Geotechnical Engineering Report

F Street Bridge Reconstruction at I-15
NDOT Project I.D. No. SPI-015-1(058)
Las Vegas, Nevada
October 11, 2011
Terracon Project No. 64105012

Prepared for:
Atkins North America, Inc.
Henderson, Nevada

Prepared by:
Terracon Consultants, Inc.
Las Vegas, Nevada

October 11, 2011

Terracon

Atkins North America, Inc.
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074

Attn: Mr. Ben R. Sprague, P.E.
Vice President

Re: Geotechnical Engineering Report
F Street Bridge Reconstruction at I-15
NDOT Project I.D. No. SPI-015-1(058)
Las Vegas, Nevada
Terracon Project Number: 64105012

Dear Mr. Sprague:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. These services were performed in general accordance with Addendum No. 1 (dated March 4, 2011) to the terms of current contract under PBS&J project 100013421 (dated April 27, 2010).

This geotechnical engineering report presents the results of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of the proposed project. Our geotechnical services have been performed in general accordance with AASHTO and NDOT specifications/guidelines.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

PROFESSIONAL ENGINEER-STATE OF NEVADA
WALTER E. VANDERPOOL
Expires 6-30-12
CIVIL
No. 8466

Walter E. Vanderpool, P.E., P. Eng.
Senior Associate

for Michael E. McGettigan, P.E.
Senior Associate, Office Manager

Attachments
Copy To: Addressee (8)

10/11/11

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NDOT PROJECT I.D. NO. SPI-015-1(018)
LAS VEGAS, NEVADA

Terracon Project No. 64105012
October 11, 2011

1.0 INTRODUCTION

1.1 General

Terracon has completed the geotechnical engineering report for the proposed improvement of F Street between Washington Avenue and Bonanza Way and the F Street bridge reconstruction at I-15 in Las Vegas, Nevada. Two borings and one core hole in F Street, designated 10B-1, 10-B2, and 10C-1, were performed on March 24, 2010 to depths of approximately 9.5, 9.3, and 1.3 feet, respectively, below the existing ground surface. Five borings on I-15, designated 11B-3 to 11B-6 were performed to depths of approximately 20 to 100 feet below the existing ground surface in May 2011. While drilling boring 11B-5, the abandoned F-Street bridge abutment footing was encountered at a depth of approximately 20 feet below the existing ground surface. Atkins North America, Inc. located an alternate boring 11B-5a approximately three feet west of Boring 11B-5 and the boring was completed at a depth of approximately 100 feet. A site location map and soil boring location maps are included in Appendix A. The boring logs are located in Appendix B.

1.2 Scope

The purposes of these services are to provide information and geotechnical engineering recommendations for use in design of bridge foundations, earth retaining structures, and F Street pavements. The report provides recommendations for the following items:

- Site investigation information;
- Geology and seismicity;
- Boring logs and in-situ test data
- Laboratory testing results;
- Recommendations for design of spread foundations;
- Recommendations for design of drilled shaft foundations;
- Recommendations for design of earth retaining structures;
- Site grading and earthwork; and
- Construction considerations.

1.3 Other Reports and Investigation

Previous geotechnical exploration data developed for the I-15 North Corridor design build project, geotechnical data reported for the reconstruction of the I-15/US95 interchange, and results of a load test program performed at sites surrounding the F-Street bridge site were reviewed during our analyses for this report. The purposes of these services were to provide information and geotechnical engineering recommendations for use in foundation type selection and preliminary design of bridge foundations, earth retaining structures, and F Street pavements.

2.0 PROJECT DESCRIPTION

ITEM	DESCRIPTION
Location	City of Las Vegas at the "F" Street intersection with the I-15 alignment;
Existing improvements	Interstate highway crossing the "F" Street alignment on an elevated embankment;
Current ground cover	Reinforced concrete and asphalt pavement;
Existing topography	Relatively flat natural surface. Highway embankments, curbs, gutters and urban grading control surface runoff.

3.0 GEOLOGIC CONDITIONS AND SEISMICITY

3.1 Local Geology

The project site is located in the central portion of the Las Vegas Valley. The Las Vegas Valley is typical of the Basin and Range Geologic Province of the southwestern United States. The valley is filled with alluvial sediments. According to a geologic map of the area[1], the project site consists of intermittently active alluvium and alluvium of active washes identified as Q_a and Q_{ai}. Area is underlain mainly of pink to pale-brown fine sand and pebble to cobble gravel occurring mainly on between-channel alluvial flats and less commonly in incised washes; unconsolidated to moderately consolidated; locally cemented by petrocalcic carbonate (case hardened); Deposits are typically veneers in wash bottoms or on flat between-wash surfaces; subject to flooding. Urban development has altered the surface topography and surface drainage is now controlled by the development.

[1] *J. C. Matti, F. W. Bachhuber, D. M. Morton, and J. W. Bell, "Geologic Map, Las Vegas NW Quadrangle" 1987, Nevada Bureau of Mines and Geology.*

3.2 Faulting and Seismicity

The nearest mapped fault scarps and fissures are located approximately as follows:

ITEM	DESCRIPTION
Nearest mapped fault scarp[2]	¼ mile to the northeast.
Nearest mapped fissure[3]	½ mile to the northeast.

We have determined the following approximate latitude and longitude of the site, along with the mapped and calculated seismic parameters per Sections 3.10.3 to 3.10.5, AASHTO LRFD Bridge Design Specification, 5th Edition, 2010. The NDOT Structure Manual minimum seismic coefficients for Clark County are included in the table below:

ITEM	DESCRIPTION	NOTES
Latitude	36.1783º	Source: Google Earth
Longitude	-115.1493º	Source: Google Earth
Site Class	D	AASHTO Table 3.10.3.1-1 & Table C3.10.3.1-1 Method B
Horizontal Peak Ground Acceleration Coefficient (PGA)	0.151g (AASHTO)/ 0.15g (NDOT Clark Co.)	AASHTO Figure 3.10.2.1-1, 7% probability of exceedance in 75 yr. & 5% critical damping
Horizontal Response Spectral Acceleration Coefficient at Period of 0.2 s (S_s)	0.359g (AASHTO)/ 0.40g (NDOT Clark Co.)	AASHTO Figure 3.10.2.1-2, 7% probability of exceedance in 75 yr & 5% critical damping
Horizontal Response Spectral Acceleration Coefficient at Period of 1.0 s (S_1)	0.117g (AASHTO)/ 0.15g (NDOT Clark Co.)	AASHTO Figure 3.10.2.1-3, seven percent probability of exceedance in 75 yr.
Value of Site Factor at Zero-Period on Acceleration Spectrum, F_{pga}	1.50	AASHTO Table 3.10.3.2-1 & NDOT
Value of Site Factor for Short-Period Range of Acceleration Spectrum, F_a	1.51/1.48	AASHTO Table 3.10.3.2-2/NDOT
Value of Site Factor for Long-Period Range of Acceleration Spectrum, F_v	2.33/2.2	AASHTO Table 3.10.3.2-3/NDOT

[2] *Las Vegas Valley Subsidence Project, Subsidence-Related Faults and Fissures of the Las Vegas Valley, compiled from Bingler (1977), Bell (1978), Bell and Smith (1980), Matti and Bachhuber (1985), Matti et al. (1987).*
[3] *Ibid.*

4.0 FIELD INVESTIGATIONS

The borings were drilled with a Diedrich D120 truck-mounted drill rig using hollow stem auger to advance the boreholes. An automatic SPT hammer was used to advance the sampler in the borings. Samples of the soil encountered in the borings were obtained by the Standard Penetration Test (SPT) method using a Standard Split Spoon (2-inch O. D.) and a California modified split spoon with brass rings (2.4-inch I. D.) and thin wall Shelby tubes (3-inch I. D.). A more detailed description of the field exploration and boring logs are presented in Appendix B.

5.0 LABORATORY ANALYSES

Representative soil samples were tested in our laboratory to determine physical engineering characteristics. Laboratory testing was performed under the direction of a geotechnical engineer and included visual classification, moisture content tests, unit weight tests, Atterberg limits tests, sieve analyses tests, direct shear strength tests, consolidation tests, R-value test and chemical analyses for corrosive salts. The laboratory testing results are presented on the boring logs at the sampling depth and in Appendix C.

6.0 DISCUSSION

6.1 Anticipated Subsurface conditions

Based on the results of the borings and laboratory tests, subsurface conditions in the borings can be generalized as follows:

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual or abrupt. Details for each of the borings can be found on the boring logs in Appendix B of this report. A discussion of field sampling procedures is included in Appendix B and laboratory testing procedures. Test results are summarized on the boring logs at the sampling depths and presented in Appendix C.

Borings along the F-Street alignment encountered an asphalt pavement section consisting of 4.25 to 5.0 inches of asphaltic concrete over 10 to 12 inches of aggregate base course. The native soils to a depth of 10 feet consisted of sandy clay and clayey sand with thin lenses of partially cemented soil and caliche.

Two distinctly differing soils profiles were encountered in the borings for the bridge structure. The borings 11B-3 and 11-B4 encountered poorly graded, non-cohesive, loose and caving embankment fill with some concrete debris. The embankment fill at borings 11B-5, 11B-5a and 11B-6 was more cohesive and contained more concrete and caliche rubble.

The natural soils at borings 11B-3 and 11B-4 encountered only 1 to 2 feet of strongly cemented caliche in the upper approximately 25 to 30 feet below the natural grade. The natural soils at borings 11B-5a and 11B-6 encountered multiple layers of strong caliche 2 to 8 feet thick in the natural soils from the contact with the fill to a depth of 40 to 45 feet below the I-15 grade.

The soil profile at depths greater than approximately 45 feet below the pavement grade was generally similar in all four of these borings and consisted of soft to very stiff, low to high plastic clay and clayey sand.

The depth to groundwater was reported in the following borings:

Boring Location	Depth to Groundwater Level (feet)	Groundwater Level Expressed as MSL (feet)
11B-3	29.2	2016.0
11B-4	32.0	2016.1
11B-5a	33.4	2017.6
11B-6	35.4	2016.2

Groundwater level fluctuations may occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. In addition, perched water can develop over low permeability soil or rock strata. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

6.2 Geologic Hazards

The project site is not within mapped fault scarp or fissure zones. No unstable slopes were present in the project area. The approximately 200 feet of F Street south of McWilliams Avenue is in a "subject to flooding" zone[4]. Based upon soil classification tests and penetration resistance, the soils have a low liquefaction potential.

[4] *J. C. Matti, F. W. Bachhuber, D. M. Morton, and J. W. Bell, "Geologic Map, Las Vegas NW Quadrangle" 1987, Nevada Bureau of Mines and Geology.*

6.3 General Site Evaluation

The project site is within a mixed commercial and residential use zone. Interstate I-15 is a limited access highway isolated from local traffic. The presence of abandoned bridge foundations at the proposed bridge site and the non-cohesive loose condition of fill in the embankment are the dominant geotechnical considerations for the proposed construction. Settlement risk is low due to the past site history. The bridge reconstruction will effectively reduce the net load on the bearing soils. As previously noted, the loose granular character of embankment fill in some zones, concrete debris in the fill, and the potential obstructions presented by the abandoned foundations may increase the difficulty of constructing new bridge foundations.

7.0 SUMMARY OF ENGINEERING CALCULATIONS AND ANALYSES

Our calculations and analyses have been performed in accordance with AASHTO, FHWA, and NDOT standard guidelines and procedures. The results of our calculations and analyses are presented in this report. A summary of our calculations and analyses are provided in Section 8 and Appendix A as follows:

- Shallow foundation bearing resistance
- MSE wall design parameters
- Cast in-place retaining wall design parameters
- Seismic design parameters
- Drilled shaft vertical analysis
- Drilled shaft lateral analysis
- Grading and Drainage design parameters
- Construction considerations

8.0 RECOMMENDATIONS

The site appears suitable for the proposed construction from a geotechnical engineering perspective. The presences of abandoned driven pile bridge foundations complicate the design and construction. Loose and caving embankment fill soils should be anticipated at some locations and elevations. Difficult drilling conditions should be anticipated where cemented soils or abandoned foundations are encountered.

8.1 Site Grading and Earthwork

Prior to placing any fill, all unsuitable material should be removed from the construction areas. Excessively wet or dry material should be either removed or moisture conditioned and recompacted. The subgrade should be proof-rolled to a stable and unyielding subgrade condition.

8.1.1 Use of Materials

Engineered fill should meet the following material property requirements or as approved by the geotechnical engineer:

Fill Type	NDOT Material Designation	Acceptable Location for Placement
On-site soils	Section 207.02.01 Backfill	On-site soils are suitable for use as embankment fill at all locations and elevations.
MSE wall backfill	Section 207.02.02 Granular Backfill	Minimum compacted dry density - 120 pcf Minimum angle of internal friction – 34 degrees

8.1.2 Drainage

Final grades should be sloped away from structures on all sides to prevent ponding of water. Buried drain systems behind MSE and CIP retaining walls should be avoided where possible. Storm water management should be designed in accordance with City of Las Vegas, AASHTO and NDOT guidelines.

8.1.3 F-Street Buried Utilities

Trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. Excavations greater than 4 feet deep should be braced and shored for safety. The contractor shall be responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Pipe bedding should follow the respective utility owner's guidelines. A minimum of 6 inches of compacted Clark County Type II is recommended beneath water and sewer lines. The pipe bedding material should extend to a minimum of 12 inches above the crown of the pipe. Placement and compaction should be performed with hand-operated tools to protect the pipe and

maintain alignment. Backfill to the pavement subgrade may consist of native soils placed and compacted in accordance with recommendations previously provided in this report.

8.1.4 F-Street Pavements

The projected F-Street average daily traffic (ADT) and vehicle-type distribution was not available at the time that this report was prepared. The existing F-Street pavement structural section was found to consist of 5 inches of asphalt over 12 inches of aggregate base course.

One R-value test was performed on the subgrade soils from beneath F-Street and the test results are presented in Appendix C. Back calculating from the pavement section (5" AC/12" AB) and the R-value (18), the Design Structural Number (SN), by the AASHTO design method, for the existing pavement section would be 3.19 and the 20-year, 18-kip ESAL design traffic would be approximately 125,000 vehicles. The 20-year, 18-kip ESAL design traffic represents approximately 3000 autos and pick-up trucks, 5 school buses and delivery trucks, and 1 loaded dump truck per day.

Without current design traffic data, we recommend that the F-Street pavement reconstruction should, as a minimum, match the existing pavement section of 5 inches of asphalt over 12 inches of Clark County Type II aggregate base course.

We recommend the moisture content and density of the top 9 inches of the subgrade be evaluated and the pavement subgrades be proof rolled within two days prior to commencement of paving operations. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills.

8.2 Foundations

Tangent or closely spaced drilled shaft foundations are recommended for the bridge structure. Foundations for monopole signs and lighting may consist of drilled shafts. Shallow spread footings are recommended for sound walls, earth retaining walls, and box culverts.

Based on the results of the laboratory testing, the on-site soils have a "Severe" (S2) classification for sulfate exposure, according to Table 4.2.1 of the American Concrete Institute (ACI) 318, Section 4.2. Therefore, we recommend that cement Type V, along with a maximum water-cement ratio of 0.45, and minimum compressive strength of 4500 psi be incorporated into the concrete mix design for this project to reduce the risk of sulfate attack as recommended in Table 4.3.1 of the ACI. Consideration should be given to providing protection to buried metal pipes or use of non-metallic pipes, where permitted by local building codes.

8.2.1 Spread Footings

Shallow foundations would be appropriate for retaining structures and isolated structures subjected to small lateral or overturning loads. Mixed shallow and deep foundations are not recommended for the bridge structure. Design recommendations for shallow foundations bearing on undisturbed natural soil or compacted NDOT select granular fill are presented in the following table:

Description	Footing
Nominal bearing resistance of soils[1]	9600 psf at 2-foot embedment
Resistance factor	0.45
Minimum dimensions	2.5 feet
Minimum embedment below finished grade	2 feet
Estimated total settlement [2]	Less than 1 inch
Estimated differential settlement [2]	Less than 1/2 inch
Nominal passive resistance [3]	1,500 plf at 2 feet embedment
Nominal coefficient of sliding friction [3]	0.46

1. This nominal bearing resistance may be linearly increased by1000 psf for each additional 1-foot of embedment up to an embedment depth of 8 feet.
2. The above settlement estimates are based on footings designed for a service load bearing pressure of 3000 psf at 2-foot embedment to 6000 psf at 8 feet of embedment.
3. The nominal passive resistance may be increased by 800 psf per additional foot of embedment to the maximum 8-foot embedment depth. The nominal coefficient of sliding resistance may be applied to the effective sustained gravity load in the applicable load case.

8.2.2 Drilled Shafts

A minimum drilled shaft diameter of 3 feet is recommended. A minimum drilled shaft length of six shaft diameters is recommended for sign and lighting pole design. Based on our analyses a minimum shaft length below finish grade of 50 feet is recommended for the proposed 3-foot diameter bridge foundations placed at 6.0 feet center to center. The drilled shaft analysis results are presented in Appendix A. Our analyses for allowable drilled shaft resistances to axial and lateral loads were based on unfactored loads of 191 kips axial load, 79.94 kips shear load, and a moment load of 767.9 kip*ft. provided by the structural engineers.

The resistance factors for geotechnical design of drilled shafts are derived from AASHTO LRFD Bridge Design Specifications Table 10.5.5.2.4-1.

ITEM	Resistance Factor
Skin Friction Compressive (Clay, Single Shaft)	0.45
Skin Friction Uplift (Clay, Single Shaft)	0.35
Group Uplift	0.45

If a full scale load test is performed the Resistance Factor may be increased to a maximum of 0.7 for gravity load and 0.6 for resistance to uplift.

The single shaft axial capacity of tangent drilled shafts should be modified by a reduction factor of 0.55 times the computed single shaft axial capacity. For resistance to lateral load, tangent drilled shafts should be evaluated as anchored wall systems. The lateral resistance of drilled shaft groups will depend on the shaft spacing in the group. Lateral capacity of drilled shaft groups should be evaluated in accordance with Section 10.8.3.8 of the AASHTO LRFD Bridge Design Specifications. For analyses of lateral resistance by LPILE, Florida Pier or other beam on elastic foundation methods, the following table of values is recommended.

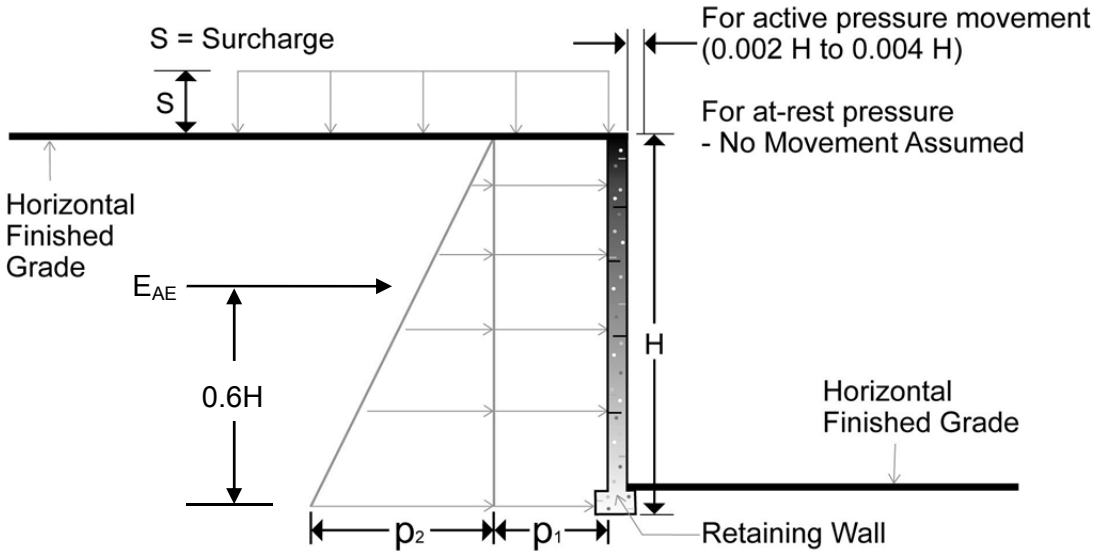
Elevation (feet MSL) from	Elevation (feet MSL) to	Cu (ksf)	e_{50}	K-value (lb/in^3)	Soil Unit Weight (pci)	Recommended LPILE catalog P-Y curve
2020	2019	4.79	0.0048	1240	0.07	#3
2019	2017	6.13	0.0045	1540	0.07	#3
2017	2013	6.13	0.0039	4020	0.07	#3
2013	2005	5.83	0.0024	2480	0.035	#3
2005	1989	11.65	0.0028	7660	0.035	#3
1989	1957	18.74	0.0040	4040	0.035	#3
1957	Depth drilled	17.20	0.0052	1870	0.035	#3

The tabulated values were determined from the boring logs, laboratory test data, SPT test data, LPILE guidelines, and lateral load tests at 10 test locations surrounding the F Street site.

8.3 Earth Retaining Structures

It is our understanding that Mechanically Stabilized Embankment (MSE) and Cast in-place (CIP) earth retaining structures will be used at this site.

Earth pressures will be influenced by structural design of the earth retaining wall system, conditions of wall restraint, methods of construction, compaction requirements, and the strength of the materials being retained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and active case wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Earth Pressure Coefficients

Earth Pressure Case	Coefficient for Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (Ka)	Granular - 0.28	34	(0.28)S	(34)H
At-Rest (Ko)	Granular - 0.44	53	(0.44)S	(53)H
Passive (Kp)	Granular - 3.53	360	-	-
Seismic Active Pressure Coefficient (Kae)	0.339	-	-	-
Earthquake Active Force (E_{AE})	-	-	-	$19.4*H^2$

Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002**H** to 0.004**H**, where **H** is wall height
- For passive earth pressure to develop, wall must move horizontally into the retained soil to mobilize resistance, with lateral movements of up to about 0.05**H**
- Uniform surcharge, where S is surcharge pressure
- In situ soil backfill weight a maximum of 120 pcf
- Horizontal backfill compacted to not less than 90 percent of the maximum density as determined by Test Method No. Nev. T101.
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No safety factor included in soil parameters
- Earthquake load applied at 0.6*H above bottom of wall

Backfill placed against structures should consist of granular soils. For the tabulated coefficients to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively.

To control hydrostatic pressure behind the wall we recommend that a drain be installed at the foundation elevation of the wall with a collection pipe leading to a gravity discharge. If this is not possible, then combined hydrostatic and lateral earth pressures should be considered in the lateral design load. These pressures do not include the influence of surcharge, traffic, or sloping toe slopes or surcharge. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those assumed by the design.

8.3.1 MSE Walls

Mechanically Stabilized Earth (MSE) walls are anticipated for retained heights of greater than 10 feet. The MSE walls should be designed for external stability of the wall system as well as internal stability of the reinforced soil mass behind the facing. Overall and compound stability failure should be considered. Structural design of the wall facing must also be considered. MSE wall backfill should consist of granular soil having a minimum angle of internal friction of 34 degrees and should meet all NDOT standard specifications for this use.

For sheet- strip-, and grid-type reinforcement, the minimum soil reinforcement length should be 70 percent of the wall height or 8 feet, whichever is longer, as measured from the leveling pad. A minimum leveling pad embedment depth of H/20 or 2 feet is recommended where the toe slope is 10 percent or less for a distance equal to the wall height.

8.3.2 CIP Walls

Cast-in-place (CIP) concrete cantilever walls are planned to support fill soils. The CIP walls should be designed for sliding along base, overturning, foundation bearing resistance, settlement, and overall stability. A minimum embedment depth of 2 foot is recommended. Lateral earth pressures for use in design are provided in section 8.3 above.

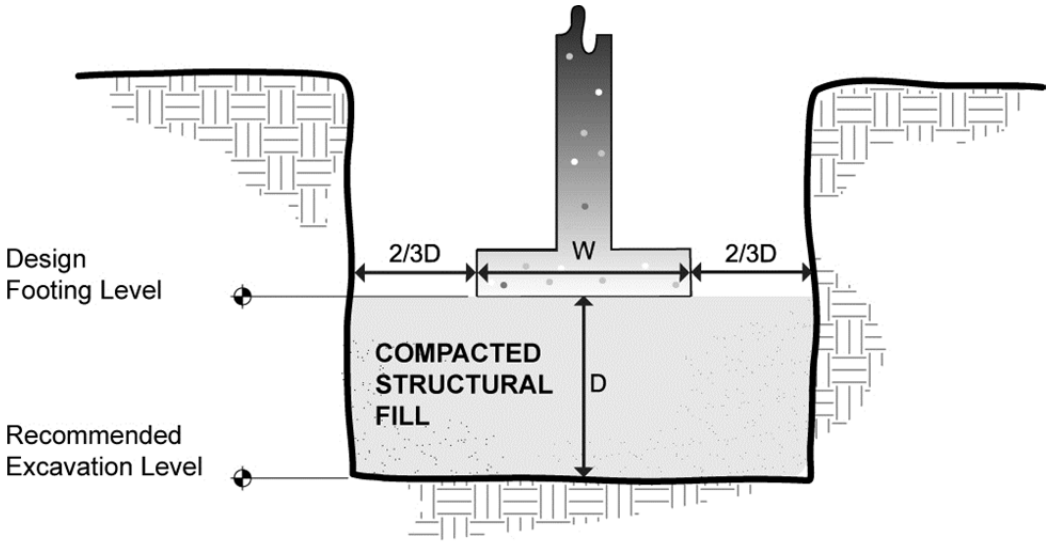
8.4 Construction Considerations

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions and in accordance with NDOT standard specifications. Temporary excavations will probably be required during shallow foundation operations. The contractor shall be responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

The NDOT “Standard Specifications for Road and Bridge Construction” should be applied where applicable.

8.4.1 Spread Footing Construction Considerations

Excavations for shallow foundations should be performed with equipment capable of providing a relatively clean bearing area. Based on the exploration data to the depths explored, excavation is feasible with conventional equipment, blasting should not be required. Strongly cemented soil and caliche excavation may require heavy-duty excavation equipment. Water should not be allowed to accumulate at the bottom of the foundation excavation. To reduce the potential for groundwater seepage into the excavations and to minimize disturbance to the bearing area, we recommend that steel and concrete be placed as soon as possible after the excavations are completed and properly cleaned. Excavations should not be left open overnight. The bearing surface for spread footings should be evaluated immediately prior to placing concrete.



Overexcavation / Backfill

NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

8.4.2 Drilled Shafts Construction Specifications

Temporary casing or drilling by oscillator methods may be required to control loose caving fill soils during drilling and concrete placement. Alternatively, hole stability could be maintained with drilling mud (bentonite or polymer slurry). However, based on our experience, contractors with local experience have generally been able to construct drilled shafts in the native soils without special drilling tools or casing. Surface casing through the fill will likely be required to control sloughing in the upper 20 to 25 feet.

Shafts should be drilled plumb at the design location (+/- 3 inches) and to the diameter indicated on plans. Prior to placing reinforcing steel, the hole should be cleaned to the depth drilled; conditions should be verified by visual observation; and sounding the bottom of the drilled shaft hole. Caliper logging of the first drilled shaft and 10 percent of the shafts in the project is recommended.

A minimum of 20 percent of the shafts should be constructed with cross-hole sonic logging (CSL) tubes evenly placed around the shaft perimeter at one tube per foot of shaft diameter. Integrity testing should be performed in accordance with NDOT standard practice.

Drilled shafts should be constructed in accordance with FHWA Publication IF-99-025 Guidelines. Reinforcing steel should be fabricated with spacers to assure proper alignment and concrete cover. Reinforcing steel should extend full length of the shaft.

Concrete should be mixed and placed in accordance with ACI guidelines, plans, and NDOT standard specifications. A minimum slump of 6 inches at the time of placement is recommended. Concrete placement should begin within one hour after final clean out. Concrete should be placed by tremie positioned within 6 inches of the bottom of the hole. The concrete placement rate should be controlled to displace cuttings, sediment, and water without mixing and to prevent floating or excessive movement of the reinforcing cage.

Concrete placement should be continuous until the shaft is filled to the design cut-off elevation. A minimum tremie pipe embedment of 10 feet should be maintained throughout concrete placement. If the cut-off elevation is below existing grade, water and contaminated concrete should be dipped from the shaft to the design cut-off elevation. Concrete test samples should be prepared and properties of the plastic concrete should be recorded.

A log of drilling and concrete placement should be maintained for each shaft. The drilling log should, as a minimum, record; start time, deviation from design location and plumb, clean-out procedure and result, total depth, water level, concrete level and quantity placed for each 10 feet of shaft, tremie embedment depth, and time at completion of concrete placement.

8.4.3 Earth Retaining Structure Construction Considerations

Placement and compaction of backfill should be performed in accordance with NDOT standard specifications. Large compaction equipment should not be used within 3 feet from of MSE wall facing panels. Only small hand, operated equipment such as vibratory plate compactors should be used within 3 feet of the panels to prevent wall distortion.

