

CEMENT AND CONCRETE REFERENCE LABORATORY
PROFICIENCY SAMPLE PROGRAM

Final Report
Concrete Masonry Units Proficiency Samples
Number 23 and Number 24

September 2007



September 21, 2007

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

Subject: Final Report for Concrete Masonry Units Proficiency Samples No. 23 and No. 24

Following is the report for the current pair of CCRL **Concrete Masonry Units** Proficiency Samples which were distributed in July 2007.

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 2008.

Sincerely,

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

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. 23 and No. 24

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 2007. 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.

¹Youden, 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. 23 and No. 24
Final Report - September 21, 2007

SUMMARY OF RESULTS

Test	#Labs	Sample No. 23			Sample No. 24			
		Average	S.D.	C.V.	Average	S.D.	C.V.	
COMPRESSION UNITS								
Received Weight	lb	103	11.3	0.61	5.42	9.4	0.42	4.41
Received Weight	lb	* 102	11.49	0.061	0.535	9.5	0.064	0.671
Max Comp Load	lbf	101	54698	9639.6	17.6	49437	8356.9	16.9
Max Comp Load	lbf	* 100	55166	8458.0	15.3	49850	7289.4	14.6
Comp Strength	psi	103	2760	475.7	17.2	2494	406.3	16.3
ABSORPTION UNITS								
Received Weight	lb	100	11.4	0.052	0.455	9.5	0.253	2.662
Received Weight	lb	* 98	11.4	0.049	0.429	9.5	0.071	0.746
Width	inch	99	3.6	0.024	0.665	3.6	0.030	0.839
Height	inch	100	7.6	0.038	0.498	7.6	0.039	0.518
Length	inch	99	7.6	0.017	0.230	7.6	0.022	0.294
Face Thickness	inch	99	1.06	0.056	5.28	1.05	0.062	5.92

CONTINUED ON NEXT PAGE

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

COMPRESSION UNITS

Received Weight 3003

Maximum Compressive 1790

ABSORPTION UNITS

Received Weight 1189 1268

CCRL PROFICIENCY SAMPLE PROGRAM
Concrete Masonry Units Proficiency Samples No. 23 and No. 24
Final Report - September 21, 2007

SUMMARY OF RESULTS

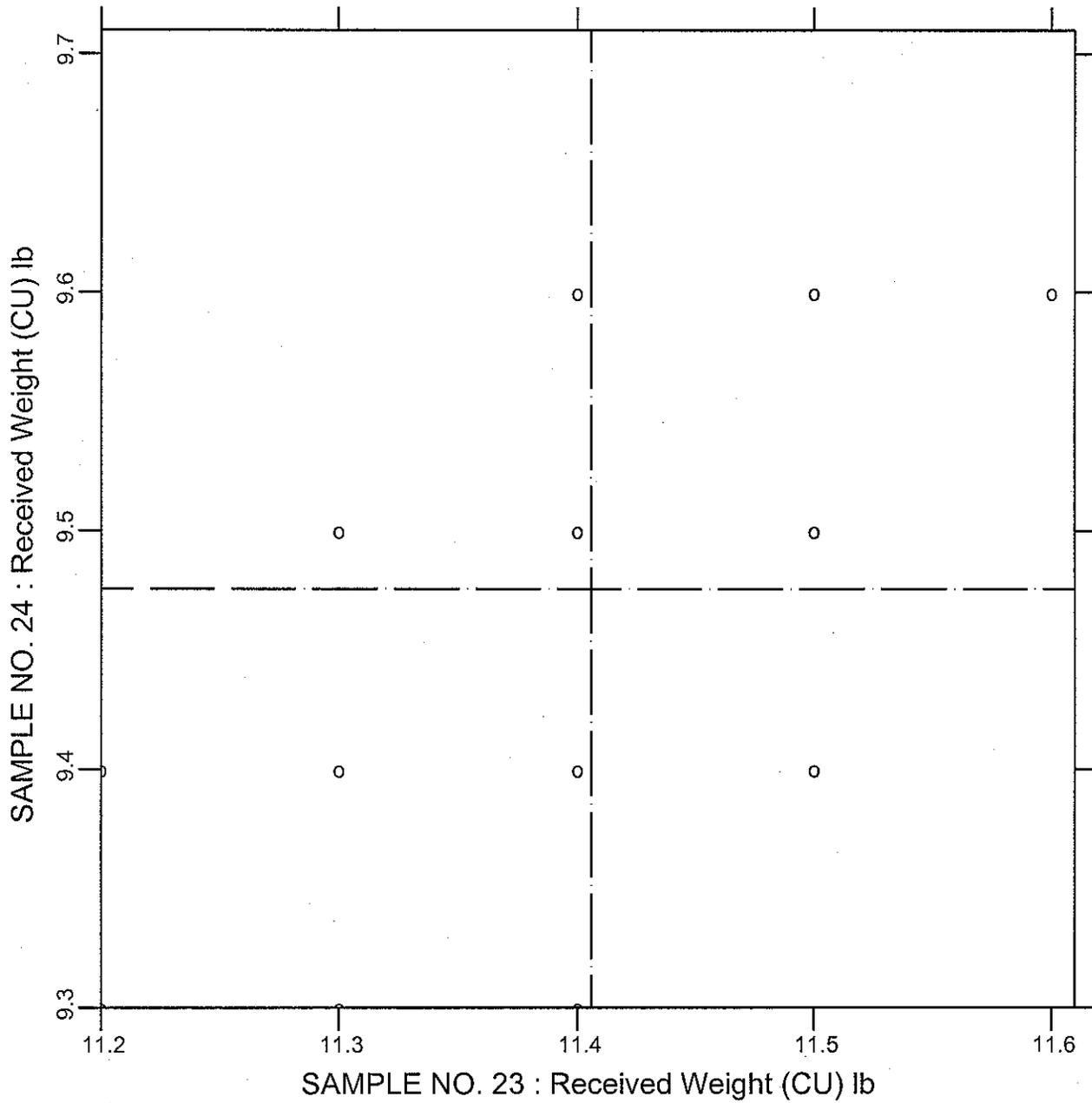
Test		#Labs	Sample No. 23			Sample No. 24		
			Average	S.D.	C.V.	Average	S.D.	C.V.
ABSORPTION UNITS - CONTINUED								
Web Thickness	inch	99	1.1	0.091	8.63	1.0	0.096	9.18
Web Thickness	inch	* 98	1.1	0.084	7.95	1.1	0.079	7.49
Immersed Weight	lb	100	6.8	0.21	3.12	4.8	0.21	4.31
Immersed Weight	lb	* 99	6.8	0.074	1.09	4.8	0.071	1.46
Saturate Weight	lb	100	12.1	0.22	1.79	10.2	0.22	2.14
Saturate Weight	lb	* 98	12.2	0.072	0.593	10.2	0.064	0.629
Oven-Dry Weight	lb	100	11.3	0.25	2.22	9.1	0.26	2.91
Oven-Dry Weight	lb	* 96	11.3	0.052	0.457	9.1	0.074	0.819
Net Area	ft ³	100	19.9	1.6	7.91	19.9	1.6	8.35
Net Area	ft ³	* 93	19.6	0.27	1.36	19.6	0.22	1.14
Absorption	lb/ft ³	100	10.0	1.0	10.60	12.9	1.1	8.88
Absorption	lb/ft ³	* 95	10.0	0.61	6.14	13.0	0.56	4.32
Density	lb/ft ³	100	130.8	3.0	2.31	105.9	2.7	2.57
Density	lb/ft ³	* 96	131.2	1.3	1.004	105.7	1.0	0.996
Equiv Thick	inch	99	8.5	58.5	689	8.4	58.1	688
Equiv Thick	inch	* 91	2.6	0.055	2.15	2.6	0.052	2.01

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

ABSORPTION UNITS

Min. Web Thickness 1110
Immersed Weight 1785
Saturated Weight 823 1785
Oven-Dry Weight 283 1268 1785 2273
Net Area 835 1306 1357 28 196 823 2273
Absorption 1268 2004 270 1785 2273
Density 646 1268 1785 2273
Equivalent Thickness 1010 1120 1310 1357 2149 2126 2250 2273

CCRL PROFICIENCY SAMPLE PROGRAM
 Received Weight - Compression Units
 CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



