

CEMENT AND CONCRETE REFERENCE LABORATORY
PROFICIENCY SAMPLE PROGRAM

Final Report
Masonry Cement Proficiency Samples
Number 71 and Number 72

October 2013



CCRL
Cement and Concrete
Reference Laboratory

www.ccrl.us

October 19, 2013

To: Participants in the CCRL Masonry Cement Proficiency Sample Program

SUBJECT: Final Report on Masonry Cement Proficiency Samples No. 71 and No. 72

Enclosed is your copy of the final report on the test results for the pair of CCRL **Masonry Cement** Proficiency Samples which were distributed in July 2013. Masonry Cement Samples No. 71 and No. 72 were ASTM C91 Type S cements.

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://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 cements 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 Cement Proficiency Samples will be distributed in August 2014.

Sincerely,

Robin K. Haupt
Supervisor, Proficiency Sample Programs
Cement and Concrete Reference Laboratory

To: Participants in the CCRL Masonry Cement Proficiency Sample Program

FROM: Robin K. Haupt, Supervisor, PSP

SUBJECT: Explanation of Final Report on Results of Tests on Masonry Cement Proficiency Samples No. 71 and No. 72

This memo and the material included with it constitute the final report and summary of results for the current pair of Masonry Cement Proficiency Samples, which were distributed in July 2013. This material includes a Table of Results for individual laboratory data, a statistical Summary of Results, and a set of 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.

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. Laboratory Ratings are calculated using the unrounded values for average and standard deviation.

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.

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

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

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
Masonry Cement Proficiency Samples No. 71 and No. 72

Final Report – October 9, 2013

SUMMARY OF RESULTS

Sample No.71

Sample No. 72

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Normal Consistency - Water (percent)							
	64	27.7	0.81	2.9	30.5	0.83	2.7
	*62	27.6	0.59	2.1	30.6	0.62	2.0
* Labs Eliminated - 103, 692							
Gillmore Time of Set - Initial (minute)							
	64	205	24	11.7	198	19	9.8
	*60	208	16	7.9	198	17	8.5
* Labs Eliminated - 103, 176, 692, 2938							
Gillmore Time of Set - Final (minute)							
	64	318	33	10.3	314	36	12
	*63	319	30	9.3	316	35	11
* Labs Eliminated - 2938							
Autoclave Expansion (percent)							
	62	-0.03	0.02	-61	0.05	0.02	38
	*57	-0.03	0.01	37	0.05	0.02	28
* Labs Eliminated - 74, 93, 440, 692, 1576							
Air Content (percent)							
	63	17.2	2.6	15.3	15.8	2.9	18.2
	*60	16.8	1.2	7.0	15.5	1.2	7.6
* Labs Eliminated - 54, 103, 698							
Air Content - Water (percent)							
	62	46.6	5.1	11.0	47.9	5.3	11.1
	*58	46.1	1.4	3.1	47.4	1.6	3.5
* Labs Eliminated - 74, 157, 159, 493							
Air Content - Flow (percent)							
	63	110	3.8	3.5	109	3.9	3.6
	*62	110	2.7	2.4	110	2.7	2.5
* Labs Eliminated - 139							

CCRL PROFICIENCY SAMPLE PROGRAM
Masonry Cement Proficiency Samples No. 71 and No. 72

Final Report – October 9, 2013

SUMMARY OF RESULTS

Sample No.71

Sample No. 72

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Compressive Strength - 7 day (psi)							
	65	2885	404	14	3097	411	13
	*63	2924	345	12	3136	351	11
* Labs Eliminated - 9, 3690							
Compressive Strength - 28 day (psi)							
	61	3601	509	14	3901	506	13
	*58	3668	419	11	3972	403	10
* Labs Eliminated - 9, 56, 3352							
Fineness - 45µm Sieve Retained (percent)							
	64	3.04	0.51	17	0.36	0.65	181
	*54	3.01	0.32	11	0.16	0.11	70
* Labs Eliminated - 56, 142, 143, 151, 284, 407, 441, 605, 1576, 3368							
Density (g/cm³)							
	59	2.97	0.10	3.4	2.98	0.10	3.4
	*57	2.98	0.04	1.5	2.98	0.04	1.5
* Labs Eliminated - 9, 157							
Water Retention - Water (percent)							
	61	46.2	5.1	11.0	47.4	5.5	11.5
	*58	46.1	1.4	3.1	47.3	1.6	3.4
* Labs Eliminated - 74, 493, 692							
Water Retention - Initial Flow (percent)							
	62	110	2.5	2.3	109	5.0	4.6
	*61	110	2.5	2.3	109	2.6	2.4
* Labs Eliminated - 157							
Water Retention - Final Flow (percent)							
	61	90	5.8	6.4	87	6.4	7.3
	*60	91	4.7	5.2	87	6.0	6.9
* Labs Eliminated - 157							

CCRL PROFICIENCY SAMPLE PROGRAM
Masonry Cement Proficiency Samples No. 71 and No. 72

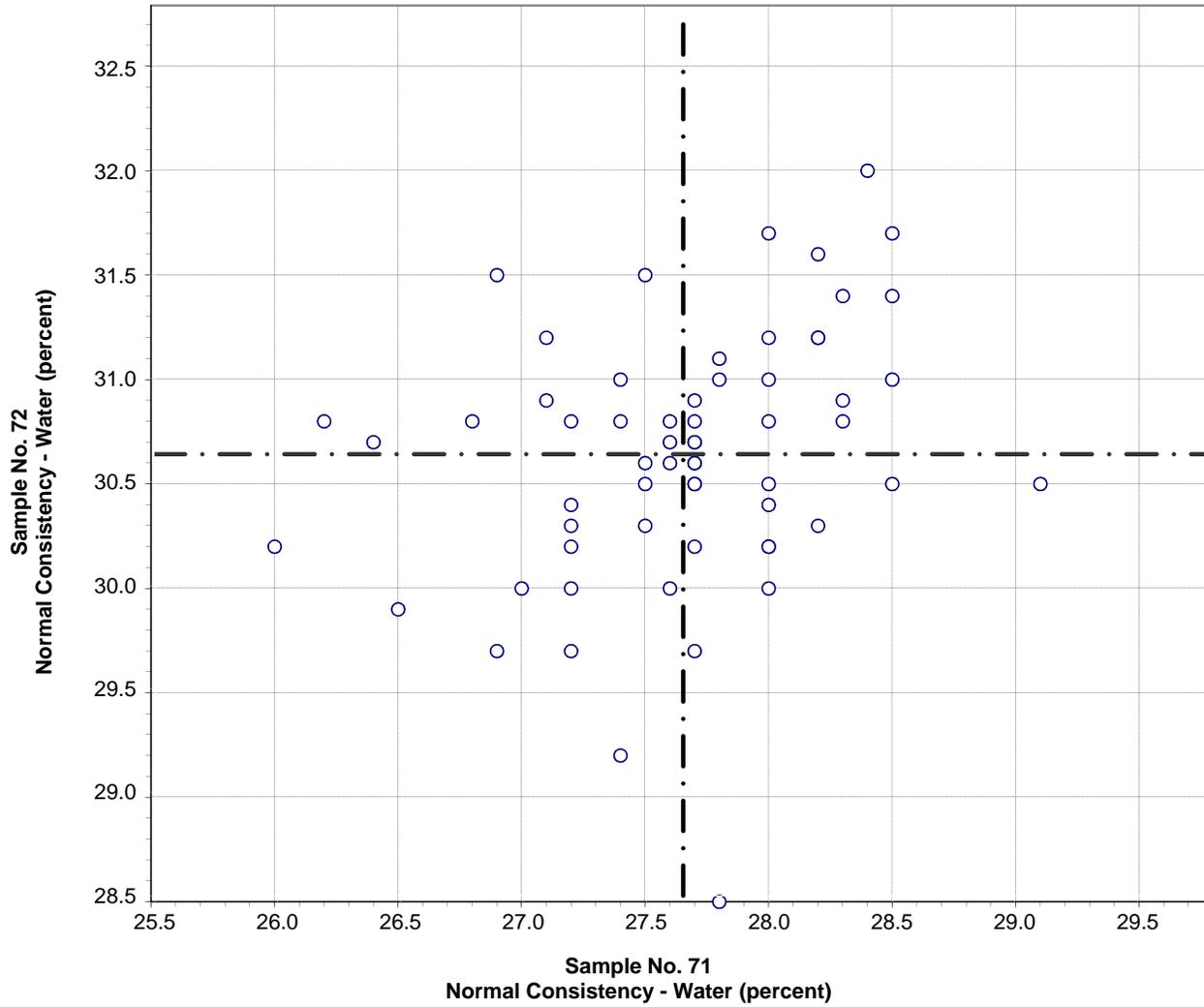
Final Report – October 9, 2013

SUMMARY OF RESULTS

Test (unit)	Sample No.71				Sample No. 72		
	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Water Retention Value (percent)							
	60	83	3.7	4.5	80	5.4	6.8
	*59	83	3.7	4.5	80	5.0	6.2

