

CEMENT AND CONCRETE REFERENCE LABORATORY
PROFICIENCY SAMPLE PROGRAM

Final Report
C270 Masonry Mortar Proficiency Samples
Number 49 and Number 50



CCRL
Cement and Concrete
Reference Laboratory

November 2019

www.ccril.us



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November 7, 2019

TO: Participants in the CCRL Masonry Mortar (ASTM C270) Proficiency Sample Program

SUBJECT: Final Report on Masonry Mortar Proficiency Samples No. 49 and No. 50

Enclosed is your copy of the final report on the test results for the pair of CCRL **Masonry Mortar Proficiency Samples** which were distributed in August 2019.

This report consists of a statistical Summary of Results, a set of general Scatter Diagrams, and associated detailed information. The Table of Results with test results and ratings for your laboratory can be downloaded at our website located at: <http://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 masonry mortars 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 Masonry Mortar Proficiency Samples will be distributed in August 2020.

Sincerely,

Kent Niedzielski
Program Manager, Proficiency Samples
Cement and Concrete Reference Laboratory

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To: Participants in the CCRL C270 Masonry Mortar Proficiency Sample Program

FROM: Kent Niedzielski, Program Manager, Proficiency Samples

SUBJECT: Explanation of Final Report on Results of Tests on C270 Masonry Mortar Proficiency Samples No. 49 and No. 50

This letter, and the material included with it, constitutes the final report and summary of results for the current pair of Masonry Mortar Proficiency Samples that were distributed in August 2019. This material includes a statistical Summary of Results, and a set of general Scatter Diagrams. If your laboratory was a participant in this program a Table of Laboratory Results (lab data and ratings) for your laboratory can be viewed and printed on the CCRL website.

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 Table of Results. The Table of Results shows the test title and the reporting unit in the first two columns. After that it lists 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.

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. A rating of 0 is given for test results eliminated from calculations. 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

Note: 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", Volume 59, *Proceedings of the 62nd Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.*

Please note that individual laboratory ratings were not given for the flow of air content, compressive strength mortar, and initial water retention flow. Mortar flows in the range of 110 ± 5 are satisfactory, laboratories with flow values outside this range will be flagged as a "Labs Eliminated" on the scatter diagram. Averages, standard deviations, and a scatter diagram are provided for your information. This information may be a helpful indicator of a problem with flow table apparatus or mortar mixing procedures.

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

Usually, averages, standard deviations, and coefficients of variation are given with all results reported, and then with one or more outlying results omitted. Sometimes, two or more recalculations with laboratories omitted, have been performed for the same 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. Often, elimination of these outlying results has 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. To find your point, just plot as you would when plotting any scatter diagram. 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 or worst 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 may indicate strong evidence of bias in many cases.

CCRL PROFICIENCY SAMPLE PROGRAM
Masonry Mortar Proficiency Samples No. 49 and No. 50

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SUMMARY OF RESULTS

Test (unit)	Sample No. 49				Sample No. 50		
	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Air Content (percent)							
	31	14.1	1.5	11	16.1	1.4	9
No Labs Eliminated for This Test							
Air Content - Water (percent)							
	32	69.9	10.0	14.2	71.3	10.2	14.2
	*30	70.9	3.5	4.9	72.5	3.9	5.3
* Labs Eliminated - 475, 2177							
Air Content - Flow (percent)							
	32	109	3.4	3.1	108	4.8	4.4
	*31	109	2.1	2.0	109	2.6	2.4
* Labs Eliminated - 565							
Compressive Strength - 7 day (psi)							
	42	1167	331	28	784	532	68
	*39	1145	195	17	698	157	22
* Labs Eliminated - 3599, 4069, 4246							
Compressive Strength - 28 day (psi)							
	39	1443	252	17	967	310	32
	*37	1405	194	14	906	143	16
* Labs Eliminated - 2960, 4246							
Compressive Strength - Mix Water (percent)							
	38	70.1	10.8	15.4	71.3	11.0	15.4
	*36	71.3	3.2	4.5	72.6	3.6	4.9
* Labs Eliminated - 1097, 2177							
Compressive Strength - Flow (percent)							
	38	109	2.2	2.0	109	2.7	2.5
No Labs Eliminated for This Test							

CCRL PROFICIENCY SAMPLE PROGRAM
Masonry Mortar Proficiency Samples No. 49 and No. 50

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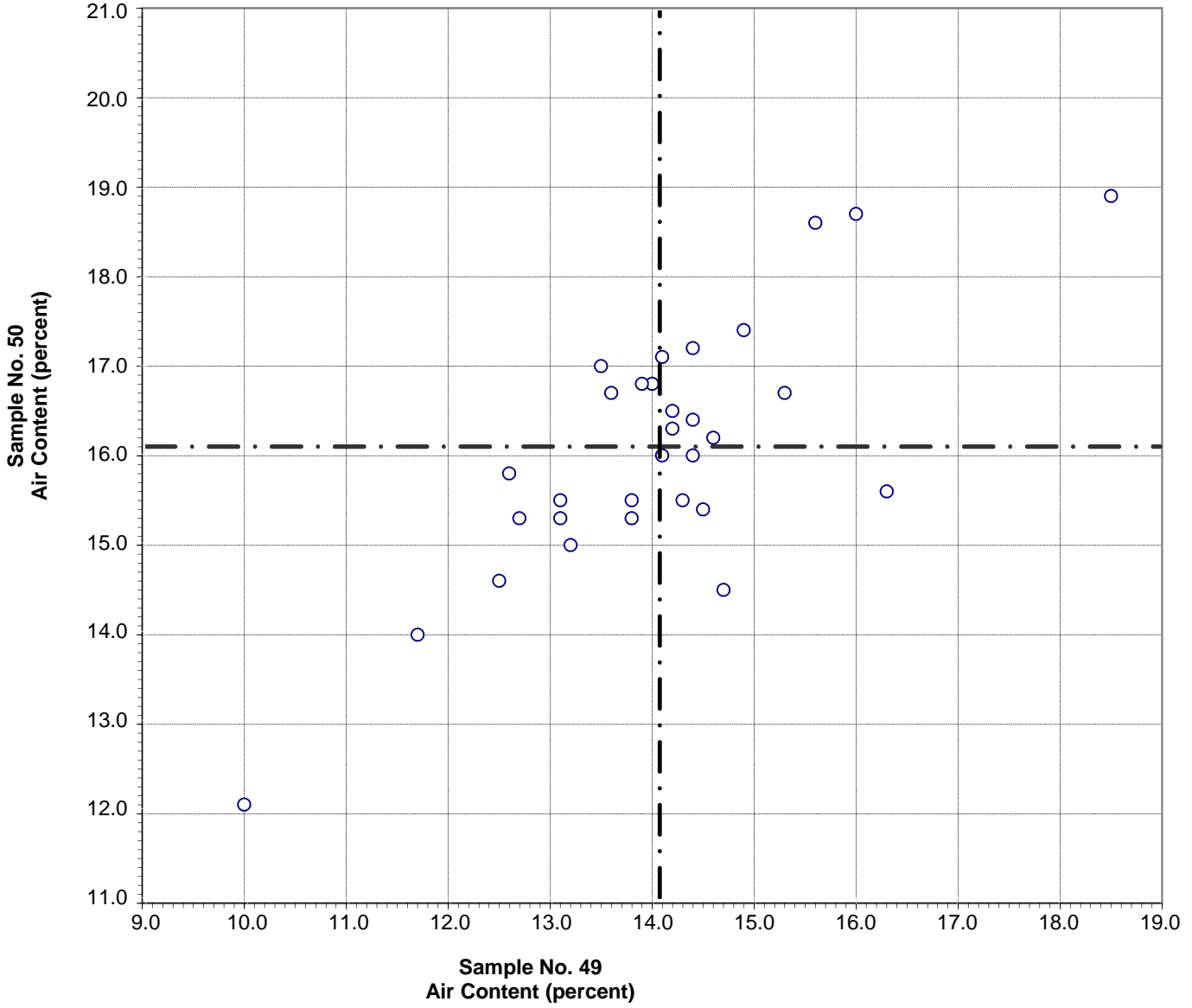
SUMMARY OF RESULTS