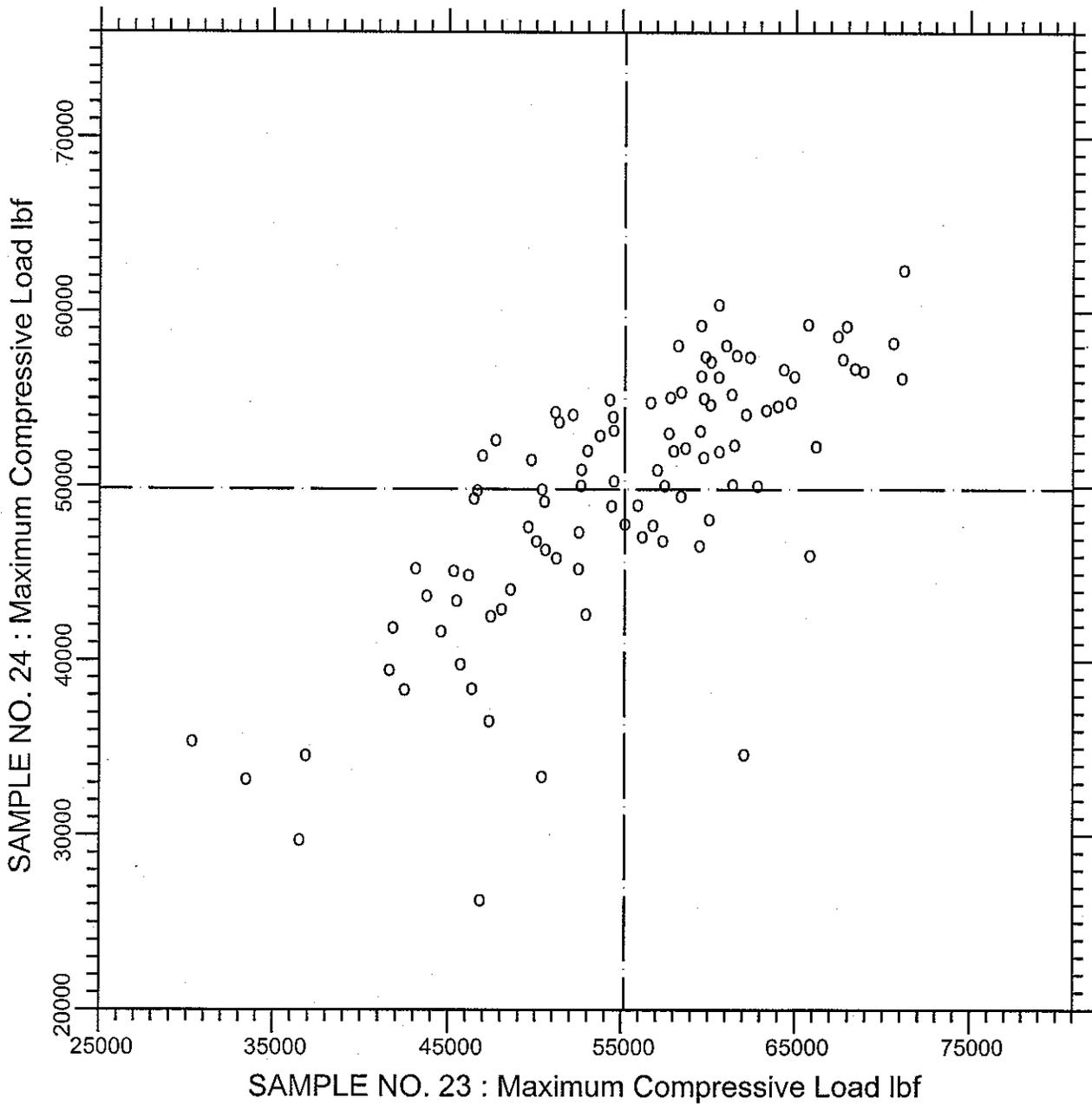
TEST NO.500 Received Weight (CU) 102 POINTS

SAMPLE NO. 23 AVE 11.4059 S.D. 0.061 C.V. 0.535

SAMPLE NO. 24 AVE 9.4755 S.D. 0.064 C.V. 0.671

LABS ELIMINATED 3003

CCRL PROFICIENCY SAMPLE PROGRAM
Maximum Compressive Load
CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



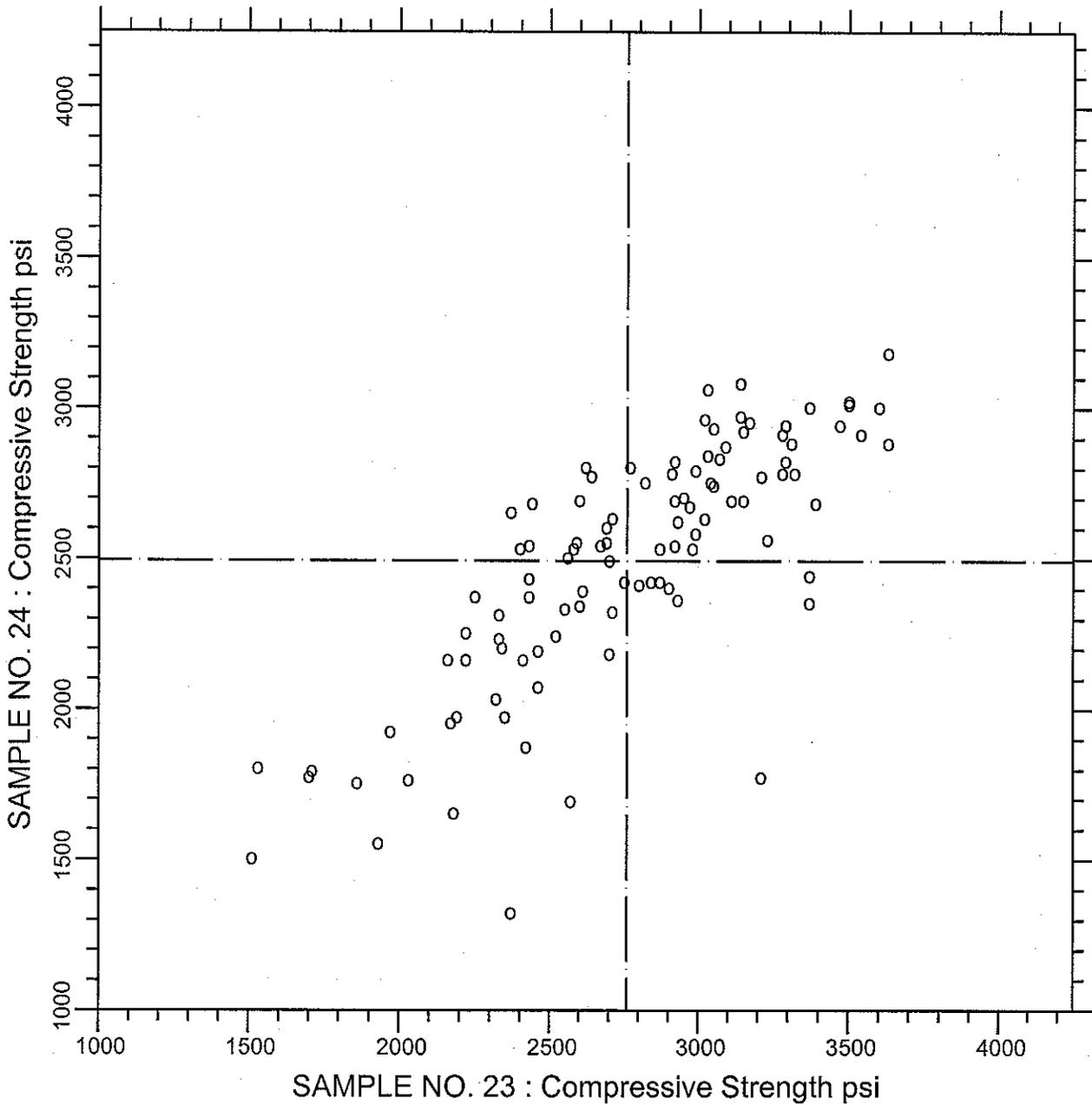
TEST NO.550 Maximum Compressive Load 100 POINTS

