SHRP-P-619

Soil Moisture Proficiency Sample Program

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Contents

Abstract

This report describes the development of the Long-Term Pavement Performance (LTPP) soil sample selection process based on the American Association of State Highway Transportation Officials (AASHTO) model. Lab results present the bias in determining moisture content in cohesive soil and base course aggregate samples.

SUMMARY OF RESEARCH

FINAL RESEARCH REPORT
on the
SHRP SOIL MOISTURE PROFICIENCY SAMPLE PROGRAM

One element of Quality Assurance (QA) for laboratory testing that was deemed to be of key importance by SHRP, as a result of Expert Task Group (ETG) recommendations, is the American Association of State Highway and Transportation Officials (AASHTO) accreditation program (AAP) for laboratories. All laboratories providing long term pavement performance (LTPP) testing services were required to be accredited by AAP. Most of the laboratory tests on LTPP field samples were addressed by the AAP, which includes on site inspections of equipment and procedures, and participation in applicable proficiency sample series. However, a few critical tests in the SHRP LTPP studies were not fully addressed. After extensive consultation and careful study, it was determined that supplemental programs should be designed to provide assurance of quality test data in a manner similar to that provided by AAP for other tests.

The Soil Moisture Proficiency Sample Program was one of the supplemental programs approved for implementation. The program was designed to provide precision and bias data concerning standard tests for moisture content of subgrade soils and base course aggregates.

The soil moisture program was modeled after the familiar AASHTO Materials Reference Laboratory (AMRL) proficiency sample programs at the National Institute of Standards and Technology (NIST). The moisture samples were prepared and distributed to participants, the raw test data was collected and collated, and a report documenting the program was issued for SHRP by the AMRL.

Two different cohesive soils were supplied for the program by the Maryland Department of Transportation's Materials Laboratory. These soils were from the same sources that were used in the Type II Soil Proficiency Sample Program. Soil classification data is contained in appendix I.

Two different base course aggregates were supplied for the program by the University of Nevada-Reno. The aggregates were from the same sources that were used in the Type I Proficiency Sample Program. It is also noted that these materials were obtained from SHRP reference material sources, Watsonville Granite at Monterey, California and Kaiser at Pleasonton, California. Classification data for the materials used is contained in appendix I.

AMRL thoroughly blended, then split each of the four primary materials into two approximately equal parts, one part to eventually provide material for dry samples and the other part to eventually provide material for wet samples. Each of these 8 parts was then split again into two approximately equal portions designated as split A and split B. Each of the 16 splits(8 A and 8 B) was then split to yield 64 test samples. 8 of the sets of 64 samples were finally processed for distribution in an air dried condition and the other 8 sets were processed for distribution in a wet condition. Finally, 20 groups of 3 test samples each were randomly selected from each of the 16 sets of 64 test samples and identified for shipment to each participating laboratory. Every participant received a total of 48 test samples (16 groups of 3 test samples each).

All samples were selected and identified in accordance with statistically acceptable random procedures. The entire experiment was designed in consultation with SHRP statisticians to allow a complete components of variance analysis to be conducted as resources allowed.

Instructions to the participants (appendix II, page 7) provided directions concerning test sequencing, identification and procedure to follow (AASHTO T265).

Raw test data was returned to AMRL for collation and incorporation into the AMRL report (appendix II). The report was forwarded to the SHRP Quality Assurance Engineer when all data had been received. It was then transmitted to the SHRP Statistician for analysis and determination of test precision and bias.

The Statistician's report (appendix V) provides a full explanation of the data analysis along with complete information derived therefrom.

Precision statements (appendix VII) were drafted in the standard AASHTO\ASTM format for use by standards writing committees as they deem appropriate.

The appendices to this report contain the complete set of supporting documents for this program as listed in the table of contents.

Seventeen (17) laboratories participated in this experiment. Each participant has made a substantial contribution to the successful completion of SHRP research in the LTPP program.

The participants are listed in Appendix II, page 11.

APPENDIX I

E

SHA-73.0-32
REVISED 3-75

MATERIALS AND RESEARCH
Laboratory Worksheet

COMBINED HYDROMETER, SIEVE ANALYSIS AND TEST DATA SHEET

IDENTIFICATION

LOG NO.: HO- 7289 CONTRACT: HO- 292- 202- 771 FIELD CLASS: A^5 & R.F.
LOCATION - STA. 672+50 150' RT. 1B SURV. DEPTH: 0.5 TO
EST. MOIST.: A OPT. MOIST. DATE: 6-5-90 CUT ☑ FILL ☐ NC/NF ☐
OPERATOR LTD DATE 6-20-90 CHECKED BY N.S DATE 6/29/9-

TEST DATA

CLASSIFICATION : MSMT A-4-7 * AASHO A-C(3) EST. C.B.R. VALUE 6
LIQUID LIMIT ☐ : 32 SHRINKAGE LIMIT: 18 SHRINKAGE ☐ FACTOR } 95% T-180 ____ 98% T-99 ____
PLASTICITY INDEX: 11 SHRINKAGE RATIO: 1.72
MOISTURE DENSITY RELATIONS } ☑ T-180 C MAX. DEN. = ____ pcf OPT. MOIST. = ____ %
☐ T-99 ____ MAX. DEN. = ____ pcf OPT. MOIST. = ____ %

GRADATION (PERCENT PASSING by WEIGHT)

2½"		½"	99	#40	71
2"		⅜"		#60	63
1½"		#4	94	#100	55
1"	100	#10	87	#200	47
¾"	99	#30		#270	

PERCENT OF SOIL MORTAR

*COARSE SAND: (2.0-0.42mm)	18	46
‡FINE SAND: (0.42-0.075mm)	28	
SILT: (0.075-0.005mm)		23
▲CLAY: (0.005-0.001mm)		31
COLLOIDS: (0.001mm Minus)		

MOISTURE AT ____ ( )= ____ %( ); MOISTURE AT ____ ( )= ____ %( )
☐ ORGANIC TEST: ____ %, ☐ P.H. ____, ☐ OTHER TESTS SP.GR = 2.67
☐ COLOR ____ ☐ C.B.R. ____ %, ( ), ☐ VOL. CHANGE ____ %
REMARKS: * TR. RF SOIL STABILIZATION ATTN. B. KOCHEN
* AND MICA

☑ 24 Hr. Bath ☐ MSMT ☐ #40 Wash ☐ #200 Wash ☐ No Bath Required

MECHANICAL ANALYSIS DATA

CALCULATIONS

HYGRO
(Wa) 23.12
(Ws)- 22.86
(Ww) .26 x 100 ÷ Ws = 1.1 % HYGRO

TEST SAMPLE
Wa x 100 ÷ (% HYGRO + 100) = Ws
Wa = 55.19 Ws = 54.59

BATH

SEDIMENTATION START	MIN.	TEMP °F	H	+	C	=	R	(R/Ws)X100 % CLAY▲	EST. MAX. GRAIN SIZE mm
									.005

*COARSE SAND
$P_P 10 - P_P 40 =$ 18

‡FINE SAND
$P_P 40 - P_P 200 =$ 28

FINE SIEVE ANALYSIS

WHERE: $P_P = \frac{W_P}{W_S} \times 100$ P_P 10=100

SIEVE	Ws = 54.59	P_P	×	S/100	= % TOTAL SAMPLE PASS.	MAX. GRAIN SIZE mm
#30	Wi — ; Wp=	‡				0.60
#40	Wi — 9.81 ; Wp= 44.78	82.03 ‡ 82		.87	71	0.425
#60	Wi — 5.53 ; Wp= 39.25	71.86 ‡ 72		.87	63	0.250
#100	Wi — 4.81 ; Wp= 34.42	63.05 ‡ 63		.87	55	0.150
#200	Wi — 5.09 ; Wp= 29.33	53.73 ‡ 54		.87	47	0.075
#270	Wi — ; Wp=	‡				0.053

NOMENCLATURE

WHERE:
- W_a = Air Dry (gm)
- W_s = Oven Dry (gm)
- W_w = Water Wt. (gm)
- H = Hydrometer Reading
- C = Temp. Correction Factor
- R = Corrected Hydrom. Reading
- P_R = % Samp. Retained on Sieve
- P_P = % Sample Passing Sieve
- W_i = Wt. Retained on Sieve (gm)
- S = % Total Sample Passing #10 Sieve
- W_P = Wt. Passing Sieve (gm)

F

LOG. NO. *HO - 7287*

24 HOUR HYDROMETER ANALYSIS

FORMULA

$P = \frac{Ra}{W_s} \times 100$

$d = d_1 \times K_L \times K_G \times K_n$

WHERE:

- P = % Soil in Suspension
- R = Corrected Hydrometer Reading
- a = Constant - Depending on Specific Gravity
- W_s = Oven Dry Weight of Test Sample
- H = Hydrometer Reading, Uncorrected.
- C = Correction Factor for Temperature
- S = % Total Sample Passing #10 Sieve
- S_1 = % Total Sample Passing

WHERE:

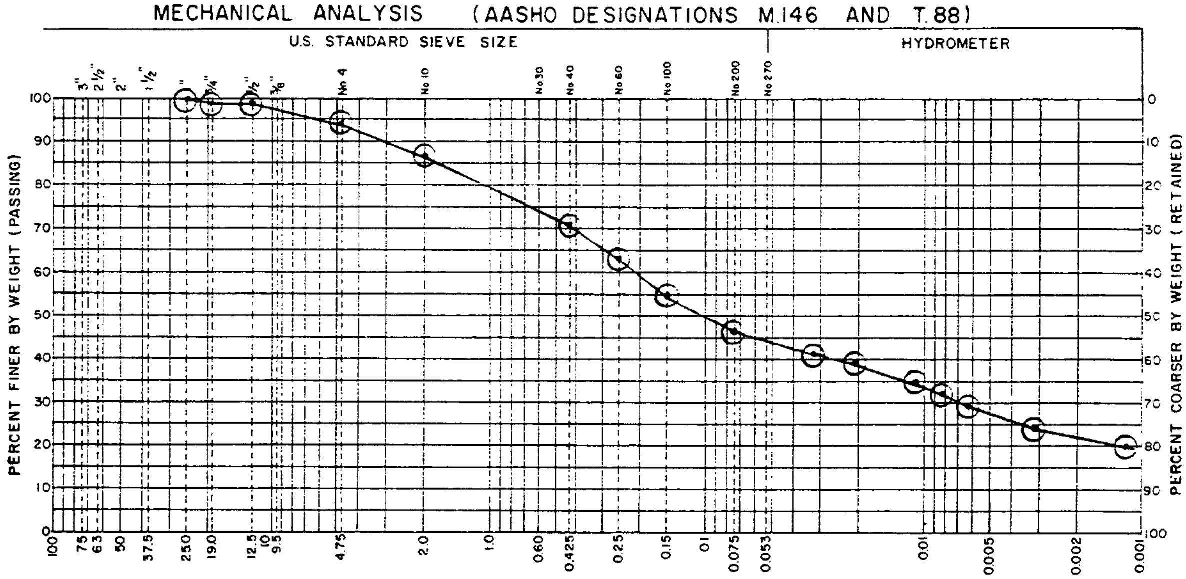
- d = Corrected Grain Diameter
- d_1 = Max. Grain Dia. Under Assumed Conditions
- K_L = Correction for Elevation of Hydrometer (H)
- K_G = Correction for Variation of Specific Gravity
- K_n = Correction for Variation of Viscosity of Suspending Medium.

CALCULATIONS

a = *0.996* W_s = *54.59* % Total Sample Passing #10 (S) *87* Sp. Gr. *2.67*

TEMP. °F	(H +	C =	R) x	$\frac{100a}{W_s}$ =	P x	$S/100 = S_1$	OBS. TIME	T MIN.	d_1 x	K_L x	K_G x	K_n =	d
		-						30 sec.	.081				
		-						1	.057				
76	31.5	-5.2	26.3	1.823	47.9	42		2	.040	.831	.0380		.032
76	30.0	-5.2	24.8		45.2	39		5	.026	.840	.0247		.021
		-											
75	27.5	-5.4	22.1		40.3	35		15	.015	.855	.0144		.012
75	26.0	-5.4	20.6		37.6	33		30	.010	.864	.0096		.0083
75	24.0	-5.4	18.6		33.9	29		60	.0074	.876	.0071		.0062
74	21.0	-5.6	15.4		28.1	24		250	.0036	.894	.0035		.0031
		-											
74	18.0	-5.6	12.4	1.823	22.6	20		1440	.0015	.910	.0014		.0013

MECHANICAL ANALYSIS (AASHO DESIGNATIONS M.146 AND T.88)



GRAVEL			SAND		SILT	CLAY
COARSE	MEDIUM	FINE	COARSE	FINE		

% SOIL MORTAR = READING FROM CURVE ÷ S/100

REMARKS: *0.005 = 27.4 ÷ .87 ≈ 31*

SHA-73.0-32
REVISED 3-75

MATERIALS AND RESEARCH
Laboratory Worksheet

COMBINED HYDROMETER, SIEVE ANALYSIS AND TEST DATA SHEET

IDENTIFICATION

LOG NO.: ______ CONTRACT: MTS # 47 FIELD CLASS: ______
LOCATION - STA. ______ DEPTH: ______
EST. MOIST.: ______ OPT. MOIST. DATE: ______ CUT ☐ FILL ☐ NC/NF ☐
OPERATOR LTD DATE 3-14-90 CHECKED BY EJo DATE 3-21-90

TEST DATA

CLASSIFICATION : MSMT A-5 AASHO A-5(8) EST. C.B.R. VALUE 1
LIQUID LIMIT ☐ : 56 SHRINKAGE LIMIT: 32 SHRINKAGE ☐ FACTOR } 95% T-180 ______ 98% T-99 ______
PLASTICITY INDEX: 11 SHRINKAGE RATIO: 1.38
MOISTURE DENSITY RELATIONS } ☑ T-180 C MAX. DEN. = 81.5 pcf OPT. MOIST. = 31.8 %
☐ T-99 ______ MAX. DEN. = ______ pcf OPT. MOIST. = ______ %

GRADATION (PERCENT PASSING by WEIGHT)

Sieve	%	Sieve	%	Sieve	%
2½"		½"		#40	91
2"		⅜"		#60	83
1½"		#4		#100	75
1"		#10	100	#200	62
¾"		#30		#270	

PERCENT OF SOIL MORTAR

*COARSE SAND: (2.0-0.42mm)	9	38
‡FINE SAND: (0.42-0.075mm)	29	
SILT: (0.075-0.005mm)		45
▲CLAY: (0.005-0.001mm)		17
COLLOIDS: (0.001mm Minus)		

MOISTURE AT ______ ( )= ______ %( ); MOISTURE AT ______ ( )= ______ %( )
☐ ORGANIC TEST: ______ %, ☐ P.H. ______, ☐ OTHER TESTS SP. GR. 2.73
☐ COLOR ______ ☐ C.B.R. ______ %, ( ), ☐ VOL. CHANGE ______ %
REMARKS: ______

☑ 24 Hr. Bath ☐ MSMT ☐ #40 Wash ☐ #200 Wash ☐ No Bath Required

MECHANICAL ANALYSIS DATA

CALCULATIONS

HYGRO
(W_a) 26.39
(W_s) - 25.65
(W_w) .74 x 100 ÷ W_s = 2.9 % HYGRO

TEST SAMPLE
W_a x 100 ÷ (% HYGRO + 100) = W_s
W_a = 55.41 W_s = 53.85

BATH SEDIMENTATION START	MIN.	TEMP °F	H	+	C	=	R	(R/Ws)X100 % CLAY▲	EST. MAX. GRAIN SIZE mm
									.005

*COARSE SAND P_p10 - P_p40 = 9
‡FINE SAND P_p40 - P_p200 = 29

FINE SIEVE ANALYSIS
WHERE: $P_p = \frac{W_p}{W_s} \times 100$ P_p 10=100

SIEVE	Ws = 53.85	P_p	S/100	% TOTAL SAMPLE PASS.	MAX. GRAIN SIZE mm
#30	Wt / Wp= —	‡			0.60
#40	Wt / Wp= — 4.76 / 49.09	91.16 ‡ 91	1.0	91	0.425
#60	Wt / Wp= — 4.31 / 44.78	83.16 ‡ 83	1.0	83	0.250
#100	Wt / Wp= — 4.50 / 40.28	74.80 ‡ 75	1.0	75	0.150
#200	Wt / Wp= — 6.91 / 33.37	61.97 ‡ 62	1.0	62	0.075
#270	Wt / Wp= —	‡			0.053

NOMENCLATURE

WHERE:
- W_a = Air Dry (gm)
- W_s = Oven Dry (gm)
- W_w = Water Wt. (gm)
- H = Hydrometer Reading
- C = Temp. Correction Factor
- R = Corrected Hydrom. Reading
- P_R = % Samp. Retained on Sieve
- P_P = % Sample Passing Sieve
- W_t = Wt. Retained on Sieve (gm)
- S = % Total Sample Passing #10 Sieve
- W_P = Wt. Passing Sieve (gm)

LOG. NO. MTS # 47

24 HOUR HYDROMETER ANALYSIS

FORMULA

$P = \frac{Ra}{W_s} \times 100$

WHERE :

P = % Soil in Suspension
R = Corrected Hydrometer Reading
a = Constant - Depending on Specific Gravity
W_s = Oven Dry Weight of Test Sample
H = Hydrometer Reading, Uncorrected.
C = Correction Factor for Temperature
S = % Total Sample Passing #10 Sieve
S_1 = % Total Sample Passing

$d = d_1 \times K_L \times K_G \times K_n$

WHERE :

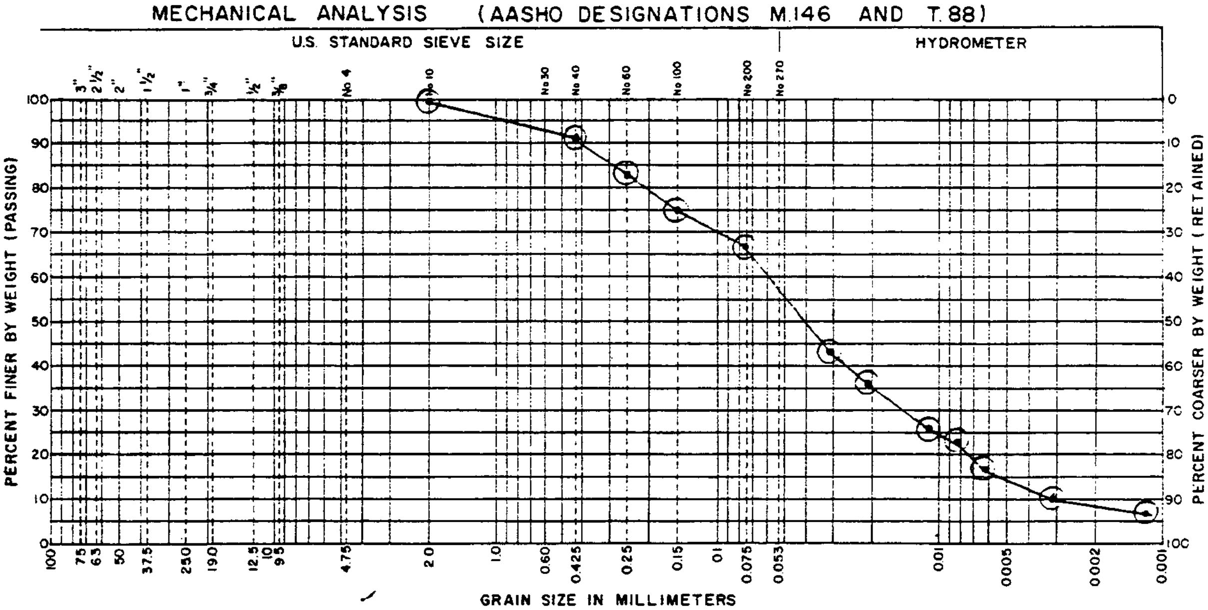
d = Corrected Grain Diameter
d_1 = Max. Grain Dia. Under Assumed Conditions
K_L = Correction for Elevation of Hydrometer (H)
K_G = Correction for Variation of Specific Gravity
K_n = Correction for Variation of Viscosity of Suspending Medium.

CALCULATIONS

a = 0.982 W_s = 53.85 % Total Sample Passing #10 (S) 100 Sp. Gr. 2.73

TEMP °F	(H	+ C =	R) x	$\frac{100a}{W_s}$ =	P x S/100 =	S_1	OBS. TIME	T MIN.	d_1 x	K_L x	K_G x	K_n =	d
		-						30 sec.	.081				
		-						1	.057				
79	28.0	- 4.5	23.5	1.824	42.9	43		2	.040	.852		.0364	.031
79	24.0	- 4.5	19.5		35.6	36		5	.026	.876		.0237	.021
		-											
79	19.0	- 4.5	14.5		26.4	26		15	.015	.905		.0137	.012
79	17.0	- 4.5	12.5		22.8	23		30	.010	.915		.0091	.0083
79	14.0	- 4.5	9.5		17.3	17		60	.0074	.930		.0067	.0062
80	10.0	- 4.3	5.7		10.4	10		250	.0036	.950		.0033	.0031
		-											
77	9.0	- 4.9	4.1	1.824	7.4	7		1440	.0015	.955		.0014	.0013

MECHANICAL ANALYSIS (AASHO DESIGNATIONS M.146 AND T.88)



GRAVEL			SAND		SILT	CLAY
COARSE	MEDIUM	FINE	COARSE	FINE		

% SOIL MORTAR = READING FROM CURVE ÷ S/100 REMARKS: 0.005 = 16.8 ÷ 1.0 ≈ 17

SHRP PROFICIENCY SAMPLES FOR RESILIENT MODULUS TESTING OF UNBOUNDED MATERIAL
(Gradation)

Sieve Size	Total % Passing
1.5"	100
1"	82
3/4"	73
1/2"	61
3/8"	52
#4	39
#8	27
#16	21
#30	15
#50	10
#100	8
#200	6

AASHTO Soil Classification	Unified Soil Classification
A-1-a	GW-GM

PLASTIC INDEX
np

Material Identification	Specific Gravity of Material Passing #4	Specific Gravity of Material Retained on #4
Watsonville	2.777	2.865
Pleasonton	2.713	2.748

APPENDIX II

SHRP Moisture Content Proficiency Sample Program

S.H.R.P. Moisture - Content Proficiency Sample Program

CONTENTS

Correspondence Document
The correspondance document that was mailed to the 17 laboratories participating in the S.H.R.P. Moisture Content Proficiency Sample Program, consists of an Instruction page, a copy of the Standard Test method, and a Data sheet to be used for recording test results.

* Although only 17 complete samples were distributed by AMRL, (17 laboratories participated in the Proficiency Sample Program) 20 complete samples were prepared, leaving 3 complete samples to serve as replacements in case of loss or damage during shipment. As a result, the following report reflects the in-house data recorded for 20 complete samples. (A **complete sample** is defined as 16 Sets of 3 sub-samples each, with one Set coming from each of the 16 Sample Types).