Sample No. 49

Sample No. 50

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Water Retention - Water (percent)							
	29	71.3	3.4	4.7	72.9	3.7	5.1
	*28	70.9	2.7	3.8	72.5	3.2	4.4
* Labs Eliminated - 3184							
Water Retention - Initial Flow (percent)							
	29	109	2.5	2.3	109	2.8	2.5
No Labs Eliminated for This Test							
Water Retention - Final Flow (percent)							
	29	81	9.7	12.0	88	6.4	7.3
No Labs Eliminated for This Test							
Water Retention Value (percent)							
	29	74	7.9	10.7	80	5.2	6.5
No Labs Eliminated for This Test							

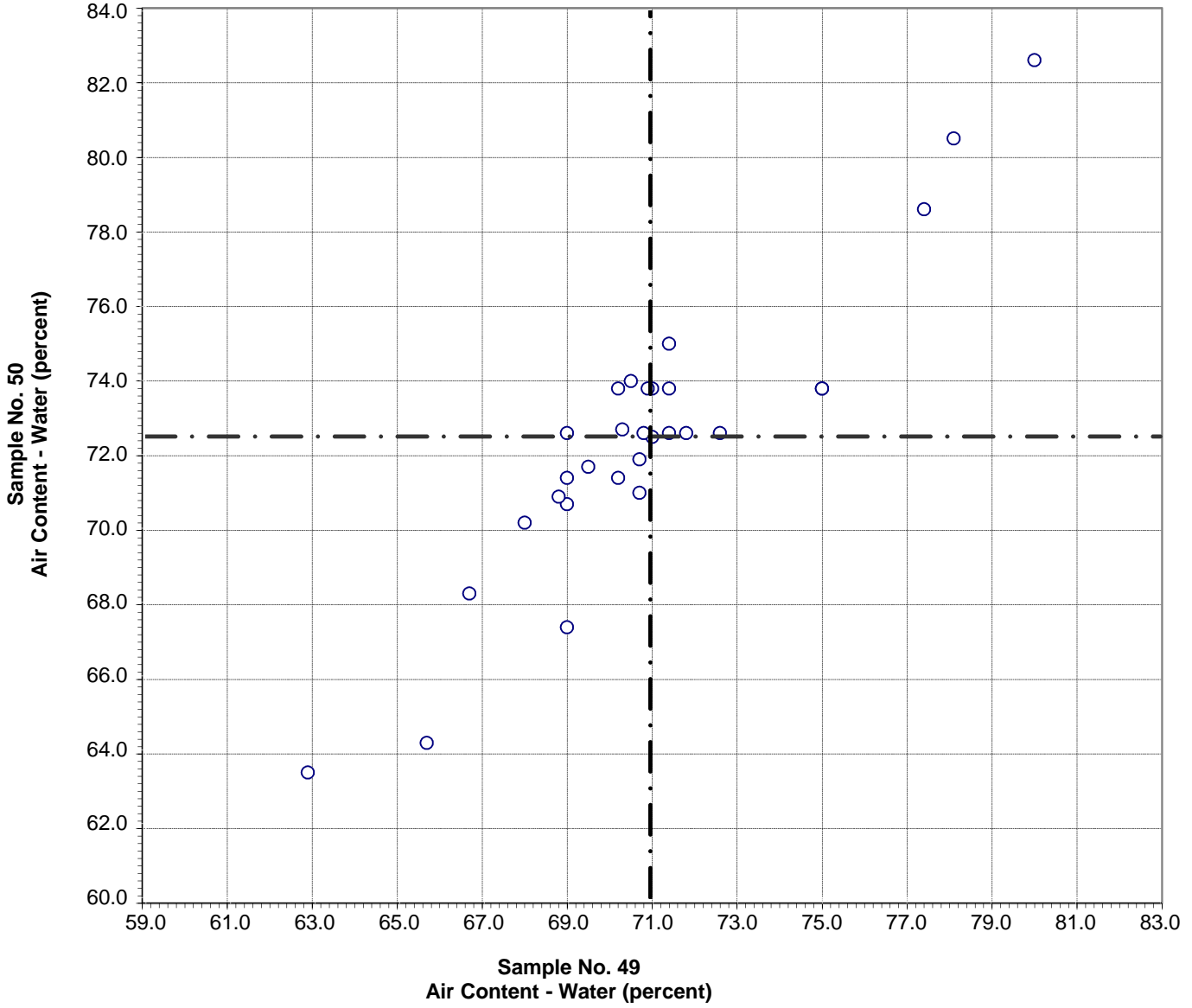
CCRL Proficiency Sample Program
Air Content
MASONRY MORTAR Samples No. 49 and No. 50