* Labs Eliminated - 354

**CCRL Proficiency Sample Program
Normal Consistency - Water
MASONRY CEMENT Samples No. 71 and No. 72**



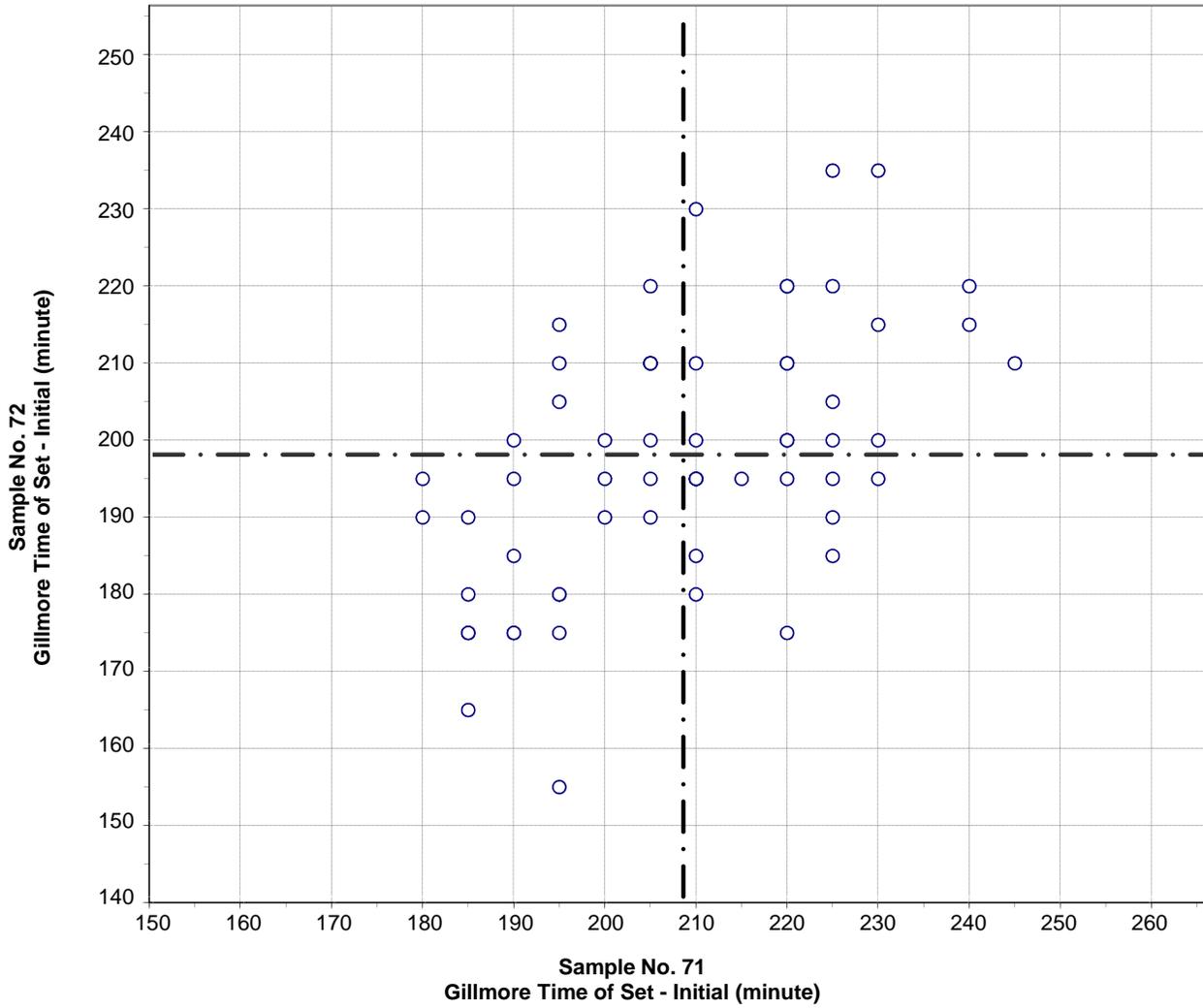
Test No. 110 Normal Consistency - Water 62 Points

Sample No. 71 Ave 27.6 S.D. 0.59 C.V. 2.1

Sample No. 72 Ave 30.6 S.D. 0.62 C.V. 2.0

Labs Eliminated: 103, 692

**CCRL Proficiency Sample Program
Gillmore Time of Set - Initial
MASONRY CEMENT Samples No. 71 and No. 72**



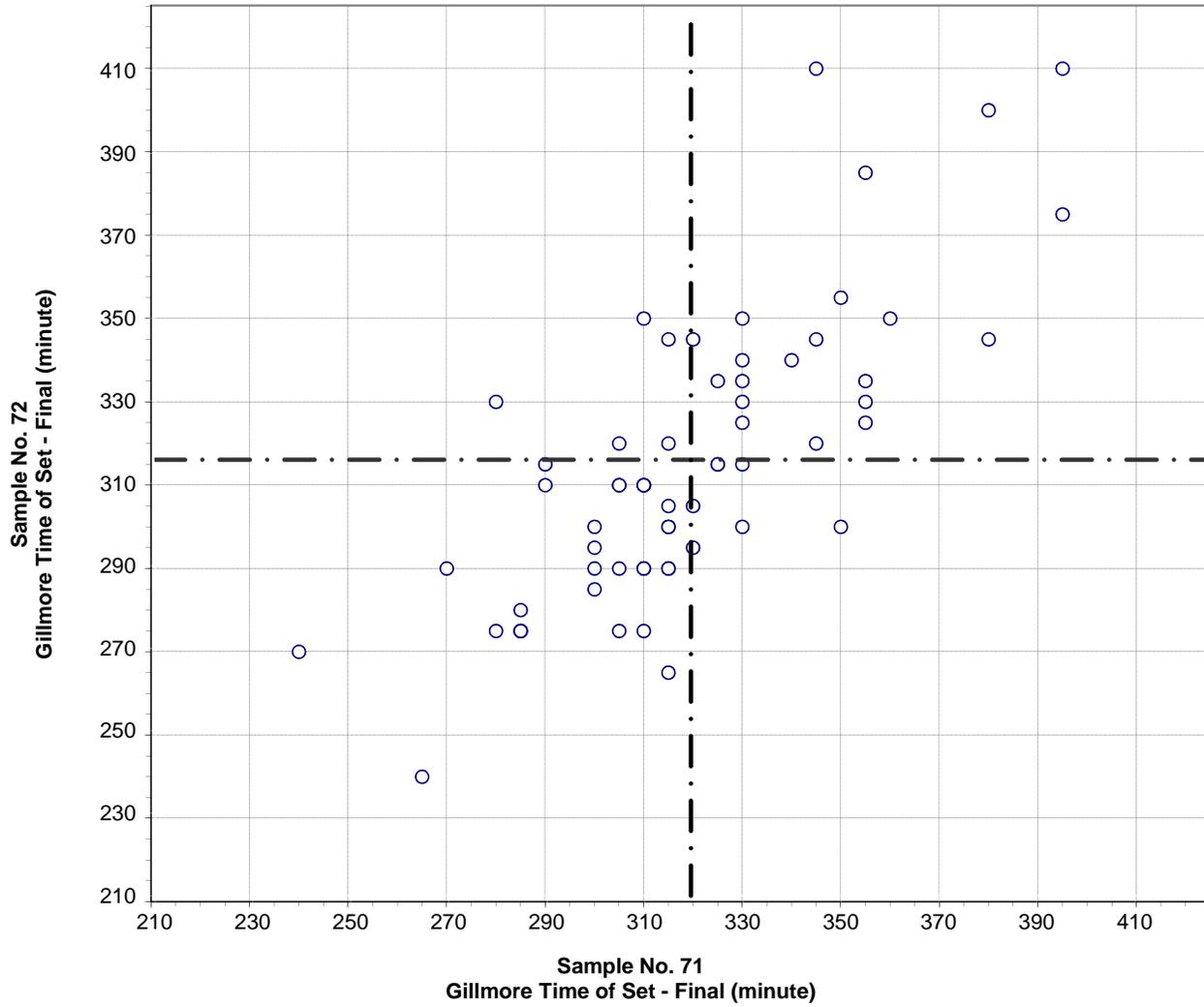
Test No. 130 Gillmore Time of Set - Initial 60 Points

