC	75/25	75/25	5			**POORLY GRADED SAND with SILTY CLAY and GRAVEL** light brown, slightly moist, very dense, with 11% nonplastic to low plasticity fines, 51% fine to coarse sand and 38% fine to coarse subrounded gravels to 1". Moderate cementation.	
	2.74									
730.04	3 3.20	B'	GRAB			50	PI, SI, MC,	GC		
									3.66	
729.04	4 4.11	C	SPT	50/25	50/25	5			**SILTY, CLAYEY SAND with GRAVEL** tan, slightly moist, very dense, with 13% nonplastic to low plasticity fines, 44% fine to coarse sand and 43% fine subrounded gravel to 1-1/2". Moderate cementation.	
	4.27							SC SM		
	4.72	C'	GRAB			50	PI, SI, MC,			
728.04	5									
									5.18	
	5.64	D	MC	75/25	75/25	5			**SILTY, CLAYEY GRAVEL with SAND** tan-grey, slightly moist, very dense, with 13% nonplastic to low plasticity fines, 40% fine to coarse sand and 47% fine subrounded limestone gravels to 1/2". Moderate to strong cementation.	
	5.79									
727.04	6 6.25	D'	GRAB			50	PI, SI, MC,	SM		
726.04	7 7.16	E	ST	50/25	50/25	5				
									7.62	
725.04	8								**SILTY SAND with GRAVEL** tan, slightly moist to moist, very dense, with 16% nonplastic to low plasticity fines, 46% fine to coarse sand and 38% fine subrounded limestone gravel to 1-1/2". Moderate cementation.	
	8.69	F	MC	75/25	75/25	5				
724.04	9									

DOT 2.GPJ T.GD1 ...1002

EXPLORATION LOG

START DATE 11/9/01
END DATE 11/9/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-7
E.A. # 0324-01-2
GROUND ELEV. 733.04 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/9/01	NE	

STATION 14+50 R
OFFSET 90 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/9/2001

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
	10.21	G	SPT	50/50	50/50	11		GC GM		
722.04	11									
	11.73	H	MC	75/25	75/25	5				
721.04	12									
	12.19									
	12.65	H'	GRAB			50	PI, SI, MC,		12.50 **CLAYEY SAND with GRAVEL** light brown, slightly moist to moist, very dense, with 14-22% low to medium plasticity fines, 46-54% fine to coarse sand and 24-40% fine subrounded limestone gravel to 1". Moderate calcareous cementation.	
720.04	13									
719.04	14									
	14.78	I	SPT	50/25	50/25	5				
718.04	15									
717.04	16									
716.04	17									
	17.83	J	MC	75/25	75/25	5		SC		
715.04	18									
	18.29									
	18.75	J'	GRAB			50	PI, SI, MC,			
714.04	19									

DOT 0324012.GPJ NV_DOT.GDT 11/12/2002

EXPLORATION LOG

START DATE 11/9/01
END DATE 11/9/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-7
E.A. # 0324-01-2
GROUND ELEV. 733.04 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/9/01	NE	

STATION 14+50 R
OFFSET 90 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/9/2001

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
	20.88	K	SPT	50/25	50/25	5				
712.04	21									
711.04	22									
	22.86									
710.04	23								**SILTY SAND with GRAVEL** light brown, slightly moist to moist, very dense, with 15% nonplastic fines, 60% fine to coarse sand and 25% fine subrounded limestone gravel to 3/4".	
	23.93	L	MC	75/25	75/25	5	PI, SI, MC,			
709.04	24									
708.04	25									
707.04	26									
								SM		
	26.97	M	SPT	50/50	50/50	11				
706.04	27									
705.04	28									
704.04	29									
	30.02									

EXPLORATION LOG

START DATE 11/9/01
END DATE 11/9/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-7
E.A. # 0324-01-2
GROUND ELEV. 733.04 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/9/01	NE	

STATION 14+50 R
OFFSET 90 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/9/2001

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
		N	MC	75-50mm	75-50mm	0				
									30.48	
702.04	31									
701.04	32									
700.04	33									
699.04	34									
698.04	35									
697.04	36									
696.04	37									
695.04	38									
694.04	39									

DOT_____.GPJ_____.GDT_____002

EXPLORATION LOG

START DATE 11/6/01
END DATE 11/6/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-8
E.A. # 0324-01-2
GROUND ELEV. 737.62 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/6/01	NE	

STATION 93+88 Q
OFFSET 103 LT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/6/2001

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
									SILTY, CLAYEY GRAVEL with SAND light brown, slightly moist, dense to very dense, with estimated 20% low plasticity fines, 35% fine to coarse sand and 45% fine subangular limestone gravel to 1-1/2".	Previously reported as boring B-D.
736.62	1 1.07									
	1.22	A	SPT	~~46~~ 50/50	50/50	44		GC GM		
735.62	2									
	2.59									
	2.74	B	MC	75/100	75/100	0				
734.62	3									
									3.35	
733.62	4 4.11								**CLAYEY GRAVEL with SAND** light brown, slightly moist, very dense, with 14% low to medium plasticity fines, 42% fine to coarse sand and 44% fine subangular limestone gravel to 1". Moderate cementation.	
	4.27	C	SPT	~~49~~ 50/75	50/75	50		SC		
732.62	5									
									5.18	
	5.64								**SILTY GRAVEL with SAND** light brown, moist, very dense, with estimated 20% low plasticity fines, 35% fine to coarse sand and 45% fine subangular limestone gravel to 1-1/2". Well cemented.	
	5.79	D	MC	50/125	50/125	28		GM		
731.62	6									
									6.40	
730.62	7 7.16								**SILTY, CLAYEY SAND with GRAVEL** light brown, moist, very dense, with 18% low plasticity fines, 50% fine to coarse sand and 32% fine subangular limestone gravel to 1-1/2". Moderate cementation. Well cemented between 53-58 feet.	
	7.32	E	SPT	50/100	50/100	22		SC SM		
									7.62	
729.62	8								**SILTY, CLAYEY GRAVEL with SAND** light brown, slightly moist to moist, very dense, with 18% low plasticity fines, 37% fine to coarse sand and 44% fine to coarse subrounded limestone gravel to 2". Moderate cementation.	
	8.69									
	8.84	F	MC	50/100	50/100	100	PI, SI, MC,			
728.62	9									

EXPLORATION LOG

START DATE 11/6/01
END DATE 11/6/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-8
E.A. # 0324-01-2
GROUND ELEV. 737.62 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/6/01	NE	

STATION 93+88 Q
OFFSET 103 LT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/6/2001

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
	10.21									
	10.36	G	SPT	50/25	50/25	5				
726.62	11									
	11.73									
	11.89	H	MC	75/40	75/40	10				
725.62	12							GC GM		
724.62	13									
723.62	14								**CLAYEY SAND with GRAVEL** light brown, slightly moist to moist, very dense with 14% low plasticity fines, 65% fine to coarse sand and 21% fine to coarse subrounded limestone gravel to 2".	
	14.78									
	14.94	I	SPT	50/25	50/25	5				
722.62	15									
721.62	16							SC		
									16.46	
720.62	17									
	17.83									
	17.98	J	MC	75/25	75/25	5				
719.62	18									
									18.29	
718.62	19								**CLAYEY GRAVEL with SAND** light brown, slightly moist, very dense, with estimated 20% low to medium plasticity fines, 35% fine to coarse sand and 45% fine subangular limestone gravel to 1". Moderate cementation.	

EXPLORATION LOG

START DATE 11/6/01
END DATE 11/6/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-8
E.A. # 0324-01-2
GROUND ELEV. 737.62 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/6/01	NE	

STATION 93+88 Q
OFFSET 103 LT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/6/2001

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
	20.88							SC		
716.62	21 21.03	K	ST	50/25	50/25	5				
715.62	22									
	22.40									
	22.56	L	MC	75/25	75/25	5				
									22.86	
714.62	23									
713.62	24									
712.62	25									
711.62	26									
710.62	27									
709.62	28									
708.62	29									

...DOT ...GPJ ... ...GDT ...

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-9
E.A. # 0324-01-2
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 13+35 R
OFFSET 15 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
722.90	1 1.07	A	SPT	50/25	50/25	5		GP GC	**POORLY GRADED GRAVEL with SILTY CLAY and SAND** light brown, slightly moist, dense to very dense, with 10% low to medium plasticity fines, 35% fine to coarse sand and 55% fine to coarse limestone gravel to 3". Cobbles to 4" comprise an estimated 15% of the unit mass. Moderate cementation.	Previously reported as boring B-E.
	1.22									
	1.68	A'	GRAB			50	PI, SI, MC			
721.90	2								1.98	
	2.59	B	MC	75/100	75/100	11		GW GC	**WELL GRADED GRAVEL with CLAY and SAND** light brown, slightly moist, very dense, with 11% low plasticity fines, 43% fine to coarse sand and 46% fine subangular limestone gravel to 3/4". Moderate cementation.	
	2.74									
720.90	3	B'	GRAB			50	PI, SI, MC, SH, CHEM		3.05	
	3.20									
719.90	4 4.11	C	SPT	50/15	50/15	3		SC	**CLAYEY SAND with GRAVEL** light brown-grey, slightly moist, very dense, with estimated 14% medium to high plasticity fines, 43% fine to coarse sand and 42% fine to coarse subangular limestone gravel to 3". Unit contains an estimated 10% subangular cobbles to 4". Moderate cementation.	
	4.27									
	4.72	C'	GRAB			50	PI, SI, MC			
718.90	5								5.18	
	5.64	D	MC	50/25	50/25	5		SC SM	**SILTY, CLAYEY SAND with GRAVEL** tan-light brown, slightly moist to moist, very dense, with 13% low plasticity fines, 60% fine to coarse sand and 27% fine to coarse subrounded limestone gravel to 2". Moderate calcareous cementation.	
	5.79									
717.90	6	D'	GRAB			50	PI, SI, MC		6.40	
	6.25									
716.90	7 7.16	E	SPT	50/125	50/125	28		SC	**CLAYEY SAND with GRAVEL** light brown-tan, slightly moist to moist, very dense, with 17-21% medium plasticity fines, 49-50% fine to coarse sand and 29-33% fine to coarse gravel to 3". Moderate cementation.	
715.90	8									
	8.69	F	MC	75/50	75/50	11				
714.90	9									

...DOT ...2.GPJ ... ...F.GDT ...002

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-9
E.A. # 0324-01-2
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 13+35 R
OFFSET 15 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
	10.21	G	SPT	50/75	50/75	17	PI, SI, MC			
712.90	11									
	11.73	H	MC	75/50	75/50	11				
711.90	12								12.19	
								SW SC	**WELL GRADED SAND with CLAY and GRAVEL** light brown, moist, very dense, with 12% low plasticity fines, 53% fine to coarse sand and 35% fine to coarse subrounded limestone gravel to 2'. Moderate cementation.	
710.90	13									
709.90	14									
	14.78	I	SPT	49 50/50	50/50	44	PI, SI, MC			
708.90	15									
707.90	16								16.15	
									CLAYEY GRAVEL with SAND light brown, moist, very dense, with estimated 15-20% low plasticity fines, 30-35 fine to coarse sand and 50% fine to coarse subrounded gravel to 3".	
706.90	17									
	17.83	J	MC	75/125	75/125	28				
705.90	18									
704.90	19							GC		

DOT 2.GPJ T.GD1 ...2002

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-9
E.A. # 0324-01-2
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 13+35 R
OFFSET 15 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
	20.88	K	SPT	50/100	50/100	22				
702.90	21									
701.90	22									
	22.40	L	MC	75/15	75/15	3				
									22.86	
700.90	23									
699.90	24									
698.90	25									
697.90	26									
696.90	27									
695.90	28									
694.90	29									

DOT 2.GPJ T.GDT 1002

EXPLORATION LOG

START DATE 11/6/01
END DATE 11/6/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-10
E.A. # 0324-01-2
GROUND ELEV. 729.39 (m)
HAMMER DROP SYSTEM Cable

STATION 12+55 R
OFFSET 33 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/6/2001

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/6/01	NE	

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	A	MC	75/50	75/50	11		SC SM	**SILTY, CLAYEY SAND with GRAVEL** light brown, slightly moist, very dense, with 14% low plasticity fines, 50% fine to coarse sand and 36% fine to coarse subangular limestone gravels to 1-1/2". Moderate calcareous cementation.	Previously reported as boring B-F.
	0.30									
	0.76	A'	GRAB			50	PI, SI, MC, SH, CHEM			
728.39	1 1.07	B	SPT	50/25	50/25	5				
	1.22									
	1.68	B'	GRAB			50	PI, SI, MC			
727.39	2								2.13	
	2.59	C	MC	75/50	75/50	11		SW SC	**WELL GRADED SAND with CLAY and GRAVEL** light brown, slightly moist, very dense, with 9% low to medium plasticity fines, 71% fine to coarse sand and 30% fine to coarse subangular limestone gravels to 1-1/2". Well cemented; difficult drilling.	
	2.74									
726.39	3 3.20	C'	GRAB			50	PI, SI, MC			
									3.66	
725.39	4 4.11	D	SPT	50/50	50/50	11		GW GM	**WELL GRADED GRAVEL with SILT and SAND** tan, slightly moist, very dense, with 10% low plasticity fines, 42% fine to coarse sand and 48% fine to coarse subangular limestone gravels to 2". Well cemented; difficult drilling.	
	4.27									
	4.72	D'	GRAB			50	PI, SI, MC			
									4.88	
724.39	5								**WELL GRADED GRAVEL with SILTY CLAY and SAND** light brown, slightly moist to moist, very dense, with 10% low plasticity fines, 43% fine to coarse sand and 47% fine to coarse subangular limestone gravels to 1-1/2". Moderate calcareous cementation.	
	5.64	E	MC	75/75	75/75	17		GW GM		
	5.79									
723.39	6	E'	GRAB			50	PI, SI, MC			
	6.25									
									6.71	
722.39	7 7.16	F	ST	50/15	50/15	2			**POORLY GRADED GRAVEL with SILT and SAND** light brown, moist, very dense, with 10% low plasticity fines, 43% fine to coarse sand and 47% fine subangular limestone gravel to 1-1/2". Moderate cementation.	
721.39	8									
	8.69	G	MC	75/15	75/15	2				
720.39	9									

EXPLORATION LOG

START DATE 11/6/01
END DATE 11/6/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-10
E.A. # 0324-01-2
GROUND ELEV. 729.39 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/6/01	NE	

STATION 12+55 R
OFFSET 33 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/6/2001

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
	10.21	H	ST	50/25	50/25	5				
718.39	11							GP GM		
	11.73	I	MC	75/25	75/25	5				
717.39	12									
716.39	13									
715.39	14									
	14.78	J	SPT	50/50	50/50	11				
714.39	15								15.24	
									CLAYEY SAND with GRAVEL light brown, moist, very dense, with 13-16% low to medium plasticity fines, 54-60% fine to coarse sand and 24-33% fine to coarse subrounded limestone gravel to 1". Moderate cementation.	
713.39	16									
712.39	17									
	17.83	K	MC	75/50	75/50	11	PI, SI, MC			
711.39	18									
710.39	19							SC		

002 .GDT .GPJ .DOT

EXPLORATION LOG

START DATE 11/6/01
END DATE 11/6/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-10
E.A. # 0324-01-2
GROUND ELEV. 729.39 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/6/01	NE	

STATION 12+55 R
OFFSET 33 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/6/2001

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
	20.88	L	SPT	50/50	50/50	11				
708.39	21									
707.39	22									
	22.40	M	MC	75/25	75/25	5	PI, SI, MC			
									22.86	
706.39	23									
705.39	24									
704.39	25									
703.39	26									
702.39	27									
701.39	28									
700.39	29									

DOT ...2.GPJ ...r.GDT ...002

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-11
E.A. # 0324-01-2
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 91+68 Q
OFFSET 31 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
722.90	1 1.07	A	ST	50/25	50/25	5		GM	**POORLY GRADED GRAVEL with SILT and SAND** light brown-tan, slightly moist, very dense, with 7% nonplastic fines, 43% fine to coarse sand and 50% fine subangular limestone gravel to 1". Moderate cementation.	Previously reported as boring B-G.
	1.22									
		A'	GRAB			50	PI, SI, MC			
	1.68									
721.90	2							SW SC	**WELL GRADED SAND with SILTY CLAY and SAND** light brown, slightly moist, very dense with 11% low plasticity fines, 54% fine to coarse sand and 35% fine subrounded limestone gravel to 3/4". Moderate calcareous cementation.	
	2.59	B	MC	75/25	75/25	5				
	2.74									
720.90	3	B'	GRAB			50	PI, SI, MC, SH, CHEM			
	3.20									
									3.35	
719.90	4 4.11	C	ST	50/50	50/50	11		GW GC	**WELL GRADED GRAVEL with SILTY CLAY and SAND** light tan, moist, very dense, with 10% low plasticity fines, 39% fine to coarse sand and 51% fine subangular limestone gravel to 1/2". Moderate cementation.	
	4.27									
		C'	GRAB			50	PI, SI, MC			
	4.72									
718.90	5									
	5.64	D	MC	75/38	75/38	10		SW SC	**WELL GRADED SAND with CLAY and GRAVEL** light brown, moist, very dense with estimated 20% low plasticity fines, 35-40% fine to coarse sand and 40-45% fine subangular limestone gravel to 3/4". Moderate cementation.	
	5.79									
717.90	6	D'	GRAB			50	PI, SI, MC			
	6.25								6.40	
716.90	7 7.16	E	ST	50/100	50/100	22	PI, SI, MC		**CLAYEY SAND with GRAVEL** light brown, moist, very dense, with 14-21% low plasticity fines, 44-65% fine to coarse sand and 18-42% fine subrounded limestone gravel to 1". Moderate cementation.	
715.90	8									
	8.69	F	MC	75/125	75/125	28	PI, SI, MC			
714.90	9									

DOT ...GPJ ...GDT ...002

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-11
E.A. # 0324-01-2
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 91+68 Q
OFFSET 31 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
	10.21	G	ST	50/25	50/25	6				
712.90	11									
	11.73	H	MC	75/50	75/50	11		SC		
711.90	12									
710.90	13									
709.90	14									
	14.78	I	SPT	50/50	50/50	11				
	14.94									
708.90	15	I'	GRAB			50				
	15.39									
707.90	16									
									16.76	
706.90	17								**SILTY, CLAYEY GRAVEL with SAND** light brown, moist, very dense, with 16% low plasticity fines, 41% fine to coarse sand and 44% fine subrounded gravel to 1". Moderate cementation.	
	17.83	J	MC	75/63	75/63	17				
705.90	18							GC GM		
704.90	19									
									19.81	
									SILTY, CLAYEY SAND tan-light brown,	

DOT ...GPJ ...GDT ...002

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-11
E.A. # 0324-01-2
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 91+68 Q
OFFSET 31 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
									moist, very dense, with 23% low plasticity fines, 67% fine to coarse sand and 10% fine to coarse subangular gravel to 2". Moderate calcareous cementation.	
	20.88	K	ST	50/25	50/25	5		SC SM		
702.90	21									
	21.34	K'	GRAB			50				
	21.79									
701.90	22									
	22.40	L	MC	75/50	75/50	11				
									22.86	
700.90	23									
699.90	24									
698.90	25									
697.90	26									
696.90	27									
695.90	28									
694.90	29									

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-12
E.A. # 0324-01-2
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 93+15 Q
OFFSET 60 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
722.90	1 1.07	A	ST	50/50	50/50	11		GP GM	**CLAYEY GRAVEL with SAND** light brown, lightly moist, very dense, with estimated 15% low plasticity and nonplastic fines, 35% fine to coarse sand and 50% fine subangular limestone gravel to 3/4". Moderate cementation.	Previously reported as boring B-H.
	1.22									
	1.68	A'	GRAB			50	PI, SI, MC, SH, CHEM			
721.90	2									
	2.59	B	MC	75/50	75/50	11				
	2.74								2.44	
720.90	3 3.20	B'	GRAB			50	PI, SI, MC	GW GM	**WELL GRADED GRAVEL with SILT and SAND** light brown, slightly moist, very dense, with 9-10% nonplastic fines, 40-44% fine to coarse sand and 47-51% fine subrounded limestone gravel to 1". Moderate calcareous cementation.	
719.90	4 4.11	C	SPT	50/25	50/25	5				
	4.27									
	4.72	C'	GRAB			50	PI, SI, MC			
718.90	5									
	5.64	D	MC	75/25	75/25	5				
	5.79									
717.90	6 6.25	D'	GRAB			50	PI, SI, MC		6.10	
716.90	7 7.16	E	SPT	50/25	50/25	5		GW	**WELL GRADED GRAVEL with SILTY CLAY and SAND** tan, slightly moist to moist, very dense, with 12% low plasticity fines, 42% fine to coarse sand and 47% fine to coarse subrounded limestone gravel to 2". Moderate cementation.	
715.90	8									
	8.69	F	MC	75/63	75/63	12				
714.90	9									

.002 .GDT .GPJ .DOT

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-12
E.A. # 0324-01-2
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 93+15 Q
OFFSET 60 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
	10.21	G	SPT	50/50	50/50	11		GC		
712.90	11									
	11.73	H	MC	75/50	75/50	11				
	11.89									
711.90	12	H'	GRAB			40	PI, SI, MC			
	12.34									
710.90	13									
									13.72	
709.90	14								**POORLY GRADED GRAVEL with SILT and SAND** light brown, slightly moist to moist, very dense, with estimated 10% nonplastic fines, 35% fine to coarse sand and 55% fine subrounded limestone gravel to 2". Moderate cementation.	
	14.78	I	SPT	50/25	50/25	5				
708.90	15									
707.90	16									
706.90	17									
	17.83	J	MC	75/75	75/75	17				
705.90	18							GP GM		
704.90	19									

DOT ....GPJ ....GDT 002

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-12
E.A. # 0324-01-2
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 93+15 Q
OFFSET 60 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
	20.88	K	SPT	50/50	50/50	11				
702.90	21									
701.90	22									
	22.40	L	MC	75/75	75/75	17				
									22.86	
700.90	23									
699.90	24									
698.90	25									
697.90	26									
696.90	27									
695.90	28									
694.90	29									

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-13
E.A. # 0324-01-2
GROUND ELEV. 720.24 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 93+15 Q
OFFSET 60 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
719.24	1 1.07								**SILTY, CLAYEY SAND with GRAVEL** light brown, dry to slightly moist, very dense, with 13-15% low plasticity fines, 52% fine to coarse sand and 34-36% fine to coarse subrounded limestone gravel to 3/4". Strong calcareous cementation.	Previously reported as boring B-I.
	1.22	A	SPT	50/75	50/75	16				
	1.68	A'	GRAB			50	PI, SI, MC	SC SM		
718.24	2									
	2.59	B	MC	75/25	75/25	5				
	2.74									
717.24	3	B'	GRAB			50	PI, SI, MC, SH, CHEM			
	3.20								3.35	
716.24	4 4.11							SC	**CLAYEY SAND with GRAVEL** light brown, slightly moist, very dense, with 15% low plasticity fines, 51% fine to coarse sand and 34% fine subangular limestone gravel to 1-1/2". Strong calcareous cementation.	
	4.27	C	SPT	50/25	50/25	5			4.27	
	4.72	C'	GRAB			50	PI, SI, MC	SC	**CLAYEY SAND with GRAVEL** tan, slightly moist, very dense, with 15% low plasticity fines, 51% fine to coarse sand and 34% fine to coarse subangular limestone gravel to 2-1/2". Moderate calcareous cementation.	
715.24	5								5.18	
	5.64	D	MC	75/0	75/0	0			**SILTY, CLAYEY SAND with GRAVEL** light brown, slightly moist, very dense, with 14% low plasticity to nonplastic fines, 49% fine to coarse sand and 37% fine subangular limestone gravel to 1-1/2". Moderate calcareous cementation.	
	5.79									
714.24	6	D'	GRAB			50	PI, SI, MC	GC		
	6.25								6.71	
713.24	7 7.16	E	SPT	50/100	50/100	22	PI, SI, MC		**CLAYEY GRAVEL with SAND** light brown, slightly moist to moist, very dense, with 15-19% low plasticity fines, 34-37% fine to coarse sand and 47-48% fine subrounded gravel to 2". Moderate calcareous cementation.	
712.24	8							GC		
	8.69	F	MC	75/75	75/75	17	PI, SI, MC			
711.24	9									

...DOT ...GPJ ...GDT ...302

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-13
E.A. # 0324-01-2
GROUND ELEV. 720.24 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 93+15 Q
OFFSET 60 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
	10.21	G	SPT	50/25	50/25	5			10.06 **SILTY, CLAYEY SAND with GRAVEL** tan, slightly moist to moist, very dense, with 13-17% low plasticity fines, 49-58% fine to coarse sand and 29-34% fine to coarse subrounded limestone gravel to 3".	
709.24	11									
	11.73	H	MC	75/50	75/50	11				
	11.89									
708.24	12	H'	GRAB			50	PI, SI, MC			
	12.34							SC SM		
707.24	13									
706.24	14									
	14.78	I	SPT	50/25	50/25	5				
705.24	15								15.24	
									CLAYEY GRAVEL with SAND light brown, slightly moist to moist, very dense, with estimated 25% low plasticity fines, 35% fine to coarse sand and 45% fine subrounded gravel to 1-1/2". Moderate cementation.	
704.24	16									
703.24	17									
	17.83	J	MC	75/38	75/38	4				
702.24	18									
701.24	19							GC		

...DOT ...GPJ ... ...GDT 302

EXPLORATION LOG

START DATE 11/7/01
END DATE 11/7/01
JOB DESCRIPTION US 95 - Rainbow Blvd Interchange
LOCATION Las Vegas, Nevada
BORING B-13
E.A. # 0324-01-2
GROUND ELEV. 720.24 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
11/7/01	NE	

STATION 93+15 Q
OFFSET 60 RT
ENGINEER MAM
EQUIPMENT Diedrich D-50 turbo
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 11/7/2001

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
	20.88	K	SPT	50/25	50/25	5				
699.24	21									
698.24	22									
	22.40	L	MC	75/63	75/63	12				
									22.86	
697.24	23									
696.24	24									
695.24	25									
694.24	26									
693.24	27									
692.24	28									
691.24	29									

...DOT ...GPJ ...GDT ...002

EXPLORATION LOG

START DATE 1/14/02
END DATE 1/14/02
JOB DESCRIPTION US 95 - Rainbow Blvd Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-14
E.A. # 0324-01-3
GROUND ELEV. 725.42 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION R1 11+50
OFFSET 5 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
	0.76–0.91	14A	SPT	50/125	50/125	20		GP GC
724.42	1 (to 1.22)	14A'	GRAB			50	SV, PI	
	1.52	14B	MC	50/75	50/75	85	SV, PI	
723.42	2							
722.42	3 / 3.05	14C	SPT	50/50	50/50	100	SV, PI	SC
721.42	4							
	4.57	14D	MC	50/75	50/75	100	SV, PI	
720.42	5							
719.42	6 / 6.10–6.25	14E	SPT	50/75	50/75	0		
	6.55	14E'	GRAB			50	SV, PI, SH	
718.42	7							GP GC
	7.62–7.77	14F	MC	50/25	50/25	0		
717.42	8 / 8.08	14F'	GRAB			50	SV, PI	
716.42	9 / 9.14	14G	SPT	50/25	50/25	100	SV, PI	

MATERIAL DESCRIPTION

Poorly Graded Gravel with Silty Clay and Sand ; light grey brown, dry, very dense, with 10-15% low plastic fines, 35-40% fine to coarse sand, 50-55% subangular limestone gravel to 3". Cobbles to 6-inch-diameter comprise 15% of the total mass at the surface. Moderately cemented with weak caliche coating on cobbles.

1.22

Clayey Sand with Gravel ; light brown grey, dry, very dense, with 15-20% low plastic fines, 50-55% fine to coarse sand, 25-35% subangular to subrounded limestone gravel to >2.5". Moderate to well cemented.

5.49

Poorly Graded Gravel with Silty Clay and Sand ; light grey brown, dry, very dense, with 10-15% low plastic fines, 30-40% fine to coarse sand, 45-60% subangular limestone gravel to 3". Moderately to well cemented.

8.53

Clayey Sand with Gravel ; light grey brown, dry, very dense, with 15-20% low to medium plastic fines, 40-60% fine to coarse sand, 20-40% subangular to subrounded limestone gravel to >2". Moderate to well cemented. Soil variability is a result of the small sample size.

REMARKS

Boring located at east end of Summerlin Westbound flyover.

Grab samples are from auger cuttings at surface. They are much larger in volume than the limited volume SPT and MC samples.

Hard, cemented gravel throughout hole. Auger bit produces angular sand and fine gravel fragments from originally larger gravel and possibly cobble clasts.

EXPLORATION LOG

START DATE 1/14/02
END DATE 1/14/02
JOB DESCRIPTION US 95 - Rainbow Blvd Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-14
E.A. # 0324-01-3
GROUND ELEV. 725.42 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION R1 11+50
OFFSET 5 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
								SC		
	10.67	14H	MC	50/100	50/100	100	SV, PI			
714.42	11									
713.42	12									
	12.19	14I	SPT	50/50	50/50	0			12.19	
712.42	13									
711.42	14									
710.42	15									
709.42	16									
708.42	17									
707.42	18									
706.42	19									

EXPLORATION LOG

START DATE 1/14/02
END DATE 1/14/02
JOB DESCRIPTION US 95 - Rainbow Blvd Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-15
E.A. # 0324-01-3
GROUND ELEV. 730.91 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION R1 12+75
OFFSET 8 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
729.91	0								**Clayey Sand with Gravel** ; light grey brown, dry, very dense, with 10-20% low plastic fines, 45-55% fine to coarse sand, 30-40% subangular limestone gravel to 3". Cobbles to 6-inch-diameter comprise 15% of the total mass at the surface. Moderately cemented with weak caliche coating on cobbles within upper 10 feet.	Boring located at east end of Summerlin Westbound flyover.
	0.76	15A	MC	50/50	50/50	100	SV, PI			
	1								The SPT and MC samples are small and have not adequately collected the larger gravel fraction.	
	1.52	15B	SPT	50/100	50/100	100	SV, PI			Grab samples are from auger cuttings at surface. They are much larger in volume than the limited volume SPT and MC samples.
728.91	2									
727.91	3 3.05	15C	MC	50/75	50/75	100	SV, PI			
726.91	4							SC		
	4.57	15D	SPT	50/130	50/130	90	SV, PI			Hard, cemented gravel throughout hole. Auger bit produces angular sand and fine gravel fragments from originally larger gravel and possibly cobble clasts.
725.91	5									
724.91	6 6.10	15E	MC	50/50	50/50	100	SV, PI			
723.91	7									
	7.62	15F	SPT	50/35	50/35	33	SV, PI			
722.91	8									
									8.53	
									Poorly Graded Gravel with Clay and Sand ; light brown grey, dry, very dense, with 10-15% low to medium plastic fines, 30-35% fine to coarse sand, 55-60% subangular to subrounded limestone gravel to >2.5". Moderate to well cemented.	
721.91	9 9.14	15G	MC	50/25	50/25	0		GP GC		
	9.30	15G'	GRAB			50	SV, P			
	9.60									

EXPLORATION LOG

START DATE 1/14/02
END DATE 1/14/02
JOB DESCRIPTION US 95 - Rainbow Blvd Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-15
E.A. # 0324-01-3
GROUND ELEV. 730.91 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION R1 12+75
OFFSET 8 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
									10.06	
	10.67	15H	SPT	50/75	50/75	0		SC	**Clayey Sand with Gravel** ; light grey brown, dry, very dense, with 15-20% low to medium plastic fines, 50-55% fine to coarse sand, 25-30% subangular to subrounded limestone gravel to >2". Moderate to well cemented.	
	10.82									
719.91	11	15H'	GRAB			50	SV, PI			
	11.13									
	11.58									
		15I'	GRAB			50	SV, PI			
718.91	12									
	12.04									
	12.19	15I	MC	50/75	50/75	0			12.19	
717.91	13									
716.91	14									
715.91	15									
714.91	16									
713.91	17									
712.91	18									
711.91	19									

EXPLORATION LOG

START DATE 1/14/02
END DATE 1/14/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-16
E.A. # 0324-01-1
GROUND ELEV. 725.42 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION 13+25 R7
OFFSET 15 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
	0.76	16A	SPT	50/25	50/25	0		GP GC	**Poorly Graded Gravel with Silty Clay and Sand** ; light grey brown, dry, very dense, with 5-10% low plastic fines, 30-45% fine to coarse sand, 45-65% subangular limestone gravel to 3". Cobbles to 6-inch-diameter comprise 15% of the total mass at the surface. Moderately cemented with weak caliche coating on cobbles.	Boring located in median west of Rainbow Boulevard.
	0.91									
724.42	1	16A'	GRAB			50	SV, PI			
	1.22									
	1.52	16B	MC	50/50	50/50	85				
	1.68									
	1.98	16B'	GRAB			50	SV, PI			**Grab samples are from auger cuttings at surface. They are much larger in volume than the limited volume SPT and MC samples.**
723.42	2									
									2.44	
722.42	3 3.05	16C	SPT	50/50	50/50	100	SV, PI	SC	**Clayey Sand with Gravel** ; light grey brown, dry, very dense, with 15-20% medium plastic fines, 60-65% fine to coarse sand, 15-20% subangular to subrounded limestone gravel to >2". Moderate to well cemented.	
									3.96	
721.42	4									
	4.57	16D	MC	50/25	50/25	0			**Clayey Gravel with Sand** ; light brown grey, dry, very dense, with 10-15% medium plastic fines, 40-45% fine to coarse sand, 40-45% subangular to subrounded limestone gravel to >2.5". Moderate to well cemented.	
	4.72									
720.42	5	16D'	GRAB			50	SV, PI			**Hard, cemented gravel throughout hole. Auger bit produces angular sand and fine gravel fragments from originally larger gravel and possibly cobble clasts.**
	5.18							GC		
719.42	6 6.10	16E	SPT	50/100	50/100	33	SV, PI			
718.42	7 7.01									
	7.32	16F'	GRAB			50	SV, PI			
	7.62	16F	MC	50/25	50/25	0			7.62	
717.42	8									
716.42	9									

EXPLORATION LOG

START DATE 1/15/02
END DATE 1/15/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-17
E.A. # 0324-01-1
GROUND ELEV. 727.86 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION 10+90 R4
OFFSET 5 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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** ; light grey, dry, very dense, with estimated <5% low plastic fines, 20-25% fine to coarse sand, 75-80% subangular to subrounded limestone gravel to 3". Cobbles to 6-inch-diameter comprise 15-20% of the total mass at the surface.	Boring located at southeast corner of Rainbow/US95 interchange.
	0.30									
	0.76	17A	SPT	50/25	50/25	0				
	0.91									
726.86	1	17A'	GRAB			50	SV, PI		**Poorly Graded Gravel with Silty Clay and Sand** ; light grey brown, dry, very dense, with 10-15% low plastic fines, 40-45% fine to coarse sand, 40-45% subangular limestone gravel to 3". Moderately to well cemented.	**Grab samples are from auger cuttings at surface. They are much larger in volume than the limited volume SPT and MC samples.**
	1.22									
	1.52	17B	MC	50/15	50/15	0				
	1.68									
	1.98	17B'	GRAB			50	SV, PI			
725.86	2							GP GC		
724.86	3	3.05								
	3.20	17C	SPT	50/50	50/50	0				
	3.51	17C'	GRAB			50	SV, PI			
									3.96	
723.86	4							GW GC	**Well Graded Gravel with Silty Clay and Sand** ; light brown grey, dry, very dense, with 10% low plastic fines, 35-40% fine to coarse sand, 50-55% subangular to subrounded limestone gravel to >2.5". Moderate to well cemented.	**Hard, cemented gravel throughout hole. Auger bit produces angular sand and fine gravel fragments from originally larger gravel and possibly cobble clasts.**
	4.57	17D	MC	50/25	50/25	0				
	4.72									
722.86	5	17D'	GRAB			50	SV, PI			
	5.18									
									5.49	
721.86	6	6.10							**Poorly Graded Sand with Silt and Gravel** ; light grey brown, dry, very dense, with 10-15% low plastic fines, 45-50% fine to coarse sand, 40-45% subangular limestone gravel to 3". Moderately to well cemented.	
	6.25	17E	SPT	50/50	50/50	25				
	6.71	17E'	GRAB			50	SV, PI	SP SM		
720.86	7	7.01								
	7.47	17F'	GRAB			50	SV, PI			
	7.62	17F	MC	50/25	50/25	0			7.62	
719.86	8									
718.86	9									

DOT ..... GPJ ..... GDT 12

EXPLORATION LOG

START DATE 1/15/02
END DATE 1/15/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-18
E.A. # 0324-01-1
GROUND ELEV. 736.40 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION 13+90 R5
OFFSET 20 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
	0.76	18A	MC	50/25	50/25	100		SC SM	**Silty, Clayey Sand with Gravel** ; light grey brown, dry, very dense, with 15-20% low plastic fines, 45-50% fine to coarse sand, 30-35% subangular limestone gravel to 3". Cobbles to 6-inch-diameter comprise 15% of the total mass at the surface. Moderately cemented with weak caliche coating on cobbles.	Boring located in field south of NDOT right-of-way at west end of Summerlin eastbound off-ramp. The westernmost of five holes.
	0.91									
735.40	1	18A'	GRAB			50	SV, PI			
	1.22								1.22	
	1.52	18B	SPT	50/25	50/25	0		GP GC	**Poorly Graded Gravel with Silt and Sand** ; light brown grey, dry, very dense, with 5-10% low plastic fines, 35-40% fine to coarse sand, 55-60% subangular to subrounded limestone gravel to >2.5". Moderate to well cemented.	
	1.68									
	1.98	18B'	GRAB			50	SV, PI			
734.40	2									
									2.74	**Grab samples are from auger cuttings at surface. They are much larger in volume than the limited volume SPT and MC samples.**
	3.05	18C	MC	50/65	50/65	100			**Well Graded Sand with Silty Clay and Gravel** ; light grey brown, dry, very dense, with 10-15% low plastic fines, 40-50% fine to coarse sand, 35-50% subangular limestone gravel to 3". Moderately to well cemented. Actual in-place soil is likely a well graded gravel with Silty Clay and Sand	
733.40	3									
732.40	4									
	4.57	18D	SPT	50/100	50/100	0				
	4.72									
		18D'	GRAB			50	SV, PI			
731.40	5							SW SC		
	5.18									
	6.10	18E	MC	50/25	50/25	100	SV, PI			**Hard, cemented gravel throughout hole. Auger bit produces angular sand and fine gravel fragments from originally larger gravel and possibly cobble clasts.**
730.40	6									
729.40	7									
	7.01									
		18F'	GRAB			50	SV, PI			
	7.47									
	7.62	18F	SPT	50/50	50/50	0			7.62	
728.40	8									
727.40	9									

EXPLORATION LOG

START DATE 1/15/02
END DATE 1/15/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-19
E.A. # 0324-01-1
GROUND ELEV. 735.48 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION 12+90 R5
OFFSET 10 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
	0.76	19A	SPT	50/15	50/15	0		GW GM	**Well Graded Gravel with Silt and Sand** ; light grey brown, dry, very dense, with 10-15% low plastic fines, 40-45% fine to coarse sand, 40-50% subangular limestone gravel to 3". Cobbles to 6-inch-diameter comprise 15% of the total mass at the surface. Moderately cemented with weak caliche coating on cobbles.	Boring located in field south of NDOT right-of-way at west end of Summerlin eastbound off-ramp.
	0.91									
734.48	1									
	1.22	19A'	GRAB			50	SV, PI			
	1.52	19B	MC	50/10	50/10	0				
	1.68									
	1.98	19B'	GRAB			50	SV, PI			
733.48	2									
732.48	3 3.05	19C	SPT	50/75	50/75	100	SV, PI			**Grab samples are from auger cuttings at surface. They are much larger in volume than the limited volume SPT and MC samples.**
731.48	4									
	4.57	19D	MC	50/75	50/75	67	SV, PI			
	4.72									
730.48	5	19D'	GRAB			50	SV, PI			
	5.18									
729.48	6 6.10	19E	SPT	50/75	50/75	67	SV, PI			**Hard, cemented gravel throughout hole. Auger bit produces angular sand and fine gravel fragments from originally larger gravel and possibly cobble clasts.**
	6.25									
	6.71	19E'	GRAB			50	SV, PI			
728.48	7								7.01	
	7.62	19F	MC	50/25	50/25	100	SV, PI	SC	**Clayey Sand with Gravel** ; light grey brown, dry, very dense, with 10-15% low to medium plastic fines, 50-55% fine to coarse sand, 35-45% subangular limestone gravel to 3". Moderately cemented with weak caliche coating on cobbles.	
727.48	8									
726.48	9 9.14	19G	SPT	50/50	50/50	50				
	9.30									
	9.75	19G'	GRAB			50	SV, PI			

EXPLORATION LOG

START DATE 1/15/02
END DATE 1/15/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-19
E.A. # 0324-01-1
GROUND ELEV. 735.48 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION 12+90 R5
OFFSET 10 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
	10.67	19H	MC	50/75	50/75	100	SV, PI			
724.48	11									
723.48	12									
	12.19	19I	SPT	50/25	50/25	0			12.19	
									Poorly Graded Gravel with Silty Clay and Sand ; light grey brown, dry, very dense, with 10% low plastic fines, 35% fine to coarse sand, 55% subangular limestone gravel to 3". Moderately to well cemented.	
722.48	13									
	13.72	19J	MC	50/25	50/25	0		GP		
	13.87							GC		
721.48	14	19J'	GRAB			50	SV, PI			
	14.33									
720.48	15									
	15.24	19K	SPT	50/125	50/125	40	SV, PI		15.24	
719.48	16									
718.48	17									
717.48	18									
716.48	19									

EXPLORATION LOG

START DATE 1/15/02
END DATE 1/15/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-20
E.A. # 0324-01-1
GROUND ELEV. 733.96 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION 11+95 R5
OFFSET 8 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
	0.76	20A	MC	50/50	50/50	50			**Poorly Graded Gravel with Silt and Sand** ; light brown grey, dry, very dense, with 10-15% low plastic fines, 40-45% fine to coarse sand, 45-50% subangular to subrounded limestone gravel to >2.5". Cobbles to 6-inch-diameter comprise 15% of the total mass at the surface. Moderately cemented with weak caliche coating on cobbles.	Boring located in field south of NDOT right-of-way at Summerlin eastbound off-ramp. Middle of five borings.
	0.91									
732.96	1									
	1.22	20A'	GRAB			50	SV, PI	GP GM		
	1.52	20B	SPT	50/50	50/50	100	SV, PI			
731.96	2									
									2.44	
									Well Graded Gravel with Silty Clay and Sand ; light grey brown, dry, very dense, with 5-10% low plastic fines, 30-40% fine to coarse sand, 50-60% subangular limestone gravel to 3". Moderately to well cemented.	**Grab samples are from auger cuttings at surface. They are much larger in volume than the limited volume SPT and MC samples.**
730.96	3 3.05	20C	MC	50/75	50/75	100	SV, PI			
729.96	4									
	4.57	20D	SPT	50/135	50/135	50	SV, PI			
728.96	5							GW GM		
727.96	6 6.10	20E	MC	50/25	50/25	0				**Hard, cemented gravel throughout hole. Auger bit produces angular sand and fine gravel fragments from originally larger gravel and possibly cobble clasts.**
	6.25									
	6.55	20E'	GRAB			50	SV, PI			
726.96	7 7.16									
	7.47	20F'	GRAB			50	SV, PI			
	7.62	20F	SPT	50/50	50/50	0			7.62	
725.96	8									
724.96	9									

...DOT ...GPJ ..._GDT ...

EXPLORATION LOG

START DATE 1/15/02
END DATE 1/15/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-21
E.A. # 0324-01-1
GROUND ELEV. 733.04 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION 11+10 R5
OFFSET 8 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
	0.76	21A	SPT	50/10	50/10	0			**Poorly Graded Sand with Silt and Gravel** ; light grey brown, dry, very dense, with 10-15% low plastic fines, 50-55% fine to coarse sand, 35-40% subangular limestone gravel to 3". Cobbles to 6-inch-diameter comprise 15% of the total mass at the surface. Moderately cemented with weak caliche coating on cobbles.	Boring located in field south of NDOT right-of-way at Summerlin eastbound off-ramp.
	0.91									
732.04	1	21A'	GRAB			50	SV, PI	SP SM		
	1.22									
	1.52	21B	MC	50/25	50/25	100				
	1.68									
	1.98	21B'	GRAB			50	SV, PI			
731.04	2									
									2.44	
									Poorly Graded Gravel with Silty Clay and Sand ; light brown grey, dry, very dense, with 5-10% low plastic fines, 30-35% fine to coarse sand, 55-60% subangular to subrounded limestone gravel to >2.5". Moderate to well cemented.	**Grab samples are from auger cuttings at surface. They are much larger in volume than the limited volume SPT and MC samples.**
730.04	3 3.05	21C	SPT	50/25	50/25	0				
	3.20									
	3.51	21C'	GRAB			50	SV, PI			
729.04	4									
	4.57	21D	MC	50/25	50/25	0				
	4.72									
728.04	5	21D'	GRAB			50	SV, PI			
	5.18									
								GP GC		**Hard, cemented gravel throughout hole. Auger bit produces angular sand and fine gravel fragments from originally larger gravel and possibly cobble clasts.**
727.04	6 6.10	21E	SPT	50/50	50/50	25				
	6.25									
	6.71	21E'	GRAB			50	SV, PI			
726.04	7									
	7.62	21F	MC	50/10	50/10	0				
	7.77									
725.04	8	21F'	GRAB			50	SV, PI			
	8.23									
									8.53	
									Well Graded Sand with Silt and Gravel ; light grey brown, dry, very dense, with 10-15% low plastic fines, 50-55% fine to coarse sand, 35-40% subangular limestone gravel to 3". Moderately to well cemented.	
724.04	9 9.14	21G	SPT	50/75	50/75	100	SV, PI	SW SM		

EXPLORATION LOG

START DATE 1/15/02
END DATE 1/15/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-21
E.A. # 0324-01-1
GROUND ELEV. 733.04 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION 11+10 R5
OFFSET 8 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
	10.06									
	10.52	21H'	GRAB			50	SV, PI			
	10.67	21H	MC	50/25	50/25	0			10.67	
722.04	11									
721.04	12									
720.04	13									
719.04	14									
718.04	15									
717.04	16									
716.04	17									
715.04	18									
714.04	19									

EXPLORATION LOG

START DATE 1/16/02
END DATE 1/16/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-22
E.A. # 0324-01-1
GROUND ELEV. 730.91 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
1/14/02	NE	

STATION 10+15 R5
OFFSET 8 RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 1/14/2002

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
	0.76							GW GM	**Well Graded Gravel with Silt and Sand** ; light grey brown, dry, very dense, with 10-15% low plastic fines, 40-45% fine to coarse sand, 45-50% subangular limestone gravel to 3". Cobbles and boulders to 1.25-foot-diameter comprise 5-10% of the total mass at the surface. Moderately cemented with weak caliche coating on cobbles.	Boring located in field south of NDOT right-of-way at Summerlin eastbound off-ramp. Easternmost of five holes.
	0.91	22A	SPT	50/25	50/25	0				
729.91	1	22A'	GRAB			50	SV, PI			
	1.22								1.22	
	1.52	22B	MC	50/40	50/40	100	SV, PI	SC SM	**Silty, Clayey Sand with Gravel** ; light grey brown, dry, very dense, with 15-20% low plastic fines, 56-60% fine to coarse sand, 25-30% subangular limestone gravel to 3". Moderately cemented with weak caliche coating on cobbles.	
728.91	2									
									2.44	
727.91	3 3.05								**Well Graded Gravel with Silt and Sand** ; light grey brown, dry, very dense, with 10% low plastic fines, 40-45% fine to coarse sand, 45-50% subangular limestone gravel to 3". Moderately to well cemented.	**Grab samples are from auger cuttings at surface. They are much larger in volume than the limited volume SPT and MC samples.**
	3.20	22C	SPT	50/50	50/50	50				
	3.51	22C'	GRAB			50	SV, PI			
726.91	4									
	4.57									
	4.72	22D	MC	50/25	50/25	100				
725.91	5	22D'	GRAB			50	SV, PI			
	5.18									
	6.10							GW GM		**Hard, cemented gravel throughout hole. Auger bit produces angular sand and fine gravel fragments from originally larger gravel and possibly cobble clasts.**
724.91	6									
	6.25	22E	SPT	50/50	50/50	0				
	6.71	22E'	GRAB			50	SV, PI			
723.91	7									
	7.62									
	7.77	22F	MC	50/25	50/25	100				
722.91	8	22F'	GRAB	50/25	50/25	50	SV, PI			
	8.23									
721.91	9									
	9.14	22G	SPT	50/25	50/25	100			9.14	

EXPLORATION LOG

START DATE 3/5/02
END DATE 3/5/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-23
E.A. # 0324-01-4
GROUND ELEV. 722.07 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/5/02	NE	

STATION 87+30 "95-N"
OFFSET 48 m RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/5/2002

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
									0.08 **Asphalt Concrete**	Boring located within asphalt concrete walkway on south side of Panorama Drive. Installed asphalt concrete patch upon completion of boring.
721.07	1 1.52							SC	**Clayey Sand with Gravel** ; light brown, dry, very dense, with 15-20 low to medium plastic fines, 45-50% fine to coarse sand and 35-40% subangular to subrounded gravel to >50 mm. Weak to moderate cementation.	
	1.68	A	SPT	50/50	50/50	100				
720.07	2 2.13	A'	AC			50	SV, PI			
									2.44	
719.07	3 3.05							GC	**Clayey Gravel with Sand** ; light grey brown, slightly moist, very dense, with 10-15% medium plastic fines, 30-35% fine to coarse sand and 50-55% subangular to subrounded gravel to >50 mm. Weak to moderate cementation.	
	3.20	B	MC	50/75	50/75	0				Only minor sample penetration. Soil samples collected from auger cuttings.
	3.66	B'	AC			50	SV, PI			
									3.66	
718.07	4 4.57							SC	**Clayey Sand with Gravel** ; light grey brown, slightly moist, very dense, with 14-18% low to medium plastic fines, 45-50% fine to coarse sand and 35-40% subangular to subrounded gravel to >38 mm. Weak cementation.	
	4.72	C	SPT	50/75	50/75	0				
717.07	5 5.18	C'	AC			50	SV, PI			
716.07	6 6.10									
	6.25	D	MC	50/50	50/50	0				
	6.71	D'	AC			50	SV, PI			
715.07	7 7.62									
	7.77	E	SPT	50/38	50/38	67				
714.07	8 8.23	E'	AC			50	SV, PI			
									8.23	
713.07	9 9.14								**Clayey Gravel with Sand** ; light grey brown, slightly moist, very dense, with 13-15% low to medium plastic fines, 36-41% fine to coarse sand and 43-51% subangular to subrounded gravel to >38 mm.	
	9.30	F	MC	50/50	50/50	0				
	9.75	F'	AC			50	SV, PI			

EXPLORATION LOG

START DATE 3/5/02
END DATE 3/5/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-23
E.A. # 0324-01-4
GROUND ELEV. 722.07 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/5/02	NE	

STATION 87+30 "95-N"
OFFSET 48 m RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/5/2002

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
	10.67	G	SPT	50/50	50/50	0		GC		
	10.82									
711.07	11	G'	AC			50	SV, PI			
	11.28									
710.07	12									
	12.19	H	MC	50/38	50/38	0				
	12.34									
	12.80	H'	AC			50	SV, PI		12.80	
709.07	13								**Clayey Sand with Gravel** ; light grey brown, slightly moist, very dense, with 30% medium plastic fines, 56% fine to coarse sand and 14% subangular to subrounded gravel to >38 mm. Weak cementation.	
	13.72	I	SPT	50/75	50/75	100	SV, PI			
708.07	14							SC		
707.07	15									
	15.24	J	MC	50/38	50/38	0			15.30	
706.07	16									
705.07	17									
704.07	18									
703.07	19									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 3/6/02
END DATE 3/6/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-24
E.A. # 0324-01-4
GROUND ELEV. 718.11 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/6/02	NE	

STATION 85+15 "95-N"
OFFSET 33 m RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/6/2002

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
717.11	1							SP SC	**Poorly Graded Sand with Clay and Gravel** ; light brown, slightly moist, very dense, with 12% low plastic fines, 46% fine to coarse sand, 42% subangular to subrounded gravel to >50 mm.	Boring located at west end of narrow NDOT right-of-way on north side of US 95.
	1.52	A	MC	50/75	50/75	0				
	1.68									
		A'	AC			50	SV, PI			
716.11	2 2.13									
									2.44	
	3.05	B	SPT	50/125	50/125	40		GP GC	**Poorly Graded Gravel with Clay and Sand** ; light grey brown, slightly moist, very dense, with 9-11% low to medium plastic fines, 35-41% fine to coarse sand and 48-56% subangular to subrounded gravel to >38 mm.	
715.11	3 3.20									
		B'	AC			50	SV, PI			
	3.66									
714.11	4									
	4.57	C	MC	50/100	50/100	100	SV, PI			
713.11	5									
	5.64									
	5.94	D'	AC			50	SV, PI			
712.11	6 6.10								6.16	
		D	SPT	50/25	50/25	0				
711.11	7									
710.11	8									
709.11	9									

EXPLORATION LOG

START DATE 3/6/02
END DATE 3/6/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-25
E.A. # 0324-01-4
GROUND ELEV. 716.89 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/6/02	NE	

STATION 83+85 "95-N"
OFFSET 37 m RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/6/2002

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
								GM	**Silty Gravel with Sand** ; light grey brown, slightly moist, very dense, with estimated 15-20% low plastic fines, 35-40% fine to coarse sand and 45-50% subangular to subrounded gravel to 180 mm. Weak to moderate cementation.	Boring located within narrow NDOT right-of-way on north side of US 95.
									0.61	
715.89	1								**Clayey Sand with Gravel** ; light brown, slightly moist, very dense, with 21% medium plastic fines, 40% fine to coarse sand and 39% subangular to subrounded gravel to >38 mm. Weak cementation.	
	1.52	A	SPT	50/88	50/88	50		SC		
	1.68									
		A'	AC			50	SV, PI			
714.89	2 2.13									
									2.44	
									Poorly Graded Gravel with Clay and Sand ; light grey brown, slightly moist, very dense, with11% medium plastic fines,27% fine to coarse sand and 62% subangular to subrounded gravel to >62 mm.	
713.89	3 3.05	B	MC	50/50	50/50	100		GP GC		
	3.20									
		B'	AC			50	SV, PI			
	3.66									
									3.96	
712.89	4								**Clayey Gravel with Sand** ; light brown, slightly moist, very dense, with 15% low plastic fines, 40% fine to coarse sand and 45% subangular to subrounded gravel to >38 mm. Weak cementation.	
	4.57	C	SPT	50/50	50/50	100				
	4.72									
711.89	5	C'	AC			50	SV, PI	GC		
	5.18									
	5.64									
	5.94	D'	AC			50	SV, PI			
710.89	6 6.10	D	MC	50/50	50/50	0			6.16	
709.89	7									
708.89	8									
707.89	9									

EXPLORATION LOG

START DATE 3/5/02
END DATE 3/5/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-26
E.A. # 0324-01-4
GROUND ELEV. 715.06 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/5/02	NE	

STATION 82+50 "95-N"
OFFSET 35 m RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/5/2002

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 GC	**Poorly Graded Gravel with Clay and Sand** ; light grey brown, dry, very dense, with11% low plastic fines, 34% fine to coarse sand and 55% subangular to subrounded gravel to >50 mm. Weak to moderate cementation.	Boring located at east end of narrow NDOT right-of-way on north side of US 95.
	1.52	A	SPT	50/75	50/75	0				
	1.68	A'	AC			50	SV, PI			
713.06	2 2.13									
									2.44	
									Clayey Gravel with Sand ; light grey brown, slightly moist, very dense, with 12-17% medium plastic fines, 26-36% fine to coarse sand and 49-57% subangular to subrounded gravel to >38 mm.	
712.06	3 3.05	B	MC	50/75	50/75	0				
	3.20	B'	AC			50	SV, PI			
	3.66									
711.06	4									
	4.57	C	SPT	50/25	50/25	0		GC		
	4.72	C'	AC			50	SV, PI			
710.06	5 5.18									
709.06	6 6.10	D	MC	50/75	50/75	100	SV, PI			
									7.01	
708.06	7								**Clayey Sand with Gravel** ; light brown, slightly moist, very dense, with 34% high plastic fines, 47% fine to coarse sand and 20% subangular gravel to >38 mm. Weak cementation.	
	7.62	E	SPT	50/100	50/100	100	SV, PI	SC		
707.06	8									
									8.53	
									Clayey Sand ; light brown, slightly moist, very dense, with 17% medium plastic fines, 72% fine to coarse sand and 11% subangular gravel to >38 mm. Weak cementation.	
706.06	9 9.14	F	MC	50/113	50/113	100	SV, PI	SC		
									9.75	
									Sandy Fat Clay ; light brown, moist, hard, with	

EXPLORATION LOG

START DATE 3/5/02
END DATE 3/5/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-26
E.A. # 0324-01-4
GROUND ELEV. 715.06 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/5/02	NE	

STATION 82+50 "95-N"
OFFSET 35 m RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/5/2002

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
	10.67	G	SPT	~~50/100~~	~~50/100~~	~~100~~	~~SV, PI~~	CH	51% high plastic fines, 46% fine to coarse sand and 3% subangular gravel to >20 mm. The limited sample penetration is a result of coarse gravel clogging the sample tube. The majority clay soil is very stiff to hard. 10.79	
704.06	11									
703.06	12									
702.06	13									
701.06	14									
700.06	15									
699.06	16									
698.06	17									
697.06	18									
696.06	19									

NV_DOT 0324014.GPJ NV_DOT.GDT 5/17/2002

EXPLORATION LOG

START DATE 3/7/02
END DATE 3/5/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-27
E.A. # 0324-01-4
GROUND ELEV. 711.10 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/7/02	NE	

STATION 80+65 "95-N"
OFFSET 35 m RT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 3/7/2002

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
710.10	1									Boring located within parking area in SW corner of Catalina Apartments.
709.10	2									
708.10	3									
707.10	4									
706.10	5									
705.10	6									
704.10	7									
703.10	8									
702.10	9									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 3/7/02
END DATE 3/7/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-28
E.A. # 0324-01-4
GROUND ELEV. 708.96 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/7/02	NE	

STATION 79+70 "95-N"
OFFSET 25 m RT
ENGINEER PGT
EQUIPMENT Foremost B90
OPERATOR Eagle Drilling
DRILLING METHOD 203 mm HS Auger
BACKFILLED Yes DATE 3/7/2002

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
	0.09								**Asphalt Concrete**	Boring located within parking area along southwest side of Catalina Apartments.
707.96	1							GC	**Clayey Gravel with Sand** ; light brown, dry, very dense, with 15% medium plastic fines,39% fine to coarse sand and 46% subangular to subrounded gravel to >50 mm. Weak to moderate cementation.	
	1.52 / 1.68	A	SPT	50/75	50/75	67				
706.96	2 2.13	A'	AC			50	SV, PI			Patch was installed in asphalt concrete surface upon completion of boring.
	2.44									
705.96	3 3.05	B	MC	50/75	50/75	67	SV, PI	SC	**Clayey Sand with Gravel** ; light brown, slightly moist, very dense, with 24% medium plastic fines, 58% fine to coarse sand and 18% subangular to subrounded gravel to >25 mm. Weak to moderate cementation.	
	3.96									
704.96	4							GP GC	**Poorly Graded Gravel with Clay and Sand** ; grey brown, slightly moist, very dense, with estimated 10-15% low plastic fines, 35-40% fine to coarse sand and 50-55% subangular to subrounded gravel to >50 mm. Moderately cemented.	
	4.57 / 4.72	C	SPT	50/50	50/50	100				
703.96	5 5.18	C'	AC			50	SV, PI		**Clayey Sand with Gravel** ; light grey brown, slightly moist, very dense, with 16-21% low to medium plastic fines, 48-57% fine to coarse sand and 27-31% subangular to subrounded gravel to >38 mm. Weak cementation.	
702.96	6 6.10							SC		
	6.55	D	MC	14 10 12	22	85	SV, PI			
									6.55	
701.96	7									
700.96	8									
699.96	9									

DOT ....4.GPJ ....T.GDT 002

EXPLORATION LOG

START DATE 3/6/02
END DATE 3/6/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-29
E.A. # 0324-01-4
GROUND ELEV. 707.14 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/6/02	NE	

STATION 78+40 "95-N"
OFFSET 10 m RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/6/2002

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
									0.09 **Asphalt Concrete**	Boring located within parking area along south side of Catalina Apartments.
706.14	1							GP GC	**Poorly Graded Gravel with Clay and Sand** ; light grey brown, dry, very dense, with 9% low plastic fines, 31% fine to coarse sand and 60% subangular to subrounded gravel to >50 mm. Weak to moderate cementation.	
	1.52 / 1.68	A	SPT	50/138	50/138	40				
		A'	AC			50	SV, PI			Patch was installed in asphalt concrete surface upon completion of boring.
705.14	2 2.13								2.13	
								GC	**Clayey Gravel with Sand** ; light grey brown, slightly moist, very dense, with estimated 13% medium plastic fines, 40% fine to coarse sand and 47% subangular to subrounded gravel to >38 mm. Weak to moderate cementation.	
704.14	3 3.05 / 3.20	B	MC	50/50	50/50	50				
	3.66	B'	AC			50	SV, PI			
									3.96	
703.14	4							GP GC	**Poorly Graded Gravel with Clay and Sand** ; light grey brown, dry, very dense, with 7% low to medium plastic fines, 21% fine to coarse sand and 72% subangular to subrounded gravel to >50 mm. Weak to moderate cementation.	
	4.57 / 4.72	C	SPT	50/75	50/75	0				
702.14	5 5.18	C'	AC			50	SV, PI			
									5.49	
701.14	6 6.10								**Clayey Sand** ; light brown, moist, very dense, with 36% medium plastic fines, 57% fine to coarse sand and 7% subangular to subrounded gravel to >38 mm. Weak cemented.	
	6.37	D	MC	32 50/125	50/125	100	SV, PI	SC		
700.14	7								7.01	
	7.62 / 7.77	E	SPT	50/50	50/50	100		SC	**Clayey Sand with Gravel** ; light brown, moist, very dense, with 29% medium plastic fines, 42% fine to coarse sand and 29% subangular to subrounded gravel to >38 mm. Weak cemented.	Drill penetration is slowing. Boring is tight.
699.14	8 8.23	E'	AC			50	SV, PI			
									8.23	
698.14	9 9.14							SC	**Clayey Sand** ; light brown, moist, very dense, with 34% medium to high plastic fines, 64% fine to coarse sand and 2% subangular to subrounded gravel to >38 mm. Weak cemented.	
	9.35	F	MC	50 50/75	50/75	100	SV, PI			

...DOT ...GPJ ...f.GDT ...002

EXPLORATION LOG

START DATE 3/6/02
END DATE 3/6/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-29
E.A. # 0324-01-4
GROUND ELEV. 707.14 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/6/02	NE	

STATION 78+40 "95-N"
OFFSET 10 m RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/6/2002

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
	10.06								**Clayey Gravel with Sand** ; light brown, moist, very dense, with 25% high plastic fines, 32% fine to coarse sand and 43% subangular to subrounded gravel to >50 mm. Weak cemented.	
696.14	11 10.67 11.13	G	SPT	45 26 43	69	60	SV, PI	GC		
	11.58								**Clayey Sand with Gravel** ; light brown, moist, very dense, with 42% medium plastic fines, 33% fine to coarse sand and 25% subangular gravel to >38 mm.	
695.14	12 12.19	H	MC	50/50	50/50	100	SV, PI	SC		Boring ended due to very tight hole.
	12.95									
694.14	13									
693.14	14									
692.14	15									
691.14	16									
690.14	17									
689.14	18									
688.14	19									

EXPLORATION LOG

START DATE 3/5/02
END DATE 3/5/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-30
E.A. # 0324-01-4
GROUND ELEV. 726.03 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/5/02	NE	

STATION 89+10 "95-S"
OFFSET 55 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/5/2002

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
725.03	1								**Poorly Graded Gravel with Silt and Sand** ; light brown grey, dry, very dense, with 7-8% low plastic fines, 25-35% fine to coarse sand and 57-68% subangular to subrounded gravel to >60 mm.	Boring located in wide NDOT right-of-way on south side of US 95.
	1.52	A	SPT	50/25	50/25	0				
	1.68									
724.03	2	A'	AC			50	SV, PI			
	2.13									
723.03	3							GP GM		
	3.05	B	MC	50/75	50/75	100				
	3.20									
		B'	AC			50	SV, PI			
	3.66									
722.03	4									
	4.57	C	SPT	50/100	50/100	50				
	4.72									
721.03	5	C'	AC			50	SV, PI			
	5.18									
									5.27	
	5.49	D	MC	50/75	50/75	100	SV, PI	GP	**Poorly Graded Gravel with Sand** ; light brown grey, dry, very dense, with 5% medium plastic fines, 22% fine to coarse sand and 73% subangular to subrounded gravel to >60 mm.	
									5.58	
720.03	6									
719.03	7									
718.03	8									
717.03	9									

DOT 4.GPJ T.GD1 002

EXPLORATION LOG

START DATE 3/5/02
END DATE 3/5/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-31
E.A. # 0324-01-4
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/5/02	NE	

STATION 87+90 "95-S"
OFFSET 30 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/5/2002

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
722.90	1								**Clayey Sand with Gravel** ; light brown grey, dry, very dense, with 12-15% low to medium plastic fines, 45-48% fine to coarse sand and 37-43% subangular to subrounded gravel to >60 mm.	Boring located in wide NDOT right-of-way on south side of US 95.
	1.52 / 1.68	A	MC	50/13	50/13	0				
721.90	2 2.13	A'	AC			50	SV, PI	SC		
720.90	3 3.05	B	SPT	50/75	50/75	100	SV, PI			
									3.96	
719.90	4								**Poorly Graded Gravel with Silt and Sand** ; light grey brown, slightly moist, very dense, with 9% low plastic fines, 35% fine to coarse sand and 56% subangular to subrounded gravel to >50 mm. Weak to moderate cementation.	
	4.57 / 4.72	C	MC	50/50	50/50	0				
718.90	5 5.18	C'	AC			50	SV, PI	GP GM		
717.90	6 6.10 / 6.25	D	SPT	50/38	50/38	0				
	6.71	D'	AC			50	SV, PI			
716.90	7								7.01	
	7.62 / 7.77	E	MC	50/25	50/25	0			**Poorly Graded Gravel with Silt and Sand** ; light brown grey, dry, very dense, with 6% low plastic fines, 17% fine to coarse sand and 77% subangular to subrounded gravel to >50 mm.	
715.90	8 8.23	E'	AC			50	SV, PI	GP		
									8.53	
714.90	9 9.14	F	SPT	50/25	50/25	0		SC	**Clayey Sand with Gravel** ; light brown, slightly moist, very dense, with 22% medium plastic fines, 52% fine to coarse sand and 26% subangular to subrounded gravel to >25 mm. Weak cementation.	

