

CEMENT AND CONCRETE REFERENCE LABORATORY
PROFICIENCY SAMPLE PROGRAM

Final Report
Concrete Masonry Units Proficiency Samples
Number 19 and Number 20

November 2005

CEMENT AND CONCRETE REFERENCE LABORATORY

AT THE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
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SPONSORED BY
COMMITTEE C-1 ON CEMENT
COMMITTEE C-9 ON CONCRETE AND
CONCRETE AGGREGATES
AMERICAN SOCIETY FOR TESTING AND MATERIALS

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November 16, 2005

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

Subject: Final Report for Concrete Masonry Units Proficiency Samples No. 19 and No. 20

Following is the report for the current pair of CCRL **Concrete Masonry Units** Proficiency Samples which were distributed in July 2005

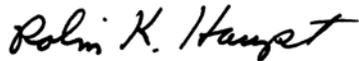
This report consists of a statistical Summary of Results, a set of general Scatter Diagrams, and associated detailed information. The Table of Results with individualized information for laboratory can be downloaded at our website located at: <http://www.ccrl.us/>.

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 2006.

Sincerely,



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. 19 and No. 20

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 2005. 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. 19 and No. 20
Final Report - November 14, 2005

SUMMARY OF RESULTS

			Sample No. 19			Sample No. 20		
Test	#Labs		Average	S.D.	C.V.	Average	S.D.	C.V.
COMPRESSION UNITS								
Received Weight	lb	86	9.3	0.21	2.28	10.9	0.26	2.36
Received Weight	lb	* 84	9.3	0.110	1.180	10.9	0.088	0.807
Max Comp Load	lbf	86	43318	6659.7	15.4	52378	8654.2	16.5
Max Comp Load	lbf	* 82	44311	4982.2	11.2	53496	6947.4	13.0
Comp Strength	psi	86	2210	613.9	27.8	2697	780.8	29.0
Comp Strength	psi	* 85	2157	370.8	17.2	26321.6	498.1	18.9
ABSORPTION UNITS								
Received Weight	lb	88	9.3	0.26	2.80	10.9	0.19	1.79
Received Weight	lb	* 86	9.3	0.103	1.112	10.9	0.080	0.731
Width	inch	88	3.6	0.43	11.8	3.6	0.43	11.8
Width	inch	* 86	3.6	0.000	0.0	3.6	0.011	0.3
Height	inch	88	7.6	0.051	0.668	7.6	0.045	0.592
Height	inch	* 87	7.6	0.029	0.383	7.6	0.015	0.198
Length	inch	88	7.5	0.43	5.67	7.5	0.43	5.67
Length	inch	* 87	7.6	0.044	0.580	7.6	0.045	0.596
Face Thickness	inch	88	1.09	0.082	7.60	1.08	0.081	7.50
Face Thick ness	inch	* 87	1.09	0.077	7.06	1.09	0.076	6.96

CONTINUED ON NEXT PAGE

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

COMPRESSION UNITS

Received Weight 22 1589
Max. Compressive Load 825 1627 537 2258
Compressive Strength 1279

ABSORPTION UNITS

Received Weight 22 1589
Width 271 1357
Height 1357
Length 271
Min. Face Shell Thickness 1357

CCRL PROFICIENCY SAMPLE PROGRAM
Concrete Masonry Units Proficiency Samples No. 19 and No. 20
Final Report - November 14, 2005

SUMMARY OF RESULTS

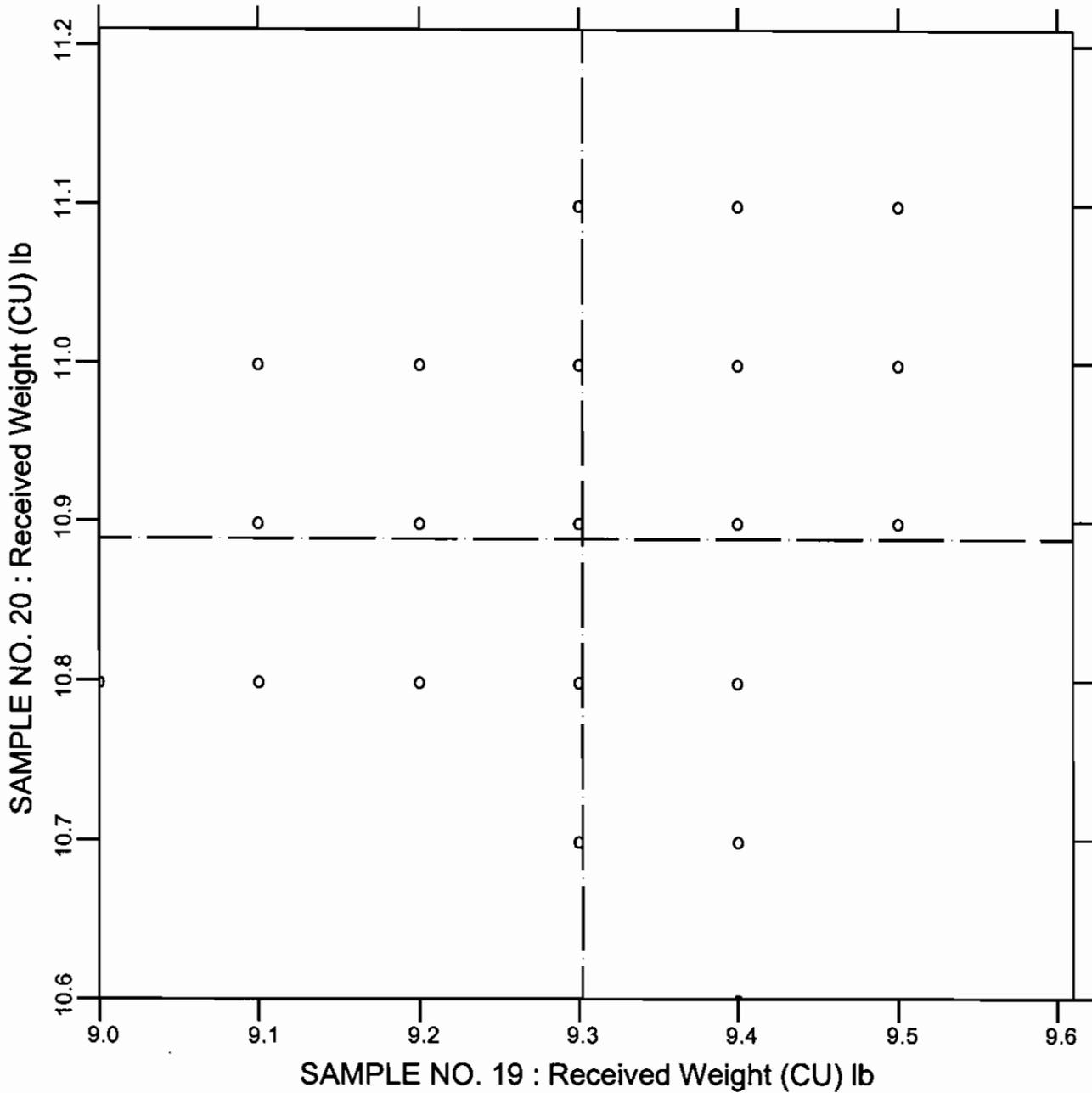
Test		#Labs	Sample No. 19			Sample No. 20		
			Average	S.D.	C.V.	Average	S.D.	C.V.
ABSORPTION UNITS - CONTINUED								
Web Thick ness	inch	87	1.1	0.10	9.78	1.1	0.10	9.74
Web Thick ness	inch	* 85	1.1	0.087	8.06	1.1	0.091	8.47
Immersed Weight	lb	88	4.84	0.30	6.10	6.26	0.34	5.41
Immersed Weight	lb	* 83	4.84	0.068	1.40	6.31	0.063	1.00
Saturated Weight	lb	88	10.2	0.22	2.12	11.6	0.21	1.83
Saturated Weigh	lb	* 85	10.2	0.099	0.967	11.7	0.082	0.703
Oven-dry Weight	lb	88	9.0	0.21	2.34	10.6	0.20	1.93
Oven-dry Weight	lb	* 87	8.9	0.095	1.061	10.7	0.082	0.765
Net Area	ft ³	88	20.6	4.4	21.3	20.4	4.5	21.8
Net Area	ft ³	* 79	19.7	0.33	1.68	19.5	0.33	1.71
Absorption	lb/ ft ³	87	14.6	1.0	7.08	11.6	1.0	8.91
Absorption	lb/ ft ³	* 83	14.6	0.76	5.22	11.5	0.74	6.39
Density	lb/ ft ³	88	104.0	4.3	4.17	124.1	6.2	4.96
Density	lb/ ft ³	* 83	104.0	1.4	1.31	124.6	1.7	1.36
Equivalent Thick	inch	88	2.79	0.98	35.0	2.77	0.98	35.5
Equivalent Thick	inch	* 76	2.58	0.038	1.48	2.57	0.041	1.61