8.5 Recommended Construction Observations and Testing

Field density tests should be conducted for each fill lift. The location of the tests in plan should be spaced to provide the adequate coverage and should be taken no farther apart than 100 feet. The Engineer may require additional tests as considered necessary to check on the uniformity of compaction. In areas where sheep's foot rollers are used, the tests should be performed in the compacted material below the disturbed surface. No additional layers of fill should be placed until the field density test results indicate that the specified density has been obtained.

9.0 CLOSURE

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, and bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

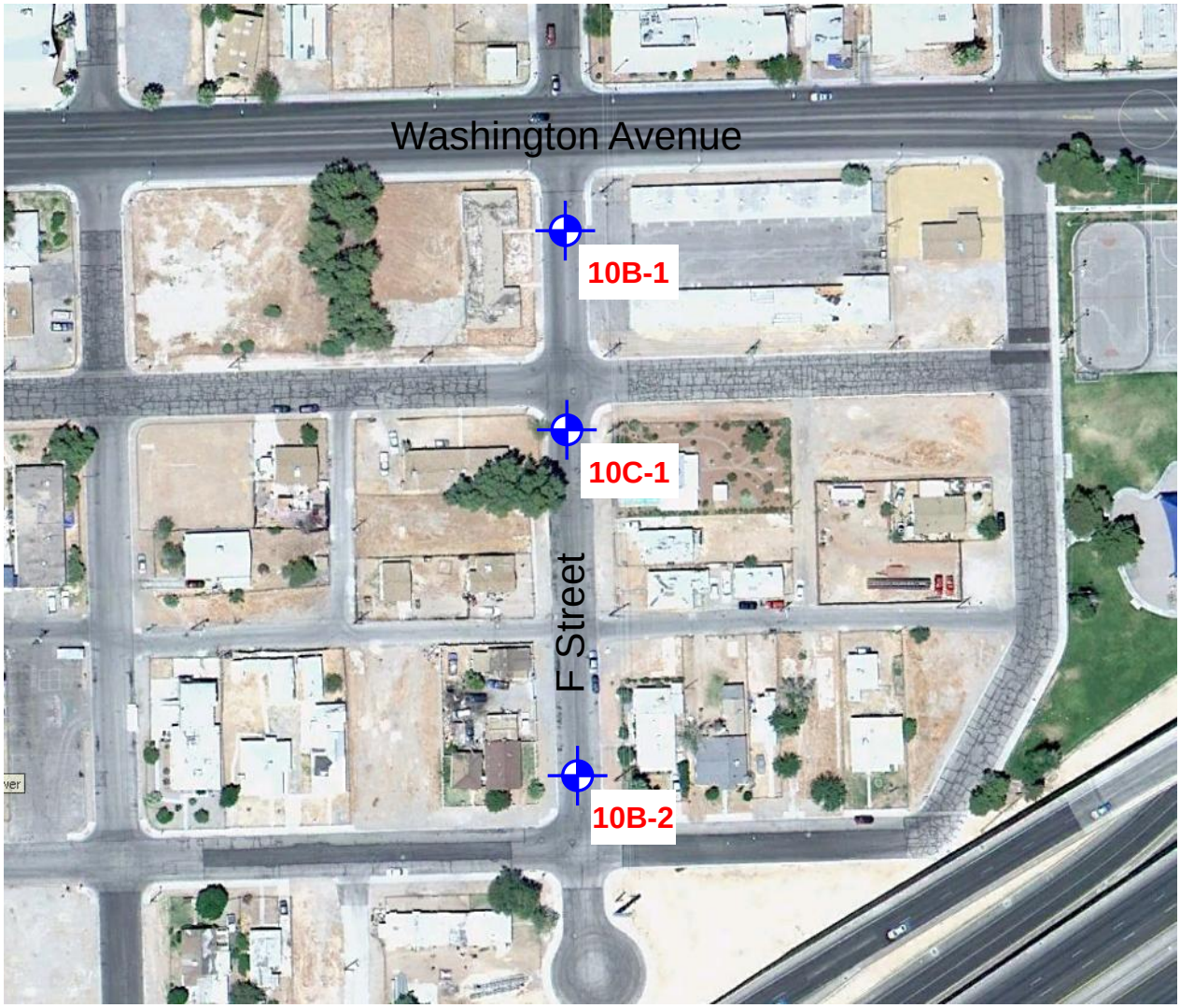
APPENDIX A
FIGURES

N

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Source: Google Earth Pro, 07 June 2011

Project Manager: LIU	Project No.: 64105012	Terracon 750 Pilot Road, Suite F Las Vegas, Nevada 89119 PH. (702) 597-9393 FAX. (702) 597-9009	SITE LOCATION MAP	Exhibit
Drawn by: LIU	Scale: NTS		F STREET BRIDGE RECONSTRUCTION AT I-15	A-1
Checked by: WEV	File Name: Exhibits			
Approved by: WEV	Date: 06/07/2011			



N

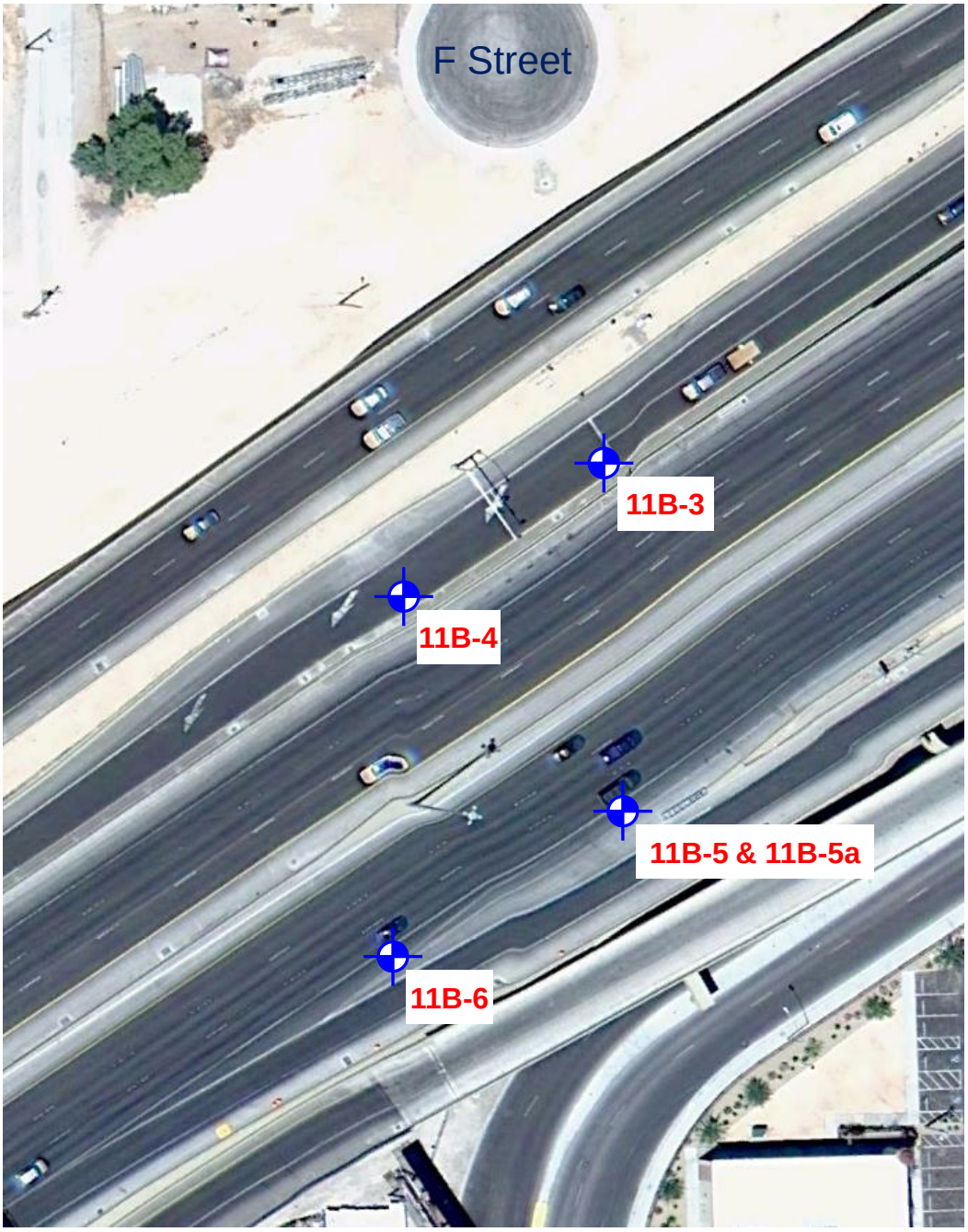
LEGEND:

B-1 BORING DESIGNATION AND APPROXIMATE LOCATION

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Source: Google Maps, 07 June 2011

Project Manager: LIU Drawn by: LIU Checked by: WEV Approved by: WEV	Project No.: 64105012 Scale: NTS File Name: Exhibits Date: 07 June 11	Terracon 750 Pilot Road, Suite F Las Vegas, Nevada 89119 PH. (702) 597-9393 FAX. (702) 597-9009	SOIL BORING LOCATION PLAN F STREET BRIDGE RECONSTRUCTION AT I-15	Exhibit A-2



N

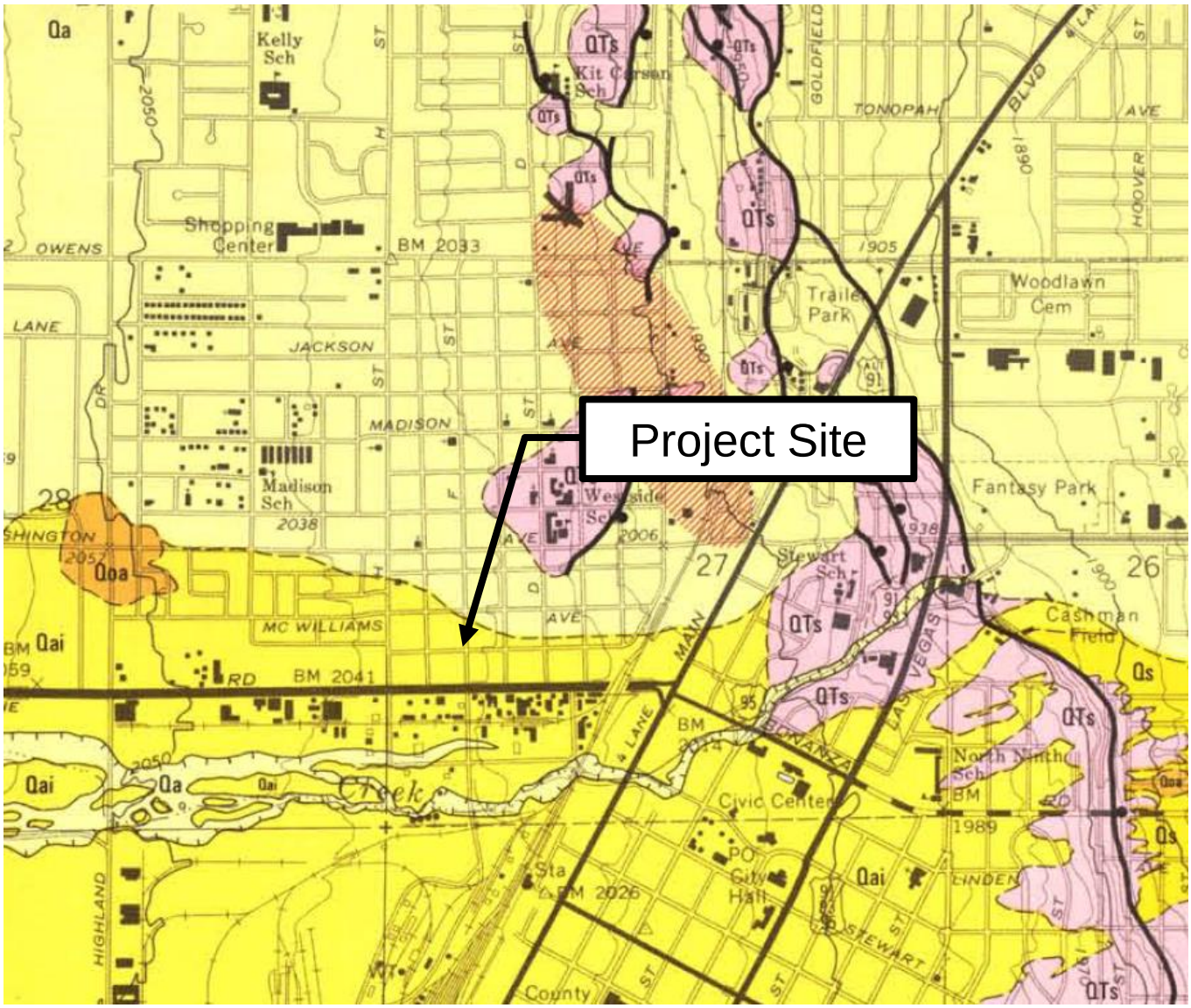
LEGEND:

B-1 BORING DESIGNATION AND APPROXIMATE LOCATION

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Source: Google Maps, 07 June 2011

Project Manager: LIU Drawn by: LIU Checked by: WEV Approved by: WEV	Project No.: 64105012 Scale: NTS File Name: Exhibits Date: 07 June 11	Terracon 750 Pilot Road, Suite F Las Vegas, Nevada 89119 PH. (702) 597-9393 FAX. (702) 597-9009	SOIL BORING LOCATION PLAN F STREET BRIDGE RECONSTRUCTION AT I-15	Exhibit A-3



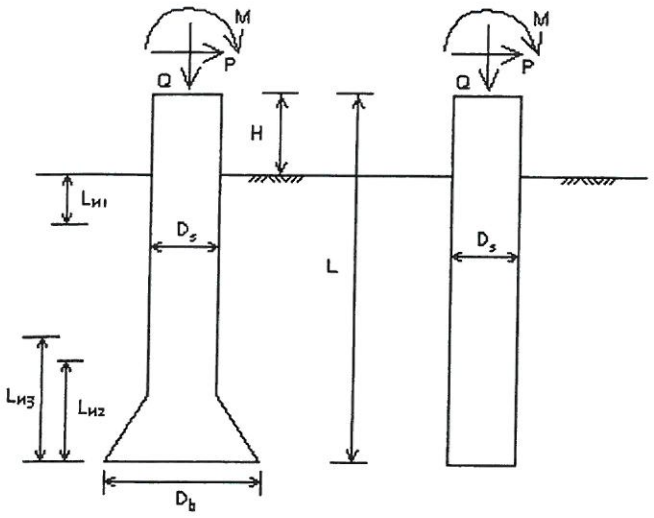
N

Source: J. C. Matti, F. W. Bachhuber, D. M. Morton, and J. W. Bell, "Map 3Dg, Geologic Map, Las Vegas NW Quadrangle." 1987, Nevada Bureau of Mines and Geology.

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: LIU	Project No.: 64105012	Terracon 750 Pilot Road, Suite F Las Vegas, Nevada 89119 PH. (702) 597-9393 FAX. (702) 597-9009	GEOLOGIC MAPPING F STREET BRIDGE RECONSTRUCTION AT I-15	Exhibit A-4
Drawn by: LIU	Scale: NTS			
Checked by: WEV	File Name: Exhibits			
Approved by: WEV	Date: 06/07/2011			

VERTICAL ANALYSIS



Drilled Shaft (dia >24 in. or 61 cm)

Loads:
Load Factor for Vertical Loads= 1.0 (Nominal)
Load Factor for Lateral Loads= 1.0 (Nominal)
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

Vertical Load, Q= 191.0 -kp
Shear Load, P= 0.0 -kp
Moment, M= 0.0 -kp-f

Profile:
Pile Length, L= 65.0 -ft
Top Height, H= 0 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0

Exclusion Zone, Ln1=Ln2=Ln3=0.

Soil Data:

Depth -ft	Gamma -lb/f3	Phi	C -kp/f2	K -lb/i3	e50 or Dr %	Nspt
0	121	0.0	4.79	1242.0	0.48	0
2	121	0.0	6.13	1540.0	0.45	0
6	121	0.0	6.13	4020	0.39	0
10	60.5	0.0	5.83	4020	0.39	0
12	60.5	0.0	11.65	2480	0.24	0
20	60.5	0.0	18.74	7660	0.28	0
30	60.5	0.0	17.20	4040	0.40	0
42	60.5	0.0	12.20	1870	0.52	0
58	60.5	0.0	30.85	660	0.58	0
78	60.5	0.0	20.56	1510.0	0.52	0

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/i2	Weight -kp/f
0.0	36	1017.9	113.1	82448.0	3000	1.060
65.0	36	1017.9	113.1	82448.0	3000	1.060

Vertical capacity:
Weight above Ground= 0.00 Total Weight= 44.65-kp *Soil Weight is not included
Side Resistance (Down)= 8836.903-kp Side Resistance (Up)= 8836.910-kp
Tip Resistance (Down)= 0.000-kp Tip Resistance (Up)= 0.000-kp
Total ~~(Ultimate)~~ Capacity (Down)= 8836.903-kp Total ~~(Ultimate)~~ Capacity (Up)= 8881.563-kp (Nominal)
Total ~~Allowable~~ Capacity (Down)= 4016.774-kp Total ~~Allowable~~ Capacity (Up)= 3062.608-kp (Factored)
OK! Qallow > Q

Single Shaft @ 1.5ϕC/C
6ϕC/C
(0.55)(4017) = 2209 KIPS/SHAFT >> 191 KIPS okay

Settlement Calculation:
At Q= 191.00-kp Settlement= 0.02616-in elastic & immediate
At ~~Xallow~~ (Service) = 1.00-in ~~Qallow~~ (Service) = 7299.93115-kp

Total settlement estimated < 0.3" okay

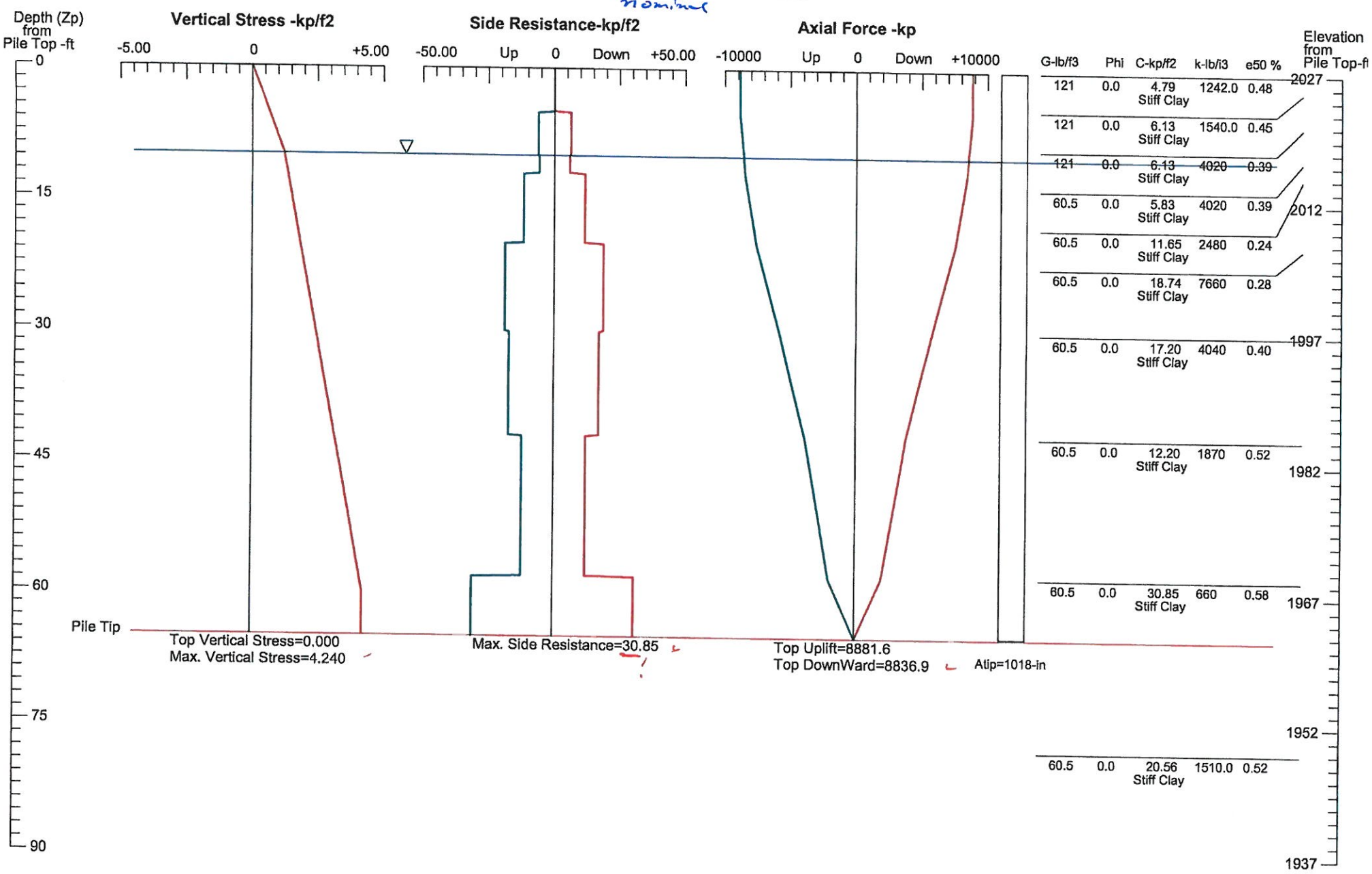
Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

8836.9 | 4016.8 .45

Resistance Factor Applied by Program = 0.45

SOIL STRESS, SIDE RESISTANCE, & AXIAL FORCE vs DEPTH

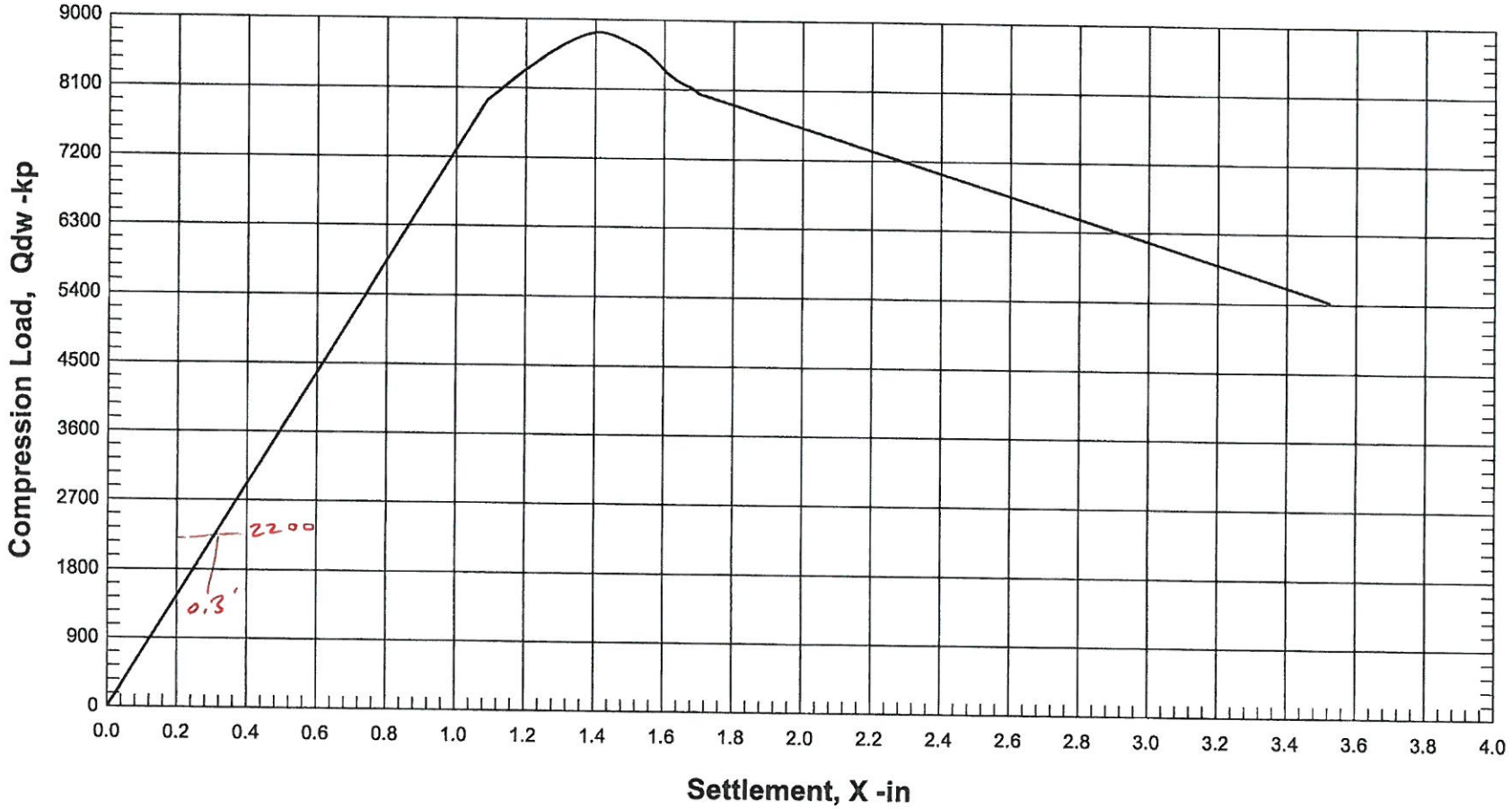
Based on ~~Ultimate~~ Nominal Load Condition



CivilTech Software

F St Bridge Reconstruction @ I15
D=3 Feet @ 4.5 Feet Center to Center

Vertical Load vs. Settlement



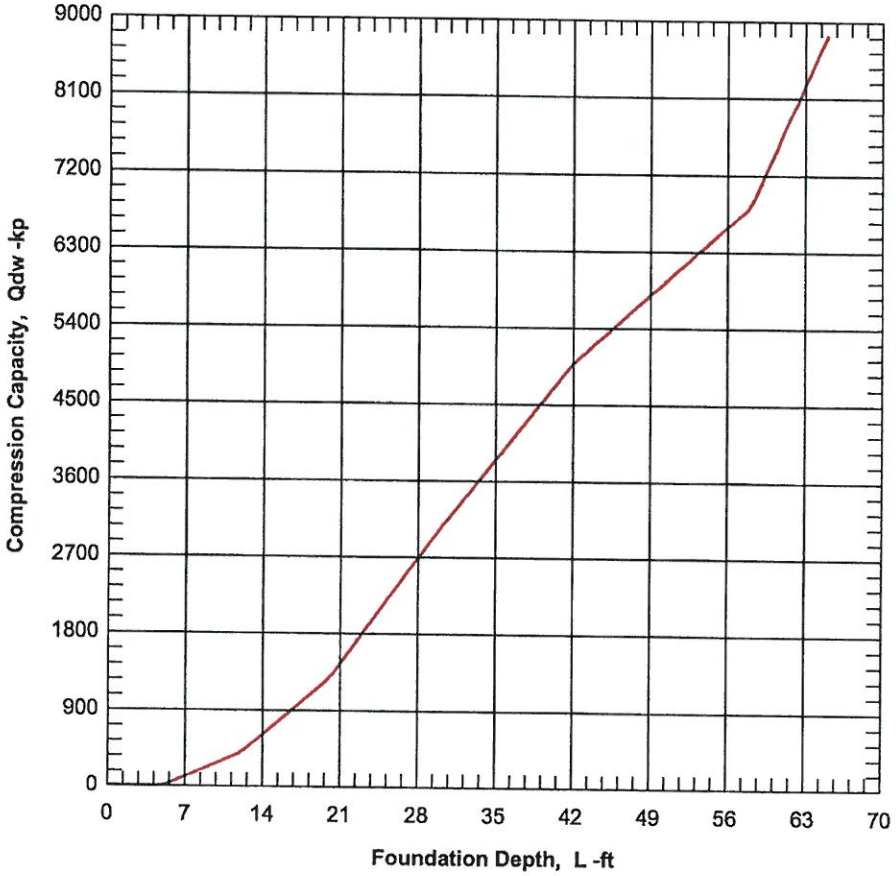
Total 0.3" @ 2200 kip in Group

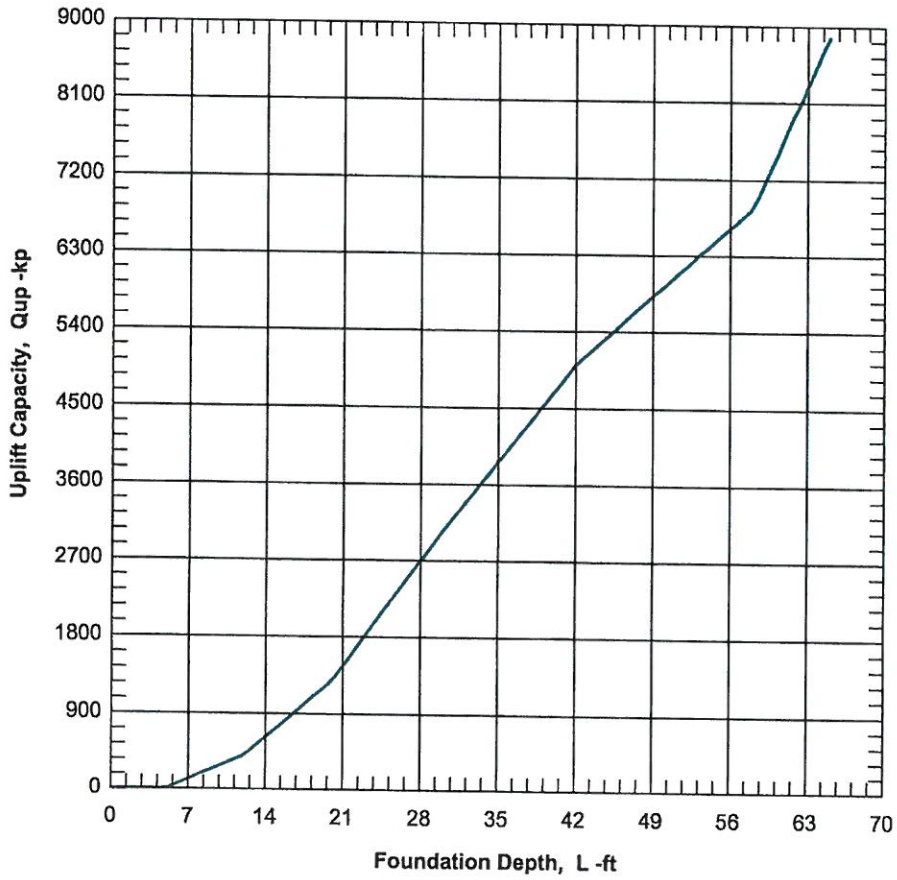
Side _____

Tip _____

(Nominal)

