RB&G
ENGINEERING
INC.

1435 WEST 820 NORTH
PROVO, UT 84601-1343
801 374-5771 Provo
801 521-5771 SLC

LEGACY PARKWAY

STRUCTURE F-719

1250 WEST OVER LEGACY PARKWAY

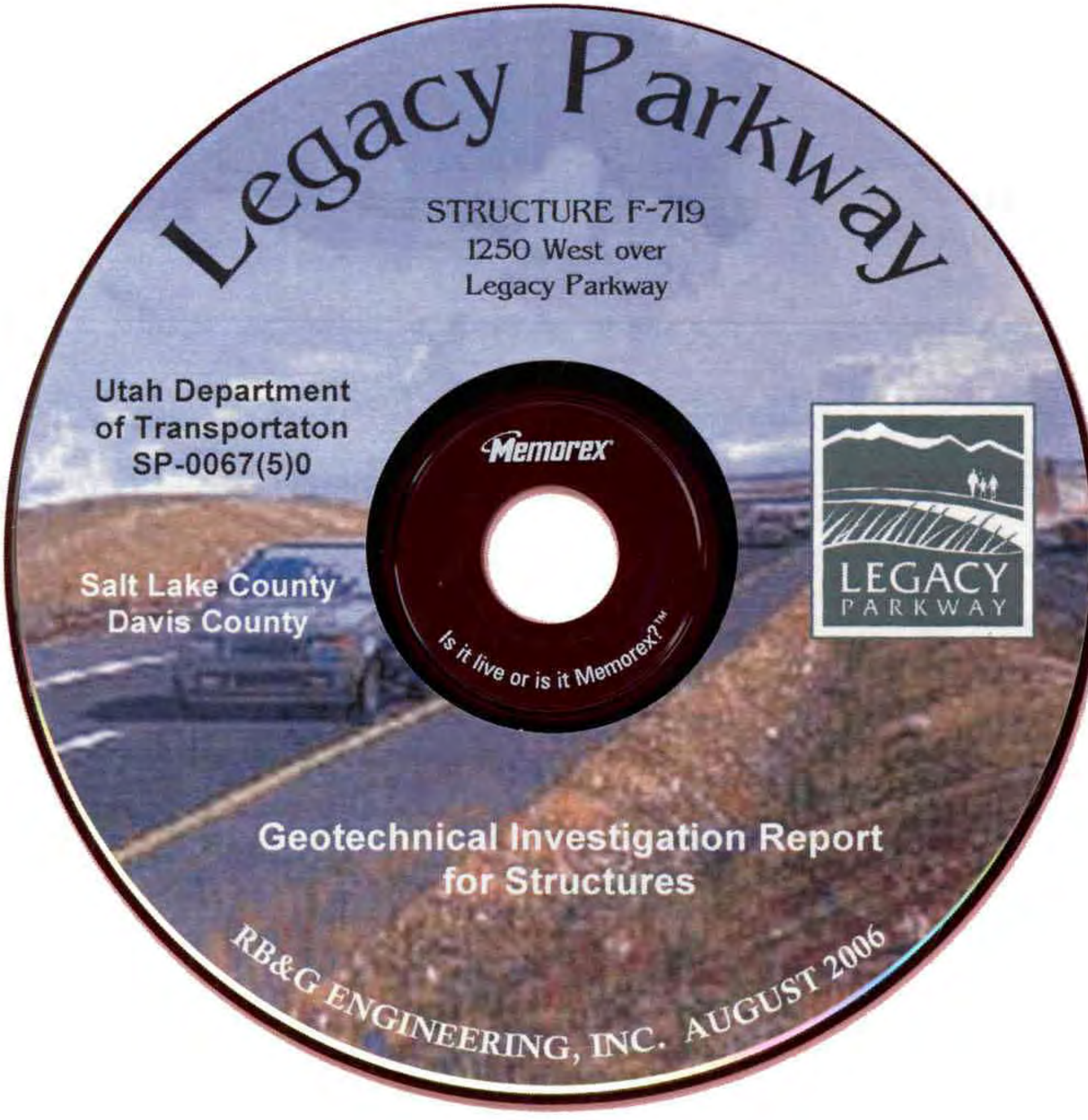
Salt Lake & Davis Counties, Utah

Utah Department of Transportation
SP-0067(5)0

August 2006

Geotechnical Investigation Report for Structures

200601-117


Legacy Parkway
STRUCTURE F-719
1250 West over
Legacy Parkway
Utah Department
of Transportaton
SP-0067(5)0
Salt Lake County
Davis County
Memorex
Is it live or is it Memorex?™
LEGACY
PARKWAY
Geotechnical Investigation Report
for Structures
RB&G ENGINEERING, INC. AUGUST 2006

RB&G
ENGINEERING
INC.

August 31, 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-719, 1250 West over Legacy Parkway 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.

REGISTERED PROFESSIONAL ENGINEER
NO. 162291
BRADFORD E. PRICE
9/05/06
STATE OF UTAH

Bradford E. Price, P.E.

bep/jag

1435 WEST 820 NORTH
PROVO, UT 84601-1343

PROVO 801-374-5771
SALT LAKE CITY 801-521-5771

Geotechnical Investigation Report for Structures

Legacy Parkway

Structure F-719
1250 West over Legacy Parkway

Salt Lake & Davis Counties, Utah

Utah Department of Transportation
SP-0067(5)0

August 2006

RB&G ENGINEERING, INC.

Professional Engineers

LEGACY PARKWAY

UTAH DEPARTMENT OF TRANSPORTATION
SP-0067(5)0

GEOTECHNICAL INVESTIGATION REPORT FOR STRUCTURES

Structure F-719 – 1250 West over Legacy Parkway

TABLE OF CONTENTS

FIGURES

LEGACY PARKWAY

UTAH DEPARTMENT OF TRANSPORTATION
SP-0067(5)0

GEOTECHNICAL INVESTIGATION REPORT FOR STRUCTURES

Structure F-719 – 1250 West over Legacy Parkway

1.0 GENERAL

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

- F-719 – 1250 West over Legacy Parkway

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

Bridge structures do not presently exist at the proposed 1250 West bridge site, located in Davis County. The proposed Legacy Parkway is located about 900 feet west of I-15 in this area, and 1250 West would be re-aligned approximately 300 feet to the east of its present location to cross over the parkway. The site is located near the westerly edge of Centerville City.

1.1.2 Proposed Improvements

The proposed bridge structure will route 1250 West Street over Legacy Parkway. It is our understanding that the bridge will be a two-span structure. 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 3 of the Design Build project was to begin near the Bountiful City Landfill and continue in a generally northwesterly direction to a point about 6,000 feet north of the proposed 1250 West bridge site. Included in the Design-Build report are logs for several test holes performed at the formerly proposed bridge site near the existing intersection of 1250 West and 1000 North Streets, located between 600 and 700 feet southwest of the currently proposed bridge site.

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 Parkway will travel at an approximate bearing of N 38° E at the crossing under the 1250 West bridge. No bridges are currently located at the site. The existing 1250 West Street is located approximately 300 feet west of the proposed bridge site. A small, dilapidated farm shed is located near center bent location of the proposed bridge structure. The nearest existing building currently in use is the new UDOT maintenance facility located approximately 500 feet to the west at about 1200 North on the west side of 1250 West. Various utility lines exist throughout the project area, including overhead power lines and buried utilities such as gas, oil, power, sewer, and communications lines.

4.0 FINDINGS

4.1 EXISTING SITE CONDITIONS

The topography is relatively flat throughout Segment 2 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.

The 1250 West bridge area is relatively flat, sloping down to a slightly depressed area in the northerly portion of the site. This low-lying area was very soft and wet at the time of the field investigations (March-April 2006). A stockpile of fill material is located at the southwesterly corner of the property on which the proposed bridge will be constructed. Vegetation at the site consists of wild grass, weeds, brush, and trees. The wetter northerly portion of the site is more heavily vegetated than the southerly portion.

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.

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 1250 West bridge site lies within Provo Formation and younger lake bottom sediments consisting of clays, silts, sands, and localized offshore sand bars mapped by Davis (1983), with salt flat deposits mapped within about a half mile west of the site. A portion of a more recent map by Nelson and Personius (1993) is reproduced on Figure 2b, and it will be noted from this figure that the area was mapped as younger (post-Bonneville) lacustrine marsh deposits (Holocene to uppermost Pleistocene silt, clay, and minor sand). The deeper soils are likely lacustrine silts and clays deposited in deep and/or quiet water of the Bonneville lake cycle. These deposits are mapped as the predominant surficial geologic unit east of the site.

Harty and Lowe (2003) have mapped landslide deposits in the northerly and southerly portions of the Legacy Parkway project area. Based on these maps, neither the North Salt Lake Landslides to the south nor the Farmington Siding Landslide Complex to the north encroaches upon the 1250 West bridge site.

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 WFZ. 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 1250 West site is provided in Section 5.0.

4.5 SOIL MATERIALS

Borings completed at the site generally encountered soft to firm lean and fat clay interbedded with some very loose silty sand layers in the upper 50 feet. Between 50 feet and the maximum boring depth of 176 feet, the soil profile was characterized by alternating layers of lean clay and fat clay (firm to very stiff) with occasional sand layers (very loose to medium-dense). 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. The depth to groundwater was measured at each boring location as indicated on the boring logs and was within about 1.5 to 2 feet of the ground surface at the 1250 West bridge site at the time of drilling (March-April 2006). Fluctuations of a few feet can be expected due to typical seasonal variations. The ground surface is saturated over portions of the site (particularly the low-lying northerly section) 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 Weber Segment of the Wasatch Fault Zone (WFZ) located about 0.9 miles east of the 1250 West bridge site. The Weber Segment is capable of generating a magnitude 7.4 earthquake. The Salt Lake City Segment of the WFZ is located about 5.5 miles to the southeast with the capability of a magnitude 7.2 earthquake.

5.1 DESIGN CRITERIA

The site is located at latitude 40.931° North and longitude 111.895° 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	24.09	62.35
0.2 sec SA	57.57	146.58
1.0 sec SA	19.78	60.77

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 structure indicate that the clayey soils in the upper 100 feet have average undrained shear strengths of about 600 to 900 psf, depending on the boring. Shear wave velocity testing performed with one of the CPT soundings indicated the average shear wave velocity in the upper 86 feet is about 450 feet per second. Based on this information, it is 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.

An evaluation of borings and testing 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 settlement 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-17-630	39	17.5	8.6	3.9
RSB-17-632	28	0	6.5	0
RSB-17-634	27	5.5	2.8	1.0

A review of the boring logs does not identify a continuous soil layer susceptible to lateral spread within the depth investigated. Borings 630 and 634 each encountered significant deposits in the upper 25 feet which showed potential for lateral spreading; however, such deposits are located at different elevations in the two borings. Boring RSB-17-632 did not encounter liquefiable soils within 80 feet of the ground surface. Due to the apparent lack of lateral continuity of potentially susceptible soil deposits across the site, lateral spread mitigation is not considered necessary for the proposed structure.

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 1250 West bridge site is number 17, corresponding on the Design-Build designation "17B" used for the originally contemplated 1250 West structure.

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 CME-55 No. 2 rig uses a rope and cathead hammer which was determined by UDOT to have an average energy ratio of about 55%.

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 reported in tons per square foot.

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) Triaxial Shear
7) Consolidation

8) Direct Shear
9) 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-719 will be a two-span prestressed concrete girder bridge structure. The bridge is expected to be about 54 feet wide with span lengths of 135 feet, for a total bridge length of about 270 feet. Controlling loads for the F-719 bridge have been provided by the structural engineer and are shown on the table below.

Structure	Foundation	Strength I (kips)	Service I (kips)	Service I DL (kips)
F-719 1250 West over Legacy Parkway	Abut 1	3669	2815	2571
	Bent 2	7172	5547	5157
	Abut 3	3670	2816	2572

It is our understanding that the abutment foundations for Structure F-719 are expected to consist of two rows of 11 piles each. The bent columns will be supported by a group of 54 piles (3 rows of 18 piles).

7.1.2 Subsurface Conditions

Boring RSB-17-630 was drilled at the east end of the proposed Abutment 3 location and encountered firm silt with sand in the upper 7 feet, followed by stiff lean clay to 14 feet, then very loose silty sand with fat clay layers to about 26 feet. Lean to fat clay (soft to very soft) with some loose sand layers was encountered between 26 and 54 feet. The remainder of the soil profile consisted of firm to stiff lean and fat clay with some interbedded sand layers to the bottom of the boring at 176.5 feet. Most of the sand layers were loose to medium-dense; however, a sample at a depth of about 155 feet appeared to be very dense. Laboratory testing of the clay samples from the boring determined the liquid limits to be between 30 and 60, with plasticity indices ranging from 11 to 37.

Boring RSB-17-632 was drilled at the west end of the proposed Abutment 1 location, and encountered firm to stiff lean clay with thin sand layers in the upper 13 feet. Similar materials were encountered between depths of 13 and 40 feet; however, the lean clay in this zone was of softer consistency. The boring continued through predominantly firm to stiff lean clay with silt lenses and layers to about 73 feet, and was followed by interbedded layers of stiff fat clay, medium-dense silty sand, and firm to stiff lean clay to 126 feet. A very stiff zone of fat clay was encountered between 126 and 134 feet, followed by very loose sandy silt and silty sand to 149 feet. The profile consisted of stiff lean clay with sand layers up to 4 feet thick between 149 and 153 feet, followed by stiff fat clay to the bottom of the boring at 176.5 feet. The liquid limits of the lean clay samples in the boring ranged from 33 to 48, with plasticity indices between 13 and 26. Samples of the fat clay tested in the laboratory had liquid limits between 56 and 91 and plasticity indices of 31 to 57.

Boring RSB-17-634, drilled at the west end of the proposed Bent 2 location, encountered 6 feet of very loose sandy silt, followed by firm lean clay to about 14 feet, then soft to very soft lean and fat clay to approximately 40 feet. The remainder of the soil profile was primarily firm to stiff lean and fat clay layers with occasional medium-dense to dense sand layers up to about 9 feet thick. The lean to fat clay encountered between about 127 and 133 feet was very stiff. Liquid limits of the lean clay ranged from 37 to 49, with plasticity indices varying from 13 to 30. The fat clay had liquid limits between 50 and 90, and plasticity indices between 28 and 59.

The CPT hole depths ranged from about 202 to 214 feet below the ground surface. CPT soundings were performed by ConeTec at ends of the abutments and bent opposite the borings, and characterized the subsurface as primarily clay and clayey silt in the upper 20 feet. Sensitive fines with some interbedded clays and silts were identified between about 20 and 45 feet, followed predominantly by materials characterized as silt and sandy silt. It has been our experience that soils identified as silts according to CPT soil behavior type correlations often classify as lean clay when samples from adjacent borings are tested in the laboratory. Based on a review of the CPT logs, no consistent layer of dense sand more than a few feet thick exists within 200 feet of the ground surface at this site.

7.1.3 Groundwater Conditions

Groundwater was encountered within 1.5 to 2 feet of the ground surface at the time of drilling (March-April 2006). It is anticipated that up to two feet of fluctuation may occur due to typical seasonal variations in precipitation and climatic cycles.

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) and generally low bearing resistance of shallow soils, 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 anticipated 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.

7.2.1.1 Driven Piles

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	**Location**		
	F-719 Abut 1	F-719 Bent 2	F-719 Abut 3
Estimated Pile Tip Elevation (ft)	4086	4086	4086
Elev. of Min. Acceptable Pile Penetration (ft)	4089	4090	4089
Strength I Axial Compression Resistance (kip)	309	309	309
Extreme Event I Compression Resistance. (kip)	425	425	425
Required Driving Resistance (kip)	476	476	476

It will be noted that the estimated resistance values and pile tip elevations are the same for each abutment and bent; however the actual tip elevations may vary across the site based on observed driving resistance and PDA test results during construction. The estimated tip elevations are located within or near relatively stiff zones of soil shown on the boring and CPT 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 such that any significant embankment settlement 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 layouts.

- Abutments with a 22 piles in an area 68.8 feet long by 3.75 feet wide
- Bent pile group with 54 piles in an area 103.3 feet long by 13.3 feet wide

In each case, 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	250	24.8	23	7.0	30	300	24.6	30	7.5	29
	300	25.8	33	7.4	31	350	25.2	41	7.7	30
	350	26.5	50	7.6	32	400	26.1	57	7.8	30
	430	27.3	121	7.9	33	485	26.4	117	8.1	31
IHC S-90*	350	45.2	23	6.6	59	400	42.3	26	6.6	59
	400	45.3	33	6.6	59	500	42.4	46	6.6	59
	450	45.3	50	6.6	59	600	42.4	95	6.6	59
	530	45.4	116	6.6	58	625	42.5	120	6.6	59

* S-90 assumed to operate at 95% efficiency.

It will be observed from the table that both hammers appear capable of driving piles to the required driving resistance of 476 kips without significantly exceeding a hammer blow count of about 10 blows per inch, although ½-inch pipe thickness may be necessary if the D-25-32 hammer is used. 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 be driven to the required driving resistance with the S-90 hammer system. 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 90 percent of the yield strength of the steel piles. Based on the WEAP analysis, the yield strength of the steel pipe should be at least 54 ksi.. 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. It is anticipated that piles may be driven to the estimated tip elevation with substantially less difficulty during initial driving conditions (prior to set-up). After set-up has occurred, it may be much more difficult to re-mobilize the pile. It may become necessary to evaluate side resistance based on PDA restrike test results, and toe resistance based on tests at the end of initial driving.

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 evaluation 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 300 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 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 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 the three borings at this site is between about 3 and 9 inches, with an average of 6 inches.

Consolidation settlement of an the bent footing for Structure F-719 was calculated assuming a service dead load of 5157 kips acts on a group of 54 piles spaced over an area 103.3 feet long by 13.3' wide. The calculated consolidation settlement of the pile group is about 0.9 inches. It is therefore anticipated that pile group settlement for bent footings will be less than 1 inch.

Settlement of abutment pile groups at Structure F-719 was estimated assuming a group of 22 piles spaced over an area 68.8 feet long by 3.75 feet wide. Assuming an axial compression service dead load of 2572 kips acts on the footing, the calculated settlement of the pile group is 0.9 inches. 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.

7.2.1.3 Uplift

Uplift capacities for individual piles computed using LRFD Procedures are 118 kips per pile for the Strength I limit state and 400 kips per pile for the Extreme Event. 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 a 22 piles in an area 68.8 feet long by 3.75 feet wide
- Bent pile group with 54 piles in an area 103.3 feet long by 13.3 feet wide

In each case, the uplift resistance of the group of individual piles was found to be more critical than the uplift resistance for block failure of the group. It is therefore recommended that the uplift resistance for pile groups at these structures 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 sites of the proposed 1250 West bridge structure can be considered to have low variability. For Structure F-719, the minimum number of tests is 4. Additional PDA testing may be necessary if pile driving conditions indicate significant variability in the soil profile from one foundation location to the next.

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 2 feet of the existing ground surface at the time of drilling, and dewatering will be required for construction of pile caps at the bents and other construction activities.

It is recommended that the groundwater be lowered to a depth of 2 feet below the bottom of the 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. As a minimum, it is recommended that an 8 inch layer of granular borrow be placed below the pile cap to provide a working platform.

Depending upon construction sequence and methods employed, excavation and shoring of embankment preload 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 should be used. 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 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

In order to obtain an indication of the corrosive nature of the subsurface material at these sites, resistivity, pH, sulfate, and chloride tests were performed on soil samples obtained in the Test Holes. The results of these tests are tabulated below:

Test Hole	Depth (ft)	Soil Type	Resistivity ohm-cm	pH	Sulfate (ppm)	Chloride (ppm)
RSB-17-630	40-41.5	Fat Clay	15,573	7.2		
RSB-17-630	95-96.5	Silty Sand	25,956	6.4		
RSB-17-632	5-6.5	Lean Clay	11,680	9.8	60	163

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. Due to the high resistivity and pH of tested samples, unusual potential for corrosion/deterioration of steel piles is not anticipated at this site. Type I or Type II cement may be used for concrete at this site; however Type II cement is preferred 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.

The information contained in this report is provided for the specific location and purpose of the client named herein and is not intended or suitable for reuse by any other person or entity whether for the specified use, or for any other use. Any such unauthorized reuse, by any other party is at that party's sole risk and RB&G Engineering, Inc. does not accept any liability or responsibility for its use.

10.0 REFERENCES

AASHTO, 2006. AASHTO LRFD bridge design specifications, 3rd edition with 2006 interim revisions, Washington, D.C.

Bartlett, S.F., and Youd, T.L., 1992, Empirical analysis of horizontal ground displacement generated by liquefaction-induced lateral spreads, Technical Report NCEER-92-0021, August 17, 1992.

Black B.D., Hecker S., Hylland, M.D., Christenson, G.E., McDonald, G.N., 2003, Quaternary fault and fold database and map of Utah: Utah Geological Survey, map 193DM scale 1:500,000.

Chang, W., and Smith, R.B., 1998, Potential for tectonically induced tilting and flooding by the Great Salt Lake, Utah, from large earthquakes on the Wasatch fault: Proceedings volume – Basin and Range Province seismic-hazards summit: Utah Geological Survey Miscellaneous Publication 98-2.

Currey, D.R. Atwood, G. And Mabey, D.R., 1984, Major levels of the Great Salt Lake and Lake Bonneville: Utah Geological and Mineral Survey Map 73, scale 1:750,000.

Davis, F.D., 1983, Geologic map of the central Wasatch Front, Utah: Utah Geological and Mineral Survey Map 54-A, scale 1:100,000.

Harty, K.M., and Lowe, M., 2003, Geologic evaluation and hazard potential of liquefaction-induced landslides along the Wasatch Front, Utah: Utah Geological Survey Special Study 104, 40 p.

Hintze, L.F. 1988, Geologic history of Utah: Brigham Young University Geology Studies Special Publication 7, 202 p. (reprinted 1993.)

Keaton, J.R., 1987, Potential consequences of earthquake-induced regional tectonic deformation along the Wasatch Front, North-Central Utah: Logan, Utah State Universitym Final technical report to the U.S. Geological Survey, National Earthquake Hazards Reduction Program, Grant 14-08-0001-G1174.

Lin, A., and Wang, P., 1978, Wind tides of the Great Salt Lake: Utah Geology, v. 5, no. 1, p. 17-25.

Nelson, A.R., and Personius, S.F., 1993, Surficial geologic map of the Weber segment of the Wasatch fault zone, Weber and Davis Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-2199 scale 1:50,000.

Personius, S.F., and Scott, W.E., 1992, Surficial geologic map of the Salt Lake City segment and parts of adjacent segments of the wasatch fault zone, Davis, Salt Lake, and Utah Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-2106 scale 1:50,000.

Seed, H.B., and Idriss, I.M., 1971, "Simplified Procedure for Evaluating Soil Liquefaction Potential," Journal of the Soil Mechanics and Foundations Division, ASCE, Vol. 97, No. SM9, p. 1249-1273.

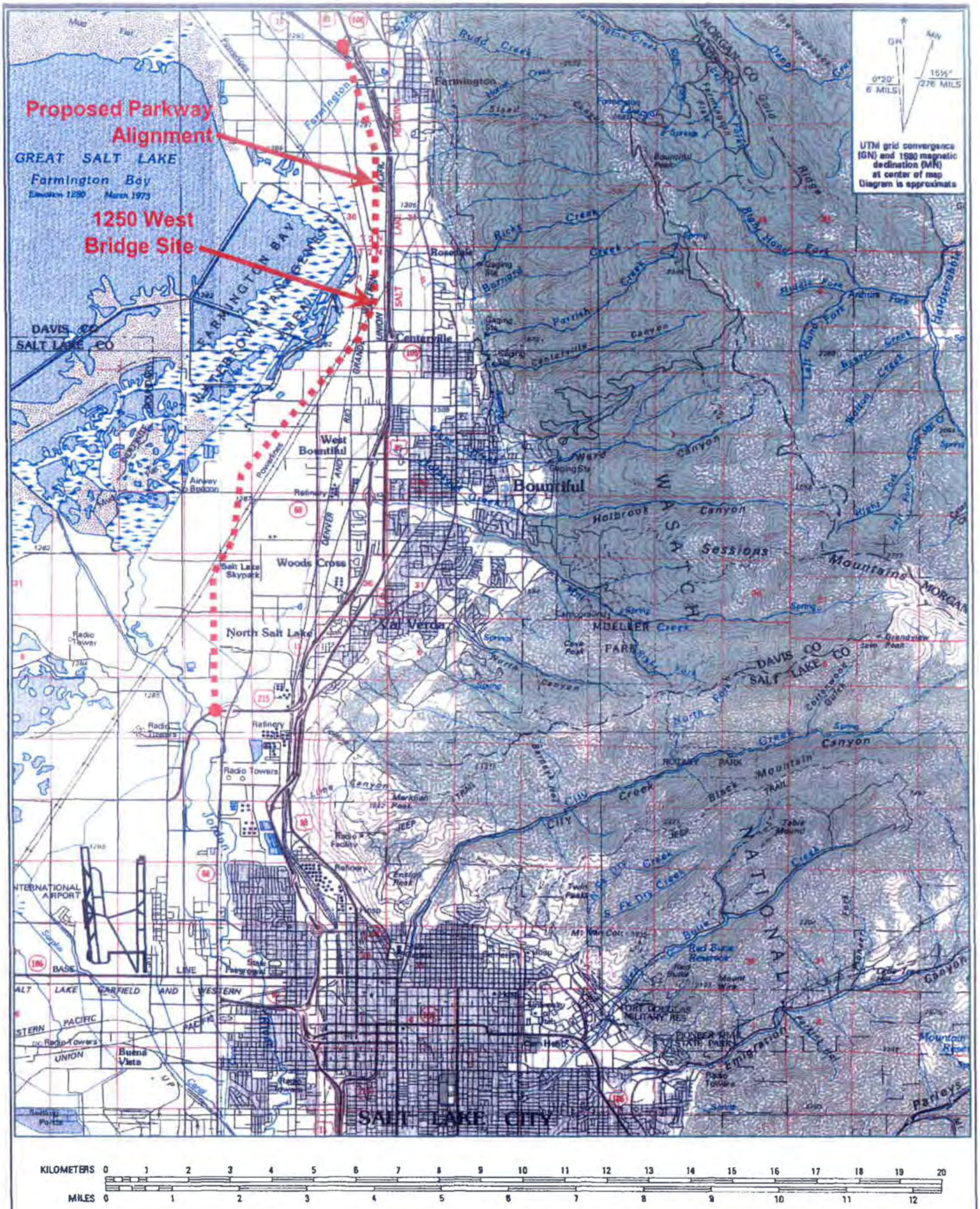
Seed, H.B., and Idriss, I.M., 1982, "Ground Motions and Soil Liquefaction During Earthquakes," Earthquake Engineering Research Institute Monograph.

Stokes, W.L., 1986, Geology of Utah: Utah Museum of Natural History and Utah Geological and Mineral Survey, 307 p.

United States Geological Survey, 2002, National Seismic Hazard Mapping Project, <http://eqint.cr.usgs.gov/eq/html/lookup-2002-interp.html>, (July 2006).

Youd, T.L., Hansen, C.M., and Bartlett, S.F., 2002, "Revised MLR Equations for Prediction of Lateral Spread Displacement," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, v. 128, no 12, p. 1007-1017.

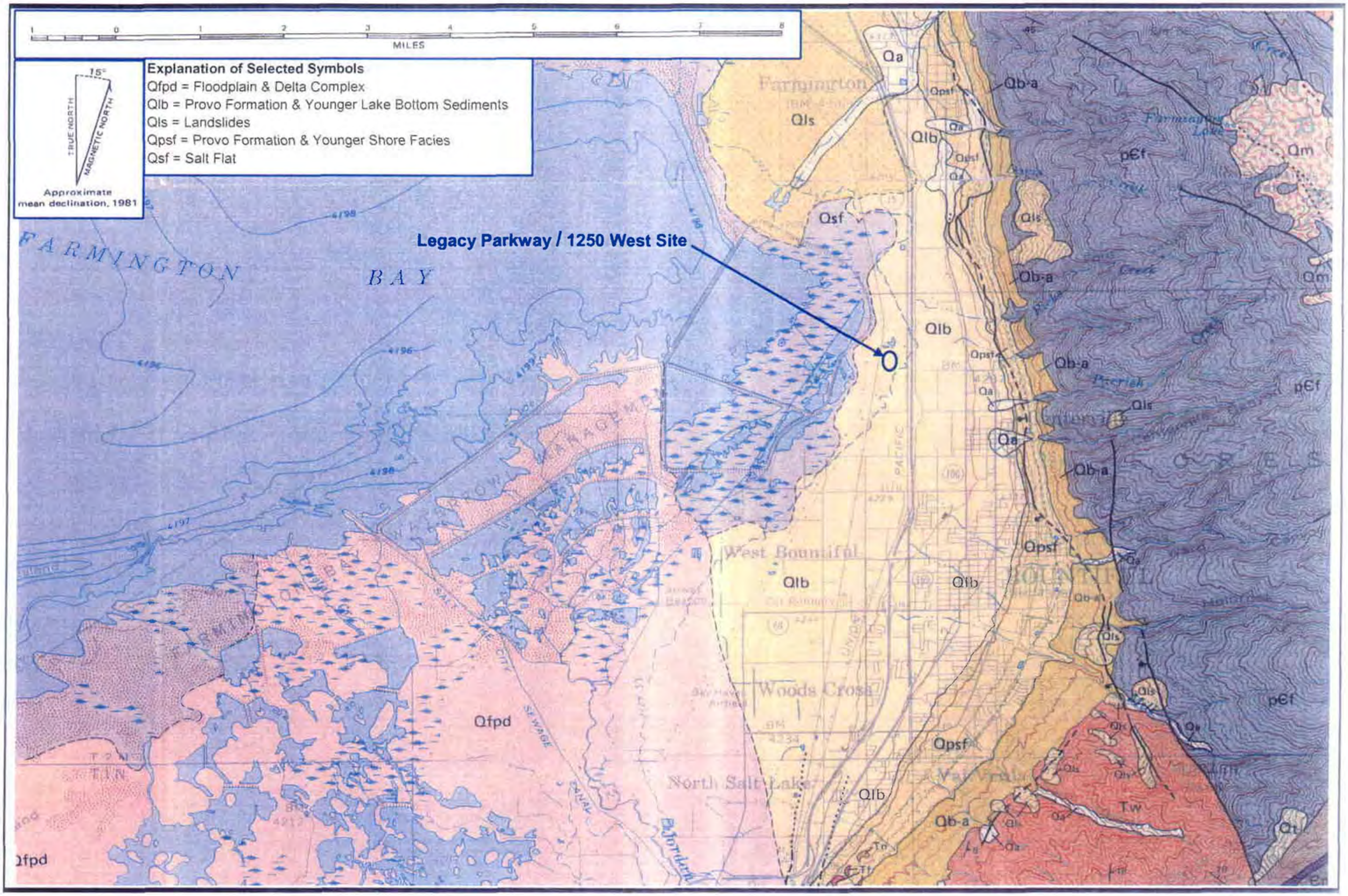
Youd, T.L., Idriss, I.M. Andrus, R.D. Arango, I., Castro, G., Christian, J.T., Dobry, R., Liam Finn, W.D.L., Harder, L.F., Jr., Hynes, M.E., Ishihara, K., Koester, J.P., Liao, S.S.C., Marcuson, W.F., III, Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R.B., Stokoe, K.H., II, 1997, "Summary Report," Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils, National Center for Earthquake Engineering Research Technical Report NCEER-97-0022, p. 1-40.



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

RB&G ENGINEERING INC.
Provo, Utah

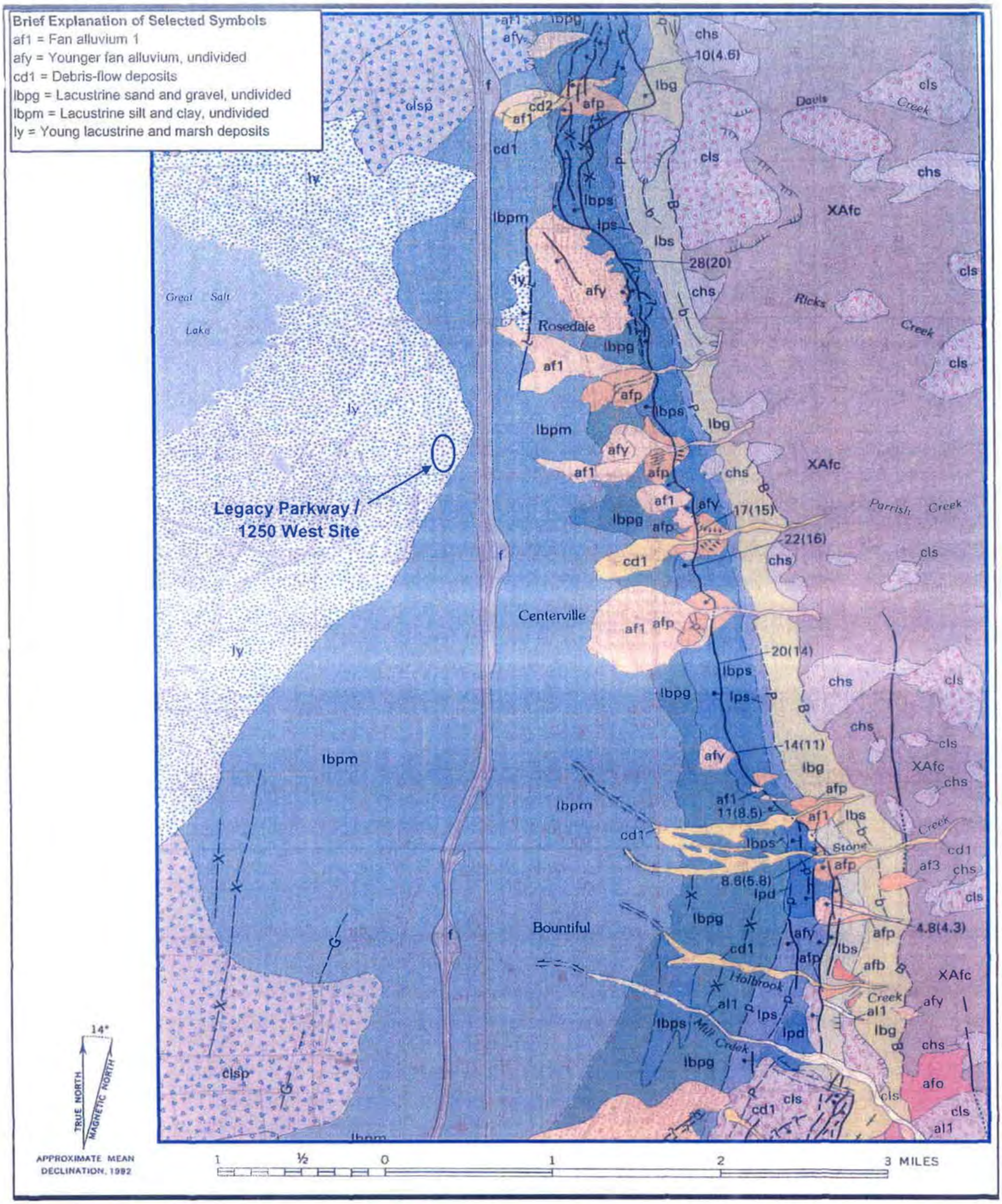
Figure 1 Vicinity Map
Proposed Legacy Parkway Alignment
Legacy Parkway
Salt Lake / Davis Counties, Utah



RB&G ENGINEERING INC.
Provo, Utah

Figure 2a Geologic Map A
1250 West Bridge Site
Legacy Parkway
Salt Lake / Davis Counties, Utah

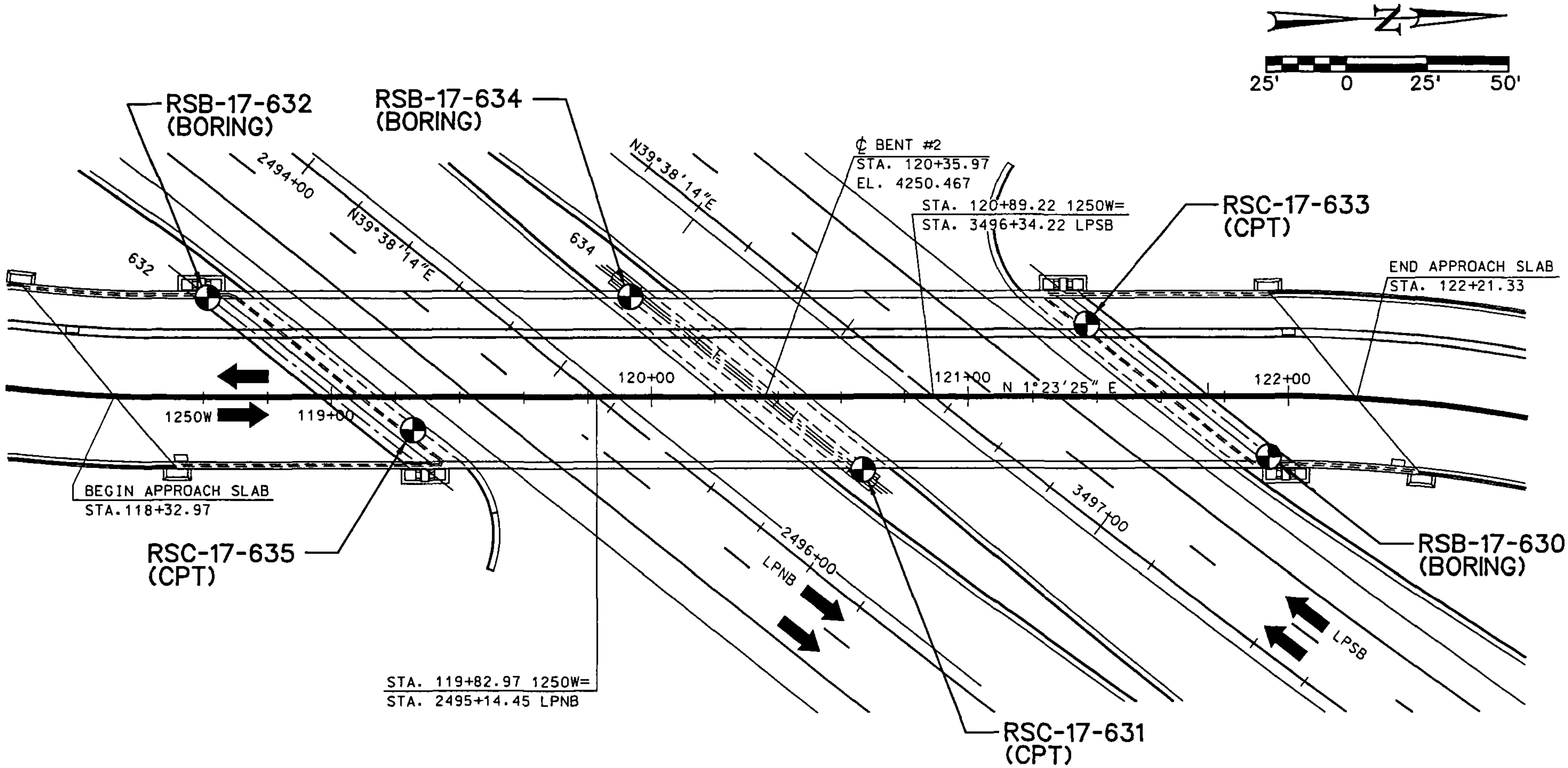
Map modified from:
Davis, 1983
Utah Geological and Mineral Survey



RB&G ENGINEERING INC.
Provo, Utah

Figure 2b Geologic Map B
1250 West Bridge Site
Legacy Parkway
Salt Lake / Davis Counties, Utah

Map modified from:
Nelson & Personius, 1993
Utah Geological Survey



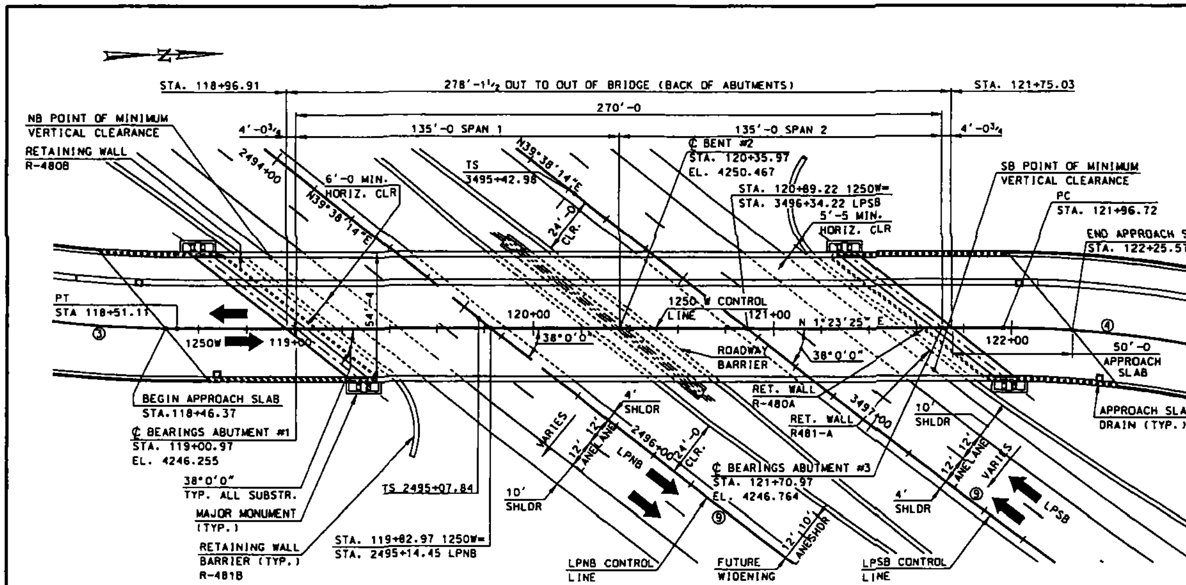
EXPLORATION LOCATION PLAN

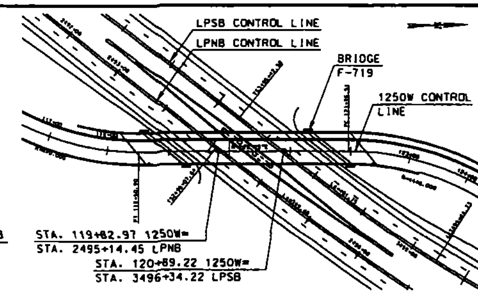
RB&G ENGINEERING INC.
Provo, Utah

Figure 3. SITE PLAN & TEST HOLE LOCATIONS
Legacy Parkway - Structure F-719
(1250 West Over Legacy Parkway
Davis County, Utah

APPENDIX A

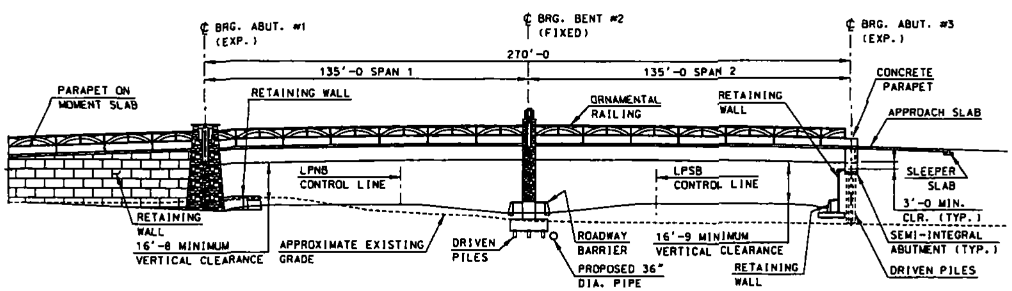
Structure Drawings





LOCATION PLAN

INDEX OF SHEETS



ELEVATION

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, EXCEPT USE ASTM A706 IN COLUMNS AND BENT CAPS.
2. USE STRUCTURAL STEEL CONFORMING TO AASHTO M 270 GRADE 36 EXCEPT WHERE NOTED OTHERWISE.
3. CHAMFER ALL EXPOSED CONCRETE CORNERS ¾" EXCEPT WHERE NOTED OTHERWISE.
4. PROVIDE 2" CONCRETE COVER TO REINFORCING STEEL EXCEPT WHERE NOTED OTHERWISE.
5. USE CLASS AA (AE) CAST-IN-PLACE CONCRETE EXCEPT WHERE NOTED OTHERWISE.
6. HORIZONTAL DIMENSIONS ARE PLAN. VERTICAL DIMENSIONS ARE PLUMB.

DESIGN DATA

HL-93 IN ACCORDANCE WITH 3rd EDITION AASHTO LRFD BRIDGE DESIGN AND INTERIM SPECIFICATIONS THROUGH 2006.
CAST-IN-PLACE CONCRETE: f'c= 4000 PSI fy (REINF.)= 60,000 PSI; n=8
PRESTRESSED CONCRETE: f'c= 8500 PSI; fy (NONPRESTRESSED)= 60,000 PSI; n=6; fs (PRESTRESSED)= 270,000 PSI
STRUCTURAL STEEL: f'y= 36,000 PSI
WEARING SURFACE: ½" CONCRETE; 35 PSF (FUTURE)
DESIGN SPEED: 70 MPH LEGACY PARKWAY; 35 MPH 1250W
SEISMIC: SEISMIC DESIGN PER MCREER/ATC 49
(2475 YR RETURN PERIOD, 3% PE IN 75 YRS.)
Ss = MAX CONSIDERATION EQ GROUND MOTION AT 0.2s = 0.975g
S1 = MAX CONSIDERATION EQ GROUND MOTION AT 1.0s = 1.4g
SITE CLASS E
PEAK HOR GROUND ACCEL (PHGA)= 0.62g
(2% IN 50 YEARS)
TRAFFIC: 2030 ADT = 9100 1250W
2020 ADT = 37300 LEGACY PARKWAY NORTHBOUND
2020 ADT = 35500 LEGACY PARKWAY SOUTHBOUND
PARAPET TEST LEVEL: TL-3

BRIDGE LOAD RATING		
	HL-93	
	RATING	LOCATION
INV.	1.08	135' F STR I
OPER.	1.40	135' F STR I

F DENOTES RATING CONTROLLED BY FLEXURE
S DENOTES RATING CONTROLLED BY SHEAR
My AT 135' = 6503 K-FT
Vy AT 135' = 552 KIPS

QUANTITIES

ITEM	ESTIMATED	UNIT	AS CONST.
GRANULAR BACKFILL BORROW (PLAN QUANTITY)	350	CU YD	
PILE DRIVING EQUIPMENT	1	LUMP	
DRIVEN PILES 16 INCH	13000	FT	
ORNAMENTAL RAILING	770	FT	
REINFORCING STEEL-COATED	420000	LB	
STRUCTURAL CONCRETE (EST. LUMP QTY 2816 CU YD)	1	LUMP	
PRESTRESSED CONCRETE MEMBERS 135'-0½ AASHTO TYPE VI	12	EACH	
STRUCTURAL STEEL (EST. LUMP QTY: 1010 LB.)	1	LUMP	
EXPANSION JOINT	136	FT	
STONE VENEER	4200	SQ FT	
ELECTRICAL WORK BRIDGES	1	LUMP	

HORIZONTAL CURVE DATA

(3) 1250F-03
CURVE DATA
Δ= 48°01'38.36"
R= 440.00
L= 368.82
T= 196.03
PC STA. 114+82.29
PI STA. 116+78.32
PT STA. 118+51.11

(4) 1250F-04
CURVE DATA
Δ= 39°59'16.36"
R= 440.00
L= 307.09
T= 160.09
PC STA. 121+96.72
PI STA. 123+56.81
PT STA. 125+03.80

(9) 2-LP NB-09
SPIRAL DATA
Δ= 5°24'29"
ENT. R= 0.00
EXIT R= 2116.14
LONG TAN.= 266.44
SHORT TAN.= 133.27
TS= 2495+07.84
SPI= 2497+74.28
SC= 2499+07.31

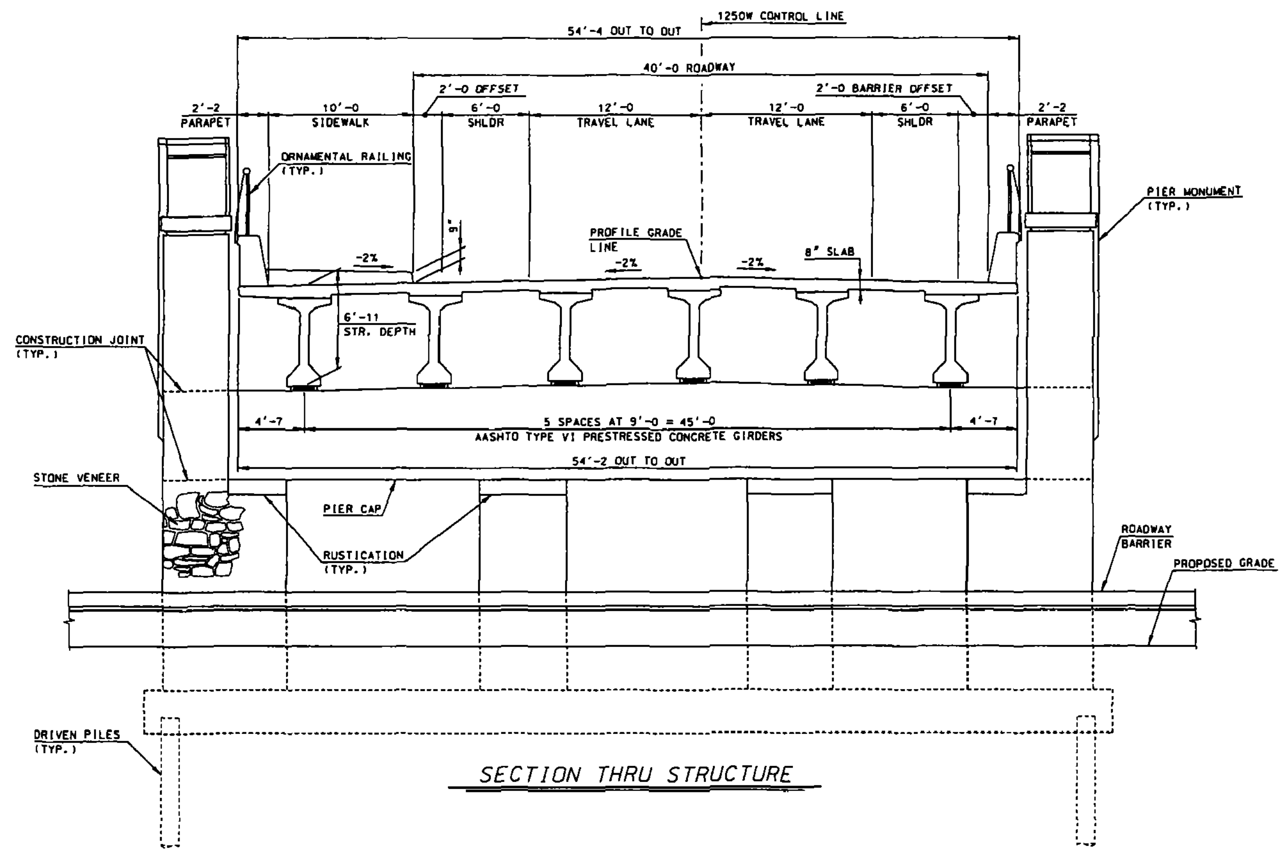
(9) 2-LP SB-09
SPIRAL DATA
Δ= 5°36'46"
ENT. R= 0.00
EXIT R= 2050.52
LONG TAN.= 267.97
SHORT TAN.= 134.04
TS= 3495+42.98
SPI= 3498+10.95
SC= 3499+44.73

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

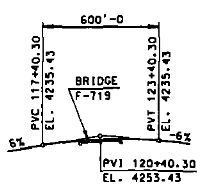
DESIGN AM 07/06 CHECK WB 07/06
DRAWN RA 07/06 CHECK WB 07/06

LEGACY PARKWAY
1250 W OVER LP
SITUATION & LAYOUT 1
SP-0067 (10) 4

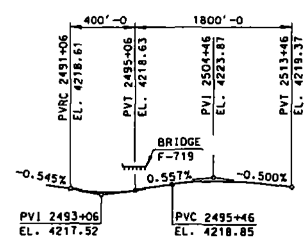
SL / DAVIS
COUNTY
F-719
DWG. NO.
SHT. 1 OF 46



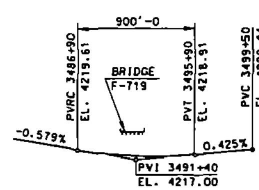
SECTION THRU STRUCTURE



1250W PROFILE



LPNB PROFILE



LPSB PROFILE

SUPERELEVATION DATA

STATION	± LEFT	± RIGHT
LPNB		
2493+77.80	+2.00%	-2.00%
2495+07.84	0.00%	0.00%
2499+07.31	-6.00%	+6.00%
LPSB		
STATION	± LEFT	± RIGHT
3488+24.92	-2.00%	+2.00%
3496+76.95	-2.00%	+2.00%
3499+44.79	-6.00%	+6.00%

REVISIONS

NO. | DATE | BY | REMARKS

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

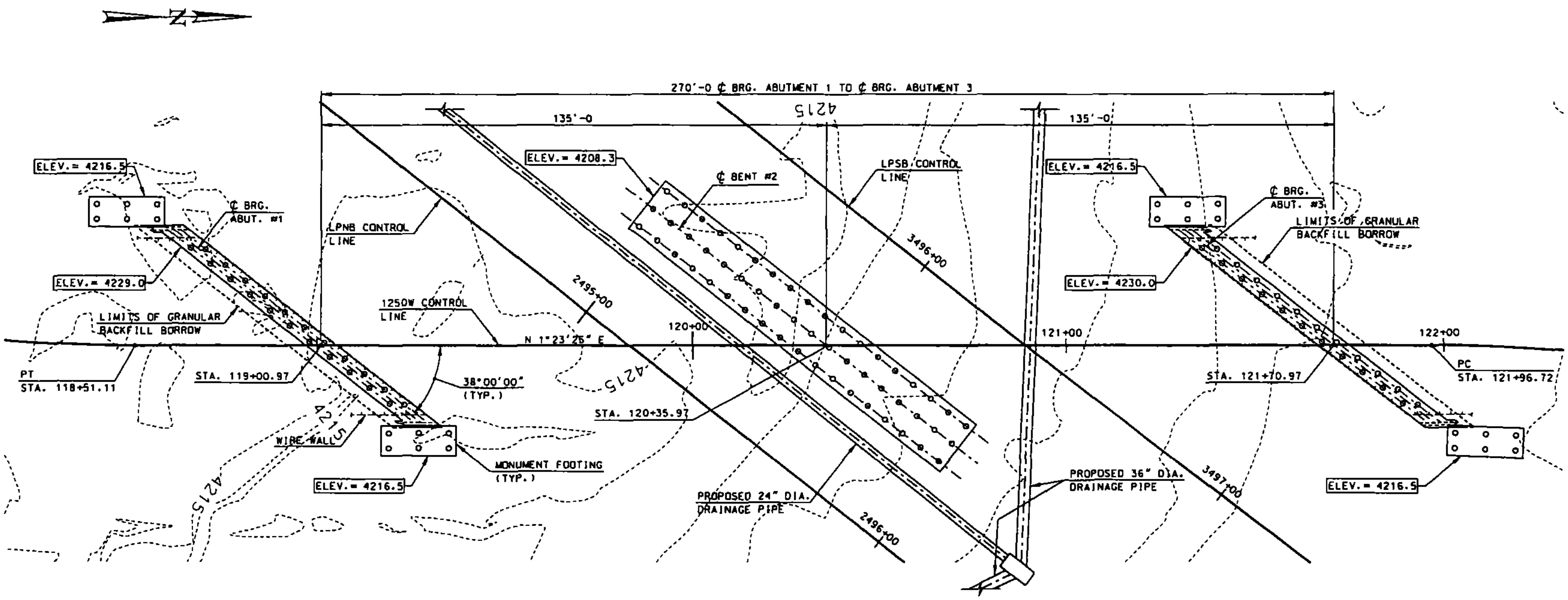
DESIGN AM 07/06 CHECK WB 07/06
DRAWN RA 07/06 CHECK WB 07/06
QUANT. CHECK

APPROVAL RECOM. DATE CONSULTANT DESIGN ENGR.
APPROVED DATE CONSULTANT PROJ. MANAGER

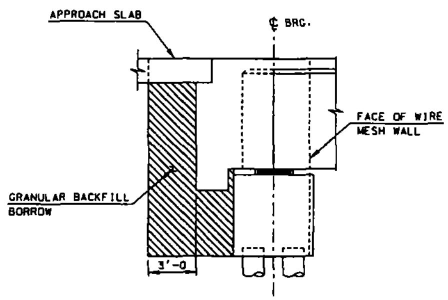
LEGACY PARKWAY
1250 W OVER LP
SITUATION & LAYOUT 2
PROJECT NUMBER SP-0067 (10) 4

SL / DAVIS
COUNTY
F-719
DWG. NO.
SHT. 2 OF 46

7/31/2006



PLAN



NOTE:
GRANULAR BACKFILL BORROW LIMITS EXTEND FROM BOTTOM OF ABUTMENT TO BOTTOM OF APPROACH SLAB.

GRANULAR BACKFILL BORROW PAY LIMITS

NOTES

1. ELEVATIONS AT BOTTOM OF ABUTMENTS AND BENT PILE CAPS ARE SHOWN THUS: ELEV.= XXXX.X
2. ALL PILES ARE 16 INCH DIAMETER. DRIVE IN ORIENTATION SHOWN.
3. ALL ABUTMENTS AND BENTS ARE PARALLEL TO BRG. N 39°23'25" E.

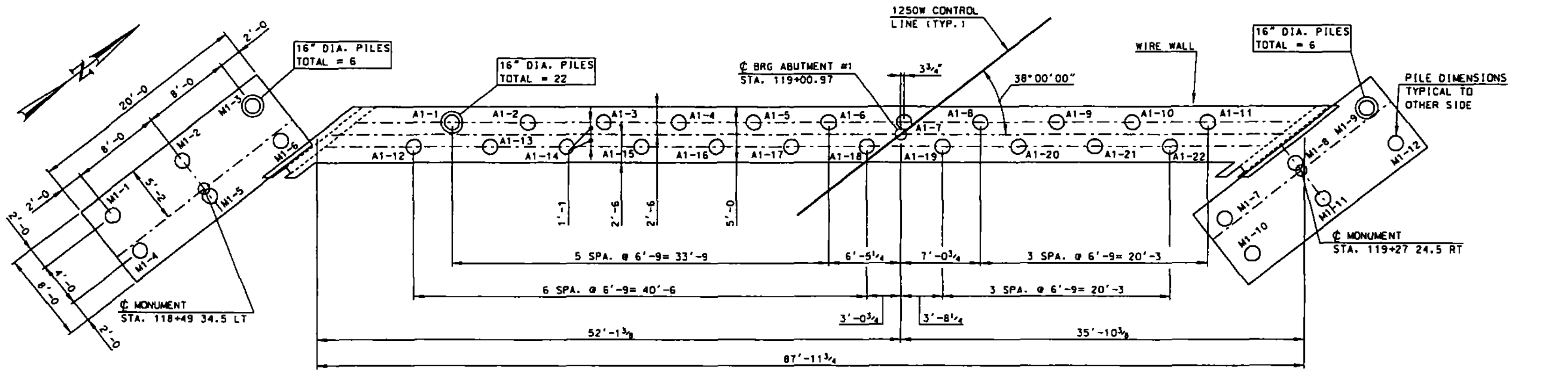
REVISIONS

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

DESIGN AM 07/06 CHECK WB 07/06
DRAWN RA 07/06 CHECK WB 07/06

LEGACY PARKWAY
1250 W OVER LP
FOUNDATION PLAN
PROJECT NUMBER SP-0067 (10) 4

SL / DAVIS
COUNTY
F-719
DWG. NO.
SHT. 4 OF 46



PLAN ABUT #1

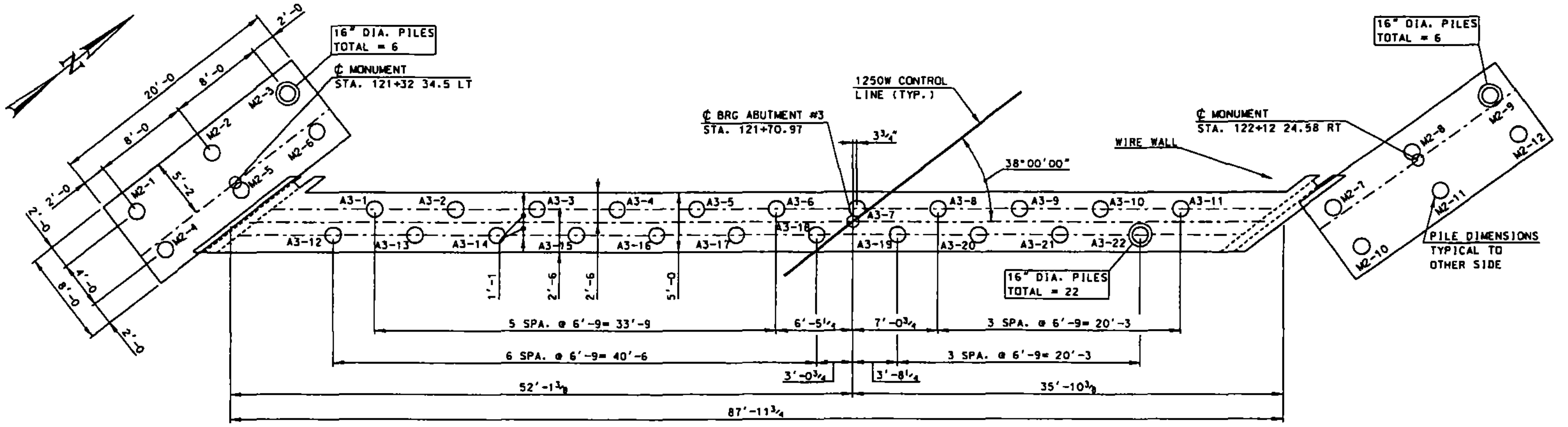
ABUTMENT #1 AS CONSTRUCTED PILE TIP ELEV	
A1-1	
A1-2	
A1-3	
A1-4	
A1-5	
A1-6	
A1-7	
A1-8	

ABUTMENT #1 AS CONSTRUCTED PILE TIP ELEV.	
A1-9	
A1-10	
A1-11	
A1-12	
A1-13	
A1-14	
A1-15	
A1-16	

ABUTMENT #1 AS CONSTRUCTED PILE TIP ELEV.	
A1-17	
A1-18	
A1-19	
A1-20	
A1-21	
A1-22	

ABUTMENT #1 MAJOR MONUMENT AS CONSTRUCTED PILE TIP ELEV.	
M1-1	
M1-2	
M1-3	
M1-4	
M1-5	
M1-6	

ABUTMENT #1 MAJOR MONUMENT AS CONSTRUCTED PILE TIP ELEV.	
M1-7	
M1-8	
M1-9	
M1-10	
M1-11	
M1-12	



PLAN ABUT #3

ABUTMENT #3 AS CONSTRUCTED PILE TIP ELEV.	
A3-1	
A3-2	
A3-3	
A3-4	
A3-5	
A3-6	
A3-7	
A3-8	

ABUTMENT #3 AS CONSTRUCTED PILE TIP ELEV.	
A3-9	
A3-10	
A3-11	
A3-12	
A3-13	
A3-14	
A3-15	
A3-16	

ABUTMENT #3 AS CONSTRUCTED PILE TIP ELEV.	
A3-17	
A3-18	
A3-19	
A3-20	
A3-21	
A3-22	

ABUTMENT #3 MAJOR MONUMENT AS CONSTRUCTED PILE TIP ELEV.	
M2-1	
M2-2	
M2-3	
M2-4	
M2-5	
M2-6	

ABUTMENT #3 MAJOR MONUMENT AS CONSTRUCTED PILE TIP ELEV.	
M2-7	
M2-8	
M2-9	
M2-10	
M2-11	
M2-12	

REVISIONS

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

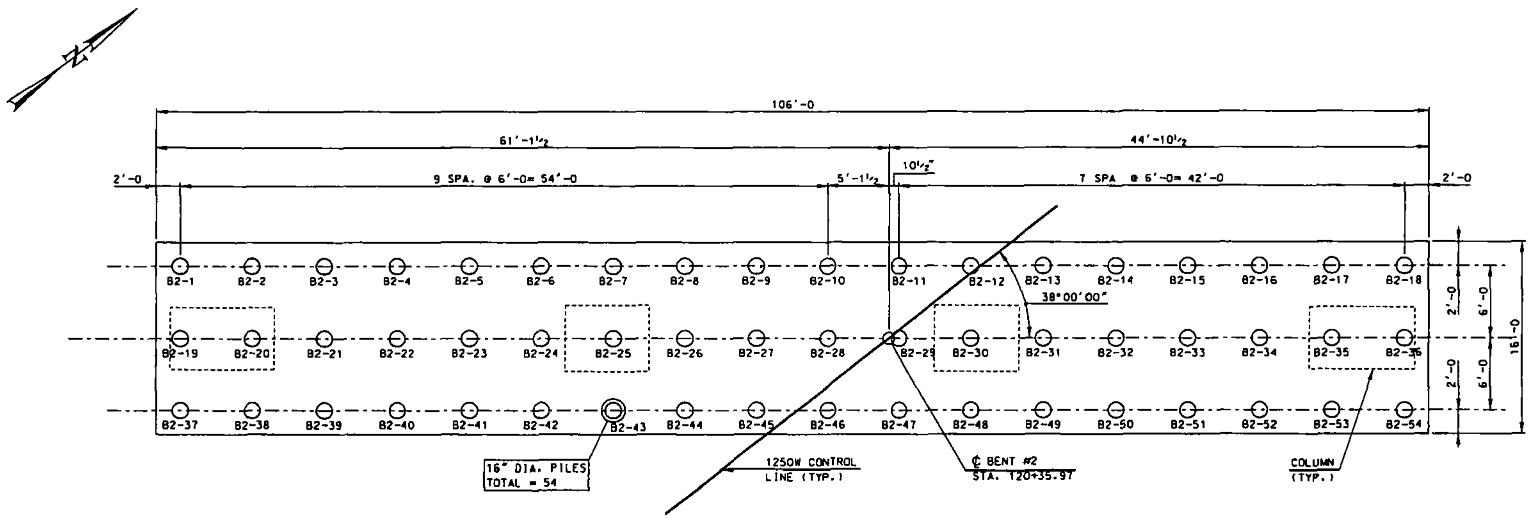
DESIGN AM 07/06 CHECK WB 07/06
DRAWN RA 07/06 CHECK WB 07/06

LEGACY PARKWAY
1250 W OVER LP
PILING PLAN 1

PROJECT NUMBER SP-0067 (10) 4

SL / DAVIS
COUNTY

F-719
DWG. NO.



PLAN BENT #2

BENT #2 AS CONSTRUCTED PILE TIP ELEV.	
B2-1	
B2-2	
B2-3	
B2-4	
B2-5	
B2-6	
B2-7	
B2-8	
B2-9	
B2-10	
B2-11	
B2-12	
B2-13	
B2-14	
B2-15	
B2-16	
B2-17	
B2-18	

BENT #2 AS CONSTRUCTED PILE TIP ELEV.	
B2-19	
B2-20	
B2-21	
B2-22	
B2-23	
B2-24	
B2-25	
B2-26	
B2-27	
B2-28	
B2-29	
B2-30	
B2-31	
B2-32	
B2-33	
B2-34	
B2-35	
B2-36	

BENT #2 AS CONSTRUCTED PILE TIP ELEV.	
B2-41	
B2-42	
B2-43	
B2-44	
B2-45	
B2-46	
B2-47	
B2-48	
B2-49	
B2-50	
B2-51	
B2-52	
B2-53	
B2-54	

REVISIONS

NO. | DATE | BY | REMARKS

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

DESIGN AM 07/06 | CHECK WB 07/06
DRAWN RA 07/06 | CHECK WB 07/06

APPROVAL RECOM. | DATE | CONSULTANT DESIGN ENGR.
APPROVED | DATE | CONSULTANT PROJ. MANAGER
SUBMIT. | CHECK

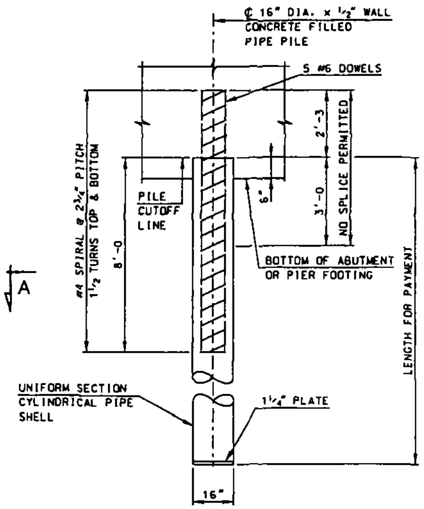
LEGACY PARKWAY
1250 W OVER LP
PILING PLAN 2

PROJECT NUMBER SP-0067 (10) 4

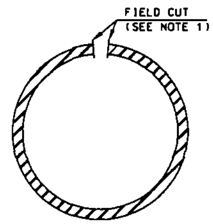
SL / DAVIS
COUNTY

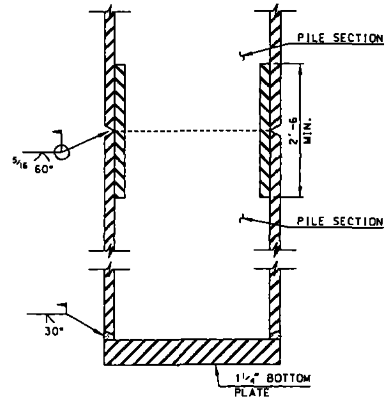
F-719
DWG. NO.

