

CEMENT AND CONCRETE REFERENCE LABORATORY
PROFICIENCY SAMPLE PROGRAM

Final Report
Masonry Cement Proficiency Samples
Number 65 and Number 66

October 2010



October 15, 2010

To: Participants in the CCRL Masonry Cement Proficiency Sample Program

SUBJECT: Final Report on Masonry Cement Proficiency Samples No. 65 and No. 66

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 2010. Masonry Cement Samples No 65 and No. 66 were ASTM C91 Type N 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 2011.

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. 65 and No. 66

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 2010. 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 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.

| 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 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 mortar and initial water retention flow. Mortar flows in the range of 110 ± 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 ± 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. 65 and No. 66
Final Report - October 15, 2010

SUMMARY OF RESULTS

| Test | | #Labs | Sample No. 65 | | | Sample No. 66 | | |
|---------------------|-----|-------|---------------|-------|------|---------------|-------|------|
| | | | Average | S.D. | C.V. | Average | S.D. | C.V. |
| N.C. Water | % | 67 | 26.2 | 0.41 | 1.6 | 27.0 | 0.39 | 1.4 |
| N.C. Water | % | * 65 | 26.2 | 0.38 | 1.5 | 27.0 | 0.31 | 1.1 |
| Gillmore TS Initial | min | 67 | 266 | 37.8 | 14 | 158 | 27.7 | 18 |
| Gillmore TS Initial | min | * 64 | 271 | 30.1 | 11.1 | 158 | 24.0 | 15 |
| Gillmore TS Final | min | 65 | 421 | 45.3 | 11 | 290 | 44.2 | 15 |
| Gillmore TS Final | min | * 64 | 424 | 42.0 | 9.9 | 291 | 43.5 | 15 |
| Autoclave Expan | % | 64 | 0.03 | 0.016 | 48 | 0.03 | 0.015 | 45 |
| Autoclave Expan | % | * 61 | 0.04 | 0.014 | 38 | 0.03 | 0.009 | 28 |
| Air Content | % | 65 | 18.3 | 1.4 | 7.5 | 16.5 | 1.3 | 7.8 |
| Air Content | % | * 63 | 18.2 | 1.1 | 6.1 | 16.3 | 0.92 | 5.6 |
| AC Mix Water | % | 67 | 45.7 | 3.5 | 7.6 | 47.9 | 4.3 | 9.0 |
| AC Mix Water | % | * 62 | 45.7 | 1.2 | 2.6 | 47.6 | 1.2 | 2.5 |
| AC Flow | % | 67 | 110 | 3.6 | 3.3 | 108 | 3.7 | 3.4 |
| AC Flow | % | * 66 | 111 | 2.4 | 2.2 | 109 | 2.3 | 2.1 |
| Comp Str 7 day | psi | 67 | 1163 | 3846 | 33 | 1240 | 3619 | 29 |
| Comp Str 7 day | psi | * 65 | 1112 | 149 | 13 | 1197 | 141 | 12 |
| Comp Str 28 day | psi | 61 | 1601 | 212 | 13 | 1453 | 167 | 12 |
| Comp Str 28 day | psi | * 60 | 1599 | 214 | 13 | 1444 | 152 | 10 |

CONTINUED ON NEXT PAGE

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

| | |
|------------------------|----------------------|
| Normal Consistency | 413 1657 |
| Gillmore Time of Set | 98 74 413 |
| Gillmore Time of Set | 413 |
| Autoclave Expansion | 146 176 687 |
| Air Content | 103 354 |
| Air Content - Water | 354 690 103 886 1715 |
| Air Content - Flow | 103 |
| Comp. Strength, 7 day | 159 1657 |
| Comp. Strength, 28 day | 1053 |

CCRL PROFICIENCY SAMPLE PROGRAM
Masonry Cement Proficiency Samples No. 65 and No. 66
Final Report - October 15, 2010

