CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Concrete Masonry Units Proficiency Samples
Number 21 and Number 22

November 2006

CCRL CEMENT AND CONCRETE REFERENCE LABORATORY

CEMENT AND CONCRETE REFERENCE LABORATORY
AT THE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
GAITHERSBURG, MARYLAND 20899
(301) 975-6704

SPONSORED BY
COMMITTEE C-1 ON CEMENT
COMMITTEE C-9 ON CONCRETE AND
CONCRETE AGGREGATES
AMERICAN SOCIETY FOR TESTING AND MATERIALS

100 Bureau Dr., Stop 8618
Fax: 301-975-2243
e-mail: ccrl@nist.gov

November 7, 2006

TO: Participants in the CCRL Concrete Masonry Units Proficiency Sample Program

SUBJECT: Final Report for Concrete Masonry Units Proficiency Samples No. 21 and No. 22

Following is the report for the current pair of CCRL **Concrete Masonry Units** Proficiency Samples which were distributed in July 2006.

This report consists of a statistical Summary of Results, a set of general Scatter Diagrams, and associated detailed information. The Table of Results with individualized information for laboratory can be downloaded at our website located at: http://www.ccrl.us/.

The CCRL Proficiency Sample Programs are intended for internal use by the laboratory as a tool to identify potential problems in laboratory procedures or test equipment and to initiate remedial actions. These programs are designed to complement the CCRL Laboratory Inspection Program as part of a total quality system. Care should be taken when using this program for any other purpose.

Additional samples of these two concrete masonry units and other CCRL samples are available for purchase. These samples may be useful for equipment verification, technician training, and research. Contact CCRL for availability and price.

It is presently anticipated that the next Concrete Masonry Units Proficiency Samples will be distributed in July 2007.

Sincerely,

Robin K. Haupt

Robin K. Haupt
Supervisor, Proficiency Sample Programs
Cement and Concrete Reference Laboratory
Materials and Construction Research Division
Building and Fire Research Laboratory

Enclosure

TO: Participants in the CCRL Concrete Masonry Units Proficiency Sample Program

FROM: Robin K. Haupt, Supervisor, PSP

SUBJECT: Explanation of Final Report on Results of Tests on Concrete Masonry Units Proficiency Samples No. 21 and No. 22

This letter, and the material included with it, constitute the final report, and summary of results for the current pair of Concrete Masonry Units Proficiency Samples, which were distributed in July 2006 This material includes a Table of Results for Individual laboratory data, a statistical Summary of Results, and a set of general scatter diagrams. Your unique laboratory number is displayed at the top of the Individual Table of Results.

An explanation of the program is contained in the paper: "Statistical Evaluation of Interlaboratory Cement Tests" by J. R. Crandall and R. L. Blaine View document, and "Statistical Aspects of the Cement Testing Program" by W.J. Youden View document, which can be found in Volume 59, Proceedings of the 62nd Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.

Laboratory Ratings

Each laboratory receives an individualized Laboratory Ratings. Each line of the ratings shows the test title and the reporting unit in the first two columns. After that it lists in order, the laboratory's results for the odd and even numbered samples, overall averages for the odd and even numbered samples, and the laboratory's ratings for the odd and even samples. Please note that individual laboratory ratings were not given for some test results. These results were gathered for information at the request of consulting ASTM Committee member.

The ratings for the individual laboratory were determined in the manner described by Crandall and Blaine using a rating scale of 1 to 5 instead of 0 to 4. The ratings have no valid standing beyond showing the difference between the individual laboratory result and the average for a particular test.

The following table details the relationship between the ratings and the averages.

Ratings	Range (Number of Standard Deviations)	Number (Per 100) of Laboratories achieving the rating [1]
5	Less than 1	69
4	1 to 1.5	18
3	1.5 to 2	9
2	2 to 2.5	3
1	Greater than 2.5	1

The sign of the rating merely shows whether the result reported was greater or less than the average obtained.

[1]Youden, W.J., "Statistical Aspects of the Cement Testing Program", *Proceedings of the American Society for testing and Materials Volume 59*, 1959.

In cases where some laboratories' results are eliminated, averages, standard deviations, coefficients of variation, and the ratings of the other laboratories' results, are recalculated using the data remaining after the elimination. Since the laboratory ratings given are the results from this one series of tests, you need not attach too much significance to a single low rating, or pair of ratings, from this one series. A continuing tendency to get low ratings on several pairs of samples should lead a laboratory to consider the types of error, systematic and random, contribute to ratings that are low. Systematic error, which is indicated by low ratings with the same signs on each pair of samples, means a consistent error is occurring in equipment and/or test procedures. One indication of random error is low ratings on both samples with different signs.. Since systematic error occurs with more regularity, its cause is generally easier to find than the cause of random error.

Summary of Results

The Summary of Results provide the statistical summary for each test. Each line lists the test, the number of participants represented, the averages, standard deviations and coefficients of variations. When necessary the data from the test is represented in two lines, one line with all results reported, and then a second line with outlying results omitted. Sometimes two or more recalculations are required to eliminate all outliers from the test. In these cases, all of the laboratories omitted in previous recalculations are also omitted in subsequent ones. Results omitted are values that are more than three standard deviations from the mean of one or both samples. Elimination of these outlying results may little effect on the average, but may have a more pronounced effect on the standard deviation and coefficient of variation.

Scatter Diagrams

General scatter diagrams are supplied with this report. Crandall and Blaine describe the manner of preparing scatter diagrams, and their interpretation, in the paper published in the 1959 ASTM Proceedings.

Using the results received from each laboratory, a scatter diagram is generated for each test method by plotting the value for the odd numbered samples on the *X*, or horizontal axis, against the value for the even numbered samples on the *Y*, or vertical axis. Vertical and horizontal dashed lines, which divide the diagrams into four sections or quadrants, place the average values for the odd and even numbered samples, respectively. The first line of print under the diagram includes the test number, as given on the data sheet, the test title, and the number of data points on the diagrams. The number of plotted points may not agree with the total number of data pairs included in the analysis because a few points may be off the diagram, and some points may represent several data pairs, which are identical. Laboratories whose points are off the diagram will have a rating of ±1 for that particular test.

As described in Crandall and Blaine, a tight circular pattern of points around the intersection of the median lines is the ideal situation. Stretching out of the pattern into the first (upper right) and third (lower left) quadrants, suggests some kind of bias, or tendency for laboratories to get high or low results on both samples. Examination of the scatter diagrams indicates strong evidence of bias on many tests.

CCRL PROFICIENCY SAMPLE PROGRAM
Concrete Masonry Units Proficiency Samples No. 21 and No. 22
Final Report - November 3, 2006

SUMMARY OF RESULTS

Test		#Labs	Sample No. 21 Average	S.D.	C.V.	Sample No. 22 Average	S.D.	C.V.
COMPRESSION UNITS								
Received Weight	lb	105	10.3	0.14	1.36	12.61	0.22	1.75
Received Weight	lb	* 103	10.3	0.141	1.366	12.64	0.07	0.533
Max Comp Load	lbf	104	81653	16337	20.0	79748	17970	22.5
Max Comp Load	lbf	* 101	81591	14768	18.1	80310	14257	17.8
Comp Strength	psi	105	3980	783	19.7	3928	753	19.2
Comp Strength	psi	* 101	4059	686	16.9	4014	629	15.7
ABSORPTION UNITS								
Received Weight	lb	106	10.3	0.130	1.266	12.6	0.076	0.604
Width	inch	106	3.7	0.054	1.48	3.6	0.053	1.45
Height	inch	106	7.7	0.053	0.697	7.7	0.053	0.691
Height	inch	* 105	7.7	0.051	0.670	7.7	0.050	0.658
Length	inch	106	7.6	0.052	0.687	7.6	0.053	0.696
Face Thickness	inch	106	1.65	5.6	337	1.65	5.6	337
Face Thickness	inch	* 105	1.11	0.058	5.26	1.11	0.058	5.20

* ELIMINATED LABS: Data over three S.D. from the mean

COMPRESSION UNITS

Received Weight (CU)	537 1168
Max. Compressive Load	1577 1790 3050
Compressive Strength	10 286 1560 2258

ABSORPTION UNITS

Height	537
Min. Face Shell Thickness	1310

CCRL PROFICIENCY SAMPLE PROGRAM
Concrete Masonry Units Proficiency Samples No. 21 and No. 22
Final Report - November 3, 2006