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

ABSORPTION UNITS - CONTINUED

Min. Web Thickness 1357 2004
Immersed Weight 1589 951 1268 1367 3003
Saturated Weight 1010 1589 2112
Oven-dry Weight 1589
Net Area 40 451 1093 1279 2042 22 1268 1982 3003
Absorption 10 951 1589 3003
Density 1268 1589 1982 1367 3003
Equivalent Thickness 271 507 1627 1110 2250 22 951 1268 1357 1982 40 3003

CCRL PROFICIENCY SAMPLE PROGRAM
 Received Weight - Compression Units
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.500

Received Weight (CU)

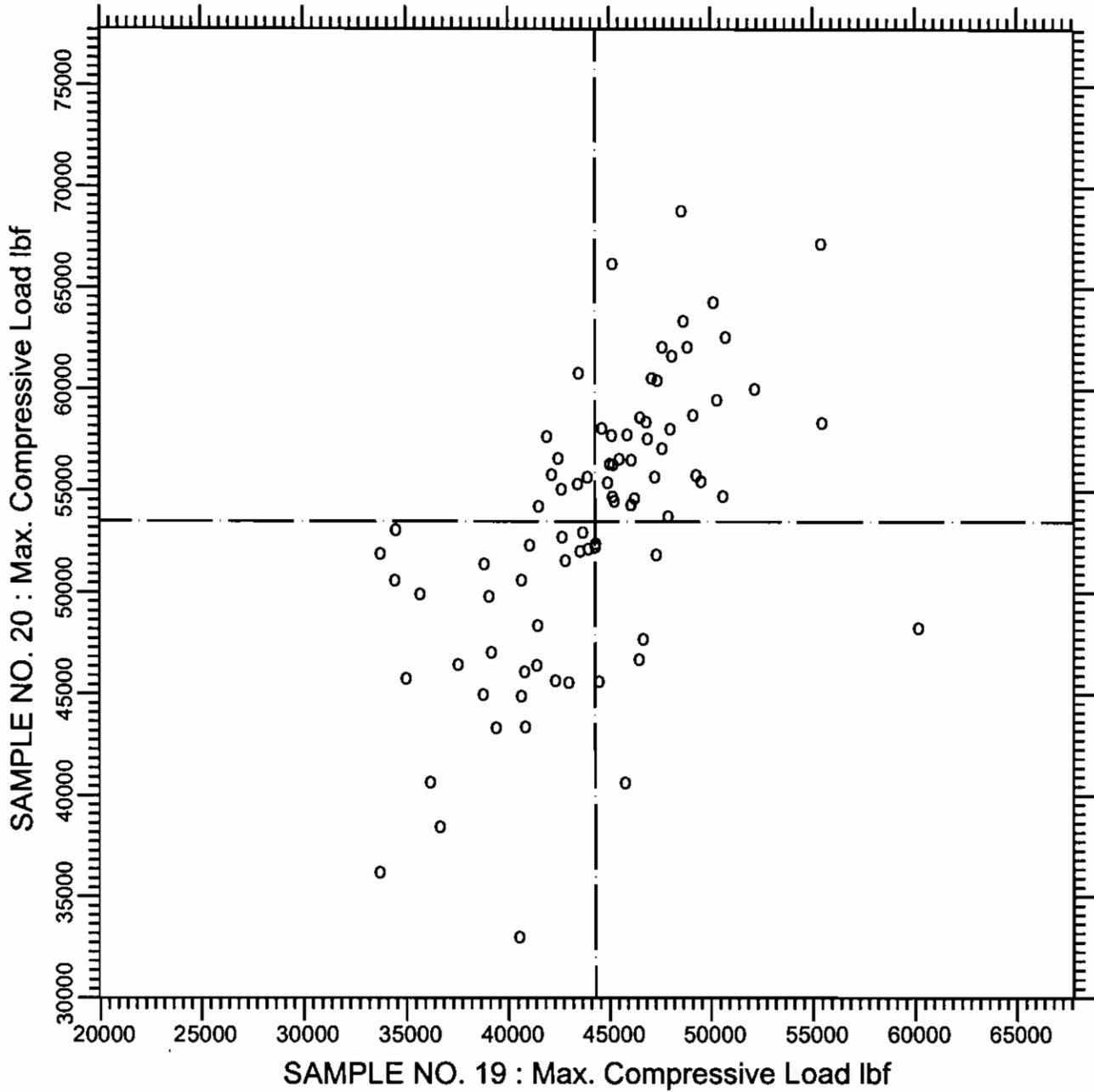
84 POINTS

SAMPLE NO. 19 AVE 9.3024 S.D. 0.110 C.V. 1.180

SAMPLE NO. 20 AVE 10.8893 S.D. 0.088 C.V. 0.807

LABS ELIMINATED 22 1589

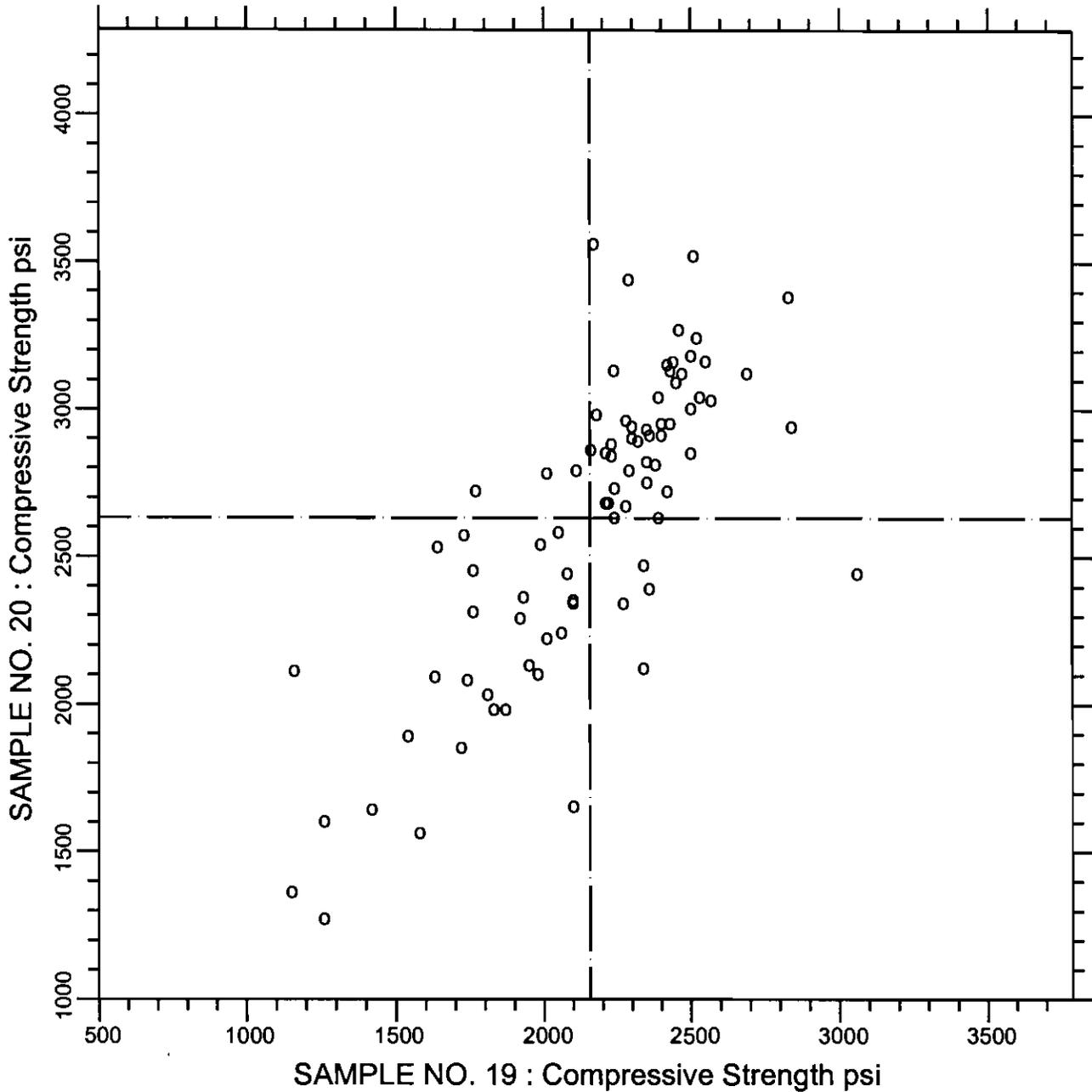
CCRL PROFICIENCY SAMPLE PROGRAM
Maximum Compressive Load
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.550 Max. Compressive Load 82 POINTS

SAMPLE NO. 19	AVE	44311.2	S.D.	4982.2	C.V.	11.2
SAMPLE NO. 20	AVE	53495.6	S.D.	6947.4	C.V.	13.0
LABS ELIMINATED 825 1627 537 2258						

CCRL PROFICIENCY SAMPLE PROGRAM
Net Area Compressive Strength
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.560