SAMPLE NO. 23 AVE 55165.5 S.D. 8458.0 C.V. 15.3

SAMPLE NO. 24 AVE 49850.3 S.D. 7289.4 C.V. 14.6

LABS ELIMINATED 1790

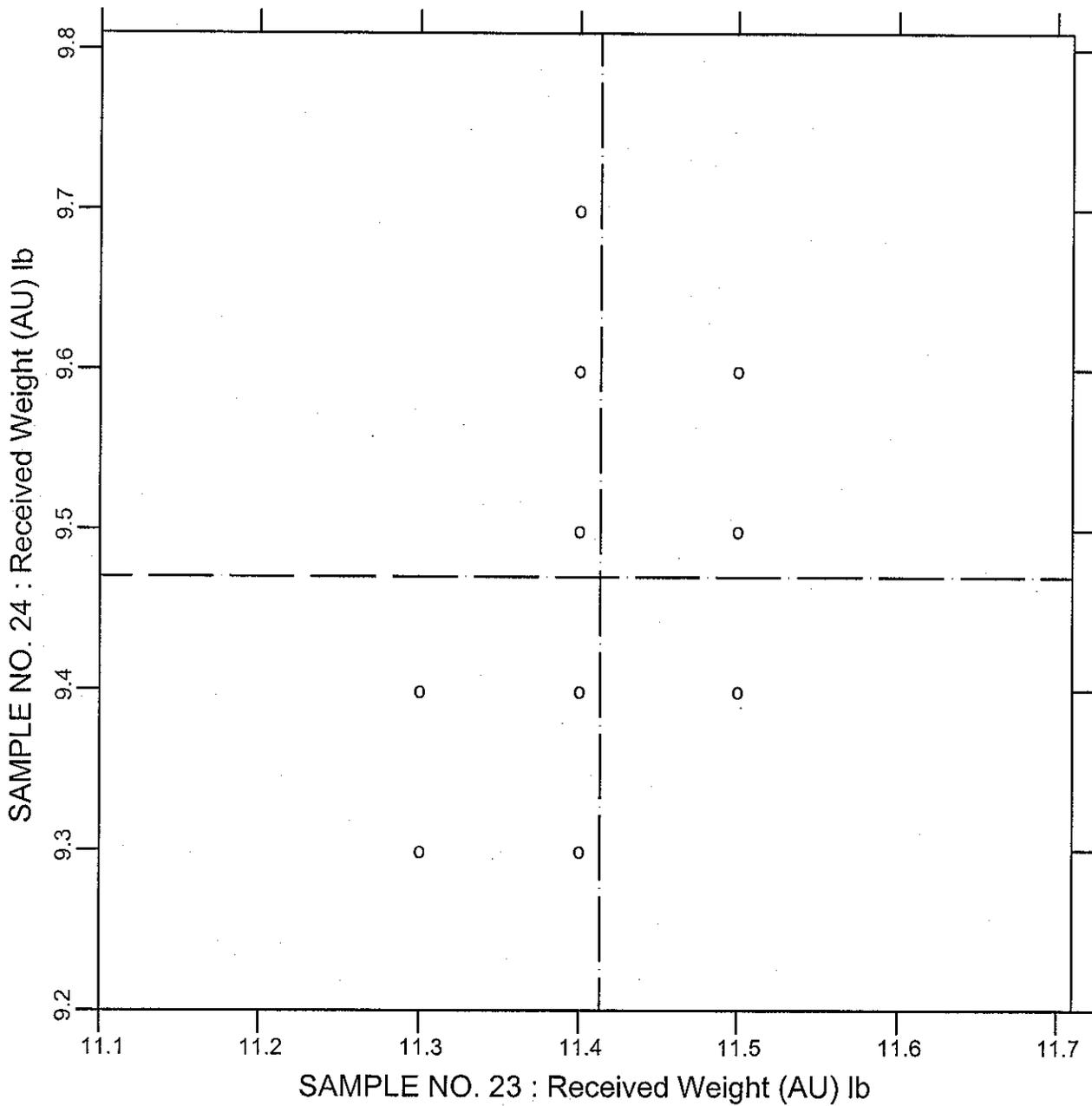
CCRL PROFICIENCY SAMPLE PROGRAM
 Net Area Compressive Strength
 CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



TEST NO.560 Compressive Strength 103 POINTS

SAMPLE NO. 23	AVE	2760.3	S.D.	475.7	C.V.	17.2
SAMPLE NO. 24	AVE	2493.5	S.D.	406.3	C.V.	16.3

CCRL PROFICIENCY SAMPLE PROGRAM
 Received Weight - Absorption Units
 CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



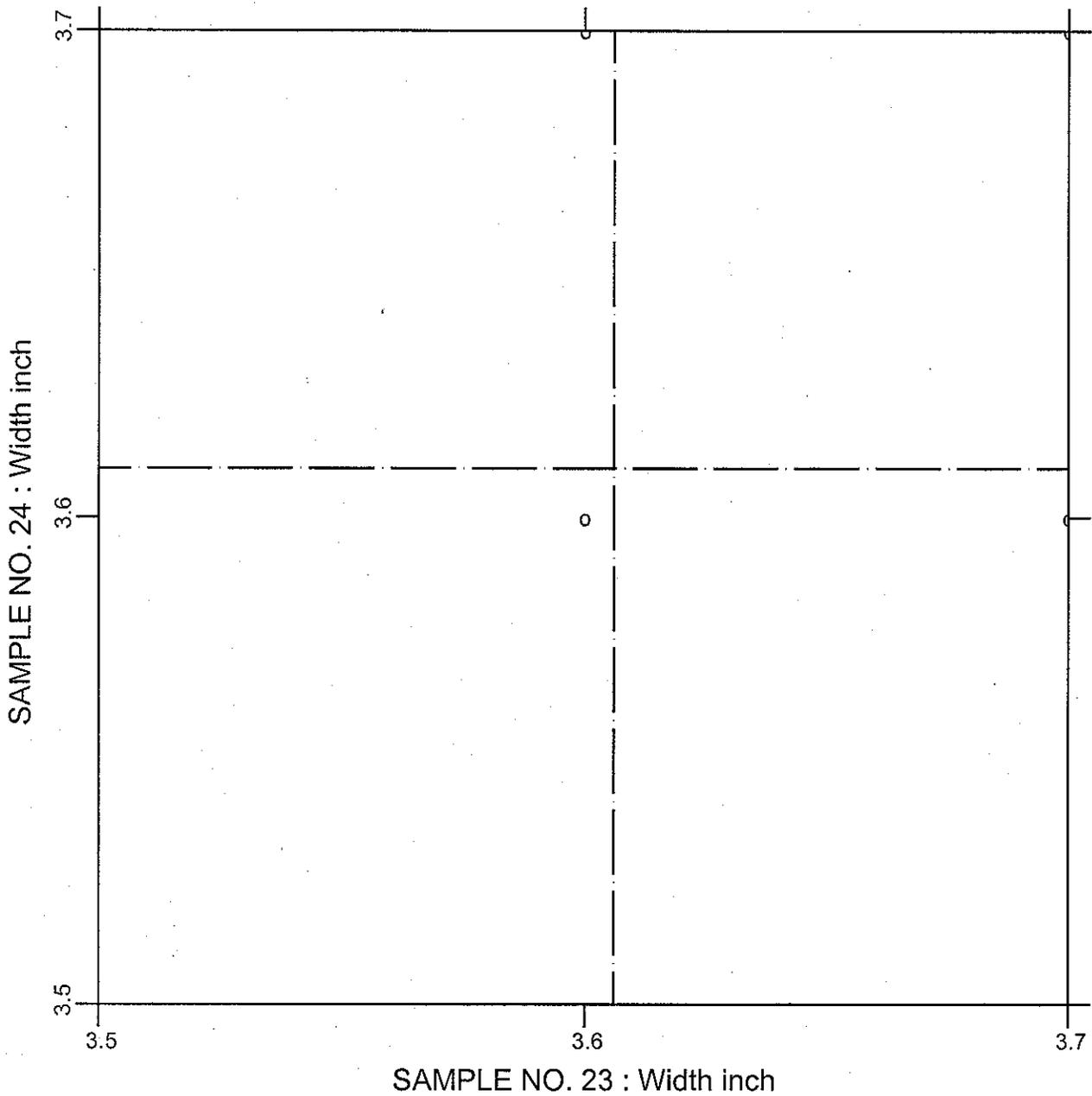
TEST NO.600 Received Weight (AU) 98 POINTS

SAMPLE NO. 23 AVE 11.4133 S.D. 0.049 C.V. 0.429

SAMPLE NO. 24 AVE 9.4704 S.D. 0.071 C.V. 0.746

LABS ELIMINATED 1189 1268

CCRL PROFICIENCY SAMPLE PROGRAM
Width
CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



