

CEMENT AND CONCRETE REFERENCE LABORATORY
PROFICIENCY SAMPLE PROGRAM

Final Report
Concrete Masonry Units Proficiency Samples
Number 17 and Number 18

November 2004

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 8, 2004

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

Subject: Final Report for Concrete Masonry Units Proficiency Samples No. 17 and No. 18

Following is the report for the current pair of CCRL **Concrete Masonry Units** Proficiency Samples which were distributed in July 2004.

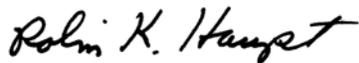
This report consists of a statistical Summary of Results, a set of general Scatter Diagrams, and associated detailed information. The Table of Results with individualized information for laboratory can be downloaded at our website located at: <http://www.ccrl.us/psp/pspdata.htm>.

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 use.

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 2005

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. 17 and No. 18

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 2004. 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. 17 and No. 18
Final Report - November 8, 2004

SUMMARY OF RESULTS

Test	#Labs	Sample No. 17			Sample No. 18			
		Average	S.D.	C.V.	Average	S.D.	C.V.	
COMPRESSION UNITS								
Received Weight	lb	71	11.30	0.28	2.52	10.21	0.25	2.45
Received Weight	lb	* 70	11.31	0.27	2.35	10.19	0.19	1.88
Max Comp Load	lbf	72	45673	8359.2	18.3	31636	5613.2	17.7
Max Comp Load	lbf	* 71	45733	8403.1	18.4	31990	4770.9	14.9
Comp Strength	psi	72	2218	438.1	19.8	1574	240.5	15.3
ABSORPTION UNITS								
Received Weight	lb	71	11.36	0.29	2.56	10.12	0.24	2.34
Received Weight	lb	* 70	11.37	0.26	2.32	10.10	0.16	1.59
Width	inch	71	2.75	0.021	0.769	2.74	0.021	0.756
Width	inch	* 69	2.75	0.018	0.637	2.74	0.017	0.612
Height	inch	71	7.63	0.028	0.368	7.63	0.024	0.309
Height	inch	* 70	7.63	0.025	0.329	7.62	0.021	0.272
Length	inch	71	7.63	0.031	0.402	7.63	0.028	0.375
Length	inch	* 69	7.63	0.027	0.357	7.63	0.023	0.304

CONTINUED ON NEXT PAGE

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

COMPRESSION UNITS

Received Weight (CU) 537

Max Compressive Load 537

ABSORPTION UNITS

Received Weight (AU) 537

Width 280 1223

Height 951

Length 20 926

CCRL PROFICIENCY SAMPLE PROGRAM
Concrete Masonry Units Proficiency Samples No. 17 and No. 18
Final Report - November 8, 2004

SUMMARY OF RESULTS

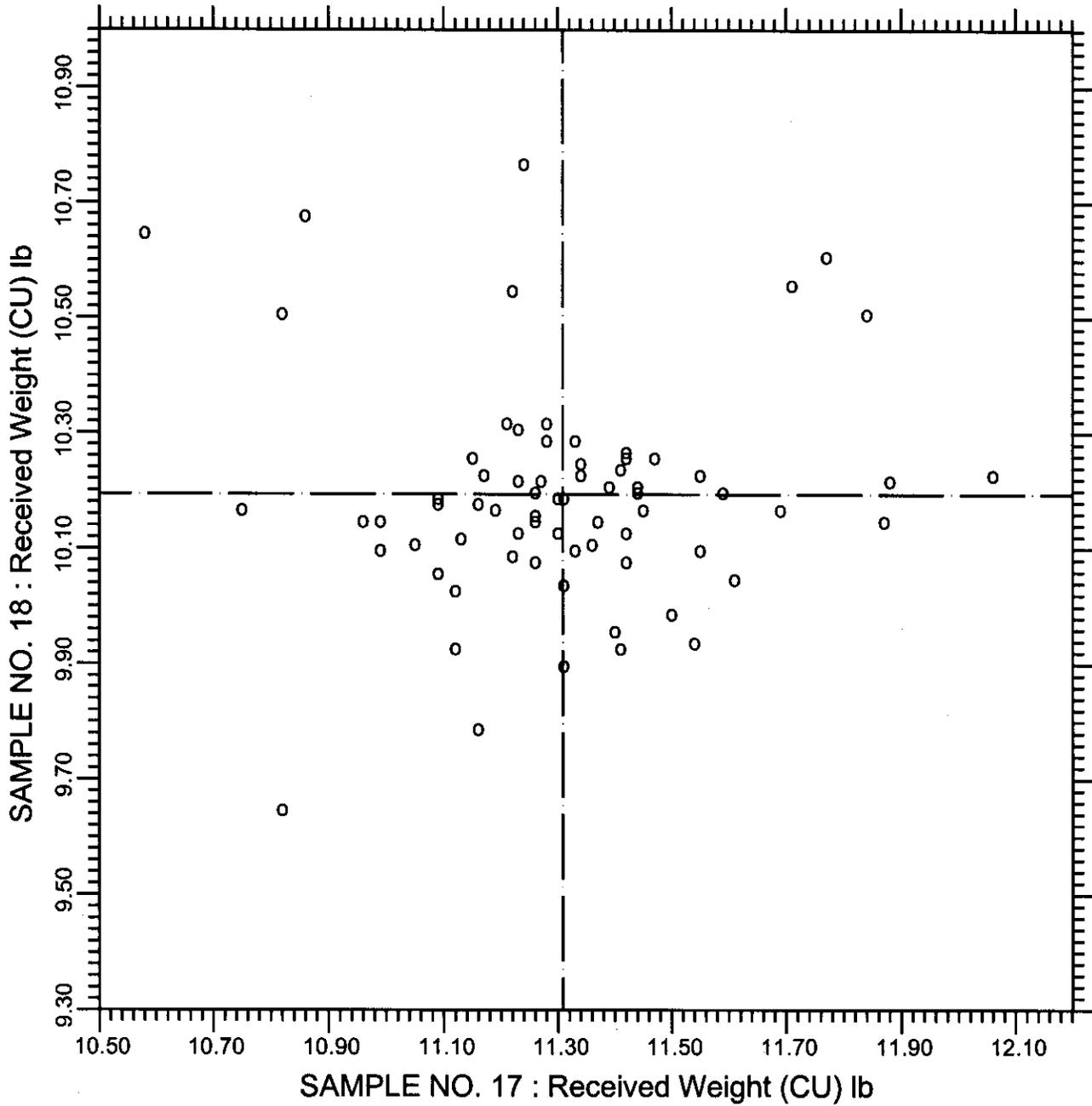
Test	Sample No. 17					Sample No. 18		
	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.	
ABSORPTION UNITS (continued)								
Immersed Weight	lb	71	6.65	0.28	4.26	5.51	0.26	4.65
Immersed Weight	lb	* 70	6.66	0.26	3.84	5.49	0.20	3.73
Saturated Weight	lb	71	12.16	0.29	2.36	11.01	0.27	2.44
Saturated Weight	lb	* 69	12.17	0.27	2.24	11.00	0.15	1.39
Oven-Dry Weight	lb	71	11.13	0.30	2.75	9.81	0.26	2.63
Oven-Dry Weight	lb	* 70	11.14	0.27	2.46	9.79	0.18	1.82
Net Area	ft ³	70	21.73	8.8	40.6	21.74	9.3	42.8
Net Area	ft ³	* 68	20.43	0.60	2.92	20.37	0.64	3.12
Absorption	lb/ft ³	70	11.6	1.3	10.9	13.7	1.4	10.5
Absorption	lb/ft ³	* 68	11.8	0.99	8.36	13.9	0.90	6.44
Density	lb/ft ³	70	126.2	4.4	3.48	111.6	4.7	4.22
Density	lb/ft ³	* 66	126.0	3.4	2.73	110.8	3.3	2.98

