

**CEMENT AND CONCRETE REFERENCE LABORATORY**  
**PROFICIENCY SAMPLE PROGRAM**

**Final Report**  
**Masonry Cement Proficiency Samples**  
**Number 61 and Number 62**

October 2008



October 29, 2008

**To: Participants in the CCRL Masonry Cement Proficiency Sample Program**

**SUBJECT: Final Report on Masonry Cement Proficiency Samples No. 61 and No. 62**

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 August 2008. Masonry Cement Samples No 61 and No. 62 were ASTM C91 Type M 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 2009.

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. 61 and No. 62**

This letter, 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 August 2008. 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 62<sup>nd</sup> 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. 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.

<b>Ratings</b>	<b>Range (Number of Standard Deviations)</b>	<b>Number (Per 100) of Laboratories achieving the rating <sup>1</sup></b>
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 shows whether the result reported was greater or less than the average obtained.

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<sup>1</sup>Youden, W.J., "Statistical Aspects of the Cement Testing Program", Volume 59, *Proceedings of the 62<sup>nd</sup> 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 mortar and initial water retention flow. Mortar flows in the range of  $110 \pm 5$  are satisfactory, labs with flow values outside this range will be flagged as a “Labs Off Diagram” 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, that 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 done 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  $\pm 1$  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 may indicate strong evidence of bias in many cases.

CCRL PROFICIENCY SAMPLE PROGRAM  
Masonry Cement Proficiency Samples No. 61 and No. 62  
Final Report - October 28, 2008

SUMMARY OF RESULTS

Test		#Labs	Sample No. 61			Sample No. 62		
			Average	S.D.	C.V.	Average	S.D.	C.V.
N.C. Water	prcnt	63	27.9	0.50	1.80	25.1	0.39	1.55
Gillmore TS Initial	min	61	210	28.6	13.6	148	24.4	16.5
Gillmore TS Initial	min	* 60	209	28.5	13.6	146	21.5	14.7
Gillmore TS Final	min	61	346	42.9	12.4	268	44.7	16.7
Autoclave Expan	prcnt	60	0.04	0.053	126.8	-0.007	0.014	-204.2
Autoclave Expan	prcnt	* 55	0.04	0.018	45.5	-0.006	0.010	-166.2
Air Content	prcnt	62	16.9	1.6	9.36	17.4	19.1	109.87
Air Content	prcnt	* 60	16.8	1.4	8.59	14.9	1.3	8.62
AC Mortar, Water	prcnt	63	45.9	4.2	9.21	43.4	4.0	9.29
AC Mortar, Water	prcnt	* 60	44.8	1.3	2.80	42.5	1.0	2.42
AC Mortar, Flow	prcnt	63	110	3.6	3.22	110	4.8	4.31
AC Mortar, Flow	prcnt	* 62	111	2.4	2.21	111	2.8	2.50
Comp Str, 7 day	psi	63	2756	391.1	14.2	2851	323.5	11.3
Comp Str, 7 day	psi	* 60	2713	336.0	12.38	2807	262.1	9.34
Comp Str, 28 day	psi	60	3462	536.7	15.5	3546	418.9	11.8
Comp Str, 28 day	psi	* 57	3401	466.4	13.72	3484	324.8	9.32

CONTINUED ON NEXT PAGE

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

Gillmore TS - Initial	1466
Autoclave Expansion	64 218 692 1379 1936
Air Content	52 146
AC Mortar - Water	159 103 218
AC Mortar - Flow	103
Comp Strength, 7 day	244 176 500
Comp Strength, 28 day	244 176 500

CCRL PROFICIENCY SAMPLE PROGRAM  
Masonry Cement Proficiency Samples No. 61 and No. 62  
Final Report - October 28, 2008

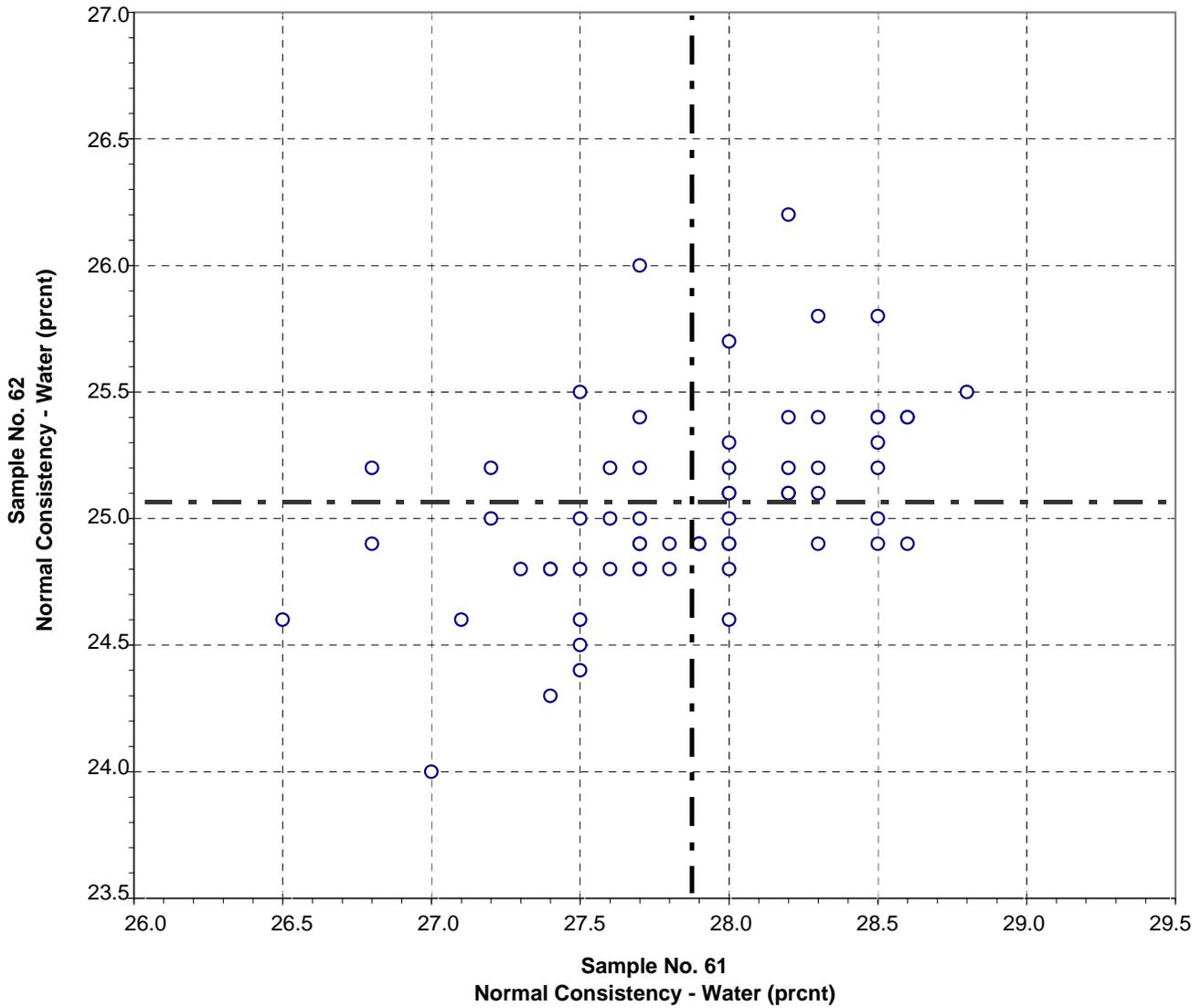
SUMMARY OF RESULTS

Test		#Labs	Sample No. 61			Sample No. 62		
			Average	S.D.	C.V.	Average	S.D.	C.V.
45µm Sieve	prcnt	62	2.44	0.84	34.3	3.11	0.75	24.0
45µm Sieve	prcnt *	59	2.39	0.38	16.1	3.08	0.42	13.8
Density	g/cm <sup>3</sup>	54	123.0	882.8	718	124.0	889.7	718
Density	g/cm <sup>3</sup> *	50	2.91	0.037	1.28	2.97	0.047	1.59
<b>WATER RETENTION</b>								
WR Mix Water	prcnt	59	45.3	3.1	6.95	43.0	3.0	6.91
WR Mix Water	prcnt *	57	44.9	1.2	2.74	42.6	1.0	2.41
WR Initial Flow	prcnt	60	110	2.5	2.30	110	2.5	2.29
WR Final Flow	prcnt	60	94	5.1	5.41	93	6.7	7.23
Water Retention	prcnt	60	85	4.3	5.05	84	5.5	6.56