SUMMARY OF RESULTS

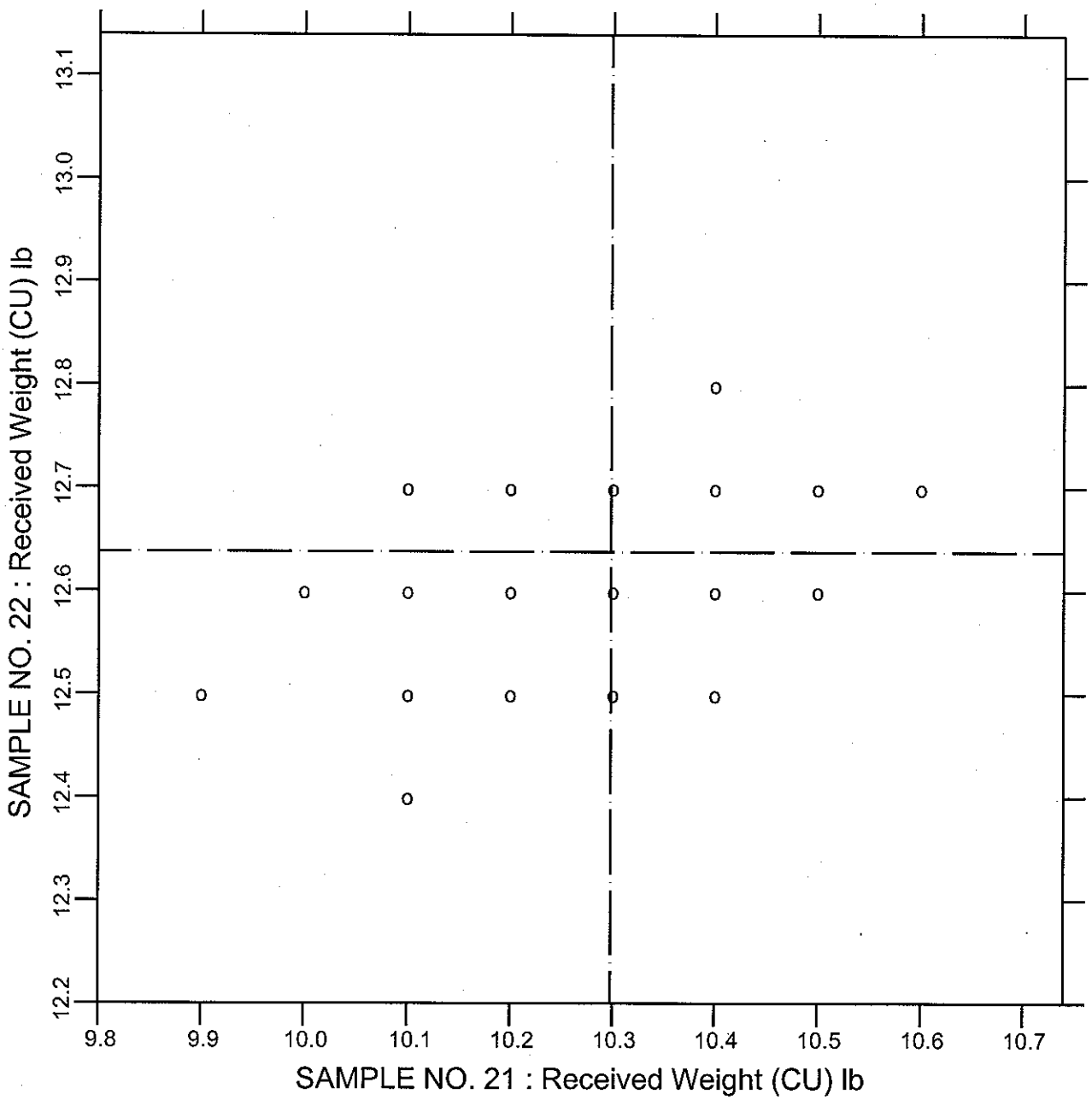
Test		#Labs	Sample No. 21 Average	S.D.	C.V.	Sample No. 22 Average	S.D.	C.V.
ABSORPTION UNITS - CONTINUED								
Web Thickness	inch	106	1.1	0.26	22.9	1.1	0.25	22.6
Web Thickness	inch	* 105	1.1	0.081	7.37	1.1	0.074	6.72
Immersed Weight	lb	106	4.8	0.20	4.11	7.4	0.34	4.50
Immersed Weight	lb	* 94	4.8	0.112	2.330	7.5	0.053	0.712
Saturated Weight	lb	106	55.2	460.6	835	68.6	572.6	834
Saturated Weight	lb	* 99	10.4	0.122	1.170	13.0	0.053	0.406
Oven-Dry Weight	lb	106	50.8	424.5	835	65.1	542.9	834
Oven-Dry Weight	lb	* 101	9.6	0.182	1.905	12.4	0.058	0.468
Net Area	ft^3	106	20.8	2.1	10.01	20.7	2.0	9.79
Net Area	ft^3	* 88	20.2	0.22	1.10	20.0	0.20	1.02
Absorption	lb/ ft^3	106	9.1	1.73	19.0	7.2	0.78	10.7
Absorption	lb/ ft^3	* 100	9.4	1.37	14.63	7.3	0.64	8.84
Density	lb/ ft^3	106	107.0	3.4	3.23	139.6	13.3	9.51
Density	lb/ ft^3	* 94	106.5	1.8	1.727	138.8	1.1	0.777
Equivalent Thick	inch	106	4.5	15.4	346	4.9	16.3	331
Equivalent Thick	inch	* 91	2.7	0.060	2.25	2.6	0.051	1.96

* ELIMINATED LABS: Data over three S.D. from the mean

ABSORPTION UNITS - CONTINUED

Min. Web Thickness	1310
Immersed Weight	946 951 1093 1306 2126 28 1189 1560 2240 2438 2996 3069
Saturated Weight	286 1168 2240 148 1093 2438 3033
Oven-Dry Weight	10 1560 2240 2250 3033
Net Area	148 1168 1306 1310 1785 2272 537 946 2126 2149 951 1537 2438 3050 28 2004 2240 3069
Absorption	10 148 270 906 1560 2438
Density	951 1560 2126 946 1093 1306 10 28 2240 2273 2438 3069
Equivalent Thickness	537 923 475 1310 946 1010 1168 1306 1577 2019 280 2112 2126 2149 2438

CCRL PROFICIENCY SAMPLE PROGRAM
Received Weight - Compression Units
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22

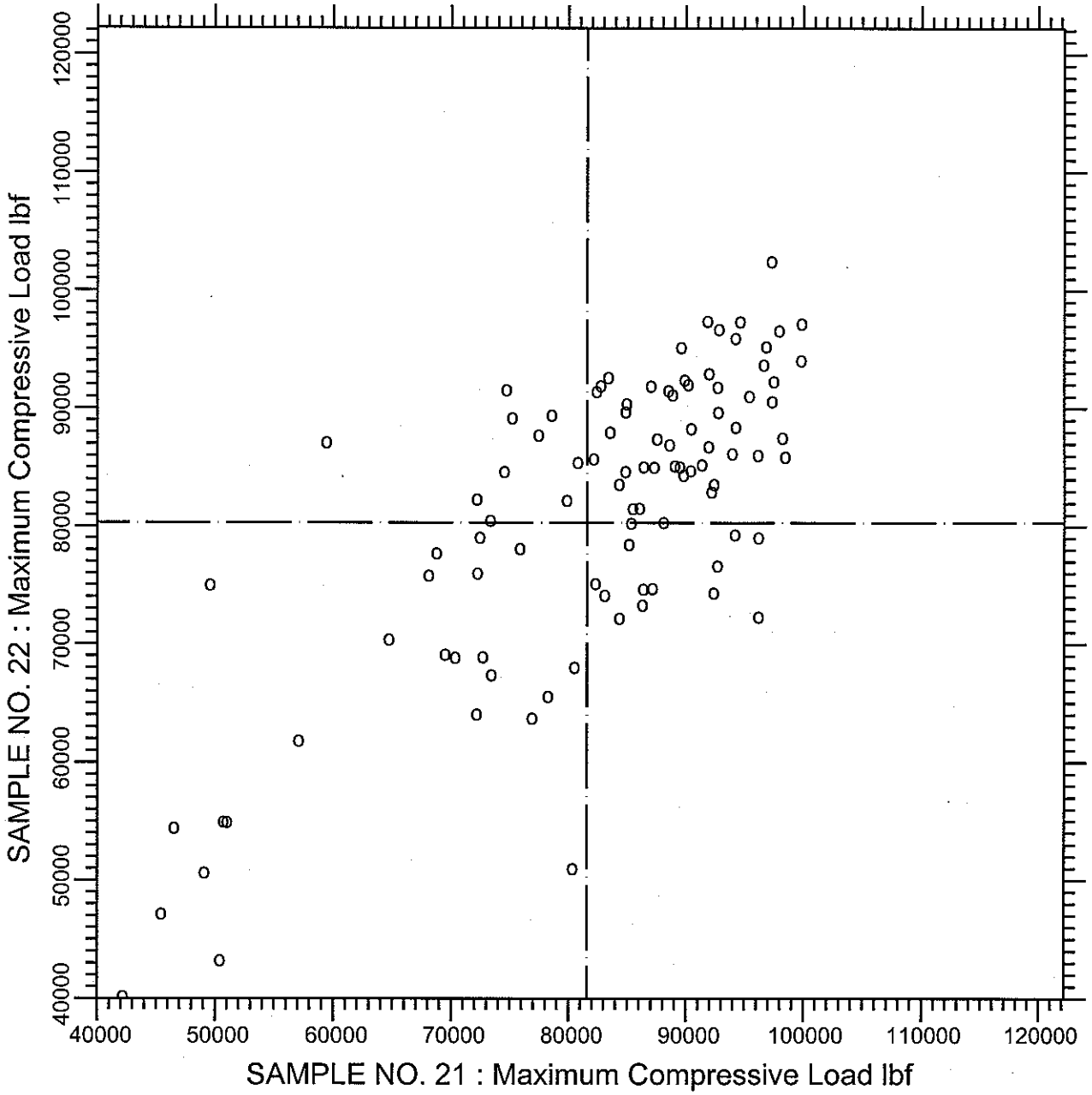


TEST NO.500 Received Weight (CU) 103 POINTS

SAMPLE NO. 21	AVE	10.2981	S.D.	0.141	C.V.	1.366
SAMPLE NO. 22	AVE	12.6379	S.D.	0.067	C.V.	0.533

LABS ELIMINATED 537 1168

CCRL PROFICIENCY SAMPLE PROGRAM
Maximum Compressive Load
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



