ATTACHMENT G

Field and Laboratory Testing Data (Groundwater)

Volume 1 of 1

ATTACHMENT G

Table of Contents

WELL DEVELOPMENT 1
WELL PURGING AND WATER SAMPLING 1
SAMPLE CONTAINERS AND SHIPPING 2
LABORATORY ANALYSES OF SAMPLES 2
DECONTAMINATION AND CLEANING 2

List of Tables

Table G-1 Groundwater Laboratory Results Summary

List of Appendices

Appendix G-1 Laboratory Testing Data (Groundwater)

Appendix G-2 Field Testing Data (Groundwater)

Appendix G-3 Calibration Records for Water Quality Meter and Turbidimeter

Introduction

Water sampling of the observation wells and field and laboratory testing was done as described in the Specifications.

WELL DEVELOPMENT

Well development was conducted as described in the Specification and the results are contained in Attachment C.

WELL PURGING AND WATER SAMPLING

Water sampling was performed using a submersible pump placed approximately one foot above the bottom of the well. The sampling method used was consistent with "sampling based on fixed volume combined with indicator parameter stabilization" as described in ASTM D 6452-99. The pumping rate during well sampling was kept low enough to minimize sample turbidity, sample aeration, bubble formation, and turbulent filling of sample containers.

Well purging was performed until field-measured water quality indicator parameters stabilized and at least three well volumes were purged, as measured by MACTEC and agreed upon by Bechtel.

Groundwater sampling and testing were performed as required by the Specification or modified as agreed upon by Bechtel. The Specification requires a combination of Fixed Volume Purging (ASTM D 6452-99, Section 6.6.4), and Purging Based on Stabilization of Indicator Parameters (ASTM D 6452-99, Section 6.6.4), and requires that at least three well volumes (including the saturated porous volume of the filter pack) be removed from the well and the indicator parameters be stabilized prior to sampling. This was modified as follows, per Bechtel's instructions: should wells go dry during the purging prior to sampling, the following procedure will be followed:

1. When possible, decrease the flow rate as low as possible and monitor the specified field (indicator) parameters during well purging activities. If the parameters have stabilized, proceed with collecting the required water samples for laboratory analyses regardless of if three well volumes have been removed from the well.
2. If the well is purged dry prior to parameter stabilization, allow the well to recover and collect the required water samples per USEPA, Region 4 Environmental Investigation Standard Operating Procedures and Quality Assurance Manual. Obtain final field parameter readings. (Reference EPA Region 4 Manual EISOPQAM Nov. 2001.)

The samples collected were controlled by the procedures provided in Attachment 9 of the Work Plan.

Field instruments were used to measure indicator parameters as specified. The field indicator parameters which were measured included temperature, pH, electrical conductivity (specific conductance), turbidity, oxidation-reduction potential (Eh or redox), and dissolved oxygen, in accordance with ASTM D 6452-99. Calibration records for the instruments used to measure the parameters are contained in Appendix G-3 of this Attachment. Field measurement methods complied with the following standards for these parameters:

- Temperature – EPA Method 170.1.

- pH - ASTM D 1293-99 (Method B), or EPA Method 150.2, or EPA Method 9040B or 9041A (SW 846).
- Electrical conductivity – ASTM D 1125-95, or EPA Method 120.1, or EPA Method 9050A (SW 846).
- Turbidity – ASTM D 1889-00, or EPA Method 180.1.
- Oxidation-reduction potential – ASTM D 1498-00.
- Dissolved oxygen – ASTM D 888-05 (Method B), or EPA Method 360.1.

SAMPLE CONTAINERS AND SHIPPING

Sample containers obtained from the testing laboratory were used for collecting water samples. The laboratory indicated on each sample container the laboratory analysis which is to be performed, and the preservative which was added to the container. Water samples were shipped to the testing laboratory in ice-filled coolers.

LABORATORY ANALYSES OF SAMPLES

Laboratory testing for general water quality parameters was performed as assigned by Bechtel and consisted of those listed below:

- Total dissolved solids – EPA Method 160.1
- Cations (metals) – EPA Method 200.7
- Inorganic ions (bromide, chloride, fluoride, sulfide) – EPA Method 300.0
- Alkalinity (bicarbonate/carbonate) – EPA Method 310.1
- Ammonia – EPA Method 350.1
- Nitrate/nitrite –EPA Method 353.1
- Cation/anion balance – Laboratory standard procedures.

The laboratory results are summarized herein in Table G-1.

DECONTAMINATION AND CLEANING

All equipment, accessories, tools and supplies used for measurement of field parameters were kept decontaminated following ASTM D 5088-02. The equipment and tools were decontaminated before work began, between each well, at the completion of the work, and/or as directed by Bechtel.

Table G-1

Groundwater Laboratory Results Summary

TABLE G-1
GROUNDWATER LABORATORY RESULTS
STP COL PROJECT
MACTEC ENGINEERING AND CONSULTING, INC
PROJECT# 5050-06-0496

Well	Date Sampled	TDS by EPA Method 160.1	Nitrite/Nitrate by EPA Method 353.1	Cations/Metals by EPA Method 200.7				Anions by EPA Method 300.0				Ion Balance by SM18 (%)	Ammonia by EPA Method 350.1	Alkalinity By EPA Method 310.1
				Calcium	Potassium	Magnesium	Sodium	Bromide	Chloride	Flouride	Sulfate			
OW-308L	12/30/2006	**661**	0.136	62.7	5.47	34.2	149	0.71	199	0.8	24.4	3.4	0.083	347
OW-308U	12/30/2006	**1,240**	0.149	97.1	2.530B	55.6	**298**	2.4	**558**	1.4	76.6	1.8	<0.050	367
OW-332L	12/29/2006	**1,020**	0.52	98.3	2.980B	53.5	208	1.5	**439**	0.77	43.9	1.4	0.15	351
OW-332U	12/29/2006	**870**	0.39	70.2	<5	35.9	213	1.2	240	1.4	104	1.6	<0.050	383
OW-408L	12/30/2006	**650**	0.05	66	1.970B	32.5	145	0.59	195	0.97	21.6	3.0	0.073	349
OW-408U	12/30/2006	**913**	0.053	74.5	1.640B	38.6	240	1.1	**344**	1.1	29.5	2.4	<0.050	385
OW-420U	12/30/2006	**1,120**	0.383	101	1.790B	46.8	**259**	1.7	**505**	0.85	44.9	0.38	<0.050	320
OW-928L	12/29/2006	**643**	<0.050	74	2.370B	36.2	110	0.75	197	0.67	17.1	4.5	0.051	284
OW-928U	12/29/2006	**1,560**	<0.050	156	2.030B	51.6	**315**	3.0	**815**	0.75	132	8.5	<0.050	296
OW-930L	12/28/2006	**726**	<0.050	65.5	2.660B	34.7	200	0.98	**260**	0.83	28.2	3.9	0.13	360
OW-930U	12/28/2006	**623**	0.16	95.6	<5	31.5	89.7	0.95	175	0.66	16.8	0.49	<0.050	358
OW-933L	12/29/2006	**713**	0.069	63.4	2.930B	38.6	149	0.57	197	0.77	25.6	0.16	0.33	392
OW-933U	12/29/2006	**908**	<0.050	39.2	1.900B	25.8	**273**	1.3	**294**	**2.1**	70.9	0.95	<0.050	367
OW-934L	12/31/2006	**731**	<0.050	62	2.300B	35.4	185	0.42	189	0.78	24.5	8.0	0.52	380
OW-934U	12/31/2006	**1,020**	0.163	87.8	<5	56.2	218	1.7	**412**	1.4	47.3	0.58	<0.050	378
Comparison Standards		**500**	**10**	**NL**	**NL**	**NL**	**250**	**NL**	**250**	**2**	**250**	**NL**	**30**	**NL**

NOTES: TDS - Total Dissolved Solids
J - Indicates analyte was detected within the method blank; actual value may be lower then reported value
B - Estimated result; reported result is below typical lab reporting limit but above lab method detection limit
All results reported in milligrams per liter (mg/L) unless otherwise noted
Comparison Standards taken from EPA *2006 Edition of the Drinking Water Standards and Health Advisories*, Drinking Water Standards and Secondary Drinking Water Regulations
NL - No listed standard for primary or secondary drinking water standards
Bold indicates concentration in excess of comparison standard
Comparison standard for sodium taken from Taste Threshold from Drinking Water Advisory Table, Page 12 of Comparison Standard document

Prepared By/ Date: MJD 4/3/07
Checked By/ Date: KAW 4/13/07

Appendix G-1

Laboratory Testing Data (Groundwater)

SEVERN TRENT STL®

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Tel: 314 298 8566 Fax: 314 298 8757
www.stl-inc.com

ANALYTICAL REPORT

PROJECT NO. 5050-06-0496

STP COL

Lot #: F6L300110

Mike Sufnarski

MACTEC Engineering & Consultin
2801 Yorkmont Rd
Suite 100
Charlotte, NC 28208

SEVERN TRENT LABORATORIES, INC.

Terry Romanko
Project Manager

January 25, 2007

Case Narrative
LOT NUMBER: F6L300110

This report contains the analytical results for the eight samples received under chain of custody by STL St. Louis on December 30, 2006. These samples are associated with your STP COL project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by STL St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Observations/Nonconformances

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Anions (Bromide, Chloride, Fluoride, Sulfate) (MCAWW 300.0A)
The anion matrix spike solution contains all routine anions. Spiking technique, sample preparation and method compliance is demonstrated by the remaining acceptable MS recoveries. Poor matrix spike recovery for Fluoride in batch 7009295 and Bromide in batch 7010063 is attributed to matrix interference.
Affected Samples:
F6L300110 (1): OW-930U
F6L300110 (2): OW-930L
F6L300110 (3): OW-928U
F6L300110 (4): OW-928L
F6L300110 (5): OW-332U
F6L300110 (6): OW-332L
F6L300110 (7): OW-933U
F6L300110 (8): OW-933L

Nitrate-Nitrite (MCAWW 353.1)
The MS recovery for Nitrate-Nitrite in batch 7002139is outside the established QC limits. A matrix interference is physically evident in the sample. Method performance is demonstrated by acceptable LCS recovery.
Affected Samples:
F6L300110 (1): OW-930U
F6L300110 (2): OW-930L
F6L300110 (3): OW-928U
F6L300110 (4): OW-928L
F6L300110 (5): OW-332U
F6L300110 (6): OW-332L
F6L300110 (7): OW-933U

The MS recovery for Nitrate-Nitrite in batch 7009378 is slightly outside (112%) of QC limits (90-110%) indicating a potential slight high bias for that analyte. The batch LCS and LCSD recovery is within limits demonstrating acceptable method performance.
Affected Samples:
F6L300110 (8): OW-933L

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F6L300110

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Alkalinity	MCAWW 310.1	MCAWW 310.1
Bromide	MCAWW 300.0A	MCAWW 300.0A
Chloride	MCAWW 300.0A	MCAWW 300.0A
Filterable Residue (TDS)	MCAWW 160.1	MCAWW 160.1
Fluoride	MCAWW 300.0A	MCAWW 300.0A
Inductively Coupled Plasma (ICP) Metals	MCAWW 200.7	
Ion Balance (%Difference)	SM18 1030F & AP	SM18 1030F & AP
Nitrate-Nitrite	MCAWW 353.1	
Nitrogen, Ammonia	MCAWW 350.1	MCAWW 350.1
Sulfate	MCAWW 300.0A	MCAWW 300.0A

References:

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SM18 "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992.

SAMPLE SUMMARY

F6L300110

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
JL904	001	OW-930U	12/28/06	16:20
JL905	002	OW-930L	12/28/06	17:15
JL906	003	OW-928U	12/29/06	09:28
JL907	004	OW-928L	12/29/06	10:00
JL908	005	OW-332U	12/29/06	11:55
JL909	006	OW-332L	12/29/06	13:00
JL91A	007	OW-933U	12/29/06	14:35
JL91C	008	OW-933L	12/29/06	15:07

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-930U

TOTAL Metals

Lot-Sample #...: F6L300110-001 **Matrix.....:** WATER
Date Sampled...: 12/28/06 16:20 **Date Received..:** 12/30/06

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**95600**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9041AK**
		Dilution Factor: 1		Analysis Time..: 15:19		
Potassium	ND	5000	ug/L	MCAWW 200.7	01/10-01/12/07	JL9041AN
		Dilution Factor: 1		Analysis Time..: 15:19		
Magnesium	**31500**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9041AL**
		Dilution Factor: 1		Analysis Time..: 15:19		
Sodium	**89700**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9041AM**
		Dilution Factor: 1		Analysis Time..: 15:19		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-930U

General Chemistry

Lot-Sample #...: F6L300110-001 **Work Order #...:** JL904 **Matrix.....:** WATER
Date Sampled...: 12/28/06 16:20 **Date Received..:** 12/30/06

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	**0.95**	**0.25**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7010063**
		Dilution Factor: 1		Analysis Time..: 03:11		
Chloride	**175**	**40.0**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009294**
		Dilution Factor: 200		Analysis Time..: 10:09		
Fluoride	**0.66**	**0.10**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009295**
		Dilution Factor: 1		Analysis Time..: 03:11		
Ion Balance Difference	**0.49**	**0.10**	**%**	**SM18 1030F & API**	**01/19-01/22/07**	**7019463**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	**0.16**	**0.050**	**mg/L**	**MCAWW 353.1**	**01/02/07**	**7002139**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	ND	0.050	mg/L	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	**16.8**	**5.0**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009296**
		Dilution Factor: 10		Analysis Time..: 04:03		
Total Alkalinity	**358**	**5.0**	**mg/L**	**MCAWW 310.1**	**01/04/07**	**7004040**
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	**623**	**5.0**	**mg/L**	**MCAWW 160.1**	**01/03/07**	**7011286**
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-930L

TOTAL Metals

Lot-Sample #...: F6L300110-002 **Matrix.....:** WATER
Date Sampled...: 12/28/06 17:15 **Date Received..:** 12/30/06

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**65500**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9051AK**
		Dilution Factor: 1		Analysis Time..: 15:40		
Potassium	**2660 B**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9051AN**
		Dilution Factor: 1		Analysis Time..: 15:40		
Magnesium	**34700**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9051AL**
		Dilution Factor: 1		Analysis Time..: 15:40		
Sodium	**200000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9051AM**
		Dilution Factor: 1		Analysis Time..: 15:40		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-930L

General Chemistry

Lot-Sample #...: F6L300110-002 **Work Order #...:** JL905 **Matrix.....:** WATER
Date Sampled...: 12/28/06 17:15 **Date Received..:** 12/30/06

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	**0.98**	**0.25**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7010063**
		Dilution Factor: 1		Analysis Time..: 05:30		
Chloride	**260**	**40.0**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009294**
		Dilution Factor: 200		Analysis Time..: 11:01		
Fluoride	**0.83**	**0.10**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009295**
		Dilution Factor: 1		Analysis Time..: 05:30		
Ion Balance Difference	**3.9**	**0.10**	**%**	**SM18 1030F & API**	**01/19-01/22/07**	**7019463**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	ND	0.050	mg/L	MCAWW 353.1	01/02/07	7002139
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	**0.13**	**0.050**	**mg/L**	**MCAWW 350.1**	**01/10/07**	**7009221**
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	**28.2**	**5.0**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009296**
		Dilution Factor: 10		Analysis Time..: 05:47		
Total Alkalinity	**360**	**5.0**	**mg/L**	**MCAWW 310.1**	**01/04/07**	**7004040**
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	**726**	**5.0**	**mg/L**	**MCAWW 160.1**	**01/03/07**	**7011286**
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-928U

TOTAL Metals

Lot-Sample #...: F6L300110-003 **Matrix.....:** WATER
Date Sampled...: 12/29/06 09:28 **Date Received..:** 12/30/06

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**156000**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9061AK**
		Dilution Factor: 1		Analysis Time..: 15:45		
Potassium	**2030 B**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9061AN**
		Dilution Factor: 1		Analysis Time..: 15:45		
Magnesium	**51600**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9061AL**
		Dilution Factor: 1		Analysis Time..: 15:45		
Sodium	**315000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9061AM**
		Dilution Factor: 1		Analysis Time..: 15:45		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-928U

General Chemistry

Lot-Sample #...: F6L300110-003 **Work Order #...:** JL906 **Matrix.....:** WATER
Date Sampled...: 12/29/06 09:28 **Date Received..:** 12/30/06

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	**3.0**	**0.25**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7010063**
		Dilution Factor: 1		Analysis Time..: 06:05		
Chloride	**815**	**40.0**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009294**
		Dilution Factor: 200		Analysis Time..: 11:18		
Fluoride	**0.75**	**0.10**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009295**
		Dilution Factor: 1		Analysis Time..: 06:05		
Ion Balance Difference	**8.5**	**0.10**	**%**	**SM18 1030F & API**	**01/19-01/22/07**	**7019463**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	ND	0.050	mg/L	MCAWW 353.1	01/02/07	7002139
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	ND	0.050	mg/L	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	**132**	**5.0**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009296**
		Dilution Factor: 10		Analysis Time..: 06:22		
Total Alkalinity	**296**	**5.0**	**mg/L**	**MCAWW 310.1**	**01/04/07**	**7004040**
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	**1560**	**5.0**	**mg/L**	**MCAWW 160.1**	**01/03/07**	**7011286**
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-928L

TOTAL Metals

Lot-Sample #...: F6L300110-004 **Matrix.....:** WATER
Date Sampled...: 12/29/06 10:00 **Date Received..:** 12/30/06

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**74000**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9071AK**
		Dilution Factor: 1		Analysis Time..: 15:50		
Potassium	**2370 B**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9071AN**
		Dilution Factor: 1		Analysis Time..: 15:50		
Magnesium	**36200**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9071AL**
		Dilution Factor: 1		Analysis Time..: 15:50		
Sodium	**110000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9071AM**
		Dilution Factor: 1		Analysis Time..: 15:50		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-928L

General Chemistry

Lot-Sample #...: F6L300110-004 **Work Order #...:** JL907 **Matrix.....:** WATER
Date Sampled...: 12/29/06 10:00 **Date Received..:** 12/30/06

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	**0.75**	**0.25**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7010063**
		Dilution Factor: 1		Analysis Time..: 06:40		
Chloride	**197**	**40.0**	**mg/L**	**MCAWW 300.0A**	**01/09-01/10/07**	**7009294**
		Dilution Factor: 200		Analysis Time..: 12:11		
Fluoride	**0.67**	**0.10**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009295**
		Dilution Factor: 1		Analysis Time..: 06:40		
Ion Balance Difference	**4.5**	**0.10**	**%**	**SM18 1030F & API**	**01/19-01/22/07**	**7019463**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	ND	0.050	mg/L	MCAWW 353.1	01/02/07	7002139
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	**0.051**	**0.050**	**mg/L**	**MCAWW 350.1**	**01/10/07**	**7009221**
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	**17.1**	**0.50**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009296**
		Dilution Factor: 1		Analysis Time..: 06:40		
Total Alkalinity	**284**	**5.0**	**mg/L**	**MCAWW 310.1**	**01/04/07**	**7004040**
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	**643**	**5.0**	**mg/L**	**MCAWW 160.1**	**01/03/07**	**7011286**
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc.

Client Sample ID: OW-332U

TOTAL Metals

Lot-Sample #...: F6L300110-005 **Matrix.....:** WATER
Date Sampled...: 12/29/06 11:55 **Date Received..:** 12/30/06

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**70200**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9081AK**
		Dilution Factor: 1		Analysis Time..: 15:55		
Potassium	ND	5000	ug/L	MCAWW 200.7	01/10-01/12/07	JL9081AN
		Dilution Factor: 1		Analysis Time..: 15:55		
Magnesium	**35900**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9081AL**
		Dilution Factor: 1		Analysis Time..: 15:55		
Sodium	**213000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9081AM**
		Dilution Factor: 1		Analysis Time..: 15:55		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-332U

General Chemistry

Lot-Sample #...: F6L300110-005 **Work Order #...:** JL908 **Matrix.....:** WATER
Date Sampled...: 12/29/06 11:55 **Date Received..:** 12/30/06

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	**1.2**	**0.25**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7010063**
		Dilution Factor: 1		Analysis Time..: 07:14		
Chloride	**240**	**40.0**	**mg/L**	**MCAWW 300.0A**	**01/09-01/10/07**	**7009294**
		Dilution Factor: 200		Analysis Time..: 12:28		
Fluoride	**1.4**	**0.10**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009295**
		Dilution Factor: 1		Analysis Time..: 07:14		
Ion Balance Difference	**1.6**	**0.10**	**%**	**SM18 1030F & API**	**01/19-01/22/07**	**7019463**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	**0.39**	**0.050**	**mg/L**	**MCAWW 353.1**	**01/02/07**	**7002139**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	ND	0.050	mg/L	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	**104**	**5.0**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009296**
		Dilution Factor: 10		Analysis Time..: 07:32		
Total Alkalinity	**383**	**5.0**	**mg/L**	**MCAWW 310.1**	**01/04/07**	**7004040**
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	**870**	**5.0**	**mg/L**	**MCAWW 160.1**	**01/03/07**	**7011286**
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-332L

TOTAL Metals

Lot-Sample #...: F6L300110-006 **Matrix.....:** WATER
Date Sampled...: 12/29/06 13:00 **Date Received..:** 12/30/06

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**98300**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9091AK**
		Dilution Factor: 1		Analysis Time..: 16:12		
Potassium	**2980 B**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9091AN**
		Dilution Factor: 1		Analysis Time..: 16:12		
Magnesium	**53500**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9091AL**
		Dilution Factor: 1		Analysis Time..: 16:12		
Sodium	**208000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL9091AM**
		Dilution Factor: 1		Analysis Time..: 16:12		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-332L

General Chemistry

Lot-Sample #...: F6L300110-006 **Work Order #...:** JL909 **Matrix.....:** WATER
Date Sampled...: 12/29/06 13:00 **Date Received..:** 12/30/06

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	1.5	0.25	mg/L	MCAWW 300.0A	01/09/07	7010063
		Dilution Factor: 1		Analysis Time..: 07:49		
Chloride	439	40.0	mg/L	MCAWW 300.0A	01/09-01/10/07	7009294
		Dilution Factor: 200		Analysis Time..: 12:45		
Fluoride	0.77	0.10	mg/L	MCAWW 300.0A	01/09/07	7009295
		Dilution Factor: 1		Analysis Time..: 07:49		
Ion Balance Difference	1.4	0.10	%	SM18 1030F & API	01/19-01/22/07	7019463
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	0.52	0.050	mg/L	MCAWW 353.1	01/02/07	7002139
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	0.15	0.050	mg/L	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	43.9	5.0	mg/L	MCAWW 300.0A	01/09/07	7009296
		Dilution Factor: 10		Analysis Time..: 08:41		
Total Alkalinity	351	5.0	mg/L	MCAWW 310.1	01/04/07	7004040
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	1020	5.0	mg/L	MCAWW 160.1	01/03/07	7011286
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-933U

TOTAL Metals

Lot-Sample #...: F6L300110-007 **Matrix.....:** WATER
Date Sampled...: 12/29/06 14:35 **Date Received..:** 12/30/06

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	39200	2500	ug/L	MCAWW 200.7	01/10-01/12/07	JL91A1AK
		Dilution Factor: 1		Analysis Time..: 16:17		
Potassium	1900 B	5000	ug/L	MCAWW 200.7	01/10-01/12/07	JL91A1AN
		Dilution Factor: 1		Analysis Time..: 16:17		
Magnesium	25800	1000	ug/L	MCAWW 200.7	01/10-01/12/07	JL91A1AL
		Dilution Factor: 1		Analysis Time..: 16:17		
Sodium	273000	1000	ug/L	MCAWW 200.7	01/10-01/12/07	JL91A1AM
		Dilution Factor: 1		Analysis Time..: 16:17		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-933U

General Chemistry

Lot-Sample #...: F6L300110-007 **Work Order #...:** JL91A **Matrix.....:** WATER
Date Sampled...: 12/29/06 14:35 **Date Received..:** 12/30/06

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	**1.3**	**0.25**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7010063**
		Dilution Factor: 1		Analysis Time..: 08:59		
Chloride	**294**	**40.0**	**mg/L**	**MCAWW 300.0A**	**01/09-01/10/07**	**7009294**
		Dilution Factor: 200		Analysis Time..: 01:03		
Fluoride	**2.1**	**0.10**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009295**
		Dilution Factor: 1		Analysis Time..: 08:59		
Ion Balance Difference	**0.95**	**0.10**	**%**	**SM18 1030F & API**	**01/19-01/22/07**	**7019463**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	ND	0.050	mg/L	MCAWW 353.1	01/02/07	7002139
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	ND	0.050	mg/L	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	**70.9**	**5.0**	**mg/L**	**MCAWW 300.0A**	**01/09/07**	**7009296**
		Dilution Factor: 10		Analysis Time..: 09:16		
Total Alkalinity	**367**	**5.0**	**mg/L**	**MCAWW 310.1**	**01/04/07**	**7004040**
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	**908**	**5.0**	**mg/L**	**MCAWW 160.1**	**01/03/07**	**7011286**
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-933L

TOTAL Metals

Lot-Sample #...: F6L300110-008 **Matrix.....:** WATER
Date Sampled...: 12/29/06 15:07 **Date Received..:** 12/30/06

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**63400**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL91C1AK**
		Dilution Factor: 1		Analysis Time..: 16:23		
Potassium	**2930 B**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL91C1AN**
		Dilution Factor: 1		Analysis Time..: 16:23		
Magnesium	**33600**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL91C1AL**
		Dilution Factor: 1		Analysis Time..: 16:23		
Sodium	**149000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JL91C1AM**
		Dilution Factor: 1		Analysis Time..: 16:23		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-933L

General Chemistry

Lot-Sample #...: F6L300110-008 **Work Order #...:** JL91C **Matrix.....:** WATER
Date Sampled...: 12/29/06 15:07 **Date Received..:** 12/30/06

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	0.57	0.25	mg/L	MCAWW 300.0A	01/09/07	7010063
		Dilution Factor: 1		Analysis Time..: 09:34		
Chloride	197	40.0	mg/L	MCAWW 300.0A	01/09-01/10/07	7009294
		Dilution Factor: 200		Analysis Time..: 01:20		
Fluoride	0.77	0.10	mg/L	MCAWW 300.0A	01/09/07	7009295
		Dilution Factor: 1		Analysis Time..: 09:34		
Ion Balance Difference	0.16	0.10	%	SM18 1030F & API	01/19-01/22/07	7019463
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	69.0	50.0	ug/L	MCAWW 353.1	01/12/07	7009378
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	0.33	0.050	mg/L	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	25.6	5.0	mg/L	MCAWW 300.0A	01/09/07	7009296
		Dilution Factor: 10		Analysis Time..: 09:51		
Total Alkalinity	392	5.0	mg/L	MCAWW 310.1	01/04/07	7004040
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	713	5.0	mg/L	MCAWW 160.1	01/03/07	7011286
		Dilution Factor: 1		Analysis Time..: 00:00		

METHOD BLANK REPORT

TOTAL Metals

Client Lot #...: F6L300110 **Matrix.....:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MB Lot-Sample #: F7A100000-145 **Prep Batch #...:** 7010145						
Calcium	ND	2500	ug/L	MCAWW 200.7	01/10-01/12/07	JMMCE1AA
		Dilution Factor: 1				
		Analysis Time..: 15:09				
Magnesium	ND	1000	ug/L	MCAWW 200.7	01/10-01/12/07	JMMCE1AC
		Dilution Factor: 1				
		Analysis Time..: 15:09				
Potassium	ND	5000	ug/L	MCAWW 200.7	01/10-01/12/07	JMMCE1AE
		Dilution Factor: 1				
		Analysis Time..: 15:09				
Sodium	ND	1000	ug/L	MCAWW 200.7	01/10-01/12/07	JMMCE1AD
		Dilution Factor: 1				
		Analysis Time..: 15:09				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT

General Chemistry

Client Lot #...: F6L300110 **Matrix.....:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide		Work Order #: JMLQ11AA		MB Lot-Sample #:	F7A100000-063	
	ND	0.25	mg/L	MCAWW 300.0A	01/09/07	7010063
		Dilution Factor: 1				
		Analysis Time..: 01:09				
Chloride		Work Order #: JMLP91AA		MB Lot-Sample #:	F7A090000-294	
	ND	0.20	mg/L	MCAWW 300.0A	01/09/07	7009294
		Dilution Factor: 1				
		Analysis Time..: 01:09				
Fluoride		Work Order #: JMLQA1AA		MB Lot-Sample #:	F7A090000-295	
	ND	0.10	mg/L	MCAWW 300.0A	01/09/07	7009295
		Dilution Factor: 1				
		Analysis Time..: 01:09				
Nitrate/Nitrite as N		Work Order #: JMAM61AA		MB Lot-Sample #:	F7A020000-139	
	ND	0.050	mg/L	MCAWW 353.1	01/02/07	7002139
		Dilution Factor: 1				
		Analysis Time..: 00:00				
Nitrate/Nitrite as N		Work Order #: JMLD91AA		MB Lot-Sample #:	F7A090000-378	
	ND	50.0	ug/L	MCAWW 353.1	01/12/07	7009378
		Dilution Factor: 1				
		Analysis Time..: 00:00				
Nitrogen, as Ammonia		Work Order #: JMKLN1AA		MB Lot-Sample #:	F7A090000-221	
	ND	0.050	mg/L	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1				
		Analysis Time..: 00:00				
Sulfate		Work Order #: JMLQE1AA		MB Lot-Sample #:	F7A090000-296	
	ND	0.50	mg/L	MCAWW 300.0A	01/09/07	7009296
		Dilution Factor: 1				
		Analysis Time..: 01:09				
Total Alkalinity		Work Order #: JMEHQ1AA		MB Lot-Sample #:	F7A040000-040	
	ND	5.0	mg/L	MCAWW 310.1	01/04/07	7004040
		Dilution Factor: 1				
		Analysis Time..: 00:00				
Total Dissolved Solids		Work Order #: JMPPG1AA		MB Lot-Sample #:	F7A110000-286	
	ND	5.0	mg/L	MCAWW 160.1	01/03/07	7011286
		Dilution Factor: 1				
		Analysis Time..: 00:00				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: F6L300110 **Matrix.....:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
LCS Lot-Sample#: F7A100000-145 **Prep Batch #...:** 7010145					
Calcium	103	(85 - 115)	MCAWW 200.7	01/10-01/12/07	JMMCE1AF
		Dilution Factor: 1	Analysis Time..: 15:14		
Magnesium	103	(85 - 115)	MCAWW 200.7	01/10-01/12/07	JMMCE1AG
		Dilution Factor: 1	Analysis Time..: 15:14		
Sodium	103	(85 - 115)	MCAWW 200.7	01/10-01/12/07	JMMCE1AH
		Dilution Factor: 1	Analysis Time..: 15:14		
Potassium	110	(85 - 115)	MCAWW 200.7	01/10-01/12/07	JMMCE1AJ
		Dilution Factor: 1	Analysis Time..: 15:14		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Lot-Sample #...: F6L300110 **Matrix.....:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide		WO#:JMLQ11AC-LCS/JMLQ11AD-LCSD LCS Lot-Sample#: F7A100000-063					
	105	(90 - 110)			MCAWW 300.0A	01/09/07	7010063
	103	(90 - 110)	1.5	(0-20)	MCAWW 300.0A	01/09/07	7010063
		Dilution Factor: 1			Analysis Time..: 12:46		
Chloride		WO#:JMLP91AC-LCS/JMLP91AD-LCSD LCS Lot-Sample#: F7A090000-294					
	96	(90 - 110)			MCAWW 300.0A	01/09/07	7009294
	95	(90 - 110)	0.54	(0-20)	MCAWW 300.0A	01/09/07	7009294
		Dilution Factor: 1			Analysis Time..: 12:46		
Fluoride		WO#:JMLQA1AC-LCS/JMLQA1AD-LCSD LCS Lot-Sample#: F7A090000-295					
	99	(90 - 110)			MCAWW 300.0A	01/09/07	7009295
	97	(90 - 110)	1.9	(0-20)	MCAWW 300.0A	01/09/07	7009295
		Dilution Factor: 1			Analysis Time..: 12:46		
Nitrate/Nitrite as N		WO#:JMAM61AC-LCS/JMAM61AD-LCSD LCS Lot-Sample#: F7A020000-139					
	94	(90 - 110)			MCAWW 353.1	01/02/07	7002139
	96	(90 - 110)	1.4	(0-20)	MCAWW 353.1	01/02/07	7002139
		Dilution Factor: 1			Analysis Time..: 00:00		
Nitrate/Nitrite as N		WO#:JMLD91AC-LCS/JMLD91AD-LCSD LCS Lot-Sample#: F7A090000-378					
	101	(90 - 110)			MCAWW 353.1	01/12/07	7009378
	104	(90 - 110)	2.9	(0-20)	MCAWW 353.1	01/12/07	7009378
		Dilution Factor: 1			Analysis Time..: 00:00		
Nitrogen, as Ammonia		WO#:JMKLN1AC-LCS/JMKLN1AD-LCSD LCS Lot-Sample#: F7A090000-221					
	93	(90 - 110)			MCAWW 350.1	01/10/07	7009221
	93	(90 - 110)	0.11	(0-20)	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1			Analysis Time..: 00:00		
Sulfate		WO#:JMLQE1AC-LCS/JMLQE1AD-LCSD LCS Lot-Sample#: F7A090000-296					
	93	(90 - 110)			MCAWW 300.0A	01/09/07	7009296
	99	(90 - 110)	6.1	(0-20)	MCAWW 300.0A	01/09/07	7009296
		Dilution Factor: 1			Analysis Time..: 12:46		
Total Alkalinity		WO#:JMEHQ1AC-LCS/JMEHQ1AD-LCSD LCS Lot-Sample#: F7A040000-040					
	100	(90 - 110)			MCAWW 310.1	01/04/07	7004040
	99	(90 - 110)	0.50	(0-15)	MCAWW 310.1	01/04/07	7004040
		Dilution Factor: 1			Analysis Time..: 00:00		

(Continued on next page)

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Lot-Sample #...: F6L300110 **Matrix.....:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Dissolved Solids		WO#:JMPPG1AC-LCS/JMPPG1AD-LCSD				LCS Lot-Sample#: F7A110000-286	
	94	(90 - 110)			MCAWW 160.1	01/03/07	7011286
	98	(90 - 110)	3.5	(0-15)	MCAWW 160.1	01/03/07	7011286

Dilution Factor: 1 Analysis Time..: 00:00

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: F6L300110 **Matrix.....:** WATER
Date Sampled...: 12/28/06 16:20 **Date Received..:** 12/30/06

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MS Lot-Sample #: F6L300110-001 **Prep Batch #...:** 7010145							
Calcium	100	(70 - 130)			MCAWW 200.7	01/10-01/12/07	JL9041A5
	95	(70 - 130)	1.0	(0-20)	MCAWW 200.7	01/10-01/12/07	JL9041A6
		Dilution Factor: 1					
		Analysis Time..: 15:29					
Magnesium	100	(70 - 130)			MCAWW 200.7	01/10-01/12/07	JL9041A7
	96	(70 - 130)	1.4	(0-20)	MCAWW 200.7	01/10-01/12/07	JL9041A8
		Dilution Factor: 1					
		Analysis Time..: 15:29					
Potassium	111	(70 - 130)			MCAWW 200.7	01/10-01/12/07	JL9041CC
	107	(70 - 130)	3.0	(0-20)	MCAWW 200.7	01/10-01/12/07	JL9041CD
		Dilution Factor: 1					
		Analysis Time..: 15:29					
Sodium	104	(70 - 130)			MCAWW 200.7	01/10-01/12/07	JL9041A9
	97	(70 - 130)	1.5	(0-20)	MCAWW 200.7	01/10-01/12/07	JL9041CA
		Dilution Factor: 1					
		Analysis Time..: 15:29					

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: F6L300110 **Matrix.....:** WATER
Date Sampled...: 12/28/06 16:20 **Date Received..:** 12/30/06

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	124 N	Work Order #...: JL9041A3 (90 - 110)	MCAWW 300.0A	MS Lot-Sample #: 01/09/07	F6L300110-001 7010063
		Dilution Factor: 1	Analysis Time..: 03:11		
Chloride	110	Work Order #...: JL9041AV (90 - 110)	MCAWW 300.0A	MS Lot-Sample #: 01/09/07	F6L300110-001 7009294
		Dilution Factor: 200	Analysis Time..: 10:09		
Fluoride	117 N	Work Order #...: JL9041AX (90 - 110)	MCAWW 300.0A	MS Lot-Sample #: 01/09/07	F6L300110-001 7009295
		Dilution Factor: 1	Analysis Time..: 03:11		
Nitrate/Nitrite as N	67 N	Work Order #...: JL9041AQ (90 - 110)	MCAWW 353.1	MS Lot-Sample #: 01/02/07	F6L300110-001 7002139
		Dilution Factor: 1	Analysis Time..: 00:00		
Nitrate/Nitrite as N	112 N	Work Order #...: JMCLT1AT (90 - 110)	MCAWW 353.1	MS Lot-Sample #: 01/12/07	F7A030115-001 7009378
		Dilution Factor: 1	Analysis Time..: 00:00		
Nitrogen, as Ammonia	106	Work Order #...: JLWTW1AN (90 - 110)	MCAWW 350.1	MS Lot-Sample #: 01/10/07	F6L200297-001 7009221
		Dilution Factor: 1	Analysis Time..: 00:00		
Sulfate	93	Work Order #...: JL9041A1 (90 - 110)	MCAWW 300.0A	MS Lot-Sample #: 01/09/07	F6L300110-001 7009296
		Dilution Factor: 10	Analysis Time..: 04:03		
Total Alkalinity	72	Work Order #...: JL9041AT (50 - 121)	MCAWW 310.1	MS Lot-Sample #: 01/04/07	F6L300110-001 7004040
		Dilution Factor: 1	Analysis Time..: 00:00		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

N Spiked analyte recovery is outside stated control limits.

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: F6L300110 **Work Order #...:** JLWTW-SMP JLWTW-DUP **Matrix.....:** WATER

Date Sampled...: 12/19/06 08:08 **Date Received..:** 12/20/06

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Nitrogen, as Ammonia						SD Lot-Sample #:	F6L200297-001	
	ND	ND	mg/L	0	(0-20)	MCAWW 350.1	01/10/07	7009221

Dilution Factor: 1 Analysis Time..: 00:00

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: F6L300110 **Work Order #...:** JMCLT-SMP JMCLT-DUP **Matrix.....:** WATER

Date Sampled...: 12/30/06 10:30 **Date Received..:** 01/03/07

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Nitrate/Nitrite as N						SD Lot-Sample #:	F7A030115-001	
	53.0	ND	ug/L	200	(0-20)	MCAWW 353.1	01/12/07	7009378

Dilution Factor: 1 Analysis Time..: 00:00

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: F6L300110 **Work Order #...:** JL904-SMP JL904-DUP **Matrix.....:** WATER

Date Sampled...: 12/28/06 16:20 **Date Received..:** 12/30/06

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Dissolved Solids						SD Lot-Sample #:	F6L300110-001	
	623	632	mg/L	1.4	(0-0.0)	MCAWW 160.1	01/03/07	7011286
			Dilution Factor: 1			Analysis Time..: 00:00		
Bromide						SD Lot-Sample #:	F6L300110-001	
	0.95	0.97	mg/L	2.8	(0-20)	MCAWW 300.0A	01/09/07	7010063
			Dilution Factor: 1			Analysis Time..: 03:11		
Chloride						SD Lot-Sample #:	F6L300110-001	
	175	168	mg/L	4.3	(0-20)	MCAWW 300.0A	01/09/07	7009294
			Dilution Factor: 200			Analysis Time..: 10:09		
Fluoride						SD Lot-Sample #:	F6L300110-001	
	0.66	0.66	mg/L	0.91	(0-20)	MCAWW 300.0A	01/09/07	7009295
			Dilution Factor: 1			Analysis Time..: 03:11		
Sulfate						SD Lot-Sample #:	F6L300110-001	
	16.8	17.6	mg/L	4.6	(0-20)	MCAWW 300.0A	01/09/07	7009296
			Dilution Factor: 10			Analysis Time..: 04:03		
Total Alkalinity						SD Lot-Sample #:	F6L300110-001	
	358	353	mg/L	1.4	(0-20)	MCAWW 310.1	01/04/07	7004040
			Dilution Factor: 1			Analysis Time..: 00:00		
Nitrate/Nitrite as N						SD Lot-Sample #:	F6L300110-001	
	0.16	0.15	mg/L	5.1	(0-20)	MCAWW 353.1	01/02/07	7002139
			Dilution Factor: 1			Analysis Time..: 00:00		

LOT# F6L300110

STL ST. LOUIS

[redacted]

Chain of Custody Record

SEVERN TRENT **STL**
Severn Trent Laboratories, Inc.

CUR 5612

STL-4124 (0901)

Client: MACTEC	Project Manager: Mike Sufnarski	Date: 12/29/06	Chain of Custody Number: 321045
Address: 2801 Yorkmont, Suite 100	Telephone Number (Area Code)/Fax Number: (361) 972-4652 / 361-972-4657	Lab Number	Page 1 of 1
City: Charlotte; State: NC; Zip Code: 28208	Site Contact: Same	Lab Contact	
Project Name and Location (State): STP-COL (Texas)	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.: Project # 5050060496			

Analysis (Attach list if more space is needed): 310.1 (Alk.); 300.0 Inorganic Ions; 160.1 TDS; 353.1 nitrate/nitrite; 350.1; 200.7 Cations

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	310.1 (Alk.)	300.0 Inorganic Ions	160.1 TDS	353.1 nitrate/nitrite	350.1	200.7 Cations	Special Instructions/ Conditions of Receipt
DW-930 U	12/28/06	16:20		✓			1	1	1				✓	✓	✓	✓	✓	✓	500p, 2x250p
DW-930 L	↓	17:15		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-928 U	12/29/06	9:28a		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-928 L		10:00a		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-332 U		11:55a		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-332 L		1:00p		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-933 U		2:35p		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-933 L	↓	3:07		✓			1	1	1				✓	✓	✓	✓	✓	✓	

QU 123006

Possible Hazard Identification: ☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☑ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____ Standard

QC Requirements (Specify): Standard

1. Relinquished By: [signature]	Date: 12/29/06	Time: 3:15p	1. Received By: Jill Clarke	Date: 123006	Time: 0826
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STL St. Louis

Lot #(s): F6L360110

- 5672 -

Condition Upon Receipt Form

Client: Mactec
Quote No: 73/014
COC/RFA No: 321045
Initiated By: QL
Date: 12-30-06
Time: 0820

Shipping Information

Shipper Name: Fed Ex

Shipping # (s):*

1. 8598 1984 7107
2.
3.
4.
5.
6.
7.
8.
9.
10.

Multiple Packages Y (N) N/A

Sample Temperature (s):**

1. 2
2.
3.
4.
5.
6.
7.
8.
9.
10.

*Numbered shipping lines correspond to Numbered Sample Temp lines

**Sample must be received at 4°C ± 2°C- If not, note contents below. Temperature variance does NOT affect the following: Metals-Liquid or Rad tests- Liquid or Solids

Condition (Circle "Y" for yes, "N" for no and "N/A" for not applicable):

1.	Y (N)	Was sample received broken?	8.	(Y) N	Sample received with Chain of Custody?
2.	(Y) N N/A	Was sample received with proper pH[1] ? (If not, make note below)	9.	(Y) N	Chain of Custody matches sample ID's on container(s)?
3.	Y N	If N/A-Was pH taken by original STL Lab?	10.	(Y) N	Are there custody seals present on cooler?
4.	(Y) N	Sample received in proper containers?	11.	Y (N) N/A	Do custody seals on cooler appear to be tampered with?
5.	(Y) N	Sample volume sufficient for analysis?	12.	Y (N)	Are there custody seals present on bottles?
6.	Y N (N/A)	Headspace in VOA or TOX liquid samples? (If Yes, note sample ID's below)	13.	Y N (N/A)	Do custody seals on bottles appear to be tampered with?
7.	(Y) N	Were contents of the cooler frisked after opening	14.	Y N (N/A)	Was Internal COC/Workshare received?

[1] For DOE-AL (Pantex, LANL, Sandia) sites, pH of ALL containers received must be verified, EXCEPT VOA, TOX and soils.

Notes:

Corrective Action:

- ☐ Client Contact Name: Informed by:
- ☐ Sample(s) processed "as is"
- ☐ Sample(s) on hold until: If released, notify:

Project Management Review: Date: 01-03-07

THIS FORM MUST BE COMPLETED AT THE TIME THE ITEMS ARE BEING CHECKED IN. IF ANY ITEM IS COMPLETED BY SOMEONE OTHER THAN THE INITIATOR, THEN THAT PERSON IS REQUIRED TO APPLY THEIR INITIAL AND THE DATE NEXT TO THAT ITEM.

ADMIN-0004, REVISED 03/01/06\\Slsvr01\QA\FORMS\ST-LOUIS\ADMIN\Admin004030106.doc

[redacted] [redacted]

Chain of Custody Record

STL-4124 (0901)

SEVERN TRENT STL

Severn Trent Laboratories, Inc.

Client	MARPOC
Address	8801 Yorktown S.
City	Houston
State	TX
Zip	
Project Name and Location (State)	STP-COL (Texas)
Contract/Purchase Order/Quote No.	Project # 3050606076
Project Manager	Mike Sufnarski
Telephone Number (Area Code)/Fax Number	(361) 972-4632 / (361) 972-4657
Site Contact	Same
Lab Contact	
Carrier/Waybill Number	
Date	12/29/06
Chain of Custody Number	321045
Lab Number	
Page	1 of 1

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): 8260 Full	8260 TCL	VOC	SVOC	Metals	Cyanide	Special Instructions/ Conditions of Receipt
DW-930U	12/26	14:20		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-930L		17:15		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-928U	12/26	9:28		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-928L		10:00		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-932U		11:55		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-932L		1:00p		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-933U		2:35p		✓			1	1	1				✓	✓	✓	✓	✓	✓	
DW-933L		3:07		✓			1	1	1				✓	✓	✓	✓	✓	✓	

Possible Hazard Identification
☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ PCB ☐ Unknown

Sample Disposal
☐ Return To Client ☑ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other ____ Standard

QC Requirements (Specify): Standard

	Date	Time		Date	Time
1. Relinquished By	12/29/06	[illegible]	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CAN Stays with the Sample; PINK - Field Copy

STP 184
1 of 1

SEVERN TRENT STL®

STL St. Louis
13715 Rider Trail North
Earth City, MO 63045

Tel: 314 298 8566 Fax: 314 298 8757
www.stl-inc.com

ANALYTICAL REPORT

PROJECT NO. 5050060496

STP COL (Texas)

Lot #: F7A030115

Mike Sufnarski

MACTEC Engineering & Consultin
2801 Yorkmont Rd
Suite 100
Charlotte, NC 28208

SEVERN TRENT LABORATORIES, INC.

Terry Romanko
Project Manager

January 25, 2007

Case Narrative
LOT NUMBER: F7A030115

This report contains the analytical results for the seven samples received under chain of custody by STL St. Louis on January 3, 2007. These samples are associated with your STP COL (Texas) project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by STL St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Observations/Nonconformances

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Anions (Bromide, Chloride, Fluoride, Sulfate) (MCAWW 300.0A)
The anion matrix spike solution contains all routine anions. Spiking technique, sample preparation and method compliance is demonstrated by the remaining acceptable MS recoveries. Poor matrix spike recovery for Bromide in batch 7009067 and Fluoride in batch 7009069 is attributed to matrix interference. The sample duplicate %RPD for Bromide in batch 7009067 is outside the established QC limits. A matrix interference is physically evident in the sample. Method performance is demonstrated by acceptable LCS recovery.
Affected Samples:
F7A030115 (1): OW-408U
F7A030115 (2): OW-408L
F7A030115 (3): OW-308U
F7A030115 (4): OW-308L
F7A030115 (5): OW-420U
F7A030115 (6): OW-934U
F7A030115 (7): OW-934L

Nitrate-Nitrite (MCAWW 353.1)
The MS recovery for Nitrate-Nitrite in batch 7009378 is slightly outside (112%) of QC limits (90-110%) indicating a potential slight high bias for that analyte. The batch LCS and LCSD recovery is within limits demonstrating acceptable method performance.
Affected Samples:
F7A030115 (1): OW-408U
F7A030115 (2): OW-408L
F7A030115 (3): OW-308U
F7A030115 (4): OW-308L
F7A030115 (5): OW-420U
F7A030115 (6): OW-934U
F7A030115 (7): OW-934L

Nitrogen, as Ammonia (MCAWW 350.1)
Batch 7009222:
The LCS recovery for NH3-N is outside the lower QC limit, indicating a potential slight negative bias for that analyte. The recoveries were 89.4 and 88.8% with a limit of 90-110%. Matrix spike recovery was within QC limits (97%) demonstrating acceptable spike performance in the sample matrix.
Affected Samples:
F7A030115 (1): OW-408U
F7A030115 (2): OW-408L
F7A030115 (3): OW-308U

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F7A030115

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Alkalinity	MCAWW 310.1	MCAWW 310.1
Bromide	MCAWW 300.0A	MCAWW 300.0A
Chloride	MCAWW 300.0A	MCAWW 300.0A
Filterable Residue (TDS)	MCAWW 160.1	MCAWW 160.1
Fluoride	MCAWW 300.0A	MCAWW 300.0A
Inductively Coupled Plasma (ICP) Metals	MCAWW 200.7	
Ion Balance (%Difference)	SM18 1030F & AP	SM18 1030F & AP
Nitrate-Nitrite	MCAWW 353.1	
Nitrogen, Ammonia	MCAWW 350.1	MCAWW 350.1
Sulfate	MCAWW 300.0A	MCAWW 300.0A

References:

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SM18 "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992.

SAMPLE SUMMARY

F7A030115

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
JMCLT	001	OW-408U	12/30/06	10:30
JMCLV	002	OW-408L	12/30/06	10:50
JMCLX	003	OW-308U	12/30/06	12:35
JMCL0	004	OW-308L	12/30/06	13:45
JMCL2	005	OW-420U	12/30/06	16:15
JMCL3	006	OW-934U	12/31/06	11:45
JMCL4	007	OW-934L	12/31/06	10:40

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-408U

TOTAL Metals

Lot-Sample #...: F7A030115-001 **Matrix.....:** WATER
Date Sampled...: 12/30/06 10:30 **Date Received..:** 01/03/07

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**74500**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLT1AK**
		Dilution Factor: 1		Analysis Time..: 16:28		
Potassium	**1640 B**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLT1AN**
		Dilution Factor: 1		Analysis Time..: 16:28		
Magnesium	**38600**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLT1AL**
		Dilution Factor: 1		Analysis Time..: 16:28		
Sodium	**240000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLT1AM**
		Dilution Factor: 1		Analysis Time..: 16:28		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-408U

General Chemistry

Lot-Sample #...: F7A030115-001 **Work Order #...:** JMCLT **Matrix.....:** WATER
Date Sampled...: 12/30/06 10:30 **Date Received..:** 01/03/07

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	1.1	0.25	mg/L	MCAWW 300.0A	01/08/07	7009067
		Dilution Factor: 1		Analysis Time..: 03:07		
Chloride	344	40.0	mg/L	MCAWW 300.0A	01/08-01/09/07	7009068
		Dilution Factor: 200		Analysis Time..: 08:34		
Fluoride	1.1	0.10	mg/L	MCAWW 300.0A	01/08/07	7009069
		Dilution Factor: 1		Analysis Time..: 03:07		
Ion Balance Difference	2.4	0.10	%	SM18 1030F & API	01/19-01/22/07	7019463
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	53.0	50.0	ug/L	MCAWW 353.1	01/12/07	7009378
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	ND	0.050	mg/L	MCAWW 350.1	01/09-01/10/07	7009222
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	29.5	5.0	mg/L	MCAWW 300.0A	01/08/07	7009070
		Dilution Factor: 10		Analysis Time..: 03:24		
Total Alkalinity	385	5.0	mg/L	MCAWW 310.1	01/04/07	7004040
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	913	5.0	mg/L	MCAWW 160.1	01/05/07	7016253
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-408L

TOTAL Metals

Lot-Sample #...: F7A030115-002 **Matrix.....:** WATER
Date Sampled...: 12/30/06 10:50 **Date Received..:** 01/03/07

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**66000**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLV1AK**
		Dilution Factor: 1		Analysis Time..: 16:33		
Potassium	**1970 B**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLV1AN**
		Dilution Factor: 1		Analysis Time..: 16:33		
Magnesium	**32500**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLV1AL**
		Dilution Factor: 1		Analysis Time..: 16:33		
Sodium	**145000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLV1AM**
		Dilution Factor: 1		Analysis Time..: 16:33		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-408L

General Chemistry

Lot-Sample #...: F7A030115-002 **Work Order #...:** JMCLV **Matrix.....:** WATER
Date Sampled...: 12/30/06 10:50 **Date Received..:** 01/03/07

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	0.59	0.25	mg/L	MCAWW 300.0A	01/08/07	7009067
		Dilution Factor: 1		Analysis Time..: 03:42		
Chloride	195	20.0	mg/L	MCAWW 300.0A	01/08-01/09/07	7009068
		Dilution Factor: 100		Analysis Time..: 08:51		
Fluoride	0.97	0.10	mg/L	MCAWW 300.0A	01/08/07	7009069
		Dilution Factor: 1		Analysis Time..: 03:42		
Ion Balance Difference	3.0	0.10	%	SM18 1030F & API	01/19-01/22/07	7019463
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	50.0	50.0	ug/L	MCAWW 353.1	01/12/07	7009378
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	0.073	0.050	mg/L	MCAWW 350.1	01/09-01/10/07	7009222
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	21.6	5.0	mg/L	MCAWW 300.0A	01/08/07	7009070
		Dilution Factor: 10		Analysis Time..: 03:59		
Total Alkalinity	349	5.0	mg/L	MCAWW 310.1	01/04/07	7004040
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	650	5.0	mg/L	MCAWW 160.1	01/05/07	7016253
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-308U

TOTAL Metals

Lot-Sample #...: F7A030115-003 **Matrix.....:** WATER
Date Sampled...: 12/30/06 12:35 **Date Received..:** 01/03/07

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**97100**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLX1AK**
		Dilution Factor: 1		Analysis Time..: 16:38		
Potassium	**2530 B**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLX1AN**
		Dilution Factor: 1		Analysis Time..: 16:38		
Magnesium	**55600**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLX1AL**
		Dilution Factor: 1		Analysis Time..: 16:38		
Sodium	**298000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCLX1AM**
		Dilution Factor: 1		Analysis Time..: 16:38		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-308U

General Chemistry

Lot-Sample #...: F7A030115-003 **Work Order #...:** JMCLX **Matrix.....:** WATER
Date Sampled...: 12/30/06 12:35 **Date Received..:** 01/03/07

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	**2.4**	**0.25**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009067**
		Dilution Factor: 1		Analysis Time..: 04:17		
Chloride	**558**	**40.0**	**mg/L**	**MCAWW 300.0A**	**01/08-01/09/07**	**7009068**
		Dilution Factor: 200		Analysis Time..: 09:08		
Fluoride	**1.4**	**0.10**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009069**
		Dilution Factor: 1		Analysis Time..: 04:17		
Ion Balance Difference	**1.8**	**0.10**	**%**	**SM18 1030F & API**	**01/19-01/22/07**	**7019463**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	**149**	**50.0**	**ug/L**	**MCAWW 353.1**	**01/12/07**	**7009378**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	ND	0.050	mg/L	MCAWW 350.1	01/09-01/10/07	7009222
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	**76.6**	**5.0**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009070**
		Dilution Factor: 10		Analysis Time..: 04:34		
Total Alkalinity	**367**	**5.0**	**mg/L**	**MCAWW 310.1**	**01/04/07**	**7004040**
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	**1240**	**5.0**	**mg/L**	**MCAWW 160.1**	**01/05/07**	**7016253**
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-308L

TOTAL Metals

Lot-Sample #...: F7A030115-004 **Matrix.....:** WATER
Date Sampled...: 12/30/06 13:45 **Date Received..:** 01/03/07

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**62700**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL01AK**
		Dilution Factor: 1		Analysis Time..: 16:43		
Potassium	**5470**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL01AN**
		Dilution Factor: 1		Analysis Time..: 16:43		
Magnesium	**34200**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL01AL**
		Dilution Factor: 1		Analysis Time..: 16:43		
Sodium	**149000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL01AM**
		Dilution Factor: 1		Analysis Time..: 16:43		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-308L

General Chemistry

Lot-Sample #...: F7A030115-004 **Work Order #...:** JMCL0 **Matrix.....:** WATER
Date Sampled...: 12/30/06 13:45 **Date Received..:** 01/03/07

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	0.71	0.25	mg/L	MCANW 300.0A	01/08/07	7009067
		Dilution Factor: 1		Analysis Time..: 04:51		
Chloride	199	20.0	mg/L	MCANW 300.0A	01/08-01/09/07	7009068
		Dilution Factor: 100		Analysis Time..: 09:26		
Fluoride	0.80	0.10	mg/L	MCANW 300.0A	01/08/07	7009069
		Dilution Factor: 1		Analysis Time..: 04:51		
Ion Balance Difference	3.4	0.10	%	SM18 1030F & API	01/19-01/22/07	7019463
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	136	50.0	ug/L	MCANW 353.1	01/12/07	7009378
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	0.083	0.050	mg/L	MCANW 350.1	01/10/07	7009221
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	24.4	5.0	mg/L	MCANW 300.0A	01/08/07	7009070
		Dilution Factor: 10		Analysis Time..: 05:09		
Total Alkalinity	347	5.0	mg/L	MCANW 310.1	01/04/07	7004040
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	661	5.0	mg/L	MCANW 160.1	01/05/07	7016253
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-420U

TOTAL Metals

Lot-Sample #...: F7A030115-005 **Matrix.....:** WATER
Date Sampled...: 12/30/06 16:15 **Date Received..:** 01/03/07

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**101000**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL21AK**
		Dilution Factor: 1		Analysis Time..: 16:48		
Potassium	**1790 B**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL21AN**
		Dilution Factor: 1		Analysis Time..: 16:48		
Magnesium	**46800**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL21AL**
		Dilution Factor: 1		Analysis Time..: 16:48		
Sodium	**259000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL21AM**
		Dilution Factor: 1		Analysis Time..: 16:48		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-420U

General Chemistry

Lot-Sample #...: F7A030115-005 **Work Order #...:** JMCL2 **Matrix.....:** WATER
Date Sampled...: 12/30/06 16:15 **Date Received..:** 01/03/07

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	**1.7**	**0.25**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009067**
		Dilution Factor: 1		Analysis Time..: 05:26		
Chloride	**505**	**40.0**	**mg/L**	**MCAWW 300.0A**	**01/08-01/09/07**	**7009068**
		Dilution Factor: 200		Analysis Time..: 09:43		
Fluoride	**0.85**	**0.10**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009069**
		Dilution Factor: 1		Analysis Time..: 05:26		
Ion Balance Difference	**0.38**	**0.10**	**%**	**SM18 1030F & API**	**01/19-01/22/07**	**7019463**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	**383**	**50.0**	**ug/L**	**MCAWW 353.1**	**01/12/07**	**7009378**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	ND	0.050	mg/L	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	**44.9**	**5.0**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009070**
		Dilution Factor: 10		Analysis Time..: 05:44		
Total Alkalinity	**320**	**5.0**	**mg/L**	**MCAWW 310.1**	**01/04/07**	**7004040**
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	**1120**	**5.0**	**mg/L**	**MCAWW 160.1**	**01/05/07**	**7016253**
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-934U

TOTAL Metals

Lot-Sample #...: F7A030115-006 **Matrix.....:** WATER
Date Sampled...: 12/31/06 11:45 **Date Received..:** 01/03/07

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**87800**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL31AK**
		Dilution Factor: 1		Analysis Time..: 16:54		
Potassium	ND	5000	ug/L	MCAWW 200.7	01/10-01/12/07	JMCL31AN
		Dilution Factor: 1		Analysis Time..: 16:54		
Magnesium	**56200**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL31AL**
		Dilution Factor: 1		Analysis Time..: 16:54		
Sodium	**218000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL31AM**
		Dilution Factor: 1		Analysis Time..: 16:54		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-934U

General Chemistry

Lot-Sample #...: F7A030115-006 **Work Order #...:** JMCL3 **Matrix.....:** WATER
Date Sampled...: 12/31/06 11:45 **Date Received..:** 01/03/07

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	**1.7**	**0.25**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009067**
		Dilution Factor: 1		Analysis Time..: 06:36		
Chloride	**412**	**40.0**	**mg/L**	**MCAWW 300.0A**	**01/08-01/09/07**	**7009068**
		Dilution Factor: 200		Analysis Time..: 10:01		
Fluoride	**1.4**	**0.10**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009069**
		Dilution Factor: 1		Analysis Time..: 06:36		
Ion Balance Difference	**0.58**	**0.10**	**%**	**SM18 1030F & API**	**01/19-01/22/07**	**7019463**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	**163**	**50.0**	**ug/L**	**MCAWW 353.1**	**01/12/07**	**7009378**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	ND	0.050	mg/L	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	**47.3**	**5.0**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009070**
		Dilution Factor: 10		Analysis Time..: 06:53		
Total Alkalinity	**378**	**5.0**	**mg/L**	**MCAWW 310.1**	**01/04/07**	**7004040**
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	**1020**	**5.0**	**mg/L**	**MCAWW 160.1**	**01/05/07**	**7016253**
		Dilution Factor: 1		Analysis Time..: 00:00		

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-934L

TOTAL Metals

Lot-Sample #...: F7A030115-007 **Matrix.....:** WATER
Date Sampled...: 12/31/06 10:40 **Date Received..:** 01/03/07

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 7010145						
Calcium	**62000**	**2500**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL41AK**
		Dilution Factor: 1		Analysis Time..: 16:59		
Potassium	**2300 B**	**5000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL41AN**
		Dilution Factor: 1		Analysis Time..: 16:59		
Magnesium	**35400**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL41AL**
		Dilution Factor: 1		Analysis Time..: 16:59		
Sodium	**185000**	**1000**	**ug/L**	**MCAWW 200.7**	**01/10-01/12/07**	**JMCL41AM**
		Dilution Factor: 1		Analysis Time..: 16:59		

NOTE(S):

B Estimated result. Result is less than RL.

MACTEC Engineering & Consulting Inc

Client Sample ID: OW-934L

General Chemistry

Lot-Sample #...: F7A030115-007 **Work Order #...:** JMCL4 **Matrix.....:** WATER
Date Sampled...: 12/31/06 10:40 **Date Received..:** 01/03/07

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide	**0.42**	**0.25**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009067**
		Dilution Factor: 1		Analysis Time..: 07:11		
Chloride	**189**	**20.0**	**mg/L**	**MCAWW 300.0A**	**01/08-01/09/07**	**7009068**
		Dilution Factor: 100		Analysis Time..: 10:18		
Fluoride	**0.78**	**0.10**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009069**
		Dilution Factor: 1		Analysis Time..: 07:11		
Ion Balance Difference	**8.0**	**0.10**	**%**	**SM18 1030F & API**	**01/19-01/22/07**	**7019463**
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrate/Nitrite as N	ND	50.0	ug/L	MCAWW 353.1	01/12/07	7009378
		Dilution Factor: 1		Analysis Time..: 00:00		
Nitrogen, as Ammonia	**0.52**	**0.050**	**mg/L**	**MCAWW 350.1**	**01/10/07**	**7009221**
		Dilution Factor: 1		Analysis Time..: 00:00		
Sulfate	**24.5**	**5.0**	**mg/L**	**MCAWW 300.0A**	**01/08/07**	**7009070**
		Dilution Factor: 10		Analysis Time..: 08:03		
Total Alkalinity	**380**	**5.0**	**mg/L**	**MCAWW 310.1**	**01/04/07**	**7004040**
		Dilution Factor: 1		Analysis Time..: 00:00		
Total Dissolved Solids	**731**	**5.0**	**mg/L**	**MCAWW 160.1**	**01/05/07**	**7016253**
		Dilution Factor: 1		Analysis Time..: 00:00		

METHOD BLANK REPORT

TOTAL Metals

Client Lot #...: F7A030115 **Matrix.....:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MB Lot-Sample #: F7A100000-145 **Prep Batch #...:** 7010145						
Calcium	ND	2500	ug/L	MCAWW 200.7	01/10-01/12/07	JMMCE1AA
		Dilution Factor: 1				
		Analysis Time..: 15:09				
Magnesium	ND	1000	ug/L	MCAWW 200.7	01/10-01/12/07	JMMCE1AC
		Dilution Factor: 1				
		Analysis Time..: 15:09				
Potassium	ND	5000	ug/L	MCAWW 200.7	01/10-01/12/07	JMMCE1AE
		Dilution Factor: 1				
		Analysis Time..: 15:09				
Sodium	ND	1000	ug/L	MCAWW 200.7	01/10-01/12/07	JMMCE1AD
		Dilution Factor: 1				
		Analysis Time..: 15:09				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT

General Chemistry

Client Lot #...: F7A030115 **Matrix.....:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide		Work Order #: JMJWJ1AA		MB Lot-Sample #:	F7A090000-067	
	ND	0.25	mg/L	MCAWW 300.0A	01/08/07	7009067
		Dilution Factor: 1				
		Analysis Time..: 07:35				
Chloride		Work Order #: JMJWK1AA		MB Lot-Sample #:	F7A090000-068	
	ND	0.20	mg/L	MCAWW 300.0A	01/08/07	7009068
		Dilution Factor: 1				
		Analysis Time..: 07:35				
Fluoride		Work Order #: JMJWL1AA		MB Lot-Sample #:	F7A090000-069	
	ND	0.10	mg/L	MCAWW 300.0A	01/08/07	7009069
		Dilution Factor: 1				
		Analysis Time..: 07:35				
Nitrate/Nitrite as N		Work Order #: JMLD91AA		MB Lot-Sample #:	F7A090000-378	
	ND	50.0	ug/L	MCAWW 353.1	01/12/07	7009378
		Dilution Factor: 1				
		Analysis Time..: 00:00				
Nitrogen, as Ammonia		Work Order #: JMKM51AA		MB Lot-Sample #:	F7A090000-222	
	ND	0.050	mg/L	MCAWW 350.1	01/09-01/10/07	7009222
		Dilution Factor: 1				
		Analysis Time..: 00:00				
Nitrogen, as Ammonia		Work Order #: JMKLN1AA		MB Lot-Sample #:	F7A090000-221	
	ND	0.050	mg/L	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1				
		Analysis Time..: 00:00				
Sulfate		Work Order #: JMJWN1AA		MB Lot-Sample #:	F7A090000-070	
	ND	0.50	mg/L	MCAWW 300.0A	01/08/07	7009070
		Dilution Factor: 1				
		Analysis Time..: 07:35				
Total Alkalinity		Work Order #: JMEHQ1AA		MB Lot-Sample #:	F7A040000-040	
	ND	5.0	mg/L	MCAWW 310.1	01/04/07	7004040
		Dilution Factor: 1				
		Analysis Time..: 00:00				
Total Dissolved Solids		Work Order #: JM0WV1AA		MB Lot-Sample #:	F7A160000-253	
	ND	5.0	mg/L	MCAWW 160.1	01/05/07	7016253
		Dilution Factor: 1				
		Analysis Time..: 00:00				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: F7A030115 **Matrix.....:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
LCS Lot-Sample#: F7A100000-145 **Prep Batch #...:** 7010145					
Calcium	103	(85 - 115)	MCAWW 200.7	01/10-01/12/07	JMMCE1AF
		Dilution Factor: 1	Analysis Time..: 15:14		
Magnesium	103	(85 - 115)	MCAWW 200.7	01/10-01/12/07	JMMCE1AG
		Dilution Factor: 1	Analysis Time..: 15:14		
Sodium	103	(85 - 115)	MCAWW 200.7	01/10-01/12/07	JMMCE1AH
		Dilution Factor: 1	Analysis Time..: 15:14		
Potassium	110	(85 - 115)	MCAWW 200.7	01/10-01/12/07	JMMCE1AJ
		Dilution Factor: 1	Analysis Time..: 15:14		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Lot-Sample #...: F7A030115 **Matrix.....:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide		WO#:JMJWJ1AC-LCS/JMJWJ1AD-LCSD				LCS Lot-Sample#: F7A090000-067	
	104	(90 - 110)			MCAWW 300.0A	01/08/07	7009067
	99	(90 - 110)	4.2	(0-20)	MCAWW 300.0A	01/08/07	7009067
		Dilution Factor: 1			Analysis Time..: 07:18		
Chloride		WO#:JMJWK1AC-LCS/JMJWK1AD-LCSD				LCS Lot-Sample#: F7A090000-068	
	91	(90 - 110)			MCAWW 300.0A	01/08/07	7009068
	95	(90 - 110)	3.8	(0-20)	MCAWW 300.0A	01/08/07	7009068
		Dilution Factor: 1			Analysis Time..: 07:18		
Fluoride		WO#:JMJWL1AC-LCS/JMJWL1AD-LCSD				LCS Lot-Sample#: F7A090000-069	
	95	(90 - 110)			MCAWW 300.0A	01/08/07	7009069
	91	(90 - 110)	4.3	(0-20)	MCAWW 300.0A	01/08/07	7009069
		Dilution Factor: 1			Analysis Time..: 07:18		
Nitrate/Nitrite as N		WO#:JMLD91AC-LCS/JMLD91AD-LCSD				LCS Lot-Sample#: F7A090000-378	
	101	(90 - 110)			MCAWW 353.1	01/12/07	7009378
	104	(90 - 110)	2.9	(0-20)	MCAWW 353.1	01/12/07	7009378
		Dilution Factor: 1			Analysis Time..: 00:00		
Nitrogen, as Ammonia		WO#:JMKLN1AC-LCS/JMKLN1AD-LCSD				LCS Lot-Sample#: F7A090000-221	
	93	(90 - 110)			MCAWW 350.1	01/10/07	7009221
	93	(90 - 110)	0.11	(0-20)	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1			Analysis Time..: 00:00		
Nitrogen, as Ammonia		WO#:JMKM51AC-LCS/JMKM51AD-LCSD				LCS Lot-Sample#: F7A090000-222	
	89 N	(90 - 110)			MCAWW 350.1	01/09-01/10/07	7009222
	89 N	(90 - 110)	0.65	(0-20)	MCAWW 350.1	01/09-01/10/07	7009222
		Dilution Factor: 1			Analysis Time..: 00:00		
Sulfate		WO#:JMJWN1AC-LCS/JMJWN1AD-LCSD				LCS Lot-Sample#: F7A090000-070	
	94	(90 - 110)			MCAWW 300.0A	01/08/07	7009070
	97	(90 - 110)	3.1	(0-20)	MCAWW 300.0A	01/08/07	7009070
		Dilution Factor: 1			Analysis Time..: 07:18		
Total Alkalinity		WO#:JMEHQ1AC-LCS/JMEHQ1AD-LCSD				LCS Lot-Sample#: F7A040000-040	
	100	(90 - 110)			MCAWW 310.1	01/04/07	7004040
	99	(90 - 110)	0.50	(0-15)	MCAWW 310.1	01/04/07	7004040
		Dilution Factor: 1			Analysis Time..: 00:00		

(Continued on next page)

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Lot-Sample #...: F7A030115 **Matrix.....:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Dissolved Solids		WO#:JM0WV1AC-LCS/JM0WV1AD-LCSD				LCS Lot-Sample#: F7A160000-253	
	91	(90 - 110)			MCAWW 160.1	01/05/07	7016253
	94	(90 - 110)	2.6	(0-15)	MCAWW 160.1	01/05/07	7016253

Dilution Factor: 1 Analysis Time..: 00:00

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

N Spiked analyte recovery is outside stated control limits.

MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: F7A030115 **Matrix.....:** WATER
Date Sampled...: 12/28/06 16:20 **Date Received..:** 12/30/06

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MS Lot-Sample #: F6L300110-001 **Prep Batch #...:** 7010145							
Calcium	100	(70 - 130)			MCAWW 200.7	01/10-01/12/07	JL9041A5
	95	(70 - 130)	1.0	(0-20)	MCAWW 200.7	01/10-01/12/07	JL9041A6
		Dilution Factor: 1					
		Analysis Time..: 15:29					
Magnesium	100	(70 - 130)			MCAWW 200.7	01/10-01/12/07	JL9041A7
	96	(70 - 130)	1.4	(0-20)	MCAWW 200.7	01/10-01/12/07	JL9041A8
		Dilution Factor: 1					
		Analysis Time..: 15:29					
Potassium	111	(70 - 130)			MCAWW 200.7	01/10-01/12/07	JL9041CC
	107	(70 - 130)	3.0	(0-20)	MCAWW 200.7	01/10-01/12/07	JL9041CD
		Dilution Factor: 1					
		Analysis Time..: 15:29					
Sodium	104	(70 - 130)			MCAWW 200.7	01/10-01/12/07	JL9041A9
	97	(70 - 130)	1.5	(0-20)	MCAWW 200.7	01/10-01/12/07	JL9041CA
		Dilution Factor: 1					
		Analysis Time..: 15:29					

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: F7A030115 **Matrix.....:** WATER
Date Sampled...: 12/30/06 10:30 **Date Received..:** 01/03/07

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide		Work Order #...: JMCL41AQ		MS Lot-Sample #: F7A030115-007	
	136 N	(90 - 110)	MCAWW 300.0A	01/08/07	7009067
		Dilution Factor: 1	Analysis Time..: 07:11		
Chloride		Work Order #...: JMCL41AT		MS Lot-Sample #: F7A030115-007	
	105	(90 - 110)	MCAWW 300.0A	01/08-01/09/07	7009068
		Dilution Factor: 100	Analysis Time..: 10:18		
Fluoride		Work Order #...: JMCL41AV		MS Lot-Sample #: F7A030115-007	
	112 N	(90 - 110)	MCAWW 300.0A	01/08/07	7009069
		Dilution Factor: 1	Analysis Time..: 07:11		
Nitrate/Nitrite as N		Work Order #...: JMCLT1AT		MS Lot-Sample #: F7A030115-001	
	112 N	(90 - 110)	MCAWW 353.1	01/12/07	7009378
		Dilution Factor: 1	Analysis Time..: 00:00		
Nitrogen, as Ammonia		Work Order #...: JLWTW1AN		MS Lot-Sample #: F6L200297-001	
	106	(90 - 110)	MCAWW 350.1	01/10/07	7009221
		Dilution Factor: 1	Analysis Time..: 00:00		
Nitrogen, as Ammonia		Work Order #...: JMCLT1AQ		MS Lot-Sample #: F7A030115-001	
	97	(90 - 110)	MCAWW 350.1	01/09-01/10/07	7009222
		Dilution Factor: 1	Analysis Time..: 00:00		
Sulfate		Work Order #...: JMCL41AX		MS Lot-Sample #: F7A030115-007	
	92	(90 - 110)	MCAWW 300.0A	01/08-01/09/07	7009070
		Dilution Factor: 10	Analysis Time..: 08:03		
Total Alkalinity		Work Order #...: JL9041AT		MS Lot-Sample #: F6L300110-001	
	72	(50 - 121)	MCAWW 310.1	01/04/07	7004040
		Dilution Factor: 1	Analysis Time..: 00:00		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

N Spiked analyte recovery is outside stated control limits.

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: F7A030115 **Work Order #...:** JL904-SMP JL904-DUP **Matrix.....:** WATER

Date Sampled...: 12/28/06 16:20 **Date Received..:** 12/30/06

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Alkalinity						SD Lot-Sample #:	F6L300110-001	
	358	353	mg/L	1.4	(0-20)	MCAWW 310.1	01/04/07	7004040

Dilution Factor: 1 Analysis Time..: 00:00

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: F7A030115 **Work Order #...:** JMCL4-SMP JMCL4-DUP **Matrix.....:** WATER

Date Sampled...: 12/31/06 10:40 **Date Received..:** 01/03/07

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Bromide						SD Lot-Sample #:	F7A030115-007	
	0.42	0.74	mg/L	56	(0-20)	MCAWW 300.0A	01/08/07	7009067
			Dilution Factor: 1			Analysis Time..: 07:11		
Chloride						SD Lot-Sample #:	F7A030115-007	
	189	198	mg/L	4.8	(0-20)	MCAWW 300.0A	01/08-01/09/07	7009068
			Dilution Factor: 100			Analysis Time..: 10:18		
Fluoride						SD Lot-Sample #:	F7A030115-007	
	0.78	0.88	mg/L	12	(0-20)	MCAWW 300.0A	01/08/07	7009069
			Dilution Factor: 1			Analysis Time..: 07:11		
Sulfate						SD Lot-Sample #:	F7A030115-007	
	24.5	24.0	mg/L	2.1	(0-20)	MCAWW 300.0A	01/08/07	7009070
			Dilution Factor: 10			Analysis Time..: 08:03		

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: F7A030115 **Work Order #...:** JLWTW-SMP JLWTW-DUP **Matrix.....:** WATER

Date Sampled...: 12/19/06 08:08 **Date Received..:** 12/20/06

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Nitrogen, as Ammonia						SD Lot-Sample #:	F6L200297-001	
	ND	ND	mg/L	0	(0-20)	MCAWW 350.1	01/10/07	7009221

Dilution Factor: 1 Analysis Time..: 00:00

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: F7A030115 **Work Order #...:** JMCLT-SMP JMCLT-DUP **Matrix.....:** WATER

Date Sampled...: 12/30/06 10:30 **Date Received..:** 01/03/07

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Dissolved Solids						SD Lot-Sample #:	F7A030115-001	
	913	954	mg/L	4.4	(0-0.0)	MCAWW 160.1	01/05/07	7016253
			Dilution Factor: 1			Analysis Time..: 00:00		
Nitrogen, as Ammonia						SD Lot-Sample #:	F7A030115-001	
	ND	ND	mg/L	0	(0-20)	MCAWW 350.1	01/09-01/10/07	7009222
			Dilution Factor: 1			Analysis Time..: 00:00		
Nitrate/Nitrite as N						SD Lot-Sample #:	F7A030115-001	
	53.0	ND	ug/L	200	(0-20)	MCAWW 353.1	01/12/07	7009378
			Dilution Factor: 1			Analysis Time..: 00:00		

LOT# F7A030115

STL ST. LOUIS

[redacted]

Chain of Custody Record

SEVERN TRENT **STL**

Severn Trent Laboratories, Inc.

CR5419

STL-4124 (0901)

Client: MACTEC	Project Manager: Mike Sufnarski / Lori Johnson	Date: [redacted]	Chain of Custody Number: 321049
Address: 2801 Yorkmont Suite 100	Telephone Number (Area Code)/Fax Number: (361) 972-4652 / (361) 972-4650	Lab Number:	Page 1 of 1
City: Charlotte; State: NC; Zip Code: 28208	Site Contact: Same	Lab Contact:	
Project Name and Location (State): STP-COL (Texas)	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.: Project # 5050060496			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	310.1 (Alk)	300.0 (Anions)	160.1 (TDS)	353.1 (Nitrate/Nitrite)	350.1 (Ammonia)	300.0 (Cations)	Special Instructions/ Conditions of Receipt
OW-408U	12/30/06	10:30		✓			1	1	1				✓	✓	✓	✓	✓	✓	500P, 8X250P 12-07
OW-408L	↓	10:50		✓			1	1	1				✓	✓	✓	✓	✓	✓	↓
OW-308U		12:35		✓			1	1	1				✓	✓	✓	✓	✓	✓	
OW-308L	↓	1:45		✓			1	1	1				✓	✓	✓	✓	✓	✓	
OW-420U	12/30/06	4:15		✓			1	1	1				✓	✓	✓	✓	✓	✓	
OW-934U	12/31/06	10:45		✓			1	1	1				✓	✓	✓	✓	✓	✓	
OW-934L	↓	10:40		✓			1	1	1				✓	✓	✓	✓	✓	✓	

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☑ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: Standard ☐ 24 Hours ☐ 48 Hours ☑ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other ____

QC Requirements (Specify): Standard

	Date	Time		Date	Time
1. Relinquished By: [signature]	1/2/07	0830	1. Received By: Carla Bailey	12-07	900 AM
2. Relinquished By:			2. Received By:		
3. Relinquished By:			3. Received By:		

Comments:

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STL St. Louis

Lot #(s): F7A030115

- 5419 -

Condition Upon Receipt Form

Client: Mastel
Quote No: 73614
COC/RFA No: 321049
Initiated By: [illegible]
Date: 1-3-07
Time: 900

Shipping Information

Shipper Name: Fed Ex
Shipping # (s):*
1. 8595 9036 5067
2. 8595 9031 [illegible]
3.
4.
5.
6.
7.
8.
9.
10.

Multiple Packages (Y) N N/A
Sample Temperature (s):**
1. 2°C
2. Sample bottles received
3.
4.
5.
6.
7.
8.
9.
10.

*Numbered shipping lines correspond to Numbered Sample Temp lines

**Sample must be received at 4°C ± 2°C- If not, note contents below. Temperature variance does NOT effect the following: Metals-Liquid or Rad tests- Liquid or Solids

Condition (Circle "Y" for yes, "N" for no and "N/A" for not applicable):

1.	Y (N)	Was sample received broken?	8.	(Y) N	Sample received with Chain of Custody?
2.	(Y) N N/A	Was sample received with proper pH[1]? (If not, make note below)	9.	(Y) N	Chain of Custody matches sample ID's on container(s)?
3.	Y N	If N/A-Was pH taken by original STL Lab?	10.	(Y) N	Are there custody seals present on cooler?
4.	(Y) N	Sample received in proper containers?	11.	Y (N) N/A	Do custody seals on cooler appear to be tampered with?
5.	(Y) N	Sample volume sufficient for analysis?	12.	(Y) N	Are there custody seals present on bottles?
6.	Y N (N/A)	Headspace in VOA or TOX liquid samples? (If Yes, note sample ID's below)	13.	Y (N) N/A	Do custody seals on bottles appear to be tampered with?
7.	(Y) N	Were contents of the cooler frisked after opening	14.	Y N (N/A)	Was Internal COC/Workshare received?

[1] For DOE-AL (Pantex, LANL, Sandia) sites, pH of ALL containers received must be verified, EXCEPT VOA, TOX and soils.

Notes: see 2nd cooler came back with unused bottles

Corrective Action:
- ☐ Client Contact Name: _____ Informed by: _____
- ☐ Sample(s) processed "as is"
- ☐ Sample(s) on hold until: _____ If released, notify: _____

Project Management Review: [illegible] Date: 01-03-07

THIS FORM MUST BE COMPLETED AT THE TIME THE ITEMS ARE BEING CHECKED IN. IF ANY ITEM IS COMPLETED BY SOMEONE OTHER THAN THE INITIATOR, THEN THAT PERSON IS REQUIRED TO APPLY THEIR INITIAL AND THE DATE NEXT TO THAT ITEM.

ADMIN-0004, REVISED 03/01/06\\Slsvr01\QA\FORMS\ST-LOUIS\ADMIN\Admin004030106.doc

[redacted] [redacted]

Chain of Custody Record

SEVERN TRENT **STL**

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client: Mobil	Project Manager: Mike Sulinski / Lori Johnson	Date: [redacted]	Chain of Custody Number: 321049
Address: 2800 Vicinity Suite	Telephone Number (Area Code)/Fax Number: (361) 772-4652 / (361) 772-4653	Lab Number	Page 1 of 1
City: Charlotte; State: NC; Zip Code: 28208	Site Contact: Sonia	Lab Contact	
Project Name and Location (State): Sitton (Texas)	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.: Mobil # 5000060176			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Special Instructions/ Conditions of Receipt
OW-110S U	9/06	10:30		✓			1	1	1				
OW-110S L		10:30		✓			1	1	1				
OW-208S U		12:35		✓			1	1	1				
OW-208S L		1:45		✓			1	1	1				
OW-420D U	9/06	4:15		✓			1	1	1				
OW-931U	9/06	10:45		✓			1	1	1				
OW-931L		10:45		✓			1	1	1				

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☒ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other ____ Standard

QC Requirements (Specify): Standard

Relinquished By	Date	Time	Received By	Date	Time
1. [signature]	11/2/07	0830	1.		
2.			2.		
3.			3.		

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CA - Stays with the Sample; PINK - Field Copy

STP184
1 of 1

Appendix G-2

Field Testing Data (Groundwater)
Consists of Well Purging and Sampling Sheets

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STP-COL	SAMPLE NUMBER	DW-308U	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/30/00
ACTIVITY	START 10:05 END 12:33 MMW 12/30/02	JOB NUMBER	50-50006049.6	FILE TYPE	NA
				WEATHER	Overcast 50°

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	48.9 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	1.9 FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	7.78 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	41.12 FT	x ~~0.163~~ GAL/FT (2 INCH WELL) = NA		15.4 GAL/VOL			
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	55 GAL		

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓ TO BE ADDED	

PURGE DATA

PURGE VOLUME (gallons)	1.0	15	30	38	46	55
PURGE RATE (gpm)	~1.0	"	"	"	"	"
TEMPERATURE (degreesC)	23.91	23.76	23.12	23.69	23.74	23.68
pH (units)	7.20	7.00	7.28	6.97	6.95	6.93
~~TURBIDITY (ntu)~~ DO	1.50	0.29	0.47	0.43	0.31	0.26
SPEC. COND. (uhmos/cm)	2317	2349	2123	2346	2350	2348
TURBIDITY (ntu)	126	44.1	7.33	3.86	3.86	3.72
REDOX POTENTIAL (+/- mv)	381.1	272.3	-53.4	-44.6	-21.1	-62.6

SAMPLE OBSERVATIONS:
- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

QUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER

DECON FLUIDS USED	
	METHANOL
✓	LIQUINOX
✓	POTABLE WATER
	DEIONIZED WATER
	STEAM CLEANING
	NITRIC ACID

WATER LEVEL EQUIPMENT USED	
✓	ELECTRIC COND. PROBE
	FLOAT ACTIVATED
	KECK INTERFACE PROBE

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		
VOC			HCL / 4 DEG. C	3 X 40 ML		
SVOC			4 DEG. C	2 X 1 L AG		
PEST / PCBs			4 DEG. C	2 X 1 L AG		
HERBICIDES			4 DEG. C	2 X 1 L AG		
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		
FERROUS IRON	FIELD METHOD		-	-		
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		
TOC	USEPA-415.1					
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		
METHANE / CARBON DIOXIDE	MOD 8015					

NOTES Sampled well at 12:35 for:
EPA 310.1 Alkalinity
EPA 300.0 Inorganic Ions
EPA 160.1 TDS
EPA 353.1 Nitrate/Nitrite
EPA 350.1 Ammonia
EPA 200.1 Cations

SIGNATURE: [illegible]

RECEIVED BY: [illegible]

1/6/03

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STD-COL	SAMPLE NUMBER	OLO-308 L	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/30/06
ACTIVITY	START 1:00 END 1:12	JOB NUMBER	50500604916	FILE TYPE	NA
				WEATHER	Overcast 60

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	97.78 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	1.9 FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	16.08 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	81.7 FT	x ~~0.163~~ NA GAL/FT (~~2~~ INCH WELL) =	22 GAL/VOL				
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	75 GAL		

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓	

TO BE ADDED

PURGE DATA

PURGE VOLUME (gallons)	10	25	45	55	65	75
PURGE RATE (gpm)	~1.0	"	"	"	"	"
TEMPERATURE (degreesC)	23.89	23.12	23.19	23.13	23.10	23.10
pH (units)	9.81	7.28	7.21	7.16	7.12	7.11
~~TURBIDITY (ntu)~~ DO	0.68	1.20	0.29	0.44	0.20	0.20
SPEC. COND. (uhmos/cm)	1385	1231	1233	1238	1245	1240
TURBIDITY (ntu)	5.13	12.0	1.78	1.48	0.32	0.21
REDOX POTENTIAL (+/- mv)	-278.7	-103.3	-113.9	-113.2	-133.3	-136.3

SAMPLE OBSERVATIONS:
- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

QUIPMENT DOCUMENTATION

PURGING	SAMPLING	
[ ]	[ ]	PERISTALTIC PUMP
[x]	[x]	SUBMERSIBLE PUMP
[x]	[x]	BLADDER PUMP
[x]	[x]	PVC/SILICON TUBING
[ ]	[ ]	TEFLON/SILICON TUBING
[ ]	[ ]	BAILER
[ ]	[ ]	IN LINE FILTER

DECON FLUIDS USED	
[ ]	METHANOL
[x]	LIQUINOX
[x]	POTABLE WATER
[ ]	DEIONIZED WATER
[ ]	STEAM CLEANING
[ ]	NITRIC ACID
[ ]	_____

WATER LEVEL EQUIPMENT USED	
[x]	ELECTRIC COND. PROBE
[ ]	FLOAT ACTIVATED
[ ]	KECK INTERFACE PROBE
[ ]	_____

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
[ ] VOC			HCL / 4 DEG. C	3 X 40 ML	[ ]	/ /
[ ] VOC			HCL / 4 DEG. C	3 X 40 ML	[ ]	/ /
[ ] SVOC			4 DEG. C	2 X 1 L AG	[ ]	/ /
[ ] PEST / PCBs			4 DEG. C	2 X 1 L AG	[ ]	/ /
[ ] HERBICIDES			4 DEG. C	2 X 1 L AG	[ ]	/ /
[ ] TAL INORGANICS			HNO3 to pH <2	1 x 1 L P	[ ]	/ /
[ ] SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P	[ ]	/ /
[ ] SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P	[ ]	/ /
[ ] IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube	[ ]	/ /
[ ] FERROUS IRON	FIELD METHOD		-	-	[ ]	/ /
[ ] TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P	[ ]	/ /
[ ] MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P	[ ]	/ /
[ ] AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P	[ ]	/ /
[ ] TOC	USEPA-415.1				[ ]	
[ ] TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P	[ ]	/ /
[ ] METHANE / CARBON DIOXIDE	MOD 8015				[ ]	/ /

NOTES Sampled well at 1:15 for: EPA 310.1 Alkalinity
EPA 300.0 Inorganic Ions
EPA 160.1 TDS
EPA 353.1 Nitrate/Nitrite
EPA 350.1 Ammonia
EPA 200.1 Cations

SIGNATURE: [signature]

RECEIVED BY: [signature]

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STD-COL	SAMPLE NUMBER	OW-332U	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/29/06
ACTIVITY	START 10:58 END 11:53	JOB NUMBER	50500604 Chlo	FILE TYPE	NA
				WEATHER	Cloudy raining Cool

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	47.55 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	NA FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	8.01 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	39.54 FT	x ~~0.163 GAL/FT (2 INCH WELL)~~ NA =	15.1 GAL/VOL				
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	45.4 GAL		

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓	

TO Be done

PURGE DATA

PURGE VOLUME (gallons)	10	15	30	35	40	45
PURGE RATE (gpm)	~1.0	"	"	"	"	"
TEMPERATURE (degreesC)	22.82	22.71	22.68	22.70	22.72	22.72
pH (units)	7.29	7.07	7.05	7.03	7.03	7.03
~~TURBIDITY (ntu)~~ DO	1.11	0.45	0.58	0.44	0.40	0.36
SPEC. COND. (uhmos/cm)	1544	1584	1584	1583	1582	1582
TURBIDITY (ntu)	19.1	67.1	~~80.8~~ 83.5	7.9	2.95	3.95
REDOX POTENTIAL (+/- mv)	168.9	120.9	~~[illegible]~~ 19.2	30.2	31.9	32.8

MW 12/29/06

SAMPLE OBSERVATIONS:

- [✓] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER

DECON FLUIDS USED	
	METHANOL
✓	LIQUINOX
✓	POTABLE WATER
	DEIONIZED WATER
	STEAM CLEANING
	NITRIC ACID

WATER LEVEL EQUIPMENT USED	
✓	ELECTRIC COND. PROBE
	FLOAT ACTIVATED
	KECK INTERFACE PROBE

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
SVOC			4 DEG. C	2 X 1 L AG		/ /
PEST / PCBs			4 DEG. C	2 X 1 L AG		/ /
HERBICIDES			4 DEG. C	2 X 1 L AG		/ /
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		/ /
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		/ /
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		/ /
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		/ /
FERROUS IRON	FIELD METHOD		–	–		/ /
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		/ /
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		/ /
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		/ /
TOC	USEPA-415.1					/ /
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		/ /
METHANE / CARBON DIOXIDE	MOD 8015					/ /

NOTES Sampled well at 11:55 for:
EPA 310.1 Alkalinity
EPA 300.0 Inorganic Ions
EPA 160.1 TDS
EPA 353.1 Nitrate/Nitrite
EPA 350.1 Ammonia
EPA 200.1 Cations

SIGNATURE: [signature]

RECEIVED BY: [signature]

1.6.07

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STD-COL	SAMPLE NUMBER	COW-932 L	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/29/06
ACTIVITY	START 10:58 END 12:45	JOB NUMBER	50500604 C16	FILE TYPE	NA
				WEATHER	Windy, Rainy, Cool

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	84.6 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	NA FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	15.22 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	89.38 FT	x ~~0.163~~ GAL/FT (~~2~~ INCH WELL) NA	23.3 GAL/VOL				
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	69.8 GAL		

95

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓	

TO BE DONE

PURGE DATA

MWD 12/29/02

PURGE VOLUME (gallons)	1.0	25	50	60	80	80	90
PURGE RATE (gpm)	~1.0	"	"	"	"	"	
TEMPERATURE (degreesC)	22.87	22.83	22.80	22.85	22.91	22.90	22.90
pH (units)	7.89	7.13	7.13	7.09	7.08	7.08	7.07
~~TURBIDITY (ntu)~~ DO	1.16	0.6	0.80	0.31	3.4	0.84	0.42
SPEC. COND. (uhmos/cm)	1197	1284	1286	1294	1295	1297	1298
TURBIDITY (ntu)	6.33	80.6	71.7	39.0	7.89	4.33	3.0
REDOX POTENTIAL (+/- mv)	88.3	-2.8	-28.4	-73.3	-94.1	-108.9	-118.6

SAMPLE OBSERVATIONS:
- ✓ CLEAR
- COLORED
- CLOUDY
- TURBID
- ODOR
- OTHER (see notes)

QUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER

DECON FLUIDS USED	
	METHANOL
✓	LIQUINOX
✓	POTABLE WATER
	DEIONIZED WATER
	STEAM CLEANING
	NITRIC ACID

WATER LEVEL EQUIPMENT USED	
✓	ELECTRIC COND. PROBE
	FLOAT ACTIVATED
	KECK INTERFACE PROBE

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		
VOC			HCL / 4 DEG. C	3 X 40 ML		
SVOC			4 DEG. C	2 X 1 L AG		
PEST / PCBs			4 DEG. C	2 X 1 L AG		
HERBICIDES			4 DEG. C	2 X 1 L AG		
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		
FERROUS IRON	FIELD METHOD		–	–		
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		
TOC	USEPA-415.1					
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		
METHANE / CARBON DIOXIDE	MOD 8015					

NOTES Sampled well at 1:00p for: EPA 310.1 Alkalinity
EPA 300.0 Inorganic Ions
EPA 160.1 TDS
EPA 353.1 Nitrate/Nitrite
EPA 350.1 Ammonia
EPA 200.1 Cations

SIGNATURE: [illegible]

RECEIVED BY: [illegible]

1:00

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STP-COL	SAMPLE NUMBER	OW-408D	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/30/06
ACTIVITY	START 9:10 END 10:28	JOB NUMBER	50500604916	FILE TYPE	NA
				WEATHER	Cloudy

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	44.29 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	2.05 FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	9.71 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	34.58 FT	x ~~0.163~~ GAL/FT (~~2~~ MA INCH WELL) =	14.3 GAL/VOL				
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	55 GAL		

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓ TO BE ADDED	

PURGE DATA

PURGE VOLUME (gallons)	Int	15	30	45	60	~~80~~ 65 gals 12/20/06
PURGE RATE (gpm)	~1.0	"	"	"	"	"
TEMPERATURE (degreesC)	23.36	23.38	23.42	23.40	23.41	23.39
pH (units)	7.12	7.04	7.02	7.00	7.00	6.99
TURBIDITY (ntu)	131	122	51.7	35.3	21.0	31.1
SPEC. COND. (uhmos/cm)	1804	1799	1790	1774	1768	1764
~~TURBIDITY (ntu)~~ DO	0.82	0.59	0.63	0.61	0.46	0.44
REDOX POTENTIAL (+/- mv)	210.0	-57.4	-61.2	-57.9	-85.7	-76.3

SAMPLE OBSERVATIONS:
- ✓ CLEAR (tinted)
- ☐ COLORED _____
- ☐ CLOUDY _____
- ☐ TURBID _____
- ☐ ODOR _____
- ☐ OTHER (see notes)

QUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER

DECON FLUIDS USED	
	METHANOL
✓	LIQUINOX
✓	POTABLE WATER
	DEIONIZED WATER
	STEAM CLEANING
	NITRIC ACID

WATER LEVEL EQUIPMENT USED	
✓	ELECTRIC COND. PROBE
	FLOAT ACTIVATED
	KECK INTERFACE PROBE

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		
VOC			HCL / 4 DEG. C	3 X 40 ML		
SVOC			4 DEG. C	2 X 1 L AG		
PEST / PCBs			4 DEG. C	2 X 1 L AG		
HERBICIDES			4 DEG. C	2 X 1 L AG		
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		
FERROUS IRON	FIELD METHOD		–	–		
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		
TOC	USEPA-415.1					
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		
METHANE / CARBON DIOXIDE	MOD 8015					

NOTES Sampled well at 10:30 for:
- EPA 310.1 Alkalinity
- EPA 300.0 Inorganic Ions
- EPA 160.1 TDS
- EPA 353.1 Nitrate/Nitrite
- EPA 350.1 Ammonia
- EPA 200.1 Cations

SIGNATURE: [signature]

RECEIVED BY: [signature]

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STD-COL	SAMPLE NUMBER	OU-408L	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/30/06
ACTIVITY	START 9:00 END 10:48	JOB NUMBER	50500604916	FILE TYPE	NA
				WEATHER	Cloudy

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	83.16 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	2.05 FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	18.05 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	65.11 FT	x 0.163 GAL/FT (2 INCH WELL) =	NA 19.3 GAL/VOL				
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	80 GAL		

WELL INTEGRITY	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓	

TO BE DONE

PURGE DATA

PURGE VOLUME (gallons)	Int	20	40	60	80	80
PURGE RATE (gpm)	~1.0	"	"	"	"	"
TEMPERATURE (degreesC)	23.74	23.33	23.37	23.38	23.36	23.35
pH (units)	8.91	7.19	7.13	7.10	7.08	7.07
TURBIDITY (ntu)	6.11	9.02	1.26	0.47	0.2	0.3
SPEC. COND. (uhmos/cm)	1189	1245	1244	1243	1242	1242
~~TURBIDITY (ntu)~~ DO	1.35	0.04	0.52	0.48	0.43	0.34
REDOX POTENTIAL (+/- mv)	161.0	-25.1	-27.3	-44.1	-24.3	-18.9

MW 12/30/06

SAMPLE OBSERVATIONS:

- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER

DECON FLUIDS USED	
	METHANOL
✓	LIQUINOX
✓	POTABLE WATER
	DEIONIZED WATER
	STEAM CLEANING
	NITRIC ACID

WATER LEVEL EQUIPMENT USED	
✓	ELECTRIC COND. PROBE
	FLOAT ACTIVATED
	KECK INTERFACE PROBE

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
SVOC			4 DEG. C	2 X 1 L AG		/ /
PEST / PCBs			4 DEG. C	2 X 1 L AG		/ /
HERBICIDES			4 DEG. C	2 X 1 L AG		/ /
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		/ /
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		/ /
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		/ /
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		/ /
FERROUS IRON	FIELD METHOD		–	–		/ /
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		/ /
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		/ /
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		/ /
TOC	USEPA-415.1					
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		/ /
METHANE / CARBON DIOXIDE	MOD 8015					

NOTES Sampled well at 10:50 for: EPA 310.1 Alkalinity
EPA 300.0 Inorganic Ions
EPA 160.1 TDS
EPA 353.1 Nitrate/Nitrite
EPA 350.1 Ammonia
EPA 200.1 Cations

SIGNATURE: [illegible]

RECEIVED BY: [illegible]

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STP-COL	SAMPLE NUMBER	OW-420V	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/30/06
ACTIVITY	START 3:20 END 4:13	JOB NUMBER	50506049 6	FILE TYPE	NA
				WEATHER	Overcast, Cold

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	50.51 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	1.51 FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	9.98 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	FT	x ~~0.163~~ GAL/FT (~~2" INCH WELL~~ NA) =	15.3 GAL/VOL				
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	45 GAL		

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓ TO BE ADDED	

PURGE DATA

PURGE VOLUME (gallons)	~2.0	15	30	35	40	45
PURGE RATE (gpm)	~1.0	"	"	"	"	"
TEMPERATURE (degreesC)	22.81	22.89	22.95	22.94	22.97	22.94
pH (units)	7.02	6.98	6.97	6.96	6.95	6.94
~~TURBIDITY (ntu)~~ DO	1.40	0.53	0.44	1.20	0.82	0.56
SPEC. COND. (uhmos/cm)	2113	2118	2115	2116	2115	2114
TURBIDITY (ntu)	1658	63.3	9.76	1.51	0.98	0.18
REDOX POTENTIAL (+/- mv)	278.0	207.9	173.5	130.7	120.8	110.3

SAMPLE OBSERVATIONS:
- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER

DECON FLUIDS USED	
	METHANOL
✓	LIQUINOX
✓	POTABLE WATER
	DEIONIZED WATER
	STEAM CLEANING
	NITRIC ACID

WATER LEVEL EQUIPMENT USED	
✓	ELECTRIC COND. PROBE
	FLOAT ACTIVATED
	KECK INTERFACE PROBE

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		
VOC			HCL / 4 DEG. C	3 X 40 ML		
SVOC			4 DEG. C	2 X 1 L AG		
PEST / PCBs			4 DEG. C	2 X 1 L AG		
HERBICIDES			4 DEG. C	2 X 1 L AG		
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		
FERROUS IRON	FIELD METHOD		–	–		
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		
TOC	USEPA-415.1					
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		
METHANE / CARBON DIOXIDE	MOD 8015					

NOTES Sampled well at 4:15 for: EPA 310.1 Alkalinity
EPA 300.0 Inorganic Ions
EPA 160.1 TDS
EPA 353.1 Nitrate/Nitrite
EPA 350.1 Ammonia
EPA 200.1 Cations

SIGNATURE: [signature]
RECEIVED BY: [signature]

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STP-COL	SAMPLE NUMBER	OW-928U	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/29/06
ACTIVITY	START 8:40 END 9:18	JOB NUMBER	50506 04 96	FILE TYPE	NA
				WEATHER	Rain, windy, cool

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	41.12 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	No pad - NA ~~NA~~ FT
PROTECTIVE CASING / WELL DIFFERENCE	NA FT	DEPTH TO WATER	8.17 FT (TOR)	SCREEN LENGTH	10 FT
WELL DIAMETER	2 IN (MW 12/29/06)	WELL MATERIAL	Schedule 40 PVC	HEIGHT OF WATER COLUMN	32.95 FT x ~~0.163~~ NA GAL/FT (2 INCH WELL) = 14.1 GAL/VOL (includes filter pack)
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	42.2 GAL

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓ TO BE DONE	

PURGE DATA

PURGE VOLUME (gallons)	10	20	30	35	40	45
PURGE RATE (gpm)	~1.0	"	"	"		
TEMPERATURE (degreesC)	22.14	22.3	22.32	22.33	22.33	22.33
pH (units)	7.40	6.85	6.81	6.82	6.82	6.82
~~TURBIDITY (ntu)~~ DO	2.40	0.85	0.74	0.70	0.66	0.65
SPEC. COND. (uhmos/cm)	3170	3032	2979	2959	2921	2885
TURBIDITY (ntu)	454	17.1	23.2	18.8	5.26	2.37
REDOX POTENTIAL (+/- mv)	376.1	346.9	282.0	274	266	257.8

SAMPLE OBSERVATIONS:
- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

QUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER

DECON FLUIDS USED
- [ ] METHANOL
- [✓] LIQUINOX
- [✓] POTABLE WATER
- [ ] DEIONIZED WATER
- [ ] STEAM CLEANING
- [ ] NITRIC ACID
- [ ] _____

WATER LEVEL EQUIPMENT USED
- [✓] ELECTRIC COND. PROBE
- [ ] FLOAT ACTIVATED
- [ ] KECK INTERFACE PROBE
- [ ] _____

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA.

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
SVOC			4 DEG. C	2 X 1 L AG		/ /
PEST / PCBs			4 DEG. C	2 X 1 L AG		/ /
HERBICIDES			4 DEG. C	2 X 1 L AG		/ /
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		/ /
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		/ /
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		/ /
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		/ /
FERROUS IRON	FIELD METHOD		–	–		/ /
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		/ /
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P.		/ /
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		/ /
TOC	USEPA-415.1					/ /
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		/ /
METHANE / CARBON DIOXIDE	MOD 8015					/ /

NOTES Sampled well at 9:28 (MW 12/29/06) for:
- EPA 310.1 Alkalinity
- EPA 300.0 Inorganic Ions
- EPA 160.1 TDS
- EPA 353.1 Nitrate/Nitrite
- EPA 350.1 Ammonia
- EPA 200.1 Cations

SIGNATURE: _____

RECEIVED BY: _____

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STD-COL	SAMPLE NUMBER	041-928L	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/29/06
ACTIVITY	START 8:35 END 10:00	JOB NUMBER	50500604916	FILE TYPE	NA
				WEATHER	Windy, Rainy (cold)

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	124 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	NA No pad FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	15.75 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	108.25 FT	x ~~0.163~~ NA GAL/FT (~~2~~ INCH WELL) =	26.4 GAL/VOL				
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	99.1 GAL		

WELL INTEGRITY:

	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓ TO BE done	

PURGE DATA

PURGE VOLUME (gallons)	1.0	25	50	65	80	
PURGE RATE (gpm)	~~0.0~~	"	"	"	"	
TEMPERATURE (degreesC)	22.23	22.48	22.49	22.56	22.54	
pH (units)	9.06	7.05	7.02	7.01	6.99	
~~TURBIDITY (ntu)~~ DO	4.97	0.85	1.35	0.57	0.50	
SPEC. COND. (uhmos/cm)	1101	1165	1166	1167	1168	
TURBIDITY (ntu)	463	33.3	4.99	3.76	2.0	
REDOX POTENTIAL (+/- mv)	185	291.2	232.4	185.6	160.2	

SAMPLE OBSERVATIONS:

- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

QUIPMENT DOCUMENTATION

PURGING	SAMPLING		DECON FLUIDS USED		WATER LEVEL EQUIPMENT USED	
[ ]	[ ]	PERISTALTIC PUMP	[ ]	METHANOL	[x]	ELECTRIC COND. PROBE
[x]	[x]	SUBMERSIBLE PUMP	[x]	LIQUINOX	[ ]	FLOAT ACTIVATED
[ ]	[ ]	BLADDER PUMP	[x]	POTABLE WATER	[ ]	KECK INTERFACE PROBE
[x]	[x]	PVC/SILICON TUBING	[ ]	DEIONIZED WATER	[ ]	_____
[ ]	[ ]	TEFLON/SILICON TUBING	[ ]	STEAM CLEANING		
[ ]	[ ]	BAILER	[ ]	NITRIC ACID		
[ ]	[ ]	IN LINE FILTER	[ ]	_____		

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
[ ] VOC			HCL / 4 DEG. C	3 X 40 ML	[ ]	/ /
[ ] VOC			HCL / 4 DEG. C	3 X 40 ML	[ ]	/ /
[ ] SVOC			4 DEG. C	2 X 1 L AG	[ ]	/ /
[ ] PEST / PCBs			4 DEG. C	2 X 1 L AG	[ ]	/ /
[ ] HERBICIDES			4 DEG. C	2 X 1 L AG	[ ]	/ /
[ ] TAL INORGANICS			HNO3 to pH <2	1 x 1 L P	[ ]	/ /
[ ] SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P	[ ]	/ /
[ ] SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P	[ ]	/ /
[ ] IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube	[ ]	/ /
[ ] FERROUS IRON	FIELD METHOD		–	–	[ ]	/ /
[ ] TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P	[ ]	/ /
[ ] MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P	[ ]	/ /
[ ] AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P	[ ]	/ /
[ ] TOC	USEPA-415.1				[ ]	
[ ] TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P	[ ]	/ /
[ ] METHANE / CARBON DIOXIDE	MOD 8015				[ ]	/ /

NOTES Sampled well at 10:00 for:
EPA 310.1 Alkalinity
EPA 300.0 Inorganic Ions
EPA 160.1 TDS
EPA 353.1 Nitrate/Nitrite
EPA 350.1 Ammonia
EPA 200.1 Cations

SIGNATURE: [signature]

RECEIVED BY: [signature]

1-6-07

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STP-COL	SAMPLE NUMBER	OW-930V	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/28/06
ACTIVITY	START 3:20p END 4:30	JOB NUMBER	50500604606	FILE TYPE	NA
				WEATHER	overcast + cloudy + warm

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	34.7 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	NA no pad FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	7.92 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	26.78 FT	x 0.163 GAL/FT (2 INCH WELL) =	NA 13.1 GAL/VOL	(includes filter pack)			
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	39.2 GAL		

WELL INTEGRITY:	YES	NO	N/A
CAP			
CASING			
COLLAR			
LOCKED			

PURGE DATA

PURGE VOLUME (gallons)	1.0	15	30	35	40	45
PURGE RATE (gpm)	~0.5	"	"	"	"	"
TEMPERATURE (degreesC)	22.42	22.39	22.38	22.43	22.44	22.38
pH (units)	7.08	7.02	6.89	6.88	6.88	6.87
~~TURBIDITY (ntu)~~ D.O.	3.78	20.35	1.29	1.21	1.12	1.33
SPEC. COND. (uhmos/cm)	1219	1175	1166	1161	1156	1152
TURBIDITY (ntu)	61.1	79.9	15.1	4.13	4.10	4.15
REDOX POTENTIAL (+/- mv)	-1.5	28.6	-6.8	26.2	28.4	34.3

SAMPLE OBSERVATIONS:
- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

QUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER

DECON FLUIDS USED	
	METHANOL
✓	LIQUINOX
✓	POTABLE WATER
	DEIONIZED WATER
	STEAM CLEANING
	NITRIC ACID

WATER LEVEL EQUIPMENT USED	
✓	ELECTRIC COND. PROBE
	FLOAT ACTIVATED
	KECK INTERFACE PROBE

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
SVOC			4 DEG. C	2 X 1 L AG		/ /
PEST / PCBs			4 DEG. C	2 X 1 L AG		/ /
HERBICIDES			4 DEG. C	2 X 1 L AG		/ /
TAL INORGANICS	NA		HNO3 to pH <2	1 x 1 L P		/ /
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		/ /
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		/ /
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		/ /
FERROUS IRON	FIELD METHOD		–	–		/ /
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		/ /
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		/ /
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		/ /
TOC	USEPA-415.1					/ /
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		/ /
METHANE / CARBON DIOXIDE	MOD 8015					/ /

NOTES

Collected samples at 16:20 for: EPA ~~310.1~~ 310.1 Alkalinity
300.0 Inorganic ions
160.1 TDS
353.1 Nitrate/Nitrite
350.1 Ammonia
200.7 Cations

SIGNATURE: _____

RECEIVED BY: _____

1-6-08

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STP-COL	SAMPLE NUMBER	OU-930L	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	1/28/06
ACTIVITY	START 3:00p END 5:20p	JOB NUMBER	5050060496	FILE TYPE	NA
				WEATHER	overcast + warm

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	104.61 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	NA no pad FT
PROTECTIVE CASING / WELL DIFFERENCE	NA FT	DEPTH TO WATER	14.9 FT (TOR)	SCREEN LENGTH	10 FT
WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC	HEIGHT OF WATER COLUMN	89.71 FT x ~~0.163~~ NA GAL/FT (~~2 INCH WELL~~) = 23.3 GAL/VOL (includes filter pack)
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	75 GAL

WELL INTEGRITY:

	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓	

TBD

PURGE DATA

PURGE VOLUME (gallons)	1	25	50	60	70	75
PURGE RATE (gpm)	~0.5	"	"	"	"	"
TEMPERATURE (degreesC)	22.45	22.38	22.31	22.30	22.27	22.29
pH (units)	9.72	7.11	7.06	7.06	7.05	7.06
~~TURBIDITY (ntu)~~ D.O.	8.85	21.2	0.51	0.78	0.62	0.49
SPEC. COND. (uhmos/cm)	1538	1501	1507	1507	1507	1506
TURBIDITY (ntu)	53.6	36.4	4.95	4.29	2.40	2.10
REDOX POTENTIAL (+/- mv)	13.6	-25.5	-78	-57.8	-106.1	-111.2

SAMPLE OBSERVATIONS:
- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER
		_____

DECON FLUIDS USED
- [ ] METHANOL
- [✓] LIQUINOX
- [✓] POTABLE WATER
- [ ] DEIONIZED WATER
- [ ] STEAM CLEANING
- [ ] NITRIC ACID
- [ ] _____

WATER LEVEL EQUIPMENT USED
- [✓] ELECTRIC COND. PROBE
- [ ] FLOAT ACTIVATED
- [ ] KECK INTERFACE PROBE
- [ ] _____

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

Sampled at 17:15.

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
SVOC			4 DEG. C	2 X 1 L AG		/ /
PEST / PCBs			4 DEG. C	2 X 1 L AG		/ /
HERBICIDES			4 DEG. C	2 X 1 L AG		/ /
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		/ /
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		/ /
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		/ /
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		/ /
FERROUS IRON	FIELD METHOD		–	–		/ /
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		/ /
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		/ /
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		/ /
TOC	USEPA-415.1					/ /
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		/ /
METHANE / CARBON DIOXIDE	MOD 8015		–	–		/ /

NOTES Collected Samples at 17:15 for:
EPA 310.1 Alkalinity
EPA 300.0 Inorganic ions
EPA 160.1 TDS
EPA 353.1 Nitrate/Nitrite
350.1 Ammonia
200.7

SIGNATURE: [signature]

RECEIVED BY: [signature]

1.6.06

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STD-C01	SAMPLE NUMBER	OW-933U	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/29/06
ACTIVITY	START 1:45 END 2:33	JOB NUMBER	5D50060496	FILE TYPE	NA
				WEATHER	Windy, overcast, rainy, cool

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	38.75 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	1.2 ~~NA~~ FT mw 12/29/06
PROTECTIVE CASING / WELL DIFFERENCE	NA FT	DEPTH TO WATER	6.44 FT (TOR)	SCREEN LENGTH	10 FT
WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC	HEIGHT OF WATER COLUMN	32.31 FT x 0.13 GAL/FT (~~2 INCH WELL~~ NA) = 14.0 GAL/VOL
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	40.9 GAL

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓	

TO be done

PURGE DATA

PURGE VOLUME (gallons)	1.0	15	30	35	40	
PURGE RATE (gpm)	~1.0	"	"	"	"	
TEMPERATURE (degreesC)	24.17	24.23	24.22	24.21	24.21	
pH (units)	7.41	7.29	7.28	7.28	7.28	
~~TURBIDITY (ntu)~~ DO	1.68	0.49 mg/L	0.67	0.64	0.51	
SPEC. COND. (uhmos/cm)	1455	1651	1658	1670	1658	
TURBIDITY (ntu)	74.1	51.9	3.6	0.62	0.81	
REDOX POTENTIAL (+/- mv)	470.3	425.1	394.2	384.8	372.1	

SAMPLE OBSERVATIONS:

- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

QUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER
		_____

DECON FLUIDS USED	
	METHANOL
✓	LIQUINOX
✓	POTABLE WATER
	DEIONIZED WATER
	STEAM CLEANING
	NITRIC ACID
	_____

WATER LEVEL EQUIPMENT USED	
✓	ELECTRIC COND. PROBE
	FLOAT ACTIVATED
	KECK INTERFACE PROBE
	_____

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
SVOC			4 DEG. C	2 X 1 L AG		/ /
PEST / PCBs			4 DEG. C	2 X 1 L AG		/ /
HERBICIDES			4 DEG. C	2 X 1 L AG		/ /
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		/ /
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		/ /
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		/ /
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		/ /
FERROUS IRON	FIELD METHOD		–	–		/ /
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		/ /
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		/ /
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		/ /
TOC	USEPA-415.1					
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		/ /
METHANE / CARBON DIOXIDE	MOD 8015					/ /

NOTES Sampled well at 2:35 for: EPA 310.1 Alkalinity
EPA 300.0 Inorganic Ions
EPA 160.1 TDS
EPA 353.1 Nitrate/Nitrite
EPA 350.1 Ammonia
EPA 200.1 Cations

SIGNATURE: [signature]

RECEIVED BY: [signature]

1.6 DO

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STP-COL	SAMPLE NUMBER	DW-933L	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/29/06
ACTIVITY	START 1:43 END 3:05	JOB NUMBER	50500604916	FILE TYPE	NA
				WEATHER	windy, rain, cool

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	88.8 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	1.15 FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	14.6 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	74.2 FT	x 0.16 GAL/FT (2 INCH WELL)	NA	28.6 GAL/VOL (AWS 12/29/06)			

PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	62.4 GAL

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓	

TO the AOC

PURGE DATA

PURGE VOLUME (gallons)	1.0	20	40	50	60	65
PURGE RATE (gpm)	~1.0					
TEMPERATURE (degreesC)	23.97	23.51	23.41	23.38	23.40	23.46
pH (units)	7.68	7.0	7.02	6.94	6.97	6.93
~~TURBIDITY (ntu)~~ DO	7.67	0.53	0.58	0.52	0.40	0.27
SPEC. COND. (uinmos/cm)	1792	1946	1945	1941	1940	1936
TURBIDITY (ntu)	3.58	4.89	3.31	3.06	3.16	3.10
REDOX POTENTIAL (+/- mv)	175.6	406.8	355.2	334.8	319.9	29.4

SAMPLE OBSERVATIONS:
- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER

DECON FLUIDS USED	
	METHANOL
✓	LIQUINOX
✓	POTABLE WATER
	DEIONIZED WATER
	STEAM CLEANING
	NITRIC ACID

WATER LEVEL EQUIPMENT USED	
✓	ELECTRIC COND. PROBE
	FLOAT ACTIVATED
	KECK INTERFACE PROBE

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

NA

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		
VOC			HCL / 4 DEG. C	3 X 40 ML		
SVOC			4 DEG. C	2 X 1 L AG		
PEST / PCBs			4 DEG. C	2 X 1 L AG		
HERBICIDES			4 DEG. C	2 X 1 L AG		
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		
FERROUS IRON	FIELD METHOD		–	–		
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		
TOC	USEPA-415.1					
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		
METHANE / CARBON DIOXIDE	MOD 8015					

NOTES Sampled well at 3:07 for:
- EPA 310.1 Alkalinity
- EPA 300.0 Inorganic Ions
- EPA 160.1 TDS
- EPA 353.1 Nitrate/Nitrite
- EPA 350.1 Ammonia
- EPA 200.1 Cations

SIGNATURE: [signature]

RECEIVED BY: [signature]

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STP-COL	SAMPLE NUMBER	OW-934U	STUDY AREA / AOC	NA
TE ID	N.A	SITE TYPE	NA	DATE	12/31/06
ACTIVITY	START 10:40 END 11:43	JOB NUMBER	5050060496	FILE TYPE	NA
				WEATHER	Sunny, Cold

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	42.43 FT (TOR)	HISTORICAL WELL DEPTH	1.6' FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	NA FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	10.22 FT (TOR)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	32.21 FT	~~x 0.163 GAL/FT (2 INCH WELL) =~~ NA		13.9 GAL/VOL			
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	45 GAL		

~42

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED			✓

To be done

PURGE DATA

PURGE VOLUME (gallons)	~1.0	15	30	35	40	45
PURGE RATE (gpm)	~1.0	"	"	"	"	"
TEMPERATURE (degreesC)	22.60	22.60	22.71	22.74	22.79	22.72
pH (units)	6.92	6.92	6.91	6.93	6.92	6.91
~~TURBIDITY (ntu)~~ D.O	114	0.36	0.72	0.36	0.33	0.32
SPEC. COND. (uhmos/cm)	1931	1915	1899	1895	1894	1891
TURBIDITY (ntu)	21.7	21.2	3.78	2.68	1.66	1.86
REDOX POTENTIAL (+/- mv)	15.0	34.4	110.8	124.7	129.2	135.7

SAMPLE OBSERVATIONS:
- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

QUIPMENT DOCUMENTATION

PURGING	SAMPLING		DECON FLUIDS USED		WATER LEVEL EQUIPMENT USED
		PERISTALTIC PUMP		METHANOL	✓ ELECTRIC COND. PROBE
✓	✓	SUBMERSIBLE PUMP	✓	LIQUINOX	FLOAT ACTIVATED
		BLADDER PUMP	✓	POTABLE WATER	KECK INTERFACE PROBE
✓	✓	PVC/SILICON TUBING		DEIONIZED WATER	
		TEFLON/SILICON TUBING		STEAM CLEANING	
		BAILER		NITRIC ACID	
		IN LINE FILTER			

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
SVOC			4 DEG. C	2 X 1 L AG		/ /
PEST / PCBs	NA		4 DEG. C	2 X 1 L AG		/ /
HERBICIDES			4 DEG. C	2 X 1 L AG		/ /
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		/ /
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		/ /
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		/ /
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		/ /
FERROUS IRON	FIELD METHOD		–	–		/ /
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		/ /
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		/ /
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		/ /
TOC	USEPA-415.1					/ /
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		/ /
METHANE / CARBON DIOXIDE	MOD 8015					/ /

NOTES Collected Samples at 10:45 for: EPA 310.1 Alkalinity } Preservative
EPA 300.0 Inorganic ions } none
EPA 160.1 TDS
EPA 353.1 nitrate/nitrite } (H_2SO_4)
EPA 350.1 Ammonia
EPA 200.7 Cations (HNO_3)

SIGNATURE: _____

RECEIVED BY: _____

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	STP-COL	SAMPLE NUMBER	04-9341L (mw 12/31/06)	STUDY AREA / AOC	NA
TE ID	NA	SITE TYPE	NA	DATE	12/31/06
ACTIVITY	START 9:10 END 10:35	JOB NUMBER	505006049 6	FILE TYPE	NA
				WEATHER	Sunny + cold (10 cols)

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	100.30 FT (TOR)	HISTORICAL WELL DEPTH	NA FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	NA - no pipe FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	17.07 FT (TOR) (mw 12/31/06)	SCREEN LENGTH	10 FT	WELL DIAMETER	2 IN	WELL MATERIAL	Schedule 40 PVC
HEIGHT OF WATER COLUMN	83.23 FT	x ~~0.163 NA~~ GAL/FT (~~2~~ INCH WELL) =	22.3 GAL/VOL				
PID AMBIENT AIR	NA PPM	PID WELL MOUTH	NA PPM	TOTAL VOLUME PURGED	70 GAL		

WELL INTEGRITY:

	YES	NO	N/A
CAP	✓		
CASING	✓		
COLLAR			✓
LOCKED		✓	

To be done

PURGE DATA

PURGE VOLUME (gallons)	~1.0	20	40	50	60	70
PURGE RATE (gpm)	~1.0	~~1.020~~	~~1.010~~	~~1.00~~	~~1.060~~	~~1.070~~
TEMPERATURE (degreesC)	22.83	22.45	22.53	22.54	22.58	22.62
pH (units)	7.53	7.16	7.12	7.10	7.10	7.10
~~TURBIDITY (ntu)~~ D.O	1.63	0.59	0.61	0.41	0.89	0.41
SPEC. COND. (uhmos/cm)	1358	1355	1359	1359	1358	1359
TURBIDITY (ntu)	2.79	1429	31.1	5.57	1.86	0.86
REDOX POTENTIAL (+/- mv)	170.6	38.9	-74.9	-85.6	-90.9	-97

(mw 12/31/06)

SAMPLE OBSERVATIONS:

- [x] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [ ] TURBID _____
- [ ] ODOR _____
- [ ] OTHER (see notes)

QUIPMENT DOCUMENTATION

PURGING	SAMPLING	
		PERISTALTIC PUMP
✓	✓	SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
		IN LINE FILTER

DECON FLUIDS USED	
	METHANOL
✓	LIQUINOX
✓	POTABLE WATER
	DEIONIZED WATER
	STEAM CLEANING
	NITRIC ACID

WATER-LEVEL EQUIPMENT USED	
✓	ELECTRIC COND. PROBE
	FLOAT ACTIVATED
	KECK INTERFACE PROBE

NUMBER OF FILTERS USED NA

ANALYTICAL PARAMETERS

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
VOC			HCL / 4 DEG. C	3 X 40 ML		/ /
SVOC			4 DEG. C	2 X 1 L AG		/ /
PEST / PCBs	NA		4 DEG. C	2 X 1 L AG		/ /
HERBICIDES			4 DEG. C	2 X 1 L AG		/ /
TAL INORGANICS			HNO3 to pH <2	1 x 1 L P		/ /
SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		/ /
SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		/ /
IRON ONLY			HNO3 to pH <2	1 x 1 L P-Cube		/ /
FERROUS IRON	FIELD METHOD		-	-		/ /
TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		/ /
MANGANESE ONLY			HNO3 to pH <2	1 X 1 L P		/ /
AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		/ /
TOC	USEPA-415.1					/ /
TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		/ /
METHANE / CARBON DIOXIDE	MOD 8015					/ /

NOTES Collected Samples at 10:40 for:

			Preservative
EPA 310.1	Alkalinity		none
EPA 300.0	Inorganic ions		
EPA 160.1	TDS		
EPA 353.1	nitrate/nitrite	(H_2SO_4)	
EPA 350.1	Ammonia		
EPA 200.7	Cations (HNO_3)		

SIGNATURE: [signature]

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1.6.07

Appendix G-3

Calibration Records for Water Quality Meter and Turbidimeter

Pine Environmental Services, Inc

10611 Harwin Drive, Suite 416, Houston, TX 77036
866-981-7463(Toll-Free)
713-981-6283(Phone)
713-981-7466(Fax)
pine-tx@pine-environmental.com

Certificate of YSI Calibration

This is to certify that the YSI 556 Serial Number 04A1059AD was calibrated with standard units traceable to manufacturer's specification

Model: 556
Pine No: 5811
Serial No: 04A1059AD

lot Number:2503365* PH7

Calibration Standard	Instrument Output	Allowable Range	% Difference
PH-Zero1: 7PH	7PH	6.65-7.35 PH	0%

lot Number:2505079* PH4

Calibration Standard	Instrument Output	Allowable Range	% Difference
PH-Span1: 4PH	4PH	3.8-4.2 PH	0%

lot Number:2509214* COND

Calibration Standard	Instrument Output	Allowable Range	% Difference
Conductivity-Span1: 1413ms/cm	1413ms/cm	1342.35-1483.65 ms/cm	0%

lot Number:G798* ORP

Calibration Standard	Instrument Output	Allowable Range	% Difference
Redox: 240mv	240mv	228-252 mv	0%

Temprature DO Chart:

Water Temperature (C)	DO(mg/L)	Result
22	8.53	8.6

Environmental Conditions of Test Area:
Temprature Degree F: %Relative Humidity

Calibrated By: Raymond Mack **Date:** 11/22/2006 1:14:00 PM

All instrument are calibrated according to manufacturer's specifications

Customer must notify PES of any defect within 24 hours of receipt of equipment
Please call 866-981-7463 for Technical Assistance

FIELD INSTRUMENTATION CALIBRATION RECORD

MACTEC Engineering and Consulting

PROJECT: STP-COL

DATE: 12/28/06

REW ID OR TASK ID: NA

JOB NUMBER: 5050060496

SAMPLER SIGNATURE: [signature]

EQUIPMENT CALIBRATION

		STANDARD VALUE		METER VALUE		ACCEPTANCE CRITERIA **
HORIBA MODEL NO. N/A	pH	N/A	units	pH N/A	units	+/- 10% of standard
UNIT ID NO. N/A	Sp. Conductivity		mS/cm	Sp. Conductivity	mS/cm	+/- 10% of standard
	Redox		mV	Redox	mV	see note 1
	DO		mg/L *	DO	mg/L	+/- 10% of standard
	Thermometer Temperature		deg. C	Temperature	deg. C	+/- 2.0 deg. C

TURBIDITY METER TYPE LaMotte	1	NTU (low)	1.0	NTU	within 0.3 NTU of the standard
MODEL NO. 2020e					
UNIT ID NO. PN-26858 SN-ME 10530	10	NTU (high)	10.0	NTU	+/- 10% of standard

mw 12/28/06

PHOTOIONIZATION

METER TYPE N/A	Background ____ ppmv	Zero Air ____ ppmv	Meter ____ ppmv		~~within 5 ppmv of Zero~~
MODEL NO. N/A	Span Gas ____ ppmv		Meter ____ ppmv		~~+/- 10% of standard~~
UNIT ID NO. N/A					

OTHER METER TYPE None			see note 2
MODEL NO. N/A			see note 2
UNIT ID NO. N/A			see note 2
OTHER METER TYPE N/A			see note 2
MODEL NO. N/A			see note 2
UNIT ID NO. N/A			see note 2

MATERIALS RECORD

		Lot Number
Deionized Water Source:	NA	
Trip Blank Water Source:	NA	
Sample Preservatives Source:	laboratory	
Disposable Filter Type:	NA	
Other	NA	

Calibration Fluids/ Standard Source: mw 12/28/06

Lot Numbers pH 8

mV

Sp. Cond.

Turb.

NOTES: None

* = Indicate in notes section what was used as the DO standard (i.e., based on saturation at room temperature)

** = If the meter reading is not within acceptance criteria, clean or replace probe and re-calibrate, or use a different meter if available. If project requirements necessitate use of the instrument, clearly document on all data sheets and log book entries that the specified parameter was not calibrated to the acceptance criteria.

1 = meter must read within specified range of the Zobell solution (usually 231 +/- 10 mv @ 25 deg C).

= specify acceptance criteria in the Notes section

FIELD INSTRUMENTATION CALIBRATION RECORD

MACTEC Engineering and Consulting

PROJECT: STP-COL

DATE: 12/29/06

REW ID OR TASK ID: NA

JOB NUMBER: 5050060496

SAMPLER SIGNATURE: [signature]

EQUIPMENT CALIBRATION		CALIBRATION INFORMATION				ACCEPTANCE
		STANDARD VALUE		METER VALUE		CRITERIA **
YSI ~~HORIBA~~ MODEL NO. 556 MPS	pH	7.0	units	pH 7.18	units	+/- 10% of standard
UNIT ID NO. 05811	Sp. Conductivity	1413	mS/cm	Sp. Conductivity 1450	mS/cm	+/- 10% of standard
	Redox	240	mV	Redox 238	mV	see note 1
Lot# 062054	DO	NA	~~mg/L~~ %	DO 94	~~mg/L~~ % @ 1 atm	+/- 10% of standard
	Thermometer Temperature	NA	deg. C	Temperature NA	deg. C	+/- 2.0 deg. C
TURBIDITY METER TYPE LaMotte		0	NTU (low)	0.0	NTU	within 0.3 NTU of the standard
MODEL NO. 2020e						
UNIT ID NO. ~~PN~~ - 07459 SN 12/29/06		10	NTU (high)	9.87	NTU	+/- 10% of standard
PHOTOIONIZATION						
METER TYPE NA	Background NA ppmv	Zero Air NA ppmv		Meter NA	ppmv	within 5 ppmv of Zero
MODEL NO. —	Span Gas —	ppmv		Meter —	ppmv	+/- 10% of standard
UNIT ID NO. —						
OTHER METER TYPE None	—			—		see note 2
MODEL NO. —	—			—		see note 2
UNIT ID NO. —	—			—		see note 2
OTHER METER TYPE None	—			—		see note 2
MODEL NO. —	—			—		see note 2
UNIT ID NO. —	—			—		see note 2

MATERIALS RECORD	Lot Number	Calibration Fluids/	
Deionized Water Source:		Standard Source:	Pine Environmental (YSI)
Trip Blank Water Source:		Lot Numbers pH	#6025
Sample Preservatives Source: Lab		mV	#6277
Disposable Filter Type:		Sp. Cond.	#2605612
Other		Turb.	NA

NOTES:

DO std - KCL - CAS 7447407
Na^2SO^4 - CAS 7757826

* = Indicate in notes section what was used as the DO standard (i.e., based on saturation at room temperature)

** = If the meter reading is not within acceptance criteria, clean or replace probe and re-calibrate, or use a different meter if available. If project requirements necessitate use of the instrument, clearly document on all data sheets and log book entries that the specified parameter was not calibrated to the acceptance criteria.

1 = meter must read within specified range of the Zobell solution (usually 231 +/- 10 mv @ 25 deg C).

= specify acceptance criteria in the Notes section

FIELD INSTRUMENTATION CALIBRATION RECORD

MACTEC Engineering and Consulting

PROJECT STP/COC

DATE 12/30/2006

REW ID OR TASK ID 5050-06-0496

JOB NUMBER 5050060496

SAMPLER SIGNATURE _____

EQUIPMENT CALIBRATION		CALIBRATION INFORMATION STANDARD VALUE		METER VALUE		ACCEPTANCE CRITERIA **
HORIBA MODEL NO. YSI 556	pH	7	units	pH 7.06	units	+/- 10% of standard
UNIT ID NO. 05811	Sp. Conductivity	1413	mS/cm	Sp. Conductivity 1525	mS/cm	+/- 10% of standard
	Redox	240	mV	Redox 239	mV	see note 1
	DO	NA	mg/L *	DO 9.13	mg/L Air	+/- 10% of standard
	Thermometer Temperature		deg. C	Temperature 19.33	deg. C Air	+/- 2.0 deg. C
TURBIDITY METER TYPE 2020 LaMotte		0	NTU (low)	-.09	NTU	within 0.3 NTU of the standard
MODEL NO. 2020e						
UNIT ID NO. RN 268558		10.0	NTU (high)	10.0	NTU	+/- 10% of standard
PHOTOIONIZATION METER TYPE NA	Background		ppmv	Zero Air	ppmv	Meter — ppmv	within 5 ppmv of Zero
MODEL NO. —	Span Gas		ppmv			Meter — ppmv	+/- 10% of standard
UNIT ID NO. —						
OTHER METER TYPE NA							see note 2
MODEL NO. —							see note 2
UNIT ID NO. —							see note 2
OTHER METER TYPE NA							see note 2
MODEL NO. —							see note 2
UNIT ID NO. —							see note 2

MATERIALS RECORD	Lot Number	Calibration Fluids/ Standard Source:	
Deionized Water Source:		Lot Numbers pH	6025
Trip Blank Water Source:		mV	6277
Sample Preservatives Source: lab		Sp. Cond.	7605612
Disposable Filter Type:		Turb.	NA
Other			

NOTES:

FIGURE 10

* = Indicate in notes section what was used as the DO standard (i.e., based on saturation at room temperature)

** = If the meter reading is not within acceptance criteria, clean or replace probe and re-calibrate, or use a different meter if available. If project requirements necessitate use of the instrument, clearly document on all data sheets and log book entries that the specified parameter was not calibrated to the acceptance criteria.

1 = meter must read within specified range of the Zobell solution (usually 231 +/- 10 mv @ 25 deg C).

= specify acceptance criteria in the Notes section

FIELD INSTRUMENTATION CALIBRATION RECORD

MACTEC Engineering and Consulting

PROJECT: STP-COL

DATE: 12/31/06

REW ID OR TASK ID: NA

JOB NUMBER: 5050060496

SAMPLER SIGNATURE: [signature]

EQUIPMENT CALIBRATION		CALIBRATION INFORMATION STANDARD VALUE		METER VALUE		ACCEPTANCE CRITERIA **
~~FLORIDA~~ YSI MODEL NO. 556 MPS	pH	7	units	pH 7.03	units	+/- 10% of standard
UNIT ID NO. 05811	Sp. Conductivity	1413	mS/cm	Sp. Conductivity 1526	mS/cm	+/- 10% of standard
	Redox	240	mV	Redox 242.4	mV	see note 1
	DO	NA	mg/L *	DO NA	mg/L	+/- 10% of standard
	Thermometer Temperature	NA	deg. C	Temperature NA	deg. C	+/- 2.0 deg. C
TURBIDITY METER TYPE Lamotte		0.0	NTU (low)	0.0	NTU	within 0.3 NTU of the standard
MODEL NO. 2020e						
UNIT ID NO. 07459		10.0	NTU (high)	10.27	NTU	+/- 10% of standard
PHOTOIONIZATION METER TYPE NA	Background ____ ppmv	Zero Air ____ ppmv		Meter ____ ppmv		within 5 ppmv of Zero
MODEL NO. ____	Span Gas ____ ppmv			Meter ____ ppmv		+/- 10% of standard
UNIT ID NO. ____						
OTHER METER TYPE NA						see note 2
MODEL NO. ____						see note 2
UNIT ID NO. ____						see note 2
OTHER METER TYPE NA						see note 2
MODEL NO. ____						see note 2
UNIT ID NO. ____						see note 2

MATERIALS RECORD	Lot Number	Calibration Fluids/	
Deionized Water Source:		Standard Source:	Equipment supplier
Trip Blank Water Source:		Lot Numbers pH	#6025
Sample Preservatives Source:		12/30/06 mV	# 26056126277
Disposable Filter Type:		Sp. Cond.	26056126
Other		Turb.	NA

NOTES:

* = Indicate in notes section what was used as the DO standard (i.e., based on saturation at room temperature)

** = If the meter reading is not within acceptance criteria, clean or replace probe and re-calibrate, or use a different meter if available. If project requirements necessitate use of the instrument, clearly document on all data sheets and log book entries that the specified parameter was not calibrated to the acceptance criteria.

1 = meter must read within specified range of the Zobell solution (usually 231 +/- 10 mv @ 25 deg C).

= specify acceptance criteria in the Notes section

ATTACHMENT H

Kd TEST RESULTS

CONSISTS OF:

SRNL Report Dated September 20, 2007

Volume 1 of 1

SRNL
SAVANNAH RIVER NATIONAL LABORATORY

Building 773-43A, Room 215

September 20, 2007

Mr. Michael Sufnarski
MACTEC Engineering and Consulting
2801 Yorkmont Road, Suite 100
Charlotte, NC 28208

Subject: Statement of Conformance for the South Texas Project COL Project, Work for Others Agreement WFO-06-015

Dear Mr. Sufnarski:

Attached is the Technical Letter Report summarizing the work conducted for project WFO-06-015. The contents of this document have been design verified by qualified SRNL personnel. The work described in this final Technical Letter Report conforms to the requirements in the above mentioned Work for Others Agreement.

Sincerely:

Daniel I. Kaplan, Ph.D.
Fellow Research Scientist of Environmental Molecular Sciences

Phone: (803) 725-2363
FAX: (803) 725-4704
email: daniel.kaplan@srnl.doe.gov

WSRC-STI-2007-00367

KEY WORDS:
Distribution coefficients, cesium, cobalt, iron, nickel, plutonium, and strontium

RETENTION:
Permanent

DISTRIBUTION COEFFICIENTS FOR THE COMBINED CONSTRUCTION AND OPERATING LICENSE (COL) APPLICATION AT THE SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION

Daniel I. Kaplan

AUGUST 20, 2007

Savannah River National Laboratory
Washington Savannah River Company
Savannah River Site
Aiken, SC 29808

SRNL

REVIEWS AND APPROVALS

Daniel I. Kaplan, Author, Environmental & Chemical Processing Technology — Date: 9/20/2007

Kim Crapse, Peer Reviewer, Environmental & Chemical Processing Technology — Date: 9/20/2007

B. T. Butcher, Level 4 Manager, Environmental & Chemical Processing Technology — Date: 9/20/07

TABLE OF CONTENTS

LIST OF TABLES 7
LIST OF ACRONYMS AND ABREVIATIONS 8
ABSTRACT 9
1.0 INTRODUCTION 10
2.0 MATERIALS AND METHODS 10
2.1 Materials 10
2.2 Methods 12
2.3 pH 12
2.4 Cation Exchange Capacity 12
2.5 K_d Values 12
2.6 Analytical Standards 13
2.6.1 pH Analyses 13
2.6.2 ICP-AES Analyses 14
2.6.3 Gamma Analyses 14
3.0 RESULTS 14
3.1 pH 14
3.2 Cation Exchange Capacity 17
3.3 K_d Values 17
4.0 REFERENCES 23
APPENDIX A. Detailed Description of the Materials and Methods for K_d, CEC, and pH Testing 24
APPENDIX B. Radioisotope Certification 37
APPENDIX C. Gamma Spectroscopy, ICP-AES, and pH Sample and QA Results 44
APPENDIX D. Data Used in K_d and CEC Calculations 96
APPENDIX E. Traceability Records of Soil and Groundwater Samples 102
APPENDIX F. Radiological Standard Certificate of Calibration 109
APPENDIX G. M&TE Approval of Balance 116
APPENDIX H. List of Equipment Used in Study 122
APPENDIX I. Personnel Qualification 124

LIST OF TABLES

Table 1. Soil and groundwater pairing used in K_d measurements. 11
Table 2. Soil pH values. 15
Table 3. Soil pH and CEC descriptive statistics of the 40 measurements. 15
Table 5. Cation exchange capacity (meq/100g). 18
Table 4. Correlation coefficients between pH and CEC. 19
Table 6 . Summary table of Co, Sr, and Cs K_d values for soils collected at the STP site (units: mL/g). 20
Table 7. Summary table of Fe, Ni, and Pu Kd values (mL/g) (average of two replicates). 21
Table 8. Descriptive statistics of K_d average values (mL/g). 22
Table 9. Correlation coefficients (r) between Co K_d, Sr K_d, Cs K_d, pH, and CEC. 22
Table 10. Sediment descriptions and weights for Fe, Ni, and Pu K_d measurements. 28
Table 11. Sediment descriptions and weights for Co, Cs, and Sr K_d measurements. 29
Table 12. pH calibration results. 45
Table 13. pH data. 46
Table 14. Na ICP-AES standards results (used for CEC analyses). 47
Table 15. Data used in the CEC calculations. 48
Table 16. Gamma analyses quality assurance results. 50
Table 17. Gamma analyses results for Co-57, Sr-85 and Cs-137. 87
Table 18 . Gamma data for Pu, Fe, and Ni. 95
Table 19. Raw data for Co, Sr, and Cs K_d calculations. 97
Table 20. Fe, Ni, and Pu gamma analyses used in the K_d determinations. 99
Table 21. Data used in CEC calculations. 100

LIST OF ACRONYMS AND ABREVIATIONS

avg	average
CEC	cation exchange capacity
COL	Combined License
ICP-AES	Inductively Coupled Plasma –Atomic Emission Spectroscopy
K_d	distribution coefficient
RSD	relative standard deviation
SRNL	Savannah River National Laboratory
STP	South Texas Project
stdev	standard deviation

ABSTRACT

Soil distribution coefficients, K_d values (the ratio of radionuclide concentration sorbed to the concentration in the aqueous phase), were determined in support of the Combined License application for the South Texas Project Electric Generating Station site in Matagorda County, Texas. Twenty soil samples and twenty representative groundwater samples from the South Texas Project site were provided for the Savannah River National Laboratory to conduct site-specific K_d determinations of cesium (Cs), cobalt (Co), iron (Fe), nickel (Ni), strontium (Sr), and plutonium (Pu). All measurements were conducted in duplicate with gamma emitting radioisotopes of these elements. Additionally, the pH and the cation exchange capacity of the soils were also measured. The median K_d values in units of mL/g were: Cs 227.4, Co 10.6, Fe >1232.8, Ni 37.2, Sr 1.9, and Pu 421.0. pH values of these sediments were remarkably uniform, ranging from 8.57 to 9.33, with a mean pH value of 9.08 ± 0.22. Cation exchange capacity values had a wide range from 0.28 and 12.2 milliequivalent/100 g soil (meq/100g), with a mean of 1.61 ± 2.14 meq/100g. Correlations of soil pH, cation exchange capacity, and Co- Sr-, and Cs-K_d values were calculated; similar correlations with Fe-, Ni, and Pu-K_d values were not permitted due to the presence of greater than numbers. All three K_d values were highly correlated to CEC and pH (probability ≥ 0.01, 19 degrees of freedom). The K_d values reported here will provide the necessary sorption data for assessing the risk associated with subsurface movement of Cs, Co, Fe, Ni, Sr, and Pu at the South Texas Project Electric Generating Station site.

1.0 INTRODUCTION

Distribution coefficients, K_d values, when used in reactive transport codes are conditional on the sediment type and groundwater (Krupka et al 1999a). For this reason it is ideal to use K_d values derived from site-specific materials when possible. The objective of this project was to provide site-specific cesium (Cs), cobalt (Co), iron (Fe), nickel (Ni), strontium (Sr), and plutonium (Pu) K_d values for the Combined License (COL) application at the South Texas Project site. Twenty soil samples and twenty groundwater samples from the site were provided for use in this study by MACTEC Engineering (Raleigh, NC). Additionally, soil pH and cation exchange capacity (CEC) were measured.

2.0 MATERIALS AND METHODS

The materials and methods for this project are described in detail in Appendix A. The K_d determinations were based on "ASTM D 4646: Standard test method for 24-hr batch-type measurement of contaminant sorption by soils and sediments" (Appendix A). CEC was measured following the standard procedure, "EPA Method 9081 for Cation-Exchange Capacity of Soils (Sodium Acetate)" (Appendix A). pH was measured by the standard method "ASTM D 4972-01 Standard Test Method for pH of Soils" (Appendix A). The following is a brief description of the materials and methods of this testing to permit understanding of the results.

2.1 MATERIALS

The soil samples and their corresponding groundwater samples from the South Texas Project Electric Generating Station site are described in Table 1. The radionuclides used in the K_d measurements were gamma emitters purchased from Eckert & Ziegler Analytics (Atlanta, Georgia, this company use to be Analytics, Inc.). The radioisotope certifications are provided in Appendix B.

The solid/groundwater suspensions used in the K_d determinations were spiked to yield the following concentrations:

- 1.8e-6 Ci/L ^{57}Co,
- 2.0e-6 Ci/L ^{137}Cs,
- 1.3e-6 Ci/L ^{85}Sr,
- 8.8e-7 Ci/L ^{55}Fe,
- 2.2e-7 Ci/L ^{59}Ni, and
- 4.0e-7 Ci/L ^{238}Pu.

The concentrations of the radionuclides used in these tests were carefully selected so that the concentrations of the spiked solutes would not exceed the linear sorption range. In the linear range, the K_d construct is appropriate to use. At higher concentrations, it is often necessary to use more complicated models, such as the Freundlich model. Another concern with using elevated radionuclide concentrations is the increased likelihood of promoting radionuclide

precipitation. If precipitation occurs, the measurement would incorrectly attribute reversible sorption to the K_d values, where in fact "less reversible" precipitation occurred. (The latter should be described with a solubility constant and not a K_d value.) The tests were conducted at several orders of magnitude lower concentrations than would be necessary for precipitation of these elements. Regarding non-linear sorption, Krupka et al. (1999b) reported that non-linear sorption of Cs occurs at concentrations greater than about 10^{-5} M (or 0.12 Ci/L ^{137}Cs) and Sr at about 10^{-7} M (or 1.2e-3 Ci/L ^{90}Sr).

The magnitude of sorption to geological materials does not vary with isotope. So even if the COL is interested in making transport calculations with different isotopes of the elements mentioned above, the K_d values will remain the same. At these very low concentrations, competition for sorption sites as a result of introducing more than one radionuclide at a time is essentially non-existent.

Table 1. Soil and groundwater pairing used in K_d measurements.

SRNL Tube #	Boring/Sample Number	Ground-water
501	B308/SS15	308-U
502	B308/SS25	308-L
503	B332/SS12	332-U
504	B332/SS23	332-La
505	B348/SS8	348-U
506	B348/SS17	348-L
507	B349/SS14	349-U
508	B349/SS23	349-L
509	B408/SS14	408-U
510	B408/SS22	408-L
511	B438/SS12	438-U
512	B438/SS24	438-L
513	B910/SS14	910-U
514	B910/SS24	910-L
515	B930/SS14	930-U
516	B930/SS27	930-L
517	B933/SS14	933-U
518	B933/SS24	933-L
519	B934/SS15	934-U
520	B934/SS26	934-L

2.2 METHODS

2.3 pH

pH was determined following ASTM D4972-01 (Appendix A). Briefly, 10 g of air-dried soil that had been sieved through a number 10 sieve (2-mm openings) was combined with either 10 mL water or 10 mL 0.01 M $CaCl_2$. These suspensions were mixed and then permitted to stand for 1 h. The pH was then measured with a pH meter. All analyses were conducted in duplicate. Calibration and standards results are discussed in Section 2.6.1.

2.4 CATION EXCHANGE CAPACITY

Cation exchange capacity (CEC) was determined following EPA Method 9081 (Appendix A). Briefly, 4 to 6 g of air dried soil that had been sieved through a number 10 sieve (2-mm openings) was put in contact with a Na^+ solution to saturate the soil exchange sites with Na^+. Then the interstial aqueous Na^+ was washed out of the sediment with isopropyl alcohol. The Na^+ saturated sediment was then put in contact with a NH_4^+ solution to desorb all the Na^+ on the soil surface. This NH_4^+ wash, exchanged the adsorbed Na^+ into the aqueous phase, where it was measured by ICP-AES. Aqueous Na^+ concentrations were used to calculate the CEC in units of meq/100 g.

Two CEC QC standards were included for every 10 samples. One QC standard was a blank tube that contained only liquids, sans sediment. It provided a measure of how clean the chemicals were and whether Na may have entered the samples as an experimental artifact. The calculated CEC value was corrected for this background Na concentration. The second CEC QC standard was a SRNL sediment for which the CEC value was known (Subsurface Clayey Sediment: CEC is 5.81 ± 1.03 meq/100 g). QA for the analytical measurement of Na by ICP-AES is described below in Section 2.6.2.

2.5 K_d VALUES

Detailed descriptions of the methods used to measure radioisotope and stable isotope K_d values is presented in Appendix A. Briefly, two near identical sets of measurements were conducted, the first was spiked with ^{57}Co, ^{137}Cs, and ^{85}Sr, and the second was spiked with ^{55}Fe, ^{59}Ni, and ^{238}Pu. These radionuclides were separated in this manner to ease analytical detection of the radionuclides. For both experiments, the soil samples were air dried and then passed through a 2-mm sieve. A 0.5-g aliquot of the dried solid phase was added to a 15-mL centrifuge tube, followed by 12 mL of groundwater. The suspension was mixed overnight to pre-equilibrate the sediments with the groundwater prior to adding the radionuclides. To separate the liquid and solid phases, the tubes were centrifuged and the aqueous phase was decanted and disposed.

Following pre-equilibrating the soil samples, 10 mL of groundwater was added to the tubes followed by 170 μL of the appropriate gamma spike solution (either the $^{57}Co/^{137}Cs/^{85}Sr$ mixture or the $^{55}Fe/^{59}Ni/^{238}Pu$ mixture). Because the background solutions of the spikes were very acidic (~0.1 M HCl for the radioisotopes spike solution and 2% HNO_3 for the Fe and Ru

spike solution), it was necessary to adjust the pH by adding base to each suspensions until the pH returned to approximately that of background. It is important to maintain background pH levels in K_d measurements because pH can influence the extent that radionuclides sorb to sediments. The suspensions were periodically shaken over a two day contact period. At the end of the contact period, the samples were permitted to settle and the aqueous phase was passed through a 0.1μm filter. The $^{57}Co/^{137}Cs/^{85}Sr$ samples were analyzed by standard high-energy liquid gamma spectroscopy. The $^{55}Fe/^{59}Ni/^{238}Pu$ samples contained low-energy gamma emitters and were first plated before counting by gamma spectroscopy.

All K_d measurements were conducted in duplicate. Three positive controls (spikes only in groundwater, no solid phase added) and two negative controls (groundwater only samples, no soil and no spike were added). Therefore a total of 94 test tubes were prepared for this study:

> For the $^{57}Co/^{137}Cs/^{85}Sr$ K_d determinations: (2 reps x 20 sediments) + 3 positive controls + 2 negative controls = 45 test tubes for the radioisotope study
>
> For the $^{55}Fe/^{59}Ni/^{238}Pu$ K_d determinations: (2 reps x 20 sediments) + 3 positive controls + 4 negative controls = 47 test tubes for the stable isotope study

The three positive controls provided estimates of radionuclide concentrations in the absence of sediment and accounted for any sorption to the labware that may have occurred as an experimental artifact. It provided a direct measure of the radionuclide concentration introduced to the sample. The negative controls provided a measure of how much of the radionuclides were in the native groundwater, either as a cross contaminations during the assay or as an existing contaminant at the study site. All negative controls had below detection limit concentrations of radionuclides. The negative controls were not used in the calculation of K_d values.

The lab notebook used to record the activity of this work was WSRC-NB-2007-00029. This unclassified notebook will be kept "permanently" by the Department of Energy.

There were no problems encountered in sample receipt, login, and analysis. Prior to shipment to SRNL, soil sample B-308 SS-15 was repackaged after the original jar cracked/broke in the field. Based on a thorough visual inspection, no glass pieces were observed in the sample. Subsequent testing of this sample produced no unusual results.

2.6 ANALYTICAL STANDARDS

2.6.1 pH Analyses

pH was measured on a Accumet, AR20 meter. The instrument was calibrated at the start and end of measurements and between every 20 samples. All calibration slopes were within specification, *i.e.*, slopes were >95% and <105% (Table 12). Furthermore, a pH 7.0 buffer was measured before and after calibration, and the difference between these values were always within specification, *i.e.*, <10% (Table 12). A SRNL standard for soil pH (Subsurface Clayey Sediment; pH 4.35 ± 0.15) was analyzed before and after measuring the

STP samples. The measured pH values of the standard were within specifications, *i.e.*, within the standard deviation of the mean (Table 2.

2.6.2 ICP-AES Analyses

ICP-AES was used to measure aqueous Na concentrations for use in the CEC determinations. The ICP-AES calibration procedure used for these measurements are presented in detail in "Perkin-Elmer Optima 3000 ICP-AES" (Manual L16.1, Procedure ADS-1510, Rev. 5, Washington Savannah River Company, Aiken, SC). This document has been submitted and accepted as part of the Document Submittal Requirements for this project. Four calibrations were conducted for the ICP-AES analyses (shown in Appendix C; Table 14). Calibration coefficients had to have a value ≥0.995, and they did. All standards had to have a relative standard deviation (RSD) of ±10% before and after calibration, and they did.

2.6.3 Gamma Analyses

The gamma spectroscopy calibration procedure used for this test is presented in detail in "Gamma Sample Preparation and Analysis (γ-PHA)" (Manual L16.1, Procedure ADS-2420, Rev. 4, Washington Savannah River Company, Aiken, SC). This document has been submitted and accepted as part of the Document Submittal Requirements for this project.

The QA standards contained nine peak energies that spanned the gamma energy range of interest. These were measured each working day prior to analyzing any samples. The results from these QA analyses are presented in Appendix C; Table 16. A mark in the QA results in the "Deviation/Flags" column of "In" means the measured value needs to be "investigated", but the instrument is within specifications of the standard. A "Deviation/Flags" comment of "Ac" means the measured value is outside the acceptable range and "action" is required. The "action" flag indicates that the analyses results are unacceptable. During the 12 days of analysis, there were a total of 345 standard energies that were measured, of which four "investigate" flag and zero "action" flags were identified. Since the four "investigate" flags were not three back-to-back days on the same instrument, no action was required. These results indicate that all measurement QA standards were within specification.

3.0 RESULTS

3.1 pH

pH was measured in water and a 0.01 M $CaCl_2$ solution (Table 2; raw data presented in Table 13). pH($CaCl_2$) has an agricultural origin and is less important than the pH(H_2O) when discussing contaminant transport calculations and regulator requirements. As expected the pH($CaCl_2$) is lower than pH(H_2O) due to the exchange of surface protons by the solution Ca^{2+} ions of the former. The pH (H_2O) values had a very narrow range, 8.57 to 9.33, suggesting that the system was buffered by carbonate minerals (Table 3). The mean and median pH(H_2O) values were about the same, pH 9.08 and 9.13, respectively. The pH($CaCl_2$) values also had a very narrow range, but they were lower than the pH(H_2O)

values, 7.93 to 8.32. The two values were strongly correlated; the correlation coefficient (r) was 0.746, which is significant at probability ≤ 0.01 for 19 degrees of freedom (d.f.) (Table 5).

Table 2. Soil pH values.

	pH(H_2O)		pH($CaCl_2$)	
ID #	**Avg**	**Stdev**	**Avg**	**Stdev**
SRNL Std. (4.35 ± 0.15)	4.37	0.12	NA	NA
B308/SS15	8.97	0.04	8.16	0.01
B308/SS25	9.10	0.01	8.15	0.00
B332/SS12	9.27	0.01	8.31	0.02
B332/SS23	8.94	0.01	8.17	0.01
B348/SS8	9.22	0.04	8.17	0.02
B348/SS17	9.23	0.01	8.21	0.00
B349/SS14	9.33	0.00	8.25	0.01
B349/SS23	9.27	0.01	8.18	0.01
B408/SS14	9.06	0.01	8.16	0.02
B408/SS22	9.14	0.01	8.16	0.00
B438/SS12	9.12	0.01	8.15	0.00
B438/SS24	8.63	0.00	8.03	0.02
B910/SS14	8.91	0.28	8.17	0.01
B910/SS24	8.58	0.01	7.95	0.02
B930/SS14	8.91	0.01	8.05	0.00
B930/SS27	9.24	0.03	8.27	0.02
B933/SS14	9.32	0.01	8.20	0.00
B933/SS24	9.23	0.01	8.26	0.01
B934/SS15	9.24	0.04	8.21	0.02
B934/SS26	8.92	0.01	8.30	0.01
SRNL Std. (4.35 ± 0.15)	4.33	0.06	NA	NA

pH measurements conducted in duplicate.

Table 3. Soil pH and CEC descriptive statistics of the 40 measurements.

	pH (H_2O)	pH ($CaCl_2$)	CEC (meq/100g)
Mean	9.08	8.17	1.61
Median	9.13	8.17	0.90
Standard Deviation	0.217	0.0875	2.14
Range	0.76	0.39	11.9
Minimum	8.57	7.93	0.28
Maximum	9.33	8.32	12.2
Count	40	40	40

3.2 CATION EXCHANGE CAPACITY

The CEC values for these soils are presented in Table 4 (the data used to calculate CEC values are presented in Appendix D, Table 15). They tend to be low, characteristic of subsurface aquifer material. The mean CEC was 1.61 ± 2.14 meq/100 g and it had a wide range of values, 0.28 to 12.2 meq/100 g Table 3. Such a wide range is consistent with their divergent appearance, both in color and texture. It is not known why there was an inverse significant relationship between CEC and both pH measurements (Table 5). One possible explanation is that the mineralogy changed with pH, such that the low CEC minerals were more abundant at higher pH values. For example, the abundance of calcite ($CaCO_3$) is closely controlled by pH.

3.3 K_d VALUES

The Co, Cs, and Sr K_d values for the 20 samples are presented in Table 6 (the data used to calculate these K_d values is presented in Table 15 and Table 17). The Fe, Ni, and Pu K_d values are presented in Table 7. The associated descriptive statistics are presented in Table 8. With few exceptions, the standard deviation of duplicate measurements was relatively quite low for Co, Cs, and Sr (Table 6). The standard deviation of the duplicate measurements of Fe, Ni, and Pu (Table 7) were larger, in part due to the presence of greater-than values. The range of the 20 Co and Sr K_d values was relatively small, whereas that of Cs, Fe, Ni, and Pu were appreciably larger (Table 8).

A ranking of K_d values by their median values is:

Sr (1.9 mL/g) < Co (10.6 mL/g) < Cs (227.4 mL/g);

There was approximately an order of magnitude increase between these ranked median K_d value (Table 8). The value of the K_d values at the STP site are quite similar to those at the Savannah River Site and they have similar rankings (Kaplan 2006). At the Savannah River Site, the best estimates for:

- Sr K_d values are 5 mL/g for sandy sediments and 17 mL/g for clayey sediments,
- Co K_d values are 7 mL/g for sandy sediments and 30 mL/g for clayey sediments, and
- Cs K_d values are 50 mL/g for sandy sediments and 250 mL/g for clayey sediments.

Detailed data used to calculate each K_d value, including soil weight and solution volume, are presented in Appendix D (Table 11 and Table 18).

Regression analysis was conducted with the Co, Sr, and Cs K_d values, but not Fe-, Ni-, and Pu K_d values because latter data sets contained less-than values. Sr, Co, and Cs K_d values had very strong correlations to pH, and especially to CEC (Table 9). These correlations are stronger than is commonly measured (Krupka et al. 1999b). The strong correlation with CEC has important implications for the transport models. It suggests that cation exchange is the

dominant process by which these radionuclides sorb to the sediment (as oppose to surface complexation or precipitation). This gives credence for the selection of the K_d construct to describe the geochemical behavior of these radionuclides at the STP site.

Table 4. Cation exchange capacity (meq/100g).

STP Soil	Rep	[Na] (ppm)	CEC (meq/100 g)	avg CEC (meq/100g)	stdev CEC (meq/100g)
B308/SS15	1		0.82	0.749	0.095
	2		0.68		
B308/SS25	1		3.69	3.365	0.466
	2		3.04		
B332/SS12	1		0.47	0.376	0.137
	2		0.28		
B332/SS23	1		0.50	0.632	0.182
	2		0.76		
B348/SS8	1		0.97	0.841	0.177
	2		0.72		
Blank #1[b]	1	2.75			
Std #1 [a]	1		3.30		
B348/SS17	1		0.76	0.822	0.093
	2		0.89		
B349/SS14	1		0.48	0.636	0.219
	2		0.79		
B349/SS23	1		1.36	1.138	0.319
	2		0.91		
B408/SS14	1		0.70	0.726	0.032
	2		0.75		
B408/SS22	1		0.89	0.925	0.043
	2		0.96		
Blank #2[b]	1	1.693			
Std #2 [a]	1		6.65		
B438/SS12	1		2.53	2.072	0.652
	2		1.61		
B438/SS24	1		1.30	0.921	0.541
	2		0.54		
B910/SS14	1		1.19	1.295	0.150
	2		1.40		
B910/SS24	1		7.62	9.889	3.215
	2		12.16		
B930/SS14	1		2.06	2.539	0.684
	2		3.02		
Blank #3[b]	1	<0.237			
Std #3 [a]	1		5.48		
B930/SS27	1		0.49	0.509	0.021
	2		0.52		
B933/SS14	1		2.05	1.928	0.170
	2		1.81		
B933/SS24	1		0.83	0.850	0.023
	2		0.87		
B934/SS15	1		1.26	1.300	0.060
	2		1.34		
B934/SS26	1		0.99	0.750	0.339
	2		0.51		
Blank #4[b]	1	2.21			
Std #4 [a]	1		6.27		

[a] The CEC standard used in this test was created by SRNL. The CEC of this standard, "Subsurface Clayey Sediment" is 5.81 ± 1.03 meq/100 g.
[b] The Blanks were negative controls, without soil. All CEC values were corrected for the Na concentrations in the Blank controls.

Table 5. Correlation coefficients between pH and CEC.

	CEC	pH (H_2O)
pH (H_20)	-0.536[a]	
pH ($CaCl_2$)	-0.698[b]	0.754[b]

[a] All coefficients > 0.433, are significant at a probability of ≤ 0.05 (for 19 degrees of freedom).
[b] All coefficients > 0.549, are significant at a probability of ≤ 0.01 (for 19 degrees of freedom).

Table 6 . Summary table of Co, Sr, and Cs K_d values for soils collected at the STP site (units: mL/g).

Boring/ Sample No	Ground-water	Rep[a]	Avg. Soil pH (H_2O)[a]	Co Kd	Sr Kd	Cs Kd	Co Kd		Sr Kd		Cs Kd	
							Average	Std. Dev.[a]	Average	Std. Dev.	Average	Std. Dev.
B308/SS15	308-U	1	8.16	14.2	2.3	368.9	13.5	1.0	2.1	0.4	359.9	12.7
		2		12.8	1.8	351.0						
B308/SS25	308-L	1	8.15	13.4	1.8	328.2	17.1	5.3	2.3	0.7	531.7	287.9
		2		20.8	2.8	735.3						
B332/SS12	332-U	1	8.31	6.7	1.4	59.5	6.4	0.3	1.5	0.1	61.0	2.2
		2		6.2	1.6	62.6						
B332/SS23	332-La	1	8.17	8.2	1.6	160.2	8.3	0.1	1.6	0.1	160.1	0.1
		2		8.4	1.5	160.1						
B348/SS8	348-U	1	8.17	11.0	1.7	433.1	10.9	0.1	2.0	0.4	348.1	120.1
		2		10.9	2.4	263.2						
B348/SS17	348-L	1	8.21	9.0	1.3	288.9	9.6	0.8	2.0	1.0	242.6	65.4
		2		10.2	2.6	196.4						
B349/SS14	349-U	1	8.25	9.5	1.5	182.8	7.7	2.5	1.0	0.7	147.4	50.1
		2		6.0	0.6	112.0						
B349/SS23	349-L	1	8.18	15.0	3.1	553.5	13.1	2.7	2.9	0.3	409.5	203.5
		2		11.2	2.7	265.6						
B408/SS14	408-U	1	8.16	16.7	4.3	197.7	15.2	2.0	3.1	1.6	189.1	12.2
		2		13.8	2.0	180.5						
B408/SS22	408-L	1	8.16	13.1	2.6	607.7	11.2	2.6	2.2	0.5	520.0	124.0
		2		9.4	1.8	432.3						
B438/SS12	438-U	1	8.15	14.1	2.1	334.6	12.8	1.8	1.7	0.5	321.0	19.3
		2		11.5	1.4	307.4						
B438/SS24	438-L	1	8.03	6.3	1.6	123.3	5.5	1.2	1.0	0.9	104.0	27.3
		2		4.7	0.3	84.7						
B910/SS14	910-U	1	8.17	9.9	1.3	206.0	10.3	0.5	1.7	0.4	212.1	8.7
		2		10.6	2.0	218.3						
B910/SS24	910-L	1	7.95	24.9	7.1	3017.4	24.1	1.2	6.5	0.8	2994.3	32.6
		2		23.2	5.9	2971.3						
B930/SS14	930-U	1	8.05	12.1	3.5	561.8	11.2	1.3	3.1	0.7	554.5	10.3
		2		10.3	2.6	547.2						
B930/SS27	930-L	1	8.27	6.3	1.6	89.9	5.9	0.6	1.3	0.4	83.3	9.3
		2		5.4	1.1	76.8						
B933/SS14	933-U	1	8.20	14.3	2.9	513.3	14.9	0.8	3.0	0.2	486.2	38.4
		2		15.5	3.1	459.0						
B933/SS24	933-L	1	8.26	5.9	1.3	78.6	5.8	0.1	1.2	0.1	78.5	0.1
		2		5.8	1.1	78.5						
B934/SS15	934-U	1	8.21	6.3	1.3	119.0	6.3	0.1	1.6	0.3	113.1	8.2
		2		6.4	1.8	107.3						
B934/SS26	934-L	1	8.30	6.0	1.3	53.6	6.6	0.9	1.9	0.8	56.5	4.1
		2		7.3	2.4	59.4						

[a] Rep = replicate; Avg. Soil pH (H_2O) = the average (two replicate) pH values of 1:1 soil:water slurries; Std. Dev. = standard deviation

Table 7. Summary table of Fe, Ni, and Pu Kd values (mL/g) (average of two replicates).

Boring/ Sample #	Groundwater	Rep [a]	Avg. Soil pH(H_2O) [a]	Fe K_d	Ni K_d	Pu K_d	Fe K_d		Ni K_d		Pu K_d	
							Average	Std. Dev. [a]	Average	Std. Dev.	Average	Std. Dev.
B308/SS15	308-U	1	8.16	>3264.1	33.1	218.5	>2079.1	1675.9	29.8	4.7	242.8	34.3
		2		>894.1	26.5	267.0						
B308/SS25	308-L	1	8.15	>426.3	40.3	1398.3	>1820.0	1971.0	35.1	7.3	>1037.7	510.0
		2		>3213.7	29.9	>677.1						
B332/SS12	332-U	1	8.31	29.3	88.3	52.7	45.4	22.7	224.4	192.4	65.3	17.8
		2		61.4	360.4	77.9						
B332/SS23	332-La	1	8.17	1481.2	48.7	>1294.7	847.5	896.2	50.2	2.1	>1577.2	399.4
		2		213.8	51.7	1859.6						
B348/SS8	348-U	1	8.17	>948.5	23.4	110.8	>2021.8	1517.9	23.0	0.5	102.3	12.0
		2		>3095.1	22.7	93.8						
B348/SS17	348-L	1	8.21	302.4	44.3	>1163.4	164.0	195.7	113.3	97.6	>962.2	284.6
		2		25.6	182.3	761.0						
B349/SS14	349-U	1	8.25	65.4	264.4	118.3	99.8	48.6	233.9	43.2	109.2	12.9
		2		134.2	203.4	100.1						
B349/SS23	349-L	1	8.18	>1916.8	44.9	2437.0	>1513.5	570.3	39.2	8.2	>2434.2	3.9
		2		>1110.2	33.4	>2431.4						
B408/SS14	408-U	1	8.16	>5763.3	27.2	59.3	>3308.4	3471.7	26.8	0.6	55.4	5.6
		2		>853.6	26.4	51.4						
B408/SS22	408-L	1	8.16	>3193.0	39.1	>684.4	>1880.5	1856.2	31.6	10.7	>979.9	417.8
		2		>567.9	24.0	>1275.3						
B438/SS12	438-U	1	8.15	>906.8	18.8	177.9	>751.9	219.1	20.0	1.7	180.2	3.2
		2		>597.0	21.2	182.5						
B438/SS24	438-L	1	8.03	>3098.2	33.9	627.4	>2447.5	920.2	30.3	5.1	877.6	353.8
		2		>1796.8	26.7	1127.8						
B910/SS14	910-U	1	8.17	74.3	171.3	140.7	289.7	304.7	110.7	85.7	364.5	316.4
		2		505.2	50.1	588.2						
B910/SS24	910-L	1	7.95	>1090.2	>1094.4	>1452.4	>2032.5	1332.7	>567.9	744.6	>1063.4	550.2
		2		>2974.9	41.3	>674.4						
B930/SS14	930-U	1	8.05	>458.9	26.1	808.1	>952.0	697.4	31.0	7.1	1060.8	357.4
		2		>1445.2	36.0	1313.5						
B930/SS27	930-L	1	8.27	33.0	102.4	>1208.8	21.7	16.0	177.6	106.2	>627.3	822.4
		2		10.4	252.7	45.8						
B933/SS14	933-U	1	8.20	>885.3	24.0	61.1	>1780.5	1266.0	25.2	1.7	53.6	10.5
		2		>2675.7	26.4	46.2						
B933/SS24	933-L	1	8.26	41.3	56.3	495.7	40.9	0.7	74.3	25.4	311.7	260.3
		2		40.4	92.3	127.6						
B934/SS15	934-U	1	8.21	>5677.1	27.5	302.3	>3361.0	3275.5	27.9	0.5	477.5	247.8
		2		1044.9	28.2	652.8						
B934/SS26	934-L	1	8.30	9.8	270.2	237.2	15.5	8.1	237.5	46.3	141.8	134.9
		2		21.2	204.7	46.4						

[a] Rep = replicate; Avg. Soil pH (1:1) = the average (two replicate) pH values of 1:1 soil:water slurries; Std. Dev. = standard deviation .

Table 8. Descriptive statistics of K_d average values (mL/g).

	Co K_d	Sr K_d	Cs K_d	Fe K_d	Ni K_d	Pu K_d
Mean	10.8	2.2	398.7	>1273.7	>105.5	>636.2
Median	10.6	1.9	227.4	>1232.8	37.2	421.0
Standard Deviation	4.7	1.2	634.0	>1099.1	132.9	>619.9
Range	18.6	5.5	2937.8	>3345.5	>547.8	>2380.6
Minimum	5.5	1.0	56.5	15.5	20.0	53.6
Maximum	24.1	6.5	2994.3	>3361.0	>567.9	>2434.2
Count	20	20	20	20	20	20

Table 9. Correlation coefficients (r) between Co K_d, Sr K_d, Cs K_d, pH, and CEC.

	pH(H_2O)	Co K_d	Sr K_d	Cs K_d
Co K_d	-0.614 [a]			
Sr K_d	-0.639 [a]	0.874 [a]		
Cs K_d	-0.694 [a]	0.797 [a]	0.911 [a]	
CEC	-0.536 [a]	0.780 [a]	0.867 [a]	0.965 [a]

[a] All coefficients > 0.549, are significant at a probability of ≤ 0.01 (for 19 degrees of freedom).

4.0 REFERENCES

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Krupka, K. M., D. I. Kaplan, G. Whelan, R. J. Serne, and S. V. Mattigod. 1999b. Understanding Variation in Partition Coefficient, K_d, Values. Volume II: Review of Geochemistry and Available K_d Values for Cadmium, Cesium, Chromium, Lead, Plutonium, Radon, Strontium, Thorium, Tritium and Uranium. EPA 402-R-99-004B. Office of Air and Radiation, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, DC. (http://www.epa.gov/radiation/cleanup/partition.htm)

APPENDIX A. Detailed Description of the Materials and Methods for K_d, CEC, and pH Testing

R&D Directions:
K_d, pH, and CEC Measurements of South Texas Project Sediment Samples

Objective

Measure Co, Cs, Fe, Ni, Pu and Sr K_d values of 20 soils collected from the South Texas Project by MACTEC. Because these K_d values will be used in a reactive transport code as part of a Combined Construction and Operating License (COL) application of the site, all attempts will be made to make the experimental conditions of the tests representative of an accidental release. These measurements will include site-specific soil, site-specific groundwater, and radionuclides concentrations that are in the linear sorption range. The linear sorption range is the lower range in an adsorption isotherm (x-axis: aqueous solute concentration, y-axis: sorbed concentration) before non-linearity occurs (the result of limitations of sorption sites with respect to aqueous radionuclide concentrations).[1] Furthermore, the sediments will be pre-equilibrated with the groundwater prior to spiking with radionuclides, again to minimize "shocking the chemistry" and to provide a measure of steady state conditions, as implied by the K_d construct.

The following K_d method is taken from "ASTM D 4646: Standard test method for 24-hr batch-type measurement of contaminant sorption by soils and sediments."

pH and CEC also have to be analyzed in duplicate. Attached are the procedures for these tests: "EPA Method 9081 for Cation-Exchange Capacity of Soils (Sodium Acetate)" and the ASTM D 4972-01 Standard Test Method for pH of Soils." These properties will be measured following these procedures, thus no write up is necessary. pH has to be measured prior to conducting the K_d measurements because we need to know pH for the K_d test. CEC will be measured after submitting the K_d solutions for gamma analysis.

Materials

1. 20 soil samples from the STP site (Table 1A).
2. 20 STP site groundwater samples
3. radionuclide standards Co-57, Cs-137, Fe-55, Ni-59, Sr-85, and Pu-238 [2] (http://www.analyticsinc.com/prod01.htm)
4. 15-mL centrifuge tubes
5. sandwich baggies
6. large weighing boats
7. 0.1-μm syringe filters

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[1] From a risk assessment point of view, it is important not to promote precipitation of the radionuclide by introducing too high a spike concentration into the sediment-groundwater system. This may be construed by regulators and reviewers of the COL application as a **non-conservative** estimate of the sorption capacity of the sediment for the radionuclide. Additionally, this may result in the precipitation of radionuclide to glassware, an experimental artifact that would be difficult (costly) to identify.

[2] The isotopes listed here differ from the isotopes of concern to facilitate measurements and save time. The degree that elements sorb to soil, i.e., their K_d value, do not differ between isotopes of the same element. Therefore the K_d value for Co-60 is the same as Co-57.

8. 0.5-M NaOH
9. pH meter
10. 0.01 M $CaCl_2$
11. Number 270 sieve (2-mm)

Methods

1. **Drying soil.** Mix field-moist sediments in jars. Transfer to a labeled aluminum weighing boats and place on counter top and permit to dry. Pass sediments through a 2-mm (No. 270) sieve.
2. Measure pH as described in procedure ASTM D 4972 01 (See attachment). Record the pH_{water} values in Table 1.
3. Record "Tube Tare (g)" weight (without cap) of labeled 15-mL centrifuge tube as identified in Table 10 and Table 11.
4. Add 0.5±0.01-g of sieved soil to each tube. Weigh and record "Soils (g)"
5. **Equilibrating soils to the groundwater.** Add 12-mL of appropriate groundwater to each tube as defined in Table 1. Put on shaker for overnight. Let sit for 1 hr. Decant liquid. If solids do not separate from the liquid, centrifuge at 15 min 6000 rpm. Then decant liquid. Throw away liquid. Error on the side of leaving liquid in tube rather than accidentally losing clays down the drain. Add 10 mL of appropriate groundwater to each tube. Also add 10-mL groundwater to the five Controls (sample # 521-A, 521-B, 521-C, 522-A, and 522-B). Record weight of each tube in "Tube + soils + Equil + GW (g)"
6. **Adding radionuclides to suspension.** Move rack of tubes to rad hood. Add 170-µL of Fe-55, Ni-59, and Pu-238 spike solution to each tube. Also add this to the No-soil Controls, (sample # 521-A, 521-B, 521-C), but **not** to Blank Controls (522-A, and 522-B). Gently shake or swirl tube sediment and solution in each tube.
7. **pH adjust suspension.** Because the spike solution is in a ~0.1 M HCl solution, you will need to add base to bring the suspensions back to their native pH. Using 0.5 M NaOH and litmus paper, add base to bring pH back to native sediment pH (1:1) noted in Table 1. Record "Final pH" you adjusted tube to.
8. **Equilibrating radionuclides with soil suspension.** Leave samples in rad hood for minimum of 2 days. During this equilibration period, shake rake of tubes twice a day for 10 seconds.
9. Collect liquids by drawing liquids into a syringe and then passing liquid through a 0.1-µm filter.
10. **Gamma Analysis.** Submit to Analytical Development Section for low energy gamma spec analysis. Note in your order, Travel Copy, that this is an expedited order, and the rads of interest are Fe-55, Ni-59, Pu-238, Co-57, Cs-137, and Sr-85.

For Co, Cs, and Sr K_d Measurements

11. Follow same procedure as Steps 1-10 above. Except
    a. Label tubes with an "a;" (e.g., 501a-A, 501a-B, 502a-A) as described in Table 2.
    b. In step 6, instead of adding Fe, Ni, and Pu, add Co-57, Cs-137, and Sr-85.

Safety, Hazards Assessment Package:

SRNL-EST-2006-00-93.

Hazards:

Radionuclides, ~3 mL of strong acids, ~3 mL of strong base

Hazards Mitigation:

Radionuclides: Follow training of Rad Worker II,
Strong Acid: wear appropriate gloves and as always, wear protective eye ware
Strong Base: wear appropriate gloves and as always, wear protective eye ware

Table 10. Sediment descriptions and weights for Fe, Ni, and Pu K_d measurements.

Tube #	Boring/Sample Number	Rep	Ground-water	Sediment pH (1:1)	Tube Tare (g)	Soil (g)	Tube + Soil + Equil + GW (g)	Final pH
Method Step			(5)	(2)	(3)	(4)	(5)	(7)
501-A	B308/SS15	1	308-U					
501-B		2						
502-A	B308/SS25	1	308-L					
502-B		2						
503-A	B332/SS12	1	332-U					
503-B		2						
504-A	B332/SS23	1	332-La					
504-B		2						
505-A	B348/SS8	1	348-U					
505-B		2						
506-A	B348/SS17	1	348-L					
506-B		2						
507-A	B349/SS14	1	349-U					
507-B		2						
508-A	B349/SS23	1	349-L					
508-B		2						
509-A	B408/SS14	1	408-U					
509-B		2						
510-A	B408/SS22	1	408-L					
510-B		2						
511-A	B438/SS12	1	438-U					
511-B		2						
512-A	B438/SS24	1	438-L					
512-B		2						
513-A	B910/SS14	1	910-U					
513-B		2						
514-A	B910/SS24	1	910-L					
514-B		2						
515-A	B930/SS14	1	930-U					
515-B		2						
516-A	B930/SS27	1	930-L					
516-B		2						
517-A	B933/SS14	1	933-U					
517-B		2						
518-A	B933/SS24	1	933-L					
518-B		2						
519-A	B934/SS15	1	934-U					
519-B		2						
520-A	B934/SS26	1	934-L					
520-B		2						
521-A	Spike control	1	308-U					
521-B		2						
521-C		3						
522-A	Blank control	2	308-U					
522-B		3						

Table 11. Sediment descriptions and weights for Co, Cs, and Sr K_d measurements.

Tube #	Boring/Sample Number	Rep	Ground-water	Sediment pH (1:1)	Tube Tare (g)	Soil (g)	Tube + Soil + Equil + GW (g)	Final pH
Method Step			(5)	(2)	(3)	(4)	(5)	(7)
501a-A	B308/SS15	1	308-U					
501a-B		2						
502a-A	B308/SS25	1	308-L					
502a-B		2						
503a-A	B332/SS12	1	332-U					
503a-B		2						
504a-A	B332/SS23	1	332-La					
504a-B		2						
505a-A	B348/SS8	1	348-U					
505a-B		2						
506a-A	B348/SS17	1	348-L					
506a-B		2						
507a-A	B349/SS14	1	349-U					
507a-B		2						
508a-A	B349/SS23	1	349-L					
508a-B		2						
509a-A	B408/SS14	1	408-U					
509a-B		2						
510a-A	B408/SS22	1	408-L					
510a-B		2						
511a-A	B438/SS12	1	438-U					
511a-B		2						
512a-A	B438/SS24	1	438-L					
512a-B		2						
513a-A	B910/SS14	1	910-U					
513a-B		2						
514a-A	B910/SS24	1	910-L					
514a-B		2						
515a-A	B930/SS14	1	930-U					
515a-B		2						
516a-A	B930/SS27	1	930-L					
516a-B		2						
517a-A	B933/SS14	1	933-U					
517a-B		2						
518a-A	B933/SS24	1	933-L					
518a-B		2						
519a-A	B934/SS15	1	934-U					
519a-B		2						
520a-A	B934/SS26	1	934-L					
520a-B		2						
521a-A	Spike control	1	308-U					
521a-B		2						
521a-C		3						
522a-A	Blank control	2	308-U					
522a-B		3						

Designation: D 4972 – 01

Standard Test Method for pH of Soils[1]

This standard is issued under the fixed designation D 4972; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope *

1.1 This test method covers the measurement of the pH of soils for uses other than for corrosion testing. Such measurements are used in the agricultural, environmental, and natural resources fields. This measurement determines the degree of acidity or alkalinity in soil materials suspended in water and a 0.01 *M* calcium chloride solution. Measurements in both liquids are necessary to fully define the soil's pH. This variable is useful in determining the solubility of soil minerals and the mobility of ions in the soil and assessing the viability of the soil-plant environment. A more detailed discussion of the usefulness of this parameter is not warranted here; however, it can be found in many discussions of the subject. A few such discussions are given as Refs (**1-6**)[2] at the end of the text.

1.2 The values given in SI units are to be regarded as the standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials[3]

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[4]

D 1193 Specification for Reagent Water[5]

D 3740 Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction[6]

G 51 Test Method for pH of Soil for Use in Corrosion Testing[7]

3. Terminology

3.1 *Definitions:*

3.1.1 For common definitions of terms used in this standard, refer to Terminology D 653.

4. Summary of Test Method

4.1 Measurement of the pH of soils in both suspensions of water and a calcium chloride solution are made with either a potentiometer using a pH sensitive electrode system (Method A), or pH sensitive paper (Method B). The potentiometer is calibrated with buffer solutions of known pH. The pH sensitive paper is a less accurate measurement and should only be used for a rough estimate of the soil pH. The electrode must be used for this measurement unless the pH sensitive paper is specified.

5. Significance and Use

5.1 The pH of the soil is a useful variable in determining the solubility of soil minerals and the mobility of ions in the soil and assessing the viability of the soil-plant environment.

5.2 pH measurements are made in both water and a calcium chloride solution because the calcium displaces some of the exchangeable aluminum. The low ionic strength counters the dilution effect on the exchange equilibrium by setting the salt concentration of the solution closer to that expected in the soil solution. The pH values obtained in the solution of calcium chloride are slightly lower than those measured in water due to the release of more aluminum ions which then hydrolyses. Therefore, both measurements are required to fully define the character of the soil's pH.

5.3 For the purpose of this test method the test soil must be sieved through a No. 10 sieve (2 mm sieve mesh openings). Measurements on soils or soil fractions having particle sizes larger than 2 mm by this test method may be invalid. If soil or soil fractions with particles larger than 2 mm are used, it must be stated in the report since the results may be significantly different.

5.4 All water used for this test method must be ASTM Type III or better. Type III water is defined by Specification D 1193. It is prepared by distillation, ion exchange, reverse osmosis, or a combination thereof.

6. Interferences

6.1 This test method as measured by a pH probe has possible interferences due to a suspension effect or sedimentation potential. Users interested in a detailed discussion of the

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.22 on Soil as a Medium for Plant Growth.

Current edition approved Jan. 10, 2001. Published February 2001. Originally published as D 4972 – 89. Last previous edition D 4972 – 95a.

[2] The boldface numbers in parentheses refer to a list of references at the end of the test method.

[3] *Annual Book of ASTM Standards*, Vol 04.02.

[4] *Annual Book of ASTM Standards*, Vol 04.09.

[5] *Annual Book of ASTM Standards*, Vol 11.01.

[6] *Annual Book of ASTM Standards*, Vol 04.08.

[7] *Annual Book of ASTM Standards*, Vol 03.02.

*A Summary of Changes section appears at the end of this standard.

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mechanism of this effect can find it in Refs (5) and (6).

6.2 This effect is the main reason Test Method G 51 can not be used for general measurement of pH outside of that for corrosion analysis. Test Method G 51 measures pH (an aqueous parameter) without adding any aqueous phase to the soil. This results in excessive soil particle-pH probe contact that overestimates the activity of the hydrogen ions in solution and is therefore unacceptable for general soil analysis.

6.3 The suspension effect can be mitigated by careful attention to 10.1.

7. Apparatus

7.1 *Method A, pH Meter*—Potentiometer equipped with glass-calomel electrode system. Follow the manufacturer's instructions for the pH meter used. A silver/silver chloride electrode system or similar is also acceptable.

7.2 *Method B, pH Paper*—pH paper sensitive to a pH range from 1 to 12, with resolution to the nearest 0.2 pH unit.

8. Reagents

8.1 *Purity of Reagents*—Reagent grade chemicals should be used in all tests. Unless otherwise indicated, it is intended that all reagents should conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.[8] Other grades may be used, provided it is first ascertained that the reagent is of sufficient purity to permit its use without lessening the accuracy of the determination.

8.2 *Purity of Water*—All water used for this test method must be ASTM Type III or better. Type III water is defined by Specification D 1193. It is prepared by distillation, ion exchange, reverse osmosis, or a combination thereof.

8.3 *Acid Potassium Phthalate Buffer Solution* (0.05 *M*)—Dissolve 10.21 g (dried 1 h at 105°C) of potassium phthalate in water and dilute to 1 L. The pH of this solution should be 4.0 at 20°C. Protect the solution against evaporation and against contamination with molds. Replace the solution when mold is noticed. The effect of temperature is as follows:

°C	pH
5 to 37	4.0

This illustrates that the pH of the solution does not change over the range in temperature from 5 to 37°C.

8.4 *Calcium Chloride Stock Solution* (1.0 *M*)—Dissolve 147 g of $CaCl_2 \cdot 2H_2O$ in water in a 1-L volumetric flask, cool, dilute to volume with water, and mix.

8.5 *Calcium Chloride Solution* (0.01 *M*)—Dilute 20.0 mL of stock 1.0 *M* $CaCl_2$ solution to 2 L with water. The pH of this solution should be between 5 and 7.

8.6 *Phosphate Buffer Solution* (0.025 *M*)—Dissolve 3.40 g of KH_2PO_4 and 3.55 g of KH_2HPO_4 in water and dilute to 1 L. Dry salts 2 h at 130°C before use. The pH of this solution should be 6.9 at 20°C. The effect of temperature is as follows:

°C	pH
0	7.0
10	6.9
20	6.9
30	6.8
40	6.8

9. Calibration of pH Meter

9.1 Calibrate the pH meter using the acid potassium phthalate and phosphate buffer solutions. Adjustment of the pH meter should follow the manufacturer's direction.

10. Procedure

10.1 When making measurements with the pH electrode, place the electrode into the partially settled suspension to mitigate the suspension effect.

10.2 For both methods, begin with an air dried soil that has been sieved through a No. 10 sieve (2 mm holes) to remove the coarser soil fraction. Air drying the soil is necessary to accomplish sieving and to control the amount of water present at the time of measurement.

10.3 *pH in Distilled Water*—For both methods, weigh out approximately 10 g of air dried soil. Place the soil into a glass container and add approximately 10 mL of water. Mix thoroughly and let stand for 1 h.

10.4 *Method A*—Read pH on pH meter.

10.5 *Method B*—Read pH on pH paper.

10.6 *pH in 0.01 M Calcium Chloride Solution*—For both methods weigh out approximately 10 g of air dried soil. Place the soil into a glass container and add approximately 10 mL of the 0.01 *M* $CaCl_2$ solution. Mix thoroughly and let stand for 1 h.

10.7 *Method A*—Read pH on pH meter.

10.8 *Method B*—Read pH on pH paper.

10.9 The mixture should be at approximately room temperature (15 to 25°C) at the time of pH measurement.

11. Report

11.1 Report the pH of the soil to the first decimal place. Specify which of the pH measurements is in water and which is in the calcium chloride solution. Also specify whether the determinations were made with Method A or Method B. If size fractions other than sieved through the No. 10 sieve are used, it must be stated in the report since the results may be significantly different.

12. Precision and Bias

12.1 *Precision:*

12.1.1 *Within-Laboratory Precision*—The within laboratory standard deviations for Method A are 0.031 (pH units) for the water mixture and 0.139[9] (pH units) for the calcium chloride mixture. Therefore, results of two properly conducted tests in the same or different laboratories should not differ by more than 0.065[9] (pH units) for the water mixture and 0.389 pH units for the calcium chloride mixture. The within-laboratory standard deviations for Method B are 0.189 (pH units) for the water mixture and 0.212[9] (pH units) for the calcium chloride mixture.

[8] *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmaceutical Convention, Inc. (USPC), Rockville, MD.

[9] These data satisfy the 1S and D2S requirements outlined in Practice C 670.

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Therefore, results of two properly conducted tests in the same or different laboratories should not differ by more than 0.53[9] (pH units) for the water mixture and 0.60 pH units for the calcium chloride mixture.

12.1.1.1 The precision of Method A presented was determined by the National Technical Center of the United States Department of Agriculture. In their evaluation they used 174 replicates for the water mixture and 32 replicates in testing the calcium chloride mixture.

12.1.1.2 The precision of Method B presented was determined by the United States Army Environmental Hygiene Agency. In their evaluation they used 25 replicates in testing each mixture.

12.1.2 *Between-Laboratory Precision*—The between-laboratory standard deviation has not been determined for either method. Subcommittee D18.22 is actively seeking data to evaluate the between laboratory precision of this test method.

12.2 *Bias*—There is no accepted reference value for this test method; therefore, bias cannot be determined.

13. Keywords

13.1 acidity; alkalinity; pH; reaction; soil

REFERENCES

(1) Garrels, R. M., and Christ, C. L., *Solutions, Minerals, and Equilibria*, Freeman Cooper, San Francisco, CA, 1965.

(2) Greenland, D. J., and Hayes, M. H. B., *The Chemistry of Soil Processes*, Wiley, New York, NY, 1981.

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(4) Davies, J. T., and Rideal, E. K., *Interfacial Phenomena*, Academic, New York, NY, 1963.

(5) Hunter, R. J., *Zeta Potential in Colloid Science*, Academic, New York, NY, 1981.

(6) Perrin, D. D., and Dempsey, B., *Buffers for pH and Metal Ion Control*, Chapman and Hall, London, United Kindom, 1974.

SUMMARY OF CHANGES

This section identifies location of changes to this practice since the last edition.

(1) Added Practice D 3740 and Terminology D 653 to Referenced Documents.

(2) Added Section 3 on Terminology.

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METHOD 9081

CATION-EXCHANGE CAPACITY OF SOILS (SODIUM ACETATE)

1.0 SCOPE AND APPLICATION

1.1 Method 9081 is applicable to most soils, including calcareous and noncalcareous soils. The method of cation-exchange capacity by summation (Chapman, 1965, p. 900; see Paragraph 10.1) should be employed for distinctly acid soils.

2.0 SUMMARY OF METHOD

2.1 The soil sample is mixed with an excess of sodium acetate solution, resulting in an exchange of the added sodium cations for the matrix cations. Subsequently, the sample is washed with isopropyl alcohol. An ammonium acetate solution is then added, which replaces the adsorbed sodium with ammonium. The concentration of displaced sodium is then determined by atomic absorption, emission spectroscopy, or an equivalent means.

3.0 INTERFERENCES

3.1 Interferences can occur during analysis of the extract for sodium content. Thoroughly investigate the chosen analytical method for potential interferences.

4.0 APPARATUS AND MATERIALS

4.1 Centrifuge tube and stopper: 50-mL, round-bottom, narrow neck.

4.2 Mechanical shaker.

4.3 Volumetric flask: 100-mL.

5.0 REAGENTS

5.1 Sodium acetate (NaOAc), 1.0 N: Dissolve 136 g of $NaC_2H_3O_2 \cdot 3H_2O$ in water and dilute it to 1,000 mL. The pH of this solution should be 8.2. If needed, add a few drops of acetic acid or NaOH solution to bring the reaction of the solution to pH 8.2.

5.2 Ammonium acetate (NH_4OAc), 1 N: Dilute 114 mL of glacial acetic acid (99.5%) with water to a volume of approximately 1 liter. Then add 138 mL of concentrated ammonium hydroxide (NH_4OH) and add water to obtain a volume of about 1,980 mL. Check the pH of the resulting solution, add more NH_4OH, as needed, to obtain a pH of 7, and dilute the solution to a volume of 2 liters with water.

5.3 Isopropyl alcohol: 99%.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 All samples must be collected using a sampling plan that addresses the considerations discussed in Chapter Nine of this manual.

7.0 PROCEDURE

7.1 Weigh 4 g of medium- or fine-textured soil or 6 g of coarse-textured soil and transfer the sample to a 50-mL, round-bottom, narrow-neck centrifuge tube. (A fine soil has >50% of the particles ≤0.074 mm, medium soil has >50% ≥0.425 mm, while a coarse soil has more than 50% of its particles ≥2 mm.

7.2 Add 33 mL of 1.0 N NaOAc solution, stopper the tube, shake it in a mechanical shaker for 5 min, and centrifuge it until the supernatant liquid is clear.

7.3 Decant the liquid, and repeat Paragraph 7.2 three more times.

7.4 Add 33 mL of 99% isopropyl alcohol, stopper the tube, shake it in a mechanical shaker for 5 min, and centrifuge it until the supernatant liquid is clear.

7.5 Repeat the procedure described in Paragraph 7.4 two more times.

7.6 Add 33 mL of NH_4OAc solution, stopper the tube, shake it in a mechanical shaker for 5 min, and centrifuge it until the supernatant liquid is clear. Decant the washing into a 100-mL volumetric flask.

7.7 Repeat the procedure described in Paragraph 7.6 two more times.

7.8 Dilute the combined washing to the 100-mL mark with ammonium acetate solution and determine the sodium concentration by atomic absorption, emission spectroscopy, or an equivalent method.

8.0 QUALITY CONTROL

8.1 All quality control data should be maintained and available for easy reference or inspection.

8.2 Employ a minimum of one blank per sample batch to determine if contamination or any memory effects are occurring.

8.3 Materials of known cation-exchange capacity must be routinely analyzed.

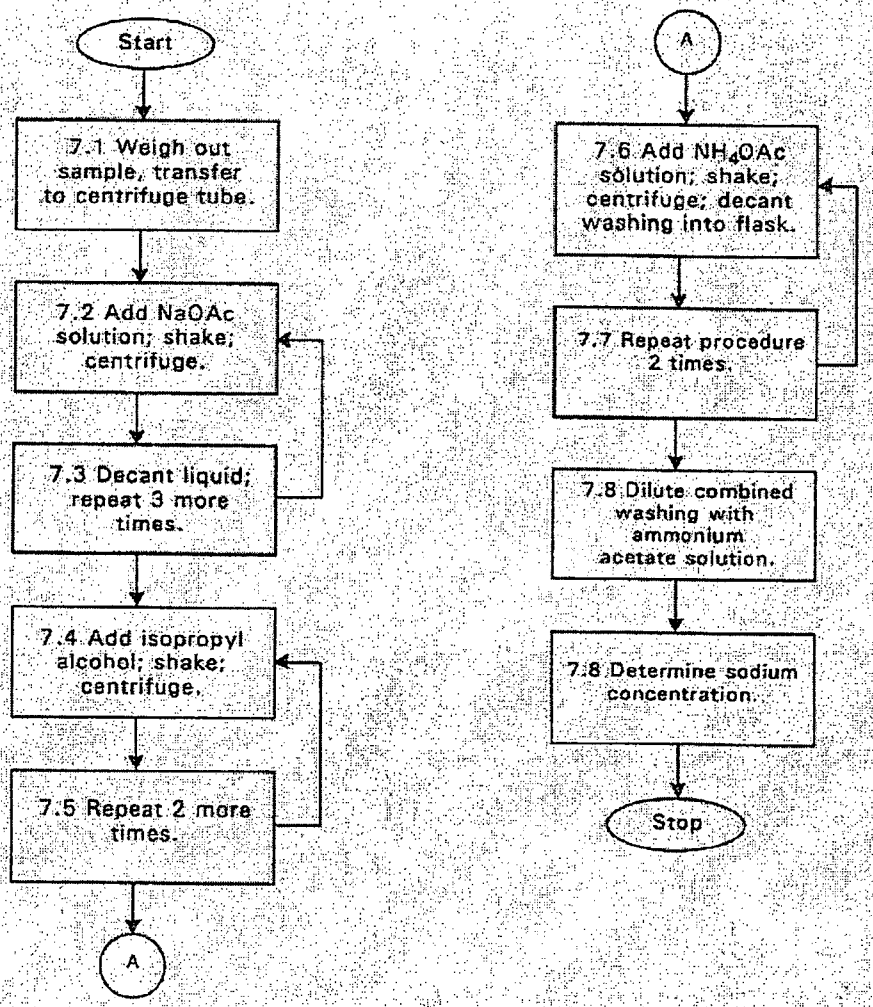
9.0 METHOD PERFORMANCE

9.1 No data provided.

10.0 REFERENCES

10.1 This method is based on Chapman, H.D., "Cation-exchange Capacity," pp. 891-900, in C.A. Black (ed.), Method of Soil Analysis, Part 2: Chemical and Microbiological Properties, Am. Soc. Agron., Madison, Wisconsin (1965).

METHOD 9081
CATION-EXCHANGE CAPACITY OF SOILS (SODIUM ACETATE)



APPENDIX B. RADIOISOTOPE CERTIFICATION

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Analytics

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Atlanta, Georgia [illegible]
[illegible]
Fax [illegible]
www.analytics.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

TS279-147

Co-57 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated with an ionization chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards.

Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and assay data for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurement Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Co-57
ACTIVITY (Bq):	1.[illegible] E8
HALF-LIFE:	271.79 days
CALIBRATION DATE:	June 14, 2007 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	1.7%

Impurities: γ-impurities <0.1%

5.05210 grams 0.1M HCl solution with 30 µg/g Co carrier.

P O NUMBER: [illegible], Item 3

SOURCE PREPARED BY: [signature]
M. I. Tankeeva, Radiochemist

Q A APPROVED: [signature] 6-14-07

Eckert & Ziegler
Analytics

[illegible]
Atlanta, Georgia [illegible]
Tel [illegible]
Fax [illegible]
[illegible]

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

TS2TG-197

Sr-89 10 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated with an ionization chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards.

Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and assay data for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Sr-89
ACTIVITY (kBq):	1.042 GB
HALF-LIFE:	50.53 days
CALIBRATION DATE:	June 19, 2007 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	1.7%

Impurities: γ-impurities <0.1%

10.00010 grams 0.1M HCl solution with 10 µg/g Sr carrier.