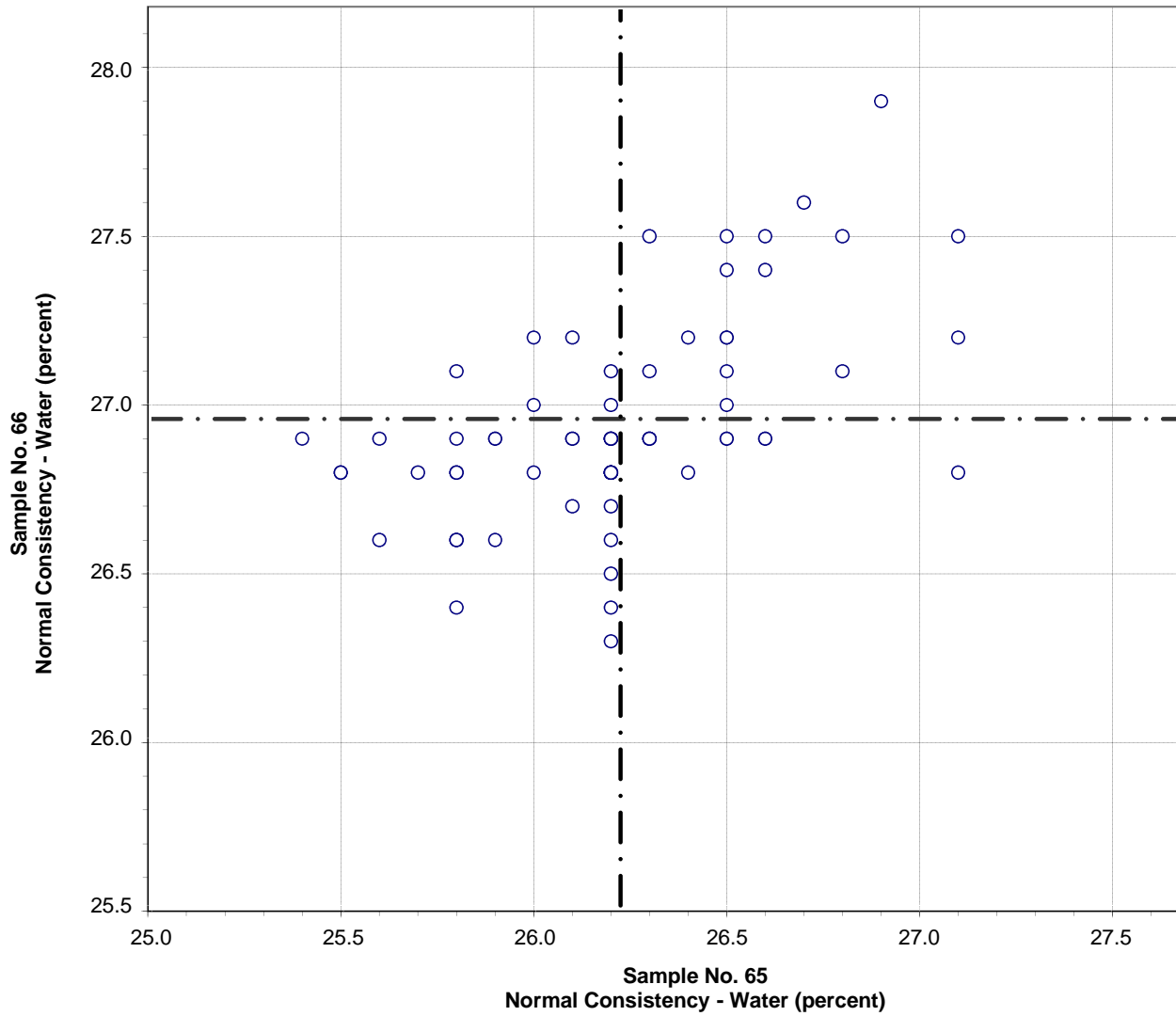
SUMMARY OF RESULTS

| Test | #Labs | Sample No. 65 | | | Sample No. 66 | | |
|------------------------|------------------------|---------------|------|------|---------------|------|------|
| | | Average | S.D. | C.V. | Average | S.D. | C.V. |
| 45- μ m Sieve | % 67 | 5.57 | 0.95 | 17 | 4.876 | 0.77 | 16 |
| 45- μ m Sieve | % * 64 | 5.55 | 0.78 | 14 | 4.822 | 0.71 | 15 |
| Density | g/cm ³ 60 | 2.88 | 0.06 | 2.1 | 2.88 | 0.05 | 1.6 |
| Density | g/cm ³ * 59 | 2.88 | 0.05 | 1.7 | 2.88 | 0.04 | 1.6 |
| WATER RETENTION | | | | | | | |
| WR Mix Water | % 64 | 45.4 | 2.7 | 5.9 | 47.4 | 2.7 | 5.6 |
| WR Mix Water | % * 63 | 45.7 | 1.4 | 3.1 | 47.6 | 1.3 | 2.7 |