TEST NO.550 Maximum Compressive Load 99 POINTS

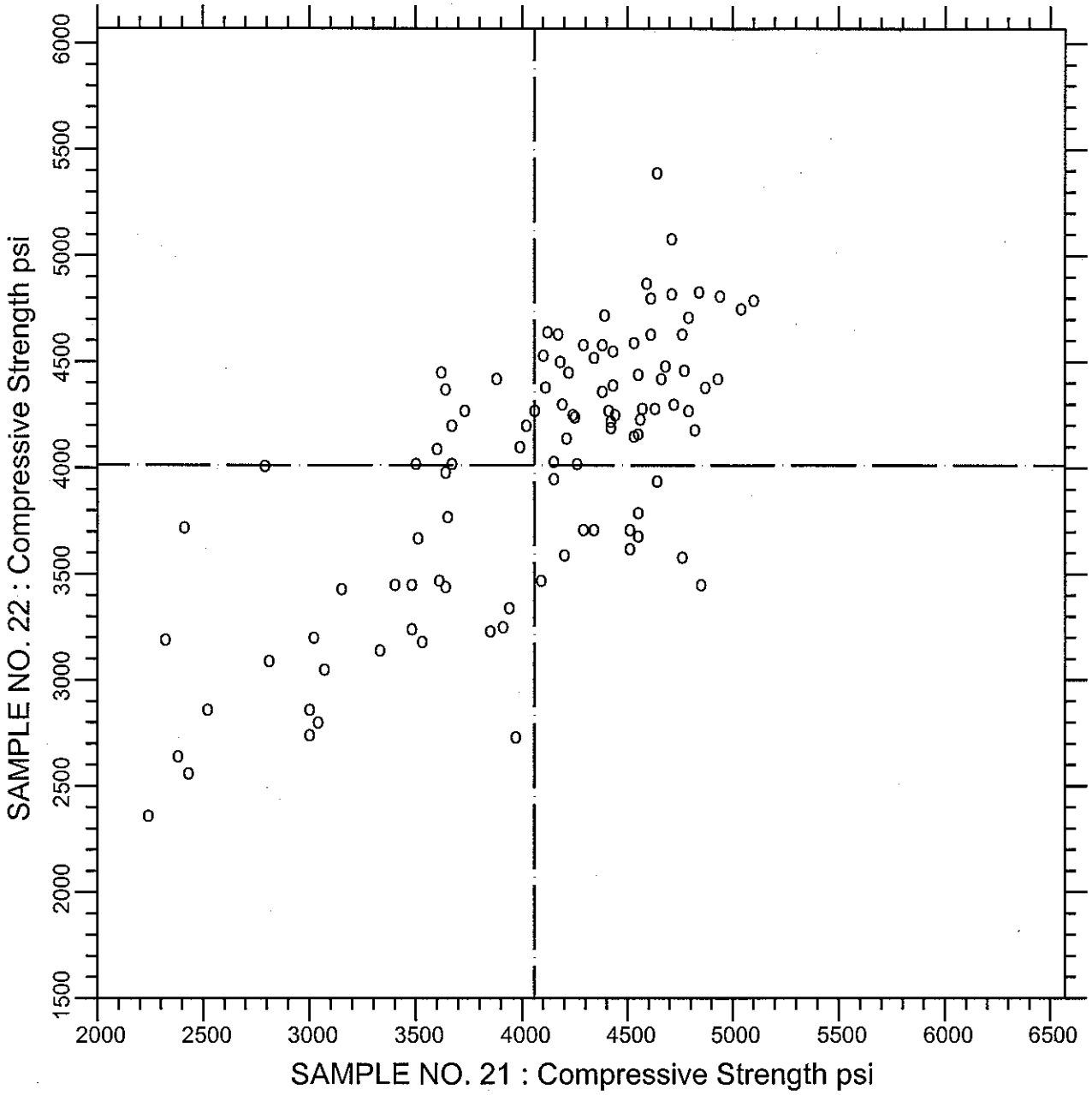
SAMPLE NO. 21 AVE 81591.0 S.D. 14768.5 C.V. 18.1

SAMPLE NO. 22 AVE 80310.4 S.D. 14257.0 C.V. 17.8

LABS ELIMINATED 1577 1790 3050

LABS OFF DIAGRAM 10 1560

CCRL PROFICIENCY SAMPLE PROGRAM
Net Area Compressive Strength
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



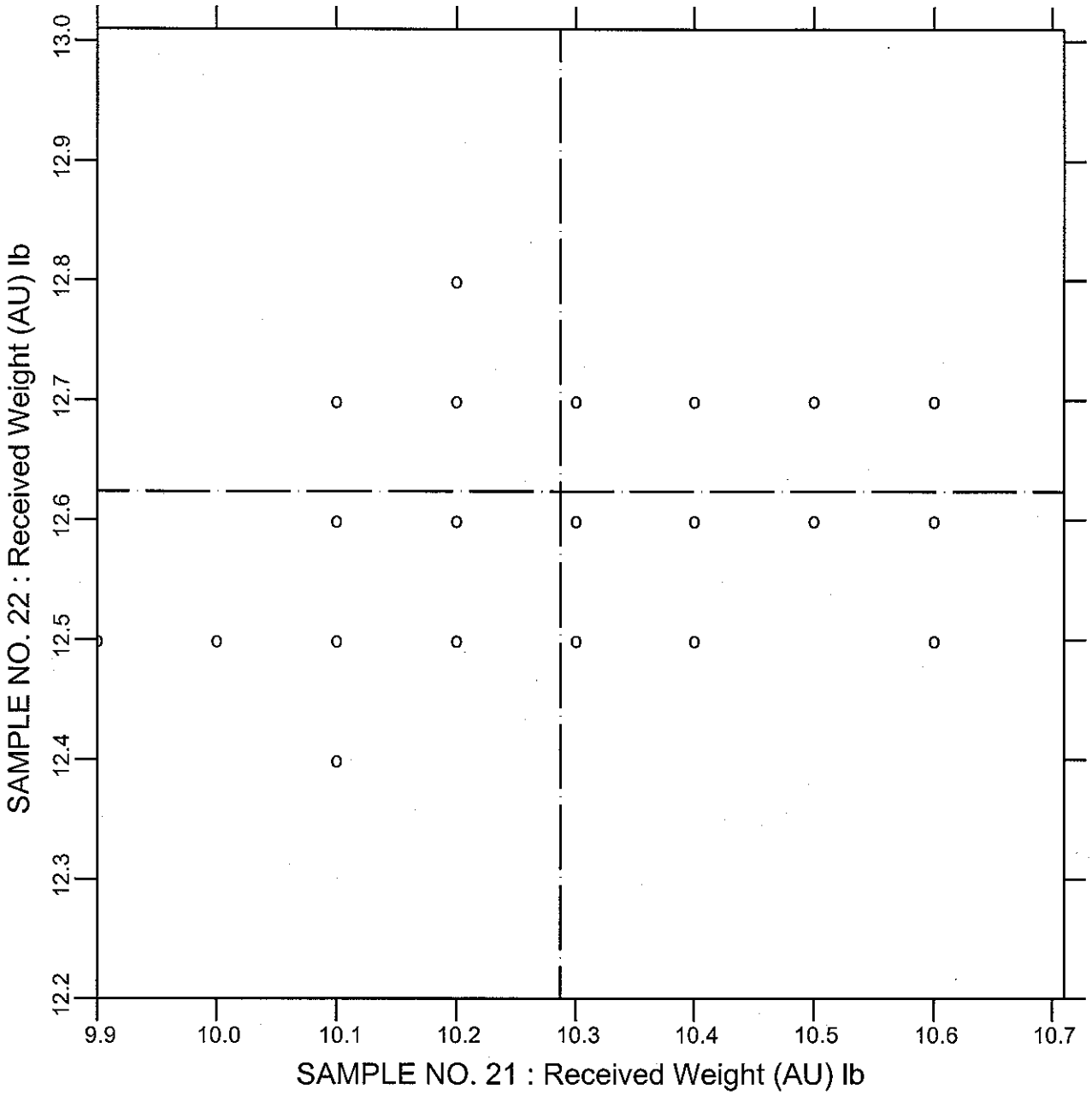
TEST NO.560 Compressive Strength 101 POINTS

SAMPLE NO. 21 AVE 4059.1 S.D. 686.2 C.V. 16.9

SAMPLE NO. 22 AVE 4013.5 S.D. 629.1 C.V. 15.7

LABS ELIMINATED 10 286 1560 2258

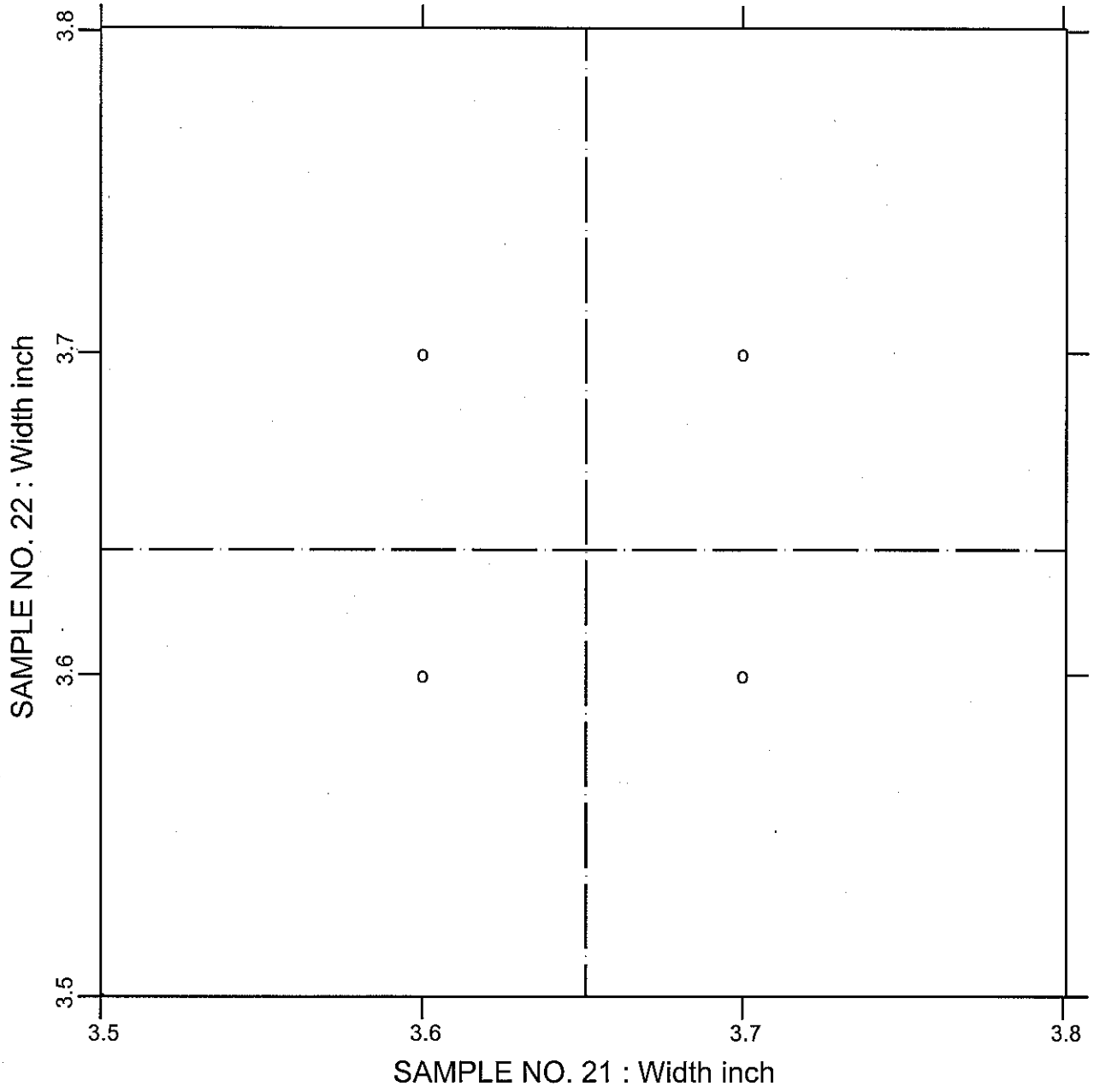
CCRL PROFICIENCY SAMPLE PROGRAM
Received Weight - Absorption Units
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