Test No. 170 Air Content 31 Points

Sample No. 49	Ave 14.1	S.D. 1.5	C.V. 11
Sample No. 50	Ave 16.1	S.D. 1.4	C.V. 9

CCRL Proficiency Sample Program
Air Content - Water
MASONRY MORTAR Samples No. 49 and No. 50



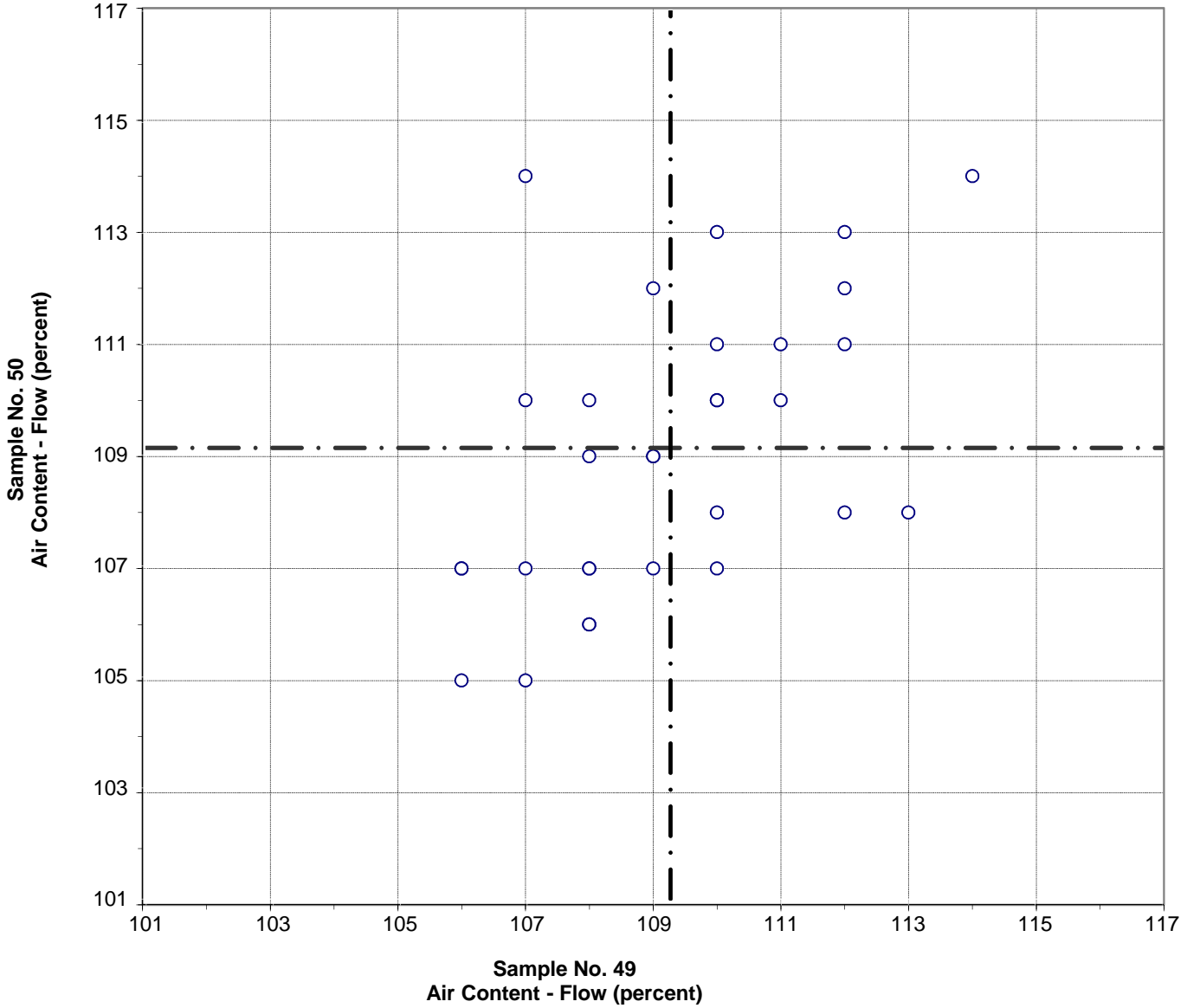
Test No. 180 Air Content - Water 30 Points