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

ABSORPTION UNITS

Immersed Weight	537
Saturated Weight	537 1311
Oven-Dry Weight	537
Net Volume	537 869
Absorption	270 1279
Density	270 537 1279 1589

CCRL PROFICIENCY SAMPLE PROGRAM
 Received Weight - Compression Units
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



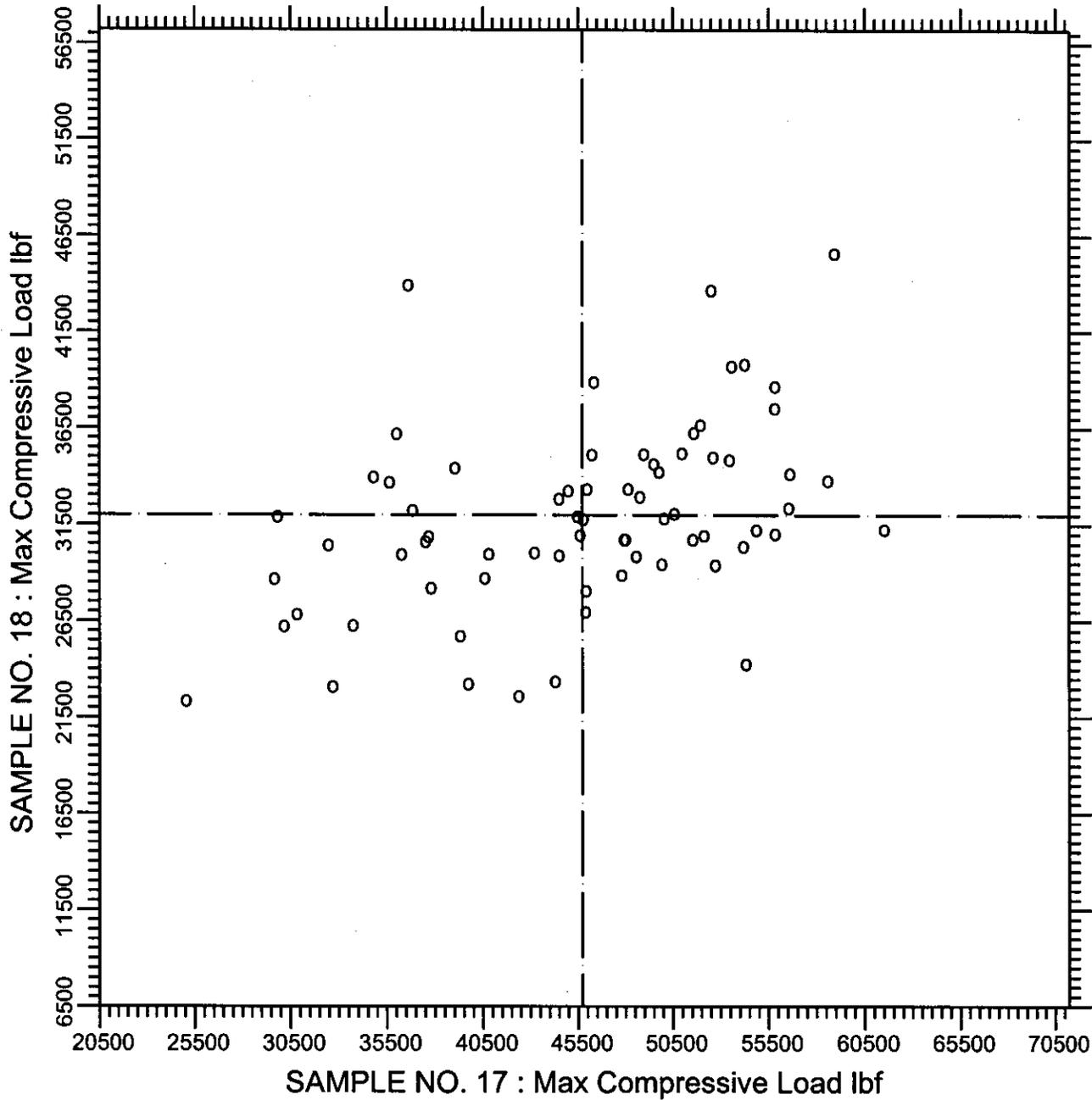
TEST NO.500 Received Weight (CU) 70 POINTS

SAMPLE NO. 17 AVE 11.308 S.D. 0.27 C.V. 2.35

SAMPLE NO. 18 AVE 10.194 S.D. 0.19 C.V. 1.88

LABS ELIMINATED 537

CCRL PROFICIENCY SAMPLE PROGRAM
Maximum Compressive Load
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



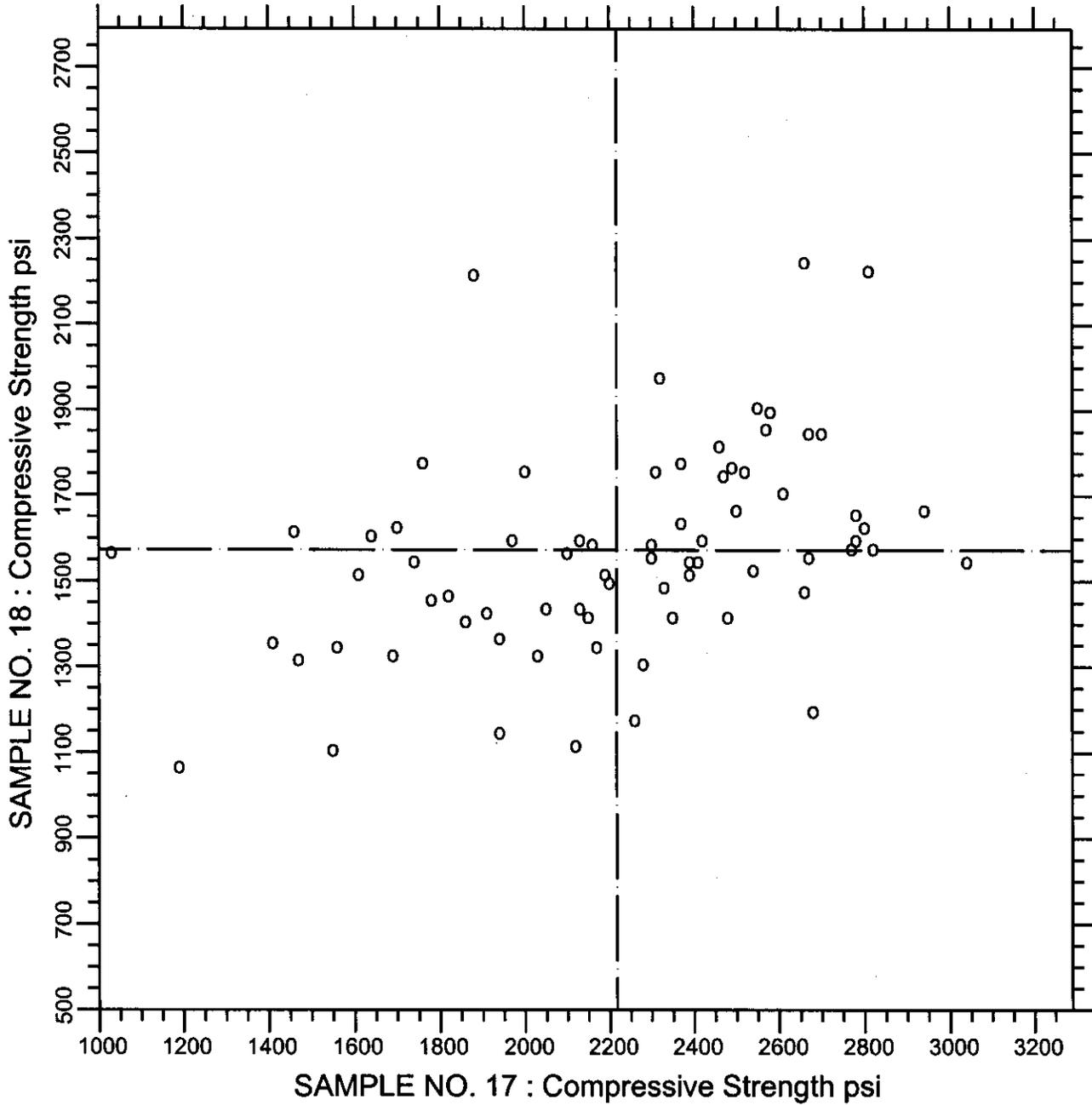
TEST NO.550 Max Compressive Load 71 POINTS

