FINAL GEOTECHNICAL ENGINEERING REPORT

REHABILITATION OF THE OLD US 80 BRIDGE AT THE GILA RIVER MARICOPA COUNTY, ARIZONA

TERRACON PROJECT NO. 65055196
JANUARY 26, 2007

Terracon
Consulting Engineers & Scientists

TranSystems

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JANUARY 26, 2007

Prepared for:

TranSystems Corporation
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Attn: Mr. Jerry Cannon, P.E.
Project Manager

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January 26, 2007

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Attn: Mr. Jerry Cannon, P.E.
Project Manager

Re: **Final Geotechnical Engineering Report**
Rehabilitation of the Old US 80 Bridge at the Gila River
Maricopa County, Arizona
Terracon Project No. 65055196

Terracon has completed the geotechnical engineering study for the proposed rehabilitation of the Old US 80 Bridge at the Gila River in Maricopa County, Arizona. This study was performed in general accordance with our Revised Scope of Work and Cost Proposal under our project number 65055196 dated September 27, 2005 and our Revised Contract Change Request No.1 dated October 30, 2006. The results of our engineering study, including the site plan, laboratory test results, logs of borings, test data and the geotechnical recommendations needed to aid in the rehabilitation, evaluation of foundations, structural concrete in the bridge deck and foundations and other earth connected phases of this project are attached. This work has been undertaken in support of the Design Concept Report being prepared by TranSystems Corporation for the Maricopa County Department of Transportation.

We appreciate being of service to you in the geotechnical engineering phase of this project. If you have any questions concerning this report or any of our testing, inspection, design and consulting services, please do not hesitate to contact us.

Sincerely,
Terracon

Registered Professional Engineer (Civil)
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Copies to: Addressee (5)

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REHABILITATION OF THE OLD US 80 BRIDGE AT THE GILA RIVER
MARICOPA COUNTY, ARIZONA

TERRACON PROJECT NO. 65055196
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INTRODUCTION

This report contains the results of our geotechnical engineering study for the proposed rehabilitation of the Old US 80 Bridge at the Gila River located in Maricopa County, Arizona. The site is located in the southern half of the southwest quarter and southeast quarter of Section 28, Township 2 South, Range 5 West of the Gila and Salt River Base Line and Meridian. This work has been undertaken in support of the Design Concept Report being prepared by TranSystems Corporation for the Maricopa County Department of Transportation.

The objectives of the geotechnical services for the project included:

- Assist the design team in evaluating the as-constructed depth of the foundation elements, particularly at each of the bridge abutment and bridge piers;
- Evaluate the bearing materials beneath the bridge piers for bearing capacity analyses of the existing foundations;
- Evaluate the material properties of the subsurface soils at the location of the existing abutments and piers for use in additional scour evaluations;
- Evaluate the strength of concrete in the existing bridge deck at randomly selected locations;
- Evaluate the strength of the concrete in randomly selected bridge piers and abutments; and,
- Evaluate the concrete for the presence of asbestos containing materials (ACM's).

The analyses and recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and experience with similar geotechnical conditions, structures and our understanding of the proposed project.

PROJECT DESCRIPTION

General Description: The Maricopa County Department of Transportation (MCDOT) is currently planning the rehabilitation of the Old US80 Bridge at the Gila River. Present plans are to

rehabilitate the bridge for continued vehicular and pedestrian traffic. As part of the evaluation, MCDOT selected TranSystems Corporation and their team of subconsultants to complete a Design Concept Report for the project. In addition to the geotechnical evaluation addressed by this report, environmental, traffic, and scour studies as well as a structural evaluation of the bridge are being completed.

Part of the bridge rehabilitation may include removal and reconstruction of the bridge deck. Structural modifications to existing members are being considered to increase load capacity of the bridge. Additionally, a pedestrian walkway, designed and constructed to the outside of the existing truss system is being considered. Structural loading on the existing bridge piers with the contemplated modifications and rehabilitation measures are expected to be on the order of 2000 kips each.

Existing Bridge: The Old US80 Bridge at the Gila River is a nine span structure approximately 1661.5 feet in length. Currently, the approach roadway to each end of the bridge is a two lane paved rural road. Based on the historic plans provided to us, we understand the bridge was designed in 1925 by R.A. Hoffman, Bridge Engineer. We also understand the bridge was constructed in 1926-27.

The plans indicate the bridge loads are carried on each span by either 160 or 200-foot steel trusses. The trusses span to bridge piers that are constructed of reinforced concrete. The plans indicate the bridge piers and abutments are supported on spread footing foundations. The footings supporting each abutment are rectangular in shape and, based on the plans, are 31 feet in length and 9 feet wide at Pier 1 and 8 feet wide at Pier 10. Dimensions of the footings supporting each bridge pier were not included in the historic original plan set provided. However, plans were developed for scour protection of the bridge in 1993 by DMJM Arizona, Inc (DMJM). Those plans indicate the footings supporting the piers are 33 feet in length and 9'-8" in width.

The original design plans indicate an as-built elevation at the bottom of the footing of Pier (Abutment) No. 1 at elevation 716.75 feet above Mean Sea Level (MSL). The plans do not indicate an as-built elevation for the bottom of footing at Pier 10; however, a design elevation of approximately 719 feet above MSL is indicated.

Reportedly, the depth of the foundations for the bridge piers varies from 25 to 42 feet below the river bed. The 1993 DMJM plans for scour protection indicate the bottom of footings supporting Piers 2, 3 and 4 are 711.75, 712.30 and 708.5 feet MSL, respectively.

The existing bridge deck is constructed of reinforced concrete. The original design plans indicate the thickness of the deck varies from 8-1/2 inches at centerline to 7-1/2 inches at the

perimeter edge of the slab. Additionally, the plans indicate the deck is reinforced with two layers of ½-inch reinforcement steel at the top and bottom of the slab.

Previous Geotechnical Exploration: Previous geotechnical study of the bridge site included work completed by SHB Agra, Inc (SHB). That work was completed in 1993 in support of the scour repair plans that were prepared by DMJM for the bridge. The scour repair plans indicate that SHB Agra completed eight (8) test borings at the site to depths ranging from approximately 29.5 to 45 feet. The SHB geotechnical study focused on bridge piers 1 through 4 where the 1993 flood of the river caused scour at the location of the Piers 2, 3 and 4. Locations of the borings drilled by SHB are summarized as follows:

Location and Depth of Borings
SHB Agra, Inc, 1993

Boring No.	Bridge Pier	Boring Depth (ft)	Boring Elev. (ft MSL)	Depth to Bedrock (ft)	Depth to Groundwater (ft)
1	Pier 1, north side	35.5	741.84	26.0	10.5
2	Pier 4, north side	45.0	732.30	N/E	3.0
3	Pier 3, north side	39.5	733.80	24.5	9.0
4	Pier 4, south side	45.0	732.87	30.0	3.0
5	Pier 3, south side	29.4	734.24	22.0	4.0
6	Pier 2, south side	29.5	733.34	20.5	7.0
7	Pier 2, north side	30.3	733.91	23.5	8.0
8	Pier 1, south side	39.5	743.23	26.5	N/E

The SHB test borings generally encountered sands, sands and gravels and sandy clays overlying bedrock at each boring location. The sands and gravels were described as being fine to medium grained and silty in part. Bedrock in each of the borings (where encountered) generally consisted of igneous basalt bedrock overlying agglomerate bedrock. The agglomerate was generally described by SHB as gravel and cobble sized clasts in a moderately welded matrix.

Scour Evaluations and Historic Repair:: A major flood occurred on the Gila River in 1993. That flood resulted in damage to, and failure of the Gillespie Dam located about 500 feet upstream of the bridge site. The resulting flows also resulted in scour at the east end of the bridge, reportedly affecting Pier (Abutment) No.1 and Piers 2 through 5. As a result of that flood, MCDOT commissioned DMJM Arizona, Inc. to prepare repair plans for Piers 2, 3 and 4 of the bridge. Part of the design work included geotechnical exploration of the bridge by SHB as previously discussed. The repair plans developed by DMJM included jet grouting on the

upstream sides of the piers. The DMJM plans indicate the grouting was to extend on each side of the pier downstream past the centerline of the foundation.

Scour evaluations were conducted by Parsons Brinkerhoff in 1995-1997. Results of that study predicted the following scour elevations at each of the abutments and bridge piers:

Bridge Element	Scour Elev. Feet (MSL)
Pier 1	708.4
Pier 2	708.2
Pier 3	705.0
Pier 4	708.0
Pier 5	716.0
Pier 6	714.9
Pier 7	711.6
Pier 8	710.5
Pier 9	712.0
Pier 10	721.6

As part of the current Drainage Report, updated scour studies have been conducted by Primatech, Inc. Based on the updated analyses, we understand the predicted scour elevation for all bridge piers and abutments is 704.2 feet MSL based on a 100-year storm event. The results of the updated scour analyses were used in part to determine the bearing capacity of existing foundations at each bridge element and for determination of scour mitigation recommendations presented in this report.

SITE EXPLORATION

The scope of the services performed for this project included site reconnaissance by a field engineer and/or an engineering geologist, a subsurface exploration program, laboratory testing, and engineering analyses.

Field Exploration: A total of ten test borings were completed at the site of the existing bridge during the period of November 6 to 18, 2006. The boring numbers for the field exploration (Borings B1 through B10) correspond with the numbers of the bridge abutments and piers (i.e. Boring B1 was located at Pier (Abutment) No. 1, Boring B2 was located at Pier 2, Boring B3 was located at Pier 3, etc.) The borings were located alternatively between the north and south sides of the piers based on site access. During the field exploration, test borings were located as close as practical to the sides of the existing bridge piers and abutments in order to install

PVC casing for use in the parallel seismic testing subsequently conducted by Olson Engineering.

All borings were drilled from the level of the existing river bed with the exception of Borings B2 and B10. Boring B2 was drilled through the existing deck due to the presence of standing water at the location of the bridge pier. Boring B10 at Pier (Abutment) 10 was drilled in the roadway immediately adjacent to the end of the pier due poor access beneath the bridge and the presence of an irrigation ditch at that location. The locations of the borings are shown on *Site Plan and Boring Locations Diagram*, Figure 1. Ground surface elevations at each boring location (except at Boring B2) were obtained by measurements with an engineer's level from the two existing bench marks Q-13 located on the north side of the Pier (Abutment) 1 and P13 located on the north side of Pier (Abutment) 10.

The borings were drilled with a track-mounted Burley 4000 drill rig. The borings were advanced through the overburden soils by means of advancing continuous steel casing. At the depth where each boring encountered concrete of the pier foundations or bedrock (where the foundation concrete was not encountered), each boring was advanced using HQ coring techniques. The final depth of borings ranged from approximately 29½ to 60½ feet.

At the completion of drilling, each boring was subsequently cased with a two-inch diameter closed wall PVC casing capped at top and bottom and filled with water as required for the Parallel Seismic evaluation. Each casing extended to depths of approximately 10 to 15 feet below the bottom of each pier foundation. After the completion of Parallel Seismic testing by Olson Engineering, each boring was abandoned by grouting the casing in place to meet Arizona Department of Water Resources (ADWR) requirements.

Continuous lithologic logs of each boring were recorded by a Terracon geotechnical engineer or an engineering geologist during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon or ring-barrel samplers. Penetration resistance measurements were obtained by driving the split-spoon and ring-barrel samplers into subsurface materials with a 140-pound hammer falling 30 inches. The penetration resistance value is a useful index for estimating the consistency or relative density of the materials encountered.

Bedrock core samples retrieved during the drilling were examined in the field and percent recovery and Rock Quality Designation (RQD) were measured for each core run. The RQD is a relative measure of rock quality and is determined by dividing the length of all intact pieces of rock core longer than 4-inches by the total length of the core run.

In addition to the borings taken at each of the bridge piers, the field exploration included obtaining core samples of concrete from the existing bridge deck and from selected bridge piers. Core samples were taken from the bridge deck at approximately the center of each span, in the center of the east bound lane. A set of three (3) core samples were initially taken from the west face of Piers 1 and 3, and from the east face of Piers 5, 7, and 9. Additional cores were obtained from piers if any of individual cores of the initial set were less than six (6) inches in length. A total of nine (9) cores were obtained from the bridge deck slab, and 14 cores were obtained from the selected bridge piers. All core holes drilled through the deck and in the piers were patched with quick-set concrete at the completion of drilling.

Groundwater conditions were measured in each boring at the time of site exploration, and at various intervals upon completion of drilling and prior to abandonment of each boring.

Laboratory Testing: Soil and cores samples retrieved during the field exploration were taken to the laboratory for observation by the project geotechnical engineer. The soils were classified in accordance with the Unified Soil Classification System and samples of bedrock were classified in accordance with the general notes for the description of rock properties as described in Appendix C. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials. Boring logs were prepared and are presented in Appendix A.

Laboratory tests were conducted on selected samples of the soils and bedrock and are presented in Appendix B and on the Logs of Borings. The test results were used for the geotechnical engineering analyses, and the development of the recommendations contained in this report. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil and bedrock samples were tested for the following engineering properties:

- Water Content
- Dry Density
- Sieve Analyses
- Compressive Strength
- Sulfate Soundness
- Percent Fines
- Specific Gravity
- Plasticity Index
- Slake Durability

All concrete cores obtained from the bridge deck and piers were tested for compressive strength in accordance with ASTM and ACI standards. A portion of each of the core samples obtained from the bridge deck were submitted to Fiberquant Analytical Services, a NVLAP accredited laboratory in Phoenix, Arizona for analysis of asbestos containing materials.

SITE CONDITIONS

Photographs, depicting selected site conditions evident during the course of the geotechnical study for the project are included on Figures 2 through 4. Site conditions along the length of the bridge vary by location. Starting at the west end, the Enterprise Canal is located immediately beneath the bridge and adjacent to Pier 10. The existing canal is approximately 10 to 12 feet in width and of unknown depth. There is an existing trail located along the south side of the bridge and extends east to the approximate location of Pier 5. The existing low flow channel of the Gila River is located between Piers 4 and 5. At the time of the field exploration the flow in the channel was about 5 to 8 feet wide.

Vegetation upstream and downstream of the bridge consists of a moderate to heavy growth of salt cedar. The salt cedar becomes less dense to the east of Pier 4 and is virtually non-existent upstream and downstream of Piers 2 and 3. Vegetation immediately beneath the bridge was typically non-existent. The ground surface is undulated between the piers and the surface is generally very soft, the result of past flows and deposition of fine sands and silts.

Pier 2 at the east end of the bridge is located in an area of standing water. An existing sand bar divides the standing water into two distinct channels, the western portion of which extended to the eastern side of Pier 3. The standing water is an estimated two to three feet in depth at the location of Pier 2. Evidence of previous scour protection repairs (installation of jet grouted concrete piers) was observed above the level of the standing water at Pier 2.

Remnants of Gillespie Dam are located about 500 feet upstream of the existing bridge. The dam was breached in an area located approximately directly north of Piers 2 and 3. The Paloma Irrigation Company owns and operates a pumping station upstream of the bridge at the east end. An earthen cofferdam has been constructed across a portion of the standing water upstream to divert water to the pumping station. The station discharges water into the Gila Bend Canal that flows south of the site and is used for crop irrigation.

SUBSURFACE CONDITIONS

Geology: Geologically, the existing bridge site is located between the Buckeye Hills to the east and the Gila Bend Mountains to the west and southwest. These mountain ranges and the Gila River valley have evolved from generally complex movements and associated erosional and depositional processes. Drainage flows to the Gila River during late Tertiary time, coupled with structural activity discussed above, are generally responsible for the present day topography.

Surficial geologic conditions mapped at the site ([1]Wilson, et al, 1957) within the Gila River flood plain consist of alluvium of Holocene to middle Pleistocene age (10,000 to 1 m.y. ago). The alluvial materials have been described as weakly to moderately consolidated deposits consisting of sand, gravel and conglomerate. Quaternary aged basalt has been mapped and outcrops on the mountain ranges to the east and west of the bridge site. This is consistent with the presence of basalt bedrock at depth beneath the river channel. Locally the basalt can include tuff and cemented gravel.

Subsurface Conditions: As presented on the Logs of Borings, surface soils to elevations ranging from 694.0 to 719.5 feet above the MSL at each of the bridge piers generally consisted of poorly to well graded sands and gravels with variable amounts of silt and sand, and, sandy silt or silty sand soils both with variable amounts of sand and gravel. Sandy lean clay was encountered at the surface at the location of borings B-6 and B-8 and extended to the elevations ranging from 727.5 to 728.0.

Immediately beneath the surface soils the borings encountered concrete of either the bridge pier or pier footing foundations. The exceptions occurred at Borings B-1 and B-4 where the foundation or bridge pier was not encountered. However, a wooden plank along with pieces of Portland cement concrete was recovered from the core interval between elevations 712.5 to 708.0 MSL in Boring B-4. The material has been assumed to be a remnant of the forms used for construction of the pier and/or pier footing at that location.