| WR Initial Flow | % 64 | 110 | 2.3 | 2.1 | 109 | 2.4 | 2.2 |
| WR Initial Flow | % * 63 | 110 | 2.3 | 2.1 | 109 | 2.4 | 2.2 |
| WR Final Flow | % 64 | 91 | 6.2 | 6.8 | 89 | 7.5 | 8.4 |
| WR Final Flow | % * 63 | 90 | 5.4 | 6.0 | 89 | 7.2 | 8.1 |
| Water Retention | % 64 | 83 | 4.8 | 5.8 | 82 | 6.4 | 7.8 |

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

| | |
|------------------------------|------------|
| Fineness - 45- μ m Sieve | 99 176 413 |
| Density | 74 |
| WR - Water | 354 |
| WR - Initial Flow | 93 |
| WR - Final Flow | 93 |

**CCRL Proficiency Sample Program
Normal Consistency - Water
MASONRY CEMENT Samples No. 65 and No. 66**



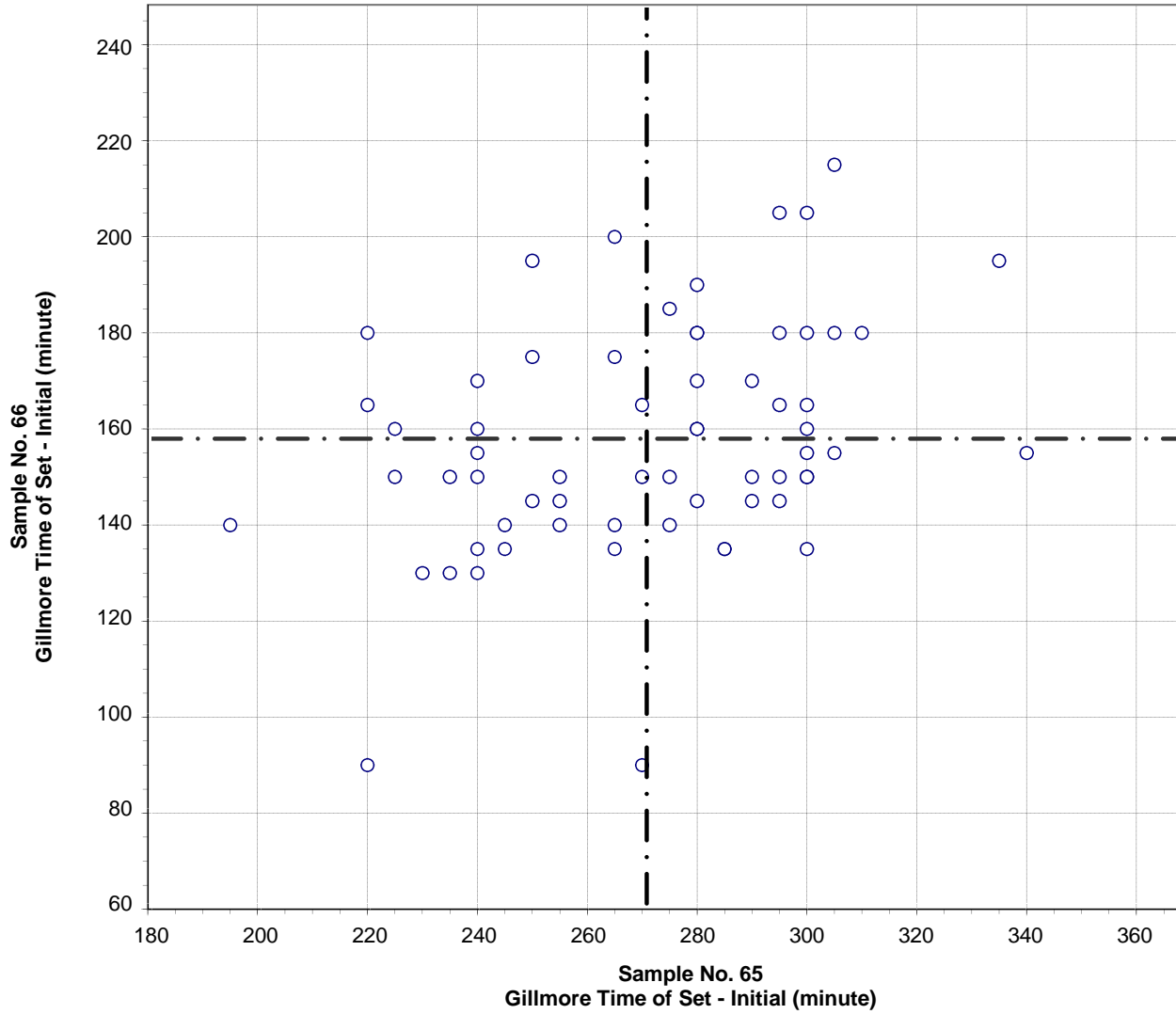
Test No. 110 Normal Consistency - Water 65 Points