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

Fineness - 45µm Sieve	162 181 413
Density	169 157 181 690
WR Mortar - Water	56 159

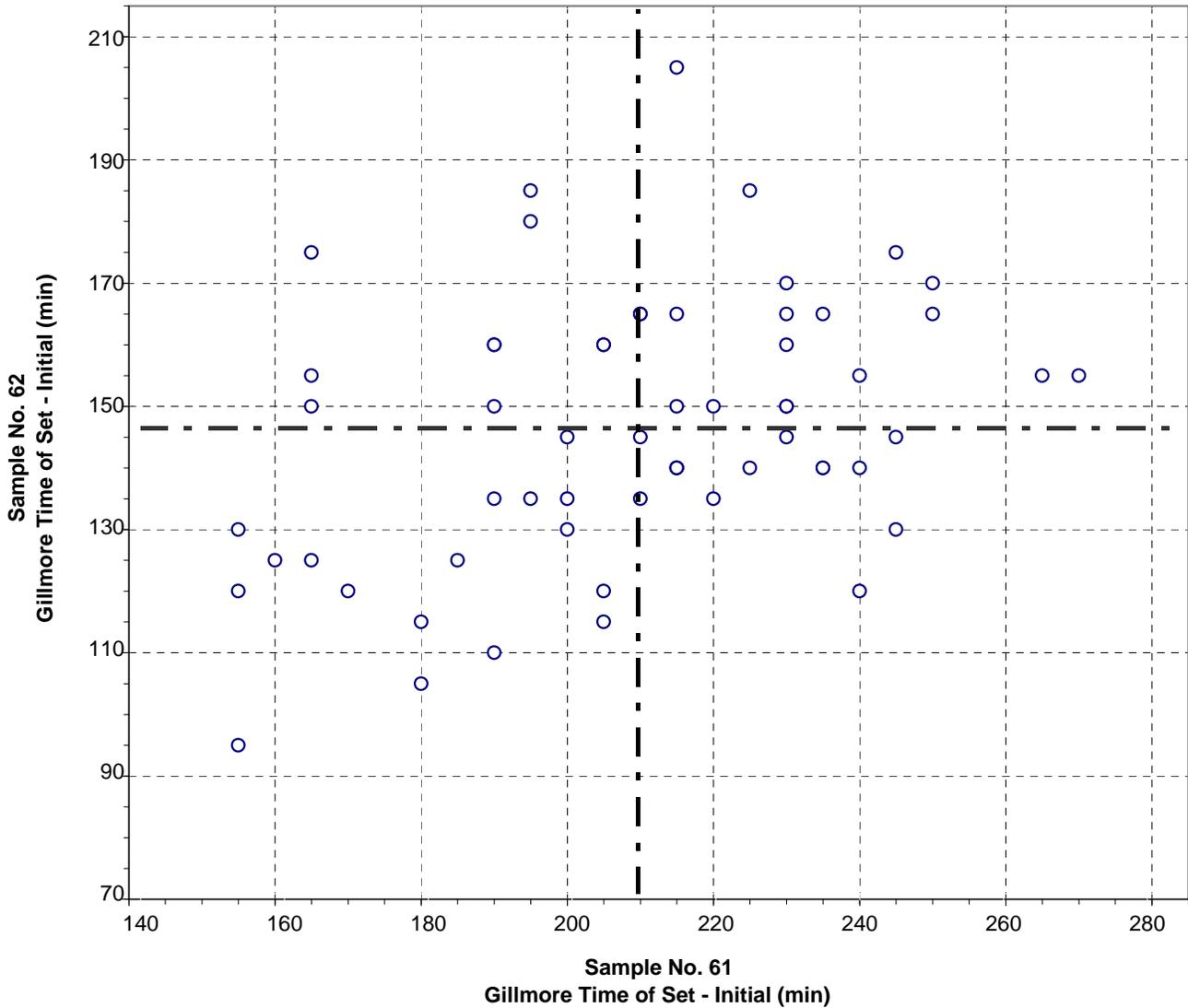
**CCRL Proficiency Sample Program**  
**Normal Consistency - Water**  
**MASONRY CEMENT Samples No. 61 and No. 62**



Test No. 110      Normal Consistency - Water      63 Points

Sample No. 61	Ave 27.9	S.D. 0.050	C.V. 1.80
Sample No. 62	Ave 25.1	S.D. 0.39	C.V. 1.55

**CCRL Proficiency Sample Program  
Gillmore Time of Set - Initial  
MASONRY CEMENT Samples No. 61 and No. 62**

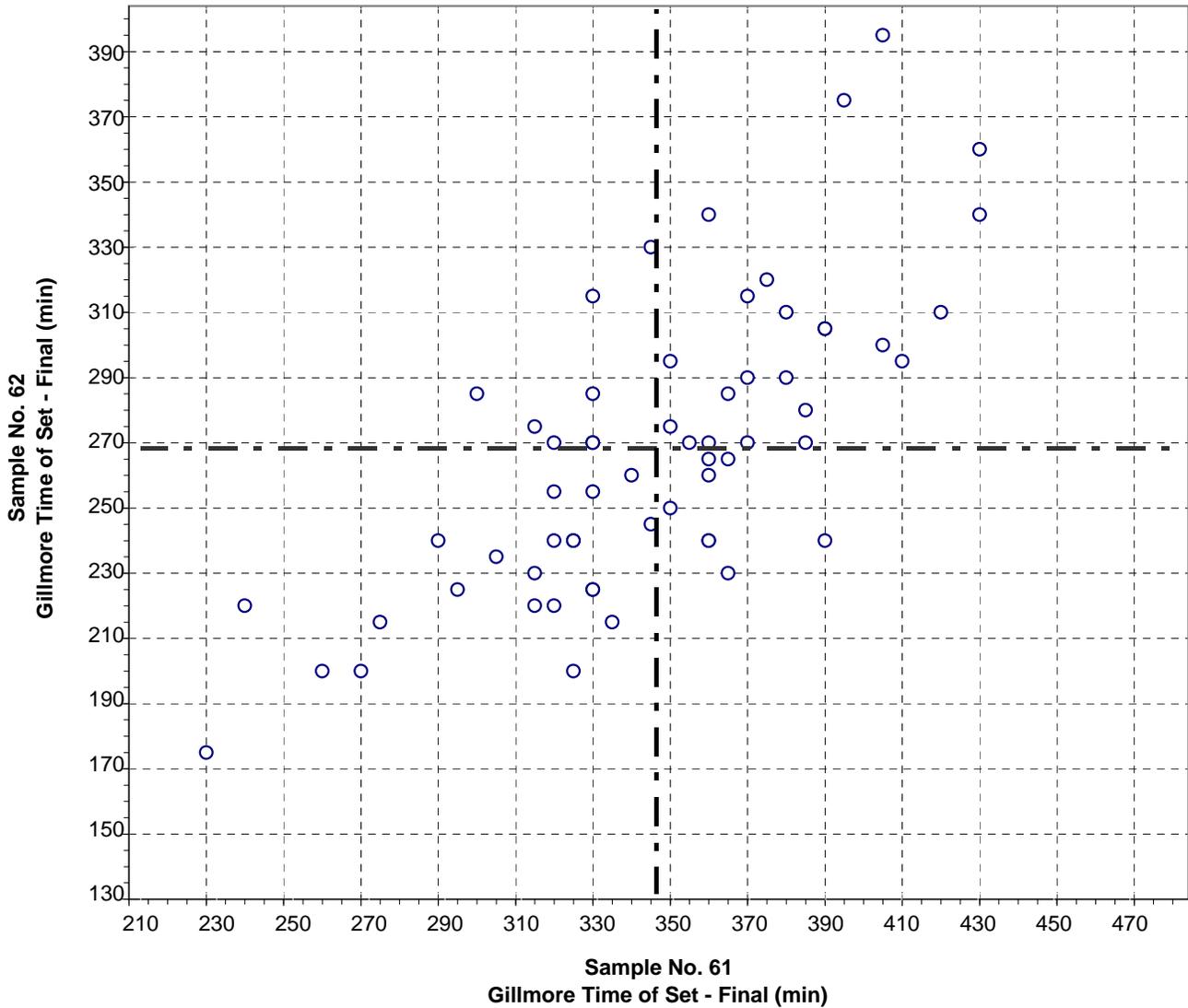


**Test No. 130      Gillmore Time of Set - Initial      60 Points**

Sample No. 61	Ave 209	S.D. 28.5	C.V. 13.6
Sample No. 62	Ave 146	S.D. 21.5	C.V. 14.7