As a result of coring through the concrete, the elevation of the bottom of each foundation element was determined at the location of the borings. Igneous bedrock consisting of basalt or agglomerate was encountered below each pier foundation and extended to the maximum depth of exploration of each boring

Where encountered, the basalt bedrock was highly fractured with the RQD generally varying between 0 to 100%.

Field and Laboratory Test Results: Field penetration test results taken in the soils above bedrock indicate that the sand soils vary from very loose to very dense in relative density. The clay soils vary from soft to medium stiff in consistency.

The basalt varies from slight to moderately weathered and is in general, fractured. The fractures were clay filled in part. The agglomerate consists of weathered basalt gravels and cobble sized clasts. The agglomerate has slight to moderate weathering. Recovery of the bedrock varied

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[1]Wilson, E.D., Moore, R.T., and Pierce, H.W., 1957, ***Geologic Map of Maricopa County, Arizona***, Arizona Bureau of Mines, University of Arizona.

from a low of 19% to 100%, averaging approximately 85% at all test boring locations. RQD determined from the rock core varied between 0 and 100%, averaging approximately 40%.

Laboratory Atterberg limit test results indicate the sand soils are generally non-plastic. Those test results and the results of grain size analyses (sieve tests) indicate the sand materials generally classify as poorly graded sands, silty sands, sandy silts and well graded sands with gravel, with Unified Soil Classifications SP, SM, ML and SW.

Results of compressive strength tests conducted on the five rock core samples obtained below the depth of pier foundations indicate the compressive strength ranges from 950 to 8,560 psi. The unit weights of these rock core samples range from 136 to 174 pcf. Sulphate soundness (loss) ranges from 9.3 to 88.1% and slake durability index (SDI) ranges from 6.3 to 98.

The following table summarizes the results of testing conducted on the rock core samples.

Boring No.	Depth (feet)	Unit Weight (pcf)	Compressive Strength (psi)	Sulphate Soundness Average Loss (%)	Slake Durability Index (%)
B1	30-35			46.7	97
B1	40.0	168	8,560		
B2	53.5	174	6,750		
B2	51.3-56.3			14.5	98
B3	17.8-19.3			88.1	67
B5	41.4	136			
B8	35.5	156	950		
B9	26.5-36.3			15.0	82
B10	32.5-35.0			9.3	95
B10	40-45			98	6.3
B10	48.0	143	1,980		

Groundwater Conditions: Groundwater was encountered in all of the test borings at the time of the field exploration with the exception of Boring B-10. Groundwater was encountered at depths of approximately 0.5 to 23.5 feet (elevations ranging from 721.5 to 730.0 feet above MSL) in the test borings. These observations represent groundwater conditions at the time of the field exploration, and may not be indicative of other times, or at other locations. Groundwater levels can be expected to fluctuate with varying seasonal and weather conditions.

ENGINEERING ANALYSES AND RECOMMNEDATIONS

Foundation Analyses: During the field exploration, test borings were located as close as practical to the sides of the existing bridge piers and abutments in order to install the PVC casing for use in the parallel seismic testing conducted by Olson Engineering. As a result, the borings and subsequent coring operations encountered the concrete foundations of eight out of ten of the bridge piers. The following table summarizes the depth at which concrete was encountered at each pier boring and the elevation of the bottom of the foundation footing:

Pier Number	Elevation at Top of Concrete (feet MSL)	Elevation of the Bottom of Foundation (feet MSL)	Concrete Thickness (feet)
Pier 1	---	716.75[1]	---
Pier 2	716.5	711.0	5.5
Pier 3	719.5	713.0	6.5
Pier 4	---	708.5[1]	---
Pier 5	706.0	699.0	7.0
Pier 6	702.0	694.0	8.0
Pier 7	696.5	687.0	9.5
Pier 8	704.0	699.0	5.0
Pier 9	718.0	713.0	5.0
Pier 10	727.0	719.5	7.5
[1] Note: This value is based upon historic data and not the field exploration.			

As shown in the above table the foundation bearing for the bridge piers ranges from elevations of 696.5 to 727.0 feet above MSL. Borings at the location of Piers 1 and 4 did not encounter the pier concrete. However, a wooden plank along with pieces of Portland cement concrete was recovered from the core interval between elevations 712.5 to 708.0 MSL in the test boring at Pier 4. The material has been assumed to be a remnant of the forms used for construction of the pier and/or pier footing at that location. Results of the parallel seismic testing should be used to confirm the depths and elevations of the foundations outlined above.

Based on our field exploration and laboratory test results, all the existing pier foundations are bearing on highly weathered, hard bedrock consisting of either basalt or agglomerate. Analysis of bearing capacity of the existing footing foundations has been determined in accordance with section 4.4.8.1.2 of the American Association of State Highway and Transportation Officials

([2]AASHTO) "Standard Specifications for Highway Bridges", 17th Edition, 2002). For purposes of the analysis the bearing materials beneath the foundation has been considered as competent rock.

The AASHTO criteria for allowable bearing on competent rock is based on one of three limiting factors including:

- the allowable contact stress determined in accordance with the Figure 4.4.8.1.1A;
- the unconfined compressive strength of the rock; and,
- the allowable bearing stress in the foundation concrete (i.e. 0.595 f'_c of the concrete).

Of the three factors listed, the allowable contact stress determined in accordance with Figure 4.4.8.1.1A controls determination of the allowable bearing stress for this project. Based conservatively on an RQD of 0 for the bearing materials within a depth of 1/2 the width of the foundation below any particular footing, an allowable contact stress on the rock of 10 tons per square foot (20,000 psf) is indicated by the AASHTO criteria.

Considering a load of 2000 kips per pier and the dimensions of the spread footing foundations, actual foundation contact stresses are anticipated to be on the order of 6,500 psf. Based the projected loading, the existing foundations and the underlying foundation materials should have more than enough capacity for the proposed rehabilitation planned for the bridge without exceeding the indicated allowable contact stress.

Seismic Considerations: Based on the depth to bedrock at the existing pier foundations, the subsurface conditions at the site should be considered as Soil Profile I, as indicated in Section 3.5 of Division 1A of the AASHTO Standard Specifications for Highway Bridges. A site coefficient of 1.0 is recommended for Soil Profile I in accordance with Section 3.5.1.

According to ([3]Lam et al, 1992) there are no faults mapped in the Sonoran Zone near the location of the Old US80 Bridge. There is a 90 percent probability of non-exceedance in 50 years of a seismic event with horizontal ground movement of magnitude 0.07g at the project site. This corresponds to a return period of 475 years using the Poisson distribution used in the Lam reference.

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[2]American Association of State Highway and Transportation Officials, 2002, ***Standard Specifications for Highway Bridges***, 17th Edition.

[3]Lam, I.P., et al, 1992, ***Map of Horizontal Acceleration at Bedrock for Arizona with 90 Percent Probability of Non-Exceedance in 50 Years,*** Arizona Department of Transportation.

Scour Considerations: For scour analysis calculations, representative samples of soils overlying bedrock were tested to determine the grain size distribution of the materials. Gradation test results are presented in Appendix C. The following table summarizes the approximate D_{50} and D_{95} diameters of the samples tested (i.e. D_{50} indicates the grain size diameter of the size where 50% of the sample is smaller):

Boring No.	Depth (feet)	Elevation (feet MSL)	D_{50} (mm)	D_{95} (mm)
B4	15	718.7	0.32	.7
B5	10	724.2	0.23	24
B6	5	727.7	0.22	0.65
B7	14	721.5	0.20	22
B8	9.5	726.6	0.22	0.45
B10	9.5	742.2	<0.75	2

Based on the current predictions completed by Primatech, Inc. for the evaluation of the bridge, existing foundations located at Piers 1 through 4, 9 and 10 could be subject to scour under certain flooding conditions. Previous repairs completed at the bridge for scour protection were completed at Piers 2, 3 and 4. The repair plans developed by DMJM included jet grouting on the upstream sides of the piers to various depths.

Results of the geotechnical exploration completed for this evaluation indicate that the pier footings are founded on bedrock. However, previous exploration of the site by SHB, Agra, Inc. concluded that a portion of Pier 4 was supported on strongly cemented soils.

As referenced in the Federal Highway Administration ([4]FHWA) Publication NHI 01-001 "Evaluating Scour at Bridges", 2001, there are well documented equations and methods that are employed to evaluate the scour potential of either cohesive or cohesionless soils. That publication further references the FHWA 1991 Memorandum "Scourabilty of Rock Formations" that provides direct and empirical methods to determine if rock is resistant to scour. The empirical methods of scour resistance evaluation for rock include:

- Evaluation of the geologic formation and rock discontinuities;
- Evaluation of the Rock Quality Designation (RQD);
- Unconfined Compressive Strength of the rock;
- The Slake Durability Index;

[4]Federal Highway Administration, Hydraulic Engineering Circular (HEC) No. 18, 2001, ***Evaluating Scour at Bridges***, Publication NHI 01-001.

- Soundness of rock in accordance with AASHTO T104; and
- Abrasion of rock in accordance with AASHTO T96

Of these empirical indicators, the first five have been used as initial indicators of scour resistance of the bedrock at the site. As previously discussed, compression test results of intact pieces of rock core ranged from 950 to 8,560 psi. Based on the FHWA Memorandum, rock with unconfined compressive strength less than 250 psi should be considered to behave as soil. Based on compressive strength, the bedrock would not be considered scour prone. However, the Memorandum also indicates that rock with an RQD less than 50 percent, a slake durability index of less than 90 and a sodium soundness loss of greater than 12% should be considered as soil-like with respect to scour potential. The measurements of RQD included on the borings logs and the results of slake durability and sodium sulphate soundness laboratory test results indicates potential scourabilty of portions of the rock formations beneath footings at Piers 1 through 4, 9 and 10. There were core runs indicating RQD above and below the critical value of 50% at various depths beneath the existing foundations. Similarly, the laboratory test results indicate intervals of the foundation materials to have slake durability indices of less than 90 and sodium sulfate soundness loss of greater than the threshold value of 12%.

All of the factors used to evaluate the scour potential of the bedrock on the site have been based on empirical indicators as outlined in the FHWA memorandum. The FHWA memorandum outlines procedures to conduct flume erosion tests that could be considered to further evaluate the scour potential of bedrock at the bridge site.

Potential scour countermeasures that could be considered for the project have been developed based on the Federal Highway Administration ([5]FHWA) Publication NHI 01-003 "Bridge Scour and Stream Instability Countermeasures", 2001. For purposes of geotechnical recommendations, only potential structural countermeasures as outlined in Section 2, Table 2.1 have been considered. Hydraulic, armoring and monitoring countermeasures that could be considered should be evaluated by others for the project.

Of the potential structural countermeasures, those considered applicable for consideration include:

- Foundation strengthening by grouting under footings; or
- Foundation strengthening by lowering (underpinning foundations).

[5]Federal Highway Administration, Hydraulic Engineering Circular (HEC) No. 23, 2001, ***Bridge Scour and Stream Instability Countermeasures***, Publication NHI 01-003.

These potential countermeasures are consistent with those proposed by SHB, Agra, Inc in their previous geotechnical report for the project and with the repairs that were previously undertaken at selected bridge piers.

Extensive excavations and dewatering would be required to underpin the existing bridge piers footing foundations making this a relatively unattractive and expensive alternative. However, underpinning consisting of the construction of new drilled shafts and structural support of the bridge independent of the existing piers could be potentially considered as an effective alternative. Grouting could be performed at existing ground level without the necessity of deep excavations on the site. The performance of the grouting program previously undertaken at the bridge should be evaluated when considering this potential alternative.

Pier Concrete: The results of the compressive strength tests conducted on the fourteen selected concrete core samples from the piers indicate the compressive strength ranges from 4,420 to 8,300 psi. Approximately six samples, A through E, were obtained horizontally at the center of each of the pier numbers 1, 3, 5, 7, and 9. Core samples were taken from approximately the center of each span, from the west face of Piers 1 and 3, and from the east face of Piers 5, 7, and 9. Additional cores were taken from piers if any of the cores were less than 6 inches long. The test results are presented in the following table:

Pier No.	Sample	Compressive Strength (psi)
1	A	5,030
	B	5,040
	E	5,600
	Average	5,220
3	D	4,420
	E	5,460
	Average	4,940
5	A	5,110
	B	8,300
	C	8,010
	Average	7,140
7	A	4,090
	B	7,380
	C	5,430
	Average	5,630
9	A	5,550
	B	6,750
	C	8,050
	Average	6,780
All Piers	Average	6,010

Bridge Deck Concrete: The results of the compressive strength tests conducted on the nine (9) concrete cores obtained from each of the nine bridge spans indicate the compressive strength ranges from 4,150 to 6,100 pounds per square inch (psi) with an average of 4,550 psi.

Asbestos testing was performed on the samples obtained from each of the core samples obtained from the bridge spans. The samples were delivered under proper chain-of-custody to Fiberquant Analytical Services, a NVLAP accredited laboratory in Phoenix, Arizona. The bulk samples were analyzed for asbestos content by Polarized Light Microscopy (PLM) techniques. No asbestos-containing materials (ACMs) were identified in any of the nine samples.

The results of the testing on cores obtained from the bridge deck are included in Appendix C; Asbestos tests are presented in Appendix D, and are summarized in the following table:

Sample Location	Compressive Strength (psi)	Asbestos Results
Span 1	5,500	Non-Detected
Span 2	4,610	Non-Detected
Span 3	3,460	Non-Detected
Span 4	6,100	Non-Detected
Span 5	3,860	Non-Detected
Span 6	4,650	Non-Detected
Span 7	4,350	Non-Detected
Span 8	4,150	Non-Detected
Span 9	4,260	Non-Detected
Average	4,550	

GENERAL COMMENTS

The analyses 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 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 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, 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 expressed 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 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.

Photo #1 View looking north at the west abutment Pier 10 of bridge and the presence of an irrigation canal at the abutment.

Photo #2 Close-up view of irrigation canal at the west abutment of the bridge

Photo #3 View looking east on the downstream (south) side of bridge at rough access road for Piers 5 through 9.

Photo #4 View of rough access road on downstream side of bridge

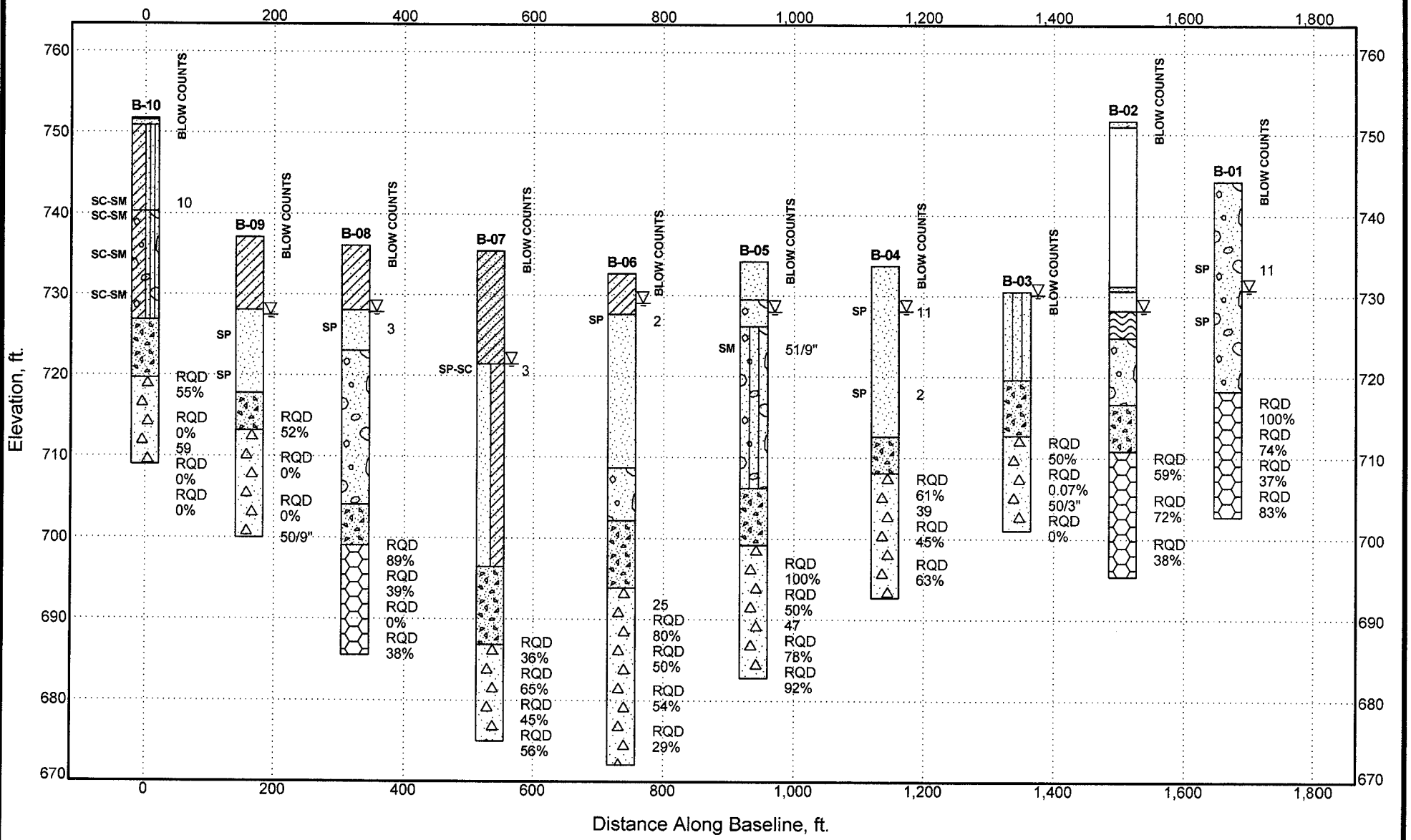
Photo #5 View looking east at underside of bridge showing access for the upstream side from the downstream access road

Photo #6 View of the current Gila River flow channel located between Piers 4 and 5.

