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LEGACY PARKWAY

STRUCTURE F-747

LP1 OVER JORDAN RIVER

STRUCTURE E-2569

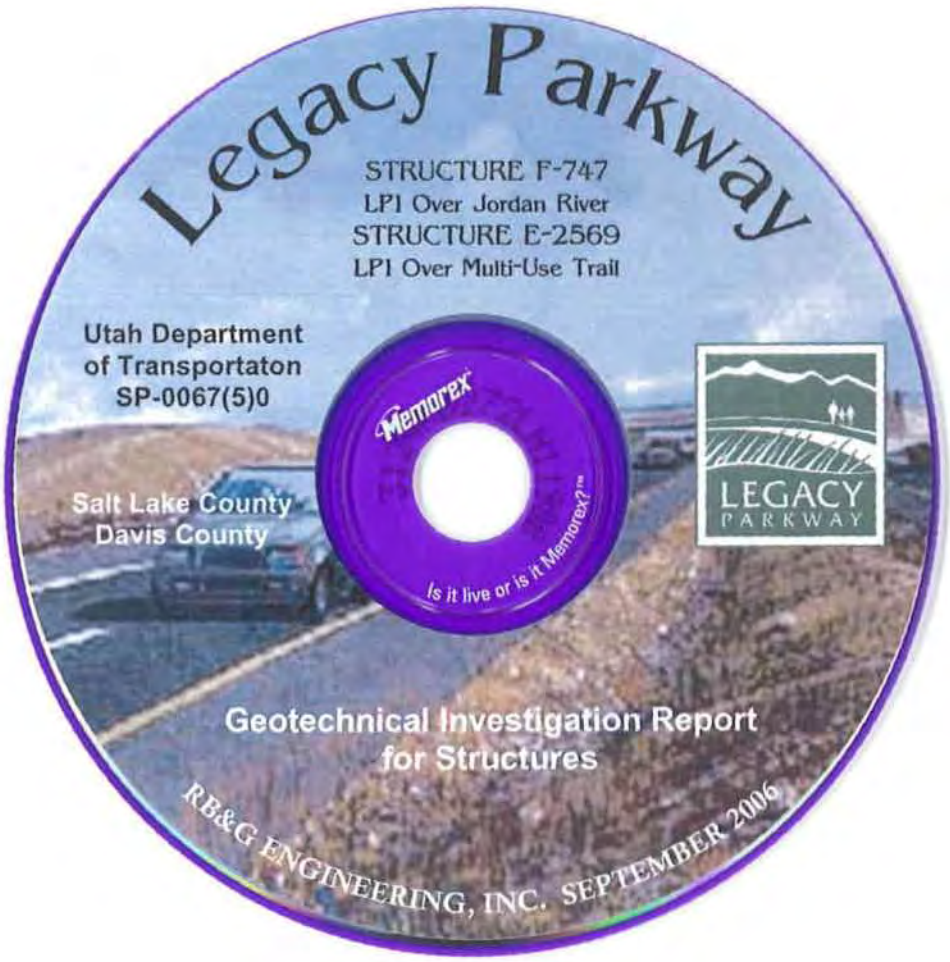
LP1 OVER MULTI-USE TRAIL

Salt Lake & Davis Counties, Utah

Utah Department of Transportation
SP-0067(5)0

September 2006

Geotechnical Investigation Report for Structures


Legacy Parkway
STRUCTURE F-747
LP1 Over Jordan River
STRUCTURE E-2569
LP1 Over Multi-Use Trail
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Salt Lake County
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Geotechnical Investigation Report
for Structures
RB&G ENGINEERING, INC. SEPTEMBER 2006

RB&G ENGINEERING INC.

September 13, 2006

Mr. Sohail Khan
Carter & Burgess
420 East South Temple Suite 342
Salt Lake City, Utah 84111-1321

Reference: Legacy Parkway Project No. SP-0067(5)0

Gentlemen:

A Geotechnical Investigation Report for Structures has been completed for Structure F-747, LP1 over Jordan River, and Structure E-2569, LP1 over Multi-Use Trail in Salt Lake and Davis Counties, Utah. The investigation has been conducted in accordance with a proposal submitted to your organization for the work, and the results of the study are summarized in the report transmitted herewith.

We appreciate the opportunity of providing this service for you. If there are any questions relating to the information contained herein, please call.

Sincerely,

RB&G ENGINEERING, INC.

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Geotechnical Investigation Report for Structures

Legacy Parkway

Structure F-747
LP1 over Jordan River

Structure E-2569
LP1 over Multi-Use Trail

Salt Lake & Davis Counties, Utah

Utah Department of Transportation
SP-0067(5)0

September 2006

RB&G ENGINEERING, INC.

Professional Engineers

LEGACY PARKWAY

UTAH DEPARTMENT OF TRANSPORTATION
SP-0067(5)0

GEOTECHNICAL INVESTIGATION REPORT FOR STRUCTURES

Structure F-747 – LP1 over Jordan River
Structure E-2569 – LP1 over Multi-Use Trail

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UTAH DEPARTMENT OF TRANSPORTATION
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GEOTECHNICAL INVESTIGATION REPORT FOR STRUCTURES

Structure F-747 – LP1 over Jordan River
Structure E-2569 – LP1 over Multi-Use Trail

1.0 GENERAL

This report presents the results of geotechnical investigations and provides foundation recommendations for the following proposed structures to be located within the Legacy Parkway Project:

- F-747 – LP1 over Jordan River
- E-2569 – LP1 over Multi-Use Trail

The primary purpose of this investigation is to determine the characteristics of the subsurface material throughout the project area, and to make appropriate foundation design recommendations for the proposed structure. The report is intended to aid designers in evaluating the site and subsurface conditions for foundation design and potential construction problems.

1.1 PROJECT DESCRIPTION

The Legacy Parkway will be a four-lane, limited-access, divided highway extending approximately 14 miles from Interstate 215 at 2100 North in North Salt Lake, northward to the junction of Interstate 15 and U.S. Highway 89 near Farmington (see Figure 1) . A multiple-use pedestrian, bicycle, and horse trail will parallel the Parkway.

1.1.1 General

The site of Structure F-747 is located in Segment 1 of the current Legacy Parkway design project. Segment 1 extends from the southerly limit of the project to north of 500 South Street in Bountiful. The site is located at the intersection of I-215 and the Jordan River. At this location, the Jordan River constitutes the boundary between Davis County to the north, and Salt Lake County to the South. Twin

bridge structures presently exist adjacent to the LP1 over Jordan River site. The existing structures carry the I-215 freeway over the Jordan River.

Structure E-2569 will be a culvert/tunnel type structure where the multi-use trail passes beneath the LP1 roadway, approximately 300 feet northeast of structure F-747.

1.1.2 Proposed Improvements

The new structures will be located on the southeast side of I-215. Structure F-747 will be the new I-215 eastbound bridge, while new bridges at the locations of the existing structures will be used to access Legacy Parkway. A fourth bridge will be constructed on the northwest side of the existing bridges to carry I-215 westbound traffic. Preliminary drawings of the proposed structure are included for reference in Appendix A.

1.1.3 Climatic Conditions

The climate in the project area is characterized by relatively warm summers and cold winters. The frost depth ranges between 20 to 30 inches. Winter snow often requires plowing, and de-icing salt is regularly deposited on major roadways during the winter months.

2.0 PREVIOUS REPORTS AND INVESTIGATIONS

The following geotechnical reports and investigations have been completed previously by others for this project.

2.1 PB/FAK GEOTECHNICAL INVESTIGATION REPORT

UDOT provided copies of the Geotechnical Reports prepared by Parsons Brinckerhoff Quade & Douglas (PB) for Fluor Ames Kraemer (FAK), LLC as a part of the Design-Build Legacy Parkway Project. The report includes the results of subsurface investigations performed by Kleinfelder, Inc. and provides geotechnical recommendations for the structures contemplated in the original project. It should be noted that the project was divided into five segments for the Design-Build Project. Segment 1 of the Design Build project was to begin at the southerly limits of the project and continue north past Center Street in North Salt Lake. Included in the Design-Build report are logs for several test holes performed at the formerly-proposed "LP NB to I-15 (I-215)" structure, which was identified as F-702 in the Design-Build study.

2.2 KLEINFELDER GEOTECHNICAL INVESTIGATION

It is our understanding the Kleinfelder, Inc. conducted an investigation of the preferred Legacy Parkway alignment for UDOT and the results were submitted in a report dated June 2, 2000. Some of its findings were reproduced in the PB/FAK Design Build reports referenced in Section 2.1 above.

2.3 DAMES & MOORE PRELIMINARY GEOTECHNICAL STUDY

It is our understanding that Dames & Moore completed a geotechnical study for the proposed preliminary Legacy Parkway corridor and presented the results in a 1998 report.

3.0 EXISTING FACILITIES

The proposed LP1 roadway will travel at an approximate bearing of N 39° E at the crossing over the Jordan River. The existing I-215 bridges are located immediately northwest of the F-747 site. I-215 is situated on embankment fill up to about 15 feet high at the abutments of the Jordan River bridges.

A review of recent aerial photos did not identify any significant buildings within 1,500 feet of the proposed bridge location. Various utility lines exist throughout the project area, including overhead power lines and buried utilities such as gas, oil, power, sewer, and communications lines. UDOT utility lines may also exist in the I-215 corridor in this area.

4.0 FINDINGS

4.1 EXISTING SITE CONDITIONS

The topography is relatively flat throughout Segment 1 and generally slopes down to the west towards the Great Salt Lake. The proposed Legacy Parkway corridor begins just west of the existing I-215 / Redwood Road interchange on the south and continues northward. The southerly portion of the corridor travels along the westerly limits of North Salt Lake, Woods Cross, West Bountiful, and Centerville, about 0.5 to 2 miles west of I-15. North of Parrish Lane in Centerville, the Parkway corridor will be located less than about 0.25 miles west of I-15, with the two corridors essentially parallel continuing north to the I-15 / US-89 interchange in Farmington. The south and north interchanges are already partially constructed. Some industrial and commercial facilities are located along the alignment.

In the vicinity of the LP1 structures, the ground surface slopes toward the Jordan River. Vegetation at the site consists of wild grass, weeds, brush, and a few small trees, with thicker vegetation along the river banks.

4.2 SURFACE DRAINAGE

Surface drainage in the project area generally follows the topography to the west and northwest towards the Great Salt Lake. In addition to the Jordan River and Oil Drain at the south interchange, some creeks, streams, and canals cross the alignment at various locations, creating the potential for flooding. Flooding and ponding on the soft surface soils can make access to bridge sites difficult. At the F-747 site, surface drainage is toward the Jordan River.

4.3 GEOLOGY

The project is located within the Wasatch Front section of the Basin and Range physiographic region. The Wasatch Front consists of a series of down dropped valleys bounded primarily by the Wasatch Mountains on the east and the Great Salt Lake, Utah Lake and the Oquirrh Mountains on the west. The area extends from Juab County in the south up through Salt Lake, Davis, Weber and Box Elder counties to the north.

The general topography of the Wasatch Front is due, in large part, to Basin and Range extensional faulting. The Wasatch Fault is an extensional normal fault which trends

northerly along the base of the Wasatch Mountains from Levan in the south, and up into Idaho to the north. Prior to extensional faulting, the region was subjected to compressional forces from the west resulting in extensive thrust faulting and mountain building. Extensional forces are still active today with various segments of the Wasatch Fault capable of generating large earthquakes with magnitudes near 7.4.

The Wasatch Mountains to the east consist predominately of Precambrian to Mesozoic, metamorphic and sedimentary bedrock. The valleys along the Wasatch Front are predominately covered with Pleistocene Lake Bonneville deposits, and younger alluvial fan and stream deposits. The Bonneville Lake Cycle began about 30,000 years ago when the climate was much cooler and wetter. The lake reached its highest elevation of about 5,100 feet, known as the Bonneville shoreline, between 16,000 to 14,500 years ago. From this shoreline, the lake eventually overtopped and breached through unconsolidated sediments near Red Rock Pass sending a catastrophic flood into the Snake River drainage system in southeastern Idaho, about 14,500 years before present. Within about a year, the lake had dropped to an elevation of about 4,740 feet, forming the Provo shoreline. Due to changing climatic conditions, the lake level gradually dropped to the historic levels of its modern day remnant, the Great Salt Lake. The last major high water shoreline of the lake was the Gilbert shoreline which reached an elevation of about 4,250 feet between 11,000 to 10,000 years ago. Historically, the Great Salt Lake has fluctuated between 4,211.9 and about 4,191 feet above sea level.

During Bonneville times thousands of feet of sediment were deposited in the valley. Deposits consist of deep-water silts and clays, shoreline sand and gravels and gravelly barrier beach and deltaic deposits. The unconsolidated to semi-consolidated valley fill deposits are thought to range from 2,000 to 5,000 feet thick (Black, and others, 2003; Currey, and others, 1984; Hintze, 1988; Stokes, 1986).

A geologic map of the Central Wasatch Front by Davis (1983) shows the surficial deposits in the proposed Parkway alignment to consist of floodplain and delta deposits (chiefly fine-grained and poorly drained sediments) in the vicinity of the south interchange, Provo Formation and younger lake bottom sediments (clays, silts, sands, and localized offshore bars) through the majority of the project, and landslide deposits near the north interchange. Newer maps of the area (Personius and Scott, 1992; Nelson and Personius, 1993), characterize the predominant surficial geologic deposits throughout the study area as Lake Bonneville lacustrine clay and silt, with Holocene to upper Pleistocene

lateral spread deposits at some locations. Post-Bonneville lacustrine and marsh deposits are encountered along the easterly shores of the Great Salt Lake and encroach on the Parkway alignment from the west at some bridge sites. Localized upper Holocene stream alluvium associated with the Jordan River can be found along the shores of the river near the southerly terminus of the project. Bonneville lacustrine sand and gravel may be encountered near the northerly terminus, along with upper Holocene fan alluvium consisting of cobbles and gravel in a sandy matrix.

As shown on Figure 2a, the F-747 site lies within Floodplain and Delta Complex deposits consisting of chiefly fine-grained and poorly drained sediments mapped by Davis (1983), with Provo Formation and younger lake bottom sediments mapped about a mile east of the site. A portion of a more recent map by Personius and Scott (1992) is reproduced on Figure 2b, and it will be noted from this figure that the area was mapped as Holocene to uppermost Pleistocene marsh and lacustrine deposits, surrounded by upper Holocene stream alluvium composed of sand, silt, and minor clay and gravel along the Jordan River. The map's authors note that these surficial geologic units are subject to flooding and high water table.

Harty and Lowe (2003) have mapped landslide deposits in the northerly and southerly portions of the Legacy Parkway project area. Based on these maps, the F-747 site does not lie within landslide deposits; however, the southerly limit of the mapped North Salt Lake landslides are shown to extend into portions of the I-215 / Redwood Road interchange about 1,700 feet west of the F-747 site (see Figure 2c).

4.4 GEOLOGIC HAZARDS

Geologic hazards identified within the Legacy Parkway project area include ground shaking, liquefaction-induced lateral spreading and landslides, and subsidence during a moderate to large seismic event on the Salt Lake or Weber segments of the Wasatch Fault Zone. Large seismic events on one of the other surrounding less-studied faults such as the Great Salt Lake fault may also trigger these hazards.

Due to the close proximity of the Parkway to the Great Salt Lake, tilting of the lake during tectonic subsidence will shift the lake toward the east. This subsidence will cause a rise in already high ground-water tables and cause the lake to inundate toward the east. Subsidence and tilting will be greatest nearest the fault and will taper off away from the

fault toward the west. Studies by Keaton (1987), and Chang and Smith (1998) have compared the 7.5 magnitude earthquake at Hebgen Lake, Montana in 1959 to a maximum credible earthuake along the Wasatch Front. Keaton's study shows the area near the most eastern extent of Farmington Bay to have the greatest potential for flooding. It should be noted that the magnitude of this hazard is directly related to the level of the lake and the location and magnitude of the earthquake. Ground shaking from surrounding faults or rupture of the Great Salt Lake fault beneath the lake also has the potential to generate wave hazards in the form of seiche (water oscillation waves) or a lake tsunami. The actual hazard potential to the Parkway from these waves is not known. Based on a study by Lin and Wang (1978) the hazard from seiche on the lake is likely low.

Other hazards include shallow ground water and potential flooding. A more detailed discussion of seismic hazards at the LP1 over Jordan River site is provided in Section 5.0.

4.5 SOIL MATERIALS

Test holes completed at the F-747 site encountered predominantly very soft to stiff cohesive soils (lean and fat clay with some silt) interbedded with silty sand layers to a depth of about 105 feet (about elevation 4110 feet). Medium-dense to dense silty sand was the predominant soil type encountered between depths of about 105 to 125 feet. Soil conditions are described in further detail in Section 7.1.2.

4.6 HYDROGEOLOGIC CONDITIONS

Groundwater in the Salt Lake Valley occurs in late Tertiary and Quaternary alluvial and lacustrine basin-fill deposits that range from coarse gravel to clay. Four hydraulically connected aquifers have been identified in the basin sediments: 1) a deep, unconfined aquifer in gravelly deposits along the fronts of the Wasatch Range and Oquirrh Mountains; 2) a deep, confined aquifer in the center of the valley in gravel deposits beneath clay confined beds; 3) a shallow, unconfined aquifer in the center of the valley overlying the confined aquifer; and 4) local perched aquifers located primarily adjacent to mountain fronts.

The hydraulic gradient in the Parkway area generally slopes down in a westerly direction toward the Great Salt Lake. Groundwater was measured at a depth of 3.5 feet below the ground surface at the F-747 site in July 2006. Fluctuations of a few feet can be expected due to typical seasonal variations, and it is expected that the groundwater elevation in this

area will generally coincide with the river water. The ground surface may be very wet during at least part of the year, creating difficult access conditions. Artesian conditions were encountered in the lower confined aquifers at some locations.

4.7 POTENTIALLY HAZARDOUS MATERIALS

Potentially hazardous materials were not noted during the field investigation. All soil samples were re-examined in the laboratory and odors indicative of contamination were not noted. Potential sources of contamination include the oil drain at the southerly end of the project along with various past and present industrial sites located in the vicinity of the Parkway alignment. The apparent lack of contamination observed by field and lab personnel does not preclude the possible presence of potentially hazardous materials in the project area.

5.0 EARTHQUAKE CONSIDERATIONS

The study area is located within the seismically active Intermountain Seismic Belt which extends from Arizona to Canada. The nearest potentially active fault is the Salt Lake Segment of the Wasatch Fault Zone (WFZ) located about 1.2 miles east of the F-747 bridge site. The Salt Lake Segment is capable of generating a magnitude 7.2 earthquake. The Weber Segment of the WFZ is located about 2.5 miles to the northeast with the capability of a magnitude 7.4 earthquake. The West Valley Fault Zone is located about 2.7 miles south of the site. It is uncertain whether the West Valley Fault Zone has a true independent seismogenic source or if it functions as an antithetic fault to the WFZ.

5.1 DESIGN CRITERIA

The F-747 site is located at latitude 40.832° North and longitude 111.944° West. USGS-NEHRP probabilistic peak ground acceleration (PGA) values are tabulated below:

Probabilistic ground motion values in %g.

	10%PE in 50 yr	2%PE in 50 yr
PGA	30.09	72.79
0.2 sec SA	69.94	170.83
1.0 sec SA	24.61	71.72

It should be noted that the USGS-NEHRP mapped values are calculated for "firm rock" sites having a shear wave velocity of 1500 feet per second in the upper 100 feet (MCEER Site Class B/C boundary), and that bedrock ground motions may amplify or attenuate as they propagate through overburden soils.

Borings and testing completed at the site of the proposed structures indicate that the predominantly cohesive soils in the upper 100 feet have average undrained shear strengths less than 1,000 psf. It is therefore recommended that MCEER Site Class E be used for seismic design.

As part of the current Legacy Parkway project, Kleinfelder, Inc. developed site specific horizontal and vertical acceleration response spectra for the 1250 West bridge site and the State Street bridge site. It is our understanding that Kleinfelder will provide a report with conclusions and recommendations for applying the site-specific spectra to seismic design of structures within the project.

5.2 LIQUEFACTION AND LATERAL SPREAD

Liquefaction analyses were performed using the "Simplified Procedure" developed by Seed and Idriss (1971). This procedure involves determining the seismic shear stress ratio induced by an earthquake and comparing it with the seismic shear stress ratio required to cause liquefaction. Recommended refinements for the "Simplified Procedure" for SPT data presented at the 1996 NCEER workshop (Youd et al., 1997) were applied.

Liquefaction-induced settlements calculated by the Design-Build team for the four Jordan River Bridges ranged from about 2.5 to 5.9 inches. An evaluation of Boring RSB-4-660 indicates that several soil layers may liquefy during the seismic event having a 2 percent probability of exceedance in 50 years. Soil layers showing potential for liquefaction during the design event are noted on the boring logs in Appendix B. Layer thicknesses and potential liquefaction-induced settlements corresponding to volumetric strain are summarized below.

Boring No.	Thickness of Liquefiable Layers (ft)		Calculated Liquefaction Settlement (in)	
	Within Depth Investigated	Within Upper 50 Feet	Within Depth Investigated	Within Upper 50 Feet
RSB-4-660	30	16	5.9	3.5

A loose to very loose deposit of silty sand and sandy silt was encountered between depths of about 25 to 41 feet in Boring RSB-4-660. The $(N_1)_{60}$ blow counts in this layer were less than 15, indicating potential for lateral spread. Of the four borings completed for the Design-Build project in the vicinity of the structure (SB-3-249, SB-3-250, SB-4-251, SB-4-252), three encountered predominantly clayey soils between depths of 25 to 41 feet. Based on this information, deposits susceptible to lateral spreading appear to be confined to localized areas and are discontinuous across the site. Due to apparent lack of continuity of susceptible soil layers, it is not anticipated that lateral spread mitigation will be necessary at this bridge site.

6.0 FIELD AND LABORATORY TEST DATA

6.1 SUBSURFACE EXPLORATION

Subsurface investigations performed at the bridge sites include borings performed by Kleinfelder in conjunction with the Design-Build project, along with supplemental borings performed in 2006 for the current project.

Boring logs for bridge subsurface investigations performed in 2006 are included in Appendix B of this report. Test holes performed by RB&G Engineering in 2006 are labeled with the prefix "RSB" (or "RSC" for CPT holes, where applicable), followed by a number identifying the bridge site, then by a hole number in the 600 series. It will be noted that the LP1 over Jordan River bridge site is number 4, corresponding to the Design-Build designation "4" used for the structure originally contemplated at this site.

Subsurface explorations for bridges performed prior to 2006 by Kleinfelder are labeled in a similar manner as the 2006 test holes; however, the prefix "SB" is used for structure borings and "SC" is used for CPT soundings. It will be noted from Figure 3 that Kleinfelder performed two borings at the F-747 (Bridge 4) site, along with other test holes at the nearby Bridges 1, 2, and 3. The prefix "RB" is used to identify roadway borings.

For all structure borings drilled in 2006, the subsurface investigation was performed using a CME 55 rotary drill rig with a tri-cone rock bit and NW casing to advance the boring and water as the drilling fluid. Sampling was generally performed at 5-foot intervals. At some locations, sampling was performed at closer intervals to evaluate liquefaction hazard for loose cohesionless soils in the upper 30 to 40 feet. Disturbed samples were obtained by driving a 2-inch split spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. The drill rig used for each boring is noted on the boring log. The automatic trip hammer on the CME-55 No. 1 rig was evaluated by UDOT using Pile Driving Analyzer equipment in March 2006 and the energy ratio was determined to be about 72%.

The number of hammer blows required to drive the sampling spoon through each 6 inches of penetration is shown on the boring logs. The sum of the last two blow counts, which represents the number of blows to drive the sampling spoon through 12 inches, is defined as the standard penetration value. The standard penetration value, corrected for overburden and hammer energy, provides a good indication of the in-place density of

sandy material; however, it only provides an indication of the relative stiffness of cohesive material, since the penetration resistance of materials of this type is a function of the moisture content. Considerable care must be exercised in interpreting the standard penetration value in gravelly-type soils, particularly where the size of granular particles exceeds the inside diameter of the sampling spoon. If the spoon can be driven through the full 18 inches with a reasonable core recovery, the standard penetration value provides a good indication of the in-place density of gravelly-type material. For materials containing more than 35% gravel size particles, the density descriptions shown on the boring logs were developed based on correlations between relative density and standard penetration value for gravelly soils.

At some locations within the project it was not possible to drive the sampling spoon through the full 18 inches at some sampling depths. Where the sampling tube could not be driven through the full 18 inches, the number of blows to drive the spoon through a given depth of penetration is shown on the boring logs.

Undisturbed samples were obtained by pushing a 2.62-inch (inside diameter) thin-walled sampling tube into the subsurface material using the hydraulic pressure on the drill rig. The locations at which the undisturbed samples were obtained are shown on the boring logs.

Miniature vane shear (torvane) tests, which provide an indication of the undrained shearing strength of cohesive materials, were performed on samples of the cohesive soils during the field investigations. The results of these tests are shown on the boring logs as the torvane value in tsf.

Each sample obtained in the field was classified in the laboratory according to the Unified Soil Classification System. The symbols designating soil types according to this system are presented on the boring logs. A description of the Unified Soil Classification System is included with the logs (see Appendix B), and the meaning of the various symbols shown on the logs can be obtained from this figure. Laboratory-tested samples were also classified according to the AASHTO Classification System, and the symbols designating the soil types according to this system are also presented on the boring logs.

6.2 LABORATORY TESTING

Laboratory tests performed during this investigation to define the characteristics of the subsurface material included:

1) Mechanical Analysis
2) Density
3) Natural Moisture Content
4) Atterberg Limits
5) Unconfined Compressive Strength
6) Consolidation
7) pH, Resistivity, Sulfates, and Chlorides

Laboratory testing was performed in accordance with applicable standards published by the American Society for Testing and Materials (ASTM) and/or the American Association of State Highway and Transportation Officials (AASHTO).

The results of laboratory tests performed during this investigation are presented on the boring logs and summarized on tables located in Appendix C of this report. Plots of applicable test data are also included in Appendix C.

7.0 STRUCTURES

7.1 DESCRIPTION

7.1.1 General

It is our understanding that Structure F-747 will be a single-span prestressed concrete girder bridge structure. The bridge will be approximately 120 feet long by 49 feet wide. Loads for the F-747 bridge have been provided by the structural engineer and are shown on the table below.

Structure	Foundation	Strength I (kips)	Service I (kips)
F-747 LP1 over Jordan River	Abut 1	2530	1960
	Abut 2	2530	1960

Structure E-2569 is expected to be a box culvert structure with inside dimensions of about 20 feet wide by 10 feet high.

7.1.2 Subsurface Conditions

Borings SB-4-251 and SB-4-252 were drilled in January 2000 for the Design-Builder's Geotechnical Report. Boring 251, at Abutment 1, encountered about 4 feet of clayey fill, followed by soft to very soft lean clay and silty clay to a depth of about 60 feet. A loose sand layer was identified between 60 and 70 feet, followed by stiff silt and clay to 86 feet. A dense sand layer was logged between 86 and 95 feet, followed by stiff lean clay to 106 feet, then silty sand to the bottom of the boring at a depth of about 124 feet. Boring 252, at Abutment 2, encountered 15 feet of silty gravel fill, followed by 10 feet of loose clayey sand with frequent clay layers. Medium-stiff to stiff lean clay and sandy silt layers were encountered between 25 and 80 feet. Between 80 and 105 feet, the boring log shows silty sand with silt and clay layers, followed by lean clay to 110 feet, then dense sand to 120 feet. Hard silt with gravelly and silty sand layers was encountered between 120 feet and the bottom of the boring at 127 feet.

Roadway Boring RB-392 was drilled in February and March 200 for the Design-Builder's Geotechnical Report. This boring, located near the proposed E-2569 location, encountered about 11 feet of silty gravel. This gravel fill was very dense in the upper 4 to 5 feet, but relatively loose between depths of 5 and 11 feet. Soft to very soft lean clay was encountered between 11 and 33 feet, followed by a two-

foot layer of medium-dense silty sand, then predominantly medium-stiff silt and clay to a depth of 90 feet. A layer of dense to very dense silty sand was encountered from 90 to 95 feet, followed by stiff lean clay to the bottom of the boring (total depth of 99 feet).

Boring RSB-4-660 was drilled in 2006 at F-747 Abutment 1. This boring encountered very soft lean clay, fat clay, and silt in the upper 25 feet. The zone between depths of 25 and 41 feet consisted of loose to very loose sand and non-plastic silt, with some soft, low-plasticity silt. From 41 feet to 105 feet, the boring encountered firm to stiff lean and fat clay with some medium-dense sand layers up to about 4 feet thick. The remainder of the boring encountered medium-dense silty sand from 105 to 115 feet (elevation 4100.5 feet). In this boring, the lean clay samples tested in the laboratory had liquid limits between 34 and 40, with plasticity indices between 15 and 21. The fat clay samples had liquid limits ranging from 56 to 67 and plasticity indices between 30 and 45. The plastic silt samples in the upper 35 feet had liquid limits between 19 and 37, and plasticity indices between 2 and 10.

7.1.3 Groundwater Conditions

Groundwater was encountered at about elevation 4212 feet (within 3.5 of the ground surface) in Boring RSB-4-660 in July 2006. The water table was not noted on the boring log for the E-2569 site; however, the soil moisture descriptions suggest that the groundwater elevation at the time of drilling was near the top of the upper lean clay layer, if not higher. It is anticipated that up to two feet of fluctuation may occur due to typical seasonal variations in precipitation and climatic cycles, and that the groundwater level will generally be similar to the level of water in the river. Artesian flow was not noted at this site; however artesian conditions are known to exist at various locations throughout the Legacy Parkway project.

7.2 RECOMMENDATIONS

7.2.1 Bridge Structures

Potential foundation types at this site include shallow foundations, such as spread footings, and deep foundations, such as drilled shafts or driven piles. Due to the magnitude of structural loads (including seismic design requirements), deep foundations are expected to be the most efficient foundation type for major bridge

structures on the project. The depth to competent soil layers, along with foundation settlement considerations, favors the use of driven piles rather than drilled shafts. Given the subsurface soil and groundwater conditions, driven piles can be more readily installed to greater depths than drilled shaft foundations.

Recommendations for driven pile foundations are summarized below. Recommendations for shallow foundations, which may be considered for the multi-use trail underpass, are provided in Section 7.2.4.

7.2.1.1 Driven Piles

It is our understanding that each abutment foundation for Structure F-747 is expected to consist of a single line of ten 16-inch OD concrete-filled pipe piles with center-to-center pile spacing of 5'-4" on centers.

Axial compression resistance values have been estimated for 16-inch OD concrete-filled steel pipe piles. The analyses were performed using the FHWA program SPILE. Geotechnical resistance factors were selected from the 2006 Interim AASHTO LRFD Bridge Design Specifications. Estimated driving depths and factored resistance values are summarized below.

Pile Data Parameters	F-747 Abut 1	F-747 Abut 2
Estimated Pile Tip Elevation (ft)	4100	4103
Elev. of Min. Acceptable Pile Penetration (ft)	4105	4107
Strength I Axial Compression Resistance (kip)	264	264
Extreme Event I Compression Resistance. (kip)	346	346
Required Driving Resistance (kip)	407	407

It will be noted that the estimated resistance values are the same for each abutment. The estimated tip elevations are located within a relatively dense zone of granular soil shown on the boring logs. The elevation of minimum acceptable pile penetration is a few feet above the estimated tip elevation to allow a limited amount of flexibility in driving depths if the required driving resistance is achieved at a shallower depth. All piles should be driven to at least the minimum penetration elevation unless the geotechnical engineer approves shorter piles based on a review of tested pile driving resistance and other foundation considerations, including foundation uplift resistance and settlement.

The estimates listed above assume that new embankments will be constructed with lightweight material and/or surcharged if necessary such that any significant embankment settlement at the abutments will be completed or otherwise mitigated prior to placement of structural loads on the piles.

We recommend that piles be spaced at least 3 diameters apart (center-to-center) to reduce group effects. Potential for pile group failure under axial compression loads was checked for the following proposed pile group layout.

- Abutments supported by a single row of 10 piles spaced 5.3 feet on centers over a total distance of 49 feet.

For the pile group layout listed above, the potential for group (block) failure was found to be less critical than the axial compressive resistance of individual piles. Group resistance can therefore be determined by multiplying the single-pile resistance by the number of piles in the group for both the Strength I and Extreme Event limit states.

A preliminary pile drivability analysis has been performed using the program GRLWEAP 2005. The analysis was performed for closed-end 16-inch OD steel pipe piles having wall thicknesses of 3/8 and 1/2 inch. The analyzed driving systems were a Delmag D 25-32 diesel hammer with the manufacturer's recommended hammer cushion, and an IHC S-90 Hydrohammer, without cushioning. The results of the analyses are summarized below.

Hammer	3/8" Pipe Thickness					1/2" Pipe Thickness				
	Ultimate Capacity (kips)	Maximum Compress. Stress (ksi)	Blow Count (per foot)	Stroke (ft)	Energy (kip-ft)	Ultimate Capacity (kips)	Maximum Compress. Stress (ksi)	Blow Count (per foot)	Stroke (ft)	Energy (kip-ft)
D 25-32	350	25.9	52	7.4	32.5	350	24.7	43	7.4	30.2
	375	26.2	66	7.5	32.7	375	25.0	51	7.5	30.5
	400	26.4	86	7.5	33.0	400	25.3	61	7.6	30.7
	430	26.7	125	7.6	33.1	475	25.9	117	7.8	31.3
IHC S-90*	350	39.1	39	6.6	43.5	350	36.5	30	6.6	43.9
	375	39.2	49	6.6	43.5	375	36.5	35	6.6	43.9
	400	39.2	63	6.6	43.5	400	36.6	41	6.6	43.8
	455	39.2	123	6.6	43.4	535	36.6	121	6.6	43.7

* S-90 assumed to operate at 70% efficiency.

It will be observed from the table that both driving systems appear capable of driving piles to the required driving resistance of 407 kips without significantly exceeding a hammer blow count of about 10 blows per inch. The calculated driving stresses are significantly greater for the IHC S-90 hammer than for the diesel hammer, due to the lack of cushioning and greater energy transfer to the pile. Based upon the results of the WEAP analysis, pipe piles with 3/8" wall thickness can likely be driven to the required driving resistance. A refined wave equation analysis should be performed for the proposed pile driving system prior to mobilizing the pile driving rig to the site.

Pile driving should be monitored to ensure that driving stresses do not exceed 0.9 times the yield strength of the steel piles. Based on the WEAP analysis, the yield strength of the steel pipe should be at least 45 ksi for this site. The pile driving hammer should have an operating energy of at least 60 kip-ft. Special care should be taken to align the hammer properly with the pile head to limit the possibility of eccentric driving stresses, which can result in over-stressing of one side of the pile. Driving should be performed only with smooth, square ends of the piles (preferable the factory-cut ends) rather than rough field-cut pile ends.

It should be noted that piles are not expected to demonstrate the required driving resistance during initial driving. Significant set-up is likely to occur as pore pressures dissipate in the hours and days following driving, increasing the geotechnical resistance of the pile.

7.2.1.2 Foundation Settlement

Pile resistance analyses were performed based on the neutral plane method. In this method, downdrag loads are not considered detrimental to the geotechnical pile resistance, and the resistance values above need not be reduced to account for downdrag. The effects of downdrag should, however, be accounted for in evaluations of the structural resistance of the pile section. For 16-inch OD steel pipe piles at each of the foundation locations listed above, the axial structural resistance of the concrete-filled pipe pile section should be checked to verify that the pile section can resist the Service I Load plus a factored downdrag load of 250 kips per pile. To account for potential corrosion, we recommend that the structural capacity evaluation be performed assuming 1/16 inch of corrosion will occur on the exterior of the steel pipe.

The Extreme Event I Resistance shown above assumes that liquefiable layers will not provide resistance during seismic loading. If this value is not exceeded, it is anticipated that the principle consequences of liquefaction will be pile group settlement resulting from downdrag loads transferred from settling soil above the liquefiable layers. The pile group could potentially settle as much as the surrounding ground surface during liquefaction before the temporary downdrag loads are neutralized and the piles regain the full Extreme Event I Resistance; however, actual pile group settlement during liquefaction is expected to be somewhat less than the settlement of the surrounding ground surface. The estimated ground settlement due to liquefaction based on Boring RSB-4-660 is 5.9 inches.

Consolidation settlement of abutment pile groups at Structure F-747 was estimated assuming a single row of 10 piles (16-inch OD) spaced over a total distance of 49 feet at each abutment. In the analysis it was assumed that settlements caused by placement of embankment and MSE fill will be mitigated/completed prior to placement of bridge loads on the piles. For a total service dead load of 1850 kips (185 kips per pile), the calculated pile group settlement is about 1.2 inches. It is expected that at least ¼ inch of the total calculated settlement will occur prior to final paving of the bridge. Average non-transient loads greater than 185 kips per pile may cause post-construction settlements greater than one inch. We therefore recommend that the average service dead load not exceed 185 kips per pile. Transient loads are not expected to contribute significantly to pile group settlement at this site. The Service I Resistance shown on the plans may be greater than 185 kips per pile if necessary to support transient loads, under the condition that the non-transient loads do not exceed 185 kips per pile.

7.2.1.3 Uplift

Uplift capacities for individual piles computed using LRFD Procedures are 85 kips per pile for the Strength I limit state and 245 kips per pile for Extreme Event I. A resistance factor of 0.35 was used for sandy soils, and a factor of 0.25 was used for clayey soils at the Strength I limit state.

Group uplift resistance for the case of block failure was evaluated by estimating the weight of each pile group plus the shear resisting force around the perimeter of the pile group for the proposed pile groups as follows:

- Abutments with 10 piles spaced at 5.3 feet on centers over a total distance of 49 feet.

The uplift resistance of the pile group to block failure was greater than the sum of the single-pile resistance values for all piles in the group. It is therefore recommended that the uplift resistance for pile groups at this structure be assumed equal to the uplift resistance of a single pile multiplied by the number of piles in the group.

7.2.1.4 Lateral Loading

Soil parameters and other recommendations for evaluation of lateral load response using the computer programs LPILE and GROUP are included on a summary sheet in Appendix D.

7.2.1.5 Load Tests

Table 10.5.5.2.3-3 of the 2006 AASHTO LRFD Interim Specifications shows the number of dynamic pile load tests with signal matching required at each site. The number of required PDA tests depends on site variability and the number of piles to be driven. With respect to the AASHTO table, the site of the proposed F-747 bridge structure can be considered to have low variability, and the minimum number of tests is 4. Additional PDA testing may be necessary if pile driving conditions indicate significant variability in the soil profile.

Pile resistance and driving criteria from PDA testing should be determined from "Beginning of Restrike" conditions. A minimum of 24 hours set-up time will likely be required after initial driving before piles demonstrate the required driving resistance, and additional time may be necessary in some instances.

7.2.1.6 Construction Considerations

Groundwater was encountered within 3.5 feet of the ground surface at the boring location in July 2006, and dewatering may be required for some construction activities.

It is recommended that the groundwater be lowered to a depth of 2 feet below the bottom of excavations. It is anticipated that dewatering can best be

achieved using sumps and drain trenches where clay exists at the foundation level.

Soils at the bottom of excavations may be too soft to provide an adequate working surface. Stabilization methods will depend upon conditions encountered. Moderately soft areas can be stabilized by over excavating the foundation footprint to a depth of about 1 foot, placing a geotextile fabric such as Mirafi 500X or equal and backfilling with compacted sandy gravel. Very soft areas may be stabilized by tamping cobble rock (preferably angular to subangular) into the subgrade as needed.