Sample No. 49 Ave 70.9 S.D. 3.5 C.V. 4.9

Sample No. 50 Ave 72.5 S.D. 3.9 C.V. 5.3

Labs Eliminated: 475, 2177

**CCRL Proficiency Sample Program
Air Content - Flow
MASONRY MORTAR Samples No. 49 and No. 50**

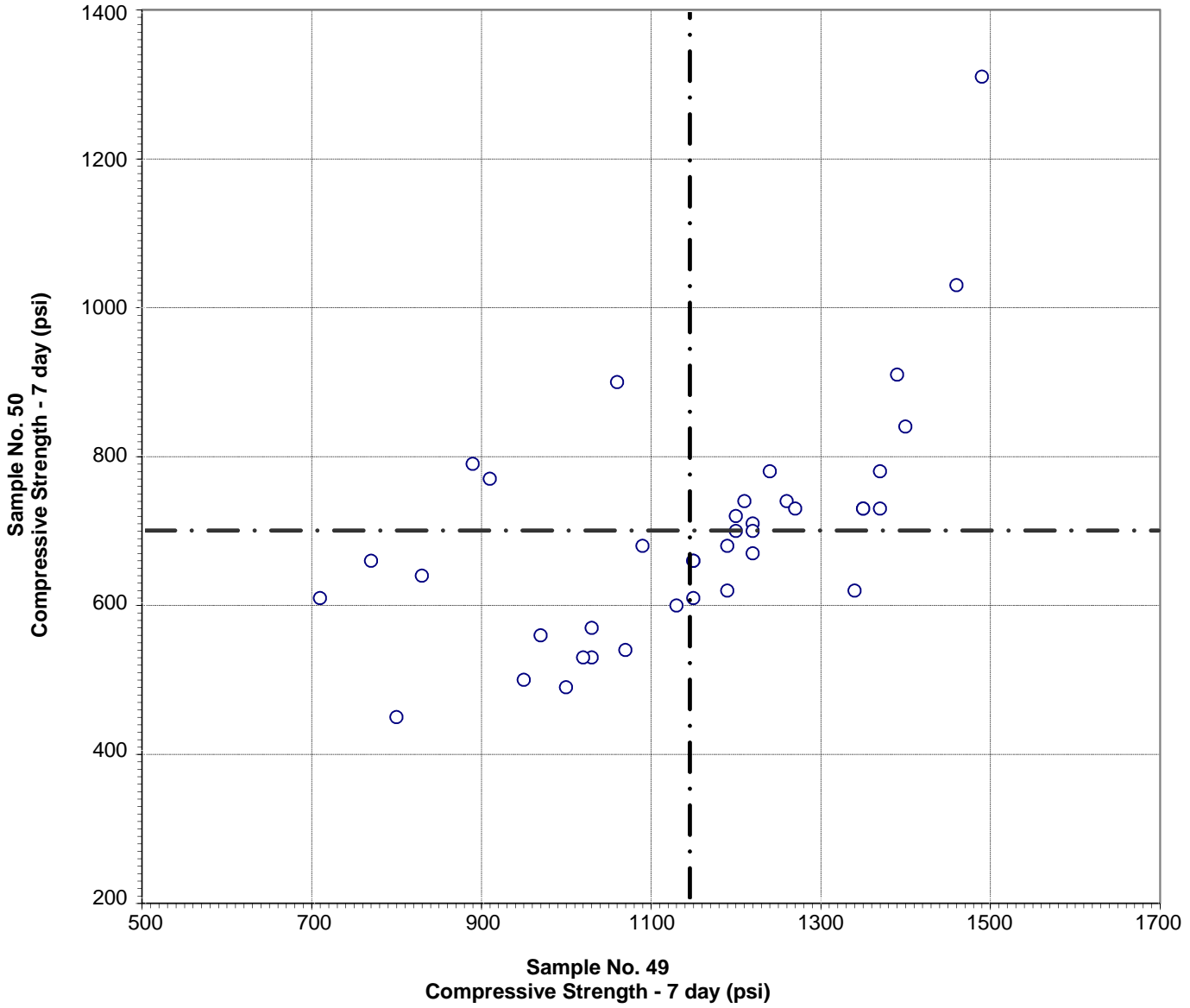


Test No. 190 Air Content - Flow 31 Points

Sample No. 49	Ave 109	S.D. 2.1	C.V. 2.0
Sample No. 50	Ave 109	S.D. 2.6	C.V. 2.4

Labs Eliminated: 565

**CCRL Proficiency Sample Program
Compressive Strength - 7 day
MASONRY MORTAR Samples No. 49 and No. 50**

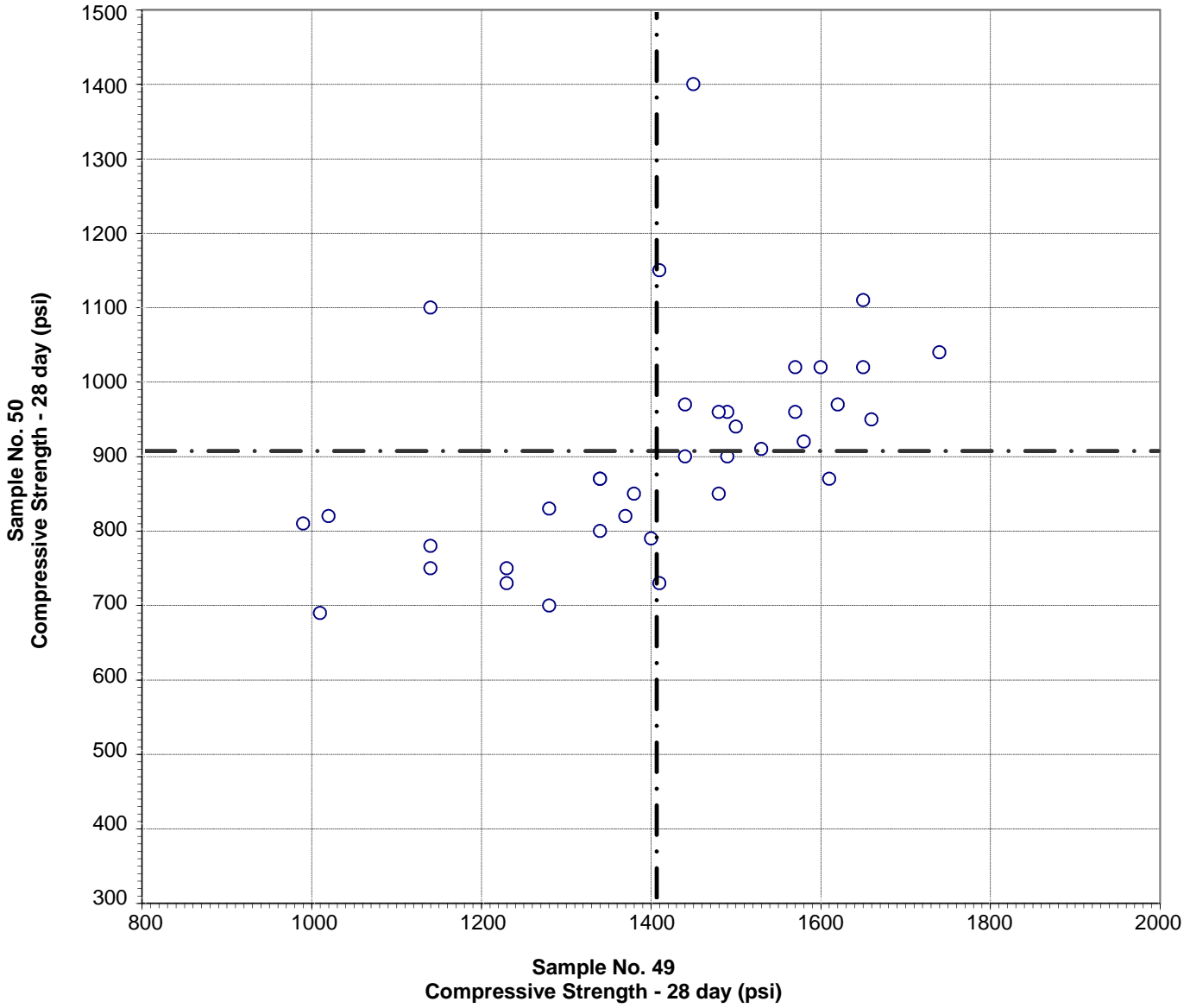


Test No. 210 Compressive Strength - 7 day 39 Points