Compressive Strength

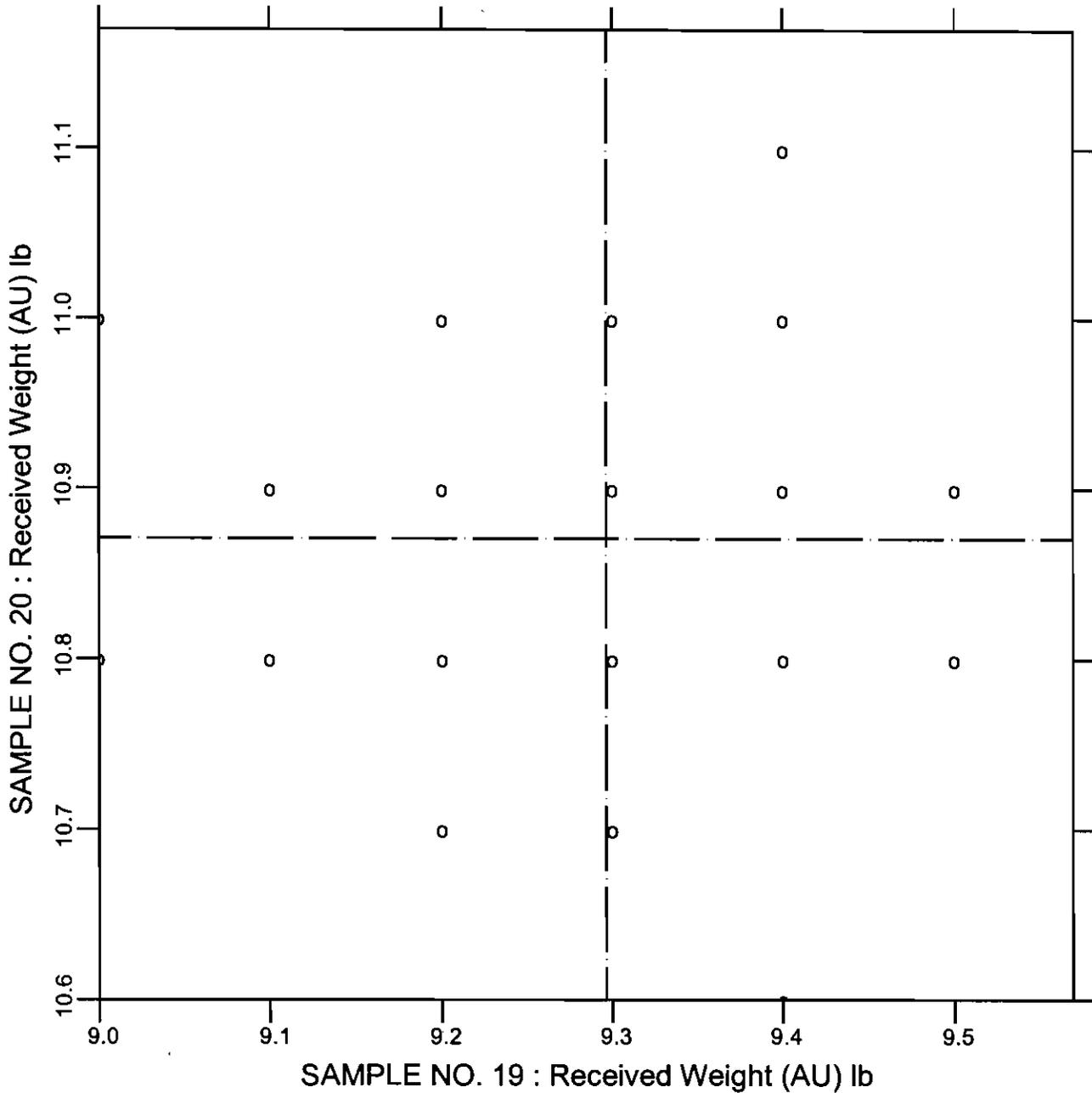
85 POINTS

SAMPLE NO. 19 AVE 2157.2 S.D. 370.8 C.V. 17.2

SAMPLE NO. 20 AVE 2631.6 S.D. 498.1 C.V. 18.9

LABS ELIMINATED 1279

CCRL PROFICIENCY SAMPLE PROGRAM
Received Weight - Absorption Units
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



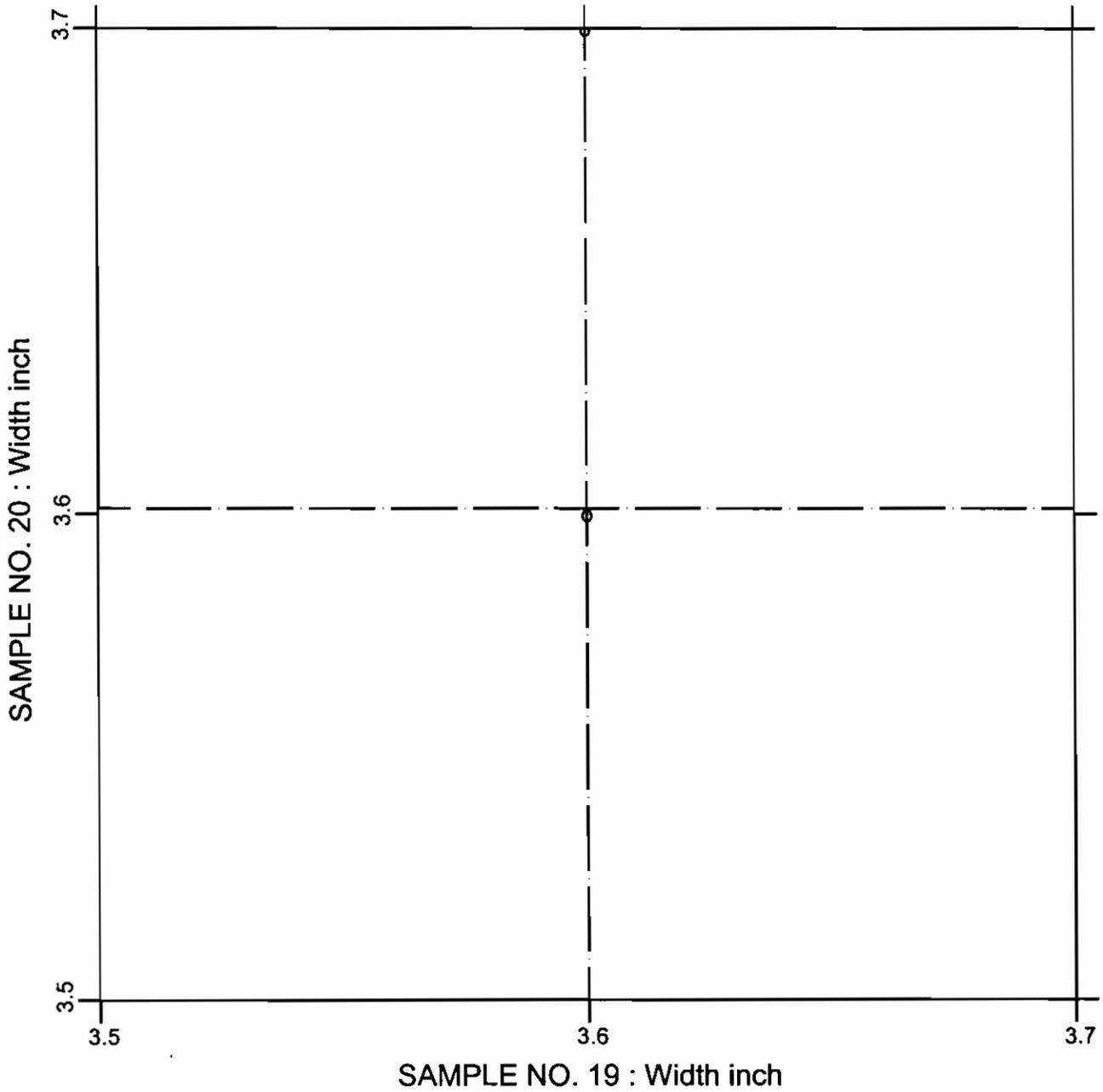
TEST NO.600 Received Weight (AU) 86 POINTS

SAMPLE NO. 19 AVE 9.2965 S.D. 0.103 C.V. 1.112

SAMPLE NO. 20 AVE 10.8709 S.D. 0.080 C.V. 0.731

LABS ELIMINATED 22 1589

CCRL PROFICIENCY SAMPLE PROGRAM
Width
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