P O NUMBER: AC001070, Item 1

SOURCE PREPARED BY: [signature]
N. I. Tankersley, Radiochemist

Q A APPROVED: [signature] 6/19/07

Corporate Office
[illegible]

Laboratory
[illegible] Atlanta, Georgia [illegible]

Eckert & Ziegler
Analytics

1400 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.eziegler.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

79230-141

Cs-137 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated with an ionization chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards.

Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The NUCLEAR decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in ORNL Reg. Guide 4.15, Revision 1.

ISOTOPE:	Cs-137
ACTIVITY (Bq):	1.921 E6
HALF-LIFE:	3.007 E1 years
CALIBRATION DATE:	June 14, 2007 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	1.7%

Impurities: γ-Impurities <0.1%

4.01021 grams 0.1M HCl solution with 10 mg/g Cs carrier.

P O NUMBER: XXX0176, Item 7

SOURCE PREPARED BY: _____
M. I. Tuckerva, Radiochemist

Q A APPROVED: _____ 6-14-07

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CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

75202-187

Pu-238 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting and alpha spectrometry. The calibration was checked by liquid scintillation counting after source preparation.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in NBS Reg. Guide 4.15, Revision 1.

ISOTOPE:	Pu-238
ACTIVITY (Bq):	3.940 E4
HALF-LIFE:	87.7 years
CALIBRATION DATE:	June 14, 2007 13:00 EDT
RELATIVE EXPANDED UNCERTAINTY (k=2):	2.0%

Impurities: γ-impurities <0.1%, α-impurities <0.2%

5.47038 grams 3M HNO_3 solution.

P O NUMBER 4700010770, Item 11

SOURCE PREPARED BY: _____
H. I. Tsukanova, Radiochemist

Q A APPROVED: _____ 6-14-07

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Analytics

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Atlanta Georgia [illegible]
[illegible]
[illegible]
[illegible]

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

T5201-147

Ni-59 10 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master liquid radionuclide solution source. The master source was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay data for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Ni-59
ACTIVITY (Bq):	1.061 E3
HALF-LIFE:	7.600 E4 years
CALIBRATION DATE:	June 14, 2007 12:00 GMT
RELATIVE EXPANDED UNCERTAINTY (k=2):	4.5%

Impurities: γ-impurities <0.1%

2.00760 grams 0.1M HCl solution with 30 mg/g Ni carrier.

P O NUMBER: AC001970, Item 10

SOURCE PREPARED BY: [signature]
N. I. Tarbanov, Radiochemist

Q A APPROVAL: [signature] 6-27-07

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[illegible]
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Fax [illegible]
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CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

TS200-147

Fe-55 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master liquid radionuclide solution source. The master source was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay data for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Program as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Fe-55
ACTIVITY (kBq):	1.297 E3
HALF-LIFE:	1001.0 days
CALIBRATION DATE:	June 14, 2007 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	4.5%

Impurities: γ-impurities <0.1%

5.12918 grams 0.1M HCl solution with 30 µg/g Fe carrier

P O NUMBER 4C601075, Item 5

SOURCE PREPARED BY: [signature]
N. I. Tsukanova, Radiochemist

Q A APPROVED: [signature] 6-14-07

Corporate Office
[illegible] Atlanta, Georgia [illegible]

Laboratory
[illegible] Atlanta, Georgia [illegible]

APPENDIX C. Gamma Spectroscopy, ICP-AES, and pH Sample and QA Results

Table 12. pH calibration results.

Calibration Trial	Pre-calibration pH	Slope (%)	Post-calibration pH
A	7.03	98.7	7.03
B	7.03	97.8	7.03
C	7.02	97.5	7.03
D	7.01	97.0	7.02

[a] Calibrations were conducted at the start and end of measurements and after every 20 sample analyses.
[b] Calibration slopes <95% and >105% are deemed unacceptable. Differences in "Pre-calibration pH" and "Post-calibration pH" greater than 10% are deemed unacceptable. All calibration slopes and differences between pre- and post-calibration pH reading were acceptable.

Table 13. pH data.

TUBE	ID NUMBER	Repli-cate	pH (H_2O)	pH ($CaCl_2$)	pH avg (H_2O)	pH stdev (H_2O)	pH avg ($CaCl_2$)	pH stdev ($CaCl_2$)
STD 1	*Subsurf. Clayey Std*	1	4.37					
501-a	B308/SS15	1	8.94	8.15	8.97	0.04	8.16	0.01
501-b	B308/SS15	2	8.99	8.17				
502-a	B308/SS25	1	9.09	8.15	9.10	0.01	8.15	0.00
502-b	B308/SS25	2	9.1	8.15				
503-a	B332/SS12	1	9.26	8.32	9.27	0.01	8.31	0.02
503-b	B332/SS12	2	9.28	8.29				
504-a	B332/SS23	1	8.93	8.16	8.94	0.01	8.17	0.01
504-b	B332/SS23	2	8.94	8.17				
505-a	B348/SS8	1	9.19	8.18	9.22	0.04	8.17	0.02
505-b	B348/SS8	2	9.24	8.15				
506-a	B348/SS17	1	9.24	8.21	9.23	0.01	8.21	0.00
506-b	B348/SS17	2	9.22	8.21				
507-a	B349/SS14	1	9.33	8.24	9.33	0.00	8.25	0.01
507-b	B349/SS14	2	9.33	8.26				
508-a	B349/SS23	1	9.27	8.17	9.27	0.01	8.18	0.01
508-b	B349/SS23	2	9.26	8.18				
509-a	B408/SS14	1	9.07	8.17	9.06	0.01	8.16	0.02
509-b	B408/SS14	2	9.05	8.14				
510-a	B408/SS22	1	9.14	8.16	9.14	0.01	8.16	0.00
510-b	B408/SS22	2	9.13	8.16				
511-a	B438/SS12	1	9.11	8.15	9.12	0.01	8.15	0.00
511-b	B438/SS12	2	9.12	8.15				
512-a	B438/SS24	1	8.63	8.01	8.63	0.00	8.03	0.02
512-b	B438/SS24	2	8.63	8.04				
513-a	B910/SS14	1	8.71	8.16	8.91	0.28	8.17	0.01
513-b	B910/SS14	2	9.1	8.18				
514-a	B910/SS24	1	8.59	7.93	8.58	0.01	7.95	0.02
514-b	B910/SS24	2	8.57	7.96				
515-a	B930/SS14	1	8.9	8.05	8.91	0.01	8.05	0.00
515-b	B930/SS14	2	8.91	8.05				
516-a	B930/SS27	1	9.22	8.25	9.24	0.03	8.27	0.02
516-b	B930/SS27	2	9.26	8.28				
517-a	B933/SS14	1	9.31	8.2	9.32	0.01	8.20	0.00
517-b	B933/SS14	2	9.33	8.2				
518-a	B933/SS24	1	9.22	8.25	9.23	0.01	8.26	0.01
518-b	B933/SS24	2	9.24	8.26				
519-a	B934/SS15	1	9.21	8.19	9.24	0.04	8.21	0.02
519-b	B934/SS15	2	9.26	8.22				
520-a	B934/SS26	1	8.91	8.29	8.92	0.01	8.30	0.01
520-b	B934/SS26	2	8.93	8.3				
STD 2	*Subsurf. Clayey Std*	1	4.28					

Table 14. Na ICP-AES standards results (used for CEC analyses).

Sample IDs	Wavelength (nm)	Calibration Coefficient	Before QC (ppm)	After QC (ppm)
300241021-032	Na 589.592	0.999988613	5.12	5.11
300241252-263	Na 589.592	0.999997831	5.03	4.69
300241264-274	Na 589.592	0.999995106	5.31	4.83
300240736-747	Na 589.592	0.999998566	5.18	5.13

Table 15. Data used in the CEC calculations.

Expt No.	Sample ID	STP Soil	Rep	Soil Wt. (g)	[Na] (ppm)	CEC (meq/100 g)	avg CEC (meq/100g)	stdev CEC (meq/100g)
501-A	300240736	B308/SS15	1	5.355	12.8	0.82	0.75	0.095
501-B	300240737		2	5.3235	11.1	0.68		
502-A	300240738	B308/SS25	1	5.2688	47.5	3.69	3.36	0.466
502-B	300240739		2	5.2239	39.2	3.04		
503-A	300240740	B332/SS12	1	5.2672	8.48	0.47	0.38	0.137
503-B	300240741		2	5.2583	6.12	0.28		
504-A	300240742	B332/SS23	1	5.2825	8.87	0.50	0.63	0.182
504-B	300240743		2	5.2324	11.9	0.76		
505-A	300240744	B348/SS8	1	5.3345	14.6	0.97	0.84	0.177
505-B	300240745		2	5.3184	11.5	0.72		
Blank 1	300240746	No soil	1	na	2.75			
Std. 1	300240747	Subsurface Clayey	1	5.2064	42.2	3.30		
506-A	300241021	B348/SS17	1	5.0072	10.4	0.76	0.82	0.093
506-B	300241022		2	5.0022	11.9	0.89		
507-A	300241023	B349/SS14	1	5.0121	7.24	0.48	0.64	0.219
507-B	300241024		2	5.0084	10.8	0.79		
508-A	300241025	B349/SS23	1	5.0104	17.4	1.36	1.14	0.319
508-B	300241026		2	5.0124	12.2	0.91		
509-A	300241027	B408/SS14	1	5.0026	9.78	0.70	0.73	0.032
509-B	300241028		2	5.0055	10.3	0.75		
510-A	300241029	B408/SS22	1	5.0108	12	0.89	0.92	0.043
510-B	300241030		2	5.0128	12.7	0.96		
Blank 2	300241031	No soil	1	na	1.69			
Std. 2	300241032	Subsurface Clayey	1	5.0109	78.3	6.65		
511-A	300241252	B438/SS12	1	5.0103	29.3	2.53	2.07	0.652
511-B	300241253		2	5.0156	18.7	1.61		
512-A	300241254	B438/SS24	1	5.0297	15.2	1.30	0.92	0.541
512-B	300241255		2	5.0165	6.33	0.54		
513-A	300241256	B910/SS14	1	5.0047	13.8	1.19	1.29	0.150
513-B	300241257		2	5.0242	16.3	1.40		
514-A	300241258	B910/SS24	1	5.008	87.8	7.62	9.89	3.215
514-B	300241259		2	5.0027	140	12.16		
515-A	300241260	B930/SS14	1	5.0106	23.8	2.06	2.54	0.684
515-B	300241261		2	5.0044	34.9	3.02		
Blank 3	300241262	No soil	1	na	<0.119			
Std. 3	300241263	Subsurface Clayey	1	5.1006	64.4	5.48		
516-A	300241264	B930/SS27	1	5.0093	7.90	0.49	0.51	0.021
516-B	300241265		2	5.0194	8.25	0.52		
517-A	300241266	B933/SS14	1	5.008	25.8	2.05	1.93	0.170
517-B	300241267		2	5.0017	23.0	1.81		
518-A	300241268	B933/SS24	1	5.0041	11.8	0.83	0.85	0.023
518-B	300241269		2	5.0172	12.2	0.87		
519-A	300241270	B934/SS15	1	5.0117	16.7	1.26	1.30	0.060

519-B	300241271		2	5.0179	17.7	1.34		
520-A	300241272	B934/SS26	1	5.0089	13.6	0.99	0.75	0.339
520-B	300241273		2	4.9949	8.07	0.51		
Blank 4	300241274	No soil	1	na	2.21			
Std. 4	300241275	Subsurface Clayey	1	5.0054	74.4	6.27		

Table 16. Gamma analyses quality assurance results.

Explanation and overview of QA results for gamma analyses: A mark in the QA results in the "Deviation/Flags" column of "In" means the measured value needs to be "investigated", but the instrument is within specifications of the standard. A "Deviation/Flags" comment of "Ac" means the measured value is outside the acceptable range and "action" is required. The "action" flag indicates that the analyses results are unacceptable. During the 12 days of analysis, there were a total of 324 standard energies that were measured, of which three "investigate" flag and zero "action" flags were identified. Since the three "investigate" flags were not for the same instrument and for three back to back days, no action was required. These results indicate that all measurement QA standards were within specification.

Last Measurement Q.A. Report 7/12/07 7:34:40 AM Page 1

G E N I E Q U A L I T Y A S S U R A N C E

Last Results Report
7/12/07 7:34:40 AM

QA File:	C:\[illegible].QAF
Sample ID:	QA
Sample Quantity:	1.0000E+000
Measurement Date:	7/12/07 7:05:39 AM
Elapsed Live Time:	600.0 seconds
Elapsed Real Time:	605.3 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags LU SD UD MB
Am-241 Peak energy [0.00+/-0.00]	5.9540E+001	0.00
Cs-137 Peak energy [0.00+/-0.00]	6.6175E+002	0.00
Co-60 Peak energy [0.00+/-0.00]	1.3326E+003	0.00
Cs-137 Peak FWHM [0.00+/-0.00]	1.4021E+000	0.00
Am-241 activity [0.00+/-0.00]	1.7604E-002	0.00
Co-60 activity [0.00+/-0.00]	1.0801E-002	0.00
Cs-137 activity [0.00+/-0.00]	1.5347E-003	0.00

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
MB = Measurement Bias Test (In = Investigate, Ac = Action)

Lead Measurement Q.A. Report 7/12/07 10:53:20 AM Page 1

QUALITY ASSURANCE

Lead Results Report
7/12/07 10:53:20 AM

BK
3/20/07

QA File:	C:\GPC2\GPC2MCA.QAF
Sample ID:	QA
Sample Quantity:	1.00000E+000
Measurement Date:	7/12/07 10:37:45 AM
Elapsed Live Time:	900.0 seconds
Elapsed Real Time:	903.2 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags = LO : SD : UO : BD =
Am-241 Peak energy [0.00+/-0.00]	5.99900E-001	0.00 = : : : =
Cs-137 Peak energy [0.00+/-0.00]	6.61688E-001	0.00 = : : : =
Co-60 Peak energy [0.00+/-0.00]	1.33200E-000	0.00 = : : : =
Co-137 Peak FWHM [0.00+/-0.00]	1.27948E-000	0.00 = : : : =
Am-241 activity [0.00+/-0.00]	1.66310E-000	0.00 = : : : =
Co-60 activity [0.00+/-0.00]	1.65746E-002	0.00 = : : : =
Cs-137 activity [0.00+/-0.00]	1.51987E-002	0.00 = : : : =

Flags Key: LO = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UO = User Defined N-Sigma Test (In = Investigate, Ac = Action)
MD = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/16/07 8:35:34 AM Page 1

***** G E N I E Q U A L I T Y A S S U R A N C E *****

Last Results Report
7/16/07 8:35:34 AM

QA File: C:\GENIE2K\CAMFILES\LGHM05S1.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/16/07 7:00:55 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.0 seconds

SKB 7/16/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9512E+001	2.4483E-002
Am-241 Wtd mean activity [UD: 3.6200E-003+/- 0.000]	3.4744E-003	-7.7035E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.4020E-001	-7.7280E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2210E+002	7.1625E-002
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	6.3251E-001	1.7171E+000
Co-57 Wtd mean activity [UD: 8.9000E-005+/- 0.000]	9.2935E-005	1.3569E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8028E+001	-4.6234E-003
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	4.7110E-001	-6.8397E-001
Cd-109 Wtd mean activity [UD: 5.6550E-003+/- 0.002]	5.2665E-003	-2.0399E-001

Flags Key:
LU = Lower/Upper Bounds Test {Ab = Above, Be = Below}
SD = Sample Driven N-Sigma Test {In = Investigate, Ac = Action}
UD = User Driven N-Sigma Test {In = Investigate, Ac = Action}
BS = Measurement Bias Test {In = Investigate, Ac = Action}

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Last Measurement Q.A. Report        7/17/07    7:37:19 AM          Page  1

*****************************************************************************
*****          G E N I E   Q U A L I T Y   A S S U R A N C E          *****
*****************************************************************************

                              Last Results Report
                              7/17/07   7:37:19 AM

QA File:                  C:\GENIE2K\CAMFILES\LGAH05S1.QAF
Sample ID:
Sample Quantity:          1.0000E+000
Sample Date:
Measurement Date:         7/17/07   7:08:58 AM
Elapsed Live Time:          1000.0 seconds
Elapsed Real Time:          1001.9 seconds

Parameter Description              Value                Deviation/Flags
 [Mean +/- Std. Dev.]                               < LU : SD : UD : BS >

Am-241 Peak Energy               5.9506E+001             1.1452E-002
 [UD: 5.9500E+001+/- 0.500]                         <    :    :    :    >

Am-241 Wtd mean activity         3.3678E-003            -1.3345E+000
 [UD: 3.6200E-003+/- 0.000]                         <    :    :    :    >

Am-241 Peak FWHM                 4.7507E-001            -4.2419E-001
 [UD: 5.1749E-001+/- 0.100]                         <    :    :    :    >

Co-57 Peak energy                1.2210E+002             8.0826E-002
 [UD: 1.2206E+002+/- 0.500]                         <    :    :    :    >

Co-57 Peak FWHM                  3.8754E-001            -7.9261E-001
 [UD: 4.6680E-001+/- 0.100]                         <    :    :    :    >

Co-57 Wtd mean activity          8.1372E-005            -2.6302E-001
 [UD: 8.9000E-005+/- 0.002]                         <    :    :    :    >

Cd-109 Peak energy               8.8030E+001             3.2043E-004
 [UD: 8.8030E+001+/- 0.500]                         <    :    :    :    >

Cd-109 Peak FWHM                 5.1410E-001            -2.5401E-001
 [UD: 5.3950E-001+/- 0.100]                         <    :    :    :    >

Cd-109 Wtd mean activity         5.2585E-003            -2.1430E-001
 [UD: 5.6550E-003+/- 0.002]                         <    :    :    :    >

Flags Key:   LU = Lower/Upper Bounds Test        (Ab = Above, Be = Below)
             SD = Sample Driven N-Sigma Test     (In = Investigate, Ac = Action)
             UD = User Driven N-Sigma Test       (In = Investigate, Ac = Action)
             BS = Measurement Bias Test          (In = Investigate, Ac = Action)
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SKB 7/17/07

Last Measurement Q.A. Report 7/18/07 7:41:47 AM Page 1

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*****************************************************************************
*****       G E N I E   Q U A L I T Y   A S S U R A N C E              *****
*****************************************************************************
```

Last Results Report
7/18/07 7:41:47 AM

QA File: C:\GENIE2K\CAMFILES\1GAMQSS1.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/18/07 7:11:41 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.0 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9513E+001	2.6131E-002
Am-241 Wtd mean activity [UD: 3.6200E-003+/- 0.000]	3.4699E-003	-7.9399E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.7318E-001	-4.4310E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2210E+002	8.3817E-002
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	5.6009E-001	9.3289E-001
Co-57 Wtd mean activity [UD: 8.9000E-005+/- 0.000]	8.9683E-005	2.3550E-002
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8022E+001	-1.6129E-002
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	4.3859E-001	-1.0091E+000
Cd-109 Wtd mean activity [UD: 5.6550E-003+/- 0.002]	5.1774E-003	-2.3818E-001

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/23/07 7:41:40 AM Page 1

GENIE QUALITY ASSURANCE

Last Results Report
7/23/07 7:41:40 AM

SKB
7/23/07

QA File: C:\GENIE2K\CAMFILES\LGAM0551.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/23/07 7:10:35 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.9 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9507E+001	1.4465E-002
Am-241 Wtd mean activity [UD: 3.6200E-002+/- 0.000]	3.2987E-003	-1.7002E+000
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.7202E-001	-4.5468E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2212E+002	1.3827E-001
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	6.0082E-001	1.3402E+000
Co-57 Wtd mean activity [UD: 8.9000E-005+/- 0.000]	8.1080E-005	-2.7309E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8024E+001	-1.2299E-002
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	4.7869E-001	-6.0814E-001
Cd-109 Wtd mean activity [UD: 5.6550E-003+/- 0.002]	5.0461E-003	-3.2912E-001

Flags Key: LU = Lower/Upper Bounds Test [Ab = Above, Be = Below]
Sb = Sample Driven N-Sigma Test [In = Investigate, Ac = Action]
UD = User Driven N-Sigma Test [In = Investigate, Ac = Action]
BS = Measurement Bias Test [In = Investigate, Ac = Action]

Last Measurement Q.A. Report 7/24/07 7:43:17 AM Page 1

****
***** G E N I E Q U A L I T Y A S S U R A N C E *****
****

Last Results Report
7/24/07 7:43:17 AM

SEB 7/24/07

QA File: C:\GENIE2K\CAMFILES\LGAM0561.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/24/07 7:12:21 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.0 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LO : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9511E+001	2.1996E-000 < : : : >
Am-241 Wtd mean activity [UD: 3.6200E-003+/- 0.000]	3.4878E-003	-6.9972E-001 < : : : >
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.5870E-001	-5.8795E-001 < : : : >
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2206E+002	-2.1973E-003 < : : : >
Co-57 Peak FWHM [UD: 4.6580E-001+/- 0.100]	5.9420E-001	1.2740E+000 < : : : >
Co-57 Wtd mean activity [UD: 8.9000E-005+/- 0.000]	9.3834E-005	1.6670E-001 < : : : >
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8033E+001	5.9357E-003 < : : : >
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	4.7556E-001	-6.3938E-001 < : : : >
Cd-109 Wtd mean activity [UD: 5.6550E-003+/- 0.002]	5.1379E-003	-2.7954E-001 < : : : >

Flags Key:
LO = Lower/Upper Bounds Test {Ab = Above, Be = Below}
SD = Sample Driven N-Sigma Test {In = Investigate, Ac = Action}
UD = User Driven N-Sigma Test {In = Investigate, Ac = Action}
BS = Measurement Bias Test {In = Investigate, Ac = Action}

Last Measurement Q.A. Report 7/31/07 8:27:04 AM Page 1

```
*****************************************************************
*****        G E N I E   Q U A L I T Y   A S S U R A N C E      *****
*****************************************************************
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Last Results Report
7/31/07 8:27:04 AM

QA File: C:\GENIE2K\CAMFILES\LGAM0551.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/31/07 7:32:01 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.0 seconds

SKB 7/31/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU	SD	UD	BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9507E+001	1.4697E-002			
Am-241 Wtd mean activity [UD: 3.6200E-003+/- 0.000]	3.6188E-003	-5.3563E-001			
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.7677E-001	-4.6720E-001			
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2208E+002	4.5334E-002			
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	4.8963E-001	2.2828E-001			
Co-57 Wtd mean activity [UD: 8.9000E-005+/- 0.000]	8.8439E-005	-1.9337E-002			
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8029E+001	-2.3651E-003			
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	4.8861E-001	-5.0893E-001			
Cd-109 Wtd mean activity [UD: 5.6550E-003+/- 0.002]	5.2069E-003	-2.4221E-001			

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 8/2/07 9:19:18 AM Page 1

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*****************************************************************************
*****          G E N I E   Q U A L I T Y   A S S U R A N C E          *****
*****************************************************************************
```

Last Results Report
8/2/07 9:19:18 AM

QA File: C:\GENIE2K\CAMFILES\LGAM05S1.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 8/2/07 7:09:35 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.0 seconds

SKB 8/2/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9509E+001	8.8640E-003 < : : : >
Am-241 Wtd mean activity [UD: 3.6200E-003+/- 0.000]	3.4065E-003	-1.1294E+000 < : : : >
Am-241 Peak FWHM D: 5.1749E-001+/- 0.100]	4.6705E-001	-5.0440E-001 < : : : >
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2210E+002	8.1360E-002 < : : : >
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	5.2314E-001	5.6341E-001 < : : : >
Co-57 Wtd mean activity [UD: 8.9000E-005+/- 0.000]	8.2540E-005	-2.2276E-001 < : : : >
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8030E+001	-4.1199E-004 < : : : >
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.1361E-001	-2.5890E-001 < : : : >
Cd-109 Wtd mean activity [UD: 5.6550E-003+/- 0.002]	4.6684E-003	-5.3328E-001 < : : : >

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 8/3/07 7:34:10 AM Page 1

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*****************************************************************
*****        G E N I E   Q U A L I T Y   A S S U R A N C E      *****
*****************************************************************
```

Last Results Report
8/3/07 7:34:10 AM

QA File: C:\GENIE2K\CANFILES\LGAM05S1.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 8/3/07 7:12:54 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.0 seconds

SKB 8/3/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9518E+001	2.0279E-002
Am-241 Wtd mean activity [UD: 3.6200E-003+/- 0.000]	3.4041E-003	-1.1421E+000
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.4338E-001	-7.4106E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2219E+002	7.7774E-002
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	5.7009E-001	1.0329E+000
Co-57 Wtd mean activity [UD: 8.9000E-005+/- 0.000]	8.1232E-005	-2.5788E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8033E+001	6.3019E-003
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.6829E-001	2.8798E-001
Cd-109 Wtd mean activity [UD: 5.6550E-003+/- 0.002]	5.0820E-003	-3.0976E-001

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test [In = Investigate, Ac = Action]
UD = User Driven N-Sigma Test [In = Investigate, Ac = Action]
BS = Measurement Bias Test [In = Investigate, Ac = Action]

Last Measurement Q.A. Report 8/8/07 7:56:47 AM Page 1

***** G E N I E Q U A L I T Y A S S U R A N C E *****

Last Results Report
8/8/07 7:56:47 AM

QA File: C:\GENIE2K\CAMFILES\LGAM0551.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 8/8/07 7:09:19 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.9 seconds

SKB 8/8/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9508E+001	1.5411E-002
Am-241 Wtd mean activity [UD: 3.6200E-003+/- 0.000]	3.2781E-003	-1.8091E+000
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.5954E-001	-5.7950E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2208E+002	4.3808E-002
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	4.4752E-001	-1.9278E-001
Co-57 Wtd mean activity [UD: 8.9000E-005+/- 0.000]	7.7243E-005	-4.0540E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8032E+001	3.6774E-003
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	4.9008E-001	-4.9417E-001
Cd-109 Wtd mean activity [UD: 5.6550E-003+/- 0.002]	4.5345E-003	-6.0566E-001

Flags Key: LU = Lower/Upper Bounds Test (AB = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/16/07 8:34:14 AM Page 1

GENIE QUALITY ASSURANCE

Last Results Report
7/16/07 8:34:14 AM

SXD 7/16/07

QA File: C:\GENIE2K\CAMFILES\LXAM05S2.QAF
Sample ID: SAMPLE
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/16/07 7:00:49 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.3 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9505E+001	9.9106E-003 < : : : >
Am-241 Wtd mean activity [UD: 3.5900E-003+/- 0.000]	3.7270E-003	7.2461E-001 < : : : >
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.0248E-001	-1.5014E-001 < : : : >
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2207E+002	1.0513E-002 < : : : >
Co-57 Peak FWHM [UD: 4.4400E-001+/- 0.100]	6.5295E-001	2.0895E+000 < : :In : >
Co-57 Wtd mean activity [UD: 8.8700E-005+/- 0.000]	8.8001E-005	-4.8194E-002 < : : : >
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8038E+001	1.6479E-002 < : : : >
Cd-109 Peak FWHM [UD: 5.4700E-002+/- 0.100]	4.9647E-001	-5.0529E-001 < : : : >
Cd-109 Wtd mean activity [UD: 5.6090E-003+/- 0.002]	5.1286E-003	-2.1341E-001 < : : : >

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/17/07 7:35:46 AM Page 1

****
***** G E N I E Q U A L I T Y A S S U R A N C E *****
****

Last Results Report
7/17/07 7:35:46 AM

QA File: C:\GENIE2K\CAMFILES\LXAM0552.QAF
Sample ID: SAMPLE
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/17/07 7:06:51 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.6 seconds

SKB 7/17/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LD : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9505E+001	1.0895E-002
Am-241 Wtd mean activity [UD: 3.5900E-003+/- 0.000]	3.5859E-003	5.0718E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.1602E-001	-1.4696E-002
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2208E+002	4.0024E-002
Co-57 Peak FWHM [UD: 4.4800E-001+/- 0.100]	6.9936E-001	1.5136E+000
Co-57 Wtd mean activity [UD: 8.8700E-005+/- 0.000]	9.7502E-005	8.1256E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8054E+001	4.7363E-002
Cd-109 Peak FWHM [UD: 5.4700E-001+/- 0.100]	6.1655E-001	6.9551E-001
Cd-109 Wtd mean activity [UD: 5.6090E-003+/- 0.002]	5.4844E-003	-5.5398E-002

Flags Key:
LD = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/18/07 7:40:31 AM Page 1

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*****************************************************************************
*****        G E N I E   Q U A L I T Y   A S S U R A N C E            *****
*****************************************************************************
```

Last Results Report
7/18/07 7:40:31 AM

QA File: C:\GENIE2K\CAMFILES\1XRM0562.QAF
Sample ID: SAMPLE
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/18/07 7:11:34 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.6 seconds

S78 7/18/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9504E+001	7.8859E-003 < : : : >
Am-241 Wtd mean activity [UD: 3.5900E-003+/- 0.000]	3.6957E-003	5.5922E-001 < : : : >
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.8389E-001	-3.3605E-001 < : : : >
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2210E+002	8.6166E-002 < : : : >
Co-57 Peak FWHM [UD: 4.4800E-001+/- 0.100]	4.7566E-001	2.7663E-001 < : : : >
Co-57 Wtd mean activity [UD: 8.8700E-005+/- 0.000]	9.4131E-005	3.7454E-001 < : : : >
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8042E+001	2.3163E-002 < : : : >
Cd-109 Peak FWHM [UD: 5.4700E-001+/- 0.100]	5.8148E-001	3.4480E-001 < : : : >
Cd-109 Wtd mean activity [UD: 5.6090E-003+/- 0.002]	5.4115E-003	-8.7787E-002 < : : : >

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/19/07 7:50:59 AM Page 1

GENIE QUALITY ASSURANCE

Last Results Report
7/19/07 7:50:59 AM

QA File: C:\GENIE2K\CAMFILES\LXAM0552.QAF
Sample ID: SAMPLE
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/19/07 7:21:44 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.6 seconds

SKB 7/19/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9499E+001	-1.4954E-003
Am-241 Wtd mean activity [UD: 3.5900E-003+/- 0.000]	3.7021E-003	5.9200E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.3967E-001	2.2162E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2213E+002	1.3051E-001
Co-57 Peak FWHM [UD: 4.4890E-001+/- 0.100]	6.3778E-001	1.8978E+000
Co-57 Wtd mean activity [UD: 8.8700E-005+/- 0.000]	9.9970E-005	7.7727E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8006E+001	-4.7470E-002
Cd-109 Peak FWHM [UD: 5.4700E-001+/- 0.100]	5.5306E-001	6.0645E-002
Cd-109 Wtd mean activity [UD: 5.6090E-003+/- 0.002]	5.2866E-003	-1.4242E-001

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/20/07 7:36:13 AM Page 1

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*****************************************************************
*****        G E N I E   Q U A L I T Y   A S S U R A N C E      *****
*****************************************************************
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Last Results Report
7/20/07 7:36:13 AM

SKB 7/20/07

QA File: C:\GENIE2K\CAMFILES\LXAM0552.QAF
Sample ID: SAMPLE
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/20/07 7:15:20 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.5 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9500E+001	8.7738E-004 < : : : >
Am-241 Wtd mean activity [UD: 3.5900E-003+/- 0.000]	3.5846E-003	-2.8341E-002 < : : : >
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.3079E-001	1.3298E-001 < : : : >
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2206E+002	9.5367E-003 < : : : >
Co-57 Peak FWHM [UD: 4.4900E-001+/- 0.100]	6.9411E-001	2.0611E+000 < : :In : >
Co-57 Wtd mean activity [UD: 8.8700E-005+/- 0.000]	7.9239E-005	-6.5251E-001 < : : : >
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8024E+001	-1.2573E-002 < : : : >
Cd-109 Peak FWHM [UD: 5.8700E-001+/- 0.100]	4.8126E-001	-6.5737E-001 < : : : >
Cd-109 Wtd mean activity [UD: 5.6090E-003+/- 0.002]	5.1057E-003	-1.9704E-001 < : : : >

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/23/07 9:17:43 AM Page 1

G E N I E Q U A L I T Y A S S U R A N C E

Last Results Report
7/23/07 9:17:43 AM

QA File: C:\GENIE2K\CAMFILES\IXAM0552.QAF
Sample ID: SAMPLE
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/23/07 8:55:15 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.6 seconds

SKB 7/23/07

3rd count

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9500E+001	5.9509E-000
Am-241 Wtd mean activity [UD: 3.5900E-003+/- 0.000]	3.7923E-003	1.0704E+000
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.2349E-001	6.0026E-002
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2208E+002	3.7857E-002
Co-57 Peak FWHM [UD: 4.4800E-001+/- 0.100]	5.5614E-001	1.0814E+000
Co-57 Wtd mean activity [UD: 8.8700E-005+/- 0.000]	9.8152E-005	6.5188E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8010E+001	-4.0192E-002
Cd-109 Peak FWHM [UD: 5.4700E-001+/- 0.100]	5.9145E-001	4.4450E-001
Cd-109 Wtd mean activity [UD: 5.5090E-003+/- 0.002]	4.9865E-003	-2.7668E-001

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

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Last Measurement Q.A. Report        7/24/07    7:42:11 AM         Page  1

*****************************************************************************
*****        G E N I E   Q U A L I T Y   A S S U R A N C E              *****
*****************************************************************************

                              Last Results Report
                              7/24/07    7:42:11 AM

QA File:                  C:\GENIE2K\CAMFILES\LXAM0552.QAF
Sample ID:                SAMPLE
Sample Quantity:           1.0000E+000
Sample Date:
Measurement Date:         7/24/07    7:12:15 AM
Elapsed Live Time:           1000.0 seconds
Elapsed Real Time:           1002.7 seconds

Parameter Description             Value                  Deviation/Flags
 [Mean +/- Std. Dev.]                                 < LU : SD : UD : BS >

Am-241 Peak Energy               5.9498E+001               -3.3569E-003
 [UD: 5.9500E+001+/- 0.500]                           <   :    :    :    >

Am-241 Wtd mean activity         3.7641E-003                9.2117E-001
 [UD: 3.5900E-003+/- 0.000]                           <   :    :    :    >

Am-241 Peak FWHM                 5.3019E-001                1.2696E-001
 [UD: 5.1749E-001+/- 0.100]                           <   :    :    :    >

Co-57 Peak energy                1.2208E+002                3.5294E-002
 [UD: 1.2206E+002+/- 0.500]                           <   :    :    :    >

Co-57 Peak FWHM                  5.6660E-001                1.1860E+000
 [UD: 4.4800E-001+/- 0.100]                           <   :    :    :    >

Co-57 Wtd mean activity          1.0584E-004                1.1821E+000
 [UD: 8.8700E-005+/- 0.000]                           <   :    :    :    >

Cd-109 Peak energy               8.8015E+001               -3.0487E-002
 [UD: 8.8030E+001+/- 0.500]                           <   :    :    :    >

Cd-109 Peak FWHM                 5.9990E-001                5.2896E-001
 [UD: 5.4700E-001+/- 0.100]                           <   :    :    :    >

Cd-109 Wtd mean activity         5.3768E-003               -1.0322E-001
 [UD: 5.6090E-003+/- 0.002]                           <   :    :    :    >


Flags Key:   LU = Lower/Upper Bounds Test           (Ab = Above, Be = Below)
             SD = Sample Driven N-Sigma Test        (In = Investigate, Ac = Action)
             UD = User Driven N-Sigma Test          (In = Investigate, Ac = Action)
             BS = Measurement Bias Test             (In = Investigate, Ac = Action)
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Last Measurement Q.A. Report 7/31/07 8:25:52 AM Page 1

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*****************************************************************
*****        G E N I E   Q U A L I T Y   A S S U R A N C E      *****
*****************************************************************
```

Last Results Report
7/31/07 8:25:52 AM

SKB 7/31/07

QA File: C:\GENIE2K\CAMFILES\LXAM0SS2.QAF
Sample ID: SAMPLE
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/31/07 7:31:55 PM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.6 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9504E+001	7.3090E-003 < : : : >
Am-241 Wtd mean activity [UD: 3.5900E-003+/- 0.000]	3.6832E-003	4.9300E-001 < : : : >
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.9885E-001	-1.8639E-001 < : : : >
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2205E+002	-2.9160E-002 < : : : >
Co-57 Peak FWHM [UD: 4.4800E-001+/- 0.100]	5.2765E-001	7.9653E-001 < : : : >
Co-57 Wtd mean activity [UD: 8.8700E-005+/- 0.000]	7.5362E-005	-9.1988E-001 < : : : >
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8026E+001	-8.4534E-003 < : : : >
Cd-109 Peak FWHM [UD: 5.4700E-001+/- 0.100]	4.5000E-001	-9.6899E-001 < : : : >
Cd-109 Wtd mean activity [UD: 5.6090E-003+/- 0.002]	5.0745E-003	-2.3754E-001 < : : : >

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 8/2/07 9:18:15 AM Page 1

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*****************************************************************
*****        G E N I E   Q U A L I T Y   A S S U R A N C E      *****
*****************************************************************
```

Last Results Report
8/2/07 9:18:15 AM

SKB 8/2/07

QA File: C:\GENIE2K\CAMFILES\LKAM05S2.DAF
Sample ID: SAMPLE
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 8/2/07 7:09:28 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1051.5 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9501E+001	1.3895E-003
Am-241 Wtd mean activity [UD: 3.5900E-003+/- 0.000]	3.7639E-003	9.3058E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.2301E-001	5.5157E-002
Co 57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2207E+002	1.8819E-002
Co-57 Peak FWHM [UD: 4.4800E-001+/- 0.100]	6.1735E-001	1.6935E+000
Co-57 Wtd mean activity [UD: 8.8700E-005+/- 0.000]	8.3429E-005	1.8819E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8032E+001	4.3489E-003
Cd-109 Peak FWHM [UD: 5.4700E-001+/- 0.100]	5.4736E-001	3.5983E-003
Cd-109 Wtd mean activity [UD: 5.6090E-003+/- 0.002]	5.6431E-003	1.5133E-002

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 8/3/07 7:32:59 AM Page 1

GENIE QUALITY ASSURANCE

Last Results Report
8/3/07 7:32:59 AM

QA File: C:\GENIE2K\CAMFILES\LMRM0552.QAF
Sample ID: SAMPLE
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 8/3/07 7:12:49 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.6 seconds

SKB 8/3/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags LU	SD	UD	BS
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9506E+001	<	1.8953E-002		>
Am-241 Wtd mean activity [UD: 3.5900E-003+/- 0.000]	3.7737E-003	<	9.7206E-001		>
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.9654E-001	<	-2.0955E-001		>
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2205E+002	<	-1.5900E-002		>
Co-57 Peak FWHM [UD: 4.4800E-001+/- 0.100]	4.9129E-001	<	4.3289E-001		>
Co-57 Wtd mean activity [UD: 8.2700E-005+/- 0.000]	6.4841E-005	<	-2.6612E-001		>
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8031E+001	<	2.2430E-003		>
Cd-109 Peak FWHM [UD: 5.4700E-001+/- 0.100]	5.8142E-001	<	3.4431E-001		>
Cd-109 Wtd mean Activity [UD: 5.6090E-003+/- 0.002]	5.3640E-003	<	-1.0889E-001		>

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 8/7/07 7:43:37 AM Page 1

***** G E N I E Q U A L I T Y A S S U R A N C E *****

Last Results Report
8/7/07 7:43:37 AM

QA File: C:\GENIE2K\CAMFILES\LKRM0552.QAF
Sample ID: SAMPLE
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 8/7/07 7:11:29 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1001.5 seconds

SKB 8/7/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [SD: 5.9600E+001+/- 0.500]	5.9501E+001	2.1439E-003
Am-241 Wtd mean activity [UD: 3.5900E-003+/- 0.000]	3.6672E-003	4.0822E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.2795E-001	1.0464E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2207E+002	1.0849E-002
Co-57 Peak FWHM [UD: 4.4800E-001+/- 0.100]	6.9681E-001	2.4881E+000 :In
Co-57 Wtd mean activity [UD: 8.8700E-005+/- 0.000]	9.2148E-005	2.3779E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8036E+001	1.1200E-002
Cd-109 Peak FWHM [UD: 5.4700E-001+/- 0.100]	5.2389E-001	-2.3109E-001
Cd-109 Wtd mean activity [UD: 5.6090E-003+/- 0.002]	5.2126E-003	-1.7618E-001

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

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Last Measurement Q.A. Report        8/8/07    7:55:49 AM        Page  1

*************************************************************************
*****         G E N I E   Q U A L I T Y   A S S U R A N C E        *****
*************************************************************************

                         Last Results Report
                         8/8/07    7:55:49 AM

QA File:                   C:\GENIE2K\CAMFILES\LXAK0552.QAF
Sample ID:                 SAMPLE
Sample Quantity:           1.0000E+000
Sample Date:
Measurement Date:          8/8/07    7:09:13 AM
Elapsed Live Time:            1000.0 seconds
Elapsed Real Time:            1001.6 seconds

Parameter Description            Value              Deviation/Flags
 [Mean +/- Std. Dev.]                             < LU : SD : UD : BS >

Am-241 Peak Energy               5.9521E+001          4.2839E-002
 [UD: 5.9500E+001+/- 0.500]                       <    :    :    :    >

Am-241 Wtd mean activity         3.6089E-003          1.0025E-001
 [UD: 3.5900E-003+/- 0.000]                       <    :    :    :    >

Am-241 Peak FWHM                 5.1458E-001         -2.9139E-002
 [UD: 5.1749E-001+/- 0.100]                       <    :    :    :    >

Co-57 Peak energy                1.2209E+002          6.3522E-002
 [UD: 1.2206E+002+/- 0.500]                       <    :    :    :    >

Co-57 Peak FWHM                  5.3888E-001          9.0879E-001
 [UD: 4.4800E-001+/- 0.100]                       <    :    :    :    >

Co-57 Wtd mean activity          8.9876E-005          8.1090E-002
 [UD: 8.8700E-005+/- 0.000]                       <    :    :    :    >

Cd-109 Peak energy               8.8046E+001          3.2257E-002
 [UD: 8.8030E+001+/- 0.500]                       <    :    :    :    >

Cd-109 Peak FWHM                 5.2373E-001         -2.3265E-001
 [UD: 5.4700E-001+/- 0.100]                       <    :    :    :    >

Cd-109 Wtd mean activity         5.0212E-003         -2.6126E-001
 [UD: 5.6090E-003+/- 0.002]                       <    :    :    :    >

Flags Key:  LU = Lower/Upper Bounds Test       (Ab = Above, Be = Below)
            SD = Sample Driven N-Sigma Test    (In = Investigate, Ac = Action)
            UD = User Driven N-Sigma Test      (In = Investigate, Ac = Action)
            BS = Measurement Bias Test         (In = Investigate, Ac = Action)
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SRB
8/8/07

Last Measurement Q.A. Report 7/16/07 8:37:05 AM Page 1

***** G E N I E Q U A L I T Y A S S U R A N C E *****

Last Results Report
7/16/07 8:37:05 AM

QA File: C:\GENIE2K\CAMFILES\LG2AM5S3.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/16/07 7:00:59 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

SKB 7/16/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9569E+001	1.3749E-001
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.000]	3.6580E-003	3.8255E-001
Am-241 Peak FWHM [UD: 6.1749E-001+/- 0.100]	4.9584E-001	-2.1647E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2218E+002	2.4126E-001
Co-57 Peak FWHM [UD: 4.5600E-001+/- 0.100]	4.3842E-001	-2.8383E-002
Co-57 Wtd mean activity [UD: 8.856DE-005+/- 0.000]	9.6797E-005	3.1802E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8076E+001	9.1644E-002
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.4558E-001	6.0824E-002
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.5185E-003	-4.5847E-002

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/17/07 7:38:49 AM Page 1

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*****************************************************************
*****        G E N I E   Q U A L I T Y   A S S U R A N C E      *****
*****************************************************************
```

Last Results Report
7/17/07 7:38:49 AM

QA File: C:\GENIE2K\CAMFILES\LG2AM5S3.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/17/07 7:07:03 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

SRB 7/17/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9562E+001	1.2463E-001
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.000]	3.5404E-003	-1.9424E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.0820E-001	-9.2925E-002
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2221E+002	2.9523E-001
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	4.9004E-001	2.3264E-001
Co-57 Wtd mean activity [UD: 8.8560E-005+/- 0.000]	9.8515E-005	3.8413E-002
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8080E+001	9.9792E-002
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.5834E-001	1.8835E-001
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.3841E-003	-1.2051E-001

Flags Key:
LU = Lower/Upper Bounds Test (AB = Above, Be = Below)
SD = Sample Driven N-Sigma Test [In = Investigate, Ac = Action]
UD = User Driven N-Sigma Test [In = Investigate, Ac = Action]
BS = Measurement Bias Test [In = Investigate, Ac = Action]

Last Measurement Q.A. Report 7/18/07 7:43:07 AM Page 1

GENIE QUALITY ASSURANCE

Last Results Report
7/18/07 7:43:07 AM

SRB 7/18/07

QA File: C:\GENIE2K\CAMFILES\LG2AM5S3.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/18/07 7:11:06 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9566E+001	1.3216E-002 < : : : >
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.000]	3.6770E-003	4.7526E-001 < : : : >
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.0610E-001	-1.1388E-001 < : : : >
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2217E+002	2.1713E-001 < : : : >
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	6.3486E-001	1.6806E+000 < : : : >
Co-57 Wtd mean activity [UD: 8.8560E-005+/- 0.000]	9.9440E-005	4.2009E-001 < : : : >
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8089E+001	1.1860E-001 < : : : >
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.7075E-001	3.1249E-001 < : : : >
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.6982E-003	5.4025E-002 < : : : >

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/19/07 7:53:24 AM Page 1

GENIE QUALITY ASSURANCE

Last Results Report
7/19/07 7:53:24 AM

QA File: C:\GENIE2K\CAMFILES\LG2AMES3.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/19/07 7:21:56 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

SKB 7/19/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9562E+001	1.2476E-001
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.000]	3.7058E-003	6.1676E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.1692E-001	-5.6559E-003
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2217E+002	2.1201E-001
Co-57 Peak FWHM [UD: 4.6980E-001+/- 0.100]	5.4330E-001	7.6499E-001
Co-57 Wtd mean activity [UD: 8.8560E-005+/- 0.000]	9.8277E-005	3.7518E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8099E+001	1.3737E-001
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.7053E-001	3.1034E-001
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.7505E-003	8.3066E-002

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/20/07 7:38:46 AM Page 1

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*****************************************************************************
*****        G E N I E   Q U A L I T Y   A S S U R A N C E                 *****
*****************************************************************************
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Last Results Report
7/20/07 7:38:46 AM

SKB 7/20/07

QA File: C:\GENIE2K\CAMFILES\LG2AMS53.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/20/07 7:15:31 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LO : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9520E+001	4.0314E-002
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.000]	3.7588E-003	8.7642E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.1436E-001	-3.1306E-002
Co-57 Peak energy [UD: 1.2206E-002+/- 0.500]	1.2210E+002	7.2617E-002
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	5.8087E-001	1.1417E+000
Co-57 Wtd mean activity [UD: 8.8560E-005+/- 0.000]	1.0118E-004	4.8796E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8034E+001	8.5417E-003
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.3546E-001	-4.0397E-002
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.3542E-003	-1.3712E-001

Flags Key:
LO = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/24/07 7:45:02 AM Page 1

**** GENIE QUALITY ASSURANCE ****

Last Results Report
7/24/07 7:45:02 AM

QA File: C:\GENIE2K\CAMFILES\LG2AM553.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/24/07 7:12:26 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

SKB 7/24/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E-001+/- 0.500]	5.9542E-001	8.4351E-002
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.000]	3.7195E-003	6.0360E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.3410E-001	1.6610E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2216E+002	1.9897E-001
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	6.1935E-001	1.5255E+000
Co-57 Wtd mean activity [UD: 8.8560E-005+/- 0.000]	9.9741E-005	4.3171E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8077E+001	9.3903E-002
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.8450E-001	4.4996E-001
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.4224E-003	-9.9209E-002

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 7/23/07 7:42:55 AM Page 1

***** G E N I E Q U A L I T Y A S S U R A N C E *****

Last Results Report
7/23/07 7:42:55 AM

QA File: C:\GENIE2K\CAMFILES\LG2AM551.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/23/07 7:10:49 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

SKB 7/23/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9550E+001	9.9228E-002
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.000]	3.5854E-003	2.6496E-002
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.3446E-001	1.6969E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2219E+002	2.6822E-002
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	6.1358E-001	1.4679E+000
Co-57 Wtd mean activity [UD: 8.8560E-005+/- 0.000]	9.9141E-005	4.0853E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8077E+001	9.3201E-002
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.9667E-001	5.7172E-001
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.3123E-003	-1.6038E-001

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test [In = Investigate, Ac = Action]
UD = User Driven N-Sigma Test [In = Investigate, Ac = Action]
BS = Measurement Bias Test [In = Investigate, Ac = Action]

Last Measurement Q.A. Report 7/31/07 8:28:22 AM Page 1

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*****************************************************************
*****        G E N I E   Q U A L I T Y   A S S U R A N C E      *****
*****************************************************************
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Last Results Report
7/31/07 8:28:22 AM

SKB 7/31/07

QA File: C:\GENIE2K\CAMFILES\LG2AM553.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 7/31/07 7:32:06 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9515E+001	2.9160E-002
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.000]	3.7084E-003	6.2955E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.0680E-001	-8.6880E-002
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2208E+002	4.9102E-002
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	6.3841E-001	1.7161E+000
Co-57 Wtd mean activity [UD: 8.8560E-005+/- 0.000]	9.3906E-005	2.0256E-001
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.6020E+001	-1.8089E-002
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.8291E-001	4.3411E-001
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.4131E-003	-1.0439E-001

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 8/2/07 9:20:43 AM Page 1

GENIE QUALITY ASSURANCE

Last Results Report
8/2/07 9:20:43 AM

QA File: C:\GENIE2K\CAMFILES\LG2AM5S3.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 8/2/07 7:09:39 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

SKB 8/3/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9515E+001	3.0129E-002 < : : : >
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.000]	3.6725E-003	4.5343E-001 < : : : >
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.3484E-001	1.7352E-001 < : : : >
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2210E+002	8.9508E-002 < : : : >
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	5.1179E-001	4.4994E-001 < : : : >
Co-57 Wtd mean activity [UD: 8.8560E-005+/- 0.000]	8.8875E-005	1.2161E-002 < : : : >
Cd-109 Peak energy [UD: 8.0030E+001+/- 0.500]	8.0026E+001	-7.1869E-003 < : : : >
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.6932E-001	2.9822E-001 < : : : >
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.4013E-003	-1.3092E-001 < : : : >

Flags Key:
LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

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Last Measurement Q.A. Report        8/3/07      7:35:22 AM        Page  1

*****************************************************************************
*****         G E N I E   Q U A L I T Y   A S S U R A N C E          *****
*****************************************************************************

                          Last Results Report
                          8/3/07    7:35:22 AM

QA File:                   C:\GENIE2K\CAMFILES\LG2AMSS3.QAF
Sample ID:
Sample Quantity:           1.0000E+000
Sample Date:
Measurement Date:          8/3/07    7:13:02 AM
Elapsed Live Time:           1000.0 seconds
Elapsed Real Time:           1002.3 seconds

Parameter Description              Value                 Deviation/Flags
 [Mean +/- Std. Dev.]                                  < LU : SD : UD : BS >

Am-241 Peak Energy                5.9560E+001              1.2073E-001
 [UD: 5.9500E+001+/- 0.500]                            <    :    :    :    >

Am-241 Wtd mean activity          3.6112E-003              1.5280E-001
 [UD: 3.5800E-003+/- 0.000]                            <    :    :    :    >

Am-241 Peak FWHM                  4.9958E-001             -1.8909E-001
 [UD: 5.1749E-001+/- 0.100]                            <    :    :    :    >

Co-57 Peak energy                 1.2218E+002              2.3848E-001
 [UD: 1.2206E+002+/- 0.500]                            <    :    :    :    >

Co-57 Peak FWHM                   6.0266E-001              1.3586E+000
 [UD: 4.6680E-001+/- 0.100]                            <    :    :    :    >

Co-57 Wtd mean activity           8.8926E-005              1.0281E-002
 [UD: 8.8560E-005+/- 0.000]                            <    :    :    :    >

Cd-109 Peak energy                8.8087E+001              1.3310E-001
 [UD: 8.8030E+001+/- 0.500]                            <    :    :    :    >

Cd-109 Peak FWHM                  5.3552E-001             -3.9763E-002
 [UD: 5.3950E-001+/- 0.100]                            <    :    :    :    >

Cd-109 Wtd mean activity          5.0940E-003             -2.8164E-001
 [UD: 5.6010E-003+/- 0.002]                            <    :    :    :    >

Flags Key:   LU = Lower/Upper Bounds Test        (Ab = Above, Be = Below)
             SD = Sample Driven N-Sigma Test     (In = Investigate, Ac = Action)
             UD = User Driven N-Sigma Test       (In = Investigate, Ac = Action)
             BS = Measurement Bias Test          (In = Investigate, Ac = Action)
```

SCB 8/3/07

Last Measurement Q.A. Report 8/7/07 7:46:23 AM Page 1

**** G E N I E Q U A L I T Y A S S U R A N C E ****

Last Results Report
8/7/07 7:46:23 AM

QA File: C:\GENIE2K\CAMFILES\LG2AM583.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 8/7/07 7:11:43 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

SKB 8/7/07

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E+001+/- 0.500]	5.9565E+001	1.2556E-001
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.090]	3.5761E-003	-1.9231E-002
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	4.9896E-001	-1.8530E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.500]	1.2217E+002	2.1566E-001
Co-57 Peak FWHM [UD: 4.668OE-001+/- 0.100]	5.6669E-001	9.9993E-001
Co-57 Wtd mean activity [UD: 8.8560E-005+/- 0.000]	8.7096E-005	-2.5642E-002
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8104E+001	1.4893E-001
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.4532E-001	5.8297E-002
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.7169E-003	6.4405E-002

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

Last Measurement Q.A. Report 8/8/07 7:58:00 AM Page 1

****

***** G E N I E Q U A L I T Y A S S U R A N C E *****

Last Results Report
8/8/07 7:58:00 AM

SKB 8/8/07

QA File: C:\GENIE2K\CAMFILES\LG2AM553.QAF
Sample ID:
Sample Quantity: 1.0000E+000
Sample Date:
Measurement Date: 8/8/07 7:09:25 AM
Elapsed Live Time: 1000.0 seconds
Elapsed Real Time: 1002.3 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LU : SD : UD : BS >
Am-241 Peak Energy [UD: 5.9500E-001+/- 0.500]	5.9565E-001	1.2940E-001
Am-241 Wtd mean activity [UD: 3.5800E-003+/- 0.000]	3.6879E-003	5.2887E-001
Am-241 Peak FWHM [UD: 5.1749E-001+/- 0.100]	5.0741E-001	-1.0080E-001
Co-57 Peak energy [UD: 1.2206E+002+/- 0.600]	1.2217E+002	2.1643E-001
Co-57 Peak FWHM [UD: 4.6680E-001+/- 0.100]	6.6269E-001	1.9589E+000
Co-57 Wtd mean activity [UD: 8.8560E-005+/- 0.000]	9.0437E-005	7.2485E-002
Cd-109 Peak energy [UD: 8.8030E+001+/- 0.500]	8.8104E+001	1.4925E-001
Cd-109 Peak FWHM [UD: 5.3950E-001+/- 0.100]	5.1910E-001	-2.0398E-001
Cd-109 Wtd mean activity [UD: 5.6010E-003+/- 0.002]	5.1001E-003	-2.7830E-001

Flags Key: LU = Lower/Upper Bounds Test (Ab = Above, Be = Below)
SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
UD = User Driven N-Sigma Test (In = Investigate, Ac = Action)
BS = Measurement Bias Test (In = Investigate, Ac = Action)

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Last Measurement Q.A. Report          7/17/07  8:15:40 AM          Page  1

*****************************************************************************
*  *        G E N I E   Q U A L I T Y   A S S U R A N C E               *****
*****************************************************************************

                           Last Results Report
                           7/17/07  8:10:45 AM

QA File:                    C:\GENIE2K\CAMFILES\BTC2QA.QAF
Sample ID:                  QA
Sample Quantity:            1.0000E+000
Measurement Date:           7/17/07  7:55:28 AM
Elapsed Live Time:             900.0 seconds
Elapsed Real Time:             903.2 seconds

Parameter Description              Value                Deviation/Flags
 [Mean +/- Std. Dev.]                               < LU : SD : UD : MB >

Am-241 Peak energy               5.9598E+001                  0.00
        [0.00+/-0.00]                               <    :    :    :    >
Cs-137 Peak energy               6.6161E+002                  0.00
        [0.00+/-0.00]                               <    :    :    :    >
Co-60 Peak energy                1.3325E+003                  0.00
        [0.00+/-0.00]                               <    :    :    :    >
Cs-137 Peak FWHM                 1.2044E+000                  0.00
        [0.00+/-0.00]                               <    :    :    :    >
Am-241 activity                  1.7595E-003                  0.00
        [0.00+/-0.00]                               <    :    :    :    >
Co-60 activity                   1.6458E-003                  0.00
        [0.00+/-0.00]                               <    :    :    :    >
Cs-137 activity                  1.5033E-003                  0.00
        [0.00+/-0.00]                               <    :    :    :    >

Flags Key:   LU = Lower/Upper Bounds Test        (Ab = Above, Be = Below)
             SD = Sample Driven N-Sigma Test     (In = Investigate, Ac = Action)
             UD = User Driven N-Sigma Test       (In = Investigate, Ac = Action)
             MB = Measurement Bias Test          (In = Investigate, Ac = Action)
```