TEST NO.600 Received Weight (AU) 106 POINTS

SAMPLE NO. 21	AVE	10.2868	S.D.	0.130	C.V.	1.266
SAMPLE NO. 22	AVE	12.6236	S.D.	0.076	C.V.	0.604

CCRL PROFICIENCY SAMPLE PROGRAM
Width
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



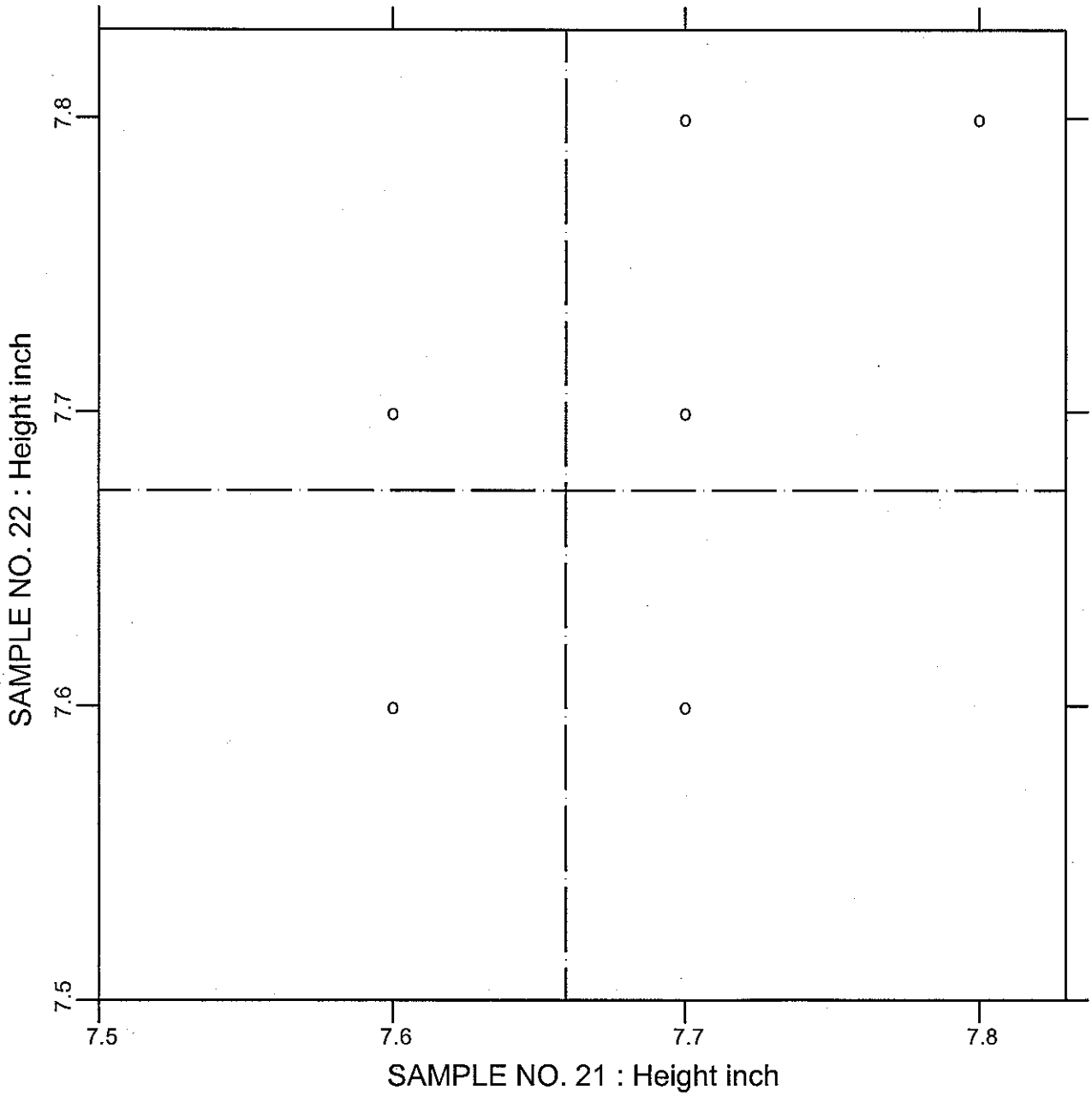
TEST NO.510 Width 106 POINTS

SAMPLE NO. 21	AVE	3.6509	S.D.	0.054	C.V.	1.48
SAMPLE NO. 22	AVE	3.6387	S.D.	0.053	C.V.	1.45

CCRL PROFICIENCY SAMPLE PROGRAM

Height

CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



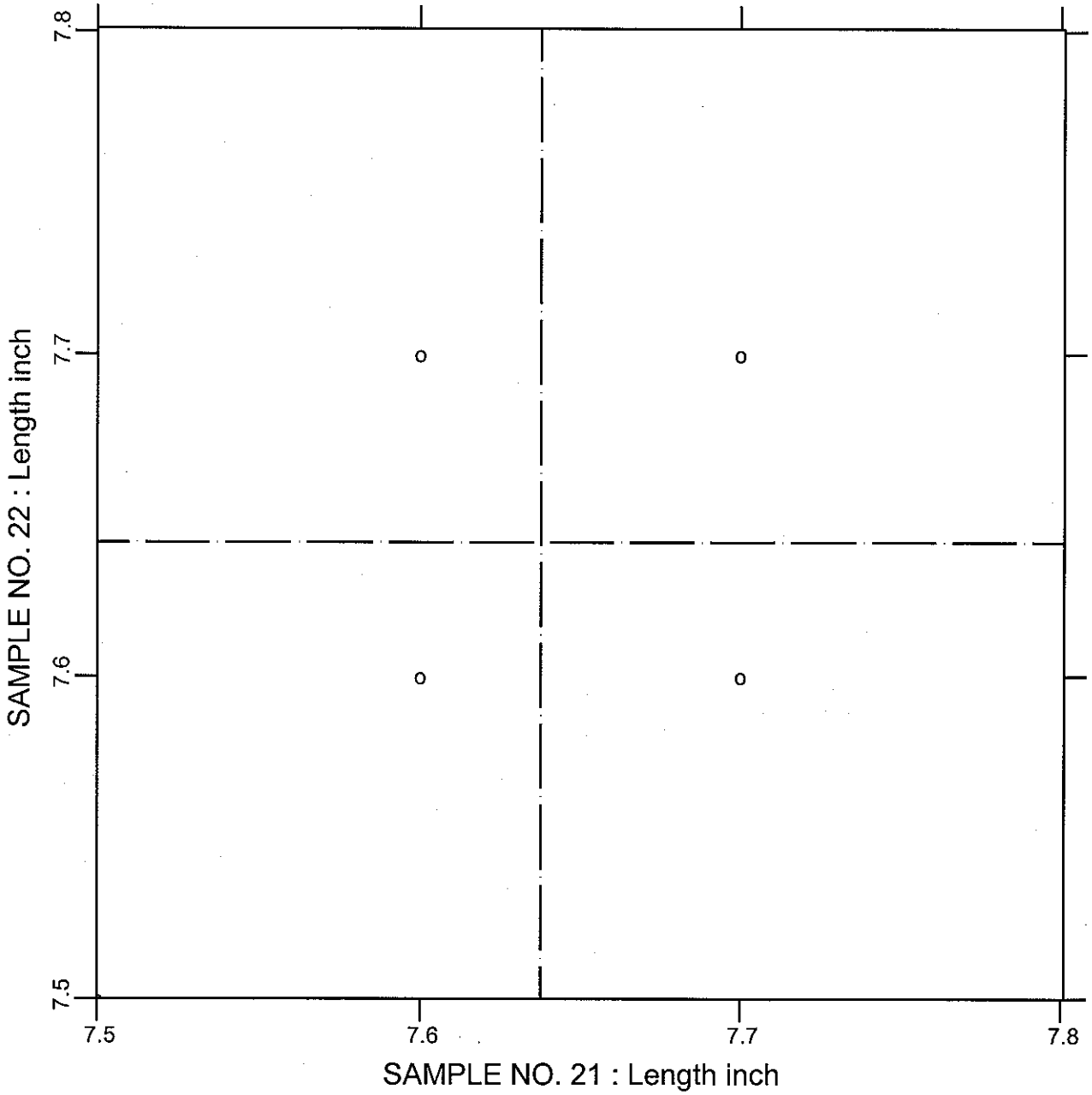
TEST NO.520 Height 105 POINTS