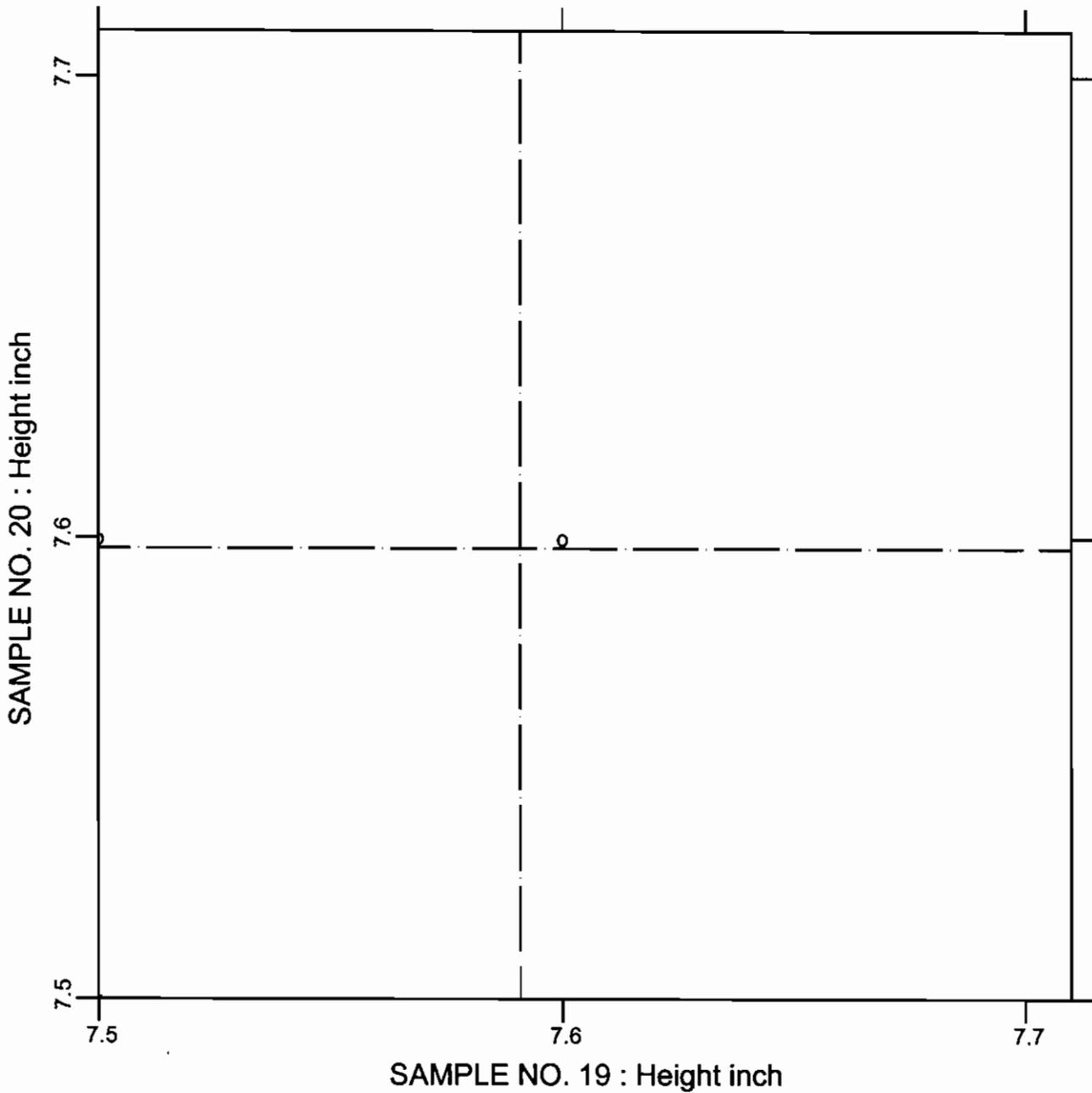
TEST NO.510

Width

86 POINTS

SAMPLE NO. 19	AVE	3.600000	S.D.	0.000000	C.V.	0.000003
SAMPLE NO. 20	AVE	3.601163	S.D.	0.010783	C.V.	0.299439
LABS ELIMINATED 271 1357						

CCRL PROFICIENCY SAMPLE PROGRAM
Height
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.520

Height

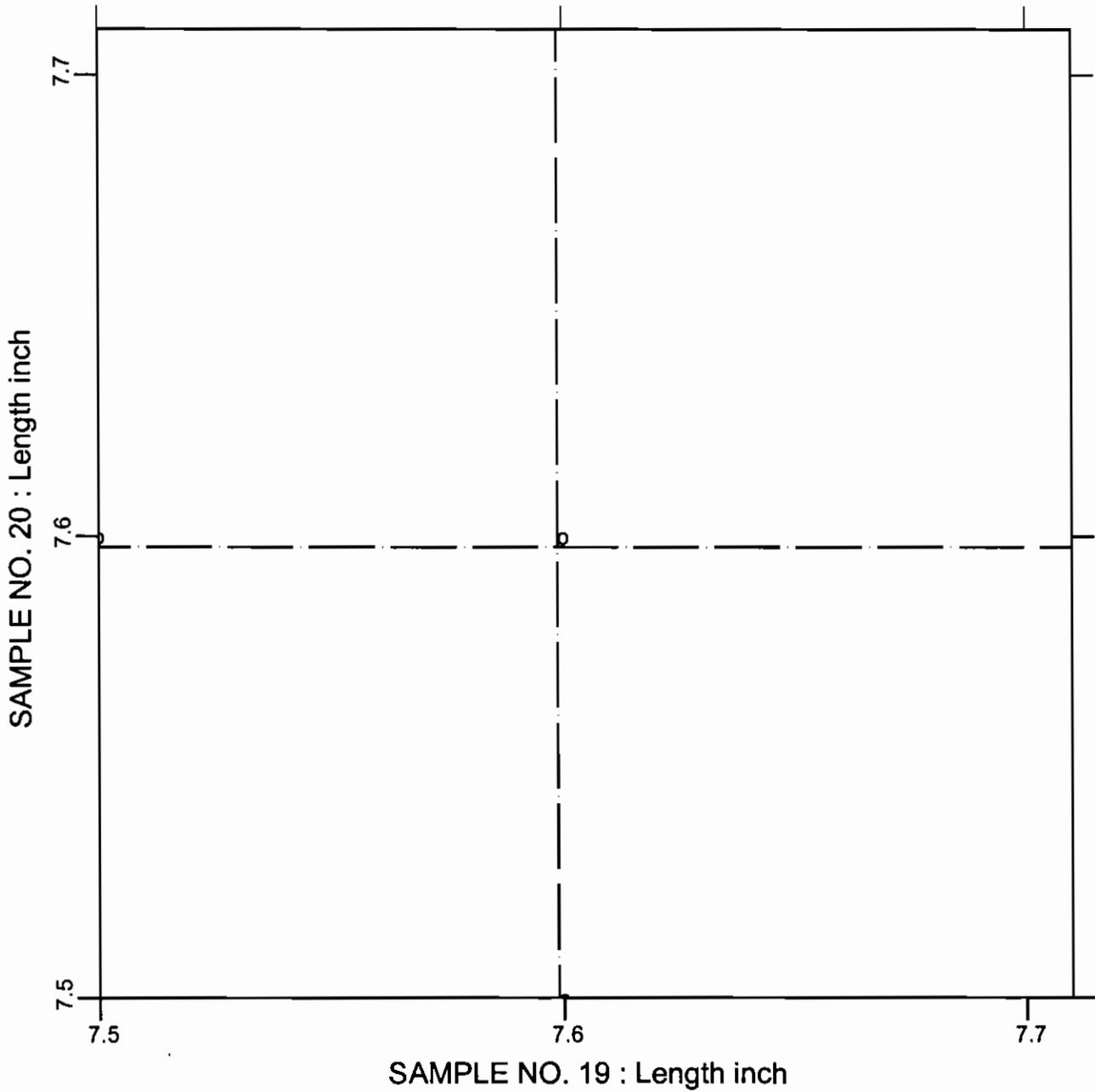
87 POINTS

SAMPLE NO. 19 AVE 7.5908 S.D. 0.029 C.V. 0.383

SAMPLE NO. 20 AVE 7.5977 S.D. 0.015 C.V. 0.198

LABS ELIMINATED 1357

CCRL PROFICIENCY SAMPLE PROGRAM
Length
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.530