SHT. 6 OF 46



PIPE PILE DETAIL

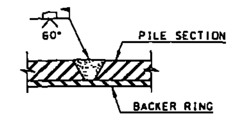




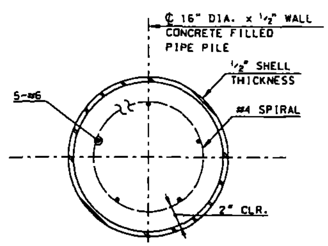
PILE SECTION

PILE SPLICE AND BOTTOM PLATE NOTES

1. FIELD CUT PIECE OF PIPE SO WHEN COMPRESSED IT WILL SLIDE INSIDE PIPE SECTIONS.
2. CONFORM TO THE AASHTO/AWS BRIDGE WELDING CODE.
3. USE FULL STRENGTH WELD SPLICES.
4. USE THE FOLLOWING WELD FOR FLAT WELD POSITION:



PILE SPLICE AND BOTTOM PLATE DETAILS



SECTION A-A

NOTES

1. FILL PILE SHELLS WITH CLASS "AA(AE)" CONCRETE, $f'c = 4000$ psi.
2. HOLD THE REINFORCING STEEL ADEQUATELY IN FINAL POSITION DURING PLACEMENT OF CONCRETE AROUND BARS.
3. PROVIDE PIPE MATERIAL CONFORMING TO ASTM A252 GRADE 3 (MOD). $Fy = 65$ ksi.
4. PROVIDE UNCOATED REINFORCEMENT FOR PLACEMENT INTO PILES.
5. FOR AS CONSTRUCTED PILE TIP ELEVATIONS, SEE SHEETS 5 AND 6.

PILE DATA

LOCATION	PILE DIAMETER (IN)	PILE SHELL THICKNESS (IN)	ESTIMATED PILE TIP ELEVATION (FT)	ELEVATION OF MIN. ACCEPTABLE PILE PENETRATION (FT)	STRENGTH I PILE LOAD (KIPS)	SERVICE I PILE RESISTANCE (KIPS)	STRENGTH I PILE RESISTANCE (KIPS)	ULTIMATE PILE RESISTANCE (KIPS)	REQ'D DRIVING RESISTANCE (KIPS)	MAXIMUM DRIVING LOAD (KIPS)
ABUT. NO. 1	16	1/2	4086	XXXX	XXX	XXX	309	425	476	1424
BENT NO. 2	16	1/2	4086	XXXX	XXX	XXX	309	425	476	1424
ABUT. NO. 3	16	1/2	4086	XXXX	XXX	XXX	309	425	476	1424

UTAH DEPARTMENT OF TRANSPORTATION
SALT LAKE CITY, UTAH
STRUCTURES DIVISION

DESIGN AM 07/06 CHECK WB 07/06
DRAWN RA 07/06 CHECK WB 07/06

REVISIONS

LEGACY PARKWAY
1250 W OVER LP
DRIVEN PILE DETAILS
PROJECT NUMBER SP-0067 (10) 4

SL / DAVIS
COUNTY
F-719
DWG. NO.
SHT. 7 OF 46

APPENDIX B
Test Hole Logs

DRILL HOLE LOG

BORING NO. RSB-17-630

SHEET 1 OF 4

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)

CLIENT: UTAH DEPARTMENT OF TRANSPORTATION

LOCATION: N 387,047, E 64,661

DRILLING METHOD: CME-55 NO. 1 / N.W. CASING

DRILLER: T. KERN

DEPTH TO WATER - INITIAL: ∇ 1.7' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200601.117

DATE STARTED: 4/13/06

DATE COMPLETED: 4/19/06

GROUND ELEVATION: 4215.6'

LOGGED BY: M. HANSEN

Elev. (ft)	Depth (ft)	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						FILL FOR DRILL PAD								
		5	1,2,3,(10)	ML	lt. gray-brown, moist, firm	SILT W/SAND								
4210	5	15	Pushed 0.32	ML (A-4(0))	lt. gray-brown, very moist, firm		100.3	25.3	26	1	10	11	79	CT UC
4205	10	18	0,1,2,(6) 0.54	CL (A-6(18))	lt. brown, moist, stiff	LEAN CLAY		28.2	38	18	1	4	95	
4200	15	3	Pushed	SM	black, wet, loose	SILTY SAND W/FAT CLAY LAYERS TO 3" THICK								
		14	1/18",(2) 0.08	SM	black, wet, very loose									
				SM	black, wet									
4195	20	12	1,1,1,(3) 0.09	CH	gray-brown, moist, very soft	FAT CLAY								
				SM	black, wet, very loose	SILTY SAND								
4190	25	15	Pushed	SM	black, wet									
				SM,CL	black/brown, wet/moist	INTERBEDDED SILTY SAND & LEAN CLAY LENSES & LAYERS TO 0.5" THICK								
		18	1/18",(1)	SM	black, wet, very loose									
		24	1/24",(1) 0.07	CL	gray-brown, moist, very soft	SILTY SAND W/CLAY LENSES								
				CL	black, moist, very soft	LEAN CLAY W/SAND LENSES								
4185	30	16	Pushed 0.11	CL (A-6(20))	lt. brown-gray, moist, very soft		80.7	39.9	40	19	0	2	98	CT UC
		18	0/18",(0) 0.10	CL	lt. brown-gray, moist, very soft									
4180	35	4	0/18",(0) 0.16	CL/CH	black, moist, soft	LEAN TO FAT CLAY								
		15	Pushed 0.24	CL (A-7-6(21))	dk. gray, moist, soft		73.5	47.8	42	20	0	5	95	CT UC
4175	40	18	0/18",(0) 0.15	CL/CH	black, moist, soft									pH Resist. Sulfate Chloride
4170	45	18	Pushed	SP (A-1-b(0))	gray, wet, loose	POORLY GRADED SAND		17		NP	0	98	2	
		20	1,1,2,(3) 0.23	CL	gray, moist, soft	LEAN CLAY W/SAND LAYERS 1" THICK & UP TO 5" APART								
						FAT CLAY								

.OGV1_COLOR 117_LOGS_COLOR.GPJ US EVAL.GDT 7/28/06

LEGEND:

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

RB&G ENGINEERING INC.
PROVO, UTAH

DRILL HOLE LOG

BORING NO. RSB-17-630

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)

CLIENT: UTAH DEPARTMENT OF TRANSPORTATION

LOCATION: N 387,047, E 64,661

DRILLING METHOD: CME-55 NO. 1 / N.W. CASING

DRILLER: T. KERN

DEPTH TO WATER - INITIAL: ∇ 1.7' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200601.117

DATE STARTED: 4/13/06

DATE COMPLETED: 4/19/06

GROUND ELEVATION: 4215.6'

LOGGED BY: M. HANSEN

Elev. (ft)	Depth (ft)	Lithology	Sample: Type	Sample: Rec. (in)	Sample: See Legend	Sample: 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				15	Pushed	CH	gray, wet, firm	FAT CLAY								
						SM	gray, wet, loose	SILTY SAND								
				20	0/18",(0) 0.25	CH	dk. gray to black, very moist, soft	FAT CLAY W/SAND LENSES								
4160	55			18	Pushed 0.75	CL (A-7-6(25))	gray, moist, stiff	LEAN CLAY	85.4	34.7	46	22	0	2	98	CT UC
4155	60			21	1,5,2,(7) 0.75 0.38	CL	gray, moist, firm to stiff, 4.5" sand layer									
4150	65			14	0,0,0,(0) 0.30	SM	gray, wet, very loose	SILTY SAND (FLOWING)								
						CH	gray, moist, firm									
4145	70			18	Pushed 0.32	CH (A-7-6(31))	dk. gray, moist, firm			44.7	56	31	0	11	89	UC
4140	75			21	0,0,0,(0) 0.33	CH	dk. gray, moist, firm	FAT CLAY W/SILT LENSES								
4135	80			17	Pushed 0.80	CH (A-7-6(30))	dk. gray, moist, stiff 5" peat layer		74.8	44.2	51	28	0	4	96	CT UC
4130	85			21	0.65 0,0,6,(5)	CH	gray, moist, stiff									
						SM	gray, wet, loose	SILTY SAND								
4125	90			16	Pushed	CL (A-6(7))	gray, wet	SANDY LEAN CLAY		23.7	33	11	0	24	76	
				14	3,4,26,(23)	SM	gray, wet, med. dense	SILTY SAND W/LEAN CLAY LENSES & LAYERS								
4120	95			15	2,7,20,(21)	SM (A-2-4(0))	gray, wet, med. dense			18.3		NP	0	76	24	
								LEAN CLAY								

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-17-630

SHEET 3 OF 4

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)

CLIENT: UTAH DEPARTMENT OF TRANSPORTATION

LOCATION: N 387,047, E 64,661

DRILLING METHOD: CME-55 NO. 1 / N.W. CASING

DRILLER: T. KERN

DEPTH TO WATER - INITIAL: ∇ 1.7' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200601.117

DATE STARTED: 4/13/06

DATE COMPLETED: 4/19/06

GROUND ELEVATION: 4215.6'

LOGGED BY: M. HANSEN

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Rec. (in)	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	0,3,4,(5) 0.48	CL	gray, moist, firm — LEAN CLAY								
4110	105			12	Pushed 0.56	CH (A-7-6(38))	gray, moist, stiff	66.4	51.8	58	33	0	0	100	CT UC
4105	110			21	0,0,3,(2) 0.36	CH	gray, moist, firm — FAT CLAY								
4100	115			18	Pushed 0.52	CH	black, moist, stiff								
4095	120			19	0,4,9,(9) 0.56	SM	dk. gray, wet, very loose — SILTY SAND								
						CL	dk. gray, moist, stiff — LEAN CLAY								
4090	125			18	Pushed	CL	gray, moist								
						SM	dk. gray, wet — SILTY SAND								
4085	130			18	6,10,11,(14) 0.70	CL (A-4(7))	gray to brown, moist, stiff — LEAN CLAY W/SILTY SAND LENSES & LAYERS TO 3" THICK		25.8	30	10	0	18	82	
4080	135			0	Pushed	-	SILTY SAND								
				18	6,7,9,(10) 0.76	SM	gray, wet, med. dense								
						CH	gray-brown, moist, stiff								
4075	140			14	Pushed 0.86	CH (A-7-6(42))	gray, moist, stiff — FAT CLAY	79.4	37	60	37	0	1	99	CT UC
4070	145			18	0.64 0,7,12,(12)	CH	gray, moist, stiff								
						SM	gray, wet, med. dense — SILTY SAND								

LOGV1_COLOR 117_LOGS_COLOR.GPJ US EVAL.GDT 7/28/06

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

RB&G ENGINEERING INC.
PROVO, UTAH

DRILL HOLE LOG

BORING NO. RSB-17-630

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)
CLIENT: UTAH DEPARTMENT OF TRANSPORTATION
LOCATION: N 387,047, E 64,661
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ∇ 1.7' **AFTER 24 HOURS:** N.M.

PROJECT NUMBER: 200601.117
DATE STARTED: 4/13/06
DATE COMPLETED: 4/19/06
GROUND ELEVATION: 4215.6'
LOGGED BY: M. HANSEN

Elev. (ft)	Depth (ft)	Lithology	Sample: Type	Sample: Rec. (in)	Sample: See Legend	Sample: USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter.: Liquid Limit	Atter.: Plast. Index	Gradation: Gravel (%)	Gradation: Sand (%)	Gradation: Silt/Clay (%)	Other Tests
4065			Undisturbed	14	Pushed	SM	brown, wet, med. dense								
							SILTY SAND W/CLAY LAYERS TO 1" THICK								
4060	155		Disturbed	16	18,32,30,(38)	SM (*A-1-b(0)*)	gray, wet, very dense		17.7		NP	0	79	21	
4055	160		Disturbed	0	0,1,4,(3)	-									
			Undisturbed	18	Pushed *0.90*	CL	LEAN CLAY gray-brown, moist, stiff								
4050	165		Disturbed	17	2,6,10,(9) *0.90*	CL	gray, moist, stiff								
						SM	gray, wet, med. dense								
							SILTY SAND								
4045	170		Disturbed	11	10,7,9,(9)	SM (*A-4(0)*)	gray, wet, med. dense		24.6		NP	0	51	49	
							FAT CLAY								
4040	175		Disturbed	21	0,3,6,(5) *0.82* *0.59*	CH	gray to brown, moist, stiff								
4035	180														
4030	185														
4025	190														
4020	195														

OGV1_COLOR 117_LOGS_COLOR.GPJ US EVAL.GDT 7/28/06

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-17-632

SHEET 1 OF 4

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)

CLIENT: UTAH DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 200601.117

LOCATION: N 386,721, E 64,606

DATE STARTED: 3/22/06

DRILLING METHOD: CME-55 NO. 1 / N.W. CASING

DATE COMPLETED: 3/28/06

DRILLER: T. KERN

GROUND ELEVATION: 4214.3'

DEPTH TO WATER - INITIAL: ∇ 1.5' **AFTER 24 HOURS:** ▼ ARTESIAN'

LOGGED BY: M. HANSEN, J. BOONE

Elev. (ft)	Depth (ft)	Sample Type	Rec. (in)	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
		Disturbed	12	1,1,2,(6) 0.48	CL	dk. to lt. brown, moist, firm organics in top 8"	LEAN CLAY								
4210	5	Disturbed	18	2,3,2,(10) 0.26	CL (A-6(13))	lt. brown, moist, firm			31.6	35	15	0	11	89	pH Resist.
4205	10	Undisturbed	14	Pushed 0.49	CL (A-6(16))	gray, moist, firm	LEAN CLAY W/SAND LAYERS UP TO 3" THICK & UP TO 12" APART	90.4	28.5	37	17	0	9	91	CT UC
		Disturbed	18	2,2,3,(10) 0.70	CL	lt. brown, moist, stiff									
4200	15	Disturbed	18	1,1,1,(4) 0.04	CL	gray-brown, very moist, very soft									
4195	20	Undisturbed	18	Pushed 0.22	CL	lt. brown, very moist, soft	LEANCLAY W/SAND LAYERS TO 6" THICK								
		Disturbed	18	2,5,1,(9) 0.15	CL	lt. brown, very moist, soft									
4190		Disturbed	18	0/12",1,(1) 0.08	CL	gray-brown, very moist, very soft									
	25	Disturbed	18	0/12",0,(0) 0.06	CL	gray to black, very moist, very soft									
		Undisturbed	16	0.10 Pushed	CL (A-7-6(20))	gray, very moist, very soft		78.6	42.4	42	21	0	9	91	CT UC
4185		Disturbed	18	0.07	CL	gray, very moist, very soft									
	30	Disturbed	18	0/18",(0) 0.09	CL	lt. to dk. gray, very moist, very soft									
		Undisturbed	0	0/18",(0) 0.09 Pushed	-										
4180	35	Undisturbed	18	Pushed 0.24	CL (A-6(15))	gray, moist, soft	LEAN CLAY W/OCCASIONAL SAND LENSES	72.4	47.7	40	16	0	12	88	CT
4175	40	Disturbed	18	0/18",(0) 0.26	CL	black to gray, moist, firm									
4170	45	Undisturbed	18	Pushed 0.30	CL (A-7-6(25))	lt. gray, moist, firm		76.4	44.9	46	23	0	2	98	TS UC
4165							LEAN CLAY W/SILT LAYERS (ORGANIC) TO 0.25" THICK								

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE 2,3,2,(6) 0.45 — Blow Count per 6"; $(N_1)_{60}$ Value; 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-17-632

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)

CLIENT: UTAH DEPARTMENT OF TRANSPORTATION

PROJECT NUMBER: 200601.117

LOCATION: N 386,721, E 64,606

DATE STARTED: 3/22/06

DRILLING METHOD: CME-55 NO. 1 / N.W. CASING

DATE COMPLETED: 3/28/06

DRILLER: T. KERN

GROUND ELEVATION: 4214.3'

DEPTH TO WATER - INITIAL: ∇ 1.5' **AFTER 24 HOURS:** ▼ ARTESIAN'

LOGGED BY: M. HANSEN, J. BOONE

Elev. (ft)	Depth (ft)	Sample Type	Rec. (in)	See Legend	USCS (AASHTO)	Material Description		Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	Silt/Clay (%)	Other Tests
		Disturbed	18	0/18",(0) 0.29 0.50	CL	greenish-gray, moist, firm	LEAN CLAY W/SILT LAYERS (ORGANIC) TO 0.25" THICK								
4160	55	Pushed	18	Pushed 0.45	CL (A-6(17))	dk. gray, moist, firm		88.9	31.7	39	16	0	5	95	CT
4155	60	Disturbed	18	0/12",3,(3) 0.40	CL	dk. gray, moist, firm	LEAN CLAY W/SILT LENSES 1" TO 2" APART								
4150	65	Pushed	18	Pushed 0.66	CL (A-7-6(27))	gk. gray, moist, stiff		78.1	44.4	48	26	0	5	95	UC
4145	70	Disturbed	18	0/18",(0) 0.20	CL	dk. gray, moist, soft	LEAN CLAY W/MANY SILT LENSES 0.06" TO 0.25" APART								
4140	75	Pushed	18	Pushed 0.90	CH (A-7-6(31))	greenish-brown, moist, stiff	FAT CLAY W/SAND LENSES	81.6	38.7	57	31	0	4	96	CT
		Disturbed	18	4,16,29,(38) 0.73	CH / SM	greenish-brown, moist, stiff / dk. gray, wet, dense	SILTY SAND								
4135	80	Disturbed	17	0,0,3,(2) 0.77	CH	greenish-gray, moist, stiff	FAT CLAY W/SAND LENSES								
4130	85	Pushed	17	Pushed	SM	greenish-gray, wet	SILTY SAND W/2" CLAY LAYER								
		Disturbed	12	0,7,6,(11)	SM	greenish-gray, wet, med dense									
4125	90	Disturbed	15	5,5,8,(10) 0.31	CL	greenish-gray, moist, firm	SANDY LEAN CLAY								
4120	95	Pushed	16	Pushed 0.70	CH (A-7-6(36))	greenish-gray, moist, stiff	FAT CLAY W/SILT LENSES UP TO 8" APART	85.3	33.6	56	33	0	3	97	UC
4115															

LOGV1_COLOR 117_LOGS_COLOR.GPJ US EVAL.GDT 7/28/06

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-17-632

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)
CLIENT: UTAH DEPARTMENT OF TRANSPORTATION
LOCATION: N 386,721, E 64,606
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ∇ 1.5' **AFTER 24 HOURS:** ▼ ARTESIAN'

PROJECT NUMBER: 200601.117
DATE STARTED: 3/22/06
DATE COMPLETED: 3/28/06
GROUND ELEVATION: 4214.3'
LOGGED BY: M. HANSEN, J. BOONE

Elev. (ft)	Depth (ft)	Sample Type	Rec. (in)	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
		Disturbed	21	0,0,0,(0) 0.37	CL	greenish-gray, moist, firm	LEAN CLAY W/SILT LENSES 2" TO 6" APART								
4110	105	Undisturbed	10	Pushed 0.53	CL (A-6(19))	greenish-gray, moist, stiff		82.5	37.7	39	18	0	2	98	CT
4105	110	Disturbed	17	0,0,4,(3) 0.52	SM	dk. gray, wet, very loose	SILTY SAND								
				0.65	CL	gray-brown, moist, stiff	LEAN CLAY								
4100	115	Undisturbed	15	Pushed	CL	moist, stiff									
					SP-SM	dk. gray, wet	SAND W/SILT								
		Disturbed	18	0,5,5,(7) 0.64	SP-SM (A-3(0))	dk. gray, wet, loose			26.6		NP	0	91	9	
					CL	gray-brown, moist, stiff	LEAN CLAY								
4095	120	Disturbed	13	8,3,5,(5) 0.63	CL	greenish-gray, moist, stiff	LEAN CLAY W/SAND LAYERS TO 3" THICK								
4090	125	Disturbed	18	2,4,7,(7)	SM	greenish-gray, wet, loose	SILTY SAND								
				0.57	CH	greenish-gray, moist, stiff	FAT CLAY W/SILT LENSES								
		Undisturbed	13	Pushed 2.15	CH (A-7-6(40))	greenish-gray, moist, hard		93.4	26	56	36	0	1	99	CT UC
4085	130	Disturbed	20	2,4,7,(7) 1.33	CH	greenish-gray, moist, very stiff									
4080	135	Undisturbed	17	Pushed 0.48	ML (A-4(0))	greenish-gray, moist, firm	SANDY SILT W/CLAY LENSES		24		NP	0	27	73	
4075	140	Disturbed	15	0,0,4,(3)	SM	lt. brown, wet, very loose	SILTY SAND								
4070	145														
					SM	greenish-gray, wet, very loose									
4065		Disturbed	18	1,4,9,(8) 0.54	CL	dk. green, moist, stiff	LEAN CLAY								

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
(red) = Potential Liquefaction
(blue) = Potential Liquefaction & Lateral Spread

RB&G ENGINEERING INC.
PROVO, UTAH

DRILL HOLE LOG

BORING NO. RSB-17-632

SHEET 4 OF 4

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)
CLIENT: UTAH DEPARTMENT OF TRANSPORTATION
LOCATION: N 386,721, E 64,606
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ∇ 1.5' **AFTER 24 HOURS:** ▼ ARTESIAN'

PROJECT NUMBER: 200601.117
DATE STARTED: 3/22/06
DATE COMPLETED: 3/28/06
GROUND ELEVATION: 4214.3'
LOGGED BY: M. HANSEN, J. BOONE

Elev. (ft)	Depth (ft)	Sample Type	Rec. (in)	See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	Silt/Clay (%)	Other Tests
		Undisturbed	18	Pushed 0.32	CL (A-6(7))	SANDY LEAN CLAY: greenish-gray, moist, firm	91.7	29.1	33	13	0	34	66	CT
4060	155	Disturbed	18	0,0,9,(5) 0.74 0.68	CL	greenish-gray, moist, stiff								
4055	160	Undisturbed	13	Pushed 0.56	SM	SILTY SAND: greenish-gray, wet								
					CL	LEAN CLAY: greenish-gray, moist, stiff								
4050	165			0.67	CL	greenish-gray, moist, stiff								
		Disturbed	11	10,19,16,(20)	SM (A-2-4(0))	SILTY SAND: dk. greenish-gray, med. dense		21.2		NP	1	69	30	
4045	170	Undisturbed	18	Pushed 0.82	CH (A-7-6(69))	FAT CLAY: lt. & dk. greenish-brown, moist, stiff	49.7	81.6	91	57	0	1	99	CT
4040	175	Disturbed	16	4,8,15,(13) 0.50	CH	gray-green, moist, firm to stiff								
4035	180													
4030	185													
4025	190													
4020	195													
4015														

OGV1_COLOR_117_LOGS_COLOR.GPJ US EVAL.GDT 7/28/06

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
(red) = Potential Liquefaction
(blue) = Potential Liquefaction & Lateral Spread

DRILL HOLE LOG

BORING NO. RSB-17-634

SHEET 1 OF 4

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)
CLIENT: UTAH DEPARTMENT OF TRANSPORTATION
LOCATION: N 386,851, E 64,610
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING W/TRICONE BIT
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ∇ 2.0' **AFTER 24 HOURS:** ▼ 0.5'

PROJECT NUMBER: 200601.117
DATE STARTED: 4/3/06
DATE COMPLETED: 4/10/06
GROUND ELEVATION: 4214.6'
LOGGED BY: N.B., C.S., J.B.

Elev. (ft)	Depth (ft)	Rec. (in)	See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	Silt/Clay (%)	Other Tests
	0	8	2,1,2,(6)	ML	dk. brown to gray, moist, very loose — SANDY SILT								
4210	5	17	2,1,1,(4)	ML (A-4(2))	lt. brown, wet, very loose		29.5	27	3	2	13	85	
				CL	lt. brown, moist, stiff — LEAN CLAY								
4205	10	16	Pushed 0.47	CL (A-7-6(20))	lt. brown, moist, firm	92.2	27.6	41	20	1	6	93	CT UC
4200	15	18	0/11",1,(2)	CL	brown, moist — LEAN CLAY W/SILTY SAND LAYERS TO 3" THICK								
4195	20	12	Pushed 0.15	CL (A-7-6(20))	brown, very moist, soft	79.7	39	41	19	0	2	98	CT
		18	0.05	CL	brown, very moist, very soft								
			2/12",1,(3)	SM (A-2-4(0))	dk. gray, wet, very loose — SILTY SAND		29.4		NP	0	76	24	
4190	25	18	0/14",1,(1) 0.13	CH	gray, very moist, soft — FAT CLAY W/SILTY SAND LENSES & LAYERS TO 2.5" THICK								
4185	30	18	0/18",(0) 0.09	CH	gray, very moist, very soft								
		16	Pushed 0.15	CH (A-7-6(37))	gray, very moist, soft	65.7	57.8	59	32	0	2	98	CT UC
4180	35	18	0/18",(0) 0.11	CH	dk. gray, very moist, very soft — FAT CLAY W/OCCASIONAL CLAY LENSES								
4175	40	13	Pushed 0.42	CH (A-7-6(52))	gray, moist, firm	62.8	61.8	72	44	0	0	100	CT
4170	45	13	2,8,8,(18) 0.57 0.38	CH	greenish-gray, moist, firm to stiff — FAT CLAY W/SILTY SAND LAYERS TO 6" THICK								
4165													

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-17-634

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)
CLIENT: UTAH DEPARTMENT OF TRANSPORTATION
LOCATION: N 386,851, E 64,610
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING W/TRICONE BIT
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ∇ 2.0' **AFTER 24 HOURS:** ▼ 0.5'

PROJECT NUMBER: 200601.117
DATE STARTED: 4/3/06
DATE COMPLETED: 4/10/06
GROUND ELEVATION: 4214.6'
LOGGED BY: N.B., C.S., J.B.

Elev. (ft)	Depth (ft)	Sample Rec. (in)	Sample See Legend	Sample USCS (AASHTO)	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
		18	Pushed 0.34	CH (A-7-6(33))	greenish-gray, moist, firm	FAT CLAY W/SILTY SAND LAYERS TO 6" THICK	73	49.7	53	28	0	0	100	CT UC
4160	55	20	0,0,0,(0) 0.56, 0.46	CL	greenish-gray, moist, firm to stiff									
4155	60	15	Pushed 0.47	CL (A-7-6(26))	greenish-gray, moist, firm	LEAN CLAY W/SILT LENSES 1" TO 2" APART	78.6	38	46	23	0	1	99	CT
4150	65	20	0,0,0,(0) 0.48	CL	greenish-gray, moist, firm									
4145	70	18	Pushed 0.53	CH (A-7-6(35))	greenish-gray, moist, stiff	FAT CLAY W/SILT LENSES 1" TO 2" APART	75.1	43.2	57	30	0	1	99	CT UC
4140	75	13	0,0,0,(0) 0.38 0.37	CH	greenish-gray, moist, firm									
4135	80	20	4,9,6,(13) 0.88	ML	greenish-gray, moist, med. dense	SANDY SILT								
				CL	greenish-gray, moist, stiff									
4130	85	17	Pushed 0.82	CL (A-6(14))	greenish-gray, moist, stiff	LEAN CLAY	90.3	32	37	13	0	4	96	CT
4125	90	18	3,10,10,(16)	SM (A-2-4(0))	greenish-gray, wet, med. dense	SILTY SAND		21.9		NP	0	75	25	
4120	95	16	1,1,7,(6) 0.60 0.67	SM	dk. gray, wet									
				CL	greenish-gray, moist, stiff	SANDY LEAN CLAY								
						LEAN CLAY W/SILT LENSES 1" TO 6" APART								
4115														

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

RB&G ENGINEERING INC.
PROVO, UTAH

DRILL HOLE LOG

BORING NO. RSB-17-634

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)
CLIENT: UTAH DEPARTMENT OF TRANSPORTATION
LOCATION: N 386,851, E 64,610
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING W/TRICONE BIT
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ∇ 2.0' **AFTER 24 HOURS:** 0.5'
PROJECT NUMBER: 200601.117
DATE STARTED: 4/3/06
DATE COMPLETED: 4/10/06
GROUND ELEVATION: 4214.6'
LOGGED BY: N.B., C.S., J.B.

Elev. (ft)	Depth (ft)	Type	Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description		Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plast. Index	Gravel (%)	Sand (%)	Silt/Clay (%)	Other Tests
		Pushed	17	Pushed 0.52	CL (A-7-6(25))	greenish-gray, moist, stiff	LEAN CLAY W/SILT LENSES 1" TO 6" APART	69.4	49.6	49	21	0	1	99	CT UC
4110	105	Disturbed	18	0,0,2,(1) 0.53	CL	greenish-gray, moist, stiff									
4105	110	Pushed	13	Pushed 0.53	CL	greenish-gray, moist, stiff									
4100	115	Disturbed	20	0,4,10,(10) 0.62	CL	greenish-gray, moist, stiff									
				0.59	ML (A-2-4(5))	greenish-gray, wet, med. dense	PLASTIC SANDY SILT		24.3	32	7	0	25	75	
4095	120	Pushed	18	Pushed 0.56	ML	~~dk. greenish-gray, wet, med. dense~~	~~SANDY SILT~~								
					CL	lt. brown, moist, stiff	LEAN CLAY								
4090	125	Disturbed	18	2,12,31,(30)	SP-SM (A-1-b(0))	dk. gray to greenish-gray, wet, dense	SAND W/SILT		20.5		NP	0	94	6	
4085	130	Pushed	15	Pushed 1.65	CL/CH (A-7-6(29))	greenish-gray, moist, very stiff	LEAN TO FAT CLAY		23.5	50	28	0	7	93	
4080	135	Disturbed	21	0,0,4,(3) 0.86 0.71	CL (A-7-6(33))	greenish-gray, moist, stiff	LEAN CLAY W/SILT & SILTY SAND LAYERS		33.5	49	30	0	1	99	
4075	140	Pushed	17	Pushed 0.57	CL	greenish-gray, moist, stiff									
4070	145	Disturbed	15	0.39	CL	greenish-gray, moist, firm									
				11,29,33,(39)	SM	gray to lt. brown, wet, dense	SILTY SAND								
4065															

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-17-634

PROJECT: LEGACY PARKWAY - STRUCTURE F-719 (1250 W. OVER LEGACY PKWY)

CLIENT: UTAH DEPARTMENT OF TRANSPORTATION

LOCATION: N 386,851, E 64,610

DRILLING METHOD: CME-55 NO. 1 / N.W. CASING W/TRICONE BIT

DRILLER: T. KERN

DEPTH TO WATER - INITIAL: ▽ 2.0' **AFTER 24 HOURS:** ▼ 0.5'

PROJECT NUMBER: 200601.117

DATE STARTED: 4/3/06

DATE COMPLETED: 4/10/06

GROUND ELEVATION: 4214.6'

LOGGED BY: N.B., C.S., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Rec. (in)	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
			Pushed (undisturbed)	13	Pushed *0.64*	SM *(A-1-b(0))*	gray, wet, med. dense	SILTY SAND		17		NP	0	79	21	
						CL	gray, moist, stiff	LEAN CLAY W/SAND LENSES 0.25" TO 4" APART								
4060	155		Disturbed	15	5,11,26,(23) *0.15*	CL	gray, moist, soft									
4055	160		Pushed (undisturbed)	8	Pushed	SM	gray, wet, med. dense	SILTY SAND W/CLAY LAYERS TO 4.5" THICK & 8" TO 12" APART								
4050	165		Disturbed	16	8,14,21,(21) *0.73*	SM *(A-4(0))*	gray, wet, dense			21.9		NP	0	62	38	
4045	170		Pushed (undisturbed)	21	Pushed *0.48*	CH *(A-7-6(70))*	brown, moist, firm	FAT CLAY W/SAND LAYERS TO 4" THICK & 8" TO 12" APART	61.7	61.4	90	59	0	1	99	CT
4040	175		Disturbed	20	0/11",1,8,(5) *0.54* *0.74*	CH	gray, moist, stiff									
4035	180															
4030	185															
4025	190															
4020	195															
4015																

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

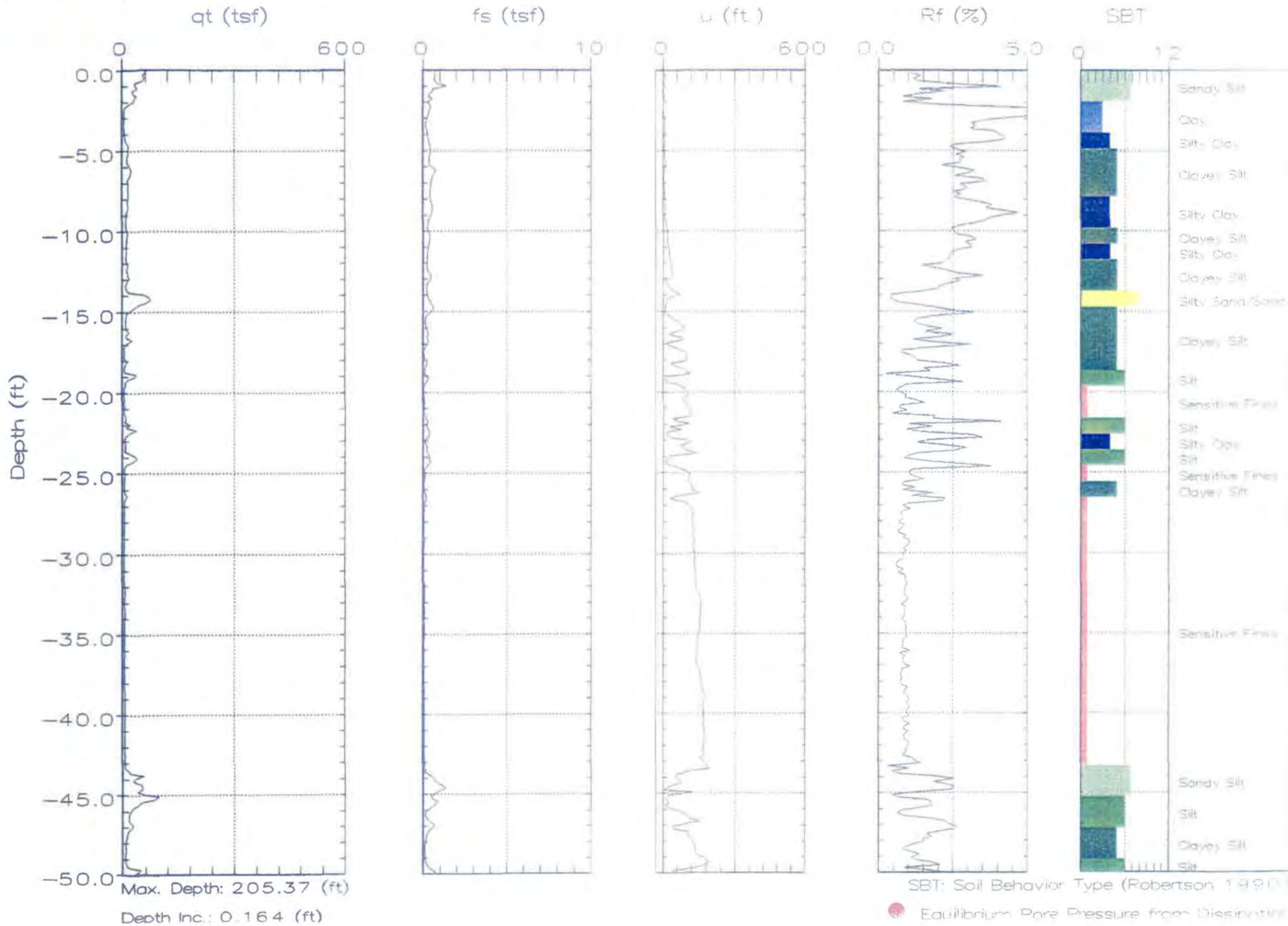
RB&G ENGINEERING INC.
PROVO, UTAH

CONETEC

RB&G Engineering

HOLE NO: RSC-17-631
LOCATION: N 386,920' E 64,663'
ELEVATION: 4215.0'

Cone: 20 Ton St 122
Date:04-26-06 11:31

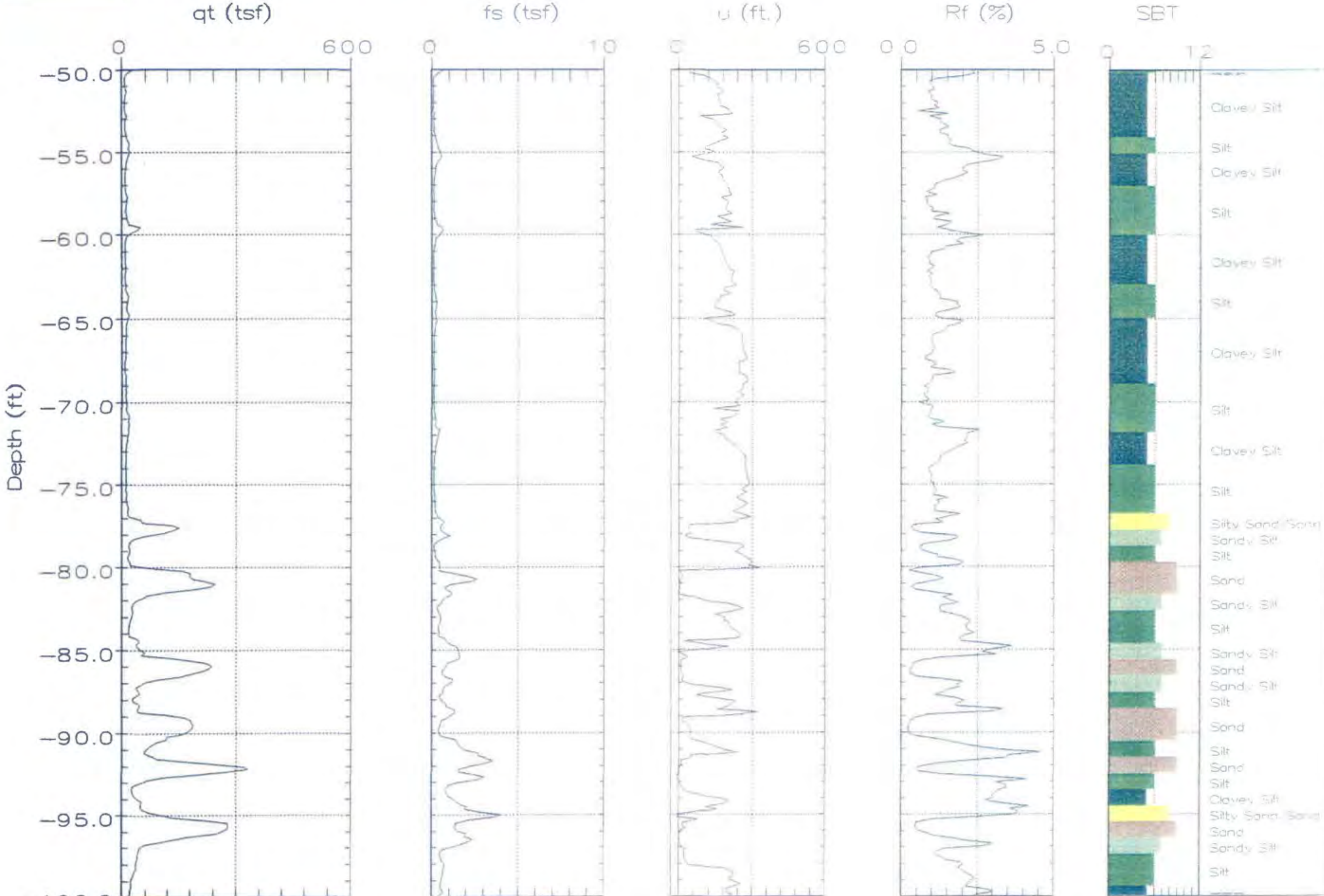


CONETEC

RB&G Engineering

HOLE NO: RSC-17-631
LOCATION: N 386,920' E 64,663'
ELEVATION: 4215.0'

Cone: 20 Ton St 122
Date:04:26:06 11:31



Max. Depth: 205.37 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

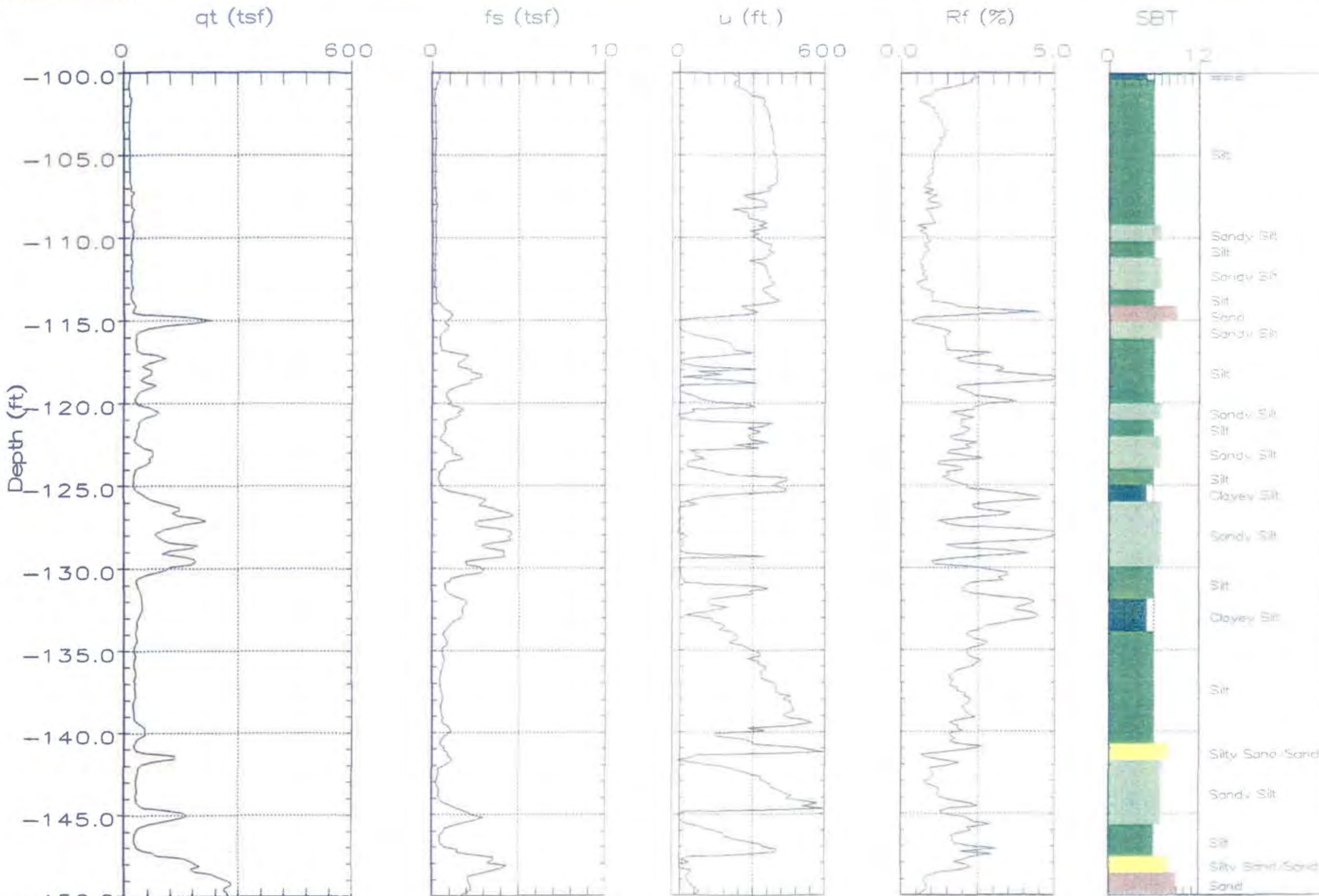
Equilibrium Pore Pressure from Dissipation

CONETEC

RB&G Engineering

HOLE NO: RSC-17-631
LOCATION: N 386,920' E 64,663'
ELEVATION: 4215.0'

Cone: 20 Ton St 122
Date:04:26:06 11:31



Max. Depth: 205.37 (ft)
Depth Inc.: 0.164 (ft)

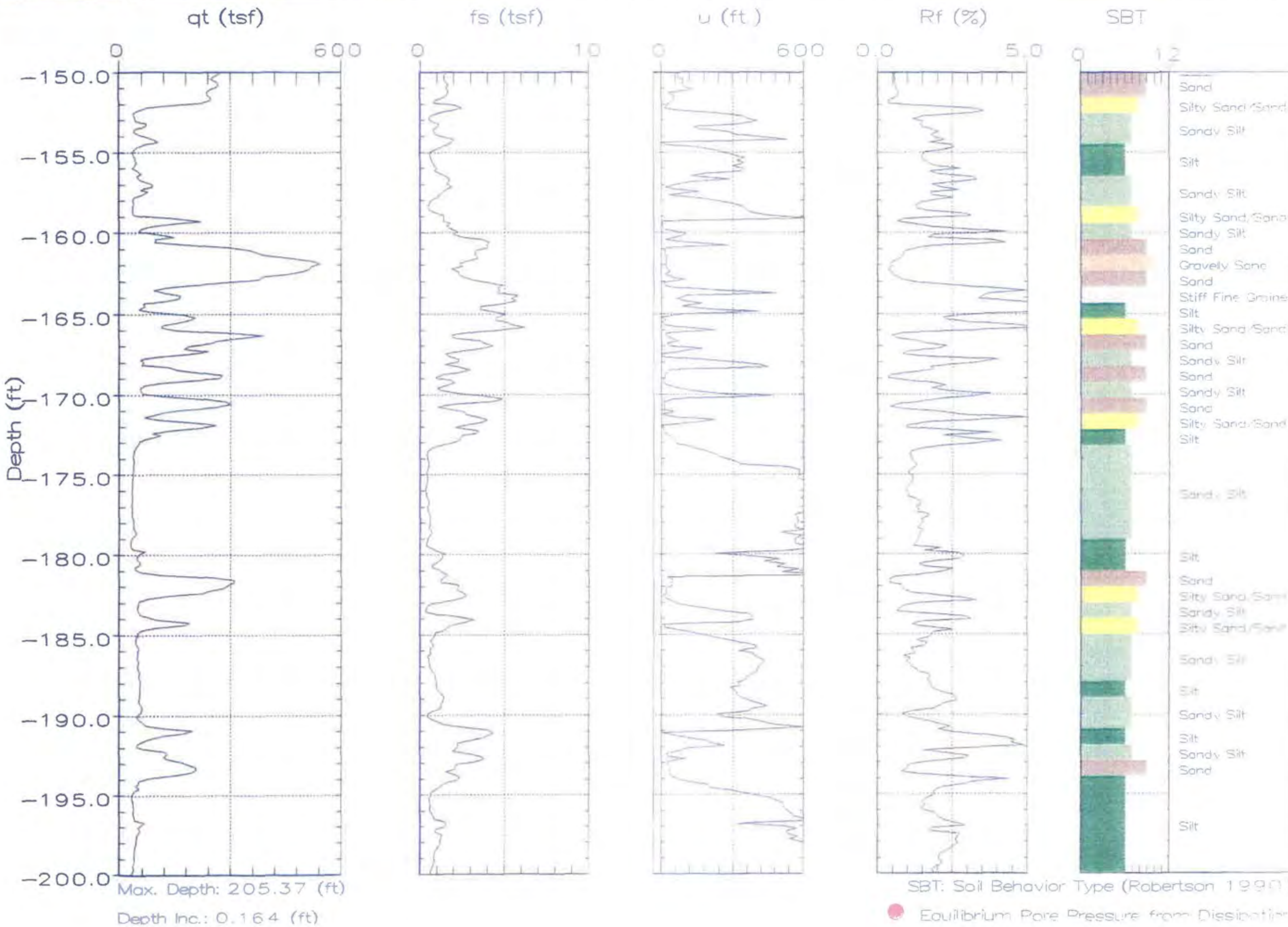
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

CONETEC

RB&G Engineering

HOLE NO: RSC-17-631
LOCATION: N 386,920' E 64,663'
ELEVATION: 4215.0'

Cone: 20 Ton St 122
Date:04:26:06 11:31



CONETEC

RB&G Engineering

HOLE NO: RSC-17-631
LOCATION: N 386,920' E 64,663'
ELEVATION: 4215.0'

Cone: 20 Ton St 122
Date:04:26:06 11:31

Max. Depth: 205.37 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 199

Equilibrium Pore Pressure from

Shear Wave Velocity Calculations

Job No.: 06-345
Client: RB&G Engineering
Hole No. RBC-17-631
Location N 386,920' E 64,663' Elevation: 4215.0'
Date: 4/26/06

Geophone Offset (m): 0.20
Source Offset (18") (m): 0.46

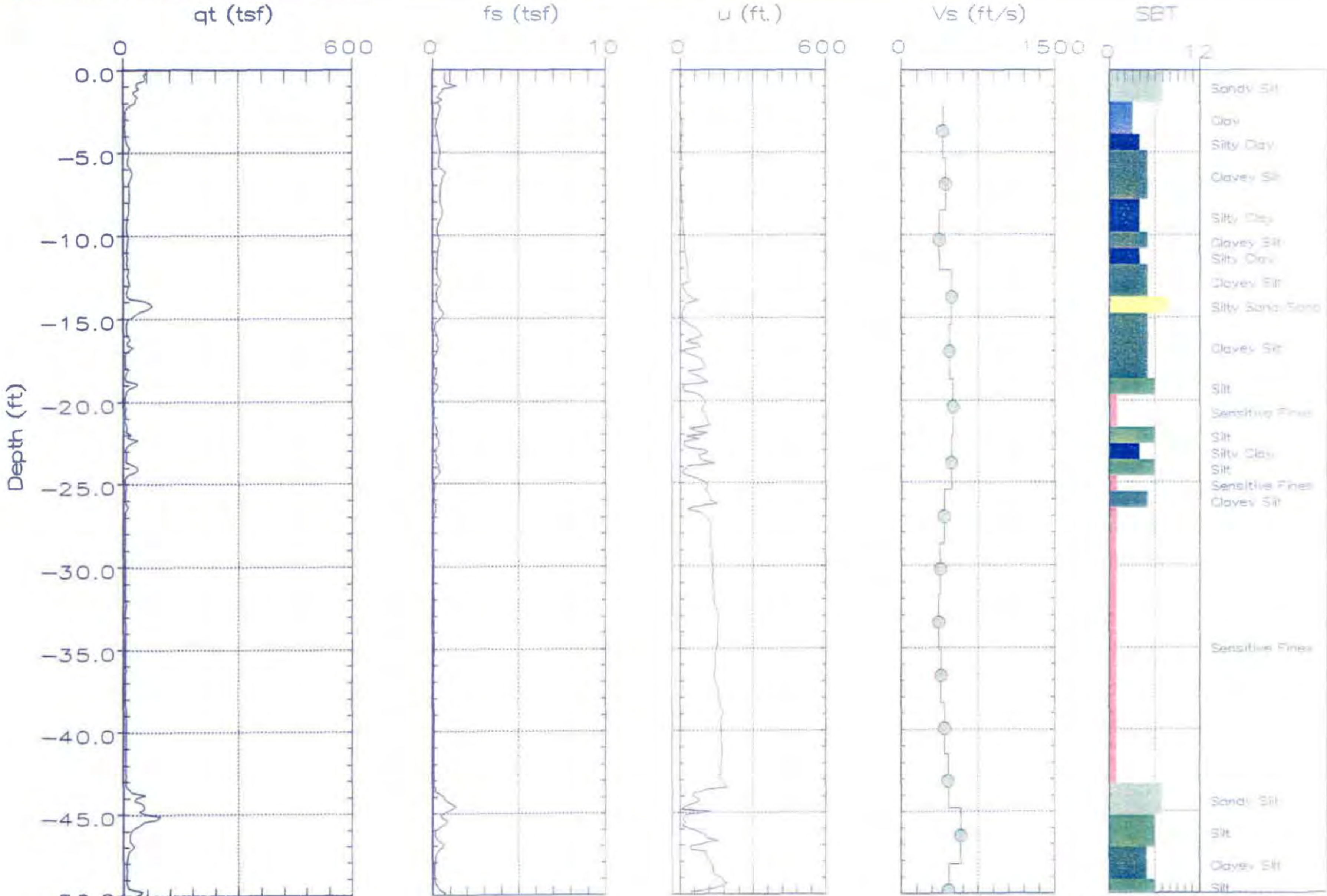
Test Depth (m)	Geophone Depth (m)	Ray Path (m)	Incremental Distance (m)	Time Interval (ms)	Interval Velocity (m/s)	Interval Depth (m)	Interval Velocity (ft/s)	Interval Depth (ft)
0.85	0.65	0.80						
1.85	1.65	1.71	0.92	7.40	124	1.15	406	3.8
2.80	2.60	2.64	0.93	7.01	132	2.12	434	7.0
3.90	3.70	3.73	1.09	9.56	114	3.15	373	10.3
4.90	4.70	4.72	0.99	6.62	150	4.20	493	13.8
5.90	5.70	5.72	1.00	6.94	143	5.20	471	17.1
6.95	6.75	6.77	1.05	6.81	154	6.22	504	20.4
7.95	7.75	7.76	1.00	6.63	151	7.25	494	23.8
8.95	8.75	8.76	1.00	7.80	128	8.25	420	27.1
9.90	9.70	9.71	0.95	8.16	116	9.22	381	30.3
10.90	10.70	10.71	1.00	8.89	112	10.20	369	33.5
11.90	11.70	11.71	1.00	8.42	119	11.20	389	36.7
12.85	12.65	12.66	0.95	7.33	129	12.17	425	39.9
13.85	13.65	13.66	1.00	7.12	140	13.15	460	43.1
14.90	14.70	14.71	1.05	5.88	178	14.17	585	46.5
15.90	15.70	15.71	1.00	7.06	142	15.20	465	49.9
16.90	16.70	16.71	1.00	7.89	127	16.20	416	53.1
17.95	17.75	17.76	1.05	7.71	136	17.22	447	56.5
18.90	18.70	18.71	0.95	6.62	144	18.22	471	59.8
19.90	19.70	19.71	1.00	6.98	143	19.20	470	63.0
20.95	20.75	20.76	1.05	6.90	152	20.22	499	66.3
21.90	21.70	21.70	0.95	6.90	138	21.22	451	69.6
22.90	22.70	22.70	1.00	5.39	185	22.20	608	72.8
23.90	23.70	23.70	1.00	6.55	153	23.20	501	76.1
24.90	24.70	24.70	1.00	8.08	124	24.20	406	79.4
25.90	25.70	25.70	1.00	8.26	121	25.20	397	82.7
26.90	26.70	26.70	1.00	7.36	136	26.20	445	85.9

CONETEC

RB&G Engineering

HOLE NO: RSC-17-631
LOCATION: N 386,920' E 64,663'
ELEVATION: 4215.0'

Cone: 20 Ton St 122
Date:04:26:06 11:51



Max. Depth: 205.37 (ft)
Depth Inc.: 0.164 (ft)

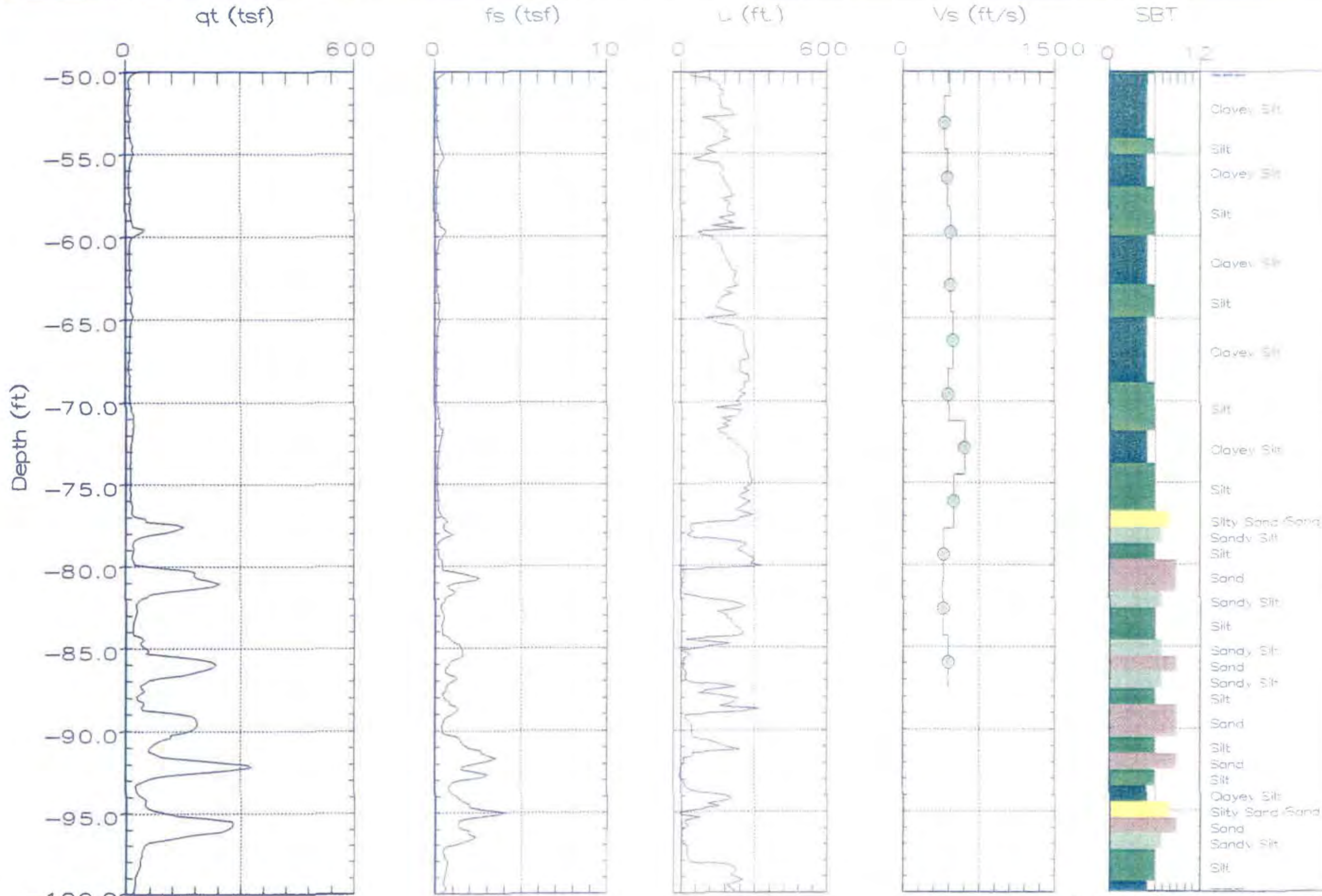
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

CONETEC

RB&G Engineering

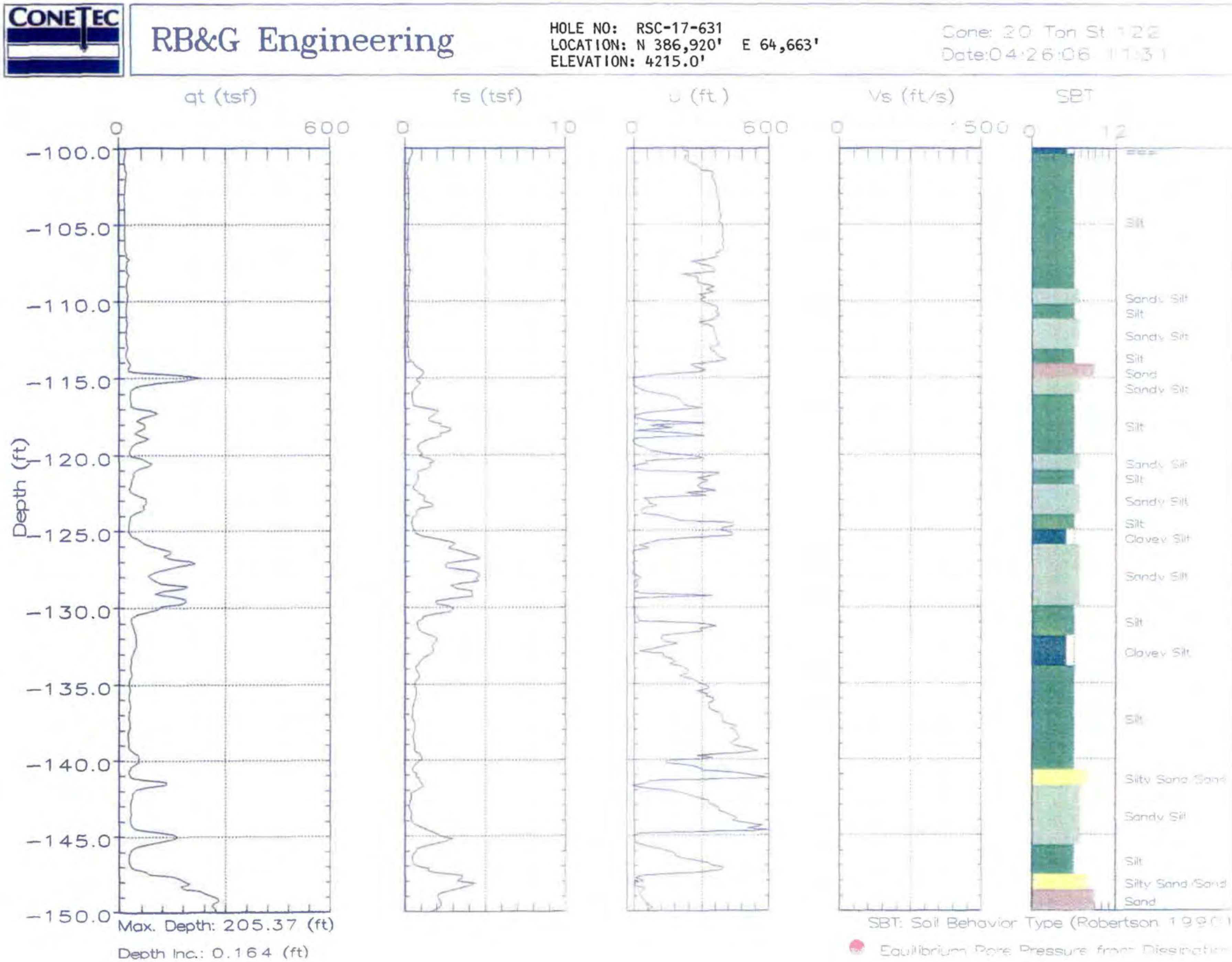
HOLE NO: RSC-17-631
LOCATION: N 386,920' E 64,663'
ELEVATION: 4215.0'

Cone: 20 Ton S1 122
Date:04:26:06 11:31



Max. Depth: 205.37 (ft)
Depth Inc.: 0.164 (ft)

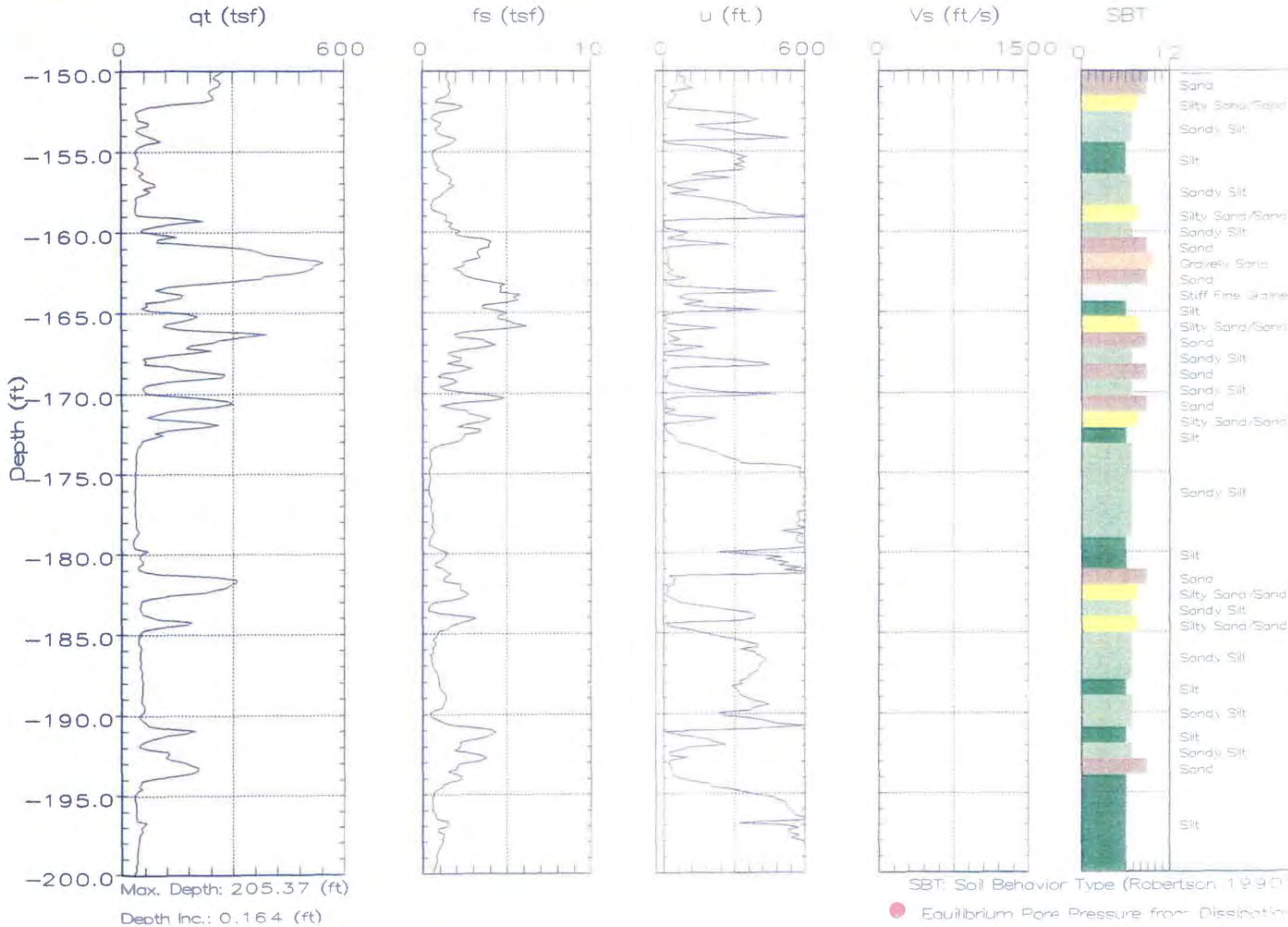
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation


CONETEC
RB&G Engineering
HOLE NO: RSC-17-631
LOCATION: N 386,920' E 64,663'
ELEVATION: 4215.0'
Cone: 20 Ton St 122
Date:04:26:06 11:31
qt (tsf)
fs (tsf)
u (ft)
Vs (ft/s)
SBT
Depth (ft)
Silt
Sandy Silt
Sand
Clayey Silt
Silty Sand/Sand
Max. Depth: 205.37 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

RB&G Engineering

HOLE NO: RSC-17-631
LOCATION: N 386,920' E 64,663'
ELEVATION: 4215.0'