EXPLORATION LOG

START DATE 3/5/02
END DATE 3/5/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-31
E.A. # 0324-01-4
GROUND ELEV. 723.90 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/5/02	NE	

STATION 87+90 "95-S"
OFFSET 30 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/5/2002

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
	10.21								10.06 **Poorly Graded Gravel with Silt and Sand ;** light grey brown, slightly moist, very dense, with 10% low plastic fines, 37% fine to coarse sand and 55% subangular to subrounded gravel to >60 mm. Weak cementation.	
	10.52	G'	AC			50	SV, PI	GP GC		
	10.67	G	MC	50/38	50/38	0			10.73	
712.90	11									
711.90	12									
710.90	13									
709.90	14									
708.90	15									
707.90	16									
706.90	17									
705.90	18									
704.90	19									

DOT .GPJ .GDT 02

EXPLORATION LOG

START DATE 3/21/02
END DATE 3/21/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-32
E.A. # 0324-01-4
GROUND ELEV. 720.85 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/21/02	NE	

STATION 85+90 "95-S"
OFFSET 30 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/21/2002

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 GM	**Poorly Graded Gravel with Silt and Sand ;** light brown grey, slightly moist, very dense, with estimated 10-15% low plastic fines, 30-35% fine to coarse sand and 50-55% subangular to subrounded gravel to >65 mm.	
719.85	0.91									
	1							GC GM	**Silty, Clayey Gravel with Sand ;** light grey brown, dry, very dense, with 14% low plastic fines, 39% fine to coarse sand and 47% subangular to subrounded gravel to >50 mm. Weak to moderate cementation.	
	1.52	A	SPT	50/38	50/38	67				
	1.68									
		A'	AC			50	SV, PI			
718.85	2 2.13									
									2.44	
								GC	**Clayey Gravel with Sand ;** light brown grey, dry, very dense, with 13% medium plastic fines, 30% fine to coarse sand and 57% subangular to subrounded gravel to >50 mm.	
717.85	3 3.05	B	MC	50/50	50/50	0				
	3.20									
		B'	AC			50	SV, PI			
	3.66									
									3.96	
716.85	4							GP GC	**Poorly Graded Gravel with Clay and Sand ;** light grey brown, slightly moist, very dense, with 8-11% low to medium plastic fines, 31-35% fine to coarse sand and 54-61% subangular to subrounded gravel to >65 mm. Weak cementation.	
	4.57	C	SPT	50/50	50/50	100				
	4.72									
		C'	AC			50	SV, PI			
715.85	5 5.18									
714.85	6 6.10	D	MC	50/100	50/100	100	SV, PI		6.20	
713.85	7									
712.85	8									
711.85	9									

DOT ...I.GPJ ...T.GDT ...002

EXPLORATION LOG

START DATE 3/5/02
END DATE 3/5/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-33
E.A. # 0324-01-4
GROUND ELEV. 715.98 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/5/02	NE	

STATION 83+00 "95-S"
OFFSET 20 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/5/2002

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
								GM	**Silty Gravel with Sand** ; light grey brown, dry, very dense, with estimated 15-20% low plastic fines, 35-40% fine to coarse sand and 45-50% subangular to subrounded gravel to 5". Weak to moderate cementation.	Boring located on the south side of US 95 within the northwest corner of the school construction zone. Site is just north of the proposed retaining wall alignment.
	0.91									
714.98	1							GP GC	**Poorly Graded Gravel with Clay and Sand** ; light grey brown, slightly moist, very dense, with 12% low plastic fines, 38% fine to coarse sand and 50% subangular to subrounded gravel to >50 mm. Weak cementation.	
	1.52	A	SPT	50/75	50/75	33				
	1.68									
		A'	AC			50	SV, PI			
713.98	2 2.13									
	2.44									
								SC	**Clayey Sand with Gravel** ; light grey brown, slightly moist, very dense, with 15-19% medium plastic fines, 52-54% fine to coarse sand and 27-33% subangular to subrounded gravel to >50 mm. Weak cementation.	
712.98	3 3.05	B	MC	50/88	50/88	100	SV, PI			
711.98	4									
	4.57	C	SPT	50/88	50/88	100	SV, PI			
710.98	5									
	5.49									
								GP GC	**Poorly Graded Gravel with Clay and Sand** ; light grey brown, slightly moist, very dense, with 10-12% medium plastic fines, 31-33% fine to coarse sand and 54-57% subangular to subrounded gravel to >50 mm. Weak cementation.	
709.98	6 6.10	D	MC	50/75	50/75	67				
	6.25									
	6.71	D'	AC			50	SV, PI			
708.98	7									
	7.62	E	SPT	50/50	50/50	67				
	7.77									
707.98	8	E'	AC			50	SV, PI			
	8.23									
	8.53									
								SC	**Clayey Sand with Gravel** ; light brown, slightly moist, very dense, with 15% high plastic fines, 56% fine to coarse sand and 29% subangular to subrounded gravel to >50 mm.	
706.98	9 9.14	F	MC	50/75	50/75	100	SV, PI			
	9.75									
									Clayey Sand with Gravel ; light brown, slightly	

002 GDT GPJ DOT

EXPLORATION LOG

START DATE 3/5/02
END DATE 3/5/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-33
E.A. # 0324-01-4
GROUND ELEV. 715.98 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/5/02	NE	

STATION 83+00 "95-S"
OFFSET 20 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/5/2002

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
	10.67	G	MC	50/63	50/63	100	SV, PI	SC	moist, very dense, with 41% medium to high plastic fines, 55% fine to coarse sand and 5% subangular to subrounded gravel to >50 mm. The limited sample penetration is a result of the coarse fraction clogging the sample tube.	
	10.76									
704.98	11									
703.98	12									
702.98	13									
701.98	14									
700.98	15									
699.98	16									
698.98	17									
697.98	18									
696.98	19									

DOT 4.GPJ T.GD1 :002

EXPLORATION LOG

START DATE 3/21/02
END DATE 3/21/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-34
E.A. # 0324-01-4
GROUND ELEV. 709.88 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/21/02	NE	

STATION 79+80 "95-S"
OFFSET 15 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/21/2002

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
	0.06								**Asphalt Concrete**: thin AC pavement on bike path.	
708.88	1							GC	**Clayey Gravel with Sand** ; light brown, slightly moist, very dense, with 14% low to medium plastic fines, 40% fine to coarse sand and 47% subangular to subrounded gravel to >50 mm. Weak to moderate cementation.	
	1.52	A	SPT	50/50	50/50	0				
	1.68									
		A'	AC			50	SV, PI			
707.88	2 2.13									
									2.44	
								SC	**Clayey Sand with Gravel** ; light brown, moist, very dense, with 28% medium plastic fines, 51% fine to coarse sand, 21% subangular to subrounded gravel to >35 mm. Weak cemented.	
706.88	3 3.05									
	3.28	B	MC	50 50/75	50/75	80	SV, PI			
									3.66	
705.88	4							SP SM	**Poorly Graded Sand with Silt and Gravel** ; light brown, moist, very dense, with 12% nonplastic fines, 55% fine to coarse sand, 34% subangular to subrounded gravel to >35 mm. Weak cemented.	
	4.57									
	4.86	C	SPT	38 50/138	50/138	80	SV, PI			
704.88	5									
									5.49	
703.88	6 6.10							SC	**Clayey Sand** ; light brown, moist, very dense, with 44% medium plastic fines, 55% fine to coarse sand and 3% subangular to subrounded gravel to 25 mm.	
	6.55	D	MC	32 50 50	100	67	SV, PI			
702.88	7								7.01	
	7.62							CL	**Sandy Lean Clay** ; light brown, moist, very hard, with 50% high plastic fines, 42% fine to coarse sand and 8% subangular to subrounded gravel to >25 mm.	
701.88	8 8.05	E	SPT	25 35 50/125	50/125	55	SV, PI			
									8.53	
700.88	9 9.14							SC	**Clayey Sand** ; light brown, moist, very dense, with 48% medium plastic fines, 52% fine to coarse sand and trace subangular to subrounded gravel to >38 mm. Weak cemented.	
	9.43	F	MC	65 75/138	75/138	65	SV, PI			
									9.75	
									Sandy Fat Clay ; light brown, moist, very hard,	

.002 .GDT .GPJ .DOT

EXPLORATION LOG

START DATE 3/21/02
END DATE 3/21/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-34
E.A. # 0324-01-4
GROUND ELEV. 709.88 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/21/02	NE	

STATION 79+80 "95-S"
OFFSET 15 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/21/2002

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
									with 52% high plastic fines, 48% fine to coarse sand and trace subangular gravel to 15 mm.	
	10.67							CH		
	10.93	G	SPT	40 50/100	50/100	100	SV, PI			
698.88	11									
									11.58	
									Clayey Sand ; light orange brown, moist, very dense, with 33% medium plastic fines and 67% fine to coarse sand.	
697.88	12 12.19									
	12.34	H	MC	75/138	75/138	100	SV, PI	SC		
696.88	13									
									13.11	
									Clayey Sand with Gravel ; light brown, moist, very dense, with 29% medium plastic fines, 54% fine to coarse sand and 17% subangular to subrounded gravel to >35 mm.	
	13.72									
695.88	14 14.17	I	SPT	32 45 50	95	60	SV, PI	SC		
694.88	15									
	15.24	J	MC	75/50	75/50	0			15.30	
693.88	16									
692.88	17									
691.88	18									
690.88	19									

DOT .GPJ .GDT ..02

EXPLORATION LOG

SHEET 1 OF 1

START DATE 3/21/02
END DATE 3/21/02
JOB DESCRIPTION US 95 Widening Project / Retaining-Sound Walls
LOCATION Las Vegas, Nevada
BORING B-35
E.A. # 0324-01-4
GROUND ELEV. 707.44 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
3/21/02	NE	

STATION 78+40 "95-S"
OFFSET 30 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 3/21/2002

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
								GM	0.06 **Asphalt Concrete**: thin AC pavement on bike path. **Silty Gravel with Sand** ; light grey brown, slightly moist, very dense, with estimated 15-20% low plastic fines, 40-45% fine to coarse sand and 40-45% subangular to subrounded gravel to >50 mm. Weak cementation.	
706.44	1								0.91	
	1.52	A	SPT	50/50	50/50	0		SC	**Clayey Sand with Gravel** ; light brown, dry, very dense, with 18-22% medium plastic fines, 47-54% fine to coarse sand, 29-31% subangular to subrounded gravel to >35 mm. Weak cemented.	
	1.68									
705.44	2 2.13	A'	AC			50	SV, PI			
704.44	3 3.05	B	MC	75/75	75/75	100	SV, PI			
									3.96	
703.44	4							GC	**Clayey Gravel with Sand** ; light brown grey, dry, very dense, with 13% medium plastic fines, 38% fine to coarse sand and 49% subangular to subrounded gravel to >35 mm.	
	4.57	C	SPT	50/50	50/50	0				
	4.72									
702.44	5 5.18	C'	AC			50	SV, PI		5.18	
701.44	6 6.10							SC	**Clayey Sand with Gravel** ; light brown, moist, very dense, with 28% medium plastic fines, 45% fine to coarse sand and 27% subangular to subrounded gravel to >35 mm.	
	6.37	D	MC	50 75/113	75/113	100	SV, PI		6.37	
700.44	7									
699.44	8									
698.44	9									

DOT .....GPJ .....GDT 02

EXPLORATION LOG

START DATE 2/22/02
END DATE 2/22/02
JOB DESCRIPTION US 95 Widening Project / Rainbow Bridge
LOCATION Las Vegas, Nevada
BORING B-36
E.A. #
GROUND ELEV. 728.78 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
2/22/02	NE	

STATION 91+74 QN-2C
OFFSET 37 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 2/22/2002

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
	0.06								**Asphalt Concrete**	Hole located on southbound shoulder 3 feet south of bridge abutment on south side of Rainbow bridge.
	0.43								**Concrete** ; thick approach slab with internal 15-mm-diameter rebar. Rebar occurs in at least 4 layers.	
	0.76								**Clayey Sand with Gravel Fill** ; light brown, moist, dense to very dense, with 12% low to medium plastic fines, 46% fine to coarse sand and 42% subrounded gravel to 50 mm.	
727.78	1	A	MC	34 31 34	65	33				
	1.22									
	1.52									
		B	SPT	18 24 19	43	60	SV, PI	SC		
726.78	1.98 2									
	2.29									
		C	MC	14 24 32	56	33				
	2.74									
725.78	3 3.05									
	3.23	C	SPT	50 50/25	50/25	100			**Clayey Sand with Gravel** ; light brown, moist, very dense, with estimated 15-20% low to medium plastic fines, 50-55% fine to coarse sand and 30-35% subangular to subrounded gravel to >50 mm. Weak to moderate cementation.	
	3.81							SC		
	3.96	D	MC	80/125	80/125	80				
724.78	4									
723.78	5									
722.78	6									
721.78	7									
720.78	8									
719.78	9									

DOT ...GPJ ...GDT ...302

EXPLORATION LOG

START DATE 2/22/02
END DATE 2/22/02
JOB DESCRIPTION US 95 Widening Project / Rainbow Bridge
LOCATION Las Vegas, Nevada
BORING B-37
E.A. #
GROUND ELEV. 727.86 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
2/22/02	NE	

STATION 92+02 QN-2C
OFFSET 27 m RT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 2/22/2002

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
	0.06								**Asphalt Concrete**	Hole located on southbound shoulder 3 feet north of bridge abutment on north side of Rainbow bridge.
	0.44								**Concrete** ; thick approach slab with internal 15-mm-diameter rebar. Rebar occurs in at least 4 layers.	
	0.76								**Clayey Sand with Gravel Fill** ; light brown, moist, dense to very dense, with 23% low to medium plastic fines, 43% fine to coarse sand and 34% subrounded gravel to 50 mm.	
	0.91	A	MC	84	84	17				
726.86	1									
	1.22									
		B	MC	26 26 31	57	50	SV, PI	SC		
	1.68									
	1.83									
725.86	2	C	SPT	12 18 33	51	50				
	2.29									
	2.59									
	2.74	D	MC	140/100	140/100	25			**Clayey Gravel with Sand** ; light grey brown, moist, very dense, with estimated 15-20% low to medium plastic fines, 35-40% fine to coarse sand and 45-50% subangular to subrounded gravel to >50 mm.	
724.86	3									
	3.35	E	SPT	100/113	100/113	45		GC		
723.86	4									
	4.11	F	MC	100/100	100/100	0				
	4.42									
722.86	5									
721.86	6									
720.86	7									
719.86	8									
718.86	9									

DOT .GPJ .GDT 02

EXPLORATION LOG

START DATE 2/21/02
END DATE 2/21/02
JOB DESCRIPTION US 95 Widening Project / Rainbow Bridge
LOCATION Las Vegas, Nevada
BORING B-39
E.A. #
GROUND ELEV. 721.77 (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
2/22/02	NE	

STATION 91+90 QN-2C
OFFSET 3 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 2/22/2002

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
									0.11 **Asphalt Concrete**	Hole located on inside shoulder of northbound US 95 beneath west side of Rainbow bridge. Site is about 9 feet NW of westernmost column and targets NW corner of base footing. The footing extends 11 feet to west and 7 feet to north of column.
720.77	1							GP GM	**Poorly Graded Gravel with Silt and Sand Fill** ; light grey brown, slightly moist, dense, with estimated 10% low plastic fines, 35-40% fine to coarse sand and 50-55% subrounded gravel to 50 mm.	
719.77	2								Encountered top of Rainbow bridge base footing at 1.98 meters. Accordings to plans supplied by PBS&J, this wider base footing is 1.22 meters (4 feet) thick. A smaller 0.914 (3-foot) thick footing sits on top of the base 1.98 footing. Accordingly, the top of the footing complex is at a depth 1.07 meters below the existing grade.	
718.77	3									
717.77	4									
716.77	5									
715.77	6									
714.77	7									
713.77	8									
712.77	9									

...DOT ...GPJ ... .GDT ...2002

EXPLORATION LOG

SHEET 1 OF 1

START DATE 4/12/02
END DATE 4/12/02
JOB DESCRIPTION US 95 Widening Project / Washington Avenue Bridge
LOCATION Las Vegas, Nevada
BORING B-40
E.A. # 0324-01-6
GROUND ELEV. (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
4/12/02	NE	

STATION
OFFSET
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 4/12/2002

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
	0.76	A	MC	75/75	75/75	100	SV, PI	SC	**Clayey Sand with Gravel Fill** ; light grey brown, slightly moist, very dense, with 25-30% medium plastic fines, 50-55% fine to coarse sand and 15-25% subangular gravel to >50 mm.	Boring Site on the North Side of the East Embankment.
	1.52	B	MC	60 75/100	75/100	40	SV, PI			
	2.29	C	MC	75/125	75/125	80	SV, PI			
	3.05	D	MC	59 63 60	123	67	SV, PI			
	3.51	E	MC	75/100	75/100	80	SV, PI			
	3.81	F	MC	75/125	75/125	0				
	4.57	G	MC	75/125	75/125	0	SV, PI			Samples G, J and K are auger cuttings.
	5.33	H	MC	70 75/75	75/75	60	SV, PI			
	6.10	I	MC	75/75	75/75	0	SV, PI			
	6.36	J	MC	75/50	75/50	0	SV, PI	GC	**Clayey Gravel with Sand Gravel** ; light grey brown, slightly moist, very dense, with estimated 15-20% medium plastic fines, 35-40% fine to coarse sand and 45-50% subangular gravel to >50 mm.	
	6.86	K	MC	75/50	75/50	0	SV, PI			
	7.62	L	MC	75/75	75/75	0				
	8.38									
	9.14									

2.74
6.71
9.22

0324C ... NV_D ... 5/17/

EXPLORATION LOG

START DATE 4/12/02
END DATE 4/12/02
JOB DESCRIPTION US 95 Widening Project / Washington Avenue Bridge
LOCATION Las Vegas, Nevada
BORING B-41
E.A. # 0324-01-6
GROUND ELEV. (m)
HAMMER DROP SYSTEM Cable

STATION
OFFSET
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 4/12/2002

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
4/12/02	NE	

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
	0.76								**Silty, Clayey Sand with Gravel Fill** ; light grey brown, slightly moist, dense to very dense, with 10-15% low plastic fines, 45-50% fine to coarse sand and 40-45% subangular gravel to >75 mm.	Boring Site on the South Side of the East Embankment.
	1 1.22	A	MC	26 41 62	103	45	SV, PI			
	1.52							SC SM		
	1.80	B	MC	41 75/125	75/125	55	SV, PI			
	2 2.29									
	2.55	C	MC	61 75/100	75/100	60	SV, PI			
									2.74	
	3 3.05							GP GC	**Poorly Graded Gravel with Silt, Clay and Sand Fill** ; light grey brown, slightly moist, very dense, with 5-10% low plastic fines, 30-35% fine to coarse sand and 60-65% subangular gravel to >75 mm.	
	3.31	D	MC	67 75/50	75/50	65	SV, PI			
									3.51	
	3.81							GC	**Silty, Clayey Gravel with Sand Fill** ; light grey brown, slightly moist, very dense, with estimated 15-20% low plastic fines, 30-35% fine to coarse sand and 55-60% subangular gravel to >75 mm.	
	4 4.08	E	MC	34 75/125	75/125	90	SV, PI			
	4.57								4.42	
	5.00	F	MC	30 62 75/125	75/125	85	SV, PI		**Clayey Sand with Gravel Fill** ; light grey brown, slightly moist, very dense, with 10-15% low plastic fines, 45-50% fine to coarse sand and 40-45% subangular gravel to >35 mm.	
	5 5.33	~~G~~	~~MC~~	~~75/100~~	~~75/100~~	~~100~~	~~SV, PI~~	SC		
	6 6.10									
	6.37	H	MC	66 75/125	75/125	80	SV, PI		6.40	
	7									
	8									
	9									

EXPLORATION LOG

SHEET 1 OF 1

START DATE 4/12/02
END DATE 4/12/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-42
E.A. # 0324-01-1
GROUND ELEV. (m)
HAMMER DROP SYSTEM Cable

GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
4/12/02	NE	

STATION 97+15 QN-2C
OFFSET 43 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 4/12/2002

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
	0.76	A	MC	75/50	75/50	0	SV, PI	GC	**Clayey Gravel with Sand Fill** ; light grey brown, slightly moist, very dense, with 10-15% low to medium plastic fines, 35-40% fine to coarse sand and 50-55% subangular gravel to 75 mm.	Boring Site on the North Side of the West Embankment.
	1.52	B	MC	75/75	75/75	100	SV, PI			
	2.29	C	MC	75/75	75/75	67	SV, PI			
	3.05	D	MC	75/125	75/125	100	SV, PI	SC	**Clayey Sand with Gravel Fill** ; light grey brown, slightly moist, very dense, with 20-25% medium plastic fines, 45-50% fine to coarse sand and 25-30% subangular gravel to >35 mm.	
	3.81	E	MC	75/75	75/75	0		GC	**Clayey Gravel with Sand Fill** ; light grey brown, slightly moist, very dense, with 15-20% medium plastic fines, 35-40% fine to coarse sand and 45-50% subangular gravel to >50 mm.	
	4.11	F	MC	75/125	75/125	60	SV, PI			
	4.57	G	MC	75/50	75/50	0	SV, PI			Sampled auger cuttings from 15-30 feet.
	5.33	H	MC	75/75	75/75	0	SV, PI	GC	**Clayey Gravel with Sand Fill** ; light grey brown, slightly moist, very dense, with 10-15% low to medium plastic fines, 30-35% fine to coarse sand and 50-55% subangular gravel to 75 mm.	
	6.10	I	MC	75/75	75/75	0				
	6.86	J	MC	75/12.5	75/12.5	0		SC	**Clayey Sand with Gravel** ; light grey brown, slightly moist, very dense, with 15-20% medium plastic fines, 45-50% fine to coarse sand and 35-40% subangular gravel to >35 mm.	
	7.62	K	MC	75/100	75/100	0	SV, PI			
	8.38	L	MC	75/75	75/75	33	SV, PI			
	9.14	M	MC	75/75	75/75	100	SV, PI			

2.44
3.66
4.88
6.71
9.22

...DOT ...GPJ ...GDT ...

EXPLORATION LOG

START DATE 4/12/02
END DATE 4/12/02
JOB DESCRIPTION US 95 Widening / Project 2D Retaining Walls
LOCATION Las Vegas, Nevada
BORING B-43
E.A. # 0324-01-1
GROUND ELEV. (m)
HAMMER DROP SYSTEM Cable

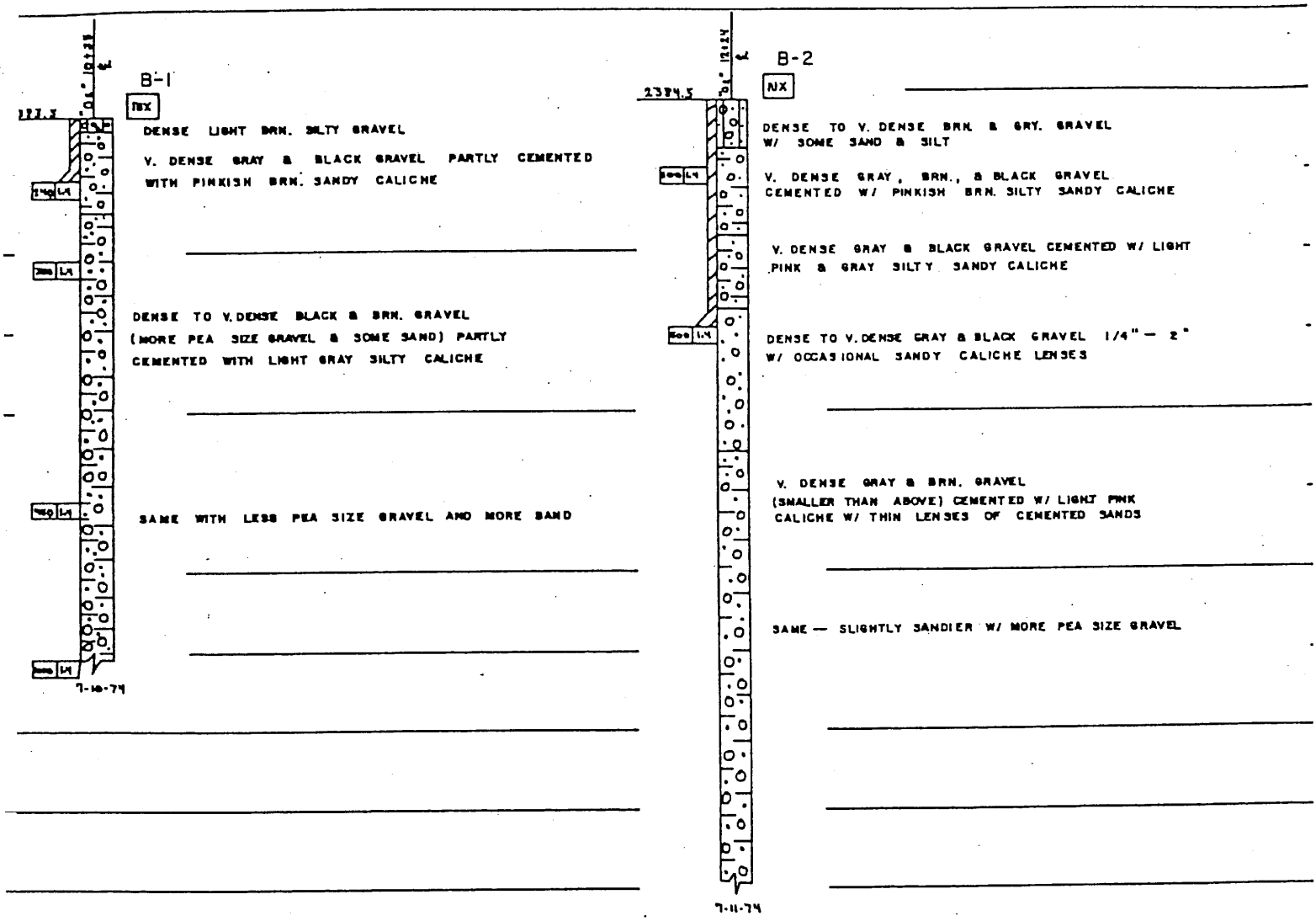
GROUNDWATER LEVEL		
DATE	DEPTH m	ELEV. m
4/12/02	NE	

STATION 96+95 QN-2C
OFFSET 43 m LT
ENGINEER PGT
EQUIPMENT Diedrich D-50
OPERATOR Eagle Drilling
DRILLING METHOD 152 mm HS Auger
BACKFILLED Yes DATE 4/12/2002

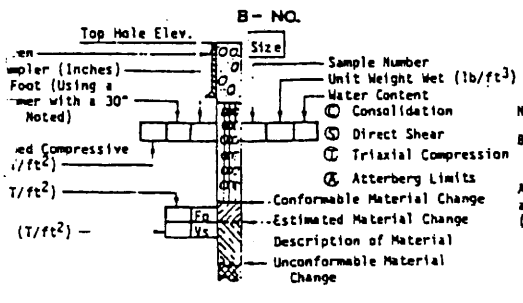
ELEV. (m)	DEPTH (m)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 150 mm Increments	BLOW COUNT Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	0.76							GP GC	**Poorly Graded Gravel with Silt, Clay and Sand Fill** ; light grey brown, slightly moist, very dense, with 5-10% low plastic fines, 25-30% fine to coarse sand and 60-65% subangular gravel to >70 mm.	Boring Site on the South Side of the West Embankment.
	1 1.04	A	MC	64 75/125	75/125	35	SV, PI			
	1.52									
	1.80	B	MC	38 75/125	75/125	75	SV, PI			
	2 2.29								2.13	
	2.74	C	MC	36 64 73	137	85	SV, PI	SC	**Clayey Sand with Gravel Fill** ; light grey brown, slightly moist, very dense, with 15-20% low to medium plastic fines, 50-55% fine to coarse sand and 30-35% subangular gravel to >70 mm.	
	3 3.05								2.90	
	3.51	D	MC	71 71 64	135	95	SV, PI	GP GC	**Poorly Graded Gravel with Silt, Clay and Sand Fill** ; light grey brown, slightly moist, very dense, with 10-15% low plastic fines, 40-45% fine to coarse sand and 45-50% subangular gravel to >70 mm.	
	3.81								3.66	
	4 4.08	E	MC	49 75/125	75/125	90	SV, PI	SC	**Clayey Sand with Gravel Fill** ; light grey brown, slightly moist, very dense, with 15-20% medium plastic fines, 45-50% fine to coarse sand and 30-35% subangular gravel to >70 mm.	
	4.57	F	MC	75/75	75/75	0				
	5 5.33	G	MC	75/125	75/125	80	SV, PI	GP GC	**Poorly Graded Gravel with Silt, Clay and Sand Fill** ; light grey brown, slightly moist, very dense, with 10-15% low plastic fines, 40-45% fine to coarse sand and 45-50% subangular gravel to >70 mm.	
	6 6.10	H	MC	75/75	75/75	100	SV, PI		6.17	
	7									
	8									
	9									

NDOT 1974 Boring

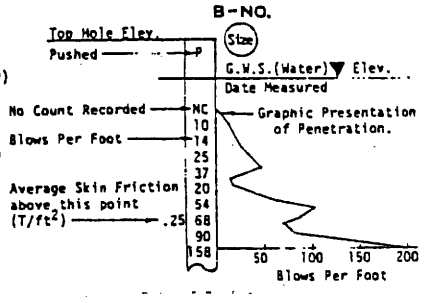
B-2



ROTARY BORING



PENETRATION BORING



PLAN OF ANY BORING
PENETROMETER (FLUSH-COUPLED)
2 " CONE PENETROMETER
SAMPLER BORING (DRY)
ROTARY BORING (WET)
AUGER BORING (DRY)
JET BORING
DIAMOND CORE BORING.
TEST PIT.

BIT SIZES: (I.D.) "AX"-1-13/16", "BX"-2-9/32", "NX"-2-29/32"
CASING SIZES: (O.D.) "BX"-2-7/8", "NX"-3-1/2"

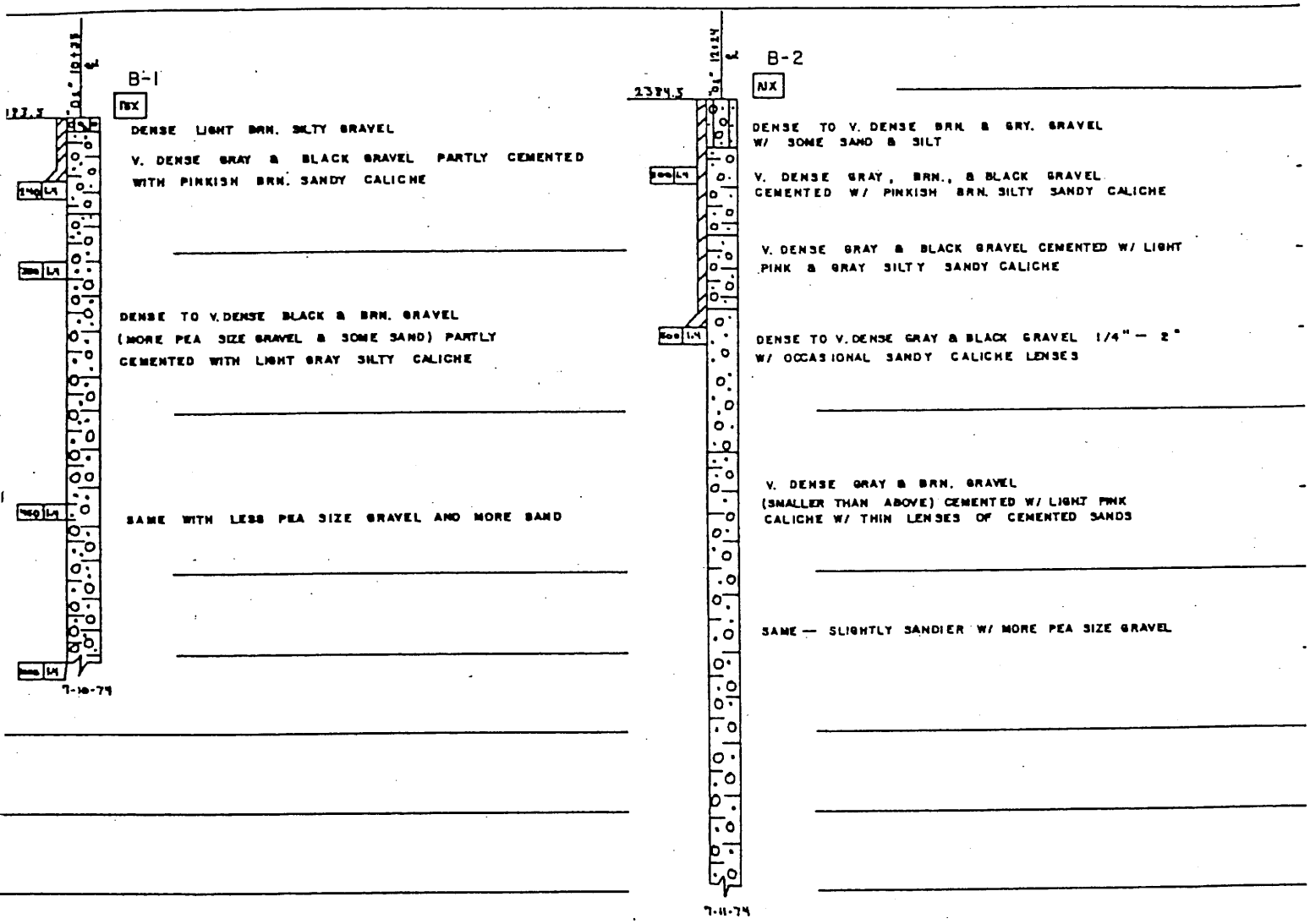
MAJ. DIV. | Coarse Grained Material | Gravel and Gravelly Soil | Sand and Sandy Soil

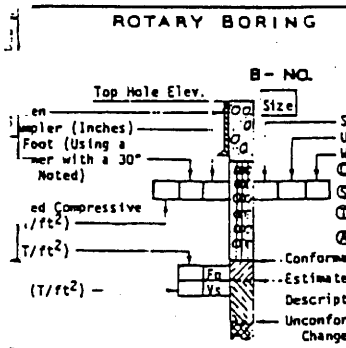
DWN. Q.Q.Q.
CHK. Jeff N.
DATE 9-30-74

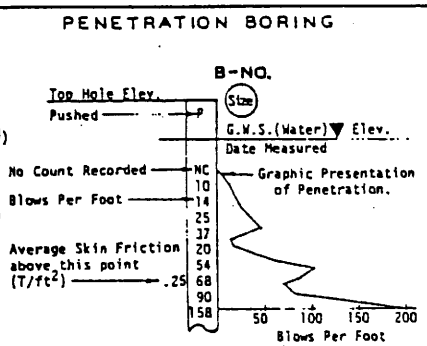
NEVADA HIGHWAY DEPART
FOUNDATIONS A

NDOT 1974 Boring

B-2







PLAN OF ANY BORING
PENETROMETER (FLUSH-COUPLED)
2" CONE PENETROMETER
SAMPLER BORING (DRY)
ROTARY BORING (WET)
AUGER BORING (DRY)
JET BORING
DIAMOND CORE BORING.
TEST PIT.

BIT SIZES: (I.D.) "AX"-1-13/16", "BX"-2-9/32", "NX"-2.29/32"
CASING SIZES: (O.D.) "BX"-2-7/8", "NX"-3-1/2".

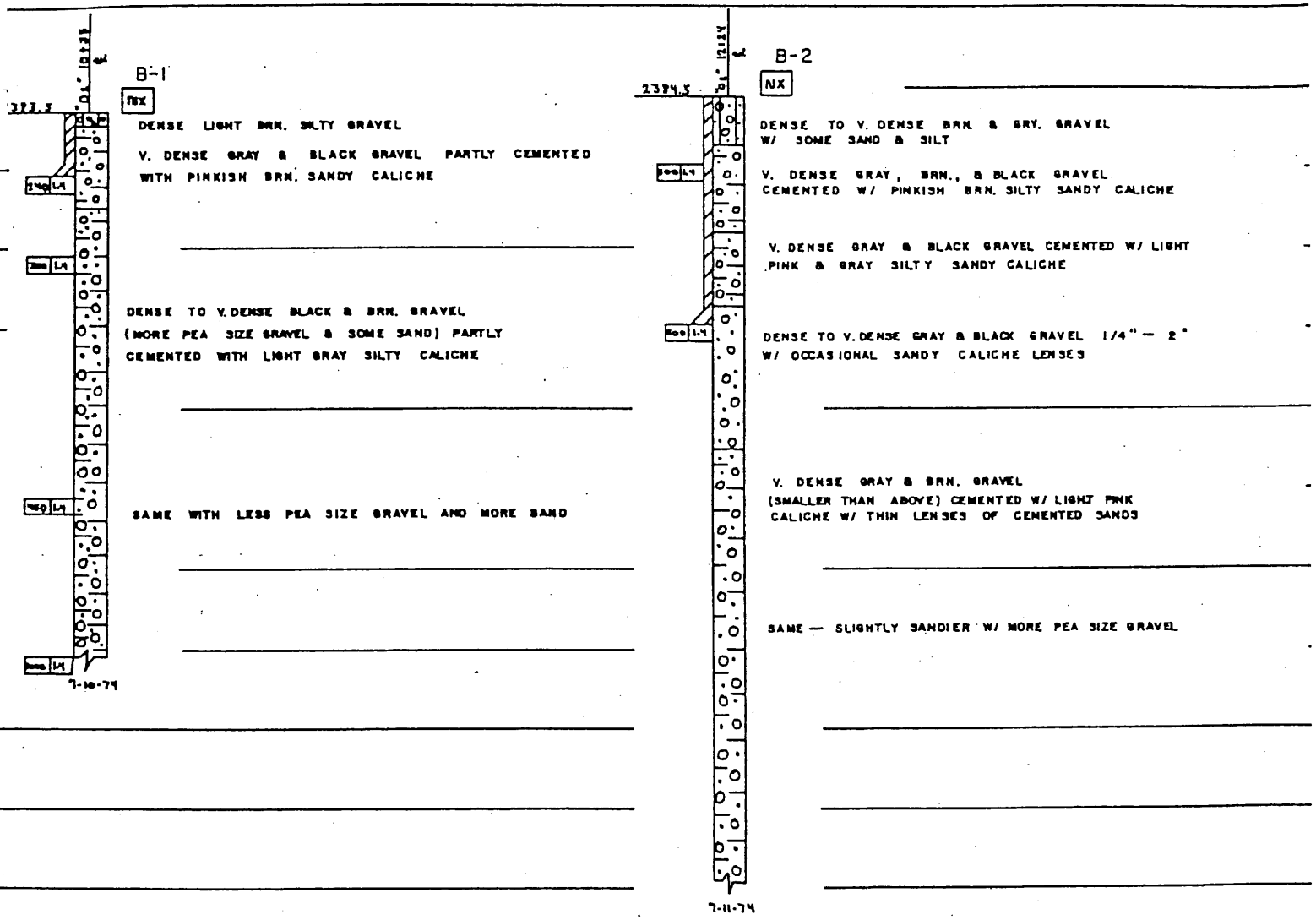
MAJ. DIV. L
Coarse Grained Material: Gravel and Gravelly Soil; Sand and Sandy Soil

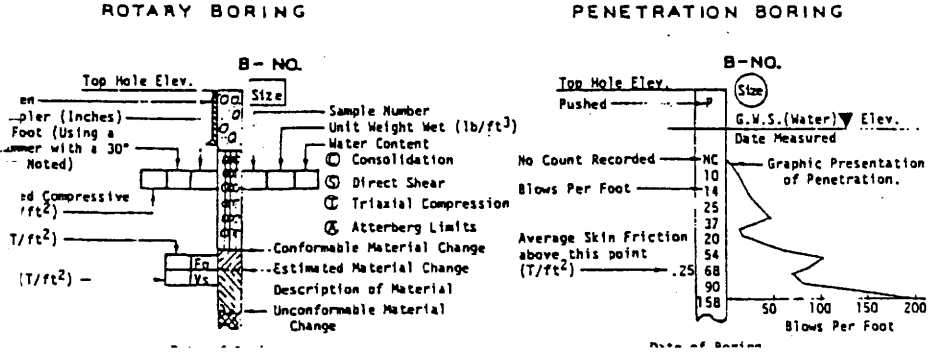
DSN. Q.Q.Q.
CHK. Jess N.
DATE 9-30-74

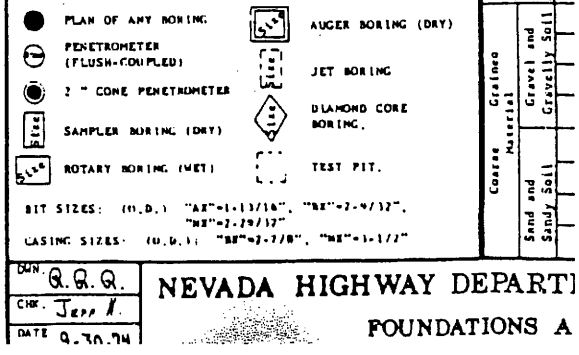
NEVADA HIGHWAY DEPART
FOUNDATIONS A

NDOT 1974 Boring

B-2



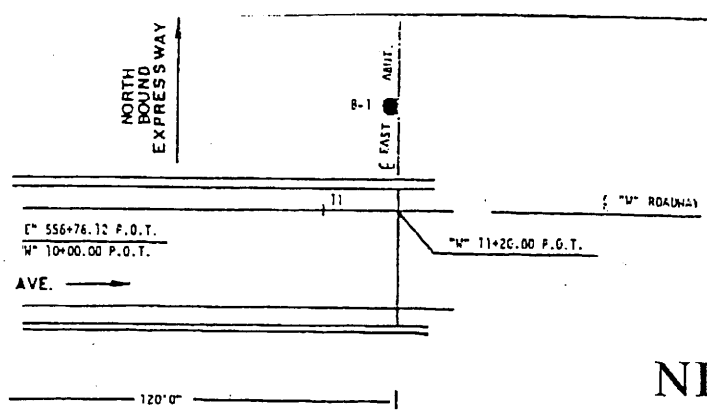




FED RD REG NO	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	[illegible]	CLARK	B-24

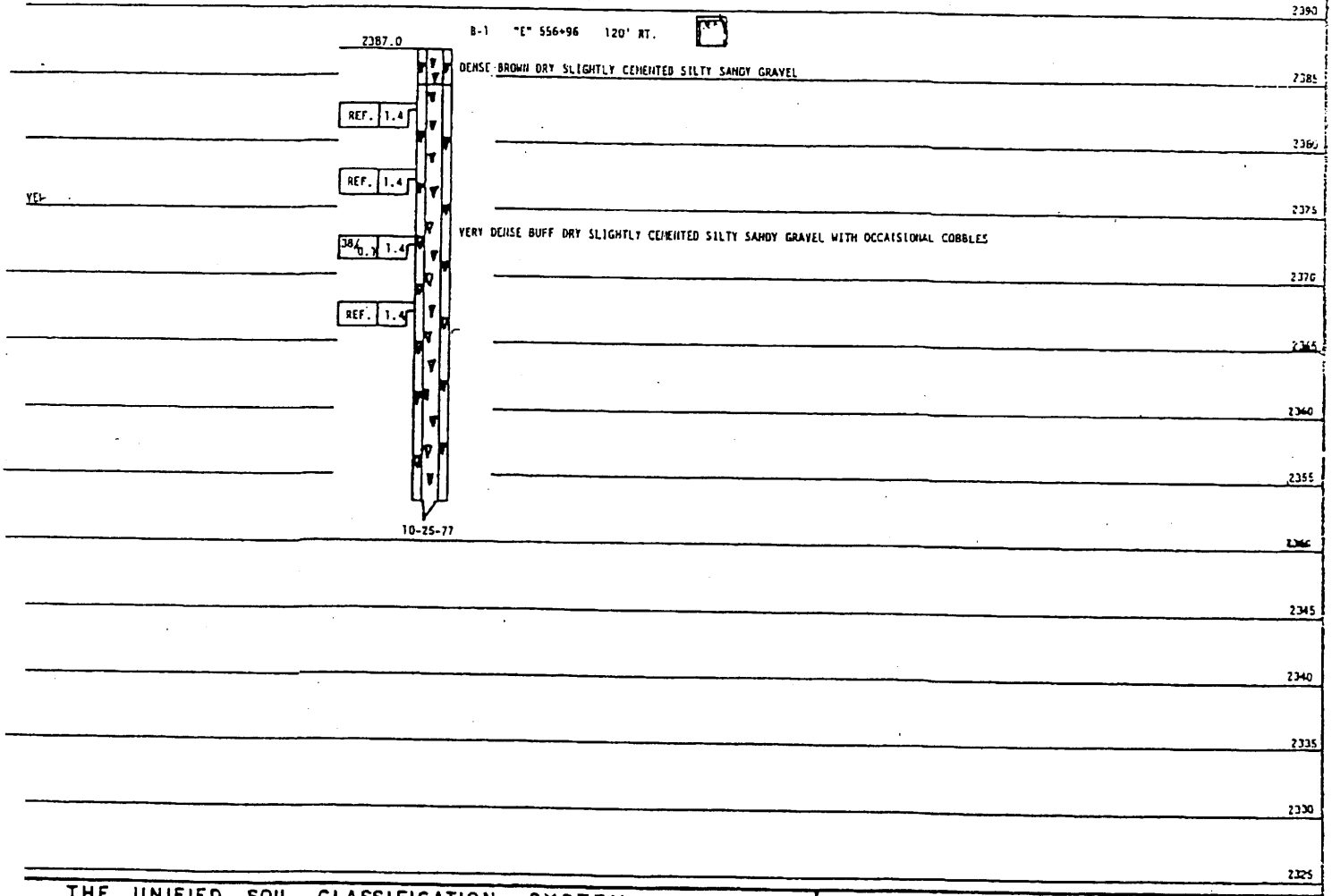
NOTE: FOUNDATION REPORT AVAILABLE FOR CONTRACTORS STUDY IN DISTRICT OFFICE AND MATERIALS & TESTING DIVISION ...

B-24



NDOT 1977 Boring

B-1



THE UNIFIED SOIL CLASSIFICATION SYSTEM

LETTER	SYM.	DESCRIPTION
GW		WELL-GRADED GRAVEL OR GRAVEL-SAND MIXTURES. LITTLE OR NO FINES.
GP		POORLY-GRADED GRAVEL OR GRAVEL-SAND MIXTURES. LITTLE OR NO FINES.
GM		SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES.
GC		CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURES.
SW		WELL-GRADED SAND OR GRAVELLY SAND, LITTLE OR NO FINES.
SP		POORLY-GRADED SAND OR GRAVELLY SAND, LITTLE OR NO FINES.
SM		SILTY SAND, SAND-SILT MIXTURES.
SC		CLAYEY SAND, SAND-CLAY MIXTURES.

MAJ. DIV.		LETTER	SYM.	DESCRIPTION
COARSE GRAINED MATERIAL				
FINE MATERIAL	SILTS AND CLAYS LL. <50	ML		INORGANIC SILT AND VERY FINE SAND, ROCK FLOUR, SILTY OR CLAYEY FINE SAND OR CLAYEY SILT WITH SLIGHT PLASTICITY.
		CL		INORGANIC CLAY OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAY, SANDY CLAY SILTY CLAY, LEAN CLAY
		OL		ORGANIC SILT AND ORGANIC SILTY-CLAY OF LOW PLASTICITY
	SILTS AND CLAYS LL. >50	MH		INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILT.
		CH		INORGANIC CLAY OF HIGH PLASTICITY, FAT CLAY.
		OH		ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILT.
		PT		PEAT AND OTHER HIGHLY ORGANIC SOILS.

STANDARD PENETRATION CLASSIFICATION

GRANULAR SOIL		CLAYEY SOIL	
BLOWS/ FT. *	DENSITY	BLOWS /FT. *	CONSISTENCY
0 - 4	VERY LOOSE	0 - 1	VERY SOFT
5 - 10	LOOSE	2 - 4	SOFT
11 - 24	MEDIUM DENSE	5 - 8	MEDIUM STIFF
25 - 50	DENSE	9 - 15	STIFF
OVER 50	VERY DENSE	16 - 30	VERY STIFF
		31 - 60	HARD
		OVER 60	VERY HARD

* STANDARD PENETRATION TEST(N) 140 lb. HAMMER, 30" FREE FALL ON 2" O.D. X 1 3/8" I.D. SAMPLER

MENT MATERIALS AND TESTING DIVISION

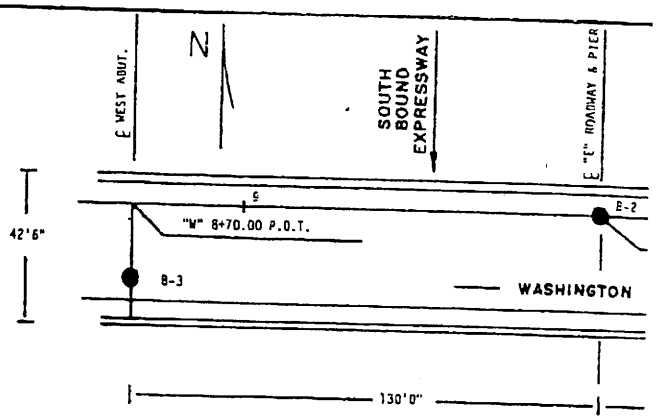
ND ENGINEERING GEOLOGY SECTION

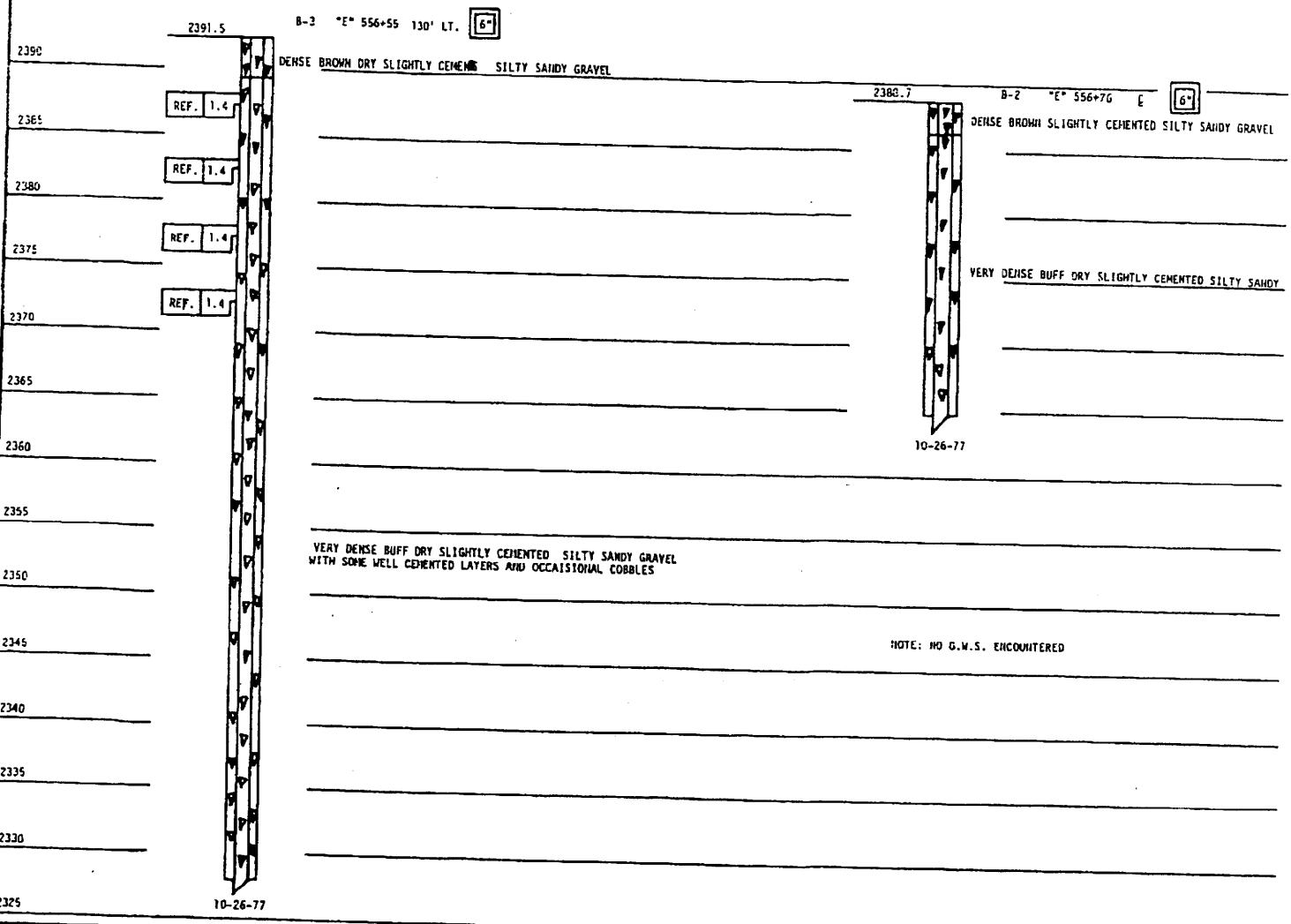
WASHINGTON AV. G.S. – L.V. EXPRESSWAY

H-1211 US 95–CL 82.05

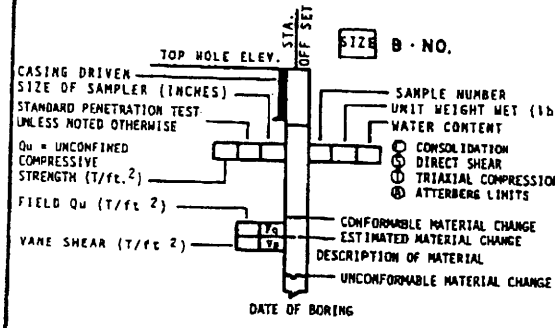
DWG. NO. 1

Washington Ave

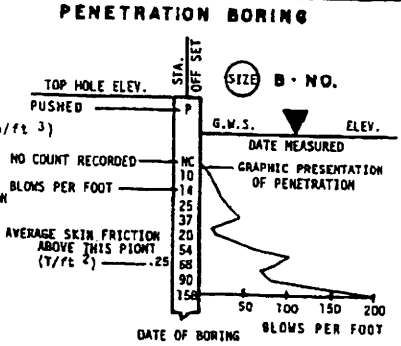




ROTARY BORING



PENETRATION BORING



- PLAN OF ANY BORING
- PENETROMETER (FLUSH-COUPLED)
- 2" CONE PENETROMETER
- SAMPLE BORING (DRY)
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- JET BORING
- DIAMOND CORE BORING
- TEST PIT

BIT SIZE: (O.D.) : "AX"-1-13/16", "BX"-2-9/32", "NX"-2-29/32"
CASING SIZES: (O.D.) : "BX"-2-7/8", "NX"-3-1/2"

COARSE GRAINED MATERIAL: SAND AND GRAVEL AND

DWN.	R.R.R.
CHK.	Gme
DATE	11-22-77

NEVADA HIGHWAY DEPA
FOUNDATION

DMC 1A

BORING 9

DATE DRILLED: 05-20-86
LOCATION: SEE KEY PLAN
ELEVATION: 2401.4

DEPTH IN FEET	FIELD MOISTURE	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.** SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0				SM	SILTY SAND - w/grv. and cobbles	sl moist	loose to m. dense
				GP	SANDY GRAVEL - w/cobbles, brown		m.d./d.
					Cemented SAND and GRAVEL - light brown	dry	hard
							m. hard
5							hard
							mod. hard
							hard
				GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	to	v. dense m. hard
					Cemented SAND and GRAVEL - lt br		hard
				GP	SANDY GRAVEL - light brown		v.d./m.
					Cemented SAND and GRAVEL - lt br		hard
				GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	sl.	very dense to m. hard
					Cemented SAND and GRAVEL - lt br		hard
				GP	SANDY GRAVEL - w/cob., lt. brn.		v.d./m.
					Cemented SAND and GRAVEL - lt br		hard
				GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	moist	very dense to mod. hard
					Bottom at 20 feet.		

BORING 10

DATE DRILLED: 05-20-86
LOCATION: SEE KEY PLAN
ELEVATION: 2398.6

DEPTH IN FEET	FIELD MOISTURE	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.** SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0				SM	SILTY SAND - w/gravel and cob.	sl. moist	bose/md
				GP	SANDY GRAVEL - w/cob., lt. brown		dense
					Cemented SAND and GRAVEL - lt br		hard
				GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v.dense to m. hard
5					Cemented SAND and GRAVEL - light brown	dry	hard
							m. hard to hard
				GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	to	very dense to mod. hard
10			60/9"				
						sl.	very
15							dense
						moist	
							v.dense to m. hard
20					Bottom at 20 feet.		

FINE GRAINED SOILS | COARSE GRAINED SOILS

Strong

Weak

Strongest

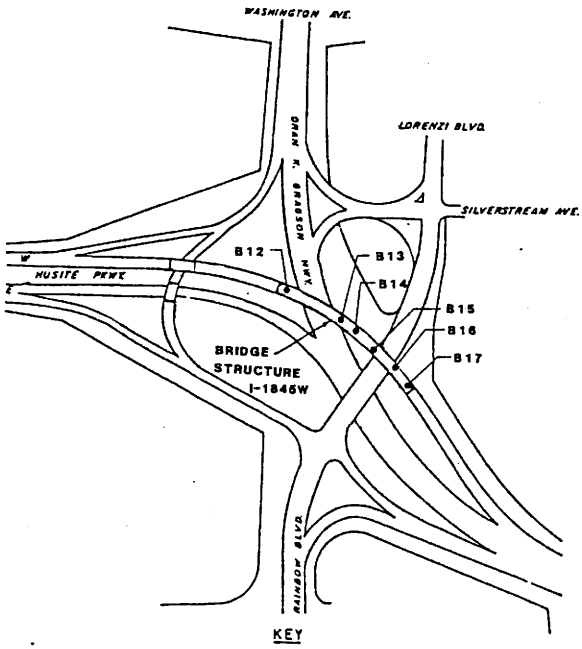
Weakest

OTHE

USING (I.D.)

NOTE

SHEET B56, OMITTED



KEY PLAN

BORING NO. 12

DATE DRILLED: 06-10-86 ELEVATION: 2393.9
LOCATION: See Key Plan

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.* SAMPLES	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0				48 10"	FILL	FILL - SANDY GRAVEL - w/cobbles, light brown	sl. moist	
5						Cemented SAND and GRAVEL - lt. brown	dry	m.h/h.
								hard to very hard
10							to	hard
15						brown		m.h/h.
								hard
							sl.	h./v.h.
20						light brown		mod. hard to hard
							moist	
25								hard
						Bottom at 25 feet.		

BORING NO. 13

DATE DRILLED: 06-10-86 ELEVATION: 2378.9
LOCATION: See Key Plan

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.* SAMPLES	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0						Cemented SAND and GRAVEL - lt. brown	dry	m. hard
								hard
5					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	to	v.dense m. hard
				50 4"				m.h/h.
						Cemented SAND and GRAVEL - lt. brown		hard
10							sl.	m. hard to hard
								hard
15					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	moist	v.dense to m. hard
								v.dense
						Cemented SAND and GRAVEL -lt br		hard
20					GP	SANDY GRAVEL - part. cemented		v.d/m.h
						Bottom at 20 feet.		

BORING NO. 14

DATE DRILLED: 06-10-86 ELEVATION: 2377.0
LOCATION: See Key Plan

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.* SAMPLES	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0					FILL	FILL - SANDY GRAVEL - lt. brown	sl.moist	
					GP	SANDY GRAVEL - light brown		v.dense m. hard
						Cemented SAND and GRAVEL - lt. brown		m.h/h.
								h./v.h.
5					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	dry	v.dense to m. hard
						Cemented SAND and GRAVEL - lt. brown	to	m. hard to hard
10					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v.dense to m. hard
				50 4"			sl.	
						Cemented SAND and GRAVEL - lt. brown		m. hard to hard
15					GP	SANDY GRAVEL - w/cob. lt. brn.		v.d/m.h
						Cemented SAND and GRAVEL -lt.br		m.h./h.
					CL	SANDY CLAY - w/gravel, brown	moist	very stiff
20						Bottom at 20 feet.		

BORING NO. 15

DATE DRILLED: 06-09-86 ELEVATION: 2384.6
LOCATION: See Key Plan

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.* SAMPLES	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0					FILL	FILL - SANDY GRAVEL - lt. brn.	sl.	
				46	GP	SANDY GRAVEL - w/cobbles, lt. brown	moist	dense to v.dense
						Cemented SAND and GRAVEL - lt. brown		hard
5								v. hard
							dry	hard
10							to	mod. hard
					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	sl.	v.dense m. hard
						Cemented SAND and GRAVEL - lt br		hard
15					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	moist	v.dense m. hard
						Cemented SAND and GRAVEL - lt. brown		hard

FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY
1	NEV.	SPS-095-2(4)	CLARK

BORING NO. 16

DATE DRILLED: 06-09-86 ELEVATION: 2384.6
LOCATION See Key Plan

FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLE	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
					FILL	FILL - SANDY GRAVEL - lt. brown	sl.moist	
						Cemented SAND and GRAVEL - lt br		hard
					GP	SANDY GRAVEL - light brown		v. dense
			50/1"			Cemented SAND and GRAVEL - lt. brown	dry to sl. moist	m. hard to hard; h./v.h.; hard; m. hard to hard; hard
			50/2"					m.h./h.
					GP	SANDY GRAVEL - w/cob. lt. brown		v.d/m.h

Bottom at 20 feet.

BORING NO. 17

DATE DRILLED: 06-10-86 ELEVATION: 2380.8
LOCATION See Key Plan

FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS*	BLOWS/FT.**	SAMPLE	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
					FILL	FILL - SANDY GRAVEL - lt. brn.	sl. moist	
					GP	SANDY GRAVEL - w/cob., lt. brn.		dense
						Cemented SAND and GRAVEL - lt. brown	dry to sl. moist	m. hard; v. hard; hard
			50/5"		GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v. dense to m. hard
						Cemented SAND and GRAVEL - lt. brown		hard; mod. hard; hard
					GP	SANDY GRAVEL - w/cobbles, lt. brown		v.d/m.h
						Cemented SAND and GRAVEL - lt. brown		hard; m. hard
			50/3"		GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v. dense m. hard
						Cemented SAND and GRAVEL - lt br		hard
					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v. dense m. hard
						Cemented SAND and GRAVEL - lt. brown	moist	very hard; hard; m. hard
			50/3"		GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v.dense m. hard
						Cemented SAND and GRAVEL - lt br		m.h/h.
					GP	SANDY GRAVEL - w/cob., lt. brn.		v.d/m.h
						Cemented SAND and GRAVEL - lt. brown	dry to sl. moist	m. hard to hard; hard
					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brn.		v. dense m. hard
						Cemented SAND and GRAVEL - lt. br		hard
					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v.dense to m. hard

Bottom at 40 feet.