Sample No. 71 Ave 208 S.D. 16 C.V. 7.9

Sample No. 72 Ave 198 S.D. 17 C.V. 8.5

Labs Eliminated: 103, 176, 692, 2938

**CCRL Proficiency Sample Program
Gillmore Time of Set - Final
MASONRY CEMENT Samples No. 71 and No. 72**

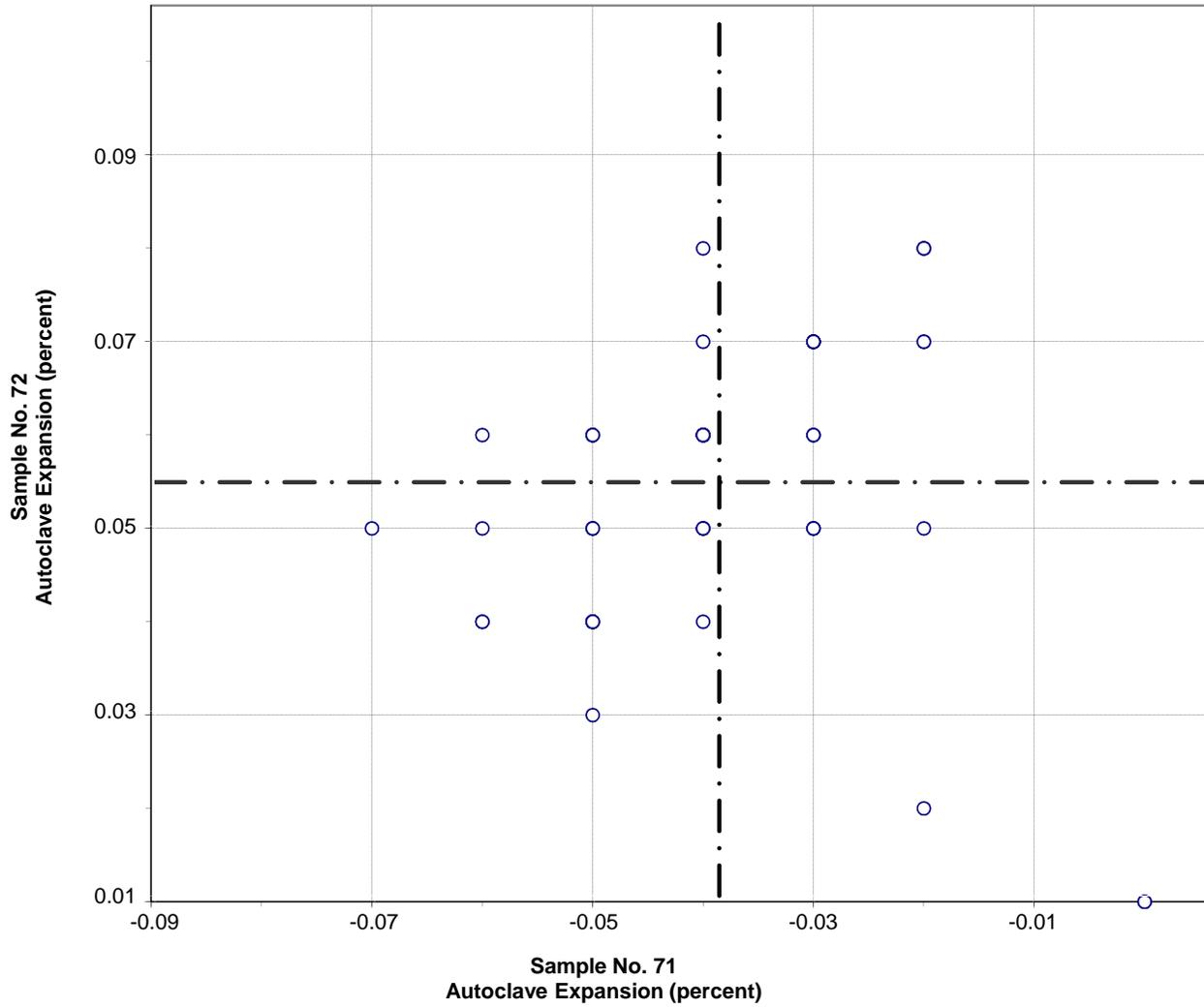


Test No. 140 Gillmore Time of Set - Final 63 Points

Sample No. 71 Ave 319 S.D. 30 C.V. 9.3
 Sample No. 72 Ave 316 S.D. 35 C.V. 11

Labs Eliminated: 2938

**CCRL Proficiency Sample Program
Autoclave Expansion
MASONRY CEMENT Samples No. 71 and No. 72**



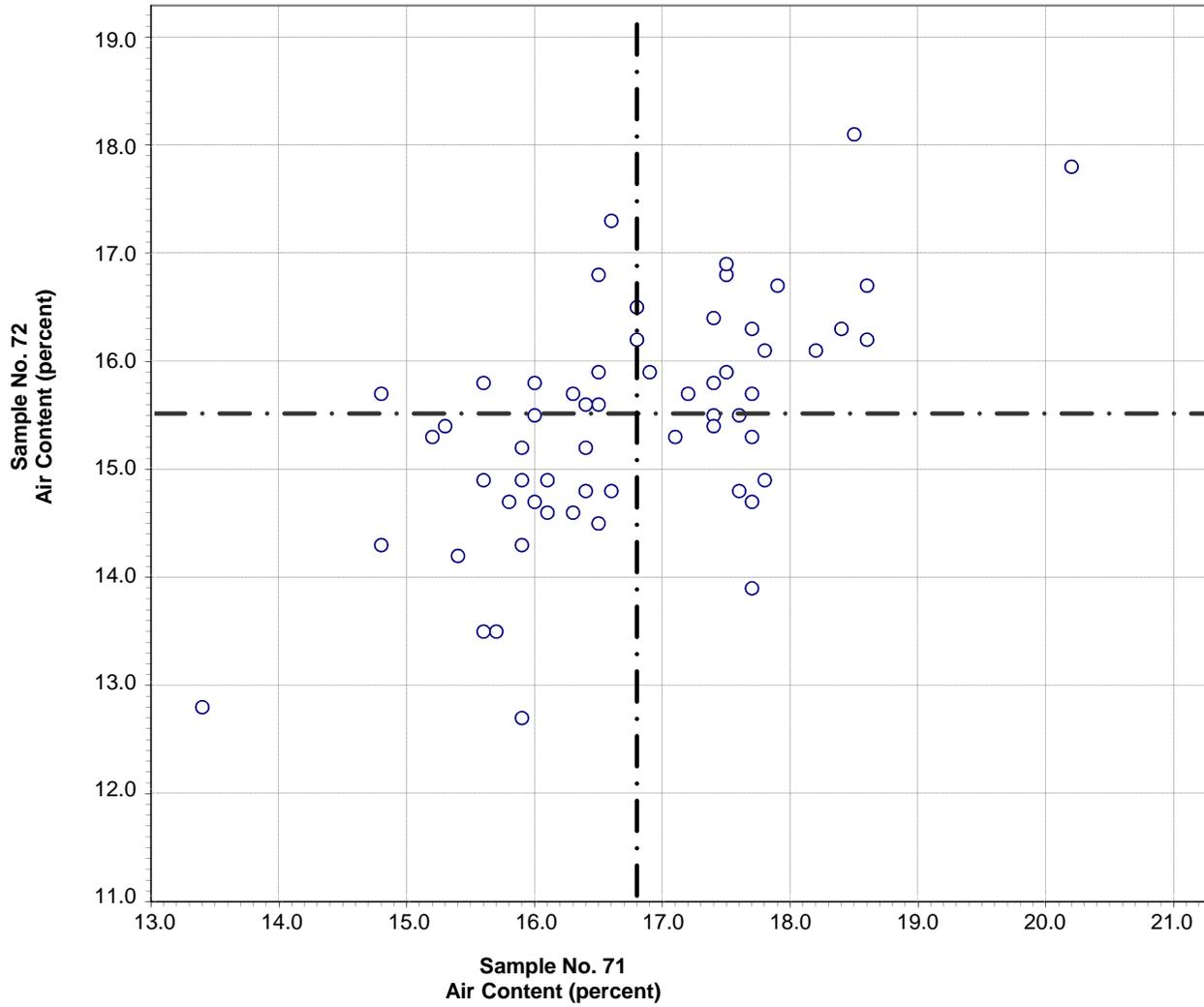
Test No. 160 Autoclave Expansion 57 Points