Sample No. 49	Ave 1145	S.D. 195	C.V. 17
Sample No. 50	Ave 698	S.D. 157	C.V. 22

Labs Eliminated: 3599, 4069, 4246

**CCRL Proficiency Sample Program
Compressive Strength - 28 day
MASONRY MORTAR Samples No. 49 and No. 50**

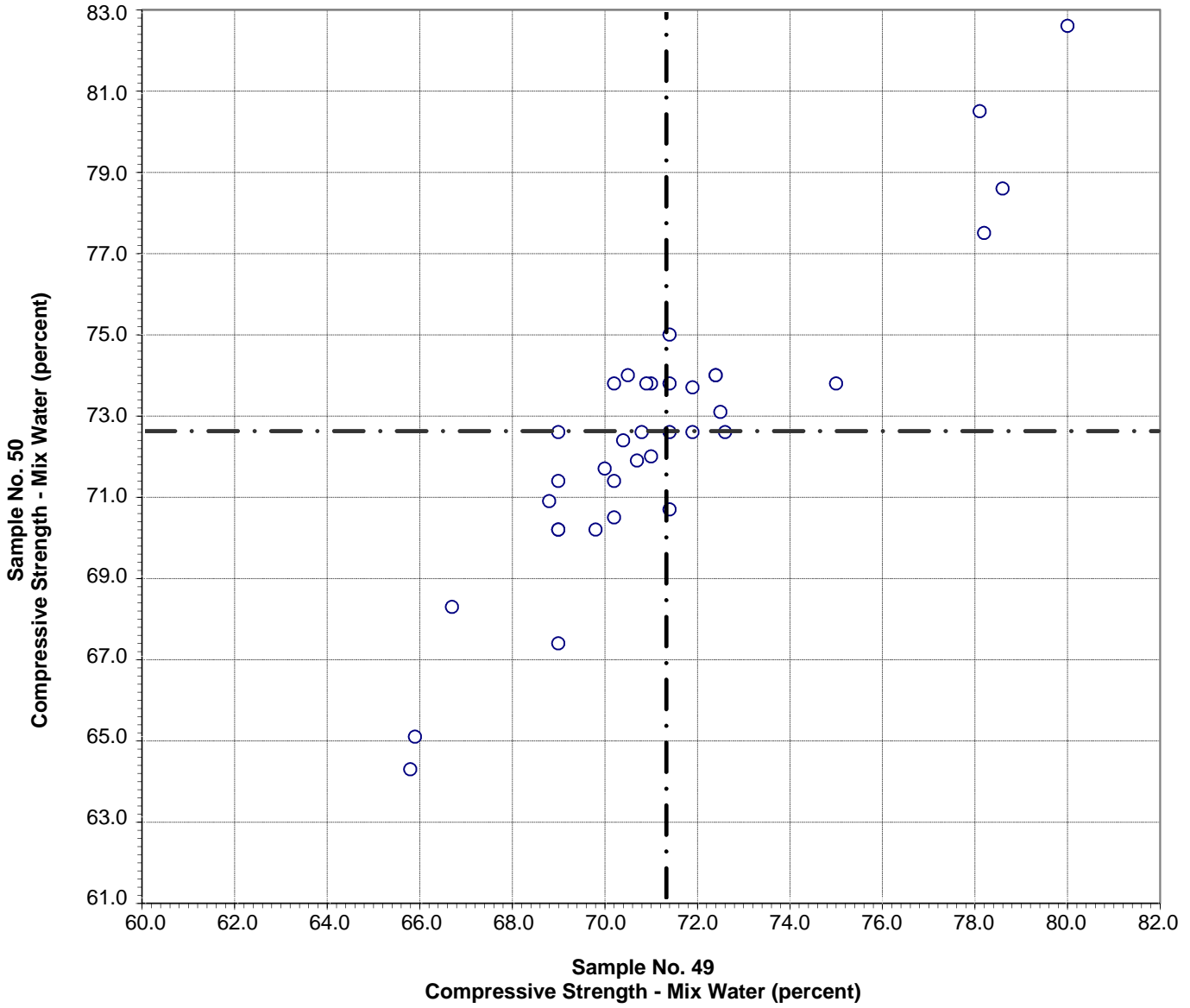


Test No. 211 Compressive Strength - 28 day 37 Points

Sample No. 49	Ave 1405	S.D. 194	C.V. 14
Sample No. 50	Ave 906	S.D. 143	C.V. 16

Labs Eliminated: 2960, 4246

**CCRL Proficiency Sample Program
Compressive Strength - Mix Water
MASONRY MORTAR Samples No. 49 and No. 50**