Photo #7 View looking northwest at Pier 2 and the standing water surrounding that pier. Boring will be drilled from deck.

Photo #8 View of Paloma Irrigation & Drainage District access road that allowed access to Piers 3 and 4.

Photo #9 View of the east abutment of bridge Pier 1, and the access from the highway to the south side of the structure.

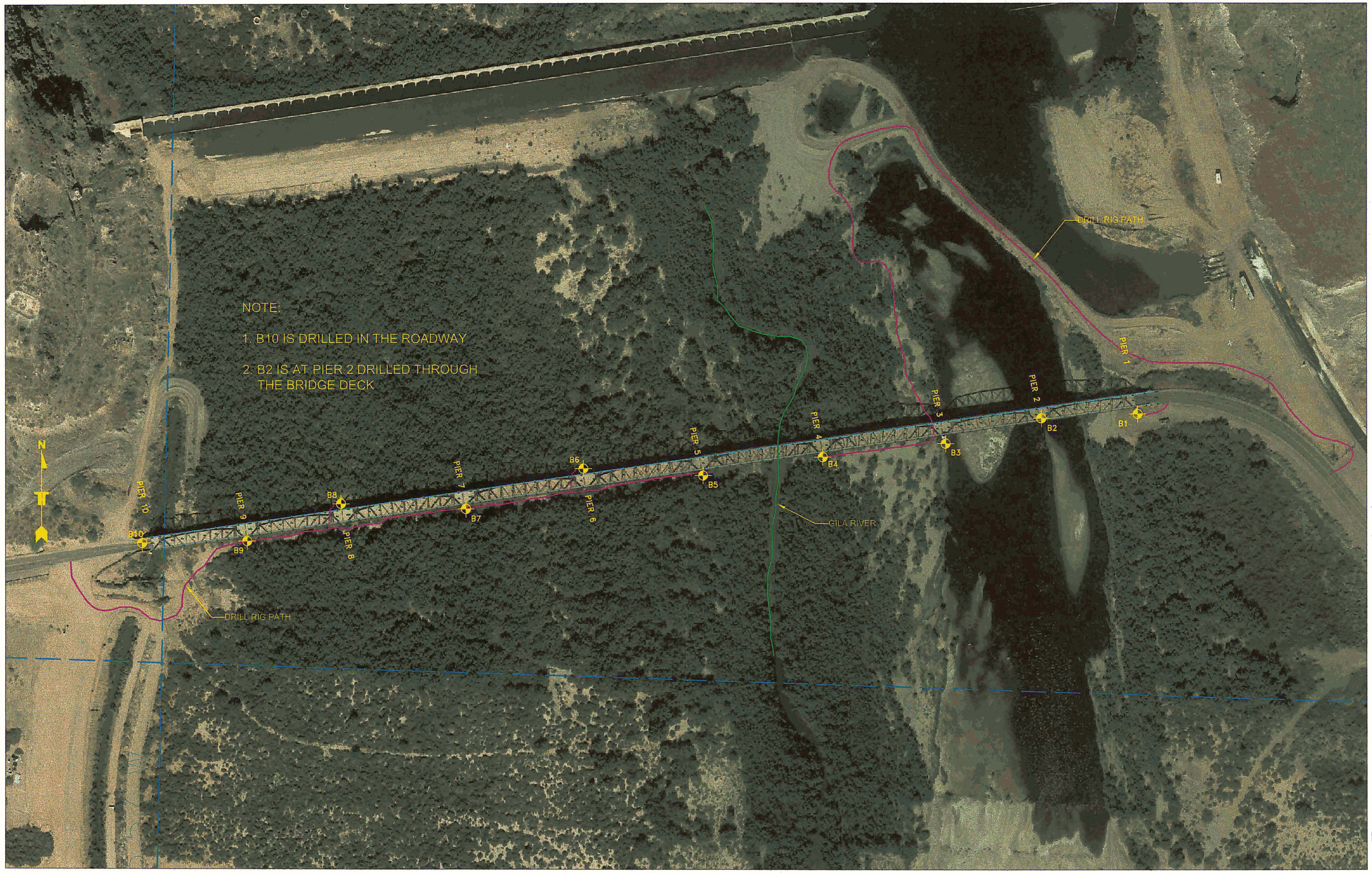


TC_LITHOLOGY ELEV W/BLOW COUNTS 65055196.US 80 BRIDGE.GPJ TERRACON.GDT 1/29/07

Terracon

SUBSURFACE DIAGRAM

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07



LEGEND:

BORING LOCATION

N

N.T.S.

Terracon
4685 SOUTH ASH AVENUE, STE H-4
TEMPE, ARIZONA 85282
(480) 897-8200 FAX (480) 897-1133

REHABILITATION OF THE OLD US 80 BRIDGE AT THE GILA RIVER MARICOPA COUNTY, ARIZONA

DRAWN BY: DRC

CHECKED BY: SDN

SCALE: NOT TO SCALE

DATE: 12/28/2006

SITE PLAN AND BORING LOCATIONS

TERRACON PROJECT NO. 65055196

FIGURE NO.

1

LOG OF BORING NO. B-01

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

Boring Location: Pier 1 Note: Surface elevation measured from Benchmark Q-13 (1927 datum) located on North side of Pier 1. Boring drilled from river channel.

Approx. Surface Elev.: 744.25 ft

GRAPHIC LOG	DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
POORLY GRADED SAND WITH GRAVEL; some cobbles, brown to light brown, loose to medium dense, moist, Alluvial fill.	5										
	10	SP	X	SS	3	6	5	6			
▽	15										
	20	SP								19	
26 718.5	25										
IGNEOUS BEDROCK-BASALT; dark grey, slight to moderate weathering, hard to medium hard, fracture filling with clay seams and crystalization, some void spaces.										100	100
	30									90	74

Continued Next Page

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft		
WL	▽ WCI, 11/18/06	▼
WL	▼	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED	11-15-06		
BORING COMPLETED	11-17-06		
RIG	Burley 4000	FOREMAN	AJS
APPROVED	SDN	JOB #	65055196

LOG OF BORING NO. B-01

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
	IGNEOUS BEDROCK-BASALT; dark grey, slight to moderate weathering, hard to medium hard, fracture filling with clay seams and crystalization, some void spaces.	35									83	37
		40									100	83
	41.5 703 **Bottom of BORING.**											

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft

WL	▽ Dry, 11/18/06	▼
WL	▼	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED			11-15-06
BORING COMPLETED			11-17-06
RIG	Burley 4000	FOREMAN	AJS
APPROVED	SDN	JOB #	65055196

LOG OF BORING NO. B-02

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

Boring Location: Pier 2 Note: Surface elevation measured from Benchmark Q-13 (1927 datum) located on North side of Pier 1. Boring drilled through the top of the bridge deck.

Approx. Surface Elev.: 751.65 ft

GRAPHIC LOG	DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
0.7 **CONCRETE**; grey, 8-inches Bridge Deck. 751 **AIR**.	0										
20.4 731.5	20										
21 **PORTLAND CEMENT CONCRETE**; grey, 6" Reinforcement Pier Protector. 730.5 **AIR**.	21										
23.4 ▽ 728.5 **Standing Water**.	23										
26.8 725 **POORLY GRADED SAND WITH GRAVEL**; some cobbles, brown to light brown, Alluvial fill.	25										
Continued Next Page	30										

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 23.4 WD & WCI	▼
WL	▼	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED	11-17-06		
BORING COMPLETED	11-18-06		
RIG	Burley 4000	FOREMAN	AJS
APPROVED	SDN	JOB #	65055196

LOG OF BORING NO. B-02

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
	POORLY GRADED SAND WITH GRAVEL; some cobbles, brown to light brown, Alluvial fill.	35										
	35 716.5											
	PORTLAND CEMENT CONCRETE; grey, Pier Foundation.	40									97	
	40.8 711											
	IGNEOUS BEDROCK-BASALT; dark grey, hard to very hard, slight to moderate weathering, Fracture filling with secondary crystalization, trace void spaces.	45									100	59
		50									92	72
		55									93	38
	56.3 695.5											
	Bottom of BORING.											

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 23.4WD & WCI	▼
WL	▼	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED			11-17-06
BORING COMPLETED			11-18-06
RIG	Burley 4000	FOREMAN	AJS
APPROVED	SDN	JOB #	65055196

CORE LOG 2000 65055196 US 80 BRIDGE.GPJ TERR2000.GDT 1/29/07

LOG OF BORING NO. B-03

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

Boring Location: Pier 3 Note: Surface elevation measured from Benchmark Q-13 (1927 datum) located on North side of Pier 1. Boring drilled from river channel.

Approx. Surface Elev.: 730.55 ft

GRAPHIC LOG	DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
SILTY SAND; dark brown to black, Alluvial fill with decaying debris.	0										
10.9 / 719.5	5										
PORTLAND CEMENT CONCRETE; grey, Pier Foundation.	10										
17.8 / 713	15									100	
AGGLOMERATE; red brown, hard, slight to moderate weathering, gravel and cobble sized Basalt clasts.	20		X	SS	4	50/3"				100	
	25									96	50
										61	0.07
29.5 / 701										73	0
Bottom of BORING.											

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft

WL	▽ DMCI, 11/15/06	▼
WL	▼	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED			11-13-06
BORING COMPLETED			11-14-06
RIG	Burley 4000	FOREMAN	AJS
APPROVED	SDN	JOB #	65055196

CORE LOG 2000 65055196.US 80 BRIDGE.GPJ TERR2000.GDT 1/29/07

LOG OF BORING NO. B-04

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

Boring Location: Pier 4 Note: Surface elevation measured from Benchmark P-13 (1927 datum) located on North side of Pier 10. Boring drilled from river channel.

Approx. Surface Elev.: 733.70 ft

GRAPHIC LOG	DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
	5	SP		SS	12	3	4	7			
	10										
	15	SP		SS	16	1	1	1			
	20										
	25			SS	19	12	15	24		91	
	30									86	61

POORLY GRADED SAND; some gravel, brown to light brown, medium dense, Alluvial fill with decaying debris.

very loose.

21.1 712.5

PORTLAND CEMENT CONCRETE; grey, single piece wood plank with concrete attatched, thought to be edge of footing and form work.

25.6 708

AGGLOMERATE; red brown to light brown, hard, gravel and cobble sized clasts, slight to moderate weathering.

Continued Next Page

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 5WCI, 11/15/06	▼
WL	▼	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED	11-14-06		
BORING COMPLETED	11-14-06		
RIG	Burley 4000	FOREMAN	AJS
APPROVED	SDN	JOB #	65055196

LOG OF BORING NO. B-04

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
	AGGLOMERATE; red brown to light brown, hard, gravel and cobble sized clasts, slight to moderate weathering.	35									95	45
		40									97	63
	41 692.5 **Bottom of BORING.**											

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 5VGI, 11/15/06	▼
WL	▼	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED	11-14-06		
BORING COMPLETED	11-14-06		
RIG	Burley 4000	FOREMAN	AJS
APPROVED	SDN	JOB #	65055196

CORE LOG 2000 65055196.US 80 BRIDGE.GPJ TERR2000.GDT 1/29/07

LOG OF BORING NO. B-05

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

Boring Location: Pier 5 Note: Surface elevation measured from Benchmark P-13 (1927 datum) located on North side of Pier 10. Boring drilled from river channel.

Approx. Surface Elev.: 734.22 ft

DEPTH, ft.	USCS SYMBOL	SAMPLES GRAPHIC	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/1st 6"	SAMPLES BLOWS/2nd 6"	SAMPLES BLOWS/3rd 6"	CORE DATA METHOD OF DRILLING	CORE DATA RECOVERY (%)	CORE DATA RQD (%)
10	SM	X	SS	9	2	1	50/3"			
30									89	

POORLY GRADED SAND; some cobbles, brown, Alluvial fill.

4.7 — 729.5

POORLY GRADED SAND WITH GRAVEL; some cobbles, brown. ▽ lense of black cuttings.

8 — 726

SILTY SAND WITH GRAVEL; some cobbles, brown, medium dense to very dense, some decaying debris.

loose, flowing sands.

28 — 706

PORTLAND CEMENT CONCRETE; grey, Pier Foundation.

Continued Next Page

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 6WCI, 11/14/06	▼
WL	▼	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED	11-13-06
BORING COMPLETED	11-13-06
RIG Burley 4000	FOREMAN AJS
APPROVED SDN	JOB # 65055196

LOG OF BORING NO. B-05

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES GRAPHIC	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/1st 6"	SAMPLES BLOWS/2nd 6"	SAMPLES BLOWS/3rd 6"	CORE DATA METHOD OF DRILLING	CORE DATA RECOVERY (%)	CORE DATA RQD (%)
	PORTLAND CEMENT CONCRETE; grey, Pier Foundation.											
	35 699	35									100	
	AGGLOMERATE; some gravel, brown to light brown, hard, slight to moderate weathering, gravel and cobble sized clasts.			X	SS	18	15	18	29		100	100
		40									74	50
		45									100	78
		50									92	92
	51.4 683											
	Bottom of BORING.											

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 6VC, 11/14/06	▼
WL	▼	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED			11-13-06
BORING COMPLETED			11-13-06
RIG	Burley 4000	FOREMAN	AJS
APPROVED	SDN	JOB #	65055196

CORE LOG 2000 65055196.US 80 BRIDGE.GPJ TERR2000.GDT 1/29/07

LOG OF BORING NO. B-06

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

Boring Location: Pier 6 Note: Surface elevation measured from Benchmark P-13 (1927 datum) located on North side of Pier 10. Boring drilled from river channel.

Approx. Surface Elev.: 732.68 ft

GRAPHIC LOG	DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
SANDY LEAN CLAY; brown, Alluvial fill.	5										
5 727.5											
POORLY GRADED SAND; trace gravel, light brown to grey, very loose.	5	SP	X	SS		2	1	1			
gravel and cobble lense from 8.5' to 9.5'.	10										
24 708.5	15										
POORLY GRADED SAND WITH GRAVEL; some cobbles, light brown to grey.	20										
30.5 702	25										
Continued Next Page	30										

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 3\6CI, 11/8/06	▼ 5VCI, 11/13/06
WL	▽	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED	11-8-06		
BORING COMPLETED	11-9-06		
RIG	Burley 4000	FOREMAN	SS
APPROVED	SDN	JOB #	65055196

LOG OF BORING NO. B-06

CLIENT: Transystems, Corporation

ENGINEER:

SITE: Maricopa County, Arizona

PROJECT: Rehabilitation of the Old US 80 Bridge at the Gila River

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
	PORTLAND CEMENT CONCRETE; grey, Pier Foundation.	35									100	
											96	
											100	
	38.8 694											
	AGGLOMERATE; red brown, hard, slight to moderate weathering, gravel and cobble sized clasts.	40		X	SS		6	9	16			
											59	80
	weak cementation.	45									84	50
		50									94	54
		55									90	29
	60.6 672	60										
	Bottom of BORING.											

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

DRILLING COMPANY: CRUX

DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft

WL	▽ 3\6'CI, 11/8/06	▼ 5'CI, 11/13/06
WL	▽	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED			11-8-06
BORING COMPLETED			11-9-06
RIG	Burley 4000	FOREMAN	SS
APPROVED	SDN	JOB #	65055196

LOG OF BORING NO. B-07

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

Boring Location: Pier 7 Note: Surface elevation measured from Benchmark P-13 (1927 datum) located on North side of Pier 10. Boring drilled from river channel.

Approx. Surface Elev.: 735.47 ft

DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)	Description
0											**CLAYEY SAND**; grey to dark grey, Alluvial fill.
14											▽ 721.5
15	SP SC	X	SS		2	2	1				**POORLY GRADED SAND WITH CLAY**; dark grey, very loose.