Length

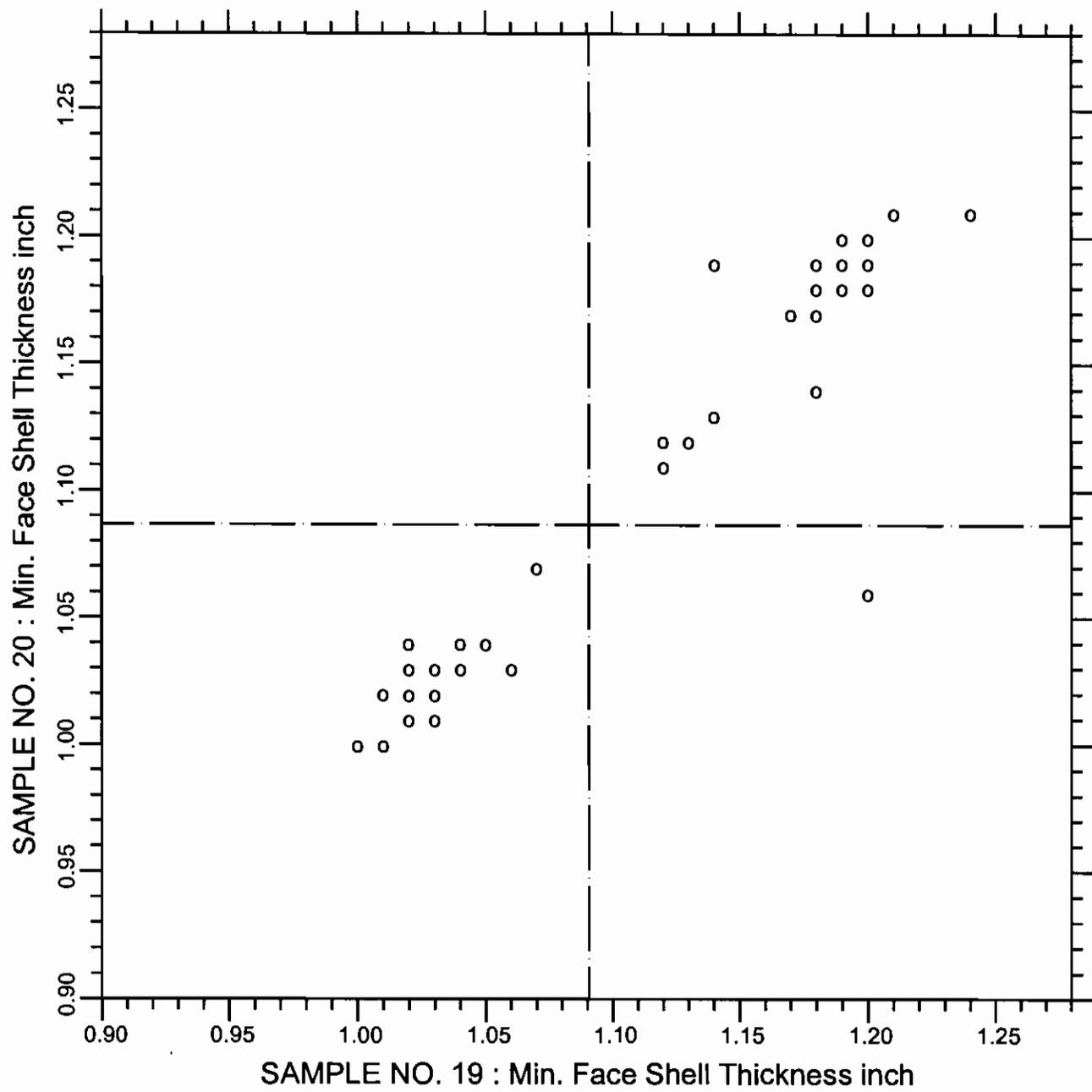
86 POINTS

SAMPLE NO. 19 AVE 7.5988 S.D. 0.011 C.V. 0.142

SAMPLE NO. 20 AVE 7.5977 S.D. 0.015 C.V. 0.200

LABS ELIMINATED 271 1357

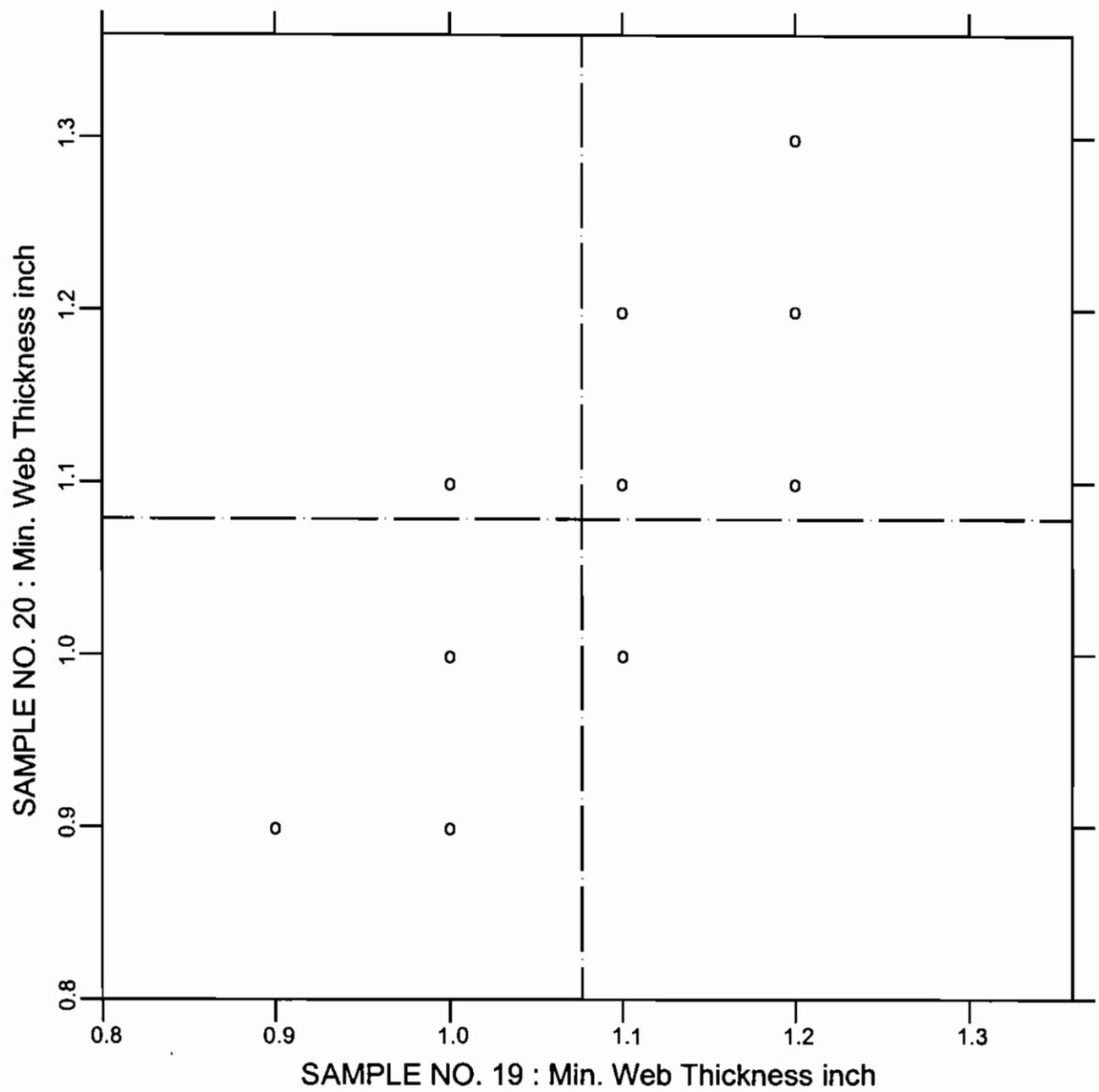
CCRL PROFICIENCY SAMPLE PROGRAM
Minimum Face Shell Thickness
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.532 Min. Face Shell Thickness 87 POINTS

SAMPLE NO. 19	AVE	1.0907	S.D.	0.077	C.V.	7.06
SAMPLE NO. 20	AVE	1.0867	S.D.	0.076	C.V.	6.96
LABS ELIMINATED 1357						

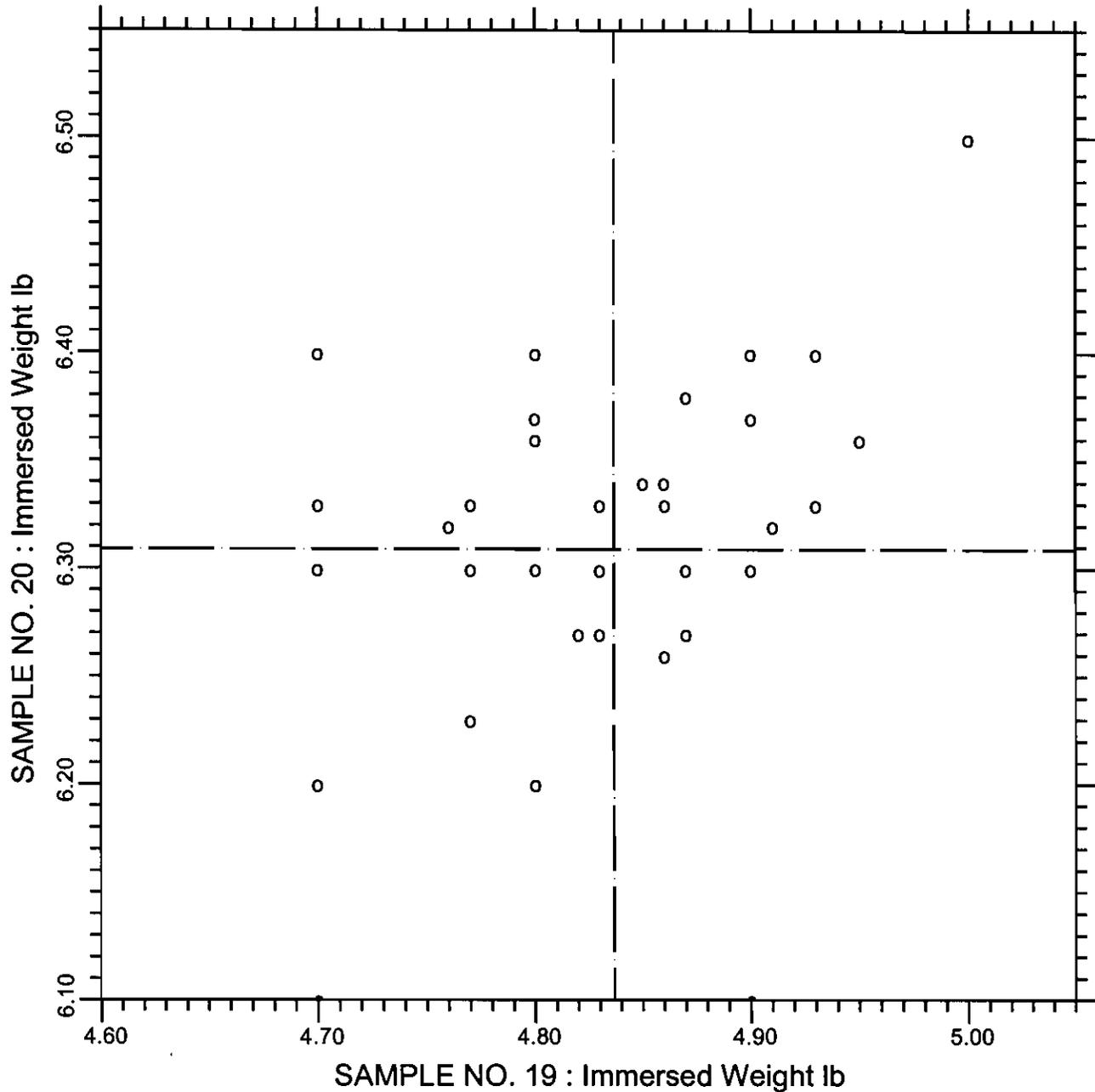
CCRL PROFICIENCY SAMPLE PROGRAM
Minimum Web Thickness
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.533 Min. Web Thickness 85 POINTS