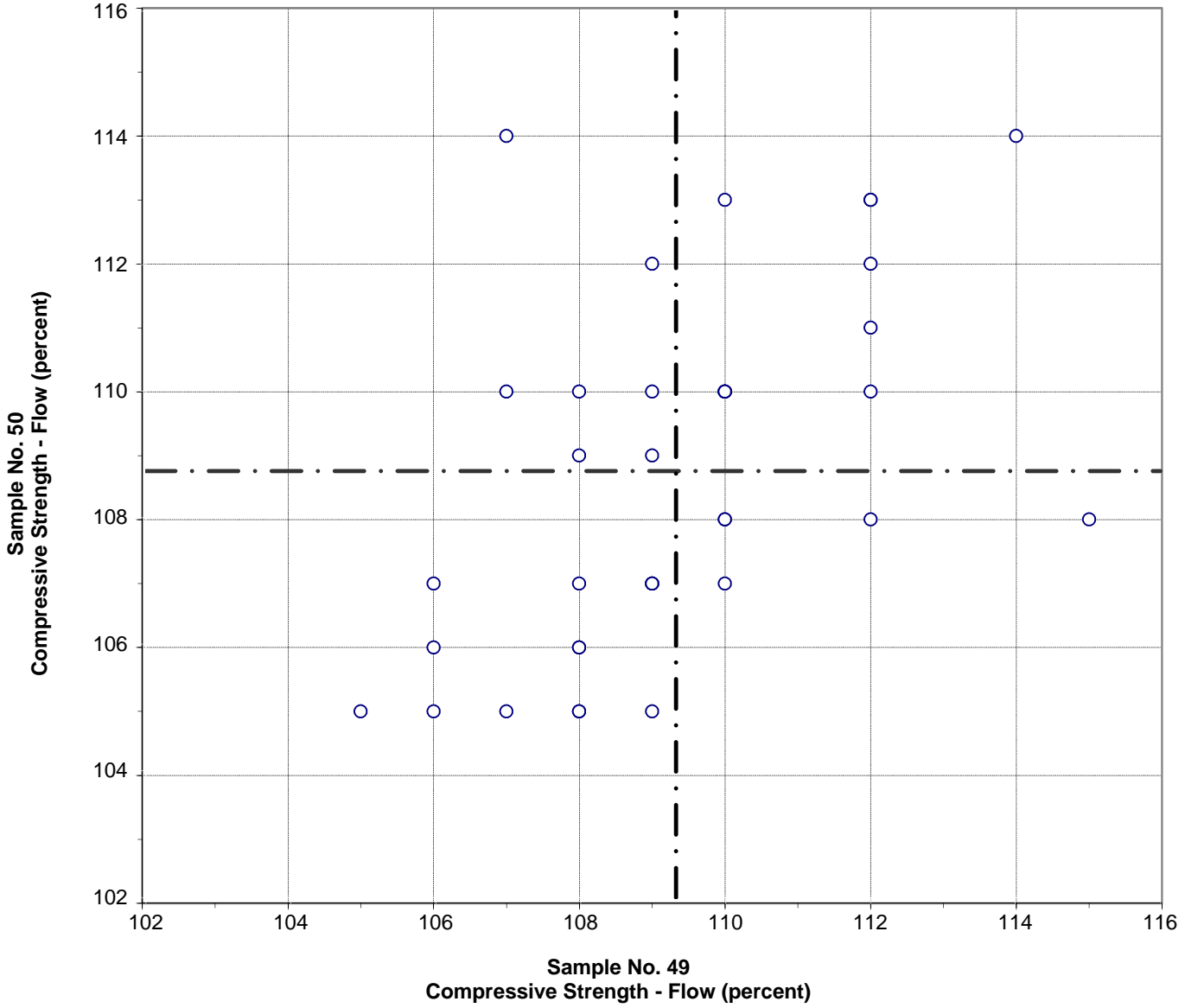


Test No. 220 Compressive Strength - Mix Water 36 Points

Sample No. 49	Ave 71.3	S.D. 3.2	C.V. 4.5
Sample No. 50	Ave 72.6	S.D. 3.6	C.V. 4.9

Labs Eliminated: 1097, 2177

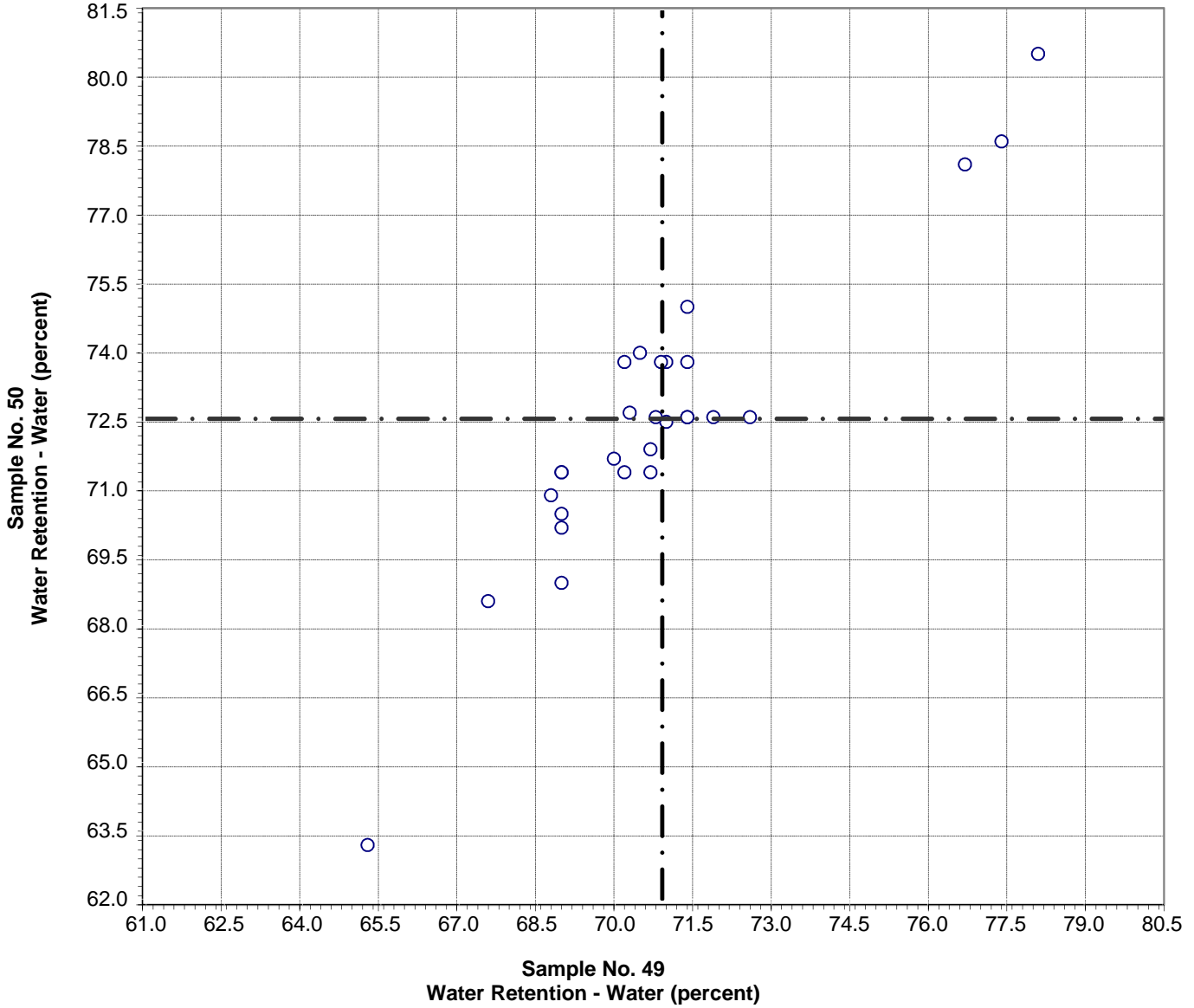
**CCRL Proficiency Sample Program
Compressive Strength - Flow
MASONRY MORTAR Samples No. 49 and No. 50**



Test No. 230 Compressive Strength - Flow 38 Points

Sample No. 49	Ave 109	S.D. 2.2	C.V. 2.0
Sample No. 50	Ave 109	S.D. 2.7	C.V. 2.5

CCRL Proficiency Sample Program
Water Retention - Water
MASONRY MORTAR Samples No. 49 and No. 50