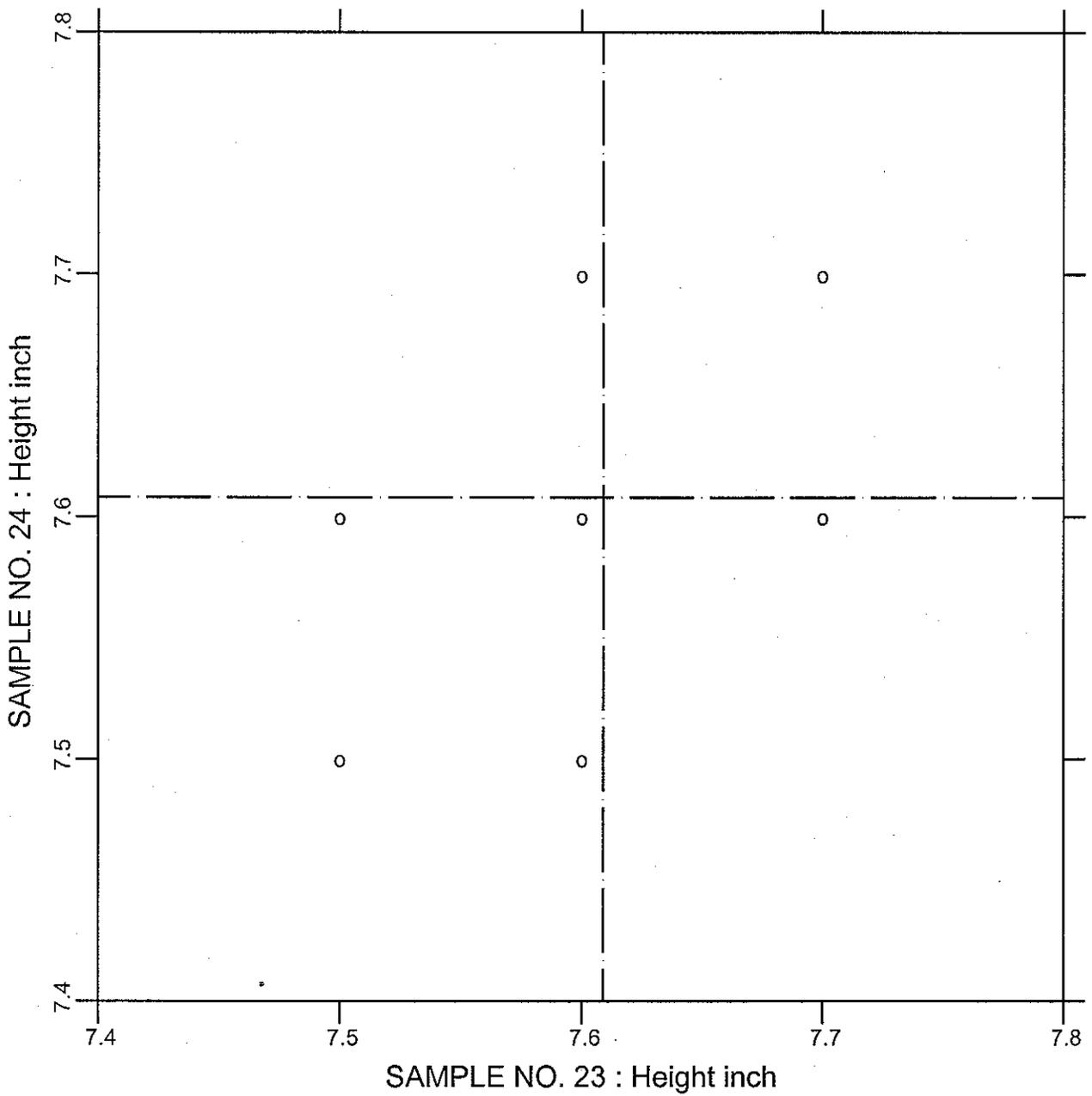
TEST NO.510

Width

99 POINTS

SAMPLE NO. 23	AVE	3.6061	S.D.	0.024	C.V.	0.665
SAMPLE NO. 24	AVE	3.6101	S.D.	0.030	C.V.	0.839

CCRL PROFICIENCY SAMPLE PROGRAM
 Height
 CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



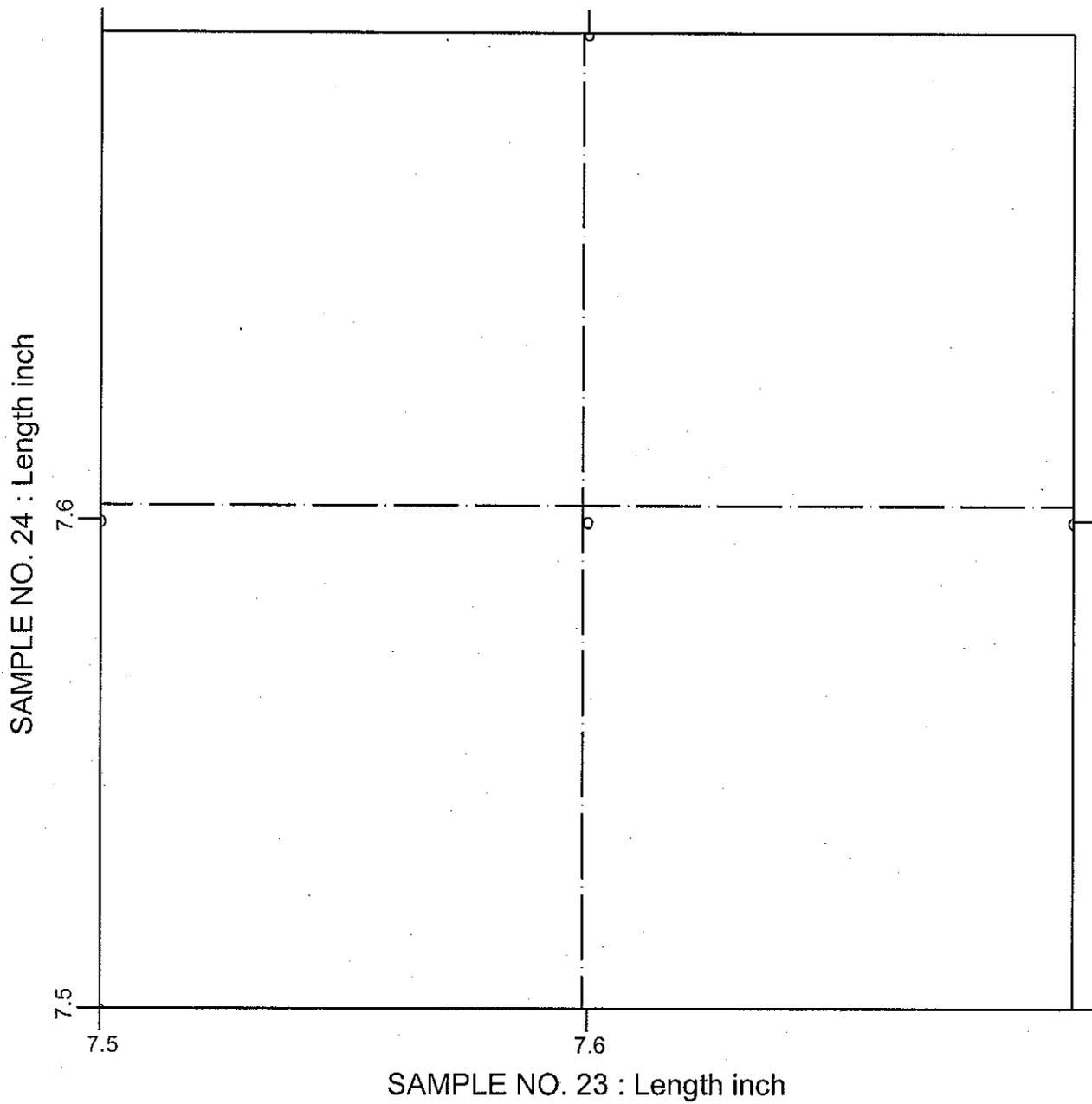
TEST NO.520

Height

100 POINTS

SAMPLE NO. 23	AVE	7.6090	S.D.	0.038	C.V.	0.498
SAMPLE NO. 24	AVE	7.6080	S.D.	0.039	C.V.	0.518

CCRL PROFICIENCY SAMPLE PROGRAM
Length
CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