Labs eliminated: 1466

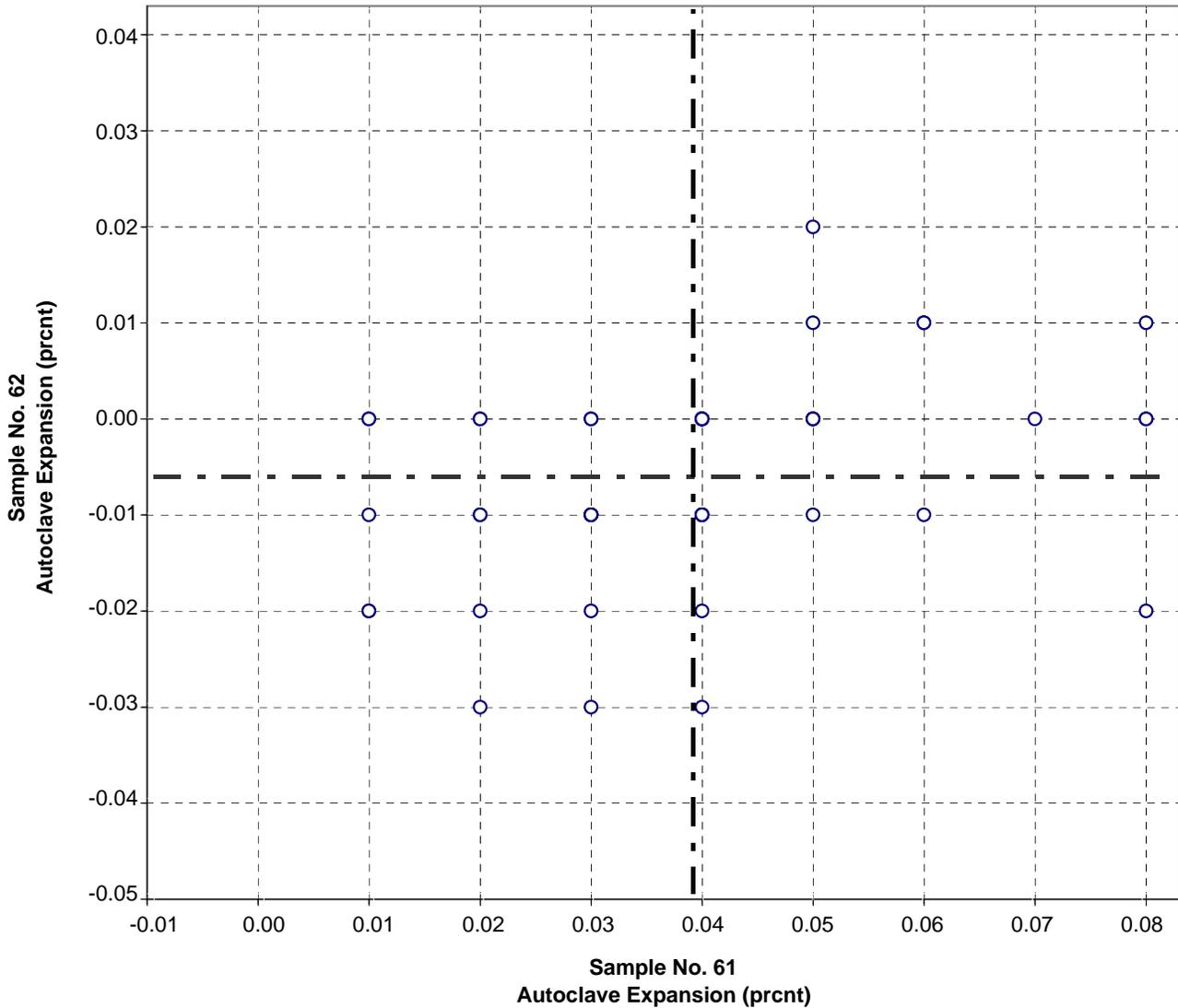
**CCRL Proficiency Sample Program**  
**Gillmore Time of Set - Final**  
**MASONRY CEMENT Samples No. 61 and No. 62**



Test No. 140      Gillmore Time of Set - Final      61 Points

Sample No. 61	Ave 346	S.D. 42.9	C.V. 12.4
Sample No. 62	Ave 268	S.D. 44.7	C.V. 16.7

**CCRL Proficiency Sample Program  
Autoclave Expansion  
MASONRY CEMENT Samples No. 61 and No. 62**

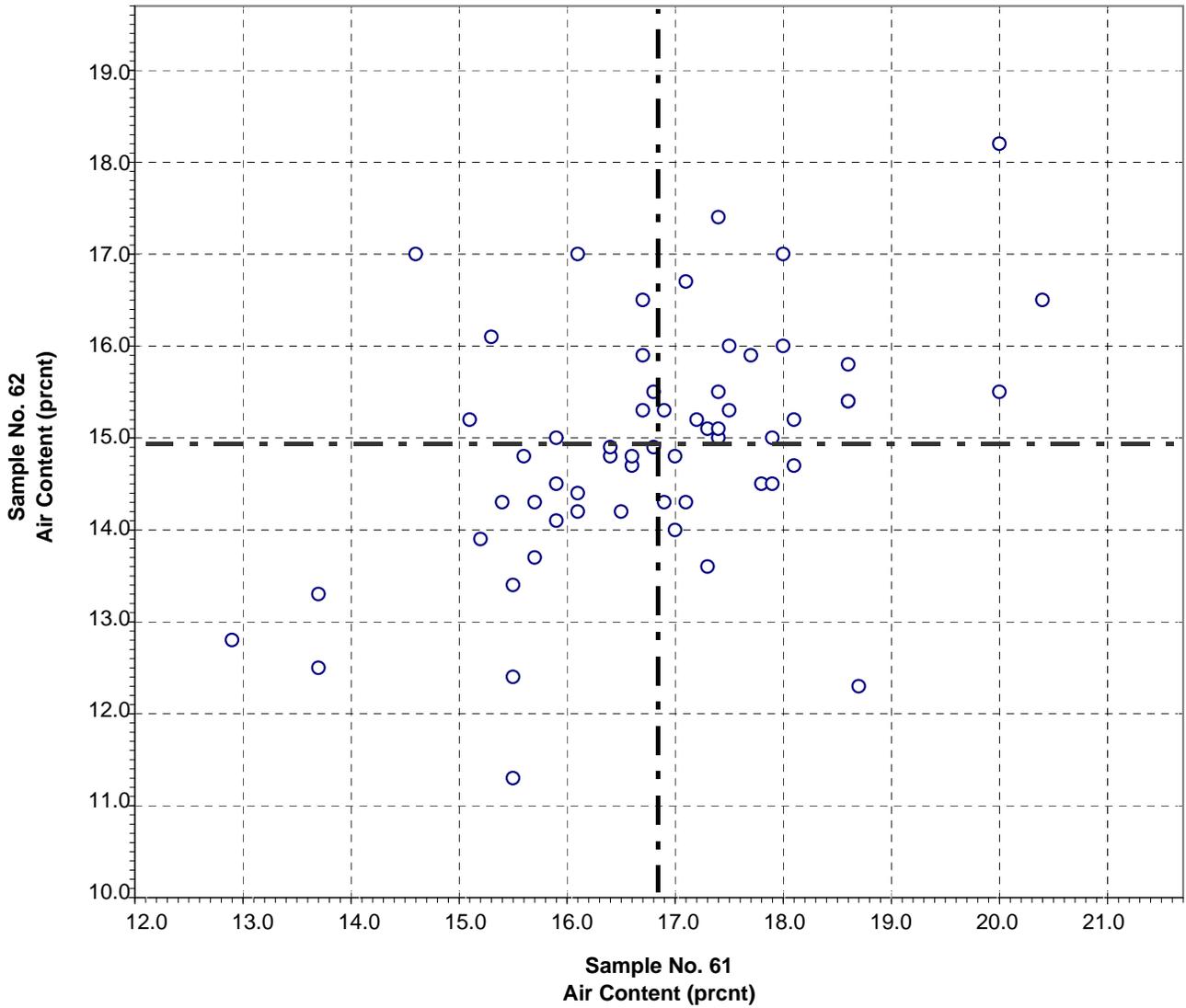


**Test No. 160      Autoclave Expansion      55 Points**

Sample No. 61    Ave 0.04    S.D. 0.018    C.V. 45.5  
 Sample No. 62    Ave -0.006    S.D. 0.010    C.V. -166.2