SAMPLE NO. 17 AVE 45733.1 S.D. 8403.1 C.V. 18.4

SAMPLE NO. 18 AVE 31990.4 S.D. 4770.9 C.V. 14.9

LABS ELIMINATED 537

CCRL PROFICIENCY SAMPLE PROGRAM
Net Area Compressive Strength
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.560

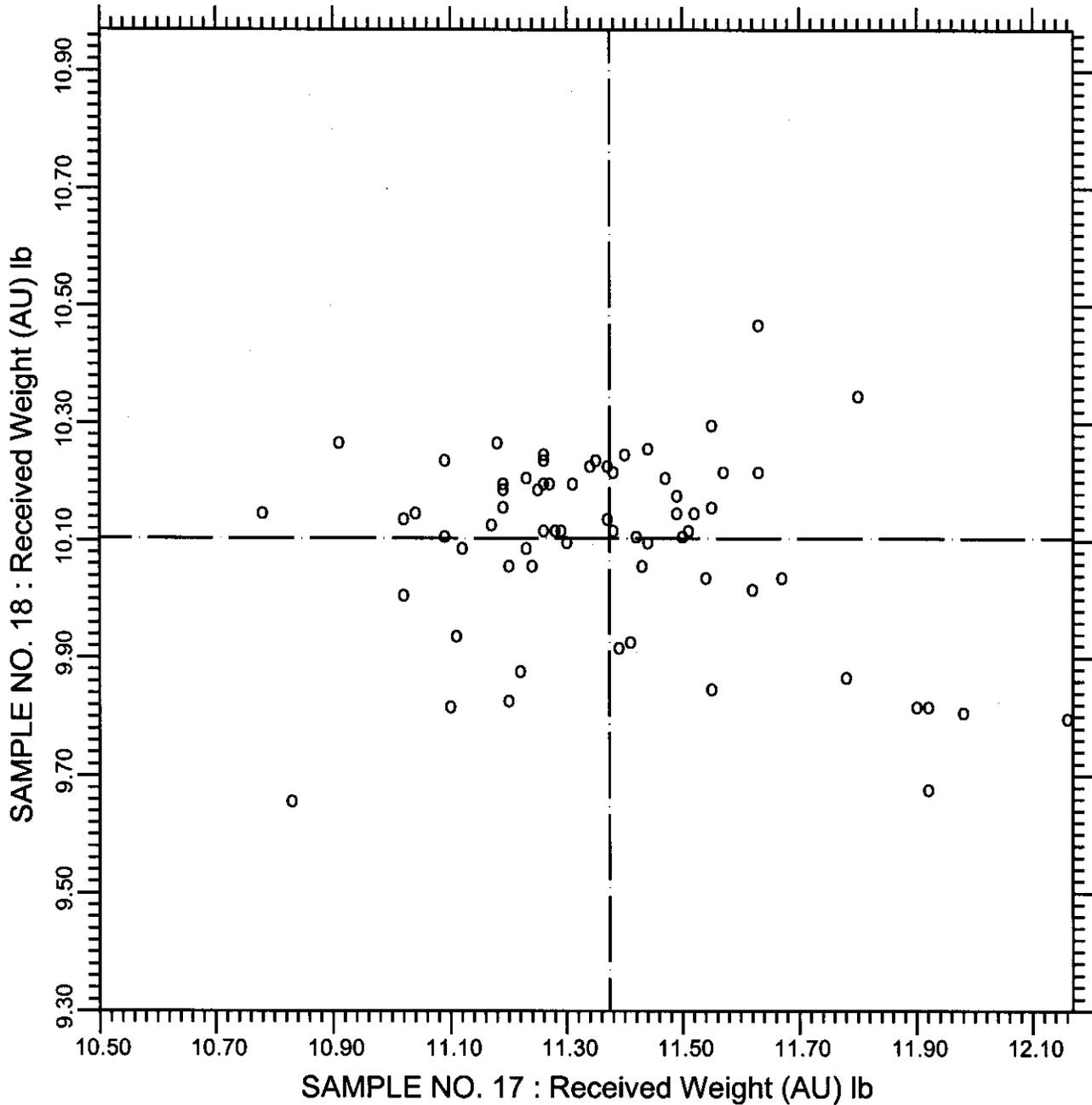
Compressive Strength

72 POINTS

SAMPLE NO. 17 AVE 2217.9 S.D. 438.1 C.V. 19.8

SAMPLE NO. 18 AVE 1573.5 S.D. 240.5 C.V. 15.3

CCRL PROFICIENCY SAMPLE PROGRAM
Received Weight - Absorption Units
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.600

Received Weight (AU)