Section 1 - Master Identification Record

Laboratory Identification Sheet
This sheet identifies each laboratory participating in the program. Each laboratory was assigned a number which is used to identify and trace the laboratories data.

Test Sample Splitting Procedure
This document illustrates the process used to split the material from the Split A or Split B portion to yield 64 **sub-samples**. Each of the 4 **Primary materials** was blended and then split into 2 approximately equal portions. Each of these portions was then split to yield 2 portions, one half being identified as Split A, and the other half being identified as Split B. Each of the splits, (Split A or Split B) was then split to yield 64 sub-samples. Each laboratory was shipped 3 randomly selected sub-samples from the 64 sub-samples. (3 sub-samples constitute one Set for a particular material type.

Sample Type Identification Sheet
This document describes the attributes of each of the 16 different sample types. It also identifies the four **primary** materials that were used to in preparing the samples. Each laboratory was shipped one set, (3 sub-samples) from each of the 16 **Sample Types**.

Each **Sample Type** is described by the following criteria:

* Primary material type. (Aggregate 1 or Aggegate 2, Soil 1 or Soil 2)
* Which half of the split the sample originated from. (Split A or Split B)
* Moisture condition of the material. (Air dry, Plastic Limit or Saturated Surface Dry.

To approximate the plastic limit or saturated surface dry condition, the following moisture contents were added to the air dry samples:

* Aggregate 1 --> 2.00 ± .04% moisture.
* Aggregate 2 --> 3.00 ± .04% moisture.
* Soil 1 --> 15.00 ± .04% moisture.
* Soil 2 --> 25.00 ± .04% moisture.

Laboratory Sub-Sample Identification Sheet
These sheets identify the 3 randomly selected sub-samples that were assigned to each laboratory for a particular sample type. The sub-samples that each laboratory received are identified by sample type number and the letter a, b or c on the data sheets. The sheets also identify the proper set testing sequence for that set of 3 sub-samples. The numbers were assigned using the Lotus random number generator function.

Example: For Sample Type No. 1, Laboratory No. 1 was assigned sub-sample No.'s 12, 42 and 57. These 3 sub-samples are identified as Sample#'s 1a, 1b and 1c respectively. These 3 sub-samples were labeled Set #11, meaning that from the total group of 16 sets received by the laboratory, Sample Type No. 1 would be the eleventh set tested.

Laboratory Set Testing Sequence Table
This table shows the Set Testing Sequence for all of the laboratories. There is a column for each sample type and a row for each laboratory.

Section 2 - Master Data Record

Master Data Record
These are the data tables used to record the mass and the amount of moisture added to the sub-samples prepared by AMRL. These data sheets may be compared with the Returned Data Sheets shown in Section 3.

Section 3 - Returned Data Sheets

Returned Data Sheets
These data sheets were filled out by participating laboratories and returned to AMRL.

Returned Tare Weights
* Note that Laboratory No.'s 3, 7, 9, 10, 11, 13 and 19 did not comply with the request to record the tare weights of the bags on the back of the Data Sheet.

* When comparing the respective masses of the sub-samples on the Master Data Sheets with the masses of the sub-samples submitted from the laboratories on the Returned Data Sheets, it appears that some of the laboratories may not have used the entire sub-sample when testing for moisture content.

Errors in processing

Note 1: Laboratory No. 15 received two sets identified as Set #1. The Set containing Sub-Samples 9a, 9b and 9c was inadvertantly identified as Set #1 when it should have been Set #3. The situation was explained to the laboratory prior to testing and is considered resolved.

Note 2: Laboratory No. 11, Set 8, Sample 9b had an excessive amount of moisture added to the sample. This error is reflected in the laboratories returned data sheet.

Written and Conducted by:

Gregory V. Uherek, AMRL Research Associate
October, 1990

Correspondence Document

Date

Name of laboratory manager
Laboratory name and address

Subject: SHRP Moisture Content Proficiency Test Samples

Dear (insert name):

SHRP has engaged the AASHTO Materials Reference Laboratory to prepare and distribute proficiency test samples for moisture content determination. In connection with this effort, we are sending two boxes containing 16 sets of material to your laboratory. Each set of material is identified with a Set Number from 1 to 16 and contains three double-bagged test samples identified with a Sample Number. The two boxes you receive should contain forty-eight test samples (16 sets containing 3 samples each).

Please determine the moisture content of each sample in accordance with Section 5 of AASHTO T265-86. A copy of this standard is attached for your convenience. **Test each set individually and in numerical order according to the Set Number** (i.e. Begin testing with Set Number 1 and end testing with Set Number 16.). Do not open the bags containing a test sample until the test sample is ready to be tested. Opening the sample bags too soon may affect the moisture content of the samples.

Please use the enclosed data sheet to record your test results. (Additional copies of this letter, test method T265 and the data sheet have been included in each box of material being sent to your laboratory.) Set and Sample Numbers have been entered in the appropriate columns on the data sheet and are exclusive to your laboratory. Record all weights to the nearest 0.1 g and calculate and report the moisture content to the nearest 0.01%. After testing record the weight of the bag containing each sample and the applicable Set and Sample Number on the back of the data sheet.

Please test all samples as soon as possible, but no later than thirty days after receipt, and return a completed data sheet: Gregory Uherek, AASHTO Materials Reference Laboratory, Building 226, Room A365, Gaithersburg, Maryland 20899.

If you have any questions, or if the samples received are damaged or incomplete, please contact Greg Uherek at (301) 975-6704.

Sincerely,

Peter A. Spellerberg, Assistant Manager
AASHTO Materials Reference Laboratory

Enclosures

24

Standard Method of Test for

Laboratory Determination of Moisture Content of Soils

AASHTO DESIGNATION: T 265-86
(ASTM DESIGNATION: D 2216-71 (1980))

. SCOPE

1.1 This method covers the laboratory determination of the moisture content of soil.

1.2 The following applies to all specified limits in this standard: For the purposes of determining conformance with these specifications, an observed value or a calculated value shall be rounded off "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding-off method of AASHTO R-11, Recommended Practice For Indicating Which Places Of Figures Are To Be Considered Significant In Specified Limiting Values.

. DEFINITION

2.1 *Moisture or Water Content of a Soil*—The ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the solid particles. Practical application is to determine the weight of water removed by drying the moist soil to a constant weight in a drying oven controlled at 230 ± 9 F (110 ± 5 C) and to use this value as the weight of water in the given soil mass. The weight of soil remaining after over-drying is used as the weight of the solid particles.

. APPARATUS

3.1 *Drying Oven,* thermostatically-controlled, preferably of the forced-draft type, capable of being heated continuously at a temperature of 230 ± 9 F (110 ± 5 C).

3.2 *Balance* —The balance shall conform to the requirements of AASHTO M 231, for the class of general purpose balance required for the principal sample weight of the sample being prepared.

3.3 *Containers*—Suitable containers made of material resistant to corrosion and not subject to change in weight or disintegration on repeated heating and cooling. Containers shall have close-fitting lids to prevent loss of mositure from samples before initial weighing and to prevent absorption of moisture from the atmosphere following drying and before final weighing. One container is needed for each moisture content determination.

. TEST SAMPLE

4.1 Select a representative quantity of moist soil in the amount indicated in the method of test. If no amount is indicated, the minimum weight of the sample shall be in accordance with the following table:

Maximum Particle Size	Minimum Weight of Sample, g
No. 40 (0.425 mm) sieve	10
No. 4 (4.75 mm) sieve	100
½ in. (12.5 mm)	300
1 in. (25.0 mm)	500
2 in. (50 mm)	1000

5. PROCEDURE

5.1 Weigh a clean, dry container with its lid, and place the moisture content sample in the container. Replace the lid immediately, and weigh the container, including the lid and the moist sample. Remove the lid and place the container with the moist sample in the drying oven maintained at a temperature of 230 ± 9 F (110 ± 5 C) and dry to a constant weight (Notes 1 and 2). Immediately upon removal from the oven, place the lid and allow the sample to cool to room temperature. Weigh the container including the lid and the dried sample (Notes 3 and 4).

NOTE 1—Checking every moisture content sample to determine that it is dried to a constant weight is impractical. In most cases, drying of a moisture content sample overnight (15 or 16 h) is sufficient. In cases where there is doubt concerning the adequacy of overnight drying, drying should be continued until the weights after two successive periods of drying indicate no change in weight. Samples of sand may often be dried to constant weight in a period of several hours. Since dry soil may absorb moisture from wet samples, dried samples should be removed before placing wet samples in the oven.

NOTE 2—Oven-drying at 230 ± 9 F (110 ± 5 C) does not result in reliable moisture content values for soil containing gypsum or other minerals having loosely bound water of hydration or for soil containing significant amounts of organic material. Reliable moisture content values for these soils can be obtained by drying in an oven at approximately 140 F (60 C), or by vacuum desiccation at a pressure of approximately 10 mm Hg and at a temperature not lower than 73 F (23 C).

NOTE 3—A container without a lid may be used provided the moist sample is weighed immediately after being taken and providing the dried sample is weighed immediately after being removed from the oven or after cooling in a desiccator.

NOTE 4—Moisture content samples should be discarded and should not be used in any other tests.

6. CALCULATION

6.1 Calculate the moisture content of the soil as follows:

$$w = [(\text{weight of moisture})/(\text{weight of oven-dry soil})] \times 100 = ([W_1 - W_2]/(W_2 - W_c)] \times 100$$

where:

w = moisture content, %
W_1 = weight of container and moist soil, g,
W_2 = weight of container and oven-dried soil, g, and
W_c = weight of container, g.

6.2 Calculate the percent of moisture content to the nearest 0.1 percent.

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Laboratory Name   Laboratory No. _____

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	5a	_____	_____	_____	9	10a	_____	_____	_____
	5b	_____	_____	_____		10b	_____	_____	_____
	5c	_____	_____	_____		10c	_____	_____	_____
2	3a	_____	_____	_____	10	6a	_____	_____	_____
	3b	_____	_____	_____		6b	_____	_____	_____
	3c	_____	_____	_____		6c	_____	_____	_____
3	12a	_____	_____	_____	11	1a	_____	_____	_____
	12b	_____	_____	_____		1b	_____	_____	_____
	12c	_____	_____	_____		1c	_____	_____	_____
4	13a	_____	_____	_____	12	8a	_____	_____	_____
	13b	_____	_____	_____		8b	_____	_____	_____
	13c	_____	_____	_____		8c	_____	_____	_____
5	4a	_____	_____	_____	13	2a	_____	_____	_____
	4b	_____	_____	_____		2a	_____	_____	_____
	4c	_____	_____	_____		2c	_____	_____	_____
6	15a	_____	_____	_____	14	16a	_____	_____	_____
	15b	_____	_____	_____		16b	_____	_____	_____
	15c	_____	_____	_____		16c	_____	_____	_____
7	14a	_____	_____	_____	15	11a	_____	_____	_____
	14b	_____	_____	_____		11b	_____	_____	_____
	14c	_____	_____	_____		11c	_____	_____	_____
8	9a	_____	_____	_____	16	7a	_____	_____	_____
	9b	_____	_____	_____		7b	_____	_____	_____
	9c	_____	_____	_____		7c	_____	_____	_____

Each set of three samples is to be tested **individually** and in **numerical** order according to the **set number.**
Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: ____________________   Checked and Approved, Date: ____________________

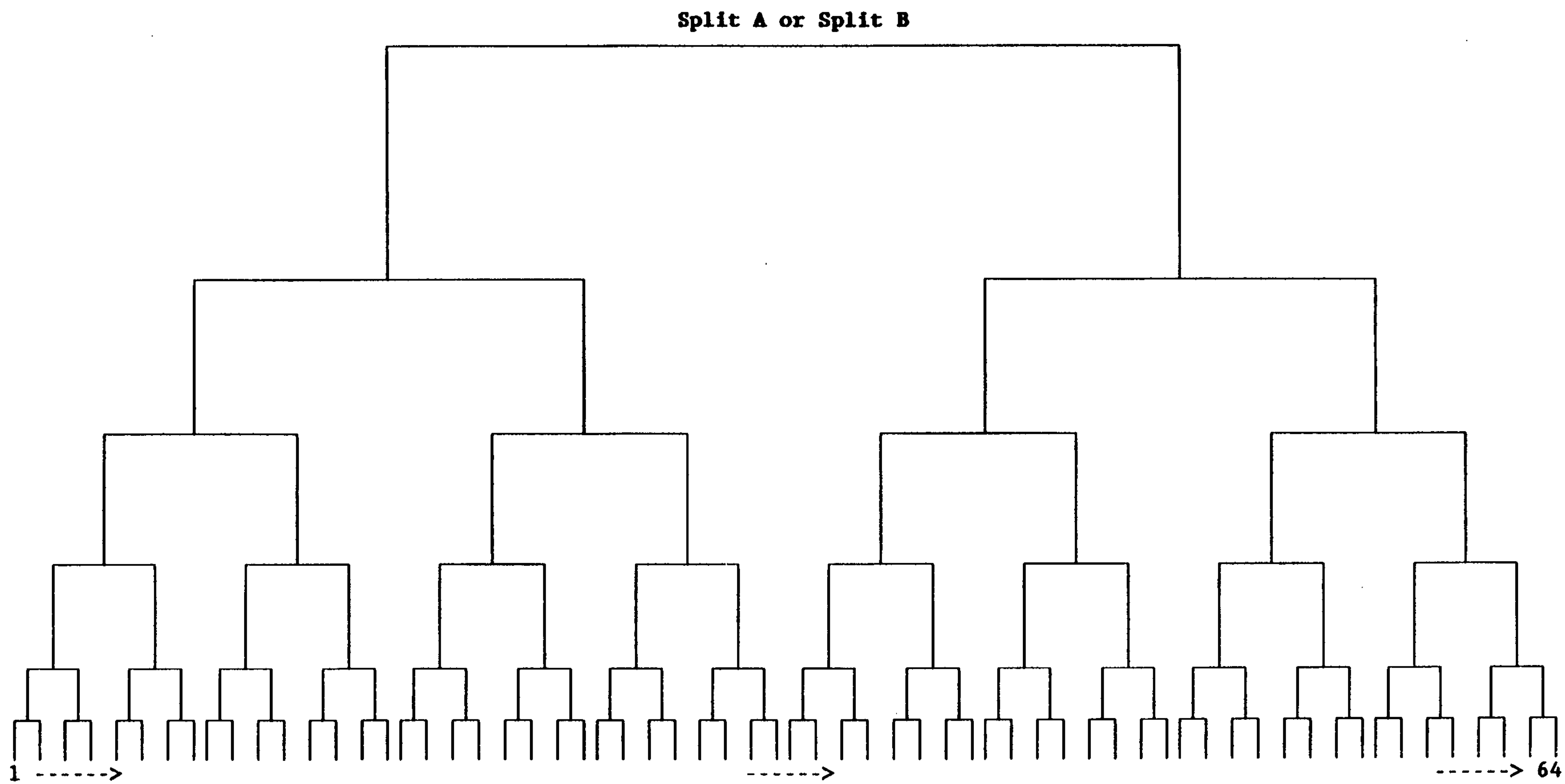
Section 1

Master Identification Record

S.H.R.P. MOISTURE CONTENT PROFICIENCY SAMPLE PROGRAM
Participating Laboratories

Braun Engineering Testing, Inc. Minneapolis, Minnesota 55435
California Department of Transportation Sacramento, California 95819
Federal Highway Administration Denver, Colorado 80225
Florida Department of Transportation Gainesville, Florida 32602
Iowa Department of Transportation Ames, Iowa 50010
Kansas Department of Transportation Topeka, Kansas 66611
Law Engineering Atlanta, Georgia 30324
Maryland State Highway Administration Brooklandville, Maryland 21022
Minnesota Department of Transportation Maplewood, Minnesota 55109
Nevada Department of Transportation Carson City, Nevada 89712
Oregon State Highway Division Salem, Oregon 97310
PSI Pittsburgh, Pennsylvania 15220
Southwestern Laboratories Houston, Texas 77249
Texas State Department of Highways and Public Transportation Austin, Texas 78731-6033
University of Nevada-Reno Reno, Nevada 89557-0030
West Virginia Department of Transportation Charleston, West Virginia 25311
Western Technologies Inc. Phoenix, Arizona 85036

S.H.R.P. Moisture Content Proficiency Sample Program
Test Sample Splitting Procedure



THE BOTTOM ROW OF THE DIAGRAM REPRESENTS THE 64 SUB-SAMPLES AS SPLIT FROM THE ORIGINAL TEST SAMPLE.
EACH PARTICIPATING LABORATORY WILL RECIEVE 3 RANDOMLY SELECTED SUB-SAMPLES.

S.H.R.P. Moisture Content Proficiency Sample Program
Sample Type Identification Sheet

SAMPLE TYPE NO.	SAMPLE DESCRIPTTION
1	Aggregate 1, Split A, SSD Condition
2	Aggregate 1, Split B, SSD Condition
3	Aggregate 2, Split A, SSD Condition
4	Aggregate 2, Split B, SSD Condition
5	Aggregate 1, Split A, Air Dry Condition
6	Aggregate 1, Split B, Air Dry Condition
7	Aggregate 2, Split A, Air Dry Condition
8	Aggregate 2, Split B, Air Dry Condition
9	Soil 1, Split A, Plastic Limit Condition
10	Soil 1, Split B, Plastic Limit Condition
11	Soil 2, Split A, Plastic Limit Condition
12	Soil 2, Split B, Plastic Limit Condition
13	Soil 1, Split A, Air Dry Condition
14	Soil 1, Split B, Air Dry Condition
15	Soil 2, Split A, Air Dry Condition
16	Soil 2, Split B, Air Dry Condition

PRIMARY MATERIALS USED

Aggregate 1 - Watsonville, Supplied by University of Reno, Nevada
Aggregate 2 - Pleasonton, Supplied by University of Reno, Nevada

Soil 1 - **, Supplied by the Department of Highways, Maryland
Soil 2 - **, Supplied by the Department of Highways, Maryland

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 1

Aggregate No. 1, Split A, Saturated - Surface - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	12	42	57	11
2	64	10	59	10
3	8	36	38	1
4	6	39	7	14
5	46	3	21	2
6	35	1	13	12
7	37	25	9	12
8	17	61	20	7
9	31	27	16	7
10	14	15	41	6
11	29	2	52	1
12	47	56	18	1
13	44	48	54	13
14	49	50	45	10
15	43	26	19	12
16	32	51	4	10
17	30	24	28	15
18	34	53	58	15
19	11	55	5	8
20	62	33	60	8

REMAINDERS : 23, 22, 40, 63

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 2

Aggregate No. 1, Split B, Saturated - Surface - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	40	46	15	13
2	52	18	13	8
3	34	22	26	8
4	36	20	43	8
5	57	33	23	10
6	51	19	2	4
7	6	49	4	1
8	50	48	27	11
9	7	37	16	12
10	25	29	41	15
11	47	45	60	11
12	14	5	38	9
13	21	9	61	2
14	3	39	64	16
15	24	31	12	1
16	58	11	42	15
17	1	32	30	3
18	56	53	63	11
19	54	35	44	4
20	55	59	28	14

REMAINDERS : 8, 17, 62, 10

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 3

Aggregate No. 2, Split A, Saturated - Surface - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	36	37	52	2
2	18	13	19	2
3	26	40	31	6
4	11	47	33	2
5	39	29	20	9
6	45	12	28	5
7	41	7	50	11
8	5	63	23	13
9	64	54	24	13
10	2	48	22	8
11	3	9	30	6
12	14	25	60	13
13	59	6	10	7
14	8	4	32	11
15	44	62	34	5
16	46	55	15	6
17	1	58	61	12
18	43	51	17	9
19	42	57	35	15
20	38	53	16	9

REMAINDERS : 56, 49, 21, 27

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 4

Aggregate No. 2, Split B, Saturated - Surface - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	17	49	18	5
2	19	35	28	12
3	63	4	13	10
4	23	43	33	12
5	42	56	14	14
6	47	50	1	1
7	58	38	40	7
8	9	36	7	10
9	20	16	22	8
10	53	26	10	12
11	30	51	12	12
12	57	45	55	14
13	44	59	11	3
14	39	32	61	15
15	6	41	25	8
16	2	62	27	14
17	64	8	24	5
18	21	46	3	7
19	60	48	34	13
20	15	29	37	5

REMAINDERS : 31, 52, 5, 54

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

__SAMPLE TYPE NO. 5__

Aggregate No. 1, Split A, Air - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	8	1	3	1
2	16	49	27	16
3	9	38	34	7
4	35	7	57	10
5	23	60	59	16
6	14	44	24	16
7	47	29	39	6
8	25	32	41	3
9	30	19	33	9
10	20	2	58	2
11	31	54	61	15
12	45	26	51	8
13	40	11	37	1
14	55	21	4	2
15	43	36	42	10
16	5	52	13	13
17	17	22	28	2
18	48	64	46	6
19	15	12	63	6
20	10	18	6	12

REMAINDERS : 56, 53, 62, 50

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 6

Aggregate No. 1, Split B, Air - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	29	26	27	10
2	58	28	15	13
3	6	21	20	4
4	47	17	30	13
5	44	62	45	3
6	13	55	3	13
7	38	23	14	5
8	16	18	11	16
9	35	37	12	3
10	54	41	56	5
11	50	48	33	2
12	2	4	8	7
13	61	59	60	10
14	24	51	5	9
15	25	40	32	7
16	39	22	34	12
17	36	49	46	4
18	53	52	43	1
19	7	9	1	2
20	64	19	31	15

REMAINDERS : 57, 63, 42, 10

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 7

Aggregate No. 2, Split A, Air - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	26	22	12	16
2	8	60	20	11
3	59	47	30	3
4	2	29	33	5
5	25	19	45	13
6	32	53	49	3
7	54	24	38	16
8	21	48	39	6
9	17	31	61	2
10	46	4	62	11
11	57	37	56	7
12	41	50	43	11
13	10	51	34	8
14	6	40	11	7
15	52	16	5	6
16	35	44	42	8
17	28	27	58	14
18	36	15	18	12
19	23	7	64	10
20	1	55	9	13

REMAINDERS : 13, 63, 14, 3

S.H.R.P. Moisture Content Proficiency Sample Program

Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 8

Aggregate No. 2, Split B, Air - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	33	27	36	12
2	26	52	40	6
3	3	2	4	15
4	57	15	38	6
5	61	59	34	11
6	12	6	64	2
7	42	11	56	15
8	23	37	21	5
9	53	55	1	11
10	58	13	8	3
11	17	62	18	5
12	25	41	28	10
13	22	16	10	4
14	14	5	20	8
15	49	31	50	16
16	51	9	24	4
17	60	48	29	1
18	35	39	47	16
19	43	44	19	5
20	45	32	7	10