Sample No. 71 Ave -0.03 S.D. 0.01 C.V. 37

Sample No. 72 Ave 0.05 S.D. 0.02 C.V. 28

Labs Eliminated: 74, 93, 440, 692, 1576

**CCRL Proficiency Sample Program
Air Content
MASONRY CEMENT Samples No. 71 and No. 72**



Test No. 170 Air Content 59 Points

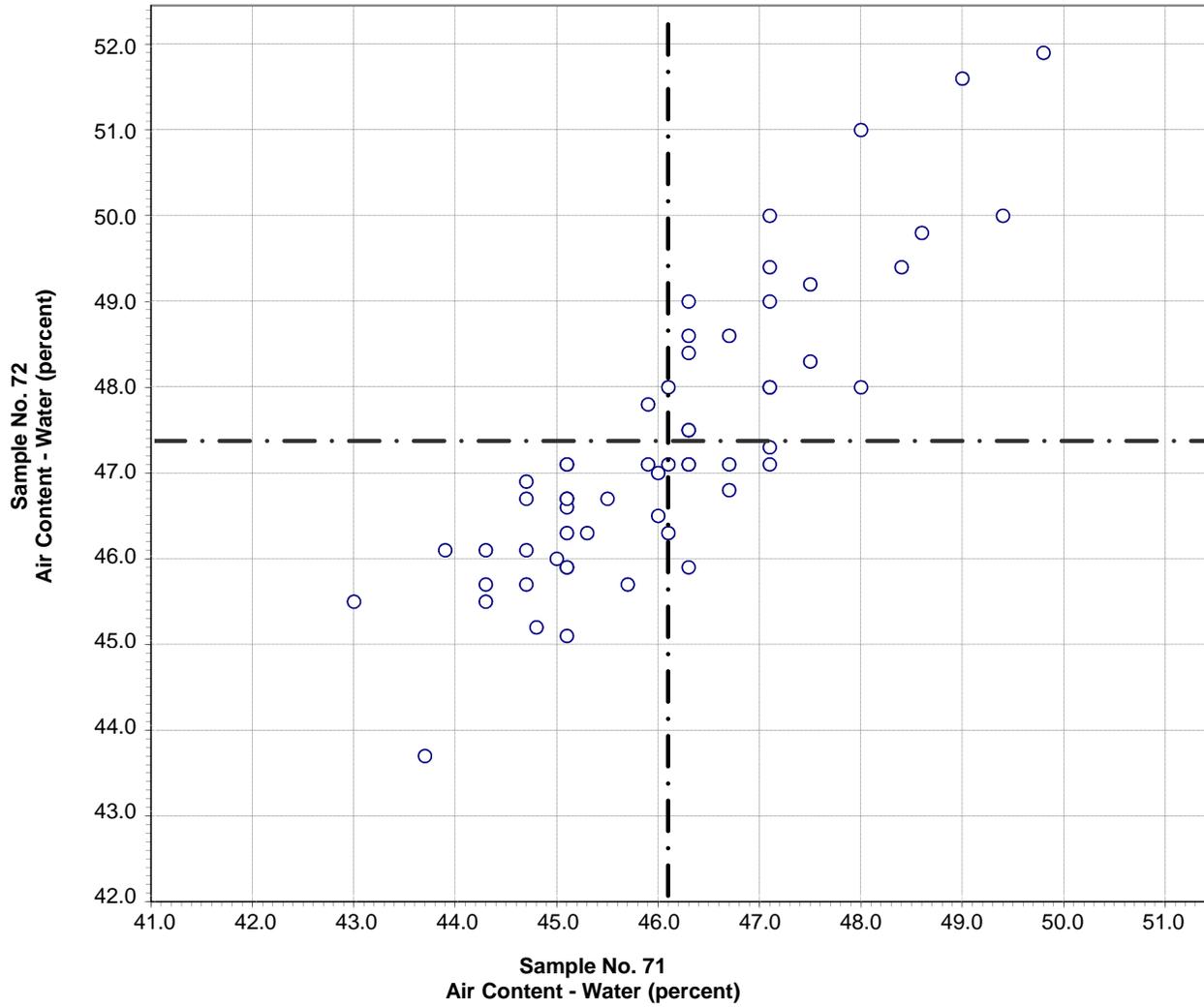
Sample No. 71 Ave 16.8 S.D. 1.2 C.V. 7.0

Sample No. 72 Ave 15.5 S.D. 1.2 C.V. 7.6

Labs Eliminated: 54, 103, 698

Labs off Diagram: 52

**CCRL Proficiency Sample Program
Air Content - Water
MASONRY CEMENT Samples No. 71 and No. 72**

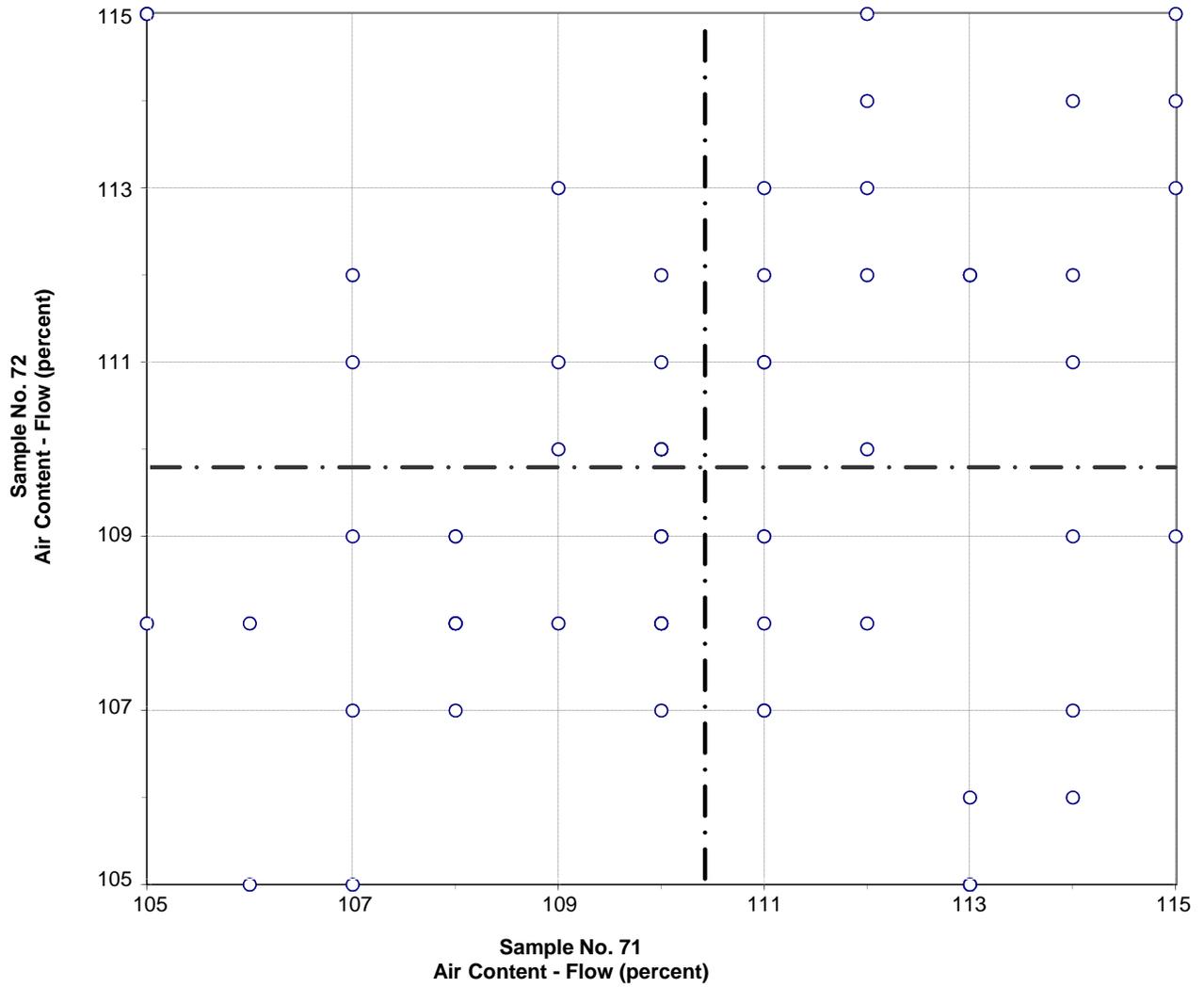


Test No. 180 Air Content - Water 58 Points

Sample No. 71 Ave 46.1 S.D. 1.4 C.V. 3.1
 Sample No. 72 Ave 47.4 S.D. 1.6 C.V. 3.5