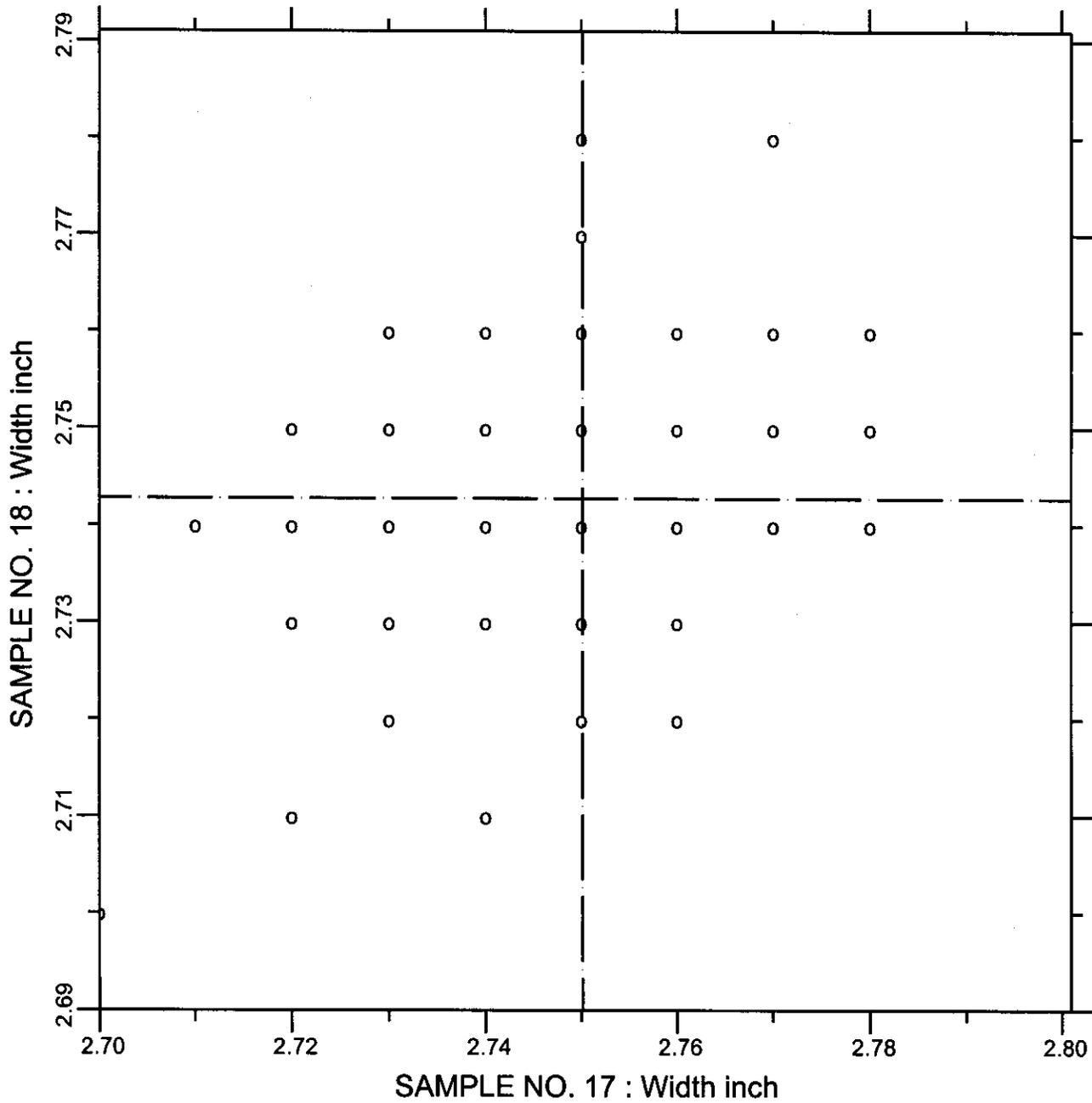
70 POINTS

SAMPLE NO. 17 AVE 11.374 S.D. 0.26 C.V. 2.32

SAMPLE NO. 18 AVE 10.104 S.D. 0.16 C.V. 1.59

LABS ELIMINATED 537

CCRL PROFICIENCY SAMPLE PROGRAM
Width
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.510

Width

68 POINTS

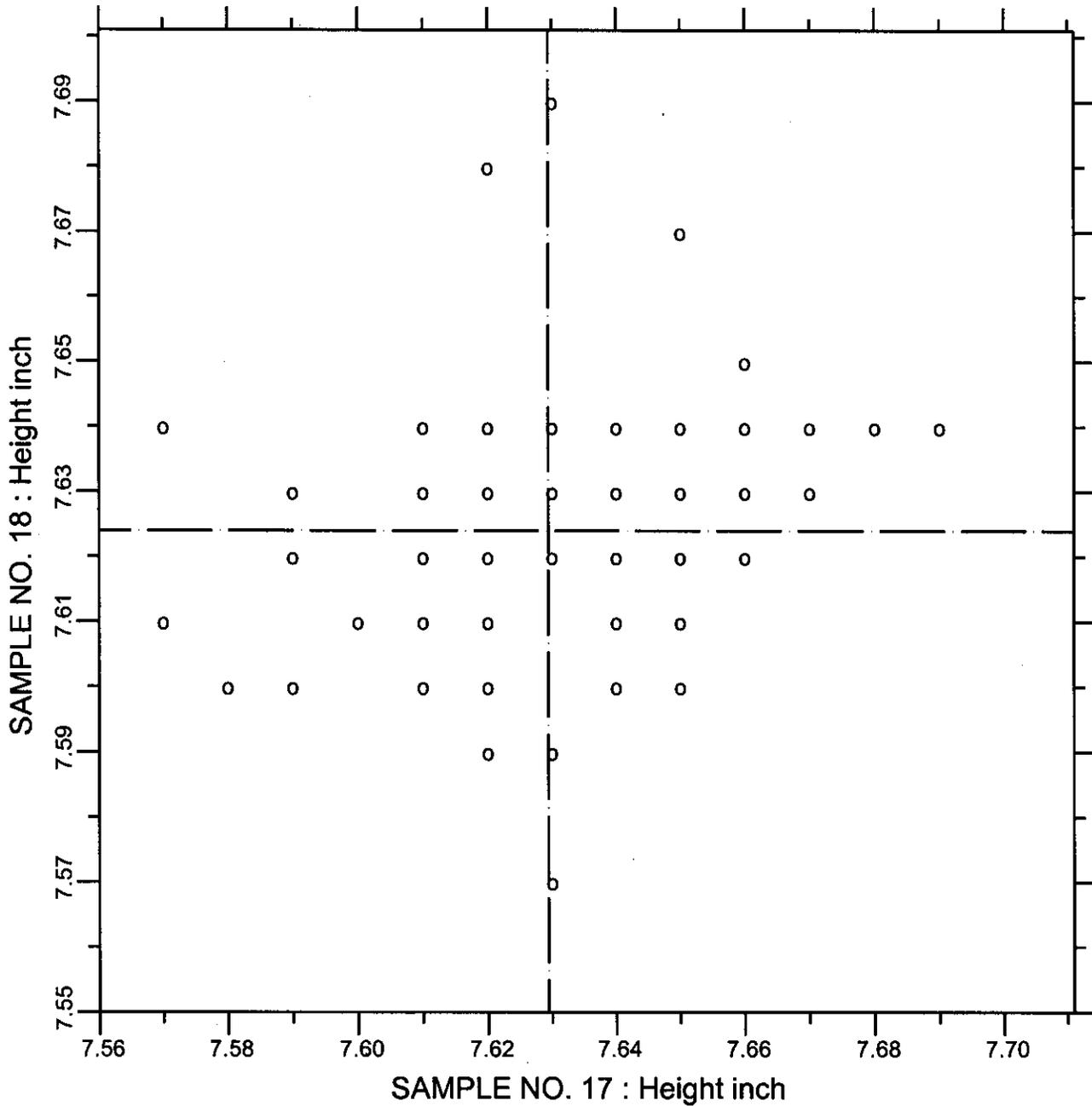
SAMPLE NO. 17 AVE 2.7501 S.D. 0.018 C.V. 0.637

SAMPLE NO. 18 AVE 2.7428 S.D. 0.017 C.V. 0.612

LABS ELIMINATED 280 1223

LABS OFF DIAGRAM 672

CCRL PROFICIENCY SAMPLE PROGRAM
Height
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.520