REMAINDERS : 54, 30, 63, 46

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 9

Soil No. 1, Split A, Plastic - Limit Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	51	59	31	8
2	56	40	26	1
3	29	7	30	2
4	46	57	32	3
5	18	34	45	8
6	8	11	50	8
7	47	37	38	2
8	44	62	63	1
9	48	2	35	15
10	41	42	52	7
11	55	3	5	8
12	64	49	14	15
13	61	54	17	14
14	43	25	53	5
15	12	20	15	3
16	4	1	10	1
17	28	27	39	9
18	9	58	16	14
19	33	19	60	12
20	23	13	24	1

REMAINDERS : 21, 22, 36, 6

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 10

Soil No. 1, Split B, Plastic - Limit Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	2	21	3	9
2	17	16	55	14
3	28	19	62	11
4	40	47	38	1
5	10	20	29	6
6	61	6	43	7
7	4	52	31	3
8	9	14	26	8
9	41	35	44	1
10	18	33	5	1
11	13	54	36	9
12	34	60	59	16
13	42	53	50	16
14	58	24	25	12
15	11	56	23	11
16	30	32	8	7
17	22	12	7	10
18	27	39	37	13
19	57	51	63	3
20	48	46	1	3

REMAINDERS : 45, 64, 49, 15

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 11

Soil No. 2, Split A, Plastic - Limit Condition

ABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	60	11	6	15
2	64	37	55	15
3	59	12	14	12
4	26	18	25	16
5	33	40	3	4
6	8	58	17	6
7	44	48	2	8
8	20	1	45	4
9	31	38	41	4
10	28	5	49	9
11	47	4	52	16
12	23	61	15	3
13	30	24	57	5
14	7	39	34	1
15	29	54	42	4
16	21	62	43	3
17	27	46	53	6
18	9	13	63	4
19	35	32	10	9
20	19	51	50	16

REMAINDERS : 56, 22, 36, 16

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 12

Soil No. 2, Split B, Plastic - Limit Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	40	24	33	3
2	39	12	55	4
3	61	49	1	16
4	25	16	62	9
5	60	3	31	7
6	22	45	53	15
7	29	9	41	14
8	8	18	54	12
9	10	36	21	5
10	52	28	4	16
11	5	7	51	13
12	19	15	6	6
13	46	63	14	15
14	50	57	30	14
15	48	34	59	15
16	58	27	13	2
17	17	56	20	13
18	23	32	35	3
19	42	11	44	11
20	64	38	43	2

REMAINDERS : 26, 2, 47, 37

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 13

Soil No. 1, Split A, Air - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	4	50	52	4
2	35	27	34	5
3	56	3	40	5
4	21	32	10	4
5	15	60	59	5
6	39	47	12	11
7	28	58	13	9
8	8	31	53	2
9	25	16	37	6
10	55	20	44	4
11	23	1	22	4
12	6	45	19	4
13	2	49	7	11
14	61	36	26	3
15	48	64	62	14
16	11	9	17	9
17	33	46	42	11
18	41	51	24	2
19	54	5	29	7
20	63	14	43	6

REMAINDERS : 30, 38, 36, 6

S.H.R.P. Moisture Content Proficiency Sample Program

Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 14

Soil No. 1, Split B, Air - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	63	49	27	7
2	24	23	60	9
3	35	10	51	13
4	6	29	48	11
5	58	43	18	12
6	9	22	38	10
7	37	50	61	13
8	12	26	30	15
9	3	53	62	10
10	8	57	39	10
11	13	40	52	14
12	5	36	59	12
13	20	14	45	12
14	28	44	7	6
15	56	31	42	9
16	2	32	41	11
17	15	34	21	8
18	4	25	46	8
19	19	54	47	1
20	16	1	64	4

REMAINDERS : 55, 17, 33, 11

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 15

Soil No. 2, Split A, Air - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	51	6	17	6
2	47	24	28	7
3	60	26	15	14
4	37	55	3	7
5	18	54	29	15
6	12	33	41	14
7	22	53	32	4
8	20	21	39	9
9	5	8	35	14
10	31	45	58	13
11	10	46	4	10
12	43	44	23	5
13	11	48	19	9
14	57	52	16	4
15	13	56	14	2
16	64	50	9	16
17	61	7	1	16
18	63	27	42	5
19	36	59	30	16
20	49	62	34	7

REMAINDERS : 40, 38, 2, 25

S.H.R.P. Moisture Content Proficiency Sample Program
Laboratory Sub-Sample Identification Sheet

SAMPLE TYPE NO. 16

Soil No. 2, Split B, Air - Dry Condition

LABORATORY NO.	SUB-SAMPLE A	SUB-SAMPLE B	SUB-SAMPLE C	TESTING SEQ.
1	62	57	8	14
2	40	20	35	3
3	22	32	29	9
4	63	5	53	15
5	7	51	17	1
6	59	4	13	9
7	28	21	16	10
8	3	48	36	14
9	12	18	47	16
10	34	49	56	14
11	43	10	6	3
12	41	58	26	2
13	24	15	19	6
14	23	25	27	13
15	42	11	60	13
16	61	31	1	5
17	55	38	45	7
18	14	54	52	10
19	9	30	2	14
20	39	44	37	11

REMAINDERS : 50, 64, 33, 46

S.H.R.P. Moisture - Content Proficiency Sample Program

Laboratory Set Testing Sequence Table

	<---------- SAMPLE TYPE NUMBER ---------->															
LAB#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	11	13	2	5	1	10	16	12	8	9	15	3	4	7	6	14
2	10	8	2	12	16	13	11	6	1	14	15	4	5	9	7	3
3	1	8	6	10	7	4	3	15	2	11	12	16	5	13	14	9
4	14	8	2	12	10	13	5	6	3	1	16	9	4	11	7	15
5	2	10	9	14	16	3	13	11	8	6	4	7	5	12	15	1
6	12	4	5	1	16	13	3	2	8	7	6	15	11	10	14	9
7	12	1	11	7	6	5	16	15	2	3	8	14	9	13	4	10
8	7	11	13	10	3	16	6	5	1	8	4	12	2	15	9	14
9	7	12	13	8	9	3	2	11	15	1	4	5	6	10	14	16
10	6	15	8	12	2	5	11	3	7	1	9	16	4	10	13	14
11	1	11	6	12	15	2	7	5	8	9	16	13	4	14	10	3
12	1	9	13	14	8	7	11	10	15	16	3	6	4	12	5	2
13	13	2	7	3	1	10	8	4	14	16	5	15	11	12	9	6
14	10	16	11	15	2	9	7	8	5	12	1	14	3	6	4	13
15	12	1	5	8	10	7	6	16	3	11	4	15	14	9	2	13
16	10	15	6	14	13	12	8	4	1	7	3	2	9	11	16	5
17	15	3	12	5	2	4	14	1	9	10	6	13	11	8	16	7
18	15	11	9	7	6	1	12	16	14	13	4	3	2	8	5	10
19	8	4	15	13	6	2	10	5	12	3	9	11	7	1	16	14
20	8	14	9	5	12	15	13	10	1	3	16	2	6	4	7	11

Section 2

Master Data Record

S.H.R.P. Master Data Sheet

Lab Name:

Laboratory No. 1

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	5a	873.9		air dry	9	10a	373.5	429.5	14.99
	5b	839.2		air dry		10b	337.0	387.6	15.01
	5c	800.0		air dry		10c	363.3	417.8	15.00
2	3a	659.4	679.1	2.99	10	6a	749.5		air dry
	3b	782.6	806.1	3.00		6b	633.6		air dry
	3c	952.3	980.9	3.00		6c	473.5		air dry
3	12a	412.5	515.6	24.99	11	1a	833.8	850.5	2.00
	12b	388.8	486.0	25.00		1b	658.7	671.8	1.99
	12c	537.7	672.2	25.01		1c	1037.0	1057.7	2.00
4	13a	453.7		air dry	12	8a	598.3		air dry
	13b	364.3		air dry		8b	889.7		air dry
	13c	336.0		air dry		8c	643.4		air dry
5	4a	699.1	720.1	3.00	13	2a	540.3	551.2	2.02
	4b	700.1	721.1	3.00		2b	673.3	686.8	2.01
	4c	713.1	734.5	3.00		2c	939.9	958.7	2.00
6	15a	547.3		air dry	14	16a	449.0		air dry
	15b	478.0		air dry		16b	417.4		air dry
	15c	363.2		air dry		16c	334.8		air dry
7	14a	303.2		air dry	15	11a	351.2	439.1	25.03
	14b	340.6		air dry		11b	488.0	610.0	25.00
	14c	381.5		air dry		11c	471.7	589.6	25.00
8	9a	347.3	399.4	15.00	16	7a	1024.7		air dry
	9b	347.1	399.2	15.01		7b	825.2		air dry
	9c	311.7	358.5	15.01		7c	847.2		air dry

Lab Name:

Laboratory No. 2

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	9a	302.1	347.4	15.00	9	14a	305.0		air dry
	9b	276.9	318.4	14.99		14b	373.4		air dry
	9c	337.2	387.8	15.01		14c	272.6		air dry
2	3a	917.6	945.1	3.00	10	1a	917.5	935.8	1.99
	3b	931.2	959.2	3.01		1b	701.4	715.4	2.00
	3c	917.4	944.9	3.00		1c	881.6	899.2	2.00
3	16a	467.5		air dry	11	7a	891.3		air dry
	16b	524.0		air dry		7b	770.6		air dry
	16c	419.7		air dry		7c	690.0		air dry
4	12a	383.4	479.3	25.01	12	4a	739.1	761.3	3.00
	12b	413.2	516.5	25.00		4b	698.0	718.9	2.99
	12c	333.7	417.1	24.99		4c	897.1	924.0	3.00
5	13a	329.4		air dry	13	6a	849.3		air dry
	13b	341.8		air dry		6b	699.1		air dry
	13c	275.0		air dry		6c	1058.5		air dry
6	8a	1156.1		air dry	14	10a	352.8	405.7	14.99
	8b	878.6		air dry		10b	404.9	465.6	14.99
	8c	698.6		air dry		10c	267.0	307.1	15.02
7	15a	394.2		air dry	15	11a	379.9	474.8	24.98
	15b	407.2		air dry		11b	428.7	535.9	25.01
	15c	360.7		air dry		11c	364.3	455.4	25.01
8	2a	552.2	563.2	1.99	16	5a	1016.9		air dry
	2b	770.7	786.1	2.00		5b	824.9		air dry
	2c	651.9	664.9	1.99		5c	860.5		air dry

Lab Name: Laboratory No. 3

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)		Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	1a	838.2	855.0	2.00		9	16a	525.9		air dry
	1b	921.7	940.2	2.01			16b	556.3		air dry
	1c	797.3	813.2	1.99			16c	500.3		air dry
2	9a	346.2	398.1	14.99		10	4a	787.7	811.3	3.00
	9b	289.5	333.0	15.03			4b	768.0	791.0	2.99
	9c	315.3	362.6	15.00			4c	958.2	987.0	3.01
3	7a	681.3		air dry		11	10a	340.4	391.4	14.98
	7b	723.5		air dry			10b	373.7	429.8	15.01
	7c	891.1		air dry			10c	262.2	301.5	15.00
4	6a	872.7		air dry		12	11a	386.0	482.5	25.00
	6b	804.8		air dry			11b	499.6	624.5	25.00
	6c	784.9		air dry			11c	423.6	529.5	25.00
5	13a	337.0		air dry		13	14a	335.6		air dry
	13b	288.0		air dry			14b	303.5		air dry
	13c	334.9		air dry			14c	224.8		air dry
6	3a	1036.3	1067.4	3.00		14	15a	475.7		air dry
	3b	822.8	847.5	3.00			15b	360.6		air dry
	3c	1087.6	1120.2	3.00			15c	583.6		air dry
7	5a	791.4		air dry		15	8a	698.3		air dry
	5b	642.4		air dry			8b	867.0		air dry
	5c	861.0		air dry			8c	782.7		air dry
8	2a	851.0	868.0	2.00		16	12a	406.8	508.5	25.00
	2b	880.4	898.0	2.00			12b	447.7	559.6	24.99
	2c	820.7	837.1	2.00			12c	426.0	532.5	25.00

Lab Name: 　　　　　　　　　Laboratory No. 4

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)		Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	10a	340.1	391.0	14.97		9	12a	483.7	604.6	24.99
	10b	297.7	342.4	15.02			12b	420.9	526.1	24.99
	10c	334.1	384.1	14.97			12c	445.5	556.9	25.01
2	3a	867.2	893.2	3.00		10	5a	786.2		air dry
	3b	769.0	792.1	3.00			5b	761.5		air dry
	3c	822.8	847.6	3.01			5c	770.9		air dry
3	9a	327.0	376.0	14.98		11	14a	326.2		air dry
	9b	321.1	369.3	15.01			14b	391.3		air dry
	9c	322.8	371.2	14.99			14c	389.6		air dry
4	13a	398.7		air dry		12	4a	701.2	722.2	2.99
	13b	352.6		air dry			4b	806.8	831.0	3.00
	13c	371.0		air dry			4c	613.7	632.1	3.00
5	7a	878.5		air dry		13	6a	950.7		air dry
	7b	848.5		air dry			6b	691.8		air dry
	7c	796.0		air dry			6c	669.4		air dry
6	8a	903.8		air dry		14	1a	980.4	1000.0	2.00
	8b	797.9		air dry			1b	858.6	875.8	2.00
	8c	771.2		air dry			1c	1048.1	1069.1	2.00
7	15a	296.0		air dry		15	16a	469.0		air dry
	15b	608.2		air dry			16b	353.0		air dry
	15c	404.4		air dry			16c	436.2		air dry
8	2a	563.3	574.6	2.01		16	11a	399.7	499.6	24.99
	2b	933.7	952.4	2.00			11b	423.2	529.0	25.00
	2c	779.1	794.7	2.00			11c	387.8	484.8	25.01

Lab Name: Laboratory No. 5

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	16a	319.4		air dry	9	3a	832.5	857.5	3.00
	16b	461.6		air dry		3b	1066.0	1098.0	3.00
	16c	512.7		air dry		3c	932.3	960.3	3.00
2	1a	734.0	748.7	2.00	10	2a	824.1	840.5	1.99
	1b	788.8	804.5	1.99		2b	949.5	968.6	2.01
	1c	1031.9	1052.5	2.00		2c	896.7	914.6	2.00
3	6a	950.4		air dry	11	8a	983.7		air dry
	6b	727.0		air dry		8b	734.2		air dry
	6c	1057.5		air dry		8c	846.7		air dry
4	11a	512.9	641.1	25.00	12	14a	267.1		air dry
	11b	436.0	545.0	25.00		14b	361.4		air dry
	11c	480.9	601.1	24.99		14c	348.9		air dry
5	13a	377.3		air dry	13	7a	969.9		air dry
	13b	357.0		air dry		7b	835.3		air dry
	13c	358.1		air dry		7c	737.0		air dry
6	10a	331.3	381.0	15.00	14	4a	788.2	811.8	2.99
	10b	371.1	426.7	14.98		4b	848.4	873.9	3.01
	10c	327.7	376.8	14.98		4c	816.0	840.5	3.00
7	12a	383.3	479.1	24.99	15	15a	400.7		air dry
	12b	431.3	539.1	24.99		15b	613.2		air dry
	12c	401.8	502.3	25.01		15c	341.6		air dry
8	9a	333.7	383.8	15.01	16	5a	889.4		air dry
	9b	293.8	337.9	15.01		5b	869.0		air dry
	9c	319.0	366.9	15.02		5c	775.1		air dry

Lab Name:

Laboratory No. 6

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	4a	1097.5	1130.4	3.00	9	16a	416.6		air dry
	4b	824.5	849.2	3.00		16b	345.5		air dry
	4c	745.0	767.4	3.01		16c	371.0		air dry
2	8a	810.3		air dry	10	14a	320.3		air dry
	8b	761.0		air dry		14b	365.3		air dry
	8c	897.4		air dry		14c	387.1		air dry
3	7a	727.4		air dry	11	13a	375.8		air dry
	7b	718.1		air dry		13b	322.2		air dry
	7c	767.9		air dry		13c	420.8		air dry
4	2a	703.2	717.3	2.01	12	1a	793.8	809.7	2.00
	2b	983.5	1003.3	2.01		1b	630.5	643.1	2.00
	2c	594.1	606.0	2.00		1c	759.7	775.0	2.01
5	3a	922.8	950.5	3.00	13	6a	914.0		air dry
	3b	887.9	914.5	3.00		6b	832.4		air dry
	3c	1035.0	1066.2	3.01		6c	762.0		air dry
6	11a	474.4	593.1	25.02	14	15a	461.6		air dry
	11b	412.5	515.6	24.99		15b	301.0		air dry
	11c	474.6	593.3	25.01		15c	404.6		air dry
7	10a	250.0	287.5	15.00	15	12a	485.8	607.3	25.01
	10b	338.3	389.0	14.99		12b	374.3	467.9	25.01
	10c	359.7	413.6	14.98		12c	456.7	570.9	25.01
8	9a	291.8	335.6	15.01	16	5a	886.0		air dry
	9b	297.0	341.6	15.02		5b	685.5		air dry
	9c	350.0	402.5	15.00		5c	895.6		air dry

Lab Name:

Laboratory No. 7

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	2a	880.9	898.5	2.00	9	13a	302.3		air dry
	2b	736.2	750.9	2.00		13b	355.6		air dry
	2c	680.3	693.9	2.00		13c	355.0		air dry
2	9a	310.2	356.7	14.99	10	16a	473.4		air dry
	9b	337.4	388.0	15.00		16b	523.2		air dry
	9c	312.4	359.3	15.01		16c	412.4		air dry
3	10a	349.4	401.7	14.97	11	3a	780.0	803.4	3.00
	10b	260.8	299.9	14.99		3b	655.7	675.4	3.00
	10c	321.1	369.3	15.01		3c	951.8	980.4	3.00
4	15a	392.8		air dry	12	1a	787.4	803.1	1.99
	15b	584.0		air dry		1b	826.0	842.5	2.00
	15c	419.8		air dry		1c	745.6	760.5	2.00
5	6a	1102.6		air dry	13	14a	370.3		air dry
	6b	729.7		air dry		14b	325.9		air dry
	6c	841.9		air dry		14c	293.7		air dry
6	5a	972.6		air dry	14	12a	498.0	622.5	25.00
	5b	794.7		air dry		12b	527.1	658.9	25.00
	5c	965.0		air dry		12c	422.2	527.8	25.01
7	4a	1027.7	1058.5	3.00	15	8a	691.0		air dry
	4b	935.7	963.9	3.01		8b	754.0		air dry
	4c	911.7	939.1	3.01		8c	867.2		air dry
8	11a	464.8	581.0	25.00	16	7a	643.7		air dry
	11b	449.1	561.5	25.03		7b	726.8		air dry
	11c	467.4	584.3	25.01		7c	963.1		air dry

Lab Name: Laboratory No. 8

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	9a	320.9	369.0	14.99	9	15a	373.1		air dry
	9b	379.8	436.8	15.01		15b	353.6		air dry
	9c	380.7	437.8	15.00		15c	310.4		air dry
2	13a	278.0		air dry	10	4a	776.2	799.5	3.00
	13b	348.4		air dry		4b	620.0	638.6	3.00
	13c	336.6		air dry		4c	936.3	964.4	3.00
3	5a	639.2		air dry	11	2a	579.1	590.7	2.00
	5b	753.9		air dry		2b	779.8	795.5	2.01
	5c	804.8		air dry		2c	911.4	929.5	1.99
4	11a	411.6	514.5	25.00	12	12a	394.2	492.8	25.01
	11b	472.4	590.6	25.02		12b	544.3	680.4	25.00
	11c	394.3	492.9	25.01		12c	398.1	497.6	24.99
5	8a	962.3		air dry	13	3a	732.9	754.9	3.00
	8b	901.7		air dry		3b	977.0	1006.3	3.00
	8c	675.9		air dry		3c	1068.8	1100.7	2.98
6	7a	802.6		air dry	14	16a	337.7		air dry
	7b	695.8		air dry		16b	532.4		air dry
	7c	789.7		air dry		16c	439.1		air dry
7	1a	1076.3	1097.8	2.00	15	14a	309.3		air dry
	1b	977.9	997.5	2.00		14b	354.5		air dry
	1c	904.7	922.9	2.01		14c	388.2		air dry
8	10a	348.4	400.6	14.98	16	6a	1001.1		air dry
	10b	352.2	405.0	15.00		6b	683.0		air dry
	10c	342.4	393.8	15.01		6c	806.6		air dry

Lab Name:

Laboratory No. 9

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	10a	348.7	401.0	15.00	9	5a	697.0		air dry
	10b	285.5	328.3	14.99		5b	1000.0		air dry
	10c	380.3	437.4	15.01		5c	834.2		air dry
2	7a	770.8		air dry	10	14a	365.8		air dry
	7b	688.1		air dry		14b	308.9		air dry
	7c	685.8		air dry		14c	288.2		air dry
3	6a	1177.3		air dry	11	8a	813.0		air dry
	6b	943.8		air dry		8b	875.0		air dry
	6c	782.9		air dry		8c	816.7		air dry
4	11a	395.5	494.4	25.01	12	2a	792.5	808.4	2.01
	11b	387.2	484.0	25.00		2b	647.4	660.5	2.02
	11c	379.9	474.9	25.01		2c	519.4	529.8	2.00
5	12a	478.0	597.5	25.00	13	3a	1089.1	1121.9	3.01
	12b	430.3	537.9	25.01		3b	855.2	880.9	3.00
	12c	397.0	496.3	25.01		3c	948.8	977.3	3.00
6	13a	294.3		air dry	14	15a	410.2		air dry
	13b	382.0		air dry		15b	483.9		air dry
	13c	339.1		air dry		15c	283.2		air dry
7	1a	916.7	935.1	2.01	15	9a	307.6	353.7	14.99
	1b	983.2	1002.9	2.00		9b	256.6	295.1	15.00
	1c	888.4	906.2	2.00		9c	320.7	368.8	15.00
8	4a	675.0	695.3	3.01	16	16a	381.3		air dry
	4b	892.1	918.9	3.00		16b	515.3		air dry
	4c	714.4	735.8	3.00		16c	458.9		air dry

Lab Name:

Laboratory No. 10

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	10a	362.0	416.3	15.00	9	11a	352.8	441.0	25.00
	10b	332.7	382.7	15.03		11b	462.4	578.0	25.00
	10c	321.6	369.8	14.99		11c	556.5	695.6	25.00
2	5a	1058.8		air dry	10	14a	278.1		air dry
	5b	904.1		air dry		14b	296.0		air dry
	5c	860.2		air dry		14c	355.2		air dry
3	8a	952.8		air dry	11	7a	751.0		air dry
	8b	815.3		air dry		7b	769.3		air dry
	8c	660.4		air dry		7c	731.4		air dry
4	13a	356.7		air dry	12	4a	1068.7	1100.8	3.00
	13b	321.1		air dry		4b	928.7	956.6	3.00
	13c	320.6		air dry		4c	786.4	810.1	3.01
5	6a	996.9		air dry	13	15a	374.8		air dry
	6b	868.3		air dry		15b	372.7		air dry
	6c	814.3		air dry		15c	448.9		air dry
6	1a	910.5	928.9	2.02	14	16a	414.8		air dry
	1b	776.4	791.9	2.00		16b	467.2		air dry
	1c	898.4	916.4	2.00		16c	482.7		air dry
7	9a	315.9	363.3	15.00	15	2a	864.1	881.4	2.00
	9b	331.1	380.8	15.01		2b	983.2	1002.9	2.00
	9c	322.7	371.1	15.00		2c	740.7	755.6	2.01
8	3a	619.0	637.6	3.00	16	12a	396.4	495.5	25.00
	3b	868.6	894.7	3.00		12b	477.0	596.3	25.01
	3c	844.7	870.0	3.00		12c	475.2	594.0	25.00

Lab Name:

Laboratory No. 11

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	1a	899.5	917.5	2.00	9	10a	326.8	375.8	14.99
	1b	800.6	816.6	2.00		10b	260.3	299.3	14.98
	1c	1040.1	1060.9	2.00		10c	271.2	311.9	15.01
2	6a	1011.6		air dry	10	15a	401.3		air dry
	6b	1130.5		air dry		15b	358.8		air dry
	6c	983.9		air dry		15c	407.1		air dry
3	16a	479.4		air dry	11	2a	653.4	666.5	2.00
	16b	360.7		air dry		2b	623.4	635.9	2.01
	16c	318.5		air dry		2c	938.1	956.9	2.00
4	13a	389.5		air dry	12	4a	994.2	1024.0	3.00
	13b	273.1		air dry		4b	716.7	738.2	3.00
	13c	350.7		air dry		4c	901.7	928.8	3.01
5	8a	960.2		air dry	13	12a	401.8	502.3	25.01
	8b	812.8		air dry		12b	363.2	454.0	25.00
	8c	710.0		air dry		12c	375.3	469.1	25.00
6	3a	701.2	722.2	2.99	14	14a	315.9		air dry
	3b	889.3	916.0	3.00		14b	385.3		air dry
	3c	1037.8	1068.9	3.00		14c	243.5		air dry
7	7a	806.1		air dry	15	5a	700.4		air dry
	7b	988.5		air dry		5b	842.5		air dry
	7c	637.3		air dry		5c	847.8		air dry
8	9a	319.5	367.4	14.99	16	11a	400.7	500.9	25.01
	9b	279.1	334.8	*19.96		11b	458.1	572.6	24.99
	9c	291.4	335.1	15.00		11c	410.4	513.0	25.00

Lab Name:

Laboratory No. 12

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	1a	671.5	685.0	2.01	9	2a	590.6	602.4	2.00
	1b	875.3	892.9	2.01		2b	893.6	911.5	2.00
	1c	1163.4	1186.7	2.00		2c	533.3	543.9	1.99
2	16a	471.1		air dry	10	8a	1006.9		air dry
	16b	436.8		air dry		8b	708.8		air dry
	16c	490.8		air dry		8c	1026.6		air dry
3	11a	436.7	545.9	25.01	11	7a	871.3		air dry
	11b	370.2	462.8	25.01		7b	851.8		air dry
	11c	454.3	567.9	25.01		7c	809.9		air dry
4	13a	274.2		air dry	12	14a	324.9		air dry
	13b	276.8		air dry		14b	302.5		air dry
	13c	380.9		air dry		14c	254.8		air dry
5	15a	401.8		air dry	13	3a	1054.0	1085.6	3.00
	15b	427.0		air dry		3b	1151.6	1186.1	3.00
	15c	382.8		air dry		3c	1035.8	1066.9	3.00
6	12a	449.3	561.6	24.99	14	4a	912.6	940.0	3.00
	12b	368.4	460.5	25.00		4b	869.5	895.7	3.01
	12c	423.9	529.9	25.01		4c	888.7	915.4	3.00
7	6a	786.5		air dry	15	9a	333.5	383.5	14.99
	6b	698.8		air dry		9b	375.1	431.4	15.01
	6c	834.2		air dry		9c	303.4	349.0	15.03
8	5a	946.8		air dry	16	10a	352.8	405.7	14.99
	5b	875.4		air dry		10b	251.1	288.8	15.01
	5c	649.5		air dry		10c	241.4	277.6	15.00

Lab Name:

Laboratory No. 13

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	5a	912.1		air dry	9	15a	442.8		air dry
	5b	838.6		air dry		15b	391.0		air dry
	5c	921.7		air dry		15c	371.6		air dry
2	2a	913.9	932.2	2.00	10	6a	759.5		air dry
	2b	711.7	725.9	2.00		6b	820.5		air dry
	2c	1238.6	1263.4	2.00		6c	755.4		air dry
3	4a	782.6	806.2	3.02	11	13a	250.6		air dry
	4b	870.1	896.2	3.00		13b	386.5		air dry
	4c	853.6	879.1	2.99		13c	280.7		air dry
4	8a	644.3		air dry	12	14a	323.9		air dry
	8b	790.4		air dry		14b	298.9		air dry
	8c	1203.4		air dry		14c	416.0		air dry
5	11a	480.0		air dry	13	1a	807.2	823.4	2.01
	11b	399.5		air dry		1b	836.5	853.2	2.00
	11c	457.7		air dry		1c	955.0	974.2	2.01
6	16a	545.1		air dry	14	9a	368.2	423.4	14.99
	16b	403.1		air dry		9b	365.8	420.7	15.01
	16c	543.6		air dry		9c	320.5	368.6	15.01
7	3a	1017.3	1047.9	3.01	15	12a	491.4	614.1	24.97
	3b	931.7	959.7	3.01		12b	354.5	443.1	25.00
	3c	707.3	728.5	3.00		12c	460.1	575.2	25.02
8	7a	847.7		air dry	16	10a	388.6	446.9	15.00
	7b	853.1		air dry		10b	252.4	290.3	15.02
	7c	895.3		air dry		10c	257.9	296.6	15.01

Lab Name: Laboratory No. 14

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)		Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	11a	438.6	548.2	24.99		9	6a	739.5		air dry
	11b	397.8	497.3	25.00			6b	1151.4		air dry
	11c	438.2	547.9	25.03			6c	884.6		air dry
2	5a	728.8		air dry		10	1a	877.8	895.4	2.01
	5b	949.3		air dry			1b	944.4	963.3	2.00
	5c	752.3		air dry			1c	789.7	805.5	2.00
3	13a	317.7		air dry		11	3a	731.0	752.9	3.00
	13b	278.0		air dry			3b	677.2	697.5	3.00
	13c	291.8		air dry			3c	961.4	990.2	3.00
4	15a	449.3		air dry		12	10a	236.8	272.3	14.99
	15b	572.3		air dry			10b	382.7	440.1	15.00
	15c	582.1		air dry			10c	331.8	381.6	15.00
5	9a	308.9	355.2	14.99		13	16a	511.9		air dry
	9b	337.1	387.7	15.01			16b	454.7		air dry
	9c	360.2	414.2	14.99			16c	461.9		air dry
6	14a	354.2		air dry		14	12a	401.6	502.1	25.02
	14b	373.6		air dry			12b	403.8	504.8	25.01
	14c	391.3		air dry			12c	414.6	518.3	25.01
7	7a	914.7		air dry		15	4a	781.9	805.3	2.99
	7b	736.1		air dry			4b	1105.1	1138.3	3.00
	7c	820.6		air dry			4c	859.2	885.0	3.00
8	8a	746.2		air dry		16	2a	611.4	623.6	2.00
	8b	740.4		air dry			2b	700.5	714.5	2.00
	8c	737.9		air dry			2c	1004.3	1024.5	2.01

Lab Name:

Laboratory No. 15

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	2a	953.3	972.5	2.01	9	14a	270.2		air dry
	2b	1054.1	1075.2	2.00		14b	319.0		air dry
	2c	799.4	815.4	2.00		14c	377.9		air dry
2	15a	554.1		air dry	10	5a	1003.0		air dry
	15b	547.8		air dry		5b	727.4		air dry
	15c	574.2		air dry		5c	758.4		air dry
3	9a	283.3	325.8	15.00	11	10a	344.3	395.9	15.00
	9b	321.4	369.6	15.00		10b	263.4	302.9	15.00
	9c	311.7	358.5	15.01		10c	365.6	420.4	14.99
4	11a	434.5	543.1	24.99	12	1a	814.8	831.1	2.00
	11b	455.0	568.8	25.01		1b	915.9	934.2	2.00
	11c	506.6	633.3	25.01		1c	992.4	1012.2	2.00
5	3a	873.8	900.0	3.00	13	16a	498.6		air dry
	3b	955.6	984.3	3.00		16b	364.2		air dry
	3c	728.7	750.6	3.01		16c	424.9		air dry
6	7a	692.6		air dry	14	13a	334.6		air dry
	7b	887.9		air dry		13b	365.1		air dry
	7c	1027.6		air dry		13c	341.0		air dry
7	6a	590.2		air dry	15	12a	427.3	534.1	24.99
	6b	924.8		air dry		12b	596.1	745.1	25.00
	6c	625.0		air dry		12c	388.4	485.5	25.00
8	4a	819.2	843.8	3.00	16	8a	828.4		air dry
	4b	719.7	741.3	3.00		8b	816.0		air dry
	4c	943.4	971.7	3.00		8c	838.5		air dry

Lab Name:

Laboratory No. 16

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	9a	292.3	336.1	14.98	9	13a	438.6		air dry
	9b	279.5	321.5	15.03		13b	373.8		air dry
	9c	318.6	366.4	15.00		13c	328.5		air dry
2	12a	470.8	588.6	25.02	10	1a	774.0	789.6	2.02
	12b	417.3	521.6	24.99		1b	792.5	808.4	2.01
	12c	417.5	521.9	25.01		1c	773.1	788.6	2.00
3	11a	461.8	577.3	25.01	11	14a	321.0		air dry
	11b	416.0	520.0	25.00		14b	311.2		air dry
	11c	396.5	495.6	24.99		14c	350.9		air dry
4	8a	801.7		air dry	12	6a	950.9		air dry
	8b	796.4		air dry		6b	899.4		air dry
	8c	953.1		air dry		6c	1067.9		air dry
5	16a	458.2		air dry	13	5a	948.3		air dry
	16b	562.5		air dry		5b	742.9		air dry
	16c	338.7		air dry		5c	996.6		air dry
6	3a	900.5	927.5	3.00	14	4a	768.7	791.8	3.01
	3b	948.7	977.2	3.00		4b	902.5	929.6	3.00
	3c	852.7	878.3	3.00		4c	926.0	953.8	3.00
7	10a	325.7	374.6	15.00	15	2a	967.8	987.3	2.01
	10b	368.3	423.5	15.00		2b	843.4	860.3	2.00
	10c	355.9	409.3	15.00		2c	873.7	891.2	2.00
8	7a	746.9		air dry	16	15a	544.6		air dry
	7b	802.5		air dry		15b	556.1		air dry
	7c	847.1		air dry		15c	369.4		air dry

Lab Name:

Laboratory No. 17

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	8a	713.6		air dry	9	9a	284.6	327.3	15.00
	8b	774.9		air dry		9b	318.6	366.4	15.00
	8c	923.5		air dry		9c	319.1	367.0	15.00
2	5a	955.0		air dry	10	10a	393.6	452.6	15.00
	5b	936.5		air dry		10b	374.6	430.8	15.00
	5c	703.5		air dry		10c	362.2	416.5	15.00
3	2a	565.4	576.7	2.00	11	13a	251.7		air dry
	2b	1052.2	1073.3	2.01		13b	304.6		air dry
	2c	1038.6	1059.4	2.00		13c	287.3		air dry
4	6a	1181.8		air dry	12	3a	650.3	669.8	3.00
	6b	971.8		air dry		3b	982.2	1011.7	3.00
	6c	1032.8		air dry		3c	966.7	995.7	3.00
5	4a	920.1	947.7	3.00	13	12a	519.5	649.5	25.02
	4b	809.0	833.3	3.00		12b	310.6	388.3	25.02
	4c	662.8	682.7	3.00		12c	476.4	595.6	25.02
6	11a	495.0	618.8	25.01	14	7a	830.2		air dry
	11b	445.0	556.3	25.01		7b	913.4		air dry
	11c	388.5	485.6	24.99		7c	868.7		air dry
7	16a	482.1		air dry	15	1a	1081.3	1102.9	2.00
	16b	457.7		air dry		1b	839.6	856.4	2.00
	16c	485.7		air dry		1c	993.4	1013.3	2.00
8	14a	311.3		air dry	16	15a	500.1		air dry
	14b	335.8		air dry		15b	427.7		air dry
	14c	405.6		air dry		15c	400.7		air dry

Lab Name:

Laboratory No. 18

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	6a	952.2		air dry	9	3a	979.5	1008.9	3.00
	6b	967.9		air dry		3b	1006.4	1036.6	3.00
	6c	897.5		air dry		3c	703.0	724.1	3.00
2	13a	313.0		air dry	10	16a	349.3		air dry
	13b	349.0		air dry		16b	461.5		air dry
	13c	369.0		air dry		16c	483.8		air dry
3	12a	397.7	497.1	24.99	11	2a	779.9	795.6	2.01
	12b	462.5	578.1	24.99		2b	811.3	827.5	2.00
	12c	419.7	524.6	24.99		2c	925.1	943.7	2.01
4	11a	483.2	604.0	25.00	12	7a	826.1		air dry
	11b	438.7	548.3	24.98		7b	955.6		air dry
	11c	375.0	468.8	25.01		7c	601.2		air dry
5	15a	502.4		air dry	13	10a	310.7	357.3	15.00
	15b	371.3		air dry		10b	341.3	392.5	15.00
	15c	389.3		air dry		10c	307.1	353.2	15.01
6	5a	821.4		air dry	14	9a	295.4	339.7	15.00
	5b	803.6		air dry		9b	327.3	376.4	15.00
	5c	898.2		air dry		9c	309.7	356.1	14.98
7	4a	753.5	776.1	3.00	15	1a	733.4	748.1	2.00
	4b	920.3	948.0	3.01		1b	1013.5	1033.8	2.00
	4c	832.3	857.3	3.00		1c	1122.8	1145.3	2.00
8	14a	334.2		air dry	16	8a	706.0		air dry
	14b	342.9		air dry		8b	748.6		air dry
	14c	419.7		air dry		8c	684.1		air dry

Lab Name: Laboratory No. 19

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	14a	332.4		air dry	9	11a	404.8	506.0	25.00
	14b	286.3		air dry		11b	345.2	431.5	25.00
	14c	370.3		air dry		11c	412.3	515.4	25.01
2	6a	810.2		air dry	10	7a	826.6		air dry
	6b	947.0		air dry		7b	844.5		air dry
	6c	637.8		air dry		7c	742.5		air dry
3	10a	255.1	293.4	15.01	11	12a	433.2	541.5	25.00
	10b	290.8	334.4	14.99		12b	417.8	522.3	25.01
	10c	246.3	283.2	14.98		12c	430.5	538.2	25.02
4	2a	863.2	880.5	2.00	12	9a	338.2	388.9	14.99
	2b	653.1	666.2	2.01		9b	322.8	371.2	14.99
	2c	622.8	635.2	1.99		9c	331.7	381.5	15.01
5	8a	655.5		air dry	13	4a	857.5	883.3	3.01
	8b	700.9		air dry		4b	893.7	920.5	3.00
	8c	950.0		air dry		4c	724.6	746.3	2.99
6	5a	895.1		air dry	14	16a	389.4		air dry
	5b	825.1		air dry		16b	461.6		air dry
	5c	800.6		air dry		16c	350.9		air dry
7	13a	310.3		air dry	15	3a	856.5	882.2	3.00
	13b	277.6		air dry		3b	838.0	863.1	3.00
	13c	328.2		air dry		3c	867.6	893.6	3.00
8	1a	822.0	838.5	2.01	16	15a	284.6		air dry
	1b	786.7	802.5	2.01		15b	420.7		air dry
	1c	776.7	792.1	1.98		15c	354.9		air dry

Lab Name:

Laboratory No. 20

Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)	Set#	Sample#	Beginning weight (0.1 g)	Ending weight (0.1 g)	Moisture Content (0.01%)
1	9a	347.4	399.5	15.00	9	3a	808.2	832.5	3.01
	9b	327.5	376.6	14.99		3b	752.4	774.9	2.99
	9c	322.3	370.6	14.99		3c	829.4	854.3	3.00
2	12a	405.3	506.6	24.99	10	8a	823.9		air dry
	12b	485.3	606.6	24.99		8b	988.6		air dry
	12c	371.4	464.3	25.01		8c	814.3		air dry
3	10a	315.0	362.3	15.00	11	16a	461.0		air dry
	10b	299.0	343.8	14.98		16b	486.2		air dry
	10c	400.1	460.0	14.97		16c	421.9		air dry
4	14a	317.4		air dry	12	5a	793.5		air dry
	14b	348.6		air dry		5b	901.2		air dry
	14c	307.1		air dry		5c	829.6		air dry
5	4a	1045.4	1076.7	2.99	13	7a	707.2		air dry
	4b	1037.3	1068.4	3.00		7b	890.6		air dry
	4c	897.7	924.6	3.00		7c	976.8		air dry
6	13a	391.3		air dry	14	2a	712.5	726.8	2.01
	13b	332.6		air dry		2b	1015.2	1035.6	2.01
	13c	338.5		air dry		2c	943.2	962.1	2.00
7	15a	502.7		air dry	15	6a	862.2		air dry
	15b	499.4		air dry		6b	713.2		air dry
	15c	311.0		air dry		6c	617.9		air dry
8	1a	1164.4	1187.8	2.01	16	11a	441.6	552.0	25.00
	1b	811.8	828.0	2.00		11b	427.2	534.0	25.00
	1c	1077.9	1099.5	2.00		11c	446.3	557.9	25.01

Section 3

Returned Data Sheets

S.H.R.P. Moisture Content Proficiency Sample Program
Data Sheet

University of Nevada-Reno
Reno, Nevada

Laboratory No. 1

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	5a	873.2	870.6	0.30	9	10a	428.1	363.8	17.67
	5b	838.3	836.4	0.23		10b	379.5	322.5	17.67
	5c	799.6	797.5	0.25		10c	416.1	353.5	17.71
2	3a	678.6	656.8	3.32	10	6a	748.8	746.4	0.32
	3b	805.4	778.4	3.47		6b	632.5	630.7	0.29
	3c	979.9	948.4	3.32		6c	472.7	471.3	0.30
3	12a	514.4	368.8	39.48	11	1a	848.9	831.2	2.13
	12b	484.8	347.8	39.39		1b	670.5	656.7	2.07
	12c	676.6	481.2	39.56		1c	1056.0	1033.8	2.15
4	13a	252.6	247.0	2.27	12	8a	597.6	595.5	0.35
	13b	356.4	347.8	2.47		8b	888.8	885.8	0.34
	13c	335.7	327.9	2.38		8c	642.8	640.4	0.37
5	4a	716.5	692.6	3.45	13	2a	550.1	538.7	2.12
	4b	719.8	695.6	3.48		2a	685.9	671.3	2.17
	4c	733.1	708.7	3.44		2c	956.8	937.0	2.11
6	15a	546.9	489.0	11.84	14	16a	448.0	402.6	11.28
	15b	477.1	428.0	11.47		16b	416.2	373.7	11.37
	15c	367.8	326.0	11.29		16c	333.7	299.9	11.27
7	14a	302.7	294.8	2.68	15	11a	437.0	312.4	39.88
	14b	340.2	331.5	2.62		11b	608.1	437.0	39.15
	14c	381.0	372.0	2.42		11c	586.8	423.0	38.72
8	9a	397.6	342.5	16.09	16	7a	1024.1	1018.7	0.53
	9b	397.4	341.3	16.44		7b	824.7	820.9	0.46
	9c	356.7	306.5	16.38		7c	846.7	843.5	0.38

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: J. MARTIN, 10-1-90

Checked and Approved, Date: Jm 10-2-90

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Federal Highway Administration
Denver, Colorado

Laboratory No. 2

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	9a	345.6	300.1	15.16	9	14a	404.6	395.2	2.38
	9b	317.1	275.1	15.27		14b	372.7	364.0	2.39
	9c	396.0	333.3	15.81		14c	272.3	266.1	2.33
2	3a	943.5	913.7	3.26	10	1a	934.4	915.2	2.10
	3b	957.9	927.7	3.26		1b	714.5	699.7	2.12
	3c	943.0	914.0	3.17		1c	897.9	879.1	2.14
3	16a	466.6	420.4	10.99	11	7a	890.9	887.6	0.37
	16b	522.9	469.9	11.28		7b	770.1	767.2	0.38
	16c	419.0	377.1	11.11		7c	689.6	686.7	0.42
4	12a	477.7	344.5	38.66	12	4a	759.4	734.4	3.40
	12b	514.8	371.3	38.65		4b	717.9	694.2	3.41
	12c	415.3	298.7	39.04		4c	922.7	892.6	3.37
5	13a	328.7	321.9	2.11	13	6a	848.6	846.6	0.24
	13b	341.1	334.4	2.00		6b	698.5	696.8	0.24
	13c	274.1	268.4	2.12		6c	1057.8	1055.8	0.19
6	8a	1155.6	1152.0	0.31	14	10a	404.0	344.0	17.44
	8b	877.9	875.1	0.32		10b	463.4	395.2	17.26
	8c	698.0	695.5	0.36		10c	305.2	257.4	18.57
7	15a	393.4	353.9	11.16	15	11a	472.0	336.9	40.10
	15b	406.8	366.2	11.09		11b	533.6	383.5	39.14
	15c	360.6	324.0	11.30		11c	453.6	324.3	39.87
8	2a	562.6	550.5	2.20	16	5a	1016.1	1013.5	0.26
	2b	785.3	768.2	2.23		5b	824.3	821.4	0.35
	2c	663.9	650.2	2.11		5c	859.7	857.2	0.29

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: LARRY SNYDER, 9/22/90

Checked and Approved, Date: DARRELL HARDING 9/25/90

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Florida Department of Transportation
Gainesville, Florida