SAMPLE NO. 19 AVE 1.0765 S.D. 0.087 C.V. 8.06
 SAMPLE NO. 20 AVE 1.0788 S.D. 0.091 C.V. 8.47
 LABS ELIMINATED 1357 2004

CCRL PROFICIENCY SAMPLE PROGRAM
Immersed Weight
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.610

Immersed Weight

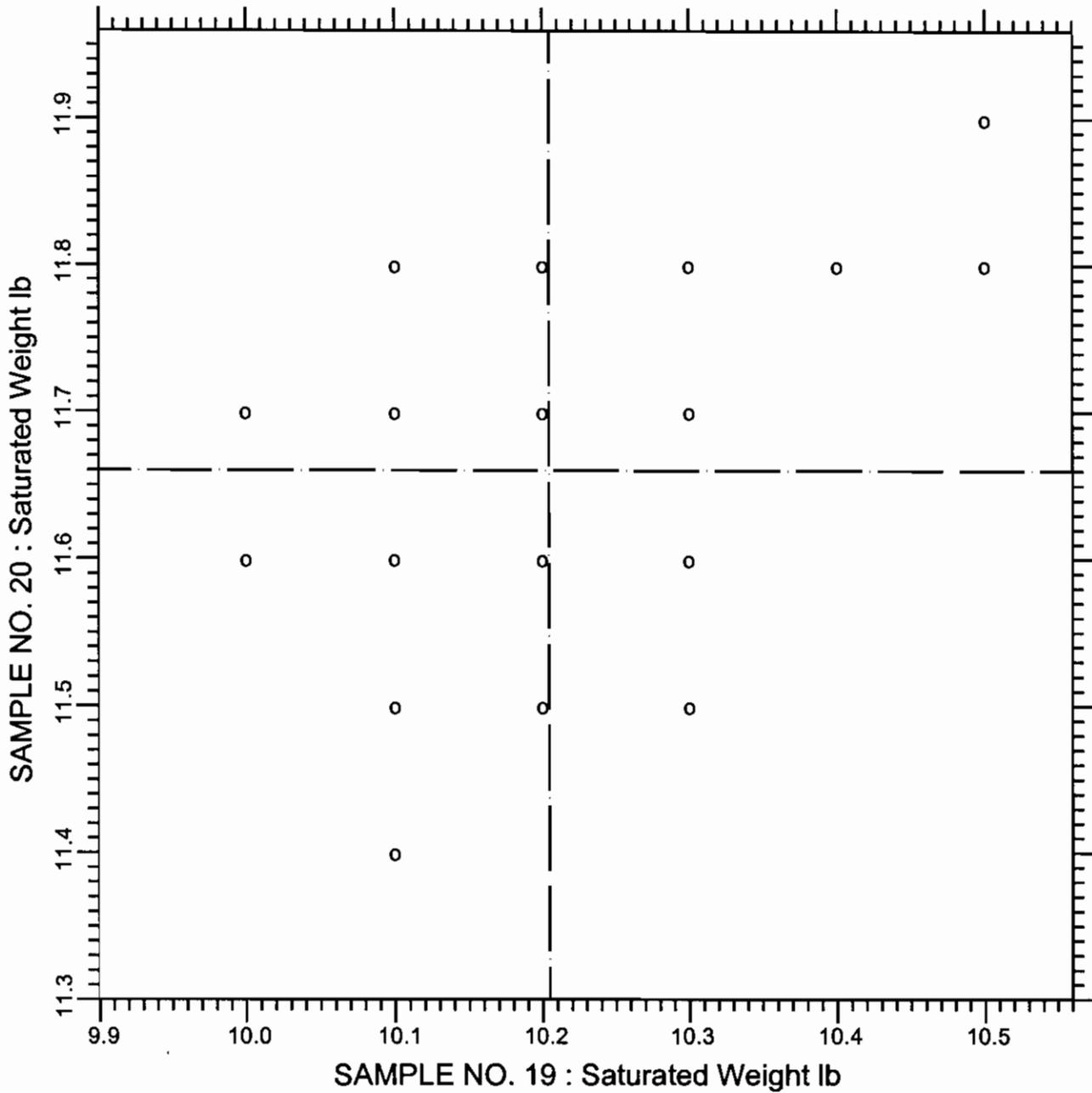
83 POINTS

SAMPLE NO. 19 AVE 4.8366 S.D. 0.068 C.V. 1.40

SAMPLE NO. 20 AVE 6.3090 S.D. 0.063 C.V. 1.00

LABS ELIMINATED 1589 951 1268 1367 3003

CCRL PROFICIENCY SAMPLE PROGRAM
Saturated Weight
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.620

Saturated Weight

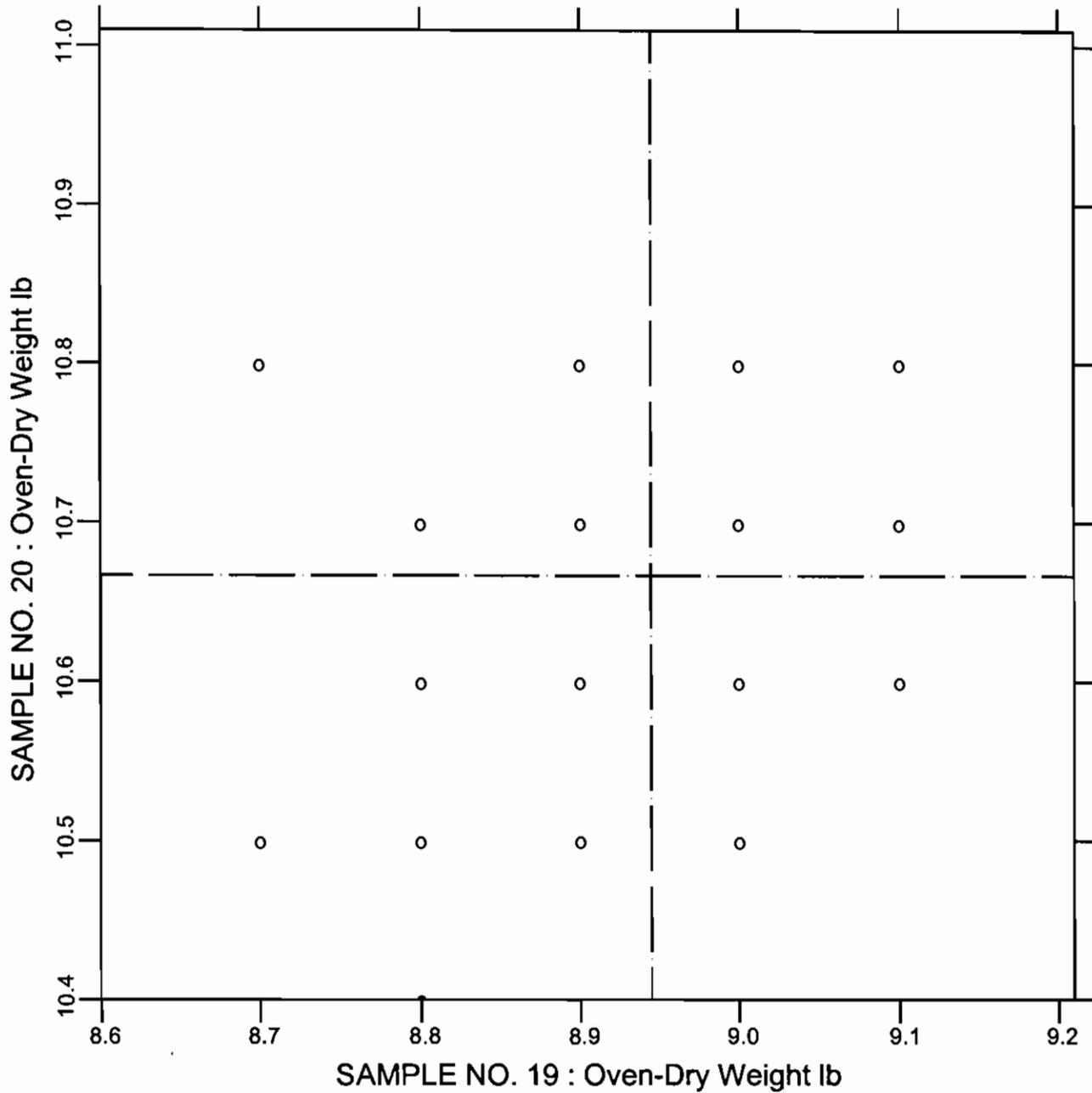
85 POINTS

SAMPLE NO. 19 AVE 10.2047 S.D. 0.099 C.V. 0.967

SAMPLE NO. 20 AVE 11.6600 S.D. 0.082 C.V. 0.703

LABS ELIMINATED 1010 1589 2112

CCRL PROFICIENCY SAMPLE PROGRAM
Oven-Dry Weight
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.630