Continued Next Page

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft

WL	▽ 14	WD	▽ 7\6Cl, 11/8/06
WL	▽ 7\8Cl,11/18/06		▽
WL	Casing Installed Upon Completion		

Terracon

BORING STARTED	11-7-06		
BORING COMPLETED	11-7-06		
RIG	Burley 4000	FOREMAN	SS
APPROVED	SDN	JOB #	65055196

LOG OF BORING NO. B-07

CLIENT: Transystems, Corporation

ENGINEER:

SITE: Maricopa County, Arizona

PROJECT: Rehabilitation of the Old US 80 Bridge at the Gila River

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
	POORLY GRADED SAND WITH CLAY; dark grey, very loose. gravel lense.											
	39 696.5	35										
	PORTLAND CEMENT CONCRETE; grey, Pier Foundation.	40									57	
		45									94	
											100	
	48.6 687	50									56	36
	AGGLOMERATE; red brown, hard, slight to moderate weathering, gravel and cobble sized clasts.										93	65
		55									75	45
											98	56
	60.5 675	60										
	Bottom of BORING.											

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft

WL	▽ 14	WD	▽ 7\6CI, 11/8/06
WL	▽ 7\8CI,11/18/06		▽
WL	Casing Installed Upon Completion		

Terracon

BORING STARTED	11-7-06		
BORING COMPLETED	11-7-06		
RIG	Burley 4000	FOREMAN	SS
APPROVED	SDN	JOB #	65055196

CORE LOG 2000 65055196.US 80 BRIDGE.GPJ TERR2000.GDT 1/29/07

LOG OF BORING NO. B-08

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

GRAPHIC LOG

Boring Location: Pier 8 Note: Surface elevation measured from Benchmark P-13 (1927 datum) located on North side of Pier 10. Boring drilled from river channel.

Approx. Surface Elev.: 736.08 ft

SANDY LEAN CLAY; brown, Alluvial fill.

8 728

POORLY GRADED SAND; trace gravel, light brown to grey, very loose.

13 723

POORLY GRADED SAND WITH GRAVEL; some cobbles, light brown to grey.

wood debris.

Continued Next Page

DEPTH, ft.	USCS SYMBOL	SAMPLES GRAPHIC	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/1st 6"	SAMPLES BLOWS/2nd 6"	SAMPLES BLOWS/3rd 6"	CORE DATA METHOD OF DRILLING	CORE DATA RECOVERY (%)	CORE DATA RQD (%)
10	SP	X	SS		2	1	2			

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 8.2	WCI	▽ WCI, 11/7/2006
WL	▽		▽
WL	Casing Installed Upon Completion		

Terracon

BORING STARTED			11-6-06
BORING COMPLETED			11-7-06
RIG	Burley 4000	FOREMAN	SS
APPROVED	SDN	JOB #	65055196

CORE LOG 2000 65055196.US 80 BRIDGE.GPJ TERR2000.GDT 1/29/07

LOG OF BORING NO. B-08

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
	32 704											
	PORTLAND CEMENT CONCRETE; grey, Pier Foundation.										74	
	37 699	35										
	IGNEOUS BEDROCK-BASALT; grey, moderately hard to hard, moderately severe weathering, Clay infill in fractures.										100	89
	moderate to moderately severe weathering.	40									100	39
											93	0
		45									92	38
	50.5 685.5	50										
	Bottom of BORING.											

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 8.2	WCI	▽ WCI, 11/7/2006
WL	▽		▽
WL	Casing Installed Upon Completion		

Terracon

BORING STARTED			11-6-06
BORING COMPLETED			11-7-06
RIG	Burley 4000	FOREMAN	SS
APPROVED	SDN	JOB #	65055196

CORE LOG 2000 65055196.US 80 BRIDGE.GPJ TERR2000.GDT 1/29/07

LOG OF BORING NO. B-09

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

Boring Location: Pier 9 Note: Surface elevation measured from Benchmark P-13 (1927 datum) located on North side of Pier 10. Boring drilled from river channel.

Approx. Surface Elev.: 737.09 ft

DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
0										
5										
10										
	SP								27	
15										
	SP								43	
20									100	
									92	52
25										
									38	0
30										

SANDY LEAN CLAY; dark brown, Alluvial fill with occasional gravel and cobbles.

light brown.

9 728

POORLY GRADED SAND; some gravel, light brown.

19.3 718

PORTLAND CEMENT CONCRETE; grey, Pier Foundation.

23.9 713

AGGLOMERATE; red brown, hard, weathered Basalt gravels and cobbles, slight to moderate weathering.

Continued Next Page

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

DRILLING COMPANY: CRUX

DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft

WL	▽ 9.6	WD	▼ 10.3 CI, 11/7/06
WL	▼ 9.5 CI, 11/18/06		▼
WL	Casing Installed Upon Completion		

Terracon

BORING STARTED	11-6-06		
BORING COMPLETED	11-6-06		
RIG	Burley 4000	FOREMAN	SS
APPROVED	SDN	JOB #	65055196

LOG OF BORING NO. B-09

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

GRAPHIC LOG	DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
AGGLOMERATE; red brown, hard, weathered Basalt gravels and cobbles, slight to moderate weathering.	35									89	0
37.1			X	SS	700	50/9"					
Bottom of BORING.											

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft

WL	▽ 9.6	WD	▼ 10 WCI, 11/7/06
WL	▼ 9 WCI, 11/18/06		▼
WL	Casing Installed Upon Completion		

Terracon

BORING STARTED	11-6-06		
BORING COMPLETED	11-6-06		
RIG	Burley 4000	FOREMAN	SS
APPROVED	SDN	JOB #	65055196

LOG OF BORING NO. B-10

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

Boring Location: Pier 10 Note: Surface elevation measured from Benchmark P-13 (1927 datum) located on North side of Pier 10. Boring drilled from roadway surface.

Approx. Surface Elev.: 751.76 ft

DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)	Description
0.2 / 751.5											**ASPHALT**; black, 2-inch Asphalt cap.
0.9 / 751											**PORTLAND CEMENT CONCRETE**; grey, 8" Concrete bridge deck.
											SILTY, CLAYEY SAND; some gravel, brown, medium dense, Alluvial Fill.
5											
10	SC SM	X	SS	14	5	5	5				
11.5 / 740.5											**SILTY, CLAYEY SAND WITH GRAVEL**; brown, some Basalt cobbles.
15	SC SM								67		
20	SC SM								53		
24.9 / 727											**PORTLAND CEMENT CONCRETE**; grey, Pier Foundation, wood pannel frame encountered from 26.3' to 27.2'.
25	SC SM								32		
									100		
30									94		

Continued Next Page

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

DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED	11-18-06
BORING COMPLETED	11-18-06
RIG Burley 4000	FOREMAN AJS
APPROVED SDN	JOB # 65055196

LOG OF BORING NO. B-10

CLIENT: **Transystems, Corporation**

ENGINEER:

SITE: **Maricopa County, Arizona**

PROJECT: **Rehabilitation of the Old US 80 Bridge at the Gila River**

GRAPHIC LOG	DEPTH, ft.	USCS SYMBOL	SAMPLES: GRAPHIC	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/1st 6"	SAMPLES: BLOWS/2nd 6"	SAMPLES: BLOWS/3rd 6"	CORE DATA: METHOD OF DRILLING	CORE DATA: RECOVERY (%)	CORE DATA: RQD (%)
32.1 719.5 **AGGLOMERATE**; brown to red brown, hard, slight to moderate weathering, gravel and cobble sized clasts.	35									100	55
			X	SS	6	6	16	43		75	0
	40									38	0
										97	0
42.8 709 **Bottom of BORING.**											

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

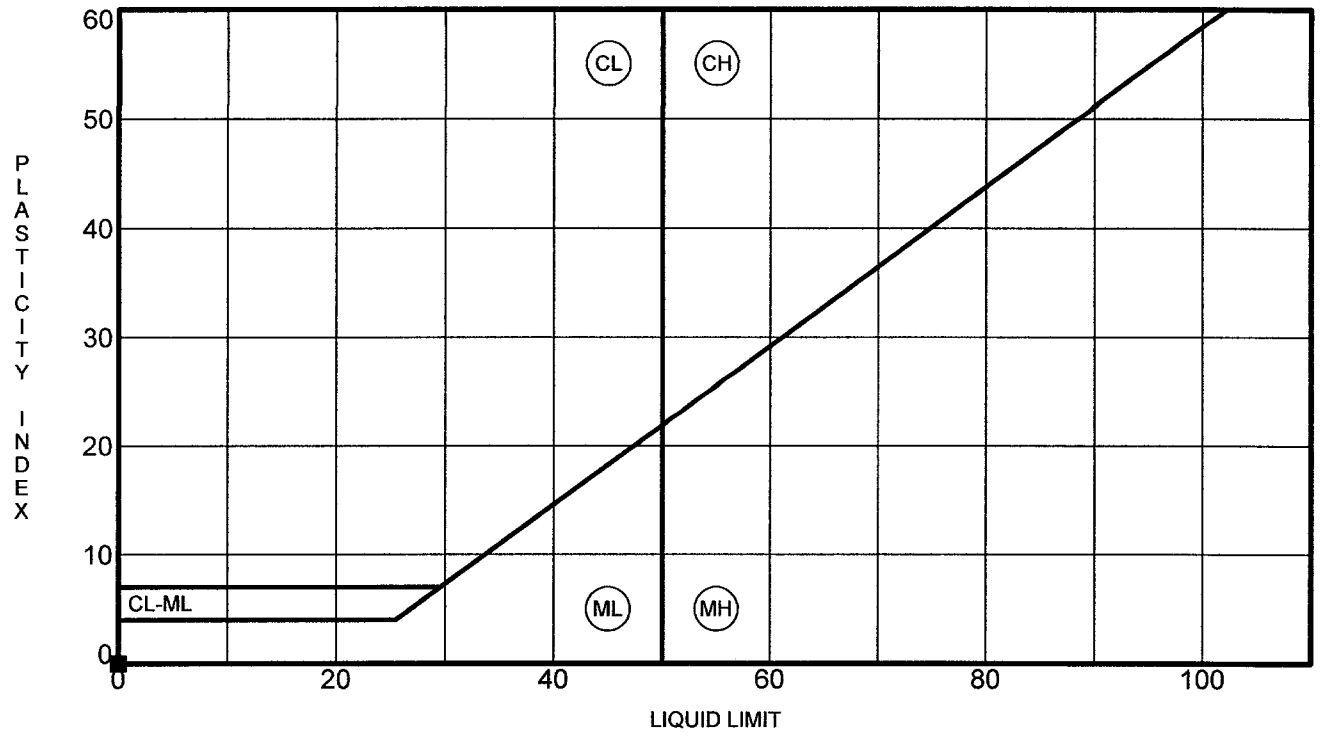
DRILLING COMPANY: CRUX
DRILLING FOREMAN: Andy Gold

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▼	▼
WL	Casing Installed Upon Completion	

Terracon

BORING STARTED	11-18-06		
BORING COMPLETED	11-18-06		
RIG	Burley 4000	FOREMAN	AJS
APPROVED	SDN	JOB #	65055196

CORE LOG 2000 65055196.US 80 BRIDGE.GPJ TERR2000.GDT 1/29/07



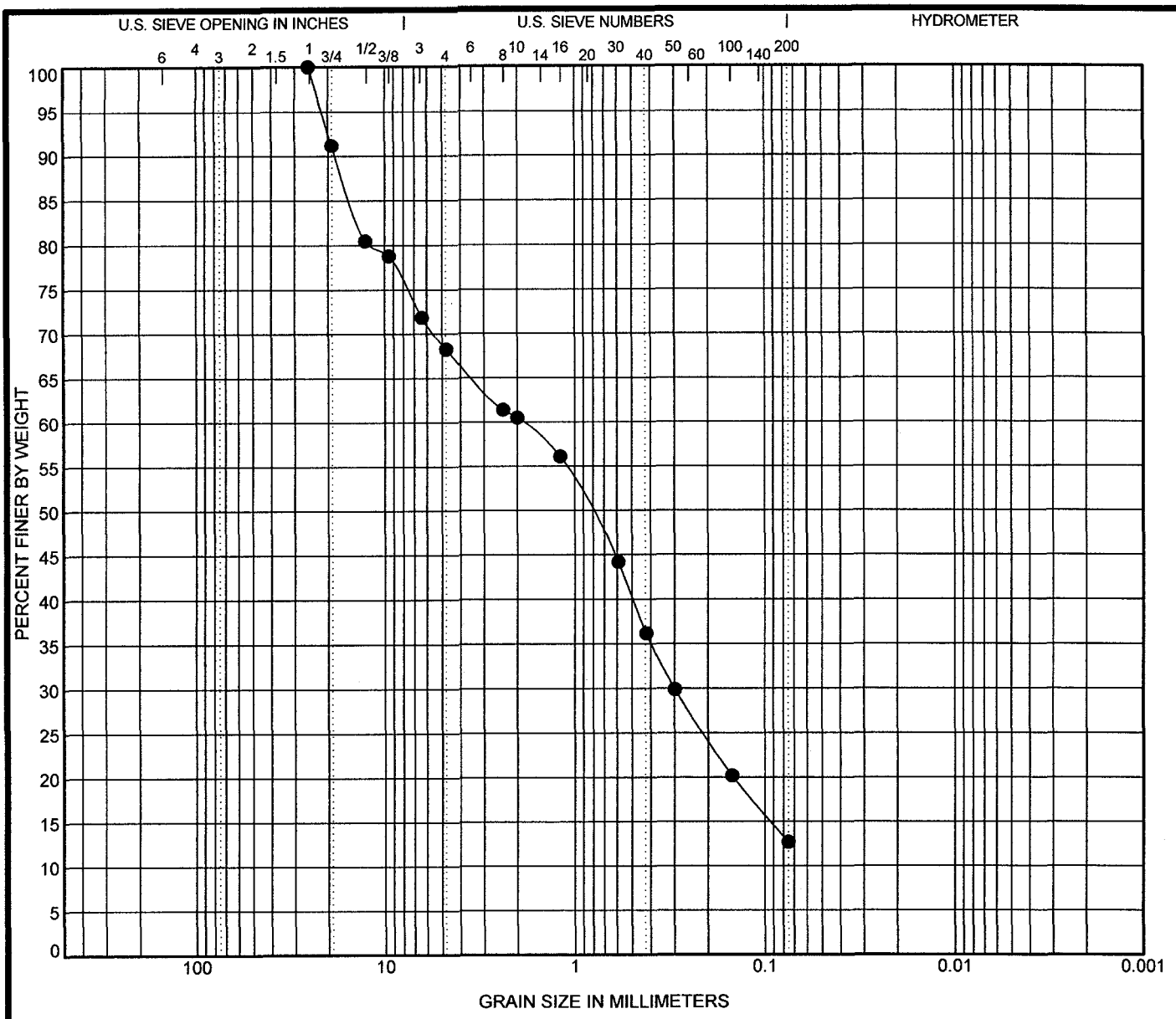
Specimen Identification			LL	PL	PI	%-#200	Soil Description
●	B-01	10.0ft	NP	NP	NP	13	SILTY SAND with GRAVEL(SM)
⊠	B-04	5.0ft	NP	NP	NP	3	POORLY GRADED SAND(SP)
▲	B-04	15.0ft	NP	NP	NP	2	POORLY GRADED SAND(SP)
★	B-05	10.0ft	NP	NP	NP	22	SILTY SAND with GRAVEL(SM)
⊙	B-06	5.0ft	NP	NP	NP	12	SILTY SAND(SM)
✿	B-07	14.0ft	NP	NP	NP	18	SILTY SAND with GRAVEL(SM)
○	B-08	9.5ft	NP	NP	NP	9	POORLY GRADED SAND with SILT(SP-SM)
△	B-09	36.5ft	NP	NP	NP	4	WELL-GRADED GRAVEL with SAND(GW)
⊗	B-10	9.5ft	NP	NP	NP	60	SANDY SILT(ML)
⊕	B-10	36.5ft	NP	NP	NP	18	SILTY SAND with GRAVEL(SM)

Terracon

ATTERBERG LIMITS RESULTS

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC ATTERBERG LIMITS 65055196.US 80 BRIDGE.GPJ TERRACON.GDT 1/29/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
● **B-01**	**10.0 ft**	**SILTY SAND with GRAVEL(SM)**	**NP**	**NP**	**NP**		