Cone: 20 Ton St
Date:04:26:06

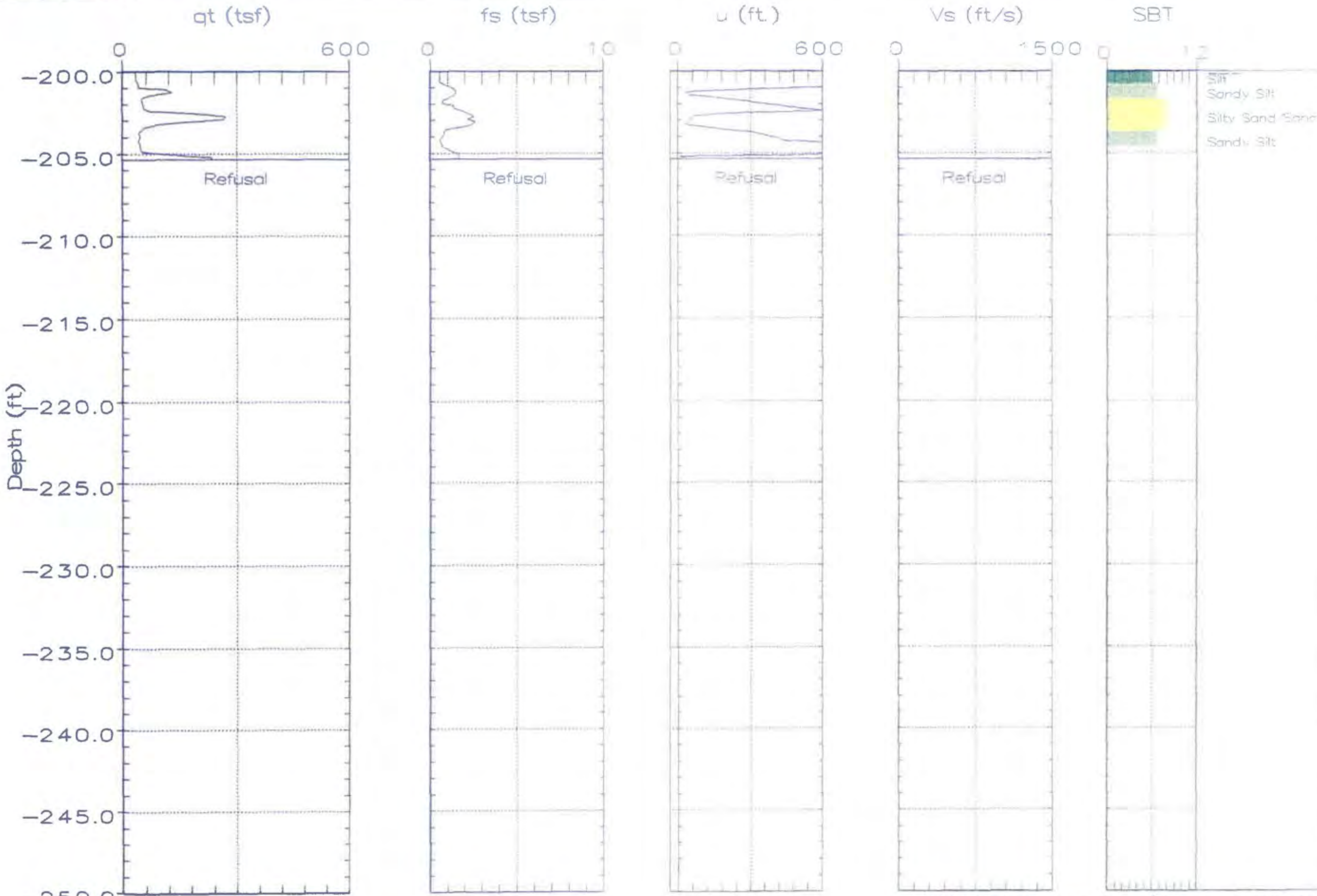


CONETEC

RB&G Engineering

HOLE NO: RSC-17-631
LOCATION: N 386,920' E 64,663'
ELEVATION: 4215.0'

Cone: 20 Ton St 122
Date:04:26:06 11:31



Max. Depth: 205.37 (ft)
Depth Inc.: 0.164 (ft)

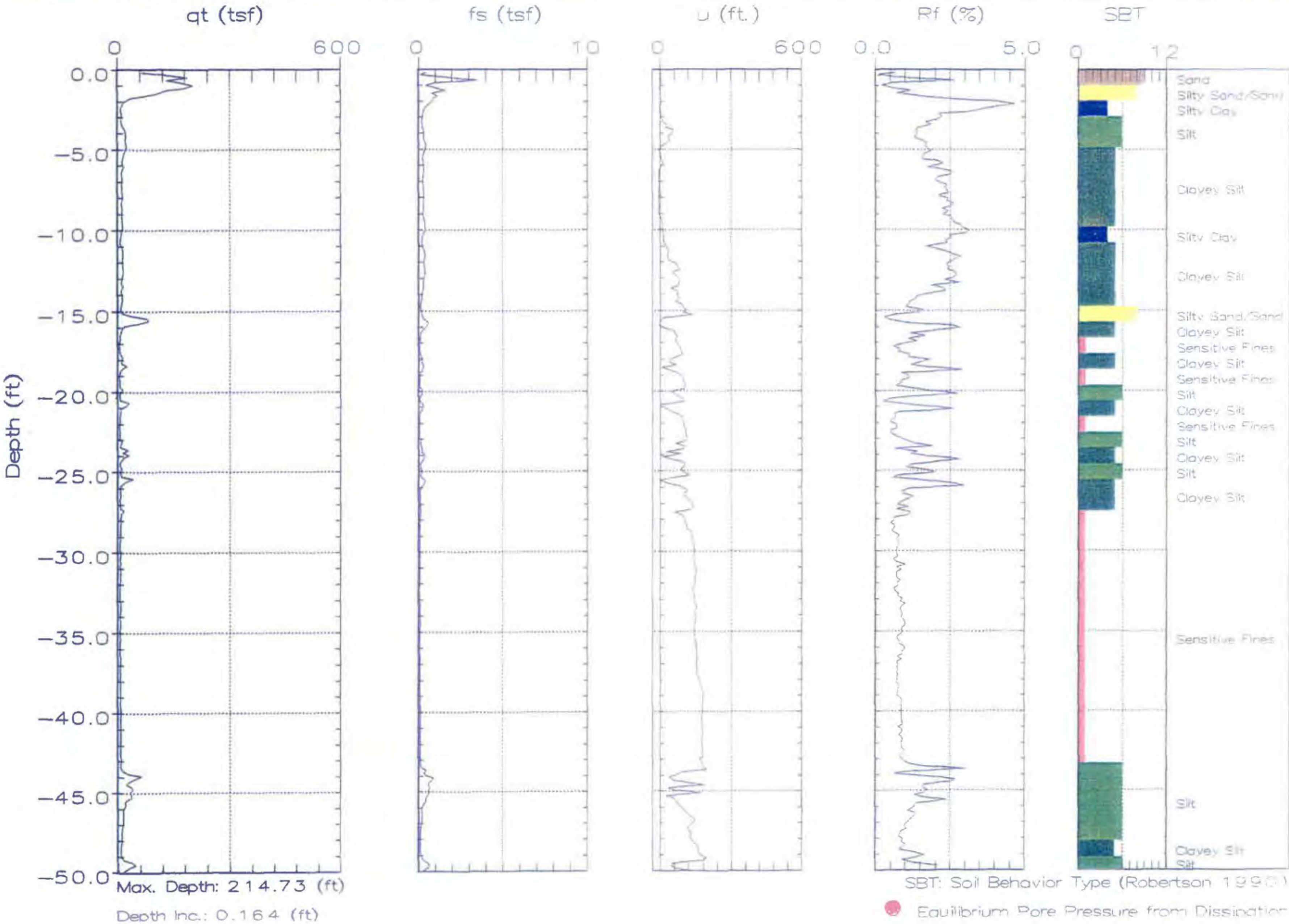
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

CONETEC

RB&G Engineering

HOLE NO.: RSC-17-633
LOCATION: N 386,991' E 64,620'
ELEVATION: 4215.2'

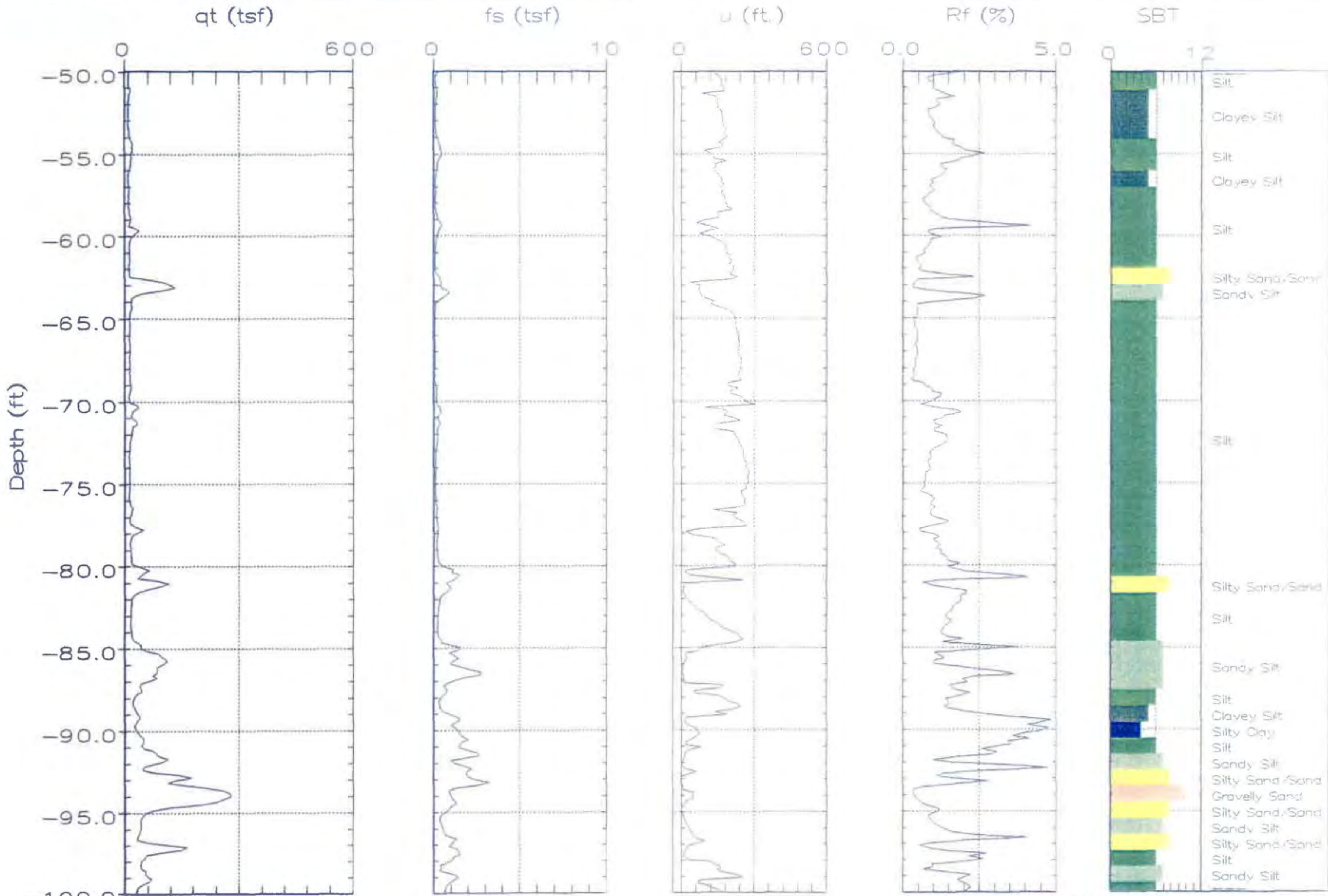
Cone: 20 Ton St 122
Date:04:26:06 09:06



ConeTec RB&G Engineering

HOLE NO.: RSC-17-633
LOCATION: N 386,991' E 64,620'
ELEVATION: 4215.2'

Cone: 20 Ton St * 22
Date:04:26:06 09:06



Max. Depth: 214.73 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

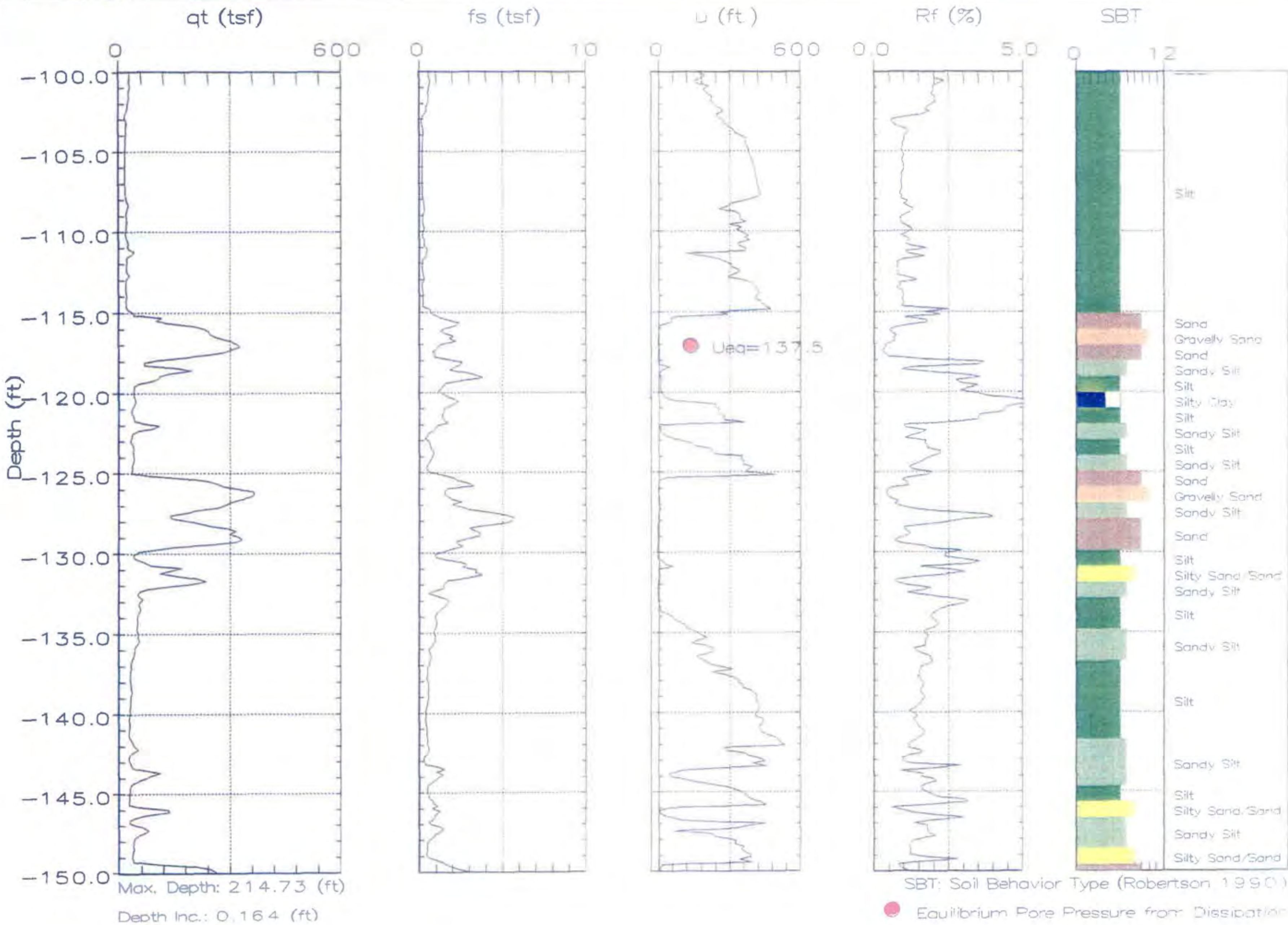
Equilibrium Pore Pressure from Dissipation

CONETEC

RB&G Engineering

HOLE NO.: RSC-17-633
LOCATION: N 386,991' E 64,620'
ELEVATION: 4215.2'

Cone: 20 Ton St 122
Date:04:26:06 09:06

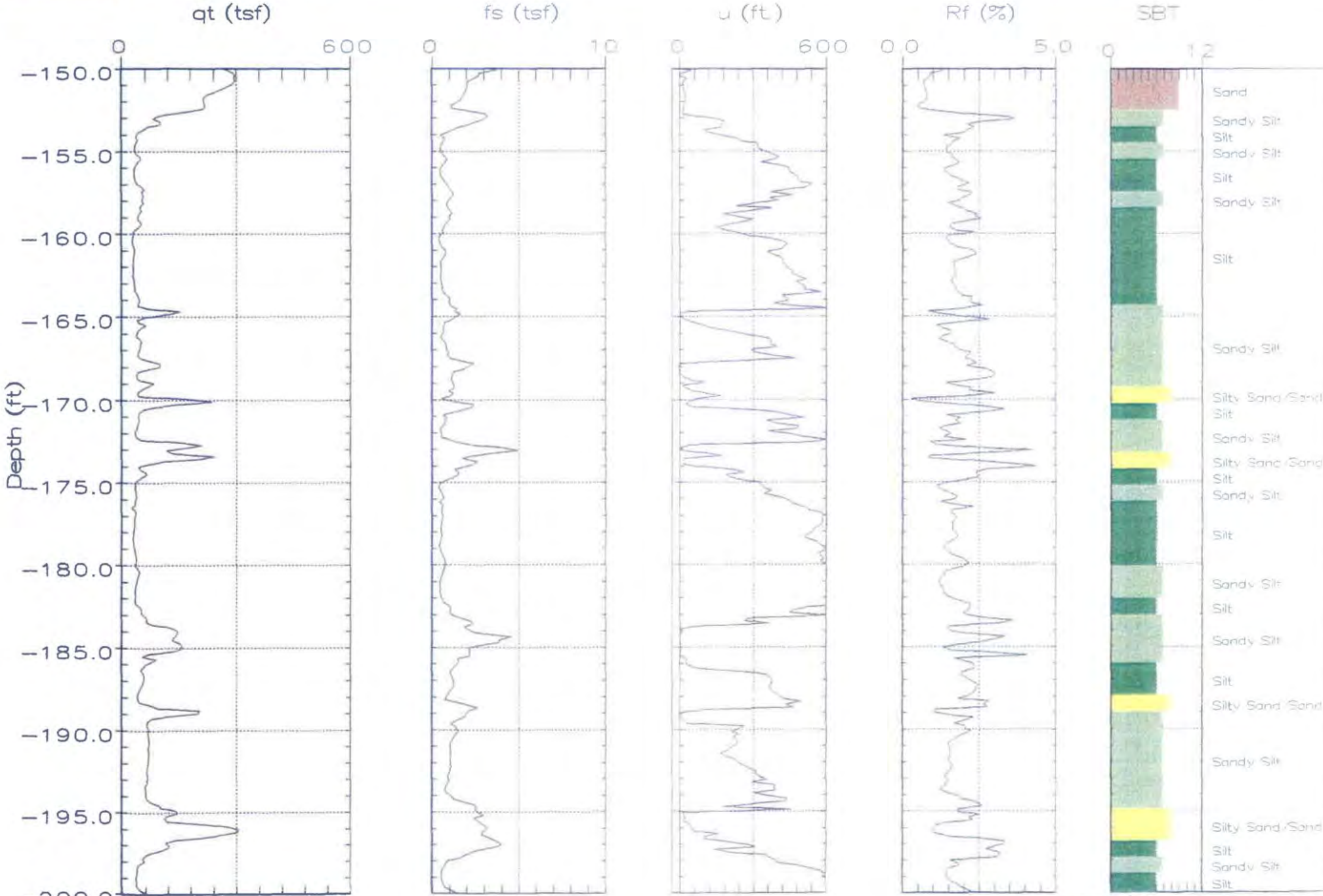


CONETEC

RB&G Engineering

HOLE NO.: RSC-17-633
LOCATION: N 386,991' E 64,620'
ELEVATION: 4215.2'

Cone: 20 Ton St 122
Date:04:26:06 09:06



Max. Depth: 214.73 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

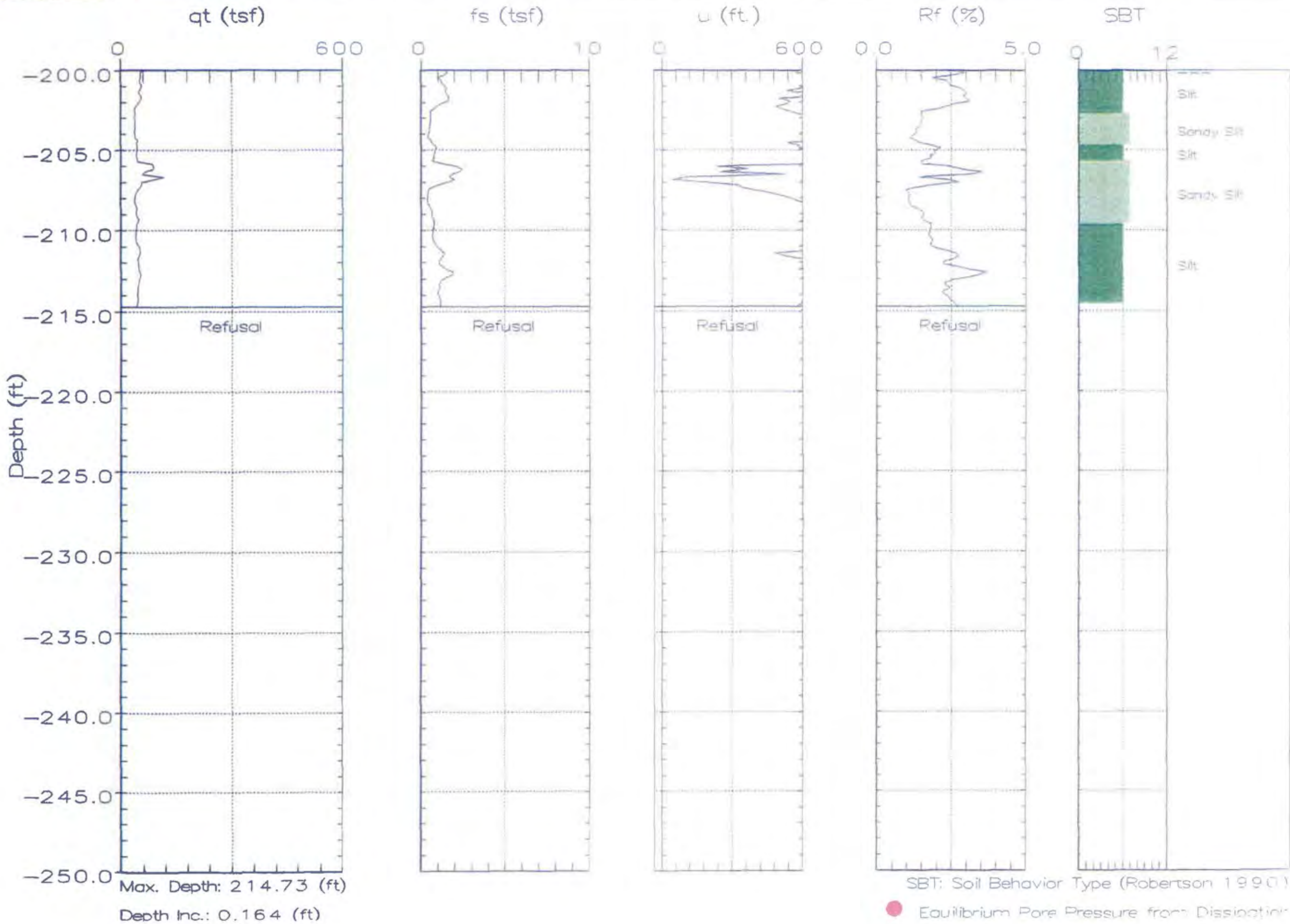
Equilibrium Pore Pressure from Dissipation

CONETEC

RB&G Engineering

HOLE NO.: RSC-17-633
LOCATION: N 386,991' E 64,620'
ELEVATION: 4215.2'

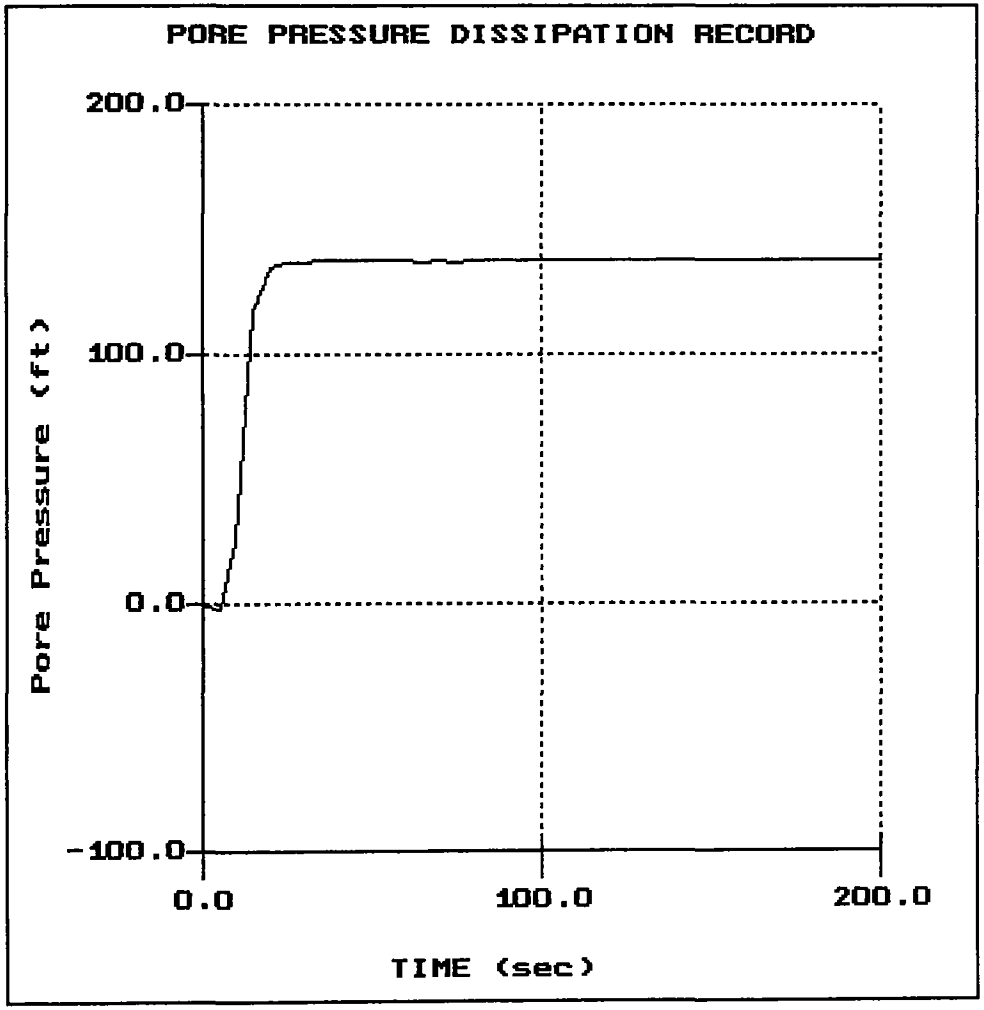
Cone: 20 Ton St 122
Date:04:26:06 09:06



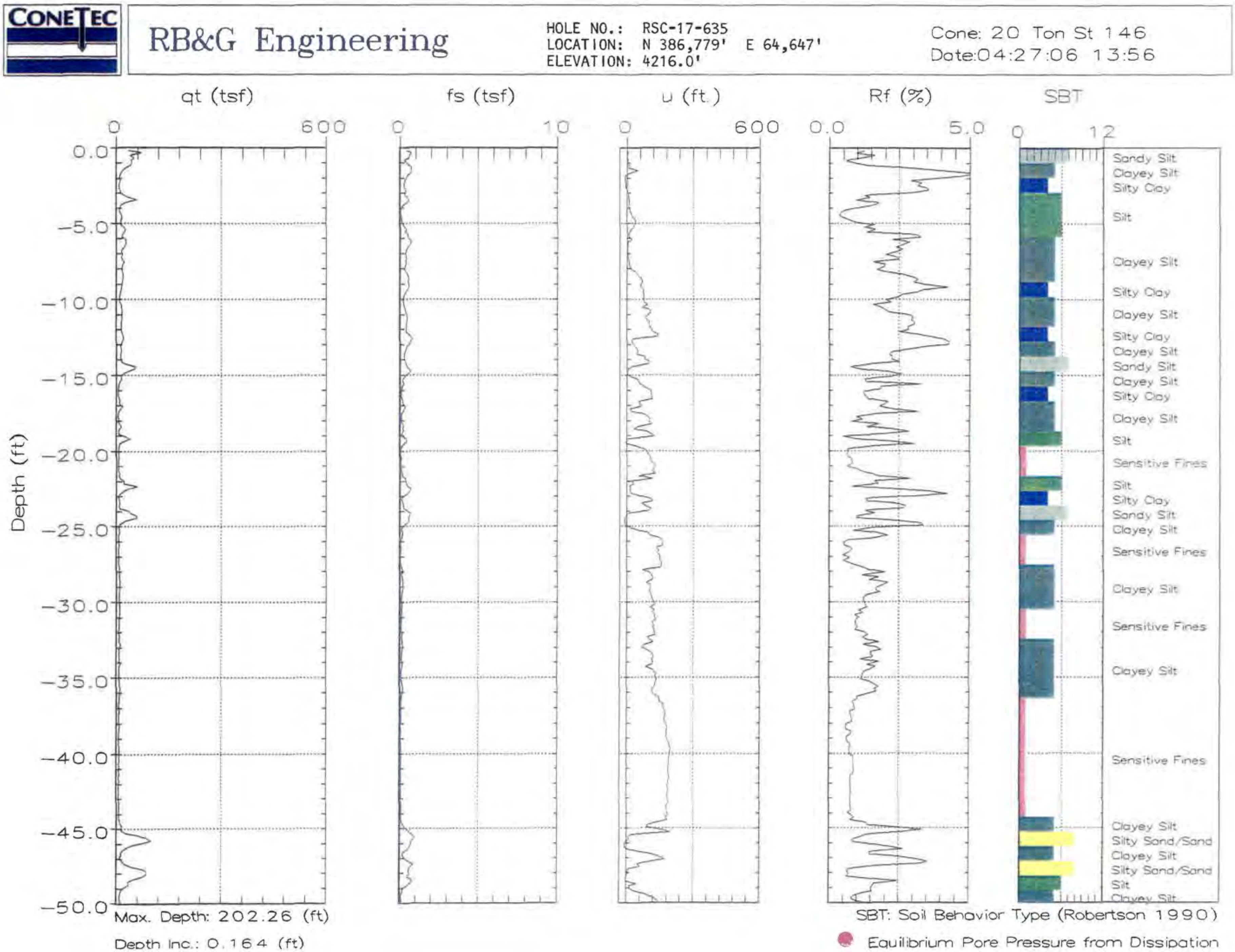
RB&G Engineering

HOLE NO.: RSC-17-633
LOCATION: N 386,991' E 64,620'
ELEVATION: 4215.2'

Cone: 20 Ton St 122
Date:04:26:06 09:06



File: 345CP01.PPD
Depth (m): 35.70
(ft): 117.13
Duration : 200.0s
U-min: -2.06 5.0s
U-max: 137.55 200.0s

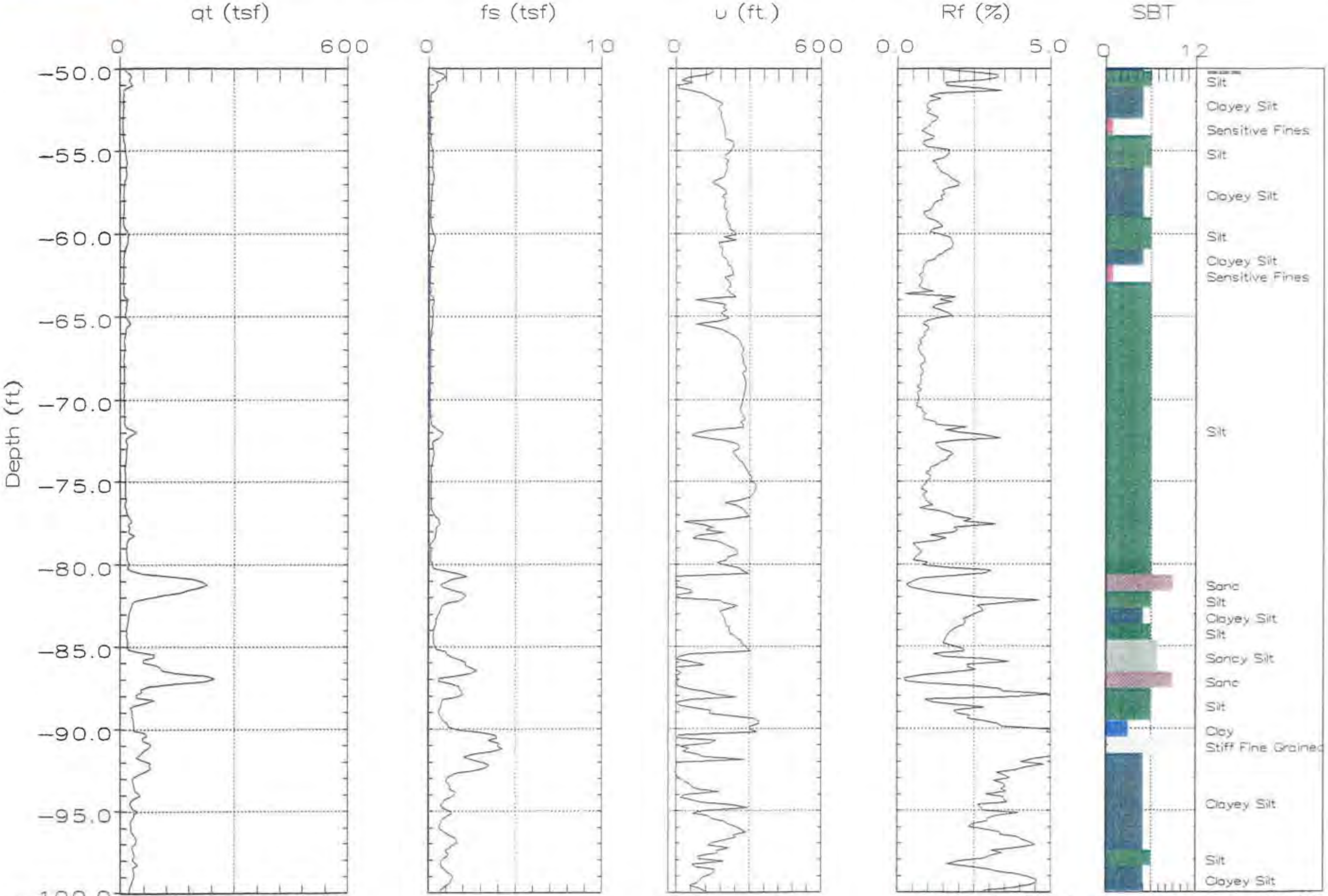


CONETEC
RB&G Engineering
HOLE NO.: RSC-17-635
LOCATION: N 386,779' E 64,647'
ELEVATION: 4216.0'
Cone: 20 Ton St 146
Date:04:27:06 13:56
qt (tsf)
fs (tsf)
u (ft.)
Rf (%)
SBT
0
600
0
10
0
600
0.0
5.0
0
12
Depth (ft)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
Sandy Silt
Clayey Silt
Silty Clay
Silt
Clayey Silt
Silty Clay
Clayey Silt
Silty Clay
Clayey Silt
Sandy Silt
Clayey Silt
Silty Clay
Clayey Silt
Silt
Sensitive Fines
Silt
Silty Clay
Sandy Silt
Clayey Silt
Sensitive Fines
Clayey Silt
Sensitive Fines
Clayey Silt
Sensitive Fines
Clayey Silt
Silty Sand/Sand
Clayey Silt
Silty Sand/Sand
Silt
Clayey Silt
Max. Depth: 202.26 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

RB&G Engineering

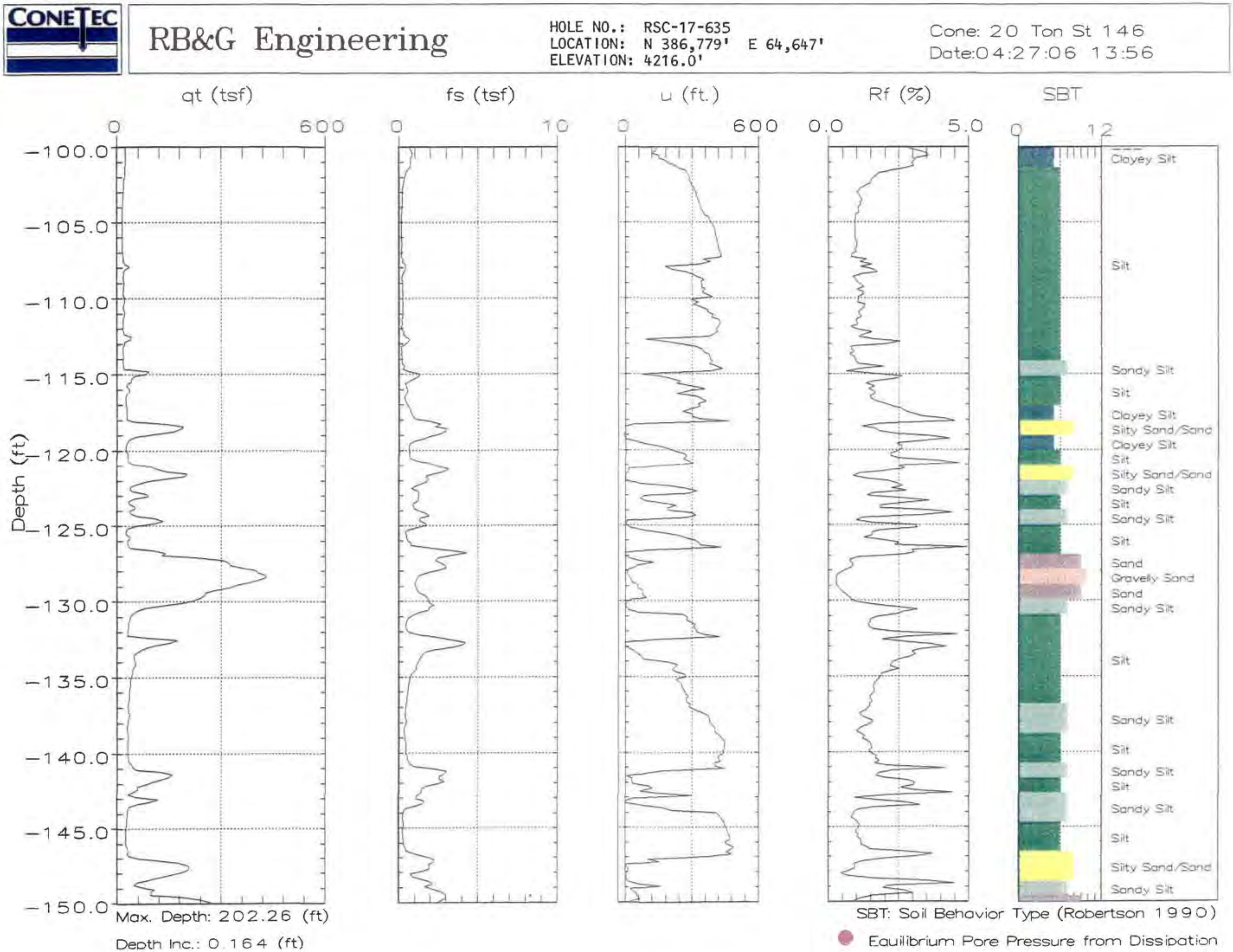
HOLE NO.: RSC-17-635
LOCATION: N 386,779' E 64,647'
ELEVATION: 4216.0'

Cone: 20 Ton St 146
Date:04:27:06 13:56



Max. Depth: 202.26 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

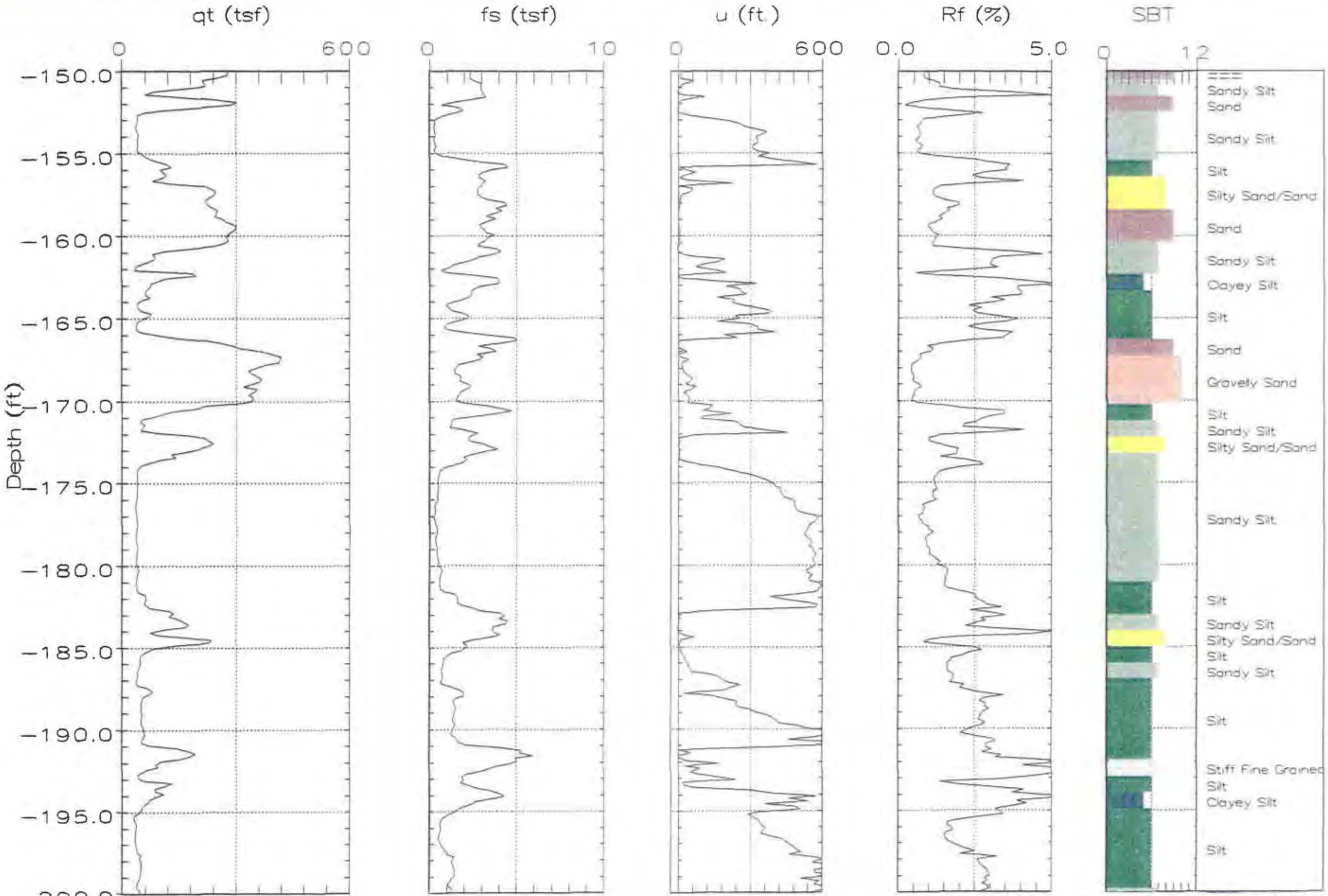

CONETEC
RB&G Engineering
HOLE NO.: RSC-17-635
LOCATION: N 386,779' E 64,647'
ELEVATION: 4216.0'
Cone: 20 Ton St 146
Date:04:27:06 13:56
qt (tsf)
fs (tsf)
u (ft.)
Rf (%)
SBT
Depth (ft)
Clayey Silt
Silt
Sandy Silt
Silty Sand/Sand
Sand
Gravelly Sand
Max. Depth: 202.26 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

CONETEC

RB&G Engineering

HOLE NO.: RSC-17-635
LOCATION: N 386,779' E 64,647'
ELEVATION: 4216.0'

Cone: 20 Ton St 146
Date:04:27:06 13:56



Max. Depth: 202.26 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

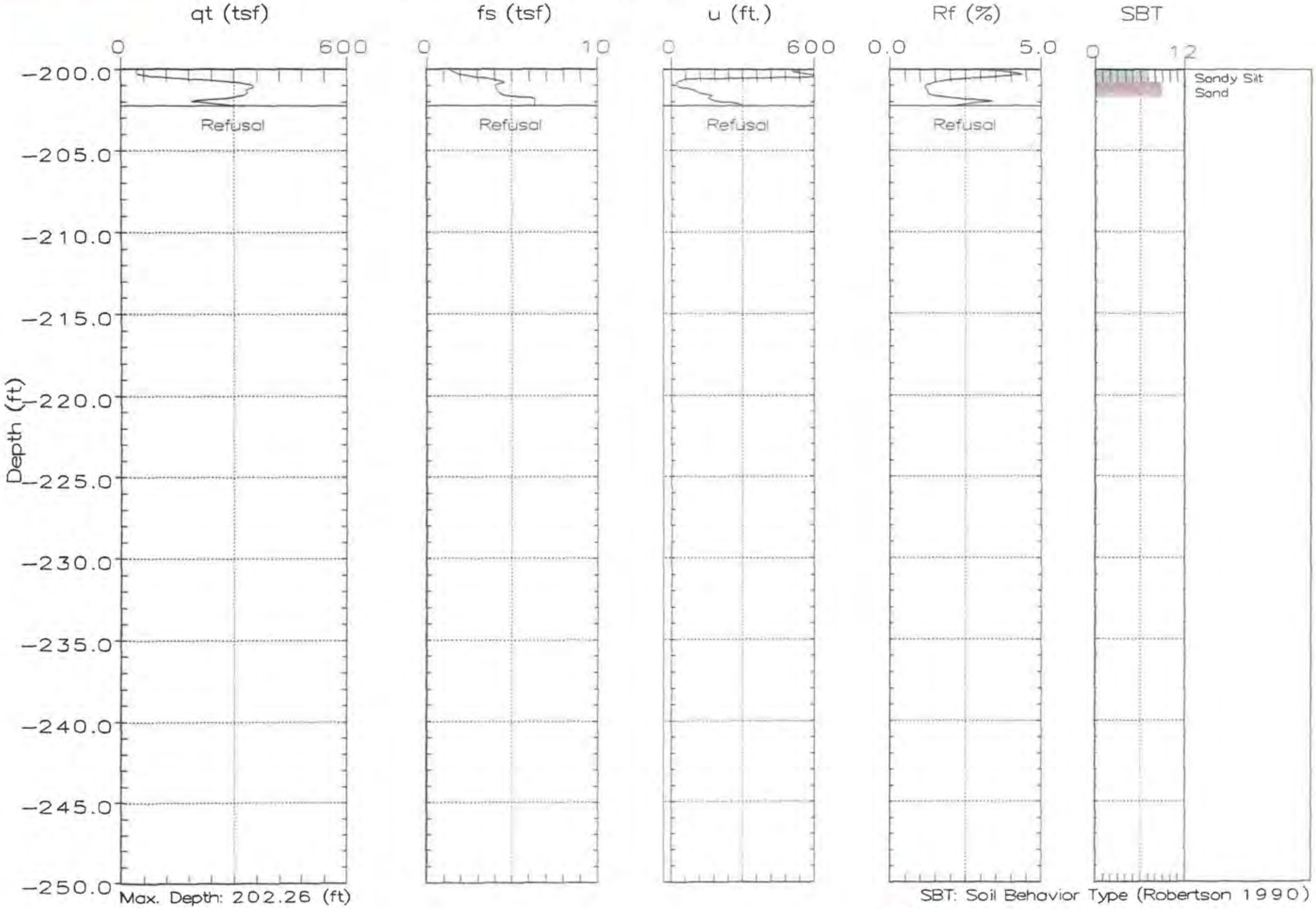
Equilibrium Pore Pressure from Dissipation

CONETEC

RB&G Engineering

HOLE NO.: RSC-17-635
LOCATION: N 386,779' E 64,647'
ELEVATION: 4216.0'

Cone: 20 Ton St 146
Date:04:27:06 13:56



Max. Depth: 202.26 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

APPENDIX C
Laboratory Testing

Table 1

SUMMARY OF TEST DATA

PROJECT	Legacy Parkway	PROJECT NO.	200601-117
LOCATION	Structure F-719 (1250 West over Legacy Parkway)	FEATURE	Foundations

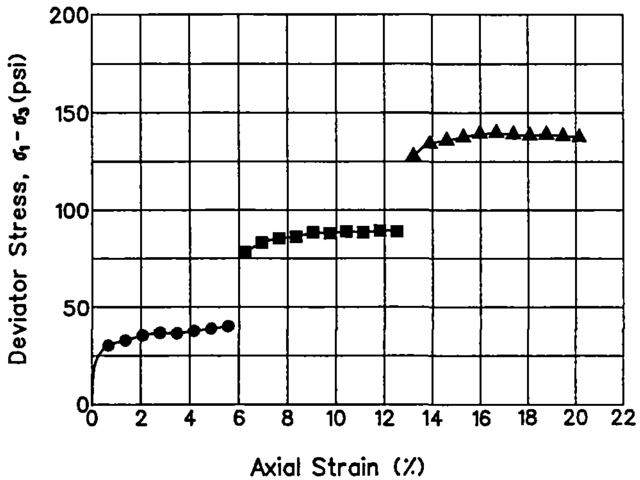
HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM / (AASHTO Classification)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
RSB-17-630	5-6.5	Shelby	100.3	25.3	807	26	25	1	10	11	79	ML / A-4(0)
	10-11.5	3		28.2		38	20	18	1	4	95	CL / A-6(18)
	16.3-17.8	1/18"		27.8				NP	0	77	13	SM / A-2-4(0)
	31-32.5	Shelby	80.7	39.9	654	40	21	19	0	2	98	CL / A-6(20)
	36.5-38	Shelby	73.5	47.8	1124	42	22	20	0	5	95	CL / A-7-6(21)
	45-46.5	Shelby		17.0				NP	0	98	2	SP / A-1-b(0)
	55-56.5	Shelby	85.4	34..7	2560	46	24	22	0	2	98	CL / A-7-6(25)
	70-71.5	Shelby		44.7	1224	56	25	31	0	11	89	CH / A-7-6(31)
	80-81.5	Shelby	74.8	44.2	1990	51	23	28	0	4	96	CH / A-7-6(30)
	90-91.5	Shelby		23.7		33	22	11	0	24	76	CL / A-6(7)
	95-96.5	27		18.3				NP	0	76	24	SM / A-2-4(0)
	105-106.5	Shelby	66.4	51.8	2913	58	25	33	0	0	100	CH / A-7-6(38)
	129-130.5	21		25.8		30	20	10	0	18	82	CL / A-4(7)
	140-141.5	Shelby	79.4	37.0	3465	60	23	37	0	1	99	CH / A-7-6(42)
	154-155.5	62		17.7				NP	0	79	21	SM / A-1-b(0)
	170-171.5	16		24.6				NP	0	51	49	SM / A-4(0)
RSB-17-632	5-6.5	5		31.6		35	20	15	0	11	89	CL / A-6(13)
	10-11.5	Shelby	90.4	28.5	1400	37	20	17	0	9	91	CL / A-6(16)
	26.5-28	Shelby	78.6	42.4	477	42	21	21	0	9	91	CL / A-7-6(20)
	35-36.5	Shelby	72.5	47.7		40	24	16	0	12	88	CL / A-6(15)
	45-46.5	Shelby	76.4	44.9	1078	46	23	23	0	2	98	CL / A-7-6(25)
	55-56.5	Shelby	88.9	31.7		39	23	16	0	5	95	CL / A-6(17)
	65-66.5	Shelby	78.1	44.4	1893	48	22	26	0	5	95	CL / A-7-6(27)
	75-76.5	Shelby	81.6	38.7		57	26	31	0	4	96	CH / A-7-6(31)
	95-96.5	Shelby	85.3	33.6	1428	56	23	33	0	3	97	CH / A-7-6(36)
	105-106.7	Shelby	82.5	37.7		39	21	18	0	2	98	CL / A-6(19)
	116.5-118	10		26.6				NP	0	91	9	SP-SM / A-3
	127-128.5	Shelby	93.4	26.0	4695	56	20	36	0	1	99	CH / A-7-6(40)
	135-136.5	Shelby		24.0				NP	0	27	73	ML / A-4(0)
	151-152.5	Shelby	91.7	29.1		33	20	13	0	34	66	CL / A-6(7)
	165-166.5	35		21.2				NP	1	69	30	SM / A-2-4
	170-171.5	Shelby	49.7	81.6		91	34	57	0	1	99	CH / A-7-6(69)

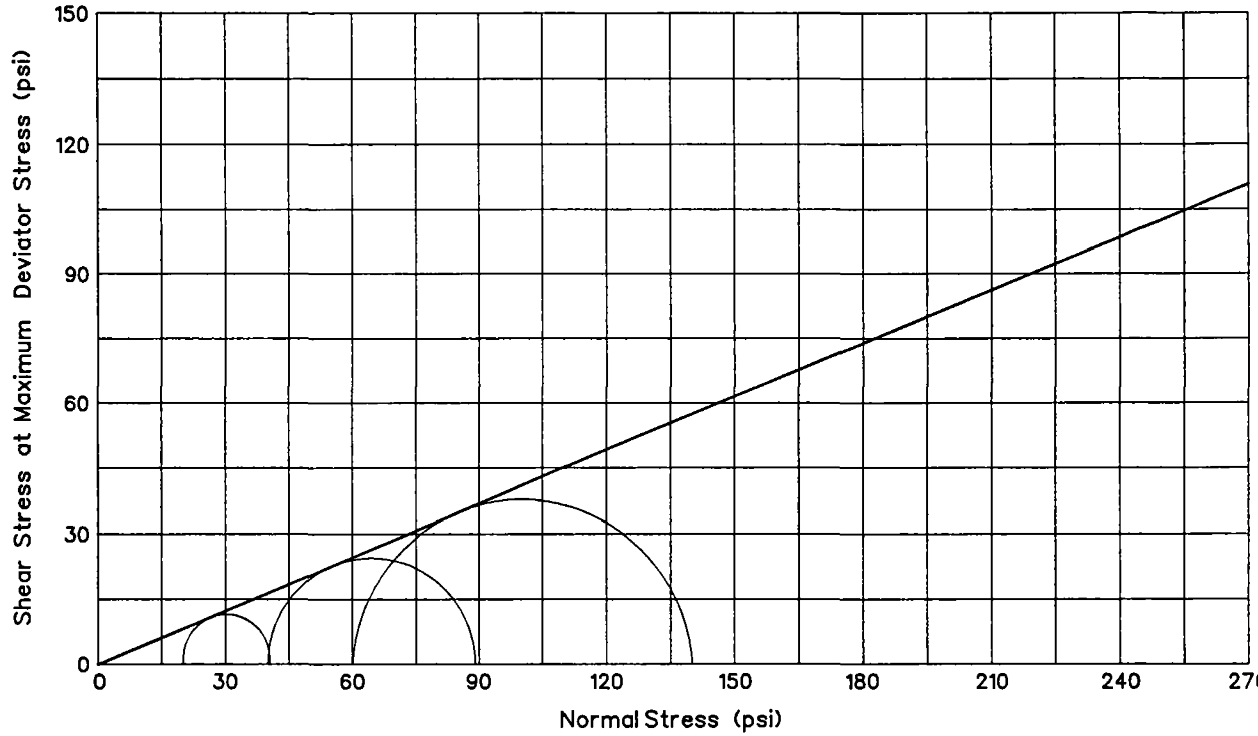
SUMMARY OF TEST DATA

PROJECT Legacy Parkway
LOCATION Structure F-719 (1250 West over Legacy Parkway)
PROJECT NO. 200601-117
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-17-634	5-6.5	2		29.5		27	24	3	2	13	85	ML / A-4(2)
	10-11.5	Shelby	92.2	27.6	2280	41	21	20	1	6	93	CL / A-7-6(20)
	20-21.5	Shelby	79.7	39.0		41	22	19	0	2	98	CL / A-7-6(20)
	21.5-23	2		29.4				NP	0	76	24	SM / A-2-4(0)
	32-33.5	Shelby	65.7	57.8	1069	59	27	32	0	2	98	CH / A-7-6(37)
	40-41.5	Shelby	62.8	61.8		72	28	44	0	0	100	CH / A-7-6(52)
	50-51.5	Shelby	73.0	49.7	1295	53	25	28	0	0	100	CH / A-7-6(33)
	60-61.5	Shelby	78.6	38.0		46	23	23	0	1	99	CL / A-7-6(26)
	70-71.5	Shelby	75.1	43.2	999	57	27	30	0	1	99	CH / A-7-6(35)
	85-86.5	Shelby	90.3	32.0		37	24	13	0	4	96	CL / A-6(14)
	90-91.5	20		21.9				NP	0	75	25	SM/ A-2-4(0)
	100-101.5	Shelby	69.4	49.6	3457	49	28	21	0	1	99	CL / A-7-6(25)
	115-116.5	14		24.3		32	25	7	0	25	75	ML / A-2-4(5)
	125-126.5	43		20.5				NP	0	94	6	SP-SM / A-1-b(0)
	130-131.5	Shelby		23.5		50	22	28	0	7	93	CL/CH / A-7-6(29)
	135-136.5	4		33.5		49	19	30	0	1	99	CL / A-7-6(33)
	150-151.5	Shelby		17.0				NP	0	79	21	SM / A-1-b(0)
	164-165.5	35		21.9				NP	0	62	38	SM / A-4(0)
	170-171.5	Shelby	61.7	61.4		90	31	59	0	1	99	CH / A-7-5(70)

NP=Nonplastic





MULTI-STAGE CONSOLIDATED UNDRAINED W/PORE PRESSURE MEASUREMENTS:

TOTAL STRESS FAILURE ENVELOPE

Test No. or Symbol	Sample Data: Dry Density (pcf)	Sample Data: Moisture Content (%)	Degree of Saturation (%)	Confining Pressure (psi)	Maximum Deviator Stress (psi)	Strength Values at Failure: Friction Angle ϕ (degrees)	Strength Values at Failure: Cohesion (c/psi)	Sample Size, L/D (inches)	Strain Rate (inches/ minute)
●	68.2	50.3	~100	20	40.4	22.3	0	2.88/1.38	0.001
■	68.2	50.3	~100	40	89.0				
▲	68.2	50.3	~100	60	140.0				

RB&G ENGINEERING INC.
Provo, Utah

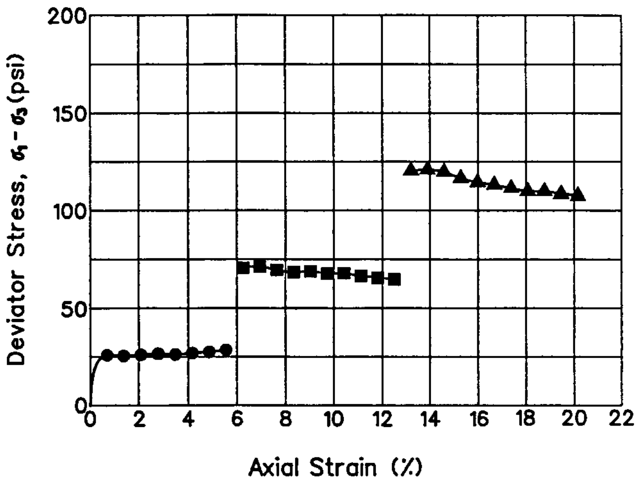
TRIAXIAL SHEAR TEST

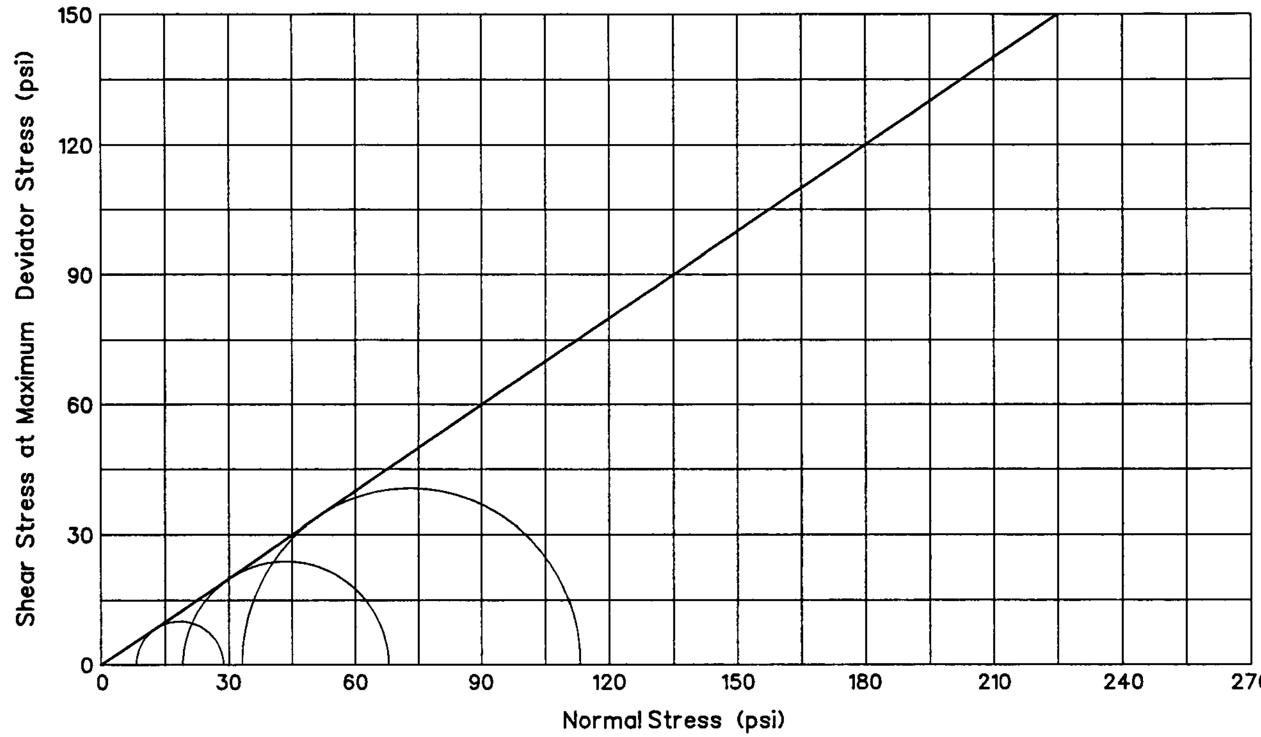
Project: *Legacy Parkway - Structure F-719*
(1250 West Over Legacy Parkway)
Davis County, Utah

HOLE NO.: RSB-17-632

DEPTH: 45'-46.5'

Figure





MULTI-STAGE CONSOLIDATED UNDRAINED W/PORE PRESSURE MEASUREMENTS:

EFFECTIVE STRESS FAILURE ENVELOPE

Test No. or Symbol	Sample Data		Degree of Saturation (%)	Confining Pressure (psi)	Maximum Deviator Stress (psi)	Strength Values at Failure		Sample Size, L/D (inches)	Strain Rate (inches/ minute)
	Dry Density (pcf)	Moisture Content (%)				Friction Angle ϕ (degrees)	Cohesion (c/psi)		
●	68.2	50.3	~100	8.2	28.6	33.7	0	2.88/1.38	0.001
■	68.2	50.3	~100	19.0	68.0				
▲	68.2	50.3	~100	33.1	113.1				

RB&G ENGINEERING INC.
Provo, Utah

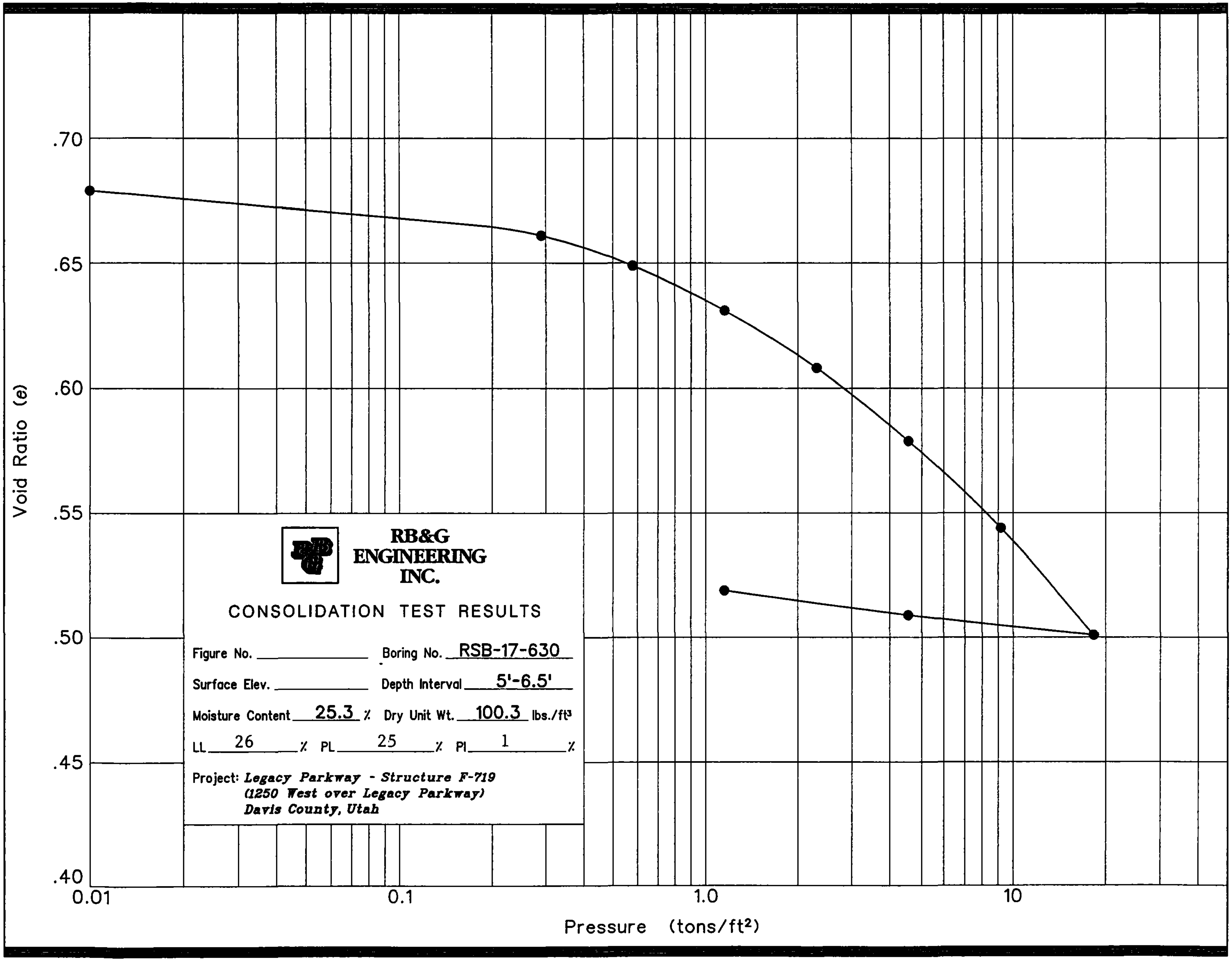
TRIAXIAL SHEAR TEST

Project: *Legacy Parkway - Structure F-719*
(1250 West Over Legacy Parkway)
Davis County, Utah

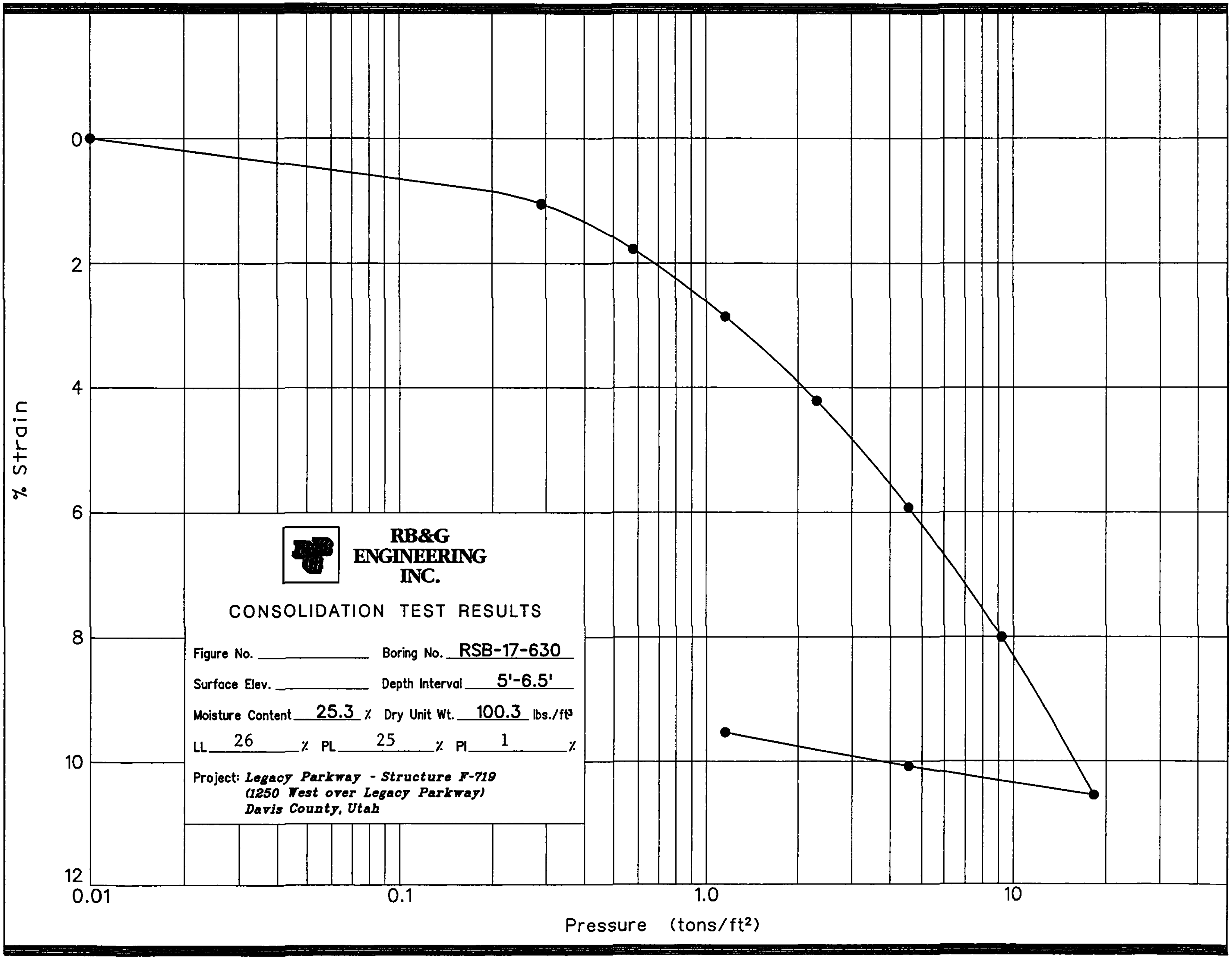
HOLE NO.: RSB-17-632

DEPTH: 45'-46.5'