Oven-Dry Weight

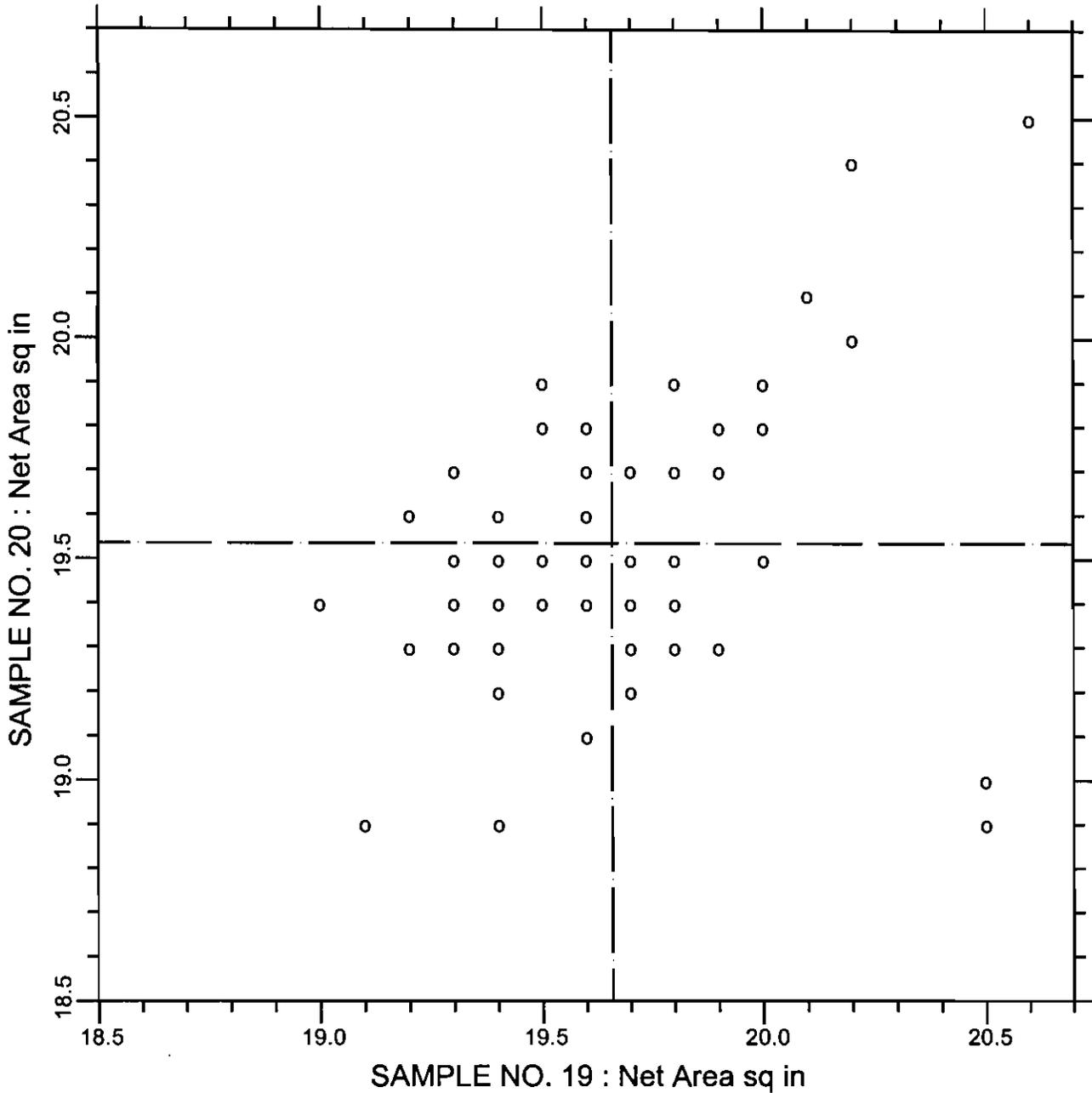
87 POINTS

SAMPLE NO. 19 AVE 8.9448 S.D. 0.095 C.V. 1.061

SAMPLE NO. 20 AVE 10.6667 S.D. 0.082 C.V. 0.765

LABS ELIMINATED 1589

CCRL PROFICIENCY SAMPLE PROGRAM
Net Area
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.635

Net Area

78 POINTS

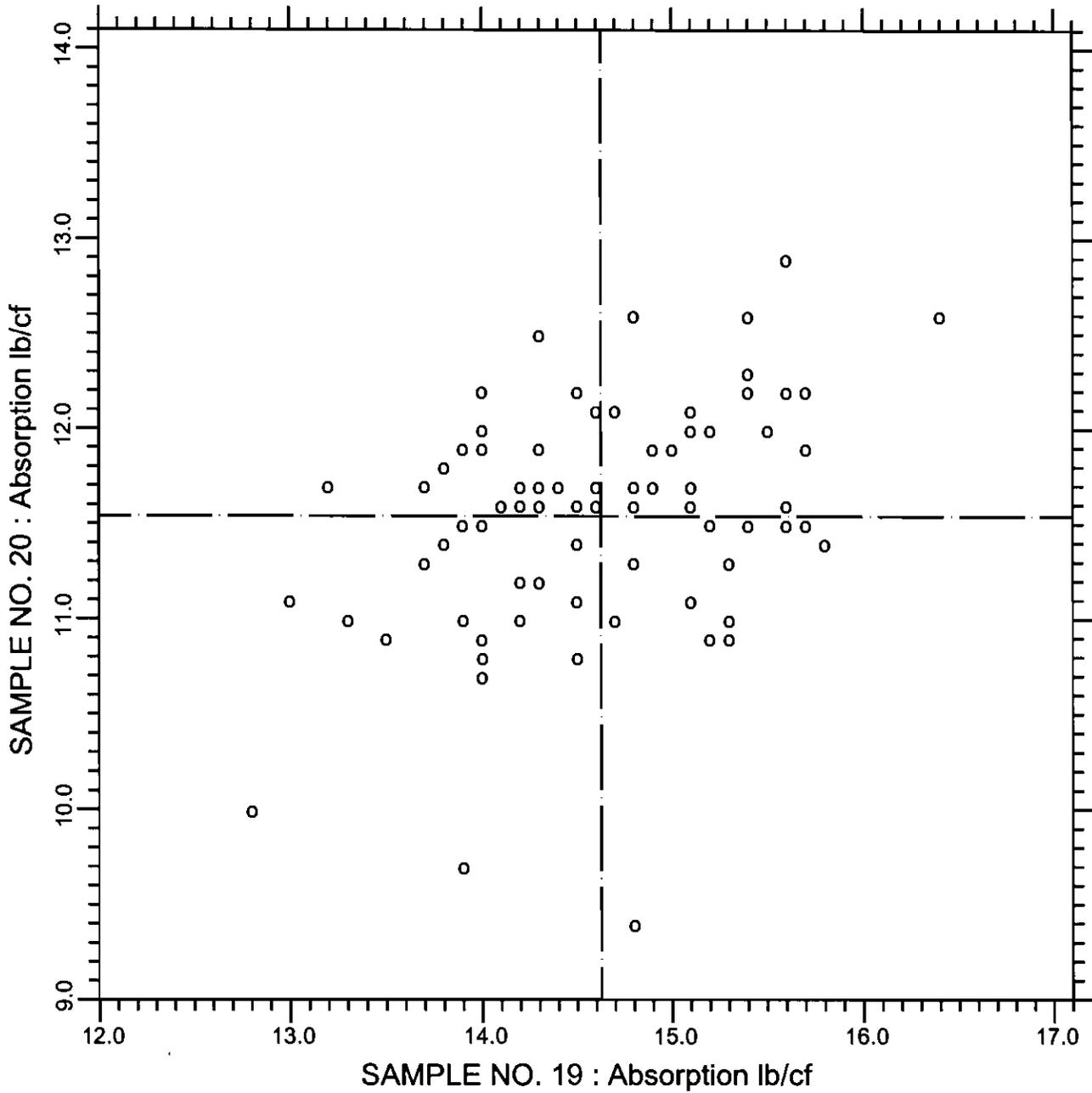
SAMPLE NO. 19 AVE 19.658 S.D. 0.33 C.V. 1.68