Labs eliminated: 64, 218, 692, 1379, 1936

**CCRL Proficiency Sample Program  
Air Content  
MASONRY CEMENT Samples No. 61 and No. 62**

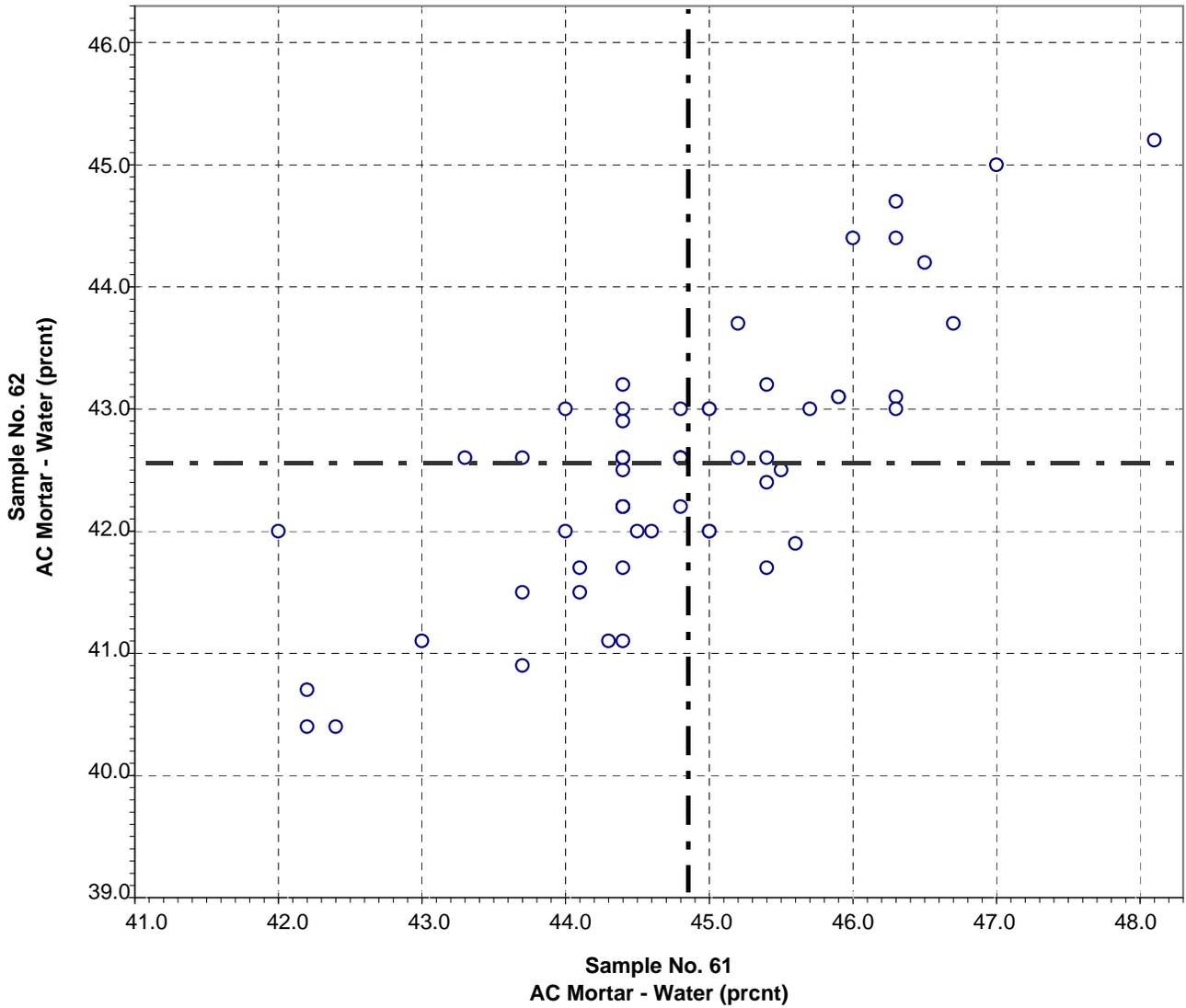


**Test No. 170      Air Content      60 Points**

Sample No. 61	Ave 16.8	S.D. 1.4	C.V. 8.59
Sample No. 62	Ave 14.9	S.D. 1.3	C.V. 8.62

Labs eliminated: 52, 146

**CCRL Proficiency Sample Program  
AC Mortar - Water  
MASONRY CEMENT Samples No. 61 and No. 62**



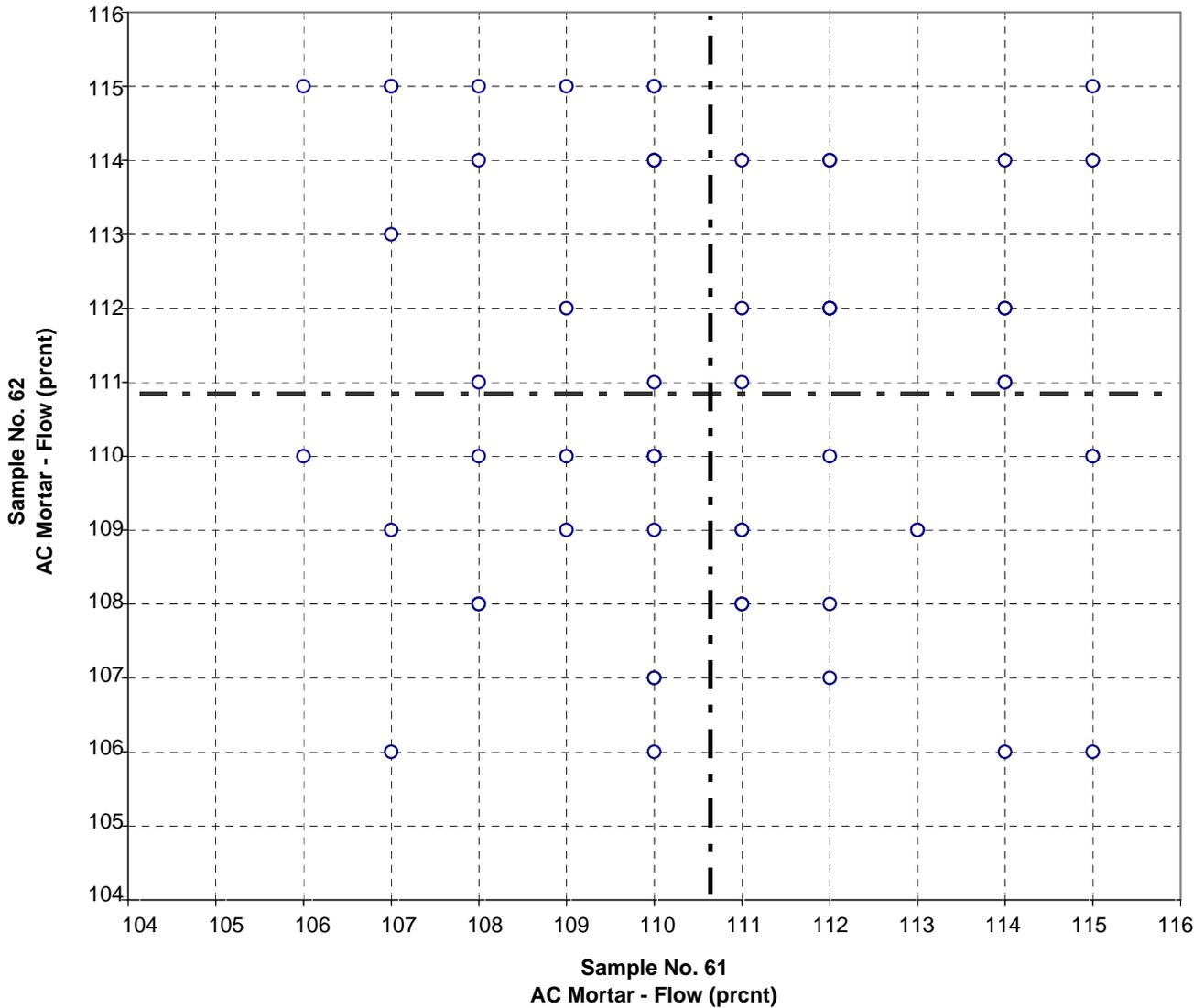
**Test No. 180      AC Mortar - Water      59 Points**

Sample No. 61    Ave 44.8    S.D. 1.3    C.V. 2.80  
 Sample No. 62    Ave 42.5    S.D. 1.0    C.V. 2.42