Depending upon construction sequence and methods employed, excavation and shoring of embankment fill may be necessary. Maximum excavation slopes in compacted granular fill material of 1H:1V can be used for temporary cuts less than 20 feet deep. For temporary cuts between 20 and 30 feet deep, 1.5H:1V cut slopes or flatter should be used for the full depth of the cut. The stability of cuts in uncompacted fill and/or natural subgrade soils should be evaluated on a case-by-case basis.

We recommend that preconstruction surveys and vibration monitoring be performed for any critical structures or utilities located within 500 feet of the construction area.

7.2.2 Embankments

Analyses and recommendations for embankments are provided in a separate report by Kleinfelder.

7.2.3 Retaining Walls

Analyses and recommendations for retaining walls are provided in a separate report by Kleinfelder.

7.2.4 Tunnels / Culverts

The LP1 Multi-Use Trail undercrossing structure (E-2569) may be supported on pile foundations using the recommendations of Section 7.2.1 above. If this option is selected, we recommend that additional subsurface exploration be performed at the site to provide refined pile resistance values and estimated pile tip elevations.

Alternatively, consideration may be given to supporting the structure on the clayey natural subgrade soils using the culvert floor as a mat-type foundation. Preliminary structure drawings indicate that the bottom of the proposed box culvert will be at about elevation 4213.9 feet. Based on the boring log, the culvert bottom would be located on about 5 to 6 feet of loose silty gravel fill overlying the natural lean clay. To provide uniform foundation support for the structure, we recommend that the culvert area be overexcavated to remove any loose fill. The overexcavated area should include the culvert footprint plus a lateral distance equal to half the overexcavation depth on all four sides of the culvert. The excavated material should be replaced with compacted granular fill. The excavated loose silty gravel may be suitable for use as compacted fill, reducing the amount of imported fill required.

If the recommendations provided above are followed, it is anticipated that the critical subgrade parameters will be controlled by the lean clay encountered beneath the loose fill. Preliminary estimates of subgrade parameters for the lean clay are summarized below.

Average Undrained Shear Strength: 500 psf
Nominal Bearing Resistance: 2570 psf
Coefficient of Subgrade Reaction: 30 pci

The nominal bearing resistance can be increased due to load spreading in the compacted granular fill. The increased bearing resistance is determined by multiplying the bearing resistance of the clay from the table above by the ratio (B+z)/B, where B is the foundation width and z is the thickness of the compacted fill layer beneath the culvert. For a footing width of 20 feet, this computation results in a 5% increase in bearing resistance per foot of compacted granular fill. In no case; however, should the nominal bearing resistance be assumed to be greater than 800B psf, where B is the footing width in feet. If at least 24 inches of compacted granular fill exist beneath the footing, the coefficient of subgrade reaction can be increased to 200 pci.

The Strength I Bearing Resistance can be estimated by multiplying the nominal resistance shown above by a resistance factor of 0.50. The bearing resistance value listed above is applicable to structures placed on the existing subgrade soils

prior to placement of roadway embankment fill around the structures. It should be noted that the placement of roadway embankment fill will consolidate subgrade soils, and the clayey and silty soils will gain strength with consolidation. If roadway embankments adjacent to the culverts are constructed in such a manner that loads from the roadway fill weight do not exceed the bearing resistance of the subgrade, bearing resistance will not be critical for the culverts. At some locations, staged construction, lightweight embankment fill, or subgrade reinforcement/modification may be necessary to provide sufficient bearing capacity for the new fill and the buried culverts.

The estimated coefficient of subgrade reaction shown on the table is for a 12-inch square footing area and is based on typical values for the lean clay encountered at the site. It is anticipated that significant consolidation settlement may occur due to placement of new roadway embankments, and that differential and total settlement considerations may control the design of box culverts. If the structure cannot be designed to tolerate the anticipated settlements, it may be advisable to preload the culvert subgrade area with temporary embankment fill, allow consolidation to occur, then excavate the temporary fill to construct the culvert.

7.2.5 Lateral Earth Pressures

Lateral earth pressures can generally be calculated using the equation

$$P = \frac{1}{2} \gamma K H^2$$

Where P = total lateral force on the wall, plf
K = earth pressure coefficient
γ = unit weight of the soil (depends on fill material)
H =height of the wall

The earth pressure coefficient used in designing the walls will depend upon whether the wall is free to move during backfilling operations, or whether the wall is restrained during backfilling. If the wall is free to move away from the soil during backfilling operations, we recommend that an active earth pressure coefficient be used in the above equation to calculate the lateral earth pressures. If the walls are restrained or braced from movement during backfilling (as is generally the case with box culverts and similar structures), we recommend that an at-rest earth pressure coefficient be used to calculate the lateral earth pressures. A passive earth pressure coefficient should be used to calculate the lateral soil

resistance where the wall is being pushed toward the soil. It should be recognized that the pressures, calculated by the above equation, are earth pressures only and do not include hydrostatic pressures. Where hydrostatic pressures may exist behind a retaining structure, we recommend either the wall be designed to resist hydrostatic pressure, or that a drainage system be placed behind the wall to prevent the development of hydrostatic pressures.

Lateral earth pressure coefficients and other recommendations for computing lateral earth pressures are included in Appendix D. A general earth pressure coefficient has been provided for calculation of earth pressures where mechanical compaction equipment is expected to be operated near non-yielding walls less than about 8 feet high. This scenario is anticipated during placement of fill around culverts. The residual pressure from compaction equipment can be reduced by limiting the proximity and weight of compacting equipment near culvert walls.

Recommendations based on the Mononobe-Okabe approach for active and passive seismic lateral earth forces are included in Appendix D. For non-yielding walls, recommended equations for calculating the dynamic thrust and dynamic overturning moment are also provided.

8.0 CORROSION INVESTIGATIONS

The Design-Build team performed chemical analyses on samples from borings at the Jordan River bridge sites, and the results are summarized below.

Test Hole	Depth (ft)	Soil Type	Resistivity ohm-cm	pH	Sulfate (ppm)
SB-1-243	4	Lean Clay	2,800	7.7	35
SB-2-247	5	Lean Clay	2,300	8.0	48
SB-2-248	17	Lean Clay	1,900	8.0	35
SB-3-249	9.5	Fat Clay	1,500	8.2	<62
SB-4-251	10	Lean Clay	2,200	8.9	25

The 2006 Interim LRFD specifications state that resistivity less than 2,000 ohm-cm, sulfate concentration greater than 1,000 ppm, and pH less than 5.5 (8.5 in highly organic soils) are all indicative of potential pile corrosion or deterioration. It will be noted that the resistivity of two of the five samples was less than 2,000 ohm-cm, indicating some potential for corrosion. Type II cement is recommended at this site for its superior resistance to deterioration. For design of driven piles, it is recommended that 1/16 inch of corrosion be assumed for all surfaces in contact with soil or groundwater. This reduction has been accounted for in the pile analyses described in Section 7.2.1.1.

9.0 LIMITATIONS

The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests. It should be recognized that soil materials are inherently heterogeneous and that conditions may exist throughout this site which were not defined during this investigation. If during construction, conditions are encountered which appear to be different than those presented in this report, it is requested that we be advised in order that appropriate action may be taken.

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10.0 REFERENCES

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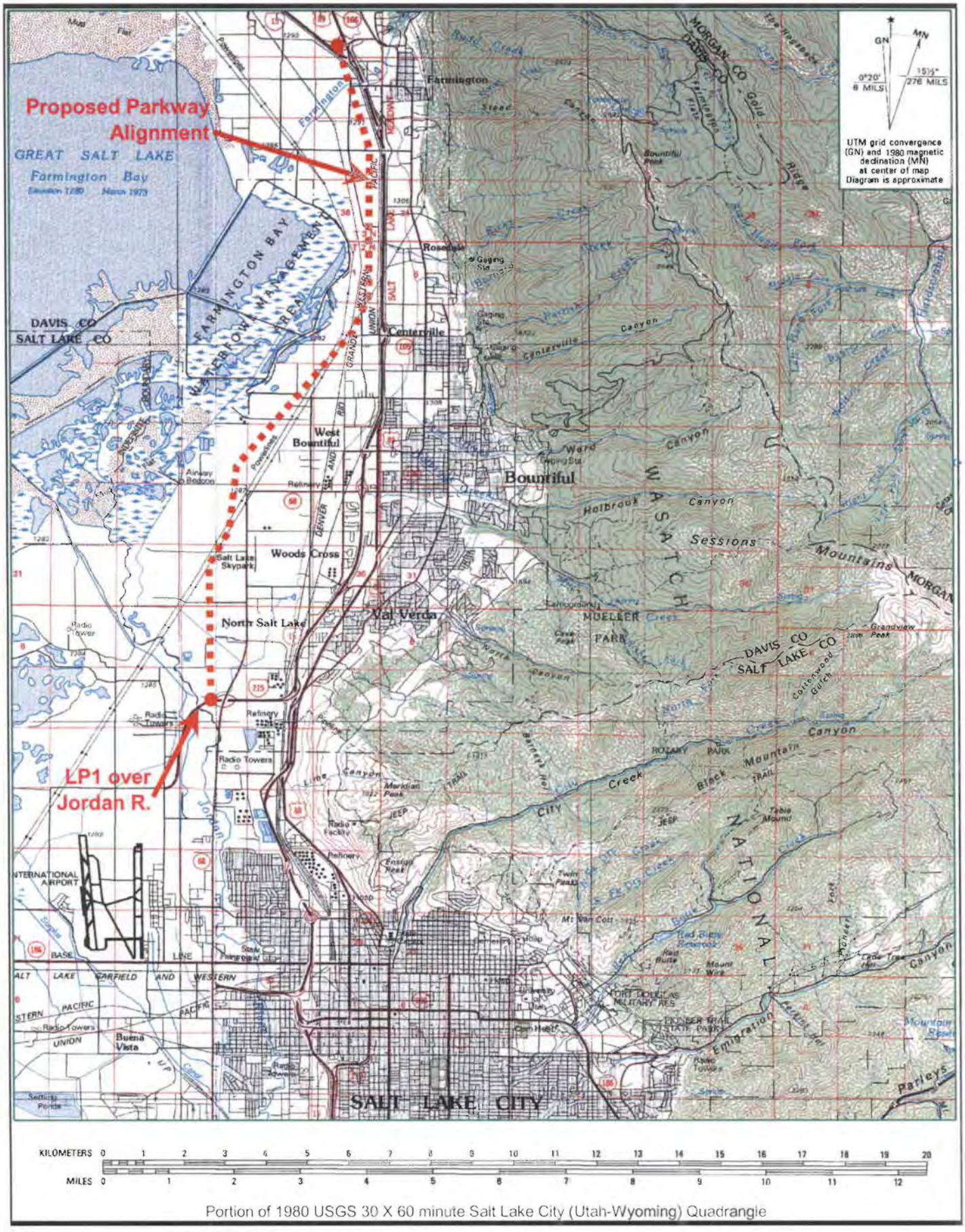
FIGURES



Portion of 1980 USGS 30 X 60 minute Salt Lake City (Utah-Wyoming) Quadrangle

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Figure 1 Vicinity Map
Proposed Legacy Parkway Alignment
Legacy Parkway
Salt Lake / Davis Counties, Utah

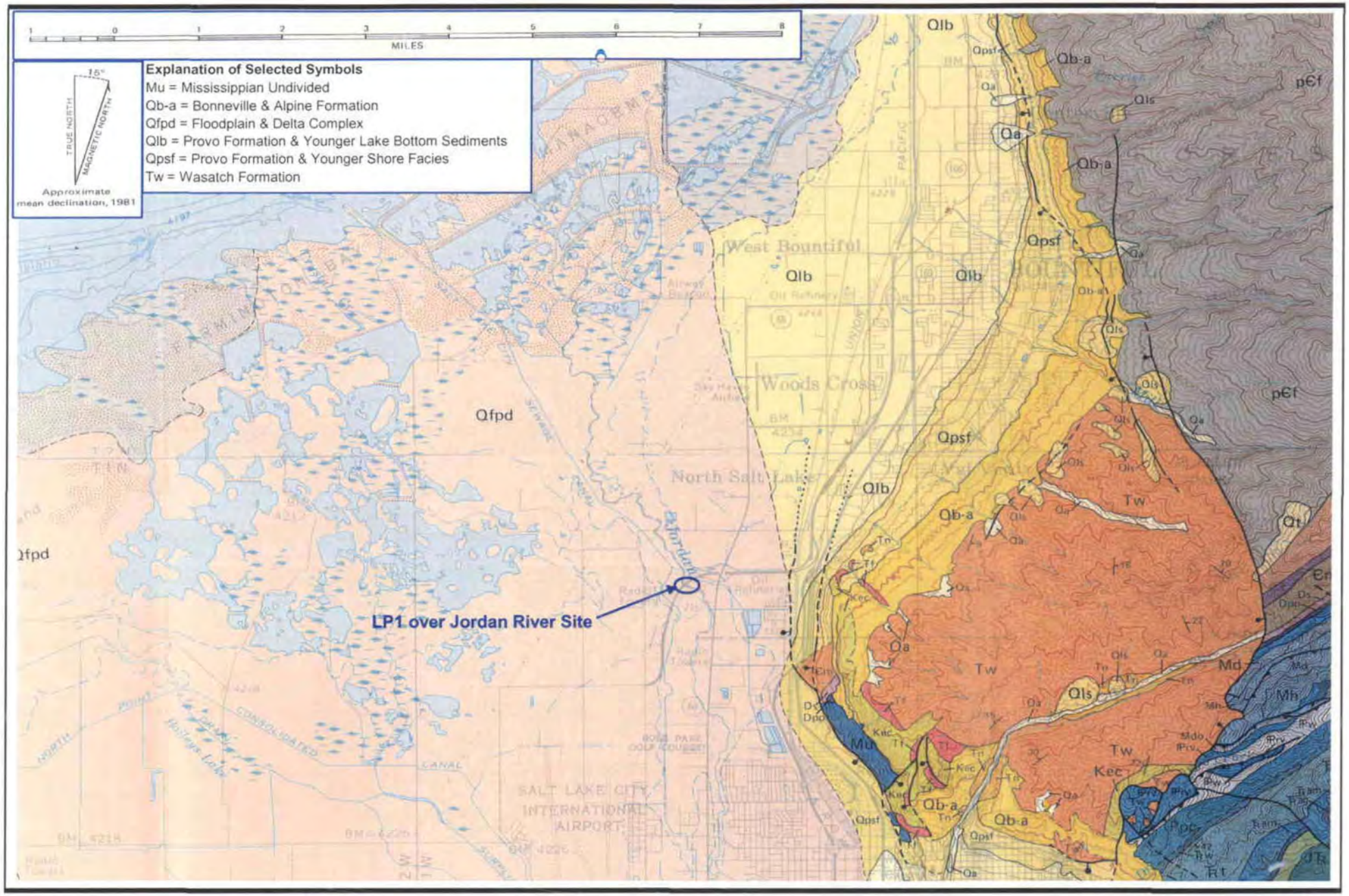

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Figure 2a Geologic Map A
F-747 Site (LP1 over Jordan River)
Legacy Parkway
Salt Lake / Davis Counties, Utah

Map modified from:
Davis, 1983
Utah Geological and Mineral Survey

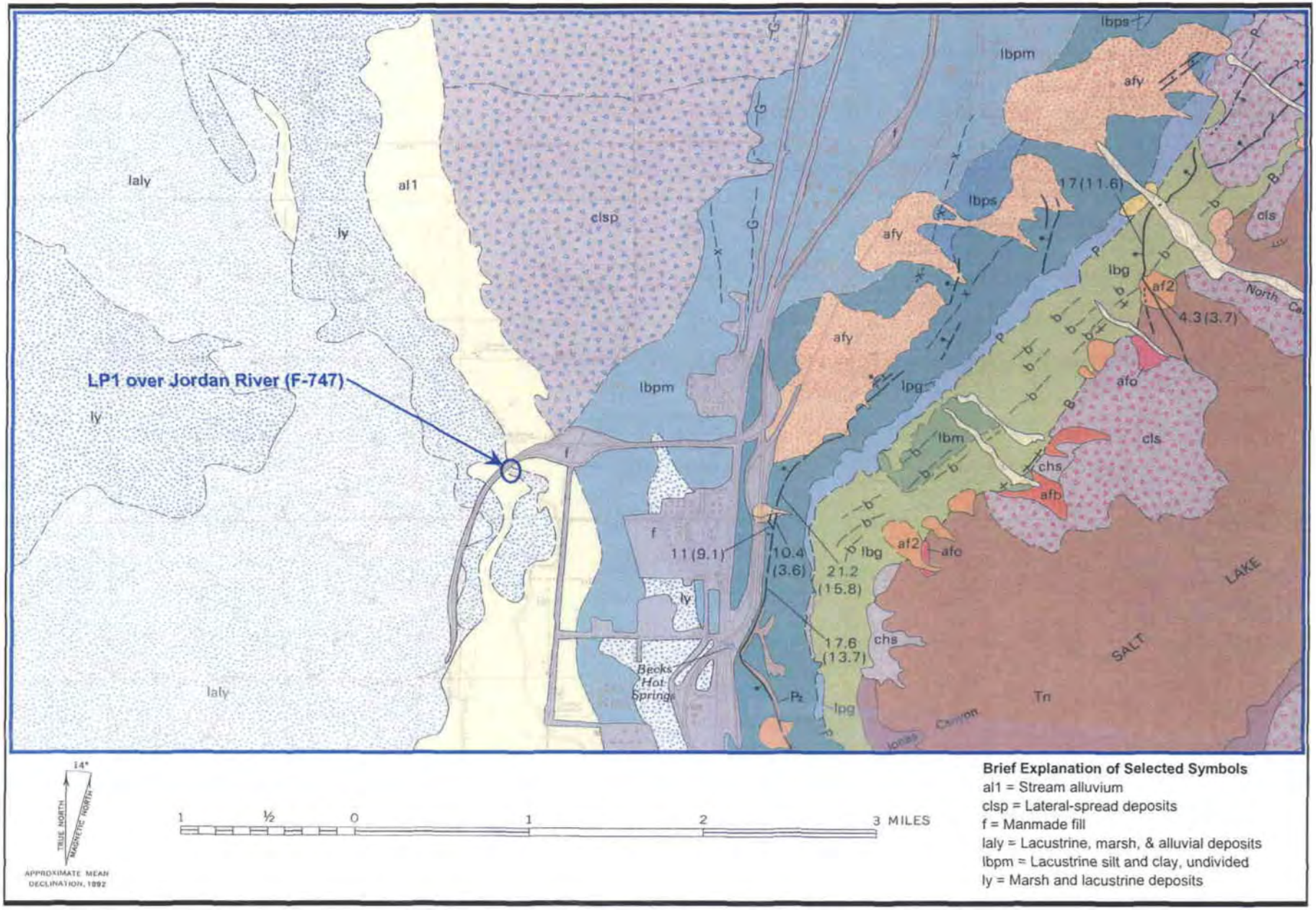

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Figure 2b Geologic Map B
LP1 over Jordan River
Legacy Parkway
Salt Lake / Davis Counties, Utah

Map modified from:
Personius & Scott, 1992 (US Geological Survey)

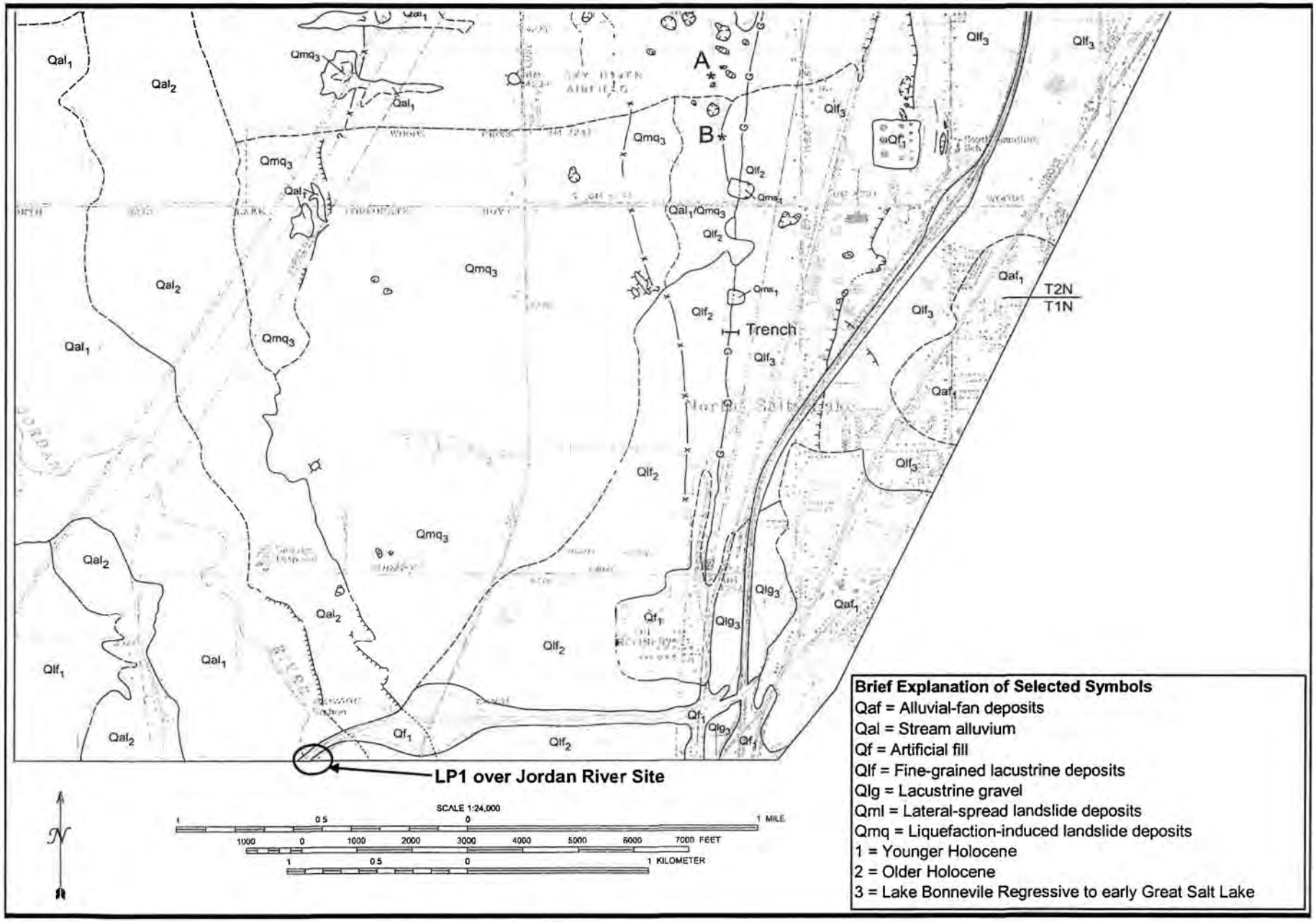

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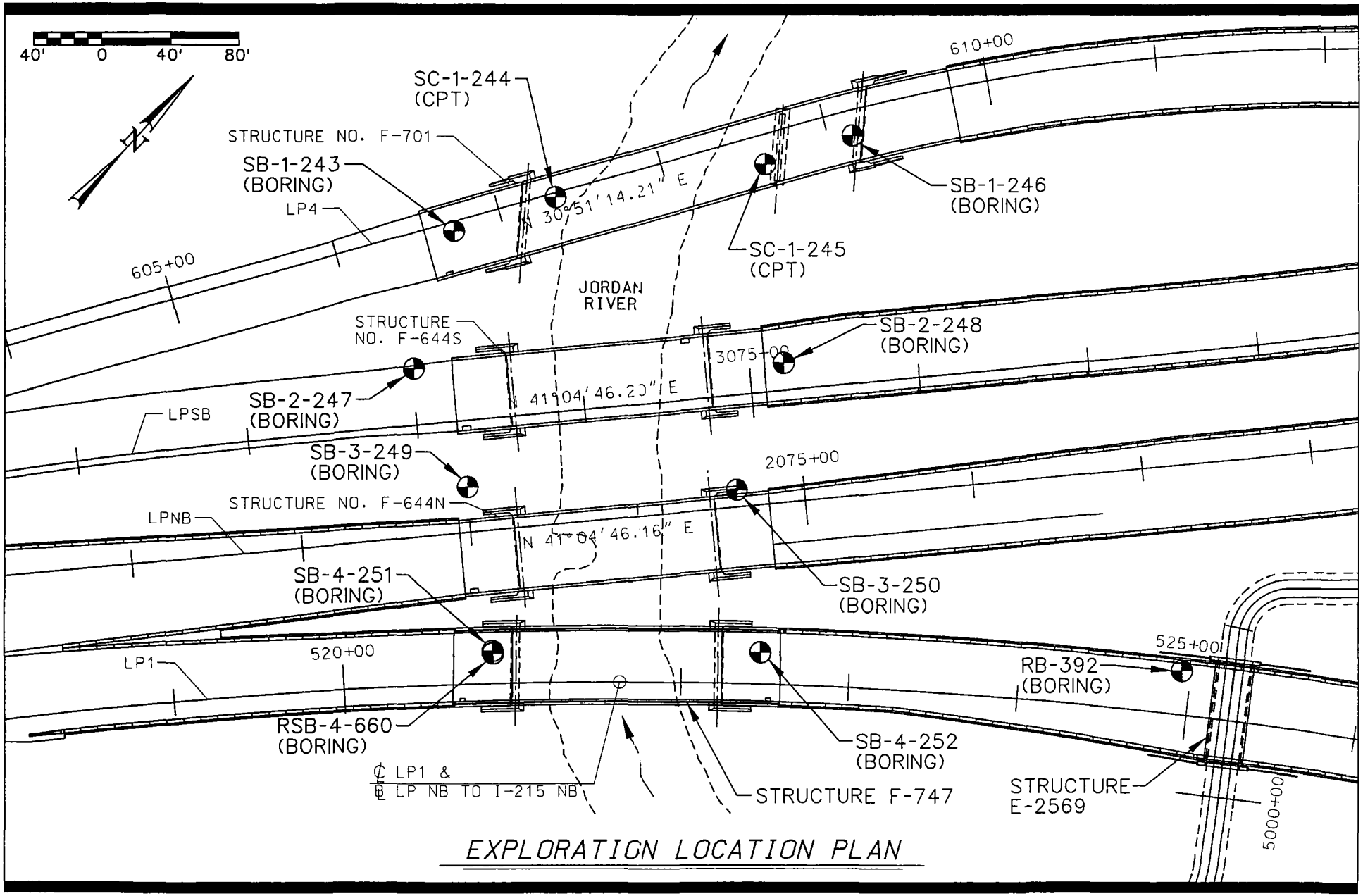
Figure 2c Geologic Map C
North Salt Lake Landslides
Legacy Parkway
Salt Lake / Davis Counties, Utah

Map modified from:
Harty & Lowe, 1992



EXPLORATION LOCATION PLAN

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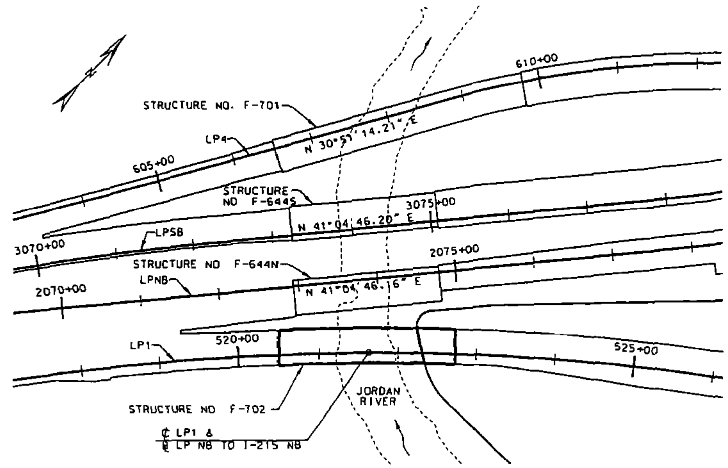
Figure 3. SITE PLAN & TEST HOLE LOCATIONS
Legacy Parkway - Structures F-747 & E-2569
(LP1 Structures)
Davis/Salt Lake County, Utah

APPENDIX A
Structure Drawings

INDEX OF SHEETS



LOCATION PLAN

HYDRAULIC DATA		
ITEM		UNIT
1. DRAINAGE AREA	89600	acre
2. APPROACH SECTION FLOWLINE ELEV.	4208.446	ft
3. BRIDGE SECTION FLOWLINE ELEV.	4207.298	ft
4. DESIGN FREQUENCY.	100	YEAR
5. DESIGN DISCHARGE (Qd).	1233.012	CFS
6. APPROACH SECTION WSE FOR Qd IN NATURAL CHANNEL.	4214.014	ft
7. APPROACH SECTION WSE FOR Qd WITH BRIDGE.	4214.024	ft
8. BRIDGE SECTION VELOCITY FOR Qd.	4.019	ft/s
9. 100 YEAR DISCHARGE (Q100).	1233.012	CFS
10. APPR. SECTION WSE FOR Q100 IN NATURAL CHANNEL.	4214.014	ft
11. APPR. SECTION WSE FOR Q100 WITH BRIDGE.	4214.024	ft
12. OVERTOPPING FREQUENCY (Qover) /500 YEAR MAX.	500	YEAR
13. OVERTOPPING DISCHARGE Qover.	2096.102	CFS
14. APPR. SECTION WSE FOR Qover NATURAL CHANNEL.	4215.526	ft
15. APPR SECTION WSE FOR Qover WITH BRIDGE.	4215.520	ft
16. DEPTH OF CONTRACTION SCOUR FOR Q100	0.262	ft
17. DEPTH OF TOTAL SCOUR FOR Q100:		
AT LEFT ABUTMENT.	5.144	ft
AT RIGHT ABUTMENT.	3.884	ft
18. DEPTH OF CONTRACTION SCOUR FOR Qover.	0.121	ft
19. DEPTH OF TOTAL SCOUR FOR Qover:		
AT LEFT ABUTMENT.	6.079	ft
AT RIGHT ABUTMENT.	4.652	ft

DESIGN DATA

HL-93 LOADING IN ACCORDANCE WITH 3rd EDITION AASHTO LRFD AND INTERIM SPECIFICATIONS THROUGH 2006

CAST-IN-PLACE CONCRETE: f'c = 4000 PSI· Fy (REINF) = 60.000 PSI: n = 8

PRESTRESSED CONCRETE: f'c = 7500 PSI: Fy (NONPRESTRESSED) = 60,000 PSI: n = 6
fs (PRESTRESSED) = 270.000 PSI

WEARING SURFACE: ½" CONCRETE: 35 PSF (FUTURE)

DESIGN SPEED 50 mph - LP NB TO I-215 NB

SEISMIC DESIGN DATA: SEISMIC DESIGN PER MCEER/ATC 49
(2475 YR. RETURN PERIOD. 3% PE IN 75 YRS.)
Ss = MAX CONSIDERATION EQ GROUND MOTION AT 0.2S = 1.41 g
S1 = MAX CONSIDERATION EQ GROUND MOTION AT 1.0S = 0.59 g
SITE CLASS X

TRAFFIC DATA: 2008 ADT = 25300 LP NB TO I-215 NB
2020 ADT = 36500 LP NB TO I-215 NB

PARAPET TEST LEVEL: TL-3

PRELIMINARY
NOT FOR CONSTRUCTION

GENERAL NOTES

1. USE COATED, DEFORMED BILLET-STEEL BARS CONFORMING TO AASHTO M 284 OR M 111 AND M 31 GRADE 60 FOR ALL REINFORCING STEEL.
2. PROVIDE STEEL FOR DRIVEN PIPE PILES CONFORMING TO ASTM A-252, GRADE 3.
3. USE STRUCTURAL STEEL CONFORMING TO AASHTO M 270 GRADE 36 EXCEPT WHERE NOTED OTHERWISE.
4. CHAMFER ALL EXPOSED CONCRETE CORNERS ¾" EXCEPT WHERE NOTED OTHERWISE.
5. PROVIDE 2" CONCRETE COVER TO REINFORCING STEEL EXCEPT WHERE NOTED OTHERWISE.
6. USE CLASS AA (AE) CAST-IN-PLACE CONCRETE EXCEPT WHERE NOTED OTHERWISE.
7. HORIZONTAL DIMESIONS ARE PLAN. VERICAL DIMENSIONS ARE PLUMB.

BRIDGE LOAD RATING

	HL-93	
	RATING	LOCATION
INV.	XXX	XXX
OPER.	XXX	XXX

F DENOTES RATING CONTROLLED BY FLEXURE
S DENOTES RATING CONTROLLED BY SHEAR
My AT XX.XX' = XXX.X K-FT
Vy AT XX.XX' = XXX.X KIPS

QUANTITIES

ITEM	ESTIMATED	UNIT	AS CONSTRUCTED
GRANULAR BACKFILL BORROW (PLAN QUANTITY)	XXX	CU. YDS.	
PILE DRIVING EQUIPMENT	1	LUMP	
DRIVEN PILES (16 INCH)	XXX	FT.	
STRUCTURAL CONCRETE (SUBSTRUCTURE EST. LUMP QTY XXX.X CU. YDS.)	1	LUMP	
STRUCTURAL CONCRETE (SUPERSTRUCTURE EST. LUMP QTY XXX.X CU. YDS.)	1	LUMP	
REINFORCING STEEL (EPOXY COATED)	XXX	LBS.	
PRESTRESSED CONCRETE MEMBERS (121'-8") TYPE W1850	5	EACH	
STRUCTURAL STEEL (EST. LUMP QTY. XXX LBS.)	1	LUMP	
ELECTRICAL WORK - BRIDGES	1	LUMP	

REVISIONS
NO. | DATE | BY | REMARKS

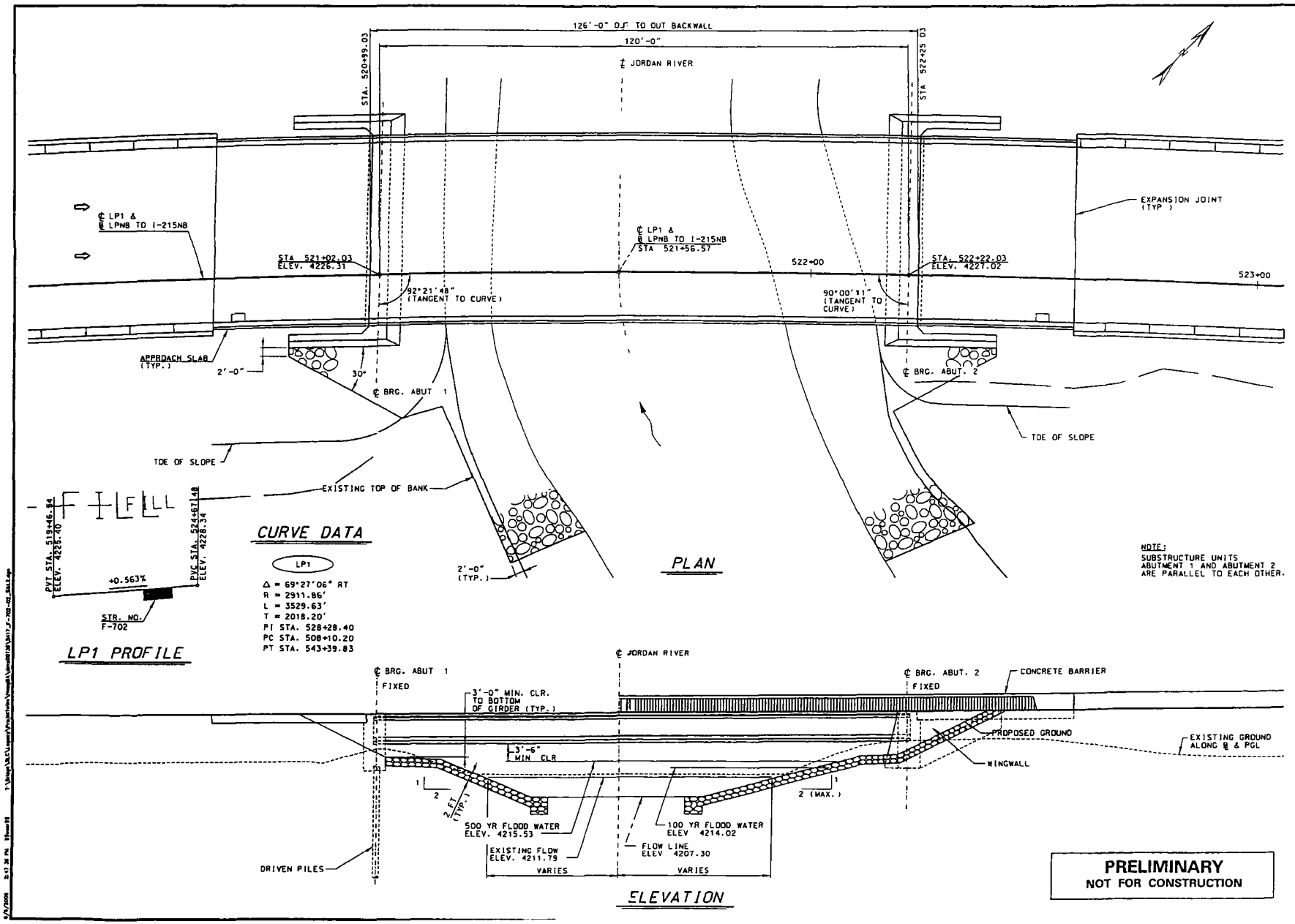
UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

DESIGN EVP 6/06 CHECK SKD 6/06
DRAWN EJH 6/06 CHECK DVP 6/06
QUANT EVP 6/06 CHECK SKD 6/06

APPROVAL RECOMM. ____ DATE ____ SENIOR DESIGN ENGINEER
APPROVED ____ DATE ____ UDOT BRIDGE ENGINEER

LEGACY PARKWAY
LP1 OVER JORDAN RIVER
SITUATION & LAYOUT 1
PROJECT NUMBER SP-0067(5)0

SL / DAVIS
COUNTY
F-702
BRIDGE NO
SHT 1 OF X



UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

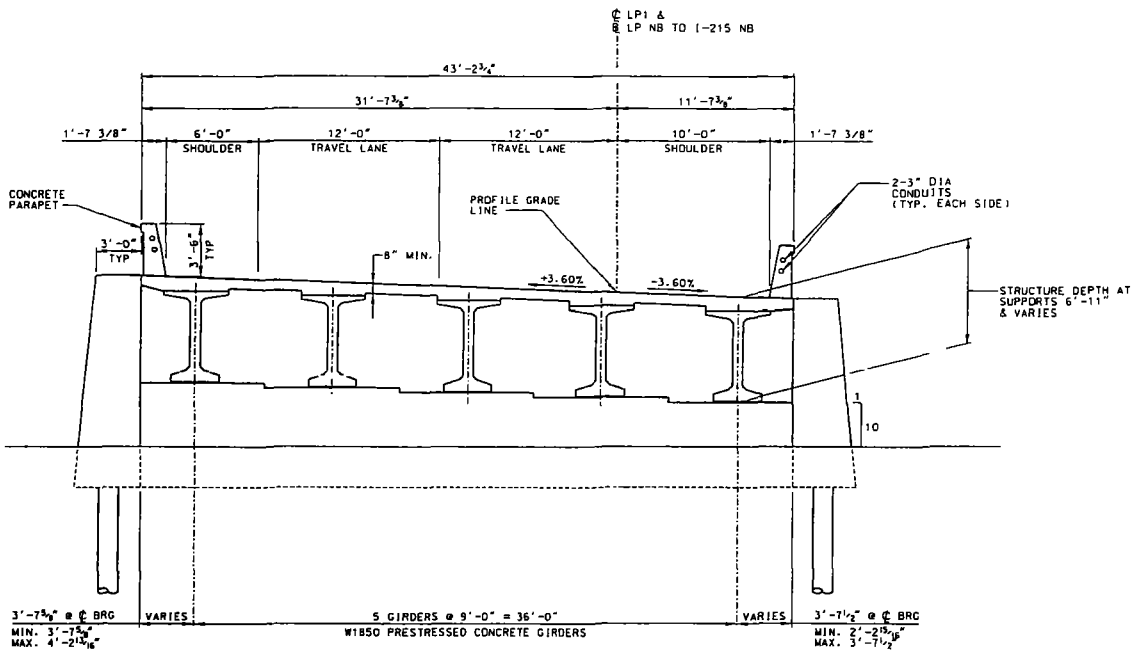
NO.	DATE	BY	REVISIONS	REMARKS

DESIGN CVP 6/06 CHECK SKD 6/06
DRAWN EAH 6/06 CHECK DVP 6/06
QUANT CVP 6/06 CHECK SKD 6/06

APPROVAL RECOMM. — SENIOR DESIGN ENGINEER — DATE
APPROVED — UDOT BRIDGE ENGINEER — DATE

LEGACY PARKWAY
LP1 OVER JORDAN RIVER
SITUATION & LAYOUT 2
PROJECT NUMBER SP-0067(5)0

SL / DAVIS
COUNTY
F-702
BRIDGE NO.
SHT 2 OF X



SECTION THRU STRUCTURE

LOOKING UP STATION

PRELIMINARY
NOT FOR CONSTRUCTION

NO.	DATE	BY	REVISIONS

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

APPROVAL RECOM.	DESIGN V.G 6/06	CHECK XXX 6/06	
DATE	DRAWN STM 6/06	CHECK XXX 6/06	
SENIOR DESIGN ENGINEER	QUANT XXX 6/06	CHECK XXX 6/06	
APPROVED			
DATE			
UDOT BRIDGE ENGINEER			

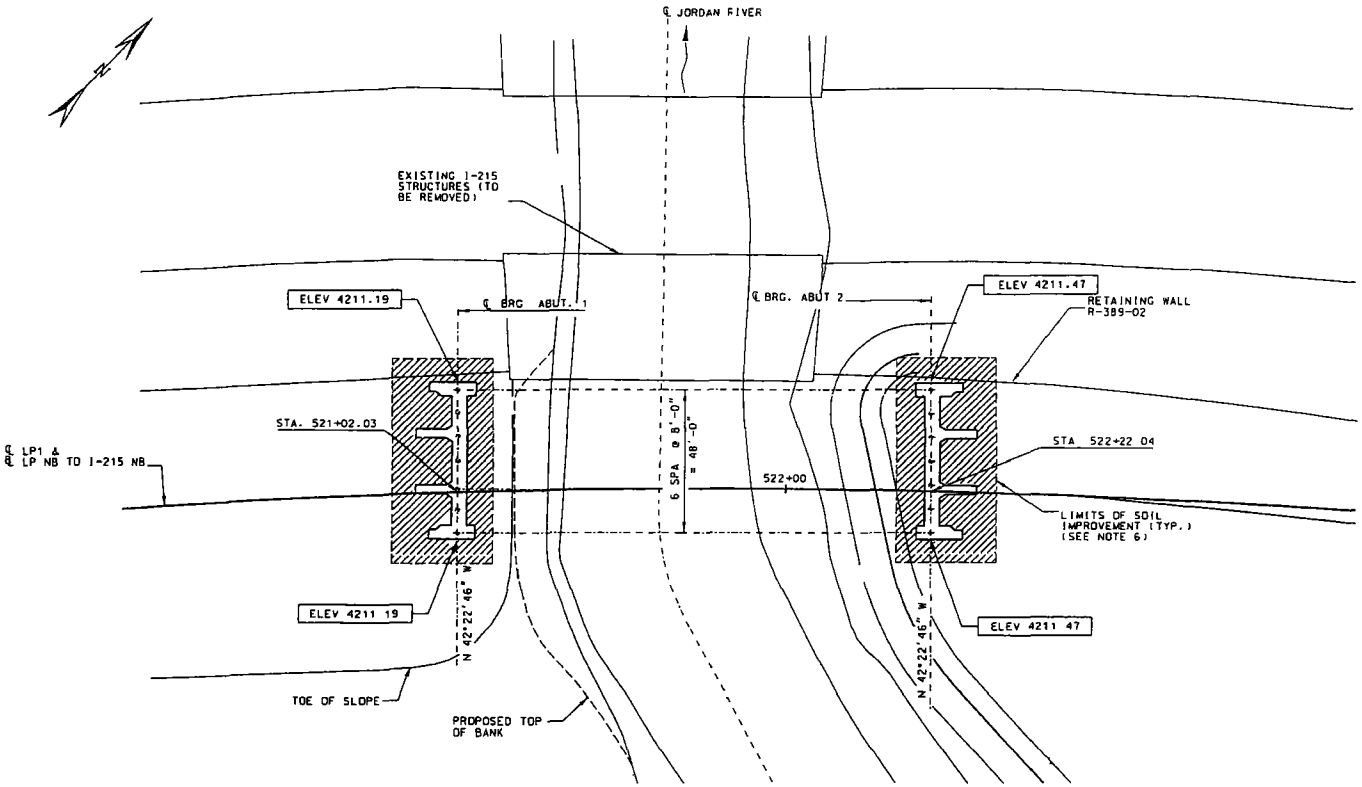
LEGACY PARKWAY
LP1 OVER JORDAN RIVER
SITUATION & LAYOUT 3

PROJECT NUMBER SP-0067I510

SL / DAVIS
COUNTY

F-~~202~~ 743
BRIDGE NO.