Labs Eliminated: 74, 157, 159, 493

**CCRL Proficiency Sample Program
Air Content - Flow
MASONRY CEMENT Samples No. 71 and No. 72**

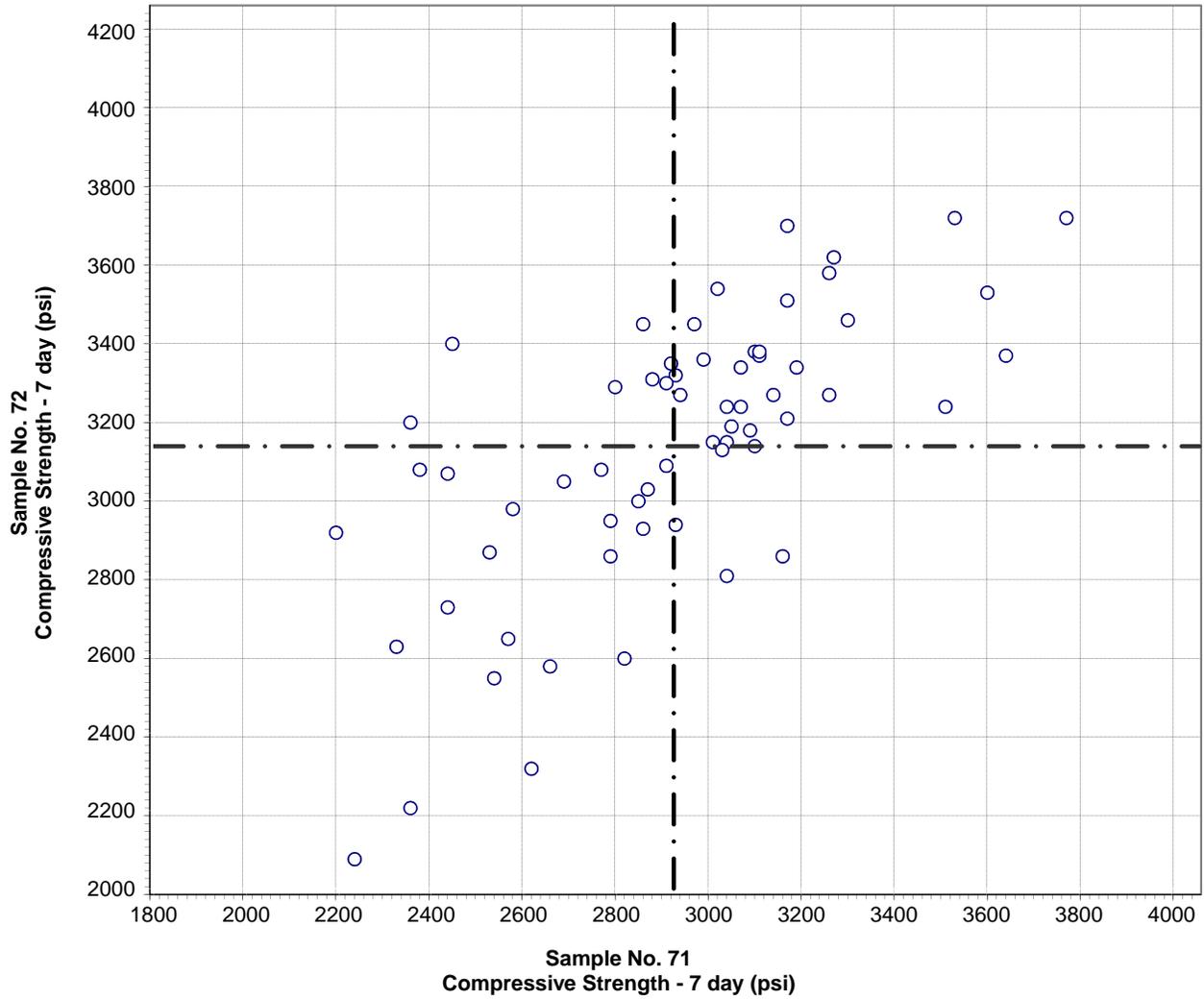


Test No. 190 Air Content - Flow 62 Points

Sample No. 71 Ave 110 S.D. 2.7 C.V. 2.4
 Sample No. 72 Ave 110 S.D. 2.7 C.V. 2.5

Labs Eliminated: 139

**CCRL Proficiency Sample Program
Compressive Strength - 7 day
MASONRY CEMENT Samples No. 71 and No. 72**



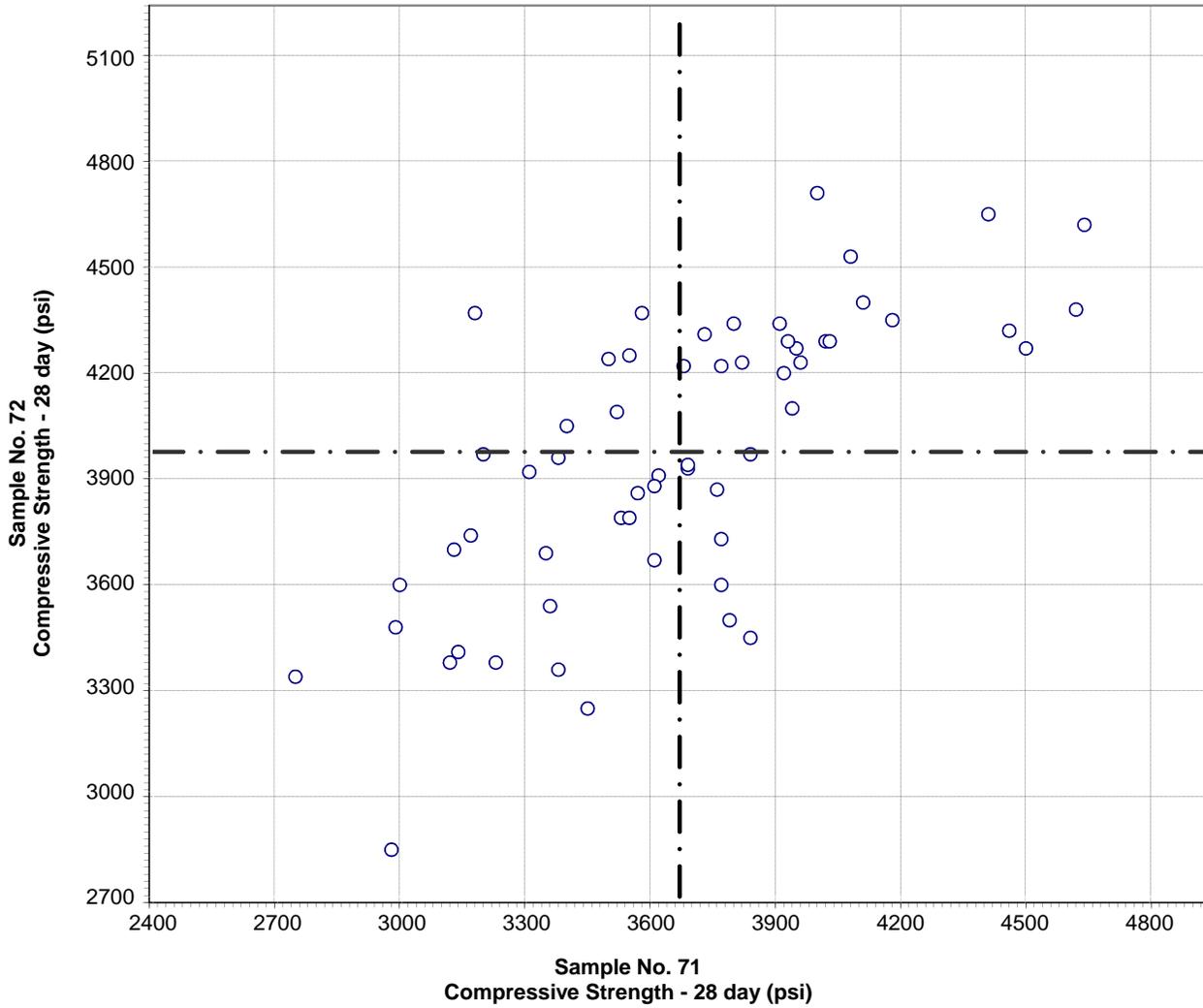
Test No. 210 Compressive Strength - 7 day 63 Points