SAMPLE NO. 21 AVE 7.6590 S.D. 0.051 C.V. 0.670

SAMPLE NO. 22 AVE 7.6733 S.D. 0.050 C.V. 0.658

LABS ELIMINATED 537

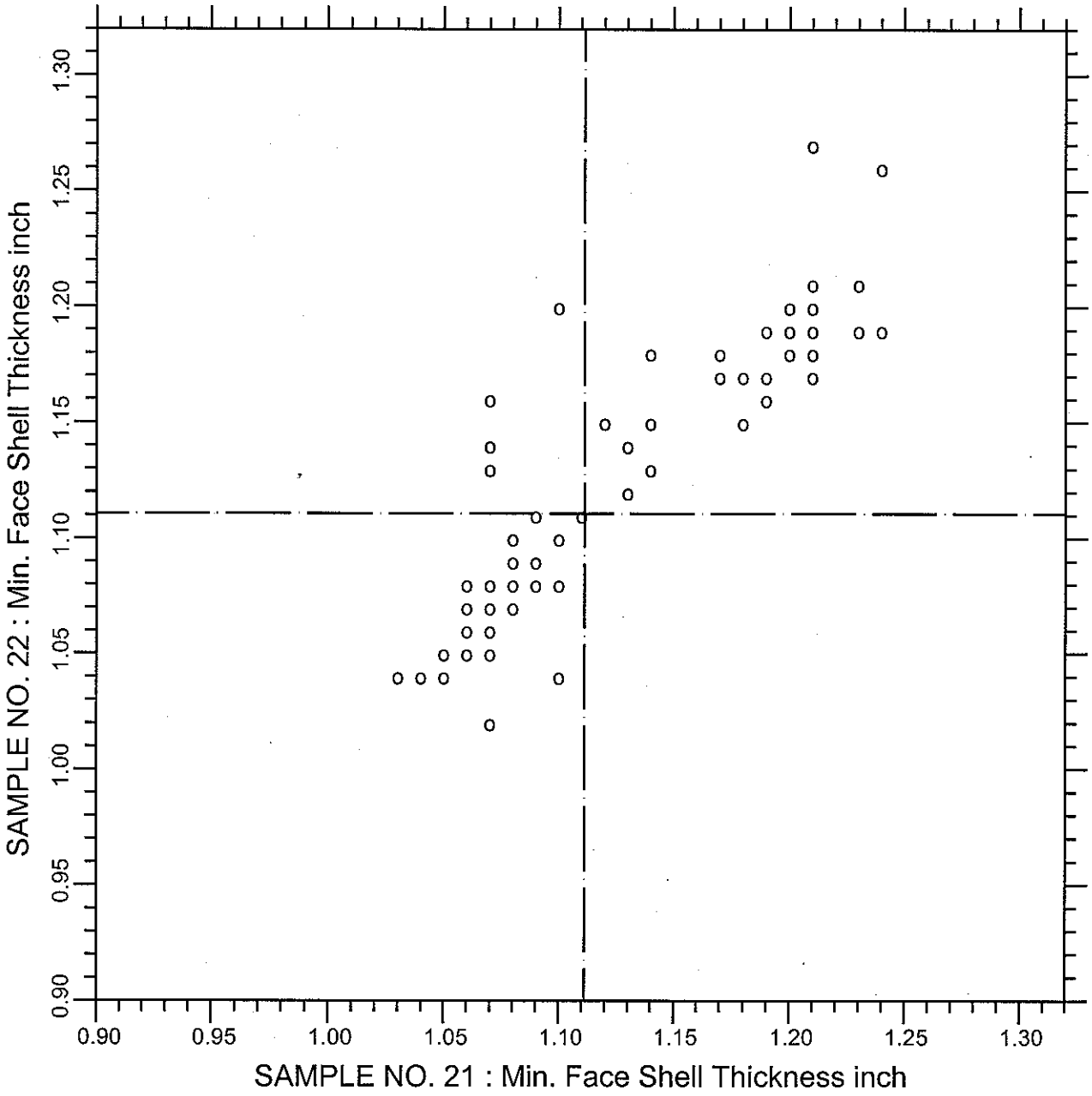
CCRL PROFICIENCY SAMPLE PROGRAM
Length
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



TEST NO.530 Length 106 POINTS

SAMPLE NO. 21	AVE	7.6377	S.D.	0.052	C.V.	0.687
SAMPLE NO. 22	AVE	7.6415	S.D.	0.053	C.V.	0.696

CCRL PROFICIENCY SAMPLE PROGRAM
Minimum Face Shell Thickness
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



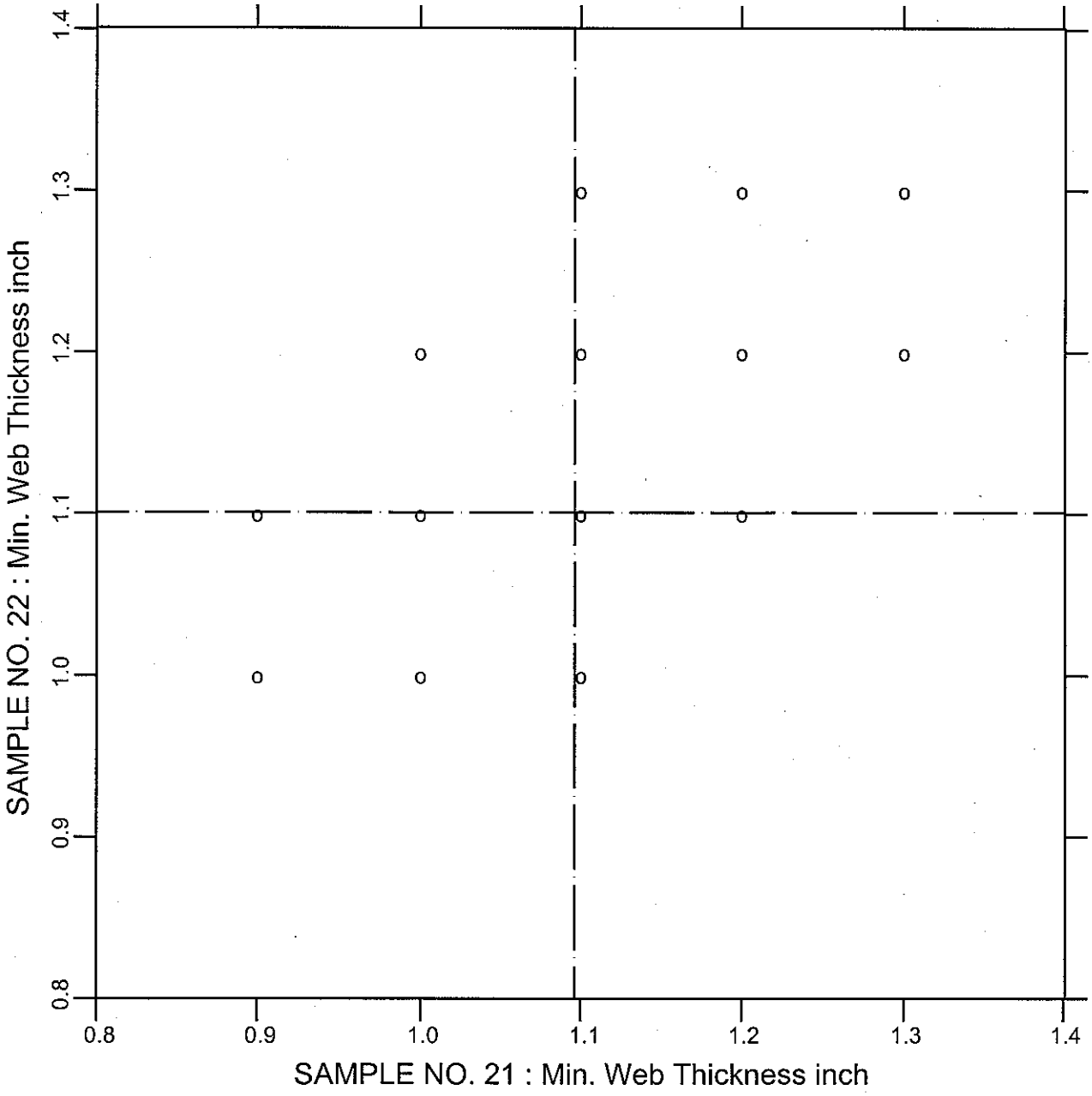
TEST NO.532 Min. Face Shell Thickness 105 POINTS