SHT 3 OF X



PLAN

PILE DATA					
LOCATION	PILE SIZE (IN)	ESTIMATED PILE TIP ELEVATION (FT)	MINIMUM PILE TIP ELEVATION (FT)	SERVICE LOAD (DL + LL) PER PILE (KIP)	REQUIRED DRIVING RESISTANCE (KIP)
ABUT 1	16	4109.3	4109.3	377	847
ABUT 2	16	4110.2	4110.2	377	847

NOTES:

1. ELEVATIONS AT BOTTOM OF FOOTING ARE SHOWN THUS ELEV 4200.00
2. SEE DRIVEN PILE SHEET FOR PILE DETAILS
3. STATIONS ARE ALONG ℄ LP NB TO I-215 NB.
4. FOR AS-CONSTRUCTED PILE TIP ELEVATIONS, SEE PILING PLAN SHEETS.
5. SOIL IMPROVEMENT SHALL BE PERFORMED TO THE HORIZONTAL LIMITS SHOWN ON THE DRAWINGS AND 10' BELOW THE BOTTOM OF THE FOOTINGS
6. SOIL IMPROVEMENT MATERIAL SHALL BE "EMBANKMENT FOR BRIDGE, SPEC SECTION 02332". MATERIAL SHALL BE A-1, AASHTO M 145 WITH 3" MAXIMUM SIZE.

PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS

NO	DATE	BY	REMARKS

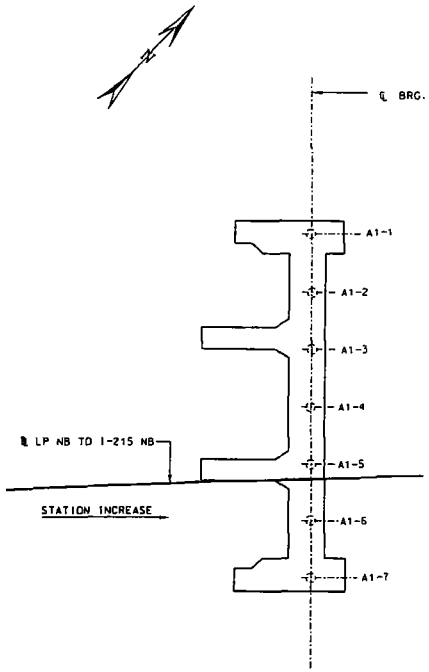
UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

DESIGN VLC 6/06 CHECK XXX 6/06
DRAWN STM 6/06 CHECK XXX 6/06
QUANT XXX 6/06 CHECK XXX 6/06

APPROVAL RECOMMENDED ____ DATE ____ SENIOR DESIGN ENGINEER
APPROVED ____ DATE ____ UDOT BRIDGE ENGINEER

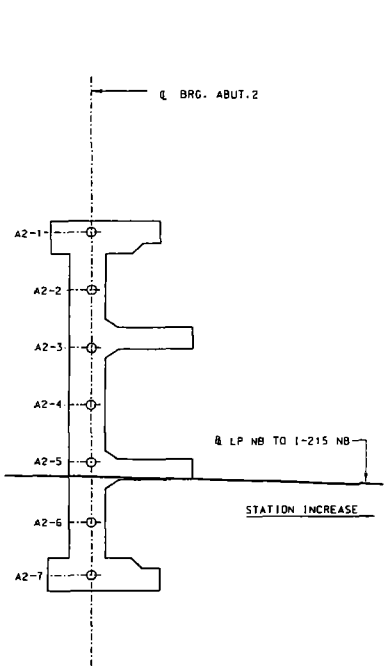
LEGACY PARKWAY
LP1 OVER JORDAN RIVER
FOUNDATION PLAN
PROJECT NUMBER SP-0067(5)0

SL / DAVIS
COUNTY
F-702 747
BRIDGE NO
SHT 5 OF ___



ABUTMENT 1 AS-CONSTRUCTED PILE TIP ELEV.	
PILE NO.	ELEV. (FT.)
A1-1	
A1-2	
A1-3	
A1-4	
A1-5	
A1-6	
A1-7	
A1-8	

PLAN - ABUTMENT 1



ABUTMENT 1 AS-CONSTRUCTED PILE TIP ELEV.	
PILE NO.	ELEV. (FT.)
A2-1	
A2-2	
A2-3	
A2-4	
A2-5	
A2-6	
A2-7	
A2-8	

PLAN - ABUTMENT 2

PRELIMINARY
NOT FOR CONSTRUCTION

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

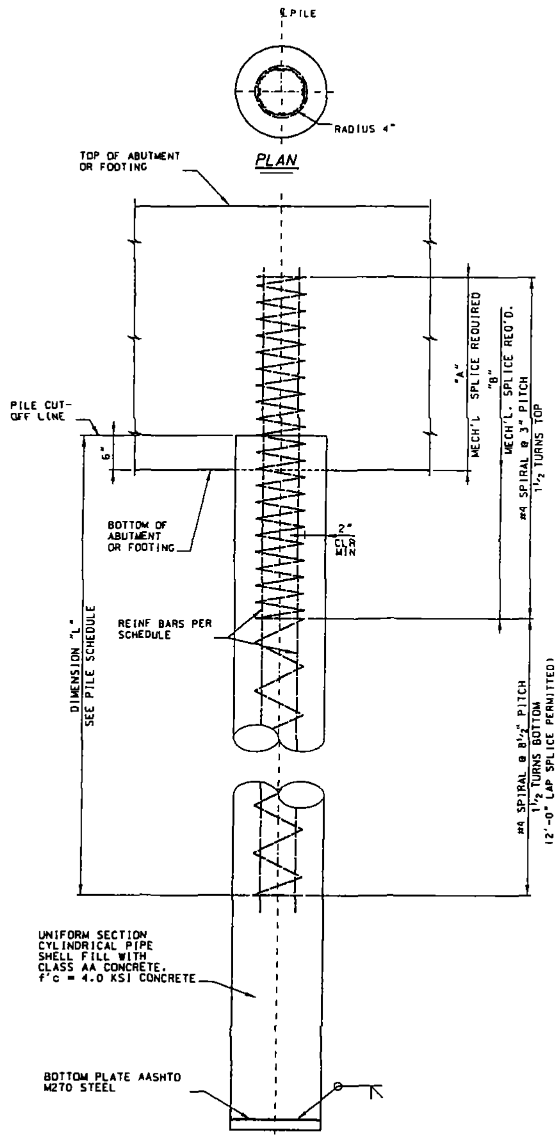
DESIGN YLC 6/06 | CHECK XXX 6/06
DRAWN STM 6/06 | CHECK XXX 6/06
QUANT. XXX 6/06 | CHECK XXX 6/06

NO. | DATE | BY | REVISIONS | REMARKS

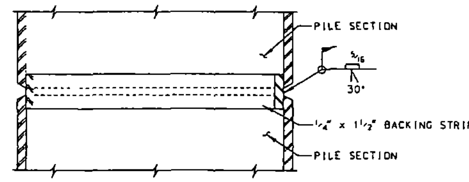
LEGACY PARKWAY
LP1 OVER JORDAN RIVER
PILING PLAN

PROJECT NUMBER SP-0067(5)0

SL / DAVIS
COUNTY
F-782(7)7
BRIDGE NO.
SHT. 6 OF X



PILE ELEVATION



SPLICE DETAIL

SPLICES SHALL BE FULL STRENGTH WELDED SPLICES

NOTES:

1 FILL PILE SHELLS WITH CLASS AA CONCRETE, f'c = 4 0 KSI

2. HOLD REINFORCING STEEL ADEQUATELY IN FINAL POSITION DURING PLACEMENT OF CONCRETE AROUND BARS.

3 PILE REINFORCING STEEL SHALL NOT BE EPOXY COATED OR GALVANIZED.

4 SEE FOUNDATION PLAN SHEET FOR ADDITIONAL PILE DATA.

5 COAT OUTSIDE OF EMBEDDED PORTION OF PIPE WITH FORM RELEASE OIL

PILE SCHEDULE									
PILE DIA (IN.)	Fu (KSI)	Fy (KSI)	PIPE SHELL THICKNESS (IN.)	BOTTOM PLATE THICKNESS (IN.)	NUMBER OF REINF BARS	SIZE	"A" MIN (IN.)	"B" MIN (IN.)	MINIMUM "L" REBAR CAGE LENGTH WITHIN PILE (IN.)
16	87	65	⅜	1¼	8	#11	63	32	288

PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS | NO | DATE | BY | REMARKS

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

DESIGN VLC 6/06 | CHECK XXX 6/06
DRAWN STM 6/06 | CHECK XXX 6/06
QUANT XXX 6/06 | CHECK XXX 6/06

APPROVAL RECOMM. ____ DATE ____ SENIOR DESIGN ENGINEER
APPROVED ____ DATE ____ UDOT BRIDGE ENGINEER

LEGACY PARKWAY
LPI OVER JORDAN RIVER
DRIVEN PILES DETAILS - PINNED HEAD, TYPE A
PROJECT NUMBER SP-0067(5)0

SL / DAVIS
COUNTY
F-~~702~~ 747
BRIDGE NO
SHT 7 OF X

INDEX OF SHEETS

QUANTITIES

ITEM	QUANT.	UNIT	AS CONST.
STRUCTURAL CONCRETE (EST. QTY. XXX CY)	X	LS	
REINFORCING STEEL (COATED)	XXXXX	LB	
GRANULAR BACKFILL BORROW	XX	CY	

GENERAL NOTES

1. USE COATED, DEFORMED BILLET-STEEL BARS IN ACCORDANCE WITH ASTM A615, GRADE 60. EPOXY COATED IN ACCORDANCE WITH AASHTO M 284.
2. PROVIDE 2 INCH COVER TO REINFORCING STEEL EXCEPT WHERE NOTED OTHERWISE.
3. CHAMFER EXPOSED CONCRETE CORNERS 3/4 INCH EXCEPT WHERE NOTED OTHERWISE.
4. USE CLASS AA (AE) CAST-IN-PLACE CONCRETE.
5. ALL DIMENSIONS ARE IN FEET AND INCHES. ALL STATIONS AND ELEVATIONS ARE IN FEET.
6. SEE ROADWAY PLANS FOR TRAIL DETAILS.
7. DRAWINGS ARE NOT TO SCALE. HORIZONTAL DIMENSIONS ARE PLAN DIMENSIONS AND VERTICAL DIMENSIONS ARE PLUMB.
8. PROVIDE GRANULAR BACKFILL BORROW TO MEET UDOT'S CRITERIA FOR FREE DRAINING GRANULAR BACKFILL BORROW. SPECIFICATION 02061.

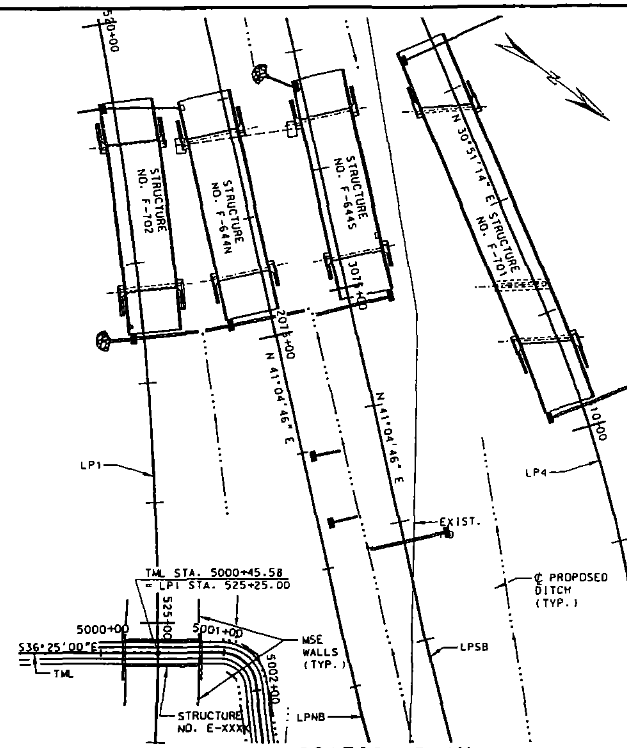
DESIGN DATA

HL-93 LOADING IN ACCORDANCE WITH 3rd EDITION AASHTO LRFD AND INTERIM SPECIFICATIONS THROUGH 2006.

CAST-IN-PLACE CONCRETE: f'c = 5000 PSI; Fy (REINF.) = 60,000 PSI; n = 7

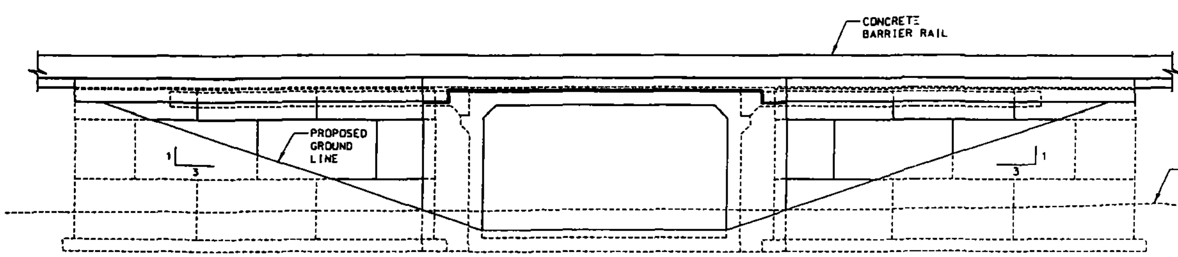
SEISMIC DESIGN DATA: SEISMIC DESIGN PER MCEER/ATC 49 (2475 YR. RETURN PERIOD, 3% PE IN 75 YRS.)
Ss = MAX CONSIDERATION EQ GROUND MOTION AT 0.2S = X.XX g
S1 = MAX CONSIDERATION EQ GROUND MOTION AT 1.0S = X.XX g
SITE CLASS X

DESIGN MAXIMUM COVER = 2'-5"
DESIGN MINIMUM COVER = 4"
SOIL DRY UNIT WEIGHT = 150 #/CF
SOIL SUBMERGED UNIT WEIGHT = XX #/CF

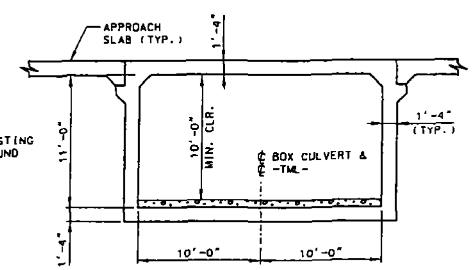


LOCATION PLAN

PRELIMINARY
NOT FOR CONSTRUCTION



ENTRANCE ELEVATION



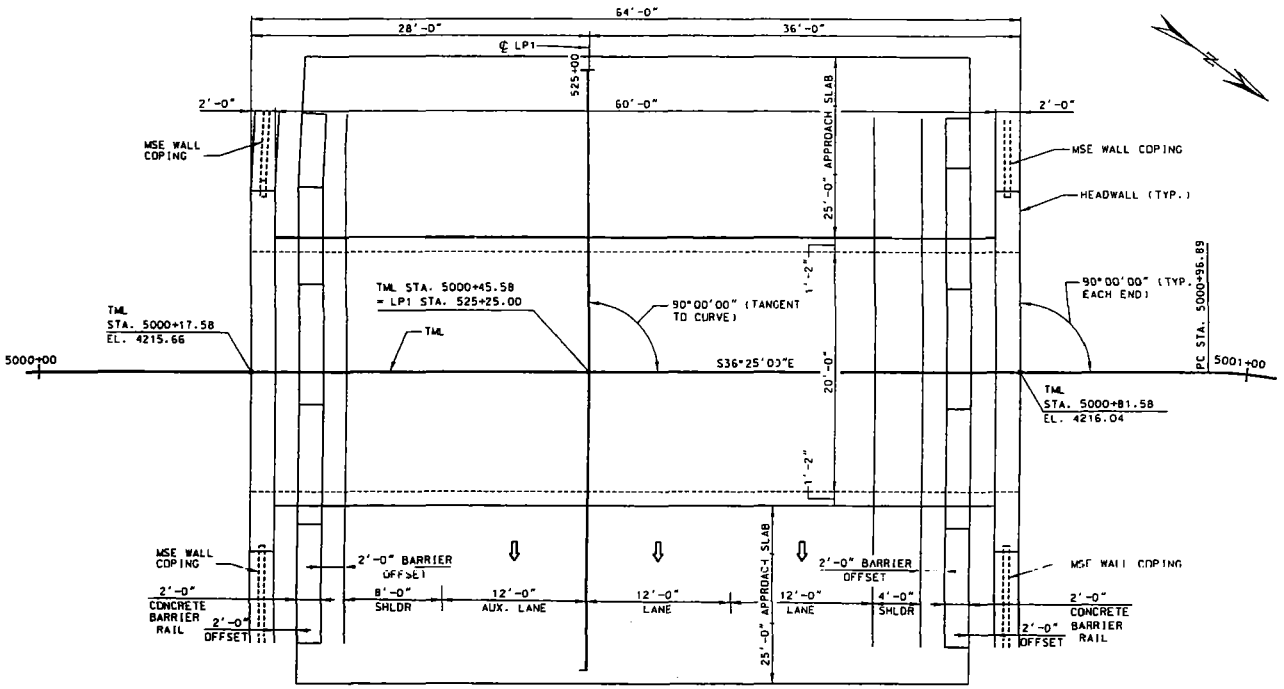
SECTION THRU STRUCTURE

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

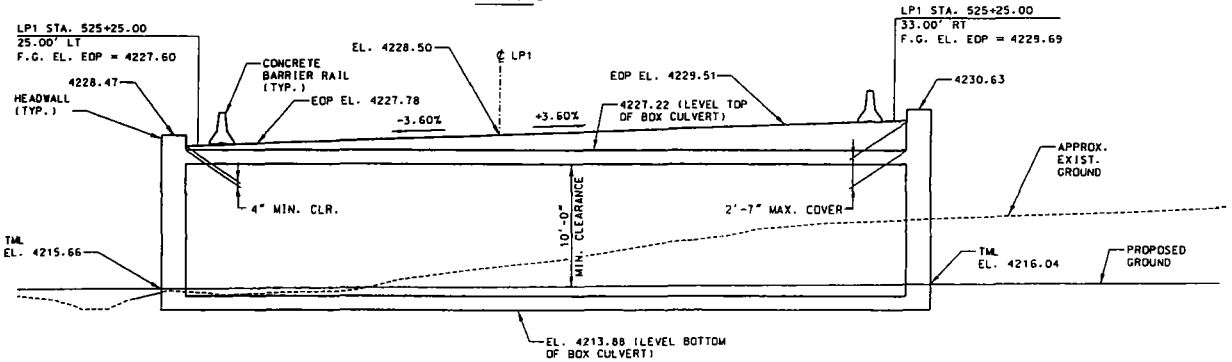
DESIGN DVP 6/06 | CHECK SKD 6/06
DRAWN JLH 6/06 | CHECK DVP 6/06
QUANT. DVP 6/06 | CHECK SKD 6/06

LEGACY PARKWAY
LP1 OVER MULTI-USE TRAIL
SITUATION & LAYOUT 1
PROJECT NUMBER SP-0067(5)0

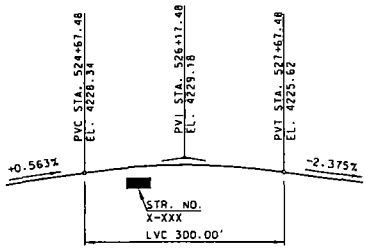
SL / DAVIS
COUNTY
X-XXX
BRIDGE NO.
SHT 1 OF X



PLAN



LONGITUDINAL SECTION

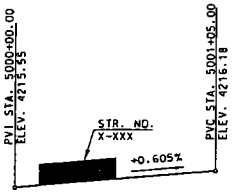


LP1 PROFILE

CURVE DATA

LP1

Δ = 69°27'06" RT
R = 2911.858'
L = 3529.63'
T = 2018.20'
PI STA. 528+28.40
PC STA. 508+10.20
PT STA. 543+39.83



TML PROFILE

PRELIMINARY
NOT FOR CONSTRUCTION

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

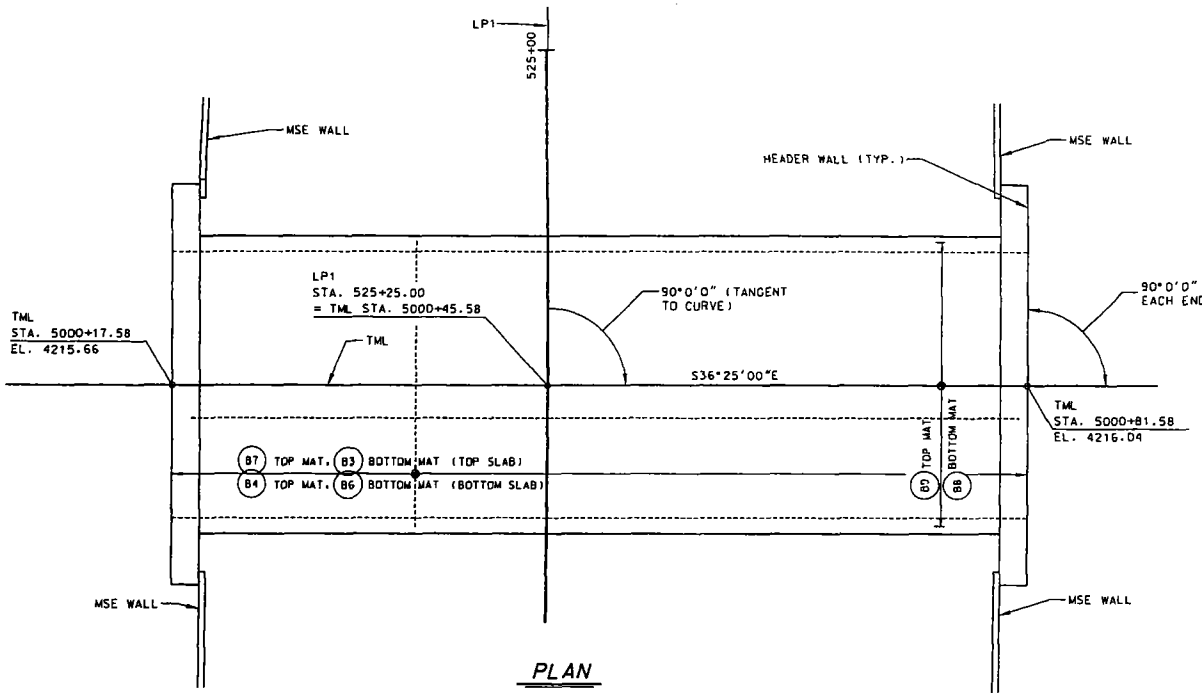
NO.	DATE	BY	REVISIONS	REMARKS

APPROVAL RECOMMENDED — DATE — SENIOR DESIGN ENGINEER
APPROVED — DATE — UDOT BRIDGE ENGINEER

DESIGN JBT 6/06 CHECK SKD 6/06
DRAWN JL-1 6/06 CHECK DVP 6/06
DRAWN DJ-2 6/06 CHECK SKD 6/06

LEGACY PARKWAY
LP1 OVER MULTI-USE TRAIL
SITUATION & LAYOUT 2
PROJECT NUMBER SP-0067(5)0

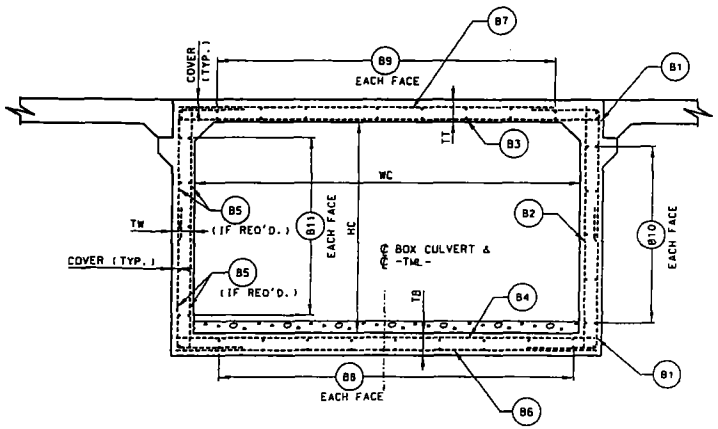
SL / DAVIS
COUNTY
X-XXXX
BRIDGE NO.
SHT. 2 OF X



PLAN

NOTES:

1. DESIGN SPECIFICATION: AASHTO LRFD 2004 W/ 2005, 2006 INTERIMS
   DESIGN LOADING: ML-93
   REINFORCING STEEL: ASTM A615/A615-96a
   SURFACE TREATMENT: ALL CONCRETE SURFACE SHALL RECIEVE A GENERAL SURFACE FINISH
2. SEE ROADWAY PLANS FOR CULVERT LOCATION, ROADWAY SKEW ANGLE AND ROADWAY CROSS SECTION.
3. DURING CONSTRUCTION PROVIDE SUPPORT FOR LOADS IN EXCESS OF AASHTO ML-93
4. PROVIDE A 6" CHAMFER WHEN ANGLE "A" IS GREATER THAN 45° MAINTAIN WALL THICKNESS FIELD ADJUST REINFORCING TO MAINTAIN COVER
5. SPACE BARS B8 (TOP) AND B9 (BOTTOM) WITH A BAR IN EACH CORNER AND THE REMAINING BARS PLACED AT EQUAL SPACING.
6. PLACE BARS B10 AT EVEN SPACES BETWEEN CORNER BARS B8 (TOP) AND B9 (BOTTOM).
7. FOR CULVERT EXTENSIONS, REMOVE HEADWALL AND WINGWALLS SUFFICIENT FOR NEW CONSTRUCTION. CUT BACK 2'-0" OF EXISTING CULVERT WHILE AVOIDING DAMAGE TO EXISTING REINFORCEMENT. CLEAN AND STRAIGHTEN EXISTING REINFORCEMENT. LAP AND TIE EXTENSION REINFORCEMENT ONTO EXISTING.
8. THE COST FOR REMOVAL AND DISPOSAL OF MATERIAL FROM THE EXISTING HEADWALLS, WINGWALLS, AND BOX, AND THE COST FOR CLEANING, STRAIGHTENING AND EXTENDING LONGITUDINAL REINFORCEMENT IS INCLUDED IN THE COST FOR CONCRETE AND STEEL IN THE CULVERT EXTENSION.



SECTION THRU STRUCTURE

PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS	BY	DATE	NO.	REMARKS

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

DESIGN VLC 6/06 CHECK XXX 6/06
DRAWN STM 6/06 CHECK XXX 6/06
QUANT. XXX 6/06 CHECK XXX 6/06

APPROVAL RECOMMENDED — DATE — SENIOR DESIGN ENGINEER
APPROVED — DATE — ASST. BRIDGE ENGINEER

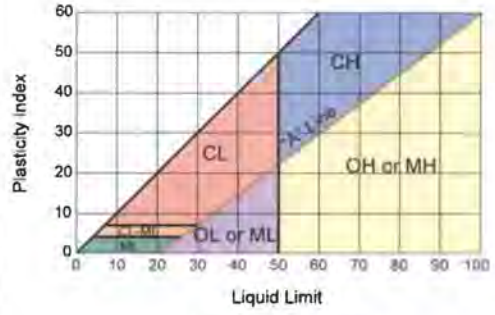
LEGACY PARKWAY
LP1 OVER MULTI-USE TRAIL
BRIDGE DETAILS
PROJECT NUMBER SP-0067(510)

SL / DAVIS
COUNTY
X-XXX
BRIDGE NO.

SHT. 4 OF X

APPENDIX B
Test Hole Logs

Unified Soil Classification System

Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria		
COARSE-GRAINED SOILS *more than half of material is larger than No. 200 sieve*	Gravels *more than half of coarse fraction is larger than No. 4 sieve size*	Clean Gravels *little or no fines*	GW		Well graded gravels, gravel-sand mixtures, little or no fines	*For laboratory classification of coarse-grained soils*	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels With Fines *appreciable amount of fines*	GM*	d	Silty gravels, poorly graded gravel-sand-silt mixtures	Determine percentage of gravel and sand from grain-size curve. Depending on percentage of fines (*fraction smaller than No. 200 sieve size*), coarse-grained soils are classified as follows: **Less than 5%** GW, GP, SW, SP **More than 12%** GM, GC, SM, SC **5% to 12%** Borderline cases requiring use of dual symbols**	Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
				u				
			GC		Clayey gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line, or PI greater	
	Sands *more than half of coarse fraction is smaller than No. 4 sieve size*	Clean Sands *little or no fines*	SW		Well graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with Fines *appreciable amount of fines*	SM*	d	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
				u				
			SC		Clayey sands, poorly graded sand-clay mixtures		Atterberg limits above "A" line, or PI greater	
FINE-GRAINED SOILS *more than half of material is smaller than No. 200 sieve*	Silts and Clays *liquid limit is less than 50*		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	*For laboratory classification of fine-grained soils*		
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silt-clays of low plasticity			
	Silts and Clays *liquid limit is greater than 50*		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
HIGHLY ORGANIC SOILS			Pt		Peat and other highly organic soils			

Plasticity Chart

*Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when liquid limit is 28 or less and the PI is 6 or less, the suffix u used when liquid limit is greater than 28.

***Borderline classification*: Soils possessing characteristics of two groups are designated by combinations of group symbols. (For example GW-GC, well graded gravel-sand mixture with clay biner.)

DRILL HOLE LOG

BORING NO. RSB-4-660

PROJECT: LEGACY PARKWAY - F-747 (LP1 OVER JORDAN RIVER)
CLIENT: UTAH DEPARTMENT OF TRANSPORTATION
LOCATION: ABUTMENT 1; N 350,682, E 51,006
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ UPPER 5' AFTER 24 HOURS: ▽ N.M.