EXPLANATION OF MATERIAL CLASSIFICATIONS

MAJOR DIVISIONS			Group Symbols	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% of material is Larger than the No. 200 sieve.	GRAVELS More than 50% of coarse part is larger than the No. 4 sieve	CLEAN GRAVELS Little or no fines	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES Appreciable amt of fines	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than 50% of coarse part is smaller than the No 4 sieve	CLEAN SANDS Little or no fines	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES Appreciable amt of fines	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% of material is smaller than No. 200 sieve.	SILTS AND CLAYS Liquid limit LESS than 50		ML	Inorganic silts & very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays of low to med. plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS Liquid limit GREATER than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

silt or clay	sand			gravel		cobbles	boulders
	fine	medium	coarse	fine	coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

DESCRIPTIVE TERMS USED WITH SOILS

	CONSISTENCY: Silts and Clays	CONSISTENCY: Sands and Gravels	MOISTURE CONTENT	
Strongest	very stiff	very dense	Wettest	wet
	stiff	dense		very moist
	firm	medium dense		moist
Weakest	soft	loose		slightly moist
			Driest	dry

DESCRIPTIVE TERMS USED WITH CALICHE AND CEMENTED SOILS

	CALICHE	CEMENTED SAND AND GRAVEL	IDENTIFICATION TEST USING KNIFE AND STANDARD GEOLOGIST'S HAMMER
Strongest	very hard	very hard	Difficult to scratch or break.
	hard	hard	Scratches leave only dust, requires many hammer blows to break.
	moderately hard	moderately hard	Can be readily cut with knife and crumbles with several hammer blows.
Weakest	partially cemented	partially cemented	Gouges easily with knife and crumbles readily with a few blows of a hammer

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

** USING 370 LB. DRIVING WEIGHT AND 2.625 INCH. (I.D.) DIAMETDER SAMPLER

NOTE: WATER NOT ENCOUNTERED

REV	DATE	DESCRIPTION

RECOMMENDED George C. Wallace 1815 9/21/87
GEORGE C. WALLACE R.E. NO. DATE

G.C. WALLACE, INC. Engineering/Architecture
1555 SOUTH RAINBOW BLVD / LAS VEGAS, NEVADA 89102

HOWARD HUGHES PROPERTIES
HUGHES PARKWAY INTERCHANGE
LOG OF BORINGS

I-1845W

BORING 18

DATE DRILLED: 05-20-86 ELEVATION: 2400.5
LOCATION: See Plate No. 1

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS	BLOWS/FT.	GRAPHIC SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0					SM	SILTY SAND - w/grv. and cobbles	sl. moist	loose/m.
					GP	SANDY GRAVEL - w/cobbles, brown		dense
						Cemented SAND and GRAVEL - lt. brown	dry	m.h./h.
								hard
5								mod. hard
				50/4"	GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	to	v. dense m. hard
						Cemented SAND and GRAVEL - lt. br		m.h./h.
10					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v. dense m. hard
						Cemented SAND and GRAVEL - lt br	sl.	m.h./h.
					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v.dense to m. hard
15						Cemented SAND and GRAVEL - lt br	moist	m. hard
					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v. dense m. hard
						Cemented SAND and GRAVEL - lt br		hard
20						Bottom at 20 feet.		

BORING 19

DATE DRILLED: 05-28-86 ELEVATION: 2401.6
LOCATION: See Plate No. 1

DEPTH IN FEET	FIELD MOISTURE %	DRY DENSITY PCF	OTHER TESTS	BLOWS/FT.	GRAPHIC SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
0					SM	SILTY SAND - w/grv. and cobbles	sl. moist	loose
					GM	SANDY GRAVEL - w/silt and cob.		dense
					GP	SANDY GRAVEL - w/cob., lt. brn.		v.d/m.h
						Cemented SAND and GRAVEL - lt. brown	dry	m.h./h.
								hard
5								mod. hard to hard
				75/8"	GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	to	hard
10				50/1"				very dense to mod. hard
						Cemented SAND and GRAVEL - lt br		m.h/h.
					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v.dense m. hard
15						Cemented SAND and GRAVEL - lt br		m. hard
					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown	sl.	very dense to mod. hard
20				50/4"			moist	
25						Cemented SAND and GRAVEL - lt. brown		hard
					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v.dense m. hard
						Cemented SAND and GRAVEL - lt br		m. hard
					GP	SANDY GRAVEL - w/cob., lt. brn.		v.d/m.h
30						Cemented SAND and GRAVEL - lt. brown	dry	hard
					GP	SANDY GRAVEL - light brown	to	v.dense m. hard
35						Cemented SAND and GRAVEL - lt. brown	sl.	mod. hard
							moist	hard
					GP	SANDY GRAVEL - w/cobbles, partially cemented, lt. brown		v.dense m. hard
40						Bottom at 40 feet.		

FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	EB-NH-095-2(029)	CLARK	BL-5

METRIC NDOT

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. ALL STATIONS AND OFFSETS ARE IN METERS.

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
CLAYEY SAND -w/trace silt, trace gravel, sl. moist, lt. green			SC	14						
white to lt. green	very dense					57	R	5.8	1618	
lt. green to lt. red brown				16		53	SPT			
partially cemented, dry to sl. moist, lt. brown						50/ 0.15	R	6.4	1682	
	very dense to mod. hard			18		50/ 0.10	SPT			
SANDY GRAVEL -w/silt, partially cemented, dry to sl. moist, lt. brown			GC	17						
SILTY SAND -w/clay, dry to sl. moist, white to lt. brown			SM							
w/clayey sand lenses	very dense					97/ 0.23	R	13.1	1490	
partially cemented	very dense to mod hard			18		50/ 0.10	SPT			

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: D = Bag, L = Bag, SPT = Standard Penetration Test, C = Core

NOTES: Groundwater not encountered. Logged by Rick Ericksen

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PROJECT NO.: 64005007A

PLATE: A-7

(CONTINUED)

FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	EB-NH-095-2(029)	CLARK	BL-5

METRIC NDOT

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. ALL STATIONS AND OFFSETS ARE IN METERS.

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
CLAYEY SAND -w/trace silt, trace gravel, sl. moist, lt. green			SC							
white to lt. green	very dense			14		57	R	5.8	1618	
lt. green to lt. red brown						53	SPT			
partially cemented, dry to sl. moist, lt. brown				16						
	very dense to mod. hard			16		50/ 0.15	R	6.4	1682	
						50/ 0.10	SPT			
SANDY GRAVEL -w/silt, partially cemented, dry to sl. moist, lt. brown			GC	17						
SILTY SAND -w/clay, dry to sl. moist, white to lt. brown			SM							
w/clayey sand lenses	very dense					97/ 0.23	R	13.1	1490	
partially cemented	very dense to mod. hard			18		50/ 0.10	SPT			
Continued Next Page										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag, L = Liner, ST = Shelby Tube, C = Core

NOTES: Groundwater not encountered. Logged by Rick Erickson

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PAGE NUMBER: Page 4 of 7

PROJECT NO.: 64005007A

PLATE: A-7

(CONTINUED)

FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	EB-NH-095-2(028)	CLARK	BL-6

METRIC NDOT

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. ALL STATIONS AND OFFSETS ARE IN METERS.

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
SILTY CLAY -w/trace sand, sl. moist, lt. red brown	very stiff		CL	23						
partially cemented	very stiff to mod hard					68/ 0.25	R	16.1	1602	
SILTY SAND -sl. moist, lt. red brown	dense		SM	24		38	SPT			
CLAYEY SAND -w/trace gravel, partially cemented, dry to sl. moist, white to lt. brown			SC	26		50/ 0.08	R			
						50/ 0.10	SPT			
SANDY GRAVEL -w/clay, partially cemented, dry to sl. moist, lt. brown	very dense to mod hard		GC	28		50/ 0.05	R			
						50/ 0.09	SPT			
				27						

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPE: D = Bag L = Liner SPT = Standard Penetration Test C = Core

NOTES: Groundwater not encountered. Logged by Rick Ericksen

DRIVING WEIGHT (kG): 63.5

Terracon

DATE DRILLED: 5-8-00

PROJECT NO.: 64005007A

PAGE NUMBER: Page 6 of 7

PLATE: A-9

(CONTINUED)

FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	EB-NH-095-2(029)	CLARK	BL-5

METRIC NDOT

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. ALL STATIONS AND OFFSETS ARE IN METERS.

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
CLAYEY SAND -w/trace silt, trace gravel, sl. moist, lt. green			SC							
white to lt. green	very dense			14		57	R	5.8	1618	
lt. green to lt. red brown						53	SPT			
partially cemented, dry to sl. moist, lt. brown				16						
	very dense to mod. hard					50/ 0.15	R	6.4	1682	
				17		50/ 0.10	SPT			
SANDY GRAVEL -w/silt, partially cemented, dry to sl. moist, lt. brown			GC							
SILTY SAND -w/clay, dry to sl. moist, white to lt. brown			SM							
w/clayey sand lenses	very dense					97/ 0.23	R	13.1	1490	
partially cemented	very dense to mod. hard			18		50/ 0.10	SPT			
Continued Next Page										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPE: D = Bag, L = Bag, SPT = Standard Penetration Test, C = Core

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

NOTES: Groundwater not encountered. Logged by Rick Erickson

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PAGE NUMBER: Page 4 of 7

PROJECT NO.: 64005007A

PLATE: A-7

(CONTINUED)

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
SILTY SAND -w/clay, sl. moist, lt. red brown w/occ. partially cemented lenses	very dense		SM							
CLAYEY SAND -w/silt, sl. moist, lt. red brown	very dense		SC	19		61	R	11.7	1842	
SILTY CLAY -w/trace sand, sl. moist, lt. red brown	very stiff		CL			41	SPT			
CLAYEY SAND -w/silt, sl. moist, lt. red brown	very dense		SC	20						
SILTY SAND -w/trace clay, sl. moist, lt. red brown w/occ. partially cemented lenses	dense		SM			58	R	7.6	1698	
	very dense			21		35	SPT			
CLAYEY SAND -partially cemented, sl. moist, lt. red brown	very dense to mod.hard		SC	22		50/ 0.14 50/ 0.13	R SPT	3.8	1634	
SANDY GRAVEL -w/clay, sl. moist, lt. brown	very dense		GC							
Continued Next Page										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag, R = Ring, SPT = Standard Penetration Test, C = Core

NOTES:
Groundwater not encountered. Logged by Rick Ericksen

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PROJECT NO.: 64005007A

PAGE NUMBER: Page 5 of 7

PLATE: A-8

LOG OF BORING NO.

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

THIS SUMMARY APPLIES ONLY AT THE LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
FILL-SANDY GRAVEL -w/silt, trace cobbles, dry, lt. brown			FILL				B	5.3		
-sl. moist				1		20	R	2.8	1602	
						9	SPT			
SANDY CRAVEL -w/silt, trace cobbles, partially cemented, dry to sl. moist, lt. brown	very dense to mod. hard		GM	2		50/ 0.10	R			
						50/ 0.05	SPT			
-sl. moist, white to lt. brown	very dense			3		45	R	4.1	1810	
SILTY SAND -sl. moist, lt. brown			SM	4						
SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, white to lt. brown			GM			47	SPT			
Continued Next Page										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPE: B = Bag, L = Ring, SPT = Standard Penetration Test, C = Core

NOTES:
Groundwater not encountered. Logged by Rick Erickson

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PAGE NUMBER: Page 1 of 7

PROJECT NO.: 64005007A

PLATE: A-4

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

THIS SUMMARY APPLIES ONLY AT THE LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
FILL-SANDY GRAVEL -w/silt, trace cobbles, dry, lt. brown			FILL				B	5.3		
sl. moist				1		20	R	2.8	1602	
						9	SPT			
SANDY CRAVEL -w/silt, trace cobbles, partially cemented, dry to sl. moist, lt. brown	very dense to mod. hard		GM	2		50/ 0.10	R			
						50/ 0.05	SPT			
-sl. moist, white to lt. brown	very dense			3		45	R	4.1	1810	
SILTY SAND -sl. moist, lt. brown			SM	4						
SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, white to lt. brown			GM			47	SPT			
Continued Next Page										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag, L = Bag, SPT = Standard Penetration Test, C = Core

NOTES: Groundwater not encountered. Logged by Rick Erickson

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PAGE NUMBER: Page 1 of 7

PROJECT NO.: 64005007A

PLATE: A-4

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m3	TESTS: ATTERBERG LIMITS
FILL-SANDY GRAVEL -w/silt, trace cobbles, dry, lt. brown			FILL				B	5.3		
sl. moist				1		20	R	2.8	1602	
						9	SPT			
SANDY GRAVEL -w/silt, trace cobbles, partially cemented, dry to sl. moist, lt. brown	very dense to mod. hard		GM	2		50/ 0.10	R			
						50/ 0.05	SPT			
-sl. moist, white to lt. brown	very dense			3		45	R	4.1	1810	
SILTY SAND -sl. moist, lt. brown			SM	4						
SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, white to lt. brown			GM			47	SPT			
Continued Next Page										

THIS SUMMARY APPLIES ONLY AT THE LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag, L = Liner, SPT = Standard Penetration Test, C = Core

NOTES: Groundwater not encountered. Logged by Rick Erickson

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PAGE NUMBER: Page 1 of 7

PROJECT NO.: 64005007A

PLATE: A-4

FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	EB-NH-095-2(029)	CLARK	BL-4

METRIC NDOT

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. ALL STATIONS AND OFFSETS ARE IN METERS.

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
SANDY GRAVEL -w/silt, trace cobbles, sl. moist, white to lt. brown	very dense		GM							
GRAVELLY SAND -w/silt, sl. moist, white to lt. brown	dense to very dense		SM	6						
						51	R	3.3	1906	
SILTY SAND -very fine, sl. moist, lt. green	very dense					49	SPT			
SANDY GRAVEL -w/silt, sl. moist, white to lt. brown	dense		GM	8						
CLAYEY SILT -w/trace gravel, sl. moist, white	stiff		ML			23	R	8.0	1442	
SILTY SAND -sl. moist, lt. green	med. dense		SM	7		14	SPT	7.9		
SILTY CLAY -sl. moist, green to lt. green	stiff		CL							
SANDY GRAVEL -w/clay, trace silt, sl. moist, lt. green	very dense		GC	8		59	R	4.6	1810	
GRAVELLY SAND -w/clay, sl. moist, lt. green			SC			51	SPT			
				9						
Continued Next Page										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: D = Bag, L = Liner, SPT = Standard Penetration Test, C = Core

NOTES:
Groundwater not encountered. Logged by Rick Ericksen

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PROJECT NO.: 64005007A

PAGE NUMBER: Page 2 of 7

PLATE: A-5

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

NO. 2

FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	EB-NH-095-2(029)	CLARK	BL-4

METRIC NDOT

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. ALL STATIONS AND OFFSETS ARE IN METERS.

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m	TESTS: ATTERBERG LIMITS
SANDY GRAVEL -w/silt, trace cobbles, sl. moist, white to lt. brown	very dense		GM							
GRAVELLY SAND -w/silt, sl. moist, white to lt. brown	dense to very dense		SM	6						
						51	R	3.3	1906	
SILTY SAND -very fine, sl. moist, lt. green	very dense					49	SPT			
SANDY GRAVEL -w/silt, sl. moist, white to lt. brown	dense		GM	6						
CLAYEY SILT -w/trace gravel, sl. moist, white	stiff		ML			23	R	8.0	1442	
SILTY SAND -sl. moist, lt. green	med. dense		SM	7						
						14	SPT	7.9		
SILTY CLAY -sl. moist, green to lt. green	stiff		CL							
SANDY GRAVEL -w/clay, trace silt, sl. moist, lt. green	very dense		GC	8		59	R	4.6	1810	
CRAVELLY SAND -w/clay, sl. moist, lt. green			SC			51	SPT			
				9						
Continued Next Page										

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: D = Bag, L = Liner, SPT = Standard Penetration Test, C = Core

NOTES: Groundwater not encountered. Logged by Rick Ericksen

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PAGE NUMBER: Page 2 of 7

PROJECT NO.: 64005007A

PLATE: A-5

NO. 2

FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	EB-NH-095-2(029)	CLARK	BL-4

METRIC NDOT

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. ALL STATIONS AND OFFSETS ARE IN METERS.

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m	TESTS: ATTERBERG LIMITS
SANDY GRAVEL -w/silt, trace cobbles, sl. moist, white to lt. brown	very dense		GM							
CRAVELLY SAND -w/silt, sl. moist, white to lt. brown	dense to very dense		SM	6						
SILTY SAND -very fine, sl. moist, lt. green	very dense					51	R	3.3	1906	
						49	SPT			
SANDY GRAVEL -w/silt, sl. moist, white to lt. brown	dense		GM	8						
CLAYEY SILT -w/trace gravel, sl. moist, white	stiff		ML							
SILTY SAND -sl. moist, lt. green	med. dense		SM			23	R	8.0	1442	
SILTY CLAY -sl. moist, green to lt. green	stiff		CL	7		14	SPT	7.9		
SANDY GRAVEL -w/clay, trace silt, sl. moist, lt. green	very dense		GC							
				8		59	R	4.6	1810	
CRAVELLY SAND -w/clay, sl. moist, lt. green			SC			51	SPT			
				9						
Continued Next Page										

THE CLASSIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: D = Bag, L = Liner, SPT = Standard Penetration Test, C = Core

NOTES: Groundwater not encountered. Logged by Rick Ericksen

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PAGE NUMBER: Page 2 of 7

PROJECT NO.: 64005007A

PLATE: A-5

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

NO. 2

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

SOIL DESCRIPTION	CONSISTENCY	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m	TESTS: ATTERBERG LIMITS
GRAVELLY SAND -w/clay, sl. moist, lt. green	very dense	SC							
SILTY SAND -sl. moist, lt. green	dense	SM	10		68	R	11.7	1554	
					33	SPT			
SANDY CLAY - sl. moist, lt. green	very stiff	CL	11						
CLAYEY SAND -w/occ. partially cemented lenses, sl. moist, lt. green	dense	SC			66	R	8.3	1522	
SILTY SAND -sl. moist, lt. green		SM	12		35	SPT			
CLAYEY SAND -sl. moist, lt. gray		SC							
SANDY CLAY -w/silt, sl. moist, white to lt. green	very stiff	CL							
w/occ. clayey sand lenses			13		50/ 0.15	R	9.1	1249	
w/trace gravel					69	SPT			
Continued Next Page									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag, L = Liner, SPT = Standard Penetration Test, C = Core

NOTES: Groundwater not encountered. Logged by Rick Erickson

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

PAGE NUMBER: Page 3 of 7

PROJECT NO.: 64005007A

PLATE: A-6

LOG OF BORING NO.

LOG OF BORING NO. 2

CLIENT: Parsons Transportation Group

PROJECT: Torrey Pines Drive Bridge

BORING LOCATION: See Alignment Plan

ELEVATION (m): 713.64

SITE: Torrey Pines and US 95

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (m)	SAMPLES: SAMPLE	SAMPLES: BLOWS/0.3m	SAMPLES: TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY kg/m³	TESTS: ATTERBERG LIMITS
SANDY GRAVEL -w/clay, dry to sl. moist, white to lt. brown	very dense to mod.hard									
CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown				28		50/ 0	R & SPT			
w/partially cemented lenses	mod. hard			29						
						50/ 0.06	SPT			
Bottom at 30.48 meters				30						
				31						
				32						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: B = Bag, L = Liner, SPT = Standard Penetration Test, C = Core

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

NOTES: Groundwater not encountered. Logged by Rick Ericksen

DRIVING WEIGHT (kg): 63.5

Terracon

DATE DRILLED: 5-8-00

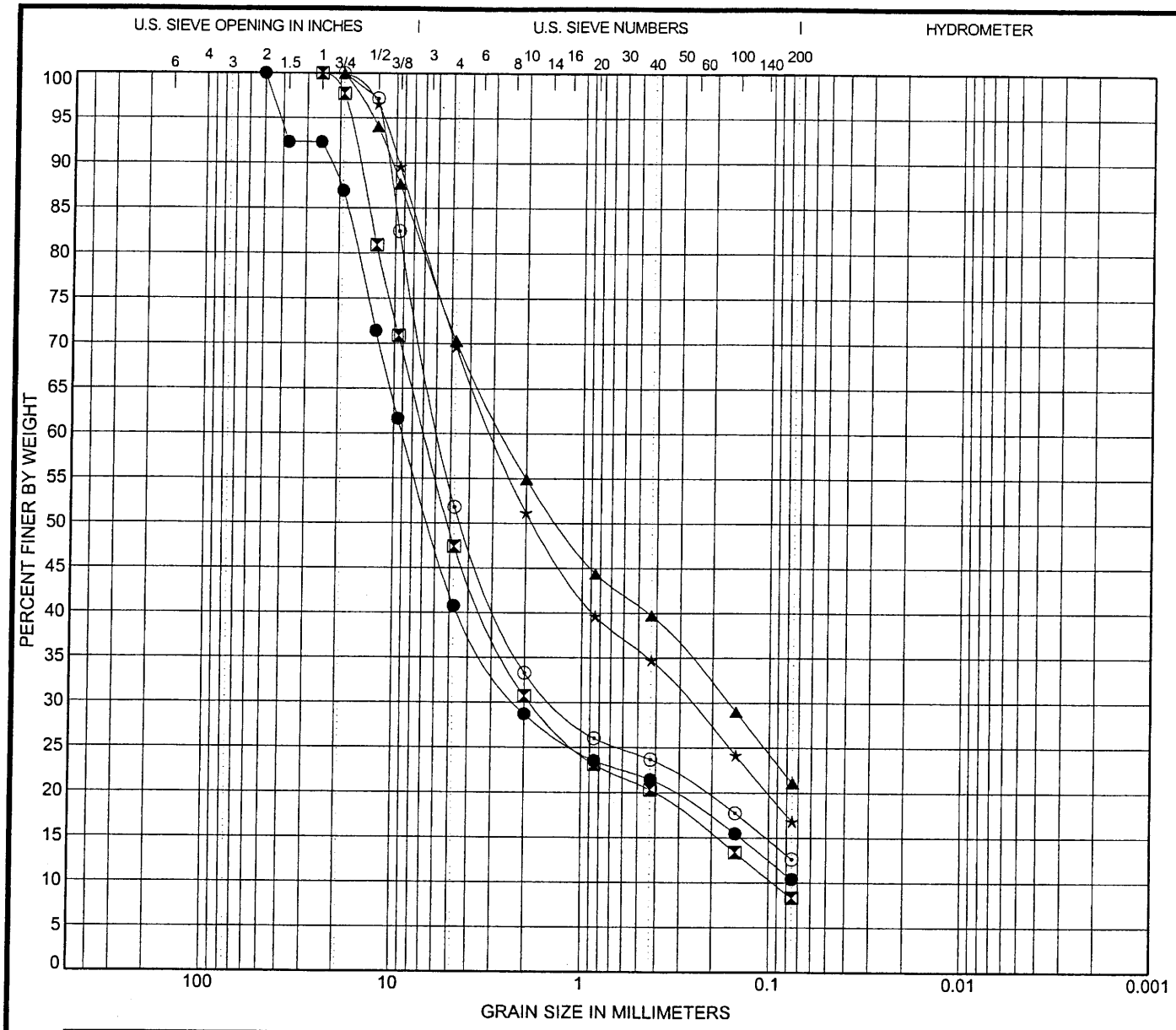
PROJECT NO.: 64005007A

PAGE NUMBER: Page 7 of 7

PLATE: A-10

APPENDIX II

TEST RESULTS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-01	1.9	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	28	16	12	7.56	127.23
⊠	B-01	6.5	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	21	15	6	5.24	73.19
▲	B-01	7.7	CLAYEY SAND with GRAVEL (SC)	31	19	12		
★	B-01	9.9	CLAYEY SAND with GRAVEL (SC)	29	18	11		
⊙	B-01	12.6	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	21	14	7		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-01	1.9	50	8.988	2.191		2.3	59.2	30.3	10.4	
⊠	B-01	6.5	25	6.894	1.844	0.094	1.4	52.6	39.0	8.3	
▲	B-01	7.7	19	2.66	0.165		4.2	29.7	49.2	21.1	
★	B-01	9.9	19	3.022	0.266		2.6	30.3	52.8	16.8	
⊙	B-01	12.6	19	5.716	1.357		2.0	48.2	39.2	12.6	

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Reno, Nevada 89502-7140
Telephone: (775) 359-6600
Fax: (775) 359-7766

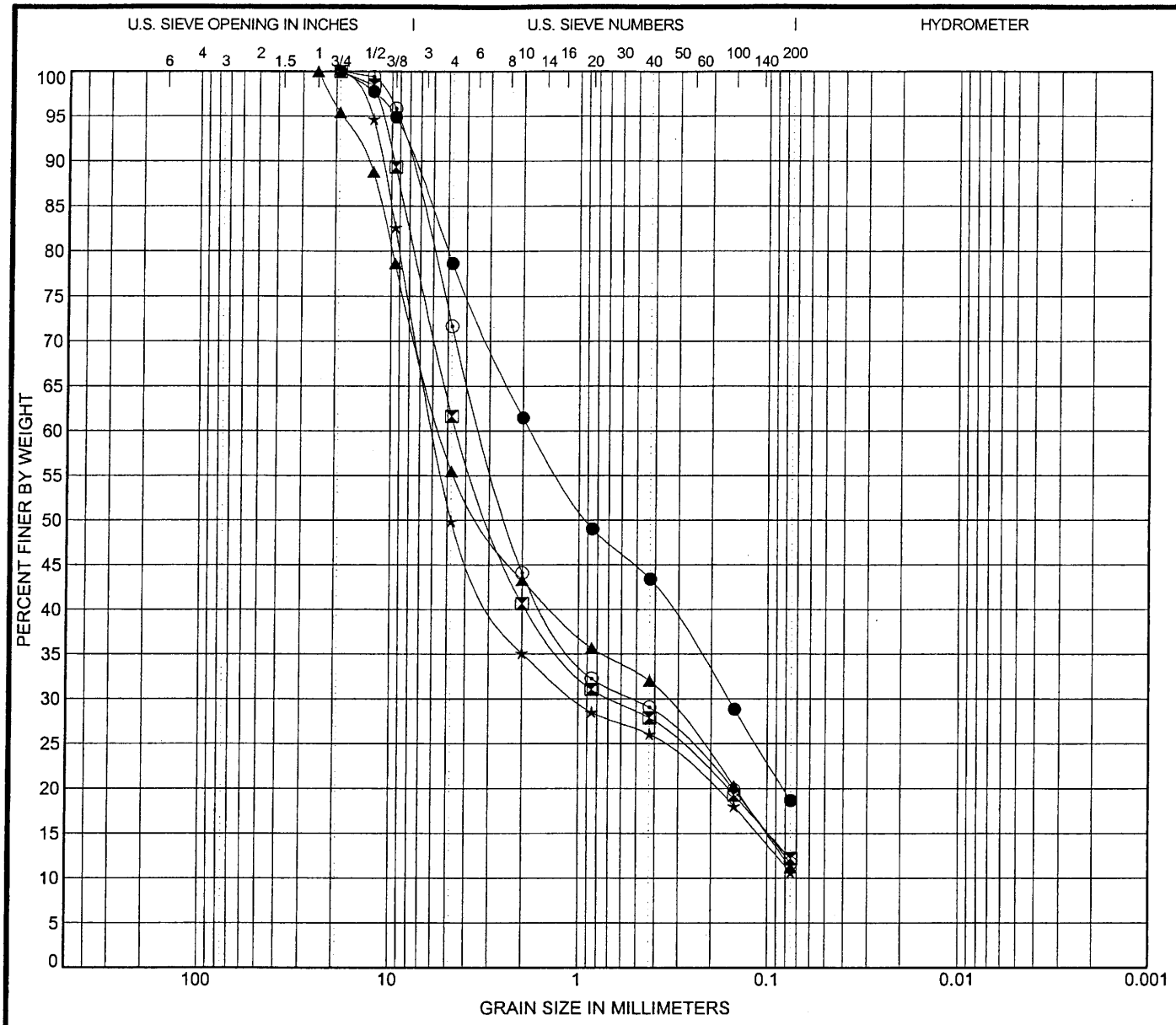
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-1 Plate Number: 4a

US GRAIN SIZE2 METRIC 0324011.GPJ US LAB.GDT 5/28/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-01	16.0	CLAYEY SAND with GRAVEL (SC)	26	17	9		
⊠	B-01	18.7	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	19	15	4	1.71	73.35
▲	B-01	21.7	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	18	15	3	0.34	79.38
★	B-01	24.8	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	18	14	4	2.56	83.37
⊙	B-01	29.3	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	NV	NV	NP	1.27	50.70

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-01	16.0	19	1.806	0.163		2.9	21.3	60.0	18.7	
⊠	B-01	18.7	19	4.44	0.677		2.4	38.4	49.4	12.2	
▲	B-01	21.7	25	5.44	0.356		2.6	44.5	44.3	11.2	
★	B-01	24.8	19	5.882	1.031		2.1	50.1	39.3	10.7	
⊙	B-01	29.3	19	3.294	0.522		2.5	28.3	60.0	11.7	

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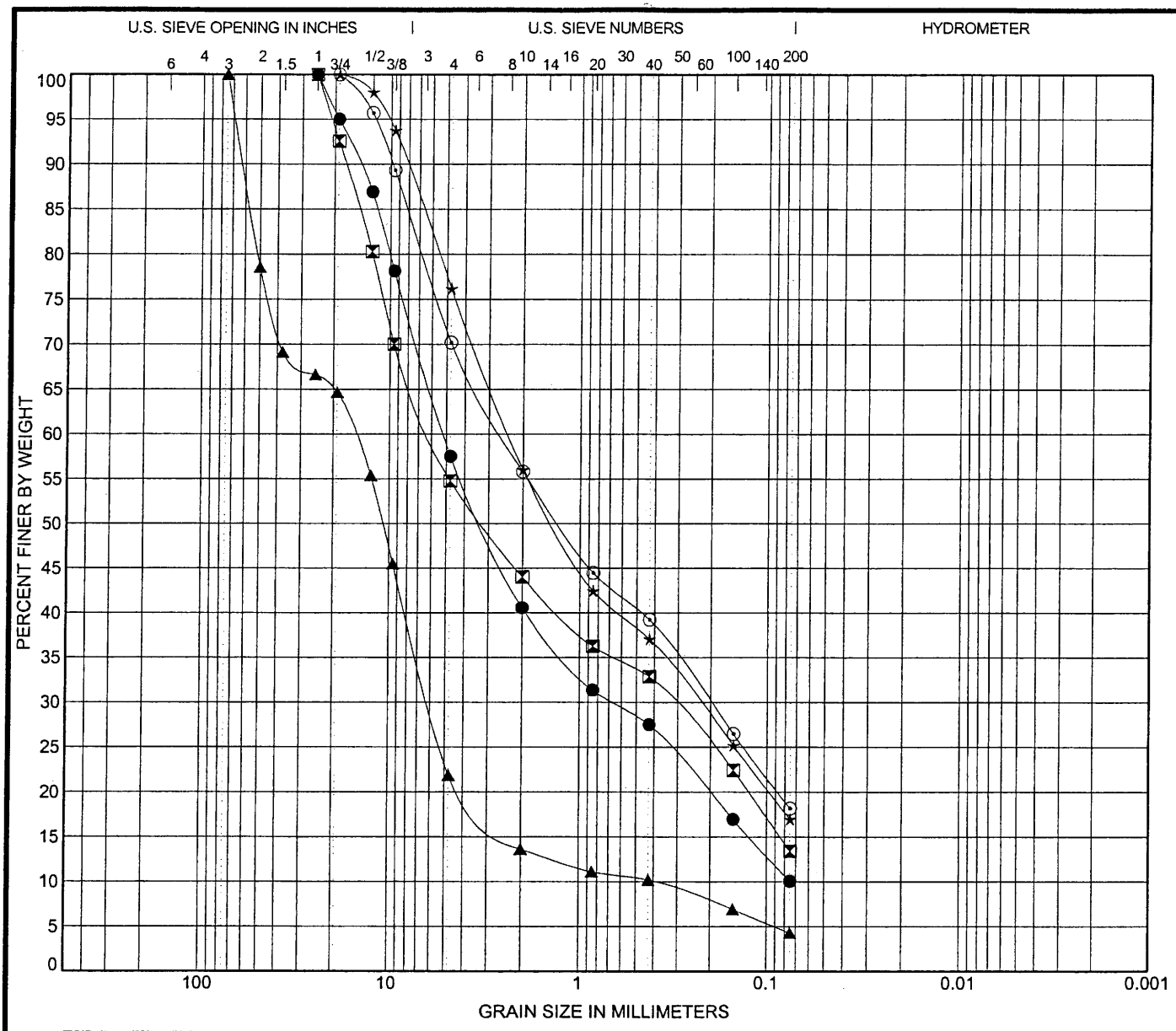
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-1 Plate Number: 4b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-02	1.9	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	20	17	3	1.15	69.43
⊠	B-02	3.4	CLAYEY GRAVEL with SAND (GC)	28	17	11		
▲	B-02	5.0	POORLY GRADED GRAVEL with SAND (GP)	26	17	9	5.99	39.01
★	B-02	6.5	CLAYEY SAND with GRAVEL (SC)	30	18	12		
⊙	B-02	7.7	CLAYEY SAND with GRAVEL (SC)	48	24	24		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-02	1.9	25	5.16	0.665		1.3	42.5	47.4	10.1	
⊠	B-02	3.4	25	6.02	0.319		2.5	45.2	41.4	13.4	
▲	B-02	5.0	75	15.389	6.033	0.394	0.7	78.2	17.5	4.3	
★	B-02	6.5	19	2.37	0.229		2.8	23.8	59.2	17.0	
⊙	B-02	7.7	19	2.571	0.2		4.4	29.8	52.0	18.2	

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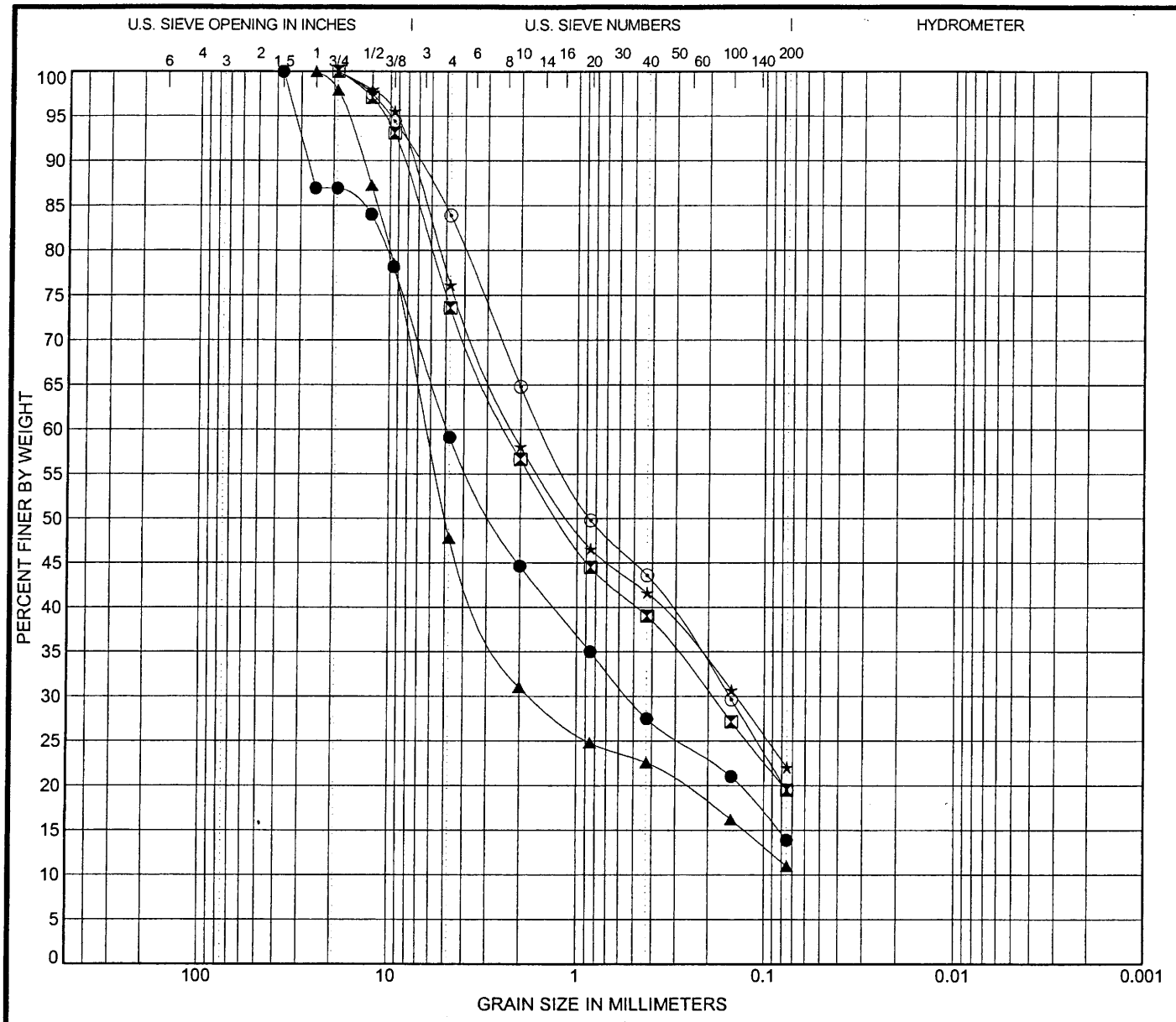
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-1 Plate Number: 4c



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-02	11.0	CLAYEY SAND with GRAVEL (SC)	32	18	14		
⊠	B-02	13.7	CLAYEY SAND with GRAVEL (SC)	26	16	10		
▲	B-02	15.6	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	22	16	6	7.36	95.37
★	B-02	16.8	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	21	14	7		
⊙	B-02	21.3	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	21	15	6		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-02	11.0	37.5	4.905	0.536		2.9	40.9	45.2	13.9	
⊠	B-02	13.7	19	2.374	0.193		2.6	26.4	54.1	19.5	
▲	B-02	15.6	25	6.256	1.738		1.8	52.2	36.8	11.0	
★	B-02	16.8	19	2.192	0.142		2.6	23.8	54.1	22.0	
⊙	B-02	21.3	19	1.521	0.154		2.6	16.1	64.4	19.5	

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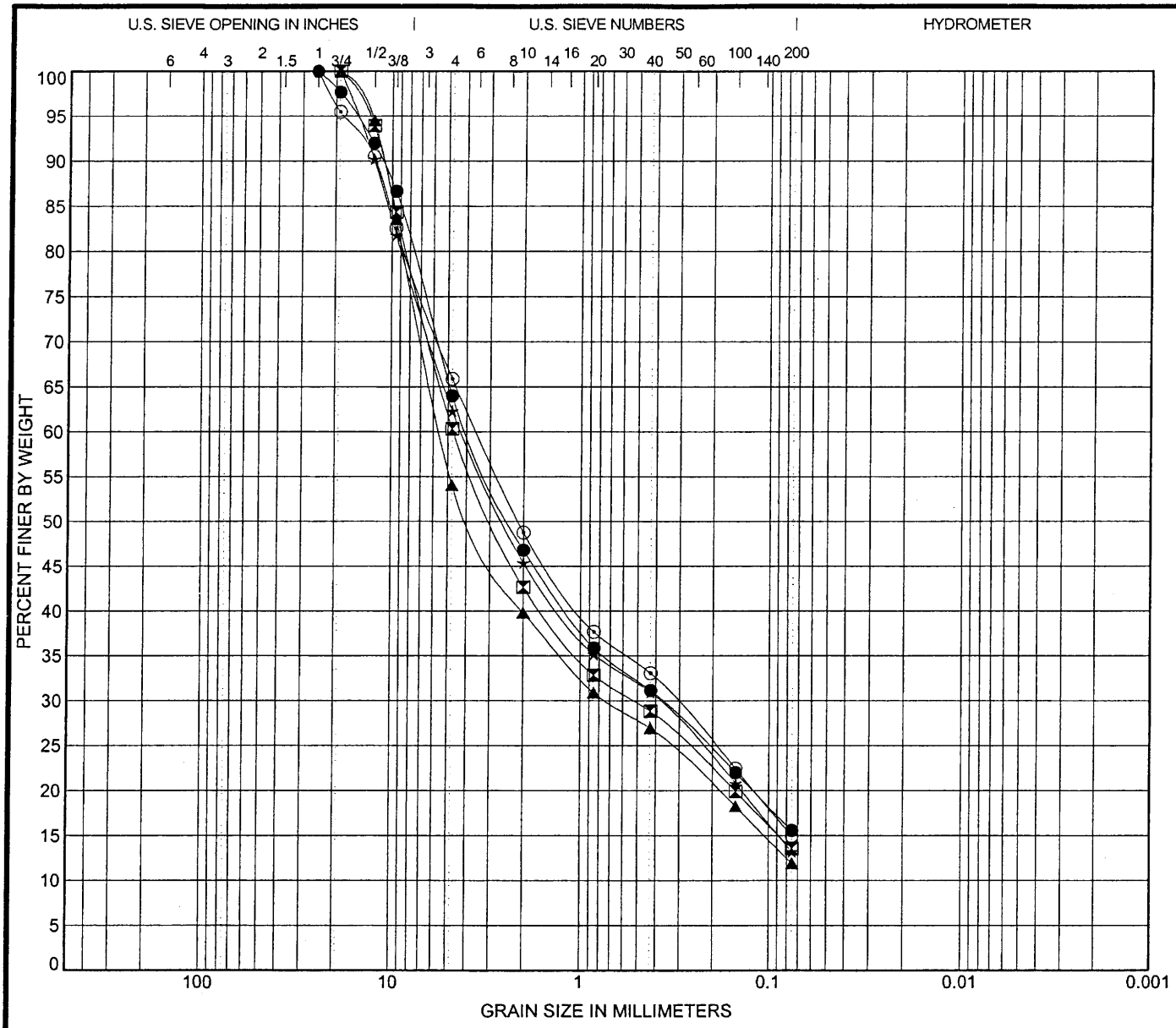
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-1 Plate Number: 4d



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-03	1.9	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	19	14	5		
⊠	B-03	3.4	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	19	15	4		
▲	B-03	5.0	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	17	15	2	1.59	90.02
★	B-03	6.5	SILTY SAND with GRAVEL (SM)	17	14	3		
⊙	B-03	9.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	19	14	5		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-03	1.9	25	3.882	0.373		0.9	36.0	48.4	15.6	
⊠	B-03	3.4	19	4.678	0.521		0.9	39.7	46.8	13.6	
▲	B-03	5.0	19	5.462	0.727		0.7	46.0	42.1	11.9	
★	B-03	6.5	19	4.221	0.385		1.8	37.7	49.1	13.2	
⊙	B-03	9.5	25	3.529	0.315		1.5	34.1	50.9	15.0	

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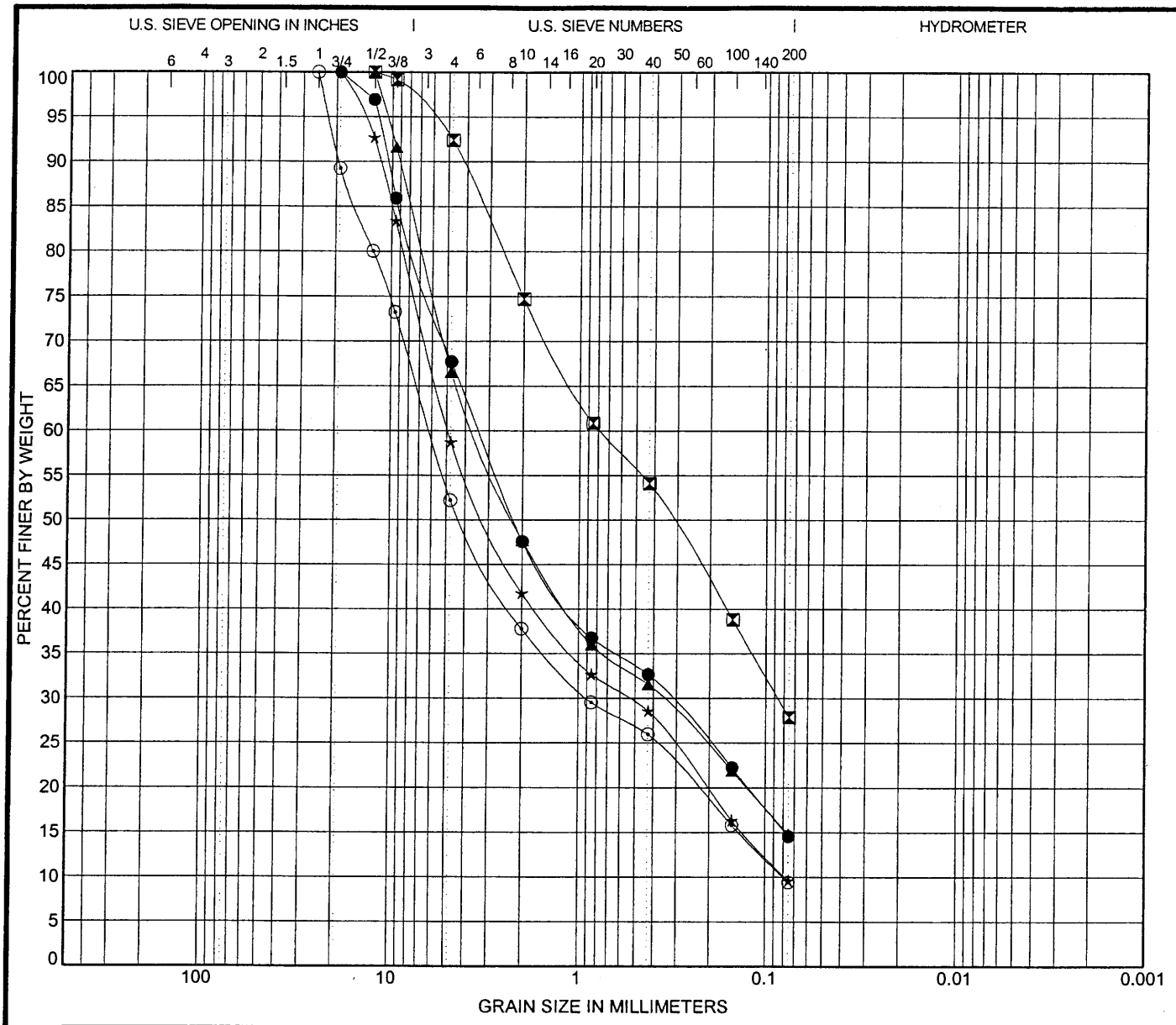
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-1 Plate Number: 4e

US_GRAIN_SIZE2_METRIC_0324011.GPJ US_LAB.GDT 5/28/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-03	12.6	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	19	15	4		
⊠	B-03	14.1	CLAYEY SAND (SC)	26	16	10		
▲	B-03	15.6	SILTY SAND with GRAVEL (SM)	15	14	1		
★	B-04	1.9	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	18	16	2	0.76	63.28
⊙	B-04	3.4	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	18	15	3	1.63	77.14

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-03	12.6	19	3.408	0.325		1.4	32.3	53.2	14.6	
⊠	B-03	14.1	12.5	0.777	0.086		3.8	7.6	64.5	27.9	
▲	B-03	15.6	12.5	3.514	0.359		2.0	33.4	51.7	14.8	
★	B-04	1.9	19	4.919	0.54	0.078	0.7	41.2	49.1	9.7	
⊙	B-04	3.4	25	6.139	0.892	0.08	0.8	47.8	42.8	9.5	

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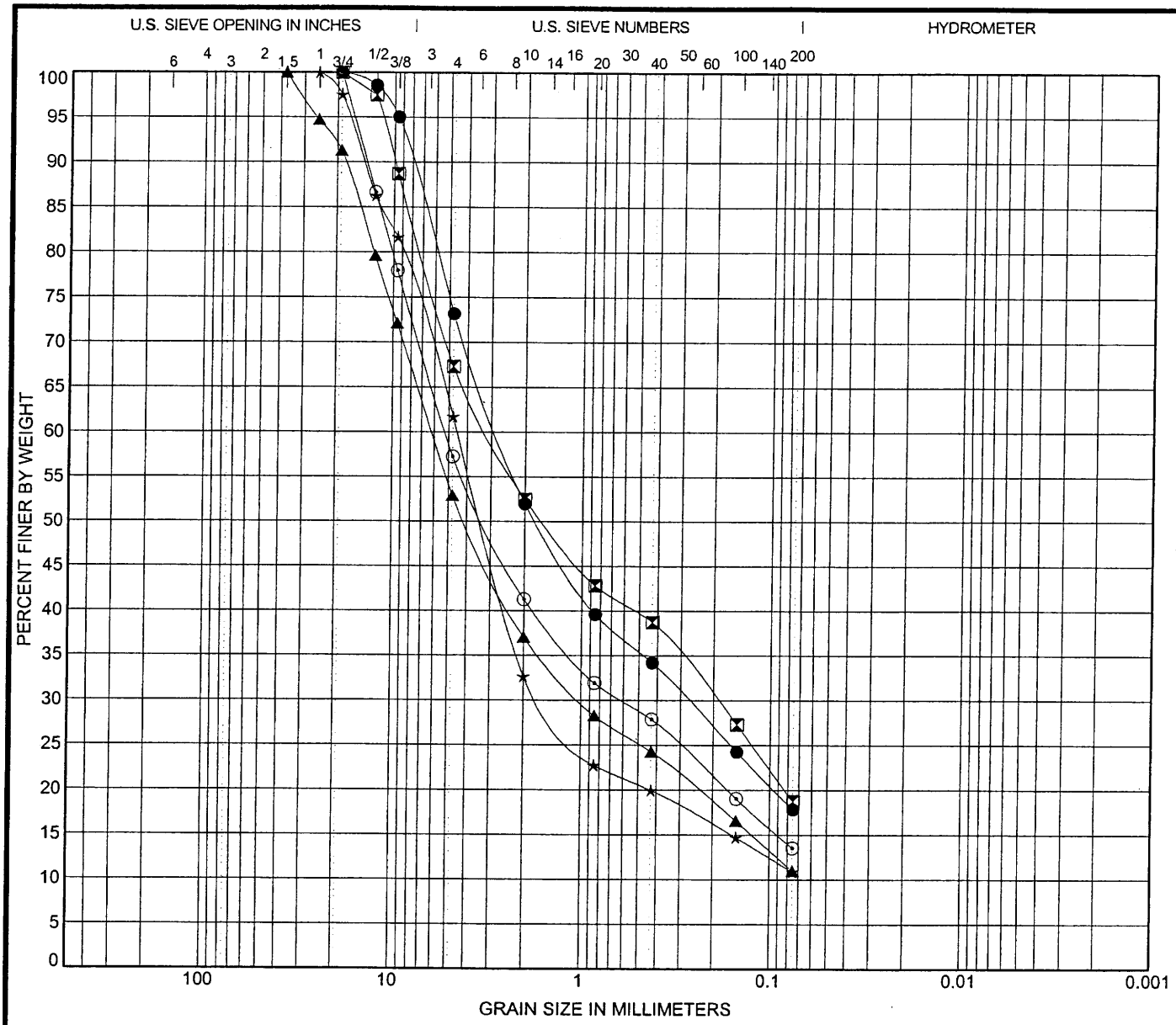
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-1 Plate Number: 4f

US_GRAIN_SIZE2 METRIC_0324011.GPJ US_LAB.GDT 5/28/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-04	7.7	CLAYEY SAND with GRAVEL (SC)	32	20	12		
⊠	B-04	10.7	CLAYEY SAND with GRAVEL (SC)	30	19	11		
▲	B-07	1.1	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	21	16	5	2.50	92.84
★	B-07	2.6	POORLY GRADED SAND with SILTY CLAY and GRAVEL (SP-SC)	21	16	5	8.85	71.06
⊙	B-07	4.1	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	20	15	5		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-04	7.7	19	2.773	0.274		2.3	26.8	55.3	17.8	
⊠	B-04	10.7	19	3.1	0.192		3.2	32.7	48.6	18.7	
▲	B-07	1.1	37.5	6.133	1.006		1.4	47.1	41.9	11.0	
★	B-07	2.6	25	4.511	1.592		1.4	38.3	50.8	10.9	
⊙	B-07	4.1	19	5.207	0.61		1.9	42.7	43.7	13.5	

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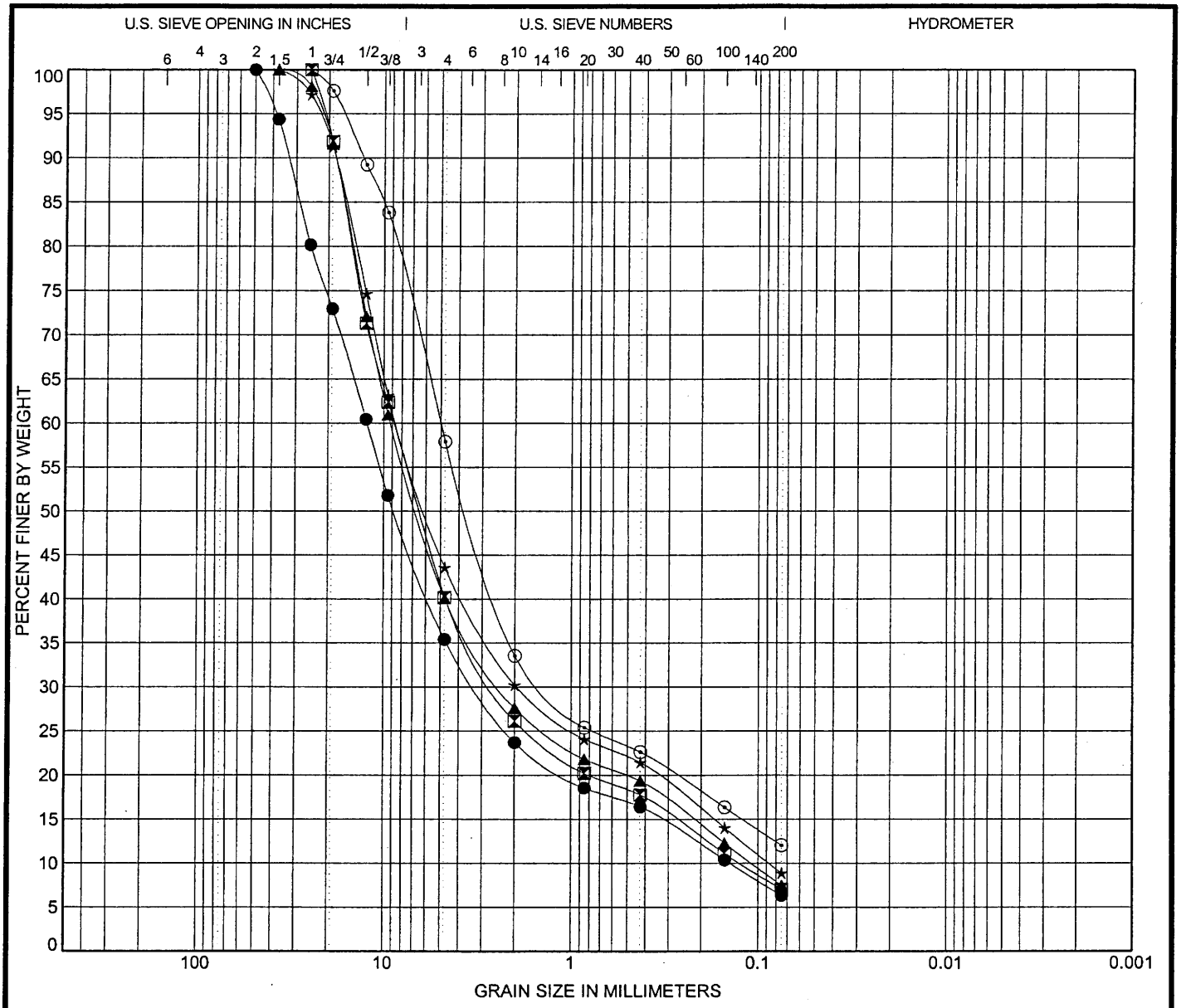
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-1 Plate Number: 4g



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-05	1.1	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	18	17	1	5.89	87.91
⊠	B-05	2.6	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	20	17	3	5.91	71.17
▲	B-05	4.1	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	20	17	3	5.64	85.58
★	B-05	5.6	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	18	17	1	5.10	97.55
⊙	B-05	11.7	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	22	17	5	7.04	93.24

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-05	1.1	50	12.326	3.19	0.14	1.0	64.6	29.0	6.4	
⊠	B-05	2.6	25	8.816	2.541	0.124	1.0	59.8	33.1	7.1	
▲	B-05	4.1	37.5	9.208	2.364	0.108	1.3	60.0	32.5	7.5	
★	B-05	5.6	37.5	8.492	1.941	0.087	1.4	56.4	34.7	8.9	
⊙	B-05	11.7	25	5.025	1.381		2.4	42.1	45.9	12.0	

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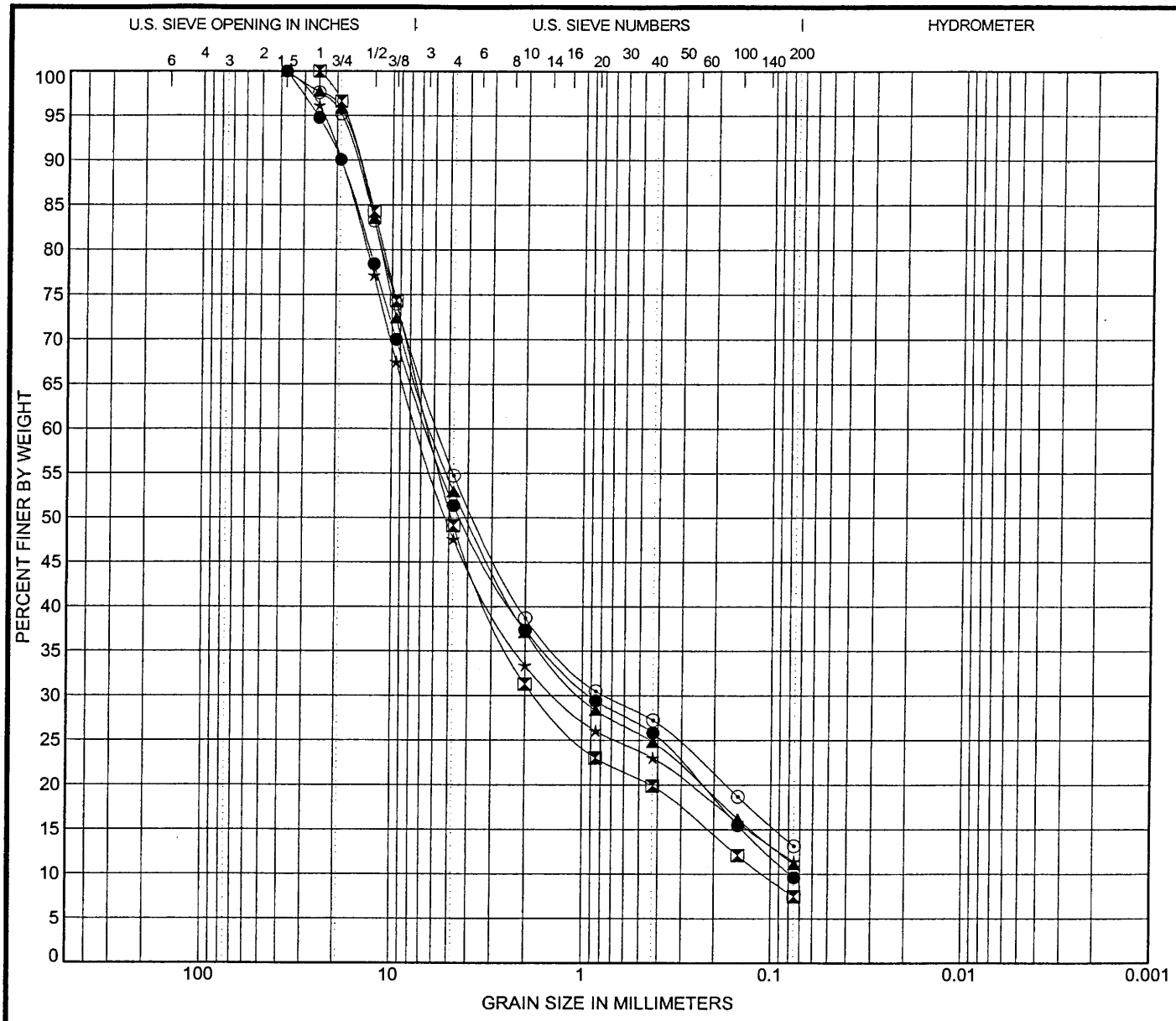
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4a

US GRAIN SIZE2 METRIC 0324011.GPJ US LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-06	1.1	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	NV	NV	NP	1.59	83.56
⊠	B-06	2.6	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	NV	NV	NP	4.38	58.57
▲	B-06	4.1	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	19	16	3	2.54	95.24
★	B-06	5.6	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	23	17	6	4.14	122.32
⊙	B-06	11.7	SILTY GRAVEL with SAND (GM)	17	17	NP		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-06	1.1	37.5	6.551	0.904	0.078	1.3	48.6	41.7	9.6	
⊠	B-06	2.6	25	6.406	1.752	0.109	1.3	50.9	41.6	7.5	
▲	B-06	4.1	37.5	6.106	0.998		2.0	47.0	41.8	11.1	
★	B-06	5.6	37.5	7.321	1.347		2.1	52.4	36.2	11.4	
⊙	B-06	11.7	37.5	5.741	0.764		2.7	45.3	41.6	13.1	

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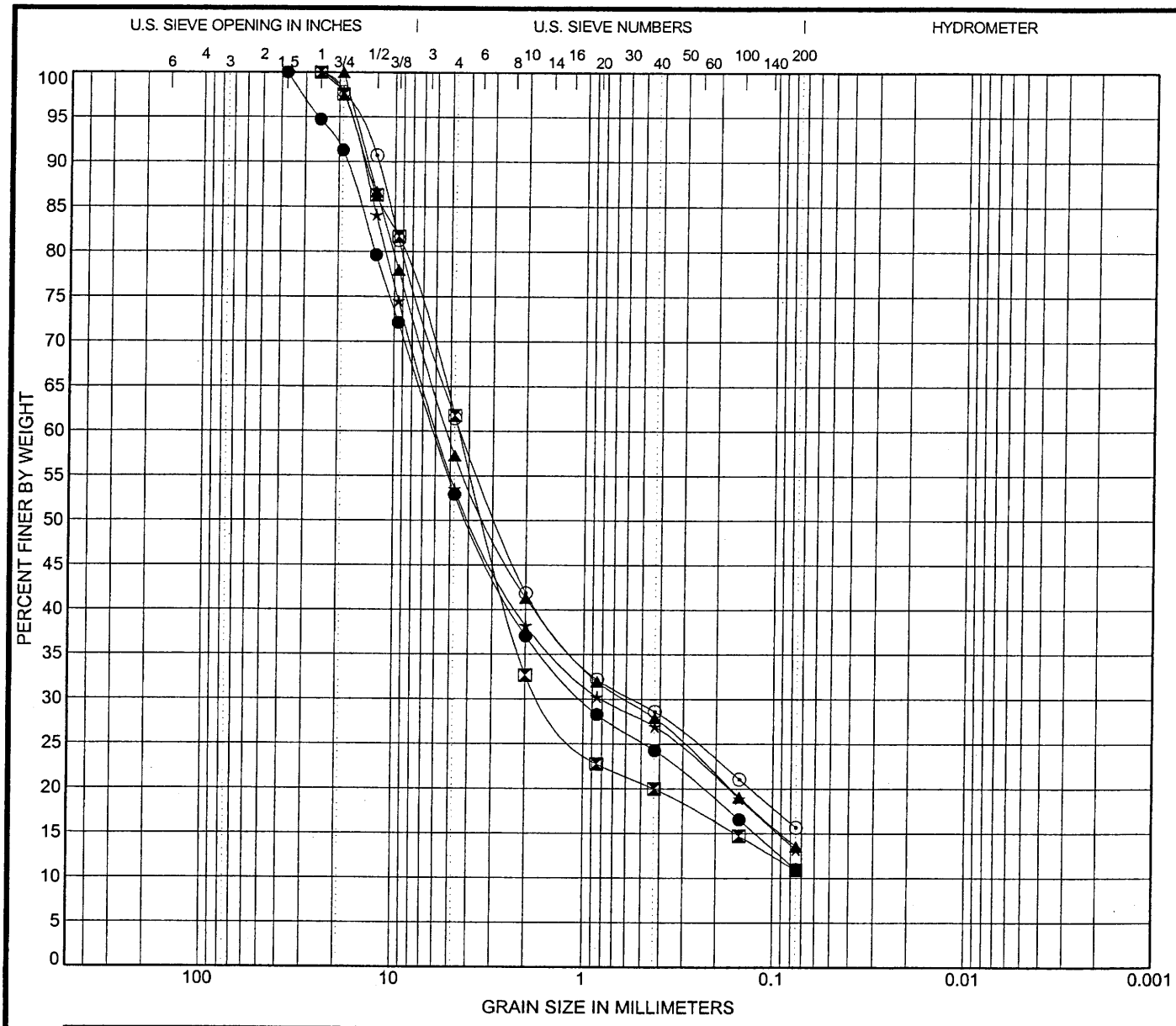
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4b