Labs eliminated: 159, 103, 218

Labs off Diagram: 1379

**CCRL Proficiency Sample Program  
AC Mortar - Flow  
MASONRY CEMENT Samples No. 61 and No. 62**

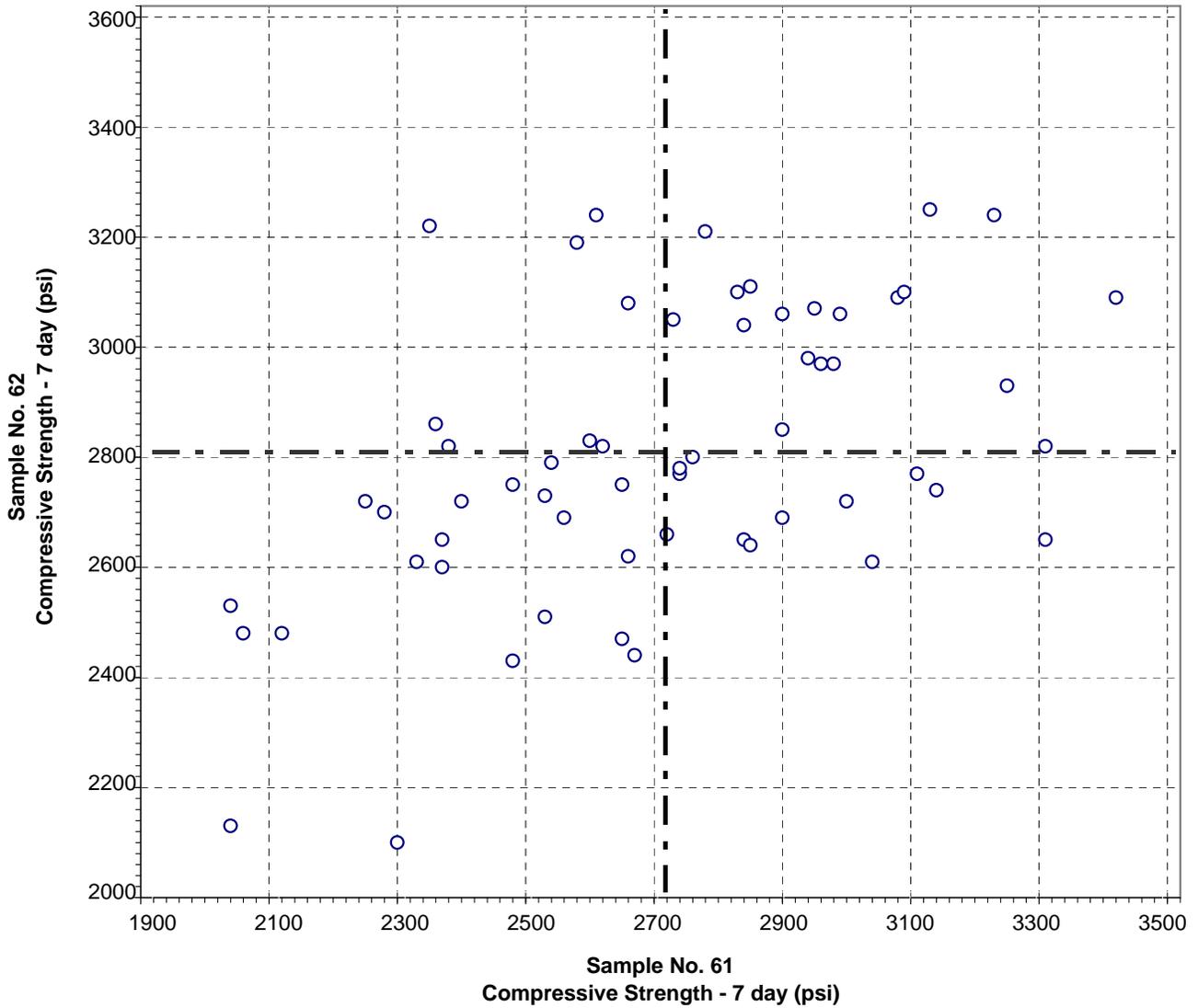


Test No. 190      AC Mortar - Flow      62 Points

Sample No. 61    Ave 111    S.D. 2.4    C.V. 2.21  
 Sample No. 62    Ave 111    S.D. 2.8    C.V. 2.50

Labs eliminated: 103

**CCRL Proficiency Sample Program  
Compressive Strength - 7 day  
MASONRY CEMENT Samples No. 61 and No. 62**



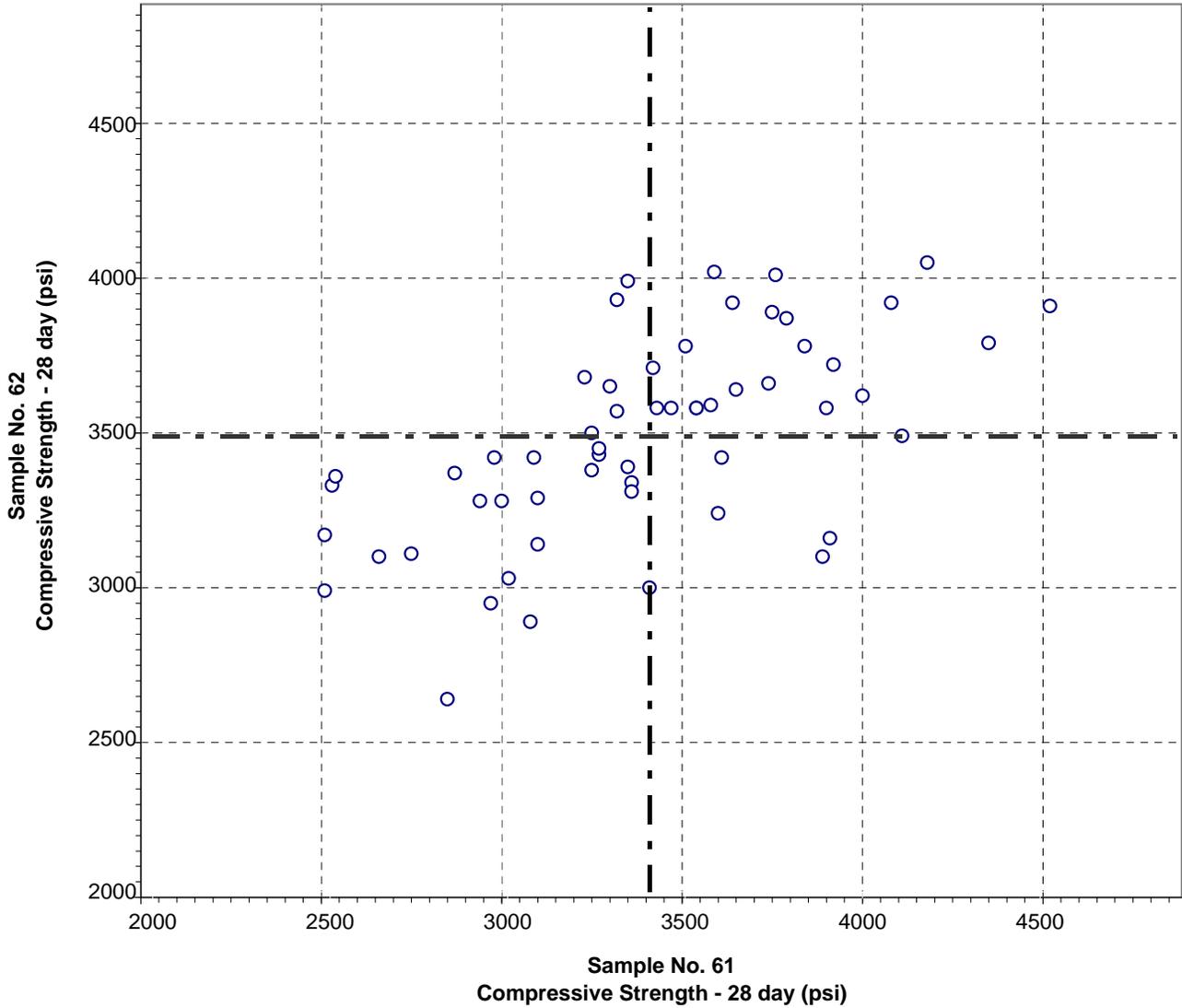
**Test No. 210      Compressive Strength - 7 day      60 Points**