PROJECT NUMBER: 200601.104
DATE STARTED: 4/25/06
DATE COMPLETED: 4/26/06
GROUND ELEVATION: 4215.5'
LOGGED BY: G. PEASLEE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
4215				8	1,2,1,(6)	CL	dk. brown, moist, soft — LEAN CLAY some gravel								
4210	5			16	0,0,0,(0) 0.00	CH (A-7-6(48))	dk. gray, wet, very soft — FAT CLAY w/shells		21.6	67	45	0	5	95	
4205	10			18	0,0,1,(2) 0.00	ML	lt. gray, wet, very soft — SILT								
4200	15			13	Pushed 0.05	ML (A-4(12))	lt. gray, wet, very soft	59	68.3	37	10	0	0	100	CT UC
4195	20			18	0,0,1,(2) 0.01	CH	black, wet, very soft — FAT CLAY								
4190	25			10	Pushed	SP	SAND								
				3	0,0,0,(0)	ML (A-4(0)) ML	gray, wet, very loose — SANDY SILT		21.8		NP	0	46	54	
4185	30			18	1,1,1,(3) 0.02	ML (A-4(0))	gray, wet, very soft, 3" sand layer — SILT W/SAND LAYERS & LENSES		21.9	19	2	0	14	86	
4180	35			10	2,3,1,(5)	SM	gray, wet, loose								
				12	2,3,1,(5)	SM (A-4(0))	gray, wet, loose — SILTY SAND		22		NP	0	53	47	
4175	40			5	3,1,0,(1)	SM CL	gray, moist, loose								
4170	45			0	Pushed	-	LEAN CLAY								
				20	2,0,0,(0) 0.36	CL	gray, moist, firm, w/sand layers								

LOGV1 COLOR 104 LOGS COLOR.GPJ US EVAL.GDT 8/3/06

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE: 2,3,2,(16) ← Blow Count per 6" / $(N_1)_{60}$ Value; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE: PUSHED; 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio
= Potential Liquefaction
= Potential Liquefaction & Lateral Spread

DRILL HOLE LOG

BORING NO. RSB-4-660

PROJECT: LEGACY PARKWAY - F-747 (LP1 OVER JORDAN RIVER)
CLIENT: UTAH DEPARTMENT OF TRANSPORTATION
LOCATION: ABUTMENT 1; N 350,682, E 51,006
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ UPPER 5' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200601.104
DATE STARTED: 4/25/06
DATE COMPLETED: 4/26/06
GROUND ELEVATION: 4215.5'
LOGGED BY: G. PEASLEE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
4165			X	20	Pushed 0.52	CL (A-6(22))	gray, moist, stiff, 4" sand layer		85.1	31.7	40	21	0	0	100	CT UC
4160	55		X	18	Pushed 0.40	CL	gray, moist, firm	LEAN CLAY								
4155	60		■	21	3,10,6,(15)	SM (A-2-4(0))	gray, wet, med. dense	SILTY SAND		26.5		NP	0	79	21	
4150	65		■	20	0,5,7,(11) 0.49	CL	gray, moist, firm	LEAN CLAY W/SAND LENSES								
								SILTY SAND								
4145	70		X	17	Pushed 0.27	CL (A-6(15))	dk. gray, wet, soft	LEAN CLAY	79.2	36.5	34	15	0	3	97	CT UC
4140	75		■	21	0,0,0,(0) 0.43	CH	dk. gray to black, moist, firm	FAT CLAY W/SAND LENSES 1" APART								
4135	80		■	18	3,7,7,(11)	SM	gray, moist, med. dense	SILTY SAND								
4130	85		X	19	Pushed 0.46	CH (A-7-6(48))	dk. gray to black, moist, firm		83.5	35.3	67	42	0	1	99	CT UC
4125	90		■	15	3,2,6,(6) 0.69	CH	gray, moist, stiff, w/sand lenses	FAT CLAY								
4120	95		X	19	Pushed 0.68	CH (A-7-5(32))	gray, moist, stiff			37.4	56	30	0	6	94	
								LEAN TO FAT CLAY W/THIN SAND LENSES 2" TO 6" APART								

I:\LOGV1 COLOR 104 LOGS COLOR.GPJ US EVAL.GDT 9/12/06

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) ← Blow Count per 6" / $(N_1)_{60}$ Value; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED; 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio
= Potential Liquefaction
= Potential Liquefaction & Lateral Spread

DRILL HOLE LOG

BORING NO. RSB-4-660

PROJECT: LEGACY PARKWAY - F-747 (LP1 OVER JORDAN RIVER)
CLIENT: UTAH DEPARTMENT OF TRANSPORTATION
LOCATION: ABUTMENT 1; N 350,682, E 51,006
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ UPPER 5' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200601.104
DATE STARTED: 4/25/06
DATE COMPLETED: 4/26/06
GROUND ELEVATION: 4215.5'
LOGGED BY: G. PEASLEE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
4115				21	0,0,4,(3) *0.46*	CL/CH	gray, moist, firm LEAN TO FAT CLAY W/THIN SAND LENSES 2" TO 6" APART								
4110	105			0	Pushed	-									
				19	2,7,12,(13)	SM	gray, wet, med. dense								
4105	110			20	5,9,18,(19)	SM (*A-2-4(0)*)	dk. gray, wet, med. dense SILTY SAND		26.7		NP	3	71	26	
4100	115														
4095	120														
4090	125														
4085	130														
4080	135														
4075	140														
4070	145														

LOGV1_COLOR_104_LOGS_COLOR.GPJ US EVAL.GDT 8/3/06

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE
2,3,2,(16) ← Blow Count per 6"
(N1)60 Value
0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE
PUSHED
0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio
= Potential Liquefaction
= Potential Liquefaction & Lateral Spread

Boring: SB- 1-243
Sheet 1 of 2

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Sample Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	Test Results * S_u kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	Elastic SILT - brown						MH	A-7-6								
	Soft to medium stiff w/ stiff zones															
	- stiff, gray	5	1		P	508				53						pH WSS R
			2													
	- soft	10	3		SPT	610			1 1 1 1							
			4													
1280	- medium stiff	15	5		P					20 24	9.2	69	51	20		C SG
	- some black coloring, trace of fine sand	20	6		SPT				1 2 2 1							
	- soft, wet, brown with some black	25	7		SPT	457			1 2 1 1							
	Sandy SILT - soft, wet with frequent silty sand layers		8				ML	A-2-4								
		30	9		SPT	508			1 2 3 6							
1275	- medium stiff, occasional gray coloring	35	10		P					29						
			11													
	Lean CLAY - very soft, wet, black	40	12		SPT	432	CL	A-7-6	0 1 0 0							
	- stiff	45	13		P					57	14.5	33	44	23		
			14													
1270	- soft, some gray coloring, some sand	50	15		SPT	457			4 2 1 1							
		55	16													
			17													
		60	18		P	51										
1265		65	19													

SPT (N₁)₆₀ ● / SPT (N₁)₆₀ (Greater than 50 Blows) ○ — 0 25 50

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 1-243**

Sheet 1 of 2

Logged by:	J. Criss
Date Start:	3/1/00
Date Finish:	3/3/00
Station:	58+220.478 1.99 RT
Line:	I-215 to LP SB
Coordinates (m):	N 106,937.510 E 15,489.756
Elevation (m):	1284.476
Total Depth Drilled (m):	38.4
Drill Contractor:	Haz-tech
Driller:	R. Knott
Rig Type:	CME-850
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter:	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

• = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

UTDOT 2003581.GPJ 4/3/08

PLATE B-1

Boring: SB- 1-243
Sheet 2 of 2

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Sample Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ / SPT $(N_1)_{60}$ (Greater than 50 Blows) 0 25 50	Test Results * S_u, kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	Lean CLAY - soft, wet, black (continued)																
	- very soft, gray	70	21		SPT	610			1 0 0 0	0							
		75	22														
			23														
			24														
1260	Sandy SILT - medium stiff, wet, gray with frequent silty sand layers	80	25		P	610	ML	A-2-4			38						
		85	26														
			27		SPT	610			5 4 6 26	7							
	- medium stiff	90	28														
		95	29														
1255			30														
	Fat CLAY - stiff, wet, gray	100	31		P		CH	A-7-6			77						
			32														
		105	33														
	Silty SAND - medium dense, wet, gray, fine to medium grained sand	110	34		SPT	330	SM	A-2-4	0 0 19 32	12							
1250			35		SPT	0			20 25 30 40	33							
		115	36														
		120	37		SPT	406			22 25 16 24	23							
		125	38		SPT	432			13 27 34 38	34							
			39														
1245		130															

UTDOT Z003SB1.GPJ 5/10/06

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 1-243**

Sheet 2 of 2

Logged by:	J. Criss
Date Start:	3/1/00
Date Finish:	3/3/00
Station:	58+220.478 1.99 RT
Line:	I-215 to LP SB
Coordinates (m):	N 106,937.510 E 15,489.756
Elevation (m):	1284.476
Total Depth Drilled (m):	38.4
Drill Contractor:	Haz-tech
Driller:	R. Knott
Rig Type:	CME-850
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter:	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50 8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

PLATE B-2

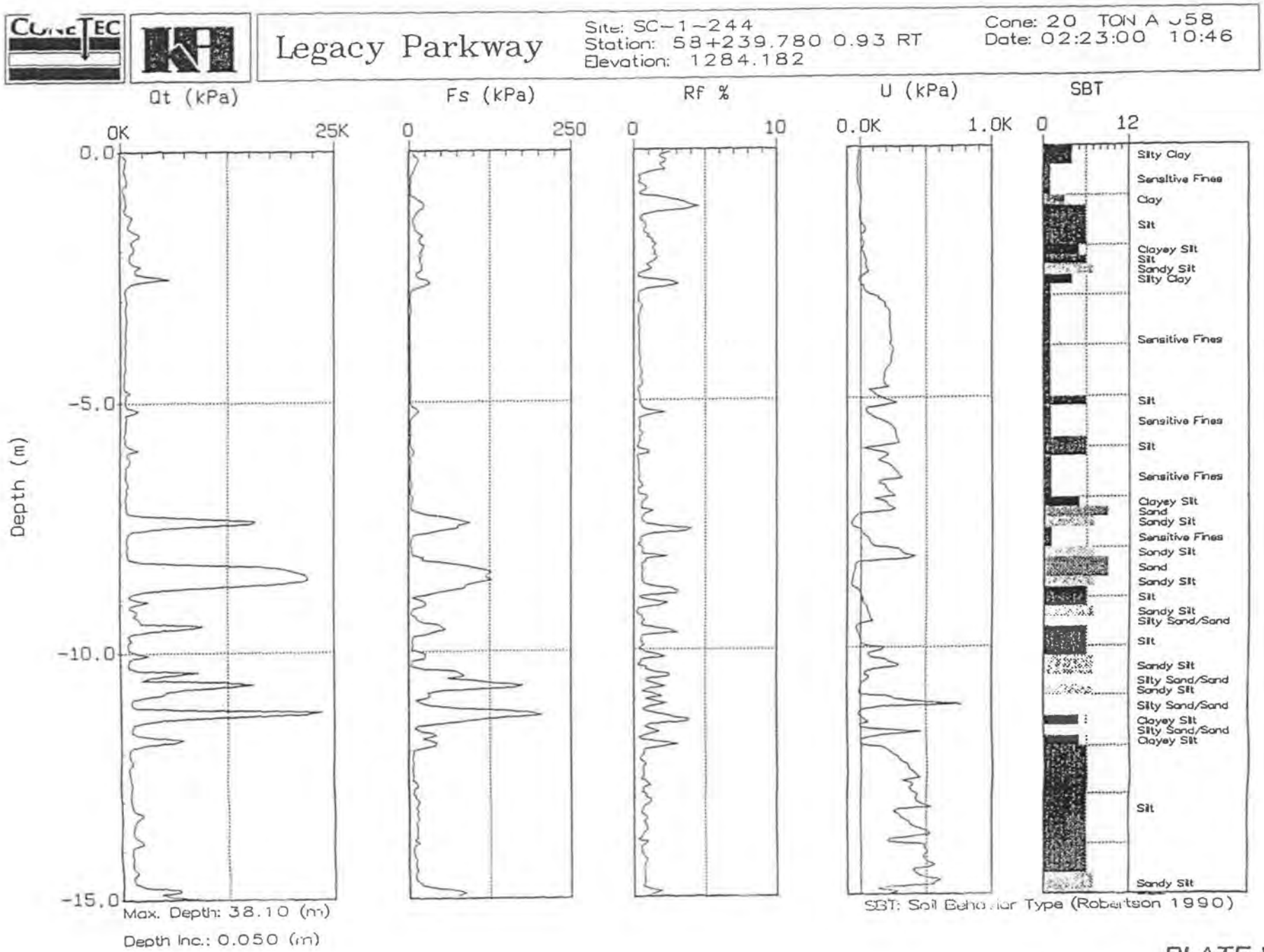

Legacy Parkway
Site: SC-1-244
Station: 58+239.780 0.93 RT
Elevation: 1284.182
Cone: 20 TON A 058
Date: 02:23:00 10:46
Qt (kPa)
Fs (kPa)
Rf %
U (kPa)
SBT
0K
25K
0
250
0
10
0.0K
1.0K
0
12
Depth (m)
0.0
-5.0
-10.0
-15.0
Silty Clay
Sensitive Fines
Clay
Silt
Clayey Silt
Silt
Sandy Silt
Silty Clay
Sensitive Fines
Silt
Sensitive Fines
Silt
Sensitive Fines
Clayey Silt
Sand
Sandy Silt
Sensitive Fines
Sandy Silt
Sand
Sandy Silt
Silt
Sandy Silt
Silty Sand/Sand
Silt
Sandy Silt
Silty Sand/Sand
Sandy Silt
Silty Sand/Sand
Clayey Silt
Silty Sand/Sand
Clayey Silt
Silt
Sandy Silt
Max. Depth: 38.10 (m)
Depth Inc.: 0.050 (m)
SBT: Soil Behavior Type (Robertson 1990)

PLATE B-3

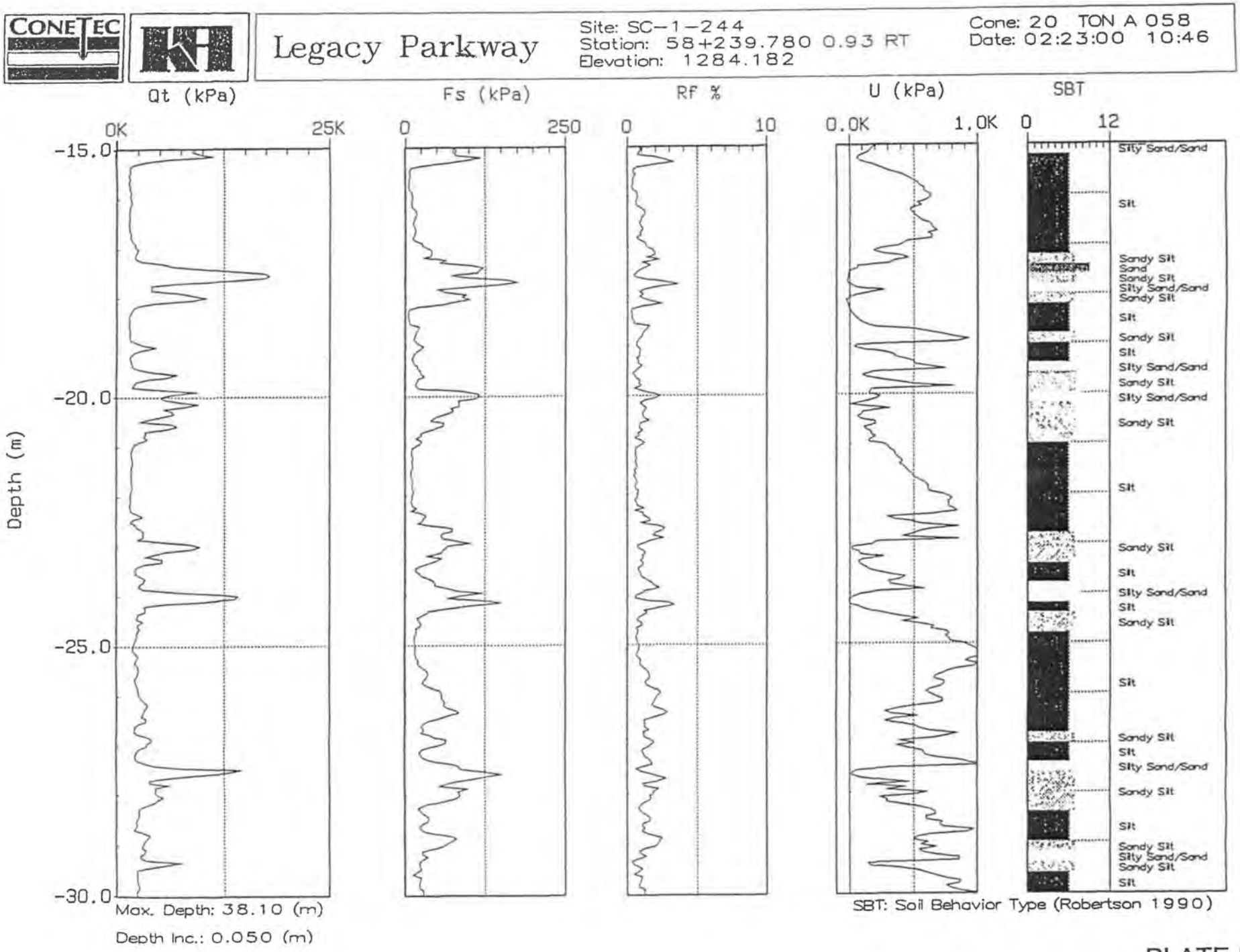

CONETEC
Legacy Parkway
Site: SC-1-244
Station: 58+239.780 0.93 RT
Elevation: 1284.182
Cone: 20 TON A 058
Date: 02:23:00 10:46
Qt (kPa)
Fs (kPa)
RF %
U (kPa)
SBT
0K
25K
0
250
0
10
0.0K
1.0K
0
12
-15.0
-20.0
-25.0
-30.0
Depth (m)
Silty Sand/Sand
Silt
Sandy Silt
Sand
Sandy Silt
Silty Sand/Sand
Sandy Silt
Silt
Sandy Silt
Silt
Silty Sand/Sand
Sandy Silt
Silty Sand/Sand
Sandy Silt
Silt
Sandy Silt
Silt
Silty Sand/Sand
Silt
Sandy Silt
Silt
Sandy Silt
Silt
Silty Sand/Sand
Sandy Silt
Silt
Sandy Silt
Silty Sand/Sand
Sandy Silt
Silt
Max. Depth: 38.10 (m)
Depth Inc.: 0.050 (m)
SBT: Soil Behavior Type (Robertson 1990)

PLATE B-4

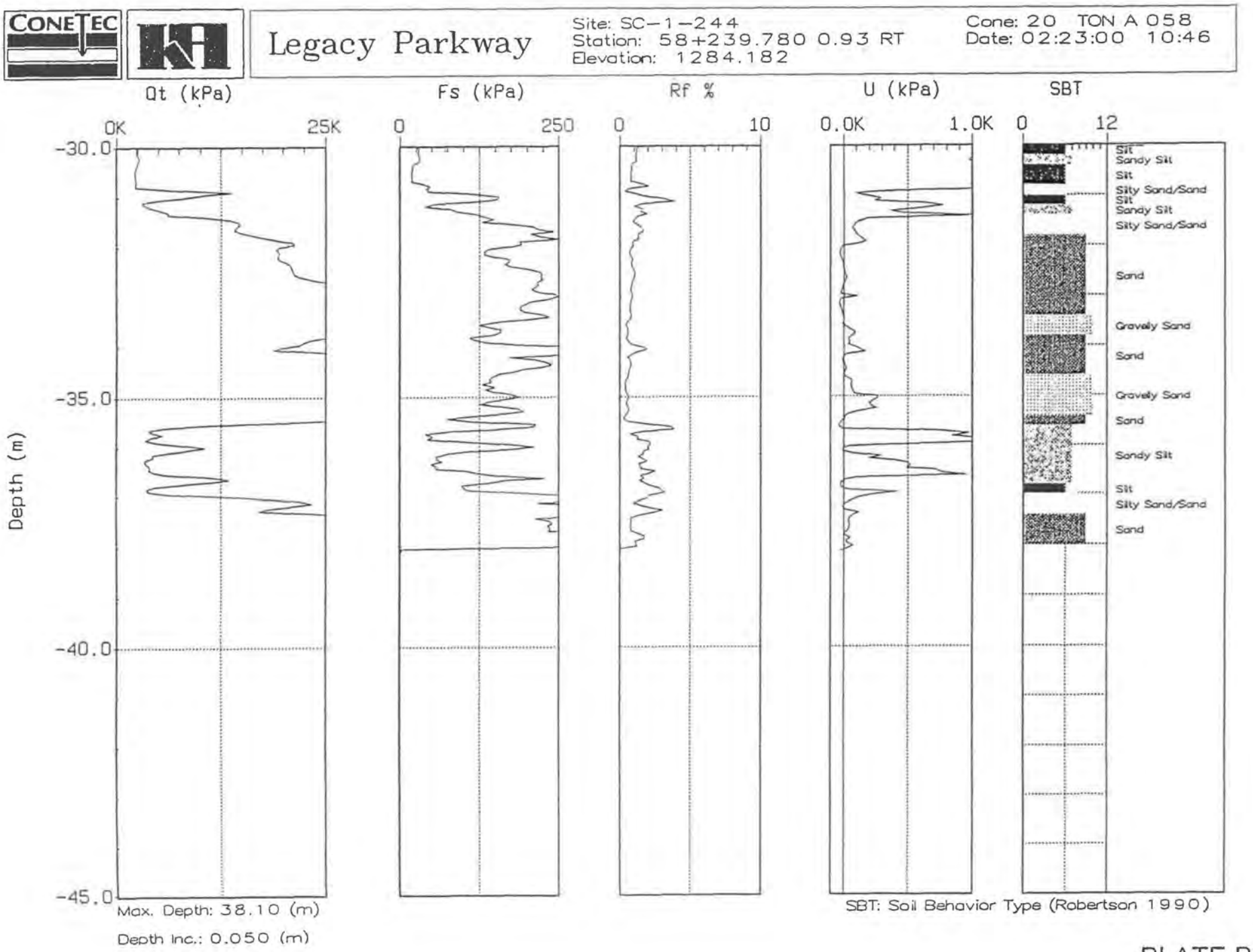
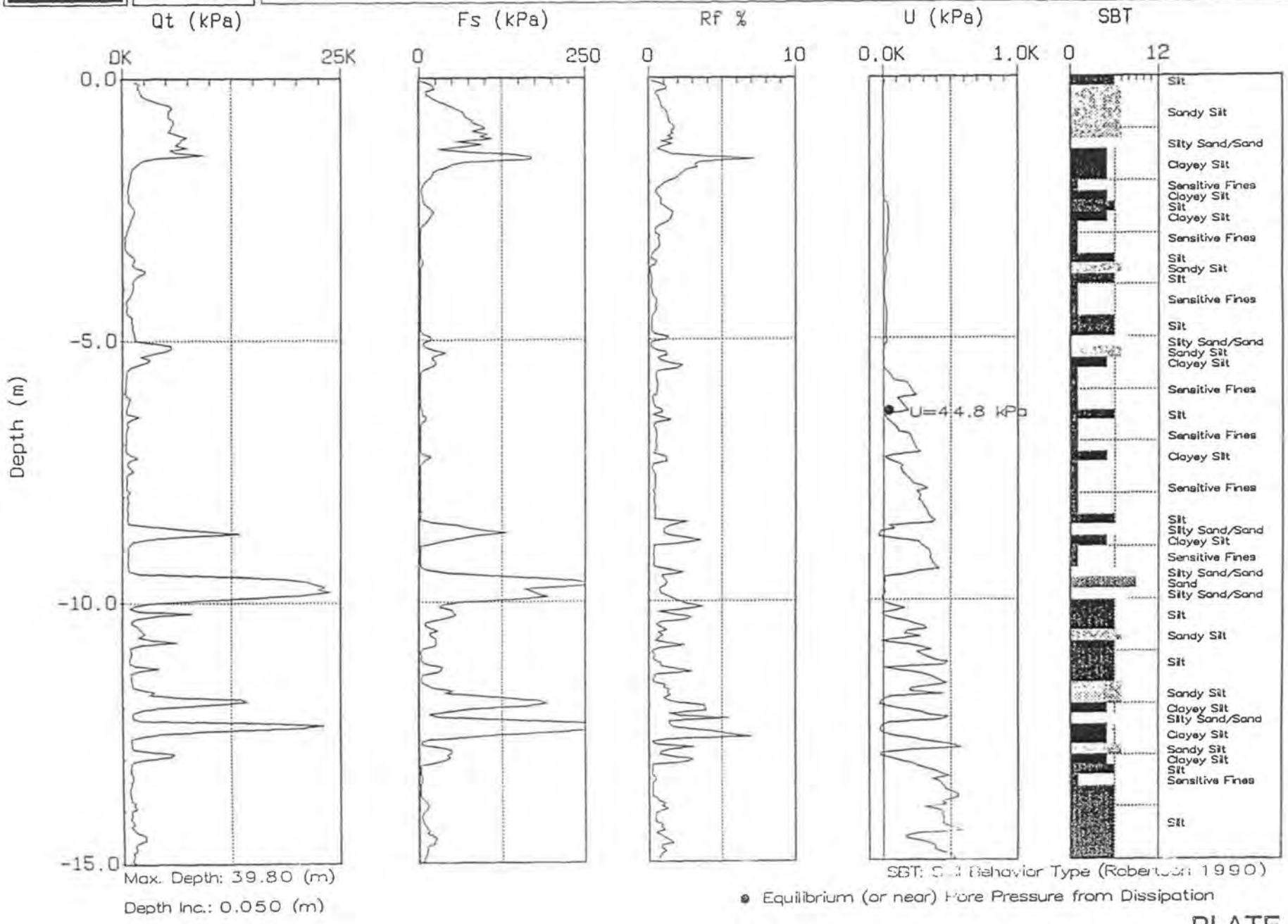

CONETEC
Legacy Parkway
Site: SC-1-244
Station: 58+239.780 0.93 RT
Elevation: 1284.182
Cone: 20 TON A 058
Date: 02:23:00 10:46
Qt (kPa)
Fs (kPa)
Rf %
U (kPa)
SBT
0K
25K
0
250
0
10
0.0K
1.0K
0
12
-30.0
-35.0
-40.0
-45.0
Depth (m)
Silt
Sandy Silt
Silt
Silty Sand/Sand
Silt
Sandy Silt
Silty Sand/Sand
Sand
Gravelly Sand
Sand
Gravelly Sand
Sand
Sandy Silt
Silt
Silty Sand/Sand
Sand
Max. Depth: 38.10 (m)
Depth Inc.: 0.050 (m)
SBT: Soil Behavior Type (Robertson 1990)

PLATE B-5

Legacy Parkway

Site: SC-1-245
Station: 58+277.957 5.45 RT
Elevation: 1286.107

Cone: 20 TON 392
Date: 02:03:00 13:27



Max. Depth: 39.80 (m)
Depth Inc.: 0.050 (m)

SBT: Soil Behavior Type (Robertson 1990)

● Equilibrium (or near) Pore Pressure from Dissipation

PLATE B-6

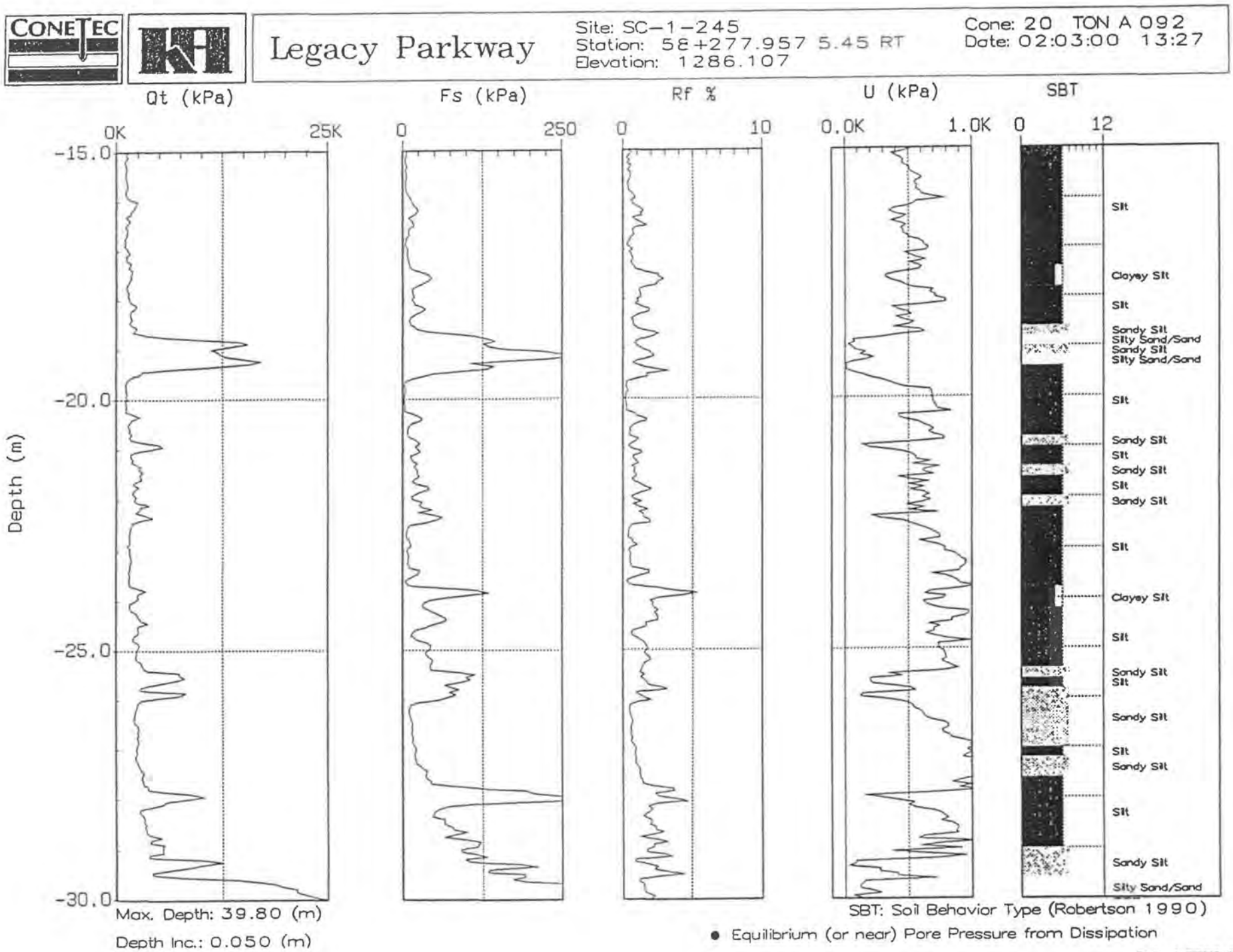

Legacy Parkway
Site: SC-1-245
Station: 5&+277.957 5.45 RT
Elevation: 1286.107
Cone: 20 TON A 092
Date: 02:03:00 13:27
Qt (kPa)
Fs (kPa)
Rf %
U (kPa)
SBT
0K
25K
0
250
0
10
0.0K
1.0K
0
12
-15.0
-20.0
-25.0
-30.0
Depth (m)
Silt
Clayey Silt
Silt
Sandy Silt
Silty Sand/Sand
Sandy Silt
Silty Sand/Sand
Silt
Sandy Silt
Silt
Sandy Silt
Silt
Sandy Silt
Silt
Clayey Silt
Silt
Sandy Silt
Silt
Sandy Silt
Silt
Sandy Silt
Silt
Sandy Silt
Silty Sand/Sand
Max. Depth: 39.80 (m)
Depth Inc.: 0.050 (m)
SBT: Soil Behavior Type (Robertson 1990)
● Equilibrium (or near) Pore Pressure from Dissipation

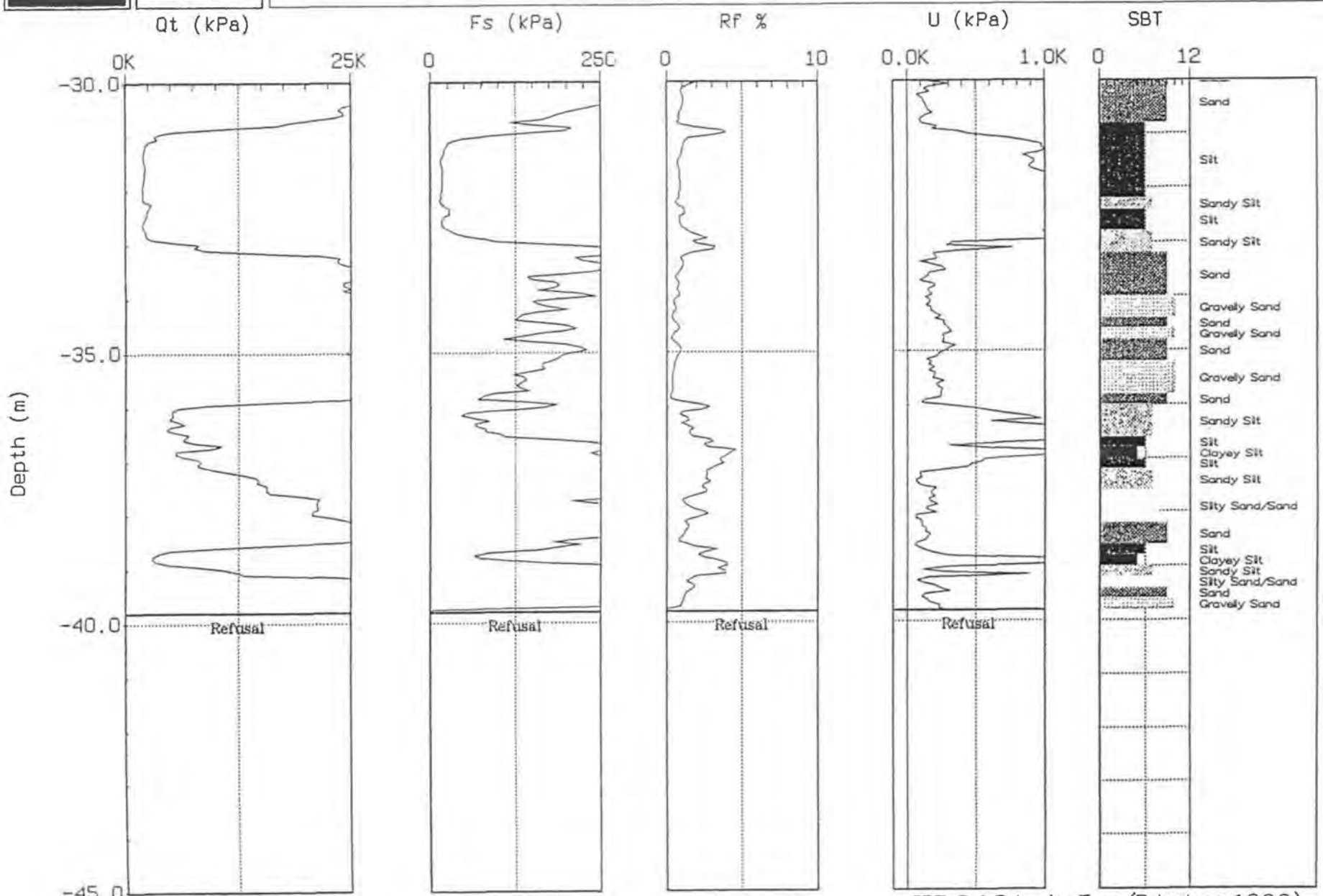
PLATE B-7

CONETEC

Legacy Parkway

Site: SC-1-245
Station: 58+277.957 5.45 RT
Elevation: 1286.107

Cone: 20 TON A 092
Date: 02:03:00 13:27

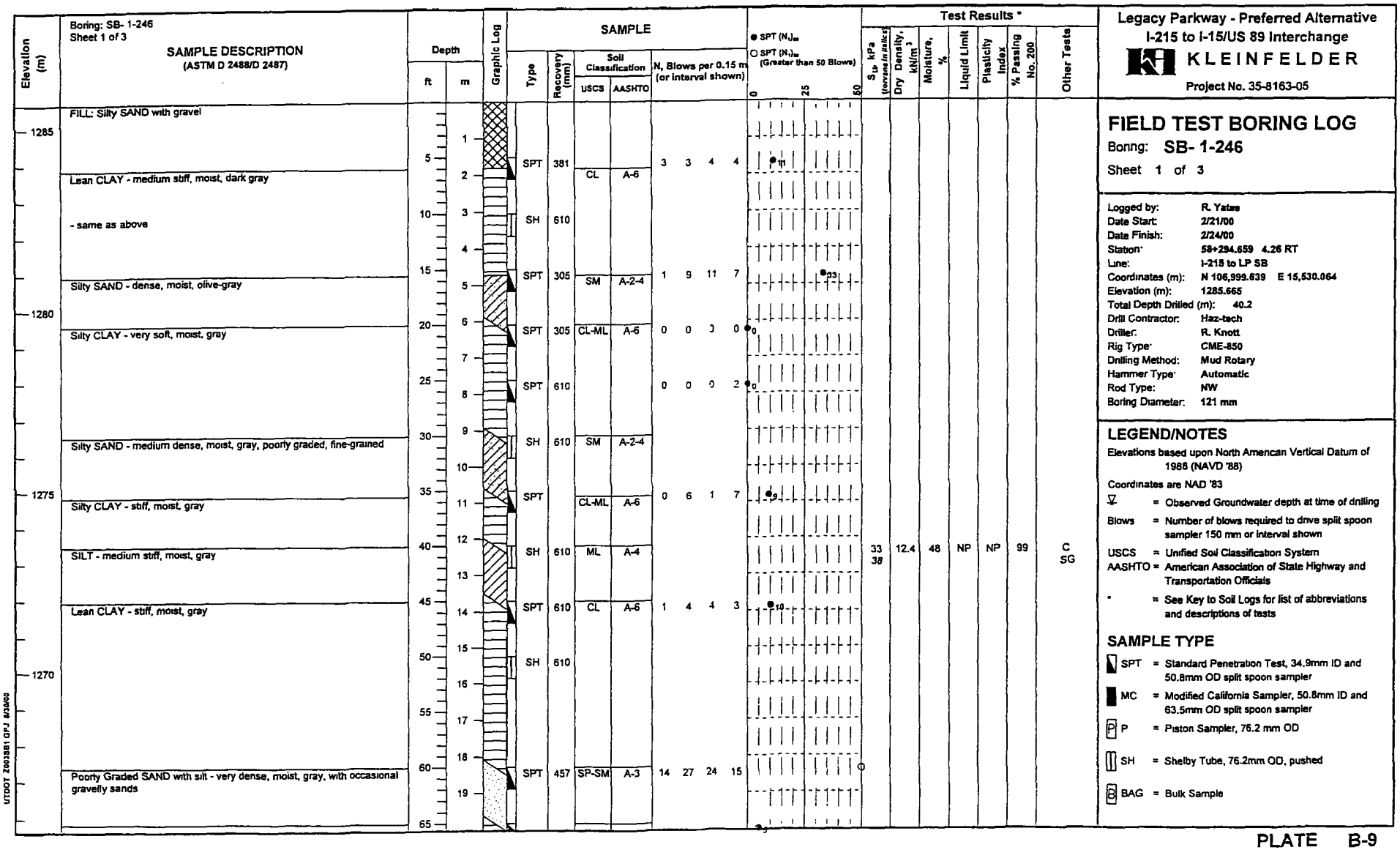


Max. Depth: 39.80 (m)
Depth Inc.: 0.050 (m)

SBT: Soil Behavior Type (Robertson 1990)

● Equilibrium (or near) Pore Pressure from Dissipation

PLATE B-8



Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange

KLEINFELDER

Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 1-246**

Sheet 1 of 3

Logged by:	R. Yates
Date Start:	2/21/00
Date Finish:	2/24/00
Station:	58+294.659 4.26 RT
Line:	I-215 to LP SB
Coordinates (m):	N 106,999.639 E 15,530.064
Elevation (m):	1285.665
Total Depth Drilled (m):	40.2
Drill Contractor:	Haz-tech
Driller:	R. Knott
Rig Type:	CME-850
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter:	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

UTDOT 2003SB1.GPJ 8/30/00

PLATE B-9

Boring: SB- 1-246
Sheet 2 of 3

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ / SPT $(N_1)_{60}$ (Greater than 50 Blows) 0 25 50	Test Results * S_u, kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	Silty CLAY - medium stiff, moist, gray				SPT	610	CL-ML	A-6	0 0 5 9								
1265			21														
		70	22														
	- stiff	75	23		SH	610					85 77	14.2	34	37	17		C SG
			24														
		80	25														
1260																	
	- very stiff	85	26		SPT	610			2 7 13 18	18							
			27														
		90	28														
	Poorly Graded SAND - moist, gray	95	29		SH	610	SP	A-3									
			30														
1255	Lean CLAY - medium stiff, moist, gray	100	31		SPT	610	CL	A-6	0 3 5 7	7							
	- very stiff	105	32		SPT	457			7 14 15 26	24							
			33														
	Poorly Graded SAND with gravel - medium dense, moist, gray	110	34		SPT		SP	A-3	3 8 13 25	16							
	Lean CLAY - very stiff, moist, gray, with trace of sandy gravel	115	35		SPT		CL	A-6	9 13 21 7	26							
1250			36														
	Poorly Graded SAND - loose, wet, brownish-gray	120	37		SH	610	SP	A-3									
					SPT	610			3 3 5	6							
	- dense	125	38		SPT	0			30 32 36	17							
			39														
		130			SPT												

UTDOT Z003SB1.GPJ 8/30/00

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: SB- 1-246

Sheet 2 of 3

Logged by:	R. Yates
Date Start:	2/21/00
Date Finish:	2/24/00
Station:	58+294.659 4.26 RT
Line:	I-215 to LP SB
Coordinates (m):	N 106,999.639 E 15,530.064
Elevation (m):	1285.665
Total Depth Drilled (m):	40.2
Drill Contractor:	Haz-tech
Driller:	R. Knott
Rig Type:	CME-850
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter:	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