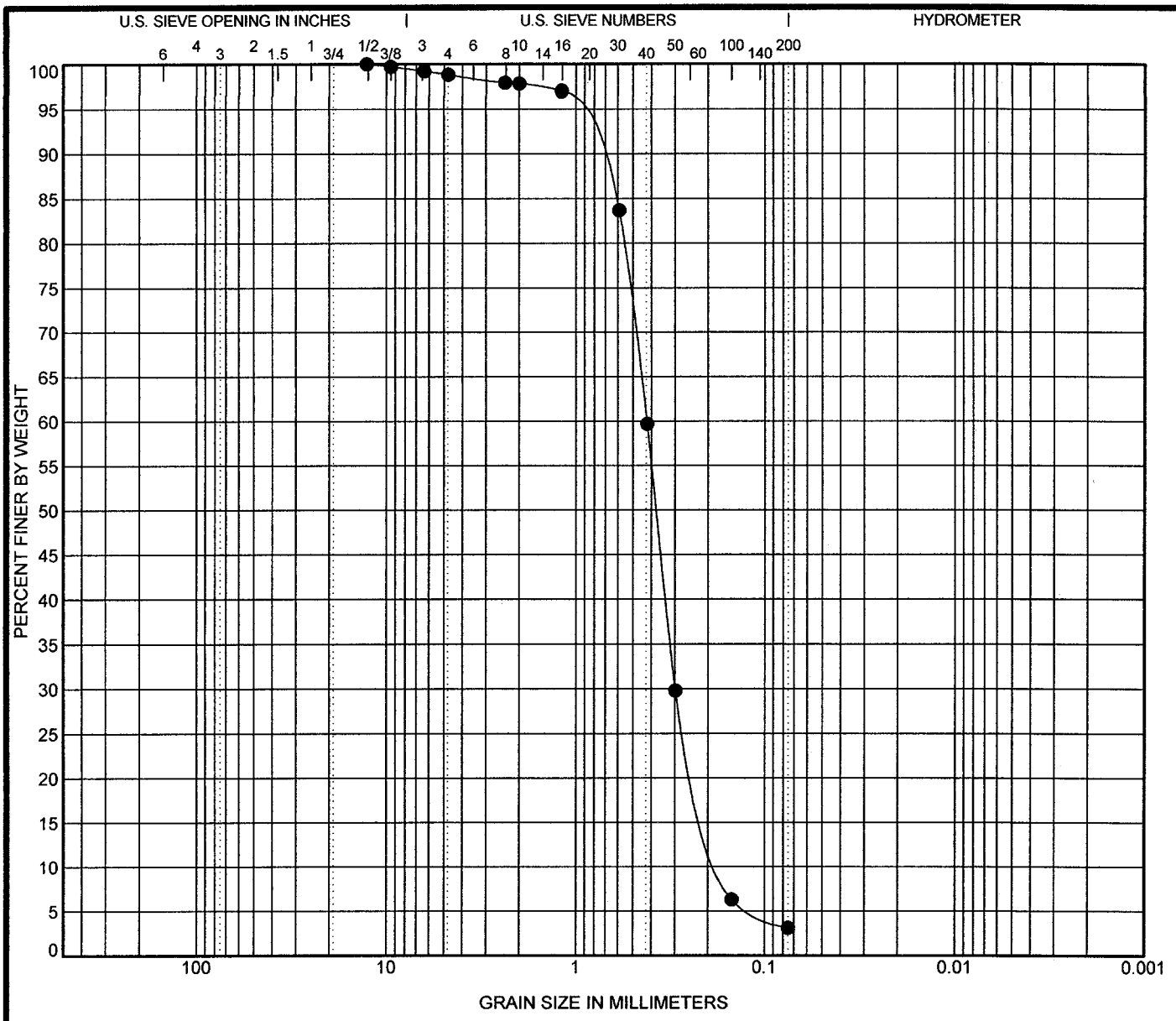
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-01**	**10.0 ft**	**25.4**	**1.885**	**0.299**		**31.7**	**55.6**	**12.7**	

Terracon

GRAIN SIZE DISTRIBUTION

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC GRAIN SIZE 65055196 US 80 BRIDGE.GPJ TERRACON.GDT 1/29/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**B-04**	**5.0 ft**	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**1.26**	**2.54**

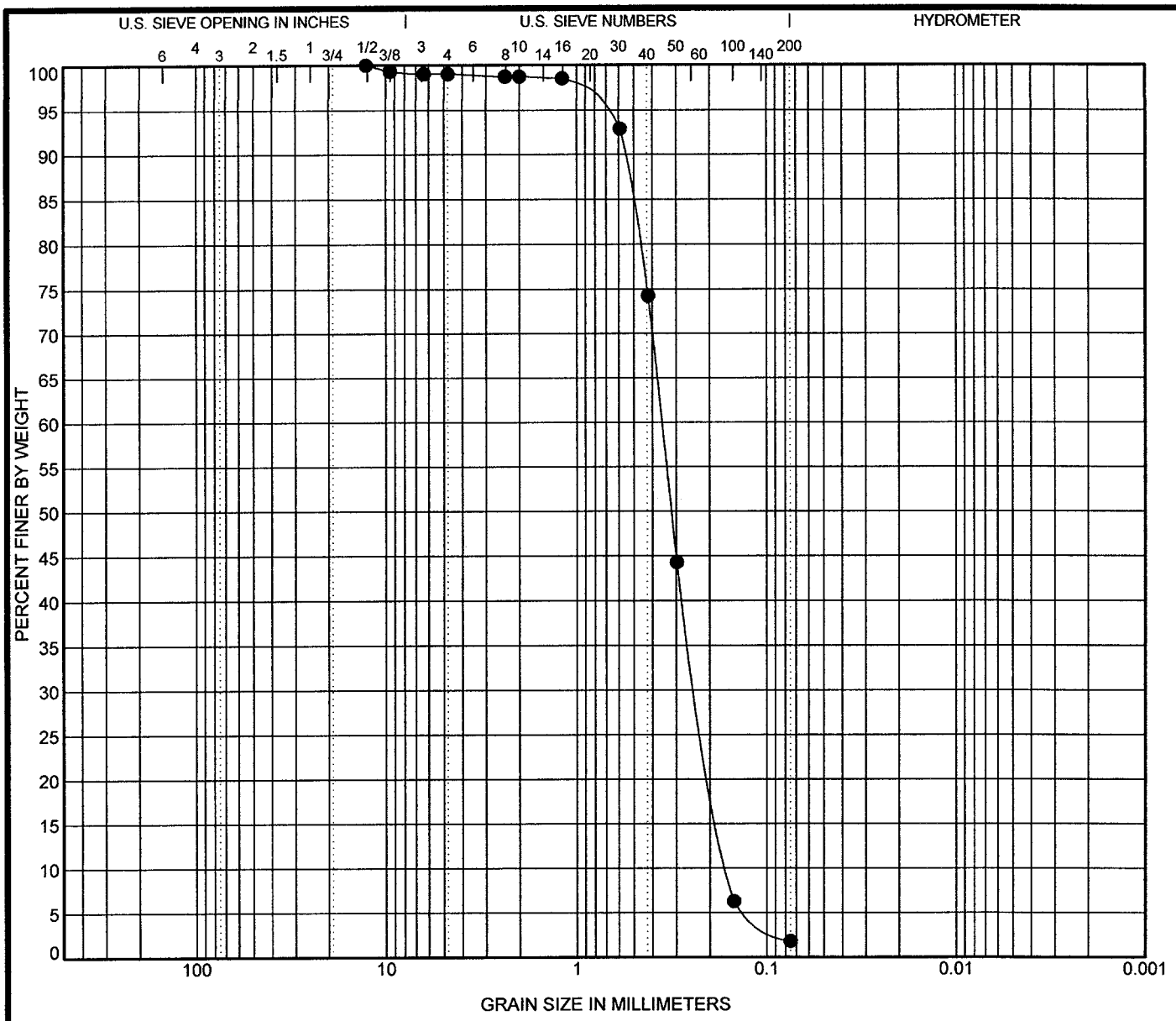
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-04**	**5.0 ft**	**12.7**	**0.422**	**0.298**	**0.166**	**1.2**	**95.7**	**3.1**	

Terracon

GRAIN SIZE DISTRIBUTION

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC GRAIN SIZE 65055196 US 80 BRIDGE.GPJ TERRACON.GDT 1/29/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
● **B-04**	**15.0 ft**	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**0.93**	**2.23**

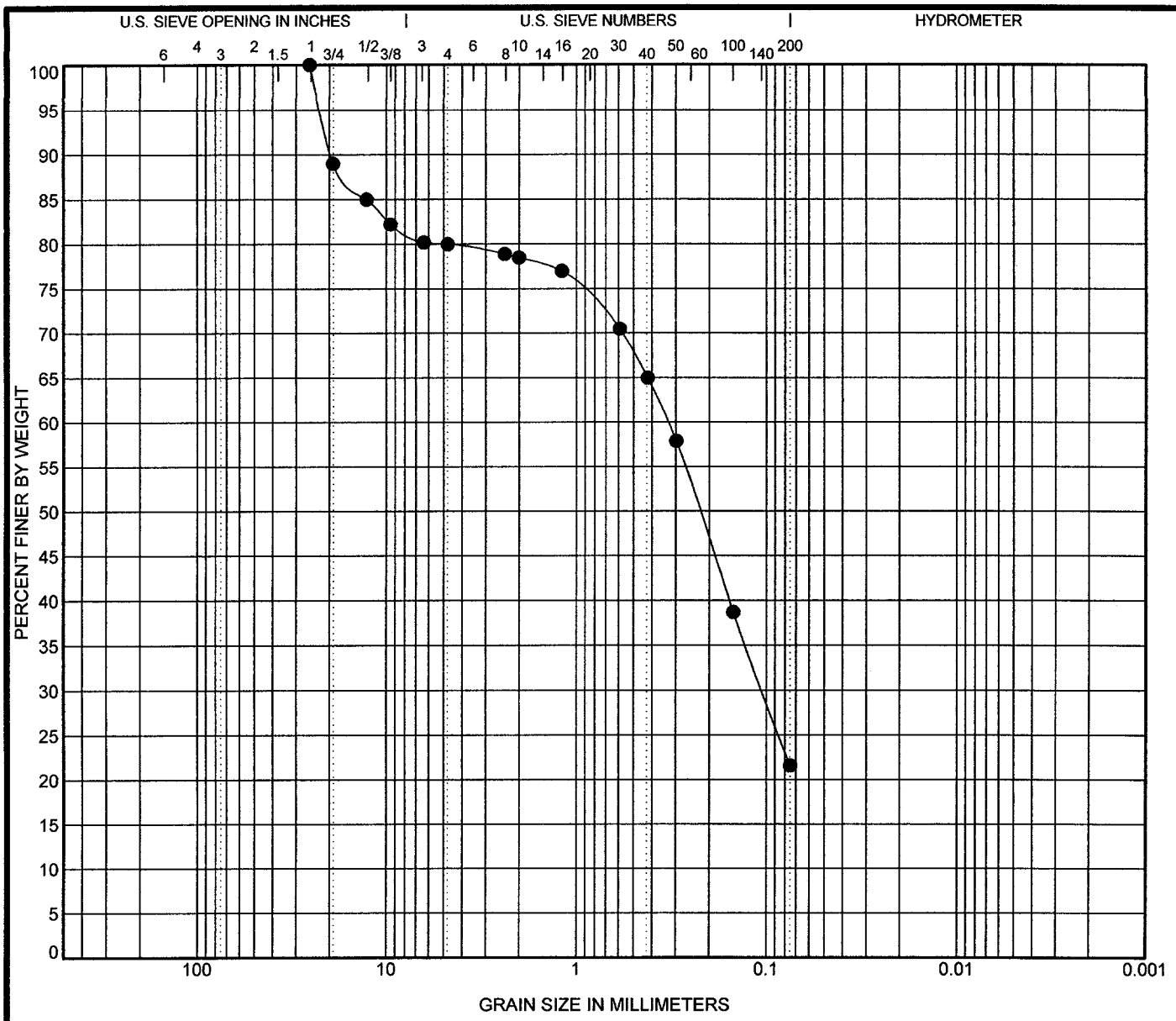
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-04**	**15.0 ft**	**12.7**	**0.356**	**0.229**	**0.159**	**1.0**	**97.2**	**1.8**	

Terracon

GRAIN SIZE DISTRIBUTION

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC_GRAIN_SIZE_65055196.US 80 BRIDGE.GPJ_TERRACON.GDT 1/29/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**B-05**	**10.0 ft**	**SILTY SAND with GRAVEL(SM)**	**NP**	**NP**	**NP**		

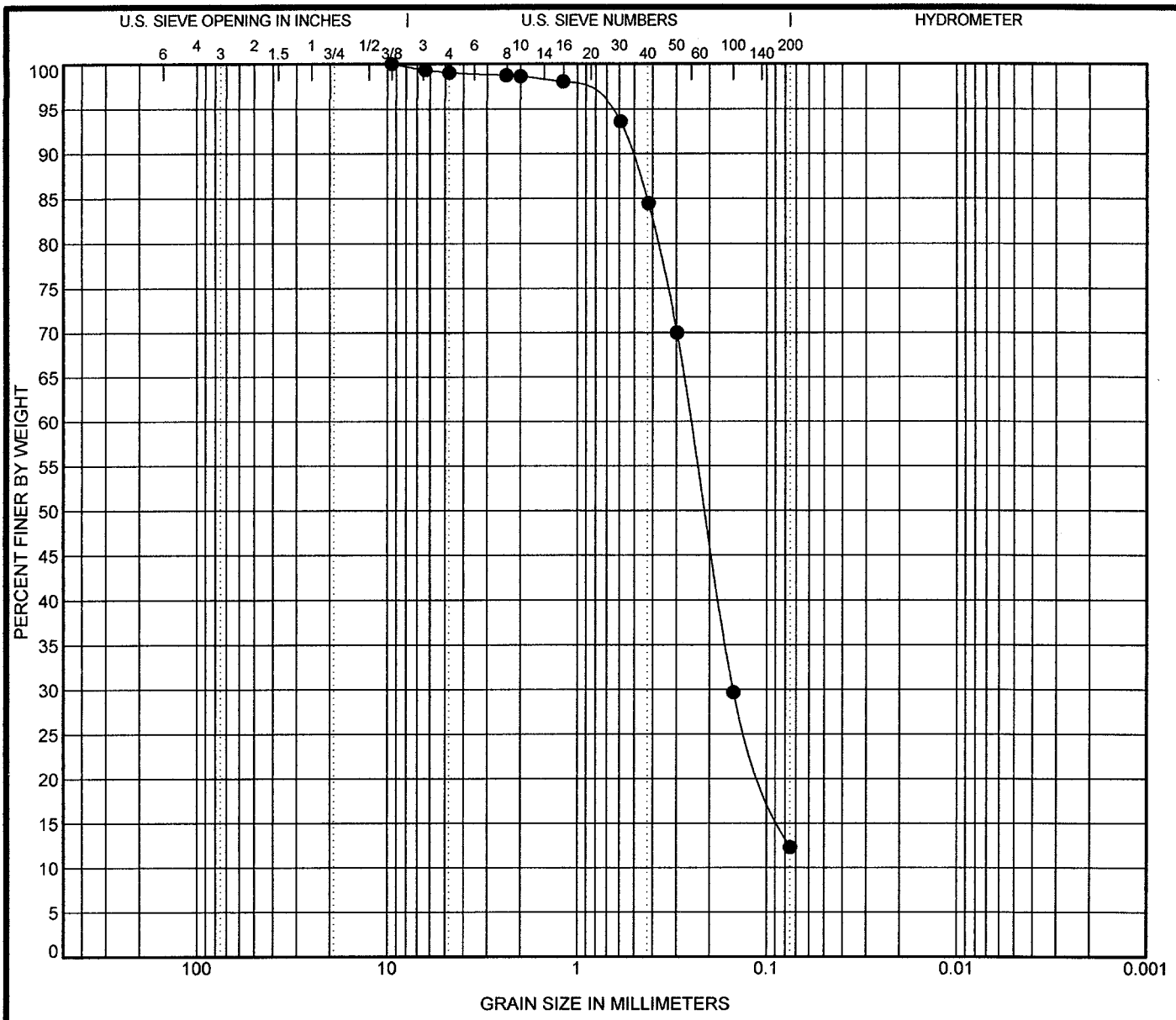
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-05**	**10.0 ft**	**25.4**	**0.329**	**0.105**		**20.0**	**58.4**	**21.6**	

Terracon

GRAIN SIZE DISTRIBUTION

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC_GRAIN_SIZE 65055196.US 80 BRIDGE.GPJ TERRACON.GDT 1/29/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	B-06	5.0 ft	SILTY SAND(SM)	NP	NP	NP	1.31	3.65