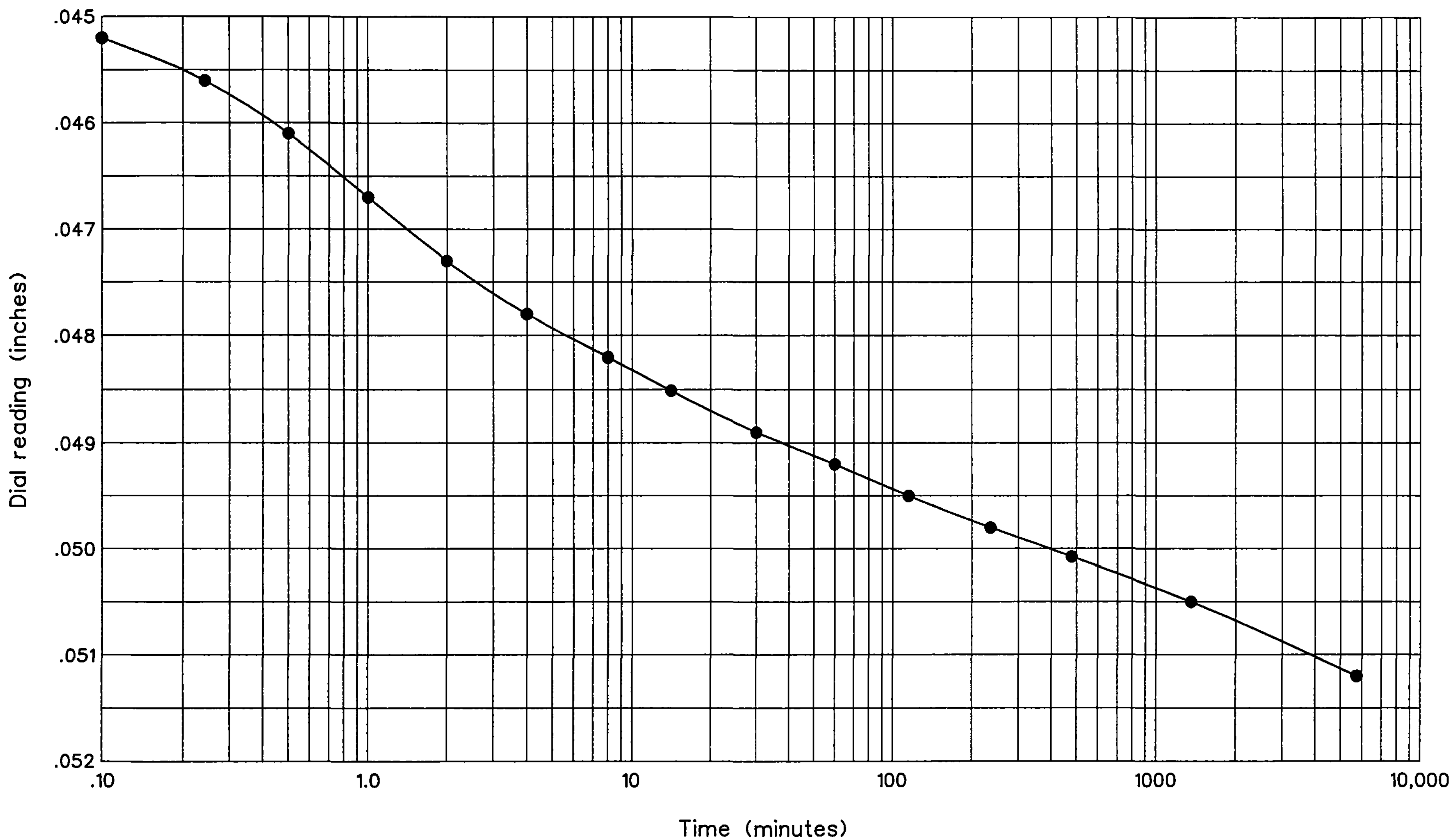
Figure



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 5'-6.5'
Moisture Content 25.3 %
Dry Unit Wt. 100.3 lbs./ft³
LL 26 %
PL 25 %
PI 1 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
Void Ratio (e)
.70
.65
.60
.55
.50
.45
.40
0.01
0.1
1.0
10
Pressure (tons/ft²)



0
2
4
6
8
10
12
% Strain
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 5'-6.5'
Moisture Content 25.3 %
Dry Unit Wt. 100.3 lbs./ft³
LL 26 %
PL 25 %
PI 1 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah



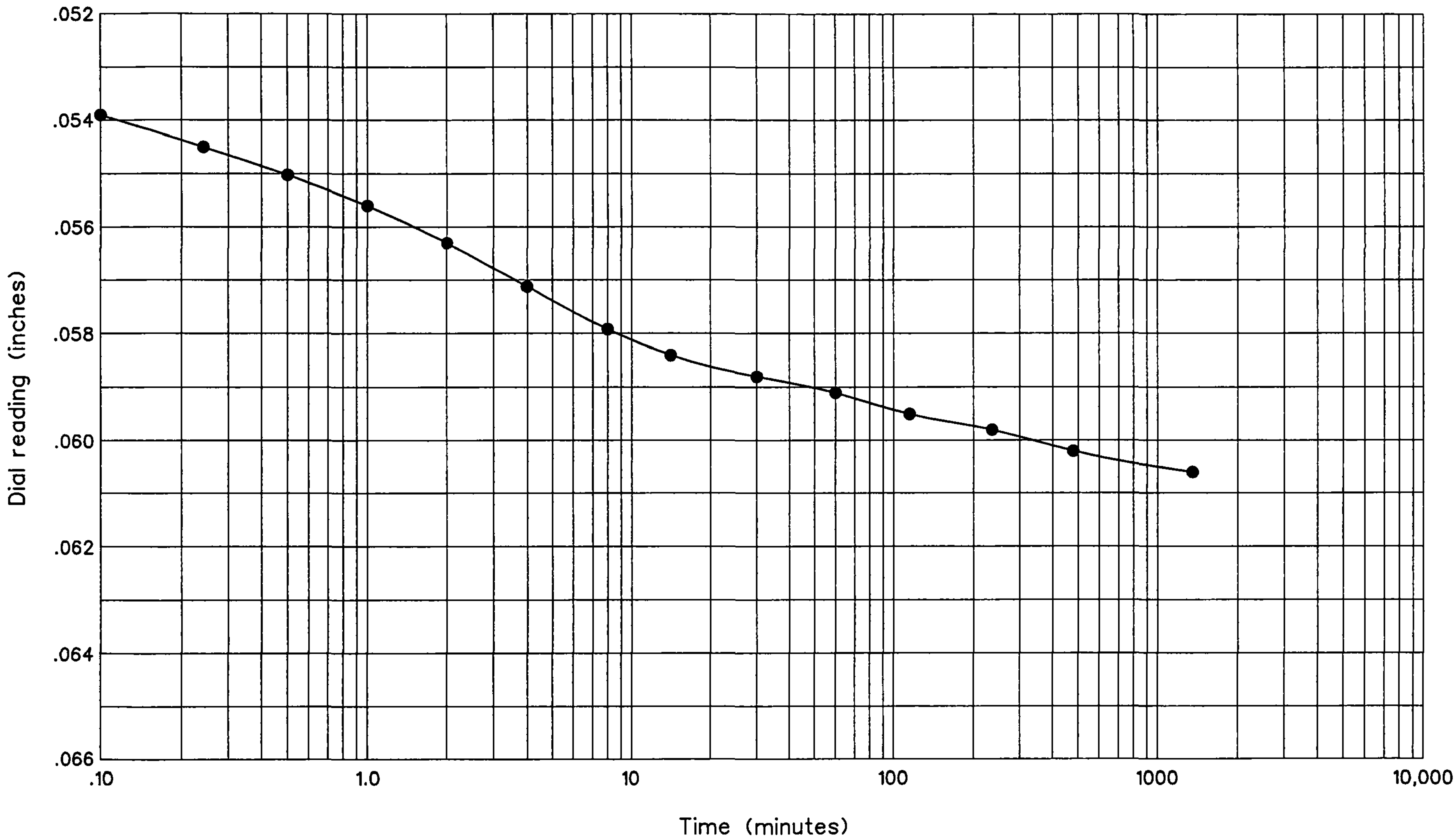
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 5'-6.5'
Load: 0.29 to 0.58 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



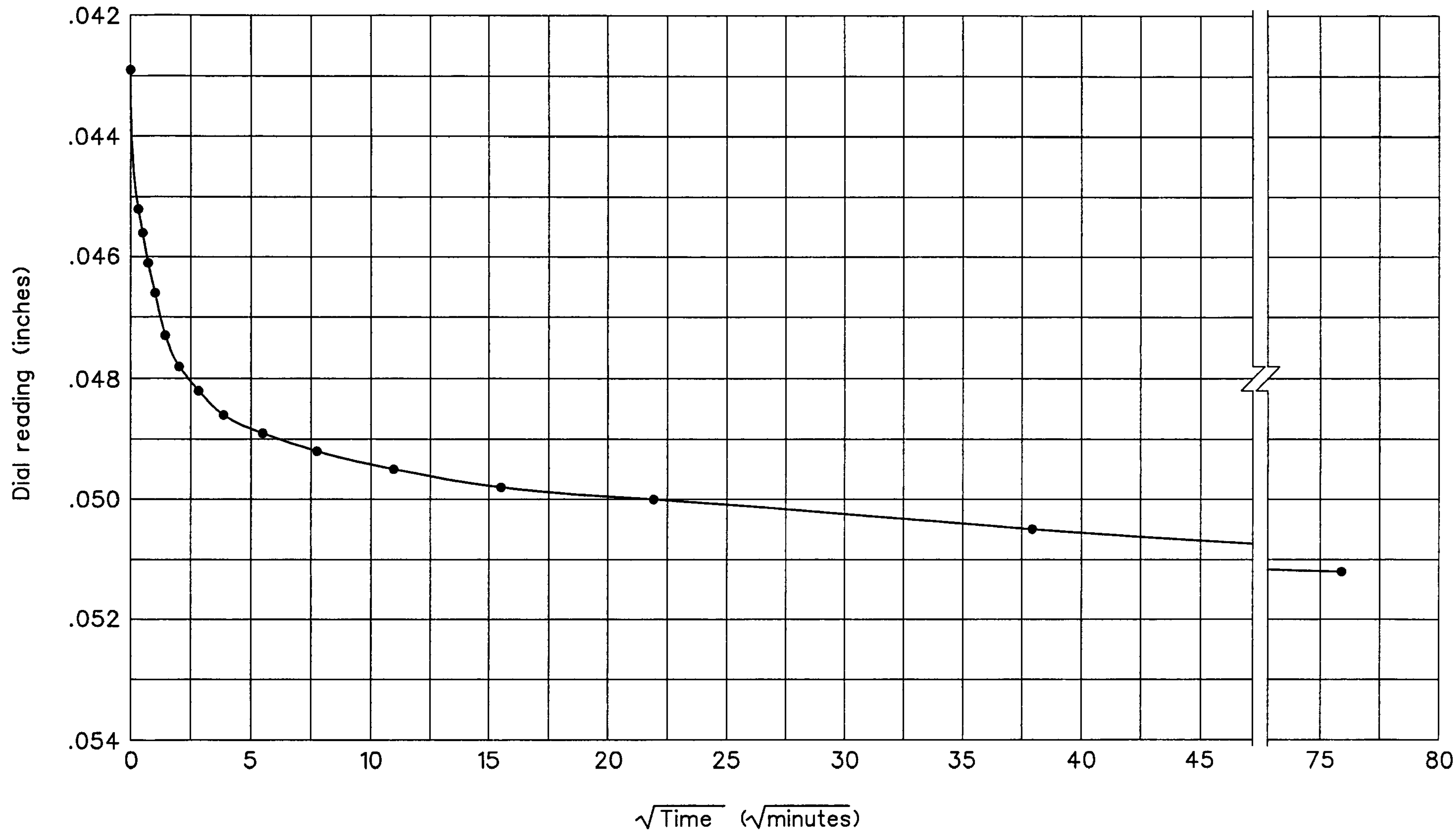
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 5'-6.5'
Load: 0.58 to 1.15 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



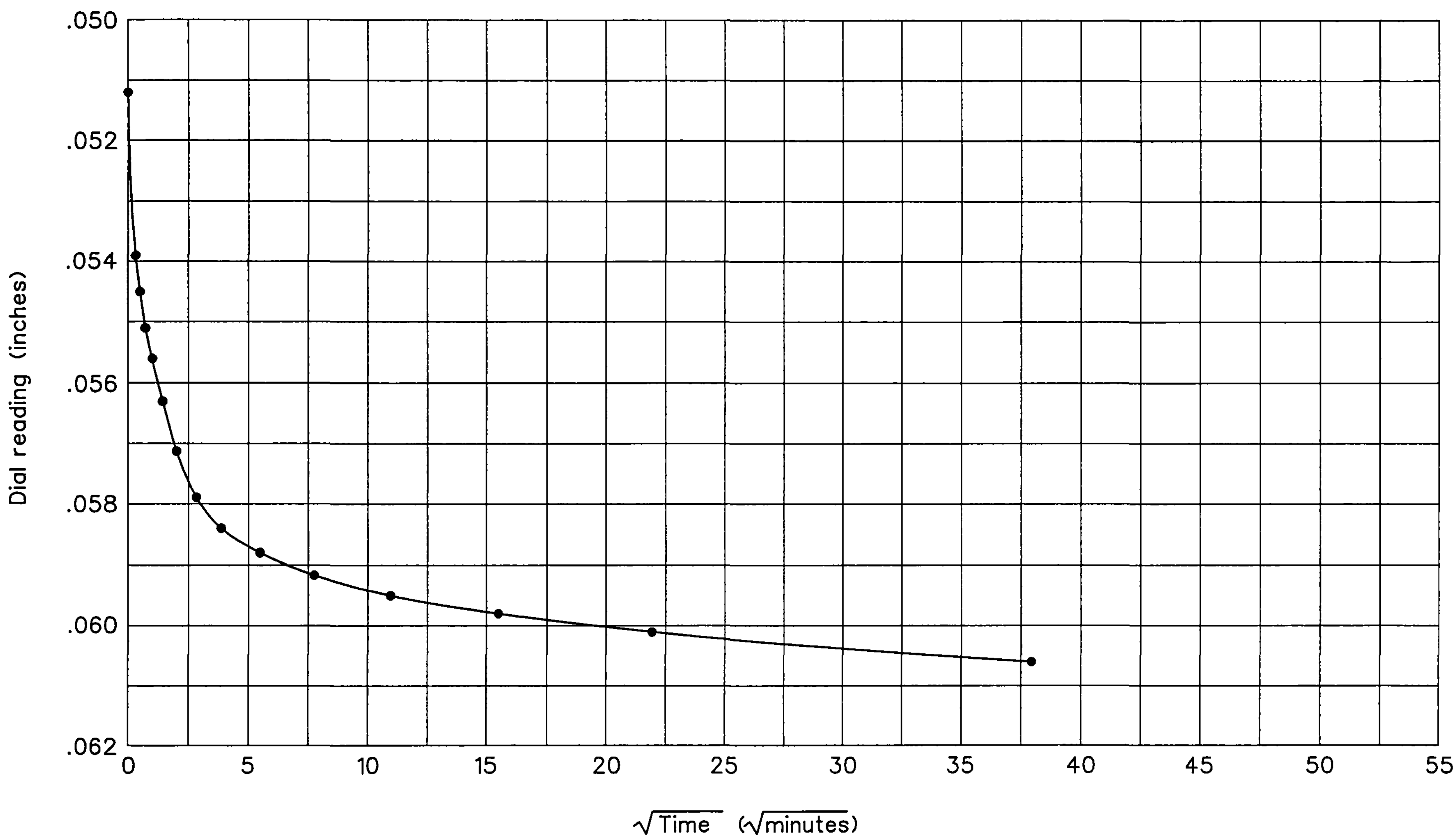
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 5'-6.5'
Load: 0.29 to 0.58 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



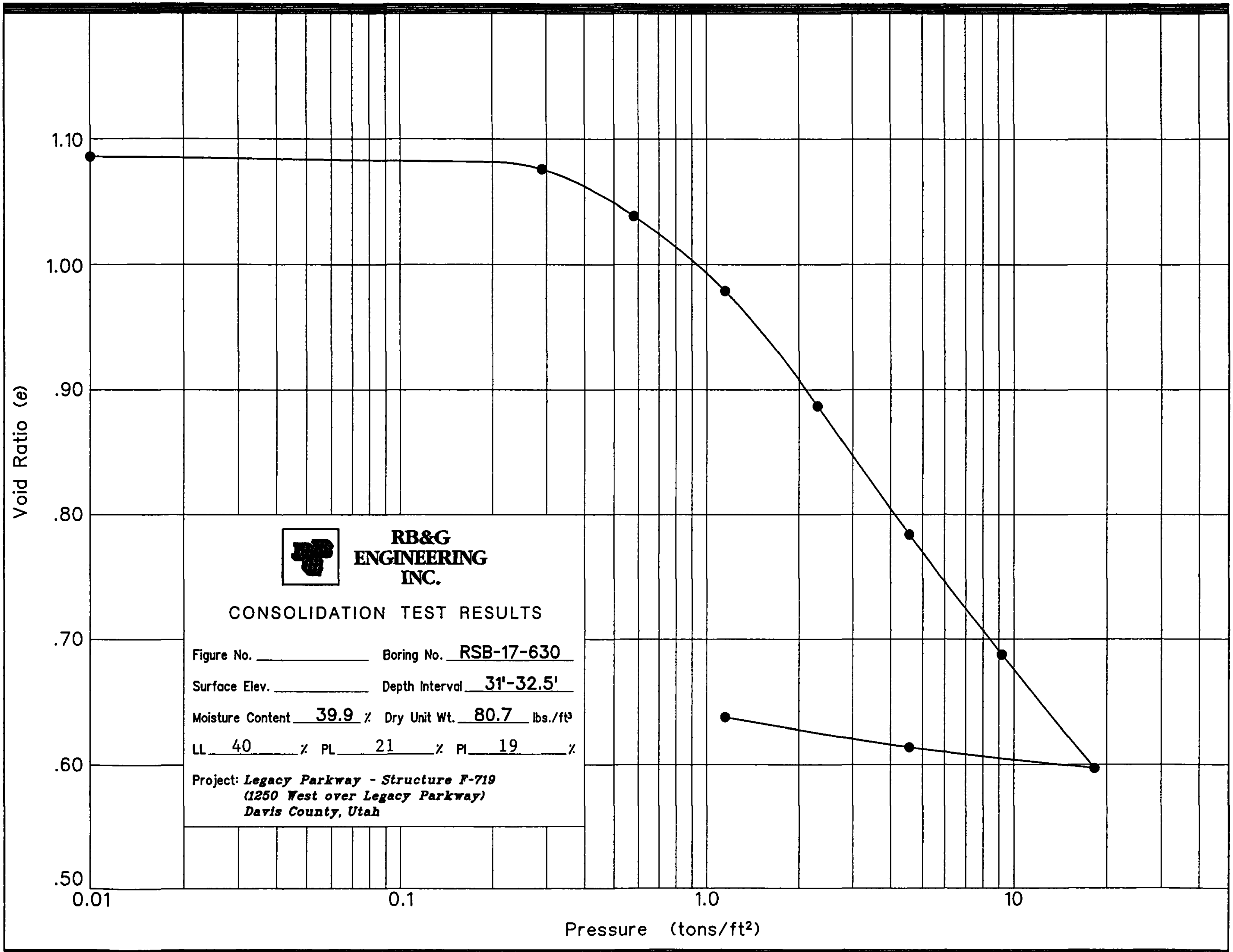
RB&G ENGINEERING INC.
Provo, Utah

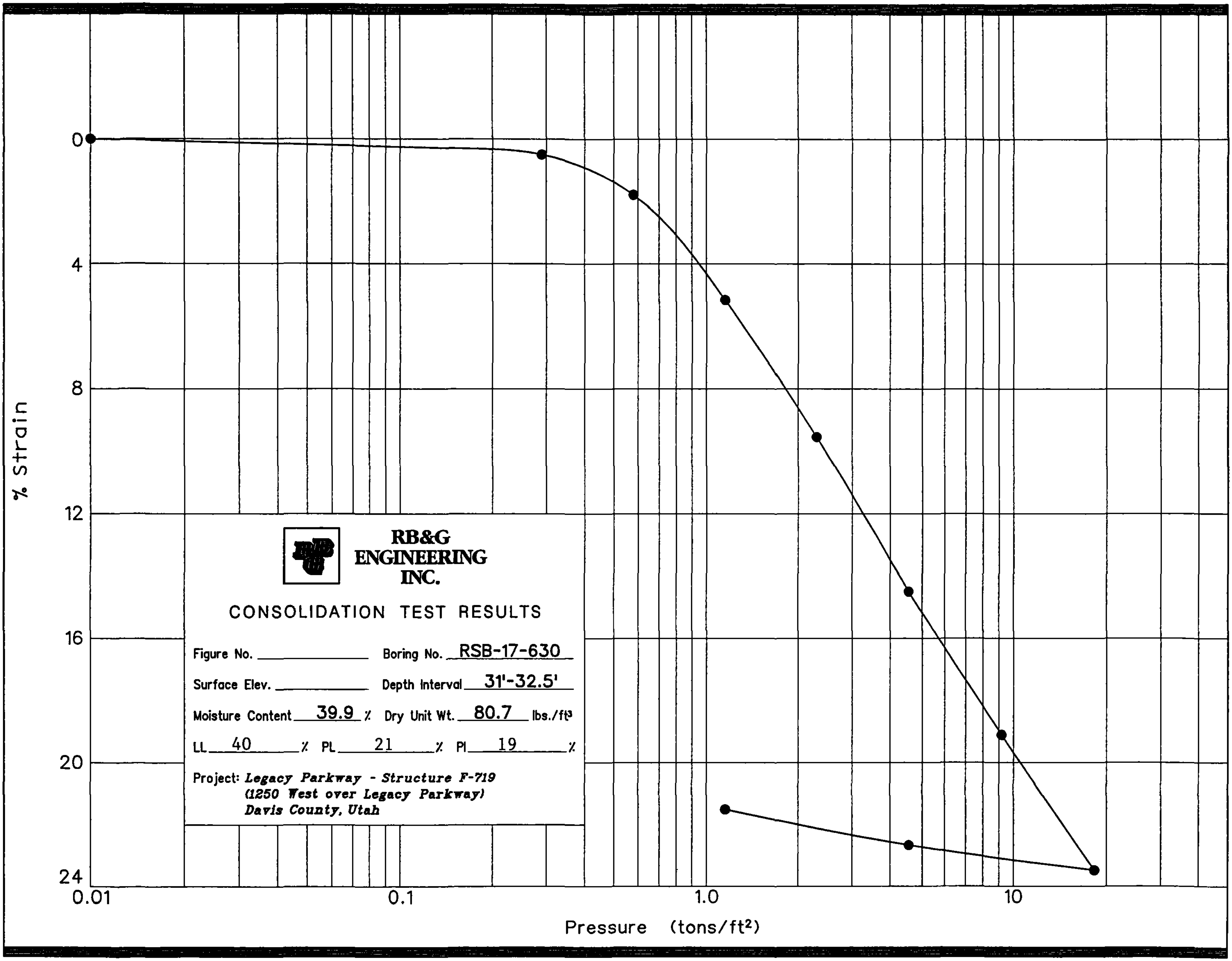
Hole no.: RSB-17-630
Depth: 5'-6.5'
Load: 0.58 to 1.15 tons

TIME CONSOLIDATION

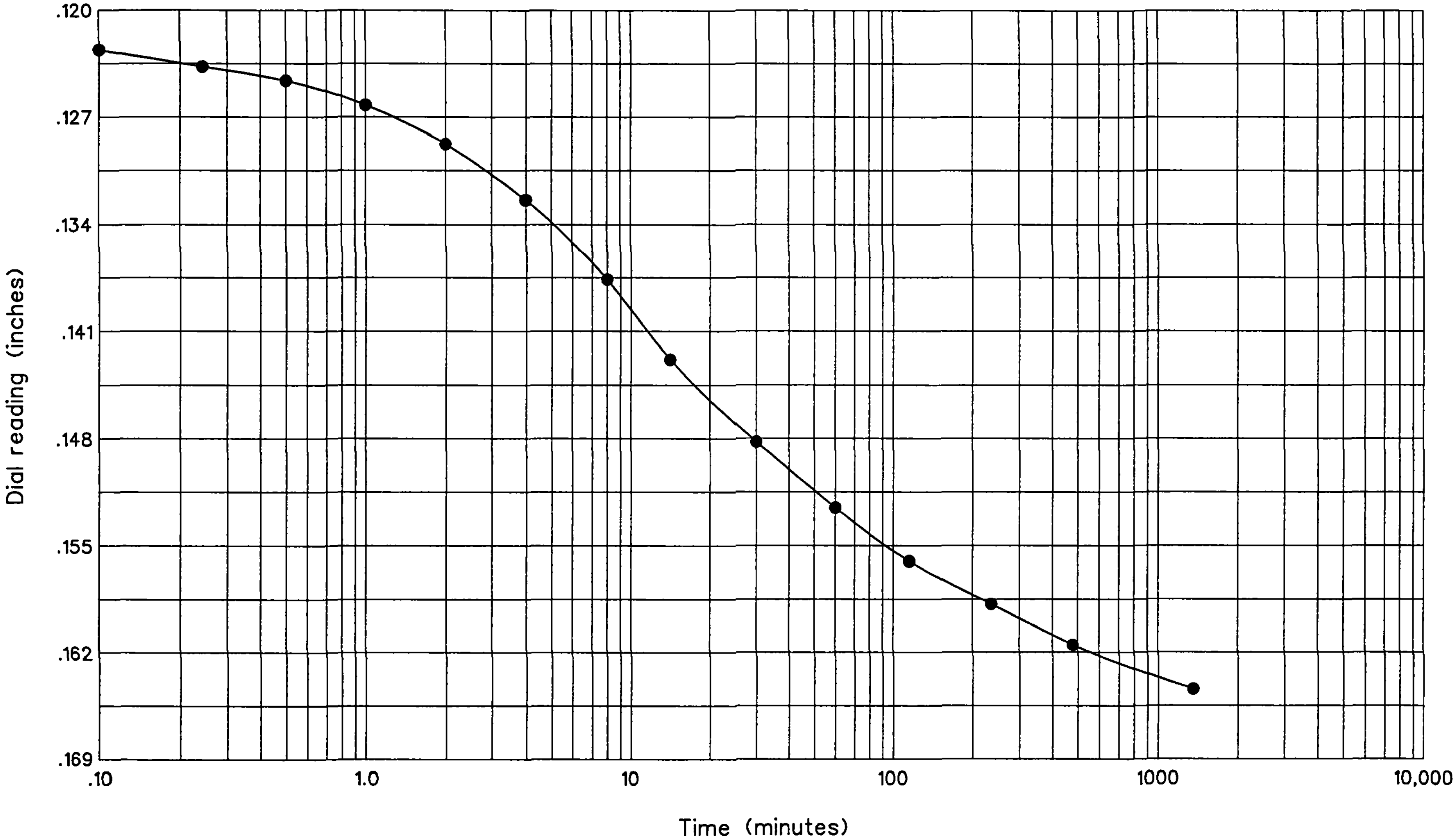
Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure


RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 31'-32.5'
Moisture Content 39.9 %
Dry Unit Wt. 80.7 lbs./ft³
LL 40 %
PL 21 %
PI 19 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
Void Ratio (e)
1.10
1.00
.90
.80
.70
.60
.50
0.01
0.1
1.0
10
Pressure (tons/ft²)

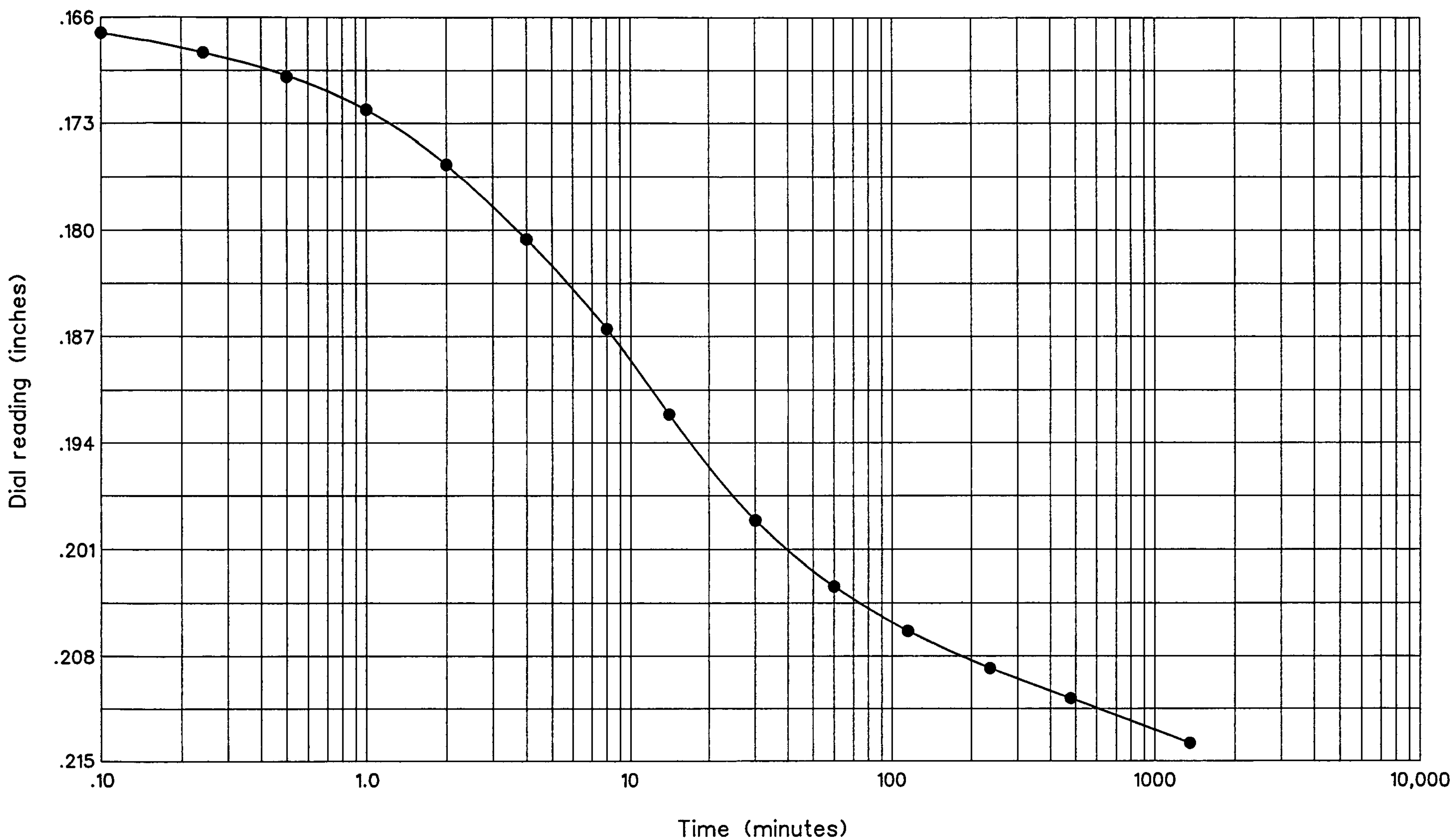


% Strain
0
4
8
12
16
20
24
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 31'-32.5'
Moisture Content 39.9 % Dry Unit Wt. 80.7 lbs./ft³
LL 40 % PL 21 % PI 19 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

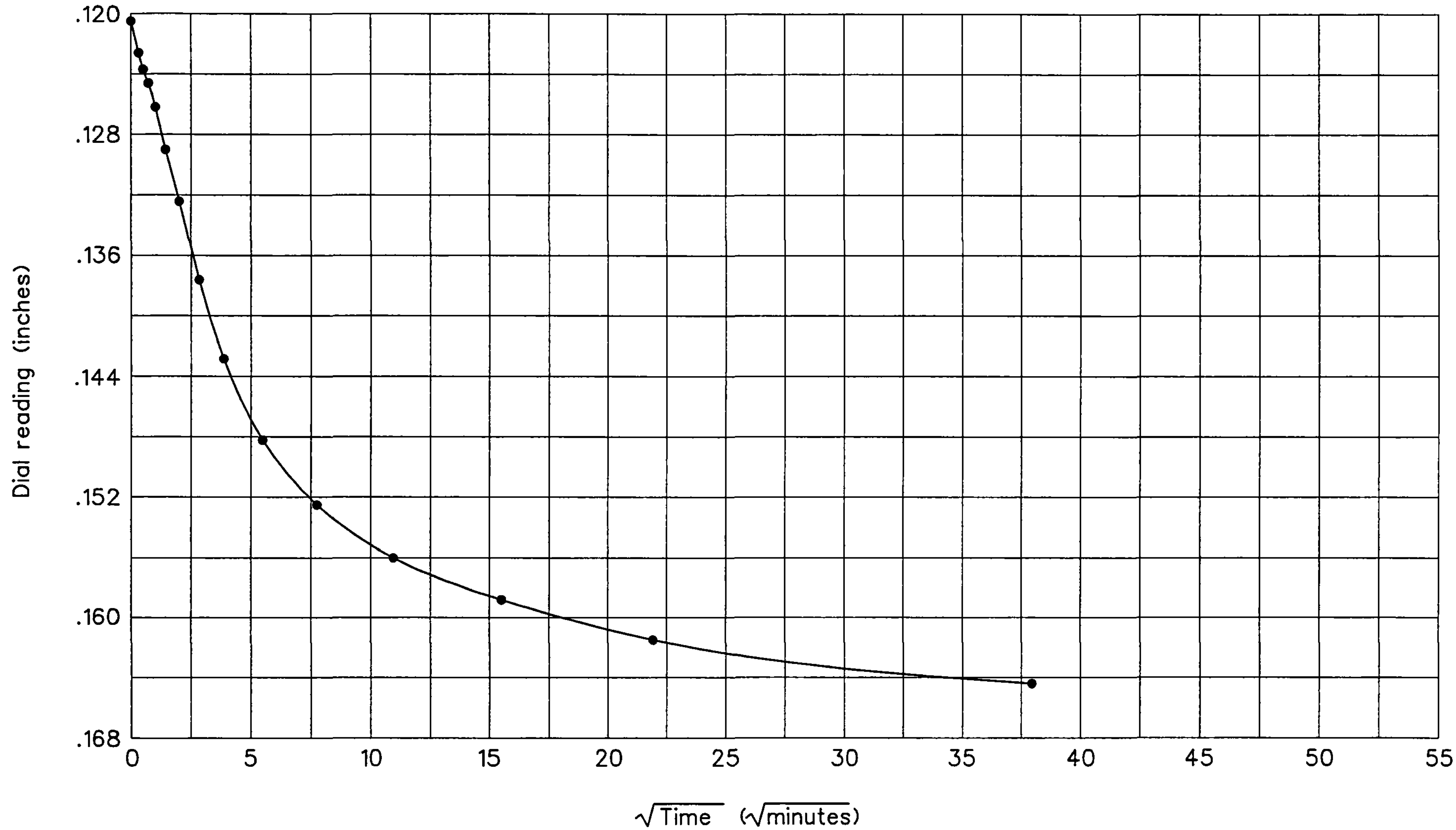


RB&G ENGINEERING INC. Provo, Utah	Hole no.: RSB-17-630 Depth: 31'-32.5' Load: 2.30 to 4.60 tons	**TIME CONSOLIDATION** *Legacy Parkway - Structure F-719* *(1250 West over Legacy Parkway)* *Davis County, Utah*

Figure



RB&G ENGINEERING INC. Provo, Utah	Hole no.: RSB-17-630 Depth: 31'-32.5' Load: 4.60 to 9.20 tons	**TIME CONSOLIDATION** *Legacy Parkway - Structure F-719* *(1250 West over Legacy Parkway)* *Davis County, Utah*	Figure



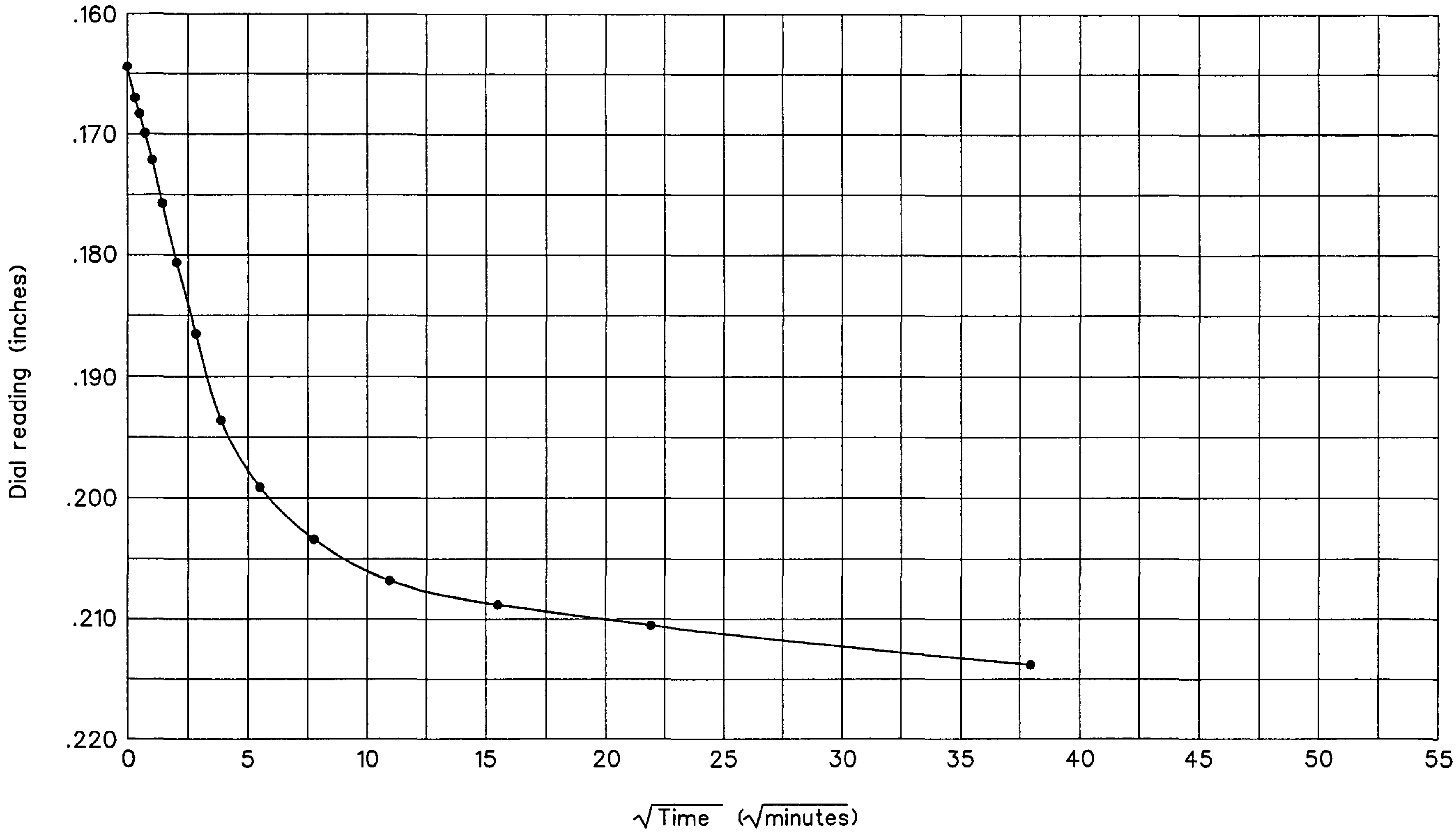
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 31'-32.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



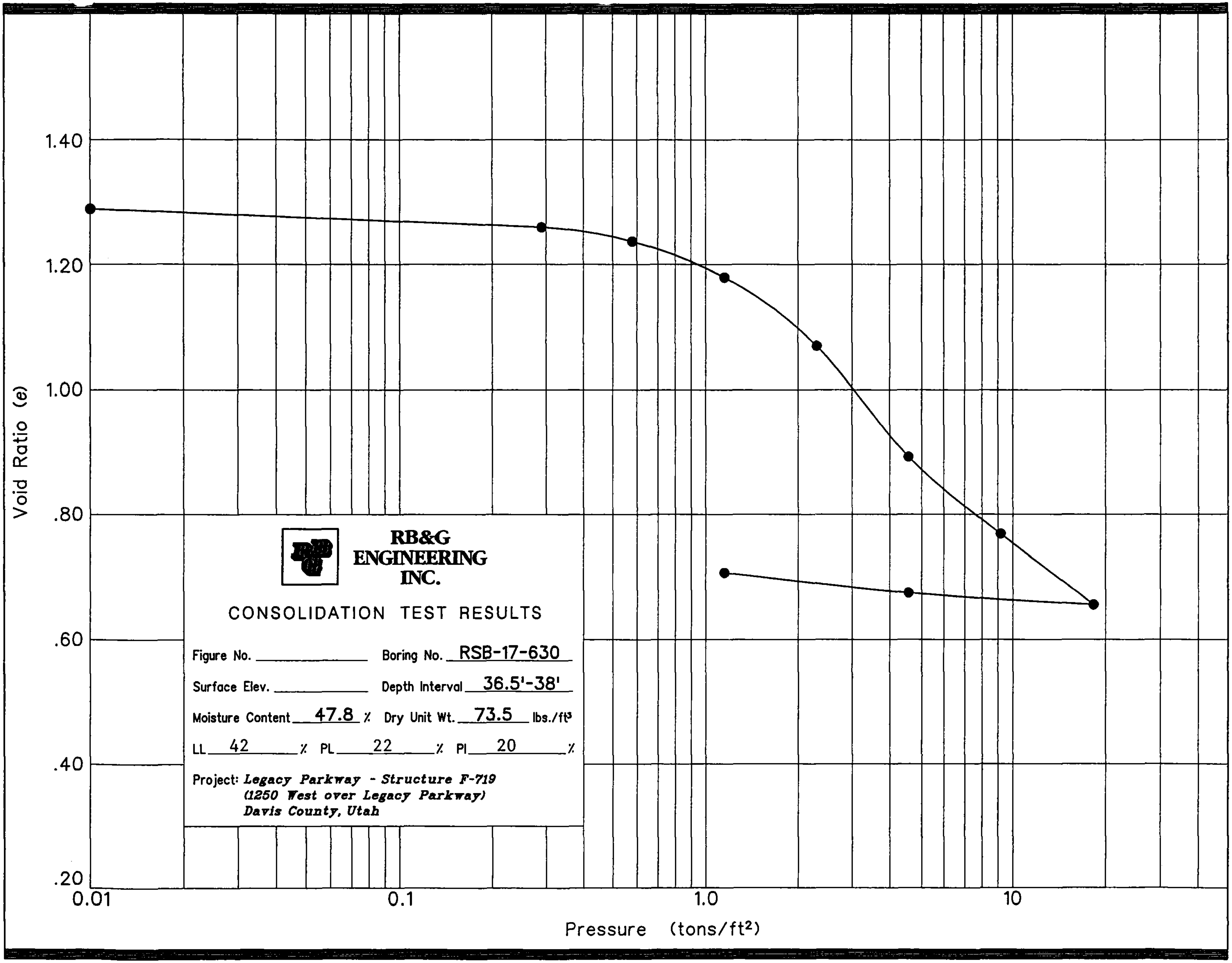
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 31'-32.5'
Load: 4.60 to 9.20 tons

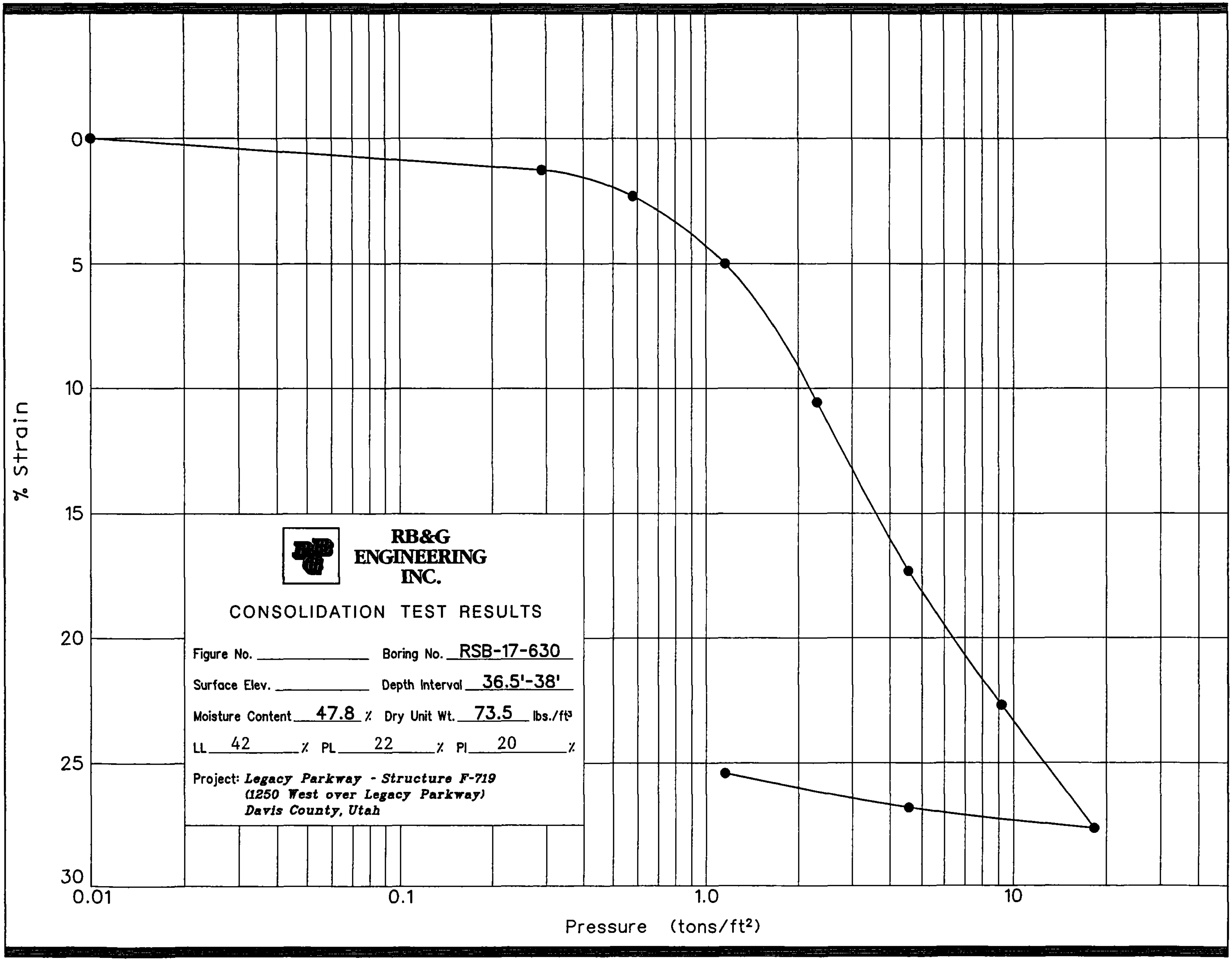
TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

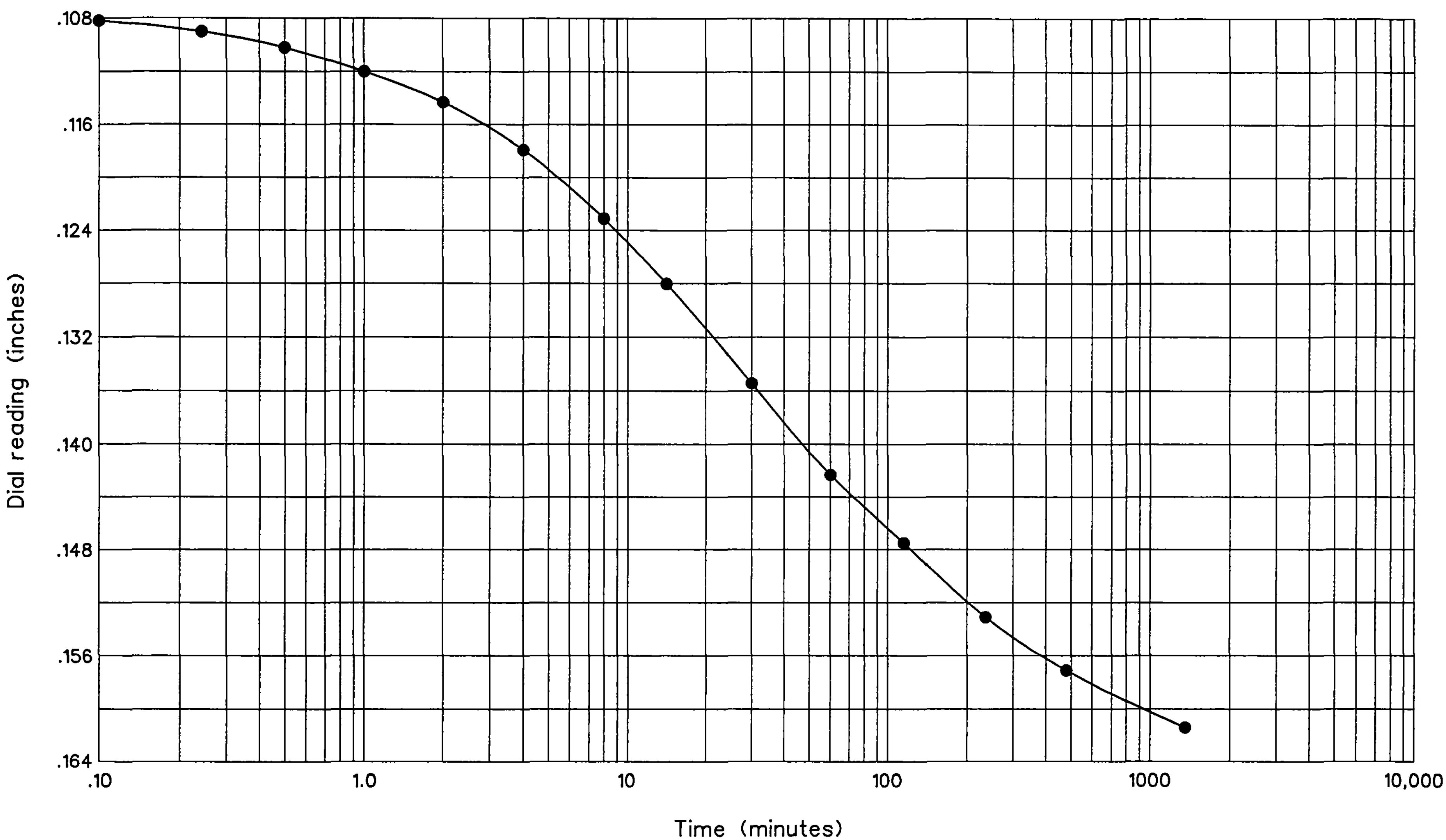
Figure



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 36.5'-38'
Moisture Content 47.8 %
Dry Unit Wt. 73.5 lbs./ft³
LL 42 %
PL 22 %
PI 20 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
Void Ratio (e)
1.40
1.20
1.00
.80
.60
.40
.20
0.01
0.1
1.0
10
Pressure (tons/ft²)



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 36.5'-38'
Moisture Content 47.8 %
Dry Unit Wt. 73.5 lbs./ft³
LL 42 %
PL 22 %
PI 20 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
% Strain
0
5
10
15
20
25
30
0.01
0.1
1.0
10
Pressure (tons/ft²)



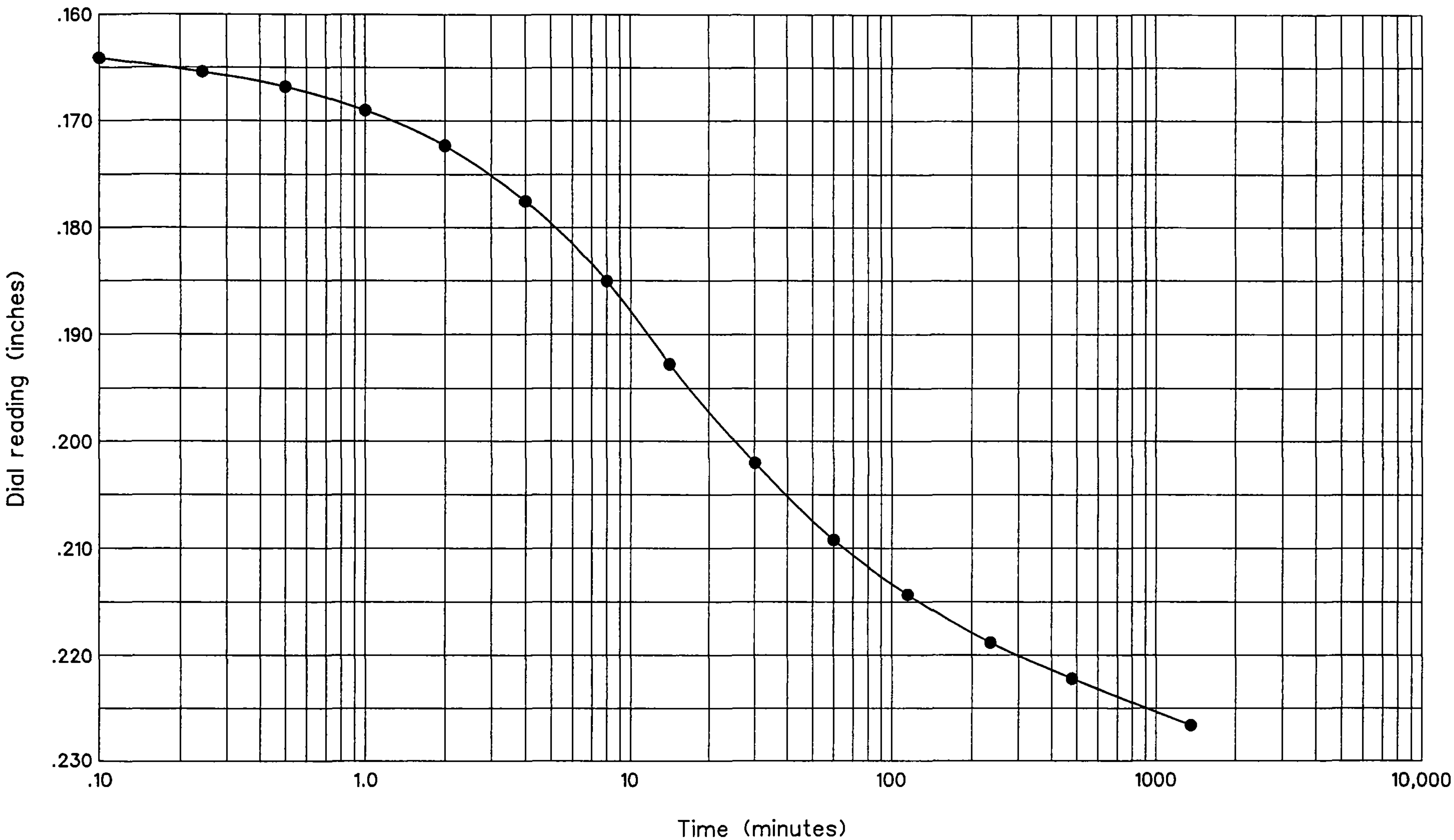
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 36.5'-38'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



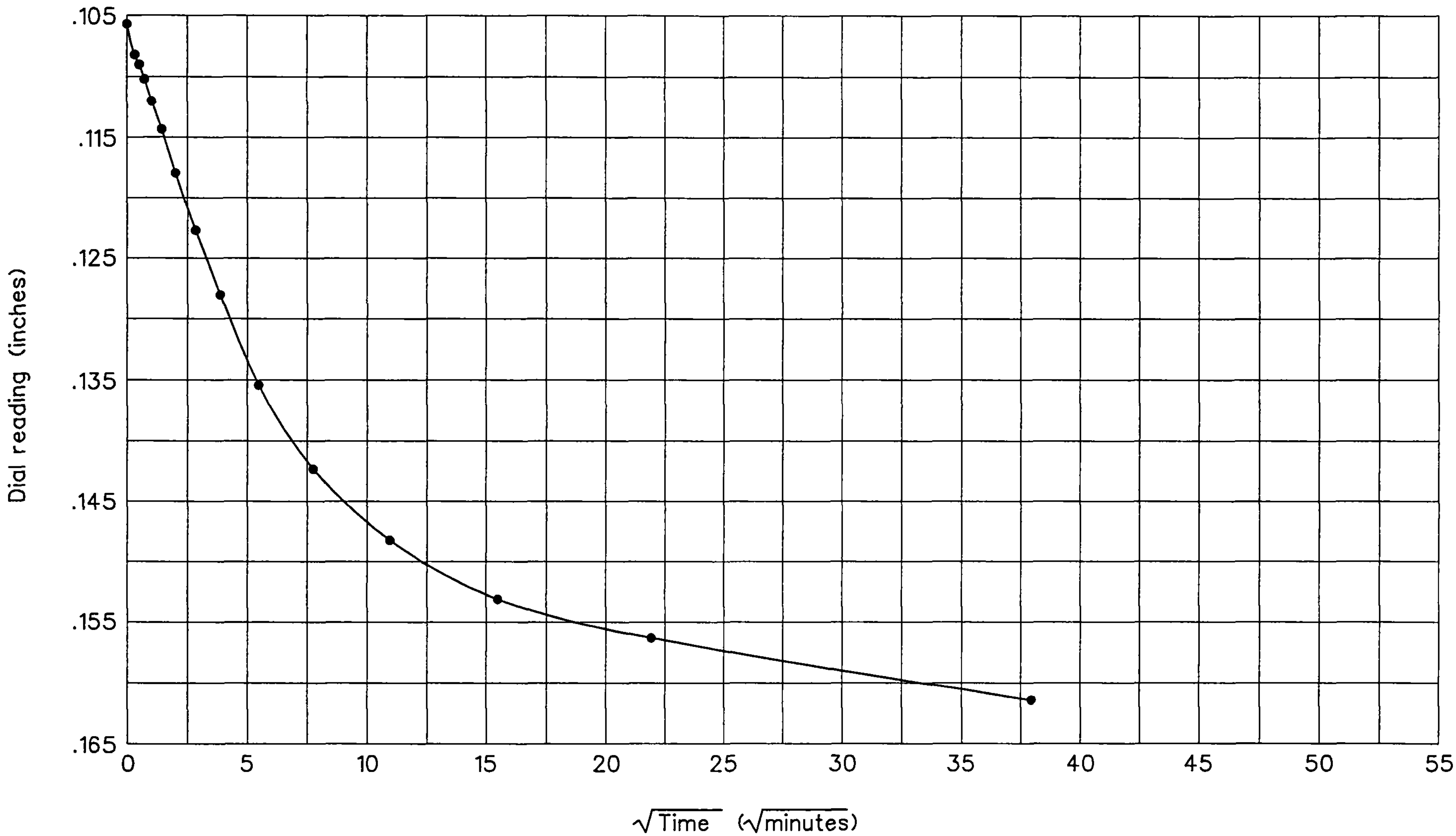
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 36.5'-38'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



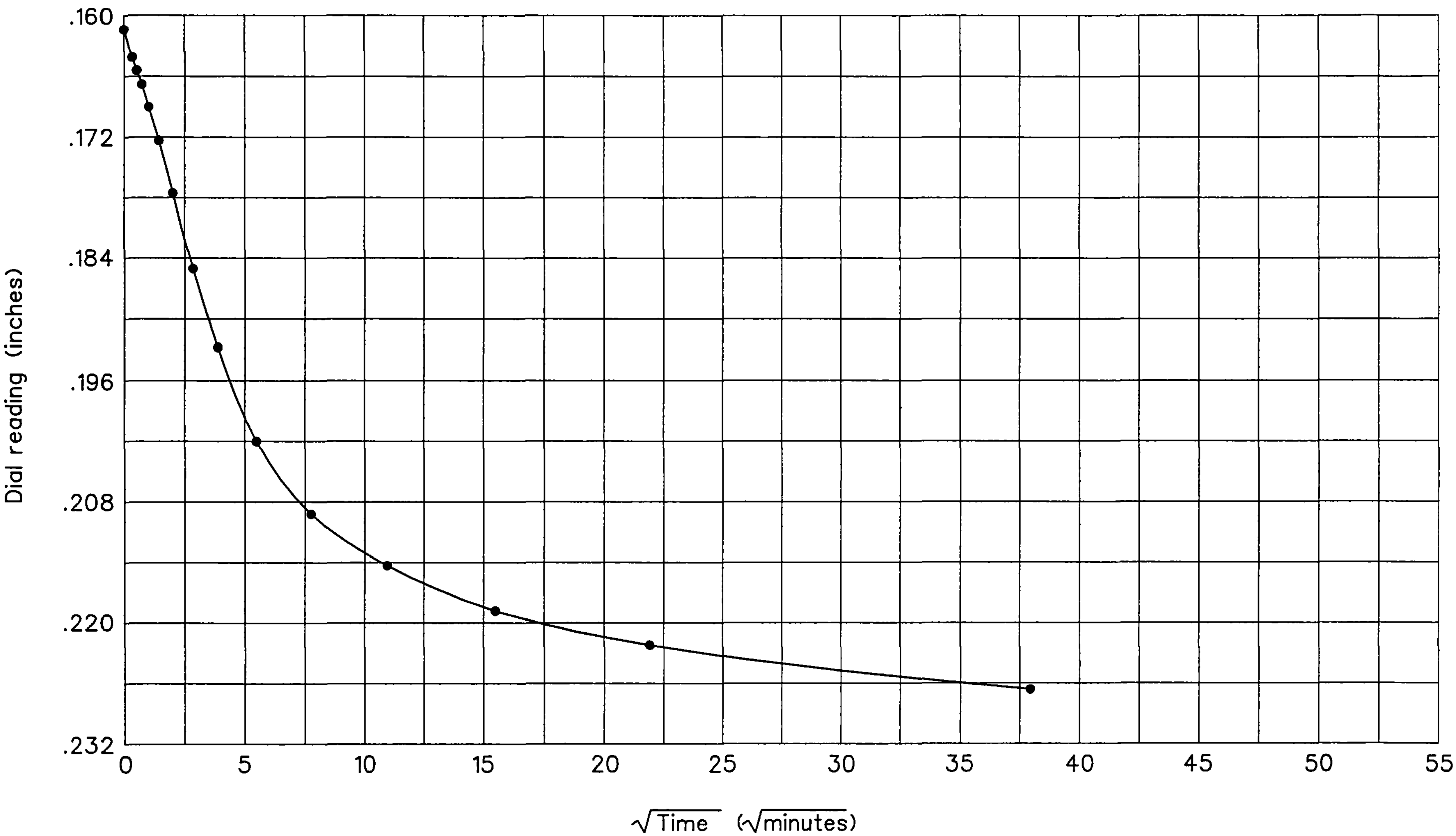
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 36.5'-38'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



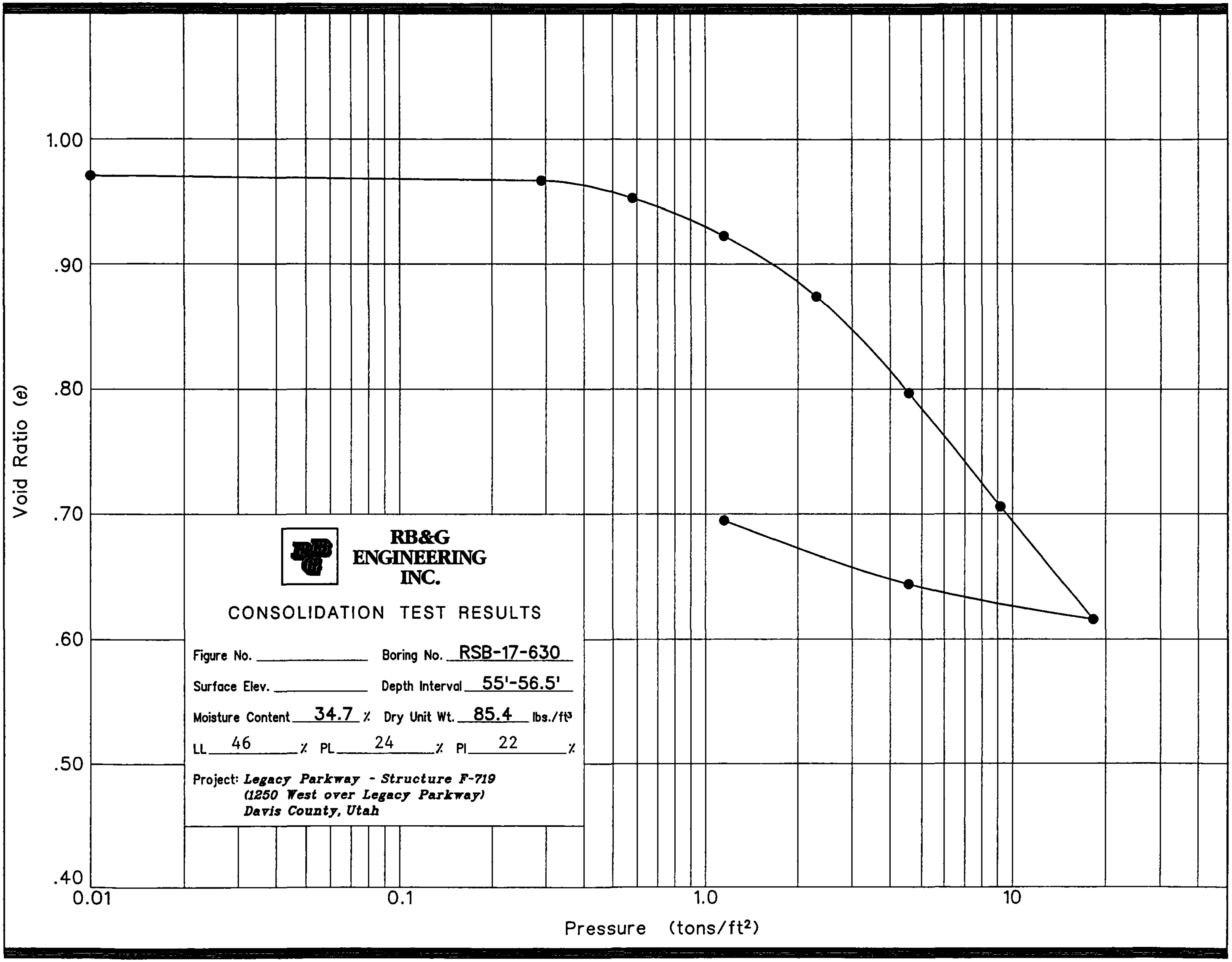
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 36.5'-38'
Load: 4.60 to 9.20 tons