US GRAIN SIZE2 METRIC 0324011.GPJ US LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-07	1.1	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	21	16	5	2.50	92.84
⊠	B-07	2.6	POORLY GRADED SAND with SILTY CLAY and GRAVEL (SP-SC)	21	16	5	8.85	71.06
▲	B-07	4.1	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	20	15	5		
★	B-07	5.6	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	24	17	7		
⊙	B-07	11.7	SILTY SAND with GRAVEL (SM)	19	16	3		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-07	1.1	37.5	6.133	1.006		1.4	47.1	41.9	11.0	
⊠	B-07	2.6	25	4.511	1.592		1.4	38.3	50.8	10.9	
▲	B-07	4.1	19	5.207	0.61		1.9	42.7	43.7	13.5	
★	B-07	5.6	25	5.88	0.807		2.3	46.5	40.3	13.2	
⊙	B-07	11.7	25	4.457	0.558		2.6	38.6	45.8	15.7	

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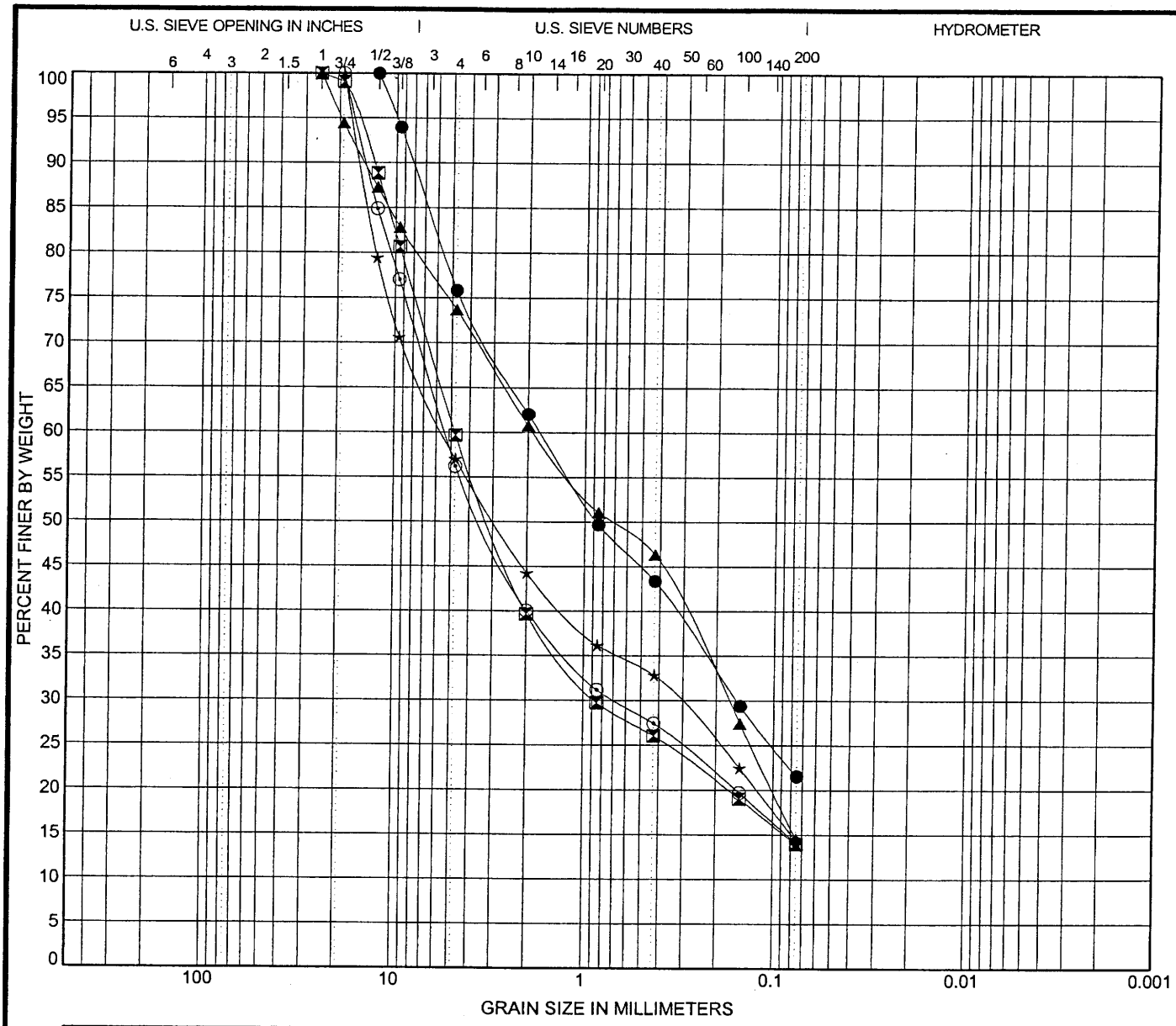
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4c

US GRAIN SIZE2 METRIC 0324011.GPJ US LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-07	14.8	CLAYEY SAND with GRAVEL (SC)	45	26	19		
⊠	B-07	15.4	CLAYEY SAND with GRAVEL (SC)	23	15	8		
▲	B-07	23.9	SILTY SAND with GRAVEL (SM)	NV	NV	NP		
★	B-08	1.1	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	20	16	4		
⊙	B-08	4.1	CLAYEY GRAVEL with SAND (GC)	27	17	10		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-07	14.8	12.5	1.736	0.157		4.1	24.2	54.3	21.5	
⊠	B-07	15.4	25	4.806	0.87		2.4	40.4	45.7	14.0	
▲	B-07	23.9	25	1.874	0.173		3.0	26.3	59.1	14.5	
★	B-08	1.1	19	5.536	0.32		0.9	43.0	42.6	14.4	
⊙	B-08	4.1	19	5.391	0.684		3.6	43.8	42.1	14.1	

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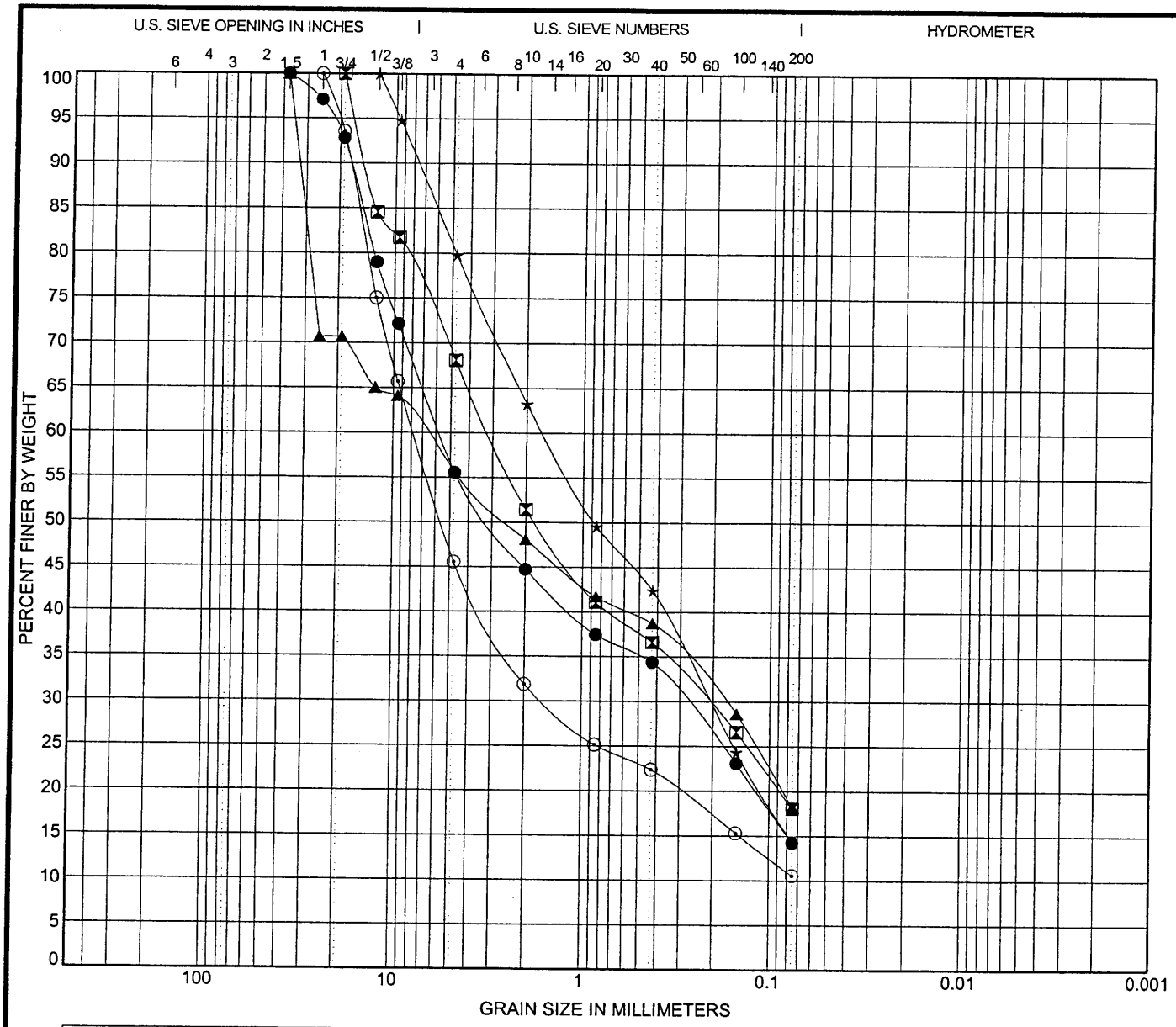
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4d



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-08	5.6	SILTY GRAVEL with SAND (GM)	15	13	2		
⊠	B-08	7.2	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	20	15	5		
▲	B-08	8.7	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	19	14	5		
★	B-08	20.9	CLAYEY SAND with GRAVEL (SC)	26	18	8		
⊙	B-09	1.1	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	26	19	7	4.63	113.32

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-08	5.6	37.5	5.719	0.284		4.7	44.4	41.3	14.2	
⊠	B-08	7.2	19	3.123	0.214		3.0	31.9	50.0	18.0	
▲	B-08	8.7	37.5	6.793	0.173		4.6	44.4	37.4	18.2	
★	B-08	20.9	12.5	1.631	0.208		1.5	20.2	65.4	14.3	
⊙	B-09	1.1	25	7.812	1.578		1.4	54.5	34.9	10.6	

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GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4e

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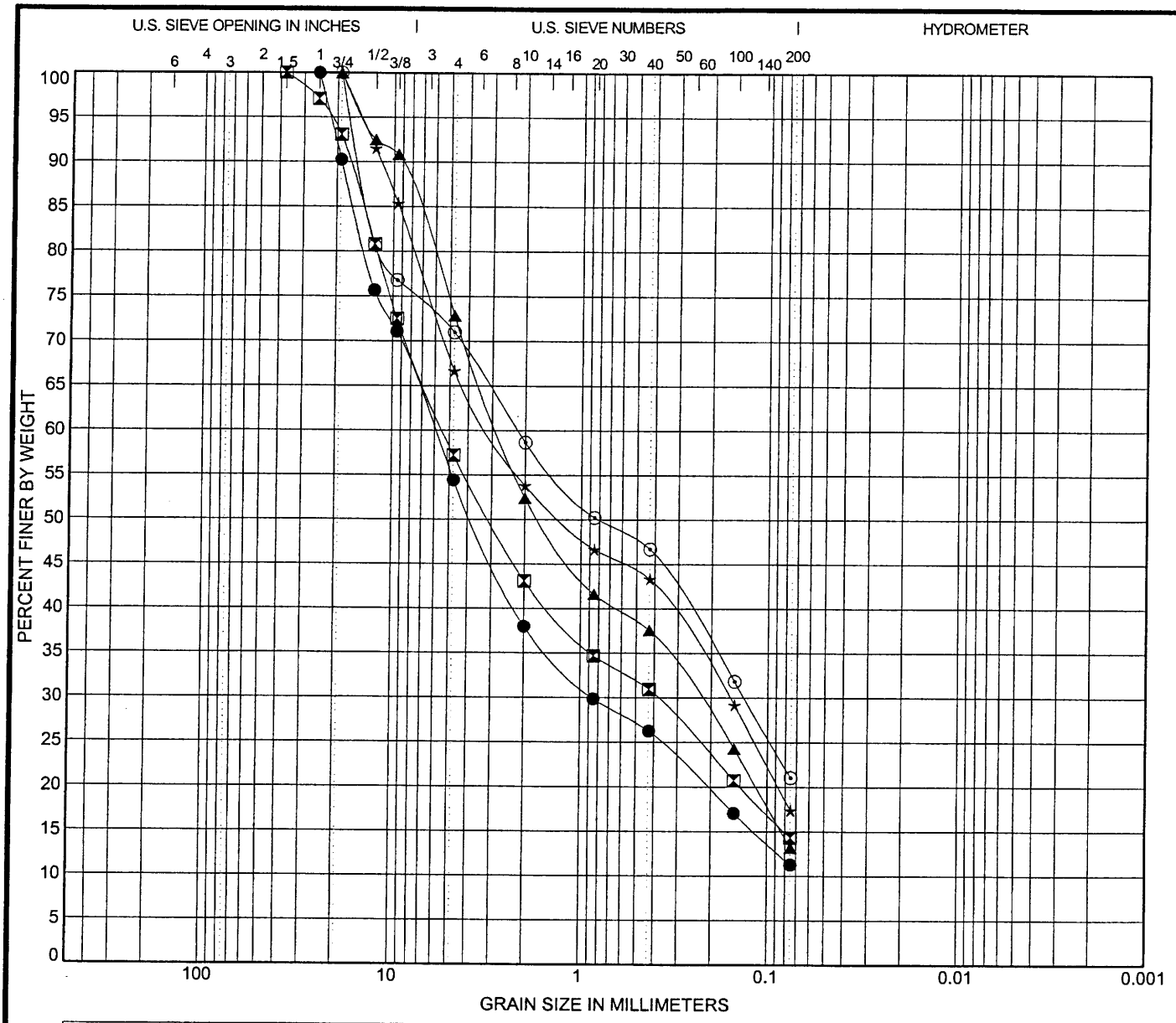

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-09	2.6	WELL-GRADED GRAVEL with CLAY and SAND (GW-GC)	30	21	9	1.94	93.34
⊠	B-09	4.1	CLAYEY SAND with GRAVEL (SC)	38	21	17		
▲	B-09	5.6	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	27	21	6		
★	B-09	7.2	CLAYEY SAND with GRAVEL (SC)	39	24	15		
⊙	B-09	10.2	CLAYEY SAND with GRAVEL (SC)	34	22	12		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-09	2.6	25	5.989	0.863		2.3	45.6	43.1	11.3	
⊠	B-09	4.1	37.5	5.394	0.386		4.1	42.8	42.9	14.3	
▲	B-09	5.6	19	2.758	0.235		2.7	27.2	59.6	13.2	
★	B-09	7.2	19	3.032	0.159		4.4	33.3	49.3	17.4	
⊙	B-09	10.2	19	2.197	0.133		5.9	29.0	50.0	21.0	

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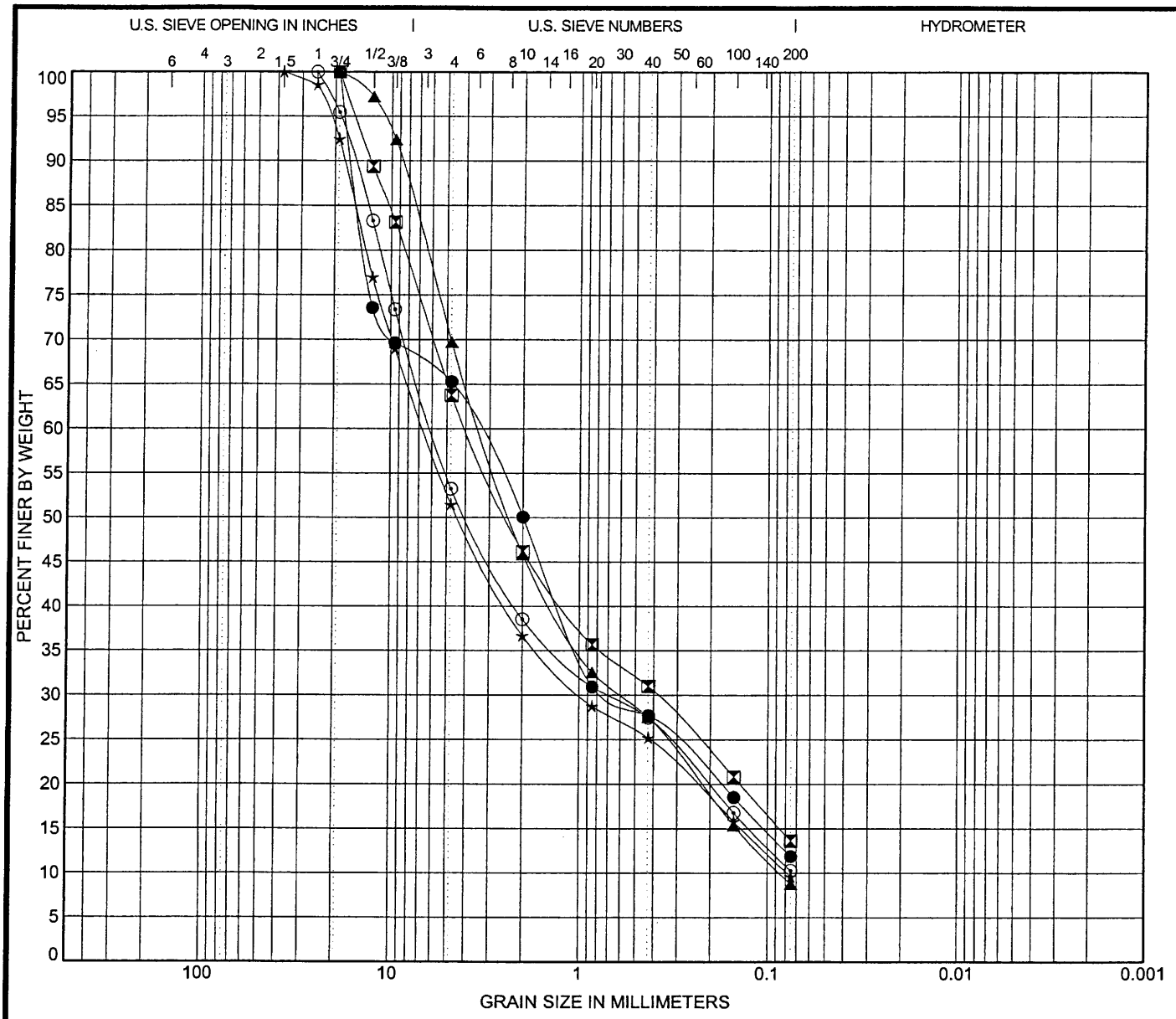
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4f

US GRAIN SIZE2 METRIC 0324011.GPJ US_LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-09	14.8	WELL-GRADED SAND with CLAY and GRAVEL (SW-SC)	28	20	8	2.25	57.32
⊠	B-10	1.1	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	27	20	7		
▲	B-10	2.6	WELL-GRADED SAND with CLAY and GRAVEL (SW-SC)	39	23	16	1.26	39.22
★	B-10	4.1	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	20	17	3	1.82	85.22
⊙	B-10	5.6	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	22	18	4	1.14	82.38

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-09	14.8	19	3.519	0.698		1.7	34.7	53.4	11.9	
⊠	B-10	1.1	19	3.949	0.385		2.2	36.2	50.2	13.6	
▲	B-10	2.6	19	3.341	0.599	0.085	0.7	30.3	60.9	8.8	
★	B-10	4.1	37.5	6.659	0.973	0.078	1.3	48.5	41.8	9.6	
⊙	B-10	5.6	25	5.994	0.706		1.6	46.8	43.0	10.3	

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GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4g

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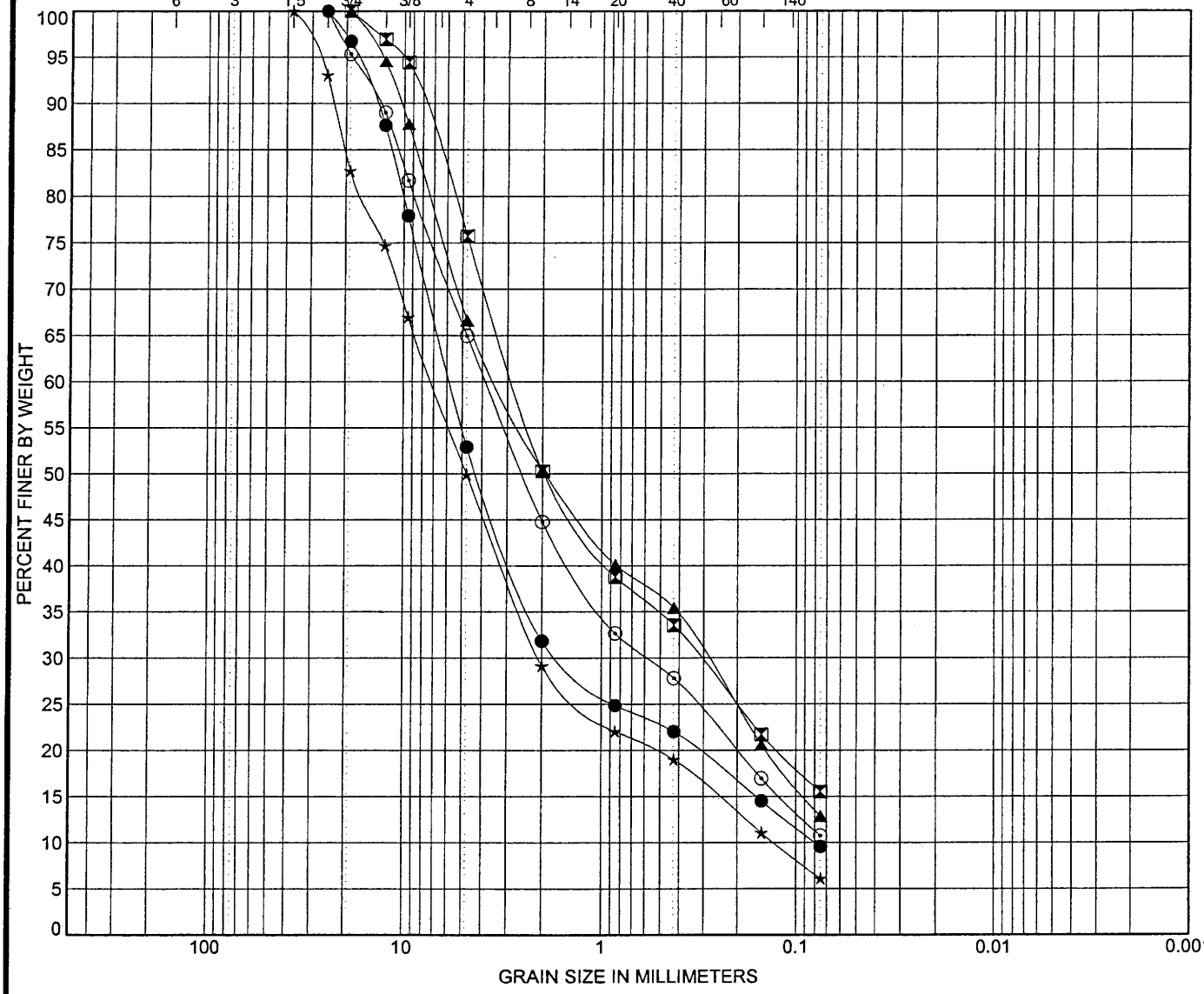

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-10	5.9	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	19	16	3	5.55	72.65
⊠	B-10	17.8	CLAYEY SAND with GRAVEL (SC)	31	20	11		
▲	B-10	22.4	CLAYEY SAND with GRAVEL (SC)	32	20	12		
★	B-11	1.1	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	NV	NV	NP	4.65	55.46
⊙	B-11	2.6	WELL-GRADED SAND with SILTY CLAY and GRAVEL (SW-SC)	21	16	5	1.28	55.65

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-10	5.9	25	5.782	1.598	0.08	1.3	47.1	43.3	9.6	
⊠	B-10	17.8	19	2.785	0.311		2.5	24.3	60.2	15.5	
▲	B-10	22.4	19	3.339	0.291		2.6	33.4	53.8	12.9	
★	B-11	1.1	37.5	7.159	2.073	0.129	0.7	50.1	43.8	6.1	
⊙	B-11	2.6	25	3.841	0.582		1.6	35.0	54.2	10.7	

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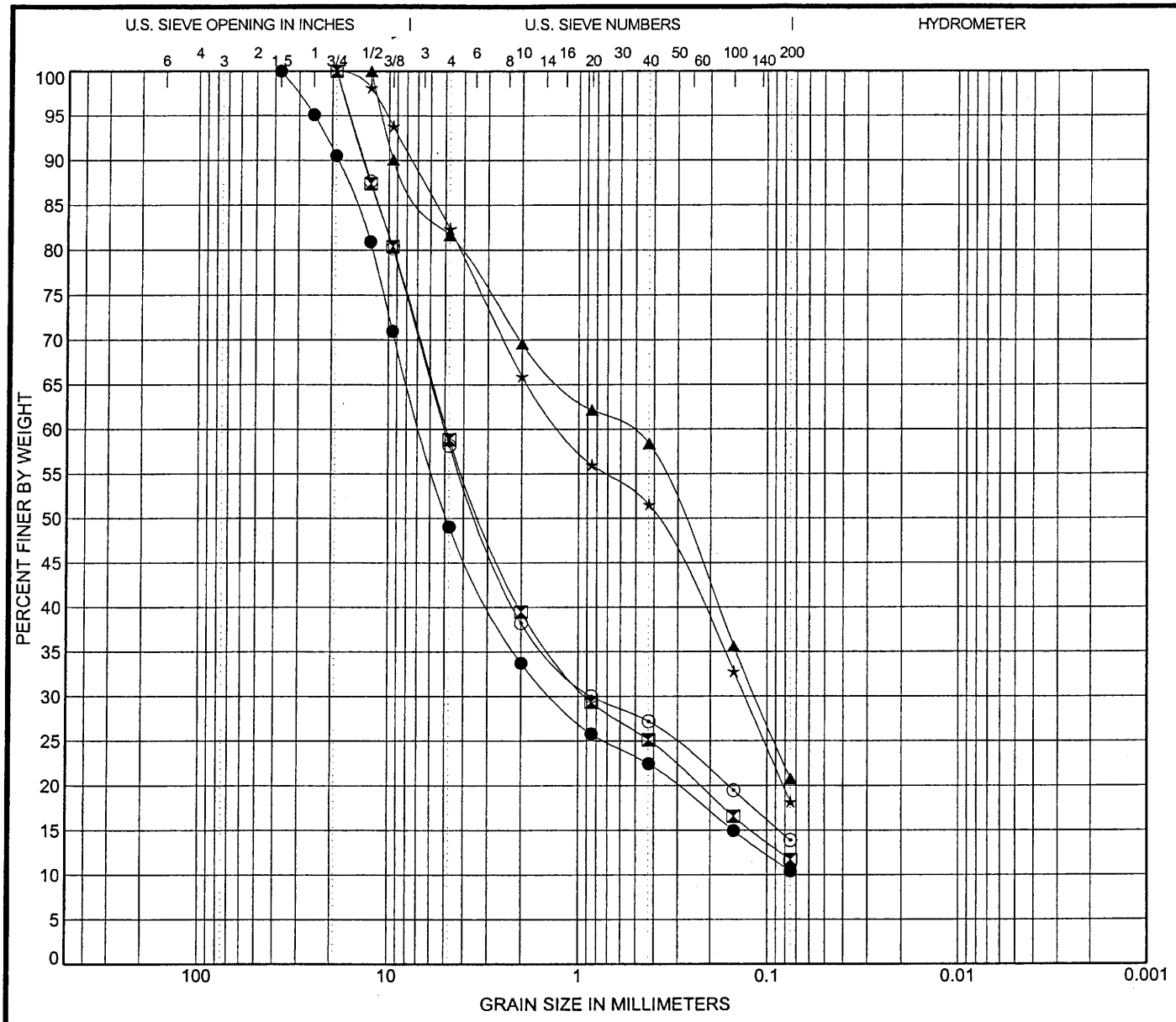
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4h

US GRAIN SIZE2 METRIC 0324011.GPJ US_LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-11	4.1	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	26	19	7	3.79	95.50
⊠	B-11	5.6	WELL-GRADED SAND with CLAY and GRAVEL (SW-SC)	30	19	11	2.80	83.94
▲	B-11	7.2	CLAYEY SAND with GRAVEL (SC)	40	22	18		
★	B-11	8.7	CLAYEY SAND with GRAVEL (SC)	35	22	13		
⊙	B-11	14.8	CLAYEY SAND with GRAVEL (SC)	26	17	9		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-11	4.1	37.5	6.716	1.338		0.9	51.0	38.6	10.4	
⊠	B-11	5.6	19	4.93	0.901		2.4	41.2	47.1	11.7	
▲	B-11	7.2	12.5	0.573	0.116		6.7	18.4	60.9	20.8	
★	B-11	8.7	19	1.2	0.132		5.9	17.6	64.2	18.1	
⊙	B-11	14.8	19	5.035	0.85		2.8	41.9	44.3	13.9	

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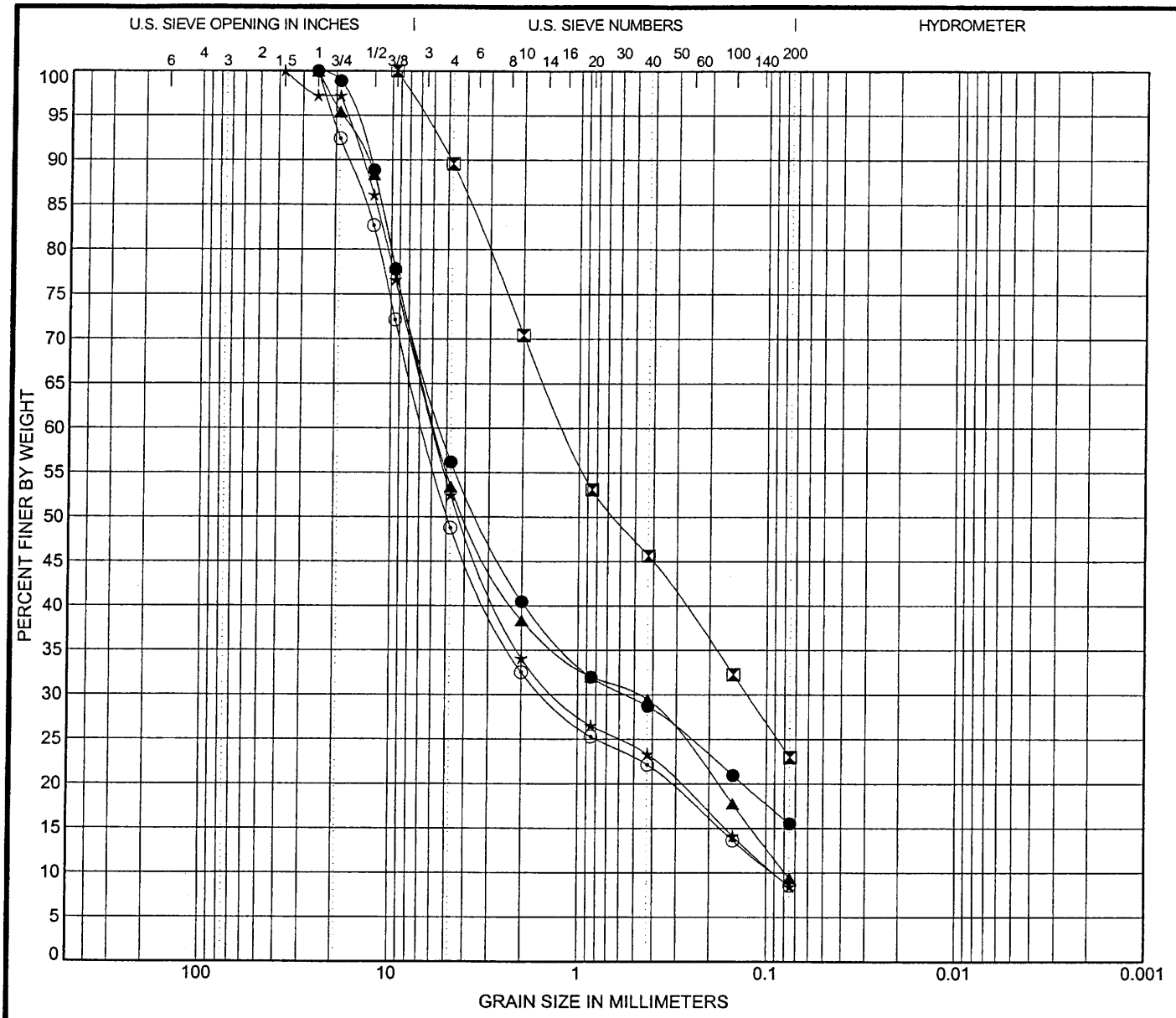
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4i



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-11	20.9	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	18	14	4		
⊠	B-11	22.4	SILTY, CLAYEY SAND (SC-SM)	25	19	6		
▲	B-12	1.1	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	NV	NV	NP	0.53	72.46
★	B-12	2.6	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	NV	NV	NP	2.97	65.21
⊙	B-12	3.8	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	19	17	2	3.65	72.78

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-11	20.9	25	5.367	0.559		2.7	43.8	40.7	15.5	
⊠	B-11	22.4	9.5	1.195	0.127		2.3	10.4	66.6	23.0	
▲	B-12	1.1	25	5.718	0.49	0.079	1.8	46.6	44.0	9.4	
★	B-12	2.6	37.5	5.897	1.259	0.09	1.4	47.5	44.0	8.5	
⊙	B-12	3.8	25	6.627	1.485	0.091	1.2	51.2	40.2	8.6	

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GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4j

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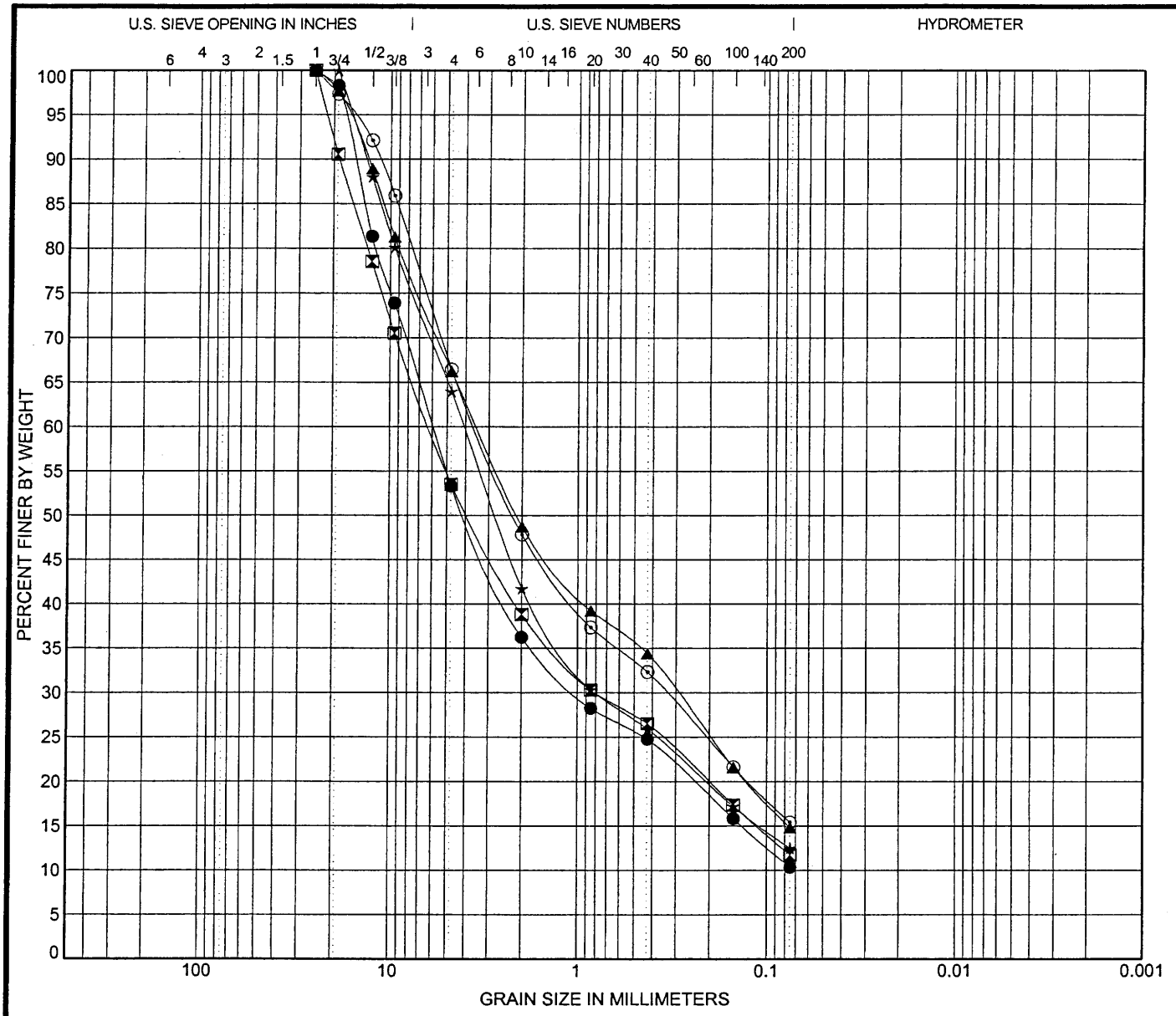

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-12	5.6	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	17	15	2	2.48	83.10
⊠	B-12	11.7	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	23	17	6	1.74	102.52
▲	B-13	1.1	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	21	17	4		
★	B-13	2.6	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	24	18	6		
⊙	B-13	4.1	CLAYEY SAND with GRAVEL (SC)	29	19	10		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-12	5.6	25	5.95	1.027		1.7	46.7	42.9	10.4	
⊠	B-12	11.7	25	6.187	0.806		2.1	46.5	41.8	11.8	
▲	B-13	1.1	25	3.49	0.297		1.7	33.8	51.4	14.8	
★	B-13	2.6	19	4.069	0.807		2.2	36.0	51.5	12.5	
⊙	B-13	4.1	25	3.521	0.339		3.0	33.6	51.0	15.4	

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GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 4k

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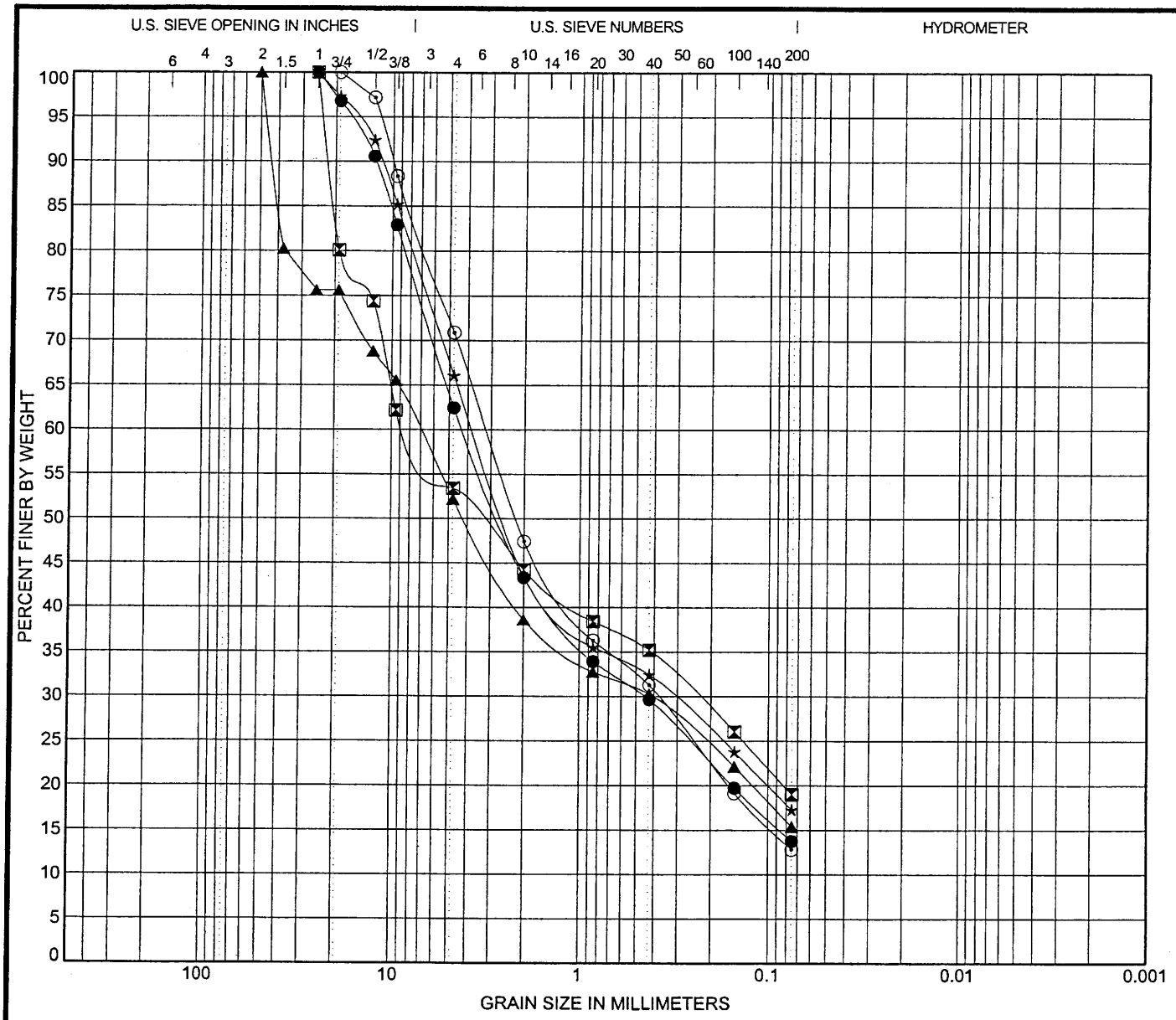

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-13	5.6	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	24	19	5		
⊠	B-13	7.2	CLAYEY GRAVEL with SAND (GC)	29	21	8		
▲	B-13	8.7	CLAYEY GRAVEL with SAND (GC)	26	17	9		
★	B-13	11.7	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	23	16	7		
⊙	B-13	14.8	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	26	21	5		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-13	5.6	25	4.251	0.45		2.5	37.5	48.7	13.8	
⊠	B-13	7.2	25	8.004	0.235		3.5	46.6	34.4	19.0	
▲	B-13	8.7	50	7.134	0.411		3.1	47.8	36.8	15.4	
★	B-13	11.7	25	3.762	0.317		3.5	33.9	48.8	17.3	
⊙	B-13	14.8	19	3.18	0.381		1.5	29.1	58.1	12.8	

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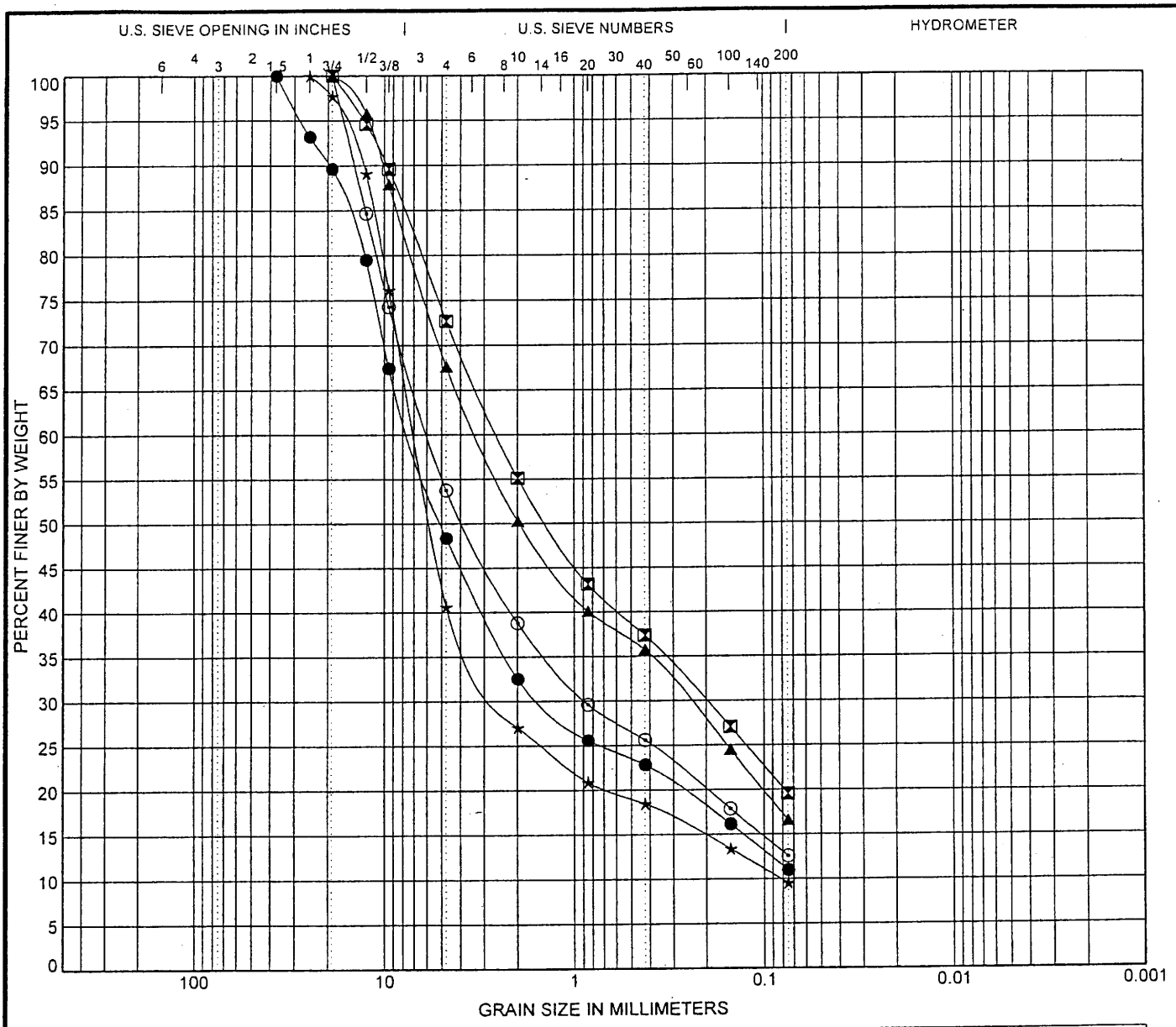
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: Plate Number: 41



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-14	0.9	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	20	16	4	4.53	110.70
⊠	B-14	1.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	19	14	5		
▲	B-14	3.0	CLAYEY SAND with GRAVEL (SC)	24	16	8		
★	B-14	6.2	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	23	14	9	10.35	85.35
⊙	B-14	7.8	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	22	15	7		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-14	0.9	37.5	7.252	1.467		2.0	51.6	37.4	11.0	
⊠	B-14	1.5	19	2.543	0.202		2.8	27.3	53.2	19.5	
▲	B-14	3.0	19	3.25	0.25		3.0	32.4	51.0	16.6	
★	B-14	6.2	25	6.931	2.413	0.081	3.2	59.4	31.1	9.6	
⊙	B-14	7.8	19	5.865	0.883		1.9	46.2	41.2	12.6	

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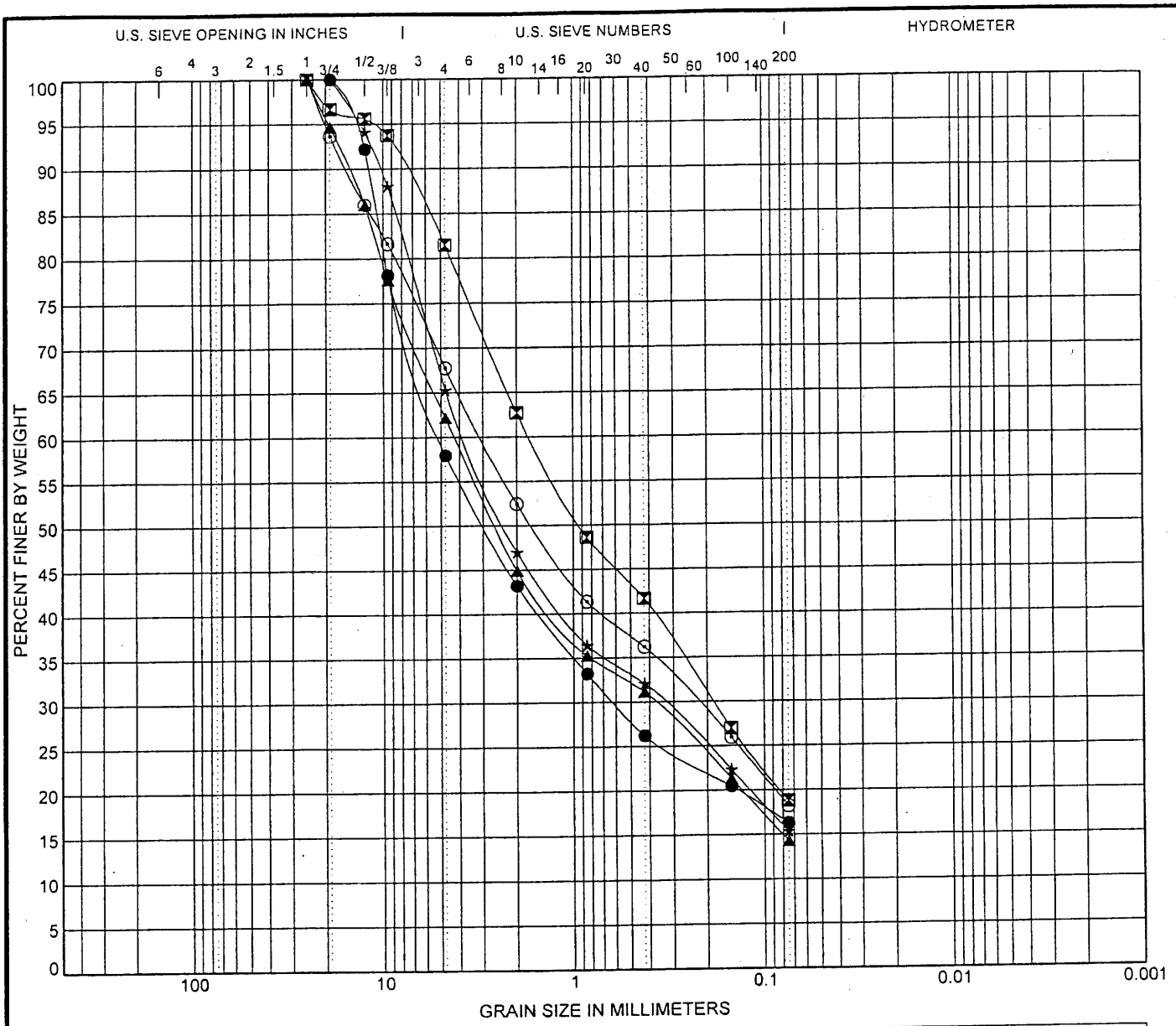
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324.01.3 Plate Number: 4a

GRAIN SIZE2 METRIC 0324013.GPJ US LAB.GDT 1/29/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-14	9.1	CLAYEY GRAVEL with SAND (GC)	38	24	14		
⊠	B-14	10.7	CLAYEY SAND with GRAVEL (SC)	30	19	11		
▲	B-15	0.8	CLAYEY SAND with GRAVEL (SC)	28	18	10		
★	B-15	1.5	CLAYEY SAND with GRAVEL (SC)	27	17	10		
⊙	B-15	3.0	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	20	15	5		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-14	9.1	19	5.095	0.618		4.0	42.0	41.7	16.3	
⊠	B-14	10.7	25	1.697	0.186		2.5	18.5	62.7	18.8	
▲	B-15	0.8	25	4.263	0.378		2.8	37.8	47.9	14.3	
★	B-15	1.5	19	3.697	0.34		3.3	34.7	49.9	15.4	
⊙	B-15	3.0	25	3.064	0.226		4.1	32.2	49.5	18.2	

GRAIN SIZE2 METRIC 0324013.GPJ US_LAB.GDT 1/29/2002

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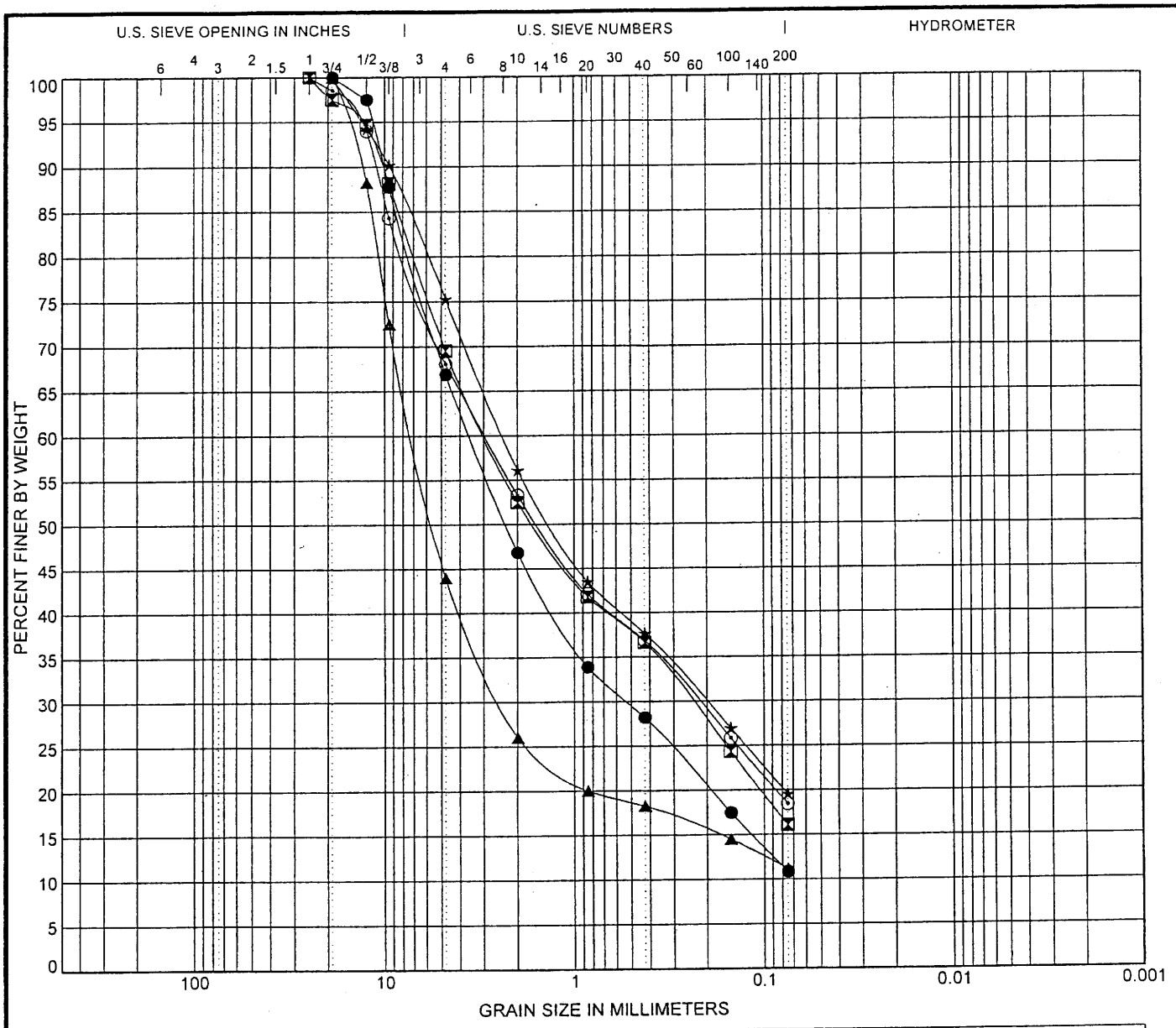
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-3 Plate Number: 4b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-15	4.6	WELL-GRADED SAND with SILTY CLAY and GRAVEL (SW-SC)	23	18	5	1.16	51.73
⊠	B-15	6.1	CLAYEY SAND with GRAVEL (SC)	25	17	8		
▲	B-15	9.3	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	23	14	9	14.32	119.92
★	B-15	10.8	CLAYEY SAND with GRAVEL (SC)	23	14	9		
⊙	B-15	11.6	CLAYEY SAND with GRAVEL (SC)	22	14	8		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-15	4.6	19	3.532	0.53		2.5	33.1	56.0	10.9	
⊠	B-15	6.1	25	2.929	0.243		3.1	30.5	53.4	16.1	
▲	B-15	9.3	19	7.012	2.423		1.8	56.0	32.8	11.2	
★	B-15	10.8	19	2.381	0.202		2.8	24.7	55.7	19.6	
⊙	B-15	11.6	25	2.963	0.222		2.6	31.9	49.6	18.5	

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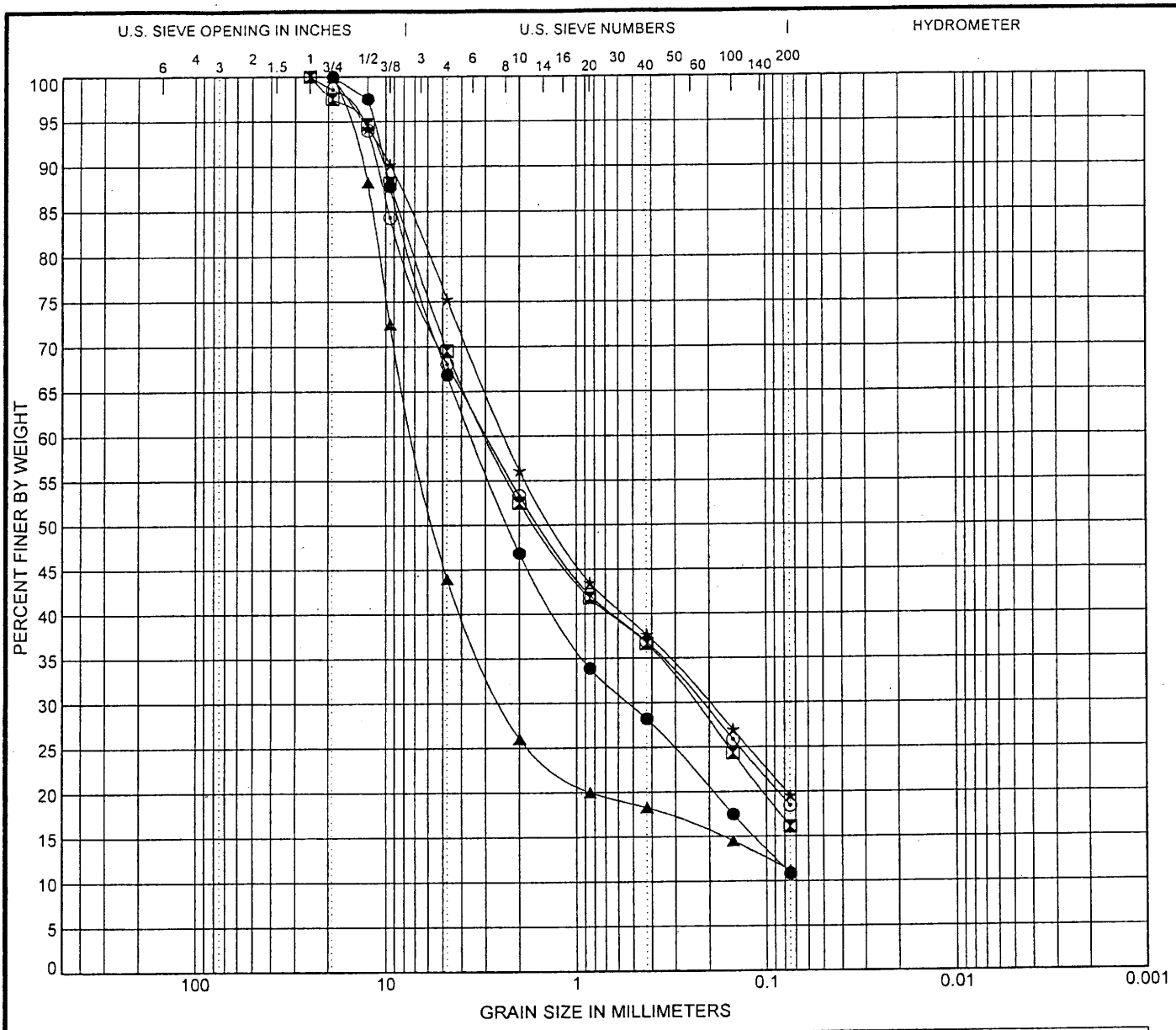
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada

GRAIN SIZE2 METRIC 0324013.GPJ US_LAB.GDT 1/29/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-15	4.6	WELL-GRADED SAND with SILTY CLAY and GRAVEL (SW-SC)	23	18	5	1.16	51.73
⊠	B-15	6.1	CLAYEY SAND with GRAVEL (SC)	25	17	8		
▲	B-15	9.3	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	23	14	9	14.32	119.92
★	B-15	10.8	CLAYEY SAND with GRAVEL (SC)	23	14	9		
⊙	B-15	11.6	CLAYEY SAND with GRAVEL (SC)	22	14	8		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-15	4.6	19	3.532	0.53		2.5	33.1	56.0	10.9	
⊠	B-15	6.1	25	2.929	0.243		3.1	30.5	53.4	16.1	
▲	B-15	9.3	19	7.012	2.423		1.8	56.0	32.8	11.2	
★	B-15	10.8	19	2.381	0.202		2.8	24.7	55.7	19.6	
⊙	B-15	11.6	25	2.963	0.222		2.6	31.9	49.6	18.5	