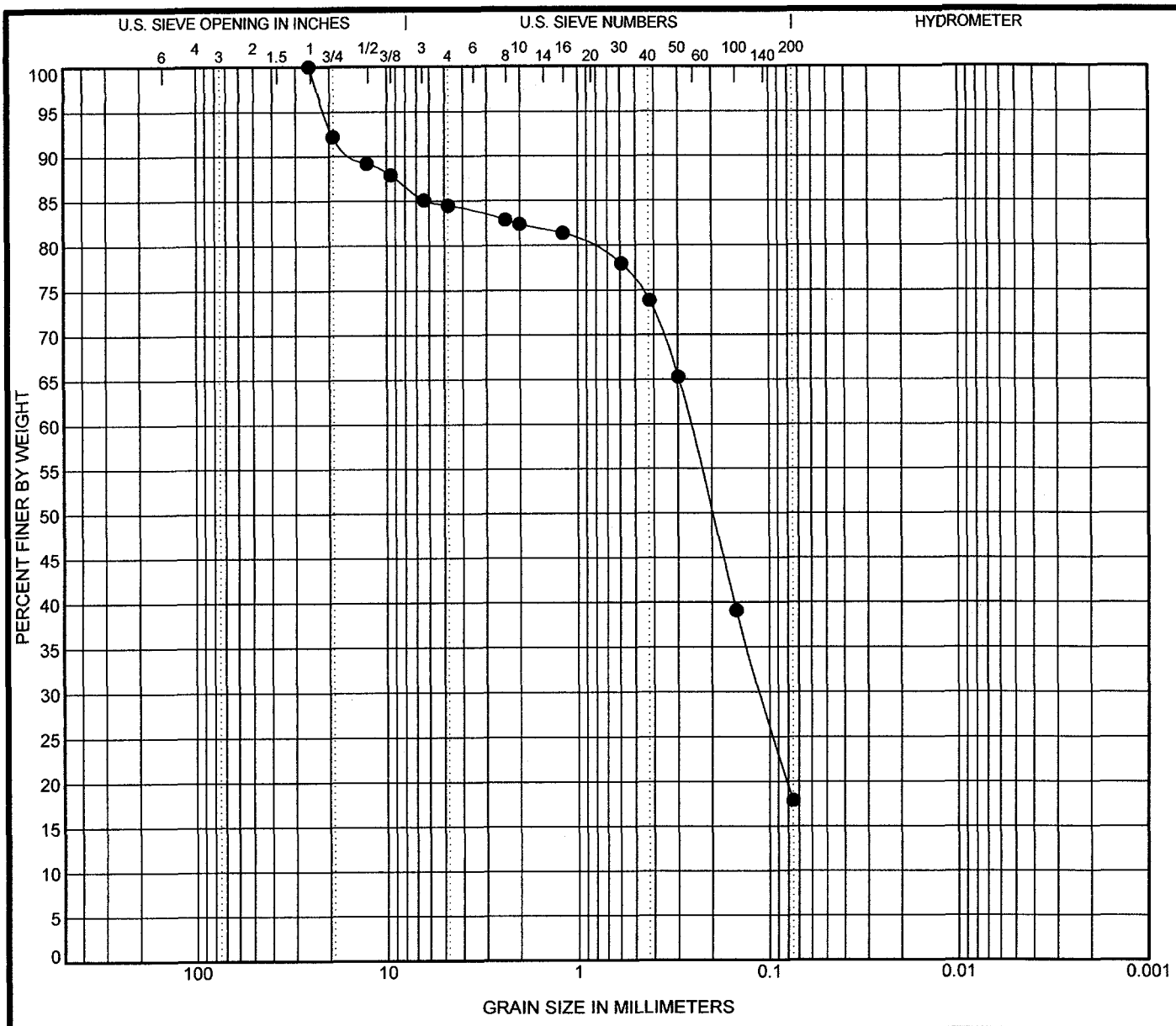
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-06	5.0 ft	9.5	0.25	0.15		1.0	86.7	12.3	

Terracon

GRAIN SIZE DISTRIBUTION

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC GRAIN SIZE 65055196.US 80 BRIDGE.GPJ TERRACON.GDT 1/29/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
● **B-07**	**14.0 ft**	**SILTY SAND with GRAVEL(SM)**	**NP**	**NP**	**NP**		

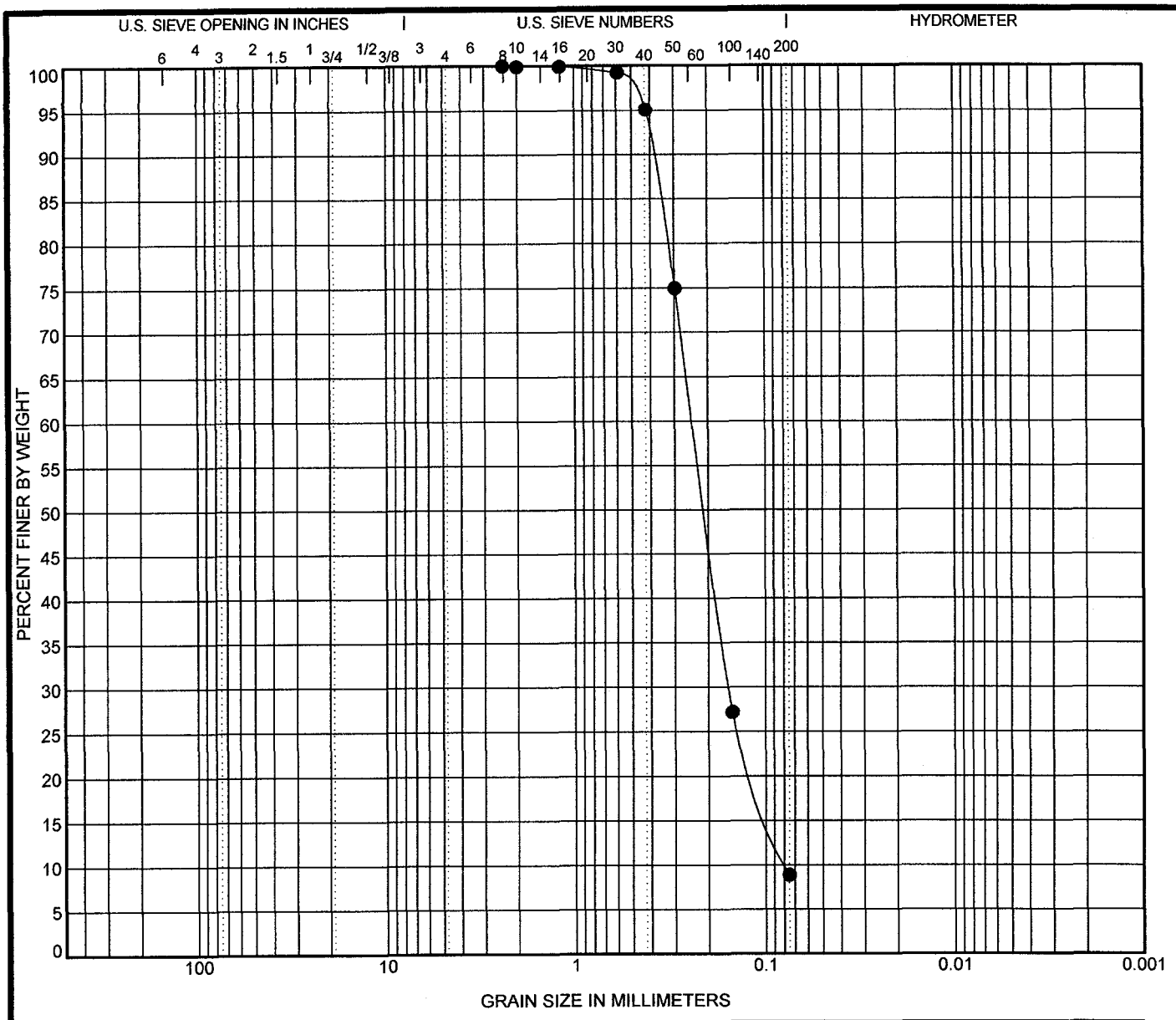
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-07**	**14.0 ft**	**25.4**	**0.258**	**0.111**		**15.5**	**66.6**	**17.9**	

Terracon

GRAIN SIZE DISTRIBUTION

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC GRAIN SIZE 65055196.US 80 BRIDGE.GPJ TERRACON.GDT 1/29/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	B-08	9.5 ft	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.29	3.06

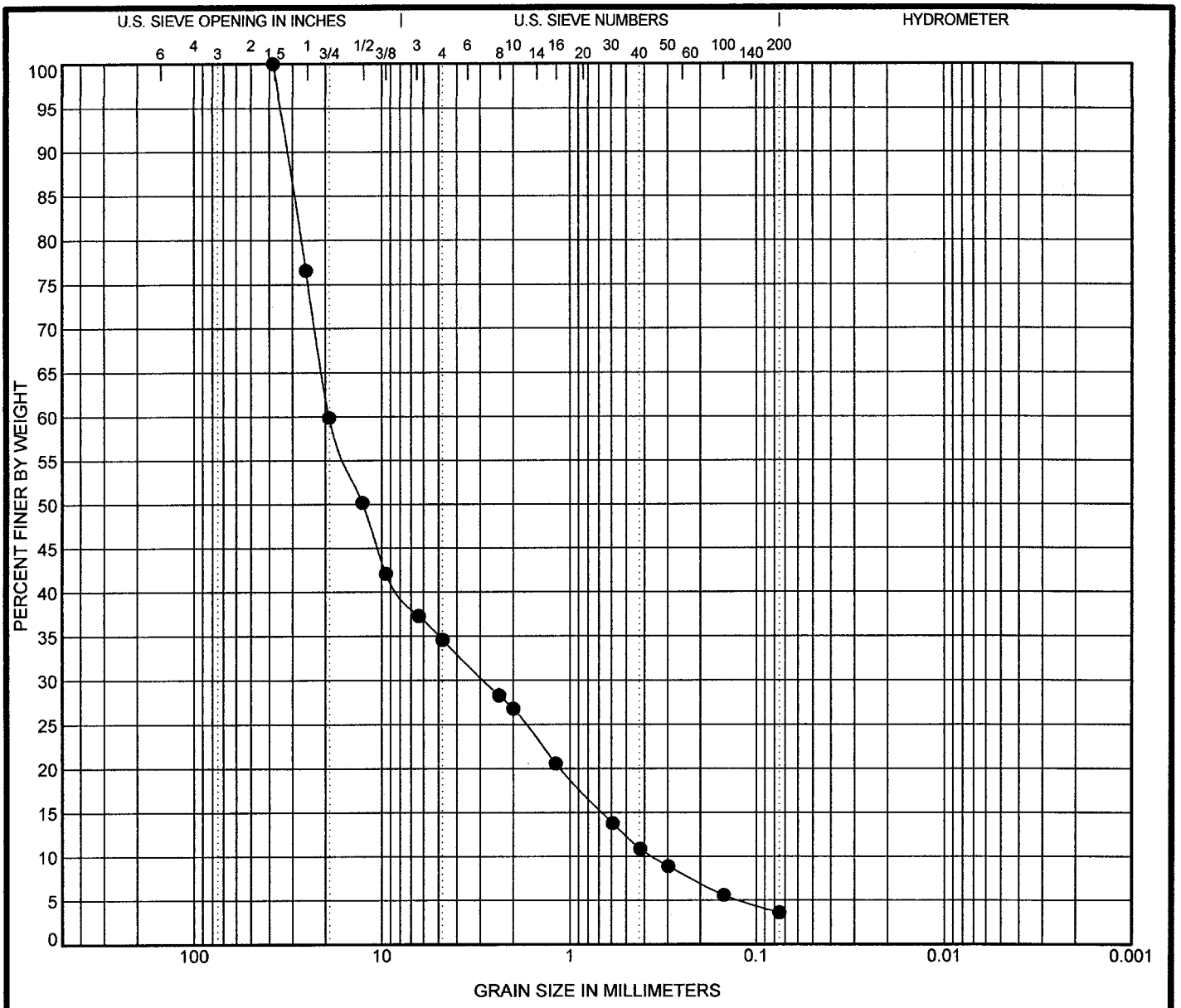
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-08	9.5 ft	2.38	0.239	0.155	0.078	0.0	91.1	8.9	

Terracon

GRAIN SIZE DISTRIBUTION

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC GRAIN SIZE 65055196.US 80 BRIDGE.GPJ TERRACON.GDT 1/29/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**B-09**	**36.5 ft**	**WELL-GRADED GRAVEL with SAND(GW)**	**NP**	**NP**	**NP**	**1.20**	**53.24**

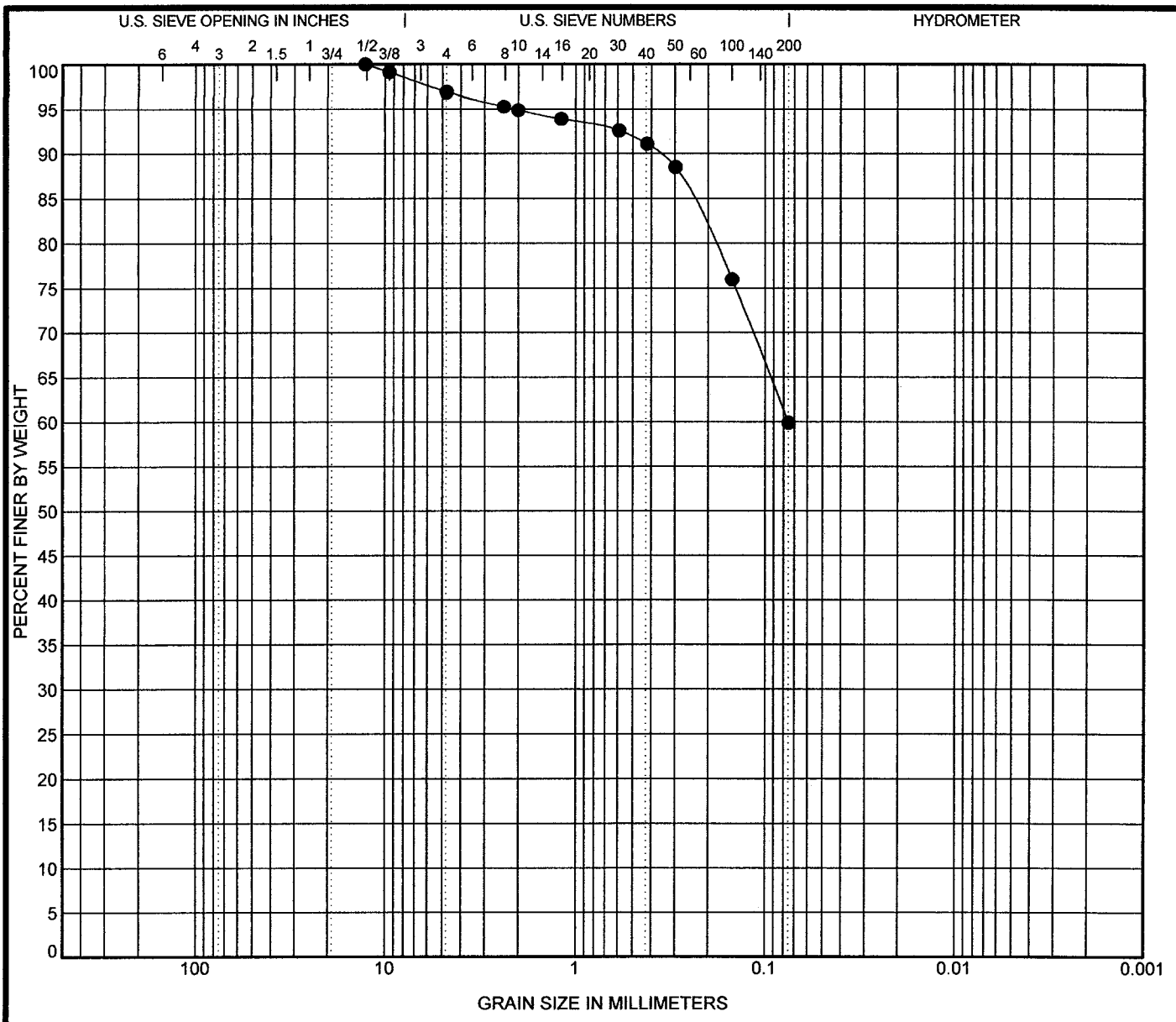
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-09**	**36.5 ft**	**38.1**	**19.133**	**2.868**	**0.359**	**65.4**	**31.0**	**3.6**	

Terracon

GRAIN SIZE DISTRIBUTION

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC_GRAIN_SIZE_65055196.US 80 BRIDGE.GPJ_TERRACON.GDT 1/29/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**B-10**	**9.5 ft**	**SANDY SILT(ML)**	**NP**	**NP**	**NP**		