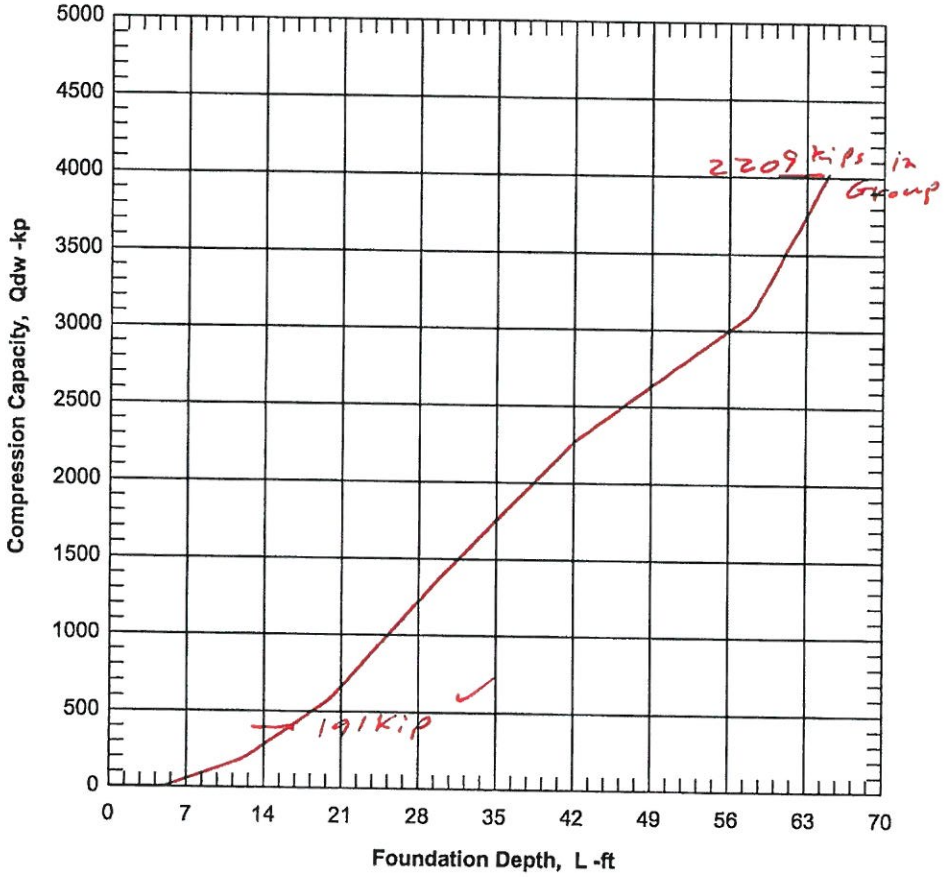
~~ULTIMATE~~ CAPACITY vs FOUNDATION DEPTH

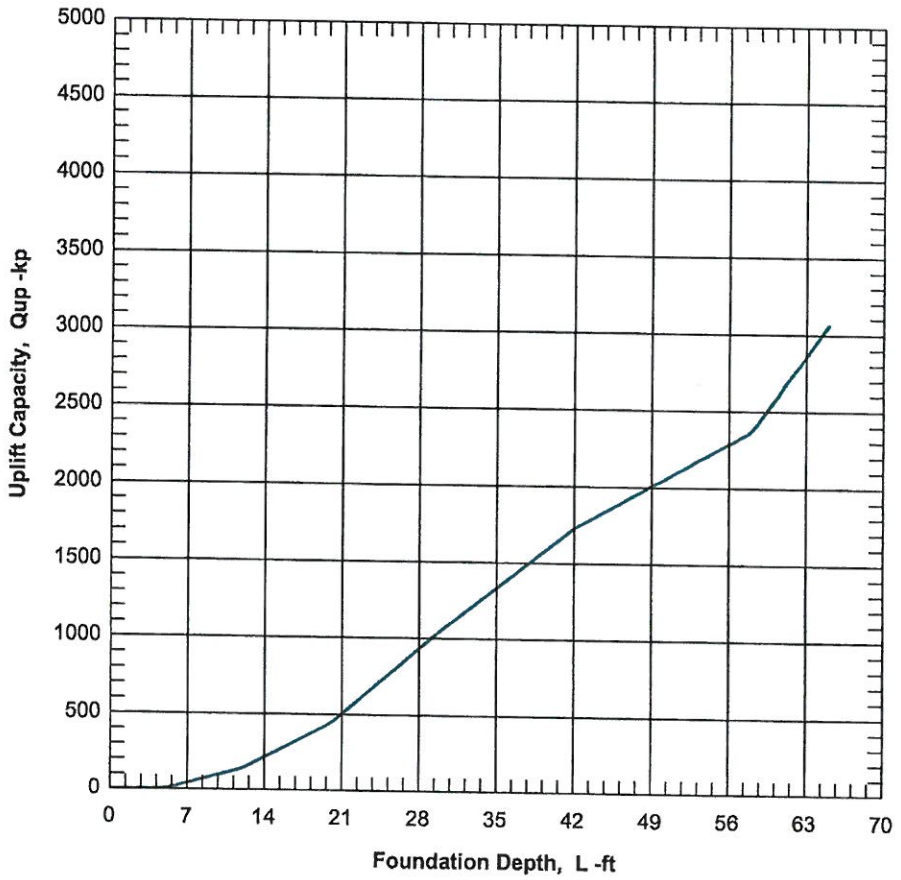




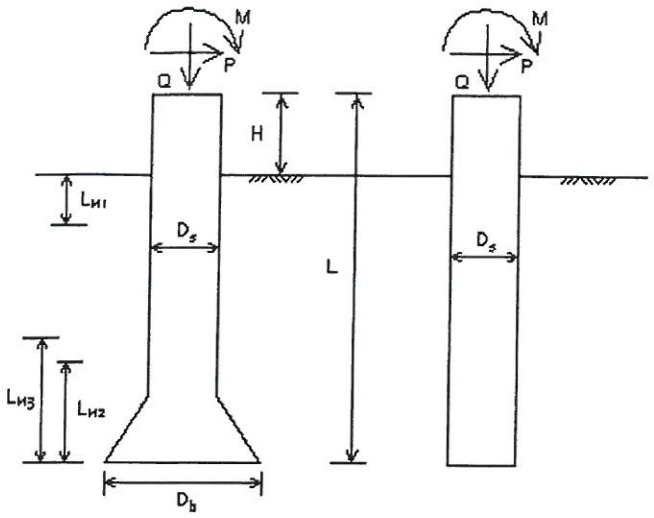
(Factored)

~~ALLOWABLE~~ CAPACITY vs FOUNDATION DEPTH





LATERAL ANALYSIS



Drilled Shaft (dia >24 in. or 61 cm)

Loads:
Load Factor for Vertical Loads= 1.0 (Nominal)
Load Factor for Lateral Loads= 1.0 (Nominal)
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

Vertical Load, Q= 191.0 -kp
Shear Load, P= 79.9 -kp
Moment, M= 767.9 -kp-f

Profile:
Pile Length, L= 65.0 -ft
Top Height, H= 0 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0

Exclusion Zone, Ln1=Ln2=Ln3=0.

Soil Data:

Depth -ft	Gamma -lb/f3	Phi	C -kp/f2	K -lb/i3	e50 or Dr %	Nspt
0	121	0.0	4.79	1242.0	0.48	0
2	121	0.0	6.13	1540.0	0.45	0
6	121	0.0	6.13	4020	0.39	0
10	60.5	0.0	5.83	4020	0.39	0
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20	60.5	0.0	18.74	7660	0.28	0
30	60.5	0.0	17.20	4040	0.40	0
42	60.5	0.0	12.20	1870	0.52	0
58	60.5	0.0	30.85	660	0.58	0
78	60.5	0.0	20.56	1510.0	0.52	0

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/i2	Weight -kp/f
0.0	36	1017.9	113.1	82448.0	3000	1.060
65.0	36	1017.9	113.1	82448.0	3000	1.060

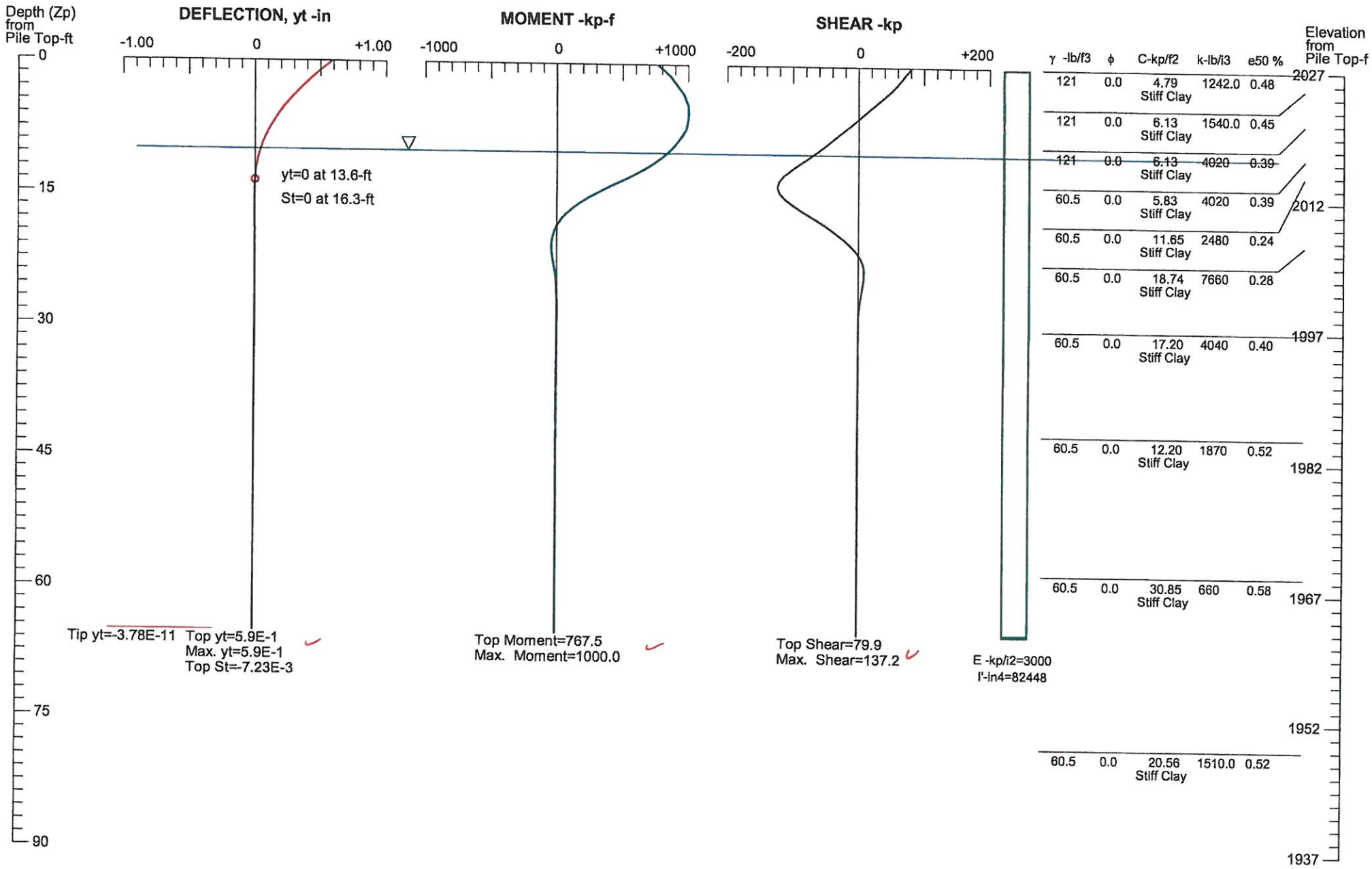
Single Pile Lateral Analysis:
Top Deflection, yt= 0.59000-in
Max. Moment, M= 1000.00-kp-f
Top Deflection Slope, St= -0.00723
OK! Top Deflection, 0.5900-in is less than the Allowable Deflection= 1.00-in

0.00723
192
1446
6507
323
1.38816 Total at Cap
1.98~

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.
The Max. Moment calculated by program is an internal force from the applied load conditions. Structural engineer has to check whether the pile has enough capacity to resist the moment with adequate factor of safety. If not, the pile may fail under the load conditions.

PILE DEFLECTION & FORCE vs DEPTH

Single Pile, Khead=1, Kbc=1

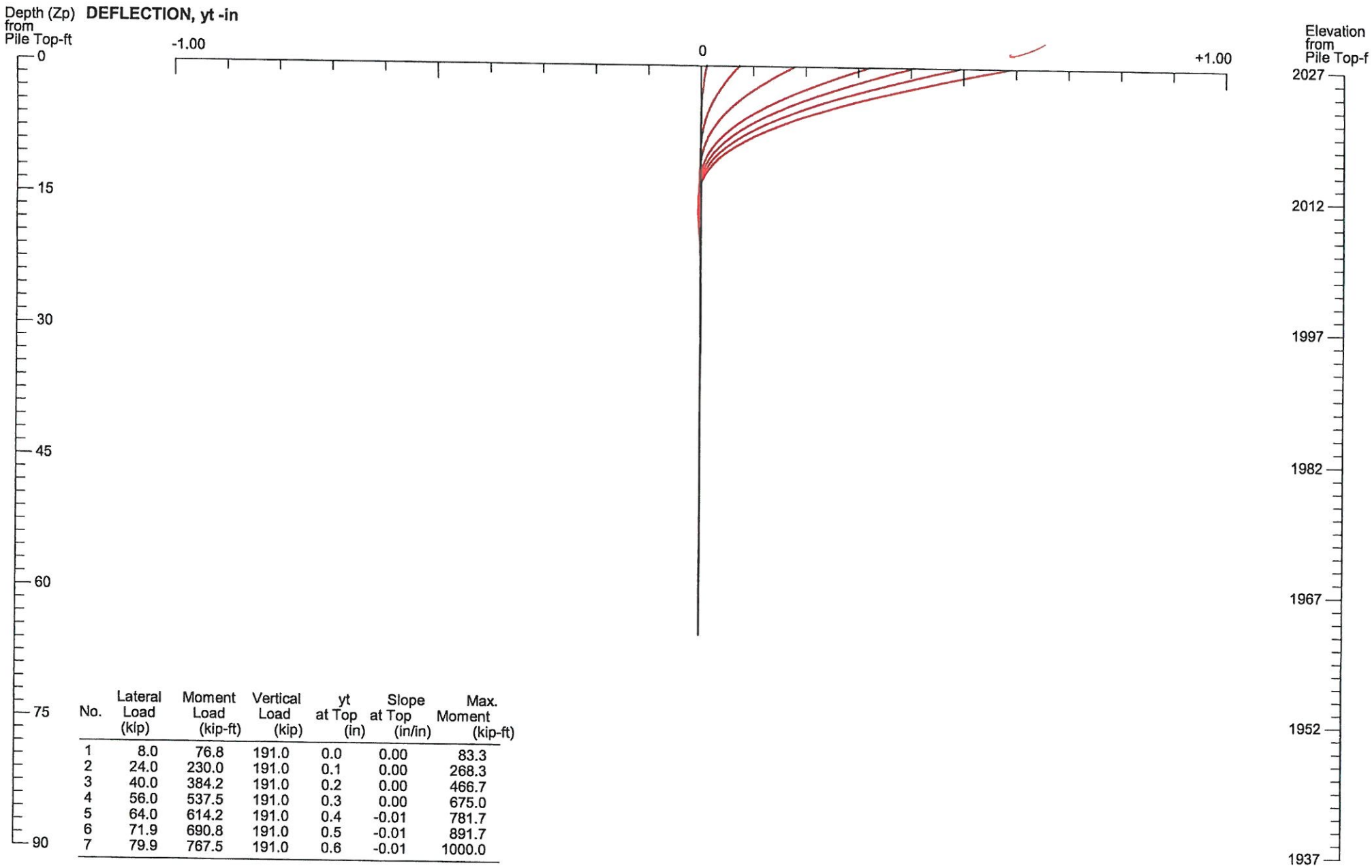


CivilTech Software

F St Bridge Reconstruction @ I15
D=3 Feet @ 4.5 Feet Center to Center

PILE DEFLECTION vs LOADING

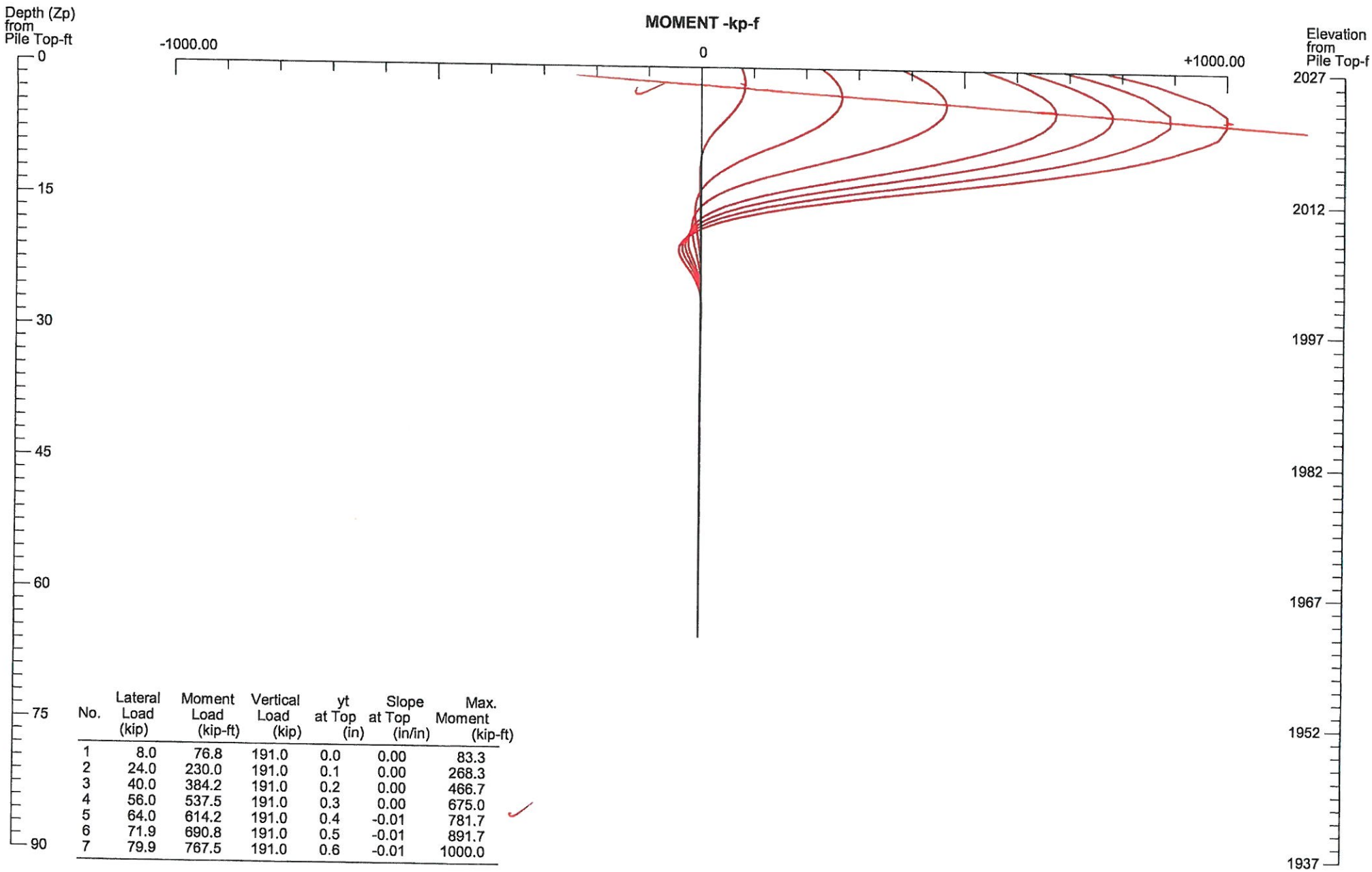
Single Pile, Khead=1, Kbc=1



No.	Lateral Load (kip)	Moment Load (kip-ft)	Vertical Load (kip)	yt at Top (in)	Slope at Top (in/in)	Max. Moment (kip-ft)
1	8.0	76.8	191.0	0.0	0.00	83.3
2	24.0	230.0	191.0	0.1	0.00	268.3
3	40.0	384.2	191.0	0.2	0.00	466.7
4	56.0	537.5	191.0	0.3	0.00	675.0
5	64.0	614.2	191.0	0.4	-0.01	781.7
6	71.9	690.8	191.0	0.5	-0.01	891.7
7	79.9	767.5	191.0	0.6	-0.01	1000.0

PILE MOMENT vs LOADING

Single Pile, Khead=1, Kbc=1



No.	Lateral Load (kip)	Moment Load (kip-ft)	Vertical Load (kip)	yt at Top (in)	Slope at Top (in/in)	Max. Moment (kip-ft)
1	8.0	76.8	191.0	0.0	0.00	83.3
2	24.0	230.0	191.0	0.1	0.00	268.3
3	40.0	384.2	191.0	0.2	0.00	466.7
4	56.0	537.5	191.0	0.3	0.00	675.0
5	64.0	614.2	191.0	0.4	-0.01	781.7
6	71.9	690.8	191.0	0.5	-0.01	891.7
7	79.9	767.5	191.0	0.6	-0.01	1000.0

APPENDIX B
SUBSURFACE EXPLORATION DATA

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	BCR:	Before Casing Removal
WCI:	Wet Cave in	WD:	While Drilling	ACR:	After Casing Removal
DCI:	Dry Cave in	AB:	After Boring	N/E:	Not Encountered

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 - 1	Very Soft
500 – 1,000	2 - 4	Soft
1,000 – 2,000	4 - 8	Medium Stiff
2,000 – 4,000	8 - 15	Stiff
4,000 – 8,000	15 - 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

Rev 04/10

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]		GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]		GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel[F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]		SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]		SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]		ML	Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay[K,L,M]
			PI plots below "A" line		MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

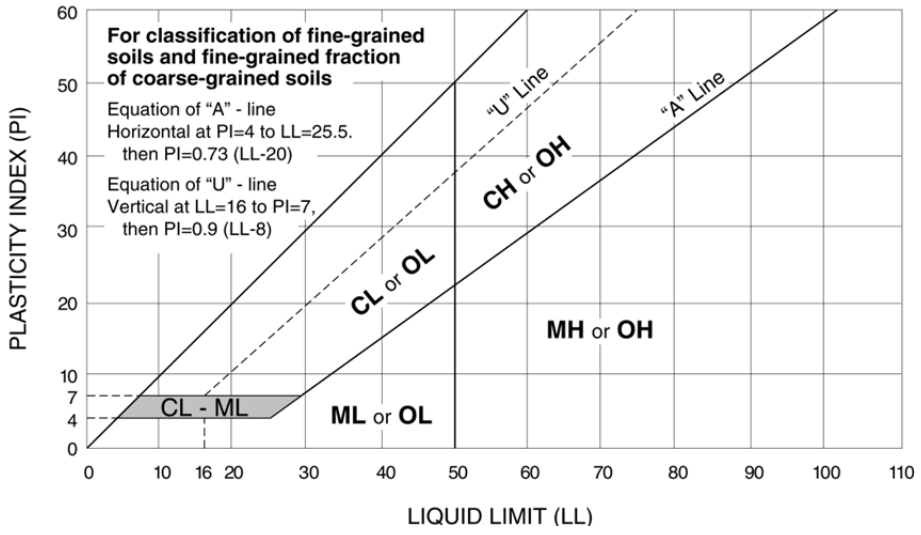


Exhibit B-2

Field Exploration Description

Terracon personnel marked the boring locations in the field for Boring Nos. 10B-1, 10B-2, and 10C-1. Atkins America, Inc. surveyed the boring locations in the field for Boring Nos. 11B-3 to 11B-6. Atkins America, Inc. provided the boring locations and elevations indicated on the boring logs for Boring Nos. 11B-3 to 11B-6.

The borings were drilled with a Diedrich D120 truck-mounted drill rig using hollow stem auger techniques to advance the boreholes. Samples of the soils encountered in the borings were obtained by the Standard Penetration Test (SPT) method using standard split spoon (2-inch O. D.) and California modified split spoon samplers with brass rings. Samples were also obtained with thin wall Shelby tubes pushed by the drill rig hydraulics.

In the SPT sampling procedure, the number of blows required to advance a standard 2-inch O.D. split barrel sampler the last 12 inches of the typical total 18-inch penetration or the middle 12 inches of total 24 inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N).

An automatic SPT hammer was used to advance the sampler in the borings performed on this site. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report. However, the penetration resistance values presented on the boring logs are not adjusted for sampler diameter or calibrated hammer efficiency.

The samples obtained were marked for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency interpretations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with Portland cement grout prior to the drill crew leaving the site.

The Terracon geologist prepared a field log of each boring during drilling. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observations and tests performed on the samples from the sampling depth. The boring logs are presented in Appendix B.

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	BCR:	Before Casing Removal
WCI:	Wet Cave in	WD:	While Drilling	ACR:	After Casing Removal
DCI:	Dry Cave in	AB:	After Boring	N/E:	Not Encountered

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 - 1	Very Soft
500 – 1,000	2 - 4	Soft
1,000 – 2,000	4 - 8	Medium Stiff
2,000 – 4,000	8 - 15	Stiff
4,000 – 8,000	15 - 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

Rev 04/10

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]		GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]		GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel[F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]		SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]		SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]		ML	Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay[K,L,M]
			PI plots below "A" line		MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

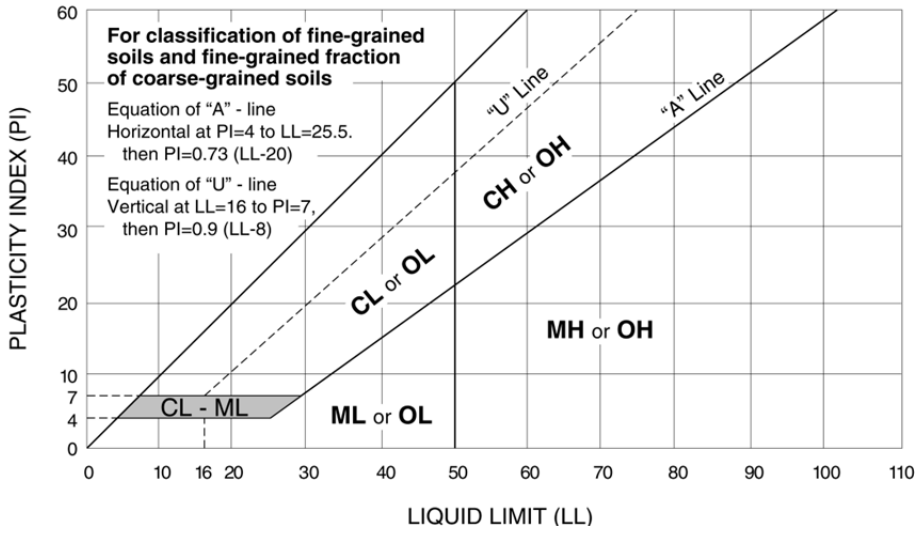


Exhibit B-2

Field Exploration Description

Terracon personnel marked the boring locations in the field for Boring Nos. 10B-1, 10B-2, and 10C-1. Atkins America, Inc. surveyed the boring locations in the field for Boring Nos. 11B-3 to 11B-6. Atkins America, Inc. provided the boring locations and elevations indicated on the boring logs for Boring Nos. 11B-3 to 11B-6.