Sample No. 71 Ave 2924 S.D. 345 C.V. 12

Sample No. 72 Ave 3136 S.D. 351 C.V. 11

Labs Eliminated: 9, 3690

**CCRL Proficiency Sample Program
Compressive Strength - 28 day
MASONRY CEMENT Samples No. 71 and No. 72**

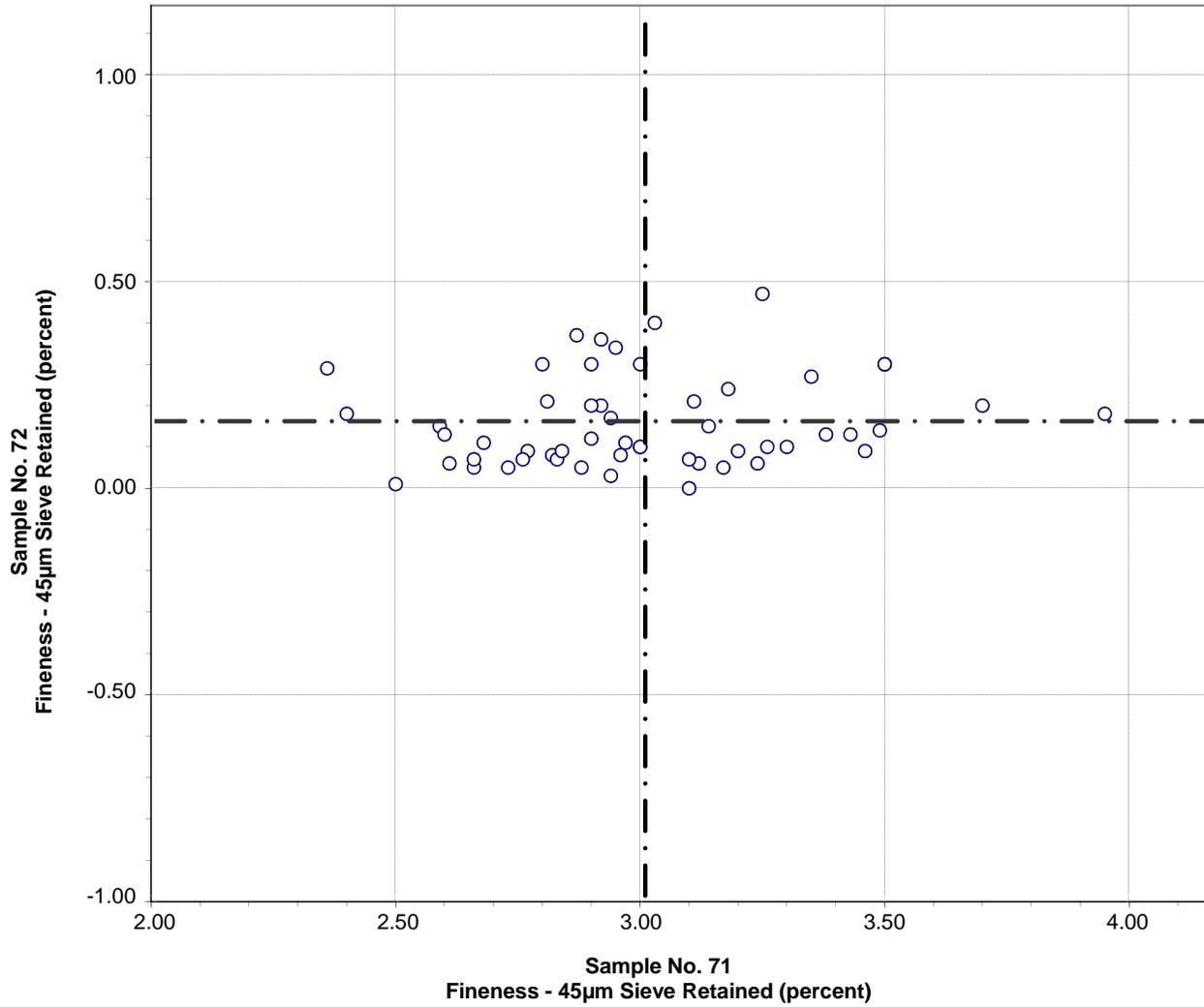


Test No. 211 Compressive Strength - 28 day 58 Points

Sample No. 71 Ave 3668 S.D. 419 C.V. 11
 Sample No. 72 Ave 3972 S.D. 403 C.V. 10

Labs Eliminated: 9, 56, 3352

CCRL Proficiency Sample Program
Fineness - 45 μ m Sieve Retained
MASONRY CEMENT Samples No. 71 and No. 72



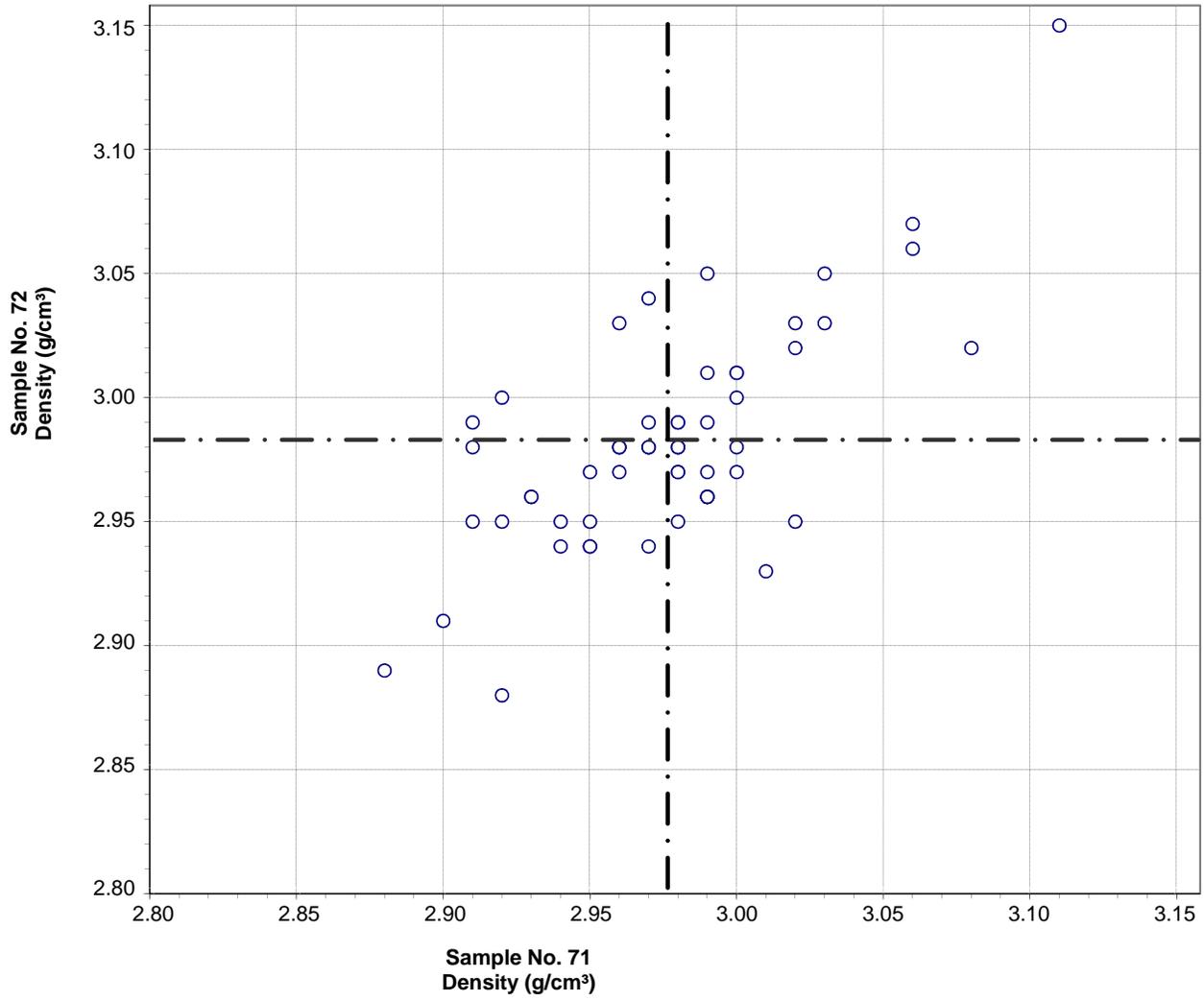
Test No. 281 Fineness - 45 μ m Sieve Retained 54 Points