Laboratory No. 3

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	1a	652.4	639.4	2.03	9	16a	336.2	305.5	10.05
	1b	753.2	738.6	1.98		16b	373.7	340.6	9.72
	1c	727.1	712.3	2.08		16c	402.1	367.3	9.47
2	9a	236.1	202.4	16.65	10	4a	810.7	783.8	3.43
	9b	206.9	177.9	16.30		4b	787.4	761.7	3.37
	9c	216.3	186.2	16.17		4c	986.1	954.0	3.36
3	7a	680.9	678.9	0.29	11	10a	210.2	180.3	16.58
	7b	722.9	720.6	0.32		10b	217.0	184.1	17.87
	7c	890.5	887.5	0.34		10c	214.3	183.3	16.91
4	6a	872.2	870.5	0.20	12	11a	221.2	156.4	41.43
	6b	804.4	802.7	0.21		11b	241.6	172.7	39.90
	6c	784.3	782.7	0.20		11c	209.9	150.7	39.28
5	13a	197.9	193.7	2.17	13	14a	211.6	206.7	2.37
	13b	20i.1	196.9	2.13		14b	225.0	220.0	2.27
	13c	217.4	212.7	2.21		14c	224.3	219.1	2.37
6	3a	1066.5	1032.7	3.27	14	15a	368.5	335.0	10.00
	3b	846.7	819.7	3.29		15b	359.6	326.5	10.14
	3c	1119.3	1084.1	3.25		15c	413.4	376.6	9.77
7	5a	791.0	789.4	0.20	15	8a	697.8	695.6	0.32
	5b	642.0	640.8	0.19		8b	866.7	864.0	0.31
	5c	860.3	858.7	0.19		8c	782.2	779.6	0.33
8	2a	867.3	849.2	2.13	16	12a	234.2	169.0	38.58
	2b	897.4	878.1	2.20		12b	350.6	254.4	37.81
	2c	836.5	818.5	2.20		12c	250.1	180.9	38.25

Each set of three samples is to be tested individually and in numerical order according to the set number.
Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: Murrel Hines 9-5-90

Checked and Approved, Date:

S.H.R.P. Moisture Content Proficiency Sample Program
Data Sheet

Maryland Department of Transportation
Brooklandville, Maryland

Laboratory No. 4

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	10a	484.3	426.0	17.61	9	12a	704.3	532.5	38.70
	10c	436.4	385.2	17.65		12b	617.5	472.5	38.47
	10c	478.3	420.9	17.63		12c	651.5	495.4	39.08
2	3a	987.1	958.3	3.33	10	5a	880.8	879.1	0.22
	3b	886.0	960.4	3.34		5b	856.0	854.3	0.22
	3c	941.9	914.5	3.34		5c	866.3	864.7	0.21
3	9a	471.0	418.0	16.43	11	14a	420.9	413.0	2.49
	9b	464.1	412.1	16.41		14b	486.7	477.6	2.38
	9c	464.9	412.9	16.31		14c	485.0	475.9	2.39
4	13a	493.0	483.9	2.34	12	4a	825.7	801.8	3.43
	13b	447.6	441.2	1.85		4b	925.4	897.2	3.52
	13c	465.5	458.0	2.07		4c	726.1	704.7	3.51
5	7a	973.4	969.9	0.40	13	6a	1045.9	1043.7	0.23
	7b	942.4	939.7	0.32		6b	786.4	784.8	0.22
	7c	890.7	887.7	0.38		6c	763.9	762.5	0.21
6	8a	998.4	995.5	0.32	14	1a	1094.4	1073.2	2.17
	8b	892.2	889.0	0.40		1b	970.8	952.1	2.18
	8c	865.4	862.7	0.35		1c	1163.4	1140.6	2.18
7	15a	390.5	360.3	11.37	15	16a	563.4	517.2	10.93
	15b	703.5	644.6	10.73		16b	454.9	419.7	11.08
	15c	499.7	458.5	11.06		16c	530.4	482.7	10.87
8	2a	669.7	657.2	2.23	16	11a	593.9	453.9	39.07
	2b	1048.1	1022.6	2.20		11b	623.6	476.2	38.76
	2c	888.9	871.7	2.21		11c	577.9	442.8	38.87

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: Jon C. Porter 9/7/90

Checked and Approved, Date: Richard [illegible] 9/9

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Iowa Department of Transportation
Ames, Iowa

Laboratory No. 5

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	16a	319.1	288.9	10.45	9	3a	857.0	829.1	3.37
	16b	461.3	422.8	9.11		3b	1097.0	1062.0	3.30
	16c	512.4	472.6	8.42		3c	959.3	928.7	3.29
2	1a	747.8	731.7	2.20	10	2a	839.9	821.8	2.20
	1b	804.1	786.8	2.20		2b	967.7	946.7	2.22
	1c	1051.5	1029.3	2.16		2c	914.0	894.0	2.24
3	6a	950.0	947.8	0.23	11	8a	983.3	980.0	0.34
	6b	726.5	724.7	0.25		8b	733.7	731.3	0.33
	6c	1056.8	1054.4	0.23		8c	846.2	843.6	0.31
4	11a	638.5	487.3	31.03	12	14a	267.1	260.8	2.42
	11b	542.5	399.6	35.76		14b	361.1	352.8	2.35
	11c	598.0	499.5	19.72		14c	348.6	340.3	2.44
5	13a	377.0	370.4	1.78	13	7a	969.5	966.5	0.31
	13b	356.3	349.9	1.83		7b	834.9	831.7	0.38
	13c	357.8	350.2	2.17		7c	736.6	734.0	0.35
6	10a	379.8	323.0	17.59	14	4a	810.1	784.2	3.30
	10b	425.4	361.7	17.61		4b	873.1	844.2	3.42
	10c	375.7	320.6	17.19		4c	838.1	811.1	3.33
7	12a	477.7	348.3	37.15	15	15a	400.3	365.5	9.52
	12b	537.9	408.5	31.68		15b	612.7	564.3	8.58
	12c	500.8	373.7	34.01		15c	340.7	309.4	10.12
8	9a	383.1	330.0	16.09	16	5a	889.0	887.1	0.21
	9b	337.3	291.5	15.71		5b	868.7	867.0	0.20
	9c	366.1	314.9	16.26		5c	774.7	773.5	0.16

**Each set of three samples is to be tested individually and in numerical order according to the set number.
Please be certain to fill in the correct blanks on the data sheet.**

Responsible Technician, Date: Steve Steel 9-10-90

Checked and Approved, Date: [signature] 9-18-90

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Oregon State Highway Division
Salem, Oregon

Laboratory No. 6

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	4a	1129.0	1091.5	3.44	9	16a	415.7	377.4	10.15
	4b	847.6	820.2	3.34		16b	344.6	311.8	10.52
	4c	765.5	740.5	3.35		16c	370.5	336.4	10.14
2	8a	809.8	807.1	0.34	10	14a	319.7	312.4	2.34
	8b	760.4	758.1	0.30		14b	364.7	356.4	2.33
	8c	896.9	893.9	0.34		14c	386.4	377.4	2.39
3	7a	726.9	724.5	0.33	11	13a	321.6	316.2	1.71
	7b	717.6	715.2	0.34		13b	375.2	367.0	2.23
	7c	767.0	764.7	0.30		13c	420.4	412.6	1.89
4	2a	716.5	701.0	2.21	12	1a	808.8	791.6	2.17
	2b	1002.4	980.8	2.20		1b	642.3	628.7	2.16
	2c	605.4	592.5	2.18		1c	774.1	757.6	2.18
5	3a	949.4	919.0	3.31	13	6a	913.2	911.1	0.23
	3b	913.4	883.9	3.34		6b	831.5	829.7	0.22
	3c	1064.9	1030.5	3.34		6c	761.4	760.0	0.18
6	11a	591.3	440.1	34.36	14	15a	460.6	418.8	9.98
	11b	514.1	371.1	38.53		15b	300.3	270.7	10.94
	11c	591.4	441.3	34.01		15c	403.5	365.6	10.37
7	10a	286.5	245.5	16.70	15	12a	605.5	448.8	34.92
	10b	388.0	330.0	17.58		12b	466.3	337.6	38.12
	10c	412.4	351.3	17.39		12c	567.9	420.4	35.09
8	9a	334.6	288.3	16.06	16	5a	885.3	883.6	0.19
	9b	340.8	293.0	16.31		5b	684.9	683.6	0.19
	9c	401.5	345.9	16.07		5c	895.0	893.3	0.19

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: Ralph Borchert 9-11-90

Checked and Approved, Date: Bill Lien 9-12-90

S.H.R.P. Moisture Content Proficiency Sample Program
Data Sheet

California Department of Transportation
Sacramento, California

Laboratory No. 7

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	2a	898.4	879.5	2.15	9	13a	226.0	221.7	1.94
	2b	750.9	734.5	2.23		13b	272.4	266.1	2.37
	2c	693.4	679.3	2.08		13c	267.4	261.7	2.18
2	9a	160.8	138.0	16.52	10	16a	246.6	221.7	11.23
	9b	186.0	161.0	15.53		16b	263.0	236.5	11.21
	9c	160.6	138.4	16.04		16c	221.8	199.4	11.23
3	10a	185.2	157.1	17.89	11	3a	802.2	775.8	3.40
	10b	155.3	132.2	17.47		3b	673.8	652.0	3.34
	10c	171.9	146.9	17.02		3c	978.7	947.1	3.34
4	15a	201.3	181.1	11.15	12	1a	801.8	784.5	2.21
	15b	286.7	259.0	10.69		1b	841.4	823.0	2.24
	15c	206.3	185.5	11.21		1c	759.3	742.8	2.22
5	6a	1102.9	1100.4	0.23	13	14a	269.9	263.6	2.39
	6b	730.0	728.3	0.23		14b	255.0	248.9	2.45
	6c	842.3	839.7	0.29		14c	226.4	221.0	2.44
6	5a	972.9	970.7	0.23	14	12a	392.2	281.4	39.37
	5b	795.3	793.6	0.21		12b	444.5	320.3	38.78
	5c	965.1	962.9	0.23		12c	425.8	305.5	39.38
7	4a	1057.6	1022.4	3.44	15	8a	690.0	687.3	0.39 *
	4b	962.3	930.2	3.45		8b	753.3	750.7	0.35 *
	4c	937.4	905.9	3.48		8c	873.7	870.1	0.41 *
8	11a	352.7	253.3	39.24	16	7a	643.0	640.3	0.42 *
	11b	374.4	267.6	39.91		7b	726.2	722.9	0.46 *
	11c	386.3	278.2	38.86		7c	962.2	958.7	0.37 *

* Bags were open or had been punctur.

Each set of three samples is to be tested individually and in numerical order according to the set number.
Please be certain to fill in the correct blanks on the data sheet.

F onsib chn Dat BT 9/20/90 — ked App 1, D JGM 9/21/90

S.H.R.P. Moisture Content Proficiency Sample Program
Data Sheet

uthwestern Laboratories
uston, Texas

Laboratory N0. 8

Set#	Sample#	Beginning Weight(0.1g)	Ending Weight(0.1g)	Moisture Loss(0.01%)	Set#	Sample#	Beginning Weight(0.1g)	Ending Weight(0.1g)	Moisture Loss(0.01%)
1	9 a	367.5	317.9	15.60	9	15 a	372.6	337.1	10.53
	9 b	435.2	375.2	15.99		15 b	353.2	319.4	10.58
	9 c	436.6	376.2	16.06		15 c	309.7	279.2	10.92
2	13 a	277.6	272.3	1.95	10	4 a	797.3	771.6	3.33
	13 b	347.7	341.9	1.70		4 b	637.5	616.7	3.37
	13 c	335.7	328.6	2.16		4 c	961.5	930.6	3.32
3	5 a	638.8	637.5	0.20	11	2 a	590.2	577.3	2.23
	5 b	753.4	751.9	0.20		2 b	794.8	777.7	2.20
	5 c	804.3	802.6	0.21		2 c	928.9	908.9	2.20
4	11 a	512.7	369.6	38.72	12	12 a	491.0	352.9	39.13
	11 b	588.1	425.1	38.34		12 b	677.8	487.6	39.01
	11 c	490.9	353.2	38.99		12 c	496.6	356.1	39.46
5	8 a	961.8	959.0	0.29	13	3 a	754.0	730.3	3.25
	8 b	901.1	898.5	0.29		3 b	1005.0	972.7	3.32
	8 c	675.5	673.3	0.33		3 c	1099.3	1064.8	3.24
6	7 a	802.4	799.9	0.31	14	16 a	337.1	303.2	11.18
	7 b	695.3	692.9	0.35		16 b	532.2	479.4	11.01
	7 c	789.4	786.6	0.36		16 c	438.9	395.0	11.11
7	1 a	1096.6	1073.5	2.15	15	14 a	309.5	302.7	2.25
	1 b	996.5	974.8	2.23		14 b	354.1	346.1	2.31
	1 c	922.0	902.2	2.19		14 c	380.1	371.3	2.37
8	10 a	399.4	340.1	17.44	16	6 a	1000.3	998.0	0.23
	10 b	403.8	345.0	17.04		6 b	682.3	680.8	0.22
	10 c	393.7	334.1	17.84		6 c	806.0	804.3	0.21

Each set of three sample is to be tested individullay and in numerical order according to the set number

PLease be certain to fill in the correct blanks on the data sheet

Responsible Technician, Date: Fatai Akinlabi · 10/1/90 Checked and Approved, Date: M Tahmoressi 10/1/90

Fatai Akinlabi, CET

Maghsoud Tahmoressi, P.E.

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Braun Engineering Testing, Inc.
Minneapolis, Minnesota

Laboratory No. 9

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	10a	400.5	340.6	17.59	9	5a	696.6	694.6	0.29
	10b	328.7	279.1	17.77		5b	999.4	996.5	0.29
	10c	438.4	373.8	17.28		5c	833.5	830.9	0.31
2	7a	770.3	766.8	0.46	10	14a	365.5	356.2	2.61
	7b	687.5	684.5	0.44		14b	308.7	300.9	2.59
	7c	685.3	682.3	0.44		14c	288.2	280.6	2.71
3	6a	1176.5	1173.7	0.24	11	8a	812.5	809.2	0.41
	6b	943.0	940.5	0.26		8b	874.0	870.4	0.41
	6c	782.1	779.9	0.28		8c	816.2	812.5	0.46
4	11a	490.9	351.1	39.82	12	2a	807.6	790.4	2.18
	11b	481.4	344.8	39.62		2b	659.8	645.3	2.25
	11c	472.0	338.4	39.48		2c	529.2	517.3	2.30
5	12a	595.7	429.1	38.82	13	3a	1120.6	1084.1	3.37
	12b	536.5	384.4	39.57		3b	879.2	851.4	3.26
	12c	494.5	354.4	39.53		3c	976.0	944.6	3.32
6	13a	293.6	285.7	2.76	14	15a	409.1	367.4	11.35
	13b	381.7	372.0	2.61		15b	482.6	434.0	11.20
	13c	338.3	329.5	2.67		15c	282.2	252.8	11.63
7	1a	905.1	885.2	2.25	15	9a	352.5	303.2	16.26
	1b	1001.6	980.0	2.20		9b	294.6	253.1	16.40
	1c	933.1	912.6	2.25		9c	368.0	317.8	15.80
8	4a	694.1	670.2	3.57	16	16a	380.8	342.6	11.15
	4b	916.4	885.9	3.44		16b	514.7	463.4	11.07
	4c	734.7	709.4	3.57		16c	458.3	410.3	11.70

Each set of three samples is to be tested individually and in numerical order according to the set number.
Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: [illegible] 9-12-90

Checked and Approved, Date: William Boyd 9-12-90

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Nevada Department of Transportation
Carson City, Nevada

Laboratory No. 10

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	10a	227.0	200.5	17.35	9	11a	213.3	168.6	36.90
	10b	211.4	186.6	17.78		11b	257.3	202.5	35.65
	10c	221.5	195.4	17.71		11c	232.7	182.8	37.21
2	5a	1337.4	1335.8	0.15	10	14a	175.7	172.9	2.18
	5b	1190.6	1189.1	0.17		14b	176.1	173.3	2.19
	5c	1150.3	1148.8	0.17		14c	207.3	203.8	2.27
3	8a	1227.3	1224.7	0.27	11	7a	1044.6	1042.6	0.27
	8b	1110.2	1107.4	0.34		7b	1078.3	1076.3	0.26
	8c	946.1	944.3	0.27		7c	1011.9	1010.0	0.26
4	*13a	227.7	224.0	2.09	12	4a	1392.1	1356.8	3.32
	13b	201.1	198.1	2.00		4b	1247.6	1216.0	3.43
	13c	191.9	189.3	1.82		4c	1084.6	1058.0	3.41
5	6a	1281.5	1280.0	0.15	13	15a	303.8	285.0	7.90
	6b	1157.8	1156.2	0.18		15b	338.7	318.4	7.55
	6c	1169.9	1168.5	0.16		15c	321.4	301.31	7.94
6	1a	1066.9	1050.3	2.14	14	16a	330.6	310.7	7.62
	*1b	1237.9	1218.4	2.15		16b	340.5	320.2	7.45
	1c	1223.7	1204.3	2.16		16c	304.9	285.8	8.10
7	9a	203.1	181.9	16.10	15	2a	1168.6	1150.1	2.15
	9b	249.1	222.0	15.58		2b	1290.1	1269.1	2.14
	9c	203.4	182.3	15.54		2c	1019.1	1003.0	2.18
8	3a	924.4	904.5	3.23	16	12a	257.0	206.0	32.49
	3b	1158.4	1129.5	3.34		12b	276.2	220.9	32.21
	3c	1160.9	1133.5	3.26		12c	262.3	206.0	35.68

*Samples had partially opened bags.

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: Pete Baker 9-6-90
Materials & Testing Div.

Checked and Approved, Date: Ted Beeston, 9-6-90
Materials & Testing Div.

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Kansas Department of Transportation
Topeka, Kansas

Laboratory No. 11

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	1a	535.7	525.5	1.94	9	10a	195.5	166.9	17.14
	1b	520.7	510.4	2.02		10b	193.8	165.3	17.24
	1c	579.9	568.0	2.10		10c	203.3	173.4	17.24
2	6a	624.6	623.6	.16	10	15a	400.7	361.4	10.87
	6b	679.3	677.4	.28		15b	358.4	322.9	10.99
	6c	700.4	698.5	.27		15c	406.7	366.4	11.00
3	16a	206.2	186.0	10.86	11	2a	577.4	566.1	2.00
	16b	327.1	294.4	11.11		2b	600.0	587.2	2.18
	16c	318.4	286.4	11.17		2c	711.7	697.3	2.07
4	13a	183.2	179.0	2.35	12	4a	684.7	663.2	3.24
	13b	192.0	187.9	2.18		4b	649.8	629.3	3.26
	13c	188.8	184.6	2.28		4c	708.9	686.6	3.25
5	8a	717.0	714.8	.31	13	12a	163.2	118.3	37.95
	8b	671.2	669.3	.28		12b	172.5	124.5	38.55
	8c	633.2	631.3	.30		12c	160.1	113.9	40.56
6	3a	591.7	573.2	3.23	14	14a	195.9	191.3	2.40
	3b	684.4	663.7	3.12		14b	196.2	191.7	2.35
	3c	701.1	679.8	3.13		14c	194.4	189.7	2.48
7	7a	741.2	739.1	.28	15	5a	613.9	613.1	.13
	7b	749.7	746.8	.39		5b	700.9	699.3	.23
	7c	627.0	625.5	.24		5c	690.2	689.5	.10
8	9a	171.2	147.8	15.83	16	11a	184.1	131.5	40.00
	9b	173.6	142.7	21.65		11b	168.9	120.5	40.17
	9c	186.2	158.9	17.18		11c	180.4	129.3	39.52

Each set of three samples is to be tested individually and in numerical order according to the set number.
Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: ____________

Checked and Approved, Date: Shelly A Kenny 9-11-92

S.H.R.P. Moisture Content Proficiency Sample Program
Data Sheet

PSI
Pittsburgh, Pennsylvania

Laboratory No. 12

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	1a	682.8	668.6	2.12	9	2a	601.6	588.6	2.21
	1b	890.2	871.6	2.13		2b	910.2	891.2	2.13
	1c	1185.2	1160.9	2.09		2c	543.4	531.5	2.24
2	16a	470.4	430.2	9.34	10	8a	1006.0	1001.5	0.45
	16b	436.5	395.6	10.34		8b	708.3	705.1	0.45
	16c	490.4	452.3	8.42		8c	1026.0	1020.7	0.52
3	11a	540.3	405.4	33.28	11	7a	870.8	867.0	0.44
	11b	460.1	336.5	36.73		7b	851.4	847.6	0.45
	11c	564.7	416.6	35.55		7c	809.4	806.8	0.32
4	13a	273.7	267.9	2.16	12	14a	324.3	316.7	2.40
	13b	276.6	272.1	1.65		14b	301.8	294.5	2.48
	13c	380.6	373.3	1.96		14c	254.4	248.5	2.37
5	15a	401.3	365.8	9.70	13	3a	1083.3	1048.7	3.30
	15b	426.5	388.5	9.78		3b	1184.1	1146.5	3.28
	15c	386.1	346.9	10.26		3c	1065.1	1031.1	3.30
6	12a	558.7	415.5	34.46	14	4a	937.9	907.6	3.34
	12b	457.7	336.1	36.18		4b	894.4	863.2	3.61
	12c	528.0	390.1	35.35		4c	914.1	883.7	3.44
7	6a	785.7	784.0	0.22	15	9a	381.6	328.6	16.13
	6b	698.5	697.0	0.22		9b	429.1	369.9	16.00
	6c	834.0	832.1	0.23		9c	347.5	299.6	15.99
8	5a	946.3	944.5	0.19	16	10a	405.7	345.0	17.59
	5b	874.7	872.9	0.21		10b	287.8	246.6	16.71
	5c	649.2	647.7	0.23		10c	277.1	237.1	16.87

OVER............