The borings were drilled with a Diedrich D120 truck-mounted drill rig using hollow stem auger techniques to advance the boreholes. Samples of the soils encountered in the borings were obtained by the Standard Penetration Test (SPT) method using standard split spoon (2-inch O. D.) and California modified split spoon samplers with brass rings. Samples were also obtained with thin wall Shelby tubes pushed by the drill rig hydraulics.

In the SPT sampling procedure, the number of blows required to advance a standard 2-inch O.D. split barrel sampler the last 12 inches of the typical total 18-inch penetration or the middle 12 inches of total 24 inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N).

An automatic SPT hammer was used to advance the sampler in the borings performed on this site. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report. However, the penetration resistance values presented on the boring logs are not adjusted for sampler diameter or calibrated hammer efficiency.

The samples obtained were marked for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency interpretations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with Portland cement grout prior to the drill crew leaving the site.

The Terracon geologist prepared a field log of each boring during drilling. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observations and tests performed on the samples from the sampling depth. The boring logs are presented in Appendix B.

LOG OF BORING 10B-1

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING ***764214*** NORTHING ***26767658***

STATION OFFSET

APPROXIMATE SURFACE ELEVATION (ft) ***2031.0***

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
0.4	**ASPHALT** - 5 inches thick	2030.6	AC								
			AB								
1.4	**AGGREGATE BASE** - brown, moist (12 inches thick)	2029.6									
	CLAYEY SAND - brown, moist, medium dense		SC	1	SS	14	18	13			
				2	BS						
	- slightly moist, dense										
4.1		2026.9									
	CALICHE - white, dry, medium strong		CALICHE	3	SS	0	50/2"				
5.0		2026.0									
5	**SANDY CLAY WITH SILT** - brown, slightly moist, very stiff		CL								
	PARTIALLY CEMENTED SANDY CLAY WITH SILT - with caliche lenses, white, dry to slightly moist, hard										
9.5		2021.5		4	SS	3	50/5"	13			
	Bottom Depth at Approximately 9.5 feet										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	NE	03-24-2011
WL DEPTH ▼	NE	03-24-2011
NOTES	Lat: 36.180628, Long: -115.149434	

Terracon

BORING STARTED	03-24-2011		
BORING COMPLETED	03-24-2011		
RIG	Diedrich D120	GEOLOGIST / ENGINEER	REE
PROJECT No.	64105012	BORING	10B-1

LOG OF BORING 10B-2

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING ***784222*** NORTHING ***26767216***

STATION OFFSET

APPROXIMATE SURFACE ELEVATION (ft) ***2032.0***

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
0.4	**ASPHALT** - 5 inches thick	2031.6	AC								
1.3	**AGGREGATE BASE** - brown, slightly moist (10 inches thick)	2030.8	AB								
	SANDY CLAY WITH SILT - moderately fat, brown, moist, medium stiff		CL	1	SS	13	17	27			
				2	BS						
3.0	- light brown, slightly moist, very dense	2029.0	GC	3	BS						
4.0	**CLAYEY CALICHE GRAVEL WITH SAND**	2028.0	SC	4	SS	14	22	14			
4.5	- white, slightly moist, medium dense	2027.5	CL								
5	**CLAYEY SAND** - light greenish brown, slightly moist, medium dense										
	SANDY CLAY WITH SILT - light greenish brown, slightly moist, very dense										
9.3	- with thin caliche lenses	2022.7		5	SS	0	50/3"				
	Bottom Depth at Approximately 9.3 feet										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	NE	03-24-2011
WL DEPTH ▼	NE	03-24-2011
NOTES	Lat: 36.179414, Long:-115.159411	

Terracon

BORING STARTED	03-24-2011		
BORING COMPLETED	03-24-2011		
RIG	Diedrich D120	GEOLOGIST / ENGINEER	REE
PROJECT No. 64105012		BORING	10B-2

LOG OF BORING 10C-1

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784300	***26767495***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2031.0***	

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLES: SAMPLE No.	SAMPLES: SAMPLE TYPE	SAMPLES: RECOVERY (inch)	SAMPLES: BLOW COUNT (blows/ft)	TESTS: WATER CONTENT, %	TESTS: DRY UNIT WEIGHT (pcf)	TESTS: UNCONFINED COMP. STRENGTH (psf)	NOTES
	0.4	**ASPHALT** - 4.25 inches thick	2030.6		AC								
	1.3	**AGGREGATE BASE** - brown, slightly moist	2029.7		AB								
		Bottom Depth at Approximately 1.3 feet											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*NE*	*03-24-2011*
WL DEPTH ▼	*NE*	*03-24-2011*
NOTES	*Lat: 36.180182, Long: -115.149416*	

Terracon

BORING STARTED	*03-24-2011*		
BORING COMPLETED	*03-24-2011*		
RIG	*Hand Augar*	GEOLOGIST / ENGINEER	*REE*
PROJECT No. *64105012*		BORING	*10C-1*

LOG OF BORING 11B-3

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING ***784285.0615*** NORTHING ***26766895.1435***

STATION OFFSET

APPROXIMATE SURFACE ELEVATION (ft) ***2045.2***

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
0.7	**ASPHALT** - 8 inches thick	2044.5	AC								
	AGGREGATE BASE - brown, slightly moist (18 inches thick)		AB								
2.2		2043.0									
	FILL(SILTY GRAVEL WITH SAND) - dark brown, slightly moist, loose		FILL								
4.0		2041.2									
	FILL(SILTY SAND WITH GRAVEL) - trace gravel, brown, moist		FILL	1	SS	12	16	14			
	- with gravel										
7.0		2038.2									
	FILL(CLAYEY GRAVEL WITH SAND) - brown, moist		FILL								
8.5		2036.7									
	FILL(POORLY GRADED SAND WITH SILT AND GRAVEL) - brown, slightly moist, loose-caving		FILL	2	SS	3	50/4	6			
	- trace clay			3	BS	12		5			
12.0		2033.2									
	FILL(WELL GRADED GRAVEL WITH SILT AND SAND) - trace silt and concrete debris, brown, slightly moist		FILL	4	SS	9	14	5			
15.0		2030.2									

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: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	29.2	05-18-2011
WL DEPTH ▼	29.2	05-18-2011
NOTES	Lat: 36.178530, Long: -115.149203	

Terracon

BORING STARTED	05-17-2011
BORING COMPLETED	05-18-2011
RIG Diechrich D120	GEOLOGIST / ENGINEER REE
PROJECT No. 64105012	BORING 11B-3

LOG OF BORING NO. 11B-3

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING ***784285.0615*** NORTHING ***26766895.1435***

STATION OFFSET

APPROXIMATE SURFACE ELEVATION (ft) ***2045.2***

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLES: SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	TESTS: WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
		FILL(SILTY GRAVEL WITH SAND) - trace clay, slightly moist			FILL								
	17.0		2028.2										
		FILL(CLAYEY SAND WITH GRAVEL) - brown, moist			FILL								
						5	RS	6	28	12			
				20									
		- wire mesh											
	21.5		2023.7										
		SANDY CLAY WITH SILT - white, slightly moist, hard			CL								
	23.0		2022.2										
		PARTIALLY CEMENTED SANDY CLAY WITH SILT - white, slightly moist, hard			CL								
						6	SS	0	50/1				
				25									
	25.5		2019.7										
		SANDY CLAY WITH SILT - white to light brown, very moist, medium stiff			CL								
	28.0		2017.2										
		PARTIALLY CEMENTED SANDY CLAY WITH SILT			CL								
	29.0	- white to light brown, slightly moist, hard	2016.2										
		CALICHE - white, dry, strong			CALICHE	7	RS	0	50/2				
				30									
		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: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	29.2	05-18-2011
WL DEPTH ▼	29.2	05-18-2011
NOTES	Lat: 36.178530, Long: -115.149203	

Terracon

BORING STARTED	05-17-2011		
BORING COMPLETED	05-18-2011		
RIG	Diechrich D120	GEOLOGIST / ENGINEER	REE
PROJECT No.	64105012	BORING	11B-3

LOG OF BORING NO. 11B-3

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING ***784285.0615*** NORTHING ***26766895.1435***

STATION OFFSET

APPROXIMATE SURFACE ELEVATION (ft) ***2045.2***

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLES: SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	TESTS: WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	30.5	**CALICHE**	2014.7										
		CLAYEY SAND - greenish brown, wet, dense			SC								
	34.5		2010.7			8	SS	18	34	21			
		SILTY SAND - light greenish brown, wet, dense		35	SM								
	36.5		2008.7										
		SANDY CLAY WITH SILT - white very moist, stiff			CL								
		- with caliche lenses (38.5' to 41.5'), hard				9	RS	2	50/2				
				40									
		- stiff											
		- with caliche lenses (43' to 44.5), hard											
		- very stiff				10	SS	6	28	16			
				45									
		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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	29.2	05-18-2011
WL DEPTH ▼	29.2	05-18-2011
NOTES	Lat: 36.178530, Long: -115.149203	

Terracon

BORING STARTED	05-17-2011
BORING COMPLETED	05-18-2011
RIG Diechrich D120	GEOLOGIST / ENGINEER REE
PROJECT No. 64105012	BORING 11B-3

LOG OF BORING NO. 11B-3

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING ***784285.0615*** NORTHING ***26766895.1435***

STATION OFFSET

APPROXIMATE SURFACE ELEVATION (ft) ***2045.2***

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLES: SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	TESTS: WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
		SANDY CLAY WITH SILT											
		- very moist to wet, medium stiff											
	49.0		1996.2										
		LEAN CLAY WITH SAND			CL	11	ST	24		39	106		93.2
		- white, moist, very stiff		50									
		- with caliche lenses(51.5' to 55.5') , moist, hard				12	SS	2	50/2	17	100		
						13	SS	2	50/3	34			
	55.5		1989.7	55									
		FAT CLAY			CH								
		- greenish brown, very moist to wet, stiff											
	59.0		1986.2										
		CLAYEY SAND			SC	14	RS	18	16	37	82		
				60									
		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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	29.2	05-18-2011
WL DEPTH ▼	29.2	05-18-2011
NOTES	Lat: 36.178530, Long: -115.149203	

Terracon

BORING STARTED	05-17-2011		
BORING COMPLETED	05-18-2011		
RIG	Diechrich D120	GEOLOGIST / ENGINEER	REE
PROJECT No.	64105012	BORING	11B-3

LOG OF BORING NO. 11B-3

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784285.0615	***26766895.1435***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2045.2***	

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLES: SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	TESTS: WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
		CLAYEY SAND - light greenish brown, moist, medium dense											
	62.0		1983.2										
		FAT CLAY WITH SAND - brown, very moist, stiff			CH								
						15	SS	18	9	69			
				65									
						16	RS	16	25	64			
	70.5		1974.7	70									
		SANDY CLAY WITH SILT - light greenish brown, very moist, medium stiff - with thin caliche lenses (70' to 72')			CL								
						17	SS	18	15	30			
				75									
		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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*29.2*	*05-18-2011*
WL DEPTH ▼	*29.2*	*05-18-2011*
NOTES	*Lat: 36.178530, Long: -115.149203*	

Terracon

BORING STARTED	*05-17-2011*		
BORING COMPLETED	*05-18-2011*		
RIG *Diechrich D120*	GEOLOGIST / ENGINEER	*REE*	
PROJECT No. *64105012*	BORING	*11B-3*	

LOG OF BORING NO. 11B-3

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784285.0615	***26766895.1435***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2045.2***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	SANDY CLAY WITH SILT - white to light brown										
78.0		1967.2									
	FAT CLAY - trace sand, brown, very moist, stiff		CH	18	RS	18	28	63			
80											
				19	SS	18	11	91			
85	- occasional white clay lenses										
				20	RS	18	25	43	75		
90											
	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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*29.2*	*05-18-2011*
WL DEPTH ▼	*29.2*	*05-18-2011*
NOTES	*Lat: 36.178530, Long: -115.149203*	

Terracon

BORING STARTED	*05-17-2011*		
BORING COMPLETED	*05-18-2011*		
RIG *Diechrich D120*	GEOLOGIST / ENGINEER	*REE*	
PROJECT No. *64105012*	BORING	*11B-3*	

LOG OF BORING NO. 11B-3

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784285.0615	***26766895.1435***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2045.2***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	FAT CLAY - trace caliche gravel										
93.0		1952.2									
	SANDY FAT CLAY - brown, very moist, stiff		CH								
				21	SS	10	12	45			
95											
98.0		1947.2									
	SANDY CLAY WITH SILT - light greenish brown, very moist, stiff		CL								
				22	RS	18	23	34	77		
100											
100.5		1944.7									
	Bottom Depth at Approximately 100.5 feet										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*29.2*	*05-18-2011*
WL DEPTH ▼	*29.2*	*05-18-2011*
NOTES	*Lat: 36.178530, Long: -115.149203*	

Terracon

BORING STARTED	*05-17-2011*
BORING COMPLETED	*05-18-2011*
RIG *Diechrich D120*	GEOLOGIST / ENGINEER *REE*
PROJECT No. *64105012*	BORING *11B-3*

LOG OF BORING 11B-4

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING ***784199.4107*** NORTHING ***26766834.9422***

STATION OFFSET

APPROXIMATE SURFACE ELEVATION (ft) ***2048.6***

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
		SAMPLES								TESTS			
	0.7	**ASPHALT** - 8 inches thick	2047.9		AC								
	2.2	**AGGREGATE BASE** - reddish brown, slightly moist (18 inches thick)	2046.4		AB								
		FILL(SILTY SAND WITH GRAVEL) - black, slightly moist			FILL								
		- brown, slightly moist		5		1	SS	12	8	7			
	6.0		2042.6										
		FILL(POORLY GRADED GRAVEL WITH SAND) - brown, slightly moist, loose-caving - occasional concrete debris			FILL	2	BS			4			
						3	SS	2	50/4"				
	10.0		2038.6	10									
		FILL(POORLY GRADED SAND WITH SILT AND SAND) - brown, slightly moist			FILL	4	BS			7			
		- occasional clayey sand lenses											
						5	SS	8	50/3"	7			
				15									
		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: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	32.0	05-16-2011
WL DEPTH ▼	32.0	05-16-2011
NOTES	Lat: 36.178366, Long: -115.149496	

Terracon

BORING STARTED	05-15-2011		
BORING COMPLETED	05-16-2011		
RIG	Diechrich D120	GEOLOGIST / ENGINEER	REE
PROJECT No.	64105012	BORING	11B-4

LOG OF BORING NO. 11B-4

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING ***784199.4107*** NORTHING ***26766834.9422***

STATION OFFSET

APPROXIMATE SURFACE ELEVATION (ft) ***2048.6***

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLES: SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	TESTS: WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
		FILL(SILTY GRAVEL WITH SAND) - trace clay											
	16.5		2032.1										
		FILL(CLAYEY GRAVEL WITH SAND) - brown, moist			FILL								
	18.0		2030.6										
		SANDY FAT CLAY - brown, moist, stiff			CH								
						6	SS	18	40	21			
				20									
		- white, slightly moist, hard											
	23.0		2025.6										
		CLAYEY SAND - brown, slightly moist, medium dense			SC								
						7	RS	16	60				
	25.0		2023.6	25									
		SANDY CLAY WITH SILT - white, slightly moist, hard			CL								
	27.5		2021.1										
		CALICHE - white, dry, medium strong			CALICHE								
	28.5		2020.1										
	29.0	**SILTY SAND**	2019.6		SM								
		- greenish brown, very moist, medium dense			CL	8	SS	18	12	6			
				30									
		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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*32.0*	*05-16-2011*
WL DEPTH ▼	*32.0*	*05-16-2011*
NOTES	*Lat: 36.178366, Long: -115.149496*	

Terracon

BORING STARTED	*05-15-2011*		
BORING COMPLETED	*05-16-2011*		
RIG *Diechrich D120*	GEOLOGIST / ENGINEER	*REE*	
PROJECT No. *64105012*	BORING	*11B-4*	

LOG OF BORING NO. 11B-4

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784199.4107	***26766834.9422***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft)	***2048.6***

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	SANDY LEAN CLAY - greenish brown, very moist, stiff										
	- white			9	ST	18		20	106		90.7
35											
	- occasional partially cemented lenses, very stiff			10	SS	15	50/3"				
	- partially cemented, dry to slightly moist, hard										
				11	SS	2	50/3"	16			
40											
40.5		2008.1									
	SANDY CLAY WITH SILT		CL								
	- white, very moist, very stiff										
	- occasional partially cemented lenses			12	RS	12	66				
45											
45.0		2003.6									

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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*32.0*	*05-16-2011*
WL DEPTH ▼	*32.0*	*05-16-2011*
NOTES	*Lat: 36.178366, Long: -115.149496*	

Terracon

BORING STARTED	*05-15-2011*
BORING COMPLETED	*05-16-2011*
RIG *Diechrich D120*	GEOLOGIST / ENGINEER *REE*
PROJECT No. *64105012*	BORING *11B-4*

LOG OF BORING NO. 11B-4

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784199.4107	***26766834.9422***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2048.6***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	SANDY CLAY WITH SILT - partially cemented, white, very moist, very stiff		CL								
47.0		2001.6									
	FAT CLAY - greenish brown, very moist to wet, medium stiff		CH								
49.0		1999.6									
	CLAYEY SAND WITH GRAVEL - white, moist, medium dense		SC	13	SS	18	16	44			
50											
	- very moist to wet							15	83		
55				14	RS	18	12	26			
	- with partially cemented lenses, very dense										
59.0		1989.6									
	SANDY LEAN CLAY		CL	15	SS	18	31	41			
60											

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: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*32.0*	*05-16-2011*
WL DEPTH ▼	*32.0*	*05-16-2011*
NOTES	*Lat: 36.178366, Long: -115.149496*	

Terracon

BORING STARTED	*05-15-2011*		
BORING COMPLETED	*05-16-2011*		
RIG *Diechrich D120*	GEOLOGIST / ENGINEER	*REE*	
PROJECT No. *64105012*	BORING	*11B-4*	

LOG OF BORING NO. 11B-4

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784199.4107	***26766834.9422***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2048.6***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	SANDY LEAN CLAY - with partially cemented lenses, white, very moist, hard										
63.0		1985.6									
	FAT CLAY - trace sand, greenish brown, very moist, very stiff		CH	16	RS	18	18	31			
65											
67.5		1981.1									
	LEAN CLAY - white, very moist to wet, medium stiff		CL	17	SS	18	6	11			
70											
73.0		1975.6									
	CLAYEY SAND - light greenish brown, wet, medium dense		SC	18	RS	18	45				
75											
	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: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*32.0*	*05-16-2011*
WL DEPTH ▼	*32.0*	*05-16-2011*
NOTES	*Lat: 36.178366, Long: -115.149496*	

Terracon

BORING STARTED	*05-15-2011*		
BORING COMPLETED	*05-16-2011*		
RIG *Diechrich D120*	GEOLOGIST / ENGINEER	*REE*	
PROJECT No. *64105012*	BORING	*11B-4*	

LOG OF BORING NO. 11B-4

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784199.4107	***26766834.9422***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft)	***2048.6***

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	CLAYEY SAND - occasional clay lenses										
				19	SS	12	19	8			
80											
82.0		1966.6									
	FAT CLAY - reddish brown, very moist, medium stiff		CH								
				20	RS	18	16				
85											
87.5		1961.1									
	SILTY SAND - reddish brown, wet, medium dense		SM								
				21	SS	0	12				
90											
	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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*32.0*	*05-16-2011*
WL DEPTH ▼	*32.0*	*05-16-2011*
NOTES	*Lat: 36.178366, Long: -115.149496*	

Terracon

BORING STARTED	*05-15-2011*		
BORING COMPLETED	*05-16-2011*		
RIG	*Diechrich D120*	GEOLOGIST / ENGINEER	*REE*
PROJECT No.	*64105012*	BORING	*11B-4*

LOG OF BORING NO. 11B-4

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784199.4107	***26766834.9422***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2048.6***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	SILTY SAND										
91.0		1957.6									
	CEMENTED SAND AND GRAVEL - light brown, dry, moderatly strong		CGS								
93.0		1955.6									
	FAT CLAY - reddish brown, very moist, stiff		CH								
				22	RS	18	25				
95											
	- trace caliche gravel										
99.0		1949.6									
	CLAYEY SAND - light brown, very moist, medium dense		SC	23	SS	18	10	48			
100											
100.5	- occasional lean clay lenses	1948.1									
	Bottom Depth at Approximately 100.5 feet										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*32.0*	*05-16-2011*
WL DEPTH ▼	*32.0*	*05-16-2011*
NOTES	*Lat: 36.178366, Long: -115.149496*	

Terracon

BORING STARTED	*05-15-2011*		
BORING COMPLETED	*05-16-2011*		
RIG *Diechrich D120*		GEOLOGIST / ENGINEER	*REE*
PROJECT No. *64105012*		BORING	*11B-4*

LOG OF BORING 11B-5

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	***784292.552***
NORTHING	***26766749.5923***
STATION	
OFFSET	
APPROXIMATE SURFACE ELEVATION (ft)	***2050.9***

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	ASPHALT		AC								
	- 12 inches thick										
1.0		2049.9									
	AGGREGATE BASE		AB								
	- brown, slightly moist										
3.0		2047.9									
	FILL(CLAYEY GRAVEL WITH SAND)		FILL								
	- brown, slightly moist to moist			1	SS	12	17	10			
5											
8.0		2042.9									
	FILL(SILTY GRAVEL WITH SAND)		FILL								
	- brown, slightly moist to moist			2	SS	14	26	10			
10											
				3	SS	15	39				
15											
	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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*NE*	*05-26-2011*
WL DEPTH ▼	*NE*	*05-26-2011*
NOTES	*Lat: 36.178130, Long: -115.149180*	

Terracon

BORING STARTED	*05-26-2011*		
BORING COMPLETED	*05-26-2011*		
RIG	*Diechrich D120*	GEOLOGIST / ENGINEER	*REE*
PROJECT No.	*64105012*	BORING	*11B-5*

LOG OF BORING NO. 11B-5

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784292.552	***26766749.5923***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2050.9***	

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLES: SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	TESTS: WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
		FILL(SILTY GRAVEL WITH SAND) - brown, slightly moist to moist		20		4	SS	0	50/2"				
	21.5	- hit footing, auger refusal-sheared drive pins	2029.4										
		Bottom Depth at Approximately 21.5 feet											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	NE	05-26-2011
WL DEPTH ▼	NE	05-26-2011
NOTES	Lat: 36.178130, Long: -115.149180	

Terracon

BORING STARTED	05-26-2011
BORING COMPLETED	05-26-2011
RIG Diechrich D120	GEOLOGIST / ENGINEER REE
PROJECT No. 64105012	BORING 11B-5

LOG OF BORING 11B-5A

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING ***784289.2308*** NORTHING ***26766749.1134***

STATION OFFSET

APPROXIMATE SURFACE ELEVATION (ft) ***2051.0***

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLES: SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	TESTS: WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
		ASPHALT			AC								
	1.0	- 12 inches thick	2050.0										
		AGGREGATE BASE			AB								
		- brown, slightly moist											
	3.0		2048.0										
		FILL(SANDY CLAY WITH SILT)			FILL								
		- trace gravel, brown, moist		5									
	6.0		2045.0										
		FILL(CLAYEY GRAVEL WITH SAND)			FILL								
		- brown, slightly moist											
		- occasional caliche debris											
	9.0		2042.0										
		FILL(SANDY CLAY WITH SILT)			FILL								
		- trace gravel, brown, moist		10									
				15									

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: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*33.4*	*05-30-2011*
WL DEPTH ▼	*33.4*	*05-30-2011*
NOTES	*Lat: 36.178131, Long: -115.149191*	

Terracon

BORING STARTED	*05-30-2011*		
BORING COMPLETED	*05-30-2011*		
RIG	*CME-85*	GEOLOGIST / ENGINEER	*REE*
PROJECT No.	*64105012*	BORING	*11B-5A*

LOG OF BORING NO. 11B-5A

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784289.2308	***26766749.1134***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2051.0***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	FILL(SANDY CLAY WITH SILT)										
18.0		2033.0									
	FILL(CLAYEY GRAVEL WITH SAND) - brown, slightly moist		FILL								
23.0		2028.0									
	CLAYEY SAND - white, moist, very dense		SC								
				1	SS	17	27	17			
	- occasional partially cemented lenses										
28.0		2023.0									
	CALICHE - white, dry, medium strong		CALICHE								

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: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*33.4*	*05-30-2011*
WL DEPTH ▼	*33.4*	*05-30-2011*
NOTES	*Lat: 36.178131, Long: -115.149191*	

Terracon

BORING STARTED	*05-30-2011*		
BORING COMPLETED	*05-30-2011*		
RIG	*CME-85*	GEOLOGIST / ENGINEER	*REE*
PROJECT No.	*64105012*	BORING	*11B-5A*

LOG OF BORING NO. 11B-5A

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784289.2308	***26766749.1134***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft)	***2051.0***

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	CALICHE			2	SS	0	50/0"				
31.0		2020.0									
	SANDY CLAY WITH SILT - caliche lenses, white, very moist, hard		CL								
	- with clayey sand lenses, wet										
35.5		2015.5		3	SS	4	50/4"	16			
	CALICHE - white, dry, medium strong		CALICHE								
37.5		2013.5									
	CLAYEY SAND WITH SILT - white to light green, wet, medium dense		SC								
	CLAYEY SAND WITH GRAVEL - very moist, very dense			4	SS	4	50/6"	15			
41.0		2010.0									
	CALICHE - white, dry. medium strong		CALICHE								
43.0		2008.0									
	CLAYEY SAND WITH CALICHE GRAVEL - white, wet, medium dense		SC								
	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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	33.4	05-30-2011
WL DEPTH ▼	33.4	05-30-2011
NOTES	Lat: 36.178131, Long: -115.149191	

Terracon

BORING STARTED	05-30-2011
BORING COMPLETED	05-30-2011
RIG CME-85	GEOLOGIST / ENGINEER REE
PROJECT No. 64105012	BORING 11B-5A

LOG OF BORING NO. 11B-5A

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784289.2308	***26766749.1134***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2051.0***	

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLES: SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	TESTS: WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
		CLAYEY SAND WITH CALICHE GRAVEL				5	RS	0	30	36			
	47.0		2004.0										
		SANDY CLAY WITH SILT - white, very moist to wet, stiff			CL								
		- occasional caliche lenses		50		6	SS	14	11	29			
		- occasional clayey sand lenses, white to light green, brown, medium stiff		55		7	RS	18	10	38	72		
		- occasional partially cemented lenses											
	60.0		1991.0	60									
		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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*33.4*	*05-30-2011*
WL DEPTH ▼	*33.4*	*05-30-2011*
NOTES	*Lat: 36.178131, Long: -115.149191*	

Terracon

BORING STARTED	*05-30-2011*		
BORING COMPLETED	*05-30-2011*		
RIG	*CME-85*	GEOLOGIST / ENGINEER	*REE*
PROJECT No.	*64105012*	BORING	*11B-5A*

LOG OF BORING NO. 11B-5A

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784289.2308	***26766749.1134***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2051.0***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	SANDY ELASTIC SILT WITH GRAVEL - white, very moist to wet, stiff		MH	8	SS	15	14	33			
	- occasional partially cemented lenses										
65				9	RS	12	19				
	- occasional partially cemented lenses, white to light green, stiff										
68.5		1982.5									
	FAT CLAY WITH SAND - greenish brown, very moist, medium stiff		CL								
70				10	SS	18	5	60			
75											

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: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*33.4*	*05-30-2011*
WL DEPTH ▼	*33.4*	*05-30-2011*
NOTES	*Lat: 36.178131, Long: -115.149191*	

Terracon

BORING STARTED	*05-30-2011*		
BORING COMPLETED	*05-30-2011*		
RIG	*CME-85*	GEOLOGIST / ENGINEER	*REE*
PROJECT No.	*64105012*	BORING	*11B-5A*

LOG OF BORING NO. 11B-5A

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784289.2308	***26766749.1134***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2051.0***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	FAT CLAY WITH SAND				11	RS	18	16	44	72		
76.0	- greenish brown, very moist, medium stiff	1975.0										
	CLAYEY SAND			SC								
	- moderately fat, greenish brown, wet, medium dense											
	- trace calicge gravel, white to light brown, very moist		80		12	SS	12	23	35			
	- with partially cemented lenses, hard											
	- trace caliche gravel		85		13	RS	18	15	37			
90.0		1961.0	90									

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: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*33.4*	*05-30-2011*
WL DEPTH ▼	*33.4*	*05-30-2011*
NOTES	*Lat: 36.178131, Long: -115.149191*	

Terracon

BORING STARTED	*05-30-2011*
BORING COMPLETED	*05-30-2011*
RIG *CME-85*	GEOLOGIST / ENGINEER *REE*
PROJECT No. *64105012*	BORING *11B-5A*