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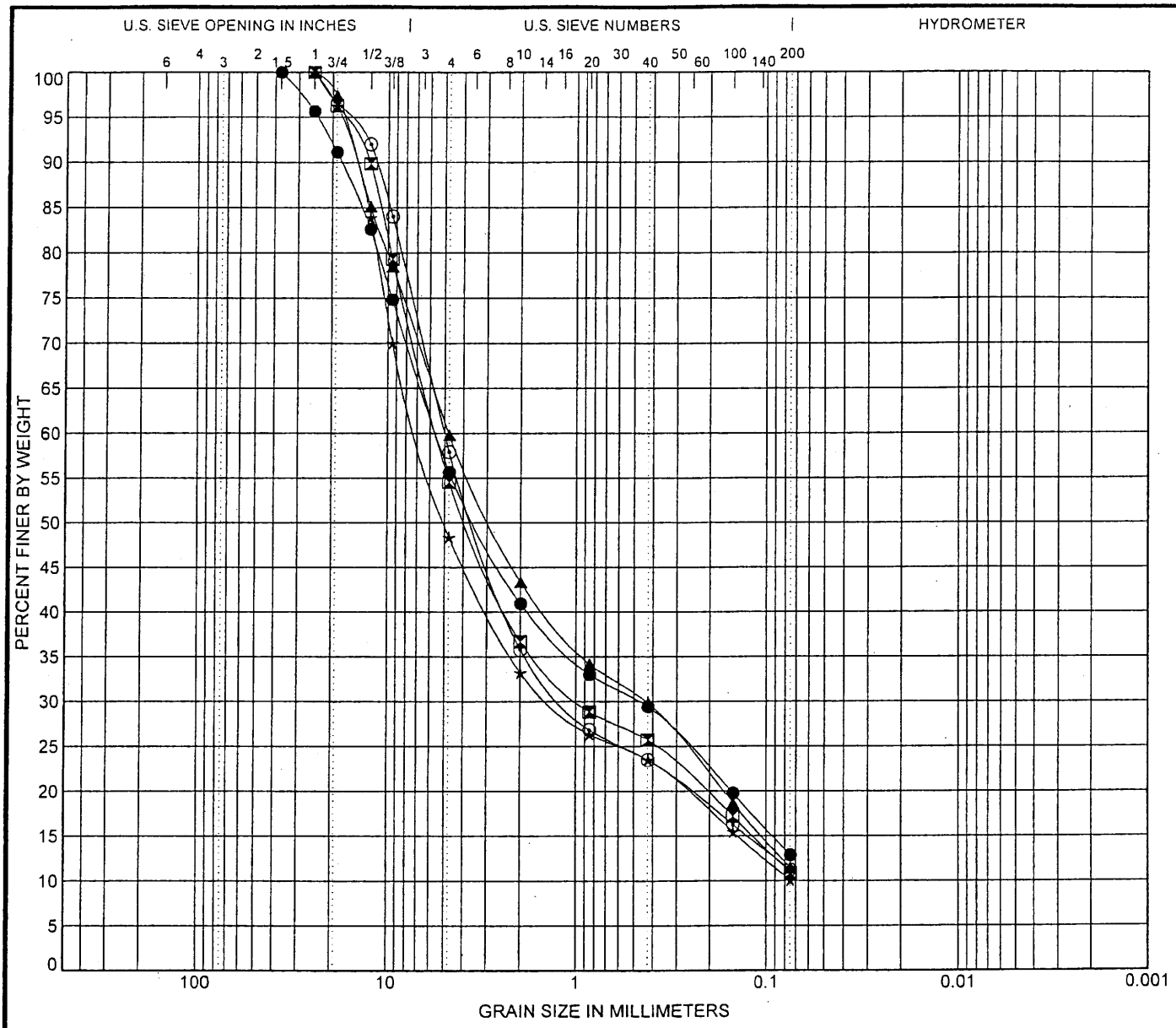
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324.01.3 Plate Number: 4c

GRAIN SIZE2 METRIC 0324013.GPJ US LAB.GDT 1/29/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-17	0.9	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	25	19	6		
⊠	B-17	1.7	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	26	19	7	2.48	81.47
▲	B-17	3.2	POORLY GRADED SAND with SILTY CLAY and GRAVEL (SP-SC)	23	18	5	0.61	73.47
★	B-17	4.7	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	21	17	4	3.51	92.63
⊙	B-17	6.2	POORLY GRADED SAND with SILTY CLAY and GRAVEL (SP-SC)	21	16	5	4.19	79.80

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-17	0.9	37.5	5.555	0.476		1.7	44.3	42.8	12.9	
⊠	B-17	1.7	25	5.532	0.965		1.4	45.5	43.6	10.9	
▲	B-17	3.2	25	4.782	0.436		1.4	40.2	48.3	11.5	
★	B-17	4.7	25	6.893	1.341		1.4	51.6	38.3	10.1	
⊙	B-17	6.2	25	5.02	1.151		0.9	42.1	46.6	11.3	

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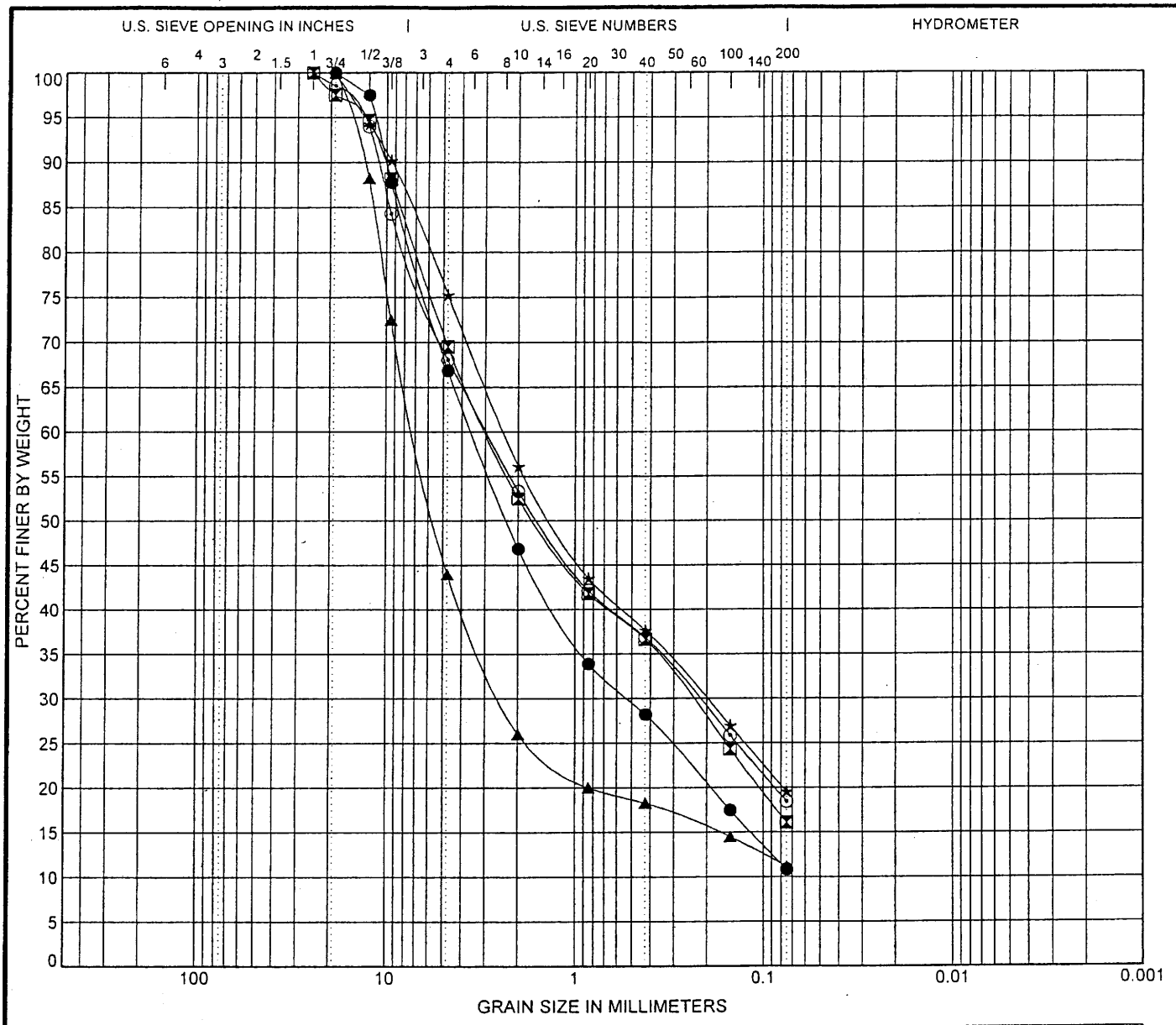
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324.01.3 Plate Number: 4e

GRAIN SIZE2 METRIC 0324013.GPJ US LAB.GDT 1/29/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-15	4.6	WELL-GRADED SAND with SILTY CLAY and GRAVEL (SW-SC)	23	18	5	1.16	51.73
⊠	B-15	6.1	CLAYEY SAND with GRAVEL (SC)	25	17	8		
▲	B-15	9.3	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	23	14	9	14.32	119.92
★	B-15	10.8	CLAYEY SAND with GRAVEL (SC)	23	14	9		
⊙	B-15	11.6	CLAYEY SAND with GRAVEL (SC)	22	14	8		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-15	4.6	19	3.532	0.53		2.5	33.1	56.0	10.9	
⊠	B-15	6.1	25	2.929	0.243		3.1	30.5	53.4	16.1	
▲	B-15	9.3	19	7.012	2.423		1.8	56.0	32.8	11.2	
★	B-15	10.8	19	2.381	0.202		2.8	24.7	55.7	19.6	
⊙	B-15	11.6	25	2.963	0.222		2.6	31.9	49.6	18.5	

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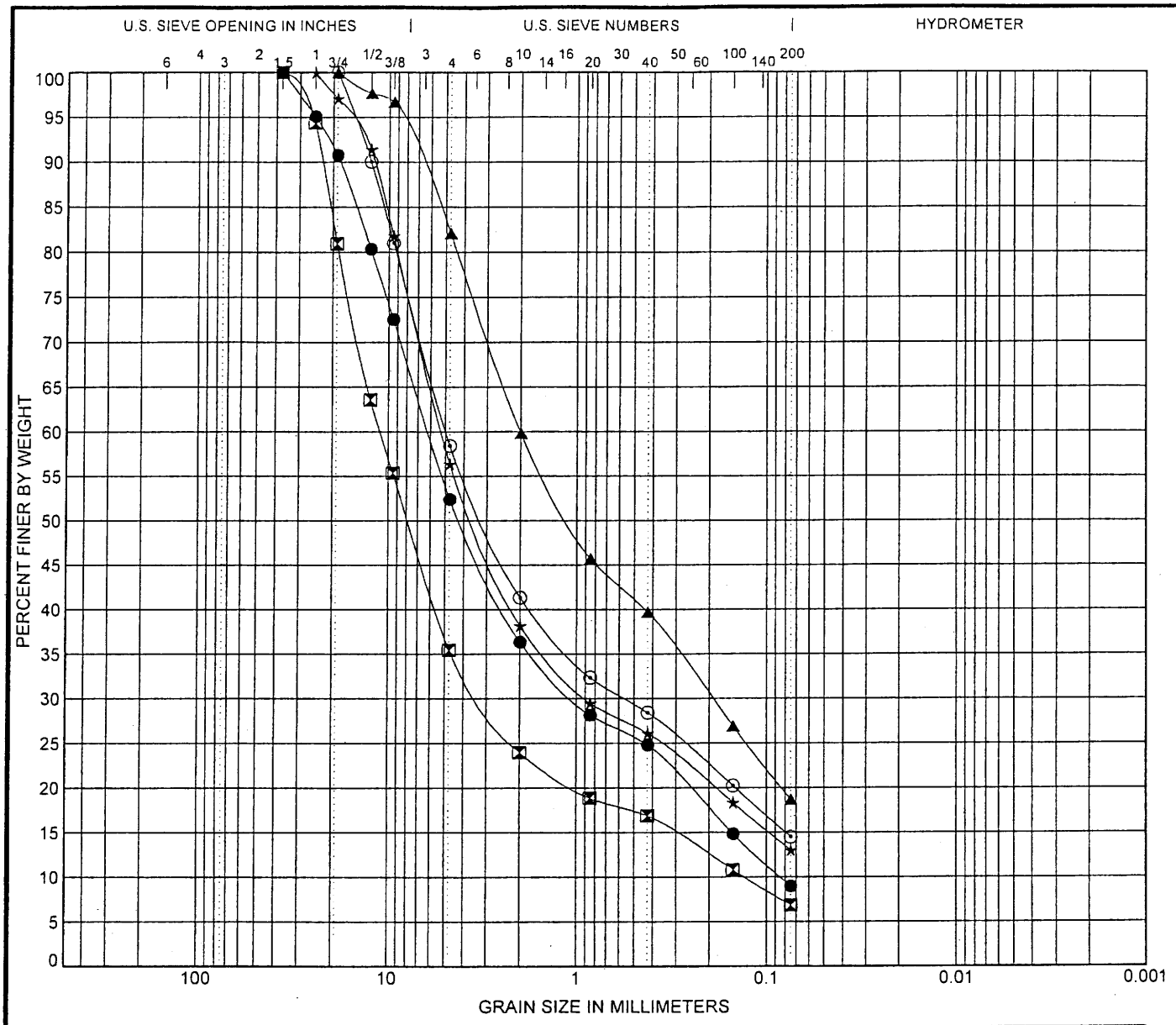
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada

GRAIN_SIZE2_METRIC_0324013.GPJ_US_LAB.GDT 1/29/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-16	0.9	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	20	17	3	2.04	73.11
⊠	B-16	1.7	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	25	18	7	6.91	85.48
▲	B-16	3.0	CLAYEY SAND with GRAVEL (SC)	43	24	19		
★	B-16	4.6	CLAYEY GRAVEL with SAND (GC)	36	20	16		
⊙	B-16	6.1	CLAYEY SAND with GRAVEL (SC)	35	21	14		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-16	0.9	37.5	6.17	1.031	0.084	1.5	47.6	43.4	9.0	
⊠	B-16	1.7	37.5	11.092	3.153	0.13	1.3	64.6	28.6	6.9	
▲	B-16	3.0	19	2.012	0.193		4.5	17.9	63.4	18.7	
★	B-16	4.6	25	5.243	0.894		2.8	43.6	43.3	13.0	
⊙	B-16	6.1	19	4.984	0.561		2.8	41.6	43.9	14.5	

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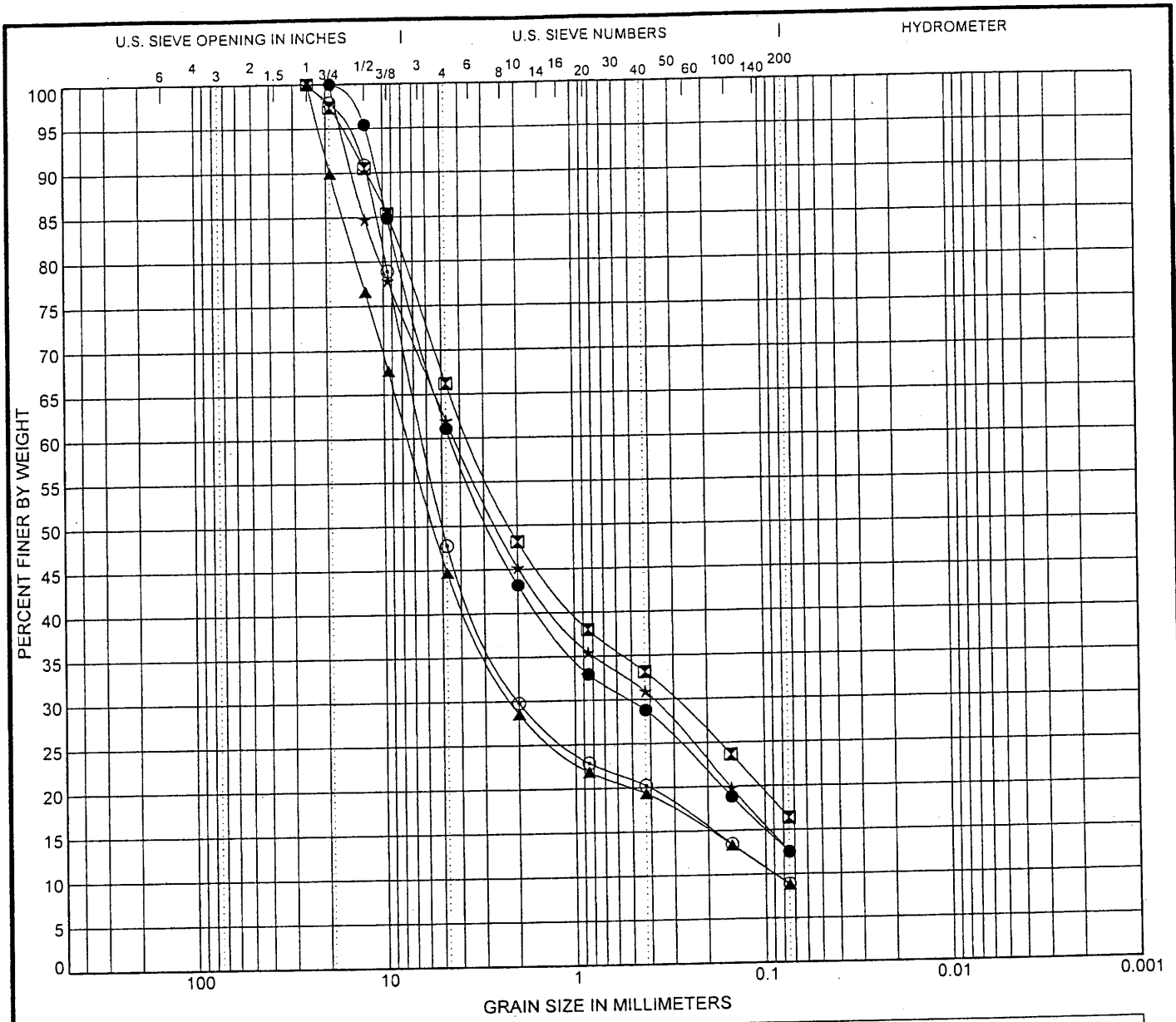
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-17	7.0	SILTY SAND with GRAVEL (SM)	19	17	2		
⊠	B-18	0.9	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	20	16	4		
▲	B-18	1.7	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	18	17	1	6.92	83.80
★	B-18	3.0	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	23	17	6		
⊙	B-18	4.7	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	21	16	5	7.37	70.29

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-17	7.0	19	4.509	0.52		1.0	38.9	48.5	12.5	
⊠	B-18	0.9	25	3.528	0.301		1.4	33.8	49.8	16.4	
▲	B-18	1.7	25	7.532	2.164	0.09	1.0	55.3	35.9	8.8	
★	B-18	3.0	19	4.286	0.39		1.6	38.0	49.4	12.6	
⊙	B-18	4.7	25	6.236	2.02	0.089	1.4	52.2	38.9	8.9	

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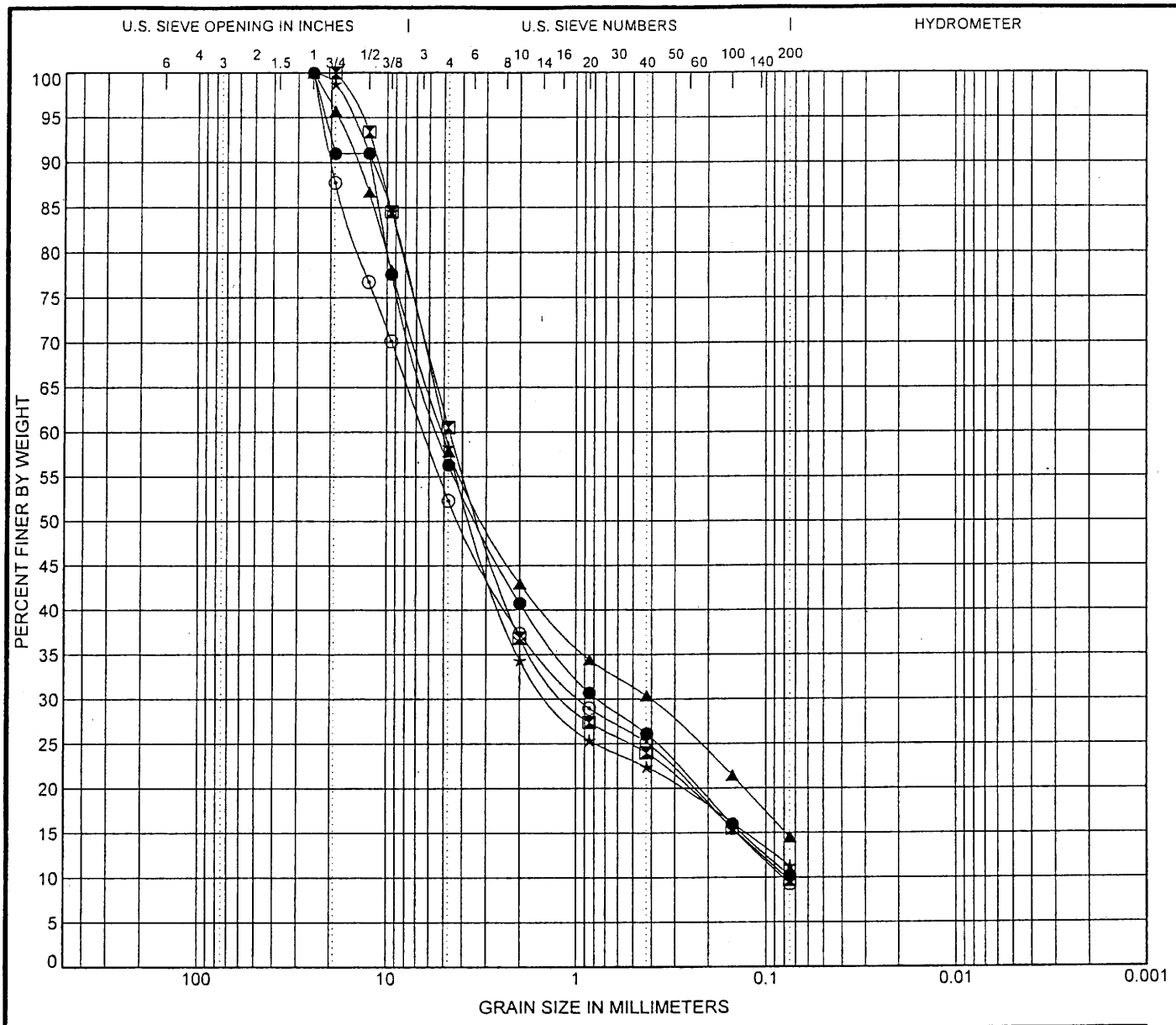
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324.01-3 Plate Number: 4f



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-18	6.1	WELL-GRADED SAND with SILTY CLAY and GRAVEL (SW-SC)	22	17	5	1.50	73.44
⊠	B-18	7.0	WELL-GRADED SAND with SILTY CLAY and GRAVEL (SW-SC)	20	15	5	3.21	60.01
▲	B-19	0.9	SILTY SAND with GRAVEL (SM)	19	16	3		
★	B-19	1.7	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	18	17	1	5.70	80.37
⊙	B-19	3.0	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	20	18	2	1.72	78.97

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-18	6.1	25	5.357	0.765		1.5	43.7	46.1	10.2	
⊠	B-18	7.0	19	4.659	1.078	0.078	1.4	39.5	50.8	9.7	
▲	B-19	0.9	25	5.115	0.407		1.0	42.2	43.3	14.5	
★	B-19	1.7	25	4.963	1.322		0.9	41.7	47.0	11.3	
⊙	B-19	3.0	25	6.405	0.944	0.081	0.8	47.7	43.0	9.3	

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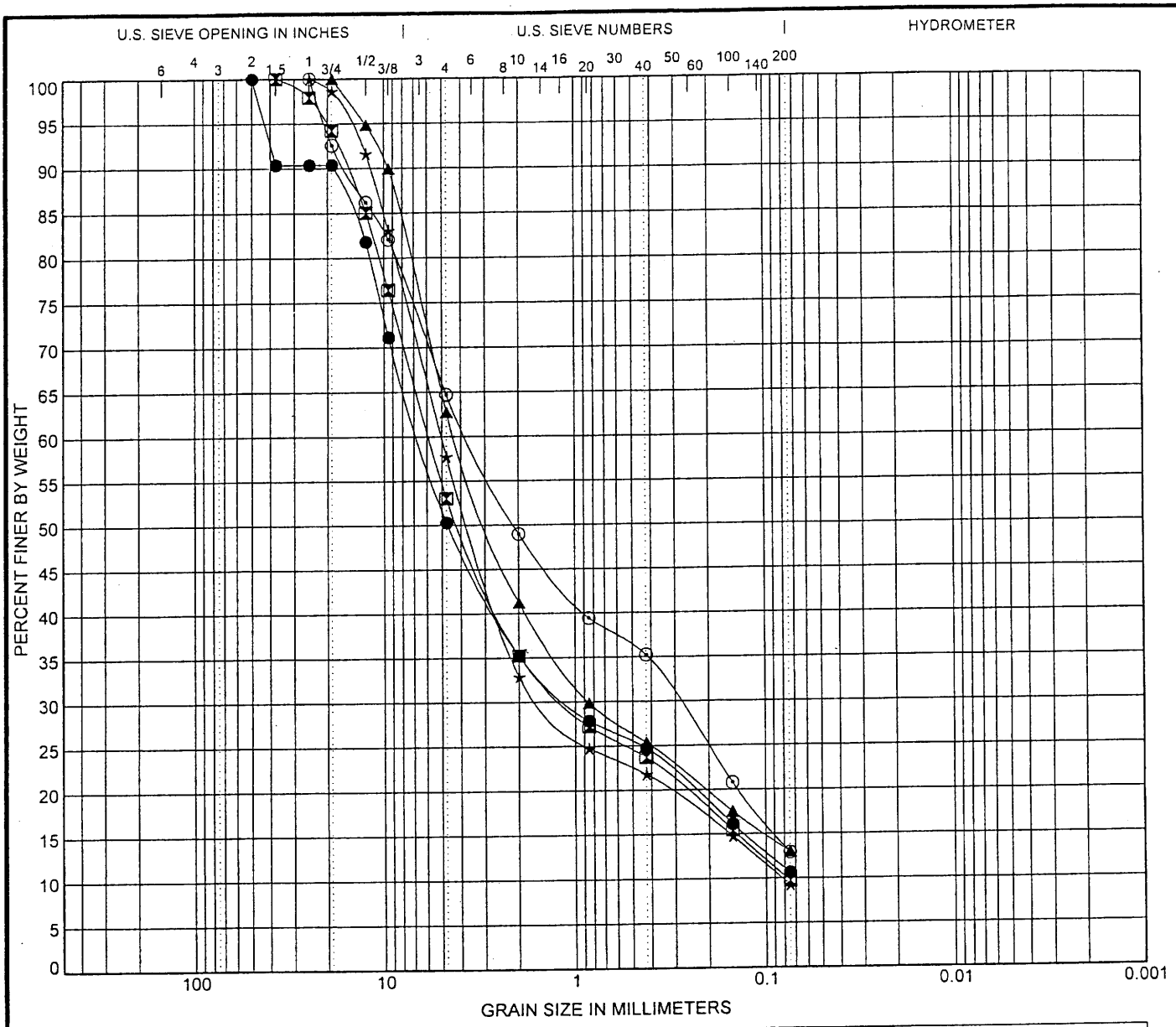
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-19	4.6	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	21	16	5	2.64	95.22
⊠	B-19	6.1	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	19	17	2	2.90	75.43
▲	B-19	7.6	CLAYEY SAND with GRAVEL (SC)	38	20	18		
★	B-19	9.1	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	19	16	3	5.27	61.39
⊙	B-19	10.7	CLAYEY SAND with GRAVEL (SC)	41	24	17		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-19	4.6	50	6.559	1.092		1.0	49.7	39.6	10.7	
⊠	B-19	6.1	37.5	5.84	1.146	0.077	1.2	47.0	43.3	9.7	
▲	B-19	7.6	19	4.257	0.861		2.9	37.3	49.7	13.0	
★	B-19	9.1	25	5.052	1.48	0.082	1.4	42.2	48.5	9.3	
⊙	B-19	10.7	25	3.669	0.291		4.1	35.3	51.8	12.9	

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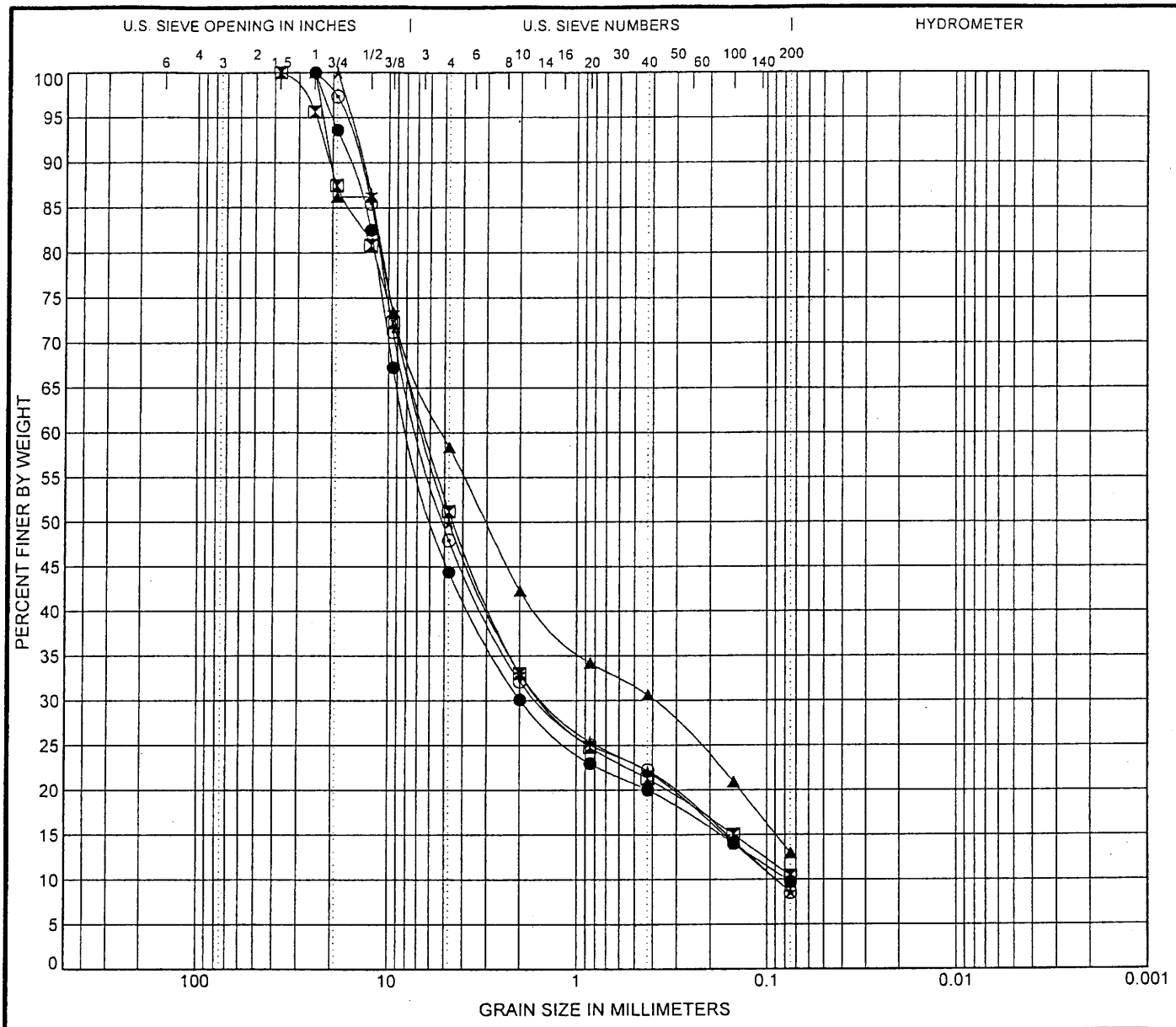
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324.01.3 Plate Number: 4b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-19	13.7	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	21	16	5	6.60	97.78
⊠	B-20	0.8	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	18	16	2	4.78	90.25
▲	B-20	1.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	27	20	7		
★	B-20	3.0	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	23	18	5	3.55	71.62
⊙	B-20	6.2	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	20	17	3	3.93	76.16

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-19	13.7	25	7.62	1.98	0.078	1.4	55.6	34.6	9.8	
⊠	B-20	0.8	37.5	6.346	1.461		1.2	48.8	40.8	10.4	
▲	B-20	1.5	25	5.119	0.398		2.9	41.6	45.4	12.9	
★	B-20	3.0	19	6.39	1.423	0.089	1.6	50.1	41.3	8.6	
⊙	B-20	6.2	25	6.798	1.545	0.089	1.7	52.1	39.4	8.5	

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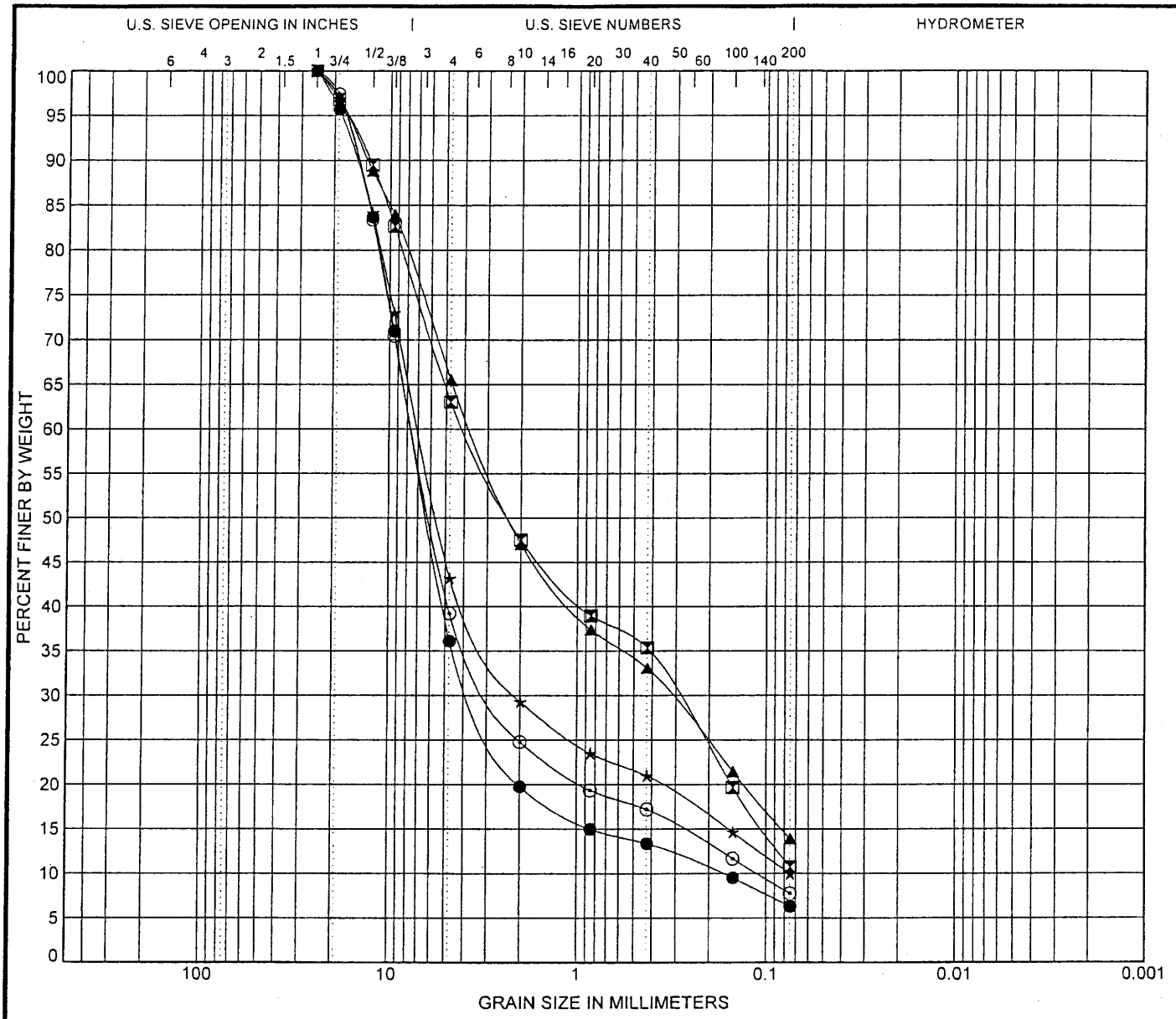
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-20	7.0	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	20	17	3	9.13	45.04
⊠	B-21	0.9	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NV	NV	NP	0.31	56.81
▲	B-21	1.5	SILTY SAND with GRAVEL (SM)	19	16	3		
★	B-21	3.2	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	28	18	10	8.31	93.74
⊙	B-21	4.7	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	23	18	5	8.94	67.94

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-20	7.0	25	7.636	3.438	0.17	1.2	63.9	29.8	6.3	
⊠	B-21	0.9	25	4.009	0.298		1.0	36.9	52.3	10.8	
▲	B-21	1.5	25	3.672	0.323		1.4	34.5	51.6	13.9	
★	B-21	3.2	25	7.019	2.09		1.2	56.8	33.2	10.0	
⊙	B-21	4.7	25	7.532	2.732	0.111	0.9	60.8	31.4	7.8	

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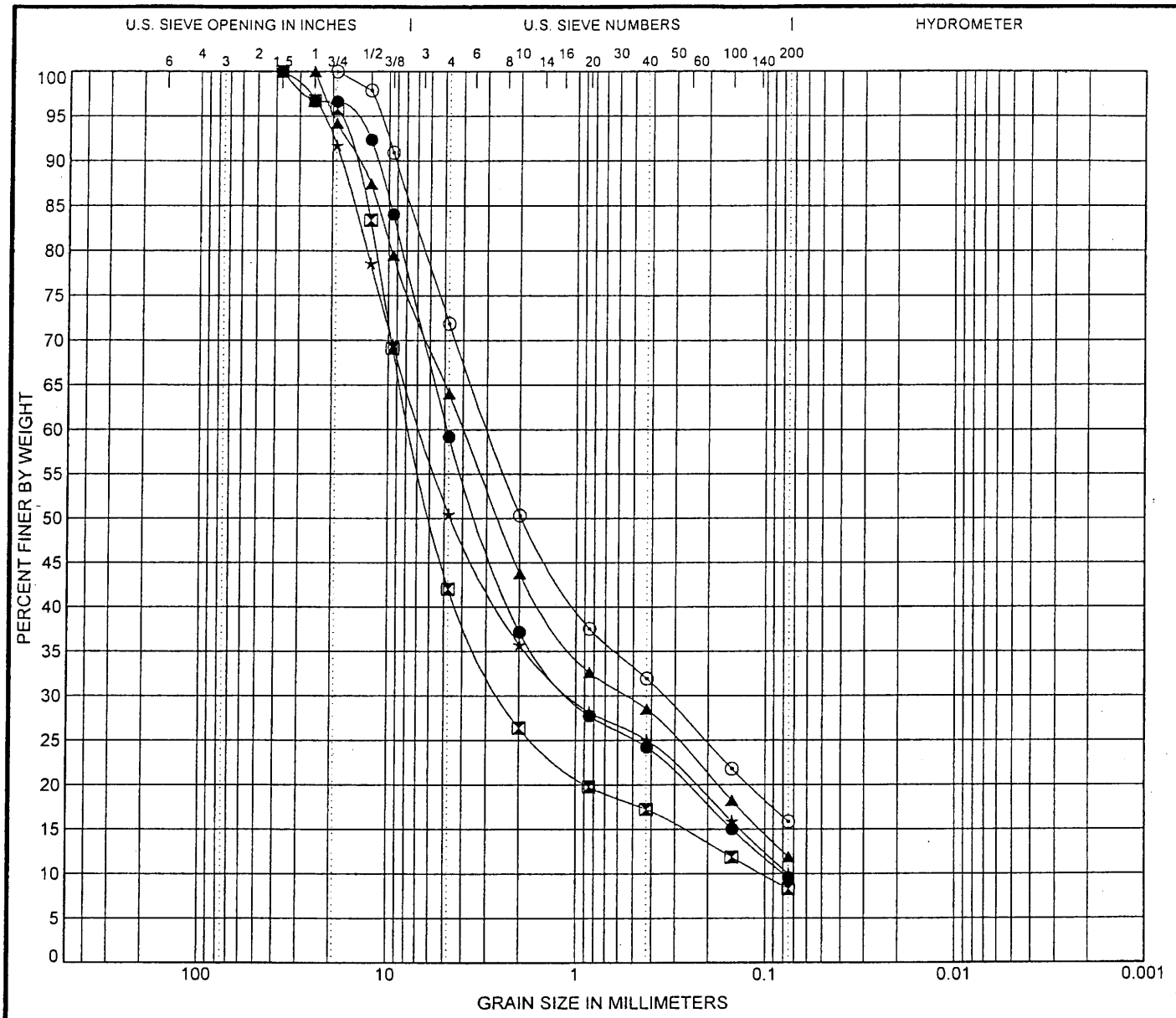
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada

GRAIN SIZE2 METRIC 0324013.GPJ US LAB.GDT 1/29/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-21	6.2	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	18	17	1	2.83	61.39
⊠	B-21	7.8	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	20	16	4	7.63	72.27
▲	B-21	9.1	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	20	17	3	1.22	65.64
★	B-22	0.9	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	20	18	2	2.17	89.67
⊙	B-22	1.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	21	17	4		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-21	6.2	37.5	4.858	1.043	0.079	0.9	40.8	49.6	9.6	
⊠	B-21	7.8	37.5	7.526	2.445	0.104	0.8	58.0	33.7	8.3	
▲	B-21	9.1	25	3.998	0.545		1.3	36.0	52.1	11.9	
★	B-22	0.9	37.5	6.714	1.045		1.3	49.5	40.5	10.0	
⊙	B-22	1.5	19	2.949	0.348		1.2	28.1	56.0	15.9	

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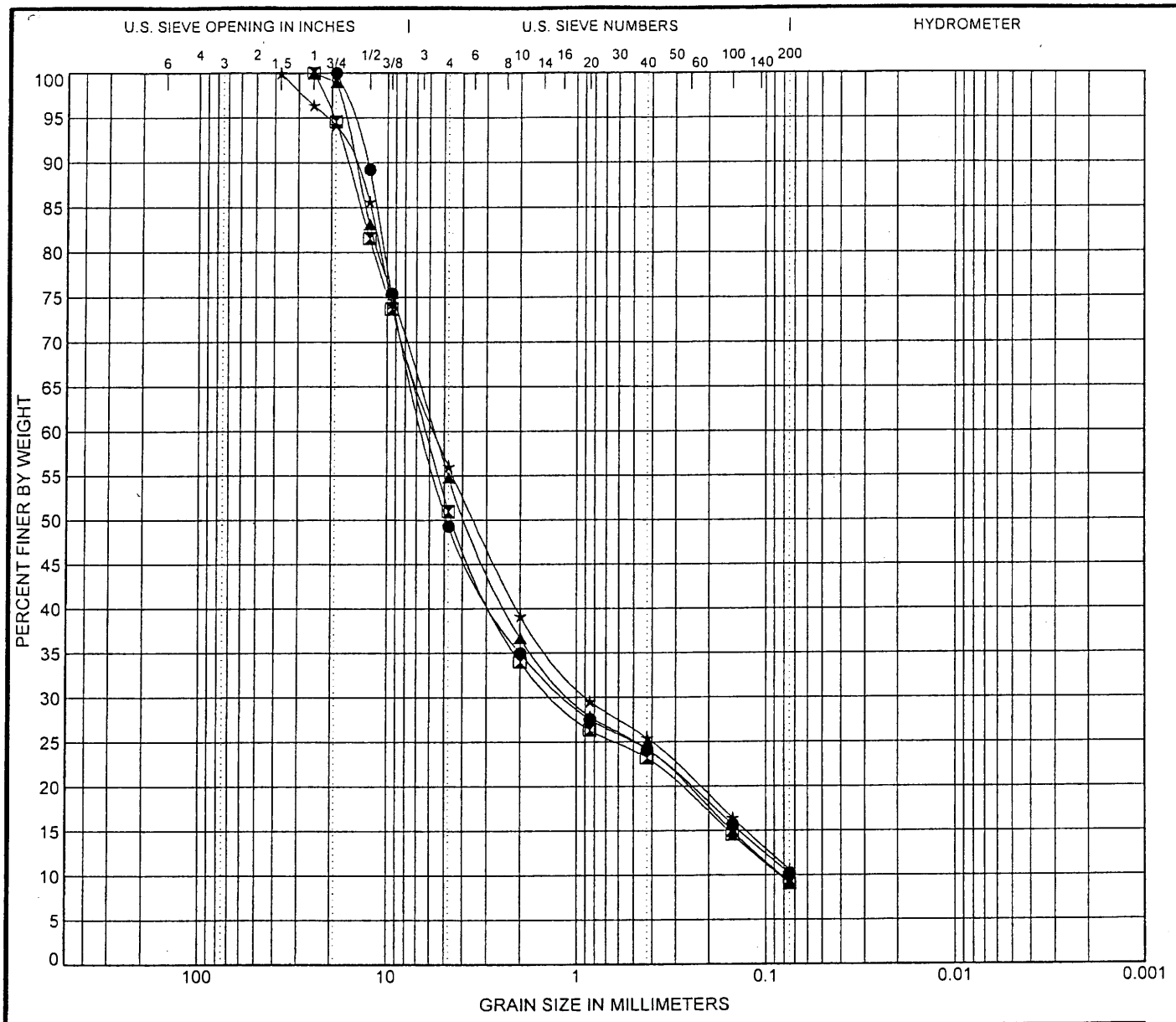
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-22	3.0	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	21	18	3	2.77	86.53
⊠	B-22	4.6	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	19	17	2	3.12	74.21
▲	B-22	6.2	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	19	17	2	2.35	68.74
★	B-22	7.6	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	19	17	2	2.04	79.45

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-22	3.0	19	6.312	1.129		0.9	50.7	39.1	10.2	
⊠	B-22	4.6	25	6.256	1.283	0.084	0.8	49.0	41.9	9.1	
▲	B-22	6.2	25	5.658	1.045	0.082	1.0	45.2	45.5	9.2	
★	B-22	7.6	37.5	5.518	0.884		1.4	44.0	45.4	10.6	

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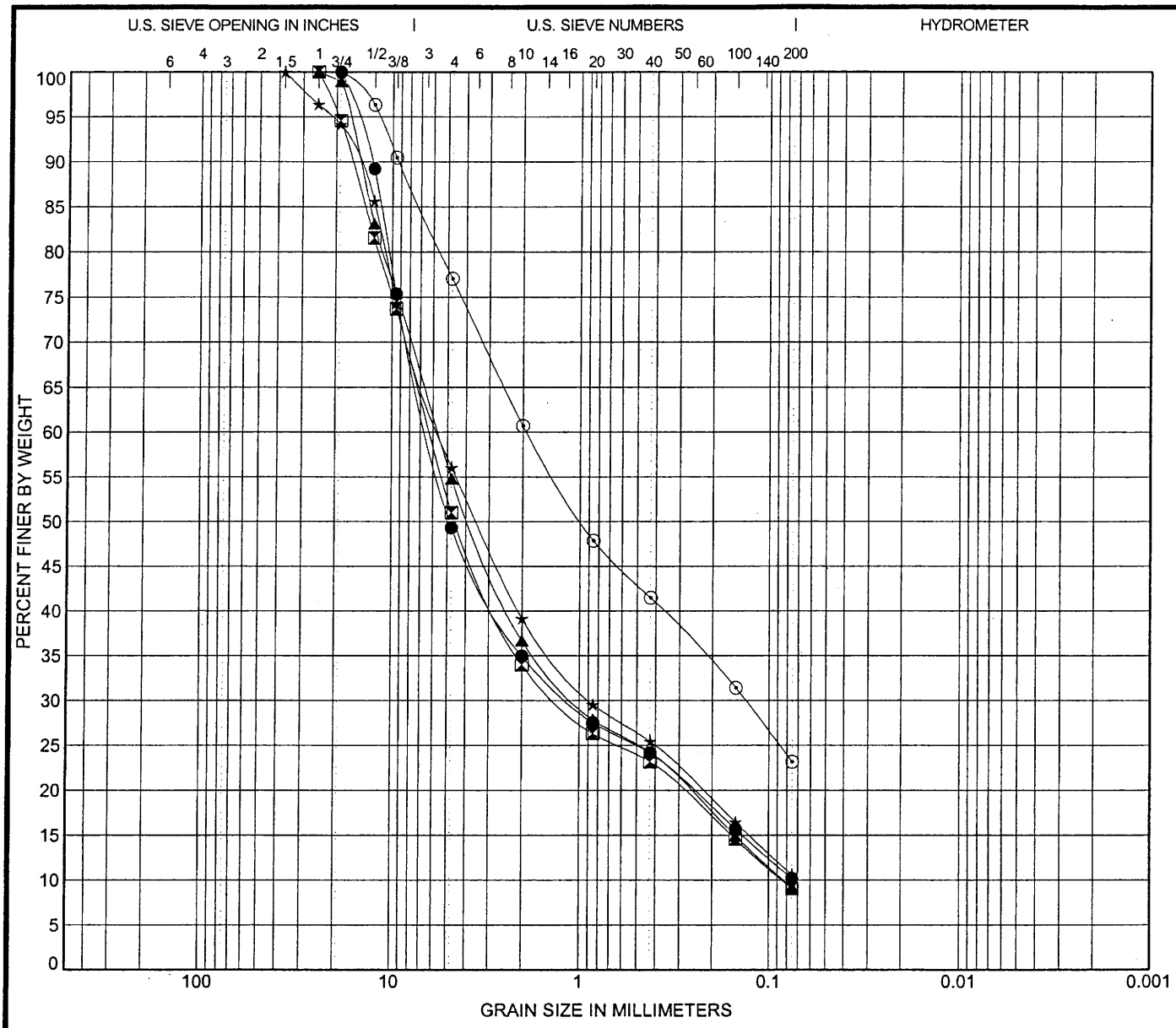
GRAIN SIZE DISTRIBUTION

Project: US 95 - Rainbow Blvd Retaining Walls

Location: Las Vegas, Nevada



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Note: NV - No Value, NP - Non Plastic, sample depth in meters.

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-22	3.0	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	21	18	3	2.77	86.53
⊠	B-22	4.6	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	19	17	2	3.12	74.21
▲	B-22	6.2	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	19	17	2	2.35	68.74
★	B-22	7.6	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	19	17	2	2.04	79.45
⊙	B-40	0.8	CLAYEY SAND with GRAVEL (SC)	37	17	20		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-22	3.0	19	6.312	1.129		0.9	50.7	39.1	10.2	
⊠	B-22	4.6	25	6.256	1.283	0.084	0.8	49.0	41.9	9.1	
▲	B-22	6.2	25	5.658	1.045	0.082	1.0	45.2	45.5	9.2	
★	B-22	7.6	37.5	5.518	0.884		1.4	44.0	45.4	10.6	
⊙	B-40	0.8	19	1.908	0.133		5.0	23.0	53.9	23.2	

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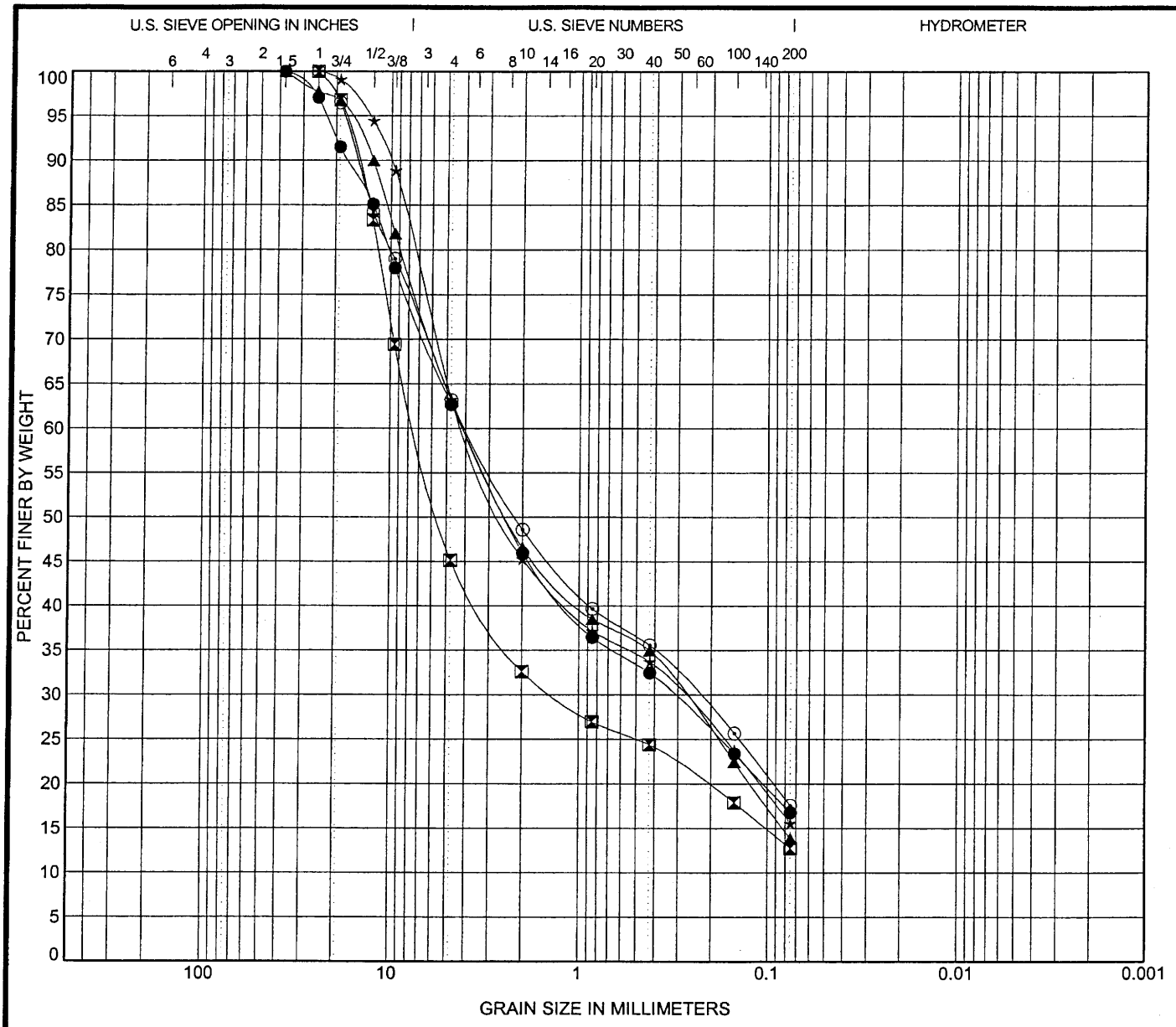
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening / Project 2D Retaining Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-1 Plate Number: 4r



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
● B-23	5.0'	CLAYEY SAND with GRAVEL (SC)	29	18	11		
⊠ B-23	10.0'	CLAYEY GRAVEL with SAND (GC)	32	18	14		
▲ B-23	15.0'	CLAYEY SAND with GRAVEL (SC)	26	16	10		
★ B-23	20.0'	CLAYEY SAND with GRAVEL (SC)	26	16	10		
⊙ B-23	25.0'	CLAYEY SAND with GRAVEL (SC)	26	17	9		

Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
● B-23	5.0'	37.5	4.134	0.321		4.1	37.3	45.9	16.8	
⊠ B-23	10.0'	25	7.259	1.349		3.0	54.9	32.4	12.8	
▲ B-23	15.0'	37.5	4.055	0.282		3.4	37.0	49.2	13.8	
★ B-23	20.0'	25	4.059	0.289		3.4	36.7	47.7	15.6	
⊙ B-23	25.0'	25	3.93	0.237		3.4	36.8	45.7	17.5	

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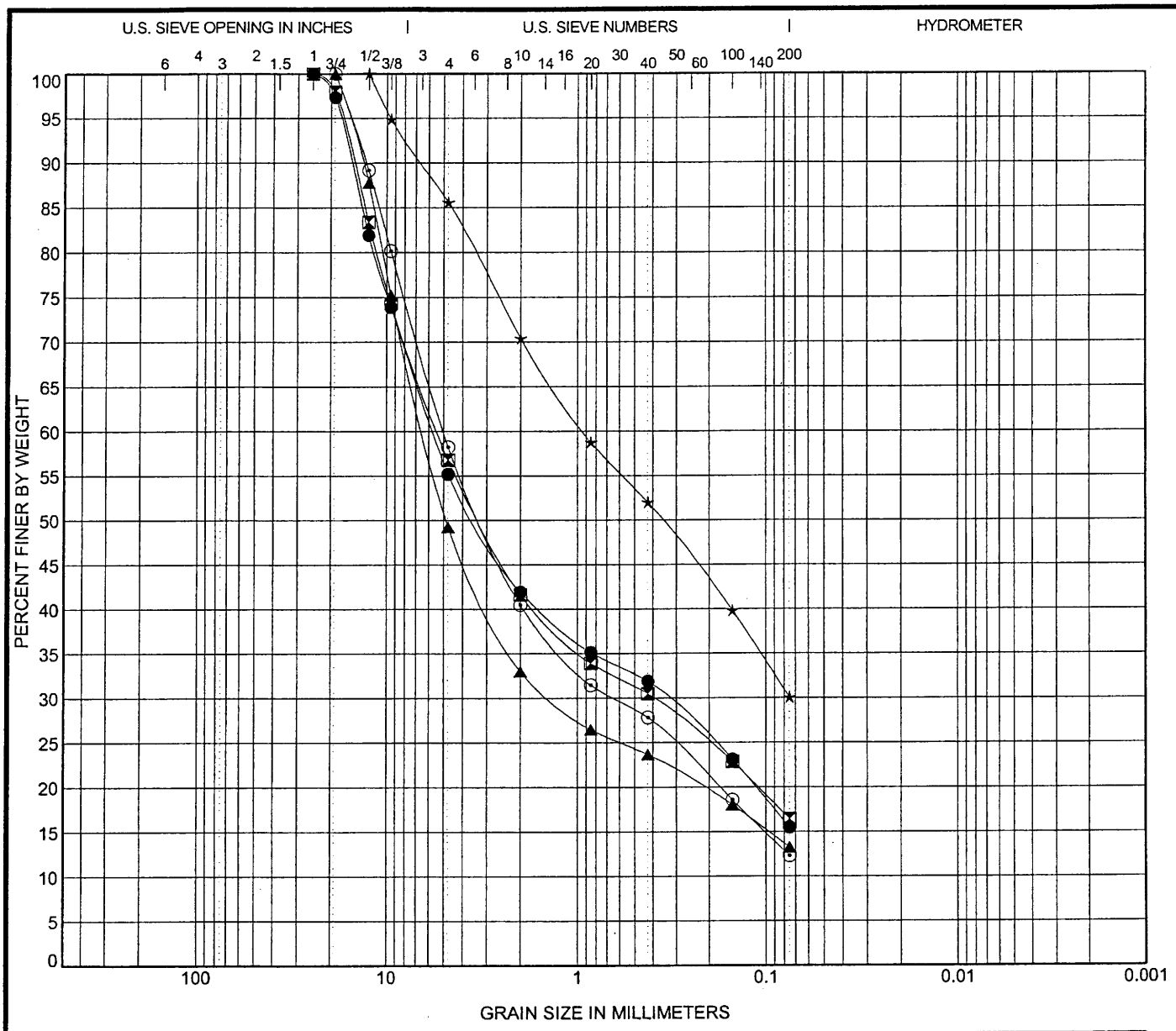
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-23	30.0'	CLAYEY GRAVEL with SAND (GC)	29	18	11		
⊠	B-23	35.0'	CLAYEY GRAVEL with SAND (GC)	29	17	12		
▲	B-23	40.0'	CLAYEY GRAVEL with SAND (GC)	30	16	14		
★	B-23	45.0'	CLAYEY SAND (SC)	30	17	13		
⊙	B-24	5.0'	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	24	18	6	1.43	86.51

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-23	30.0'	25	5.676	0.34		3.6	44.8	39.7	15.5	
⊠	B-23	35.0'	25	5.396	0.398		3.6	43.2	40.4	16.4	
▲	B-23	40.0'	19	6.329	1.351		2.9	50.8	36.0	13.3	
★	B-23	45.0'	12.5	0.931			3.7	14.4	55.5	30.0	
⊙	B-24	5.0'	19	5.023	0.646		2.0	41.8	45.9	12.3	

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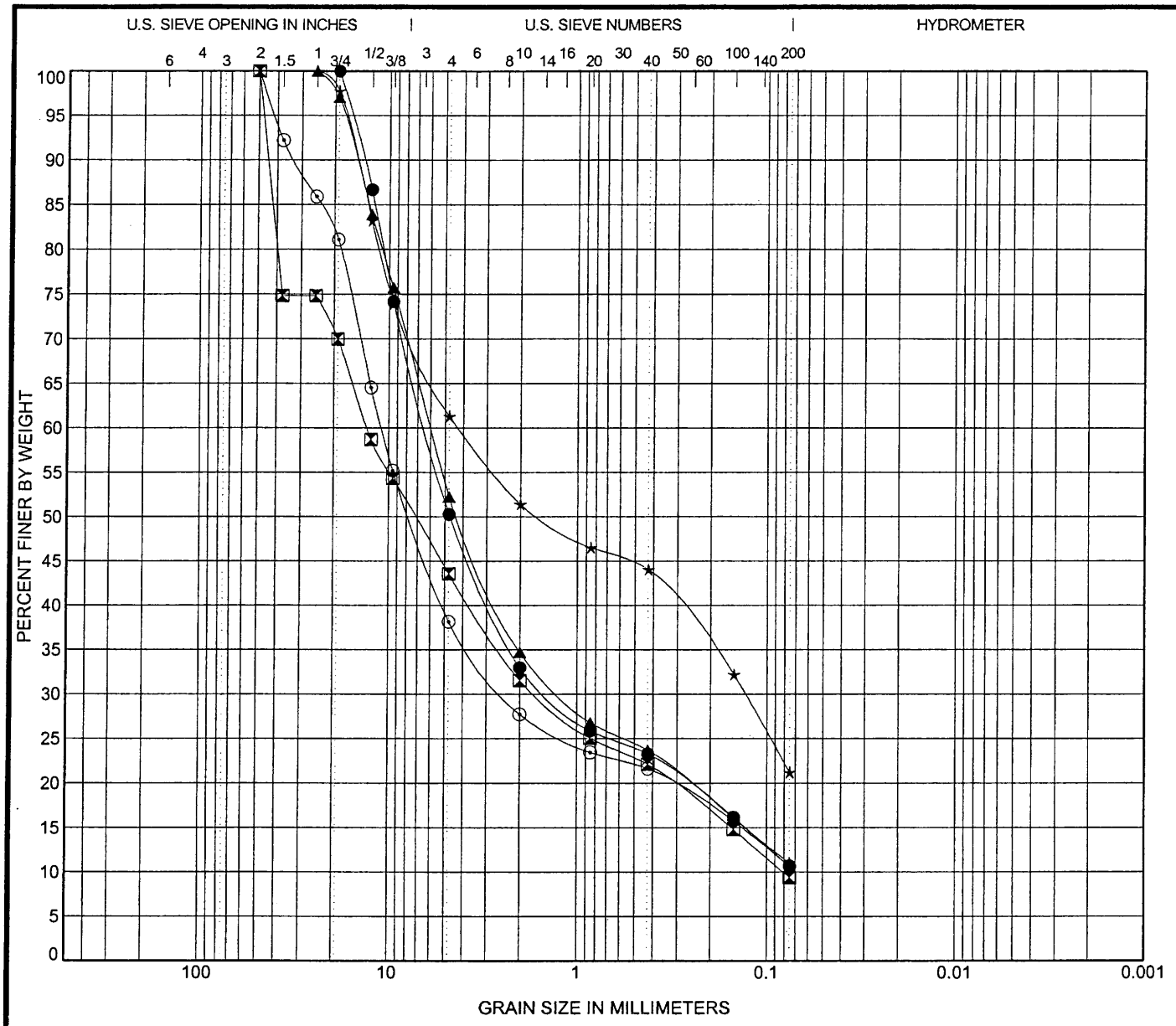
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-24	10.0'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	30	19	11	4.48	90.92
⊠	B-24	15.0'	WELL-GRADED GRAVEL with CLAY and SAND (GW-GC)	28	17	11	2.51	161.83
▲	B-24	19.0'	WELL-GRADED GRAVEL with CLAY and SAND (GW-GC)	28	18	10	3.73	91.85
★	B-25	5.0'	CLAYEY SAND with GRAVEL (SC)	35	19	16		
⊙	B-25	10.0'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	31	18	13	7.84	160.87

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-24	10.0'	19	6.299	1.399		1.8	49.7	39.6	10.6	
⊠	B-24	15.0'	50	13.127	1.634	0.081	1.5	56.4	34.2	9.4	
▲	B-24	19.0'	25	5.974	1.204		1.6	47.8	41.2	11.0	
★	B-25	5.0'	25	4.24	0.131		4.5	38.7	40.1	21.2	
⊙	B-25	10.0'	50	10.942	2.416		1.9	61.9	27.4	10.7	

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GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4c