Height

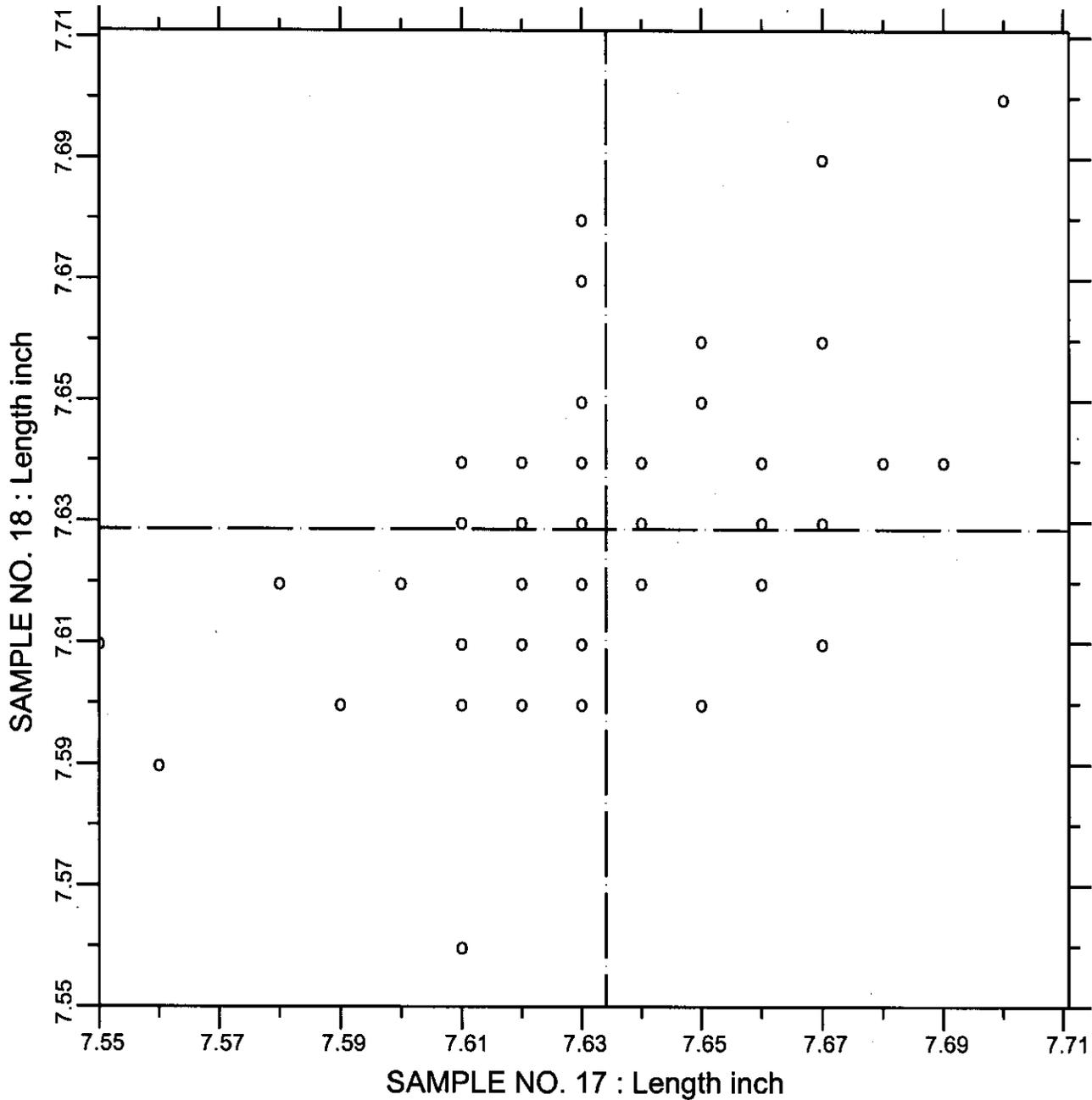
70 POINTS

SAMPLE NO. 17 AVE 7.6294 S.D. 0.025 C.V. 0.329

SAMPLE NO. 18 AVE 7.6240 S.D. 0.021 C.V. 0.272

LABS ELIMINATED 951

CCRL PROFICIENCY SAMPLE PROGRAM
Length
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.530

Length

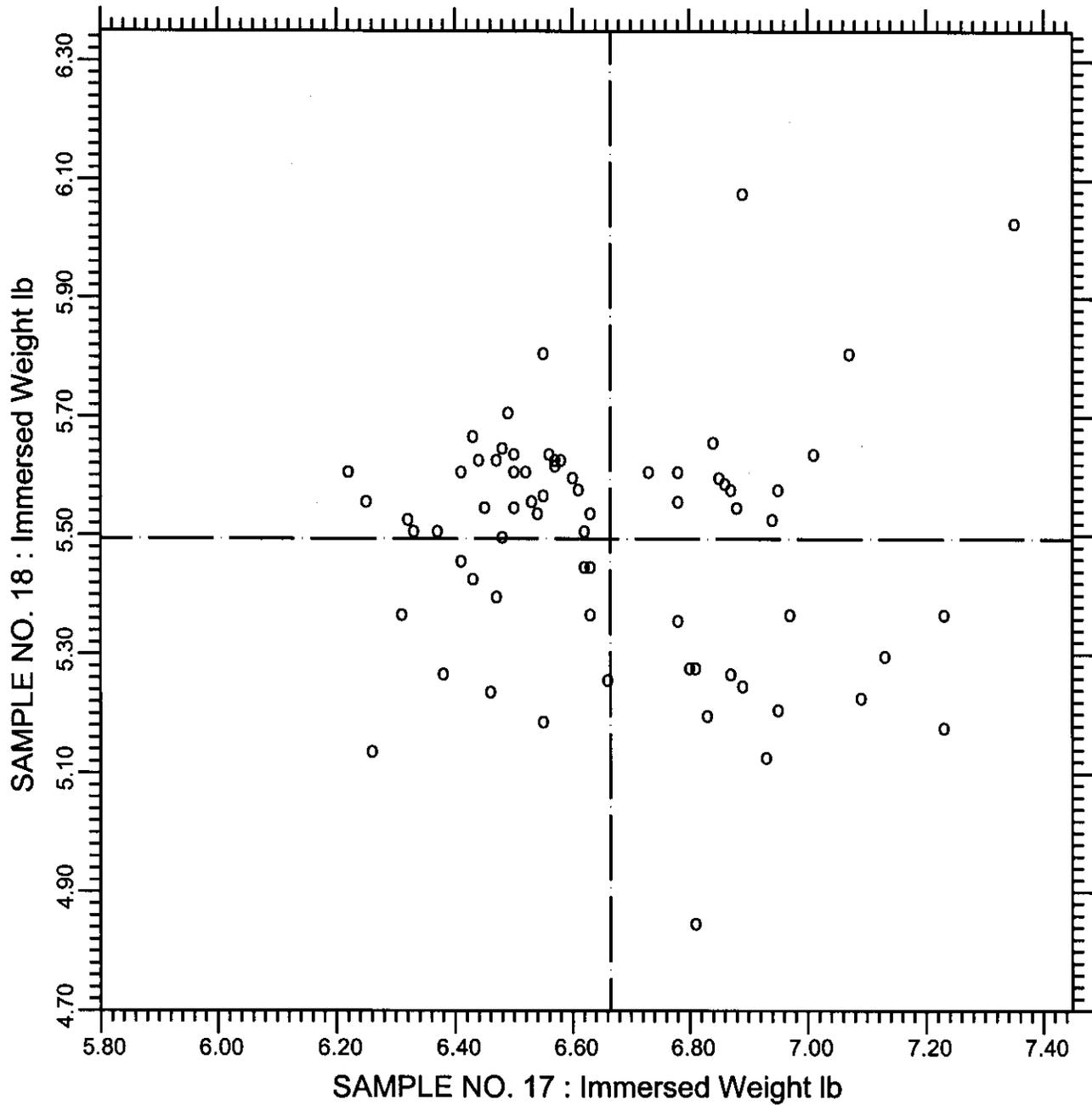
69 POINTS

SAMPLE NO. 17 AVE 7.6340 S.D. 0.027 C.V. 0.357

SAMPLE NO. 18 AVE 7.6287 S.D. 0.023 C.V. 0.304

LABS ELIMINATED 20 926

CCRL PROFICIENCY SAMPLE PROGRAM
Immersed Weight
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.610