LOG OF BORING NO. 11B-5A

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784289.2308	***26766749.1134***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2051.0***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	SILTY SAND - white to light brown, very moist, medium dense - occasional fat clay lenses		SM	14	SS	18	16	64			
93.0		1958.0									
	FAT CLAY WITH PARTIALLY CEMENTED LENSES - trace sand, light brown, very moist, very stiff		CH								
95				15	RS	18	47	20	91		
97.0		1954.0									
	FAT CLAY WITH SAND - brown, very moist, soft		CH								
100				16	SS	18	4	63			
101.5		1949.5									
	Bottom Depth at Approximately 101.5 feet										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*33.4*	*05-30-2011*
WL DEPTH ▼	*33.4*	*05-30-2011*
NOTES	*Lat: 36.178131, Long: -115.149191*	

Terracon

BORING STARTED	*05-30-2011*		
BORING COMPLETED	*05-30-2011*		
RIG	*CME-85*	GEOLOGIST / ENGINEER	*REE*
PROJECT No.	*64105012*	BORING	*11B-5A*

LOG OF BORING 11B-6

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784196.9732	***26766682.1492***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2051.6***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	ASPHALT		AC								
	- 12 inches thick										
1.0		2050.6									
	AGGREGATE BASE		AB								
	- brown, slightly moist										
2.5		2049.1									
	FILL(CLAYEY SAND WITH GRAVEL)		FILL								
	- brown, slightly moist to moist										
				1	SS	18	24	8			
5											
				2	SS	16	25	13			
10											
	- caliche debris (12 ft. to 14 ft.)										
				3	SS	12	34	12			
15											
	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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*35.4*	*05-24-2011*
WL DEPTH ▼	*35.4*	*05-25-2011*
NOTES	*Lat: 36.177947, Long: -115.149508*	

Terracon

BORING STARTED	*05-23-2011*		
BORING COMPLETED	*05-24-2011*		
RIG *Diechrich D120*		GEOLOGIST / ENGINEER	*REE*
PROJECT No. *64105012*		BORING	*11B-6*

LOG OF BORING NO. 11B-6

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784196.9732	***26766682.1492***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft)	***2051.6***

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	FILL(CLAYEY SAND WITH GRAVEL) - trace, brown, moist										
				4	SS	9	17	15			
20											
21.0		2030.6									
	FILL(SILTY GRAVEL WITH SAND) - brown, slightly moist		FILL								
24.0		2027.6									
	SANDY SILTY CLAY - white, slightly moist, very stiff		CL-ML	5	SS	9	25	12			
25											
	- partially cemented, hard										
	- with caliche lenses										
28.5		2023.1									
	CALICHE - white, dry, medium strong (drilling resistance: 20 min / foot)		CALICHE	6	SS	0	50/0"				
30											
	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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*35.4*	*05-24-2011*
WL DEPTH ▼	*35.4*	*05-25-2011*
NOTES	*Lat: 36.177947, Long: -115.149508*	

Terracon

BORING STARTED	*05-23-2011*		
BORING COMPLETED	*05-24-2011*		
RIG	*Diechrich D120*	GEOLOGIST / ENGINEER	*REE*
PROJECT No.	*64105012*	BORING	*11B-6*

LOG OF BORING NO. 11B-6

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784196.9732	***26766682.1492***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2051.6***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	CALICHE - (drilling resistance: 30 min / foot) - (drilling resistance: 15 min / foot)										
				7	SS	0	50/0"				
35 ▼											
36.5		2015.1									
	CLAYEY SAND WITH GRAVEL - white, very moist to wet, dense		SC								
	- with caliche lenses, hard			8	RS	3	50/3"	33			
40.0		2011.6									
40	**CALICHE** - white, dry, medium strong - with uncemented lenses		CALICHE								
				9	SS	0	50/0"				
45.0		2006.6									
45											

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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*35.4*	*05-24-2011*
WL DEPTH ▼	*35.4*	*05-25-2011*
NOTES	*Lat: 36.177947, Long: -115.149508*	

Terracon

BORING STARTED	*05-23-2011*		
BORING COMPLETED	*05-24-2011*		
RIG *Diechrich D120*	GEOLOGIST / ENGINEER	*REE*	
PROJECT No. *64105012*	BORING	*11B-6*	

LOG OF BORING NO. 11B-6

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784196.9732	***26766682.1492***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2051.6***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	FAT CLAY WITH SAND - greenish brown, very moist, very stiff		CH								
49.5		2002.1		10	RS	18	38	60	69		84.3
50	**SANDY CLAY WITH SILT** - trace partially cemented lenses, white, very moist, hard		CL								
54.0	- occasional brown fat clay lenses, stiff	1997.6									
	CLAYEY SAND WITH GRAVEL - white, very moist, dense		SC	11	SS	12	29	39			
55	- occasional thin caliche lenses - hard			12	RS	7	70	33	84		
60											
	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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*35.4*	*05-24-2011*
WL DEPTH ▼	*35.4*	*05-25-2011*
NOTES	*Lat: 36.177947, Long: -115.149508*	

Terracon

BORING STARTED	*05-23-2011*		
BORING COMPLETED	*05-24-2011*		
RIG *Diechrich D120*	GEOLOGIST / ENGINEER	*REE*	
PROJECT No. *64105012*	BORING	*11B-6*	

LOG OF BORING NO. 11B-6

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING ***784196.9732*** NORTHING ***26766682.1492***

STATION OFFSET

APPROXIMATE SURFACE ELEVATION (ft) ***2051.6***

GRAPHIC LOG	DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	DEPTH (ft)	USCS SYMBOL	SAMPLES: SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	TESTS: WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
		SANDY CLAY WITH SILT											
		- stiff											
	64.0		1987.6										
		FAT CLAY WITH SAND			CH	13	SS	13	15	35			
		- brown, very moist, stiff		65									
						14	RS	13	22	47	71		95.0
				70									
	73.0		1978.6										
		SANDY CLAY WITH SILT			CL								
		- white, very moist to moist, stiff				15	SS	17	11	29			
		- with clayey sand lenses											
	75.0		1976.6	75									
		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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	*35.4*	*05-24-2011*
WL DEPTH ▼	*35.4*	*05-25-2011*
NOTES	*Lat: 36.177947, Long: -115.149508*	

Terracon

BORING STARTED	*05-23-2011*		
BORING COMPLETED	*05-24-2011*		
RIG *Diechrich D120*	GEOLOGIST / ENGINEER	*REE*	
PROJECT No. *64105012*	BORING	*11B-6*	

LOG OF BORING NO. 11B-6

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784196.9732	***26766682.1492***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2051.6***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
	CLAYEY SAND - white, wet, medium dense		SC								
	- occasional clay lenses **CLAYEY SAND WITH GRAVEL** - white to light green, very moist, medium dense			16	RS	18	36	43	71		
81.0		1970.6									
	FAT CLAY - trace gravel, brown, very moist, stiff		CH								
				17	SS	18	15	41			
	- very stiff										
				18	RS	15	36	45	75		
	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: RS = Ring BS = Bag CPT = Cone Penetration Test
SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	35.4	05-24-2011
WL DEPTH ▼	35.4	05-25-2011
NOTES	Lat: 36.177947, Long: -115.149508	

Terracon

BORING STARTED	05-23-2011		
BORING COMPLETED	05-24-2011		
RIG	Diechrich D120	GEOLOGIST / ENGINEER	REE
PROJECT No.	64105012	BORING	11B-6

LOG OF BORING NO. 11B-6

PROJECT ***F Street Bridge Reconstruction at I-15***

SITE ***F Street at I-15, Las Vegas, Nevada***

CLIENT ***Atkins North America, Inc***

EASTING	NORTHING
784196.9732	***26766682.1492***
STATION	OFFSET
APPROXIMATE SURFACE ELEVATION (ft) ***2051.6***	

DEPTH (ft)	DESCRIPTION	ELEVATION (ft)	USCS SYMBOL	SAMPLE No.	SAMPLE TYPE	RECOVERY (inch)	BLOW COUNT (blows/ft)	WATER CONTENT, %	DRY UNIT WEIGHT (pcf)	UNCONFINED COMP. STRENGTH (psf)	NOTES
92.0	**FAT CLAY** - trace gravel, brown, very moist, very stiff	1959.6									
96.0	**CLAYEY SAND** - brown, very moist, very dense	1955.6	SC	19	SS	4	50/4"	25			
98.0	**CALICHE** - light brown, dry, medium strong	1953.6	CALICHE								
100.0	**SANDY CLAY WITH SILT AND PARTIALLY CEMENTED LENSES** - brown, moist, hard	1951.6	CL	20	RS	6	50/3"	46	69		
	Bottom Depth at Approximately 100 feet										

DEPTH (ft): 95, 100

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

SAMPLE TYPES: RS = Ring BS = Bag CPT = Cone Penetration Test SS = Standard Penetration Test C = Core ST = Shelby Tube

WATER LEVEL OBSERVATIONS, ft		
WL DEPTH ▽	35.4	05-24-2011
WL DEPTH ▼	35.4	05-25-2011
NOTES	Lat: 36.177947, Long: -115.149508	

Terracon

BORING STARTED	05-23-2011		
BORING COMPLETED	05-24-2011		
RIG	Diechrich D120	GEOLOGIST / ENGINEER	REE
PROJECT No.	64105012	BORING	11B-6

APPENDIX C
LABORATORY TEST RESULTS

Laboratory Testing

Soil samples were tested in the laboratory to measure their natural moisture content and density. The test results are presented on the boring logs at the sampling depth in Appendix B.

Soil samples from the borings were tested for grain size distribution (ASTM D422), Atterberg limits (D4318), direct shear strength (D3080), 1-dimentional consolidation (ASTM D2435), R-value (ASTM D2844), and soluble salt (AWWA 4500 E). The soil samples were classified by the Unified Soil Classification System (ASTM 2487). The laboratory test results are presented in Appendix C.

Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	USCS Class-ification	Water Content (%)	Dry Unit Weight (pcf)	Derived Saturation (%)	Derived Void Ratio
10B-1	1.5	41	16	25	12.5	46	SC	12.6			
10B-1	9.0							12.5			
10B-2	1.5							26.9			
10B-2	4.0	38	14	24	12.5	47	SC	13.7			
11B-3	4.0	NP	NP	NP	25.4	22	SM	13.5			
11B-3	9.0							6.4			
11B-3	11.0	NP	NP	NP	9.5	10	SP-SM	5.1			
11B-3	14.0	NP	NP	NP	9.5	7	GW-GM	4.5			
11B-3	19.0							11.7			
11B-3	34.0							20.9			
11B-3	44.0							15.9			
11B-3	49.0	48	18	30	9.5	72	CL	38.7	105.6		
11B-3	51.5							17.0	100.3		
11B-3	54.0							34.3			
11B-3	59.0	52	22	30	9.5	48	SC	36.9	82.5		
11B-3	64.0							68.6			
11B-3	69.0	82	30	52	9.5	75	CH	63.9			
11B-3	74.0							29.5			
11B-3	79.0							63.4			
11B-3	84.0	106	21	85	4.75	96	CH	91.2			
11B-3	89.0							43.1	74.8		
11B-3	94.0	56	23	33	9.5	58	CH	44.5			
11B-3	99.0							33.7	76.9		
11B-4	4.0							6.8			
11B-4	6.0	NP	NP	NP	19	2	GP	4.3			
11B-4	11.0							7.4			
11B-4	14.0	NP	NP	NP	19	7	SP-SM	6.8			
11B-4	19.0	79	21	58	9.5	64	CH	21.0			
11B-4	29.0	40	20	20	9.5	52	CL	5.5			
11B-4	34.0							19.9	106.2		
11B-4	39.0							16.2			
11B-4	49.0	67	22	45	12.5	41	SC	43.9			
11B-4	54.0							15.1	83.0		
11B-4	55.0							26.2			
11B-4	59.0	41	18	23	12.5	69	CL	41.0			
11B-4	64.0							31.4			
11B-4	69.0	45	22	23	9.5	90	CL	11.0			
11B-4	79.0	42	23	19	4.75	48	SC	7.7			
11B-4	99.0	73	25	48	9.5	47	SC	48.2			
11B-5	4.0	39	23	16	25.4	23	GC	9.8			
11B-5	9.0	NP	NP	NP	25.4	29	GM	10.0			
11B-5	14.0	NP	NP	NP	19	24	GM				

Terracon

SUMMARY OF LABORATORY RESULTS

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Plate: B-1**

Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	USCS Class-ification	Water Content (%)	Dry Unit Weight (pcf)	Derived Saturation (%)	Derived Void Ratio
11B-5A	25.0	31	16	15	12.5	38	SC	16.7			
11B-5A	35.0							15.9			
11B-5A	40.0	25	14	11	9.5	33	SC	14.7			
11B-5A	45.0							36.4			
11B-5A	50.0							29.4			
11B-5A	55.0							37.8	72.0		
11B-5A	60.0	73	36	37	12.5	63	MH	33.1			
11B-5A	70.0	76	28	48	4.75	82	CH	59.6			
11B-5A	75.0							43.8	72.3		
11B-5A	80.0	48	23	25	19	21	SC	34.7			
11B-5A	85.0							37.1			
11B-5A	90.0	110	48	62	9.5	48	SM	64.2			
11B-5A	95.0							20.5	91.0		
11B-5A	100.0	58	20	38	1.18	81	CH	63.5			
11B-6	4.0	31	13	18	19	37	SC	7.9			
11B-6	9.0							13.2			
11B-6	14.0	41	19	22	19	31	SC	11.9			
11B-6	19.0							14.8			
11B-6	24.0	23	17	6	19	53	CL-ML	12.2			
11B-6	39.0	23	12	11	25.4	40	SC	33.0			
11B-6	49.0							60.4	69.3		
11B-6	54.0	62	24	38	19	40	SC	38.6			
11B-6	59.0							32.7	83.9		
11B-6	64.0	51	21	30	9.5	77	CH	34.7			
11B-6	69.0							47.0	71.4		
11B-6	74.0							29.4			
11B-6	79.0	69	27	42	12.5	46	SC	42.9	71.2		
11B-6	84.0							40.5			
11B-6	89.0							44.6	75.0		
11B-6	94.0	41	16	25	19	42	SC	24.8			
11B-6	99.0							46.3	69.5		

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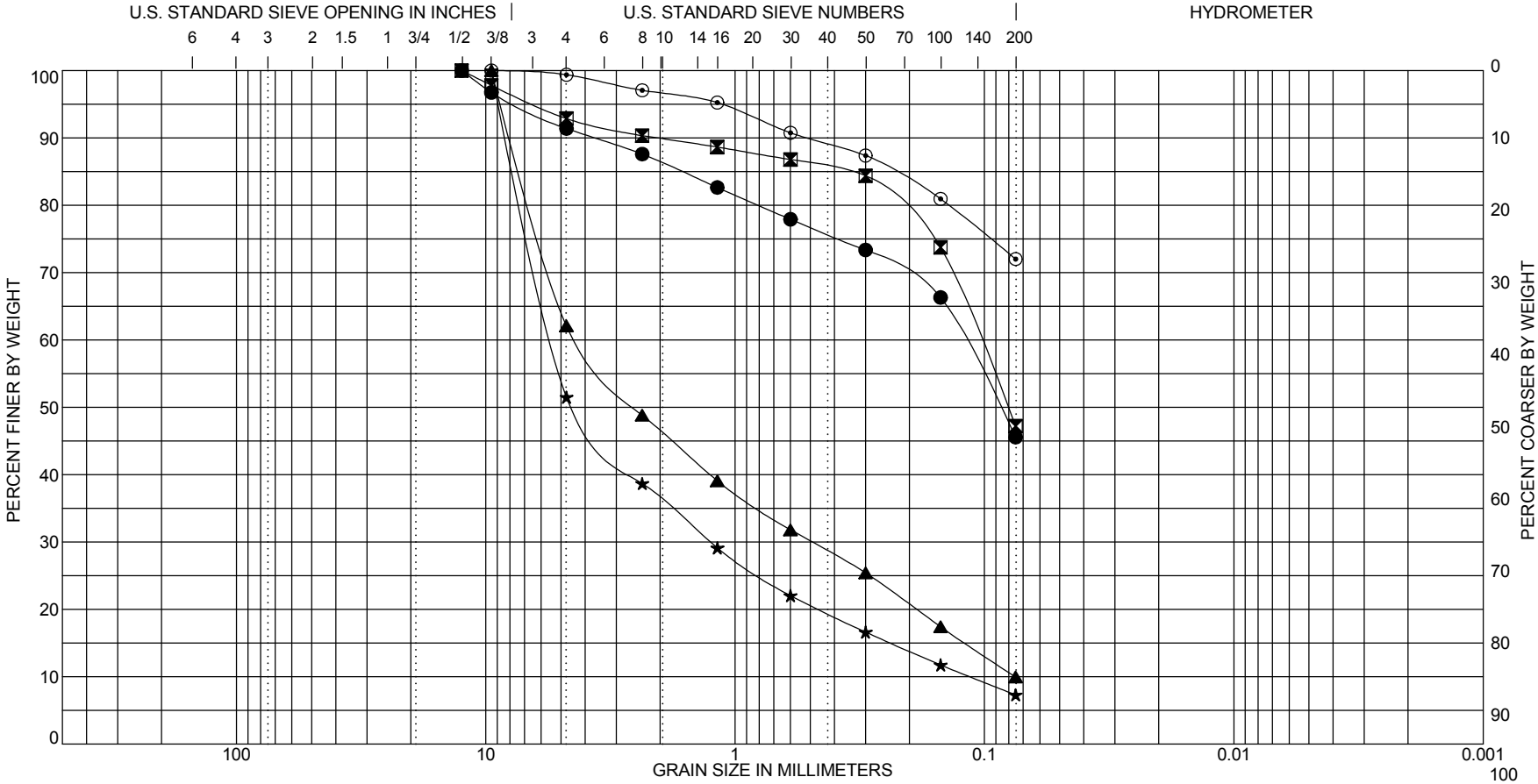
SUMMARY OF LABORATORY RESULTS

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Plate: B-2**



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	*10B-1*	*@ 1.5 ft.*	*CLAYEY SAND SC*	*41*	*16*	*25*		
⊠	*10B-2*	*@ 4.0 ft.*	*CLAYEY SAND SC*	*38*	*14*	*23*		
▲	*11B-3*	*@ 11.0 ft.*	*POORLY GRADED SAND with SILT and GRAVEL SP-SM*	*NP*	*NP*	*NP*	*0.76*	*56.6*
★	*11B-3*	*@ 14.0 ft.*	*WELL-GRADED GRAVEL with SILT and SAND GW-GM*	*NP*	*NP*	*NP*	*2.58*	*46.9*
⊙	*11B-3*	*@ 49.0 ft.*	*LEAN CLAY with SAND CL*	*48*	*18*	*31*		

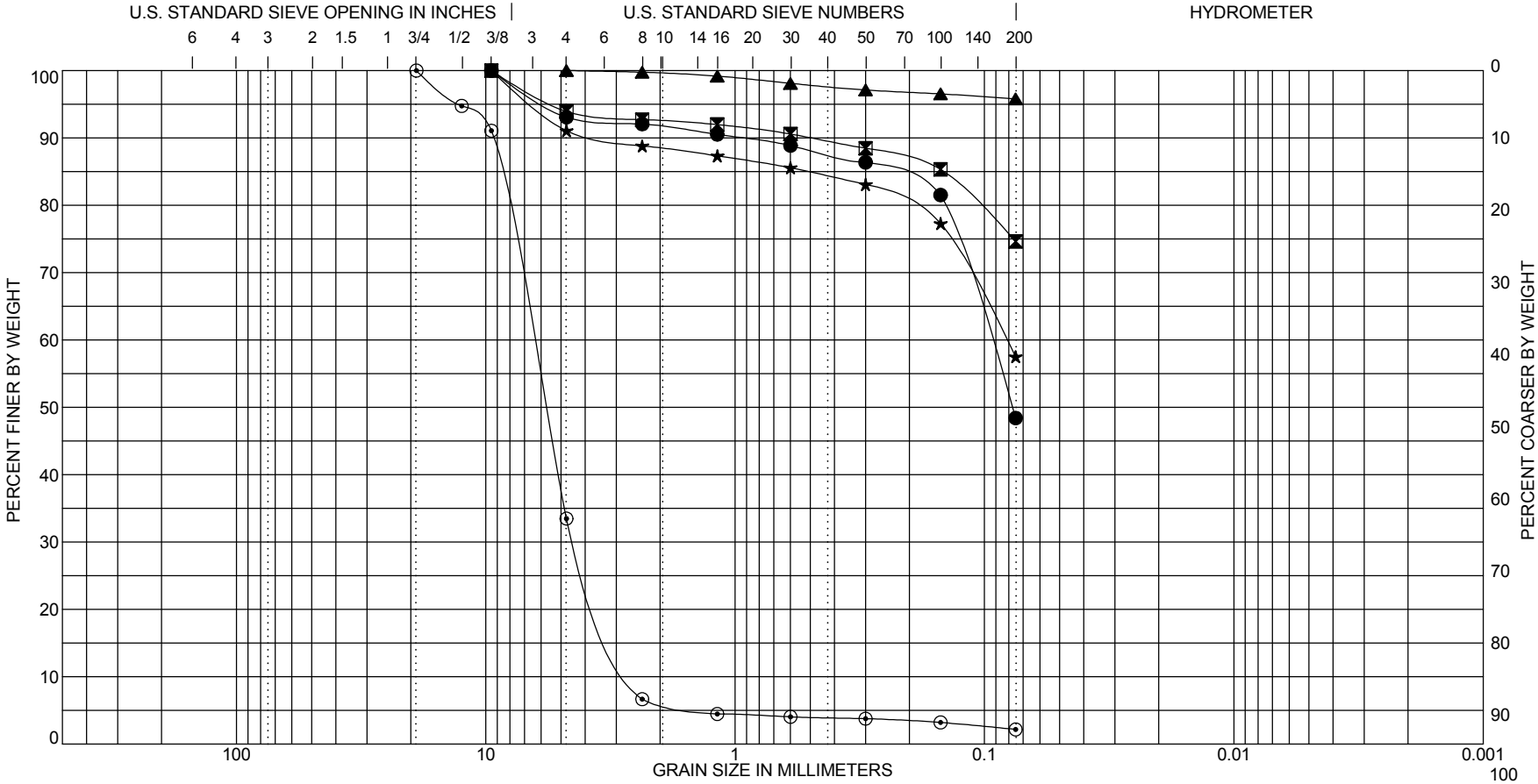
	Specimen Identification		D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	*10B-1*	*@ 1.5 ft.*	*12.50*	*1.64*	*0.087*		*8.6*	*45.8*	*45.6*	
⊠	*10B-2*	*@ 4.0 ft.*	*12.50*	*0.36*	*0.081*		*7.1*	*45.7*	*47.2*	
▲	*11B-3*	*@ 11.0 ft.*	*9.50*	*7.22*	*2.512*	*0.1198*	*37.9*	*52.1*	*10.0*	
★	*11B-3*	*@ 14.0 ft.*	*9.50*	*7.67*	*4.375*	*0.2382*	*48.5*	*44.2*	*7.3*	
⊙	*11B-3*	*@ 49.0 ft.*	*9.50*	*0.23*			*0.6*	*27.4*	*72.0*	

Terracon

Client: *Atkins North America, Inc*
Project: *F Street Bridge Reconstruction at I-15*
Project Site *F Street at I-15, Las Vegas, Nevada*
Project No. *64105012*

SIEVE ANALYSES

Exhibit: C



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	11B-3	@ 59.0 ft.	CLAYEY SAND SC	52	22	30		
⊠	11B-3	@ 69.0 ft.	FAT CLAY with SAND CH	82	30	52		
▲	11B-3	@ 84.0 ft.	FAT CLAY CH	106	21	85		
★	11B-3	@ 94.0 ft.	SANDY FAT CLAY CH	56	23	33		
⊙	11B-4	@ 6.0 ft.	POORLY GRADED GRAVEL with SAND GP	NP	NP	NP	1.12	2.5

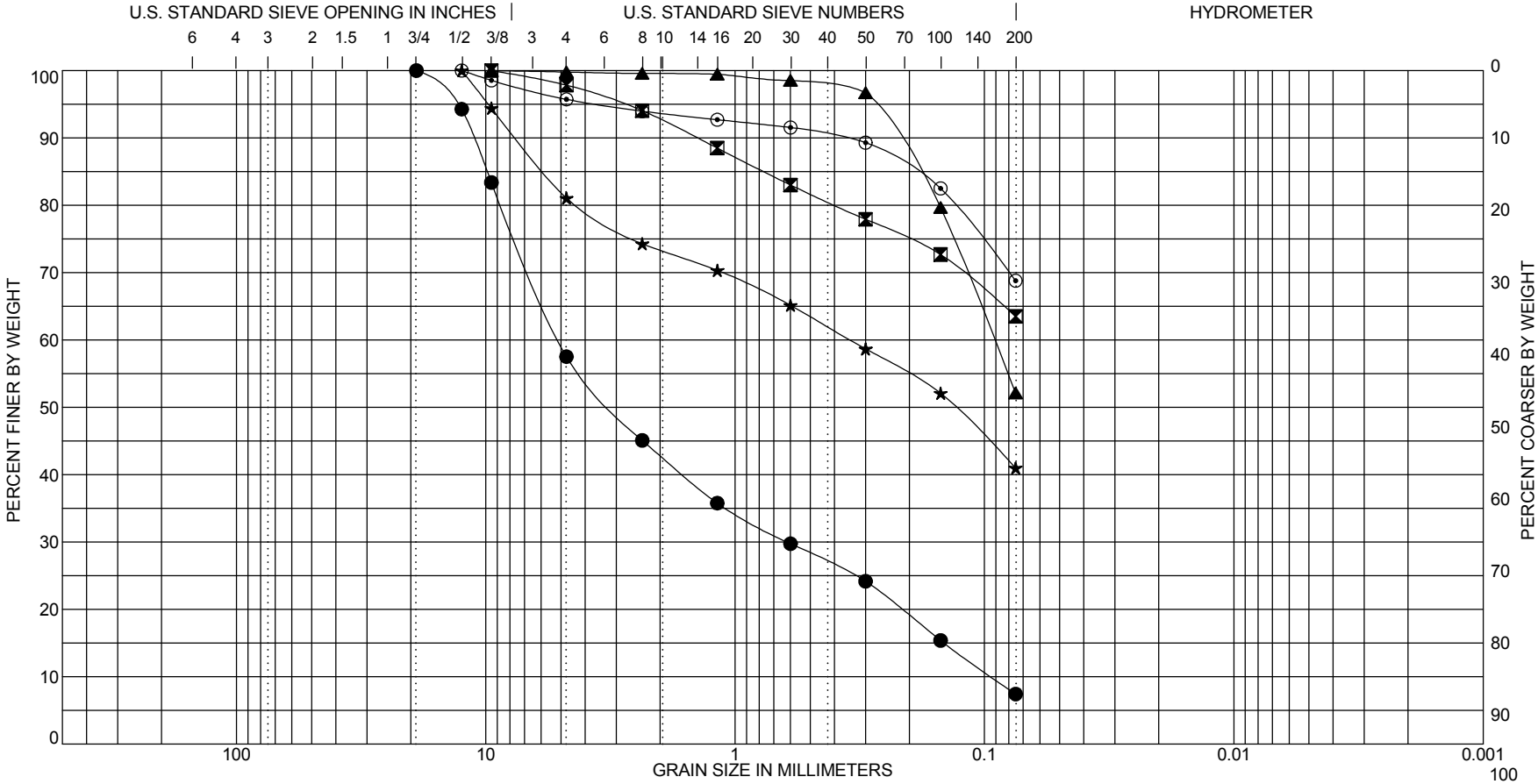
	Specimen Identification		D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	11B-3	@ 59.0 ft.	9.50	0.25	0.078		6.9	44.7	48.4	
⊠	11B-3	@ 69.0 ft.	9.50	0.15			6.1	19.3	74.6	
▲	11B-3	@ 84.0 ft.	4.75				0.0	4.2	95.8	
★	11B-3	@ 94.0 ft.	9.50	0.51			8.9	33.6	57.5	
⊙	11B-4	@ 6.0 ft.	19.00	8.83	5.795	2.9337	66.5	31.3	2.2	

Terracon

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Project Site F Street at I-15, Las Vegas, Nevada
Project No. 64105012

SIEVE ANALYSES

Exhibit: C



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	11B-4	@ 14.0 ft.	POORLY GRADED SAND with SILT and GRAVEL SP-SM	NP	NP	NP	0.80	54.1
⊠	11B-4	@ 19.0 ft.	SANDY FAT CLAY CH	79	21	58		
▲	11B-4	@ 29.0 ft.	SANDY LEAN CLAY CL	40	20	20		
★	11B-4	@ 49.0 ft.	CLAYEY SAND with GRAVEL SC	67	22	45		
⊙	11B-4	@ 59.0 ft.	SANDY LEAN CLAY CL	41	18	23		