SAMPLE NO. 21 AVE 1.1112 S.D. 0.058 C.V. 5.26

SAMPLE NO. 22 AVE 1.1108 S.D. 0.058 C.V. 5.20

LABS ELIMINATED 1310

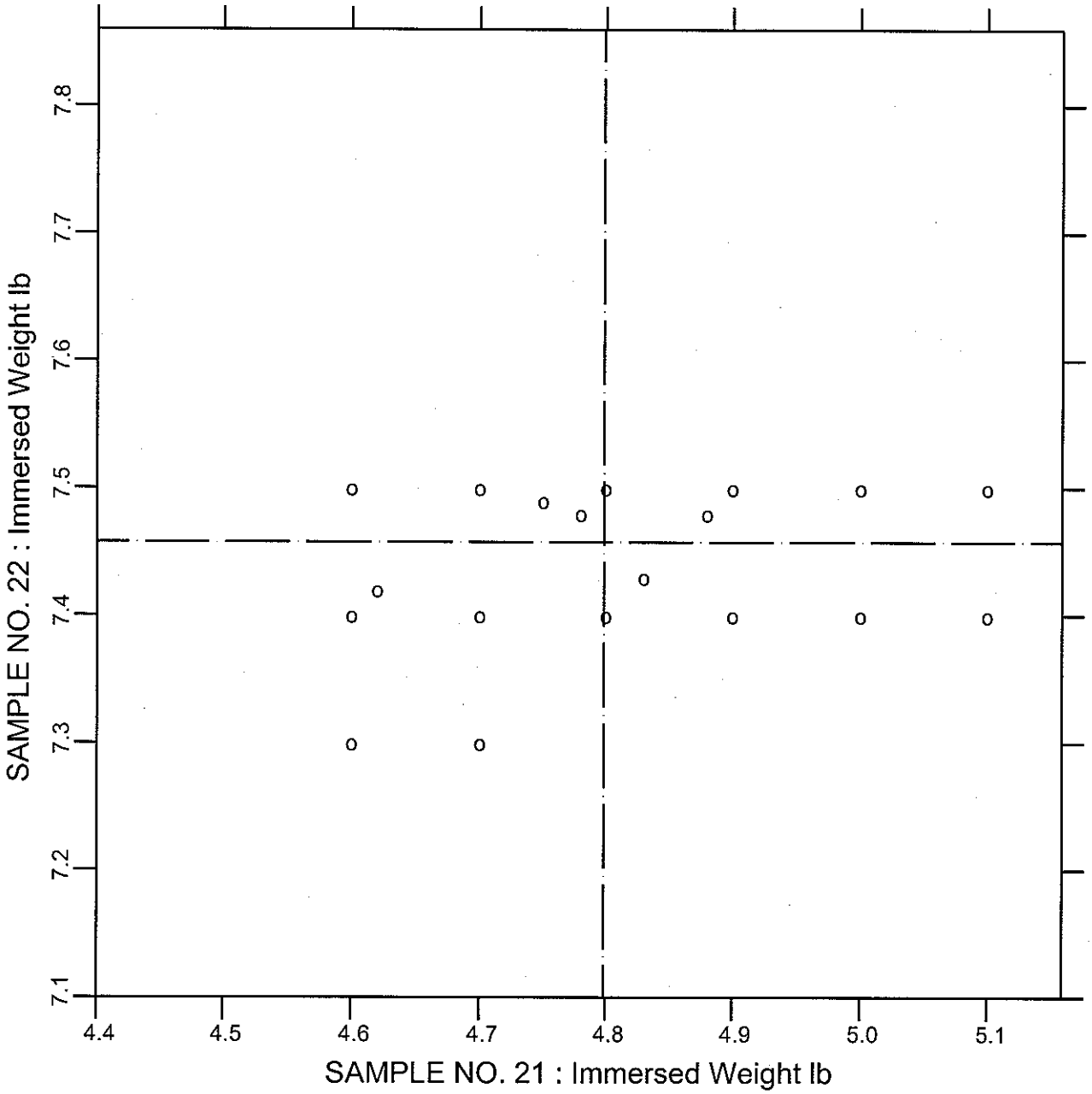
CCRL PROFICIENCY SAMPLE PROGRAM
Minimum Web Thickness
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



TEST NO.533 Min. Web Thickness 105 POINTS

SAMPLE NO. 21 AVE 1.0962 S.D. 0.081 C.V. 7.37
SAMPLE NO. 22 AVE 1.1010 S.D. 0.074 C.V. 6.72
LABS ELIMINATED 1310

CCRL PROFICIENCY SAMPLE PROGRAM
Immersed Weight
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



TEST NO.610 Immersed Weight 94 POINTS

SAMPLE NO. 21 AVE 4.7985 S.D. 0.112 C.V. 2.330

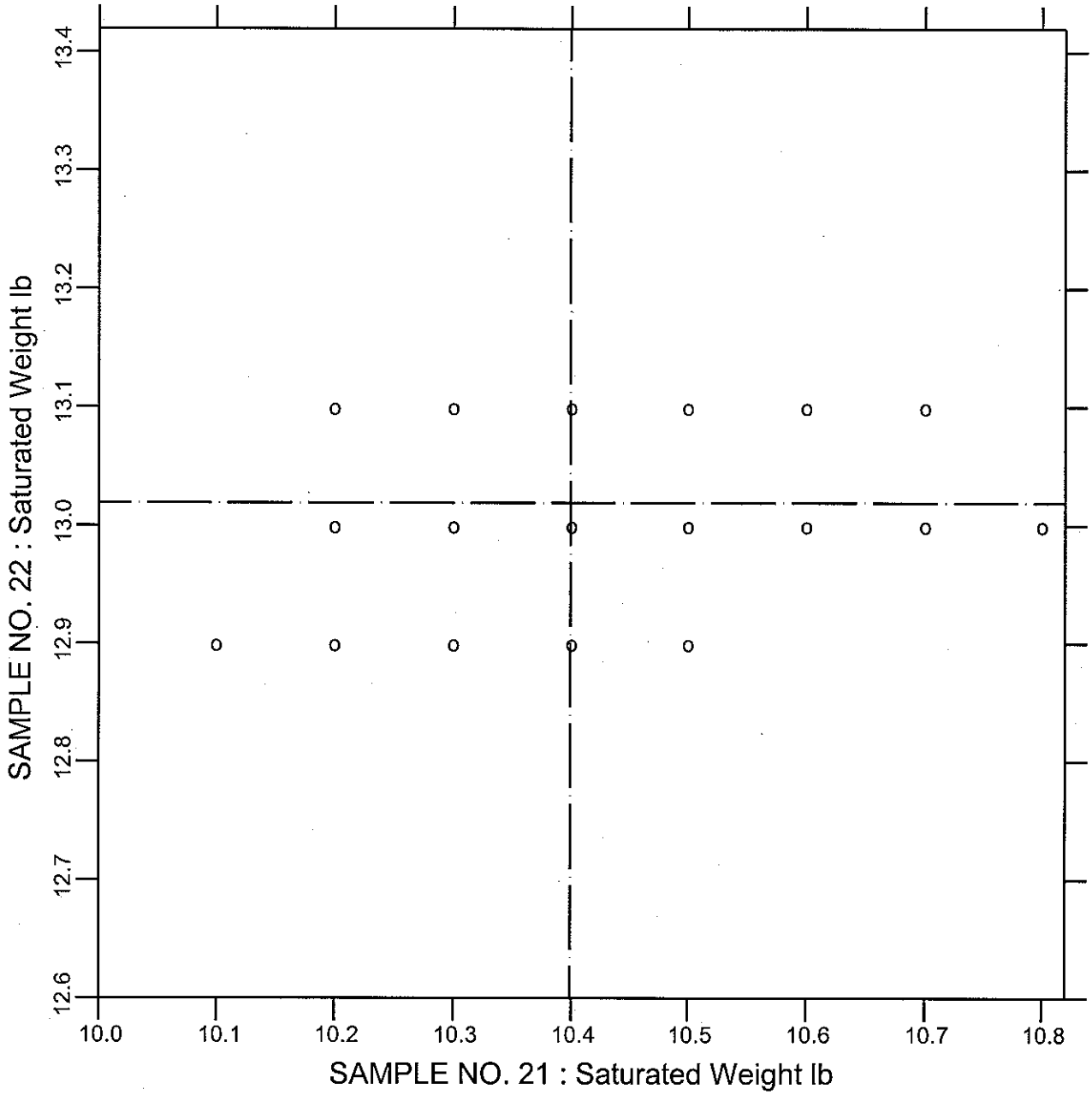
SAMPLE NO. 22 AVE 7.4574 S.D. 0.053 C.V. 0.712