JPE

Lant Measurement Q.A. Report 7/17/07 8:10:50 AM Page 1

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*****************************************************************************
**  *        G E N I E   Q U A L I T Y   A S S U R A N C E          *****
*****************************************************************************
```

Lant Results Report
7/17/07 8:10:50 AM

QA File:	C:\GAMMA\SPECTRA\QA.QAF
Sample ID:	QA
Sample Quantity:	1.00000E+000
Measurement Date:	7/17/07 7:50:39 AM
Elapsed Live Time:	600.0 seconds
Elapsed Real Time:	605.1 seconds

Parameter Description [Mean +/- Std. Dev.]	Value	Deviation/Flags < LD : SD : UD : SB >
Am-241 Peak energy [0.00+/-0.00]	5.5507E+001	0.00
Cs-137 Peak energy [0.00+/-0.00]	6.6173E+002	0.00
Co-60 Peak energy [0.00+/-0.00]	1.3320E+003	0.00
Ba-133 Peak FWHM [0.00+/-0.00]	1.1390E+000	0.00
Am-241 activity [0.00+/-0.00]	1.7636E-002	0.00
Co-60 activity [0.00+/-0.00]	1.6021E-002	0.00
Cs-137 activity [0.00+/-0.00]	1.5204E-002	0.00

OK DAL

Flags Key: LD = Lower/Upper Bounds Test (Hb = Above, Bb = Below)
SD = Sample Driven H-Sigma Test (Hn = Investigate, Ac = Action)
OD = User Driven H-Sigma Test (Hn = Investigate, Ac = Action)
SB = Measurement Blank Test (Hn = Investigate, Ac = Action)

Table 17. Gamma analyses results for Co-57, Sr-85 and Cs-137.

ADP FILE/NOTEBOOK REF	WSRC-NB-2003-00207 PAGE 93	
Sample ID	300241078	
	Date Counted	
Comment	7/12/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.53E+03	1.29%
Sr-85	2.65E+03	1.60%
Cs-137	2.69E+02	1.84%
Sample ID	300241079	
	Date Counted	
Comment	7/12/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.62E+03	1.30%
Sr-85	2.70E+03	1.60%
Cs-137	2.82E+02	1.82%
Sample ID	300241080	
	Date Counted	
Comment	7/13/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.58E+03	1.30%
Sr-85	2.70E+03	1.60%
Cs-137	3.01E+02	1.77%
Sample ID	300241081	
	Date Counted	
Comment	7/13/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.15E+03	1.37%
Sr-85	2.60E+03	1.61%
Cs-137	1.39E+02	2.42%
Sample ID	300241082	
	Date Counted	
Comment	7/13/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	3.14E+03	1.28%
Sr-85	2.74E+03	1.60%
Cs-137	1.26E+03	1.27%

Sample ID	300241083	
	Date Counted	
Comment	7/13/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	3.19E+03	1.29%
Sr-85	2.72E+03	1.60%
Cs-137	1.22E+03	1.27%

Sample ID	300241084	
	Date Counted	
Comment	7/13/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.99E+03	1.30%
Sr-85	2.72E+03	1.60%
Cs-137	5.71E+02	1.48%

Sample ID	300241085	
	Date Counted	
Comment	7/14/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.97E+03	1.31%
Sr-85	2.73E+03	1.60%
Cs-137	5.75E+02	1.46%

Sample ID	300241086	
	Date Counted	
Comment	7/14/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.75E+03	1.30%
Sr-85	2.71E+03	1.60%
Cs-137	2.31E+02	1.95%

Sample ID	300241087	
	Date Counted	
Comment	7/14/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.76E+03	1.29%
Sr-85	2.64E+03	1.60%
Cs-137	3.67E+02	1.68%

Sample ID	300241088	
	Date Counted	
Comment	7/14/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.92E+03	1.29%
Sr-85	2.76E+03	1.60%
Cs-137	3.38E+02	1.72%

Sample ID	300241089	
	Date Counted	
Comment	7/14/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.82E+03	1.30%
Sr-85	2.62E+03	1.60%
Cs-137	4.82E+02	1.54%

Sample ID	300241090	
	Date Counted	
Comment	7/15/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.87E+03	1.29%
Sr-85	2.73E+03	1.60%
Cs-137	5.09E+02	1.53%

Sample ID	300241091	
	Date Counted	
Comment	7/15/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	3.21E+03	1.29%
Sr-85	2.84E+03	1.60%
Cs-137	7.74E+02	1.38%

Sample ID	300241092	
	Date Counted	
Comment	7/15/07	
		1 Sigma
Nuclide	dpm/mL	Uncertainty
Co-57	2.48E+03	1.32%
Sr-85	2.58E+03	1.61%
Cs-137	1.85E+02	2.15%

ADP FILE/NOTEBOOK REF	WSRC-NB-2003-00207 PAGE 093	
Sample ID	300241093	
Comment	Date Counted 7/15/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.73E+03	1.31%
Sr-85	2.61E+03	1.60%
Cs-137	3.63E+02	1.67%

Sample ID	300241094	
Comment	Date Counted 7/15/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.36E+03	1.35%
Sr-85	2.47E+03	1.61%
Cs-137	4.75E+02	1.54%

Sample ID	300241095	
Comment	Date Counted 7/16/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.54E+03	1.29%
Sr-85	2.68E+03	1.60%
Cs-137	5.14E+02	1.51%

Sample ID	300241096	
Comment	Date Counted 7/16/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.60E+03	1.29%
Sr-85	2.62E+03	1.60%
Cs-137	1.68E+02	2.29%

Sample ID	300241097	
Comment	Date Counted 7/16/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.88E+03	1.28%
Sr-85	2.70E+03	1.60%
Cs-137	2.30E+02	1.95%

Sample ID	300241098	
Comment	Date Counted 7/12/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.53E+03	1.34%
Sr-85	2.67E+03	1.61%
Cs-137	2.93E+02	1.89%

Sample ID	300241099	
Comment	Date Counted 7/12/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.71E+03	1.32%
Sr-85	2.74E+03	1.61%
Cs-137	3.18E+02	1.85%

Sample ID	300241100	
Comment	Date Counted 7/13/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.17E+03	1.29%
Sr-85	2.72E+03	1.61%
Cs-137	7.12E+02	1.45%

Sample ID	300241101	
Comment	Date Counted 7/13/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.36E+03	1.27%
Sr-85	2.86E+03	1.61%
Cs-137	9.70E+02	1.36%

Sample ID	300241102	
Comment	Date Counted 7/13/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.84E+03	1.30%
Sr-85	2.75E+03	1.61%
Cs-137	4.60E+02	1.63%

Sample ID	300241103	
Comment	Date Counted 7/13/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.78E+03	1.32%
Sr-85	2.68E+03	1.61%
Cs-137	4.35E+02	1.66%

Sample ID	300241104	
Comment	Date Counted 7/13/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	1.97E+03	1.39%
Sr-85	2.25E+03	1.62%
Cs-137	3.48E+01	5.56%

Sample ID	300241105
Comment	Date Counted 7/14/07

Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.04E+03	1.35%
Sr-85	2.33E+03	1.62%
Cs-137	3.52E+01	5.32%

Sample ID	300241106	
Comment	Date Counted 7/14/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.67E+03	1.31%
Sr-85	2.53E+03	1.62%
Cs-137	1.80E+02	2.35%

Sample ID	300241107	
Comment	Date Counted 7/14/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.80E+03	1.31%
Sr-85	2.62E+03	1.61%
Cs-137	1.84E+02	2.27%

ADP FILE/NOTEBOOK REF	WSRC-NB-2003-00207 PAGE 94	
Sample ID	300241108	
Comment	Date Counted 7/14/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.18E+03	1.30%
Sr-85	2.72E+03	1.61%
Cs-137	9.27E+02	1.37%

Sample ID	300241109	
Comment	Date Counted 7/14/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.27E+03	1.29%
Sr-85	2.78E+03	1.61%
Cs-137	1.05E+03	1.34%

Sample ID	300241110	
Comment	Date Counted 7/15/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.51E+03	1.33%
Sr-85	2.59E+03	1.62%
Cs-137	1.96E+02	2.20%

Sample ID	300241111
Comment	Date Counted 7/15/07

Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	2.44E+03	1.33%
Sr-85	2.57E+03	1.62%
Cs-137	2.19E+02	2.08%

Sample ID	300241112	
Comment	Date Counted 7/15/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.22E+03	1.28%
Sr-85	2.76E+03	1.61%
Cs-137	1.03E+03	1.34%

Sample ID	300241113	
Comment	Date Counted 7/15/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.23E+03	1.00%
Sr-85	2.78E+03	1.61%
Cs-137	1.03E+03	1.35%

Sample ID	300241114	
Comment	Date Counted 7/15/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.18E+03	1.29%
Sr-85	2.75E+03	1.61%
Cs-137	7.38E+02	1.44%

Sample ID	300241115	
Comment	Date Counted 7/16/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.16E+03	1.30%
Sr-85	2.70E+03	1.61%
Cs-137	7.99E+02	1.42%

Sample ID	300241116	
Comment	Date Counted 7/16/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.21E+03	1.39%
Sr-85	2.75E+03	1.61%
Cs-137	1.36E+03	1.28%

Sample ID	300241117	
Comment	Date Counted 7/16/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.08E+03	1.34%

Sr-85	2.64E+03	1.61%
Cs-137	1.27E+03	1.30%

Sample ID	300241118	
Comment	Date Counted 7/16/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	4.07E+03	1.28%
Sr-85	2.99E+03	1.61%
Cs-137	4.49E+03	1.14%

Sample ID	300241119	
Comment	Date Counted 7/17/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	3.86E+03	1.27%
Sr-85	2.77E+03	1.61%
Cs-137	4.21E+03	1.14%

Sample ID	300241120	
Comment	Date Counted 7/17/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	4.09E+03	1.30%
Sr-85	2.95E+03	1.62%
Cs-137	4.45E+03	1.15%

Sample ID	300241121	
Comment	Date Counted 7/17/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	<2.66E+00	MDA
Sr-85	<4.72E+00	MDA
Cs-137	<4.06E+00	MDA

Sample ID	300241122	
Comment	Date Counted 7/17/07	
Nuclide	dpm/mL	1 Sigma Uncertainty
Co-57	<2.63E+00	MDA
Sr-85	<4.63E+00	MDA
Cs-137	<4.07E+00	MDA

Table 18 . Gamma data for Pu, Fe, and Ni.

ADS LIMS#	Pu-238 (DPM/ml)	1 Sigma %Unc	Fe-55 (DPM/ml)	1 Sigma %Unc	Ni-59 (DPM/ml)	1 Sigma %Unc
241033	8.74E+01	15.10%	< 1.44E+01	mda	2.10E+02	10.00%
241034	7.21E+01	13.84%	< 5.10E+01	mda	2.36E+02	10.00%
241035	1.46E+01	32.86%	< 1.03E+02	mda	1.84E+02	9.61%
241036	< 3.02E+01	MDA	< 1.46E+01	mda	2.22E+02	7.26%
241037	2.74E+02	8.63%	8.80E+02	15.00%	1.06E+02	14.04%
241038	2.07E+02	7.20%	5.51E+02	15.00%	3.11E+01	24.16%
241039	< 1.58E+01	MDA	3.09E+01	21.83%	1.63E+02	6.75%
241040	1.12E+01	24.70%	1.98E+02	16.07%	1.58E+02	7.39%
241041	1.55E+02	10.33%	< 4.79E+01	mda	2.51E+02	7.77%
241042	1.79E+02	10.90%	< 1.51E+01	mda	2.56E+02	7.09%
241043	< 1.76E+01	MDA	1.43E+02	29.10%	1.74E+02	10.50%
241044	2.69E+01	21.65%	9.50E+02	13.74%	5.80E+01	20.21%
241045	1.49E+02	10.25%	5.29E+02	17.74%	4.17E+01	30.44%
241046	1.68E+02	10.88%	2.94E+02	13.10%	5.19E+01	15.85%
241047	8.62E+00	27.65%	< 2.44E+01	mda	1.74E+02	6.83%
241048	< 8.65E+00	MDA	< 4.18E+01	mda	2.09E+02	7.26%
241049	2.54E+02	7.47%	< 8.18E+00	mda	2.34E+02	6.20%
241050	2.75E+02	8.63%	< 5.24E+01	mda	2.34E+02	7.96%
241051	< 2.97E+01	MDA	< 1.46E+01	mda	1.89E+02	7.47%
241052	< 1.61E+01	MDA	< 7.89E+01	mda	2.48E+02	8.78%
241053	1.03E+02	11.70%	< 4.98E+01	mda	2.77E+02	7.59%
241054	1.02E+02	11.43%	< 7.57E+01	mda	2.64E+02	8.60%
241055	3.20E+01	29.74%	< 1.49E+01	mda	2.05E+02	7.40%
241056	1.82E+01	17.75%	< 2.57E+01	mda	2.35E+02	6.54%
241057	1.28E+02	8.99%	4.79E+02	11.25%	6.12E+01	10.84%
241058	3.47E+01	12.82%	8.96E+01	26.26%	1.62E+02	8.08%
241059	< 1.43E+01	MDA	< 4.23E+01	mda	< 1.07E+01	mda
241060	< 3.02E+01	MDA	< 1.57E+01	mda	1.83E+02	7.60%
241061	2.54E+01	23.05%	< 9.77E+01	mda	2.39E+02	9.07%
241062	1.55E+01	19.74%	< 3.15E+01	mda	1.97E+02	6.79%
241063	< 1.71E+01	MDA	8.25E+02	10.88%	9.45E+01	8.85%
241064	2.99E+02	6.81%	1.36E+03	12.41%	4.26E+01	22.32%
241065	2.48E+02	9.04%	< 5.18E+01	mda	2.49E+02	7.94%
241066	3.00E+02	9.48%	< 1.74E+01	mda	2.37E+02	7.27%
241067	4.03E+01	17.91%	7.17E+02	16.19%	1.48E+02	11.71%
241068	1.38E+02	7.96%	7.27E+02	12.58%	1.02E+02	9.65%
241069	6.42E+01	12.07%	< 8.20E+00	mda	2.31E+02	6.20%
241070	3.12E+01	13.48%	4.41E+01	40.60%	2.29E+02	7.24%
241071	8.03E+01	12.59%	1.39E+03	13.17%	4.04E+01	29.75%
241072	2.99E+02	7.21%	1.04E+03	10.76%	5.21E+01	12.25%
241073	5.84E+02	7.31%	1.70E+03	13.86%	< 5.44E+02	upper limit
241074	1.04E+03	6.80%	2.10E+03	12.67%	< 1.58E+02	upper limit
241075	1.01E+03	6.74%	2.08E+03	13.60%	< 7.91E+02	upper limit
241076	< 7.83E+00	MDA	< 3.72E+01	mda	< 7.84E+00	mda
247077	< 7.17E+00	MDA	< 2.18E+01	mda	< 4.97E+00	mda

APPENDIX D. Data Used in K_d and CEC Calculations

Table 19. Raw data for Co, Sr, and Cs K_d calculations.

Boring/ Sample No	ADS LIMS #	Rep	Soil (g)	Final aqueous vol (mL)	Co-57 (dpm/mL)	Sr-85 (dpm/mL)	Cs-137 (dpm/mL)	Co Kd (mL/g)	Sr Kd (mL/g)	Cs Kd (mL/g)
B308/SS15	300241078	1	0.5068	12.236	2525.0	2646.0	269.3	14.2	2.3	368.9
	300241079	2	0.5042	12.155	2617.1	2704.3	281.7	12.8	1.8	351.0
B308/SS25	300241080	1	0.5041	12.183	2580.3	2701.6	300.7	13.4	1.8	328.2
	300241081	2	0.4981	11.973	2146.0	2600.0	138.8	20.8	2.8	735.3
B332/SS12	300241082	1	0.4976	11.947	3136.8	2744.7	1260.1	6.7	1.4	59.5
	300241083	2	0.4998	12.025	3188.5	2724.3	1217.2	6.2	1.6	62.6
B332/SS23	300241084	1	0.4969	11.911	2985.5	2716.7	570.6	8.2	1.6	160.2
	300241085	2	0.5057	12.231	2973.0	2733.7	575.3	8.4	1.5	160.1
B348/SS8	300241086	1	0.5017	12.096	2753.5	2710.3	231.2	11.0	1.7	433.1
	300241087	2	0.4981	11.961	2757.7	2644.2	366.5	10.9	2.4	263.2
B348/SS17	300241088	1	0.5035	12.162	2918.6	2758.8	338.2	9.0	1.3	288.9
	300241089	2	0.5081	12.327	2821.8	2618.5	482.0	10.2	2.6	196.4
B349/SS14	300241090	1	0.5019	12.064	2869.7	2732.0	509.3	9.5	1.5	182.8
	300241091	2	0.4958	11.908	3210.6	2837.9	774.2	6.0	0.6	112.0
B349/SS23	300241092	1	0.5048	12.282	2480.9	2578.4	184.6	15.0	3.1	553.5
	300241093	2	0.4972	11.932	2731.2	2613.2	363.2	11.2	2.7	265.6
B408/SS14	300241094	1	0.4978	11.958	2364.9	2466.8	474.8	16.7	4.3	197.7
	300241095	2	0.4974	11.926	2544.1	2676.7	514.0	13.8	2.0	180.5
B408/SS22	300241096	1	0.5073	12.280	2601.9	2622.4	167.9	13.1	2.6	607.7
	300241097	2	0.4992	11.965	2882.2	2695.4	230.2	9.4	1.8	432.3
B438/SS12	300241098	1	0.498	11.942	2525.8	2673.1	293.1	14.1	2.1	334.6
	300241099	2	0.4997	12.014	2709.2	2744.6	318.0	11.5	1.4	307.4
B438/SS24	300241100	1	0.4953	11.841	3171.4	2718.6	712.0	6.3	1.6	123.3
	300241101	2	0.4997	12.024	3357.6	2862.9	969.7	4.7	0.3	84.7
B910/SS14	300241102	1	0.5059	12.217	2840.9	2750.2	460.0	9.9	1.3	206.0
	300241103	2	0.5011	12.048	2777.3	2684.8	434.9	10.6	2.0	218.3
B910/SS24	300241104	1	0.5088	12.301	1974.0	2246.9	34.8	24.9	7.1	3017.4
	300241105	2	0.5006	12.058	2038.9	2334.0	35.2	23.2	5.9	2971.3
B930/SS14	300241106	1	0.5044	12.163	2670.0	2533.9	180.4	12.1	3.5	561.8
	300241107	2	0.4995	11.986	2804.7	2619.9	184.2	10.3	2.6	547.2
B930/SS27	300241108	1	0.5053	12.178	3180.0	2720.0	927.0	6.3	1.6	89.9
	300241109	2	0.5087	12.300	3270.0	2780.0	1050.0	5.4	1.1	76.8

B933/SS14	300241110	1	0.4988	11.986	2510.0	2590.0	196.0	14.3	2.9	513.3
	300241111	2	0.506	12.214	2440.0	2570.0	219.0	15.5	3.1	459.0
Boring/ Sample No	**ADS LIMS #**	**Rep**	**Soil (g)**	**Final aqueous vol (mL)**	**Co-57 (dpm/mL)**	**Sr-85 (dpm/mL)**	**Cs-137 (dpm/mL)**	**Co Kd (mL/g)**	**Sr Kd (mL/g)**	**Cs Kd (mL/g)**
B933/SS24	300241112	1	0.5063	12.218	3220.0	2760.0	1030.0	5.9	1.3	78.6
	300241113	2	0.5047	12.164	3230.0	2780.0	1030.0	5.8	1.1	78.5
B934/SS15	300241114	1	0.505	12.161	3180.0	2750.0	738.0	6.3	1.3	119.0
	300241115	2	0.4975	11.902	3160.0	2700.0	799.0	6.4	1.8	107.3
B934/SS26	300241116	1	0.5066	12.220	3210.0	2750.0	1360.0	6.0	1.3	53.6
	300241117	2	0.5021	12.173	3080.0	2640.0	1270.0	7.3	2.4	59.4
Spike no soil control	300241118	1		10.201	4070	2990	4490			
	300241119	2		10.198	3860	2770	4210			
	300241120	3		10.195	4090	2950	4450			
Blank no soil control	300241121	2		10.203	<2.66E+00	<4.72E+00	<4.06E+00			
	300241122	3		10.198	<2.63E+00	<4.63E+00	<4.07E+00			
				10.198	**4006.7**	**2903.3**	**4383.3**			

Table 20. Fe, Ni, and Pu gamma analyses used in the K_d determinations.

Tube #	Boring/ Sample #	ADS LIMS #	Rep	Fe (dpm/mL)	Ni(dpm/mL)	Pu (dpm/mL)
501-A	B308/SS15	300241033	1	1.44E+01	2.10E+02	8.74E+01
501-B		300241034	2	5.10E+01	2.36E+02	7.21E+01
502-A	B308/SS25	300241035	1	1.03E+02	1.84E+02	1.46E+01
502-B		300241036	2	1.46E+01	2.22E+02	< 3.02E+01
503-A	B332/SS12	300241037	1	8.80E+02	1.06E+02	2.74E+02
503-B		300241038	2	5.51E+02	3.11E+01	2.07E+02
504-A	B332/SS23	300241039	1	3.09E+01	1.63E+02	< 1.58E+01
504-B		300241040	2	1.98E+02	1.58E+02	1.12E+01
505-A	B348/SS8	300241041	1	4.79E+01	2.51E+02	1.55E+02
505-B		300241042	2	1.51E+01	2.56E+02	1.79E+02
506-A	B348/SS17	300241043	1	1.43E+02	1.74E+02	< 1.76E+01
506-B		300241044	2	9.50E+02	5.80E+01	2.69E+01
507-A	B349/SS14	300241045	1	5.29E+02	4.17E+01	1.49E+02
507-B		300241046	2	2.94E+02	5.19E+01	1.68E+02
508-A	B349/SS23	300241047	1	2.44E+01	1.74E+02	8.62E+00
508-B		300241048	2	4.18E+01	2.09E+02	< 8.65E+00
509-A	B408/SS14	300241049	1	8.18E+00	2.34E+02	2.54E+02
509-B		300241050	2	5.24E+01	2.34E+02	2.75E+02
510-A	B408/SS22	300241051	1	1.46E+01	1.89E+02	< 2.97E+01
510-B		300241052	2	7.89E+01	2.48E+02	< 1.61E+01
511-A	B438/SS12	300241053	1	4.98E+01	2.77E+02	1.03E+02
511-B		300241054	2	7.57E+01	2.64E+02	1.02E+02
512-A	B438/SS24	300241055	1	1.49E+01	2.05E+02	3.20E+01
512-B		300241056	2	2.57E+01	2.35E+02	1.82E+01
513-A	B910/SS14	300241057	1	4.79E+02	6.12E+01	1.28E+02
513-B		300241058	2	8.96E+01	1.62E+02	3.47E+01
514-A	B910/SS24	300241059	1	4.23E+01	< 1.07E+01	< 1.43E+01
514-B		300241060	2	1.57E+01	1.83E+02	< 3.02E+01
515-A	B930/SS14	300241061	1	9.77E+01	2.39E+02	2.54E+01
515-B		300241062	2	3.15E+01	1.97E+02	1.55E+01
516-A	B930/SS27	300241063	1	8.25E+02	9.45E+01	< 1.71E+01
516-B		300241064	2	1.36E+03	4.26E+01	2.99E+02
517-A	B933/SS14	300241065	1	5.18E+01	2.49E+02	2.48E+02
517-B		300241066	2	1.74E+01	2.37E+02	3.00E+02
518-A	B933/SS24	300241067	1	7.17E+02	1.48E+02	4.03E+01
518-B		300241068	2	7.27E+02	1.02E+02	1.38E+02
519-A	B934/SS15	300241069	1	8.20E+00	2.31E+02	6.42E+01
519-B		300241070	2	4.41E+01	2.29E+02	3.12E+01
520-A	B934/SS26	300241071	1	1.39E+03	4.04E+01	8.03E+01
520-B		300241072	2	1.04E+03	5.21E+01	2.99E+02
521-A	Spike control	300241073	1	1.70E+03	5.44E+02	5.84E+02
521-B		300241074	2	2.10E+03	1.58E+02	1.04E+03
521-C		300241075	3	2.08E+03	7.91E+02	1.01E+03
522-A	Blank control	300241076	1	3.72E+01	< 7.84E+00	< 7.83E+00
522-B		300241077	2	2.18E+01	< 4.97E+00	< 7.17E+00

Table 21. Data used in CEC calculations.

ID		STP Soil	Rep	Soil Wt. (g)	[Na] (ppm)	CEC (meq/100g)	avg CEC (meq/100g)	stdev CEC (meq/100g)
501-A	300240736	B308/SS15	1	5.355	12.8	0.82	0.749	0.095
501-B	300240737		2	5.3235	11.1	0.68		
502-A	300240738	B308/SS25	1	5.2688	47.5	3.69	3.365	0.466
502-B	300240739		2	5.2239	39.2	3.04		
503-A	300240740	B332/SS12	1	5.2672	8.48	0.47	0.376	0.137
503-B	300240741		2	5.2583	6.12	0.28		
504-A	300240742	B332/SS23	1	5.2825	8.87	0.50	0.632	0.182
504-B	300240743		2	5.2324	11.9	0.76		
505-A	300240744	B348/SS8	1	5.3345	14.6	0.97	0.841	0.177
505-B	300240745		2	5.3184	11.5	0.72		
Blank 1	300240746	No soil	1	na	2.75			
Std. 1	300240747	Subsurface Clayey	1	5.2064	42.2	3.30		
506-A	300241021	B348/SS17	1	5.0072	10.4	0.76	0.822	0.093
506-B	300241022		2	5.0022	11.9	0.89		
507-A	300241023	B349/SS14	1	5.0121	7.24	0.48	0.636	0.219
507-B	300241024		2	5.0084	10.8	0.79		
508-A	300241025	B349/SS23	1	5.0104	17.4	1.36	1.138	0.319
508-B	300241026		2	5.0124	12.2	0.91		
509-A	300241027	B408/SS14	1	5.0026	9.78	0.70	0.726	0.032
509-B	300241028		2	5.0055	10.3	0.75		
510-A	300241029	B408/SS22	1	5.0108	12	0.89	0.925	0.043
510-B	300241030		2	5.0128	12.7	0.96		
Blank 2	300241031	No soil	1	na	1.693			
Std. 2	300241032	Subsurface Clayey	1	5.0109	78.3	6.65		
511-A	300241252	B438/SS12	1	5.0103	29.3	2.53	2.072	0.652
511-B	300241253		2	5.0156	18.7	1.61		
512-A	300241254	B438/SS24	1	5.0297	15.2	1.30	0.921	0.541
512-B	300241255		2	5.0165	6.33	0.54		
513-A	300241256	B910/SS14	1	5.0047	13.8	1.19	1.295	0.150
513-B	300241257		2	5.0242	16.3	1.40		
514-A	300241258	B910/SS24	1	5.008	87.8	7.62	9.889	3.215
514-B	300241259		2	5.0027	140	12.16		
515-A	300241260	B930/SS14	1	5.0106	23.8	2.06	2.539	0.684
515-B	300241261		2	5.0044	34.9	3.02		
Blank 3	300241262	No soil	1	na	< 0.237			
Std. 3	300241263	Subsurface Clayey	1	5.1006	64.4	5.48		
516-A	300241264	B930/SS27	1	5.0093	7.9	0.49	0.509	0.021
516-B	300241265		2	5.0194	8.25	0.52		
517-A	300241266	B933/SS14	1	5.008	25.8	2.05	1.928	0.170
517-B	300241267		2	5.0017	23	1.81		
518-A	300241268	B933/SS24	1	5.0041	11.8	0.83	0.850	0.023
518-B	300241269		2	5.0172	12.2	0.87		
519-A	300241270	B934/SS15	1	5.0117	16.7	1.26	1.300	0.060
519-B	300241271		2	5.0179	17.7	1.34		

ID		STP Soil	Rep	Soil Wt. (g)	[Na] (ppm)	CEC (meq/100g)	avg CEC (meq/100g)	stdev CEC (meq/100g)
520-A	300241272	B934/SS26	1	5.0089	13.6	0.99	0.750	0.339
520-B	300241273		2	4.9949	8.07	0.51		
Blank 4	300241274	No soil	1	na	2.21			
Std. 4	300241275	Subsurface Clayey	1	5.0054	74.4	6.27		

APPENDIX E. Traceability Records of Soil and Groundwater Samples

MACTEC

LABORATORY ASSIGNMENT SHEET / CHAIN OF CUSTODY RECORD

MACTEC PROJECT NUMBER: 5250-05-0496

Page 1 of 4

LABORATORY RECIEVING ID: Savannah River

DATE: January 11, 2007
PREPARED BY (NAME / COMPANY): Lem Hodges/MACTEC
LAB MANAGER: Dan Kaplan
MACTEC PROJECT MANAGER: Michael D. Schwartz

JOB NAME: South Texas COL Project

DATE REPORT REQUIRED (Lab Mgr initials required):
ACTUAL DATE OF REPORT (Lab Mgr initials required):

CLIENT CONTACT: Michael D. Schwartz
CLIENT PHONE: Office: 704-357-5633 Mobile: 704-599-0724
CLIENT FAX: 704-357-5634
RETAIN SAMPLES UNTIL: Contact M. Schwartz before disposal

NOTE: LIST QUANTITY OF EACH TEST FOR EACH SAMPLE BELOW

SAMPLE NUMBER	Boring No.	Sample Number	Sample Depth Top (ft)	Sample Depth Bottom (ft)	Sample Type	Field Classification (USCS)	ADSORPTION DISTRIBUTION COEFFICIENT (Kd)									EFFECTIVE OVERBURDEN STRESS (psf)	ESTIMATED Kd	REMARKS
1	B-308	55-15	58.5	62	soil	SP	X											
2	B-308 DH	55-23	86.5	90	soil	SP	X											
3	B-332	68-12	38.5	40	soil	SM	X											
4	B-332	68-23	93.5	95	soil	SP	X											
5	B-345	55-9	28.5	30	soil	SP	X											
6	B-345	55-17	73.5	75	soil	SP	X											
7	B-349	69-14	33.5	35	soil	SP	X											
8	B-349	69-23	78.5	80	soil	SP	X											
9	B-408	69-14	33.5	35	soil	SP	X											
10	B-408 DH	69-17	73.5	75	soil	SP	X											
11	B-438	55-17	28.5	30	soil	SM	X											
12	B-438	55-24	98.5	102	soil	SM	X											
TOTAL NUMBER OF TESTS							12											

Special Instructions:

DATE / TIME RELINQUISHED FROM SITE	1/11/07 10:30	RELINQUISHED BY (SIGNATURE OF SITE PERSONNEL) / RELINQUISHED TO (SIGNATURE OF CARRIER)	
DATE / TIME RELINQUISHED TO	1/12/07 6:10 PM	RELINQUISHED BY (SIGNATURE OF CARRIER) / RECEIVED BY (LABORATORY)	
DATE / TIME RELINQUISHED TO	2/14/07 16:00	RELINQUISHED BY / RECEIVED BY	
DATE / TIME RELINQUISHED TO	2/20/07 08:00	RELINQUISHED BY / RECEIVED BY	Carol Blanks

MACTEC

LABORATORY ASSIGNMENT SHEET / CHAIN OF CUSTODY RECORD

MACTEC PROJECT NUMBER: 5050-05-0489

Page 2 of 4

LABORATORY RECIEVING ID: Savannah River

DATE: January 11, 2007
PREPARED BY (NAME / COMPANY): Lon Johnson MACTEC
LAB MANAGER:
MACTEC PROJECT MANAGER: Michael D. Dubinski

JOB NAME: South Tetra CDT Project

CLIENT CONTACT: Michael D. Dubinski
CLIENT PHONE: Office: 704-357-5033 Mobile: 704-399-0624
CLIENT FAX: 704-357-8656

DATE REPORT REQUIRED: (Lab Mgr details required)
ACTUAL DATE OF REPORT: (Lab Mgr details required)

RETAIN SAMPLES UNTIL: Contact M. Dubinski before disposal

NOTE: LIST QUANTITY OF EACH TEST FOR EACH SAMPLE BELOW

	SAMPLE NUMBER	Boring No.	Sample Number	Sample Depth Top (ft)	Sample Depth Bottom (ft)	Sample Type	Field Classification (USCS)	ADSORPTION DISTRIBUTION COEFFICIENT (Kd)									EFFECTIVE OVERBURDEN STRESS (psi)	ESTIMATED Tc	REMARKS
✓	13	B-910	SS-14	33.5	35	soil	SP	X											
✓	14	B-910	SS-24	53.5	55	soil	SM	X											
✓	15	B-930	SS-14	33.5	35	soil	SM	X											
✓	16	B-930	SS-27	98.5	100	soil	SP	X											
✓	17	B-933	SS-14	33.5	35	soil	SP	X											
✓	18	B-933	SS-24	53.5	55	soil	SP	X											
✓	19	B-934	SS-15	38.5	40	soil	SP	X											
✓	20	B-934	SS-28	93.5	95	soil	SP	X											
	21																		
	22																		
	23																		
	TOTAL NUMBER OF TESTS							20											

Special Instructions:

DATE / TIME RELINQUISHED FROM SITE	1.11.07 10:30	RELINQUISHED BY (SIGNATURE OF SITE PERSONNEL) / RELINQUISHED TO (SIGNATURE OF CARRIER)	
DATE / TIME RELINQUISHED TO	1/12/07 6:00	RELINQUISHED BY (SIGNATURE OF CARRIER) / RECEIVED BY (LABORATORY)	
DATE / TIME RELINQUISHED TO	2/14/07 16:00	RELINQUISHED BY / RECEIVED BY	
DATE / TIME RELINQUISHED TO	2/20/07 08:00	RELINQUISHED BY / RECEIVED BY	Carl Black

4-2

MACTEC

LABORATORY ASSIGNMENT SHEET / CHAIN OF CUSTODY RECORD

MACTEC PROJECT NUMBER: 6050-08-0438

Page 3 of 4

LABORATORY RECIEVING ID: Savannah River

DATE: January, 112007
PREPARED BY (NAME / COMPANY): Lori Johnson/MACTEC
LAB MANAGER: Dan Kaplan
MACTEC PROJECT MANAGER: Michael D. Sulinski

JOB NAME: South Texas COL Project

DATE REPORT REQUIRED (Lab Mgr initials required):
ACTUAL DATE OF REPORT (Lab Mgr initials required):

CLIENT CONTACT: Michael D. Sulinski
CLIENT PHONE: Office: 704-357-5037 Mobile: 704-369-0024
CLIENT FAX: 704-357-8518
RETAIN SAMPLES UNTIL: Contact M. Sulinski before disposal

NOTE: LIST QUANTITY OF EACH TEST FOR EACH SAMPLE BELOW

	SAMPLE NUMBER	Observation Well No.	Associated Soil Sample Number	Screen Interval - Top	Screen Interval - Bottom	Sample Type	Field Classification (USCS)	MS/MSD/TICH ACCURACY/PRECISION COEFFICIENT (%) SPIKE									EFFECTIVE OVERBURDEN STRESS (psi)	ESTIMATED K_d	REMARKS
1	1	OW-338-U	SS-15	35	45	water	NA	X											
2	2	OW-338-L	SS-25	83	93	water	NA	X											
3	3	OW-332-U	SS-12	35	45	water	NA	X											
4	4	OW-332-L	SS-23	93	103	water	NA	X											
5	5	OW-343-U	SS-8	22	39	water	NA	X											
6	6	OW-343-L	SS-17	68	78	water	NA	X											
7	7	OW-349-U	SS-14	35	45	water	NA	X											
8	8	OW-349-L	SS-23	78	93	water	NA	X											
9	9	OW-408-U	SS-14	32	42	water	NA	X											
10	10	OW-408-L	SS-27	70	80	water	NA	X											
11	11	OW-436-U	SS-12	30	40	water	NA	X											
	12	OW-436-L	SS-24	93	103	water	NA	X											
	TOTAL NUMBER OF TESTS							11											

Special Instructions:

DATE / TIME RELINQUISHED FROM SITE	1.11.07 10:30	RELINQUISHED BY (SIGNATURE OF SITE PERSONNEL) / RELINQUISHED TO (SIGNATURE OF CARRIER)	
DATE / TIME RELINQUISHED TO	1/12/07 6:00PM	RELINQUISHED BY (SIGNATURE OF CARRIER) / RECEIVED BY (LABORATORY)	
DATE / TIME RELINQUISHED TO	2/11/07 1600	RELINQUISHED BY / RECEIVED BY	
DATE / TIME RELINQUISHED TO	2/20/07 08:00	RELINQUISHED BY / RECEIVED BY	

MS 1/12/07
1.11.07

4-3

MACTEC

LABORATORY ASSIGNMENT SHEET / CHAIN OF CUSTODY RECORD

MACTEC PROJECT NUMBER: 6050-06-0496

LABORATORY RECIEVING ID: Savannah River

DATE: January 11, 2007
PREPARED BY (NAME / COMPANY): Lori Johnson/MACTEC
LAB MANAGER: [signature]
MACTEC PROJECT MANAGER: Michael D. Suinarski

JOB NAME: South Texas COL Project
CLIENT CONTACT: Michael D. Suinarski
CLIENT PHONE: Office: 704-357-8600 Mobile: 704 309 0674
CLIENT FAX: 704-357-8638
RETAIN SAMPLES UNTIL: Contact M. Suinarski before disposal.

DATE REPORT REQUIRED (Lab Mgr initials required)
ACTUAL DATE OF REPORT (Lab Mgr initials required)

NOTE: LIST QUANTITY OF EACH TEST FOR EACH SAMPLE BELOW

SAMPLE NUMBER	Boring No.	Associated Soil Sample Number	Screen Interval - Top	Screen Interval - Bottom	Sample Type	Field Classification (USCS)	ADSORPTION DISTRIBUTION COEFFICIENT (Kd) SPIKE		EFFECTIVE OVERBURDEN STRESS (psf)	ESTIMATED K_o	REMARKS
12	OW-910-U	SS-14	25	35	water	NA	X				
13	OW-910-L	SS-24	82	92	water	NA	X				
14	OW-930-U	SS-14	25	35	water	NA	X				
15	OW-930-L	SS-27	95	105	water	NA	X	MDS 1/12/07			
16	OW-933-U	SS-14	28	38	water	NA	X				
~~[illegible]~~	~~OW-933-L~~	~~SS-24~~	~~78~~	~~88~~	~~water~~	~~NA~~	~~X~~	yjj 1-11-07			
17	OW-934-U	SS-15	30	40	water	NA	X				
18	OW-934-L	SS-20	89	99	water	NA	X				
19	OW-932La (2/8/07)				water	NA	X	MO 2/14/07			
20	OW-933L (1/14/07)				water	NA	X	MO 2/14/07			
[illegible]											
TOTAL NUMBER OF TESTS							20	MO 2/14/07			

Special Instructions:

DATE / TIME RELINQUISHED FROM SITE	1.11.07 10:30	RELINQUISHED BY (SIGNATURE OF SITE PERSONNEL) / RELINQUISHED TO (SIGNATURE OF CARRIER)	[signature]
DATE / TIME RELINQUISHED TO	1/12/07 6:00PM	RELINQUISHED BY (SIGNATURE OF CARRIER) / RECEIVED BY (LABORATORY)	[signature]
DATE / TIME RELINQUISHED TO	2/14/07 16:00	RELINQUISHED BY / RECEIVED BY	[signature]
DATE / TIME RELINQUISHED TO	2/20/07 08:20	RELINQUISHED BY / RECEIVED BY	[signature]

4-4

MACTEC

LABORATORY ASSIGNMENT SHEET / CHAIN OF CUSTODY RECORD

MACTEC PROJECT NUMBER: 5050.06.0406

Page 1 of 2

LABORATORY RECIEVING ID: Savannah River ~~Savannah River Ecology~~

DATE: January 11, 2007
PREPARED BY (NAME / COMPANY): Lori Lehman/MACTEC
LAB MANAGER: ~~Lisha Powell-contact~~ Dan Vaughn
MACTEC PROJECT MANAGER: Michael D. Sulinski

JOB NAME: Savannah River Site, Project

CLIENT CONTACT: Michael D. Sulinski
CLIENT PHONE: Office: 704-357-6233 Mobile: 704-329-5624
CLIENT FAX: 704-357-8616
RETAIN SAMPLES UNTIL: Contact M. Sulinski before disposal

DATE REPORT REQUIRED: (Lab Mgr initials required)
ACTUAL DATE OF REPORT: (Lab Mgr initials required)

NOTE: LIST QUANTITY OF EACH TEST FOR EACH SAMPLE BELOW

SAMPLE NUMBER	Boring No.	Sample Number	Sample Depth Top (ft)	Sample Depth Bottom (ft)	Sample Type	Field Classification (USCS)	CATION EXCHANGE CAPACITY EPA METHOD 9080	Ph ASTM D4972								EFFECTIVE CONSOLIDATION STRESS (psf)	ESTIMATED K_0	REMARKS
1	B-308	SS-15	36.5	40	soil	SP	X	X										
2	B-309	SS-75	88.5	90	soil	SP	X	X										
3	B-332	SS-12	38.5	40	soil	SM	X	X										
4	B-332	SS-21	92.5	95	soil	SP	X	X										
5	B-348	SS-8	28.5	30	soil	SP	X	X										
6	B-348	SS-17	73.5	75	soil	SP	X	X										
7	B-348	SS-14	33.5	35	soil	SP	X	X										
8	B-348	SS-23	78.5	80	soil	SC	X	X										
9	B-406	SS-14	33.5	35	soil	SP	X	X										
10	B-408	SS-22	73.5	75	soil	SP	X	X										
11	B-433	SS-12	23.5	30	soil	SM	X	X										
12	B-433	SS-24	95.5	100	soil	SM	X	X										
TOTAL NUMBER OF TESTS							12	12										

Special Instructions:

DATE / TIME RELINQUISHED FROM SITE: 1-11-07 10:30
RELINQUISHED BY (SIGNATURE OF SITE PERSONNEL)
RELINQUISHED TO (SIGNATURE OF CARRIER)

DATE / TIME RELINQUISHED TO:
RELINQUISHED BY (SIGNATURE OF CARRIER)
RECEIVED BY (LABORATORY)

DATE / TIME RELINQUISHED TO: 2/14/07 16:00
RELINQUISHED BY
RECEIVED BY

DATE / TIME RELINQUISHED TO: 2/20/07 08:00
RELINQUISHED BY
RECEIVED BY

4-5

MACTEC

LABORATORY ASSIGNMENT SHEET / CHAIN OF CUSTODY RECORD

MACTEC PROJECT NUMBER: 5050-05-0490

Page 2 of 2

LABORATORY RECEIVING ID: Savannah River / Severn Trent - St. Louis

DATE: January 11, 2007

PREPARED BY (NAME / COMPANY): Laboratory/MACTEC

LAB MANAGER: John Powell / Contact

MACTEC PROJECT MANAGER: Michael D. Schwartz

JOB NAME: South Texas CCL Project

DATE REPORT REQUIRED (Lab Mgr initials required):

ACTUAL DATE OF REPORT (Lab Mgr initials required):

CLIENT CONTACT: Michael D. Schwartz

CLIENT PHONE: Office: 704-357-5833 Mobile: 704-209-0824

CLIENT FAX: 704-357-9938

RETAIN SAMPLES UNTIL: Contact M. Schwartz before disposal

NOTE: LIST QUANTITY OF EACH TEST FOR EACH SAMPLE BELOW

SAMPLE NUMBER	Boring No.	Sample Number	Sample Depth Top (ft)	Sample Depth Bottom (ft)	Sample Type	Field Classification (USCS)	CATION EXCHANGE CAPACITY EPA METHOD 9080	pH ASTM D 4972								EFFECTIVE OVERBURDEN STRESS (psi)	ESTIMATED PC	REMARKS
13	B-910	SS-14	33.5	35	soil	SM	X	X										
14	B-910	SS-24	83.5	85	soil	CH	X	X										
15	B-920	SS-14	33.5	35	soil	SM	X	X										
16	B-930	SS-27	93.5	100	soil	SM	X	X										
17	B-933	SS-14	33.5	35	soil	SP	X	X										
18	B-933	SS-24	83.5	85	soil	SP	X	X										
19	B-934	SS-19	58.5	60	soil	CH	X	X										
20	B-934	SS-29	93.5	95	soil	SP	X	X										
21																		
22																		
23																		
TOTAL NUMBER OF TESTS							20	20										

Special Instructions:

DATE / TIME RELINQUISHED FROM SITE: 1.11.07 10:30

RELINQUISHED BY (SIGNATURE OF SITE PERSONNEL)
RELINQUISHED TO (SIGNATURE OF CARRIER)

DATE / TIME RELINQUISHED TO:

RELINQUISHED BY (SIGNATURE OF CARRIER)
RECEIVED BY (LABORATORY)

DATE / TIME RELINQUISHED TO: 2/14/07 16:00

RELINQUISHED BY
RECEIVED BY

DATE / TIME RELINQUISHED TO: 2/20/07 08:00

RELINQUISHED BY
RECEIVED BY

4-6

APPENDIX F. Radiological Standard Certificate of Calibration

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

75273-147

Co-57 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated with an ionization chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards.

Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Co-57
ACTIVITY (Bq):	1.886 E6
HALF-LIFE:	271.79 days
CALIBRATION DATE:	June 14, 2007 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	1.7%

Impurities: γ-impurities <0.1%

5.02210 grams 0.1M HCl solution with 30 µg/g Co carrier.

P O NUMBER AC60107G, Item 2

SOURCE PREPARED BY: MTaskaeva
M. I. Taskaeva, Radiochemist

Q A APPROVED: WM Mf 6-14-07

ANA FM1003 Rev. 1

Corporate Office Laboratory

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

75278-147

Cs-137 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated with an ionization chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards.

Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Cs-137
ACTIVITY (Bq):	1.922 E6
HALF-LIFE:	3.007 E1 years
CALIBRATION DATE:	June 14, 2007 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	1.7%

Impurities: γ-impurities <0.1%

5.01021 grams 0.1M HCl solution with 30 µg/g Cs carrier.

P O NUMBER: AC60107G, Item 7

SOURCE PREPARED BY: M. I. Taskaeva, Radiochemist

Q A APPROVED: 6-14-07

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

75280-147

Fe-55 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master liquid radionuclide solution source. The master source was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Fe-55
ACTIVITY (Bq):	1.987 E5
HALF-LIFE:	1001.0 days
CALIBRATION DATE:	June 14, 2007 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	4.5%

Impurities: γ-impurities <0.1%

5.12918 grams 0.1M HCl solution with 30 µg/g Fe carrier.

P O NUMBER AC60107G, Item 9

SOURCE PREPARED BY: MITaskaeva
M. I. Taskaeva, Radiochemist

Q A APPROVED: VM Mo 6-14-07

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

75281-147

Ni-59 10 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master liquid radionuclide solution source. The master source was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Ni-59