Sample No. 61    Ave 2713    S.D. 336.0    C.V. 12.38

Sample No. 62    Ave 2807    S.D. 262.1    C.V. 9.34

Labs eliminated: 244, 176, 500

**CCRL Proficiency Sample Program  
Compressive Strength - 28 day  
MASONRY CEMENT Samples No. 61 and No. 62**



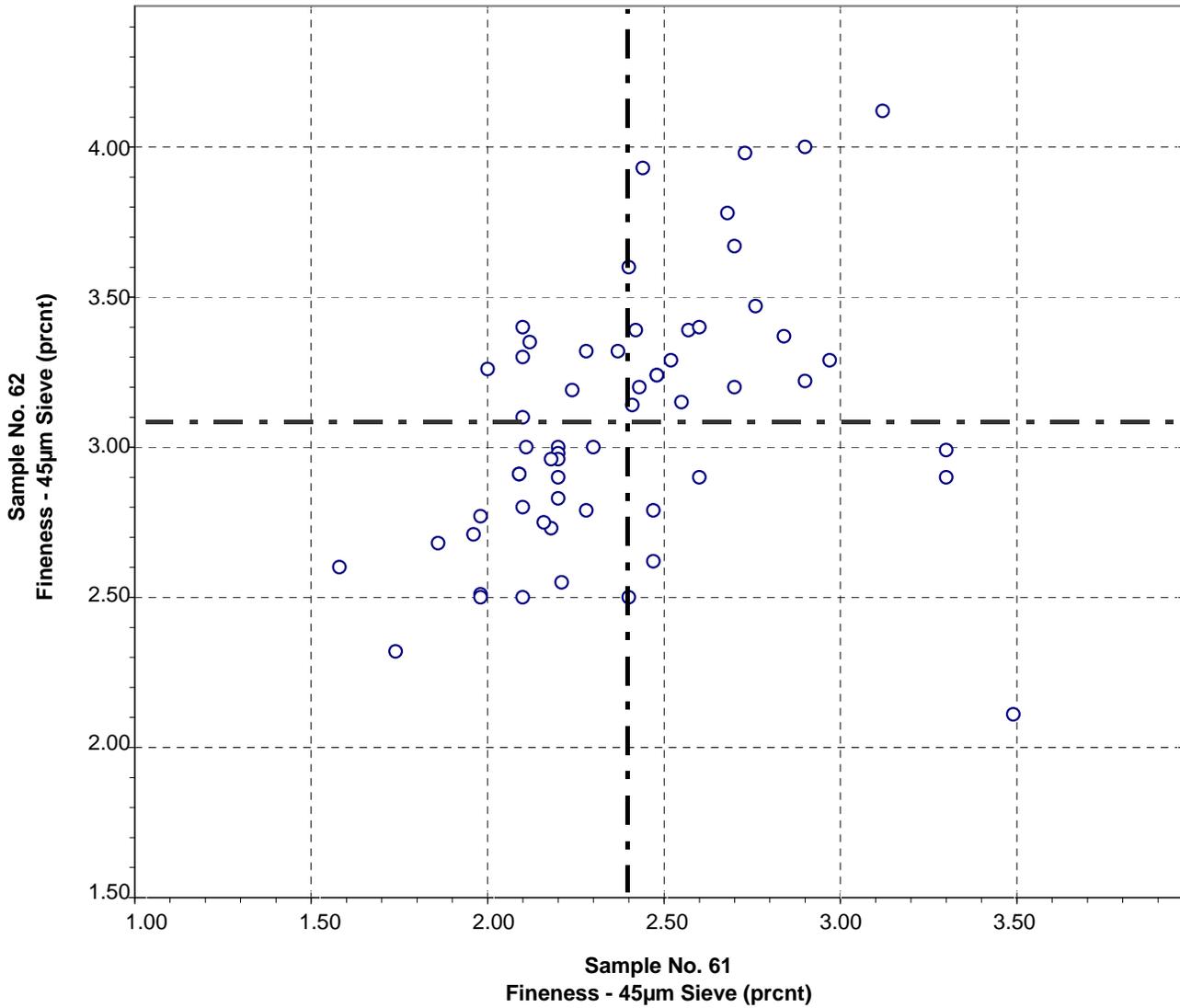
**Test No. 211      Compressive Strength - 28 day      57 Points**

Sample No. 61    Ave 3401    S.D. 466.4    C.V. 13.72

Sample No. 62    Ave 3484    S.D. 324.8    C.V. 9.32

Labs eliminated: 244, 176, 500

**CCRL Proficiency Sample Program  
Fineness - 45µm Sieve Retained  
MASONRY CEMENT Samples No. 61 and No. 62**



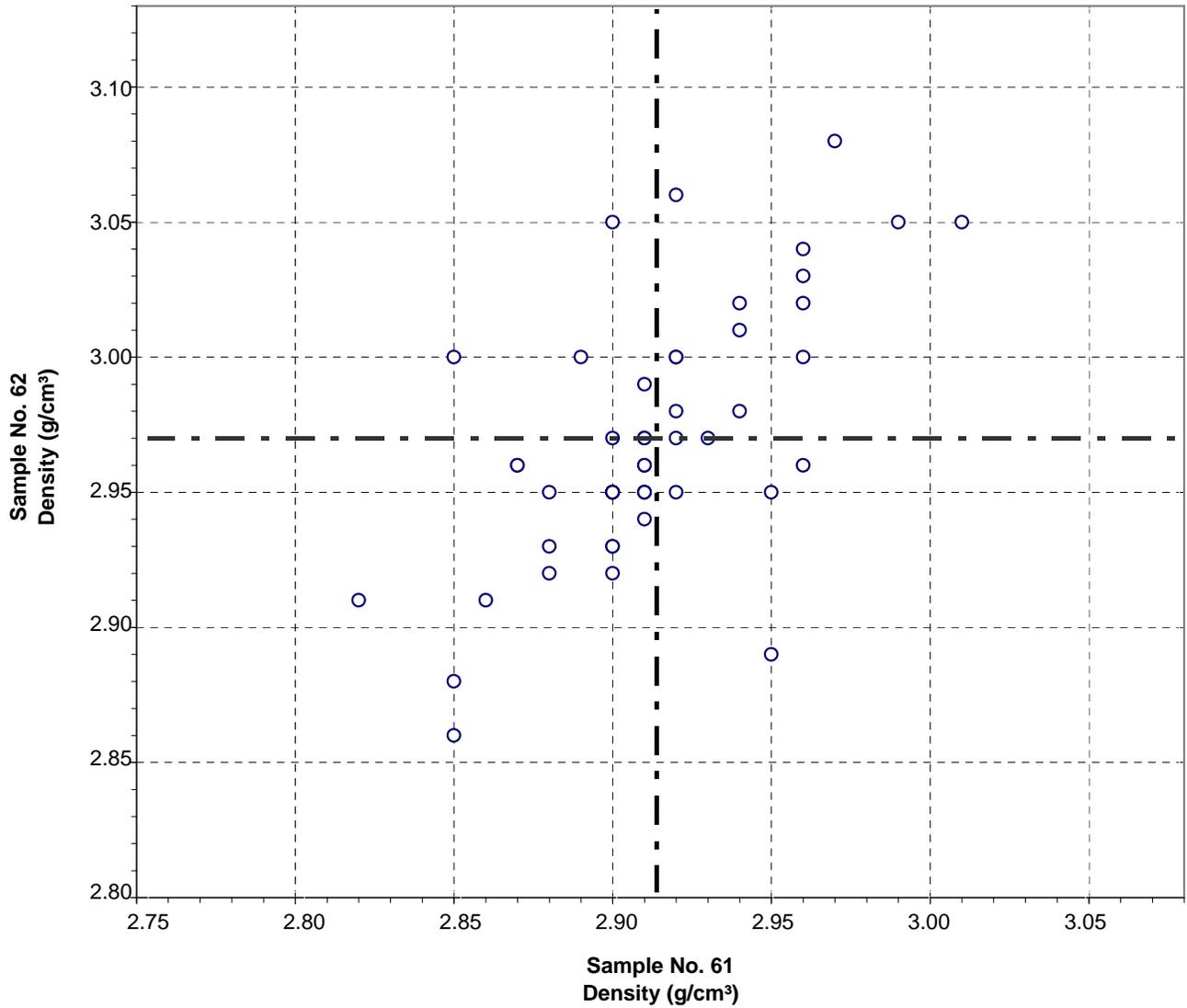
**Test No. 281      Fineness - 45µm Sieve Retained      59 Points**