TEST NO.530

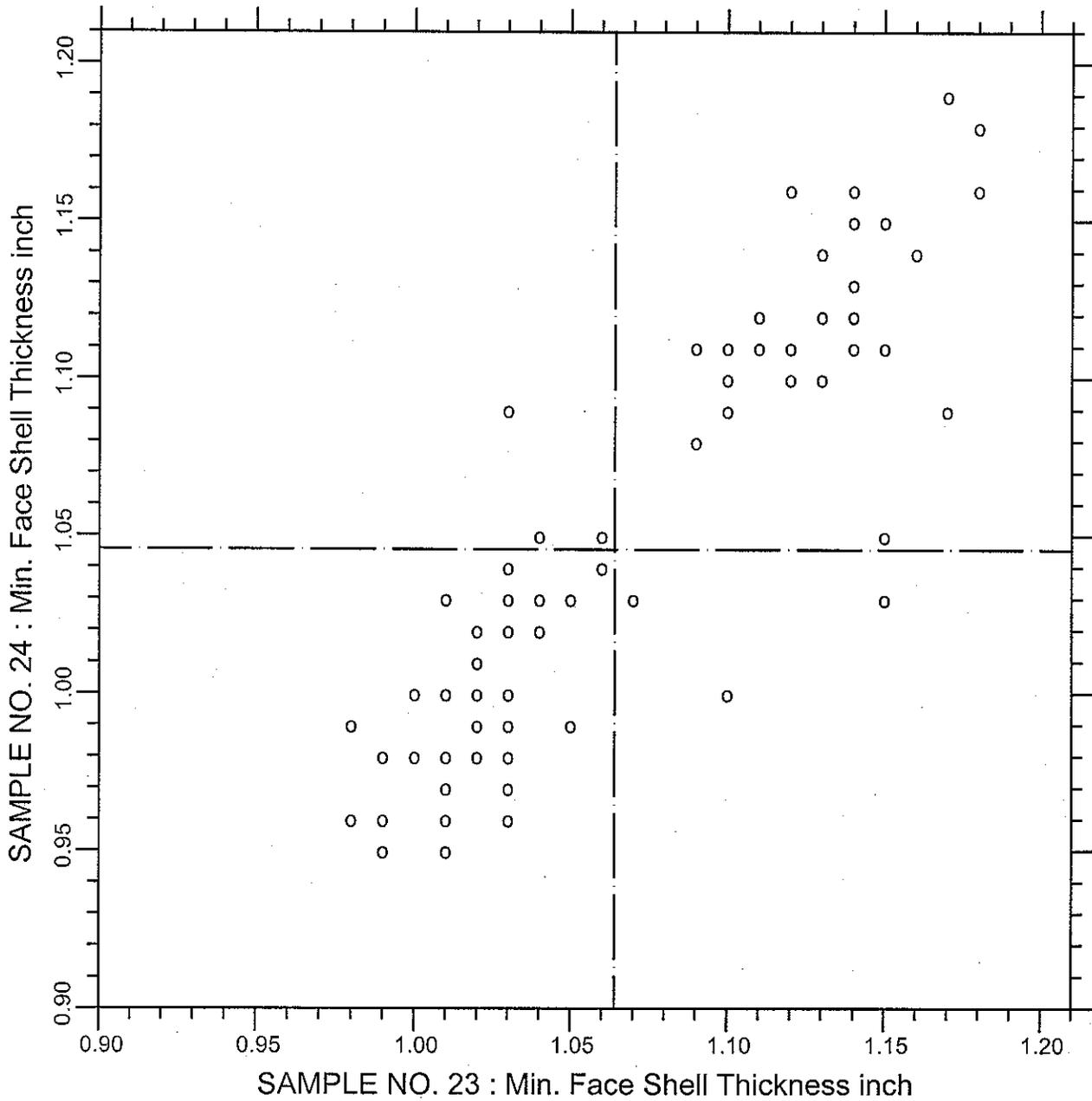
Length

99 POINTS

SAMPLE NO. 23 AVE 7.5990 S.D. 0.017 C.V. 0.230

SAMPLE NO. 24 AVE 7.6030 S.D. 0.022 C.V. 0.294

CCRL PROFICIENCY SAMPLE PROGRAM
 Minimum Face Shell Thickness
 CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24

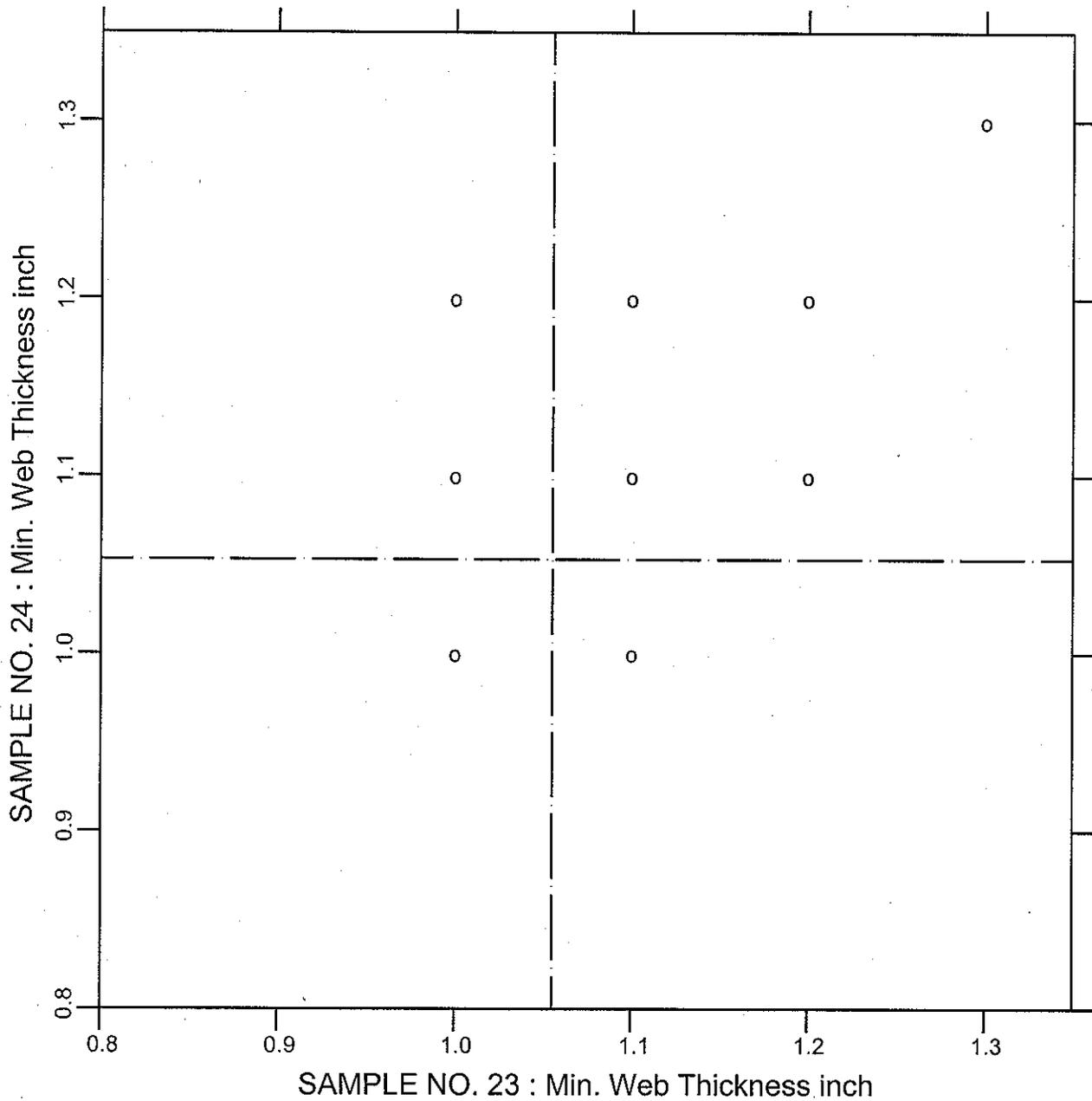


TEST NO.532 Min. Face Shell Thickness 99 POINTS

SAMPLE NO. 23 AVE 1.0641 S.D. 0.056 C.V. 5.28

SAMPLE NO. 24 AVE 1.0456 S.D. 0.062 C.V. 5.92

CCRL PROFICIENCY SAMPLE PROGRAM
 Minimum Web Thickness
 CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



TEST NO.533

Min. Web Thickness

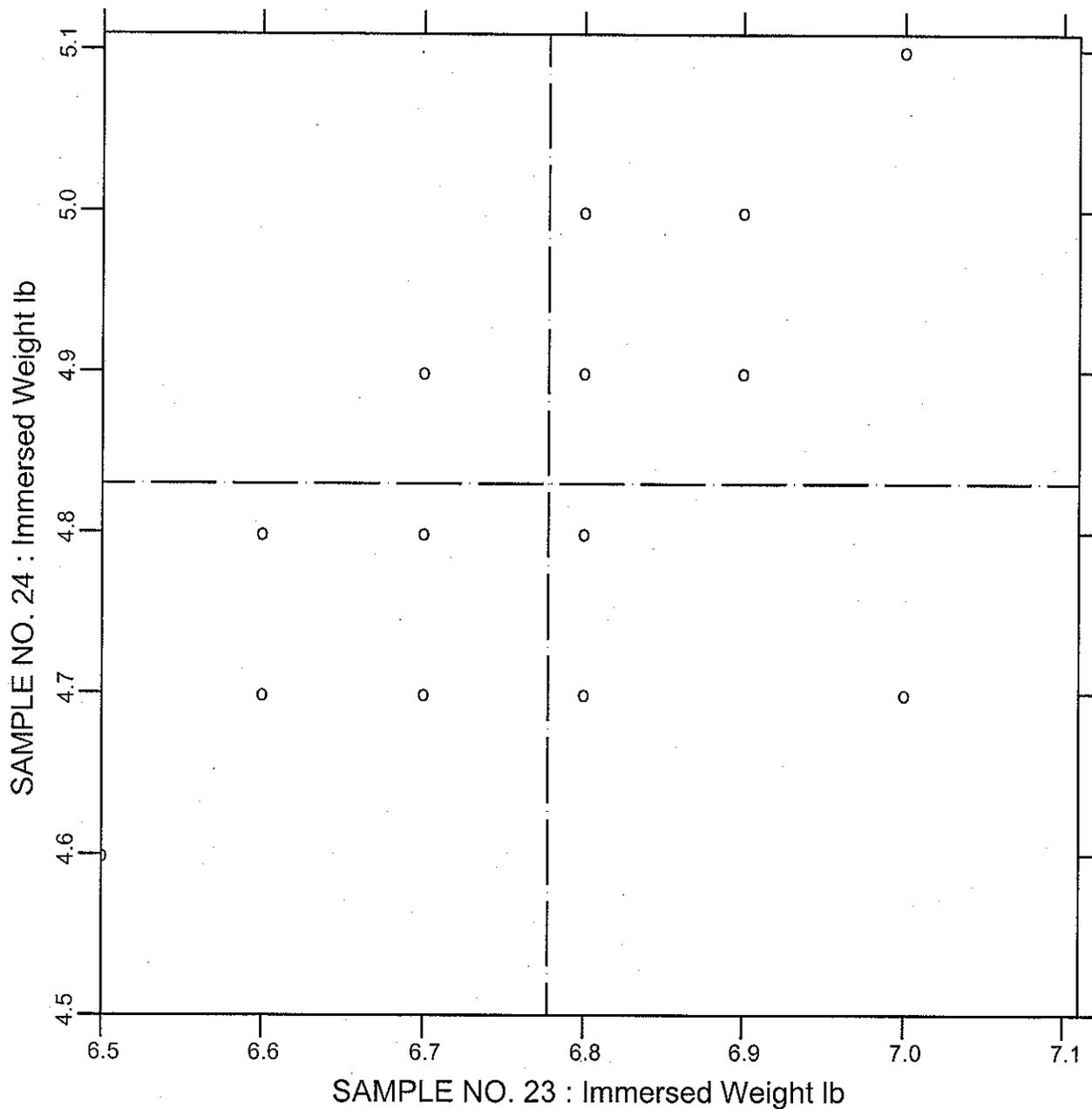
98 POINTS

SAMPLE NO. 23 AVE 1.0551 S.D. 0.084 C.V. 7.95

SAMPLE NO. 24 AVE 1.0531 S.D. 0.079 C.V. 7.49

LABS ELIMINATED 1110

CCRL PROFICIENCY SAMPLE PROGRAM
 Immersed Weight
 CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