ACTIVITY (Bq):	3.841 E3
HALF-LIFE:	7.600 E4 years
CALIBRATION DATE:	June 14, 2007 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	4.5%

Impurities: γ-impurities <0.1%

9.99750 grams 0.1M HCl solution with 30 μg/g Ni carrier.

P O NUMBER AC60107G, Item 10

SOURCE PREPARED BY: M. I. Taskaeva
M. I. Taskaeva, Radiochemist

Q A APPROVED: 6-14-07

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia 30318

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

75282-147

Pu-238 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting and alpha spectroscopy. The calibration was checked by liquid scintillation counting after source preparation.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Pu-238
ACTIVITY (Bq):	3.940 E4
HALF-LIFE:	87.7 years
CALIBRATION DATE:	June 14, 2007 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	2.0%

Impurities: γ-impurities <0.1%, α-impurities ~0.2%

5.47038 grams 3M HNO_3 solution.

P O NUMBER AC60107G, Item 11

SOURCE PREPARED BY: MTaskaeva
M. I. Taskaeva, Radiochemist

Q A APPROVED: 6-14-07

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia 30318

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

75276-147

Sr-85 10 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated with an ionization chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards.

Radionuclide purity and calibration were checked with a germanium gamma spectrometer system. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Sr-85
ACTIVITY (Bq):	1.842 E6
HALF-LIFE:	64.84 days
CALIBRATION DATE:	June 14, 2007 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	1.7%

Impurities: γ-impurities <0.1%

10.04818 grams 0.1M HCl solution with 30 µg/g Sr carrier.

P O NUMBER AC60107G, Item 1

SOURCE PREPARED BY: MTaskaeva
M. I. Taskaeva, Radiochemist

Q A APPROVED: WM. Mt 6-14-07

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

APPENDIX G. M&TE Approval of Balance

Certificate of Calibration

Issued by

Savannah River Standards Laboratory

Westinghouse SRC, Building 736-A
Aiken, SC 29801

M & TE #:	IW-0105	Cal Procedure:	
Description:	BALANCE		BAL-CAL/11.4 (08/16/05)
Manufacturer:	SARTORIUS		
Model#:	R-200D		
Serial#:	30200365	Cal Calculation:	
Calibrated:	03/07/2007		N/A
Frequency:	12 Months		
Expires:	03/07/2008		

NIST Traceable Standard(s) used, (Expiration Date):
SL-407 (2/27/2011)

Print Specification: N/A
The estimated uncertainty (k=2) of the standard(s) and measurement process at SRSL is:
SEE ATTACHED

The measurements made on IW-0105 were obtained at 23 +/- 2.0 °c and 24% RH

CALIBRATION DATA FOR IW-0105

RUSH
Calibrate balance to ISO 17025 (NVLAP, A2LA, OR NIST).
SEE ATTACHED FOR BALANCE CALIBRATION
ONSITE CALIBRATION

THIS INSTRUMENT PASSED CALIBRATION. AS FOUND = AS LEFT.

The assigned uncertainty of the UUT as determined by tolerance test is:
SEE ATTACHED

Metrologist: D. R. SMITH DR Smith
Signature

PR Init. Engr. Init. 3/12/07

Note 1: This certificate shall not be reproduced except in full without the advanced written approval of the SRSL.
Note 2: The 'as received' condition of the standard, set of standards, or measurement equipment described herein was as expected, unless otherwise noted in the body of the certificate.

Page 1 of 3

SRS Method

Analyst Information	
Calibrator Initials:	DRS
Calibrator ID #	W0894
Date:	3/7/2007
Balance Information	
Location	773A/B122
Unique ID Number	IW-0105
Manufacturer	Sartorius
MODEL#	R200D
Confidence Level	3-Stdev
QA Limit (%)	0.0100
Sen. Limit (g)	0.00060
1 Bal. Maint. SD	0.00020
Wt. Set Selection	SL-107

Function Tests	
Power	Pass
Load	Pass
Taring	Pass
P/NDisplay	Pass

Visual Inspection Parameters	
Damaged	Pass
Level	Pass
Clean	Pass
Complete	Pass

Cornerloading(g)	100
Position	Reading
Top	99.9996
Right	99.9996
Bottom	99.9997
Left	99.9996

Environmental Conditions			
	Before	After	Average
Temp (C)	25	24	24
Humidity (%)	24	24	24

	MEASUREMENTS (in grams)			
Stacking Information	High Wt(s).	Mid Wt(s).	Low Wt.	Sensitivity Wt.
High Weights(g)	200	100	50	1
200	199.9996	99.9997	50.0000	1.0000
No stacking	199.9996	99.9998	50.0000	1.0010
Mid-Weights(g)	199.9996	99.9997	50.0000	0.9999
100	199.9996	99.9997	50.0000	1.0000
No stacking	199.9996	99.9997	50.0000	1.0000

Pg 2 of 3

QA BALANCE CERTIFICATION
Next Certification due date: 6-Mar-08

BalCell1v3 7/15/04

Minimum Quantities Calculations updated to match industry standards

Analyst Information	
Initials:	DHS
Calibrator ID #	m0894
Date:	3/7/2007

Balance Information	
Manufacturer	Sartorius
MODEL#	R200D
ID Number	IW-0105
Lab/Rooms	773A/B122

Weight Set Information	
Expiration	02/20/11
Manufacturer	Troemner
Wt. Set ID	SL-407

Functionality	
Power	Pass
Level	Pass
Tarrim	Pass
P/NDisplay	Pass

Visual Inspection	
Damaged	Pass
Level	Pass
Clean	Pass
Complete	Pass

Statistics	High Wt(s).	Mid Wt(s).	Low Wt.	Minimal Wt.
AVERAGE	199.999900	99.999720	50.000000	1.000180
Bias (abs)	0.000163	0.000007	0.000059	0.000216
% Bias	0.000081	0.000007	0.000118	0.021538
% RSD	0.000000	0.000045	0.000000	0.045035
SD(abs)	0.000000	0.000045	0.000000	0.000460
Max SD	0.000238	0.000232	0.000231	0.000231
Calculated t	Not Significant	Not Significant	Not Significant	Not Significant
Pooled Abs. Std. Dev., 16 df =		0.000731	Tab. Chi Sq =	32.0
Tabled t, 16 df (99% Conf.) =		2.921	Cal. Chi Sq =	21.4
Tabled F, 2, 16 df (99% Conf.)=		6.23	F Statistic =	Not Significant

Bal/Wt.Uncertainty Ratio	
HighWt(s).	7.27273
MidWt(s).	34.75251
LowWt.	50.00000
Minimal Wt.	307.00231

Cornerloading	
Position	t-Statistic
Top	0.52
Right	0.52
Bottom	0.09
Left	0.52

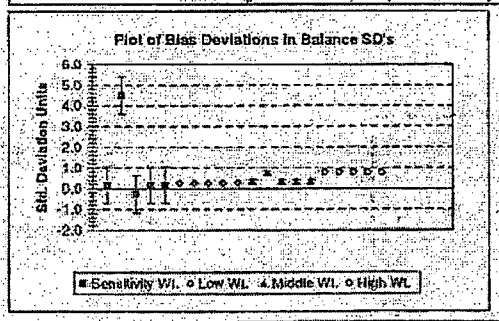
Total Uncertainty 95% CL (K=2)	Grams	Percent
High Wt.	0.00051	0.00025%
Middle Wt.	0.00047	0.00047%
Low Wt.	0.00047	0.00093%
Minimal Wt.	0.00051	0.05103%

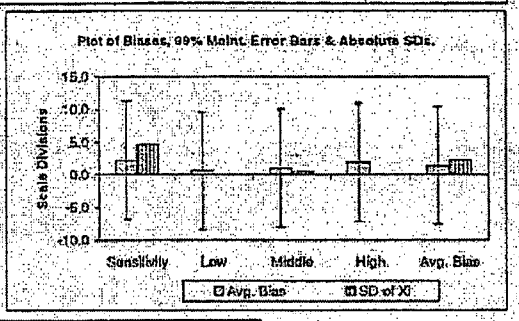
Control Limits	Mean Wt.	3 DEV'S	Low Limit	High Limit
High Wt.	199.9999	0.000713242	199.9988868	200.0009132
Middle Wt.	99.99972	0.000694752	99.99902525	100.0004148
Low Wt.	50	0.00069431	49.99930569	50.00069431
Minimal Wt.	1.00018	0.000693906	0.999486094	1.000873906

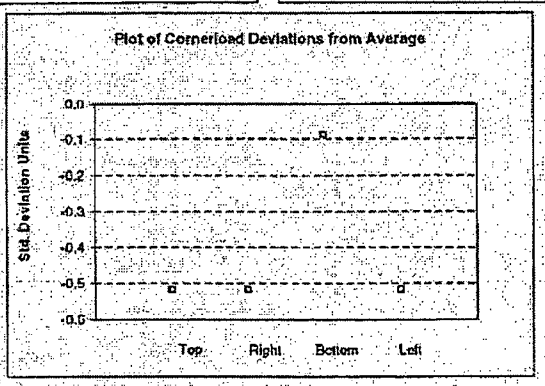
ACCEPTANCE CRITERIA	
Summary:	Balance passes QA Limits
Linearity(Bias)	Balance passes
Precision (SD)	Balance passes
Corner Loading	Balance passes
Disposition	AS LEFT = AS FOUND

0.8 grams minimum quantity that can be weighed to maintain QA Test Limits with 99.7% confidence

1.0 grams minimum quantity that can be weighed to maintain a Standard Deviation Limits @ 0.1% Tolerance per USP







Pg 3of3

copy

Certificate of Calibration

Issued by

Savannah River Standards Laboratory

Westinghouse SRC, Building 736-A
Aiken, SC 29801

M & TE #: WP-550 **Cal. Procedure:** L10.1-301,REV.2

Description: WEIGHT SET,1MG-100G

Manufacturer: TROEMNER

Model#: N/A

Serial#: 53514

Calibrated: 08/08/2005

Frequency: 24 Months

Expires: 08/08/2007

NIST Traceable Standard(s) used, (Expiration Date):
SL-1005 (CBU), SL-749A (CBU), SL-20KGWTSET (04/21/08)

Print Specification: n/a
The estimated uncertainty (k=2) of the standard(s) and measurement process at SRSL is:
SEE ATTACHED DATA SHEET

The measurements made on WP-550 were obtained at 23 +/- 2.0°c and 33% RH

CALIBRATION DATA FOR WP-550

SEE ATTACHED INSTRUMENT TEST REPORT FOR MEASUREMENT DATA

NOTE: CUSTODIAN REQUESTED TOLERANCE: NONE
NOTE: THE WEIGHT SET HAS MET CLASS 2 TOLERANCES PREVIOUSLY. THE WEIGHT SET MEETS CLASS 2 " EXCEPT" THE 20MG WEIGHT. IT MEETS CLASS 3.

THIS INSTRUMENT PASSED CALIBRATION. AS FOUND = AS LEFT

The assigned uncertainty of the UUT as determined by tolerance test is:
SEE ATTACHED SHEET

Metrologist: D. R. SMITH D R Smith — Signature | PR Init. | Engr. Init. 8/10/05

Note 1: This certificate shall not be reproduced except in full without the advanced written approval of the SRSL.
Note 2: The 'as received' condition of the standard, set of standards, or measurement equipment described herein was as expected, unless otherwise noted in the body of the certificate.

Page 1 of 2

Mass Calibration Data Summary

Issued By
Savannah River Standards Laboratory
Westinghouse SRC, Building 736-A
Aiken, SC 29801

Calibration Serial No.	M&TE No.	Metrologist	Date
WP-550-2005001	WP-550	D Smith	08/08/2005
Tolerance Class			
ASTM 3			

Comments:

CUSTODIAN TOLERANCE REQUEST: NONE. THE WEIGHT SET HAS MET CLASS 2 TOLERANCES PREVIOUSLY. THE WEIGHT SET MEETS CLASS 2 "EXCEPT" THE 20MG WEIGHT. IT MEETS CLASS 3.

Uncertainties are calculated using the GUM method of RSS. They are reported at K=2, 95% Confidence. Standards used are 1 piece ASTM Class 0 Weights Calibrated at NIST 5/15/01.

Nom Wt		Wt # or Marking	True Mass		App. Mass at 8g/cc		Uncertainty (mg)	Density (g/cc)	Method
1	mg		1.011583330	mg	1.011285430	mg	0.0020	2.70	Comparison
2	mg		2.008920000	mg	2.008328400	mg	0.0020	2.70	Comparison
2	mg	*	2.010420000	mg	2.009827950	mg	0.0020	2.70	Comparison
5	mg		4.990903330	mg	4.989433570	mg	0.0021	2.70	Comparison
10	mg		9.990190000	mg	9.987248000	mg	0.0020	2.70	Comparison
20	mg		19.99070667	mg	19.98481963	mg	0.0020	2.70	Comparison
20	mg	*	19.99627333	mg	19.99038466	mg	0.0020	2.70	Comparison
50	mg		50.00707667	mg	50.01096334	mg	0.0020	16.60	Comparison
100	mg		100.0143592	mg	100.0221325	mg	0.0020	16.60	Double Substitution
200	mg		200.0054846	mg	200.0210295	mg	0.0020	16.60	Double Substitution
200	mg	*	200.0037489	mg	200.0192937	mg	0.0020	16.60	Double Substitution
500	mg		499.9703844	mg	500.0092433	mg	0.0020	16.60	Double Substitution
1	g		1.000035040	g	1.000033040	g	0.0026	8.00	Double Substitution
2	g		2.000031400	g	2.000031400	g	0.0026	8.00	Double Substitution
2	g	*	2.000019300	g	2.000019300	g	0.0026	8.00	Double Substitution
5	g		5.000008760	g	5.000008760	g	0.0031	8.00	Double Substitution
10	g		9.9999887	g	9.9999887	g	0.012	8.00	Double Substitution
20	g		19.999987	g	19.999987	g	0.013	8.00	Double Substitution
20	g	*	19.999987	g	19.999987	g	0.013	8.00	Double Substitution
50	g		49.999907	g	49.999907	g	0.016	8.00	Double Substitution
100	g		100.00002	g	100.00002	g	0.023	8.00	Double Substitution

APPENDIX H. List of Equipment Used in Study

List of Equipment Used for South Texas Project

Instrument	Room	Building
Balance	B122	773A
Gamma Analyzer	B022	773A
ICP-AES	B054	773A

6/8/2007

APPENDIX I. Personnel Qualification

Approval of Personnel Qualification Working on South Texas Project are Qualified for their Tasks.

Individuals	Task
Daniel Kaplan	Project Leader, Scientist
Carl Black	Kd Measurement, geochemistry measurements
Dave Diprete	gamma radiation measurements
John Connelly	QA
Mark Jones	ICP

I approve that the above personnel are qualified to complete their respective tasks

Daniel I. Kaplan 6/8/2007

DANIEL I. KAPLAN

Savannah River National Laboratory, Aiken, SC 29808
Phone: 803/725-2363; Fax: 803/725-4707; daniel.kaplan@srnl.doe.gov

EDUCATION

Ph.D. Environmental Chemistry, University of Georgia 1993
M.S. Soil and Plant Science, University of New Hampshire 1983
B.S. Soil and Plant Science, University of New Hampshire 1977

EMPLOYMENT

1998 to Present. Research Fellow, Savannah River National Laboratory, Aiken, SC.
1993 to 1998. Senior Research Scientist, Transport Geochemistry. Pacific Northwest National Laboratory, Richland, WA.
1985 to 1993. Laboratory Technician, Biogeochemistry, University of Georgia, Savannah River Ecology Laboratory, Aiken, SC.
1983 to 1985 Laboratory Researcher. Molecular Biology/Genetic Engineering. Agracetus,Corporation, Middleton, WI

RESEARCH FOCUS

- Developing geochemical models for reactive transport codes
- Geochemical processes at the water/mineral interface
- Speciation and transport of radionuclide, especially as they related to the vadose zone
- Remediation: In-situ groundwater and soil remediation and monitored natural attenuation
- Nanoparticle and colloid chemistry

SELECTED PROFESSIONAL APPOINTMENTS and AWARDS

- 8 Patents or Pending Patents related to environmental remediation, analytical chemistry, & molecular biology
- Adjunct Professor: Washington State University and Clemson University

SELECTED PUBLICATIONS (10 of >80)

Kaplan, D. I., B. A. Powell, L. Gumapas, J. T. Coates, and R. A. Fjeld.. 2006. Influence of pH on Plutonium Deosportion /Solubilization from Sediment. **Environ. Sci. Technol.** (In press).

Kaplan, D. I., D. I. Demirkanli, L. Gumapas, B. A. Powell, R. A. Fjeld, F. J. Molz, and S. M. Serkiz. 2006. 11-Year Field Study of Pu Migration from Pu III, IV, and VI Sources. **Environ. Sci. Technol.** 40(2): 443-448.

Powell, B. A., Duff, M. C., Kaplan, D. I., Fjeld, R. A., Hunter, D. B., Bertsch, P. M., Eng, P., Newville, M., Rivers, M. L., Sutton, S. R., Triay, I. R., and Vaniman, D. T. 2006. Plutonium Oxidation and Subsequent Reduction by Mn(IV) Minerals in Yucca Mountain Tuff. **Environ Sci. Technol.** 40(11):3508-3514.

Kaplan, D. I., B. A. Powell, D. I. Demirkanli, R. A. Fjeld, F. J. Molz, S. M. Serkiz. 2004. Plutonium Mobility During Long-Term Transport Through an Unsaturated Subsurface Environment. **Environ. Sci. Technol.** 38:6016–6024.

Gamerdinger, A. P., and D. I. Kaplan. 2001. Physical and Chemical Determinants of Colloid Transport and Deposition in Water-Unsaturated Sand and Yucca Mountain Tuff. **Environ. Sci. Technol.** 35:2497-2504.

Powell, B. A., R. A. Fjeld, D. I. Kaplan, J. T. Coates, and S. M. Serkiz. 2005. $Pu(V)O_2^+$ Adsorption and Reduction by Synthetic Hematite (α-Fe_2O_3) and Goethite (α-FeOOH). **Environ. Sci. Technol.** 39:2107–2114.

Gamerdinger, A. P., D. I. Kaplan, and R. J. Serne. 2001. Two-region Flow Contributes to Rate-Limited Sorption of Uranium(VI) During Transport in an Unsaturated Silt Loam. **Water Resources Research** 37(12), 3147-3153.

Kaplan, D. I., P. M. Bertsch, and D. C. Adriano. 1995. Facilitated Transport of Metals Through an Acidified Coastal Plain Aquifer. **Ground Water** 33:708-717.

Kaplan, D. I., P. M. Bertsch, and K. A. Orlandini. 1994. Actinide Association with Groundwater Colloids as a Function of Distance from a Point Source. **Radiochimica Acta** 66/67:181-187.

Kaplan, D. I., D. B. Hunter, P. M. Bertsch, and D. C. Adriano. 1994. Application of Synchrotron X-Ray Fluorescence Spectroscopy and Energy Dispersive X-Ray to Identify Contaminant Metals on Groundwater Colloids. **Environ. Sci. Technol.** 28:1186-1189.

John J. Connelly, PE, CM
Resume
Experience and Qualifications

Work Experience

1988 to Present: DuPont and Westinghouse/Washington Savannah River Company
Principal Quality Engineer in the Savannah River National Laboratory on the Department of Energy's Savannah River Site: Responsible for providing quality engineering services to assigned Savannah River National Laboratory (SRNL) organizations. Additional duties include the performance of audits, surveillances, and assessments on SNNL organizations. Provided QE services including: reviewing and approving task QA plans, task technical plans, procurement documents, nonconformance reports (NCRs), and corrective actions. Review and comment on site-level QA Manual and SRNL L1 Manual revisions. Interfacing with quality engineers, researchers and managers, as required, on QA matters. Assist in the training and qualification of auditors and lead auditors.

1974 to 1988: Gilbert Associates, Inc./Gilbert Commonwealth, Inc.
Lead Civil Quality Engineer and Lead Auditor on nuclear power plants during the construction phase. Performed oversight for owner utility of contractor's civil construction activities.

1972-1974: Stone & Webster Engineering Corporation.
Materials Testing Laboratory Supervisor over testing of civil construction materials on nuclear power plant under construction.

1970-1972: General Public Utilities.
Quality Assurance Engineer and Auditor. Provided owner's oversight of contractor's and designer's on-site civil activities.

1966-1970: United States Air Force

1966: NYC Board of Water Supply.
Civil Engineer. Provide surveying for water tunnel 900 feet under New York harbor.

Military

United States Air Force, Civil Engineering Officer, 4 years active duty (including Vietnam service) + 16 years Air National Guard in combat engineering squadron. Retired LTC.

Education:

- Bachelor of Civil Engineering, Manhattan College, 1966
- Graduate program for Master of Science in Engineering Management, University of Alabama Huntsville, not completed.

ASME Codes & Standards

Participant in ASME/ASTM Nuclear QA Standards development since 1971.

- Member & secretary of working groups of "daughter standards."
- Member of NQA subcommittees
- Vice Chair of SC on Applications
- Member, ASME NQA Main Committee

Training History

Last Name	DIPRETE	First Name	DAVID	User ID	L5694	Org Code	LA200

Course Code	Course Title	Setting	Revision	Class Status	Completion Date
V1000000	10TH ANNUAL CONF ON MODERN TRENDS IN ACTIVATION	Offsite		COMPLETED	null
V1000000	37TH ORNL-DOE CONF. ANAL. CHEM	Offsite		COMPLETED	null
V1000000	43RD BIOASSAY,ANALYTICAL & RADIOCHEMISTRY	Offsite		COMPLETED	null
V1000000	46TH ANNUAL CONF BIOASSAY,ENVIRON,& ANALYTICAL RAD	Offsite		COMPLETED	null
V1000000	ACS 220TH NATIONAL MEETING	Offsite		COMPLETED	null
V1000000	49TH ANNUAL RADIOBIOASSAY & RADIOCHEMICAL MEASUREM	Offsite		COMPLETED	null
V1000000	47TH ANNUAL CONF BIOASSAY,ANALYTICAL,&ENVIROMENTAL	Offsite		COMPLETED	null
V1000000	44TH ANNUAL BIOASSAY, ANALYTICAL & ENV. CHEM CONF.	Offsite		COMPLETED	null
V1000000	AMERICAN CHEMICAL SOCIETY NATIONAL MEETING	Offsite		COMPLETED	null
V1000000	TWELFTH SYMP ON SEPARATION SCIENCE & TECH ENERGY	Offsite		COMPLETED	null
V1000000	TSA CLASS FOR SLD PROGRAM	Offsite		COMPLETED	null
V1000000	NUCLEAR CHEMISTRY AND THE SAVANNAH RIVER SITE	Offsite		COMPLETED	null
V1000000	METHODS AND APPLICATIONS OF RADIOANALYTICAL CHEM	Offsite		COMPLETED	null
V1000000	METHODS & APPLCIATIONS OF RADIOANALYTICAL CHEMISTR	Offsite		COMPLETED	null
TMME1305	ELECTRICAL HAZARDS AWARENESS BRIEFING	SP	00	COMPLETED	02-Jul-2007
LSGEN058	L7.7, 1.06 & 1.07 PROCEDURE CHANGES	BR	00	COMPLETED	07-Jun-2007
XTMGTTAV	TRITIATED WATER ANALYSIS AND SOLIDIFICATION	BR	00	COMPLETED	16-May-2007
TMEE3050	SAFE PRACTICE ON OR NEAR ELECTRICAL CONDUCTORS	SP	04	COMPLETED	30-Apr-2007
HPSSRC11	HEALTH PHYSICS ASPECTS OF HOMELAND SECUITY	BS	00	COMPLETED	20-Apr-2007
SLBE3013	SRNL 3013 PROJECT BERYLLIUM & MEDICAL SURVEILLANCE	BR	00	COMPLETED	08-Mar-2007
TRWG5203	RADIATION INSTRUMENTATION AND MONITORING	PA	02	COMPLETED	07-Mar-2007
TRWG5204	BETA-GAMMA INSTRUMENTATION AND MONITORING	PA	02	COMPLETED	07-Mar-2007
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION AND MONITOR	PA	02	COMPLETED	07-Mar-2007
LSGEN048	NUCLEAR MATERIAL CUSTODIAN DELTA TRAINING	RS	00	COMPLETED	04-Mar-2007
LSGEN049	ACCOUNTABLE MATERIAL HANDLER DELTA TRAINING	RS	00	COMPLETED	04-Mar-2007
LSGEN050	NUCLEAR CRITICALITY SAFETY DELTA TRAINING	RS	00	COMPLETED	04-Mar-2007
TREG0014	BLOODBORNE PATHOGEN ALTERNATE YEAR BRIEFING	SP	02	COMPLETED	28-Feb-2007
LSLST003	LAB STANDARD TRAINING REFRESHER FOR 2007	SP	04	COMPLETED	20-Feb-2007
LSCT0046	RESPONSE TO ABNORMAL EVENTS	BR	00	COMPLETED	14-Feb-2007
SG152951	SRNL ACCOUNTABLE MATERIAL HANDLER	SP	05	COMPLETED	13-Feb-2007

LSADS054	OPERATE B003 WATER FILTRATION SYSTEM	PF	00	GRANTED EXCEPTION	23-Jan-2007
TRGCAT07	CONSOLIDATED ANNUAL TRAINING 2007 (CAT)	SP	00	COMPLETED	23-Jan-2007
LSGEN034	SRNL R&D BRIEF ON WORK PLANNING & CONTROL FOR EMPL	BR	00	COMPLETED	18-Jan-2007
LSGEN037	CONTROLLING FLAM. GASES & LIQ. IN RAD. GLOVEBOXES	BR	00	COMPLETED	17-Jan-2007
HRDOD285	WSRC LEADERS FORUM	CR	00	COMPLETED	15-Nov-2006
LSGEN031	VESSEL PROCUREMENT	RS	00	COMPLETED	06-Oct-2006
LSADS052	HANDLE TREATABILITY SAMPLES	PF	01	COMPLETED	19-Sep-2006
TMEE6400	MINOR/EDITORIAL CHANGES TO 18Q-2	BR	00	COMPLETED	13-Sep-2006
LSGEN029	R&D RQMTS FOR WORKING W/CLASS 1 FLAMMABLE LIQUID	RS	00	COMPLETED	27-Jul-2006
QHRG0400	RADIOLOGICAL WORKER 2 SELF-STUDY	SP	17	COMPLETED	30-Jun-2006
TMME1300	ELECTRICAL HAZARD AWARENESS - ADMINISTRATIVE	BR	01	COMPLETED	30-Jun-2006
TMME1302	ELECTRICAL HAZARD AWARENESS-ELECTRICAL WORKERS	BR	01	COMPLETED	30-Jun-2006
TMME1301	ELECTRICAL HAZARD AWARENESS-NON-ELECTRICAL WORKERS	BR	01	COMPLETED	28-Jun-2006
LSGEN025	TREATABILITY STUDY AWARENESS TRAINING	BR	00	COMPLETED	08-Jun-2006
TMEE3050	SAFE PRACTICE ON OR NEAR ELECTRICAL CONDUCTORS	SP	04	COMPLETED	28-Apr-2006
LSADS052	HANDLE TREATABILITY SAMPLES	PF	00	COMPLETED	15-Mar-2006
TMEE6200	GENERAL REVISION BRIEFING PACKAGE	BR	00	COMPLETED	14-Mar-2006
TREG0013	BLOODBORNE PATHOGENS/FIRST AID/CPR	CR	05	COMPLETED	01-Mar-2006
TREG0013	BLOODBORNE PATHOGENS/FIRST AIT/CPR	JP	01	COMPLETED	01-Mar-2006
LSLST003	LABORATORY STANDARD REFRESHER TRNG. (2006)	SP	03	COMPLETED	24-Feb-2006
TRGCAT06	CONSOLIDATED ANNUAL TRAINING 2006 (CAT)	SP	00	COMPLETED	20-Jan-2006
LSGEN024	R&D ARW RADCON PRACTICES REFRESHER (2005)	CR	00	COMPLETED	14-Nov-2005
LSGEN016	PRESSURE PROTECTION PRACTICES	SP	00	COMPLETED	27-Sep-2005
QCSC0001	SOURCE CONTROL CUSTODIAN PROCEDURE UPDATE TRAINING	SP	00	COMPLETED	21-Sep-2005
LSGEN020	R&D PROCEDURE COMPLIANCE	BR	00	COMPLETED	01-Sep-2005
SSPOE002	ASSIGN COMPETENT PERSON (ACP) BRIEFING	SP	00	COMPLETED	01-Aug-2005
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	26-May-2005
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	01	COMPLETED	26-May-2005
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	26-May-2005
TMEE0300	SAFE PRACTICE ON OR NEAR ELECTRICA L CONDUCTORS	CR	05	COMPLETED	20-Apr-2005
TMEE2800	ELECTRICAL SYSTEMS SAFETY	CL	01	COMPLETED	12-Apr-2005
LSLST003	LAB STANDARD REFRESHER FOR 2005	SP	02	COMPLETED	24-Mar-2005
STGN0016	HANFORD TREATABILITY STUDY - MATERIAL HANDLING, MO	RS	03	COMPLETED	18-Mar-2005
LSWEM002	L1, 6.24 CHANGES: TRU RADIOACTIVE WASTE PROCEDURE	BR	00	COMPLETED	01-Mar-2005
SG152950	SRNL NUCLEAR MATERIAL CUSTODIAN	SP	05	COMPLETED	22-Feb-2005
SG152951	SRNL ACCOUNTABLE MATERIAL HANDLER	SP	05	COMPLETED	22-Feb-2005
SG152952	SRNL NUCLEAR CRITICALITY SAFETY TRAINING	SP	05	COMPLETED	22-Feb-2005
LSWPT001	RPP TREATABILITY STUDY AND RESIDUE MANAGEMENT OVER	CR	02	COMPLETED	03-Feb-2005

TRGCAT05	CONSOLIDATED ANNUAL TRAINING	SP	00	COMPLETED	26-Jan-2005
QRIS5008	BEHAVIOR BASED SAFETY BBS OBSERVER WORKSHOP(MOD 4)	CL	00	COMPLETED	19-Jan-2005
TRGCAT04	CONSOLIDATED ANNUAL TRAINING	SP	02	COMPLETED	09-Nov-2004
QRIH3030	LASER SAFETY FOR CLASS III & IV	CR	00	COMPLETED	27-Oct-2004
LSADS037	ANALYZE SAMPLE (ALPHA SPECTROSCOPY)	OJ	00	GRANTED EXCEPTION	16-Sep-2004
LSADS038	ANALYZE SAMPLE (GAS FLOW PROPORTIONAL COUNTER)	OJ	00	GRANTED EXCEPTION	16-Sep-2004
ST020045	PREPARE SAMPLE FOR LIQUID SCINTILLATION	OM	00	GRANTED EXCEPTION	16-Sep-2004
ST020051	PREPARE SAMPLE FOR TRITIUM ANALYSIS	OM	00	GRANTED EXCEPTION	16-Sep-2004
ST020053	ANALYZE SAMPLE (GAMMA SPECTROSCOPY)	OM	00	GRANTED EXCEPTION	16-Sep-2004
ST020065	PREPARE ALPHA PLANCHET	OM	00	GRANTED EXCEPTION	16-Sep-2004
ST020066	ANALYZE SAMPLE (LIQUID SCINTILLATION)	OM	00	GRANTED EXCEPTION	16-Sep-2004
ST020067	ANALYZE SAMPLE NEUTRON ACTIVATION ANALYSIS METHOD	OM	00	GRANTED EXCEPTION	16-Sep-2004
ST020068	PERFORM SOLVENT/SOLVENT EXTRACTION	OM	01	GRANTED EXCEPTION	16-Sep-2004
LSGEN007	SRTC JHA TRAINING	SP	00	COMPLETED	04-Aug-2004
QHRG0400	RADIOLOGICAL WORKER II SELF-STUDY	SP	16	COMPLETED	14-Jun-2004
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	01-Apr-2004
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	01	COMPLETED	01-Apr-2004
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	01-Apr-2004
LSGEN006	SRTC ARW PRACTICE REFRESHER AND PROFICIENCY	CR	00	COMPLETED	31-Mar-2004
LSLST003	LAB STANDARD REFRESHER TRAINING	SP	01	COMPLETED	24-Mar-2004
QRRP1001	NEGATIVE PRESSURE RESPIRATOR RETRAINING CHALLENGE	SP	01	COMPLETED	27-Feb-2004
TRPG4001	GENERAL RESPIRATORY RETRAINING	SP	01	COMPLETED	27-Feb-2004
LSMTD002	SUMMARY OF CHANGES TO SRTC DRAIN SYSTEM TRAINING	SP	00	COMPLETED	27-Jan-2004
STGN0022	DOE/RW-0333P QUALITY ASSURANCE REQUIREMENTS DOCUME	SP	02	COMPLETED	13-Jan-2004
TRGCAT03	CONSOLIDATED ANNUAL TRAINING	SP	00	COMPLETED	25-Nov-2003
LSGEN005	L1, 2.32 RADIOLOGICAL WORK PRACTICES OVERVIEW	CR	00	COMPLETED	28-Oct-2003
LSBMDV02	SRTC HUMAN PERFORMANCE - UNDERSTANDING RISK	CR	00	COMPLETED	10-Sep-2003
LSLST003	LAB STANDARD REFRESHER FOR 2003 (TOXICS)	SP	00	COMPLETED	26-Jun-2003
STGN0024	ENGINEERING CALCULATIONS	RS	00	COMPLETED	12-Jun-2003
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	31-Mar-2003
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	00	COMPLETED	31-Mar-2003
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	31-Mar-2003
LSGEN004	FIRE SUPRESSION TRAINING FOR GLOVE BOX USERS	RS	00	COMPLETED	03-Mar-2003
SG152950	SRTC NUCLEAR MATERIAL CUSTODIAN	SP	04	COMPLETED	28-Feb-2003
SG152951	SRTC ACCOUNTABLE MATERIAL HANDLER	SP	04	COMPLETED	27-Feb-2003

SG152952	SRTC NUCLEAR CRITICALITY SAFETY TRAINING	SP	04	COMPLETED	27-Feb-2003
STGN0022	DOE/RW-0333P QUALITY ASSURANCE REQUIREMENTS DOCUME	SP	01	COMPLETED	18-Feb-2003
QRRP1000	INITIAL NEGATIVE PRESSURE RESPIRATOR TRAINING	CR	05	COMPLETED	13-Feb-2003
QRRP1000	INITIAL NEGATIVE PRESSURE RESPIRATOR TRAINING	JP	01	COMPLETED	13-Feb-2003
TRPG4000	GENERAL RESPIRATORY PROTECTION	CR	02	COMPLETED	13-Feb-2003
SE010402	SRTC WASTE GENERATOR - CBT	SP	01	COMPLETED	21-Nov-2002
TRGCAT02	CONSOLIDATED ANNUAL TRAINING (CAT)	SP	00	COMPLETED	01-Nov-2002
LSLST002	LAB STANDARD REFRESHER 2002-HIGHLY TOXIC MATERIALS	SP	00	COMPLETED	28-Jun-2002
QHRG0400	RADIOLOGICAL WORKER II SELF STUDY TRAINING	JP	09	COMPLETED	28-Jun-2002
QHRG0400	RADIOLOGICAL WORKER II SELF-STUDY	SE	14	COMPLETED	28-Jun-2002
LSMTD001	SRTC DRAINS TRAINING	SP	00	COMPLETED	23-Apr-2002
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	01-Apr-2002
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	00	COMPLETED	01-Apr-2002
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	01-Apr-2002
STGN0003	SRTC LAB STANDARD ANNUAL REFRESHER TRAINING (U)	SP	02	COMPLETED	28-Mar-2002
QRIS5007	BEHAVIOR BASED SAFETY TEAM SAFETY WORKSHOP (MOD 3)	CR	00	COMPLETED	14-Mar-2002
TICTS003	OJT TRAINER EVALUATOR	CR	03	GRANTED EXCEPTION	06-Mar-2002
SE010401	SRTC TECHNICAL AREA TRU WASTE HANDLER	SP	01	COMPLETED	15-Feb-2002
TRGCAT01	CONSOLIDATED ANNUAL TRAINING	SP	00	COMPLETED	12-Oct-2001
TRWG2001	RWT REFRESHER TRAINING	RS	00	COMPLETED	13-Sep-2001
SL090606	SRTC/TNX/AL RCRA SATELLITE AREAS	RS	06	COMPLETED	18-Jul-2001
STGN0022	RW-0333P QUALITY ASSURANCE REQUIRED READING	RS	00	COMPLETED	15-May-2001
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	28-Mar-2001
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	00	COMPLETED	28-Mar-2001
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	28-Mar-2001
STGN0003	SRTC LAB STANDARD ANNUAL REFRESHER TRAINING (U)	SC	00	COMPLETED	21-Mar-2001
SG152950	SRTC NUCLEAR MATERIAL CUSTODIAN INITIAL BRIEFING	BR	03	COMPLETED	06-Feb-2001
SG152951	SRTC ACCOUNTABLE MATERIAL HANDLER INITIAL BRIEFING	BR	03	COMPLETED	06-Feb-2001
SG152952	SRTC NUCLEAR CRITICALITY SAFETY TRNG INITIAL BRIEF	BR	03	COMPLETED	06-Feb-2001
STGN0028	CRC/ARC REQUIRED READING	RS	00	COMPLETED	11-Jan-2001
STGN0037	SRTC CONSTANT AIR MONITORING (CAM) SYSTEM	WE	00	COMPLETED	19-Dec-2000
SE010402	SRTC WASTE GENERATOR	WE	00	COMPLETED	06-Nov-2000
SE010417	L1 MANUAL 2.17/6.03 OVERVIEW	BR	00	COMPLETED	19-Oct-2000
TRGCAT00	CONSOLIDATED ANNUAL TRAINING	WE	00	COMPLETED	18-Oct-2000
QHRG0400	RADIOLOGICAL WORKER II SELF-STUDY TRAINING	JP	07	COMPLETED	31-Jul-2000
QHRG0400	RADIOLOGICAL WORKER II SELF-STUDY	SE	11	COMPLETED	31-Jul-2000
HRDGV001	APRIL 2000 DIVERSITY STAND-DOWN	BS	00	COMPLETED	19-Apr-2000
STGN0031	L7.7, PROCEDURE 1.07, INTERIM REV. 5 (U)	RS	00	COMPLETED	21-Oct-1999

TREGCAT9	CONSOLIDATED ANNUAL TRAINING (CAT)	SP	00	COMPLETED	14-Oct-1999
STGN0007	SRTC NUCLEAR CRITICALITY SAFETY ANNUAL REFRESHER	BS	00	COMPLETED	28-Sep-1999
STGN0008	SRTC ACCOUNTABLE MATERIAL HANDLER ANNUAL REFRESHE	BS	00	COMPLETED	28-Sep-1999
STGN0009	SRTC NUCLEAR MATERIAL CUSTODIAN ANNUAL REFRESHER	BS	00	COMPLETED	28-Sep-1999
STGN0003	SRTC LAB STANDARD ANNUAL REFRESHER TRAINING (U)	SC	00	COMPLETED	01-Sep-1999
QSCL1600	SITEWIDE SECURITY STANDDOWN	VC	00	COMPLETED	03-Aug-1999
QSCL1601	SITEWIDE SECURITY STANDDOWN	RS	01	COMPLETED	03-Aug-1999
QRCID208	SOURCE CONTROL CUSTODIAN TRAINING	CR	02	COMPLETED	12-Jul-1999
STGN0016	BNFL - I-WPT-003	RS	01	COMPLETED	28-Jun-1999
TRWG8000	F-CANYON OPERATOR INTAKE	VC	00	COMPLETED	24-Jun-1999
TICTS023	OJT CONTINUING TRAINING	CR	01	COMPLETED	03-Jun-1999
TMEE0300	SAFE PRACTCES ON OR NEAR ELECTRICAL CONDUCTORS	CR	01	COMPLETED	15-Apr-1999
TICTS023	OJT CONTINUING TRAINING	CR	01	EXEMPTION B	14-Apr-1999
TRWG5220	ARWT CORE SELF STUDY	JP	01	COMPLETED	10-Mar-1999
TRWG5220	ARWT CORE SELF STUDY	SE	01	COMPLETED	10-Mar-1999
STGN0015	RECEIPT OF SPECIAL NUCLEAR MATERIAL, MISSED SIGNA	RS	00	COMPLETED	16-Feb-1999
STGN0005	JOB HAZARDS ANALYSIS: HANDLING LEAD BRICKS AND OTH	RS	00	COMPLETED	28-Jan-1999
STVE0002	SYSTEMATIC INDUSTRIAL OPERATIONS SEMINAR (U)	CR	00	COMPLETED	15-Dec-1998
TRWG5200	ADVANCED RADIOLOGICAL WORKER TRAINING CORE	CR	01	GRANTED EXCEPTION	07-Dec-1998
TREGCATB	CONSOLIDATED ANNUAL TRAINING (CAT)	WE	00	COMPLETED	01-Dec-1998
STGN0010	SRTC NUCLEAR MATERIAL CUSTODIAN REQUIRED READING	RS	00	COMPLETED	24-Nov-1998
STGN0016	BNFL - I-WPT-003	RS	00	COMPLETED	26-Oct-1998
SG152901	LOW LEVEL WASTE HANDLING & MINIMIZATION FOR WASTE	CR	01	TESTOUT	29-Sep-1998
STGN0007	SRTC NUCLEAR CRITICALITY SAFETY ANNUAL REFRESHER	SE	00	COMPLETED	23-Sep-1998
STGN0008	SRTC ACCOUNTABLE MATERIAL HANDLER ANNUAL REFRESHE	SE	00	COMPLETED	23-Sep-1998
STGN0009	SRTC NUCLEAR MATERIAL CUSTODIAN ANNUAL REFRESHER	SE	00	COMPLETED	23-Sep-1998
LSADS011	ADS JOB SPECIFIC TRAINING FOR HANDLING SAMPLES CON	BS	00	COMPLETED	01-Sep-1998
TMEE2800	ELECTRICAL SYSTEMS SAFETY	CL	00	COMPLETED	07-Aug-1998
STGN0003	SRTC LAB STANDARD ANNUAL REFRESHER TRAINING (U)	SC	00	COMPLETED	31-Jul-1998
QHRG0400	RADIOLOGICAL WORKER II SELF-STUDY	JP	06	COMPLETED	14-Jul-1998
QHRG0400	RADIOLOGICAL WORKER II SELF-STUDY	SE	08	COMPLETED	14-Jul-1998
TRWG5200	ADVANCED RADIOLOGICAL WORKER TRAINING CORE	PA	00	COMPLETED	08-Jul-1998
HRD10923	TEAMWORK, THE KEY TO VALUING DIVERSITY	CR	00	COMPLETED	27-May-1998
STGN0002	SRTC ADVANCED RAD WORKER HANDOUT	BS	00	COMPLETED	27-May-1998
TICTS023	OJT TRAINER/EVALUATOR CONTINUING TRAINING	CR	00	COMPLETED	15-Apr-1998
SE010401	SRTC TECHNICAL AREA TRU WASTE HANDLER	CL	00	COMPLETED	24-Feb-1998
SG152980	SRTC TECHNICAL AREA FACILITY ACCESS TRAINING	SC	00	COMPLETED	04-Nov-1997

TRWG9700	RWT REFRESHER 1997, VOL. 2	RS	01	COMPLETED	04-Nov-1997
TREGCAT7	CONSOLIDATED ANNUAL TRAINING	SC	00	COMPLETED	14-Oct-1997
SG152950	SRTC NUCLEAR MATERIAL CUSTODIAN INITIAL BRIEFING	CR	00	COMPLETED	11-Sep-1997
SG152952	SRTC NUCLEAR CRITICALITY SAFETY TRAINING	CR	00	COMPLETED	11-Sep-1997
SG152954	WSRC GENERAL CRITICALITY	CR	00	COMPLETED	11-Sep-1997
SG152951	SRTC NUCLEAR MATERIAL HANDLER	CR	00	COMPLETED	04-Sep-1997
QRCTS014	GLOVE CHANGEOUT	CR	00	COMPLETED	23-Apr-1997
TRWG5200	ADVANCED RADIOLOGICAL WORKER TRAINING CORE	JP	01	COMPLETED	19-Mar-1997
TRWG5200	ADVANCED RADIOLOGICAL WORKER TRAINING CORE	CR	01	COMPLETED	12-Dec-1996
TRWG5210	ADVANCED RAD WORKER TRAINING CORE PRE-TEST	CE	00	COMPLETED	07-Nov-1996
TREGCAT6	CONSOLIDATED ANNUAL TRAINING	SC	00	COMPLETED	30-Oct-1996
V1000000	QUALITY ASSURANCE IN RADIOCHEMISTRY	Offsite		COMPLETED	23-Oct-1996
QRCID208	SOURCE CONTROL	CR	01	COMPLETED	29-Aug-1996
V1000000	GAMMA-RAY SPECTROSCOPY FOR NUCLEAR MATR'LS ACCTNG	Offsite		COMPLETED	08-Aug-1996
QHRG0400	RADIOLOGICAL WORKER II SELF STUDY	JP	02	COMPLETED	22-Jul-1996
QHRG0400	RWT SELF STUDY - LEVEL II	SE	04	COMPLETED	22-Jul-1996
SG152901	LOW LEVEL WASTE HANDLING & MINIMIZATION FOR WASTE	CR	01	TESTOUT	09-Jul-1996
V1000000	41ST CONFERENCE ON BIOASSAY, ANALYTICAL & ENVIR	Offsite		COMPLETED	16-Nov-1995
TICATB00	CONSOLIDATED ANNUAL TRAINING	SC	00	COMPLETED	04-Oct-1995
QHRG2501	RWT REFRESHER 95 VOLUME I	SP	00	COMPLETED	27-Mar-1995
LEPBRF94	1994 SRTC EP BRIEFING	RS	00	COMPLETED	23-Nov-1994
SS152900	LOW LEVEL WASTE HANDLING & MINIMIZATION	CR	00	COMPLETED	18-Nov-1994
V1000000	US DOE SAFEGUARDS TECH TRNG PROGRAM	Offsite		COMPLETED	30-Sep-1994
QRIH1200	OSHA'S LAB STANDARD TRAINING	CR	00	COMPLETED	14-Sep-1994
QHRG0300	RWT LEVEL II FULL PRESENTATION	CL	04	COMPLETED	04-Aug-1994
TRSGETC2	INITIAL GENERAL EMPLOYEE TRAINING	CR	00	COMPLETED	27-Jul-1994

Training History

Last Name	JONES	First Name	MARK	User ID	A430	Org Code	LA100

Course Code	Course Title	Setting	Revision	Class Status	Completion Date
TSUBMP02	SUBCONTRACT TECHNICAL REPRESENTATIVE TRAINING II	SP	00	COMPLETED	15-Jul-2007
TSUBMP01	SUBCONTRACT MANAGEMENT PROGRAM TRAINING	SP	02	COMPLETED	09-Jul-2007
TMME1305	ELECTRICAL HAZARDS AWARENESS BRIEFING	SP	00	COMPLETED	27-Jun-2007
QHRG0400	RADIOLOGICAL WORKER TRAINING 2 RETRAINING	SP	18	COMPLETED	12-Jun-2007
ZSAF0705	2007 SAFETY CONFERENCE - TAKE IT PERSONALLY	BR	00	COMPLETED	12-Jun-2007
LSADS060	ANALYZE SAMPLE USING LEEMAN ICP-ES	PF	00	GRANTED EXCEPTION	11-Jun-2007
LSGEN058	L7.7, 1.06 & 1.07 PROCEDURE CHANGES	BR	00	COMPLETED	06-Jun-2007
LSMTD003	USE OF DRAIN SYSTEMS DELTA TRAINING	RS	00	COMPLETED	09-Mar-2007
SLBE3013	SRNL 3013 PROJECT BERYLLIUM & MEDICAL SURVEILLANCE	BR	00	COMPLETED	08-Mar-2007
LSGEN048	NUCLEAR MATERIAL CUSTODIAN DELTA TRAINING	RS	00	COMPLETED	04-Mar-2007
LSGEN049	ACCOUNTABLE MATERIAL HANDLER DELTA TRAINING	RS	00	COMPLETED	04-Mar-2007