LABS ELIMINATED 946 951 1093 1306 2126 28 1189 1560 2240 2438 2996 3069

CCRL PROFICIENCY SAMPLE PROGRAM

Saturated Weight

CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



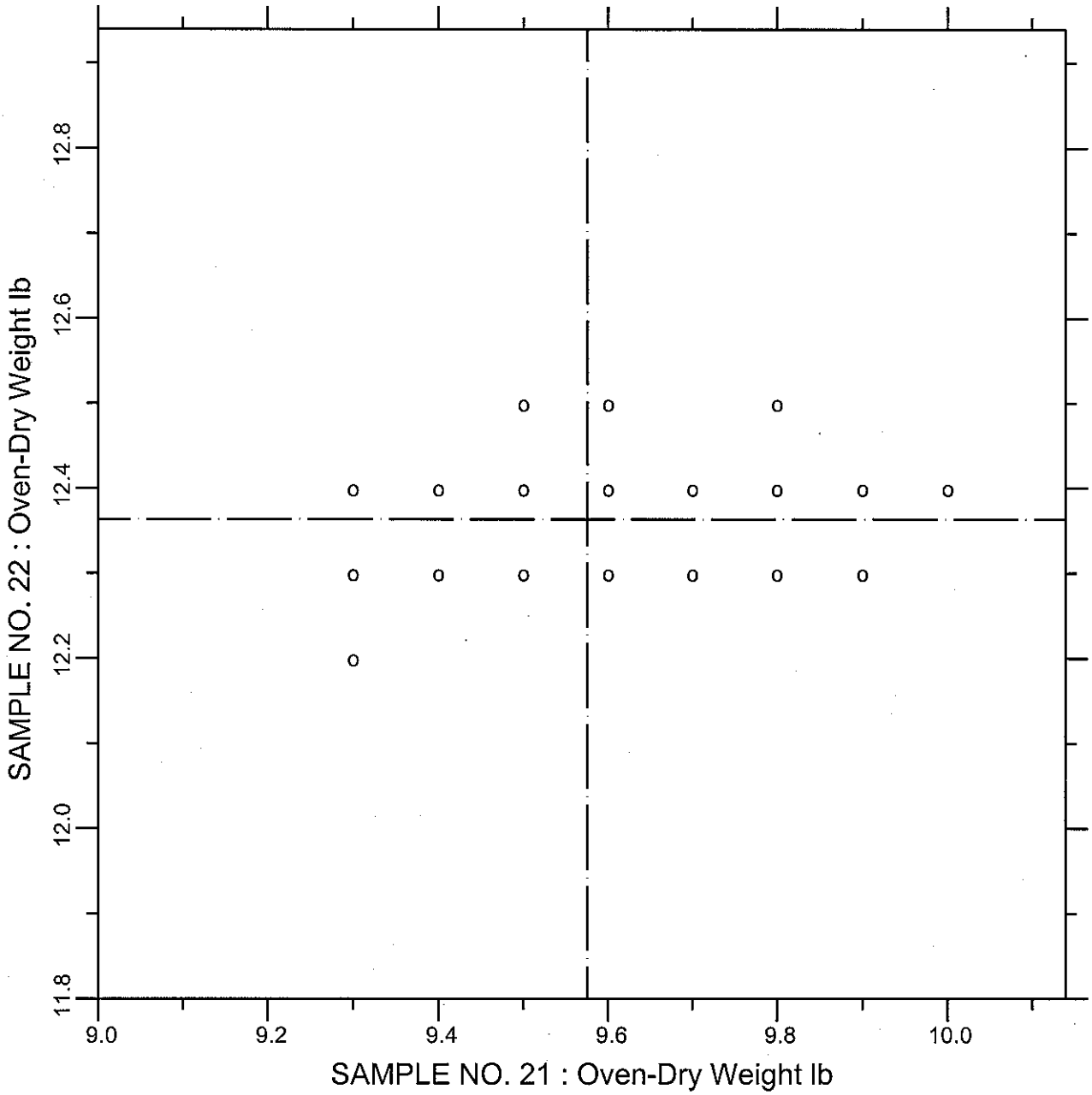
TEST NO.620 Saturated Weight 99 POINTS

SAMPLE NO. 21 AVE 10.3990 S.D. 0.122 C.V. 1.170

SAMPLE NO. 22 AVE 13.0192 S.D. 0.053 C.V. 0.406

LABS ELIMINATED 286 1168 2240 148 1093 2438 3033

CCRL PROFICIENCY SAMPLE PROGRAM
Oven-Dry Weight
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



TEST NO.630 Oven-Dry Weight 98 POINTS

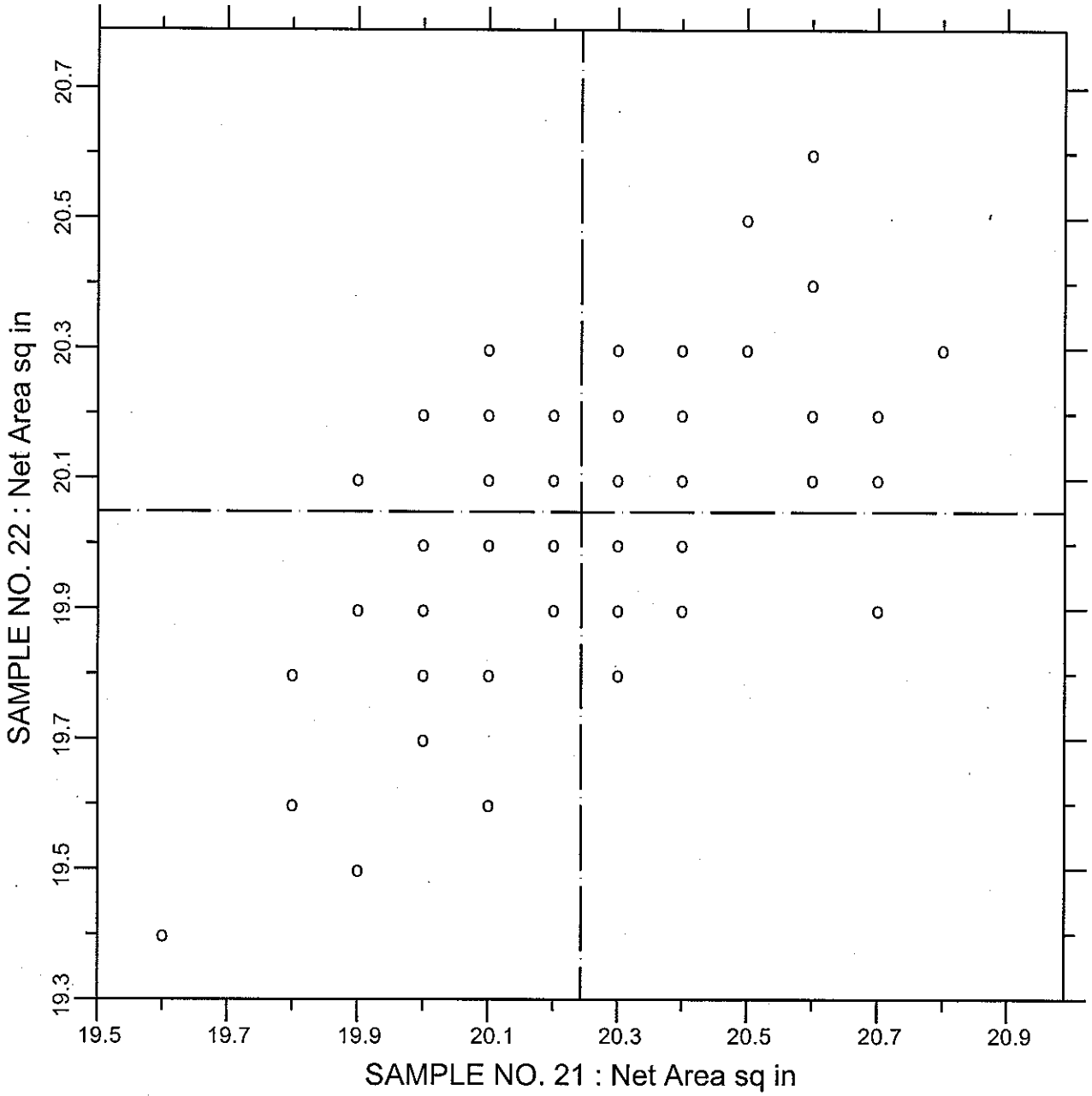
SAMPLE NO. 21 AVE 9.5752 S.D. 0.182 C.V. 1.905

SAMPLE NO. 22 AVE 12.3634 S.D. 0.058 C.V. 0.468

LABS ELIMINATED 10 1560 2240 2250 3033

LABS OFF DIAGRAM 906 1093 2273

CCRL PROFICIENCY SAMPLE PROGRAM
Net Area
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



TEST NO.635 Net Area 88 POINTS

SAMPLE NO. 21 AVE 20.243 S.D. 0.22 C.V. 1.10

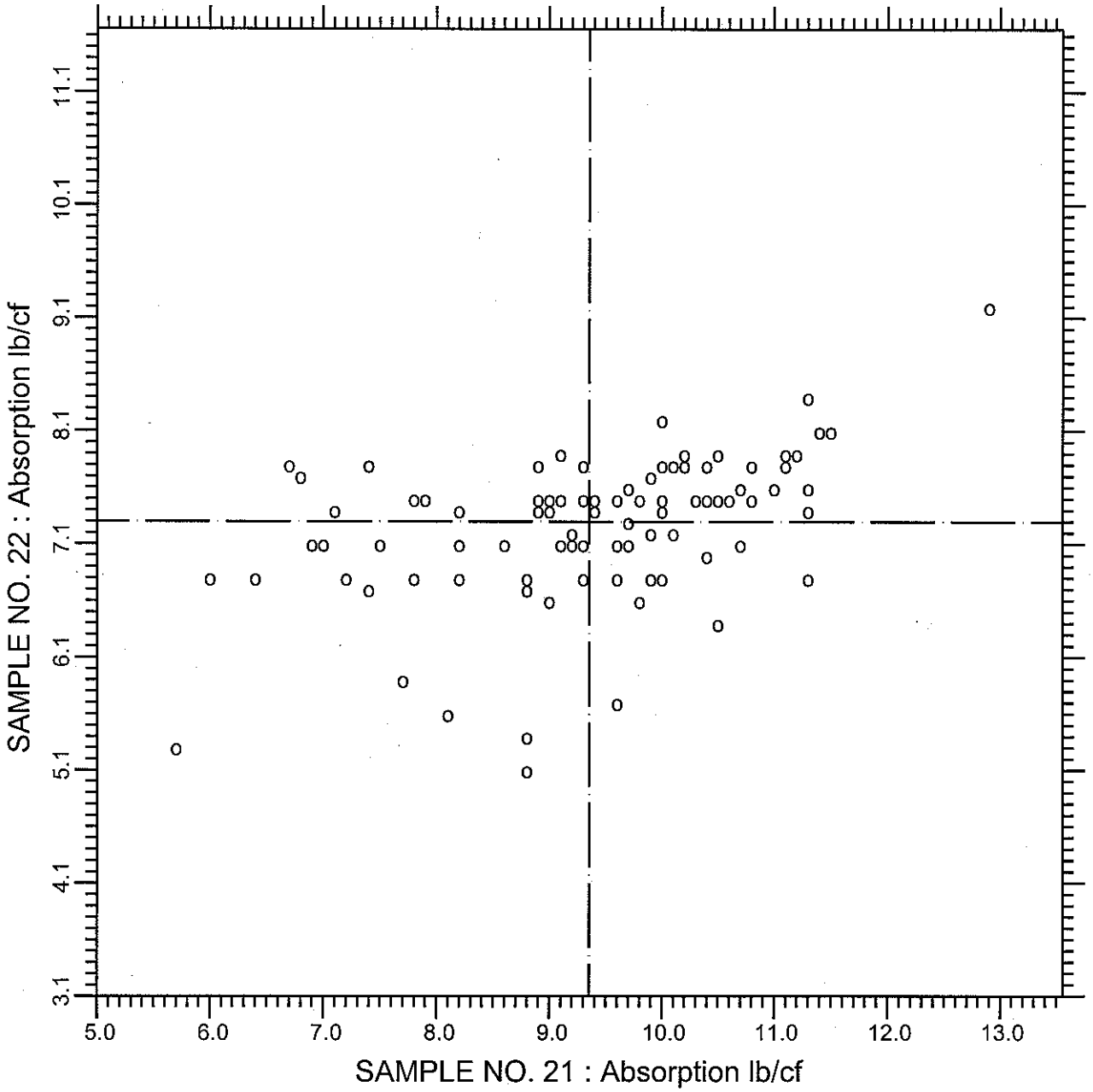
SAMPLE NO. 22 AVE 20.049 S.D. 0.20 C.V. 1.02