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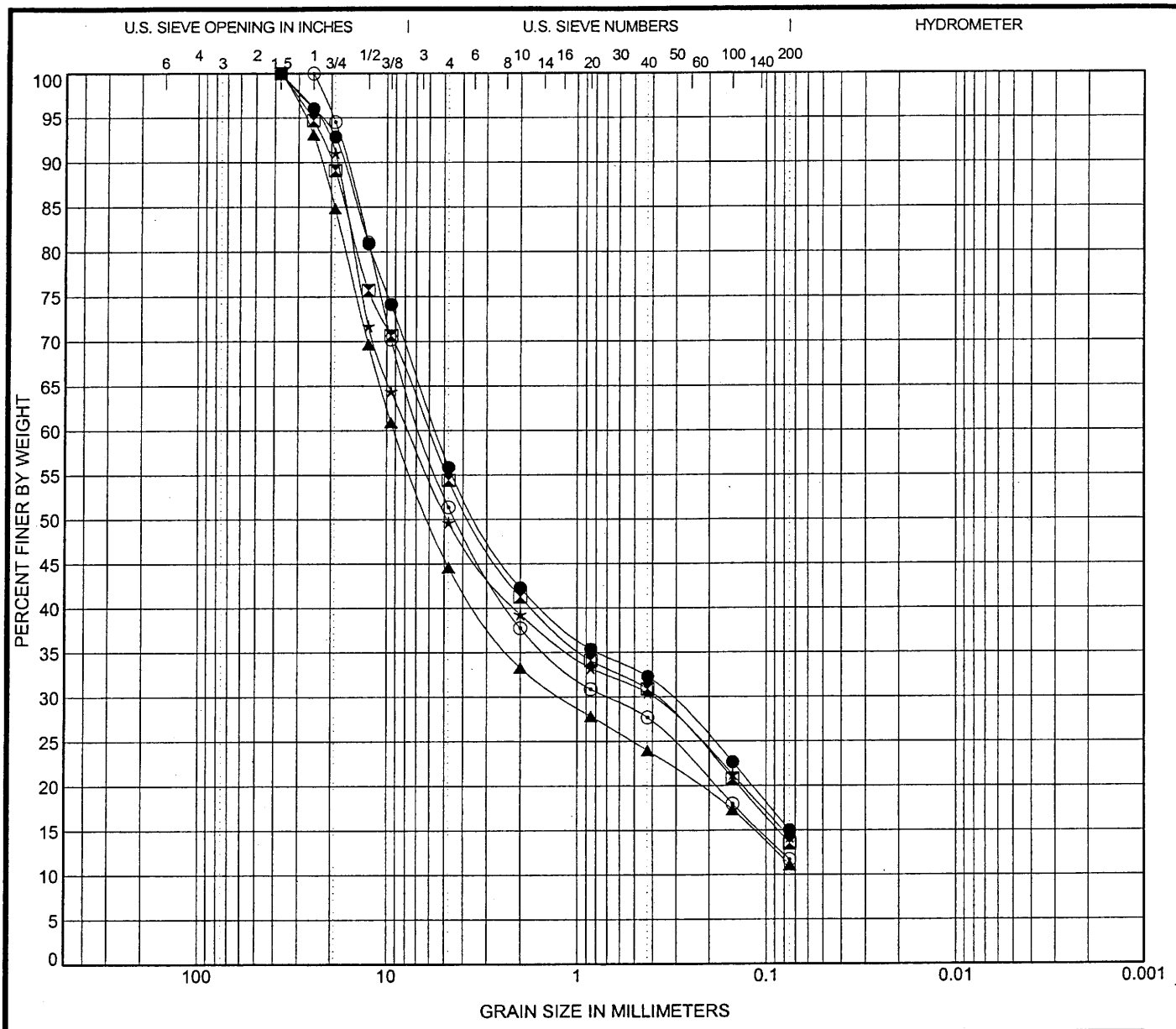

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-25	15.0'	CLAYEY GRAVEL with SAND (GC)	30	17	13		
⊠	B-25	19.0'	CLAYEY GRAVEL with SAND (GC)	27	16	11		
▲	B-26	5.0'	WELL-GRADED GRAVEL with CLAY and SAND (GW-GC)	25	17	8	2.37	137.93
★	B-26	10.0'	CLAYEY GRAVEL with SAND (GC)	41	22	19		
⊙	B-26	15.0'	WELL-GRADED GRAVEL with CLAY and SAND (GW-GC)	28	17	11	1.23	105.44

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-25	15.0'	37.5	5.557	0.332		2.8	44.1	40.9	15.0	
⊠	B-25	19.0'	37.5	6.031	0.389		2.4	45.6	40.9	13.5	
▲	B-26	5.0'	37.5	9.135	1.198		2.5	55.4	33.5	11.1	
★	B-26	10.0'	37.5	7.729	0.405		2.7	50.4	35.4	14.2	
⊙	B-26	15.0'	25	6.525	0.706		1.9	48.6	39.6	11.7	

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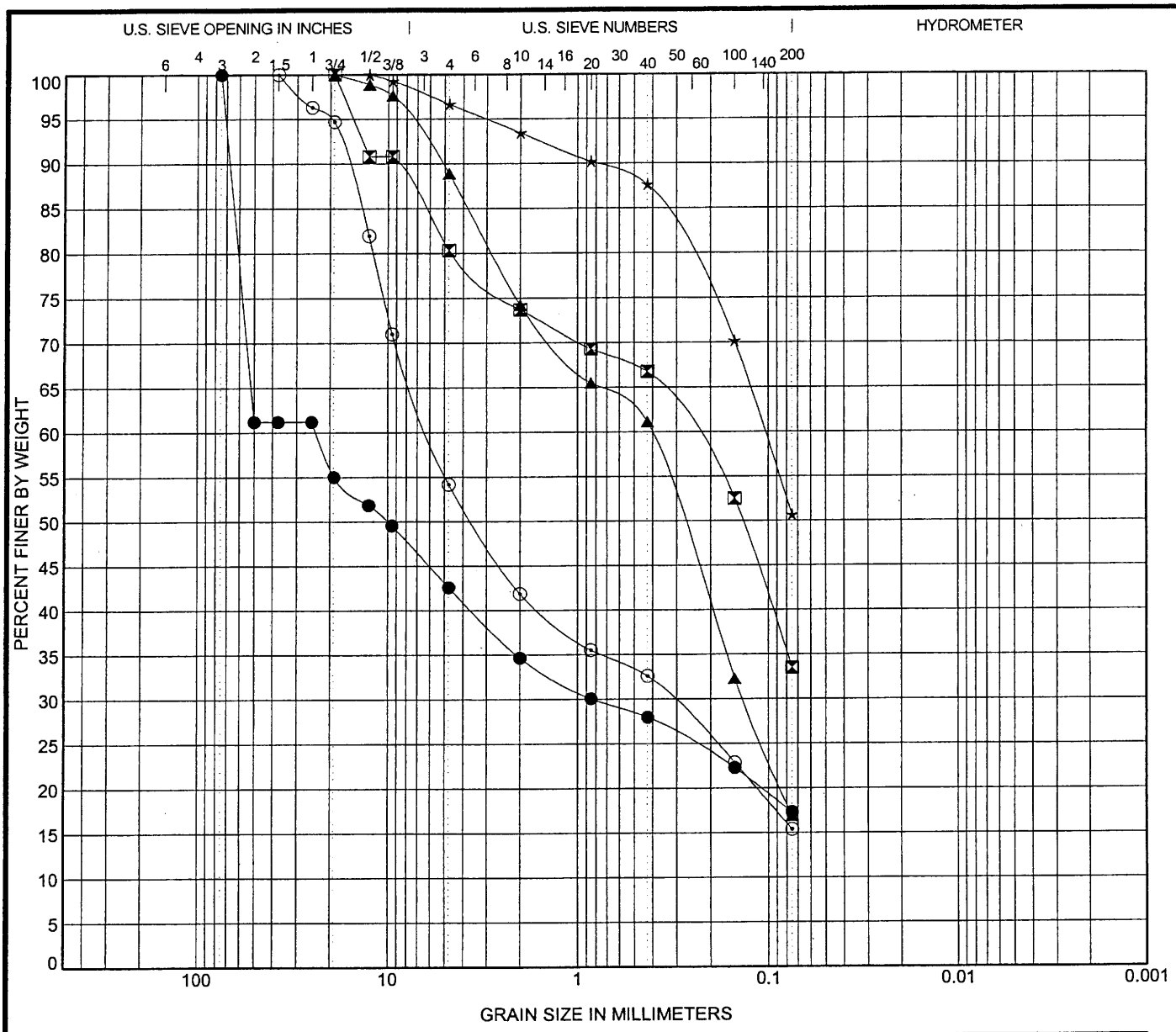
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4d



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-26	20.0'	CLAYEY GRAVEL with SAND (GC)	32	18	14		
⊠	B-26	25.0'	CLAYEY SAND with GRAVEL (SC)	55	23	32		
▲	B-26	30.0'	CLAYEY SAND (SC)	32	18	14		
★	B-26	35.0'	SANDY FAT CLAY (CH)	57	23	34		
⊙	B-28	5.0'	CLAYEY GRAVEL with SAND (GC)	40	23	17		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-26	20.0'	75	23.705	0.835		3.4	57.4	25.3	17.3	
⊠	B-26	25.0'	19	0.26			2.9	19.7	46.8	33.5	
▲	B-26	30.0'	19	0.408	0.135		5.0	11.1	72.0	16.9	
★	B-26	35.0'	12.5	0.105			16.0	3.3	46.0	50.6	
⊙	B-28	5.0'	37.5	6.039	0.323		3.6	45.8	38.8	15.4	

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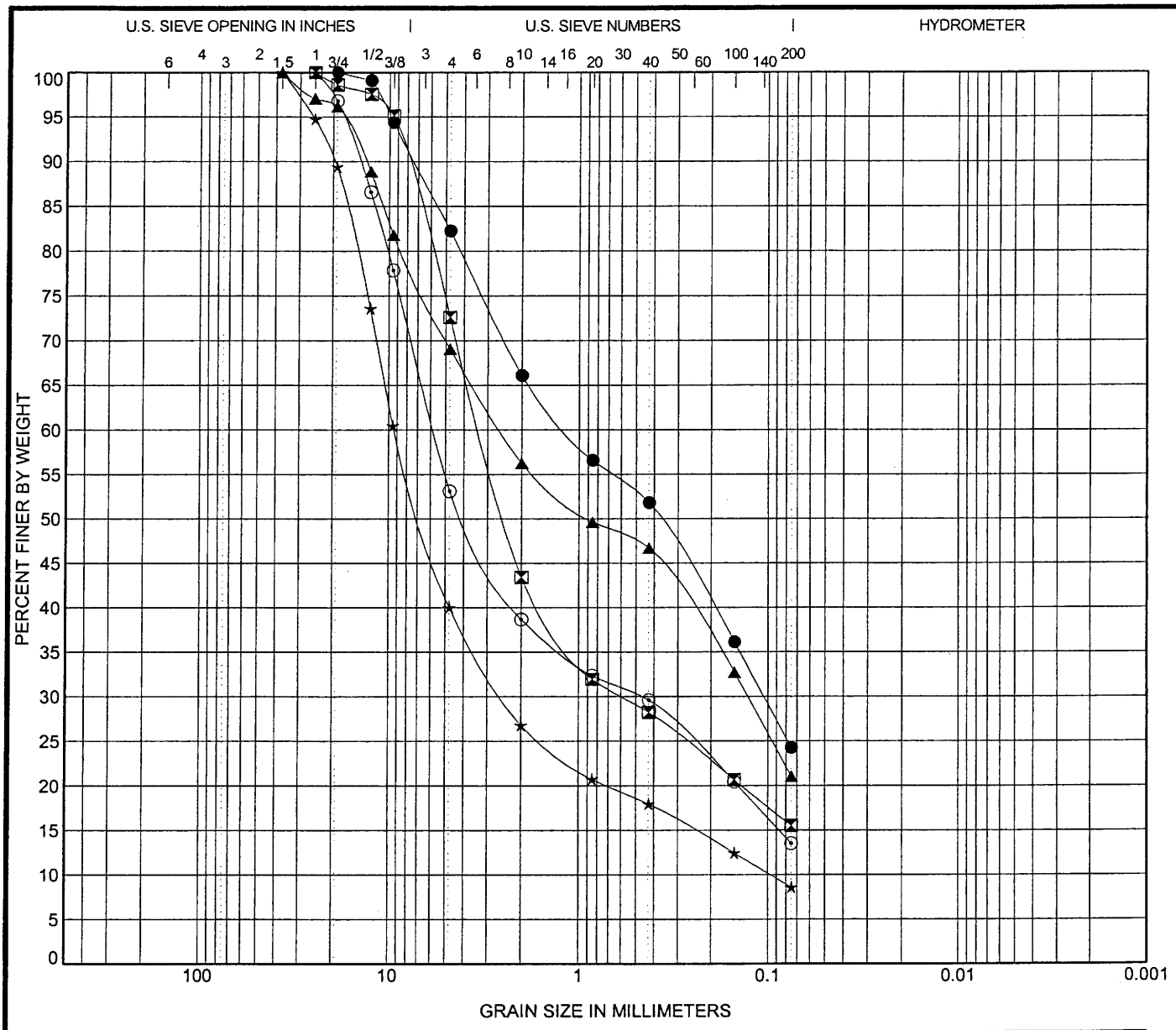
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4e



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-28	10.0'	CLAYEY SAND with GRAVEL (SC)	28	15	13		
⊠	B-28	15.0'	CLAYEY SAND with GRAVEL (SC)	23	13	10		
▲	B-28	20.0'	CLAYEY SAND with GRAVEL (SC)	31	17	14		
★	B-29	5.0	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	23	17	6	6.77	97.02
⊙	B-29	10.0'	CLAYEY GRAVEL with SAND (GC)	30	15	15		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-28	10.0'	19	1.156	0.105		5.0	17.7	58.0	24.2	
⊠	B-28	15.0'	25	3.271	0.593		2.7	27.4	57.1	15.5	
▲	B-28	20.0'	37.5	2.576	0.128		8.2	30.9	48.0	21.0	
★	B-29	5.0'	37.5	9.351	2.47	0.096	1.4	60.0	31.4	8.6	
⊙	B-29	10.0'	25	5.762	0.472		3.1	46.9	39.6	13.5	

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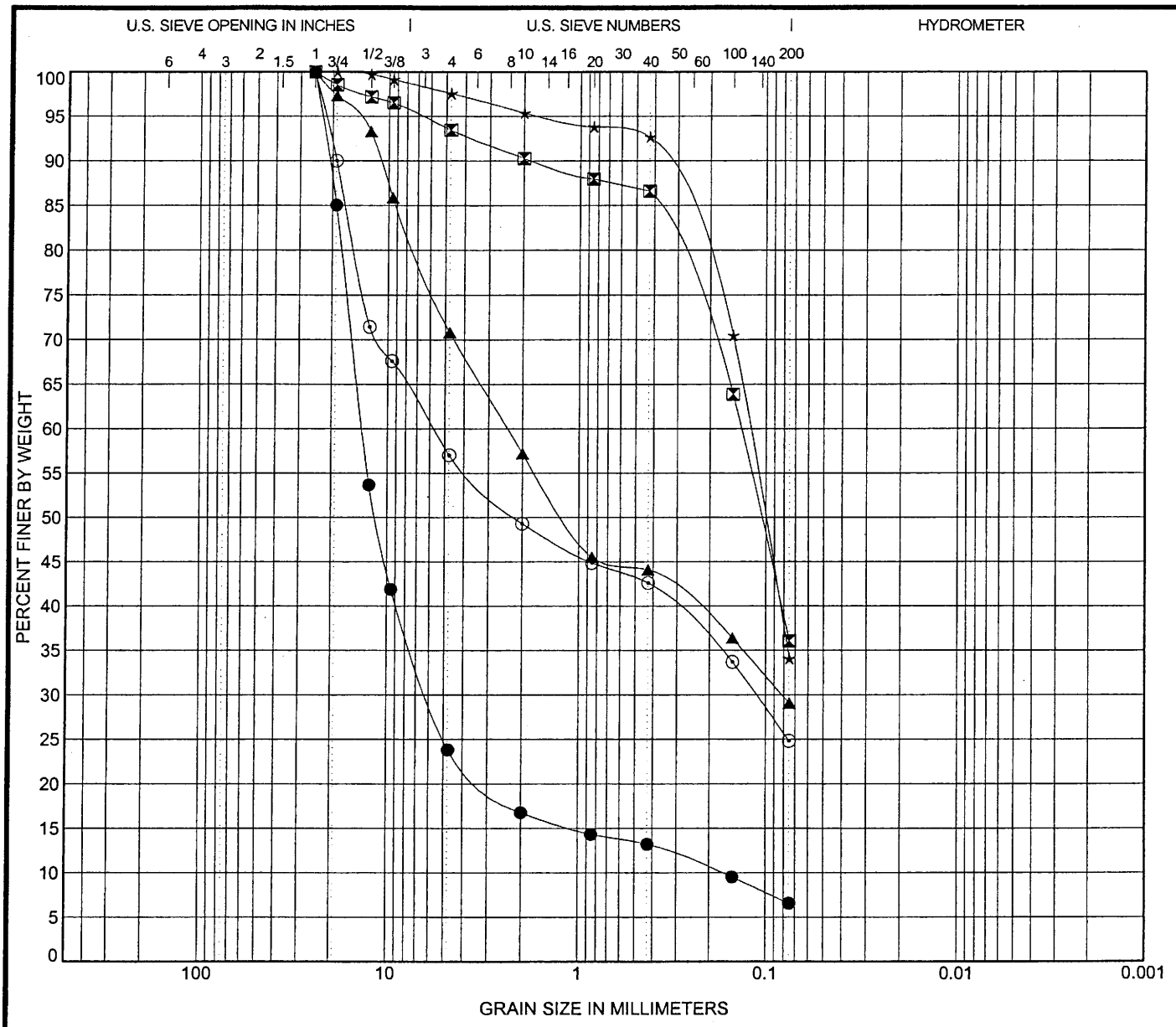
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4f



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-29	15.0'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	25	14	11	15.65	79.83
⊠	B-29	20.0'	CLAYEY SAND (SC)	26	14	12		
▲	B-29	25.0'	CLAYEY SAND with GRAVEL (SC)	25	13	12		
★	B-29	30.0'	CLAYEY SAND (SC)	40	17	23		
⊙	B-29	35.0'	CLAYEY GRAVEL with SAND (GC)	51	16	35		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-29	15.0'	25	13.602	6.022	0.17	1.2	76.2	17.2	6.6	
⊠	B-29	20.0'	25	0.136			12.5	6.5	57.4	36.1	
▲	B-29	25.0'	25	2.39	0.082		5.6	29.2	41.8	29.0	
★	B-29	30.0'	19	0.123			14.0	2.4	63.5	34.1	
⊙	B-29	35.0'	25	5.77	0.112		9.4	43.0	32.2	24.8	

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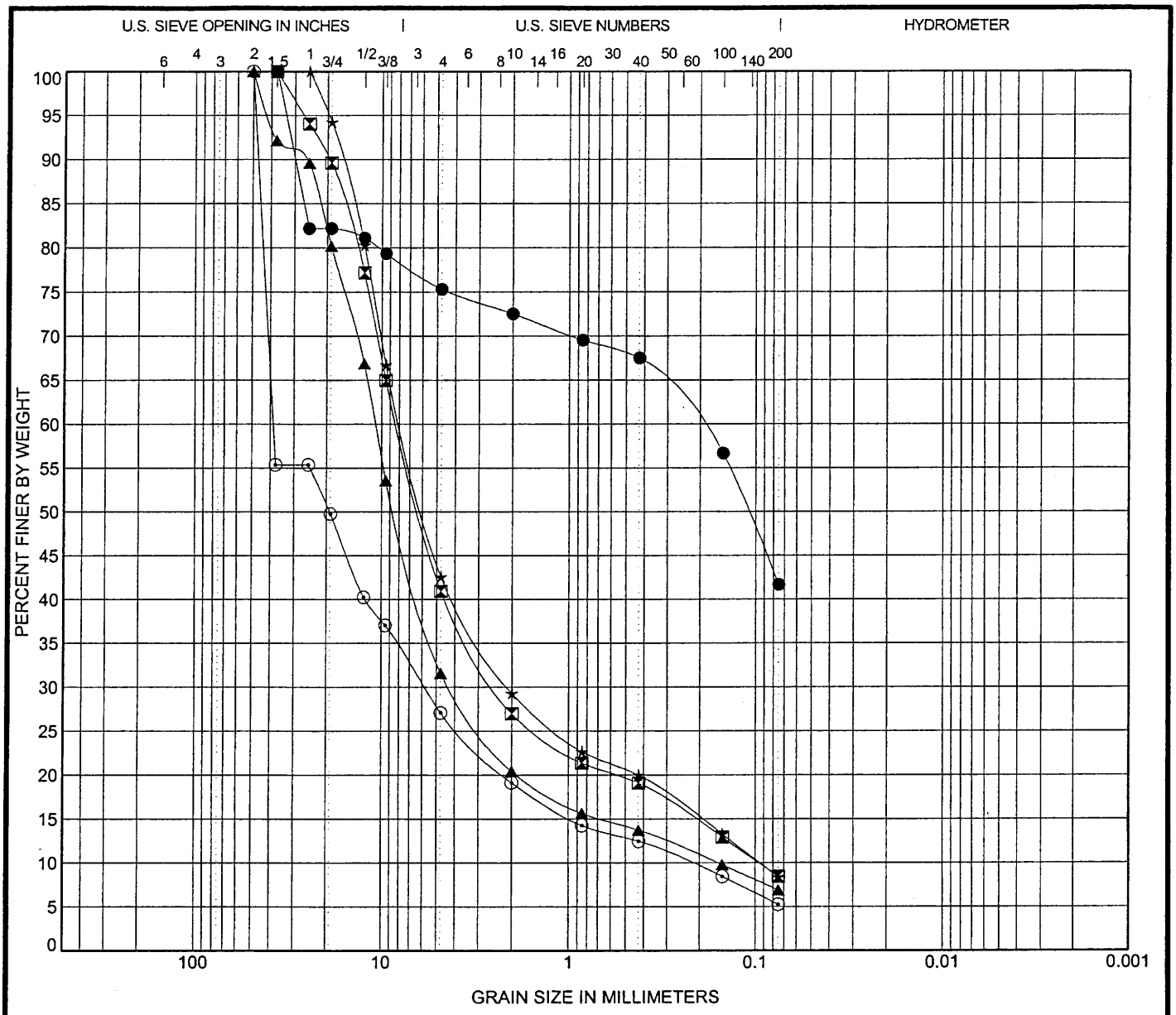
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4g

US_GRAIN_SIZE2_0324014.GPJ US_LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-29	40.0'	CLAYEY SAND with GRAVEL (SC)	25	11	14		
⊠	B-30	5.0	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	22	18	4	7.45	86.55
▲	B-30	10.0'	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	21	18	3	10.30	68.39
★	B-30	15.0'	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	19	18	1	5.96	83.15
⊙	B-30	20.0'	WELL-GRADED GRAVEL with CLAY and SAND (GW-GC)	38	23	15	3.93	172.62

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-29	40.0'	37.5	0.207			7.8	24.7	33.6	41.7	
⊠	B-30	5.0'	37.5	8.236	2.416	0.095	1.3	59.1	32.5	8.5	
▲	B-30	10.0'	50	10.846	4.208	0.159	0.6	68.4	24.6	6.9	
★	B-30	15.0'	25	7.829	2.096	0.094	0.9	57.4	34.2	8.4	
⊙	B-30	20.0'	50	38.637	5.826	0.224	0.8	72.9	21.8	5.3	

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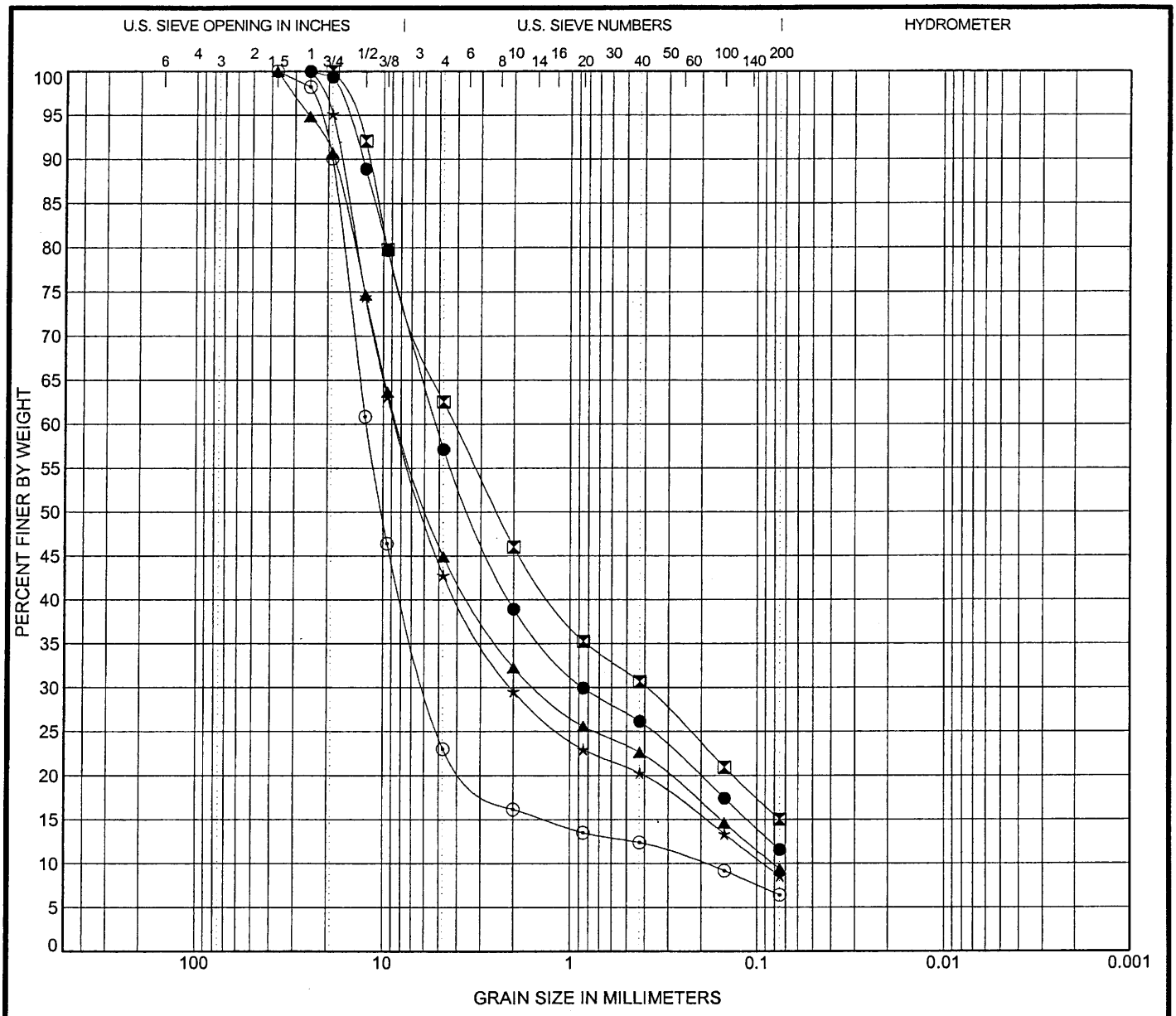
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4h



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-31	5.0'	WELL-GRADED SAND with CLAY and GRAVEL (SW-SC)	29	16	13	2.27	83.43
⊠	B-31	10.0'	CLAYEY SAND with GRAVEL (SC)	26	18	8		
▲	B-31	15.0'	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	18	17	1	3.33	102.30
★	B-31	20.0'	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	18	17	1	5.40	92.87
⊙	B-31	25.0	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	24	17	7	14.22	62.96

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-31	5.0'	25	5.189	0.856		1.3	42.9	45.6	11.6	
⊠	B-31	10.0'	19	4.161	0.396		1.3	37.5	47.5	15.0	
▲	B-31	15.0'	37.5	8.299	1.497	0.081	1.4	55.1	35.5	9.4	
★	B-31	20.0'	25	8.549	2.062	0.092	1.3	57.2	34.2	8.6	
⊙	B-31	25.0'	37.5	12.299	5.845	0.195	0.7	77.0	16.6	6.4	

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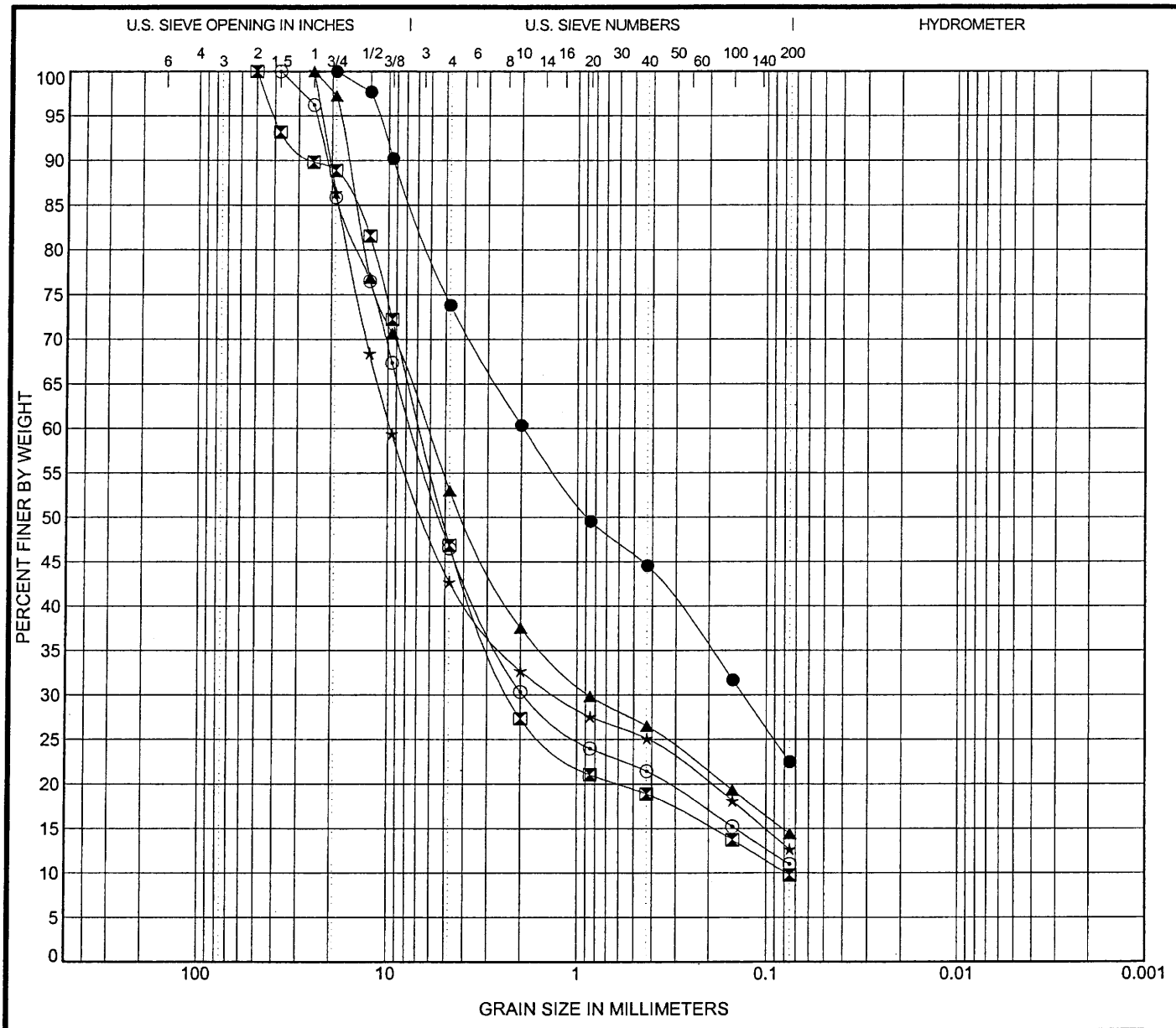
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4i



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-31	30.0'	CLAYEY SAND with GRAVEL (SC)	37	23	14		
⊠	B-31	35.0'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	26	17	9	9.56	87.14
▲	B-32	5.5'	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	21	15	6		
★	B-32	10.5'	CLAYEY GRAVEL with SAND (GC)	33	19	14		
⊙	B-32	15.5'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	31	17	14	7.70	116.74

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-31	30.0'	19	1.947	0.132		4.5	26.2	51.3	22.5	
⊠	B-31	35.0'	50	6.802	2.253	0.078	2.0	53.2	37.1	9.8	
▲	B-32	5.5'	25	6.249	0.865		2.2	47.0	38.6	14.4	
★	B-32	10.5'	25	9.678	1.277		2.5	57.3	30.0	12.7	
⊙	B-32	15.5'	37.5	7.438	1.911		2.1	53.5	35.5	11.0	

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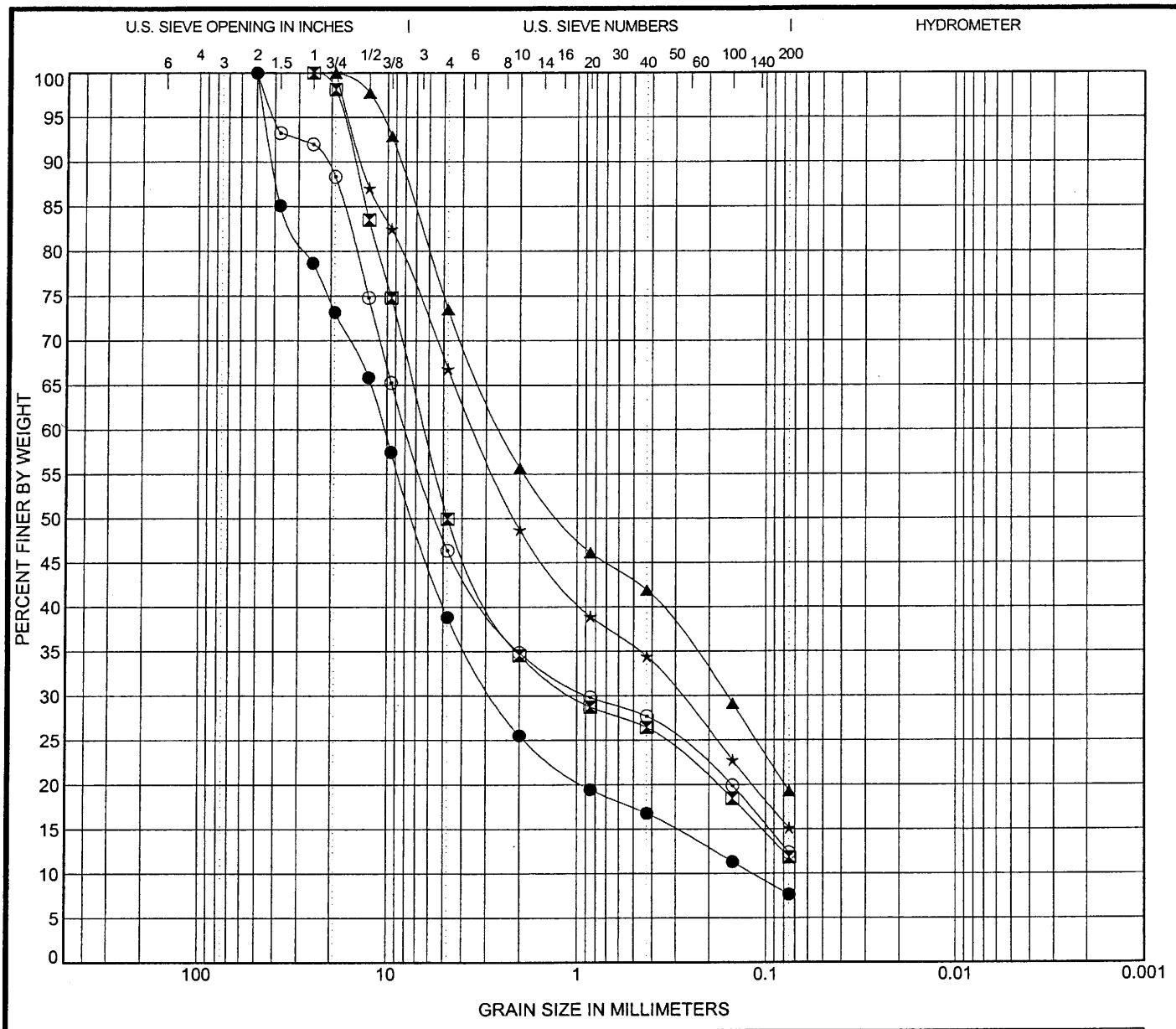
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4j

US GRAIN SIZE2 0324014.GPJ US LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-32	20.0'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	26	17	9	5.95	88.54
⊠	B-33	5.0'	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	22	16	6	2.70	101.76
▲	B-33	10.0'	CLAYEY SAND with GRAVEL (SC)	36	18	18		
★	B-33	15.0'	CLAYEY SAND with GRAVEL (SC)	33	17	16		
⊙	B-33	20.0'	CLAYEY GRAVEL with SAND (GC)	28	16	12	1.63	129.42

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-32	20.0'	50	10.326	2.676	0.117	1.4	61.2	31.2	7.7	
⊠	B-33	5.0'	25	6.289	1.025		2.7	50.1	38.1	11.8	
▲	B-33	10.0'	19	2.467	0.161		5.1	26.5	54.2	19.3	
★	B-33	15.0'	19	3.428	0.287		2.8	33.2	51.7	15.1	
⊙	B-33	20.0'	50	7.832	0.879		2.4	53.6	34.0	12.3	

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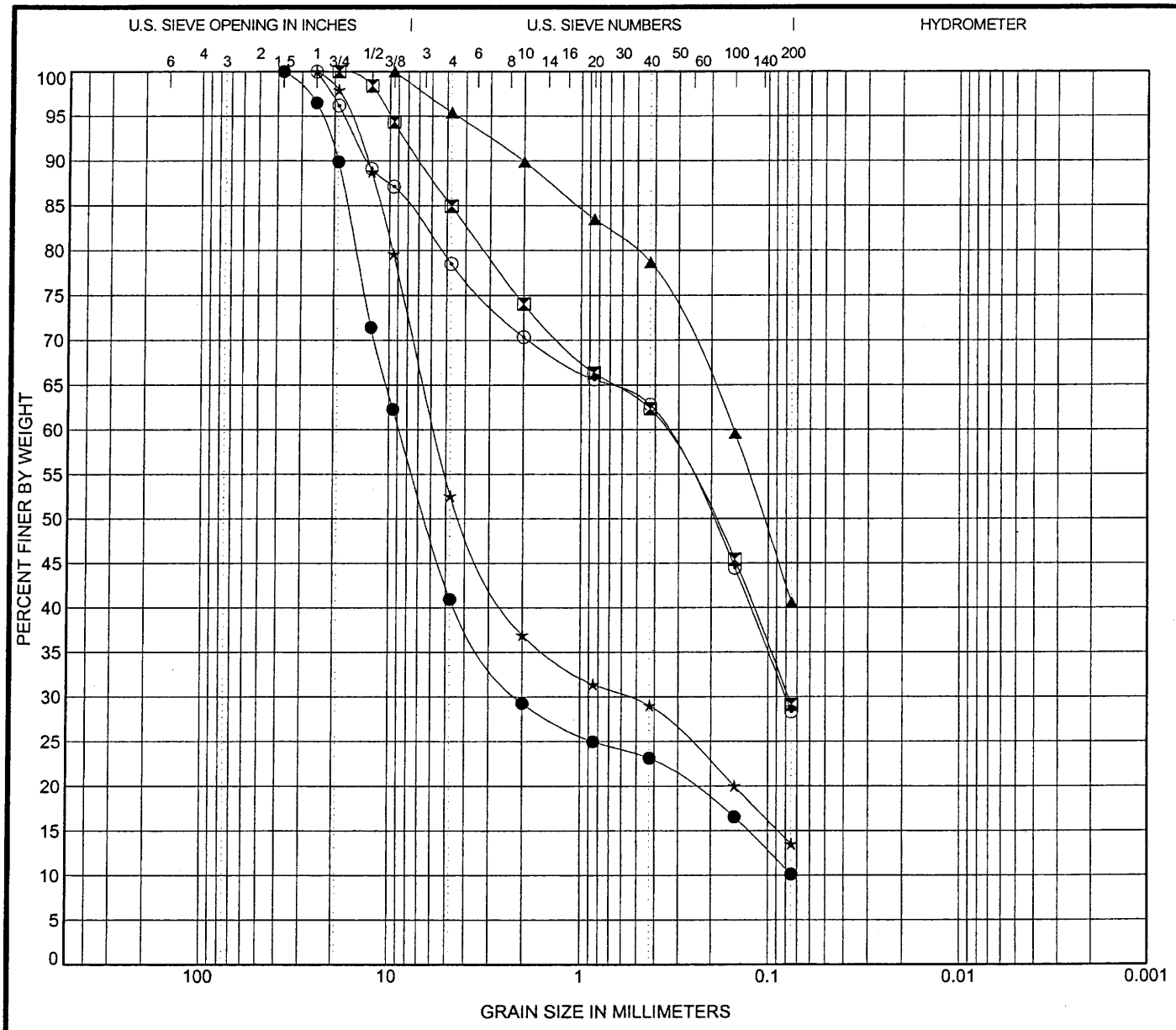
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4k

US GRAIN SIZE2 0324014.GPJ US LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-33	25.0'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	28	16	12	6.84	119.38
⊠	B-33	30.0'	CLAYEY SAND with GRAVEL (SC)	48	19	29		
▲	B-33	35.0'	CLAYEY SAND (SC)	46	21	25		
★	B-34	5.5'	CLAYEY GRAVEL with SAND (GC)	28	18	10		
⊙	B-34	10.0'	CLAYEY SAND with GRAVEL (SC)	35	19	16		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-33	25.0'	37.5	8.821	2.112		2.1	59.1	30.8	10.1	
⊠	B-33	30.0'	19	0.369	0.078		7.0	15.1	55.8	29.1	
▲	B-33	35.0'	9.5	0.153			10.4	4.6	54.8	40.6	
★	B-34	5.5'	25	5.748	0.566		4.7	47.4	39.0	13.5	
⊙	B-34	10.0'	25	0.363	0.081		11.4	21.5	50.2	28.3	

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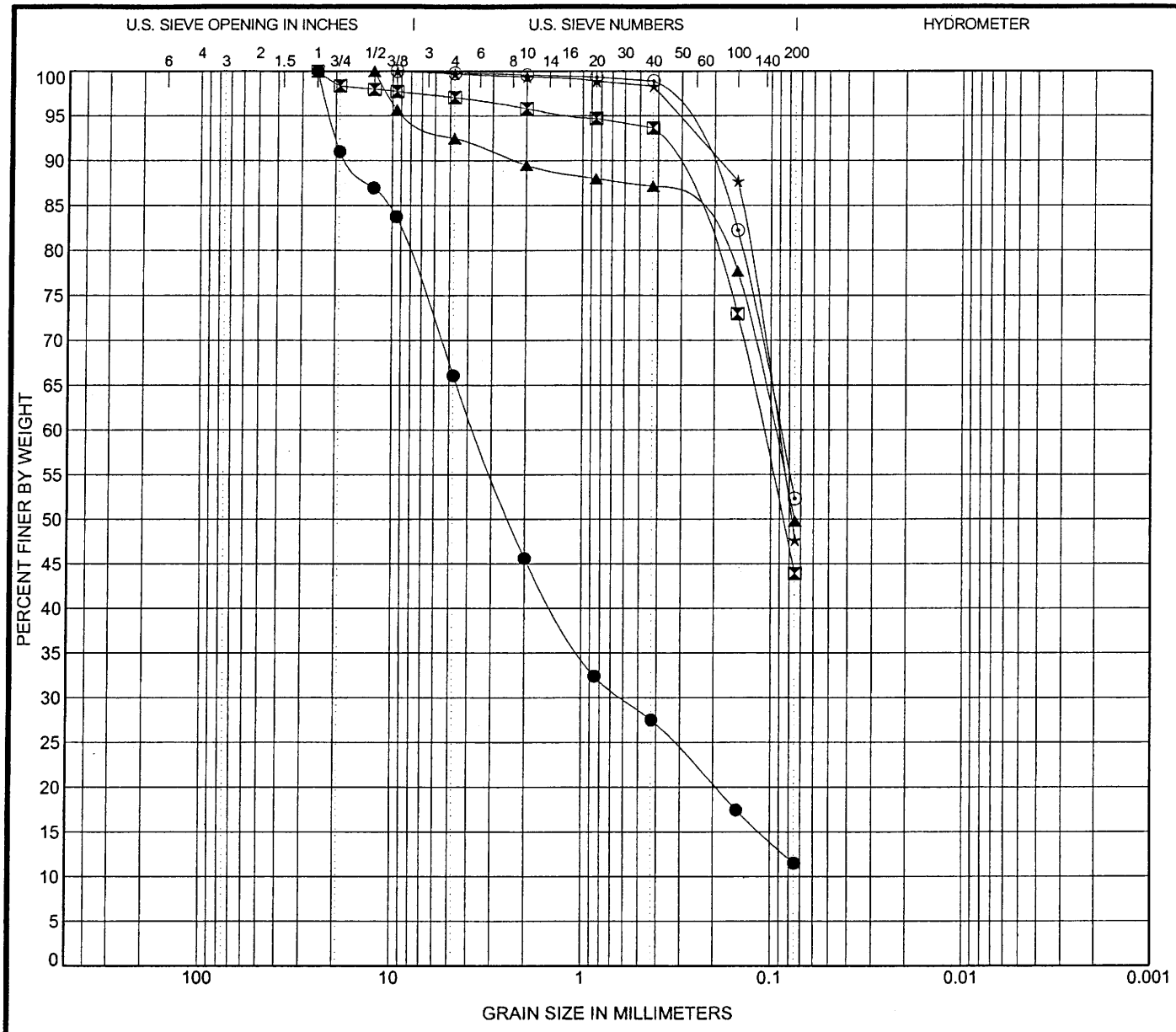
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4I

US_GRAIN_SIZE2 0324014.GPJ US_LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-34 15.0'	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	NP	NP	NP	1.59	58.41
⊠	B-34 20.0'	CLAYEY SAND (SC)	32	16	16		
▲	B-34 25.0'	CLAYEY SAND (SC)	52	17	35		
★	B-34 30.0'	CLAYEY SAND (SC)	38	22	16		
⊙	B-34 35.0'	SANDY FAT CLAY (CH)	65	16	49		

Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-34 15.0'	25	3.675	0.606		3.6	33.9	54.6	11.5	
⊠	B-34 20.0'	25	0.11			14.5	2.9	53.2	43.9	
▲	B-34 25.0'	12.5	0.097			18.9	7.5	42.7	49.8	
★	B-34 30.0'	9.5	0.093			15.5	0.3	52.0	47.6	
⊙	B-34 35.0'	9.5	0.09			19.0	0.2	47.5	52.3	

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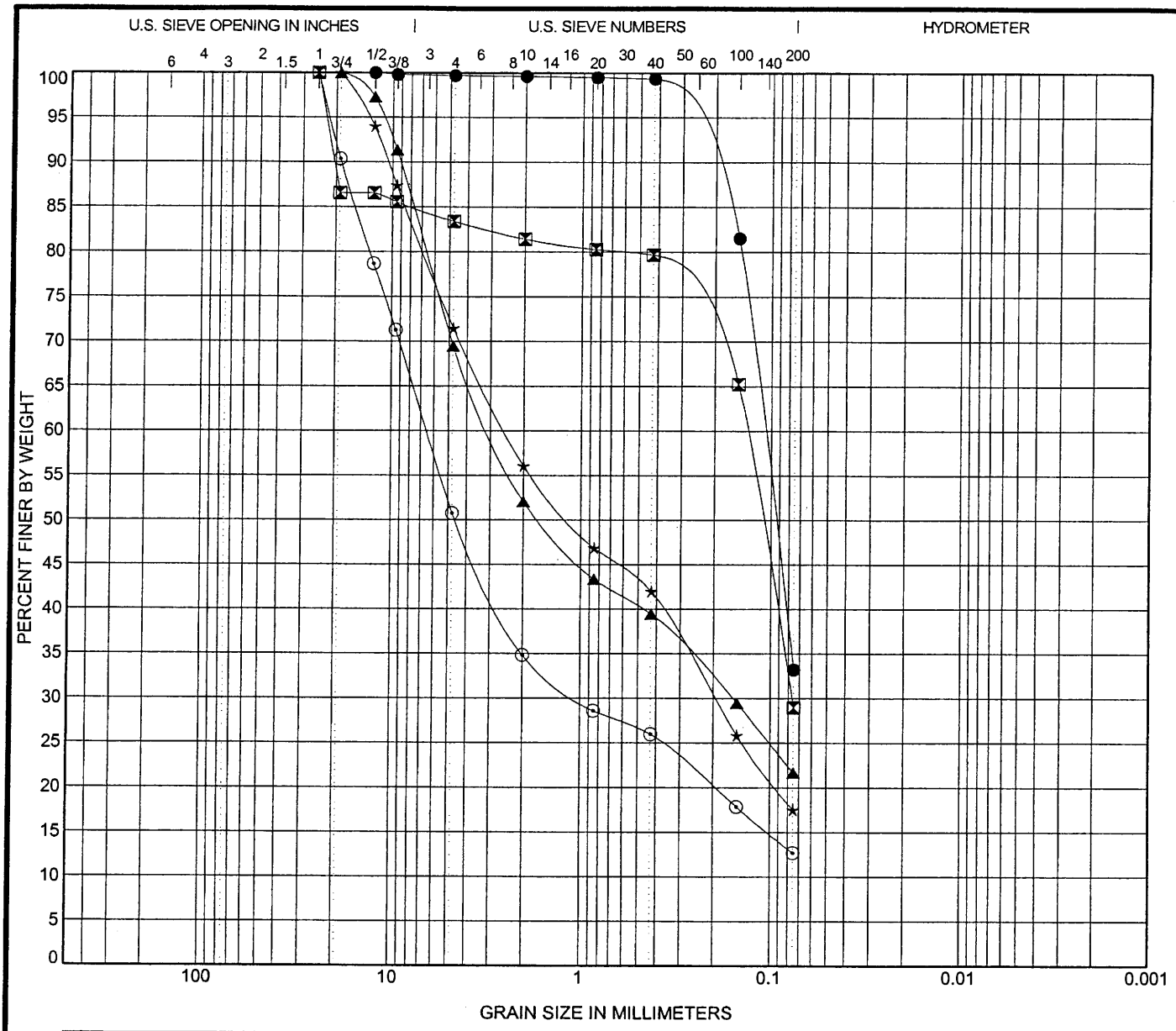
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4m

US_GRAIN_SIZE2_0324014.GPJ US_LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-34	40.0'	CLAYEY SAND (SC)	35	21	14		
⊠	B-34	45.0'	CLAYEY SAND with GRAVEL (SC)	36	20	16		
▲	B-35	5.5'	CLAYEY SAND with GRAVEL (SC)	37	19	18		
★	B-35	10.0'	CLAYEY SAND with GRAVEL (SC)	29	16	13		
⊙	B-35	15.5'	CLAYEY GRAVEL with SAND (GC)	32	16	16		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-34	40.0'	12.5	0.11			15.6	0.3	66.5	33.2	
⊠	B-34	45.0'	25	0.136	0.077		13.0	16.6	54.4	29.0	
▲	B-35	5.5'	19	2.966	0.159		5.0	30.5	47.8	21.7	
★	B-35	10.0'	19	2.495	0.196		4.3	28.5	54.0	17.5	
⊙	B-35	15.5'	25	6.495	1.035		2.9	49.3	38.0	12.7	

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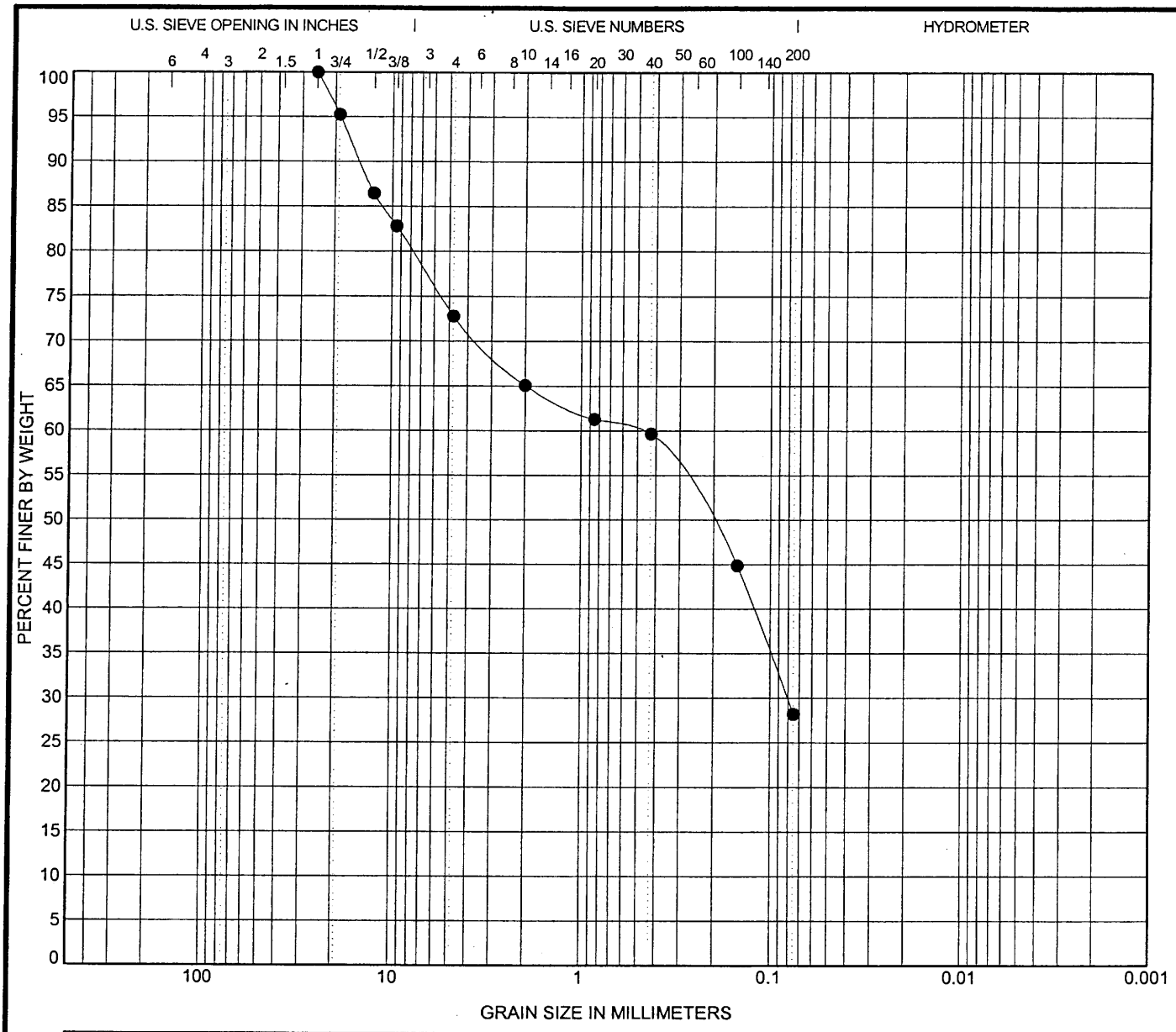
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4n



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	**B-35**	**20.0'**	**CLAYEY SAND with GRAVEL (SC)**	**30**	**14**	**16**		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	**B-35**	**20.0'**	**25**	**0.491**	**0.081**		**9.0**	**27.2**	**44.6**	**28.2**	

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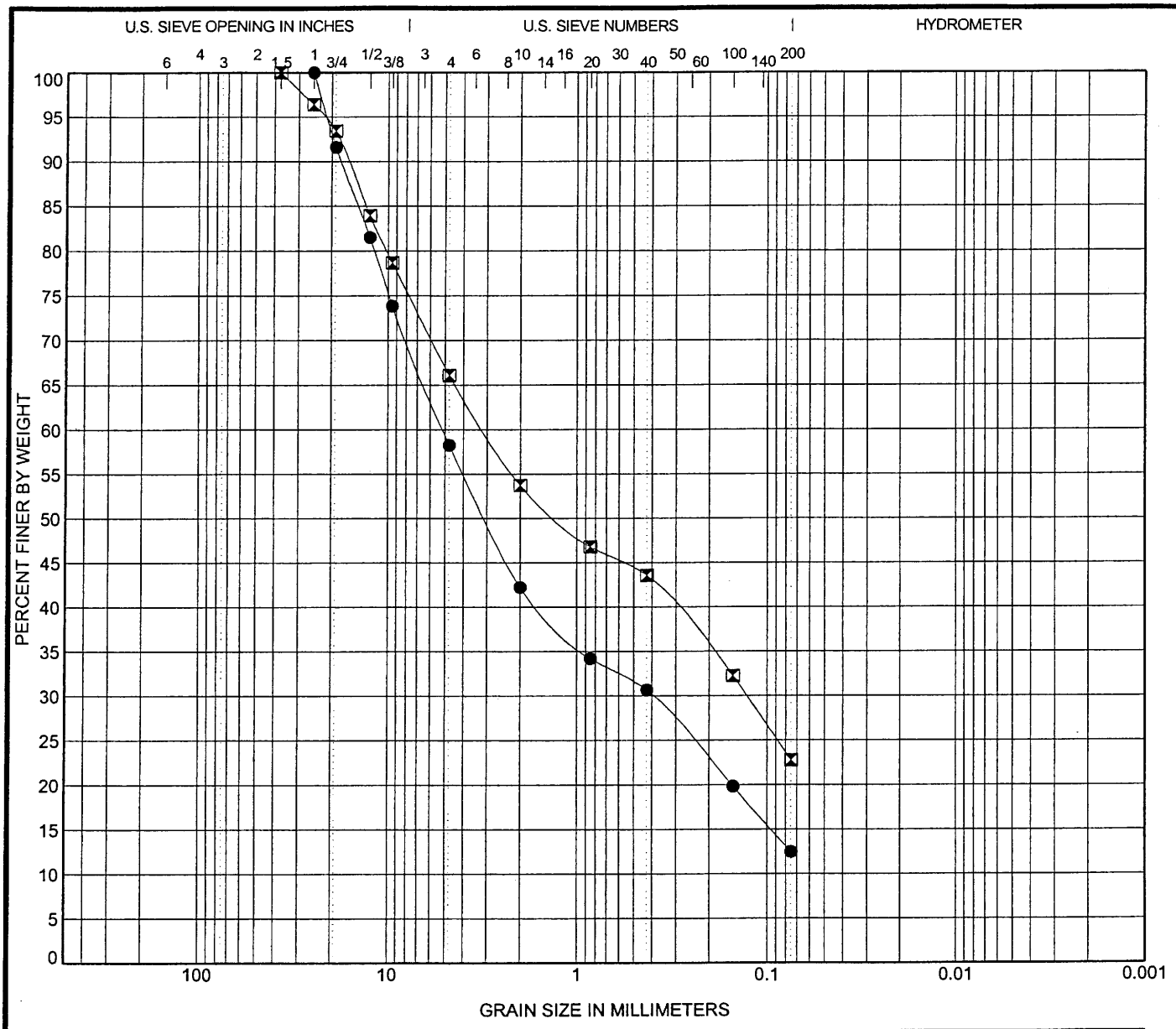
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Retaining-Sound Walls

Location: Las Vegas, Nevada

Project Number: 0324-01-4 Plate Number: 4o

US GRAIN SIZE2 0324014.GPJ US_LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-36	5.0'	CLAYEY SAND with GRAVEL (SC)	27	18	9	0.52	86.48
⊠	B-37	4.0'	CLAYEY SAND with GRAVEL (SC)	26	15	11		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-36	5.0'	25	5.136	0.399		5.7	41.8	45.8	12.5	
⊠	B-37	4.0'	37.5	3.102	0.127		5.6	33.9	43.4	22.7	

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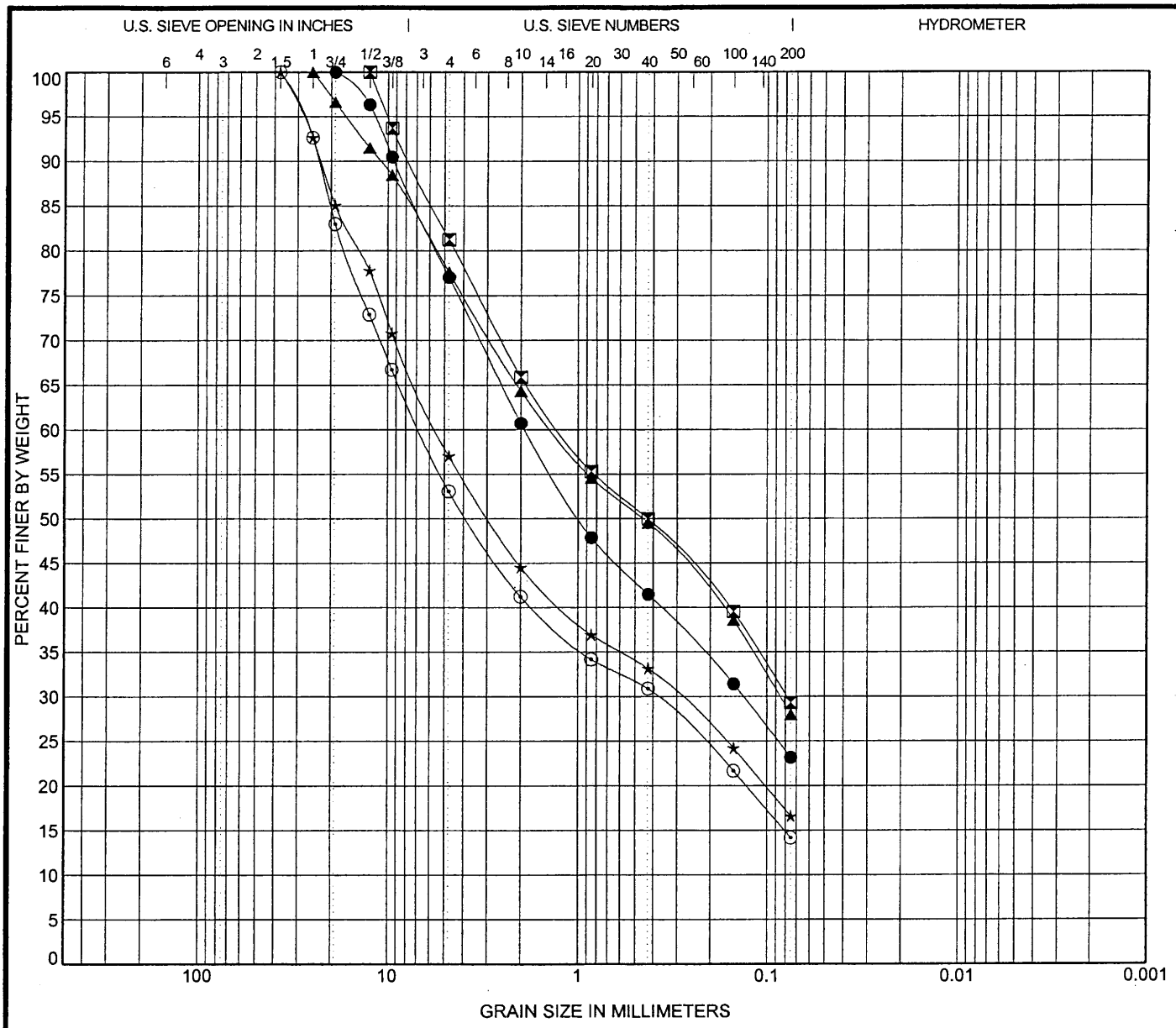
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Rainbow Bridge

Location: Las Vegas, Nevada

Project Number: Plate Number: 4a

US GRAIN SIZE2 0324015.GPJ US LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-40	2.5'	CLAYEY SAND with GRAVEL (SC)	37	17	20		
⊠	B-40	5.0'	CLAYEY SAND with GRAVEL (SC)	41	18	23		
▲	B-40	7.5'	CLAYEY SAND with GRAVEL (SC)	41	18	23		
★	B-40	10.0'	CLAYEY GRAVEL with SAND (GC)	29	16	13		
⊙	B-40	12.5'	CLAYEY GRAVEL with SAND (GC)	26	17	9		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-40	2.5'	19	1.908	0.133		5.0	23.0	53.9	23.2	
⊠	B-40	5.0'	12.5	1.243	0.079		7.4	18.8	52.0	29.3	
▲	B-40	7.5'	25	1.368	0.086		7.6	22.4	49.6	28.0	
★	B-40	10.0'	37.5	5.513	0.295		4.3	43.0	40.5	16.6	
⊙	B-40	12.5'	37.5	6.754	0.385		2.4	46.9	38.9	14.2	