LSGEN050	NUCLEAR CRITICALITY SAFETY DELTA TRAINING	RS	00	COMPLETED	04-Mar-2007
LSLST003	LAB STANDARD TRAINING REFRESHER FOR 2007	SP	04	COMPLETED	02-Mar-2007
LSCT0046	RESPONSE TO ABNORMAL EVENTS	BR	00	COMPLETED	14-Feb-2007
LSADS017	CONTAINED INDUCTIVELY COUPLED PLASMA EMISSION SPEC	JP	00	GRANTED EXCEPTION	13-Feb-2007
TMEE3050	SAFE PRACTICE ON OR NEAR ELECTRICAL CONDUCTORS	SP	04	COMPLETED	10-Feb-2007
LSGEN034	SRNL R&D BRIEF ON WORK PLANNING & CONTROL FOR EMPL	BR	00	COMPLETED	16-Jan-2007
TRGCAT07	CONSOLIDATED ANNUAL TRAINING 2007 (CAT)	SP	00	COMPLETED	02-Jan-2007
LSMTD001	SRTC DRAINS TRAINING	SP	01	COMPLETED	01-Dec-2006
TRPG5600	INITIAL BULLARD PA30 PAPR	CR	01	COMPLETED	17-Nov-2006
TRPG5600	INITIAL BULLARD PA 30 PAPR	JP	00	COMPLETED	17-Nov-2006
HRDOD285	WSRC LEADERS FORUM	CR	00	COMPLETED	15-Nov-2006
STGN0022	DOE/RW-0333P QUALITY ASSURANCE REQUIREMENTS DOCUME	SP	02	COMPLETED	07-Nov-2006
QRRP1000	INITIAL NEGATIVE PRESSURE RESPIRATOR TRAINING	CR	05	COMPLETED	02-Nov-2006
QRRP1000	INITIAL NEGATIVE PRESSURE RESPIRATOR TRAINING	JP	01	COMPLETED	02-Nov-2006
TRPG4000	GENERAL SUPERVISOR RESPIRATORY PROTECTION	CR	03	COMPLETED	02-Nov-2006
SA230111	QUALITY ASSURANCE PLAN FOR INDUSTRIAL HYGIENE LAB	BR	00	COMPLETED	16-Oct-2006
CLGENSAR	SAFETY ANALYSIS REPORT & TECH SAFETY REQUIREMENTS	BR	00	COMPLETED	05-Oct-2006
SE010402	SRTC WASTE GENERATOR - CBT	SP	01	COMPLETED	05-Oct-2006
CLGEN118	HUMAN PERFORMANCE FUNDAMENTALS	BR	01	COMPLETED	04-Oct-2006

SG152904	SRNL R&D COMPRESSED GAS CYLINDER TRAINING	SP	01	COMPLETED	04-Oct-2006
LSLST003	LABORATORY STANDARD REFRESHER TRNG. (2006)	SP	03	COMPLETED	03-Oct-2006
TMEE6400	MINOR/EDITORIAL CHANGES TO 18Q-2	BR	00	COMPLETED	27-Sep-2006
SA220972	N500 AV ALPHA SPECTROSCOPY TRAINING	SM	00	COMPLETED	21-Jul-2006
TMME1302	ELECTRICAL HAZARD AWARENESS-ELECTRICAL WORKERS	BR	01	COMPLETED	29-Jun-2006
TMEE2900	ELECTRICAL HAZARD AWARENESS	CR	00	COMPLETED	12-Jun-2006
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	12-Apr-2006
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	01	COMPLETED	12-Apr-2006
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	12-Apr-2006
SA200260	SAFE CHEMICAL HANDLING	SP	00	COMPLETED	21-Mar-2006
SE010502	F/H AREA LABORATORY WASTE GENERATOR (CBT)	SP	03	COMPLETED	11-Mar-2006
TMEE3050	SAFE PRACTICE ON OR NEAR ELECTRICAL CONDUCTORS	SP	04	COMPLETED	10-Feb-2006
TRGCAT06	CONSOLIDATED ANNUAL TRAINING 2006 (CAT)	SP	00	COMPLETED	06-Jan-2006
CLGEN117	USE OF CALCIUM GLUCONATE FOR HF SKIN CONTACT	BR	00	COMPLETED	10-Nov-2005
TRWGHA03	HAZARD ANALYSIS FOR WORKERS	CR	03	COMPLETED	15-Sep-2005
TMEE2850	ELECTRICAL SYSTEMS SAFETY WEB BASED	SP	01	COMPLETED	09-Aug-2005
TMME1302	ELECTRICAL HAZARD AWARENESS - E	BR	00	COMPLETED	30-Jun-2005
QHRG0400	RADIOLOGICAL WORKER 2 SELF-STUDY	SP	17	COMPLETED	17-Jun-2005
SA102701	SAMPLE ANALYSIS BY LEEMAN LAB ICP - PROCESS SAMPLE	JP	02	COMPLETED	12-May-2005
TMEE3050	SAFE PRACTICVE ON OR NEAR ELECTRICAL CONDUCTORS	SP	01	COMPLETED	09-Feb-2005
TRGCAT05	CONSOLIDATED ANNUAL TRAINING	SP	00	COMPLETED	01-Jan-2005
SA220300	NUCLEAR CRITICALITY SAFETY	SP	01	COMPLETED	15-Nov-2004
SA260700	INDEPENDENT ANALYYSIS PROTOCOL BRIEFING	BR	00	COMPLETED	15-Oct-2004
LSLST003	LAB STANDARD REFRESHER TRAINING	SP	01	COMPLETED	25-Aug-2004
SE010304	OSHA LAB STANDARD INITIAL (WEB BASED)	SP	00	COMPLETED	25-Aug-2004
SA220105	SOURCE CONTROL AND ACCOUNTABILITY, CLAB	BS	00	COMPLETED	21-Aug-2004
SA113100	ORGANIC EXTRACTANTS IN AQUEOUS SOLUTION BY INFRACA	JP	00	COMPLETED	30-Jul-2004
CLGEN116	LAB BACK TO BASICS/CONDUCT OF OPERATIONS	BR	00	COMPLETED	23-Jul-2004
V1000000	ICP EMISSION SPECTROMETERS TRAINING	Offsite		COMPLETED	18-Jun-2004
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	26-Apr-2004
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	01	COMPLETED	26-Apr-2004
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	26-Apr-2004
SE010502	F/H AREA LABORATORY WASTE GENERATOR. (CBT)	SP	02	COMPLETED	13-Apr-2004
TRGCAT04	CONSOLIDATED ANNUAL TRAINING	SP	02	COMPLETED	07-Apr-2004
TMEE0300	SAFE PRACTCES ON OR NEAR ELECTRICAL CONDUCTORS	CR	04	COMPLETED	29-Mar-2004
CLCT4005	FB-LINE CASE STUDY (ACTION #2)	BR	00	COMPLETED	06-Feb-2004
SA103100	URANIUM ISOTOPICS BY MASS SPECTROMETRY: IAP BRIEF.	BR	00	COMPLETED	16-Dec-2003
SA103200	URANIUM BY DAVIES-GRAY: IAP BRIEFING	BR	00	COMPLETED	16-Dec-2003

SA260600	HEU SAMPLING & ANALYTICAL QUALITY ASSURANCE PLAN	BR	00	COMPLETED	11-Nov-2003
FESHAHAO	AUTOMATED HAZARD ANALYSIS ORIENTATION	SP	00	COMPLETED	08-Nov-2003
WETISI01	ETF PROCESS SYSTEMS OVERVIEW	CR	02	COMPLETED	28-Aug-2003
QHRG0400	RADIOLOGICAL WORKER II SELF-STUDY	SP	16	COMPLETED	31-Jul-2003
SA220500	PROCEDURE PROCESS IN AL	BR	00	COMPLETED	22-Jul-2003
WAAIGO01	LIQUID WASTE PROCESSING OVERVIEW	CR	02	COMPLETED	10-Jun-2003
TRGCAT03	CONSOLIDATED ANNUAL TRAINING	SP	00	COMPLETED	11-Apr-2003
QRIS5008	BEHAVIOR BASED SAFETY BBS OBSERVER WORKSHOP(MOD 4)	CL	00	COMPLETED	19-Mar-2003
SA220300	NUCLEAR CRITICALITY SAFETY	SP	01	COMPLETED	14-Jan-2003
SA220700	THE IMPORTANCE OF ACCOUNTABILITY MEASUREMENTS	BR	00	COMPLETED	06-Jan-2003
TFSHC00F	F - AREA HAZCOM WITH FACILITY SPECIFIC	SP	00	COMPLETED	03-Jan-2003
EE000103	SYSTEMS APPROACH TO ENGINEERING	CR	00	COMPLETED	10-Dec-2002
V1000000	ION CHROMATOGRAPHY TRAINING COURSE - DIONEX	Offsite		COMPLETED	15-Oct-2002
CLGENFET	CLAB FACILITY ENTRANCE TRAINING	SP	03	COMPLETED	17-Sep-2002
QRRP1001	NEGATIVE PRESSURE RESPIRATOR RETRAINING CHALLENGE	SP	01	COMPLETED	30-Aug-2002
TRPG4001	GENERAL RESPIRATORY RETRAINING	RS	01	COMPLETED	15-Aug-2002
TRPG4001	GENERAL RESPIRATORY RETRAINING	SP	01	COMPLETED	15-Aug-2002
SA172000	HOW TO ISSUE, USE & CONTROL OPERATOR AIDS-BRIEFING	BR	00	COMPLETED	08-Aug-2002
TMEE2850	ELECTRICAL SYSTEMS SAFETY WEB BASE	SP	00	COMPLETED	02-Aug-2002
QTIHAT05	ANNUAL HEAT STRESS BRIEFING FOR AT RISK WORKERS	BS	05	COMPLETED	23-Jul-2002
TSUBMP01	SUBCONTRACT MANAGEMENT PROGRAM TRAINING	CR	00	COMPLETED	21-May-2002
SE010502	CLAB WASTE GENERATOR	SP	01	COMPLETED	20-May-2002
TRGCAT02	CONSOLIDATED ANNUAL TRAINING (CAT)	SP	00	COMPLETED	09-May-2002
EE000219	MEASUREMENT UNCERTAINTY	CR	00	COMPLETED	02-May-2002
EELT0092	DENSITY MEASUREMENT WORKSHOP	BR	00	COMPLETED	30-Apr-2002
EELT0093	TITRATION AND ELECTRODE WORKSHOP	BR	00	COMPLETED	30-Apr-2002
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	29-Apr-2002
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	00	COMPLETED	29-Apr-2002
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	29-Apr-2002
SA171002	CLAS CHEMICAL CONTROL BRIEFING	BR	00	COMPLETED	12-Feb-2002
SE010529	TRU WASTE BRIEFING	BR	00	COMPLETED	09-Jan-2002
QQMA1010	WSRC QUALITY ASSURANCE ORIENTATION	CR	11	COMPLETED	08-Jan-2002
SA220401	LABORATORY REFRESHER TRAINING (CLAS 2002)	SP	00	COMPLETED	05-Dec-2001
SA220600	WORKING IN CLAS RAD. CONTAINMENT UNITS IN A CA	JP	01	COMPLETED	05-Dec-2001
QRIS5007	BEHAVIOR BASED SAFETY TEAM SAFETY WORKSHOP (MOD 3)	CR	00	COMPLETED	31-Oct-2001
SC220001	L2.1-00118: ACCOUNTABILITY METHOD QC CHART REVIEW	BR	00	COMPLETED	31-Oct-2001
QHRG0400	RADIOLIGICAL WORKER II SELF STUDY TRAINING	JP	08	COMPLETED	20-Aug-2001
QHRG0400	RADIOLOGICAL WORKER II SELF-STUDY	SE	12	COMPLETED	20-Aug-2001
QRRP1001	NEGATIVE PRESSURE RETRAINING (U)	JP	01	COMPLETED	20-Aug-2001
TRPG4001	GENERAL RESPIRATORY RETRAINING	RS	01	COMPLETED	20-Aug-2001

SA120100	INITIAL TECHNICAL SUPPORT READING--CLAB	SP	01	COMPLETED	08-Aug-2001
TRGCAT01	CONSOLIDATED ANNUAL TRAINING	SP	00	COMPLETED	10-Jun-2001
ZTAIXB00	ETF FACILITY ENTRY BRIEFING	RS	01	COMPLETED	09-Mar-2001
NSMTCH02	H AREA PROCESSING & CHEMICAL COMPATABILITY O'VIEW	BS	00	COMPLETED	05-Mar-2001
CLGENTSR	CLAB AUTHORIZATION BASIS BRIEFING (U)	BR	00	COMPLETED	20-Feb-2001
SA220400	CLAS PROFICIENCY TOPIC " LABORATORY SAFETY (U)	WE	00	COMPLETED	20-Feb-2001
SA120300	USING STATISTICS IN THE LABORATORY	SM	00	COMPLETED	06-Feb-2001
SA220300	NUCLEAR CRITICALITY SAFETY	CR	00	TESTOUT	23-Jan-2001
TFSHC033	SFSD K-REACTOR, FS HAZCOM	SP	00	COMPLETED	18-Dec-2000
TFSHC040	TSD CENTRAL LAB, OPS & MAINT, FS HAZCOM	SP	00	COMPLETED	18-Dec-2000
EE000199	BASIC RADIOCHEMISTRY	CR	00	COMPLETED	12-Dec-2000
SA220200	2SMANUAL TRAINING FOR AL SUPPORT PERSONNEL	CR	00	COMPLETED	09-Nov-2000
TRPG2000	INITIAL PLASTIC SUIT AND HOOD AIRLINE RESPIRATOR	CR	01	COMPLETED	09-Nov-2000
TRPG2000	INITIAL PLASTIC SUIT AND HOOD AIRLINE RESPIRATORY	JP	01	COMPLETED	09-Nov-2000
SA220103	ACCESS CONTROL BRIEFING, L2-100035 (U)	BS	00	COMPLETED	18-Oct-2000
CLGENFET	CLAB FACILITY ENTRANCE TRAINING	WE	02	COMPLETED	16-Oct-2000
SA102701	SAMPLE ANALYSIS BY THE LEEMAN LABS ICP (U)	OM	00	COMPLETED	09-Oct-2000
QRRP1001	NEGATIVE PRESSURE RETRAINING (U)	JP	01	COMPLETED	14-Aug-2000
TRPG4001	GENERAL RESPIRATORY RETRAINING	RS	01	COMPLETED	14-Aug-2000
TRGCAT00	CONSOLIDATED ANNUAL TRAINING	WE	00	COMPLETED	21-Jul-2000
SE010502	CLAB WASTE GENERATOR	WE	00	COMPLETED	18-Jul-2000
SA140101	AL FACILITY SPECIFIC HAZARD COMMUNICATION	SE	03	COMPLETED	16-Jul-2000
SA171001	CHEMICAL CONTROL	CL	02	COMPLETED	20-Jun-2000
SA220106	RADIOLOGICAL CONTROL PRACTICES	BS	00	COMPLETED	09-Jun-2000
SA052009	QUALS&TNG REQ FOR WQL CURIE MAT.CTF 772-F	BS	00	COMPLETED	20-May-2000
SA052010	QUALS/TRNG REQ FOR WQL NUC MAT CUSTODIAN	BS	00	COMPLETED	20-May-2000
SA171801	NUCLEAR SAFETY SAMPLES: PROGRAM CONTROLS (U)	CR	01	COMPLETED	15-May-2000
HRDGV001	APRIL 2000 DIVERSITY STAND-DOWN	BS	00	COMPLETED	26-Apr-2000
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	13-Apr-2000
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	00	COMPLETED	13-Apr-2000
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	13-Apr-2000
SA220105	SOURCE CONTROL AND ACCOUNTABILITY, CLAB	BS	00	COMPLETED	03-Apr-2000
V1000000	ICP TRAINING SEMINAR	Offsite		COMPLETED	28-Jan-2000
SA050701	PH AND ION SELECTIVE ELECTRODE (ISE)	OM	00	COMPLETED	24-Jan-2000
SA050901	WQL CONDUCTIVITY (U)	OM	01	COMPLETED	24-Jan-2000
SA051001	LIQUID SCINTILLATION COUNTING ANALYSIS/OPERATION	OJ	00	COMPLETED	24-Jan-2000
SA051401	RADIOMETRIC COUNTING-CALIBRATION/OPERATION/MAINT.	OJ	00	COMPLETED	24-Jan-2000
SA051501	MERCURY ANALYSIS BY COLD VAPOR	OJ	00	COMPLETED	24-Jan-2000
SS061201	ICP ANALYSIS/OPERATION/MAINTENANCE (U)	CJ	01	COMPLETED	24-Jan-2000
SA050501	WQL ION CHROMATOGRAPH (U)	OM	01	COMPLETED	21-Jan-2000
SA220104	OVERVIEW OF ALARMS & INDICATORS IN THE LABS	SC	00	COMPLETED	21-Jan-2000

V1000000	SU-800-3 TENNELEC ECLIPSE/SERIES 5 LB TRNG	Offsite		COMPLETED	12-Jan-2000
QSOG0002	SAFETY OBSERVER MOCKUP TRAINING	CL	00	COMPLETED	16-Dec-1999
QSOG0001	SAFETY OBSERVER TRAINING	CR	02	COMPLETED	15-Dec-1999
QSOG0001	SAFETY OBSERVER TRAINING WORKBOOK W/ PRETEST	SP	01	COMPLETED	13-Dec-1999
THRV0033	TWELVE ANGRY MEN: TEAMS DON'T QUIT	VC	00	COMPLETED	07-Dec-1999
SA050901	WQL CONDUCTIVITY (U)	OM	01	COMPLETED	01-Dec-1999
SA051601	SOLVENT EXTRACTION ANALYZER-OPERATION/MAINTENANCE	OM	00	COMPLETED	01-Dec-1999
SA051801	WQ REAGENT AND STANDARD PREPARATION	OM	00	COMPLETED	01-Dec-1999
SA220300	NUCLEAR CRITICALITY SAFETY	CR	00	COMPLETED	30-Nov-1999
SA220104	OVERVIEW OF ALARMS & INDICATORS IN THE LABS	SC	00	COMPLETED	23-Nov-1999
SA041101	PROPER HANDLING OF SPILLS	CL	02	COMPLETED	27-Oct-1999
HRD11000	JOB HAZARD ANALYSIS (COMPUTER BASED)	SC	00	COMPLETED	13-Oct-1999
TRWG5200	ADVANCED RADIOLOGICAL WORKER TRAINING CORE	JP	01	COMPLETED	23-Sep-1999
TICTS003	OJT TRAINER EVALUATOR	CR	02	COMPLETED	16-Sep-1999
TMEE0300	SAFE PRACTCES ON OR NEAR ELECTRICAL CONDUCTORS	CR	01	COMPLETED	14-Sep-1999
TRWG5200	ADVANCED RADIOLOGICAL WORKER TRAINING CORE	CR	01	COMPLETED	02-Sep-1999
TRWG5210	ADVANCED RADIOLOGICAL WORKER TRNG CORE PRE-TEST	CE	03	COMPLETED	30-Aug-1999
TTSWCP01	WORK CLEARANCE & AUTHORIZATION	CR	01	COMPLETED	30-Aug-1999
QRRP1000	INITIAL NEGATIVE PRESSURE RESPIRATOR TRAINING	CR	04	COMPLETED	26-Aug-1999
QRRP1000	INITIAL NEGATIVE PRESSURE RESPIRATOR TRAINING	JP	00	COMPLETED	26-Aug-1999
TRPG4000	GENERAL RESPIRATORY PROTECTION	CR	01	COMPLETED	26-Aug-1999
QHRG0300	RADIOLOGICAL WORKER II INITIAL TRAINING	CR	11	COMPLETED	25-Aug-1999
QHRG0300	RADIOLOGICAL WORKER II INITIAL TRAINING	JP	07	COMPLETED	23-Aug-1999
TMEE2800	ELECTRICAL SYSTEMS SAFETY	CL	00	COMPLETED	18-Aug-1999
SS060807	OVERVIEW OF ANALYTICAL LABORATORIES REQUIREMENTS	CR	01	COMPLETED	17-Aug-1999
TREGGETA	GENERAL EMPLOYEE TRAINING (GET)	CR	01	COMPLETED	12-Aug-1999
NSRGFET4	CLAB FACILITY ENTRANCE TRAINING	SC	00	COMPLETED	11-Aug-1999
QSCL1600	SITEWIDE SECURITY STANDDOWN	VC	00	COMPLETED	03-Aug-1999
QSCL1601	SITEWIDE SECURITY STANDDOWN	RS	01	COMPLETED	03-Aug-1999

Training History

Last Name	BLACK	First Name	JOHN	User ID	W620	Org Code	L3435

Course Code	Course Title	Setting	Revision	Class Status	Completion Date
TMME1305	ELECTRICAL HAZARDS AWARENESS BRIEFING	SP	00	COMPLETED	27-Jun-2007
LSGEN058	L7.7, 1.06 & 1.07 PROCEDURE CHANGES	BR	00	COMPLETED	13-Jun-2007
QHRG0400	RADIOLOGICAL WORKER TRAINING 2 RETRAINING	SP	18	COMPLETED	18-May-2007
LSGEN049	ACCOUNTABLE MATERIAL HANDLER DELTA TRAINING	RS	00	COMPLETED	20-Mar-2007
LSGEN050	NUCLEAR CRITICALITY SAFETY DELTA TRAINING	RS	00	COMPLETED	20-Mar-2007
TRWG5203	RADIATION INSTRUMENTATION AND MONITORING	PA	02	COMPLETED	07-Mar-2007
TRWG5204	BETA-GAMMA INSTRUMENTATION AND MONITORING	PA	02	COMPLETED	07-Mar-2007
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION AND MONITOR	PA	02	COMPLETED	07-Mar-2007
LSMTD003	USE OF DRAIN SYSTEMS DELTA TRAINING	RS	00	COMPLETED	05-Mar-2007
LSCT0046	RESPONSE TO ABNORMAL EVENTS	BR	00	COMPLETED	15-Feb-2007
LSLST003	LAB STANDARD TRAINING REFRESHER FOR 2007	SP	04	COMPLETED	30-Jan-2007
TRGCAT07	CONSOLIDATED ANNUAL TRAINING 2007 (CAT)	SP	00	COMPLETED	11-Jan-2007
QRRP1001	NEGATIVE PRESSURE RETRAINING (U)	JP	01	COMPLETED	19-Dec-2006
TRPG4001	GENERAL/SUPERVISOR RESPIRATOR RETRAINING	SP	03	COMPLETED	19-Dec-2006
TMAD0022	MATERIALS OF TRADE TRAINING	CR	00	COMPLETED	05-Dec-2006
LSTRCT29	TRU WASTE TOOL HANDLING AND SAFE PRACTICES	BR	00	COMPLETED	16-Aug-2006
QRRP7000	RESPIRATORY PROTECTION ISSUANCE TRAINING (U)	SP	00	COMPLETED	14-Aug-2006
LSGEN029	R&D RQMTS FOR WORKING W/CLASS 1 FLAMMABLE LIQUID	RS	00	COMPLETED	02-Aug-2006
TREG0013	BLOODBORNE PATHOGENS/FIRST AID/CPR	CR	05	COMPLETED	28-Jun-2006
TREG0013	BLOODBORNE PATHOGENS/FIRST AIT/CPR	JP	01	COMPLETED	28-Jun-2006
TMME1301	ELECTRICAL HAZARD AWARENESS-NON-ELECTRICAL WORKERS	BR	01	COMPLETED	26-Jun-2006
LSTRCT20	MANAGEMENT REVIEW BRIEFING FROM 6/15/06 EVENT	BR	00	COMPLETED	15-Jun-2006
LSDR0031	SRNL TRU REPACKAGING CAM ALARM DRILL	DR	02	COMPLETED	22-May-2006
LSDRTQOE	DRT OPERATIONAL EVALUATION	OE	00	GRANTED EXCEPTION	22-May-2006
LSTRCT16	MONITORING WHEN EXITING GLOVEBOX GLOVES EXPECTATIO	BR	00	COMPLETED	09-May-2006
LSTRCT17	RESPONSE TO ABNORMAL CONDITIONS FOR RADCON	BR	00	COMPLETED	09-May-2006
LSTRCT21	EMERGENCY EXIT F-091	BR	00	COMPLETED	08-May-2006
LSTRCT22	REPORTING UNSAFE CONDITIONS	BR	00	COMPLETED	08-May-2006
LSTRCT23	REVIEW OF HEAT STRESS PROCEDURES IN 4Q MANUAL	BR	00	COMPLETED	08-May-2006

LSTRCT24	HAND AND FINGER PROTECTION	BR	00	COMPLETED	08-May-2006
LSTRCT26	WORK UNDERNEATH SUSPENDED LOAD	BR	00	COMPLETED	08-May-2006
LSTRCT27	GENERAL SITE SAFETY REQUIREMENTS	BR	00	COMPLETED	08-May-2006
LSTRCT28	BARRICADES	BR	00	COMPLETED	08-May-2006
LSTRU800	TRU WASTE DRUM REMEDIATION PROCESS LESSONS LEARNED	BR	00	COMPLETED	05-May-2006
LSTRCT15	TRU INSPECTION FORM CHANGES	BR	00	COMPLETED	04-May-2006
LSTRCT19	DRT DOSIMETRY AND PPE ADHERENCE	BR	00	COMPLETED	04-May-2006
LSDR0030	TRU PROCESS PHEX PRESSURE GAUGE READ DRUM LID REM	DR	00	COMPLETED	26-Apr-2006
LSTRCT14	SP-18-002 REVIEW OF REV. 1 CHANGES	BR	00	COMPLETED	21-Apr-2006
LSTRCT11	OPS S.O.: F091 TRU PROG. PROC. IMPLEMENTATION	BR	00	COMPLETED	12-Apr-2006
LSTRCT12	SRNL TRU GLOVEBOX REM. PROCESS LESSONS LEARNED	BR	00	COMPLETED	12-Apr-2006
LSDR0025	TRU WASTE GLOVE CONTAMINATION	DR	00	COMPLETED	11-Apr-2006
LSTRCT13	RCRA REVIEW/CONTINGENCY PLAN	BR	00	COMPLETED	11-Apr-2006
LSTRCT05	CHEMICAL HAZARD AWARENESS BRIEFING	BR	00	COMPLETED	10-Apr-2006
LSEP0005	TRU WASTE DRUMS DRILL (U)	DR	01	COMPLETED	07-Apr-2006
ZEAIXD01	SWMF E-AREA FACILITY ENETRY BRIEFING	BR	01	COMPLETED	07-Apr-2006
LSTRD300	DELTA TRU WASTE DRUM REMEDIATION PROCESS	BR	00	COMPLETED	03-Apr-2006
LSTRD301	DELTA TRU WASTE DRUM REMEDIATION PROCESS PRACFAC	PF	00	COMPLETED	03-Apr-2006
LSTRCT05	CHEMICAL HAZARD AWARENESS BRIEFING	BR	00	COMPLETED	30-Mar-2006
LSTRCT07	RADCON PRACTICES BRIEF	BR	00	COMPLETED	30-Mar-2006
LSTRCT09	INCOMPATIBLE MATERIALS IN GLOVEBOX	BR	00	COMPLETED	30-Mar-2006
LSTRCT10	LCOS 3.2.6/3.2.7 REVIEW WITH TRU TEAM	BR	00	COMPLETED	28-Mar-2006
LSCT0D20	TRU DRUM ALARM RESPONSE AND AOPS	BR	00	COMPLETED	23-Mar-2006
LSDR0031	SIMULATED TRU PROCESS CAM ALARM	DR	00	COMPLETED	23-Mar-2006
LSEP0005	TRU WASTE DRUMS DRILL (U)	DR	01	COMPLETED	23-Mar-2006
LSOPS0D4	DELTA JCO BRIEFING FOR DRTS & RCO	BR	00	COMPLETED	23-Mar-2006
LSDR0028	SIMULATED TRU PROCESS GLOVEBOX DROP IN FLOW	DR	00	COMPLETED	20-Mar-2006
LSTRCT04	DOFFING AND POTENTIAL CONTAMINATION ACTIONS	BR	00	COMPLETED	15-Mar-2006
LSTRCT08	POSTED SIGNAGE	BR	00	COMPLETED	15-Mar-2006
LSDR0030	TRU PROCESS PHEX PRESSURE GAUGE READ DRUM LID REM	DR	00	COMPLETED	14-Mar-2006
LSTRCT02	USE OF SAFETY GLASSES DURING TRU WASTE OPERATIONS	BR	00	COMPLETED	14-Mar-2006
LSTRCT03	DRUM HANDLING SAFETY	BR	00	COMPLETED	14-Mar-2006
LSWEM004	TRU REMEDIATION AREA INSPECTION BRIEFING	BR	00	COMPLETED	13-Mar-2006
LSDR0023	TRU REPACKAGING WASTE LIQUID SPILL	DR	00	COMPLETED	08-Mar-2006
LSTRCT01	RESPONSE TO ABNORMAL EVENTS	BR	00	COMPLETED	01-Mar-2006
LSTRU700	CONDUCT OF OPERATIONS TRAINING FOR TRU WASTE WORK	BR	00	COMPLETED	28-Feb-2006
LSTRU600	FIRE PROTECTION TRAINING FOR TRU WASTE WORKERS	BR	00	COMPLETED	27-Feb-2006
LSCT0011	PROCEDURE COMPLIANCE	BR	00	COMPLETED	23-Feb-2006
LSDR0030	TRU PROCESS PHEX PRESSURE GAUGE READ DRUM LID REM	CR	00	COMPLETED	15-Feb-2006

LSDR0028	SIMULATED TRU PROCESS GLOVEBOX DROP IN FLOW	DR	00	COMPLETED	13-Feb-2006
LSTRU301	TRU WASTE DRUM REMEDIATION PROCESS PRACFAC	PF	00	COMPLETED	06-Feb-2006
LSDR0025	TRU WASTE GLOVE CONTAMINATION	DR	00	COMPLETED	02-Feb-2006
LSTRU101	PREPARE/REPLACE GLOVES AND BAGS ON GLOVEBOXES	PF	00	COMPLETED	23-Jan-2006
LSTRU401	OPERATING THE RAMAN SPECTROMETER PRACFAC	PF	00	COMPLETED	19-Jan-2006
LSDR0027	TRU WASTE SUSPECT DRUM F-091	DR	00	COMPLETED	17-Jan-2006
LSLST003	LABORATORY STANDARD REFRESHER TRNG. (2006)	SP	03	COMPLETED	17-Jan-2006
LSTRU300	TRU WASTE DRUM REMEDIATION PROCESS	BR	00	COMPLETED	09-Jan-2006
TRGCAT06	CONSOLIDATED ANNUAL TRAINING 2006 (CAT)	SP	00	COMPLETED	03-Jan-2006
LSDR0023	TRU REPACKAGING WASTE LIQUID SPILL	DR	00	COMPLETED	28-Dec-2005
LSDR0025	TRU WASTE GLOVE CONTAMINATION	DR	00	COMPLETED	28-Dec-2005
LSDR0024	TRU WASTE SUSPECT DRUM	DR	00	COMPLETED	27-Dec-2005
SL090012	MONITOR THE BREATHING AIR MANIFOLD (U)	PF	02	COMPLETED	21-Dec-2005
TRPG2000	INITIAL PLASTIC SUIT AND HOOD AIRLINE RESPIRATOR	CR	03	COMPLETED	20-Dec-2005
TRPG2000	INITIAL PLASTIC SUIT AND HOOD AIRLINE RESPIRATOR	JP	02	COMPLETED	20-Dec-2005
LSCT0020	TRU DRUM ALARM RESPONSE & ABNORMAL OPERATING PROC.	BR	00	COMPLETED	16-Dec-2005
LSOPS004	SRNL JUSTIFICATION FOR CONTINUED OPERATION (JCO)	BR	00	COMPLETED	16-Dec-2005
LSTRU201	TRU WASTE DRUM INSPECTION AND HANDLING PRACFAC	PF	00	COMPLETED	15-Dec-2005
LSTRU100	TRU WASTE DRUM REMEDIATION OPERATION IN SRNL	CR	00	COMPLETED	14-Dec-2005
SE010425	PREPARE TRU WASTE CONTAINERS FOR SHIPMENT	PF	00	COMPLETED	14-Dec-2005
LSTRU200	TRU WASTE DRUM INSPECTION AND HANDLING TECHNIQUES	BR	00	COMPLETED	13-Dec-2005
LSTRU400	RAMAN SPECTROMETER BRIEFING	BR	00	COMPLETED	07-Dec-2005
QRRP1001	NEGATIVE PRESSURE RETRAINING (U)	JP	01	COMPLETED	06-Dec-2005
LSGEN004	FIRE SUPPRESSION SYS TRNG FOR GLOVEBOX AND ILC USE	RS	01	COMPLETED	05-Dec-2005
SE010425	PREPARE TRU WASTE CONTAINERS FOR SHIPMENT	OJ	01	COMPLETED	05-Dec-2005
LSTRU302	OPERATE TORQUE WRENCH PRACFAC	PF	00	COMPLETED	30-Nov-2005
TRPG4001	GENERAL RESPIRATORY RETRAINING	SP	02	COMPLETED	18-Nov-2005
QREP2000	24 HR. HAZARDOUS WASTE SAFETY & HEALTH TRAINING	CR	02	COMPLETED	17-Nov-2005
QREP2000	24 HR. HAZARDOUS WASTE SAFETY & HEALTH TRAINING	JP	03	COMPLETED	17-Nov-2005
TMAR3700	LIFT TRUCK SAFETY BRIEFING	BR	00	COMPLETED	10-Nov-2005
QSMC1201	TID TRAINING FOR APPLICATORS (U)	CR	03	COMPLETED	08-Nov-2005
LSWEM003	SRNL TRU REMEDIATION RCRA TRAINING	SP	00	COMPLETED	07-Nov-2005
BMPSPCC0	BMP/SPCC/STORM WATER BRIEFING	SP	00	COMPLETED	27-Oct-2005
TMAM0601	FORKLIFT OPERATIONS	JP	01	COMPLETED	16-Sep-2005
LSGEN020	R&D PROCEDURE COMPLIANCE	BR	00	COMPLETED	14-Sep-2005
TMAR0600	INCIDENTAL RIGGER/OPERATOR	CR	03	COMPLETED	14-Sep-2005
TMAR0601	INCIDENTAL RIGGER/OPERATOR	JP	03	COMPLETED	14-Sep-2005
LSMTD001	SRTC DRAINS TRAINING	SP	01	COMPLETED	06-Sep-2005

SE010419	RCRA TRAINING FOR SRTC TECHNICAL AREA	SP	02	COMPLETED	06-Sep-2005
THMWCBT1	HAZMAT (INITIAL AND RECURRENT) TRAINING	SP	01	COMPLETED	06-Sep-2005
TMAM0600	FORKLIFT OPERATIONS, STANDARD	SP	00	COMPLETED	06-Sep-2005
QHRG0400	RADIOLOGICAL WORKER 2 SELF-STUDY	SP	17	COMPLETED	06-Jun-2005
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	31-Mar-2005
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	01	COMPLETED	31-Mar-2005
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	31-Mar-2005
STGN0016	HANFORD TREATABILITY STUDY - MATERIAL HANDLING, MO	RS	03	COMPLETED	21-Mar-2005
SG152951	SRNL ACCOUNTABLE MATERIAL HANDLER	SP	05	COMPLETED	23-Feb-2005
SG152952	SRNL NUCLEAR CRITICALITY SAFETY TRAINING	SP	05	COMPLETED	23-Feb-2005
LSWPT001	RPP TREATABILITY STUDY AND RESIDUE MANAGEMENT OVER	CR	02	COMPLETED	26-Jan-2005
QRRP1001	NEGATIVE PRESSURE RETRAINING (U)	JP	01	COMPLETED	18-Jan-2005
TRPG4001	GENERAL RESPIRATORY RETRAINING	SP	02	COMPLETED	18-Jan-2005
TMAD0022	MATERIALS OF TRADE TRAINING	CR	00	COMPLETED	13-Jan-2005
LSLST003	LAB STANDARD REFRESHER FOR 2005	SP	02	COMPLETED	10-Jan-2005
TRGCAT05	CONSOLIDATED ANNUAL TRAINING	SP	00	COMPLETED	05-Jan-2005
SG152904	SRNL R&D COMPRESSED GAS CYLINDER TRAINING	SP	01	COMPLETED	20-Sep-2004
TREG0013	BLOODBORNE PATHOGENS/FIRST AID/CPR	CR	03	COMPLETED	15-Jun-2004
TREG0013	BLOODBORNE PATHOGENS/FIRST AIT/CPR	JP	00	COMPLETED	15-Jun-2004
QRIS5008	BEHAVIOR BASED SAFETY BBS OBSERVER WORKSHOP(MOD 4)	CL	00	COMPLETED	14-Jun-2004
LSGEN010	SRNL TRAINING FOR RADIOACTIVE MATERIAL PACKAGER,PA	SP	00	COMPLETED	19-May-2004
LSGEN006	SRTC ARW PRACTICE REFRESHER AND PROFICIENCY	CR	00	COMPLETED	01-Mar-2004
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	01-Mar-2004
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	01	COMPLETED	01-Mar-2004
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	01	COMPLETED	01-Mar-2004
QRRP1001	NEGATIVE PRESSURE RETRAINING (U)	JP	01	COMPLETED	28-Jan-2004
THMWCBT1	HAZMAT COMPUTER BASED TRAINING (CBT)	SP	00	COMPLETED	28-Jan-2004
TRPG4001	GENERAL RESPIRATORY RETRAINING	RS	01	COMPLETED	27-Jan-2004
LSLST003	LAB STANDARD REFRESHER FOR 2003 (TOXICS)	SP	00	COMPLETED	15-Jan-2004
LSLST003	LAB STANDARD REFRESHER TRAINING	SP	01	COMPLETED	15-Jan-2004
LSMTD002	SUMMARY OF CHANGES TO SRTC DRAIN SYSTEM TRAINING	SP	00	COMPLETED	15-Jan-2004
TRGCAT04	CONSOLIDATED ANNUAL TRAINING (CAT)	SP	00	COMPLETED	15-Jan-2004
LSGEN005	L1, 2.32 RADIOLOGICAL WORK PRACTICES OVERVIEW	CR	00	COMPLETED	10-Nov-2003
LSBMDV02	SRTC HUMAN PERFORMANCE - UNDERSTANDING RISK	CR	00	COMPLETED	11-Sep-2003
TFSHC00A	A - AREA HAZCOM WITH FACILITY SPECIFIC	SP	00	COMPLETED	19-Aug-2003
QHRG0400	RADIOLOGICAL WORKER II SELF-STUDY	SP	16	COMPLETED	03-Jul-2003
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	26-Jun-2003
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	00	COMPLETED	26-Jun-2003

TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	26-Jun-2003
LSWPT003	PERFORM TOXICITY CHARACTERISTIC LEACHING TEST	JP	00	GRANTED EXCEPTION	12-May-2003
LSWPT013	PERFORM CUTTING OF SHELBY TUBES	JP	00	GRANTED EXCEPTION	12-May-2003
LSLST003	LAB STANDARD REFRESHER FOR 2003 (TOXICS)	SP	00	COMPLETED	17-Apr-2003
SE010401	SRTC TECHNICAL AREA TRU WASTE HANDLER	SP	02	COMPLETED	18-Mar-2003
STGN0022	DOE/RW-0333P QUALITY ASSURANCE REQUIREMENTS DOCUME	SP	01	COMPLETED	24-Feb-2003
SG152951	SRTC ACCOUNTABLE MATERIAL HANDLER	SP	04	COMPLETED	05-Feb-2003
SG152952	SRTC NUCLEAR CRITICALITY SAFETY TRAINING	SP	04	COMPLETED	05-Feb-2003
QRRP1001	NEGATIVE PRESSURE RETRAINING (U)	JP	01	COMPLETED	29-Jan-2003
TRPG4001	GENERAL RESPIRATORY RETRAINING	RS	01	COMPLETED	29-Jan-2003
TRGCAT03	CONSOLIDATED ANNUAL TRAINING	SP	00	COMPLETED	13-Jan-2003
STGN0016	BNFL - I-WPT-003	RS	02	COMPLETED	06-Sep-2002
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	28-Jun-2002
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	00	COMPLETED	28-Jun-2002
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	28-Jun-2002
LSLST002	LAB STANDARD REFRESHER 2002-HIGHLY TOXIC MATERIALS	SP	00	COMPLETED	07-Jun-2002
SE010402	SRTC WASTE GENERATOR - CBT	SP	01	COMPLETED	07-Jun-2002
QRIS5007	BEHAVIOR BASED SAFETY TEAM SAFETY WORKSHOP (MOD 3)	CR	00	COMPLETED	14-May-2002
EELT0091	GETTING THE MOST FROM YOUR ELECTRONIC BALANCES	BR	00	COMPLETED	30-Apr-2002
LSGEN001	SRTC SAR/TSR R&D OVERVIEW BRIEFING	BS	00	COMPLETED	25-Apr-2002
LSWPT001	RPP TREATABILITY STUDY EXTENSION	RS	00	COMPLETED	23-Apr-2002
STGN0016	BNFL - I-WPT-003	RS	01	COMPLETED	23-Apr-2002
STGN0022	RW-0333P QUALITY ASSURANCE REQUIRED READING	RS	00	COMPLETED	23-Apr-2002
HRD11000	JOB HAZARD ANALYSIS (COMPUTER BASED)	SC	00	COMPLETED	13-Mar-2002
TRWG2002	RWT REFRESHER TRAINING	RS	00	COMPLETED	13-Mar-2002
LSMTD001	SRTC DRAINS TRAINING	SP	00	COMPLETED	20-Feb-2002
TRGCAT02	CONSOLIDATED ANNUAL TRAINING (CAT)	SP	00	COMPLETED	15-Jan-2002
QRRP1000	INITIAL NEGATIVE PRESSURE RESPIRATOR TRAINING	CR	05	COMPLETED	10-Jan-2002
QRRP1000	INITIAL NEGATIVE PRESSURE RESPIRATOR TRAINING	JP	01	COMPLETED	10-Jan-2002
TRPG4000	GENERAL RESPIRATORY PROTECTION	CR	02	COMPLETED	10-Jan-2002
SL980015	DRAIN SYSTEMS GUIDELINES	BS	00	COMPLETED	18-Dec-2001
SE010304	OSHA LAB STANDARD INITIAL (WEB BASED)	SC	00	COMPLETED	05-Dec-2001
SF300000	LAB SKILLS (WRITTEN) FOR LABORATORY TECHNICIANS CH	CH	00	COMPLETED	24-Oct-2001
QHRG0400	RADIOLIGICAL WORKER II SELF STUDY TRAINING	JP	08	COMPLETED	31-Jul-2001
QHRG0400	RADIOLOGICAL WORKER II SELF-STUDY	SE	12	COMPLETED	31-Jul-2001
TRWG5203	RADIATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	12-Jun-2001
TRWG5204	BETA-GAMMA CONTAMINATION INSTRUMENTATION & MONITOI	PA	00	COMPLETED	12-Jun-2001
TRWG5205	ALPHA CONTAMINATION INSTRUMENTATION & MONITORING	PA	00	COMPLETED	12-Jun-2001

SG152951	SRTC ACCOUNTABLE MATERIAL HANDLER INITIAL BRIEFING	BR	03	COMPLETED	06-Feb-2001
SG152952	SRTC NUCLEAR CRITICALITY SAFETY TRNG INITIAL BRIEF	BR	03	COMPLETED	06-Feb-2001
SG152904	COMPRESSED GAS CYLINDERS (U)	CR	00	COMPLETED	30-Jan-2001
TMAMHAZ1	HAZMAT (INITIAL & RECURRENT)	CR	01	COMPLETED	24-Jan-2001
TRGCAT01	CONSOLIDATED ANNUAL TRAINING	SP	00	COMPLETED	24-Jan-2001
TRWG1401	RADIATION GENERATING DEVICE OPERATOR	CR	01	COMPLETED	09-Nov-2000
STGN0013	BNFL PART B1 TRAINING	BS	00	COMPLETED	03-Nov-2000
STGN0014	L1,2.21 RAD SAMPLE REC'G,LABELING & TRACKING	BS	00	COMPLETED	03-Nov-2000
STGN0016	BNFL - I-WPT-003	RS	01	COMPLETED	03-Nov-2000
STGN0037	SRTC CONSTANT AIR MONITORING (CAM) SYSTEM	WE	00	COMPLETED	03-Nov-2000
STGN0039	SRTC BNFL OR LISTED SAMPLE PROCESSING AUTHORIZA.	BS	00	COMPLETED	03-Nov-2000
STGN0040	LESSONS LEARNED B154/158 DISCHARGE TO HAD 5-20-99	BS	00	COMPLETED	03-Nov-2000
SE010417	L1 MANUAL 2.17/6.03 OVERVIEW	BR	00	COMPLETED	25-Oct-2000
SL090606	SRTC/TNX/AL RCRA SATELLITE AREAS	RS	05	COMPLETED	06-Sep-2000
SE010304	OSHA LAB STANDARD INITIAL (WEB BASED)	SC	00	COMPLETED	30-Aug-2000
SE010402	SRTC WASTE GENERATOR	WE	00	COMPLETED	30-Aug-2000
SG152980	SRTC TECHNICAL AREA FACILITY ACCESS TRAINING	SC	01	COMPLETED	29-Aug-2000
SF200000	GENERAL CHEMISTRY FOR LAB TECHS (CHALLENGE EXAM)	CE	00	COMPLETED	26-Jul-2000
SL980015	DRAIN SYSTEMS GUIDELINES	BS	00	COMPLETED	19-Apr-2000
HRDGV001	APRIL 2000 DIVERSITY STAND-DOWN	BS	00	COMPLETED	12-Apr-2000
TRGCAT00	CONSOLIDATED ANNUAL TRAINING	WE	00	COMPLETED	21-Jan-2000
TRWG5200	ADVANCED RADIOLOGICAL WORKER TRAINING CORE	JP	01	COMPLETED	27-Oct-1999
TRWG5200	ADVANCED RADIOLOGICAL WORKER TRAINING CORE	CR	01	COMPLETED	23-Sep-1999
TRWG5210	ADVANCED RADIOLOGICAL WORKER TRNG CORE PRE-TEST	CE	03	COMPLETED	30-Aug-1999
SE010300	GREEN IS CLEAN/ASSOCIATED WASTE	WE	00	COMPLETED	06-Aug-1999
QSCL1600	SITEWIDE SECURITY STANDDOWN	VC	00	COMPLETED	03-Aug-1999
QSCL1601	SITEWIDE SECURITY STANDDOWN	RS	01	COMPLETED	03-Aug-1999
QHRG0300	RADIOLOGICAL WORKER II INITIAL TRAINING	CR	11	COMPLETED	14-Jul-1999
QHRG0300	RADIOLOGICAL WORKER II INITIAL TRAINING	JP	07	COMPLETED	14-Jul-1999
SF100000	MATHEMATICS FOR LABORATORY TECHNICIANS	CE	00	COMPLETED	17-Mar-1999
SF100000	MATHEMATICS FOR LABORATORY TECHNICIANS	SE	00	COMPLETED	17-Mar-1999
TREGCAT9	CONSOLIDATED ANNUAL TRAINING (CAT)	SP	00	COMPLETED	03-Feb-1999
TREGO13Q	HAZCOM: FACILITY-SPECIFIC TRNG-ESH&QA	RS	00	COMPLETED	04-Sep-1998
SE010904	SRTC TA/CALB BRIEFING FOR POLLUTION PREVENTION & .	BS	00	COMPLETED	27-Aug-1998
HRD10923	TEAMWORK, THE KEY TO VALUING DIVERSITY	CR	00	COMPLETED	02-Jun-1998
QHRG1300	RADIOLOGICAL WORKER I SELF STUDY	JP	07	COMPLETED	17-Mar-1998
QHRG1300	RADIOLOGICAL WORKER I SELF-STUDY	SE	08	COMPLETED	17-Mar-1998
TREGCATB	CONSOLIDATED ANNUAL TRAINING (CAT)	SC	00	COMPLETED	27-Jan-1998
SG152980	SRTC TECHNICAL AREA FACILITY ACCESS TRAINING	SC	00	COMPLETED	03-Dec-1997

QSHP9701	EMERGENCY PREPAREDNESS DRILL FOR CRITICALITY	BS	00	COMPLETED	05-Aug-1997
BMMG0001	TIME & ATTENDANCE COLLECTION SYSTEMS (TACS)	CR	01	COMPLETED	13-Mar-1997
TREGCAT7	CONSOLIDATED ANNUAL TRAINING	SC	00	COMPLETED	23-Jan-1997
TREGCAT6	CONSOLIDATED ANNUAL TRAINING	SC	00	COMPLETED	24-Jan-1996
TREGGERT	GENERAL EMPLOYEE RADIOLOGICAL TRAINING (GERT)	SC	00	COMPLETED	24-Jan-1996
TICATB00	CONSOLIDATED ANNUAL TRAINING	SC	00	COMPLETED	12-Jan-1995
QRIH1100	BASIC HAZARD COMM TRNG FOR OFFICE/ADMIN PERSONNEL	CR	00	COMPLETED	23-Jun-1994
TICATA00	CONSOLIDATED ANNUAL TRAINING	CR	00	COMPLETED	18-Jan-1994
QRIH1000	BASIC HAZARD COMMUNICATION TRAINING	CR	00	COMPLETED	06-Dec-1993
TICTS003	OJT TRAINER/EVALUATOR	CR	00	COMPLETED	18-Nov-1993
QRIS110C	EMERGENCY PREPAREDNESS TRAINING	CR	00	COMPLETED	12-Nov-1993
SS140300	OCCUPANT FIRE SAFETY	CR	00	COMPLETED	22-Oct-1993
QSED1293	1993 ANNUAL SECURITY REFRESHER BRIEFING	CR	00	COMPLETED	23-Sep-1993
QRISINFO	HAZARDOUS ENERGY CONTROL TRAINING	RS	00	COMPLETED	23-Aug-1993
QRIS120B	SEVEN BASIC SAFETY PROCEDURES	RS	00	COMPLETED	21-Jun-1993
QTIHAT05	HEAT STRESS	CR	00	COMPLETED	19-May-1993
QSCP3000	COMPUTER SECURITY AWARENESS TRAINING	CR	00	COMPLETED	26-Mar-1993
TRSGETCN	CONTINUING GENERAL EMPLOYEE TRAINING	SC	00	COMPLETED	26-Feb-1993
NMMG9360	RESP NIM ALARM	CR	00	COMPLETED	21-Nov-1991
BIF91001	FIELD PROPERTY ADMINISTRATOR (FPA)	CR	00	COMPLETED	23-Jul-1991
QHRC0000	RADIATION WORKER TRAINING - NMP/SRTC/RM PRACTICAL	CL	02	COMPLETED	24-May-1991
TRSGETC1	GENERAL EMPLOYEE TRAINING COMMON	CR	00	COMPLETED	01-Feb-1991
BIE92102	INTRO TO THE IBM PC/IBM	CL	00	COMPLETED	19-Nov-1990
QHRA0000	RADIATION WORKER TRAINING – CORE	CR	03	COMPLETED	23-Aug-1990

DISTRIBUTION

Mike Sufnarski	MACTEC Engineering and Consulting, Inc., 2801 Yorkmont Road, Suite 100, Charlotte, NC 28208 (3 copies)
Dan Kaplan	Savannah River National Laboratory, 773-43A, Rm. 215, Aiken, SC 29808
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Attachment I

RCTS Test Data

Volume 1 of 1

Applicability of Report

The laboratory testing results, as well as the conclusions and recommendations, if any, contained in this report, were completed based on our scope of services and on our established technical practice. We have prepared this report exclusively for MACTEC to assist in their STP project. We conducted our services using the standard level of care and diligence normally practiced by recognized engineering laboratories now performing similar services under similar circumstances. We intend for this report, including all illustrations, to be used in its entirety. Data as presented in this report should be used along with other available information and questions should be asked when inconsistency, if any, is observed.

RCTS Procedure Summary

Fugro laboratory personnel used resonant column and torsional shear (RCTS) equipment to measure the material properties (shear modulus and material damping in shear) of soil specimens. The RCTS equipment used is of the fixed-free type, with the bottom of the specimen fixed and shear stress applied to the top.

Both the resonant column (RC) and torsional shear (TS) tests were performed in a sequential series on the same specimen over a shearing strain range from about 10^{-4}% to about 1%, depending upon specimen stiffness.

The basic operational principle is to vibrate the cylindrical specimen in first-mode torsional motion. Harmonic torsional excitation is applied to the top of the specimen over a range in frequencies, and the variation of the acceleration amplitude of the specimen with frequency is obtained. Once first-mode resonance is established, measurements of the resonant frequency and amplitude of vibration are made. These measurements are then combined with equipment characteristics and specimen size to calculate shear wave velocity and shear modulus based on elastic wave propagation.