Immersed Weight

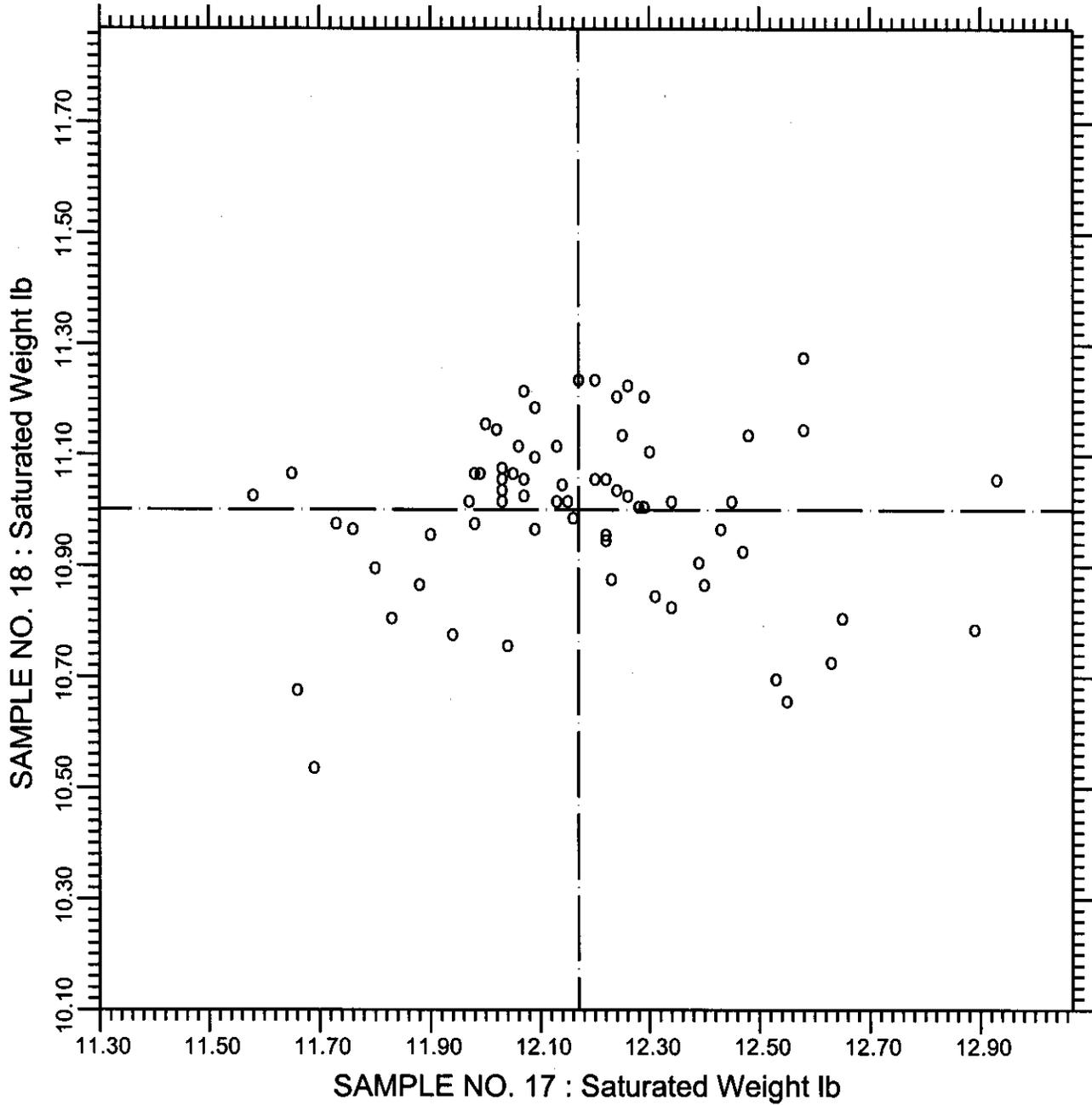
70 POINTS

SAMPLE NO. 17 AVE 6.665 S.D. 0.26 C.V. 3.84

SAMPLE NO. 18 AVE 5.494 S.D. 0.20 C.V. 3.73

LABS ELIMINATED 537

CCRL PROFICIENCY SAMPLE PROGRAM
Saturated Weight
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.620