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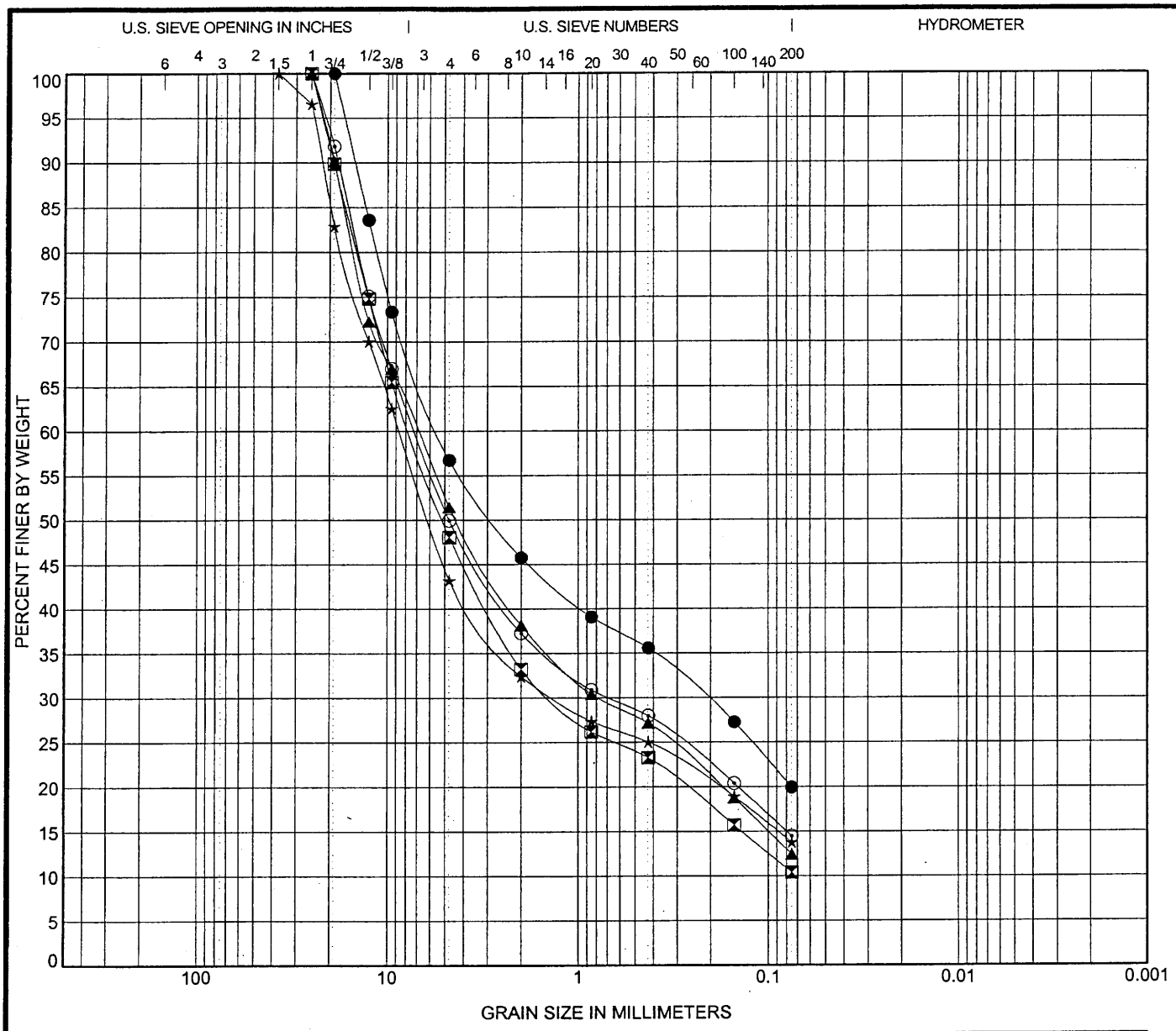
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Washington Avenue Brid

Location: Las Vegas, Nevada

Project Number: 0324-01-6 Plate Number: 4a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-40	17.5'	CLAYEY GRAVEL with SAND (GC)	30	12	18		
⊠	B-40	20.0'	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	22	17	5	3.37	107.28
▲	B-40	22.5'	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	23	16	7	1.53	121.06
★	B-40	25.0'	CLAYEY GRAVEL with SAND (GC)	28	15	13		
⊙	B-40	27.5'	CLAYEY GRAVEL with SAND (GC)	25	15	10		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-40	17.5'	19	5.446	0.212		3.8	43.3	36.8	19.9	
⊠	B-40	20.0'	25	7.636	1.353		2.0	51.9	37.7	10.4	
▲	B-40	22.5'	25	6.957	0.782		1.9	48.6	39.0	12.4	
★	B-40	25.0'	37.5	8.675	1.331		2.3	56.8	29.4	13.8	
⊙	B-40	27.5'	25	7.149	0.69		2.5	50.1	35.5	14.5	

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1345 Capital Blvd., Suite A
Reno, Nevada 89502-7140
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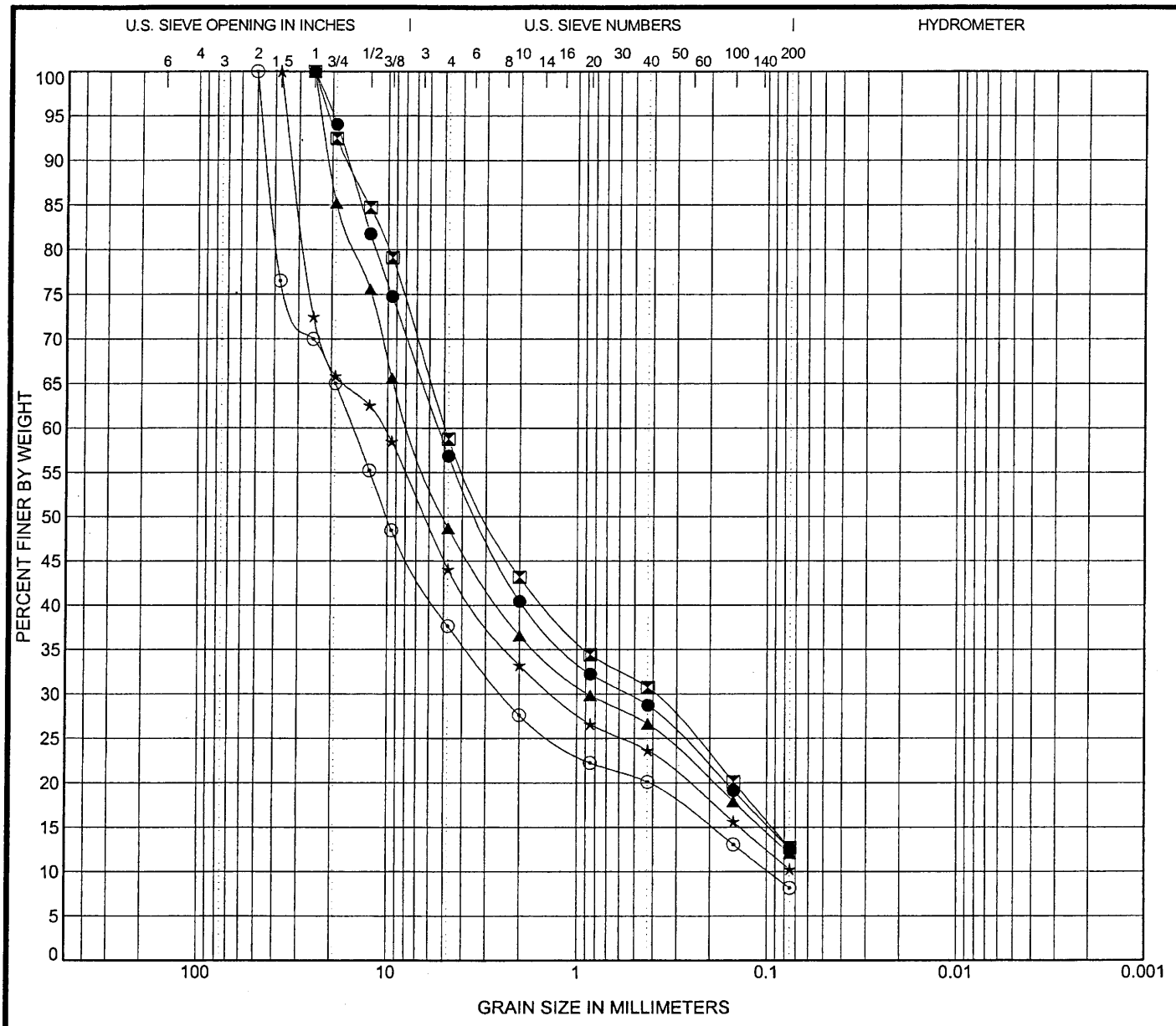
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Washington Avenue Bridg

Location: Las Vegas, Nevada

Project Number: 0324-01-6 Plate Number: 4b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-41	2.5'	CLAYEY SAND with GRAVEL (SC)	28	18	10		
⊠	B-41	5.0'	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	28	21	7		
▲	B-41	7.5'	CLAYEY GRAVEL with SAND (GC)	28	18	10	1.69	128.55
★	B-41	10.0'	WELL-GRADED GRAVEL with CLAY and SAND (GW-GC)	27	18	9	2.28	145.45
⊙	B-41	12.5'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	27	19	8	4.06	158.02

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-41	2.5'	25	5.367	0.547		3.8	43.2	44.2	12.6	
⊠	B-41	5.0'	25	4.956	0.396		4.2	41.2	46.0	12.7	
▲	B-41	7.5'	25	7.553	0.867		3.6	51.3	36.6	12.1	
★	B-41	10.0'	37.5	10.529	1.318		3.2	55.9	33.8	10.3	
⊙	B-41	12.5'	50	15.334	2.458	0.097	3.3	62.4	29.5	8.2	

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Reno, Nevada 89502-7140
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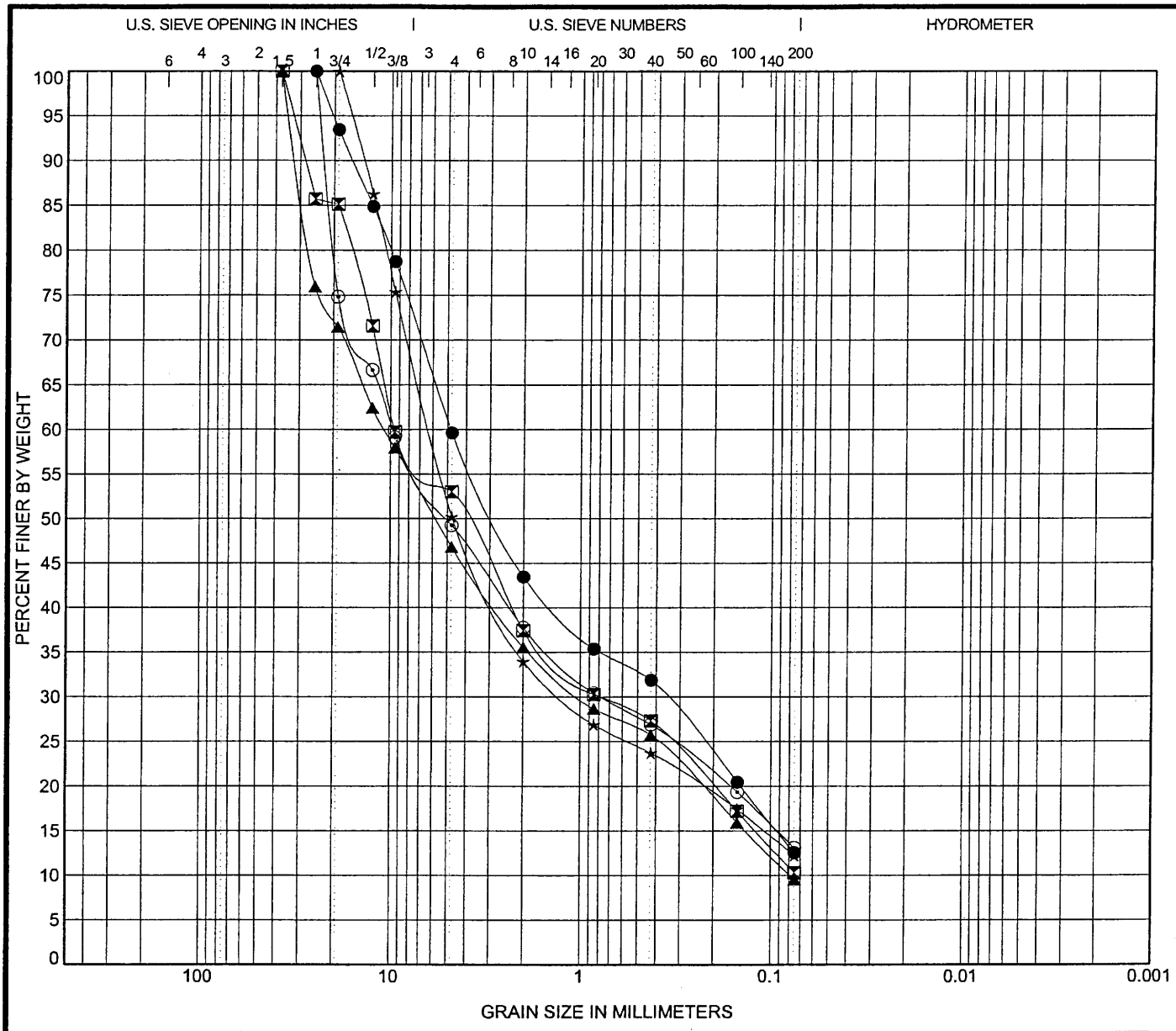
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Washington Avenue Bridg

Location: Las Vegas, Nevada

Project Number: 0324-01-6 Plate Number: 4c

US_GRAIN_SIZE2_0324016.GPJ US_LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			USCS Classification	LL	PL	PI	Cc	Cu
●	B-41	15.0'	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	26	19	7		
⊠	B-41	17.5'	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	25	18	7	0.92	131.75
▲	B-41	20.0'	WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GC)	23	18	5	1.19	137.07
★	B-42	2.5'	CLAYEY GRAVEL with SAND (GC)	27	15	12	4.45	112.18
⊙	B-42	5.0'	CLAYEY GRAVEL with SAND (GC)	25	16	9		

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-41	15.0'	25	4.816	0.359		5.2	40.4	47.0	12.6	
⊠	B-41	17.5'	37.5	9.56	0.799		4.8	47.0	42.7	10.3	
▲	B-41	20.0'	37.5	10.783	1.005	0.079	3.4	53.2	37.2	9.6	
★	B-42	2.5'	19	6.222	1.24		2.7	49.8	37.9	12.2	
⊙	B-42	5.0'	25	9.816	0.784		3.8	50.8	36.2	13.1	

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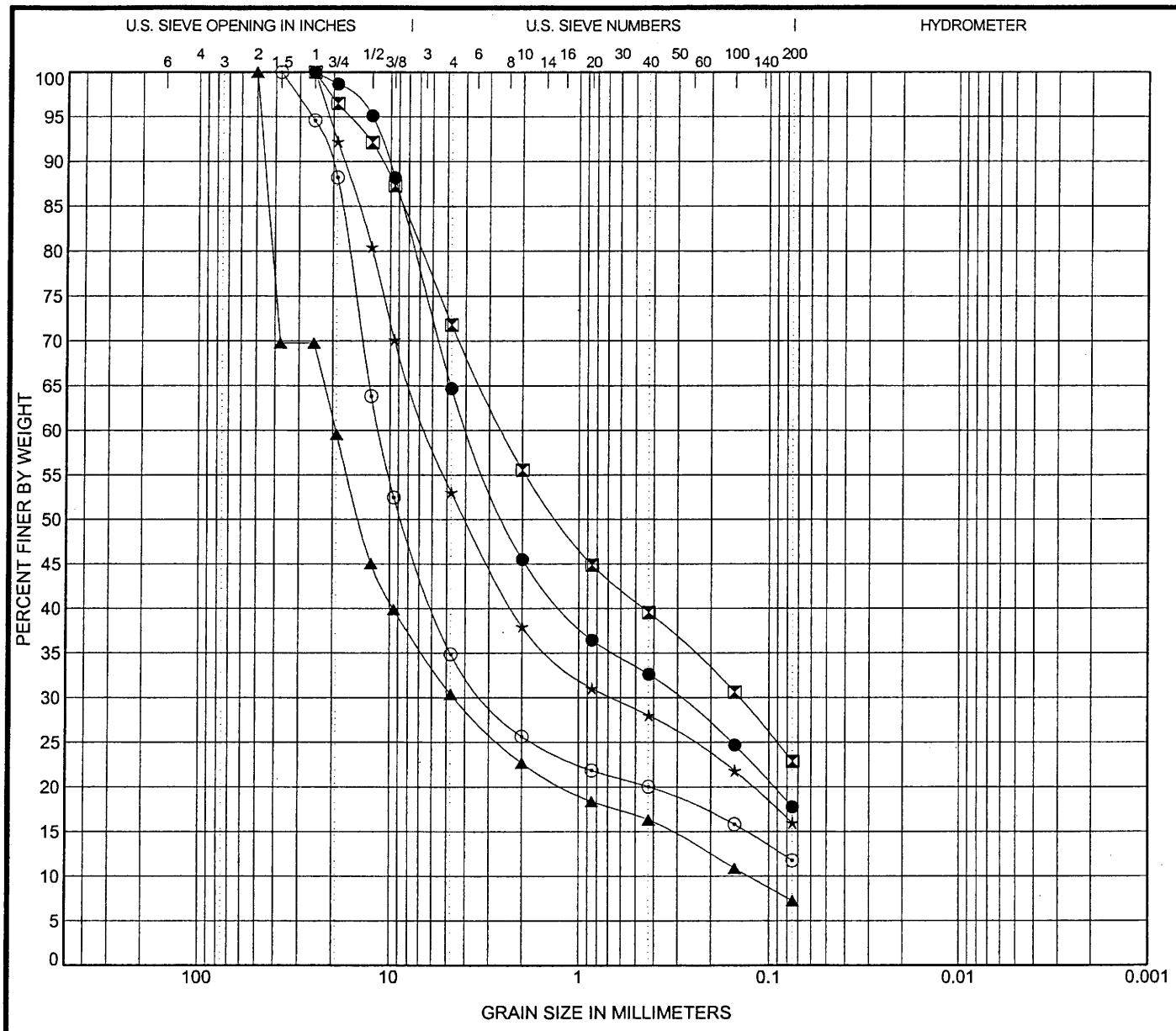
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Washington Avenue Bridg

Location: Las Vegas, Nevada

Project Number: 0324-01-6 Plate Number: 4d

US GRAIN SIZE2 0324016.GPJ US LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			USCS Classification	LL	PL	PI	Cc	Cu
●	B-42	7.5'	CLAYEY SAND with GRAVEL (SC)	27	15	12		
⊠	B-42	10.0'	CLAYEY SAND with GRAVEL (SC)	28	16	12		
▲	B-42	13.5'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	28	19	9	8.56	152.54
★	B-42	15.0'	CLAYEY GRAVEL with SAND (GC)	28	15	13		
⊙	B-42	17.5'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	27	15	12	14.38	205.74

Specimen Identification			D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-42	7.5'	25	3.845	0.302		4.7	35.3	46.9	17.7	
⊠	B-42	10.0'	25	2.536	0.142		5.8	28.2	48.9	22.8	
▲	B-42	13.5'	50	19.219	4.553	0.126	1.3	69.6	23.1	7.3	
★	B-42	15.0'	25	6.301	0.672		3.6	47.0	37.1	16.0	
⊙	B-42	17.5'	37.5	11.394	3.013		20.2	65.2	23.1	11.8	

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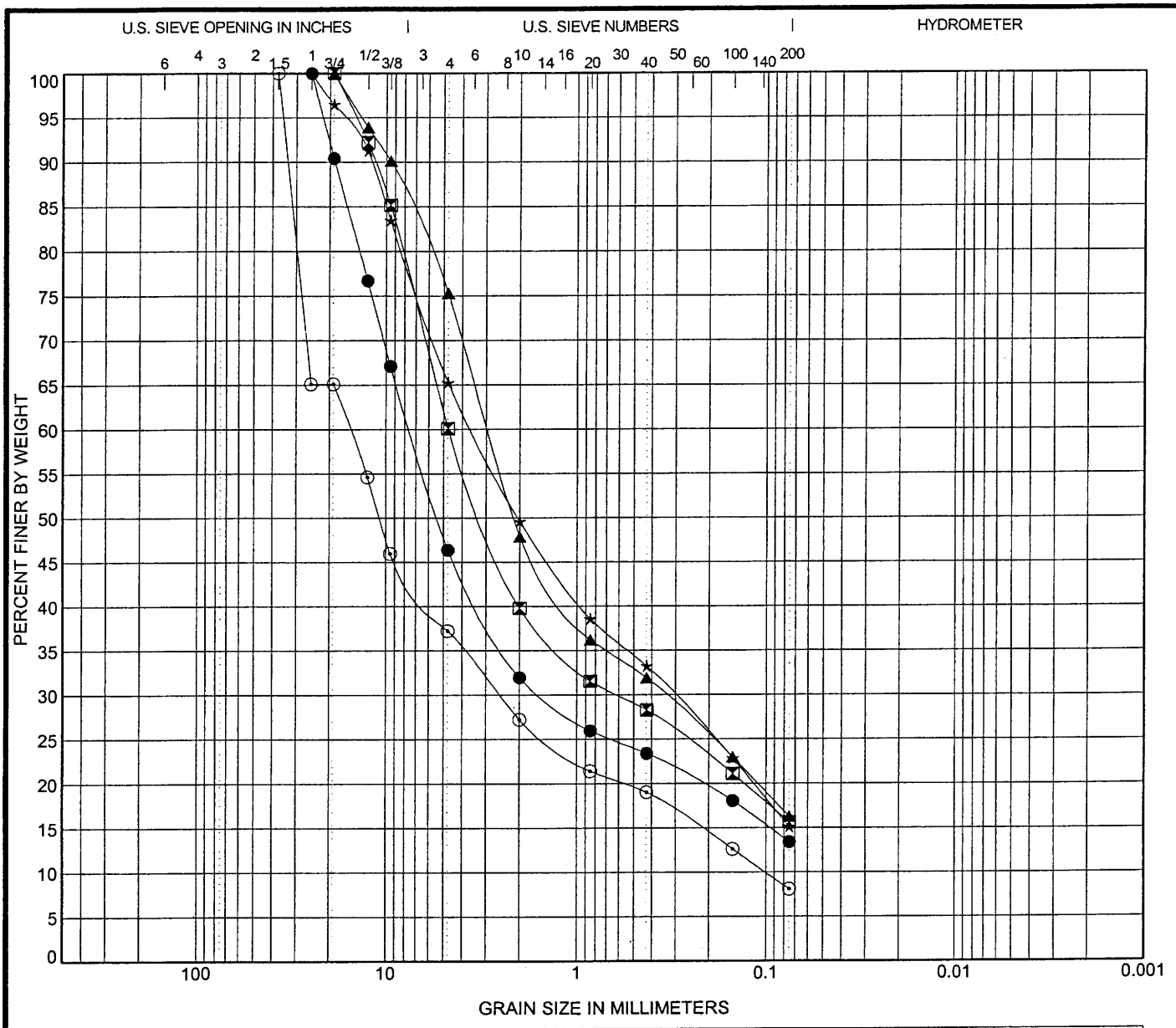
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Washington Avenue Bridg

Location: Las Vegas, Nevada

Project Number: 0324-01-6 Plate Number: 4e



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-42	20.0'	CLAYEY GRAVEL with SAND (GC)	25	15	10		
⊠	B-42	25.0'	CLAYEY SAND with GRAVEL (SC)	24	14	10		
▲	B-42	27.5'	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	23	16	7		
★	B-42	30.0'	CLAYEY SAND with GRAVEL (SC)	26	18	8		
⊙	B-43	2.5	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	25	18	7	4.17	154.40

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-42	20.0'	25	7.492	1.515		2.6	53.6	33.0	13.4	
⊠	B-42	25.0'	19	4.736	0.616		2.5	39.9	44.4	15.6	
▲	B-42	27.5'	19	2.933	0.341		2.6	24.7	59.0	16.3	
★	B-42	30.0'	25	3.553	0.308		2.2	34.7	50.1	15.1	
⊙	B-43	2.5'	37.5	15.5	2.546	0.1	2.7	62.8	29.1	8.1	

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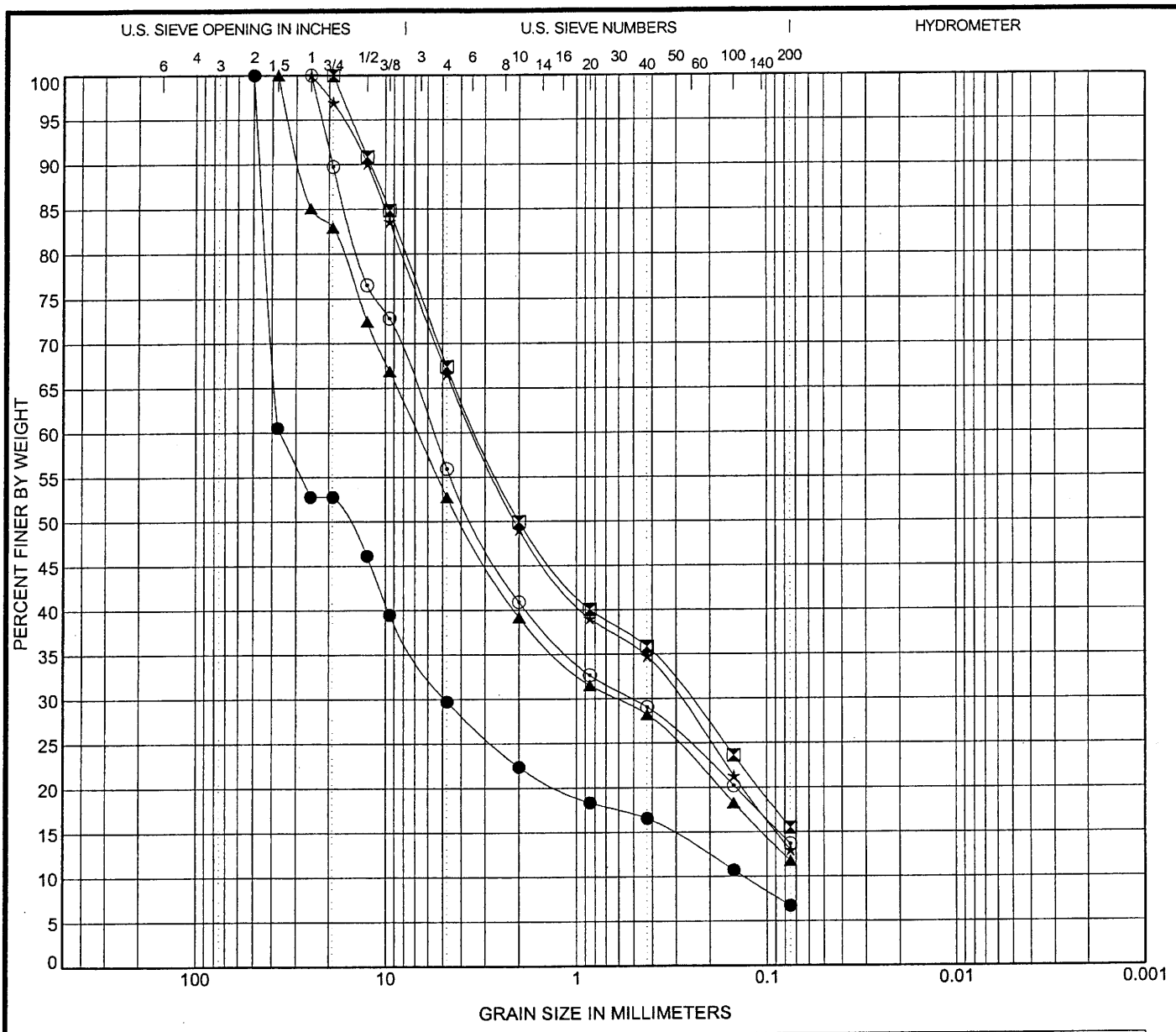
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Washington Avenue Bridg

Location: Las Vegas, Nevada

Project Number: 0324-01-6 Plate Number: 4f

US_GRAIN_SIZE2 0324016.GPJ US_LAB.GDT 11/22/2002



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-43	5.0'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	27	18	9	4.88	275.98
⊠	B-43	7.5'	CLAYEY SAND with GRAVEL (SC)	28	18	10		
▲	B-43	10.0'	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	25	18	7	0.91	109.03
★	B-43	12.5'	CLAYEY SAND with GRAVEL (SC)	27	19	8		
⊙	B-43	17.5'	CLAYEY GRAVEL with SAND (GC)	25	17	8		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-43	5.0'	50	36.484	4.85	0.132	2.5	70.3	23.0	6.7	
⊠	B-43	7.5'	19	3.294	0.259		5.4	32.6	51.9	15.5	
▲	B-43	10.0'	37.5	6.783	0.62		4.8	47.3	41.0	11.8	
★	B-43	12.5'	25	3.437	0.294		6.3	33.5	53.6	13.0	
⊙	B-43	17.5'	25	5.617	0.512		3.5	44.1	42.3	13.7	

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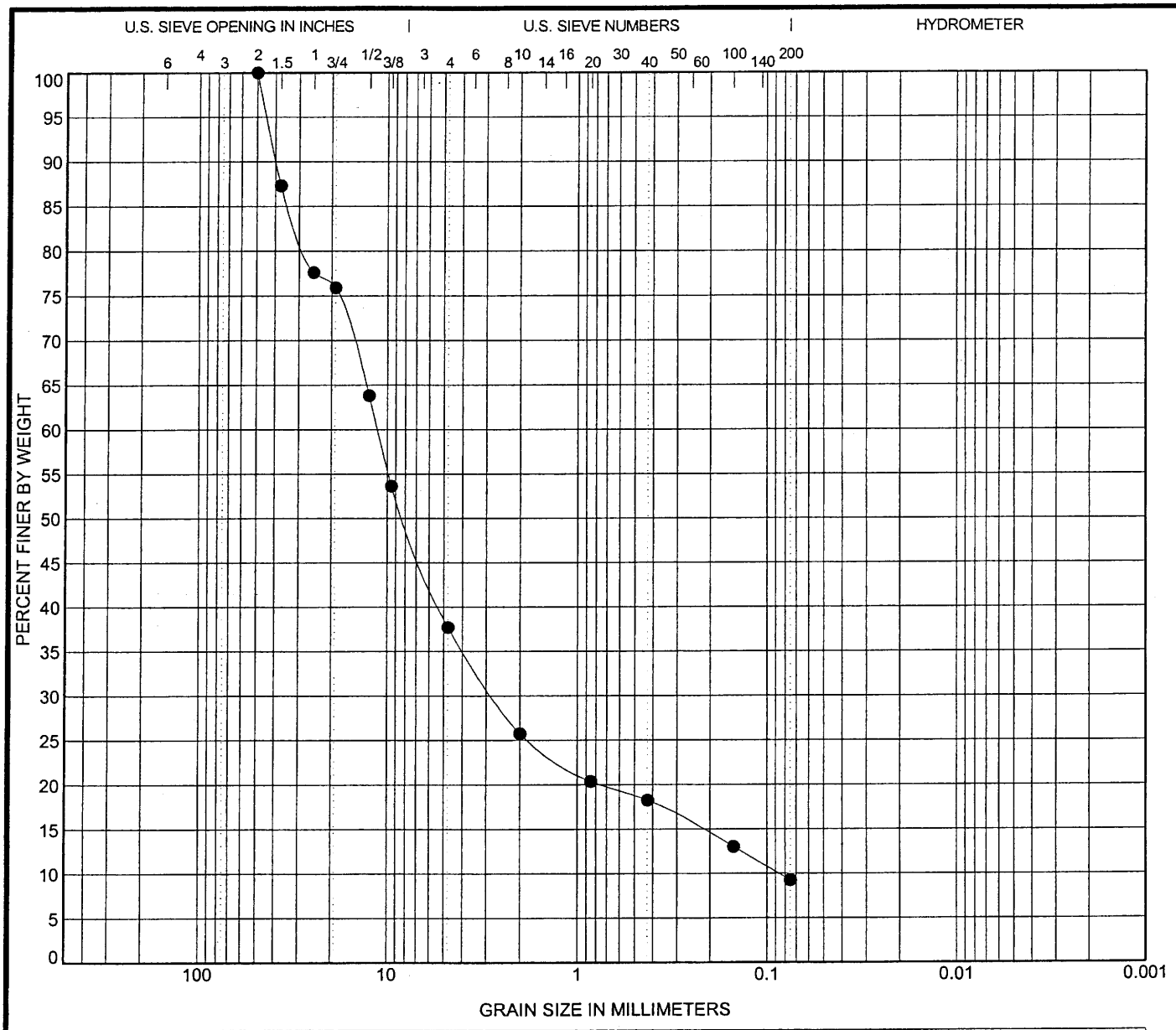
GRAIN SIZE DISTRIBUTION

Project: US 95 Widening Project / Washington Avenue Bridg

Location: Las Vegas, Nevada

Project Number: 0324-01-6 Plate Number: 4g



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-43	20.0'	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	24	16	8	7.65	131.24

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-43	20.0'	50	11.275	2.722	0.086	2.8	62.3	28.4	9.3	

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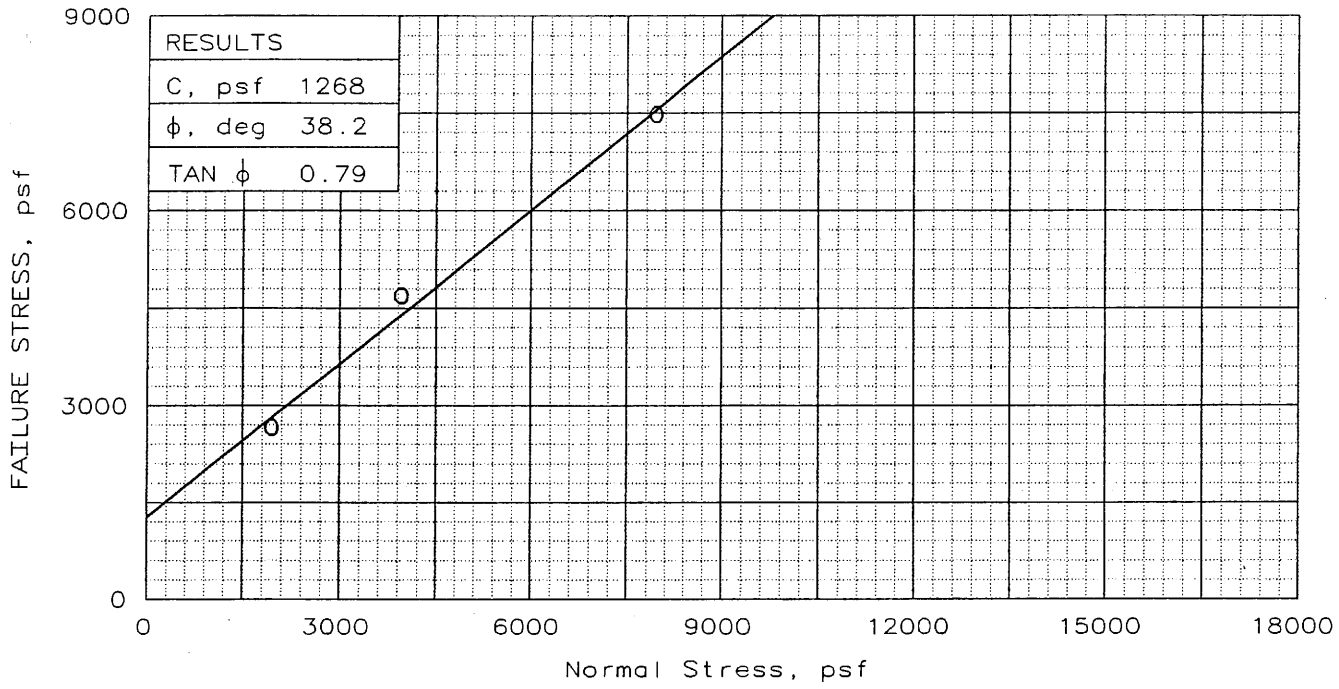
GRAIN SIZE DISTRIBUTION

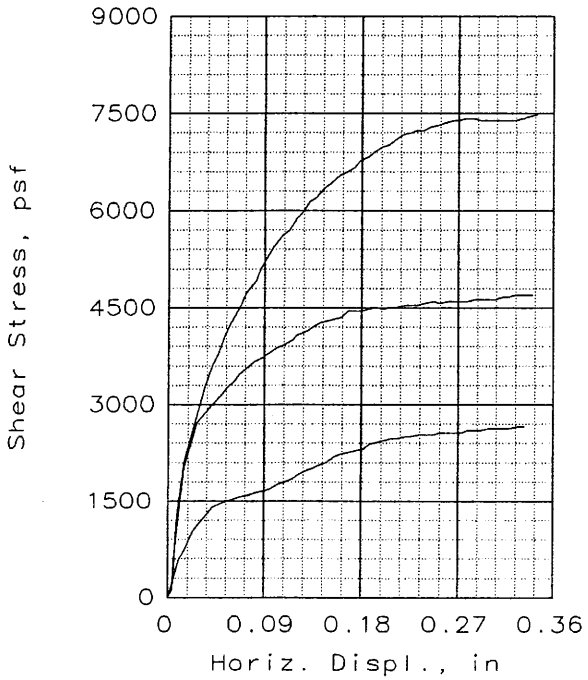
Project: US 95 Widening Project / Washington Avenue Bridg

Location: Las Vegas, Nevada

Project Number: 0324-01-6 Plate Number: 4h

US GRAIN SIZE2 0324016.GPJ US LAB.GDT 11/22/2002





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	4.4	4.4	4.4
	DRY DENSITY, pcf	119.7	119.7	119.7
	SATURATION, %	32.0	32.0	32.0
	VOID RATIO	0.356	0.356	0.356
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	7.1	6.5	4.7
	DRY DENSITY, pcf	125.5	122.3	122.3
	SATURATION, %	62.7	51.6	37.3
	VOID RATIO	0.293	0.327	0.327
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.95	0.98	0.98
NORMAL STRESS, psf		8000	2000	4000
FAILURE STRESS, psf		7482	2661	4696
DISPLACEMENT, in		0.34	0.33	0.32
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, in/min		0.0400	0.0400	0.0400

SAMPLE TYPE: Remolded
DESCRIPTION: Poorly Graded Gravel with Silty Clay and Sand
LL= 22 PL= 6 PI= 16
SPECIFIC GRAVITY= 2.6
REMARKS:

Fig. No.: _____

CLIENT: PBS & J

PROJECT: U.S. 95 Widening

SAMPLE LOCATION: B-1, Sample 1B

PROJ. NO.: 0324-01-1 DATE: 10/30/2001

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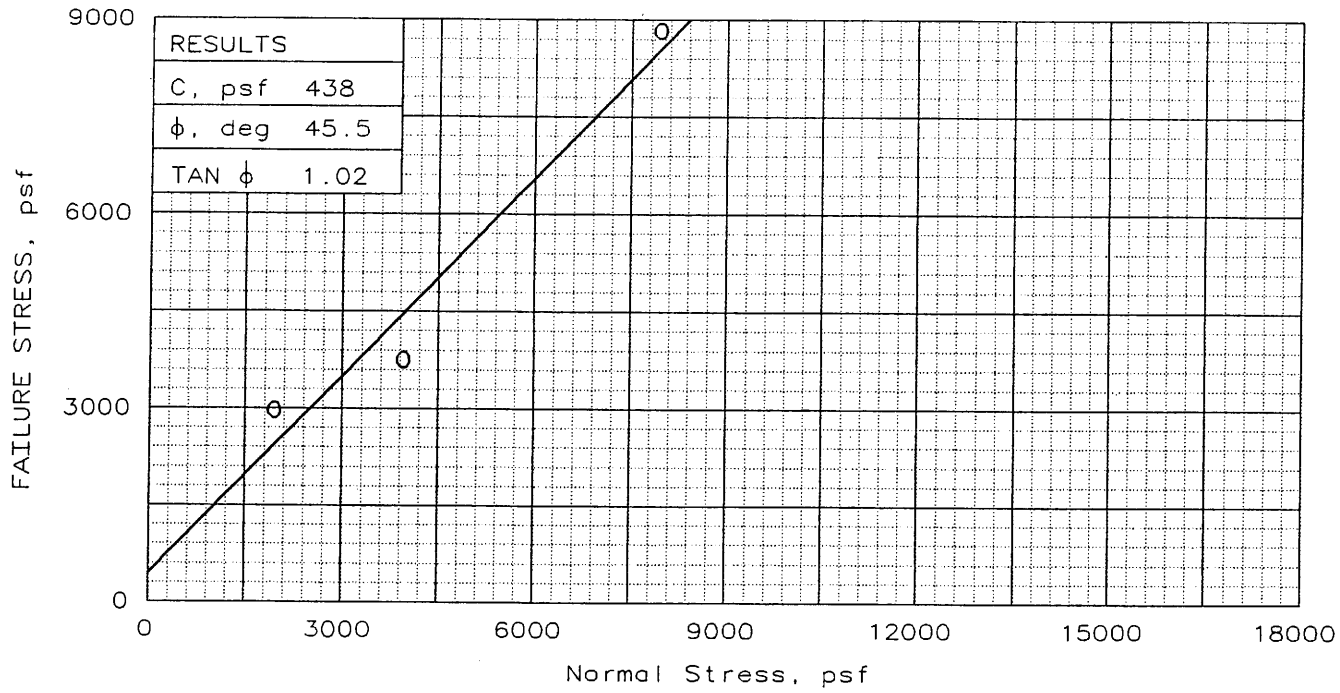

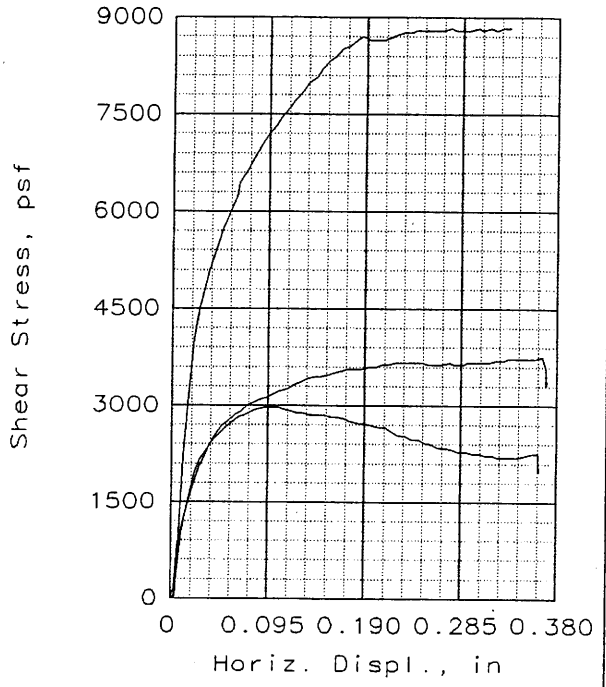

SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	6.2	6.2	6.2
	DRY DENSITY, pcf	117.7	117.7	117.7
	SATURATION, %	42.7	42.7	42.7
	VOID RATIO	0.380	0.380	0.380
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	6.2	6.0	8.7
	DRY DENSITY, pcf	122.4	120.2	120.8
	SATURATION, %	49.5	44.6	65.5
	VOID RATIO	0.326	0.351	0.344
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.96	0.98	0.97
NORMAL STRESS, psf		8000	2000	4000
FAILURE STRESS, psf		8829	2974	3757
DISPLACEMENT, in		0.27	0.09	0.37
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, in/min		0.0400	0.0400	0.0400

SAMPLE TYPE: Remolded
DESCRIPTION: Clayey Sand
with Gravel
LL= 32 PL= 18 PI= 14
SPECIFIC GRAVITY= 2.6
REMARKS:

Fig. No.: _____

CLIENT: PBS & J

PROJECT: U.S. 95 Widening

SAMPLE LOCATION: B-2, Sample 2G

PROJ. NO.: 0324-01-1 DATE: 10/30/2001

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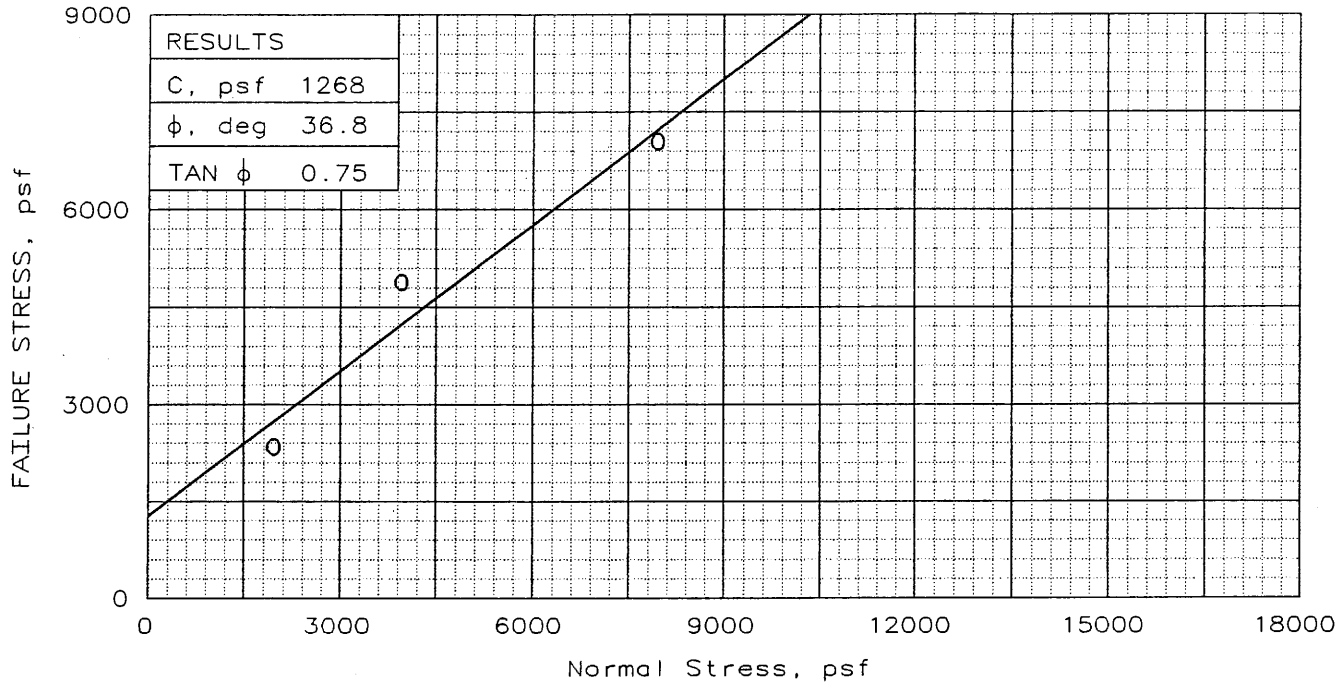

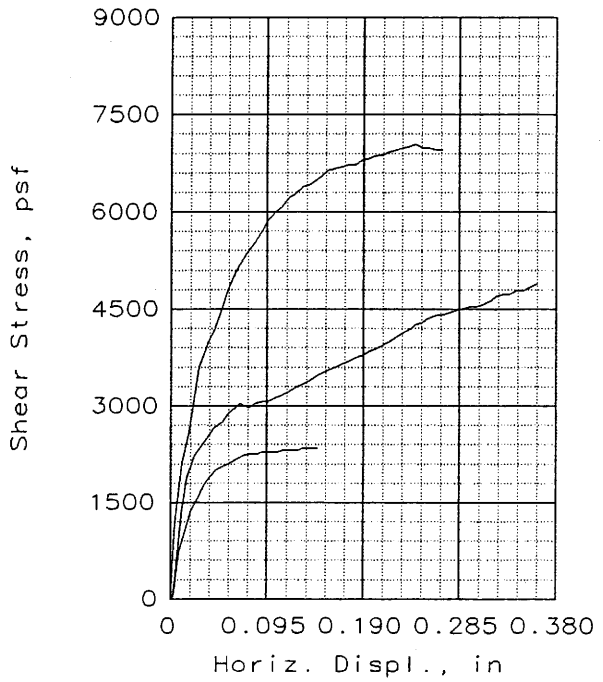

SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	6.1	6.1	6.1
	DRY DENSITY, pcf	117.8	117.8	117.8
	SATURATION, %	41.8	41.8	41.8
	VOID RATIO	0.378	0.378	0.378
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	6.9	6.2	8.3
	DRY DENSITY, pcf	122.9	121.1	121.3
	SATURATION, %	56.1	47.4	63.9
	VOID RATIO	0.321	0.340	0.338
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.96	0.97	0.97
NORMAL STRESS, psf		8000	2000	4000
FAILURE STRESS, psf		7044	2348	4884
DISPLACEMENT, in		0.24	0.13	0.36
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, in/min		0.0400	0.0400	0.0400

SAMPLE TYPE: Remolded
DESCRIPTION: Silty, Clayey Sand with Gravel
LL= 21 PL= 14 PI= 7
SPECIFIC GRAVITY= 2.6
REMARKS:

Fig. No.: _____

CLIENT: PBS & J

PROJECT: U.S. 95 Widening

SAMPLE LOCATION: B-3, Sample 3L

PROJ. NO.: 0324-01-1 DATE: 11/5/2001

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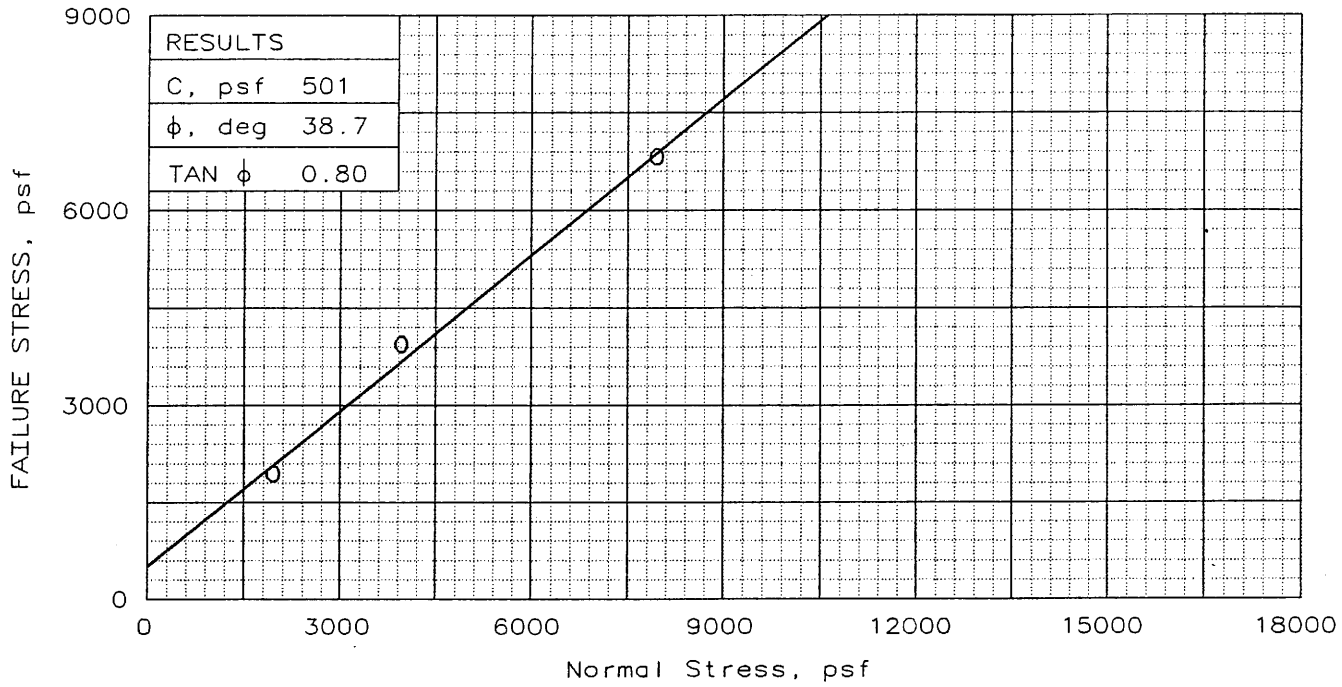

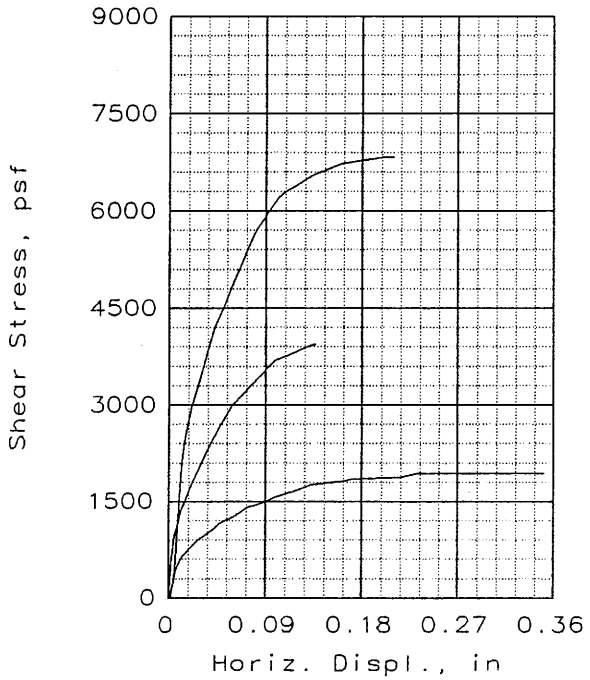

SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	3.1	3.1	3.1
	DRY DENSITY, pcf	114.5	114.5	114.5
	SATURATION, %	24.1	24.1	24.1
	VOID RATIO	0.309	0.309	0.309
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	11.5	11.0	11.2
	DRY DENSITY, pcf	117.4	118.3	118.1
	SATURATION, %	99.5	99.2	100.1
	VOID RATIO	0.276	0.266	0.268
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.98	0.97	0.97
NORMAL STRESS, psf		2000	4000	8000
FAILURE STRESS, psf		1941	3945	6825
DISPLACEMENT, in		0.23	0.14	0.20
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, in/min		0.0200	0.0200	0.0200

SAMPLE TYPE: Remolded
DESCRIPTION: Poorly Graded Gravel with Silt and Sand
LL= 20 PL= 17 PI= 3
SPECIFIC GRAVITY= 2.4
REMARKS:

Fig. No.: _____

CLIENT: PBS&J

PROJECT: U.S. 95 / Rainbow Boulevard Bridge Reconstruction
SAMPLE LOCATION: B-~~4~~ 5, Sample B

PROJ. NO.: 0324-01-2 DATE: 12/13/2001

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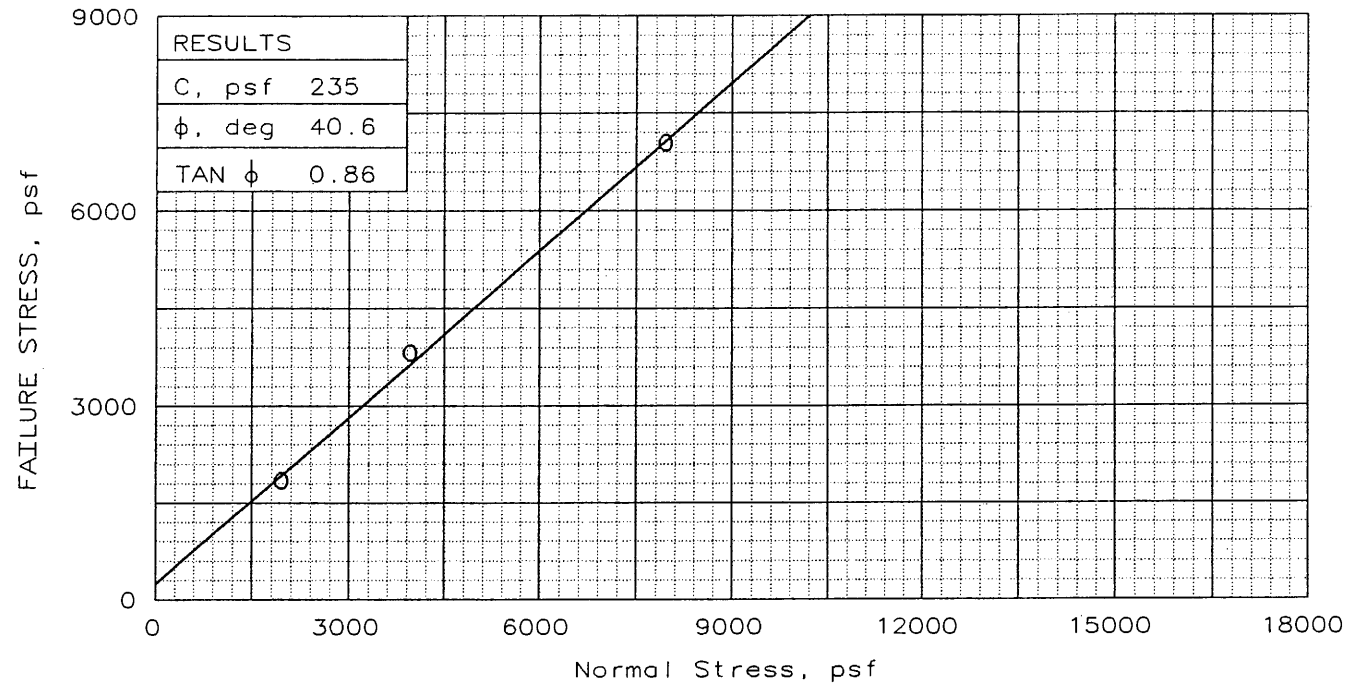
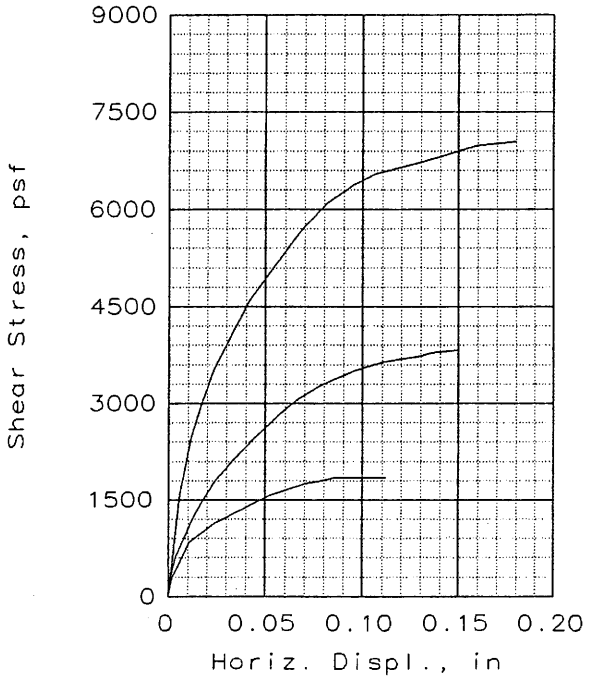




SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	3.0	3.0	3.0
	DRY DENSITY, pcf	114.6	114.6	114.6
	SATURATION, %	20.7	20.7	20.7
	VOID RATIO	0.362	0.362	0.362
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	13.6	13.1	12.7
	DRY DENSITY, pcf	116.5	117.5	118.4
	SATURATION, %	99.9	99.7	99.8
	VOID RATIO	0.340	0.328	0.318
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.98	0.98	0.97
NORMAL STRESS, psf		2000	4000	8000
FAILURE STRESS, psf		1847	3819	7044
DISPLACEMENT, in		0.09	0.15	0.18
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, in/min		0.0200	0.0200	0.0200

SAMPLE TYPE: Remolded
DESCRIPTION: Silty, Clayey Sand with Gravel
LL= 27 PL= 20 PI= 7
SPECIFIC GRAVITY= 2.5
REMARKS:

Fig. No.: _____

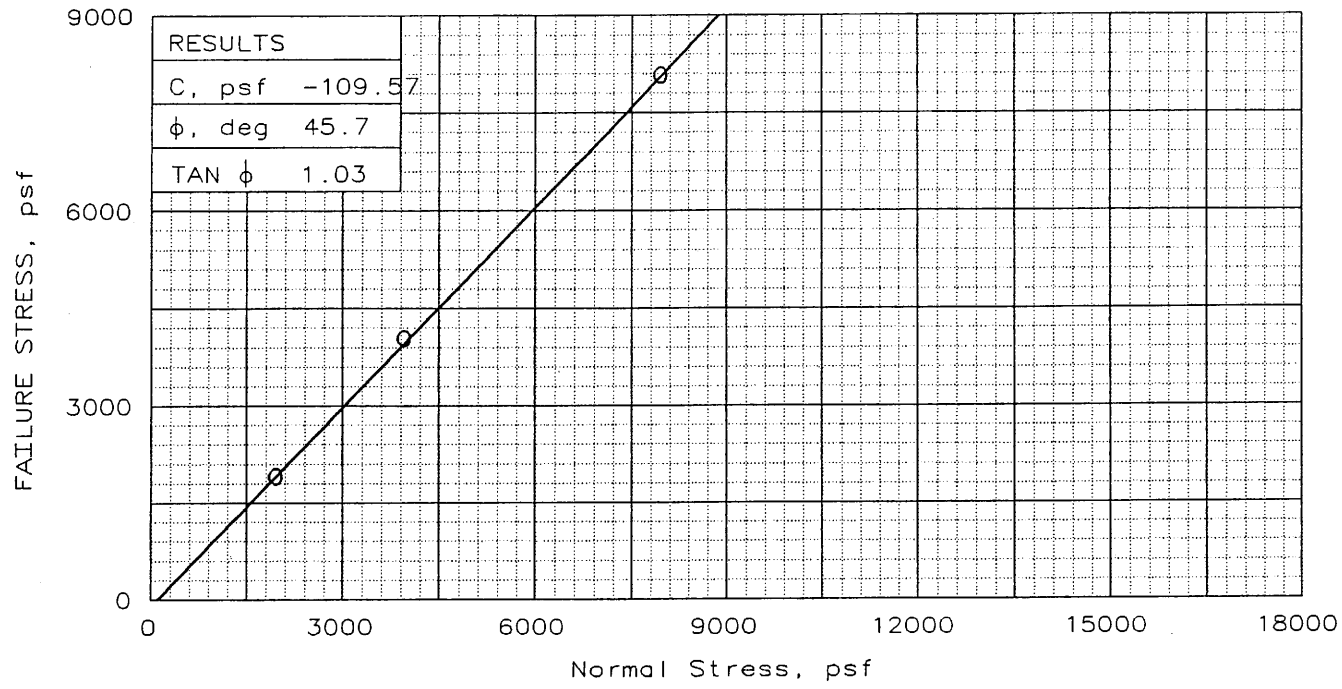
CLIENT: PBS&J

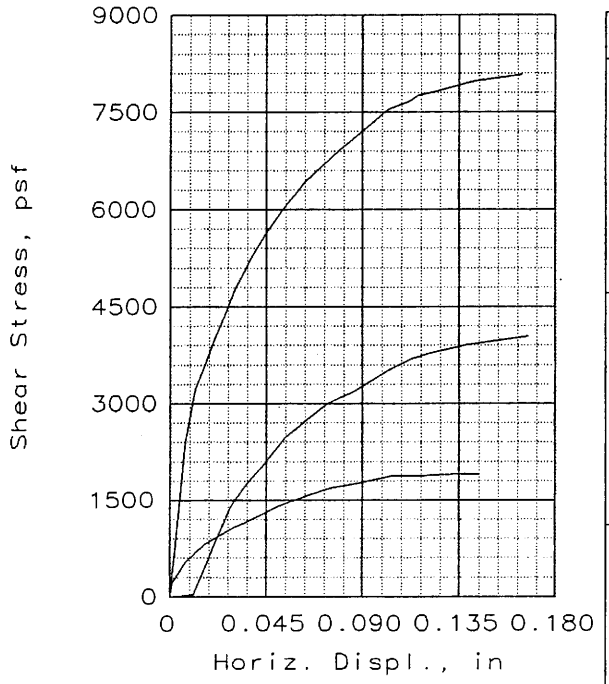
PROJECT: U.S. 95 / Rainbow Boulevard Bridge Reconstruction
SAMPLE LOCATION: B-[illegible], Sample A

PROJ. NO.: 0324-01-2 DATE: 12/14/2001

DIRECT SHEAR TEST REPORT

BLACK EAGLE CONSULTING, INC.