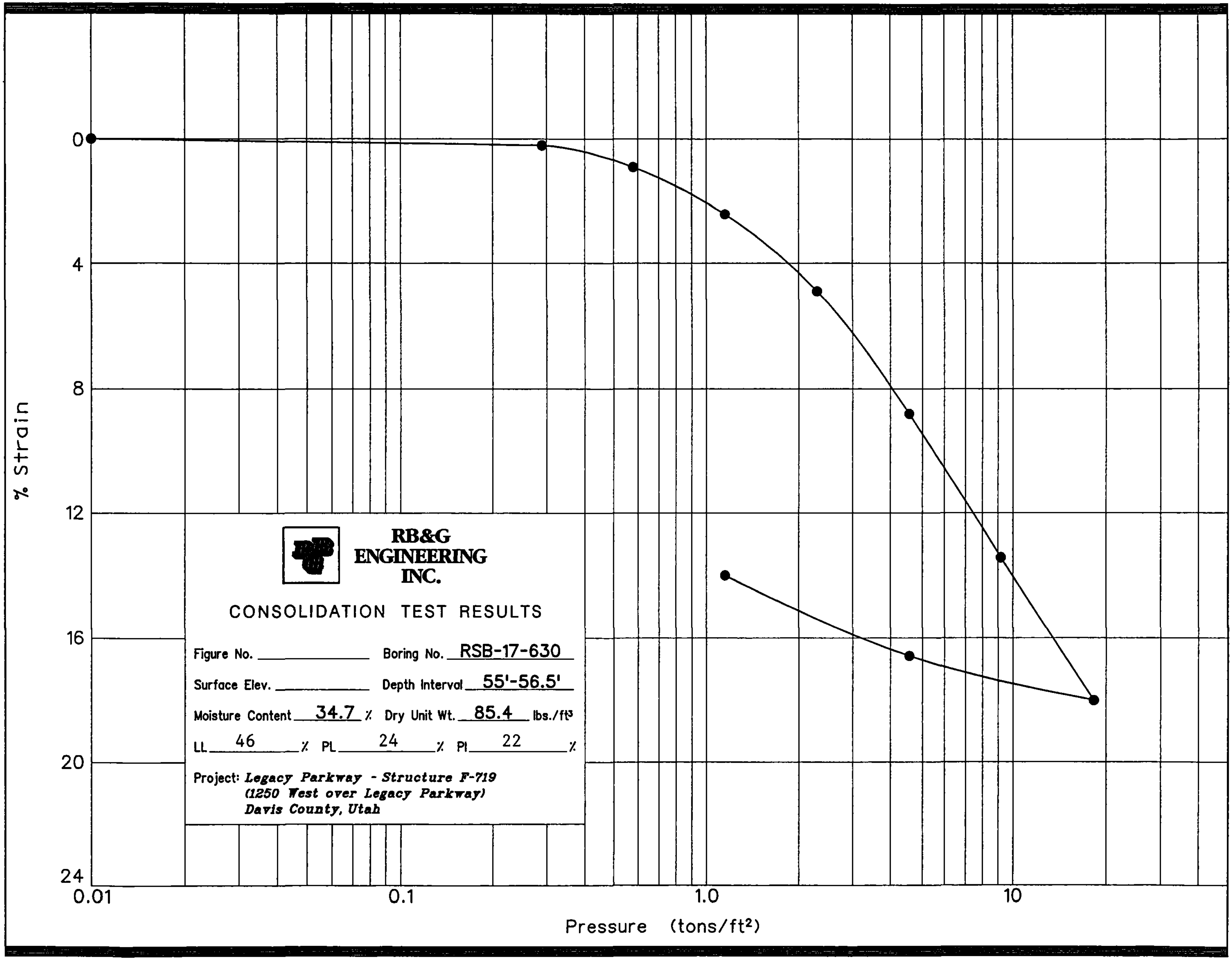
TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

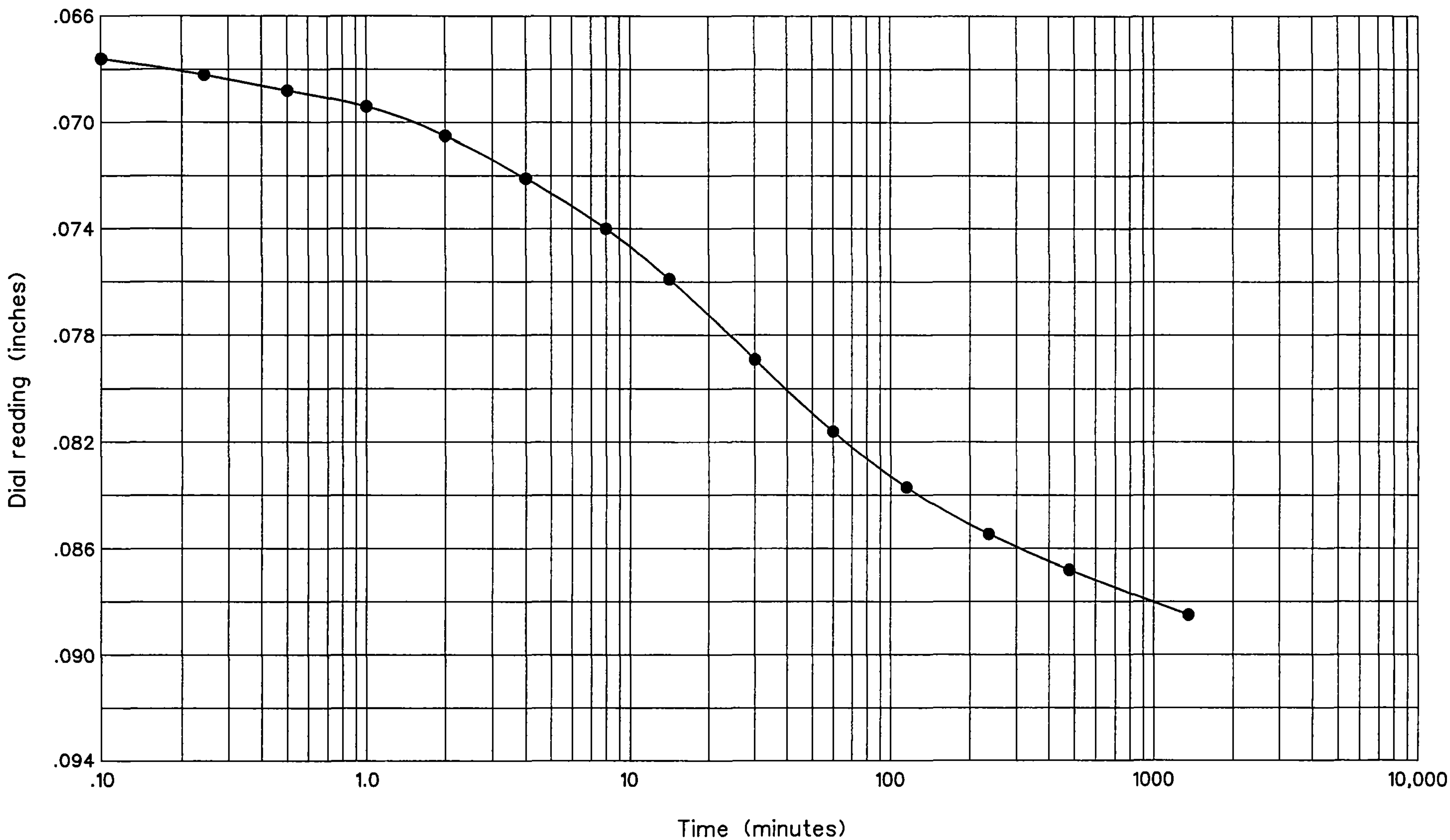
Figure



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 55'-56.5'
Moisture Content 34.7 %
Dry Unit Wt. 85.4 lbs./ft³
LL 46 %
PL 24 %
PI 22 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
Void Ratio (e)
1.00
.90
.80
.70
.60
.50
.40
0.01
0.1
1.0
10
Pressure (tons/ft²)



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 55'-56.5'
Moisture Content 34.7 %
Dry Unit Wt. 85.4 lbs./ft³
LL 46 %
PL 24 %
PI 22 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
% Strain
0
4
8
12
16
20
24
0.01
0.1
1.0
10
Pressure (tons/ft²)



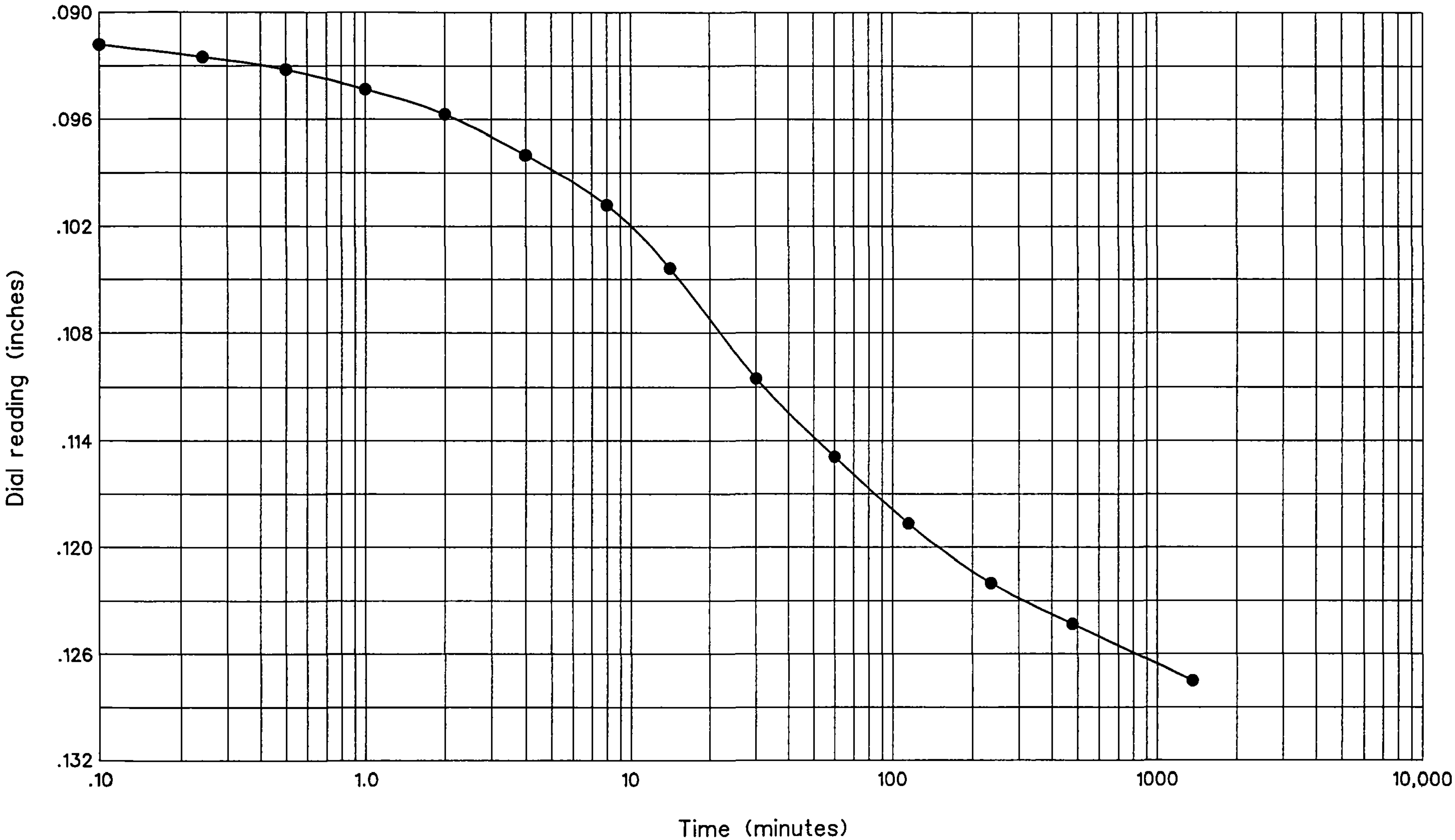
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 55'-56.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



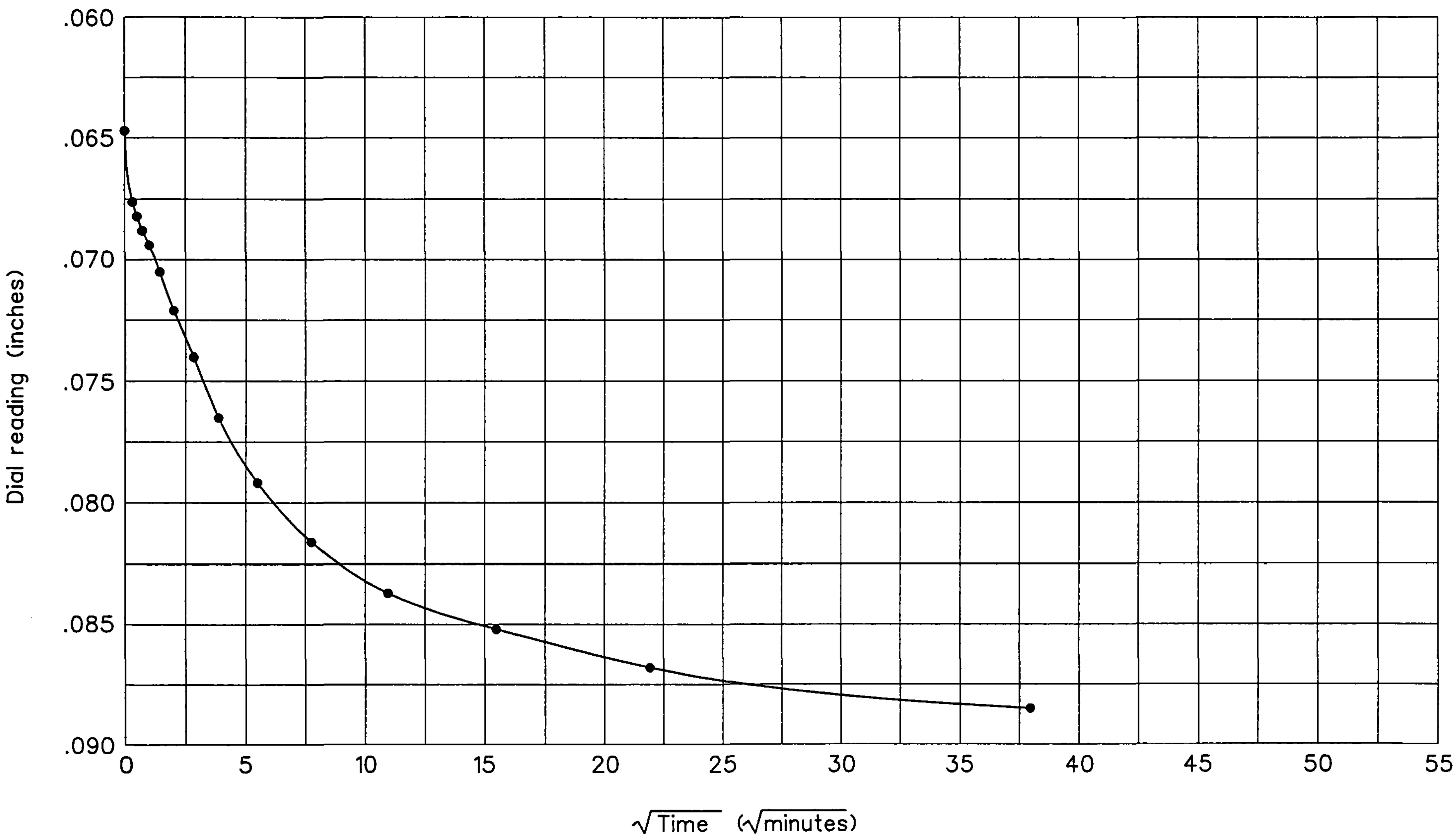
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 55'-56.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



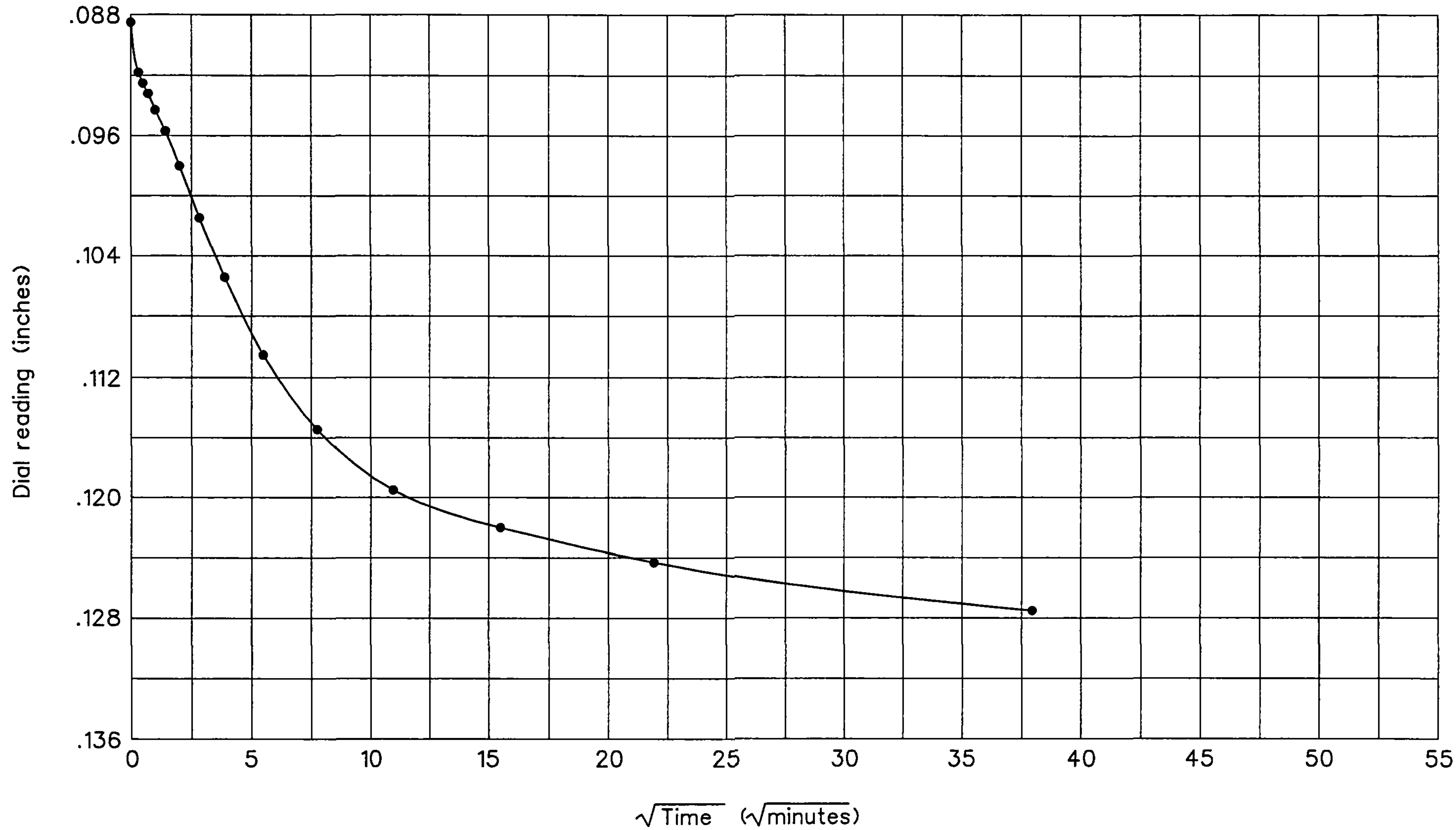
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 55'-56.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



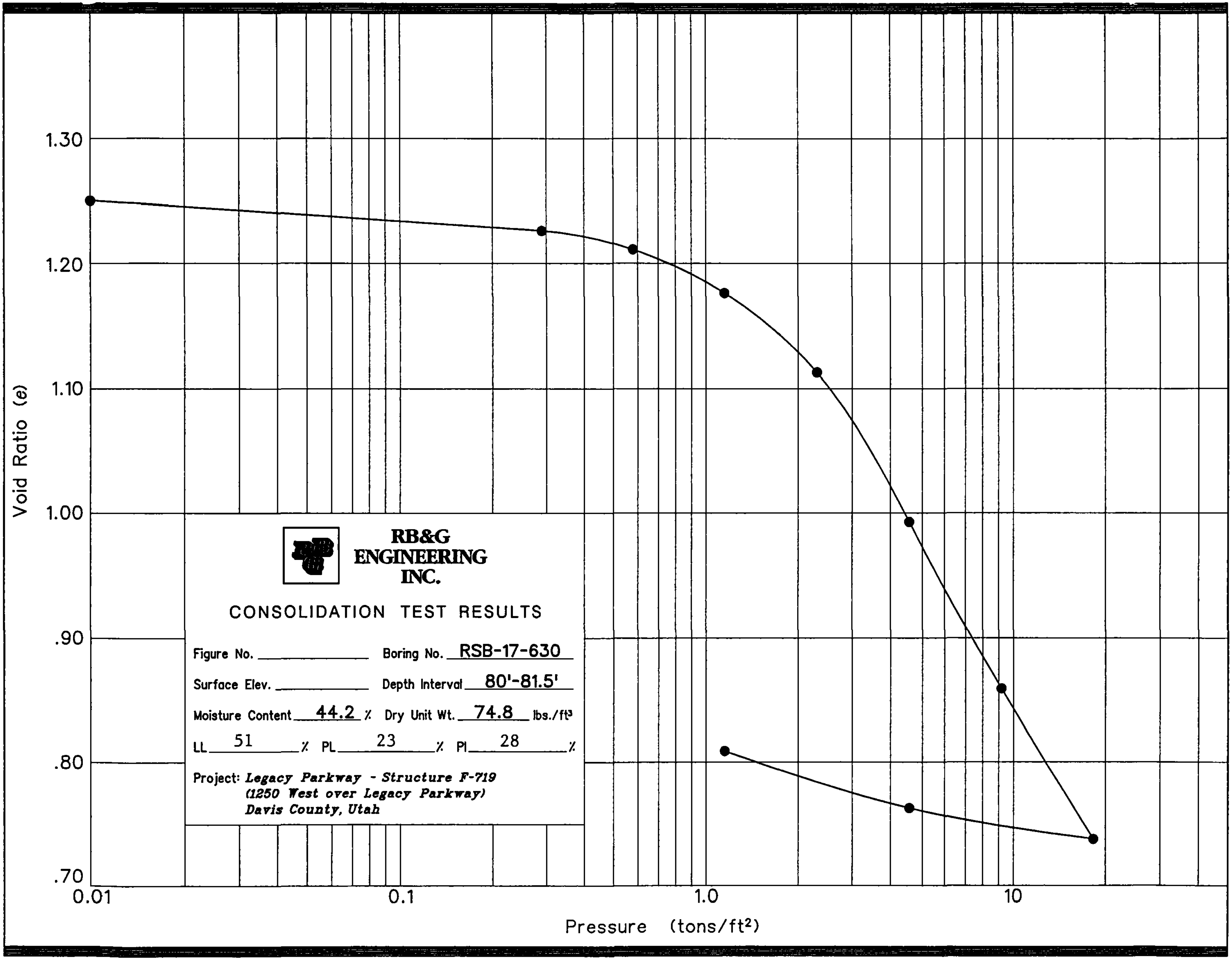
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 55'-56.5'
Load: 4.60 to 9.20 tons

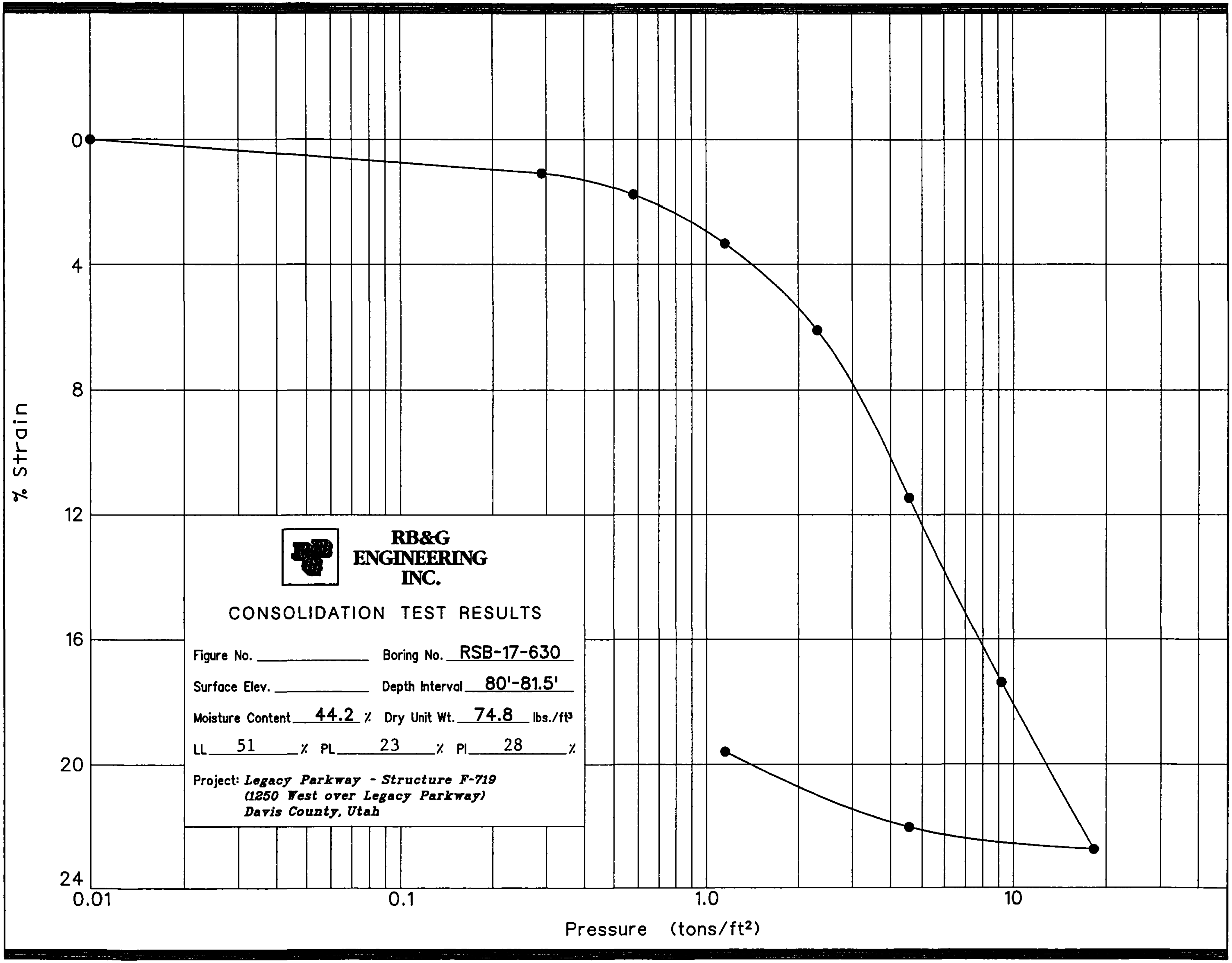
TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

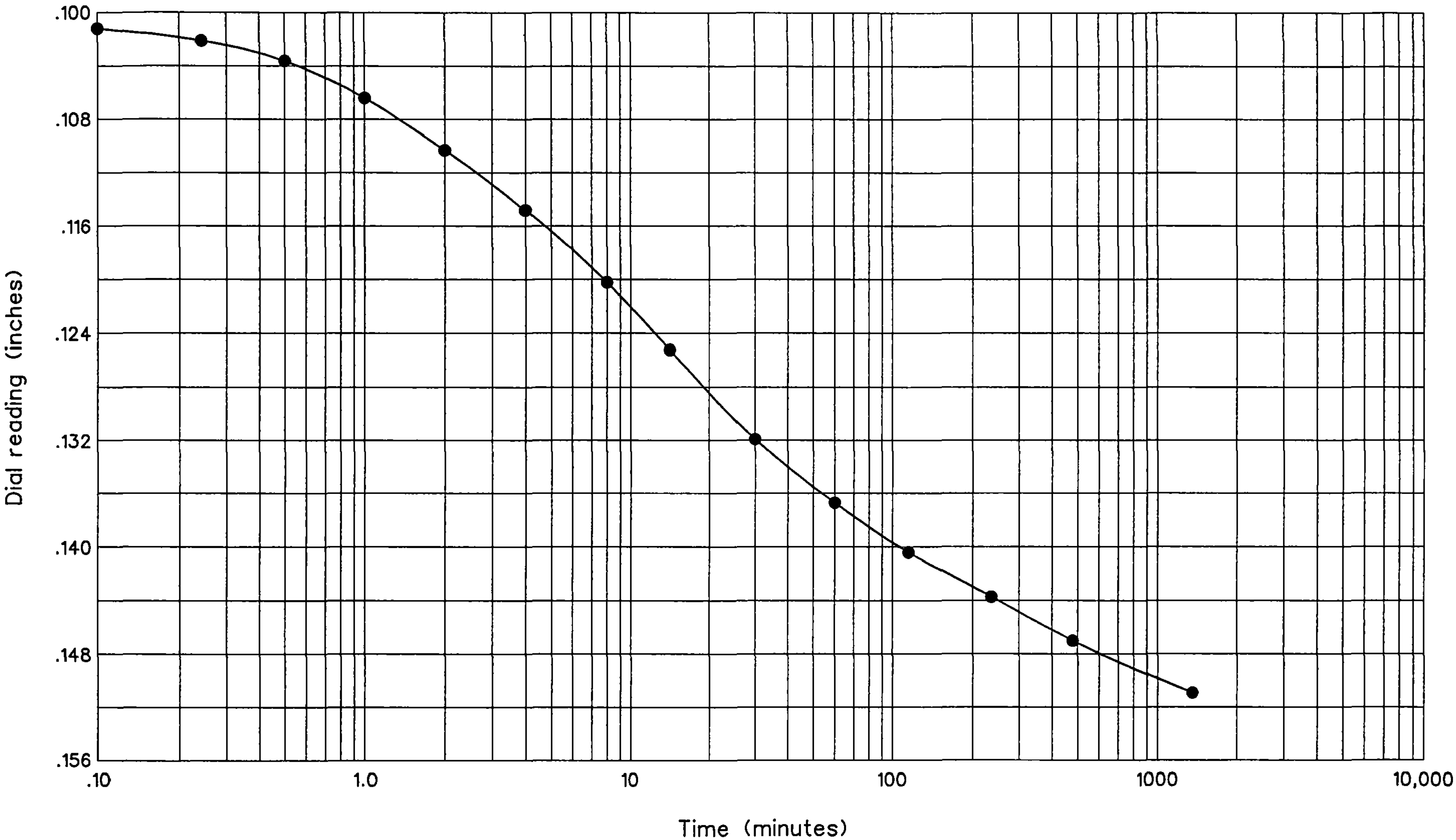
Figure



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 80'-81.5'
Moisture Content 44.2 % Dry Unit Wt. 74.8 lbs./ft³
LL 51 % PL 23 % PI 28 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
Void Ratio (e)
1.30
1.20
1.10
1.00
.90
.80
.70
0.01
0.1
1.0
10
Pressure (tons/ft²)



% Strain
0
4
8
12
16
20
24
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 80'-81.5'
Moisture Content 44.2 %
Dry Unit Wt. 74.8 lbs./ft³
LL 51 %
PL 23 %
PI 28 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah



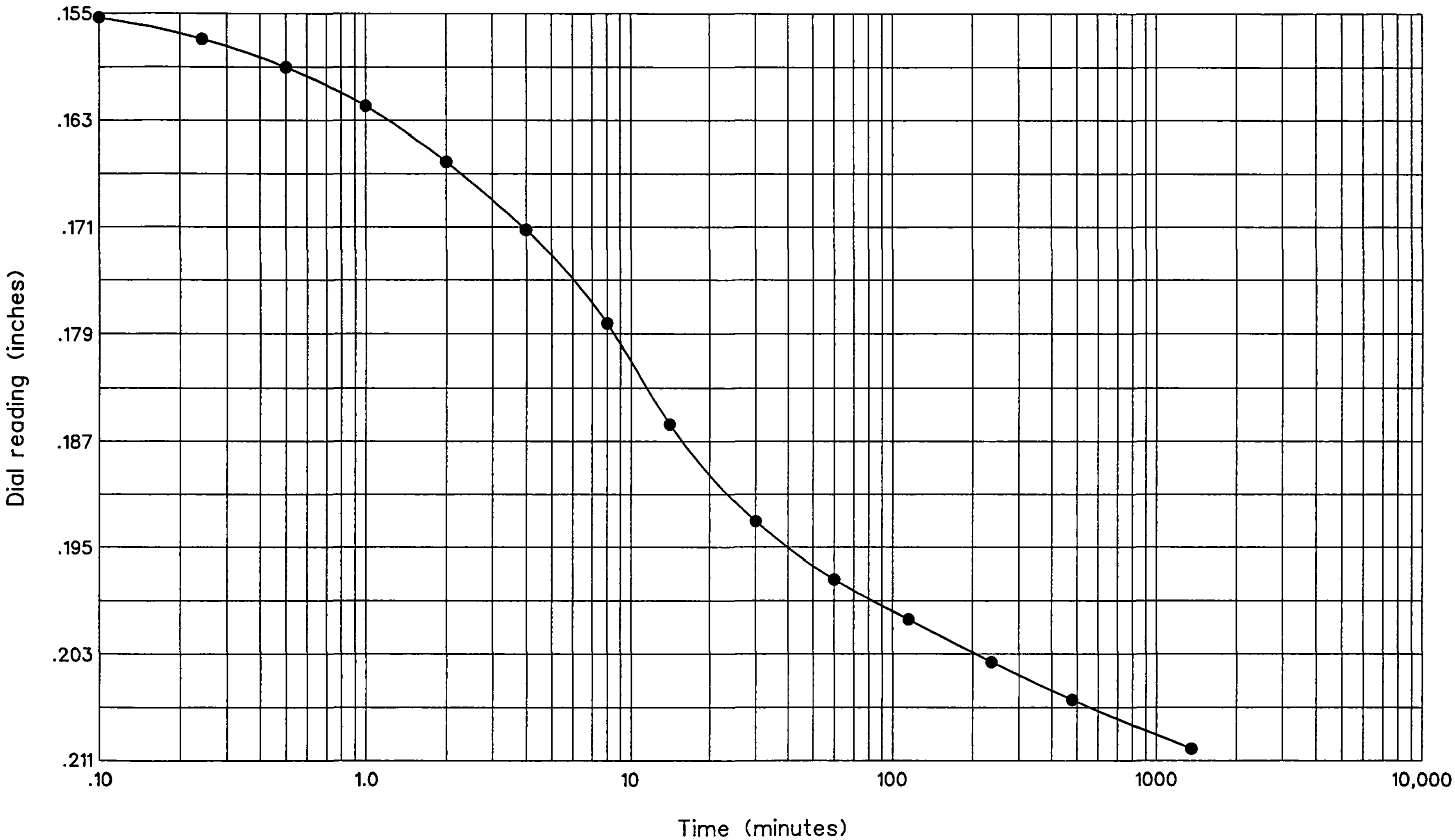
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 80'-81.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



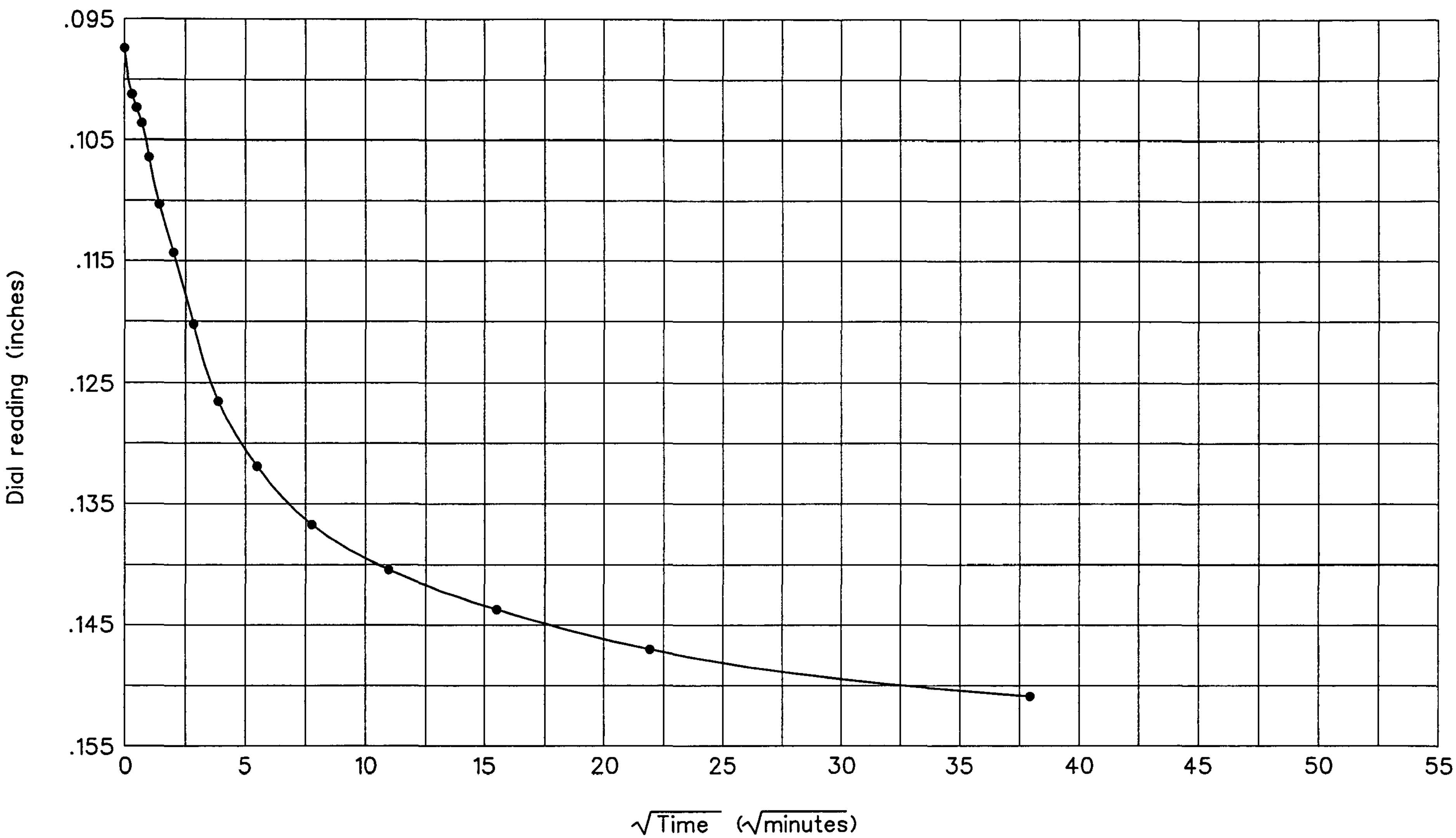
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 80'-81.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



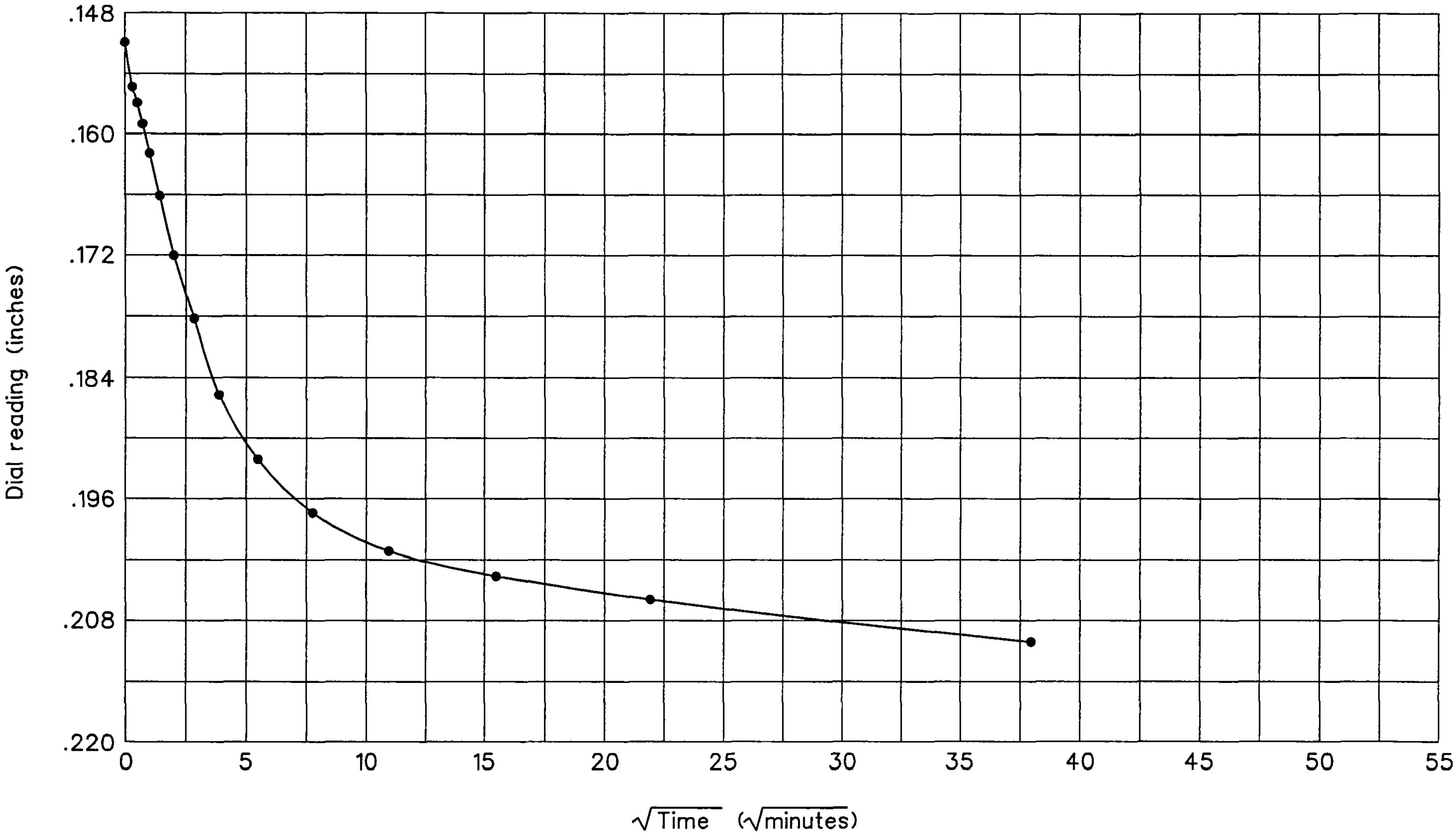
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 80'-81.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



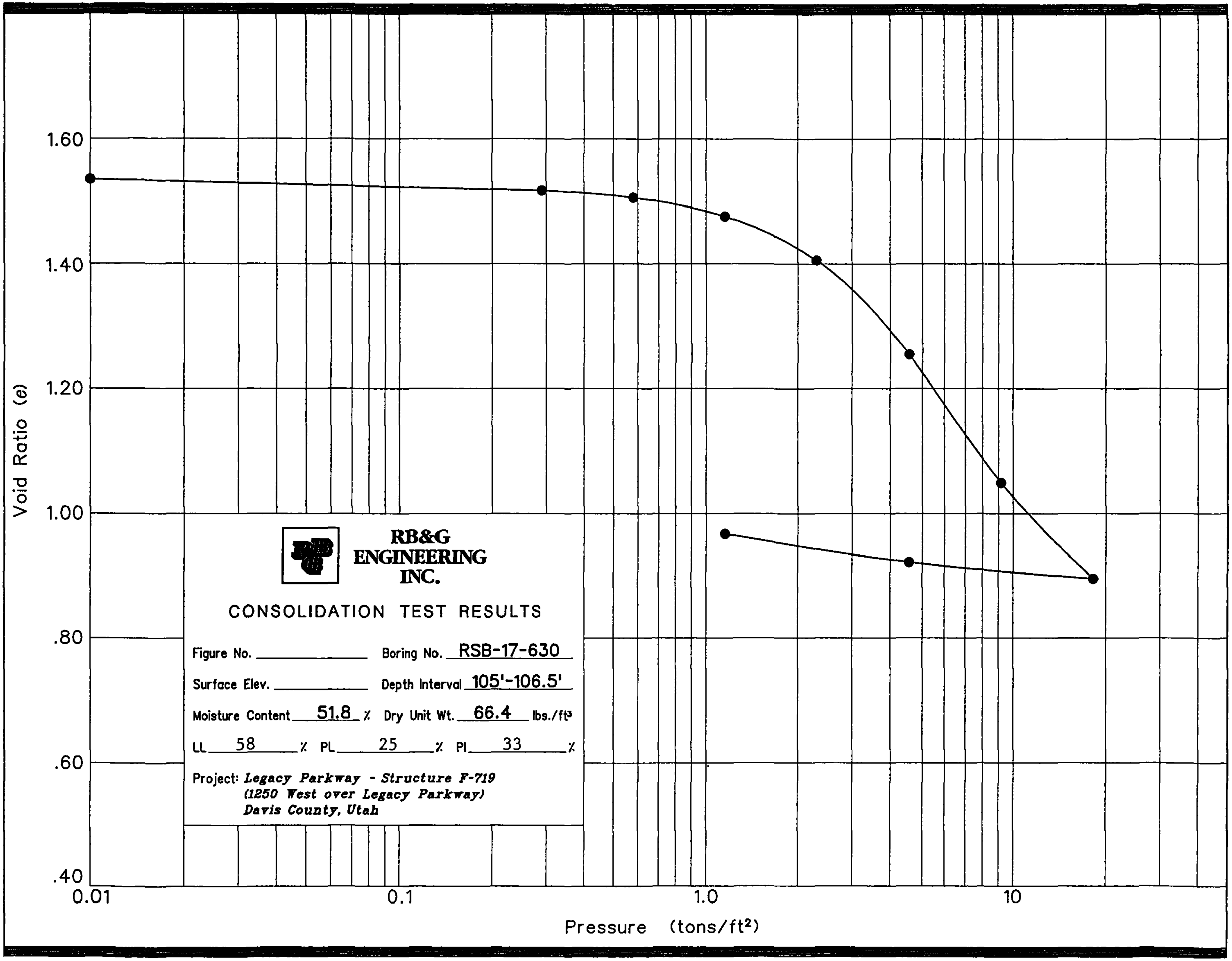
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 80'-81.5'
Load: 9.20 to 18.40 tons

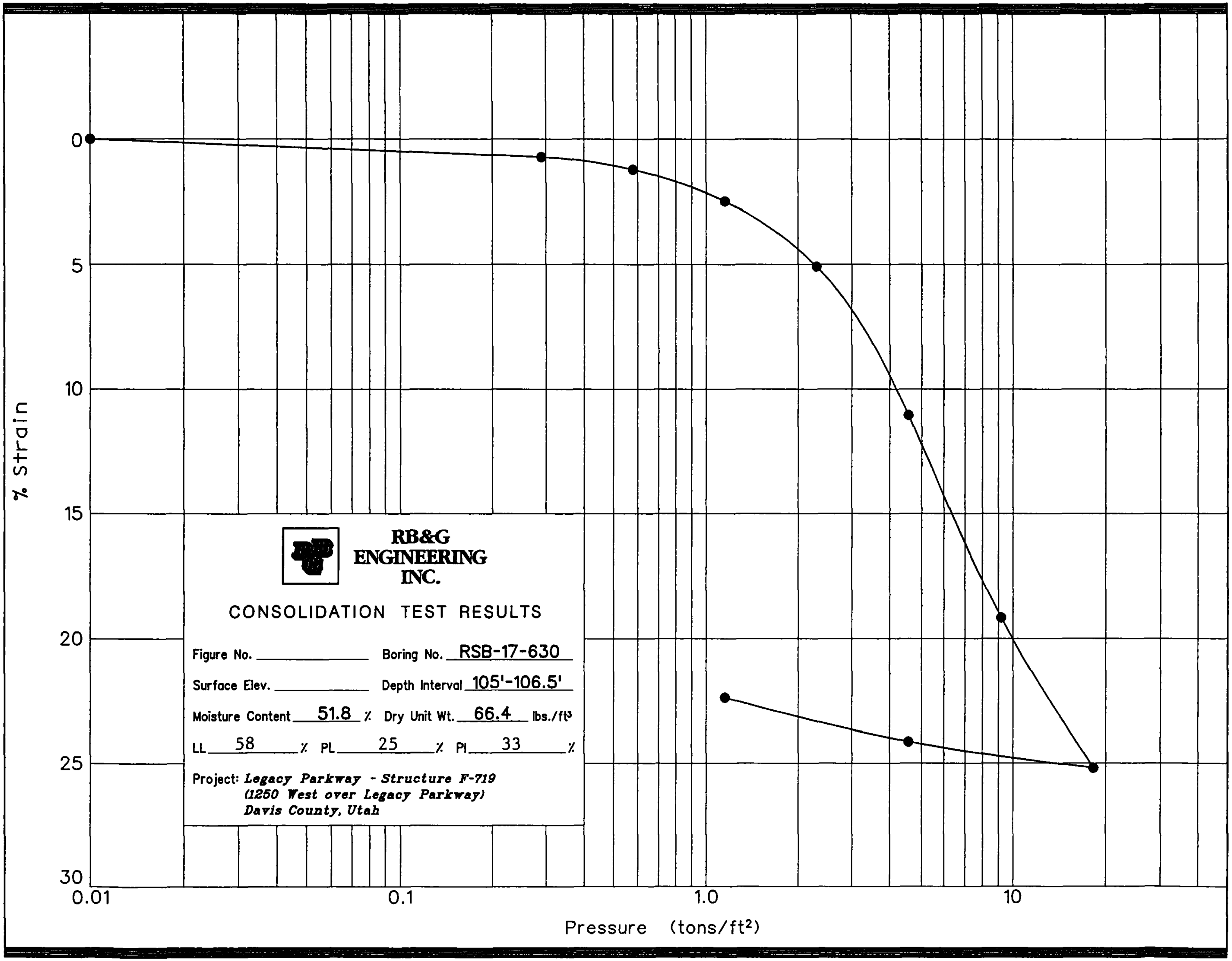
TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

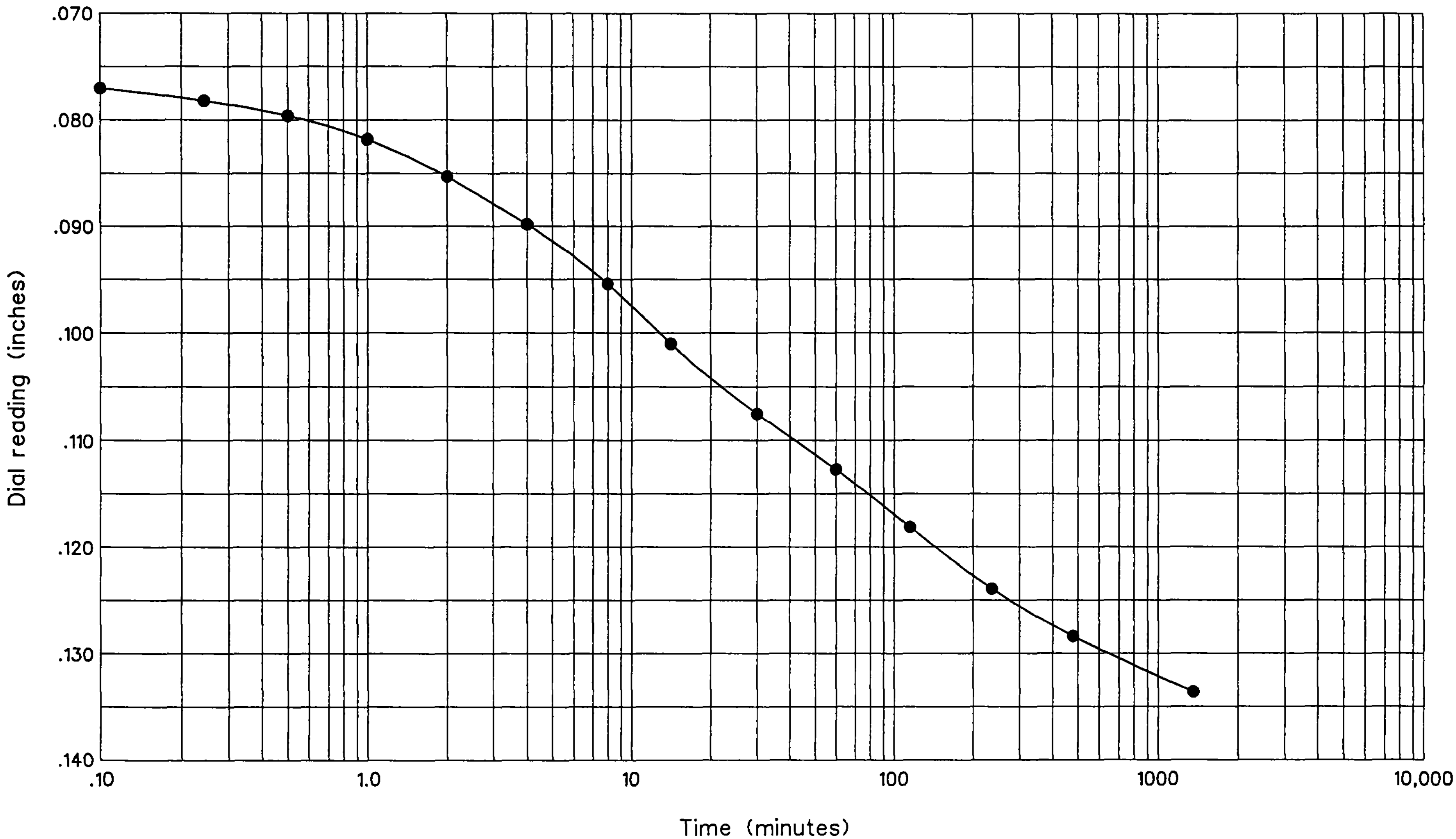
Figure



Void Ratio (e)
1.60
1.40
1.20
1.00
.80
.60
.40
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING
INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 105'-106.5'
Moisture Content 51.8 % Dry Unit Wt. 66.4 lbs./ft³
LL 58 % PL 25 % PI 33 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah



0
5
10
15
20
25
30
% Strain
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 105'-106.5'
Moisture Content 51.8 %
Dry Unit Wt. 66.4 lbs./ft³
LL 58 %
PL 25 %
PI 33 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah



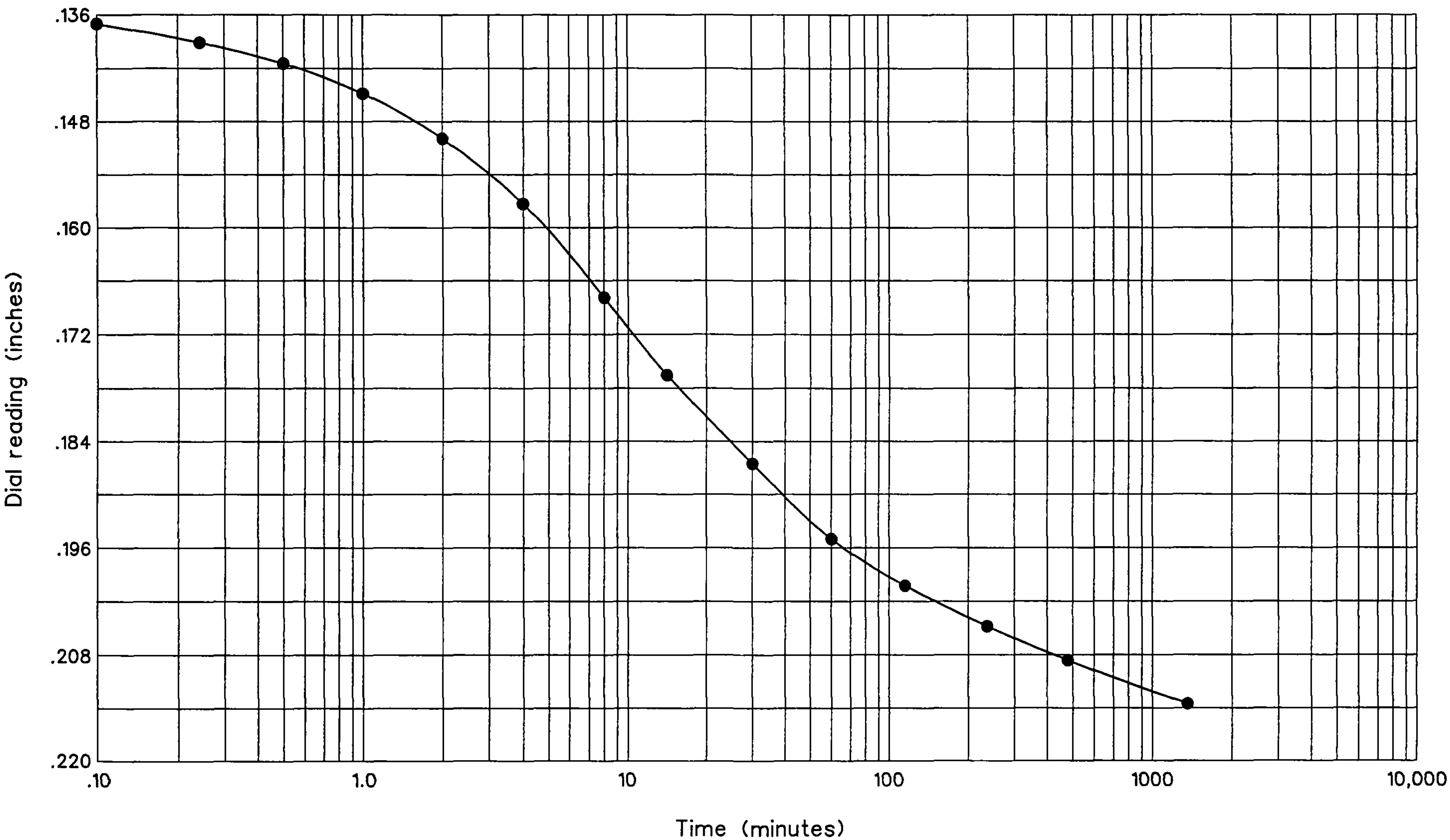
RB&G ENGINEERING INC.
Provo, Utah

Hole no.:	RSB-17-630
Depth:	105'-106.5'
Load:	4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



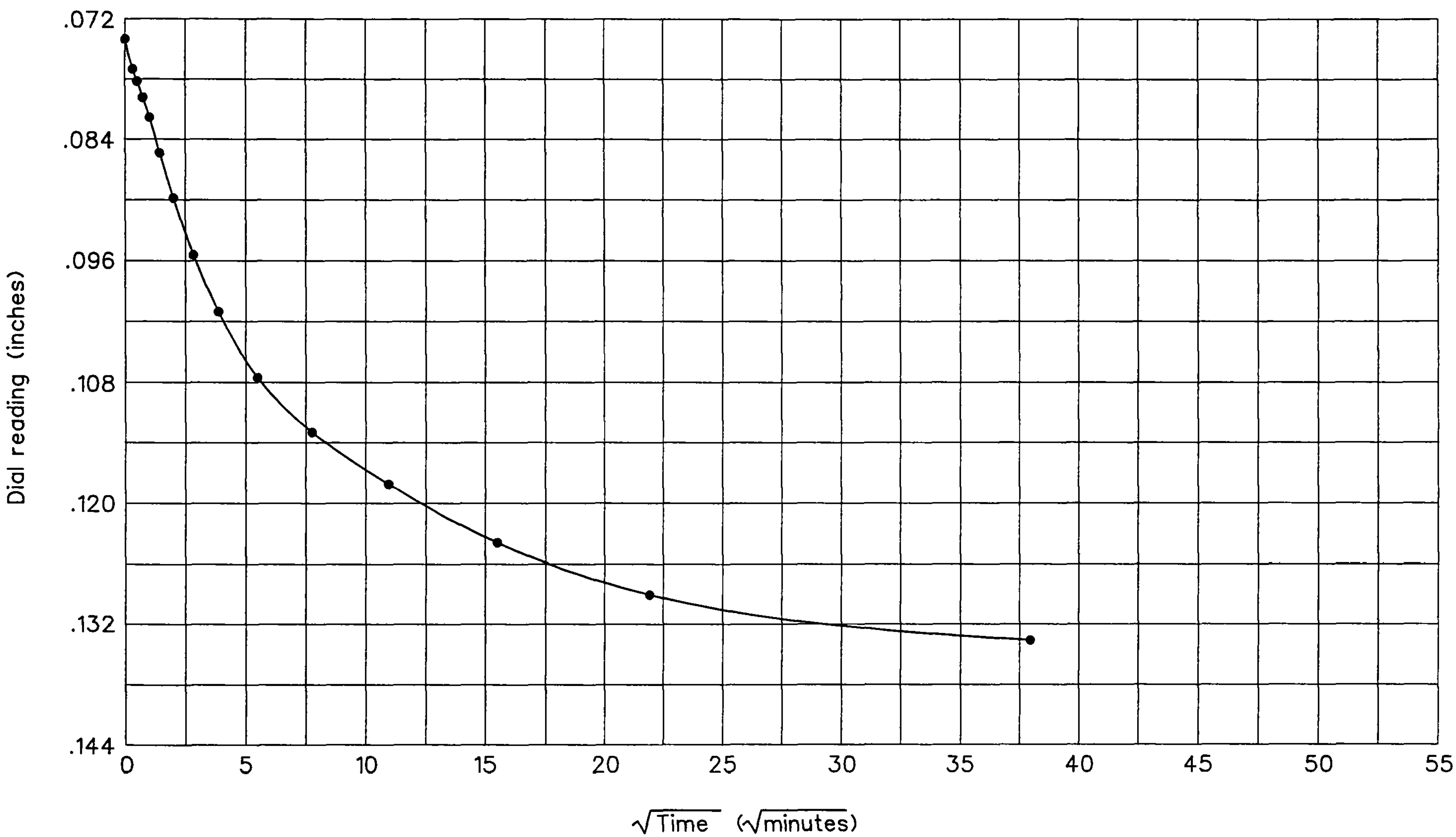
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 105'-106.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



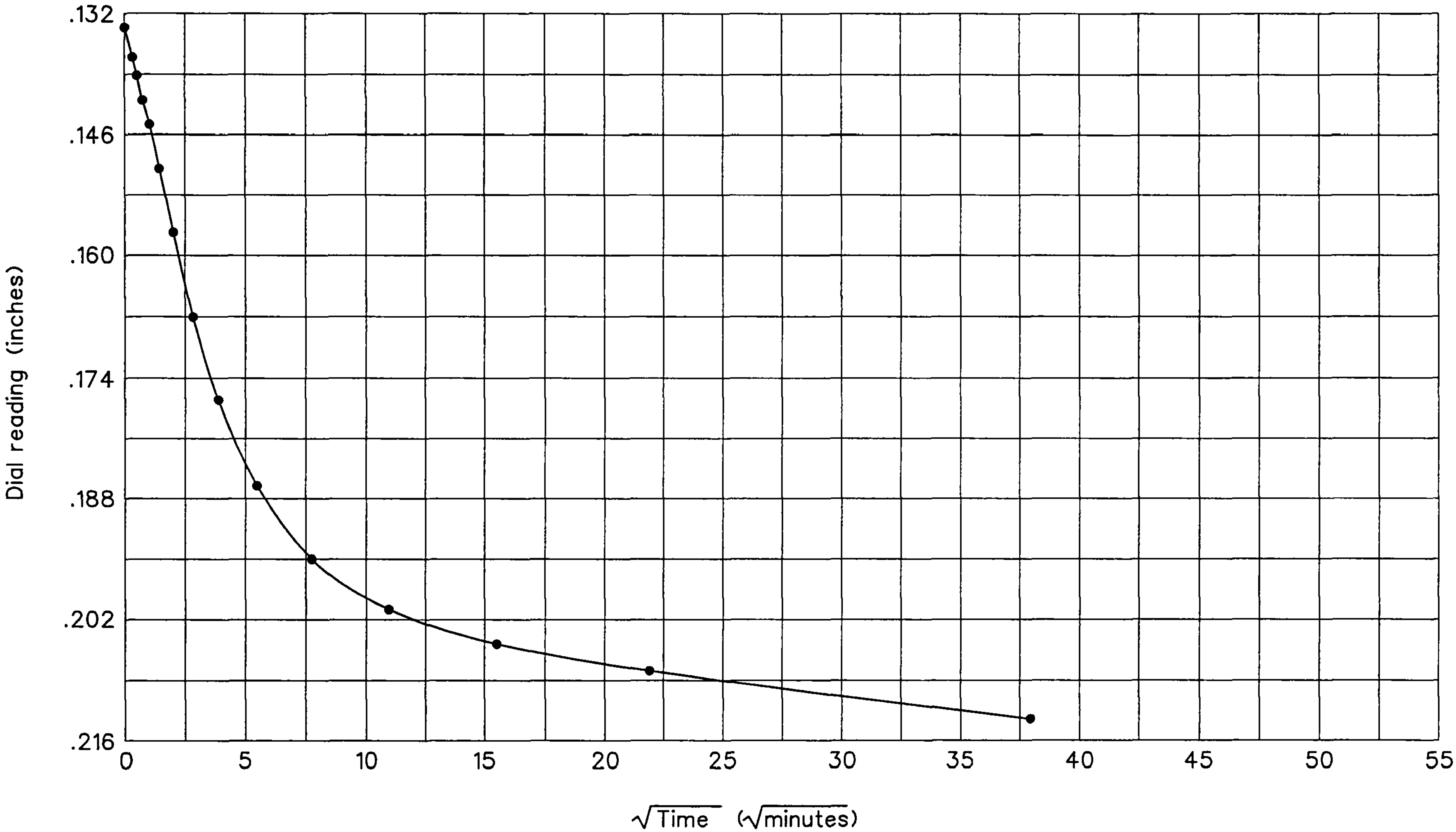
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 105'-106.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



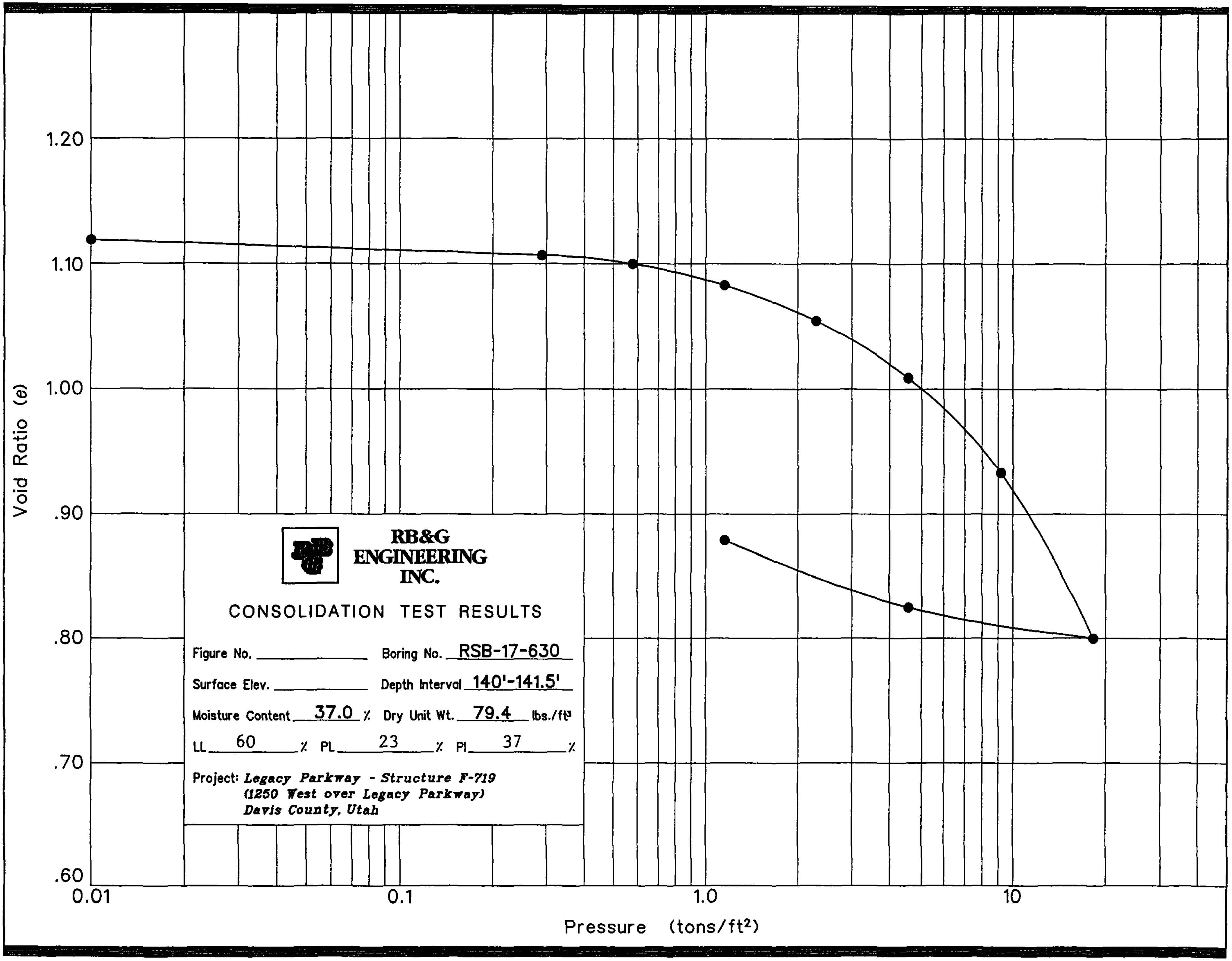
RB&G ENGINEERING INC.
Provo, Utah

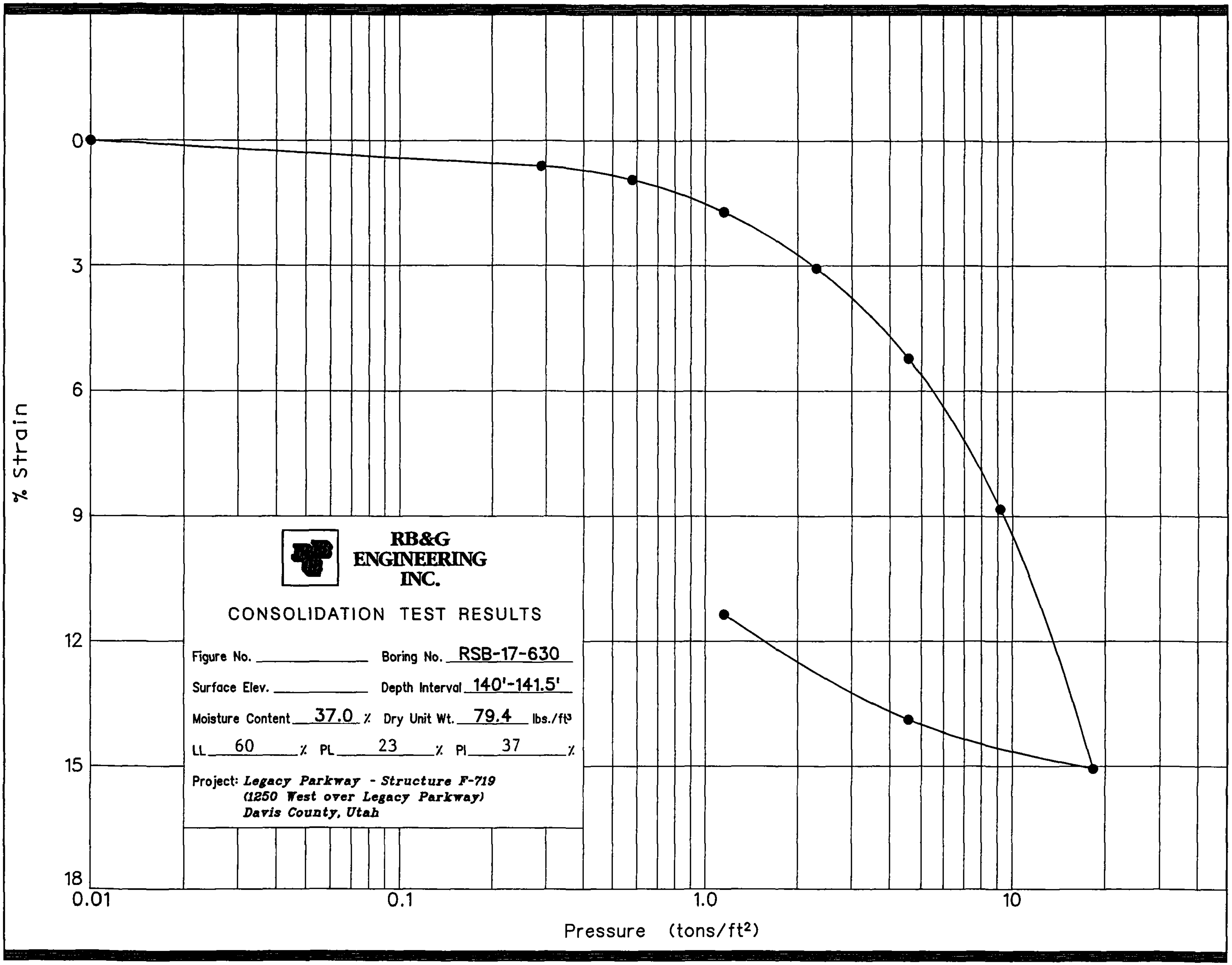
Hole no.: RSB-17-630
Depth: 105'-106.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