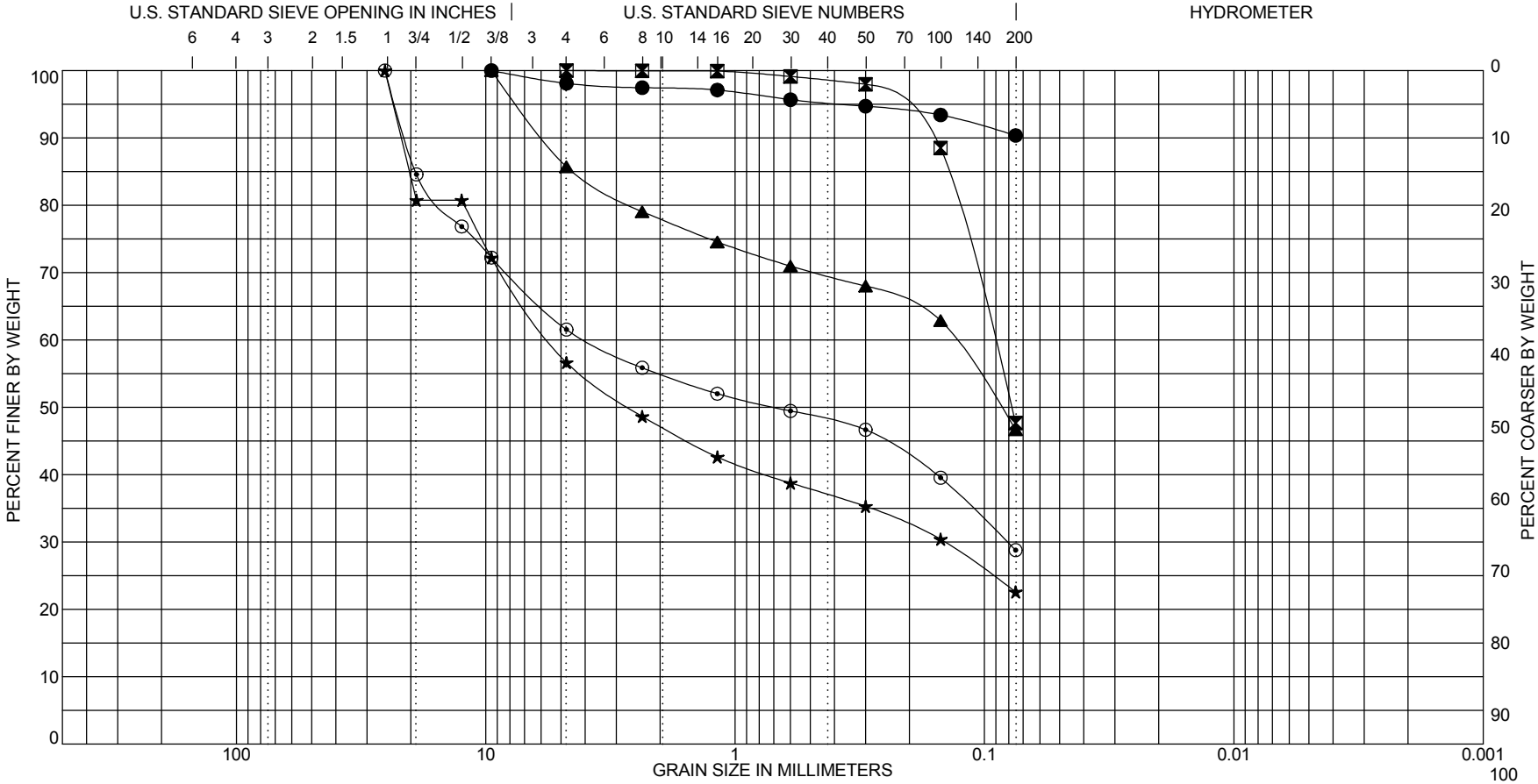
	Specimen Identification		D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	11B-4	@ 14.0 ft.	19.00	9.90	3.112	0.1451	42.5	50.1	7.4	
⊠	11B-4	@ 19.0 ft.	9.50	0.77			2.2	34.3	63.5	
▲	11B-4	@ 29.0 ft.	9.50	0.19			0.2	47.7	52.1	
★	11B-4	@ 49.0 ft.	12.50	5.83	0.132		18.9	40.1	41.0	
⊙	11B-4	@ 59.0 ft.	12.50	0.19			4.3	26.9	68.8	

Terracon

Client: *Atkins North America, Inc*
Project: *F Street Bridge Reconstruction at I-15*
Project Site *F Street at I-15, Las Vegas, Nevada*
Project No. *64105012*

SIEVE ANALYSES

Exhibit: C



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	*11B-4*	*@ 69.0 ft.*	*LEAN CLAY CL*	*45*	*22*	*23*		
⊠	*11B-4*	*@ 79.0 ft.*	*CLAYEY SAND SC*	*42*	*23*	*19*		
▲	*11B-4*	*@ 99.0 ft.*	*CLAYEY SAND SC*	*73*	*25*	*48*		
★	*11B-5*	*@ 4.0 ft.*	*CLAYEY GRAVEL with SAND GC*	*39*	*23*	*16*		
⊙	*11B-5*	*@ 9.0 ft.*	*SILTY GRAVEL with SAND GM*	*NP*	*NP*	*NP*		

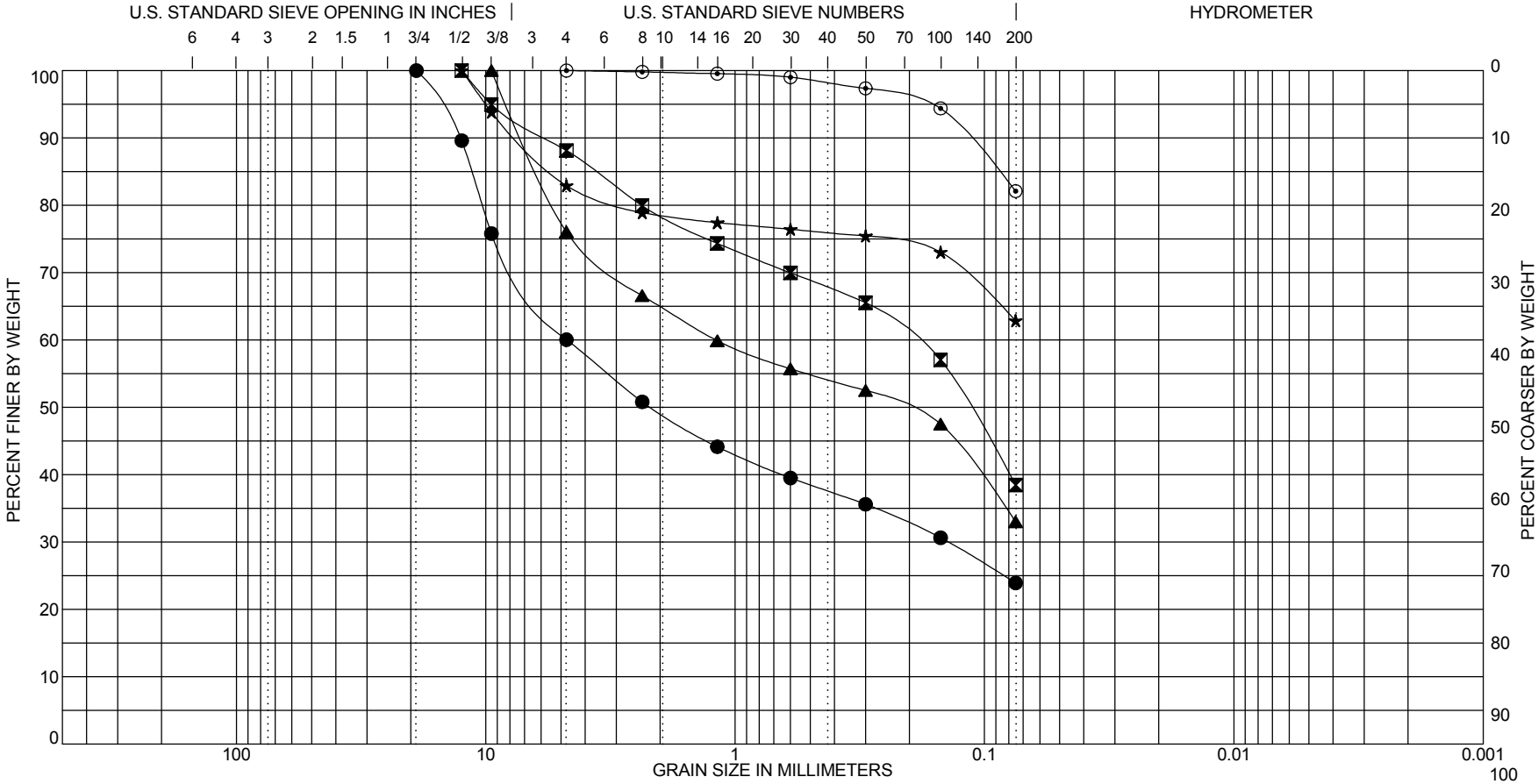
	Specimen Identification		D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	*11B-4*	*@ 69.0 ft.*	*9.50*				*1.9*	*7.7*	*90.4*	
⊠	*11B-4*	*@ 79.0 ft.*	*4.75*	*0.14*	*0.078*		*0.0*	*52.3*	*47.7*	
▲	*11B-4*	*@ 99.0 ft.*	*9.50*	*4.40*	*0.086*		*14.3*	*39.0*	*46.7*	
★	*11B-5*	*@ 4.0 ft.*	*25.40*	*20.26*	*2.657*		*43.4*	*34.0*	*22.6*	
⊙	*11B-5*	*@ 9.0 ft.*	*25.40*	*19.15*	*0.693*		*38.5*	*32.8*	*28.8*	

Terracon

Client: *Atkins North America, Inc*
Project: *F Street Bridge Reconstruction at I-15*
Project Site *F Street at I-15, Las Vegas, Nevada*
Project No. *64105012*

SIEVE ANALYSES

Exhibit: C



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	*11B-5*	*@ 14.0 ft.*	*SILTY GRAVEL with SAND GM*	*NP*	*NP*	*NP*		
⊠	*11B-5A*	*@ 25.0 ft.*	*CLAYEY SAND SC*	*31*	*16*	*15*		
▲	*11B-5A*	*@ 40.0 ft.*	*CLAYEY SAND with GRAVEL SC*	*25*	*14*	*11*		
★	*11B-5A*	*@ 60.0 ft.*	*SANDY ELASTIC SILT with GRAVEL MH*	*73*	*36*	*37*		
⊙	*11B-5A*	*@ 70.0 ft.*	*FAT CLAY with SAND CH*	*76*	*28*	*48*		

	Specimen Identification		D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	*11B-5*	*@ 14.0 ft.*	*19.00*	*11.41*	*2.170*		*40.0*	*36.1*	*23.9*	
⊠	*11B-5A*	*@ 25.0 ft.*	*12.50*	*3.64*	*0.115*		*11.9*	*49.7*	*38.5*	
▲	*11B-5A*	*@ 40.0 ft.*	*9.50*	*6.16*	*0.212*		*24.0*	*43.0*	*33.0*	
★	*11B-5A*	*@ 60.0 ft.*	*12.50*	*5.42*			*17.1*	*20.0*	*62.9*	
⊙	*11B-5A*	*@ 70.0 ft.*	*4.75*	*0.09*			*0.0*	*17.9*	*82.1*	

Terracon

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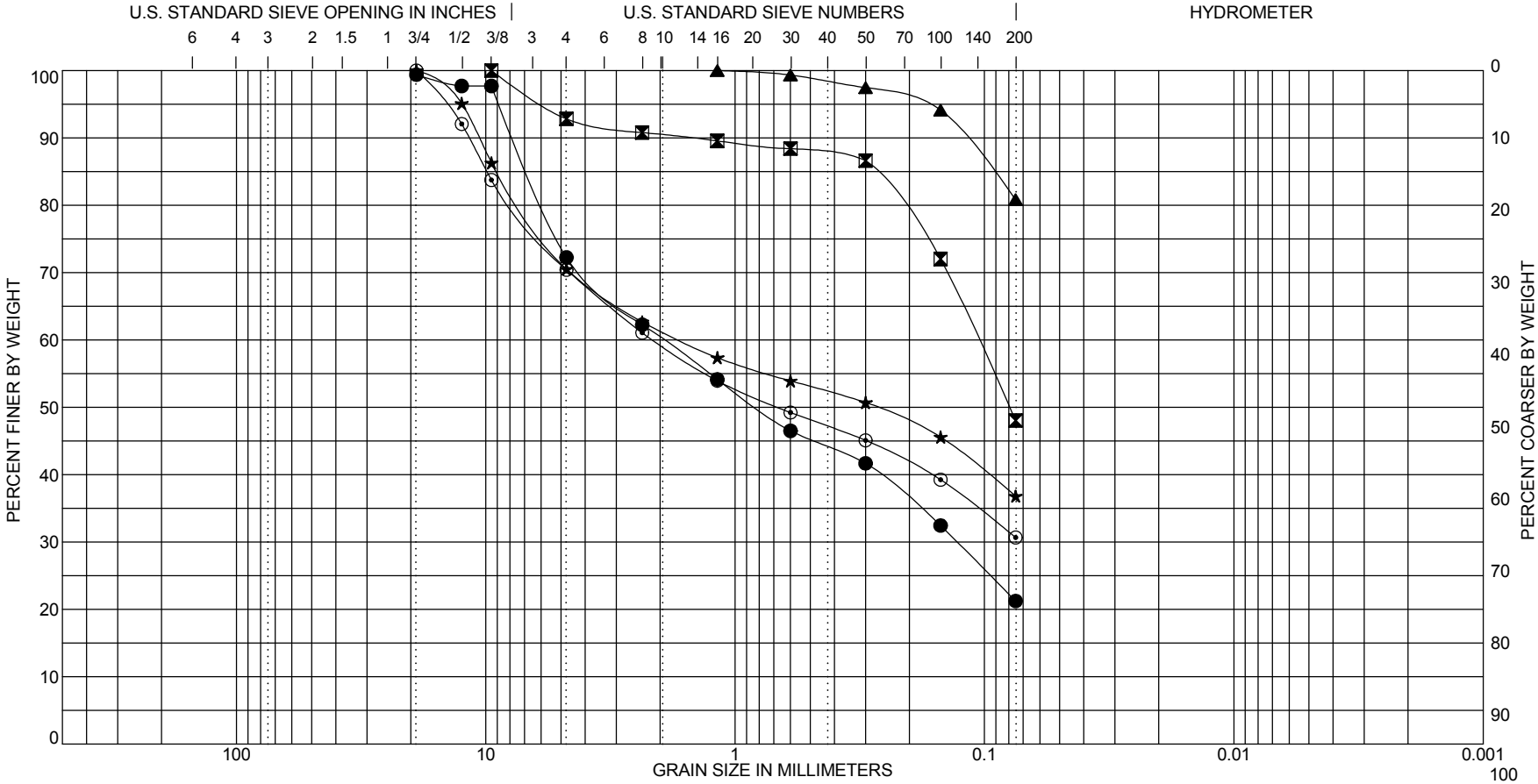
Project: *F Street Bridge Reconstruction at I-15*
Project Site *F Street at I-15, Las Vegas, Nevada*
Project No. *64105012*

SIEVE ANALYSES

Exhibit: C



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	11B-5A @ 80.0 ft.	CLAYEY SAND with GRAVEL SC	48	23	25		
⊠	11B-5A @ 90.0 ft.	SILTY SAND SM	110	48	62		
▲	11B-5A @ 100.0 ft.	FAT CLAY with SAND CH	58	20	38		
★	11B-6 @ 4.0 ft.	CLAYEY SAND with GRAVEL SC	31	13	18		
⊙	11B-6 @ 14.0 ft.	CLAYEY SAND with GRAVEL SC	41	19	22		

Specimen Identification		D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	11B-5A @ 80.0 ft.	19.00	6.72	0.817		27.1	51.0	21.2	
⊠	11B-5A @ 90.0 ft.	9.50	0.28	0.079		7.2	44.8	48.0	
▲	11B-5A @ 100.0 ft.	1.18	0.09			0.0	19.2	80.8	
★	11B-6 @ 4.0 ft.	19.00	8.97	0.272		29.5	33.7	36.8	
⊙	11B-6 @ 14.0 ft.	19.00	9.90	0.671		29.6	39.7	30.7	

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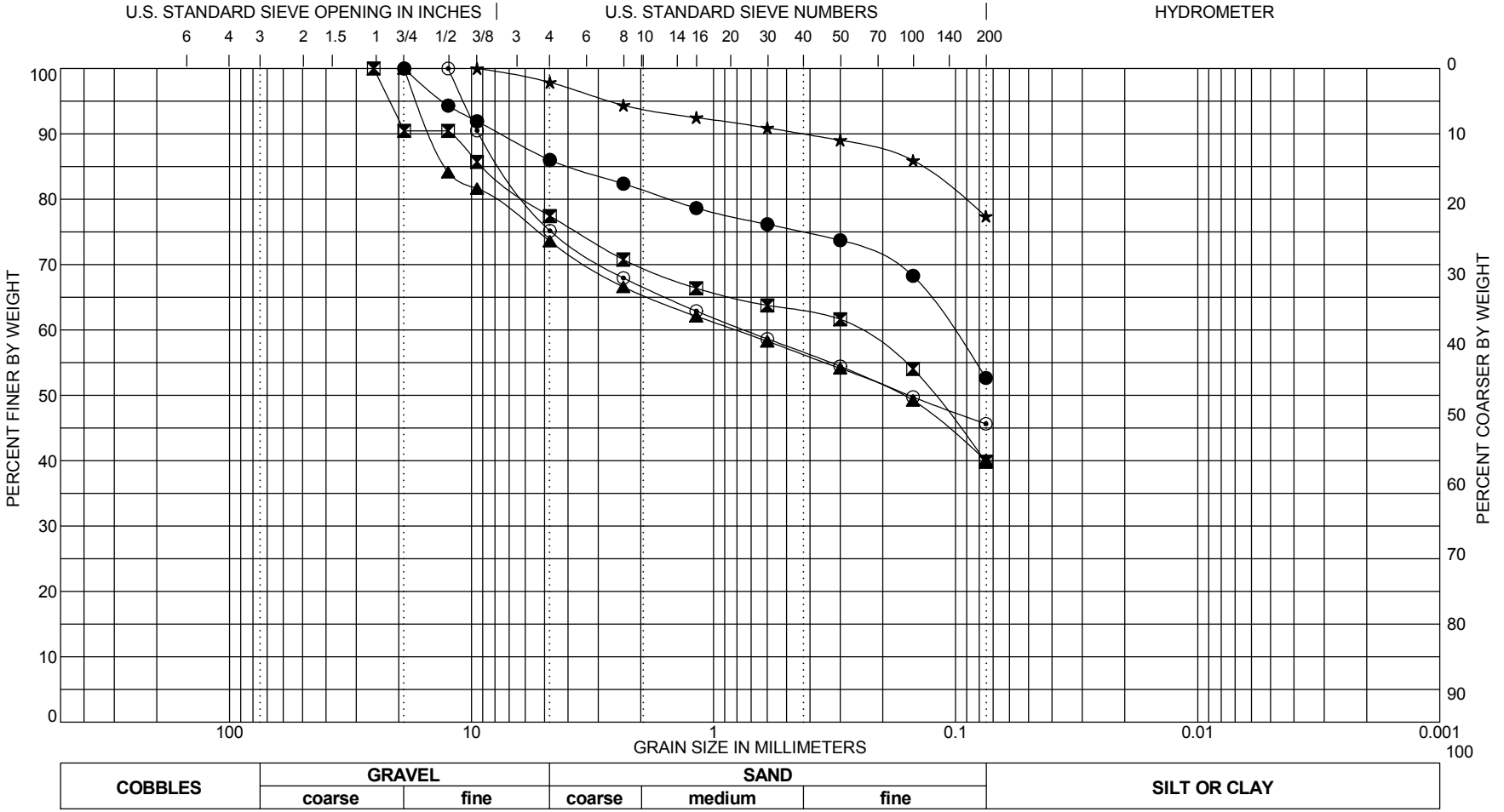
Client: *Atkins North America, Inc*
Project: *F Street Bridge Reconstruction at I-15*
Project Site *F Street at I-15, Las Vegas, Nevada*
Project No. *64105012*

SIEVE ANALYSES

Exhibit: C



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	*11B-6*	*@ 24.0 ft.*	*SANDY SILTY CLAY CL-ML*	*23*	*17*	*6*		
⊠	*11B-6*	*@ 39.0 ft.*	*CLAYEY SAND with GRAVEL SC*	*23*	*12*	*11*		
▲	*11B-6*	*@ 54.0 ft.*	*CLAYEY SAND with GRAVEL SC*	*62*	*24*	*38*		
★	*11B-6*	*@ 64.0 ft.*	*FAT CLAY with SAND CH*	*51*	*21*	*30*		
⊙	*11B-6*	*@ 79.0 ft.*	*CLAYEY SAND with GRAVEL SC*	*69*	*27*	*42*		

	Specimen Identification		D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	*11B-6*	*@ 24.0 ft.*	*19.00*	*3.92*			*14.0*	*33.3*	*52.7*	
⊠	*11B-6*	*@ 39.0 ft.*	*25.40*	*8.96*	*0.123*		*22.6*	*37.6*	*39.8*	
▲	*11B-6*	*@ 54.0 ft.*	*19.00*	*12.79*	*0.168*		*26.4*	*33.5*	*40.1*	
★	*11B-6*	*@ 64.0 ft.*	*9.50*	*0.14*			*2.1*	*20.5*	*77.4*	
⊙	*11B-6*	*@ 79.0 ft.*	*12.50*	*7.41*	*0.156*		*24.8*	*29.5*	*45.6*	

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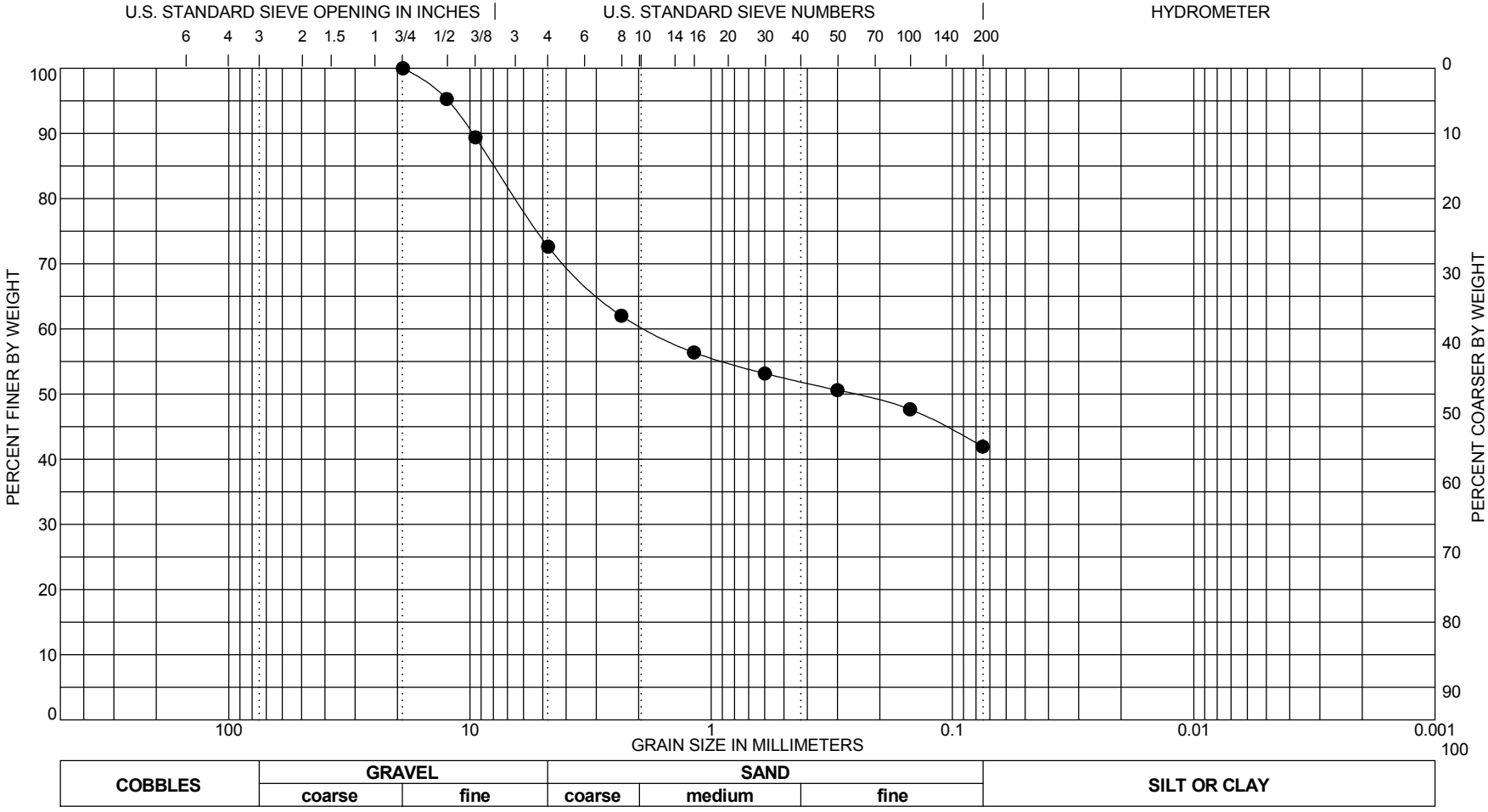
Client: *Atkins North America, Inc*
Project: *F Street Bridge Reconstruction at I-15*
Project Site *F Street at I-15, Las Vegas, Nevada*
Project No. *64105012*

SIEVE ANALYSES

Exhibit: C



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	*11B-6*	*@ 94.0 ft.*	*CLAYEY SAND with GRAVEL SC*	*41*	*16*	*25*		

	Specimen Identification		D100	D85	D50	D15	%Gravel	%Sand	%Silt	%Clay
●	*11B-6*	*@ 94.0 ft.*	*19.00*	*7.92*	*0.260*		*27.4*	*30.7*	*41.9*	

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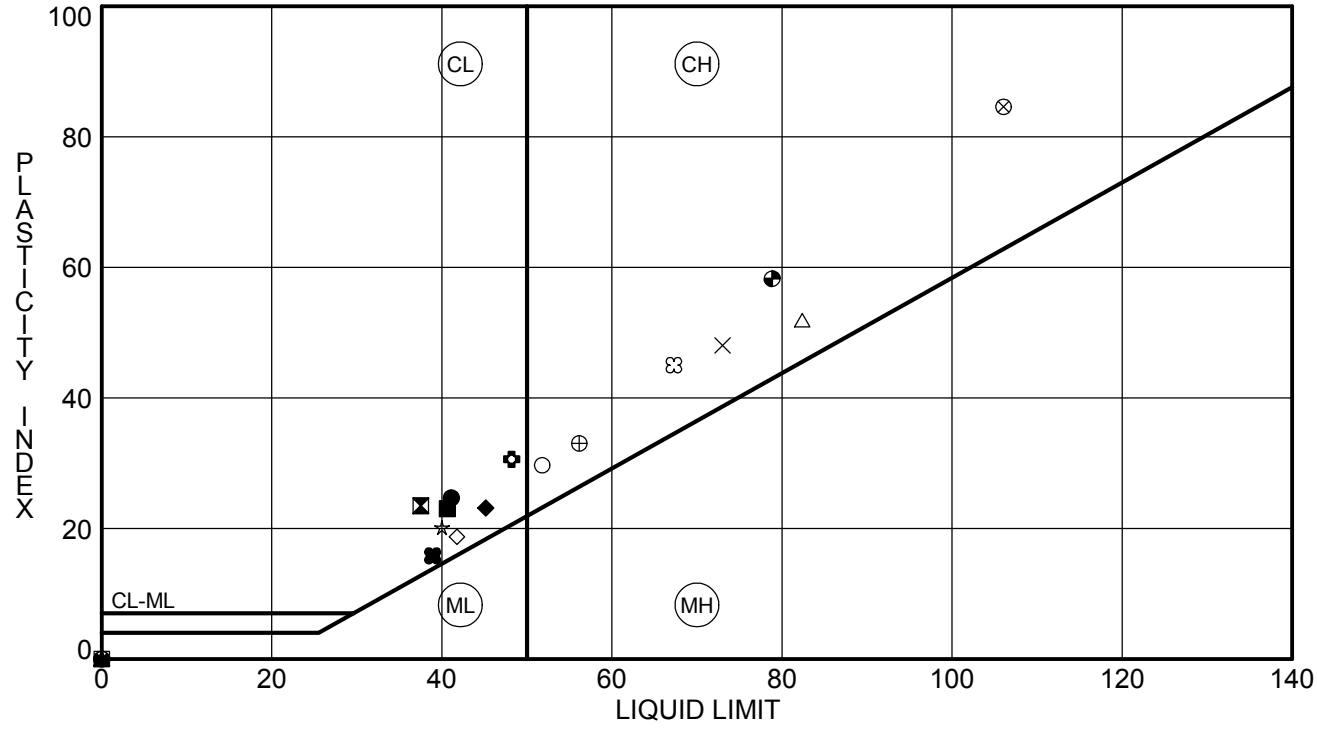
Client: *Atkins North America, Inc*
Project: *F Street Bridge Reconstruction at I-15*
Project Site *F Street at I-15, Las Vegas, Nevada*
Project No. *64105012*