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician. Date: [signature] 10 ______ Checked and Approved, Date 10-9- ______

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Minnesota Department of Transportation
Maplewood, Minnesota

Laboratory No. 13

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	5a	911.5	910.4	.12	9	15a	442.6	399.3	10.67
	5b	837.9	836.8	.13		15b	370.6	351.2	11.22
	5c	920.8	919.7	.12		15c	371.2	333.2	11.40
2	2a	931	INADVERTENTLY SPILLED		10	6a	758.9	756.5	.32
	2b	725.2	709.7	2.18		6b	754.9	752.9	.27
	2c	1261.9	1235.4	2.15		6c	819.4	817.6	.22
3	4a	804	777.7	3.38	11	13a	250.7	245.6	2.08
	4b	895.3	865.7	3.42		13b	386.2	377.9	2.20
	4c	878	848.9	3.43		13c	280.7	275	2.07
4	8a	643.8	641.8	.31	12	14a	323.6	316.3	2.31
	8b	789.8	787	.31		14b	298.7	291.7	2.40
	8c	1203.0	1198.4	.38		14c	415.4	404.2	2.77
5	11a	597.9	431	38.72	13	1a	822.5	805.3	2.14
	11b	497.9	358.4	38.92		1b	852.1	834.2	2.15
	11c	569.8	409	39.31		1c	973	955	1.88
6	16a	544.3	INADVERTENTLY SPILLED		14	9a	422	363.2	16.19
	16b	402.5	361.2	11.43		9b	419.5	359.3	16.75
	16c	542.7	489.3	10.91		9c	367.7	317	15.99
7	3a	1047.9	1012.8	3.47	15	12a	612	440.3	39.00
	3b	958.1	926.5	3.41		12b	440.8	316.3	39.36
	3c	727.6	704.8	3.24		12c	573.1	413.8	38.50
8	7a	846.9	843.3	.43	16	10a	445.3	379.5	17.34
	7b	852.5	847.8	.55		10b	287.1	245.9	17.57
	7c	894.6	892.1	.28		10c	295.2	249.8	18.17

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: [illegible signature]

Checked and Approved, Date: Neil McDue [illegible date]

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Texas State Dept. of Hwys. & Public Transportation
Austin, Texas

Laboratory No. 14

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	11a	546.7	392.2	39.39	9	6a	739.0	737.3	0.23
	11b	495.5	355.7	39.30		6b	1150.7	1147.9	0.24
	11c	546.1	393.4	38.82		6c	884.3	881.9	0.27
2	5a	728.1	725.8	0.32	10	1a	894.3	874.7	2.24
	5b	948.6	945.9	0.29		1b	962.2	941.4	2.21
	5c	751.6	749.7	0.25		1c	804.7	787.5	2.18
3	13a	317.8	312.3	1.76	11	3a	752.0	726.7	3.48
	13b	277.6	271.0	2.44		3b	696.4	674.0	3.32
	13c	292.0	285.4	2.31		3c	989.1	956.8	3.38
4	15a	449.1	403.5	11.30	12	10a	271.1	232.4	16.65
	15b	572.1	514.7	11.15		10b	438.7	373.2	17.55
	15c	581.9	523.3	11.20		10c	379.5	323.1	17.46
5	9a	353.8	305.0	16.00	13	16a	511.2	460.3	11.06
	9b	386.8	332.9	16.19		16b	454.2	409.0	11.05
	9c	413.0	356.0	16.01		16c	461.5	415.8	10.99
6	14a	353.6	342.4	3.27	14	12a	499.3	357.4	39.70
	14b	373.2	364.3	2.44		12b	502.7	360.9	39.29
	14c	391.0	379.7	2.98		12c	516.4	371.4	39.04
7	7a	914.0	910.0	0.44	15	4a	803.8	777.0	3.45
	7b	735.6	732.8	0.38		4b	1136.4	1098.5	3.45
	7c	819.8	816.7	0.38		4c	876.5	826.5	6.05
8	8a	745.8	743.2	0.35	16	2a	622.6	608.9	2.25
	8b	739.9	736.5	0.46		2b	713.7	698.3	2.21
	8c	737.6	734.9	0.37		2c	1023.6	1000.7	2.29

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: David M. Gaskspor 9-20-90
Janet D. Evans 9-20-90

Checked and Approved, Date: Leonard [illegible] P.E. 9/20/90

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

West Virginia Department of Transportation
Charleston, West Virginia

Laboratory No. 15

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	2a	970.9	949.8	2.22	9	14a	269.2	263.2	2.28
	2b	1073.1	1049.7	2.23		14b	318.0	310.8	2.32
	2c	814.1	796.3	2.23		14c	377.4	368.8	2.33
2	15a	553.0	502.5	10.05	10	5a	1001.3	999.6	0.17
	15b	546.8	495.9	10.26		5b	726.3	724.8	0.21
	15c	573.7	522.0	9.90		5c	757.4	755.5	0.25
3	9a	289.9	288.1	16.24	11	10a	394.4	335.8	17.45
	9b	320.6	275.7	16.18		10b	301.1	257.1	17.11
	9c	365.5	314.0	16.40		10c	418.7	356.3	17.51
4	11a	539.6	395.0	36.61	12	1a	829.6	812.2	2.14
	11b	564.9	410.1	37.75		1b	932.7	912.5	2.21
	11c	630.0	475.9	37.58		1c	1010.3	988.7	2.18
5	3a	898.2	868.7	3.40	13	16a	497.9	451.7	10.23
	3b	982.4	950.8	3.32		16b	363.7	328.9	10.58
	3c	749.5	724.7	3.42		16c	424.0	385.7	9.93
6	7a	691.5	689.3	0.32	14	13a	334.4	328.8	1.70
	7b	886.3	882.9	0.39		13b	365.1	359.5	1.56
	7c	1026.1	1022.3	0.37		13c	340.5	335.0	1.64
7	6a	589.2	588.0	0.20	15	12a	531.3	385.0	38.00
	6b	923.4	921.2	0.24		12b	742.4	543.7	36.55
	6c	624.2	622.5	0.27		12c	483.8	350.1	38.19
8	4a	841.7	813.9	3.42	16	8a	827.2	824.6	0.32
	4b	739.0	714.5	3.43		8b	814.9	812.0	0.36
	4c	969.8	937.3	3.47		8c	837.3	835.0	0.28

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: M. Sajid

Checked and Approved, Date: R. Capper 9/7/90

S.H.R.P. Moisture Content Proficiency Sample Program
Data Sheet

Law Engineering
Atlanta, Georgia

Laboratory No. 16

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	9a	116.0	100.9	14.97	9	13a	206.8	202.7	2.02
	9b	136.5	118.7	15.00		13b	197.0	193.1	2.02
	9c	122.9	106.00	15.94		13c	196.7	192.6	2.13
2	12a	161.5	115.7	39.59	10	1a	537.3	526.3	2.09
	12b	156.4	112.7	38.78		1b	807.3	790.0	2.19
	12c	162.5	117.9	37.83		1c	787.5	770.5	2.21
3	11a	158.9	115.6	37.46	11	14a	204.9	200.2	2.35
	11b	163.2	116.1	40.57		14b	211.2	206.6	2.23
	11c	135.5	97.2	39.40		14c	201.0	196.5	2.29
4	8a	376.4	375.2	0.32	12	6a	950.3	948.1	0.23
	8b	342.6	341.5	0.32		6b	898.7	896.8	0.21
	8c	625.0	626.6	0.38		6c	1064.5	1062.1	0.23
5	16a	314.0	286.0	9.79	13	5a	947.4	945.0	0.25
	16b	321.2	292.4	9.85		5b	739.8	737.5	0.31
	16c	331.3	301.4	9.92		5c	994.0	991.6	0.24
6	3a	523.3	504.9	3.64	14	4a	743.9	720.3	3.28
	3b	805.5	781.5	3.07		4b	815.1	788.3	3.40
	3c	689.3	668.4	3.13		4c	952.3	920.7	3.43
7	10a	158.2	135.5	16.75	15	2a	985.7	964.2	2.23
	10b	229.2	196.1	16.88		2b	858.5	840.2	2.18
	10c	163.3	139.3	17.23		2c	889.8	871.0	2.16
8	7a	708.9	706.1	0.40	16	15a	319.9	290.8	10.01
	7b	730.1	727.8	0.32		15b	303.6	276.0	10.00
	7c	625.2	622.9	0.37		15c	313.9	286.1	9.72

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: H. Johnson 10/3/90

Checked and Approved; Date: William Kilpatrick 10/5/90

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

Western Technologies
Phoenix, Arizona

Laboratory No. 17

Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)	Set#	Sample#	Beginning weight(0.1g)	Ending weight(0.1g)	Moisture loss(0.01%)
1	8a	713.2	712.6	0.08	9	9a	324.1	278.8	16.25
	8b	774.3	773.3	0.13		9b	363.7	[illegible]	16.05
	8c	923.1	921.7	0.15		9c	364.3	314.6	15.80
2	5a	954.4	953.9	0.05	10	10a	449.6	383.1	17.36
	5b	935.5	934.4	0.12		10b	427.6	365.6	16.96
	5c	702.9	702.2	0.10		10c	413.2	352.0	17.39
3	2a	576.0	564.7	2.00	11	13a	251.4	250.8	0.24
	2b	1072.4	1050.6	2.08		13b	304.6	301.9	0.89
	2c	1058.4	1037.4	2.02		13c	287.4	285.1	0.81
4	6a	1181.3	1181.0	0.03	12	3a	668.7	648.5	3.11
	6b	971.2	970.8	0.04		3b	1001.1	980.1	2.14
	6c	1031.9	1030.9	0.10		3c	994.2	973.3	2.15
5	4a	946.8	917.3	3.22	13	12a	645.3	481.0	34.16
	4b	831.9	806.9	3.10		12b	386.7	281.8	37.22
	4c	681.2	661.0	3.06		12c	591.0	436.8	35.30
6	11a	610.6	447.2	36.54	14	7a	829.4	828.4	0.12
	11b	549.0	400.6	37.04		7b	912.7	911.7	0.11
	11c	481.8	342.2	40.79		7c	868.4	867.2	0.14
7	16a	481.7	440.4	9.38	15	1a	1101.7	1080.0	2.01
	16b	457.2	421.3	8.52		1b	855.4	839.2	1.93
	16c	485.4	446.1	8.81		1c	1012.1	992.4	1.99
8	14a	311.0	305.8	1.70	16	15a	500.3	458.6	9.09
	14b	335.8	329.7	1.85		15b	427.2	391.2	9.20
	14c	405.5	397.5	2.01		15c	400.3	367.2	9.01

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: [signature] 9/12/90

Checked and Approved, Date: M. Kunt[signature] 9-25-90

Returned Tare Weights

LAB No. 1

SET #	SAMPLE		BAG WT.
1	5	A	7.8
		B	7.7
		C	7.3
2	3	A	7.1
		B	7.6
		C	7.7
3	12	A	7.7
		B	8.1
		C	8.5
4	13	A	7.1
		B	7.1
		C	7.0
5	4	A	9.7
		B	8.2
		C	9.1
6	15	A	7.4
		B	7.9
		C	7.5
7	14	A	7.7
		B	7.3
		C	7.4
8	9	A	8.3
		B	8.0
		C	7.7
9	10	A	7.4
		B	7.6
		C	7.7
10	6	A	7.4
		B	7.7
		C	7.7
11	1	A	7.6
		B	7.4
		C	7.1
12	8	A	7.7
		B	7.6
		C	7.1

SET #	SAMPLE		BAG WT.
13	2	A	7.3
		B	7.6
		C	7.4
14	16	A	7.9
		B	7.9
		C	7.9
15	11	A	8.3
		B	8.2
		C	7.9
16	7	A	7.2
		B	7.6
		C	7.3

LAB No. 2

1. 9a-8.5
   9b-7.6
   9c-8.1

2. 3a-7.4
   3b-7.7
   3c-7.4

3. 16a-7.9
   16b-7.9
   16c-7.8

4. 12a-8.4
   12b-8.0
   12c-8.1

5. 13a-7.3
   13b-7.5
   13c-7.6

6. 8a-7.9
   8b-7.9
   8c-7.8

7. 15a-8.0
   15b-7.6
   15c-7.5

8. 2a-7.1
   2b-7.2
   2c-7.8

9. 14a-7.4
   14b-7.4
   14c-7.5

10. 1a-7.2
    1b-7.4
    1c-7.4

11. 7a-7.6
    7b-7.2
    7c-7.3

12. 4a-8.5
    4b-7.8
    4c-8.0

13. 6a-7.4
    6b-7.4
    6c-7.5

14. 10a-8.3
    10b-8.5
    10c-8.1

15. 11a-9.1
    11b-8.9
    11c-8.2

16. 5a-7.2
    5b-7.6
    5c-7.8

LAB No.4

SAMPLE #		BAG WEIGHT
10	A	8.08
	B	7.60
	C	7.57
3	A	7.60
	B	7.28
	C	7.17
9	A	7.37
	B	7.67
	C	7.24
13	A	7.07
	B	7.03
	C	7.40
7	A	7.59
	B	7.52
	C	7.27
8	A	7.34
	B	7.23
	C	7.22
15	A	7.38
	B	7.78
	C	7.71
2	A	7.51
	B	7.05
	C	7.48
12	A	7.87
	B	11.41
	C	7.90
5	A	7.36
	B	7.61
	C	7.36
14	A	7.61
	B	7.18
	C	7.22
4	A	7.67
	B	7.86
	C	7.66

SAMPLE #		BAG WEIGHT
6	A	7.20
	B	7.24
	C	7.31
1	A	7.15
	B	7.43
	C	7.10
16	A	7.40
	B	7.33
	C	7.76
11	A	8.17
	B	8.45
	C	9.02

LAB NO. 5

Bag Weights

Sample No.	Bag Weight	Sample No.	Bag Weight	Sample No.	Bag Weight
1A	7.2	8A	7.6	15A	7.4
1B	7.6	8B	7.8	15B	7.4
1C	7.3	8C	7.8	15C	7.9
2A	7.2	9A	7.8	16A	7.4
2B	7.7	9B	7.4	16B	7.5
2C	7.6	9C	8.0	16C	7.3
3A	7.6	10A	7.7		
3B	7.2	10B	7.7		
3C	7.8	10C	7.9		
4A	8.6	11A	9.2		
4B	7.8	11B	9.3		
4C	9.4	11C	10.0		
5A	7.5	12A	8.1		
5B	7.3	12B	8.0		
5C	7.7	12C	8.7		
6A	7.5	13A	7.0		
6B	7.7	13B	7.4		
6C	7.4	13C	7.1		
7A	7.6	14A	7.3		
7B	7.3	14B	7.2		
7C	7.4	14C	7.7		

LAB NO. 6

Oregon State Highway Division
Salem, Oregon

Set#	Sample#	WEIGHT OF EMPTY BAG	Set#	Sample#	WEIGHT OF EMPTY BAG
1	4a	7.84	9	16a	7.98
	4b	8.18		16b	8.28
	4c	8.57		16c	7.87
2	8a	7.36	10	14a	7.71
	8b	7.29		14b	7.68
	8c	7.70		14c	7.80
3	7a	7.60	11	13a	7.36
	7b	7.61		13b	7.65
	7c	7.32		13c	7.20
4	2a	7.56	12	1a	7.27
	2b	7.55		1b	7.46
	2c	7.24		1c	7.63
5	3a	7.71	13	6a	7.86
	3b	7.60		6b	7.34
	3c	7.29		6c	7.77
6	11a	8.36	14	15a	8.04
	11b	8.00		15b	8.30
	11c	8.68		15c	8.30
7	10a	7.80	15	12a	8.51
	10b	7.71		12b	8.46
	10c	7.47		12c	9.85
8	9a	7.89	16	5a	7.82
	9b	7.75		5b	7.64
	9c	7.88		5c	8.14

S.H.R.P. Moisture Content Proficiency Sample Program
Data Sheet

Southwestern Laboratories
Houston, Texas

Laboratory NO. 8

Set#	Sample#	Weight of Empty Bag(0.1g)	Set#	Sample#	Weight of Empty Bag(0.1g)
1	9 a	8.3	9	15 a	7.5
	9 b	8.0		15 b	7.5
	9 c	7.9		15 c	7.7
2	13 a	7.0	10	4 a	8.8
	13 b	7.4		4 b	7.7
	13 c	7.5		4 c	8.8
3	5 a	7.7	11	2 a	7.3
	5 b	7.6		2 b	7.5
	5 c	7.7		2 c	6.9
4	11 a	8.8	12	12 a	8.1
	11 b	9.2		12 b	9.1
	11 c	8.7		12 c	7.6
5	8 a	7.4	13	3 a	7.3
	8 b	7.3		3 b	7.7
	8 c	7.4		3 c	7.8
6	7 a	7.2	14	16 a	7.7
	7 b	7.3		16 b	7.3
	7 c	7.4		16 c	7.3
7	1 a	7.3	15	14 a	7.2
	1 b	7.3		14 b	7.6
	1 c	7.6		14 c	7.4
8	10 a	7.8	16	6 a	7.3
	10 b	7.8		6 b	7.8
	10 c	7.4		6 c	7.8

LAB NO. 12

Set #	Sample #	Bag Weight(0.1g)	Set #	Sample #	Bag Weight(0.1g)
1	1a	7.2	9	2a	7.6
	1b	7.4		2b	7.5
	1c	7.3		2c	7.5
2	16a	7.8	10	8a	7.4
	16b	7.4		8b	7.4
	16c	7.4		8c	7.8
3	11a	8.9	11	7a	7.3
	11b	9.0		7b	7.3
	11c	9.5		7c	7.4
4	13a	7.5	12	14a	7.6
	13b	7.5		14b	7.8
	13c	7.5		14c	7.4
5	15a	7.8	13	3a	7.7
	15b	7.8		3b	7.5
	15c	7.8		3c	7.4
6	12a	8.4	14	4a	7.7
	12b	9.1		4b	7.4
	12c	7.9		4c	7.7
7	6a	7.6	15	9a	8.5
	6b	7.6		9b	8.6
	6c	7.9		9c	8.2
8	5a	7.2	16	10a	7.7
	5b	7.3		10b	7.7
	5c	7.4		10c	7.8

LAB NO. 14

	Bag	Weight
#1	11A	8.3
	11B	8.5
	11C	8.1
#2	5A	7.4
	5B	7.3
	5C	7.3
#3	13A	7.3
	13B	7.4
	13C	7.1
#4	15A	7.6
	15B	7.5
	15C	7.6
#5	9A	8.3
	9B	7.8
	9C	8.5
#6	14A	7.6
	14B	7.5
	14C	7.0
#7	7A	7.3
	7B	7.2
	7C	7.1
#8	8A	7.7
	8B	7.7
	8C	7.6

	Bag	Weight
#9	6A	7.7
	6B	7.4
	6C	7.6
#10	1A	7.3
	1B	7.3
	1C	7.6
#11	3A	7.6
	3B	8.0
	3C	7.7
#12	10A	7.9
	10B	7.9
	10C	7.9
#13	16A	7.5
	16B	7.5
	16C	7.3
#14	12A	9.3
	12B	8.6
	12C	8.2
#15	4A	7.9
	4B	8.0
	4C	14.0
#16	2A	7.9
	2B	2.2
	2C	2.3

LAB NO. 15

Set#	Sample#	Bag weight(0.1g)
1	2a	7.5
	2b	7.7
	2c	7.0
2	15a	7.7
	15b	7.7
	15c	7.4
3	9a	8.2
	9b	8.4
	9c	8.2
4	11a	9.8
	11b	10.5
	11c	9.6
5	3a	7.4
	3b	7.3
	3c	7.7
6	7a	7.3
	7b	7.3
	7c	7.4
7	6a	7.4
	6b	7.2
	6c	7.3
8	4a	8.0
	4b	8.8
	4c	7.6

Set#	Sample#	Bag weight(0.1g)
9	14a	7.5
	14b	7.7
	14c	7.1
10	5a	7.3
	5b	7.3
	5c	7.7
11	10a	8.3
	10b	8.1
	10c	8.2
12	1a	7.0
	1b	7.1
	1c	7.2
13	16a	7.2
	16b	7.2
	16c	7.5
14	13a	7.2
	13b	7.0
	13c	7.3
15	12a	8.8
	12b	8.6
	12c	8.3
16	8a	7.3
	8b	7.6
	8c	7.2

S.H.R.P. Moisture Content Proficiency Sample Program

Data Sheet

WEIGHT OF PLASTIC BAGS

Law Engineering
Atlanta, Georgia

Laboratory No. 16

Set#	Sample#	WT. OF PLASTIC BAG GRAMS			Set#	Sample#	WT. OF PLASTIC BAG GRAMS		
1	9a	7.35			9	13a	7.44		
	9b	7.50				13b	7.20		
	9c	7.32				13c	7.37		
2	12a	7.71			10	1a	7.03		
	12b	7.46				1b	7.21		
	12c	7.25				1c	7.50		
3	11a	7.70			11	14a	7.15		
	11b	7.64				14b	7.52		
	11c	7.38				14c	7.54		
4	8a	7.60			12	6a	7.59		
	8b	7.48				6b	7.58		
	8c	7.71				6c	7.57		
5	16a	7.31			13	5a	7.53		
	16b	7.78				5b	7.64		
	16c	7.13				5c	7.61		
6	3a	7.32			14	4a	7.35		
	3b	7.34				4b	7.25		
	3c	7.54				4c	7.53		
7	10a	7.68			15	2a	7.63		
	10b	7.80				2b	7.60		
	10c	7.81				2c	7.24		
8	7a	7.21			16	15a	7.27		
	7b	7.55				15b	7.34		
	7c	7.46				15c	7.42		

Each set of three samples is to be tested individually and in numerical order according to the set number. Please be certain to fill in the correct blanks on the data sheet.

Responsible Technician, Date: H. Johnson

Checked and Approved, Date: Willie Kilpatrick 10/5/90

APPENDIX III

Steele Engineering, Inc.

October 17, 1990

Robin High
TRDF
2602 Dellana Lane
Austin, TX 78746

Dear Robin:

Subject: SHRP Soil Moisture Proficiency Sample Program.

Enclosed is a report which summarizes implementation activities to date concerning the subject program. All test data sheets are contained under the blue page titled Section 3, Returned Data Sheets. Information needed to construct the data array for a components of variance analysis as previously discussed is contained in other sections of the report.

Please proceed with the analysis as soon as possible. As indicated in the past, participating laboratories should be identified only by a number in the final report compiled for distribution to interested parties.

Call me if anything has been overlooked or further elaboration is needed. I will review the analysis report upon receipt and contact you by telephone if questions arise.

Yours very truly

Garland W. Steele, P.E.
President, Steele Engineering, Inc.

enclosure: SHRP Soil H_2O Proficiency Sample Report

cc: Adrian Pelzner (letter only)

Box 173 • Tornado, West Virginia 25202 • Tele. (304) 727-8719

APPENDIX IV

Steele Engineering, Inc.

January 11, 1991

Virgil Anderson
48 Oaks Place
Lago Vista, TX 78645

Dear Virgil:

Subject: SHRP Soil Moisture Proficiency Sample Program.

This will confirm the substance of telephone discussions with Robin during the past few days concerning the format for presenting precision data which can be determined from the analyses now underway of test data from the subject program.

The most desirable approach is to use a format that is generally used by AASHTO and ASTM. Examples are contained in ASTM C670, Standard Practice for Preparing Precision and Bias Statements for Construction Materials. For example, if the analysis yields an estimate of 2.1% for σ within laboratories by single operators, the statement could read-

> Precision-The within laboratory single operator standard deviation has been found to be 2.1%.[A] Therefore, results of two properly conducted tests by the same operator in the same laboratory on the same soil with the same moisture content should not differ by more than 5.94%.[A]
>
> [A]These numbers represent, respectively, the 1S and D2S limits as described in ASTM Practice C670, for Preparing Precision Statements for Test Methods for Construction Materials.

The data available from the subject program will, of course, yield considerably more information concerning the components of variance and, as discussed with Robin, will hopefully allow an estimate of bias to be determined.

As originally discussed during the design of this program, the within sample variance could be quantified by comparing the odd numbered (1 through 63) samples to the even numbered (2 through 64) samples for each of the 16 sample types. The between sample variance could be quantified by comparing the first two samples (1 and 2) of each group of four samples to the second two samples (3 and 4) of the same group of four etc. for all 16 groups of four in each of the 16 sample types. Likewise, the within material-same condition variance can be quantified by comparing the 64 samples from split A to the 64 samples from split B for each of the 8 pairs of A and B splits.