TEST NO.610

Immersed Weight

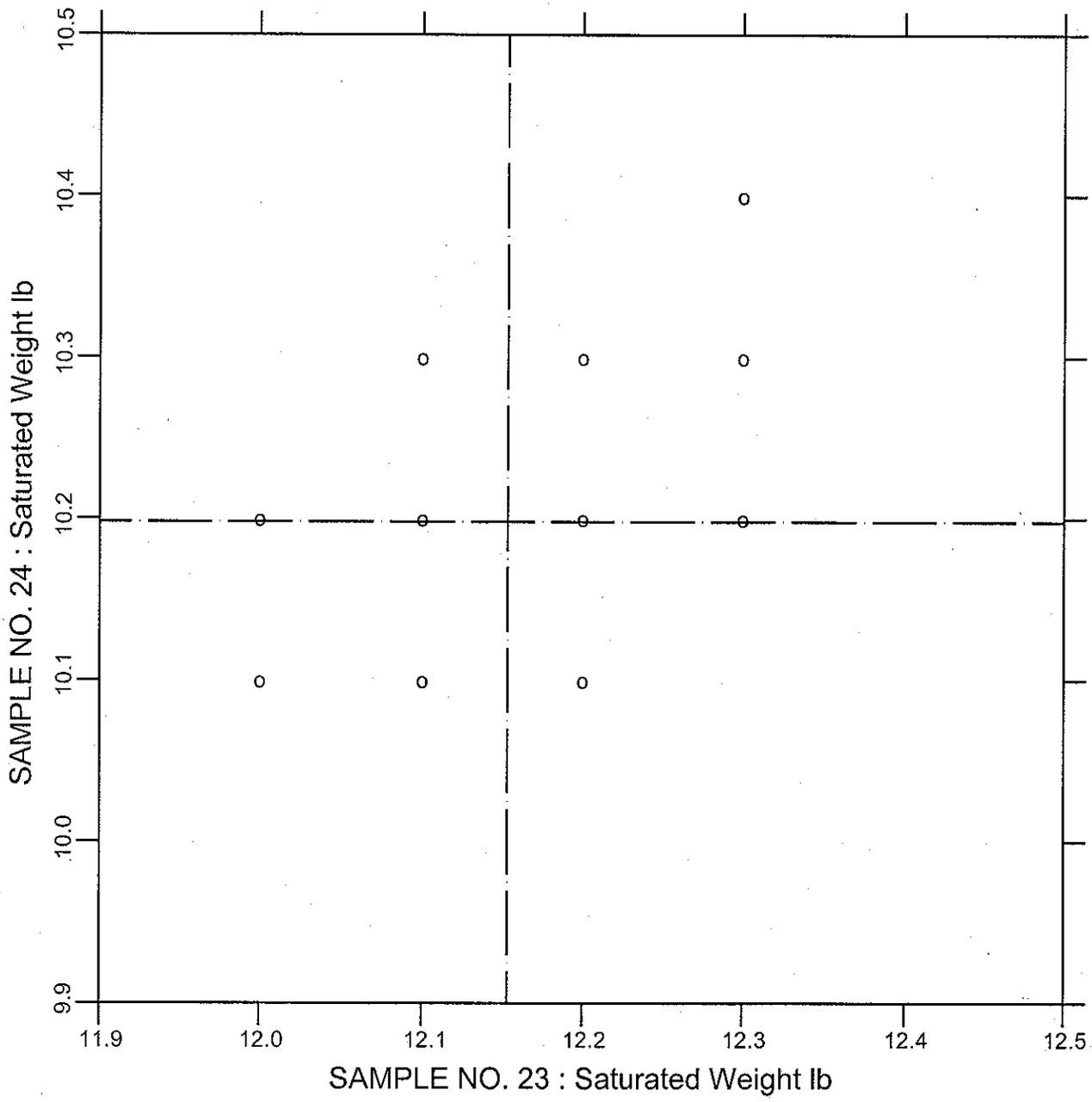
99 POINTS

SAMPLE NO. 23 AVE 6.7778 S.D. 0.074 C.V. 1.09

SAMPLE NO. 24 AVE 4.8303 S.D. 0.071 C.V. 1.46

LABS ELIMINATED 1785

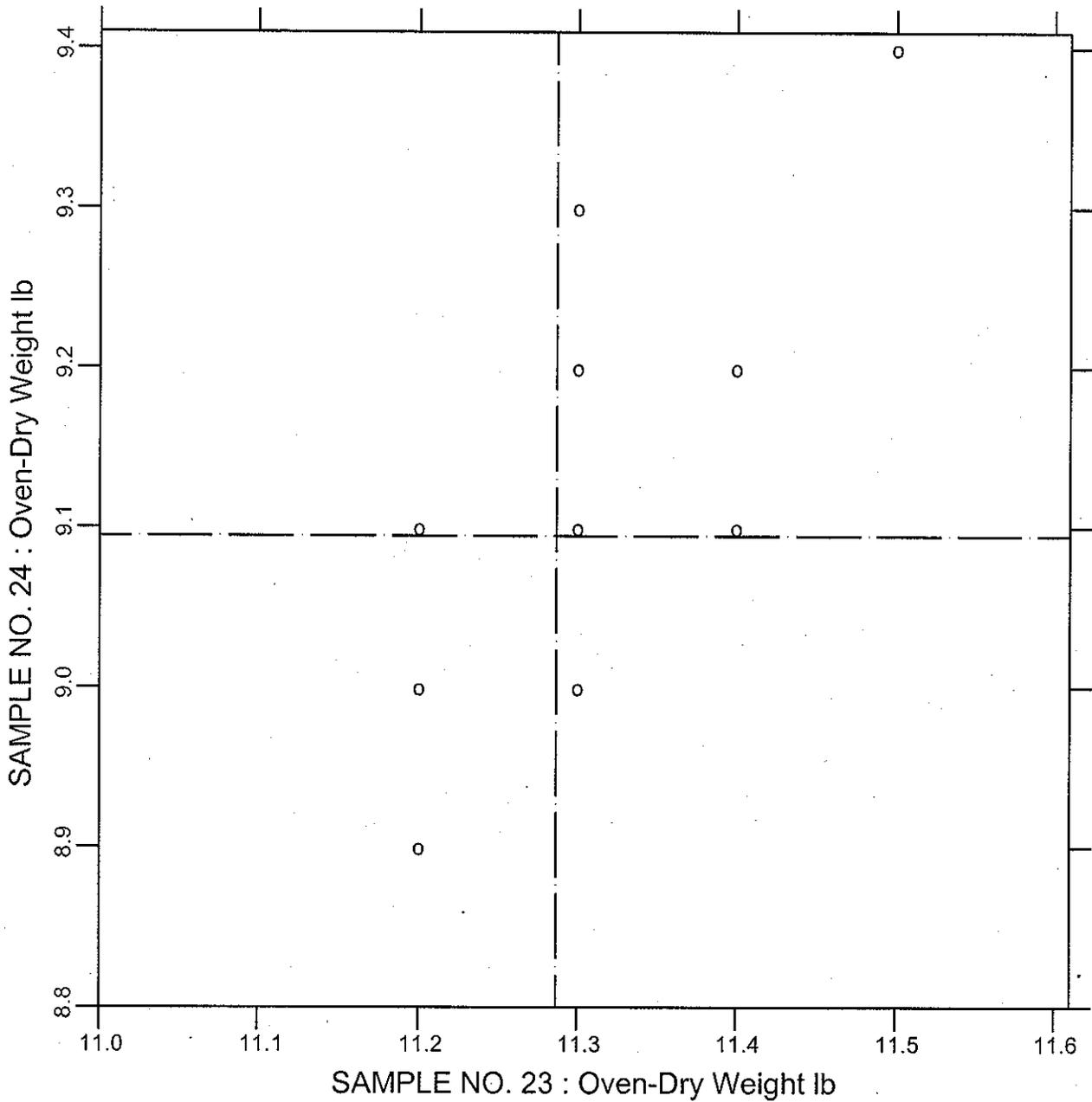
CCRL PROFICIENCY SAMPLE PROGRAM
Saturated Weight
CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