Sample No. 65 Ave 26.2 S.D. 0.39 C.V. 1.5

Sample No. 66 Ave 27.0 S.D. 0.31 C.V. 1.1

Labs eliminated: 413, 1657

**CCRL Proficiency Sample Program
Gillmore Time of Set - Initial
MASONRY CEMENT Samples No. 65 and No. 66**

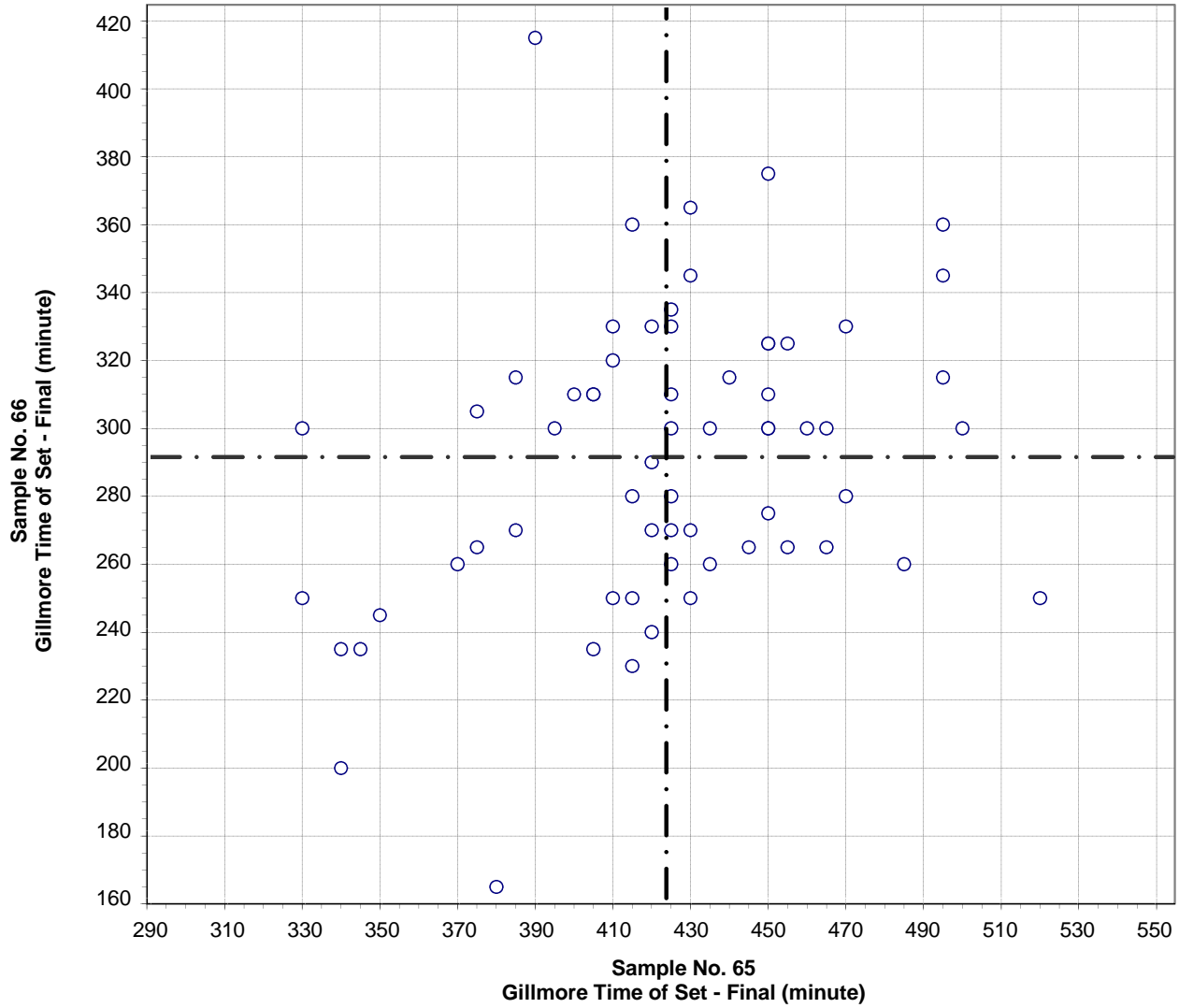


Test No. 130 Gillmore Time of Set - Initial 64 Points

Sample No. 65 Ave 271 S.D. 30 C.V. 11.1
 Sample No. 66 Ave 158 S.D. 24 C.V. 15.2

Labs eliminated: 98, 74, 413

**CCRL Proficiency Sample Program
Gillmore Time of Set - Final
MASONRY CEMENT Samples No. 65 and No. 66**

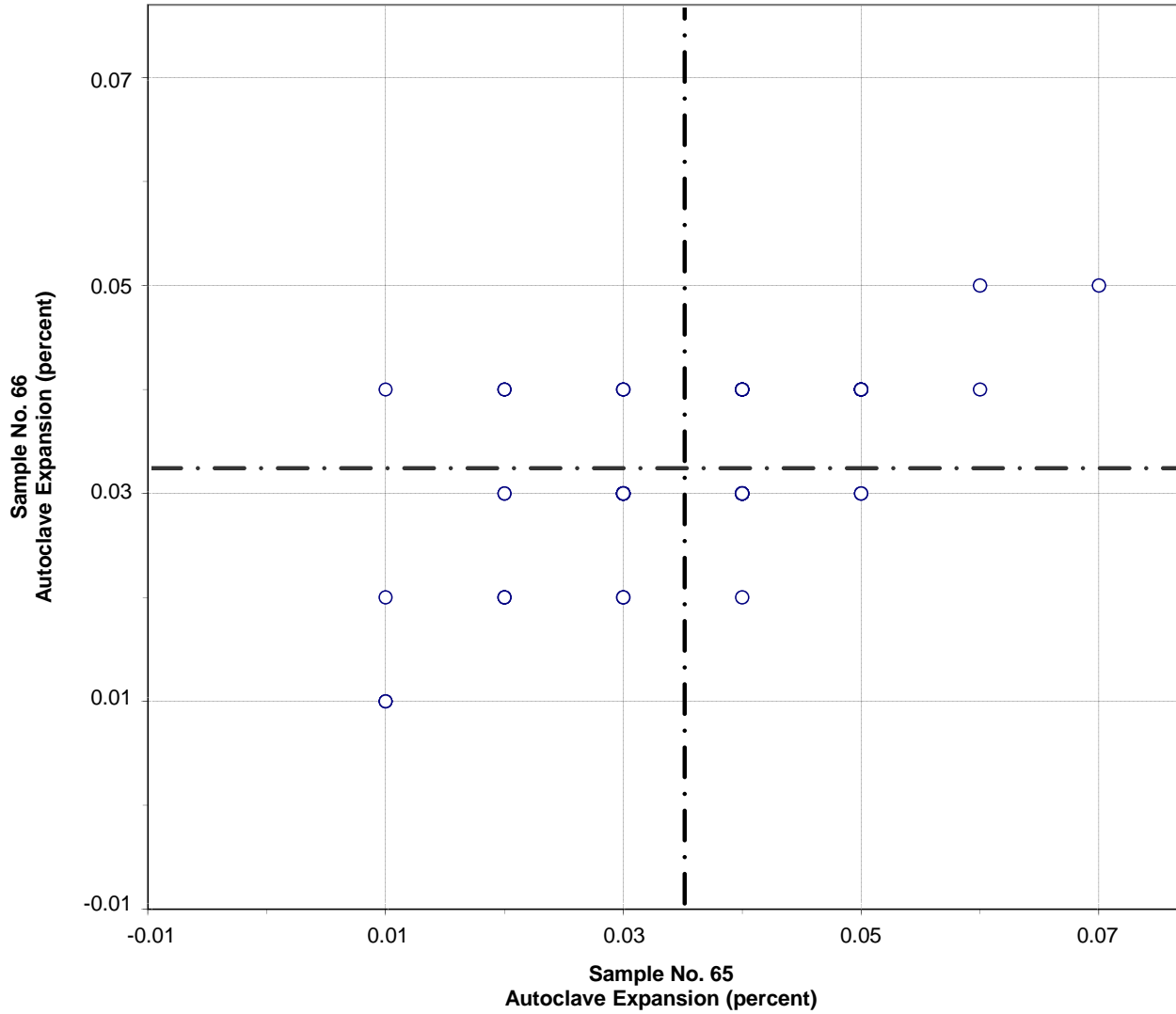


Test No. 140 Gillmore Time of Set - Final 64 Points

| | | | |
|---------------|---------|---------|-----------|
| Sample No. 65 | Ave 424 | S.D. 42 | C.V. 9.9 |
| Sample No. 66 | Ave 291 | S.D. 44 | C.V. 15.0 |