SIEVE ANALYSES

Exhibit: C



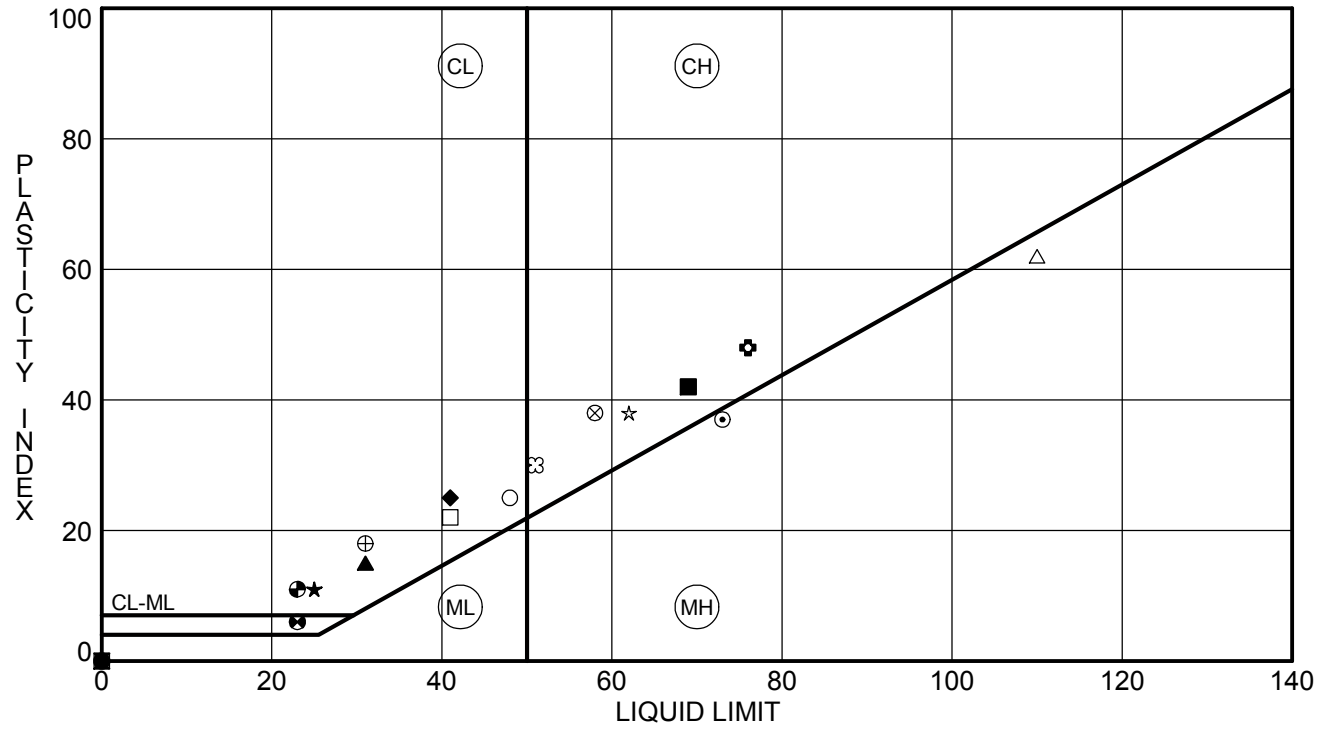
Specimen Identification			LL	PL	PI	Fines, (%)	Classification
●	10B-1	1.5 ft	41	16	25	46	CLAYEY SAND(SC)
⊠	10B-2	4.0 ft	38	14	24	47	CLAYEY SAND(SC)
▲	11B-3	4.0 ft	NP	NP	NP	22	SILTY SAND with GRAVEL(SM)
★	11B-3	11.0 ft	NP	NP	NP	10	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)
⊙	11B-3	14.0 ft	NP	NP	NP	7	WELL-GRADED GRAVEL with SILT and SAND(GW-GM)
✿	11B-3	49.0 ft	48	18	30	72	LEAN CLAY with SAND(CL)
○	11B-3	59.0 ft	52	22	30	48	CLAYEY SAND(SC)
△	11B-3	69.0 ft	82	30	52	75	FAT CLAY with SAND(CH)
⊗	11B-3	84.0 ft	106	21	85	96	FAT CLAY(CH)
⊕	11B-3	94.0 ft	56	23	33	58	SANDY FAT CLAY(CH)
□	11B-4	6.0 ft	NP	NP	NP	2	POORLY GRADED GRAVEL with SAND(GP)
⊗	11B-4	14.0 ft	NP	NP	NP	7	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)
◕	11B-4	19.0 ft	79	21	58	64	SANDY FAT CLAY(CH)
☆	11B-4	29.0 ft	40	20	20	52	SANDY LEAN CLAY(CL)
⊠	11B-4	49.0 ft	67	22	45	41	CLAYEY SAND with GRAVEL(SC)
■	11B-4	59.0 ft	41	18	23	69	SANDY LEAN CLAY(CL)
◆	11B-4	69.0 ft	45	22	23	90	LEAN CLAY(CL)
◇	11B-4	79.0 ft	42	23	19	48	CLAYEY SAND(SC)
×	11B-4	99.0 ft	73	25	48	47	CLAYEY SAND(SC)
⊠	11B-5	4.0 ft	39	23	16	23	CLAYEY GRAVEL with SAND(GC)

Terracon

ATTERBERG LIMITS RESULTS

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit:** C

ATTERBERG LIMITS 05012 GINT.GPJ LV TEMPLATE.GDT 6/10/11



Specimen Identification			LL	PL	PI	Fines, (%)	Classification
●	11B-5	9.0 ft	NP	NP	NP	29	SILTY GRAVEL with SAND(GM)
⊠	11B-5	14.0 ft	NP	NP	NP	24	SILTY GRAVEL with SAND(GM)
▲	11B-5A	25.0 ft	31	16	15	38	CLAYEY SAND(SC)
★	11B-5A	40.0 ft	25	14	11	33	CLAYEY SAND with GRAVEL(SC)
⊙	11B-5A	60.0 ft	73	36	37	63	SANDY ELASTIC SILT with GRAVEL(MH)
✿	11B-5A	70.0 ft	76	28	48	82	FAT CLAY with SAND(CH)
○	11B-5A	80.0 ft	48	23	25	21	CLAYEY SAND with GRAVEL(SC)
△	11B-5A	90.0 ft	110	48	62	48	SILTY SAND(SM)
⊗	11B-5A	100.0 ft	58	20	38	81	FAT CLAY with SAND(CH)
⊕	11B-6	4.0 ft	31	13	18	37	CLAYEY SAND with GRAVEL(SC)
□	11B-6	14.0 ft	41	19	22	31	CLAYEY SAND with GRAVEL(SC)
⊗	11B-6	24.0 ft	23	17	6	53	SANDY SILTY CLAY(CL-ML)
◕	11B-6	39.0 ft	23	12	11	40	CLAYEY SAND with GRAVEL(SC)
☆	11B-6	54.0 ft	62	24	38	40	CLAYEY SAND with GRAVEL(SC)
⊠	11B-6	64.0 ft	51	21	30	77	FAT CLAY with SAND(CH)
■	11B-6	79.0 ft	69	27	42	46	CLAYEY SAND with GRAVEL(SC)
◆	11B-6	94.0 ft	41	16	25	42	CLAYEY SAND with GRAVEL(SC)

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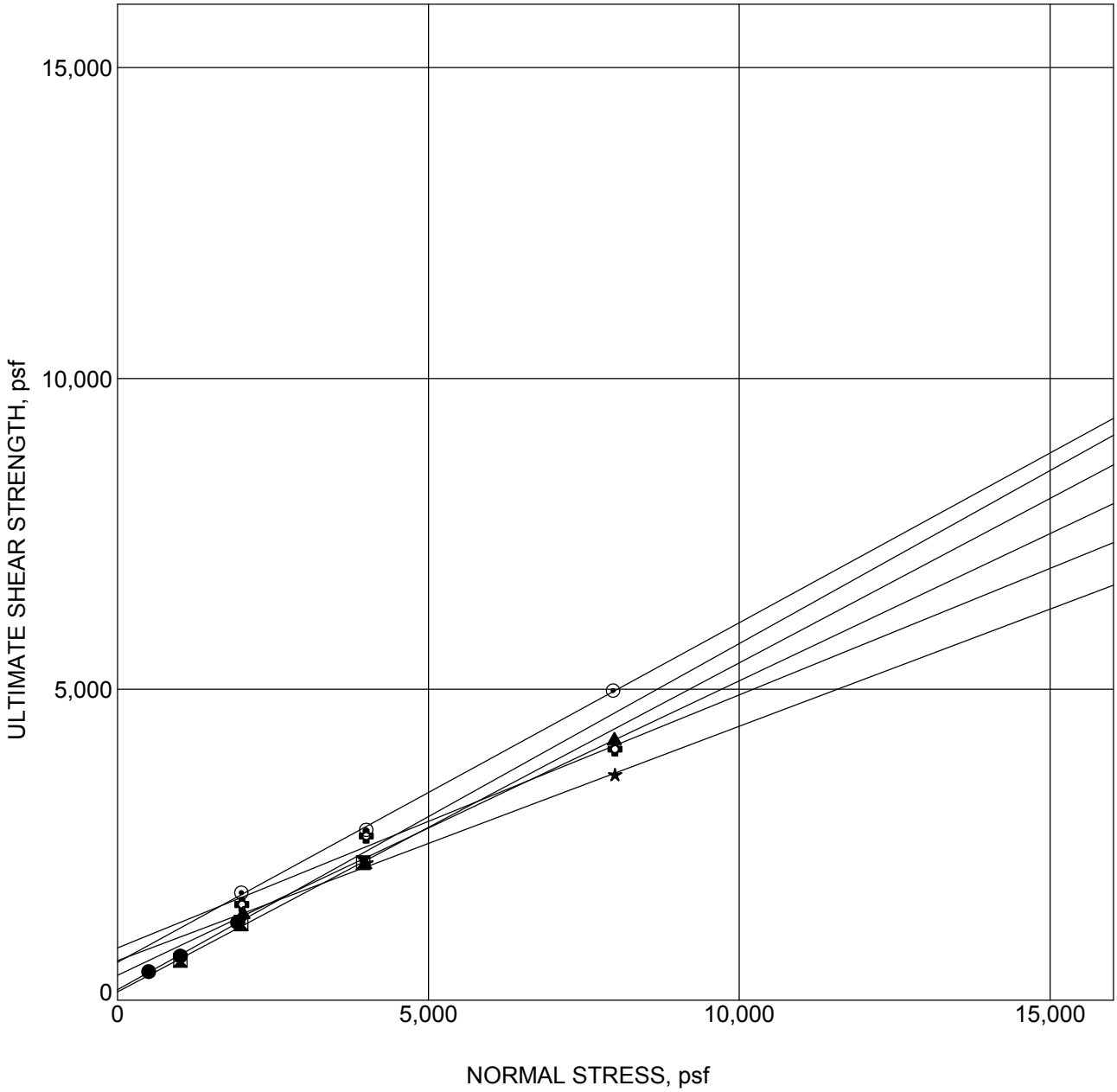
ATTERBERG LIMITS RESULTS

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit:** C

ATTERBERG LIMITS 05012 GINT.GPJ LV TEMPLATE.GDT 6/10/11



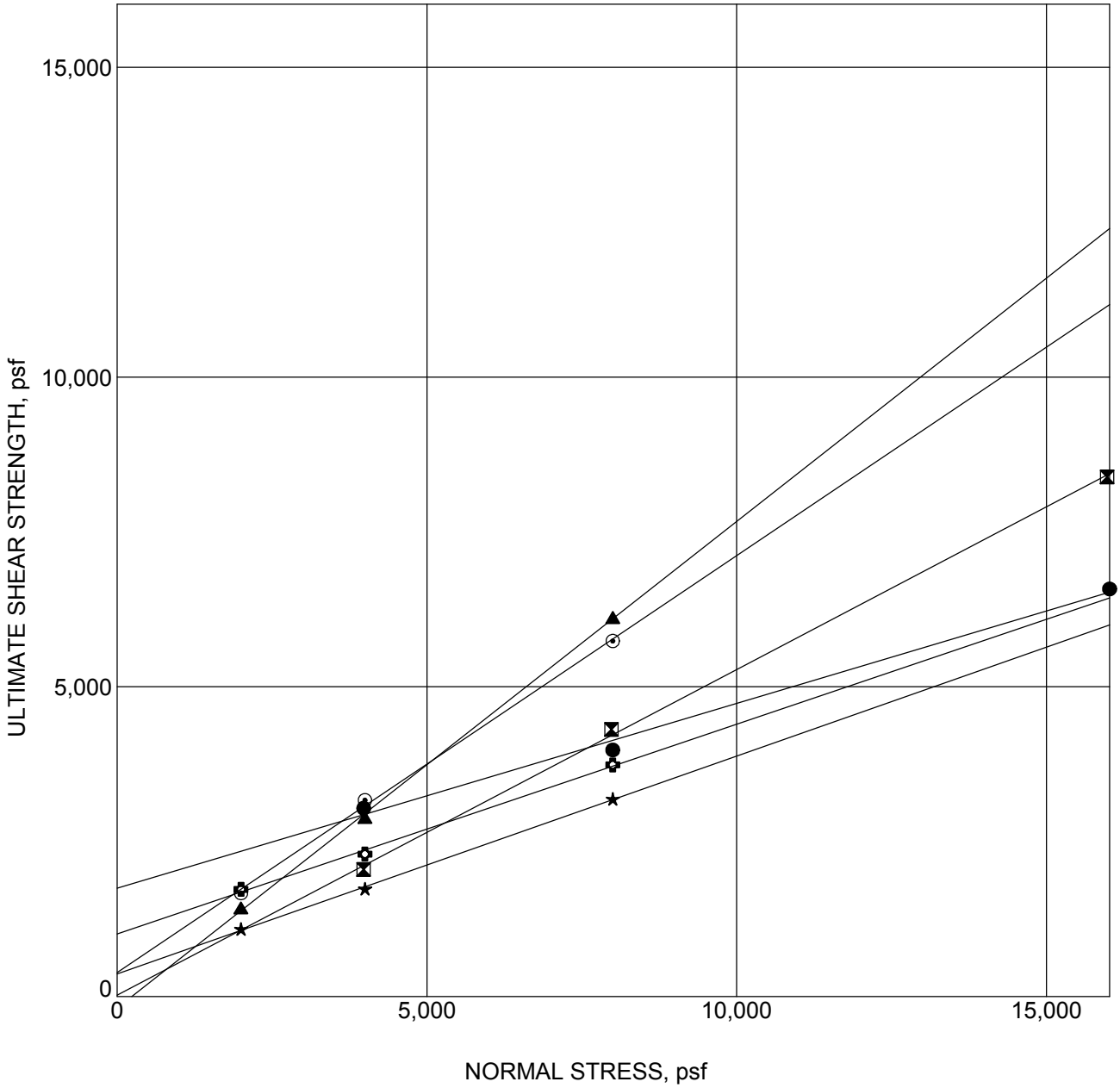
Specimen Identification		Final Moisture Content (%)	Initial Dry Density (pcf)	Ultimate Friction Angle	Ultimate Cohesion (psf)	Peak Friction Angle	Peak Cohesion (psf)
●	11B-3 @ 4.0 ft	13.5	107.0	29	168		
⊠	11B-3 @ 34.0 ft	20.9	102.7	28	134		
▲	11B-3 @ 44.0 ft	15.9	105.3	25	402		
★	11B-3 @ 51.5 ft	17.0	120.2	21	637		
⊙	11B-3 @ 64.0 ft	41.2	66.9	29	607		
✿	11B-3 @ 79.0 ft	63.4	61.0	22	840		

Terracon

DIRECT SHEAR TEST

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit: C**

DIRECT SHEAR 05012 GINT.GPJ LV TEMPLATE.GDT 6/10/11



Specimen Identification	Final Moisture Content (%)	Initial Dry Density (pcf)	Ultimate Friction Angle	Ultimate Cohesion (psf)	Peak Friction Angle	Peak Cohesion (psf)
● 11B-3 @ 89.0 ft	20.0	86.4	17	1749		
⊠ 11B-3 @ 99.0 ft	33.7	76.9	28	21		
▲ 11B-4 @ 11.0 ft	7.4	106.5	37	0		
★ 11B-4 @ 24.0 ft	19.7	103.4	19	365		
⊙ 11B-4 @ 44.0 ft	20.0	103.2	34	385		
✿ 11B-4 @ 64.0 ft	56.7	81.2	19	1010		

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DIRECT SHEAR TEST

Client: Atkins North America, Inc
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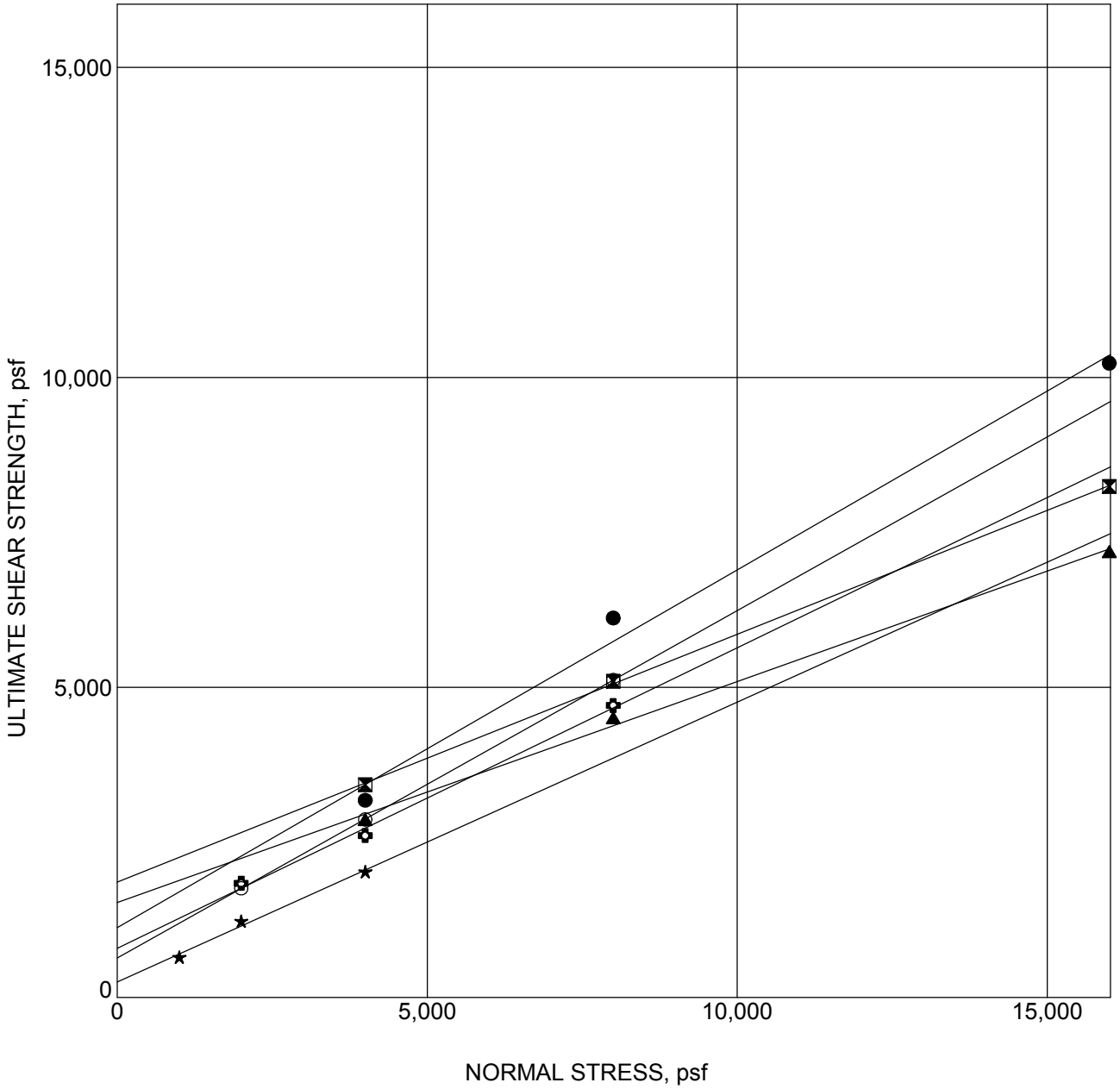
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit: C**

DIRECT SHEAR 05012 GINT.GPJ LV TEMPLATE.GDT 6/10/11



Specimen Identification	Final Moisture Content (%)	Initial Dry Density (pcf)	Ultimate Friction Angle	Ultimate Cohesion (psf)	Peak Friction Angle	Peak Cohesion (psf)
● 11B-4 @ 74.0 ft	27.2	94.2	30	1125		
⊠ 11B-4 @ 84.0 ft	24.8	85.5	22	1860		
▲ 11B-4 @ 94.0 ft	37.2	81.7	20	1530		
★ 11B-5 @ 14.0 ft	7.7	114.9	24	250		
⊙ 11B-5A @ 45.0 ft	18.9	101.3	29	636		
✿ 11B-5A @ 55.0 ft	26.9	98.9	26	791		

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DIRECT SHEAR TEST

Client: Atkins North America, Inc
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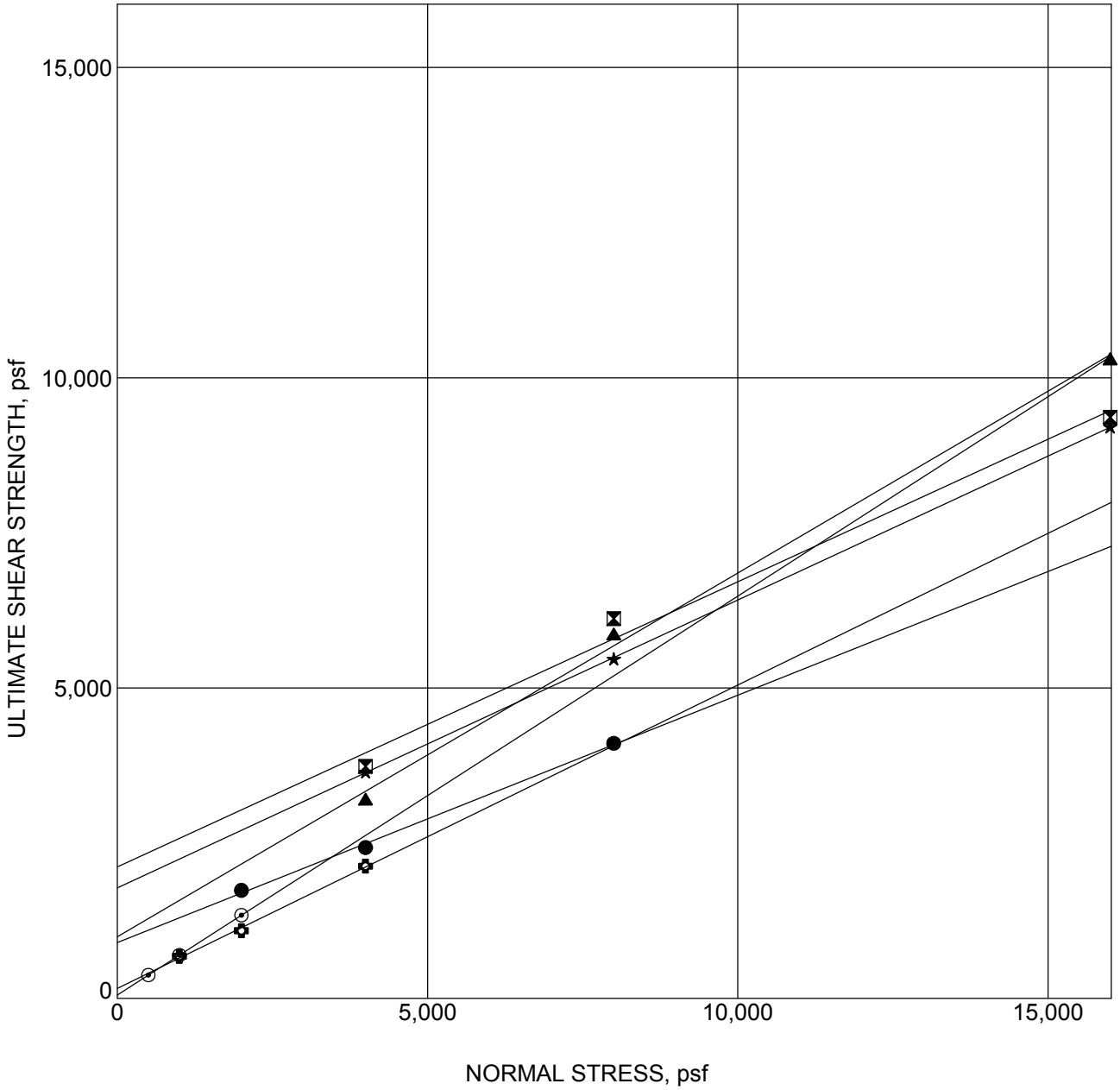
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit: C**



Specimen Identification		Final Moisture Content (%)	Initial Dry Density (pcf)	Ultimate Friction Angle	Ultimate Cohesion (psf)	Peak Friction Angle	Peak Cohesion (psf)
●	11B-5A @ 65.0 ft	37.6	82.7	22	900		
⊠	11B-5A @ 75.0 ft	43.6	89.7	25	2120		
▲	11B-5A @ 85.0 ft	49.7	113.4	30	993		
★	11B-5A @ 95.0 ft	31.5	109.7	25	1780		
⊙	11B-6 @ 9.0 ft	34.4	86.4	33	55		
✿	11B-6 @ 19.0 ft	34.9	89.0	26	158		

Terracon

DIRECT SHEAR TEST

Client: Atkins North America, Inc
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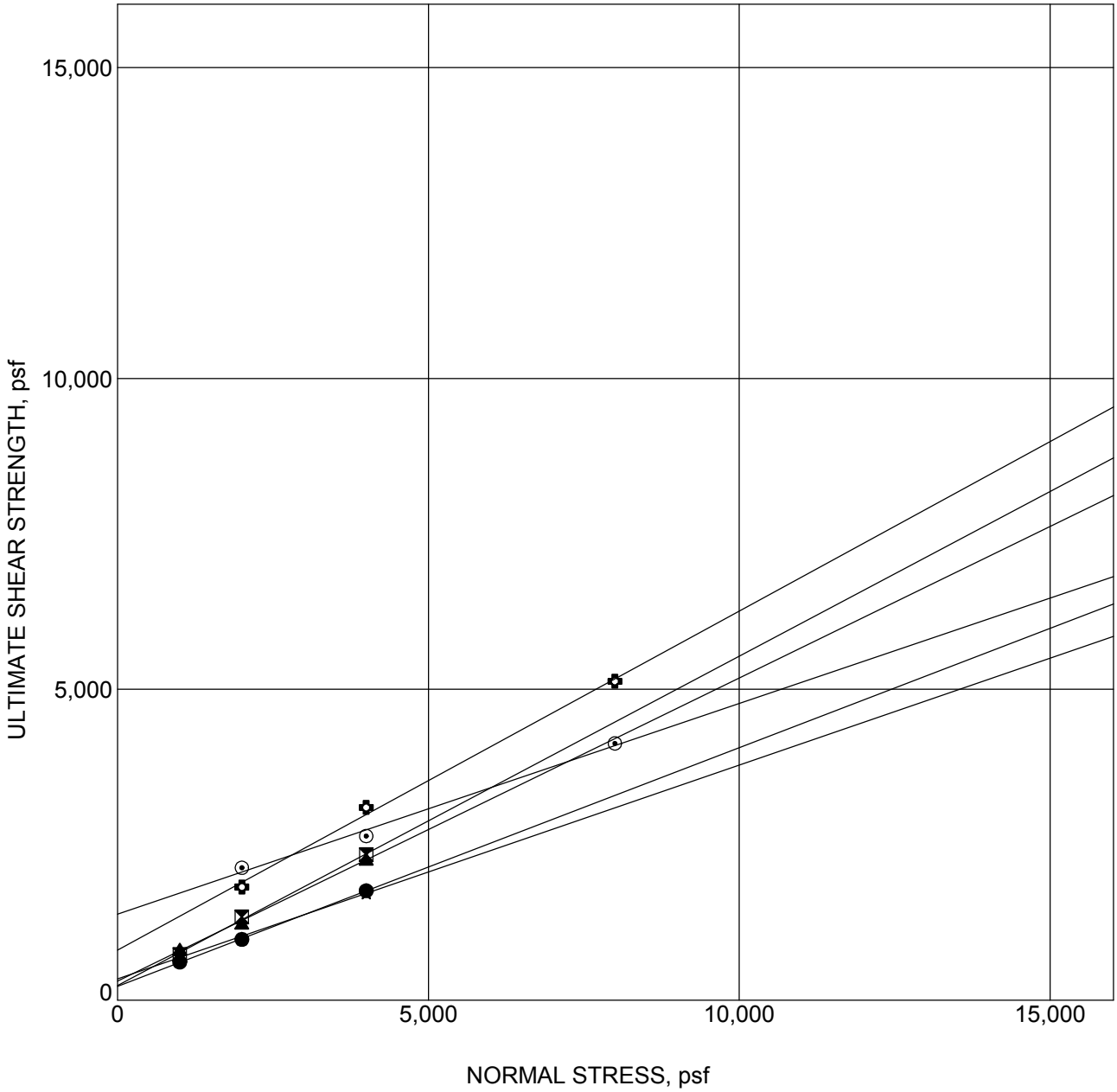
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit: C**