Sample No. 61    Ave 2.39    S.D. 0.38    C.V. 16.1

Sample No. 62    Ave 3.08    S.D. 0.42    C.V. 13.8

Labs eliminated: 162, 181, 413

**CCRL Proficiency Sample Program  
Density  
MASONRY CEMENT Samples No. 61 and No. 62**

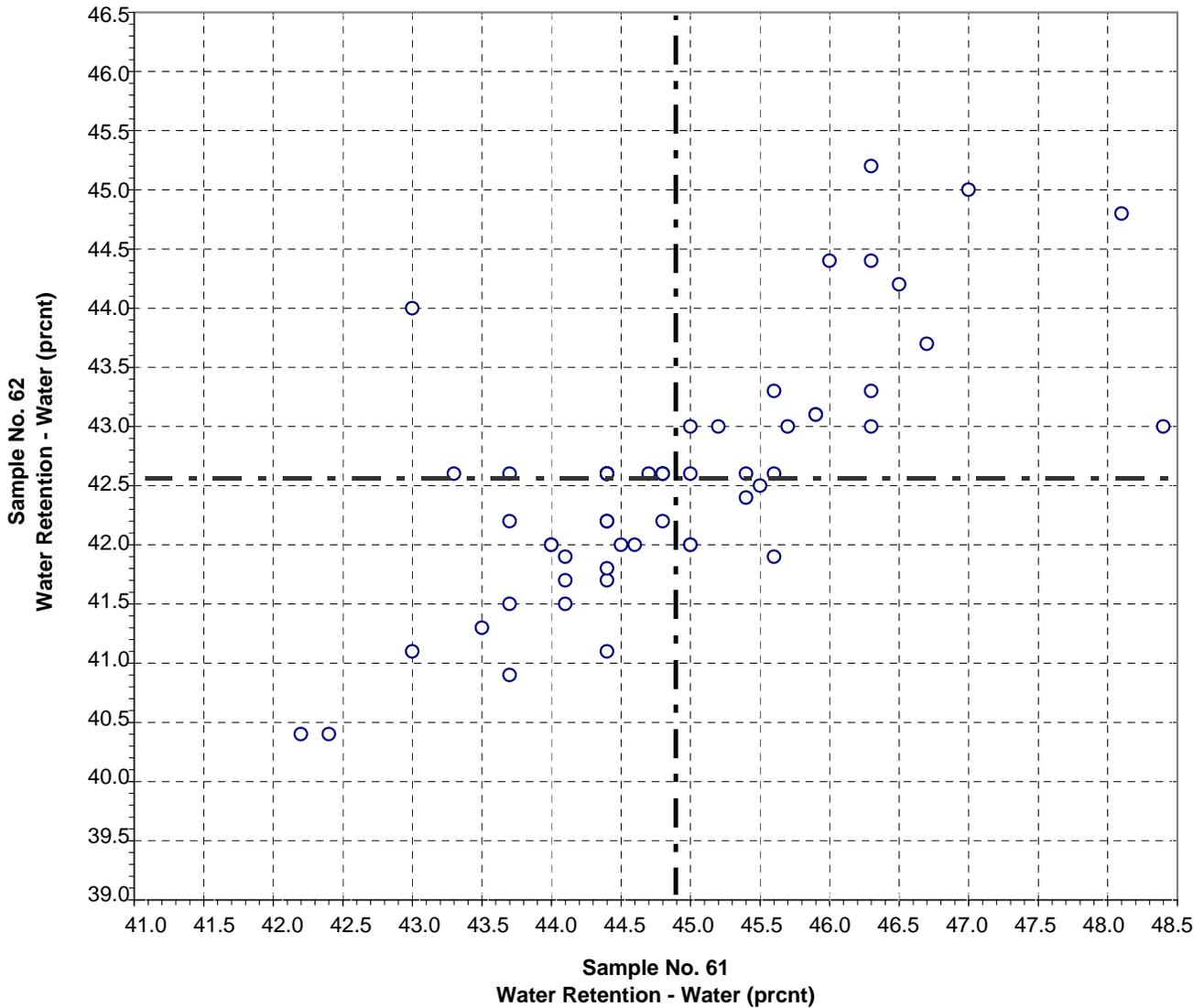


Test No. 310    Density    50 Points

Sample No. 61	Ave 2.91	S.D. 0.037	C.V. 1.28
Sample No. 62	Ave 2.97	S.D. 0.047	C.V. 1.59

Labs eliminated: 169, 157, 181, 690

**CCRL Proficiency Sample Program  
Water Retention - Water  
MASONRY CEMENT Samples No. 61 and No. 62**

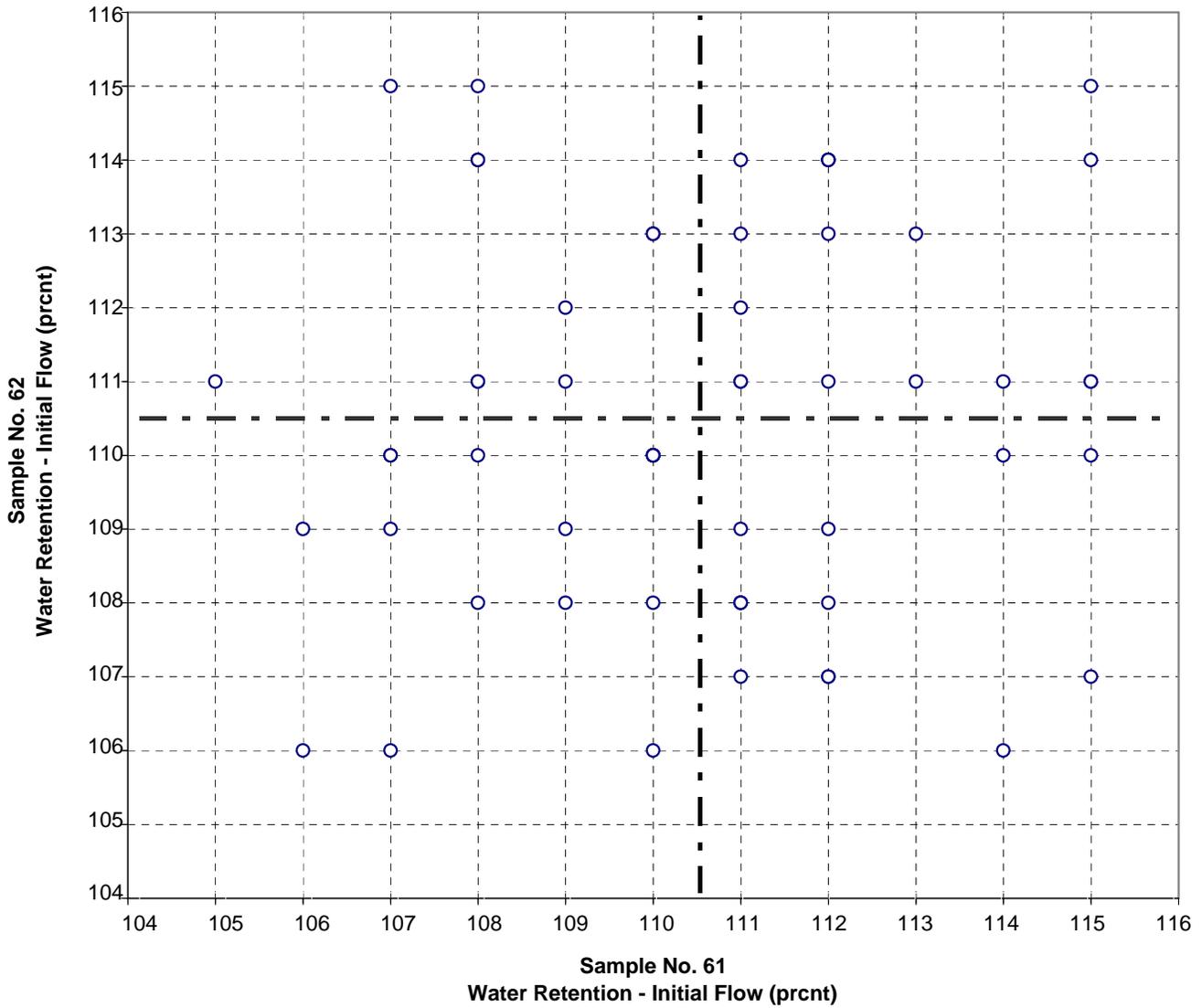


**Test No. 330      Water Retention - Water      57 Points**

Sample No. 61    Ave 44.9    S.D. 1.2    C.V. 2.74  
 Sample No. 62    Ave 42.6    S.D. 1.0    C.V. 2.41