Labs eliminated: 413

**CCRL Proficiency Sample Program
Autoclave Expansion
MASONRY CEMENT Samples No. 65 and No. 66**

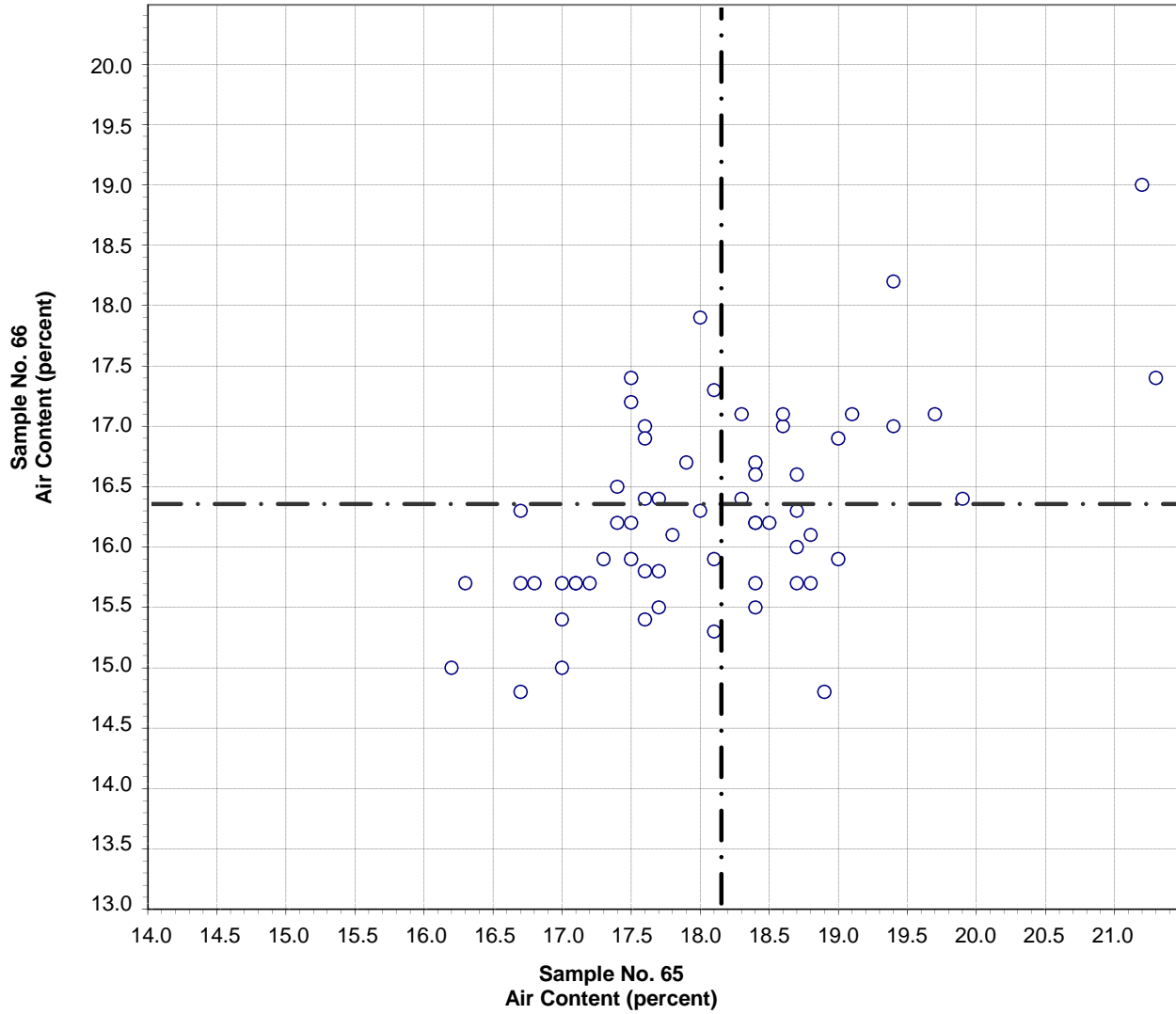


Test No. 160 Autoclave Expansion 61 Points

| | | | |
|---------------|----------|-----------|-----------|
| Sample No. 65 | Ave 0.04 | S.D. 0.01 | C.V. 38.5 |
| Sample No. 66 | Ave 0.03 | S.D. 0.01 | C.V. 27.9 |

Labs eliminated: 146, 176, 687

CCRL Proficiency Sample Program
Air Content
MASONRY CEMENT Samples No. 65 and No. 66



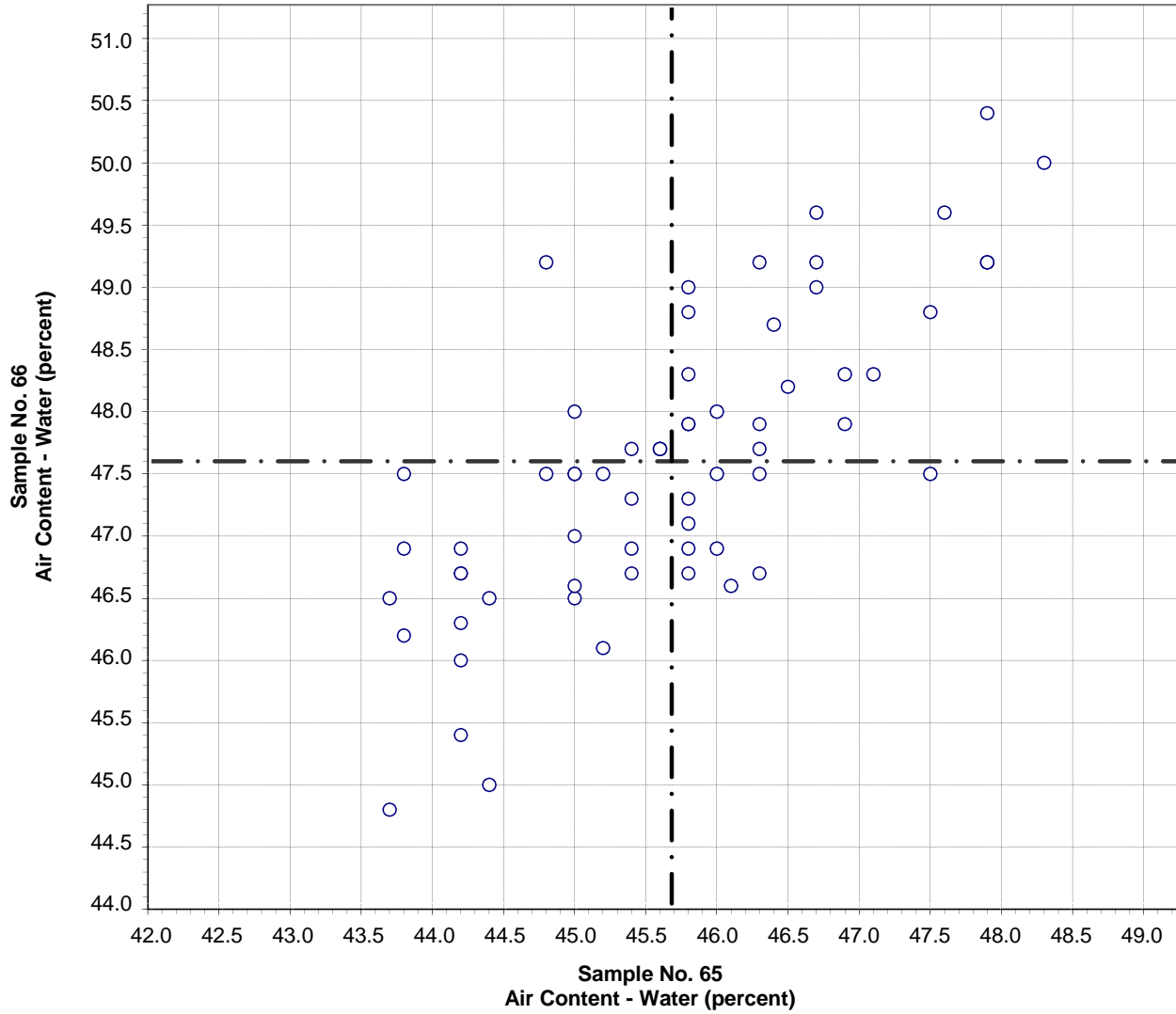
Test No. 170 Air Content 62 Points

| | | | |
|---------------|----------|----------|----------|
| Sample No. 65 | Ave 18.1 | S.D. 1.1 | C.V. 6.1 |
| Sample No. 66 | Ave 16.3 | S.D. 0.9 | C.V. 5.6 |