DIRECT SHEAR 05012 GINT.GPJ LV TEMPLATE.GDT 6/10/11



Specimen Identification		Final Moisture Content (%)	Initial Dry Density (pcf)	Ultimate Friction Angle	Ultimate Cohesion (psf)	Peak Friction Angle	Peak Cohesion (psf)
●	11B-6 @ 39.0 ft	18.9	83.5	21	221		
⊠	11B-6 @ 59.0 ft	18.9	97.0	28	236		
▲	11B-6 @ 64.0 ft	34.7	89.6	26	306		
★	11B-6 @ 74.0 ft	41.1	83.3	19	341		
⊙	11B-6 @ 84.0 ft	27.3	94.0	19	1385		
✿	11B-6 @ 99.0 ft	19.7	96.4	29	805		

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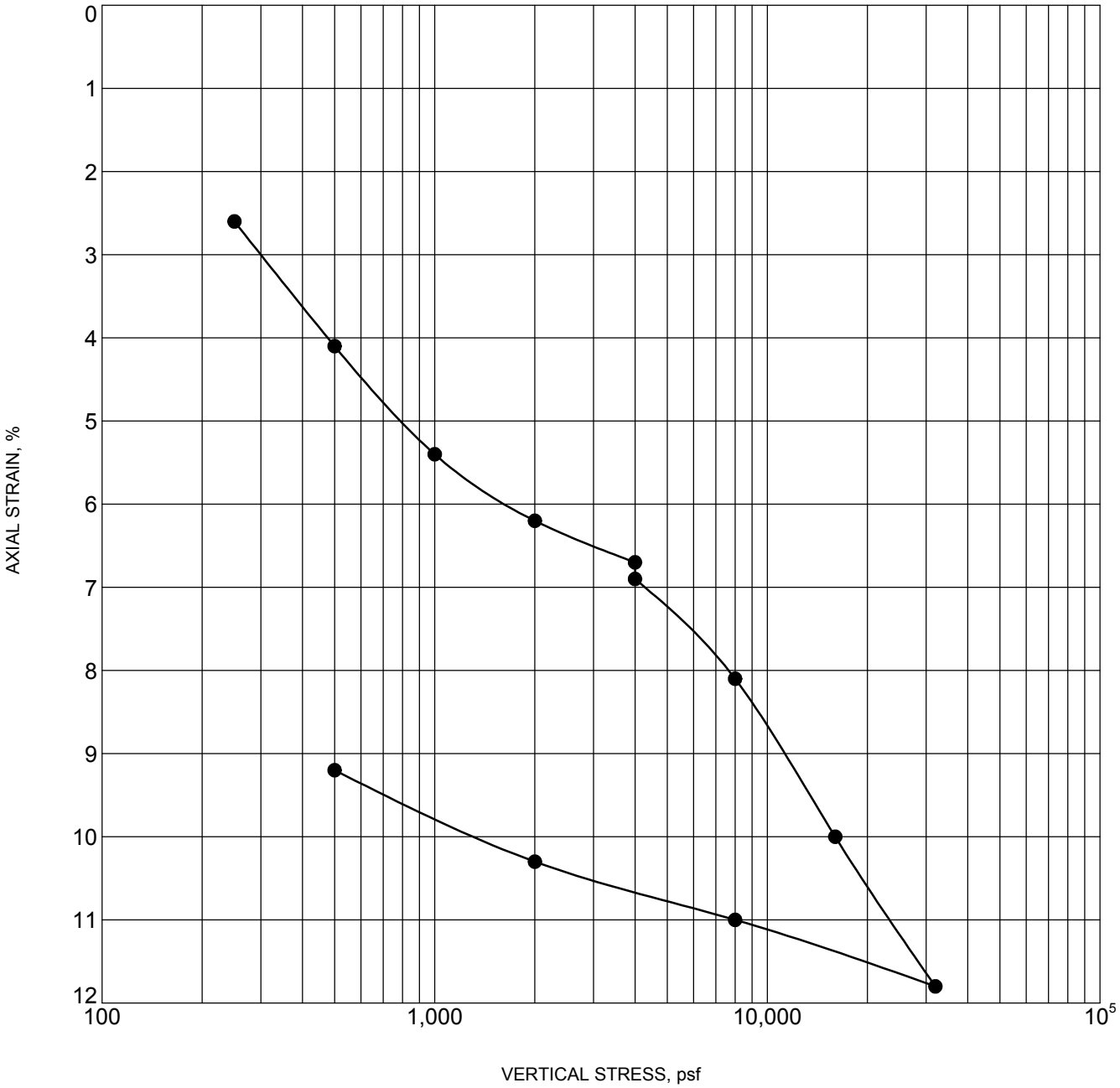
DIRECT SHEAR TEST

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit: C**



Specimen Identification	Moisture Content, %		Dry Density, pcf		Saturation, %		Void Ratio	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
11B-3 @ 49.0 ft	**59.7**	**37.0**	**60.5**	**78.3**				

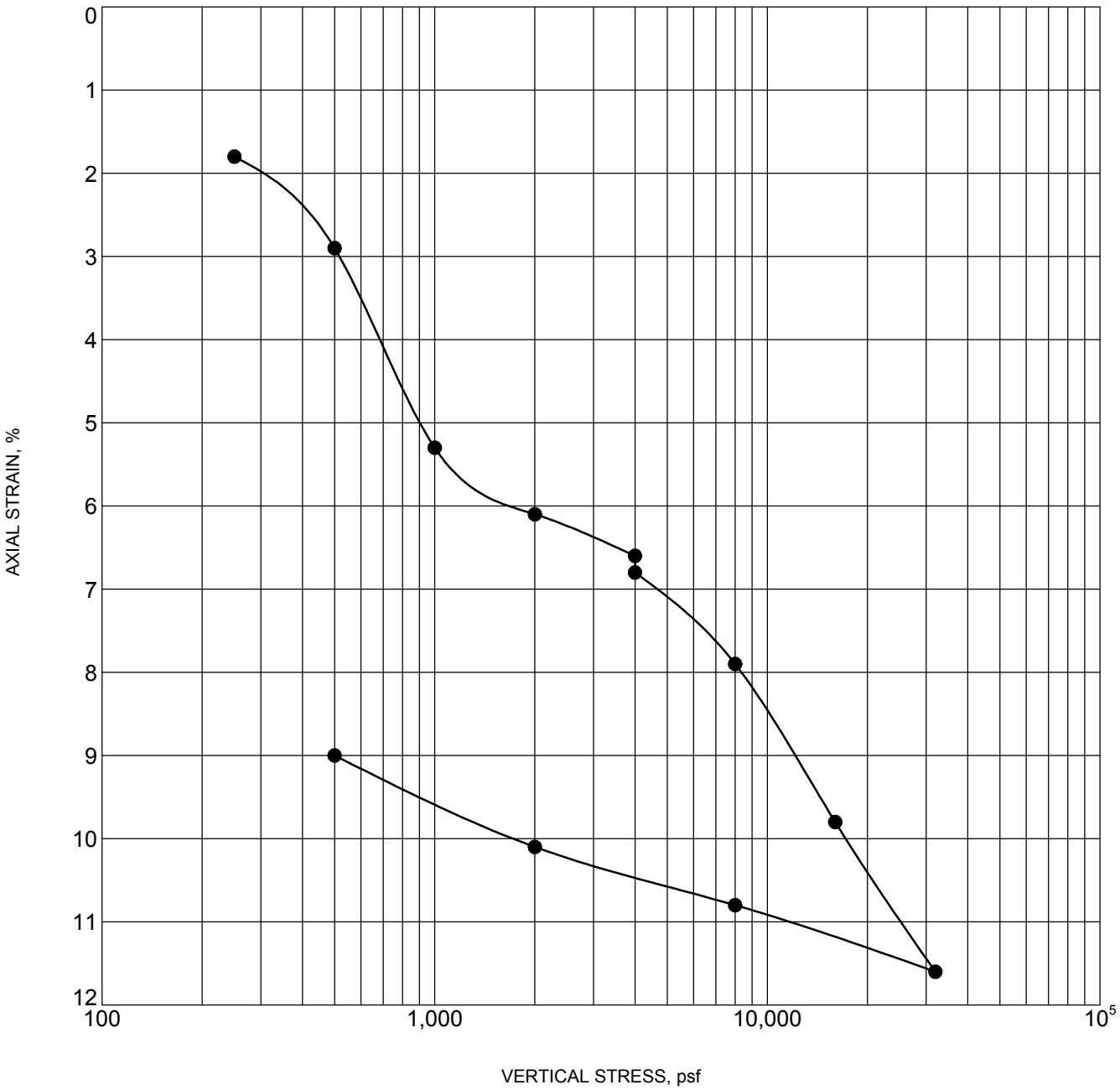
Notes: Water Added at 4000 psf

Terracon

CONSOLIDATION TEST

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit: C**

CONSOLIDATION - STRAIN 05012 GINT.GPJ LV TEMPLATE.GDT 6/16/11



Specimen Identification	Moisture Content, %		Dry Density, pcf		Saturation, %		Void Ratio	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
11B-4 @ 34.0 ft	**19.9**	**17.3**	**106.2**	**112.7**				

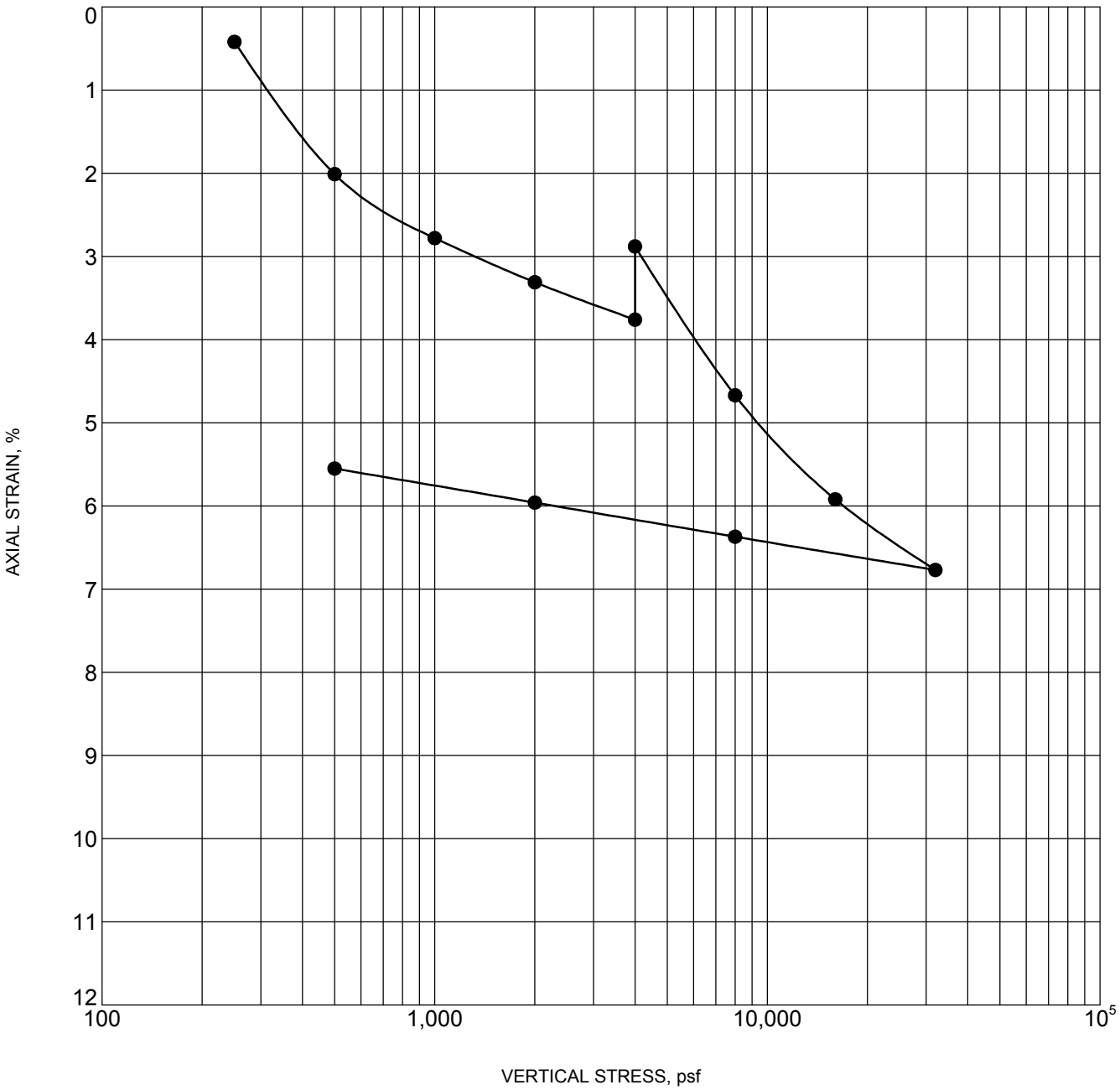
Notes: Water Added at 4000 psf

Terracon

CONSOLIDATION TEST

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit: C**

CONSOLIDATION - STRAIN 05012 GINT.GPJ LV TEMPLATE.GDT 6/16/11



Specimen Identification	Moisture Content, %		Dry Density, pcf		Saturation, %		Void Ratio	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
11B-4 @ 54.0 ft	**15.1**	**13.7**	**83.0**	**124.2**				

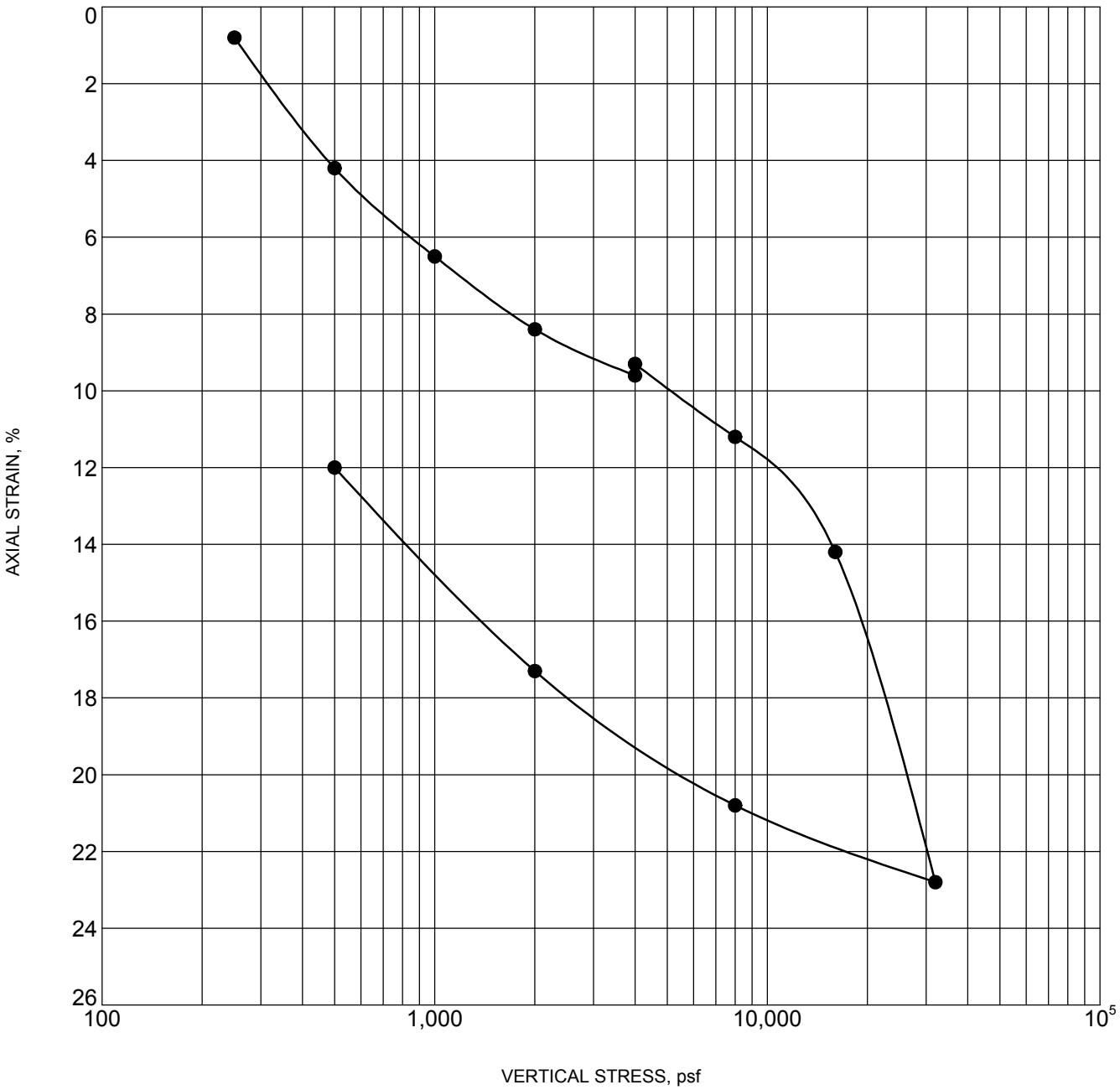
Notes: Water Added at 4000 psf

Terracon

CONSOLIDATION TEST

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit: C**

CONSOLIDATION - STRAIN 05012 GINT.GPJ LV TEMPLATE.GDT 6/16/11



Specimen Identification	Moisture Content, %		Dry Density, pcf		Saturation, %		Void Ratio	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
11B-6 @ 49.0 ft	**63.9**	**55.2**	**60.8**	**67.7**				

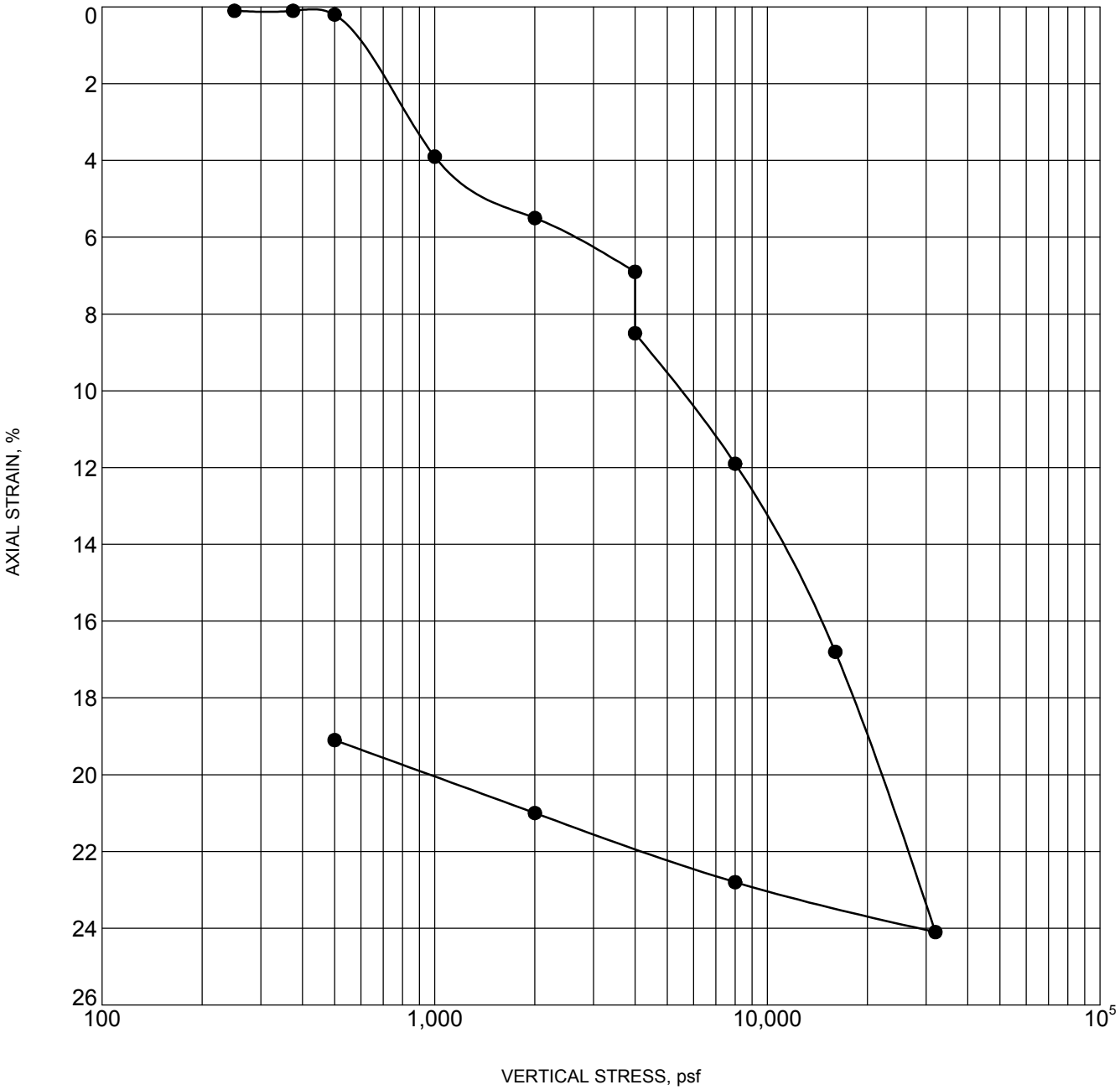
Notes: Water Added at 4000 psf

Terracon

CONSOLIDATION TEST

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012

Exhibit: C



Specimen Identification	Moisture Content, %		Dry Density, pcf		Saturation, %		Void Ratio	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
11B-6 @ 69.0 ft	**45.7**	**30.7**	**73.1**	**73.6**				

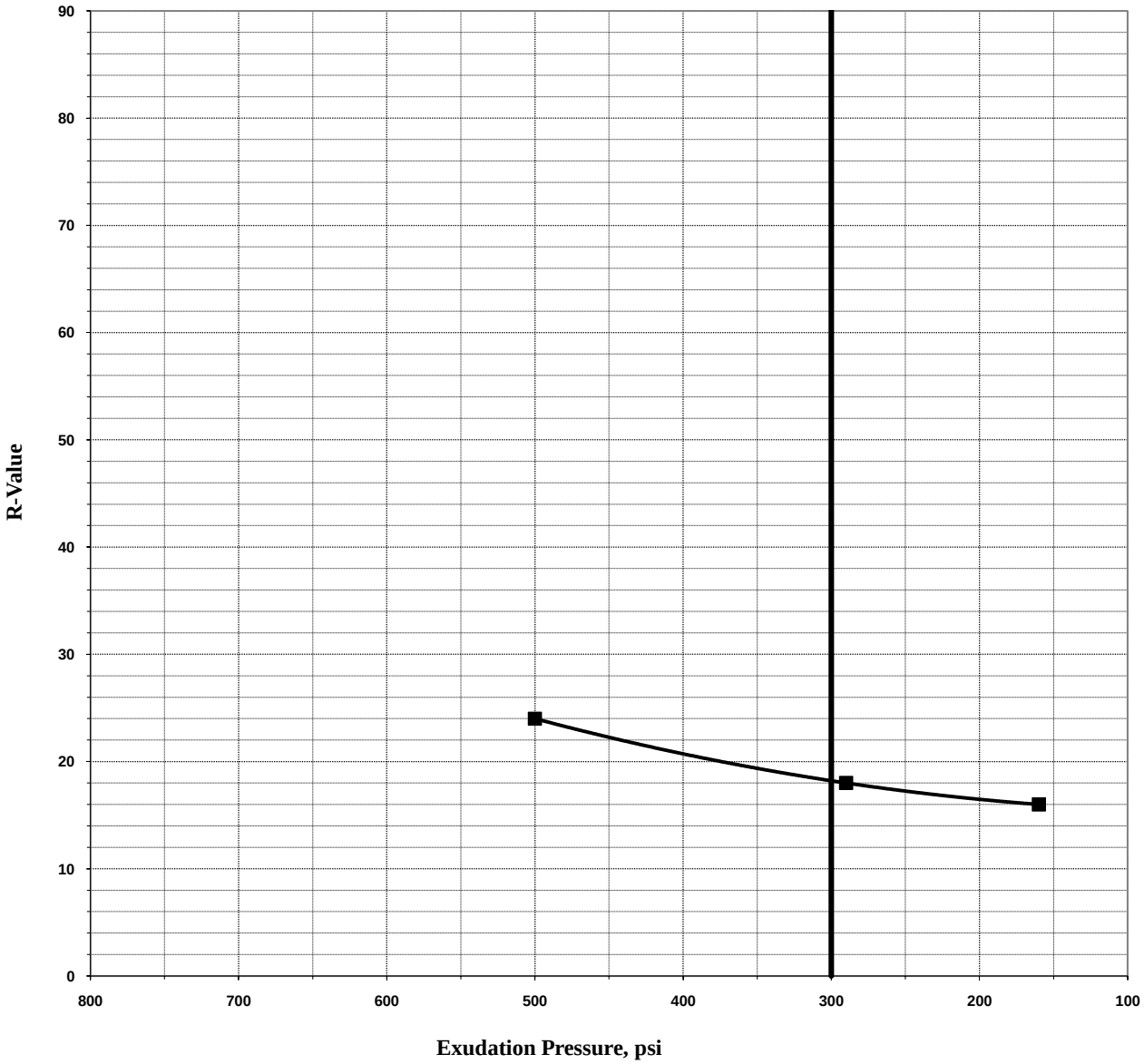
Notes: Water Added at 4000 psf

Terracon

CONSOLIDATION TEST

Client: Atkins North America, Inc
Project: F Street Bridge Reconstruction at I-15
Site: F Street at I-15, Las Vegas, Nevada
Project No.: 64105012 **Exhibit: C**

CONSOLIDATION - STRAIN 05012 GINT.GPJ LV TEMPLATE.GDT 6/16/11



Specimen Identification		Compaction Pressure (psi)	Dry Density (pcf)	Moisture Content (%)	R-Value at 300 psi
■	**10B-2 @ 1.5-3'**	**125.0**	**126.2**	**14.2**	**18.0**
◆					
●					
△					
□					
○					

Terracon

R-Value Test

Client: *Atkins North America, Inc*
Project: *F Street Bridge Reconstruction at I-15*
Site: *F Street at I-15, Las Vegas Nevada*
Project No.: 64105012 **Exhibit: C**

CHEMICAL LABORATORY TEST REPORT

Project Number: 64105012
Service Date: 06/01/11
Report Date: 06/06/11
Task:

Terracon
750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client
Adkins North America, Inc

Project
F Street Bridge Reconstruction at I-15
F Street at I-15
Las Vegas Nevada

Sample Submitted By: R. Erickson **Date Received:** 6/1/2011 Lab No.: 11-0506
Analyzed By: Kurt Ergun

Results of Soluble Salt Analysis

Sample Number	**5**	**4**
Sample Location	**11B-4**	**11B-6**
Sample Depth (ft.)	**14**	**19.0**
Sodium, AWWA 3500-Na D (percent %)	0.03	0.05
Water Soluble Sulfate (SO4), AWWA 4500 E (percent %)	0.23	1.09
Total Water Soluble Sodium Sulfate Na2SO4, By Calculation, (percent %)	0.09	0.14
Solubility, AWWA 2540 C (percent %)	0.99	2.32

Services:
Terracon Rep:
Reported To:
Contractor:

Reviewed By:
Charlie Kajkowski
Laboratory Supervisor

CHEMICAL LABORATORY TEST REPORT

Project Number: 64105012
Service Date: 06/01/11
Report Date: 06/06/11
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Terracon
750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client
Adkins North America, Inc

Project
F Street Bridge Reconstruction at I-15
F Street at I-15
Las Vegas Nevada

Sample Submitted By: R. Erickson **Date Received:** 6/1/2011 Lab No.: 11-0506
Analyzed By: Kurt Ergun

Results of Soluble Salt Analysis

Sample Number	1	2
Sample Location	11B-3	11B-3
Sample Depth (ft.)	11.0	34.0
Water Soluble Sulfate (SO4), AWWA 4500 E (percent %)	0.08	0.01

Services:
Terracon Rep:
Reported To:
Contractor:

Reviewed By:
Charlie Kajkowski
Laboratory Supervisor