The RC test is based on the one-dimensional wave equation derived from the theory of elasticity. The shear modulus is obtained by measuring the first-mode resonant frequency while material damping is evaluated from either the free-vibration decay curve or from the width of the frequency response curve at the so-called half power points. In the TS test, the actual stress-strain hysteresis loop is determined by means of measuring the torque-twist curve. Shear modulus is calculated from the slope of the hysteresis loop, and the hysteric damping ratio is calculated using the area of the hysteresis loop compared to the triangle made by the slope of the hysteresis loop and a line passing horizontally through the origin. The primary difference between the two types of tests is the excitation frequency. In the RC test, frequencies above 20 Hz are generally required and inertia of the specimen and drive system is considered when analyzing the measurements. The TS test is associated with slow cyclic loading frequencies generally below 10 Hz and inertia is not considered in the data analysis.

Equipment wise, the RCTS apparatus consists of four basic subsystems which are: 1) a confinement system, 2) a drive system, 3) a height-change measurement system, and 4) a motion monitoring system. The test apparatus is automated so that a microcomputer controls the test and collects the data. Compressed air is used to confine isotropically the specimen in the stainless steel confining chamber. The drive system consists of a drive plate, magnets, drive coils, a power amplifier and a signal generating source. The magnets are fixed to the drive plate and the drive coils encircle the ends of the magnets such that the drive plate excites the soil specimen in torsional motion when a current is passed through the coils. The height change of the specimen is measured by a linear variable differential transformer to determine the changes in the length and mass of the specimen during consolidation or swell, and to calculate change in the mass moment of inertia, mass density, and void ratio during testing.

RCTS testing was performed on each soil specimen at confining pressures of 0.25, 0.5, 1, 2, and 4 times the estimated effective stress. Testing at each successive stage (i.e., confining pressure condition) occurred after the specimens were allowed to consolidate at each pressure step. The soil specimen is sealed in a membrane and pore pressure in the specimen is vented to atmospheric pressure. In general, the rate of consolidation decreased with increasing confining pressure for each specimen, and cohesive soil specimens longer to consolidate than granular soils. Consolidation times range from about 1 day up to about 21 days or longer. Fugro laboratory personnel analyzed the resulting stress/strain curve to determine when the sample was sufficiently consolidated for testing.

At each level of shear strain amplitude, the shear modulus (G) and material damping ratio (λ) were determined. For each consolidation stage, the maximum shear modulus (G_{max}) and minimum material damping ratio (λ_{min}) were determined, along with some values of G and λ versus strain amplitude. Typically in the 0.25, 0.5, 1, 2, and 4 times consolidation stages, a less than 0.001% shear strain amplitude is generally applied throughout each of the testing sequence. In the 1 and 4 consolidation stages, additional levels of shear strain amplitude are applied, up to that obtainable by the equipment. In each consolidation stage, after testing at the maximum strain amplitude, additional values of G were determined to monitor specimen recovery.

Because different frequencies are applied in the RC and TS tests, different motion monitoring systems are used. The motion monitoring system in the RC test consists of an accelerometer, a charge amplifier, a data acquisition system (DAQ). The motion monitoring system in the RS test consists of two proximitor probes, an operational amplifier, a DC power supply, a U-shaped target and a digital data acquisition system to monitor torque-twist hysteresis loops of the specimen.

Fugro conducted the RCST testing under MACTEC's QA program. MACTEC audited Fugro's QA program and provided additional QA requirements through a procurement agreement with Fugro. Per MACTEC's work instructions, RCTS testing was conducted following the procedure developed by Dr. Stokoe of the University of Texas.

Equipment calibrations provided traceability to NIST standards or physical constants. Equipment calibration records were provided separately to MACTEC.

In accordance with the agreement between Fugro and MACTEC, a trial test on a standard sand was performed and furnished to Dr. Stokoe for review prior to proceeding with assigned tests. Dr. Stokoe, based on the results of the trial test, approved the Fugro setup and procedure as acceptable to proceed. Individual test results were provided to Dr. Stokoe for review prior to submission to MACTEC. Evidence of Dr. Stokoe's review and approval is included with the test results. Comments made by Dr. Stokoe were incorporated into the final test reports.

Index Testing Summary for RCTS Samples
STP Project

Appendix No.	Sample	Sample No.	Sample Depth (ft)	Sample Type	Field Class*	Index Properties			
						UW (lb/ft^3)	MC (%)	LL	PI
A	B405	UD13	294.7	UD	CH	120.3	29	80	60
B	B305	UD13	265.5	UD	SP-SM/CH	116	19.2	NP	NP
C	B405	UD16	358.5	UD	CH	116.3	29.5	92	65
D	B405	UD19	440.5	UD	CH	131.7	17.4	33	22
E	B305	UD18	387.5	UD	SP-SM	128.8	21.2	NP	NP
F	B305	UD25	590.5	UD	CH	128.8	20.6	67	48
G	B405	UD4	85	UD	CL/CH	131	22.6	60	41
H	B405	UD8	170	UD	CH/ML	124.4	22.9	NP	NP
I	B305	UD10	195	UD	CH	120	27.9	70	48
J	B405	UD1	11.8	UD	CH	117.9	28.2	73	52
K	B405	UD24	569.2	UD	CH	122.1	27.2	84	62
L	B405	UD10	224	UD	CL	114.9	34.5	73	51
M	B405	UD6	127	UD	CL	121.8	27.2	68	50
N	B306	UD3	75	UD	SC	132.6	24.7	NP	NP

* Information provided by MACTEC, Inc.

RCTS TEST APROVAL

PROJECT SITE/NAME	STP

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#A	B405-UD13	294.7	KHS	12-July '07
RCTS#B	B305-UD13	265.5	KHS	12 July '07
RCTS#C	B405-UD16	358.5	KHS (1)	12 July '07
RCTS#D	B405-UD19	440.5	KHS (1)	13 July '07
RCTS#E	B305-UD18	387.5	KHS (1)	13-July '07
RCTS#				

The RCTS tests for the site referenced above were tested, and a report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K H Stokoe

Dr. Kenneth Stokoe

Notes:
(1) Minor corrections are suggested on the figures which need to be made.

RCTS TEST APROVAL

PROJECT SITE/NAME	STP

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#F	B305-UD25	590.5	KHS ⊕	6 Sept 07

The RCTS tests for the site referenced above were tested, and a report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K.H. Stokoe

Dr. Kenneth Stokoe

⊕ Consider comments on Fig. F.5

RCTS TEST APROVAL

PROJECT SITE/NAME	STP

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#G	B405-UD4	85	KHS +	5 Sept '01

The RCTS test for the site referenced above was tested, and a report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K. H. Stokoe

Dr. Kenneth Stokoe

+ Please make minor corrections as noted on the figures.

RCTS TEST APROVAL

PROJECT SITE/NAME	STP

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#H	B405-UD8	170	KHS (+)	6 Sept 07

The RCTS test for the site referenced above was tested, and a report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K. H. Stokoe

Dr. Kenneth Stokoe

(+) minor suggestions and changes

RCTS TEST APROVAL

PROJECT SITE/NAME	STP

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#I	B305-UD10	195.0	KHS	29 Sept. 07

The RCTS test for the site referenced above was tested, and a report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K. H. Stokoe

Dr. Kenneth Stokoe

RCTS TEST APROVAL

PROJECT SITE/NAME	STP

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#J	B405-UD1	11.8	KHS +	17 Oct 07

The RCTS test for the site referenced above was tested, and a report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K. H. Stokoe II

Dr. Kenneth Stokoe

+ See suggestions on a few figures

RCTS TEST APROVAL

PROJECT SITE/NAME	STP

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#K	B405-UD24	569.2	KHS	23 Oct 07

The RCTS test for the site referenced above was tested, and a report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By: K. H. Stokoe

Dr. Kenneth Stokoe

RCTS TEST APROVAL

PROJECT SITE/NAME	STP

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#L	B405-UD10	224.0	KHS (+)	11 Nov. 03

The RCTS test for the site referenced above was tested, and a report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K. H. Stokoe

Dr. Kenneth Stokoe

(+) See notes on the figures for minor changes.

RCTS TEST APROVAL

PROJECT SITE/NAME	STP

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#M	B405-UD6	127	KHS (+)	14 Dec '07
RCTS#N	B306-UD3	75	KHS (+)	14 Dec '07

The RCTS tests for the site referenced above were tested, and two reports were prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By: K H. Stokoe

Dr. Kenneth Stokoe

(+) see minor notes on above figures.

APPENDIX A

Specimen STP B405-UD13
CLAY (LL=80, PI=60; Gs=2.75)

Borehole B405
Sample UD13
Depth = 294.7 ft (89.8 m)
Total Unit Weight = 120.3 lb/ft^3
Water Content = 29.0 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 87.3 psi

FUGRO JOB #: 0401-1660
Testing Station: RC9

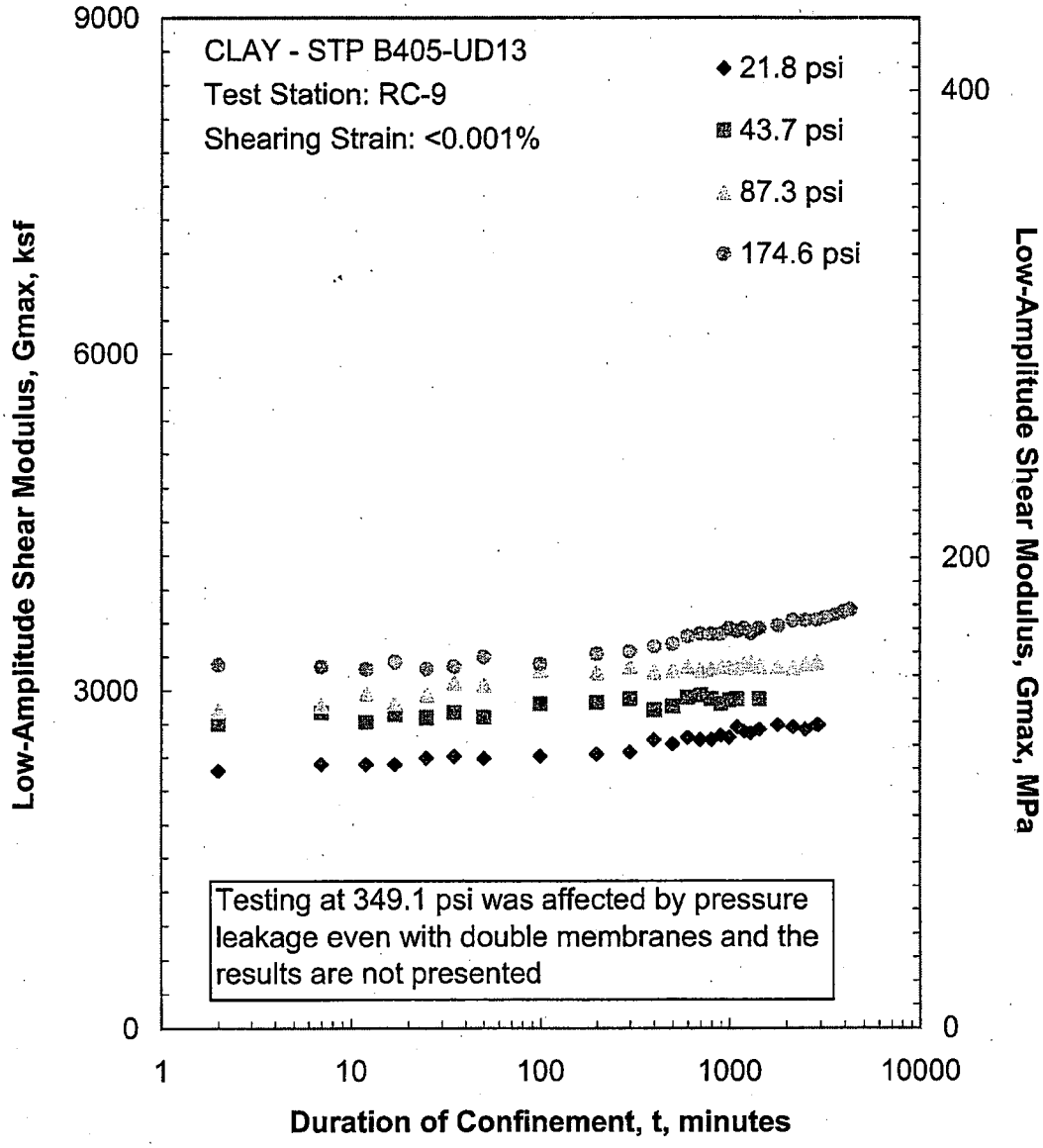


Figure A.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

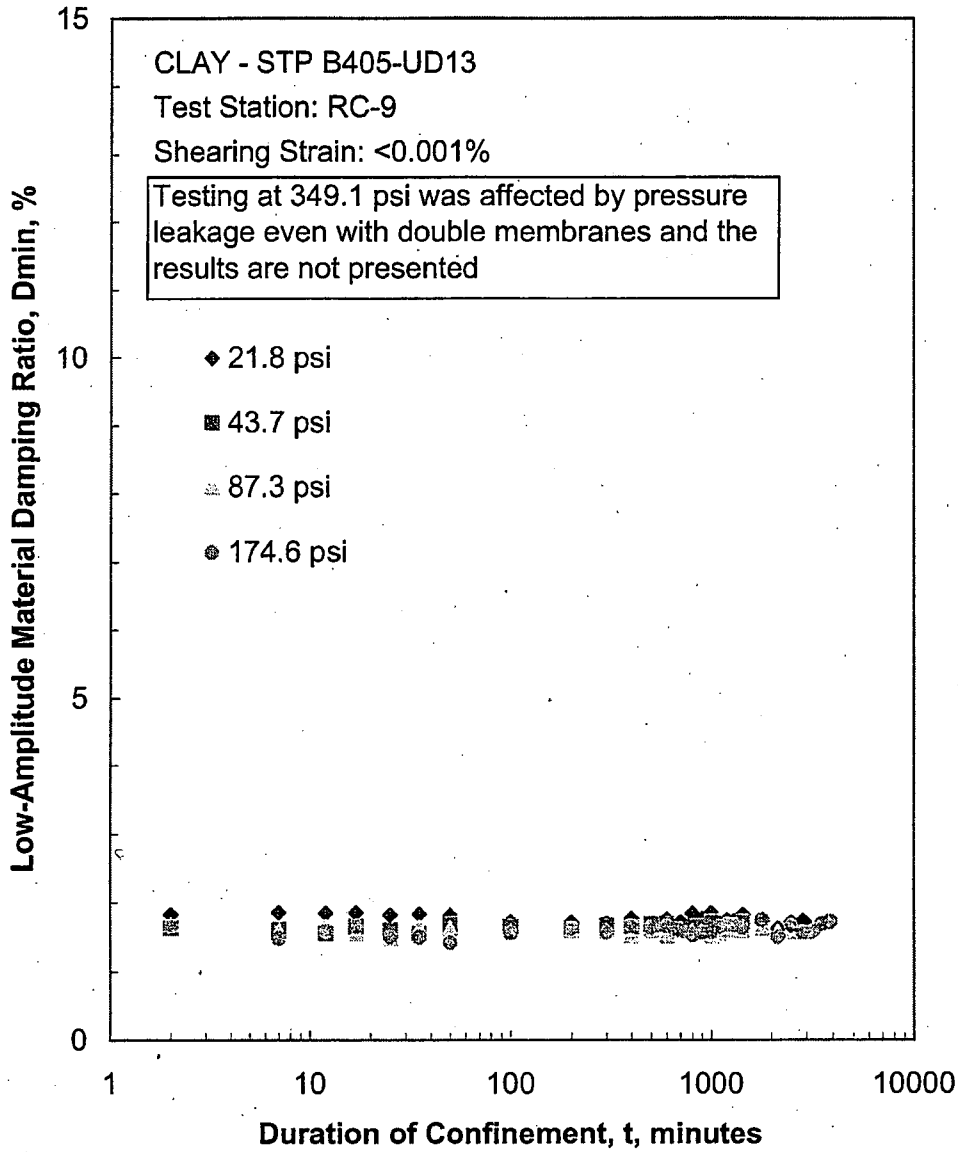


Figure A.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

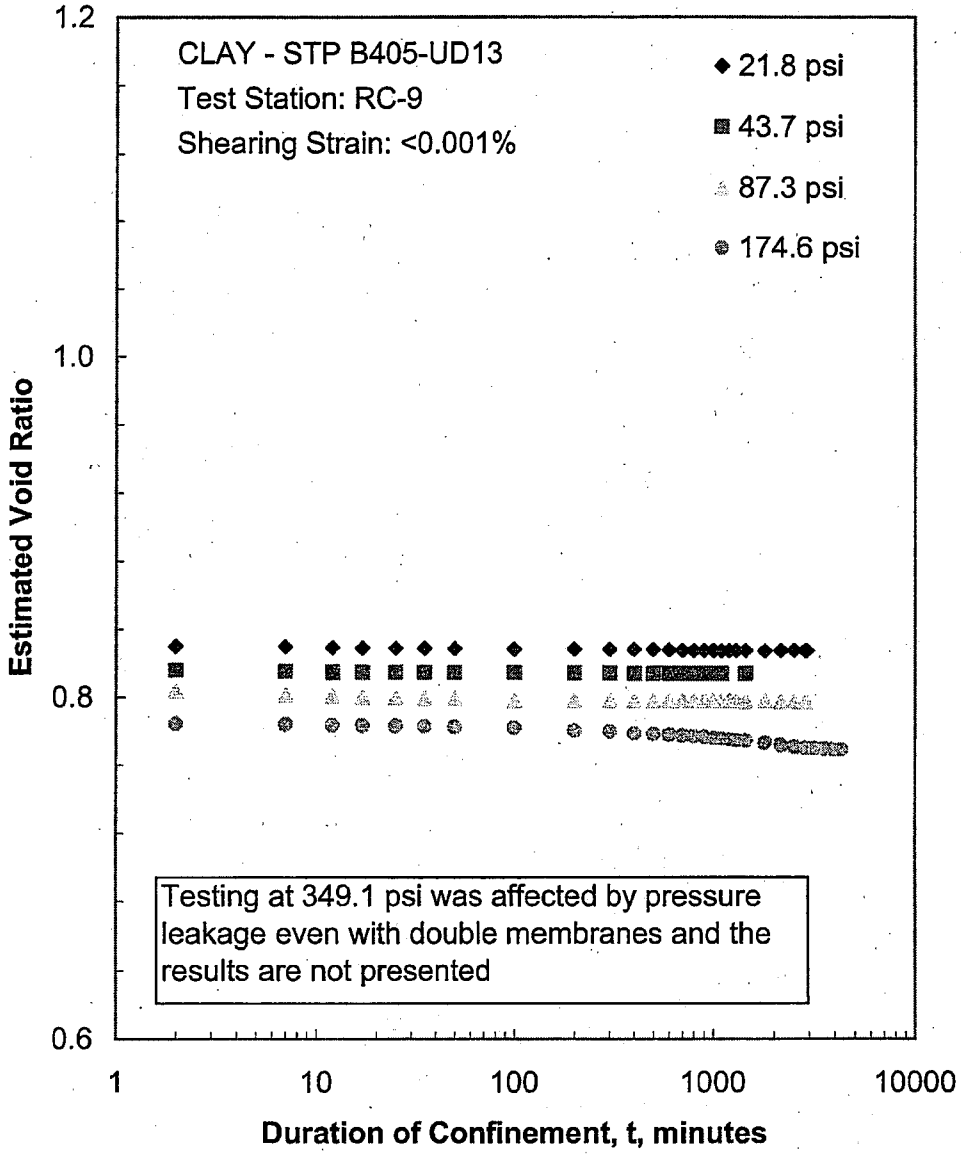


Figure A.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

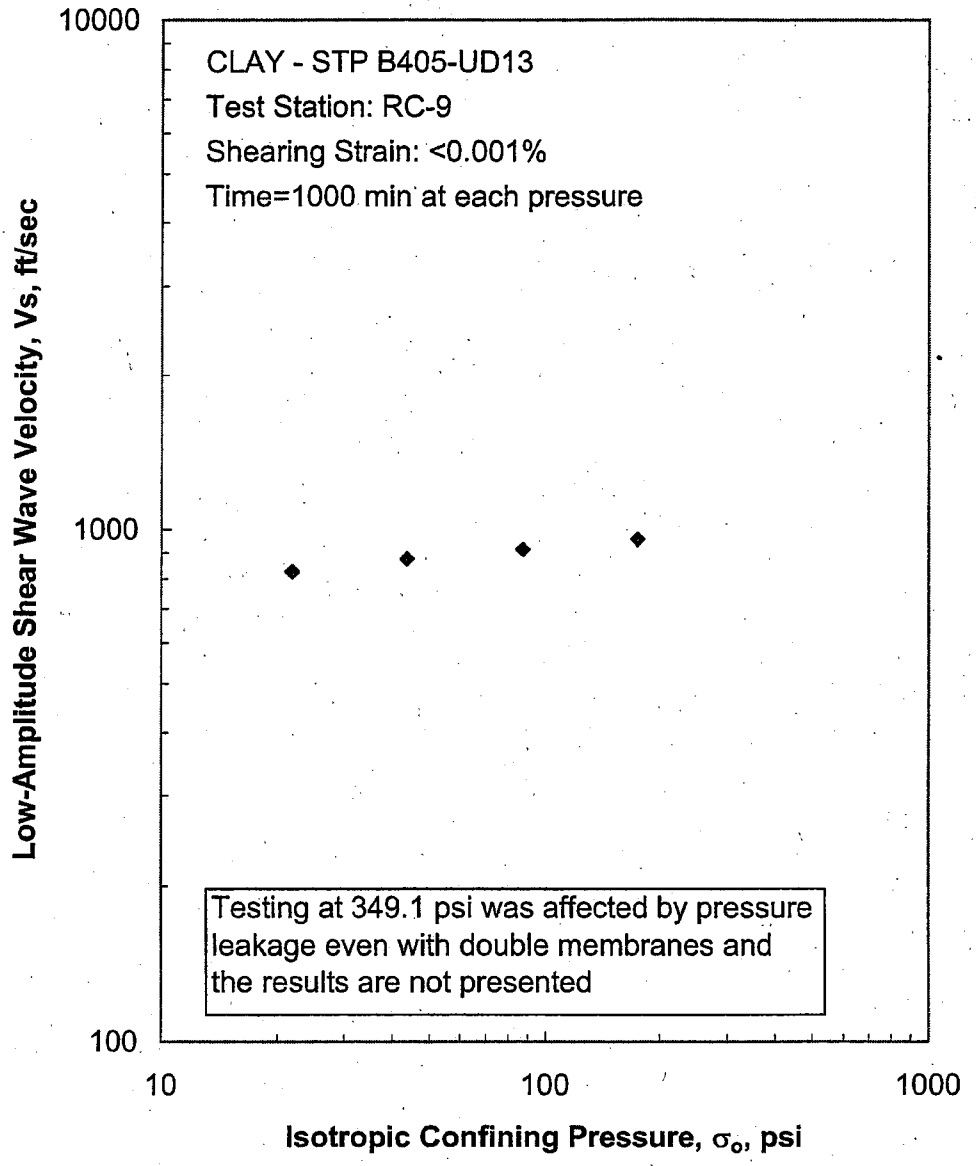


Figure A.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

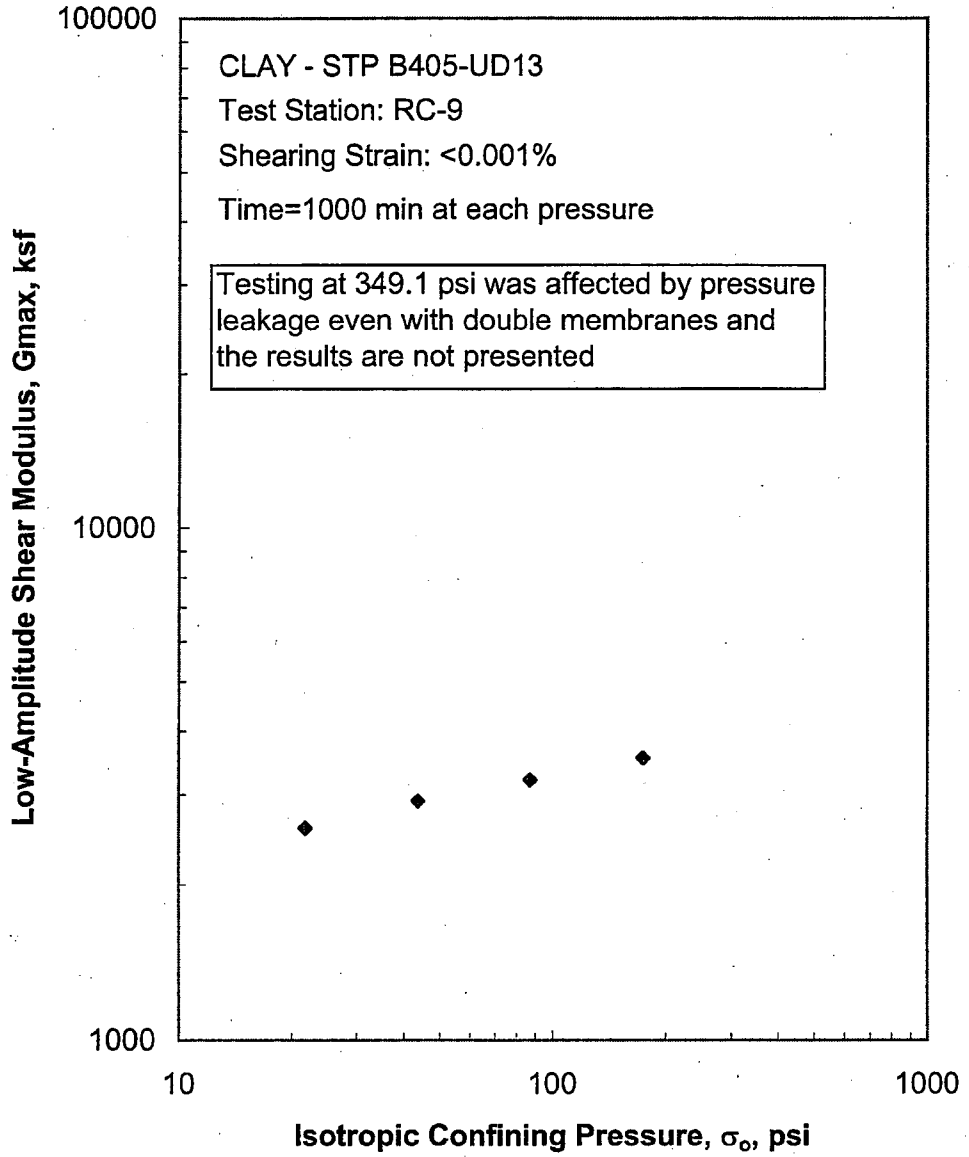


Figure A.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

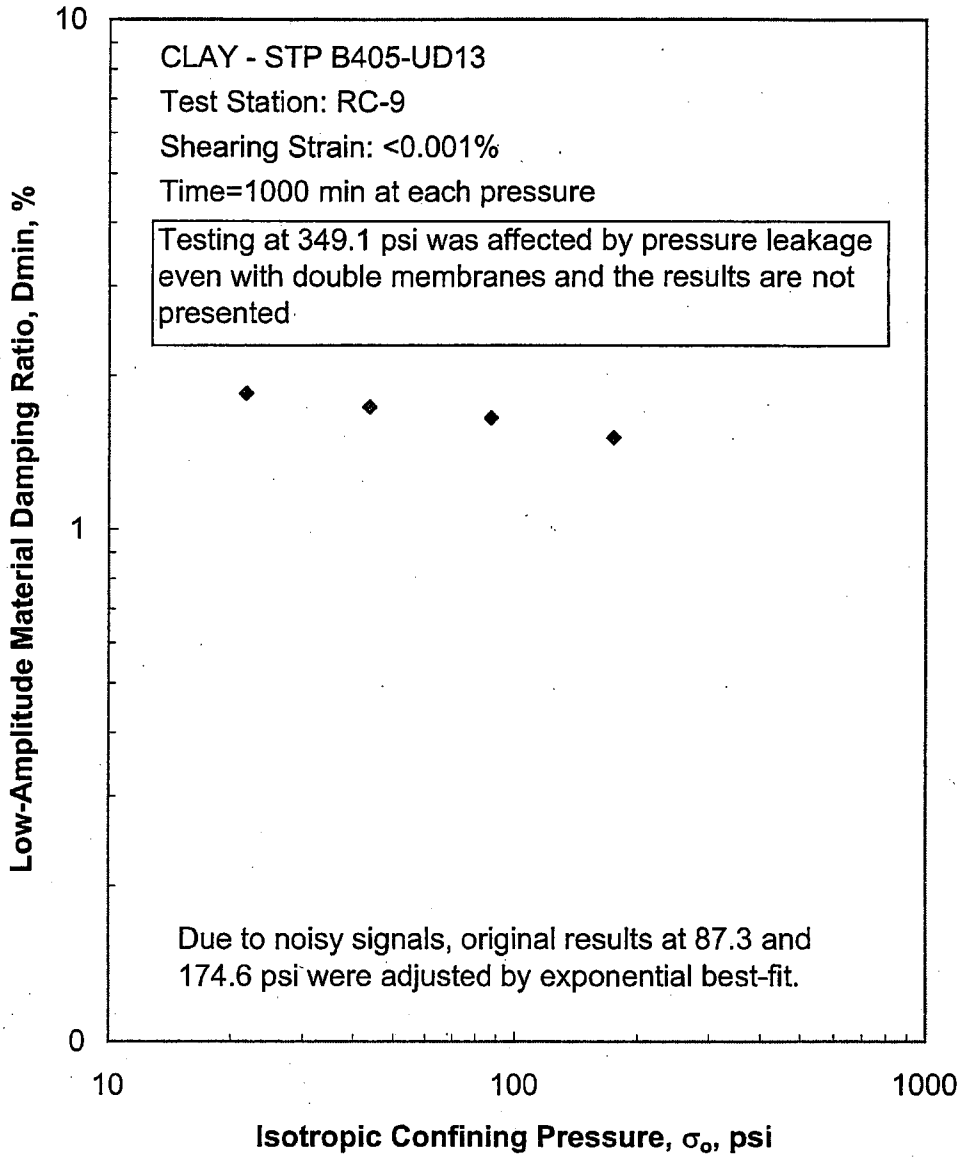


Figure A.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

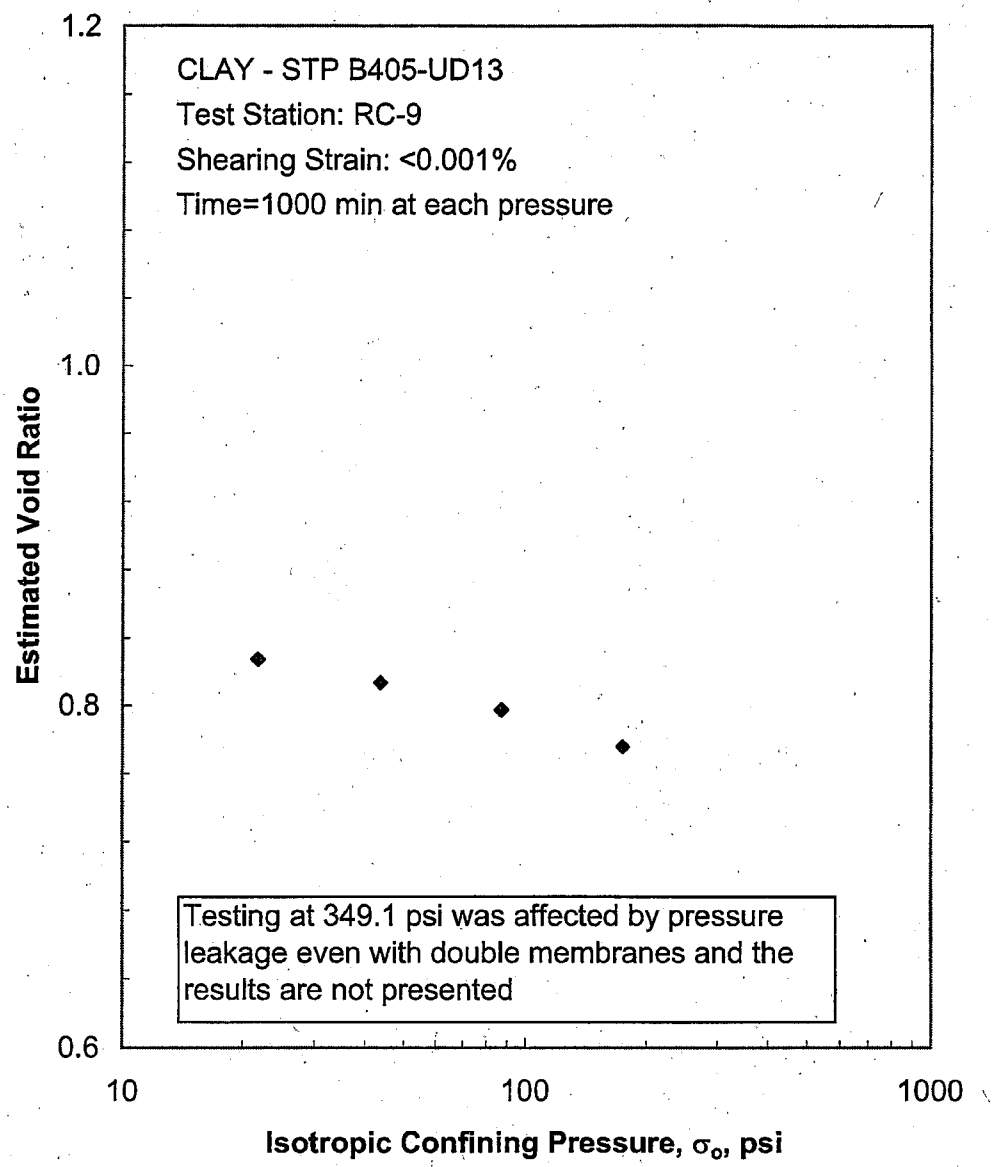


Figure A.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

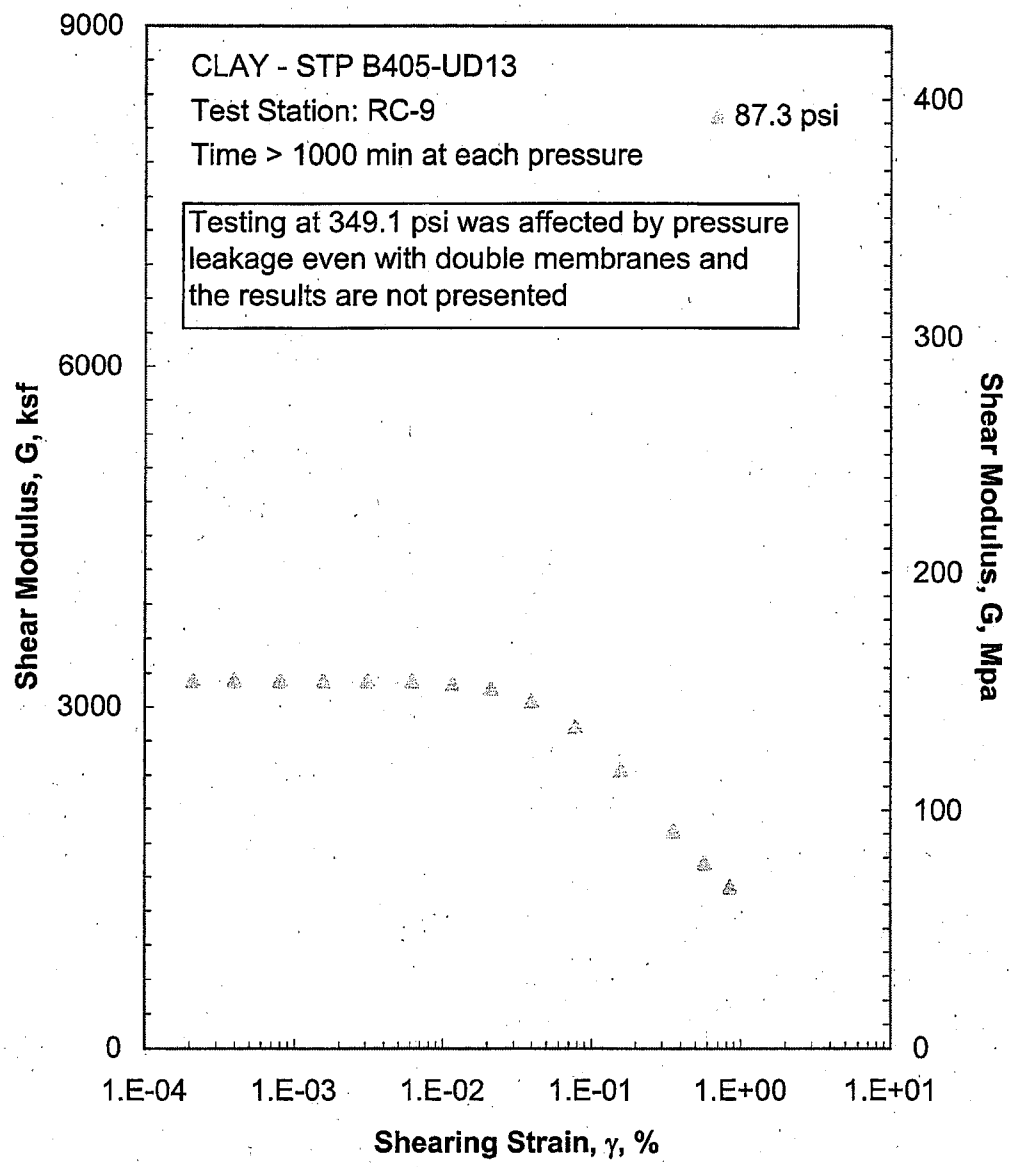


Figure A.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

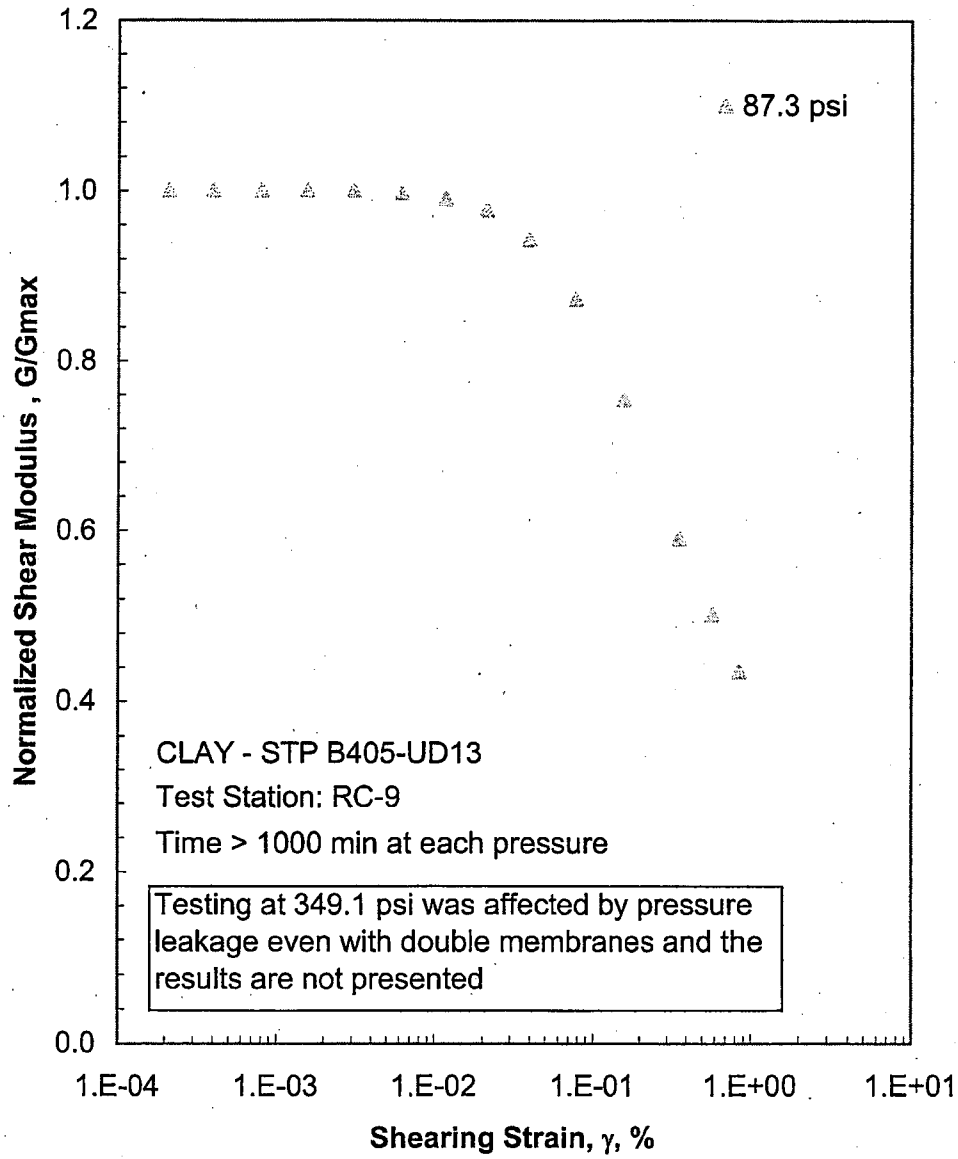


Figure A.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

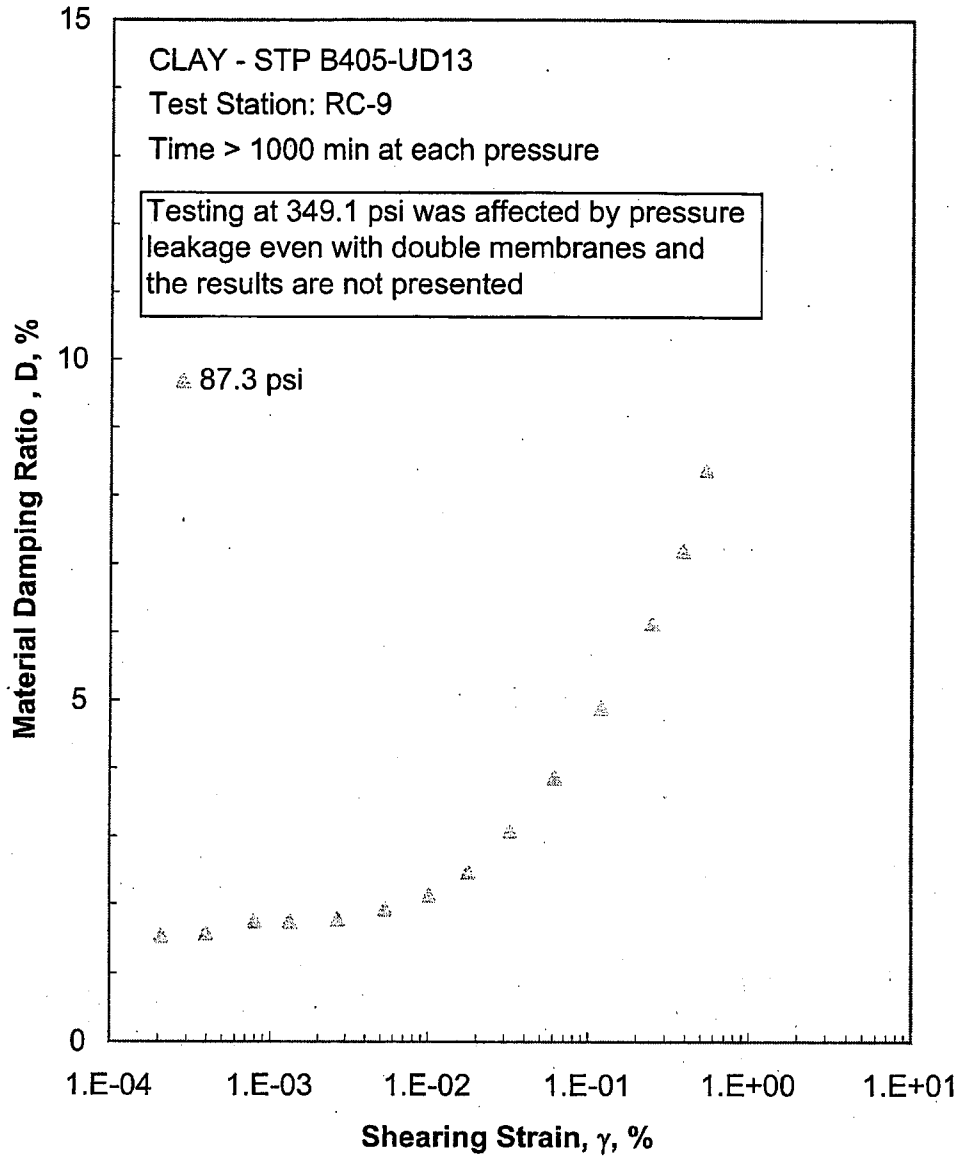


Figure A.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

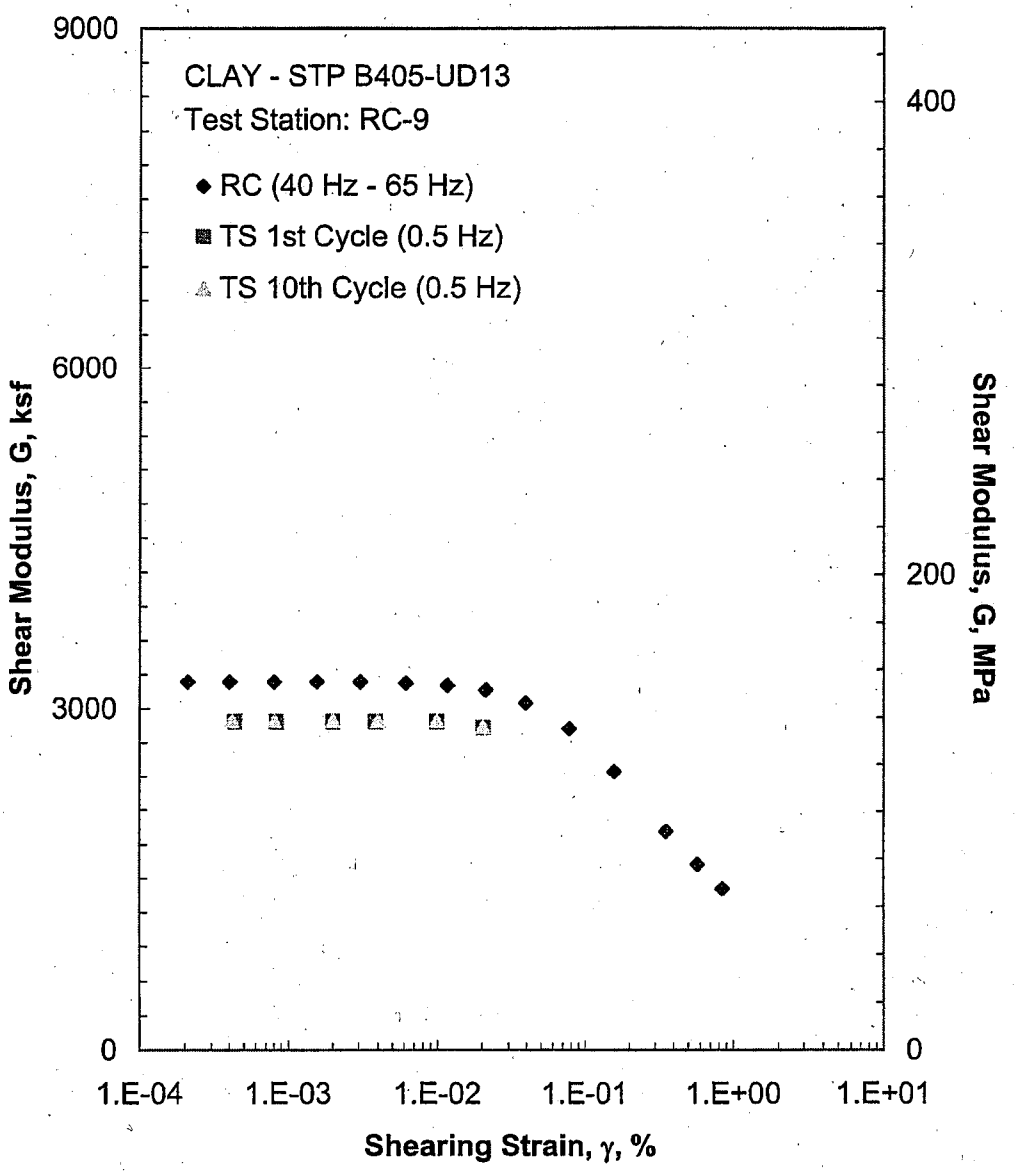


Figure A.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 87.3 psi from the Combined RCTS Tests

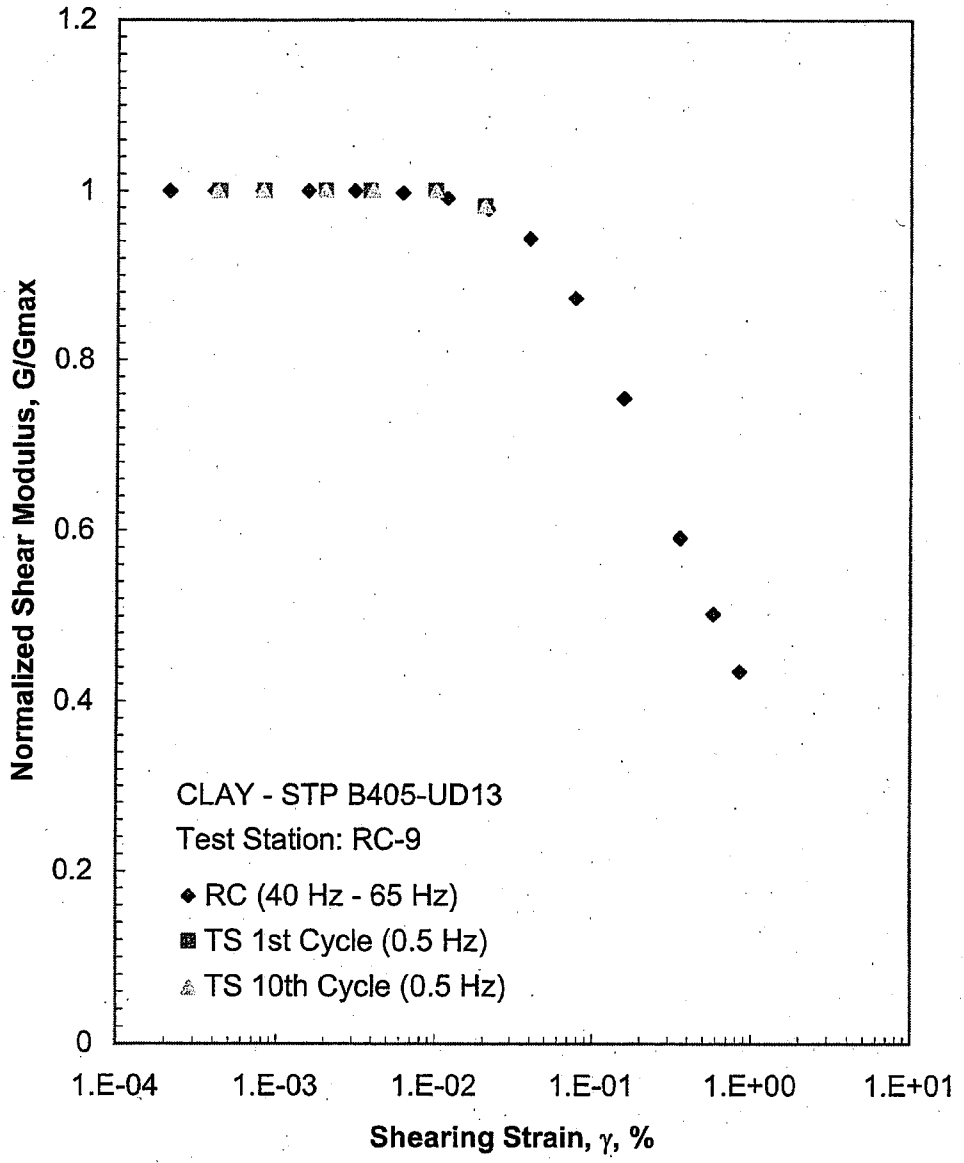


Figure A.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 87.3 psi from the Combined RCTS Tests

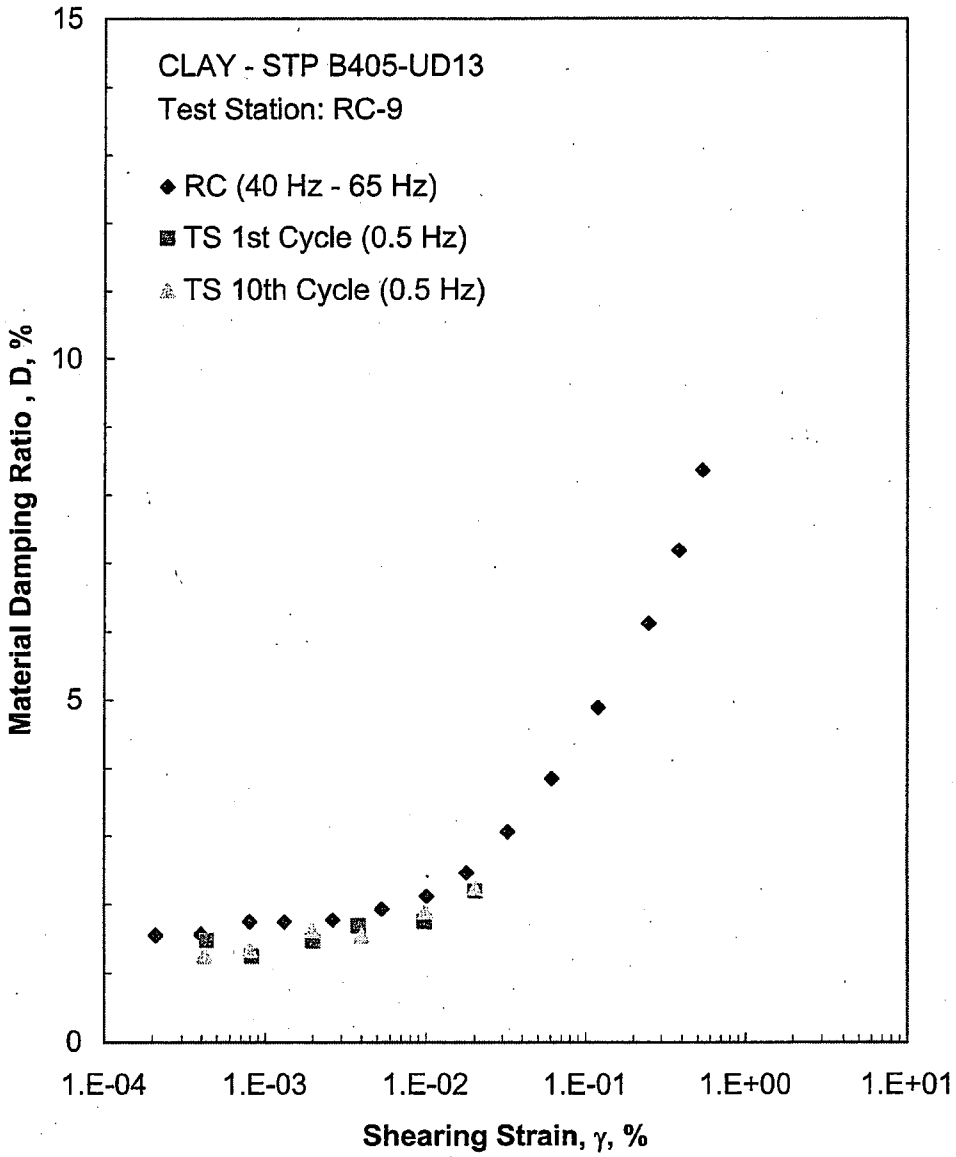


Figure A.13 Comparison of the Variation in Materail Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 87.3 psi from the Combined RCTS Tests

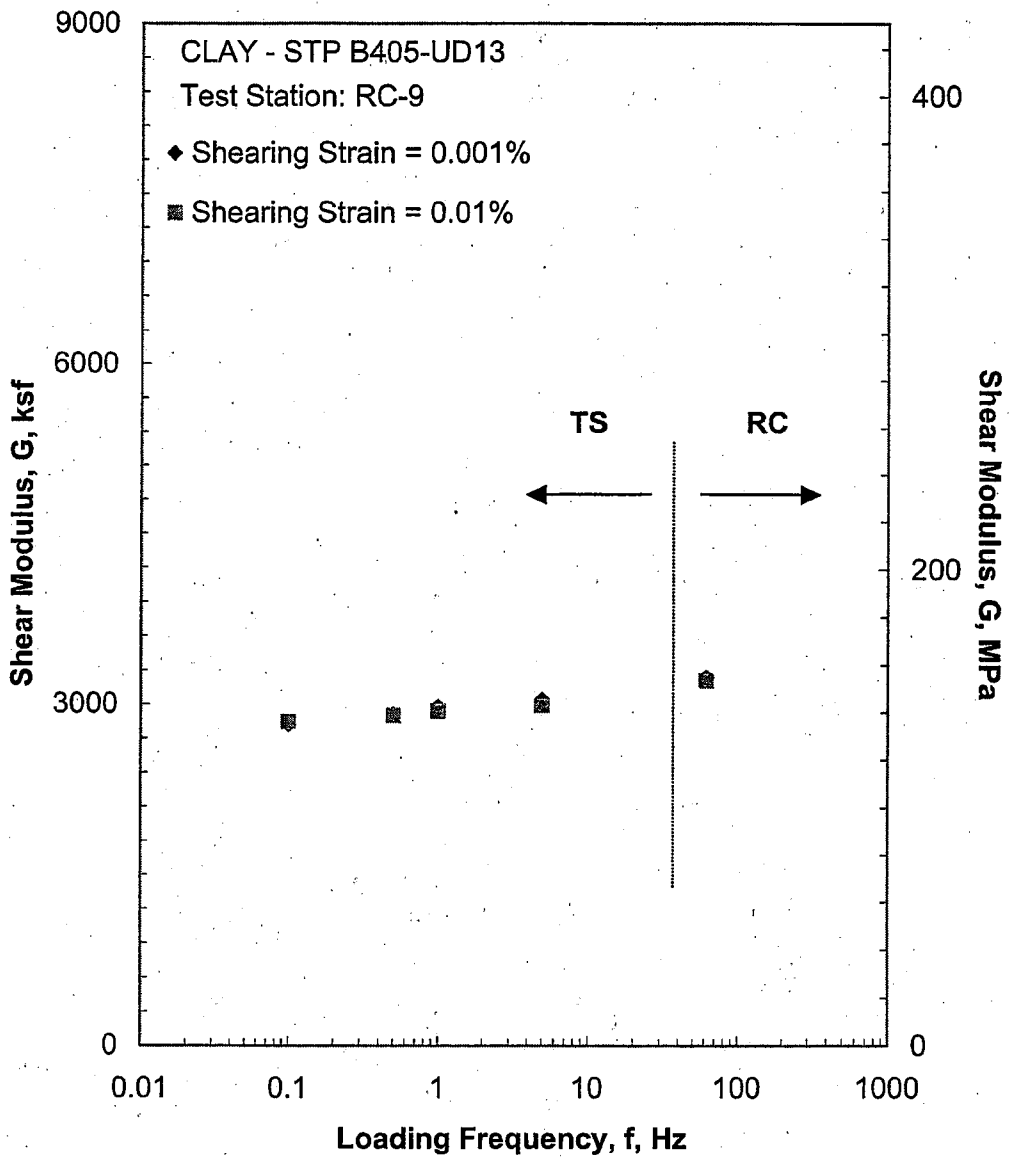


Figure A.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 87.3 psi from the Combined RCTS Tests

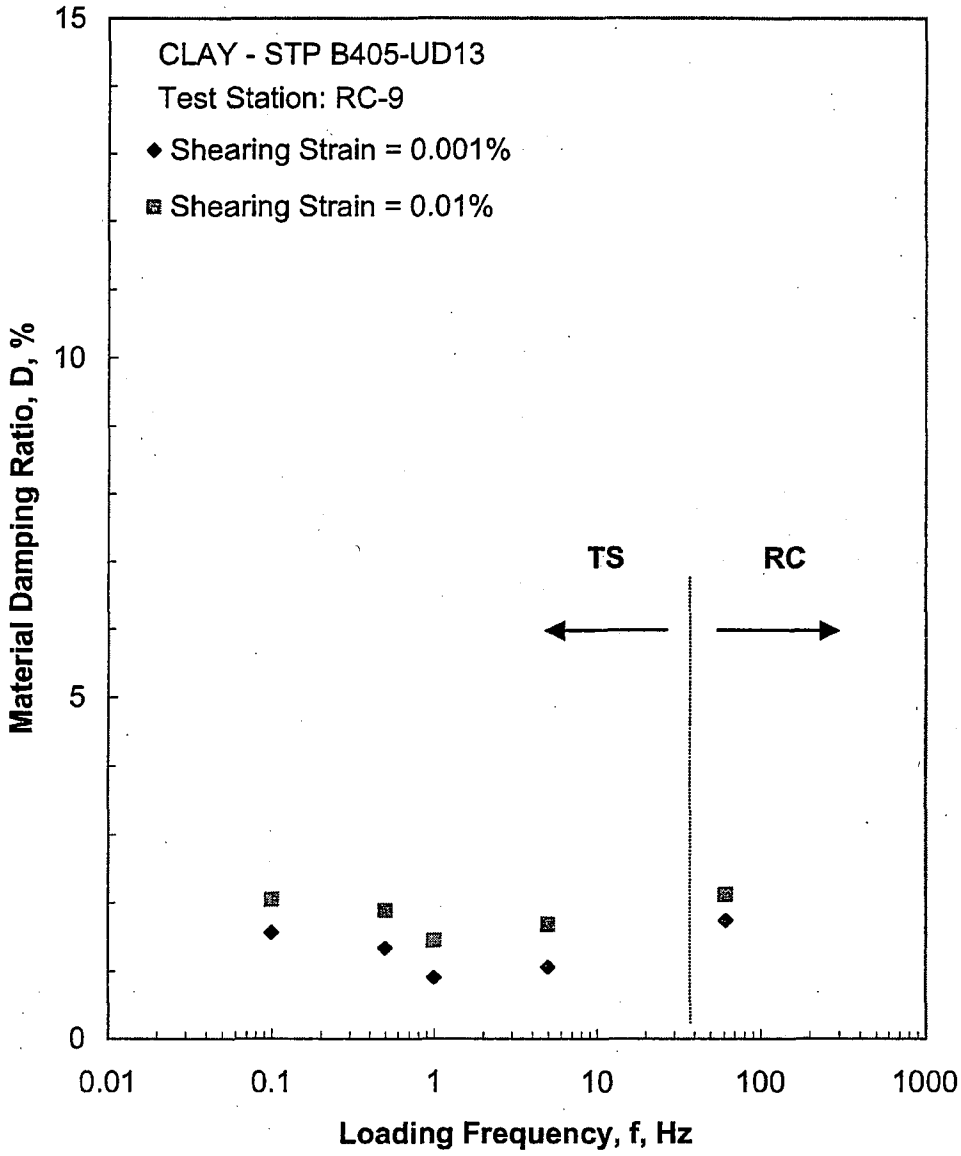


Figure A.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 87.3 psi from the Combined RCTS Tests

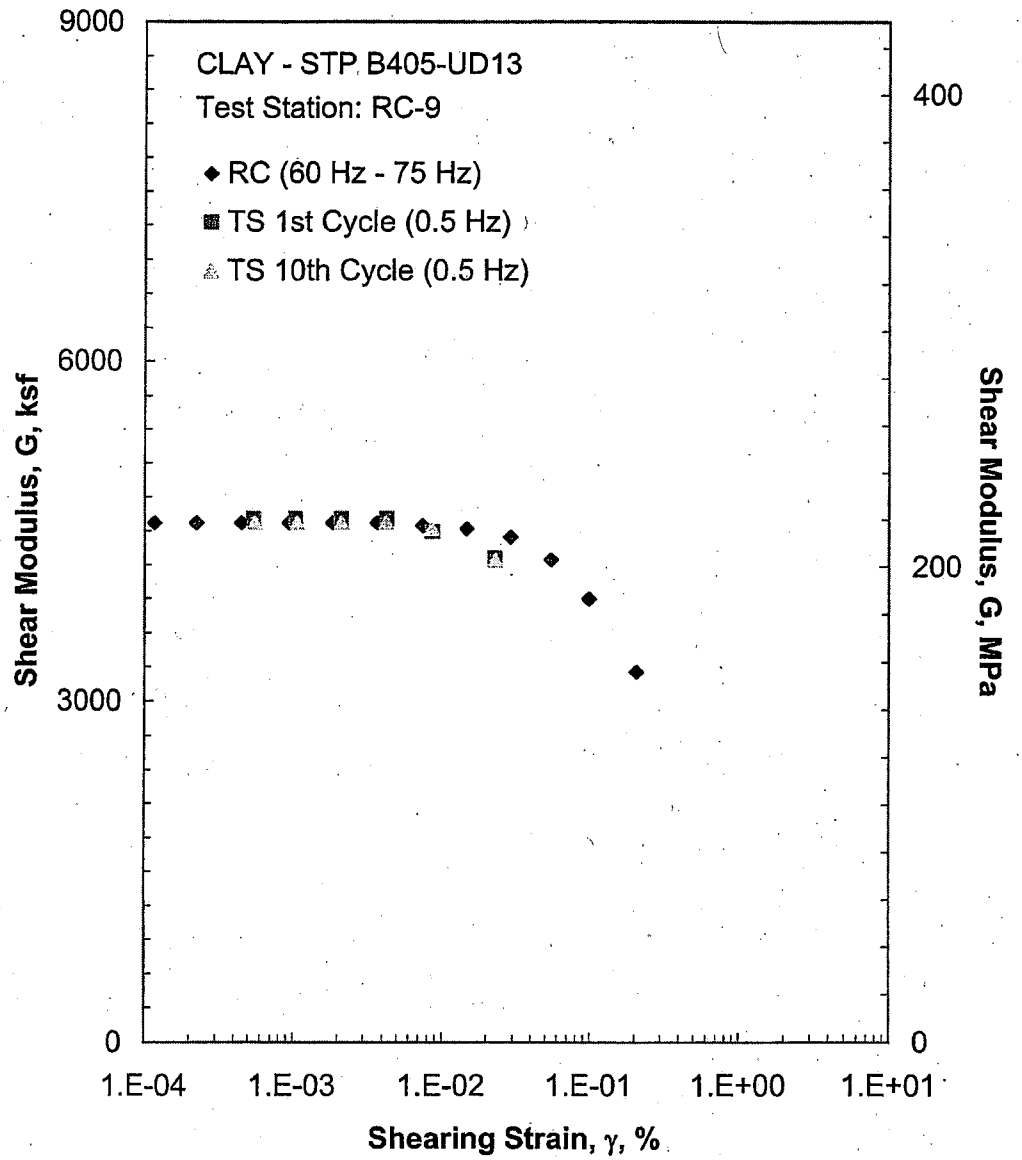


Figure A.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 349.1 psi from the Combined RCTS Tests

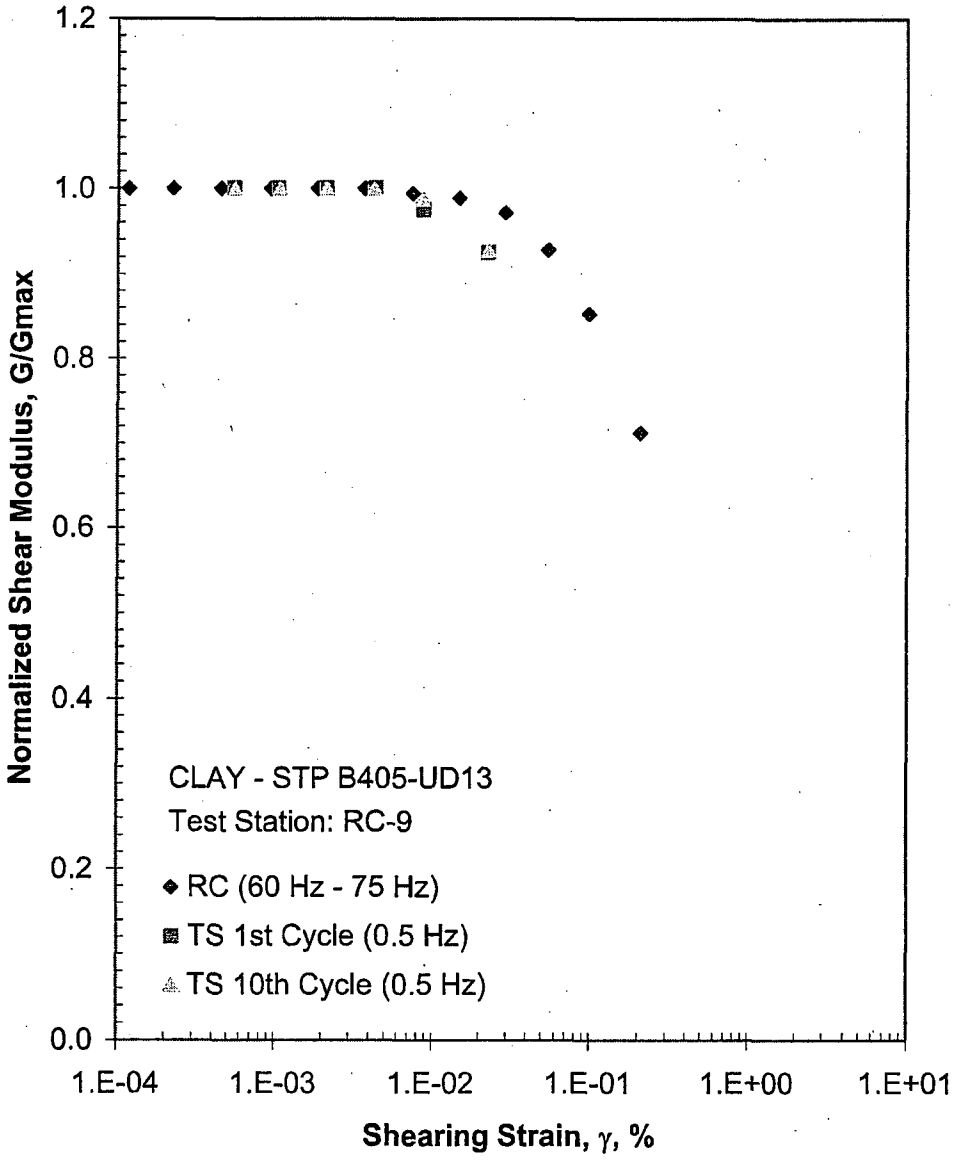


Figure A.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 349.1 psi from the Combined RCTS Tests

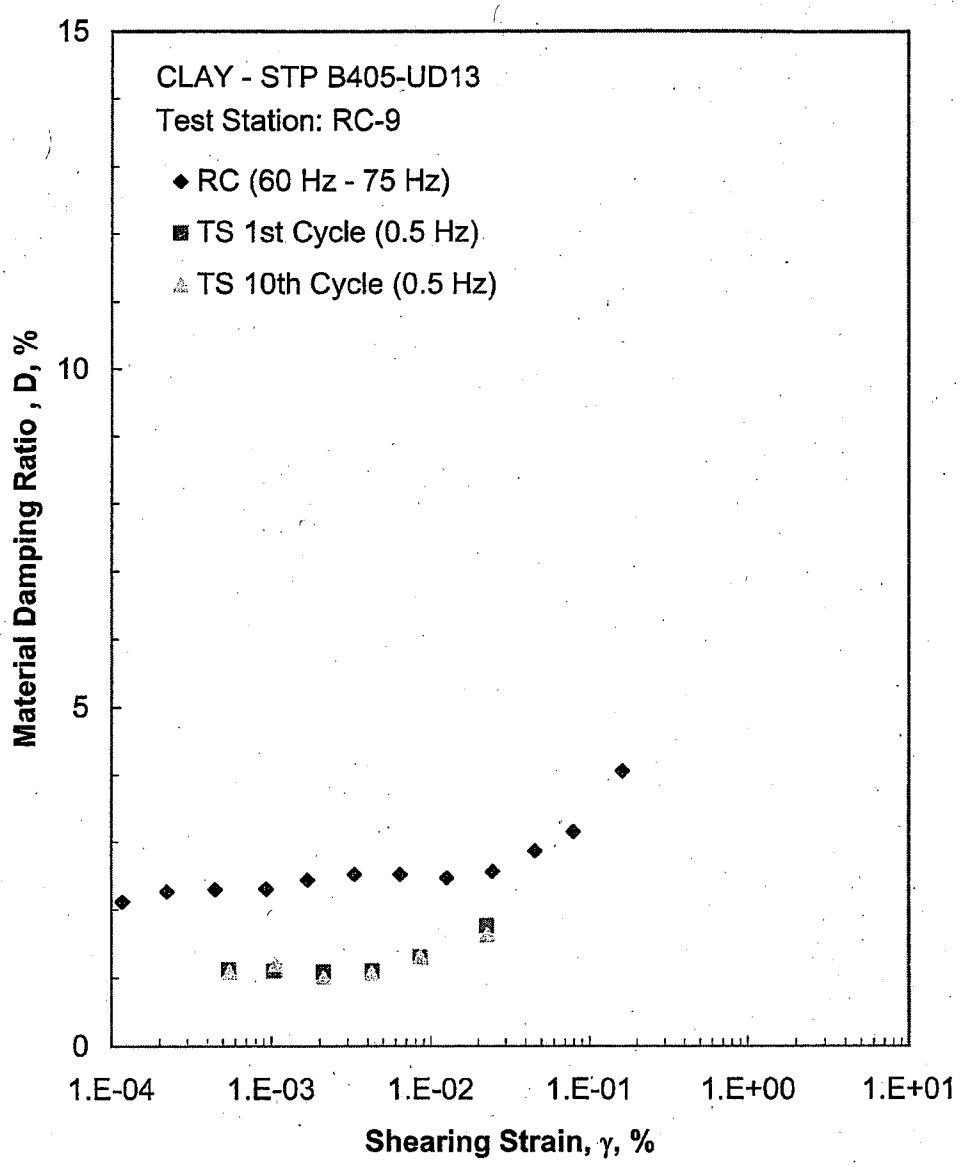


Figure A.18 Comparison of the Variation in Materail Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 349.1 psi from the Combined RCTS Tests

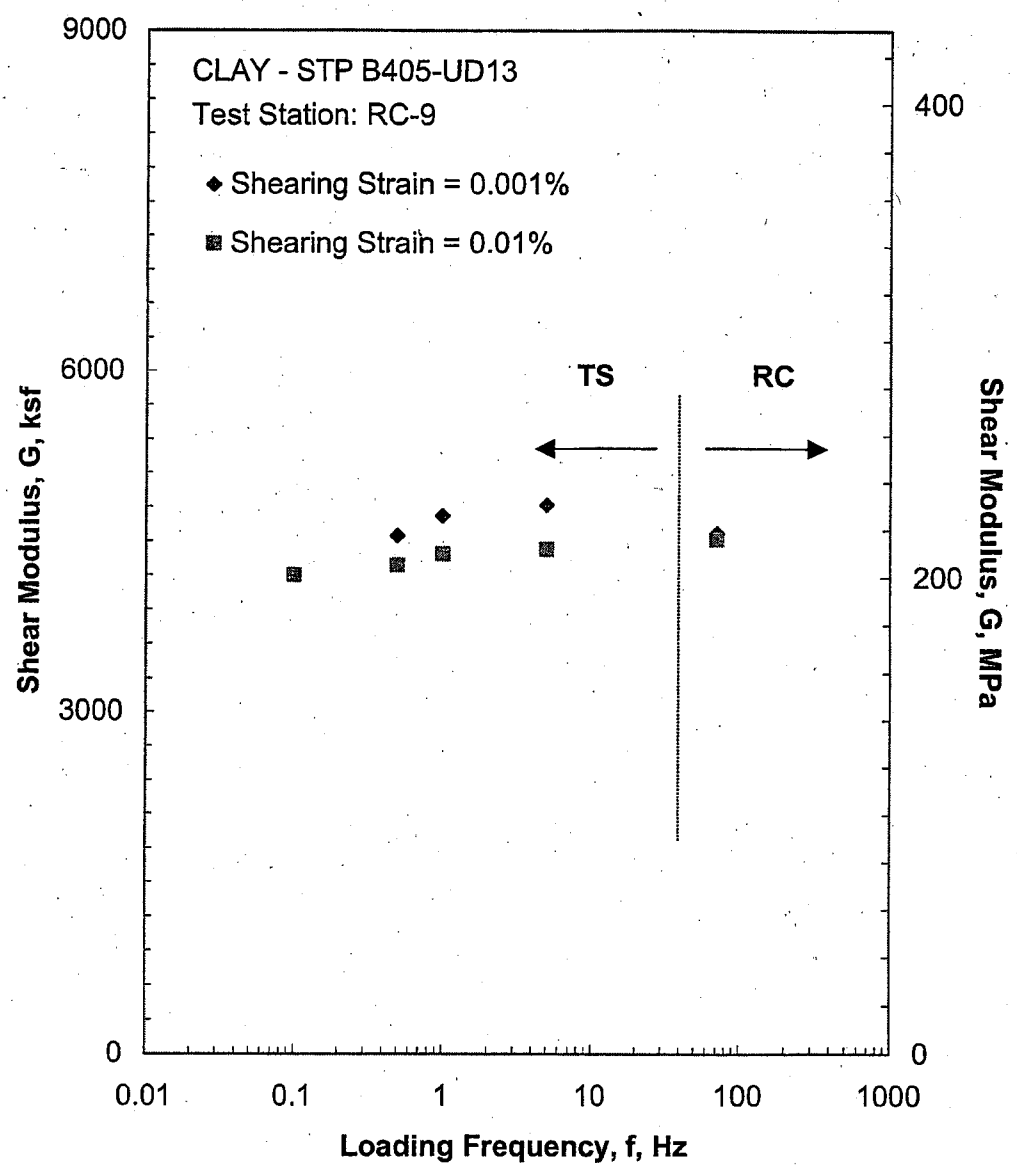


Figure A.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 349.1 psi from the Combined RCTS Tests

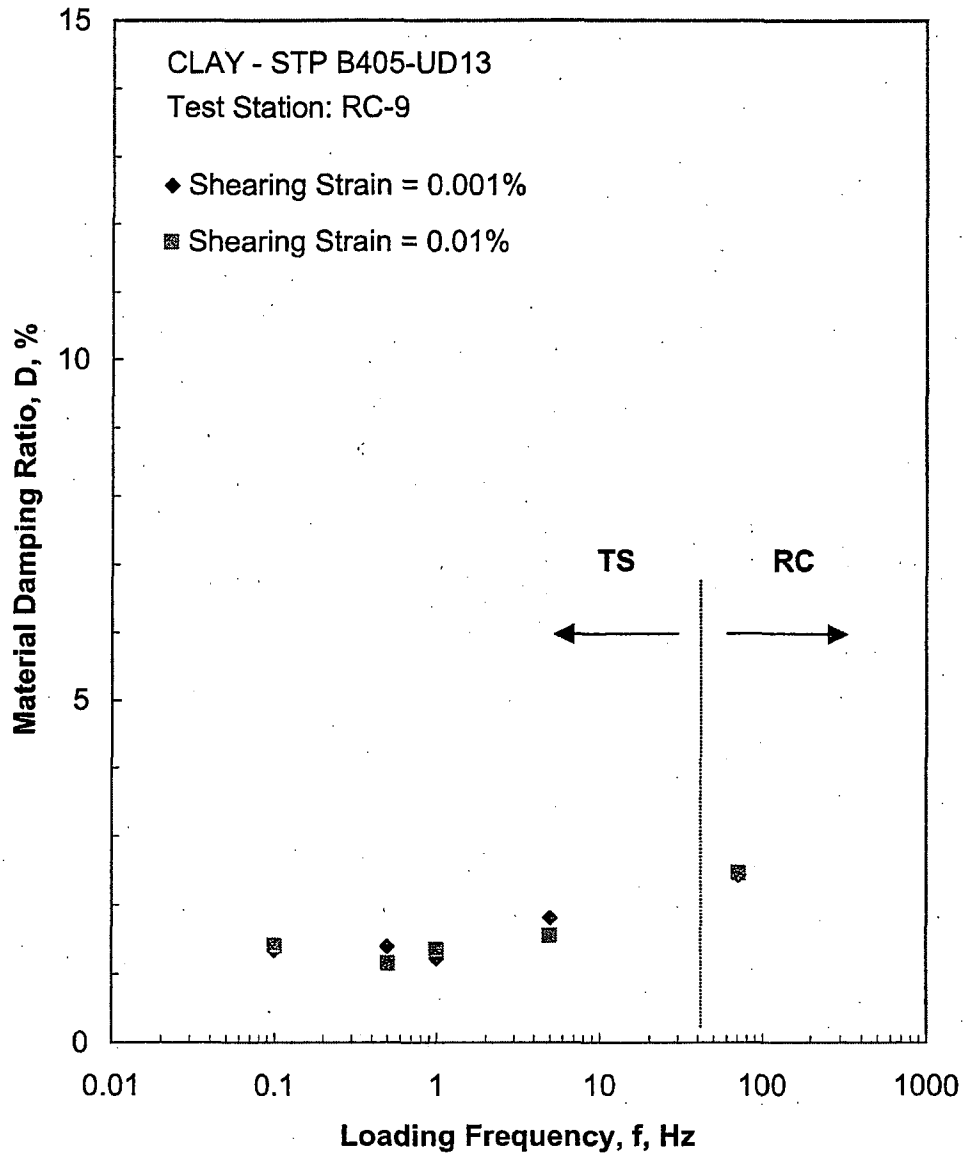


Figure A.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 349.1psi from the Combined RCTS Tests

Table A.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B405-UD13

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
21.8	3139	150	2575	124	827	1.85	0.827
43.7	6293	301	2913	140	876	1.73	0.814
87.3	12571	601	3205	154	915	1.65	0.798
174.6	25142	1203	3547	170	957	1.51	0.776

Table A.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD13; Isoptropic Confining Pressure, σ_o=87.3 psi (12.6 ksf = 602 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
2.09E-04	3235	1.00	2.09E-04	1.55
3.98E-04	3235	1.00	3.98E-04	1.57
8.01E-04	3235	1.00	8.01E-04	1.74
1.56E-03	3235	1.00	1.33E-03	1.74
3.07E-03	3235	1.00	2.67E-03	1.77
6.15E-03	3226	1.00	5.36E-03	1.93
1.17E-02	3205	0.99	1.01E-02	2.12
2.11E-02	3163	0.98	1.79E-02	2.46
3.93E-02	3050	0.94	3.24E-02	3.06
7.74E-02	2823	0.87	6.13E-02	3.85
1.58E-01	2441	0.75	1.20E-01	4.89
3.55E-01	1910	0.59	2.49E-01	6.12
5.76E-01	1623	0.50	3.83E-01	7.18
8.46E-01	1407	0.43	5.37E-01	8.36

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table A.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD13; Isotropic Confining Pressure, σ_o= 87.3 psi (12.6 ksf = 602 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
4.31E-04	2886	1.00	1.47	4.16E-04	2893	1.00	1.25
8.23E-04	2886	1.00	1.24	8.04E-04	2893	1.00	1.33
2.00E-03	2886	1.00	1.46	1.99E-03	2893	1.00	1.61
3.84E-03	2886	1.00	1.68	4.01E-03	2893	1.00	1.54
9.85E-03	2886	1.00	1.75	9.88E-03	2893	1.00	1.88
2.02E-02	2835	0.98	2.19	2.02E-02	2839	0.98	2.23

Table A.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD13; Isoptropic Confining Pressure, σ_o=349 psi (50.3 ksf = 2406 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
---*	---*	---*	---*	---*

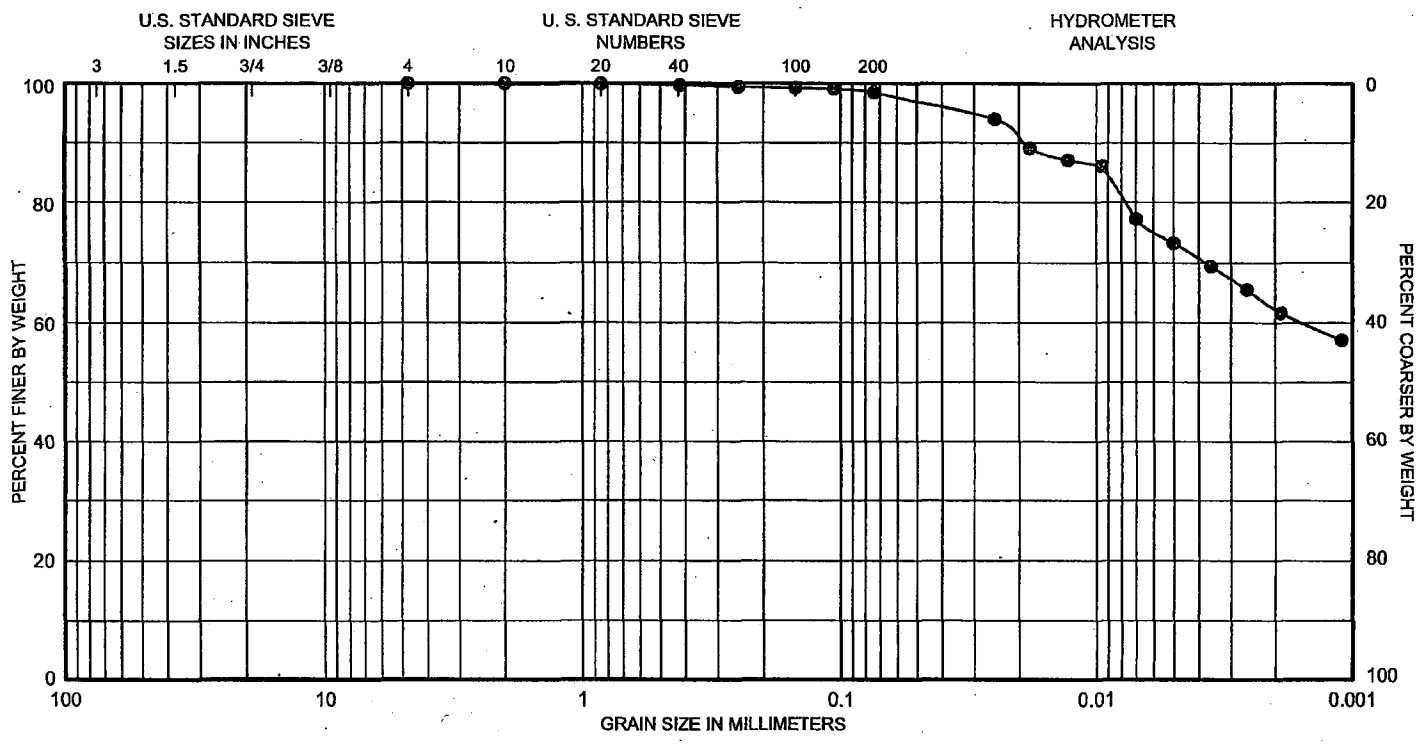
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve
[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve
* Data not available due to leakage.

Table A.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD13; Isotropic Confining Pressure, σ_o=160 psi (23.0 ksf = 1103 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D,	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D,
---*	---*	---*	---*	---*	---*	---*	---*

* Data not available due to leakage.

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{60}	CLASSIFICATION
●	B-405-UD13	294.65				0.02	Clay, olive gray, slickensided, with calcareous nodules and sand pockets

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX B

Specimen STP B305-UD13
Silty SAND (Non Plasticity; Gs=2.65)

Borehole B305
Sample UD13
Depth = 265.5 ft (80.8 m)
Total Unit Weight = 116.0 lb/ft^3
Water Content = 19.2 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 78.6 psi

FUGRO JOB #: 0401-1660
Testing Station: RC9

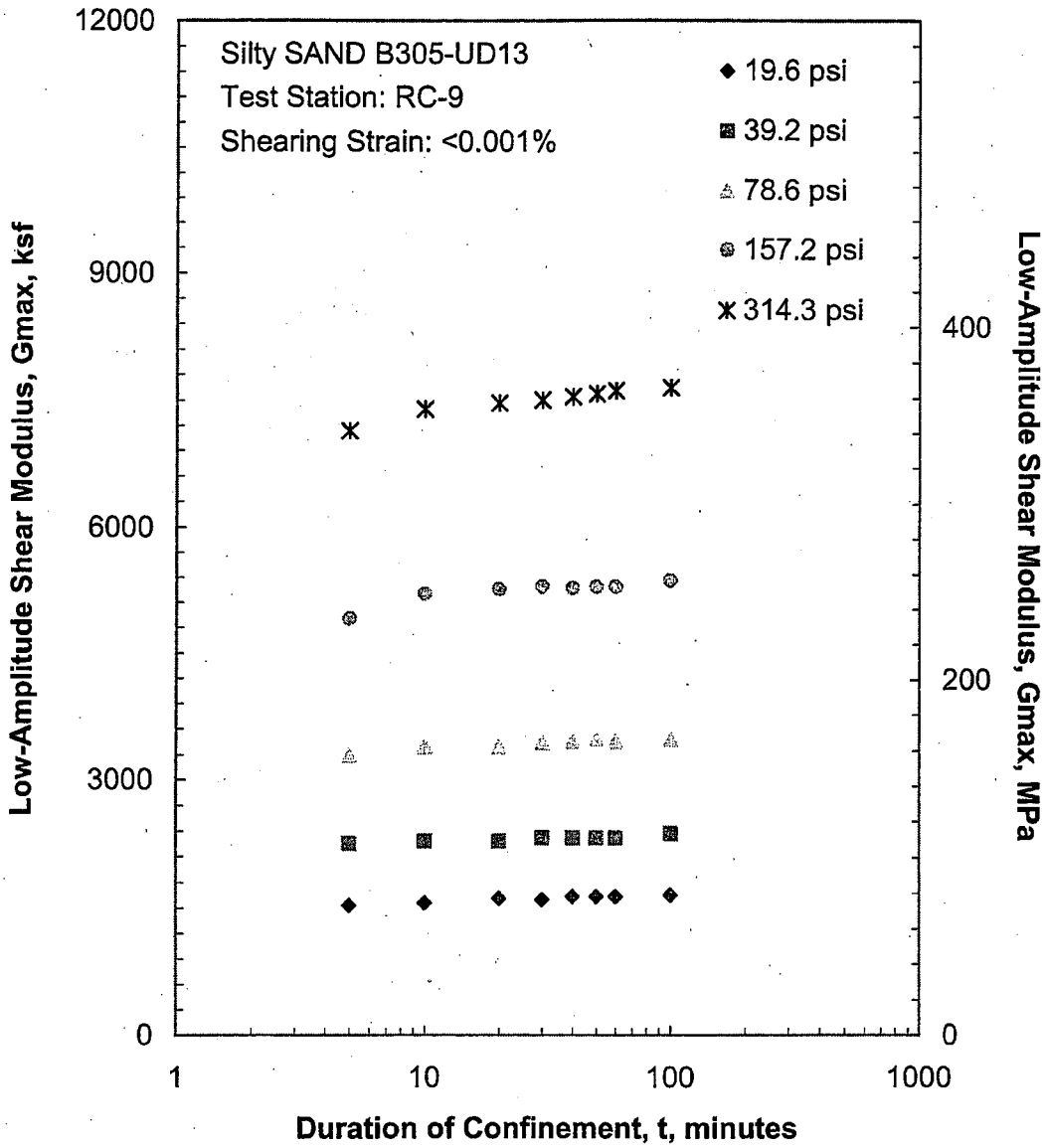


Figure B.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

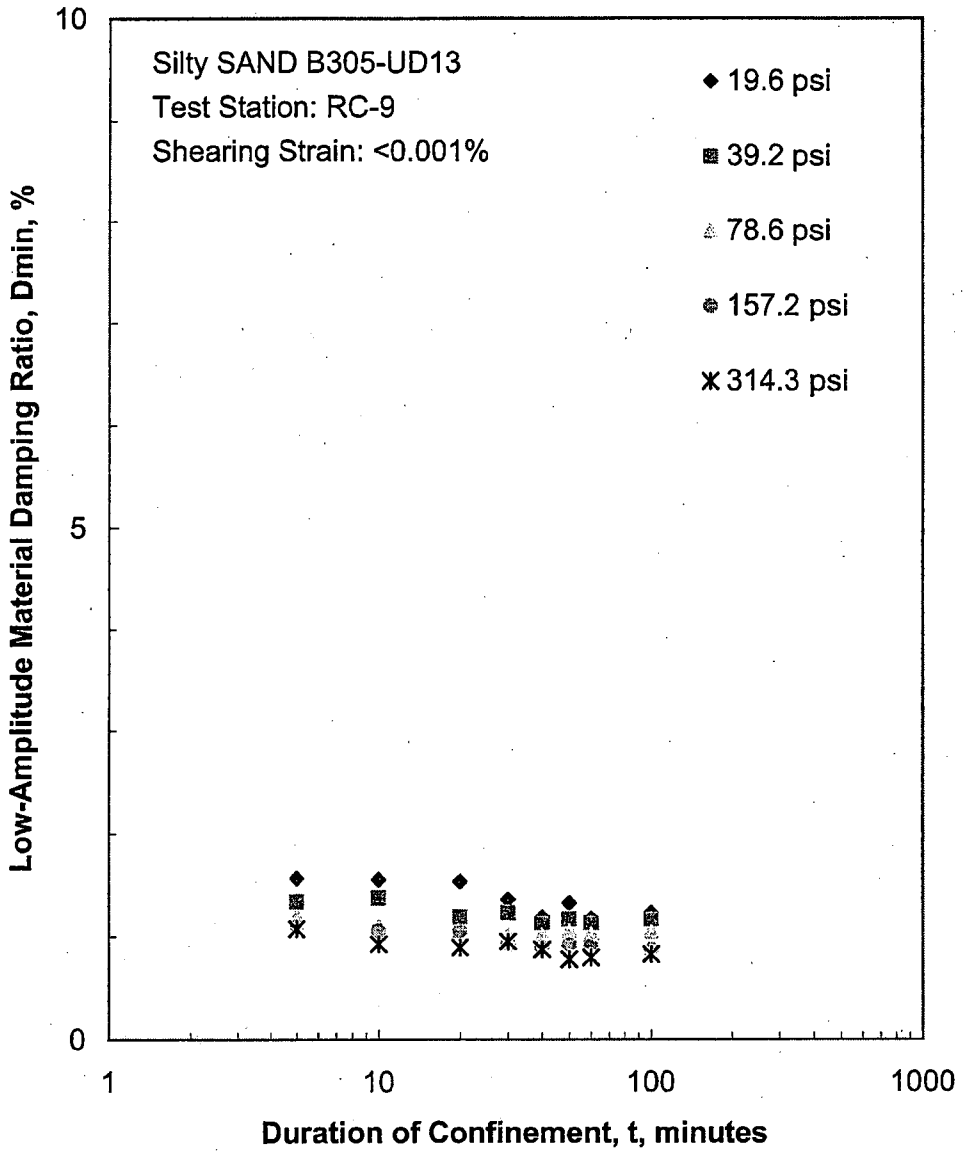


Figure B.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

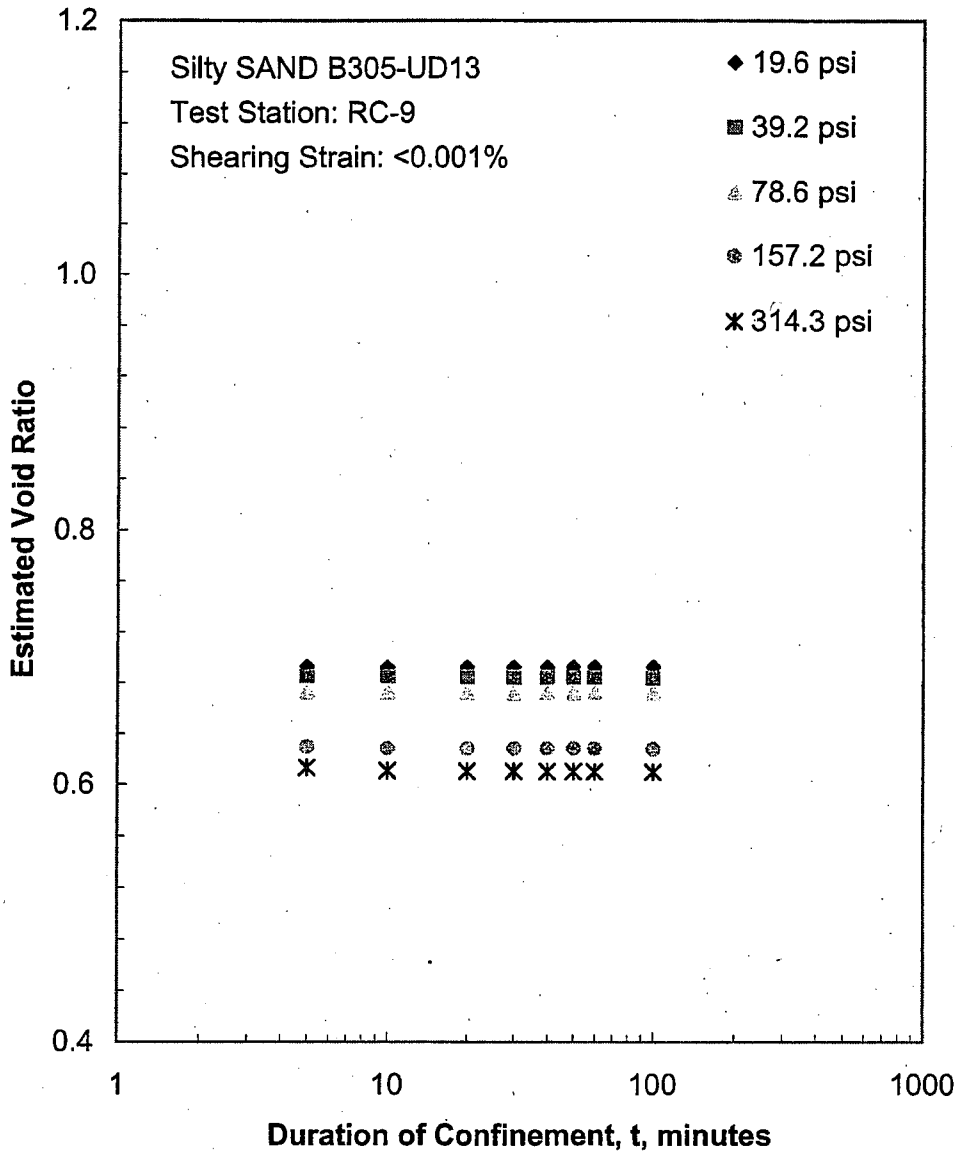


Figure B.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

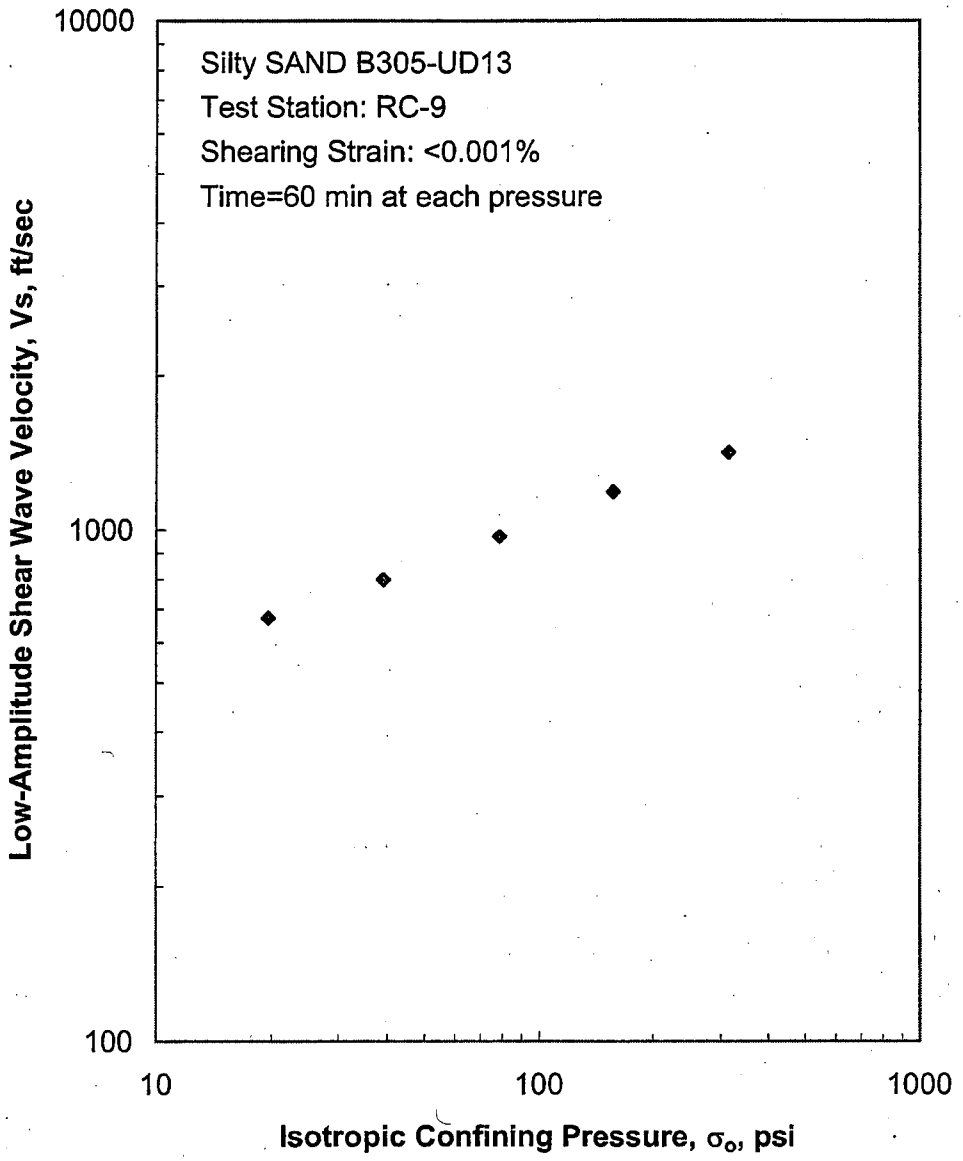


Figure B.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

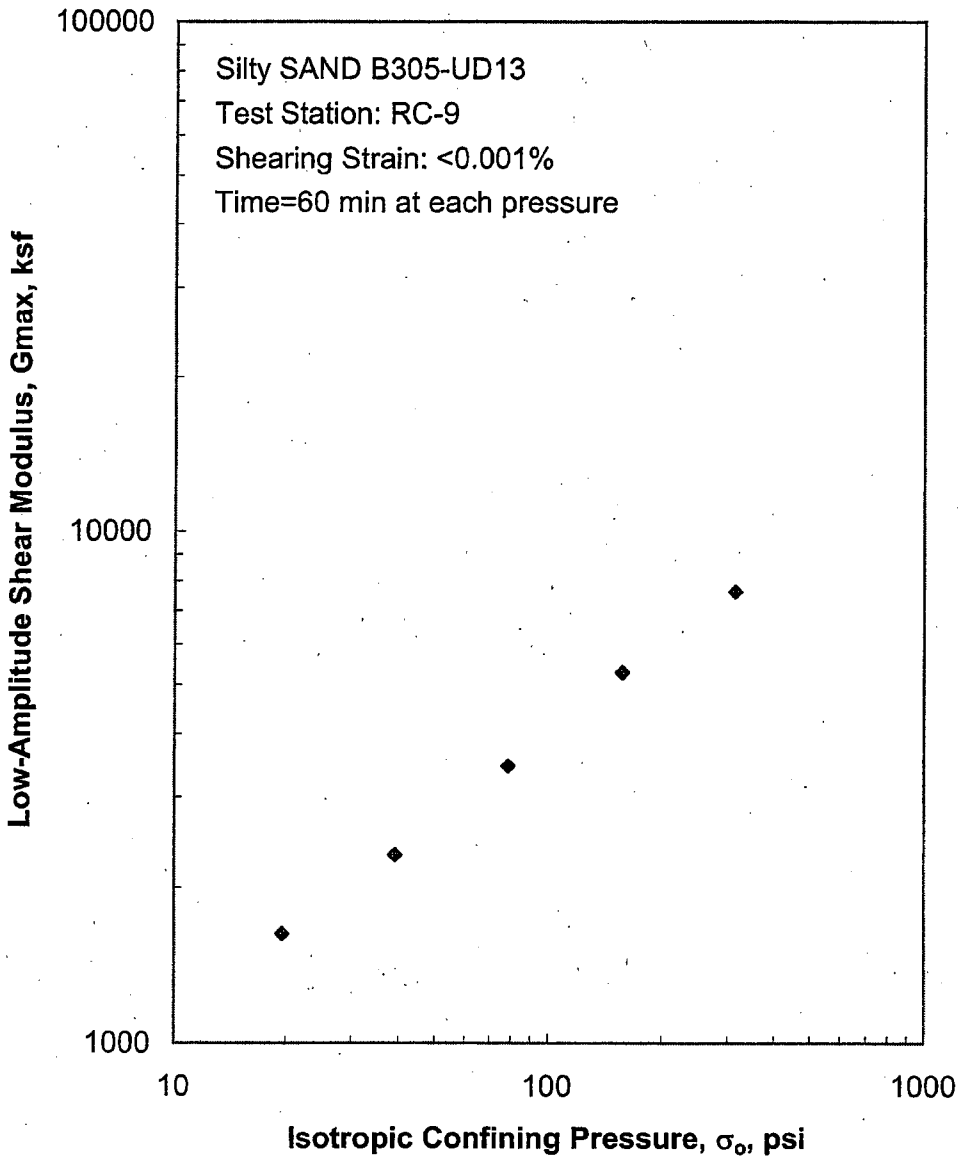


Figure B.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

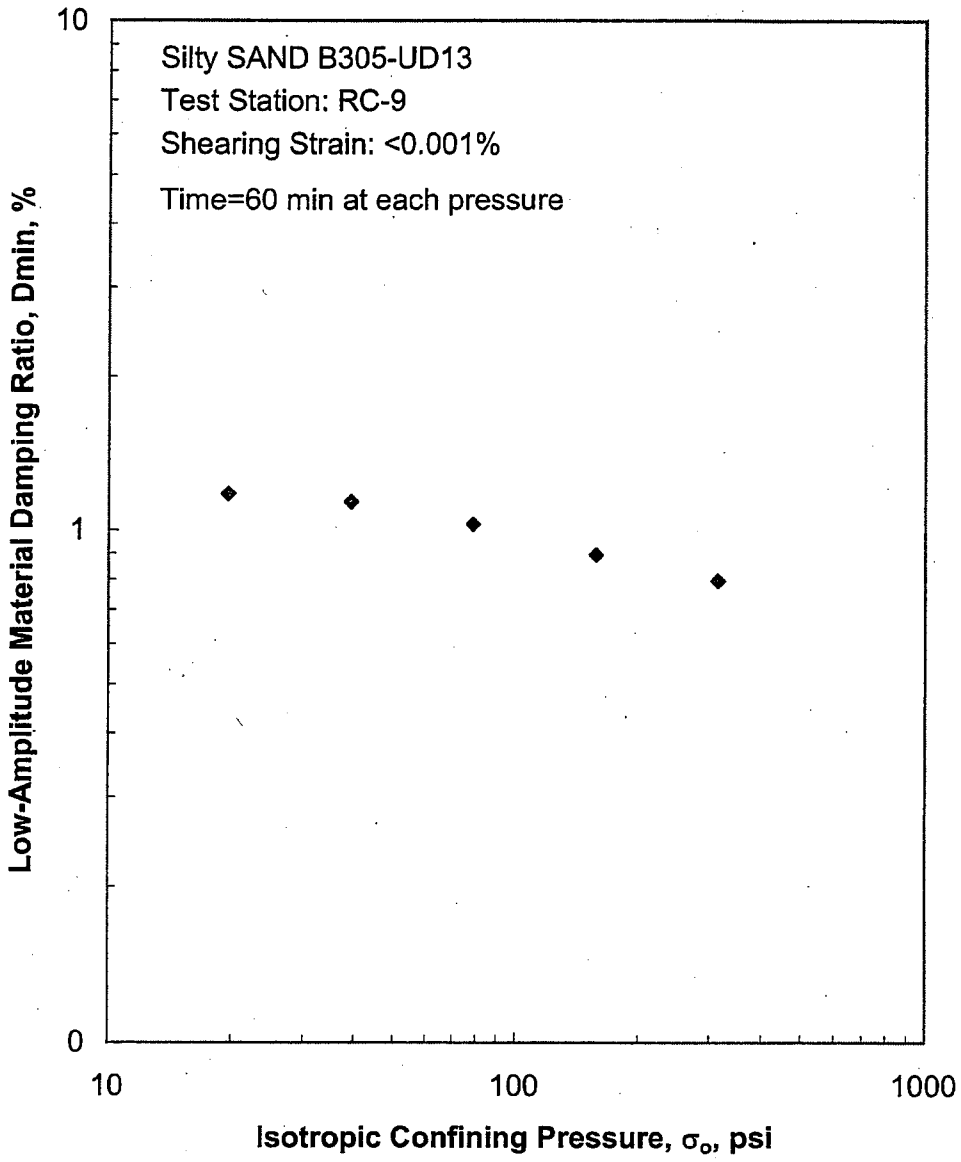


Figure B.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

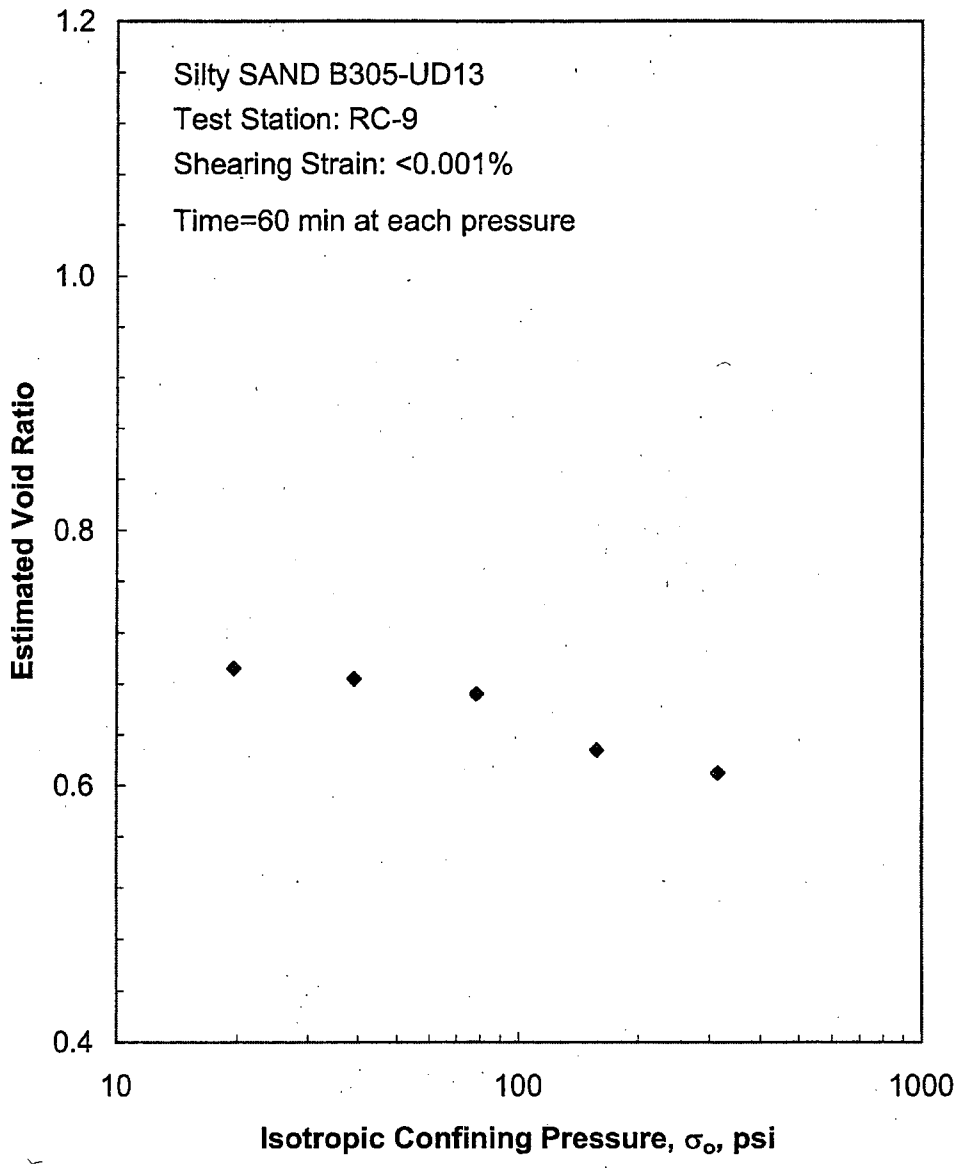


Figure B.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

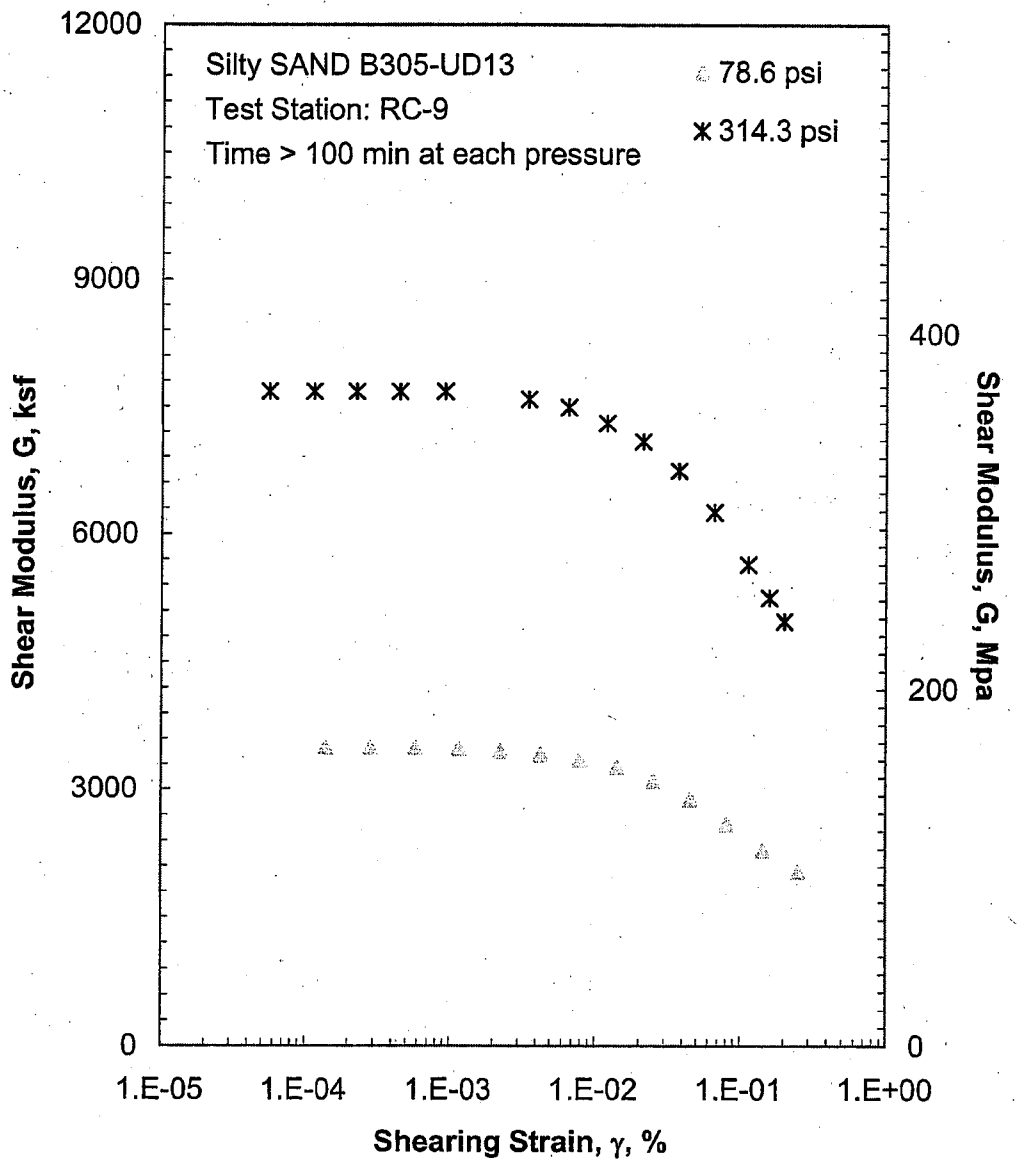


Figure B.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

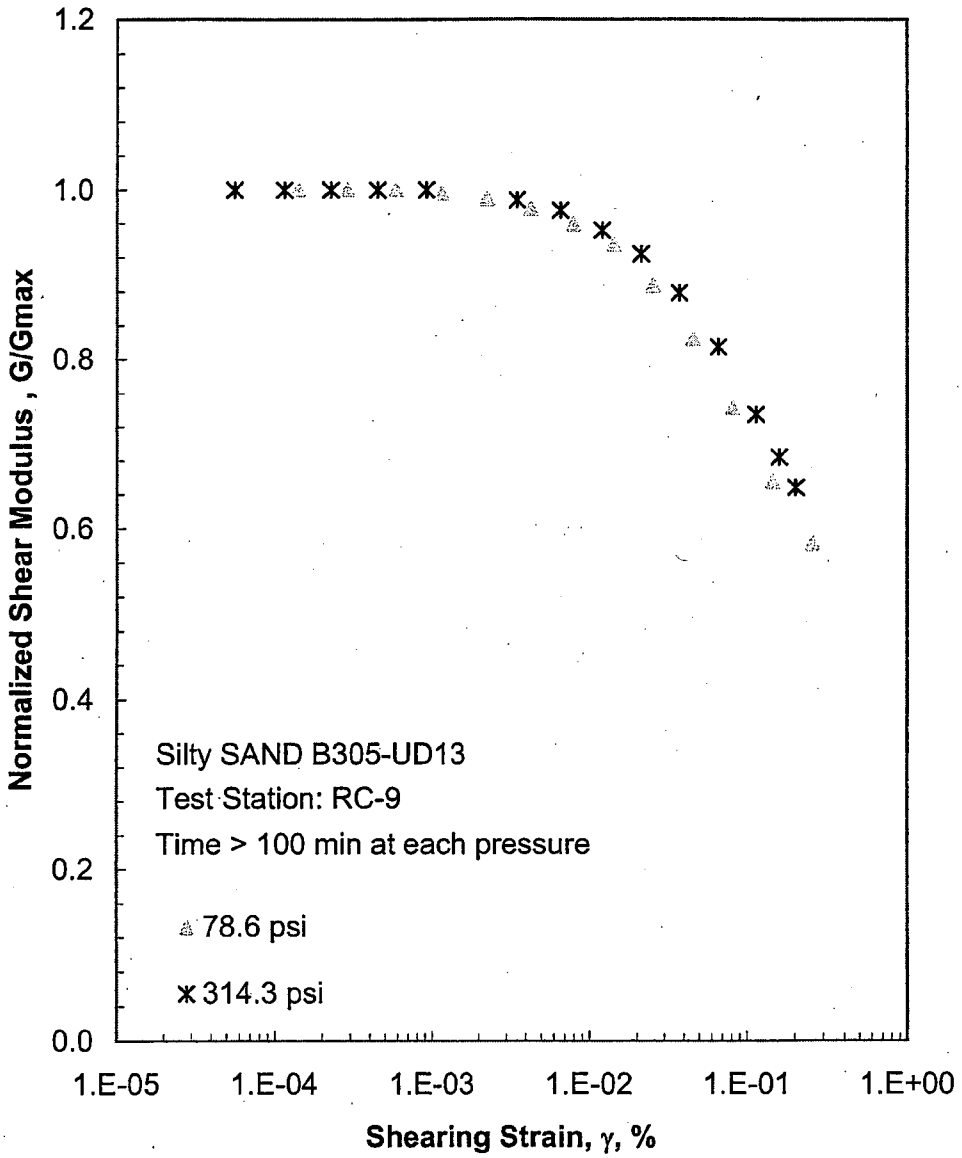


Figure B.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

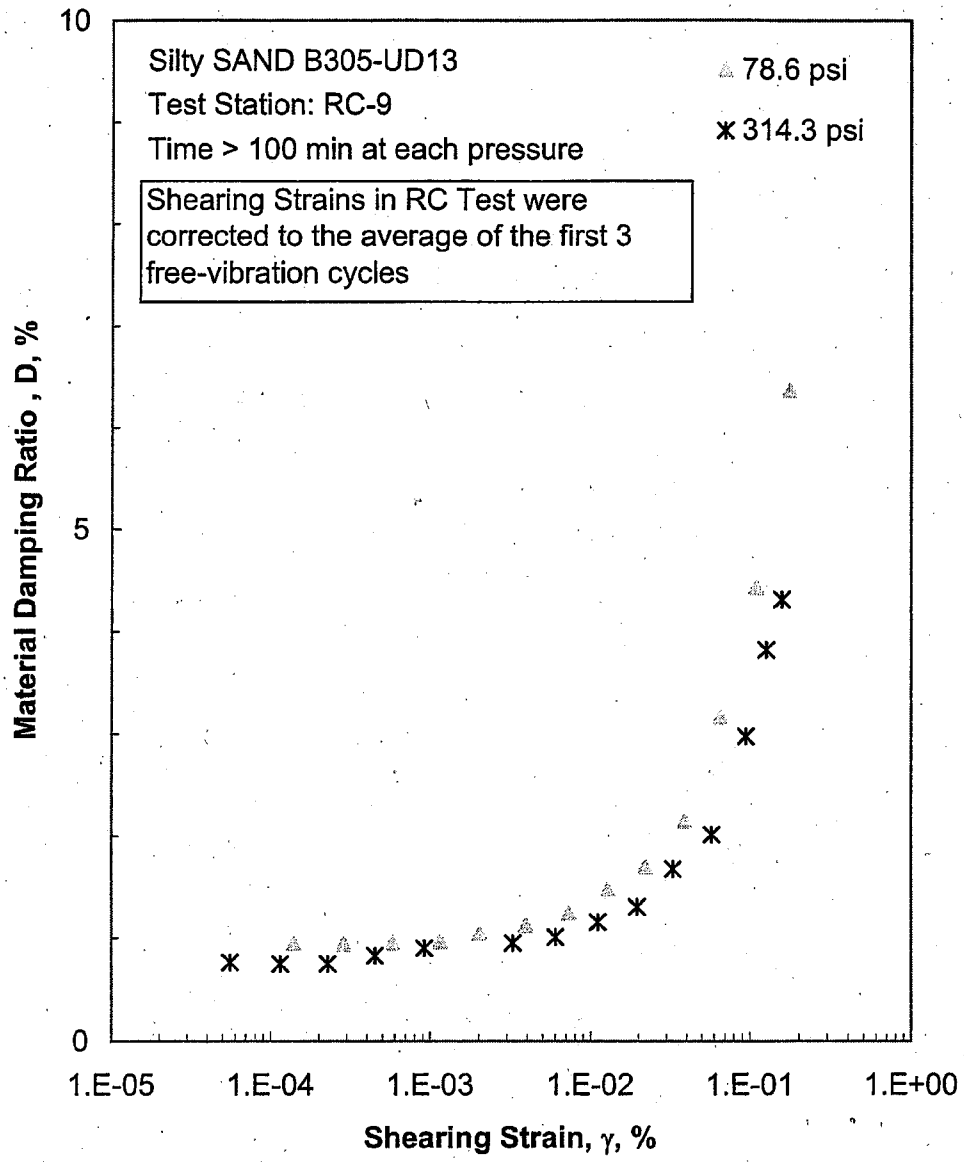


Figure B.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

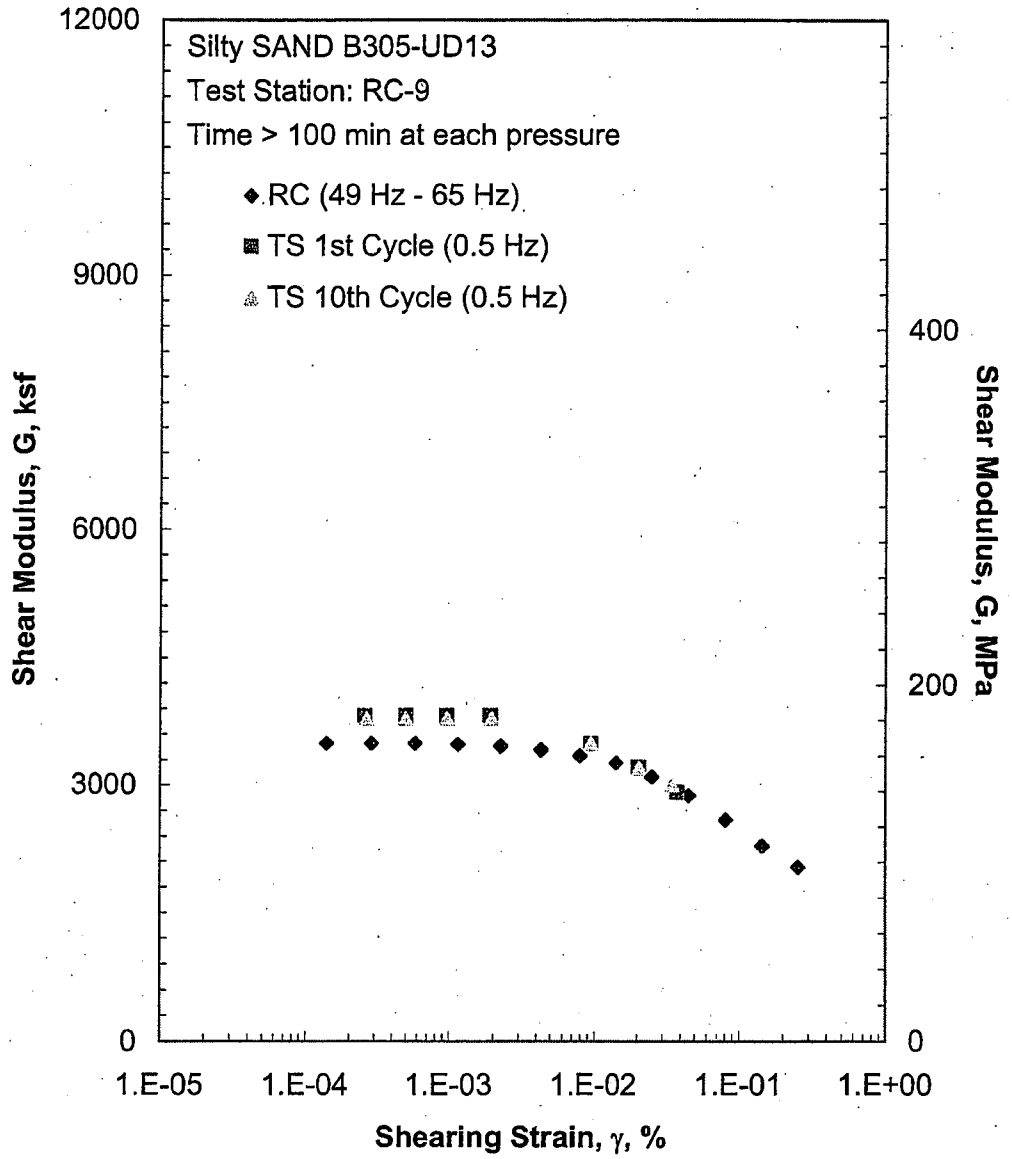


Figure B.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 78.6 psi from the Combined RCTS Tests

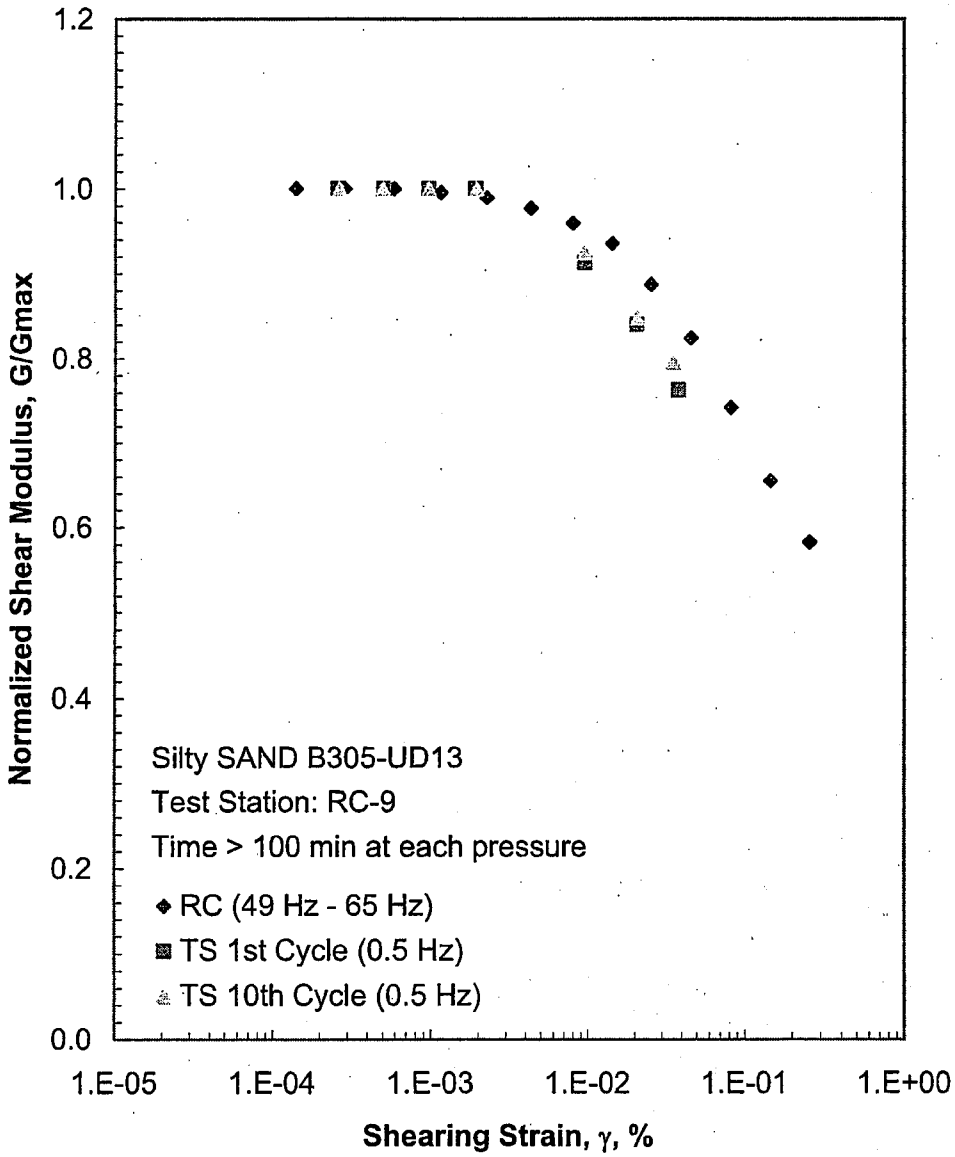


Figure B.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 78.6 psi from the Combined RCTS Tests

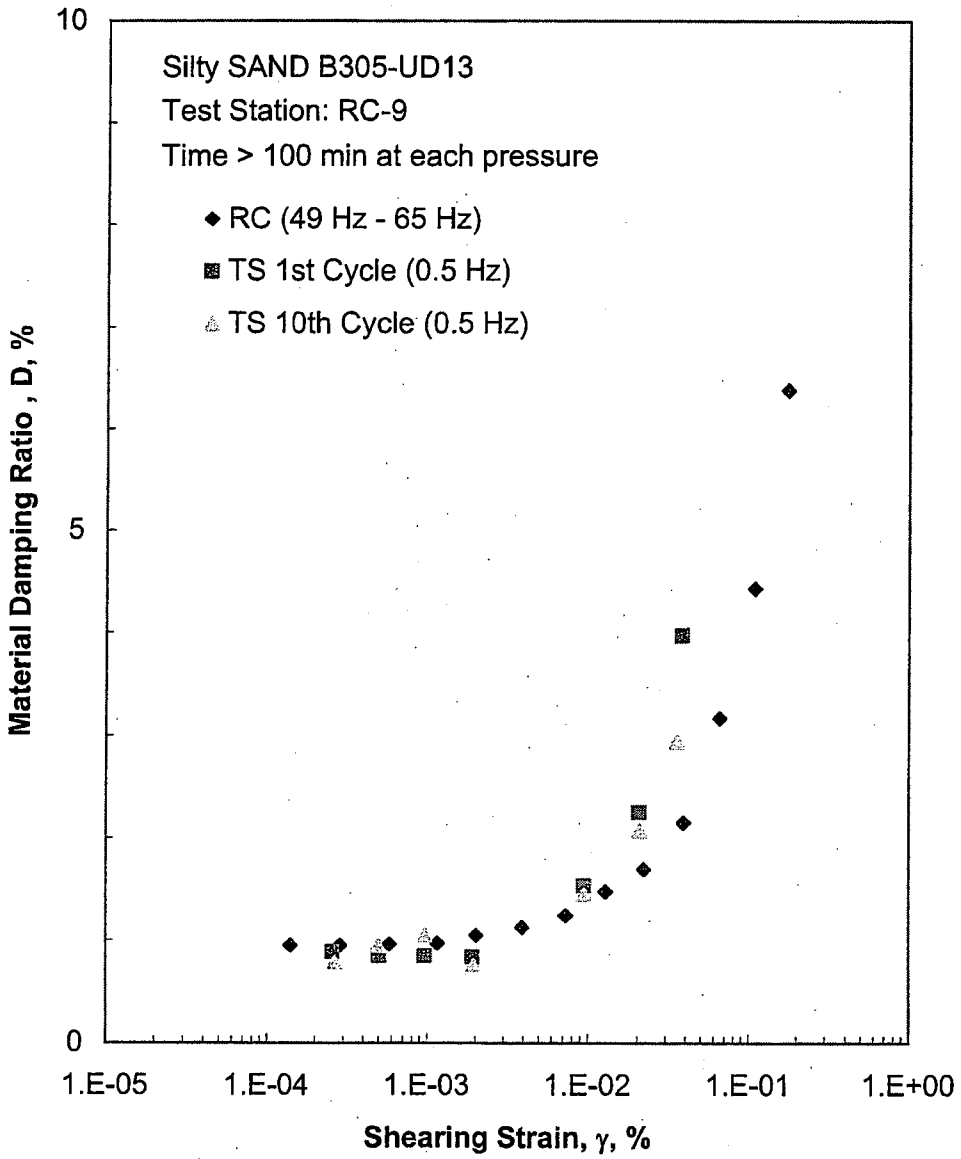


Figure B.13 Comparison of the Variation in Materail Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 78.6 psi from the Combined RCTS Tests

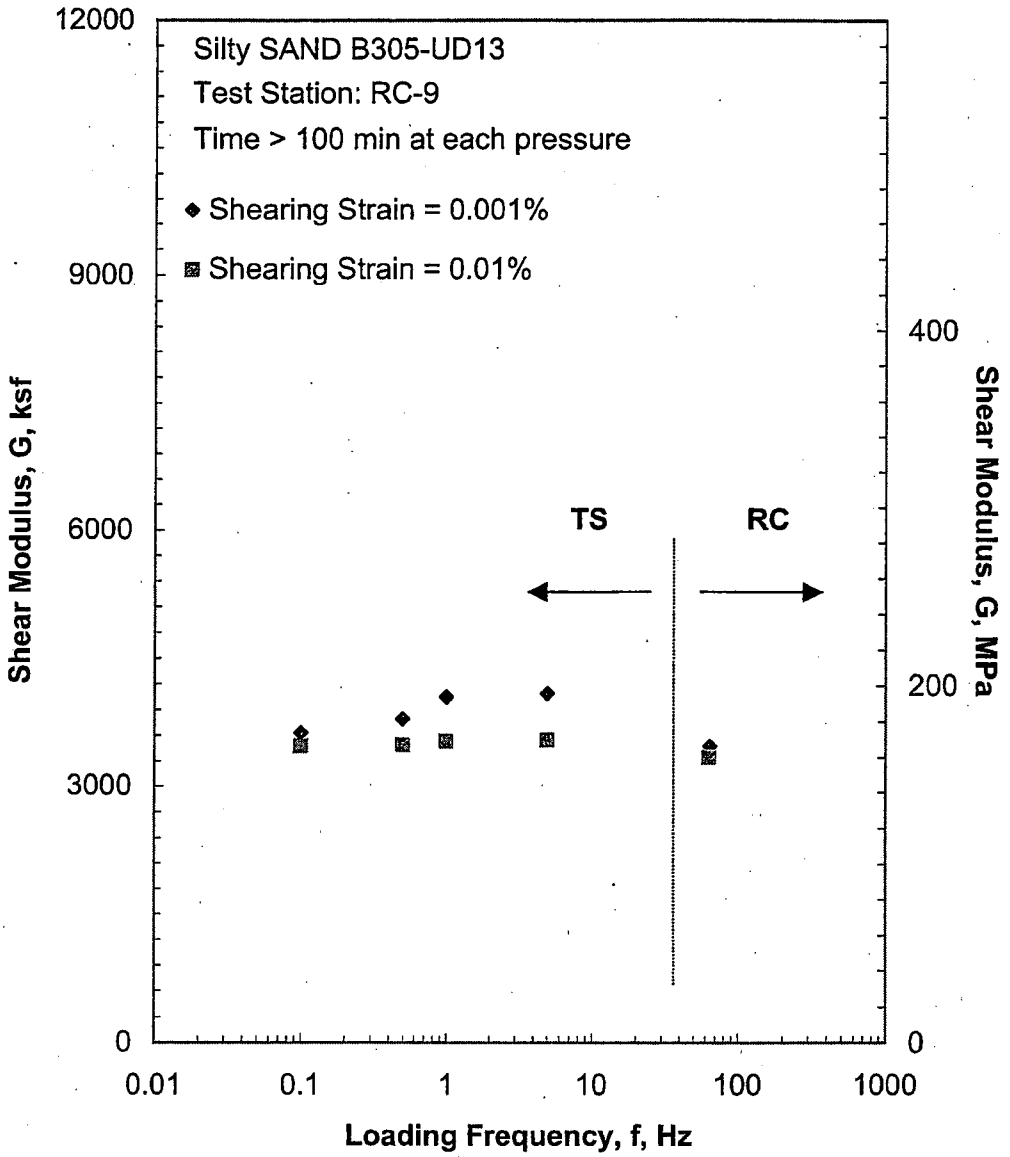


Figure B.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 78.6 psi from the Combined RCTS Tests

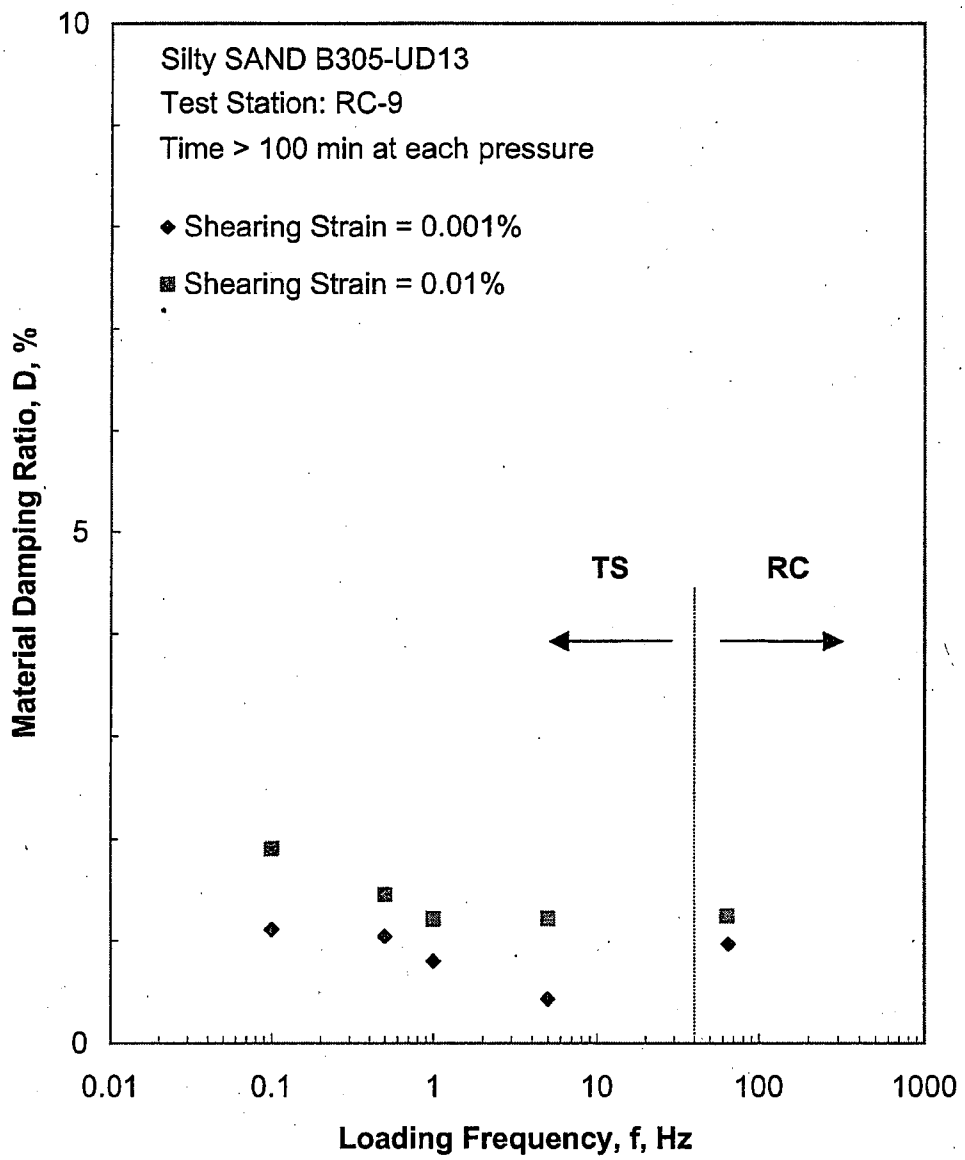


Figure B.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 78.6 psi from the Combined RCTS Tests

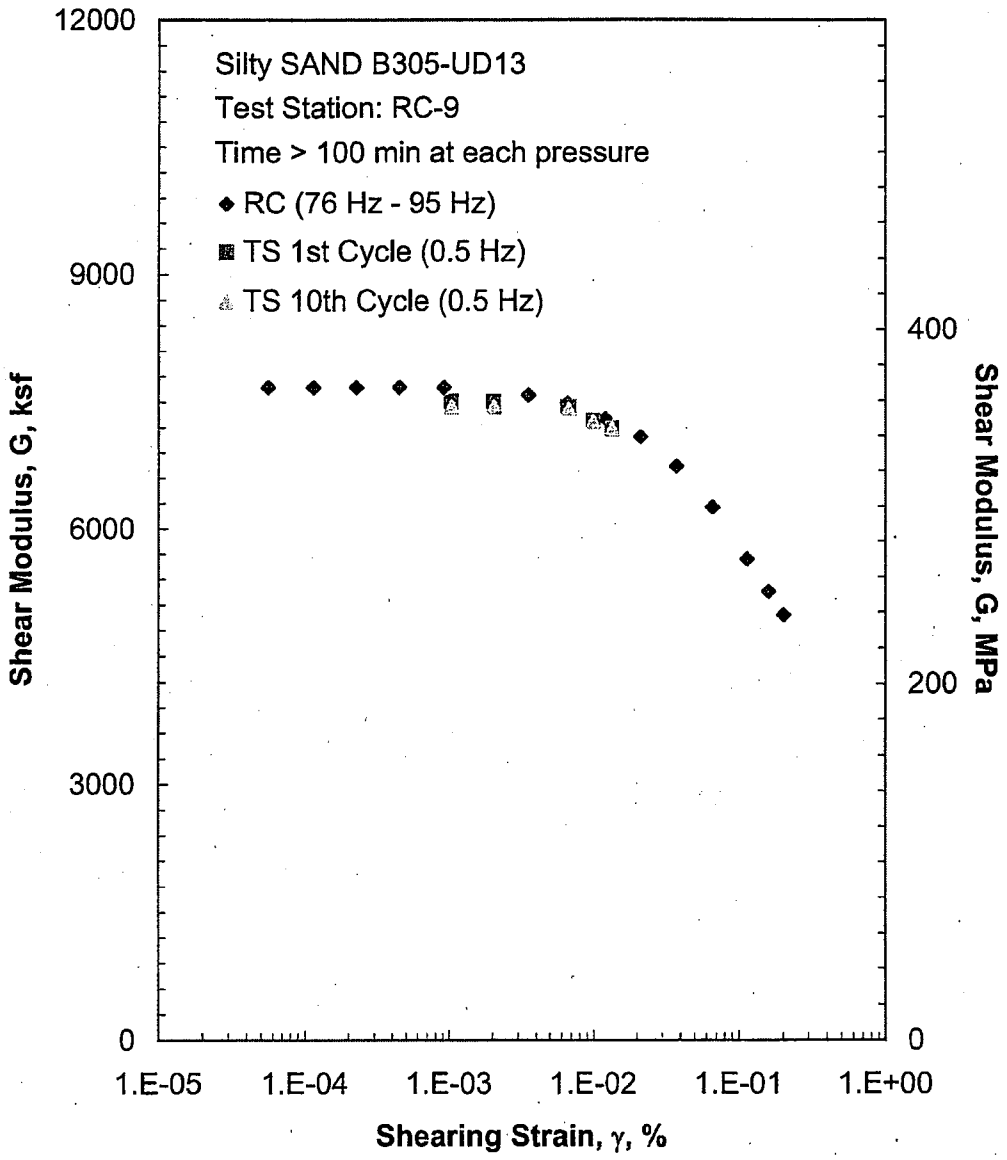


Figure B.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 314.3 psi from the Combined RCTS Tests

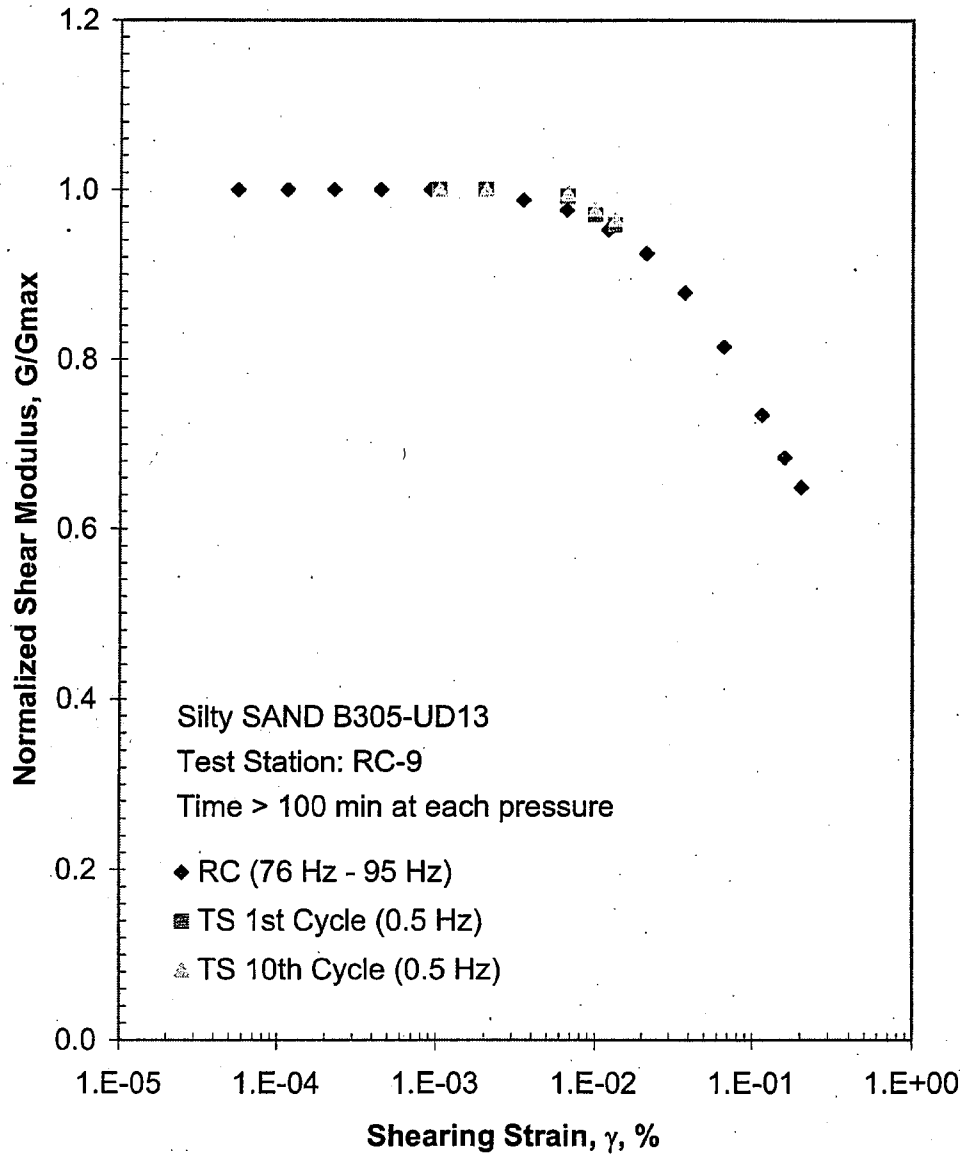


Figure B.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 314.3 psi from the Combined RCTS Tests

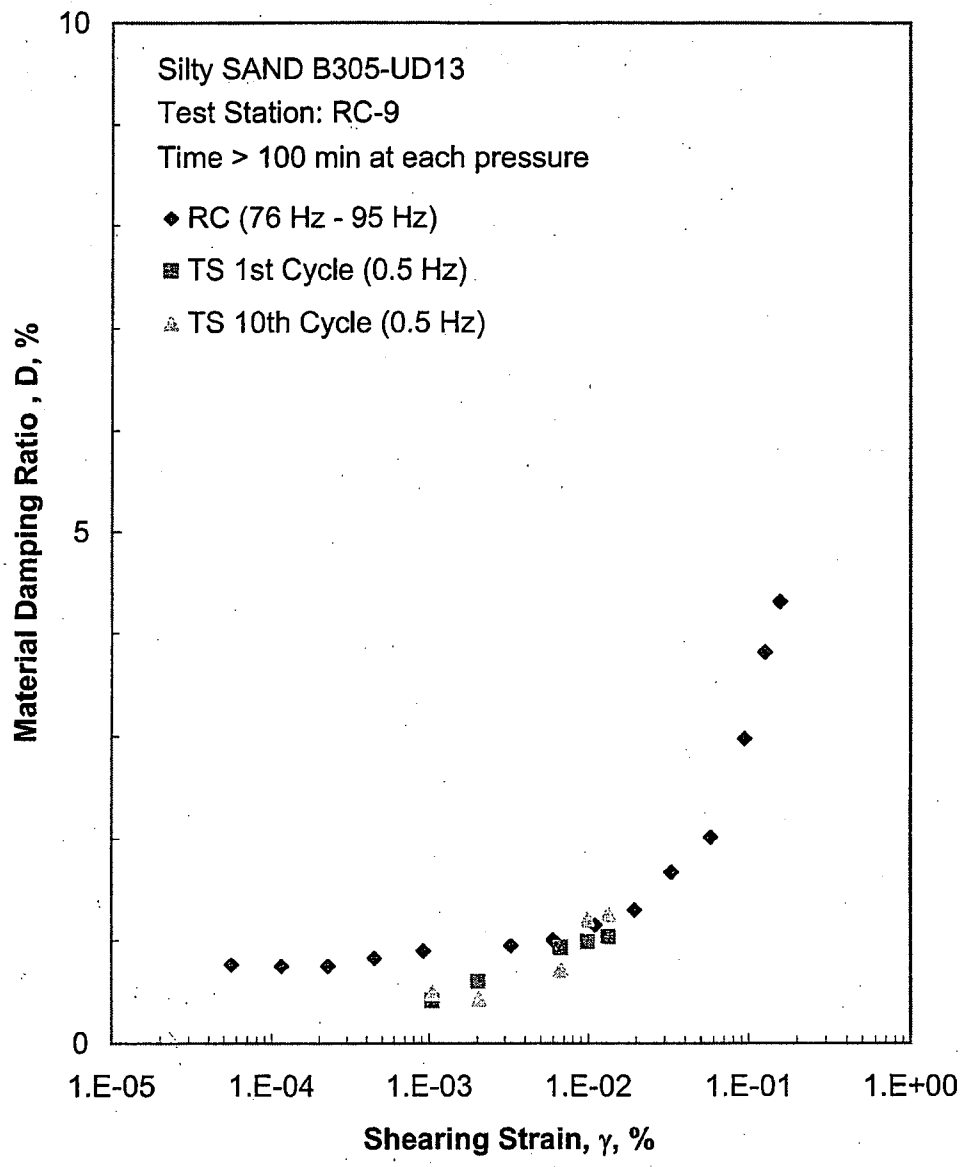


Figure B.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 314.3 psi from the Combined RCTS Tests

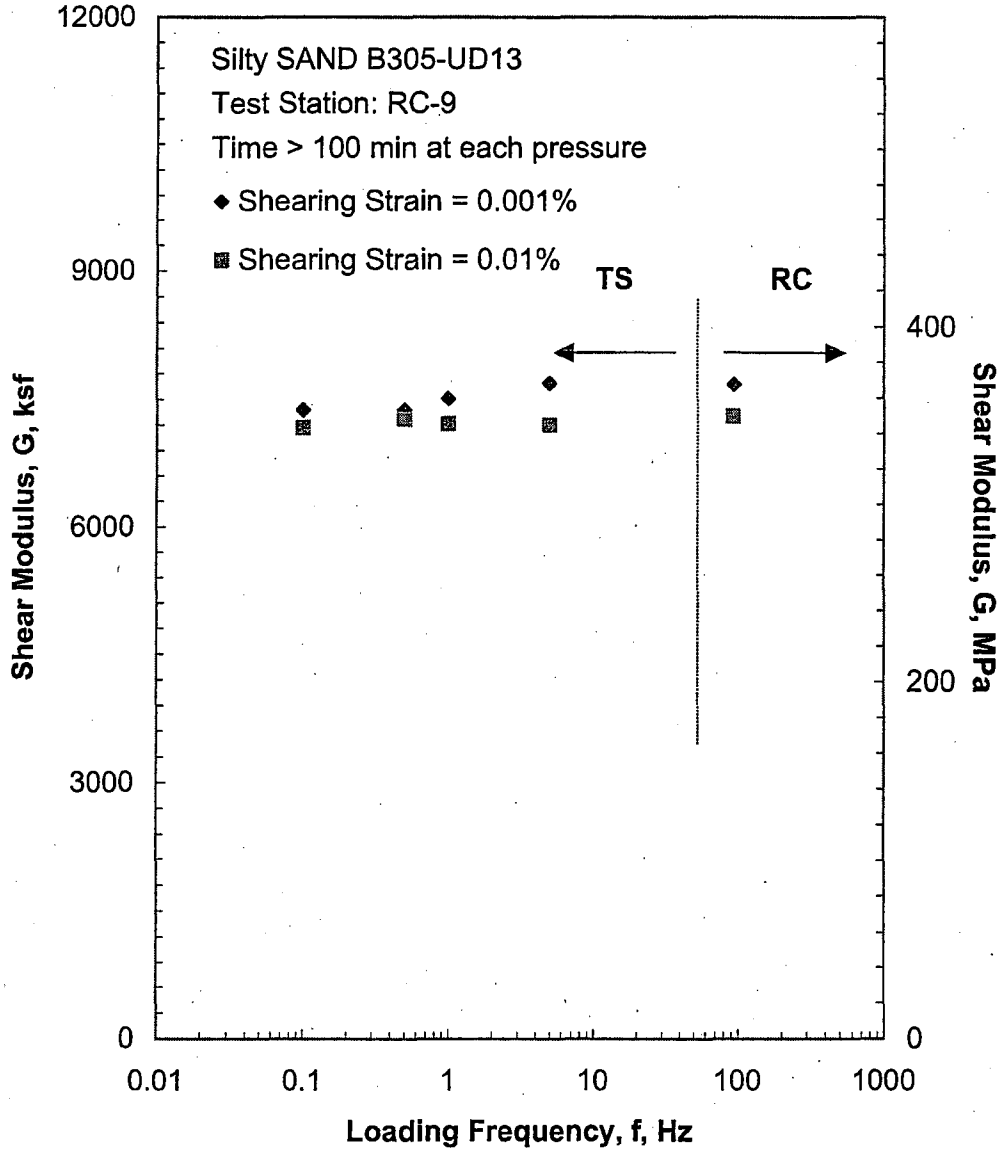


Figure B.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 314.3 psi from the Combined RCTS Tests

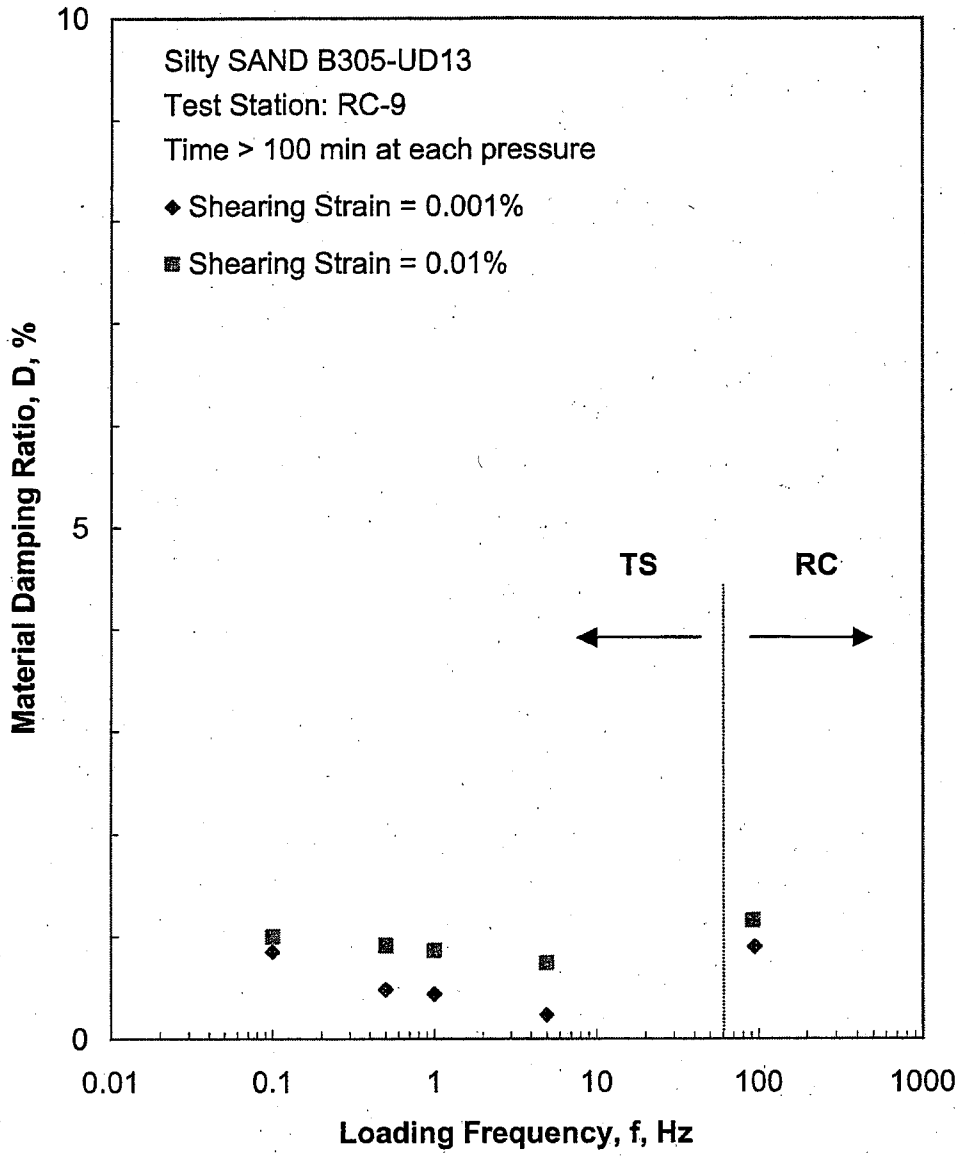


Figure B.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 314.3 psi from the Combined RCTS Tests

Table B.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B305-UD13

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
19.6	2822	135	1631	78	671	1.18	0.692
39.2	5645	270	2315	111	798	1.13	0.684
78.6	11318	542	3452	166	970	1.03	0.672
157.2	22637	1083	5283	254	1185	0.89	0.628
314.3	45259	2166	7609	365	1414	0.80	0.610

Table B.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B305-UD13; Isoptropic Confining Pressure, σ_o=78.6 psi (11.3 ksf = 542 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.40E-04	3489	1.00	1.40E-04	0.95
2.86E-04	3489	1.00	2.86E-04	0.95
5.83E-04	3489	1.00	5.83E-04	0.96
1.15E-03	3474	1.00	1.15E-03	0.97
2.25E-03	3453	0.99	2.02E-03	1.05
4.29E-03	3409	0.98	3.93E-03	1.12
7.96E-03	3346	0.96	7.32E-03	1.24
1.43E-02	3261	0.93	1.28E-02	1.47
2.54E-02	3096	0.89	2.20E-02	1.69
4.56E-02	2875	0.82	3.90E-02	2.15
8.12E-02	2588	0.74	6.56E-02	3.17
1.44E-01	2284	0.65	1.09E-01	4.43
2.55E-01	2032	0.58	1.75E-01	6.38

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table B.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B305-UD13; Isotropic Confining Pressure, σ_o=78.6 psi (11.3 ksf = 542 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
2.58E-04	3818	1.00	0.88	2.66E-04	3777	1.00	0.78
5.01E-04	3818	1.00	0.84	4.97E-04	3777	1.00	0.94
9.62E-04	3818	1.00	0.84	9.67E-04	3777	1.00	1.04
1.91E-03	3818	1.00	0.83	1.94E-03	3777	1.00	0.75
9.46E-03	3485	0.91	1.53	9.45E-03	3490	0.92	1.45
2.05E-02	3210	0.84	2.25	2.06E-02	3202	0.85	2.07
3.79E-02	2912	0.76	3.98	3.51E-02	3001	0.79	2.94

Table B.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B305-UD13; Isoptropic Confining Pressure, σ_o= 314.3 psi (45.3 ksf = 2166 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
5.60E-05	7674	1.00	5.60E-05	0.77
1.15E-04	7674	1.00	1.15E-04	0.75
2.27E-04	7674	1.00	2.27E-04	0.75
4.49E-04	7674	1.00	4.49E-04	0.83
9.22E-04	7674	1.00	9.22E-04	0.90
3.52E-03	7580	0.99	3.27E-03	0.95
6.60E-03	7487	0.98	6.03E-03	1.01
1.20E-02	7303	0.95	1.11E-02	1.15
2.13E-02	7087	0.92	1.95E-02	1.30
3.74E-02	6738	0.88	3.30E-02	1.67
6.62E-02	6249	0.81	5.79E-02	2.01
1.14E-01	5638	0.73	9.46E-02	2.97
1.59E-01	5248	0.68	1.26E-01	3.82
2.03E-01	4974	0.65	1.56E-01	4.31

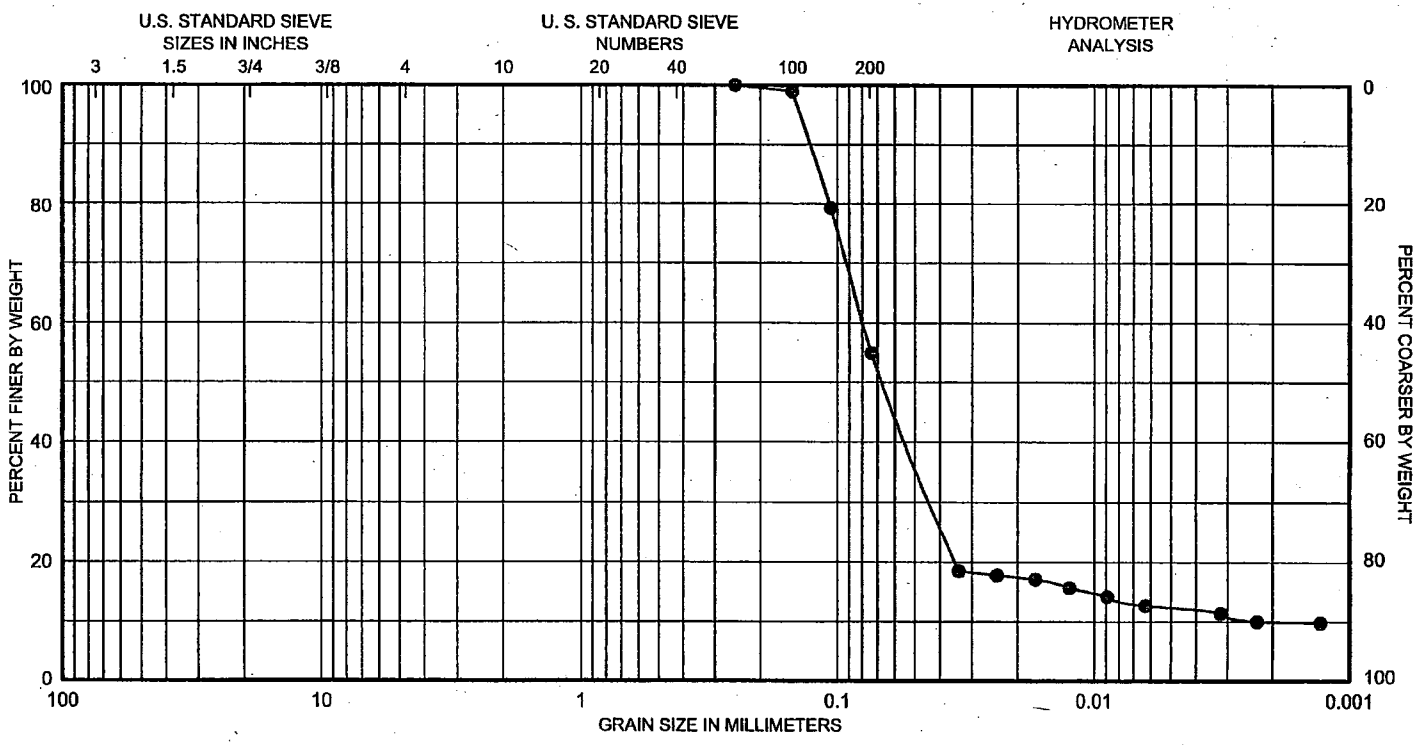
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table B.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B305-UD13; Isotropic Confining Pressure, σ_o=314.3 psi (45.3 ksf = 2166 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D,	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D, %
1.04E-03	7504	1.00	0.41	1.04E-03	7448	1.00	0.48
2.03E-03	7504	1.00	0.59	2.05E-03	7448	1.00	0.43
6.65E-03	7445	0.99	0.93	6.68E-03	7418	1.00	0.71
9.92E-03	7276	0.97	1.00	9.93E-03	7272	0.98	1.21
1.34E-02	7188	0.96	1.04	1.34E-02	7181	0.96	1.26

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{60}	CLASSIFICATION
●	B-305-UD13	265.5	10.21	34.64	0.0665	0.13	Silty Sand, tan

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX C

Specimen STP B405-UD16
CLAY (LL=92, PI=65; Gs=2.74)

Borehole B405
Sample UD16
Depth = 358.5 ft (109.3 m)
Total Unit Weight = 116.3 lb/ft^3
Water Content = 29.5 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 106.1 psi

FUGRO JOB #: 0401-1660
Testing Station: RC8

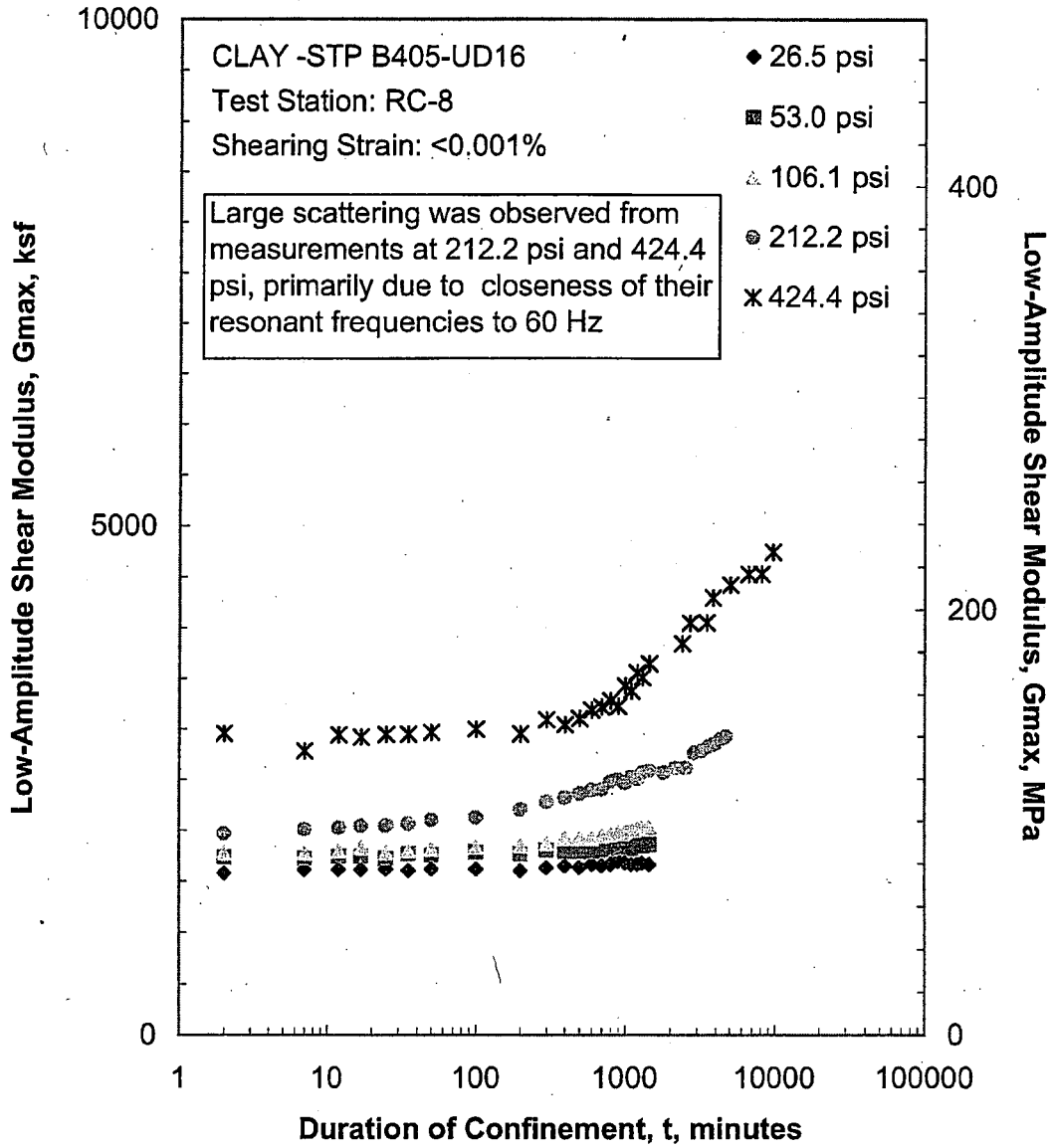


Figure C.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

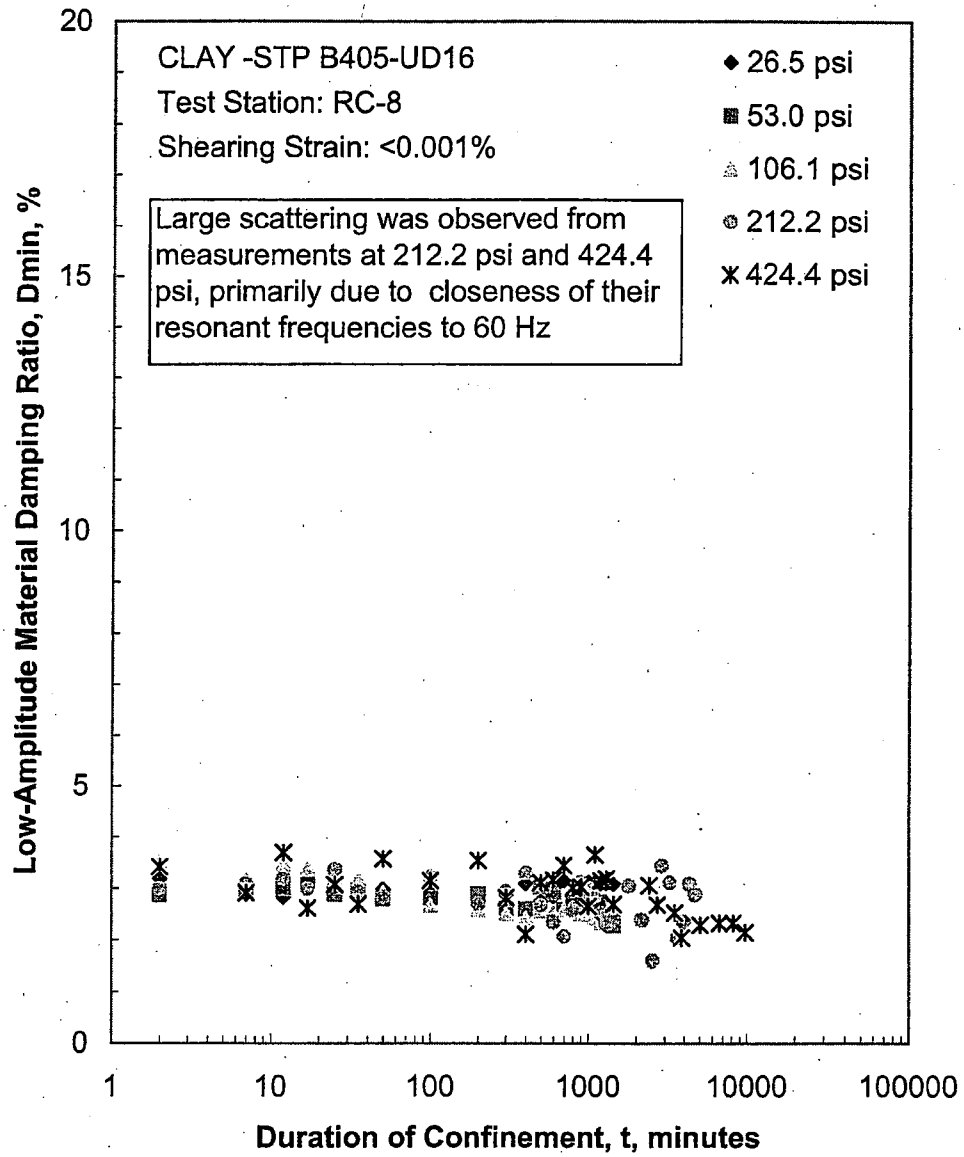


Figure C.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

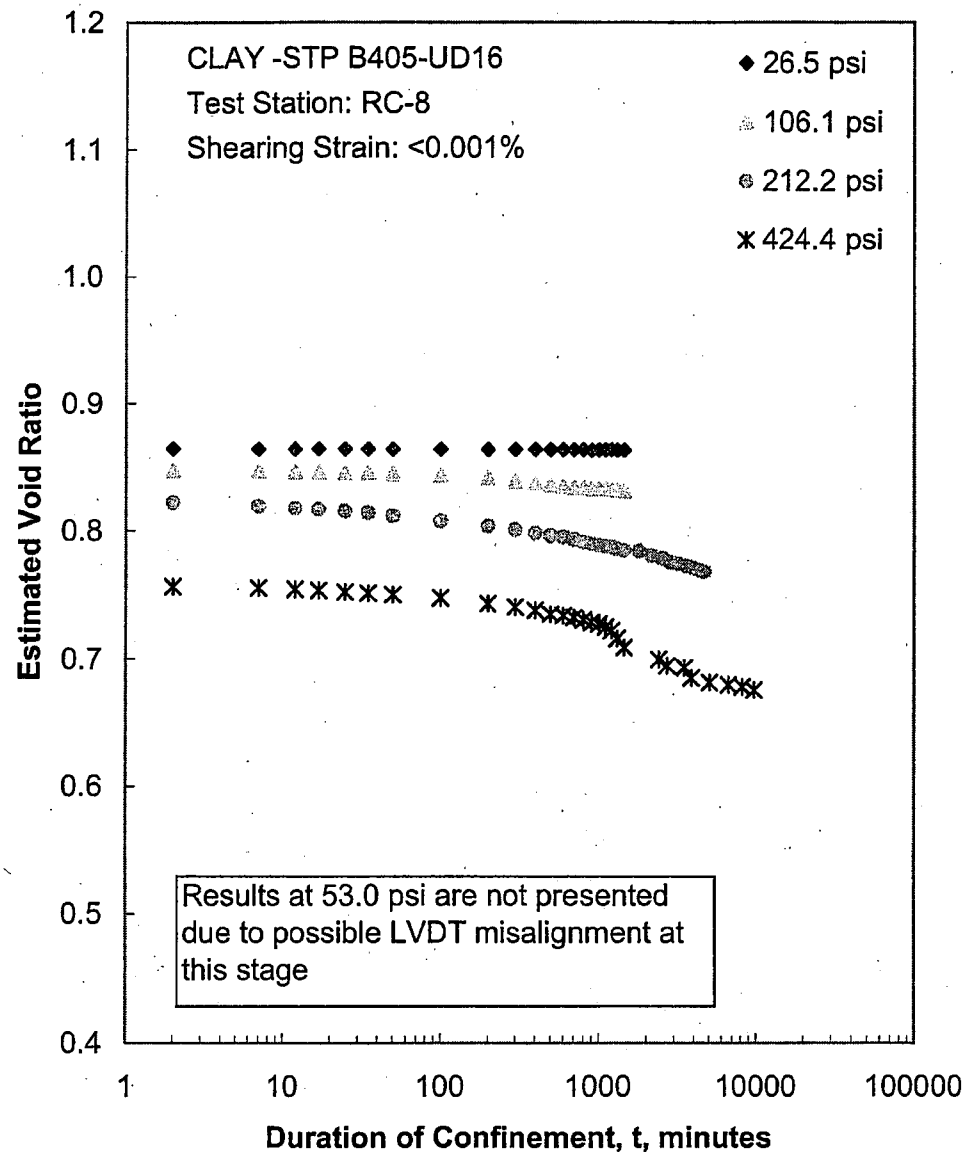


Figure C.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

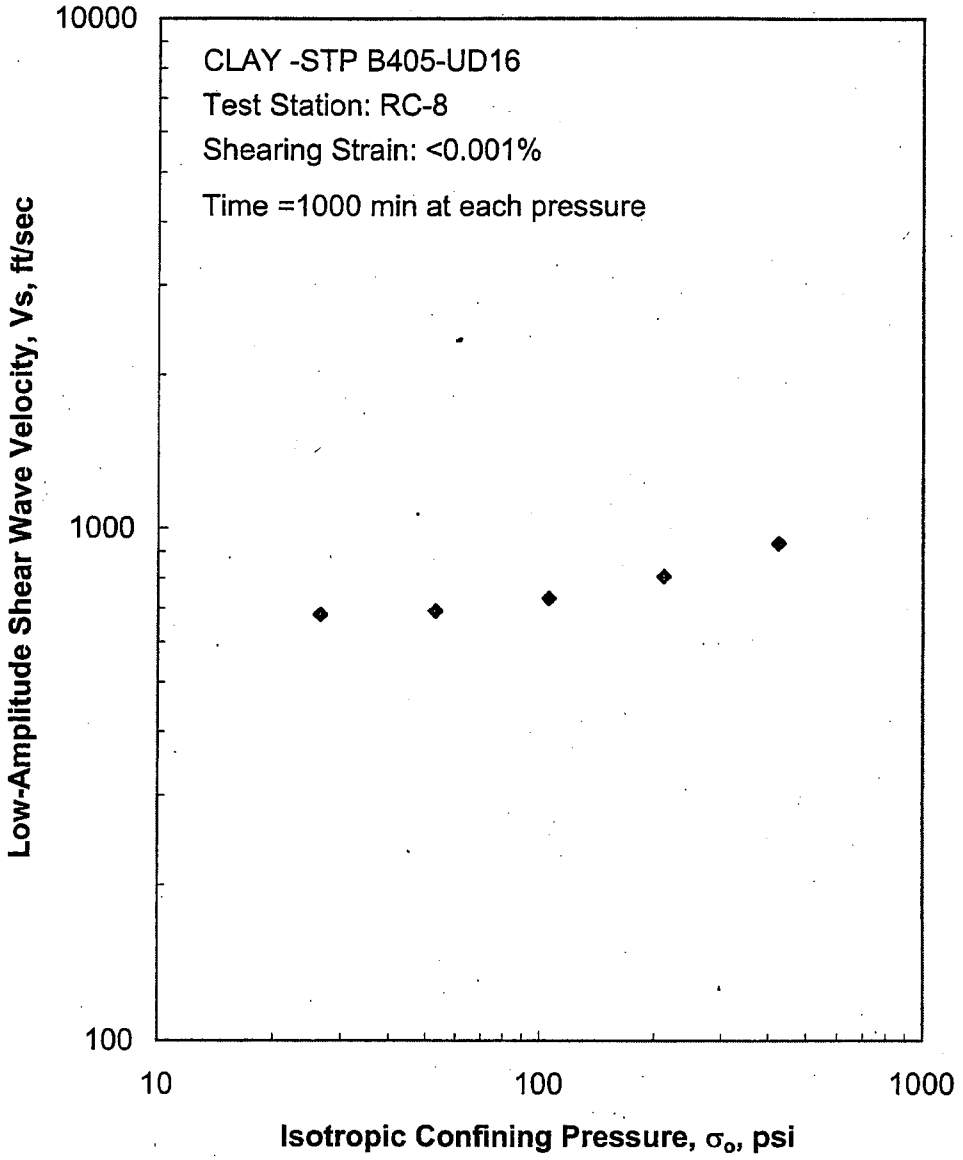


Figure C.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

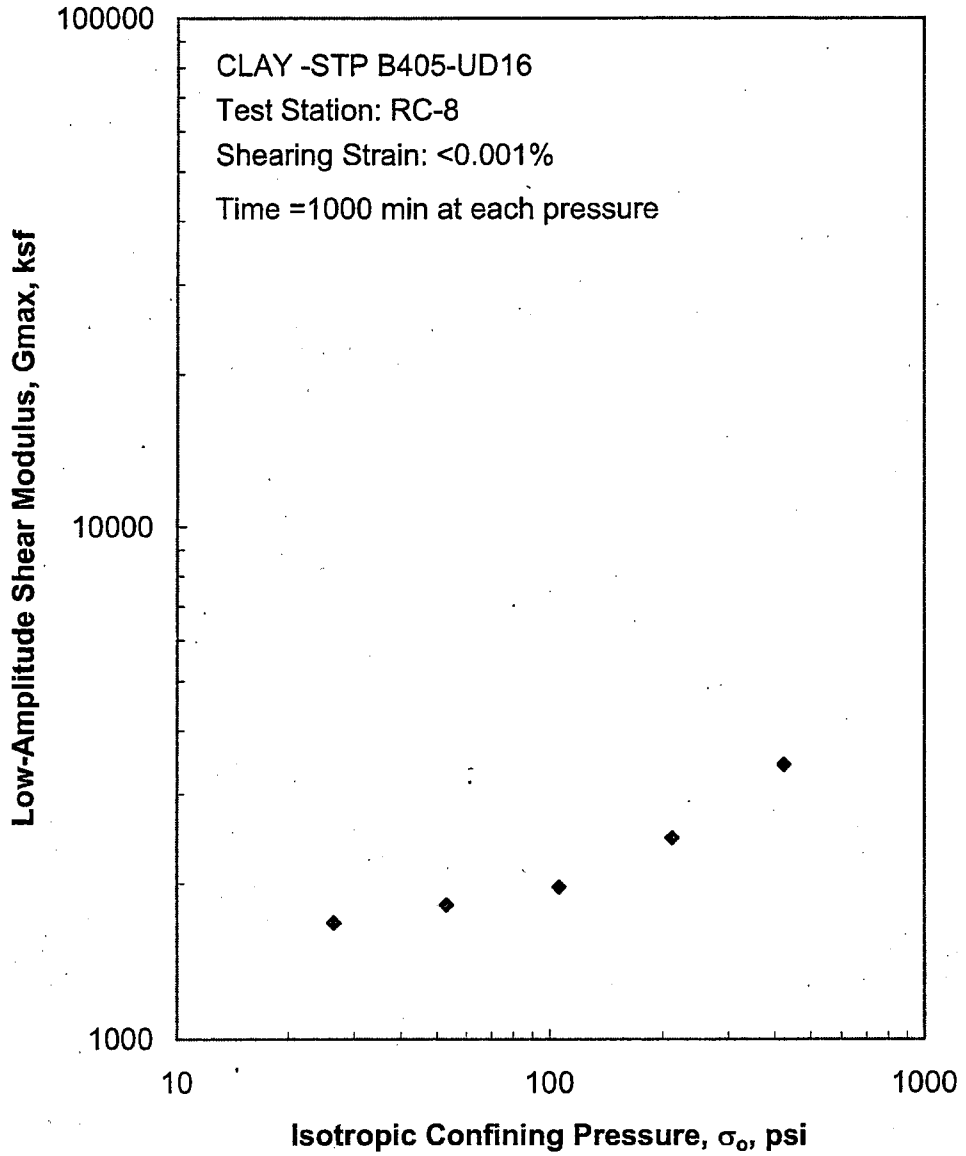


Figure C.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

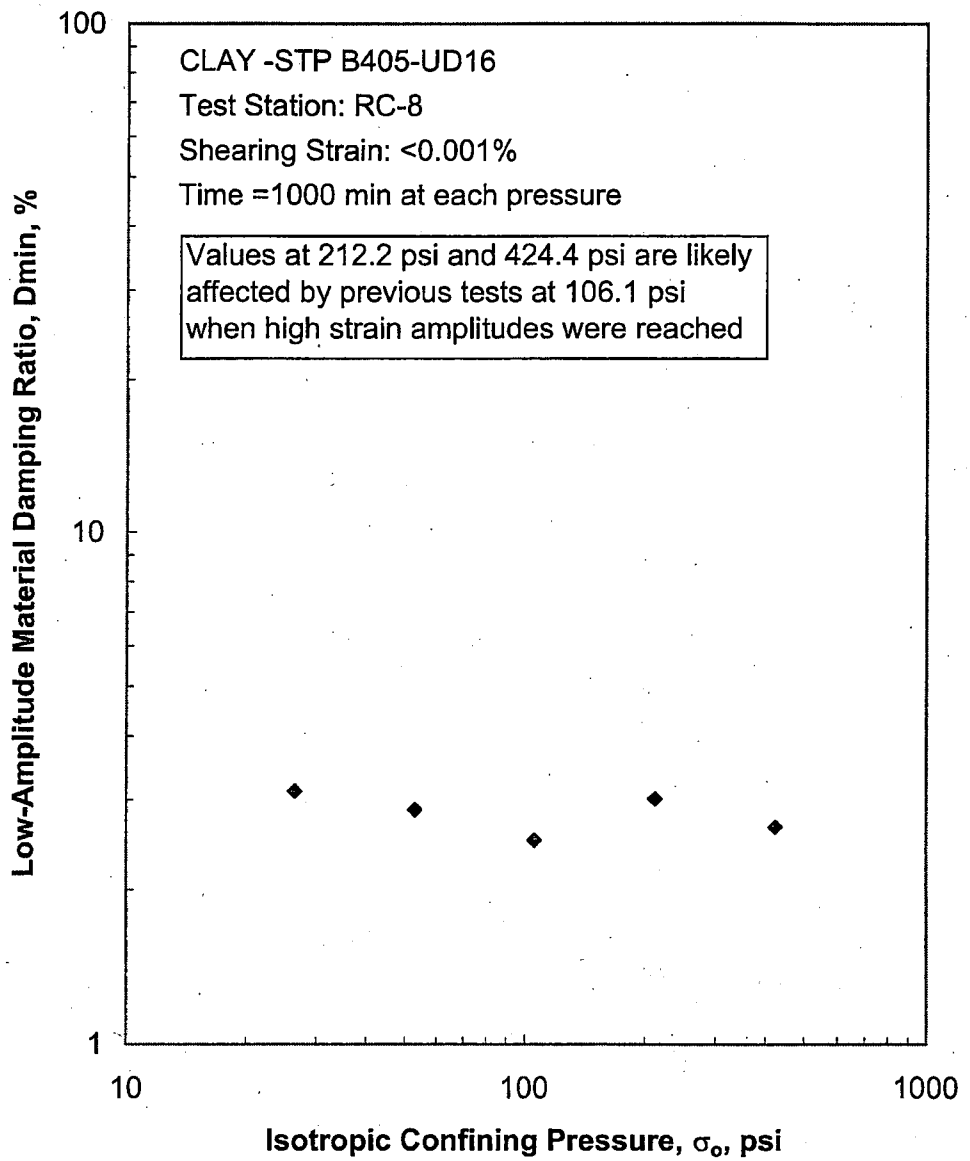


Figure C.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

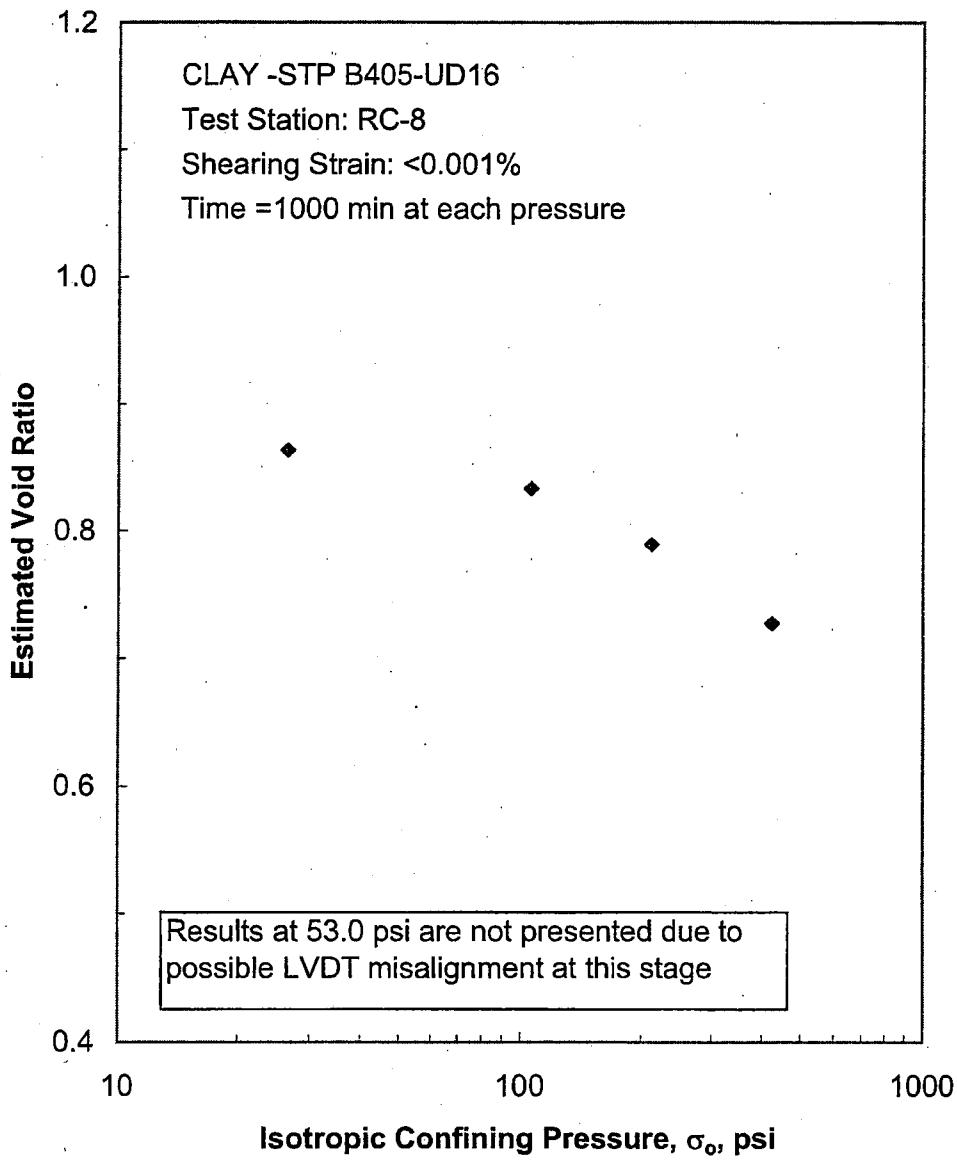


Figure C.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

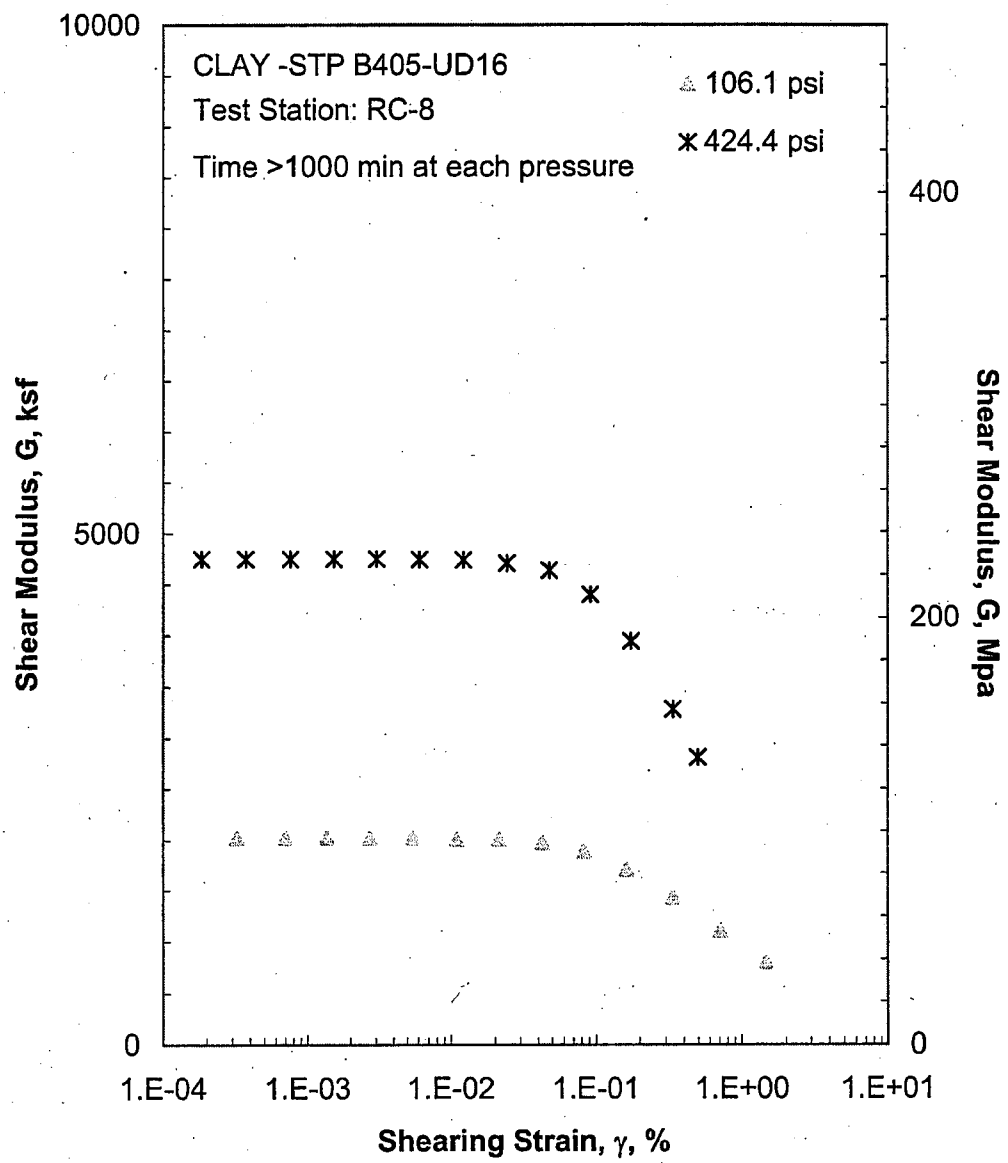


Figure C.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

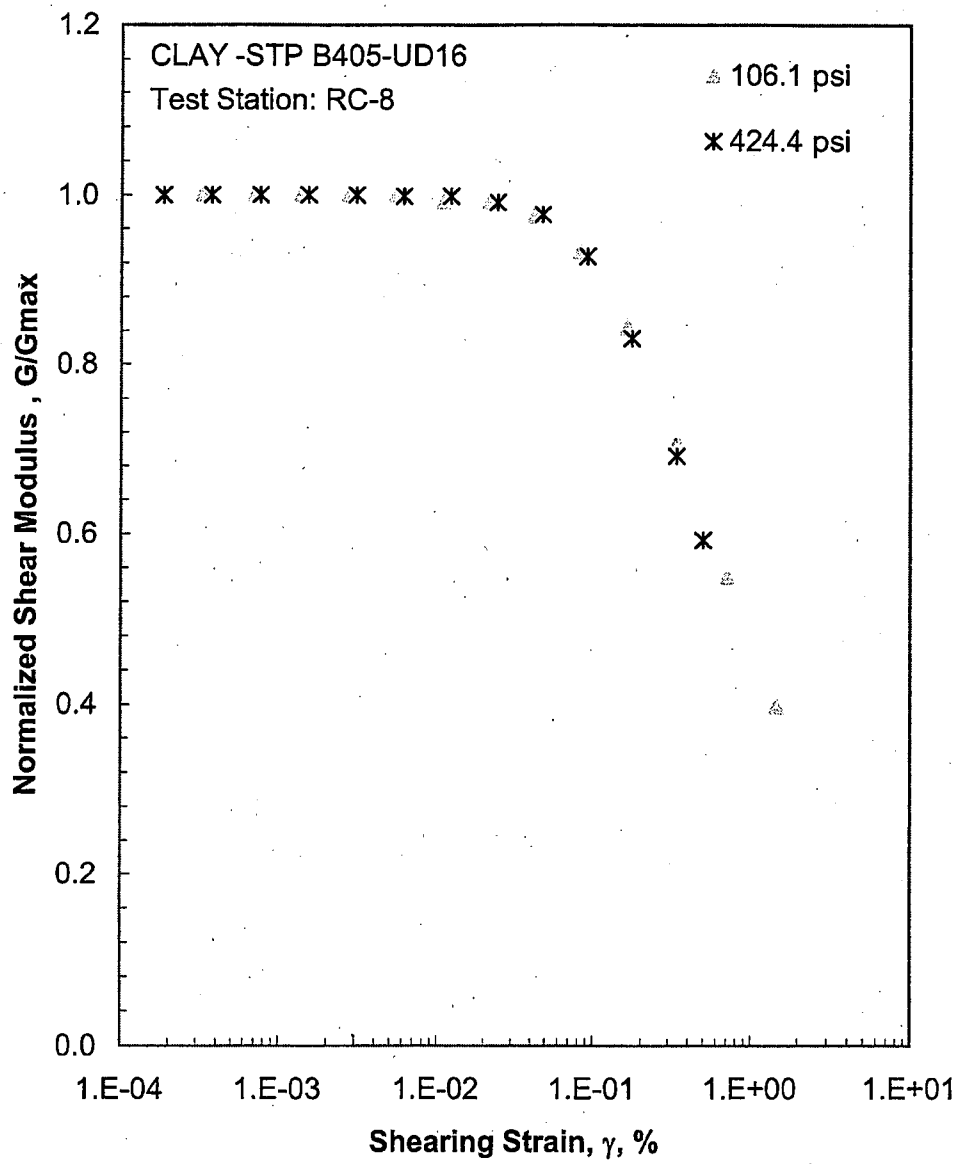


Figure C.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

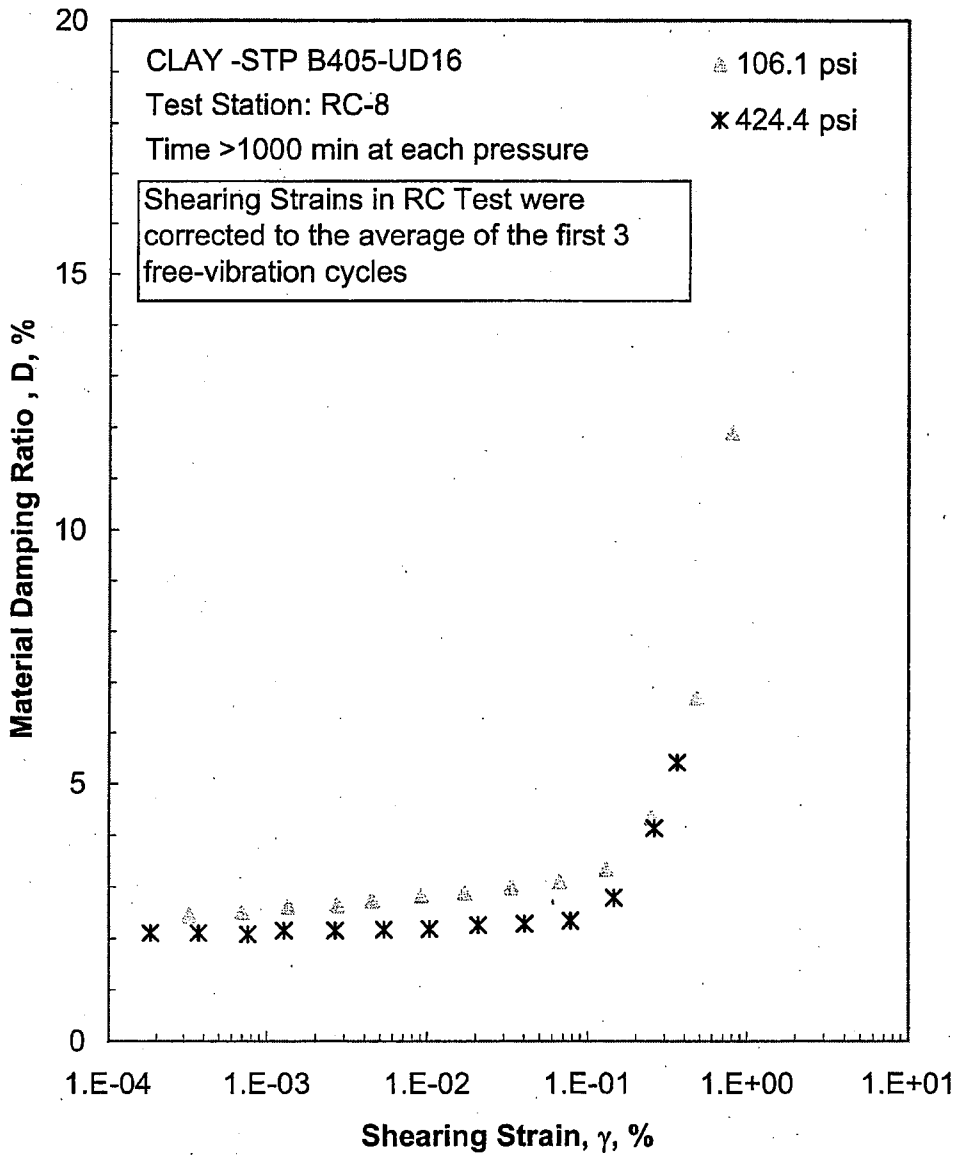


Figure C.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

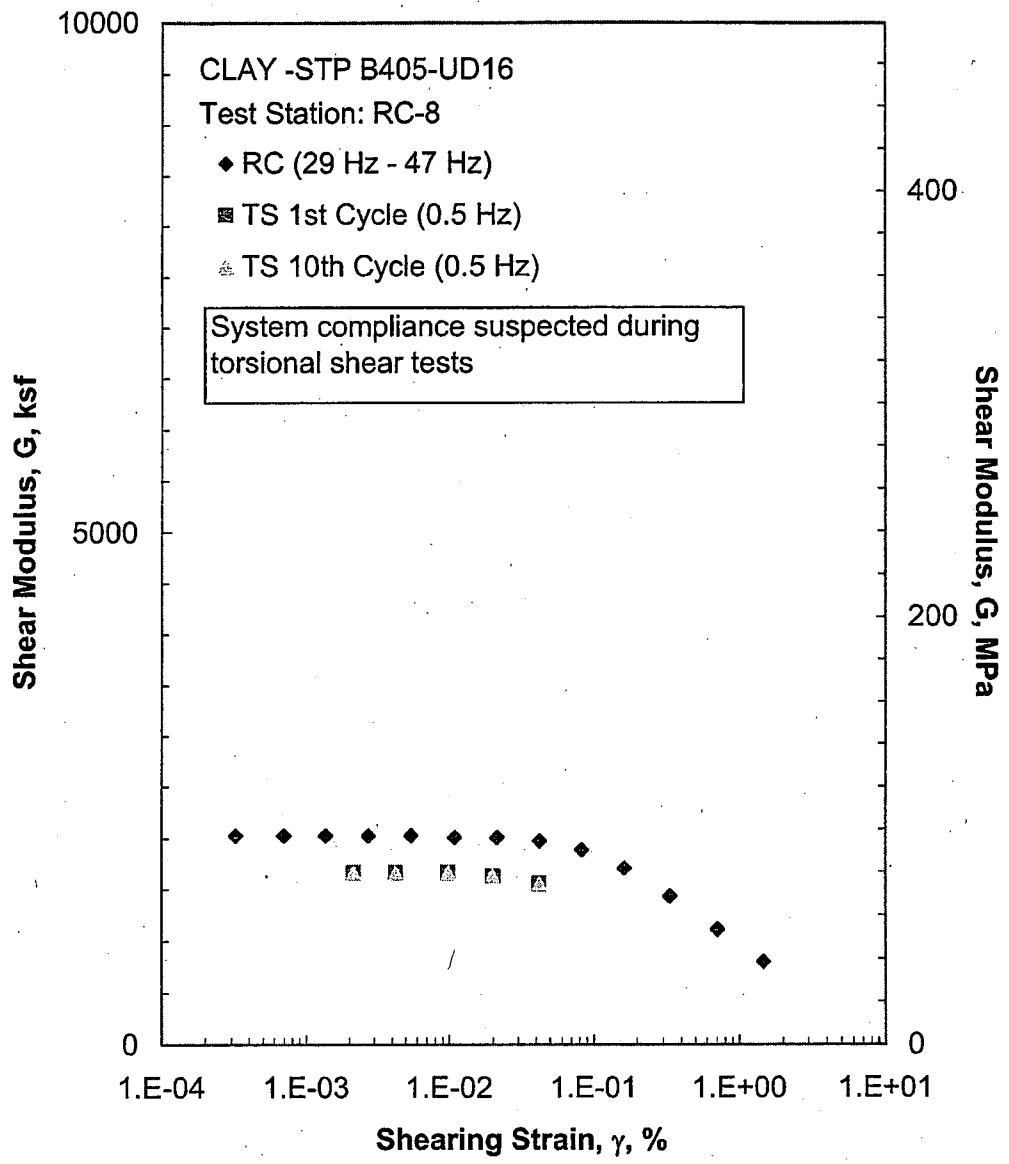


Figure C.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 106.1 psi from the Combined RCTS Tests

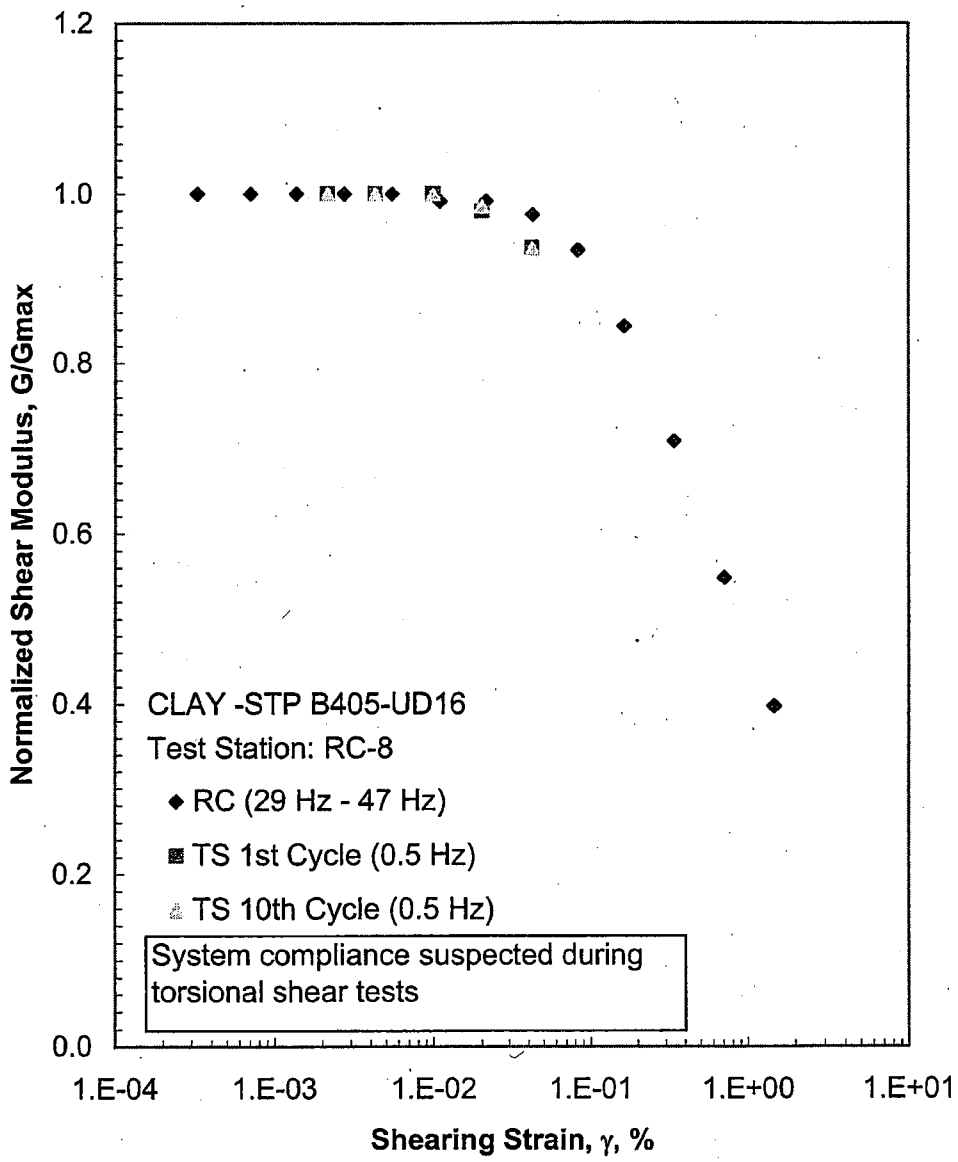


Figure C.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 106.1 psi from the Combined RCTS Tests

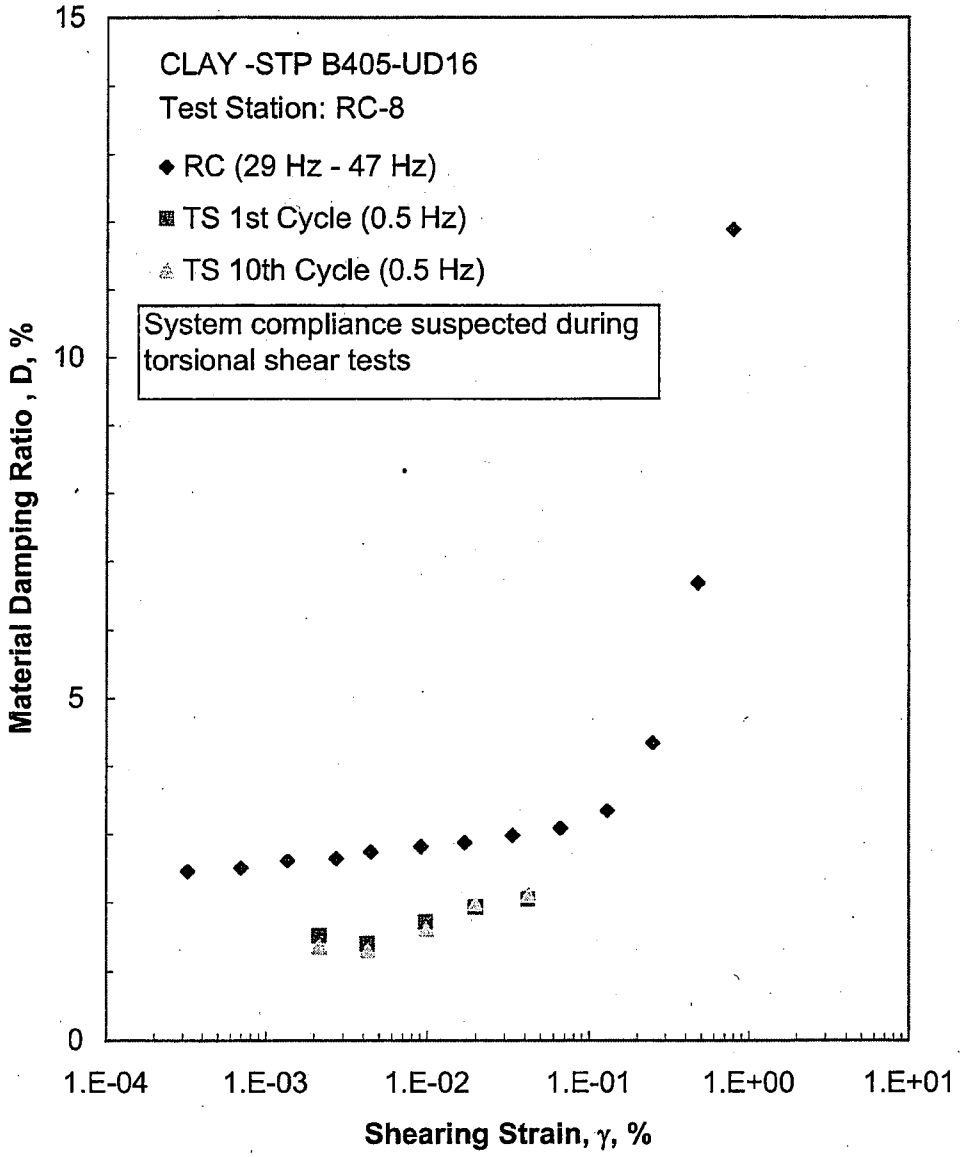


Figure C.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 106.1 psi from the Combined RCTS Tests

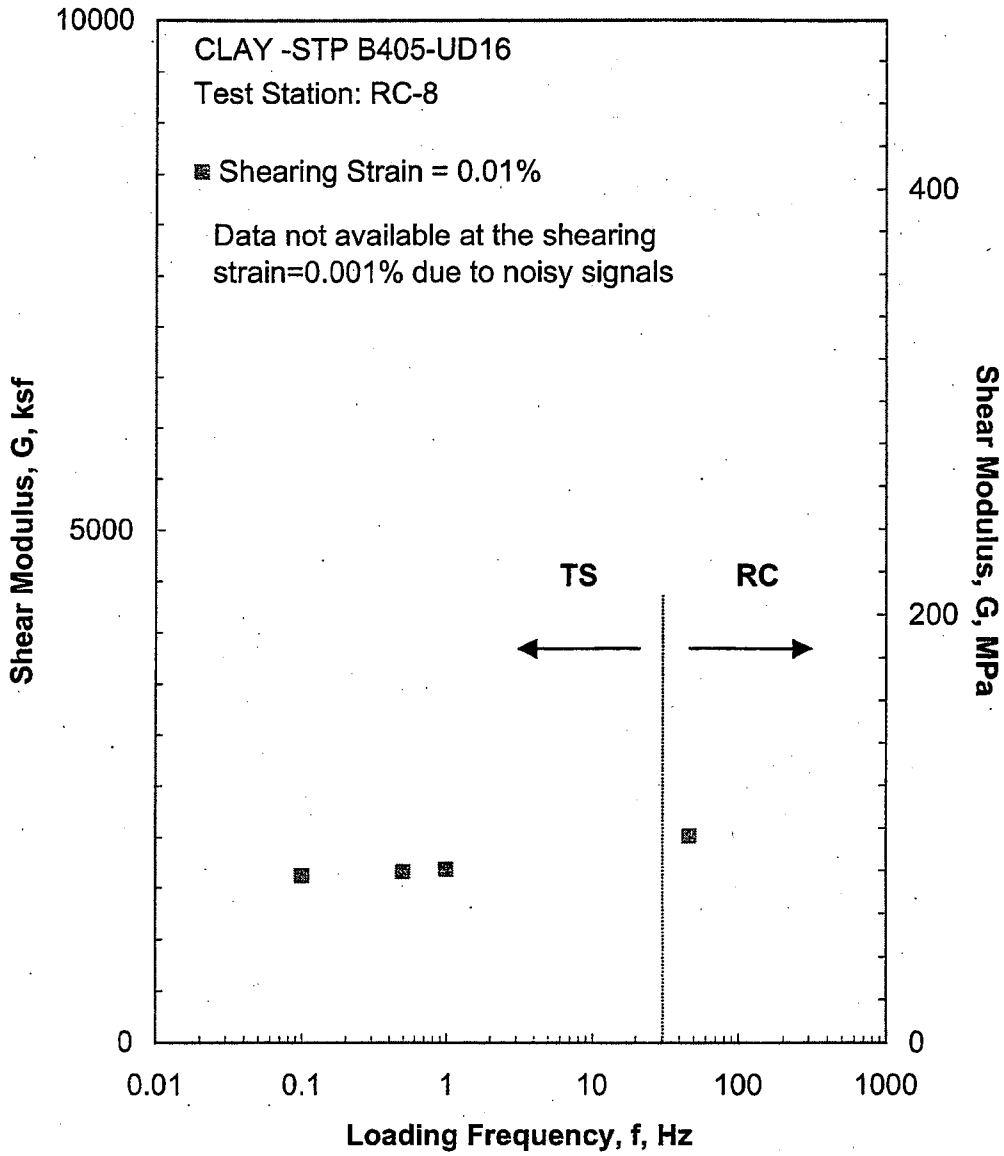


Figure C.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 106.1 psi from the Combined RCTS Tests

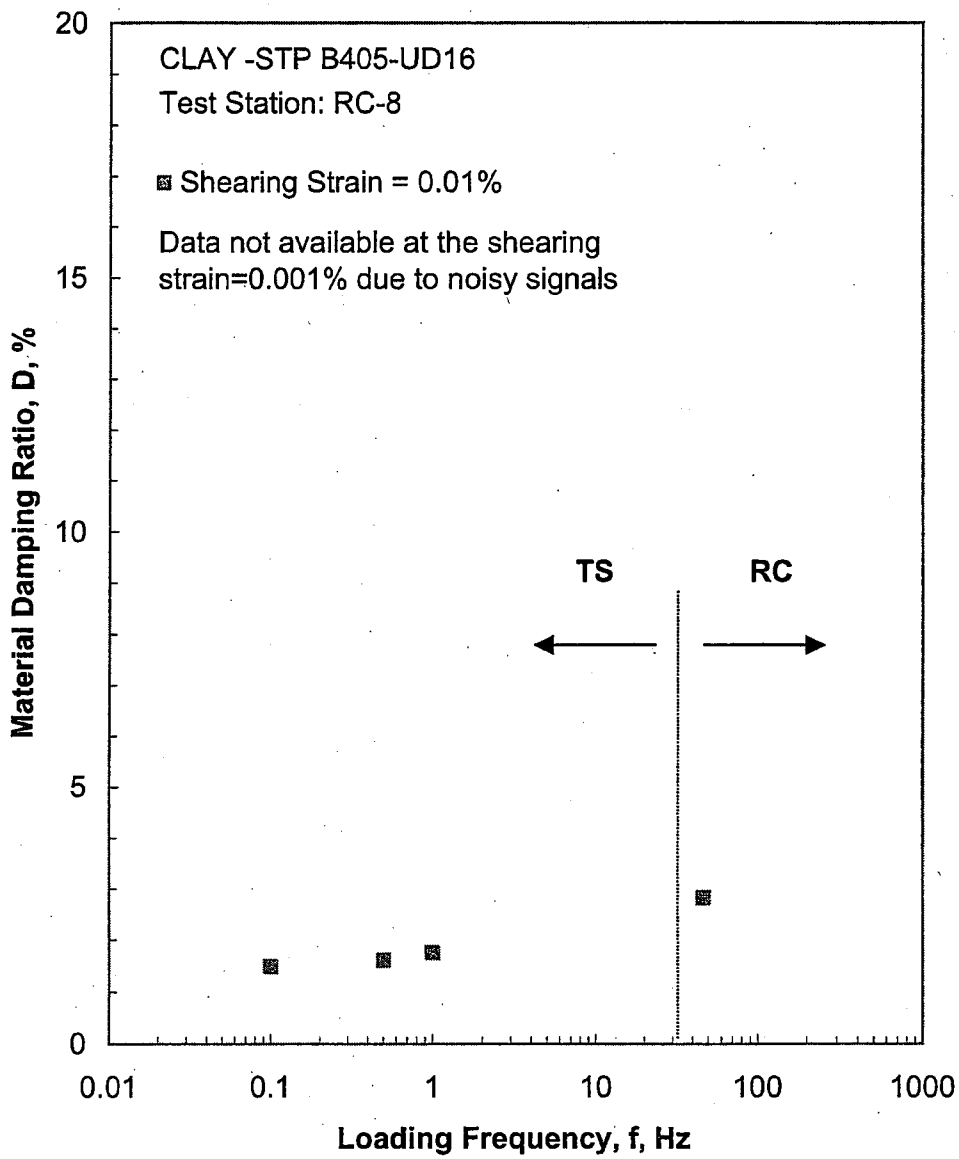


Figure C.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 106.1 psi from the Combined RCTS Tests

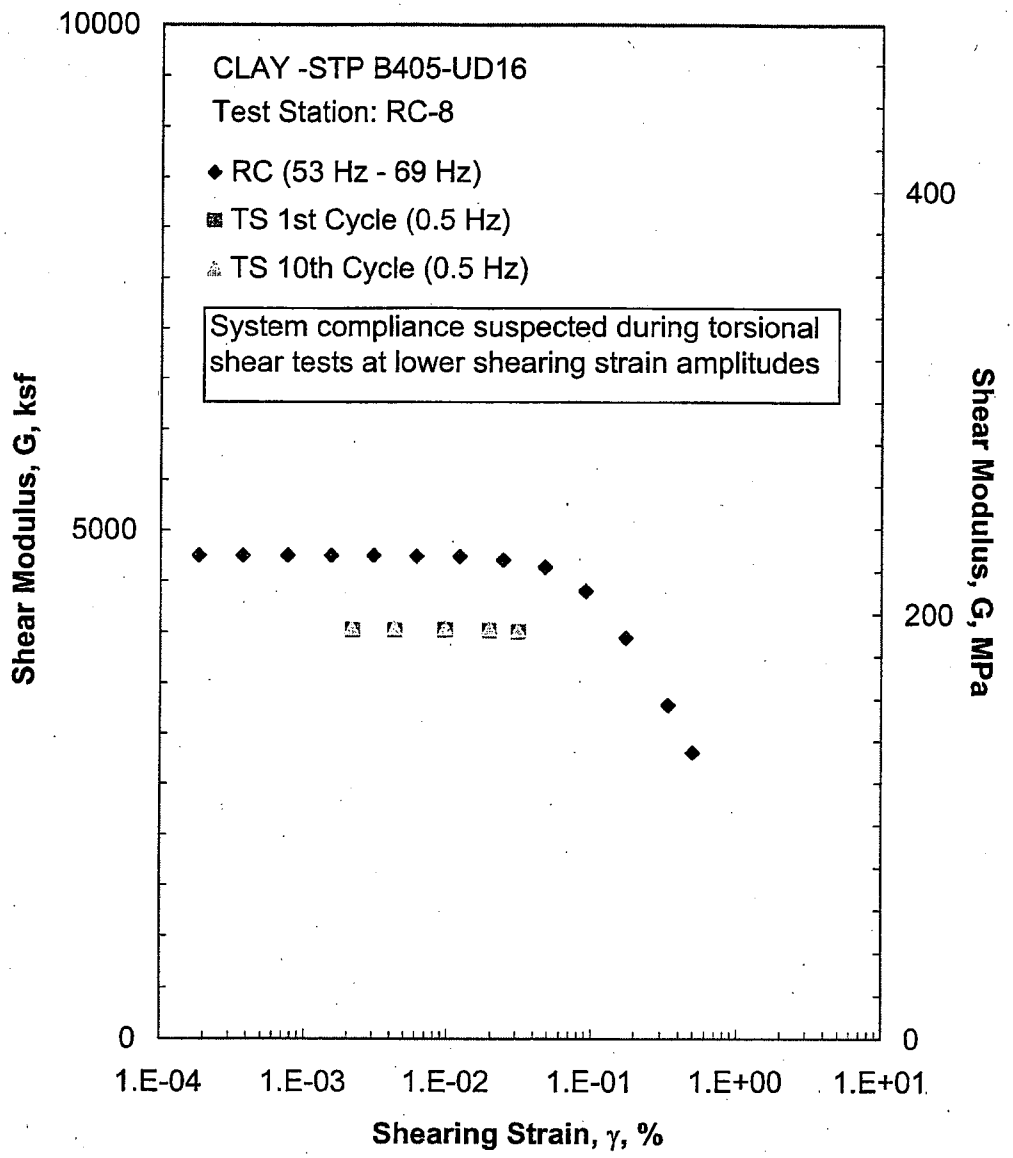


Figure C.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 424.4 psi from the Combined RCTS Tests

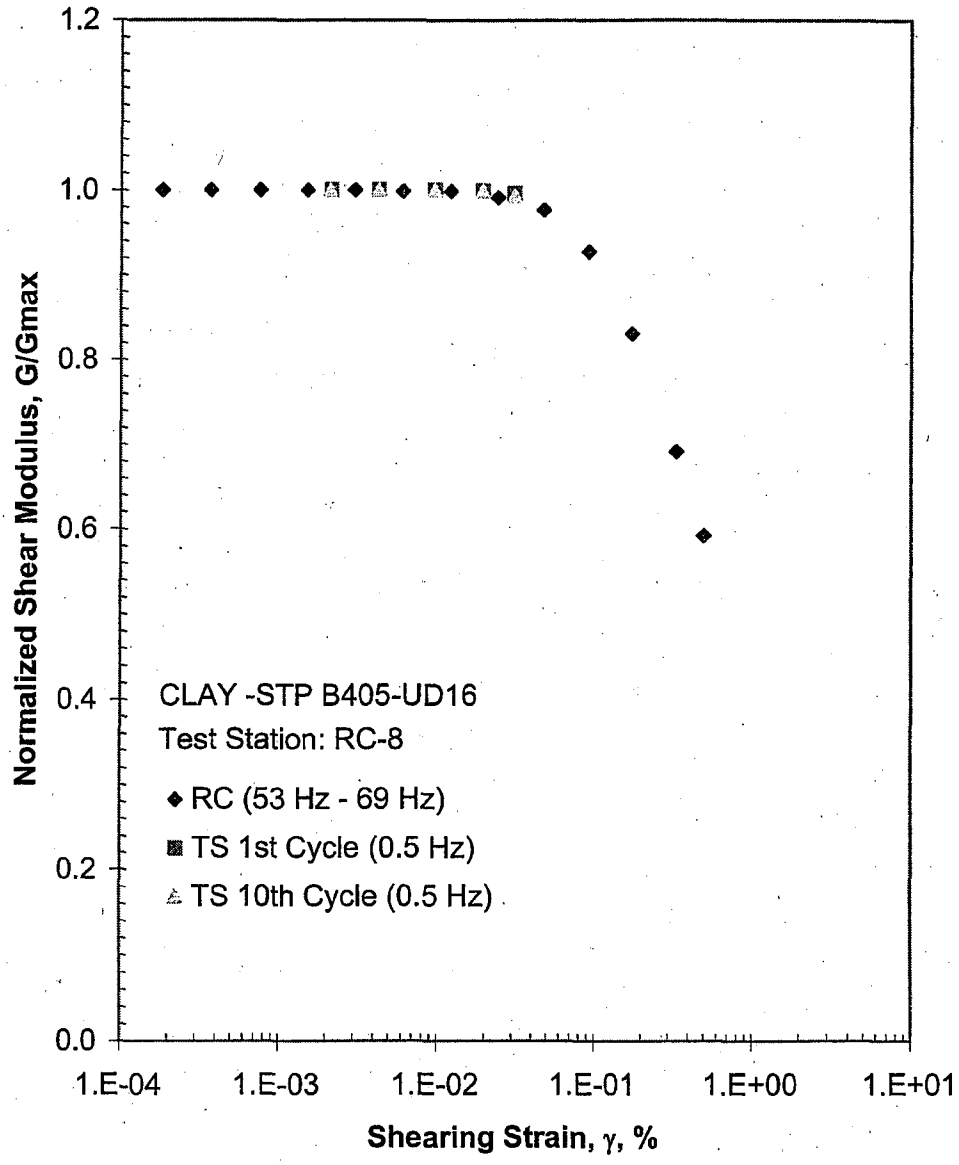


Figure C.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 424.4 psi from the Combined RCTS Tests

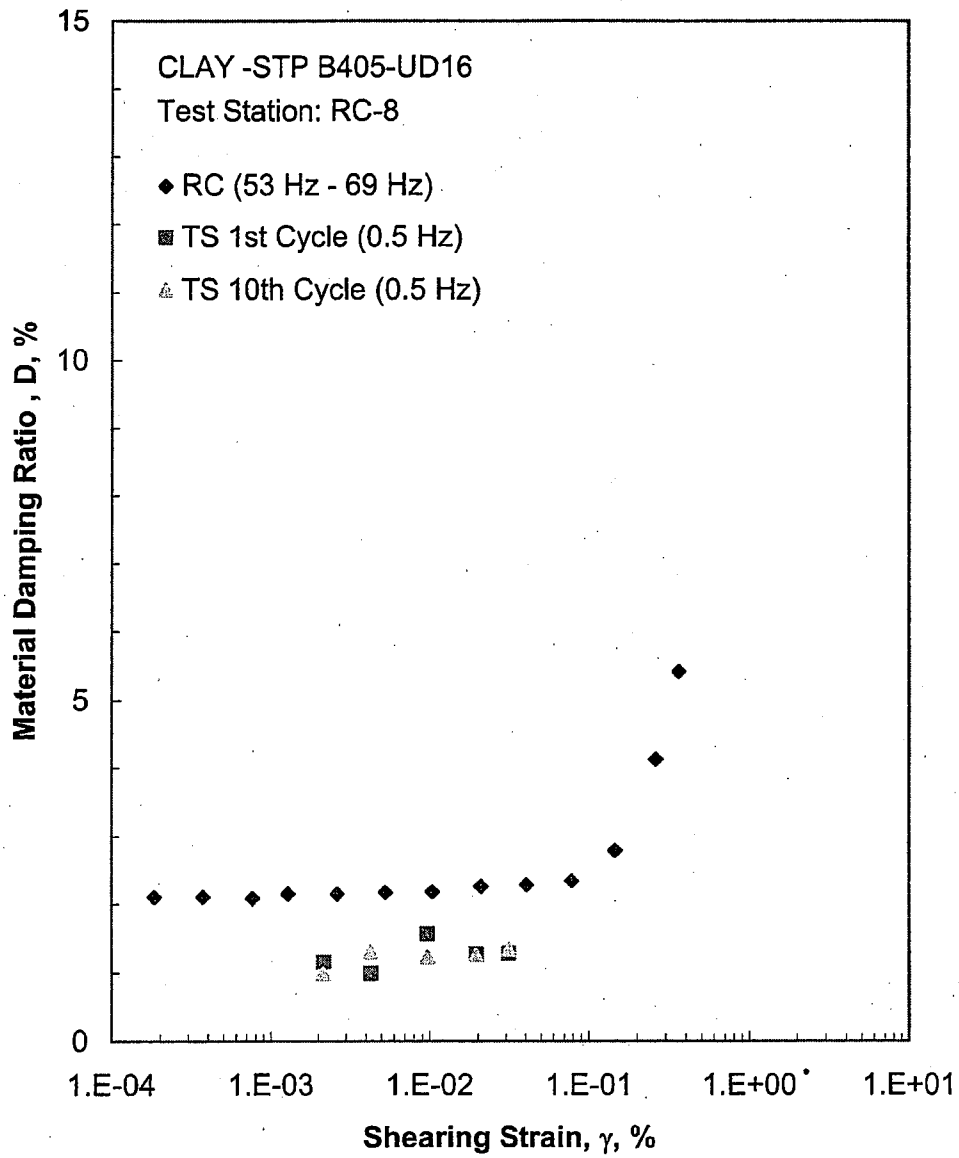


Figure C.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 424.4 psi from the Combined RCTS Tests

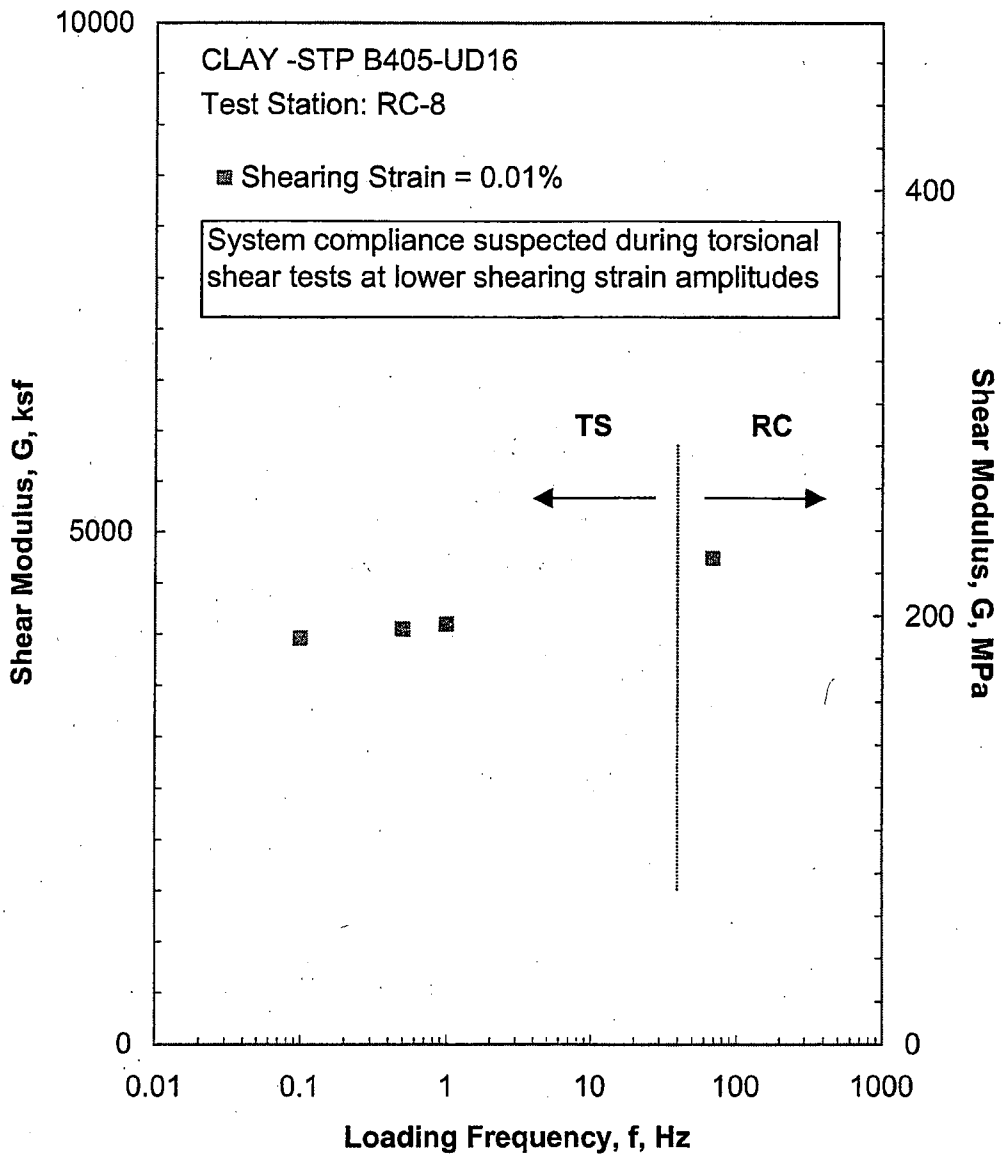


Figure C.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 424.4 psi from the Combined RCTS Tests

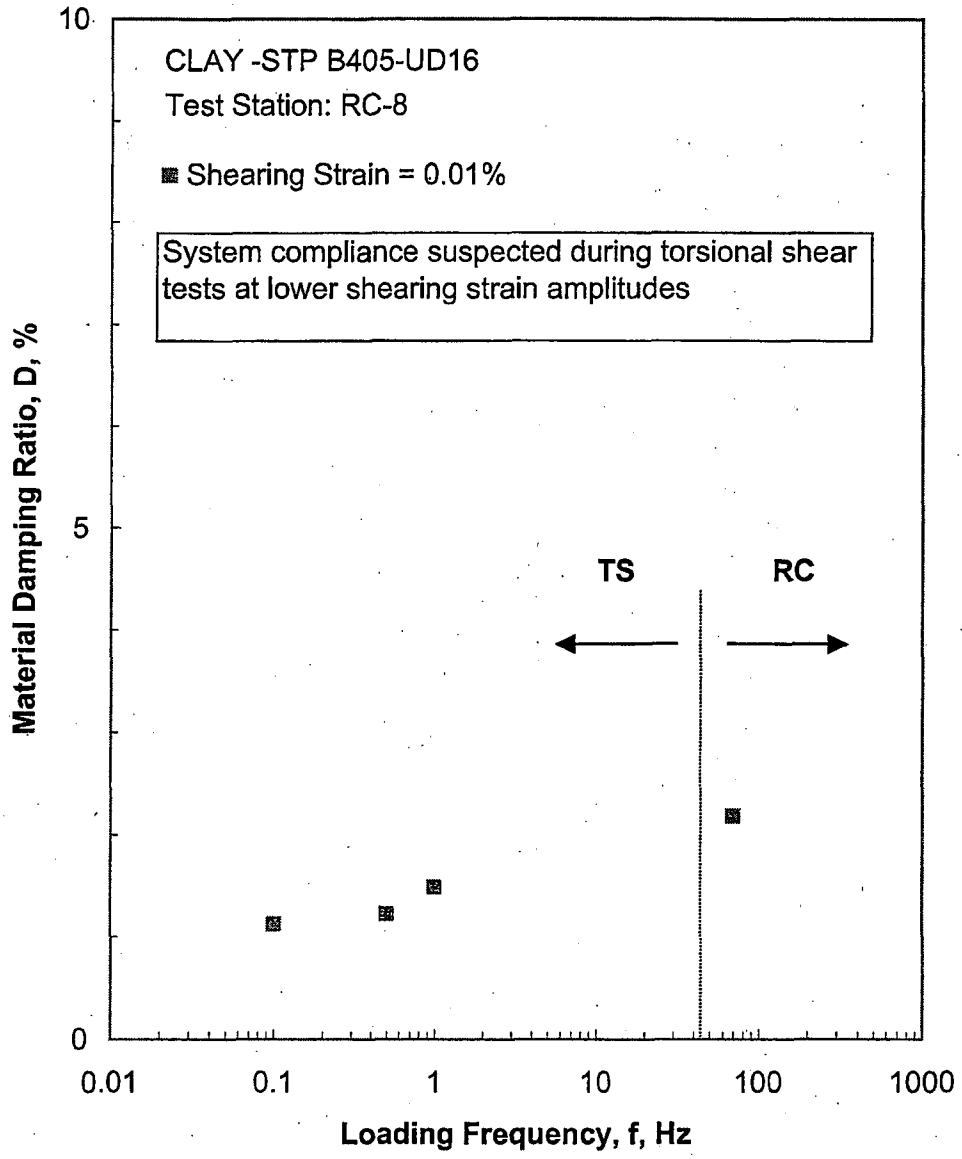


Figure C.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 424.4 psi from the Combined RCTS Tests

Table C.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B405-UD16

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
26.5	3816	183	1679	81	679	3.12	0.863
53.0	7632	365	1819	87	689	2.87	—
106.1	15278	731	1971	95	730	2.50	0.833
212.2	30557	1462	2463	118	806	3.01	0.789
424.4	61114	2924	3426	164	934	2.65	0.727

Table C.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD16; Isoptropic Confining Pressure, σ_o=106.1 psi (15.3 ksf = 731 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
3.24E-04	2025	1.00	3.24E-04	2.45
7.02E-04	2025	1.00	7.02E-04	2.50
1.37E-03	2025	1.00	1.37E-03	2.61
2.73E-03	2025	1.00	2.73E-03	2.64
5.45E-03	2025	1.00	4.48E-03	2.74
1.09E-02	2008	0.99	9.18E-03	2.82
2.14E-02	2008	0.99	1.72E-02	2.88
4.23E-02	1973	0.97	3.37E-02	2.98
8.27E-02	1888	0.93	6.67E-02	3.09
1.64E-01	1708	0.84	1.31E-01	3.34
3.37E-01	1433	0.71	2.50E-01	4.34
7.07E-01	1110	0.55	4.77E-01	6.68
1.46E+00	804	0.40	7.97E-01	11.88

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table C.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD16; Isotropic Confining Pressure, σ_o=106.1 psi (15.3 ksf = 731 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
2.15E-03	1666	1.00	1.52	2.15E-03	1662	1.00	1.36
4.25E-03	1666	1.00	1.40	4.26E-03	1662	1.00	1.31
9.84E-03	1666	1.00	1.72	9.87E-03	1662	1.00	1.61
2.00E-02	1632	0.98	1.94	2.00E-02	1637	0.99	1.98
4.19E-02	1559	0.94	2.05	4.21E-02	1554	0.93	2.10

Table C.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD16; Isoptropic Confining Pressure, σ_o= 424.4 psi (61.1 ksf = 2924 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.84E-04	4747	1.00	1.84E-04	2.11
3.72E-04	4747	1.00	3.72E-04	2.10
7.63E-04	4747	1.00	7.63E-04	2.08
1.53E-03	4747	1.00	1.28E-03	2.15
3.06E-03	4747	1.00	2.65E-03	2.15
6.12E-03	4740	1.00	5.33E-03	2.17
1.22E-02	4740	1.00	1.03E-02	2.18
2.43E-02	4706	0.99	2.09E-02	2.26
4.77E-02	4637	0.98	4.07E-02	2.29
9.21E-02	4399	0.93	7.85E-02	2.34
1.75E-01	3944	0.83	1.46E-01	2.79
3.37E-01	3281	0.69	2.60E-01	4.13
4.98E-01	2811	0.59	3.62E-01	5.42

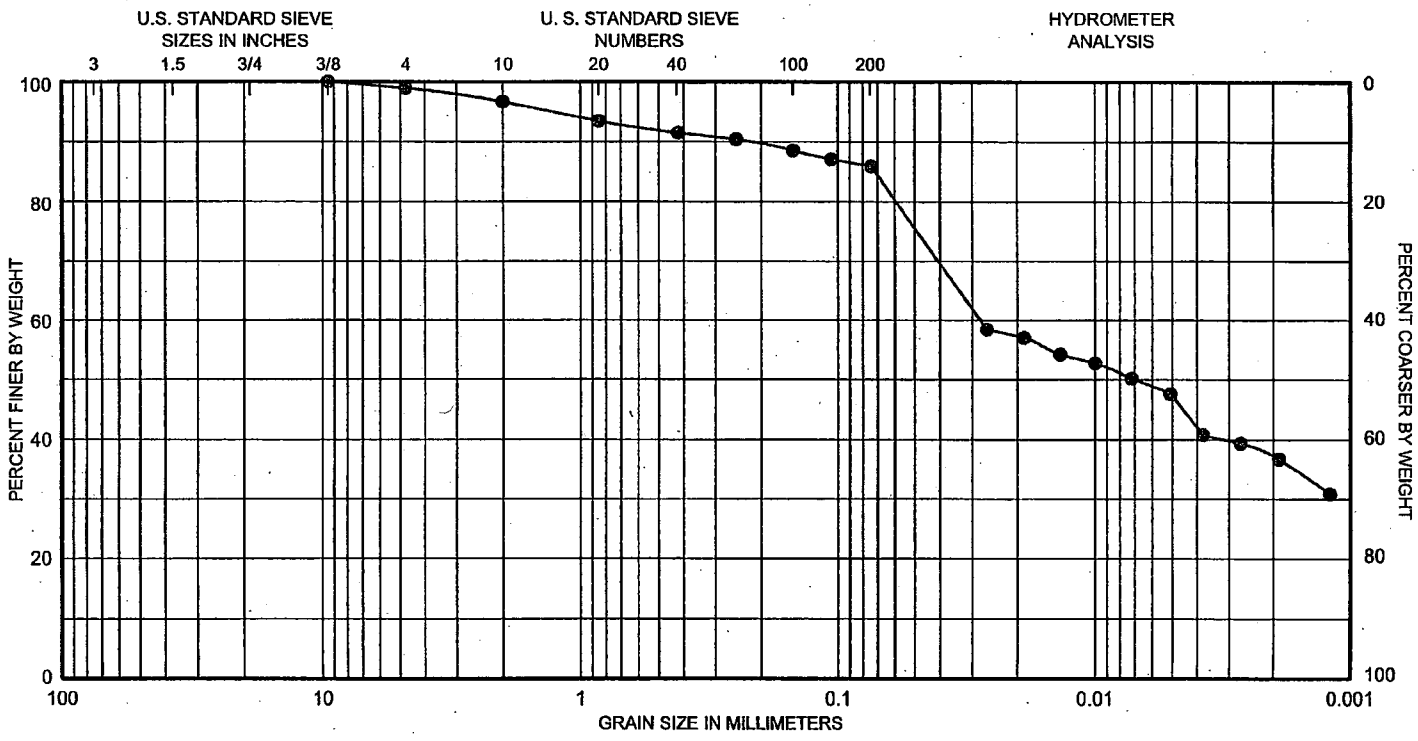
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table C.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD16; Isotropic Confining Pressure, σ_o=424.4 psi (61.1 ksf = 2924 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D,	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D, %
2.16E-03	4018	1.00	1.15	2.14E-03	4038	1.00	0.98
4.31E-03	4018	1.00	0.98	4.29E-03	4038	1.00	1.30
9.67E-03	4018	1.00	1.56	9.67E-03	4038	1.00	1.22
1.95E-02	4015	1.00	1.27	1.94E-02	4034	1.00	1.26
3.11E-02	4001	1.00	1.28	3.10E-02	4013	0.99	1.34

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-405-UD16	358.53			0.007	0.22	Clay, olive gray, with calcareous deposits

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX D

Specimen STP B405-UD19
CLAY (LL=33, PI=22; Gs=2.66)

Borehole B405
Sample UD19
Depth = 440.5 ft (134.3 m)
Total Unit Weight = 131.7 lb/ft^3
Water Content = 17.4 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 129.4 psi

FUGRO JOB #: 0401-1660
Testing Station: RC9

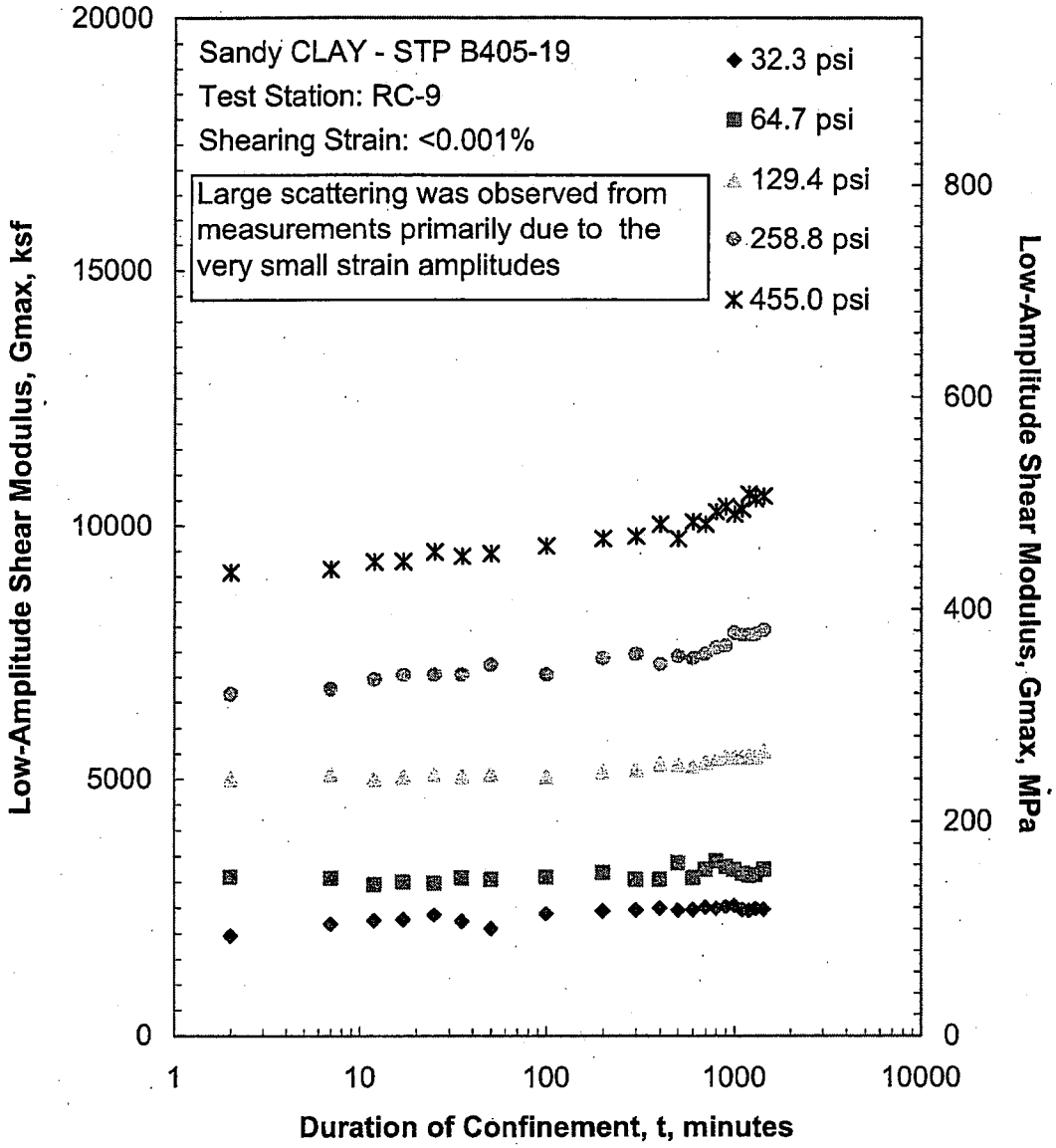


Figure D.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

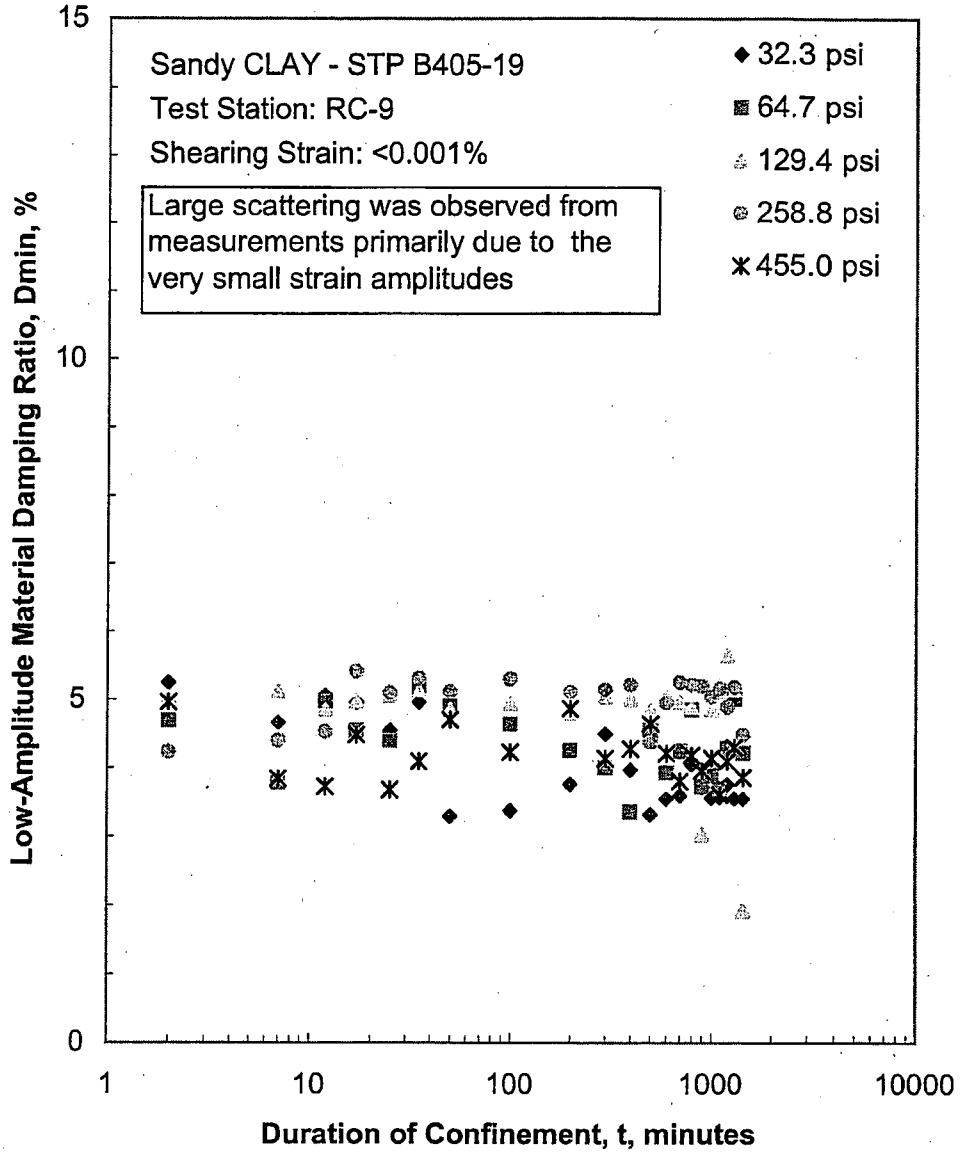


Figure D.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

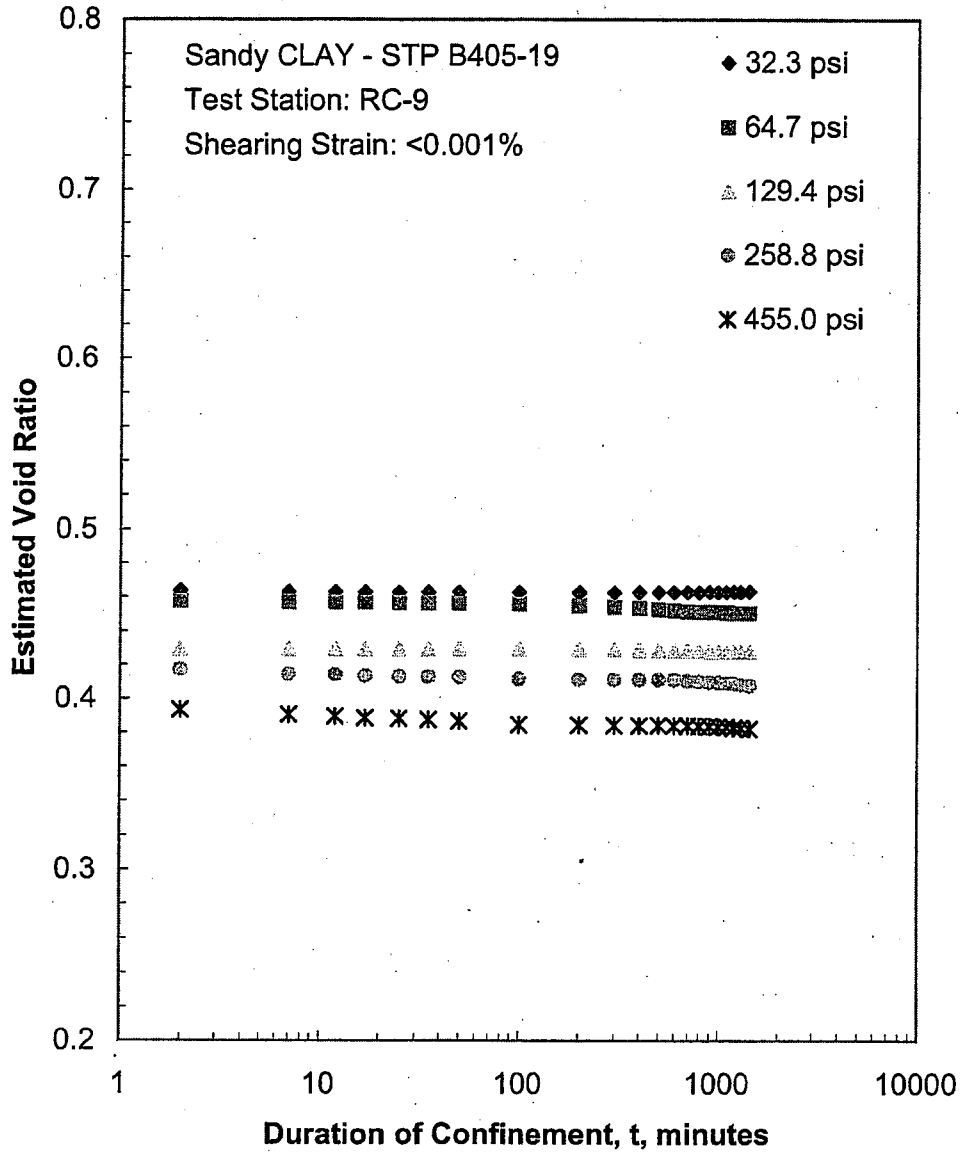


Figure D.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

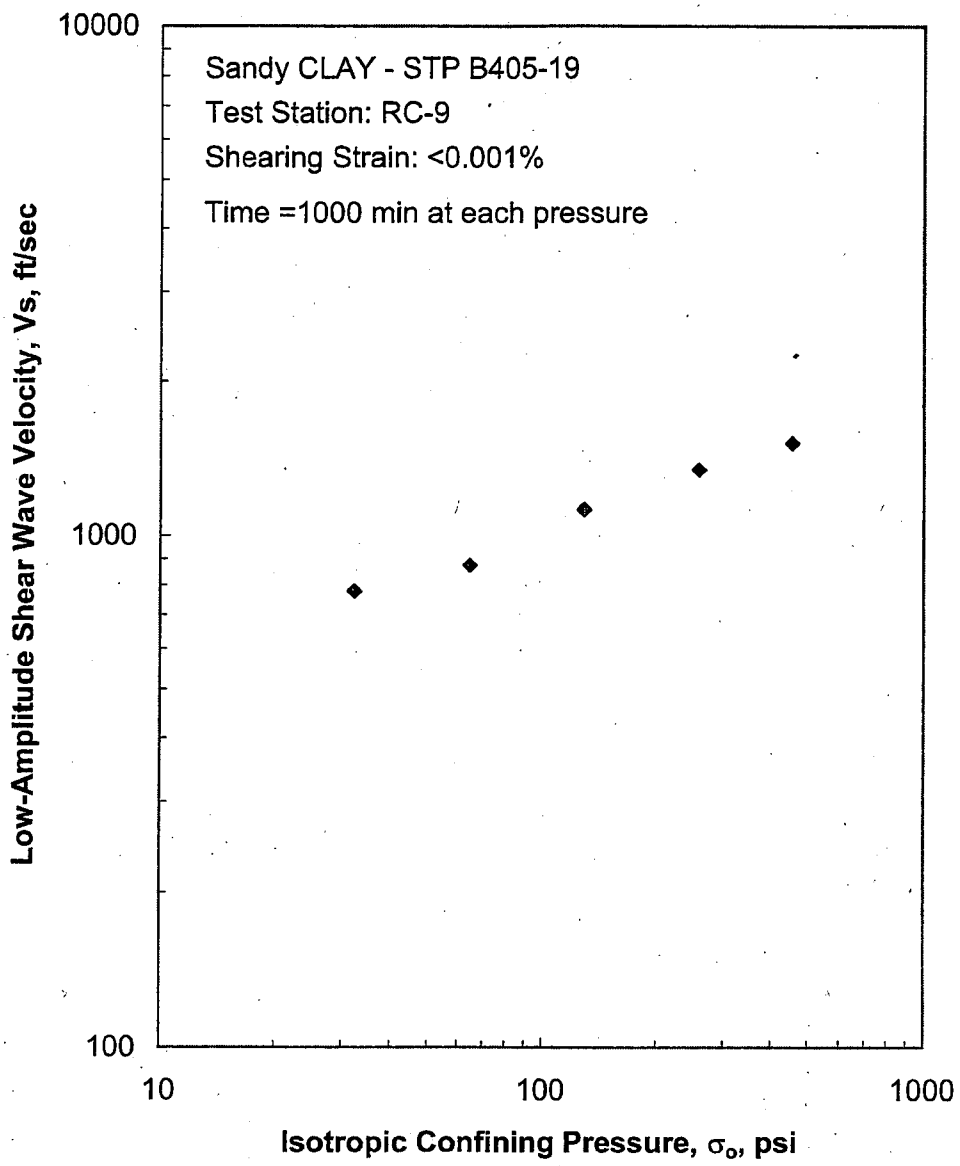


Figure D.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

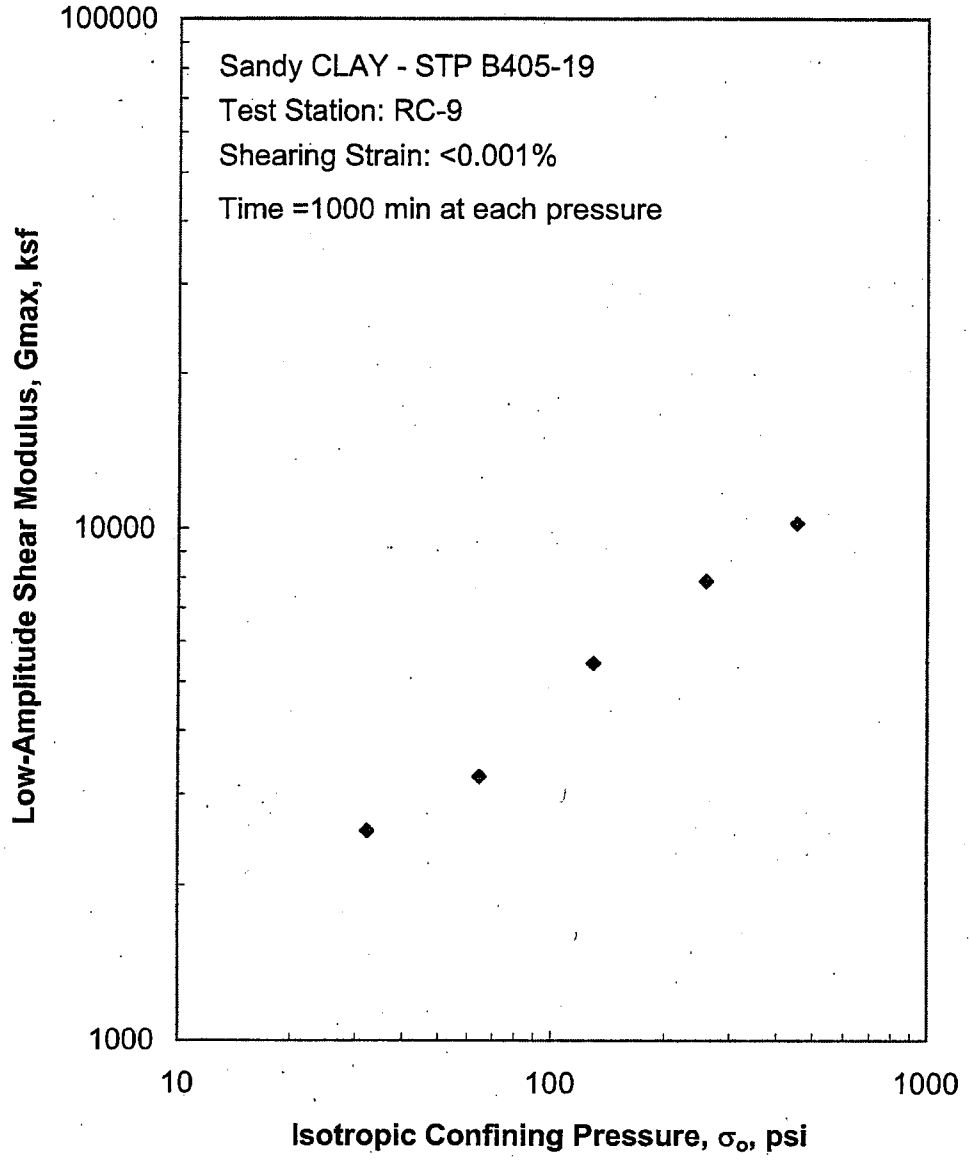


Figure D.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

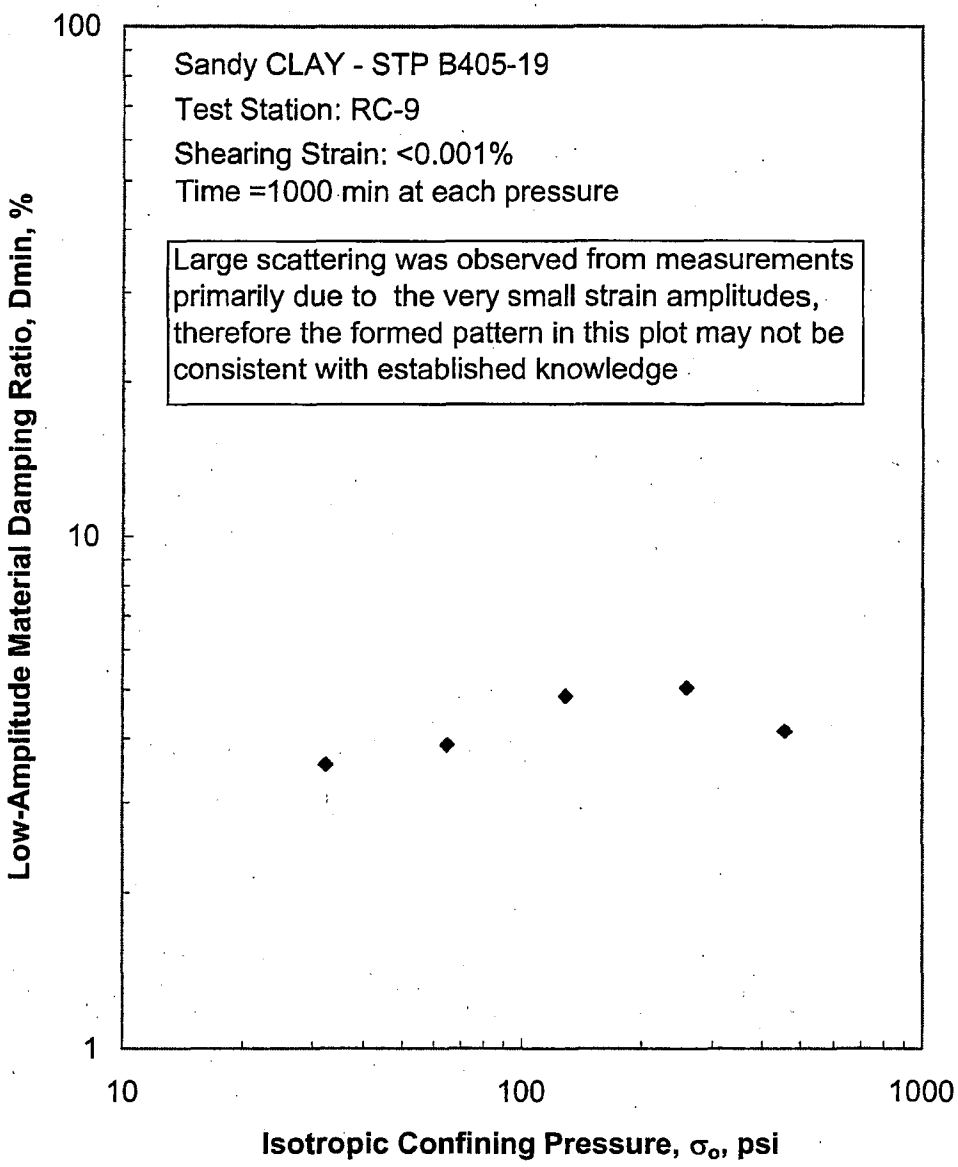


Figure D.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

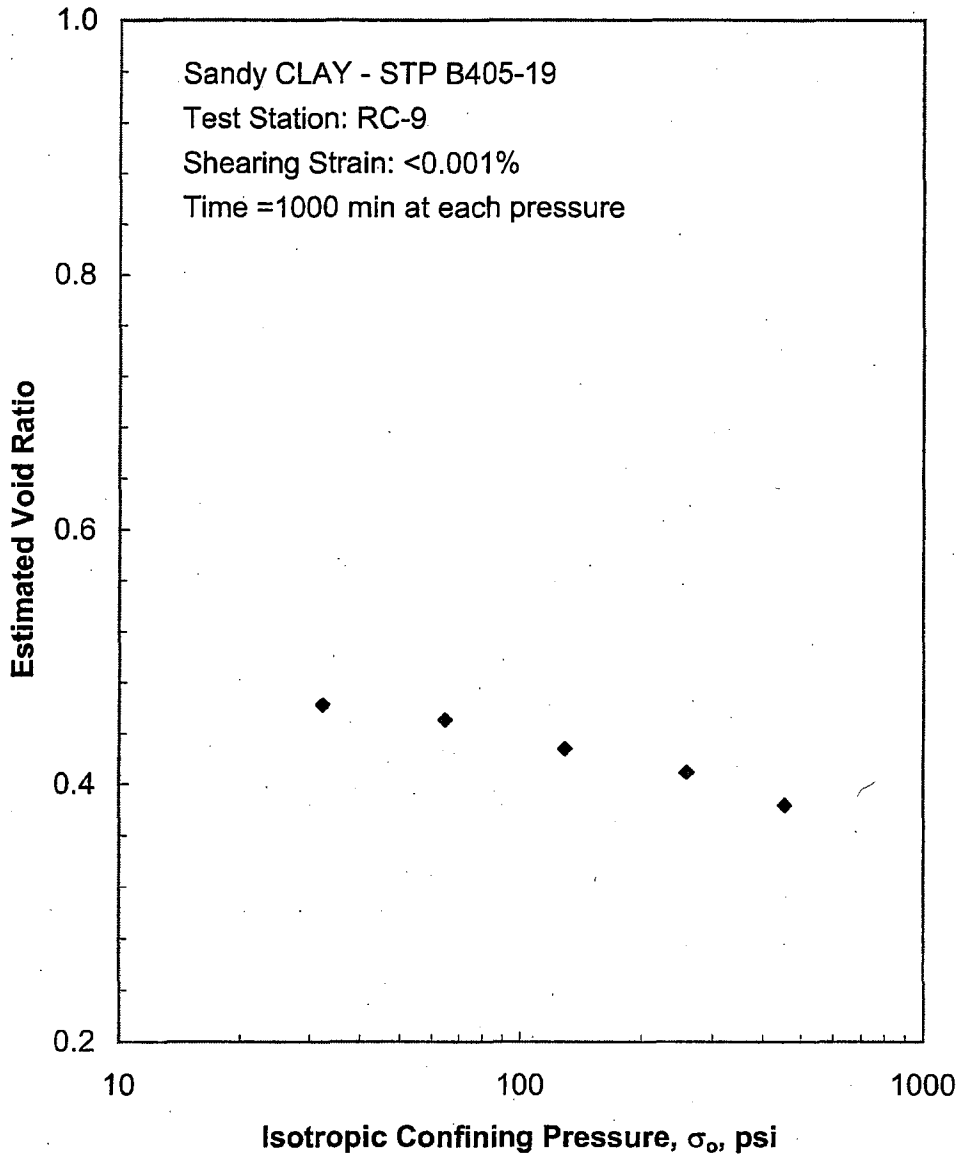


Figure D.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

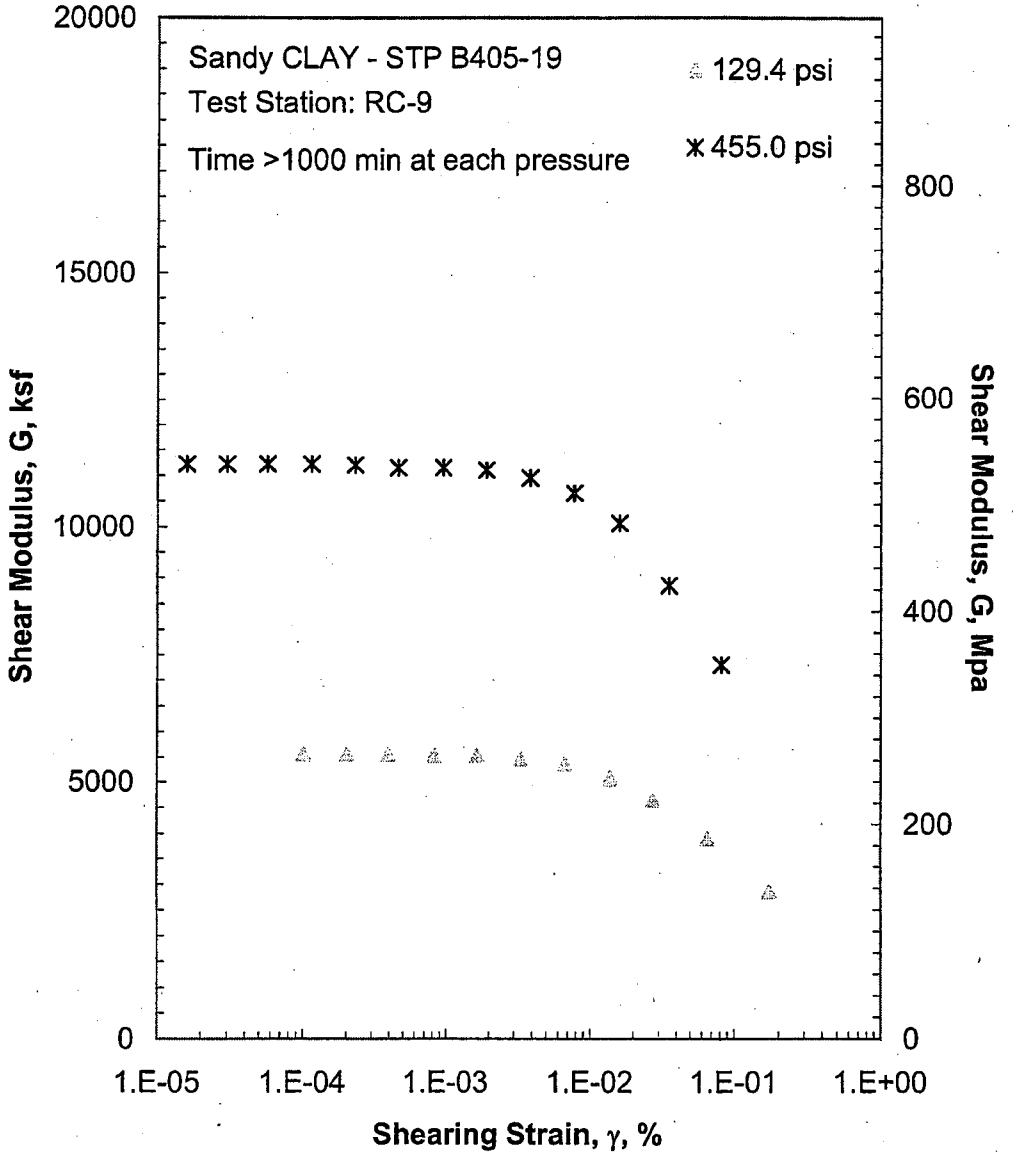


Figure D.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

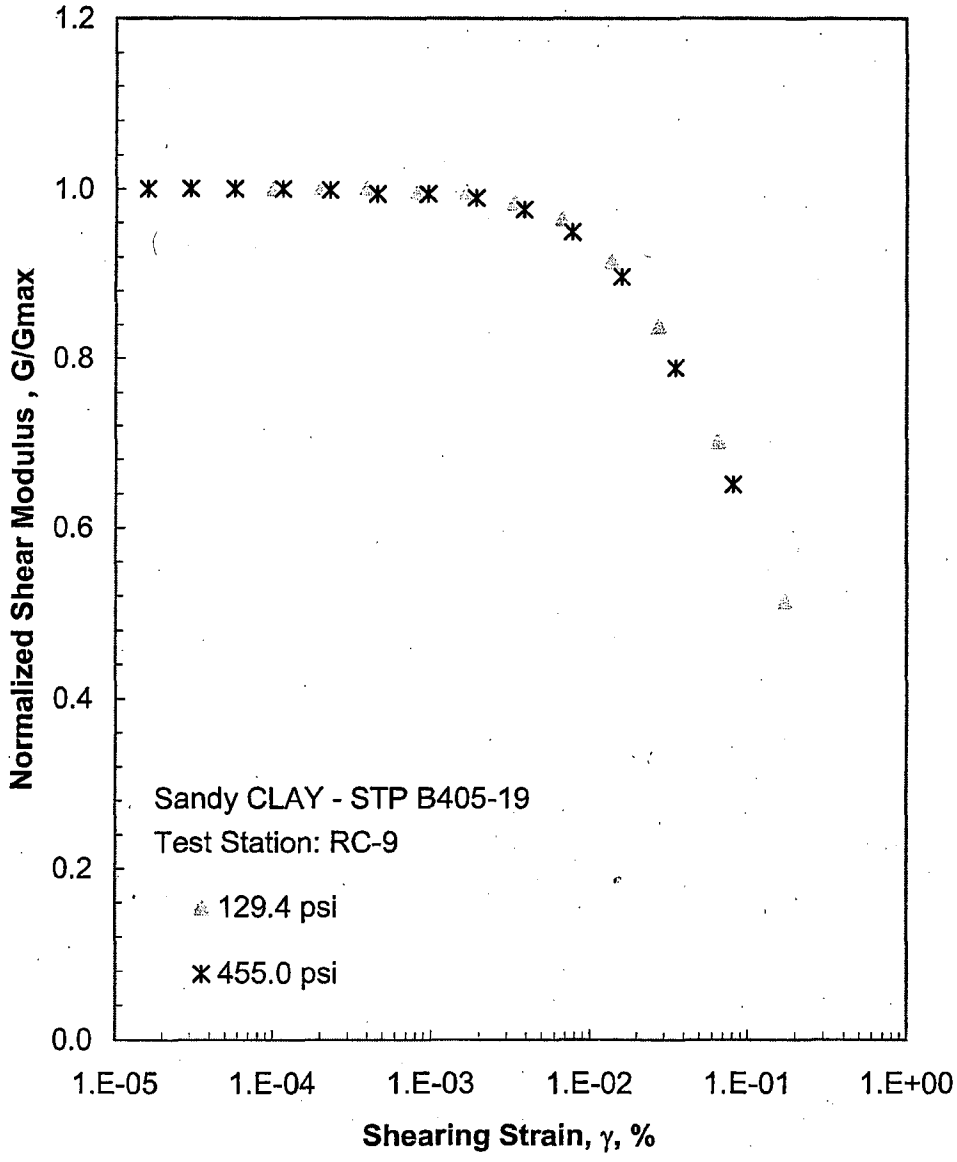


Figure D.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

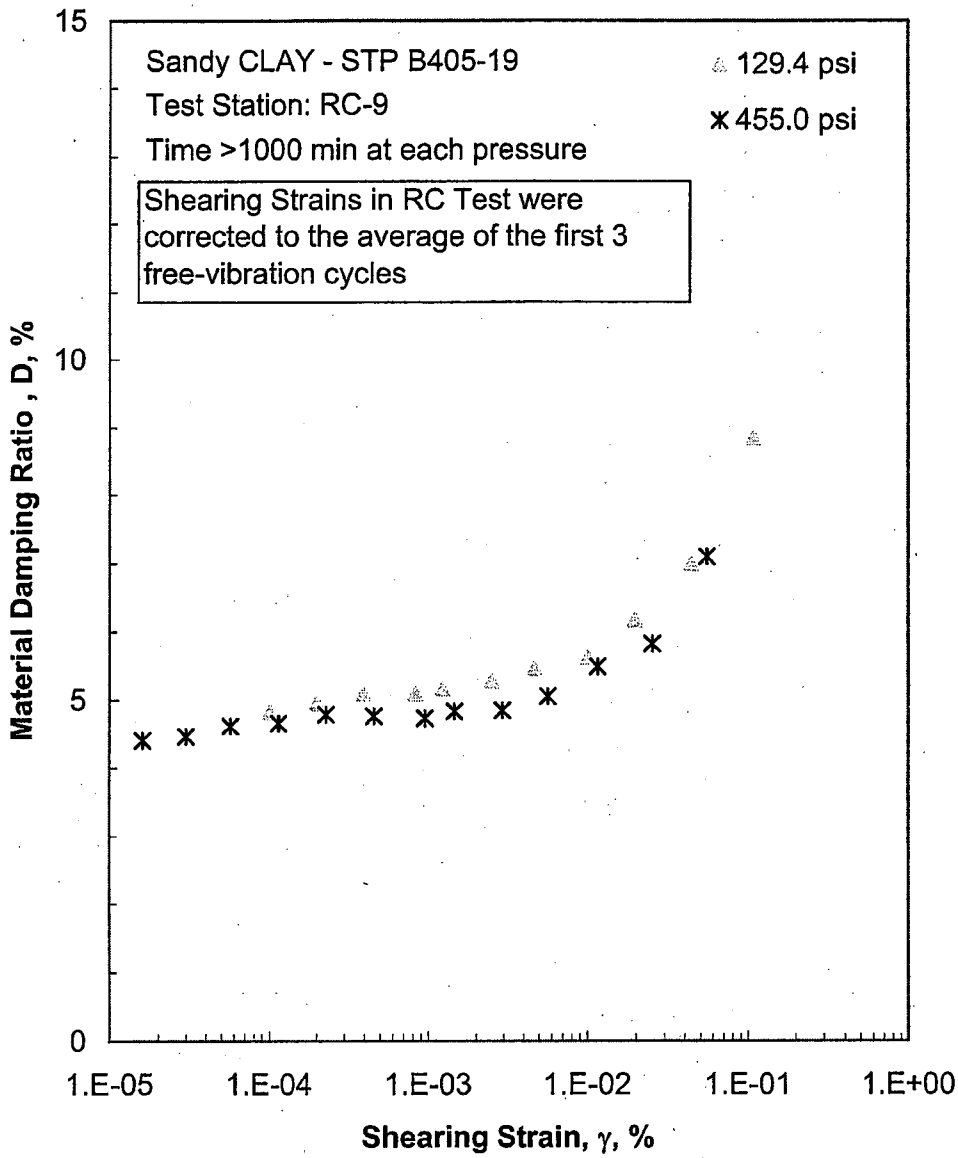


Figure D.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

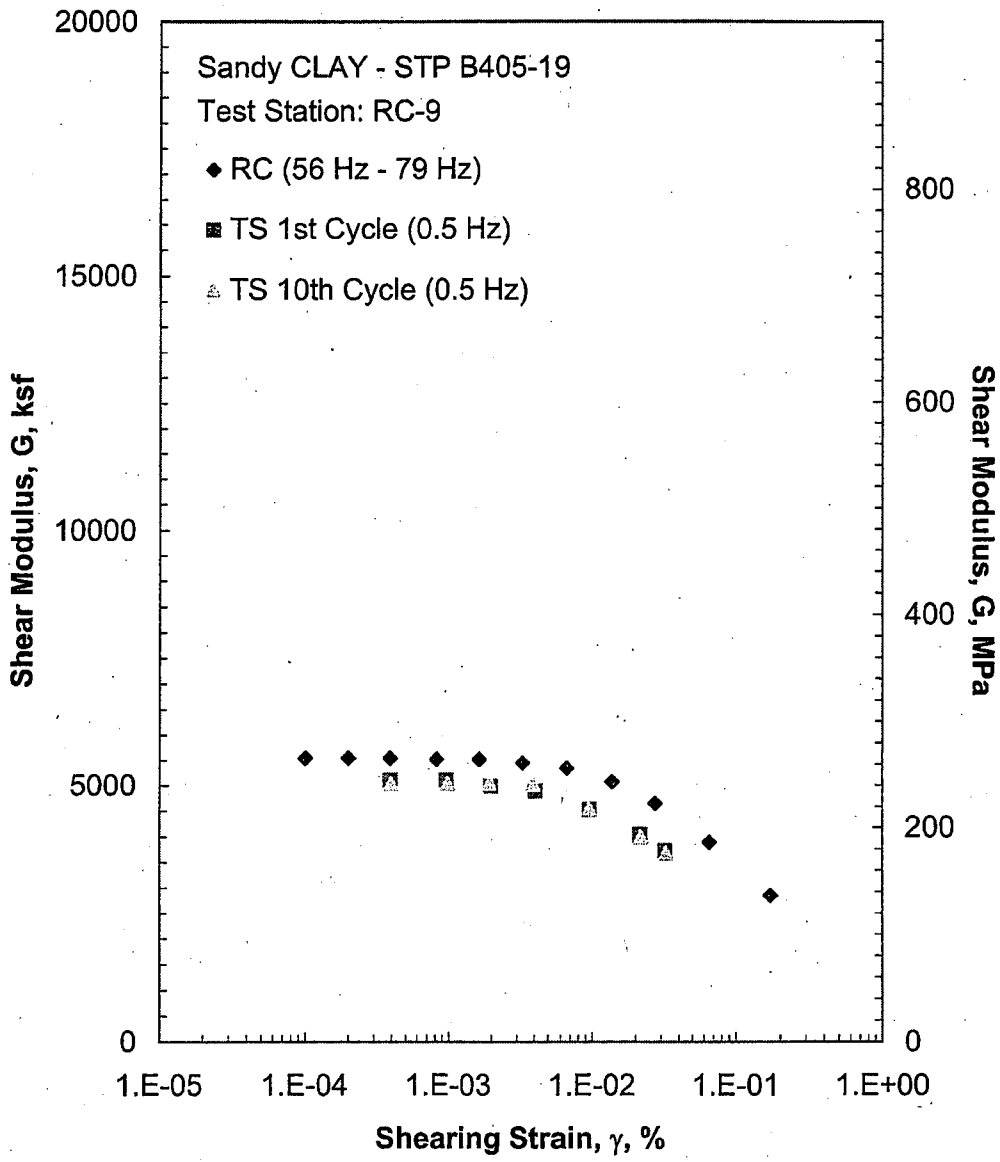


Figure D.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 129.4 psi from the Combined RCTS Tests

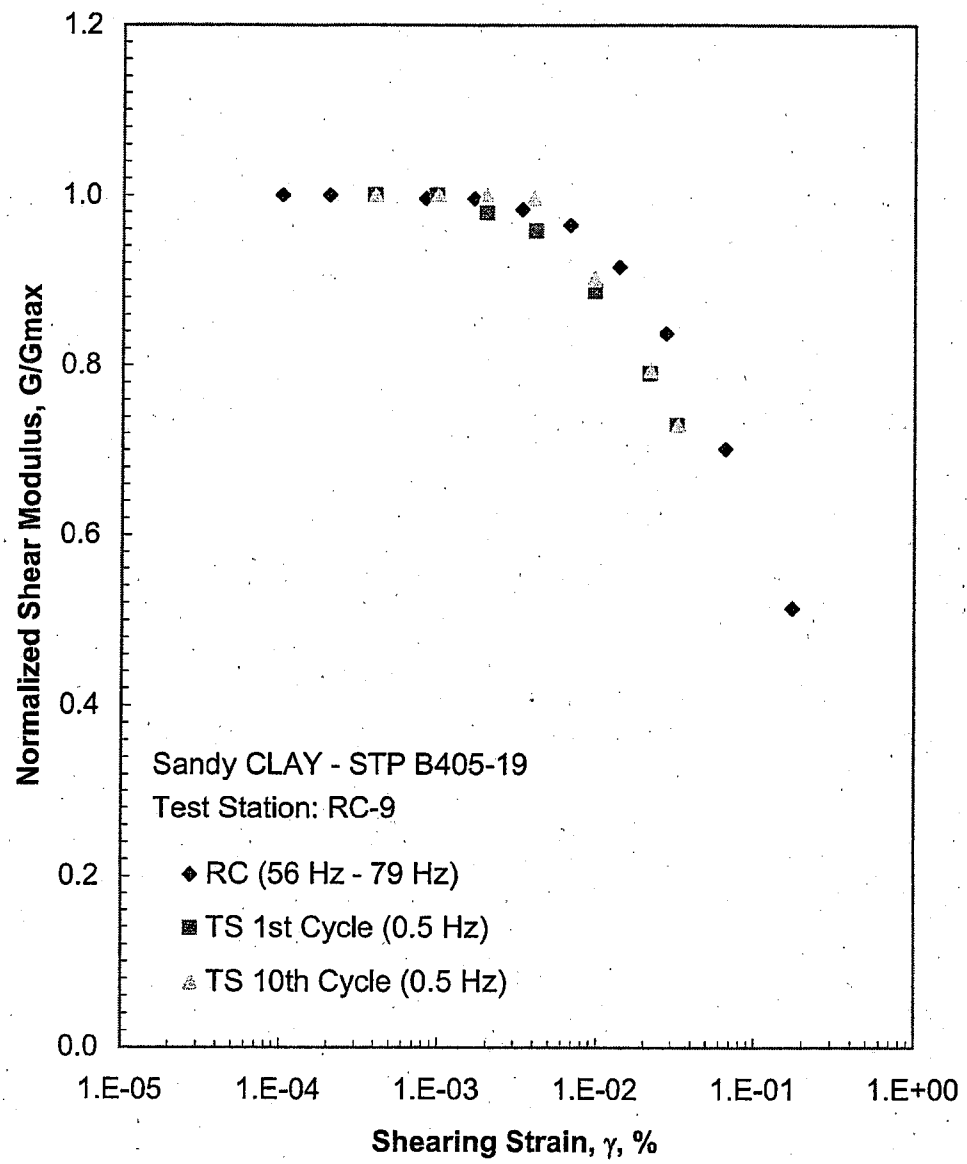


Figure D.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 129.4 psi from the Combined RCTS Tests

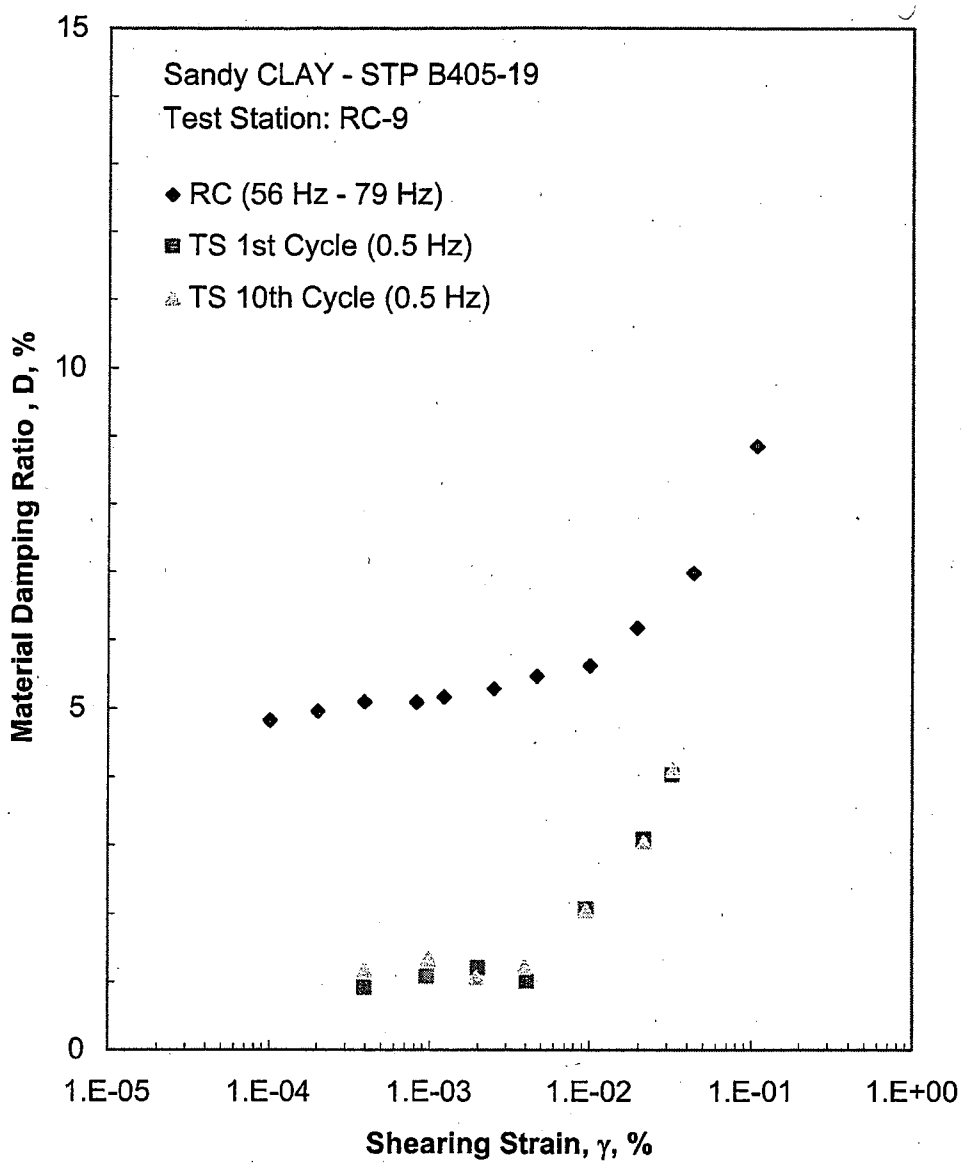


Figure D.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 129.4 psi from the Combined RCTS Tests

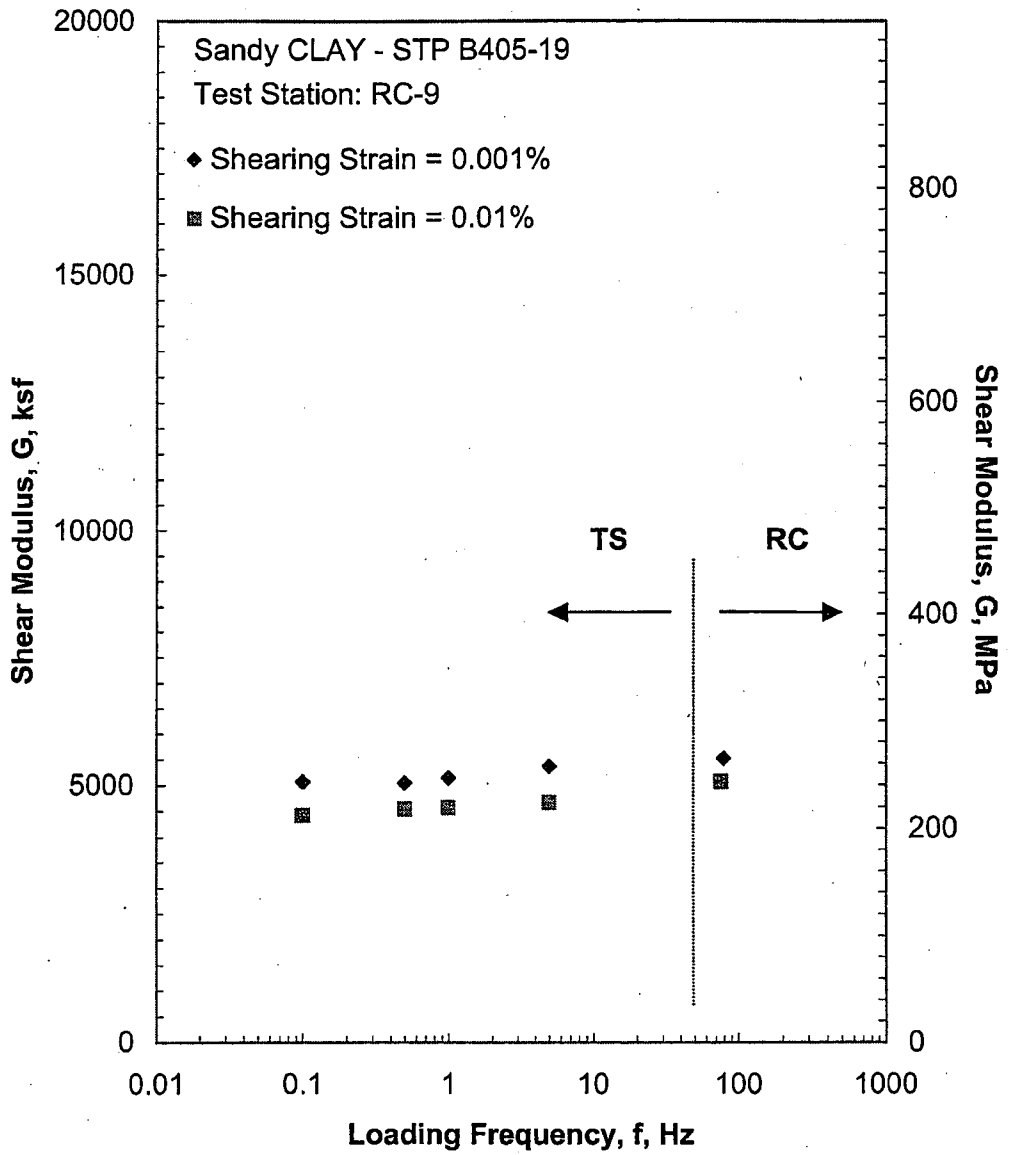


Figure D.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 129.4 psi from the Combined RCTS Tests

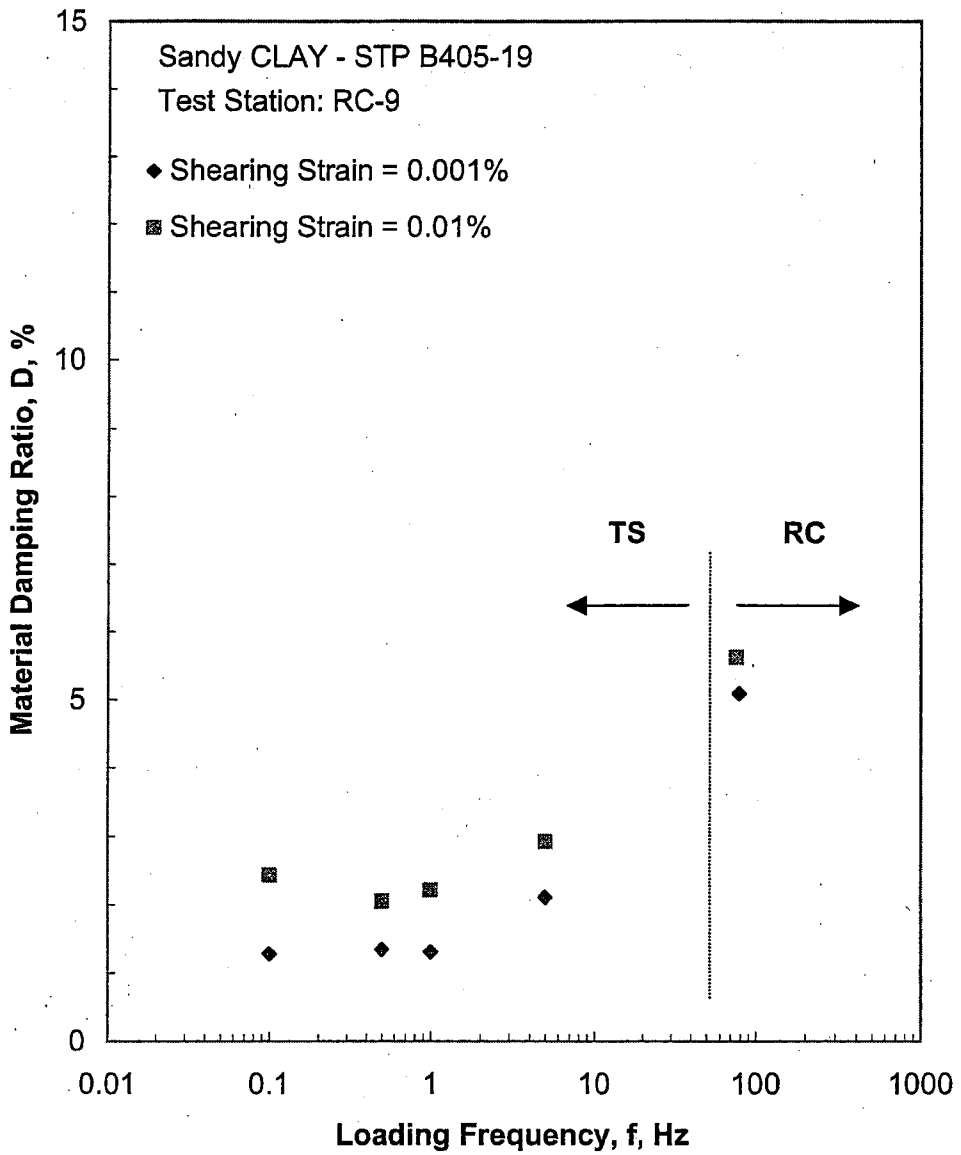


Figure D.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 129.4 psi from the Combined RCTS Tests

NOTE: Figures D.16- D.20 are not available

Table D.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B405-UD19

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
32.3	4651	223	2544	122	778	3.56	0.463
64.7	9317	446	3248	156	875	3.88	0.451
129.4	18634	892	5443	261	1124	4.85	0.428
258.8	37267	1783	7881	378	1344	5.04	0.409
455.0	65520	3135	10225	491	1517	4.14	0.384

Table D.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD19; Isoptropic Confining Pressure, σ_o=129.4 psi (18.6 ksf = 892 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.01E-04	5545	1.00	1.01E-04	4.82
2.02E-04	5545	1.00	2.02E-04	4.96
3.93E-04	5545	1.00	3.93E-04	5.09
8.26E-04	5521	1.00	8.26E-04	5.09
1.65E-03	5522	1.00	1.22E-03	5.16
3.32E-03	5451	0.98	2.50E-03	5.28
6.68E-03	5347	0.96	4.70E-03	5.46
1.37E-02	5072	0.91	1.01E-02	5.62
2.75E-02	4643	0.84	1.96E-02	6.17
6.54E-02	3886	0.70	4.36E-02	6.98
1.73E-01	2847	0.51	1.07E-01	8.85

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table D.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD19; Isotropic Confining Pressure, σ_o=129.4 psi (18.6 ksf = 892 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
3.94E-04	5105	1.00	0.91	3.97E-04	5047	1.00	1.17
9.61E-04	5105	1.00	1.08	9.84E-04	5047	1.00	1.34
1.99E-03	4996	0.98	1.20	1.95E-03	5047	1.00	1.06
4.06E-03	4889	0.96	1.00	3.95E-03	5026	1.00	1.21
9.59E-03	4530	0.89	2.07	9.56E-03	4546	0.90	2.05
2.15E-02	4035	0.79	3.09	2.17E-02	4004	0.79	3.04
3.21E-02	3726	0.73	4.02	3.26E-02	3681	0.73	4.10

Table D.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD19; Isoptropic Confining Pressure, σ_o= 455.0 psi (65.5 ksf = 3135 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
8.00E-06	11224	1.00	8.00E-06	4.37
1.60E-05	11224	1.00	1.60E-05	4.41
3.00E-05	11224	1.00	3.00E-05	4.47
5.70E-05	11224	1.00	5.70E-05	4.62
1.15E-04	11224	1.00	1.15E-04	4.66
2.30E-04	11204	1.00	2.30E-04	4.79
4.60E-04	11153	0.99	4.60E-04	4.76
9.53E-04	11152	0.99	9.53E-04	4.73
1.91E-03	11102	0.99	1.46E-03	4.83
3.85E-03	10951	0.98	2.95E-03	4.85
7.74E-03	10650	0.95	5.71E-03	5.05
1.60E-02	10063	0.90	1.16E-02	5.49
3.54E-02	8848	0.79	2.52E-02	5.82
8.13E-02	7297	0.65	5.49E-02	7.10

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

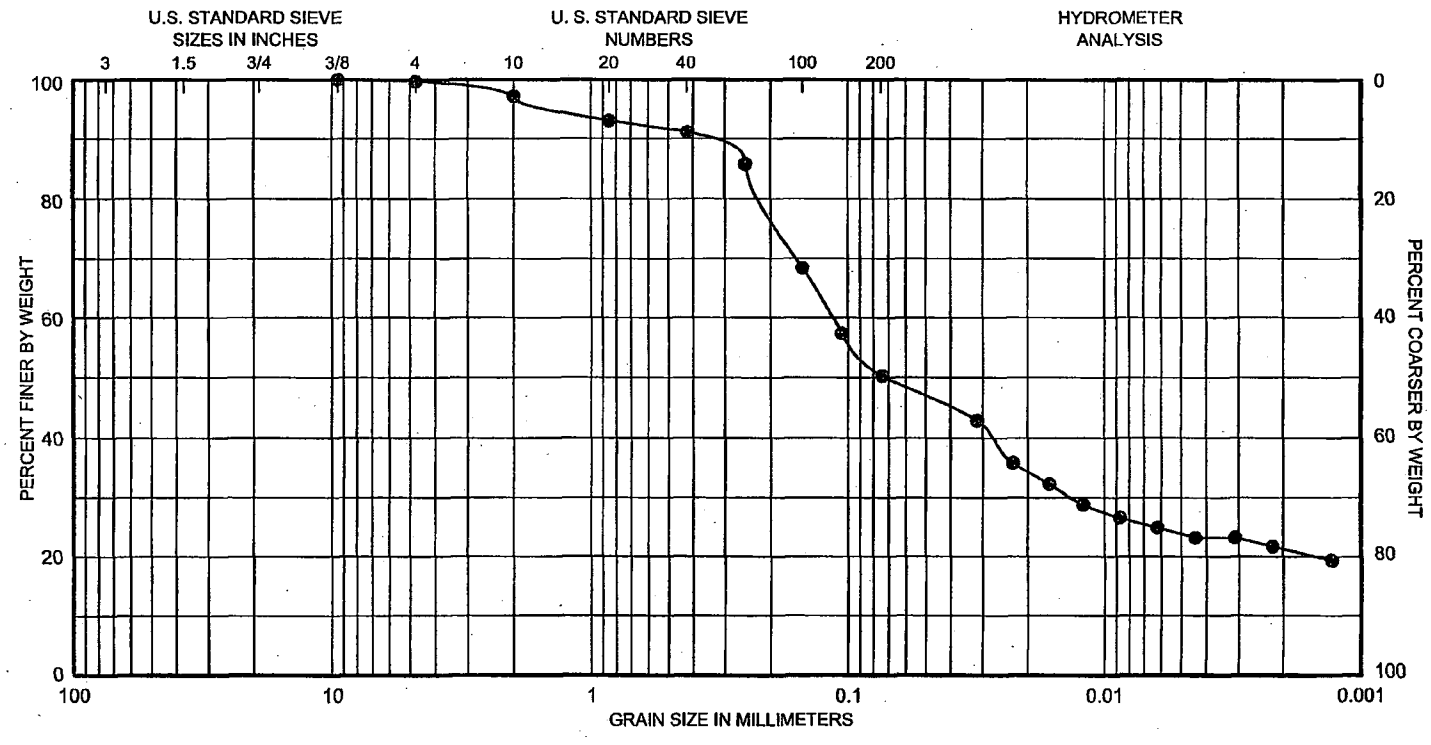
[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table D.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD19; Isotropic Confining Pressure, σ_o=455.0 psi (65.5 ksf = 3135 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D,	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D, %
—*	—*	—*	—*	—*	—*	—*	—*

* Data are NOT available. System compliance was suspected at the confining pressure of 455 psi during torsional shear tests, dynamic soil behavior could not be determined accordingly.

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-405-UD19	440.5			0.0719	0.38	Sandy Clay, brown, with calcareous nodules

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX E

Specimen STP B305-UD18
SAND (Non Plasticity; Gs=2.67)

Borehole B305
Sample UD18
Depth = 387.5 ft (118.1 m)
Total Unit Weight = 128.8 lb/ft^3
Water Content = 21.2 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 113.9 psi

FUGRO JOB #: 0401-1660
Testing Station: RC9

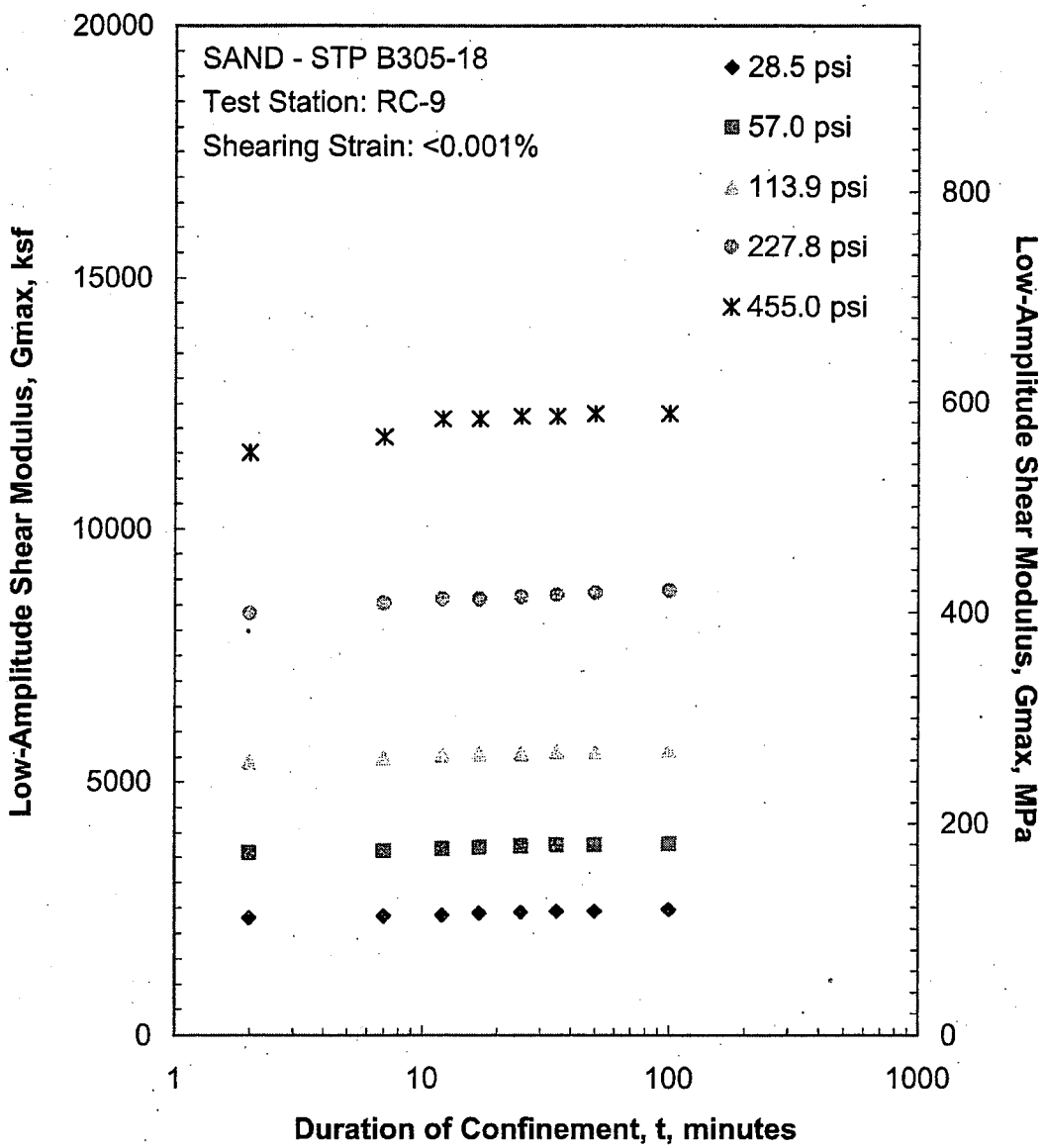


Figure E.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

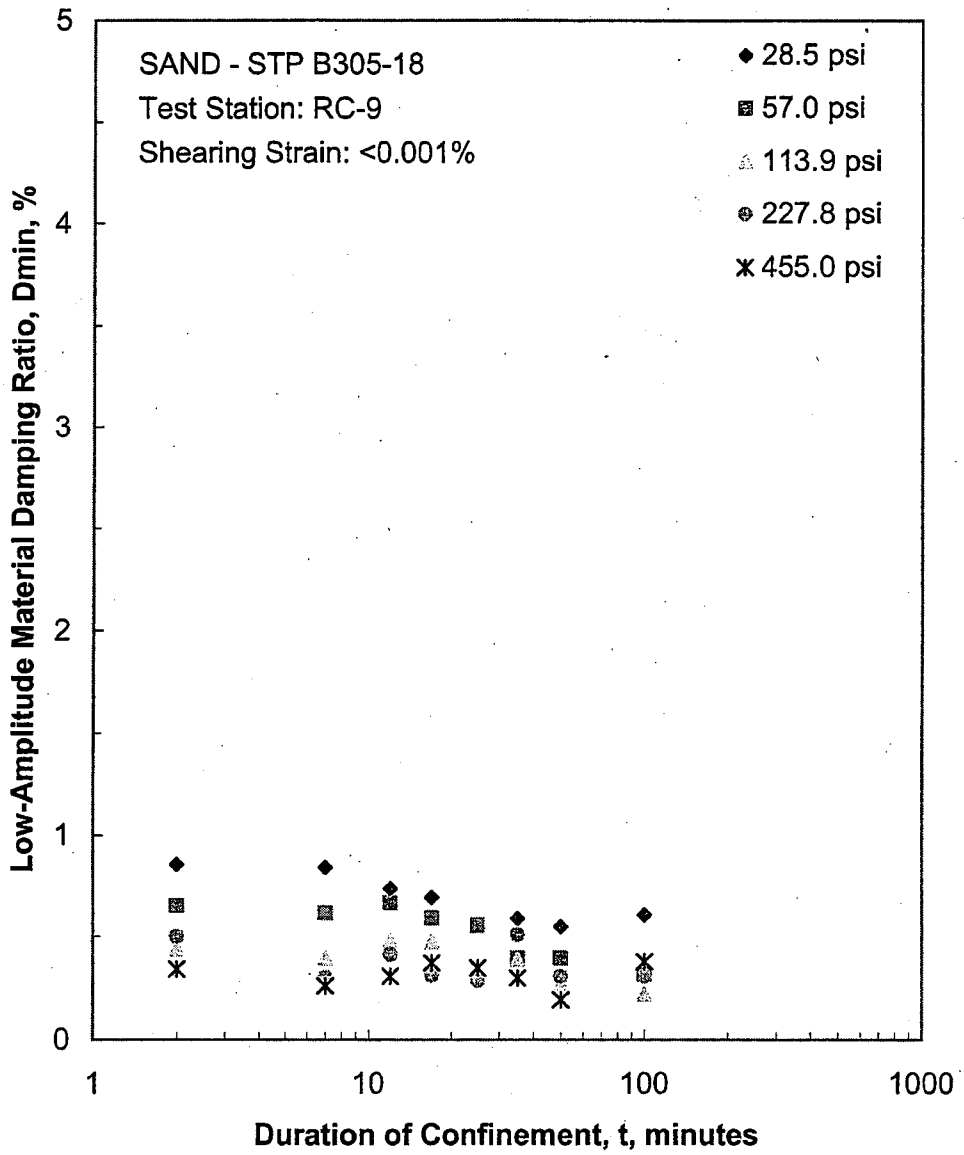


Figure E.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

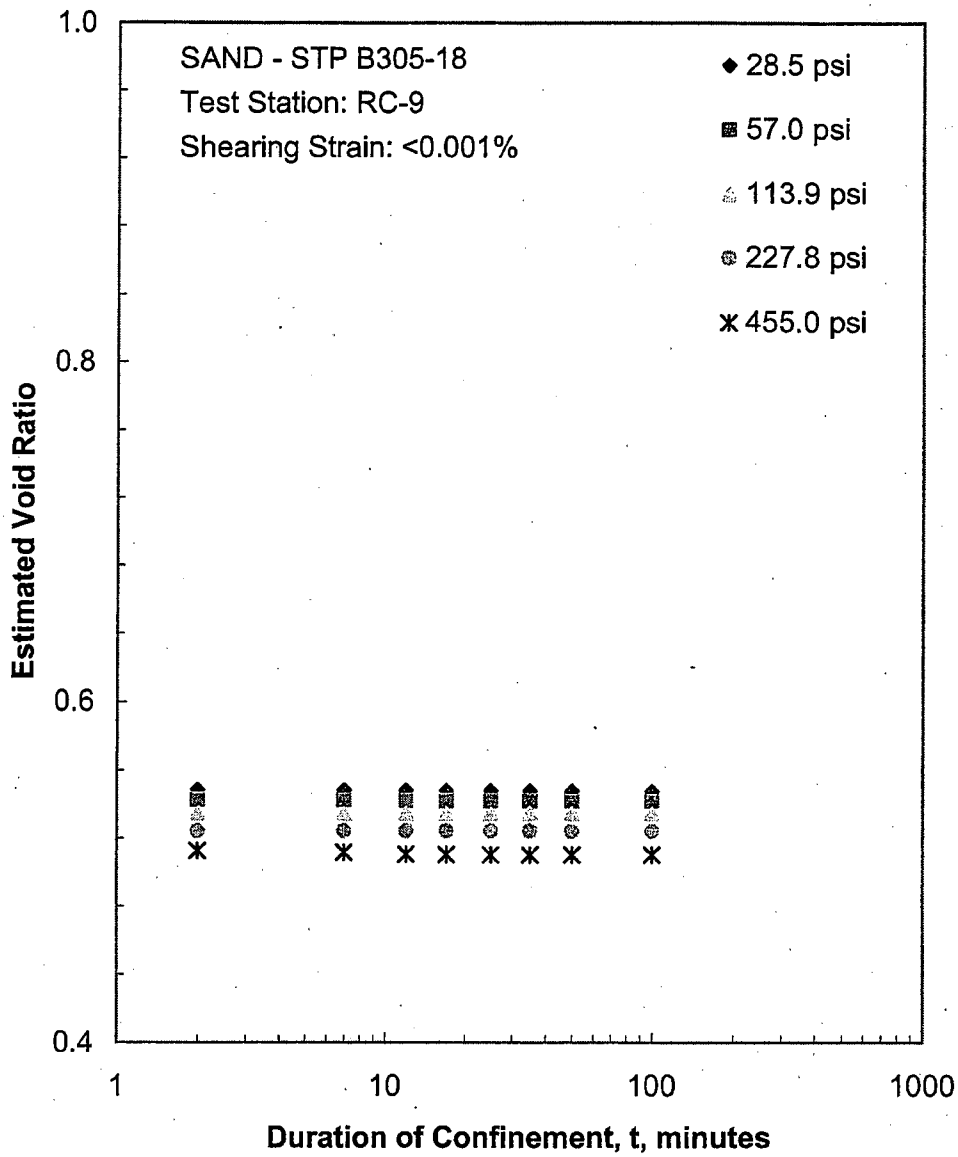


Figure E.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

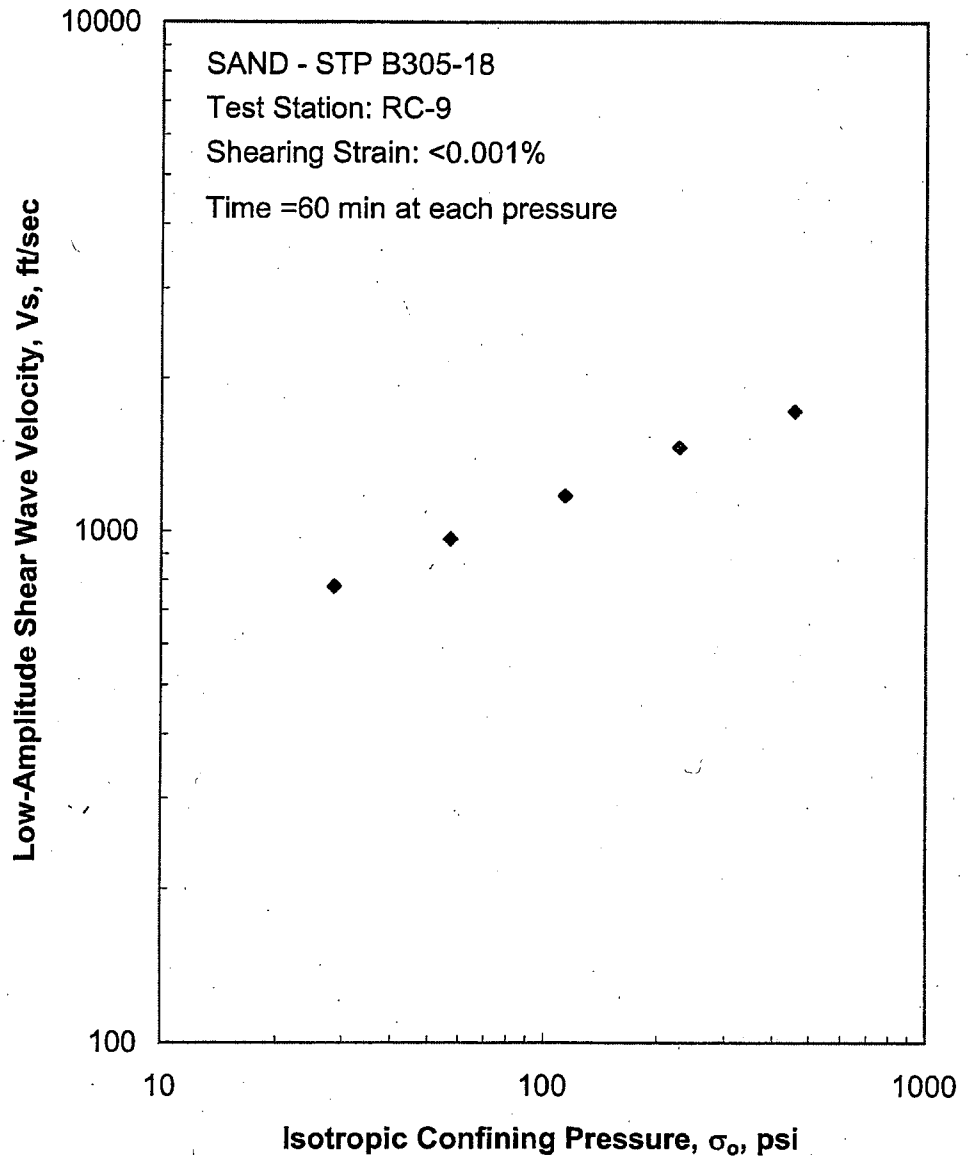


Figure E.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

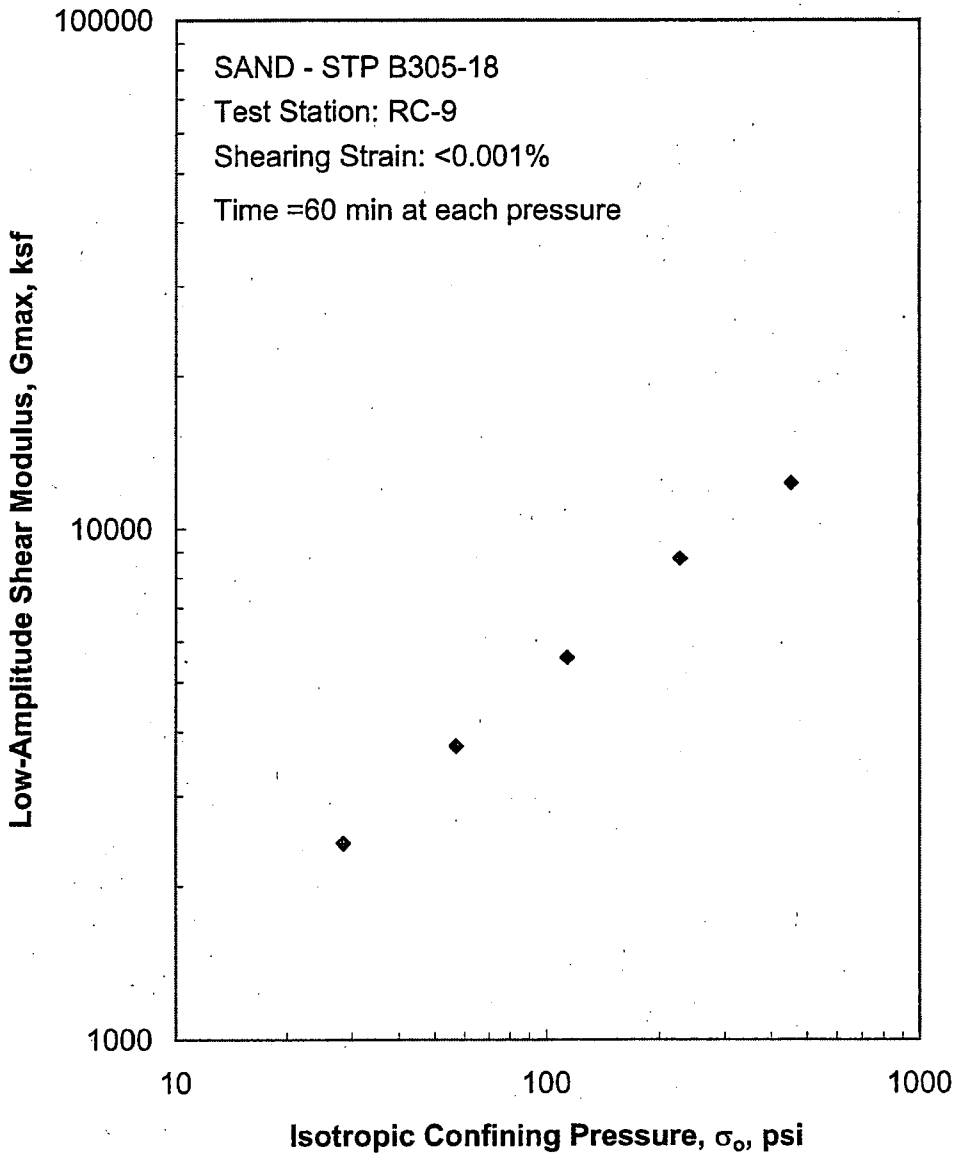


Figure E.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

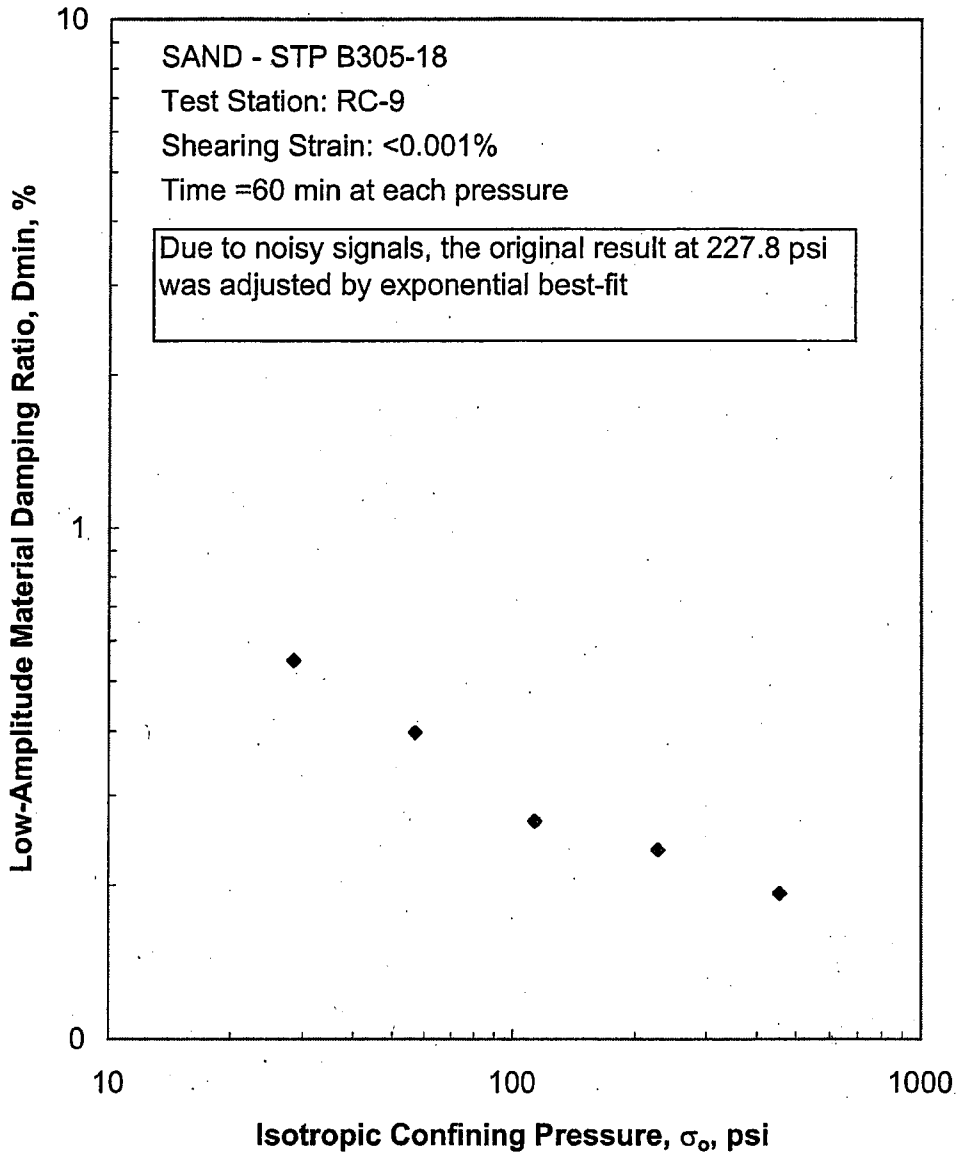


Figure E.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

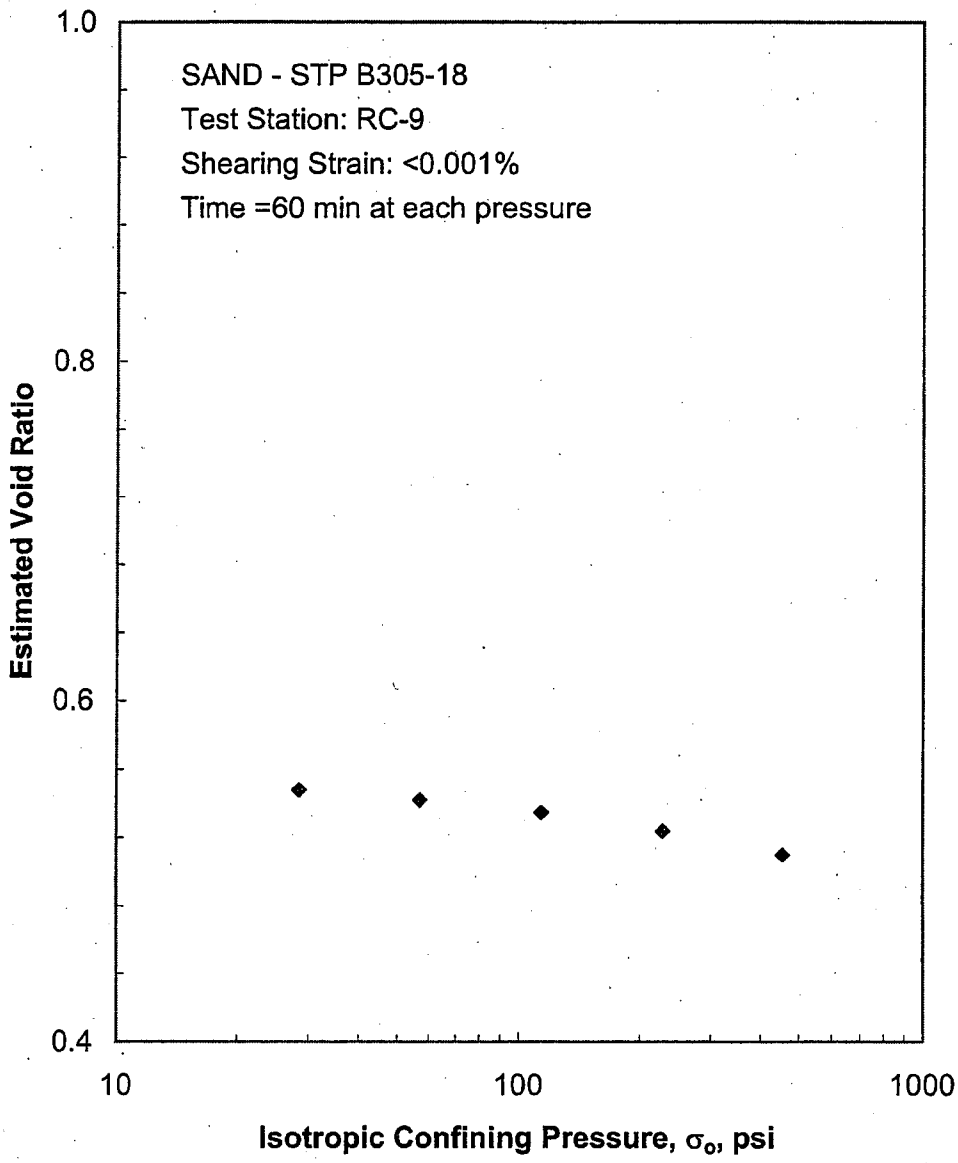


Figure E.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

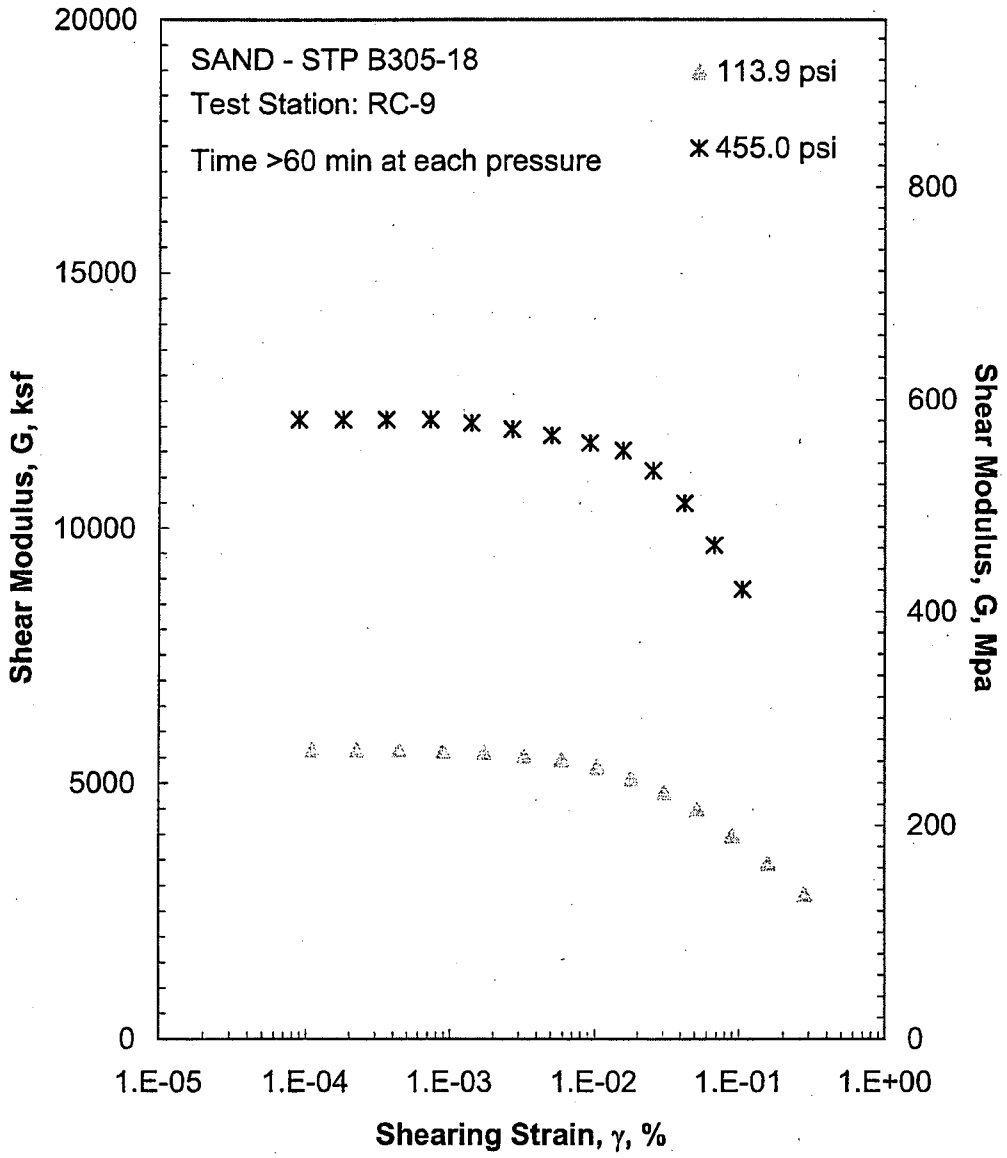


Figure E.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

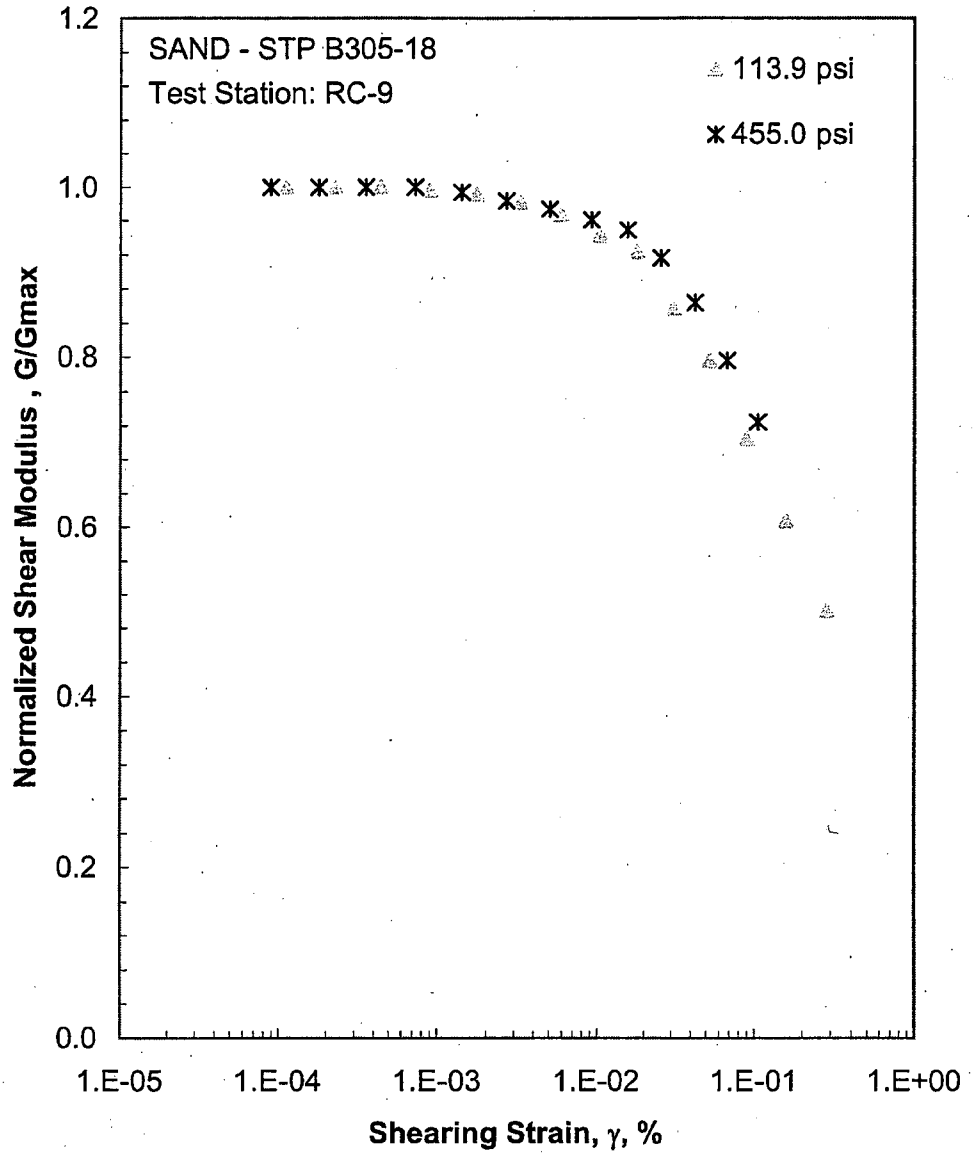


Figure E.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

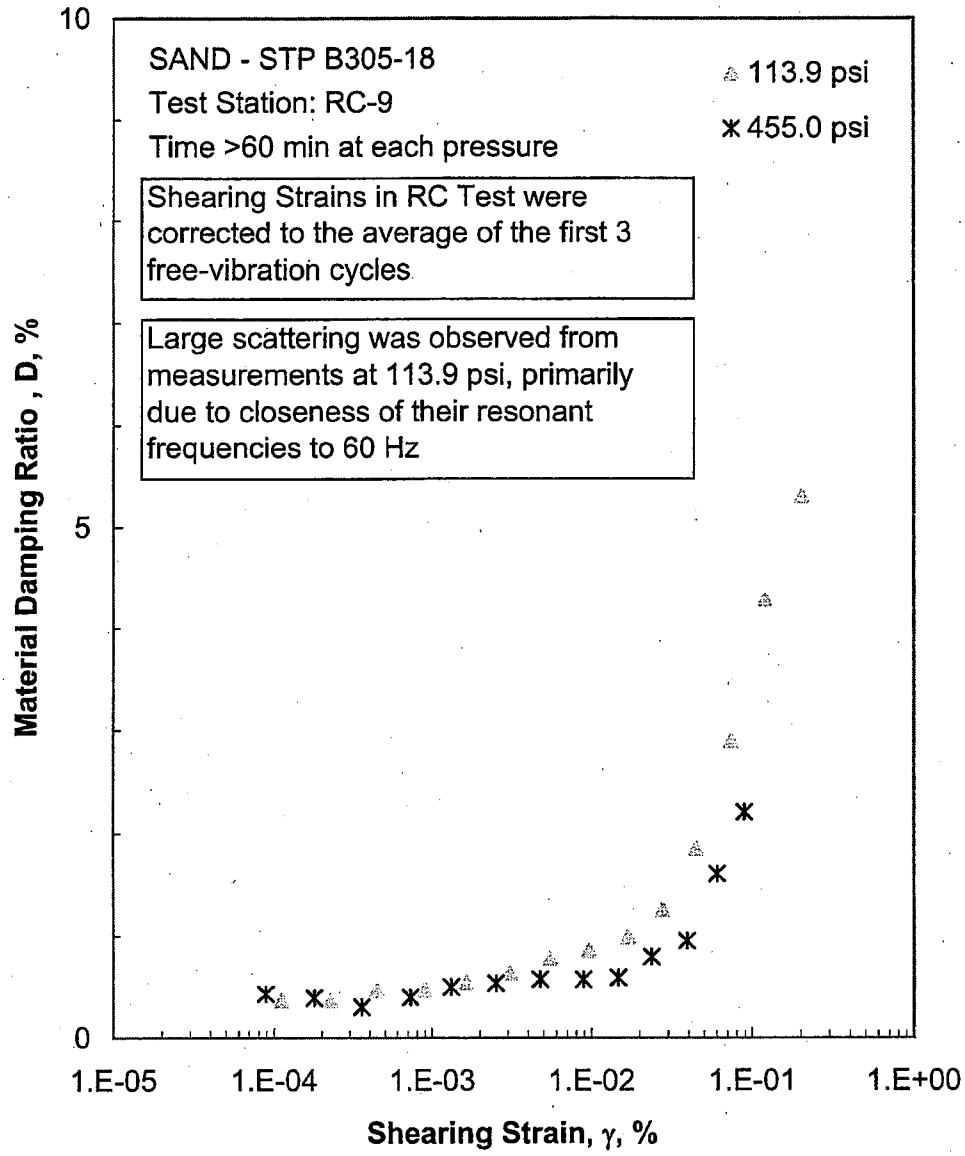


Figure E.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

NOTE: Figures E.11- E.20 are not available

Table E.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B305-UD18

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
28.5	4104	196	2427	116	776	0.55	0.548
57.0	8208	393	3757	180	964	0.40	0.542
113.9	16402	785	5589	268	1173	0.27	0.535
227.8	32803	1570	8735	419	1462	0.24	0.524
455.0	65520	3135	12296	590	1726	0.19	0.510

Table E.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B305-UD18; Isoptropic Confining Pressure, σ_o=113.9 psi (16.4 ksf = 785 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.11E-04	5636	1.00	1.11E-04	0.37
2.26E-04	5636	1.00	2.26E-04	0.37
4.43E-04	5636	1.00	4.43E-04	0.47
8.98E-04	5617	1.00	8.98E-04	0.47
1.74E-03	5589	0.99	1.65E-03	0.55
3.28E-03	5534	0.98	3.07E-03	0.63
5.92E-03	5451	0.97	5.48E-03	0.78
1.04E-02	5314	0.94	9.63E-03	0.86
1.81E-02	5100	0.92	1.69E-02	0.99
3.09E-02	4832	0.86	2.77E-02	1.25
5.21E-02	4483	0.80	4.45E-02	1.85
9.01E-02	3970	0.70	7.35E-02	2.90
1.58E-01	3423	0.61	1.20E-01	4.28
2.82E-01	2821	0.50	2.03E-01	5.30

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table E.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B305-UD18; Isotropic Confining Pressure, σ_o=113.9 psi (16.4 ksf = 785 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
—*	—*	—*	—*	—*	—*	—*	—*