LABS ELIMINATED 148 1168 1306 1310 1785 2272 537 946 2126 2149 951 1537 2438 3050 28 2004 2240 3069

CCRL PROFICIENCY SAMPLE PROGRAM

Absorption

CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



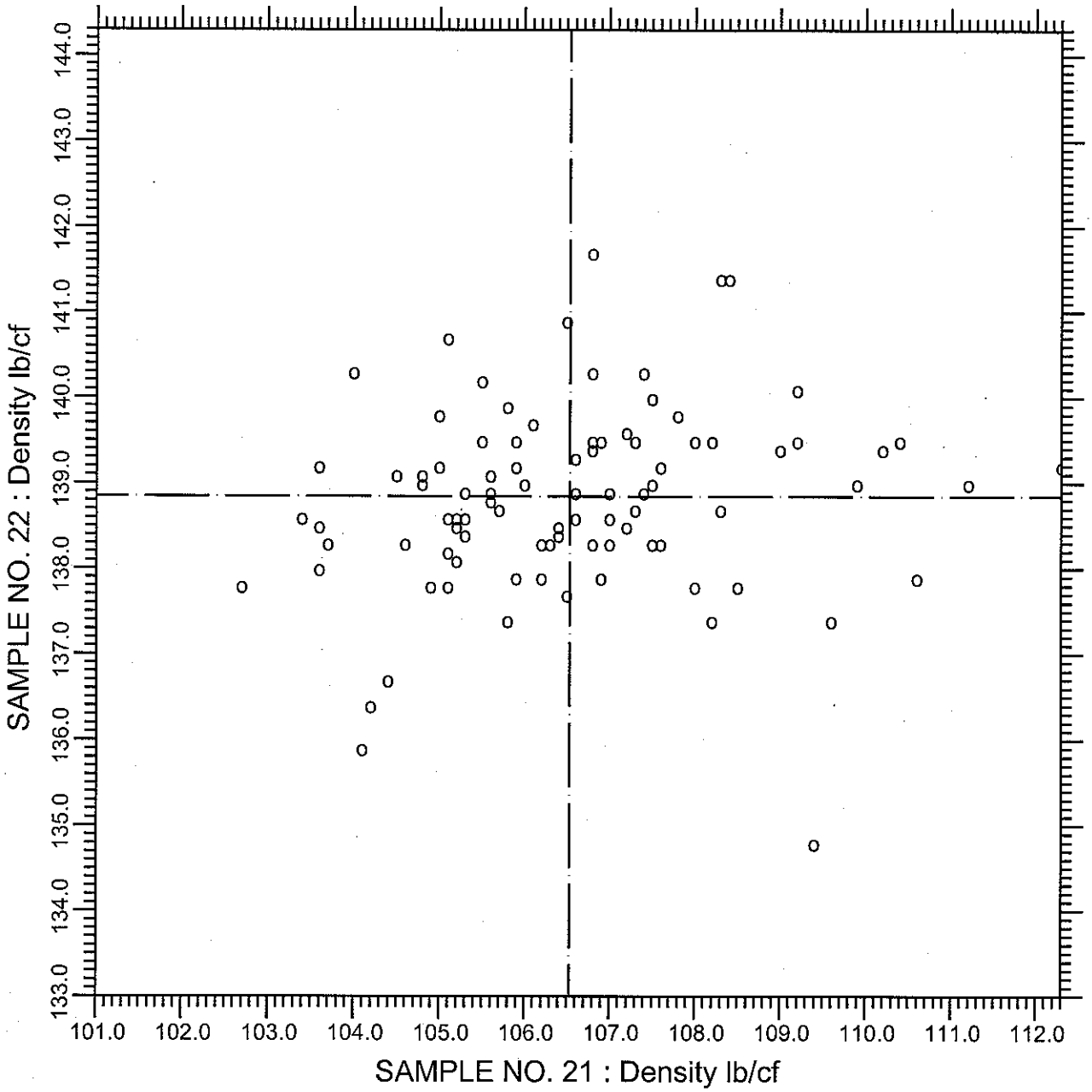
TEST NO.640 Absorption 100 POINTS

SAMPLE NO. 21 AVE 9.355 S.D. 1.37 C.V. 14.63

SAMPLE NO. 22 AVE 7.298 S.D. 0.64 C.V. 8.84

LABS ELIMINATED 10 148 270 906 1560 2438

CCRL PROFICIENCY SAMPLE PROGRAM
Density
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



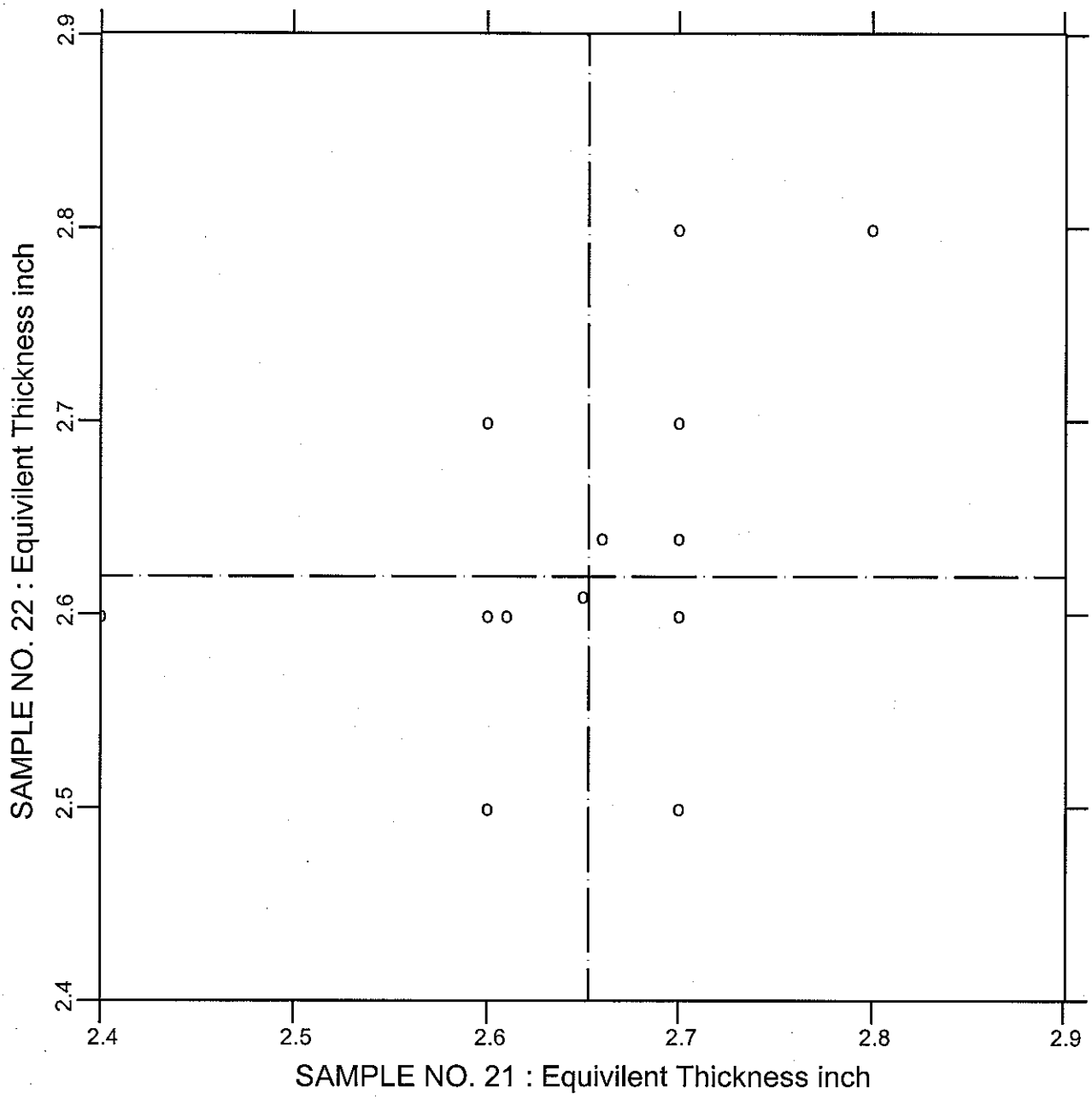
TEST NO.650 Density 94 POINTS

SAMPLE NO. 21 AVE 106.53 S.D. 1.8 C.V. 1.727

SAMPLE NO. 22 AVE 138.84 S.D. 1.1 C.V. 0.777

LABS ELIMINATED 951 1560 2126 946 1093 1306 10 28 2240 2273 2438 3069

CCRL PROFICIENCY SAMPLE PROGRAM
Equivalent Thickness
CONCRETE MASONRY UNITS SAMPLES NO. 21 & NO. 22



TEST NO.660 Equivilent Thickness 91 POINTS

SAMPLE NO. 21 AVE 2.6530 S.D. 0.060 C.V. 2.25

SAMPLE NO. 22 AVE 2.6197 S.D. 0.051 C.V. 1.96

LABS ELIMINATED 537 923 475 1310 946 1010 1168 1306 1577 2019 280 2112 2126 2149 2438