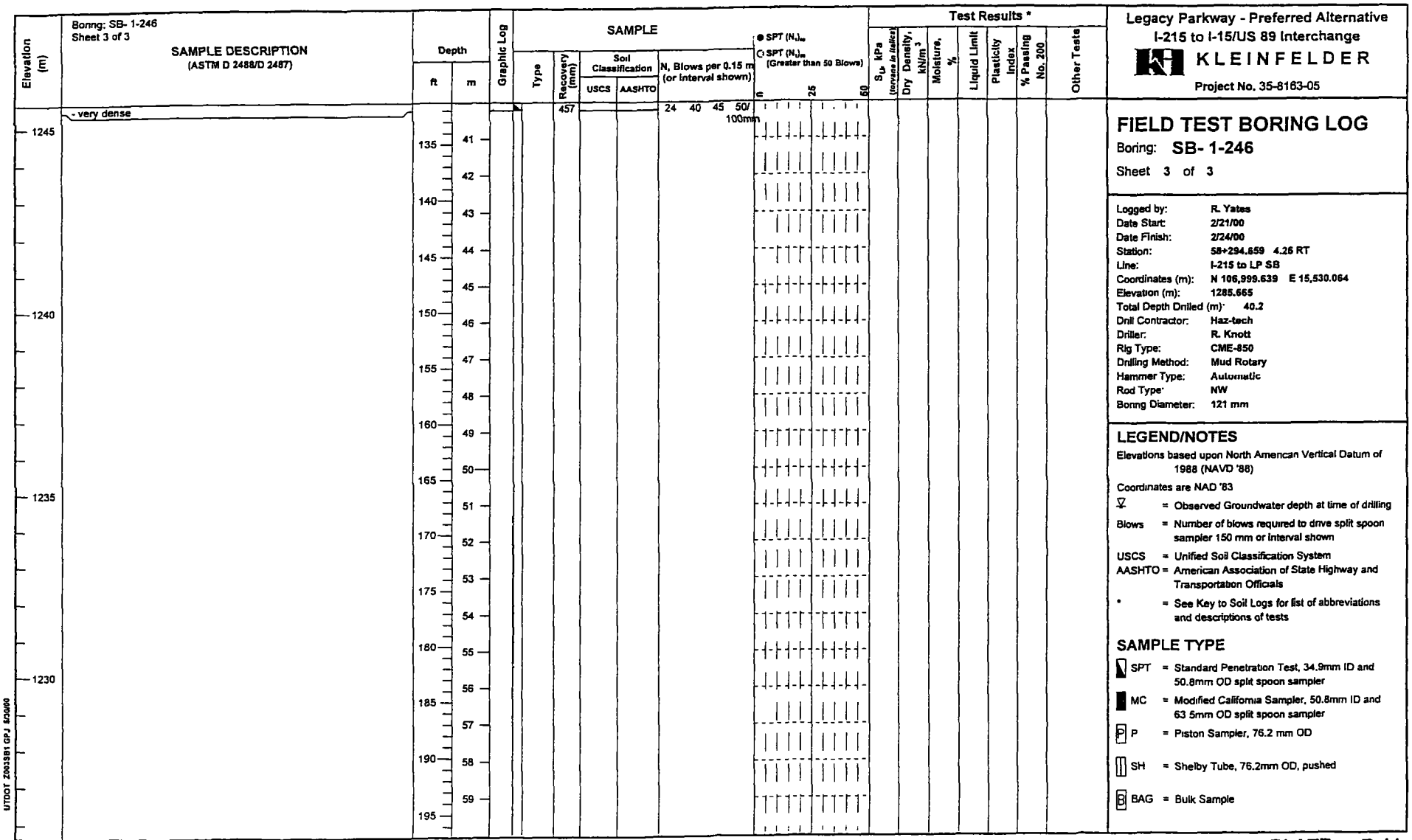
MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

PLATE B-10



Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange

KLEINFELDER

Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 1-246**

Sheet 3 of 3

Logged by:	R. Yates
Date Start:	2/21/00
Date Finish:	2/24/00
Station:	58+294.859 4.26 RT
Line:	I-215 to LP SB
Coordinates (m):	N 106,999.639 E 15,530.064
Elevation (m):	1285.665
Total Depth Drilled (m):	40.2
Drill Contractor:	Haz-tech
Driller:	R. Knott
Rig Type:	CME-850
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter:	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

PLATE B-11

Boring: SB- 2-247
Sheet 1 of 3

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ / SPT $(N_1)_{60}$ (Greater than 50 Blows)	Test Results * S_u kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	FILL. Poorly Graded GRAVEL with sand - dense, moist, yellowish-brown		1		SPT	610	GP	A-1-a	7 10 7 7	34							
1285	- very dense	5	2		SPT	381			9 18 18 22		0						pH WSS R
	SILT - very soft, wet, yellowish-brown	10	3		SPT	152	ML	A-4	0 1 1 1	½							
	Lean CLAY - medium stiff, wet, gray	15	5		SH	610	CL	A-6			34	13.7	34				C SG
	- very soft	20	6		SPT				0 0 0 0	0							
1280	- medium stiff	25	8		SH	610					24		48	48	24		H
	- stiff	30	9		SPT	610			9 9 3 2	15							
		35	11		SH	584					24						
1275	- soft	40	12		SPT	610			0 1 2 3	3							
	- medium stiff	45	14		SH	610					38 43	15 9	23				
	SILT - medium stiff, wet, gray	50	15		SPT	610	ML	A-4	0 3 3 6	6							
1270		55	16														
	Lean CLAY - stiff, wet, gray	60	18		SH	584	CL	A-6			62	15 6	28				C SG
		65	19														

UTDOT 2003581.GPJ 6/30/00

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 2-247**

Sheet 1 of 3

Logged by:	J. Rajek
Date Start:	1/23/00
Date Finish:	1/24/00
Station:	6002+221.649 19.91 LT
Line:	D MAINLINE
Coordinates (m):	N 106,914.589 E 15,501.290
Elevation (m):	1286.873
Total Depth Drilled (m):	43.1
Drill Contractor:	Haz-tech
Driller:	C. Peterson
Rig Type:	CME-75
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter:	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

PLATE B-11

Boring: SB- 2-247
Sheet 2 of 3

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ / SPT $(N_1)_{60}$ (Greater than 50 Blows) 0 25 50	Test Results * S_u, kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	Lean CLAY - wet, gray (continued)																
	- soft, with frequent layers of silt to 50 mm	70	21		SPT	610			1 2 2 2	●4							
1265			22														
		75	23														
			24														
		80			SH	0											
	- medium stiff		25		SH	584					34						
		85	26														
1260			27														
	- very soft	90	28		SPT	610			2 1 1 1	●2							
		95	29														
			30														
	- medium stiff	100	31		SH	559					77						
1255		105	32														
			33														
	- medium stiff, 150 mm sand layer	110	34		SPT	610			3 2 8 20	●5							
		115	35														
			36														
1250	Silty SAND - medium dense, wet, gray	120	37		SPT	610	SM	A-2-4	7 17 18 30	●25							
	- very dense	125	38		SPT	610			9 32 42 42	○							
			39														
		130			SPT					●23							

UTDOT 2003581.GPJ 6/30/00

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 2-247**

Sheet 2 of 3

Logged by:	J. Rajek
Date Start:	1/23/00
Date Finish:	1/24/00
Station:	6002+221.649 19.91 LT
Line:	D MAINLINE
Coordinates (m):	N 106,914.589 E 15,501.290
Elevation (m):	1286.873
Total Depth Drilled (m):	43.1
Drill Contractor:	Haz-tech
Driller:	C. Peterson
Rig Type:	CME-75
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

PLATE B-12

Boring: SB- 2-247
Sheet 3 of 3

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	Test Results * S_u, kPa (tervane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	Lean CLAY - very stiff, wet, gray, some fine-grained sand					610	CL	A-6	6 12 22 35							
	Silty SAND - very dense, wet, gray, fine-grained with layers of lean clay	135	41		SPT	610	SM	A-2-4	9 36 42 50/125mm							
1245			42													
	- dense	140	43		SPT	457			9 22 32							
			44													
		145	45													
			46													
1240		150	47													
		155	48													
		160	49													
			50													
		165	51													
		170	52													
1235			53													
		175	54													
		180	55													
			56													
		185	57													
1230			58													
		190	59													
		195														

● SFT $(N_1)_{60}$
○ SFT $(N_1)_{60}$ (Greater than 50 Blows)
0 25 50

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 2-247**

Sheet 3 of 3

Logged by:	J. Rajek
Date Start:	1/23/00
Date Finish:	1/24/00
Station:	6002+221.649 19.91 LT
Line:	D MAINLINE
Coordinates (m):	N 106,914.589 E 15,501.290
Elevation (m):	1286.873
Total Depth Drilled (m):	43.1
Drill Contractor:	Haz-tech
Driller:	C. Peterson
Rig Type:	CME-75
Drilling Method:	Mud Rotary
Hammer Type	Automatic
Rod Type:	NW
Boring Diameter	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34 9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63 5mm OD split spoon sampler

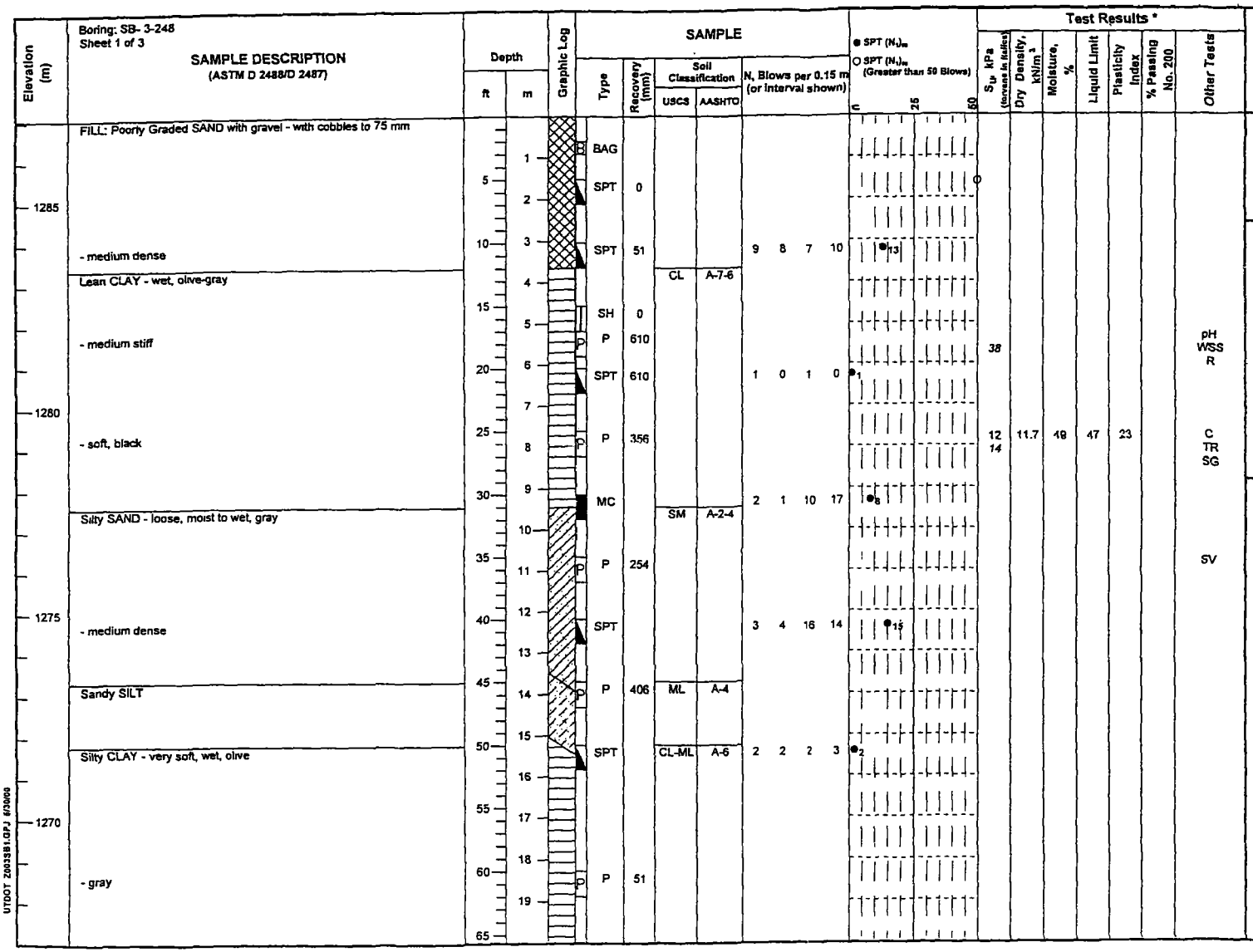
P = Piston Sampler, 76 2 mm OD

SH = Shelby Tube, 76 2mm OD, pushed

BAG = Bulk Sample

UTDOT Z003SB1 GPJ 8/30/00

PLATE B-13



Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange

KLEINFELDER

Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: SB-~~3~~2-248

Sheet 1 of 3

Logged by:	M. Ivers
Date Start:	1/21/00
Date Finish:	1/24/00
Station:	6002+288.897 14.78 LT
Line:	D MAINLINE
Coordinates (m):	N 106,961.761 E 15,549.213
Elevation (m):	1287.035
Total Depth Drilled (m):	39.9
Drill Contractor:	Layne Christensen
Driller:	S. Church
Rig Type:	Mobile B-80
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	AW
Boring Diameter:	133 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

UTDOT 2003SB1.GPJ 6/30/00

PLATE B-14

FIELD TEST BORING LOG

Boring: SB-~~3~~2-248
Sheet 2 of 3

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth (ft)	Depth (m)	Sample Type	Recovery (mm)	USCS	AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$	S_u, kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	Silty CLAY - very soft, wet, gray (continued)															
1265	- stiff, olive-gray to gray, occasional fine-grained sand lenses approximately 50 mm thick	70	21	SPT	610			4 9 8 10	17							
	Fat CLAY - medium stiff, wet, dark gray to olive	80	24	P	610	CH	A-7-6			*43*	12.3	42	56	32		C SG
1260	- stiff	90	27	SPT	610			6 10 12 19	13							
	Poorly Graded SAND - dense, wet, gray	100	30	P BAG		SP	A-3	15 37 25	55	57 *34*	15.7	26			97	
1255	Lean CLAY - soft, wet, dark gray to olive	105	32	SPT	610	CL	A-6	3 3 3 5	4							
	Poorly-Graded SAND with clay - dense, moist, gray	115	35	SPT		SP-SC	A-3	25 41 35 39	40							
1250	- medium dense	120	36	SPT				13 21 26 36	24							
	- dense	125	38	SPT				12 32 50	41							
		130	39	SPT												

Test Results *

● SPT $(N_1)_{60}$
○ SPT $(N_1)_{60}$ (Greater than 50 Blows)

Logged by:	M. Ivers
Date Start:	1/21/00
Date Finish:	1/24/00
Station:	6002+288.697 14.78 LT
Line:	D MAINLINE
Coordinates (m):	N 106,961.761 E 15,549.213
Elevation (m):	1287.035
Total Depth Drilled (m):	39.9
Drill Contractor:	Layne Christensen
Driller:	S. Church
Rig Type:	Mobile B-80
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	AW
Boring Diameter:	133 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

∇ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

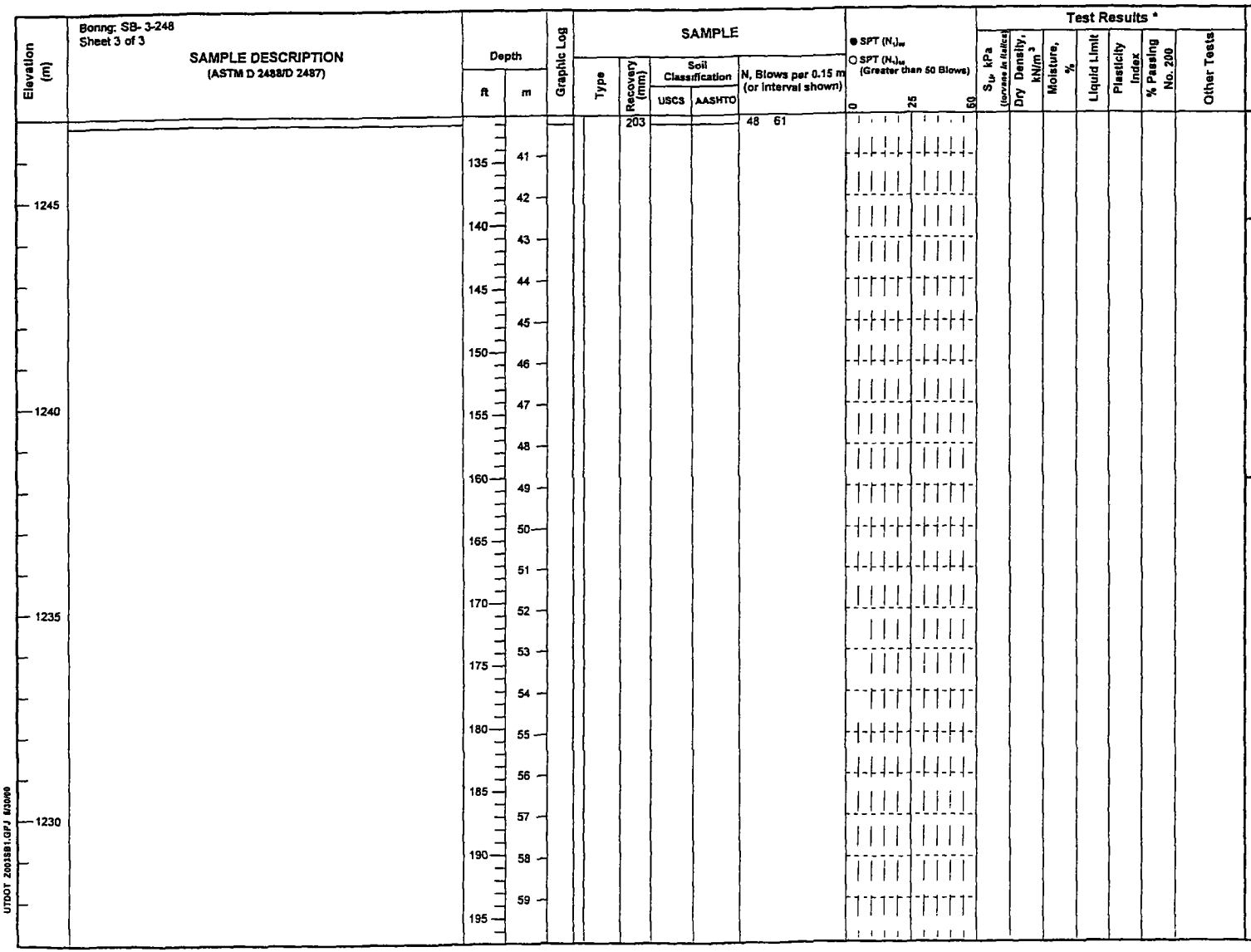
SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76 2mm OD, pushed

BAG = Bulk Sample



Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange

KLEINFELDER

Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: SB-~~3~~ 2-248

Sheet 3 of 3

Logged by:	M. Ivers
Date Start:	1/21/00
Date Finish:	1/24/00
Station:	6002+288.697 14.78 LT
Line:	D MAINLINE
Coordinates (m):	N 106,961.761 E 15,549.213
Elevation (m):	1287.035
Total Depth Drilled (m):	39.9
Drill Contractor:	Layne Christensen
Driller:	S. Church
Rig Type:	Mobile B-80
Drilling Method:	Mud Rotary
Hammer Type.	Automatic
Rod Type:	AW
Boring Diameter:	133 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

UTDOT 2003SB1.GPJ M30060

PLATE B-16

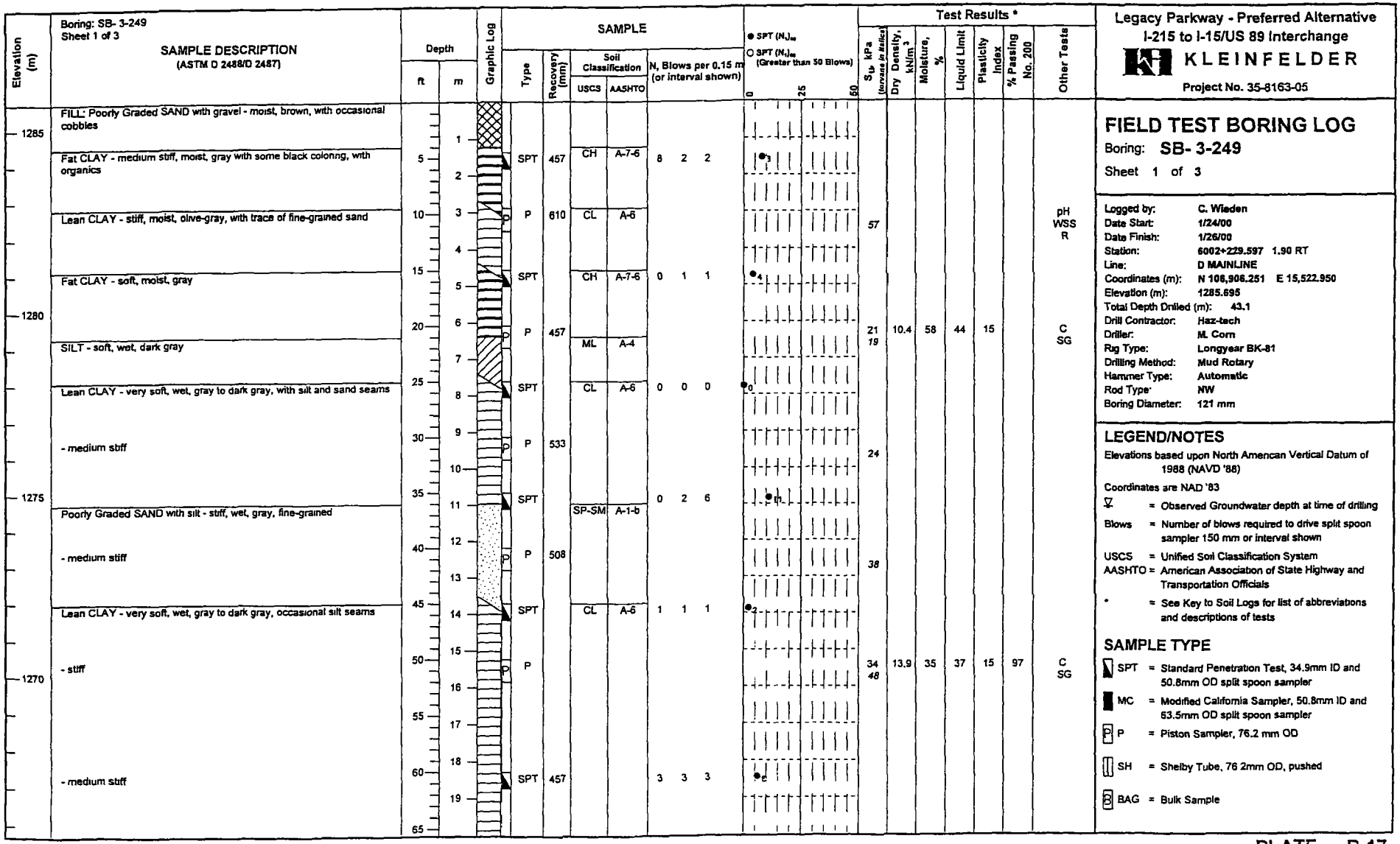

Boring: SB- 3-249
Sheet 1 of 3
SAMPLE DESCRIPTION
(ASTM D 2488/D 2487)
Depth
ft
m
Graphic Log
SAMPLE
Type
Recovery (mm)
Soil Classification
USCS
AASHTO
N, Blows per 0.15 m (or interval shown)
SPT (N1)60
SPT (N1)60 (Greater than 50 Blows)
Test Results *
Su, kPa (torvane in italics)
Dry Density, kN/m3
Moisture, %
Liquid Limit
Plasticity Index
% Passing No. 200
Other Tests
Elevation (m)
1285
1280
1275
1270
FILL: Poorly Graded SAND with gravel - moist, brown, with occasional cobbles
Fat CLAY - medium stiff, moist, gray with some black coloring, with organics
Lean CLAY - stiff, moist, olive-gray, with trace of fine-grained sand
Fat CLAY - soft, moist, gray
SILT - soft, wet, dark gray
Lean CLAY - very soft, wet, gray to dark gray, with silt and sand seams
- medium stiff
Poorly Graded SAND with silt - stiff, wet, gray, fine-grained
- medium stiff
Lean CLAY - very soft, wet, gray to dark gray, occasional silt seams
- stiff
- medium stiff
SPT 457 CH A-7-6 8 2 2
P 610 CL A-6
57
pH WSS R
SPT 457 CH A-7-6 0 1 1
P 457 ML A-4
21 19
10.4
58
44
15
C SG
SPT CL A-6 0 0 0
P 533
24
SPT SP-SM A-1-b 0 2 6
P 508
38
SPT CL A-6 1 1 1
P
34 48
13.9
35
37
15
97
C SG
SPT 457 3 3 3
Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05
FIELD TEST BORING LOG
Boring: SB- 3-249
Sheet 1 of 3
Logged by: C. Wieden
Date Start: 1/24/00
Date Finish: 1/26/00
Station: 6002+229.597 1.90 RT
Line: D MAINLINE
Coordinates (m): N 106,906.251 E 15,522.950
Elevation (m): 1285.695
Total Depth Drilled (m): 43.1
Drill Contractor: Haz-tech
Driller: M. Corn
Rig Type: Longyear BK-81
Drilling Method: Mud Rotary
Hammer Type: Automatic
Rod Type: NW
Boring Diameter: 121 mm
LEGEND/NOTES
Elevations based upon North American Vertical Datum of 1988 (NAVD '88)
Coordinates are NAD '83
= Observed Groundwater depth at time of drilling
Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown
USCS = Unified Soil Classification System
AASHTO = American Association of State Highway and Transportation Officials
* = See Key to Soil Logs for list of abbreviations and descriptions of tests
SAMPLE TYPE
SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler
MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler
P = Piston Sampler, 76.2 mm OD
SH = Shelby Tube, 76 2mm OD, pushed
BAG = Bulk Sample
UTDOT Z003881.GPJ 6/30/00

PLATE B-17

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange

KLEINFELDER

Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 3-249**

Sheet 2 of 3

Logged by:	C. Wieden
Date Start:	1/24/00
Date Finish:	1/26/00
Station:	6002+229.597 1.90 RT
Line:	D MAINLINE
Coordinates (m):	N 106,908.251 E 15,522.950
Elevation (m):	1285.695
Total Depth Drilled (m):	43.1
Drill Contractor:	Haz-tech
Driller:	M. Corn
Rig Type:	Longyear BK-81
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter:	121 mm

Boring: SB- 3-249
Sheet 2 of 3

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Sample Type	Recovery (mm)	USCS	AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$	S_u, kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
1265	Lean CLAY - medium stiff, wet, gray to dark gray, occasional silt seams (continued)		21													
	- frequent silt and occasional fine sand layers	70	22	P	610					*38*						
		75	23–24													
	- stiff	80	25	SPT				3 7 8	14							
1260		85	26–27													
		90	28	P	0											
	SILT			P		ML	A-4									
		95	29	SPT				9 7 9	14							
	Lean CLAY - stiff, wet, gray		30			CL	A-6									
1255		100	31	P	0											
	- medium stiff			SPT	457			4 4 5	7							
		105	32–33													
	SILT with sand - stiff, wet, gray, fine-grained sand	110	34	SPT	457	ML	A-4	5 4 10	11							
	Poorly Graded SAND - loose, wet, gray	115	35	SPT	0	SP	A-1-b	7 5 7	9							
1250			36													
	- dense, fine to medium-grained with trace of coarse-grained sand	120	37	SPT	0			15 23 30	49							
	SILT with sand - stiff, wet, gray, fine-grained sand	125	38	SPT	457	ML	A-4	7 9 7	12							
		130	39	SPT					29							

● SPT $(N_1)_{60}$
○ SPT $(N_1)_{60}$ (Greater than 50 Blows)
Scale: 0, 25, 50

Test Results *

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

∇ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

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AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

Boring: SB- 3-249
Sheet 3 of 3

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ / CPT $(N_1)_{60}$ (Greater than 50 Blows) 0 25 50	Test Results * S_u, kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	Poorly Graded SAND - dense, wet, gray, fine-grained					457	SP	A-1-b	7 12 27								
1245		135	41		SPT	457			15 32 40								
	- very dense		42														
		140	43		SPT				22 25 26	● 35							
	- dense		44														
		145	45														
1240		150	46														
			47														
		155	48														
		160	49														
			50														
		165	51														
1235		170	52														
			53														
		175	54														
		180	55														
1230			56														
		185	57														
		190	58														
			59														
		195															

UTDOT Z003SB1.GPJ 6/30/00

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange

KLEINFELDER

Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 3-249**

Sheet 3 of 3

Logged by:	C. Wieden
Date Start:	1/24/00
Date Finish:	1/26/00
Station:	6002+229.597 1.90 RT
Line:	D MAINLINE
Coordinates (m):	N 106,906.251 E 15,522.950
Elevation (m):	1285.695
Total Depth Drilled (m):	43.1
Drill Contractor:	Haz-tech
Driller:	M. Corn
Rig Type:	Longyear BK-81
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter:	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

PLATE B-19

Boring: SB- 3-250
Sheet 1 of 3

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ / SPT $(N_1)_{60}$ (Greater than 50 Blows)	Test Results * S_u kPa (torvane or falkes)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	FILL: Silty SAND - dense, slightly moist, light to dark brown, with coarse-grained gravels		1		SPT	533			5 14 7 9	47							
1285		5	2		SPT	305			10 15 6 8	38							pH WSS R
	Silty CLAY - dense, wet, dark brown, with some roots and wood material						CL-ML	A-6									
	Clayey SAND - medium dense, wet, gray, fine-grained sand	10	3		SPT	203	SC	A-2-6	3 1 3 3	5							
			4														
	Lean CLAY - very soft, wet, light gray, with frequent very fine sand seams	15	5		SPT	610	CL	A-6	2 1 1 1	2							
1280		20	6		SH	102											
			7														
	- very soft, gray and black coloring	25	8		SPT	610			0 0 1 1	1							
	- medium stiff, some fine sand layers	30	9		SH	508					34	12.5	39	42	19		C SG
			10														
1275	- medium stiff, with 150 mm sand layer	35	11		SPT	610			6 2 2 2	6							
	- very stiff, with 0 35 m layer of silty sand and frequent silty sand seams	40	12		SPT	610			0 15 6 6	27							
			13														
	- medium stiff, mottled, with wood material, occasional very thin seams of peat	45	14		SPT	610			0 2 2 3	4							
		50	15		SH	686					30 48	13.7	33	39	20	93	C TR SG
1270	- very soft		16														
		55	17														
			18														
	Poorly Graded SAND - loose, wet, gray, with a trace of fines, frequent thin layers of silty clay, sandy clay, and clayey silt	60	19		SPT	610	SP	A-3	0 0 5 7	5							
		65															

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 3-250**

Sheet 1 of 3

Logged by:	M. Bostrom
Date Start:	1/24/00
Date Finish:	1/25/00
Station:	6002+277.848 6.92 RT
Line:	D MAINLINE
Coordinates (m):	N 106,939.326 E 15,558.438
Elevation (m):	1286.011
Total Depth Drilled (m):	43.3
Drill Contractor:	RC Exploration
Driller:	N. Young
Rig Type:	Diedrich D-120 Truck
Drilling Method:	Hollow-Stem Auger
Hammer Type:	Automatic
Rod Type:	AW
Boring Diameter:	203 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76 2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

UTDOT Z0035B1.GPJ 6/30/00

PLATE B-20

Boring: SB- 3-250
Sheet 2 of 3

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or Interval shown)	SPT $(N_1)_{60}$ / SPT $(N_1)_{60}$ (Greater than 50 Blows) 0 25 50	Test Results * S_u, kPa (Values in Italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	Poorly Graded SAND - loose, wet, gray, with a trace of fines, frequent thin layers of silty clay, sandy clay, and clayey silt (continued)																
1265	SILT with sand - medium stiff, wet, olive gray, with very fine-grained sand and clay seams	70	21		SPT	610	ML	A-4	3 3 5 6	8							
			22														
		75	23														
			24														
		80	25		SH	0											
1260			26														
		85	27														
	- stiff, 0.15 m poorly graded sand layer	90	28		SPT	610			7 6 8 10	12							
			29														
		95	30														
	Silty CLAY - very stiff, wet, olive gray, 0.15 m poorly graded sand layer	100	31		SPT	610	CL-ML	A-6	7 10 12 16	19							
1255			32														
		105	33														
	Poorly Graded SAND - very loose, wet, gray, medium-grained	110	34		SPT	610	SP	A-3	0 0 0 0	0							
	Silty SAND - very dense, wet, brownish-gray	115	35		SPT	457	SM	A-2-4	12 24 32 44	45							
1250			36														
	SILT - very stiff, wet, grayish-brown, with very fine-grained sand layers	120	37		SPT	610	ML	A-4	15 12 19 20	25							
			38														
	Silty SAND - dense, wet, brownish-gray	125	39		SPT	610	SM	A-2-4	9 21 39 47	45							
		130			SPT												

UTDOT Z003581.GPJ 9/30/00

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 3-250**

Sheet 2 of 3

Logged by:	M. Bostrom
Date Start:	1/24/00
Date Finish:	1/25/00
Station:	6002+277.848 6.92 RT
Line:	D MAINLINE
Coordinates (m):	N 106,939.326 E 15,558.438
Elevation (m):	1286.011
Total Depth Drilled (m):	43.3
Drill Contractor:	RC Exploration
Driller:	N. Young
Rig Type:	Diedrich D-120 Truck
Drilling Method.	Hollow-Stem Auger
Hammer Type.	Automatic
Rod Type:	AW
Boring Diameter:	203 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

PLATE B-21

Boring: SB- 3-250
Sheet 3 of 3

SAMPLE DESCRIPTION
(ASTM D 2488/D 2487)

Elevation (m)	Depth ft	Depth m	Graphic Log	Sample Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ / SPT $(N_1)_{60}$ (Greater than 50 Blows)	Test Results * S_u, kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
					610			16 30 44 60								
		41														
1245	135			SPT	305			9 10 12 13	18							
		42				CL	A-6									
	140															
		43		SPT	810			9 25 38 42	45							
						SM	A-2-4									
		44														
	145															
		45														
	150															
1240		46														
		47														
	155															
		48														
	160															
		49														
		50														
	165															
		51														
1235	170															
		52														
		53														
	175															
		54														
	180															
		55														
		56														
	185															
		57														
1230																
	190	58														
		59														
	195															

Silty SAND - dense, wet, brownish-gray (continued)

Lean CLAY - very stiff, wet, gray

- dense

Silty SAND - very dense, wet, gray

UTDOT Z0035B1.GPJ 8/30/00

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 3-250**

Sheet 3 of 3

Logged by:	M. Bostrom
Date Start:	1/24/00
Date Finish:	1/25/00
Station:	6002+277.848 6.92 RT
Line:	D MAINLINE
Coordinates (m):	N 106,939.325 E 15,558.438
Elevation (m):	1286.011
Total Depth Drilled (m):	43.3
Drill Contractor:	RC Exploration
Driller:	N. Young
Rig Type:	Diedrich D-120 Truck
Drilling Method:	Hollow-Stem Auger
Hammer Type:	Automatic
Rod Type:	AW
Boring Diameter:	203 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34 9mm ID and 50.8mm OD split spoon sampler

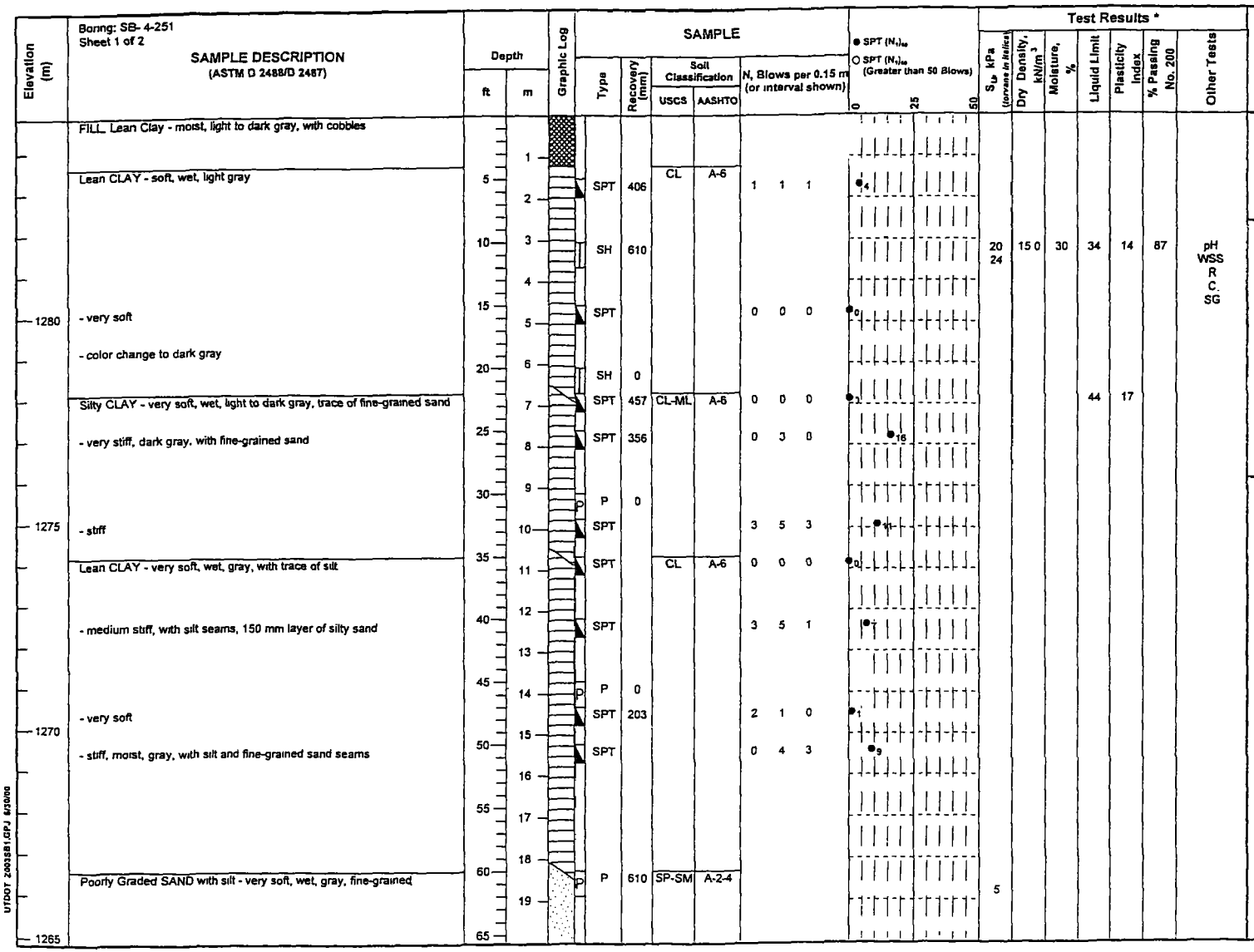
MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76 2mm OD, pushed

BAG = Bulk Sample

PLATE B-22



Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange

KLEINFELDER

Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 4-251**

Sheet 1 of 2

Logged by:	C. Wieden
Date Start:	1/22/00
Date Finish:	1/24/00
Station:	54+663.358 0.41 RT
Line:	LP NB to I-15 (I-215)
Coordinates (m):	N 106,888.086 E 15,546.287
Elevation (m):	1284.833
Total Depth Drilled (m):	37.5
Drill Contractor:	Haz-tech
Driller:	M. Corn
Rig Type:	Longyear BK-81
Drilling Method:	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter:	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbrevrations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

UTDOT 2003581.GPJ 8/3/00

PLATE B-23

Boring: SB- 4-251
Sheet 2 of 2

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Sample Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ / SPT $(N_1)_{60}$ (Greater than 50 Blows) 0 25 50	Test Results: S_u kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	Poorly Graded SAND with silt - very soft, wet, gray, fine-grained (continued)																
	SILT - stiff, wet, gray, with fine-grained sand and clay seams	70	21		SPT	457	ML	A-4	4 6 6	12							
		75	22														
			23														
			24														
	Lean CLAY - wet, gray, with silt and organics	80	25		P	0	CL	A-6									
1260					P	0											
	Silty SAND - wet, gray, fine-grained	85	26		P	610	SM	A-2-4			68 / *38*	12.7	41	47	22	98	C SG
			27														
	- dense	90	28		SPT				10 20 30	45							
	Lean CLAY - stiff, wet, gray to olive-gray	95	29		SPT		CL	A-6	4 6 6	19							
1255			30														
		100	31														
		105	32		P	508					39 / *19*	15.5	26			84	C TR SG
	Silty SAND - soft, wet, gray, fine-grained						SM	A-2-4									
		110	33														
			34		SPT				10 19 27	38							
1250		115	35		SPT				17 19 24	34							
			36														
		120	37		SPT	0			16 22 22	34							
	- 150 mm lean clay layer				SPT				17 16 12	9							
		125	38														
			39														
1245		130															