SAMPLE NO. 20 AVE 19.535 S.D. 0.33 C.V. 1.71

LABS ELIMINATED 40 451 1093 1279 2042 22 1268 1982 3003

LABS OFF DIAGRAM 2079

CCRL PROFICIENCY SAMPLE PROGRAM
Absorption
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.640

Absorption

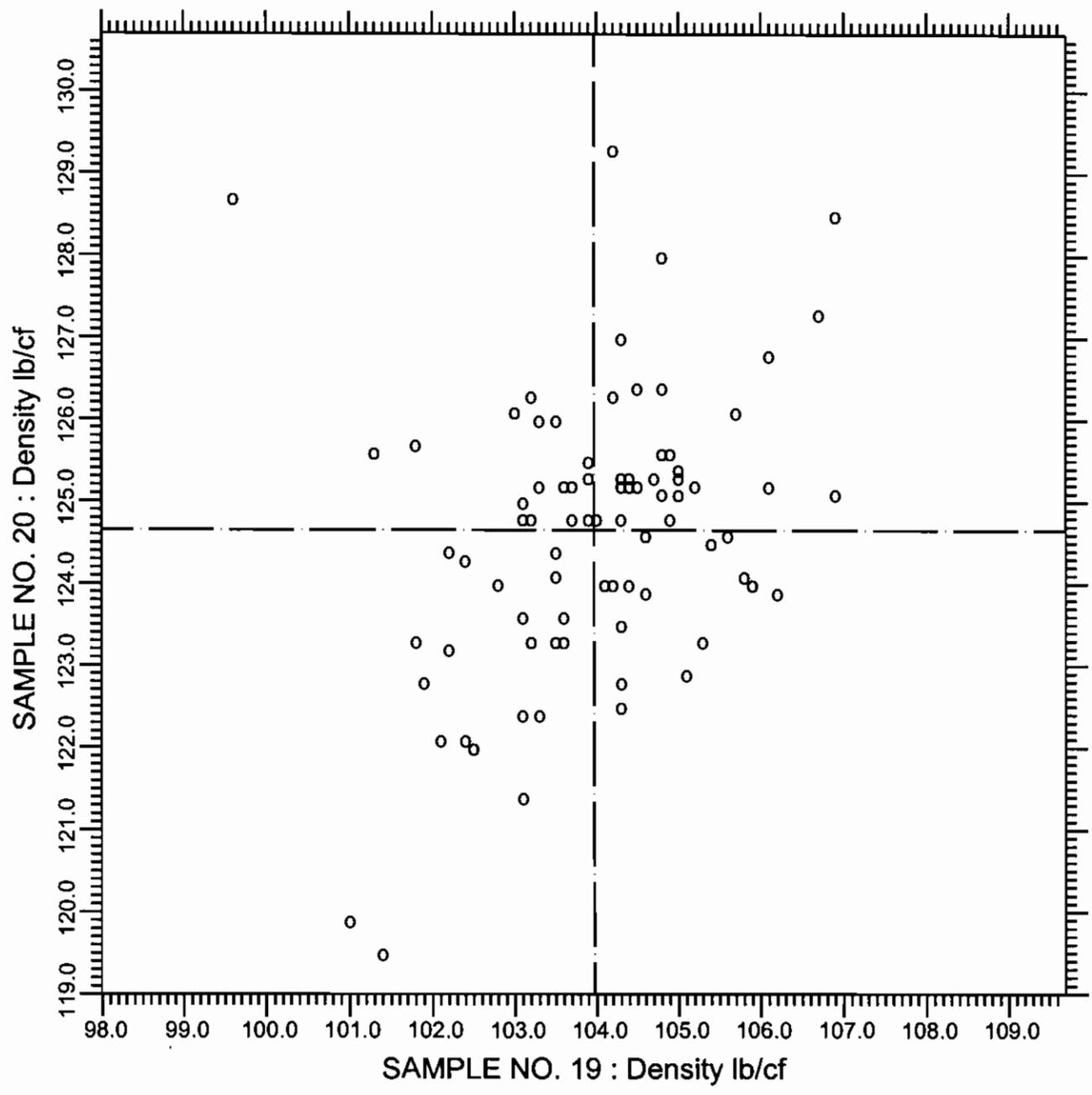
81 POINTS

SAMPLE NO. 19 AVE 14.627 S.D. 0.72 C.V. 4.92

SAMPLE NO. 20 AVE 11.541 S.D. 0.61 C.V. 5.26

LABS ELIMINATED 10 951 1589 270 1982 3003

CCRL PROFICIENCY SAMPLE PROGRAM
Density
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



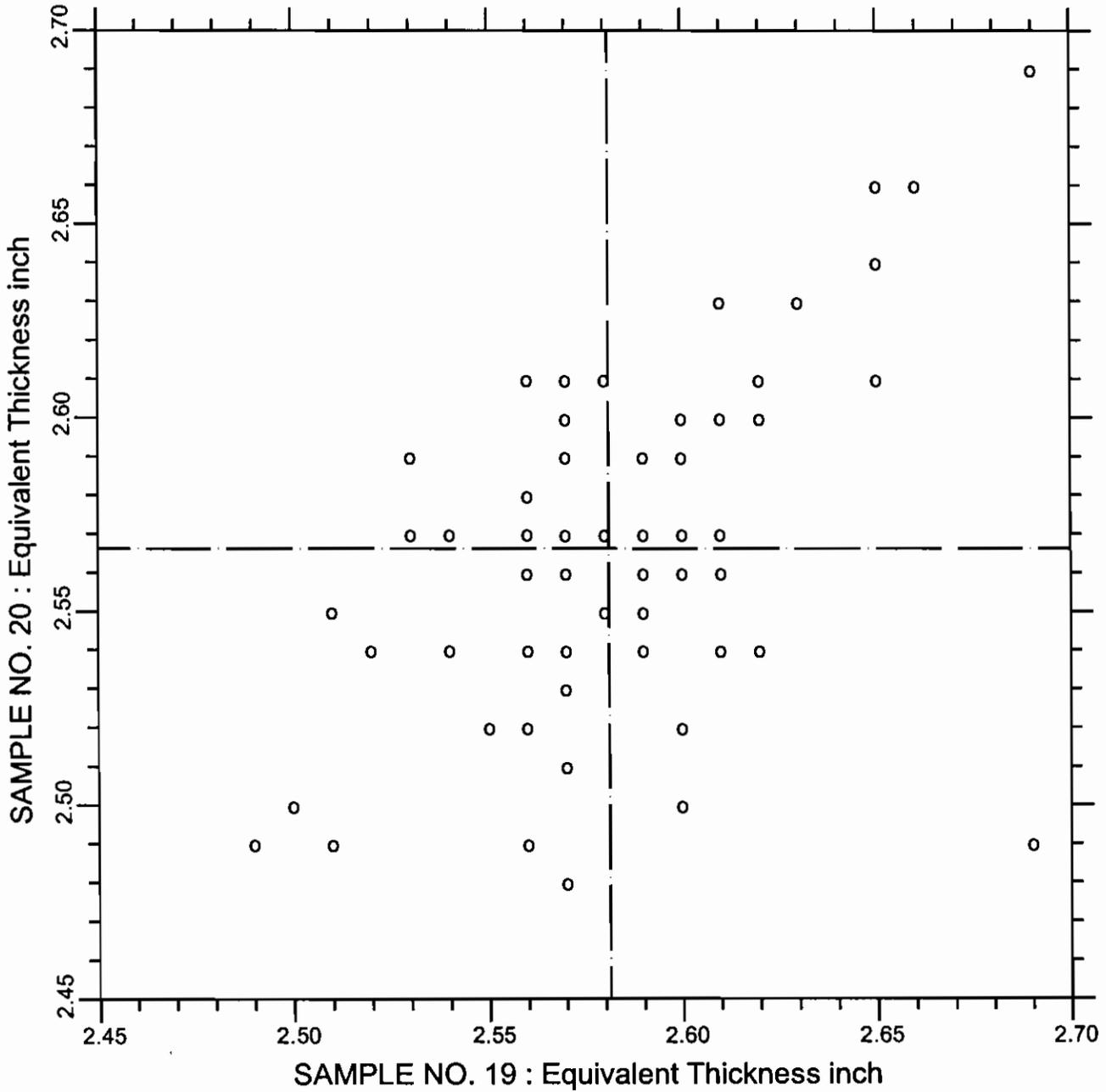
TEST NO.650

Density

83 POINTS

SAMPLE NO. 19 AVE 103.97 S.D. 1.4 C.V. 1.31
 SAMPLE NO. 20 AVE 124.65 S.D. 1.7 C.V. 1.36
 LABS ELIMINATED 1268 1589 1982 1367 3003

CCRL PROFICIENCY SAMPLE PROGRAM
Equivalent Thickness
CONCRETE MASONRY UNITS SAMPLES NO. 19 & NO. 20



TEST NO.660 Equivalent Thickness 76 POINTS

SAMPLE NO. 19 AVE 2.5812 S.D. 0.038 C.V. 1.48
 SAMPLE NO. 20 AVE 2.5662 S.D. 0.041 C.V. 1.61
 LABS ELIMINATED 271 507 1627 1110 2250 22 951 1268 1357 1982 40
 3003