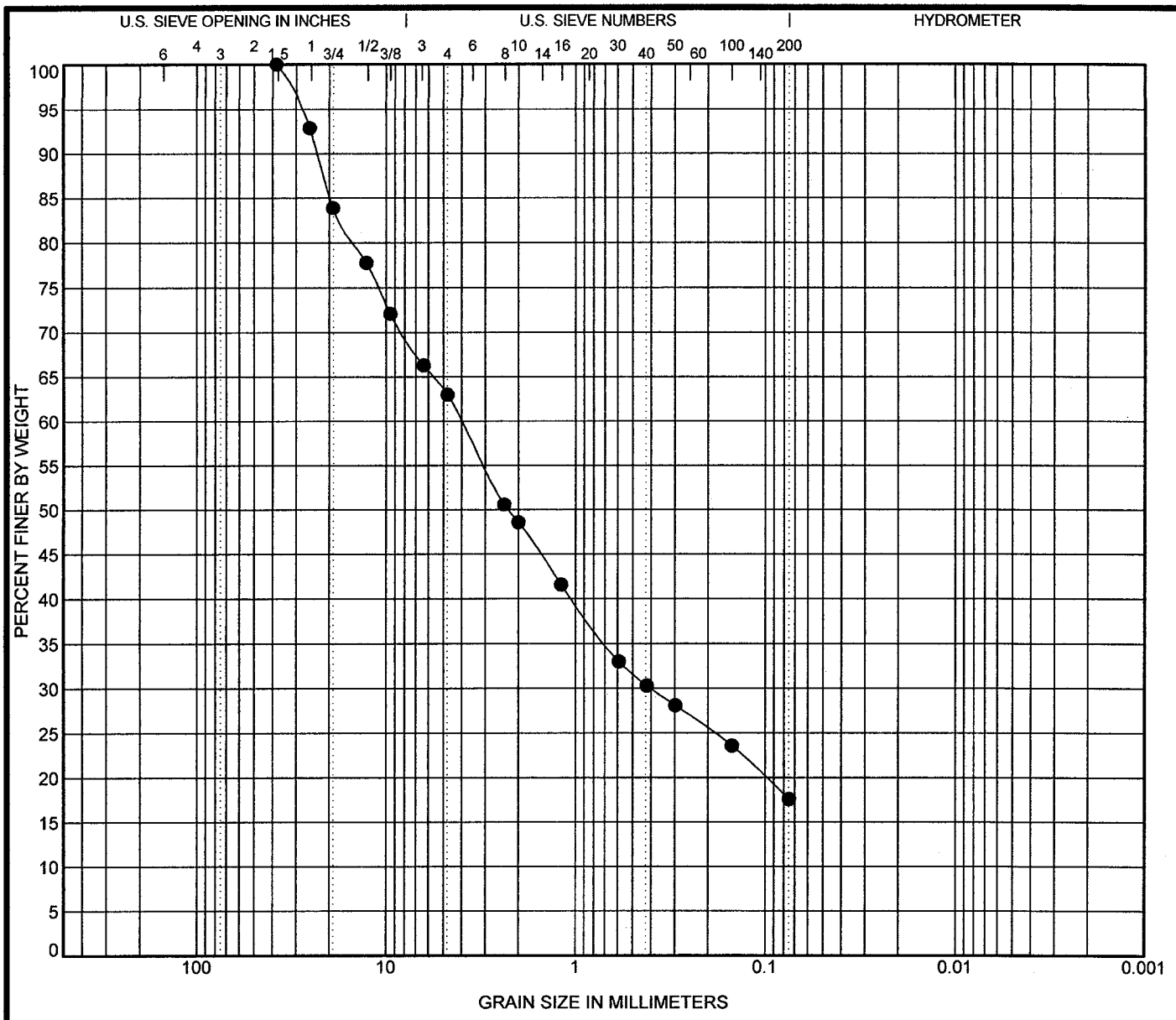
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-10**	**9.5 ft**	**12.7**	**0.075**			**3.1**	**37.0**	**59.9**	

Terracon

GRAIN SIZE DISTRIBUTION

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC_GRAIN_SIZE 65055196.US 80 BRIDGE.GPJ TERRACON.GDT 1/29/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	B-10	36.5 ft	SILTY SAND with GRAVEL(SM)	NP	NP	NP		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-10	36.5 ft	38.1	4.019	0.401		37.0	45.4	17.6	

Terracon

GRAIN SIZE DISTRIBUTION

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

TC_GRAIN_SIZE_65055196.US 80 BRIDGE.GPJ_TERRACON.GDT_1/29/07

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SULFATE SOUNDNESS OF AGGREGATES

4685 South Ash Ave, H-4
Tempe, AZ 85282
480-897-8200

CLIENT: _____ LAB NO. _____

PROJECT NUMBER: 65055196

PROJECT NAME: US 80 Bridge SAMPLED BY: _____

MATERIAL TYPE: Crushed Rock Core DATE SAMPLED: _____

MATERIAL SOURCE: _____ SUBMITTED BY: _____

LOCATION: _____

Test Procedure:

☐ AASHTO T104 ☑ ASTM C88 ☑ SODIUM SULFATE ☐ MAGNESIUM SULFATE

Coring/Boring Location	Depth (ft)	Size	Size	Size	Average (%) Loss	Weighted (%) Loss
B1	30-35	**1.5"-3/4"**	**3/4"-3/8"**	**3/8"-#4**	46.7	**47.4**
		1294.1	995	299.5		
		668.3	528	165.1		
		48.4	46.9	44.9		
B2	51.3-56.3	**1.5"-3/4"**	**3/4"-3/8"**	**3/8"-#4**	14.5	**14.8**
		1344.1	1003.6	300.2		
		1114.9	882.3	257.5		
		17.1	12.1	14.2		
B3	17.8-19.8	**1.5"-3/4"**	**3/4"-3/8"**	**3/8"-#4**	88.1	**87.7**
		675.4	875.1	295.7		
		68.6	124.5	33.4		
		89.8	85.8	88.7		
B9	26.5-36.3	**1.5"-3/4"**	**3/4"-3/8"**	**3/8"-#4**	15.0	**13.8**
		1496.6	999.8	303.1		
		1285.2	883.8	244.3		
		14.1	11.6	19.4		
B10	32.5-35.0	**1.5"-3/4"**	**3/4"-3/8"**	**3/8"-#4**	9.3	**9.3**
		1082.4	966	299.7		
		982	877	271.1		
		9.3	9.2	9.5		
B10	40-45	**1.5"-3/4"**	**3/4"-3/8"**	**3/8"-#4**	6.3	**6.3**
		943.3	1001.2	299.9		
		854.7	967	281.8		
		9.4	3.4	6.0		

Comments: The grading fo the sample that was used in the calculation of the weighted percent loss was based upon only that material tested for sodium sulfate soundness.

COMPRESSIVE STRENGTH TEST RESULTS FOR THE SAMPLES FROM THE PIERS

REHABILITATION OF THE US 80 BRIDGE AT THE GILA RIVER

Terracon Project No. 65055196

CORE NO.	LOCATION	DATE TESTED	AVG. DIA. IN.	CROSS SECTION AREA (in^2)	Uncappded Length (in)	Capped LENGTH (in)	L/D RATIO	Weight (grams)	UNIT WEIGHT (pcf)	BREAK (lbs.)	Compressive Strength (psi)	REMARKS
1A	Pier 1	12/9/2006	2.766	6.009	5.479	5.744	2.08	1280.5	148.2	30,240	5,030	1,2
1B	Pier 1	12/9/2006	2.763	5.996	5.223	5.470	1.98	1238.2	150.6	30,220	5,040	1,2
1E	Pier 1	12/9/2006	2.759	5.979	5.520	5.832	2.11	1300.9	150.2	33,480	5,600	1,2
3D	Pier 3	12/9/2006	2.757	5.970	5.454	5.730	2.08	1276.6	149.4	26,410	4,420	1,2
3E	Pier 3	12/9/2006	2.755	5.961	5.513	5.785	2.10	1250.5	145.0	32,550	5,460	1,2
5A	Pier 5	12/9/2006	2.757	5.970	5.521	5.760	2.09	1271.1	146.9	30,480	5,110	1,2
5B	Pier 5	12/9/2006	2.758	5.974	5.493	5.713	2.07	1284.1	149.1	49,580	8,300	1,2
5C	Pier 5	12/9/2006	2.760	5.983	5.456	5.719	2.07	1279.3	149.3	47,900	8,010	1,2
7A	Pier 7	12/9/2006	2.758	5.974	5.527	5.800	2.10	1292.5	149.1	24,460	4,090	1,2
7B	Pier 7	12/9/2006	2.762	5.992	5.511	5.777	2.09	1321.1	152.4	44,240	7,380	1,2
7C	Pier 7	12/9/2006	2.758	5.974	5.459	5.739	2.08	1283.0	149.9	32,430	5,430	1,2
9A	Pier 9	12/9/2006	2.762	5.992	5.210	5.435	1.97	1198.5	146.3	33,230	5,550	1,2
9B	Pier 9	12/9/2006	2.767	6.013	5.477	5.713	2.06	1308.6	151.4	40,610	6,750	1,2
9C	Pier 9	12/9/2006	2.758	5.974	5.485	5.736	2.08	1280.8	148.9	48,090	8,050	1,2

NOTES:

1. L/D ratio is the capped length over the diameter.
2. Sample capped with sulfur compound prior to breaking.
3. Unit weight is a moist unit weight as obtained in the field.

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COMPRESSIVE STRENGTH TEST RESULTS FOR THE BRIDGE DECK SAMPLES

REHABILITATION OF THE US 80 BRIDGE AT THE GILA RIVER

Terracon Project No. 65055196

CORE NO.	LOCATION	DATE TESTED	AVG. DIA. IN.	CROSS SECTION AREA (in^2)	Uncappded Length (in)	Capped LENGTH (in)	L/D RATIO	Weight (grams)	UNIT WEIGHT (pcf)	BREAK (lbs.)	Compressive Strength (psi)	REMARKS
1	Span 1	12/9/2006	2.750	5.940	5.458	5.702	2.07	1249.4	146.8	32,670	5,500	1,2
2	Span 2	12/9/2006	2.760	5.983	5.263	5.567	2.02	1283.2	155.2	27,595	4,610	1,2
3	Span 3	12/9/2006	2.753	5.953	5.481	5.701	2.07	1326.2	154.8	20,620	3,460	1,2
4	Span 4	12/9/2006	2.755	5.961	5.482	5.733	2.08	1391.4	162.2	36,345	6,100	1,2
5	Span 5	12/9/2006	2.757	5.970	5.448	5.775	2.09	1352.6	158.4	23,015	3,860	1,2
6	Span 6	12/9/2006	2.756	5.966	4.601	4.871	1.77	1046.9	145.3	27,725	4,650	1,2
7	Span 7	12/9/2006	2.757	5.970	5.434	5.682	2.06	1267.6	148.9	25,960	4,350	1,2
8	Span 8	12/9/2006	2.756	5.966	5.476	5.752	2.09	1278.5	149.1	24,730	4,150	1,2
9	Span 9	12/9/2006	2.757	5.970	5.548	5.834	2.12	1321.6	152.0	25,420	4,260	1,2

NOTES:

1. L/D ratio is the capped length over the diameter.
2. Sample capped with sulfur compound prior to breaking.
3. Unit weight is a moist unit weight as obtained in the field.

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COMPRESSIVE STRENGTH TEST RESULTS FOR THE ROCK CORE SAMPLES

REHABILITATION OF THE US 80 BRIDGE AT THE GILA RIVER

Terracon Project No. 65055196

CORE NO.	LOCATION	DATE TESTED	AVG. DIA. IN.	CROSS SECTION AREA (in^2)	Uncappded Length (in)	L/D RATIO	Weight (grams)	UNIT WEIGHT (pcf)	BREAK (lbs.)	Compressive Strength (psi)	REMARKS
1	B1 (40-40.5')	12/9/2006	2.383	4.460	4.768	2.00	938.5	168.1	38,190	8,560	1,2
2	B2 (53.5-54')	12/9/2006	2.381	4.453	4.735	1.99	960.7	173.6	30,080	6,750	1,2
3	B5 (41.4')	12/9/2006	2.374	4.426	4.734	1.99	745.8	135.6	< 500		1,2
4	B10 (35.5-36')	12/9/2006	2.392	4.494	4.778	2.00	877.0	155.6	8,910	1,980	1,2
5	B8 (48-49')	12/9/2006	2.384	4.464	4.704	1.97	790.6	143.4	4,220	950	1,2

NOTES:

1. L/D ratio is the capped length over the diameter.
2. Sample capped with sulfur compound prior to breaking.
3. Unit weight is a moist unit weight as obtained in the field.

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Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity			Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (%)	
						LL	PL	PI									
B-01	10	SM		3	13	NP	NP	NP									
B-01	40		168														
B-02	53.5		174														
B-04	5	SP		3	3	NP	NP	NP									
B-04	15	SP		3	2	NP	NP	NP									
B-05	10	SM		3	22	NP	NP	NP									
B-05	41.5		136														
B-06	5	SM		3	12	NP	NP	NP									
B-07	14	SM		3	18	NP	NP	NP									
B-08	9.5	SP-SM		3	9	NP	NP	NP									
B-08	48		143														
B-09	36.5	GW			4	NP	NP	NP									
B-10	9.5	ML		3	60	NP	NP	NP									
B-10	35.5		156														
B-10	36.5	SM		3	18	NP	NP	NP									

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

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SUMMARY OF LABORATORY RESULTS

Project: Rehabilitation of the Old US 80 Bridge at the Gila River
Site: Maricopa County, Arizona
Job #: 65055196
Date: 1-29-07

SOIL PROPERTIES 65055196 US 80 BRIDGE.GPJ TERR2000.GDT 1/29/07

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
MC:	Modified California Sampler – 2.5" O.D., unless otherwise noted	DC:	Dynamic Cone
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
BS:	Bulk Sample or Auger Sample	GS:	Grab Sample
Hammer Blows:	Number of Blows to advance the 9" O.D. steel casing one foot with the diesel hammer at "full" throttle.	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". For 3" O.D. ring samplers (RS) the penetration value is reported as the number of blows required to advance the sampler 12 inches using a 140-pound hammer falling 30 inches, reported as "blows per foot," and is not considered equivalent to the "Standard Penetration"or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling
WCI:	Wet Cave in	WD:	While Drilling
DCI:	Dry Cave in	BCR:	Before Casing Removal
AB:	After Boring	ACR:	After Casing Removal

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 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	<2	Very Soft
500 – 1,000	2-3	Soft
1,001 – 2,000	4-6	Medium Stiff
2,001 – 4,000	7-12	Stiff
4,001 – 8,000	13-26	Very Stiff
8,000+	26+	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Ring Sampler (RS) Blows/Ft.	Relative Density
0 – 3	0-6	Very Loose
4 – 9	7-17	Loose
10 – 29	18-55	Medium Dense
30 – 49	56-95	Dense
50+	96+	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

RELATIVE PROPORTIONS OF FINES

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

GRAIN SIZE TERMINOLOGY

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

PLASTICITY DESCRIPTION

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

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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 lots 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.

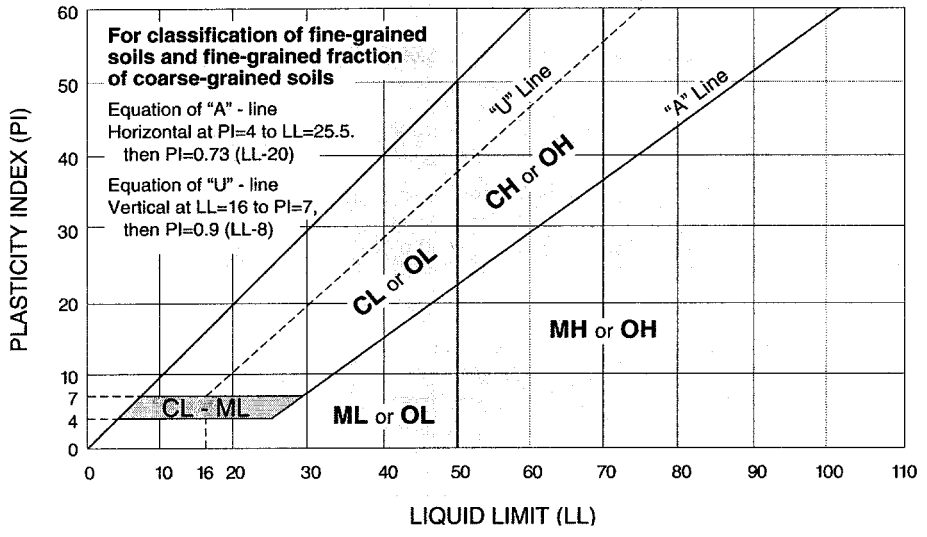
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[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.



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GENERAL NOTES

Description of Rock Properties

WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding and Foliation Spacing in Rock[a]

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

Rock Quality Designator (RQD)[b]		Joint Openness Descriptors	
RQD, as a percentage	Diagnostic description	Openness	Descriptor
Exceeding 90	Excellent	No Visible Separation	Tight
90 – 75	Good	Less than 1/32 in.	Slightly Open
75 – 50	Fair	1/32 to 1/8 in.	Moderately Open
50 – 25	Poor	1/8 to 3/8 in.	Open
Less than 25	Very poor	3/8 in. to 0.1 ft.	Moderately Wide
		Greater than 0.1 ft.	Wide

a. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.
b. RQD (given as a percentage) = length of core in pieces 4 in. and longer/length of run.

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976.
U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

December 22, 2006

Terracon
Consulting Engineers & Scientists

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TranSystems Corporation
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Tucson, Arizona 85701

Attn: Mr. Jerry Cannon, P.E.
Project Manager

Re: **Limited Asbestos Sampling Report**
Rehabilitation of the Old US 80 Bridge at the Gila River
Maricopa County, Arizona
Terracon Project No. 65055196

The purpose of this letter report is to present the results of limited asbestos sampling performed at the site's bridge on November 29, 2006. A total of nine samples (SPAN 1 through SPAN 9) were collected, consisting of sub-sample splits of concrete cores from the existing bridge deck slab. The samples were delivered under proper chain-of-custody to Fiberquant Analytical Services, a NVLAP accredited laboratory in Phoenix, Arizona.