Labs eliminated: 56, 159

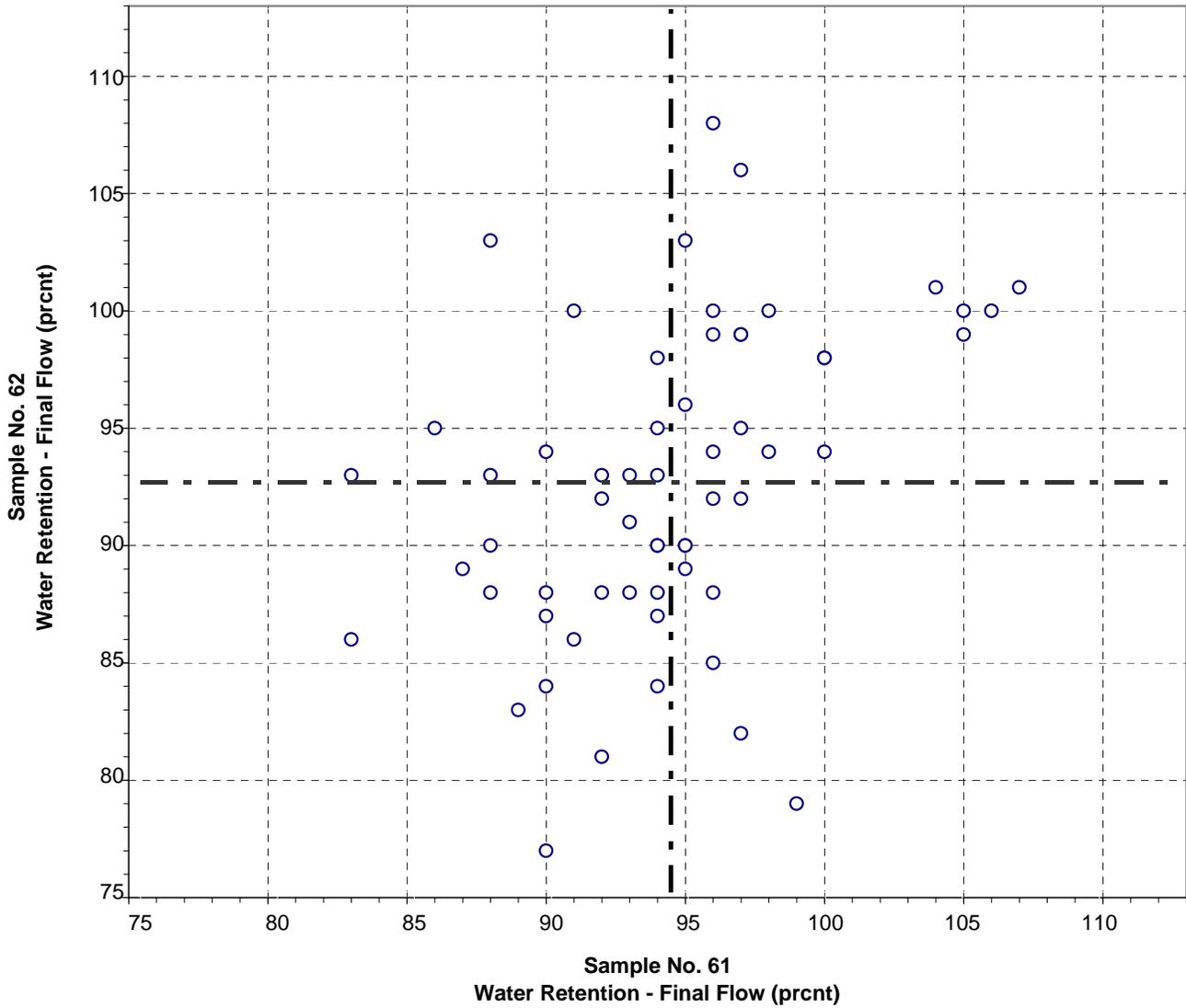
**CCRL Proficiency Sample Program  
Water Retention - Initial Flow  
MASONRY CEMENT Samples No. 61 and No. 62**



Test No. 331      Water Retention - Initial Flow      60 Points

Sample No. 61	Ave 110	S.D. 2.5	C.V. 2.30
Sample No. 62	Ave 110	S.D. 2.5	C.V. 2.29

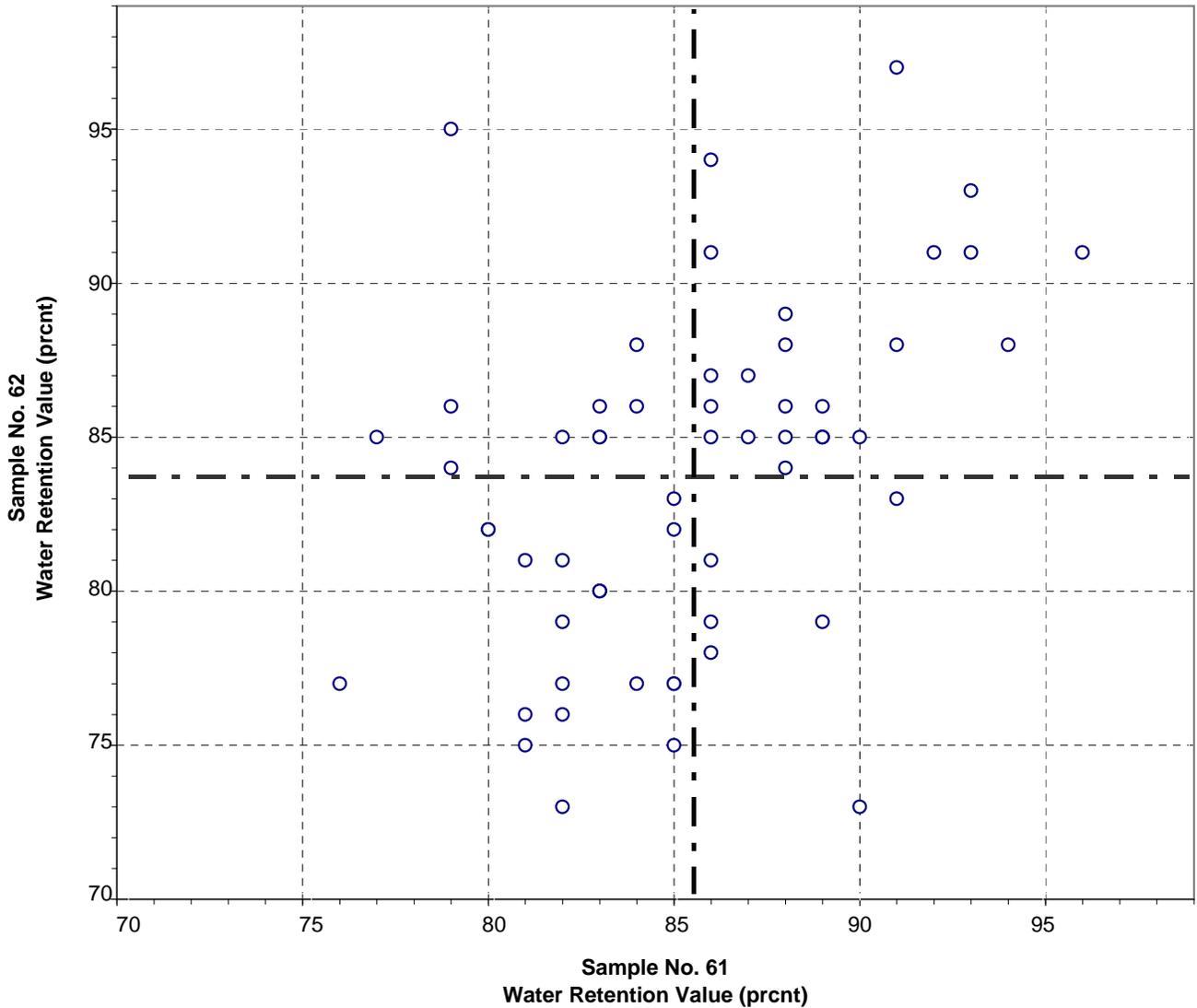
**CCRL Proficiency Sample Program  
Water Retention - Final Flow  
MASONRY CEMENT Samples No. 61 and No. 62**



Test No. 332      Water Retention - Final Flow      60 Points

Sample No. 61	Ave 94	S.D. 5.1	C.V. 5.41
Sample No. 62	Ave 93	S.D. 6.7	C.V. 7.23

**CCRL Proficiency Sample Program  
Water Retention Value  
MASONRY CEMENT Samples No. 61 and No. 62**



**Test No. 333      Water Retention Value      60 Points**

Sample No. 61	Ave 85	S.D. 4.3	C.V. 5.05
Sample No. 62	Ave 84	S.D. 5.5	C.V. 6.56