UTDOT Z003SB1.GPJ 8/30/00

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **SB- 4-251**

Sheet **2** of **2**

Logged by:	C. Wieden
Date Start:	1/22/00
Date Finish:	1/24/00
Station.	54+663.358 0.41 RT
Line:	LP NB to I-15 (I-215)
Coordinates (m):	N 106,888.086 E 15,546.287
Elevation (m):	1284.833
Total Depth Drilled (m):	37.5
Drill Contractor:	Haz-tech
Driller:	M. Corn
Rig Type:	Longyear BK-81
Drilling Method.	Mud Rotary
Hammer Type:	Automatic
Rod Type:	NW
Boring Diameter:	121 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

PLATE B-24

Boring: SB- 4-252
Sheet 1 of 2

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ / SPT $(N_1)_{60}$ (Greater than 50 Blows)	S_u, kPa (torvane in *italics*)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	FILL: Silty GRAVEL - medium dense, moist, dark brown to gray, with occasional 150 mm silt layers		1		SPT	356			4 6 6 2	26							
1285		5															
	- dark brown to brown		2		SPT	305			9 8 5 7	21							
	- wet	10	3		SPT	152			3 6 4 3	12							
			4														
	Clayey SAND - loose, wet, gray, with frequent clay layers approximately 150 mm thick	15	5		SPT	406	SC	A-2-6	3 2 2 3	4							
1280	- very loose	20	6		SPT	508			2 2 1 1	3							
			7														
	Lean CLAY - medium stiff, wet, gray, with frequent silt seams and layers varying from 10 to 150 mm	25	8		SH	508	CL	A-6			24			40	17		
	- hard	30	9		SPT	508			7 15 18 16	33							
			10														
1275		35	11		SH	0											
	- very stiff				SPT	610			15 16 10 11	28							
	- stiff, light brown mottling, silt layers up to 200 mm thick	40	12		SPT	610			15 6 8 6	14							
			13														
		45	14		SH	457					39 53	37.4	31	32	14		C SG
			15														
	- medium stiff, dark gray mottling	50	16		SPT	610			3 3 2 4	5							
1270																	
		55	17														
			18														
	- stiff	60			SH	406					53						
	Sandy SILT - stiff, wet, gray		19				ML	A-4									
		65															

Test Results *

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: SB- 4-252

Sheet 1 of 2

Logged by:	M. Hislop
Date Start:	1/24/00
Date Finish:	1/25/00
Station:	54+711.938 0.83 RT
Line:	LP NB to I-15 (I-215)
Coordinates (m):	N 106,921.417 E 15,581.574
Elevation (m):	1286.042
Total Depth Drilled (m):	38.7
Drill Contractor:	RC Drilling
Driller:	M. Labenski
Rig Type:	Diedrich D-120 ATV
Drilling Method:	Hollow-Stem Auger
Hammer Type:	Automatic
Rod Type:	AW
Boring Diameter:	152 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

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SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

UTDOT Z0015B1.GPJ 4/10/00

PLATE B-25

Boring: SB- 4-252
Sheet 2 of 2

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ (Greater than 50 Blows) 0 25 50	Test Results * S_u kPa (tonsare in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	Sandy SILT - stiff, wet, gray (continued)																
1265	- medium stiff, light brown	70	21		SPT	610	CL	A-6	6 3 4 8	6							
	Lean CLAY - medium stiff, wet, gray to dark gray	75	22														
			23														
		80	24														
	Silty SAND - wet, gray, with silt layers		25		SH	559	SM	A-2-4			25 57	17 4	26			51	C SG
		85	26														
1260			27														
	- dense, with silt and clay layers 150 to 200 mm thick	90	28		SPT	610			28 27 24 35	49							
		95	29		SPT				7 12 22 14	26							
			30														
		100	31														
1255																	
	Lean CLAY - medium stiff, wet, gray, with peat inclusions and silt seams	105	32		SPT	610	CL	A-6	3 3 4 5	5							
			33														
	Silty SAND - dense, wet, gray	110	34		SPT	610	SM	A-2-4	8 18 28 45	33							
		115	35		SPT	305	SP	A-3	18 30 36 50	47							
	Poorly Graded SAND with gravel - dense, wet, gray		36														
1250		120	37		SPT	457	ML	A-4	12 19 26 49	31							
	SILT - hard, wet, light brown		38														
	- with gravelly and silty sand layers up to 150 mm thick	125	39		SPT	457			18 26 41 38	48							
		130															

UTDOT Z003581.GPJ 8/30/00

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: SB- 4-252

Sheet 2 of 2

Logged by:	M. Hislop
Date Start:	1/24/00
Date Finish:	1/25/00
Station:	54+711.938 0.83 RT
Line:	LP NB to I-15 (I-215)
Coordinates (m):	N 106,921.417 E 15,581.574
Elevation (m):	1286.042
Total Depth Drilled (m):	38.7
Drill Contractor:	RC Drilling
Driller:	M. Labenski
Rig Type:	Diedrich D-120 ATV
Drilling Method:	Hollow-Stem Auger
Hammer Type:	Automatic
Rod Type:	AW
Boring Diameter:	152 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

PLATE B-26

Boring: RB-392
Sheet 1 of 2

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	SPT $(N_1)_{60}$ / SPT $(N_1)_{60}$ (Greater than 50 Blows)	Test Results: S_u, kPa (torvane in italics)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	FILL: Silty GRAVEL - very dense, moist to wet, brown, fine-grained				SPT	152			14 19 12 9	49							
1285		5	1		MC	0			26 36 27 25								
					MC	152			5 4 4 5	8							
	- loose		2		SPT	0			6 5 3 5	8							
		10	3		P	610											
	Lean CLAY - medium stiff, wet, brownish-gray, mottled rust-colored				SPT	305	CL	A-7-6	1 3 2 2	5	29						
	- frequent seams of fine to medium-grained sand	15	4		MC	610			1 1 1 1	2							
			5		SPT	610											
	- very soft		6		P	610					14	11.3	51	41	17		C
1280		20			SPT	610			1 2 1 0	3	24						
	- soft, with frequent seams of silt to very fine-grained sands	25	7		MC	610			0 0 17 11	16							
			8		SPT	610			1 2 1 2	3							
		30	9		P	0											
	Silty SAND - medium dense, wet, gray, fine-grained		10		SPT	305	SM	A-2-4	5 9 3 3	12							
1275	SILT - stiff, wet, grayish -brown	35	11		MC	381	ML	A-4	6 6 7 5	11							
					SPT	305			11 17 5 6	22							
	- occasional seams of fine-grained sand	40	12		P	610	CL	A-7-6									
	Lean CLAY - medium stiff, wet, olive gray, interlayered with seams of silt		13		SPT	610			4 2 3 3	5	48						
	Clayey SILT - medium stiff, wet, dark gray	45					CL-ML	A-4									
			14		MC	610			2 3 4 4	5							
					SPT	610			2 3 4 3	7							
		50	15		P	610	CL	A-7-6									
1270	Lean CLAY - medium stiff, wet, blue		16								34						
		55	17		SPT	610			4 7 5 4	12							
			18														
		60			SPT	610			4 2 2 2	4							
	- soft, gray		19														
		65															

UTDOT 2003RB.GPJ 8/30/00

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange
KLEINFELDER
Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **RB-392**

Sheet 1 of 2

Logged by:	M. Bostrom
Date Start:	2/29/00
Date Finish:	3/2/00
Station:	54+787.955 1.05 LT
Line:	LP NB to I-15 (I-215)
Coordinates (m):	N 106,971.375 E 15,638.881
Elevation (m):	1286.010
Total Depth Drilled (m):	30.2
Drill Contractor:	Layne Christensen
Driller:	J. Hulse
Rig Type:	Terramac
Drilling Method:	Mud Rotary
Hammer Type:	Safety
Rod Type:	AW
Boring Diameter:	133 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

PLATE D-70

Boring: RB-392
Sheet 2 of 2

Elevation (m)	SAMPLE DESCRIPTION (ASTM D 2488/D 2487)	Depth ft	Depth m	Graphic Log	Sample Type	Recovery (mm)	Soil Classification USCS	Soil Classification AASHTO	N, Blows per 0.15 m (or interval shown)	$(N_1)_{60}$ (Greater than 50 Blows)	Test Results * S_u, kPa (tonsf/ft²)	Dry Density, kN/m³	Moisture, %	Liquid Limit	Plasticity Index	% Passing No. 200	Other Tests
	SILT - stiff, wet, gray to gray-brown				P	610	ML	A-4			48						
1265		70	21		SPT	610			1 2 2 2	4							
	- soft to medium stiff, black	75	22														
			23		P	610					48						
			24														
	- medium stiff, wet, gray, interbedded with clay	80	25		SPT	610			3 3 3 3	6							
1260	Lean CLAY - stiff, wet, gray	85	26		P	610	CL	A-7-6			79 48	18.3	7	45	22		C TR SG
			27														
	Silty SAND - dense to very dense, wet, gray-brown, fine-grained	90	28		SPT	508	SM	A-2-4	10 17 19 36	35							
	Lean CLAY - stiff, wet, green-gray, mottled tan	95	29		P	508	CL	A-7-6									
			30		SPT	203			5 5 7 7	11							
1255		100	31														
		105	32														
			33														
		110	34														
		115	35														
1250			36														
		120	37														
		125	38														
			39														
		130															

Legacy Parkway - Preferred Alternative
I-215 to I-15/US 89 Interchange

KLEINFELDER

Project No. 35-8163-05

FIELD TEST BORING LOG

Boring: **RB-392**

Sheet 2 of 2

Logged by:	M. Bostrom
Date Start:	2/29/00
Date Finish:	3/2/00
Station:	54+787.955 1.05 LT
Line:	LP NB to I-15 (I-215)
Coordinates (m):	N 106,971.375 E 15,638.881
Elevation (m):	1286.010
Total Depth Drilled (m):	30.2
Drill Contractor:	Layne Christensen
Driller:	J. Hulse
Rig Type:	Terramac
Drilling Method:	Mud Rotary
Hammer Type:	Safety
Rod Type:	AW
Boring Diameter:	133 mm

LEGEND/NOTES

Elevations based upon North American Vertical Datum of 1988 (NAVD '88)

Coordinates are NAD '83

▽ = Observed Groundwater depth at time of drilling

Blows = Number of blows required to drive split spoon sampler 150 mm or interval shown

USCS = Unified Soil Classification System

AASHTO = American Association of State Highway and Transportation Officials

* = See Key to Soil Logs for list of abbreviations and descriptions of tests

SAMPLE TYPE

SPT = Standard Penetration Test, 34.9mm ID and 50.8mm OD split spoon sampler

MC = Modified California Sampler, 50.8mm ID and 63.5mm OD split spoon sampler

P = Piston Sampler, 76.2 mm OD

SH = Shelby Tube, 76.2mm OD, pushed

BAG = Bulk Sample

UTDOT 2003RB.GPJ 8/8/00

PLATE D-71

APPENDIX C
Laboratory Testing

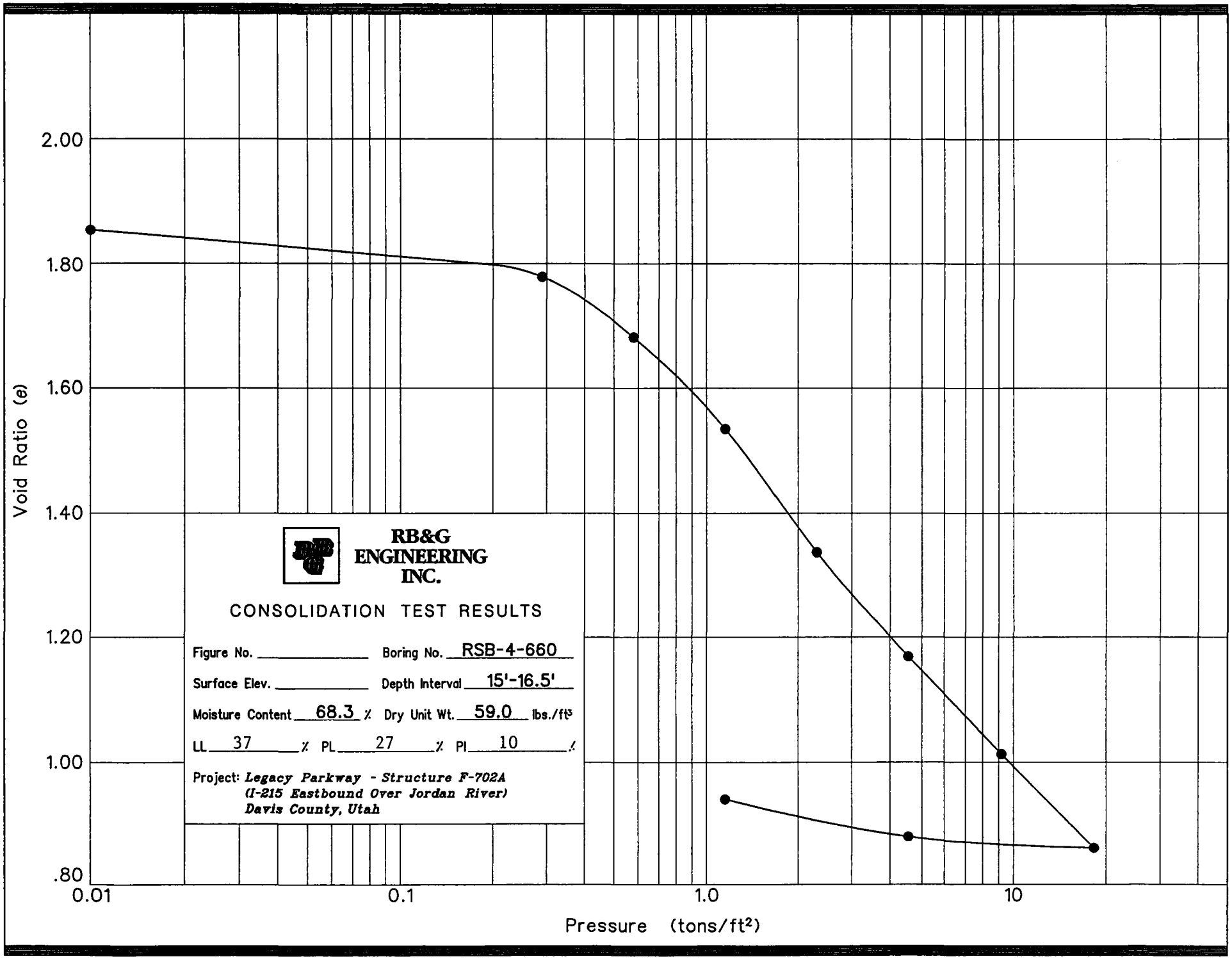
Table 1

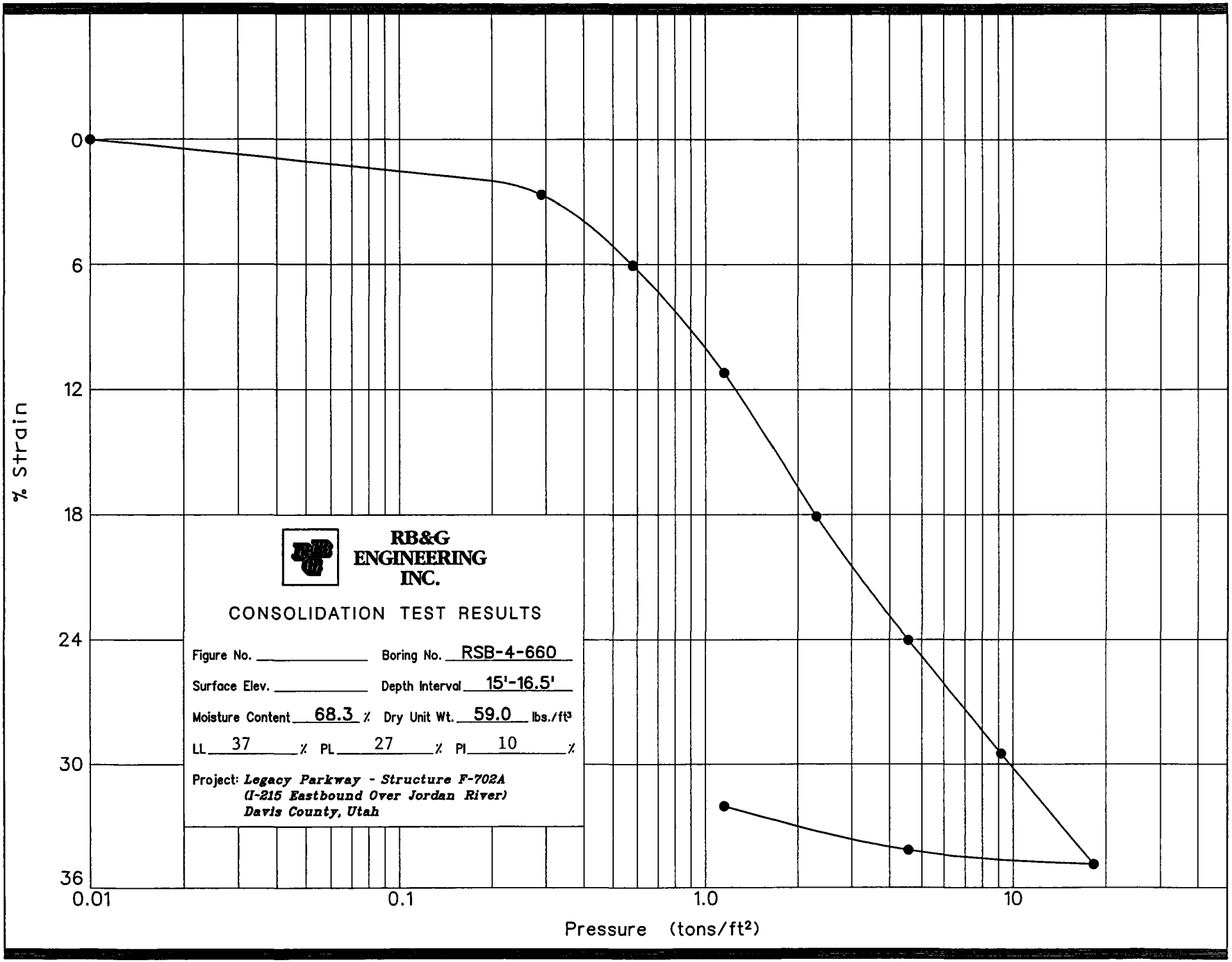
SUMMARY OF TEST DATA

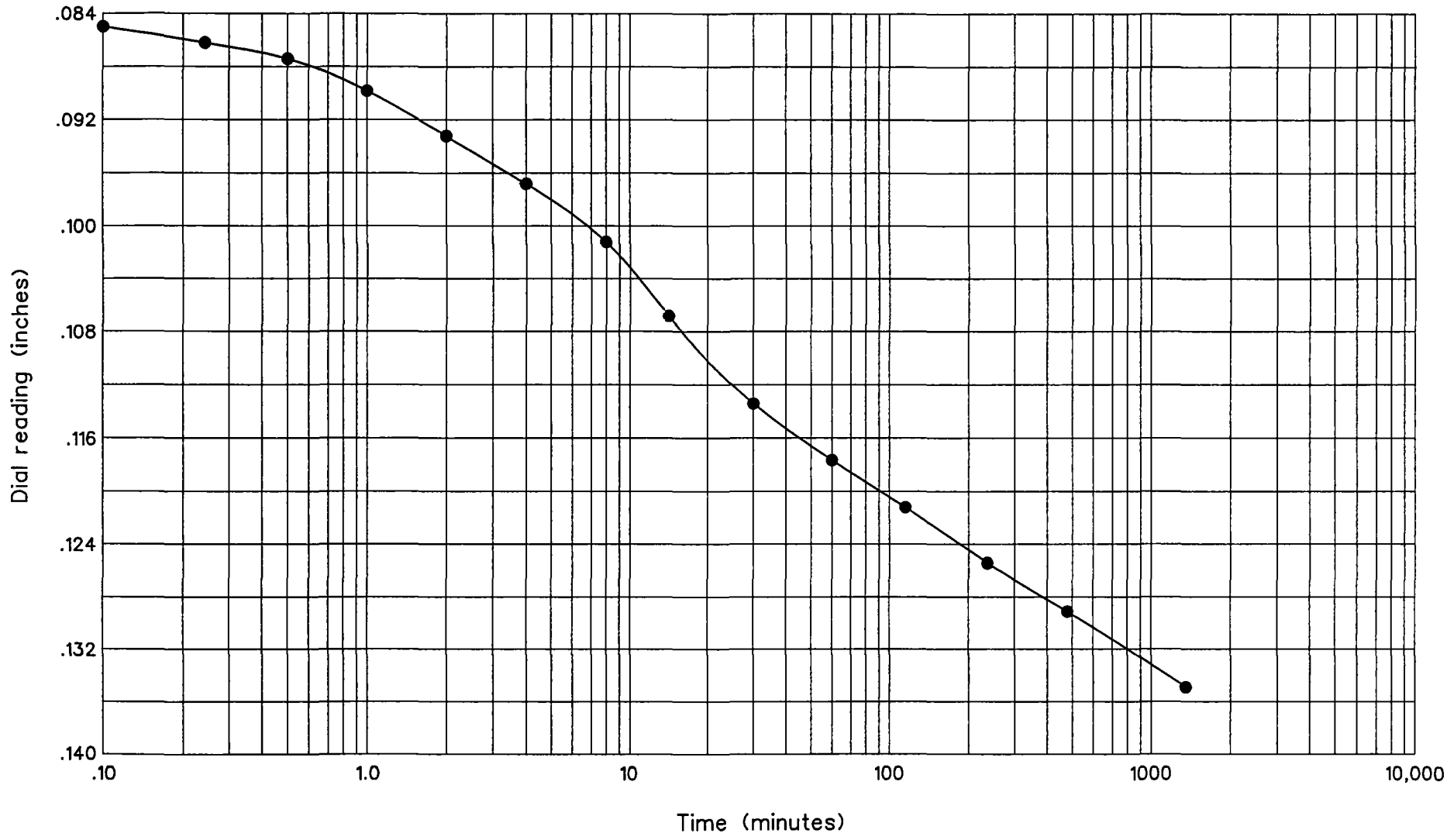
PROJECT Legacy Parkway – Structure F-702 PROJECT NO. 200601-104
LOCATION LP1 over Jordan River FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM / (AASHTO Classification)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
RSB-4-660	5-6.5	0		21.6		67	22	45	0	5	95	CH / A-7-6(48)
	15-16.5		59.0	68.3	562	37	27	10	0	0	100	ML / A-4(12)
	25-26.5			21.8				NP	0	46	54	ML / A-4(0)
	31-31.5	2		21.9		19	17	2	0	14	86	ML / A-4(0)
	36-37.5	4		22.0				NP	0	53	47	SM / A-4(0)
	50-51.5		85.1	31.7	1749	40	19	21	0	0	100	CL / A-6(22)
	60-61.5	16		26.5				NP	0	79	21	SM / A-2-4
	70-71.5		79.2	36.5	2561	34	19	15	0	3	97	CL / A-6(15)
	85-86.5		83.5	35.3	3267	67	25	42	0	1	99	CH / A-7-6(48)
	95-96.5			37.4		56	26	30	0	6	94	CH / A-7-5(32)
	110-111.5	27		26.7				NP	3	71	26	SM / A-2-4

NP=Nonplastic


2.00
1.80
1.60
1.40
1.20
1.00
.80
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No. _____ Boring No. RSB-4-660
Surface Elev. _____ Depth Interval 15'-16.5'
Moisture Content 68.3 % Dry Unit Wt. 59.0 lbs./ft³
LL 37 % PL 27 % PI 10 %
Project: Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah


0
6
12
18
24
30
36
% Strain
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No. _____ Boring No. RSB-4-660
Surface Elev. _____ Depth Interval 15'-16.5'
Moisture Content 68.3 % Dry Unit Wt. 59.0 lbs./ft³
LL 37 % PL 27 % PI 10 %
Project: Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah



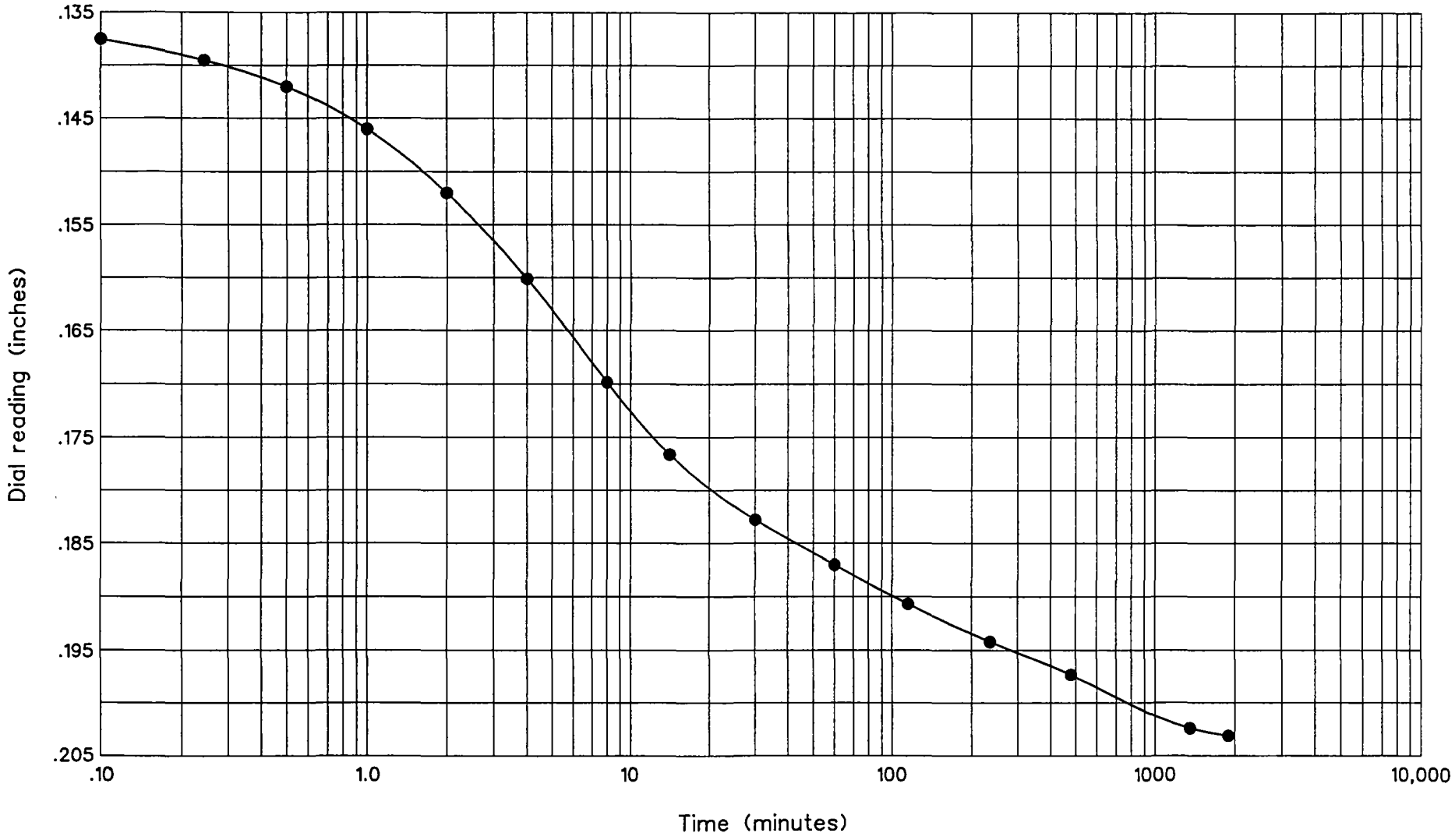
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 15'-16.5'
Load: 1.15 to 2.30 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



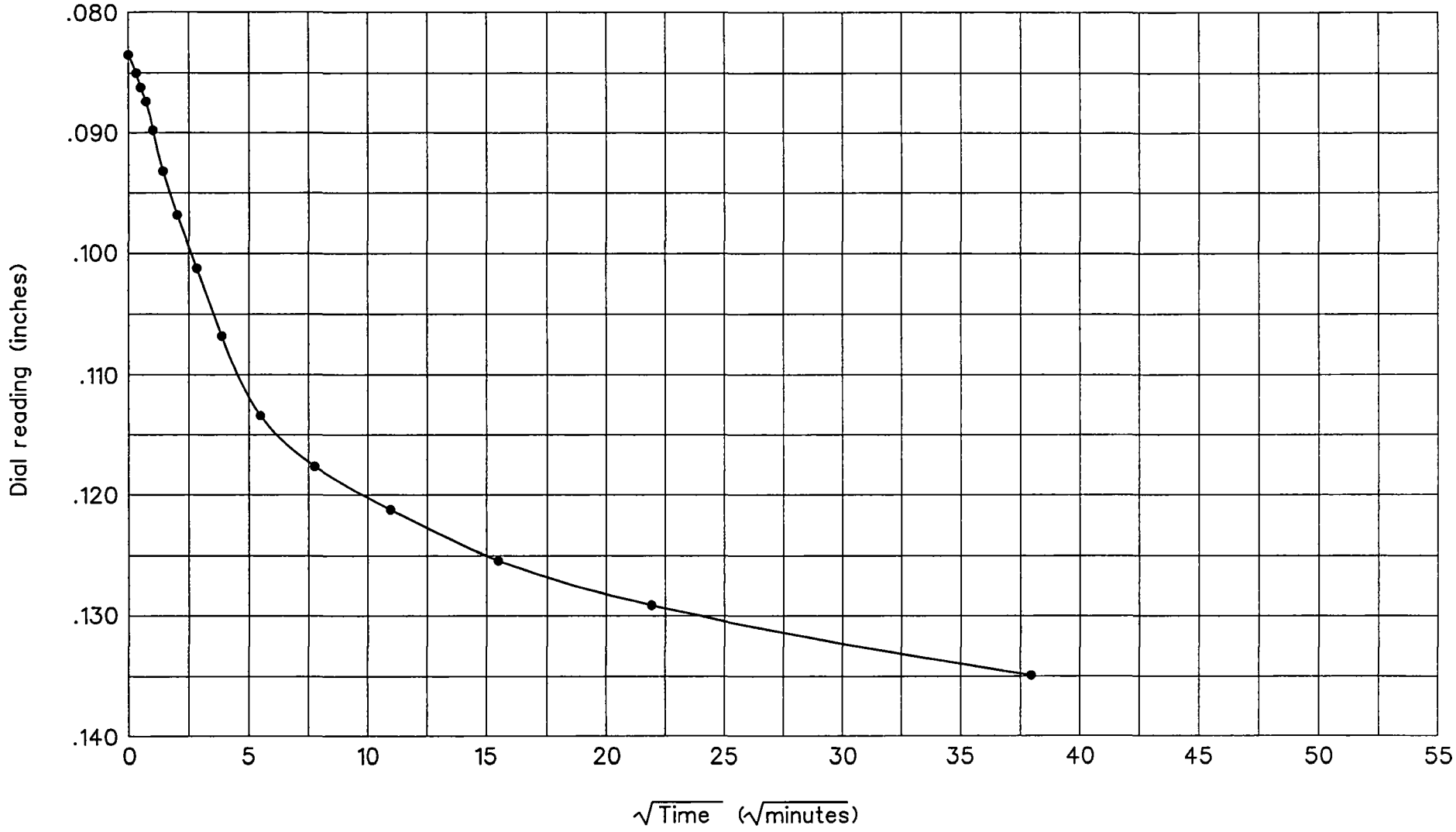
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 15'-16.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



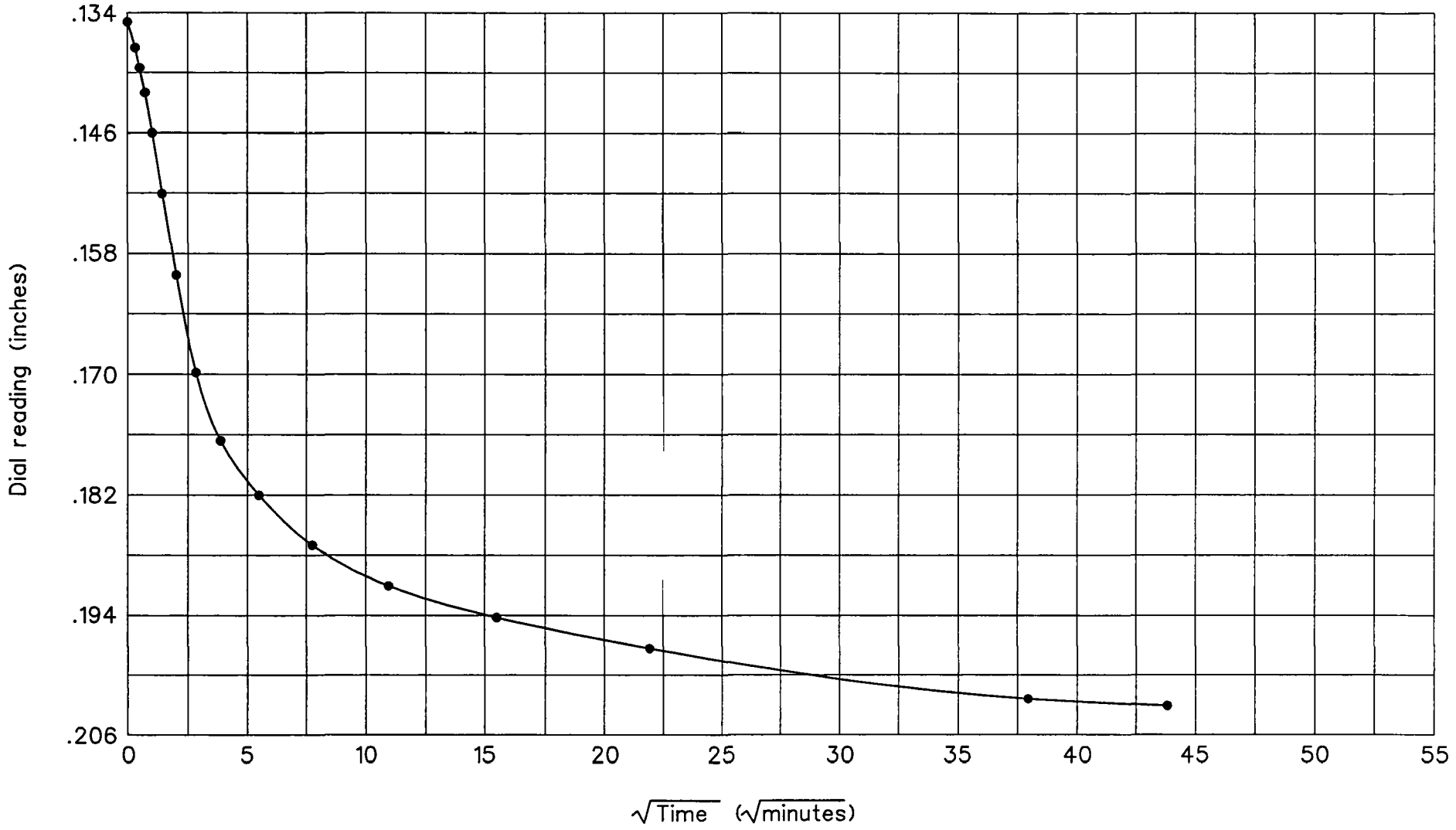
RB&G ENGINEERING INC.
Provo. Utah

Hole no.: RSB-4-660
Depth: 15'-16.5'
Load: 1.15 to 2.30 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