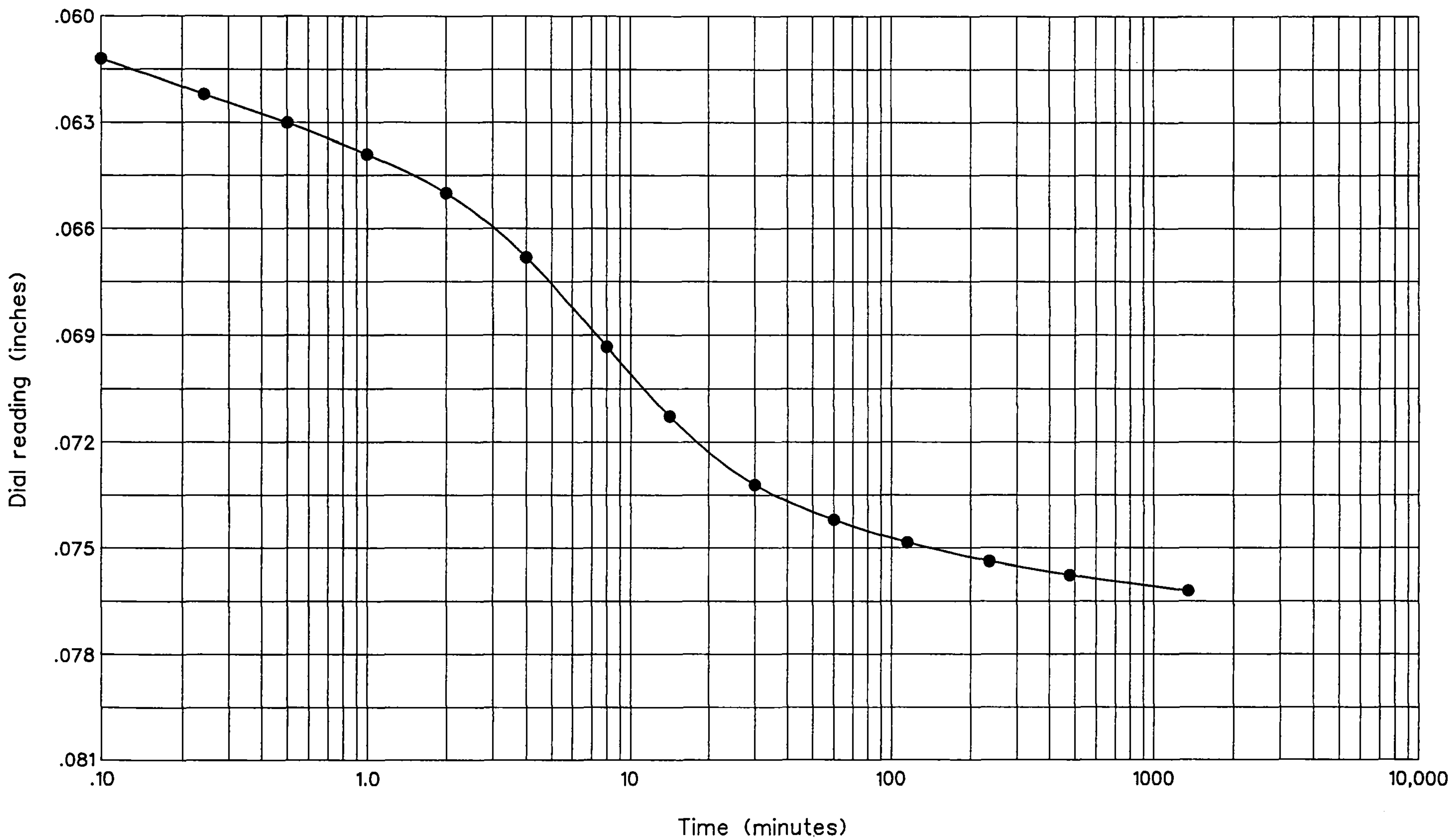
Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure


RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 140'-141.5'
Moisture Content 37.0 % Dry Unit Wt. 79.4 lbs./ft³
LL 60 % PL 23 % PI 37 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
Void Ratio (e)
1.20
1.10
1.00
.90
.80
.70
.60
0.01
0.1
1.0
10
Pressure (tons/ft²)



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-630
Surface Elev.
Depth Interval 140'-141.5'
Moisture Content 37.0 %
Dry Unit Wt. 79.4 lbs./ft³
LL 60 %
PL 23 %
PI 37 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
% Strain
0
3
6
9
12
15
18
0.01
0.1
1.0
10
Pressure (tons/ft²)



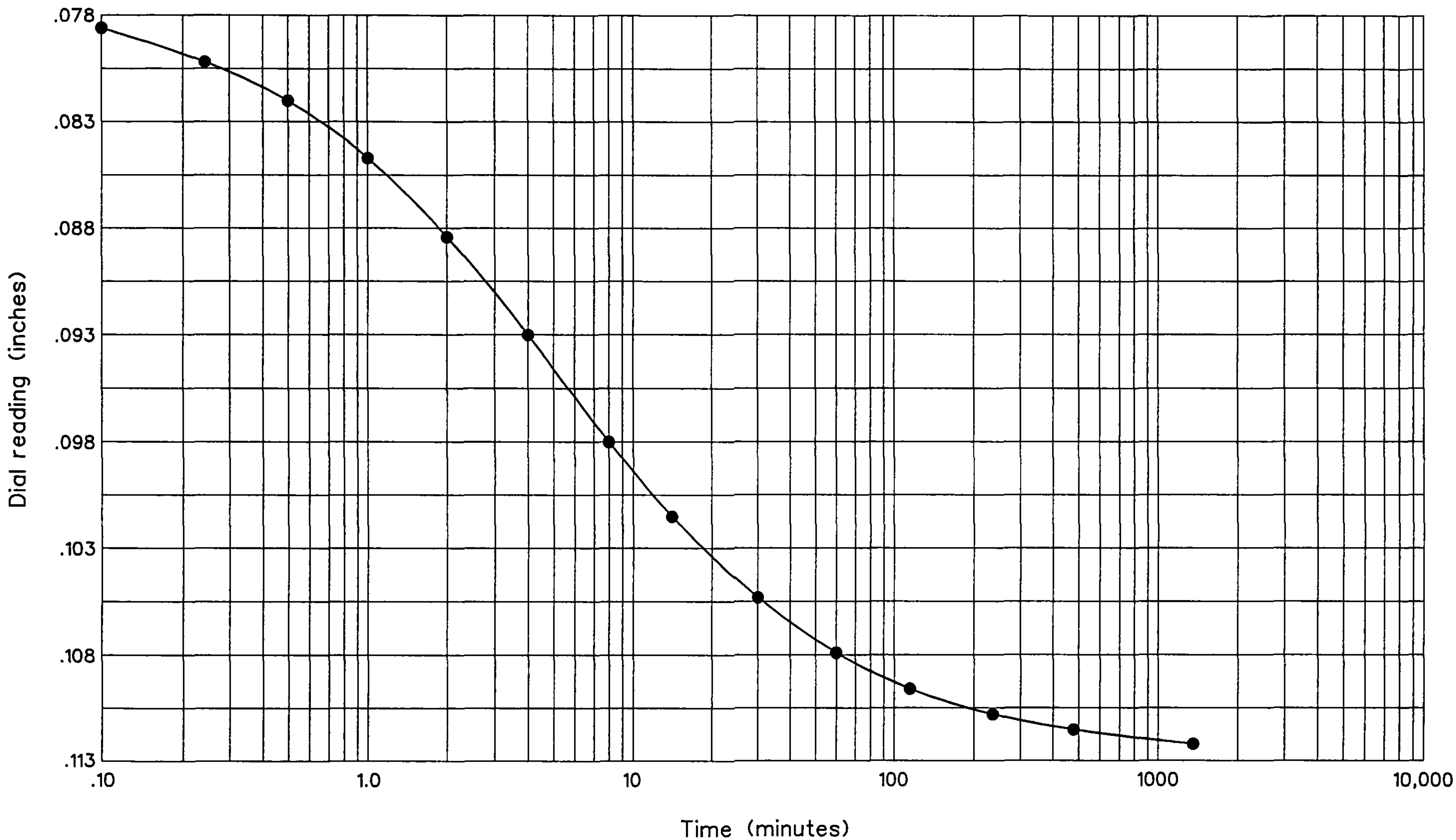
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 140'-141.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



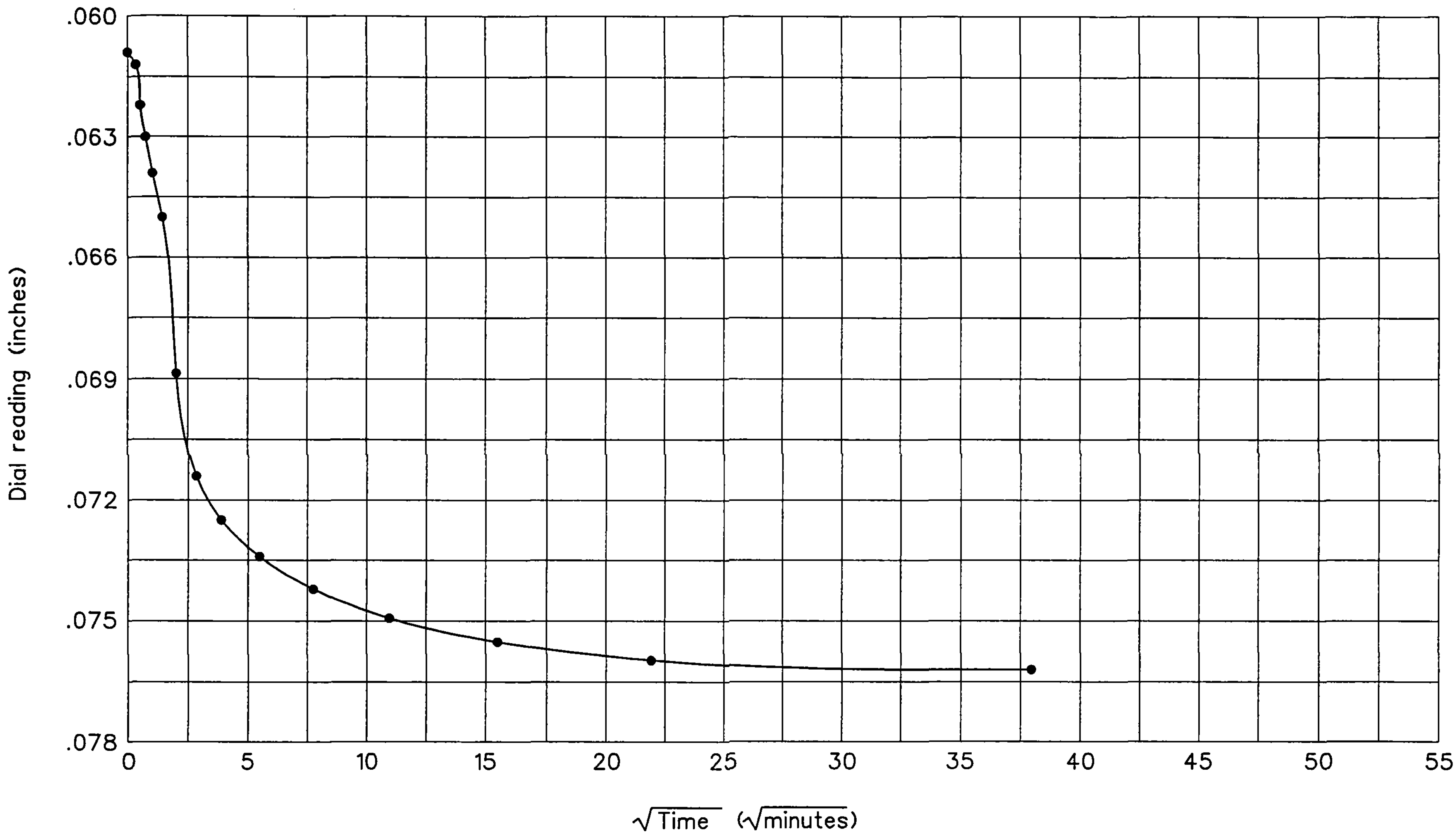
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 140'-141.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



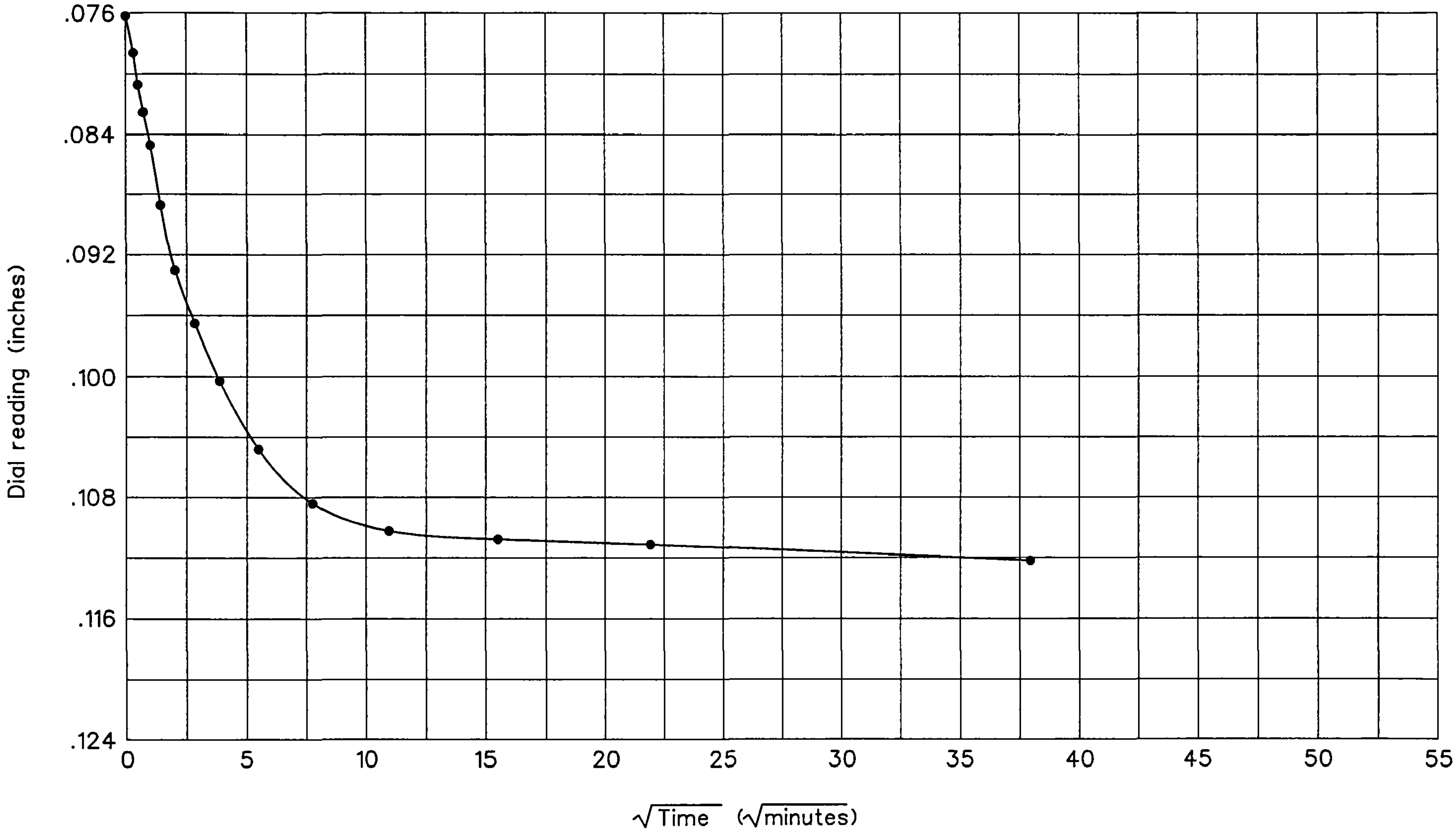
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 140'-141.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



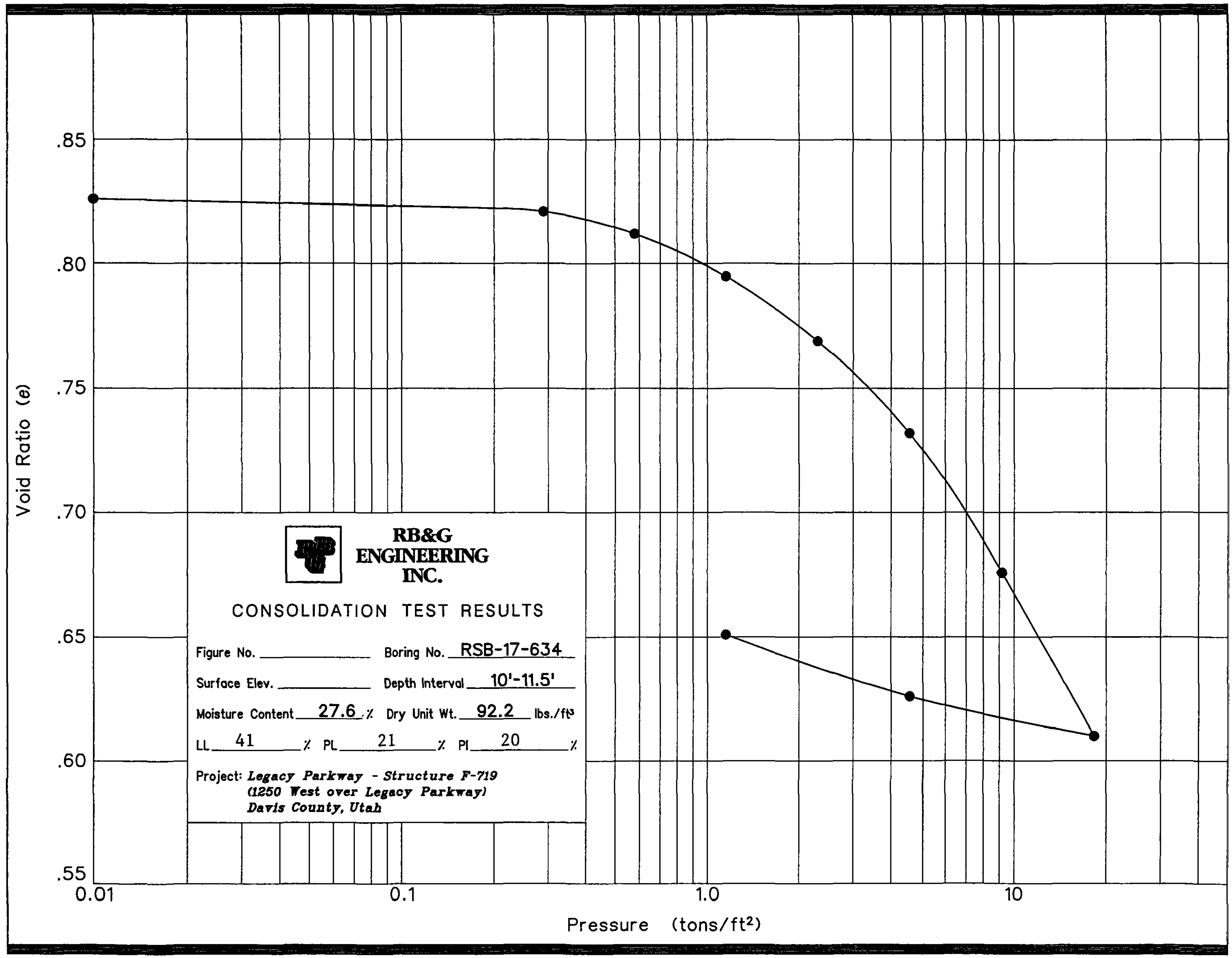
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-630
Depth: 140'-141.5'
Load: 9.20 to 18.40 tons

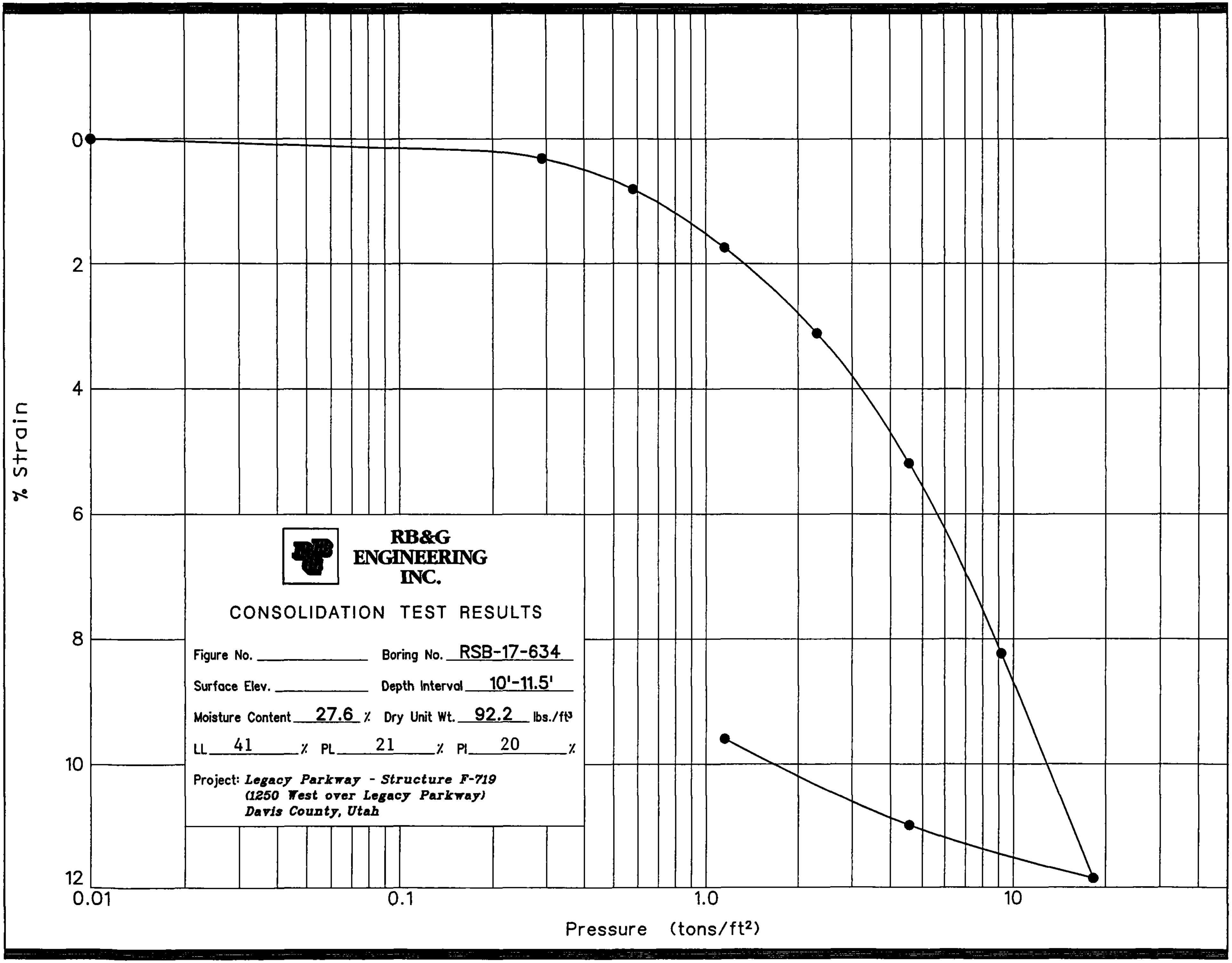
TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

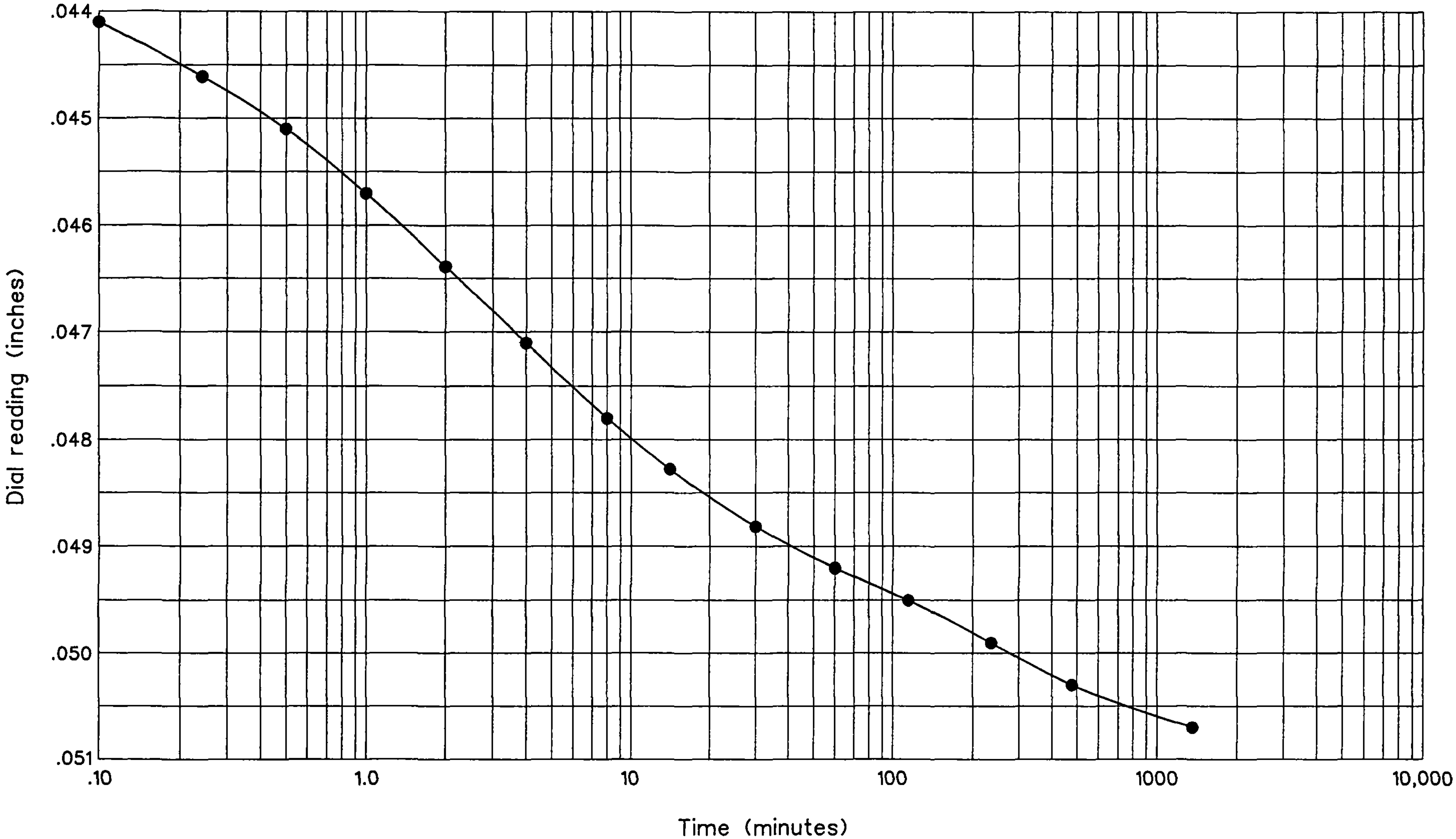
Figure



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 10'-11.5'
Moisture Content 27.6 %
Dry Unit Wt. 92.2 lbs./ft³
LL 41 %
PL 21 %
PI 20 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
Void Ratio (e)
.85
.80
.75
.70
.65
.60
.55
0.01
0.1
1.0
10
Pressure (tons/ft²)



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 10'-11.5'
Moisture Content 27.6 %
Dry Unit Wt. 92.2 lbs./ft³
LL 41 %
PL 21 %
PI 20 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
% Strain
0
2
4
6
8
10
12
0.01
0.1
1.0
10
Pressure (tons/ft²)



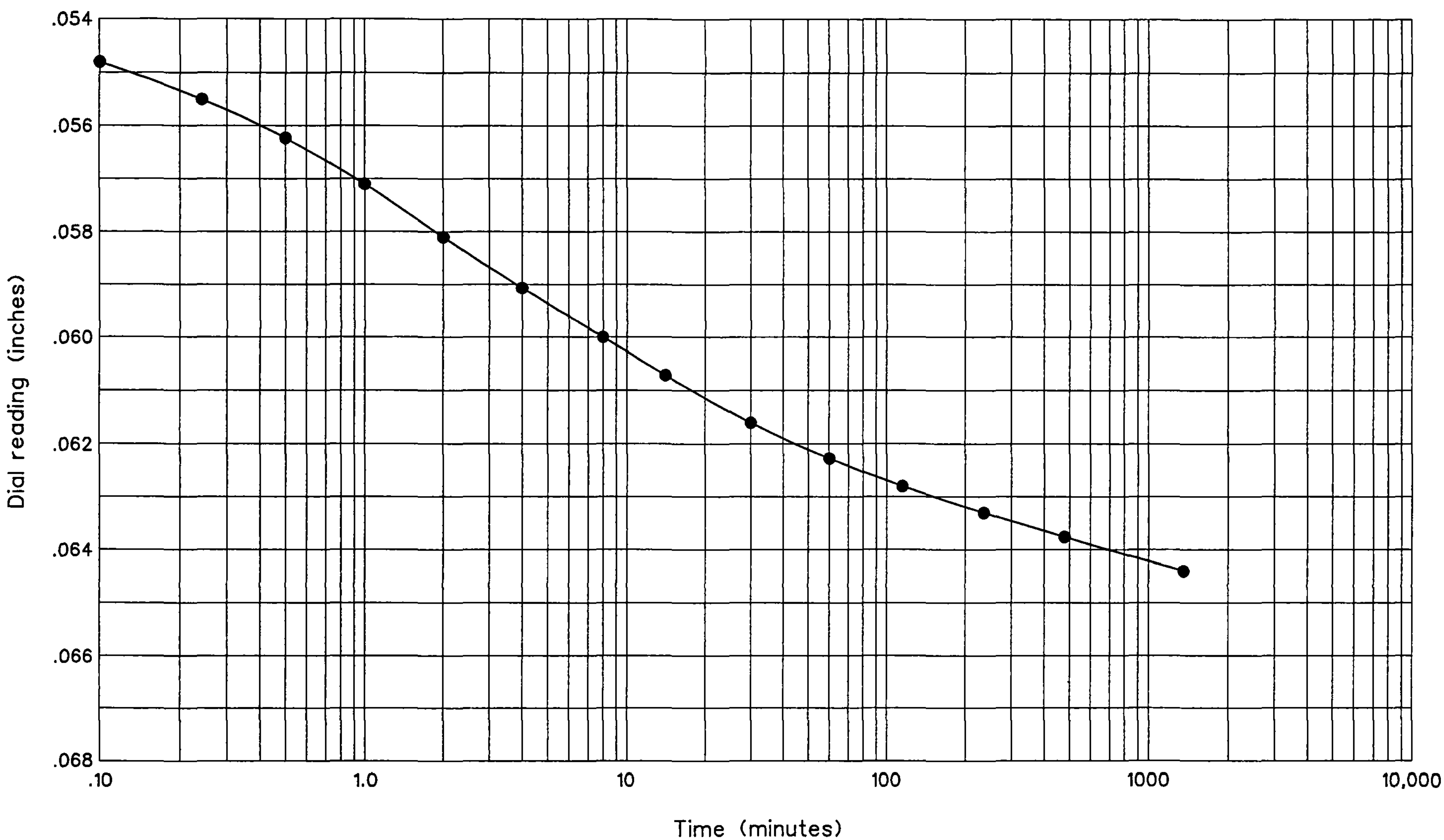
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 10'-11.5'
Load: 1.15 to 2.30 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



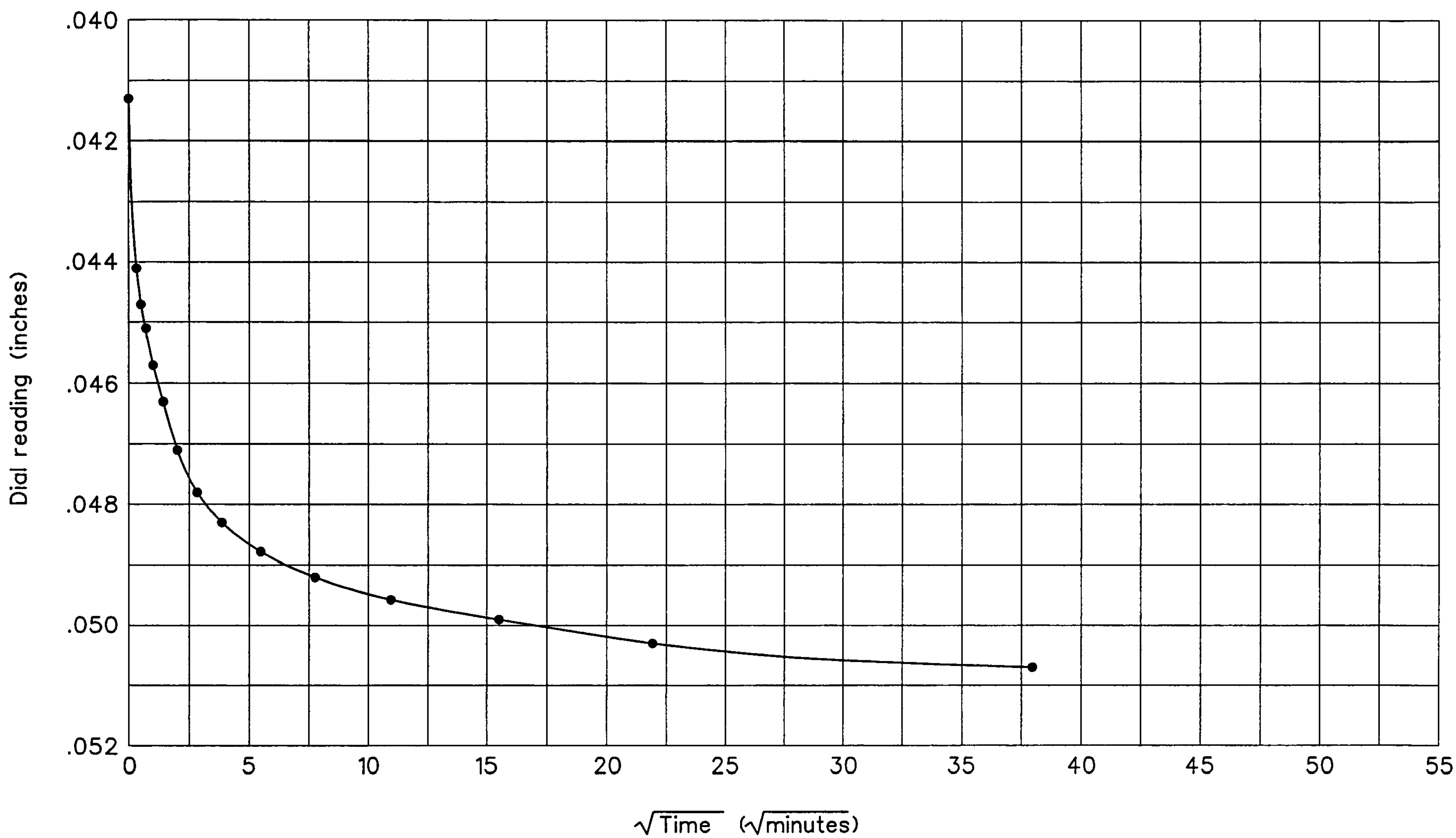
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 10'-11.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



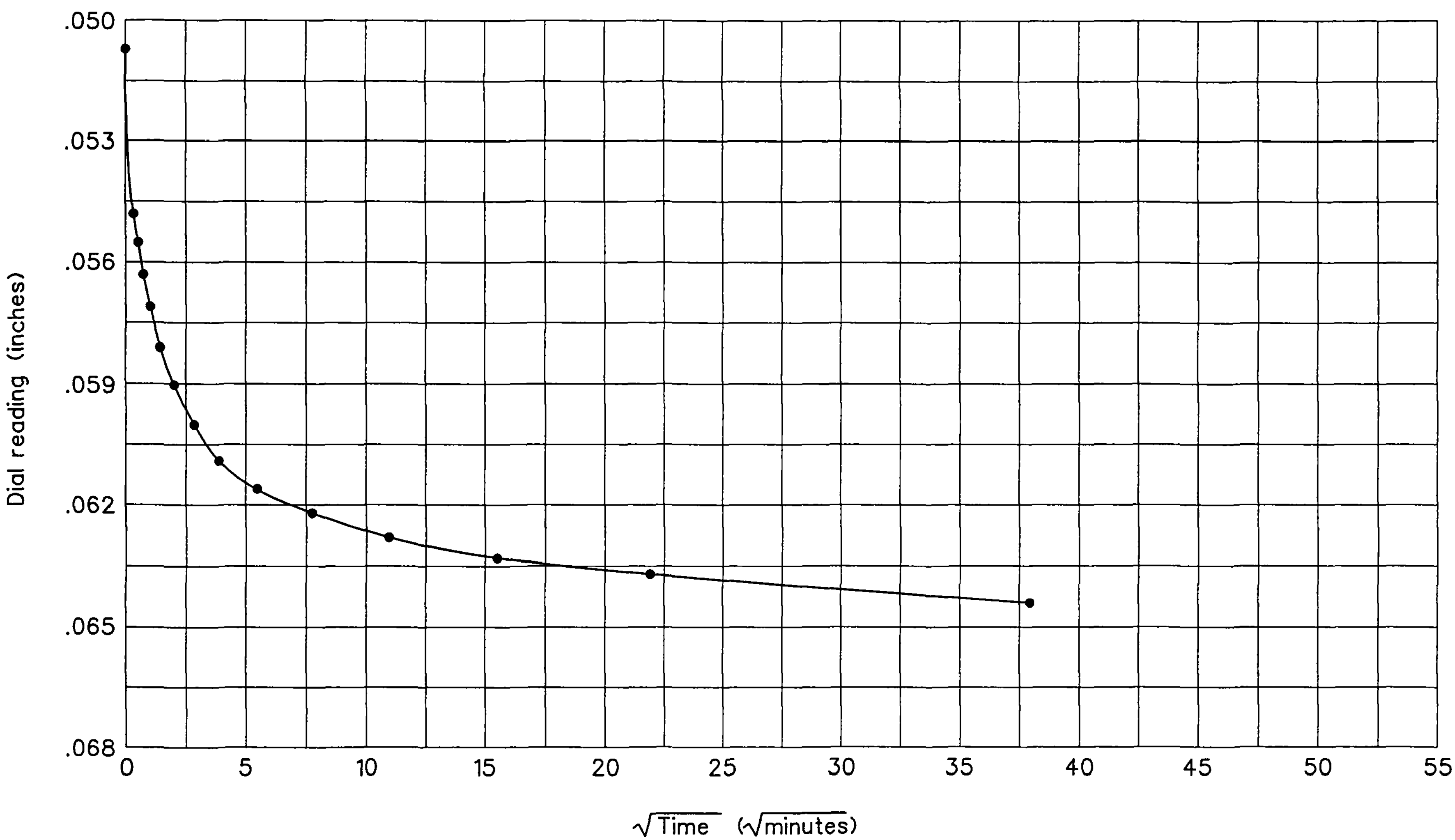
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 10'-11.5'
Load: 1.15 to 2.30 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



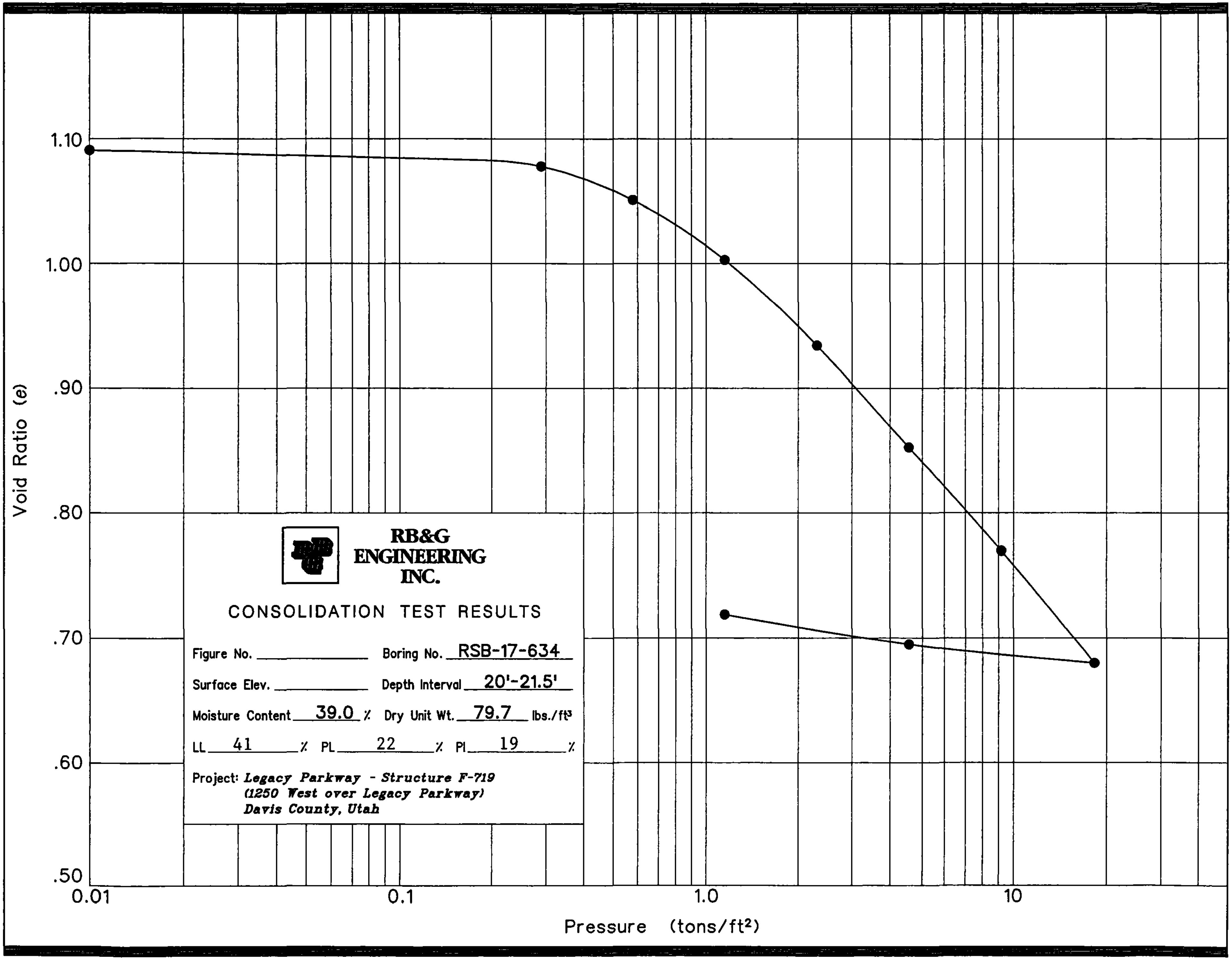
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 10'-11.5'
Load: 2.30 to 4.60 tons

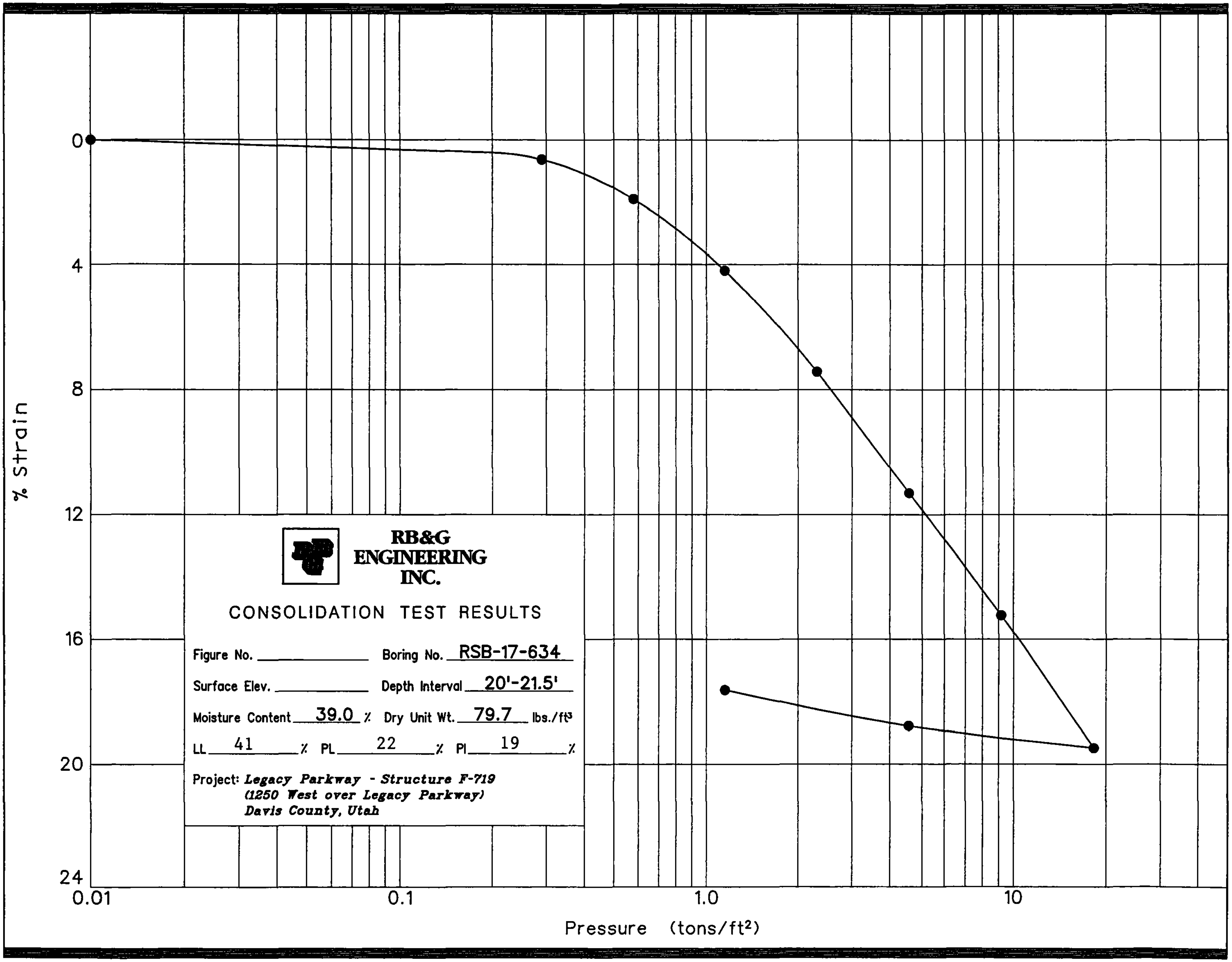
TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

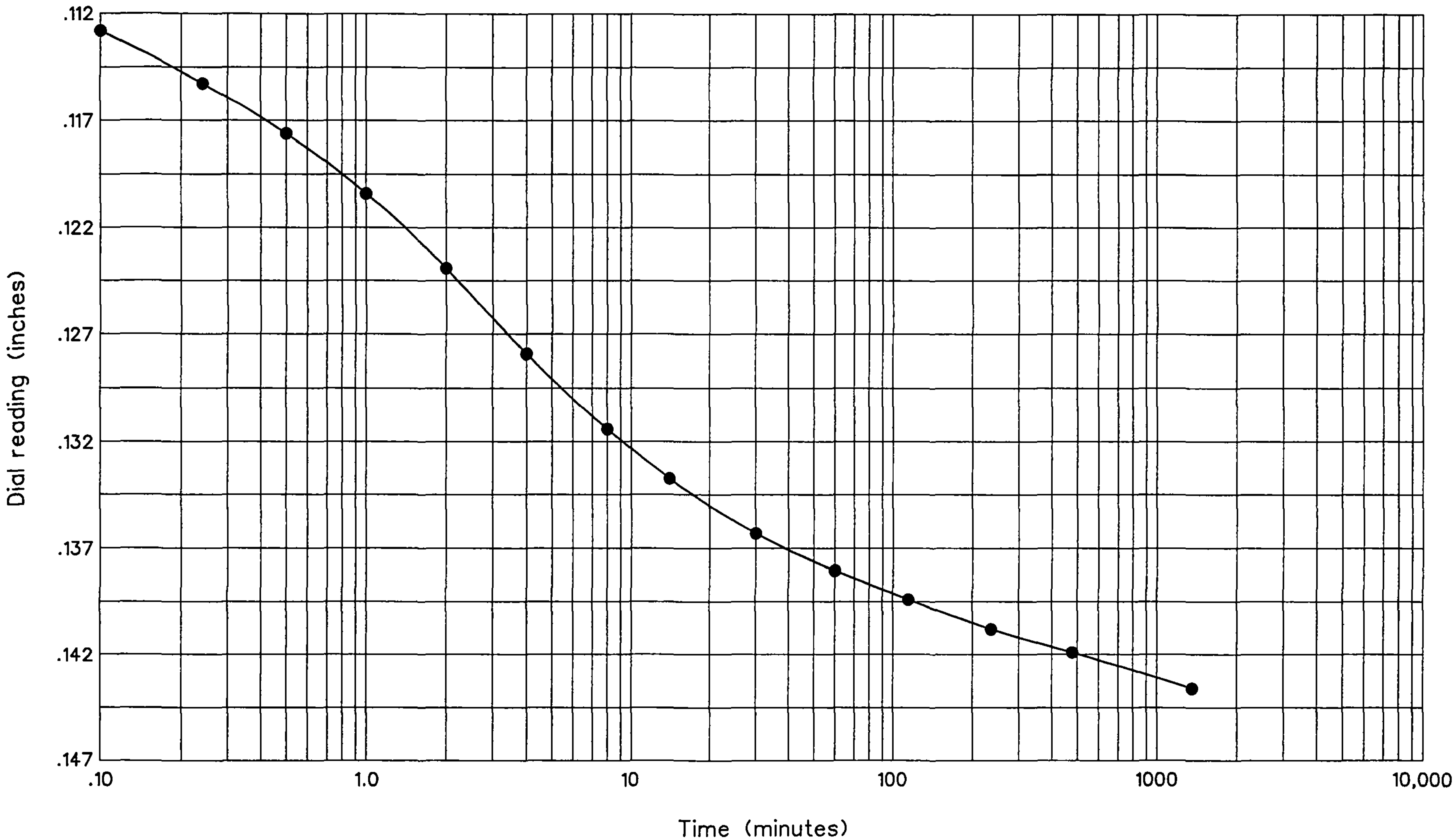
Figure



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-17-634
Surface Elev.
Depth Interval 20'-21.5'
Moisture Content 39.0 %
Dry Unit Wt. 79.7 lbs./ft³
LL 41 %
PL 22 %
PI 19 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 20'-21.5'
Moisture Content 39.0 %
Dry Unit Wt. 79.7 lbs./ft³
LL 41 %
PL 22 %
PI 19 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
% Strain
0
4
8
12
16
20
24
0.01
0.1
1.0
10
Pressure (tons/ft²)



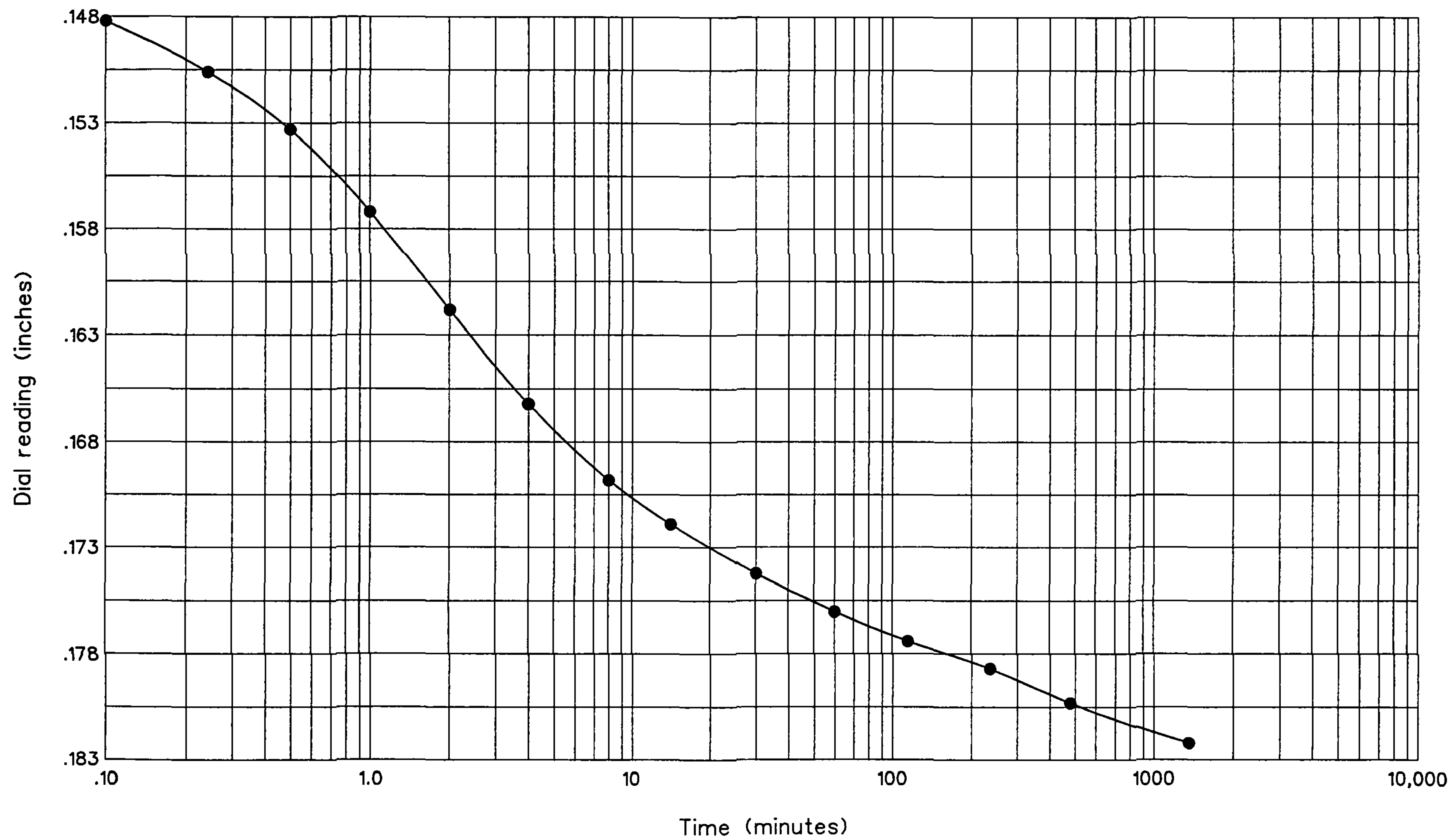
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 20'-21.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



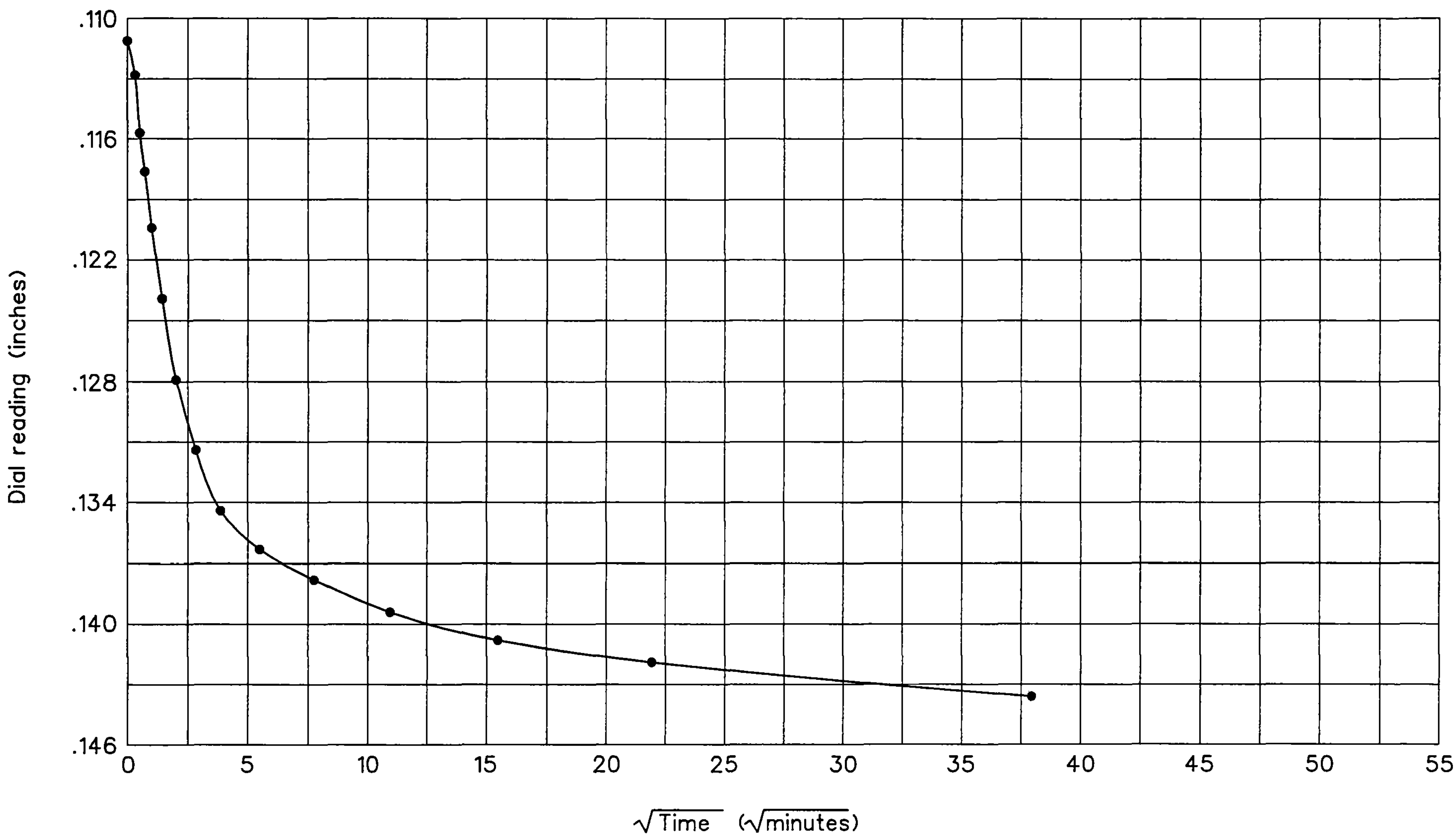
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 20'-21.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



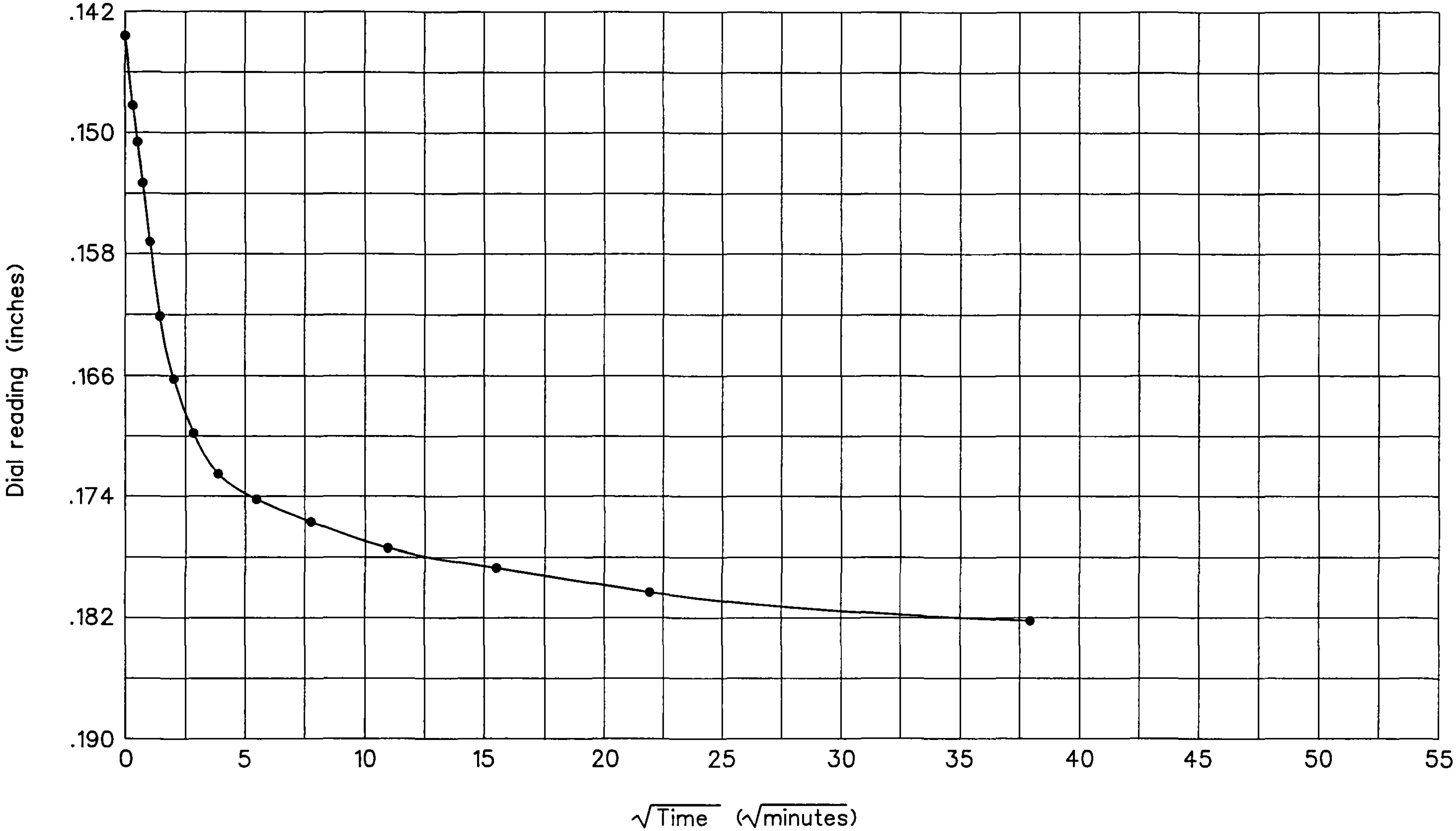
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 20'-21.5'
Load: 2.30 to 4.60 tons

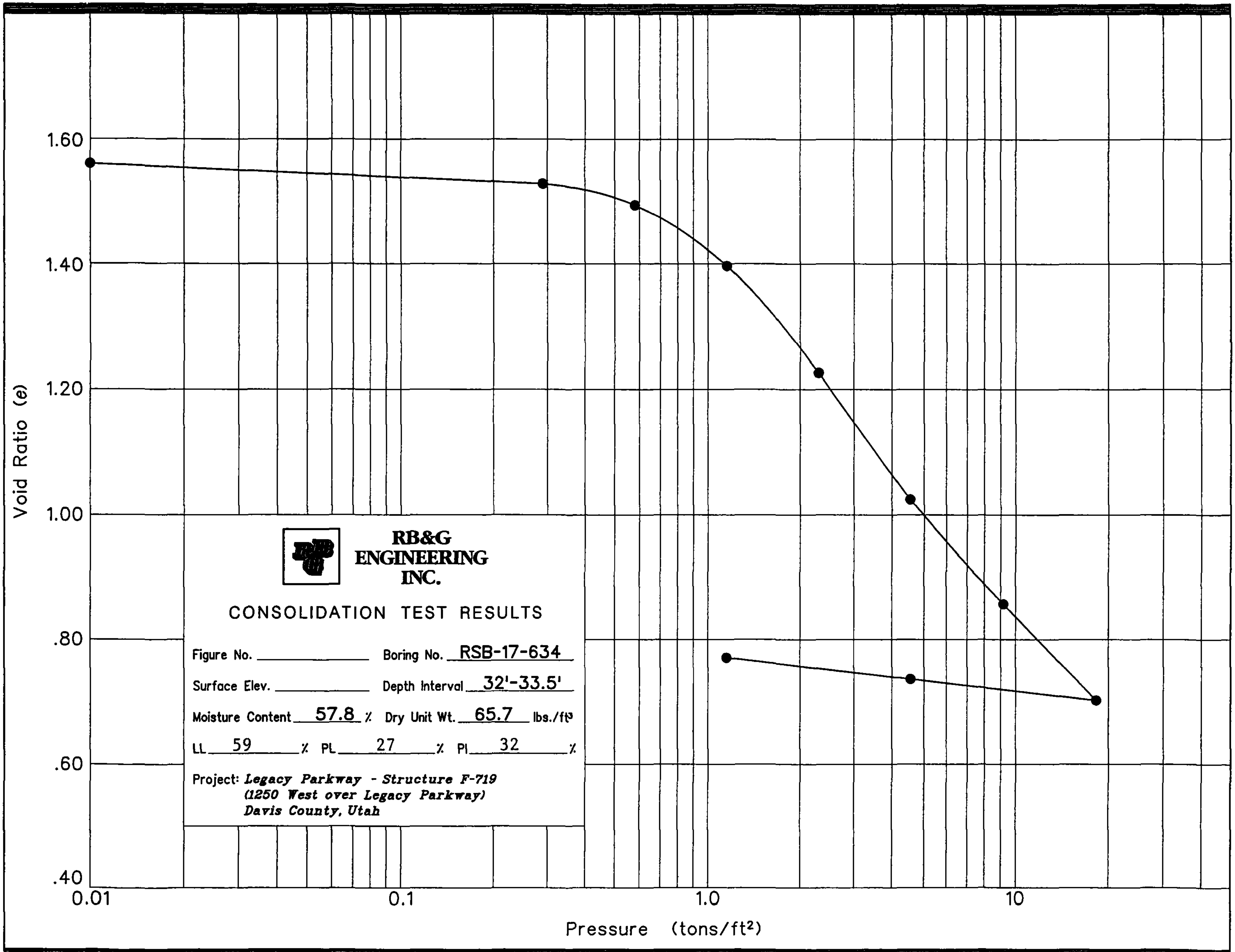
TIME CONSOLIDATION

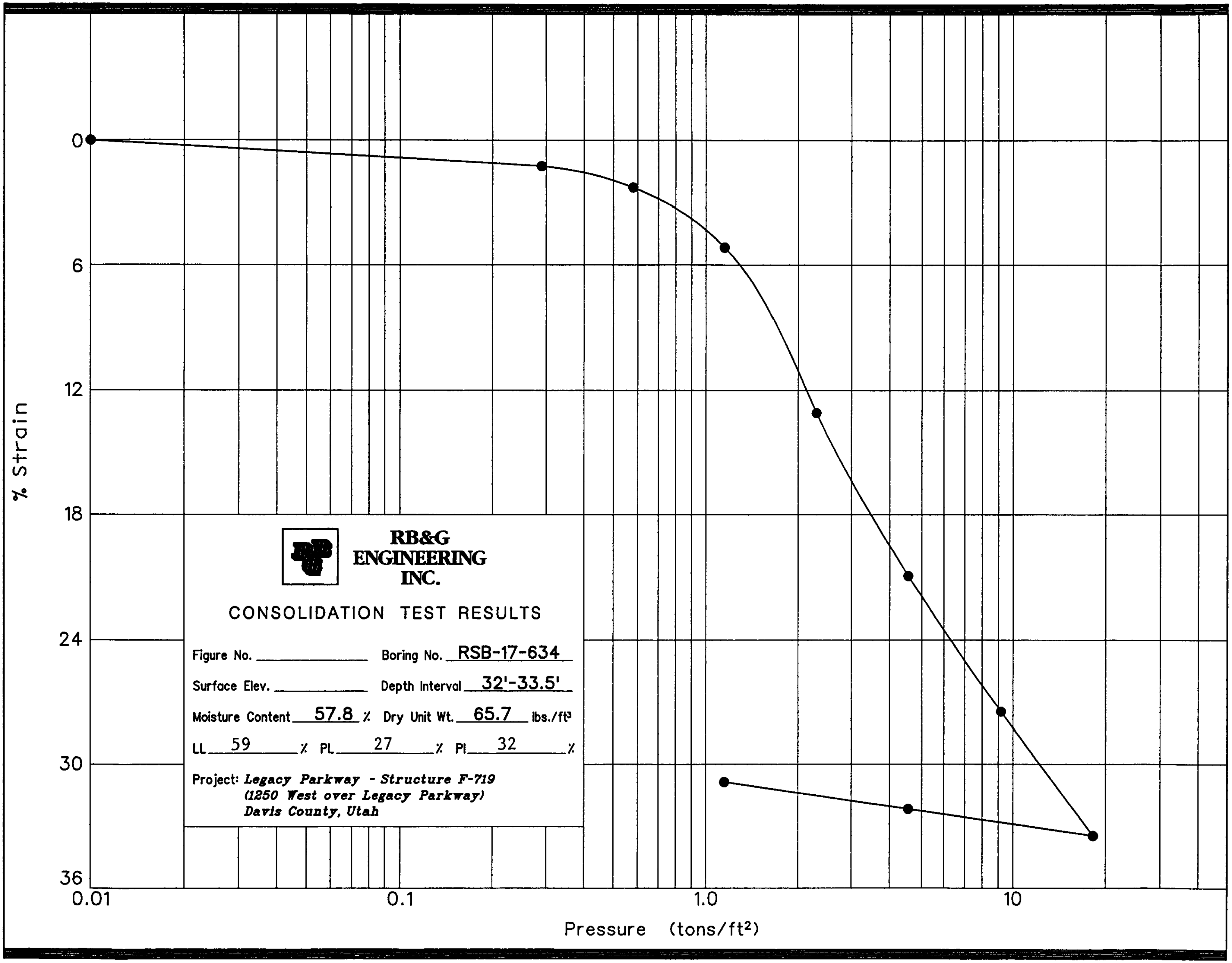
Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