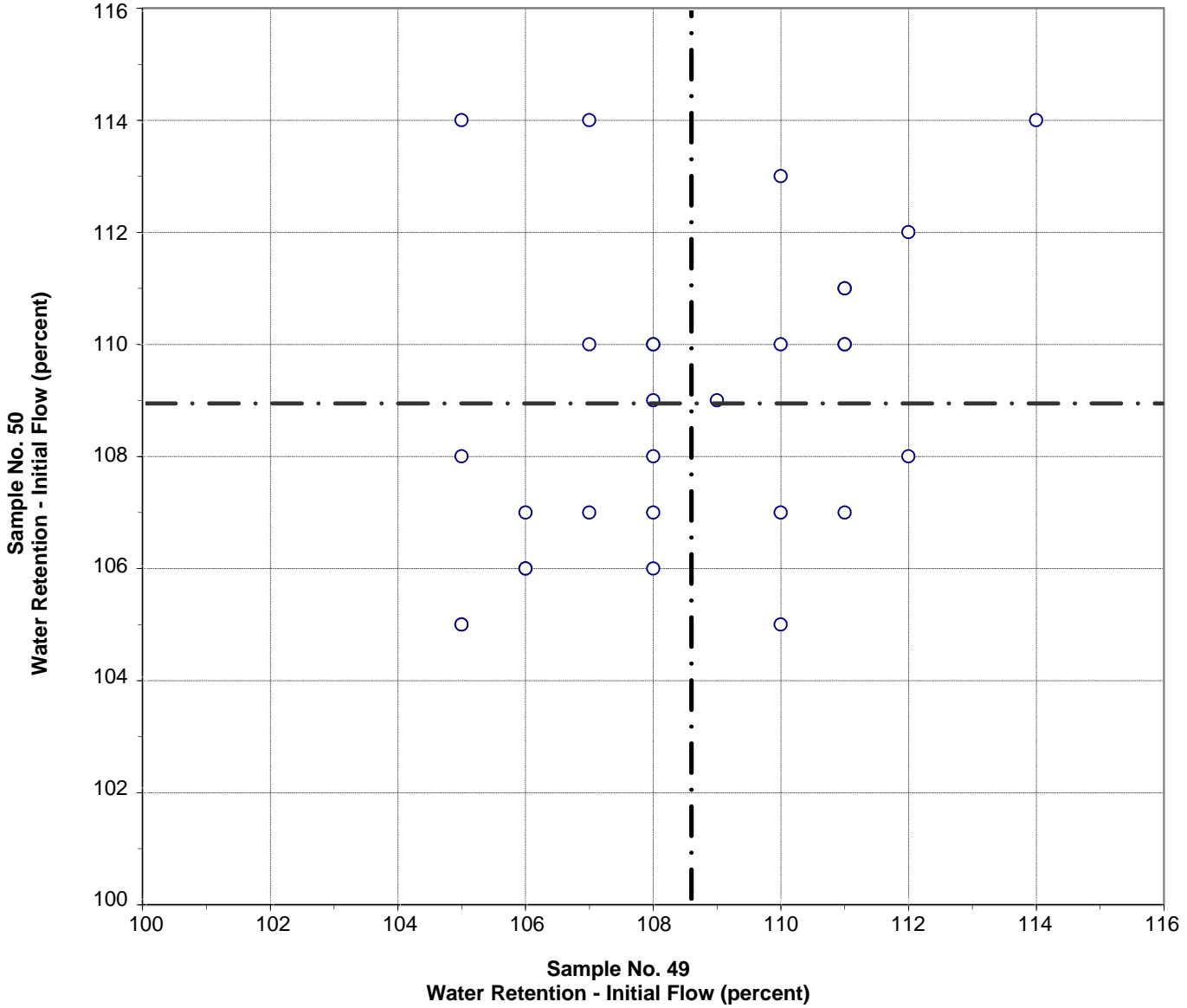


Test No. 330 Water Retention - Water 28 Points

Sample No. 49	Ave 70.9	S.D. 2.7	C.V. 3.8
Sample No. 50	Ave 72.5	S.D. 3.2	C.V. 4.4

Labs Eliminated: 3184

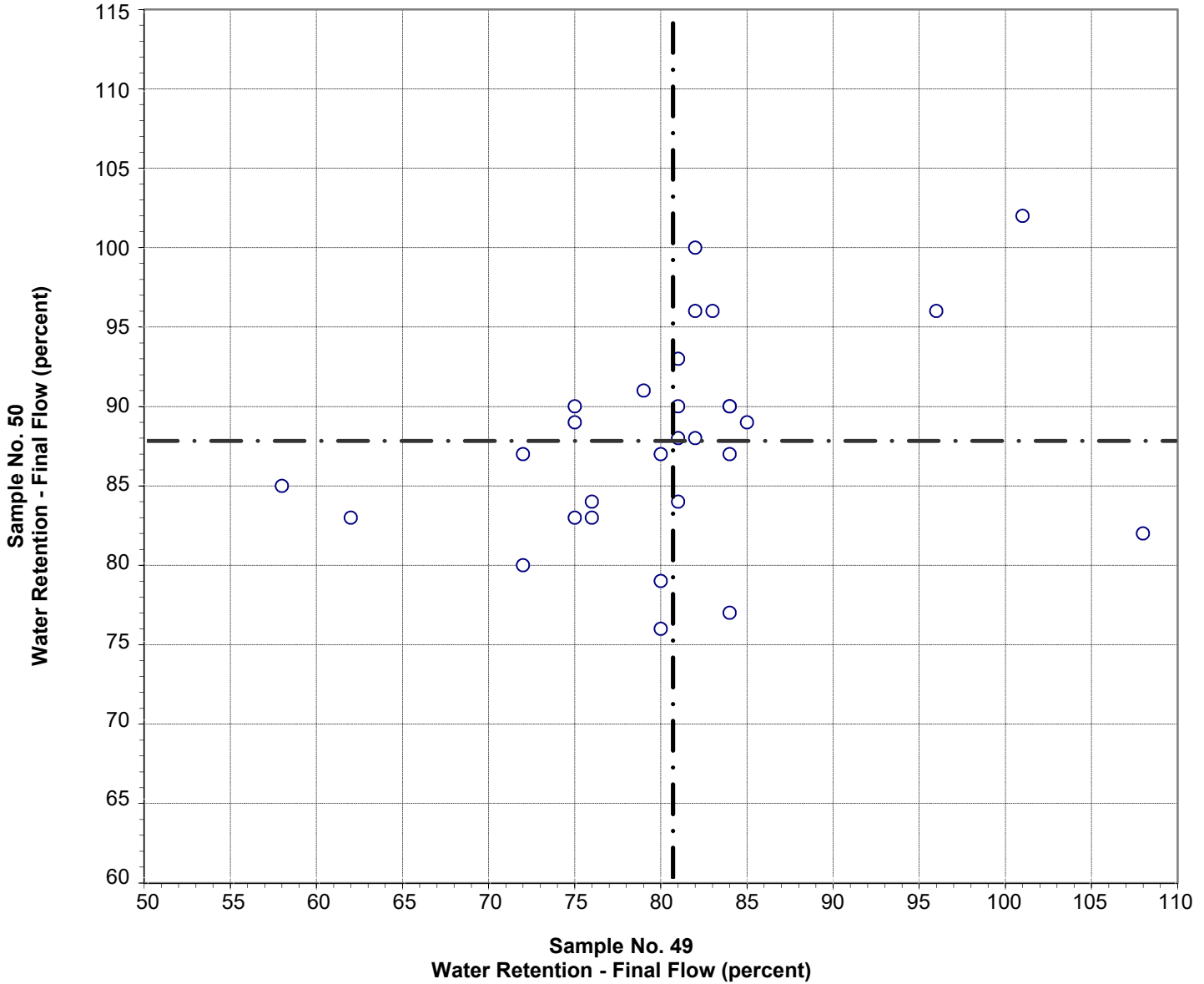
CCRL Proficiency Sample Program
Water Retention - Initial Flow
MASONRY MORTAR Samples No. 49 and No. 50