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	2.2	2.2	2.2
	DRY DENSITY, pcf	115.5	115.5	115.5
	SATURATION, %	15.6	15.6	15.6
	VOID RATIO	0.351	0.351	0.351
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	11.4	10.4	10.3
	DRY DENSITY, pcf	121.1	123.4	123.9
	SATURATION, %	98.9	98.5	98.9
	VOID RATIO	0.289	0.265	0.259
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.95	0.94	0.93
NORMAL STRESS, psf		2000	4000	8000
FAILURE STRESS, psf		1910	4039	8077
DISPLACEMENT, in		0.13	0.17	0.16
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, in/min		0.0200	0.0200	0.0200

SAMPLE TYPE: Remolded
DESCRIPTION: Well-Graded Sand with Silty Clay and Gravel
LL= 21 PL= 16 PI= 5
SPECIFIC GRAVITY= 2.5
REMARKS:

Fig. No.: _____

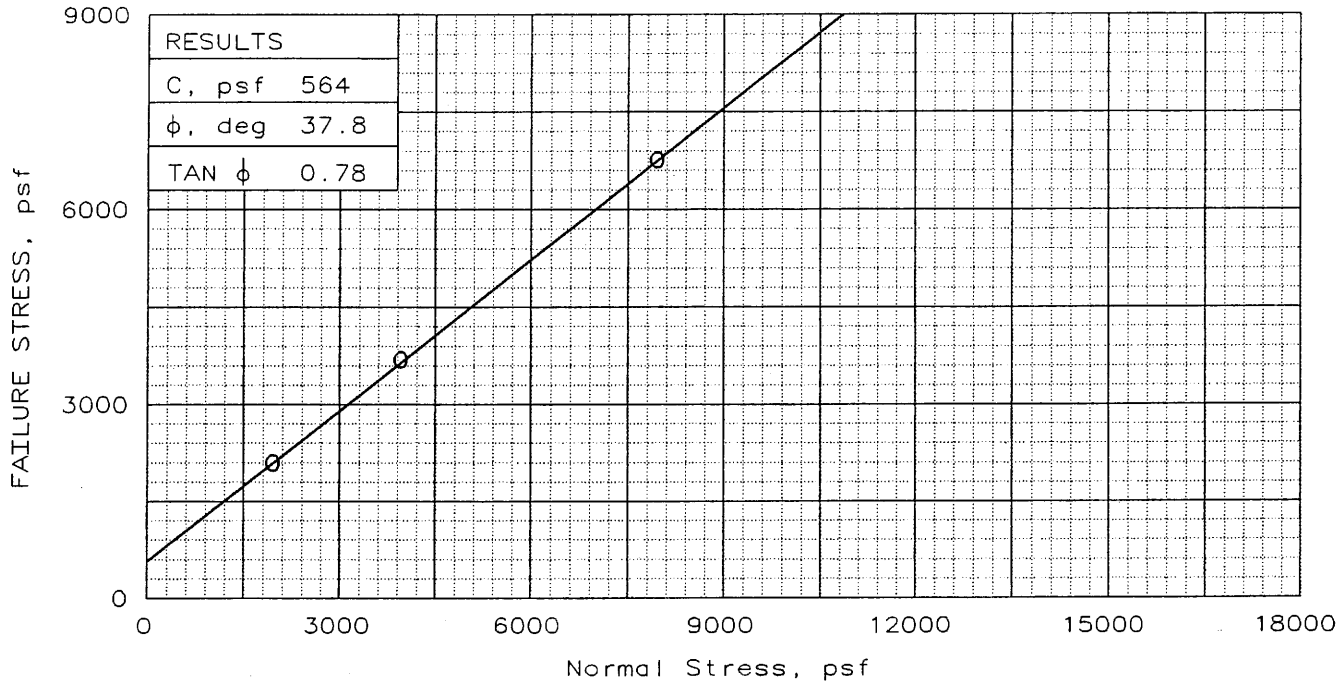
CLIENT: PBS&J

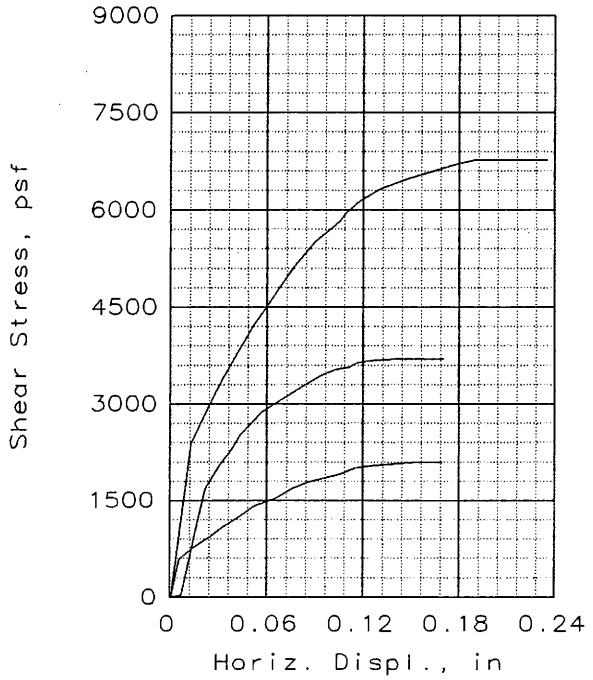
PROJECT: U.S. 95 / Rainbow Boulevard Bridge Reconstruction
SAMPLE LOCATION: B-~~X~~ 11, Sample B

PROJ. NO.: 0324-01-2 DATE: 12/14/2001

DIRECT SHEAR TEST REPORT

BLACK EAGLE CONSULTING, INC.





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	1.2	1.2	1.2
	DRY DENSITY, pcf	116.6	116.6	116.6
	SATURATION, %	8.4	8.4	8.4
	VOID RATIO	0.365	0.365	0.365
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	12.6	12.1	11.9
	DRY DENSITY, pcf	120.2	121.5	122.0
	SATURATION, %	99.3	99.7	99.7
	VOID RATIO	0.324	0.310	0.305
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.97	0.96	0.96
NORMAL STRESS, psf		2000	4000	8000
FAILURE STRESS, psf		2098	3694	6762
DISPLACEMENT, in		0.15	0.14	0.19
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, in/min		0.0200	0.0200	0.0200

SAMPLE TYPE: Remolded
DESCRIPTION: Poorly Graded Gravel with Silt and Sand

SPECIFIC GRAVITY= 2.55
REMARKS:

Fig. No.: _____

CLIENT: PBS&J

PROJECT: U.S. 95 / Rainbow Boulevard Bridge Reconstruction
SAMPLE LOCATION: B-~~1~~ 12 Sample A

PROJ. NO.: 0324-01-2 DATE: 12/14/2001

DIRECT SHEAR TEST REPORT

BLACK EAGLE CONSULTING, INC.

APPENDIX III

CALCULATIONS

TABLE 3-4
Empirical values for ϕ, D_r, and unit weight of granular soils based on the SPT at about 6 m depth and normally consolidated [approximately, $\phi = 28° + 15° D_r$ ($\pm 2°$)]

Description	Very loose	Loose	Medium	Dense	Very dense
Relative density D_r	0	0.15	0.35	0.65	0.85
SPT N'_{70} fine	1–2	3–6	7–15	16–30	?
medium	2–3	4–7	8–20	21–40	> 40
coarse	3–6	5–9	10–25	26–45	> 45
ϕ: fine	26–28	28–30	30–34	33–38	
medium	27–28	30–32	32–36	36–42	< 50
coarse	28–30	30–34	33–40	40–50	
γ, kN/m^3	11–16*	14–18	17–20	17–22,	20–23

* Excavated soil or material dumped from a truck has a unit weight of 11 to 14 kN/m^3 ar... ...ust be quite dense to weigh much over 21 kN/m^3. No existing soil has a $D_r = 0.00$ nor a value of 1.00. Common ranges are from 0.3 to 0.7.

The following are several SPT N-value correlations for angle of friction ϕ. The top two of Eq. (3-5) are from Shioi and Fukui (1982), who obtained them from the Japanese Railway Standards:

$$\phi = \sqrt{18N'_{70}} + 15$$
$$\phi = 0.36N_{70} + 27 \qquad (3\text{-}5)$$
$$\phi = 4.5N_{70} + 20 \text{ (in general)}$$

The top equation of this set is for roads and bridges, and the second is for buildings (refer also to Table 3-4).

A relationship for N and D_r was proposed indirectly by Meyerhof (1957) as

$$\frac{N}{D_r^2} = A + Bp_o \qquad (3\text{-}5a)$$

For this equation Skempton (1986), using a database of five different soils, found that A and B are site-dependent with a range in A of 15 to about 54 and in B from 0.306 to 0.204 (using the N'_{70} base). This spread is such that using average values for A and B is somewhat risky; however, using averages we obtain

$$\frac{N'_{70}}{D_r^2} = 32 + 0.288p'_o \qquad (3\text{-}5b)$$

with p'_o in kPa. For an average unit weight γ of 16 to 17 kN/m^3 and a depth of about 6 m one obtains $N'_{70}/D_r^2 \approx 60$, which was also used as a guide in designating the N values for normally consolidated sands of Table 3-4. For overconsolidated sands (OCR > 1), Skempton (1986) suggested the following adjustment:

$$\frac{N'_{70}}{D_r^2} = A + BC_{OCR}p'_o \qquad (3\text{-}5c)$$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Project Name:US-95 Widening Proj. 5-A/B
Project Number: 0324-01-1

Date: 12/28/01

Calculated By:HEB
Checked By: SDB

CALCULATION OF STATIC BEARING CAPACITY

Location: Bridges R6, R7, and HOV Flyover Native Soils also conservitive for retaining walls

References

1. AASHTO, 1997: Standard Specifications for Highway Bridges, 16th edition, American Association of State Highway and Transportation Officials

Conversions

Checked By:SDB

$kN := 1000 \cdot N$ $kPa := 1000 \cdot Pa$ $kip := 1000 \cdot lbf$ $ksf := 1000 \cdot \frac{lbf}{ft^2}$ $psf := \frac{lbf}{ft^2}$ $pcf := \frac{lbf}{ft^3}$

$MPa := 1000 \cdot kPa$

Assumptions

Checked By:SDB

1. Conditions are dry
2. Footings will be at least 1.4 meters wide
3. Native soils can be modeled as phi=40 degrees

Input Data

Checked By:SDB

Width of Footing:	$B := 4.6ft$	$B = 1.402\,m$
Length of Footing	$L := 40 \cdot ft$	
Depth of Embedment:	$D := 4ft$	$D = 1.219\,m$
Unit Weight of Soil:	$\gamma := 130pcf$	$\gamma = 20.421 \frac{kN}{m^3}$
Cohesion:	$c := 0psf$	$c = 0\,kPa$
Friction Angle:	$\phi := 40deg$	
Safety Factor:	$FS := 3$	

Poissons Ratio $\nu := 0.2$

Youngs Mod $E_s := 4200 \cdot \frac{kip}{ft^2}$

Rigidity shape Factor $\beta_z := 1.41$

Calculate Bearing Capacity Factors:

$N_q := e^{(\pi \cdot \tan(\phi))} \cdot \tan\left(45 \cdot deg + \frac{\phi}{2}\right)^2$ $N_q = 64.195$

$N_c := (N_q - 1) \cdot \cot(\phi)$ $N_c = 75.313$

$N_\gamma := 2 \cdot (N_q + 1) \cdot \tan(\phi)$ $N_\gamma = 109.411$

Calculate Overburden Pressure:

$q := \gamma \cdot D$ $q = 520\,psf$ $q = 24.898\,kPa$

Shape factors Assume Worst Case -- a strip footing

Calculate Ultimate Bearing Capacity:

$q_{ult} := (c \cdot N_c) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma) + (q \cdot N_q)$ $q_{ult} = 6.61 \times 10^4\,psf$ $q_{ult} = 3.165\,MPa$

Calculate Allowable Bearing Capacity:

$q_{allow} := \frac{q_{ult}}{FS}$ $q_{allow} = 2.203 \times 10^4\,psf$ $q_{allow} = 1.055\,MPa$

Settlement

$q_o := q_{allow}$

$S_c := \frac{\left[q_o \cdot \left(1 - \nu^2\right) \cdot \sqrt{B \cdot L}\right]}{E_s \cdot \beta_z}$ $S_c = 14.766\,mm$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Project Name:US-95 Widening Proj. 5-A/B
Project Number: 0324-01-1

Date: 12/28/01
Page: 1 of 2
Calculated By:HEB
Checked By: SDB

CALCULATION OF STATIC BEARING CAPACITY

Location: Bridges R6, R7, and HOV Flyover (Fills) also suitable as conservitive for Retaining Walls

References

1. AASHTO, 1997: Standard Specifications for Highway Bridges, 16th edition, American Association of State Highway and Transportation Officials

Conversions

Checked By:SDB

$kN := 1000 \cdot N$ $kPa := 1000 \cdot Pa$ $kip := 1000 \cdot lbf$ $ksf := 1000 \cdot \frac{lbf}{ft^2}$ $psf := \frac{lbf}{ft^2}$ $pcf := \frac{lbf}{ft^3}$

$MPa := 1000 \cdot kPa$

Assumptions

Checked By:SDB

1. Conditions are dry
2. Footings will be at least 1.0 meters wide
3. Embankment soils can be modeled as phi=32 degrees

Input Data

Checked By:SDB

Width of Footing:	$B := 1 \cdot m$	$B = 1\ m$
Length of Footing	$L := 40 \cdot ft$	
Depth of Embedment:	$D := 2 \cdot ft$	$D = 0.61\ m$
Unit Weight of Soil:	$\gamma := 125 pcf$	$\gamma = 19.636 \frac{kN}{m^3}$
Cohesion:	$c := 0 psf$	$c = 0\ kPa$
Friction Angle:	$\phi := 32 deg$	
Safety Factor:	$FS := 3$	

Poissons Ratio $\nu := 0.2$

Youngs Mod $E_s := 4200 \cdot \frac{kip}{ft^2}$

Rigidity shape Factor $\beta_z := 1.41$

Calculate Bearing Capacity Factors:

$N_q := e^{(\pi \cdot \tan(\phi))} \cdot \tan\left(45 \cdot deg + \frac{\phi}{2}\right)^2$ $N_q = 23.177$

$N_c := (N_q - 1) \cdot \cot(\phi)$ $N_c = 35.49$

$N_\gamma := 2 \cdot (N_q + 1) \cdot \tan(\phi)$ $N_\gamma = 30.215$

Calculate Overburden Pressure:

$q := \gamma \cdot D$ $q = 250\,psf$ $q = 11.97\,kPa$

Shape factors Assume Worst Case -- a strip footing

Calculate Ultimate Bearing Capacity:

$q_{ult} := (c \cdot N_c) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma) + (q \cdot N_q)$ $q_{ult} = 1.199 \times 10^4\,psf$ $q_{ult} = 574.074\,kPa$

Calculate Allowable Bearing Capacity:

$q_{allow} := \frac{q_{ult}}{FS}$ $q_{allow} = 3.997 \times 10^3\,psf$ $q_{allow} = 191.358\,kPa$

$D = 0.61\,m$

Settlement

$x := 190 \cdot kPa$ $x = 3.968\,\frac{kip}{ft^2}$

$q_o := q_{allow}$

$S_c := \frac{\left[q_o \cdot \left(1 - \nu^2\right) \cdot \sqrt{B \cdot L}\right]}{E_s \cdot \beta_z}$ $S_c = 2.262\,mm$

TABLE 1
Ultimate Friction Factors and Adhesion for Dissimilar Materials

Interface Materials	Friction factor, tan δ	Friction angle, δ degrees
Mass concrete on the following foundation materials:		
Clean sound rock	0.70	35
Clean gravel, gravel-sand mixtures, coarse sand	0.55 to 0.60	29 to 31
Clean fine to medium sand, silty medium to coarse sand, silty or clayey gravel	0.45 to 0.55	24 to 29
Clean fine sand, silty or clayey fine to medium sand	0.35 to 0.45	19 to 24
Fine sandy silt, nonplastic silt	0.30 to 0.35	17 to 19
Very stiff and hard residual or preconsolidated clay	0.40 to 0.50	22 to 26
Medium stiff and stiff clay and silty clay	0.30 to 0.35	17 to 19
(Masonry on foundation materials has same friction factors.)		
Steel sheet piles against the following soils:		
Clean gravel, gravel-sand mixtures, well-graded rock fill with spalls	0.40	22
Clean sand, silty sand-gravel mixture, single size hard rock fill	0.30	17
Silty sand, gravel or sand mixed with silt or clay	0.25	14
Fine sandy silt, nonplastic silt	0.20	11
Formed concrete or concrete sheet piling against the following soils:		
Clean gravel, gravel-sand mixture, well-graded rock fill with spalls	0.40 to 0.50	22 to 26
Clean sand, silty sand-gravel mixture, single size hard rock fill	0.30 to 0.40	17 to 22
Silty sand, gravel or sand mixed with silt or clay	0.30	17
Fine sandy silt, nonplastic silt	0.25	14
Various structural materials:		
Masonry on masonry, igneous and metamorphic rocks:		
Dressed soft rock on dressed soft rock	0.70	35
Dressed hard rock on dressed soft rock	0.65	33
Dressed hard rock on dressed hard rock	0.55	29
Masonry on wood (cross grain)	0.50	26
Steel on steel at sheet pile interlocks	0.30	17

Interface Materials (Cohesion)	Adhesion C_a (psf)
Very soft cohesive soil (0 - 250 psf)	0 - 250
Soft cohesive soil (250 - 500 psf)	250 - 500
Medium stiff cohesive soil (500 - 1000 psf)	500 - 750
Stiff cohesive soil (1000 - 2000 psf)	750 - 950
Very stiff cohesive soil (2000 - 4000 psf)	950 - 1,300

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

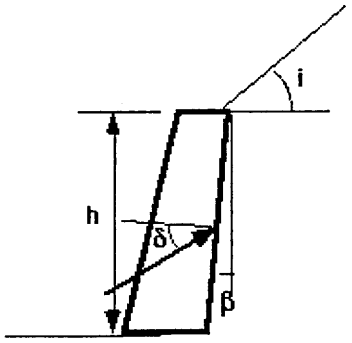
Date:11-2002

Project Name: US 95 Widening; Retaining Walls 2C/2D
Project Number: 324-01-3
Calculated By: HEB Checked By: SDB

Cut 34 / level Backfill for Cantilever walls
(i = 0 degrees)

MONONOBE- OKABE ANALYSIS

Reference: Federal Highway Administration,1998:
Geotechnical Earthquake Engineering,
Publication No. FHWA HI-99-012.



$k_h := .18$ $K_h := 0.5 \cdot k_h$ $K_h = 0.09$

(per AASHTO)

$k_v := 0.0$

For structural backfill: $\phi := 34 \cdot deg$

$\delta := 0$ (may approach 0 during earthquake; is conservative))

$\beta := 0 \cdot deg$ $i := 0deg$

$$\theta := atan\left(\frac{K_h}{1 - k_v}\right) \qquad \theta = 0.09$$

$$K_{ae} := \frac{\cos(\phi - \theta - \beta)^2}{\cos(\theta)\cdot\cos(\beta)^2\cdot\cos(\delta + \beta + \theta)\cdot\left(1 + \sqrt{\frac{\sin(\phi + \delta)\cdot\sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta)\cdot\cos(i - \beta)}}\right)^2}$$

$K_{ae} = 0.334$

$$K_a(\phi, i, \beta) \equiv \frac{\cos(\phi - \beta)^2}{\left(\cos(\beta)^2 \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^2\right]}$$

$K_a := K_a(\phi, i, \beta)$

$K_a = 0.283$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 5-28-2002

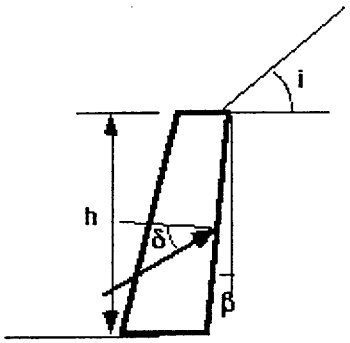
Project Name: US 95 Widening; Retaining Walls 2C/2D
Project Number: 324-01-3
Calculated By: KWK Checked By: SDB

Cut 34 / Sloping Backfill for Cantilever walls
(i = 26.6 degrees)

$\text{atan}\left(\frac{1}{2}\right) = 26.565\ \text{deg}$

MONONOBE- OKABE ANALYSIS

Reference: Federal Highway Administration,1998:
Geotechnical Earthquake Engineering,
Publication No. FHWA HI-99-012.



$k_h := .18$ $K_h := 0.5 \cdot k_h$ (per AASHTO) $K_h = 0.09$

$k_v := 0.0$

For structural backfill: $\phi := 34 \cdot \text{deg}$

$\delta := 0$ (may approach 0 during earthquake; is conservative))

$\beta := 0 \cdot \text{deg}$ $i := 26.6\text{deg}$

$\theta := \text{atan}\left(\frac{K_h}{1 - k_v}\right)$ $\theta = 0.09$

$$K_{ae} := \frac{\cos(\phi - \theta - \beta)^2}{\cos(\theta)\cdot\cos(\beta)^2\cdot\cos(\delta + \beta + \theta)\cdot\left(1 + \sqrt{\frac{\sin(\phi + \delta)\cdot\sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta)\cdot\cos(i - \beta)}}\right)^2}$$

$K_{ae} = 0.577$

Calculate Ka and Kp for static conditions (Assumes $\delta = 0$):

$$K_a(\phi, i, \beta) \equiv \frac{\cos(\phi - \beta)^2}{\left(\cos(\beta)^2 \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^2\right]}$$

$K_a := K_a(\phi, i, \beta)$

$K_a = 0.417$

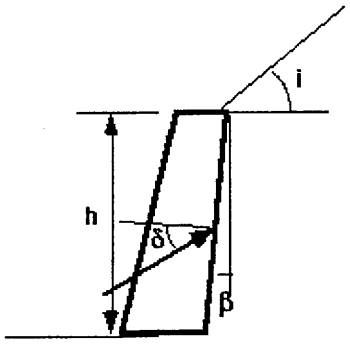
BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Date: 11/07/02

Project Name: US 95 Widening; Retaining Walls 2c 2d **Level Backfill (i = 0 degrees)MSE Walls**
Project Number: 324-01-3
Calculated By: heb Checked By:sdb

MONONOBE- OKABE ANALYSIS

Reference: Federal Highway Administration,1998:
Geotechnical Earthquake Engineering,
Publication No. FHWA HI-99-012.



$A := .18$ $A_m := (1.45 - A) \cdot A$

$k_h := A_m$ $K_h := k_h$ $K_h = 0.229$

$k_v := 0$

For structural backfill: $\phi := 34 \cdot deg$

$\delta := 0$ (may approach 0 during earthquake;))

$\beta := 0 \cdot deg$ $i := 0deg$

$\theta := \operatorname{atan}\left(\frac{K_h}{1 - k_v}\right)$ $\theta = 12.877\,deg$

$$K_{ae} := \frac{\cos(\phi - \theta - \beta)^2}{\cos(\theta) \cdot \cos(\beta)^2 \cdot \cos(\delta + \beta + \theta) \cdot \left(1 + \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta) \cdot \cos(i - \beta)}}\right)^2}$$

$K_{ae} = 0.433$

Calculate Ka for static conditions (Assumes $\delta = 0$):

$$K_a(\phi, i, \beta) \equiv \frac{\cos(\phi - \beta)^2}{\left(\cos(\beta)^2 \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^2\right]}$$

$K_a := K_a(\phi, i, \beta)$

$K_a = 0.283$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

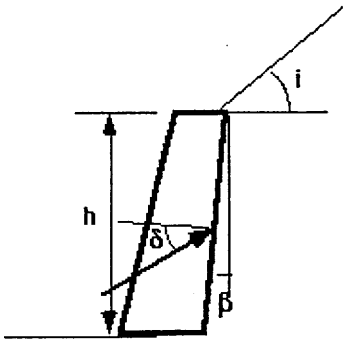
Sheet 1 of 2
Date: 11/07/02

Project Name: US 95 Widening; Retaining Walls 2c 2d **Sloping Backfill (i =21.1 degrees)MSE Walls**
Project Number: 324-01-3
Calculated By: heb Checked By:sdb

use 21.1degrees because slope fails to this

MONONOBE- OKABE ANALYSIS

Reference: Federal Highway Administration,1998:
Geotechnical Earthquake Engineering,
Publication No. FHWA HI-99-012.



$A := .18$ $A_m := (1.45 - A) \cdot A$

$k_h := A_m$ $K_h := k_h$ $K_h = 0.229$

$k_v := 0$

For structural backfill: $\phi := 34 \cdot deg$

$\delta := 0$ (may approach 0 during earthquake;))

$\beta := 0 \cdot deg$ $i := 21.1 deg$

$\theta := \operatorname{atan}\left(\frac{K_h}{1 - k_v}\right)$ $\theta = 12.877\,deg$

$$K_{ae} := \frac{\cos(\phi - \theta - \beta)^2}{\cos(\theta) \cdot \cos(\beta)^2 \cdot \cos(\delta + \beta + \theta) \cdot \left(1 + \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta) \cdot \cos(i - \beta)}}\right)^2}$$

$K_{ae} = 0.887$

Calculate Ka for static conditions (Assumes $\delta = 0$):

$$K_a(\phi, i, \beta) \equiv \frac{\cos(\phi - \beta)^2}{\left(\cos(\beta)^2 \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^2\right]}$$

$K_a := K_a(\phi, i, \beta)$

$K_a = 0.368$

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Sheet 1 of 2
Date: 8-24-2002

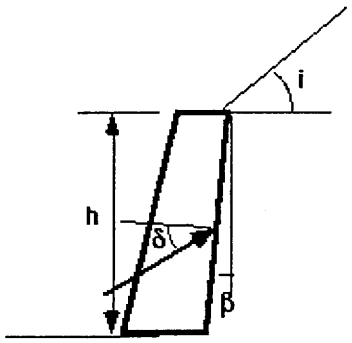
Project Name: US 95 Widening 2C/2D **Tieback walls**

Project Number: 324-01-3 (i = 21.6 degrees)
Calculated By: HEB Checked By:

MONONOBE- OKABE ANALYSIS

Reference: Federal Highway Administration,1998:
Geotechnical Earthquake Engineering,
Publication No. FHWA HI-99-012.

ground acceleration from reports
k_h = .18g for 10% probability in 50 years.
K_h=1.5k_h from AASHTO 5.7.4



$k_h := .18$ $K_h := 1.5 \cdot k_h$

$K_h = 0.27$

$k_v := 0.0$

For structural backfill: $\phi := 34 \cdot deg$

$\delta := 0$ (may approach 0 during earthquake; will use 0)

$\beta := 0 \cdot deg$ $i := 18.5deg$ Slope fails to18.5

$$\theta := \operatorname{atan}\left(\frac{K_h}{1 - k_v}\right) \qquad \theta = 0.264$$

$$K_{ae} := \frac{\cos(\phi - \theta - \beta)^2}{\cos(\theta)\cdot\cos(\beta)^2\cdot\cos(\delta + \beta + \theta)\cdot\left(1 + \sqrt{\frac{\sin(\phi + \delta)\cdot\sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta)\cdot\cos(i - \beta)}}\right)^2}$$

$K_{ae} = 0.848$

$i := 21.6 \cdot deg$

$$K_a(\phi, i, \beta) \equiv \frac{\cos(\phi - \beta)^2}{\left(\cos(\beta)^2 \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^2\right]}$$

$K_a := K_a(\phi, i, \beta)$

$K_a = 0.372$

BLACK EAGLE CONSULTING Sheet 1 of 2

Geotechnical and Construction Services Date: 8/24/2002

Project Name: US 95 2c&2d **Lateral Earth Pressure: RW-6**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Lateral Pressure Calculations from FHWA-IF-99-015 - Static Conditions

For backfill:

$\phi := 34 \cdot deg$ $\gamma := 125 \cdot \frac{lbf}{ft^3}$ $kip := 1000 \cdot lbf$

$K_a := .37$ $H_t := 5.447 \cdot m - 0.5 \cdot m$ $H_t = 16.23\,ft$

$p := 0.65 \cdot K_a \cdot \gamma \cdot H_t$ from page 51

Location on Wall of Pressure Calculation

H_1 and H_n assumed $H_1 := \frac{H_t}{4}$ $\frac{2 \cdot H_1}{3} = 2.705\,ft$

$H_n := \frac{H_t}{4}$

Apparent Earth Pressure Distribution:

$$H := \begin{pmatrix} 0 \\ 2 \cdot \frac{H_1}{3} \\ H_t - 2 \cdot \frac{H_n}{3} \\ H_t \end{pmatrix} \quad p_{wall} := \begin{pmatrix} 0 \\ p \\ p \\ 0 \end{pmatrix}$$

$$H = \begin{pmatrix} 0 \\ 2.705 \\ 13.525 \\ 16.23 \end{pmatrix} ft \quad p_{wall} = \begin{pmatrix} 0 \\ 0.488 \\ 0.488 \\ 0 \end{pmatrix} \frac{kip}{ft^2}$$

Project Name: US 95 Widening 2c&2d **Surcharge Load: RW-6 - Dead Load only**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Pressure Calculations from Surcharge Loads on Tie-Back Walls

$kip := 1000 \cdot lbf$

Strip Load Information

Horizontal dimension from top of wall to center of strip load: $d := 9.2\,ft$

Width of strip load: $w := 10 \cdot ft$

Load (kips/ft^2): $q := 2.2 \cdot \frac{kip}{ft^2}$

Location on Wall of Pressure Calculation

Vertical position on wall (measured from bottom of strip load):

$$H := ft \cdot \begin{pmatrix} 0.001 \\ 2 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 11 \\ 13.7 \end{pmatrix}$$

Angles used in p_h calculation:

$$\alpha := \operatorname{atan}\left(\frac{d}{H}\right)$$

$$\alpha = \begin{pmatrix} 89.994 \\ 77.735 \\ 66.501 \\ 61.477 \\ 56.889 \\ 52.734 \\ 48.991 \\ 45.63 \\ 39.908 \\ 33.883 \end{pmatrix} deg$$

$$\beta := 2\left(\operatorname{atan}\left(\frac{d + \frac{w}{2}}{H}\right) - \alpha\right)$$

$$\beta = \begin{pmatrix} 4.386 \times 10^{-3} \\ 8.495 \\ 15.533 \\ 18.251 \\ 20.411 \\ 22.05 \\ 23.226 \\ 24.008 \\ 24.658 \\ 24.288 \end{pmatrix} deg$$

Pressure at Specific Wall Height (kips/ft^2):

$$P_h := \overrightarrow{\left[\left(\frac{2q}{\pi}\right)\left[\beta - (\sin(\beta))(\cos(2\alpha))\right]\right]}$$

$$H = \begin{pmatrix} 1\times 10^{-3} \\ 2 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 11 \\ 13.7 \end{pmatrix} \text{ft} \qquad P_h = \begin{pmatrix} 2.144\times 10^{-4} \\ 0.396 \\ 0.636 \\ 0.685 \\ 0.696 \\ 0.679 \\ 0.644 \\ 0.599 \\ 0.499 \\ 0.376 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

Ret Wall RW-6 8/27/02

Dead Load Only

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height Meters
0	0.376	0	18.0	0.0
3	0.499	0.488	47.3	0.9
5	0.599	0.488	52.0	1.5
6	0.644	0.488	54.2	1.8
7	0.679	0.488	55.9	2.1
8	0.696	0.488	56.7	2.4
9	0.685	0.488	56.2	2.7
10	0.636	0.488	53.8	3.0
12	0.396	0.488	42.3	3.7
14	0	0.488	23.4	4.3
18	0	0	0.0	5.5

Geotechnical and Construction Services Date:8/24 /2002

Project Name: US 95 Widening 2c&2d **Surcharge Load: RW-6 - Dead Load + Live Load**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Pressure Calculations from Surcharge Loads on Tie-Back Walls

$kip := 1000 \cdot lbf$

Strip Load Information

Horizontal dimension from top of wall to center of strip load: $d := 9.2\,ft$

Width of strip load: $w := 10 \cdot ft$

Load (kips/ft^2): $q := 2.6 \cdot \frac{kip}{ft^2}$

Location on Wall of Pressure Calculation

Vertical position on wall (measured from bottom of strip load):

$$H := ft \cdot \begin{pmatrix} 0.001 \\ 2 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 11 \\ 13.7 \end{pmatrix}$$

Angles used in p_h calculation:

$$\alpha := \operatorname{atan}\left(\frac{d}{H}\right) \qquad \alpha = \begin{pmatrix} 89.994 \\ 77.735 \\ 66.501 \\ 61.477 \\ 56.889 \\ 52.734 \\ 48.991 \\ 45.63 \\ 39.908 \\ 33.883 \end{pmatrix} deg$$

$$\beta := 2\left(\operatorname{atan}\left(\frac{d + \frac{w}{2}}{H}\right) - \alpha\right) \qquad \beta = \begin{pmatrix} 4.386 \times 10^{-3} \\ 8.495 \\ 15.533 \\ 18.251 \\ 20.411 \\ 22.05 \\ 23.226 \\ 24.008 \\ 24.658 \\ 24.288 \end{pmatrix} deg$$

Pressure at Specific Wall Height (kips/ft^2):

$$P_h := \overrightarrow{\left[\left(\frac{2q}{\pi}\right)\left[\beta - (\sin(\beta))(\cos(2\alpha))\right]\right]}$$

$$H = \begin{pmatrix} 1\times 10^{-3} \\ 2 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 11 \\ 13.7 \end{pmatrix} \text{ft} \qquad P_h = \begin{pmatrix} 2.534\times 10^{-4} \\ 0.468 \\ 0.751 \\ 0.809 \\ 0.822 \\ 0.803 \\ 0.762 \\ 0.708 \\ 0.59 \\ 0.444 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

Ret Wall RW-6 8/27/02

Dead Load + Live Load

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height feet
0	0.444	0	21.3	0.0
3	0.59	0.488	51.6	0.9
5	0.712	0.488	57.5	1.5
6	0.762	0.488	59.9	1.8
7	0.803	0.488	61.8	2.1
8	0.82	0.488	62.6	2.4
9	0.809	0.488	62.1	2.7
10	0.751	0.488	59.3	3.0
12	0.468	0.488	45.8	3.7
14	0	0.488	23.4	4.3
18	0	0	0.0	5.5

BLACK EAGLE CONSULTING

Sheet 1 of 2

Geotechnical and Construction Services

Date: 8/24/2002

Project Name: US 95 2c&2d **Lateral Earth Pressure: RW-6**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Lateral Pressure Calculations from FHWA-IF-99-015 - Dynamic Conditions

For backfill:

$\phi := 34 \cdot deg$ $\gamma := 125 \cdot \frac{lbf}{ft^3}$ $kip := 1000 \cdot lbf$

$K_{ae} := .848$ $H_t := 5.447 \cdot m - 0.5 \cdot m$ $H_t = 16.23\,ft$

$p := 0.65 \cdot K_{ae} \cdot \gamma \cdot H_t$ from page 51

Location on Wall of Pressure Calculation

H_1 and H_n assumed $H_1 := \frac{H_t}{4}$ $\frac{2 \cdot H_1}{3} = 2.705\,ft$

$H_n := \frac{H_t}{4}$

Apparent Earth Pressure Distribution:

$$H := \begin{pmatrix} 0 \\ 2 \cdot \frac{H_1}{3} \\ H_t - 2 \cdot \frac{H_n}{3} \\ H_t \end{pmatrix} \quad p_{wall} := \begin{pmatrix} 0 \\ p \\ p \\ 0 \end{pmatrix}$$

$$H = \begin{pmatrix} 0 \\ 2.705 \\ 13.525 \\ 16.23 \end{pmatrix} ft \quad p_{wall} = \begin{pmatrix} 0 \\ 1.118 \\ 1.118 \\ 0 \end{pmatrix} \frac{kip}{ft^2}$$

Ret Wall RW-6 8/27/02

Dead Load + Sies

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height meters
0	0.376	0	18.0	0.0
3	0.499	1.118	77.6	0.9
5	0.599	1.118	82.4	1.5
6	0.644	1.118	84.6	1.8
7	0.679	1.118	86.2	2.1
8	0.696	1.118	87.1	2.4
9	0.685	1.118	86.5	2.7
10	0.636	1.118	84.2	3.0
12	0.396	1.118	72.7	3.7
14	0	1.118	53.7	4.3
18	0	0	0.0	5.5

BLACK EAGLE CONSULTING Sheet 1 of 1

Geotechnical and Construction Services Date: 8/24/2002

Project Name: US 95 2c&2d **Lateral Earth Pressure: RW-7**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Lateral Pressure Calculations from FHWA-IF-99-015 - Static Conditions

For backfill:

$\phi := 34 \cdot deg$ $\gamma := 125 \cdot \frac{lbf}{ft^3}$ $kip := 1000 \cdot lbf$

$K_a := .37$ $H_t := 5.638 \cdot m - 0.52 \cdot m$ $H_t = 16.791\,ft$

$p := 0.65 \cdot K_a \cdot \gamma \cdot H_t$ from page 51

Location on Wall of Pressure Calculation

H_1 and H_n assumed $H_1 := \frac{H_t}{4}$ $\frac{2 \cdot H_1}{3} = 2.799\,ft$

$H_n := \frac{H_t}{4}$

Apparent Earth Pressure Distribution:

$$H := \begin{pmatrix} 0 \\ 2 \cdot \frac{H_1}{3} \\ H_t - 2 \cdot \frac{H_n}{3} \\ H_t \end{pmatrix} \quad p_{wall} := \begin{pmatrix} 0 \\ p \\ p \\ 0 \end{pmatrix}$$

$$H = \begin{pmatrix} 0 \\ 2.799 \\ 13.993 \\ 16.791 \end{pmatrix} ft \quad p_{wall} = \begin{pmatrix} 0 \\ 0.505 \\ 0.505 \\ 0 \end{pmatrix} \frac{kip}{ft^2}$$

Geotechnical and Construction Services Date:8/24 /2002

Project Name: US 95 Widening 2c&2d **Surcharge Load: RW-7 - Dead Load only**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Pressure Calculations from Surcharge Loads on Tie-Back Walls

$$kip := 1000 \cdot lbf$$

Strip Load Information

Horizontal dimension from top of wall to center of strip load: $d := 12.5ft$

Width of strip load: $w := 10 \cdot ft$

Load (kips/ft^2): $q := 2.3 \cdot \frac{kip}{ft^2}$

Location on Wall of Pressure Calculation

Vertical position on wall (measured from bottom of strip load):

$$H := ft \cdot \begin{pmatrix} 0.001 \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 17.1 \end{pmatrix}$$

Angles used in p_h calculation:

$$\alpha := \operatorname{atan}\left(\frac{d}{H}\right) \qquad \alpha = \begin{pmatrix} 89.995 \\ 80.91 \\ 72.255 \\ 64.359 \\ 57.381 \\ 51.34 \\ 46.169 \\ 41.76 \\ 37.999 \\ 36.167 \end{pmatrix} deg$$

$$\beta := 2\left(\operatorname{atan}\left(\frac{d + \frac{w}{2}}{H}\right) - \alpha\right) \qquad \beta = \begin{pmatrix} 2.619 \times 10^{-3} \\ 5.141 \\ 9.739 \\ 13.433 \\ 16.104 \\ 17.83 \\ 18.784 \\ 19.16 \\ 19.13 \\ 18.992 \end{pmatrix} deg$$

Pressure at Specific Wall Height (kips/ft^2):

$$P_h := \overrightarrow{\left[\left(\frac{2q}{\pi}\right)\left[\beta - (\sin(\beta))(\cos(2\alpha))\right]\right]}$$

$$H = \begin{pmatrix} 1\times 10^{-3} \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 17.1 \end{pmatrix} \text{ft} \qquad P_h = \begin{pmatrix} 1.339\times 10^{-4} \\ 0.256 \\ 0.451 \\ 0.556 \\ 0.582 \\ 0.554 \\ 0.499 \\ 0.435 \\ 0.373 \\ 0.341 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

Ret Wall RW-7 8/27/02

Dead Load Only

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height meters
0	0.341	0	16.3	0.0
2	0.373	0.505	42.0	0.6
4	0.435	0.505	45.0	1.2
6	0.499	0.505	48.1	1.8
8	0.554	0.505	50.7	2.4
10	0.582	0.505	52.0	3.0
12	0.556	0.505	50.8	3.7
14	0.451	0.505	45.8	4.3
16	0.256	0.505	36.4	4.9
17.6	0	0	0.0	5.4
18	0	0	0.0	5.5

Geotechnical and Construction Services Date:8/24 /2002

Project Name: US 95 Widening 2c&2d **Surcharge Load: RW-7 - Dead Load + Live Load**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Pressure Calculations from Surcharge Loads on Tie-Back Walls

$$kip := 1000 \cdot lbf$$

Strip Load Information

Horizontal dimension from top of wall to center of strip load: $d := 12.5ft$

Width of strip load: $w := 10 \cdot ft$

Load (kips/ft^2): $q := 2.6 \cdot \frac{kip}{ft^2}$

Location on Wall of Pressure Calculation

Vertical position on wall (measured from bottom of strip load):

$$H := ft \cdot \begin{pmatrix} 0.001 \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 17.1 \end{pmatrix}$$

Angles used in p_h calculation:

$$\alpha := \operatorname{atan}\left(\frac{d}{H}\right) \qquad \alpha = \begin{pmatrix} 89.995 \\ 80.91 \\ 72.255 \\ 64.359 \\ 57.381 \\ 51.34 \\ 46.169 \\ 41.76 \\ 37.999 \\ 36.167 \end{pmatrix} deg$$

$$\beta := 2\left(\operatorname{atan}\left(\frac{d + \frac{w}{2}}{H}\right) - \alpha\right) \qquad \beta = \begin{pmatrix} 2.619 \times 10^{-3} \\ 5.141 \\ 9.739 \\ 13.433 \\ 16.104 \\ 17.83 \\ 18.784 \\ 19.16 \\ 19.13 \\ 18.992 \end{pmatrix} deg$$

Pressure at Specific Wall Height (kips/ft^2):

$$P_h := \overrightarrow{\left[\left(\frac{2q}{\pi}\right)\left[\beta - (\sin(\beta))(\cos(2\alpha))\right]\right]}$$

$$H = \begin{pmatrix} 1\times 10^{-3} \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 17.1 \end{pmatrix} \text{ft} \qquad P_h = \begin{pmatrix} 1.513\times 10^{-4} \\ 0.289 \\ 0.509 \\ 0.629 \\ 0.658 \\ 0.626 \\ 0.564 \\ 0.492 \\ 0.421 \\ 0.385 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

Ret Wall RW-7 8/27/02

Dead Load + Live Load

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height meters
0	0.385	0	18.4	0.0
2	0.421	0.505	44.3	0.6
4	0.492	0.505	47.7	1.2
6	0.564	0.505	51.2	1.8
8	0.626	0.505	54.2	2.4
10	0.658	0.505	55.7	3.0
12	0.629	0.505	54.3	3.7
14	0.509	0.505	48.6	4.3
16	0.289	0.505	38.0	4.9
17.6	0	0	0.0	5.4
18	0	0	0.0	5.5

BLACK EAGLE CONSULTING

Sheet 1 of 2

Geotechnical and Construction Services

Date: 8/24/2002

Project Name: US 95 2c&2d **Lateral Earth Pressure: RW-7**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Lateral Pressure Calculations from FHWA-IF-99-015 - Dynamic Conditions

For backfill:

$\phi := 34 \cdot deg$ $\gamma := 125 \cdot \frac{lbf}{ft^3}$ $kip := 1000 \cdot lbf$

$K_{ae} := .848$ $H_t := 5.638 \cdot m - 0.52 \cdot m$ $H_t = 16.791\,ft$

$p := 0.65 \cdot K_{ae} \cdot \gamma \cdot H_t$ from page 51

Location on Wall of Pressure Calculation

H_1 and H_n assumed $H_1 := \frac{H_t}{4}$ $\frac{2 \cdot H_1}{3} = 2.799\,ft$

$H_n := \frac{H_t}{4}$

Apparent Earth Pressure Distribution:

$$H := \begin{pmatrix} 0 \\ 2 \cdot \frac{H_1}{3} \\ H_t - 2 \cdot \frac{H_n}{3} \\ H_t \end{pmatrix} \quad p_{wall} := \begin{pmatrix} 0 \\ p \\ p \\ 0 \end{pmatrix}$$

$$H = \begin{pmatrix} 0 \\ 2.799 \\ 13.993 \\ 16.791 \end{pmatrix} ft \quad p_{wall} = \begin{pmatrix} 0 \\ 1.157 \\ 1.157 \\ 0 \end{pmatrix} \frac{kip}{ft^2}$$

Ret Wall RW-7 8/27/02

Dead Load + Seismic Load

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height meters
0	0.341	0	16.3	0.0
2	0.373	1.157	73.3	0.6
4	0.435	1.157	76.2	1.2
6	0.499	1.157	79.3	1.8
8	0.554	1.157	81.9	2.4
10	0.582	1.157	83.3	3.0
12	0.556	1.157	82.0	3.7
14	0.451	1.157	77.0	4.3
16	0.256	1.157	67.7	4.9
17.6	0	0	0.0	5.4
18	0	0	0.0	5.5

BLACK EAGLE CONSULTING

Sheet 1 of 1

Geotechnical and Construction Services

Date: 8/24/2002

Project Name: US 95 2c&2d **Lateral Earth Pressure: RW-19**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Lateral Pressure Calculations from FHWA-IF-99-015 - Static Conditions

For backfill:

$\phi := 34 \cdot deg$ $\gamma := 125 \cdot \frac{lbf}{ft^3}$ $kip := 1000 \cdot lbf$

$K_a := .37$ $H_t := 5.366 \cdot m - 0.5 \cdot m$ $H_t = 15.965\,ft$

$p := 0.65 \cdot K_a \cdot \gamma \cdot H_t$ from page 51

Location on Wall of Pressure Calculation

H_1 and H_n assumed $H_1 := \frac{H_t}{4}$ $\frac{2 \cdot H_1}{3} = 2.661\,ft$

$H_n := \frac{H_t}{4}$

Apparent Earth Pressure Distribution:

$$H := \begin{pmatrix} 0 \\ 2 \cdot \frac{H_1}{3} \\ H_t - 2 \cdot \frac{H_n}{3} \\ H_t \end{pmatrix} \quad p_{wall} := \begin{pmatrix} 0 \\ p \\ p \\ 0 \end{pmatrix}$$

$$H = \begin{pmatrix} 0 \\ 2.661 \\ 13.304 \\ 15.965 \end{pmatrix} ft \quad p_{wall} = \begin{pmatrix} 0 \\ 0.48 \\ 0.48 \\ 0 \end{pmatrix} \frac{kip}{ft^2}$$

Geotechnical and Construction Services Date:8/24 /2002

Project Name: US 95 Widening 2c&2d **Surcharge Load: RW-19 - Dead Load only**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Pressure Calculations from Surcharge Loads on Tie-Back Walls

$kip := 1000 \cdot lbf$

Strip Load Information

Horizontal dimension from top of wall to center of strip load: $d := 8.1 \cdot ft$

Width of strip load: $w := 6.0 \cdot ft$

Load (kips/ft^2): $q := 3.1 \cdot \frac{kip}{ft^2}$

Location on Wall of Pressure Calculation

Vertical position on wall (measured from bottom of strip load):

$$H := ft \cdot \begin{pmatrix} 0.001 \\ 2 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 10 \\ 12 \\ 14 \end{pmatrix}$$

Angles used in p_h calculation:

$$\alpha := \operatorname{atan}\left(\frac{d}{H}\right)$$

$$\beta := 2\left(\operatorname{atan}\left(\frac{d + \frac{w}{2}}{H}\right) - \alpha\right)$$

$$\alpha = \begin{pmatrix} 89.993 \\ 76.13 \\ 63.719 \\ 58.314 \\ 53.471 \\ 49.167 \\ 45.356 \\ 39.007 \\ 34.019 \\ 30.052 \end{pmatrix} deg$$

$$\beta = \begin{pmatrix} 3.824 \times 10^{-3} \\ 7.311 \\ 12.929 \\ 14.874 \\ 16.272 \\ 17.193 \\ 17.726 \\ 17.954 \\ 17.499 \\ 16.714 \end{pmatrix} deg$$

Pressure at Specific Wall Height (kips/ft^2):

$$P_h := \overrightarrow{\left[\left(\frac{2q}{\pi}\right)\left[\beta - (\sin(\beta))(\cos(2\alpha))\right]\right]}$$

$$H = \begin{pmatrix} 1\times 10^{-3} \\ 2 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 10 \\ 12 \\ 14 \end{pmatrix} \text{ft} \qquad P_h = \begin{pmatrix} 2.634\times 10^{-4} \\ 0.474 \\ 0.714 \\ 0.739 \\ 0.722 \\ 0.677 \\ 0.618 \\ 0.492 \\ 0.381 \\ 0.293 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

Ret Wall RW-19 8/27/02

Dead Load Only

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height meters
0	0.293	0	14.0	0.0
2	0.381	0.48	41.2	0.6
4	0.492	0.48	46.5	1.2
6	0.618	0.48	52.6	1.8
7	0.677	0.48	55.4	2.1
8	0.722	0.48	57.6	2.4
9	0.739	0.48	58.4	2.7
10	0.714	0.48	57.2	3.0
12	0.474	0.48	45.7	3.7
14	0	0.48	23.0	4.3
17.6	0	0	0.0	5.4

Geotechnical and Construction Services Date:8/24 /2002

Project Name: US 95 Widening 2c&2d **Surcharge Load: RW-19 - Dead Load + Live Load**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Pressure Calculations from Surcharge Loads on Tie-Back Walls

$kip := 1000 \cdot lbf$

Strip Load Information

Horizontal dimension from top of wall to center of strip load: $d := 8.1 \cdot ft$

Width of strip load: $w := 6.0 \cdot ft$

Load (kips/ft^2): $q := 3.9 \cdot \frac{kip}{ft^2}$

Location on Wall of Pressure Calculation

Vertical position on wall (measured from bottom of strip load):

$$H := ft \cdot \begin{pmatrix} 0.001 \\ 2 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 10 \\ 12 \\ 14 \end{pmatrix}$$

Angles used in p_h calculation:

$$\alpha := \operatorname{atan}\left(\frac{d}{H}\right) \qquad \alpha = \begin{pmatrix} 89.993 \\ 76.13 \\ 63.719 \\ 58.314 \\ 53.471 \\ 49.167 \\ 45.356 \\ 39.007 \\ 34.019 \\ 30.052 \end{pmatrix} deg$$

$$\beta := 2\left(\operatorname{atan}\left(\frac{d + \frac{w}{2}}{H}\right) - \alpha\right) \qquad \beta = \begin{pmatrix} 3.824 \times 10^{-3} \\ 7.311 \\ 12.929 \\ 14.874 \\ 16.272 \\ 17.193 \\ 17.726 \\ 17.954 \\ 17.499 \\ 16.714 \end{pmatrix} deg$$

Pressure at Specific Wall Height (kips/ft^2):

$$P_h := \overrightarrow{\left[\left(\frac{2q}{\pi}\right)\left[\beta - (\sin(\beta))(\cos(2\alpha))\right]\right]}$$

$$H = \begin{pmatrix} 1\times 10^{-3} \\ 2 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 10 \\ 12 \\ 14 \end{pmatrix} \text{ft} \qquad P_h = \begin{pmatrix} 3.314\times 10^{-4} \\ 0.596 \\ 0.898 \\ 0.93 \\ 0.908 \\ 0.851 \\ 0.778 \\ 0.619 \\ 0.479 \\ 0.368 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

Ret Wall RW-19 8/27/02

Dead Load + Live Load

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height meters
0	0.368	0	17.6	0.0
2	0.479	0.48	45.9	0.6
4	0.619	0.48	52.6	1.2
6	0.778	0.48	60.2	1.8
7	0.851	0.48	63.7	2.1
8	0.908	0.48	66.5	2.4
9	0.93	0.48	67.5	2.7
10	0.898	0.48	66.0	3.0
12	0.596	0.48	51.5	3.7
14	0	0.48	23.0	4.3
17.6	0	0	0.0	5.4

BLACK EAGLE CONSULTING Sheet 1 of 2

Geotechnical and Construction Services Date: 8/24/2002

Project Name: US 95 2c&2d **Lateral Earth Pressure: RW-19**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Lateral Pressure Calculations from FHWA-IF-99-015 - Dynamic Conditions

For backfill:

$\phi := 34 \cdot \text{deg}$ $\gamma := 125 \cdot \frac{\text{lbf}}{\text{ft}^3}$ $\text{kip} := 1000 \cdot \text{lbf}$

$K_a := .848$ $H_t := 5.366 \cdot \text{m} - 0.5 \cdot \text{m}$ $H_t = 15.965\,\text{ft}$

$p := 0.65 \cdot K_a \cdot \gamma \cdot H_t$ from page 51

Location on Wall of Pressure Calculation

H_1 and H_n assumed $H_1 := \frac{H_t}{4}$ $\frac{2 \cdot H_1}{3} = 2.661\,\text{ft}$

$H_n := \frac{H_t}{4}$

Apparent Earth Pressure Distribution:

$$H := \begin{pmatrix} 0 \\ 2 \cdot \frac{H_1}{3} \\ H_t - 2 \cdot \frac{H_n}{3} \\ H_t \end{pmatrix} \quad p_{wall} := \begin{pmatrix} 0 \\ p \\ p \\ 0 \end{pmatrix}$$

$$H = \begin{pmatrix} 0 \\ 2.661 \\ 13.304 \\ 15.965 \end{pmatrix} \text{ft} \quad p_{wall} = \begin{pmatrix} 0 \\ 1.1 \\ 1.1 \\ 0 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

Ret Wall RW-19 8/27/02

Dead Load + Seismic

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height meters
0	0.293	0	14.0	0.0
2	0.381	1.1	70.9	0.6
4	0.492	1.1	76.2	1.2
6	0.618	1.1	82.3	1.8
7	0.677	1.1	85.1	2.1
8	0.722	1.1	87.2	2.4
9	0.739	1.1	88.1	2.7
10	0.714	1.1	86.9	3.0
12	0.474	1.1	75.4	3.7
14	0	1.1	52.7	4.3
17.6	0	0	0.0	5.4

BLACK EAGLE CONSULTING
Geotechnical and Construction Services

Sheet 1 of 2
Date: 8-24-2002

Project Name: US 95 Widening 2C/2D

Tieback walls RW-16

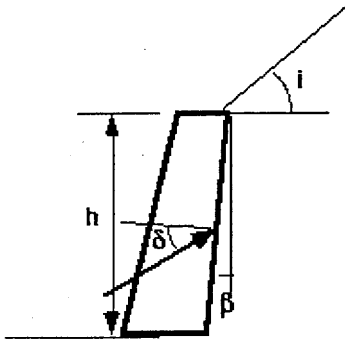
Project Number: 324-01-3

(i = 26.6 degrees)

Calculated By: HEB Checked By:

MONONOBE- OKABE ANALYSIS

Reference: Federal Highway Administration,1998:
Geotechnical Earthquake Engineering,
Publication No. FHWA HI-99-012.



ground acceleration from reports
k_h = .18g for 10% probability in 50 years.
K_h=1.5k_h from AASHTO 5.7.4

$k_h := .18$ $K_h := 1.5 \cdot k_h$

$K_h = 0.27$

$k_v := 0.0$

For native soil: $\phi := 40 \cdot deg$

$\delta := 0$ (may approach 0 during earthquake; will use 0)

$\beta := 0 \cdot deg$ $i := 22.6deg$ Slope fails to22.6

$$\theta := \operatorname{atan}\left(\frac{K_h}{1 - k_v}\right) \qquad \theta = 0.264$$

$$K_{ae} := \frac{\cos(\phi - \theta - \beta)^2}{\cos(\theta)\cdot\cos(\beta)^2\cdot\cos(\delta + \beta + \theta)\cdot\left(1 + \sqrt{\frac{\sin(\phi + \delta)\cdot\sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta)\cdot\cos(i - \beta)}}\right)^2}$$

$K_{ae} = 0.645$

$i := 26.6 \cdot deg$

$$K_a(\phi, i, \beta) \equiv \frac{\cos(\phi - \beta)^2}{\left(\cos(\beta)^2 \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^2\right]}$$

$K_a := K_a(\phi, i, \beta)$

$K_a = 0.296$

BLACK EAGLE CONSULTING Sheet 1 of 1

Geotechnical and Construction Services Date: 3/26/2002

Project Name: US 95 Widening; Retaining Walls 2C/2D **Lateral Earth Pressure: RW-16**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Lateral Pressure Calculations from FHWA-IF-99-015 - Static Conditions

For native soils

$\phi := 40 \cdot \text{deg}$ $\gamma := 130 \cdot \frac{\text{lbf}}{\text{ft}^3}$ $\text{kip} := 1000 \cdot \text{lbf}$

$K_a := .29$ $H_t := 18 \cdot \text{ft}$

$p := 0.65 \cdot K_a \cdot \gamma \cdot H_t$ from page 51

Location on Wall of Pressure Calculation

Top of wall $H_1 := 2.13 \cdot \text{ft}$

$H_n := 2.44 \cdot \text{ft}$

Apparent Earth Pressure Distribution:

$$H := \begin{pmatrix} 0 \\ 2 \cdot \frac{H_1}{3} \\ H_t - 2 \cdot \frac{H_n}{3} \\ H_t \end{pmatrix} \quad p_{wall} := \begin{pmatrix} 0 \\ p \\ p \\ 0 \end{pmatrix}$$

$$H = \begin{pmatrix} 0 \\ 1.42 \\ 16.373 \\ 18 \end{pmatrix} \text{ft} \quad p_{wall} = \begin{pmatrix} 0 \\ 0.441 \\ 0.441 \\ 0 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

BLACK EAGLE CONSULTING

Geotechnical and Construction Services

Date: 3/26/2002

Project Name: US 95 Widening; Retaining Walls 2c **Lateral Earth Pressure: RW-16**
Project Number: 324-01-3
Calculated By: HEB Checked By:

Lateral Pressure Calculations from FHWA-IF-99-015 - Dynamic Conditions

For native soils

$\phi := 40 \cdot \text{deg}$ $\gamma := 130 \cdot \frac{\text{lbf}}{\text{ft}^3}$ $\text{kip} := 1000 \cdot \text{lbf}$

$K_{ae} := .65$ $H_t := 18 \cdot \text{ft}$

$p := 0.65 \cdot K_{ae} \cdot \gamma \cdot H_t$ from page 51

Location on Wall of Pressure Calculation

Top of wall $H_1 := 2.13 \cdot \text{ft}$

$H_n := 2.44 \cdot \text{ft}$

Apparent Earth Pressure Distribution:

$$H := \begin{pmatrix} 0 \\ 2 \cdot \frac{H_1}{3} \\ H_t - 2 \cdot \frac{H_n}{3} \\ H_t \end{pmatrix} \quad p_{wall} := \begin{pmatrix} 0 \\ p \\ p \\ 0 \end{pmatrix}$$

$$H = \begin{pmatrix} 0 \\ 1.42 \\ 16.373 \\ 18 \end{pmatrix} \text{ft} \quad p_{wall} = \begin{pmatrix} 0 \\ 0.989 \\ 0.989 \\ 0 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

BLACK EAGLE CONSULTING

Sheet 1 of 2

Geotechnical and Construction Services

Date: 3/11/2002

Project Name: US 95 Widening; Retaining Walls 2c
Project Number: 324-01-3
Calculated By: HEB Checked By:

Surcharge Load: RW-16
Dead Load

Pressure Calculations from Surcharge Loads on Tie-Back Walls

$$kip := 1000 \cdot lbf$$

Strip Load Information

Horizontal dimension from top of wall to center of strip load: $d := 14 \cdot ft$

Width of strip load: $w := 6.5 \cdot ft$

Load (kips/ft^2): $q := 2.4 \cdot \frac{kip}{ft^2}$

Location on Wall of Pressure Calculation

Vertical position on wall (measured from top of wall):

$$H := ft \cdot \begin{pmatrix} 0.001 \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 18 \end{pmatrix}$$

Angles used in p_h calculation:

$$\alpha := \operatorname{atan}\left(\frac{d}{H}\right) \qquad \alpha = \begin{pmatrix} 89.996 \\ 81.87 \\ 74.055 \\ 66.801 \\ 60.255 \\ 54.462 \\ 49.399 \\ 45 \\ 41.186 \\ 37.875 \end{pmatrix} deg$$

$$\beta := 2\left(\operatorname{atan}\left(\frac{d + \frac{w}{2}}{H}\right) - \alpha\right) \qquad \beta = \begin{pmatrix} 1.542 \times 10^{-3} \\ 3.033 \\ 5.78 \\ 8.039 \\ 9.729 \\ 10.873 \\ 11.554 \\ 11.875 \\ 11.934 \\ 11.812 \end{pmatrix} deg$$

Pressure at Specific Wall Height (kips/ft^2):

$$P_h := \left[\left(\frac{2q}{\pi} \right) \left[\beta - (\sin(\beta))(\cos(2\alpha)) \right] \right]$$

$$H = \begin{pmatrix} 1 \times 10^{-3} \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 18 \end{pmatrix} \text{ft} \qquad P_h = \begin{pmatrix} 8.225 \times 10^{-5} \\ 0.159 \\ 0.285 \\ 0.362 \\ 0.391 \\ 0.383 \\ 0.355 \\ 0.317 \\ 0.276 \\ 0.238 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

$$h := H \cdot \frac{m}{ft}$$

$$ph := P_h \cdot \frac{Pa}{\frac{kip}{ft^2}}$$

BLACK EAGLE CONSULTING Sheet 1 of 2

Geotechnical and Construction Services Date: 3/11/2002

Project Name: US 95 Widening; Retaining Walls 2c **Surcharge Load: RW-16**
Project Number: 324-01-3 **Dead+Live Load**
Calculated By: HEB Checked By:

Pressure Calculations from Surcharge Loads on Tie-Back Walls

$$\mathbf{kip} := 1000 \cdot \mathbf{lbf}$$

Strip Load Information

Horizontal dimension from top of wall to center of strip load: $\mathbf{d} := 14 \cdot \mathbf{ft}$

Width of strip load: $\mathbf{w} := 6.5 \cdot \mathbf{ft}$

Load (kips/ft²): $\mathbf{q} := 3.1 \cdot \frac{\mathbf{kip}}{\mathbf{ft}^2}$

Location on Wall of Pressure Calculation

Vertical position on wall (measured from top of wall):

$$\mathbf{H} := \mathbf{ft} \cdot \begin{pmatrix} 0.001 \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 18 \end{pmatrix}$$

Angles used in p_h calculation:

$$\alpha := \operatorname{atan}\left(\frac{\mathbf{d}}{\mathbf{H}}\right) \qquad \alpha = \begin{pmatrix} 89.996 \\ 81.87 \\ 74.055 \\ 66.801 \\ 60.255 \\ 54.462 \\ 49.399 \\ 45 \\ 41.186 \\ 37.875 \end{pmatrix} \mathbf{deg}$$

$$\beta := 2\left(\operatorname{atan}\left(\frac{\mathbf{d} + \frac{\mathbf{w}}{2}}{\mathbf{H}}\right) - \alpha\right) \qquad \beta = \begin{pmatrix} 1.542 \times 10^{-3} \\ 3.033 \\ 5.78 \\ 8.039 \\ 9.729 \\ 10.873 \\ 11.554 \\ 11.875 \\ 11.934 \\ 11.812 \end{pmatrix} \mathbf{deg}$$

Pressure at Specific Wall Height (kips/ft^2):

$$P_h := \overrightarrow{\left[\left(\frac{2q}{\pi}\right)\left[\beta - (\sin(\beta))(\cos(2\alpha))\right]\right]}$$

$$H = \begin{pmatrix} 1\times 10^{-3} \\ 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 18 \end{pmatrix} \text{ft} \qquad P_h = \begin{pmatrix} 1.062\times 10^{-4} \\ 0.205 \\ 0.368 \\ 0.467 \\ 0.504 \\ 0.495 \\ 0.458 \\ 0.409 \\ 0.357 \\ 0.307 \end{pmatrix} \frac{\text{kip}}{\text{ft}^2}$$

$$h := H\frac{m}{ft}$$

$$ph := P_h \frac{Pa}{\frac{kip}{ft^2}}$$

Ret Wall RW-16 3/26/02 REVISION

Dead Load Only

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height Meters
0	0.238	0	11.4	0.0
2	0.276	0.441	34.3	0.6
4	0.317	0.441	36.3	1.2
6	0.355	0.441	38.1	1.8
8	0.383	0.441	39.5	2.4
10	0.391	0.441	39.8	3.0
12	0.362	0.441	38.4	3.7
14	0.285	0.441	34.8	4.3
16	0.159	0.441	28.7	4.9
18	0	0	0.0	5.5

Dead Load + Live Load

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height Meters
0	0.307	0	14.7	0.0
2	0.357	0.441	38.2	0.6
4	0.409	0.441	40.7	1.2
6	0.458	0.441	43.0	1.8
8	0.495	0.441	44.8	2.4
10	0.504	0.441	45.2	3.0
12	0.467	0.441	43.5	3.7
14	0.368	0.441	38.7	4.3
16	0.205	0.441	30.9	4.9
18	0	0	0.0	5.5

Dead and Seismic Load

Wall Hight feet	Sur Press kip/sq.ft.	Lat Press kip/sq.ft.	Total Press kPa	Wall Height Meters
0	0.238	0	11.4	0.0
2	0.276	0.989	60.6	0.6
4	0.317	0.989	62.5	1.2
6	0.355	0.989	64.4	1.8
8	0.383	0.989	65.7	2.4
10	0.391	0.989	66.1	3.0
12	0.362	0.989	64.7	3.7
14	0.285	0.989	61.0	4.3
16	0.159	0.989	55.0	4.9
18	0	0	0.0	5.5