TEST NO.620 Saturated Weight 98 POINTS

SAMPLE NO. 23 AVE 12.1531 S.D. 0.072 C.V. 0.593
 SAMPLE NO. 24 AVE 10.1980 S.D. 0.064 C.V. 0.629
 LABS ELIMINATED 823 1785

CCRL PROFICIENCY SAMPLE PROGRAM
 Oven-Dry Weight
 CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



TEST NO.630

Oven-Dry Weight

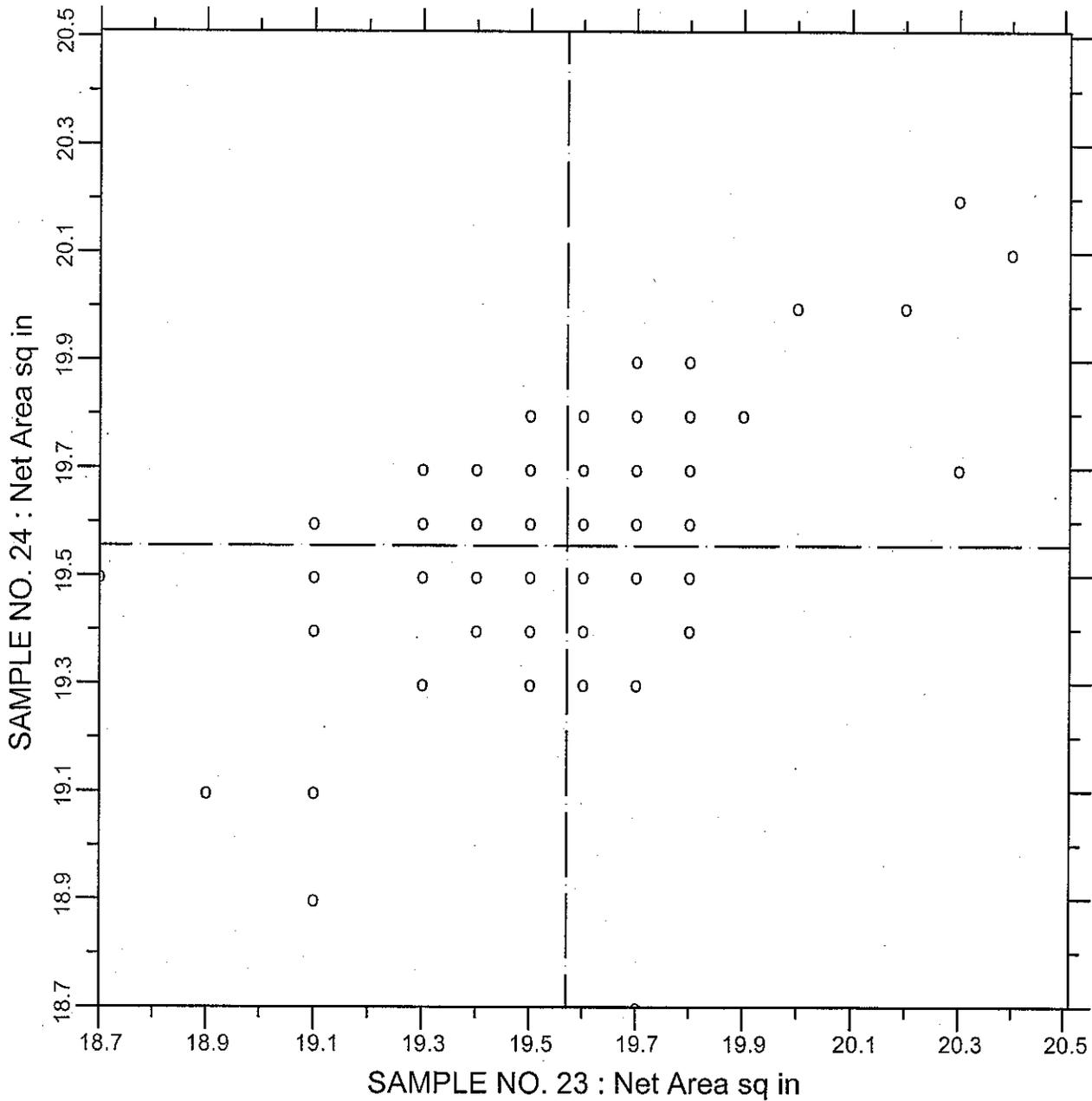
96 POINTS

SAMPLE NO. 23 AVE 11.2865 S.D. 0.052 C.V. 0.457

SAMPLE NO. 24 AVE 9.0948 S.D. 0.074 C.V. 0.819

LABS ELIMINATED 283 1268 1785 2273

CCRL PROFICIENCY SAMPLE PROGRAM
 Net Area
 CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



TEST NO.635

Net Area

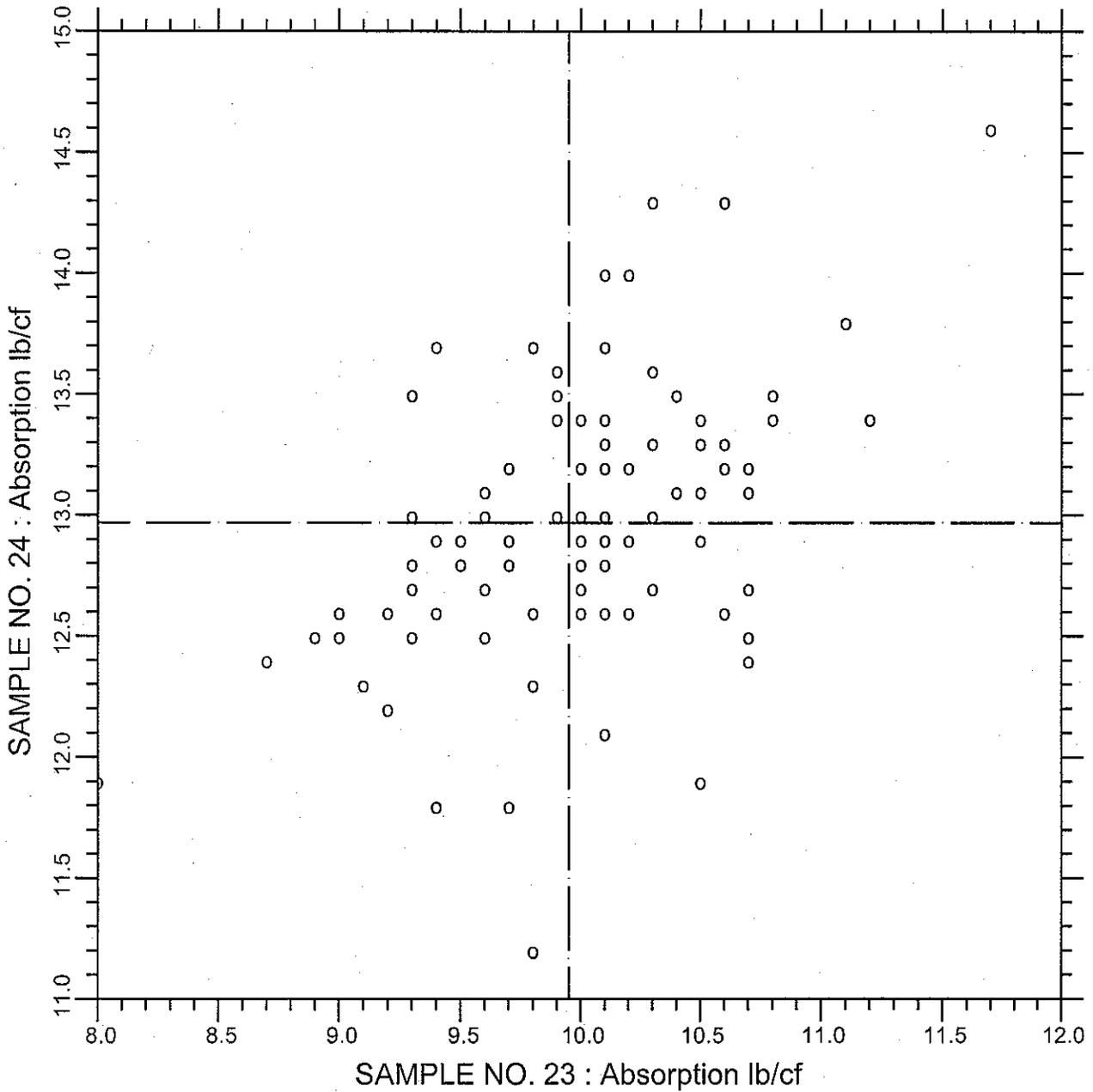
93 POINTS

SAMPLE NO. 23 AVE 19.570 S.D. 0.27 C.V. 1.36

SAMPLE NO. 24 AVE 19.556 S.D. 0.22 C.V. 1.14

LABS ELIMINATED 835 1306 1357 28 196 823 2273

CCRL PROFICIENCY SAMPLE PROGRAM
Absorption
CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