Test No. 331 Water Retention - Initial Flow 29 Points

Sample No. 49	Ave 109	S.D. 2.5	C.V. 2.3
Sample No. 50	Ave 109	S.D. 2.8	C.V. 2.5

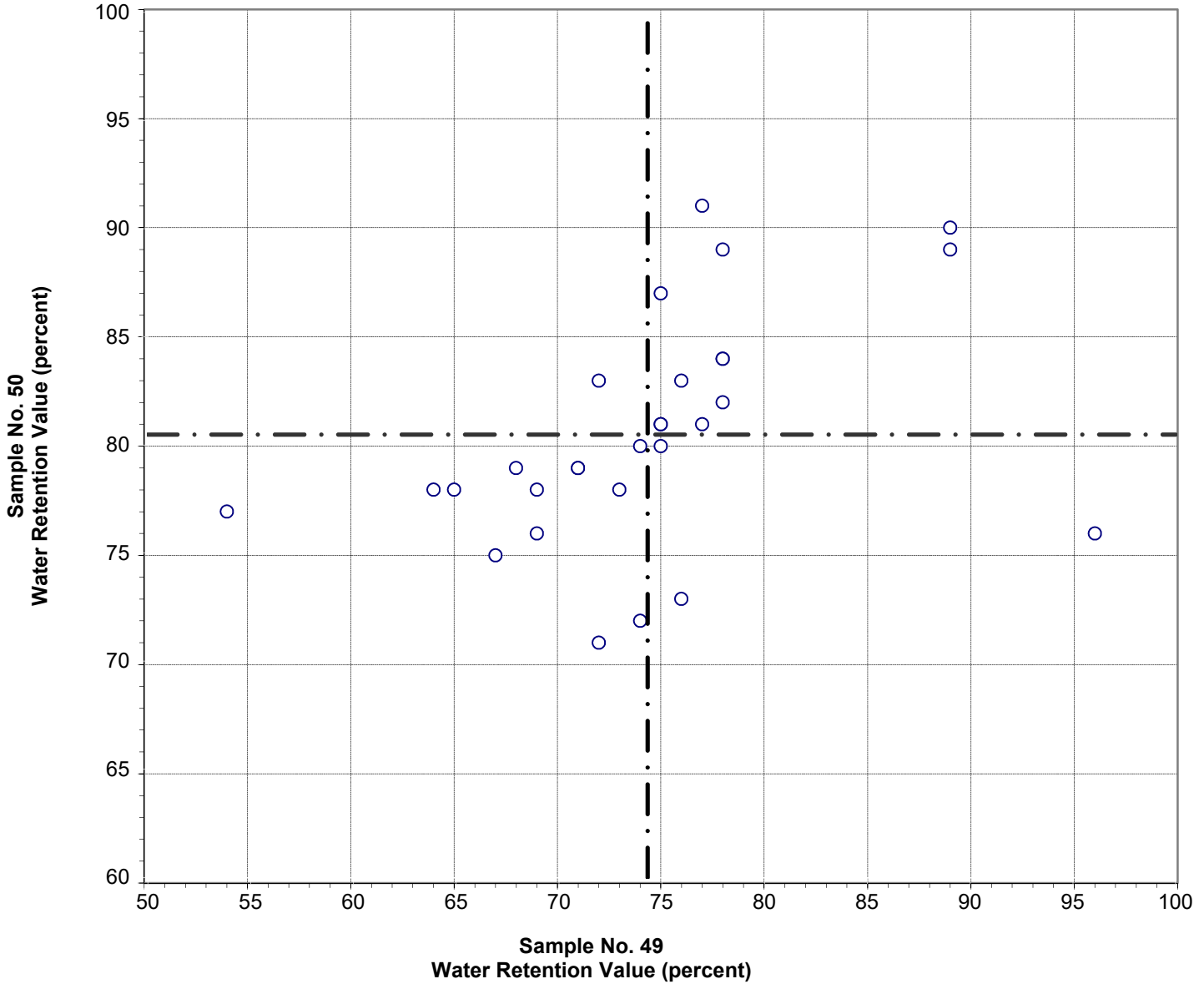
**CCRL Proficiency Sample Program
Water Retention - Final Flow
MASONRY MORTAR Samples No. 49 and No. 50**



Test No. 332 Water Retention - Final Flow 29 Points

Sample No. 49	Ave 81	S.D. 9.7	C.V. 12.0
Sample No. 50	Ave 88	S.D. 6.4	C.V. 7.3

**CCRL Proficiency Sample Program
Water Retention Value
MASONRY MORTAR Samples No. 49 and No. 50**



Test No. 333 Water Retention Value 29 Points

Sample No. 49	Ave 74	S.D. 7.9	C.V. 10.7
Sample No. 50	Ave 80	S.D. 5.2	C.V. 6.5