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In addition, the within material-different condition variance of variances could be quantified by comparing the variance of the 128 samples from sample types 1 and 2 to the variance of the 128 samples from sample types 5 and 6 and similarly for each of the other three sets. Further the between material-same condition and the between material-different condition variance of variances could be quantified in a similar manner.

Each of the above would provide valuable insight to SHRP and to other researchers and practitioners concerning a necessary and widely used test procedure.

Enclosed is a copy of a proposed revision to ASTM D2216 which Adrian suggested should be made available to you and Robin for information. Note particularly section 13 on page 11 of the proposed revision. Apparently, SHRP results will provide information of considerable interest to those responsible for such standards.

Please call if you have further suggestions or if my terminology needs clarification.

I appreciate very much your and Robin's efforts to expedite the statistical analyses necessary to allow the highest and best use of data now available from this program.

Yours very truly

Garland W. Steele, P.E.
President, Steele Engineering Inc.

enclosures: 12 pages

cc: Robin High
Adrian Pelzner (letter only)
Bill Hadley (letter only)

Steele Engineering, Inc.

February 7, 1991

Virgil Anderson
48 Oaks Place
Lago Vista, TX 78645

Dear Virgil:

Subject: SHRP Soil Moisture Proficiency Sample Program.

This will confirm the substance of a previous telephone discussion with Robin concerning an "AMRL style" scatter diagram report to be distributed to the participants in the subject program.

Enclosed, as promised, is a copy of some information concerning such reports. It is my understanding, based on discussions with AMRL, that the quadrants are now formed by intersecting mean lines rather than intersecting median lines. Also, that laboratory results eliminated (last paragraph of attachment) are those results outside the 3σ limits of the data as calculated using all results. The remaining results are then recalculated and no further eliminations are made.

Such a report would only be compiled after the currently scheduled analyses are completed.

Please let me know if there are any questions or recommended modifications to the above.

Yours very truly

Garland W. Steele
President, Steele Engineering, Inc.

cc: Adrian Pelzner(letter only)
Bill Hadley(letter only)

APPENDIX V

TECH MEMO: AU-181 DATE: June 12, 1991

AUTHOR: Robin High FILE: P-001

DISTRIBUTION: Garland Steele, Bill Hadley

SUBJECT: Variance Components and Bias Estimation for SHRP Moisture Content Proficiency Sample Program

This memorandum summarizes the test results from the analysis of the SHRP moisture content proficiency sample program. When a test procedure is applied repeatedly to a set of identical material samples the same results rarely occur. An experimental design was structured to evaluate this variability when testing both aggregate and soil material samples for moisture content. Its purpose is to present the within-laboratory and between-laboratory variance components estimated from the data collected during this experiment.

The different factors of the experiment which represent sources of variability and how the materials were to be processed in each laboratory were originally developed as Design 4 in Technical Memorandum AU-95 (Ref 1). The analysis of data from these designs were described in Technical Memorandum AU-108 (Ref 2). The word "material" in this analysis represents both aggregate and soil samples and will be used throughout this report to refer to the applicable type of sample.

Due to the lack of an accepted reference value, an estimate of the amount of bias in the testing procedure for moisture content in the samples has not previously been evaluated. This study presents a unique opportunity to estimate the amount of bias due to the moisture measurement process. Results corresponding to this portion of the study will also be provided.

DATA DESCRIPTION

A brief description of the data is included in this report for completeness. Further details are available in the AMRL report (Ref 3). In this document a description of the experimental design, testing procedures, and and a list of all of the data provided by AMRL collected by the 17 laboratories who participated in the experiment were provided.

Two types of material were used in the experimental plan (aggregates and soils). For both aggregates and soils, material from two different sources was acquired for the study. At each of the two levels of the factor representing the source of the material (MATL) the batch was randomly split into two portions (A or B).

For one-half of each split, moisture was added to the samples; the remaining samples were air dried. One level of the moisture factor refers to the Saturated Surface Dry (SSD) condition for aggregates and Plastic Limit (PLM) condition for soils. The other level for each material refers to the air dry condition.

Table 1 gives a brief summary the factors in the design. Sixteen different types of samples were created and then shipped to the laboratories. Sample numbers 1 through 4 refer to aggregates in the wet condition and samples 5 through 8 refer to aggregates in the dry condition. Sample numbers 9 through 12 refer to soils in the wet condition and 13 through 16 refer to soils in the dry condition. Each laboratory received 3 sets of the nearly identical subsamples from each of the sixteen samples processed by AMRL. Since the magnitude and the variability in the test results for soils was much larger than for aggregates, two separate analyses for each type of material will be given.

VARIANCE COMPONENT ANALYSIS

The experimental plan was developed to estimate the variance components associated with testing the moisture content of both aggregate and soil samples. Three replicate sets of material samples for each combination of the design factors were provided to the seventeen laboratories.

The analysis phase for the determination of moisture content first creates an analysis of variance table (ANOVA). The results are then used to

Table 1. Factor levels and sample type identification.

FACTOR	DESCRIPTION	TYPE OF EFFECT
MST	Moisture	Fixed
MATL	Material	Fixed
LAB	Laboratory	Random

SAMPLE TYPE NO.	SAMPLE DESCRIPTION
	AGGREGATES
	SSD Condition
1	Aggregate 1, Split A
2	Aggregate 1, Split B
3	Aggregate 2, Split A
4	Aggregate 2, Split B
	Air Dry Condition
5	Aggregate 1, Split A
6	Aggregate 1, Split B
7	Aggregate 2, Split A
8	Aggregate 2, Split B

Aggregate 1: WA - Supplied by University of Reno, Nevada
Aggregate 2: PL - Supplied by University of Reno, Nevada

SAMPLE TYPE NO.	SAMPLE DESCRIPTION
	SOILS
	Plastic Limit Condition
9	Soil 1, Split A
10	Soil 1, Split B
11	Soil 2, Split A
12	Soil 2, Split B
	Air Dry Condition
13	Soil 1, Split A
14	Soil 1, Split B
15	Soil 2, Split A
16	Soil 2, Split B

Soil 1: M1 - Supplied by Department of Highways, Maryland
Soil 2: M2 - Supplied by Department of Highways, Maryland

estimate the magnitudes of the between- and the within-laboratory testing variations (σ^2_{LAB} and σ^2 respectively) for both types of materials.

Estimation of the Variance Components

The experimental design under which the data were collected has a direct impact on how the statistical analysis should proceed. The statistical model used to summarize these data takes the following form:

$$MSTLAB = \mu + MST + MATL + LAB + SPLT(MATL) + ERROR$$

The terms MST, MATL, and SPLT(MATL) remove the variability due to the planned moisture content and material type. This allows more accurate estimates of the random variation due to laboratories (LAB) and the random variation due to other unknown factors (ERROR).

Tables 2 and 3 provide the Analysis of Variance (ANOVA) tables for the results. From these summary statistics the two variance components representing the between-laboratory (σ^2_{LAB}) and the within-laboratory (σ^2) components are estimated and appear in the lower portion of the tables.

Differences Among Means

Tables 2 and 3 are also used to identify the laboratories which produce statistically different results from other laboratories. The average test results from each laboratory are presented in a column and are ranked from largest to smallest. Groups of laboratory means are underlined to indicate which ones are not statistically different from one another. The averages to be most concerned with are those which lie on either end of the row. If one continuous line does not appear underneath these averages, there is evidence to suggest the mean from that laboratory exceeds the two standard deviation control limits and does not conform with the remainder of the data.

The mean results from laboratory 17 for aggregates appears to be considerably smaller than the means from the other laboratories. A closer

Table 2. Variance component analysis for aggregate samples.

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Pr > F
Model	18	659.049	36.6138	470.41	0.0001
MST	1	614.220	614.2196	7891.49	0.0001
MATL	1	43.343	43.3428	556.87	0.0001
LAB	16	1.486	0.0929	1.19	0.2699
Error	385	29.966	0.07783		
Corrected Total	403	689.015			

Variance Components

$$\sigma^2_{LAB} = 0.0006345$$

$$\sigma^2 = 0.07783$$

Student-Newman-Keuls test for variable: MSTLAB

Means with the same underline are not significantly different.

SNK Grouping	Mean	LAB
|	1.5937	09
|	1.5583	07
|	1.5562	01
|	1.5467	04
|	1.5467	12
|	1.5438	15
|	1.5246	16
|	1.5221	05
|	1.5208	02
|	1.5154	06
|	1.5096	08
|	1.4974	14
|	1.4909	13
|	1.4871	03
|	1.4817	10
|	1.4379	11
|	1.1677	17

Table 3. Variance component analysis for soil samples.

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Pr > F
Model	18	66999.245	3722.180	292.19	0.0001
MST	1	45014.471	45014.471	3533.67	0.0001
MATL	1	21723.755	21723.755	1705.33	0.0001
LAB	16	261.019	16.314	1.28	0.2059
Error	388	4942.622	12.739		
Corrected Total	406	71941.867			

Variance Components

$$\sigma^2_{LAB} = 0.1493$$

$$\sigma^2 = 12.739$$

Student-Newman-Keuls test for variable: MSTLAB

Means with the same underline are not significantly different.

SNK Grouping	Mean	N	LAB
|	17.628	24	11
|	17.621	23	13
|	17.583	24	09
|	17.554	24	01
|	17.390	24	14
|	17.354	24	07
|	17.301	24	02
|	17.252	24	04
|	17.154	24	08
|	17.017	24	03
|	16.780	24	16
|	16.598	24	15
|	16.255	24	06
|	15.932	24	17
|	15.904	24	12
|	15.388	24	10
|	14.958	24	05

examination of the raw data for this laboratory is required to determine a reason for this difference.

PRECISION STATEMENTS FOR MOISTURE CONTENT

The within laboratory variance components for the moisture contents of the two material types are given in Tables 2 and 3. This section provides the within-laboratory precision statements for moisture content testing. The two standard deviation limits for the difference between two observations are given. These values imply that within one laboratory, a pair of measurements selected at random will differ by more than $2\sqrt{2}\,\sigma$ in only 5% of all cases.

Aggregates

Precision - The within-laboratory single operator standard deviation for aggregates is determined to be $\sigma = \sqrt{0.07783} = 0.2790$. Therefore, results of two properly conducted tests by the same operator in the same laboratory on this aggregate should not differ by more than $2\sqrt{2}\,\sigma = 0.7891$ from each other.

These numbers represent, respectively, the 1S and D2S limits as described in ASTM Practice C670, for Preparing Precision Statements for Test Methods for Construction Materials.

Soils

Precision - The within-laboratory single operator standard deviation for aggregates has been found to be $\sigma = \sqrt{12.739} = 3.5692$. Therefore, results of two properly conducted tests by the same operator in the same laboratory on this aggregate should not differ by more than $2\sqrt{2}\,\sigma = 10.0951$ from each other.

These numbers represent, respectively, the 1S and D2S limits as described in ASTM Practice C670, for Preparing Precision Statements for Test Methods for Construction Materials.

BETWEEN LABORTORIES PRECISION STATEMENTS FOR MOISTURE SAMPLES

The between-laboratory variance components for the moisture content of the two material types, are given in Tables 2 and 3. This section provides between-laboratory precision statements based on these results for resilient modulus testing. The two standard deviations limits for the difference between two observations from different laboratories are given. These values imply that the difference between one measurement selected at random from each of two laboratories will differ from each other by more than $2\sqrt{2(\sigma^2_{LAB} + \sigma^2)}$ in only 5% of all cases.

Aggregates

Precision - The between laboratory single operator standard deviation for moisture content has been found to be $\sqrt{\sigma^2_{LAB} + \sigma^2} = 0.28012$. Therefore, the results of properly conducted tests from two laboratories on the same aggregate should not differ by more than $2\sqrt{2\ (\sigma^2_{LAB} + \sigma^2)} = 0.7923$ from each other.

These numbers represent, respectively, the 1S and D2S limits as described in ASTM Practice C670, for Preparing Precision Statements for Test Methods for Construction Materials.

Soils

Precision - The between laboratory single operator standard deviation for moisture content has been found to be $\sqrt{\sigma^2_{LAB} + \sigma^2} = 3.5900$. Therefore, the results of properly conducted tests from two laboratories on the same soil should not differ by more than $2\sqrt{2\ (\sigma^2_{LAB} + \sigma^2)} = 10.1541$ from each other.

These numbers represent, respectively, the 1S and D2S limits as described in ASTM Practice C670, for Preparing Precision Statements for Test Methods for Construction Materials.

ESTIMATION OF BIAS

The precision of the standard test method for the determination of moisture content of aggregates and soils in a laboratory was the primary topic of the two previous sections. These results showed the degree of mutual agreement of individual measurements both within and across laboratories. The accuracy of a test procedure takes the precision statements one step further. It covers both the precision and bias of the test method. The bias of a result, often called the systematic error, involves consistent deviations from a reference value. That is, the mean of the test will consistently be larger or smaller than its true value. Further explanations of precision and accuracy can be found in the ASTM publication E177 (Ref 3).

In order to have a valid statement on the bias of a test procedure, a reference value is required. Because data to support this requirement have not been available no estimate of bias has ever been determined. If an acceptable reference value for moisture content can be derived, then the data obtained from these test results may be used in estimating the bias of the test procedure.

The material samples, processed by AMRL, were bagged and shipped to the participating laboratories. An important requirement for estimating moisture content is to test the samples as soon as possible so that they do not remain in the bags for long periods of time. They should also have been stored at the proper temperature and kept away from direct sunlight. If any of these conditions were not satisfied, the possible impact on the bias calculations remains unknown.

Moisture samples constructed by AMRL were developed such that water was added in a known quantity to one-half of the samples and no water was added to the other half. Since no water was added to the "dry" samples, the moisture determined by the test results in the laboratories for these samples is the best estimate possible of the amount which occurs naturally in air-dried material.

The following procedure for estimating the bias in the moisture content test method for aggregates was followed. Each laboratory was sent 3 subsamples for each of the 8 samples of material for a total of 24 subsamples. The only difference between sample 1 and sample 5 materials is the added moisture content. The same association exists between sample pairs (2,6), (3,7), and (4,8).

For each laboratory the average moisture content was found for the three subsamples of material produced by AMRL for sample number 1. This average was added to the average moisture content found by each laboratory for sample number 5. This total represents the best estimate of the average moisture content contained in the "wet" samples. The average moisture content of the 3 subsamples for sample 1 as determined by the respective laboratory was subtracted to determine a bias term. The same procedure was used for "wet" samples 2 through 4 and "dry" samples 6 through 8.

The resulting means for the aggregate samples from the 17 laboratories across the different levels of factors in the study are shown in Table 4. The analysis of variance performed on these data is given in Table 5. The results indicate that only a small amount of bias exists for the aggregate samples. The overall average is 0.03113. This positive number indicates the laboratories did not estimate as much water in the sample as one would have expected to find. The individual means found in the right hand column of Table 4 indicate most of the laboratories produced a positive bias with laboratory 11 having the largest bias of 0.1200. Another interesting result is that material from source WA generally produced large positive results (average = 0.0615) and material from source PL generally produced both positive and negative results (average = 0.0007). Thus, the magnitude of the bias depends on the source of material used.

The same procedure was also followed for the soils. Sample numbers 9 through 12 had specific amounts of moisture added by AMRL. The corresponding pairs are given by sample numbers 13 through 16 left in the air-dry condition.

Table 4. Bias estimates for aggregate samples 1 through 8 (SSD condition).

M S A P T L L L A I B T	WA		PL		
	A	B	C	D	Mean
01	0.14000	0.18000	0.08333	-0.10333	0.0750
02	0.17667	0.03667	0.16333	-0.06667	0.0775
03	0.16333	0.02667	0.04667	-0.06667	0.0425
04	0.04000	0.01000	0.03333	-0.13333	-0.0125
05	0.00000	0.01667	0.02667	-0.02333	0.005
06	0.02333	0.02000	-0.00333	-0.04667	-0.0017
07	-0.00333	0.09667	0.05667	-0.06667	0.0208
08	0.01667	0.01000	0.06333	-0.03667	0.0133
09	0.06667	0.02667	0.13333	-0.09667	0.0325
10	0.02000	0.01000	-0.01333	-0.09000	-0.0183
11	0.13333	0.15667	0.14000	0.05000	0.1200
12	0.10333	0.02667	0.11000	0.01333	0.0633
13	0.07333	0.10500	0.05333	-0.07333	0.0396
14	0.08000	0.00000	0.00667	-0.06167	0.00625
15	0.03333	0.01333	-0.01667	-0.12000	-0.0225
16	0.11333	0.03667	0.08333	-0.02667	0.05170
17	0.11333	0.02667	0.01333	-0.00667	0.03667
Averages	0.0761	0.0470	0.0576	-0.0562	
	0.0615		0.0007		
	0.03113				

Table 5. Analysis of Variance for bias estimates in aggregate samples.

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	0.1576	0.00927	2.23	0.0143
LAB	16	0.0948	0.00592	1.43	0.1675
MATL	1	0.0628	0.06281	15.14	0.0003
Error	50	0.2075	0.00415		
Corrected Total	67	0.3650			

Student-Newman-Keuls test for variable: BIAS

Means with the same underline are not significantly different.

SNK Grouping	Mean	N	LAB
|	0.1200	4	11
|	0.0775	4	02
|	0.0750	4	01
|	0.0633	4	12
|	0.0517	4	16
|	0.0425	4	03
|	0.0396	4	13
|	0.0367	4	17
|	0.0325	4	09
|	0.0208	4	07
|	0.0133	4	08
|	0.0063	4	14
|	0.0050	4	05
|	-0.0017	4	06
|	-0.0125	4	04
|	-0.0183	4	10
|	-0.0225	4	15

The resulting means for the soil samples from the 17 laboratories across the levels of the factors in the study are shown in Table 6. The analysis of variance performed on these data is given in Table 7. The results indicate that a larger amount of bias exists for the soil samples, except now the difference is the negative value of -0.9834. This negative number indicates the laboratories overestimated the amount of water in the sample one would have expected to find. The individual means found in the right hand column of Table 6 indicate most of the laboratories produced a negative bias. However, laboratory 05 has a very large positive overall bias term of 1.614. Another interesting result is that material from source M1 generally produced positive results (average = 0.4749) and material from source M2 generally produced large negative results (average = -2.4418). Thus, the magnitude of the bias depends on the source of material used.

In summary, an interesting contrast emerges from these results. Bias is positive for aggregates and therefore the laboratories did not estimate as much water in the sample as one would have expected to find. The negative bias for soils indicates the laboratories overestimated the amount of water in the sample one would have expected to find. Also, for both aggregates and soils the source of the material influenced the size and the magnitude of the bias term.

PRECISION STATEMENTS FOR BIAS

The average laboratory bias components for the moisture contents of aggregates and soils are given in Tables 4 and 6. These means provide the basis for statements concerning the precision of the moisture content estimate. The appropriate standard deviation to apply depends upon the desired inference. Table 8 summarizes the calculations of the appropriate mean squares. Given the data provided for this experiment, confidence intervals for the true bias estimates will be provided.

Table 6. Bias estimates for soil samples 9 through 16 (PLM condition).

M S A P T L L L A I B T	M1		M2		
	A	B	C	D	Mean
01	1.07667	-0.11000	-2.70667	-3.10333	-1.2108
02	1.66333	-0.39000	-3.52000	-2.65667	-1.2258
03	0.80333	0.21333	-5.23333	-3.47000	-1.9217
04	0.69667	-0.22333	-2.84667	-2.62667	-1.2500
05	0.92000	-0.07333	5.56667	0.04333	1.6142
06	0.80667	0.12000	-0.19667	-0.76333	-0.0083
07	1.13333	-0.04333	-3.30667	-2.95000	-1.2917
08	1.05333	-0.13333	-2.99667	-3.10000	-1.2942
09	1.52333	0.09000	-3.24000	-2.99333	-1.1550
10	1.23333	-0.39333	-3.79000	-0.73333	-0.9208
11	0.70000	0.19667	-3.94333	-2.97000	-1.5042
12	0.89333	0.36000	-0.26333	-0.96333	0.0067
13	0.81000	-0.19000	-2.88667	-2.78667	-1.2633
14	1.10000	0.67333	-2.94667	-3.29667	-1.1175
15	0.36333	-0.05000	-2.24000	-2.33667	-1.0658
16	1.75667	0.33667	-4.23333	-3.87333	-1.5033
17	-0.38667	-0.38333	-4.02000	-1.63667	-1.6067
Averages	0.9498	0.0000	-2.5178	-2.3657	
	0.4749		-2.4418		
	-0.9834				

Table 7. Analysis of Variance for bias estimates in aggregate samples.

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	188.612	11.0948	6.56	0.0001
LAB	16	43.993	2.7496	1.62	0.0966
MATL	1	144.618	144.6181	85.46	0.0001
Error	50	84.6079	1.6922		
Corrected Total	67	273.2194			

Student-Newman-Keuls test for variable: BIAS

Means with the same underline are not significantly different.

```
SNK Grouping          Mean     N  LAB
          |           1.614    4  05
   |      |           0.007    4  12
   |      |          -0.008    4  06
   |      |          -0.921    4  10
   |      |          -1.066    4  15
   |      |          -1.117    4  14
   |      |          -1.155    4  09
   |      |          -1.211    4  01
   |      |          -1.226    4  02
   |      |          -1.250    4  04
   |      |          -1.263    4  13
   |      |          -1.292    4  07
   |      |          -1.294    4  08
   |      |          -1.503    4  16
   |      |          -1.504    4  11
   |      |          -1.607    4  17
   |                 -1.922    4  03
```

Table 8. Mean square calculations for the bias of aggregates and soils.

AGGREGATES

Source	DF	Sum of Squares	Mean Square
Error	67	0.3650	0.005448
Corrected Total	67	0.3650	
Total	68	0.4309	

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
AGGR	1	0.0628	0.06281	13.72	0.0004
Error	66	0.3022	0.004578		
Corrected Total	67	0.3650			
Total	68	0.4309			

SOILS

Source	DF	Sum of Squares	Mean Square
Error	67	273.2194	4.0779
Corrected Total	67	273.2194	
Total	68	338.9847	

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
SOIL	1	144.6180	144.6180	74.22	0.0001
Error	66	128.6013	1.9485		
Corrected Total	67	273.2194			
Total	68	338.9847			

Precision Statements of Bias for Aggregates

Aggregates. Table 8 shows the within-laboratory single operator standard deviation for aggregates is determined to be $\sigma = \sqrt{0.005448} = 0.0738$. Therefore, the bias of a properly conducted test by one operator in the same laboratory on an aggregate material should not differ by more than $2\sigma = 0.1476$ from the true value of the bias. When the experimental results were compared with a known reference value, the 95% confidence limits for the bias of a moisture test on an aggregate material was found to lie between $0.0311 \pm 2\sigma$ or (-0.116, 0.179).