Saturated Weight

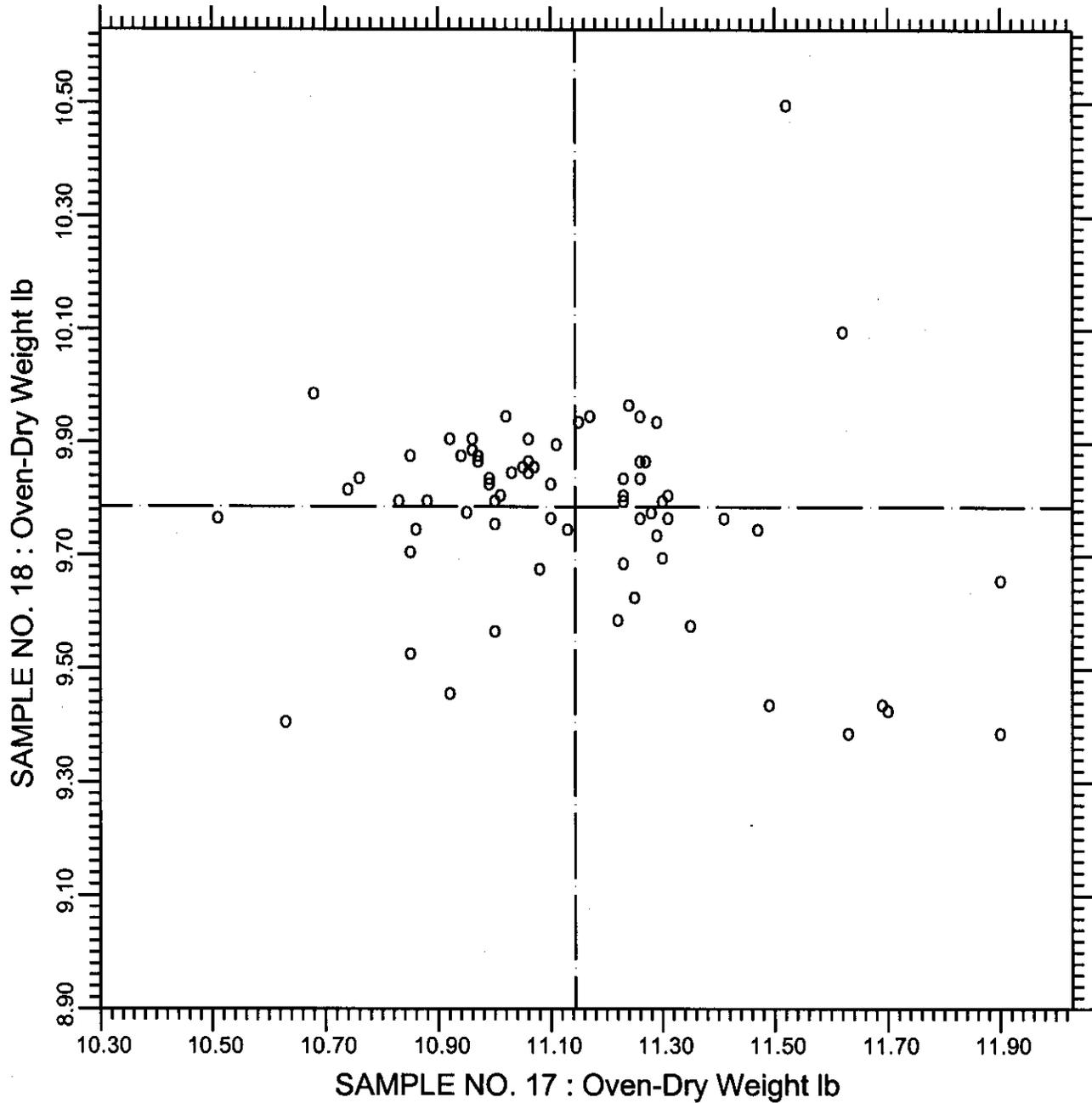
69 POINTS

SAMPLE NO. 17 AVE 12.170 S.D. 0.27 C.V. 2.24

SAMPLE NO. 18 AVE 11.001 S.D. 0.15 C.V. 1.39

LABS ELIMINATED 537 1311

CCRL PROFICIENCY SAMPLE PROGRAM
Oven-Dry Weight
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.630

Oven-Dry Weight

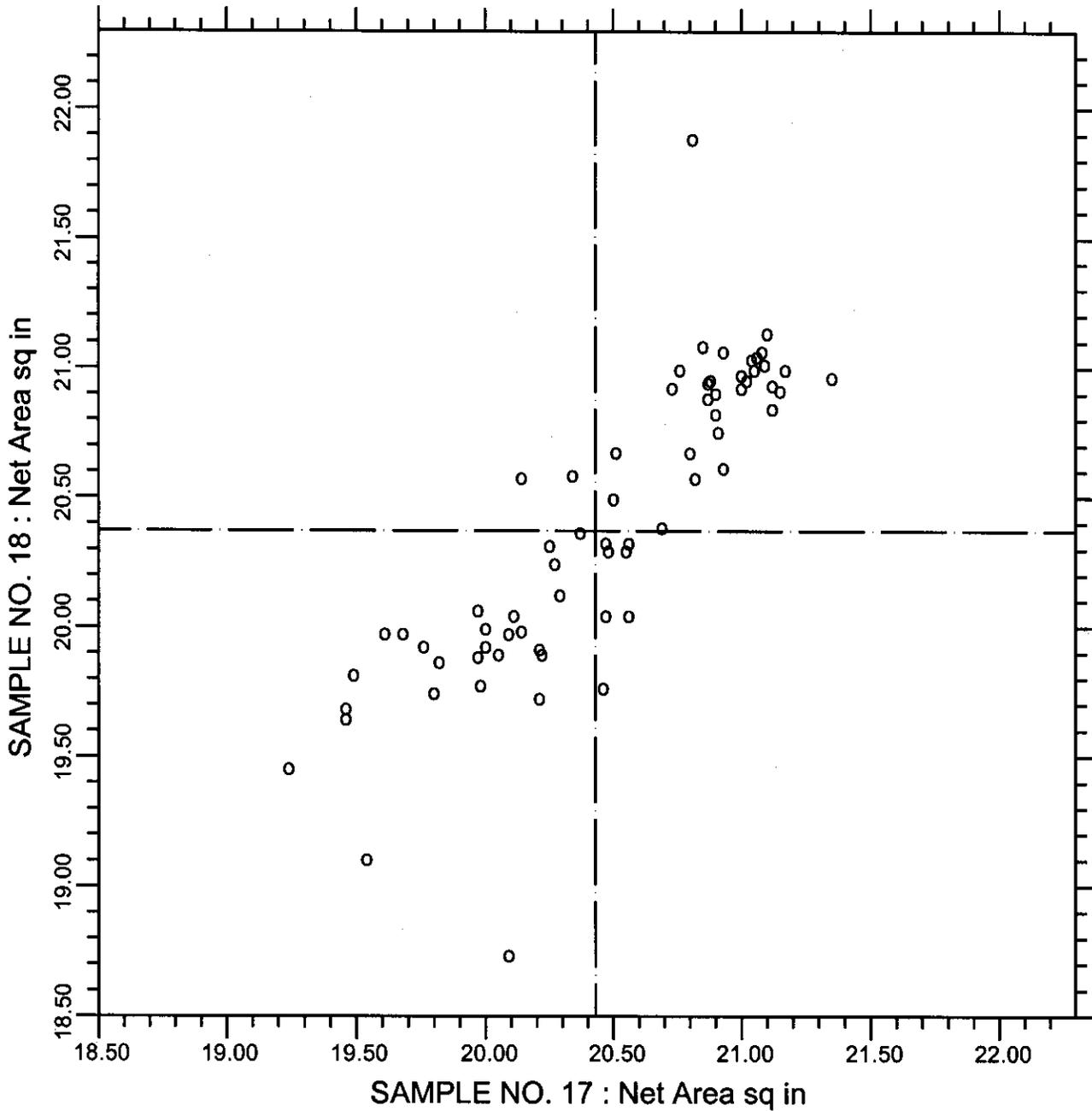
70 POINTS

SAMPLE NO. 17 AVE 11.144 S.D. 0.27 C.V. 2.46

SAMPLE NO. 18 AVE 9.786 S.D. 0.18 C.V. 1.82

LABS ELIMINATED 537

CCRL PROFICIENCY SAMPLE PROGRAM
Net Area
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.635