Sample No. 71 Ave 3.01 S.D. 0.32 C.V. 11

Sample No. 72 Ave 0.16 S.D. 0.11 C.V. 70

Labs Eliminated: 56, 142, 143, 151, 284, 407, 441, 605, 1576, 3368

**CCRL Proficiency Sample Program
Density
MASONRY CEMENT Samples No. 71 and No. 72**

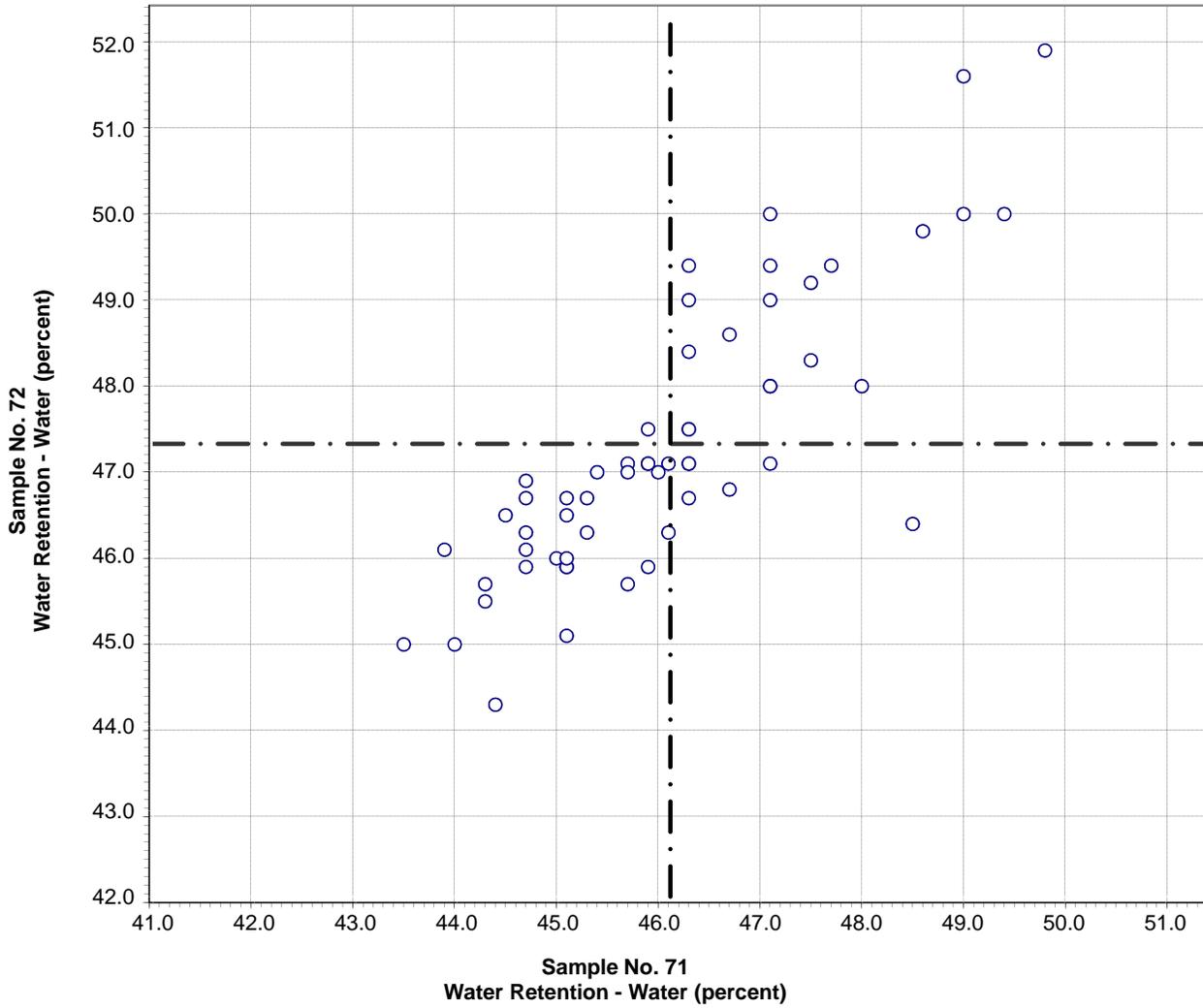


Test No. 310 Density 57 Points

Sample No. 71	Ave 2.98	S.D. 0.04	C.V. 1.5
Sample No. 72	Ave 2.98	S.D. 0.04	C.V. 1.5

Labs Eliminated: 9, 157

**CCRL Proficiency Sample Program
Water Retention - Water
MASONRY CEMENT Samples No. 71 and No. 72**

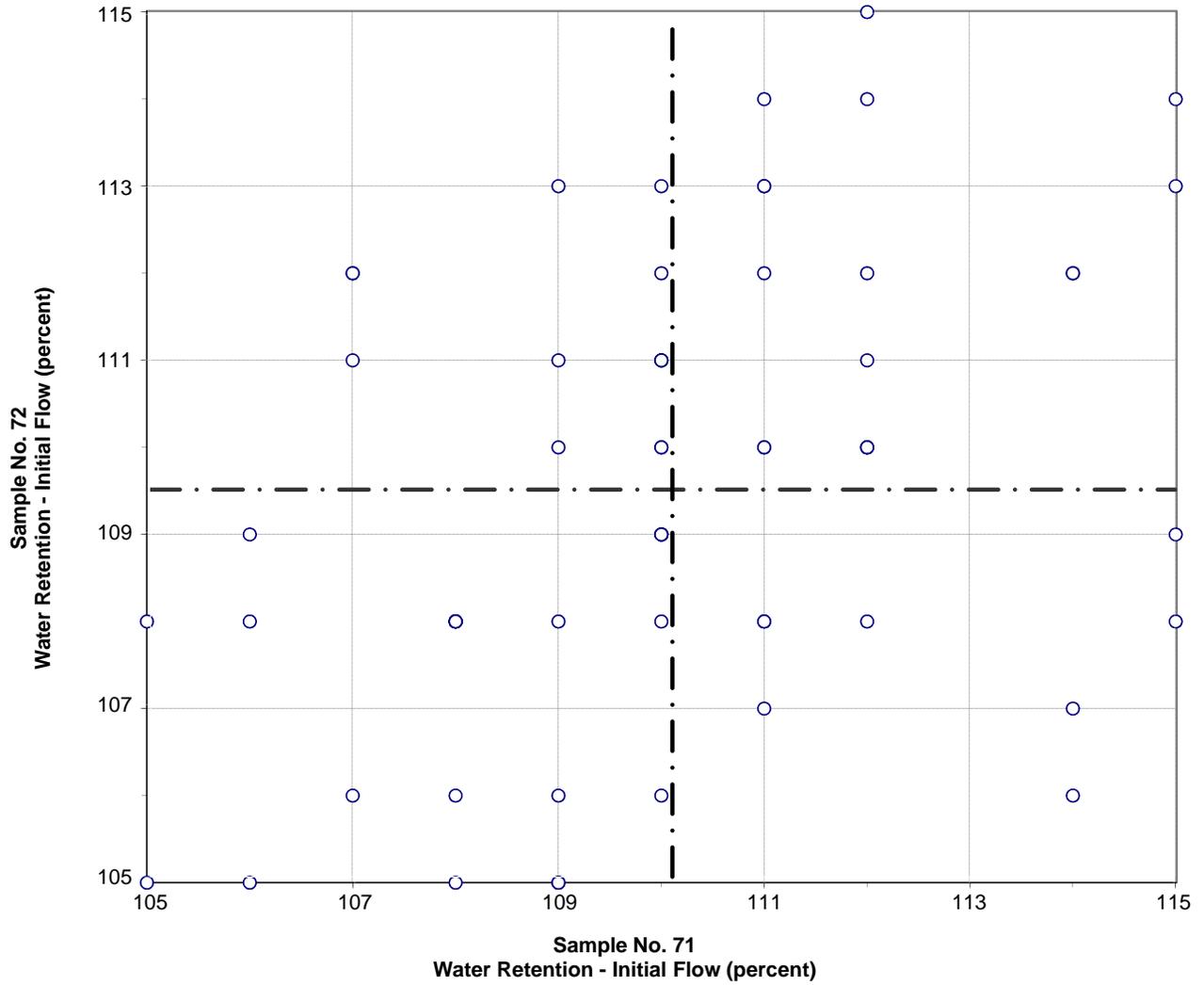


Test No. 330 Water Retention - Water 58 Points

Sample No. 71 Ave 46.1 S.D. 1.4 C.V. 3.1
 Sample No. 72 Ave 47.3 S.D. 1.6 C.V. 3.4