TEST NO.640

Absorption

94 POINTS

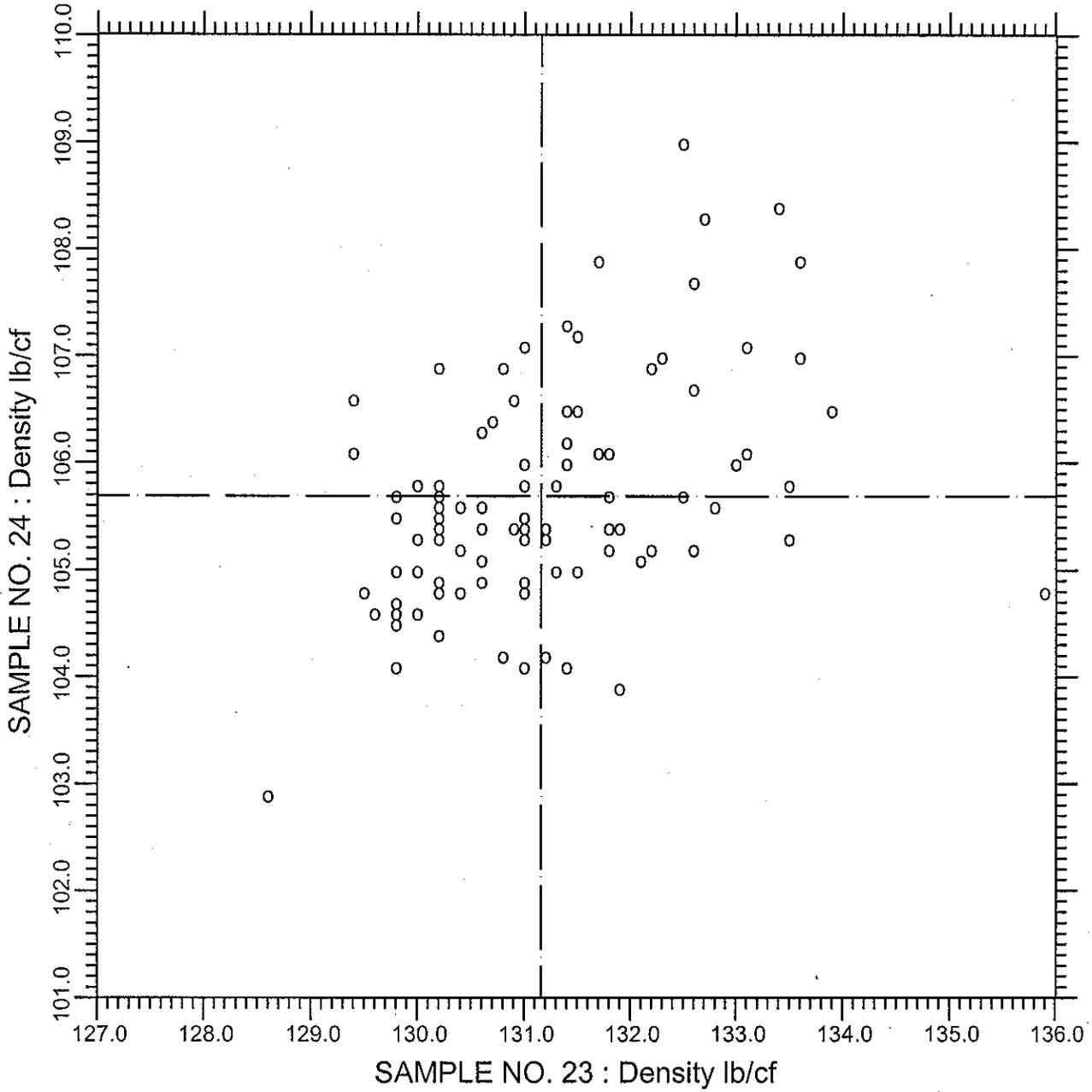
SAMPLE NO. 23 AVE 9.950 S.D. 0.61 C.V. 6.14

SAMPLE NO. 24 AVE 12.968 S.D. 0.56 C.V. 4.32

LABS ELIMINATED 1268 2004 270 1785 2273

LABS OFF DIAGRAM 148

CCRL PROFICIENCY SAMPLE PROGRAM
Density
CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



TEST NO.650

Density

95 POINTS

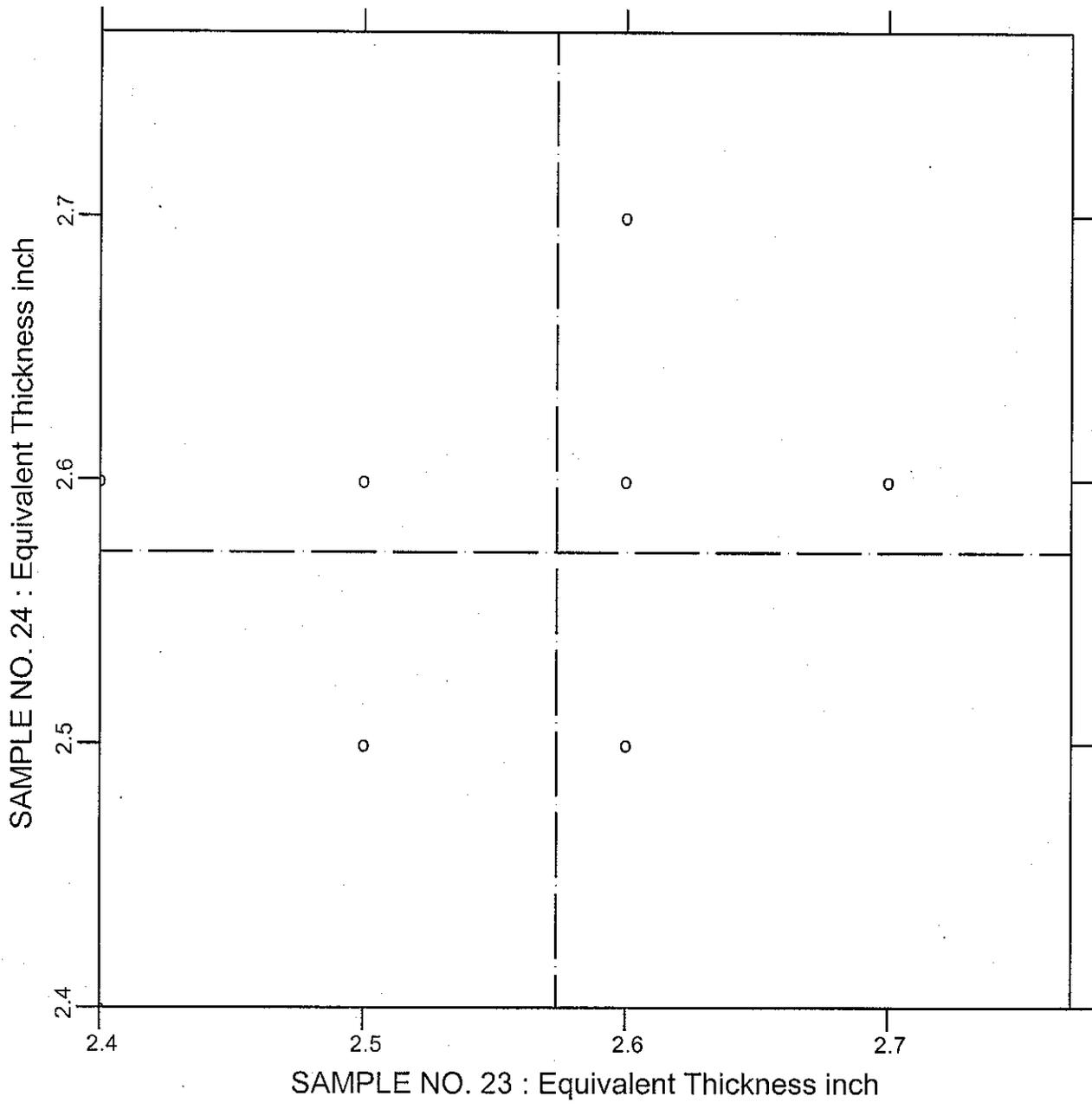
SAMPLE NO. 23 AVE 131.16 S.D. 1.3 C.V. 1.004

SAMPLE NO. 24 AVE 105.69 S.D. 1.0 C.V. 0.996

LABS ELIMINATED 646 1268 1785 2273

LABS OFF DIAGRAM 1151

CCRL PROFICIENCY SAMPLE PROGRAM
 Equivalent Thickness
 CONCRETE MASONRY UNITS SAMPLES NO. 23 & NO. 24



TEST NO.660 Equivalent Thickness 91 POINTS

SAMPLE NO. 23 AVE 2.5736 S.D. 0.055 C.V. 2.15

SAMPLE NO. 24 AVE 2.5725 S.D. 0.052 C.V. 2.01

LABS ELIMINATED 1010 1120 1310 1357 2149 2126 2250 2273