Labs eliminated: 103, 354

Labs off Diagram: 52

**CCRL Proficiency Sample Program
Air Content - Water
MASONRY CEMENT Samples No. 65 and No. 66**

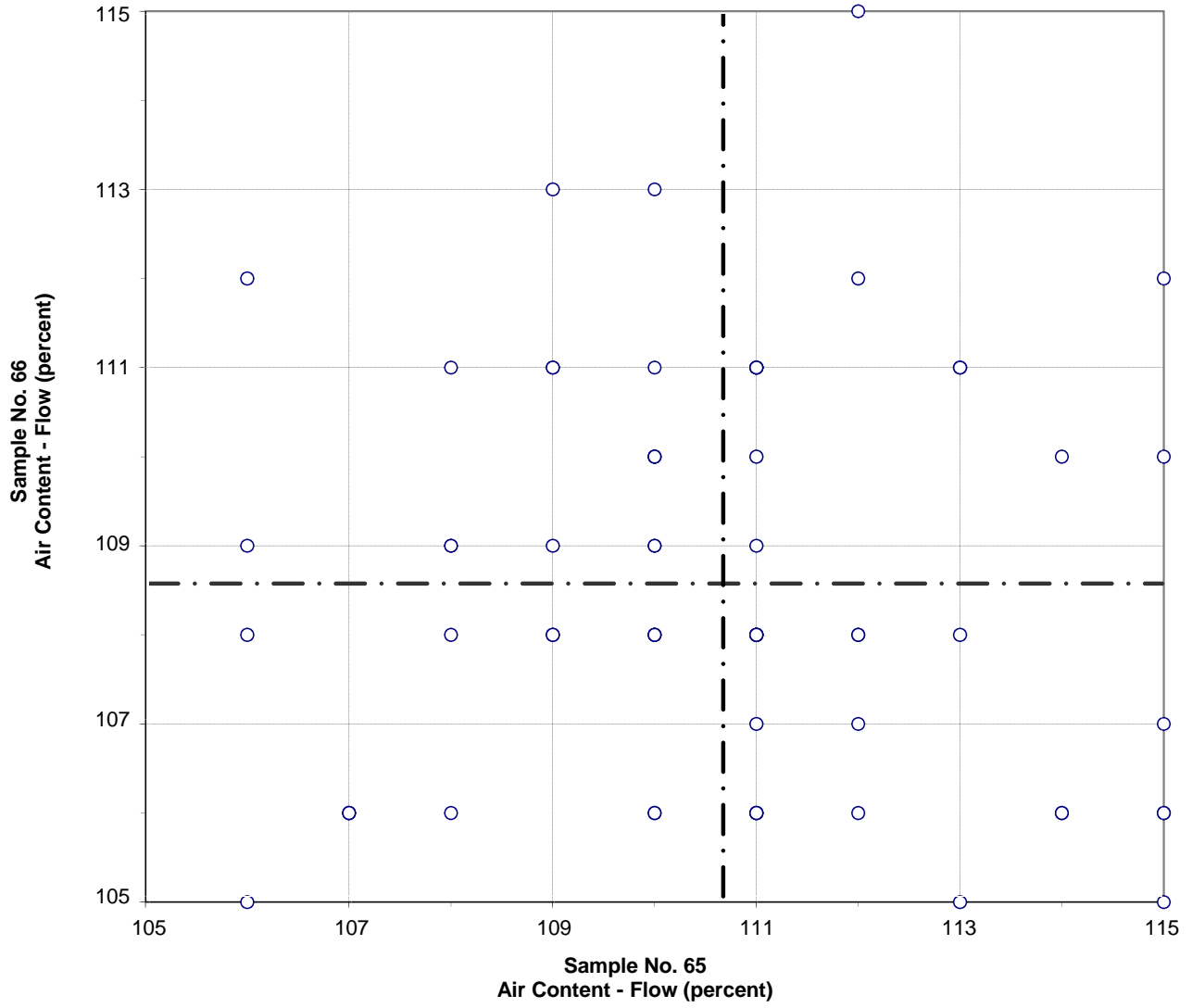


Test No. 180 Air Content - Water 62 Points

Sample No. 65 Ave 45.7 S.D. 1.2 C.V. 2.6
 Sample No. 66 Ave 47.6 S.D. 1.2 C.V. 2.5