Labs Eliminated: 74, 493, 692

**CCRL Proficiency Sample Program
Water Retention - Initial Flow
MASONRY CEMENT Samples No. 71 and No. 72**

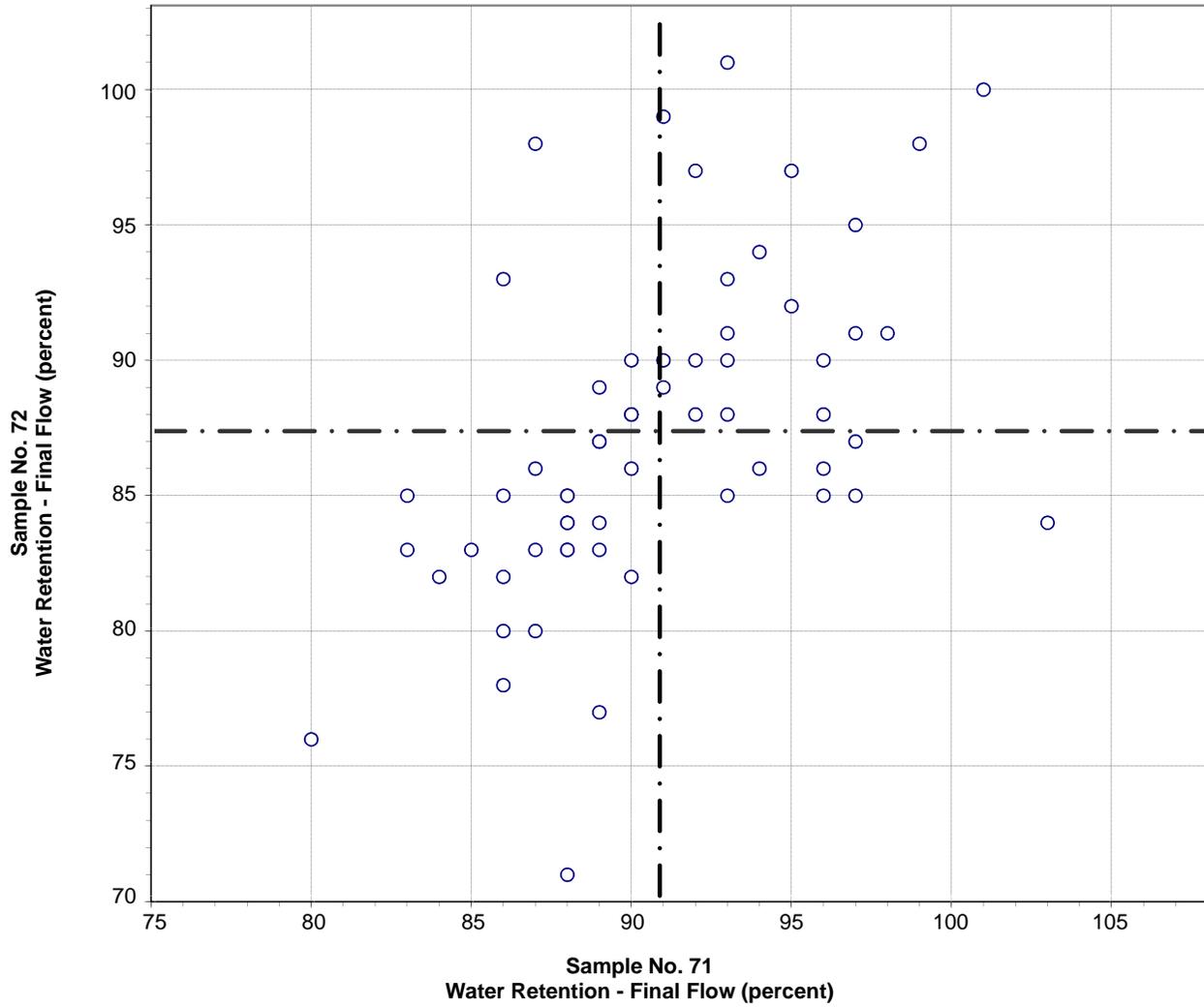


Test No. 331 Water Retention - Initial Flow 61 Points

Sample No. 71	Ave 110	S.D. 2.5	C.V. 2.3
Sample No. 72	Ave 109	S.D. 2.6	C.V. 2.4

Labs Eliminated: 157

**CCRL Proficiency Sample Program
Water Retention - Final Flow
MASONRY CEMENT Samples No. 71 and No. 72**

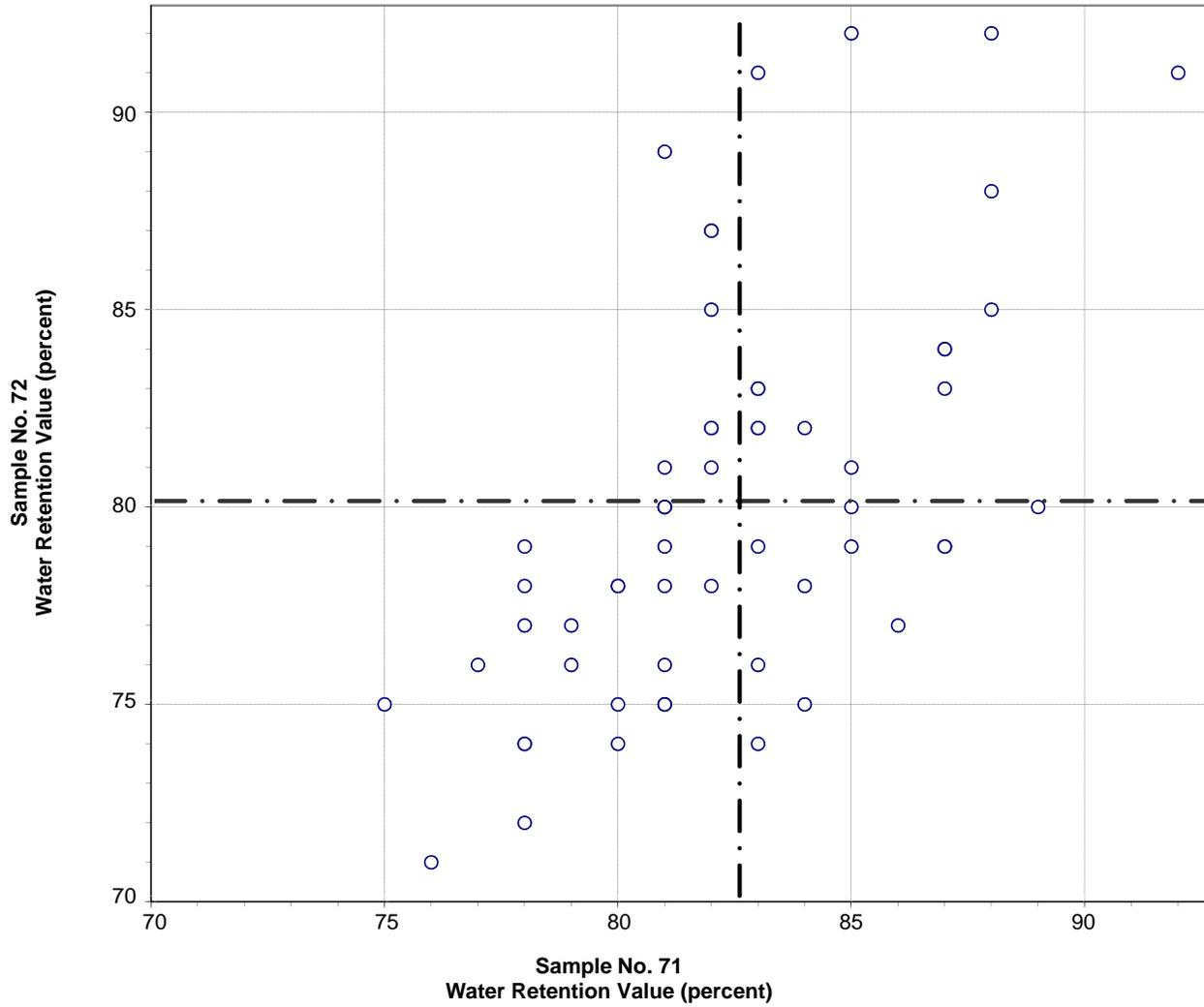


Test No. 332 Water Retention - Final Flow 60 Points

Sample No. 71	Ave 91	S.D. 4.7	C.V. 5.2
Sample No. 72	Ave 87	S.D. 6.0	C.V. 6.9

Labs Eliminated: 157

**CCRL Proficiency Sample Program
Water Retention Value
MASONRY CEMENT Samples No. 71 and No. 72**



Test No. 333 Water Retention Value 58 Points

Sample No. 71 Ave 83 S.D. 3.7 C.V. 4.5

Sample No. 72 Ave 80 S.D. 5.0 C.V. 6.2

Labs Eliminated: 354

Labs off Diagram: 493