The bulk samples were analyzed for asbestos content by Polarized Light Microscopy (PLM) techniques. No asbestos-containing materials (ACMs) were identified in the nine samples. Please refer to the attached laboratory report for details.

We appreciate being of service to you and trust that the report has satisfactorily fulfilled your asbestos-related requirements for this project. If you have any questions concerning our report, please do not hesitate to contact us.

Sincerely,
Terracon

Donald R. Clark, P.E.
Senior Principal

n:\...\65055196.Transystems.US 80 Bridge.Asbestos Rpt.Doc

FIBERQUANT ANALYTICAL SERVICES

Polarized Light Microscope (PLM) Analysis for Asbestos

JobNumber: 200609169

DEC 19 2006

Client: TERRACON INC

4685 S ASH AVE #H-4

TEMPE, AZ 85282-0000

Office Phone: (480) 897-8200

FAX: (480) 897-1133

 # Samples: 9 PLM **Rec:** 12/13/2006 **Method:** EPA 600/R-93/116 PLM analysis for asbestos in bulk smp

Client Job: Old US 80 Bridge **PO Number:** 65055196

Report Date: 12/15/2006 **Date Analyzed:** 12/14/2006 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** PLMn

Each bulk sample is first dissected under a 7-30x magnification stereo-microscope. This examination is used to determine the general type of sample, how many and what type of layers it has, and initial estimates of fiber types and quantities. Second, liquid media mounts are made of each layer - such mounts may be of selected fibers (used solely for identification purposes) or may be representative of the layer as a whole (used for quantitation purposes). The mounts may be made in a synthetic Canadian balsam, one of several solvents, or in refractive index oils (media of known refractive index). Generally, a variety of different mounts are made: some optimized for fiber visibility, some optimized for fiber identification, and some optimized for fiber quantitation. The mounted slides are then examined at 50-400x magnification on a Nikon Labphot-pol microscope. Optical characteristics are used to identify each observed fiber type; the optical data are contained for each sample on its detail analysis sheet, attached.

Current EPA, NESHAP and OSHA regulations designate a result of <=1 % asbestos as "negative" and >1 % asbestos as "positive". Samples containing layers that have been determined to be "positive" may have to be handled differently during a renovation or demolition than samples whose layers have been determined to be "negative."

The method of fiber analysis and identification is the EPA Method 600/R-93/116. The method of fiber quantitation is an estimation technique in which the analysts quantitation is routinely calibrated by reference quantitation standards, and which has been shown to be equivalent in precision and accuracy to point counting. Friability is estimated for the purposes of deciding when to point count. Friabilities determined in the field take precedence over those determined in the laboratory. Those sample layers which are friable and estimated by the analyst to contain <= 1% asbestos are point counted using 400 points. Such point counting is required by NESHAP (National Emission Standards for Hazardous Air Polutants, Nov. 1990) in order to rely on analytical results that are <= 1%. The coefficient of variation for the estimation quantitation technique is 100% in the range 0-5%. This means that PLM analysis is not capable of conclusively determining whether a layer containing close to 1% asbestos is actually "positive" or "negative". For this reason, Fiberquant refers to results where asbestos was detected but <= 1% as "borderline negative", and results where asbestos was >1 % but <= 2% as "borderline positive" to indicate the uncertainty in assigning a "positive" or "negative" label. In the sample summary, "ND" means that no asbestos was detected during the analysis. A "Tr" or "Trace" of asbestos reported is defined for our purposes as the detection of several asbestos fibers during the analysis; this level would be right at the limit of detection for the method. Trace is only reported on the analysis detail - in the summary a trace would be reported as <=1%. The limit of detection (the smallest % of asbestos that can be detected) varies greatly depending on the matrix in which the asbestos is found. As little as 0.001% asbestos can be detected in favorable samples, while detection in unfavorable samples may approach the detection limit of 1% stated in the method. During the analysis, the analyst, for Fiberquant identification purposes only, determines the "apparent sample type" and "apparent layer types." It must be emphasized that these types are only what is apparent. Often, different materials appear similar or identical after sampling, so the analyst may assign a type other than what was sampled.

Floor tiles present a special problem for PLM asbestos analysis. Floor tile can contain chrysotile fibers so thin that they cannot be resolved by optical methods. In such a case, we may observe a percentage of asbestos which is lower than the actual percentage, or not observe asbestos at all when some is present. For this reason, floor tiles reported as negative should be confirmed to be negative using transmission electron microscope (TEM) analysis. Likewise, vermiculite insulation materials containing traces of asbestiform asbestos present a problem for routine PLM analysis - the amphiboles are sometimes present in trace amounts inhomogeneously distributed. We recommend a hydro-separation technique for such samples.

Vermiculite-containing samples may contain trace amounts of asbestiform amphibole that may or may not be detected during routine PLM analysis. For this reason, loose vermiculite samples reported as negative should be confirmed to contain no amphibole using hydroseparation techniques.

The samples were analyzed under the following ongoing quality assurance program: Blank samples are routinely analyzed to maintain contamination-free materials. Each analyst has at least a bachelor's degree in physical science, and has also completed extensive training specific to asbestos analysis for 1-3 months before being allowed to analyze client samples. Qualitative reference samples are routinely analyzed to assure that analysts can identify asbestos and asbestos-look-alike fibers. Quantitative reference samples are routinely analyzed to calibrate and characterize the estimation procedure. Microscope alignment is checked each day. Refractive index oils are calibrated at least quarterly. At least 10% of client samples are re-analyzed from scratch by a different analyst than the original, and any discrepancies are resolved for the sample and similar sample types before the results are reported. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. All analysts participate in interlab round robins and proficiency testing to assure competence. Fiberquant is accredited by NVLAP (#101031) for the analysis of bulk samples for asbestos using PLM. Accreditation does not imply endorsement by the EPA, any other United States governmental

agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

PLM Analysis Summary: **Job Number: 200609169** Old US 80 Bridge

Sample Number	Layer	Color	Apparent Layer Type *	Lab Number	Apparent Sample Type * / *Asbestos Results*	Positive Layer Yes or No
Sample **SPAN 1**	Layer # 1	Gray	concrete	2006-09169- 1	Cementitious / *no asbestos detected*	Positive Layer? No
Sample **SPAN 2**	Layer # 1	Gray	concrete	2006-09169- 2	Cementitious / *no asbestos detected*	Positive Layer? No
Sample **SPAN 3**	Layer # 1	Gray	concrete	2006-09169- 3	Cementitious / *no asbestos detected*	Positive Layer? No
Sample **SPAN 4**	Layer # 1	Gray	concrete	2006-09169- 4	Cementitious / *no asbestos detected*	Positive Layer? No
Sample **SPAN 5**	Layer # 1	Gray	concrete	2006-09169- 5	Cementitious / *no asbestos detected*	Positive Layer? No
Sample **SPAN 6**	Layer # 1	Gray	concrete	2006-09169- 6	Cementitious / *no asbestos detected*	Positive Layer? No
Sample **SPAN 7**	Layer # 1	Gray	concrete	2006-09169- 7	Cementitious / *no asbestos detected*	Positive Layer? No
Sample **SPAN 8**	Layer # 1	Gray	concrete	2006-09169- 8	Cementitious / *no asbestos detected*	Positive Layer? No
Sample **SPAN 9**	Layer # 1	Gray	concrete	2006-09169- 9	Cementitious / *no asbestos detected*	Positive Layer? No

* Apparent Sample Types and Apparent Layer Types are as they appeared to the analyst. Since many types of materials appear similar after sampling damage, the apparent type of material may not be the actual type of material.

Sample SPAN 1 **Lab Number** 2006-09169- 1 **Sampled:** 11/29/2006 8:30 **Condition:** acceptable
Analyzed By MAC 12/15/2006 **An?** OK **Apparent Smp Type** Cementitious Non-fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): powder, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	concrete	100	Gray	1	n.d.	-	-	-	-	-
	Total %	100		**Average %**	n.d.	-	-	-	-	-

Fiber Identification: none

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: grinding using mortar and pestle. Procedure: dissolution of matrix using dilute HCl acid.

Sample SPAN 2 **Lab Number** 2006-09169- 2 **Sampled:** 11/29/2006 8:50 **Condition:** acceptable
Analyzed By MAC 12/15/2006 **An?** OK **Apparent Smp Type** Cementitious Non-fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): powder, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	concrete	100	Gray	1	n.d.	-	-	-	-	-
	Total %	100		**Average %**	n.d.	-	-	-	-	-

Fiber Identification: none

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: grinding using mortar and pestle. Procedure: dissolution of matrix using dilute HCl acid.

Sample SPAN 3 **Lab Number** 2006-09169- 3 **Sampled:** 11/29/2006 9:10 **Condition:** acceptable
Analyzed By MAC 12/15/2006 **An?** OK **Apparent Smp Type** Cementitious Non-fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): powder, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	concrete	100	Gray	1	n.d.	-	-	-	-	-
	Total %	100		**Average %**	n.d.	-	-	-	-	-

Fiber Identification: none

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: grinding using mortar and pestle. Procedure: dissolution of matrix using dilute HCl acid.

Sample SPAN 4 **Lab Number** 2006-09169- 4 **Sampled:** 11/29/2006 9:30 **Condition:** acceptable
Analyzed By MAC 12/15/2006 **An?** OK **Apparent Smp Type** Cementitious Non-fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): powder, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	concrete	100	Gray	1	n.d.	-	-	-	-	-
	Total %	100		**Average %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers	Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1 none												
2												
3												
4												
5												
6												

Sample Analytical Note
Procedure: grinding using mortar and pestle. Procedure: dissolution of matrix using dilute HCl acid.

Sample SPAN 5 **Lab Number** 2006-09169- 5 **Sampled:** 11/29/2006 9:50 **Condition:** acceptable
Analyzed By MAC 12/15/2006 **An?** OK **Apparent Smp Type** Cementitious Non-fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): powder, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	concrete	100	Gray	1	n.d.	-	-	-	-	-
	Total %	100		**Average %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers	Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1 none												
2												
3												
4												
5												
6												

Sample Analytical Note
Procedure: grinding using mortar and pestle. Procedure: dissolution of matrix using dilute HCl acid.

Sample SPAN 6 **Lab Number** 2006-09169- 6 **Sampled:** 11/29/2006 10:10 **Condition:** acceptable
Analyzed By MAC 12/15/2006 **An?** OK **Apparent Smp Type** Cementitious Non-fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): powder, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	concrete	100	Gray	1	n.d.	-	-	-	-	-
	Total %	100		**Average %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers	Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1 none												
2												
3												
4												
5												
6												

Sample Analytical Note
Procedure: grinding using mortar and pestle. Procedure: dissolution of matrix using dilute HCl acid.

Sample SPAN 7 **Lab Number** 2006-09169- 7 **Sampled:** 11/29/2006 10:30 **Condition:** acceptable
Analyzed By MAC 12/15/2006 **An?** OK **Apparent Smp Type** Cementitious Non-fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): powder, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	concrete	100	Gray	1	n.d.	-	-	-	-	-
	Total %	100		**Average %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: grinding using mortar and pestle. Procedure: dissolution of matrix using dilute HCl acid.

Sample SPAN 8 **Lab Number** 2006-09169- 8 **Sampled:** 11/29/2006 10:50 **Condition:** acceptable
Analyzed By MAC 12/15/2006 **An?** OK **Apparent Smp Type** Cementitious Non-fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): powder, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	concrete	100	Gray	1	n.d.	-	-	-	-	-
	Total %	100		**Average %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: grinding using mortar and pestle. Procedure: dissolution of matrix using dilute HCl acid.

Sample SPAN 9 **Lab Number** 2006-09169- 9 **Sampled:** 11/29/2006 11:10 **Condition:** acceptable
Analyzed By MAC 12/15/2006 **An?** OK **Apparent Smp Type** Cementitious Non-fibrous Solid
Homogeneous Yes **# Layers** 1 **Pos Layer?** No **# Sub-Samples** 3
Non-Fibrous Components (in approx. decreasing order): powder, rock,

Layers

#	Layer Type	%	Color	Friability	Percents of Each Fiber Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	concrete	100	Gray	1	n.d.	-	-	-	-	-
	Total %	100		**Average %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note
Procedure: grinding using mortar and pestle. Procedure: dissolution of matrix using dilute HCl acid.

Fr=Friability: 1=very non-friable; 2= non-friable; 3=friable; 4=highly friable
Colors: B=black;BL=blue;BR=brown;CL=clear;G=Green;GY=gray;OR=orange;OW=off-white;PN=pink;PU=purple;R=red;TN=tan;W=white;Y=yellow;V=various
Fiber Morphology: A=fine fibers/bundles, white, sinewy, flexible; B=fine fibers/bundles, w-br, straight, broomed ends; C=fine fibers/bundles, blue, straight, broomed ends; D=fine to coarse fibers, CL-B, brittle; E=coarse fibers,CL or dyed, striated; F=coarse fibers or splinters, W-BR, ribbon-like; G=lath-like or shards, low aspect ratio, may taper
Iso=isotropism - may be yes or no; Pleo=pleochroism - may be yes or no; Bi=birefringence - may be None, Low, Medium or High
Elg=sign of elongation - may be + or -; Ext=extinction - may be Parallel, Oblique, None or Undulating; Oil=medium used to for dispersion staining
Col Par=dispersion staining colors parallel to the fiber (fiber/halo): b/w=black/white; dg/py=dark gray/pale yellow; vg/y=violet gray/yellow; db/ly=dark blue/lemon yellow; vb/g= vivid blue/gold; sb/o=sky blue/orange; pb/r=pale blue/red; gb/dr=gray blue/dark red; w/b=white/black. Col Perp=same only perpendicular to fiber.
RI Par=refractive index parallel to fiber; RI Perp=refractive index perpendicular to fiber

Analyst: MICHAEL A. COOK

Printed: 15-Dec-06

Original Print Date: 15-Dec-06

Larry S. Pierce, Approved Accreditation Signatory

Fiberquant Analytical Services 5025 S. 33rd St.; Phoenix, AZ 85040; Phone: 602-276-6139; FAX: 602-276-4558; Fiberquant@abilnet.com

FIBERQUANT ANALYTICAL SERVICES

Chain-of-Custody Form

Submitted by (Company)	Terracon Consultants, Inc.
Address	4685 S. Ash Ave., Ste. H4
City, State, Zip Code	Tempe, AZ 85282
Phone	480-897-8200
FAX	480-897-1133

Invoice to (Company)	same as above
Address	
City, State, Zip Code	
Phone	FAX

Contact (print)	David Matson
Sampled by (signature)	
Job Number or Project Name	Old US80 Bridge
PO Number	65055196

Sample Method Requested ONLY ONE METHOD per COC		Turn-around-time (circle one) Rush	Norm	Ext.
Asbestos by **PLM**	Improved Interim	<6 hrs	1-3 days	15-30 days
	Analyze all samples? (Yes) No			
	Analyze til positive found (ATPF) If so then by Layer or Sample			
	Single Layer Protocol Yes Np			
Fibers by **PCM**	7400(Area) ORM (Personal)	<4 hrs	24 hrs	3-5 days
Asbestos by **TEM**	AIR: AHERA Mod. AHERA	<6 hrs	24 hrs	3-5 days
	Water*: Water Sludge	1-2 days	3-5 days	10 days
	Annex2 : Chatfield Full			
	Vacuum Dust (ASTM)	3.5 days	5-10 days	N/A
Metals by FLAA	Analyte: Cd Cr Cu Ni Pb Zn	<6 hrs	2-3 days	N/A
	Matrix: Filter: MCE FG			
	Paint: by Area by Weight			
	Soil			
	Wipe			
	Initial here certifying wipes used are ASTM E1792 compliant			
Fungi	Air Sample: Zefon Other	<6 hrs	1-2 days	N/A
	ID/Count: Bulk Swab			
	Tape: Qualitative (%)			
	Tape:Quantitative (cm2)			
	Culturable Air Bulk/Dust Swab	7 days Only		
Dust	NIOSH 500	<4 hrs	24 hrs	N/A
Other		Call	Call	

Review of Analysis Request _____ Date_____

Sample Number	Description/Location (include agar type/maker/exp. Date)	Sample Date	Sample Time	Vol/Area
1) SPAN 1	Concrete	11/29/06	08:30	
2) SPAN 2			08:50	
3) SPAN 3			09:10	
4) SPAN 4			09:30	
5) SPAN 5			09:50	
6) SPAN 6			10:10	
7) SPAN 7			10:30	
8) SPAN 8			10:50	
9) SPAN 9			11:10	
10)				
11)				
12)				
13)				
14)				
15)				
16)				
17)				
18)				
19)				
20)				

1)Relinquished by:	Date: 12-13-06	Time: 15:31	3)Relinquished by:	Date:	Time:
2)Received by:	Date: 12-13-06	Time: 15:31	4)Received by:	Date:	Time:
* **TEM Water: Sampler's name Required by State of Arizona**	Print Name				