Labs eliminated: 354, 690, 103, 886, 1715

**CCRL Proficiency Sample Program
Air Content - Flow
MASONRY CEMENT Samples No. 65 and No. 66**

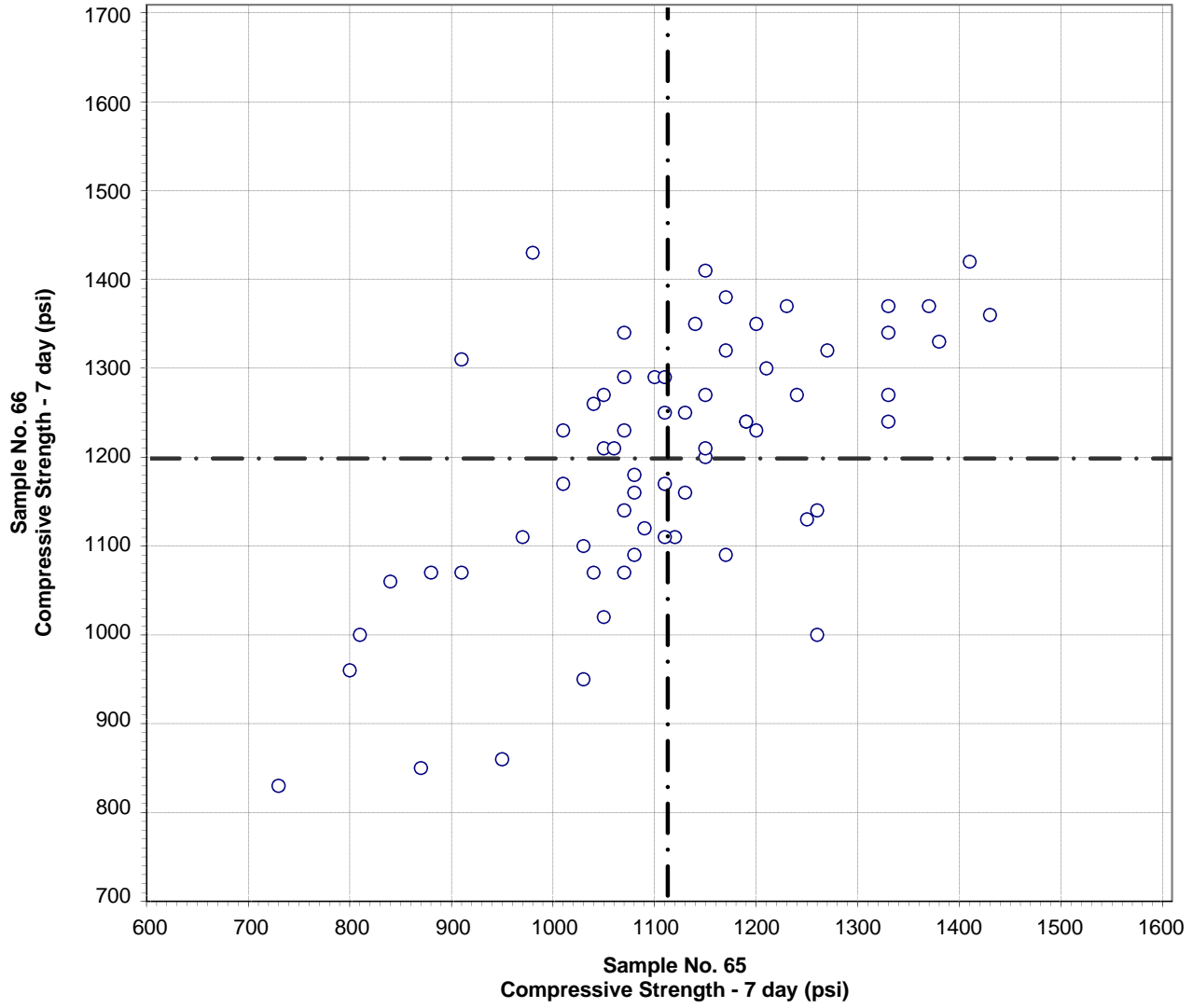


Test No. 190 Air Content - Flow 66 Points

| | | | |
|---------------|---------|----------|----------|
| Sample No. 65 | Ave 111 | S.D. 2.4 | C.V. 2.2 |
| Sample No. 66 | Ave 109 | S.D. 2.3 | C.V. 2.1 |