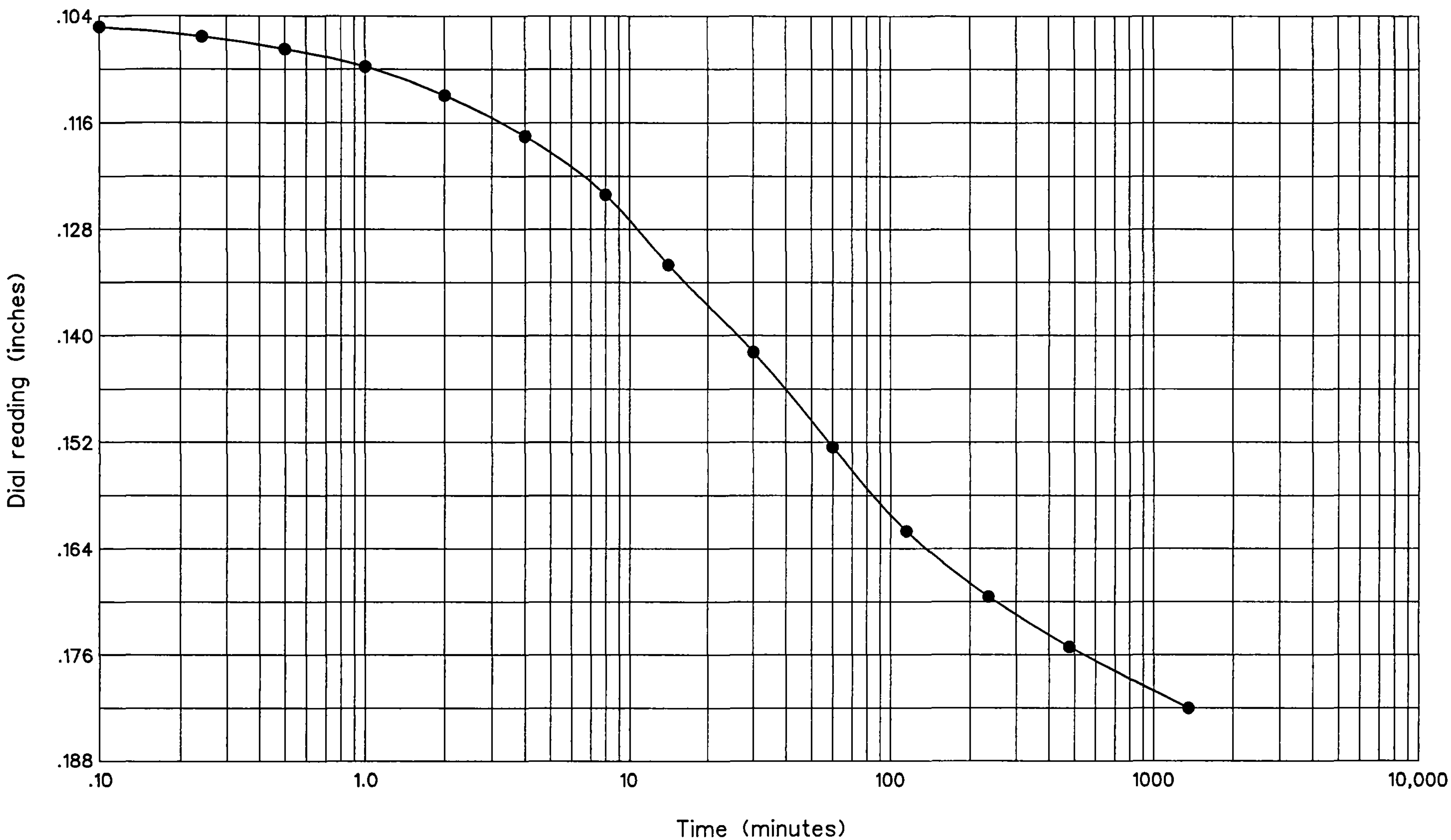
Figure



RB&G ENGINEERING INC. Provo, Utah	Hole no.: RSB-17-634 Depth: 20'-21.5' Load: 4.60 to 9.20 tons	**TIME CONSOLIDATION** *Legacy Parkway - Structure F-719* *(1250 West over Legacy Parkway)* *Davis County, Utah*	Figure


1.60
1.40
1.20
1.00
.80
.60
.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-17-634
Surface Elev.
Depth Interval 32'-33.5'
Moisture Content 57.8 %
Dry Unit Wt. 65.7 lbs./ft³
LL 59 %
PL 27 %
PI 32 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah


% Strain
0
6
12
18
24
30
36
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 32'-33.5'
Moisture Content 57.8 %
Dry Unit Wt. 65.7 lbs./ft³
LL 59 %
PL 27 %
PI 32 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah



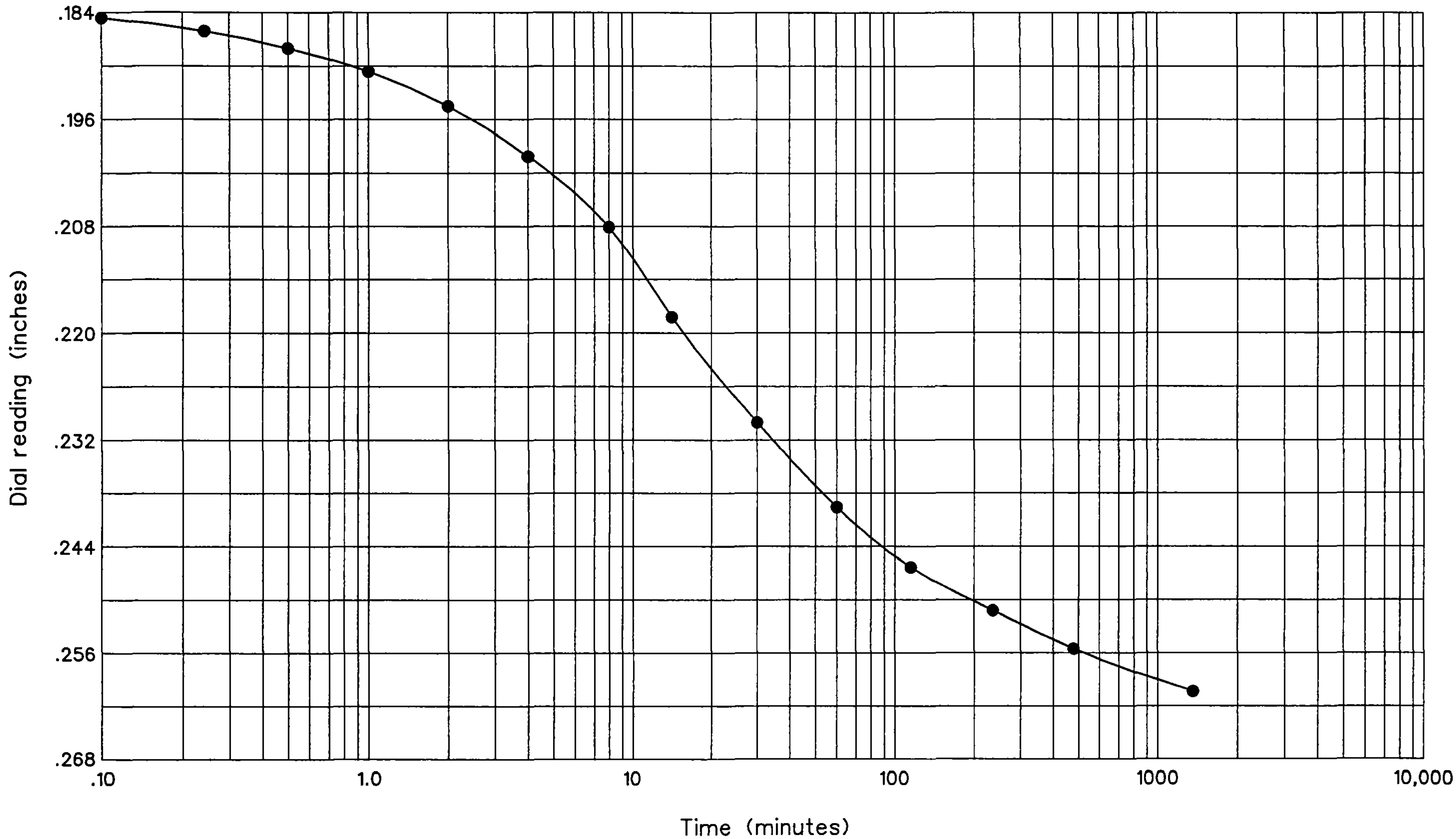
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 32'-33.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



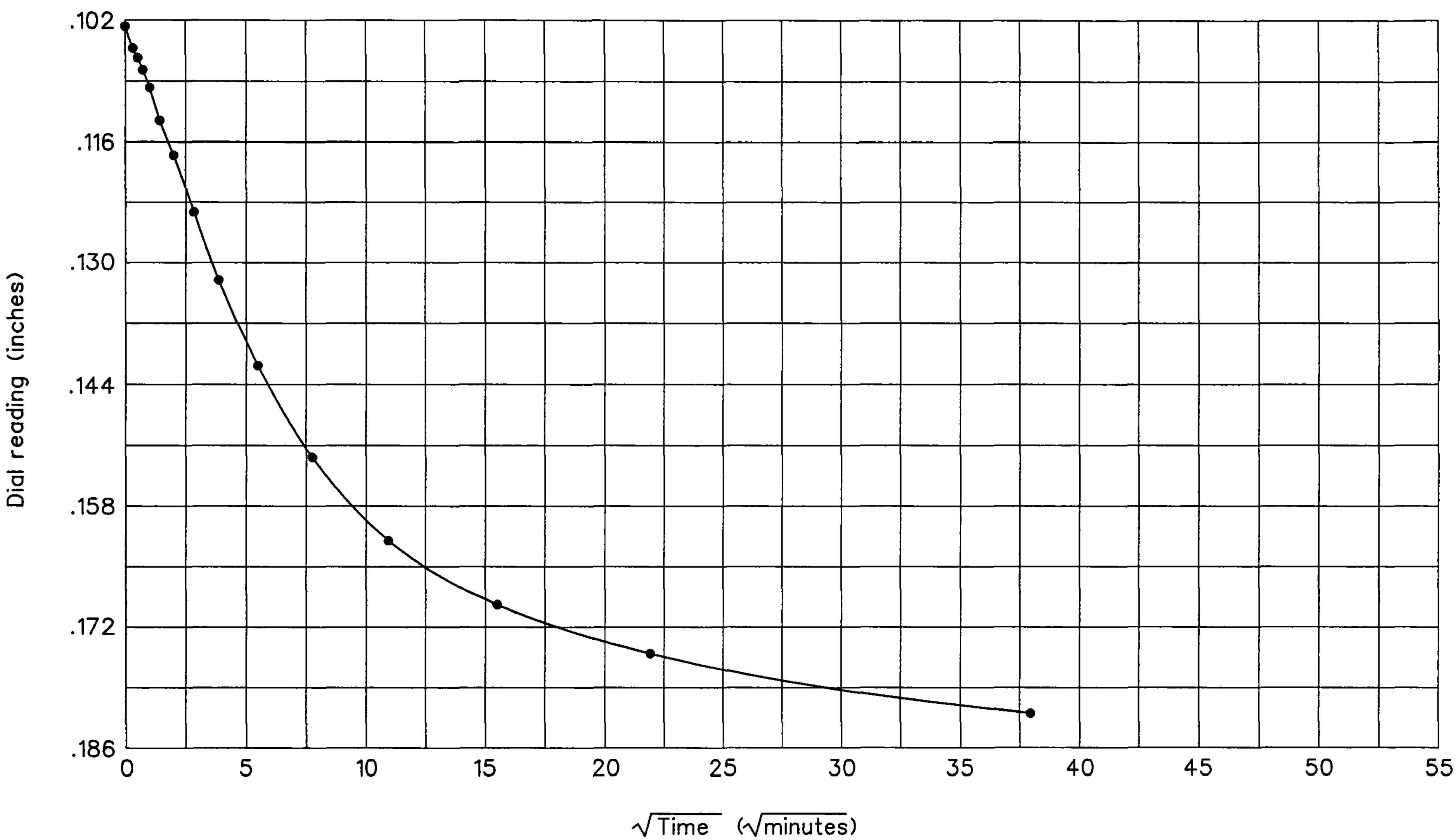
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 32'-33.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



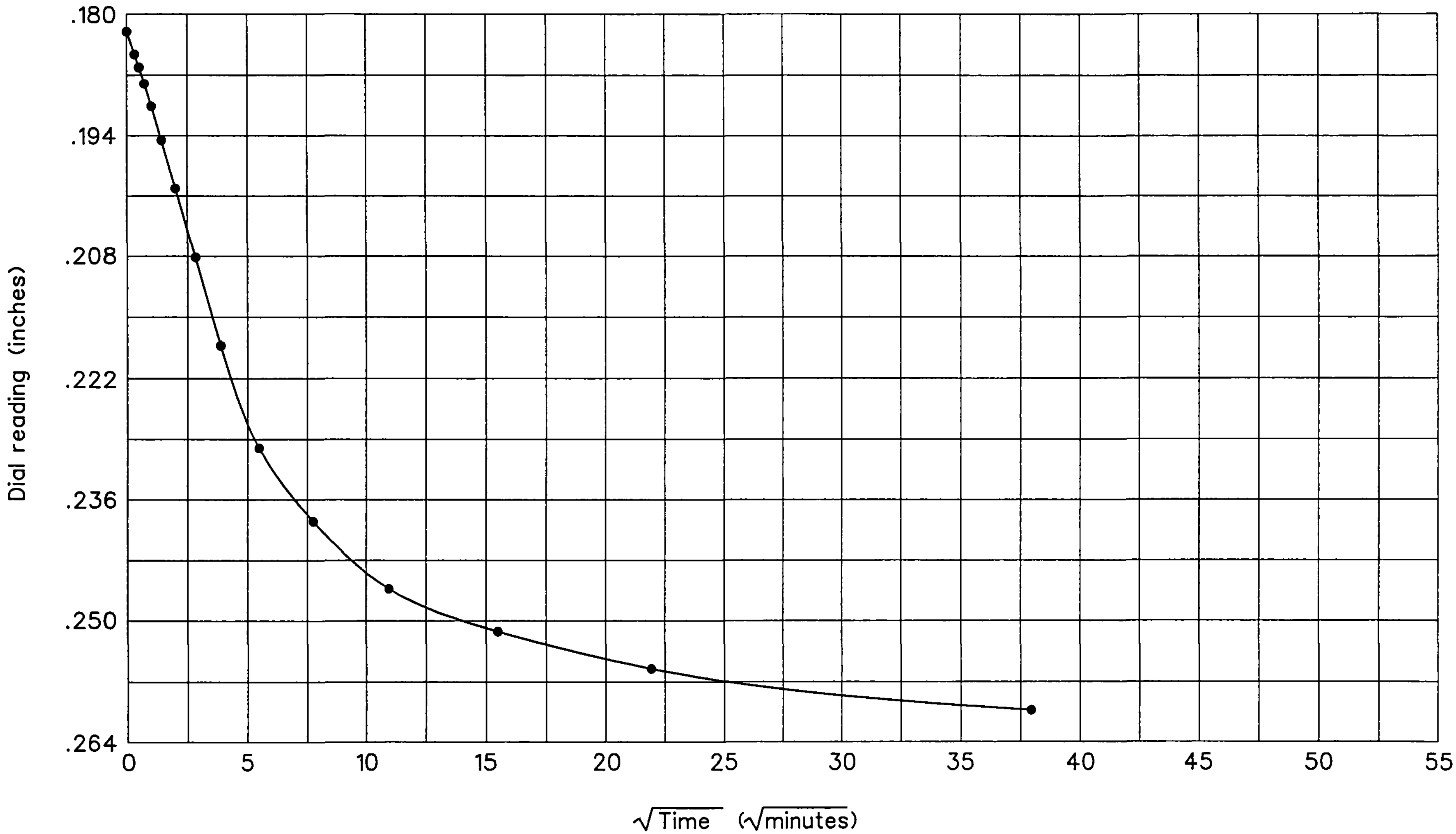
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 32'-33.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



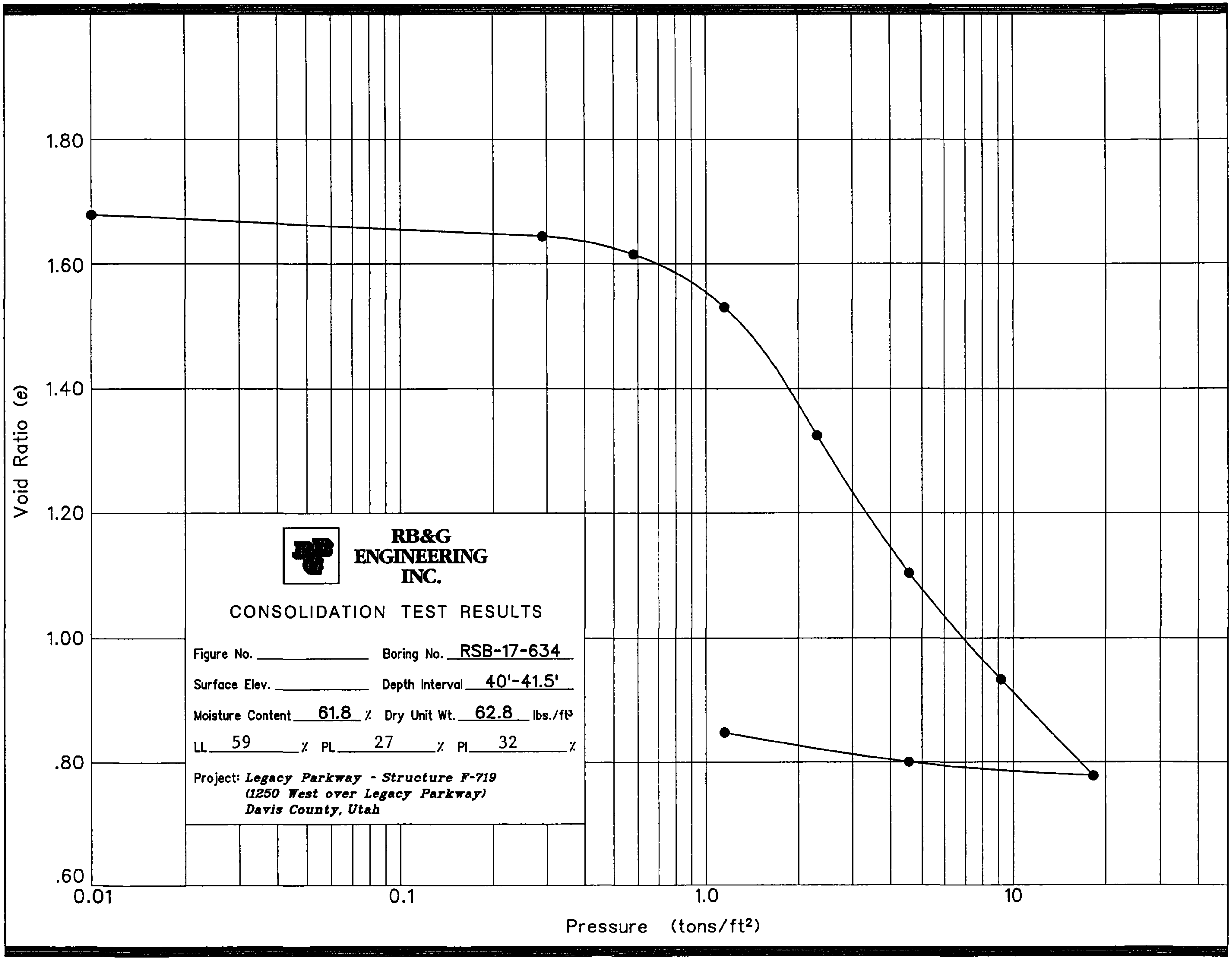
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 32'-33.5'
Load: 4.60 to 9.20 tons

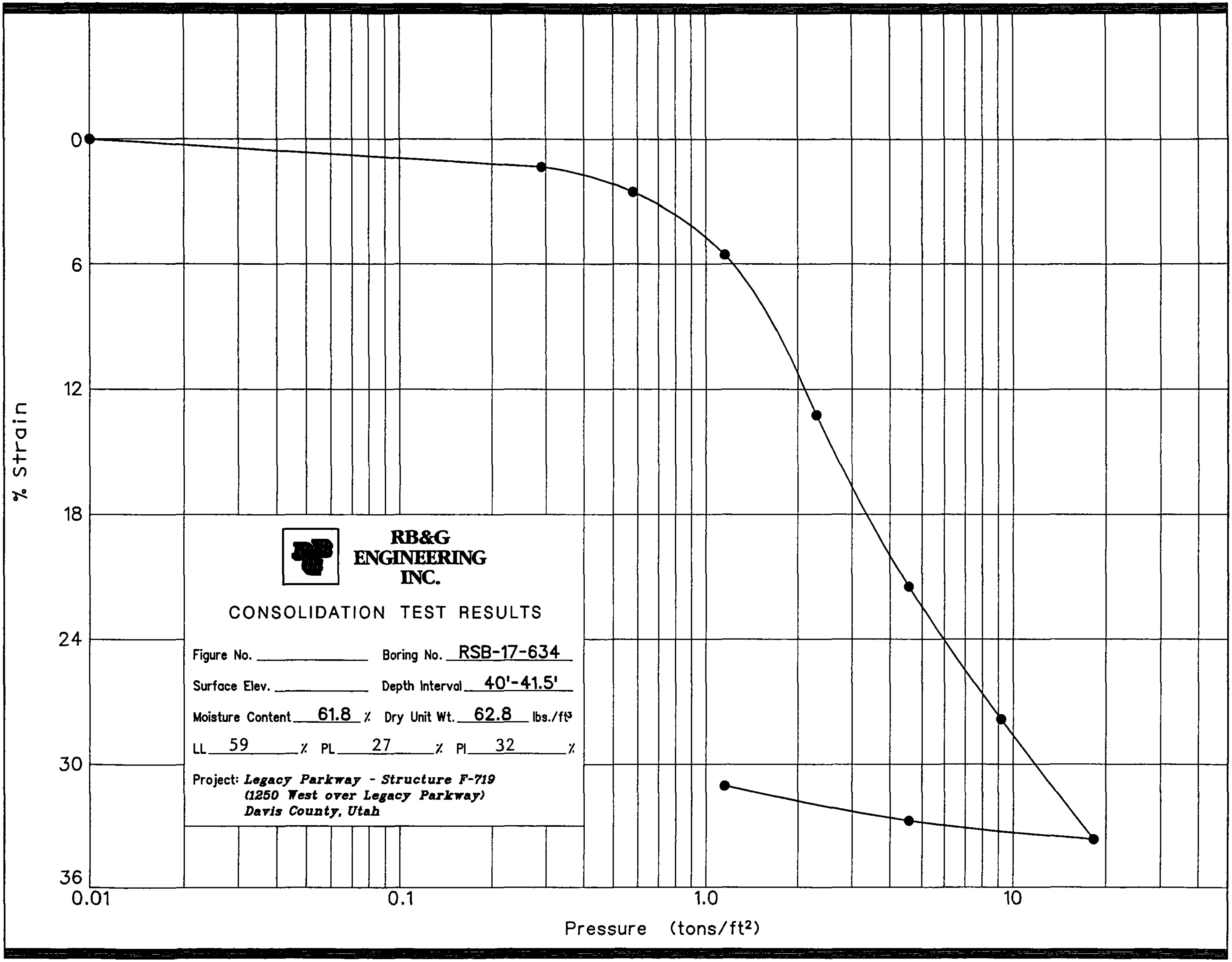
TIME CONSOLIDATION

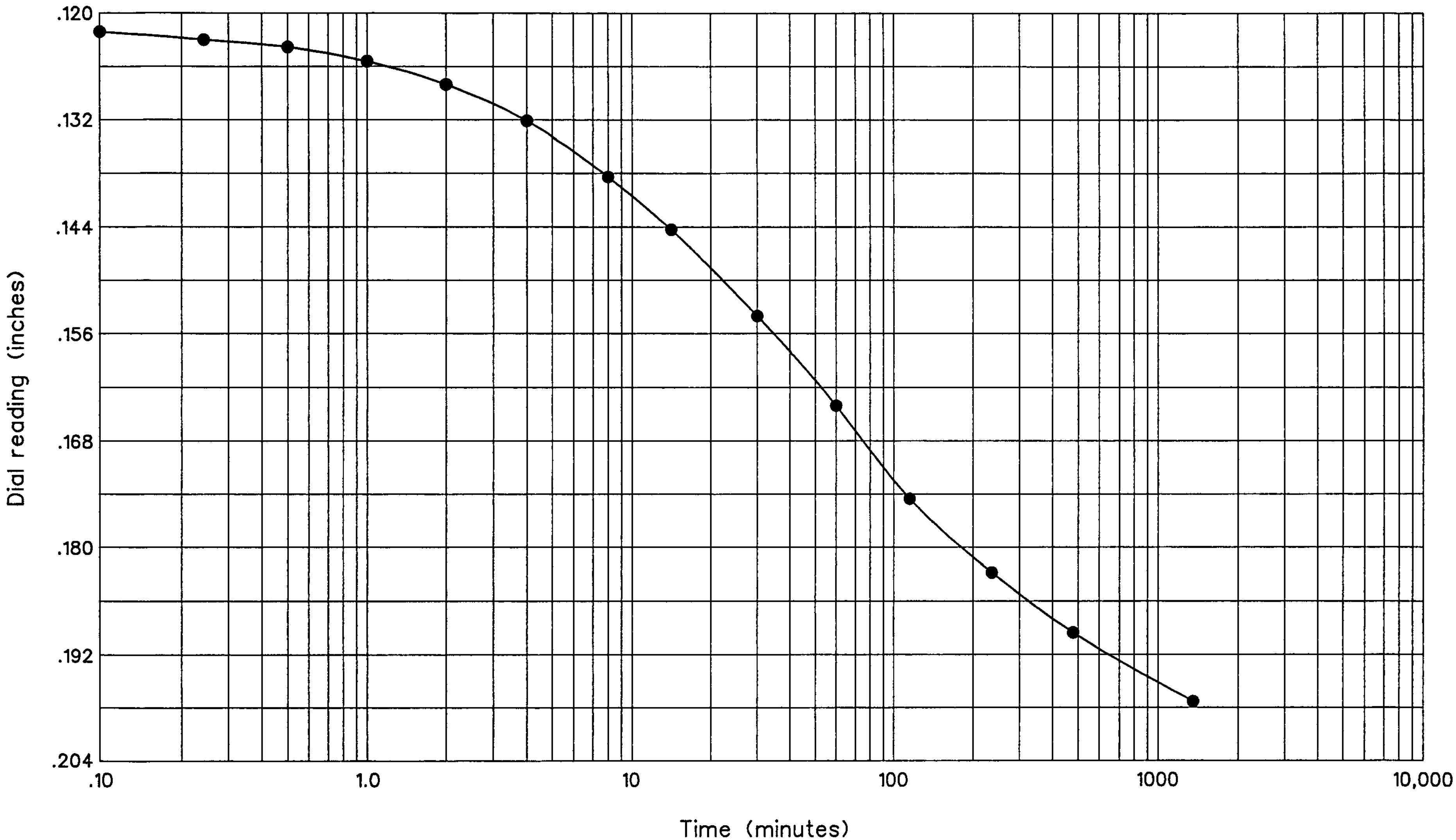
Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure

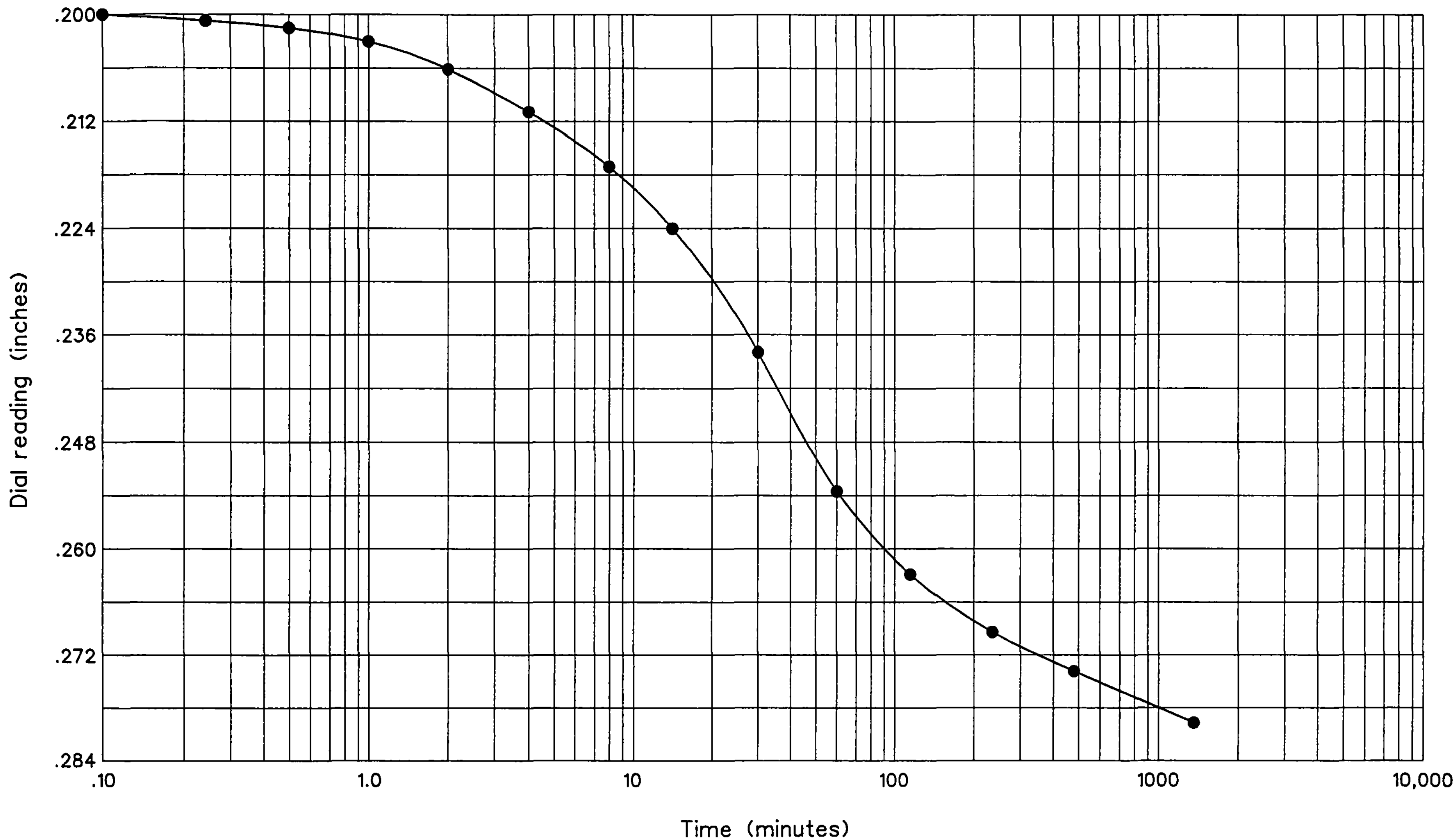


1.80
1.60
1.40
1.20
1.00
.80
.60
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 40'-41.5'
Moisture Content 61.8 % Dry Unit Wt. 62.8 lbs./ft³
LL 59 % PL 27 % PI 32 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah


% Strain
0
6
12
18
24
30
36
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 40'-41.5'
Moisture Content 61.8 %
Dry Unit Wt. 62.8 lbs./ft³
LL 59 %
PL 27 %
PI 32 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah



RB&G ENGINEERING INC. Provo, Utah	Hole no.: RSB-17-634 Depth: 40'-41.5' Load: 2.30 to 4.60 tons	**TIME CONSOLIDATION** *Legacy Parkway - Structure F-719* *(1250 West over Legacy Parkway)* *Davis County, Utah*	Figure



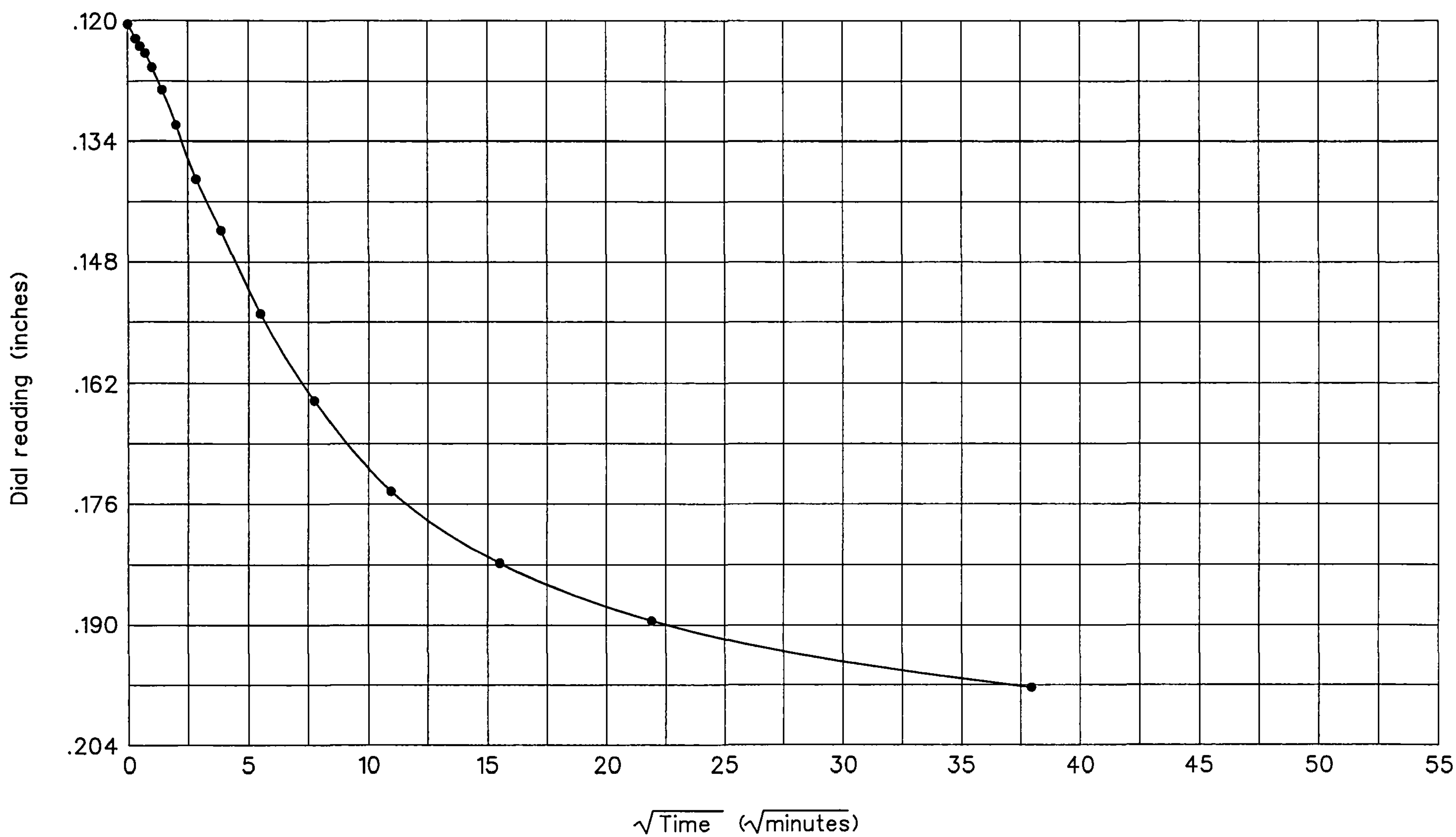
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 40'-41.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



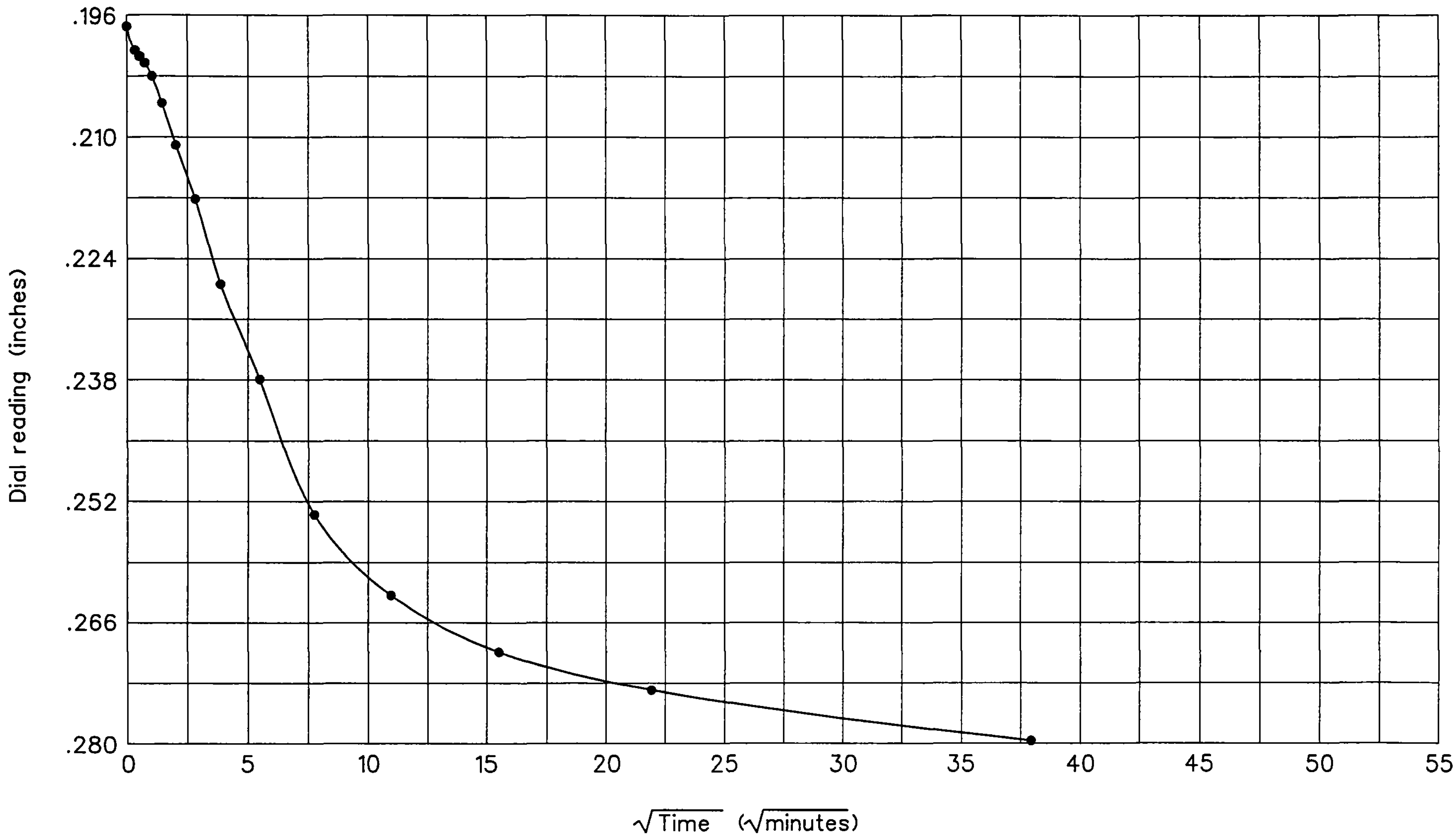
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 40'-41.5'
Load: 2.30 to 4.60 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



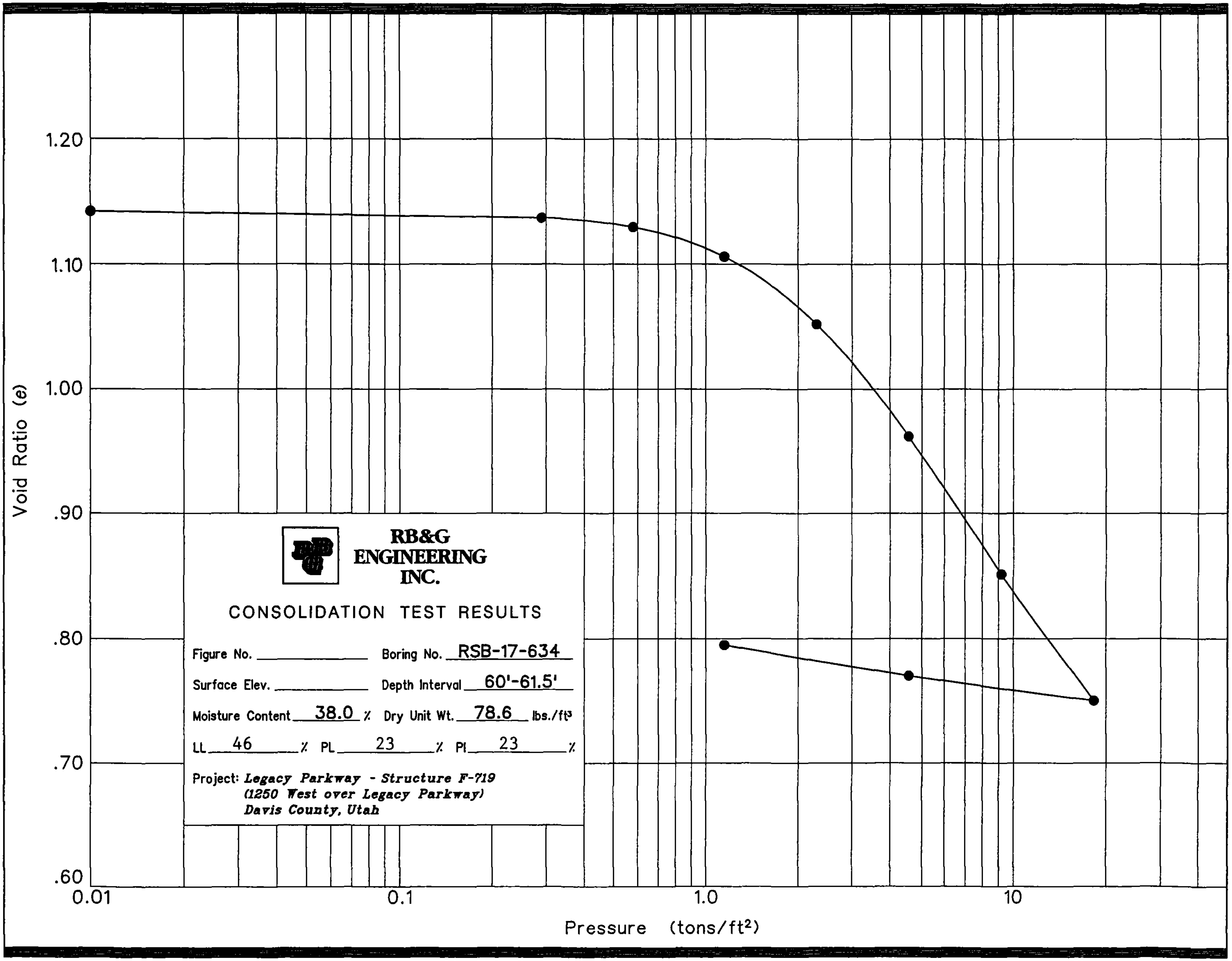
RB&G ENGINEERING INC.
Provo, Utah

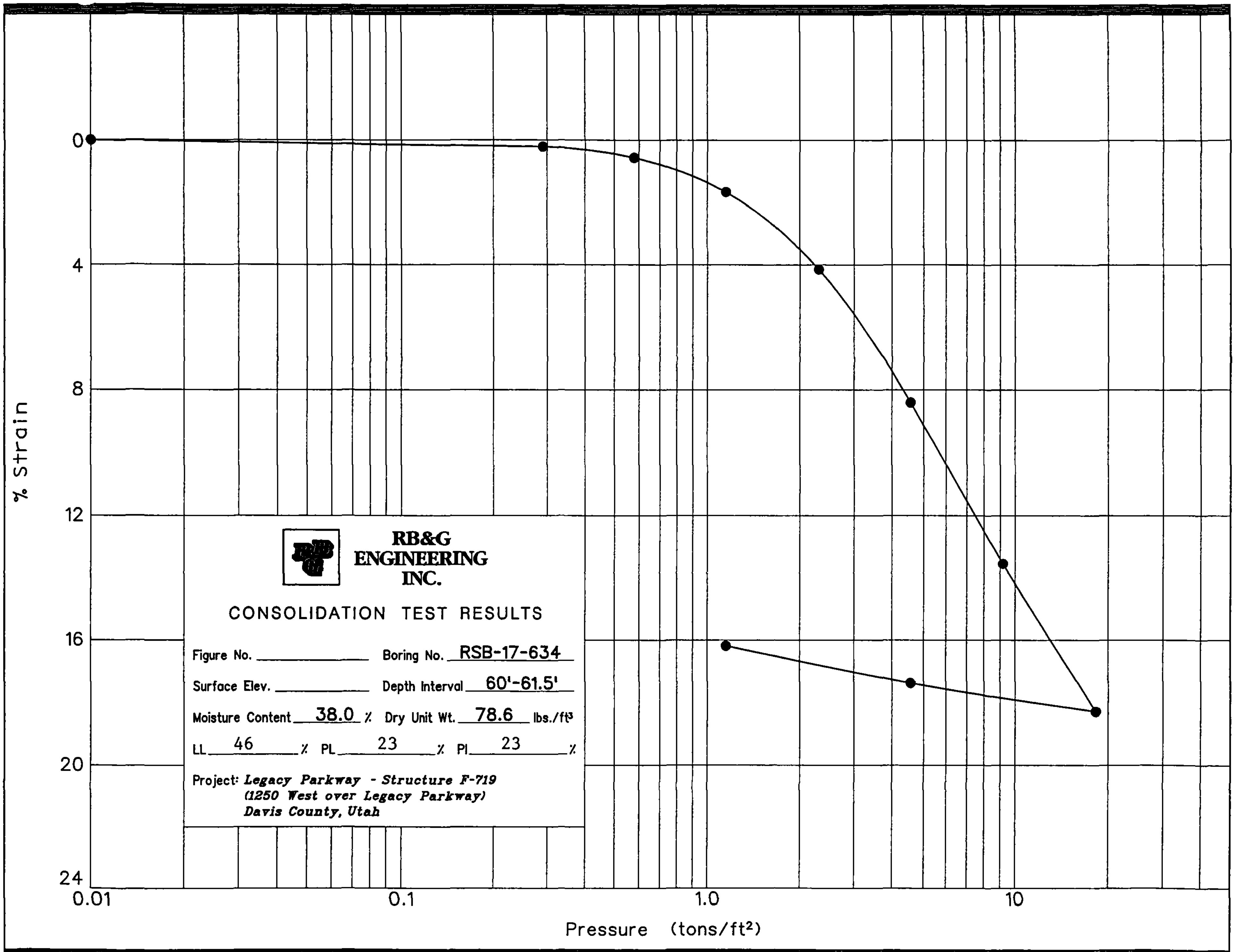
Hole no.: RSB-17-634
Depth: 40'-41.5'
Load: 4.60 to 9.20 tons

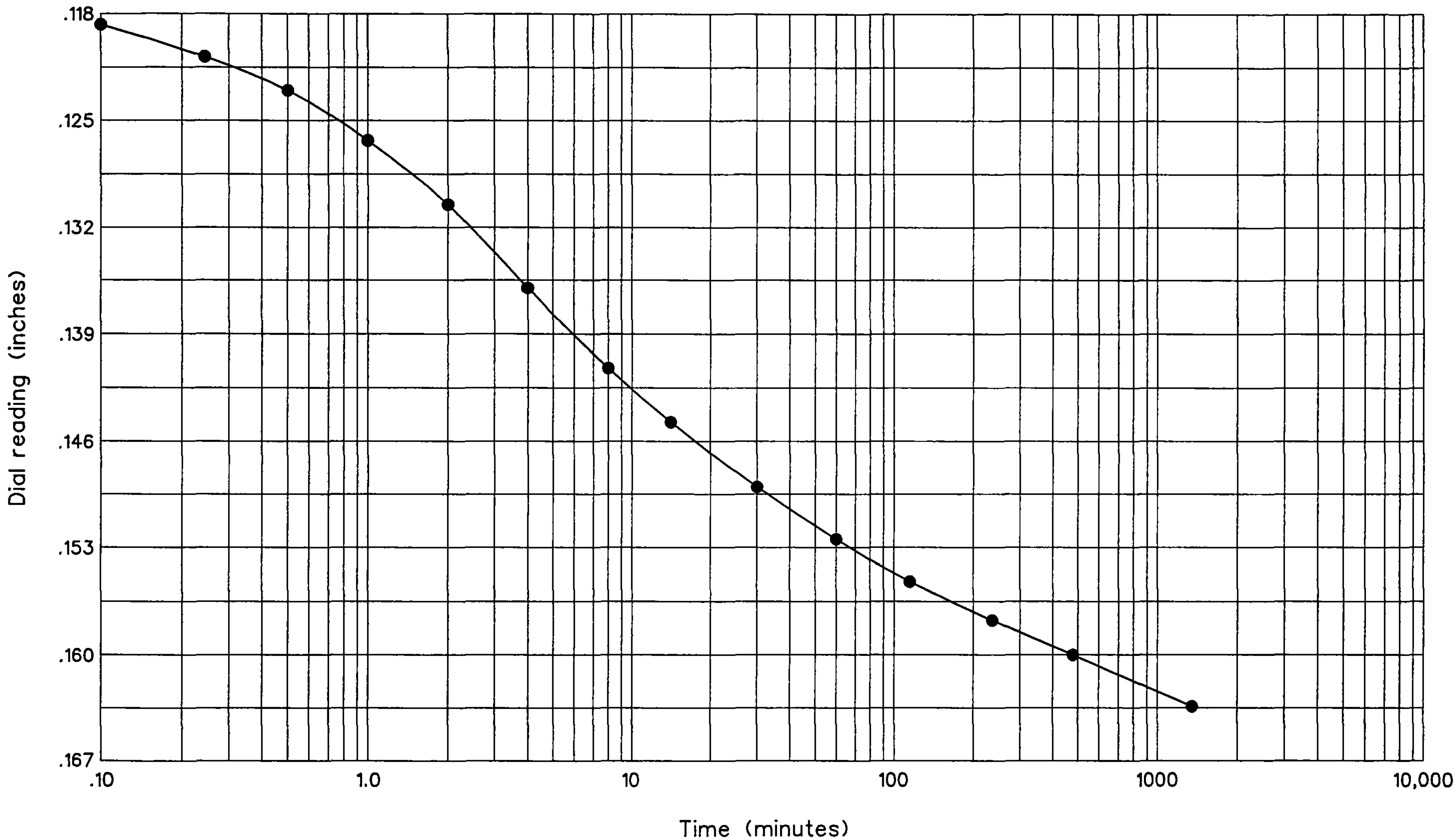
TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure


RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 60'-61.5'
Moisture Content 38.0 %
Dry Unit Wt. 78.6 lbs./ft³
LL 46 %
PL 23 %
PI 23 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
Void Ratio (e)
1.20
1.10
1.00
.90
.80
.70
.60
0.01
0.1
1.0
10
Pressure (tons/ft²)


0
4
8
12
16
20
24
% Strain
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 60'-61.5'
Moisture Content 38.0 % Dry Unit Wt. 78.6 lbs./ft³
LL 46 % PL 23 % PI 23 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah



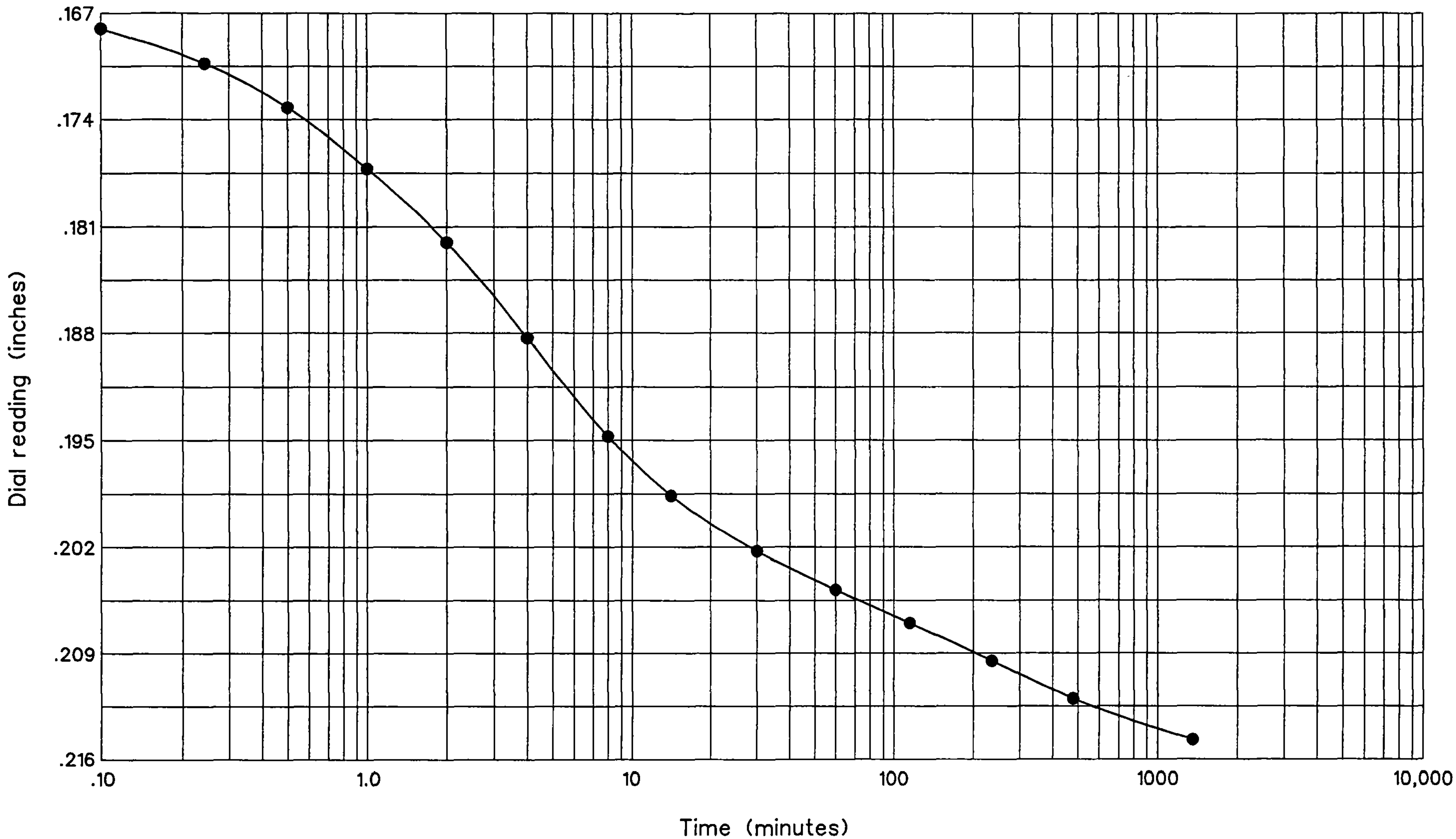
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 60'-61.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



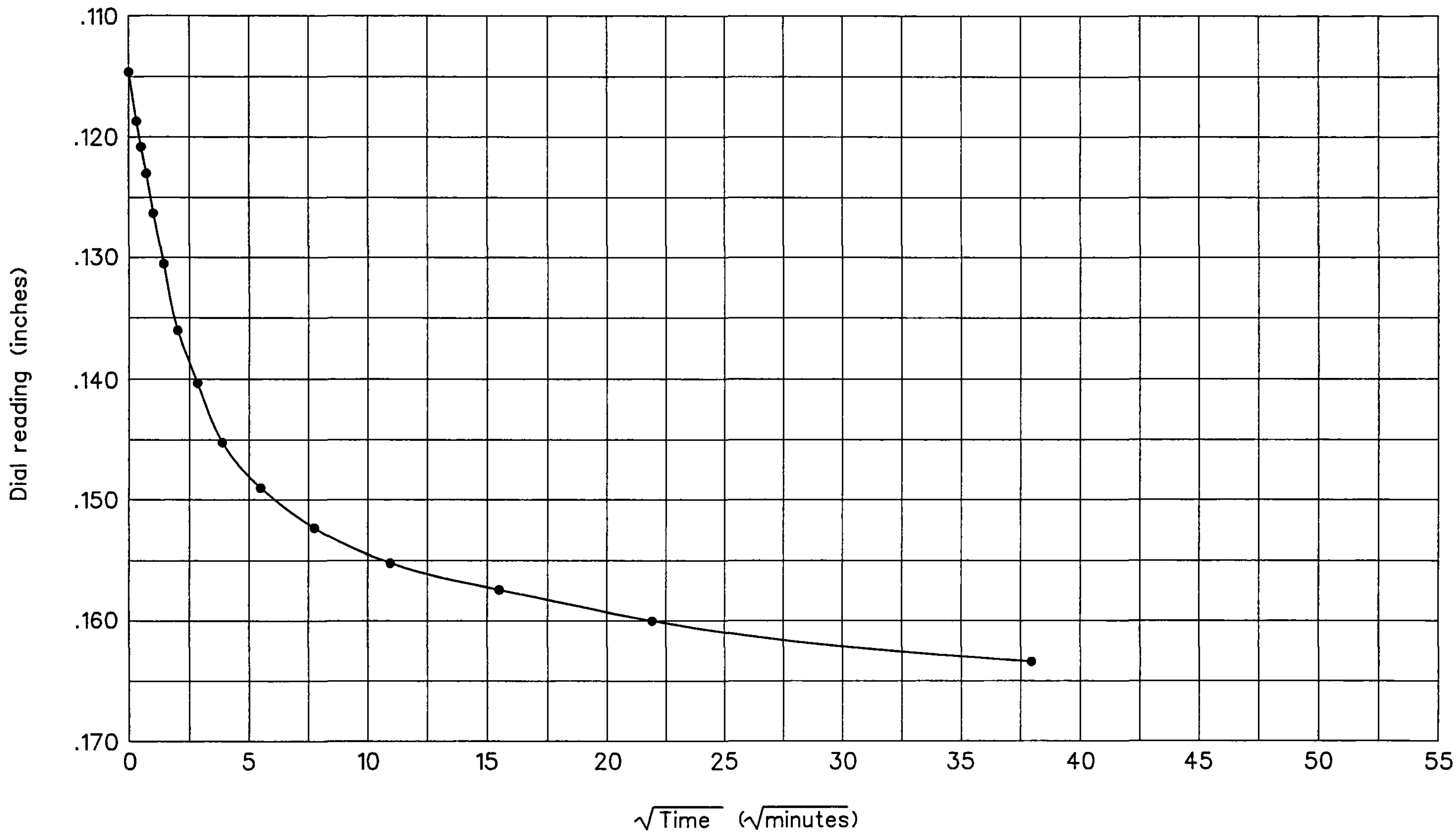
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 60'-61.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



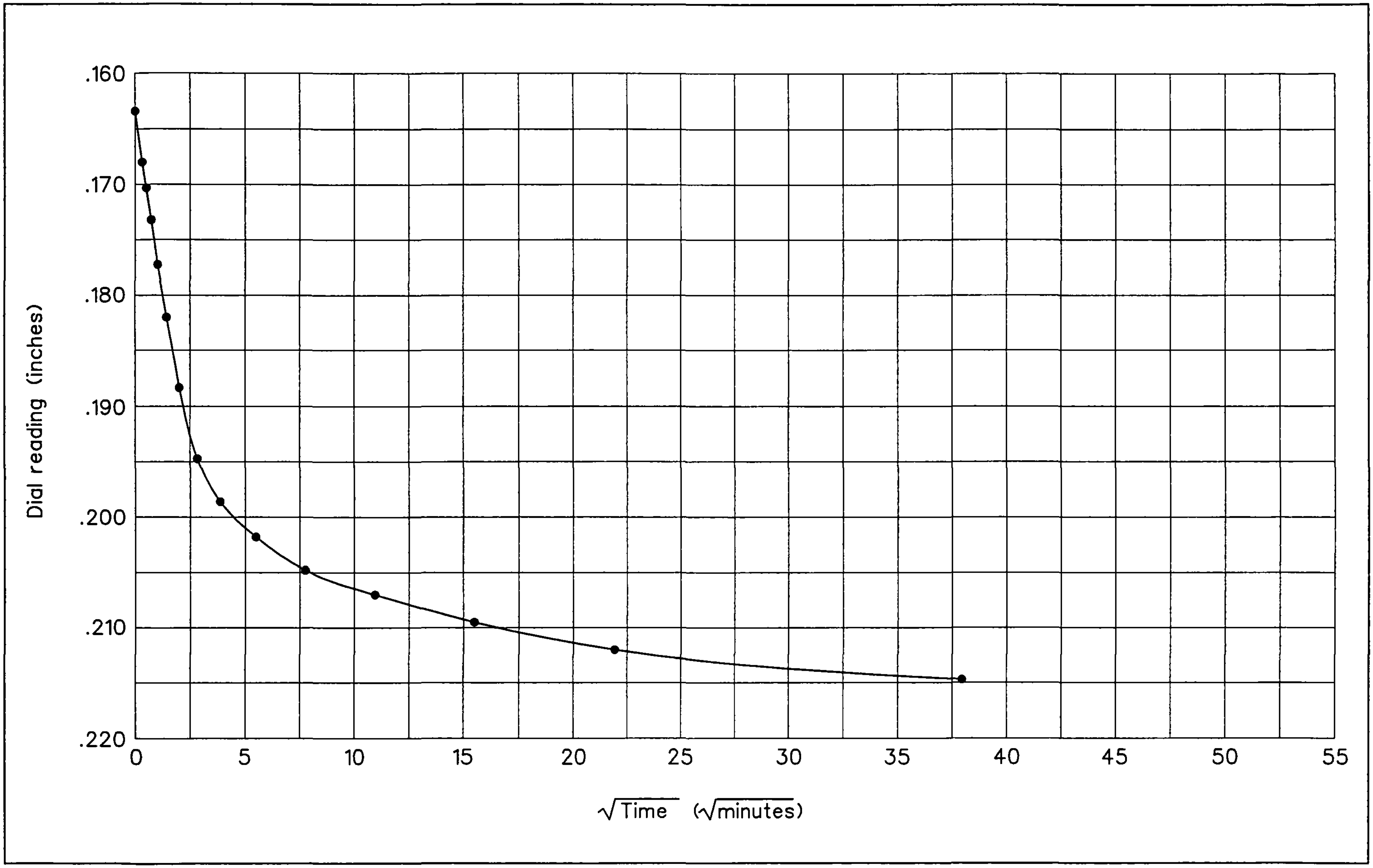
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 60'-61.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



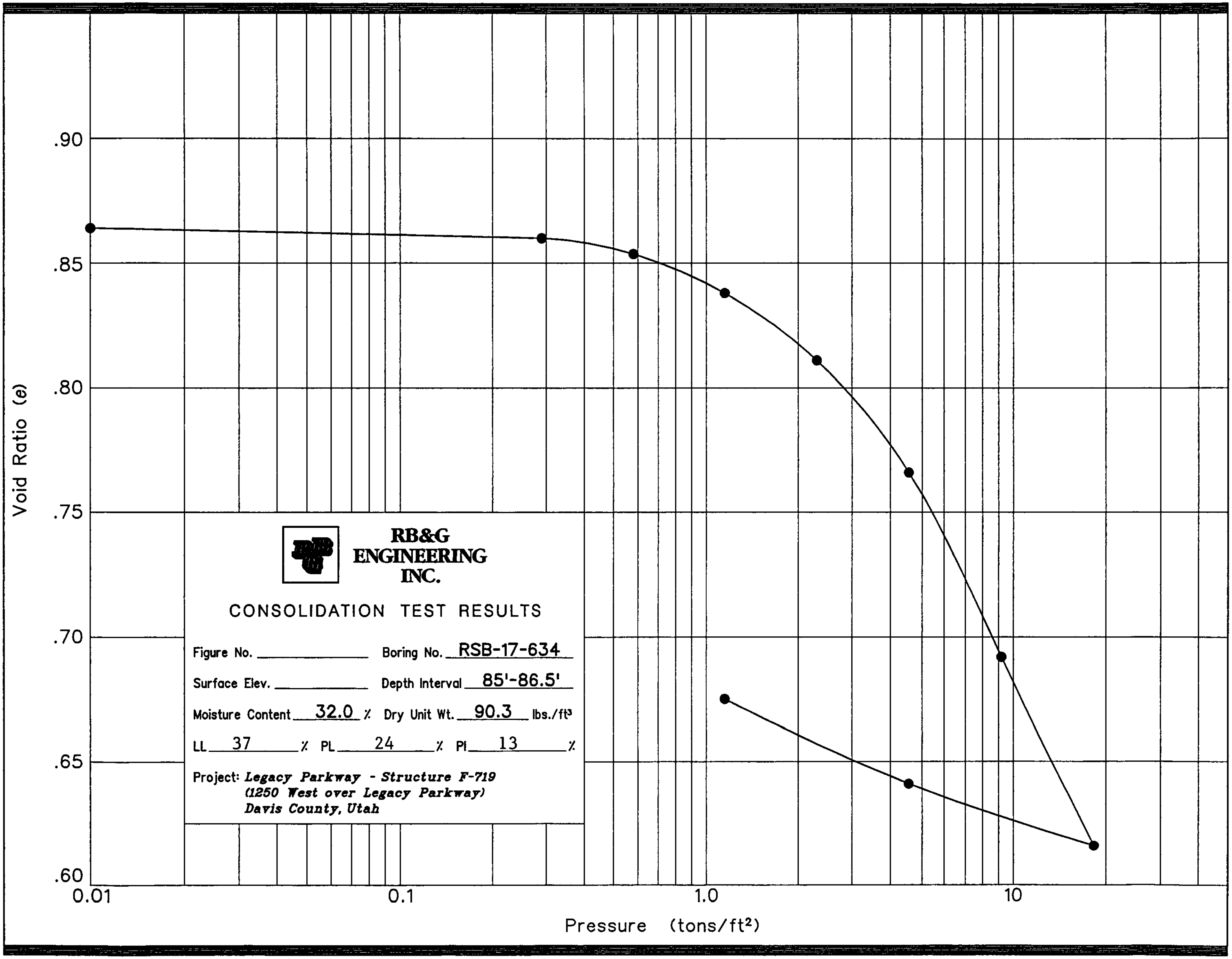
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 60'-61.5'
Load: 9.20 to 18.40 tons