*Data are NOT available. System compliance was suspected at the confining pressures of 113.9 psi during torsional shear tests, dynamic soil behavior could not be determined accordingly.

Table E.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B305-UD18; Isoptropic Confining Pressure, σ_o= 455.0 psi (65.5 ksf = 3135 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
8.90E-05	12144	1.00	8.90E-05	0.43
1.79E-04	12144	1.00	1.79E-04	0.39
3.57E-04	12144	1.00	3.57E-04	0.30
7.28E-04	12144	1.00	7.28E-04	0.40
1.41E-03	12069	0.99	1.32E-03	0.50
2.68E-03	11946	0.98	2.51E-03	0.54
5.02E-03	11823	0.97	4.76E-03	0.57
9.22E-03	11671	0.96	8.87E-03	0.57
1.57E-02	11520	0.95	1.48E-02	0.59
2.56E-02	11121	0.92	2.39E-02	0.79
4.24E-02	10489	0.86	3.91E-02	0.95
6.77E-02	9658	0.80	6.03E-02	1.60
1.05E-01	8791	0.72	8.92E-02	2.20

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

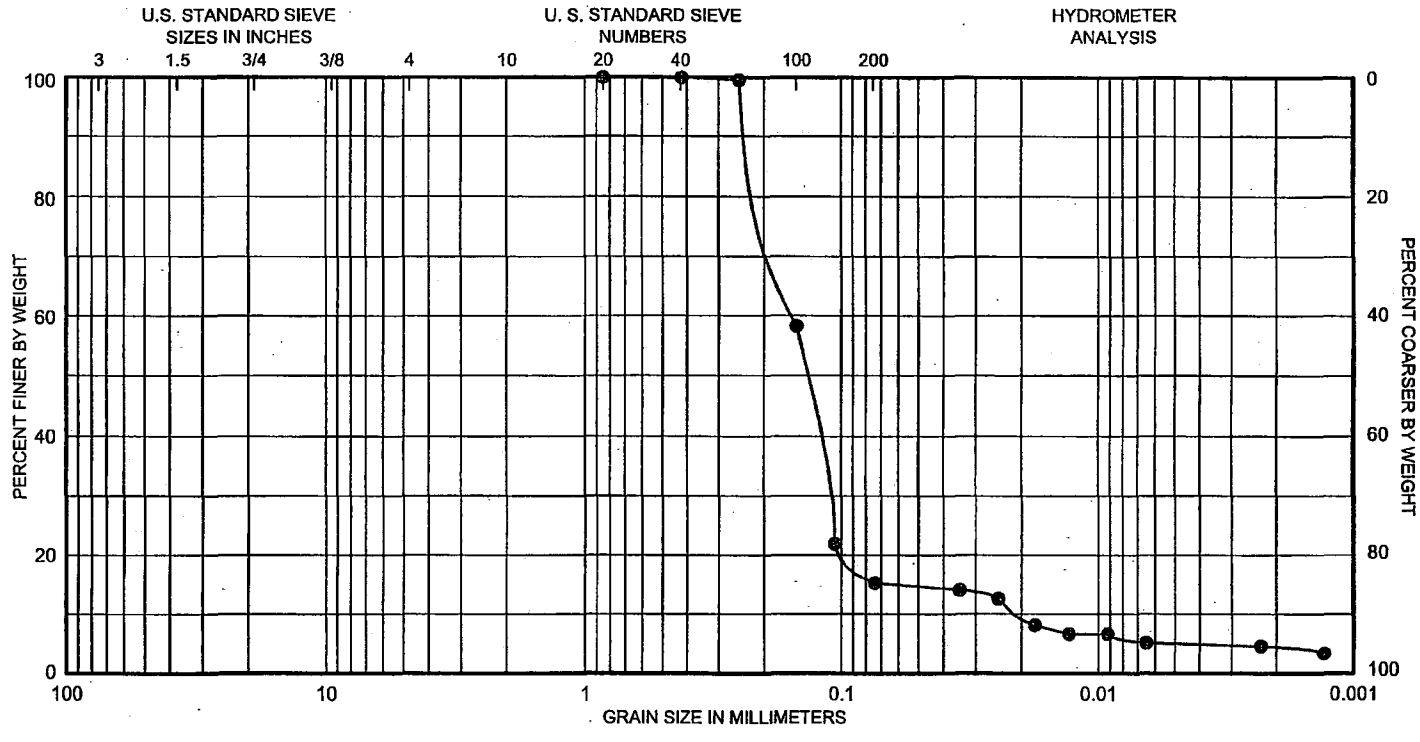
[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table E.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B305-UD18; Isotropic Confining Pressure, σ_o=455.0 psi (65.5 ksf = 3135 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D,	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D, %
---*	---*	---*	---*	---*	---*	---*	---*

*Data are NOT available. System compliance was suspected at the confining pressures of 455.0 psi during torsional shear tests, dynamic soil behavior could not be determined accordingly.

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-305-UD18	387.5	4.21	7.54	0.1386	0.22	

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX F

Specimen STP B305-UD25
CLAY (LL=67, PI=48)

Borehole B305
Sample UD25
Depth = 590.5 ft (180.0 m)
Total Unit Weight = 128.8 lb/ft^3
Water Content = 20.6 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 172.7 psi

FUGRO JOB #: 0401-1660
Testing Station: RC9

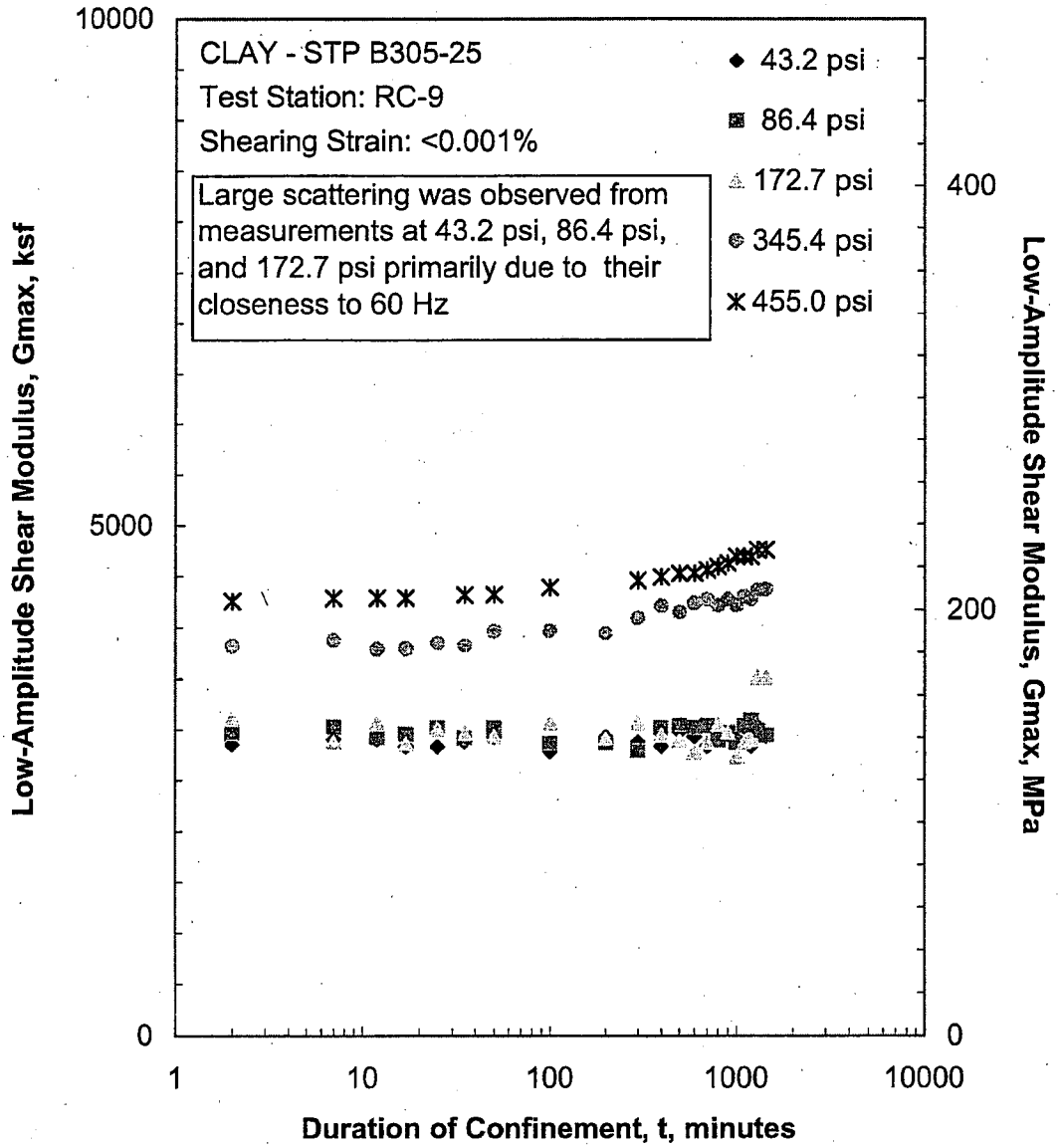


Figure F.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

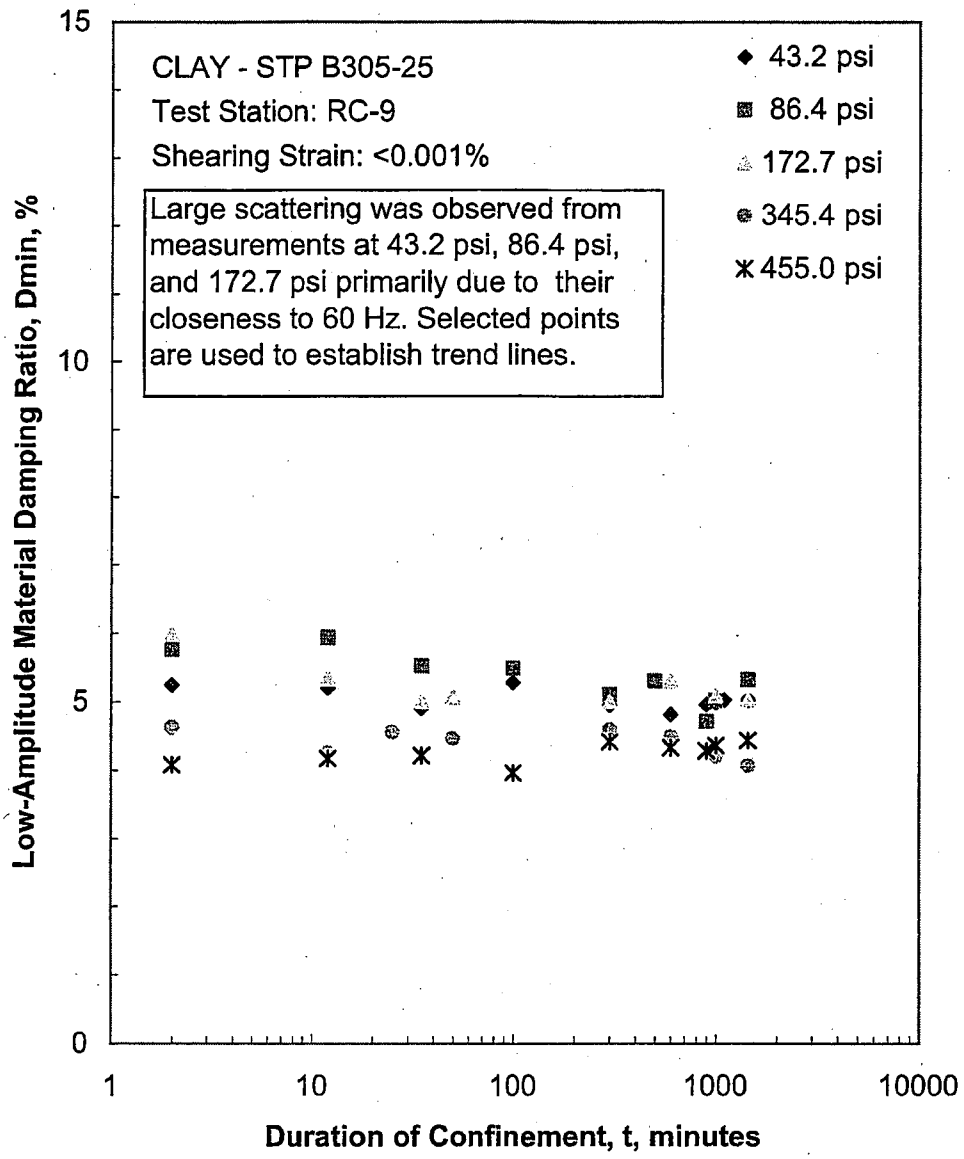


Figure F.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

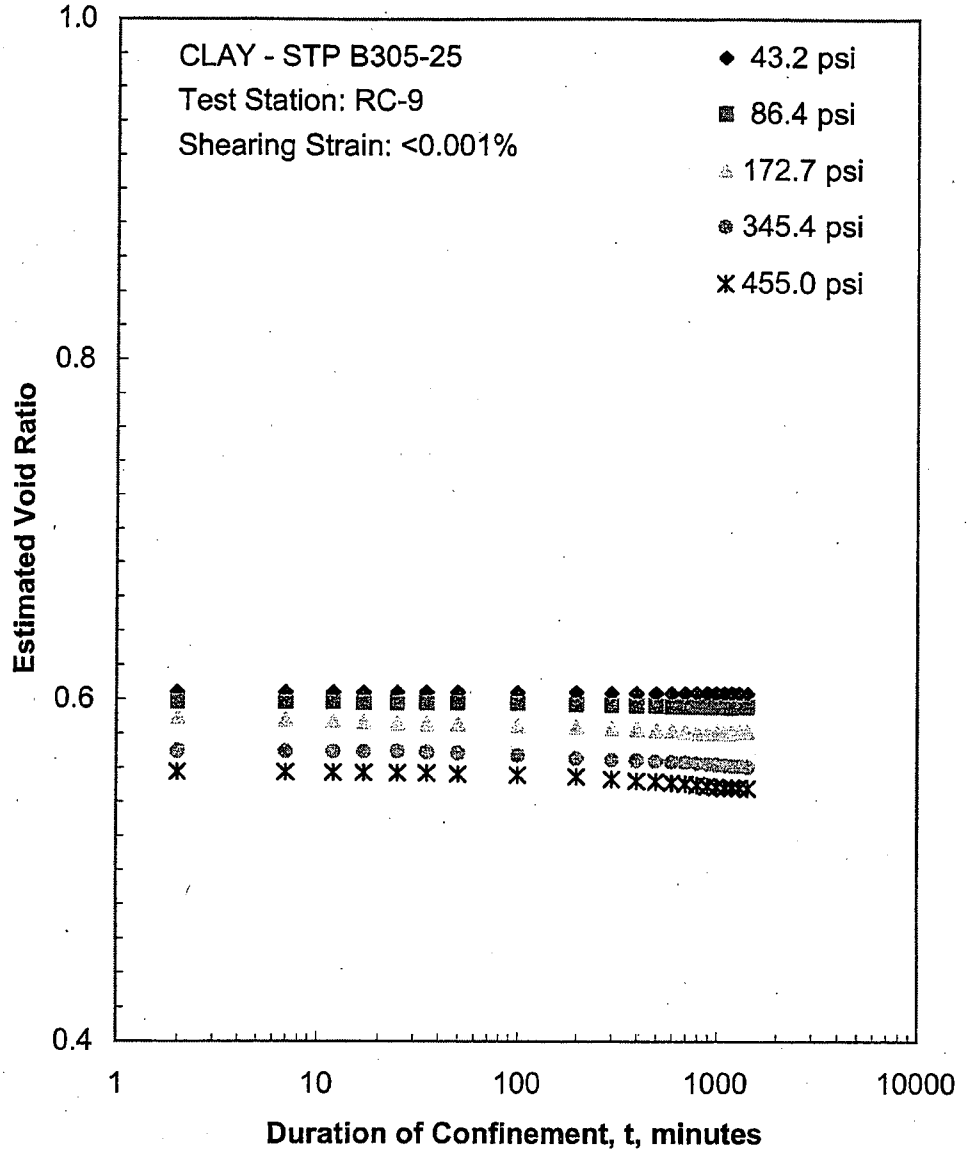


Figure F.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

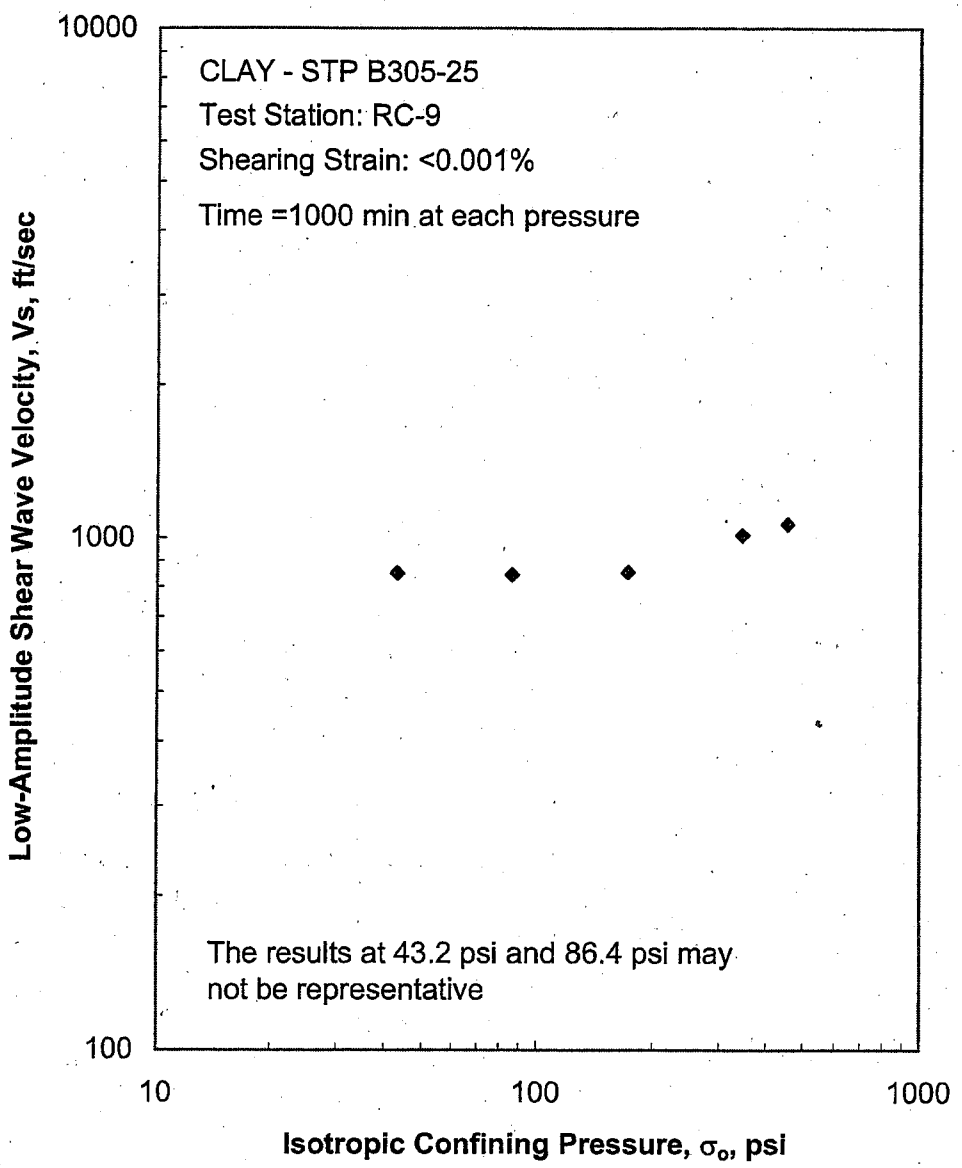


Figure F.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

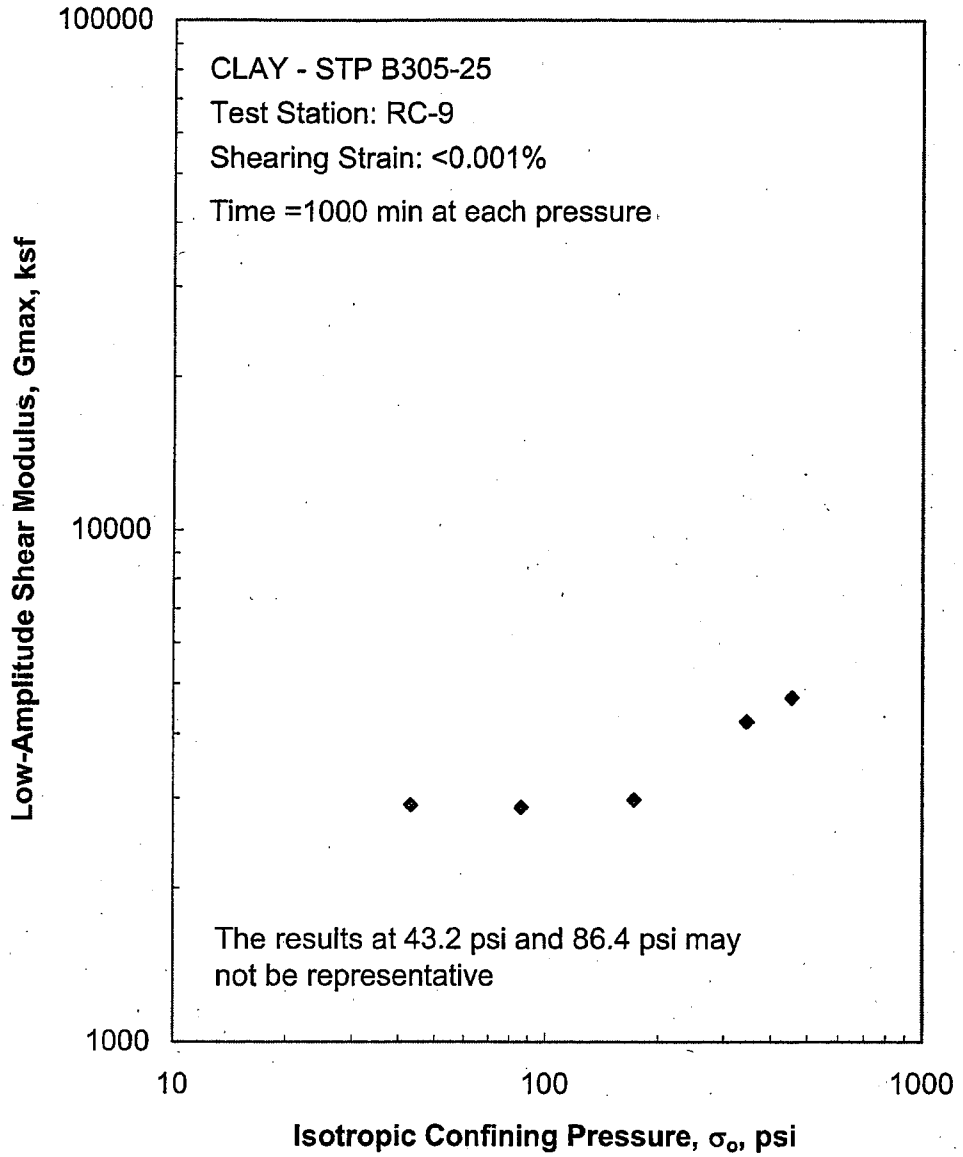


Figure F.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

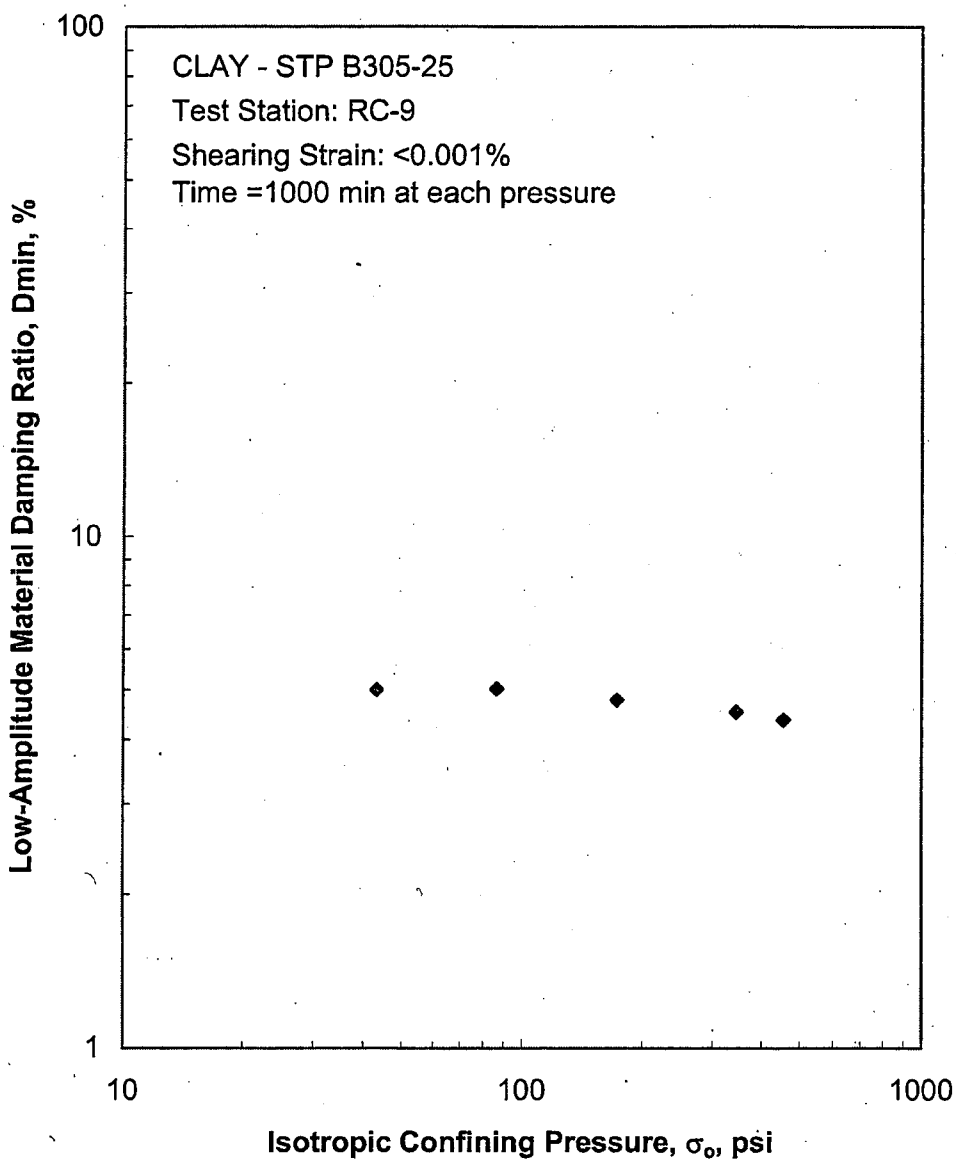


Figure F.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

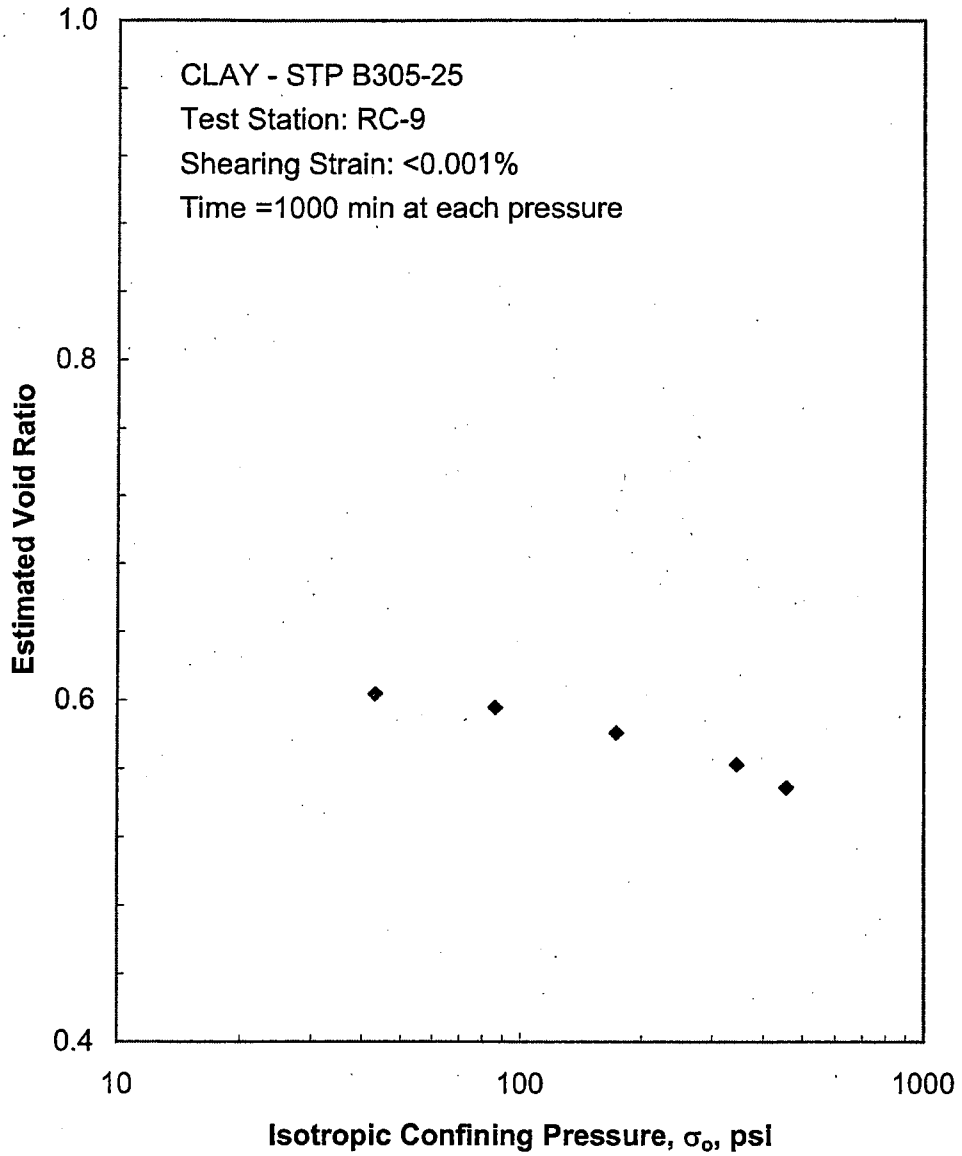


Figure F.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

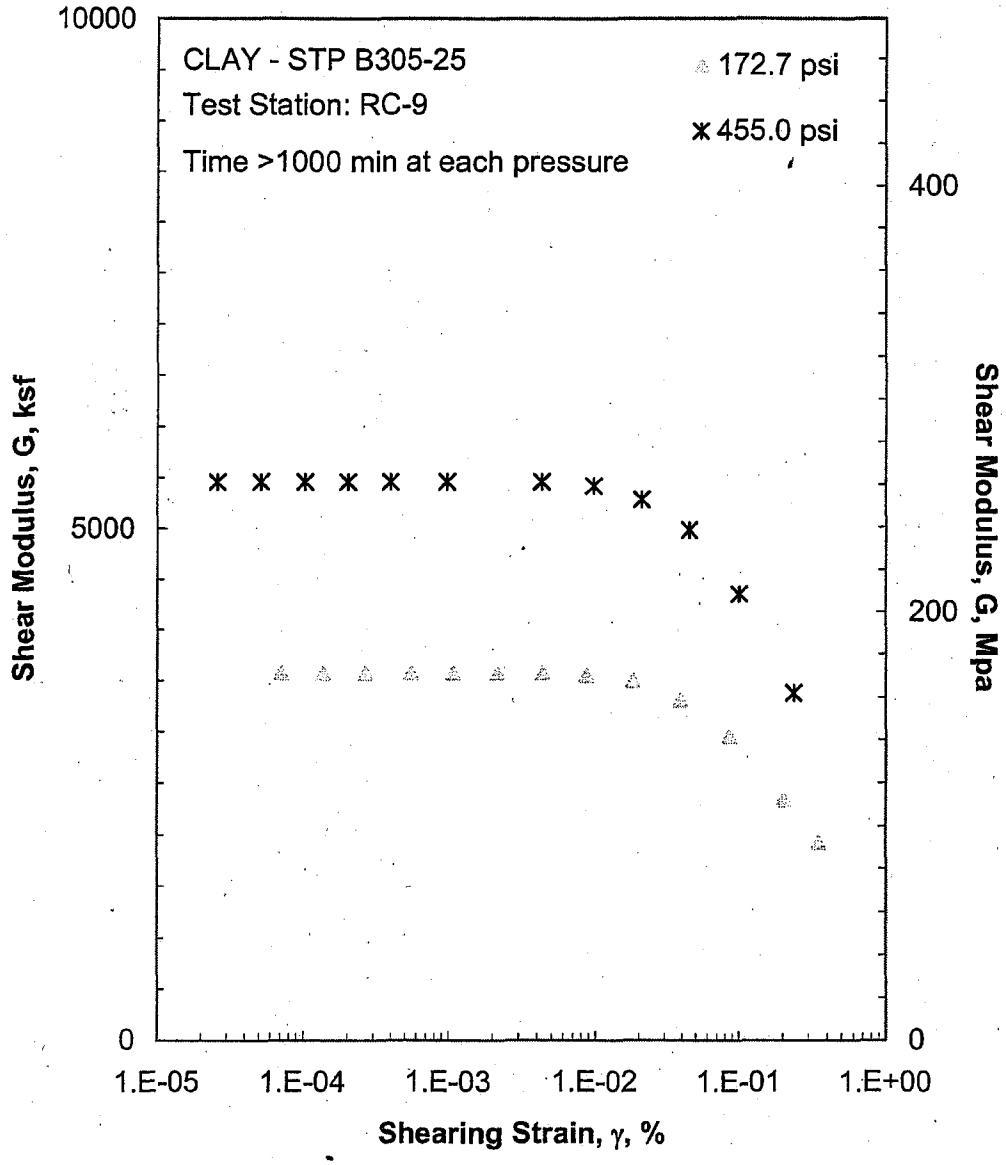


Figure F.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

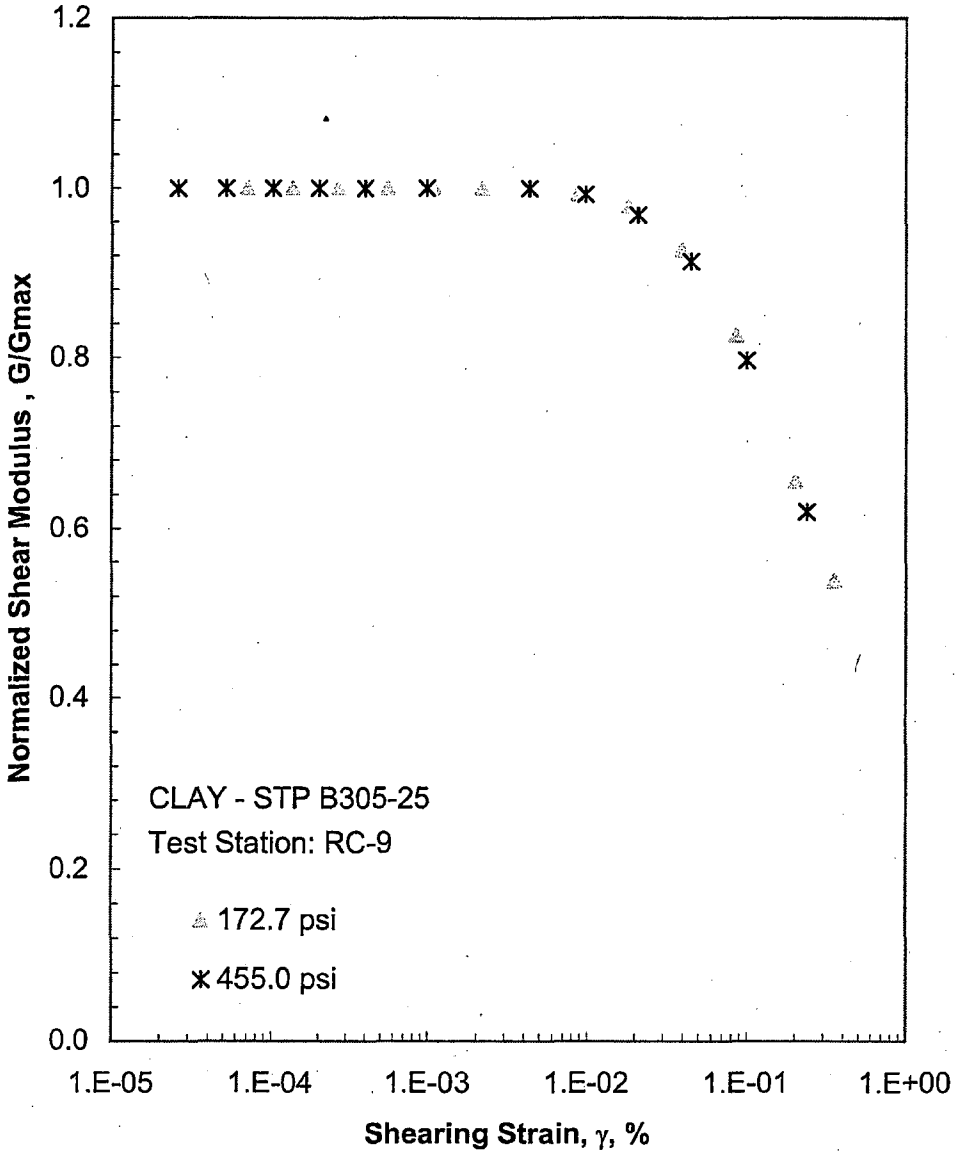


Figure F.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

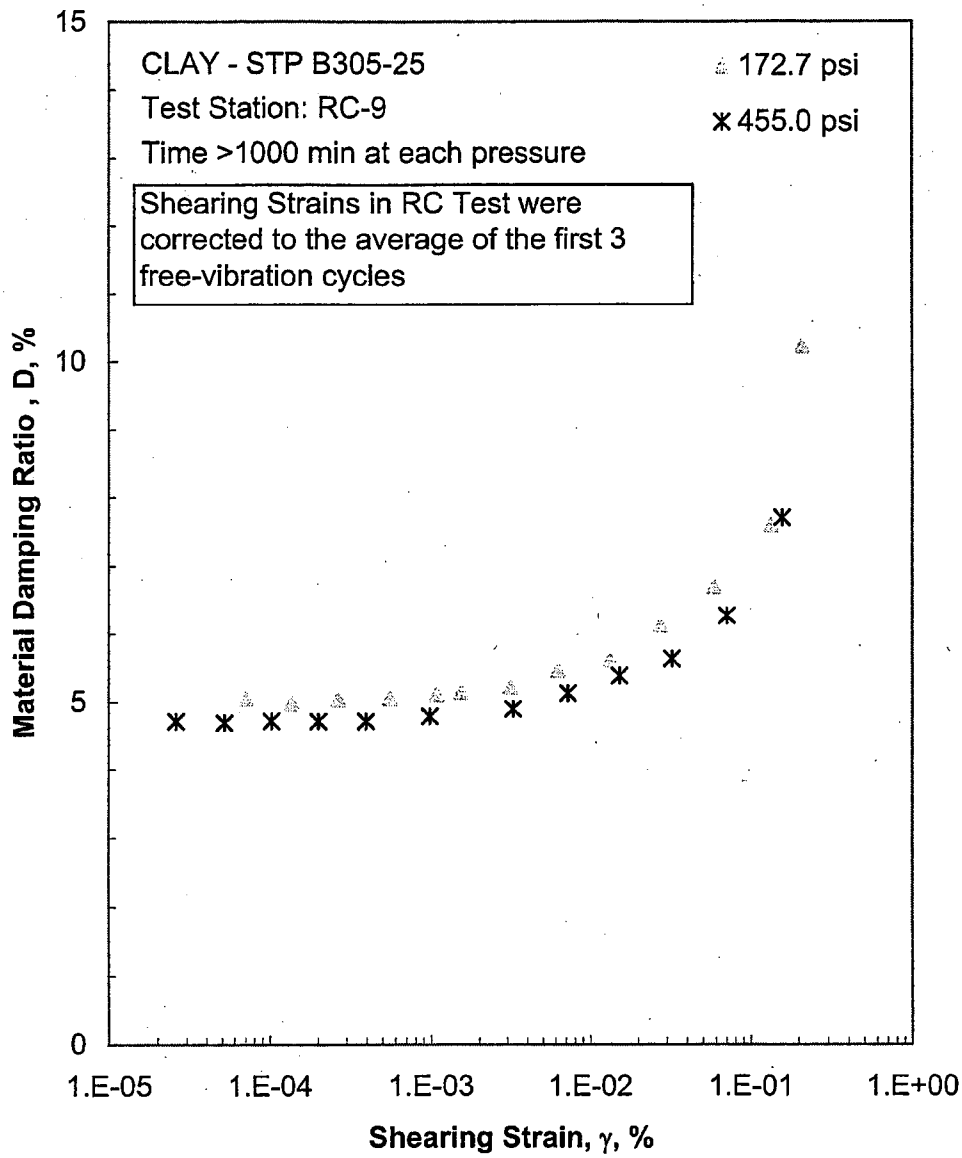


Figure F.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

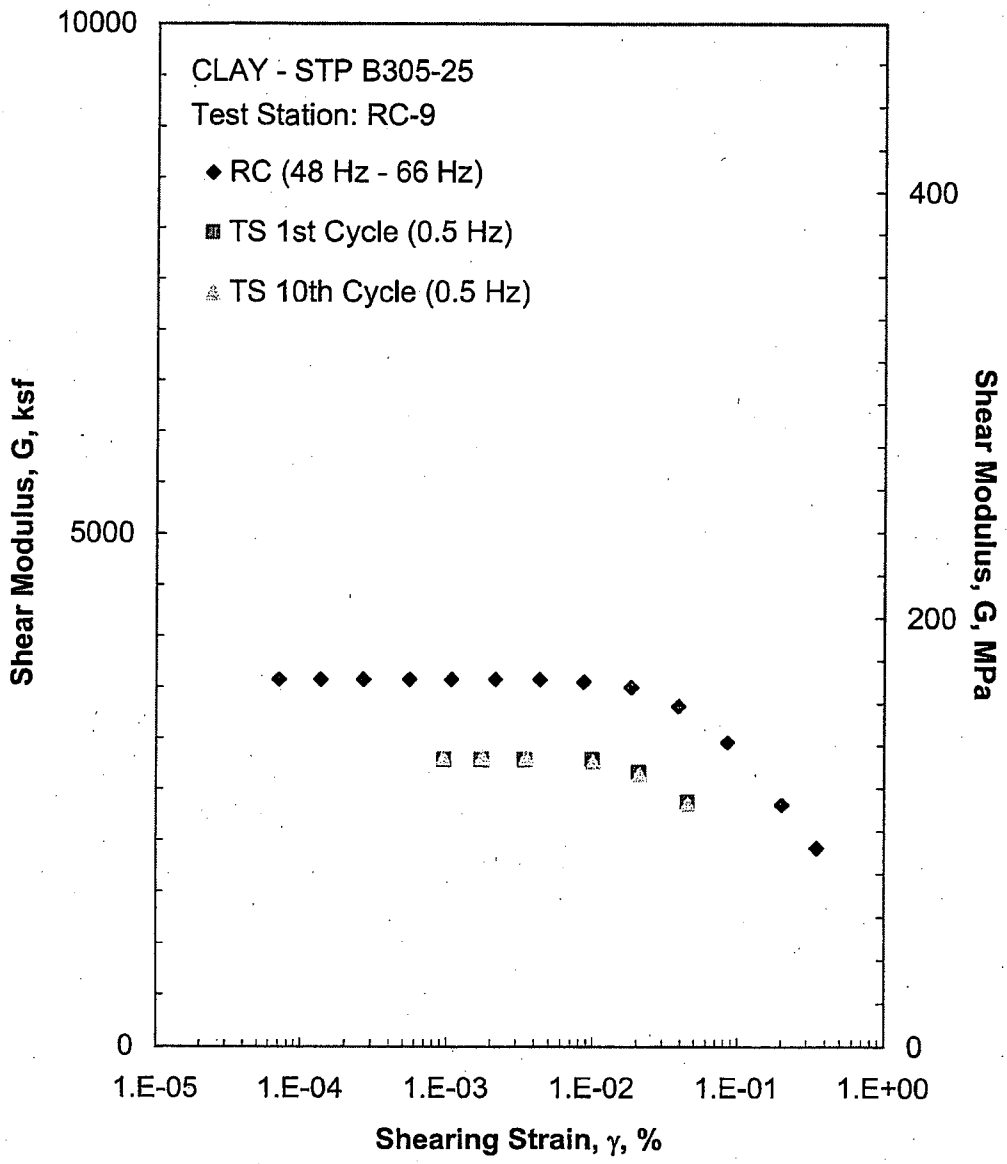


Figure F.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 172.7 psi from the Combined RCTS Tests

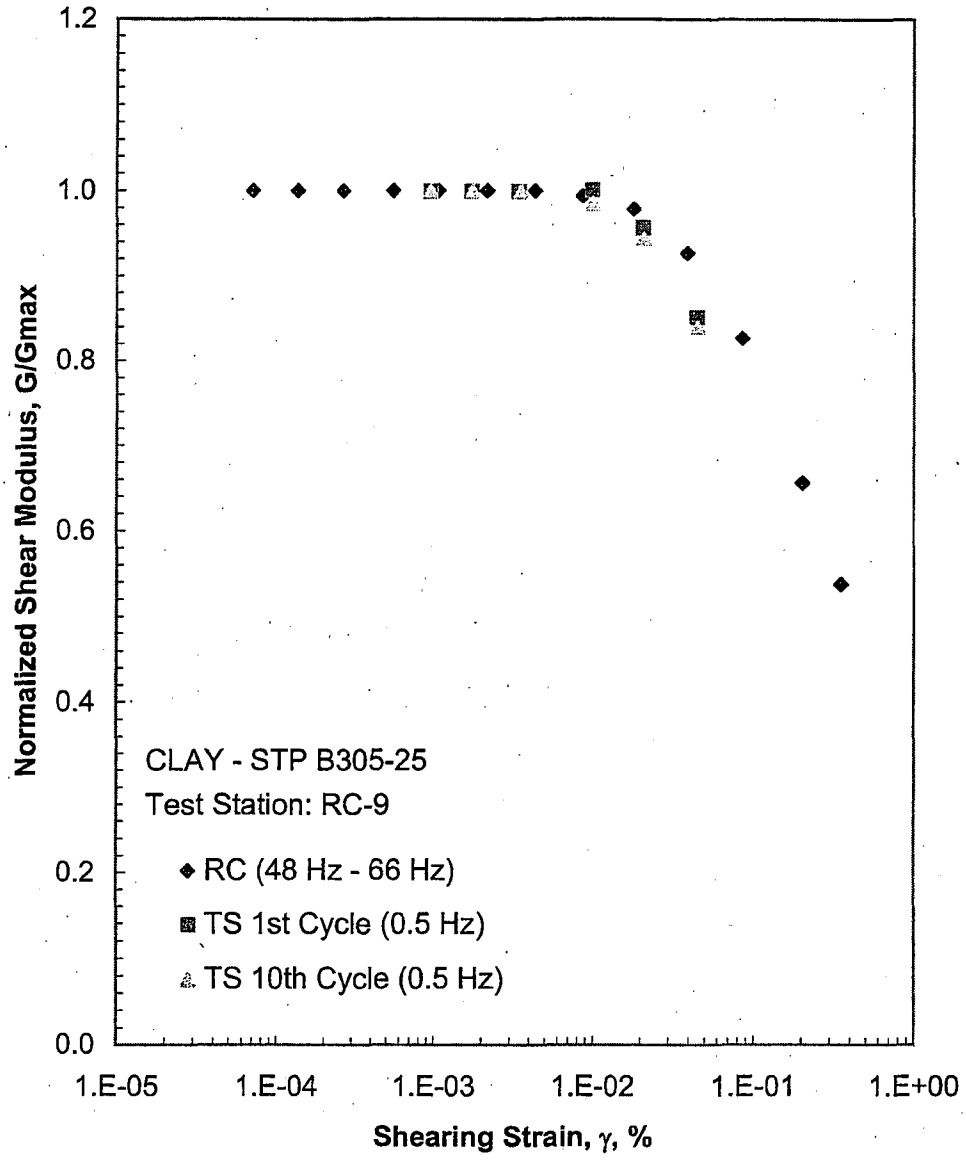


Figure F.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 172.7 psi from the Combined RCTS Tests

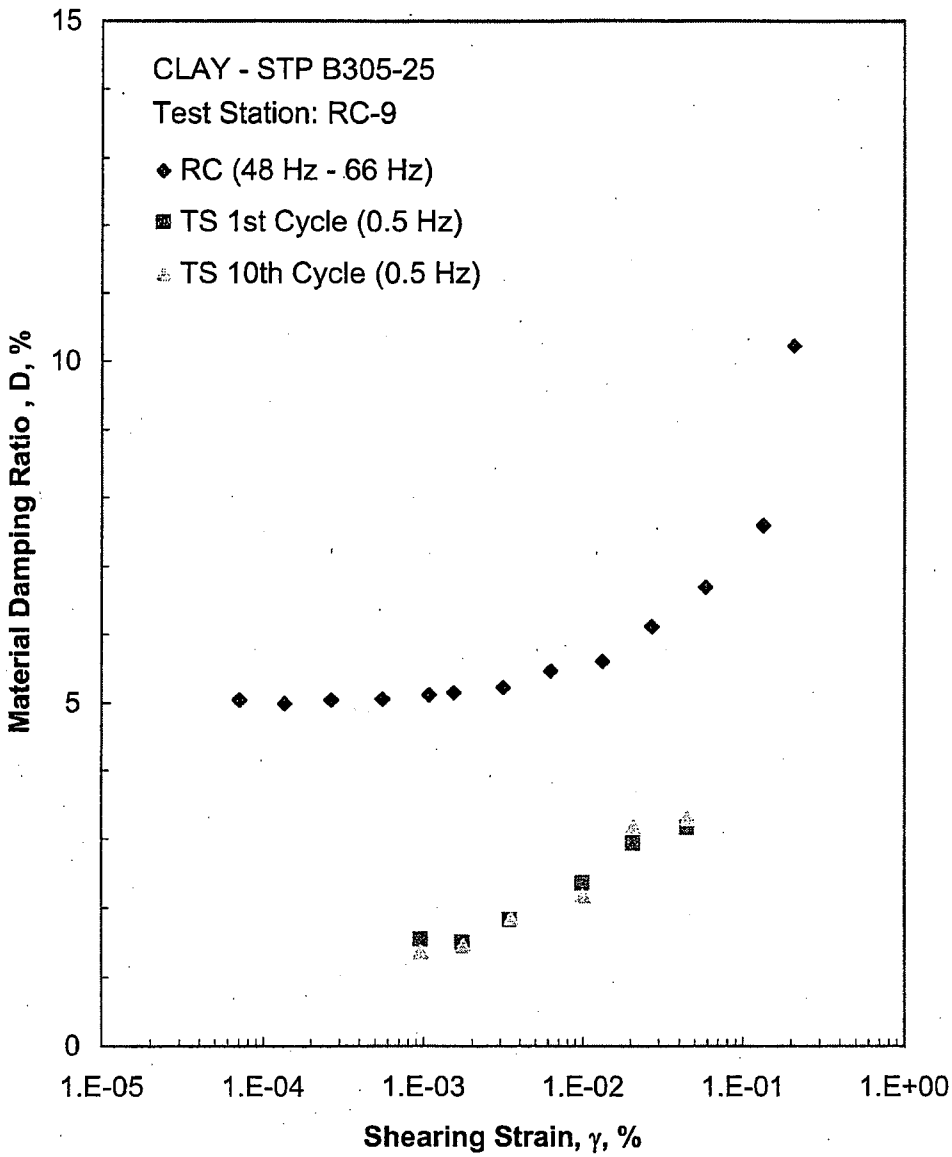


Figure F.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 172.7 psi from the Combined RCTS Tests

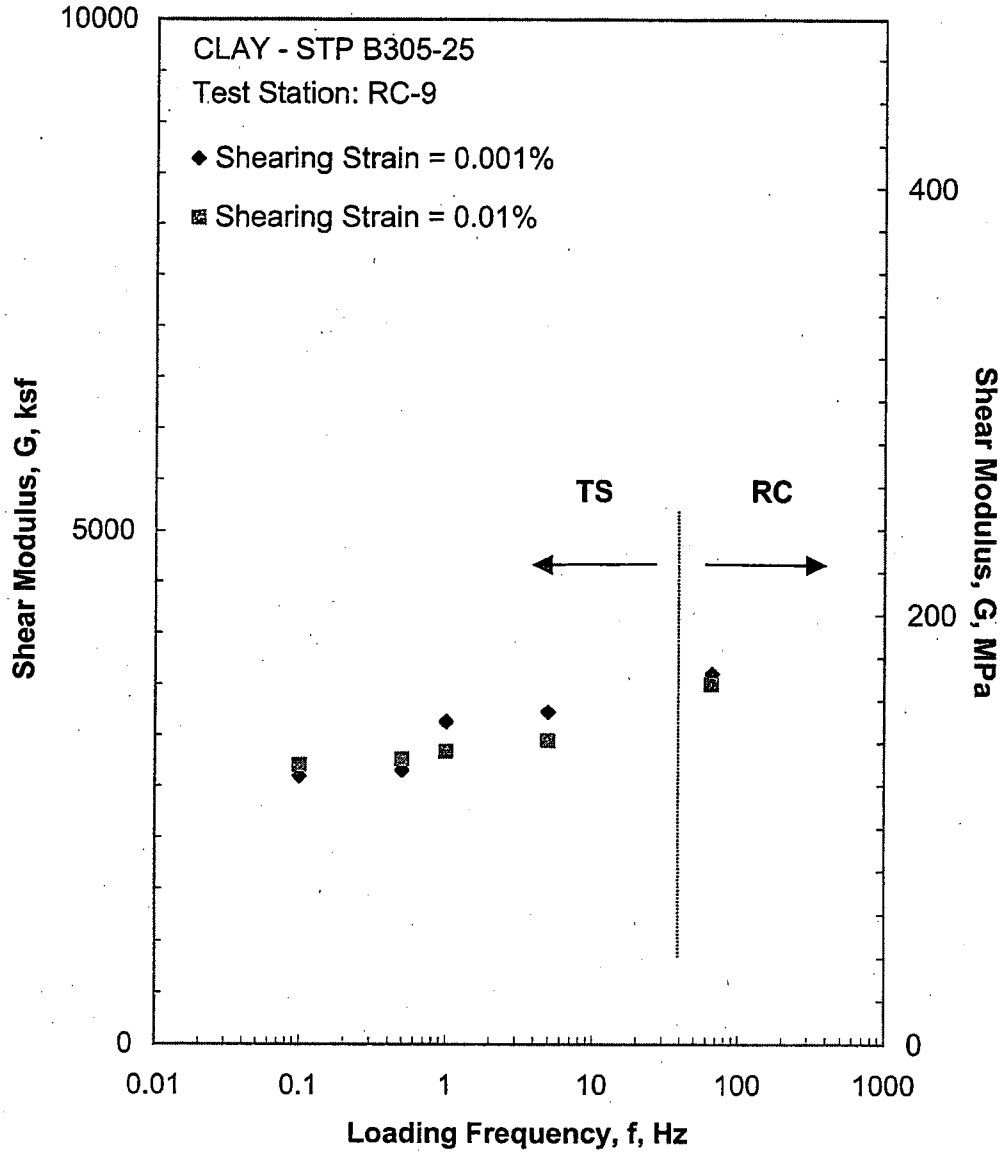


Figure F.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 172.7 psi from the Combined RCTS Tests

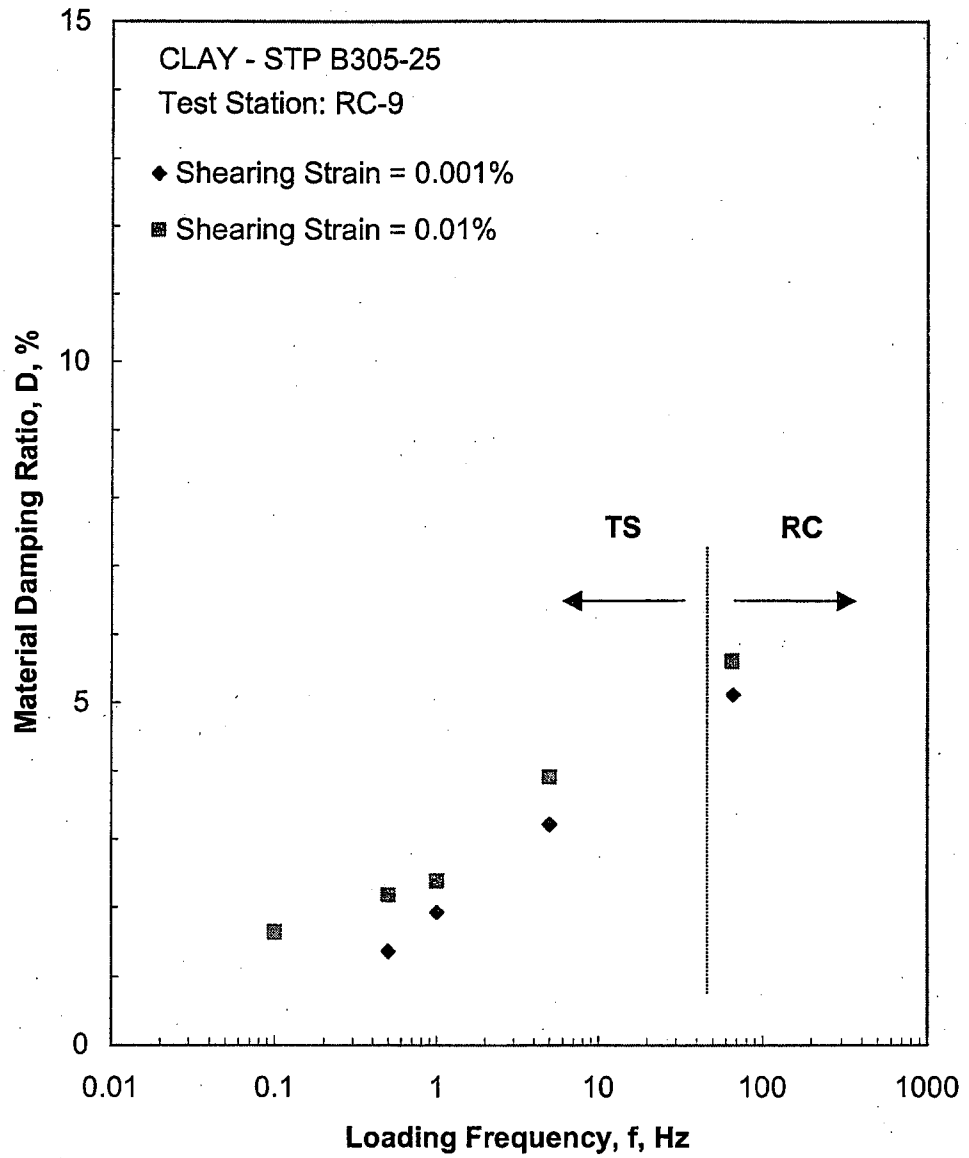


Figure F.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 172.7 psi from the Combined RCTS Tests

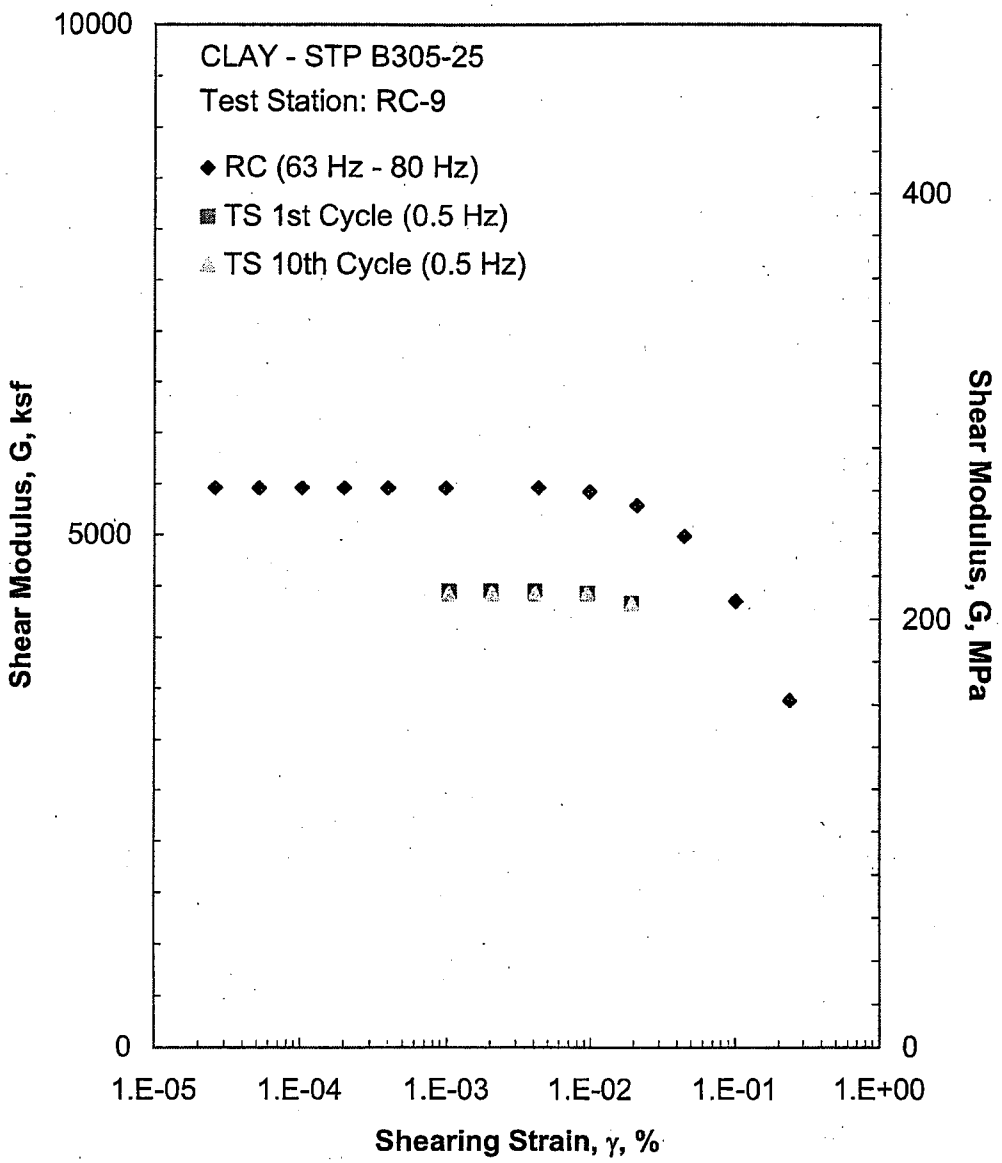


Figure F.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 455.0 psi from the Combined RCTS Tests

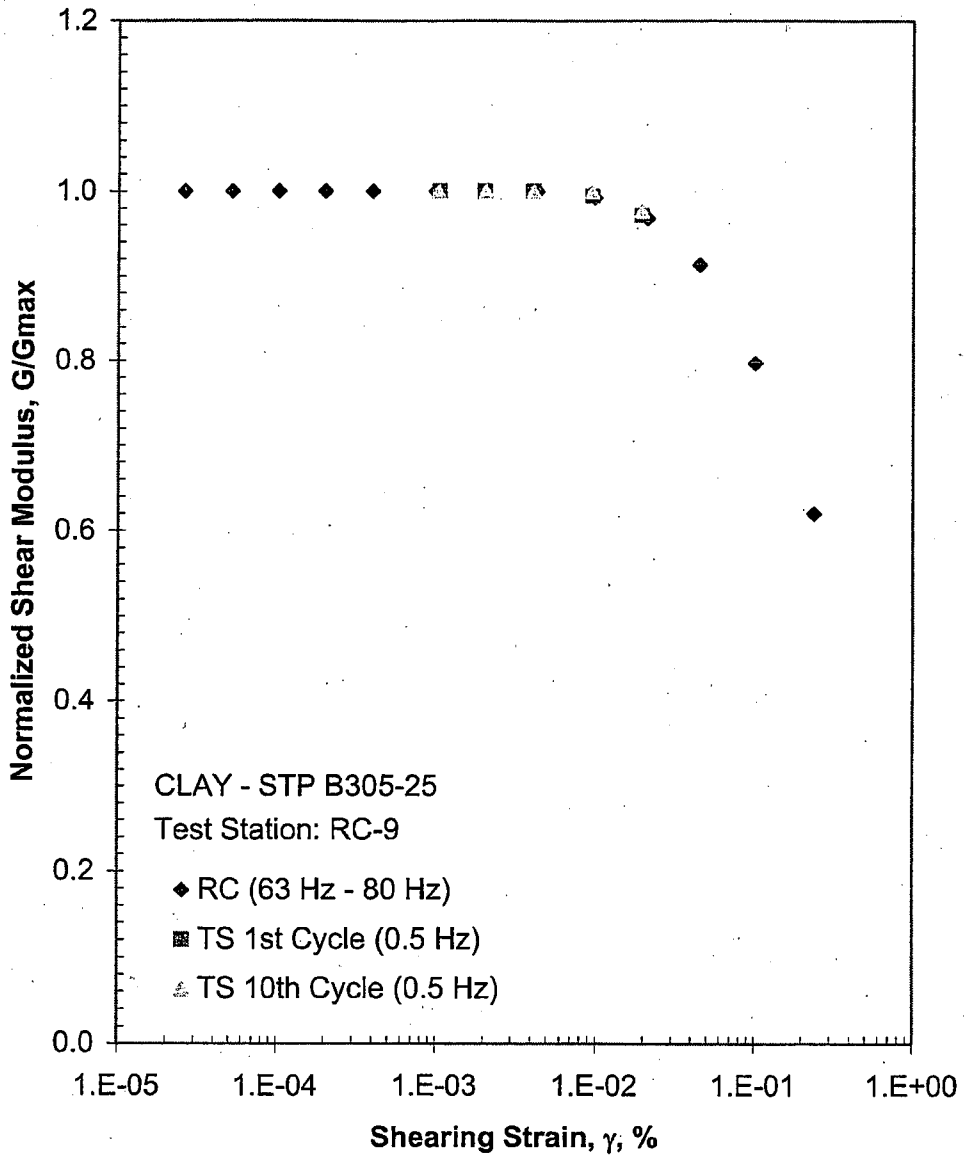


Figure F.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 455.0 psi from the Combined RCTS Tests

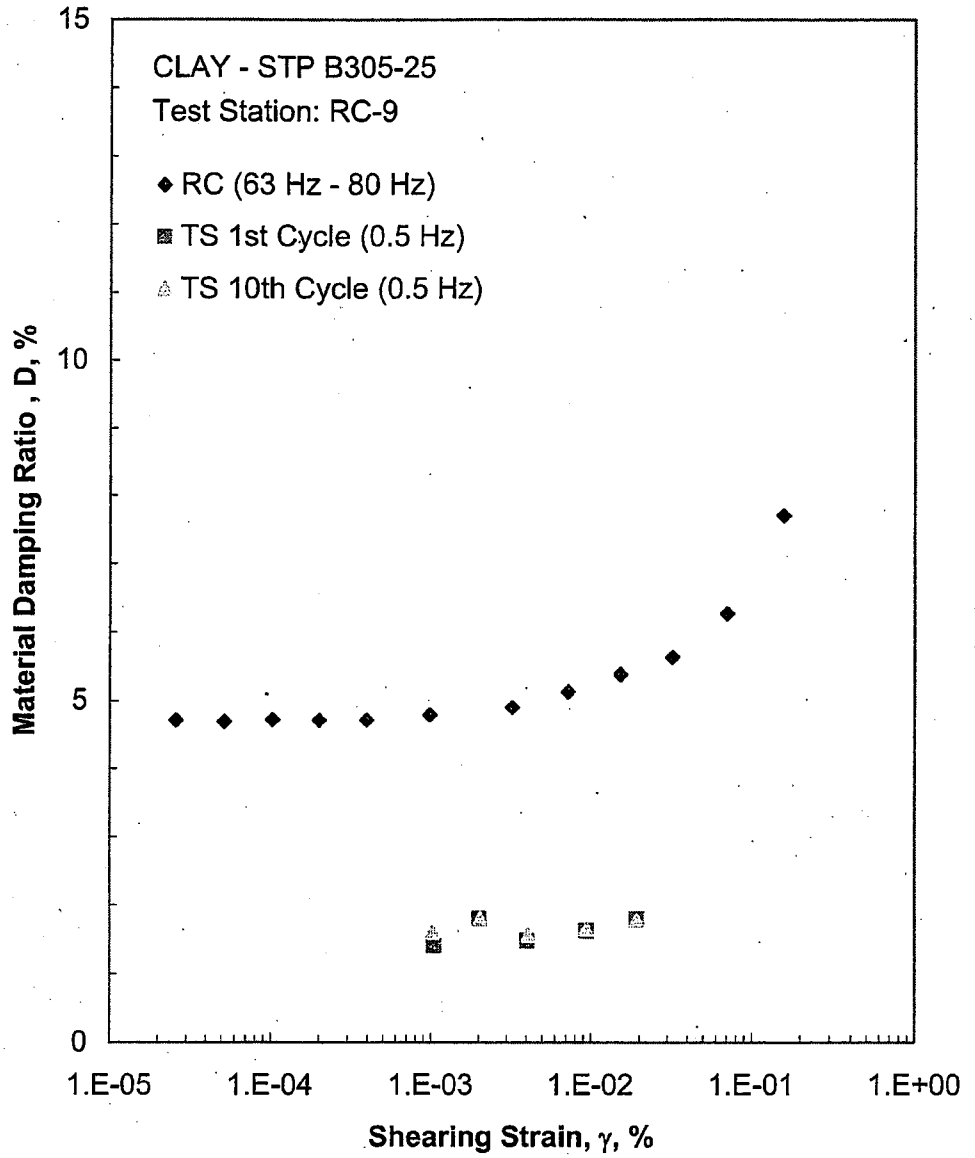


Figure F.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 455.0 psi from the Combined RCTS Tests

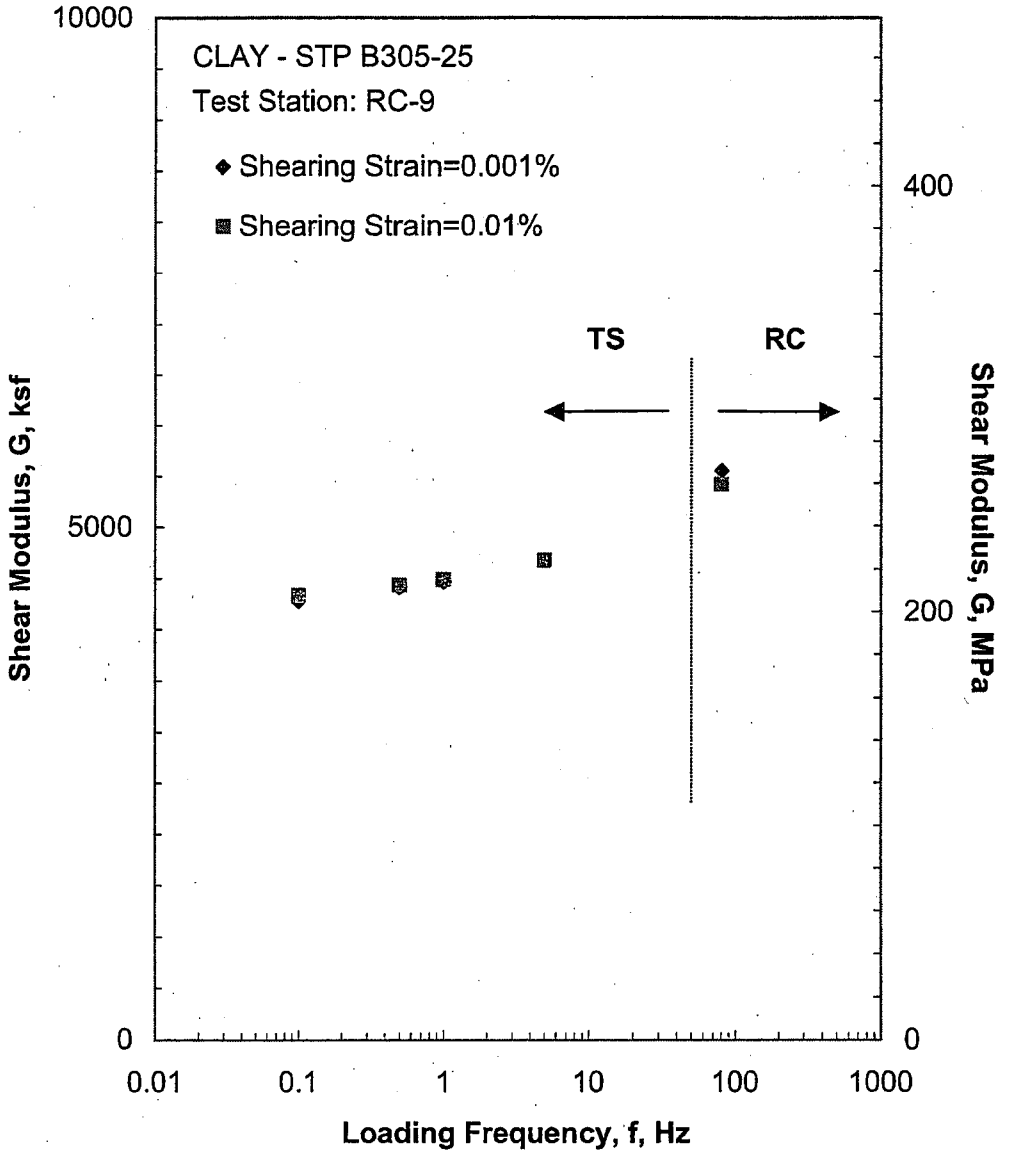


Figure F.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 455.0 psi from the Combined RCTS Tests

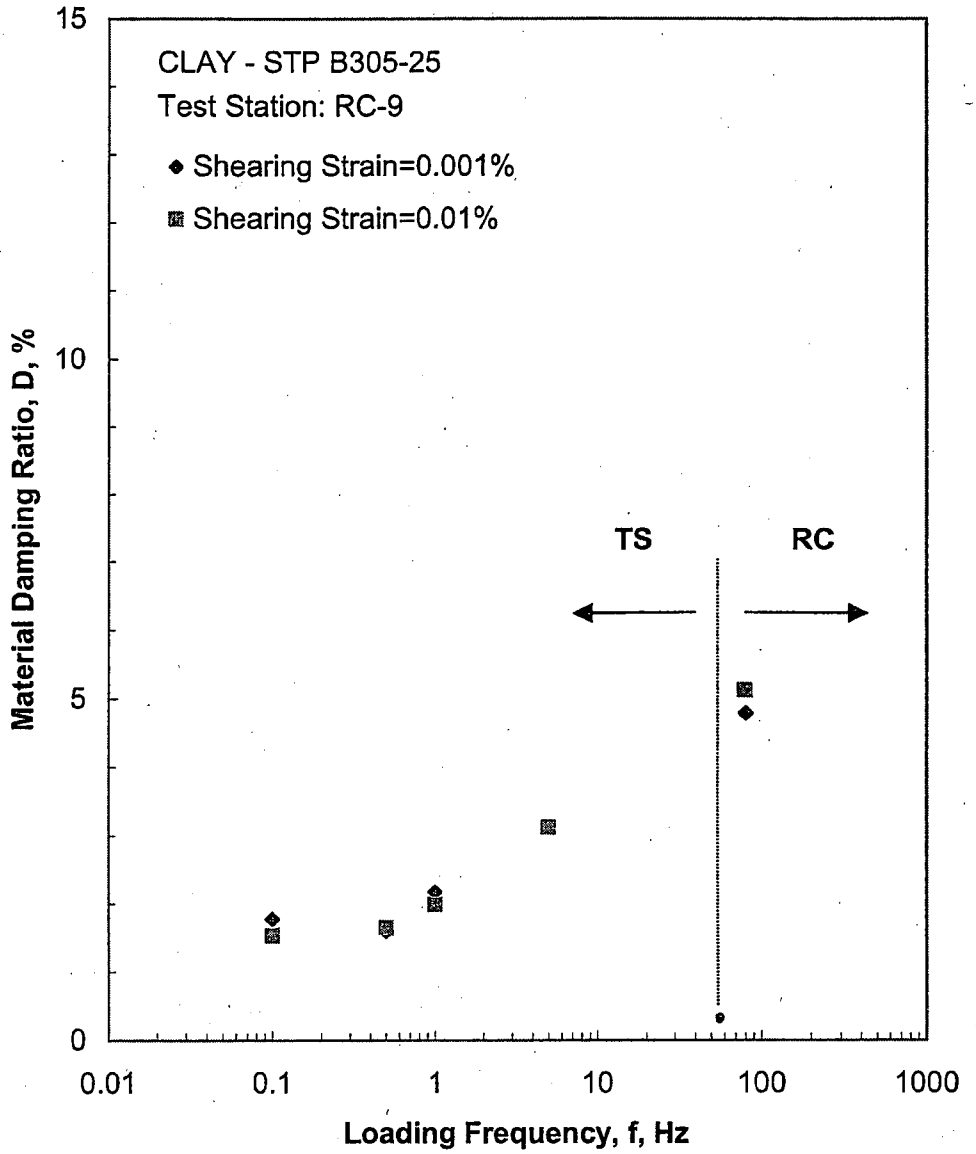


Figure F.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 455.0 psi from the Combined RCTS Tests

Table F.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B305-UD25

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
43.2	6221	298	2906	139	851	5.00	0.603
86.4	12442	595	2872	138	844	5.02	0.595
172.7	24869	1190	2973	143	854	4.78	0.580
345.4	49738	2380	4217	202	1012	4.53	0.562
455.0	65520	3135	4692	225	1063	4.37	0.549

Table F.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B305-UD25; Isoptropic Confining Pressure, σ_o=172.7 psi (24.9 ksf = 1190 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
7.10E-05	3575	1.00	7.10E-05	5.04
1.37E-04	3575	1.00	1.37E-04	4.99
2.67E-04	3575	1.00	2.67E-04	5.04
5.54E-04	3575	1.00	5.54E-04	5.05
1.08E-03	3575	1.00	1.08E-03	5.12
2.17E-03	3575	1.00	1.54E-03	5.15
4.34E-03	3575	1.00	3.13E-03	5.23
8.66E-03	3552	0.99	6.23E-03	5.46
1.82E-02	3498	0.98	1.33E-02	5.61
3.89E-02	3312	0.93	2.72E-02	6.12
8.56E-02	2954	0.83	5.82E-02	6.69
2.03E-01	2344	0.66	1.34E-01	7.60
3.49E-01	1923	0.54	2.10E-01	10.22

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table F.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B305-UD25; Isotropic Confining Pressure, σ_o=172.7 psi (24.9 ksf = 1190 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
9.58E-04	2784	1.00	1.55	9.57E-04	2805	1.00	1.36
1.74E-03	2784	1.00	1.50	1.76E-03	2805	1.00	1.46
3.43E-03	2784	1.00	1.83	3.52E-03	2805	1.00	1.85
9.94E-03	2787	1.00	2.36	1.00E-02	2761	0.98	2.17
2.08E-02	2665	0.96	2.94	2.09E-02	2646	0.94	3.17
4.47E-02	2370	0.85	3.17	4.52E-02	2352	0.84	3.30

Table F.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B305-UD25; Isoptropic Confining Pressure, σ_o= 455.0 psi (65.5 ksf = 3135 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
2.60E-05	5456	1.00	2.60E-05	4.72
5.20E-05	5456	1.00	5.20E-05	4.69
1.03E-04	5456	1.00	1.03E-04	4.72
2.02E-04	5456	1.00	2.02E-04	4.72
3.97E-04	5456	1.00	3.97E-04	4.72
9.85E-04	5456	1.00	9.85E-04	4.79
4.29E-03	5456	1.00	3.26E-03	4.90
9.75E-03	5416	0.99	7.22E-03	5.13
2.09E-02	5281	0.97	1.53E-02	5.38
4.47E-02	4981	0.91	3.22E-02	5.63
1.01E-01	4348	0.80	7.06E-02	6.27
2.39E-01	3381	0.62	1.58E-01	7.71

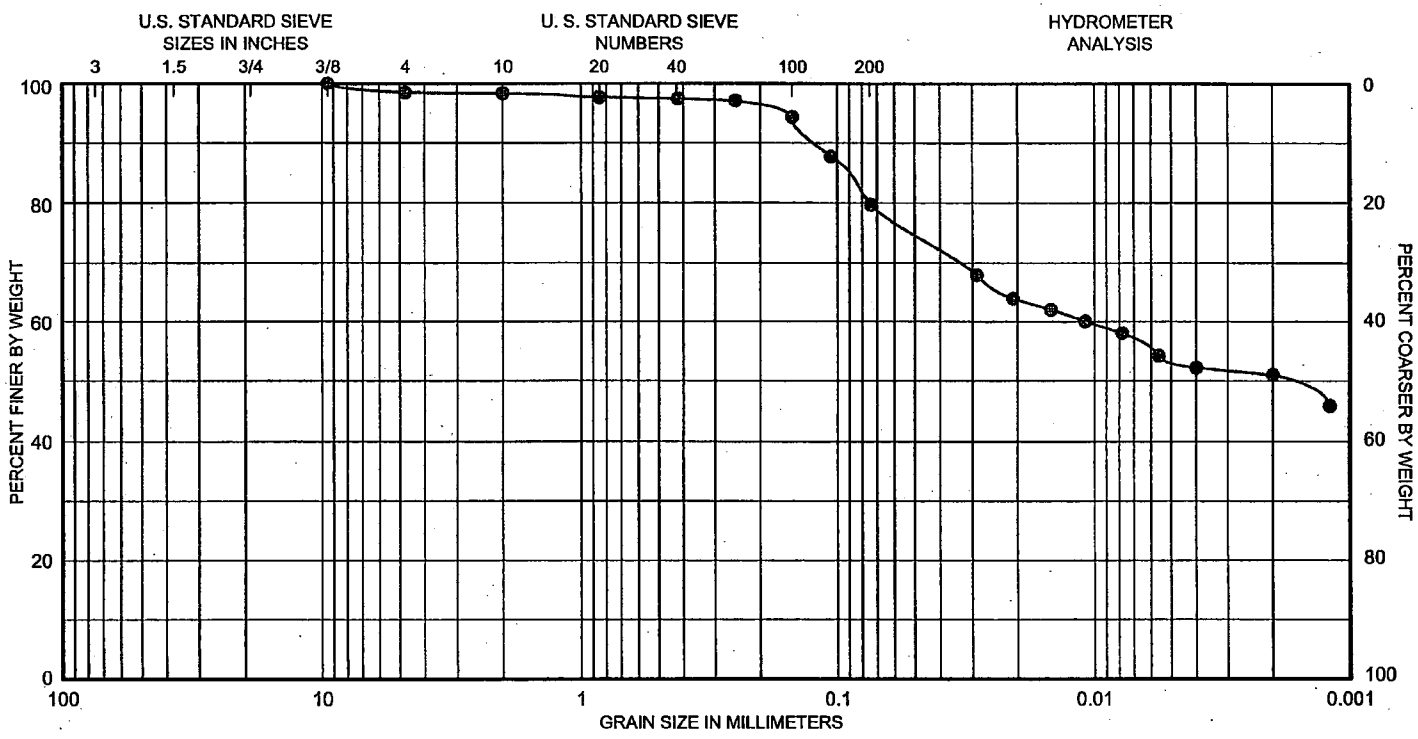
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table F.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B305-UD25; Isotropic Confining Pressure, σ_o=455.0 psi (65.5 ksf = 3135 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D,	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D, %
1.04E-03	4452	1.00	1.40	1.03E-03	4429	1.00	1.59
2.01E-03	4452	1.00	1.80	2.04E-03	4429	1.00	1.80
4.06E-03	4452	1.00	1.47	4.08E-03	4429	1.00	1.55
9.41E-03	4428	0.99	1.63	9.39E-03	4429	1.00	1.65
1.93E-02	4327	0.97	1.79	1.93E-02	4327	0.98	1.78

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-305A-UD25	590.5			0.0018	0.12	Clay, gray and brown, with carbonate nodules and silt pockets

GRAIN SIZE CURVE

Report No. 0401-1660

PLATE 1

APPENDIX G

Specimen STP B405-UD4
CLAY (LL=60, PI=41)

Borehole B405
Sample UD4
Depth = 85 ft (25.9 m)
Total Unit Weight = 131.0 lb/ft^3
Water Content = 22.6 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 26.4 psi

FUGRO JOB #: 0401-1660
Testing Station: RC8

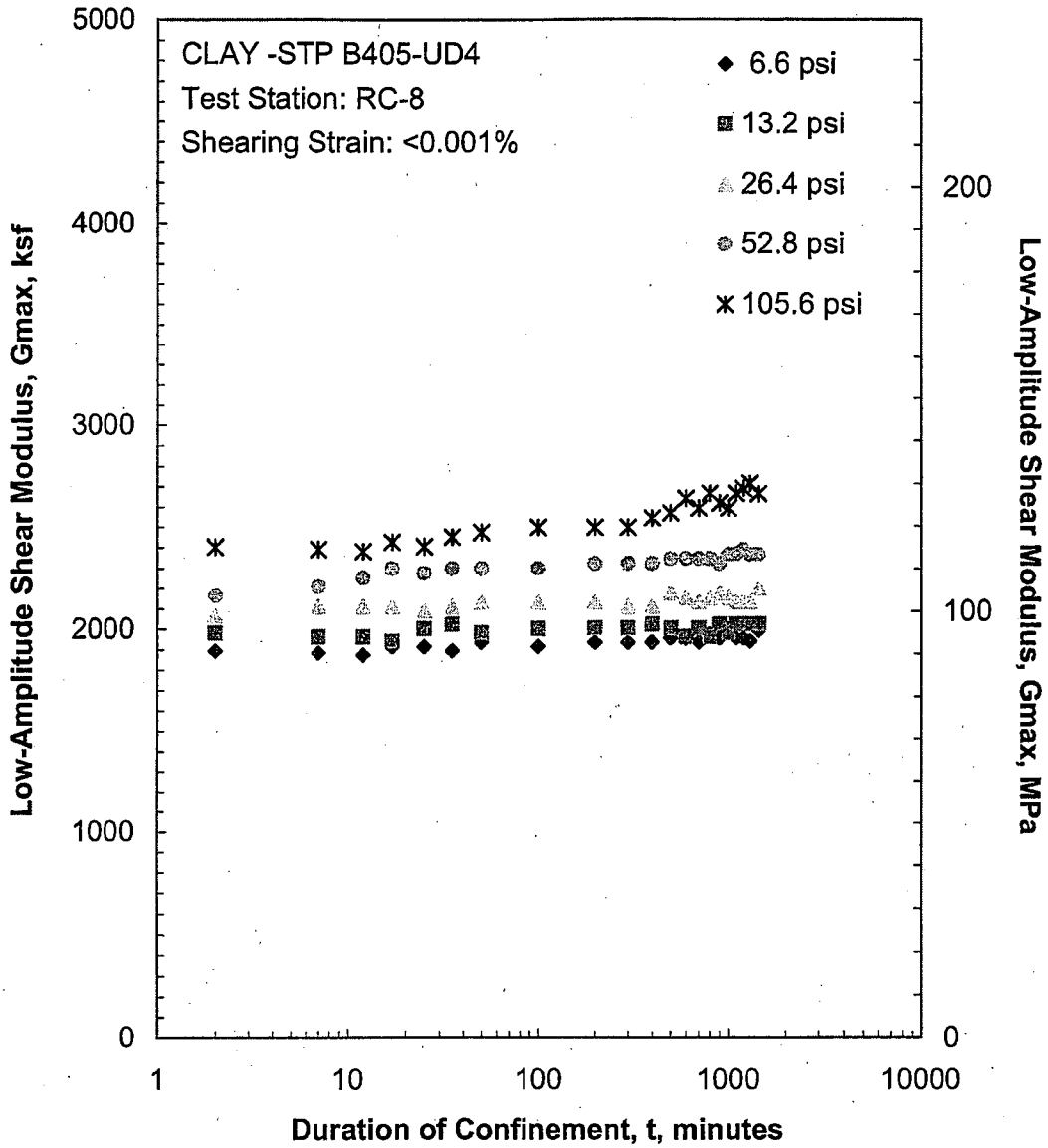


Figure G.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

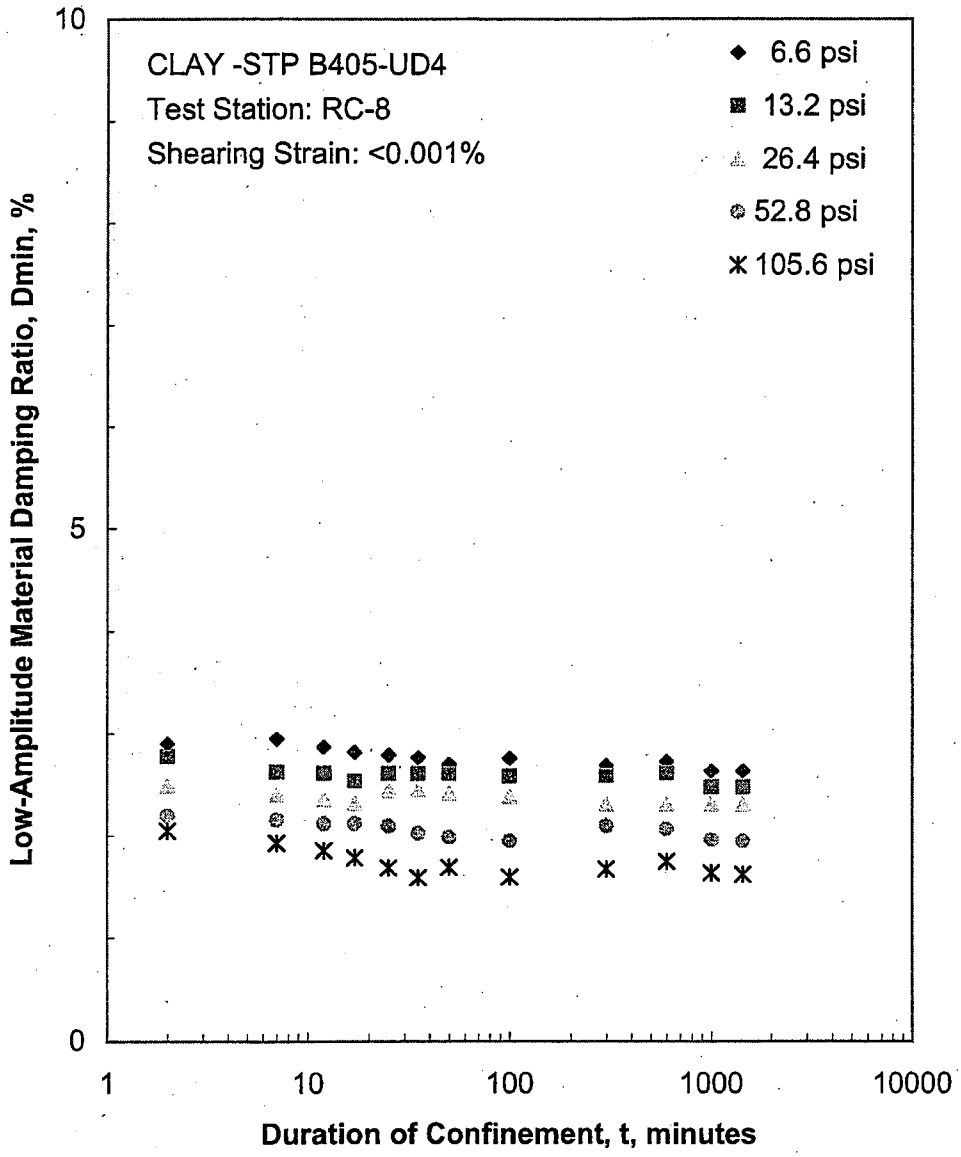


Figure G.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

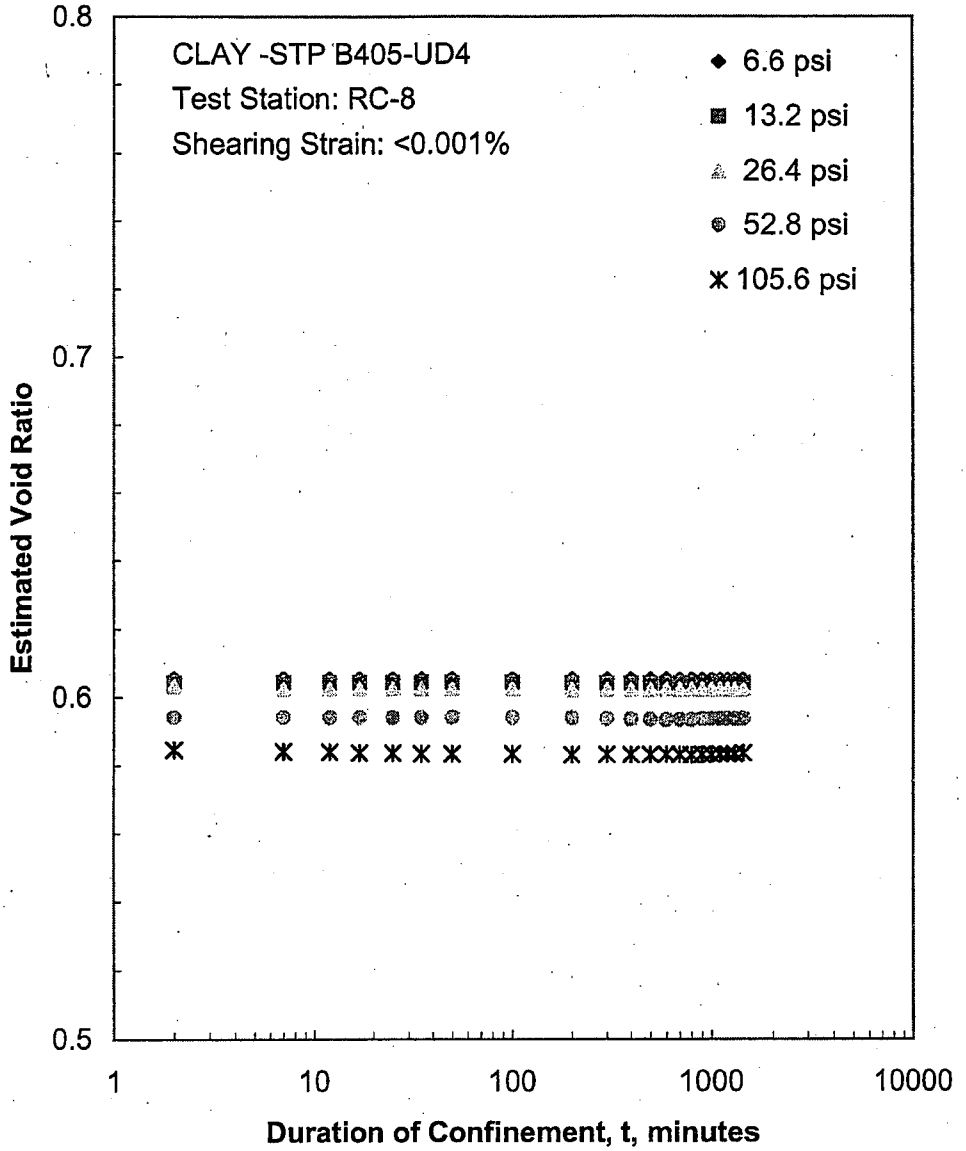


Figure G.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

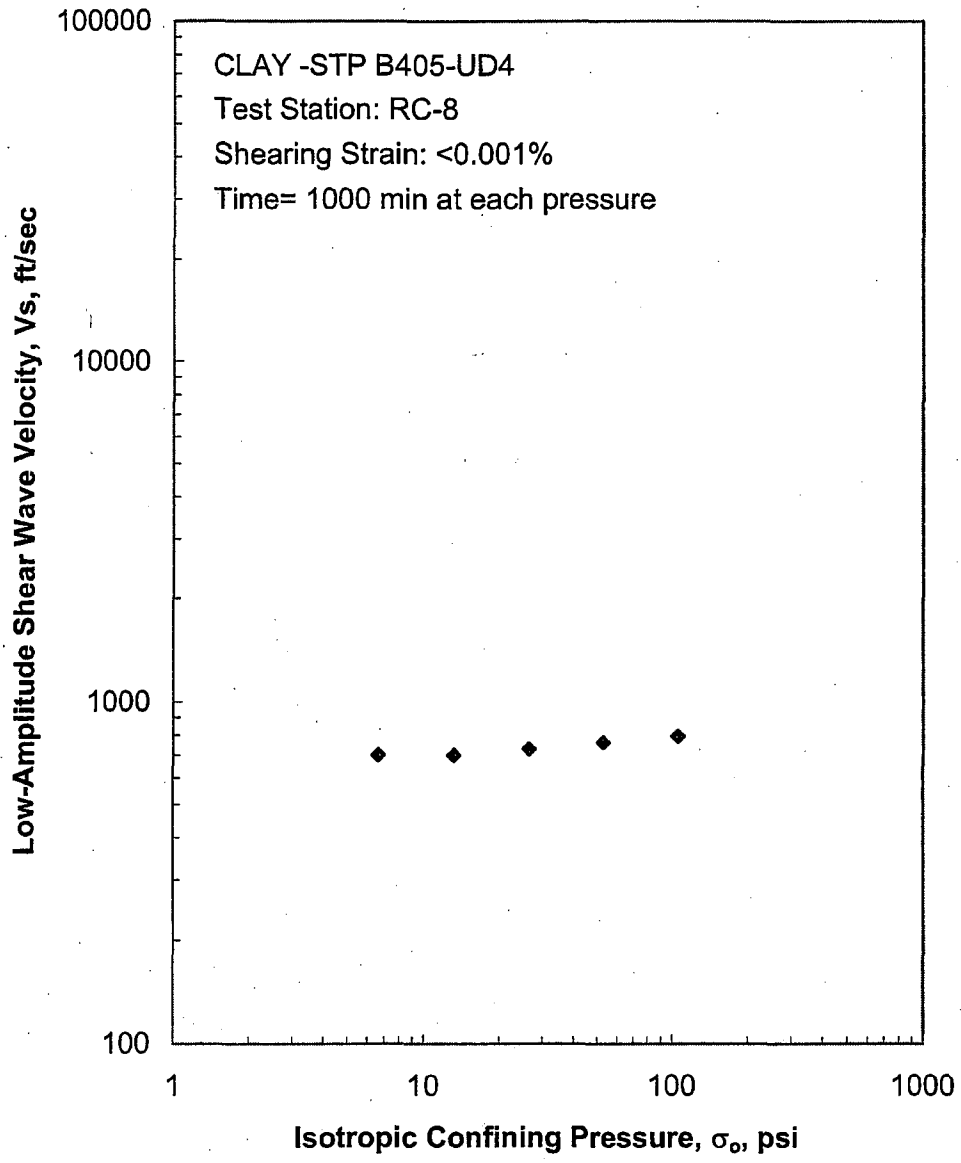


Figure G.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

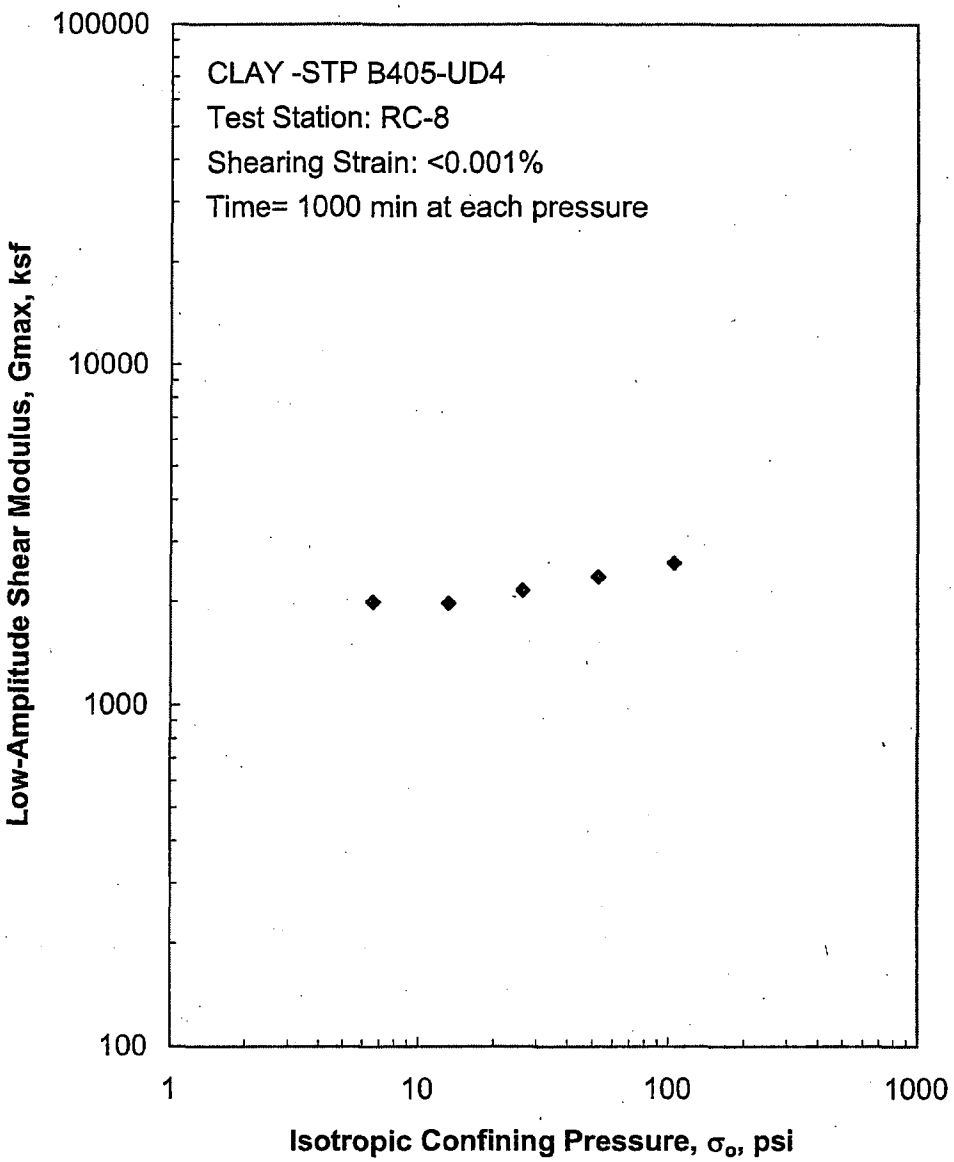


Figure G.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

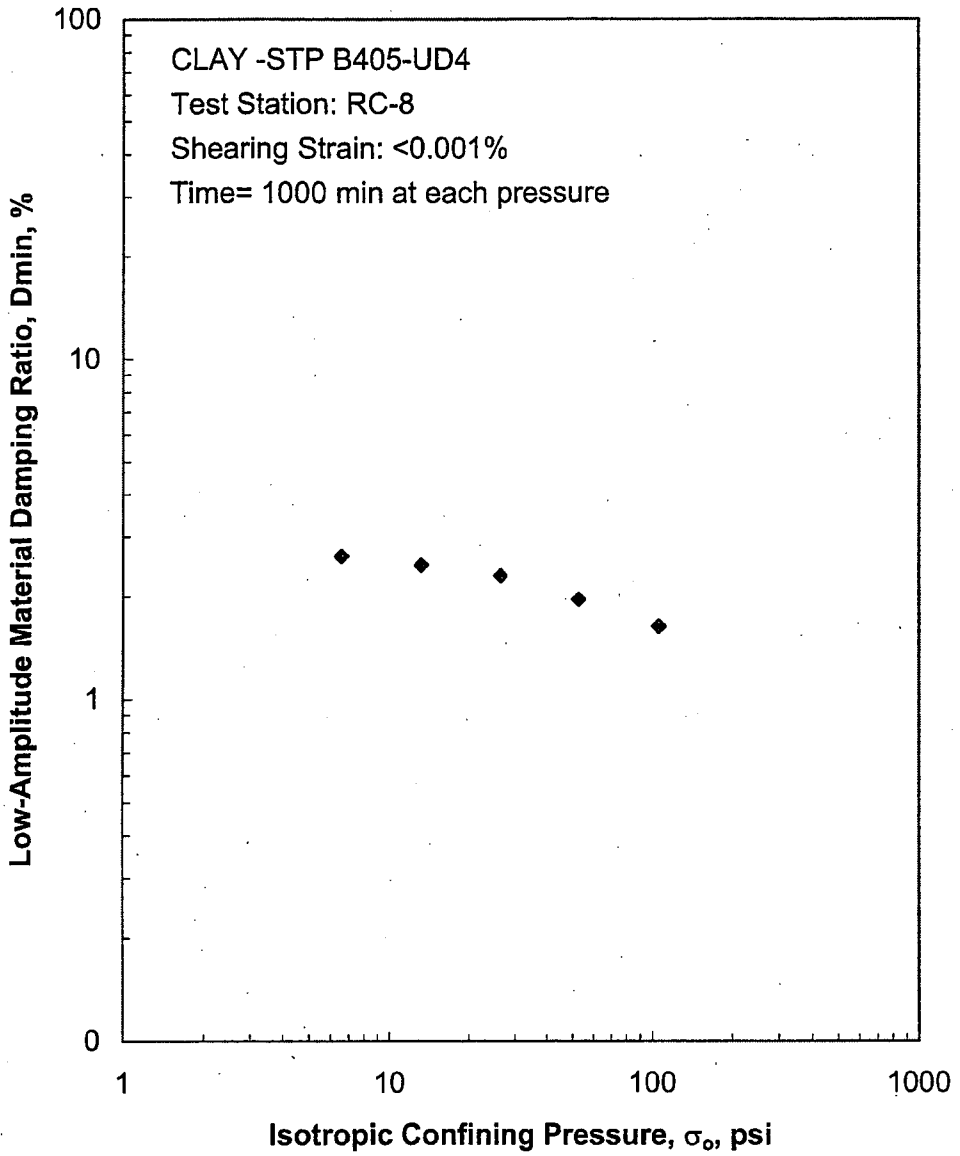


Figure G.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

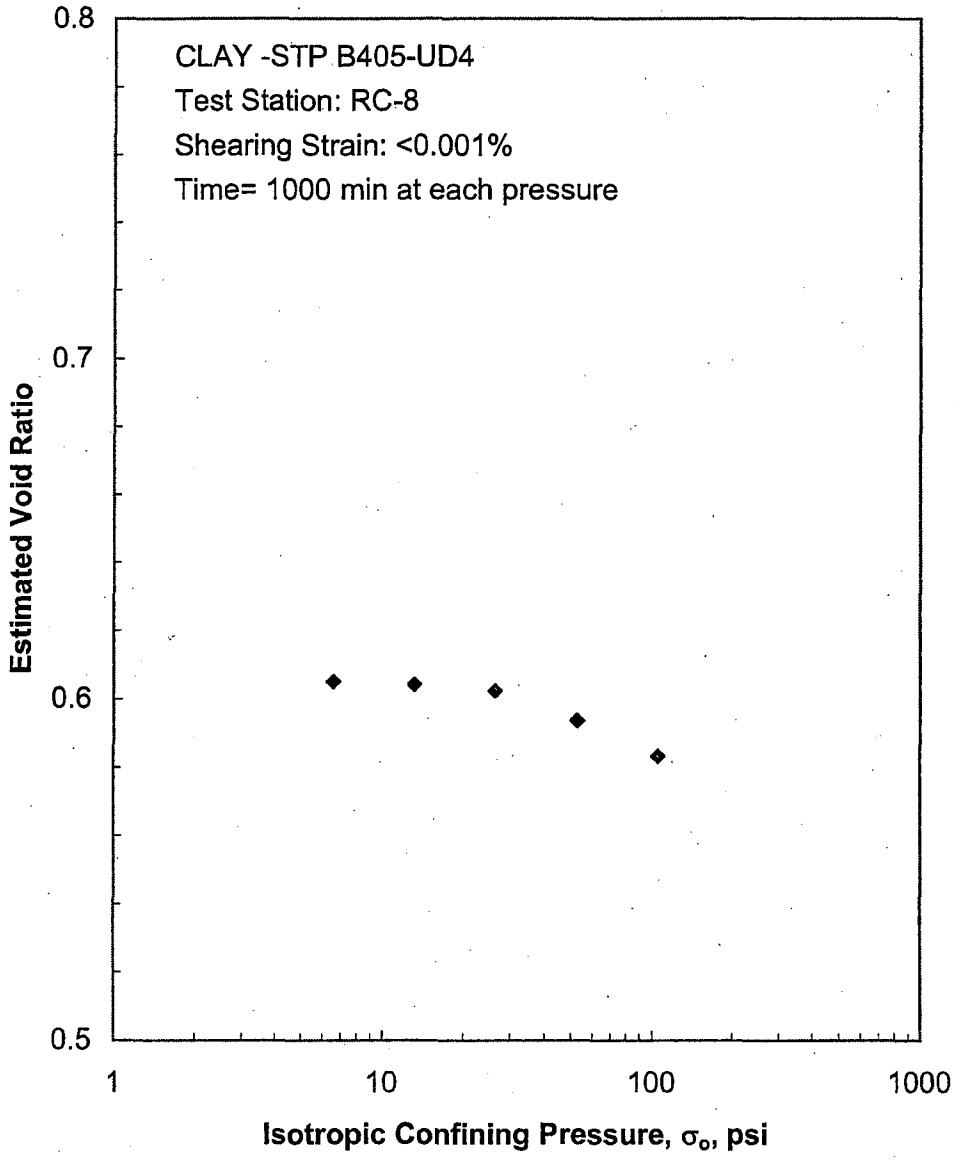


Figure G.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

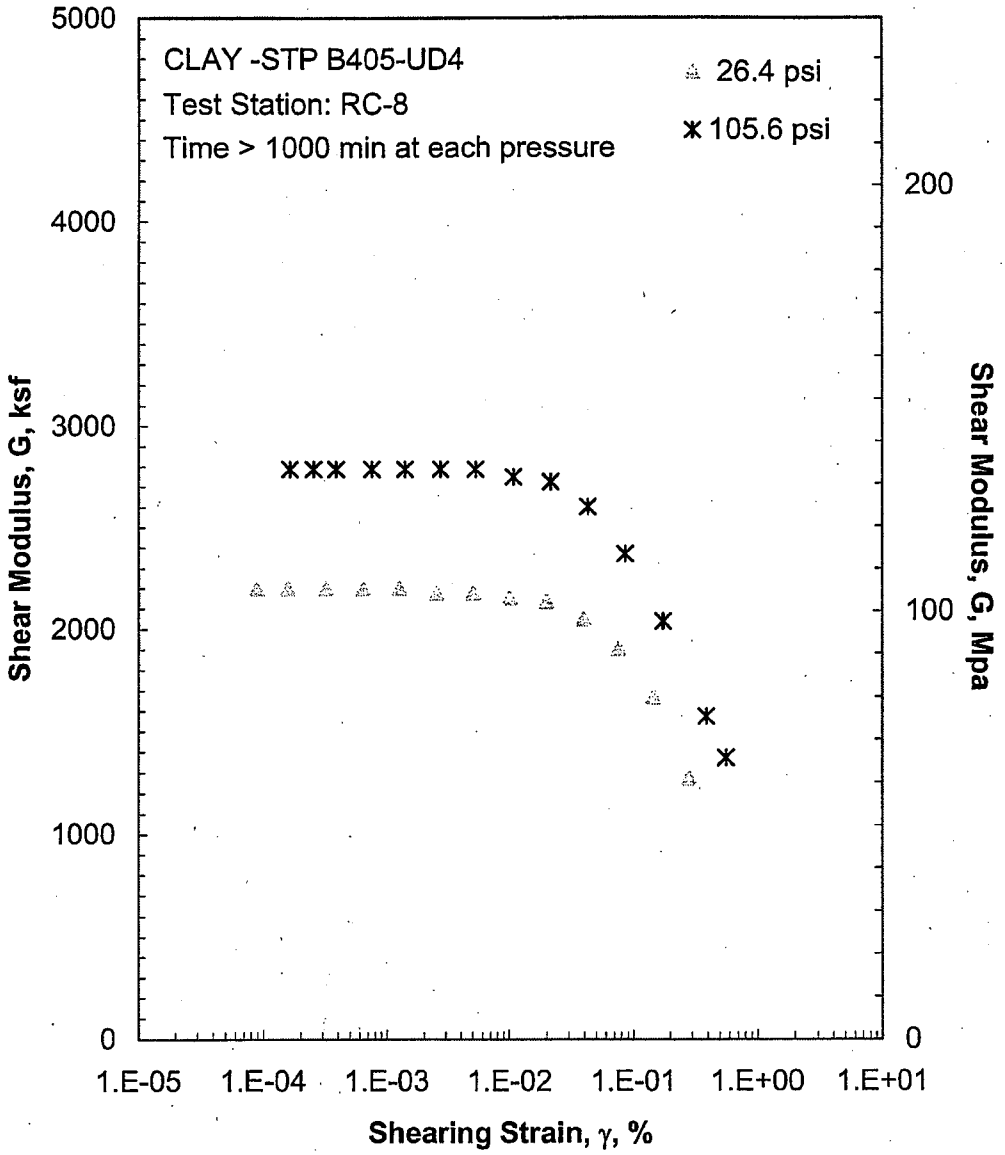


Figure G.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

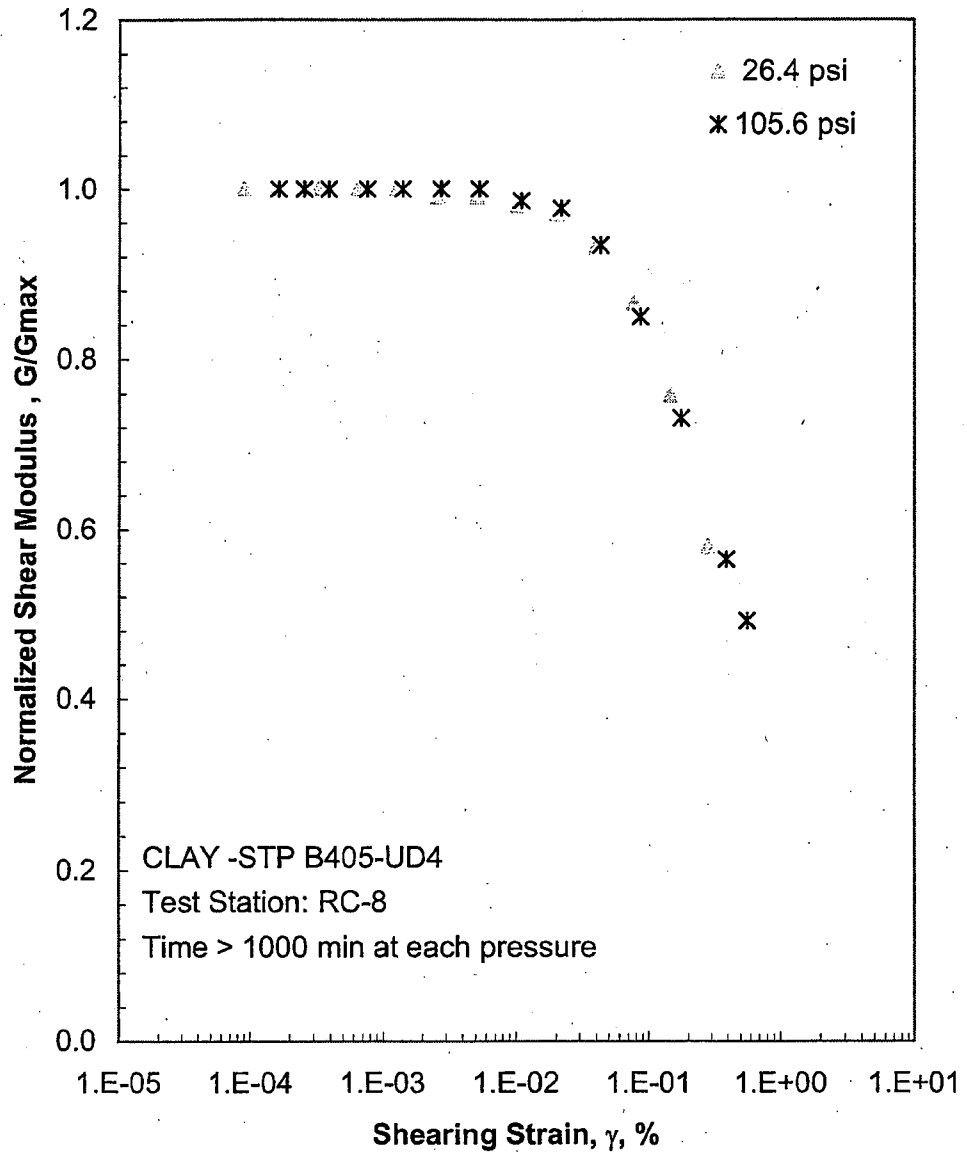


Figure G.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

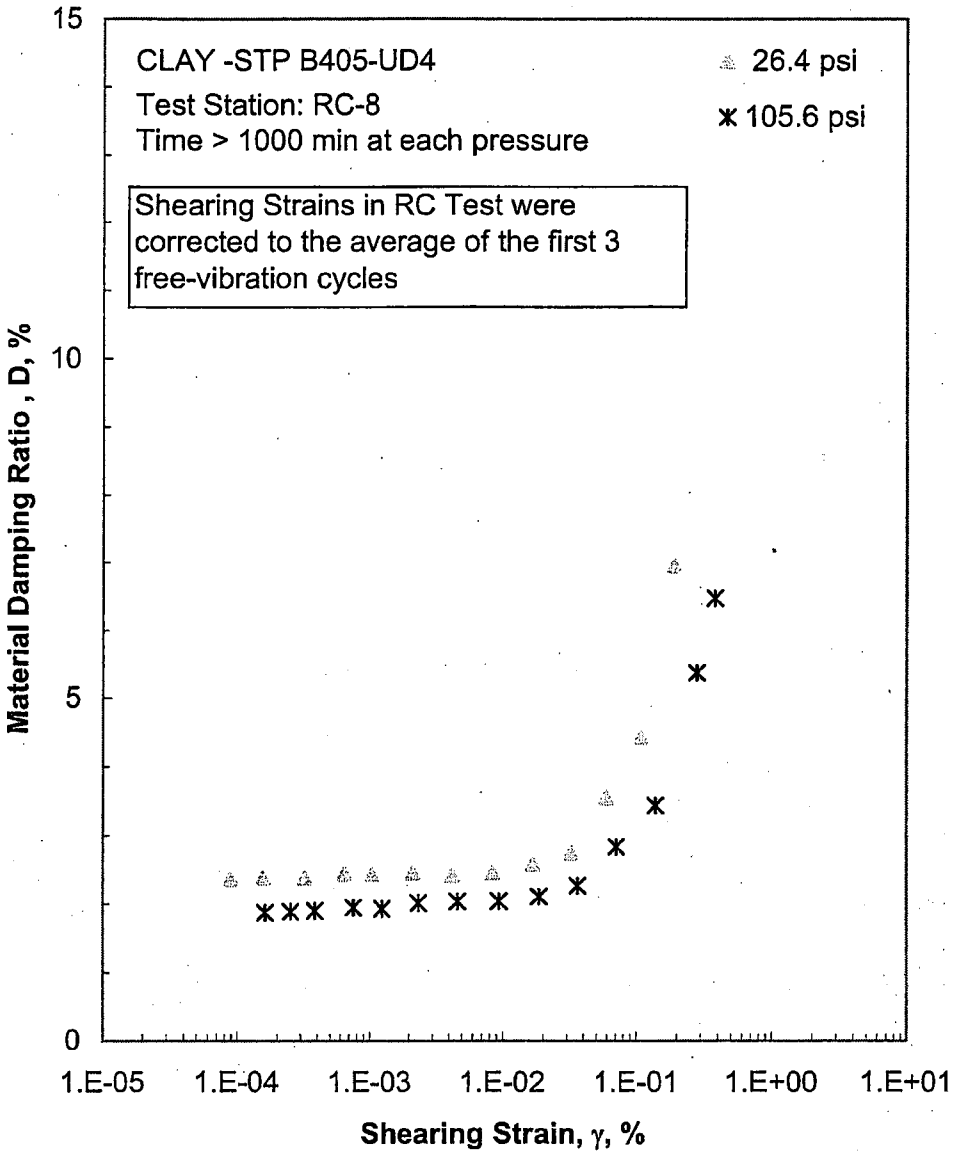


Figure G.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

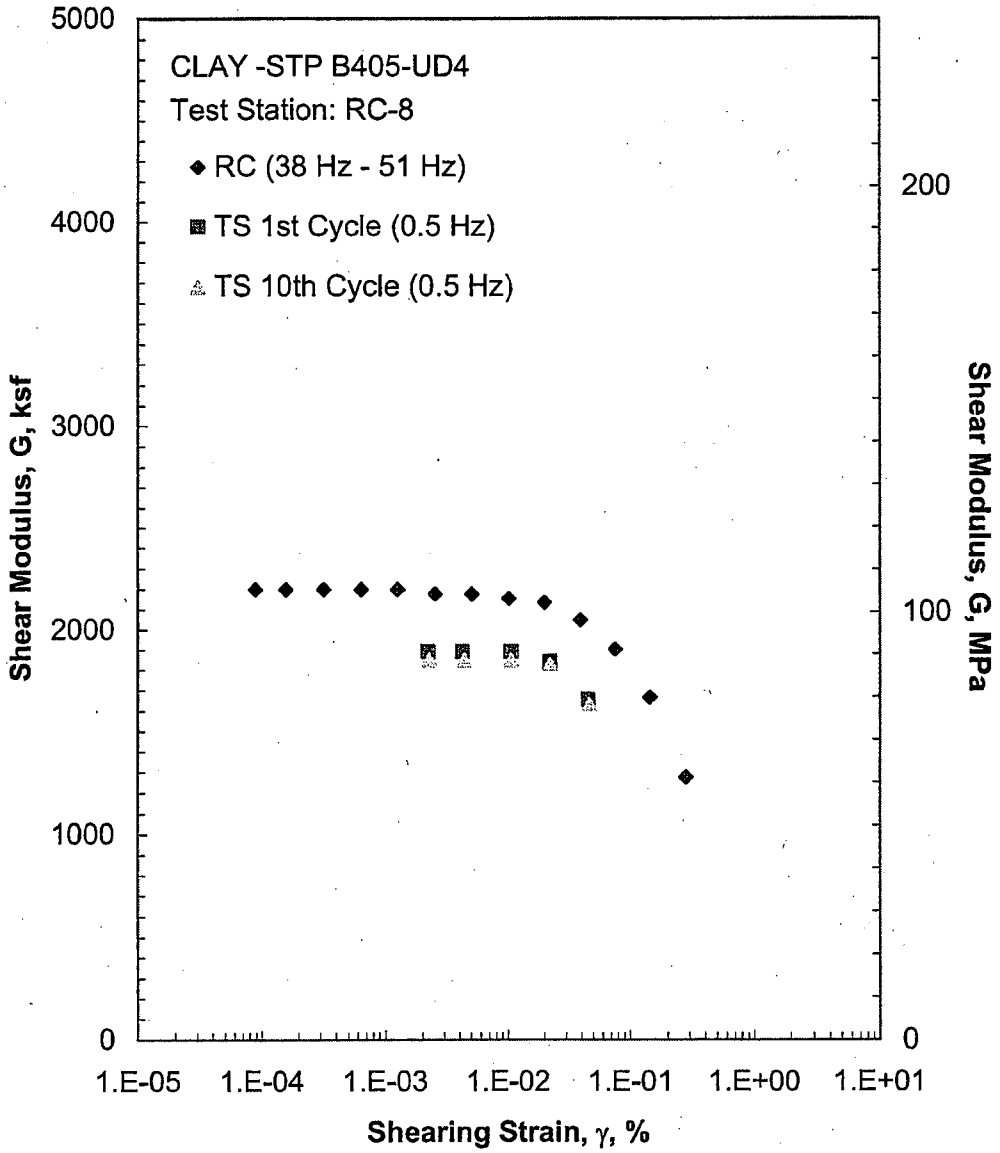


Figure G.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 26.4 psi from the Combined RCTS Tests

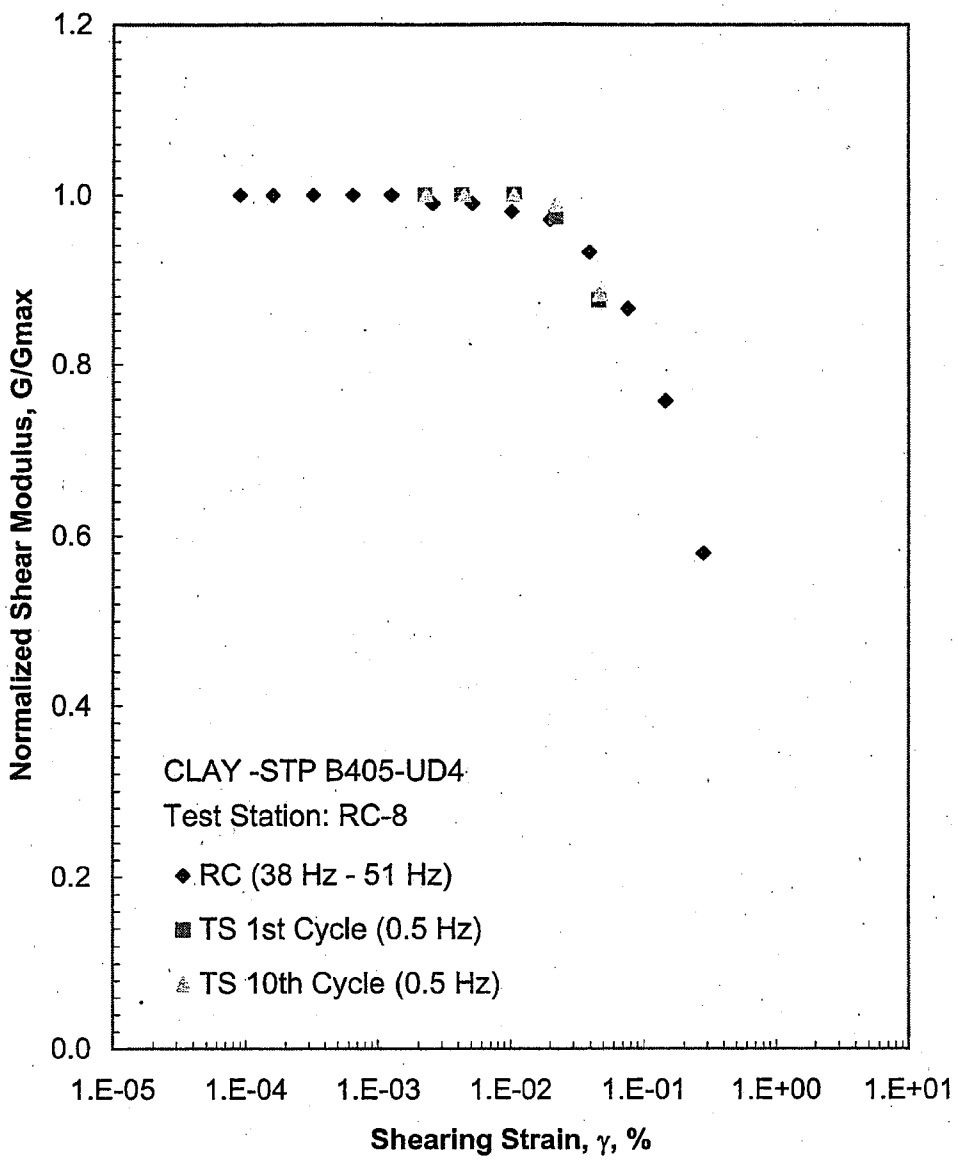


Figure G.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 26.4 psi from the Combined RCTS Tests

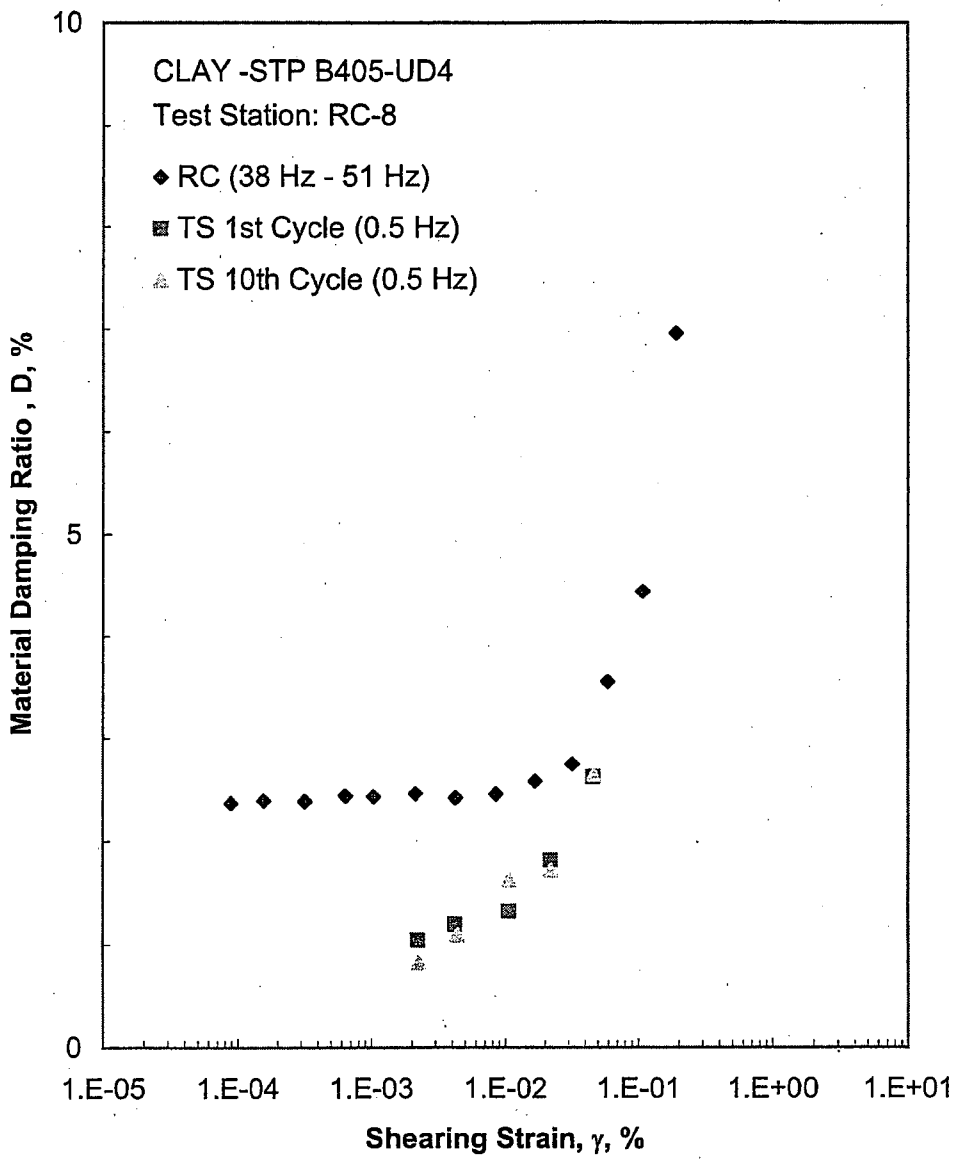


Figure G.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 26.4 psi from the Combined RCTS Tests

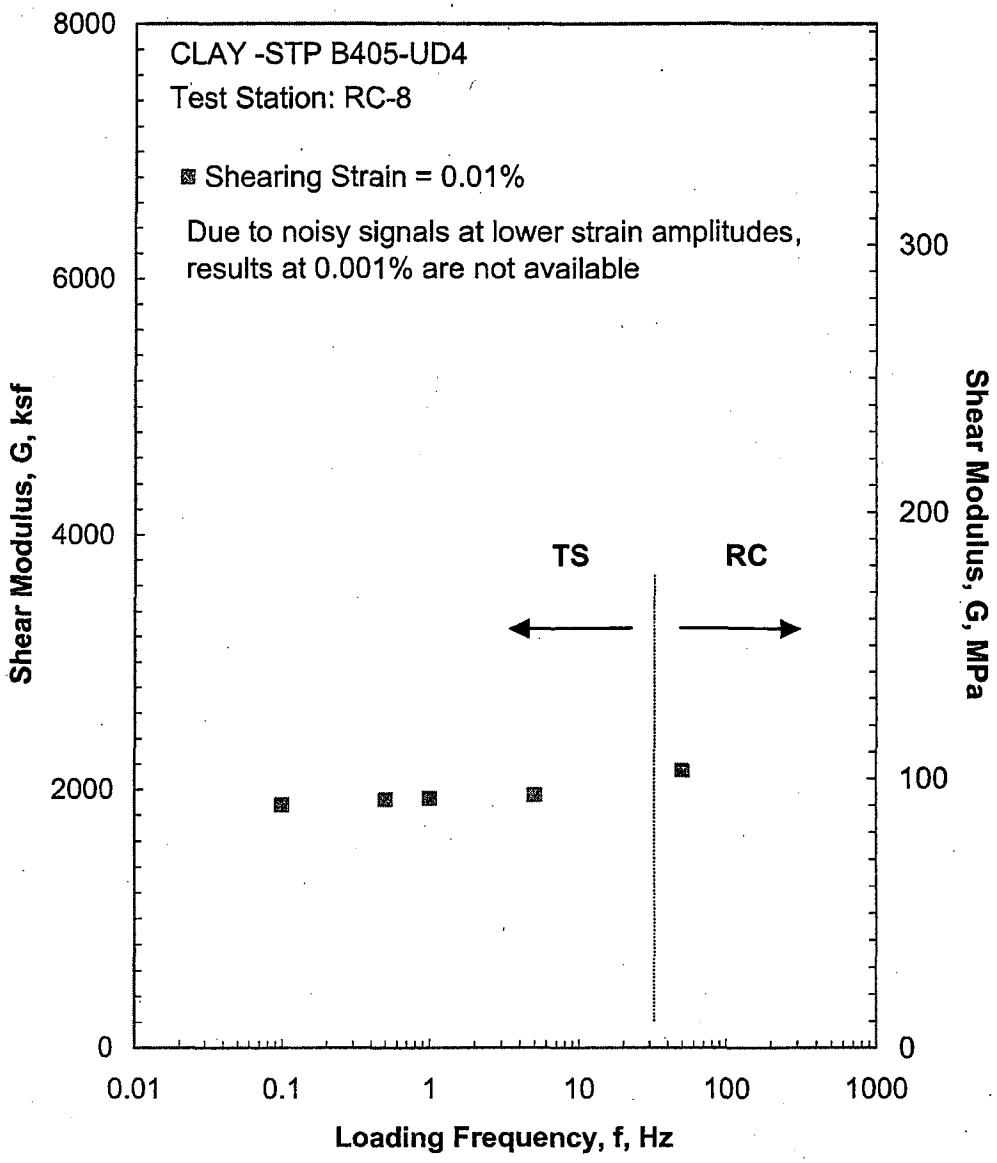


Figure G.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 26.4 psi from the Combined RCTS Tests

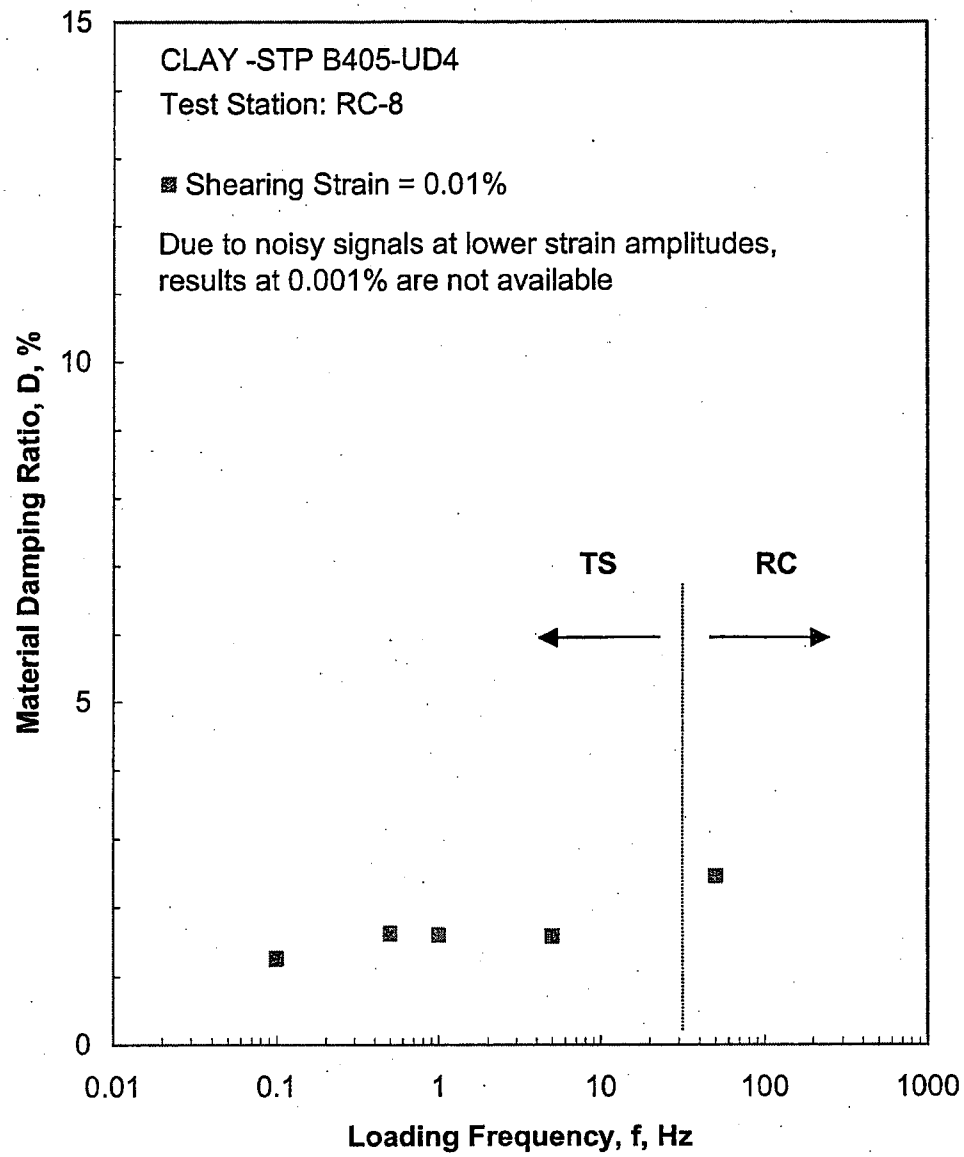


Figure G.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 26.4 psi from the Combined RCTS Tests

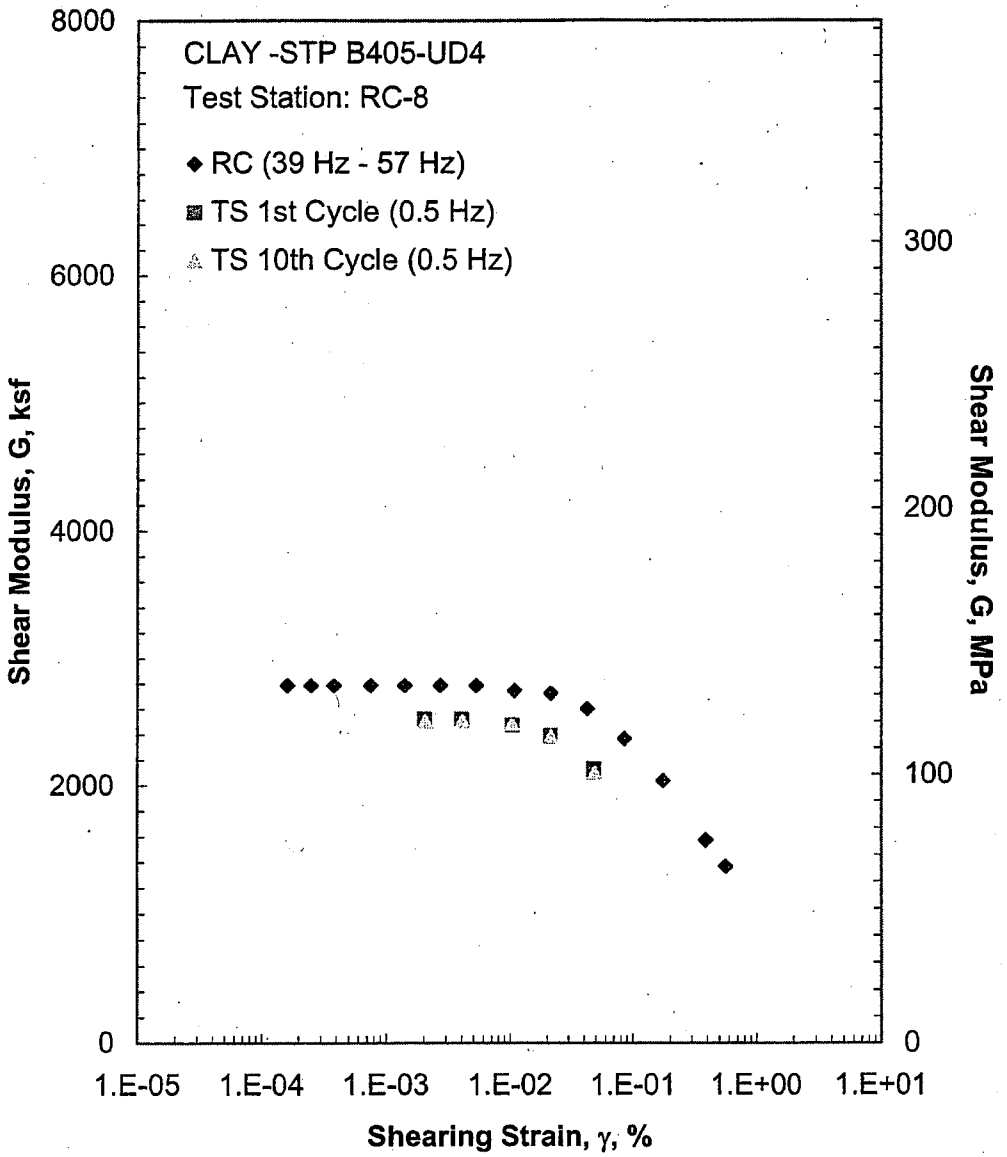


Figure G.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 105.6 psi from the Combined RCTS Tests

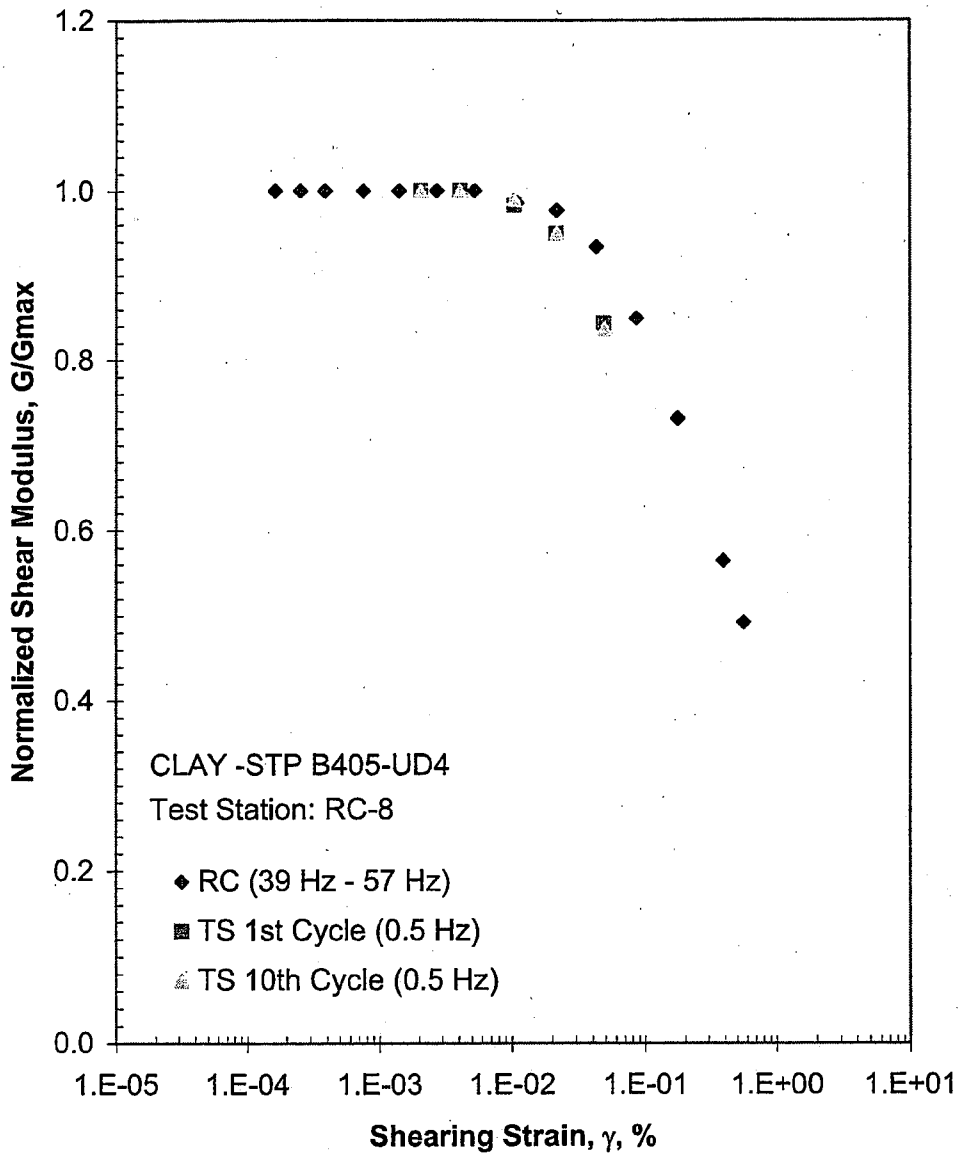


Figure G.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 105.6 psi from the Combined RCTS Tests

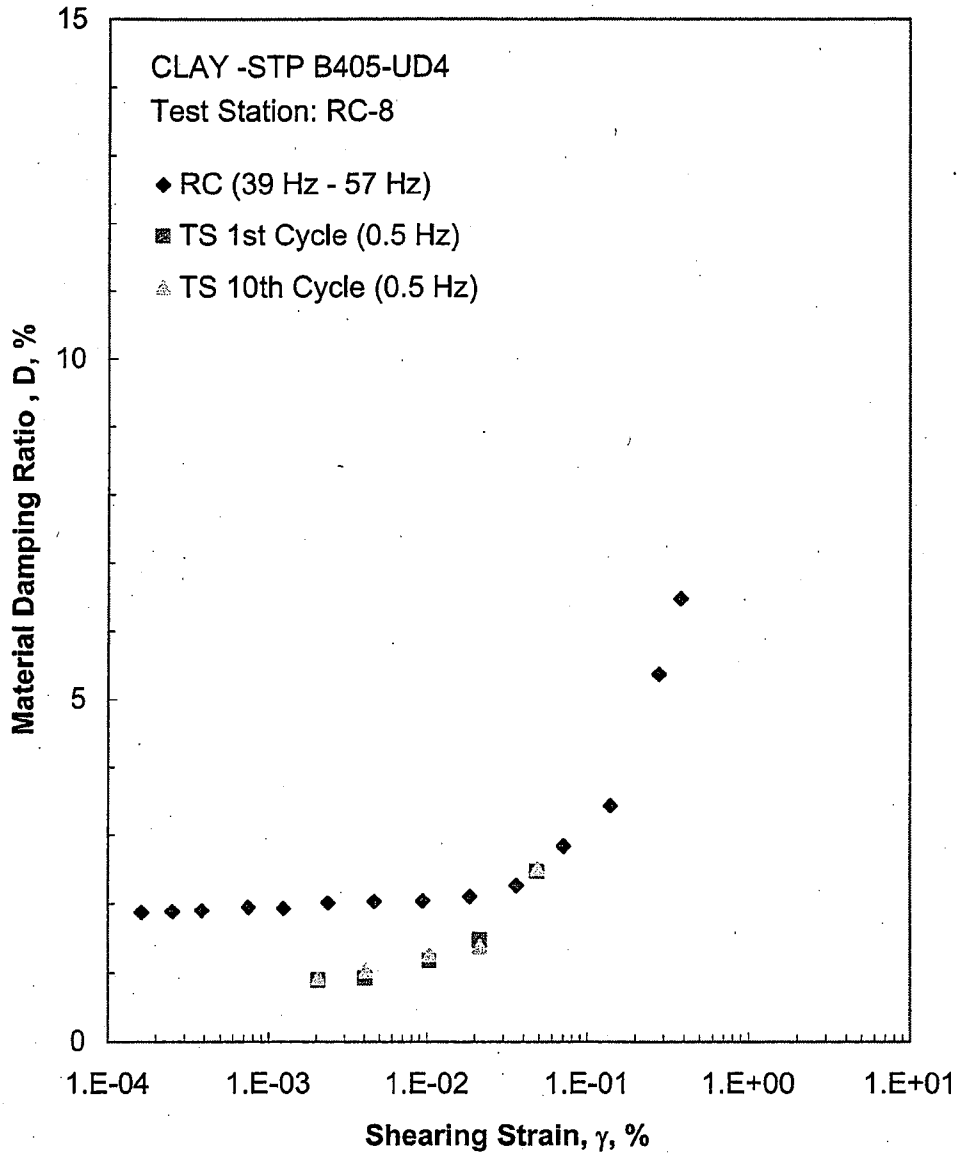


Figure G.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 105.6 psi from the Combined RCTS Tests

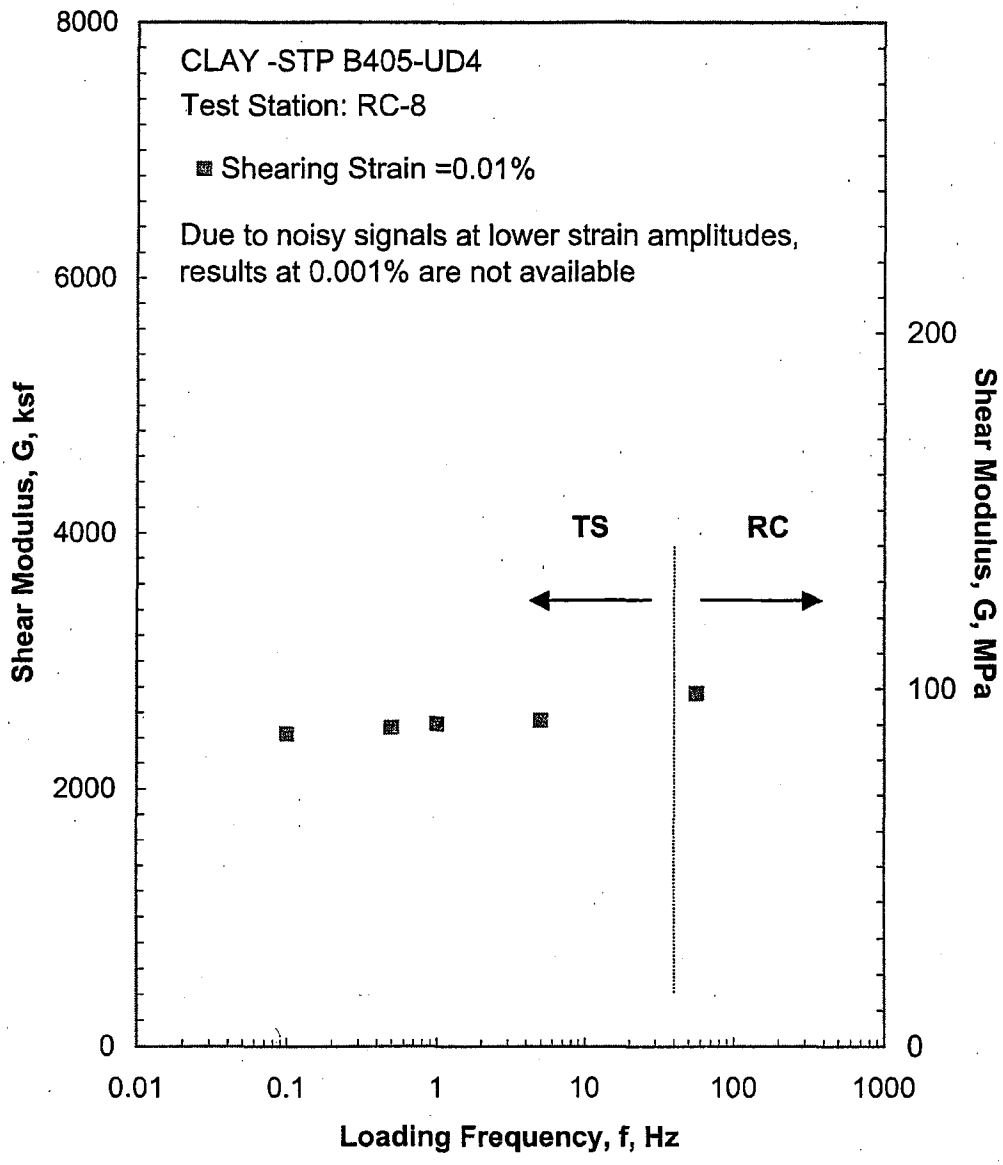


Figure G.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 105.6 psi from the Combined RCTS Tests

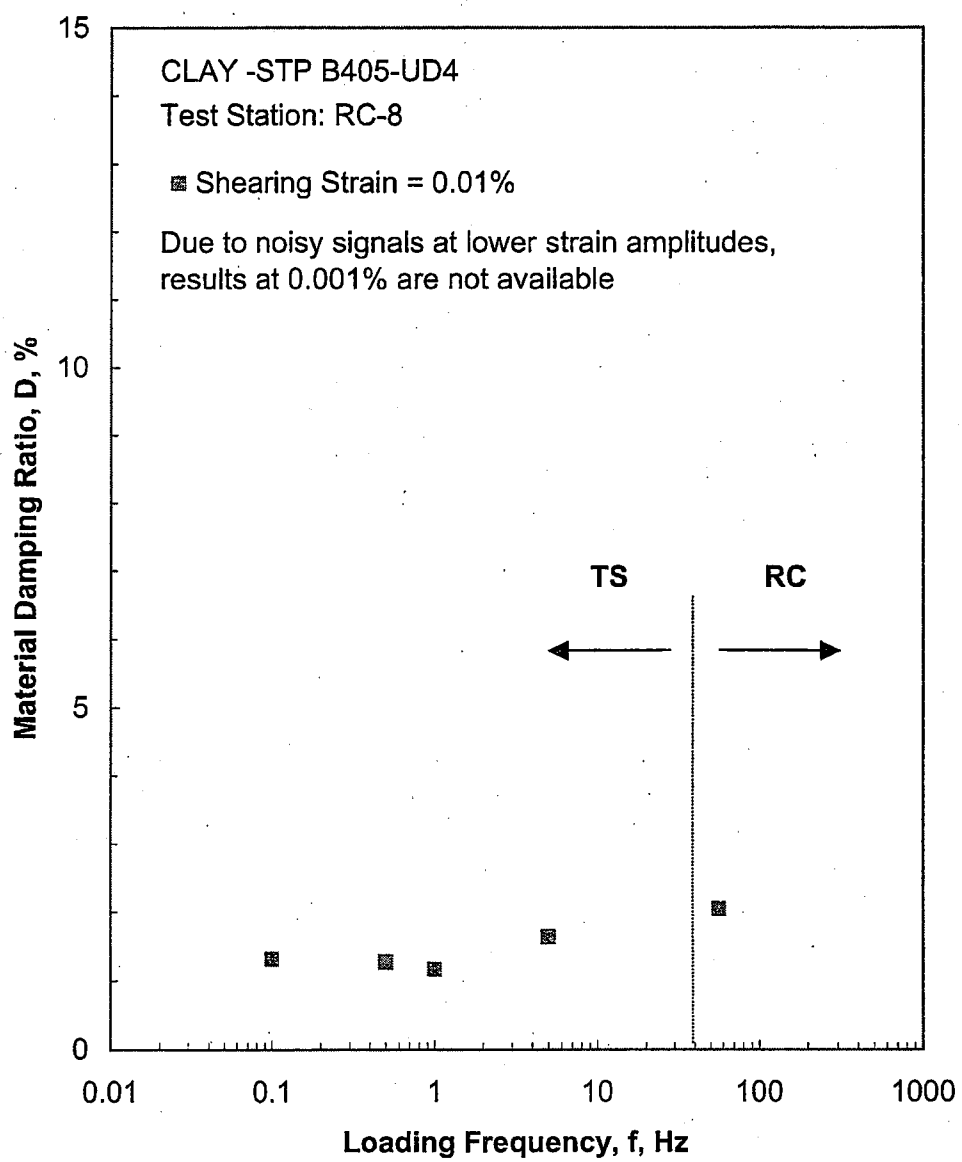


Figure G.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 105.6 psi from the Combined RCTS Tests

Table G.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B405-UD4

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
6.6	950	45	1998	96	700	2.63	0.605
13.2	1901	91	1983	95	697	2.47	0.604
26.4	3802	182	2155	103	727	2.30	0.602
52.8	7603	364	2367	114	759	1.96	0.594
105.6	15206	728	2593	124	792	0.73	0.583

Table G.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD4; Isoptropic Confining Pressure, σ_o=26.4 psi (3.8 ksf = 182 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
8.90E-05	2198	1.00	8.90E-05	2.37
1.58E-04	2198	1.00	1.58E-04	2.39
3.21E-04	2198	1.00	3.21E-04	2.38
6.42E-04	2198	1.00	6.42E-04	2.44
1.25E-03	2198	1.00	1.04E-03	2.43
2.55E-03	2176	0.99	2.14E-03	2.45
5.06E-03	2176	0.99	4.25E-03	2.41
1.01E-02	2155	0.98	8.50E-03	2.45
2.00E-02	2133	0.97	1.68E-02	2.58
3.93E-02	2048	0.93	3.22E-02	2.75
7.61E-02	1903	0.87	5.94E-02	3.55
1.44E-01	1666	0.76	1.08E-01	4.44
2.81E-01	1274	0.58	1.91E-01	6.95

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table G.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD4; Isotropic Confining Pressure, σ_o=26.4 psi (3.8 ksf = 182 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
2.22E-03	1891	1.00	1.04	2.27E-03	1852	1.00	0.82
4.21E-03	1891	1.00	1.19	4.39E-03	1852	1.00	1.09
1.06E-02	1891	1.00	1.32	1.06E-02	1852	1.00	1.62
2.20E-02	1840	0.97	1.81	2.22E-02	1830	0.99	1.72
4.60E-02	1654	0.87	2.62	4.66E-02	1634	0.88	2.65

Table G.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD4; Isoptropic Confining Pressure, σ_o= 105.6 psi (15.2 ksf = 728 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.63E-04	2787	1.00	1.63E-04	1.87
2.53E-04	2787	1.00	2.53E-04	1.89
3.85E-04	2787	1.00	3.85E-04	1.90
7.52E-04	2787	1.00	7.52E-04	1.95
1.40E-03	2787	1.00	1.24E-03	1.93
2.72E-03	2787	1.00	2.37E-03	2.01
5.27E-03	2787	1.00	4.64E-03	2.03
1.08E-02	2748	0.99	9.42E-03	2.04
2.15E-02	2723	0.98	1.87E-02	2.11
4.26E-02	2602	0.93	3.62E-02	2.26
8.56E-02	2368	0.85	7.11E-02	2.84
1.74E-01	2037	0.73	1.40E-01	3.43
3.89E-01	1573	0.56	2.80E-01	5.37
5.60E-01	1371	0.49	3.81E-01	6.48

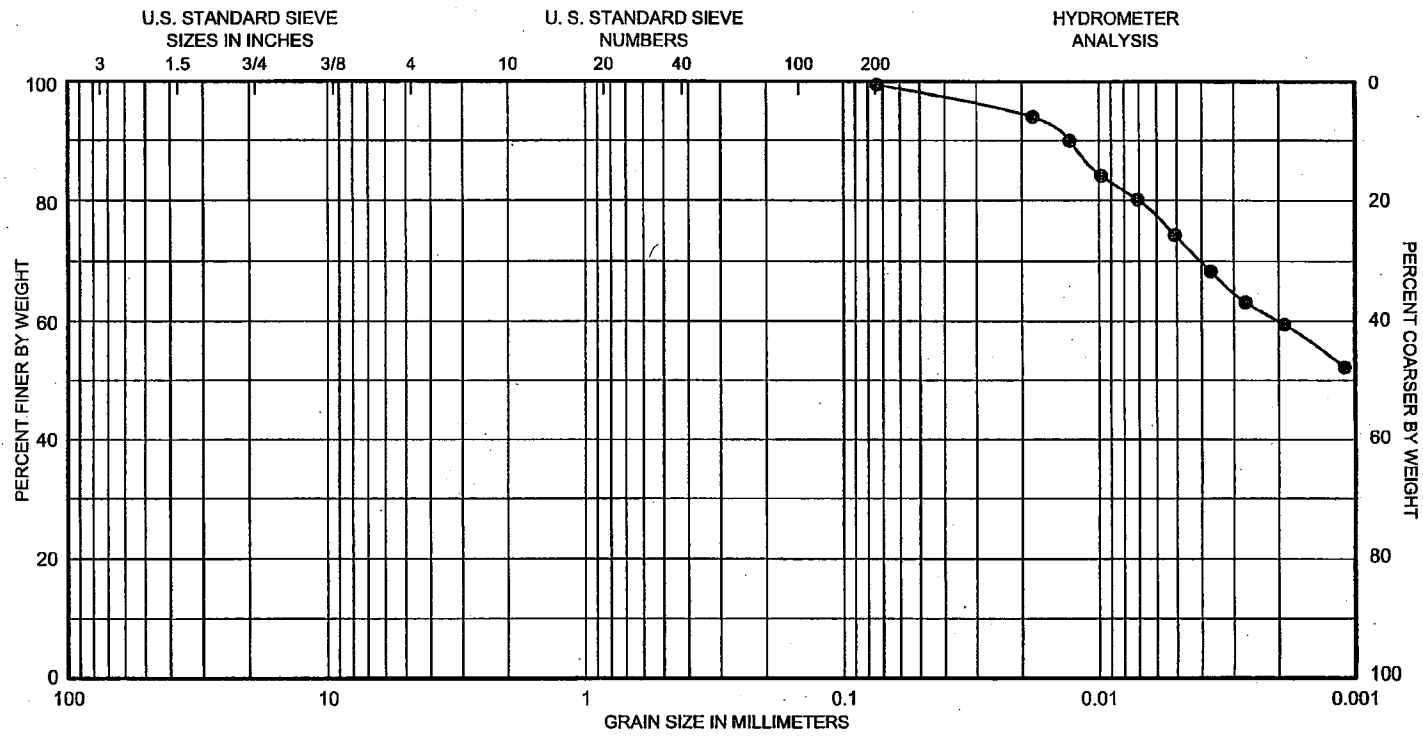
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table G.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD4; Isotropic Confining Pressure, σ_o=105.6 psi (15.2 ksf = 728 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D,	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D, %
2.04E-03	2521	1.00	0.89	2.05E-03	2509	1.00	0.92
4.06E-03	2521	1.00	0.92	4.09E-03	2509	1.00	1.02
1.04E-02	2477	0.98	1.17	1.03E-02	2484	0.99	1.26
2.14E-02	2395	0.95	1.47	2.15E-02	2384	0.95	1.38
4.83E-02	2128	0.84	2.47	4.89E-02	2099	0.84	2.52

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-405-UD4	85				0.01	Clay, red, with carbonate nodules

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX H

Specimen STP B405-UD8
SILT (Non-Plastic; Gs=2.65)

Borehole B405
Sample UD8
Depth = 170 ft (51.8 m)
Total Unit Weight = 124.4 lb/ft^3
Water Content = 22.9 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 51 psi

FUGRO JOB #: 0401-1660
Testing Station: RC9

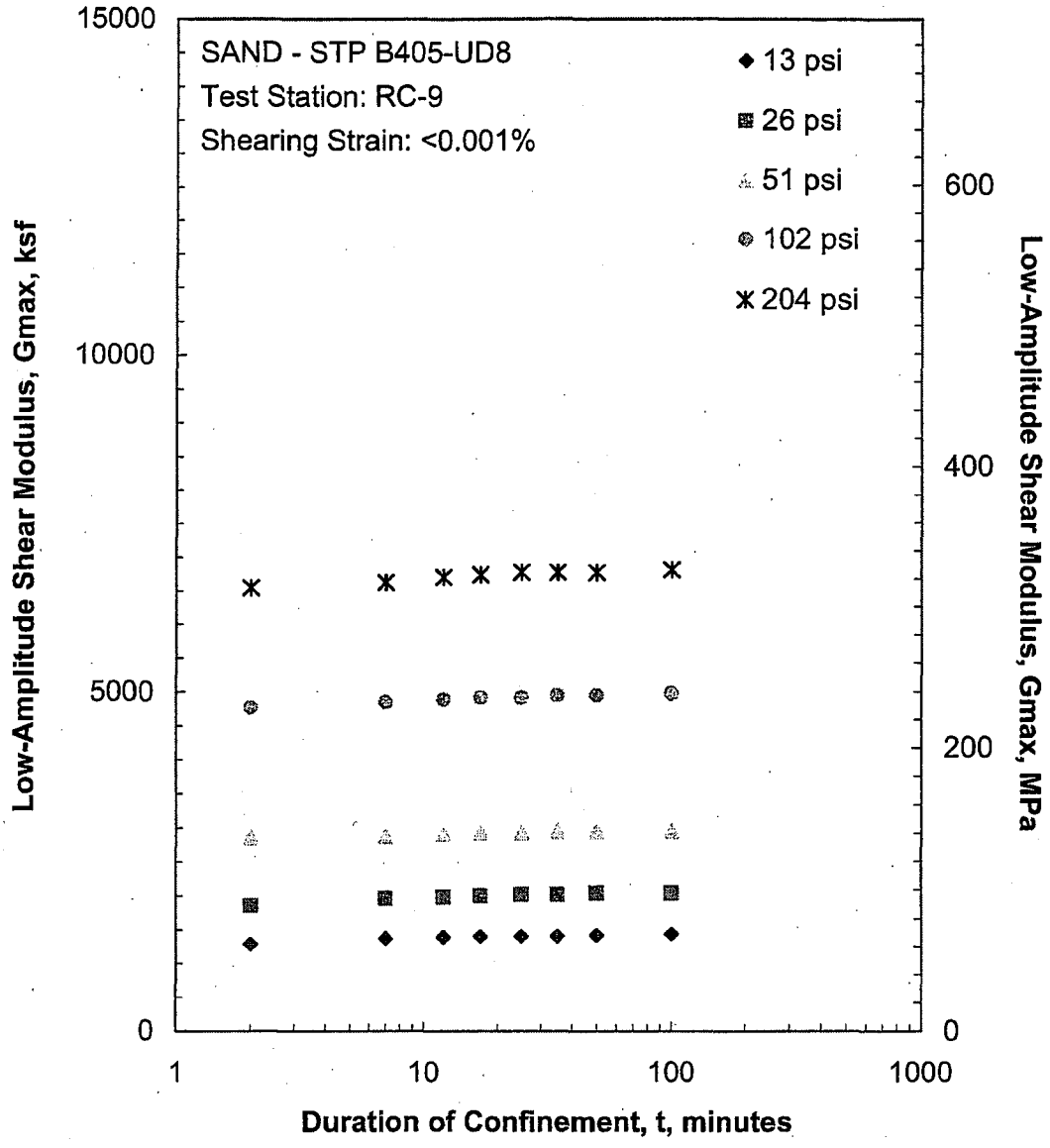


Figure H.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

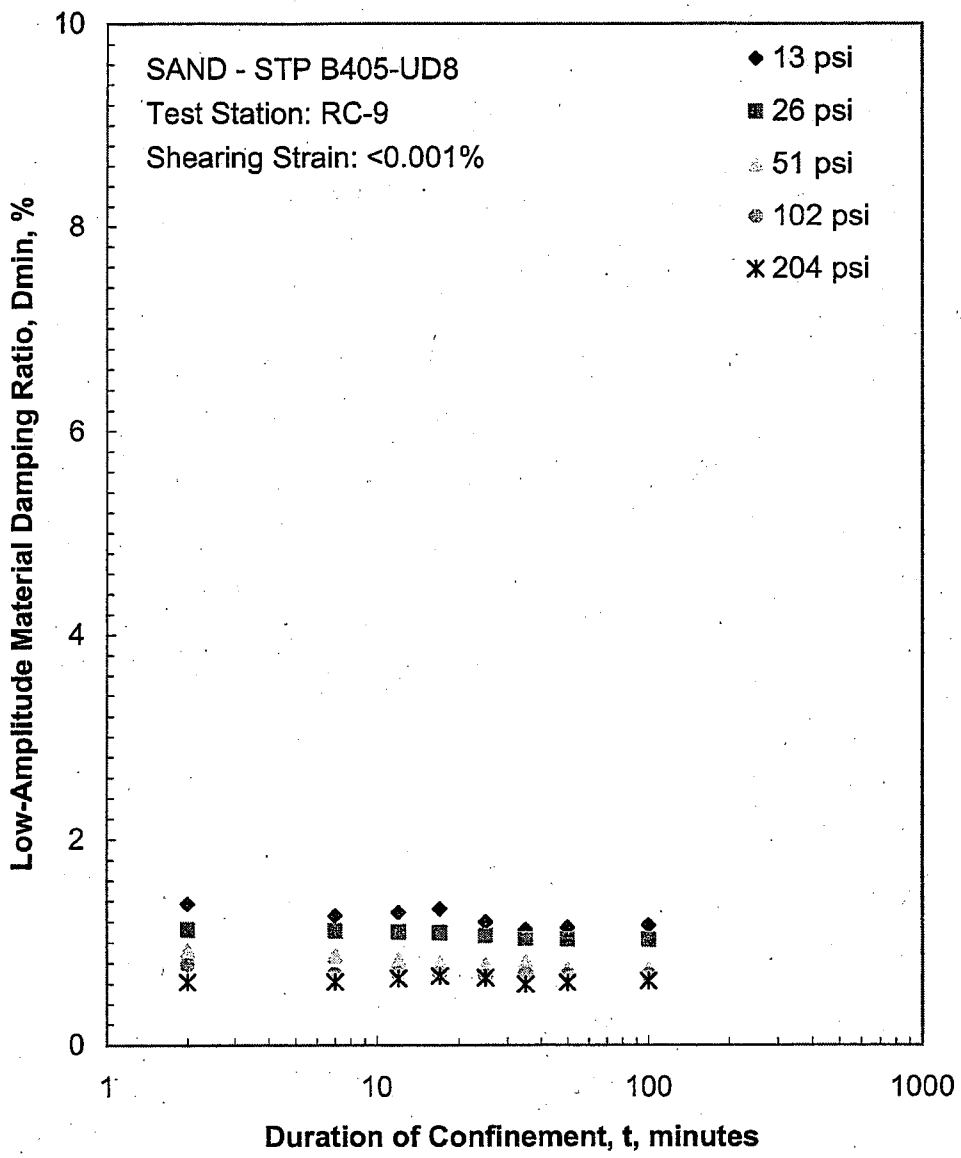


Figure H.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

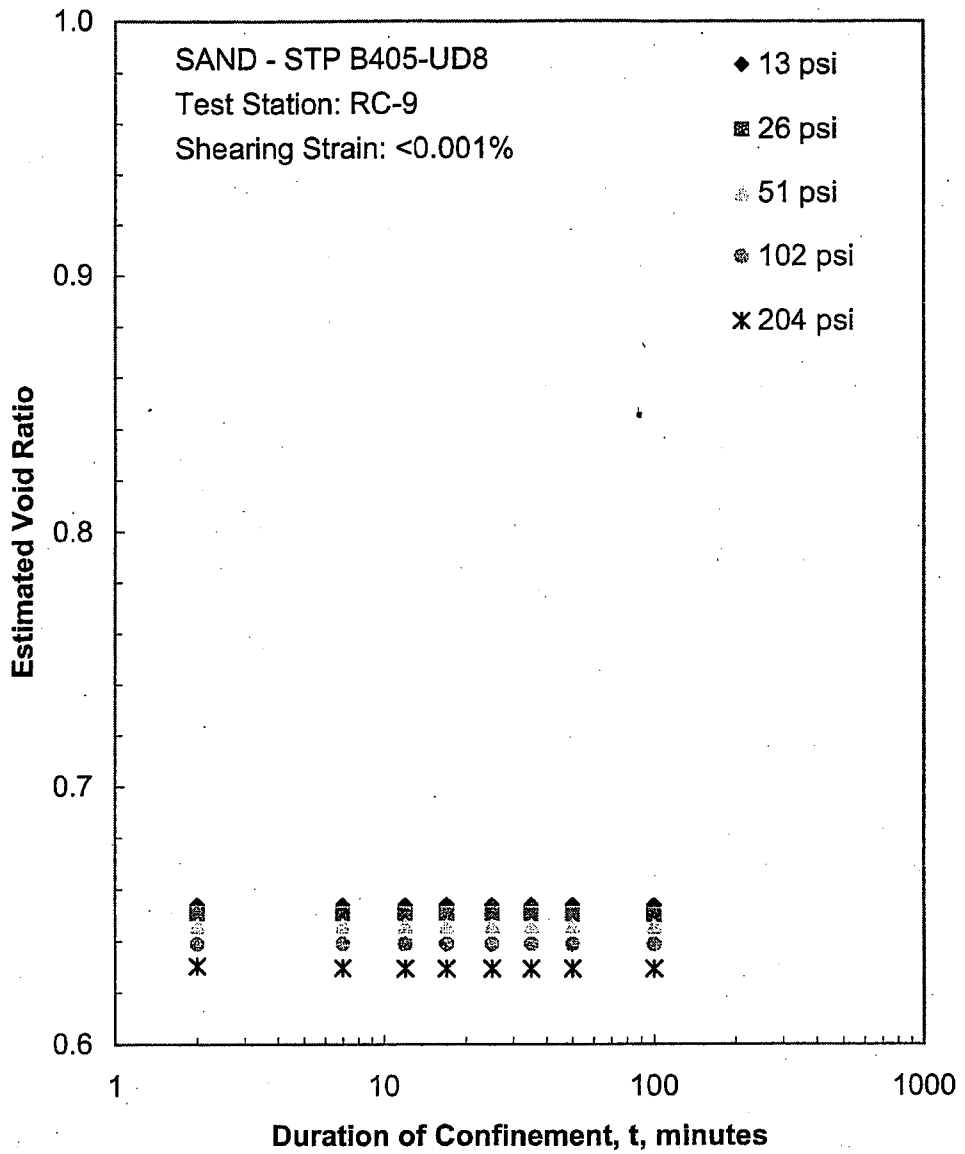


Figure H.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

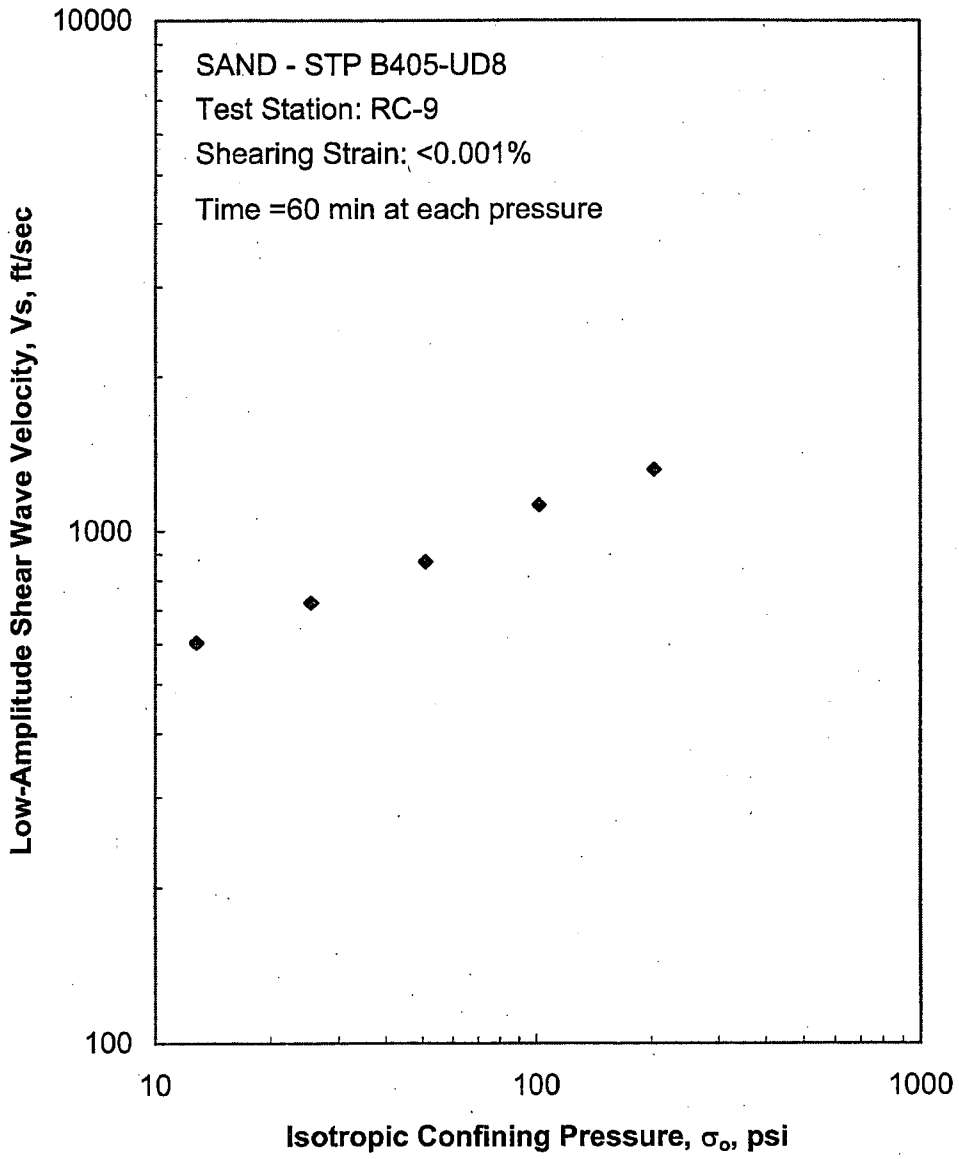


Figure H.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

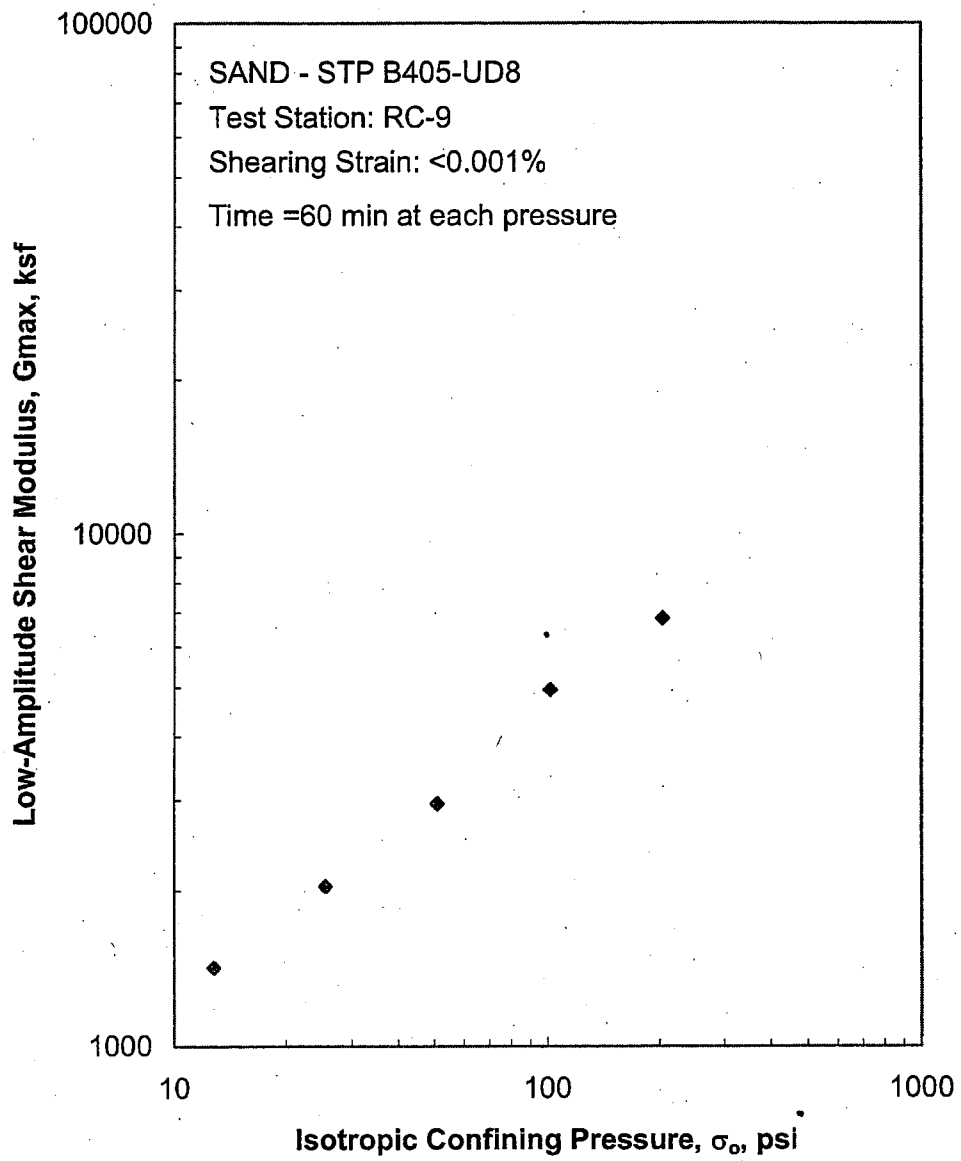


Figure H.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

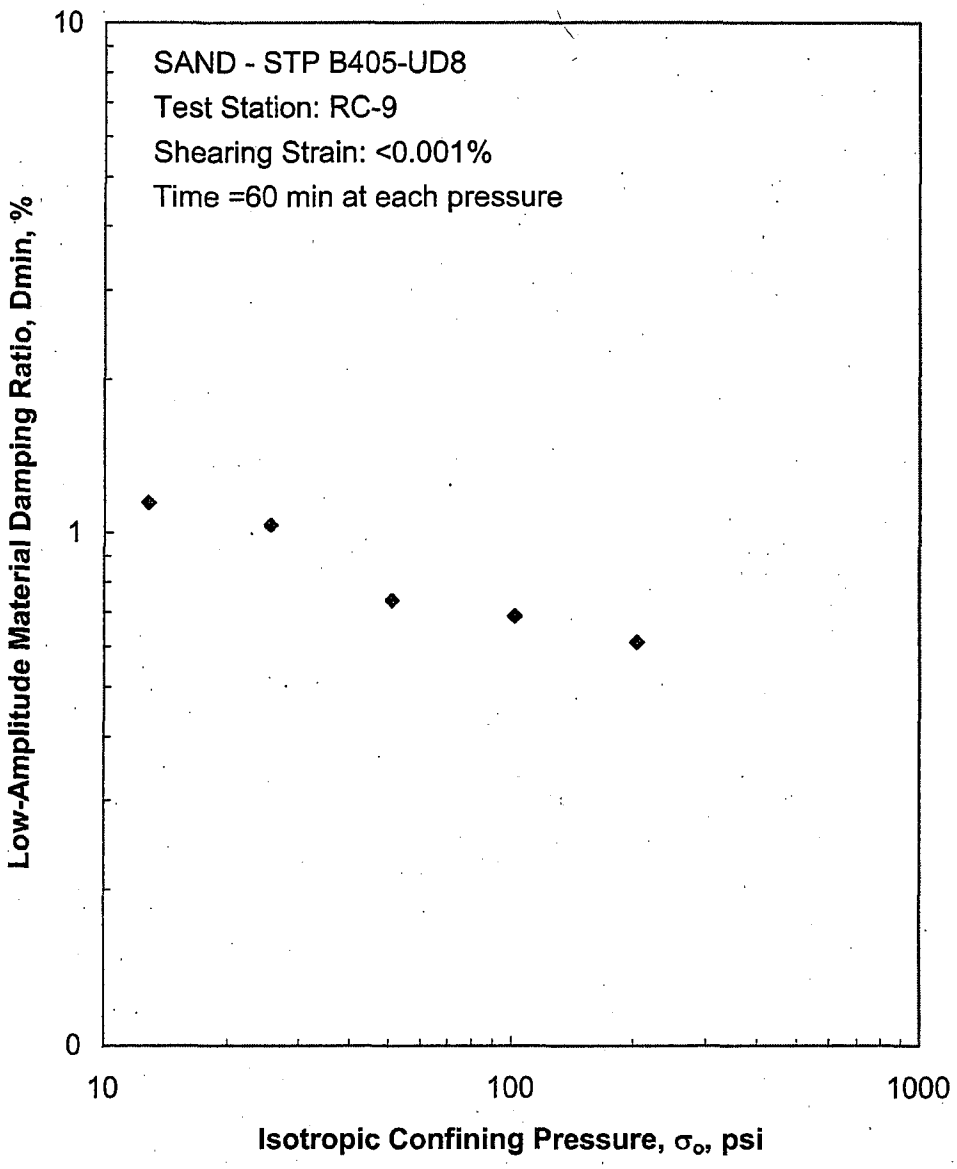


Figure H.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

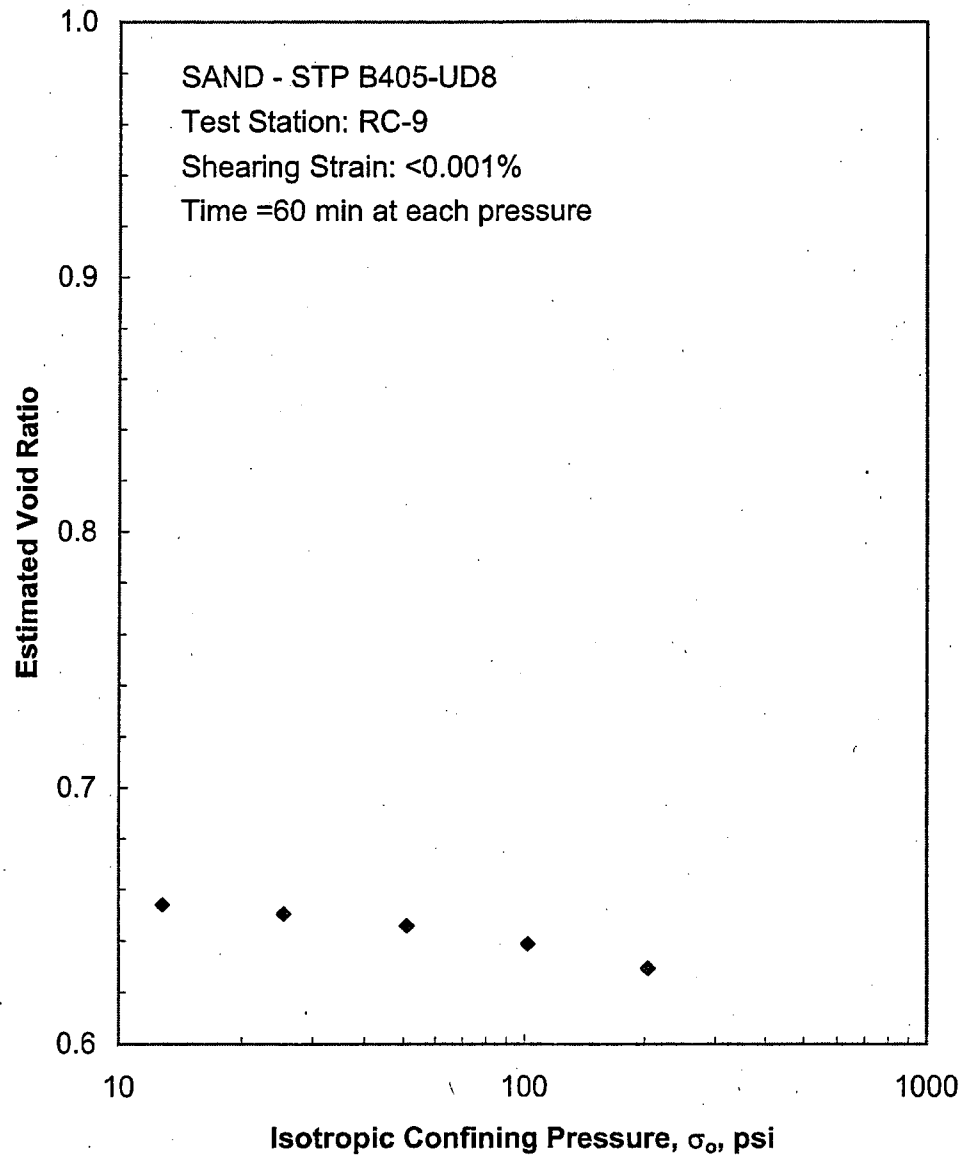


Figure H.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

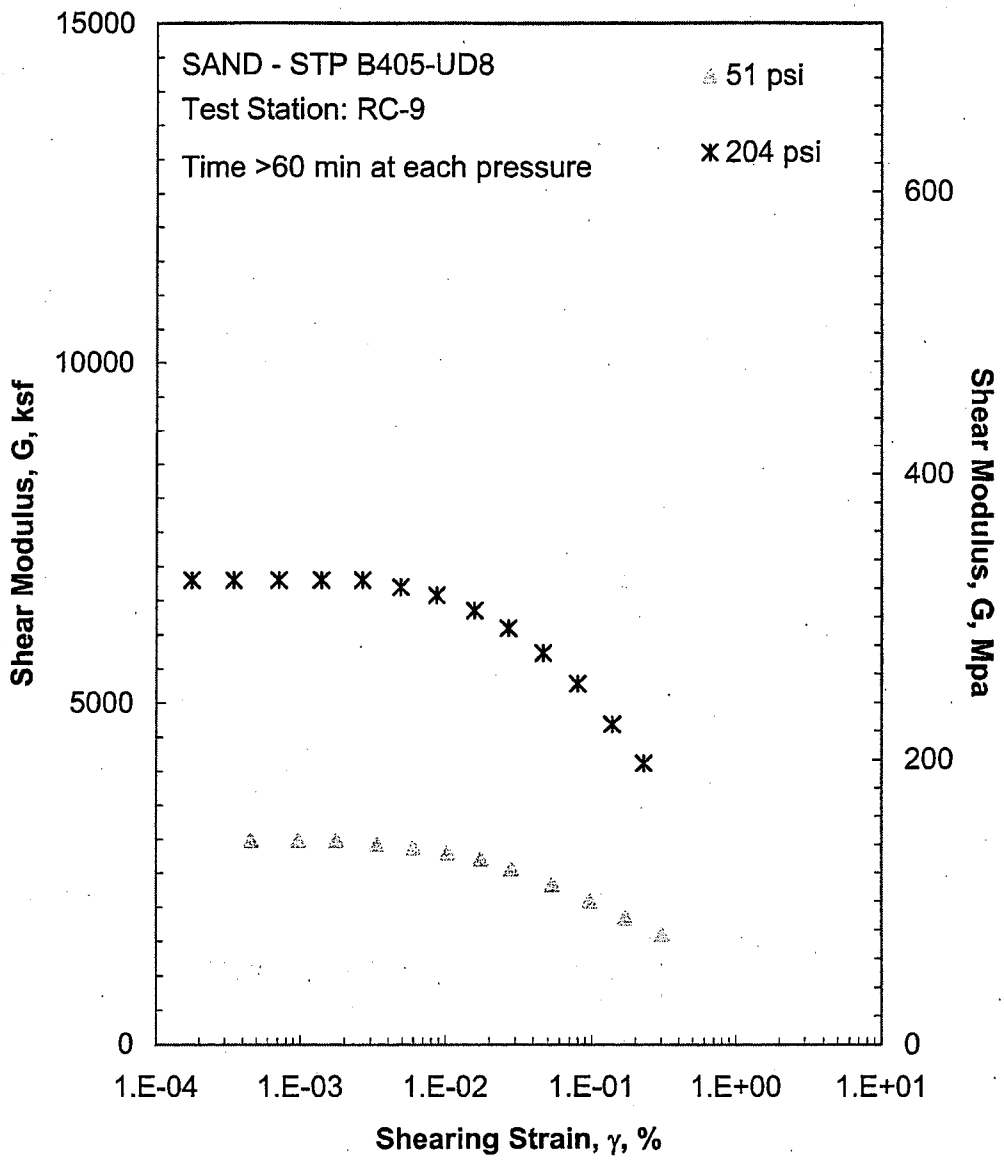


Figure H.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

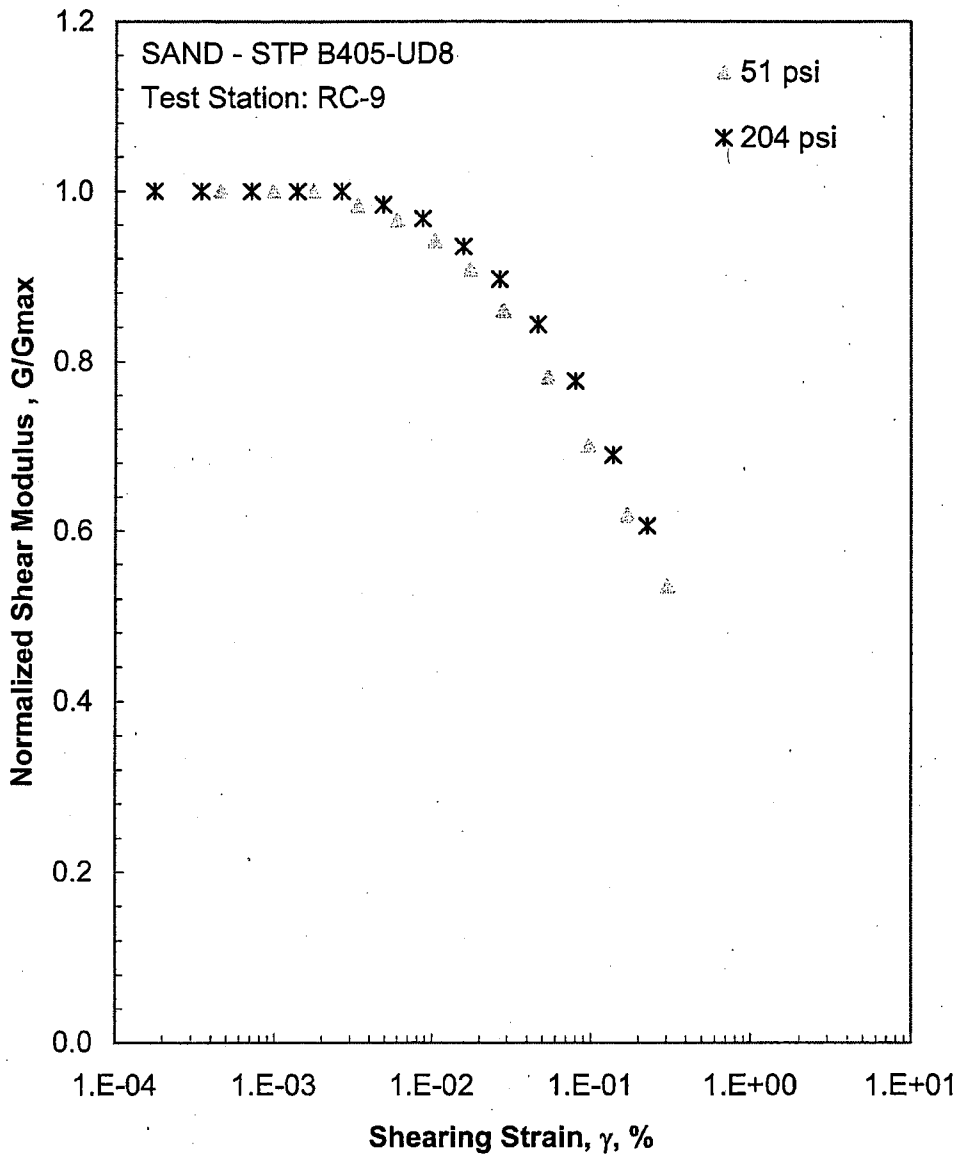


Figure H.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

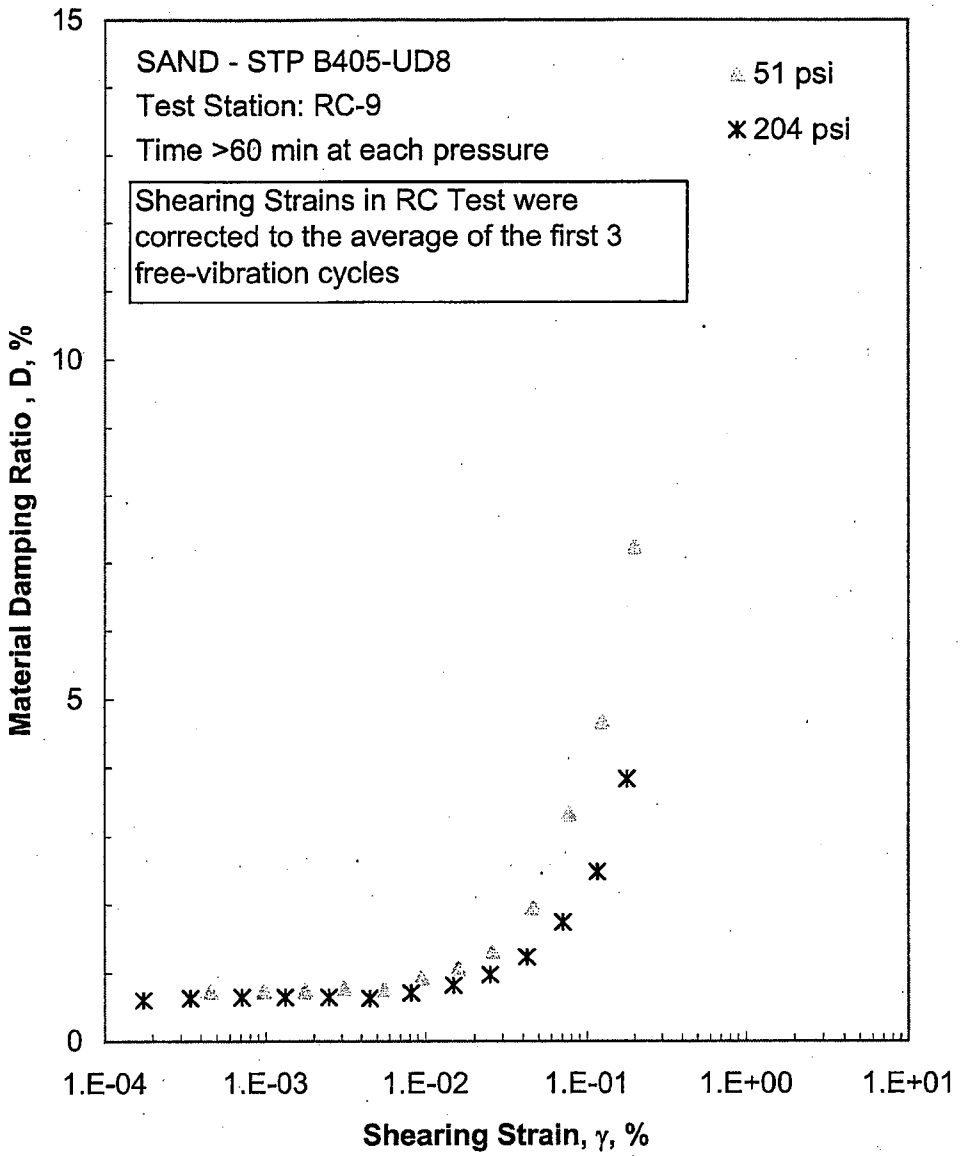


Figure H.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

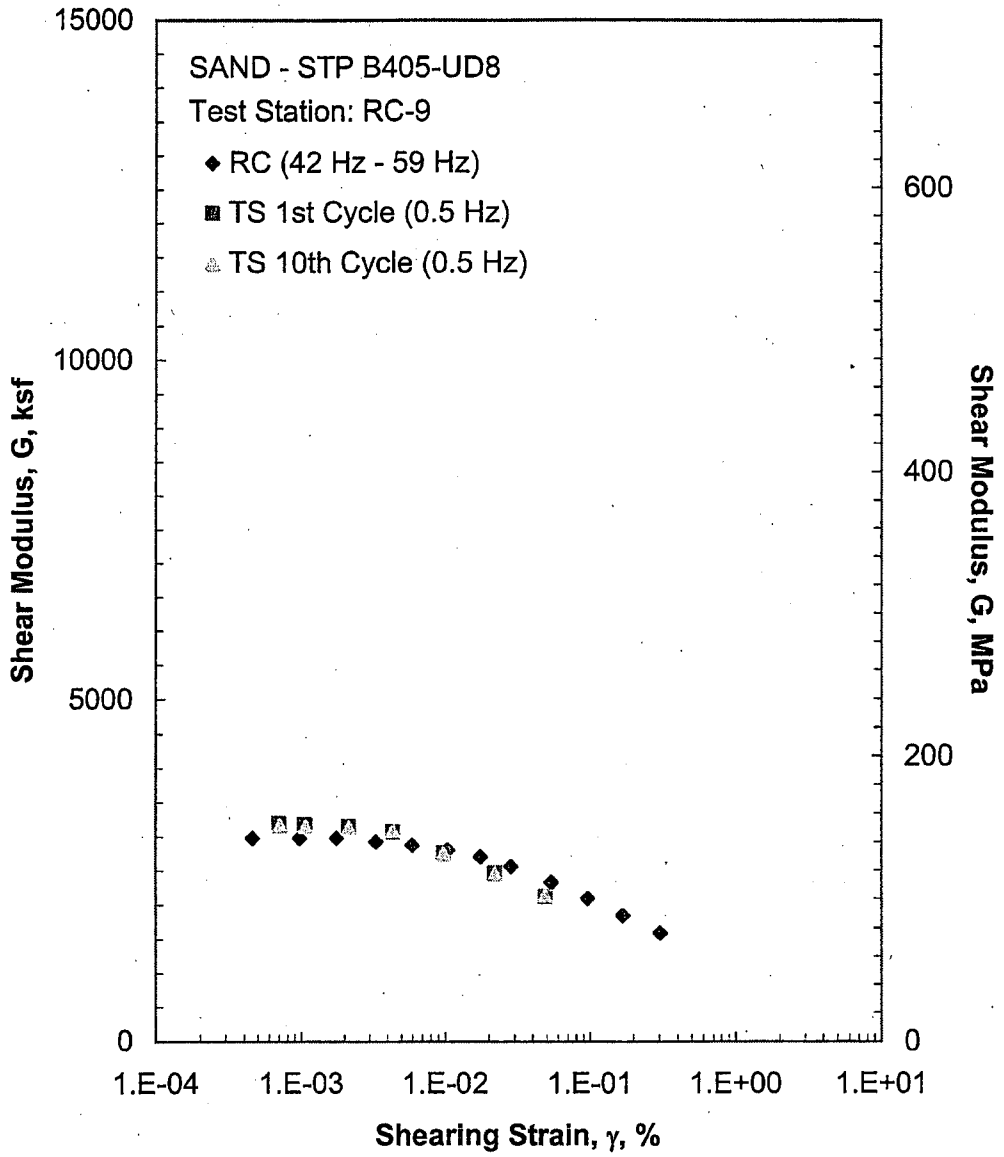


Figure H.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 51 psi from the Combined RCTS Tests

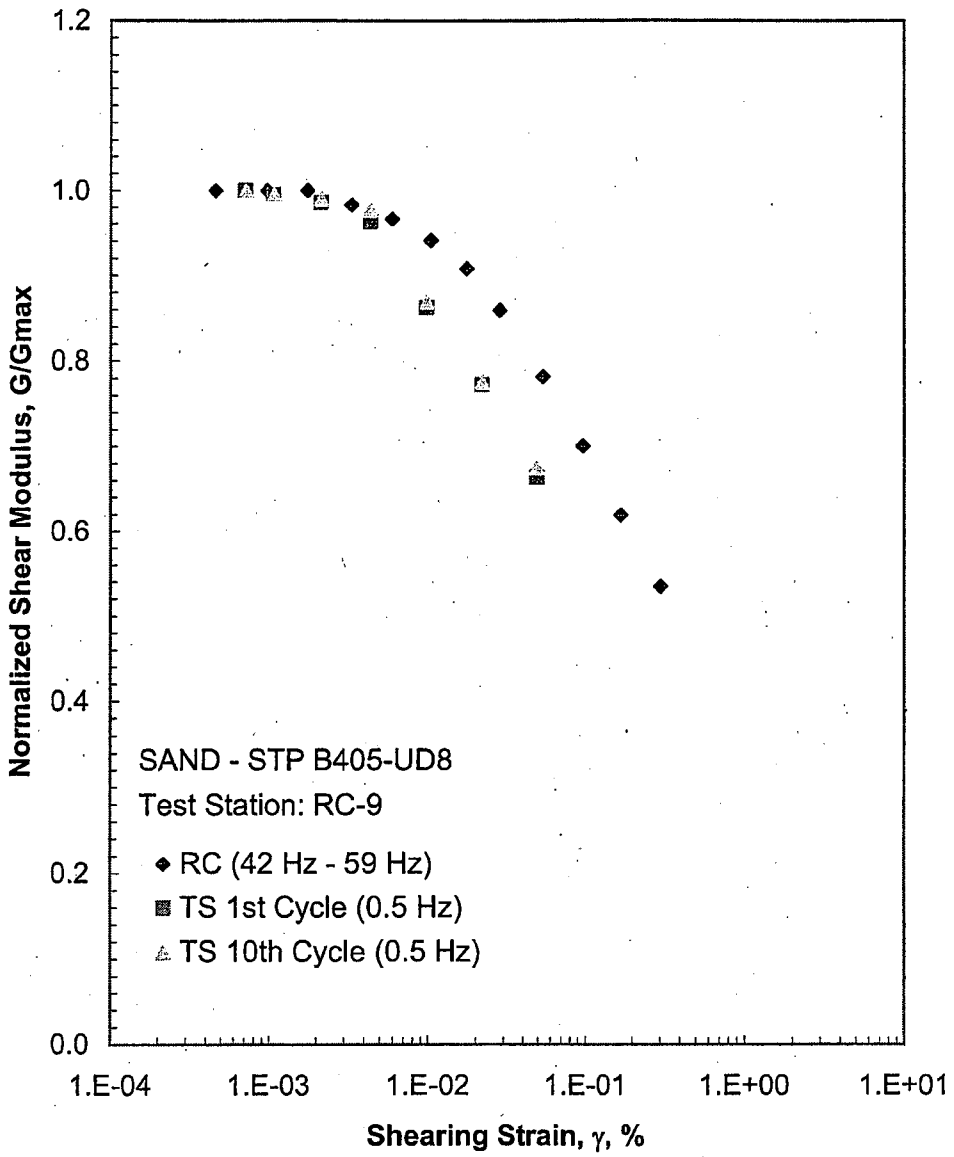


Figure H.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 51 psi from the Combined RCTS Tests

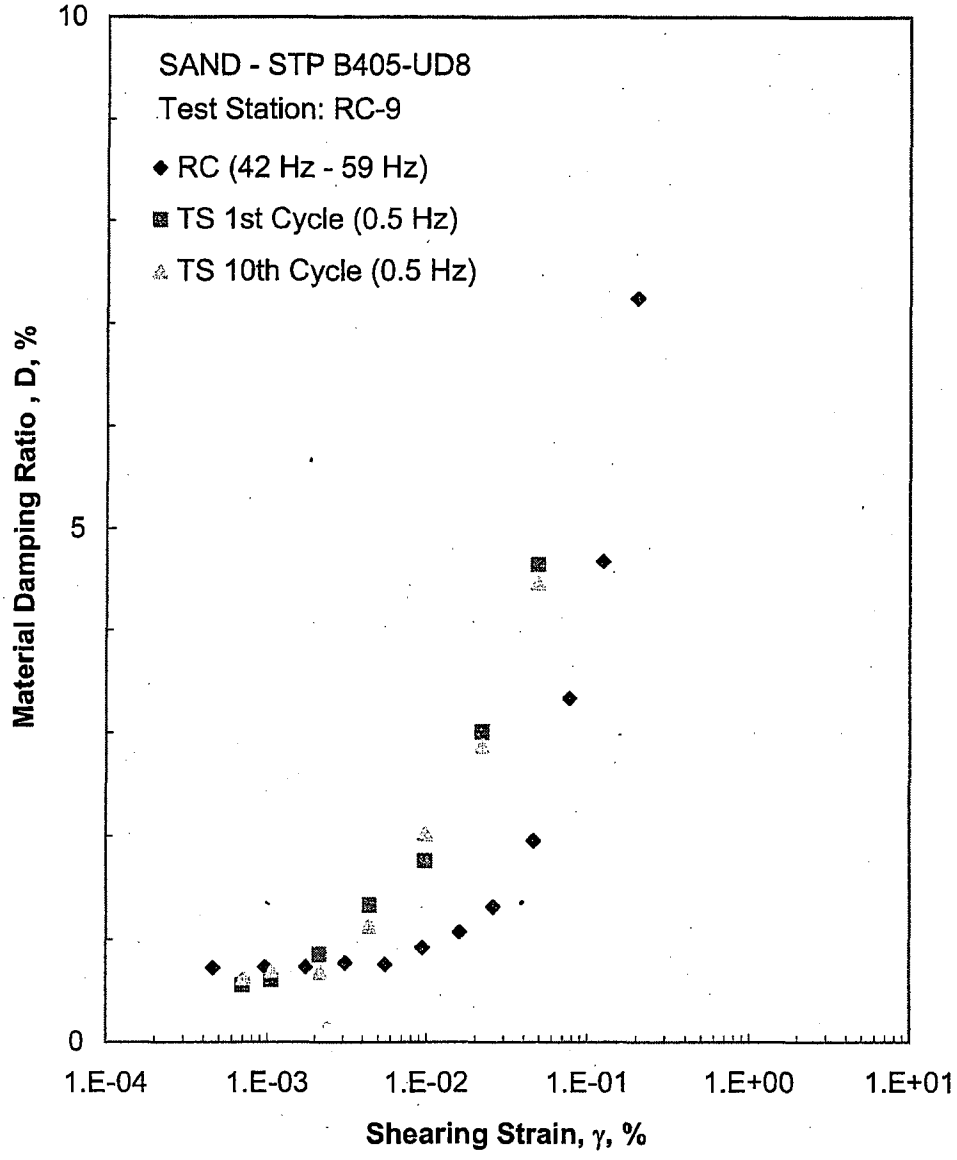


Figure H.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 51 psi from the Combined RCTS Tests

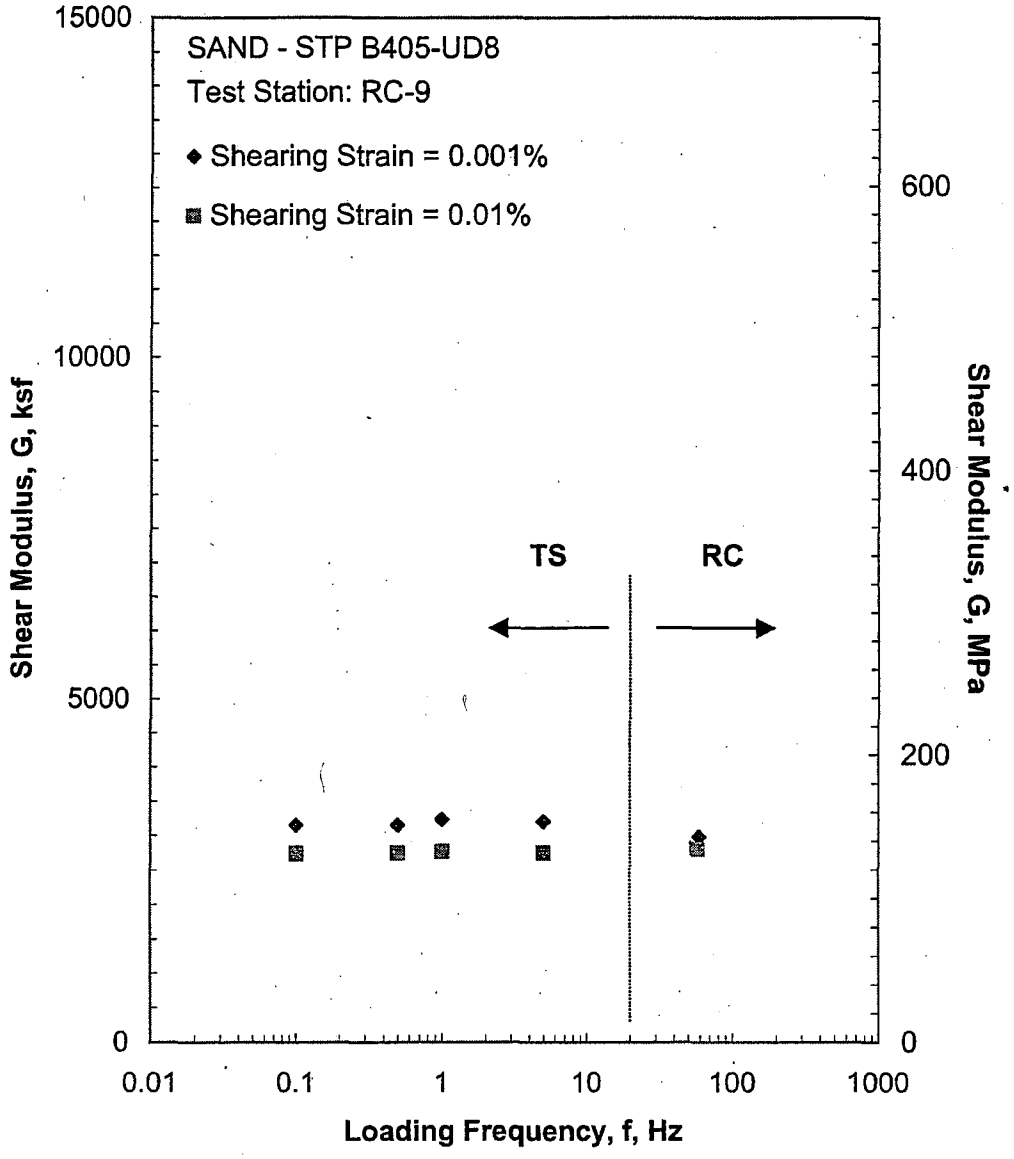


Figure H.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 51 psi from the Combined RCTS Tests

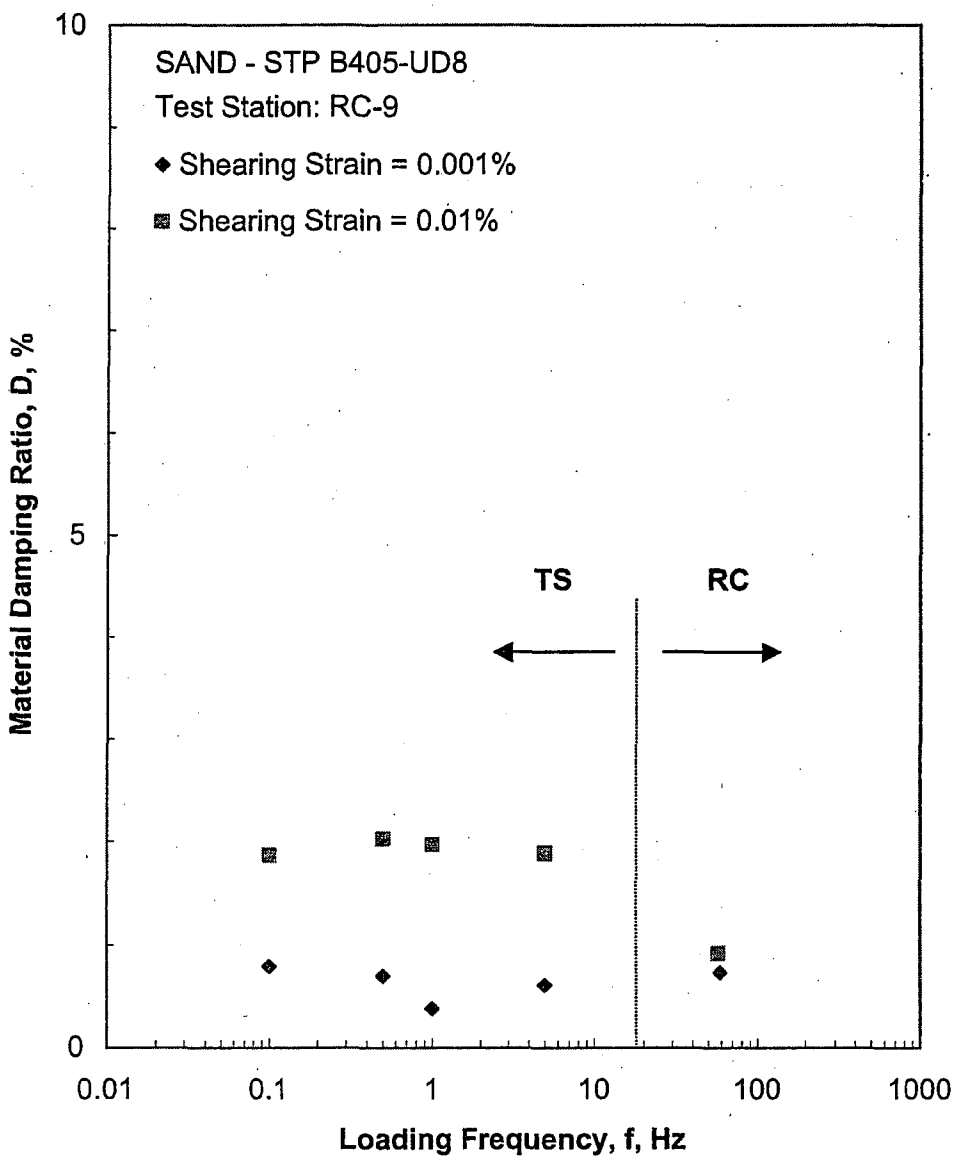


Figure H.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 51 psi from the Combined RCTS Tests

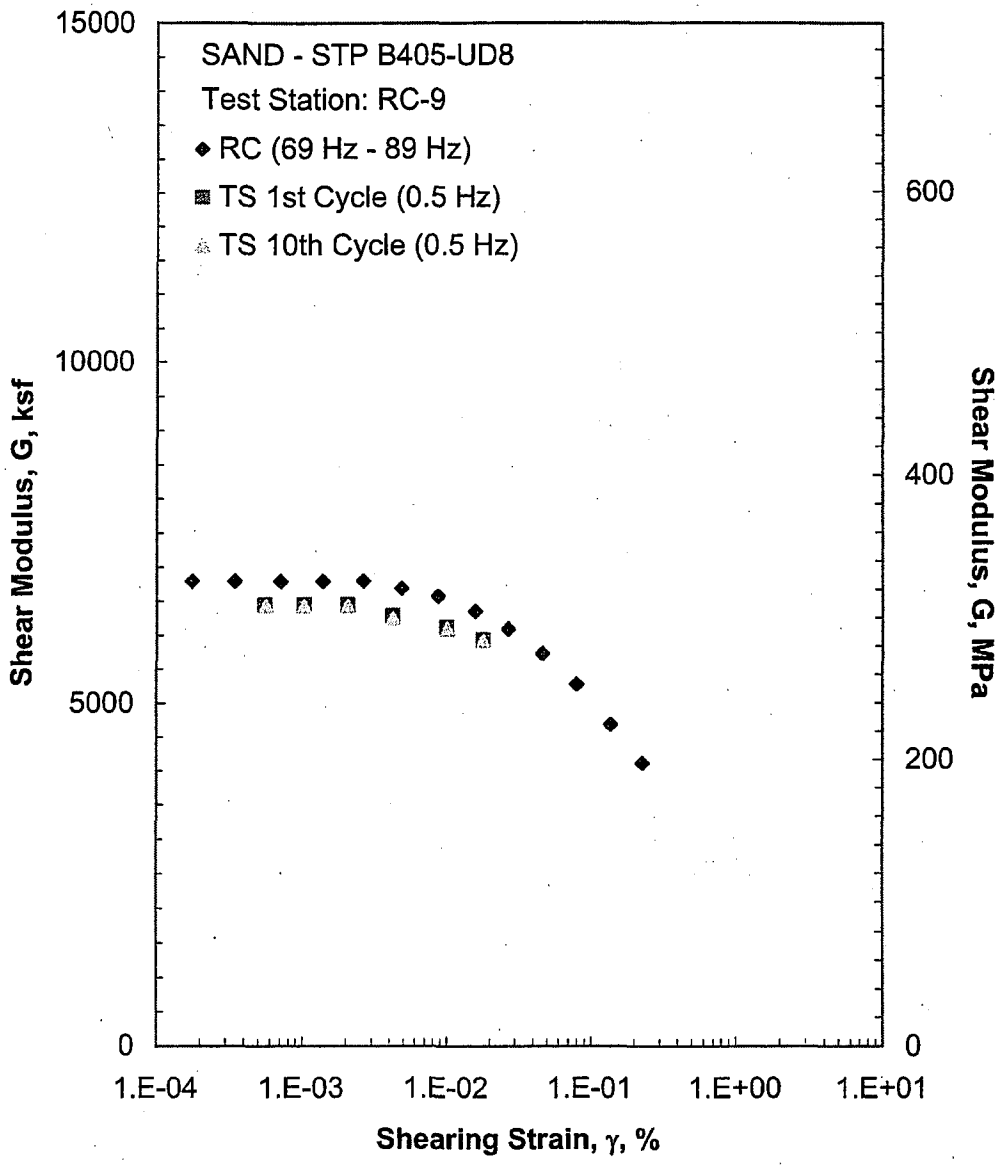


Figure H.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 204 psi from the Combined RCTS Tests

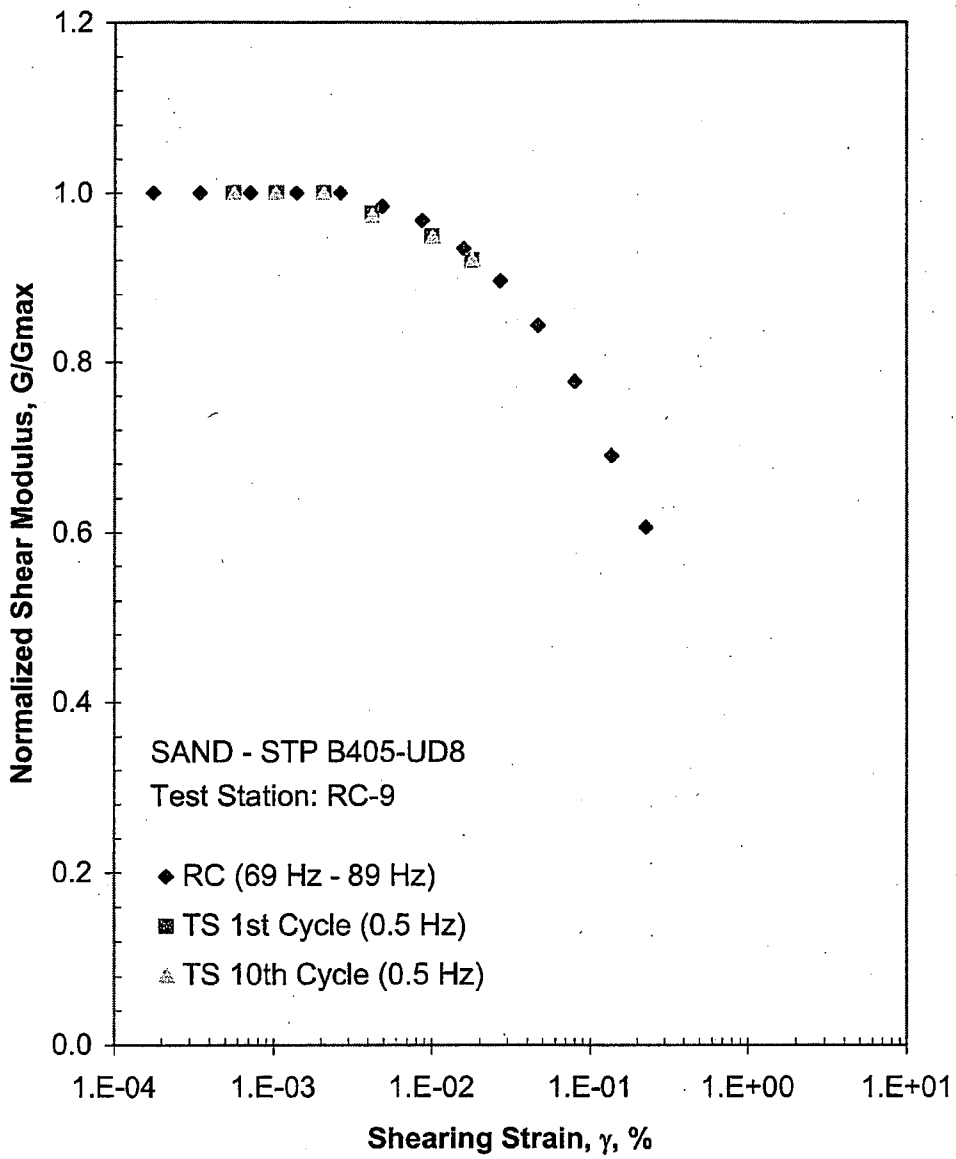


Figure H.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 204 psi from the Combined RCTS Tests

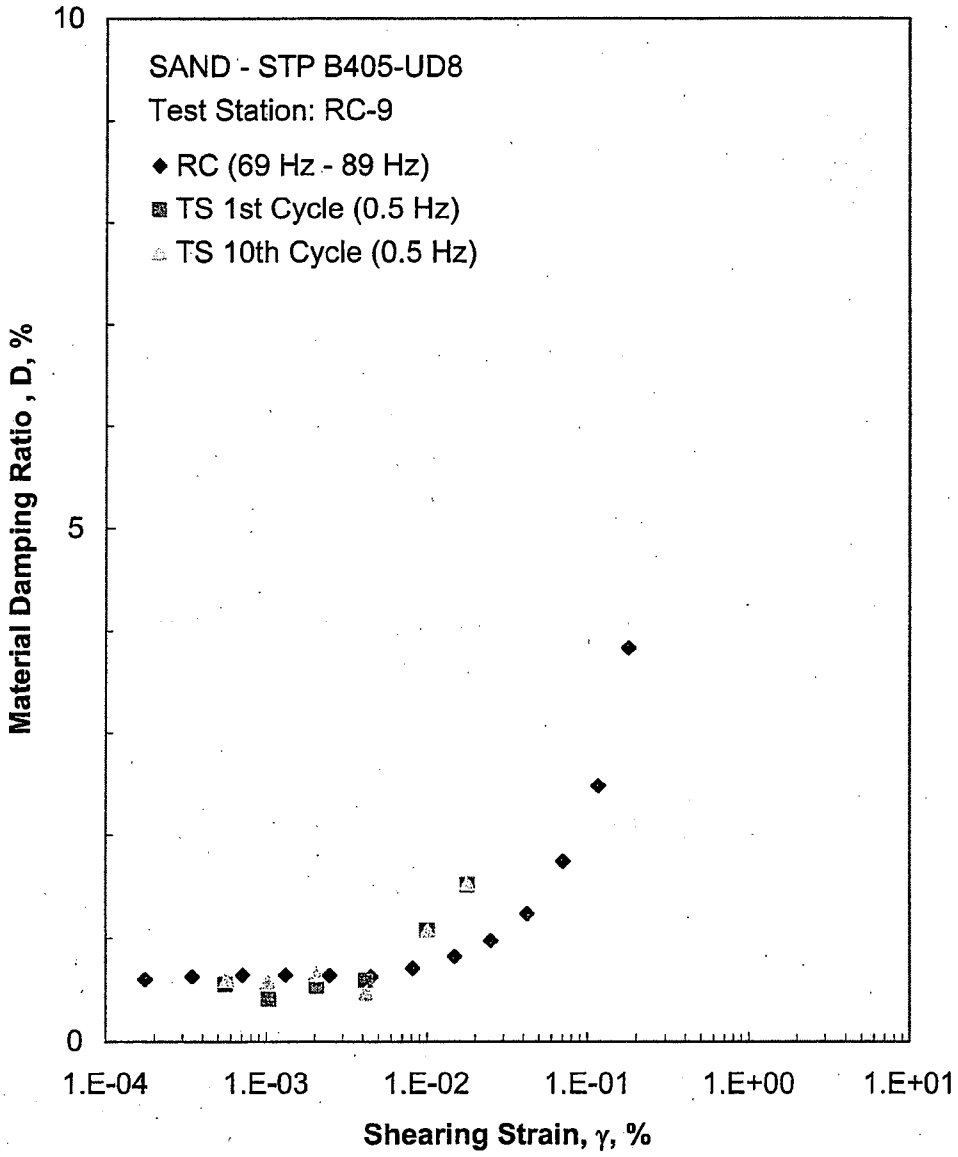


Figure H.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 204 psi from the Combined RCTS Tests

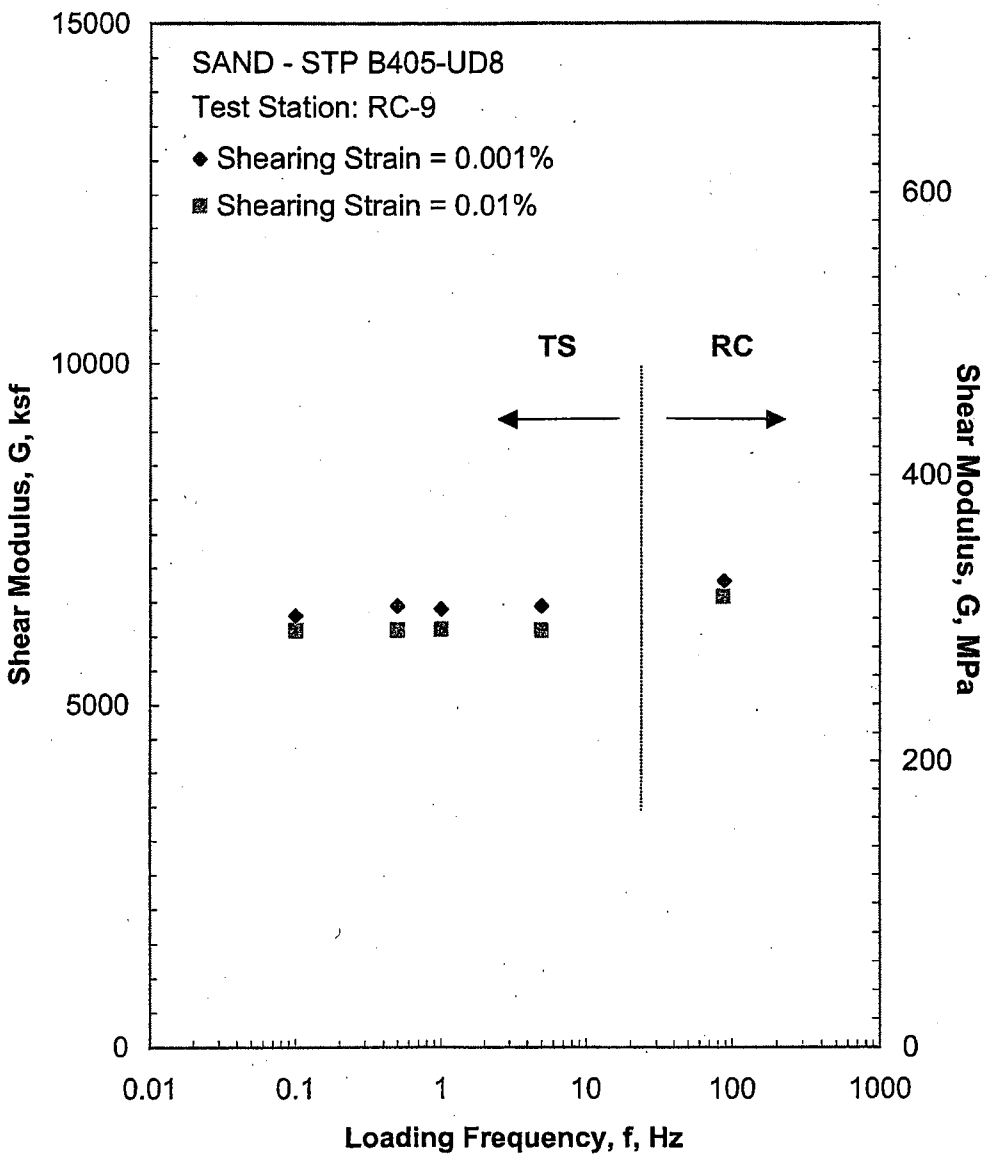


Figure H.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 204 psi from the Combined RCTS Tests

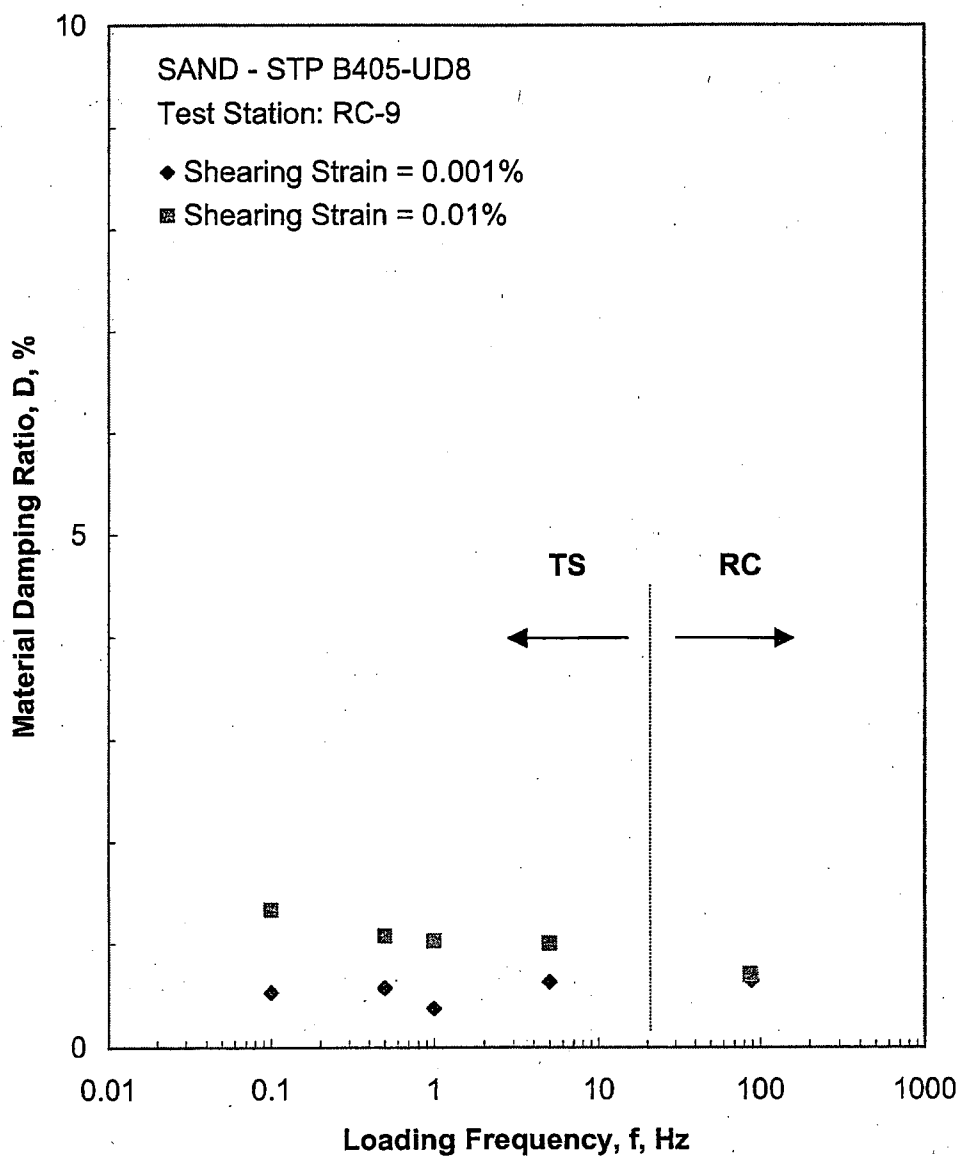


Figure H.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 204 psi from the Combined RCTS Tests

Table H.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B405-UD8

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
13	1843	88	1421	68	604	1.14	0.65
26	3672	176	2042	98	724	1.03	0.65
51	7344	351	2953	142	869	0.74	0.65
102	14688	703	4949	238	1123	0.69	0.64
204	29390	1406	6818	327	1314	0.61	0.63

Table H.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD8; Isoptropic Confining Pressure, σ_o=51 psi (7.3 ksf = 351 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
4.59E-04	2978	1.00	4.59E-04	0.73
9.74E-04	2978	1.00	9.74E-04	0.73
1.76E-03	2978	1.00	1.76E-03	0.73
3.34E-03	2927	0.98	3.11E-03	0.77
5.97E-03	2877	0.97	5.55E-03	0.76
1.04E-02	2802	0.94	9.47E-03	0.92
1.75E-02	2704	0.91	1.60E-02	1.07
2.84E-02	2560	0.86	2.58E-02	1.32
5.38E-02	2328	0.78	4.63E-02	1.95
9.68E-02	2086	0.70	7.74E-02	3.33
1.69E-01	1843	0.62	1.25E-01	4.68
3.03E-01	1592	0.53	2.00E-01	7.24

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table H.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD8; Isotropic Confining Pressure, σ_o=51 psi (7.3 ksf = 351 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
7.04E-04	3197	1.00	0.55	7.10E-04	3169	1.00	0.63
1.06E-03	3182	1.00	0.60	1.07E-03	3155	1.00	0.69
2.14E-03	3151	0.99	0.85	2.15E-03	3137	0.99	0.68
4.39E-03	3077	0.96	1.33	4.36E-03	3094	0.98	1.13
9.79E-03	2759	0.86	1.76	9.80E-03	2754	0.87	2.02
2.19E-02	2470	0.77	3.01	2.20E-02	2457	0.78	2.87
4.89E-02	2121	0.66	4.65	4.87E-02	2137	0.67	4.47

Table H.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD8; Isoptropic Confining Pressure, σ_o= 204 psi (29.4 ksf = 1406 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.76E-04	6800	1.00	1.76E-04	0.60
3.46E-04	6800	1.00	3.46E-04	0.63
7.12E-04	6800	1.00	7.12E-04	0.64
1.39E-03	6800	1.00	1.32E-03	0.64
2.65E-03	6800	1.00	2.49E-03	0.64
4.87E-03	6692	0.98	4.53E-03	0.63
8.71E-03	6577	0.97	8.18E-03	0.71
1.59E-02	6351	0.93	1.49E-02	0.82
2.69E-02	6093	0.90	2.50E-02	0.98
4.65E-02	5733	0.84	4.23E-02	1.23
7.99E-02	5282	0.78	7.11E-02	1.74
1.38E-01	4689	0.69	1.17E-01	2.48
2.28E-01	4117	0.61	1.80E-01	3.83

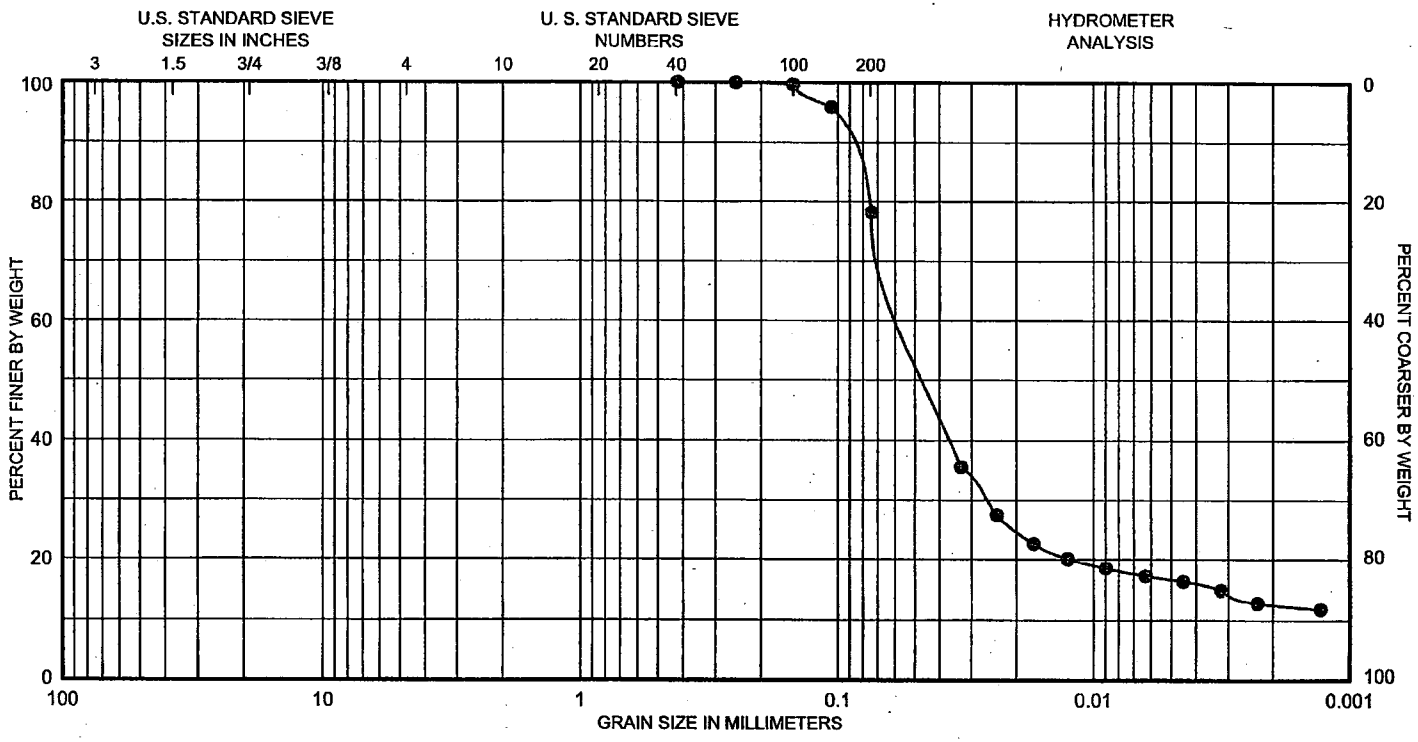
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table H.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD8; Isotropic Confining Pressure, σ_o=204 psi (29.4 ksf = 1406 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D,	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D, %
5.56E-04	6449	1.00	0.55	5.63E-04	6431	1.00	0.59
1.03E-03	6449	1.00	0.41	1.02E-03	6431	1.00	0.58
2.06E-03	6449	1.00	0.53	2.07E-03	6431	1.00	0.65
4.19E-03	6296	0.98	0.59	4.22E-03	6256	0.97	0.47
1.00E-02	6120	0.95	1.07	1.01E-02	6096	0.95	1.07
1.79E-02	5934	0.92	1.51	1.79E-02	5922	0.92	1.53

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_u	C_z	D_{50}	D_{90}	CLASSIFICATION
●	B-405-UD8	170			0.0433	0.09	Fine Sandy Silt, red

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX I

Specimen STP B305-UD10
CLAY (LL=70, PI=48; Gs=2.73)

Borehole B305
Sample UD10
Depth = 195.0 ft (59.4 m)
Total Unit Weight = 120.0 lb/ft^3
Water Content = 27.9 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 58.2 psi

FUGRO JOB #: 0401-1660
Testing Station: RC9

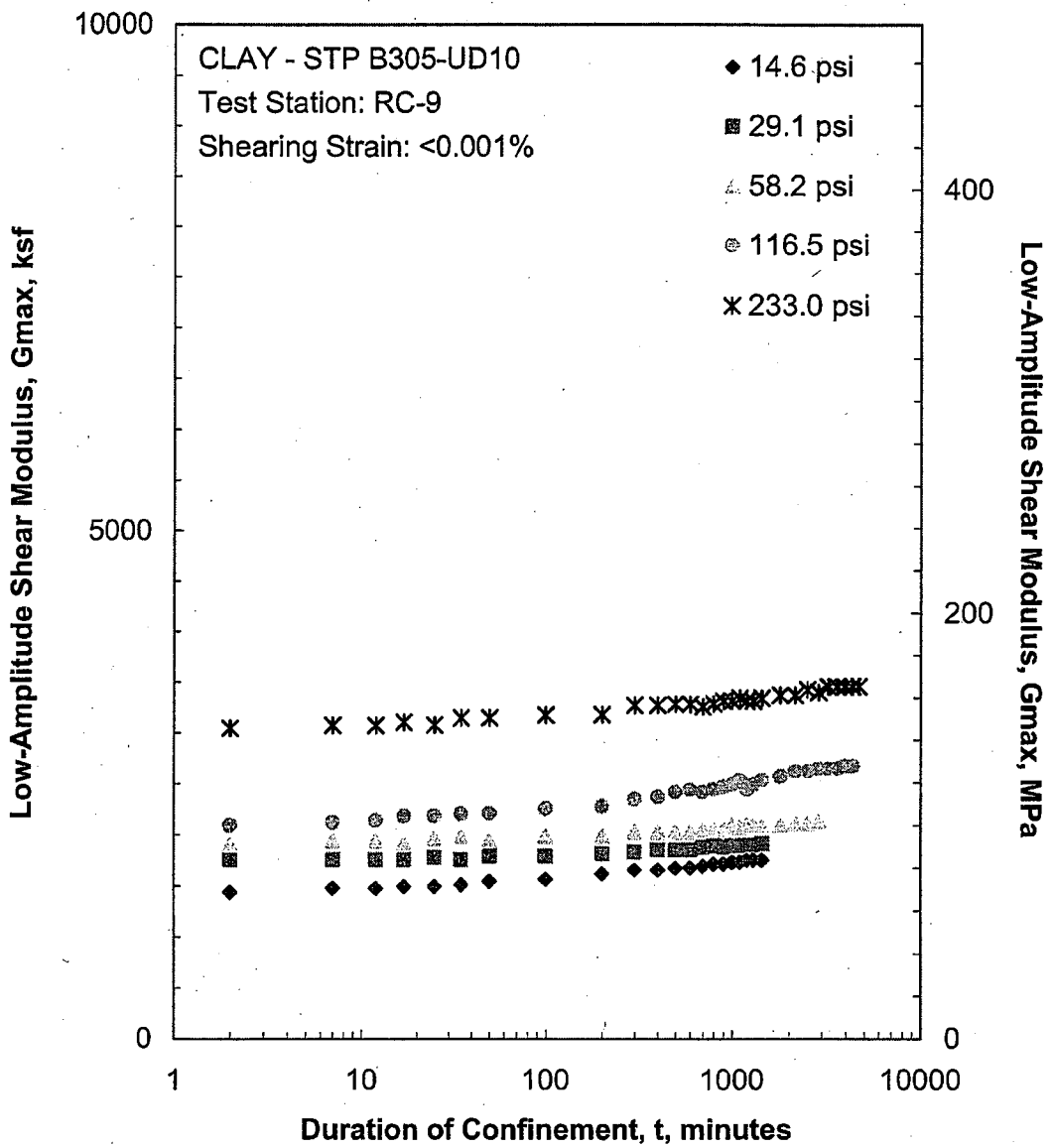


Figure I.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

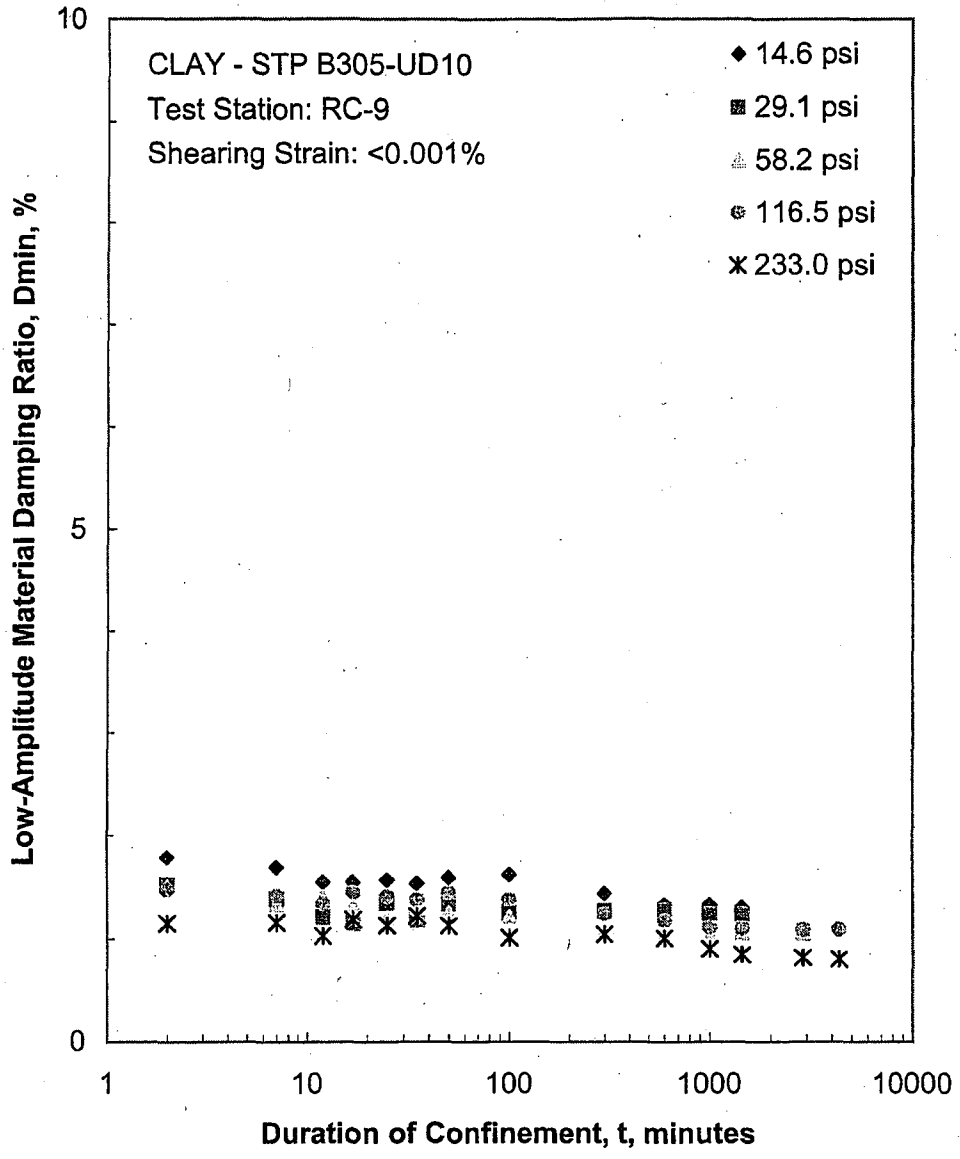


Figure I.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

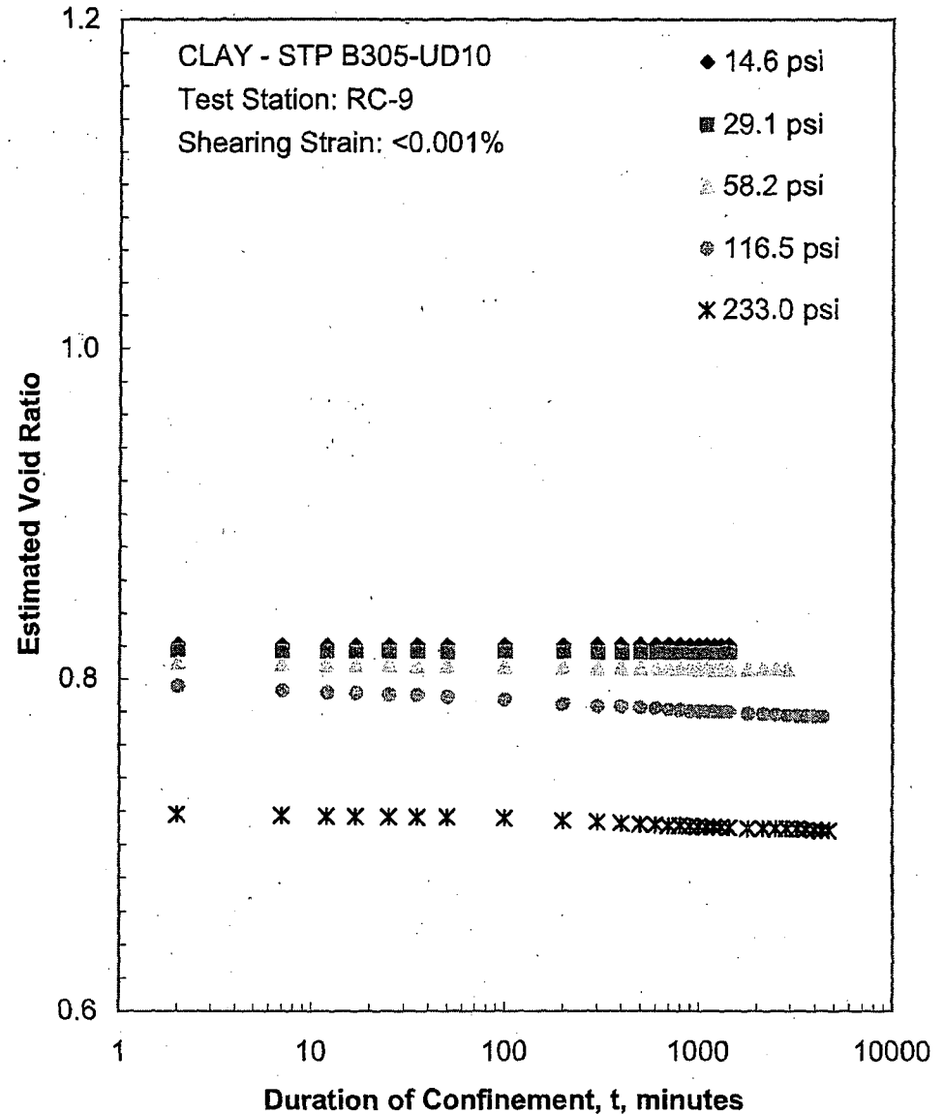


Figure I.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

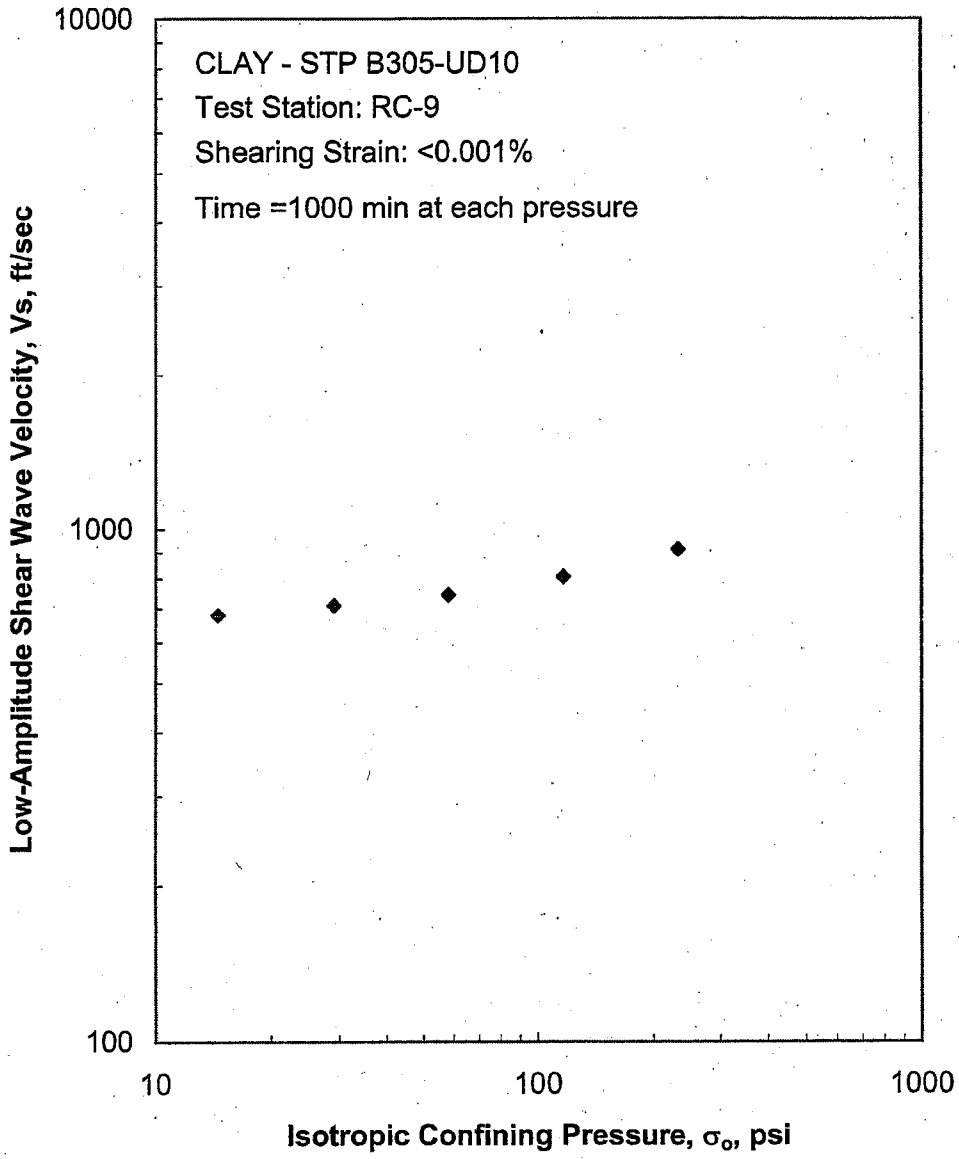


Figure I.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

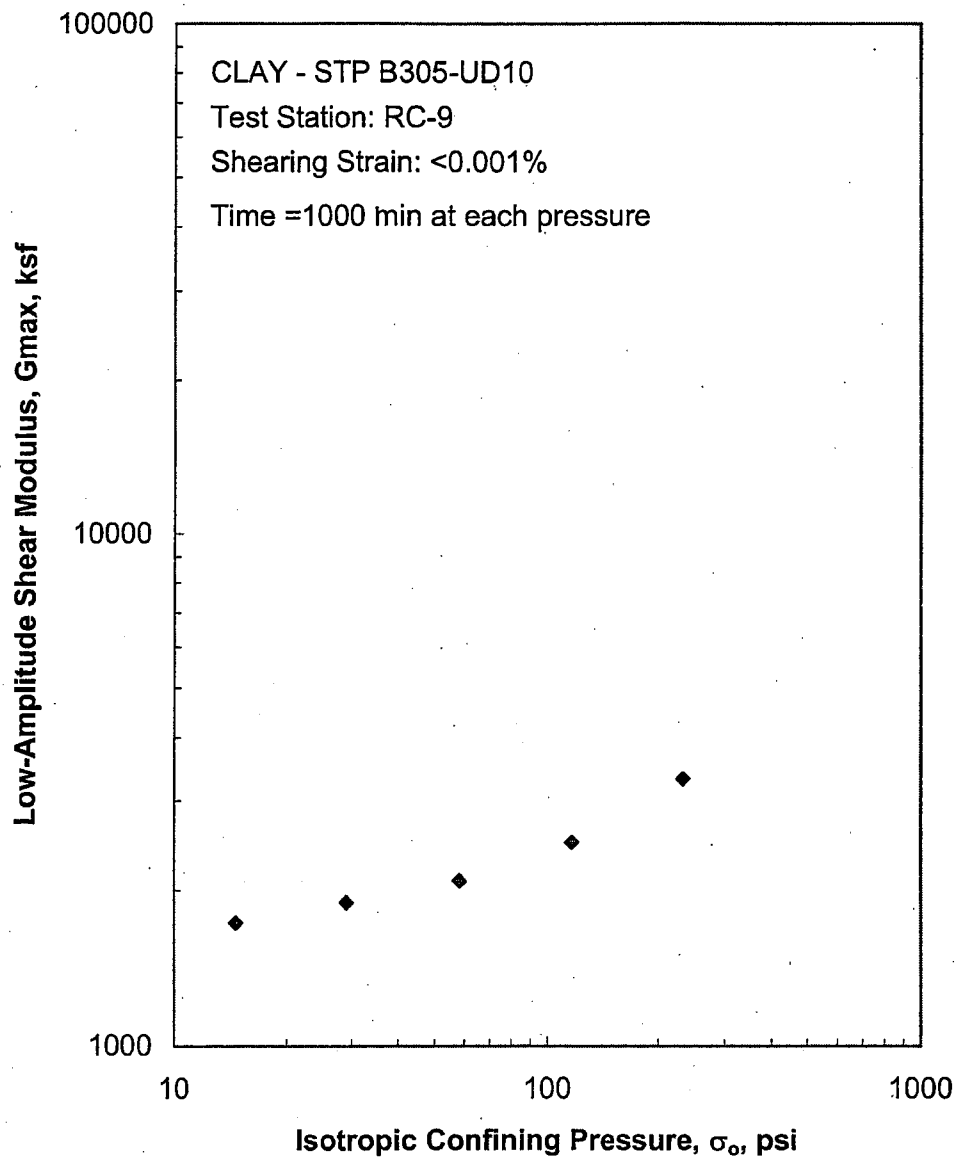


Figure I.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

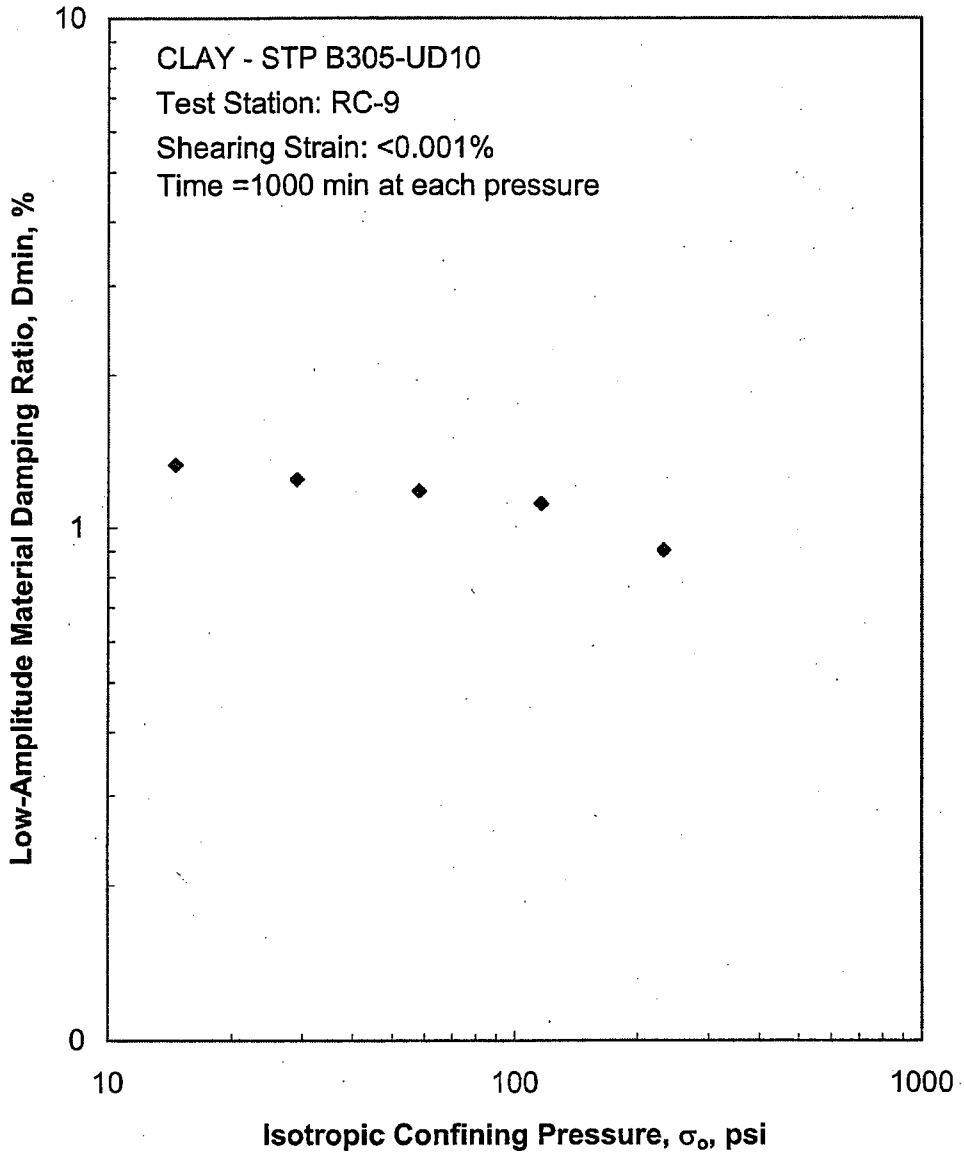


Figure I.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

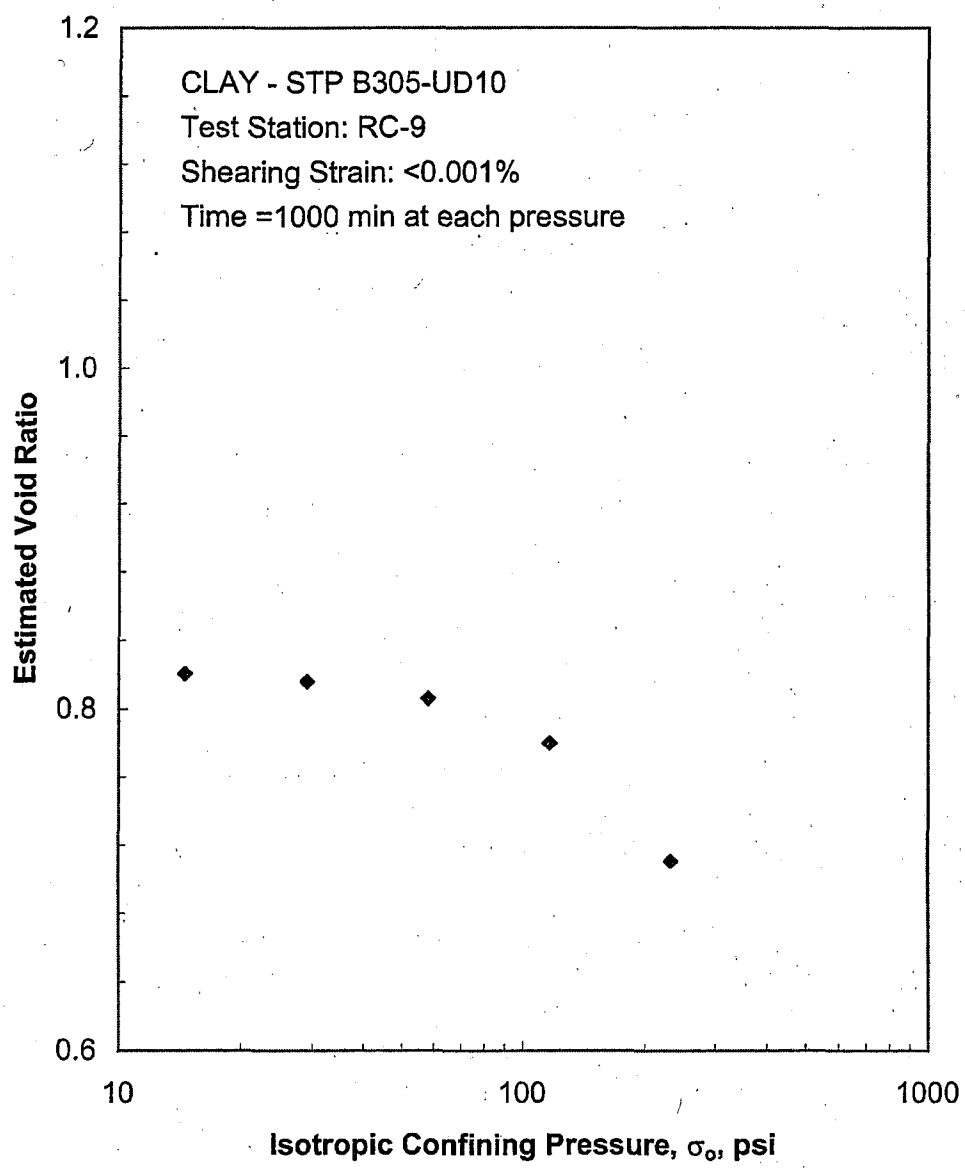


Figure I.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

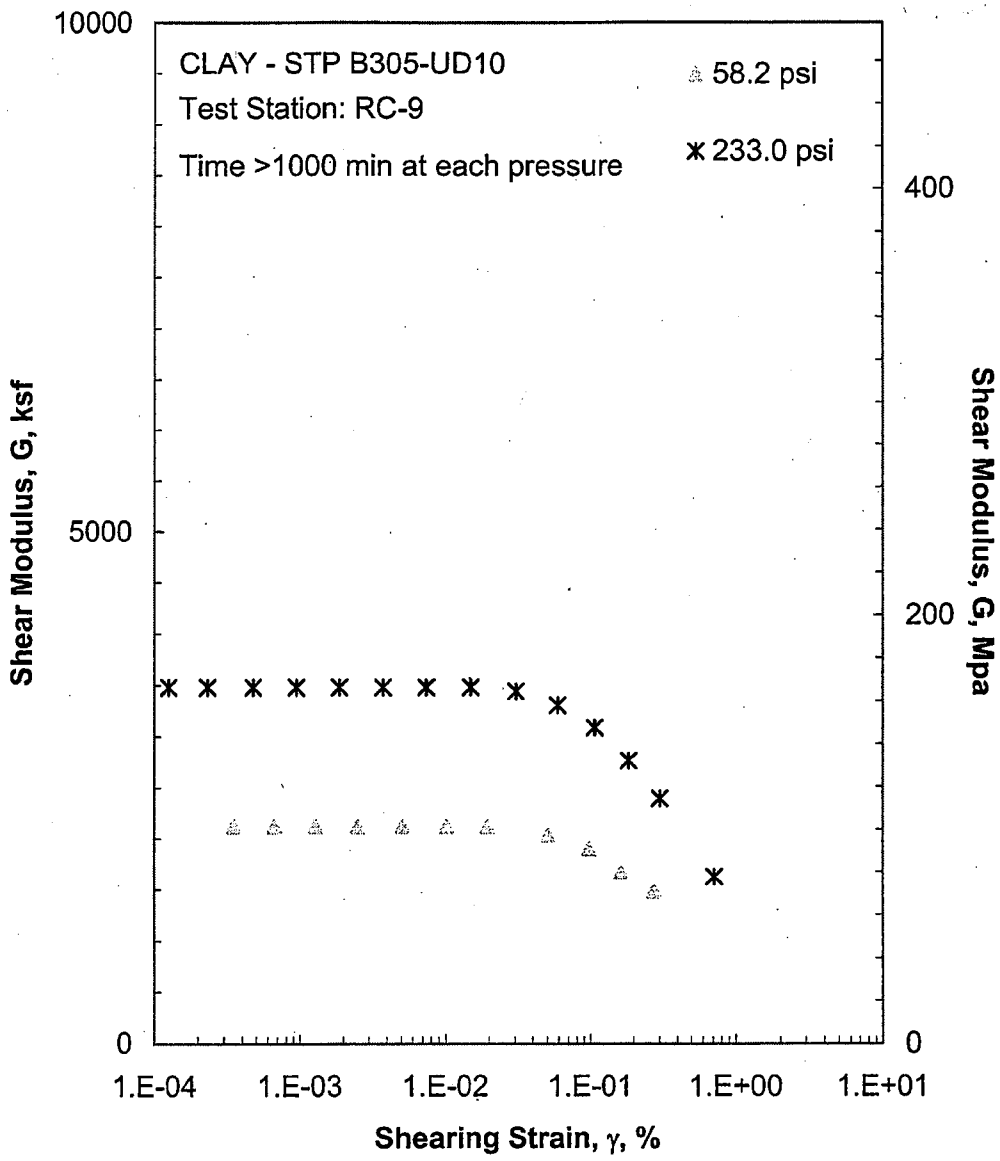


Figure I.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

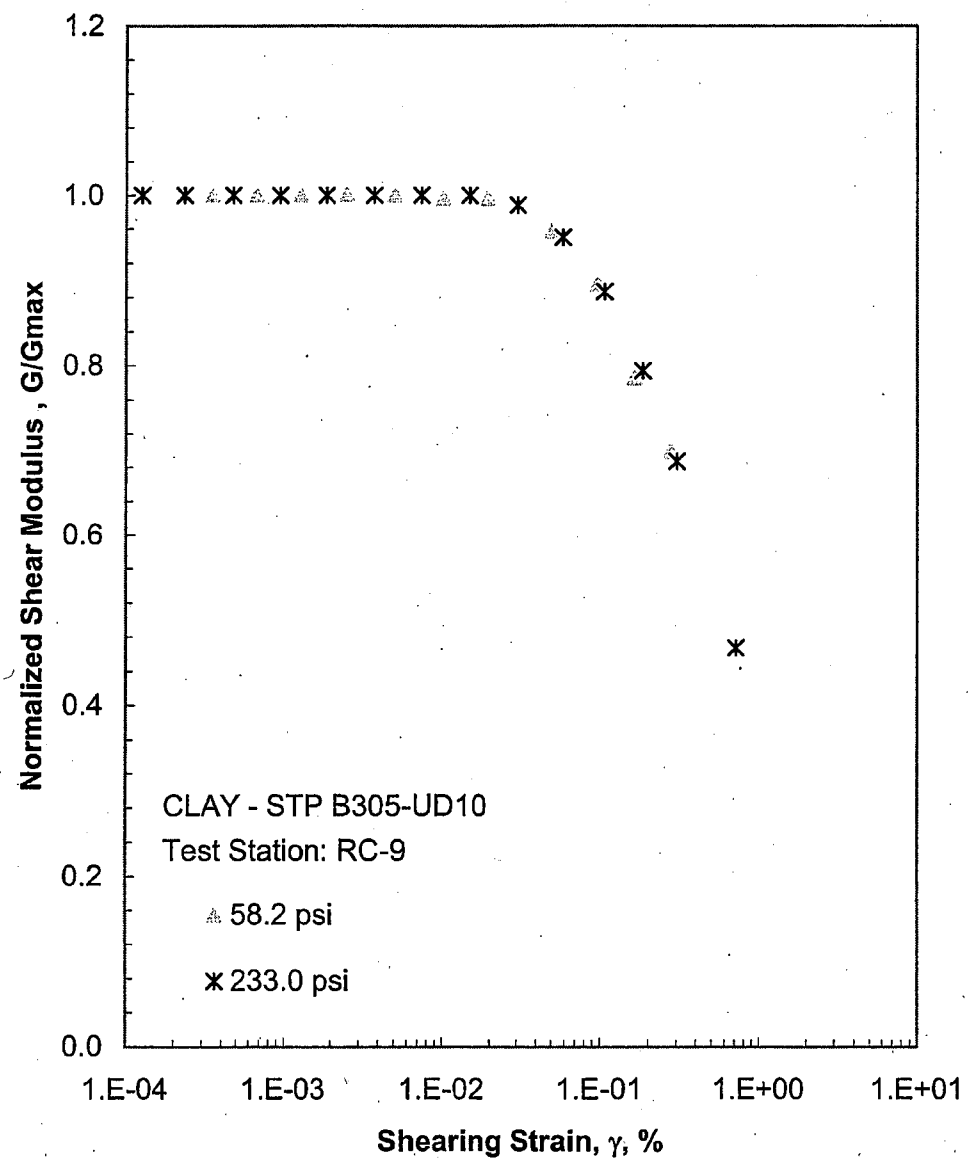


Figure I.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

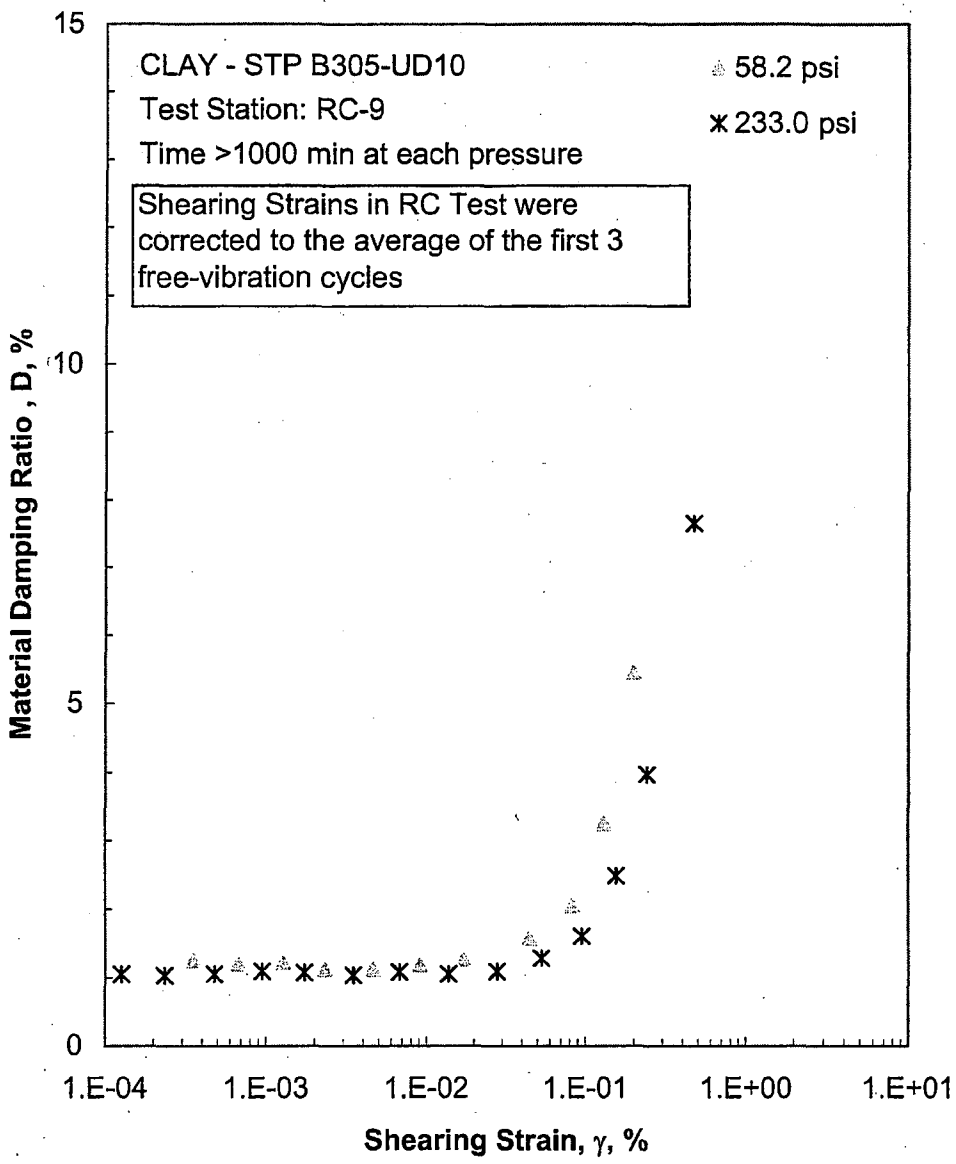


Figure I.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

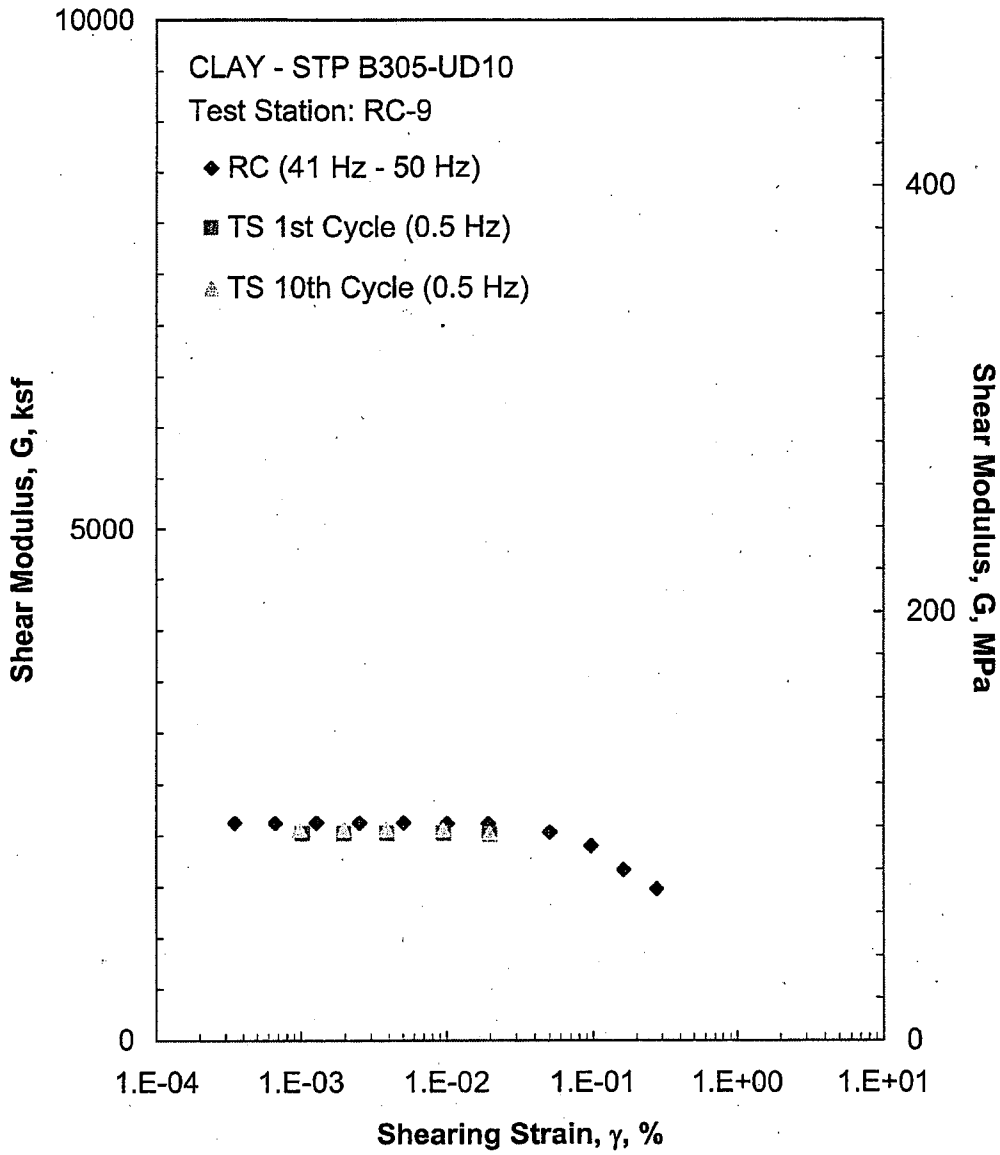


Figure I.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 58.2 psi from the Combined RCTS Tests

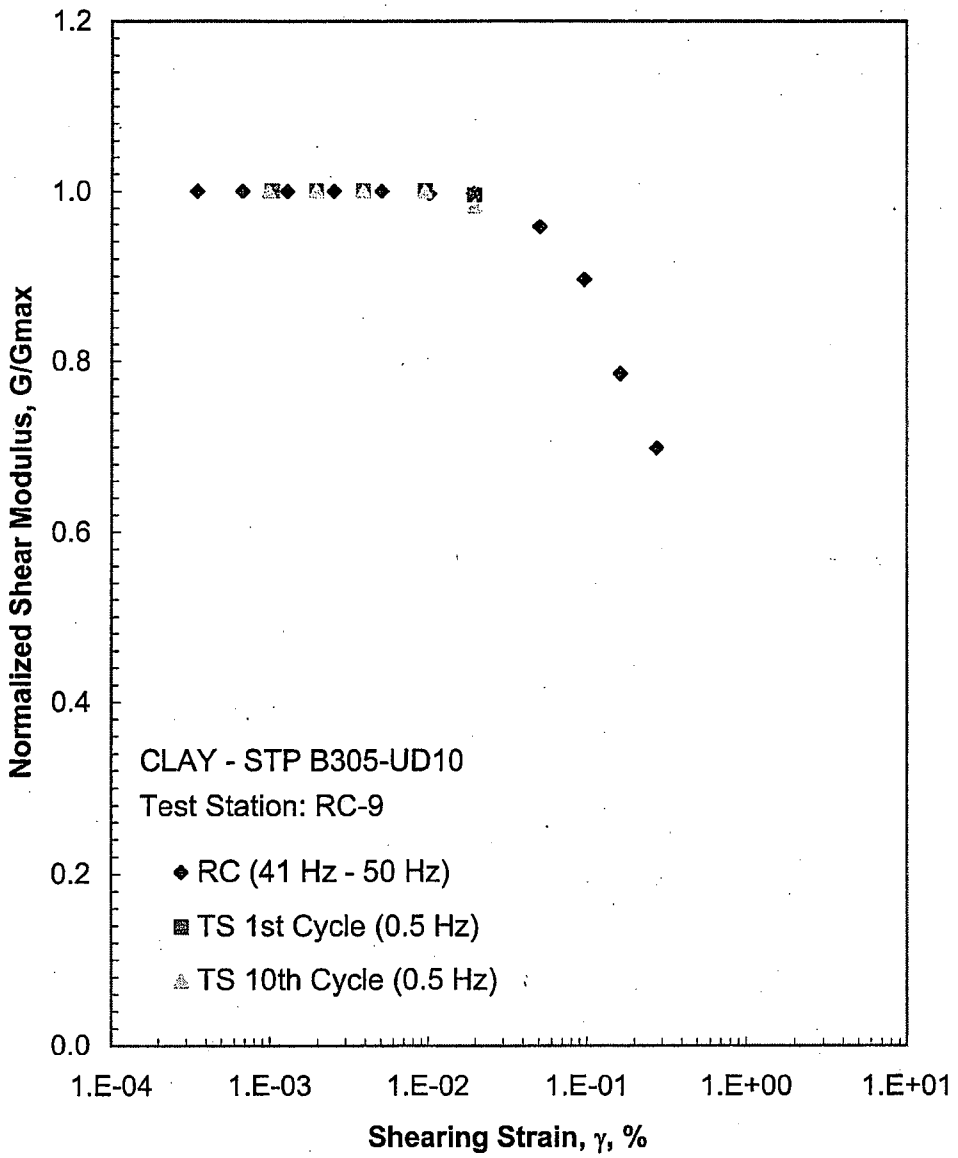


Figure I.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 58.2 psi from the Combined RCTS Tests

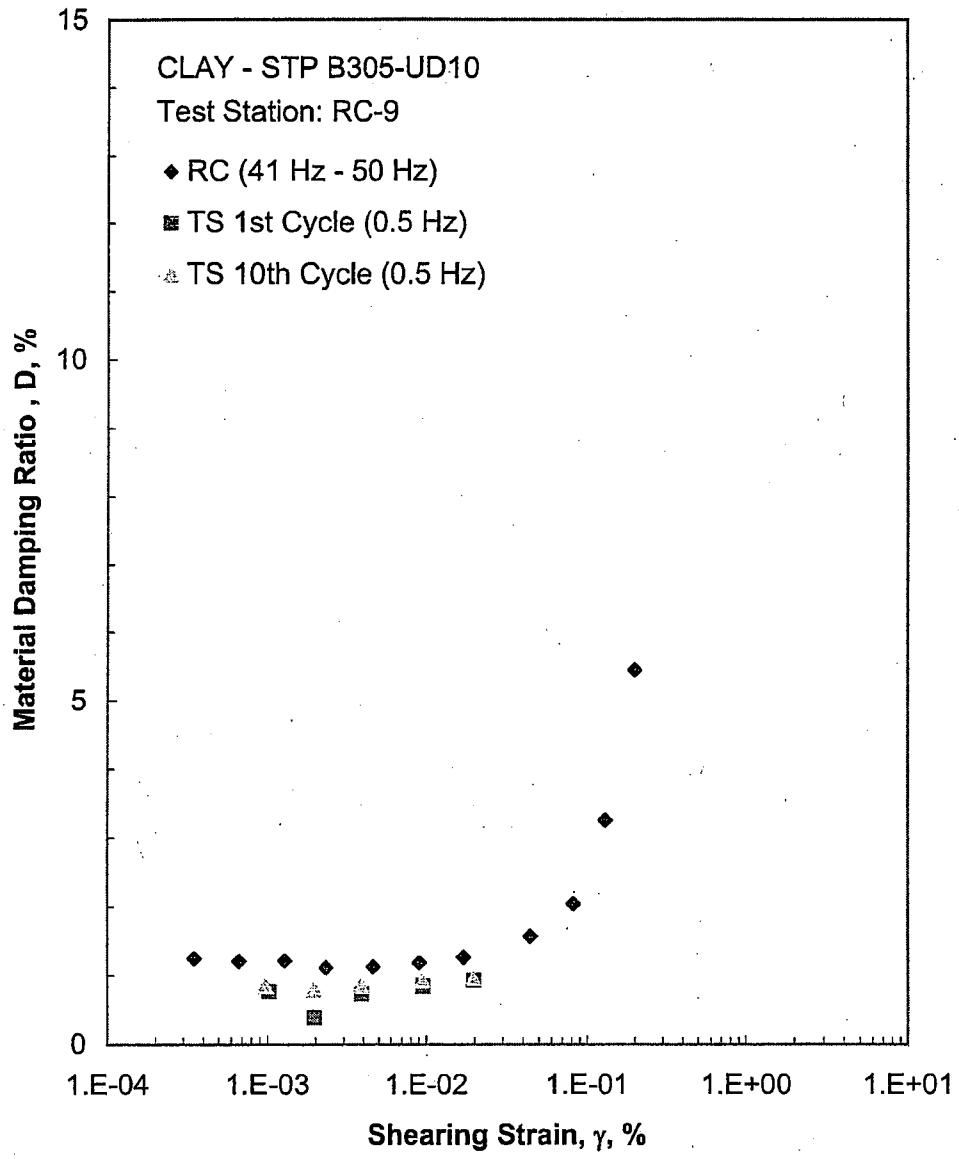


Figure I.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 58.2 psi from the Combined RCTS Tests

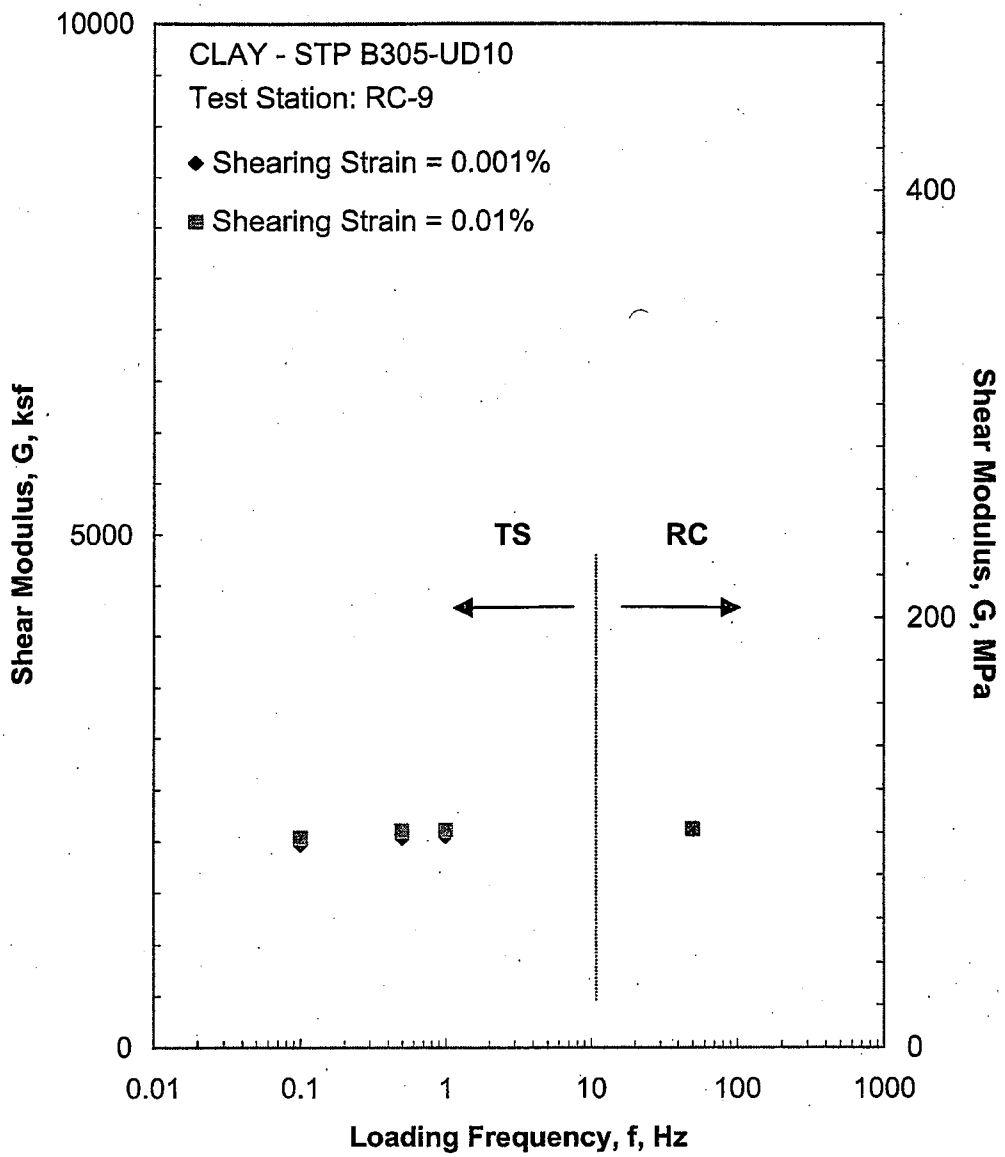


Figure I.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 58.2 psi from the Combined RCTS Tests

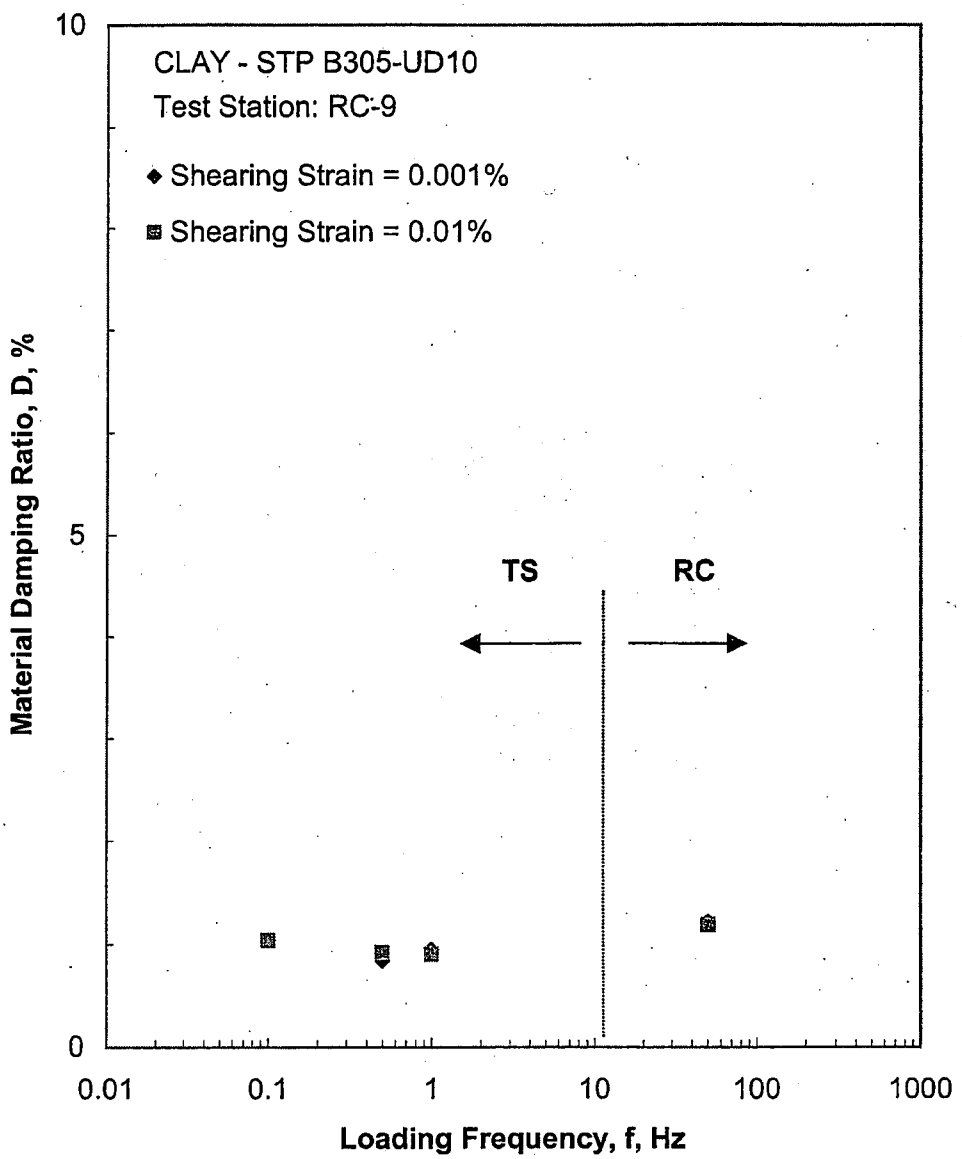


Figure I.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 58.2 psi from the Combined RCTS Tests

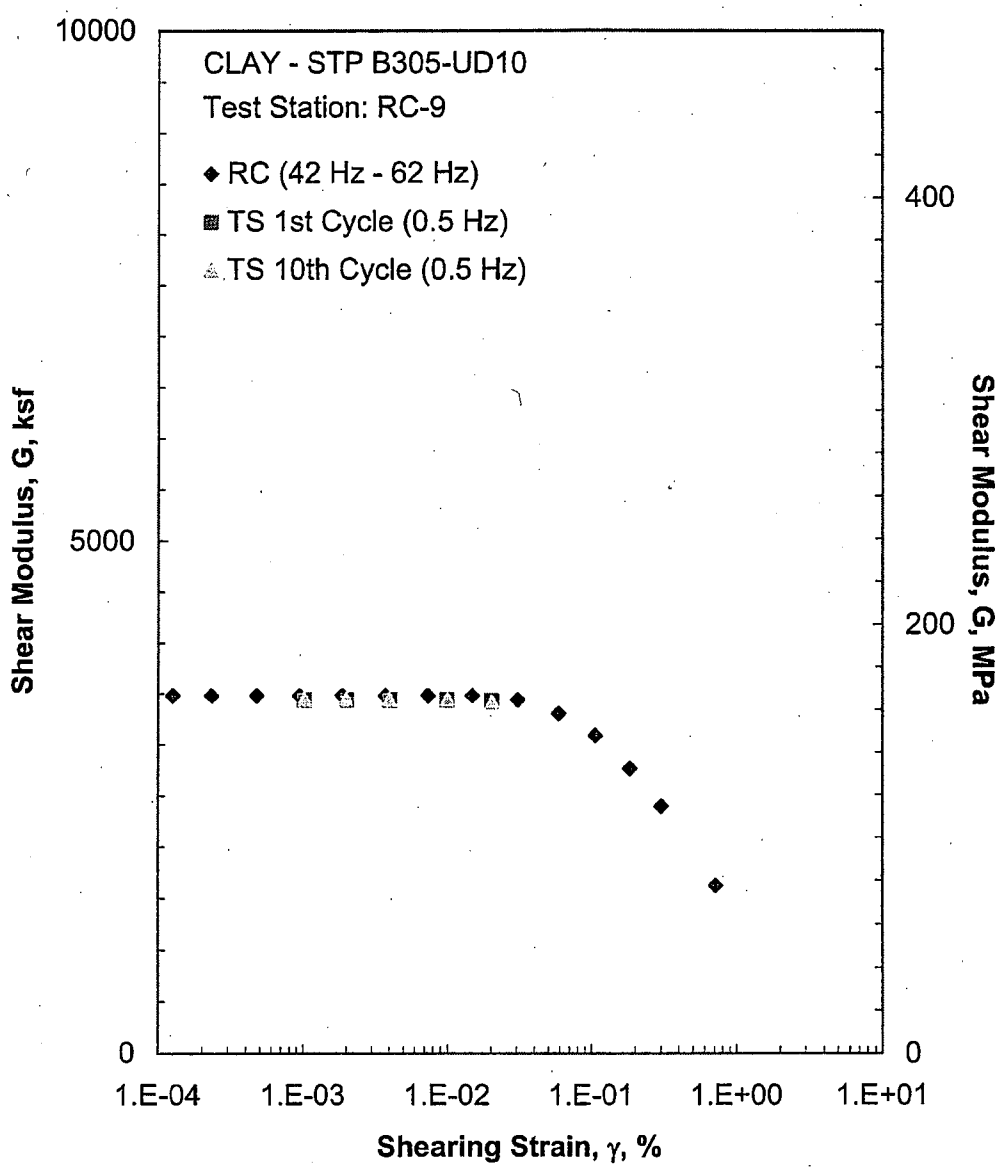


Figure I.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 233.0 psi from the Combined RCTS Tests

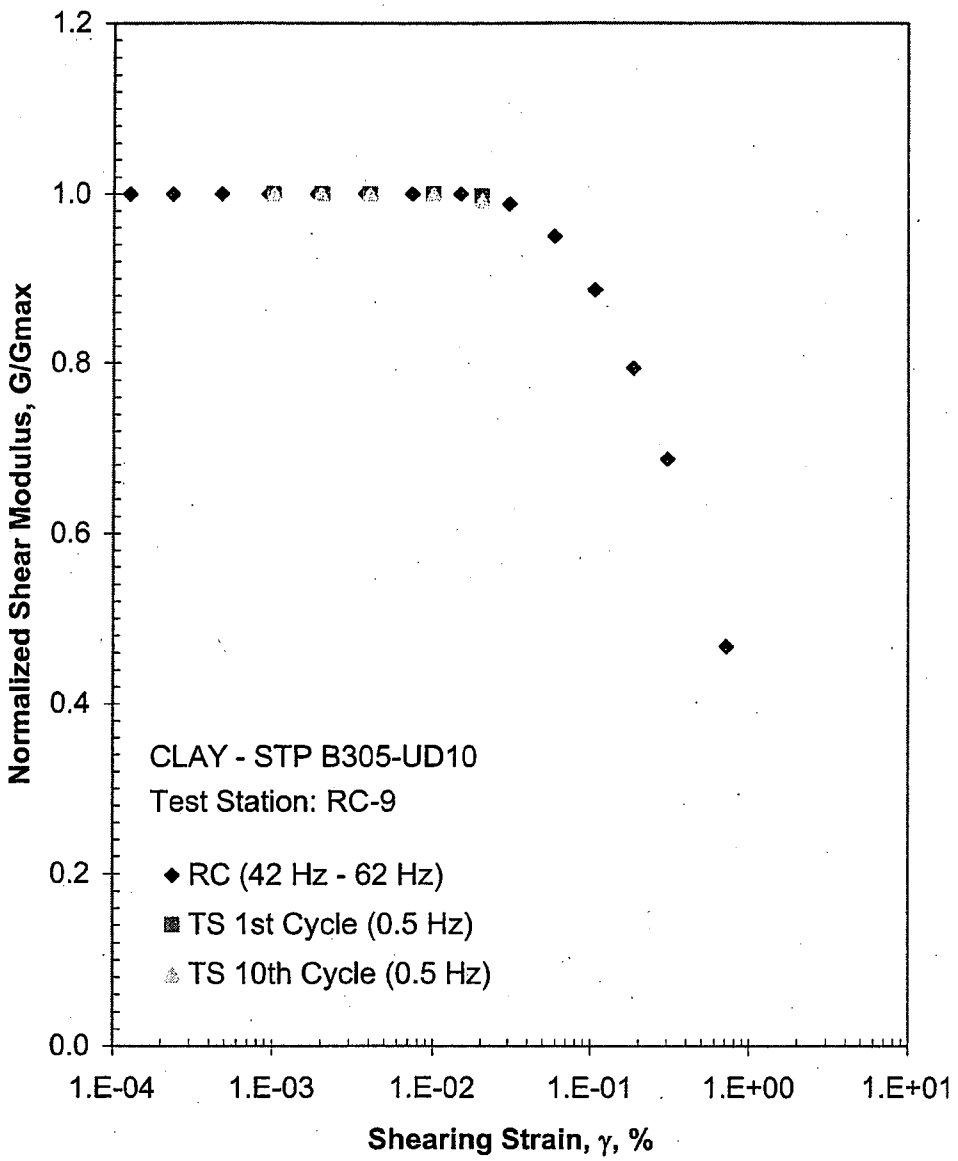


Figure I.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 233.0 psi from the Combined RCTS Tests

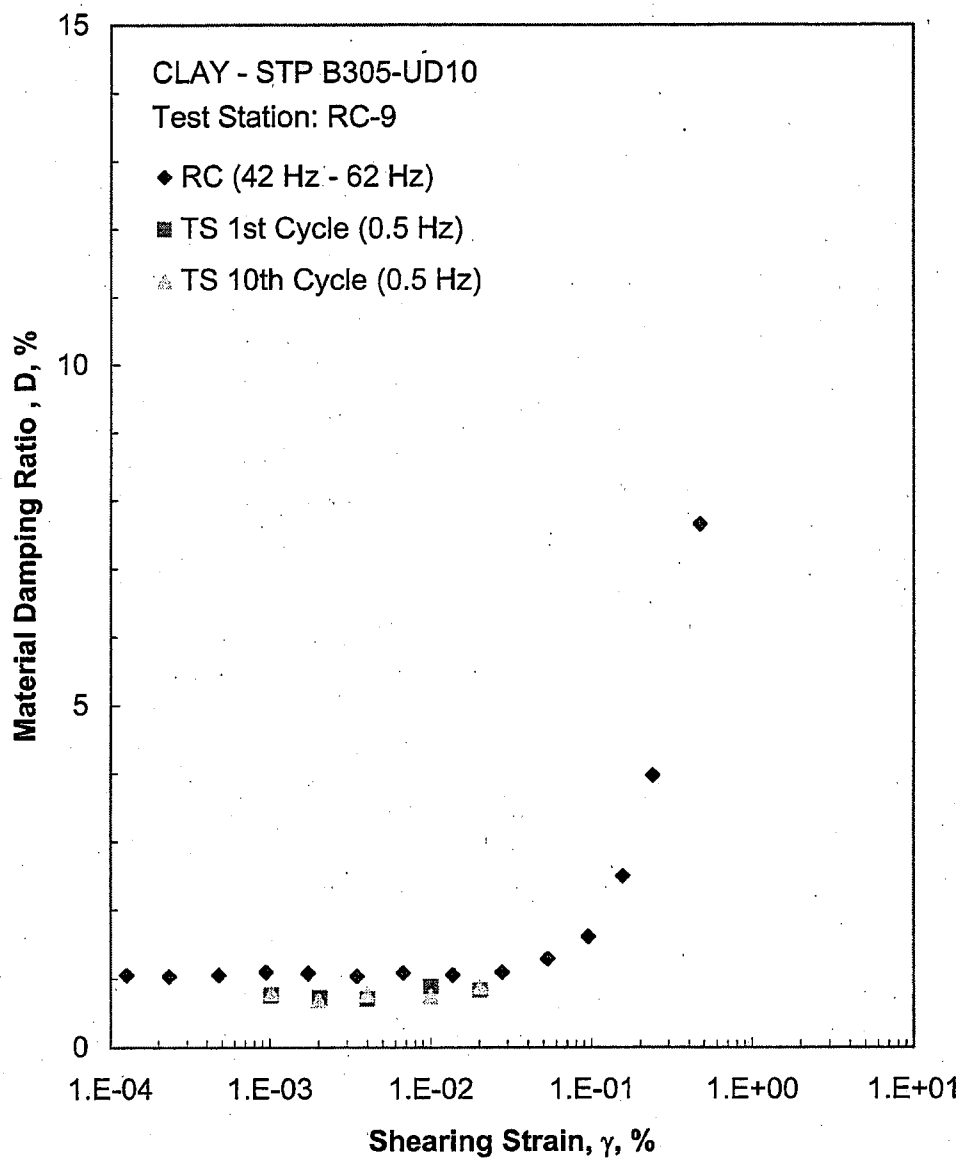


Figure I.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 233.0 psi from the Combined RCTS Tests

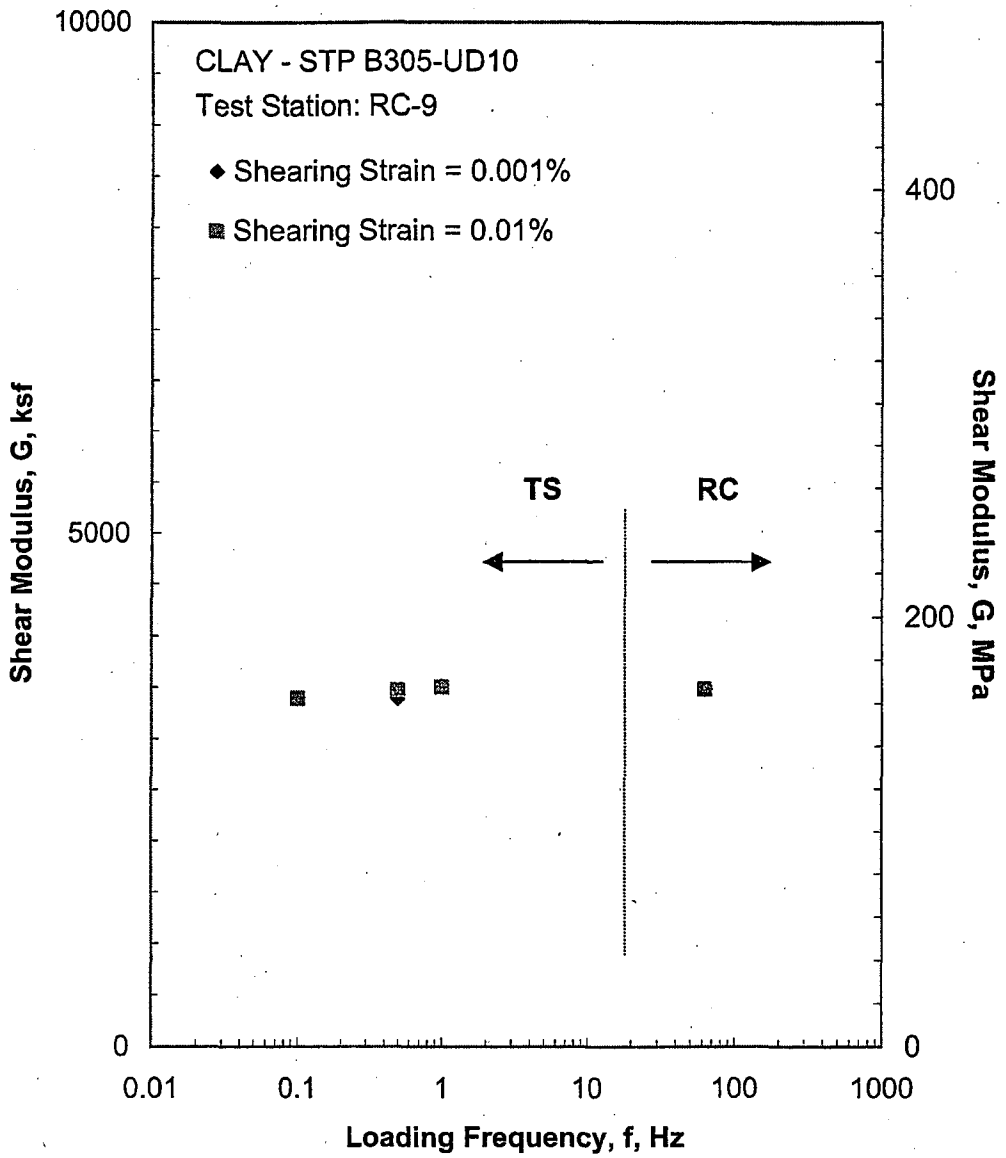


Figure I.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 233.0 psi from the Combined RCTS Tests

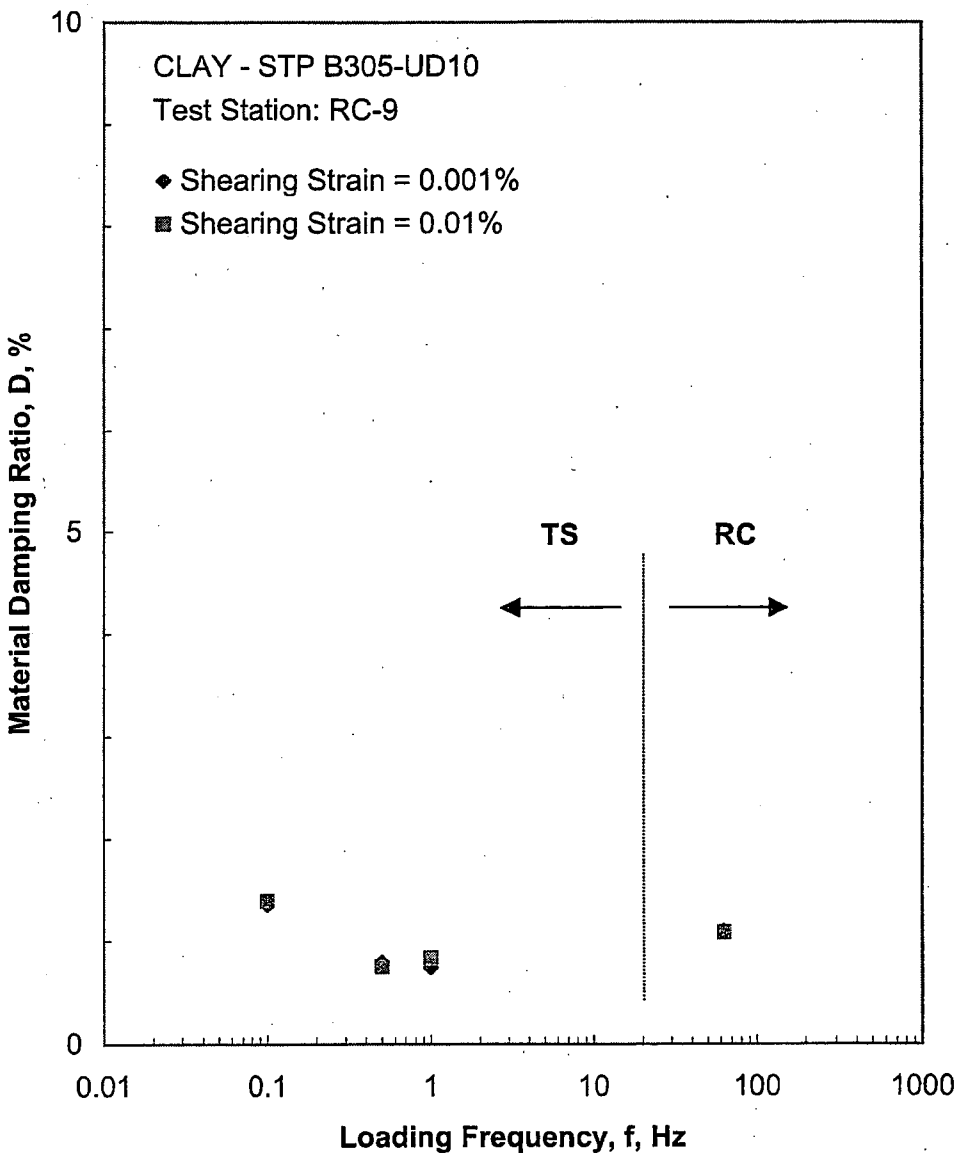


Figure I.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 233.0 psi from the Combined RCTS Tests

Table I.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B305-UD10

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
14.6	2102	101	1734	83	680	1.33	0.820
29.1	4190	200	1895	91	710	1.24	0.816
58.2	8381	401	2091	100	744	1.18	0.806
116.5	16776	803	2490	120	806	1.11	0.780
233.0	33552	1605	3313	159	911	0.90	0.711

Table I.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B305-UD10; Isoptropic Confining Pressure, σ_o=58.2 psi (8.4 ksf = 401 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
3.50E-04	2124	1.00	3.50E-04	1.25
6.71E-04	2124	1.00	6.71E-04	1.21
1.28E-03	2124	1.00	1.28E-03	1.22
2.52E-03	2124	1.00	2.32E-03	1.12
5.07E-03	2124	1.00	4.61E-03	1.13
1.02E-02	2117	1.00	9.05E-03	1.18
1.94E-02	2117	1.00	1.71E-02	1.26
5.06E-02	2033	0.96	4.46E-02	1.57
9.69E-02	1902	0.90	8.24E-02	2.04
1.63E-01	1668	0.79	1.30E-01	3.25
2.76E-01	1483	0.70	1.99E-01	5.45

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table I.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B305-UD10; Isotropic Confining Pressure, σ_o= 58.2 psi (8.4 ksf =401 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
1.03E-03	2025	1.00	0.76	9.80E-04	2057	1.00	0.84
1.96E-03	2025	1.00	0.39	1.95E-03	2057	1.00	0.78
3.89E-03	2025	1.00	0.72	3.87E-03	2057	1.00	0.84
9.56E-03	2025	1.00	0.84	9.50E-03	2057	1.00	0.92
1.98E-02	2016	1.00	0.92	1.97E-02	2020	0.98	0.95

Table I.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B305-UD10; Isoptropic Confining Pressure, σ_o= 233.0 psi (33.6 ksf = 1605 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.26E-04	3480	1.00	1.26E-04	1.05
2.33E-04	3480	1.00	2.33E-04	1.03
4.76E-04	3480	1.00	4.76E-04	1.05
9.48E-04	3480	1.00	9.48E-04	1.09
1.88E-03	3480	1.00	1.73E-03	1.07
3.77E-03	3480	1.00	3.46E-03	1.03
7.41E-03	3480	1.00	6.74E-03	1.08
1.49E-02	3480	1.00	1.37E-02	1.05
3.05E-02	3439	0.99	2.77E-02	1.09
5.90E-02	3305	0.95	5.31E-02	1.28
1.07E-01	3087	0.89	9.51E-02	1.61
1.85E-01	2764	0.79	1.55E-01	2.49
3.03E-01	2391	0.69	2.39E-01	3.97
7.15E-01	1626	0.47	4.72E-01	7.65

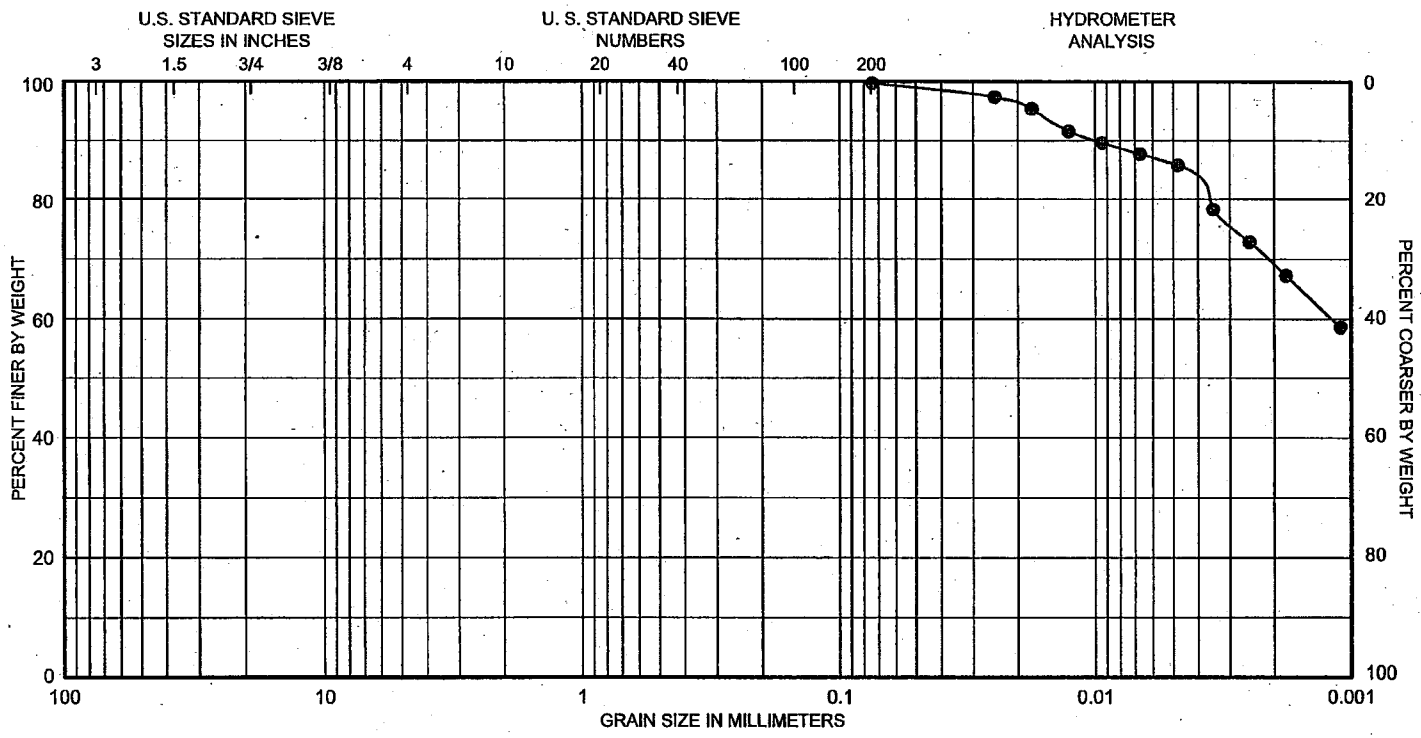
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table I.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B305-UD10; Isotropic Confining Pressure, σ_o=233.0 psi (33.6 ksf = 1605 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
1.02E-03	3437	1.00	0.76	1.02E-03	3450	1.00	0.79
2.03E-03	3437	1.00	0.72	2.00E-03	3450	1.00	0.68
4.02E-03	3437	1.00	0.71	4.01E-03	3450	1.00	0.77
1.00E-02	3437	1.00	0.88	1.00E-02	3450	1.00	0.74
2.03E-02	3429	1.00	0.84	2.03E-02	3424	0.99	0.88

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-305-UD10	195				0.01	Clay Stiff, red and gray, slickensided, with ferrous deposits

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX J

Specimen STP B405-UD1
CLAY (LL=73, PI=52; Gs=2.77)

Borehole B405
Sample UD1
Depth = 11.8 ft (3.4 m)
Total Unit Weight = 117.9 lb/ft^3
Water Content = 28.2 %
Estimated In-Situ Ko = 0.5*
Estimated In-Situ Mean Effective
Stress = 5.2 psi

* Regarding the value as provided by MACTEC, Dr. Stokoe indicates *"results show that this is not correct."*

FUGRO JOB #: 0401-1660
Testing Station: RC8

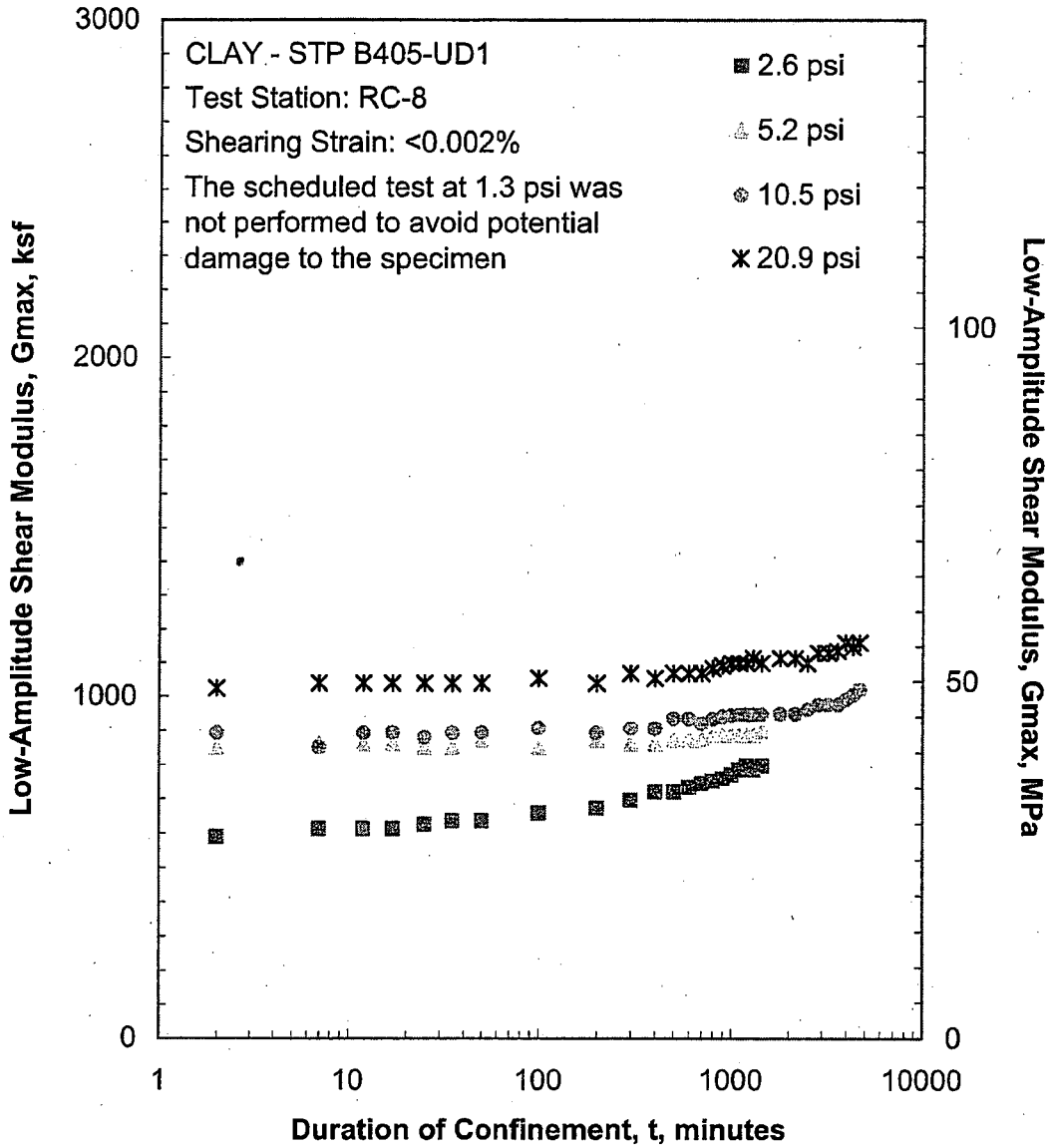


Figure J.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

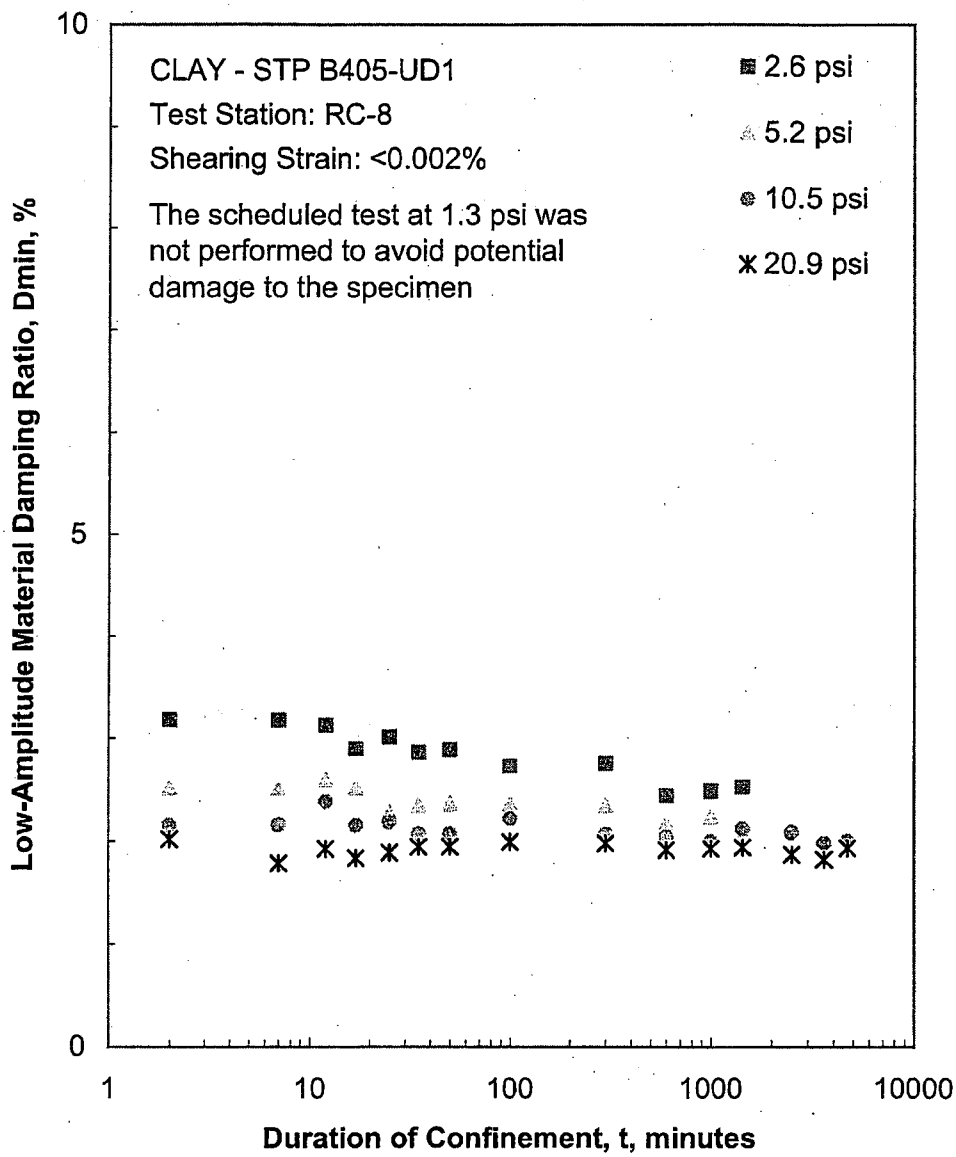


Figure J.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

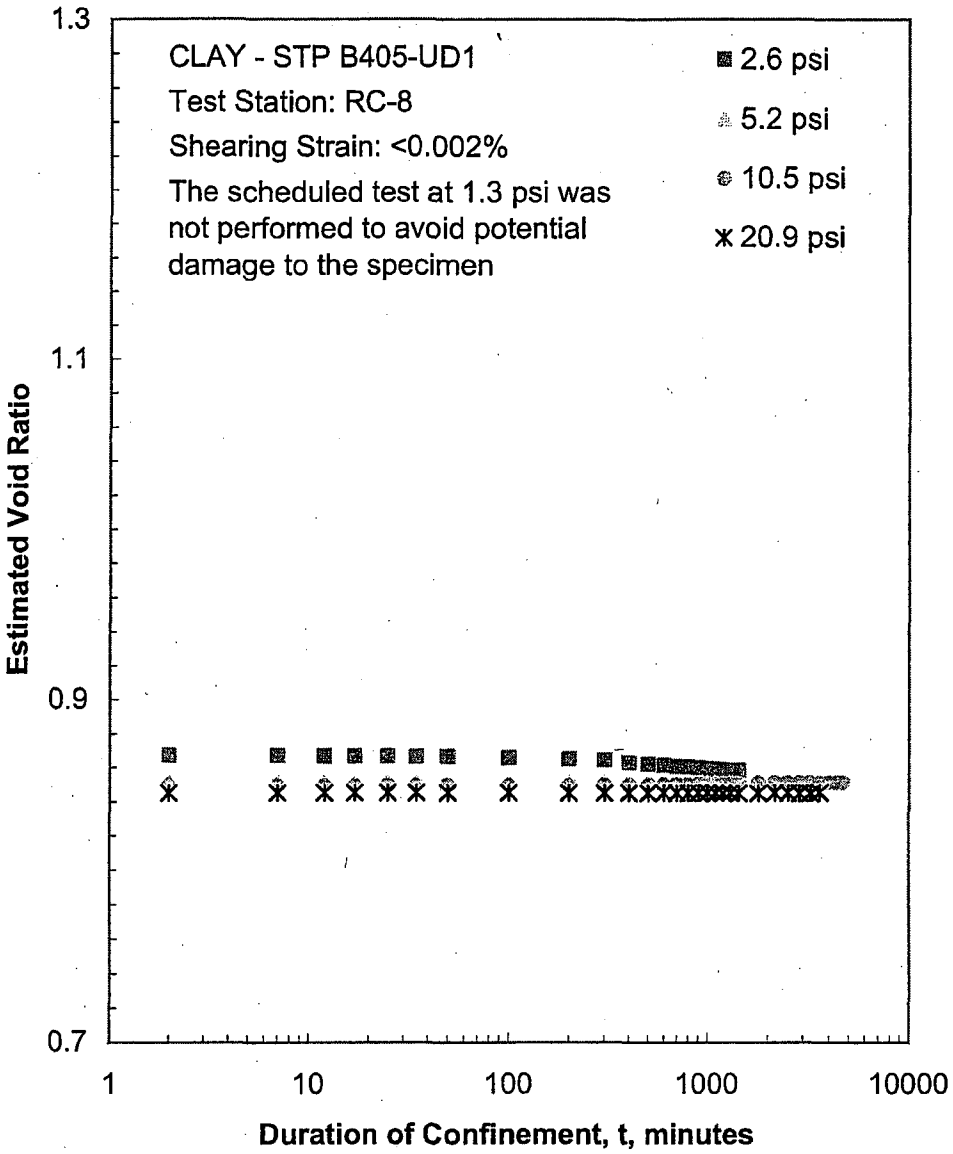


Figure J.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

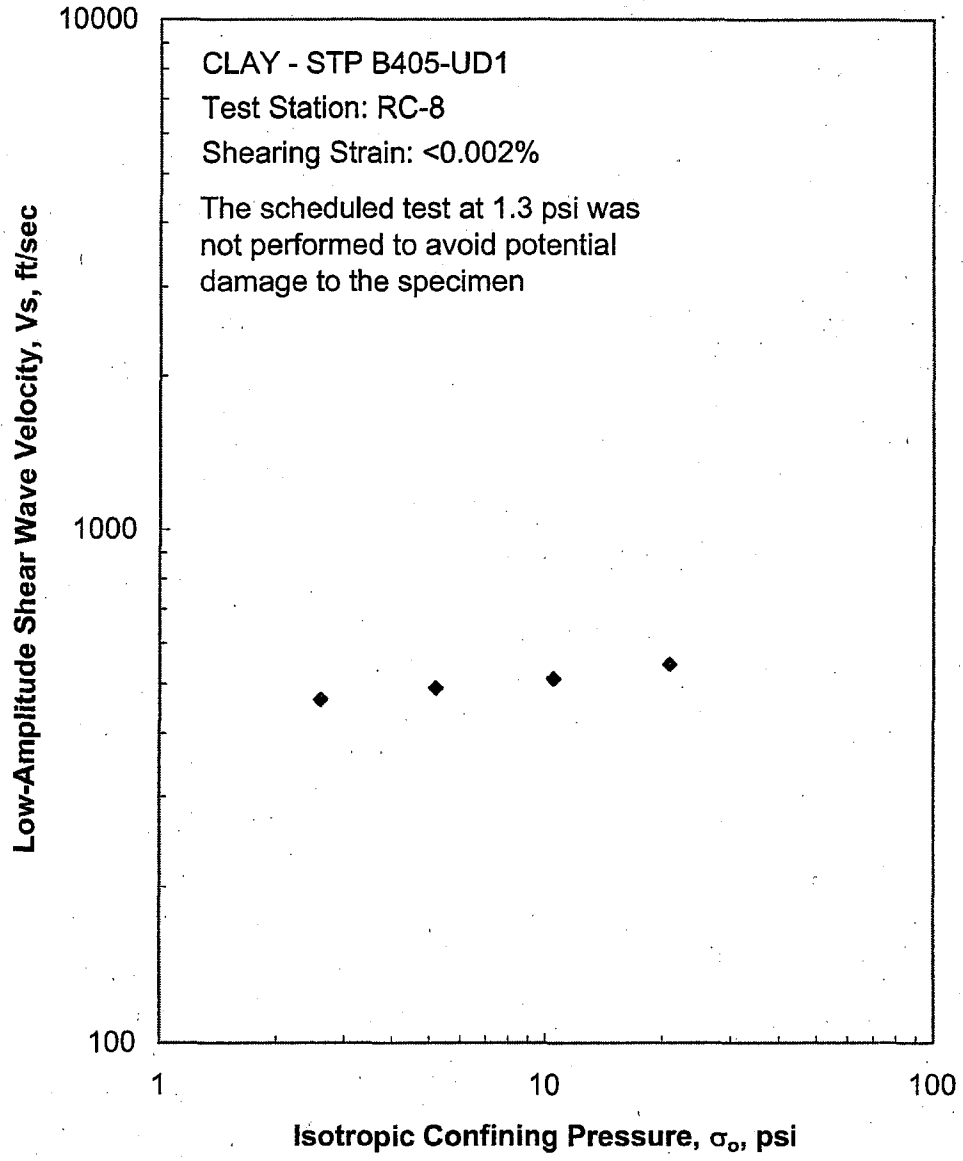


Figure J.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

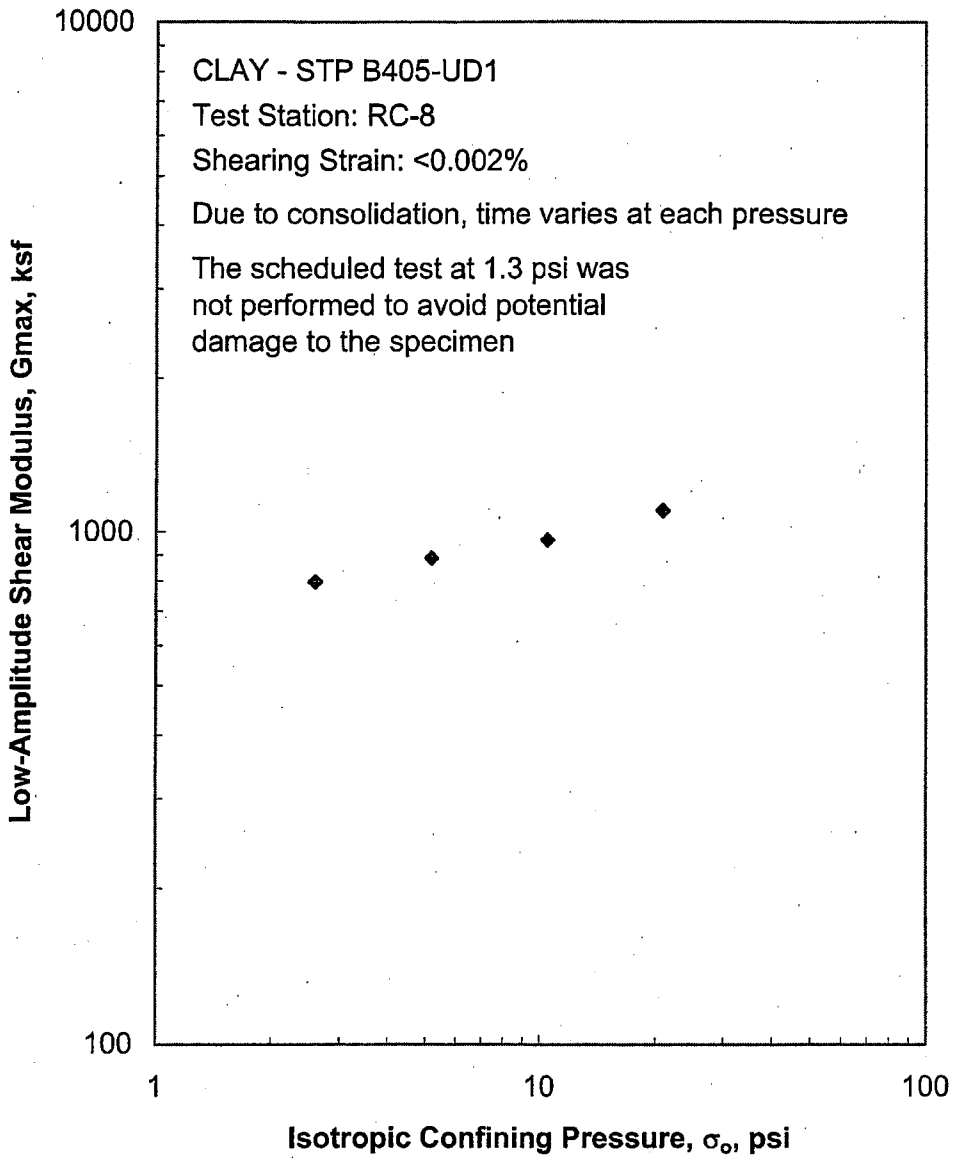


Figure J.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

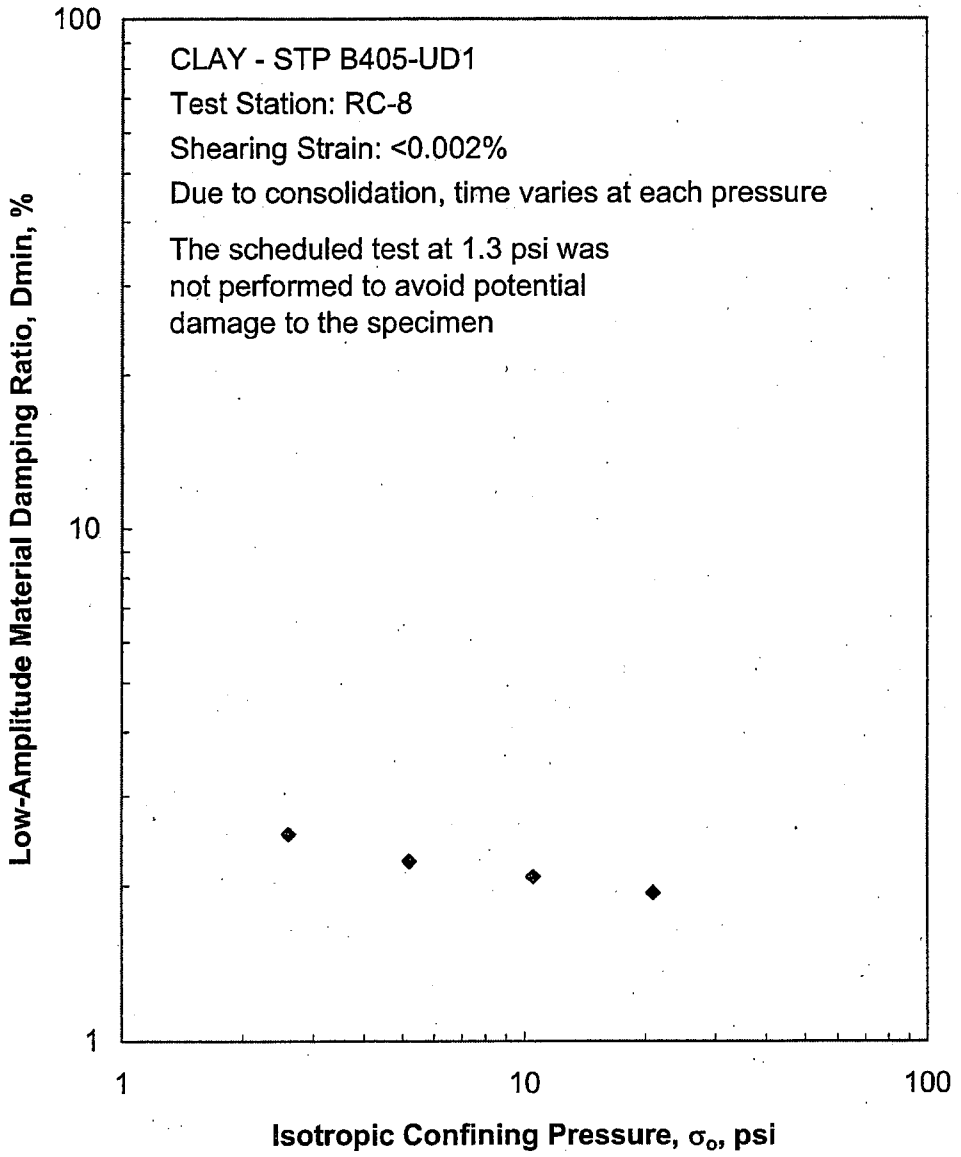


Figure J.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

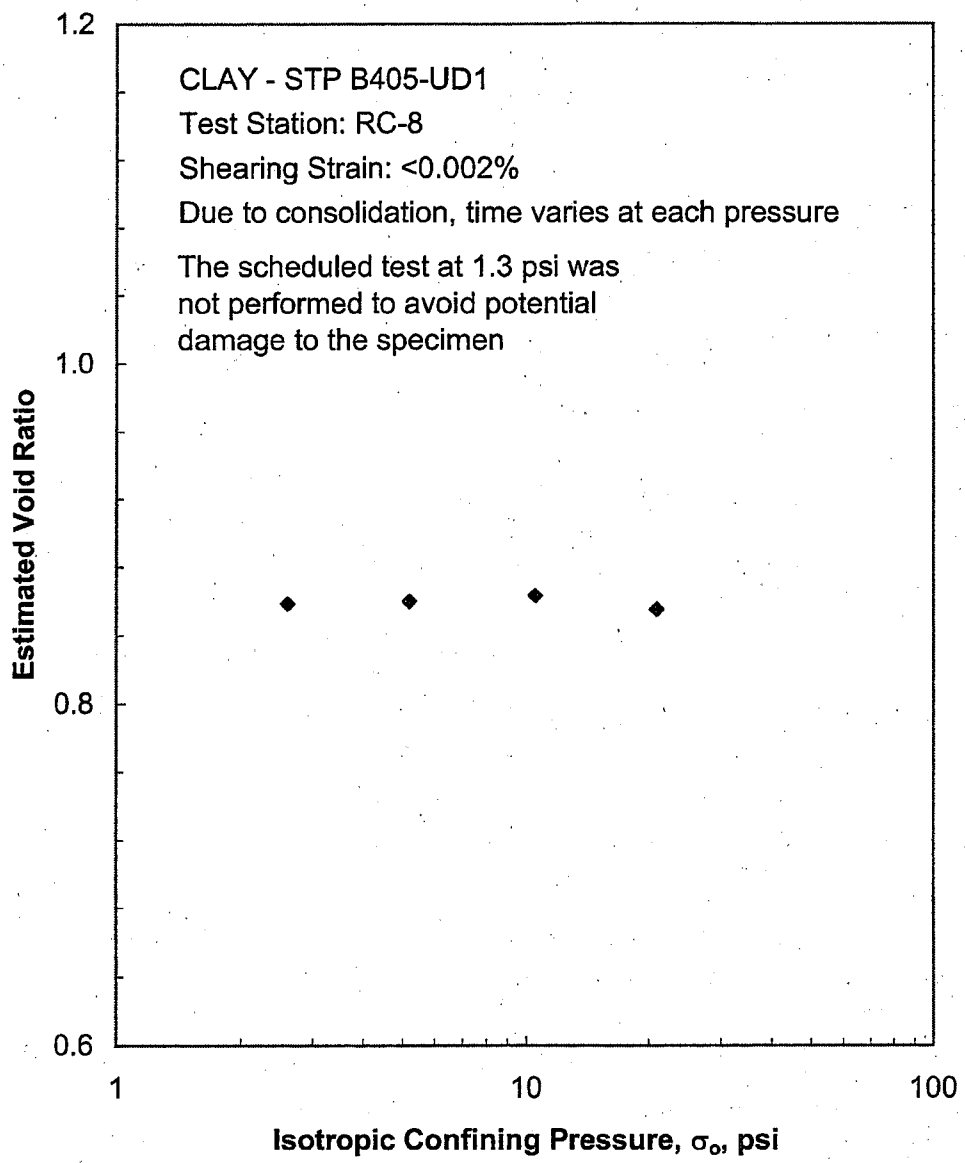


Figure J.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

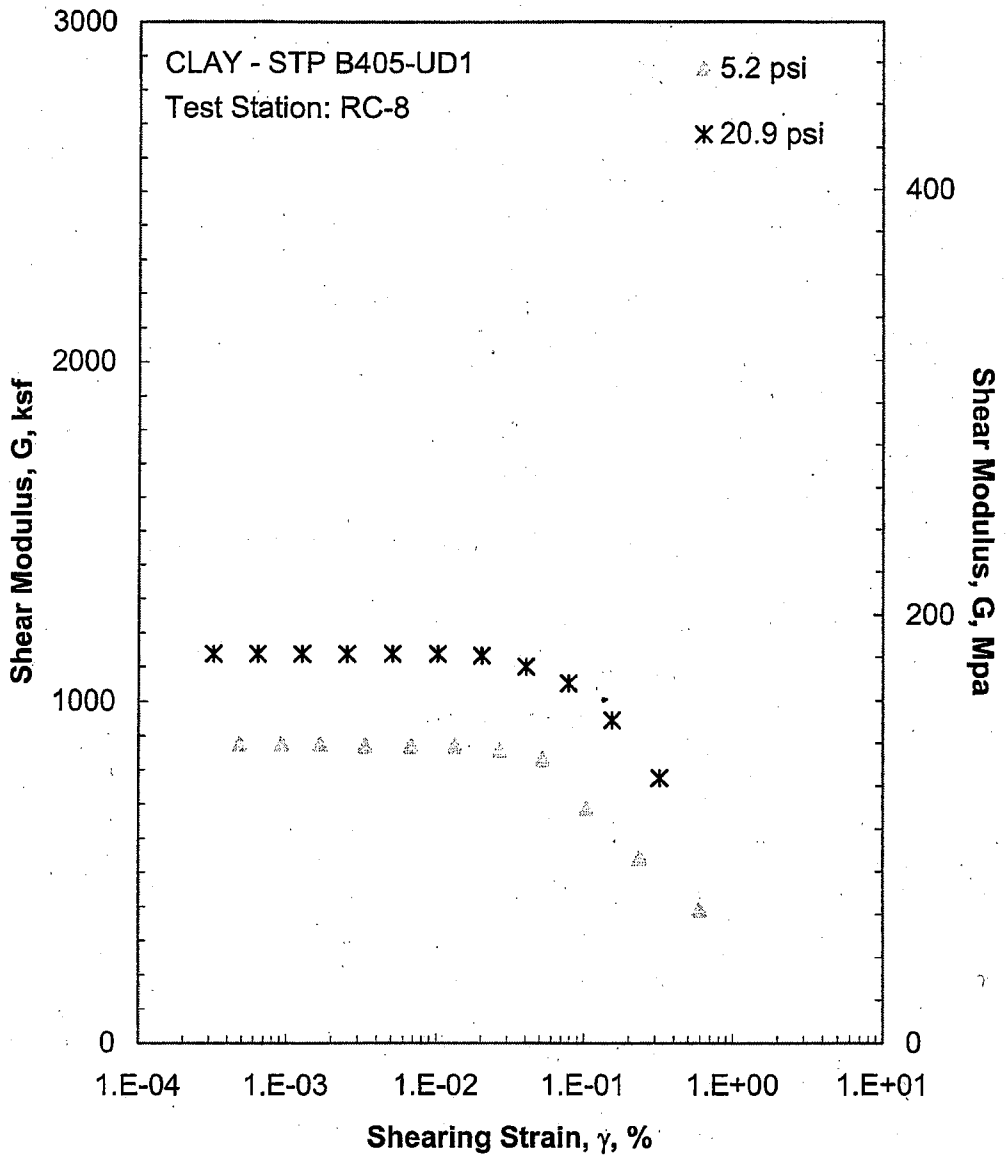


Figure J.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

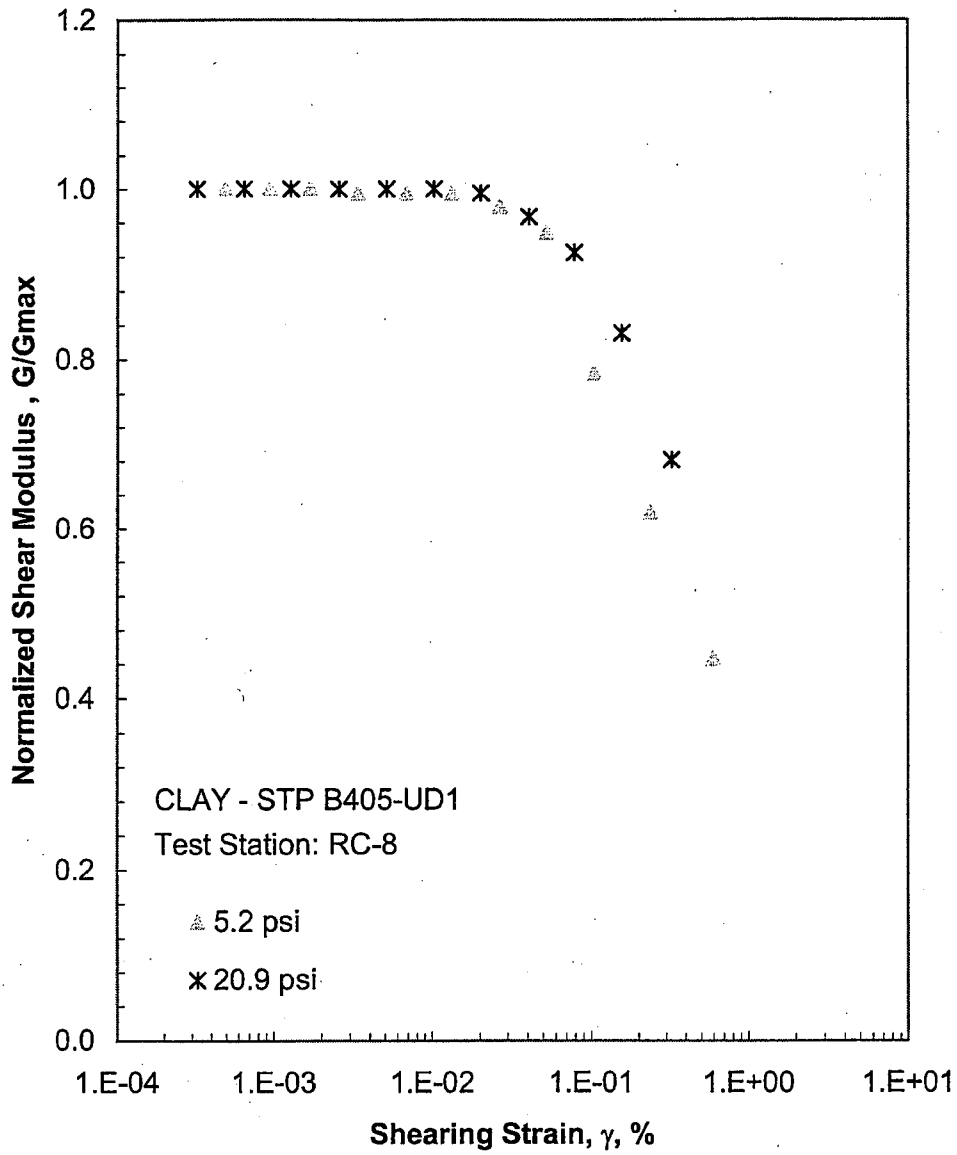


Figure J.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

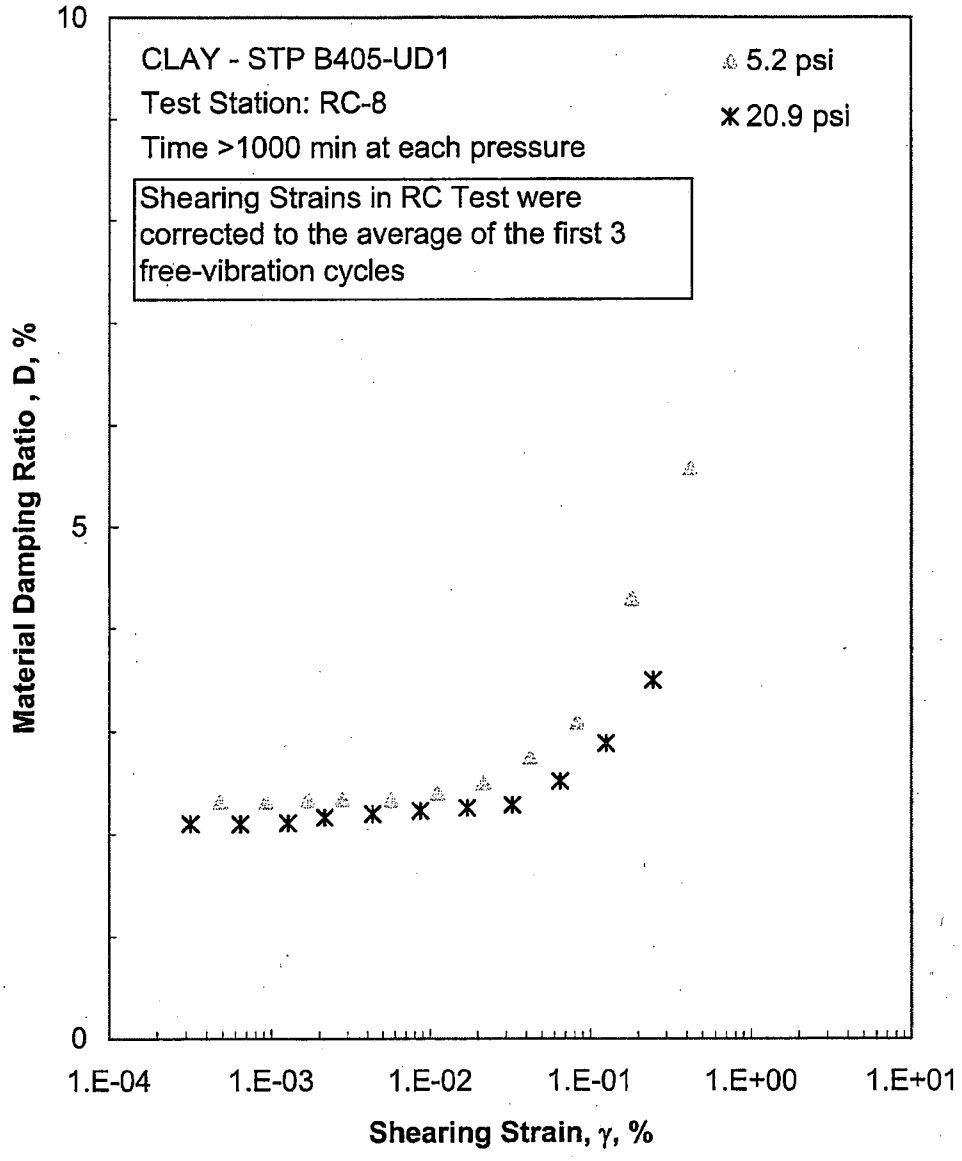


Figure J.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

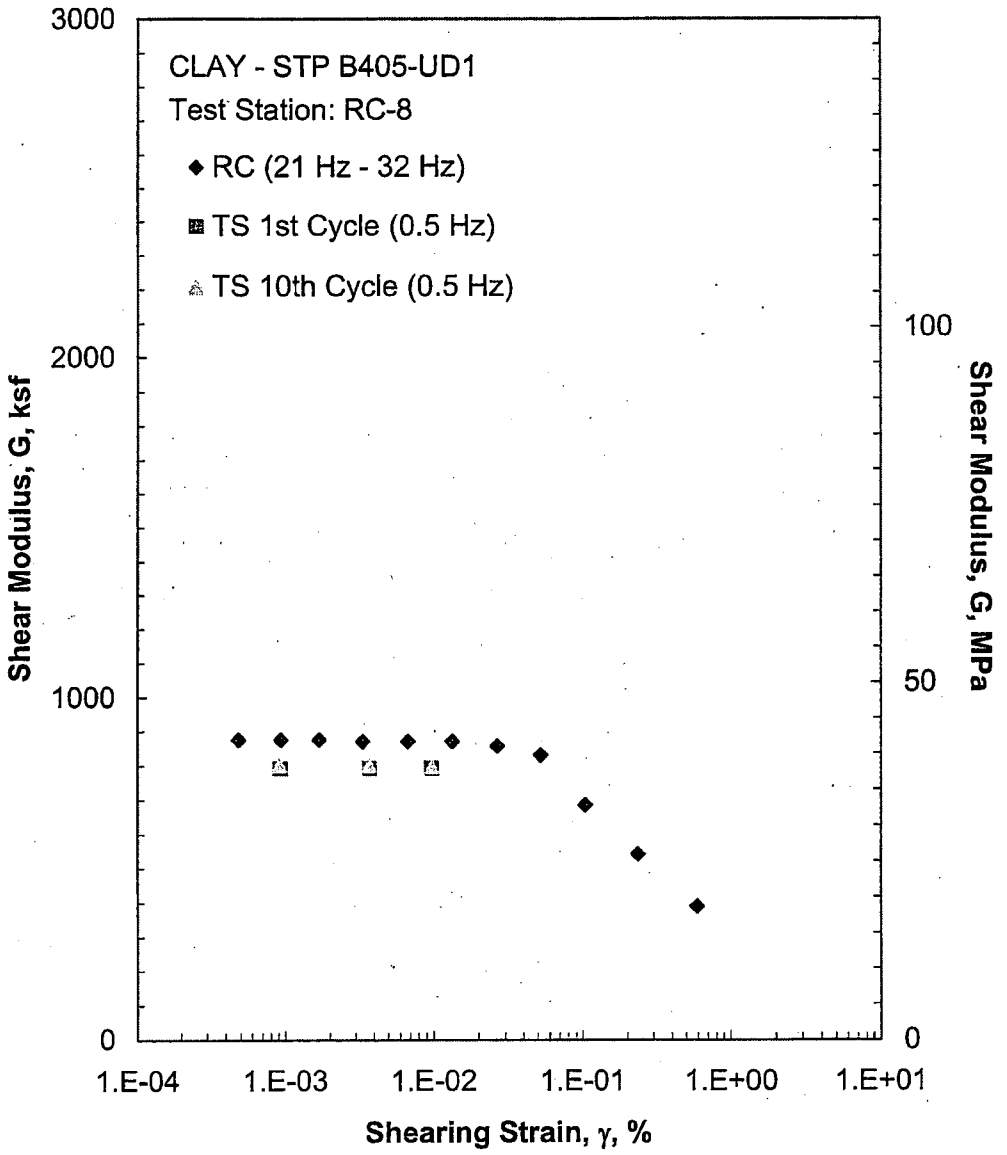


Figure J.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 5.2 psi from the Combined RCTS Tests

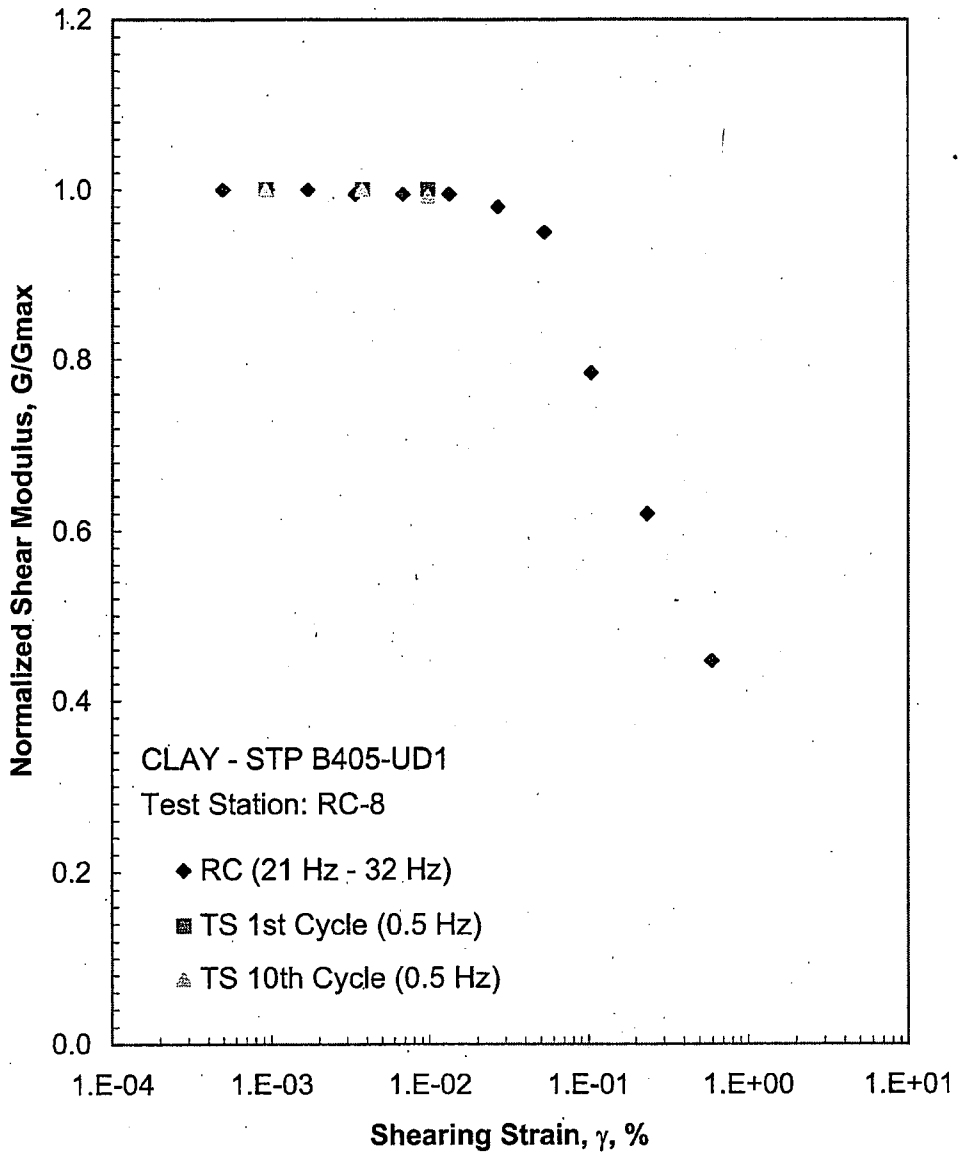


Figure J.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 5.2 psi from the Combined RCTS Tests

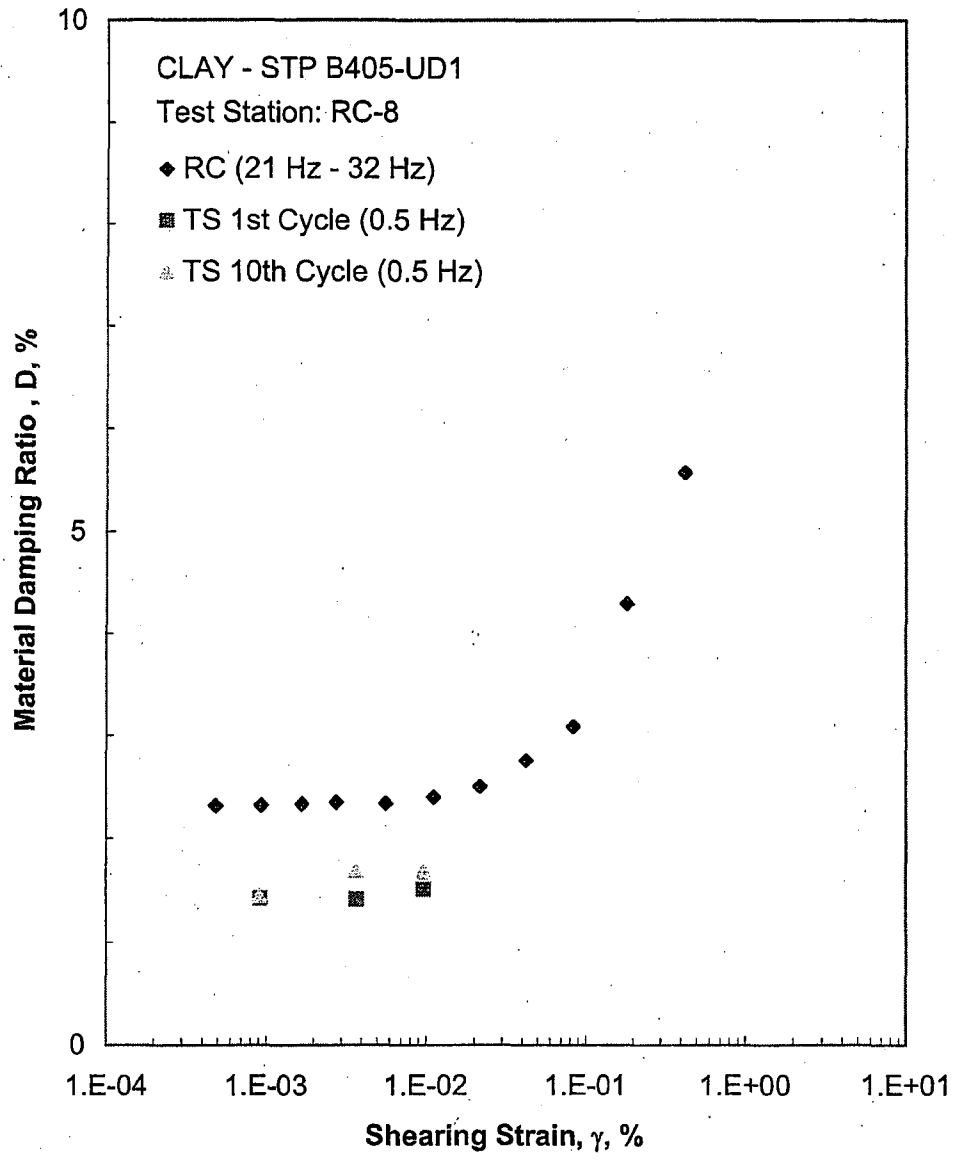


Figure J.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 5.2 psi from the Combined RCTS Tests

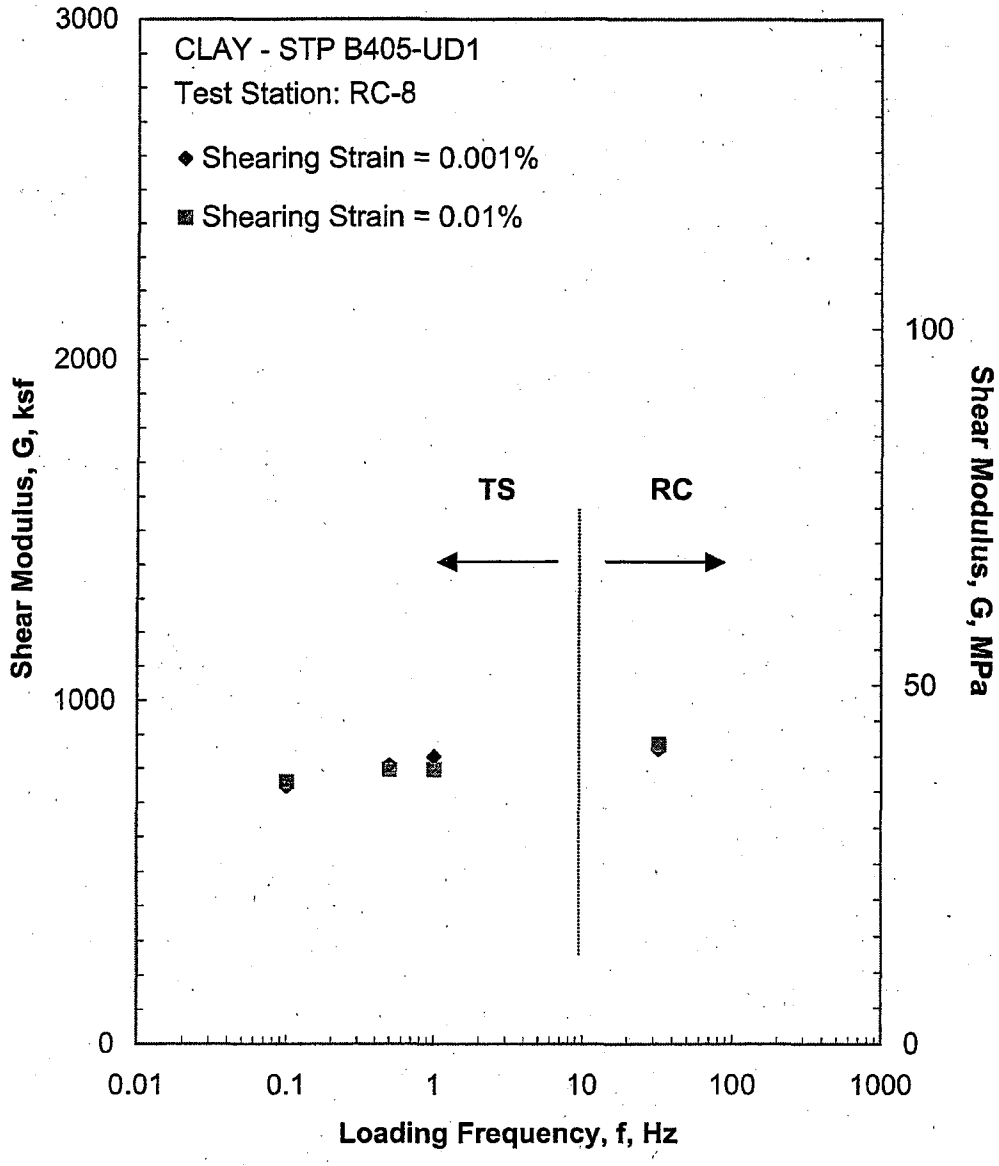


Figure J.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 5.2 psi from the Combined RCTS Tests

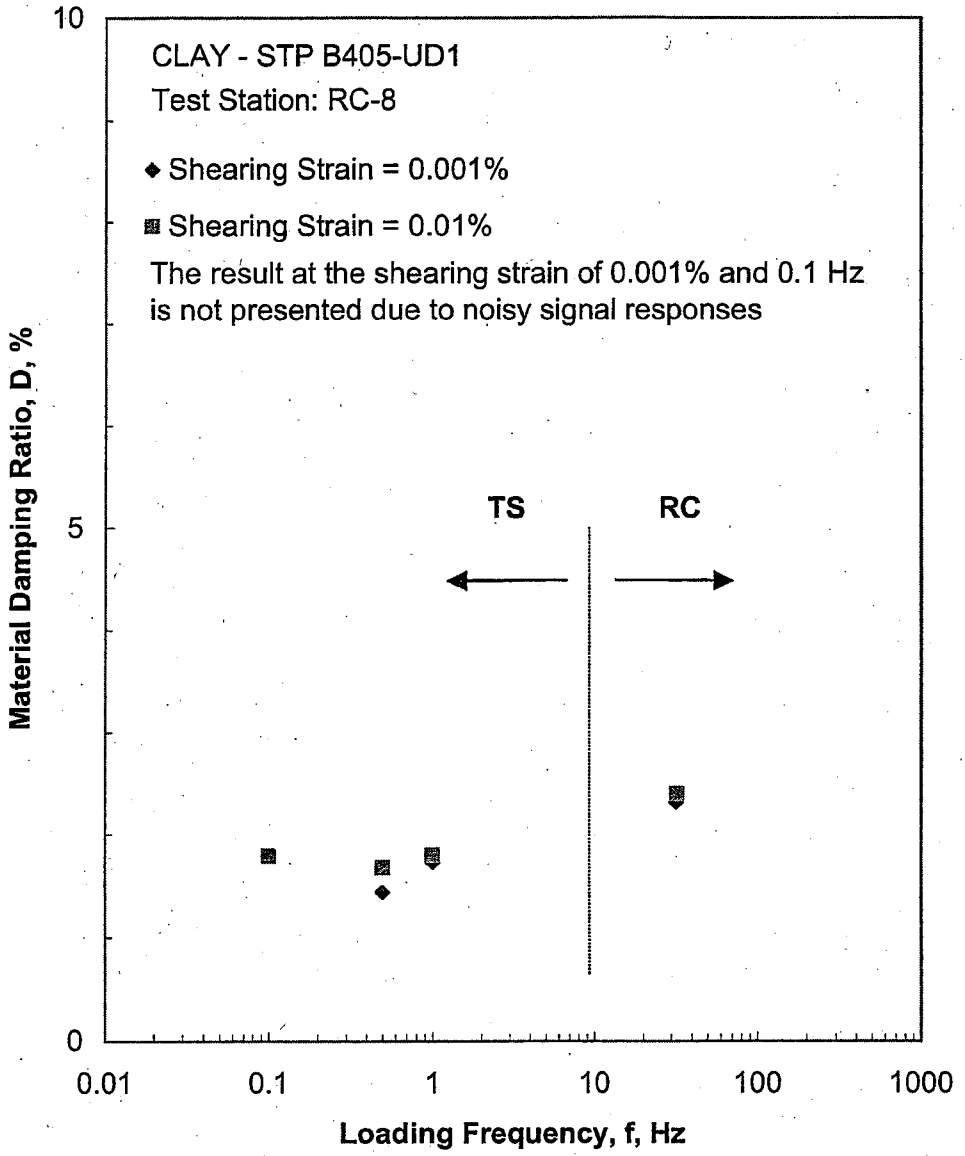


Figure J.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 5.2 psi from the Combined RCTS Tests

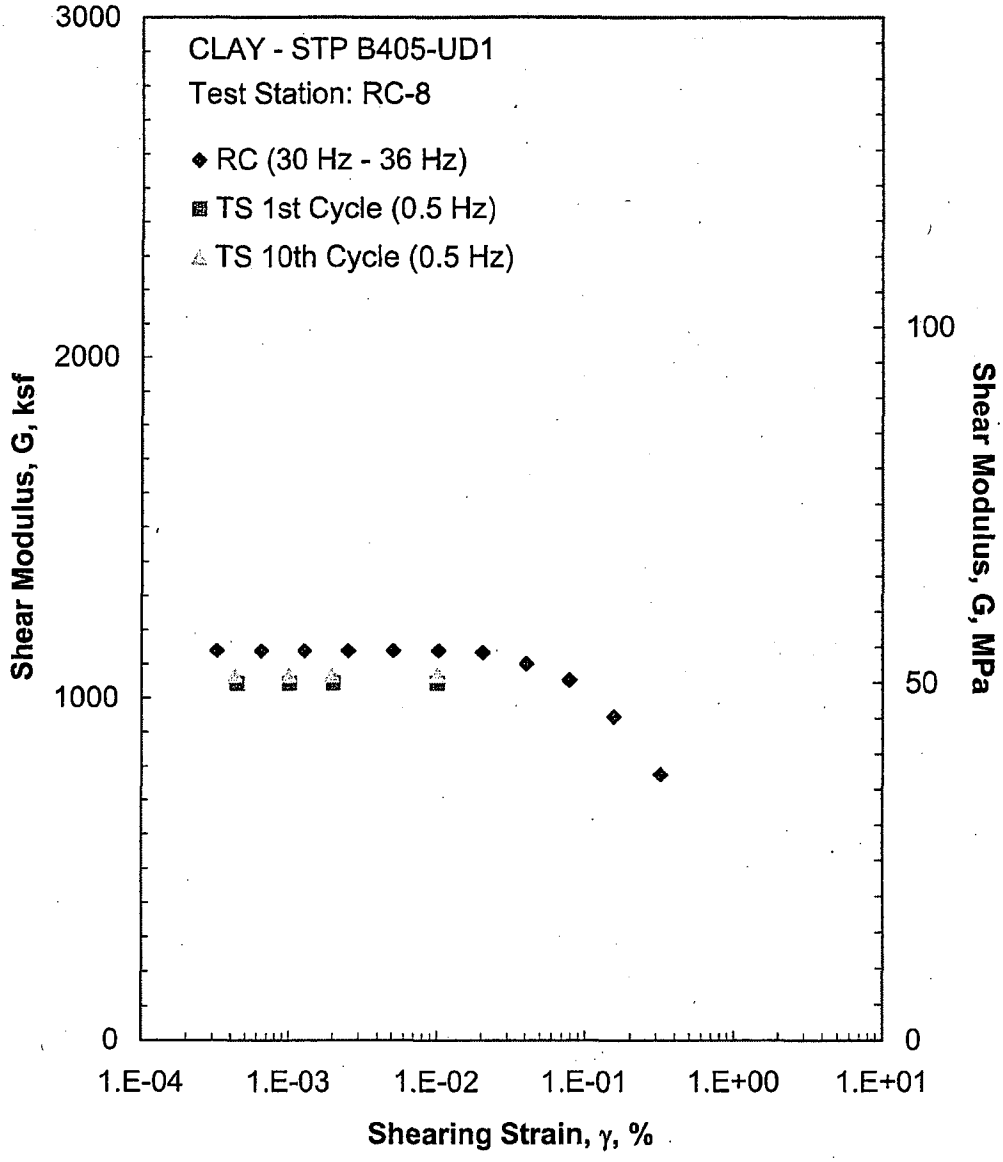


Figure J.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 20.9 psi from the Combined RCTS Tests

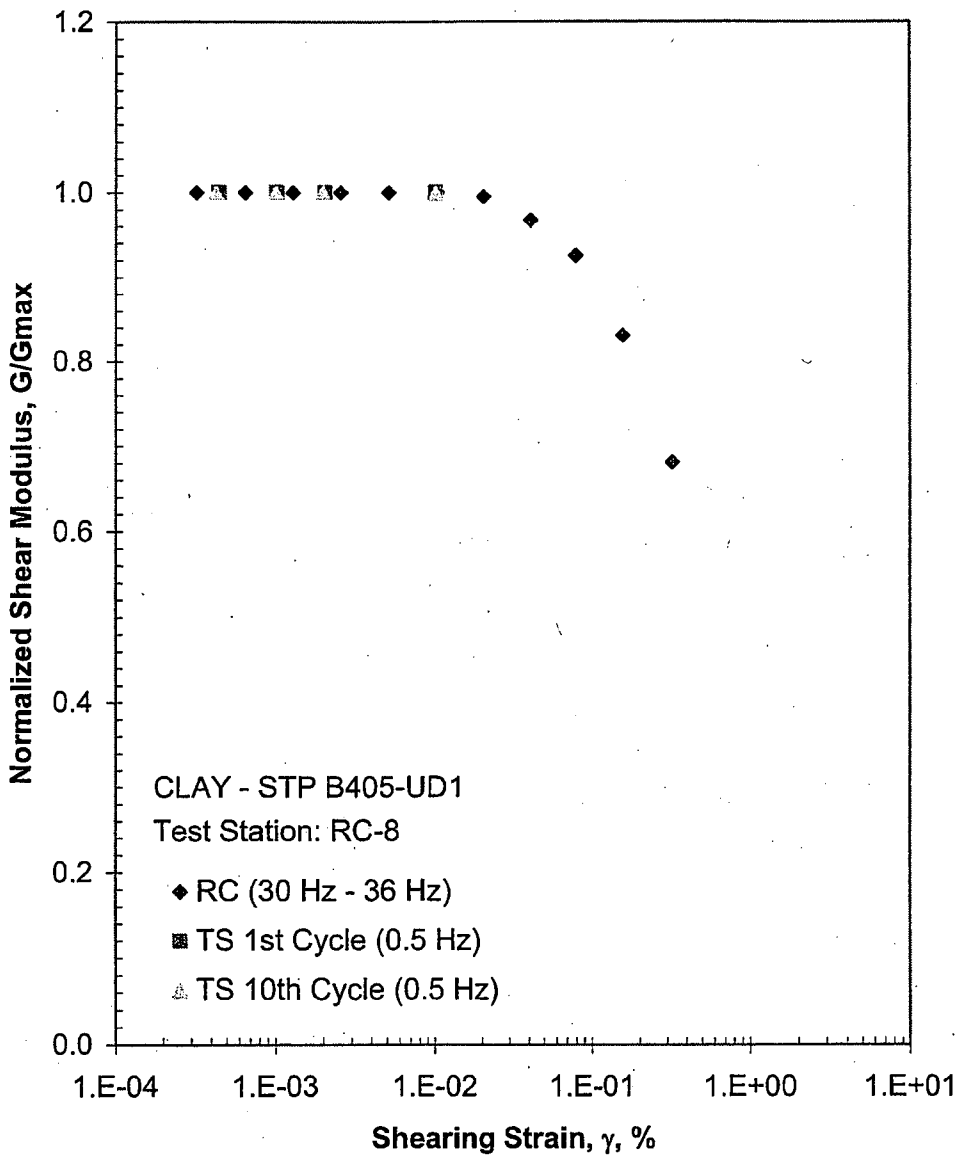


Figure J.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 20.9 psi from the Combined RCTS Tests

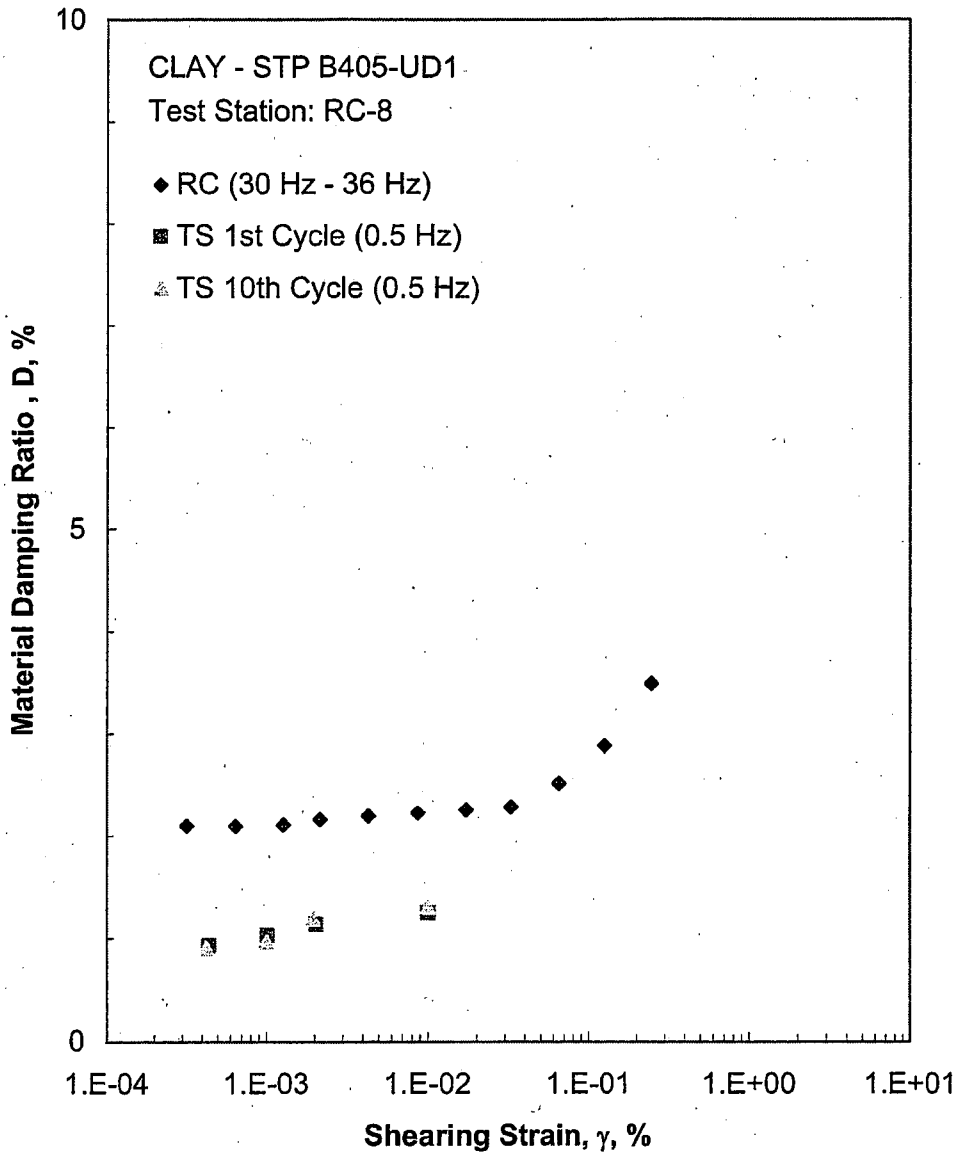


Figure J.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 20.9 psi from the Combined RCTS Tests

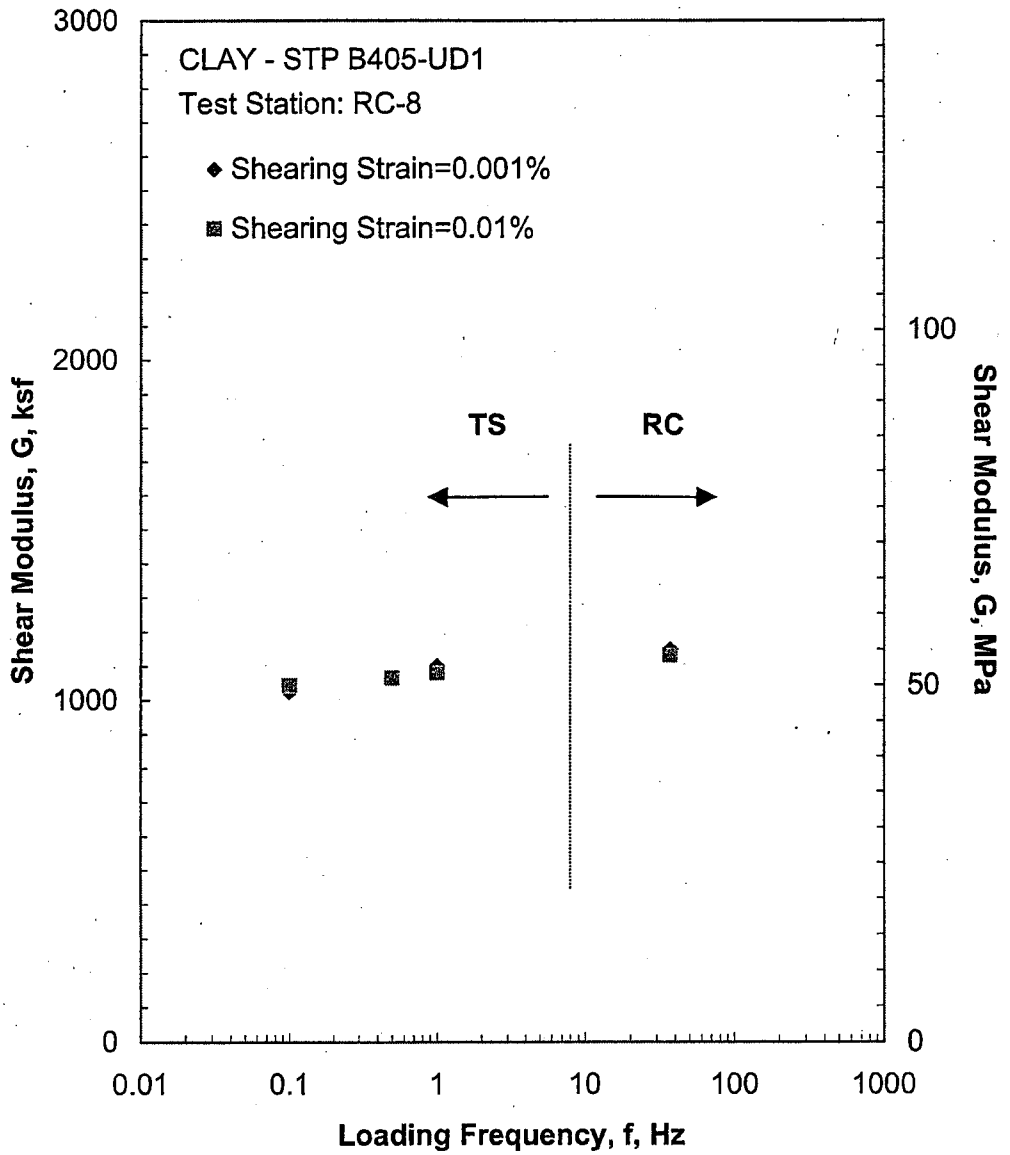


Figure J.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 20.9 psi from the Combined RCTS Tests

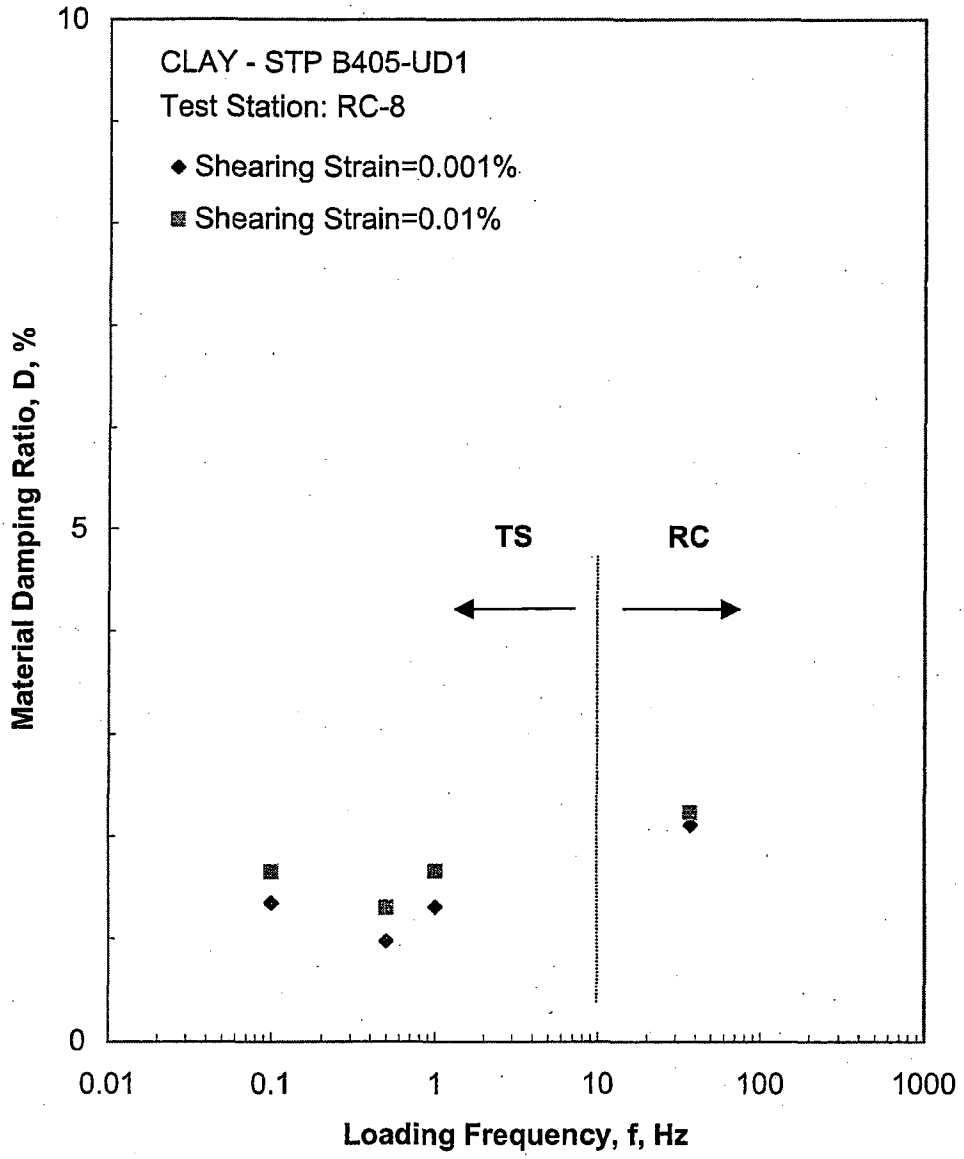


Figure J.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 20.9 psi from the Combined RCTS Tests

Table J.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B405-UD1

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
1.3	187	9	—*	—*	—*	—*	—*
2.6	374	18	798	38	466	2.52	0.858
5.2	749	36	887	43	491	2.23	0.860
10.5	1512	72	962	46	512	2.08	0.863
20.9	3010	144	1099	53	546	1.94	0.855

* The scheduled test was not performed to avoid potential damge to the specimen

Table J.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD1; Isoptropic Confining Pressure, σ_o=5.2 psi (0.7 ksf = 36 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
4.88E-04	875	1.00	4.88E-04	2.31
9.37E-04	875	1.00	9.37E-04	2.32
1.69E-03	875	1.00	1.69E-03	2.33
3.36E-03	871	0.99	2.79E-03	2.34
6.76E-03	871	0.99	5.68E-03	2.33
1.33E-02	871	0.99	1.12E-02	2.39
2.66E-02	857	0.98	2.18E-02	2.50
5.24E-02	830	0.95	4.24E-02	2.75
1.04E-01	686	0.78	8.33E-02	3.09
2.36E-01	542	0.62	1.82E-01	4.29
5.93E-01	391	0.45	4.21E-01	5.57

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table J.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD1; Isotropic Confining Pressure, σ_o= 5.2 psi (0.7 ksf =36 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
9.24E-04	793	1.00	1.42	9.13E-04	802	1.00	1.44
3.75E-03	793	1.00	1.41	3.72E-03	802	1.00	1.68
9.75E-03	793	1.00	1.50	9.73E-03	795	0.99	1.68

Table J.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD1; Isoptropic Confining Pressure, σ_o= 20.9 psi (3.0 ksf = 144 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
3.21E-04	1138	1.00	3.21E-04	2.10
6.47E-04	1138	1.00	6.47E-04	2.10
1.28E-03	1138	1.00	1.28E-03	2.11
2.55E-03	1138	1.00	2.17E-03	2.16
5.10E-03	1138	1.00	4.33E-03	2.20
1.03E-02	1138	1.00	8.72E-03	2.23
2.03E-02	1133	1.00	1.72E-02	2.26
4.06E-02	1100	0.97	3.29E-02	2.28
7.87E-02	1053	0.92	6.53E-02	2.51
1.56E-01	945	0.83	1.26E-01	2.88
3.22E-01	775	0.68	2.48E-01	3.49

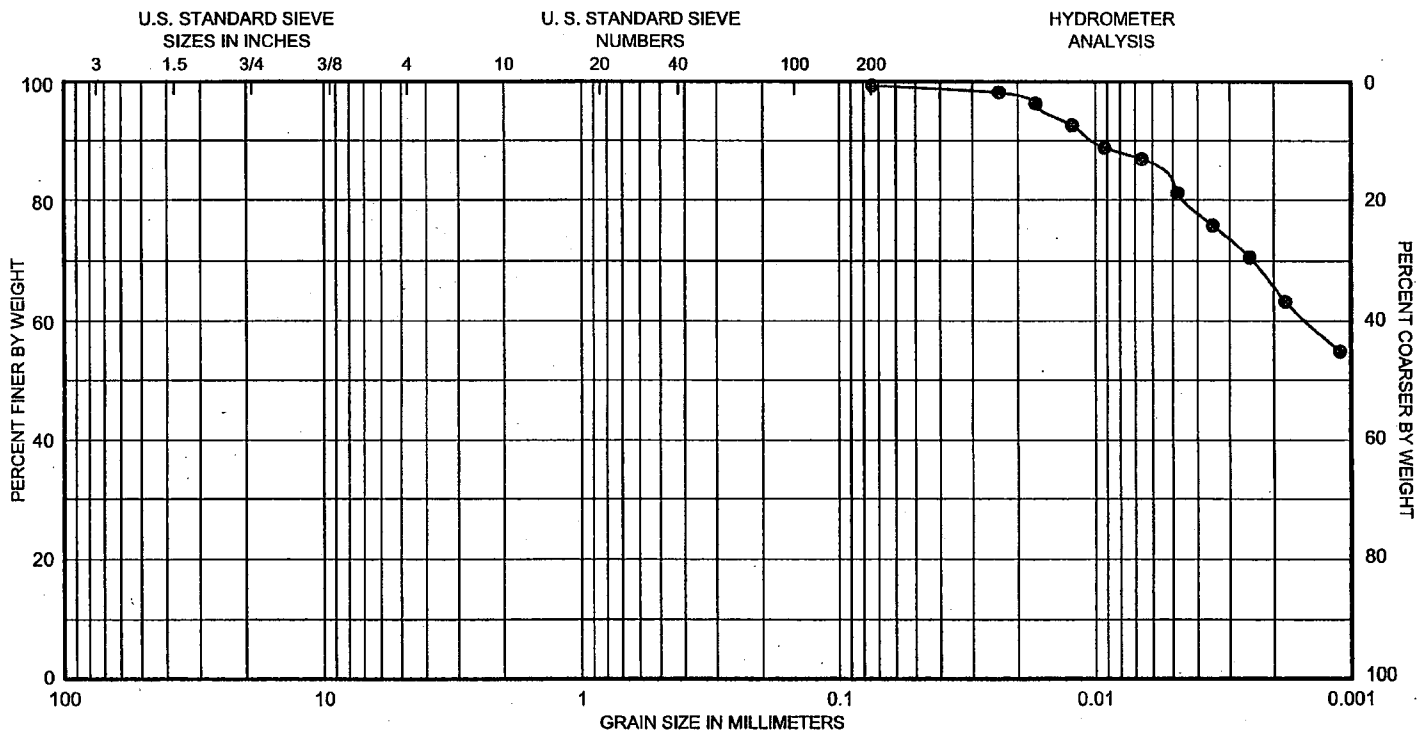
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table J.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD1; Isotropic Confining Pressure, σ_o=20.9 psi (3.0 ksf = 144 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
4.42E-04	1045	1.00	0.93	4.26E-04	1067	1.00	0.91
1.01E-03	1045	1.00	1.03	1.00E-03	1067	1.00	0.97
2.03E-03	1045	1.00	1.13	1.97E-03	1067	1.00	1.18
1.00E-02	1045	1.00	1.24	1.00E-02	1066	1.00	1.30

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-405-UD1	12				0.01	Clay, stiff, red and gray, with carbonate nodules, and deposits

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX K

Specimen STP B405-UD24
CLAY (LL=84, PI=62; Gs=2.70)

Borehole B405
Sample UD24
Depth = 569.2 ft (173.5 m)
Total Unit Weight = 122.1 lb/ft^3
Water Content = 27.2 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 167 psi

FUGRO JOB #: 0401-1660
Testing Station: RC9

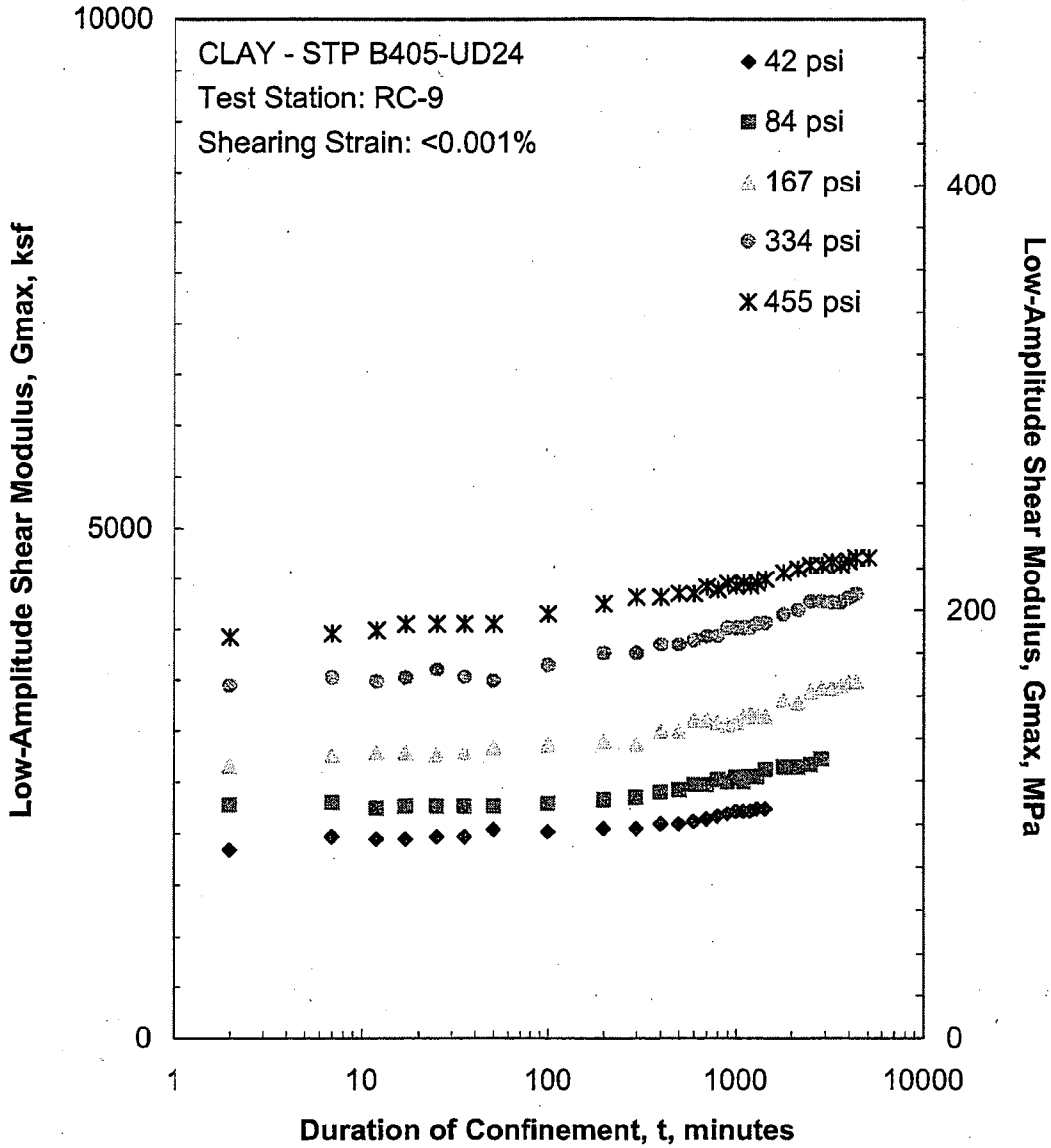


Figure K.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

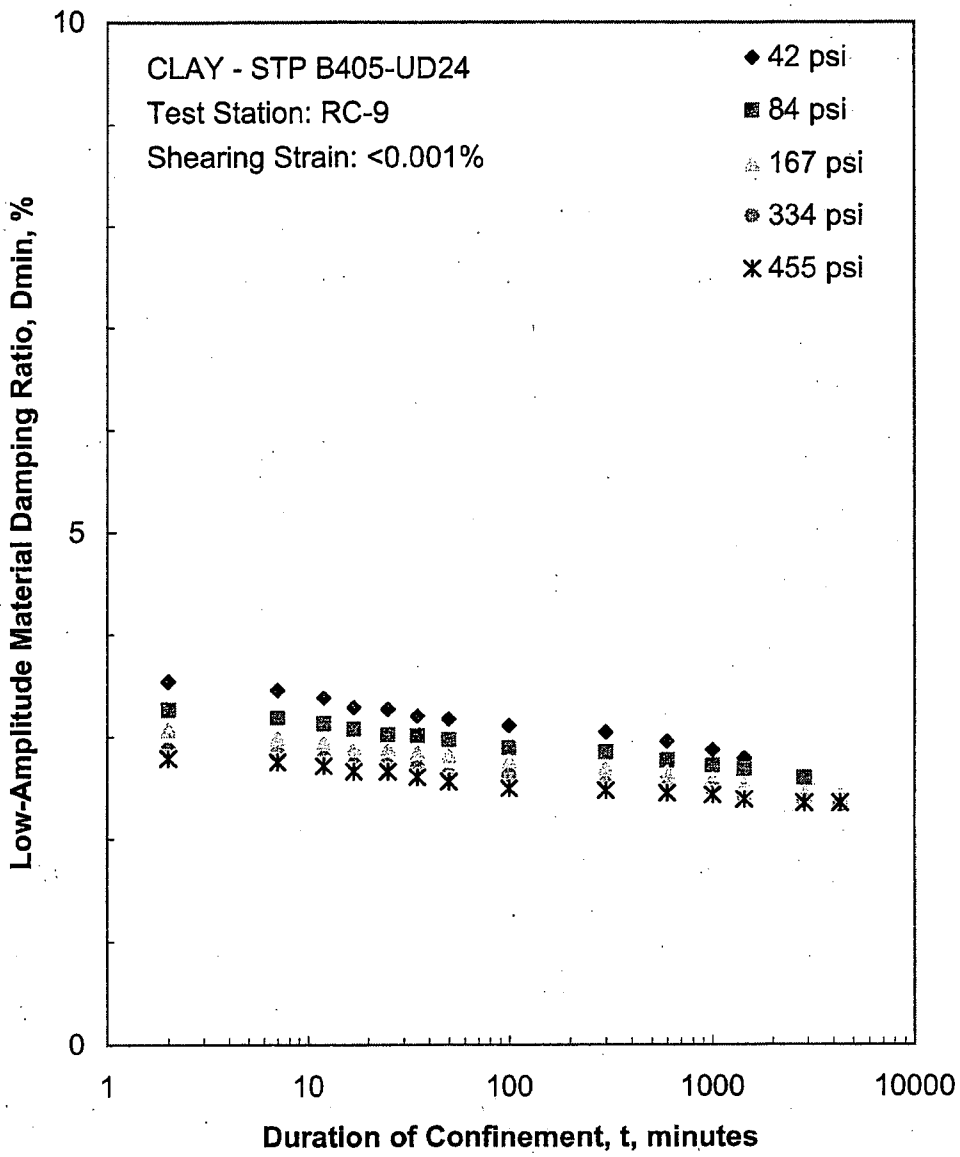


Figure K.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

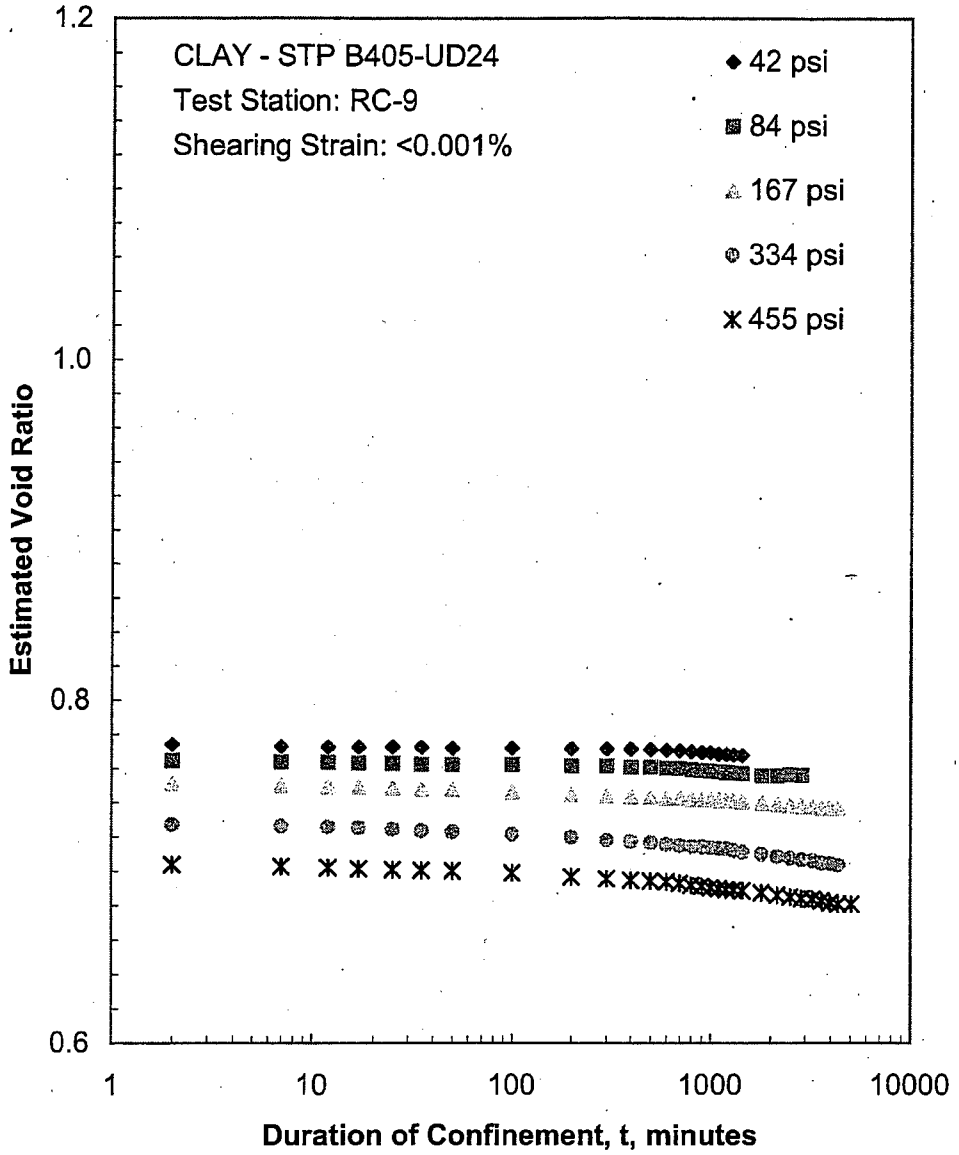


Figure K.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

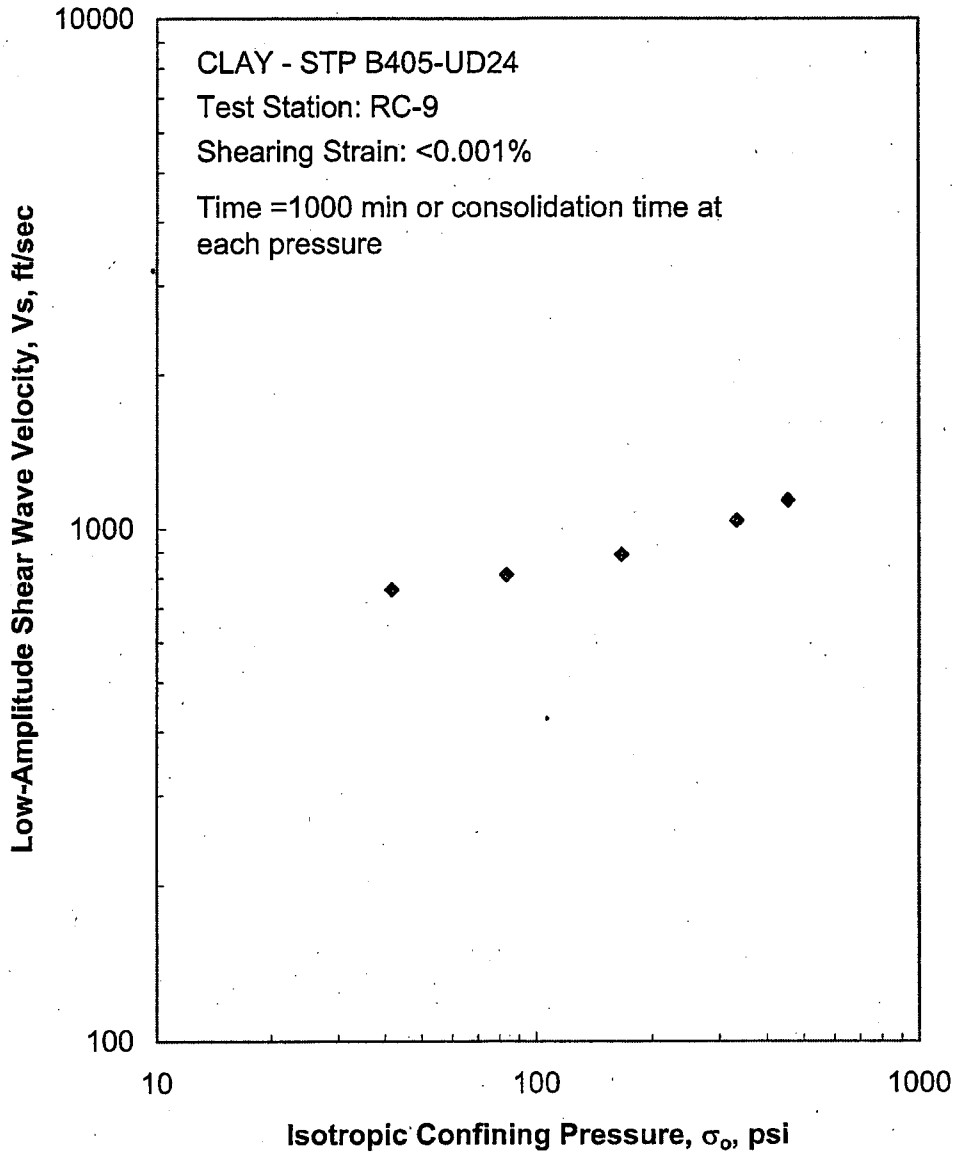


Figure K.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

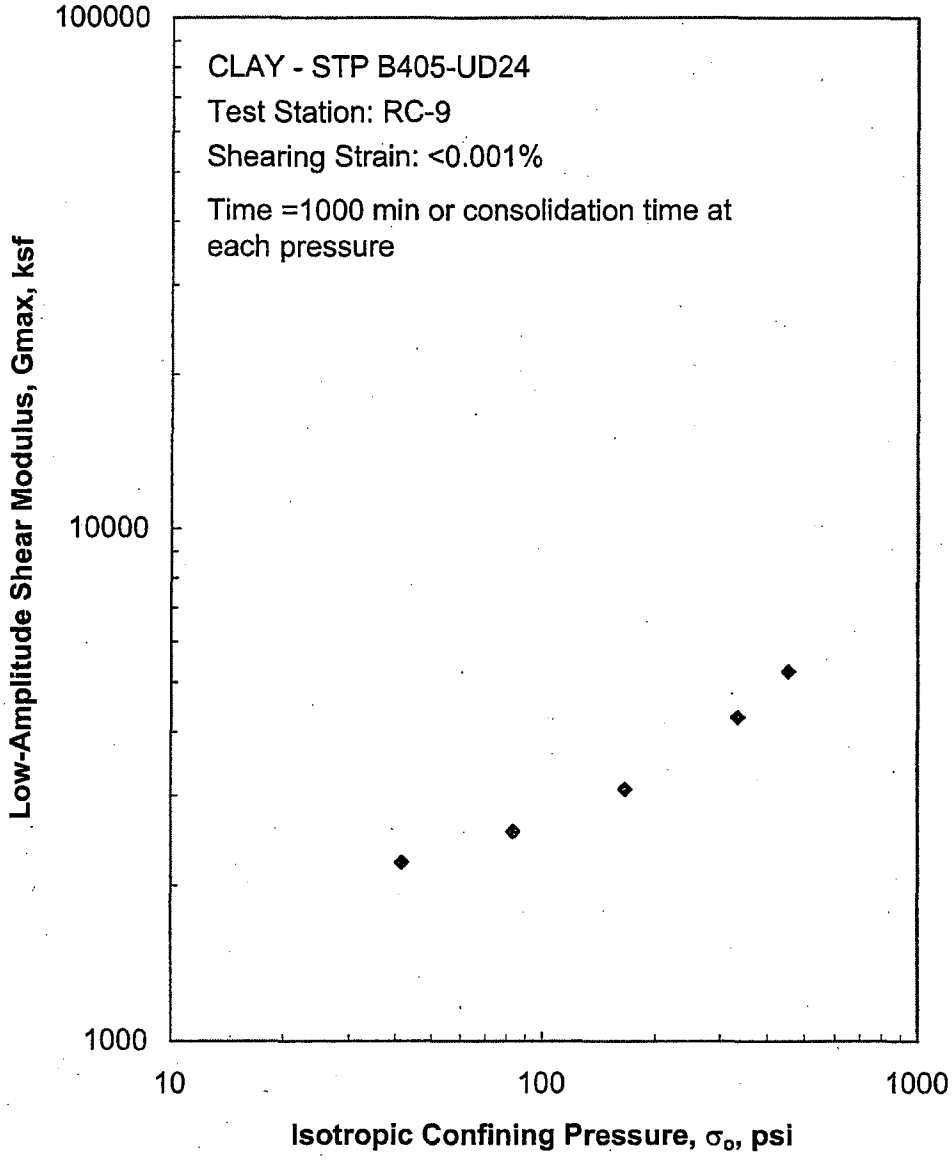


Figure K.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

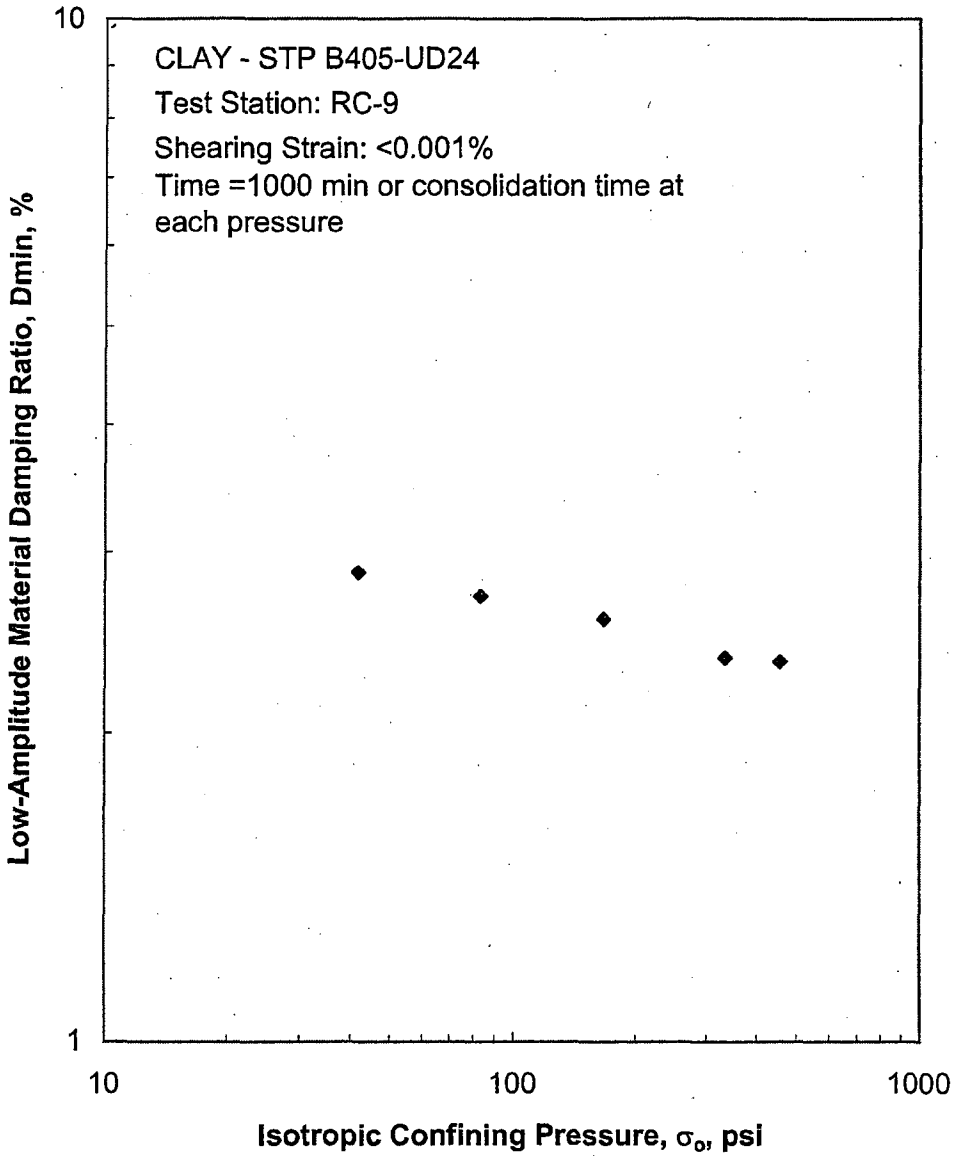


Figure K.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

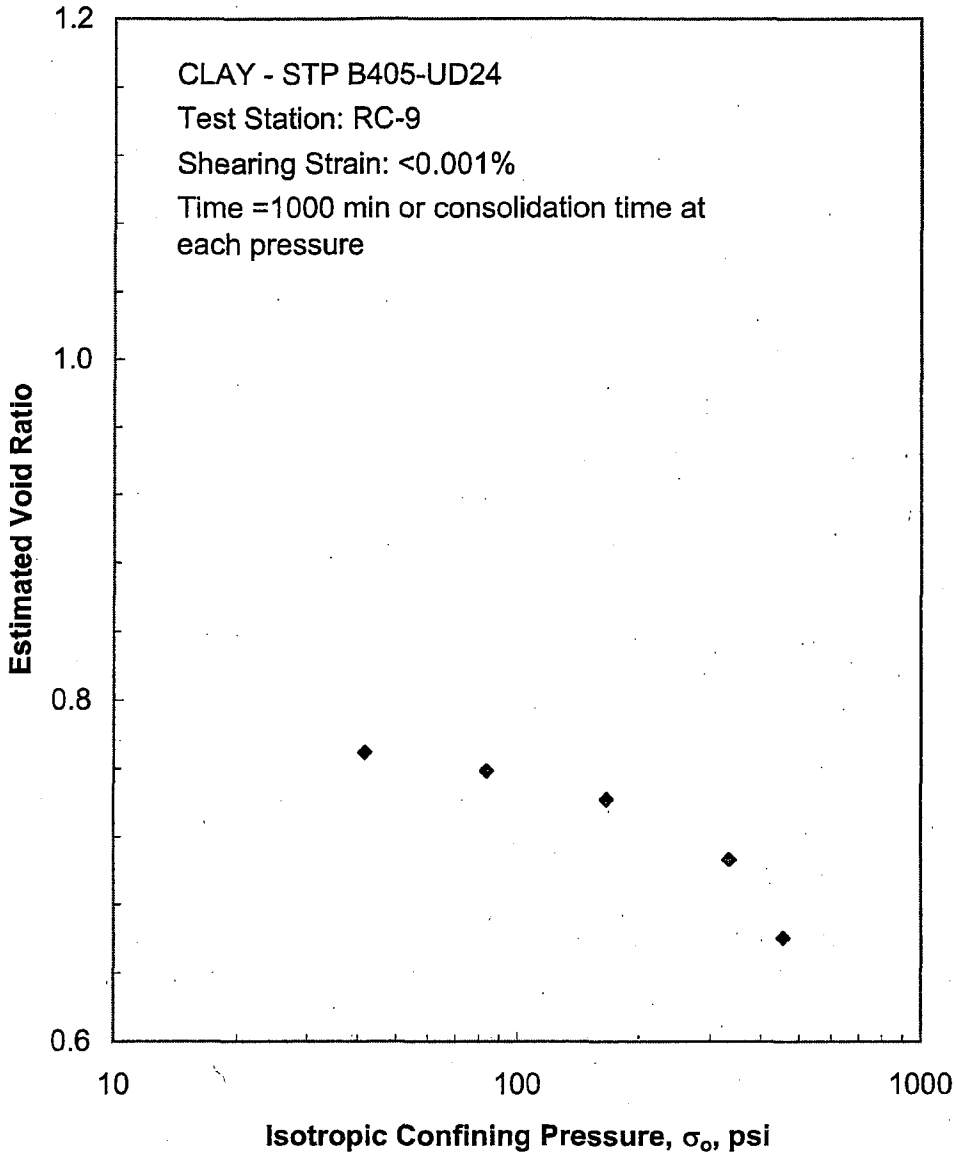


Figure K.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

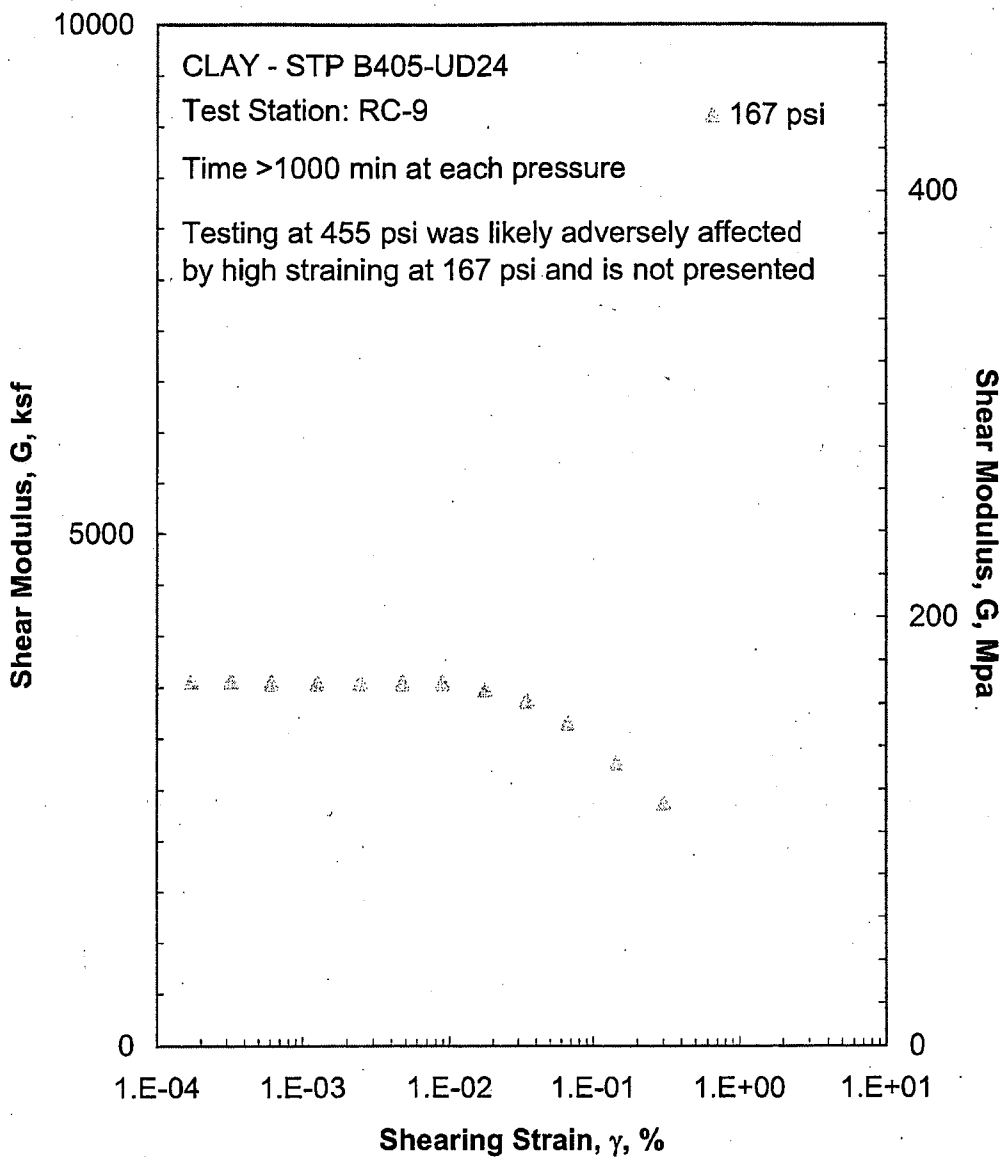


Figure K.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

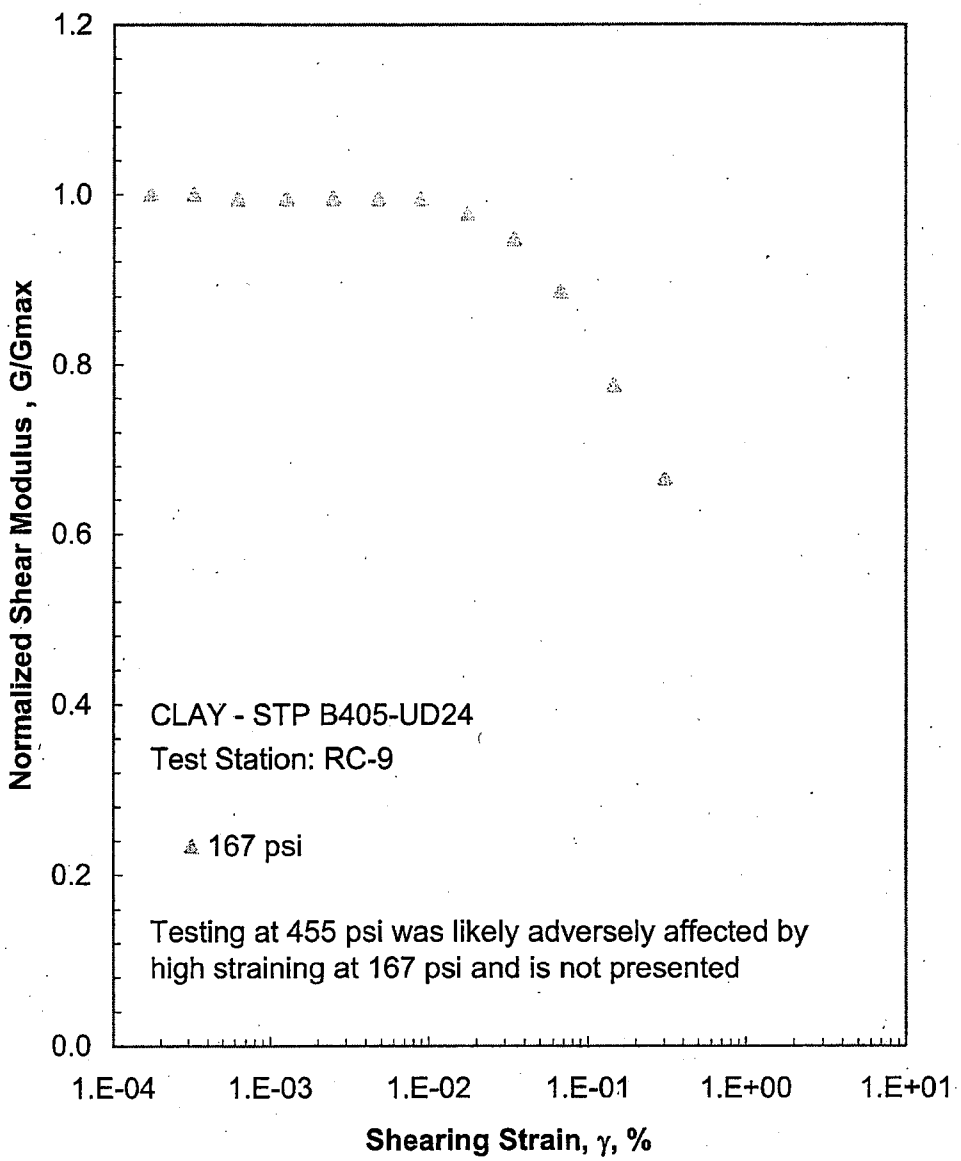


Figure K.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

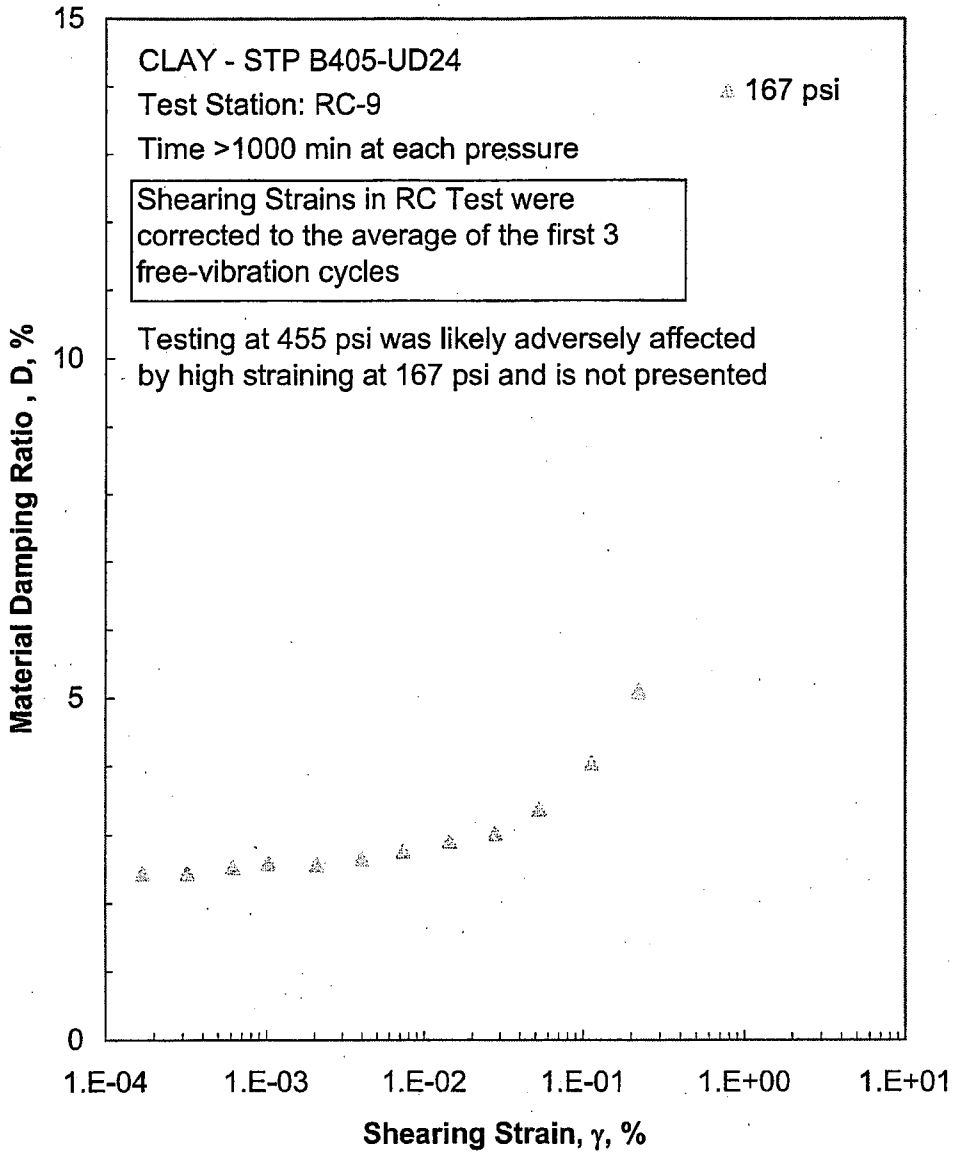


Figure K.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

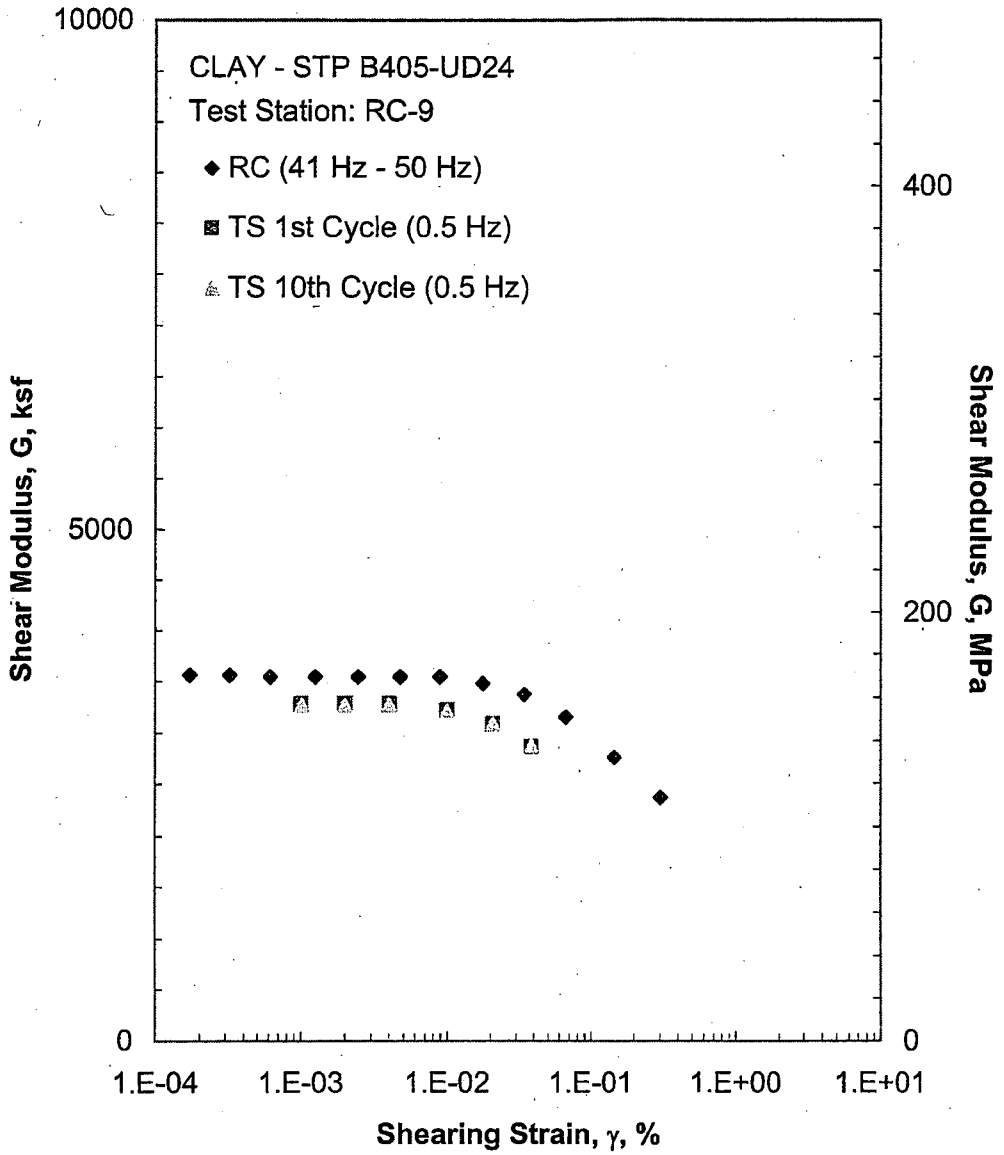


Figure K.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 167 psi from the Combined RCTS Tests

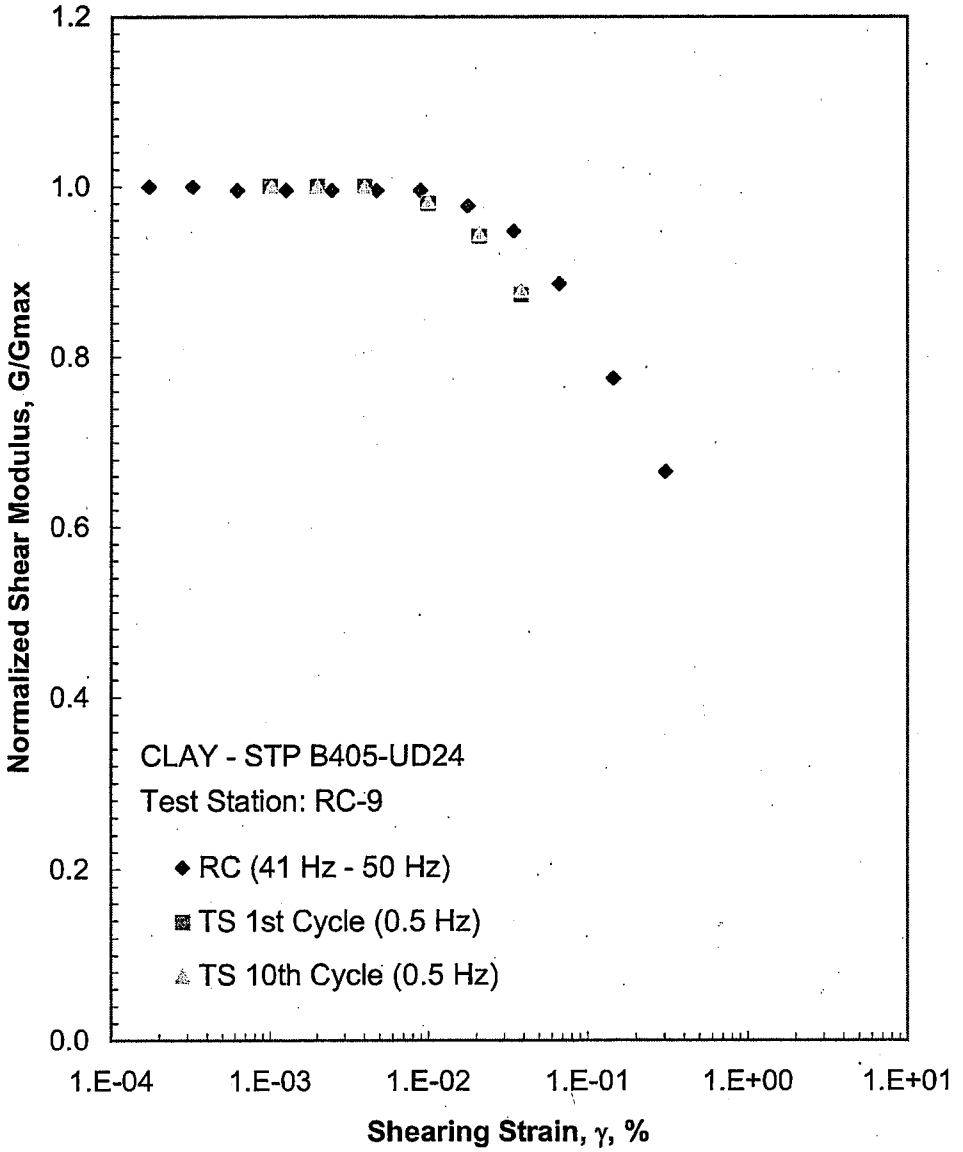


Figure K.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 167 psi from the Combined RCTS Tests

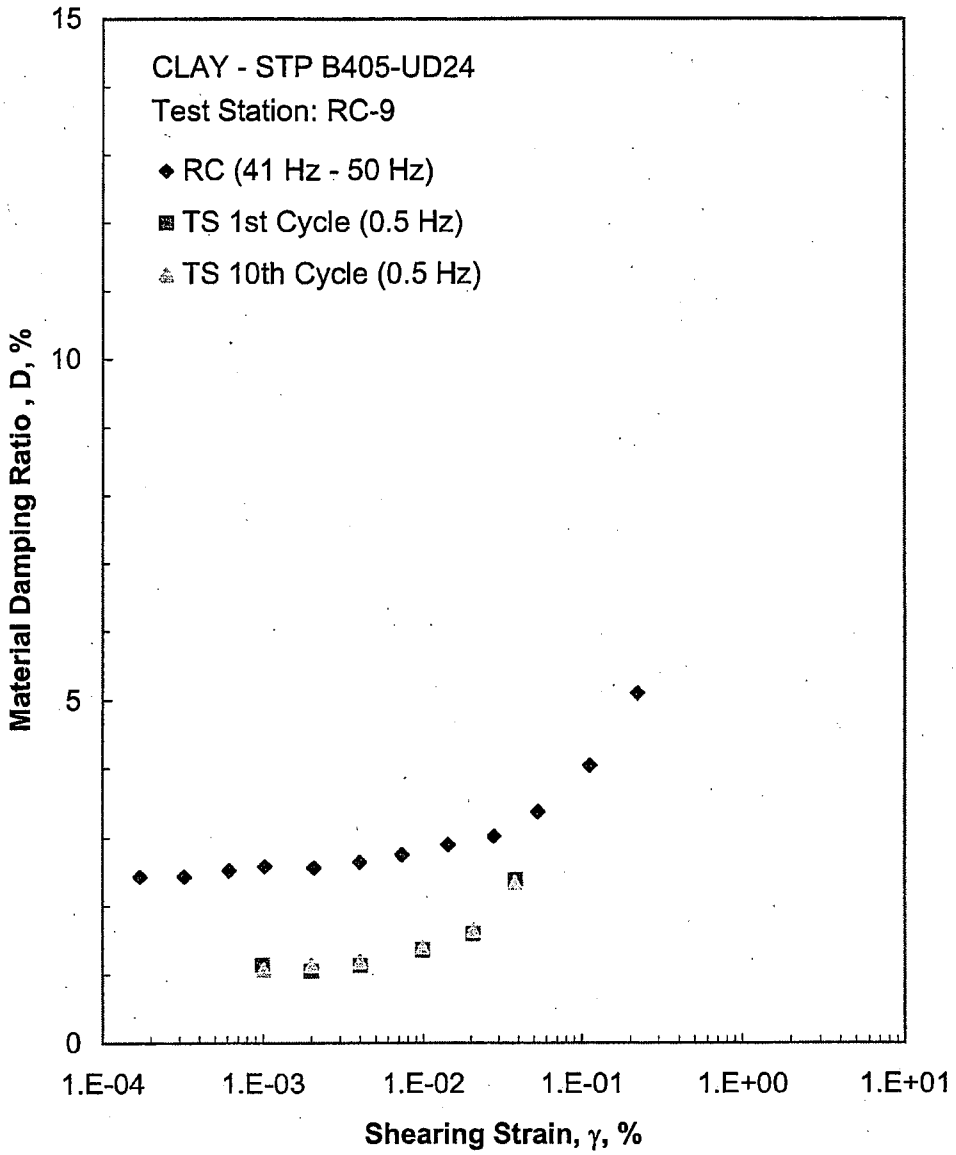


Figure K.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 167 psi from the Combined RCTS Tests

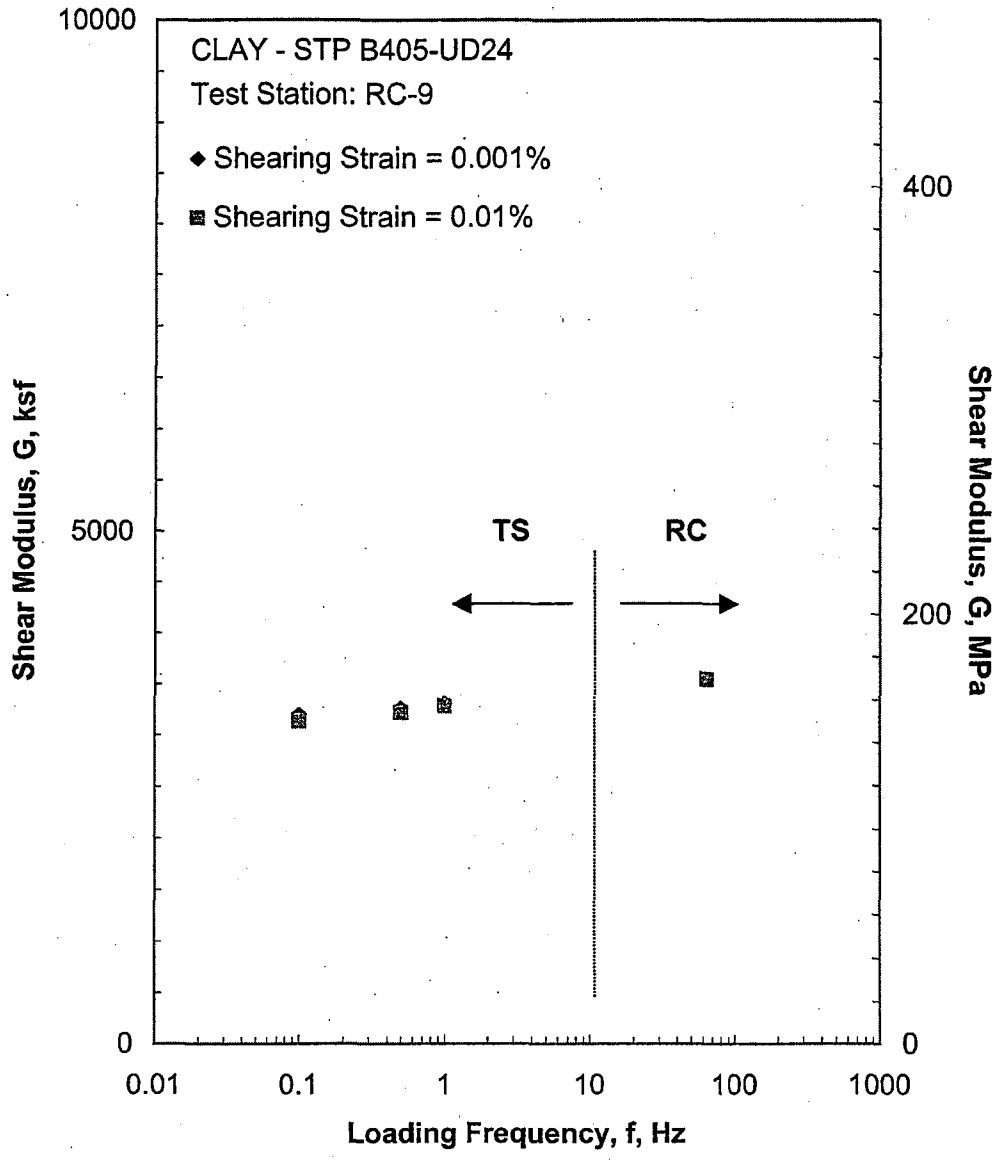


Figure K.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 167 psi from the Combined RCTS Tests

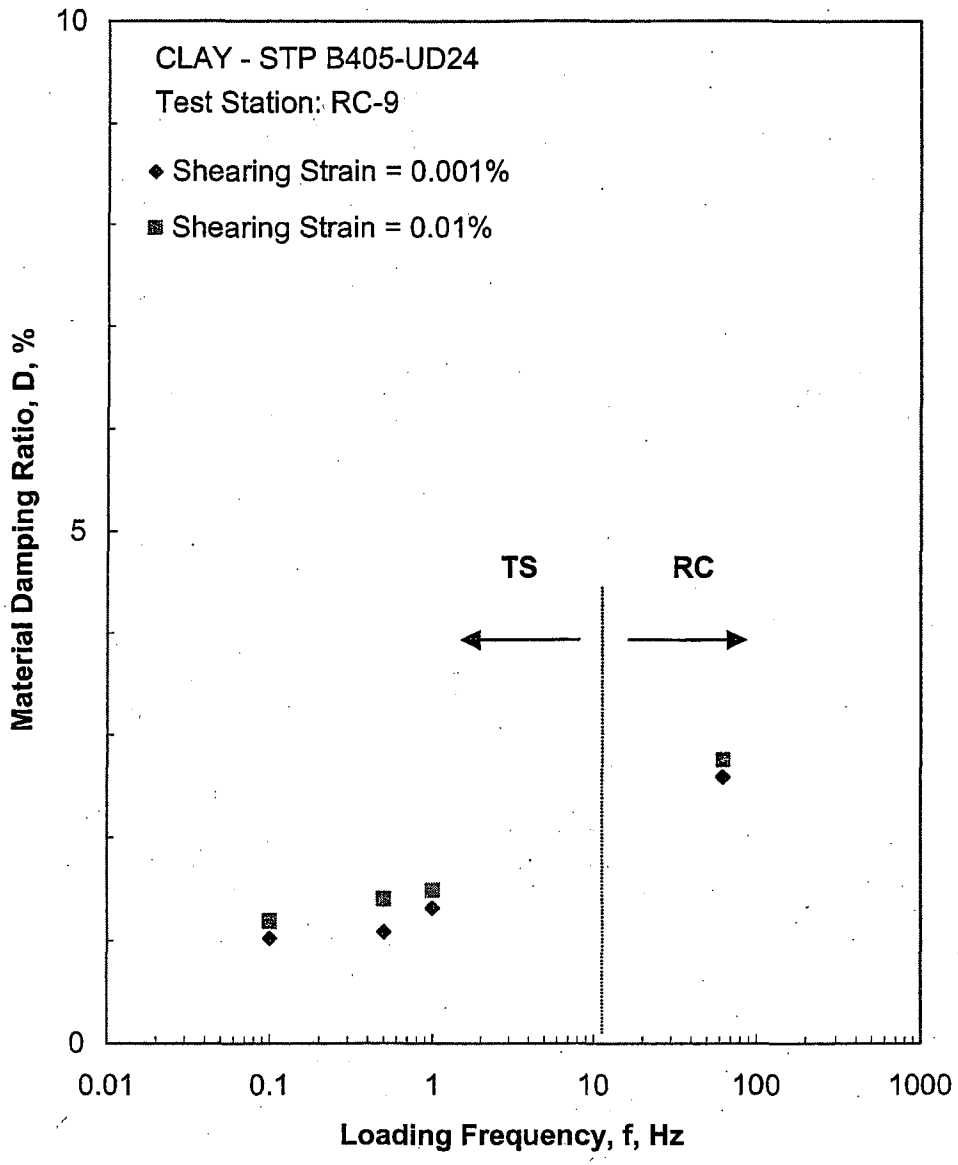


Figure K.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 167 psi from the Combined RCTS Tests

NOTE: Figures K.16- K.20 are not available

Table K.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B405-UD24

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
42	6005	287	2214	106	760	2.86	0.77
84	12024	575	2547	122	812	2.72	0.76
167	24034	1150	3082	148	889	2.58	0.74
334	48082	2301	4271	205	1036	2.37	0.71
455	65520	3135	5249	252	1133	2.35	0.66

Table K.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD24; Isoptropic Confining Pressure, σ_o=167 psi (24.0 ksf = 1150 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.71E-04	3562	1.00	1.71E-04	2.43
3.22E-04	3562	1.00	3.22E-04	2.44
6.16E-04	3546	1.00	6.16E-04	2.52
1.26E-03	3546	1.00	1.03E-03	2.58
2.47E-03	3545	1.00	2.08E-03	2.56
4.75E-03	3545	1.00	3.99E-03	2.64
8.91E-03	3545	1.00	7.39E-03	2.75
1.75E-02	3480	0.98	1.44E-02	2.90
3.43E-02	3373	0.95	2.81E-02	3.02
6.66E-02	3153	0.89	5.33E-02	3.38
1.45E-01	2761	0.78	1.13E-01	4.05
3.05E-01	2370	0.67	2.22E-01	5.10

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table K.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD24; Isotropic Confining Pressure, σ_o= 167 psi (24.0 ksf =1150 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
9.99E-04	3287	1.00	1.14	1.02E-03	3277	1.00	1.08
2.00E-03	3287	1.00	1.06	2.00E-03	3277	1.00	1.14
4.02E-03	3287	1.00	1.14	4.00E-03	3277	1.00	1.19
9.90E-03	3223	0.98	1.37	9.91E-03	3220	0.98	1.41
2.06E-02	3093	0.94	1.60	2.07E-02	3092	0.94	1.65
3.83E-02	2869	0.87	2.38	3.82E-02	2877	0.88	2.34

Table K.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD24; Isoptropic Confining Pressure, σ_o= 455 psi (65.5 ksf = 3135 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
---*	---*	---*	---*	---*

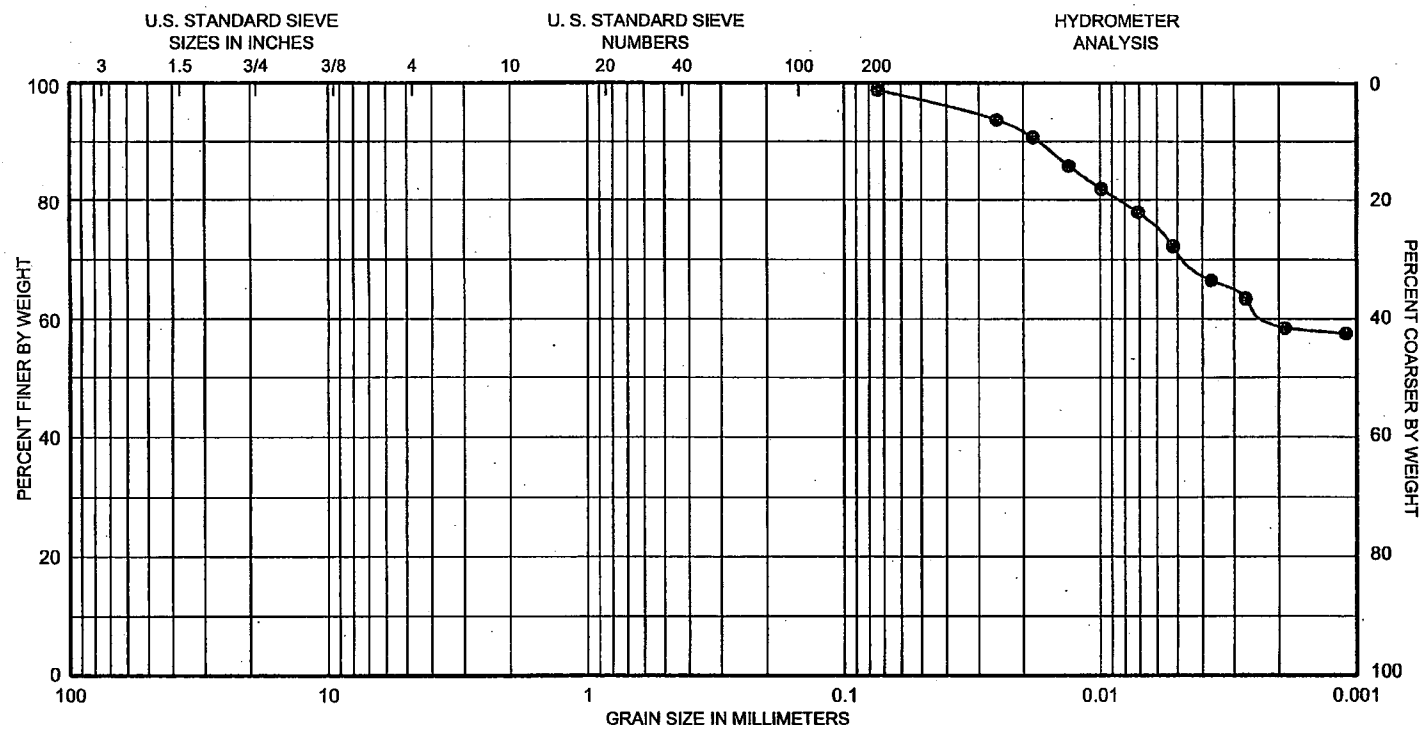
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve