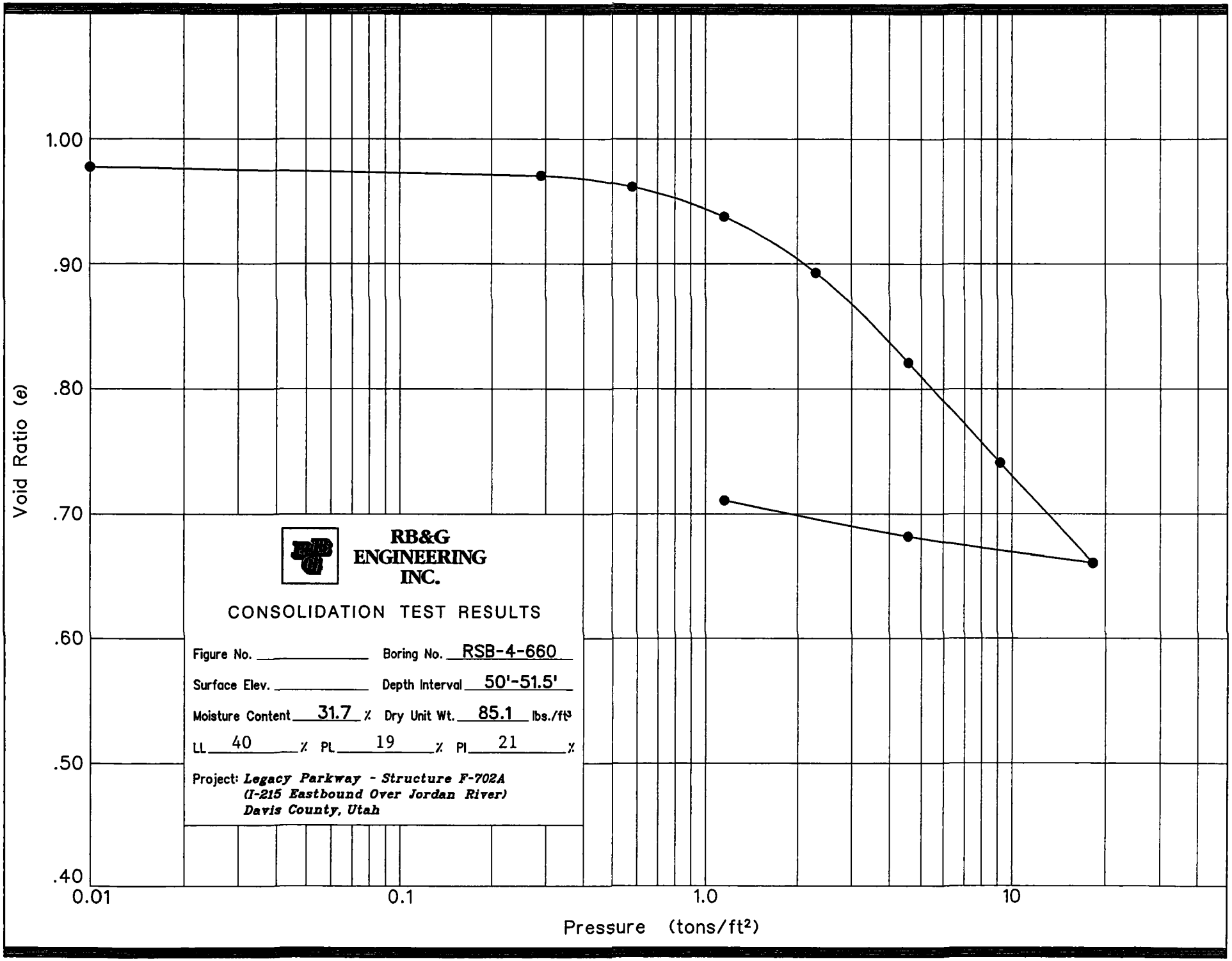
RB&G ENGINEERING INC.
Provo, Utah

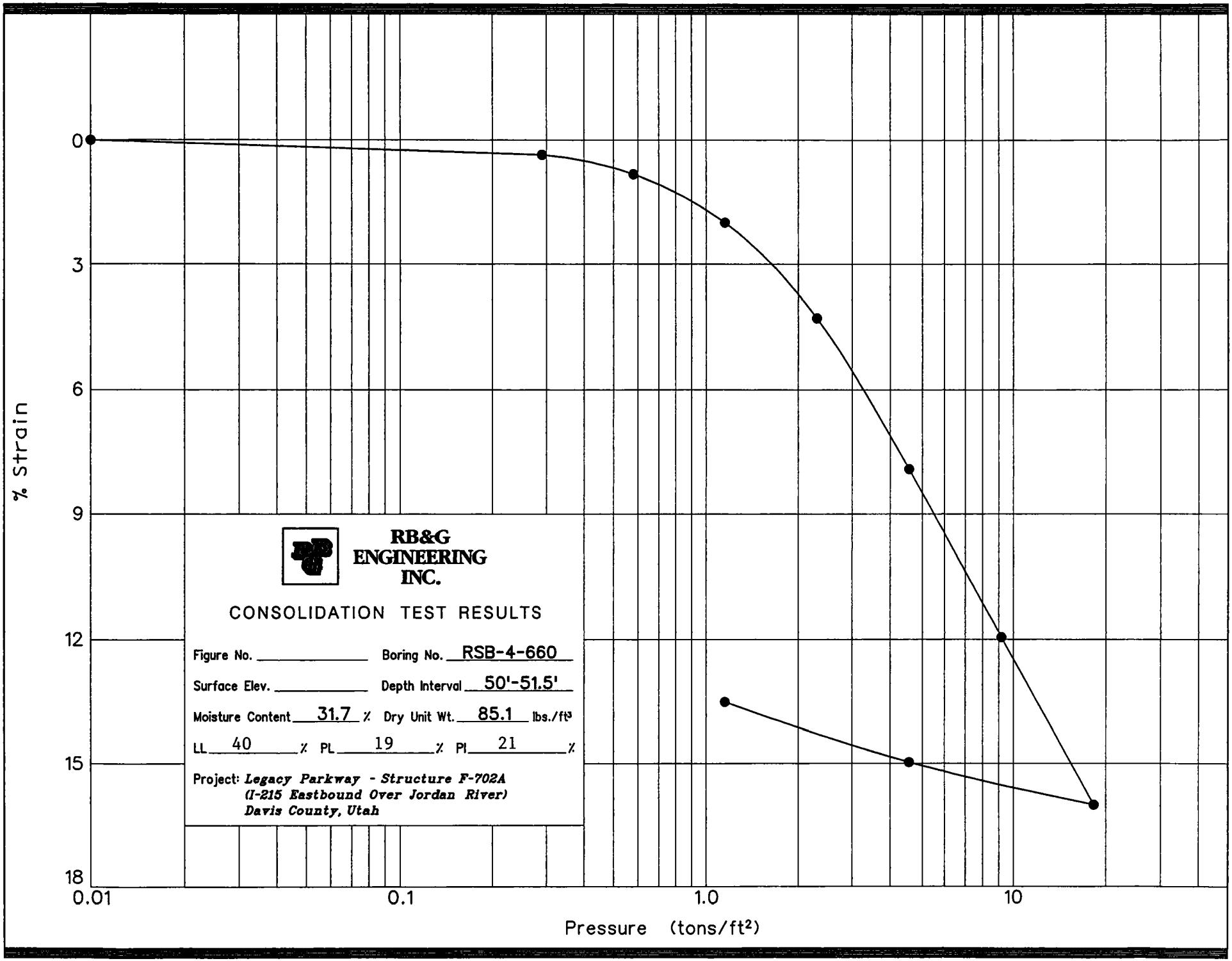
Hole no.: RSB-4-660
Depth: 15'-16.5'
Load: 2.30 to 4.60 tons

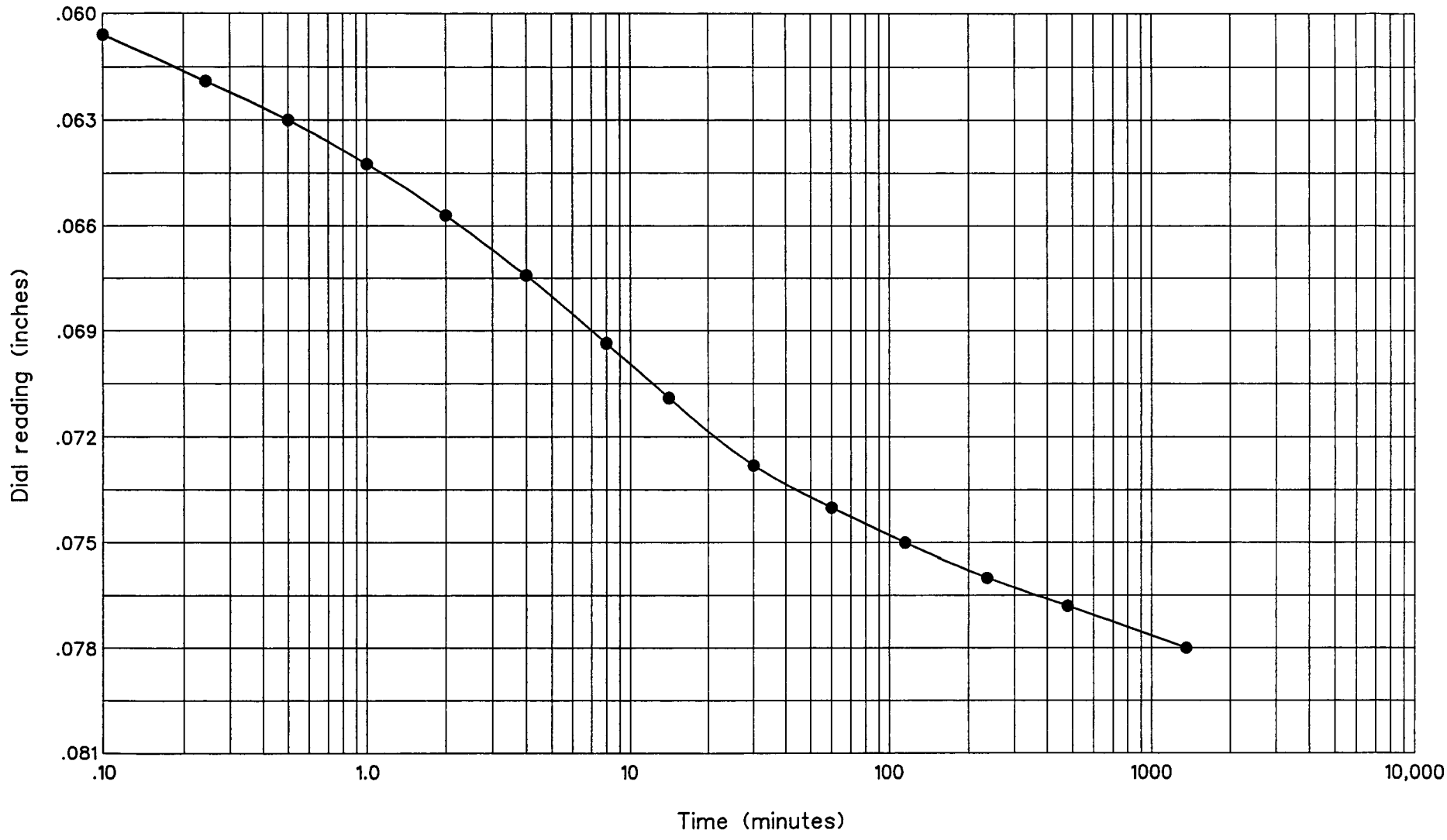
TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure


1.00
.90
.80
.70
.60
.50
.40
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No. _____ Boring No. RSB-4-660
Surface Elev. _____ Depth Interval 50'-51.5'
Moisture Content 31.7 % Dry Unit Wt. 85.1 lbs./ft³
LL 40 % PL 19 % PI 21 %
Project: Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah


% Strain
0
3
6
9
12
15
18
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No. _____ Boring No. RSB-4-660
Surface Elev. _____ Depth Interval 50'-51.5'
Moisture Content 31.7 % Dry Unit Wt. 85.1 lbs./ft³
LL 40 % PL 19 % PI 21 %
Project: Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah



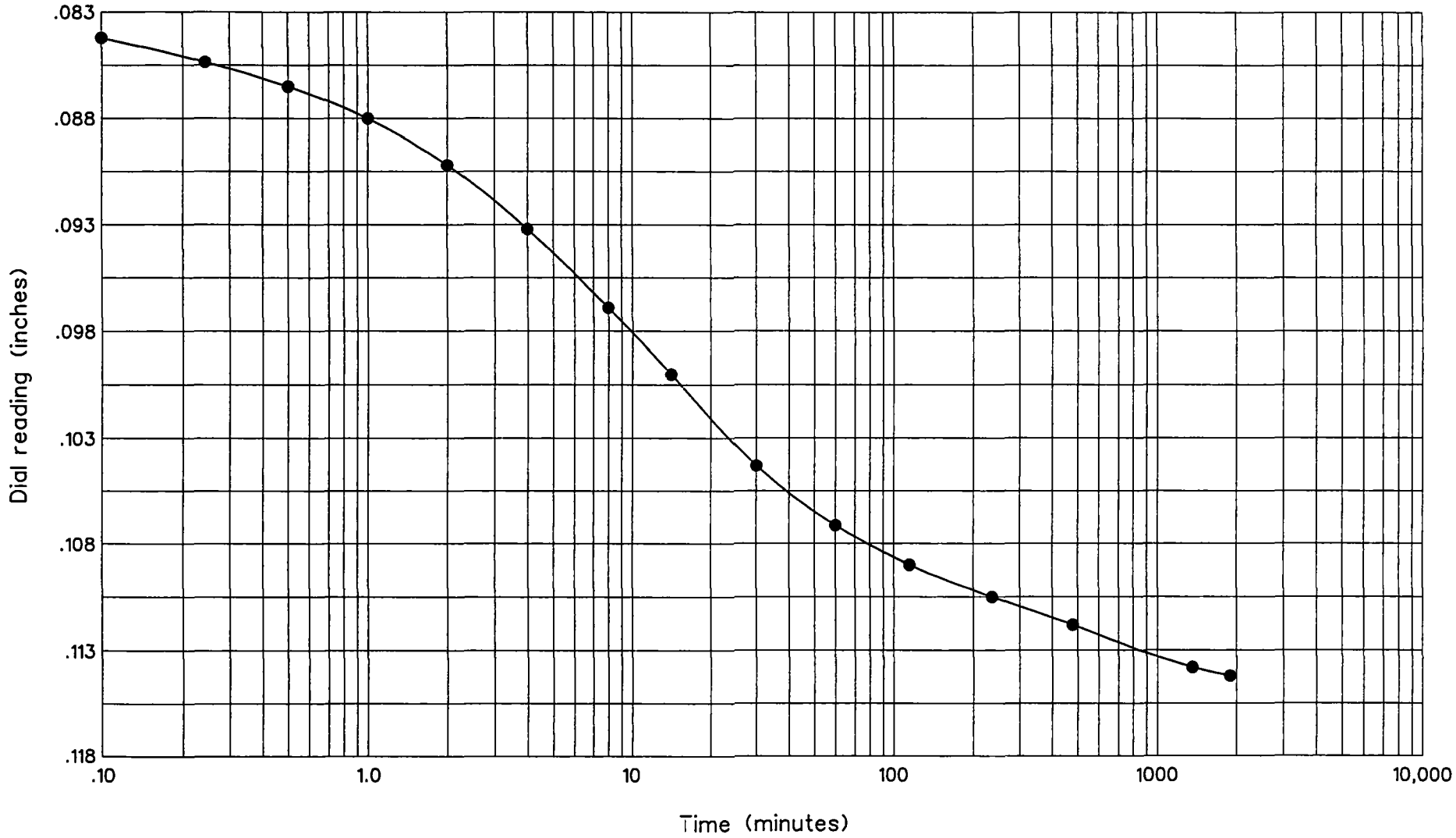
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 50'-51.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



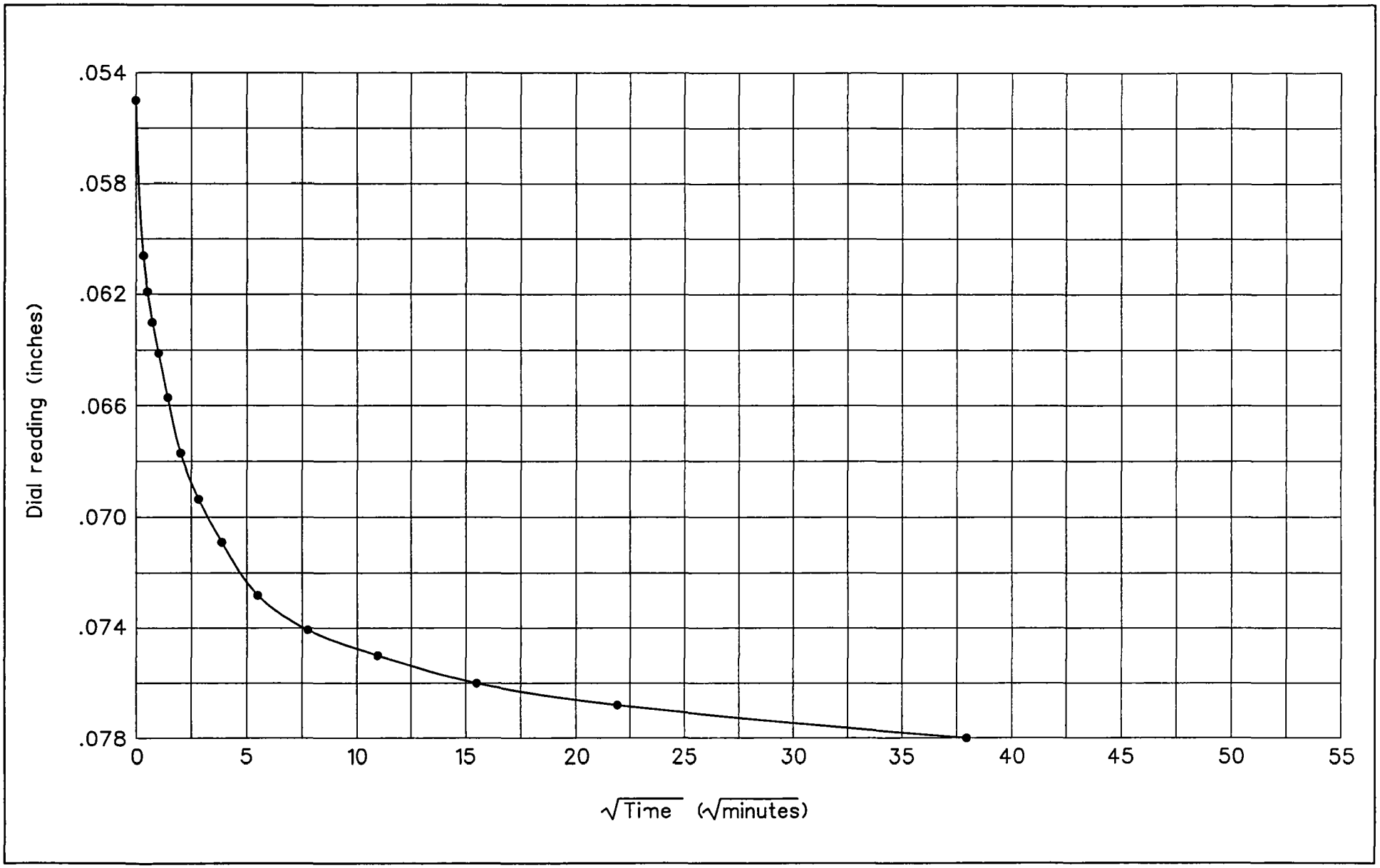
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 50'-51.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



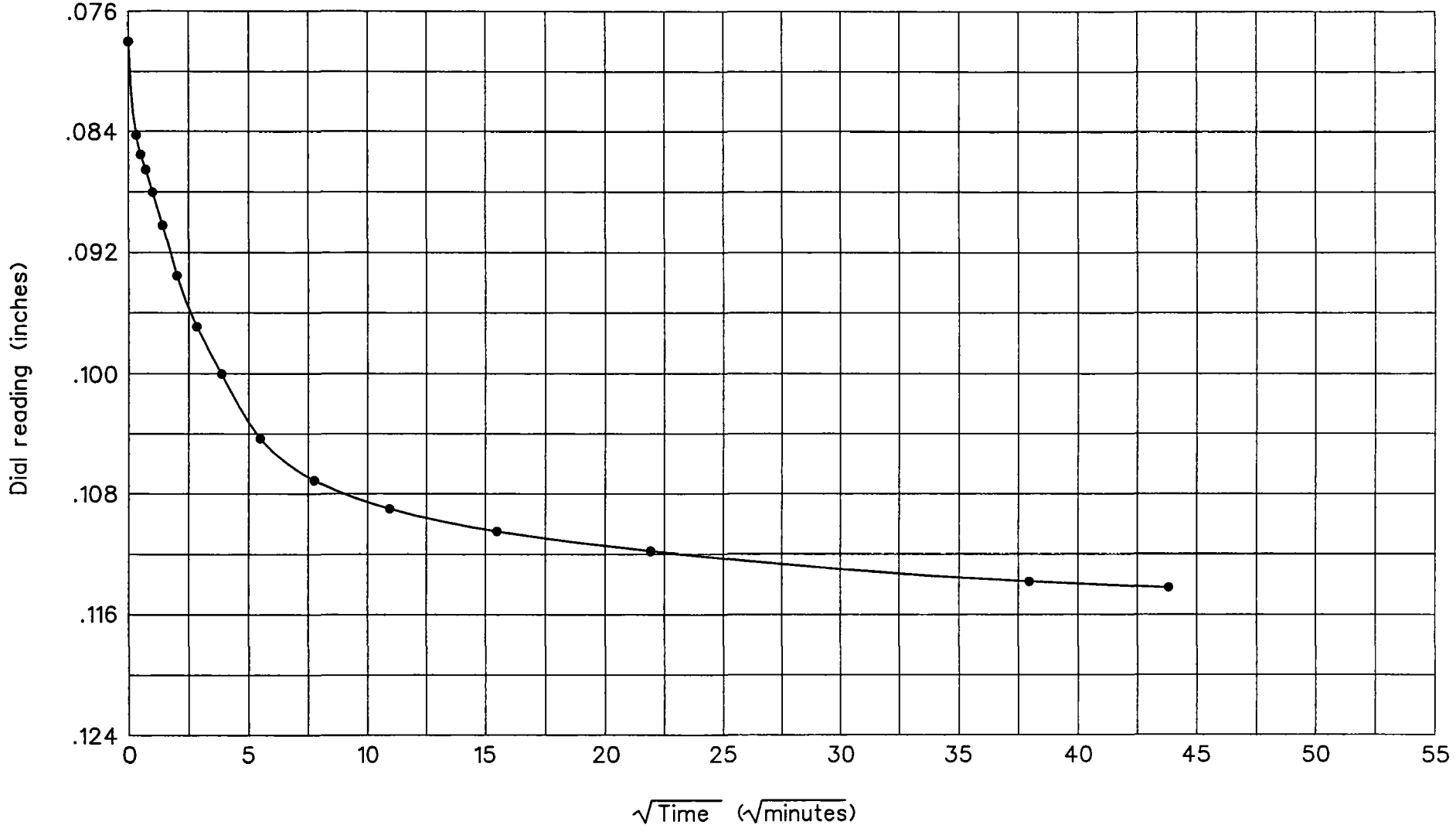
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 50'-51.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



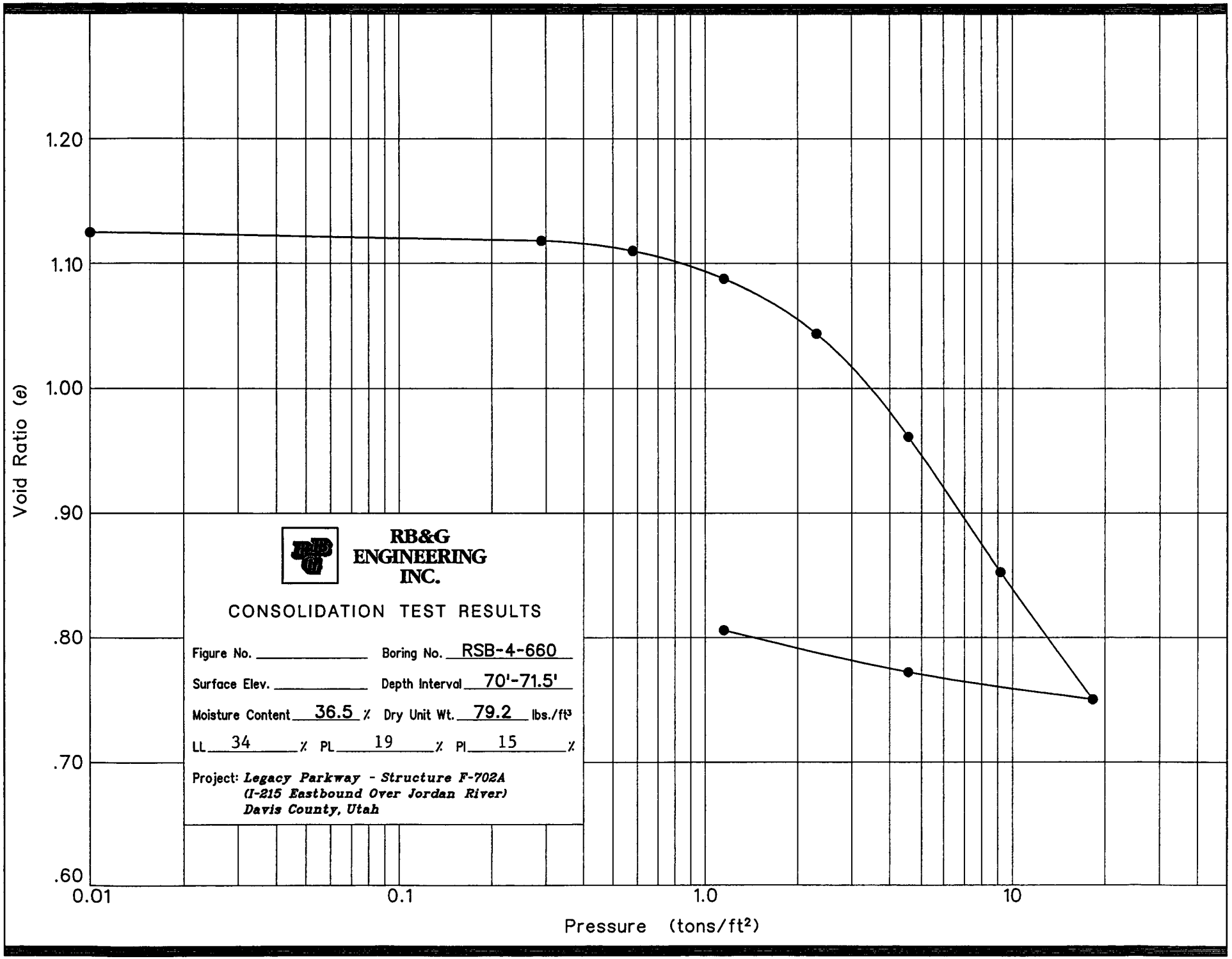
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 50'-51.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



RB&G ENGINEERING INC.

CONSOLIDATION TEST RESULTS

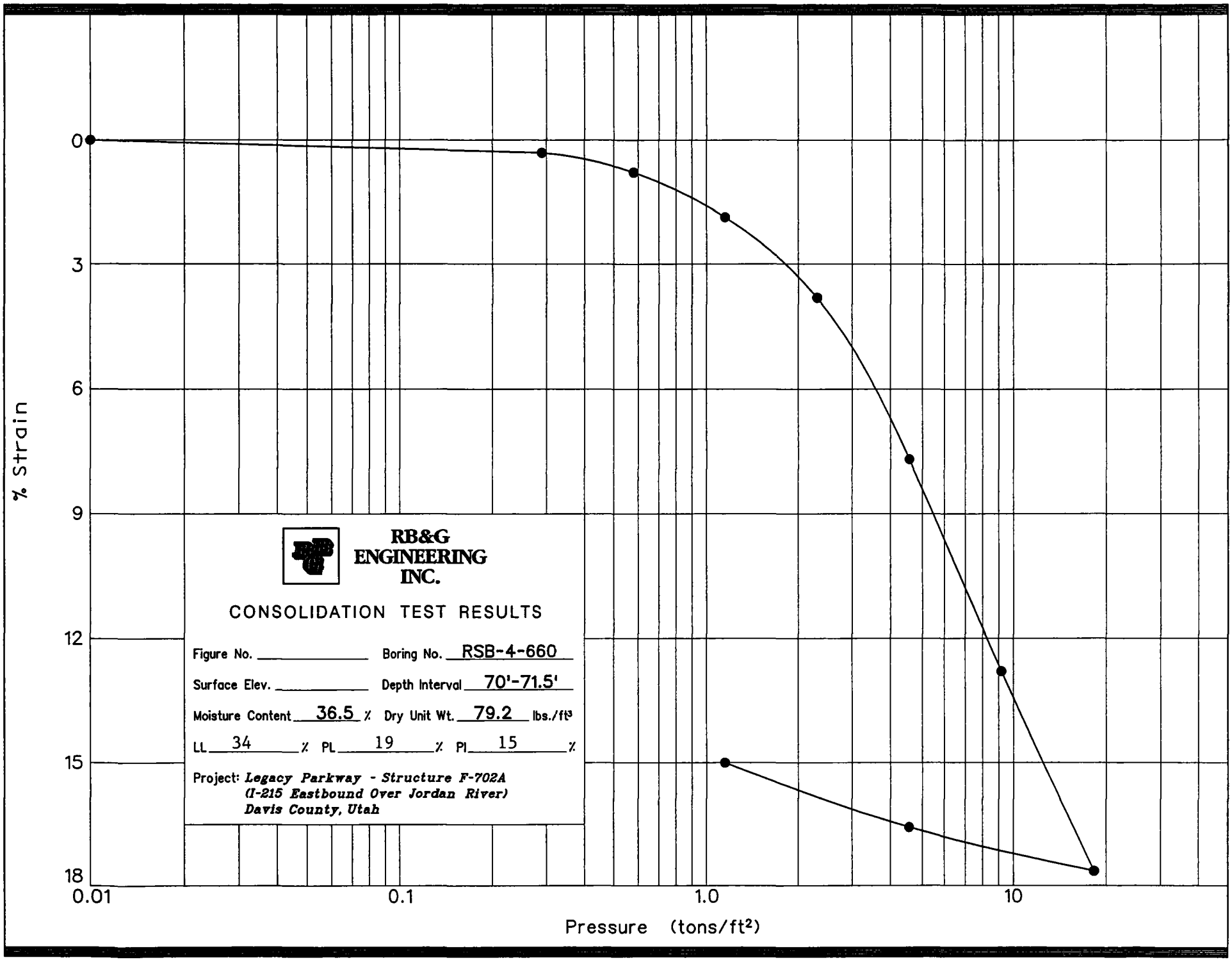
Figure No. _____ Boring No. RSB-4-660

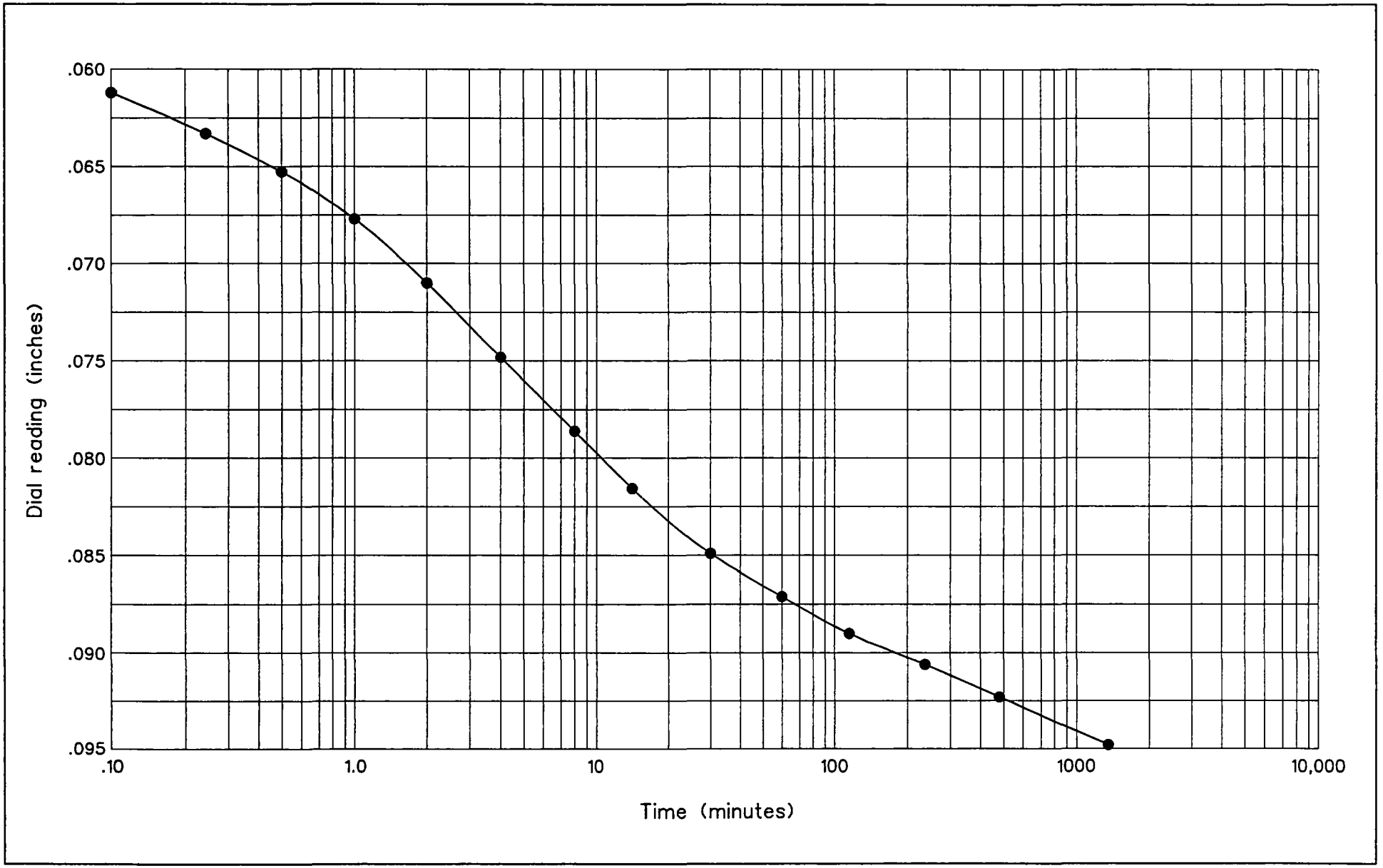
Surface Elev. _____ Depth Interval 70'-71.5'

Moisture Content 36.5 % Dry Unit Wt. 79.2 lbs./ft³

LL 34 % PL 19 % PI 15 %

Project: *Legacy Parkway - Structure F-702A*
(I-215 Eastbound Over Jordan River)
Davis County, Utah


% Strain
0
3
6
9
12
15
18
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No. _____ Boring No. RSB-4-660
Surface Elev. _____ Depth Interval 70'-71.5'
Moisture Content 36.5 % Dry Unit Wt. 79.2 lbs./ft³
LL 34 % PL 19 % PI 15 %
Project: Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah



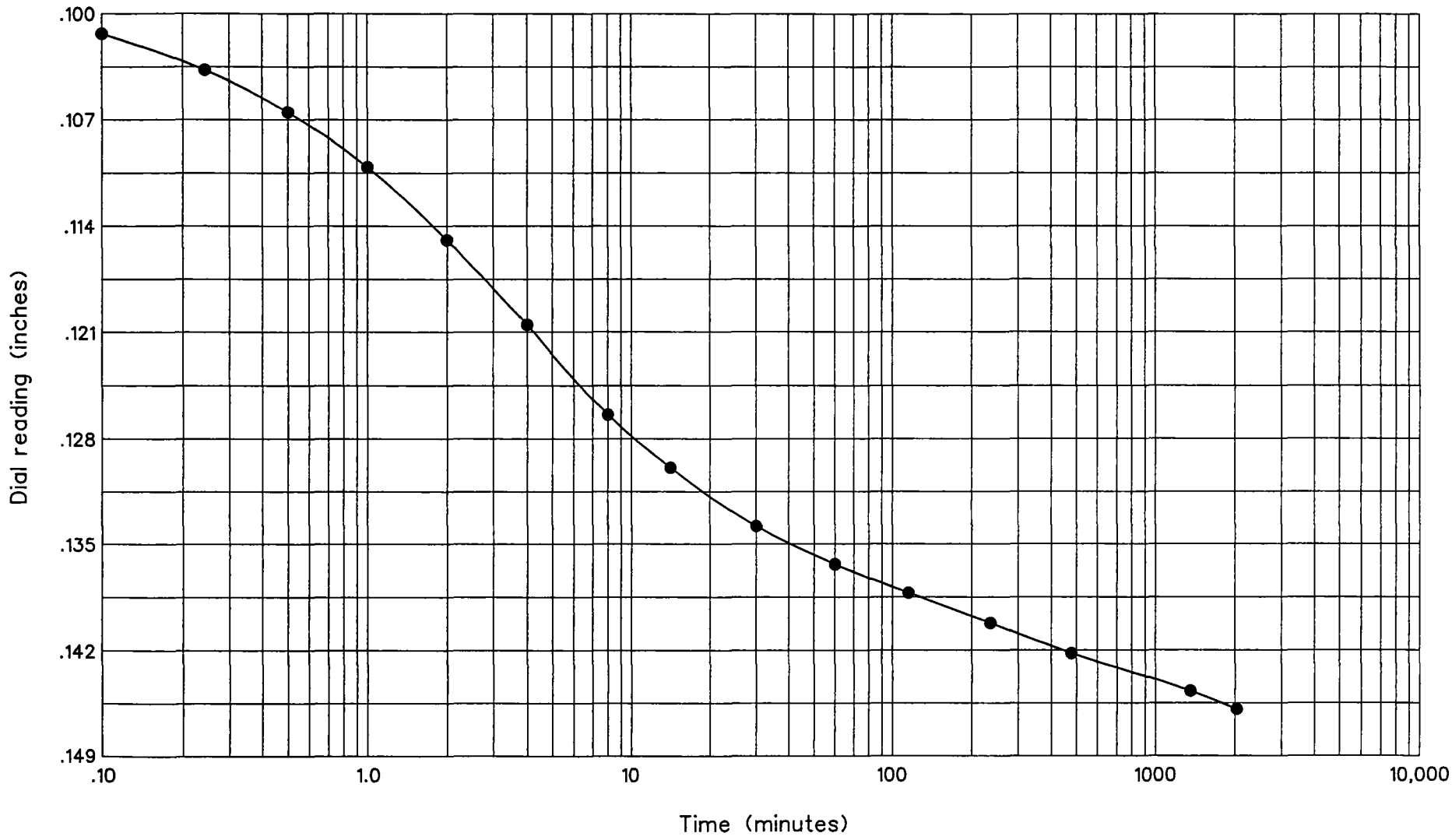
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 70'-71.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



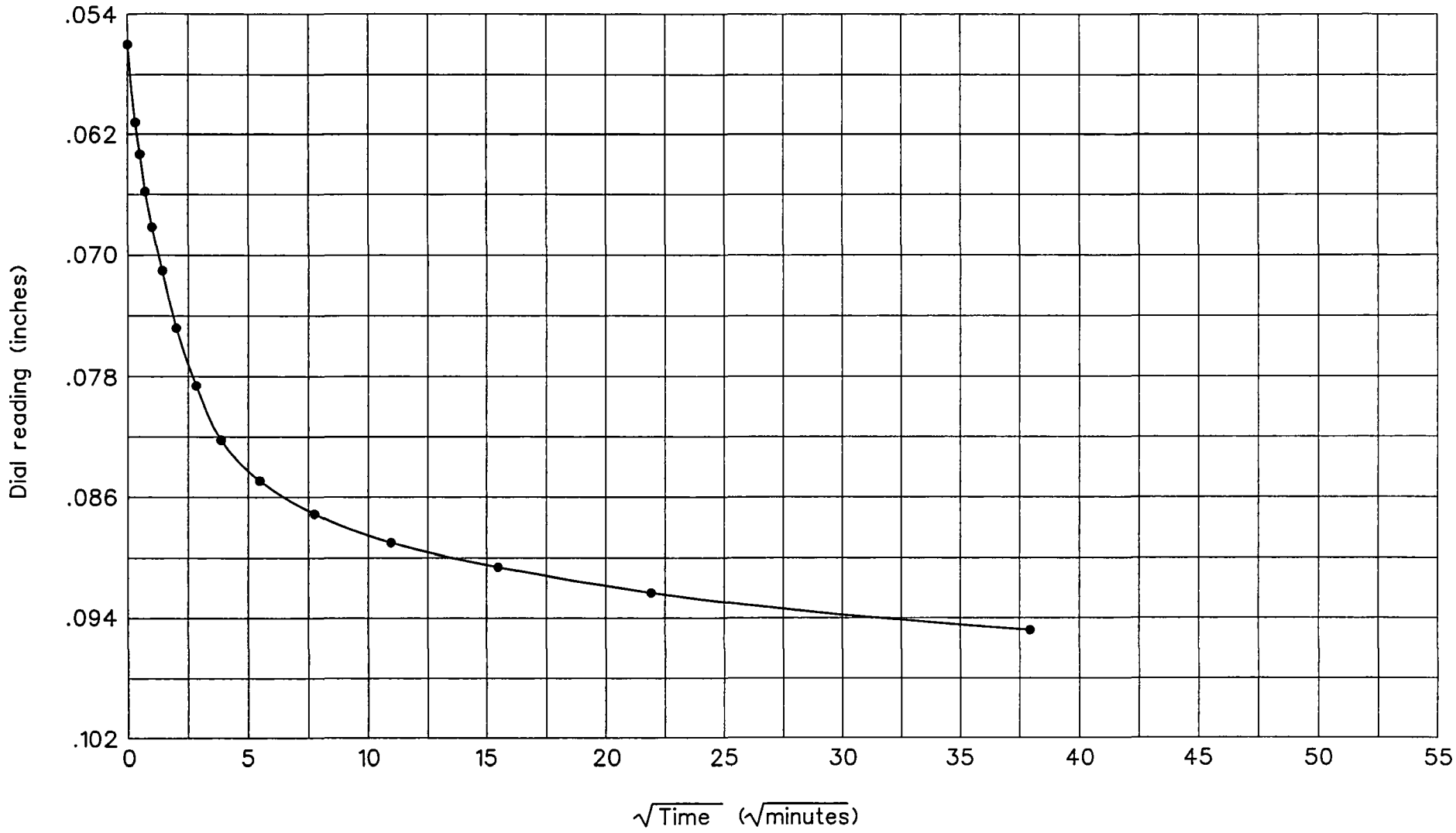
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 70'-71.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