Aggregates from Source WA. The within-laboratory single operator standard deviation for aggregates from source WA is determined to be $\sigma = \sqrt{0.004578} = 0.06766$. Therefore, the bias of a properly conducted test by one operator in the same laboratory on an aggregate from this source should not differ by more than $2\sigma = 0.1353$ from the true value of bias. A 95% confidence interval for the bias of the moisture content of aggregates from this source is $0.0615 \pm 2\sigma$ or (-0.074, 0.197).

Aggregates from Source PL. The within-laboratory single operator standard deviation for aggregates from source PL is determined to be $\sigma = \sqrt{0.004578} = 0.06766$. Therefore, the bias of a properly conducted test by one operator in the same laboratory on an aggregate from this source should not differ by more than $2\sigma = 0.1353$ from the true value of bias. A 95% confidence interval for the bias of the moisture content of aggregates from this source is $0.0007 \pm 2\sigma$ or (-0.135, 0.136).

These numbers represent, respectively, the 1S and 2S limits as described in ASTM Practice C670, for Preparing Precision Statements for Test Methods for Construction Materials.

Precision Statements of Bias for Soils

Soils. Table 8 shows the within-laboratory single operator standard deviation for soils is determined to be $\sigma = \sqrt{4.0779} = 2.0194$. Therefore, the bias of a properly conducted test by one operator in the same laboratory on a soil material should not differ by more than $2\sigma = 4.0388$ from the true value of the bias. When the experimental results were compared with a known reference value, the 95% confidence limits for the bias of a moisture test on a soil material was found to lie between $-0.983 \pm 2\sigma$ or (-5.022, 3.056).

Soils from Source M1. The within-laboratory single operator standard deviation for soils from source M1 is determined to be $\sigma = \sqrt{1.9485} = 1.3959$. Therefore, the bias of a properly conducted test by one operator in the same laboratory on a soil from this source should not differ by more than $2\sigma = 2.7918$ from the true value of bias. A 95% confidence interval for the bias of the moisture content of soils from this source is $0.475 \pm 2\sigma$ or (-2.317, 3.267).

Soils from Source M2. The within-laboratory single operator standard deviation for soils from source M2 is determined to be $\sigma = \sqrt{1.9485} = 1.3959$. Therefore, the bias of a properly conducted test by one operator in the same laboratory on a soil from this source should not differ by more than $2\sigma = 2.7918$ from the true value of bias. A 95% confidence interval for the bias of the moisture content of soils from this source is $-2.442 \pm 2\sigma$ or (-5.234, 0.350).

These numbers represent, respectively, the 1S and 2S limits as described in ASTM Practice C670, for Preparing Precision Statements for Test Methods for Construction Materials.

REFERENCES

1. High, R., "Materials Testing Sampling Designs", Technical Memorandum AU-95, TRDF, December, 1989.

2. Anderson, V., "Analysis of Material Testing Sampling Designs", Technical Memorandum AU-108, TRDF, January, 1990.

3. Uherek, G., "SHRP Moisture Content Proficiency Sample Program", AMRL, October, 1990.

4. American Society for the Testing of Materials, "Use of the Terms Precision and Accuracy as Applied to Measurement of a Property of a Material", E177, 1980.

APPENDIX VI

Steele Engineering, Inc.

November 18, 1991

Fred Martinez
South Western Laboratories
222 Cavalcade Street
PO Box 8768
Houston, TX 77249

Dear Fred:

Subject: SHRP Soil Moisture Proficiency Sample Program

Enclosed for your information is a copy of following four scatter diagrams showing results of tests on the subject Program.

°Aggregate(SHRP Type I)-air dry condition
°Aggregate(SHRP Type I)-saturated surface dry condition
°Soil(SHRP Type II)-air dry condition
°Soil(SHRP Type II)-plastic limit condition

The vertical and horizontal lines on each diagram are the means of the A and B samples respectively for each of the four conditions noted above.

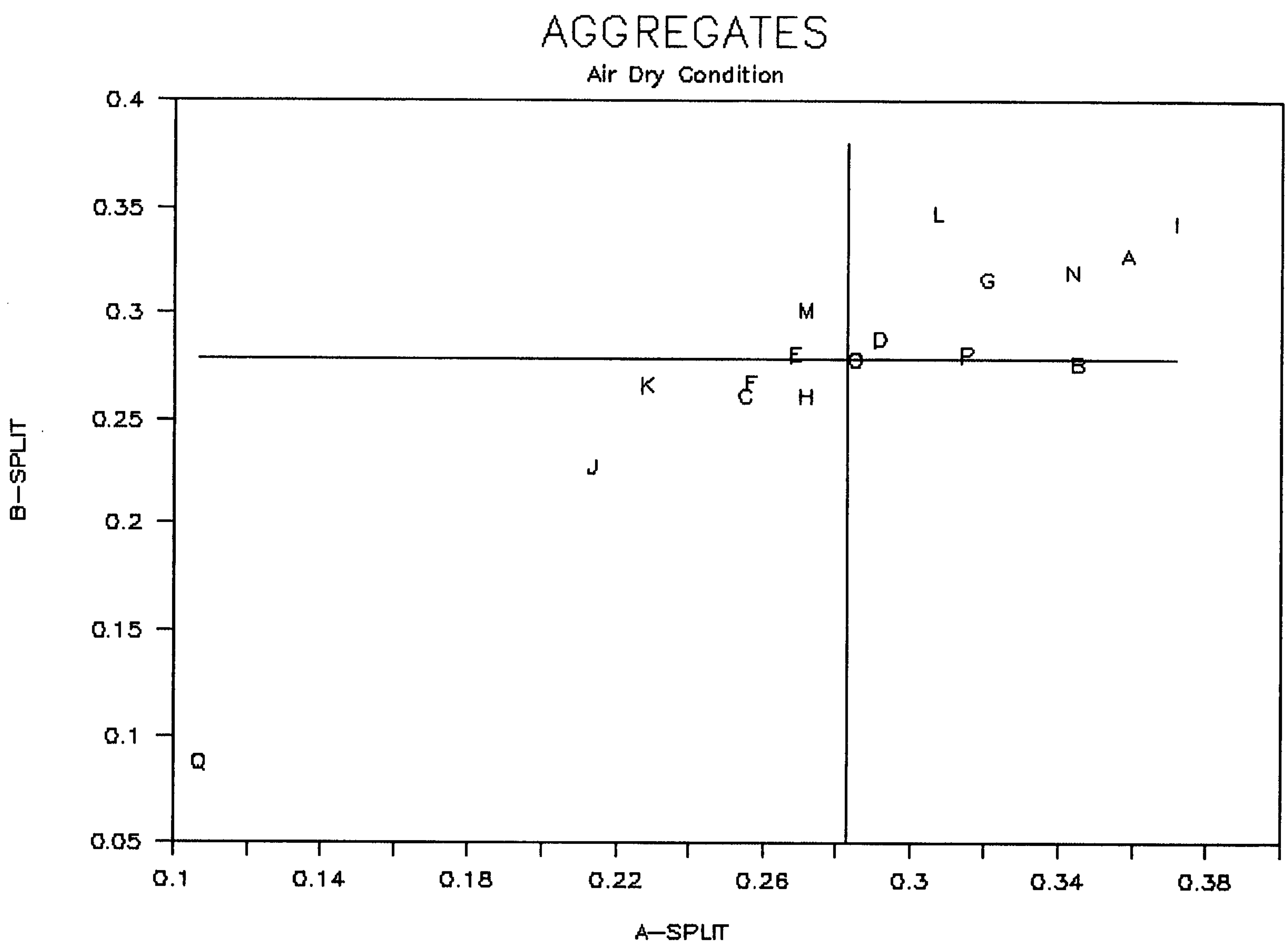
The test data derived by your laboratory is identified by the letter H.

Yours very truly

Garland W. Steele, P.E.
President, Steele Engineering Inc.

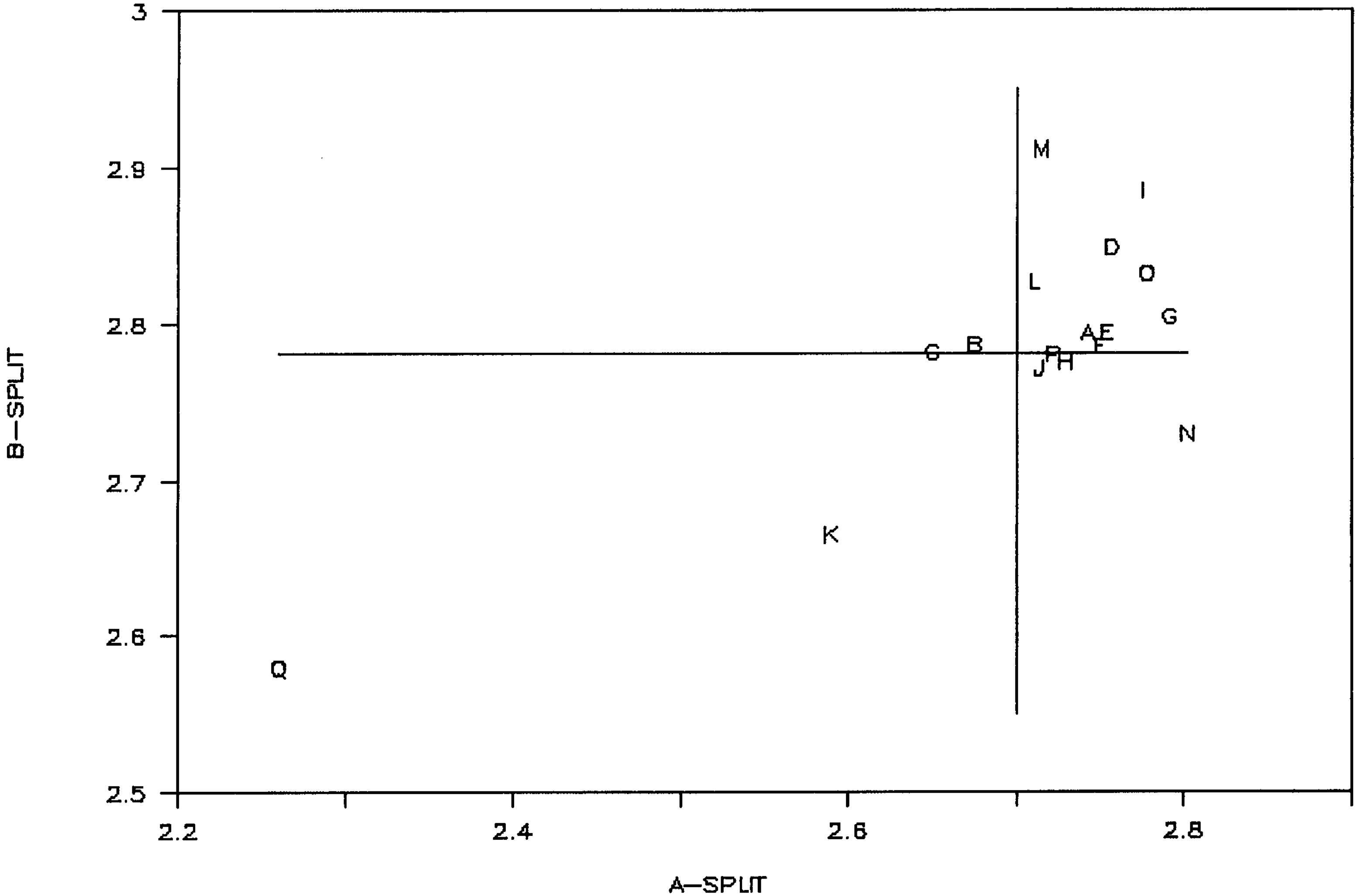
enclosure: 4 pages

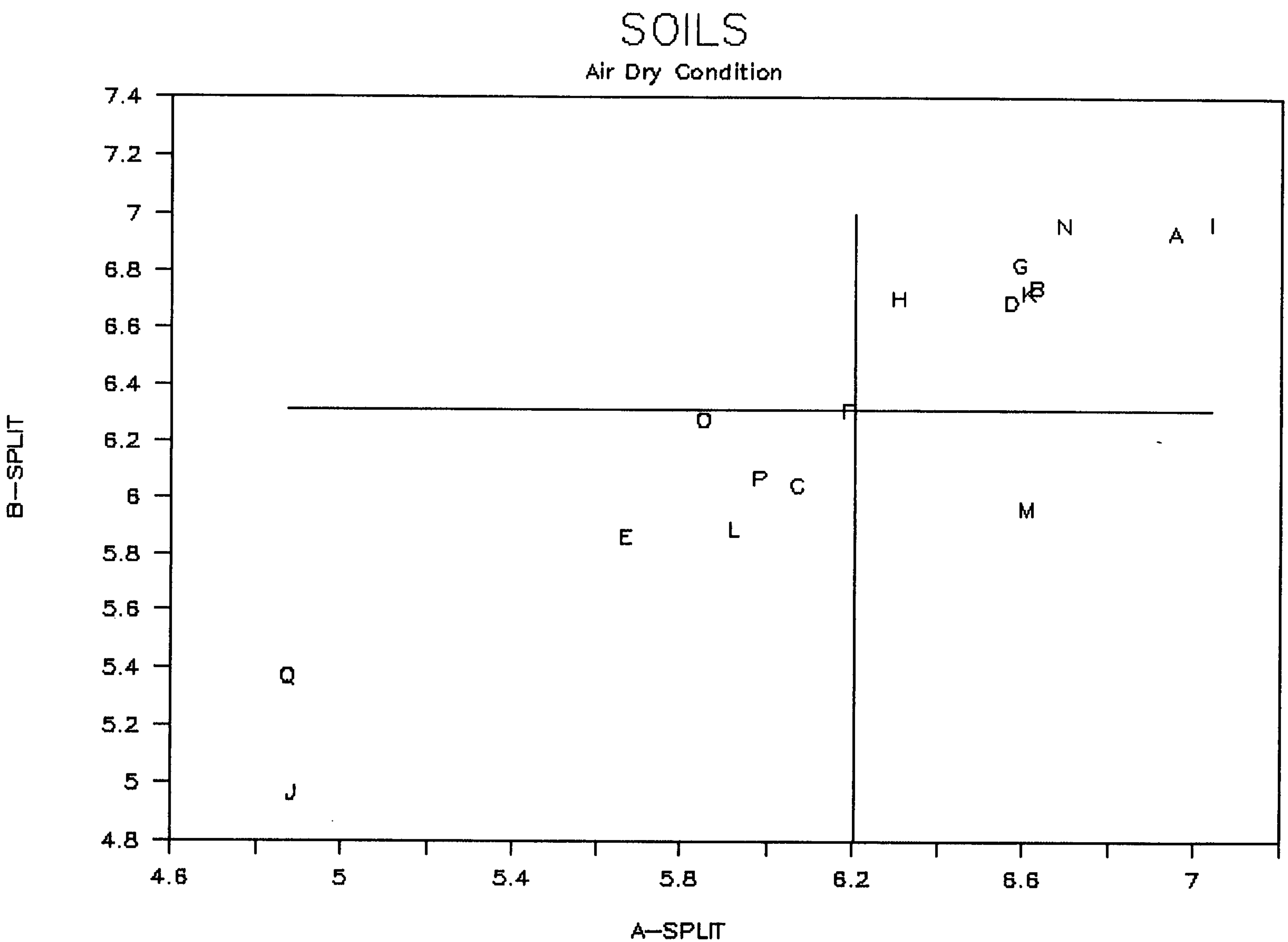
cc: Neil Hawks(letter only)
Paul Teng(letter only)
Dave Esch(letter only)
Bill Hadley(letter only)
Robin High(letter only)


AGGREGATES
Air Dry Condition
B—SPLIT
A—SPLIT
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0.1
0.14
0.18
0.22
0.26
0.3
0.34
0.38
L
I
A
N
G
M
D
E
O
P
B
K
F
C
H
J
Q

AGGREGATES

SSD Condition




SOILS
Air Dry Condition
B—SPLIT
A—SPLIT
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
5
5.4
5.8
6.2
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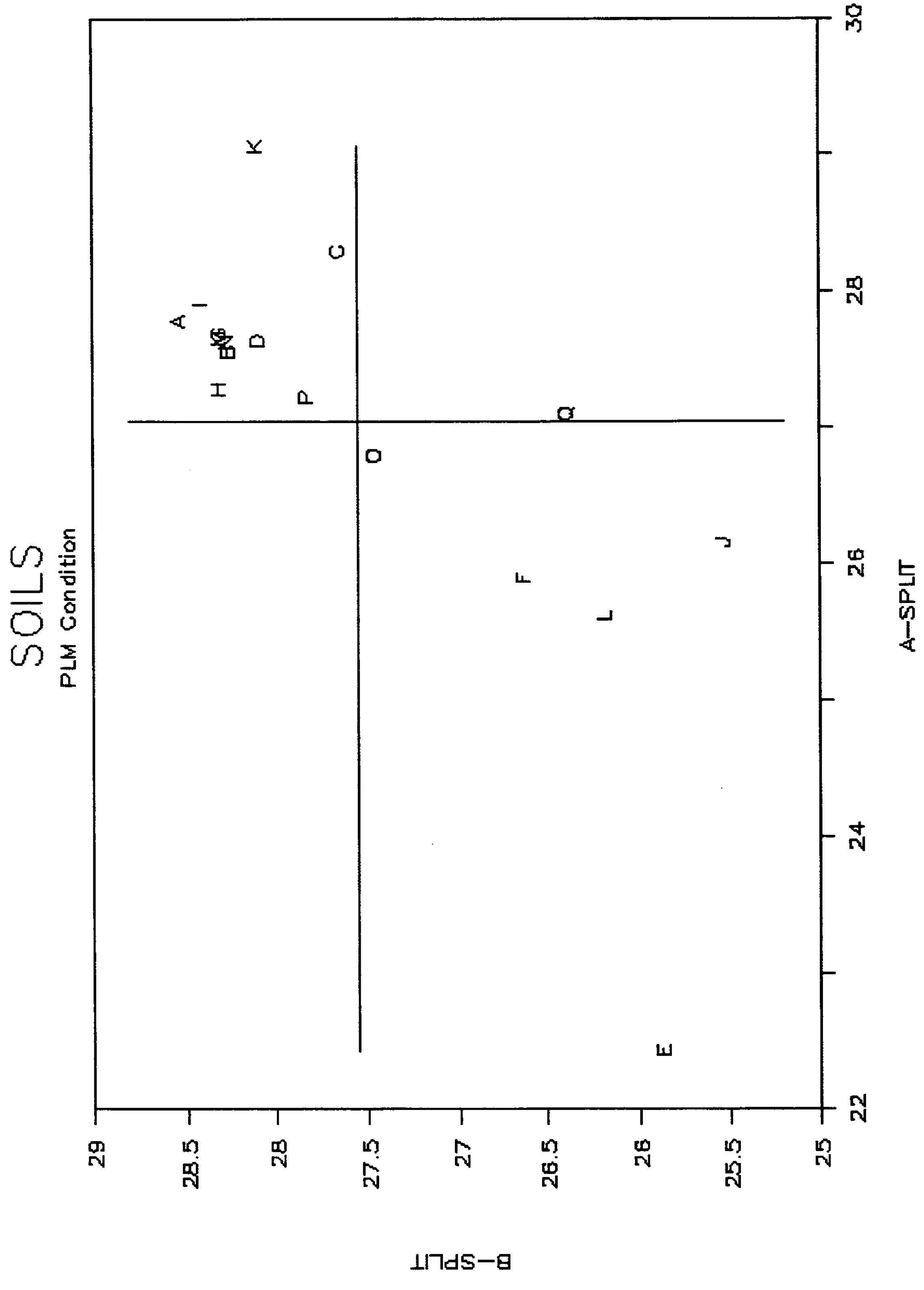
M
E
L
Q
J


SOILS
PLM Condition
A—SPLIT
B—SPLIT
22
24
26
28
30
25
25.5
26
26.5
27
27.5
28
28.5
29
A
B
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D
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APPENDIX VII

Moisture Content-Aggregates

Precision

The within-laboratory single operator standard deviation for moisture content of aggregates has been found to be σ = [A]0.2790%. Therefore, results of two properly conducted tests by the same operator in the same laboratory on the same type of aggregate sample should not differ by more than $2\sqrt{2}\,\sigma$ = [B]0.7891% from each other.

The between-laboratory single operator standard deviation for moisture content of aggregates has been found to be $\sqrt{(\sigma^2_{lab}+\sigma^2)}$ = [A]0.28012%. Therefore, results of properly conducted tests from two laboratories on the same aggregate should not differ by more than $2\sqrt{(2(\sigma^2_{lab}+\sigma^2))}$ = [B]0.7923% from each other.

These numbers represent, respectively, the [A]1S and [B]D2S limits as described in ASTM Practice C670, Preparing Precision Statements for Test Methods for Construction Materials.

Bias

When experimental results are compared with known values from accurately compounded specimens:

The bias of moisture tests on one aggregate material has been found to have a mean of +0.0615%. The bias of individual test values from the same aggregate material has been found with 95% confidence to lie between -0.074% and +0.197%.

The bias of moisture tests on a second aggregate material has been found to have a mean of +0.0007%. The bias of individual test values from the same aggregate material has been found with 95% confidence to lie between -0.135% and +0.136%.

The bias of moisture tests overall on both aggregate materials has been found to have a mean of +0.0311%. The bias of individual test values overall from both aggregate materials has been found with 95% confidence to lie between -0.116% and +0.179%.

Moisture Content-Soil

Precision

The within-laboratory single operator standard deviation for soils has been found to be σ = [A]3.5692%. Therefore, results of two properly conducted tests by the same operator in the same laboratory on the same type soil should not differ by more than $2\sqrt{2}\,\sigma$ = [B]10.0951% from each other.

The between-laboratory single operator standard deviation for moisture content of soils has been found to be $\sqrt{(\sigma^2_{lab}+\sigma^2)}$ = [A]3.5900%. Therefore, results of properly conducted tests from two laboratories on the same soil should not differ by more than $2\sqrt{(2(\sigma^2_{lab}+\sigma^2))}$ = [B]10.1541% from each other.

These numbers represent, respectively, the [A]1S and [B]D2S limits as described in ASTM Practice C670, Preparing Precision Statements for Test Methods for Construction Materials.

Bias

When experimental results are compared with known values from accurately compounded specimens:

The bias of moisture tests on one soil material has been found to have a mean of +0.475%. The bias of individual test values from the same soil material has been found with 95% confidence to lie between -2.317% and +3.267%.

The bias of moisture tests on a second soil material has been found to have a mean of -2.442%. The bias of individual test values from the same soil material has been found with 95% confidence to lie between -5.234% and +0.350%.

The bias of moisture tests overall on both soil materials has been found to have a mean of -0.983%. The bias of individual test values overall from both soil materials has been found with 95% confidence to lie between -5.022% and +3.056%.