Net Area

67 POINTS

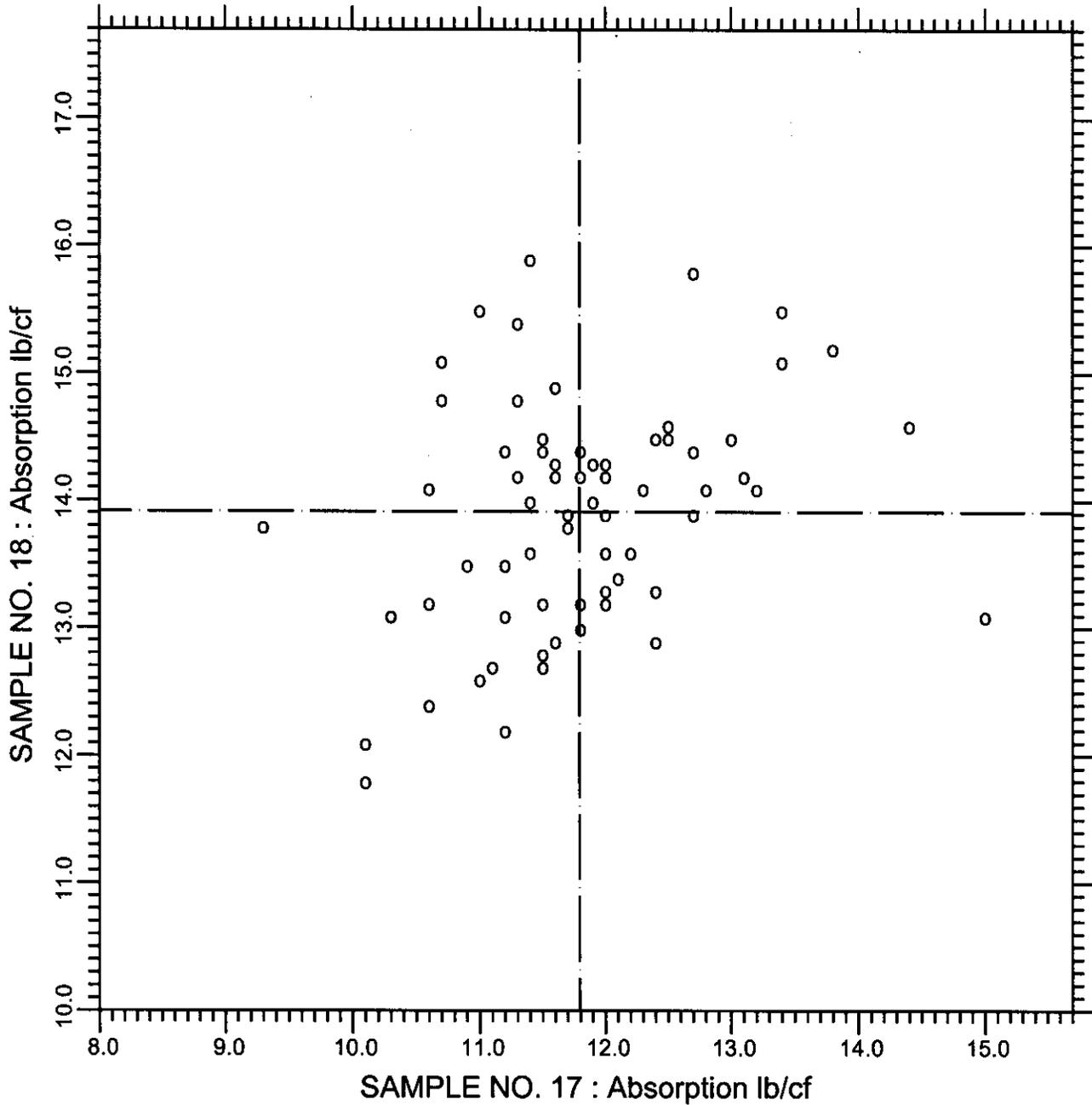
SAMPLE NO. 17 AVE 20.429 S.D. 0.60 C.V. 2.92

SAMPLE NO. 18 AVE 20.371 S.D. 0.64 C.V. 3.12

LABS ELIMINATED 537 869

LABS OFF DIAGRAM 1589

CCRL PROFICIENCY SAMPLE PROGRAM
Absorption
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.640

Absorption

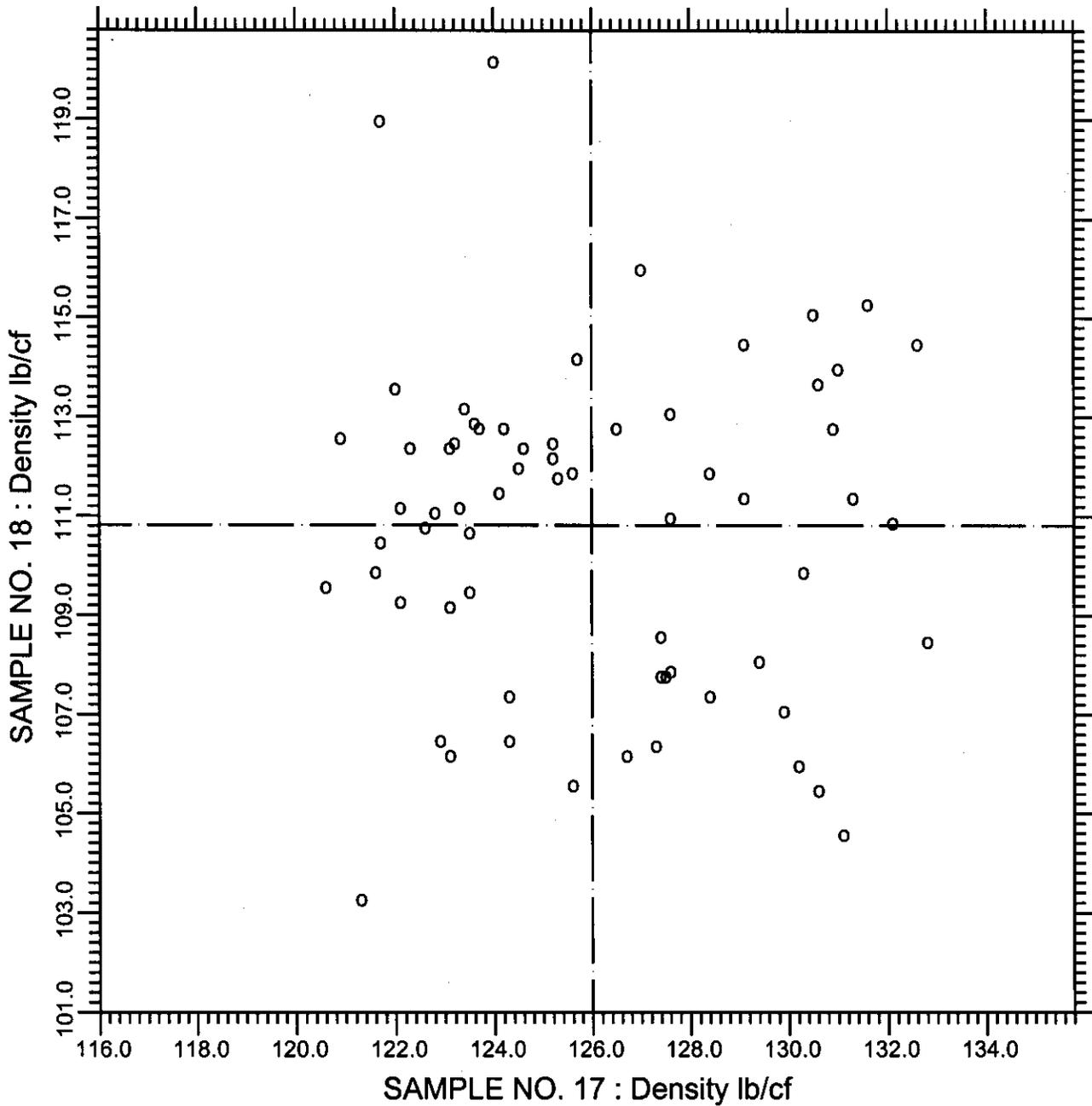
68 POINTS

SAMPLE NO. 17 AVE 11.79 S.D. 0.99 C.V. 8.36

SAMPLE NO. 18 AVE 13.91 S.D. 0.90 C.V. 6.44

LABS ELIMINATED 270 1279

CCRL PROFICIENCY SAMPLE PROGRAM
Density
CONCRETE MASONRY UNITS SAMPLES NO. 17 & NO. 18



TEST NO.650

Density

66 POINTS

SAMPLE NO. 17 AVE 125.99 S.D. 3.4 C.V. 2.73

SAMPLE NO. 18 AVE 110.82 S.D. 3.3 C.V. 2.98

LABS ELIMINATED 270 537 1279 1589