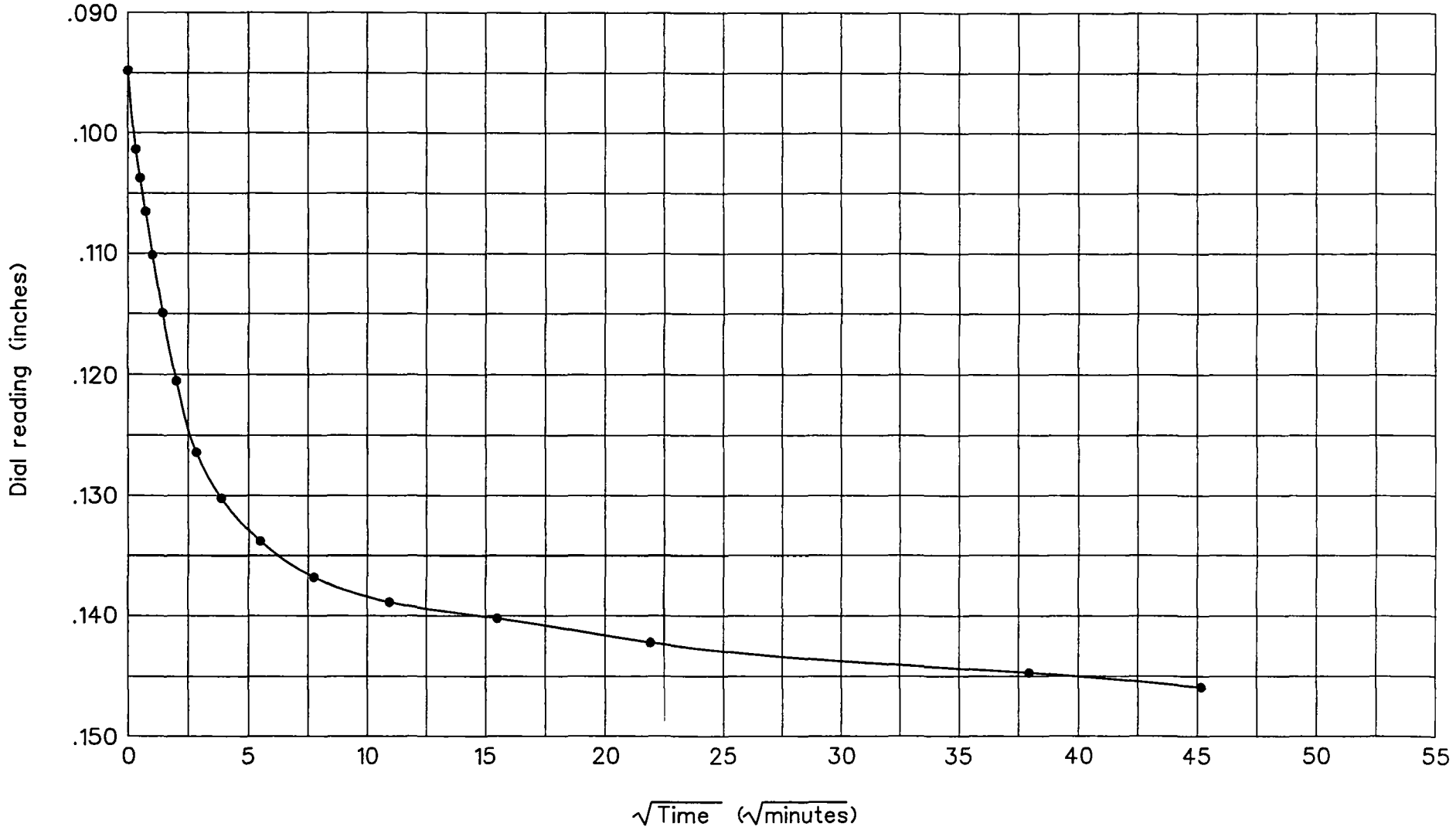
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 70'-71.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



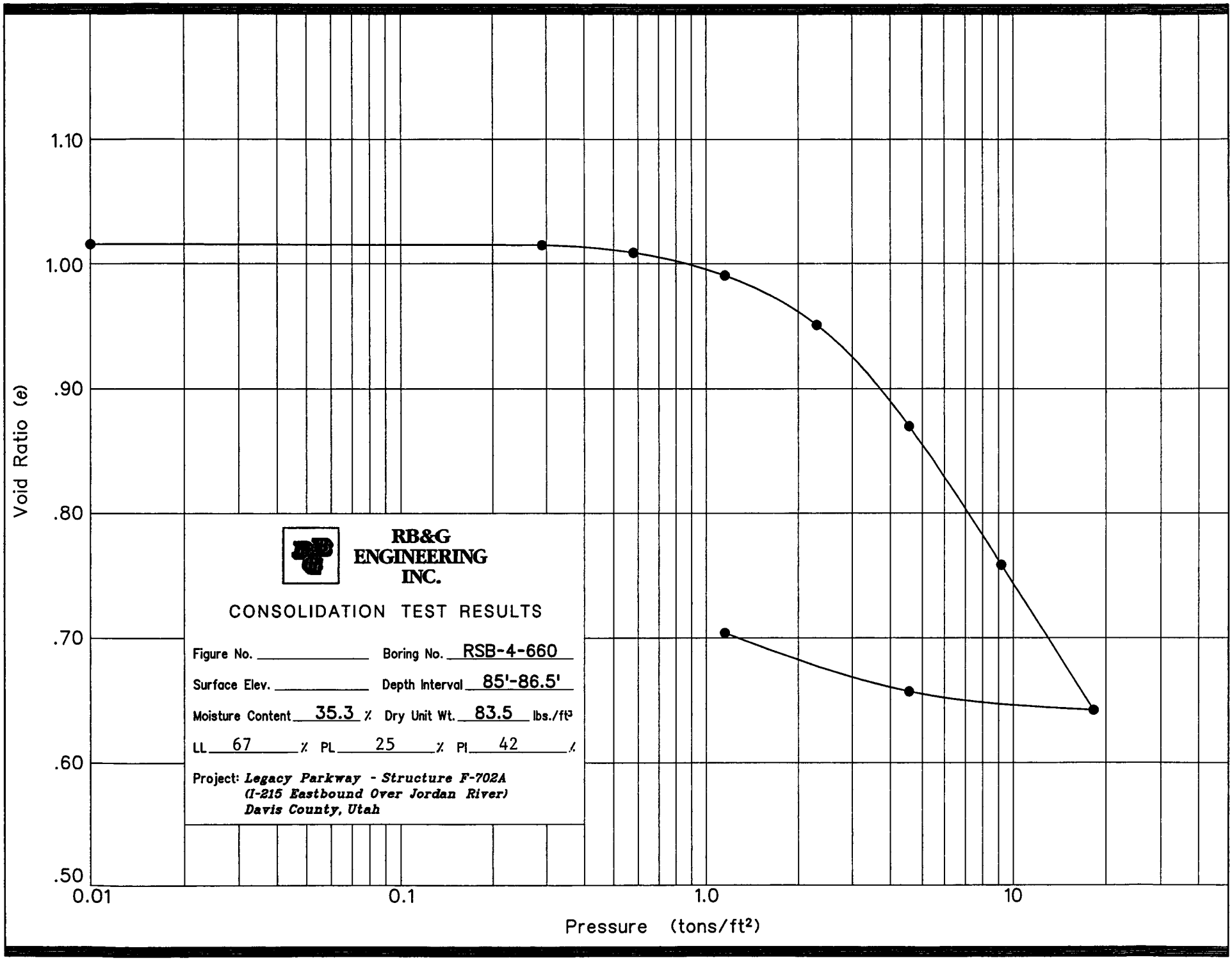
RB&G ENGINEERING INC.
Provo, Utah

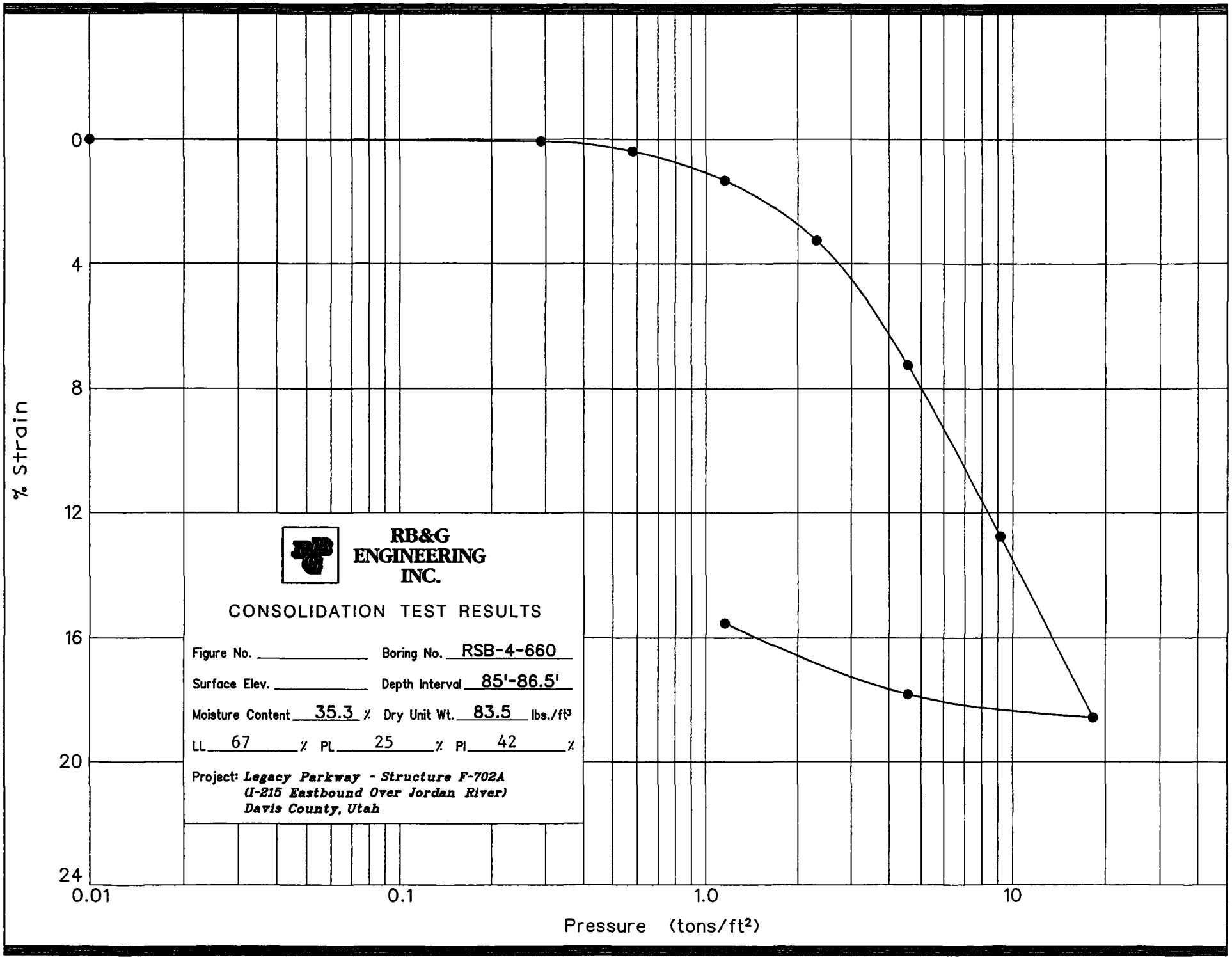
Hole no.: RSB-4-660
Depth: 70'-71.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure


1.10
1.00
.90
.80
.70
.60
.50
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No. _____ Boring No. RSB-4-660
Surface Elev. _____ Depth Interval 85'-86.5'
Moisture Content 35.3 % Dry Unit Wt. 83.5 lbs./ft³
LL 67 % PL 25 % PI 42 %
Project: Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah



RB&G ENGINEERING INC.

CONSOLIDATION TEST RESULTS

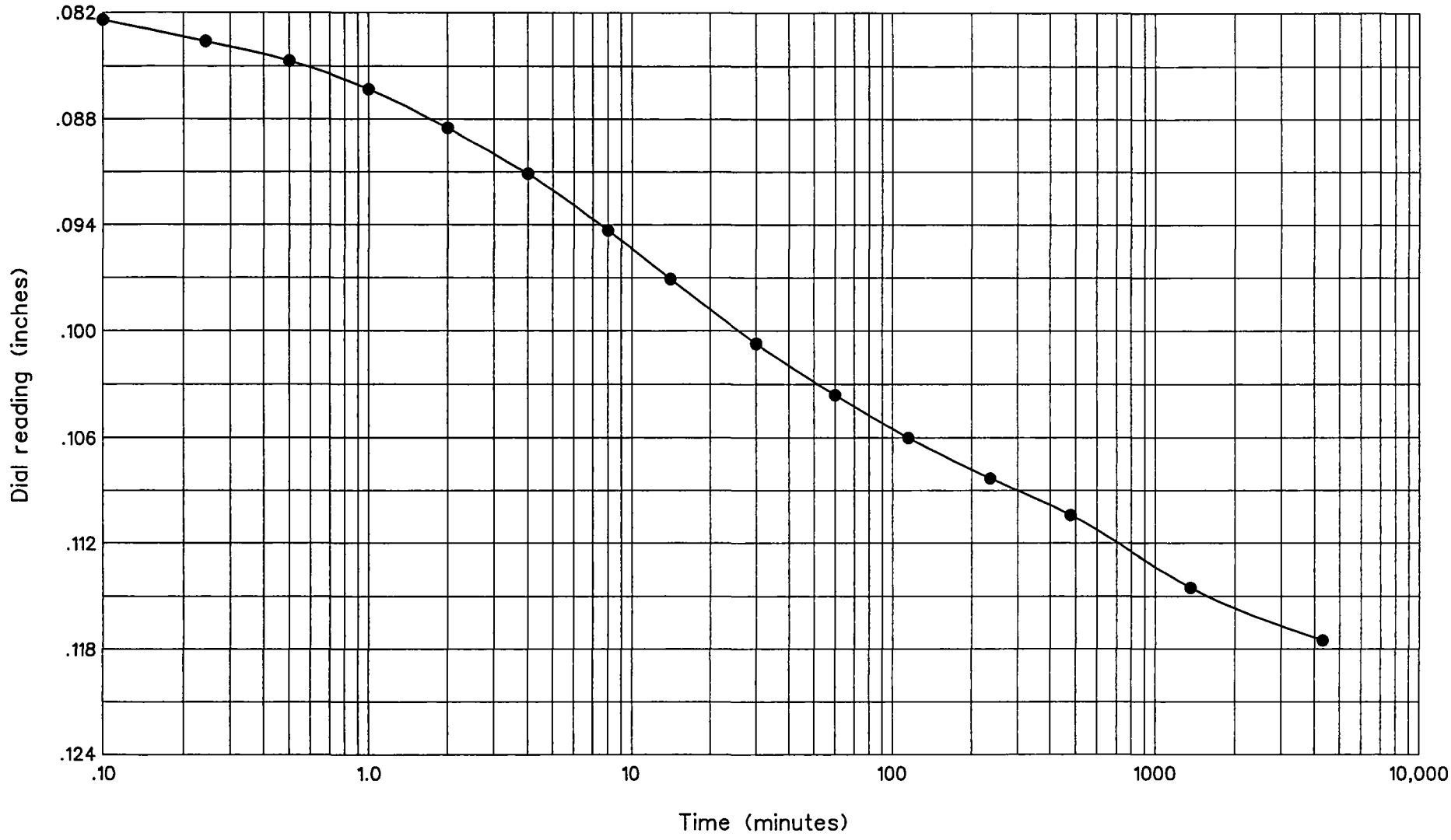
Figure No. _____ Boring No. RSB-4-660

Surface Elev. _____ Depth Interval 85'-86.5'

Moisture Content 35.3 % Dry Unit Wt. 83.5 lbs./ft³

LL 67 % PL 25 % PI 42 %

Project: ***Legacy Parkway - Structure F-702A***
(I-215 Eastbound Over Jordan River)
Davis County, Utah



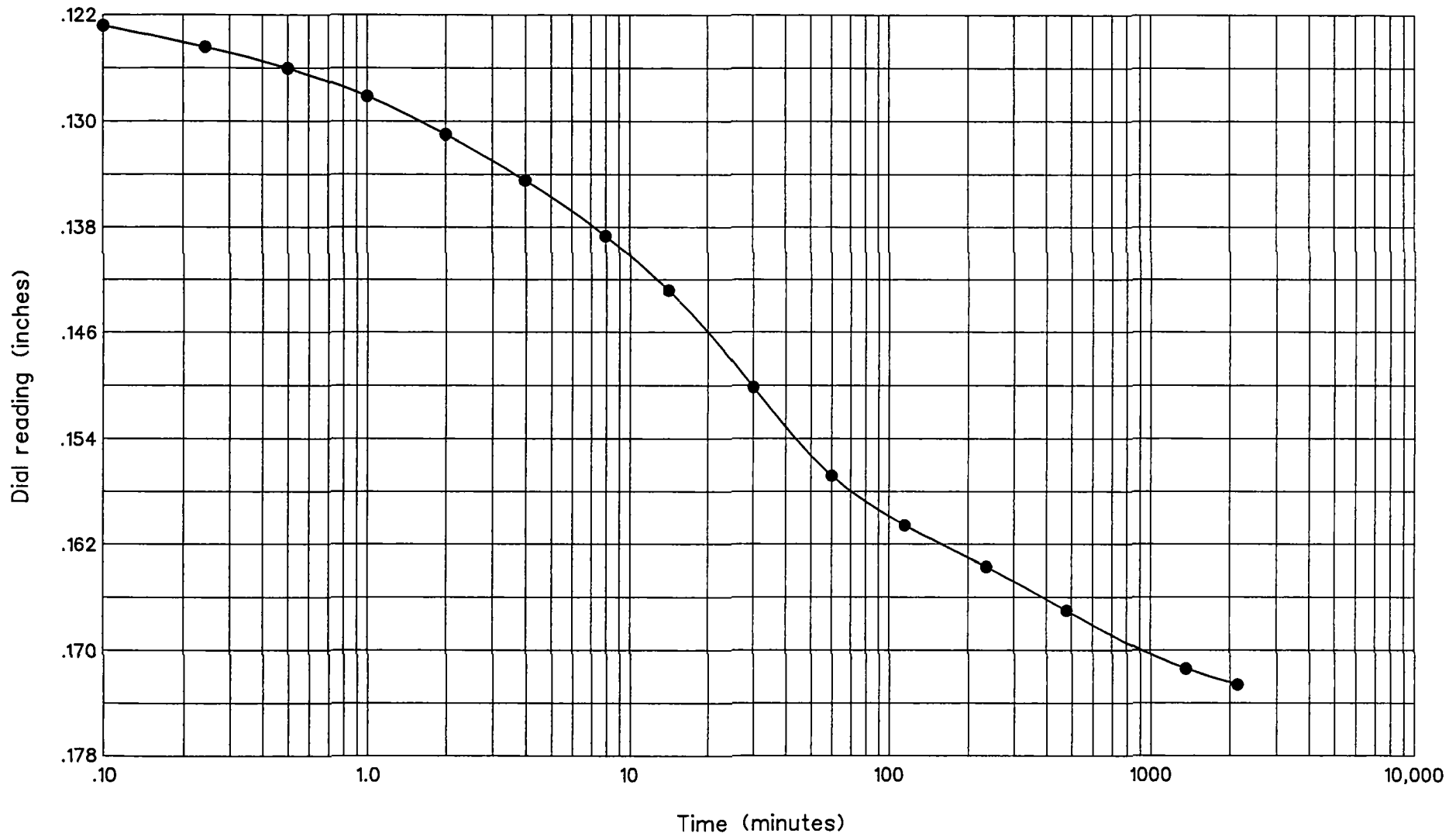
RB&G ENGINEERING INC.
Provo. Utah

Hole no.: RSB-4-660
Depth: 85'-86.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



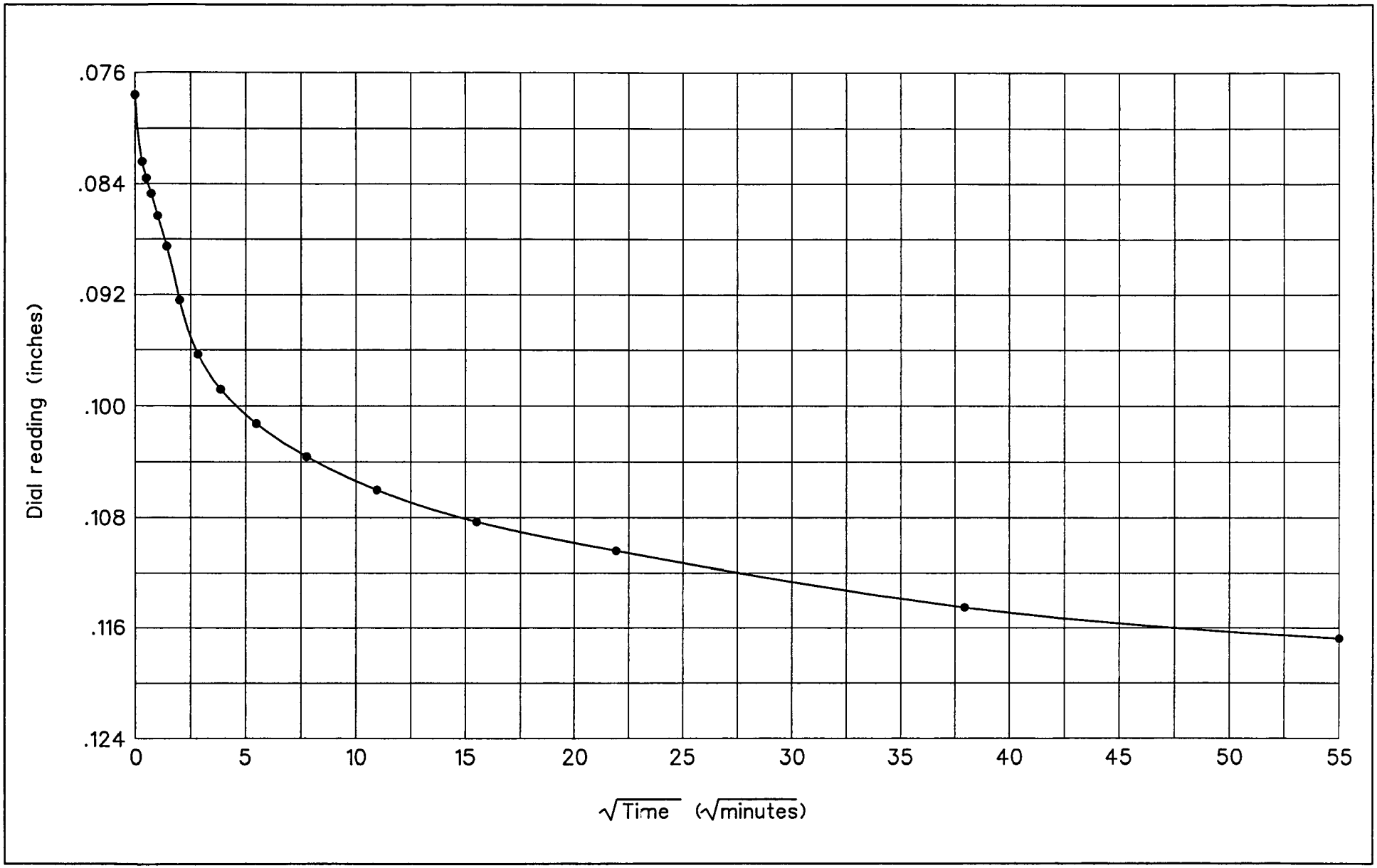
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 85'-86.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



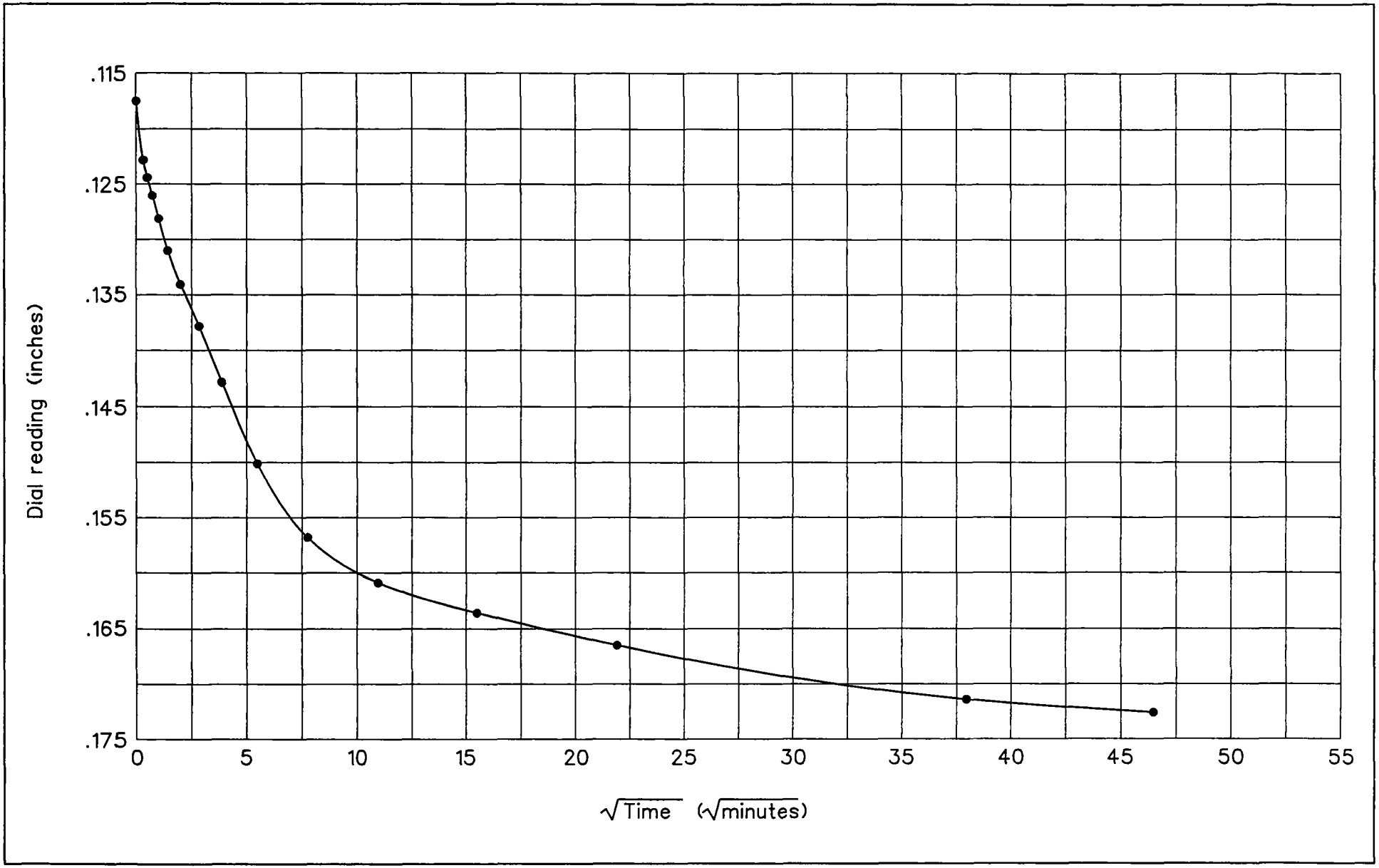
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 85'-86.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure



RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-4-660
Depth: 85'-86.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-702A
(I-215 Eastbound Over Jordan River)
Davis County, Utah

Figure

Recommendations for LPILE and GROUP analyses.

Project: Legacy Parkway — by: srj
Structure No: F-702A — FAK No: 4 — date: 6/19/2006
Description: Center Street over Legacy Parkway

Exist. Ground Surface Elev: 4211 ft — Pile Type: Closed-End Pipe Pile
Est. Pile Tip Elev: 4103 ft — Size: 16 inch O.D.
Pile Length Below Ground: 108 ft — Water Table: Upper 5 feet

Soil Layers

Thickness (ft)	Top Elev (ft)	Bottom Elev (ft)	Soil Type (p-y model)	Eff. Unit Wt. (pci)	Cohesion (psi)	Strain Factor ε_{50}	Friction Angle (degrees)	p-y Modulus, k (pci)	Max Unit Resistance Side (psi)	Max Unit Resistance End (psi)
21	4211	4190	Soft Clay (Matlock)	0.022	1.4	0.02	0	25	1.4	0
16	4190	4174	Liquefiable Sand	0.028	0	0	0	20	2.0	0
39	4174	4135	Soft Clay (Matlock)	0.028	5.6	0.015	0	50	4.3	0
4	4135	4131	Sand (Reese)	0.030	0	0	34	60	14.4	0
28	4131	4103	Soft Clay (Matlock)	0.029	4.5	0.015	0	45	4.5	510

Other Considerations

Corrosion of Pipe Pile
Reduce Pipe pile wall thickness by 1/16 inch to account for corrosion.

Group Effects
Use P-Multipliers for pile groups as outlined in AASHTO LRFD 2006 Interim Section 10.7.2.4

Abutment Fill
For the length of the pile extending through the abutment fill:
For Effective Unit Weights use 0.072 pci (regular weight) or 0.046 pci (pumice)
Assume Friction Angle of 34 degrees for conventional fill, and 38 degrees for pumice. Consider reduced parameters for loading towards MSE wall face.
Use Subgrade Modulus k = 90 pci for fill above water table, with Max. Unit Side Resistance of 2 psi.

MSE Walls
For piles located less than 6B from MSE wall, use P-Multiplier of 0.3 or less for the MSE fill layer when loading is perpendicular to MSE wall face. MSE wall designer should be notified if MSE fill will be relied upon for lateral pile resistance.

Legacy Parkway Project

Summary of Lateral Earth Pressure Recommendations

Recommended Soil Parameters

Fill Description	Total Unit Weight (pcf)	Internal Friction Angle (degrees)	Cohesion (psf)	Comments
Sandy Gravel	150	38	0	Recommend 150 pcf and 38 degrees for loads, and 125 pcf and 34 degrees for resistance.*
Silty Sand	125	34	0	
Pumice	85	38	0	Recommend 85 pcf for loads and 80 pcf for resistance.*

*Recommendations per Memo dated April 18, 2006

In the equations listed herein:
γ = effective unit weight of soil
H = height of wall

(1) Active Lateral Earth Force (yielding walls)

$P_A = 0.5K_A\gamma H^2$ (triangular distribution)

K_A = 0.24 for Sandy Gravel and Pumice

0.28 for Silty Sand

(2) Passive Lateral Earth Force (yielding walls)

$P_P = 0.5K_P\gamma H^2$ (triangular distribution)

K_P = 4.2 for Sandy Gravel and Pumice

3.5 for Silty Sand

(3) At-Rest Lateral Earth Force (non-yielding walls)

$P_O = 0.5K_O\gamma H^2$ (triangular distribution)

K_O = 0.38 for Sandy Gravel and Pumice

0.44 for Silty Sand

(4) At-Rest Lateral Earth Force Modified for Compaction (non-yielding walls)

Use if activity of mechanical compaction equipment is anticipated within a distance equal to half the wall height.

General Equations for walls less than about 8 feet high

$P_O^* = 0.5K_O\gamma H^2$ (triangular distribution)

K_O^* = 2.8 for Sandy Gravel and Pumice

Walls greater than 8 feet high should be considered on a case-by-case basis.
Pressures listed above may be reduced by limiting size of compaction equipment permitted within a distance equal to half the wall height.

(5) Seismic Lateral Earth Forces (yielding walls)

Probabilistic Peak Ground Accelerations

General Bridge Site Location	10% PE in 50 Years	2% PE in 50 Years
From Mill Creek North	0.22g - 0.26g	0.60g - 0.63g
South of Mill Creek	0.26g - 0.30g	0.65g - 0.73g

Equations by Okabe (1926) and Mononobe and Matsuo (1929), referenced in Kramer (1996)

Total Active Thrust

$P_{AE} = 0.5K_{AE}\gamma H^2$

K_{AE} = (see table below)

Dynamic Component

$\Delta P_{AE} = P_{AE} - P_A$

P_A has triangular distribution (resultant at H/3 above base of wall)

ΔP_{AE} acts at about 0.6H above base of wall (same direction as P_A)

(5) Seismic Lateral Earth Forces (continued from previous page)

Total Passive Thrust

$P_{PE} = 0.5K_{PE}\gamma H^2$

K_{PE} = (see table below)

Dynamic Component

$\Delta P_{PE} = P_P - P_{PE}$

P_P has triangular distribution (resultant at H/3 above base of wall)

ΔP_{PE} acts at about 0.6H above base of wall (opposite P_P)

Dynamic Earth Pressure Coefficients (for minimal wall displacement)*

Case	Friction Angle	Peak Ground Acceleration			
		0.25	0.30	0.63	0.73
Active (K_{AE})	38	0.35	0.38	0.65	0.77
	34	0.41	0.44	0.75	0.92
Passive (K_{PE})	38	3.77	3.68	3.01	2.76
	34	3.14	3.05	2.39	2.11

* Assumes k_h = 0.8PGHA. See memo dated April 18, 2006

*Dynamic Earth Pressure Coefficients (for wall displacement up to 10A inches**)*

Case	Friction Angle	Peak Ground Acceleration			
		0.25	0.30	0.63	0.73
Active (K_{AE})	38	0.31	0.32	0.44	0.49
	34	0.36	0.37	0.51	0.56
Passive (K_{PE})	38	3.94	3.89	3.51	3.38
	34	3.29	3.24	2.89	2.77

** Assumes k_h = 0.5PGHA. See memo dated April 18, 2006

(6) Seismic Lateral Earth Pressures (non-yielding walls)

Equations by Wood (1973), referenced in Kramer (1996)

Dynamic Thrust

$\Delta P_{eq} = a_h\gamma H^2$

a_h= Peak Ground Acceleration Coefficient (PGA/g)

Dynamic Overturning Moment

$\Delta M_{eq} = 0.53a_h\gamma H^3$

Point of Application of Dynamic Thrust

$h_{eq} = \Delta M_{eq}/\Delta P_{eq}$

$\approx 0.53H$

References

Kramer, S. (1996). "Geotechnical earthquake engineering," Prentice Hall, Upper Saddle River, NJ.

Mononobe, N. and Matsuo, H. (1929). "On the determination of earth pressures during earthquakes," *Proceedings, World Engineering Congress,* 9 p.

Okabe, S. (1926). "General theory of earth pressures," *Journal of the Japan Society of Civil Engineering*, Vol. 12, No. 1.

RB&G Engineering, Inc.

Memo

To: Sohail T. Khan, P.E; Larry Reasch, P.E.
From: Brad Price / Rob Johnson
CC: Steven K. Doerrer, PE; Brian Byrne, PE
Date: April 18, 2006
Re: Response to Design Criteria Questions

Responses to the questions submitted by Steven Doerrer are listed below. The email listing the questions is also attached for reference:

1) As discussed on last week's conference call (4/26/06), recommended total unit weights for fill material are as follows:

   - Regular-Weight Fill – 150 pcf for load calculations, 125 pcf for resistance calculations
   - Lightweight Fill (Pumice) – 85 pcf for load calculations, 80 pcf for resistance calculations

   It has been noted that the unit weight of regular-weight fill varies widely depending upon the source. However, it is our understanding that it is not desirable to limit the potential regular-weight borrow sources by specifying a permissible range of fill unit weight. In the interest of conservatism, we recommend using the larger unit weight to calculate soil loads, and the smaller unit weight to calculate soil resistance. The following values are recommended for fill friction angle:

   - Regular-Weight Fill – 38 degrees for load calculations, 34 degrees for resistance
   - Lightweight Fill (Pumice) – 38 degrees for load and resistance calculations

2) The Mononobe-Okabe equations are in accordance with AASHTO LRFD A11.1.1.1 and do not include inertia forces. Page 11-85 of the AASHTO LRFD states that it is not conservative to neglect inertia forces of the abutment mass. We believe it is appropriate to add seismic inertia forces of the heel backfill and concrete abutments.

3) The dynamic earth pressure coefficients provided previously, K_{AE} and K_{PE}, are for total active and passive thrust, respectively, and include both static and dynamic components. The dynamic components are ΔK_{AE} and ΔK_{PE} and are computed by subtracting the static force from the total thrust as shown on the memo. It should be noted that the equations by Wood (1973) for non-yielding walls provide only the dynamic thrust components of force and moment, and do not include static components.

4) In the memo dated 04/17/06, the horizontal acceleration coefficient k_h was assumed to be 80% of the peak horizontal ground acceleration coefficient for calculation of the Mononobe-

Okabe coefficients K_{AE} and K_{PE}. AASHTO LRFD A11.1.1.2 states that a k_h value equal to ½ the PHGA is adequate for most design purposes, provided that allowance is made for an outward displacement of the abutment of up to 10A inches (see page 11-88), where A is the maximum acceleration coefficient (PHGA). Mononobe-Okabe coefficients *for the 50% reduction* are summarized below, and may be used if allowance is made for the corresponding displacement.

Case	Friction Angle	Peak Ground Acceleration Coefficient			
		0.25	0.30	0.63	0.73
Active (K_{AE})	38	0.31	0.32	0.44	0.49
	34	0.36	0.37	0.51	0.56
Passive (K_{PE})	38	3.94	3.89	3.51	3.38
	34	3.29	3.24	2.89	2.77

If displacement must be minimized, we recommend that the factors shown in the initial memo (04/17/06) be used.

It should be noted that the Mononobe-Okabe factors provided to date neglect vertical acceleration. Seed and Whitman (1970) concluded that vertical accelerations can be ignored when the Mononobe-Okabe analysis is used to estimate P_{AE} for typical wall design (see Kramer, 1996). It is estimated that positive vertical accelerations, if considered, may increase the Seismic Active Thrust coefficient (K_{AE}) by as much as 30%. If desired, the coefficients on the table above can be refined to consider vertical acceleration once Peak Vertical Ground Accelerations have been determined (see Response No. 7 below).

5) We can evaluate the potential pile capacities at different depths and provide results along with uplift. It is assumed that the request of estimated pile tip elevations for compression resistance of 70, 100, and 120 tons applies only to the Pedestrian Bridge over Legacy Parkway (P-21). At any bridge we can evaluate the potential for providing a specific resistance per pile if we are provided with the desired resistance values (see also Response No. 6 below). The given extreme event capacities assume a resistance factor of 1.0, and are reduced for potential liquefaction.

6) It is possible to consider pile diameters larger than 16", although driven piles with diameters/widths greater than 16" are somewhat rare locally and local pile driving capabilities may be limited. Also, it is our understanding that a consistent pile section is preferred for the project to limit potential errors and confusion (primarily during construction). Is increased axial resistance the only reason for considering larger diameter piles? We would like to know the specific purpose for considering other diameters (such as target resistance values), as it would be inefficient to estimate capacities for an unlimited range of diameters, toe elevations, etc.

7) Kleinfelder is working on site-specific response spectra for 1250 West and State Street. It is our understanding that this data will be used to develop general response spectra (including vertical accelerations) for use at all bridge sites.

8) It was agreed at a previous meeting that the structural firms would perform the LPILE analysis using soil parameters provided by the geotechnical engineer. We recommend that p-

multipliers be used as input in LPILE or GROUP to account for group effects. As noted on the LPILE parameters sheet included with the initial recommendations for each structure, p-multipliers for laterally-loaded pile groups are outlined in AASHTO LRFD 10.7.2.4. The factors listed in the 2006 LRFD interim are in relatively good agreement with full-scale pile group lateral load tests performed at the Salt Lake City International Airport, where shallow soils are reasonably representative of the shallow soils typically encountered at the Legacy bridge sites.