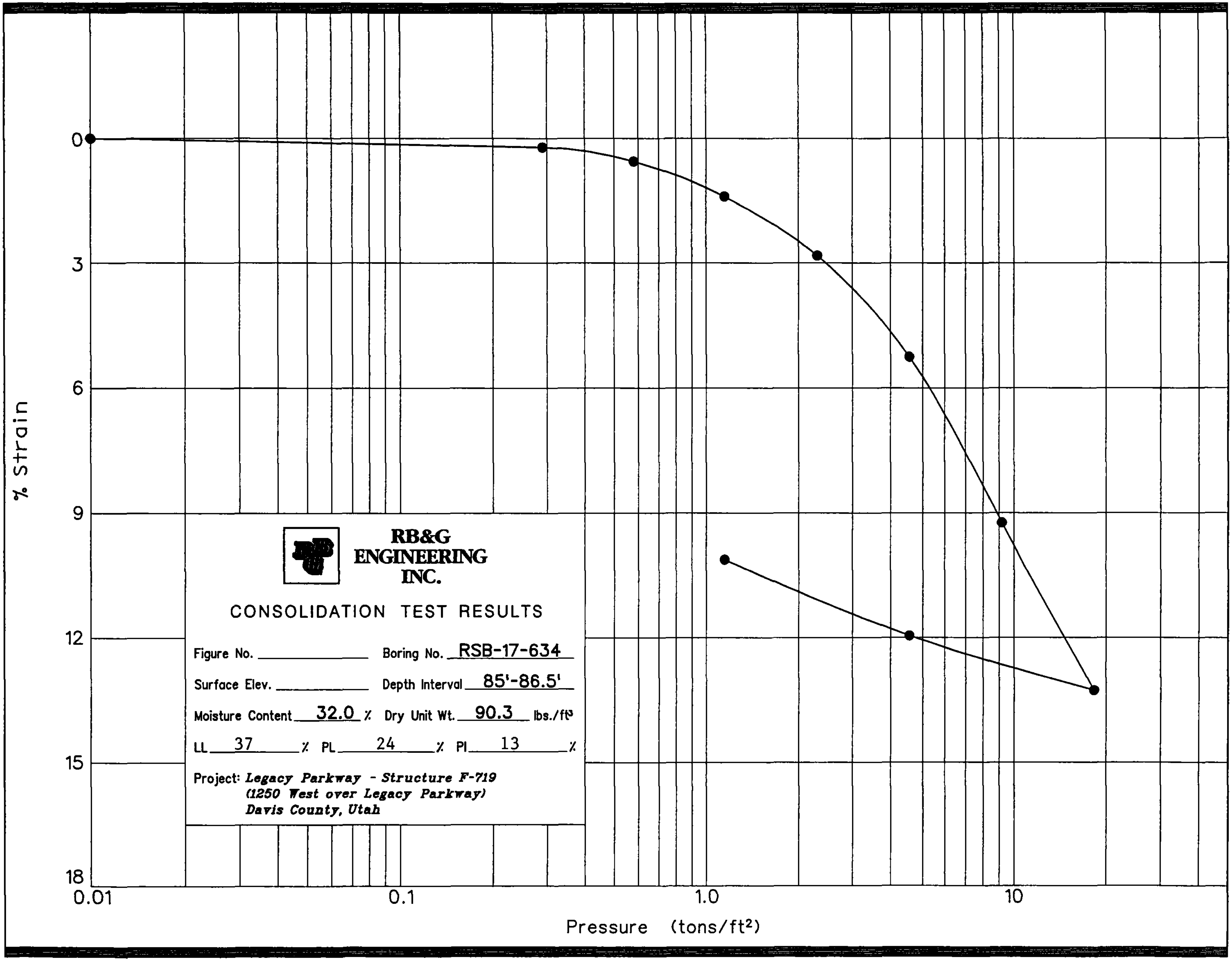
TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

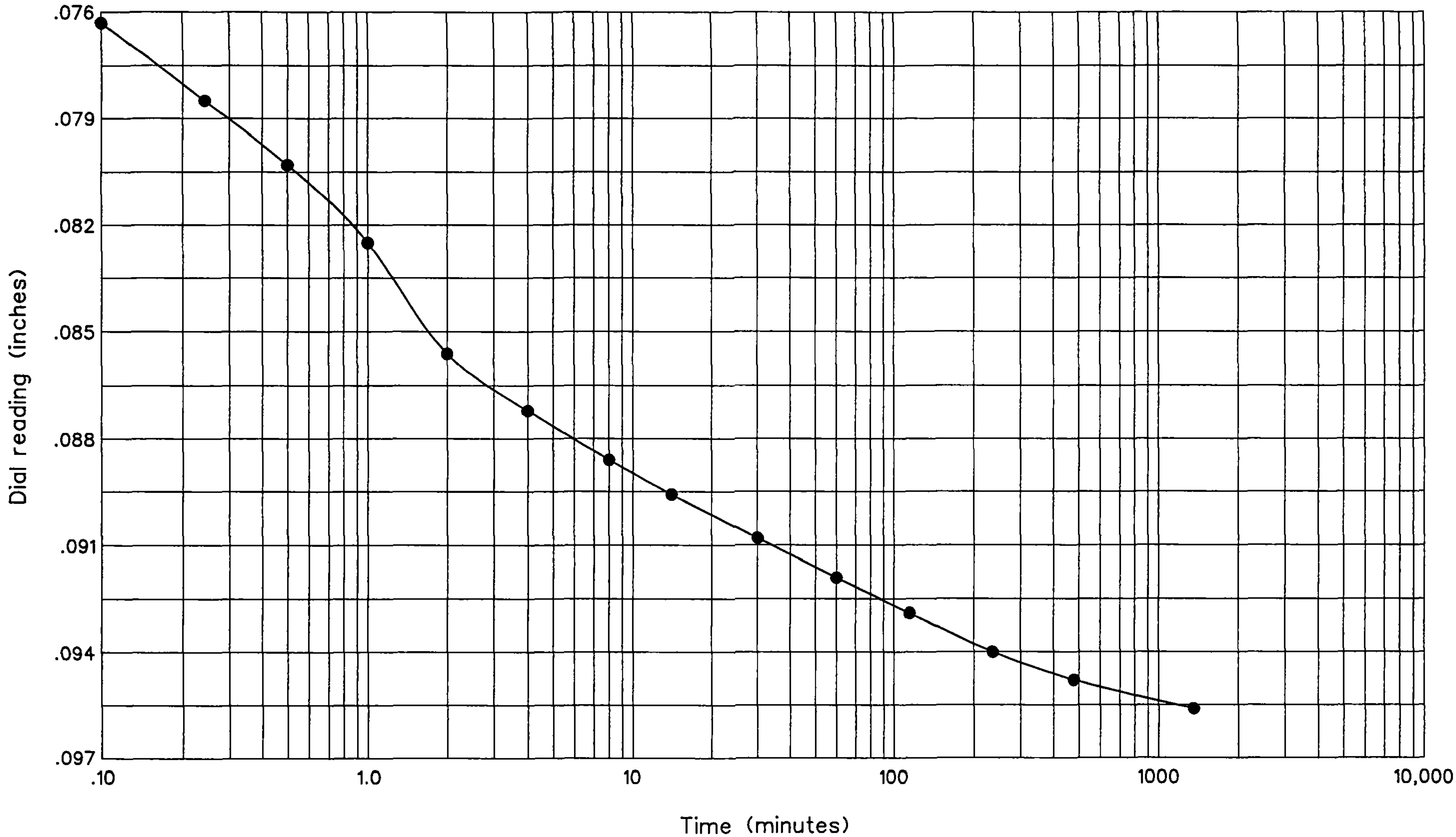
Figure



.90
.85
.80
.75
.70
.65
.60
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-17-634
Surface Elev.
Depth Interval 85'-86.5'
Moisture Content 32.0 %
Dry Unit Wt. 90.3 lbs./ft³
LL 37 %
PL 24 %
PI 13 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah



RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 85'-86.5'
Moisture Content 32.0 % Dry Unit Wt. 90.3 lbs./ft3
LL 37 % PL 24 % PI 13 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
% Strain
0
3
6
9
12
15
18
0.01
0.1
1.0
10
Pressure (tons/ft2)



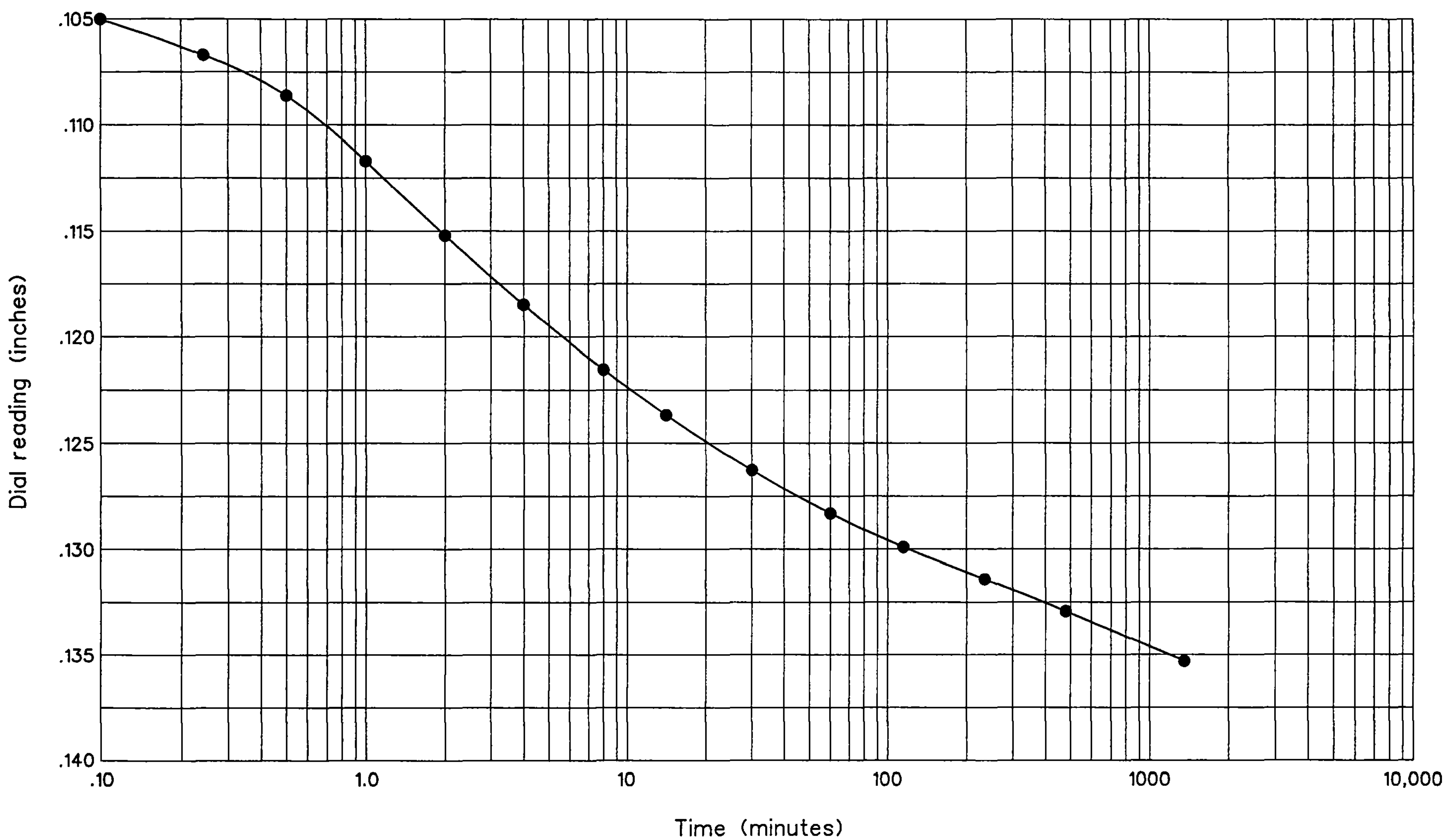
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 85'-86.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



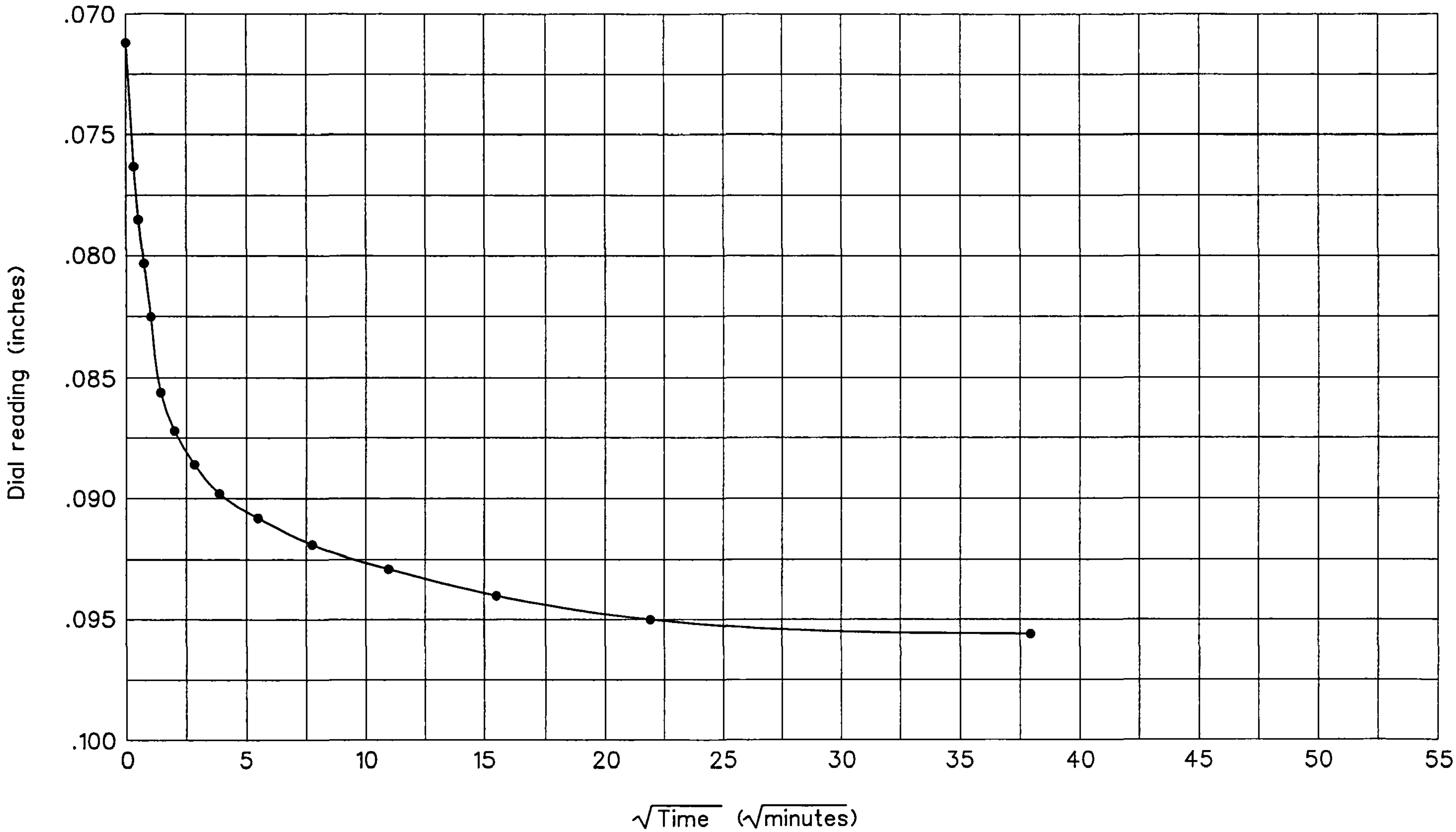
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 85'-86.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



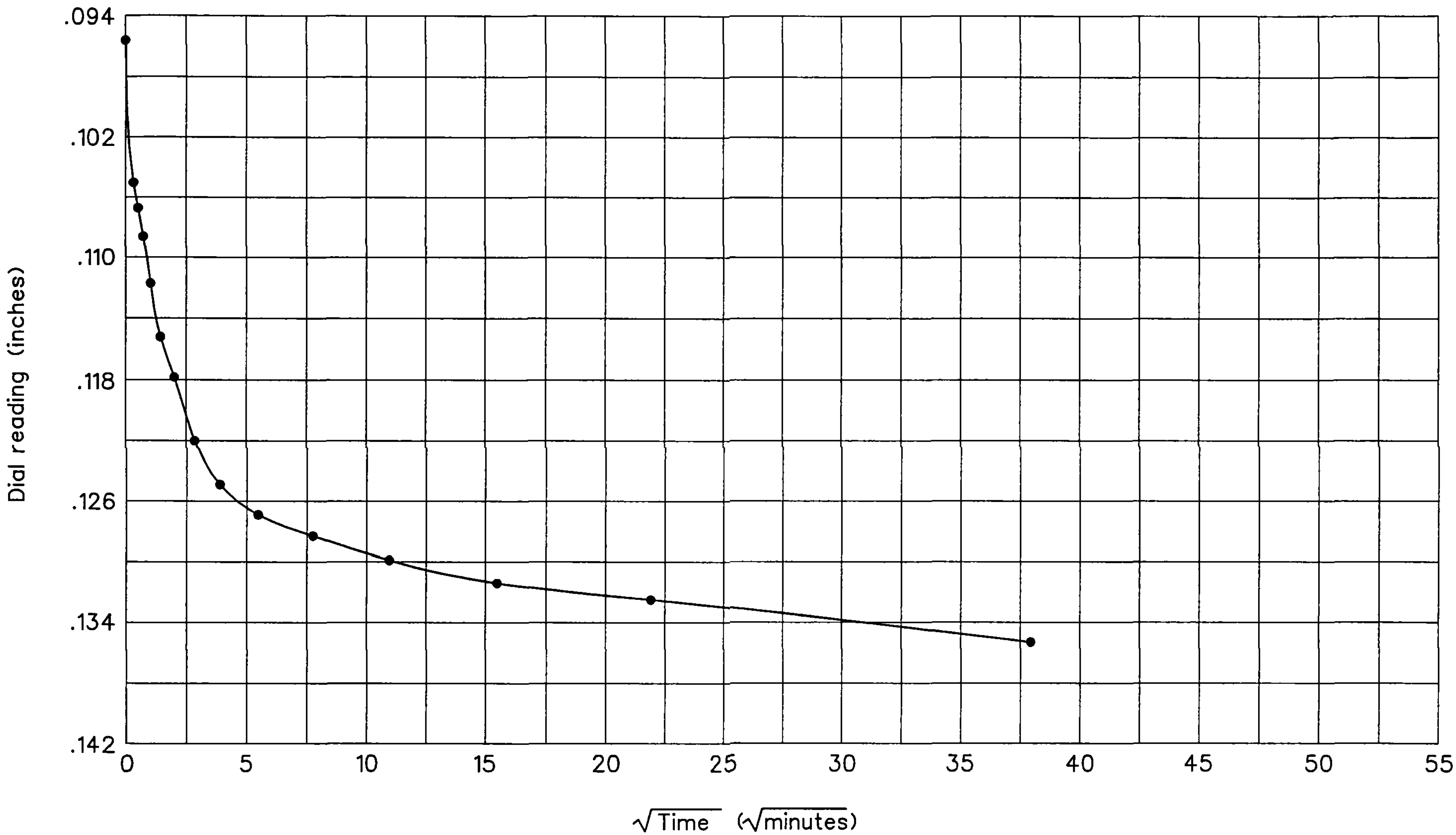
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 85'-86.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



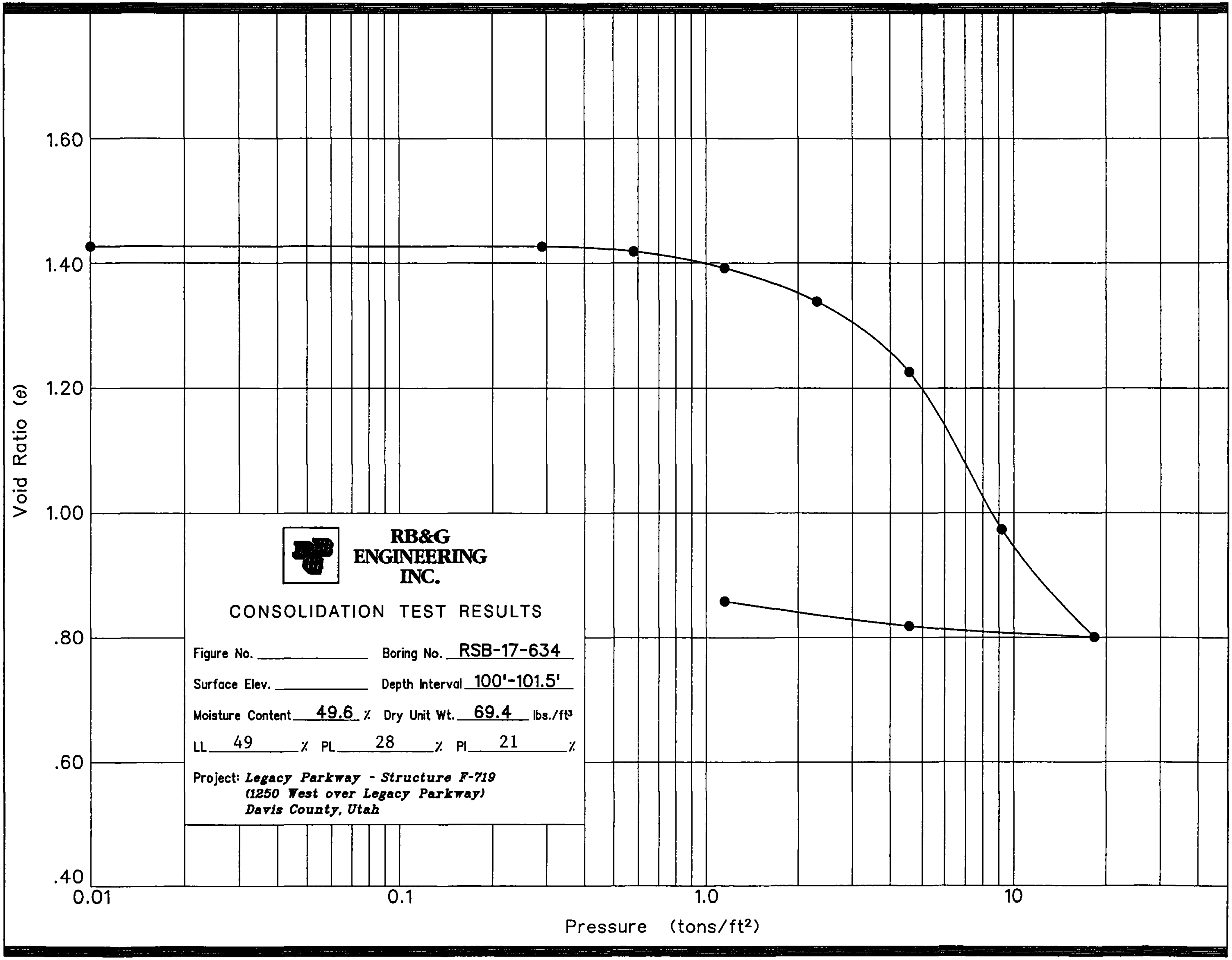
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 85'-86.5'
Load: 9.20 to 18.40 tons

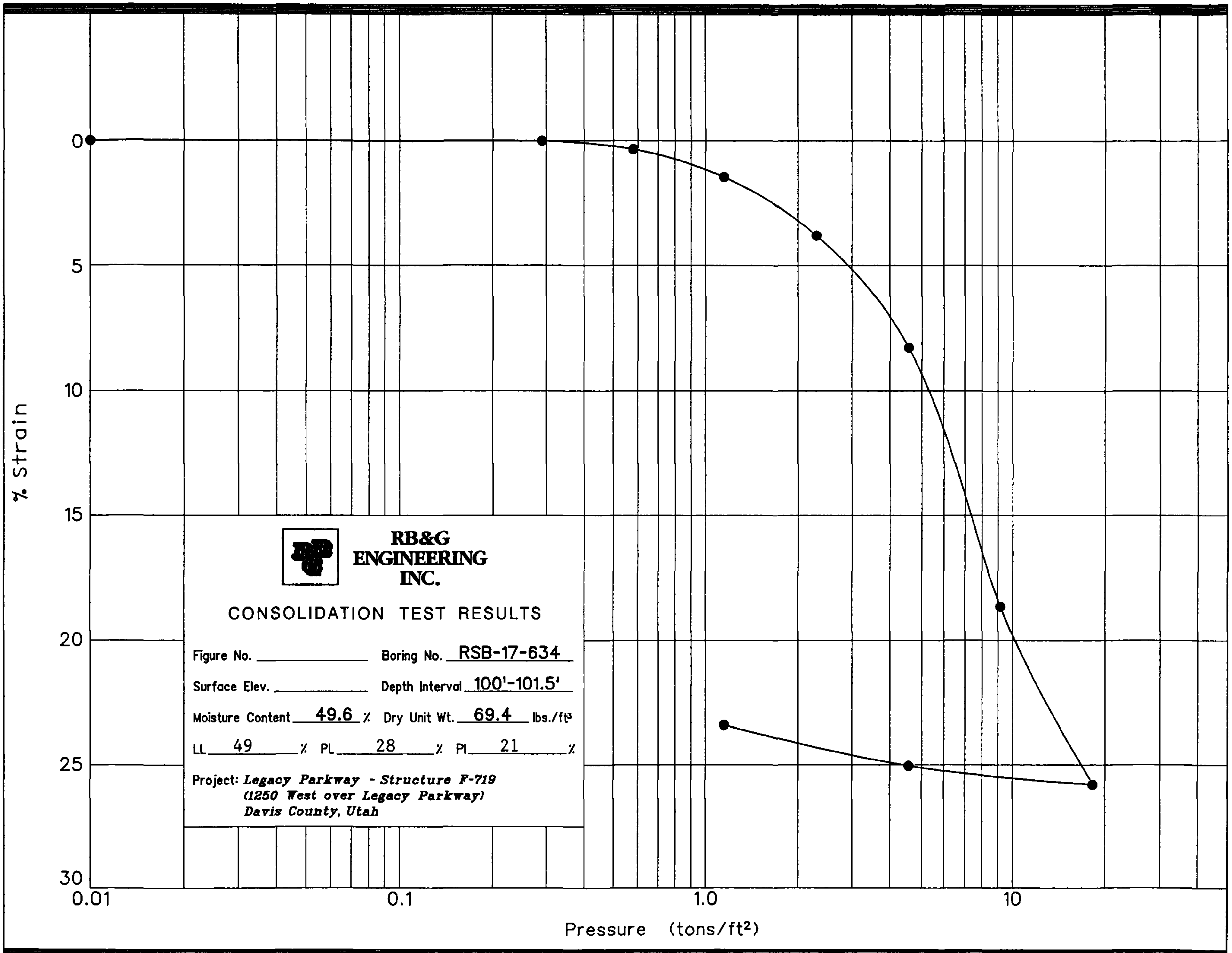
TIME CONSOLIDATION

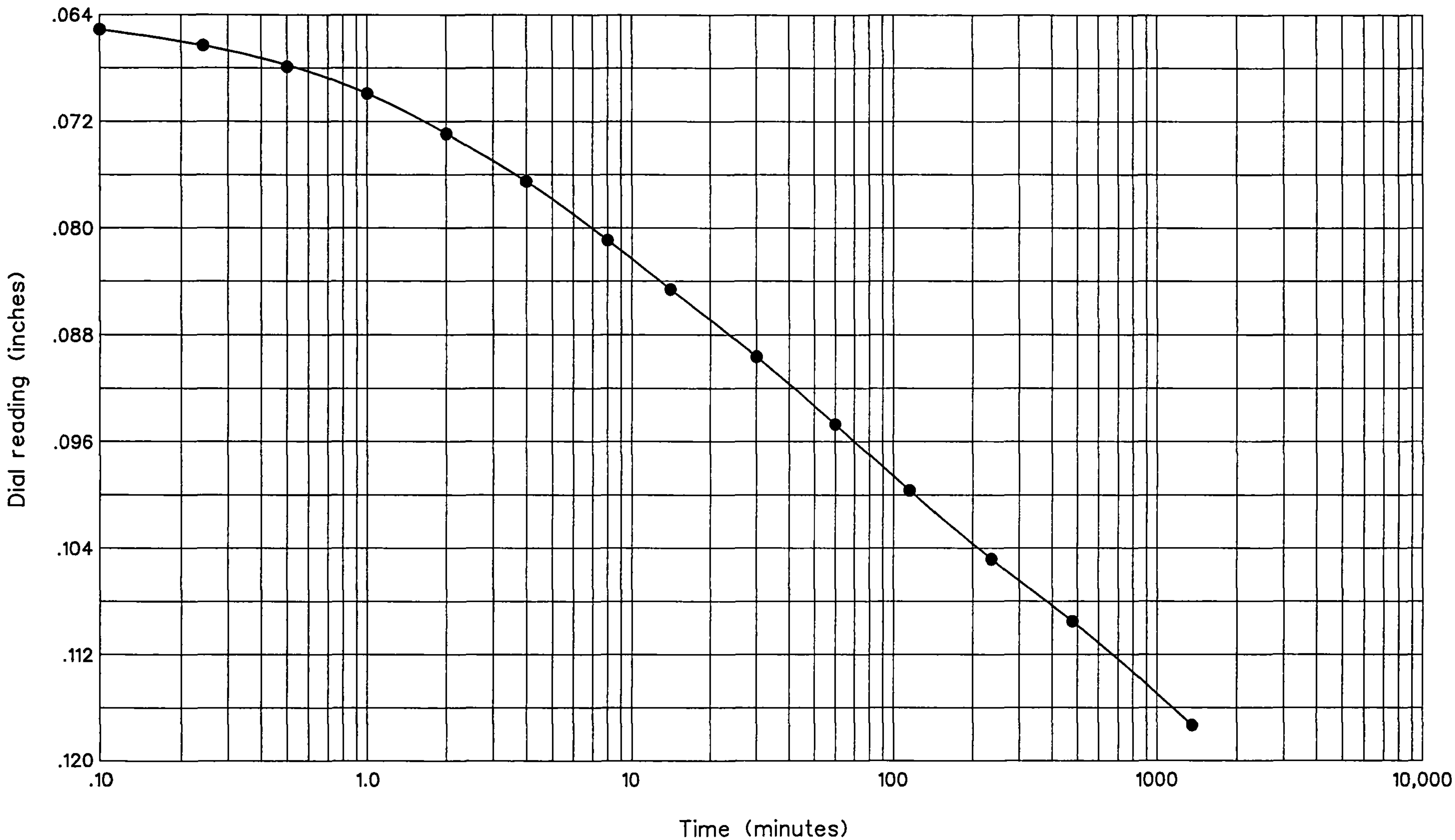
Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



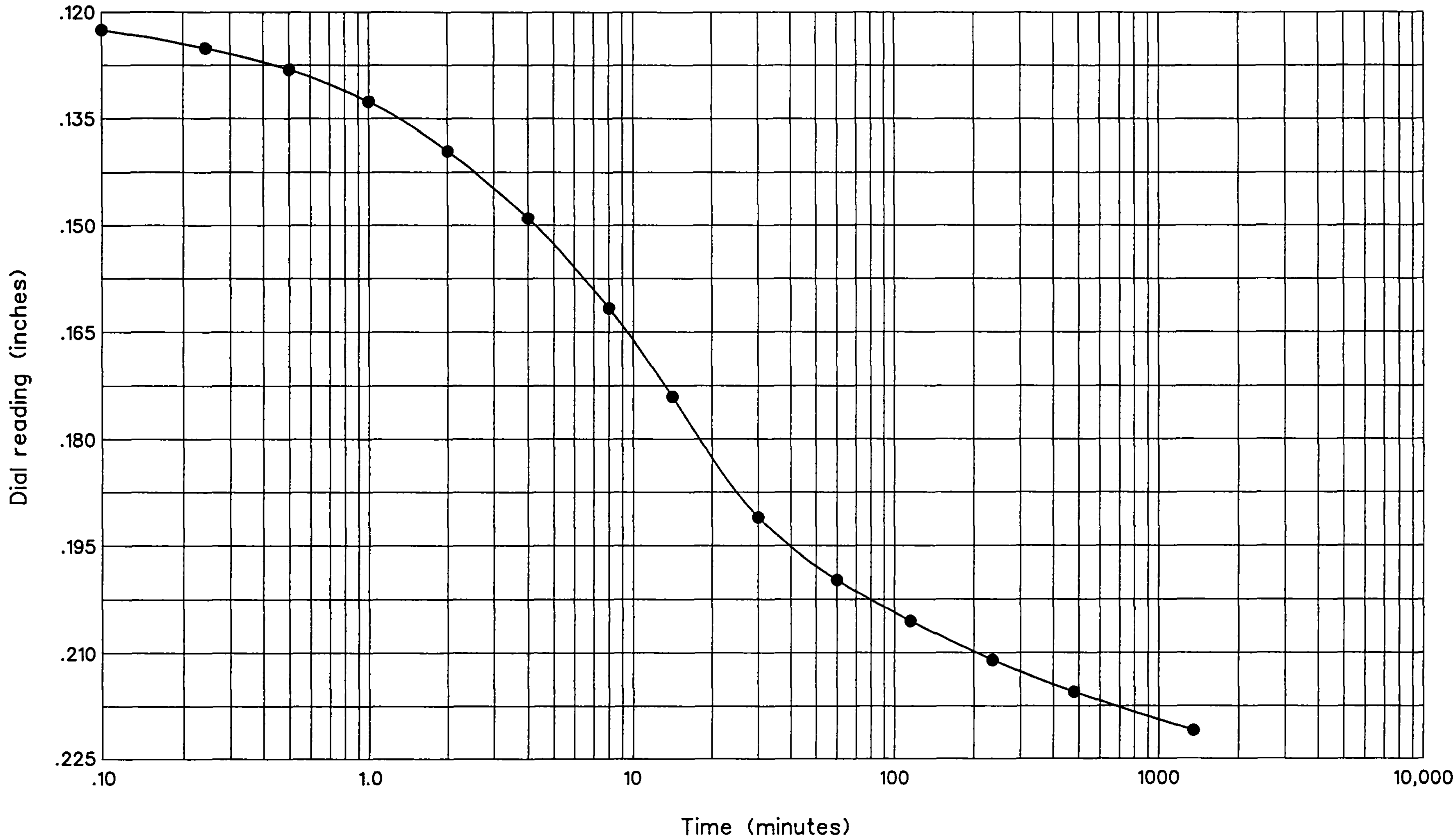
1.60
1.40
1.20
1.00
.80
.60
.40
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 100'-101.5'
Moisture Content 49.6 % Dry Unit Wt. 69.4 lbs./ft³
LL 49 % PL 28 % PI 21 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah


RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No. ______ Boring No. RSB-17-634
Surface Elev. ______ Depth Interval 100'-101.5'
Moisture Content 49.6 % Dry Unit Wt. 69.4 lbs./ft³
LL 49 % PL 28 % PI 21 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
% Strain
0
5
10
15
20
25
30
0.01
0.1
1.0
10
Pressure (tons/ft²)



RB&G ENGINEERING INC. Provo, Utah	Hole no.: RSB-17-634 Depth: 100'-101.5' Load: 4.60 to 9.20 tons	**TIME CONSOLIDATION** *Legacy Parkway - Structure F-719* *(1250 West over Legacy Parkway)* *Davis County, Utah*

Figure



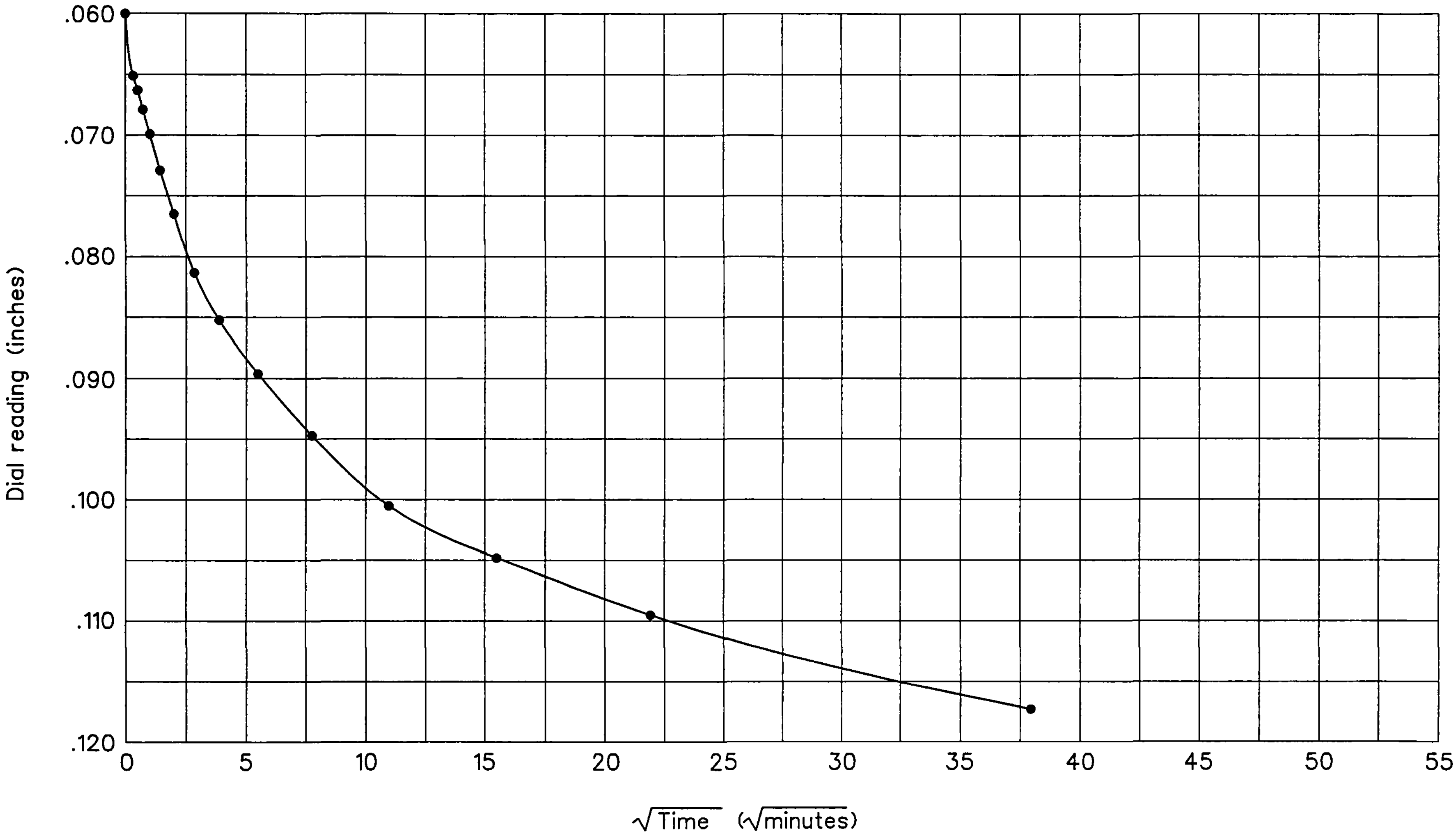
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 100'-101.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



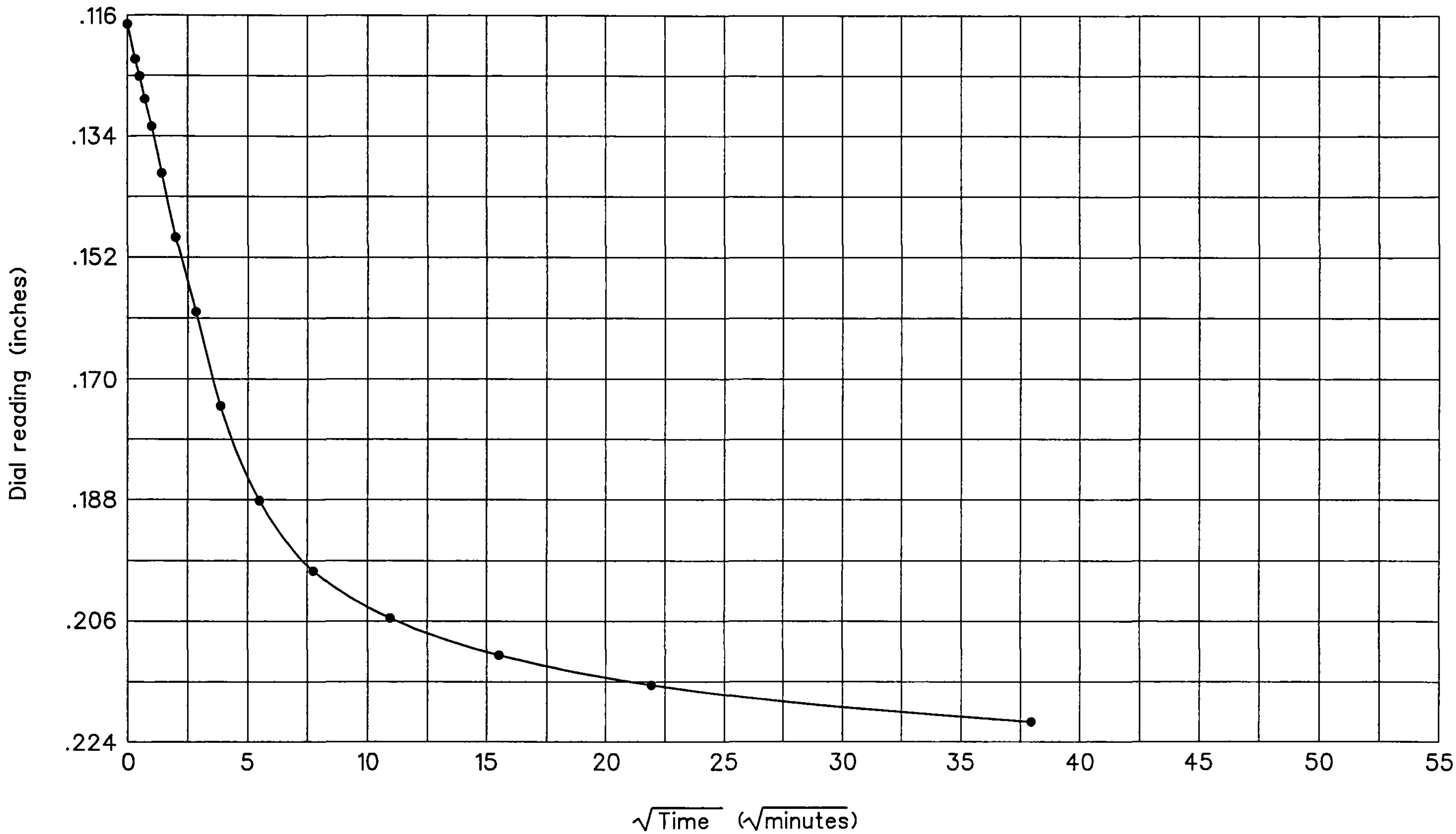
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 100'-101.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



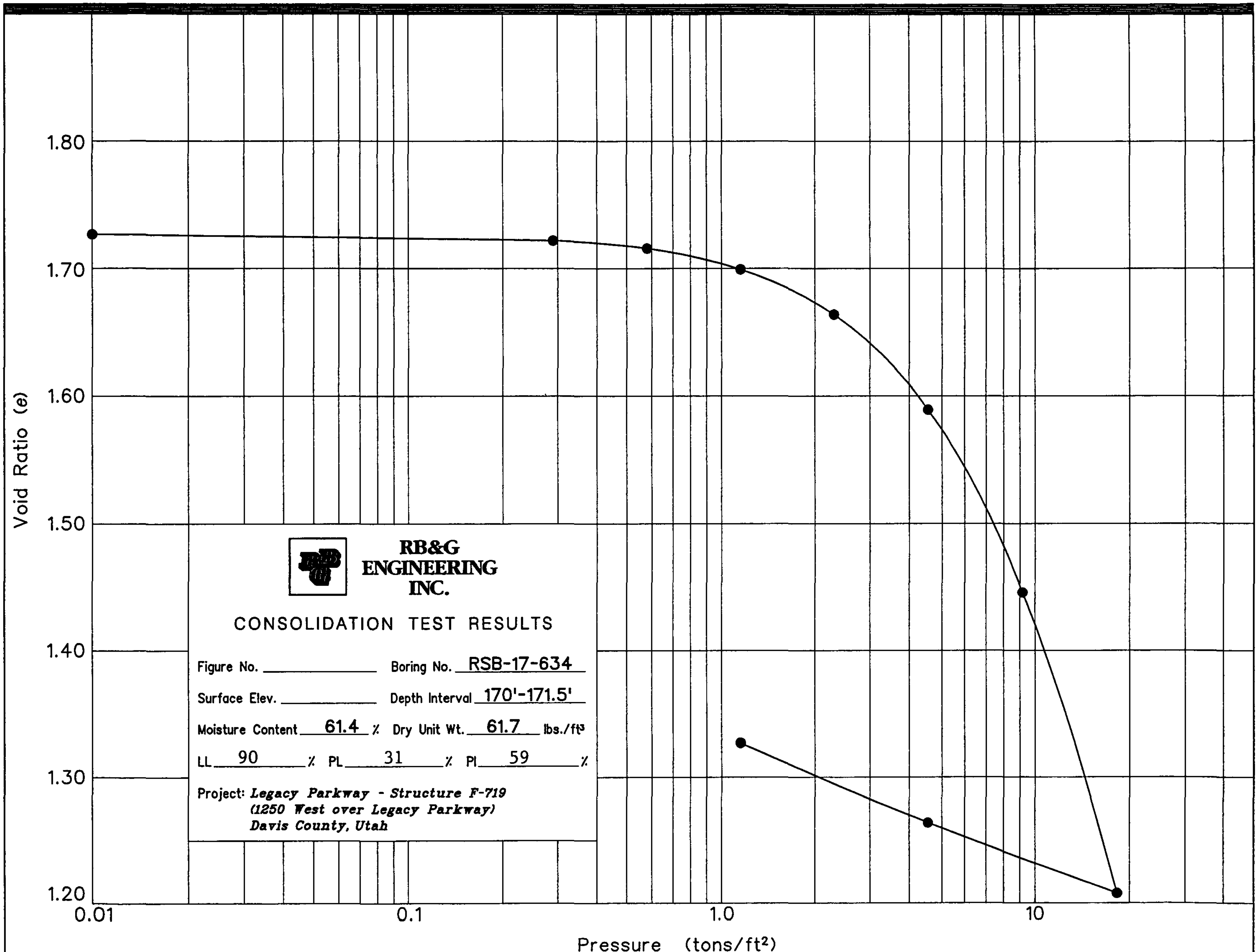
RB&G ENGINEERING INC.
Provo, Utah

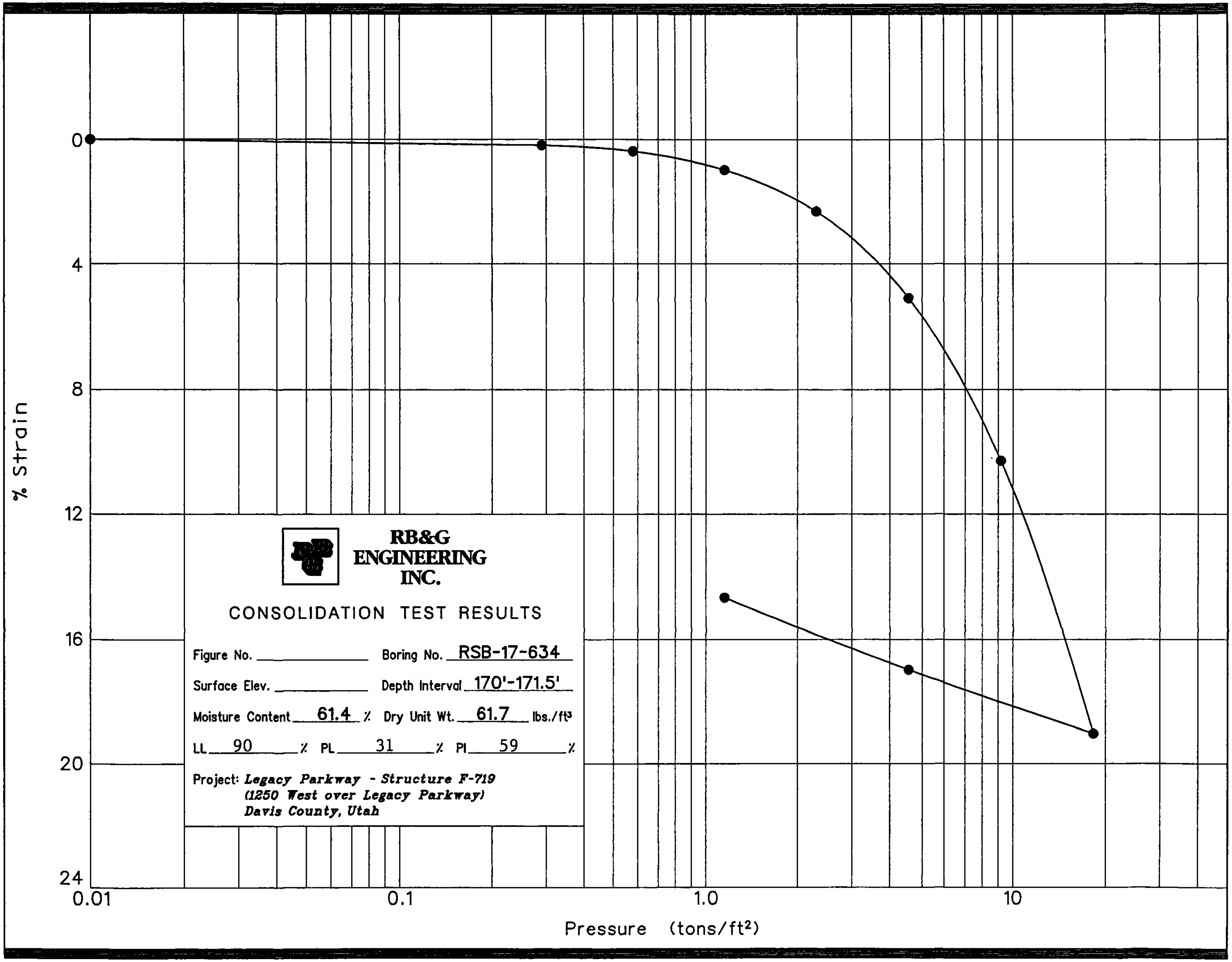
Hole no.: RSB-17-634
Depth: 100'-101.5'
Load: 9.20 to 18.40 tons

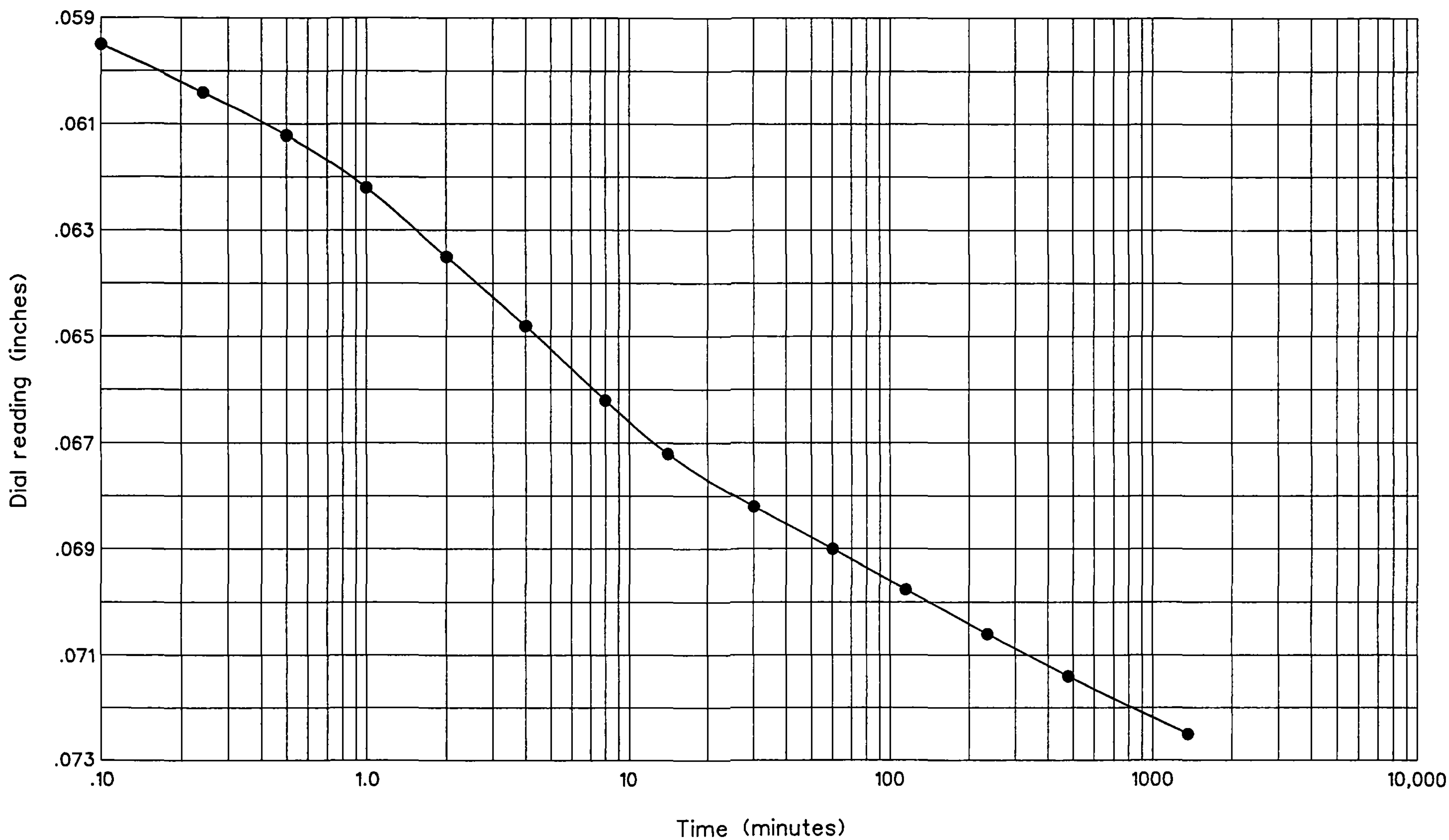
TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure


RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 170'-171.5'
Moisture Content 61.4 %
Dry Unit Wt. 61.7 lbs./ft³
LL 90 %
PL 31 %
PI 59 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah
Void Ratio (e)
1.80
1.70
1.60
1.50
1.40
1.30
1.20
0.01
0.1
1.0
10
Pressure (tons/ft²)


0
4
8
12
16
20
24
% Strain
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. RSB-17-634
Surface Elev.
Depth Interval 170'-171.5'
Moisture Content 61.4 %
Dry Unit Wt. 61.7 lbs./ft³
LL 90 %
PL 31 %
PI 59 %
Project: Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah



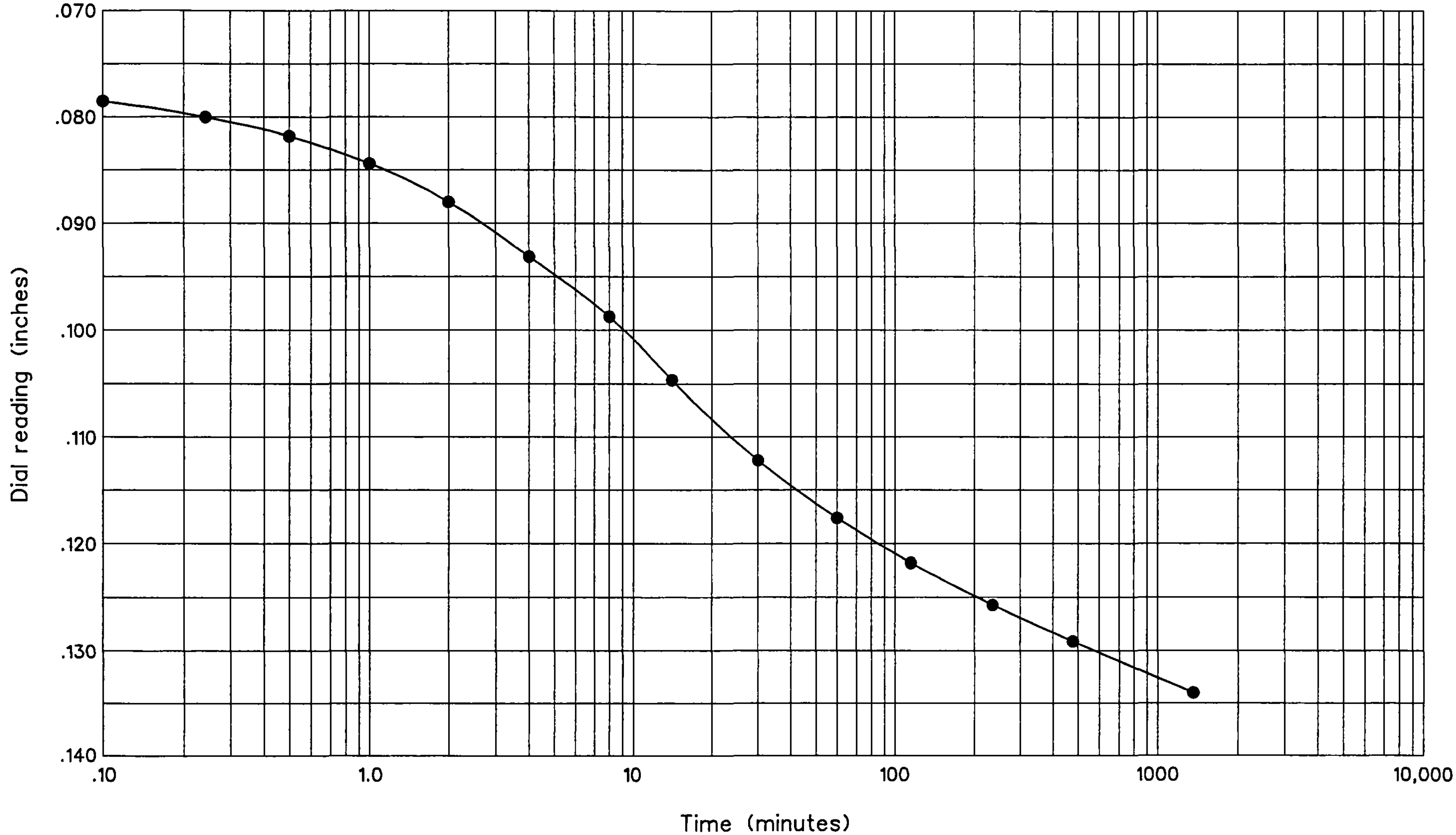
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 170'-171.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



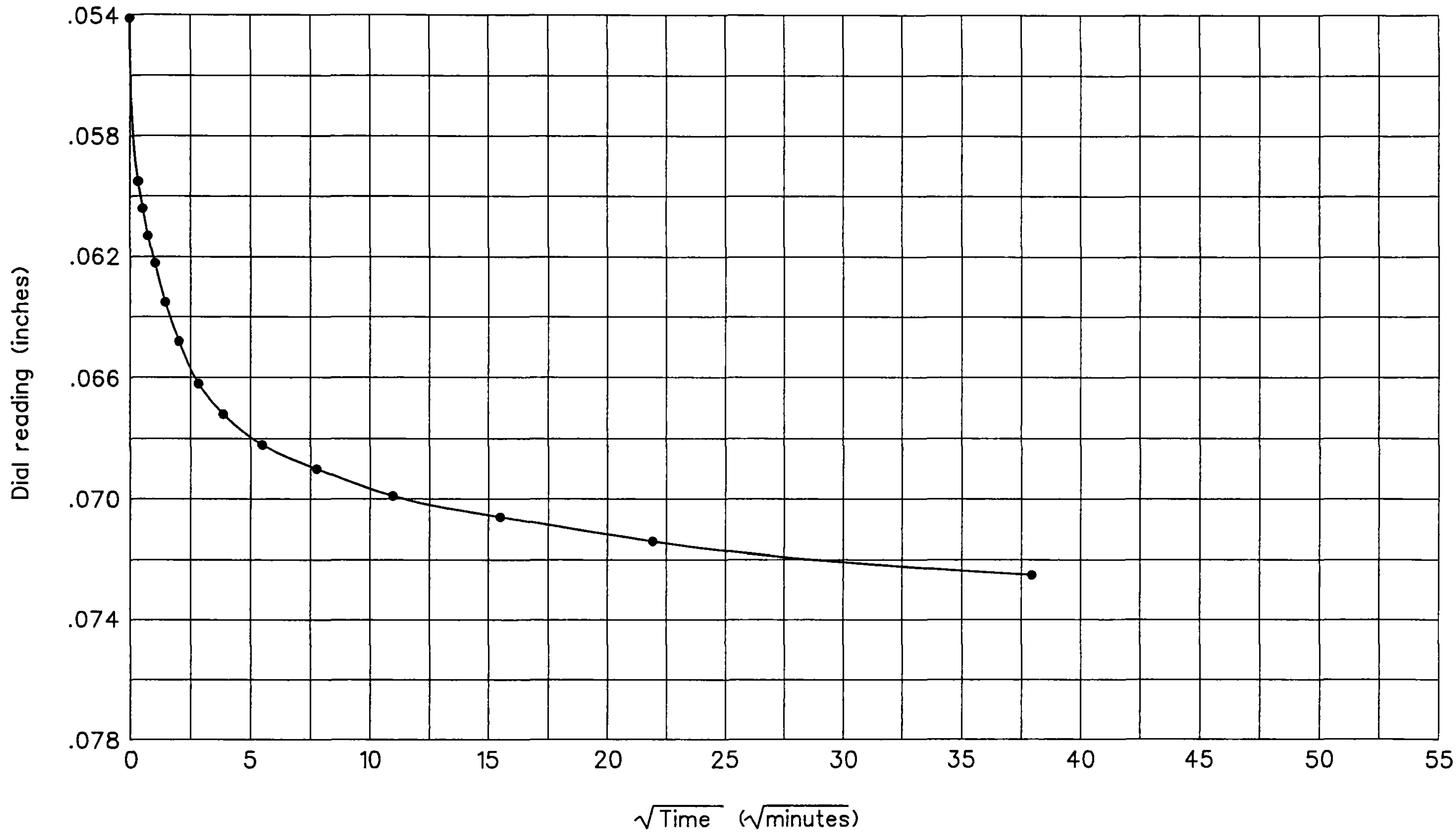
RB&G ENGINEERING INC.
Provo, Utah

Hole no.:	RSB-17-634
Depth:	170'-171.5'
Load:	9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



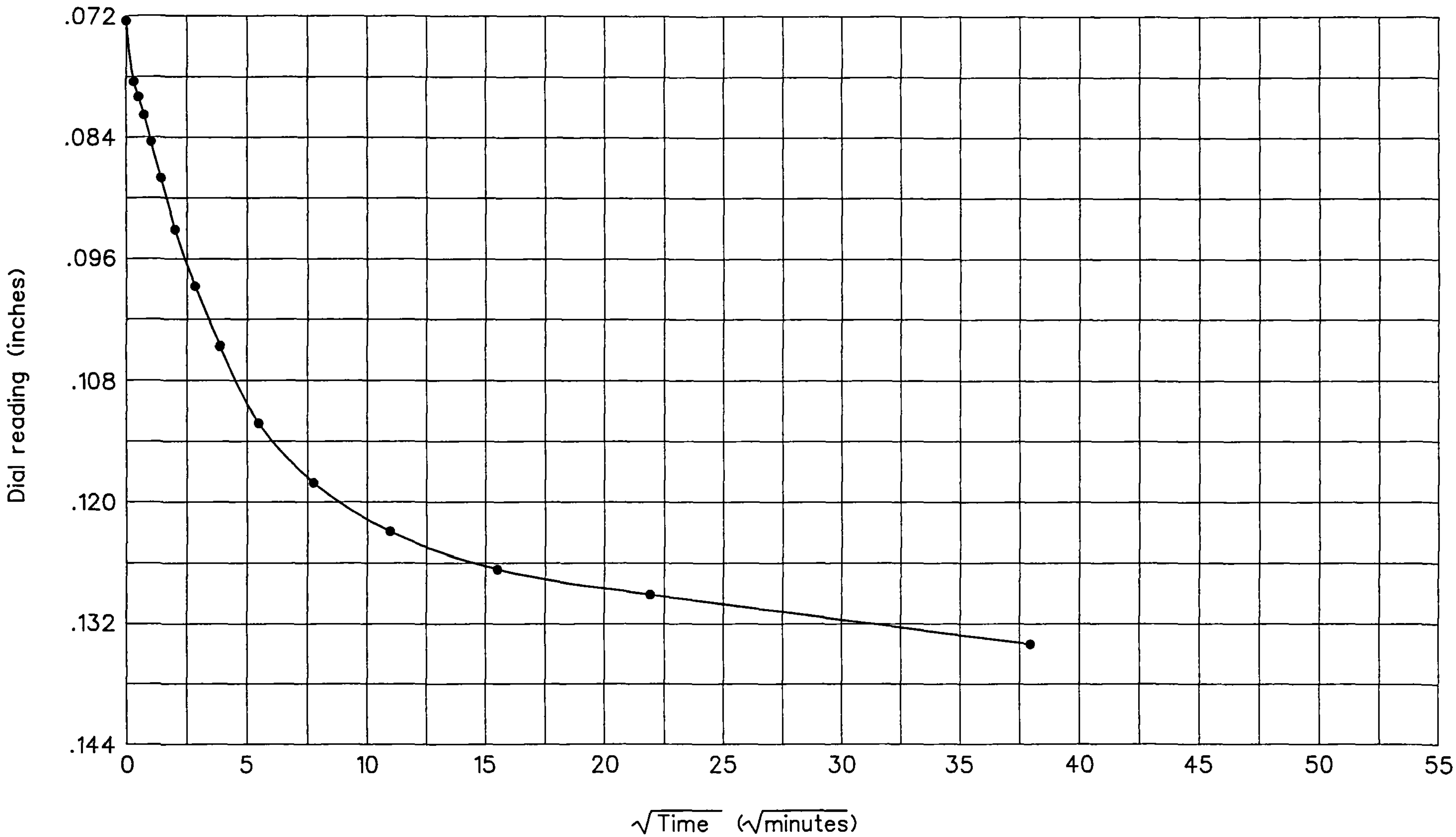
RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 170'-171.5'
Load: 4.60 to 9.20 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure



RB&G ENGINEERING INC.
Provo, Utah

Hole no.: RSB-17-634
Depth: 170'-171.5'
Load: 9.20 to 18.40 tons

TIME CONSOLIDATION

Legacy Parkway - Structure F-719
(1250 West over Legacy Parkway)
Davis County, Utah

Figure

Recommendations for LPILE and GROUP analyses.

Project: Legacy Parkway
Structure No: F-719 FAK No: 17B
Description: 1250 West over Legacy Parkway

by: srj
date: 4/8/2006

Exist. Ground Surface Elev: 4214 ft
Est. Pile Tip Elev: 4086 ft
Pile Length Below Ground: 128 ft

Pile Type: Closed-End Pipe Pile
Size: 16 inch O.D.
Water Table: Upper 3 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)
13	4214	4201	Soft Clay (Matlock)	0.031	5.9	0.015	0	50	4.9	0
24	4201	4177	Soft Clay (Matlock)	0.027	1.6	0.020	0	20	1.6	0
23	4177	4154	Soft Clay (Matlock)	0.028	4.9	0.017	0	40	4.9	0
15	4154	4139	Soft Clay (Matlock)	0.028	5.5	0.015	0	45	5.5	0
10	4139	4129	Soft Clay (Matlock)	0.030	9.0	0.010	0	100	8.0	0
6	4129	4123	Liquefiable Sand	0.030	0	0	0	10	2.0	0
33	4123	4090	Soft Clay (Matlock)	0.030	7.6	0.010	0	100	7.5	0
4	4090	4086	Soft Clay (Matlock)	0.028	13.8	0.007	0	100	11.7	124.9

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 0.069 pci (regular weight) or 0.046 pci (pumice)
Assume Friction Angle of 38 degrees. Consider reduced parameters for loading towards MSE wall face.

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.