[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve
* Testing at 455 psi was likely adversely affected by high straining at 167 psi and is not presented.

Table K.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD24; Isotropic Confining Pressure, σ_o=455 psi (65.5 ksf = 3135 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
—*	—*	—*	—*	—*	—*	—*	—*

* Testing at 455 psi was likely adversely affected by high straining at 167 psi and is not presented.

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-405-UD24	569.2				0.02	Clay, olive gray and brown, with ferrous nodules

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX L

Specimen STP B405-UD10
CLAY (LL=73, PI=51; Gs=2.72)

Borehole B405
Sample UD10
Depth = 224.0 ft (68.3 m)
Total Unit Weight = 114.9 lb/ft^3
Water Content = 34.5 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 67 psi

FUGRO JOB #: 0401-1660
Testing Station: RC9

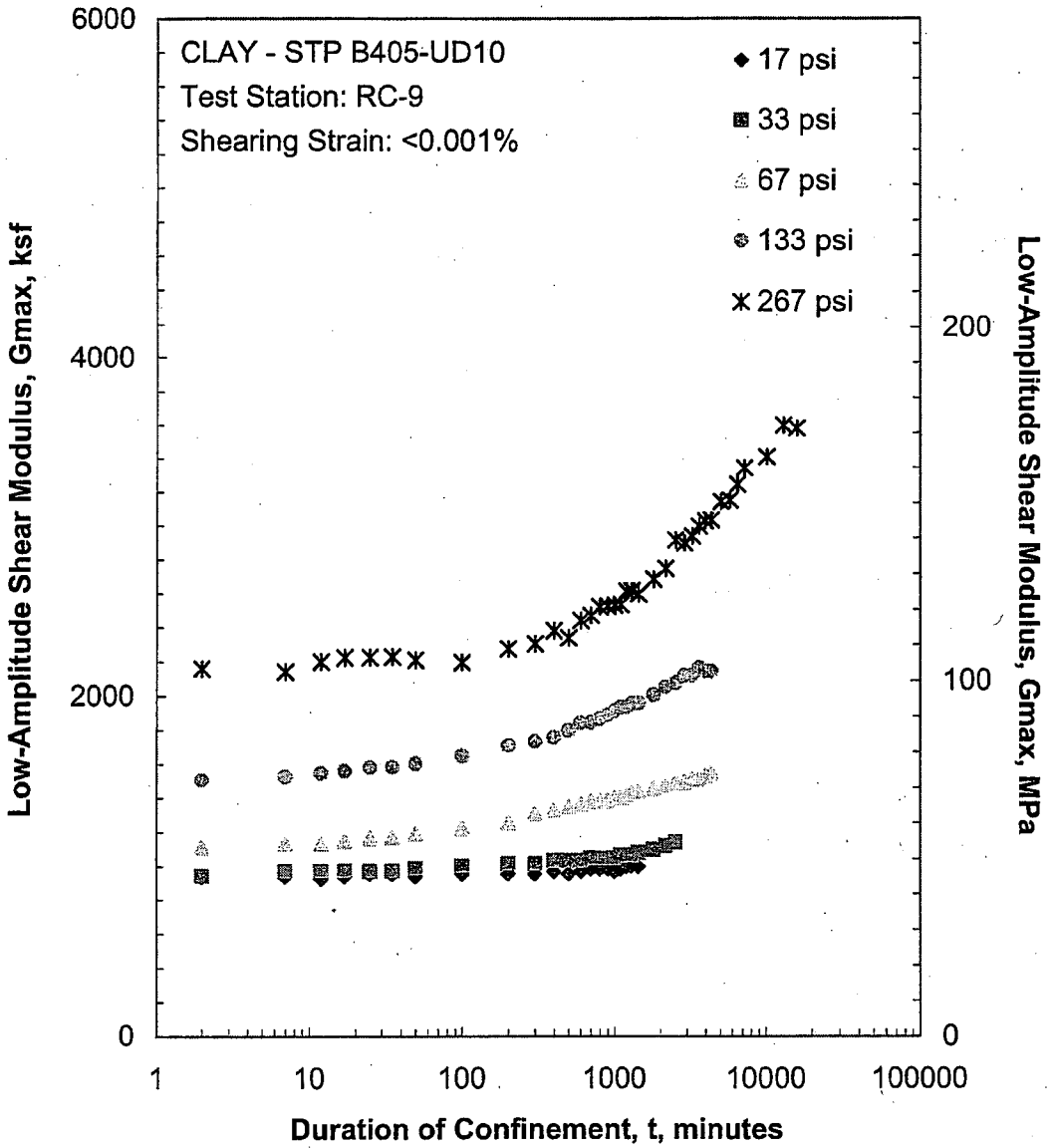


Figure L.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

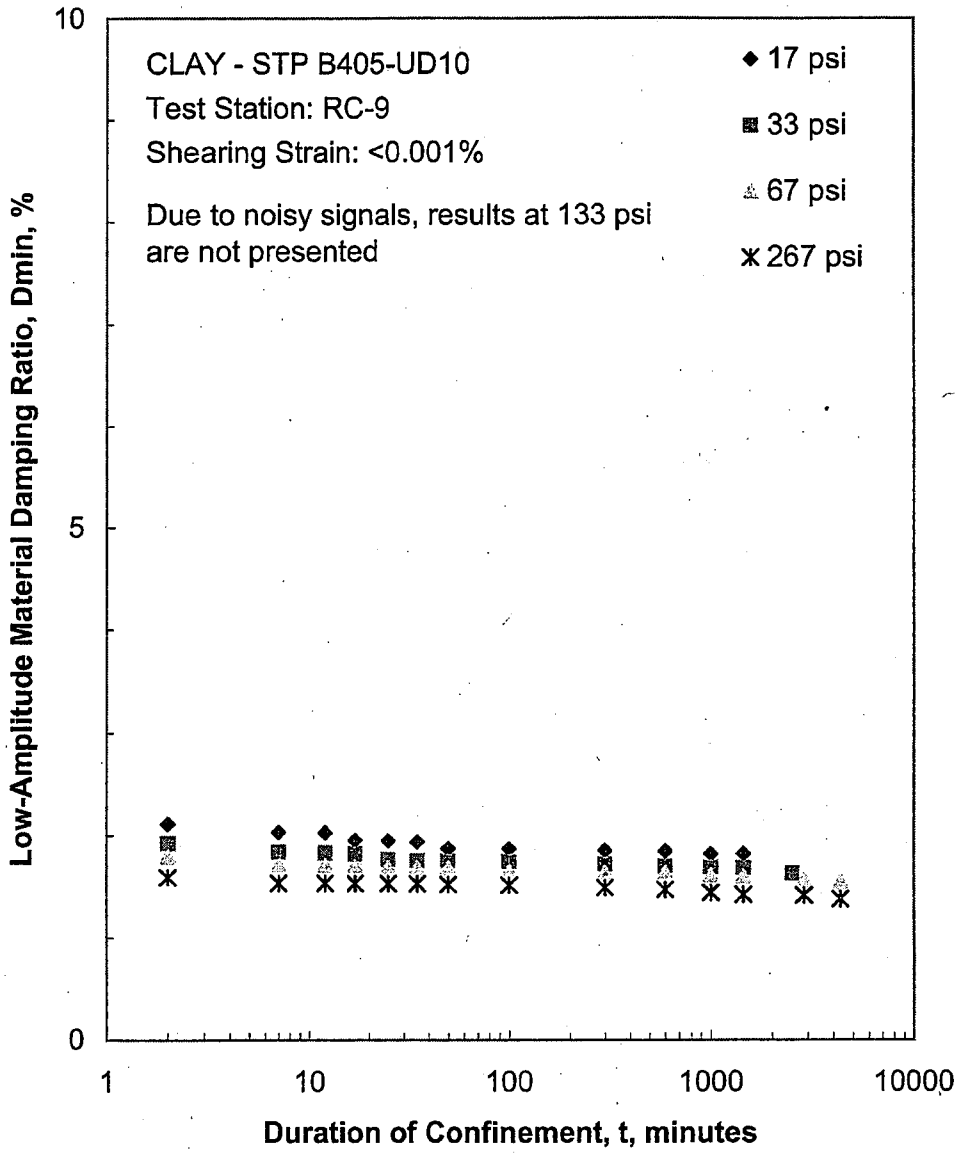


Figure L.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

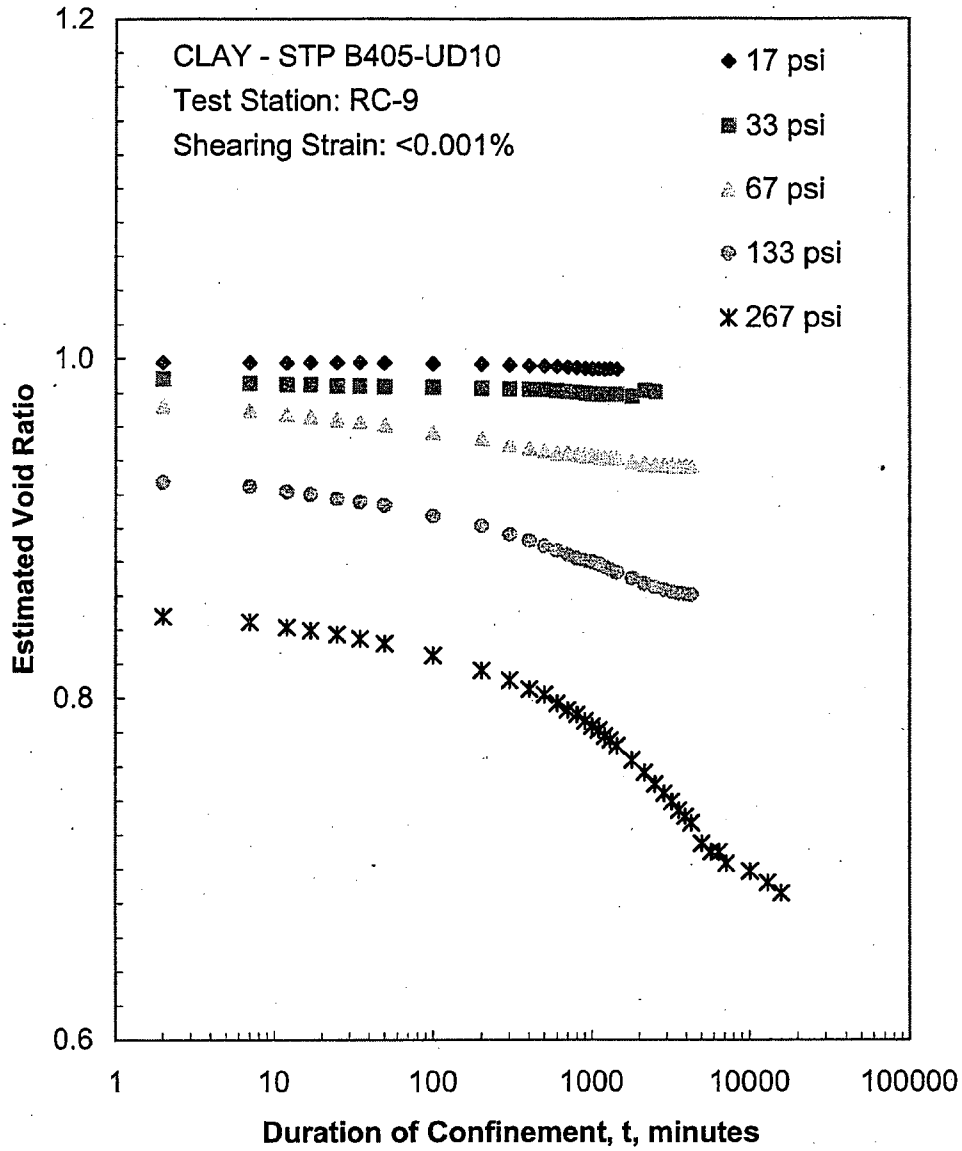


Figure L.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

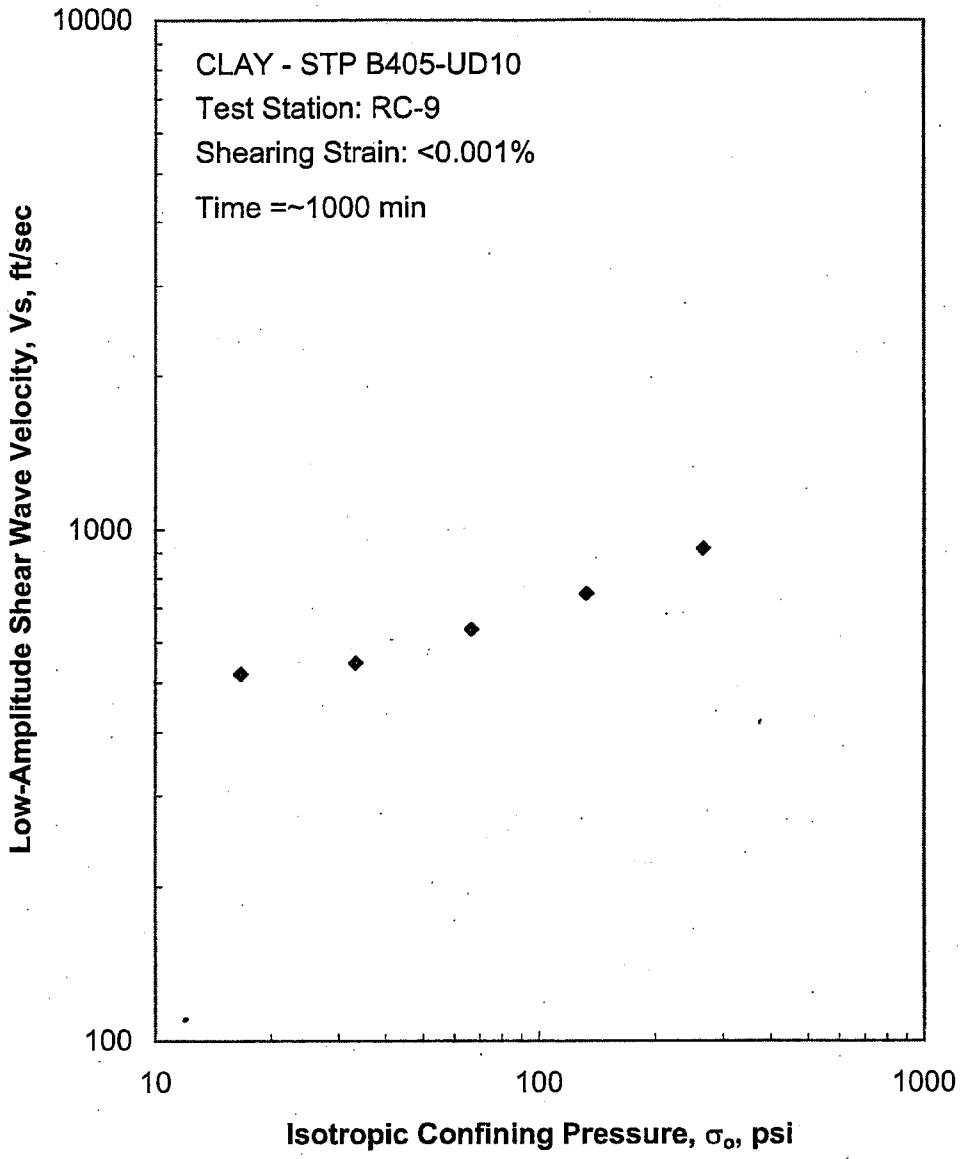


Figure L.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

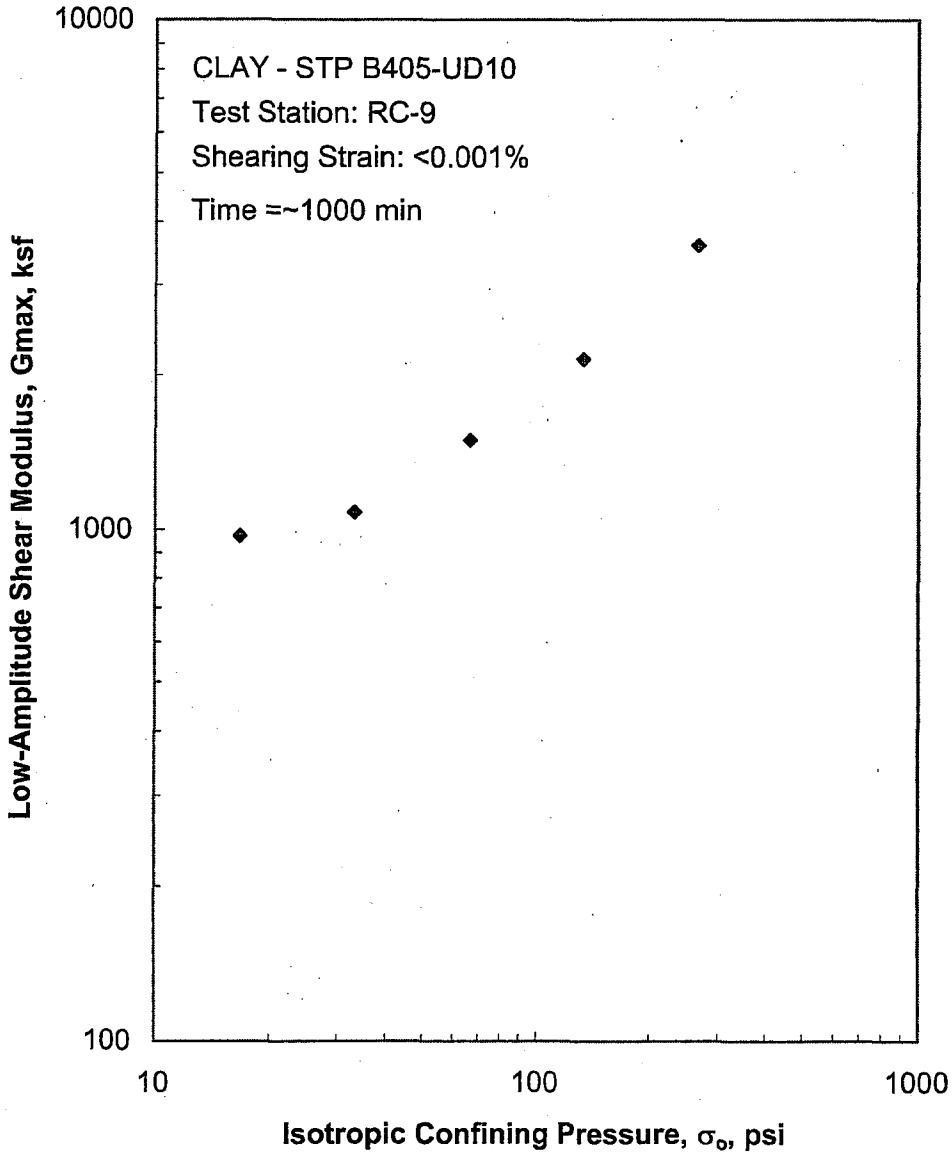


Figure L.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

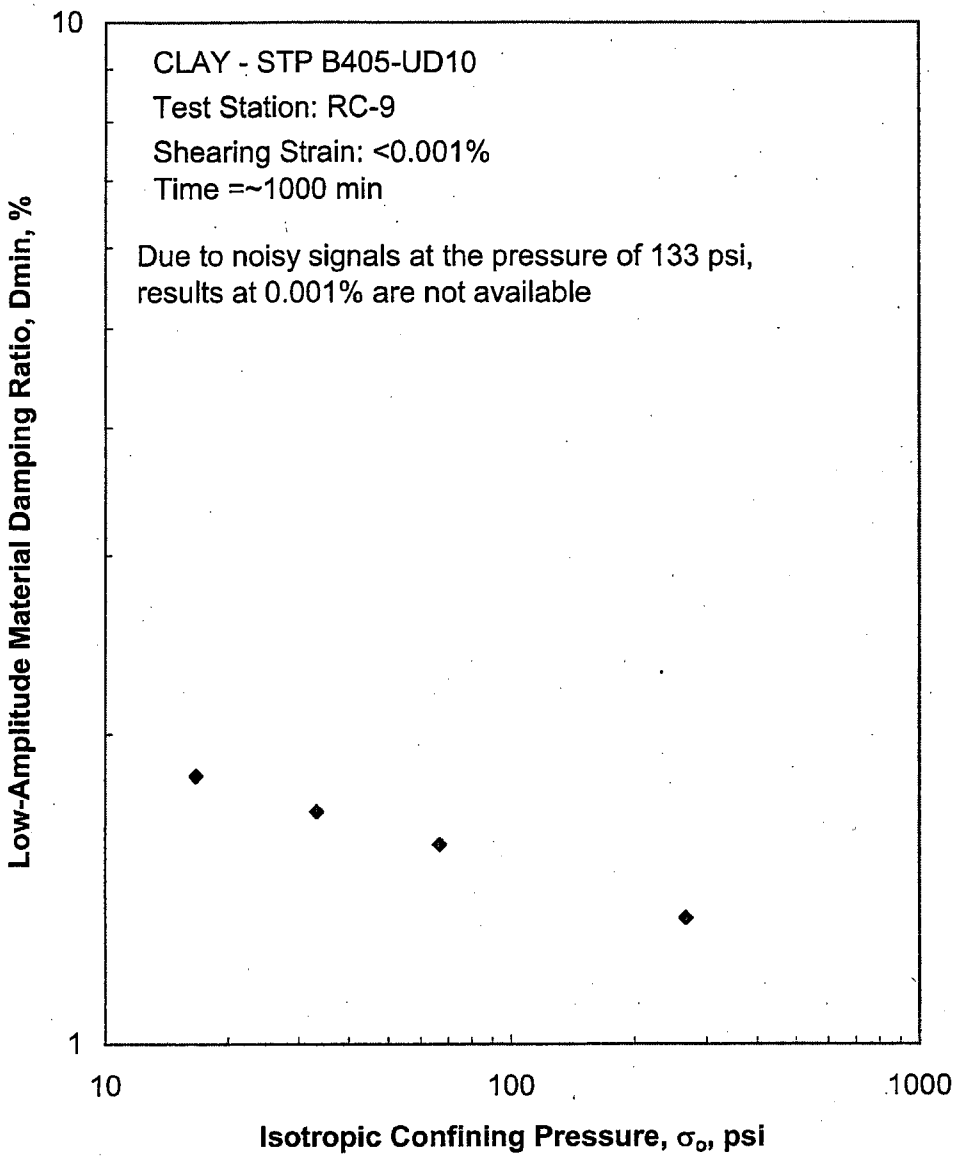


Figure L.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

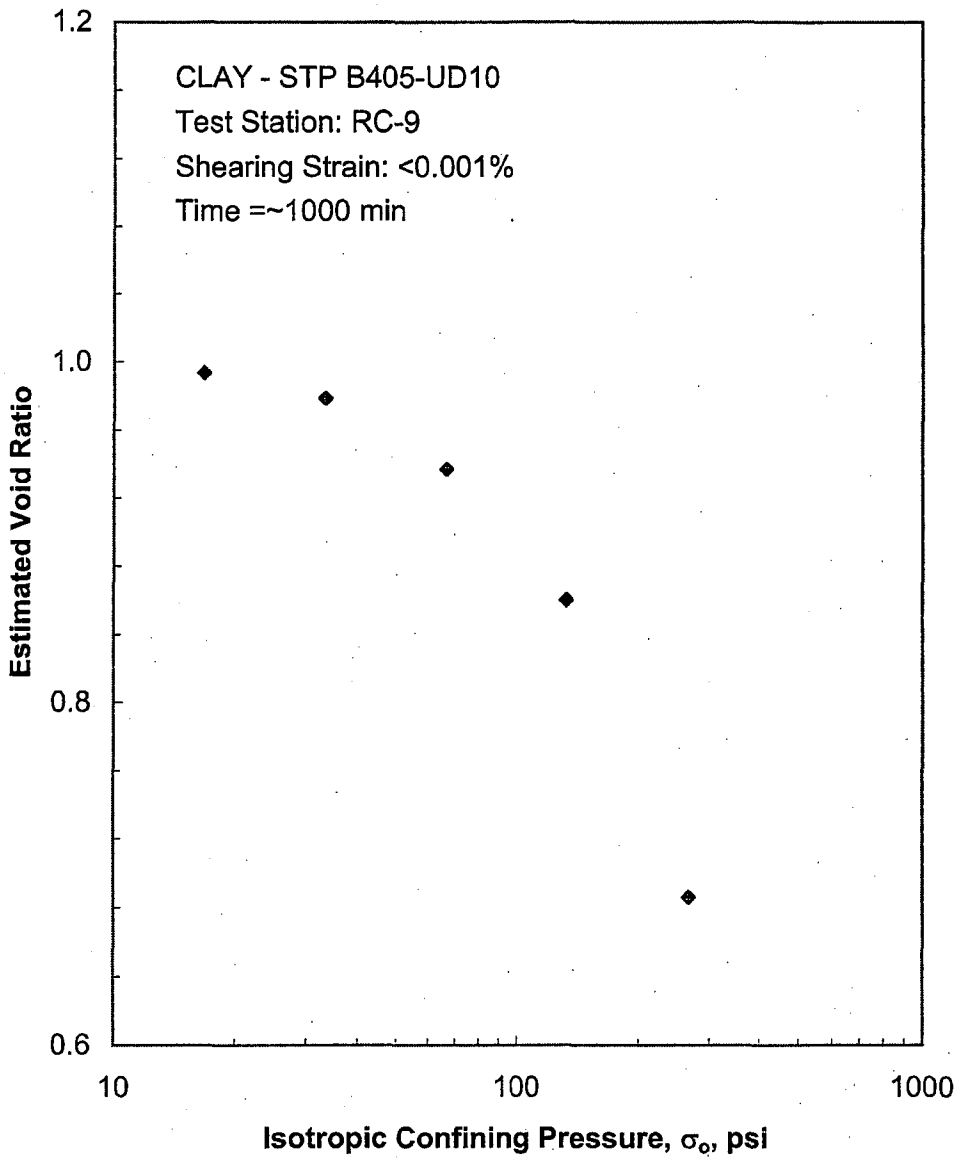


Figure L.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

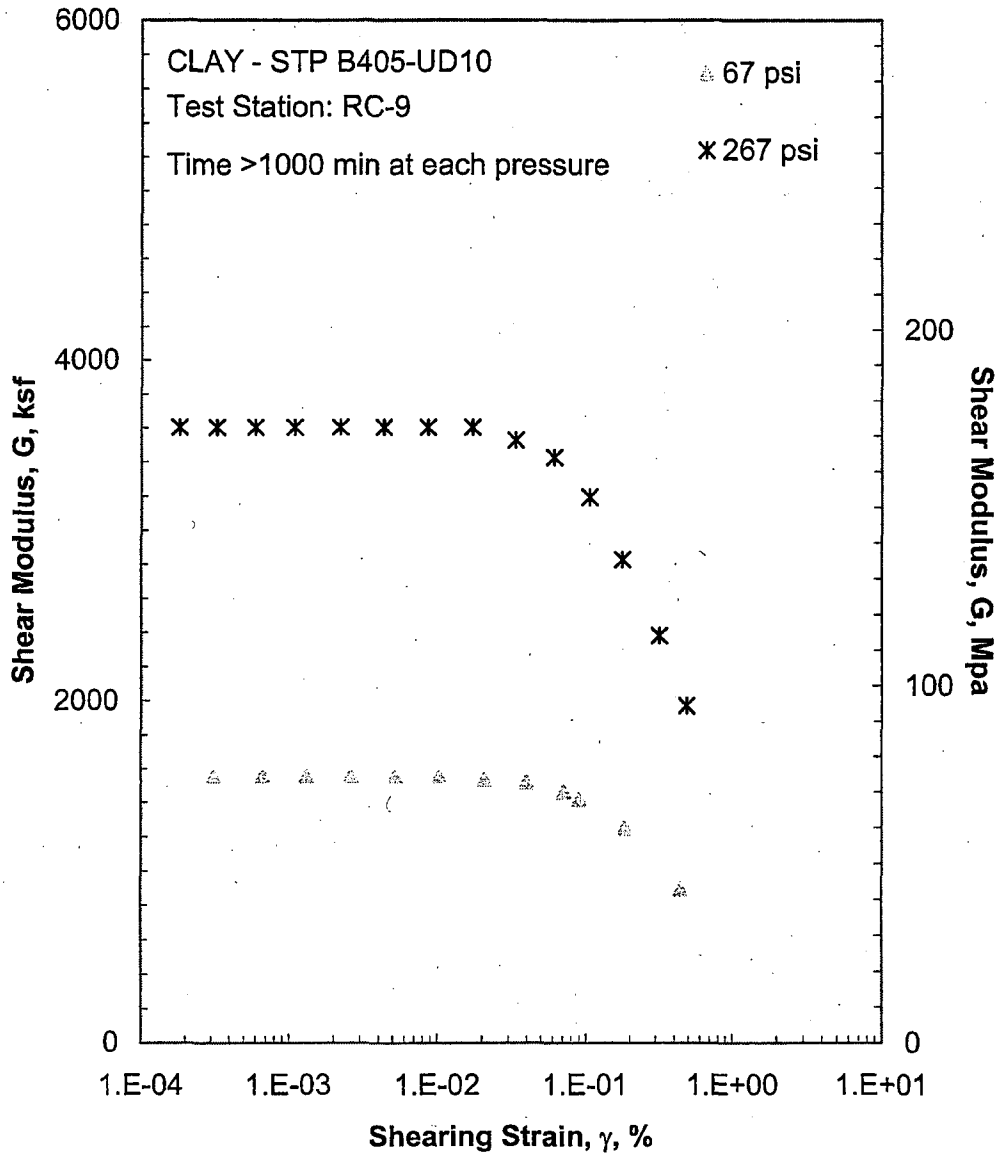


Figure L.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

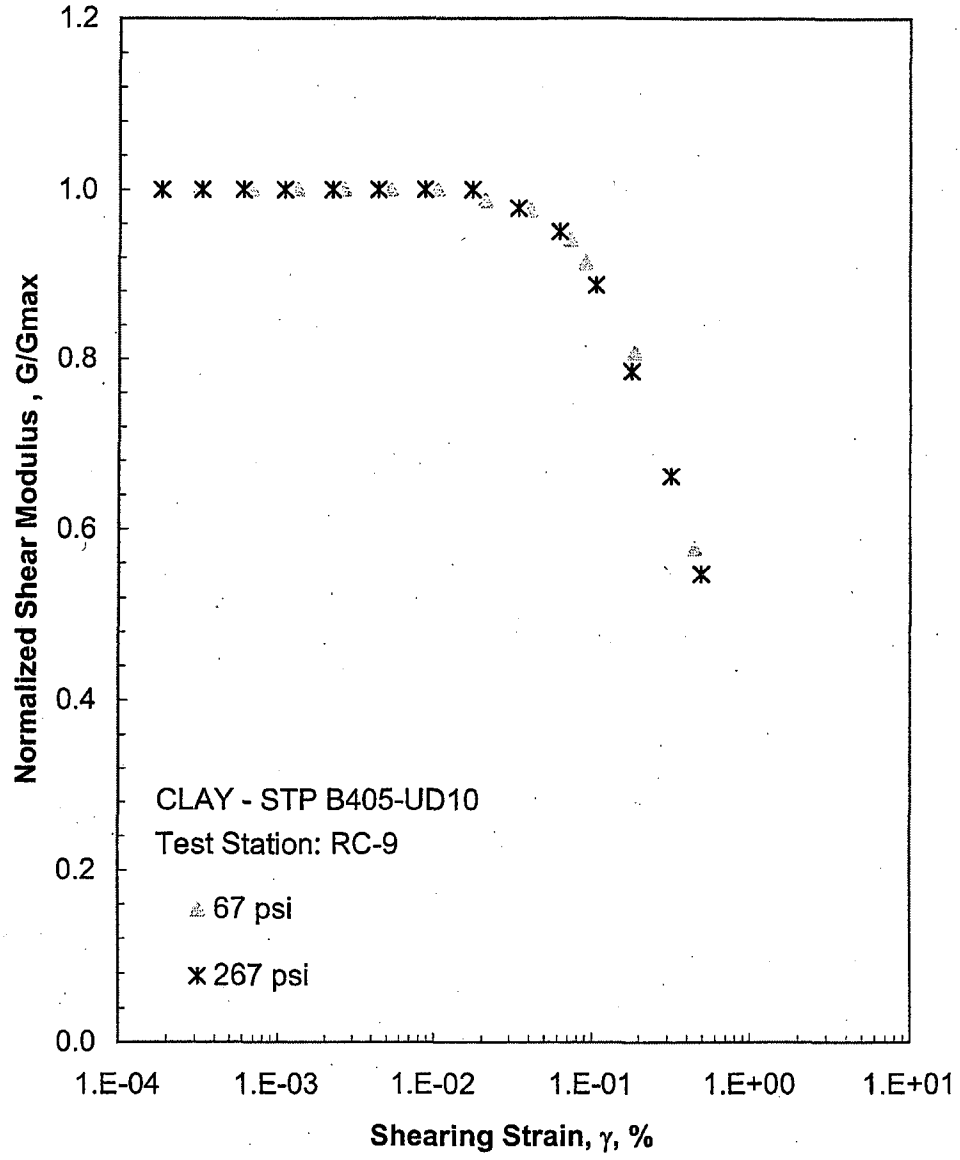


Figure L.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

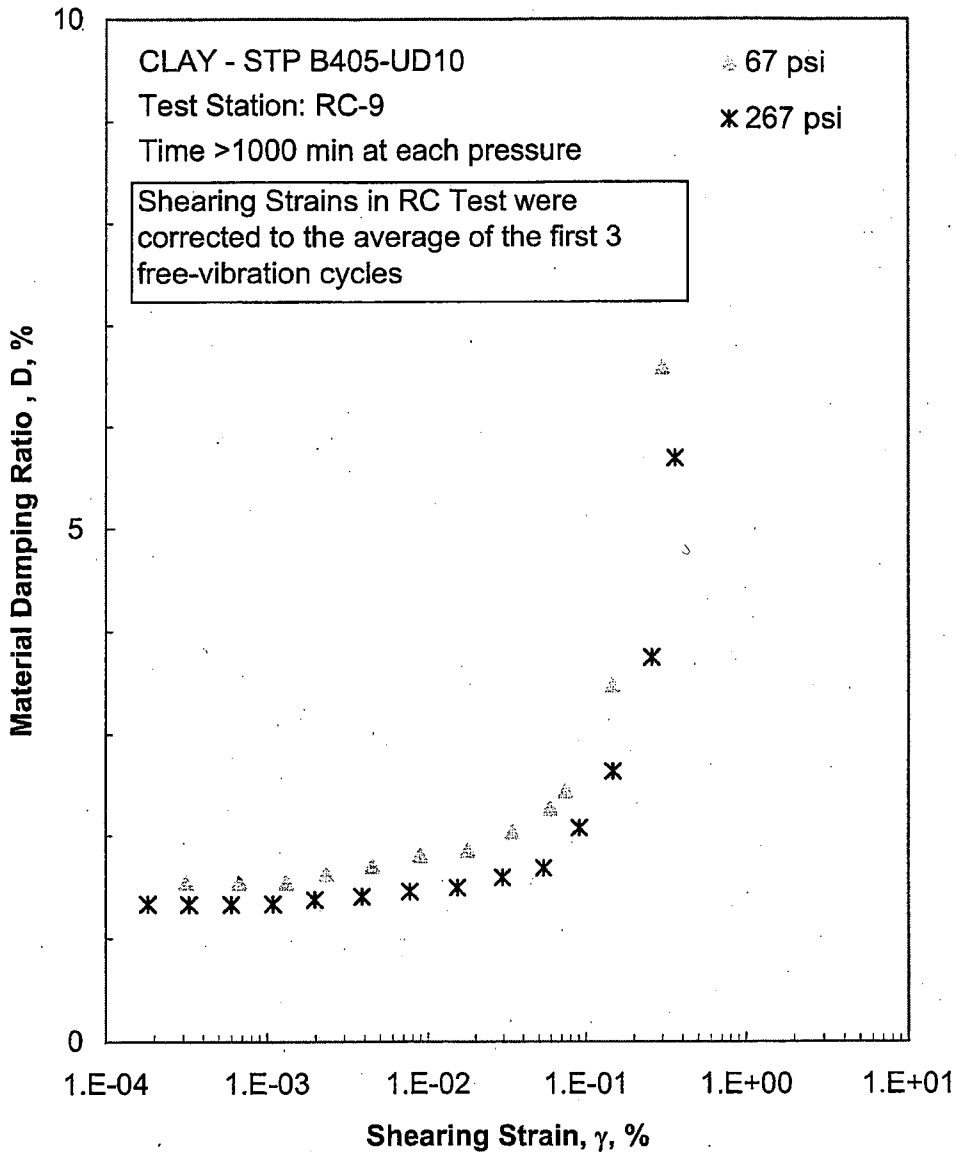


Figure L.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

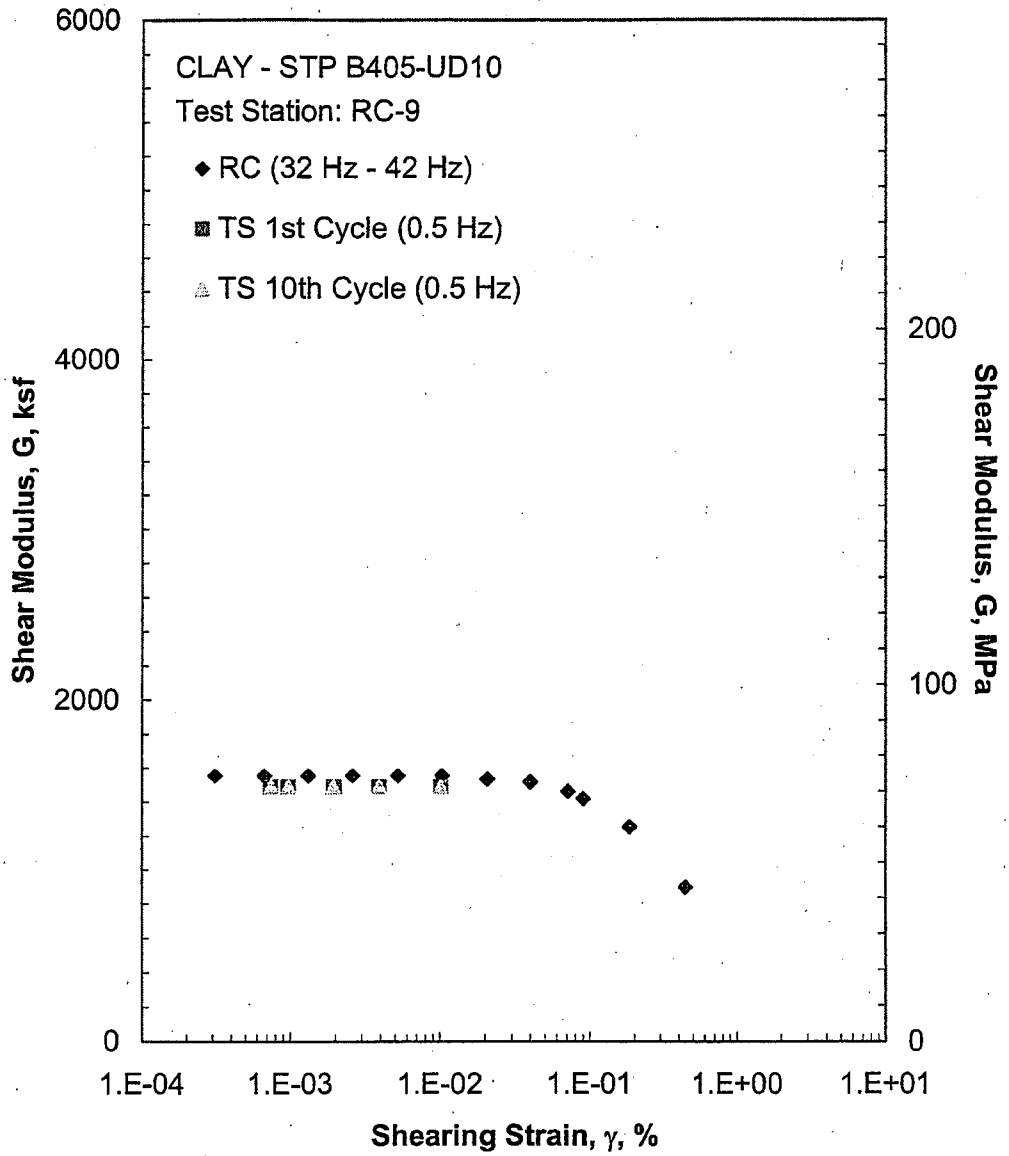


Figure L.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 67 psi from the Combined RCTS Tests

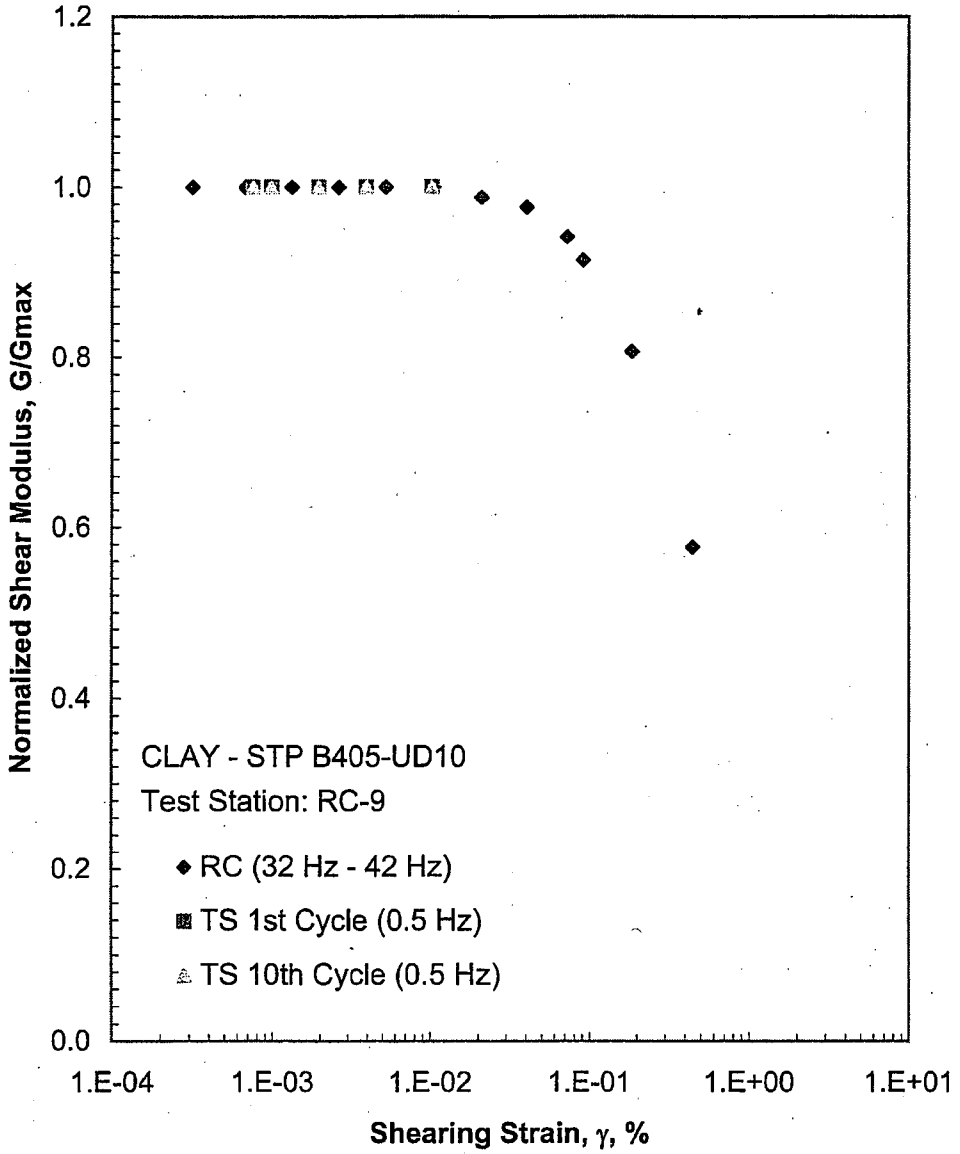


Figure L.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 67 psi from the Combined RCTS Tests

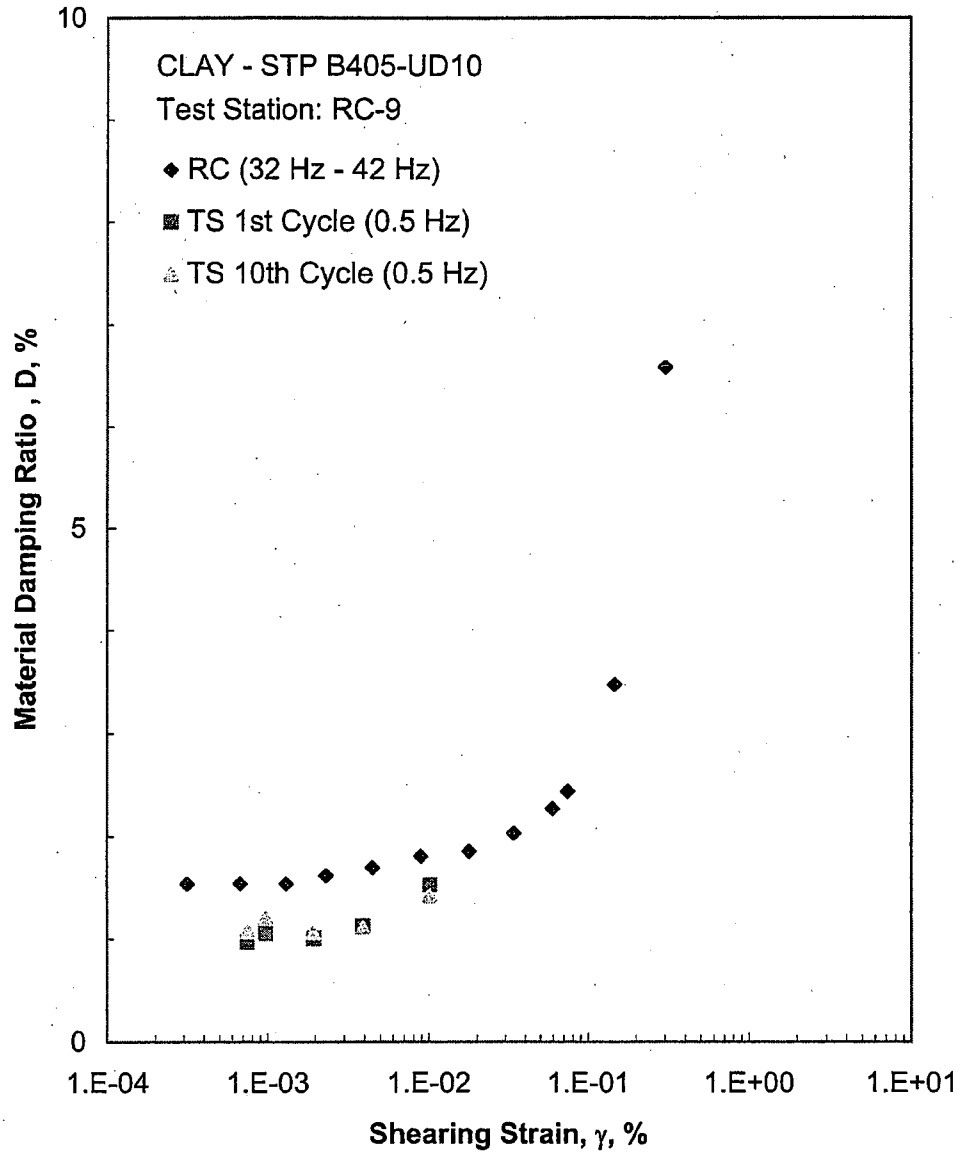


Figure L.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 67 psi from the Combined RCTS Tests

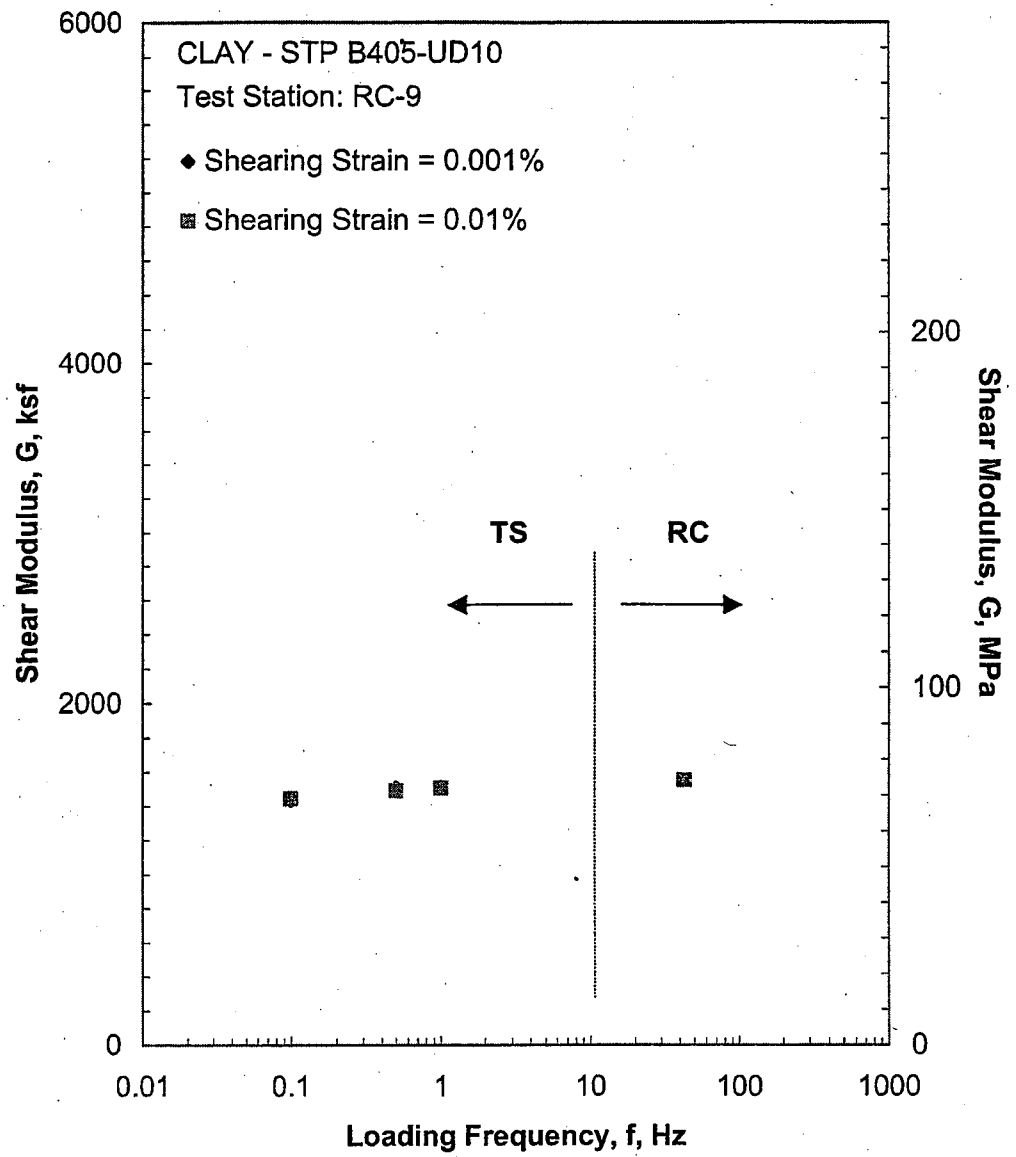


Figure L.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 67 psi from the Combined RCTS Tests

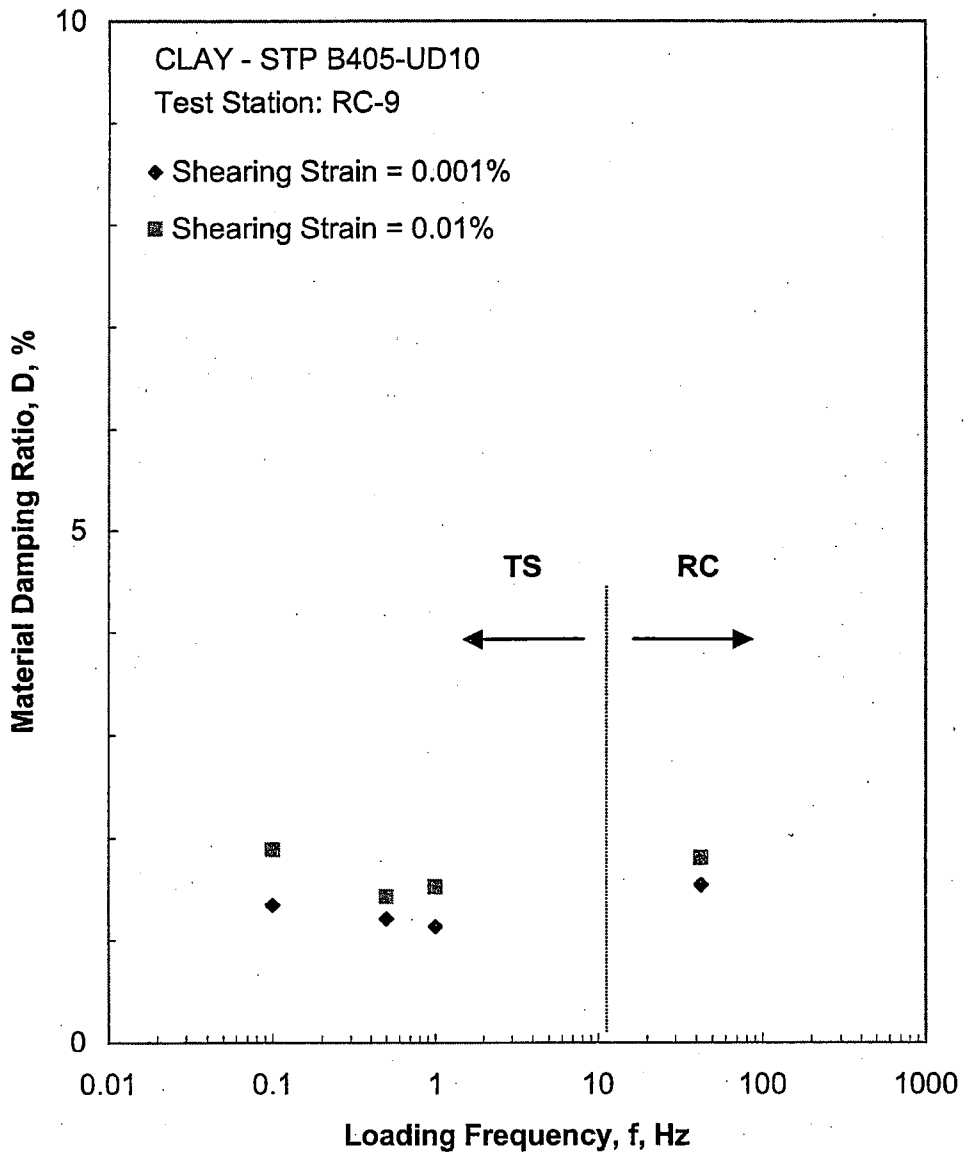


Figure L.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 67 psi from the Combined RCTS Tests

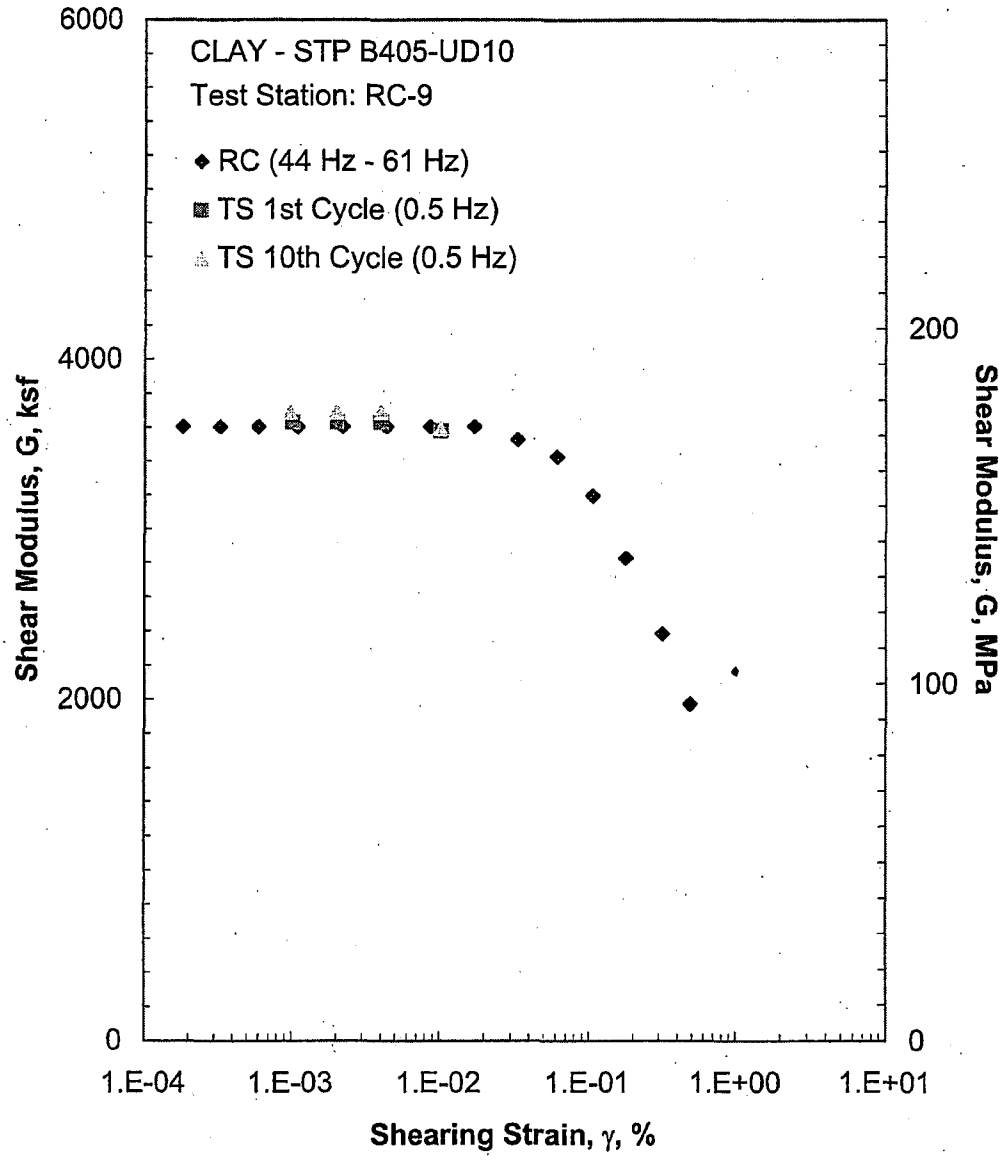


Figure L.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 267 psi from the Combined RCTS Tests

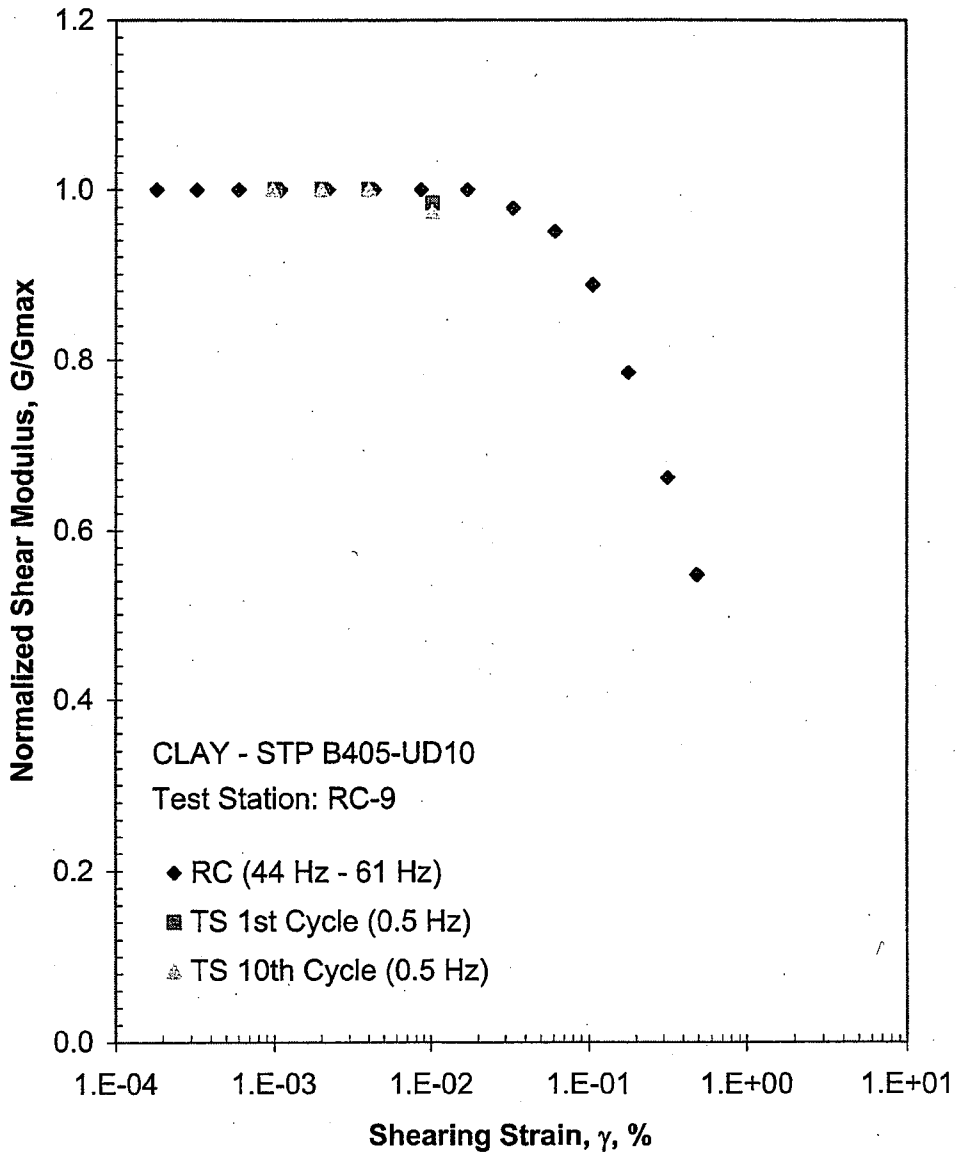


Figure L.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 267 psi from the Combined RCTS Tests

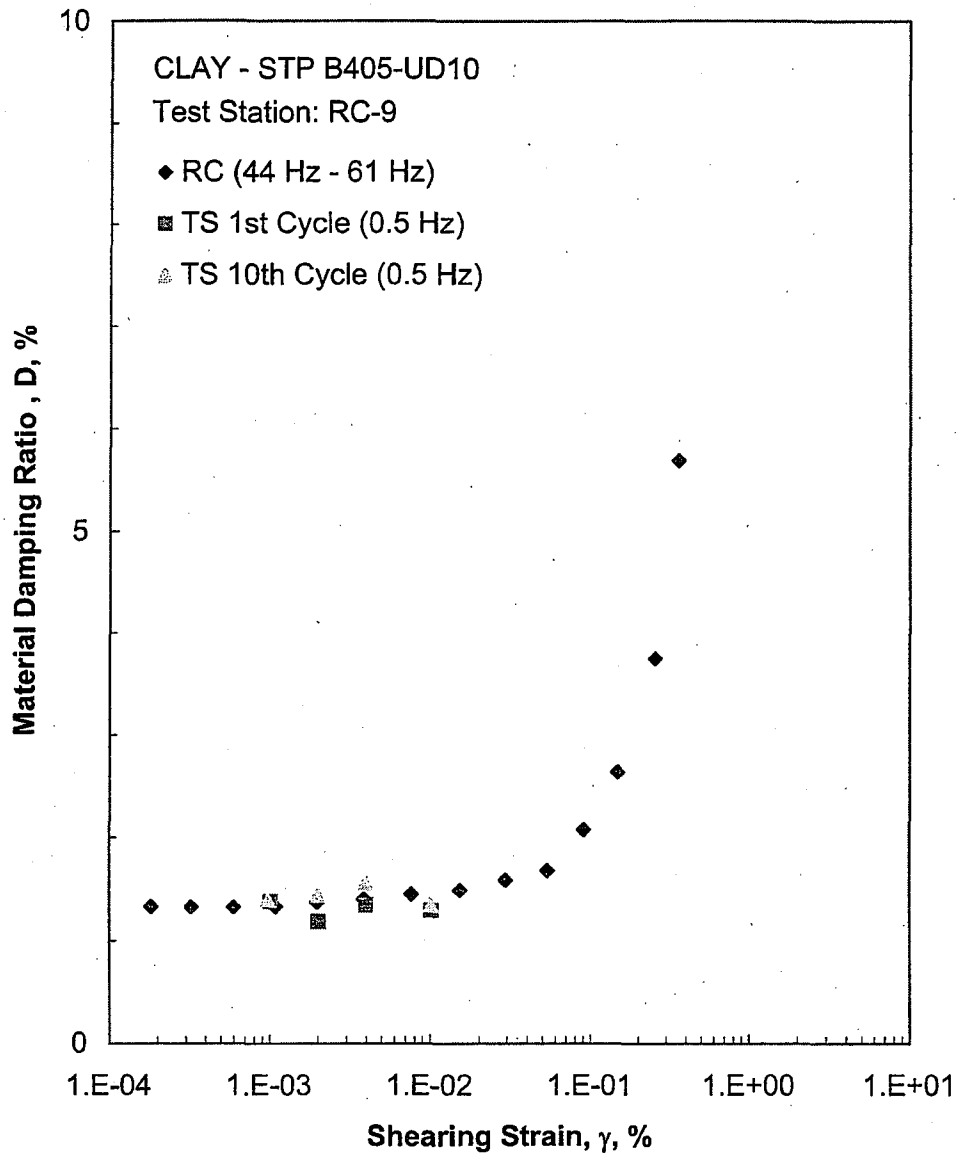


Figure L.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 267 psi from the Combined RCTS Tests

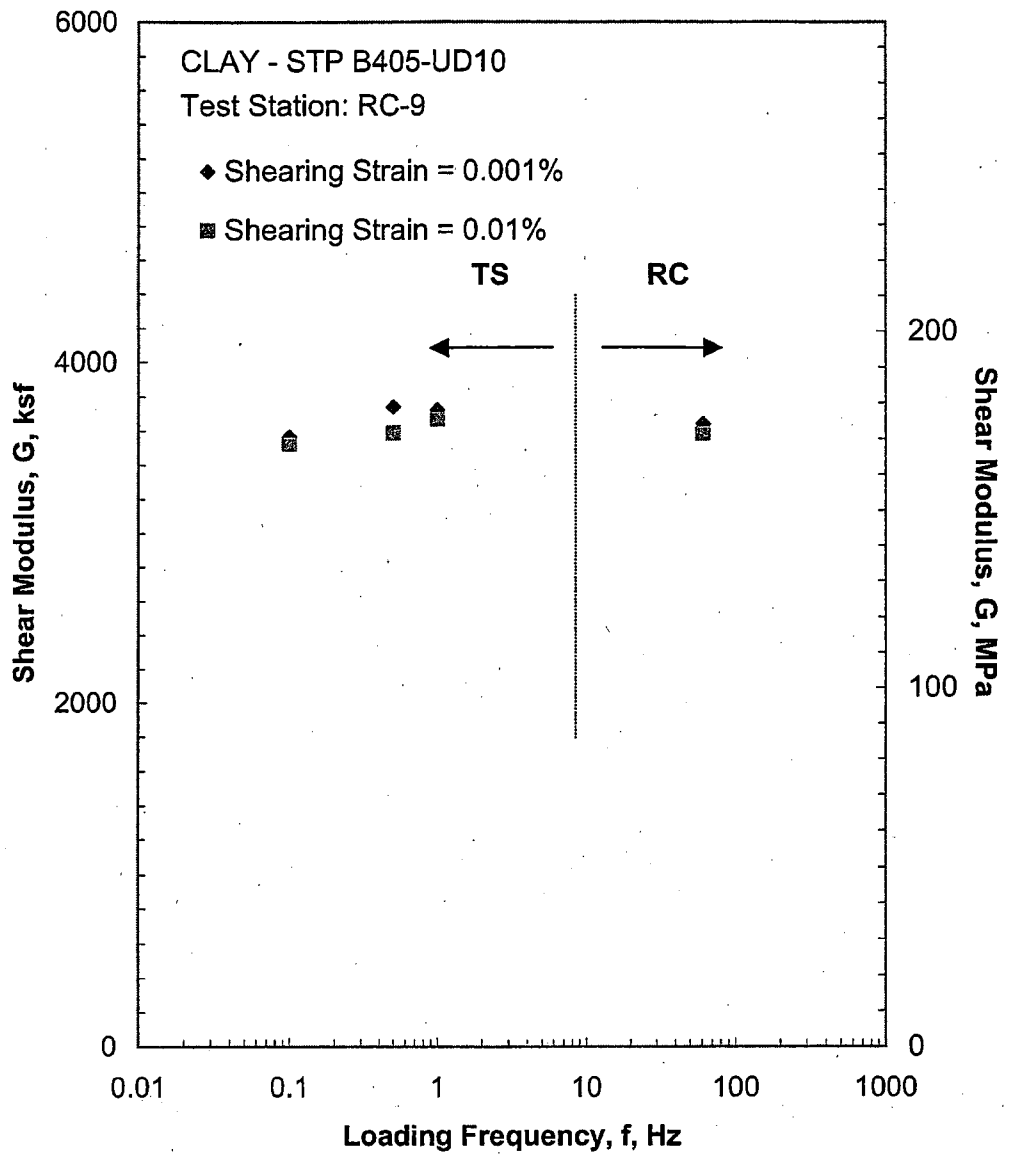


Figure L.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 267 psi from the Combined RCTS Tests

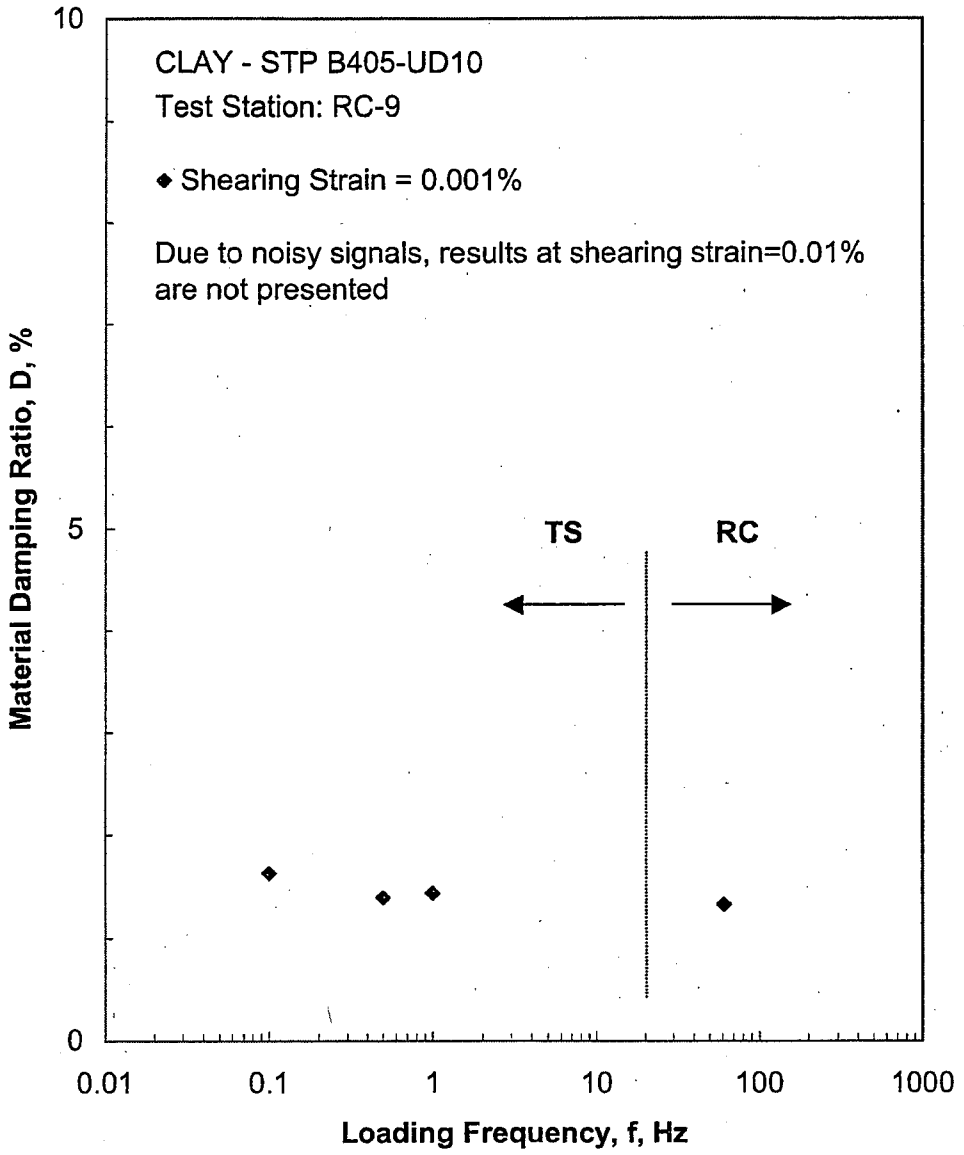


Figure L.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 267 psi from the Combined RCTS Tests

Table L.1 *Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B405-UD10*

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
17	2405	115	970	47	519	1.82	0.99
33	4795	229	1081	52	546	1.68	0.98
67	9605	460	1495	72	635	1.56	0.94
133	19195	918	2146	103	746	---	0.86
267	38405	1838	3581	172	917	1.33	0.69

Table L.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD10; Isoptropic Confining Pressure, σ_o=67 psi (9.6 ksf = 460 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
3.14E-04	1553	1.00	3.14E-04	1.54
6.75E-04	1553	1.00	6.75E-04	1.54
1.32E-03	1553	1.00	1.32E-03	1.54
2.61E-03	1553	1.00	2.33E-03	1.62
5.22E-03	1553	1.00	4.49E-03	1.70
1.04E-02	1553	1.00	8.95E-03	1.81
2.08E-02	1535	0.99	1.79E-02	1.85
4.00E-02	1517	0.98	3.40E-02	2.03
7.17E-02	1462	0.94	5.95E-02	2.27
9.07E-02	1420	0.91	7.44E-02	2.44
1.85E-01	1254	0.81	1.46E-01	3.47

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table L.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD10; Isotropic Confining Pressure, σ_o= 67 psi (9.6 ksf =460 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
7.42E-04	1489	1.00	0.97	7.49E-04	1492	1.00	1.07
9.80E-04	1489	1.00	1.05	9.75E-04	1492	1.00	1.21
1.96E-03	1489	1.00	1.01	1.94E-03	1492	1.00	1.06
3.90E-03	1489	1.00	1.12	3.91E-03	1492	1.00	1.11
1.02E-02	1489	1.00	1.52	1.02E-02	1492	1.00	1.42

Table L.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B405-UD10; Isoptropic Confining Pressure, σ_o= 267 psi (38.4 ksf = 1838 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.82E-04	3604	1.00	1.82E-04	1.33
3.27E-04	3604	1.00	3.27E-04	1.33
6.00E-04	3604	1.00	6.00E-04	1.33
1.09E-03	3604	1.00	1.09E-03	1.33
2.20E-03	3604	1.00	1.98E-03	1.37
4.34E-03	3604	1.00	3.86E-03	1.40
8.67E-03	3604	1.00	7.72E-03	1.45
1.72E-02	3604	1.00	1.54E-02	1.49
3.35E-02	3526	0.98	2.95E-02	1.59
6.13E-02	3425	0.95	5.40E-02	1.68
1.06E-01	3196	0.89	9.09E-02	2.07
1.79E-01	2828	0.78	1.48E-01	2.63
3.17E-01	2384	0.66	2.57E-01	3.75
4.86E-01	1972	0.55	3.60E-01	5.69

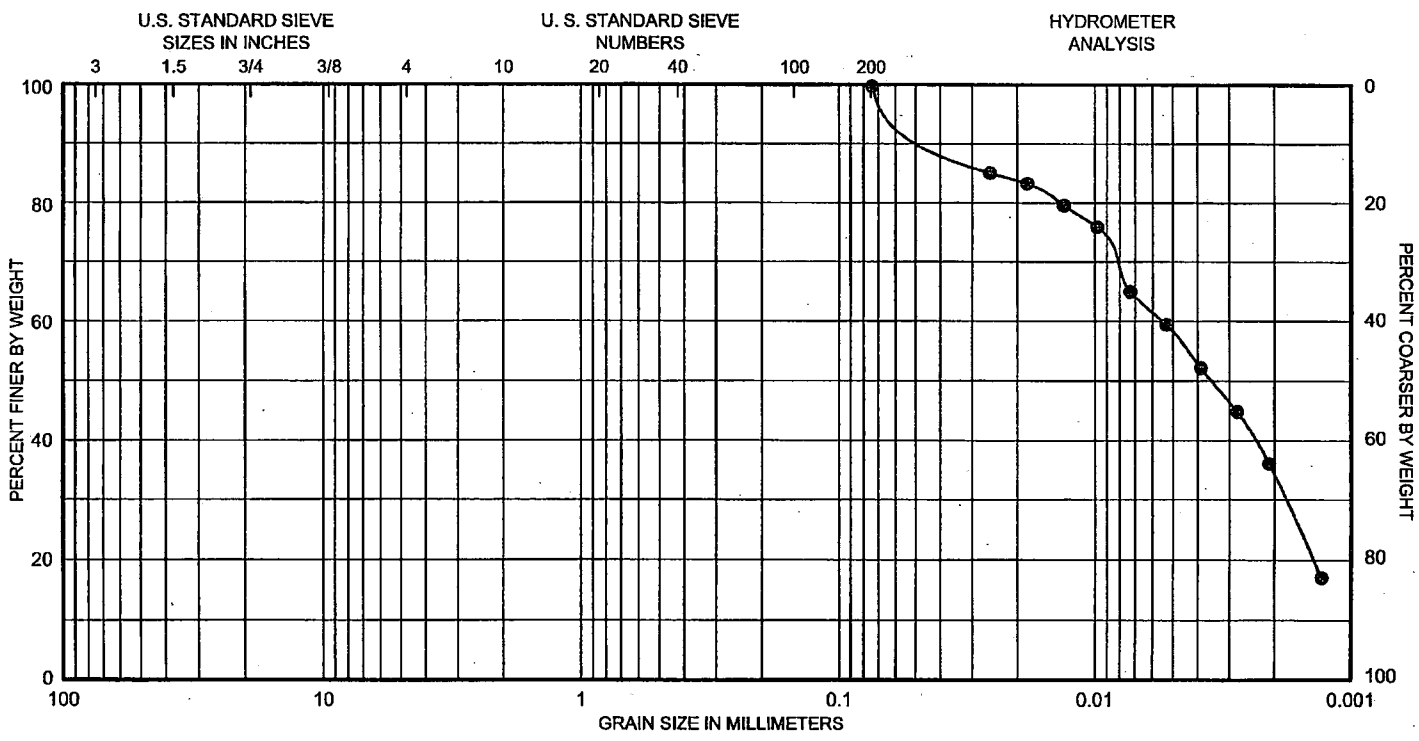
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table L.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B405-UD10; Isotropic Confining Pressure, σ_o=267 psi (38.4 ksf = 1838 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
1.01E-03	3631	1.00	1.38	9.78E-04	3688	1.00	1.39
2.02E-03	3631	1.00	1.19	2.00E-03	3688	1.00	1.43
4.00E-03	3631	1.00	1.34	3.99E-03	3688	1.00	1.55
1.02E-02	3575	0.98	1.29	1.02E-02	3591	0.97	1.34

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-405-UD10	224			0.0035	0.04	Clay, olive gray, with silt seams

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX M

Specimen STP B405-UD6
CLAY (LL=68, PI=50; Gs=2.73)

Borehole B405
Sample UD6
Depth = 127.0 ft (38.7 m)
Total Unit Weight = 121.8 lb/ft^3
Water Content = 27.2 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 39 psi

FUGRO JOB #: 0401-1660
Testing Station: RC8

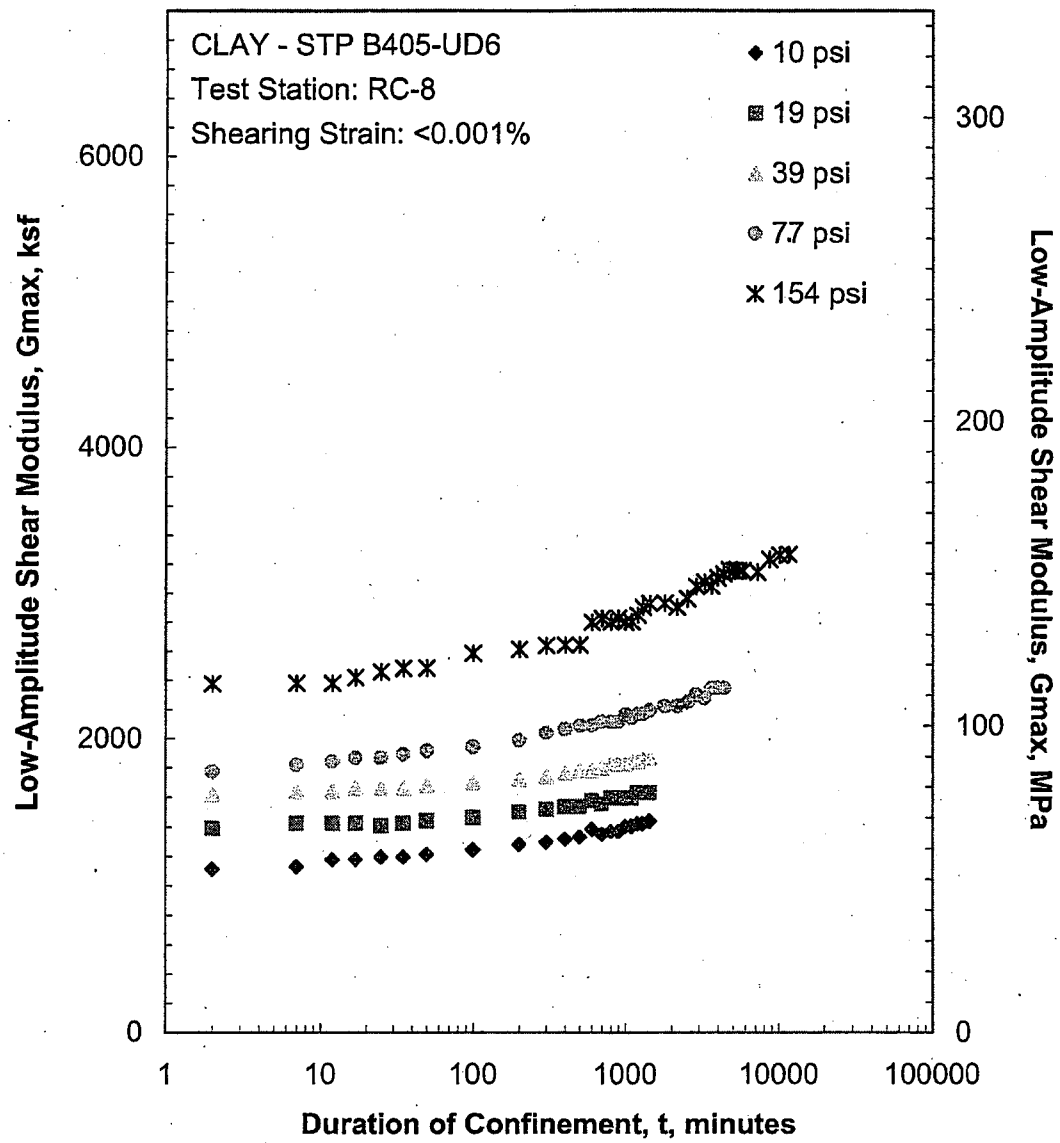


Figure M.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

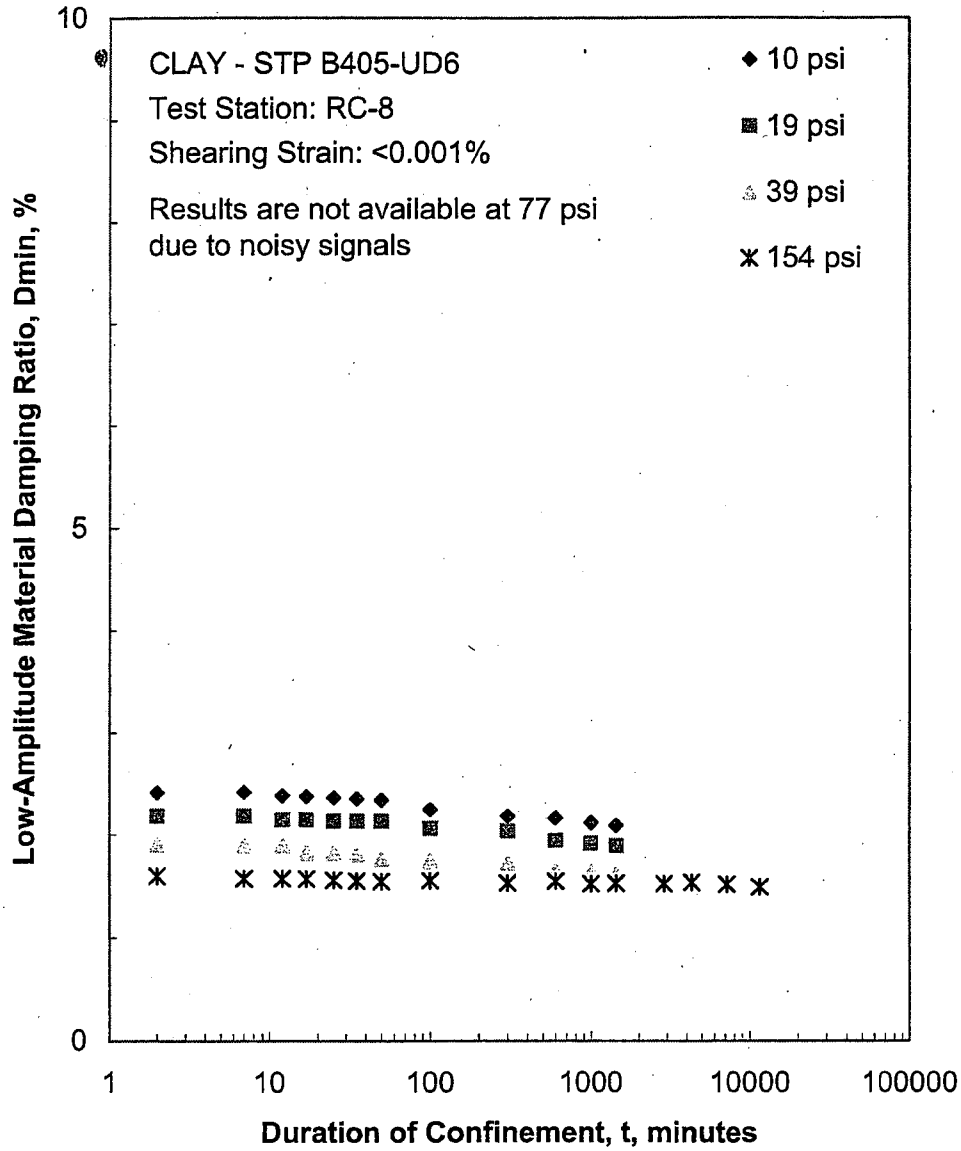


Figure M.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

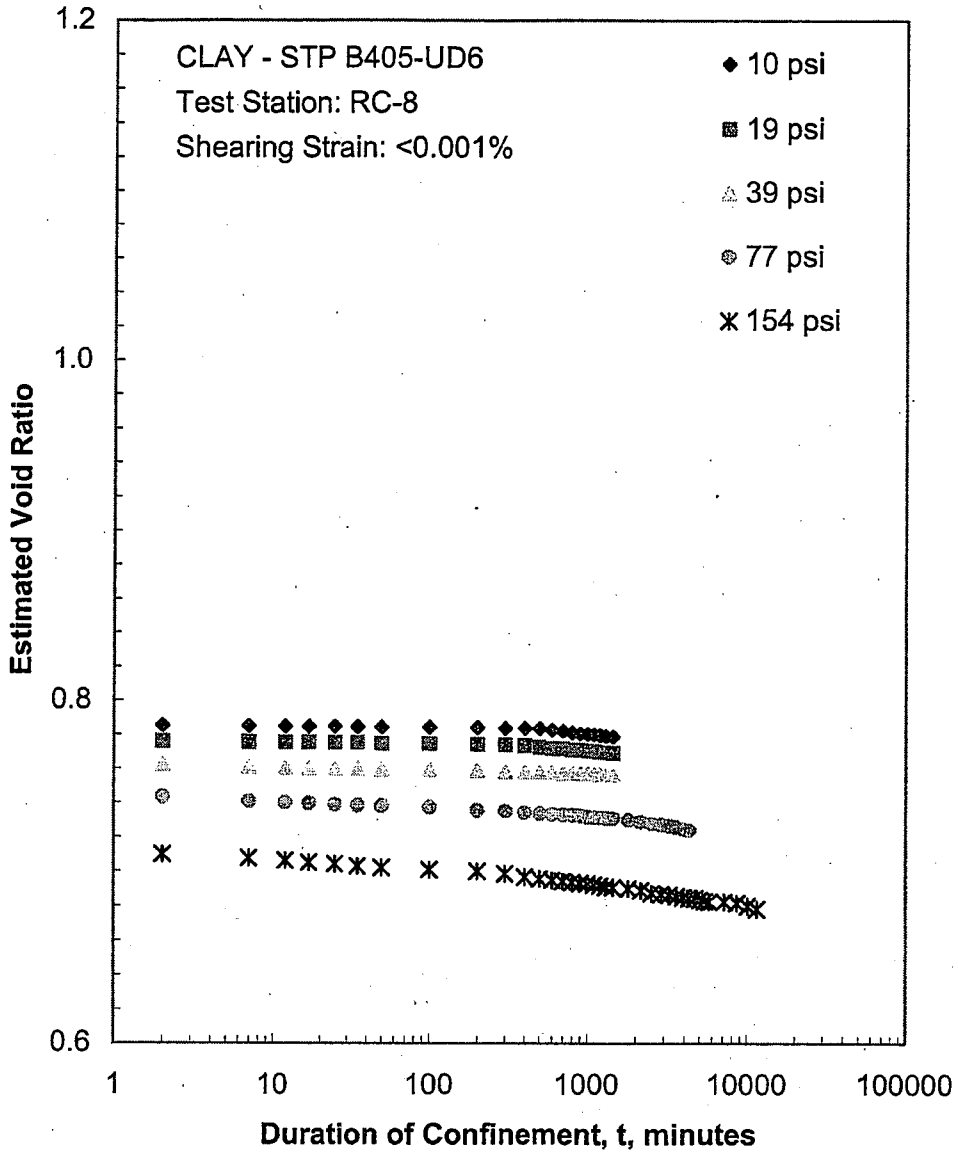


Figure M.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

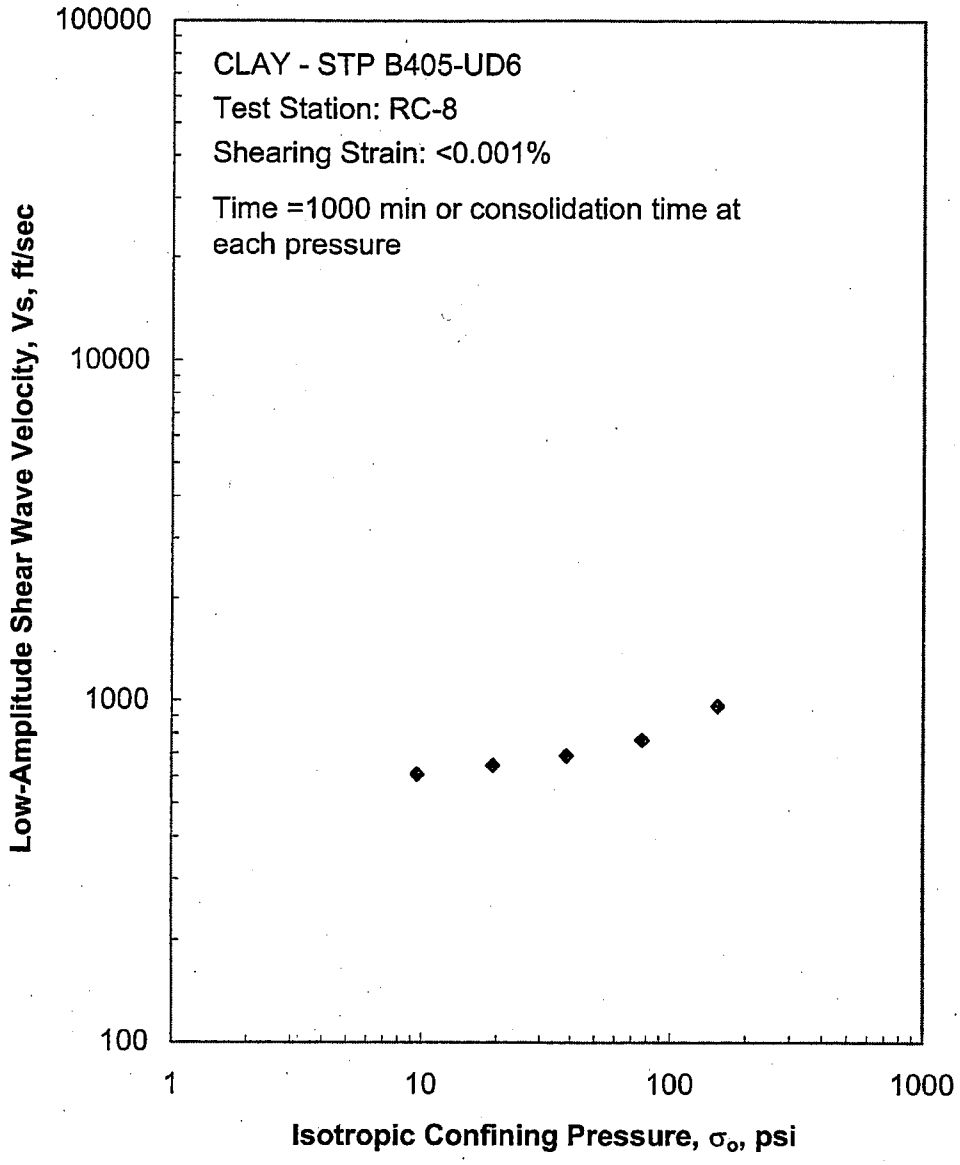


Figure M.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

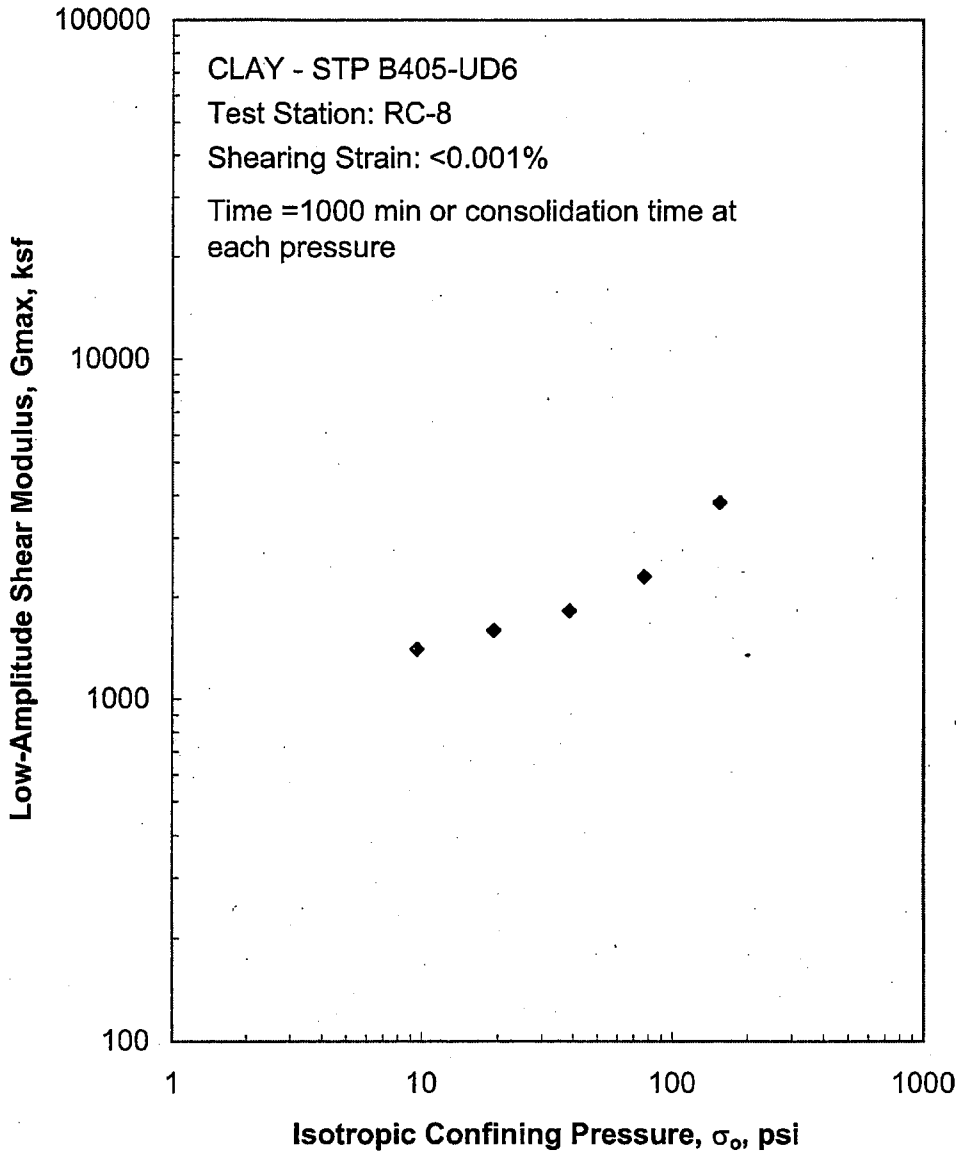


Figure M.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

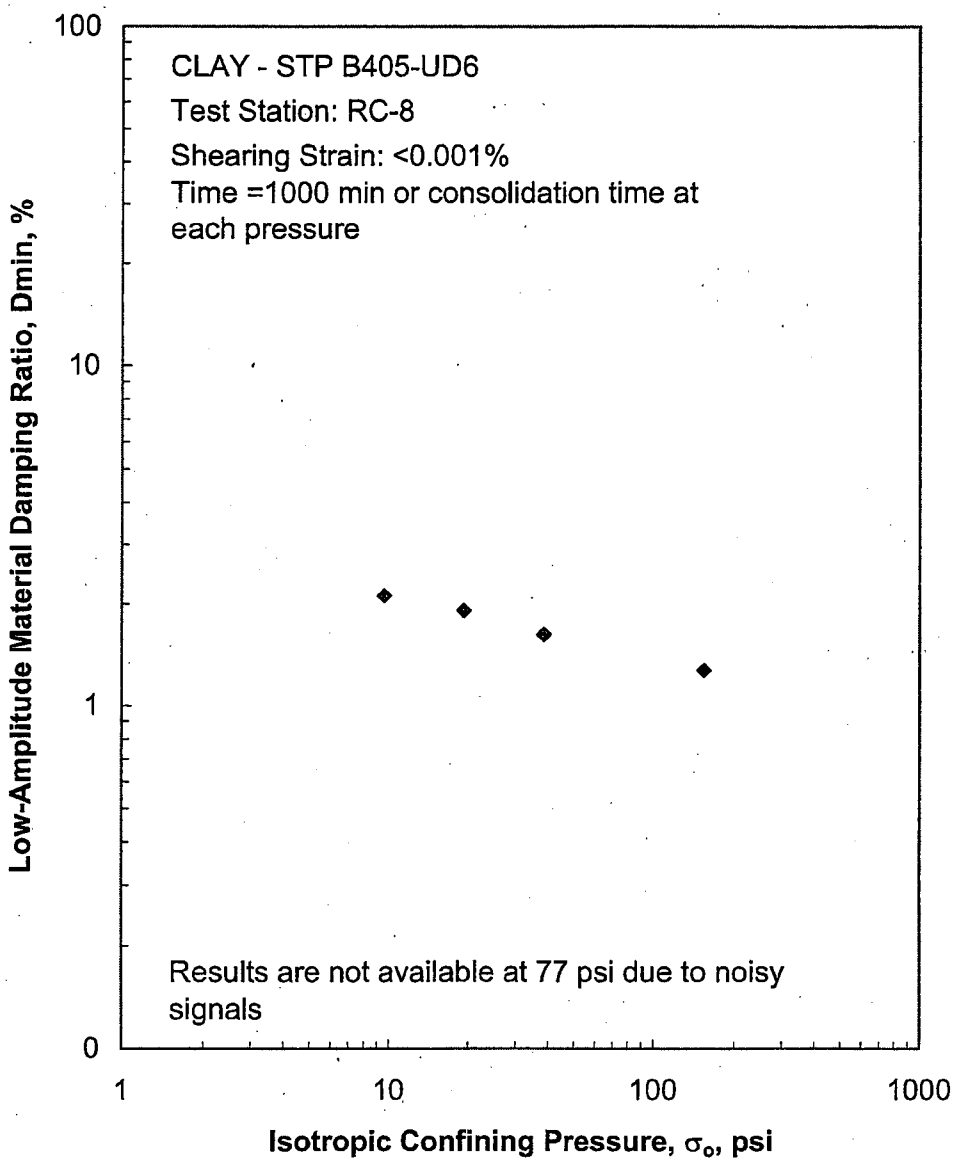


Figure M.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

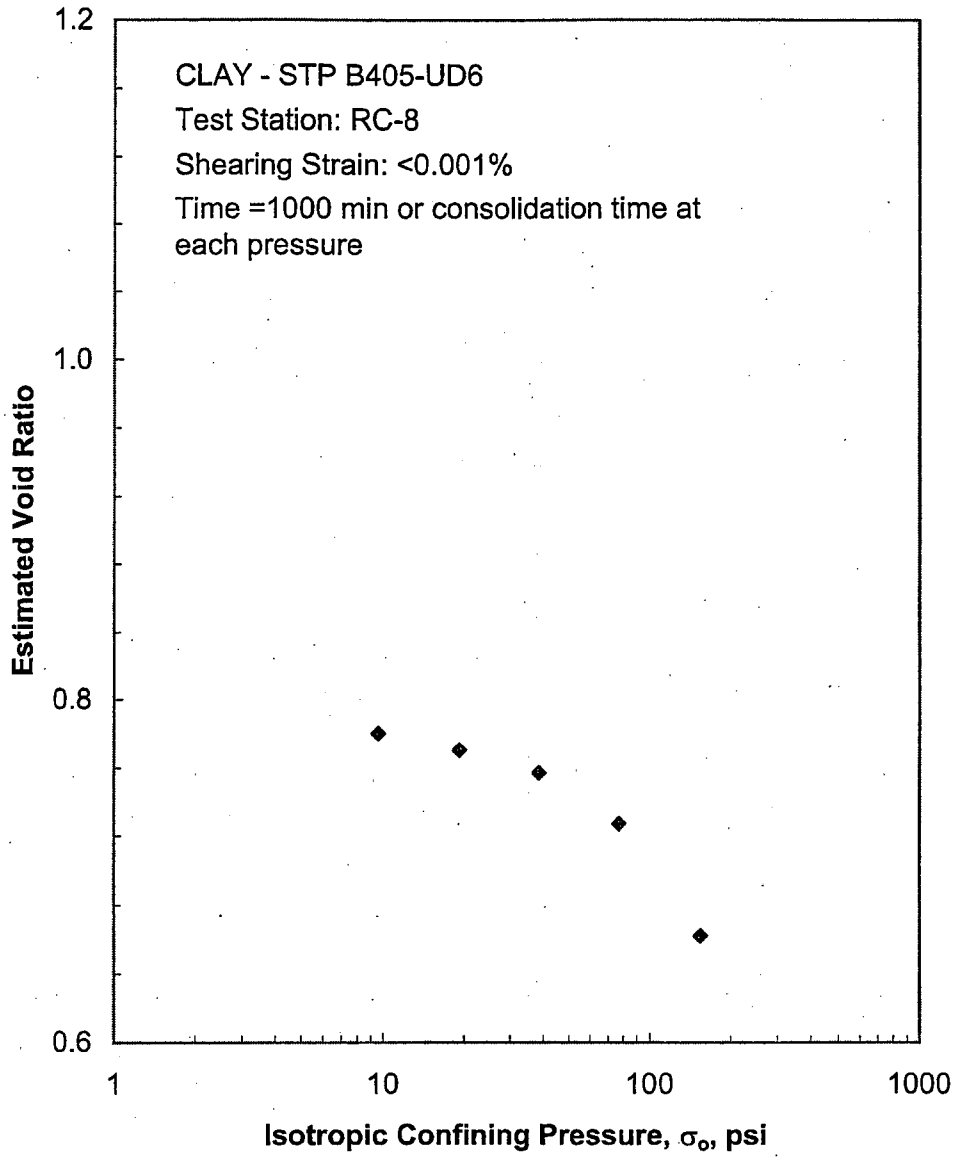


Figure M.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

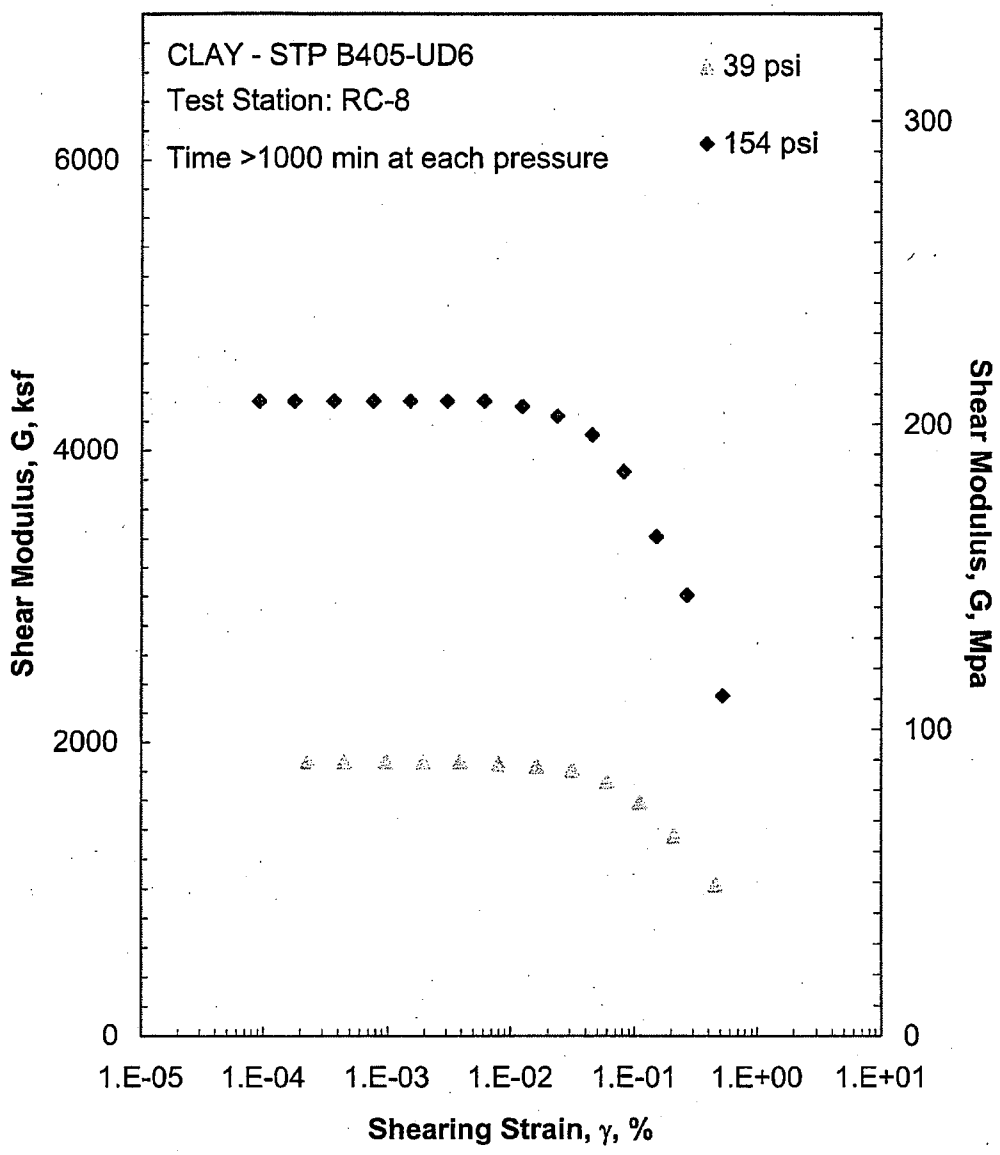


Figure M.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

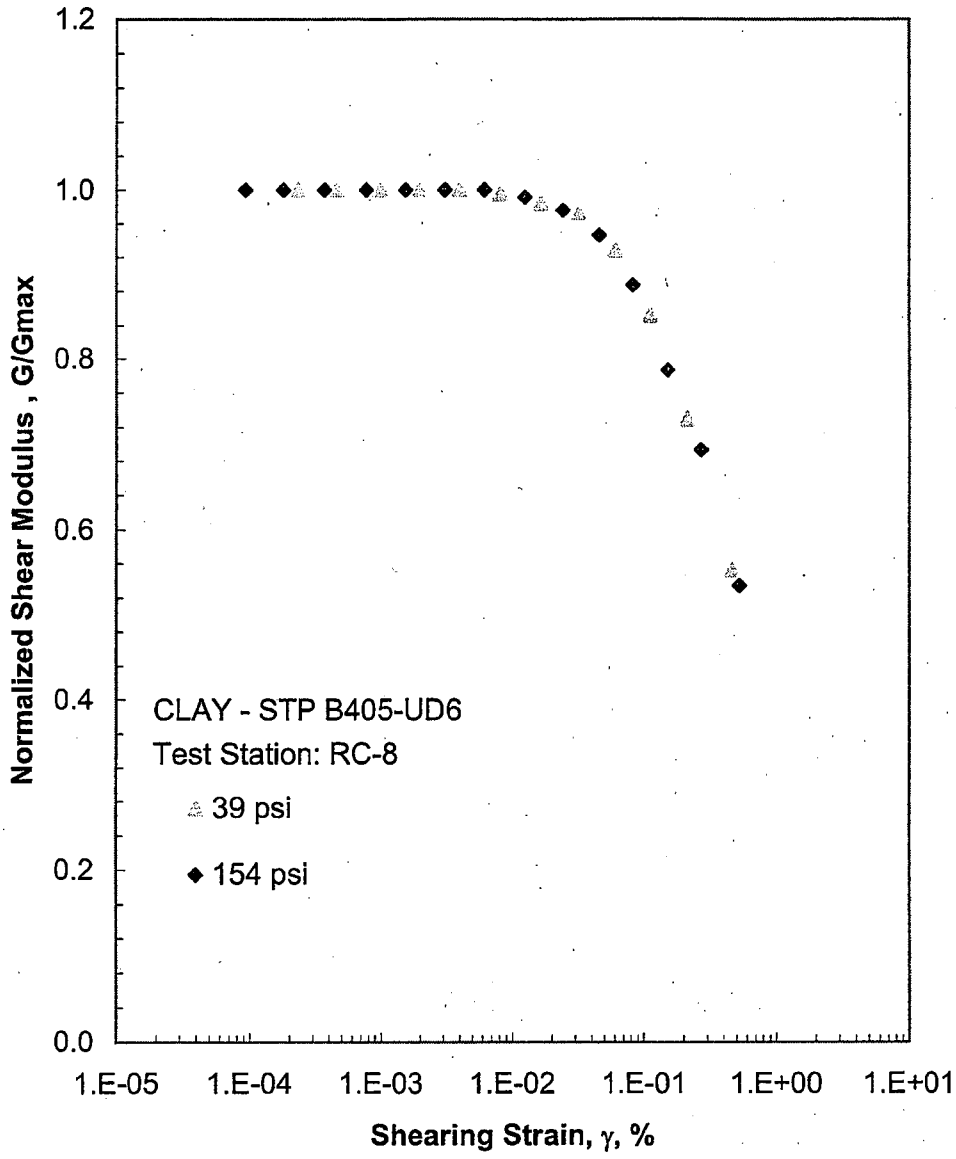


Figure M.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

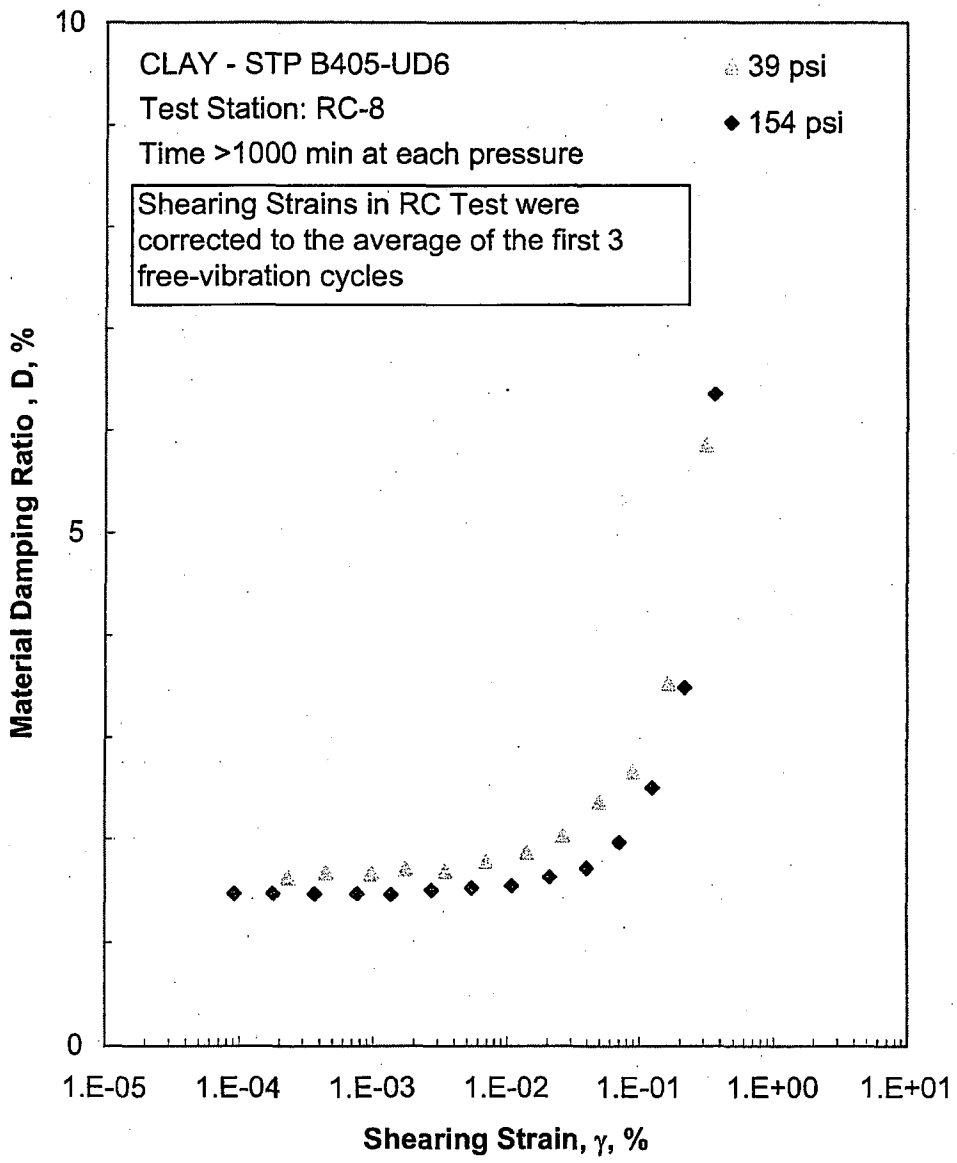


Figure M.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

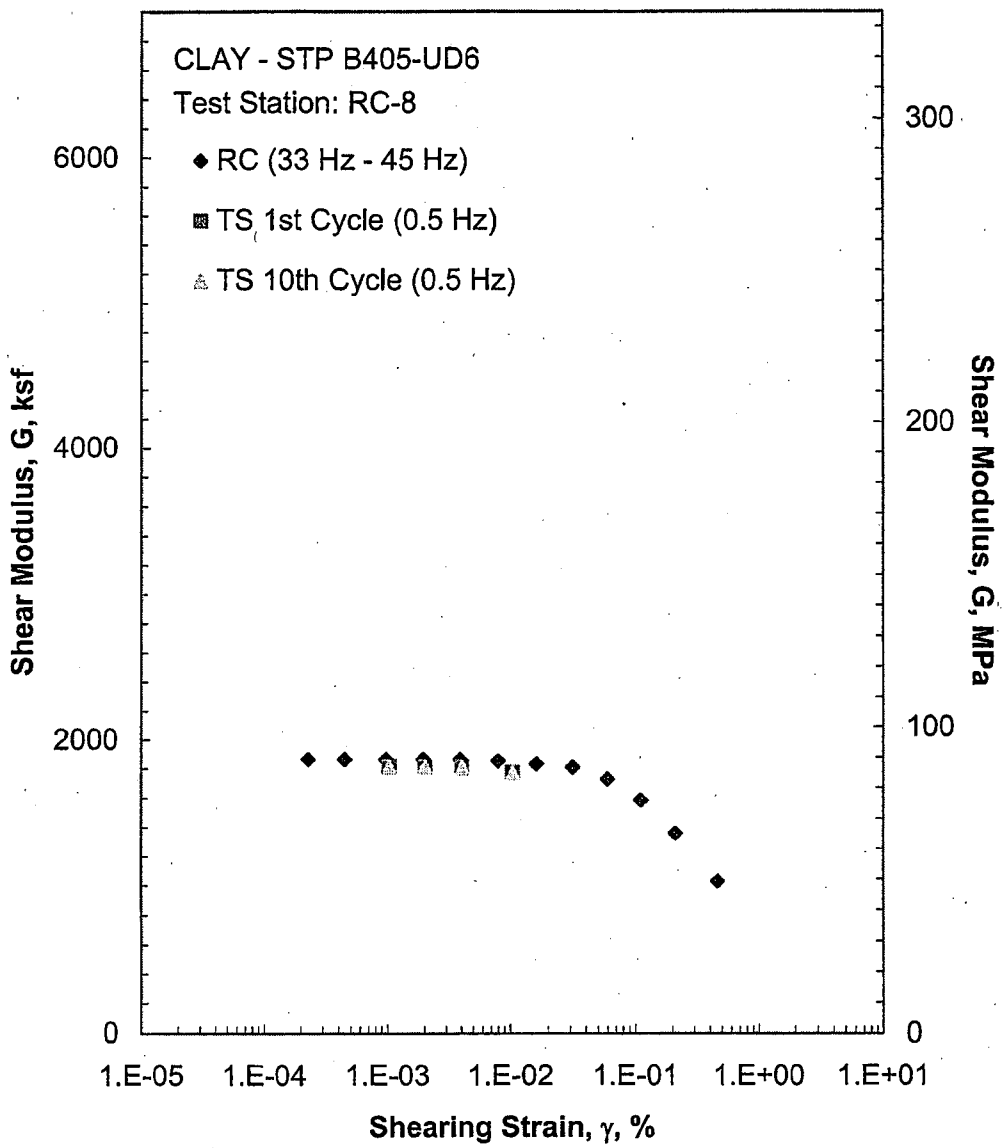


Figure M.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 39 psi from the Combined RCTS Tests

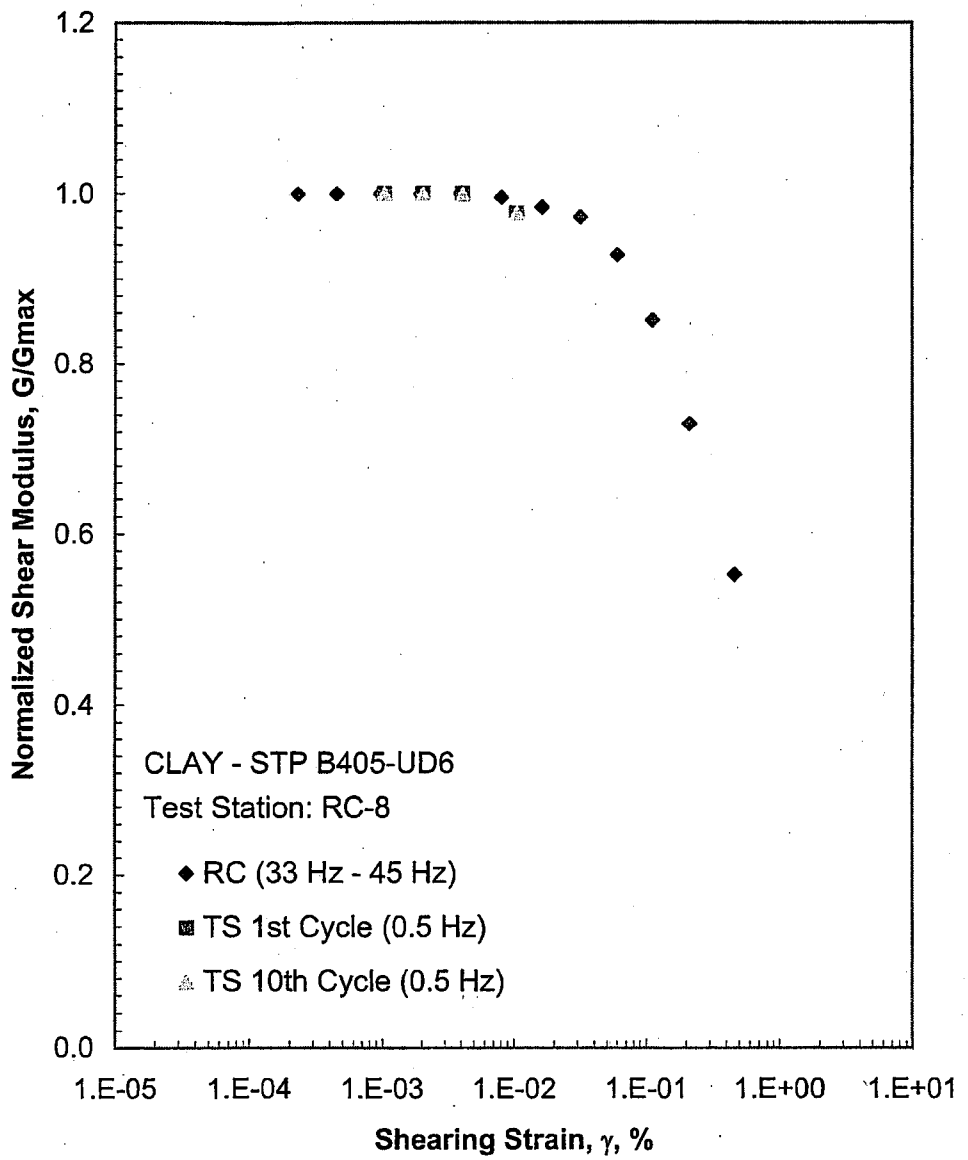


Figure M.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 39 psi from the Combined RCTS Tests

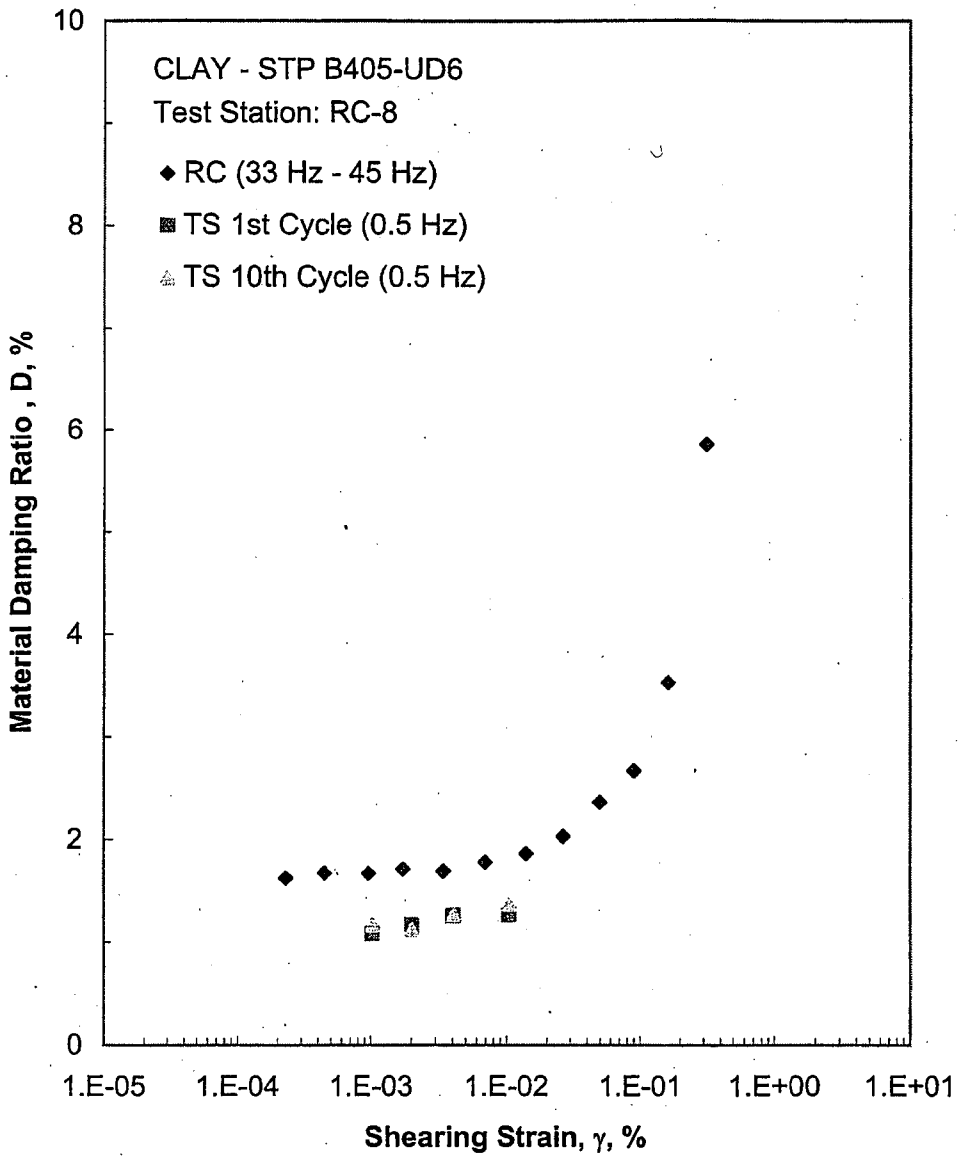


Figure M.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 39 psi from the Combined RCTS Tests

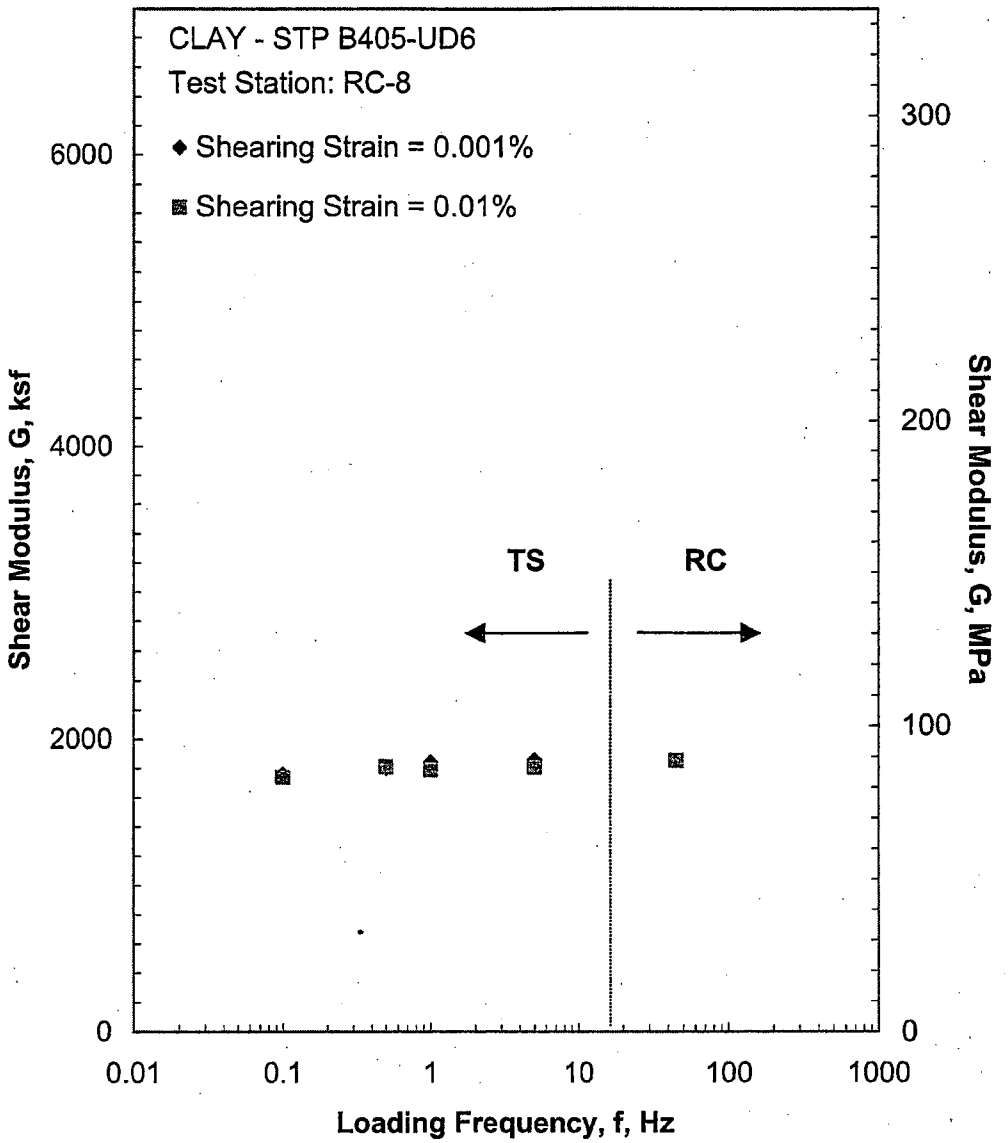


Figure M.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 39 psi from the Combined RCTS Tests

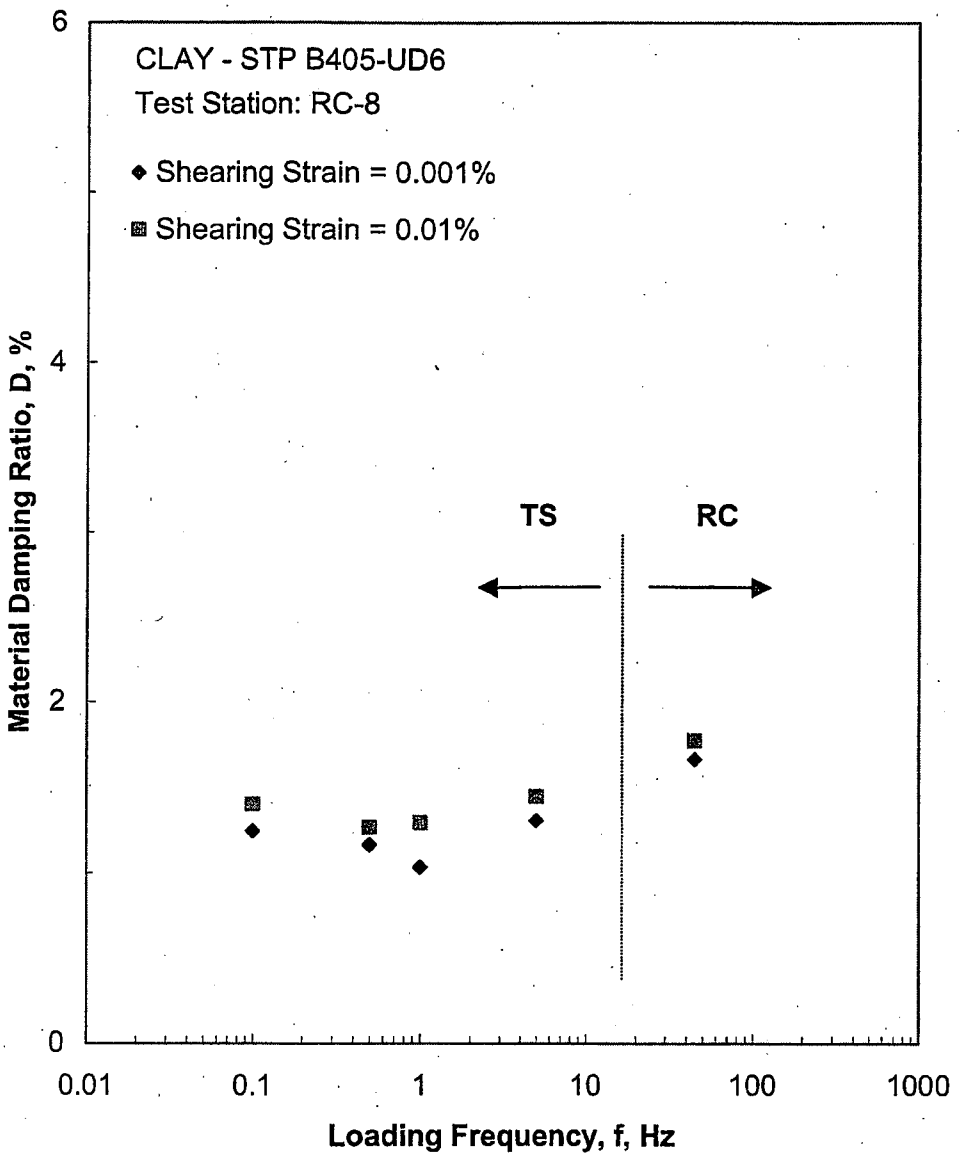


Figure M.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 39 psi from the Combined RCTS Tests

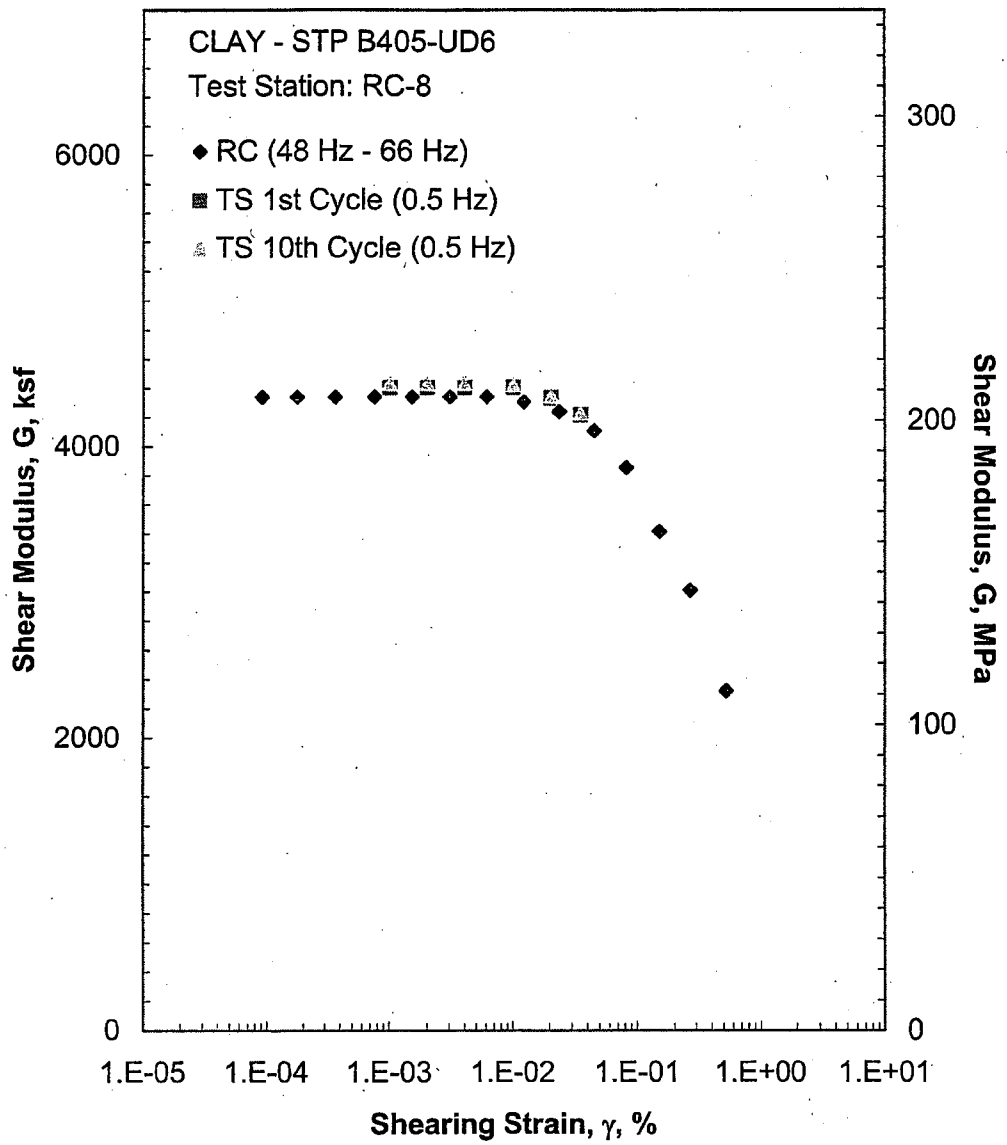


Figure M.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 154 psi from the Combined RCTS Tests

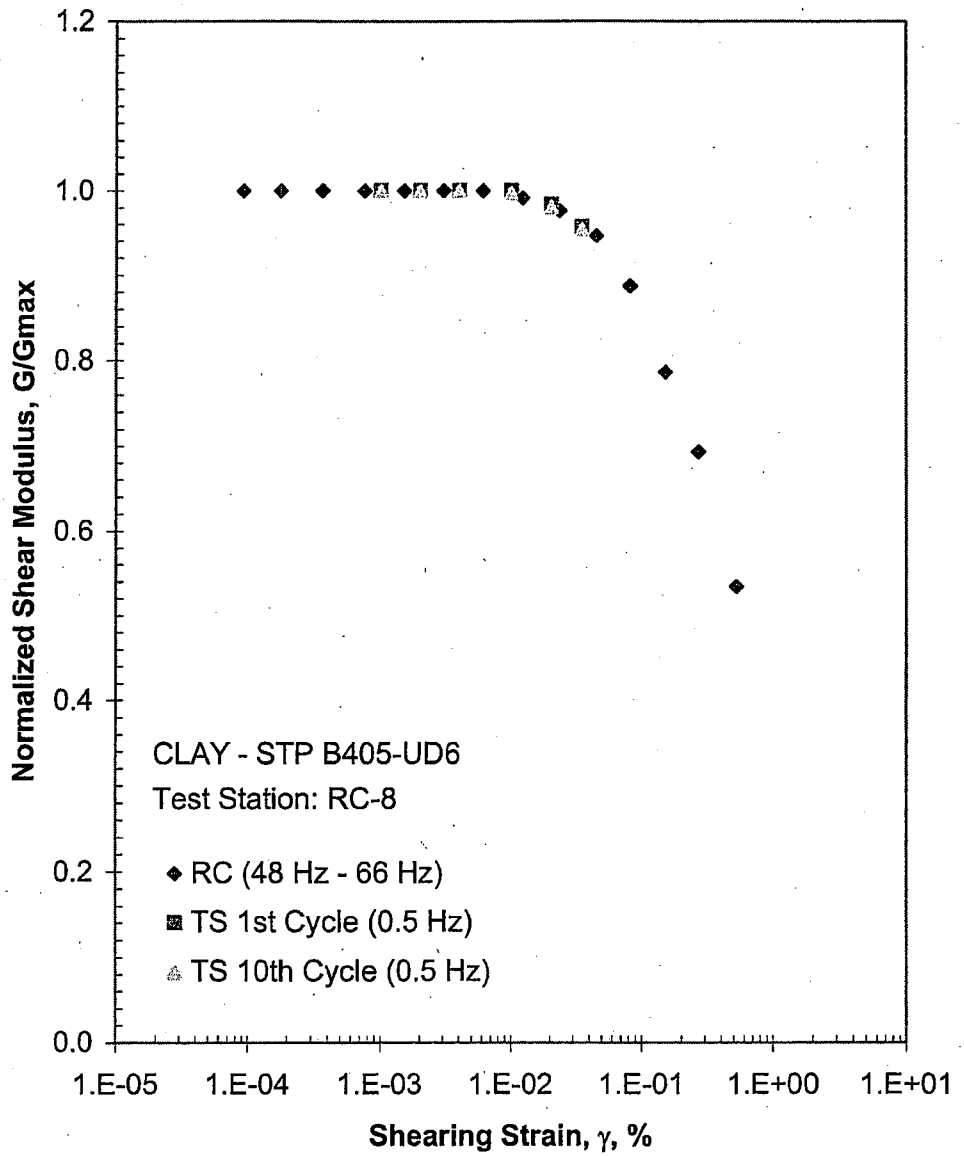


Figure M.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 154 psi from the Combined RCTS Tests

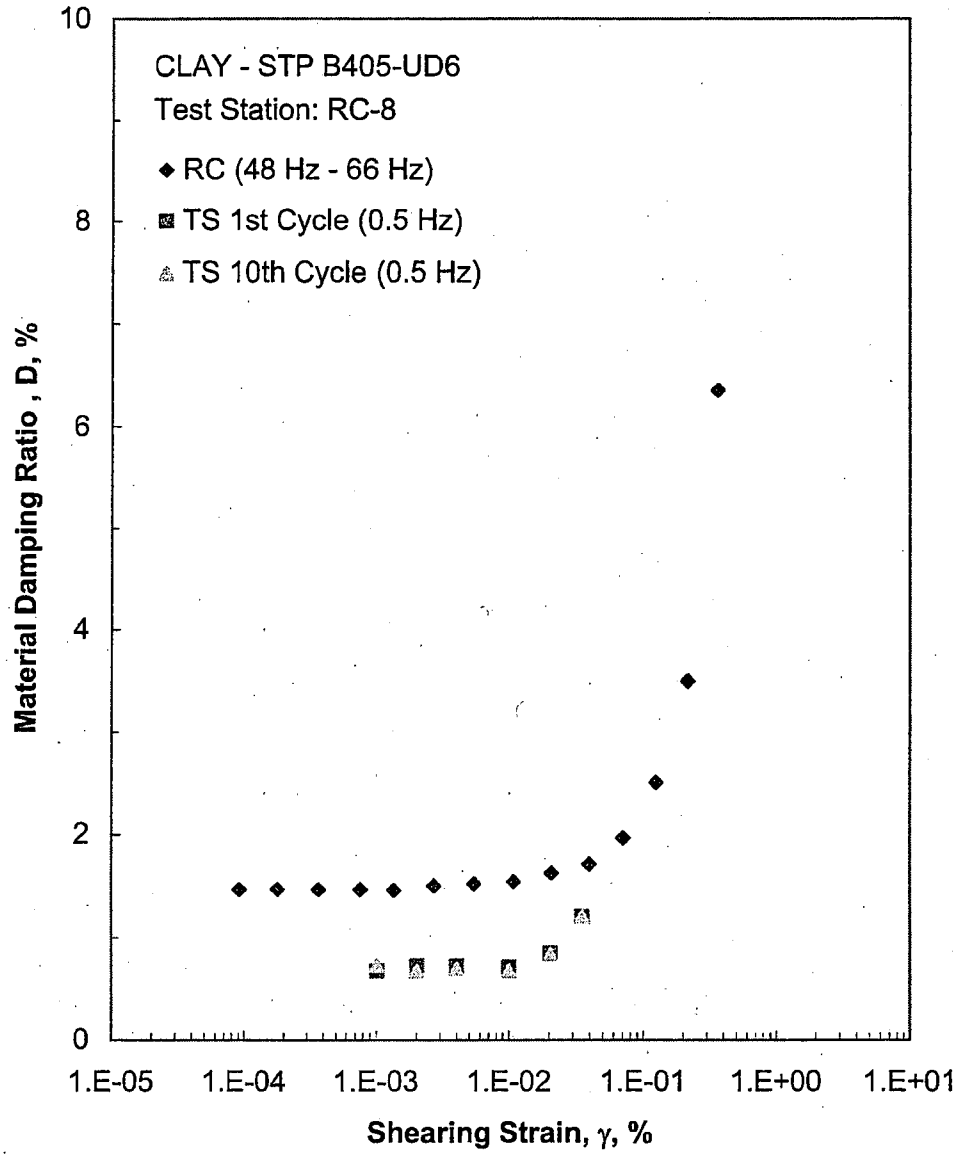


Figure M.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 154 psi from the Combined RCTS Tests

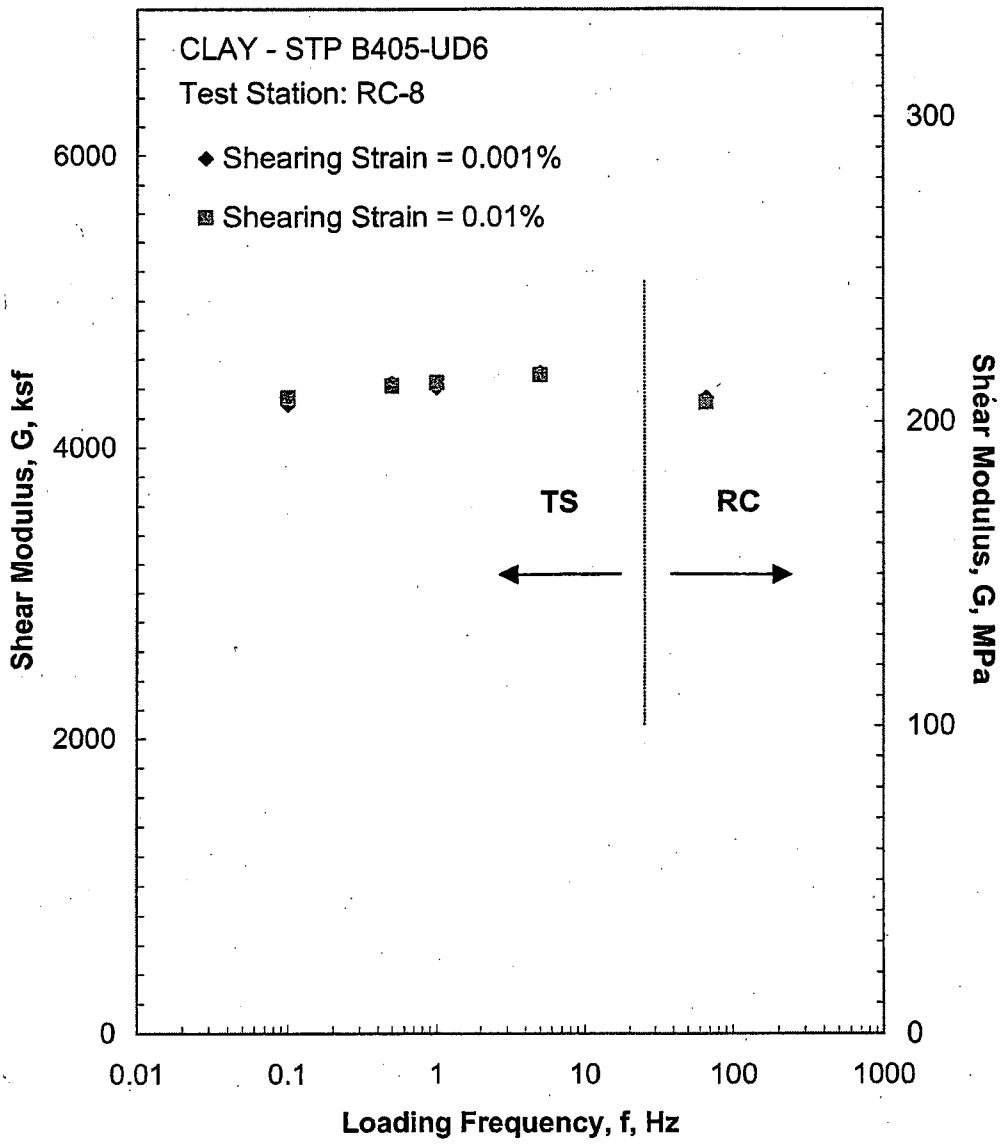


Figure M.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 154 psi from the Combined RCTS Tests

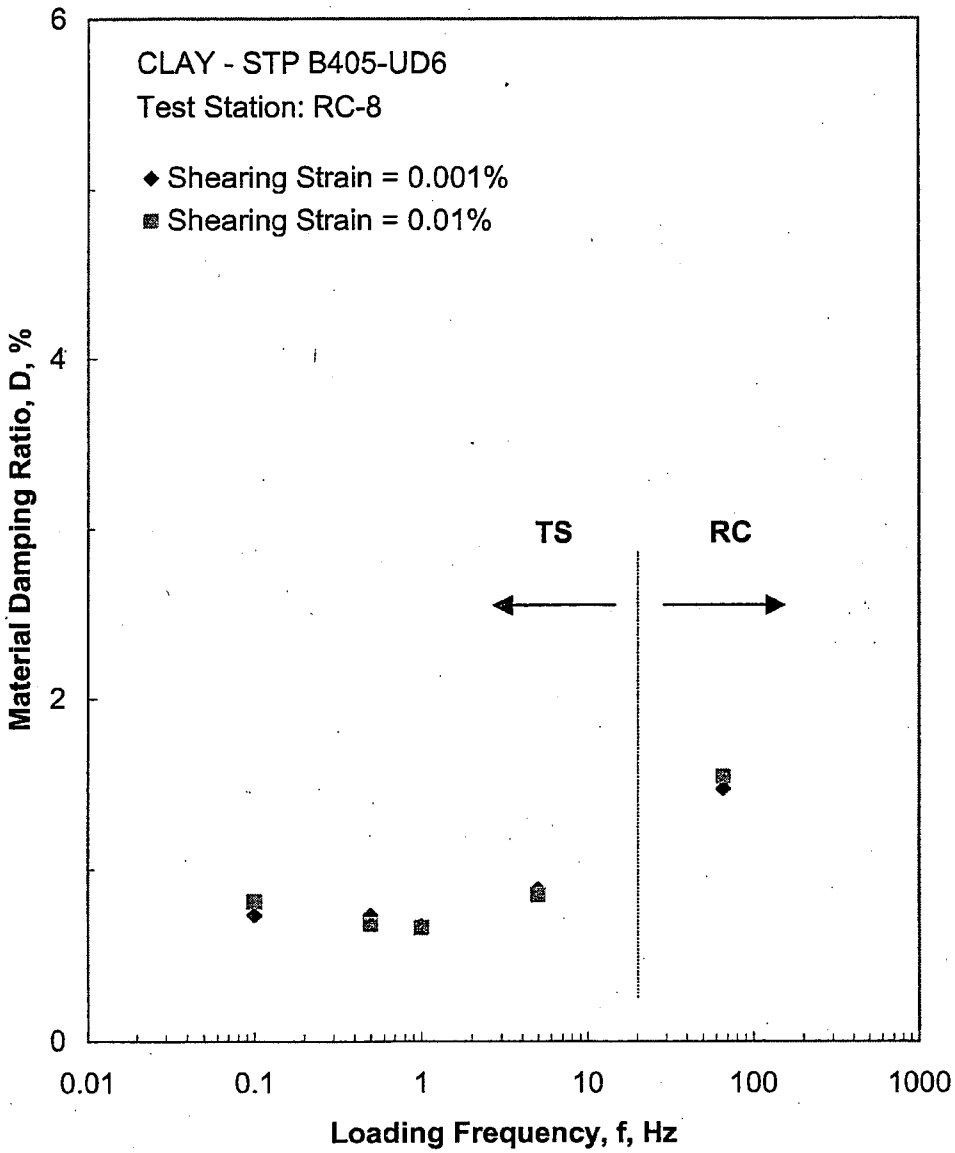
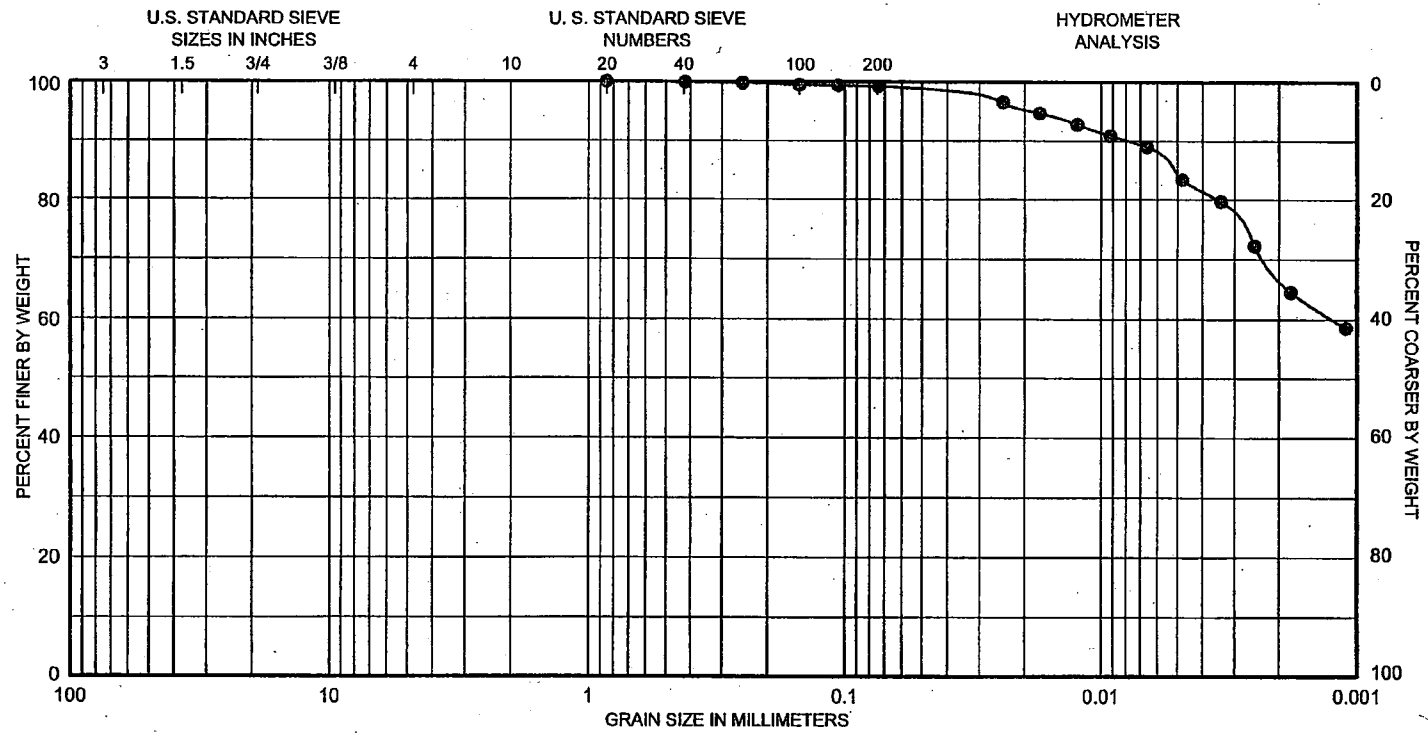


Figure M.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 154 psi from the Combined RCTS Tests

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-405-UD6	127				0.01	Clay, red and gray, with calcareous nodules

Report No. 0401-1660

GRAIN SIZE CURVE

PLATE 1

APPENDIX N

Specimen STP B306-UD3
SAND (Non-Plastic; Gs=2.67)

Borehole B306
Sample UD3
Depth = 75 ft (22.9 m)
Total Unit Weight = 132.6 lb/ft^3
Water Content = 24.7 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 24 psi

FUGRO JOB #: 0401-1660
Testing Station: RC9

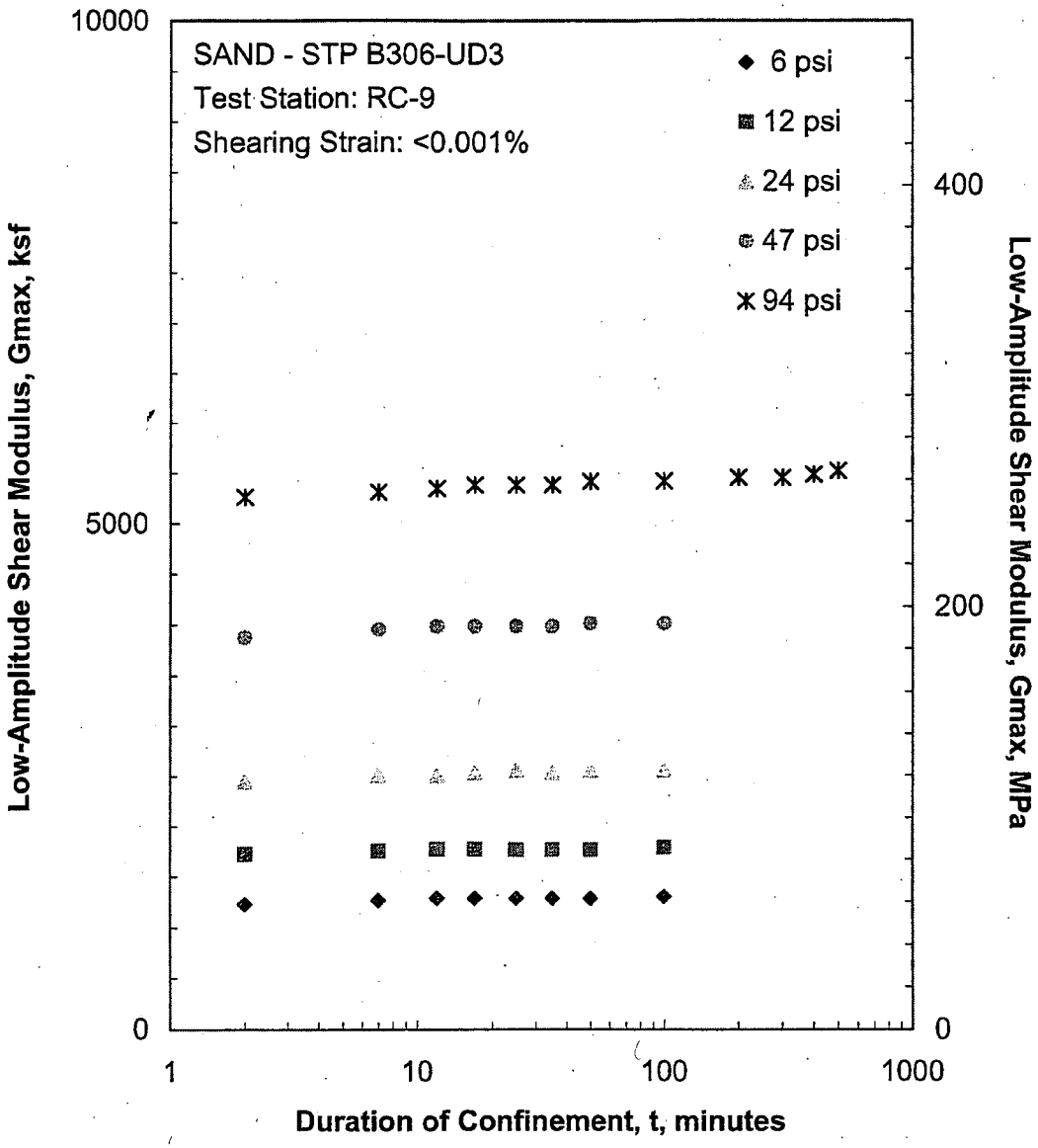


Figure N.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

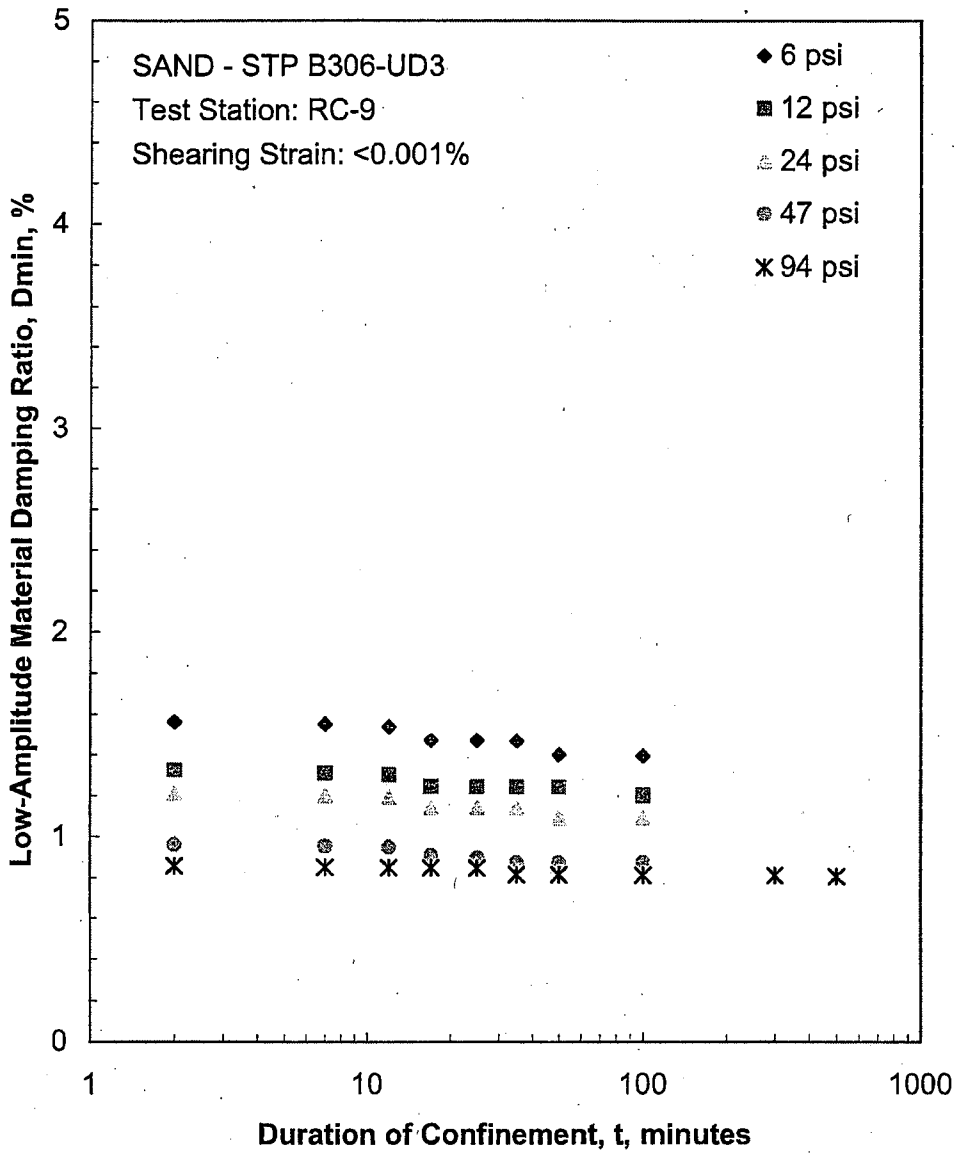


Figure N.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

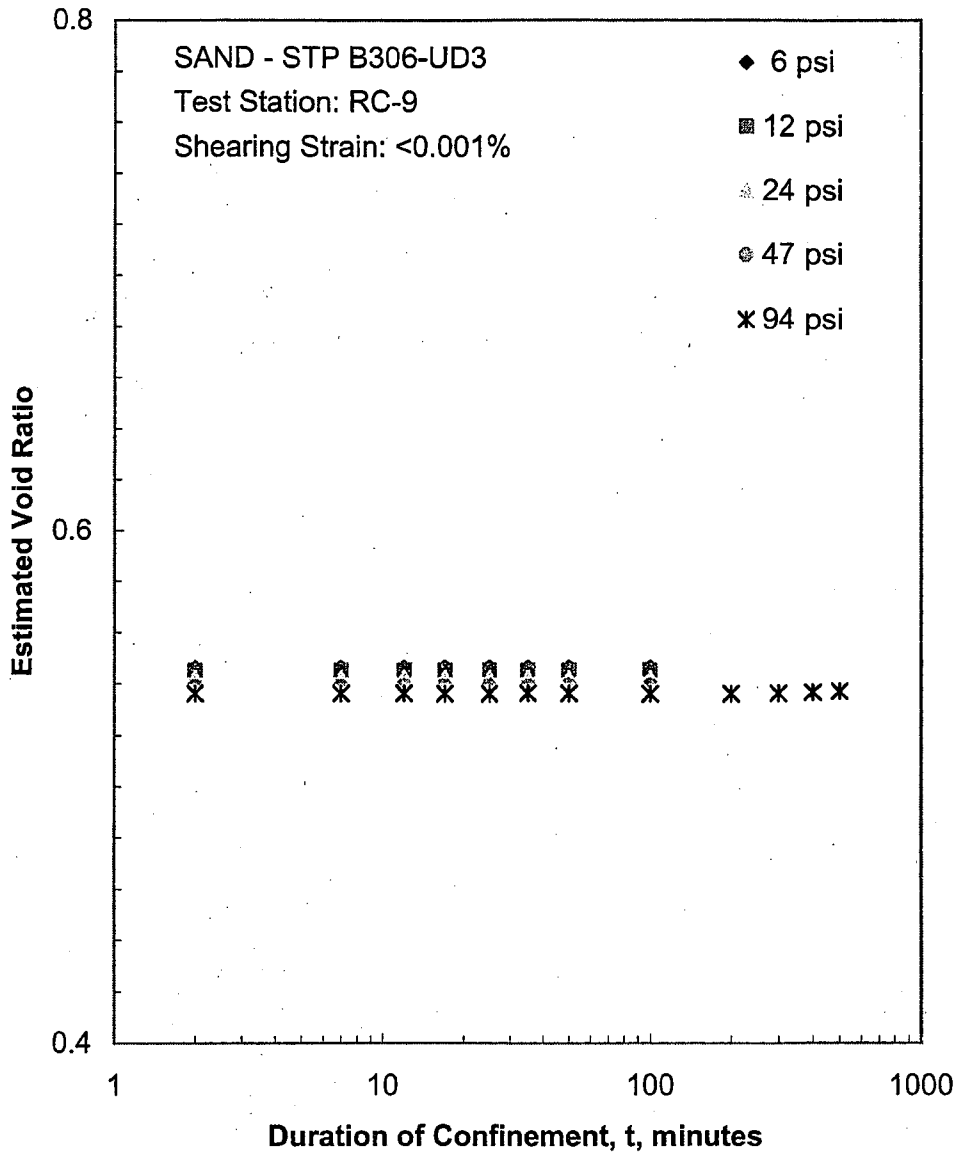


Figure N.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

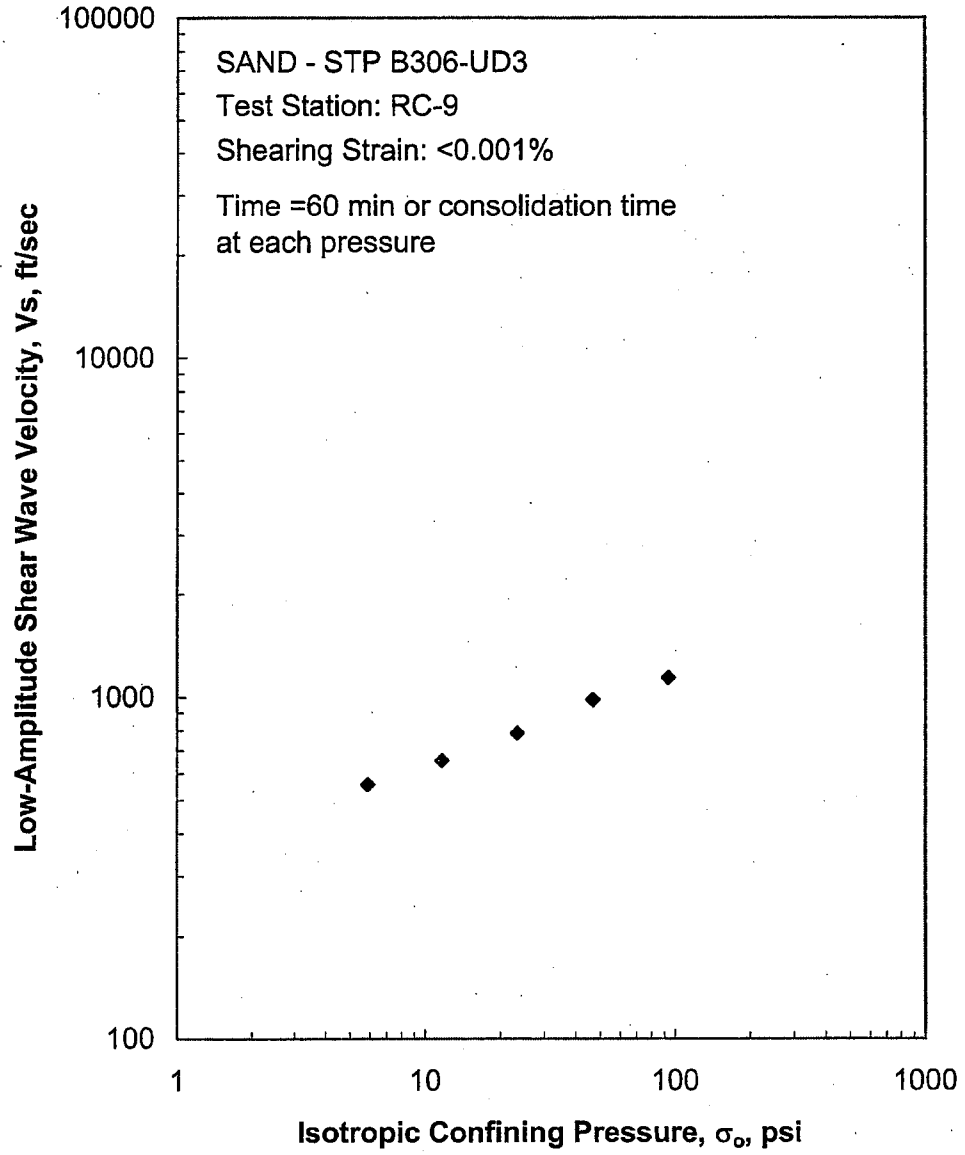


Figure N.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

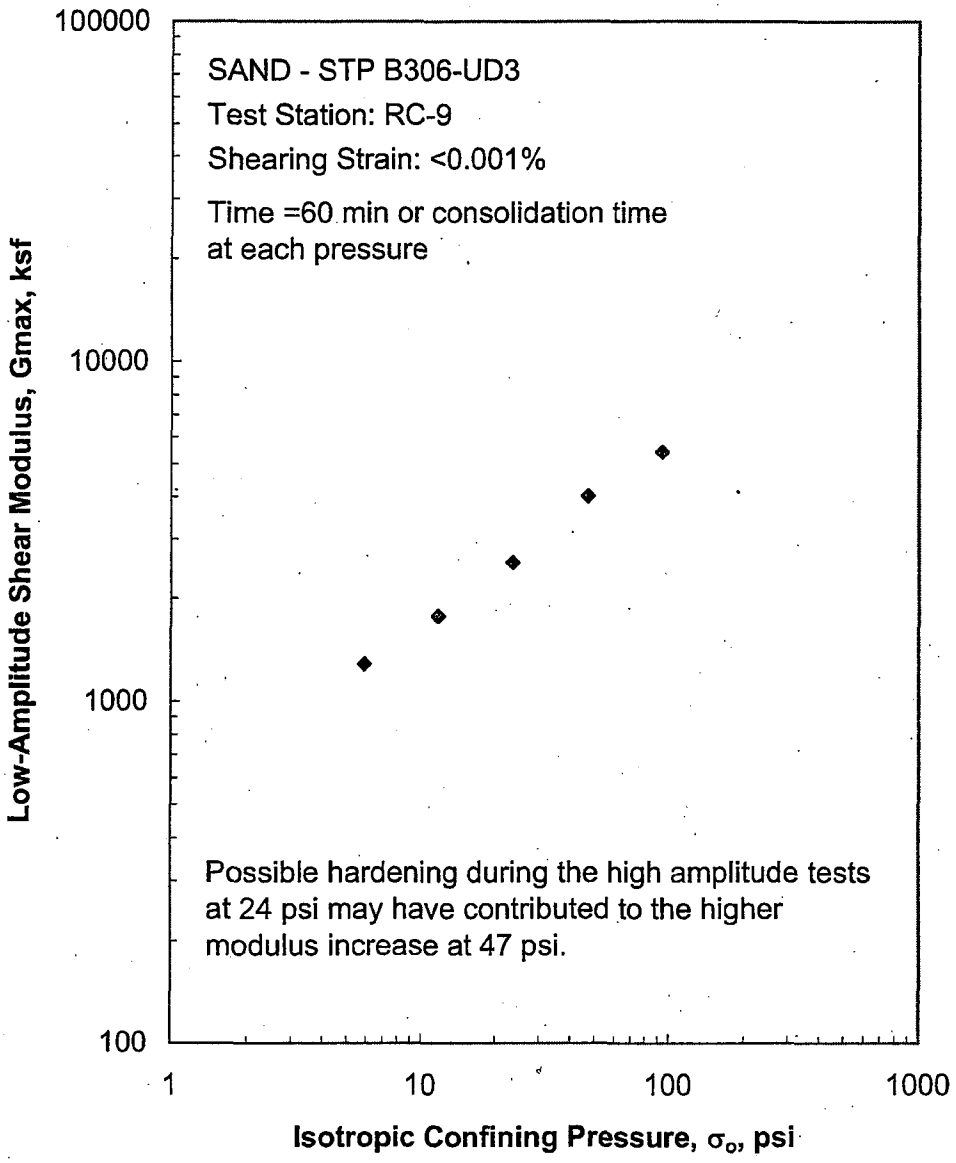


Figure N.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

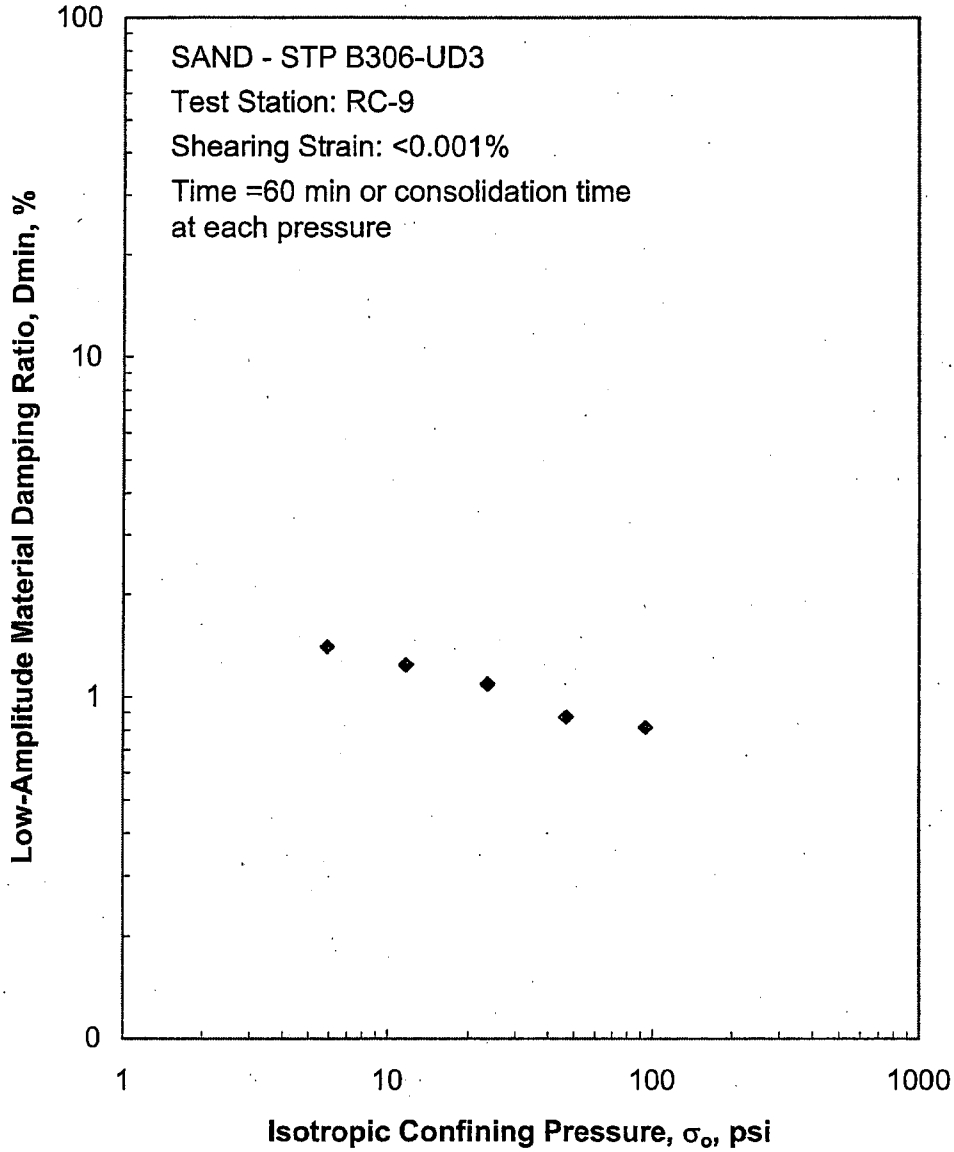


Figure N.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

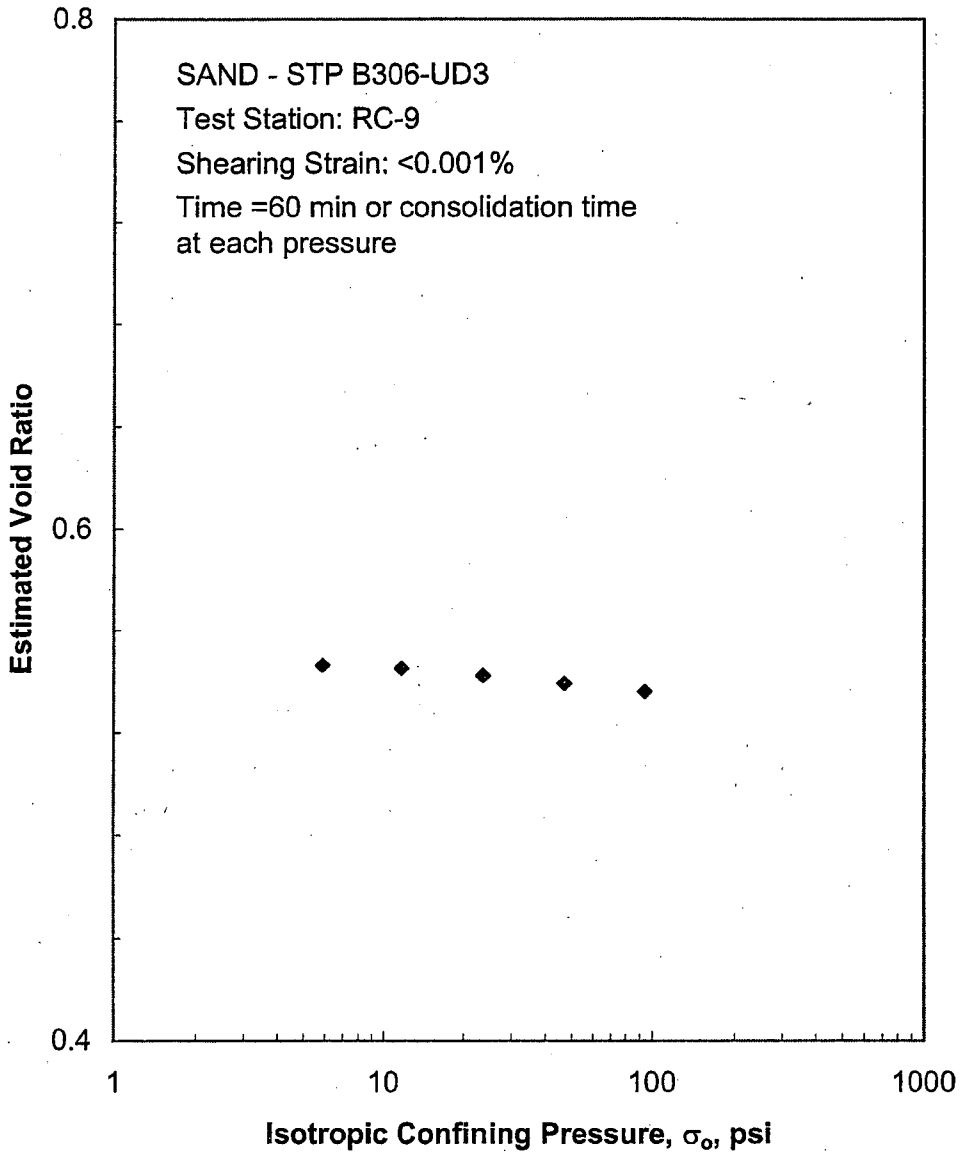


Figure N.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

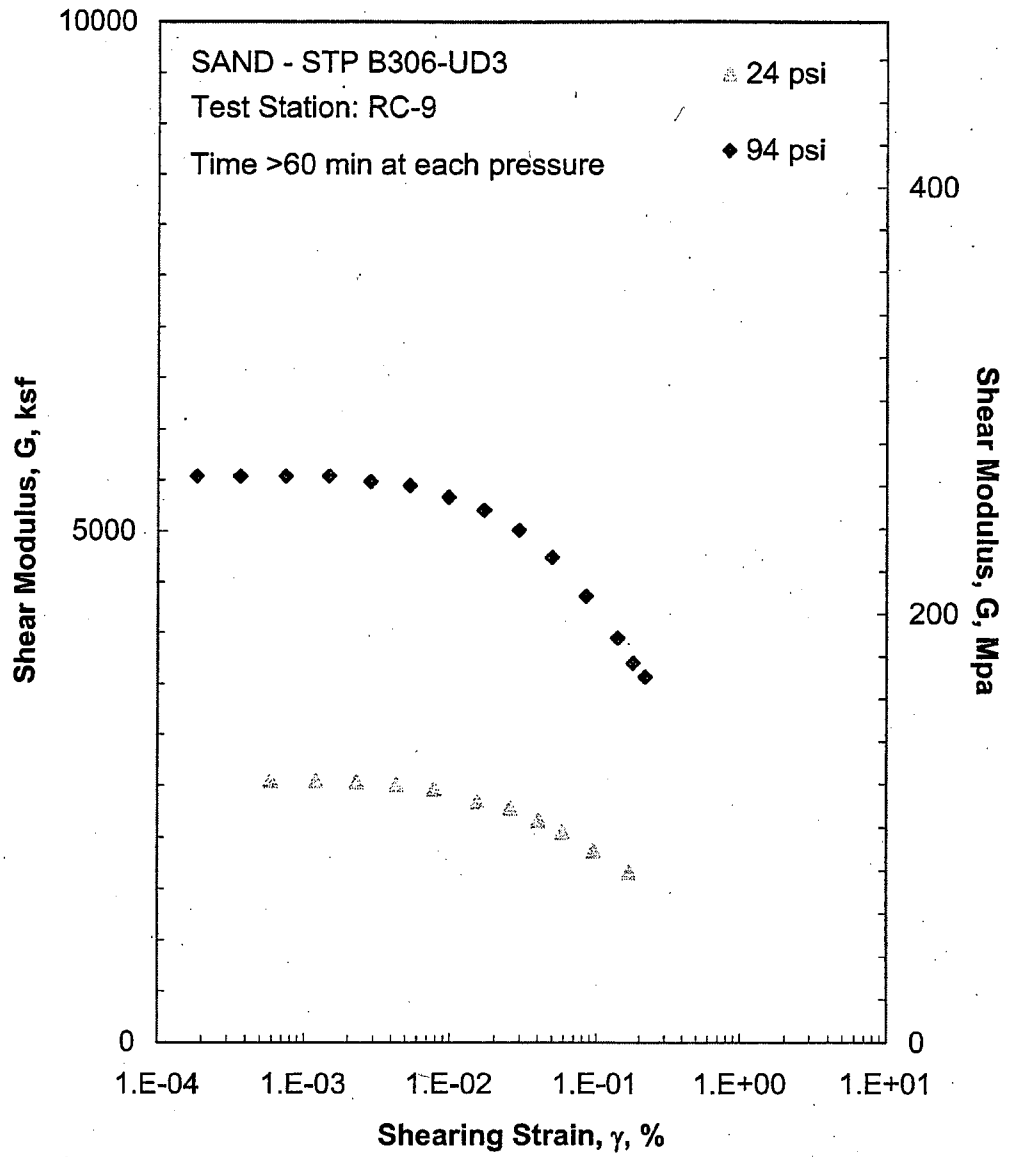


Figure N.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

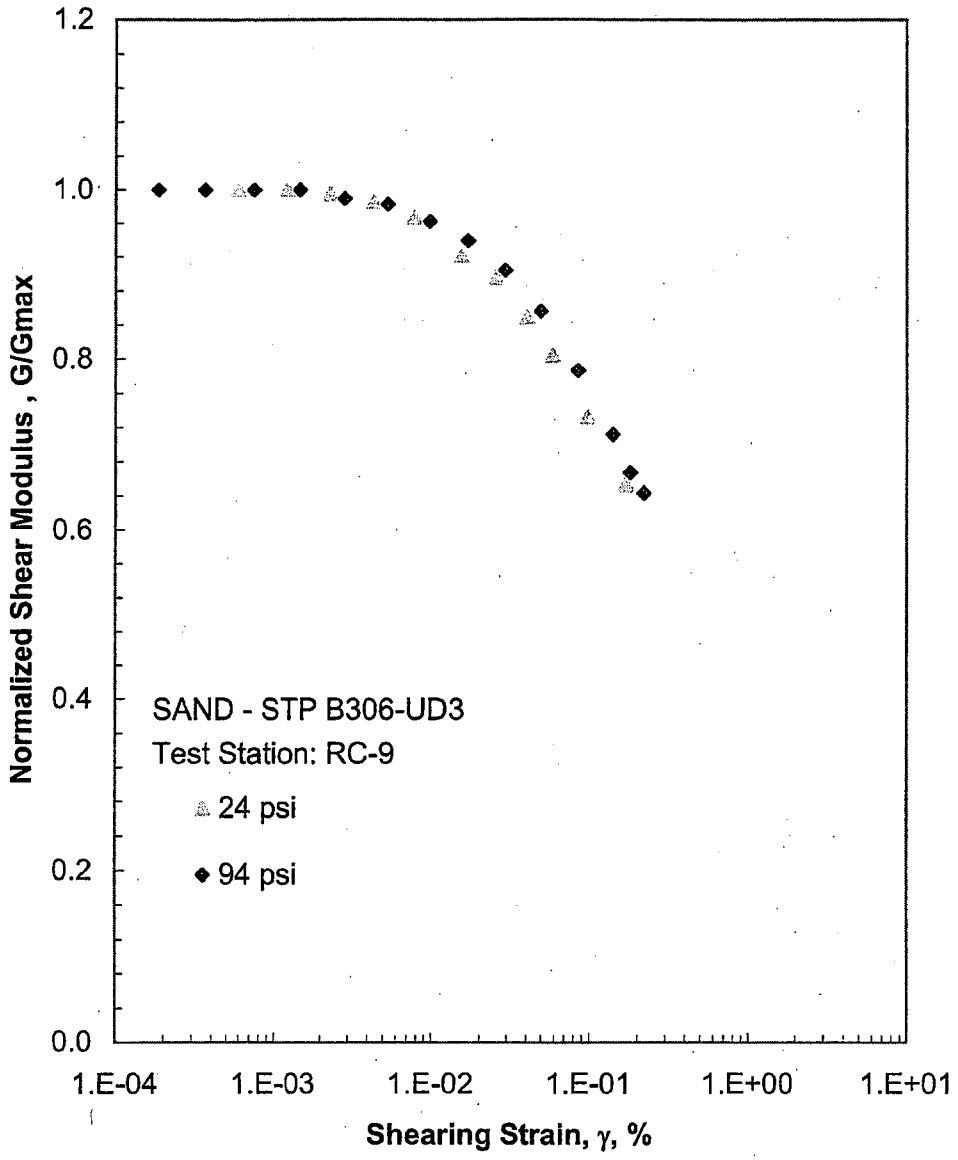


Figure N.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

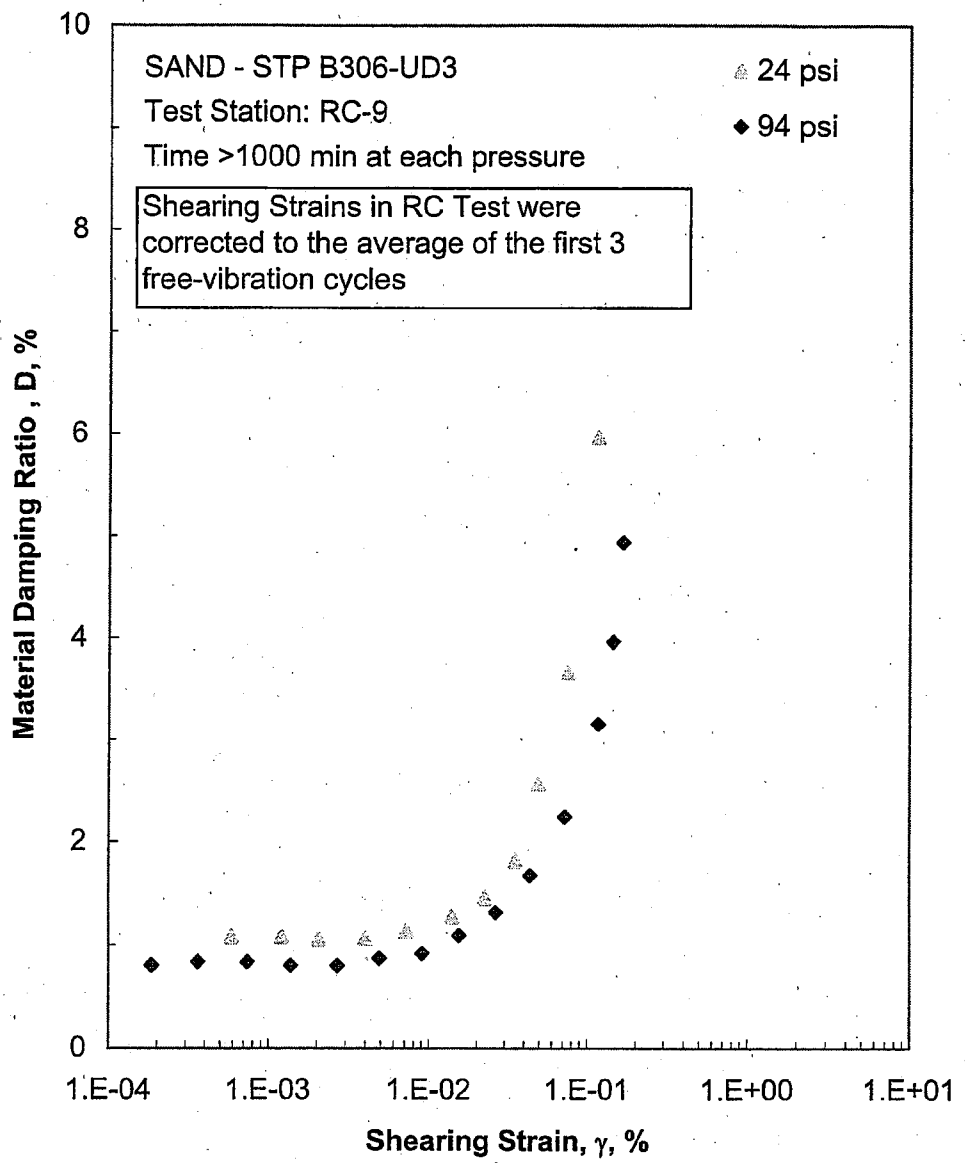


Figure N.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

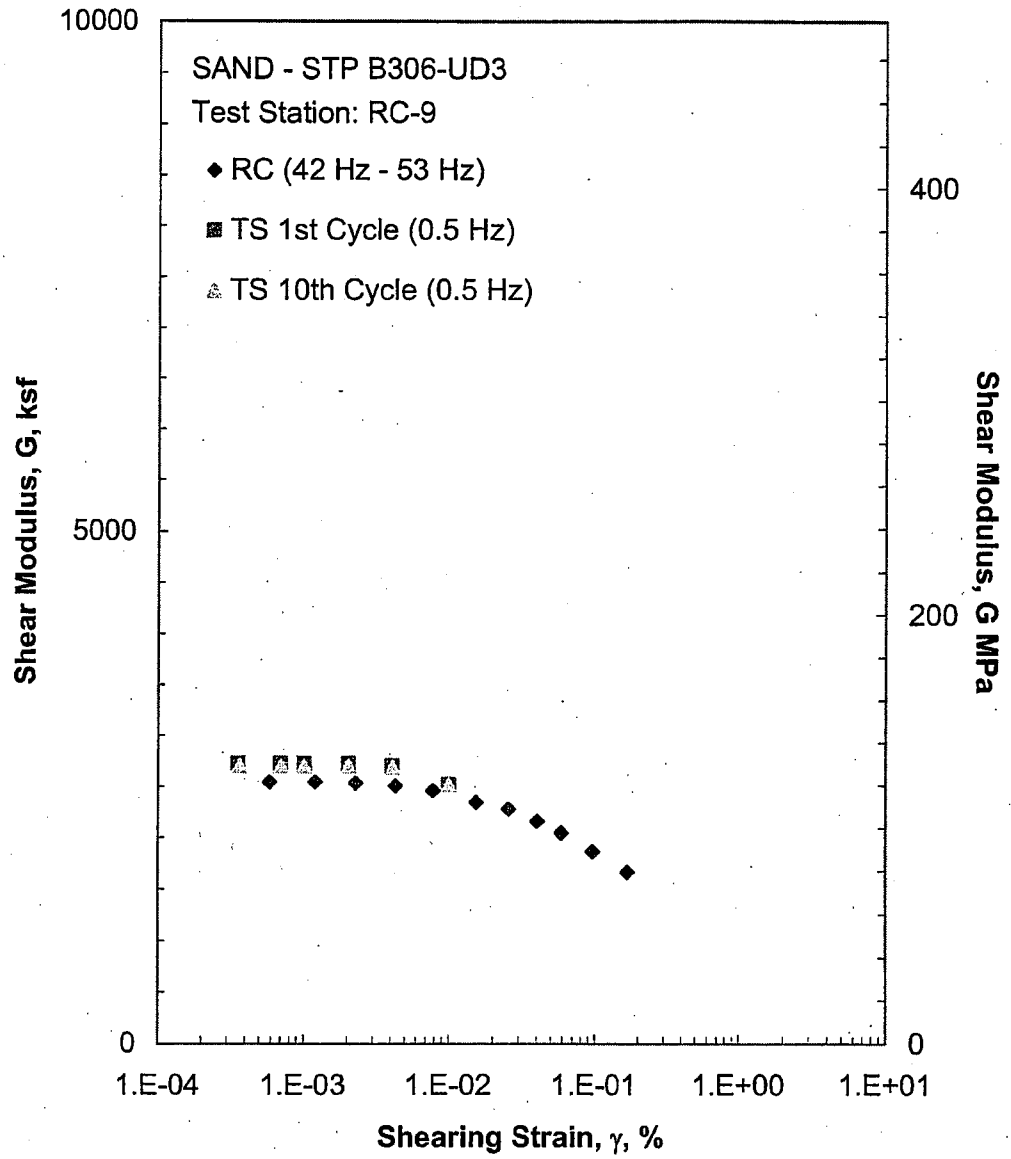


Figure N.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 24 psi from the Combined RCTS Tests

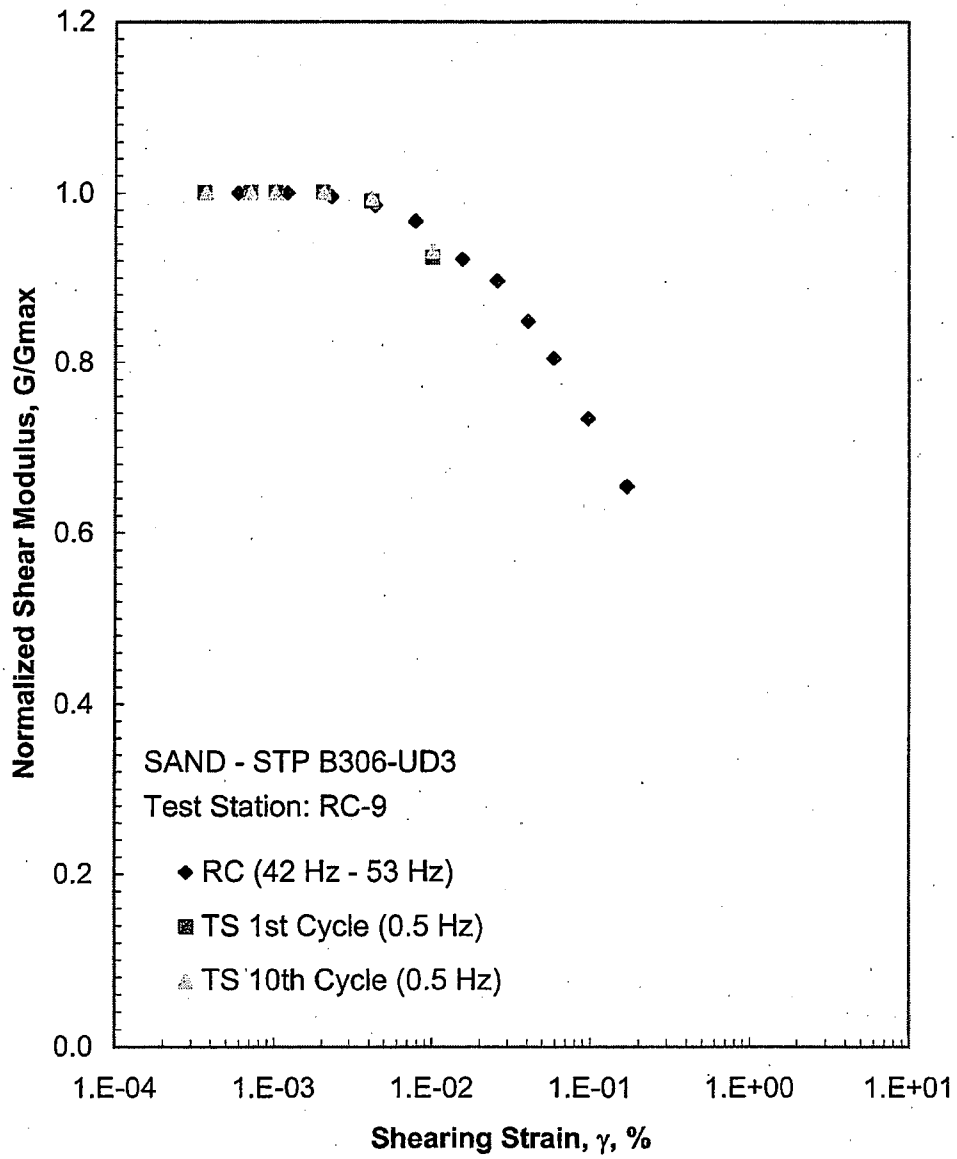


Figure N.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 24 psi from the Combined RCTS Tests

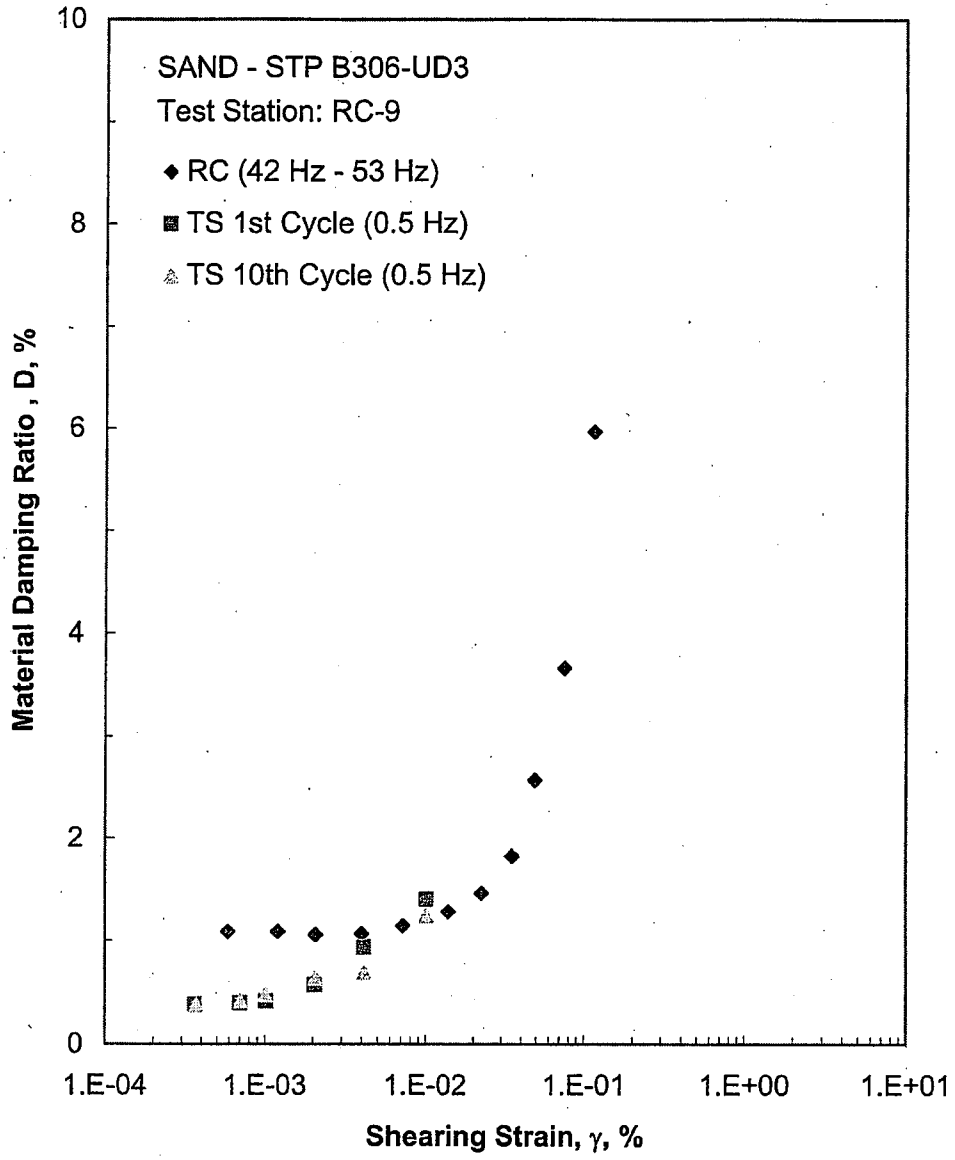


Figure N.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 24 psi from the Combined RCTS Tests

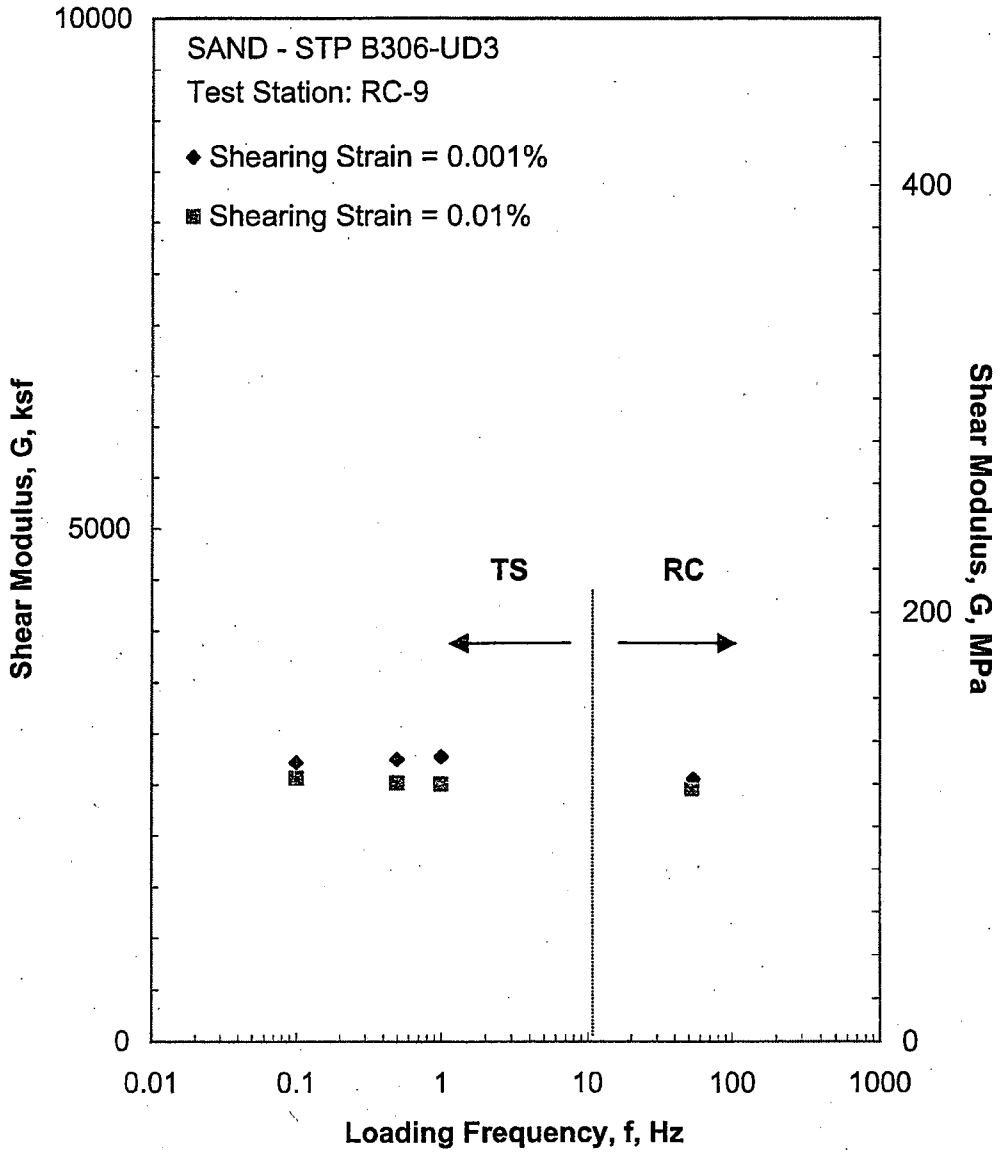


Figure N.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 24 psi from the Combined RCTS Tests

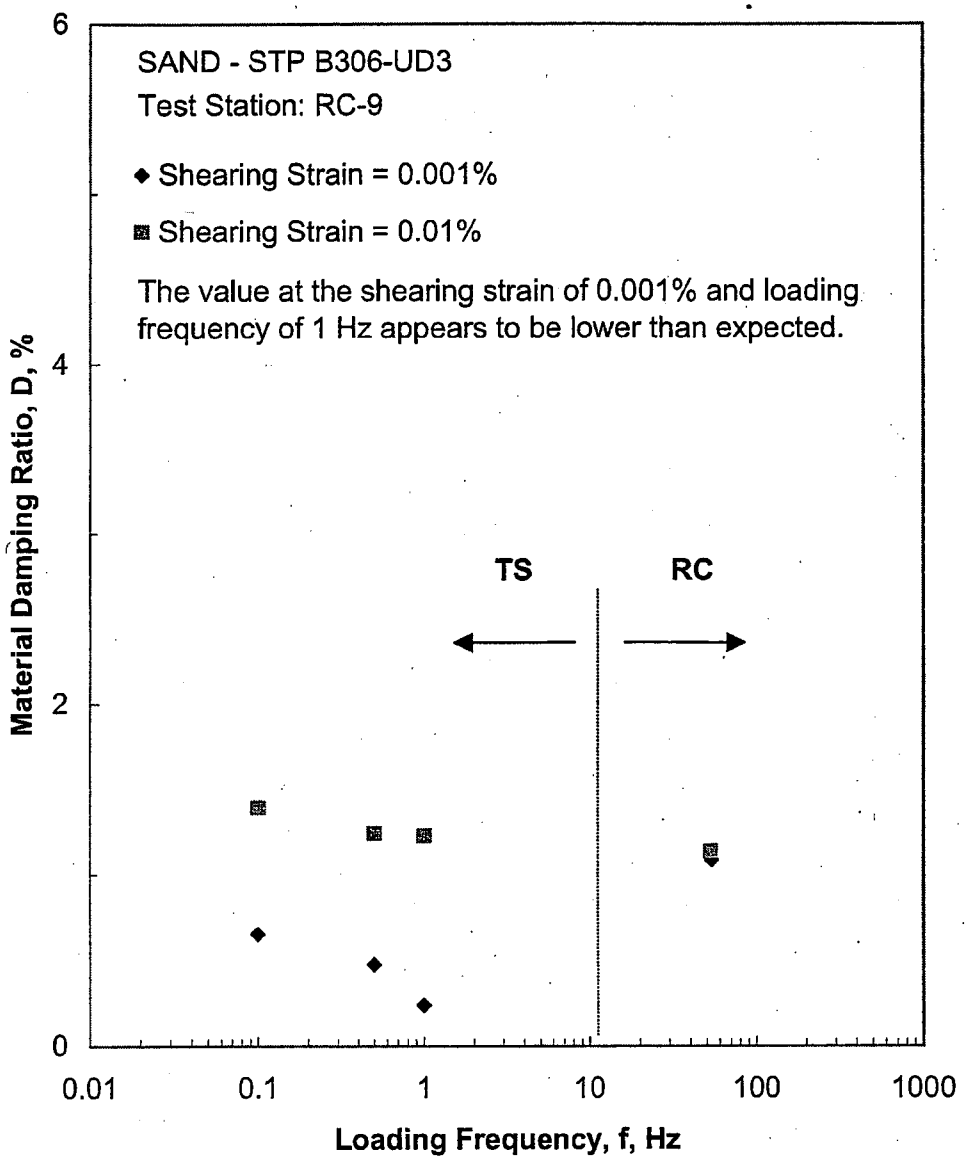


Figure N.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 24 psi from the Combined RCTS Tests

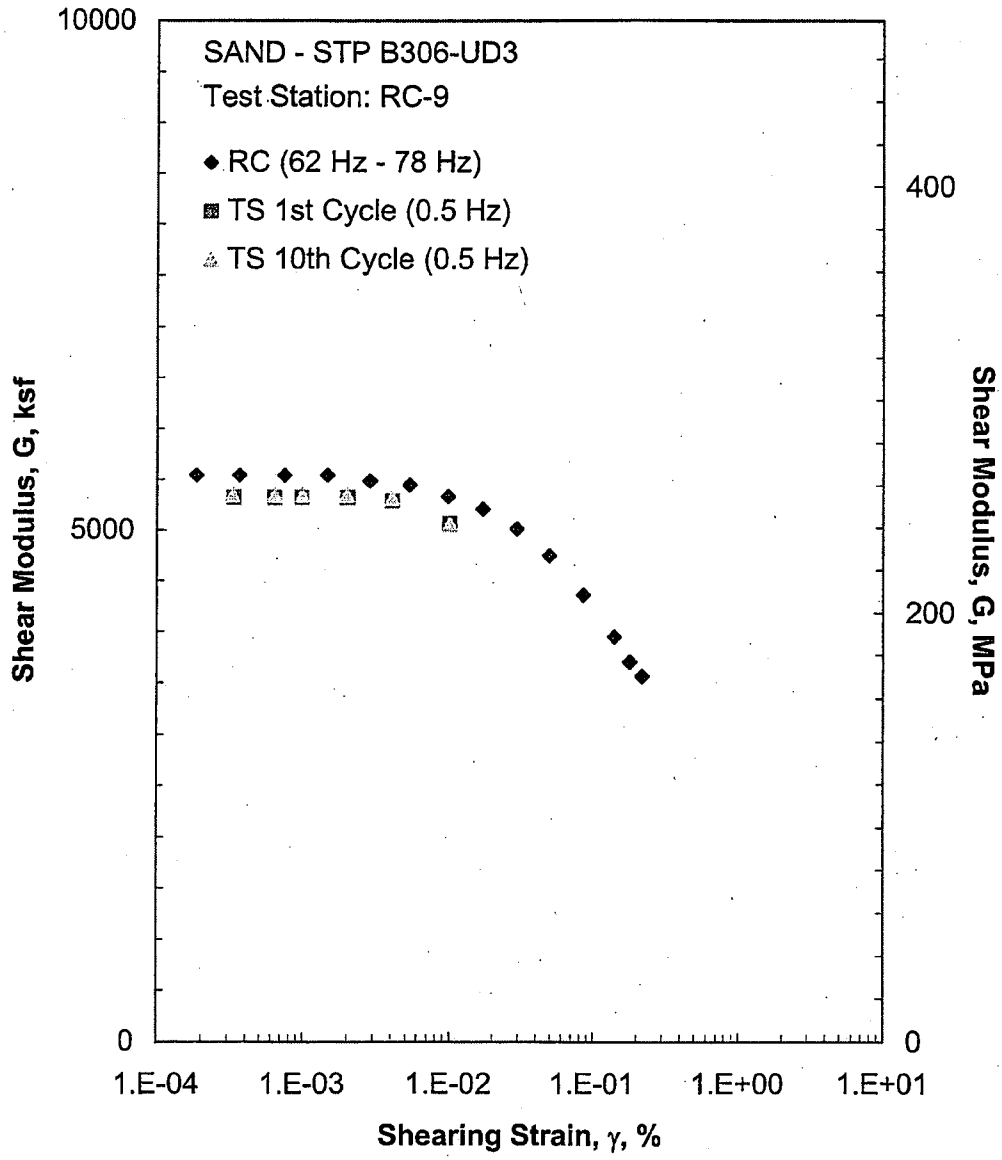


Figure N.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 94 psi from the Combined RCTS Tests

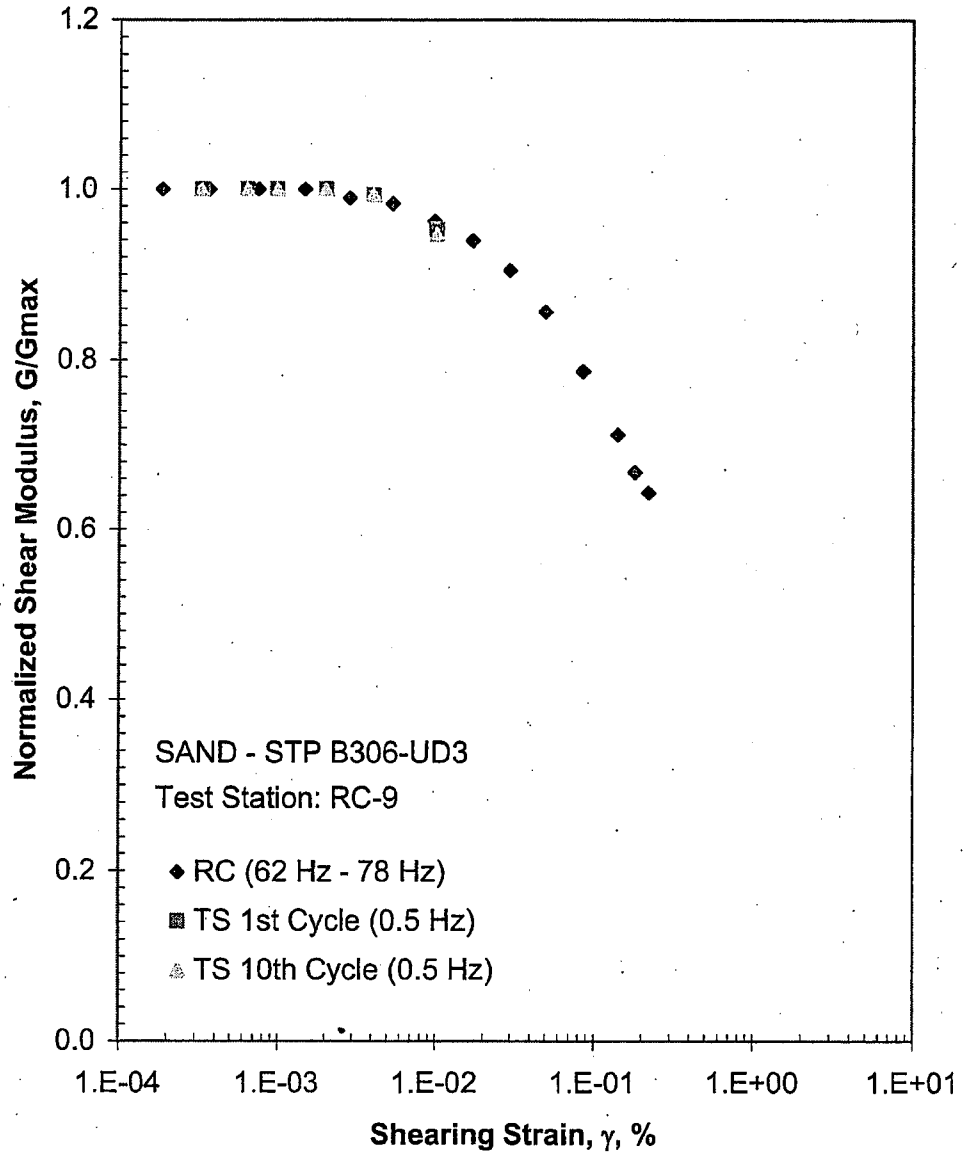


Figure N.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 94 psi from the Combined RCTS Tests

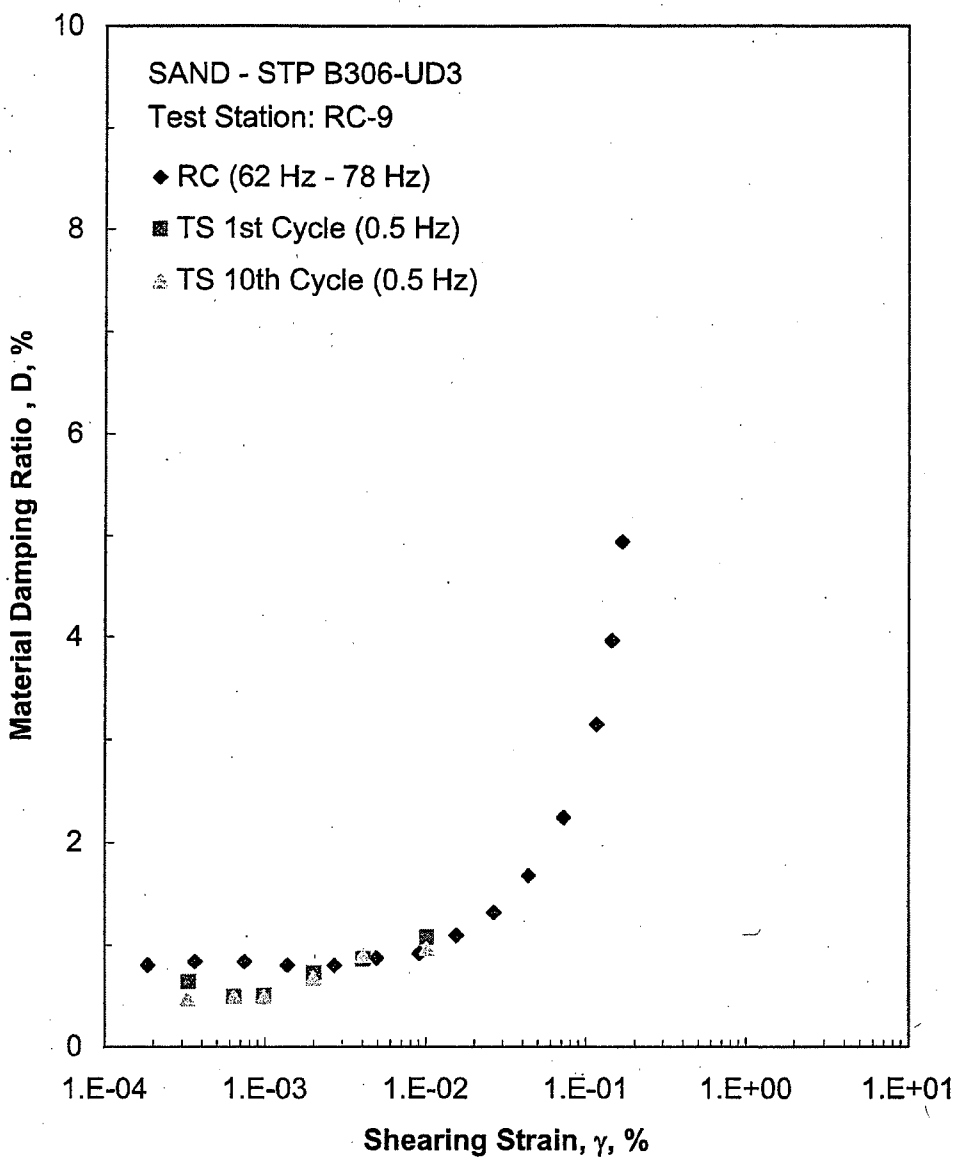


Figure N.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 94 psi from the Combined RCTS Tests

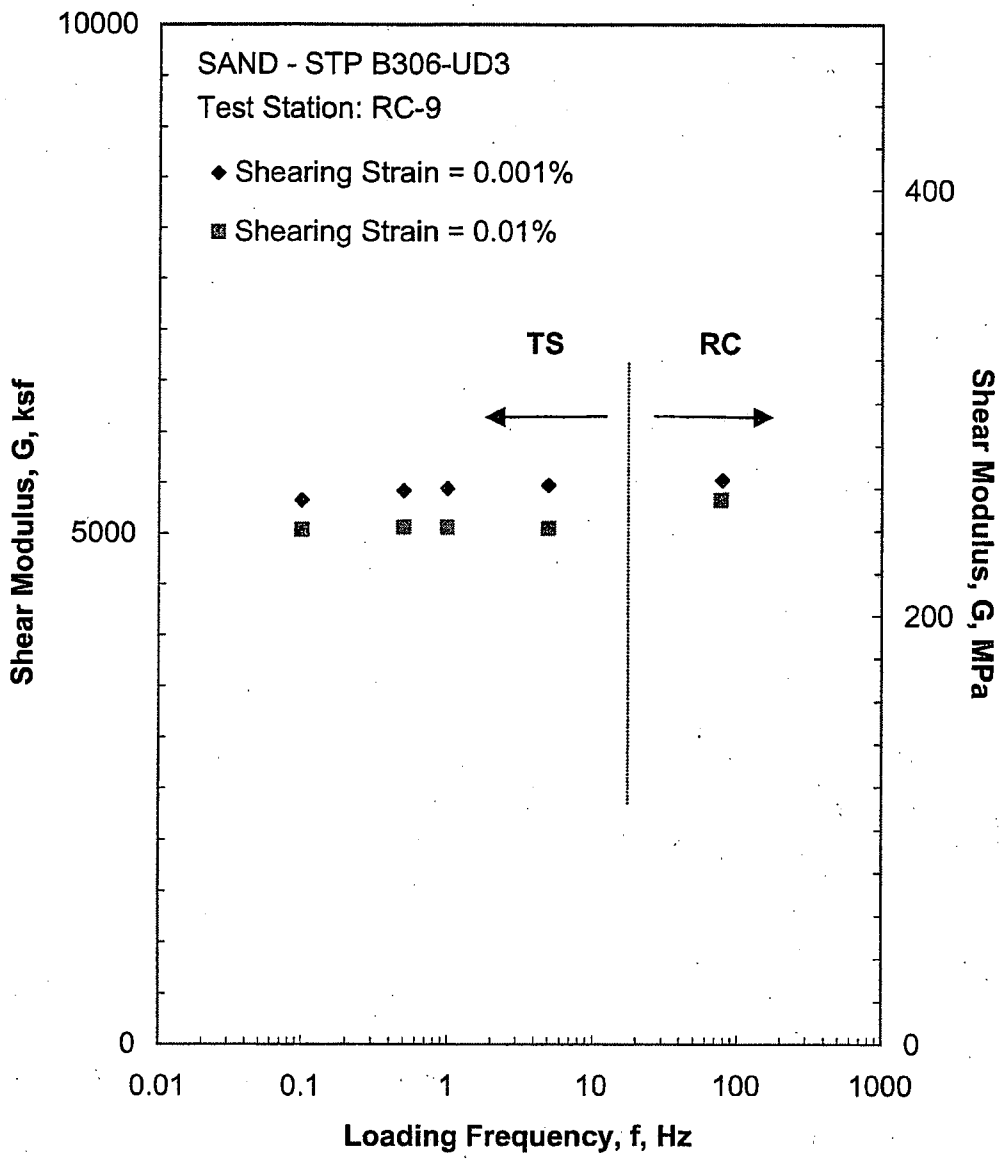


Figure N.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 94 psi from the Combined RCTS Tests

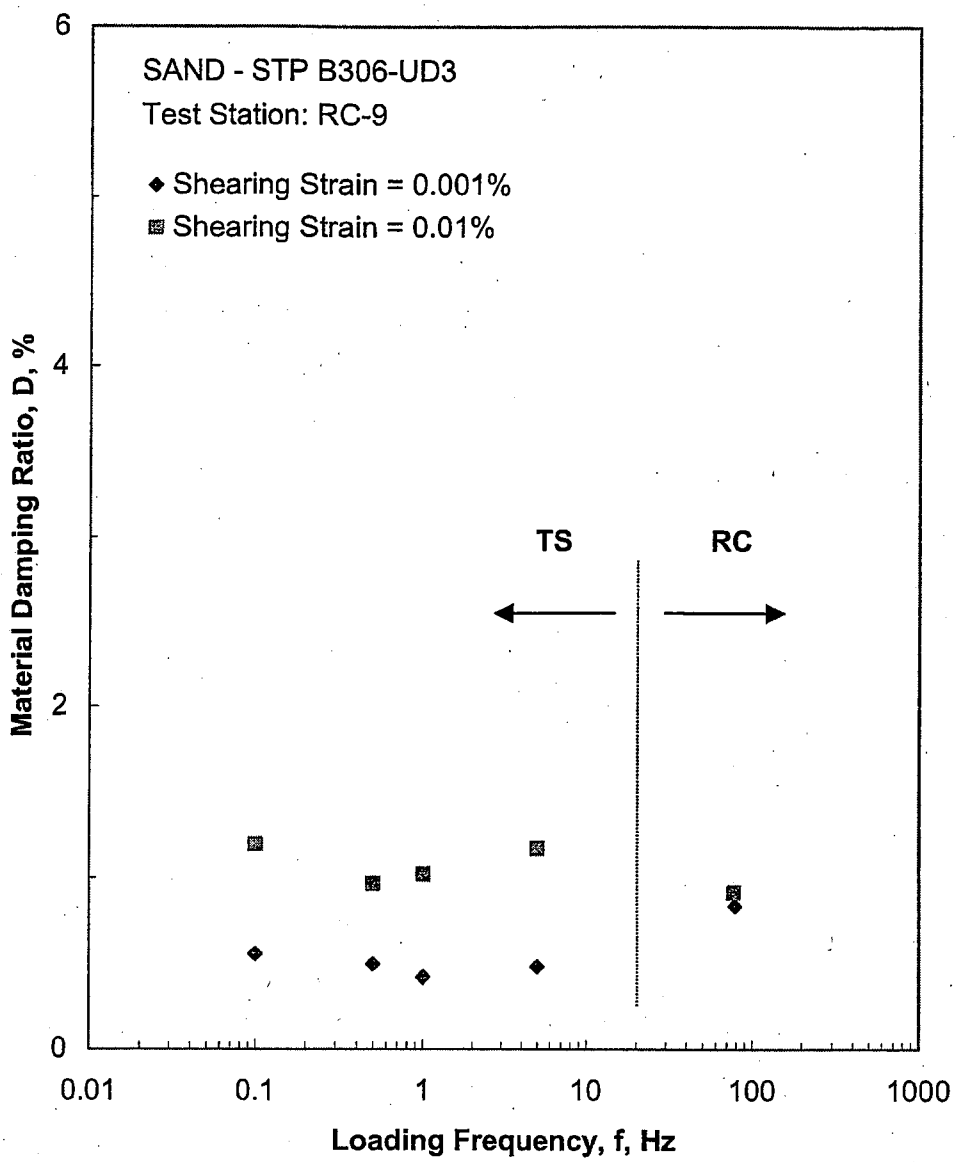


Figure N.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 94 psi from the Combined RCTS Tests

Table N.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen STP B306-UD3

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
6	850	41	1284	62	556	1.40	0.55
12	1685	81	1770	85	653	1.24	0.55
24	3384	162	2557	123	784	1.09	0.54
47	6754	323	4016	193	982	0.87	0.54
94	13522	647	5419	260	1139	0.81	0.54

Table N.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B306-UD3; Isoptropic Confining Pressure, σ_o=24 psi (3.4 ksf = 162 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
5.91E-04	2542	1.00	5.91E-04	1.08
1.21E-03	2542	1.00	1.21E-03	1.08
2.30E-03	2530	1.00	2.07E-03	1.06
4.35E-03	2506	0.99	4.00E-03	1.06
7.86E-03	2458	0.97	7.23E-03	1.14
1.55E-02	2344	0.92	1.39E-02	1.28
2.56E-02	2279	0.90	2.26E-02	1.46
4.04E-02	2158	0.85	3.51E-02	1.82
5.90E-02	2045	0.80	4.90E-02	2.57
9.70E-02	1864	0.73	7.56E-02	3.66
1.69E-01	1662	0.65	1.15E-01	5.96

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table N.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B306-UD3; Isotropic Confining Pressure, σ_o= 24 psi (3.4 ksf =162 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
3.61E-04	2724	1.00	0.38	3.70E-04	2705	1.00	0.38
7.00E-04	2724	1.00	0.39	7.05E-04	2705	1.00	0.41
1.02E-03	2724	1.00	0.42	1.01E-03	2705	1.00	0.47
2.04E-03	2724	1.00	0.57	2.05E-03	2705	1.00	0.63
4.12E-03	2697	0.99	0.94	4.14E-03	2689	0.99	0.69
1.01E-02	2518	0.92	1.40	1.01E-02	2518	0.93	1.24

Table N.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen STP B306-UD3; Isoptropic Confining Pressure, σ_o= 94 psi (13.5 ksf = 647 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.85E-04	5540	1.00	1.85E-04	0.80
3.63E-04	5540	1.00	3.63E-04	0.84
7.45E-04	5540	1.00	7.45E-04	0.84
1.47E-03	5540	1.00	1.38E-03	0.80
2.86E-03	5483	0.99	2.68E-03	0.80
5.33E-03	5445	0.98	4.91E-03	0.87
9.79E-03	5332	0.96	9.11E-03	0.92
1.70E-02	5205	0.94	1.55E-02	1.09
2.94E-02	5010	0.90	2.65E-02	1.32
4.97E-02	4744	0.86	4.38E-02	1.68
8.53E-02	4358	0.79	7.25E-02	2.24
1.41E-01	3946	0.71	1.17E-01	3.15
1.81E-01	3698	0.67	1.45E-01	3.96
2.20E-01	3564	0.64	1.67E-01	4.94

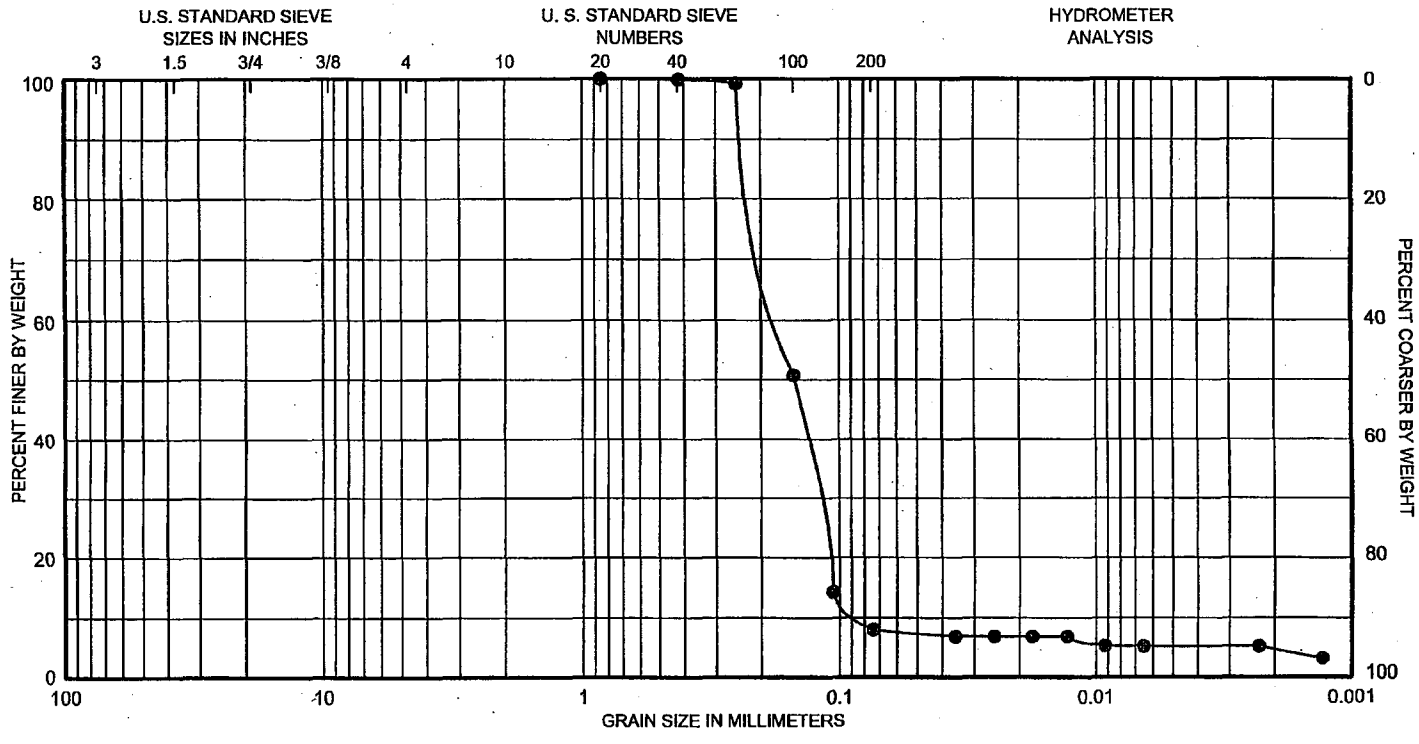
[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table N.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen STP B306-UD3; Isotropic Confining Pressure, σ_o=94 psi (13.5 ksf = 647 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
3.30E-04	5318	1.00	0.64	3.25E-04	5343	1.00	0.46
6.37E-04	5318	1.00	0.49	6.37E-04	5343	1.00	0.49
9.82E-04	5318	1.00	0.50	9.87E-04	5343	1.00	0.49
2.01E-03	5318	1.00	0.73	1.99E-03	5343	1.00	0.68
4.05E-03	5285	0.99	0.86	4.03E-03	5311	0.99	0.90
1.01E-02	5067	0.95	1.08	1.01E-02	5061	0.95	0.96

Checked By: Date: Drawn By: Date:



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-306-UD3	75	1.11	2.00	0.149	0.23	Sand, tan

GRAIN SIZE CURVE

Report No. 0401-1660

PLATE 1

Table A.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen UTA-57-A (1C)

Isotropic Confining Pressure, so			Low-Amplitude Shear Modulus, Gmax		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio,e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
16	2304	110	2289	109.6	755	0.31	0.516
32	4608	221	3282	157.1	903	0.25	0.514
65	9360	448	4683	224.2	1078	0.19	0.510
130	18720	896	6539	313.1	1273	0.16	0.506
260	37440	1793	9934	475.6	1566	0.16	0.494

Table A.2 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen UTA-57-A (1C); Isotropic Confining Pressure, σ_o =130 psi (18.7 ksf=896 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio^x, D, %
1.38E-04	6537	1.00	1.37E-04	0.18
2.68E-04	6538	1.00	2.66E-04	0.16
5.26E-04	6538	1.00	5.22E-04	0.16
1.01E-03	6538	1.00	1.00E-03	0.16
2.02E-03	6488	0.99	2.00E-03	0.19
3.81E-03	6487	0.99	3.76E-03	0.21
6.50E-03	6436	0.98	6.39E-03	0.26
1.13E-02	6336	0.97	1.10E-02	0.36
1.86E-02	6236	0.95	1.80E-02	0.49
2.91E-02	5941	0.91	2.78E-02	0.74
4.58E-02	5652	0.86	4.27E-02	1.15
6.71E-02	5375	0.82	6.05E-02	1.70
1.00E-01	5014	0.77	8.66E-02	2.43
1.34E-01	4756	0.73	1.10E-01	3.40

+ Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

x Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table A.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen UTA-57-A (1C); Isotropic Confining Pressure, σ_o =130 psi (18.7 ksf=896 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
4.82E-04	8220	1.00	0.12	4.81E-04	8250	1.00	0.12
9.65E-04	8220	1.00	0.09	9.64E-04	8220	1.00	0.10
1.46E-03	8160	0.99	0.11	1.46E-03	8160	0.99	0.14

Table A.4 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen UTA-57-A (1C); Isotropic Confining Pressure, σ_o =260 psi (37.4 ksf=1793 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio x, D, %
9.34E-05	9939	1.00	9.53E-05	0.17
1.90E-04	9940	1.00	1.94E-04	0.16
3.78E-04	9943	1.00	3.77E-04	0.16
7.38E-04	9941	1.00	7.31E-04	0.16
1.45E-03	9941	1.00	1.43E-03	0.21
2.78E-03	9878	0.99	2.76E-03	0.09
4.87E-03	9879	0.99	4.80E-03	0.24
9.46E-03	9754	0.98	9.31E-03	0.25
1.65E-02	9628	0.97	1.60E-02	0.47
2.61E-02	9381	0.94	2.53E-02	0.53
4.25E-02	9138	0.92	4.07E-02	0.71
6.46E-02	8778	0.88	6.07E-02	1.00
9.70E-02	8079	0.81	8.81E-02	1.59
1.31E-01	7521	0.76	1.15E-01	2.18

+ Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

x Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table A.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen UTA-57-A (1C); Isotropic Confining Pressure, so =260 psi (37.4 ksf=1793 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/Gmax	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/Gmax	Material Damping Ratio, D, %
5.44E-04	10900	1.01	0.13	5.40E-04	10800	1.00	0.11
1.09E-03	10800	1.00	0.09	1.09E-03	10800	1.00	0.09
2.19E-03	10800	1.00	0.10	2.19E-03	10800	1.00	0.10
3.30E-03	10800	1.00	0.16	3.30E-03	10800	1.00	0.15
4.75E-03	10800	1.00	0.19	4.72E-03	10800	1.00	0.19

Table B.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen UTA-57-B (2C)

Isotropic Confining Pressure, so			Low-Amplitude Shear Modulus, Gmax		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio,e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
8	1152	55	1030	49.3	524	0.45	0.633
16	2304	110	1537	73.6	640	0.40	0.632
32	4608	221	2268	108.6	777	0.31	0.629
64	9216	441	3368	161.2	946	0.23	0.625
128	18432	883	4813	230.4	1130	0.20	0.621

Table B.2 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen UTA-57-B (2C); Isotropic Confining Pressure, σ_o =32 psi (4.6 ksf=221 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio^x, D, %
2.49E-04	2212	1.01	2.44E-04	0.35
4.89E-04	2201	1.00	4.87E-04	0.29
9.37E-04	2188	0.99	9.23E-04	0.32
1.76E-03	2177	0.99	1.73E-03	0.28
3.23E-03	2144	0.97	3.15E-03	0.37
5.93E-03	2111	0.96	5.74E-03	0.51
9.74E-03	2052	0.93	9.32E-03	0.72
1.64E-02	1968	0.89	1.55E-02	0.96
2.65E-02	1834	0.83	2.43E-02	1.42
4.07E-02	1656	0.75	3.60E-02	2.03

+ Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

x Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table B.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen UTA-57-B (2C); Isotropic Confining Pressure, σ_o =32 psi (4.6 ksf=221 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
2.67E-04	2720	1.00	0.26	2.71E-04	2740	1.00	0.18
5.41E-04	2730	1.00	0.20	5.39E-04	2720	0.99	0.21
1.09E-03	2700	0.99	0.24	1.09E-03	2710	0.99	0.21
2.04E-03	2680	0.98	0.47	2.06E-03	2670	0.97	0.49
4.20E-03	2630	0.97	0.77	4.21E-03	2620	0.96	0.62
1.04E-02	2500	0.92	1.63	1.05E-02	2490	0.91	1.26
2.05E-02	2320	0.85	3.07	2.05E-02	2320	0.85	2.29

Table B.4 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen UTA-57-B (2C); Isotropic Confining Pressure, σ_o =128 psi (18.4 ksf=883 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio^x, D, %
9.41E-05	4803	1.00	9.06E-05	0.15
1.68E-04	4820	1.00	1.67E-04	0.24
3.21E-04	4804	1.00	3.19E-04	0.15
6.22E-04	4801	1.00	6.13E-04	0.22
1.17E-03	4760	0.99	1.16E-03	0.17
2.24E-03	4752	0.99	2.21E-03	0.22
4.23E-03	4711	0.98	4.15E-03	0.30
7.23E-03	4630	0.96	7.07E-03	0.36
1.25E-02	4511	0.94	1.21E-02	0.50
2.22E-02	4352	0.91	2.13E-02	0.69
3.54E-02	4122	0.86	3.33E-02	0.99
5.53E-02	3823	0.80	5.08E-02	1.40
7.99E-02	3536	0.74	7.02E-02	2.15
1.16E-01	3262	0.68	9.68E-02	3.09

+ Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

x Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table B.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen UTA-57-B (2C); Isotropic Confining Pressure, σ_o =128 psi (18.4 ksf=883 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
2.69E-04	5880	1.00	0.12	2.64E-04	5810	1.00	0.12
5.07E-04	5840	1.00	0.20	5.13E-04	5830	1.00	0.27
1.03E-03	5770	0.98	0.18	1.03E-03	5770	0.99	0.15
1.96E-03	5740	0.98	0.22	1.96E-03	5730	0.99	0.22
3.95E-03	5680	0.97	0.43	3.95E-03	5690	0.98	0.37
8.68E-03	5510	0.94	0.78	8.67E-03	5520	0.95	0.64

APPENDIX A

UT Specimen UTA-57-A (1C)

Index Testing Not Performed
Visual Classification: SP-SM

Boring No. B-305-A
Sample No. UD-21
Depth = 455.2 ft (138.7 m)
Total Unit Weight = 129.2 lb/ft^3
Water Content = 18.8%
Estimated In-Situ K_o = 0.5
Estimated In-Situ Mean Effective
Stress = 133.8 psi

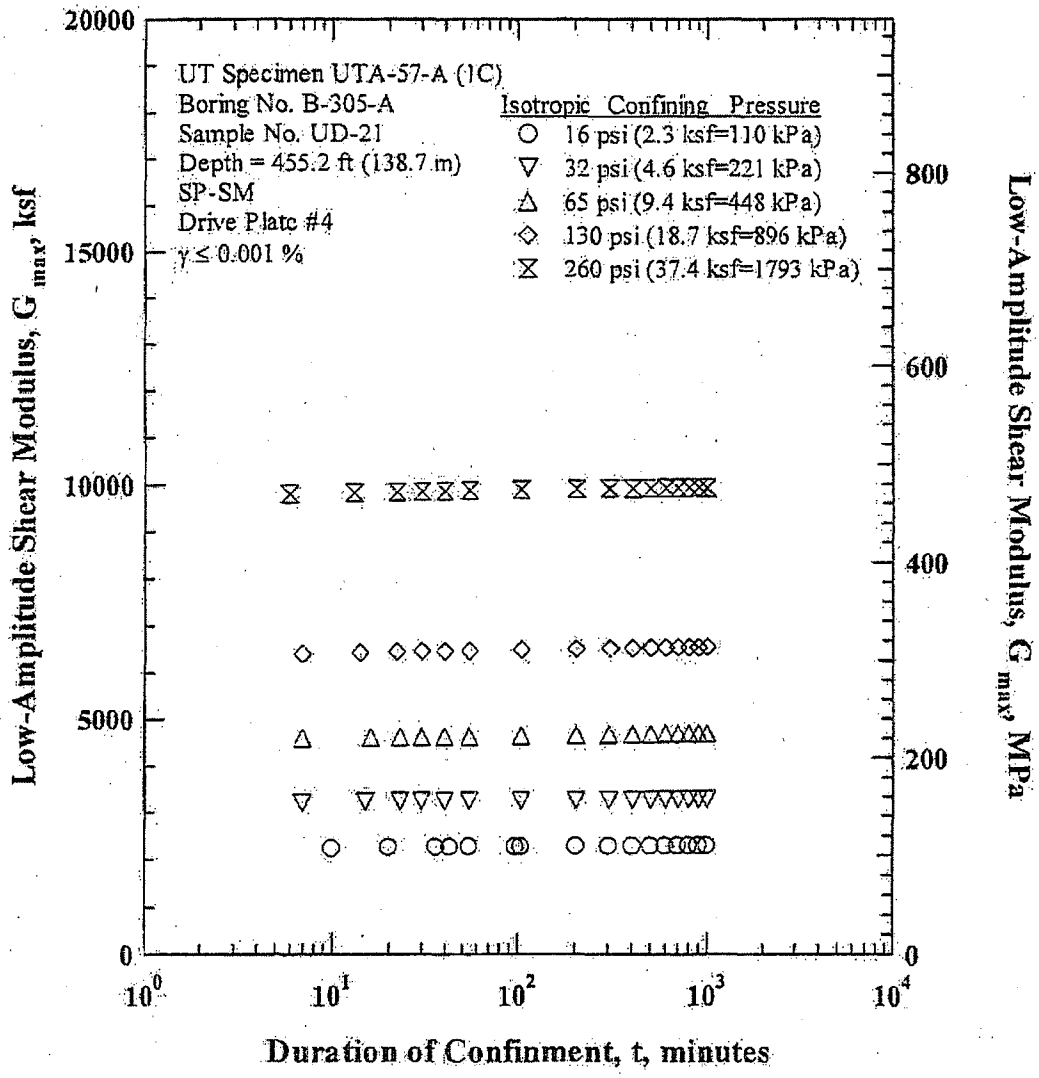


Figure A.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-A (1C)

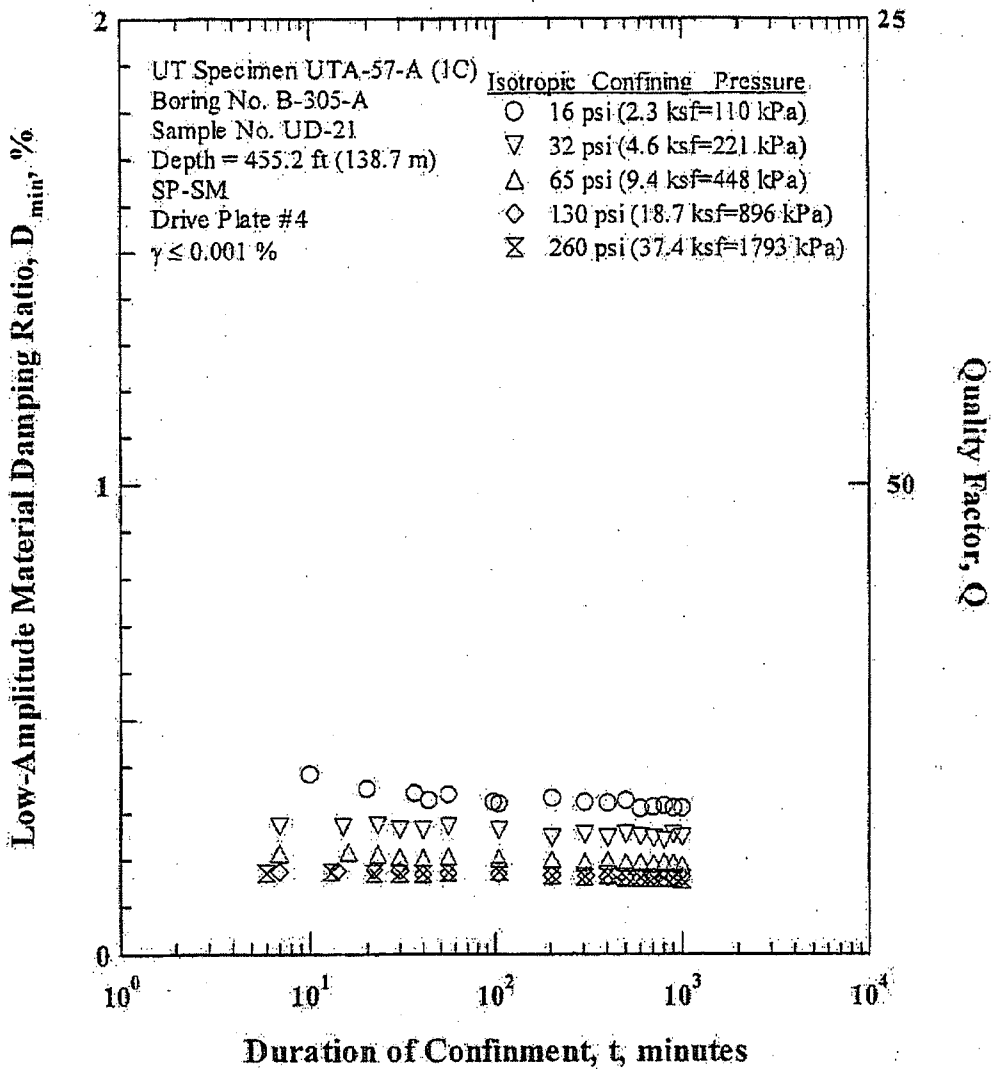


Figure A.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-A (1C)

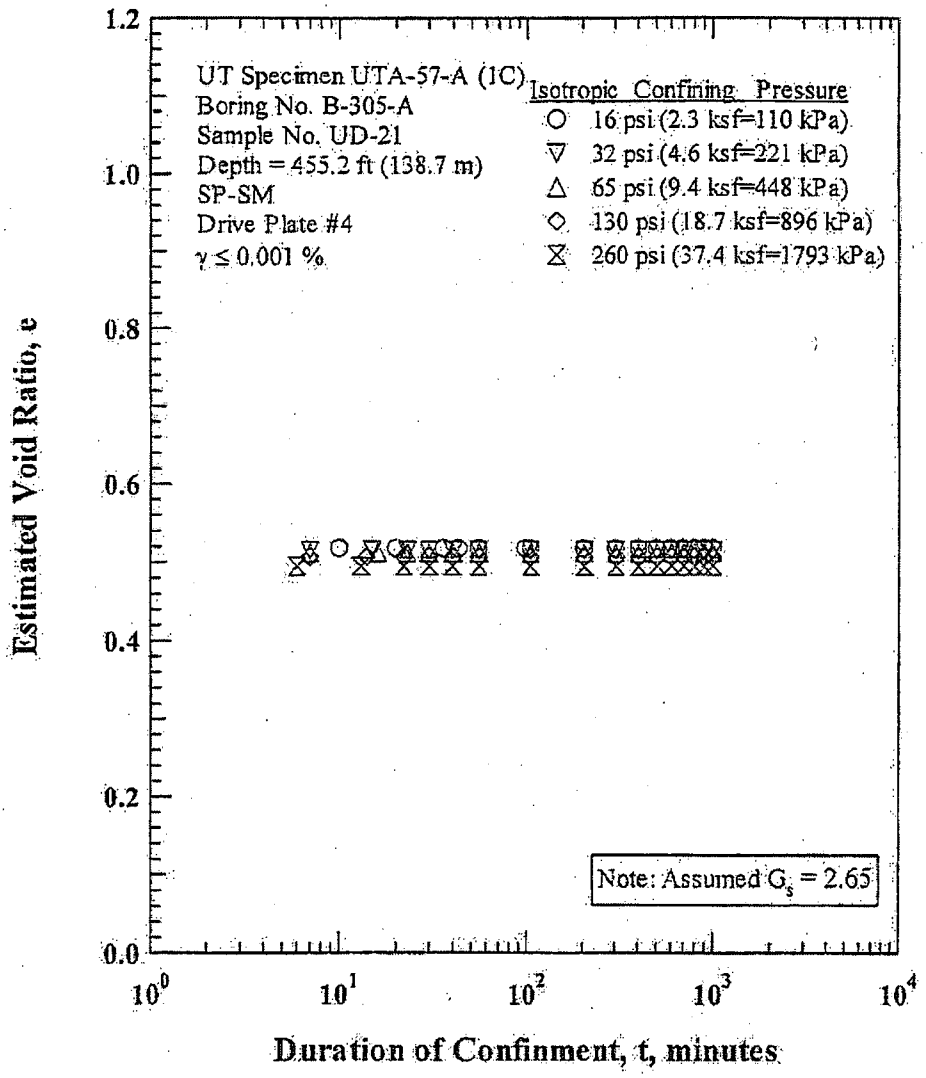


Figure A.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-A (1C)

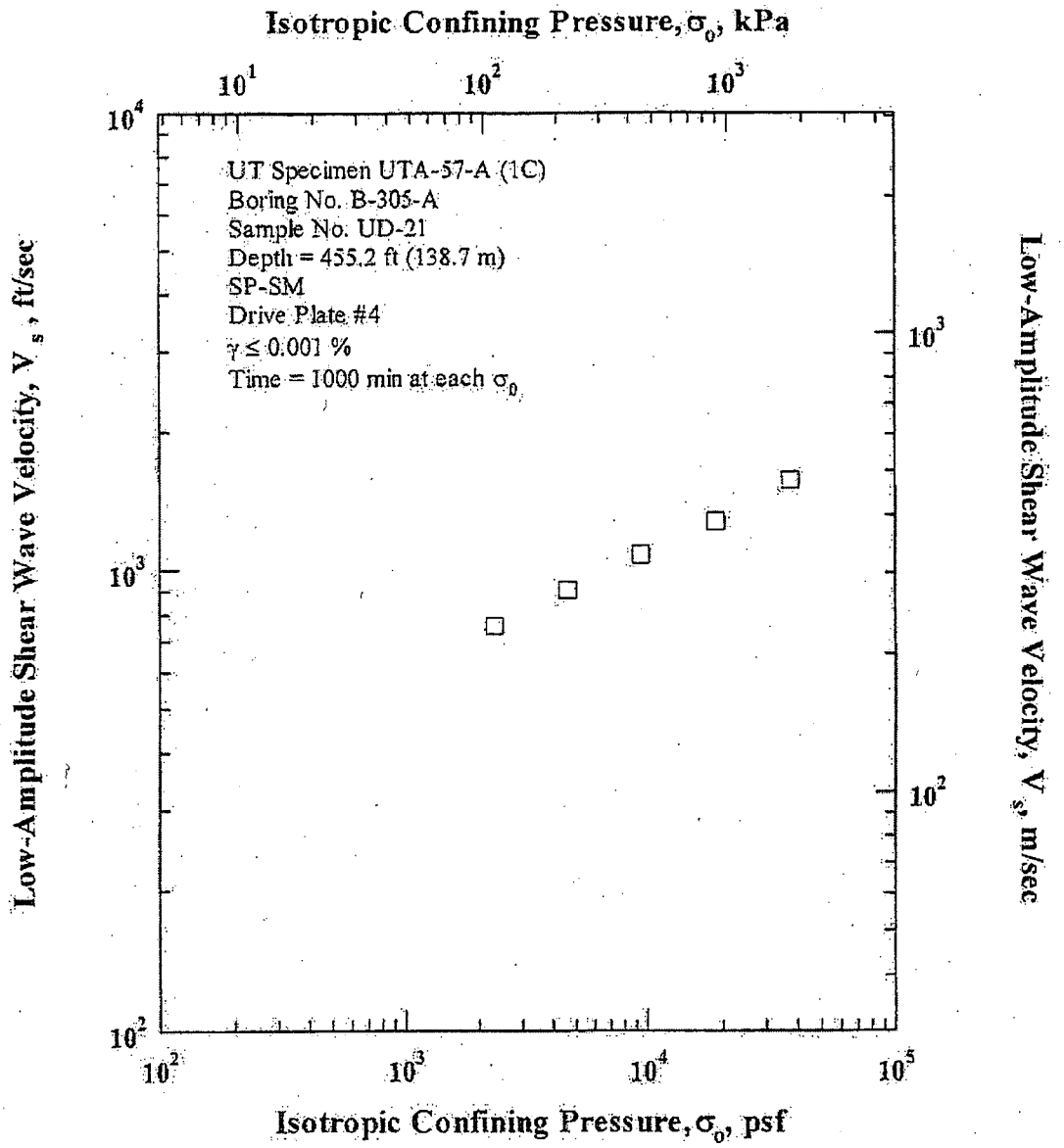


Figure A.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-A (1C)

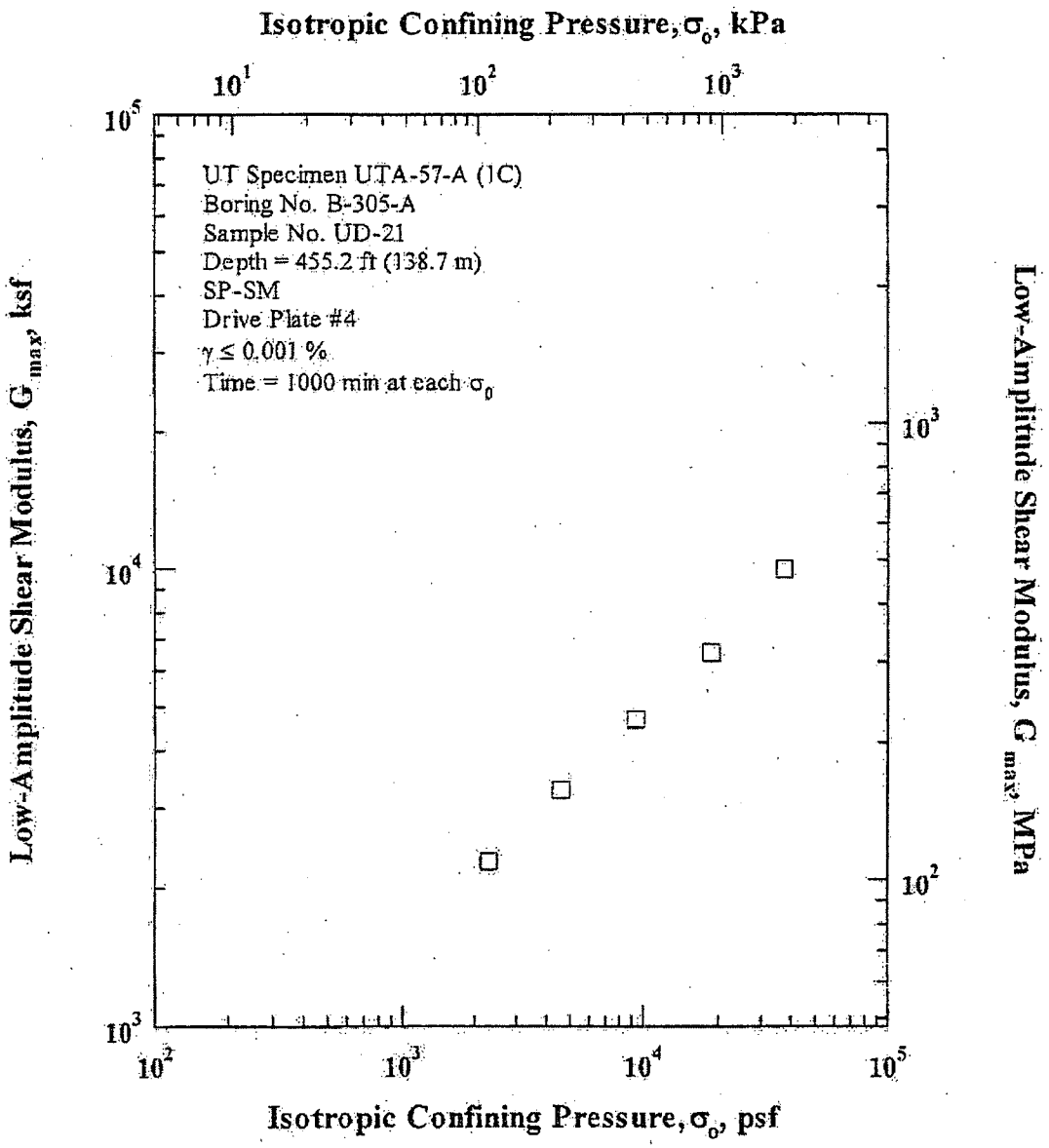


Figure A.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-A (1C)

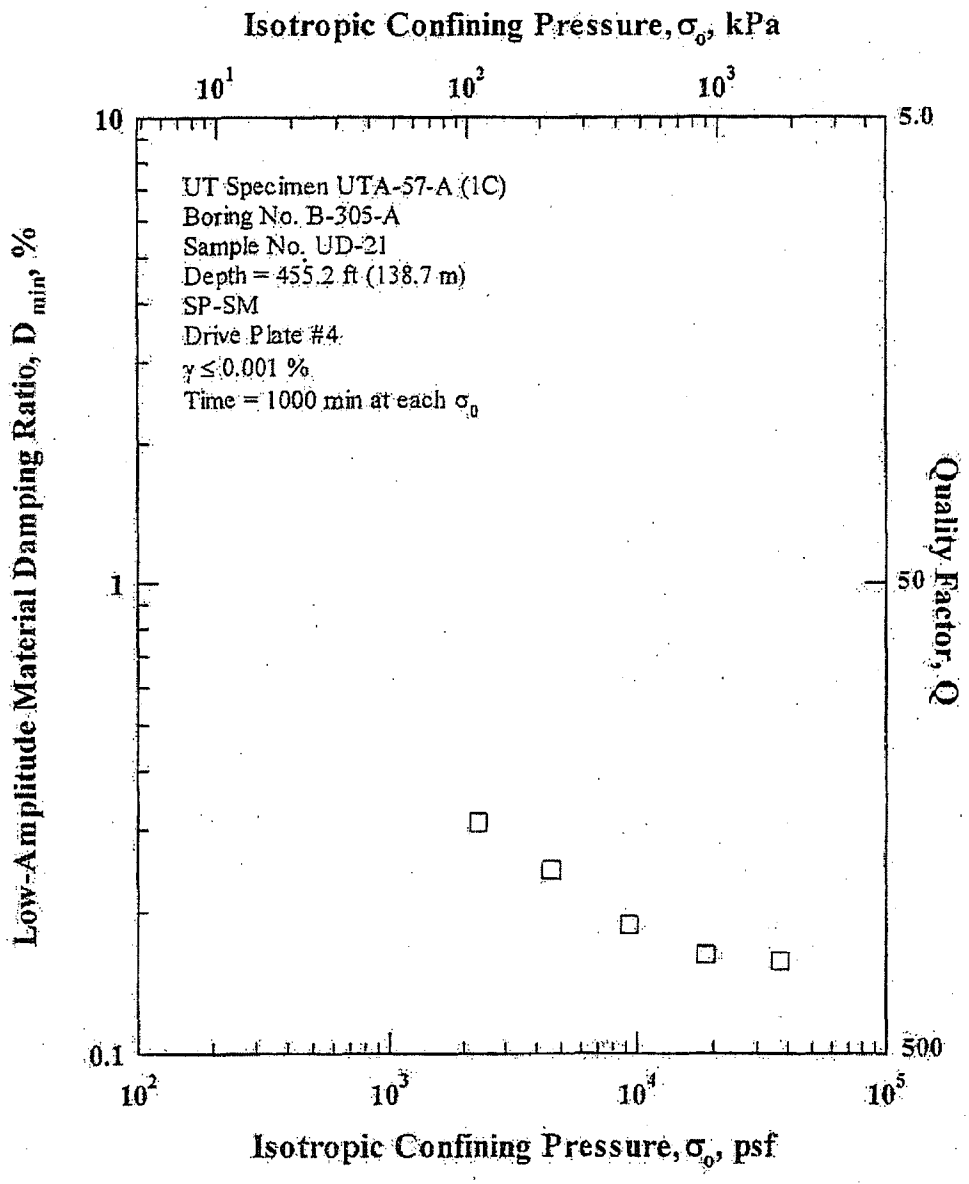


Figure A.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-A (1C)

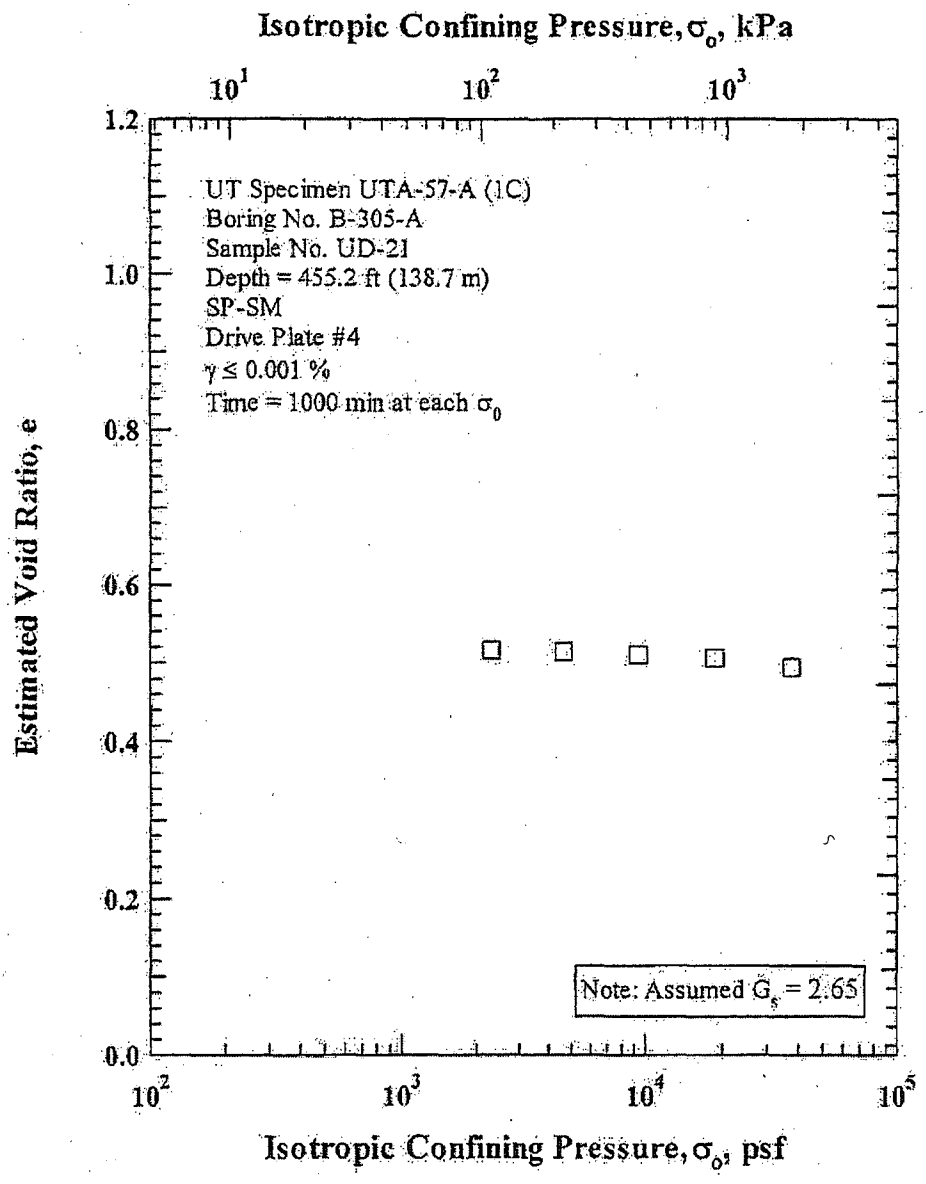


Figure A.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-A (1C)

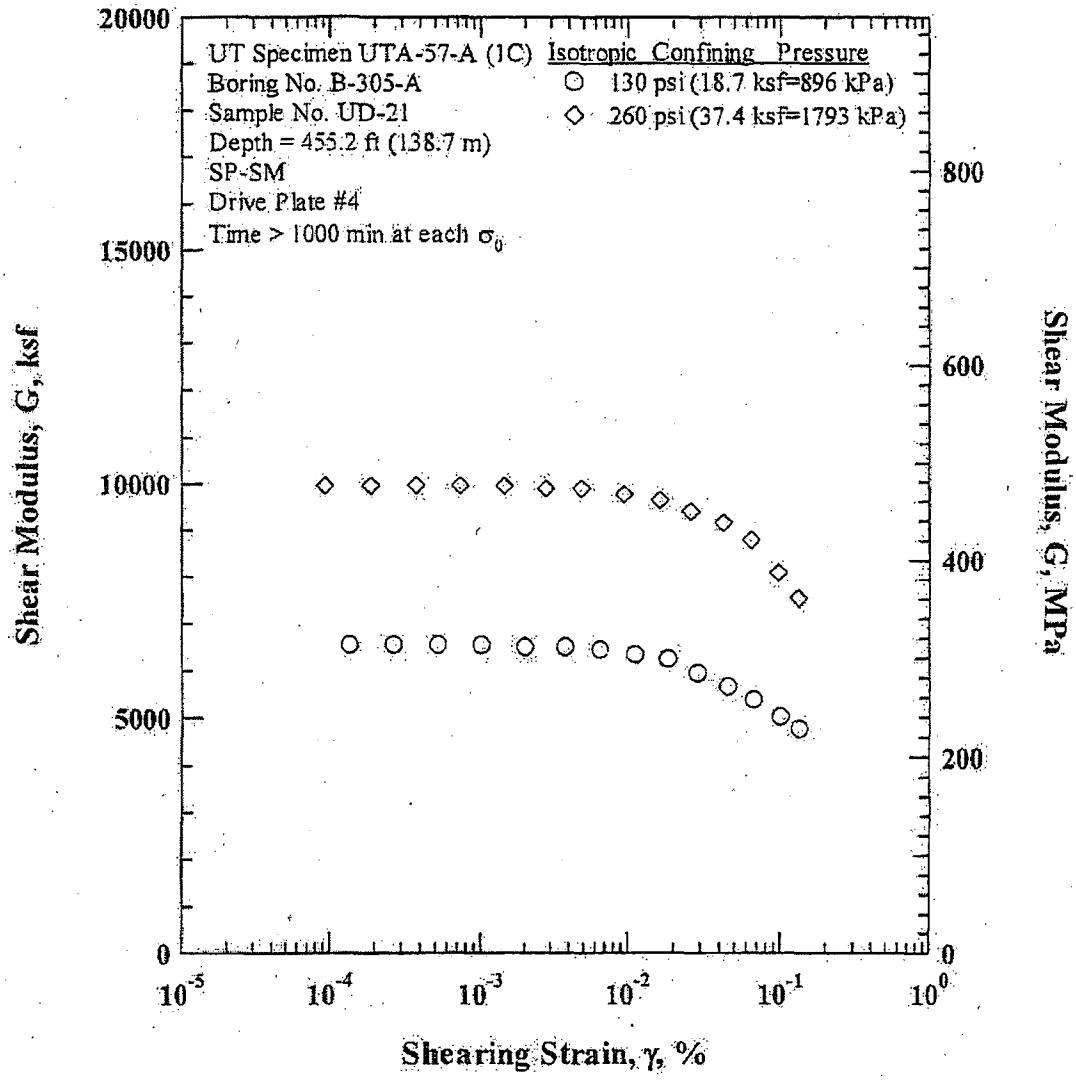


Figure A.8 Variation in Shear Modulus with Shearing Strain at Different Isotropic Confining Pressures from Resonant Column Tests of SP-SM Specimen UTA-57-A (1C)

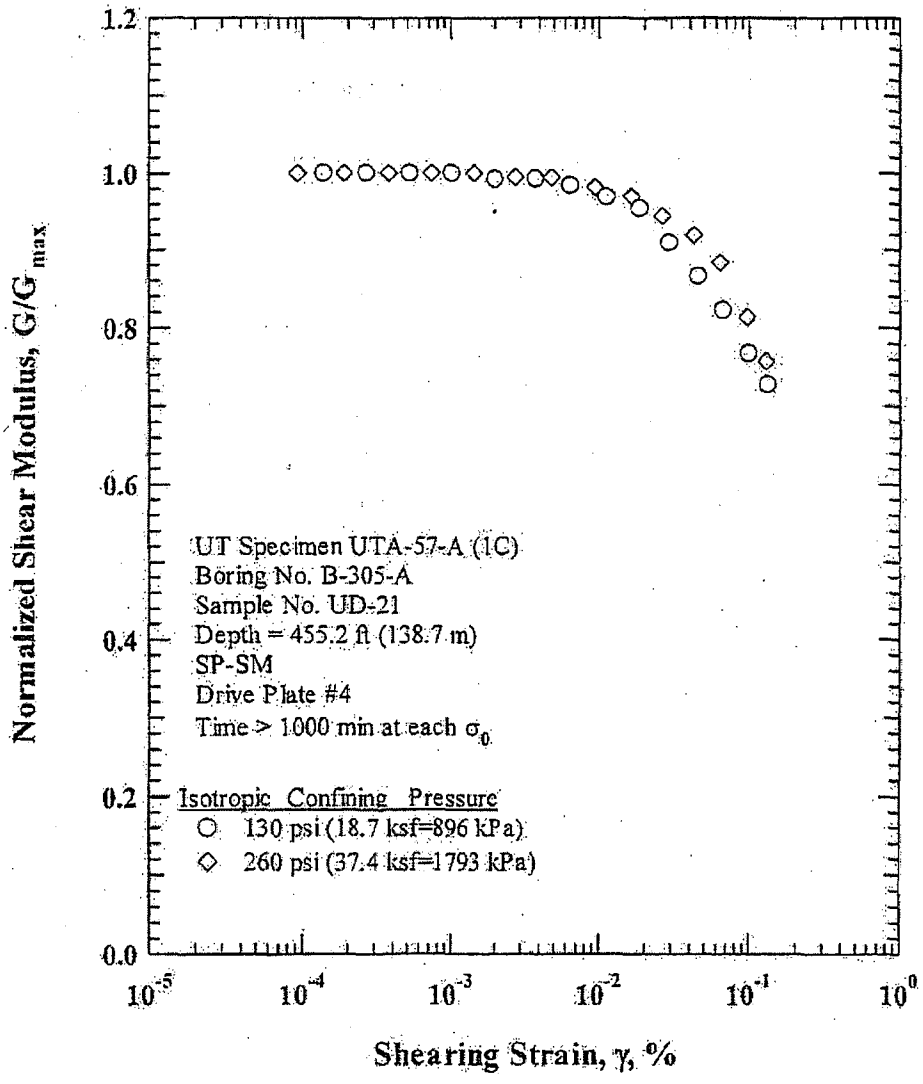


Figure A.9 Variation in Normalized Shear Modulus with Shearing Strain at Different Isotropic Confining Pressures from Resonant Column Tests of SP-SM Specimen UTA-57-A (1C)

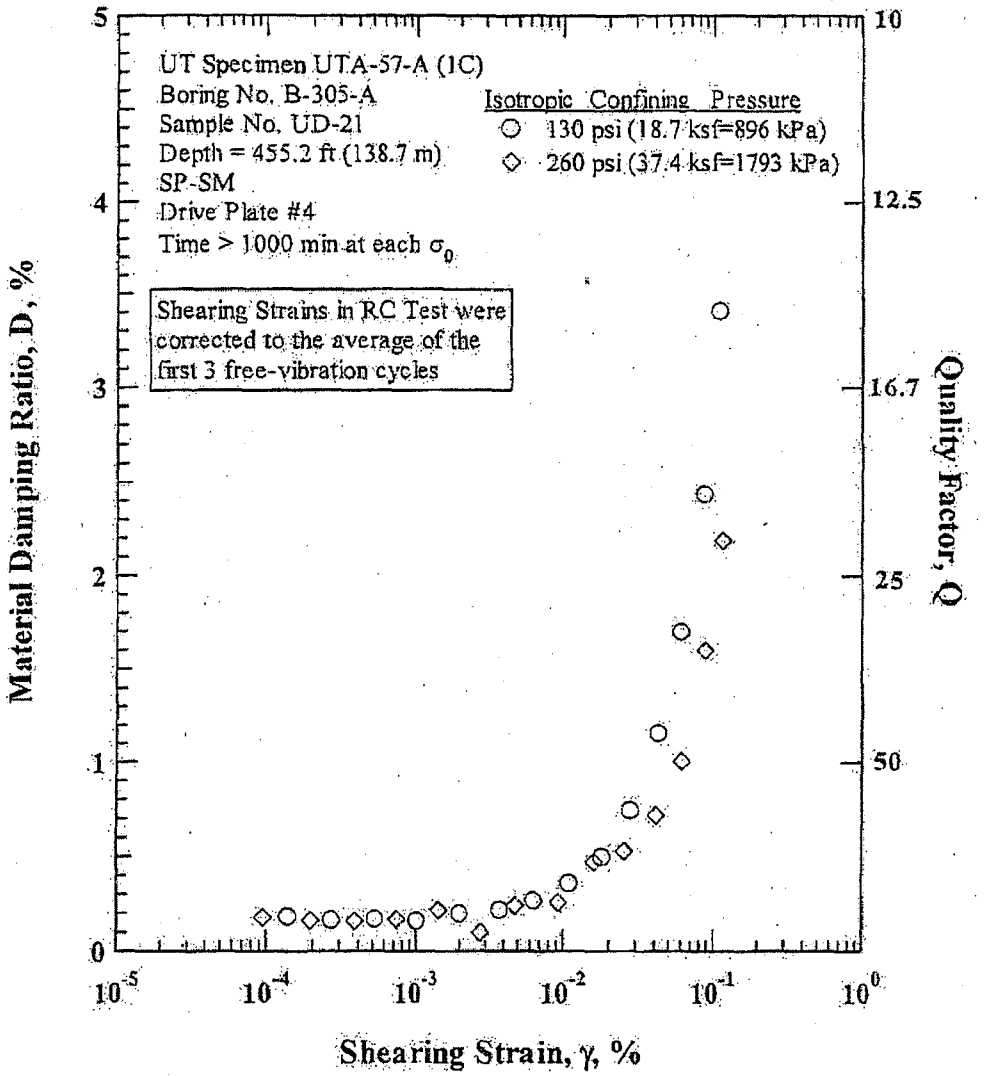


Figure A.10 Variation in Material Damping Ratio with Shearing Strain at Different Isotropic Confining Pressures from Resonant Column Tests of SP-SM Specimen UTA-57-A (1C)

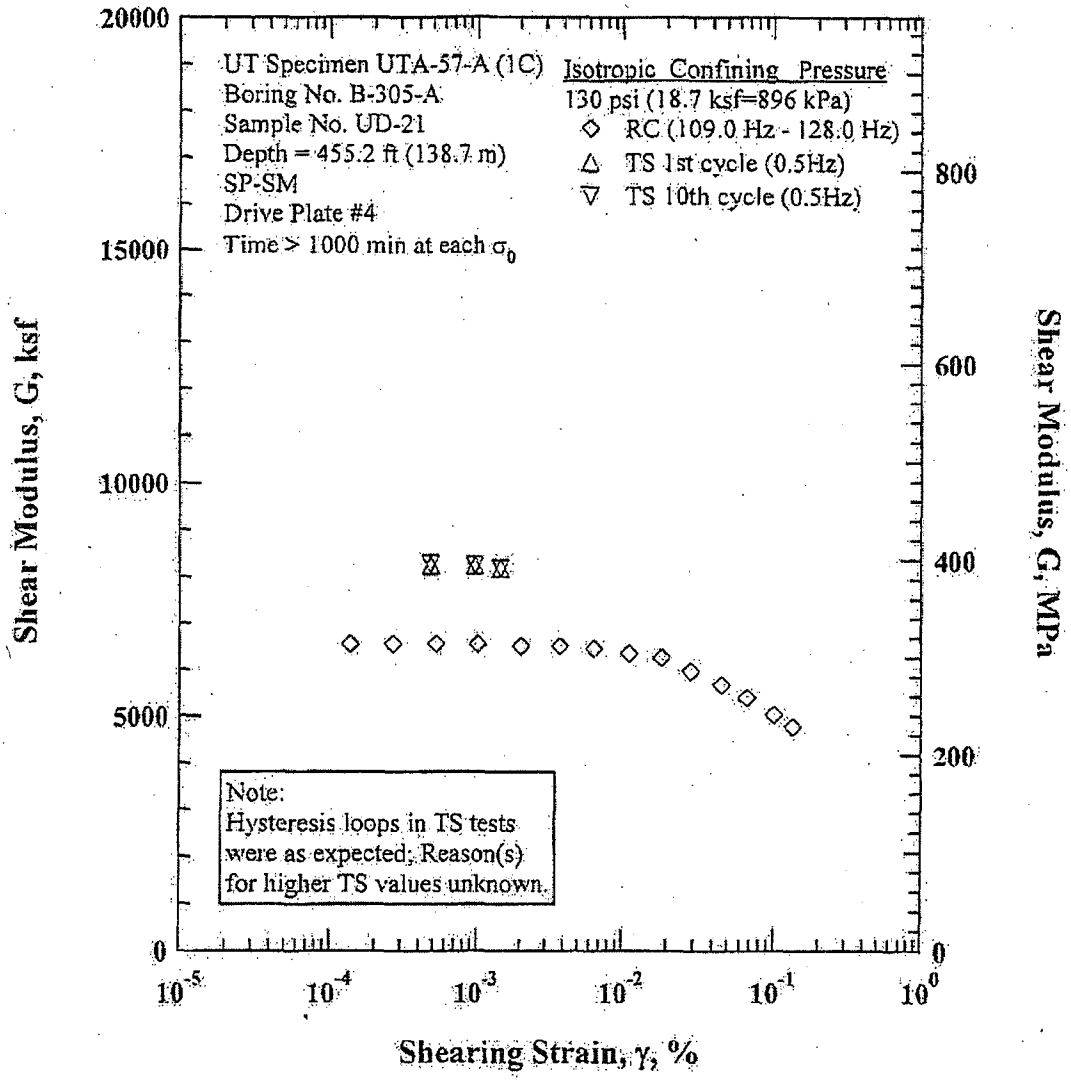


Figure A.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 130 psi (18.7 ksf=896 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-A (1C).

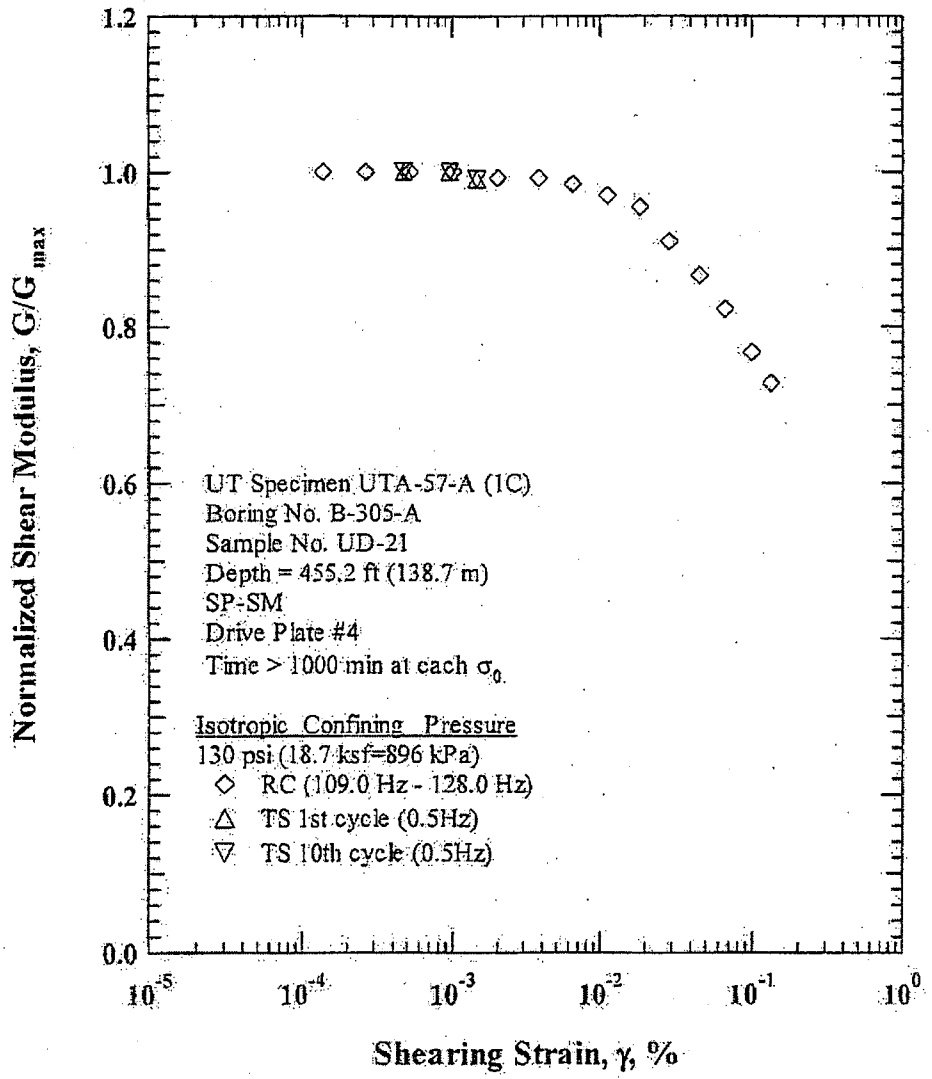


Figure A.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 130 psi (18.7 ksf=896 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-A (1C)

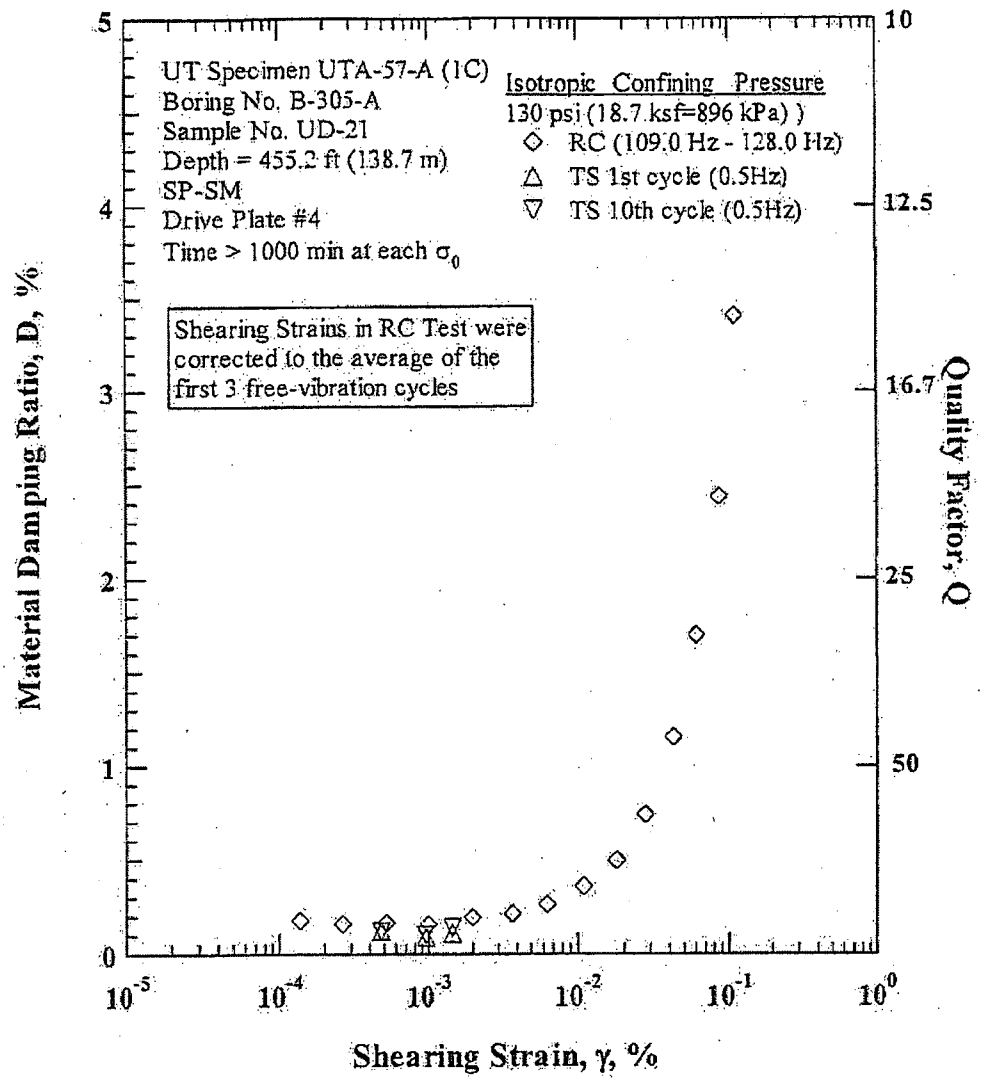


Figure A.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 130 psi (18.7 ksf=896 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-A (1C)

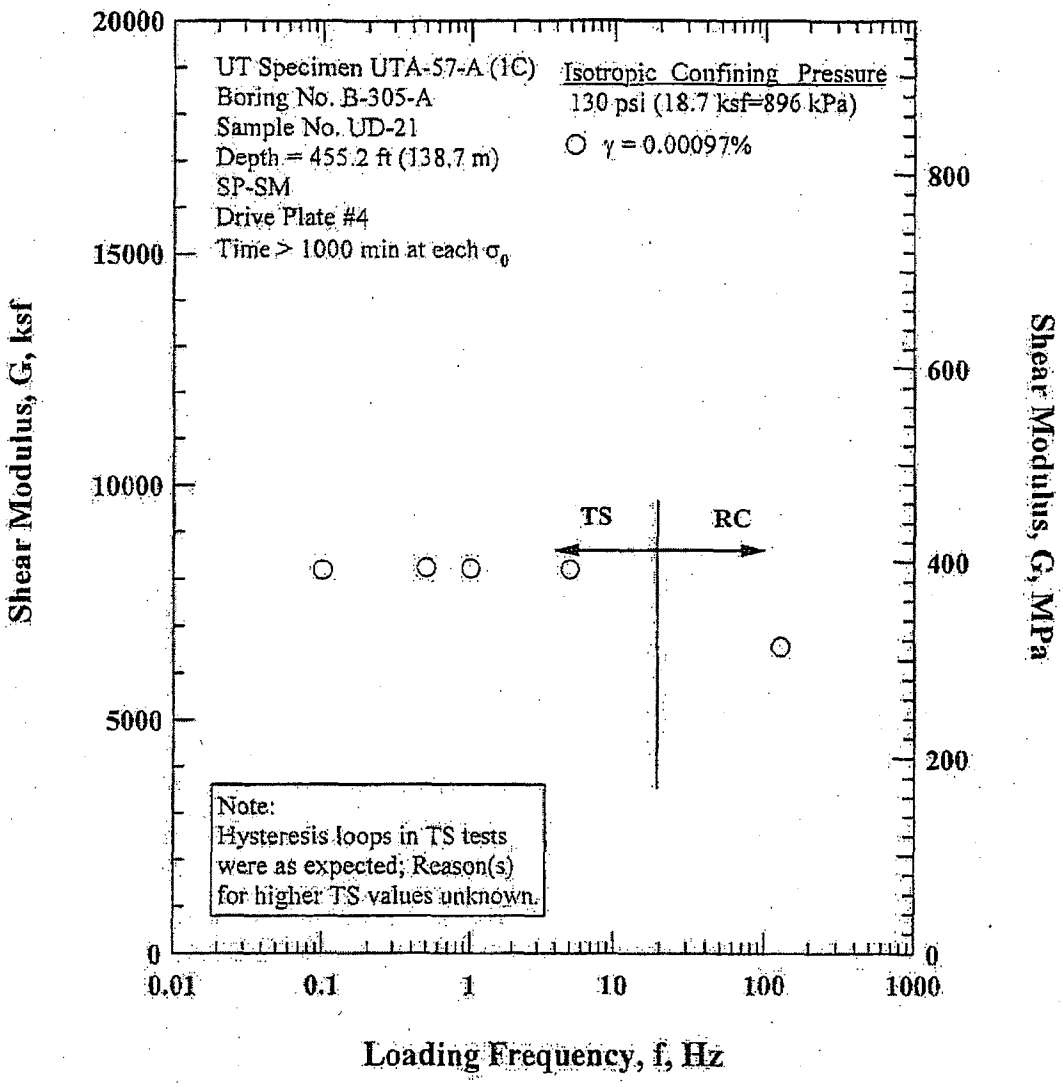


Figure A.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 130 psi (18.7 ksf=896 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-A (1C)

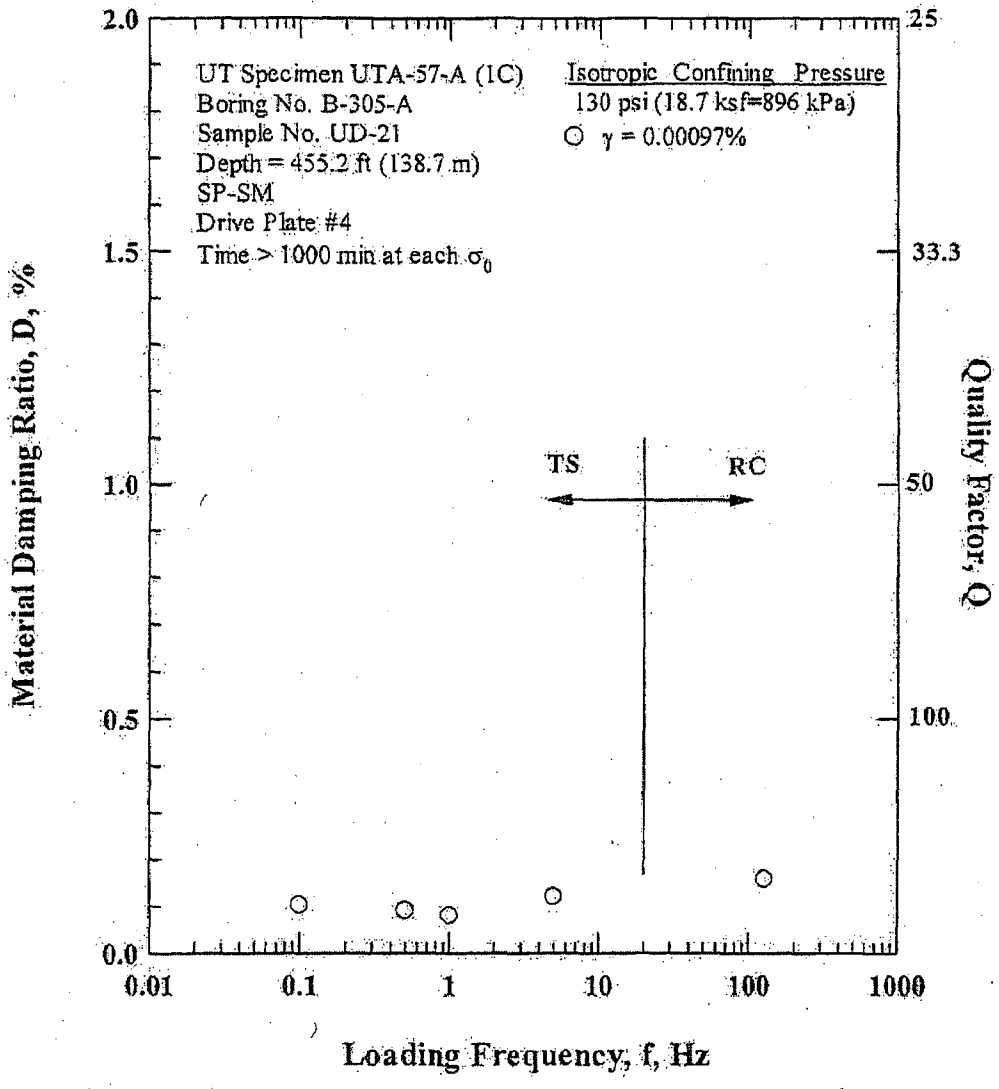


Figure A.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure 130 psi (18.7 ksf=896 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-A (1C)

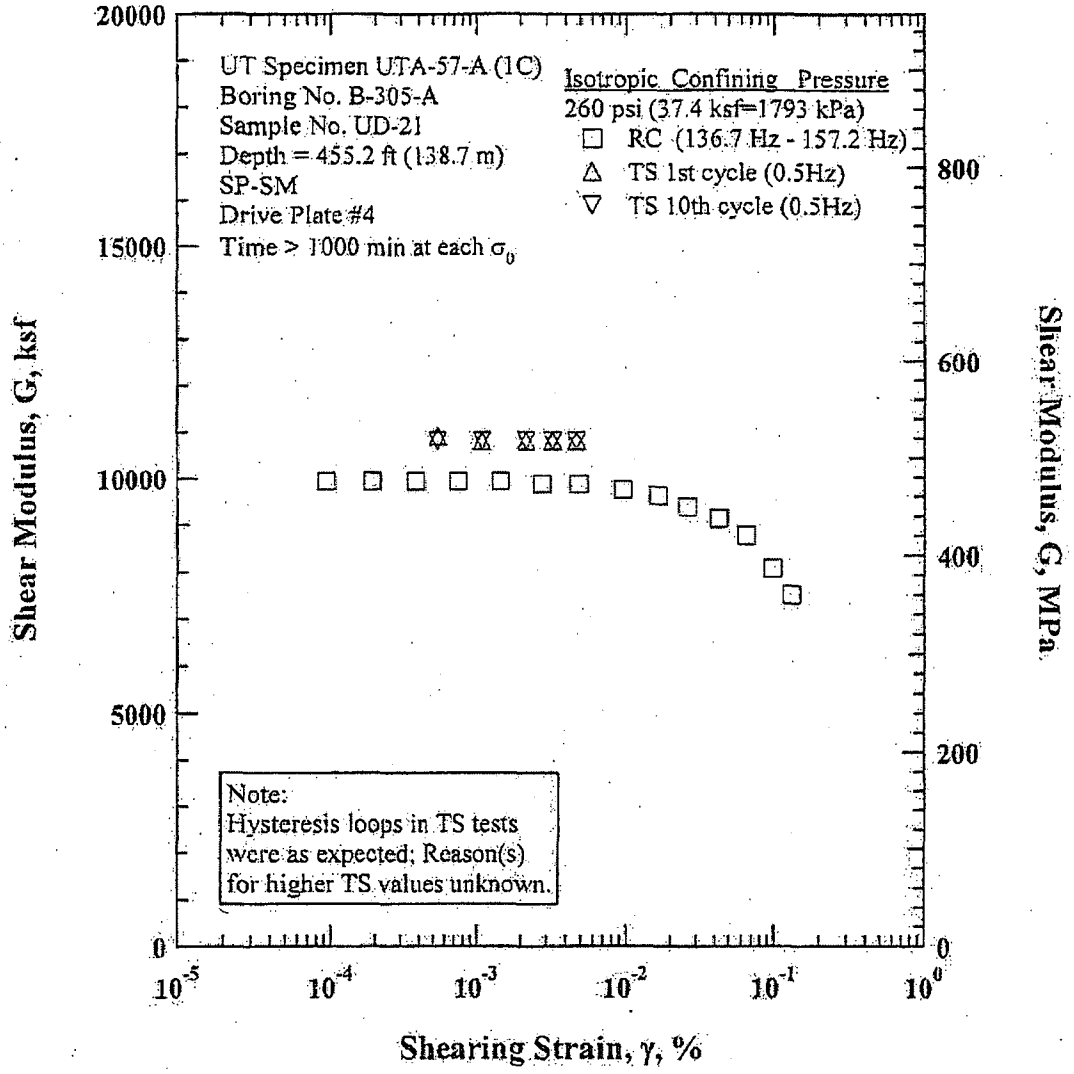


Figure A.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 260 psi (37.4 ksf=1793 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-A (1C)

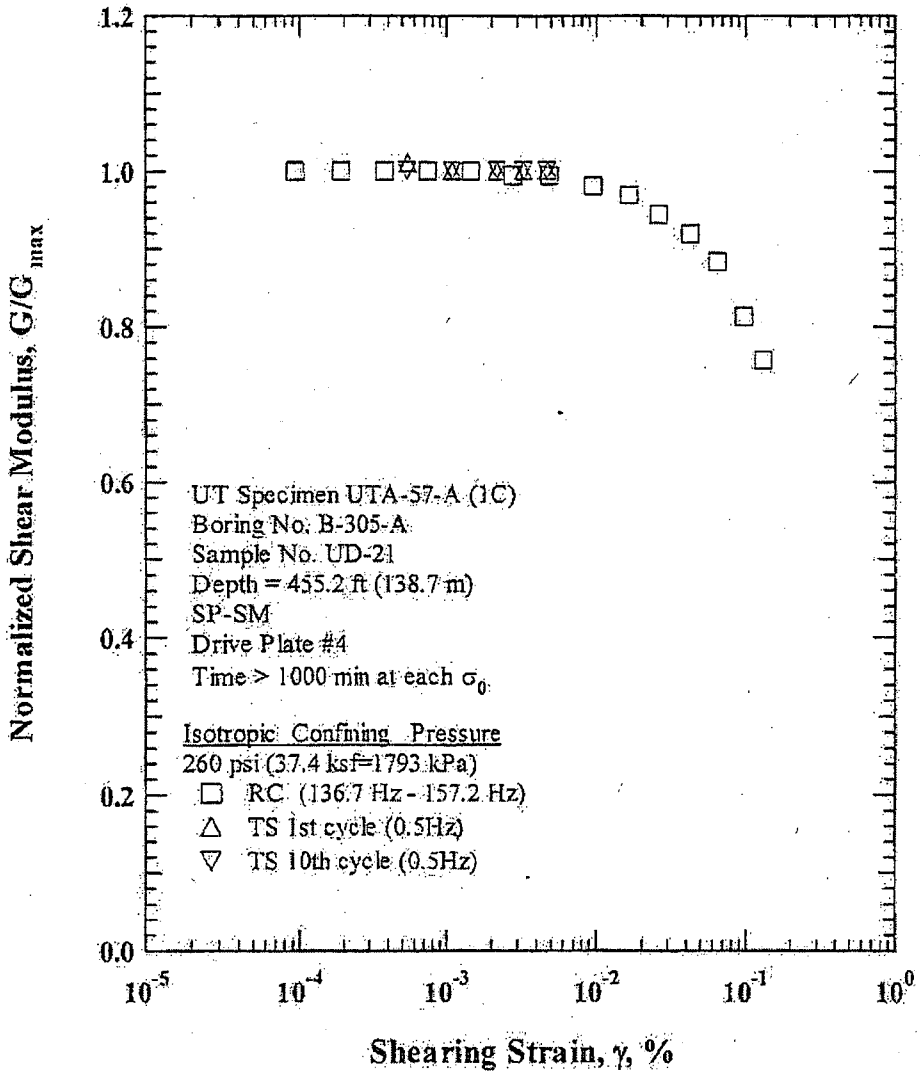


Figure A.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 260 psi (37.4 ksf=1793 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-A (1C)

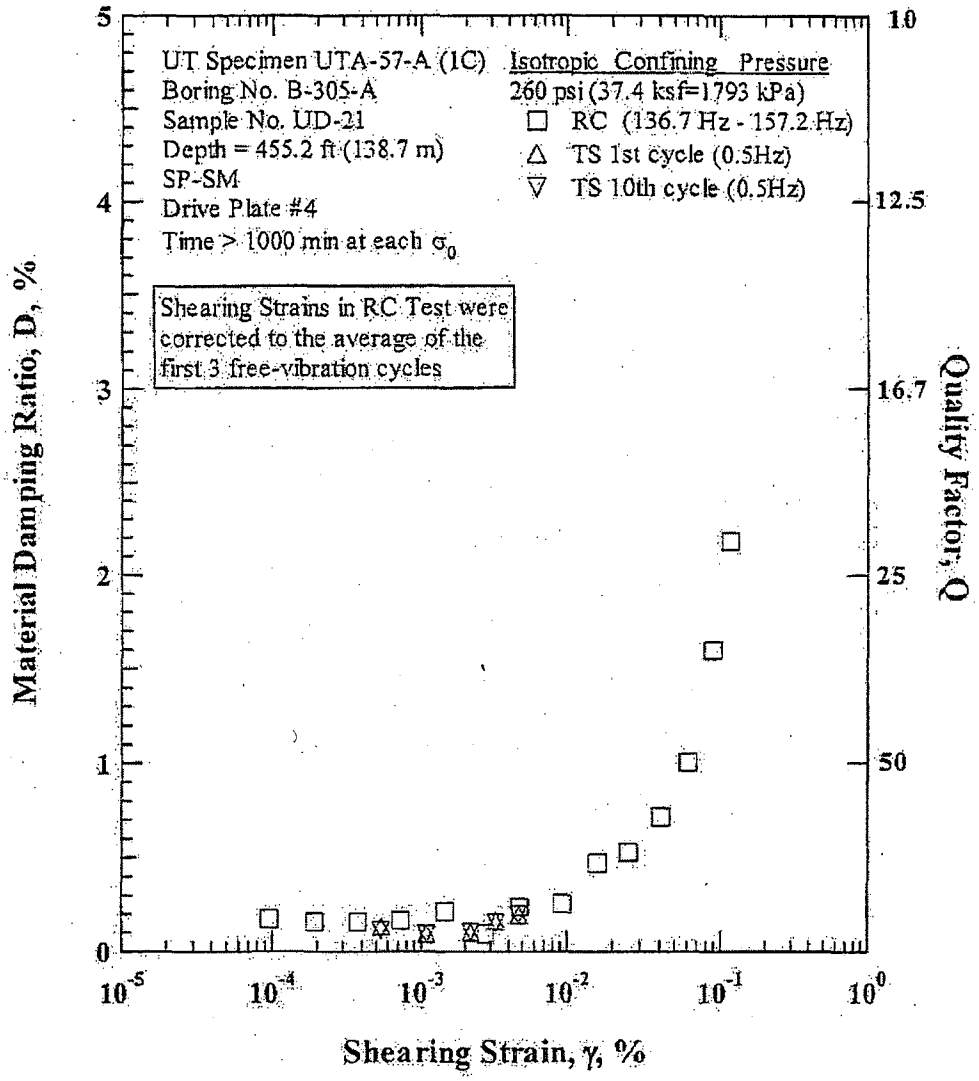


Figure A.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 260 psi (37.4 ksf=1793 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-A (1C)

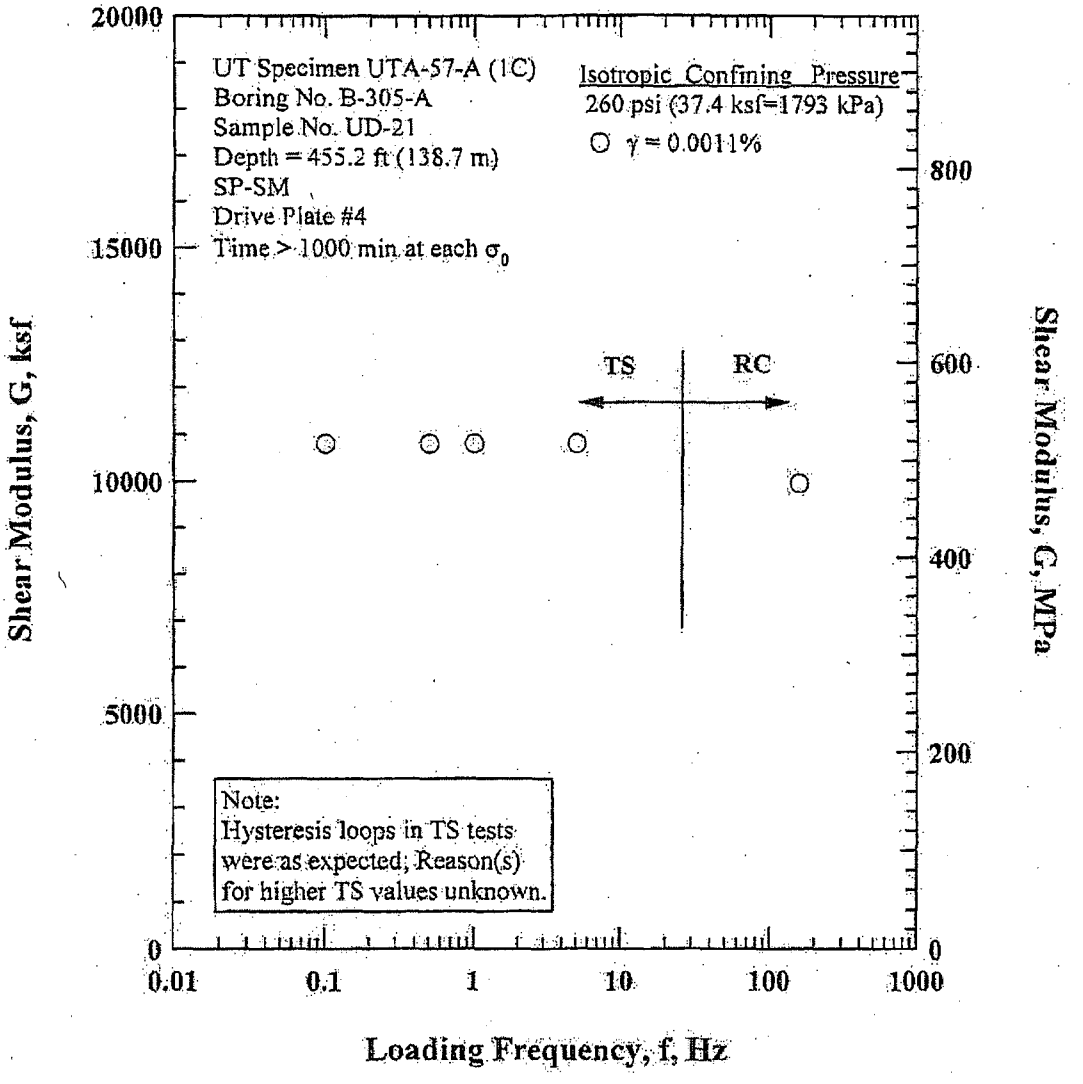


Figure A.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 260 psi (37.4 ksf=1793 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-A (1C)

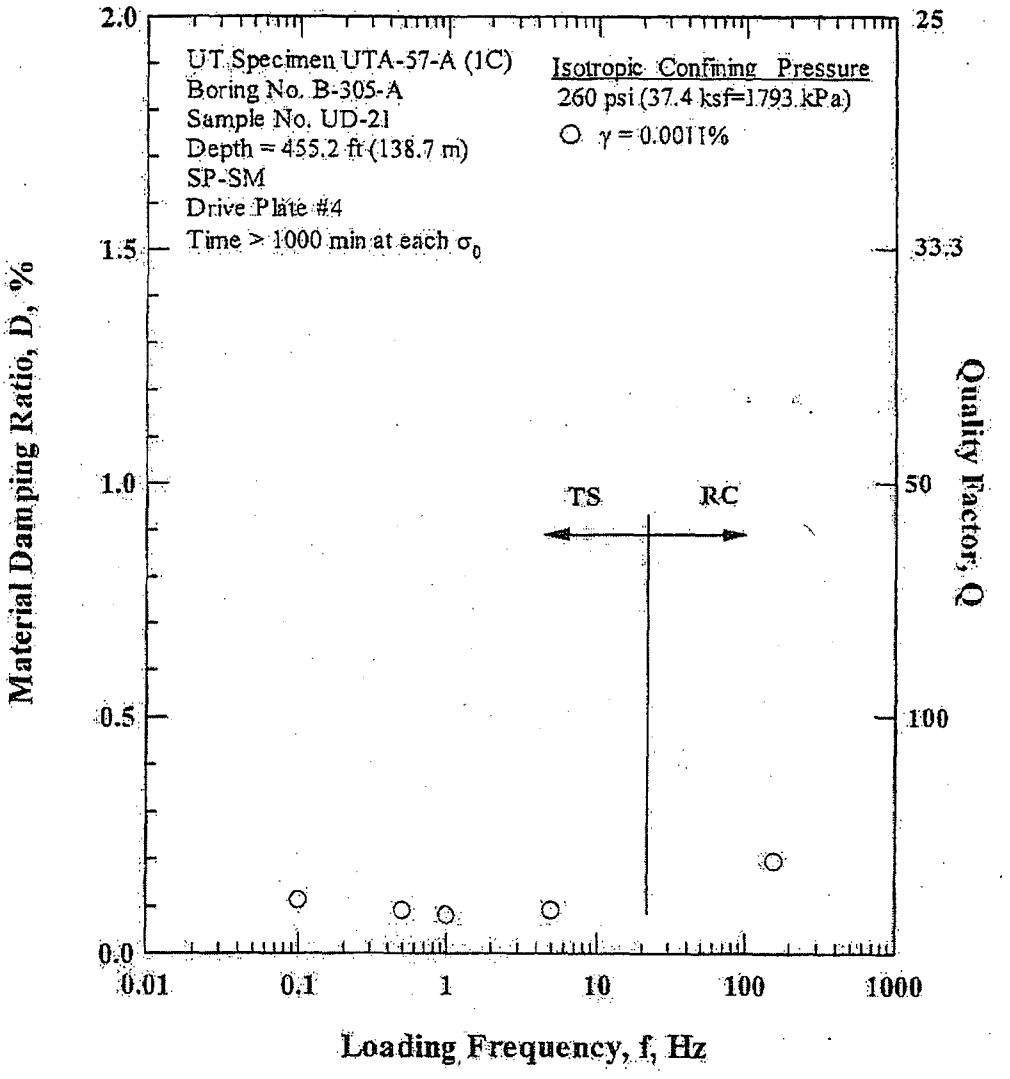


Figure A.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure 260 psi (37.4 ksf=1793 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-A (1C)

Table A.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen UTA-57-A (1C)

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
16	2304	110	2289	109.6	755	0.31	0.516
32	4608	221	3282	157.1	903	0.25	0.514
65	9360	448	4683	224.2	1078	0.19	0.510
130	18720	896	6539	313.1	1273	0.16	0.506
260	37440	1793	9934	475.6	1566	0.16	0.494

Table A.2 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen UTA-57-A (1C); Isotropic Confining Pressure, σ_o=130 psi (18.7 ksf=896 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio×, D, %
1.38E-04	6537	1.00	1.37E-04	0.18
2.68E-04	6538	1.00	2.66E-04	0.16
5.26E-04	6538	1.00	5.22E-04	0.16
1.01E-03	6538	1.00	1.00E-03	0.16
2.02E-03	6488	0.99	2.00E-03	0.19
3.81E-03	6487	0.99	3.76E-03	0.21
6.50E-03	6436	0.98	6.39E-03	0.26
1.13E-02	6336	0.97	1.10E-02	0.36
1.86E-02	6236	0.95	1.80E-02	0.49
2.91E-02	5941	0.91	2.78E-02	0.74
4.58E-02	5652	0.86	4.27E-02	1.15
6.71E-02	5375	0.82	6.05E-02	1.70
1.00E-01	5014	0.77	8.66E-02	2.43
1.34E-01	4756	0.73	1.10E-01	3.40

+ Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

× Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table A.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen UTA-57-A (1C); Isotropic Confining Pressure, σ_o=130 psi (18.7 ksf=896 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
4.82E-04	8220	1.00	0.12	4.81E-04	8250	1.00	0.12
9.65E-04	8220	1.00	0.09	9.64E-04	8220	1.00	0.10
1.46E-03	8160	0.99	0.11	1.46E-03	8160	0.99	0.14

Table A.4 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen UTA-57-A (1C); Isotropic Confining Pressure, σ_o=260 psi (37.4 ksf=1793 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average* Shearing Strain, %	Material Damping Ratio*, D, %
9.34E-05	9939	1.00	9.53E-05	0.17
1.90E-04	9940	1.00	1.94E-04	0.16
3.78E-04	9943	1.00	3.77E-04	0.16
7.38E-04	9941	1.00	7.31E-04	0.16
1.45E-03	9941	1.00	1.43E-03	0.21
2.78E-03	9878	0.99	2.76E-03	0.09
4.87E-03	9879	0.99	4.80E-03	0.24
9.46E-03	9754	0.98	9.31E-03	0.25
1.65E-02	9628	0.97	1.60E-02	0.47
2.61E-02	9381	0.94	2.53E-02	0.53
4.25E-02	9138	0.92	4.07E-02	0.71
6.46E-02	8778	0.88	6.07E-02	1.00
9.70E-02	8079	0.81	8.81E-02	1.59
1.31E-01	7521	0.76	1.15E-01	2.18

* Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

* Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table A.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen UTA-57-A (1C); Isotropic Confining Pressure, σ_o=260 psi (37.4 ksf=1793 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
5.44E-04	10900	1.01	0.13	5.40E-04	10800	1.00	0.11
1.09E-03	10800	1.00	0.09	1.09E-03	10800	1.00	0.09
2.19E-03	10800	1.00	0.10	2.19E-03	10800	1.00	0.10
3.30E-03	10800	1.00	0.16	3.30E-03	10800	1.00	0.15
4.75E-03	10800	1.00	0.19	4.72E-03	10800	1.00	0.19

APPENDIX B

UT Specimen UTA-57-B (2C)

Index Testing Not Performed
Visual Classification: SP-SM

Boring No. B-306
Sample No. UD-6
Depth = 104.7 ft (31.9 m)
Total Unit Weight = 120.6 lb/ft^3
Water Content = 19.3%
Estimated In-Situ K_o = 0.5
Estimated In-Situ Mean Effective
Stress = 32.2 psi

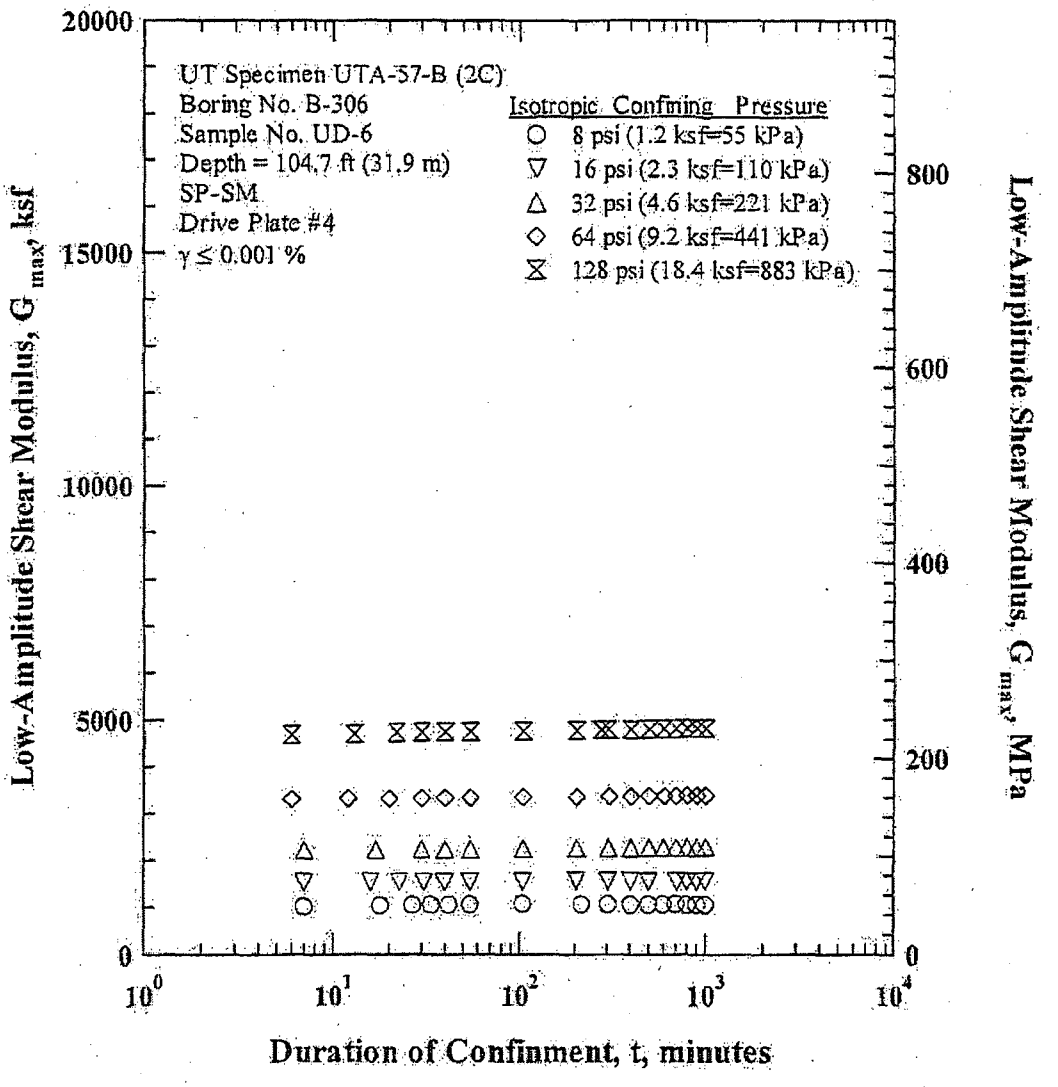


Figure B.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-B (2C)

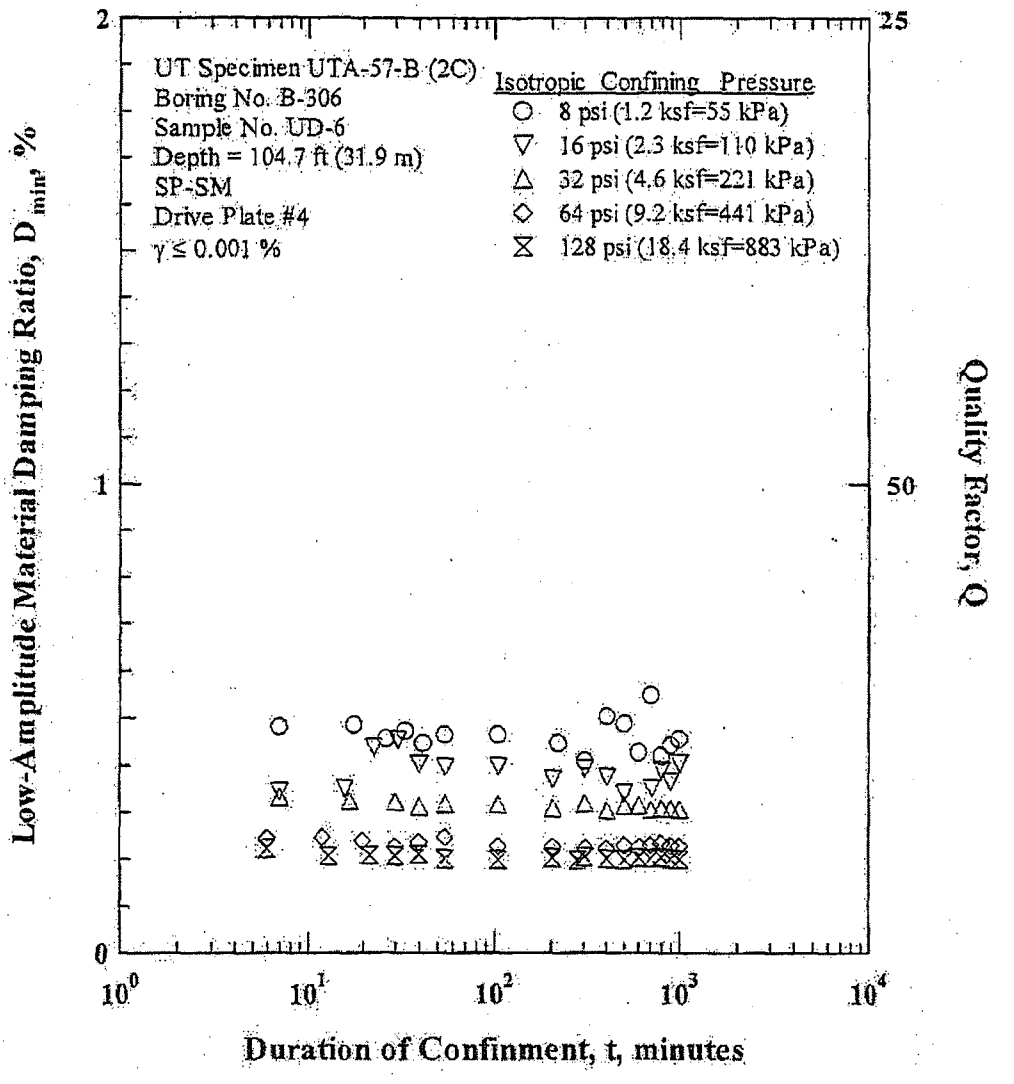


Figure B.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-B (2C)

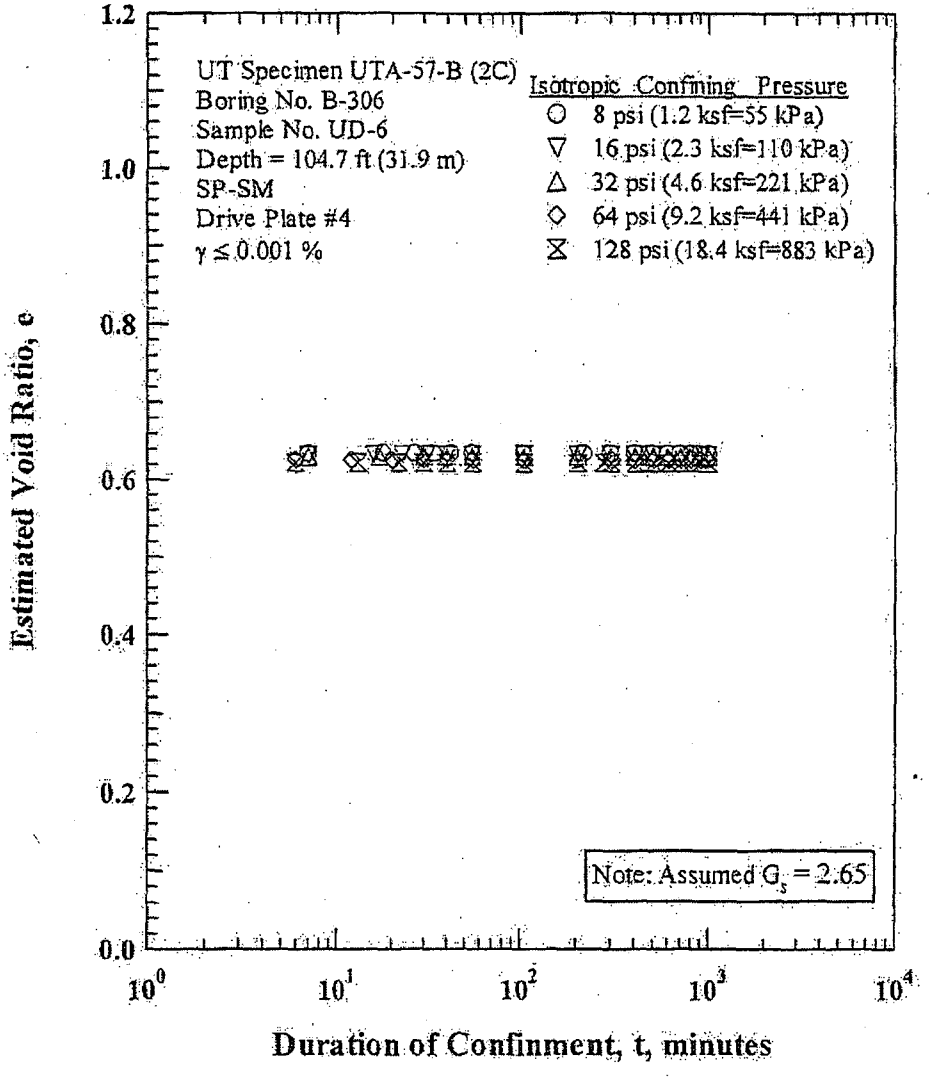


Figure B.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-B (2C)

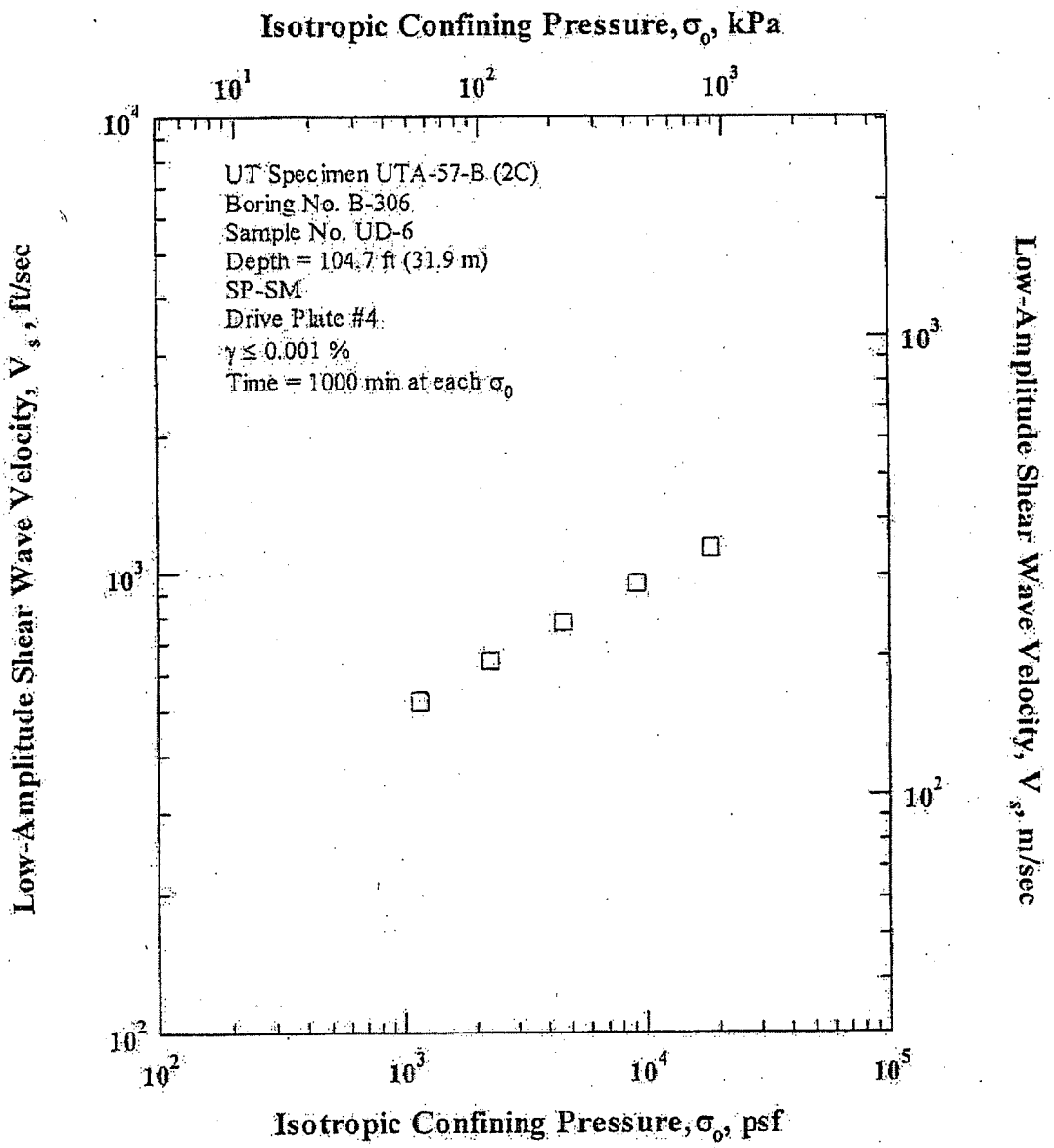


Figure B.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-B (2C)

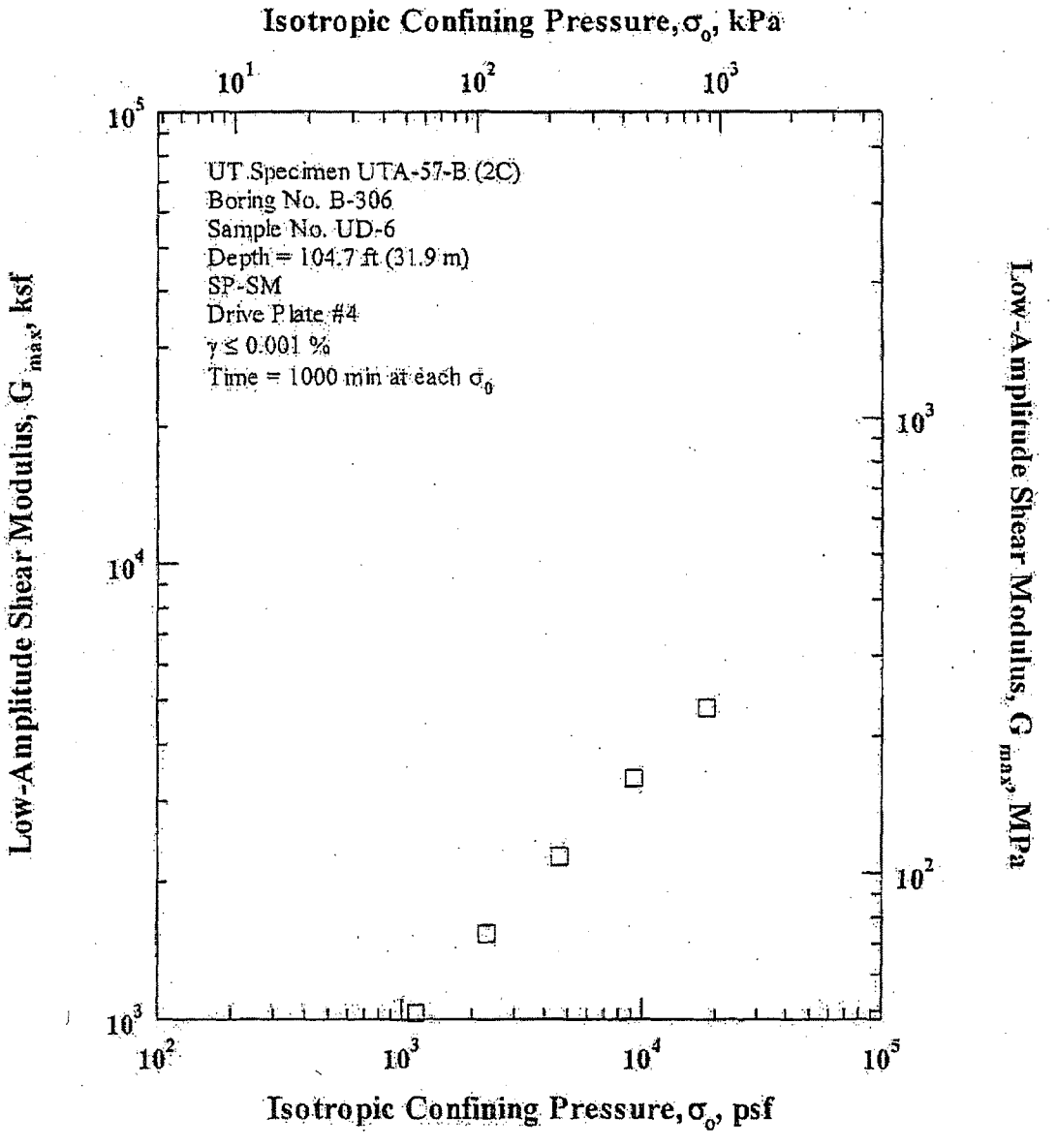


Figure B.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-B (2C)

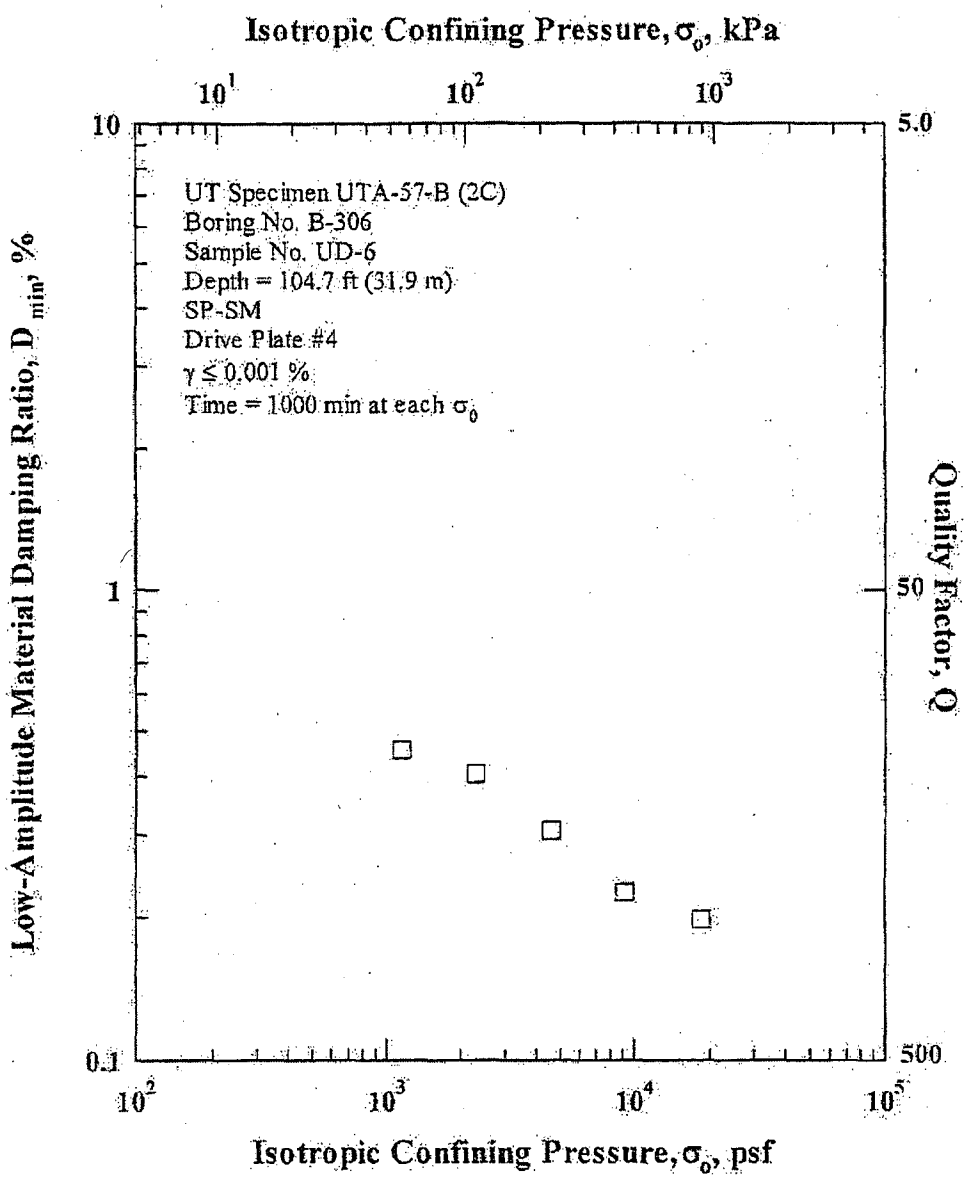


Figure B.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-B (2C)

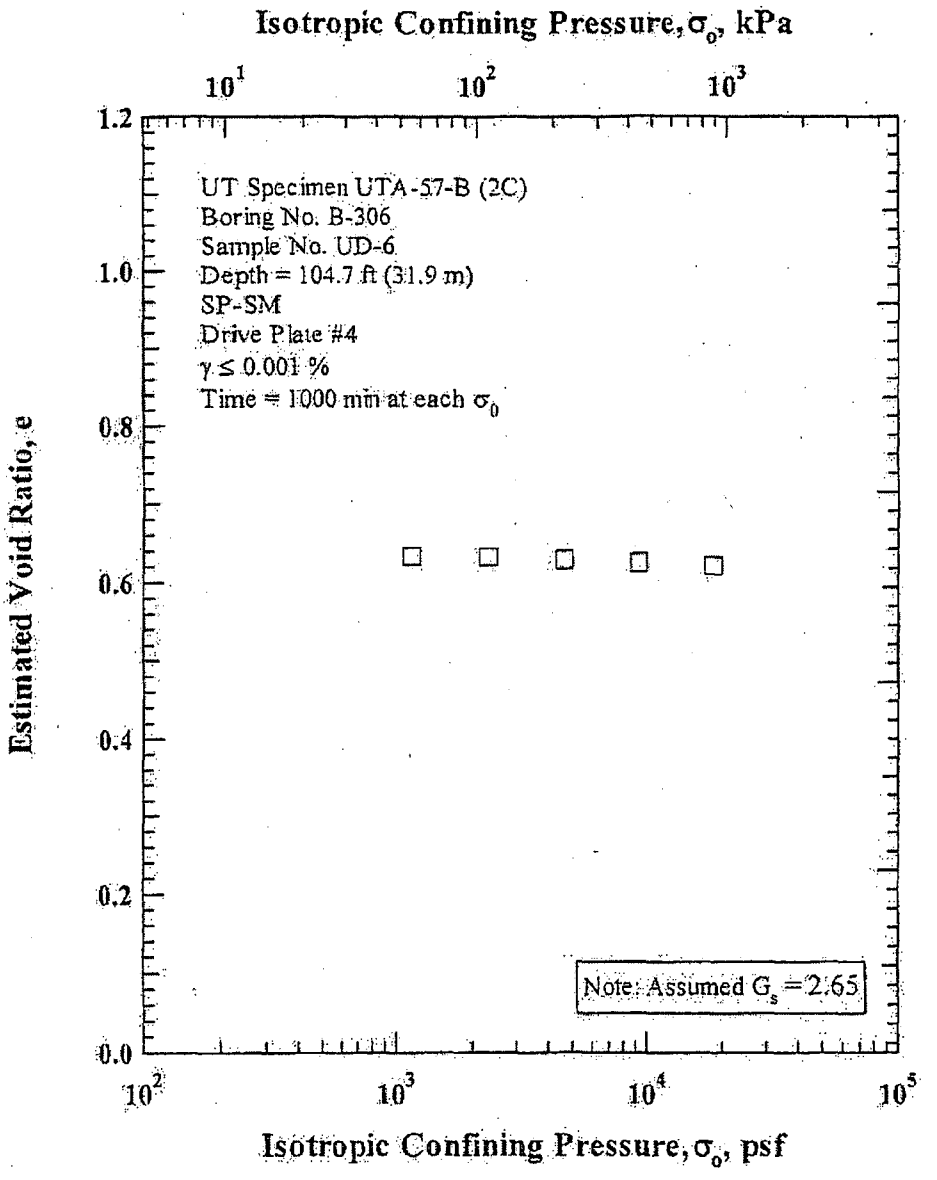


Figure B.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests of SP-SM Specimen UTA-57-B (2C)

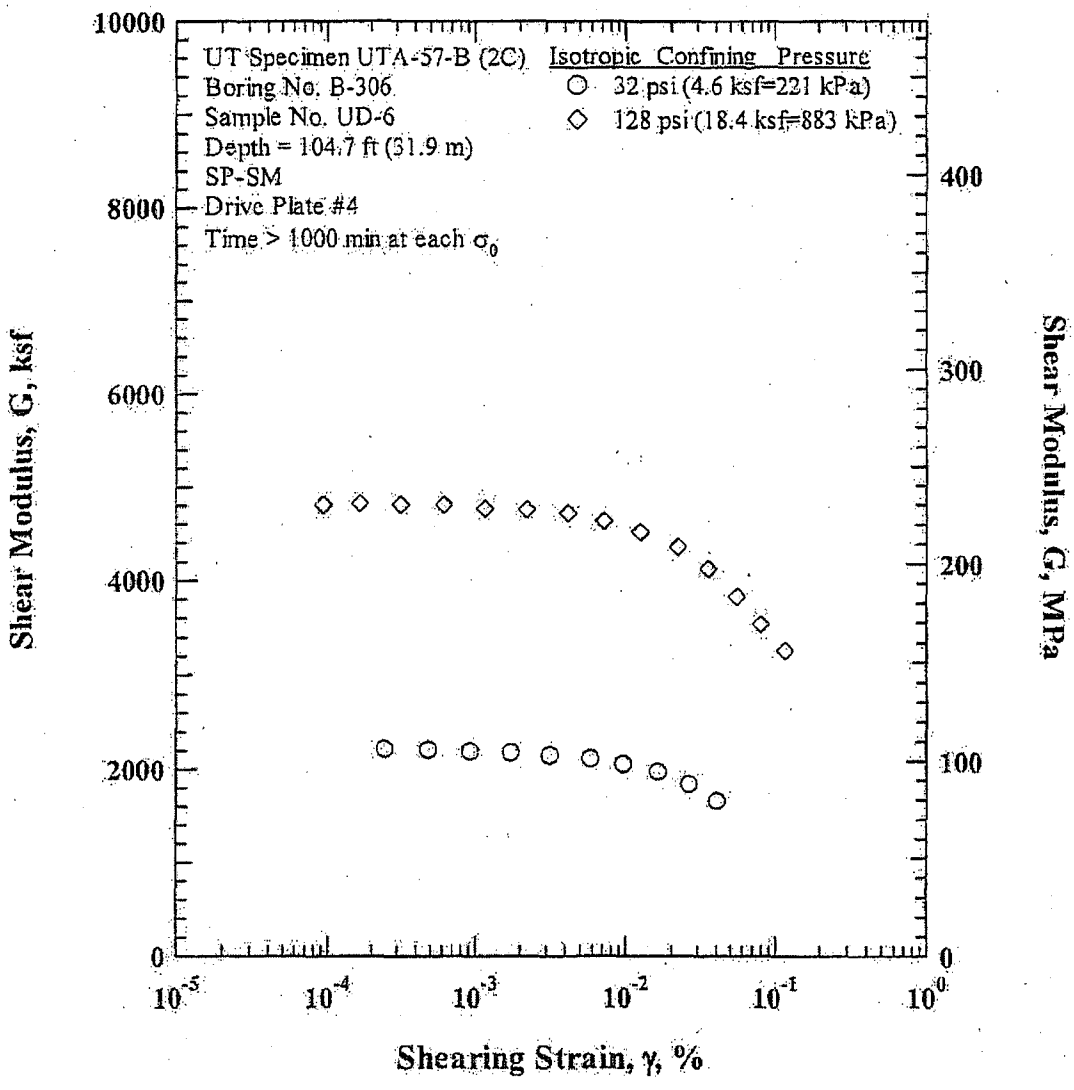


Figure B.8 Variation in Shear Modulus with Shearing Strain at Different Isotropic Confining Pressures from Resonant Column Tests of SP-SM Specimen UTA-57-B (2C)

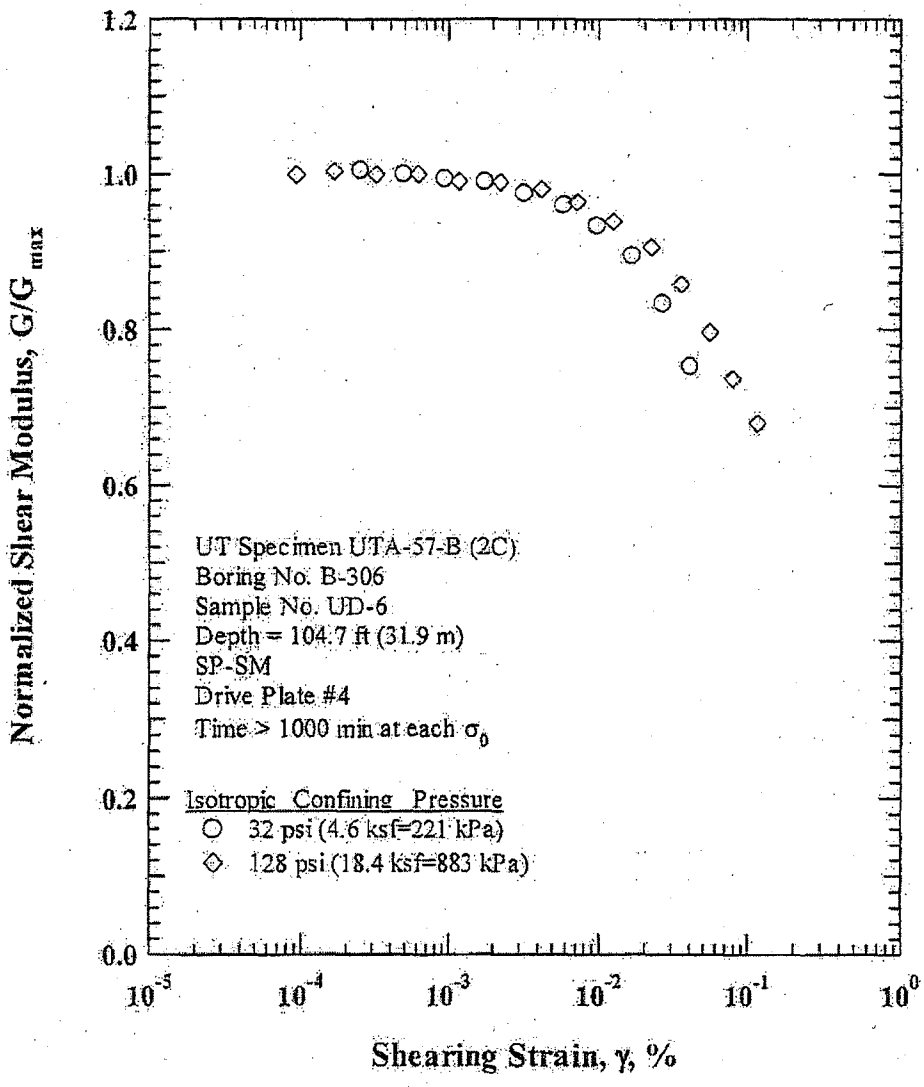


Figure B.9 Variation in Normalized Shear Modulus with Shearing Strain at Different Isotropic Confining Pressures from Resonant Column Tests of SP-SM Specimen UTA-57-B (2C)

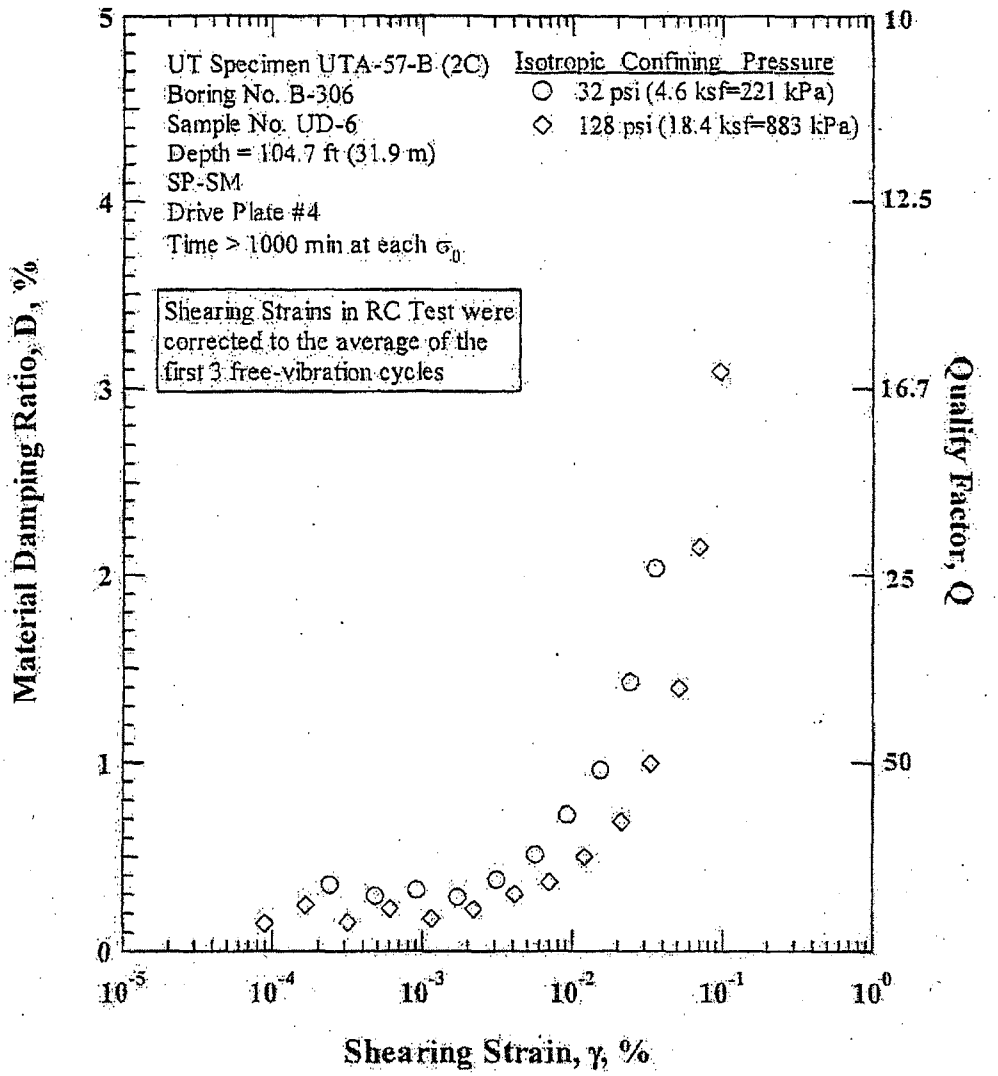


Figure B.10 Variation in Material Damping Ratio with Shearing Strain at Different Isotropic Confining Pressures from Resonant Column Tests of SP-SM Specimen UTA-57-B (2C)

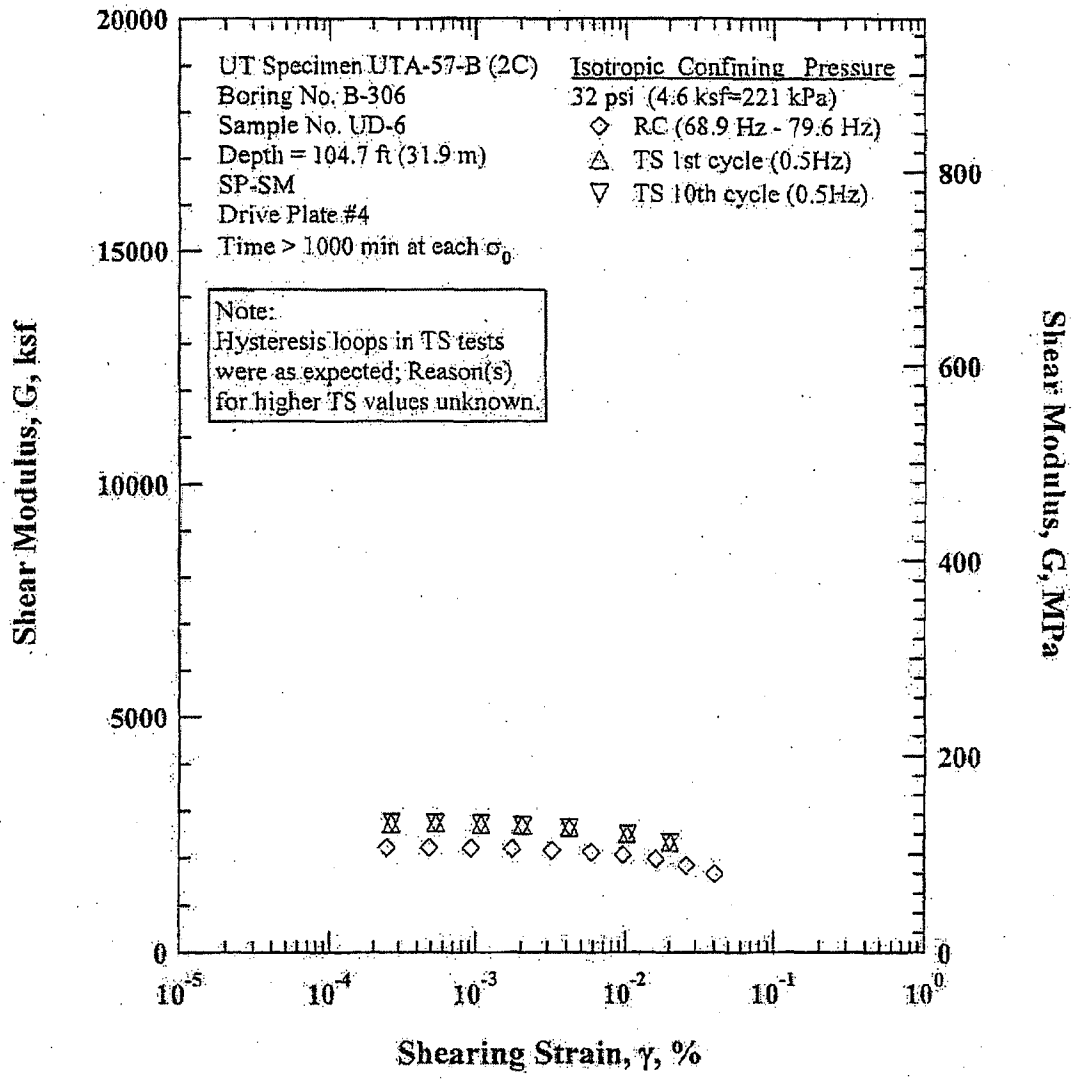


Figure B.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 32 psi (4.6 ksf=221 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-B (2C)

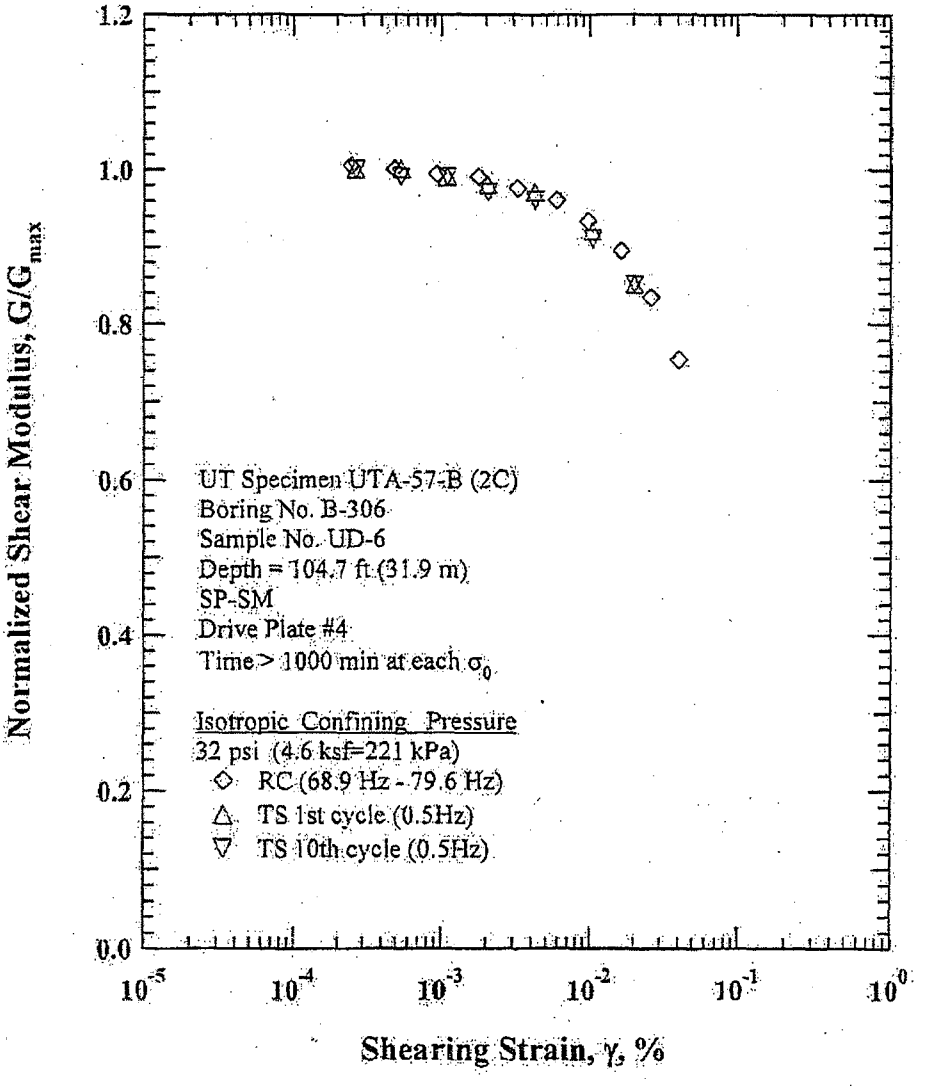


Figure B.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 32 psi (4.6 ksf=221 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-B (2C)

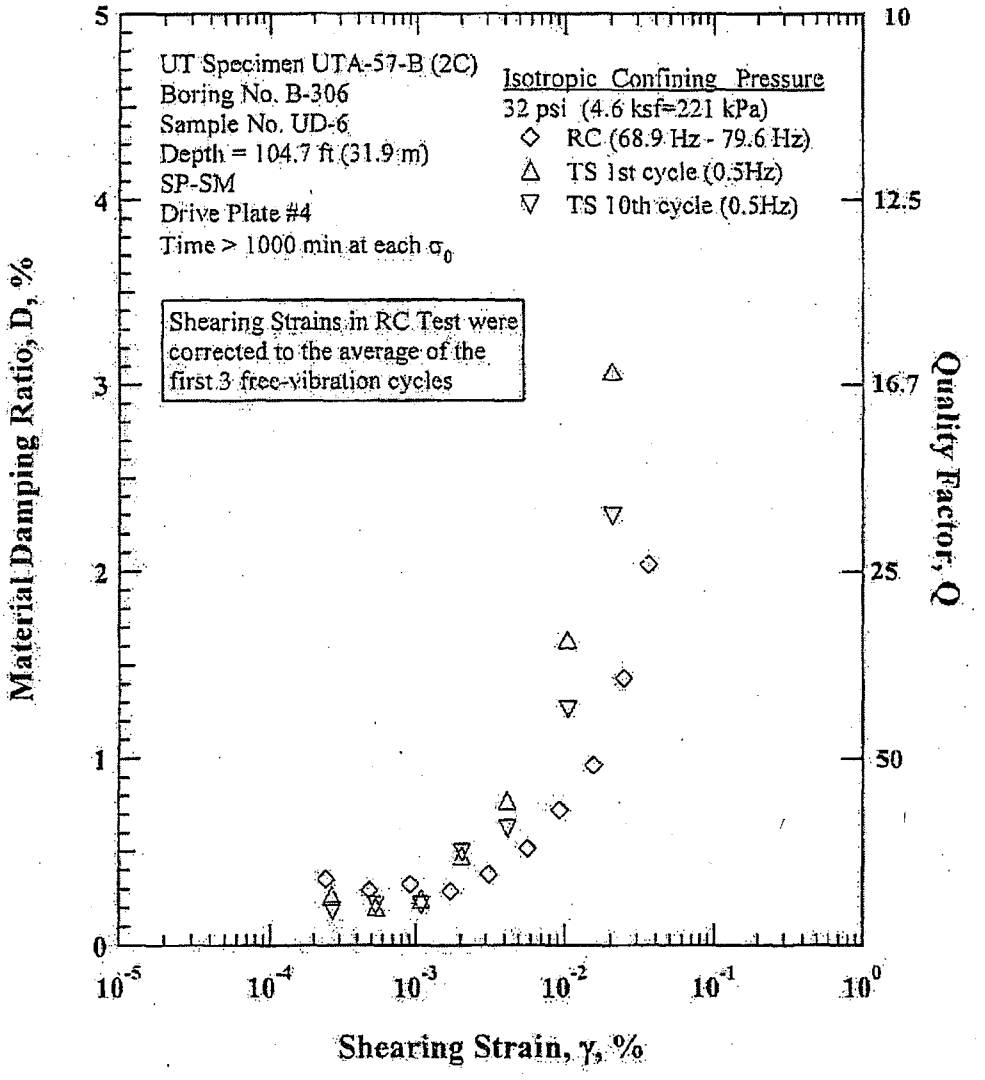


Figure B.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 32 psi (4.6 ksf=221 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-B (2C)

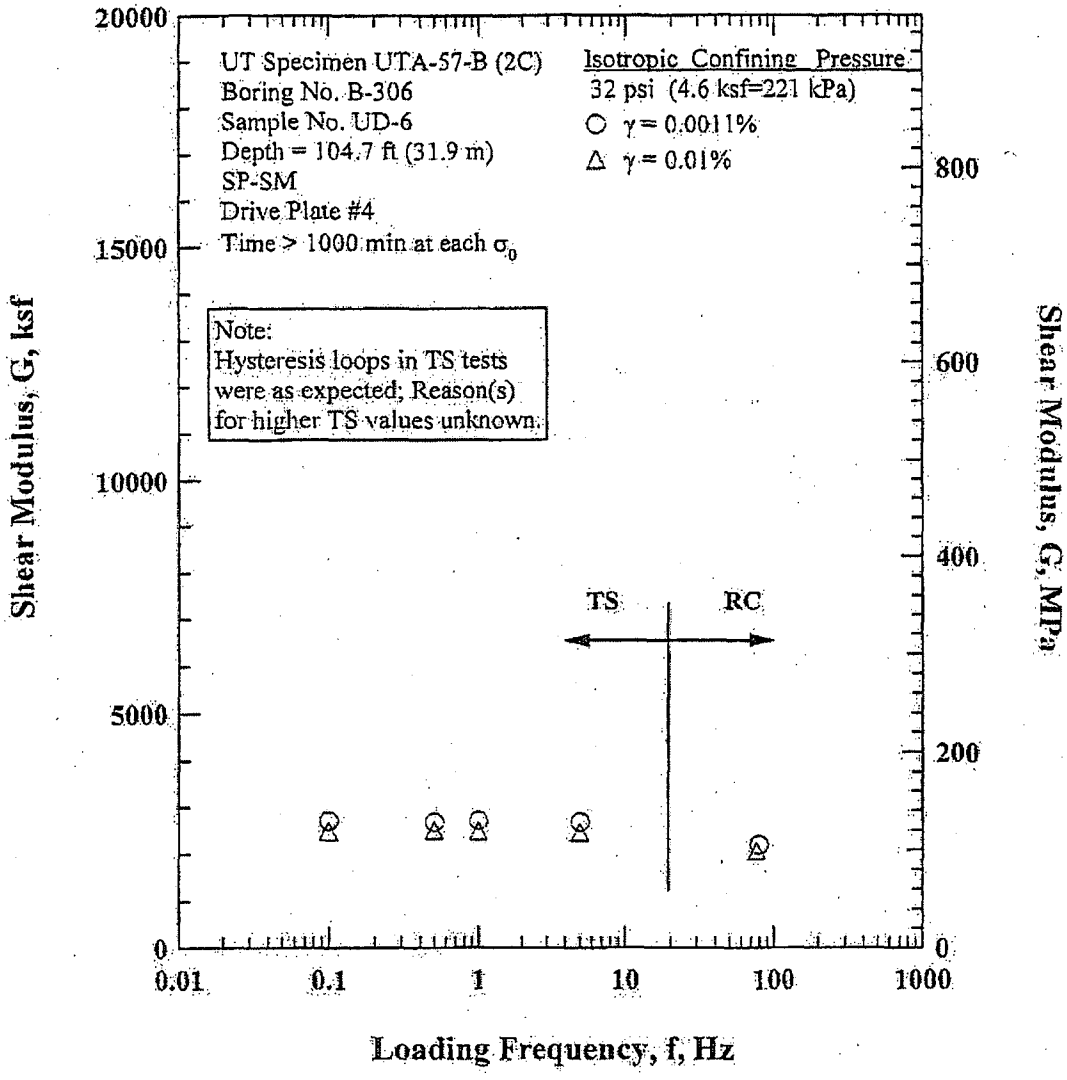


Figure B.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 32 psi (4.6 ksf=221 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-B (2C)

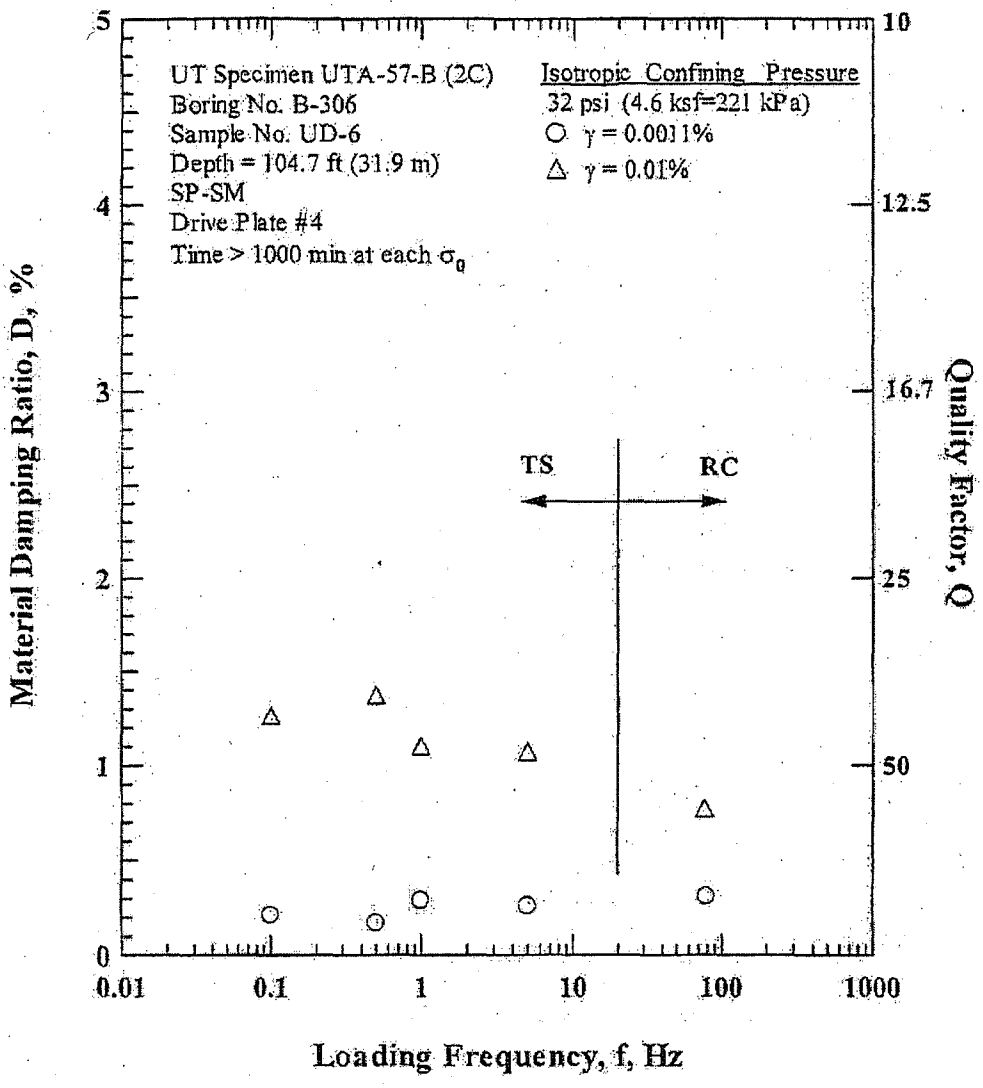


Figure B.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure 32 psi (4.6 ksf=221 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-B (2C)

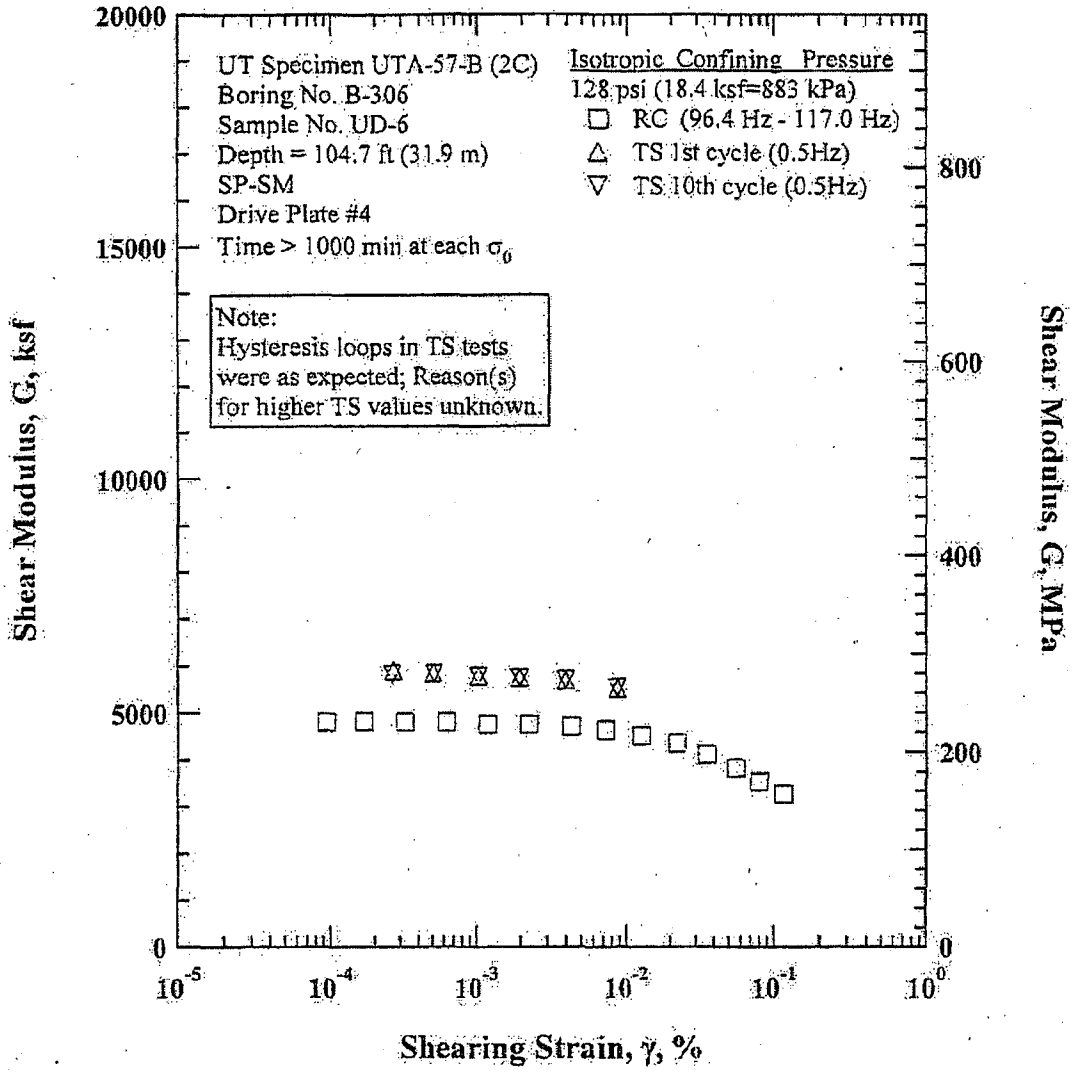


Figure B.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 128 psi (18.4 ksf=883 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-B (2C)

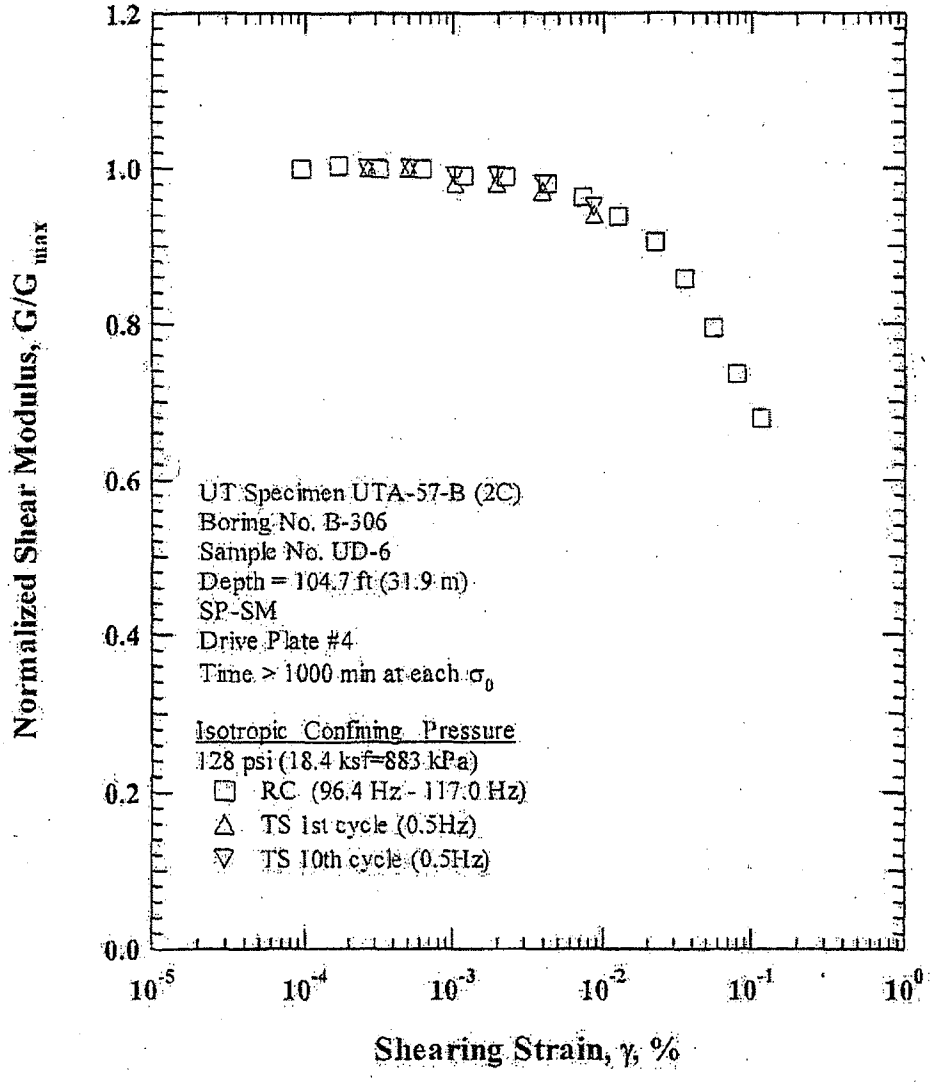


Figure B.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 128 psi (18.4 ksf=883 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-B (2C)

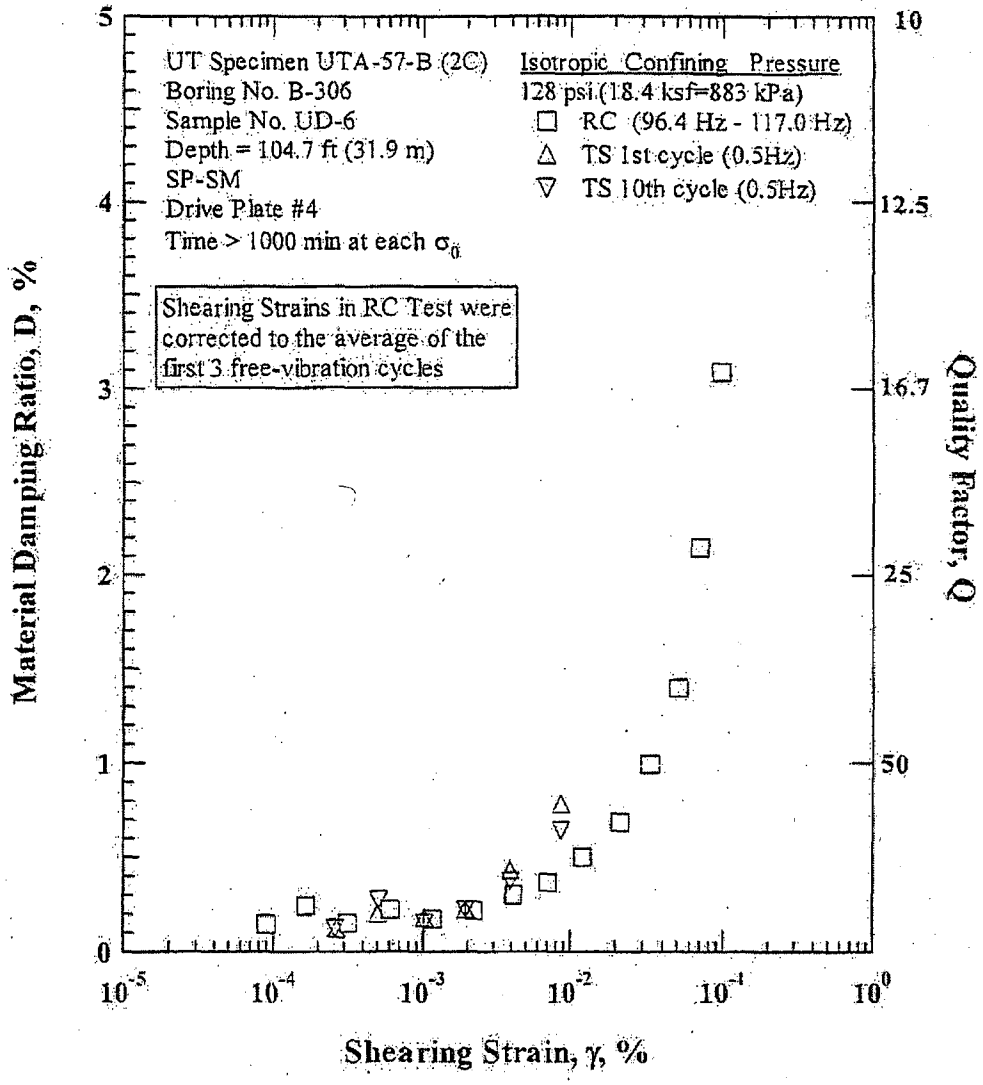


Figure B.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 128 psi (18.4 ksf=883 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-B (2C)

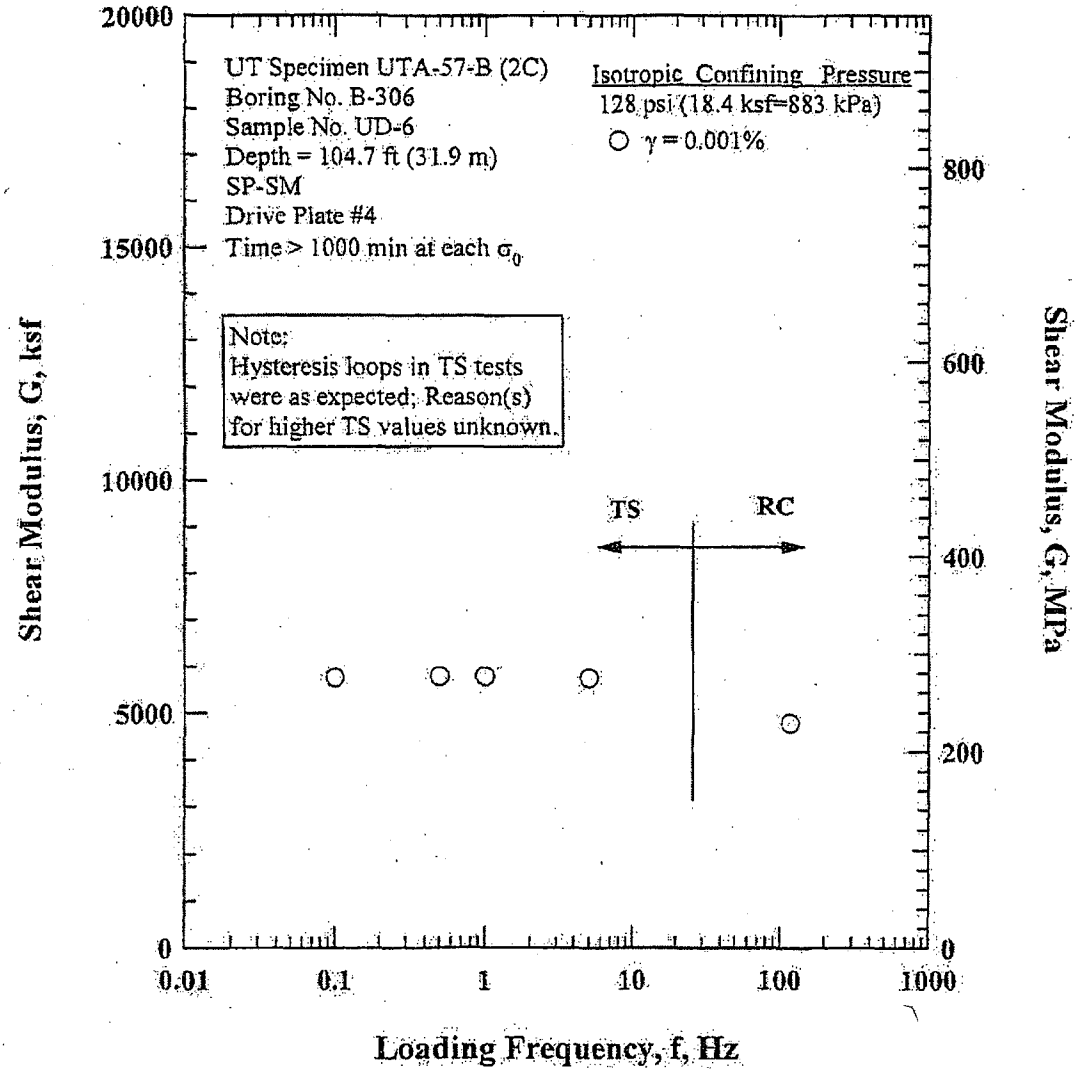


Figure B.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 128 psi (18.4 ksf=883 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-B (2C)

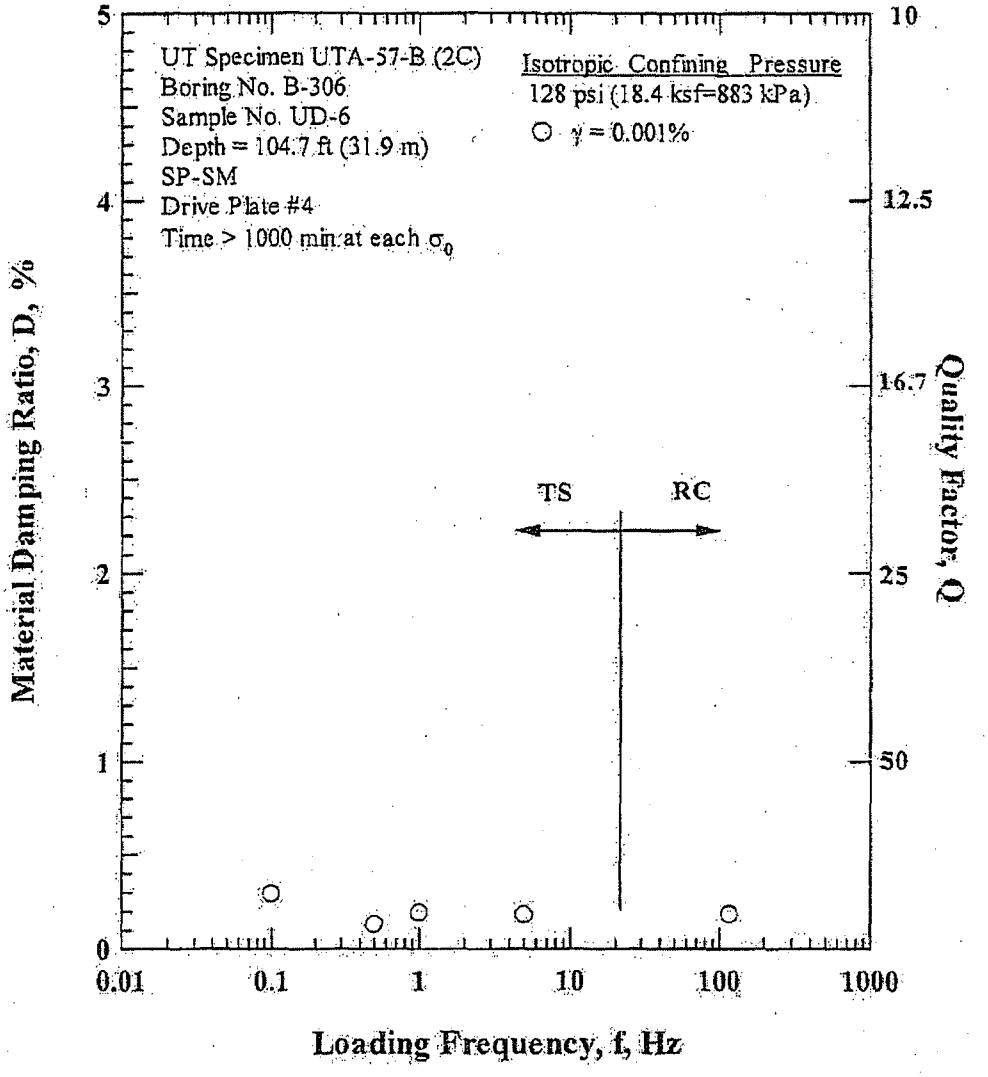


Figure B.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure 128 psi (18.4 ksf=883 kPa) from Combined RCTS Tests of SP-SM Specimen UTA-57-B (2C)

Table B.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen UTA-57-B (2C).

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio,e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
8	1152	55	1030	49.3	524	0.45	0.633
16	2304	110	1537	73.6	640	0.40	0.632
32	4608	221	2268	108.6	777	0.31	0.629
64	9216	441	3368	161.2	946	0.23	0.625
128	18432	883	4813	230.4	1130	0.20	0.621

Table B.2 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen UTA-57-B (2C); Isotropic Confining Pressure, σ_o =32 psi (4.6 ksf=221 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
2.49E-04	2212	1.01	2.44E-04	0.35
4.89E-04	2201	1.00	4.87E-04	0.29
9.37E-04	2188	0.99	9.23E-04	0.32
1.76E-03	2177	0.99	1.73E-03	0.28
3.23E-03	2144	0.97	3.15E-03	0.37
5.93E-03	2111	0.96	5.74E-03	0.51
9.74E-03	2052	0.93	9.32E-03	0.72
1.64E-02	1968	0.89	1.55E-02	0.96
2.65E-02	1834	0.83	2.43E-02	1.42
4.07E-02	1656	0.75	3.60E-02	2.03

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table B.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen UTA-57-B (2C); Isotropic Confining Pressure, σ_o =32 psi (4.6 ksf=221 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Smin, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
2.67E-04	2720	1.00	0.26	2.71E-04	2740	1.00	0.18
5.41E-04	2730	1.00	0.20	5.39E-04	2720	0.99	0.21
1.09E-03	2700	0.99	0.24	1.09E-03	2710	0.99	0.21
2.04E-03	2680	0.98	0.47	2.06E-03	2670	0.97	0.49
4.20E-03	2630	0.97	0.77	4.21E-03	2620	0.96	0.62
1.04E-02	2500	0.92	1.63	1.05E-02	2490	0.91	1.26
2.05E-02	2320	0.85	3.07	2.05E-02	2320	0.85	2.29

Table B.4 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen UTA-57-B (2C); Isotropic Confining Pressure, σ_o=128 psi (18.4 ksf=883 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average Shearing Strain, %	Material Damping Ratio[x], D, %
9.41E-05	4803	1.00	9.06E-05	0.15
1.68E-04	4820	1.00	1.67E-04	0.24
3.21E-04	4804	1.00	3.19E-04	0.15
6.22E-04	4801	1.00	6.13E-04	0.22
1.17E-03	4760	0.99	1.16E-03	0.17
2.24E-03	4752	0.99	2.21E-03	0.22
4.23E-03	4711	0.98	4.15E-03	0.30
7.23E-03	4630	0.96	7.07E-03	0.36
1.25E-02	4511	0.94	1.21E-02	0.50
2.22E-02	4352	0.91	2.13E-02	0.69
3.54E-02	4122	0.86	3.33E-02	0.99
5.53E-02	3823	0.80	5.08E-02	1.40
7.99E-02	3536	0.74	7.02E-02	2.15
1.16E-01	3262	0.68	9.68E-02	3.09

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table B.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen UTA-57-B (2C); Isotropic Confining Pressure, σ_o=128 psi (18.4 ksf=883 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
2.69E-04	5880	1.00	0.12	2.64E-04	5810	1.00	0.12
5.07E-04	5840	1.00	0.20	5.13E-04	5830	1.00	0.27
1.03E-03	5770	0.98	0.18	1.03E-03	5770	0.99	0.15
1.96E-03	5740	0.98	0.22	1.96E-03	5730	0.99	0.22
3.95E-03	5680	0.97	0.43	3.95E-03	5690	0.98	0.37
8.68E-03	5510	0.94	0.78	8.67E-03	5520	0.95	0.64