Labs eliminated: 103

**CCRL Proficiency Sample Program
Compressive Strength - 7 day
MASONRY CEMENT Samples No. 65 and No. 66**

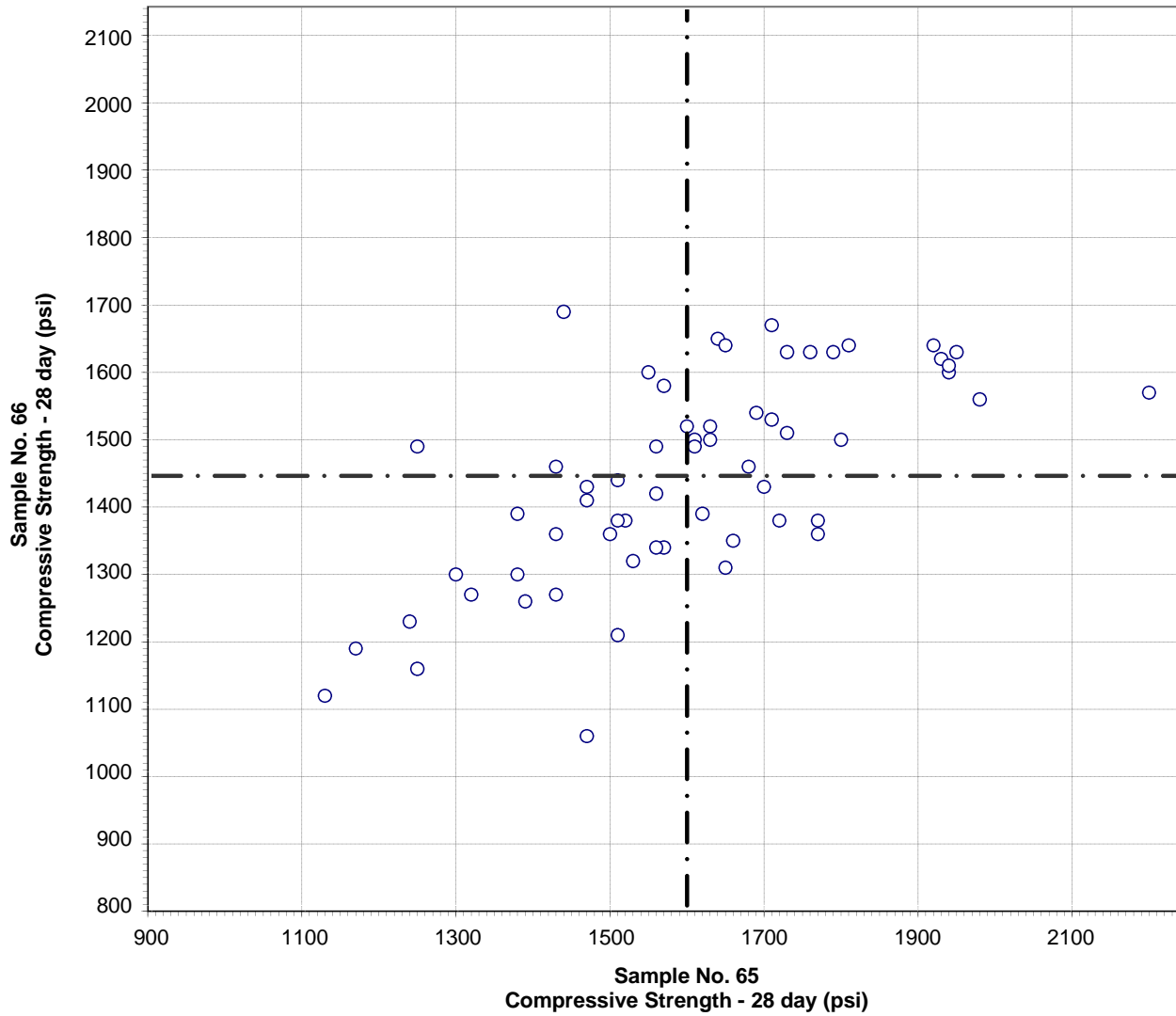


Test No. 210 Compressive Strength - 7 day 65 Points

Sample No. 65 Ave 1112 S.D. 149 C.V. 13.4
 Sample No. 66 Ave 1197 S.D. 141 C.V. 11.8

Labs eliminated: 159, 1657

**CCRL Proficiency Sample Program
Compressive Strength - 28 day
MASONRY CEMENT Samples No. 65 and No. 66**

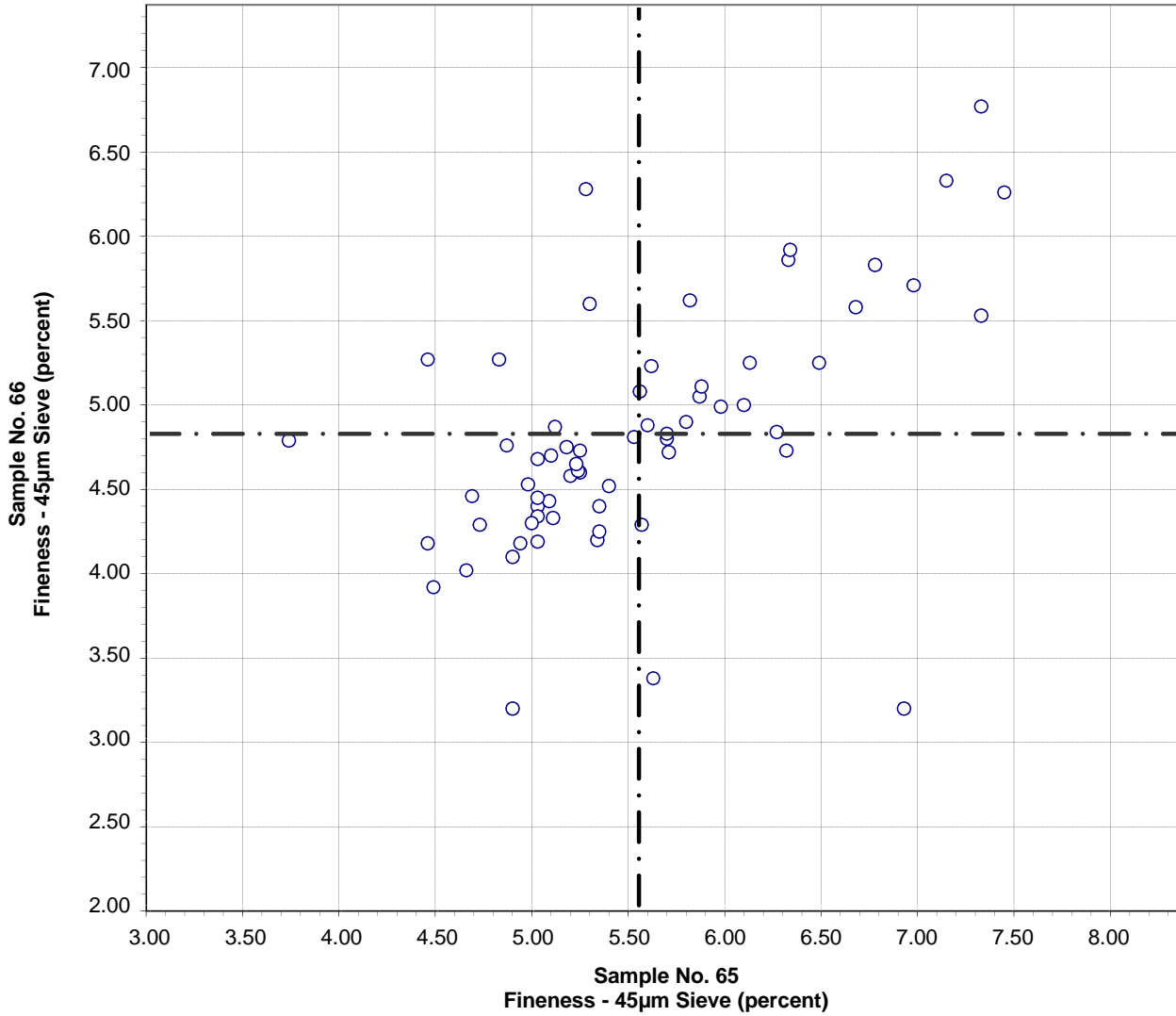


Test No. 211 Compressive Strength - 28 day 60 Points

| | | | |
|---------------|----------|----------|---------|
| Sample No. 65 | Ave 1599 | S.D. 214 | C.V. 13 |
| Sample No. 66 | Ave 1444 | S.D. 152 | C.V. 10 |

Labs eliminated: 1053

**CCRL Proficiency Sample Program
 Fineness - 45µm Sieve Retained
 MASONRY CEMENT Samples No. 65 and No. 66**

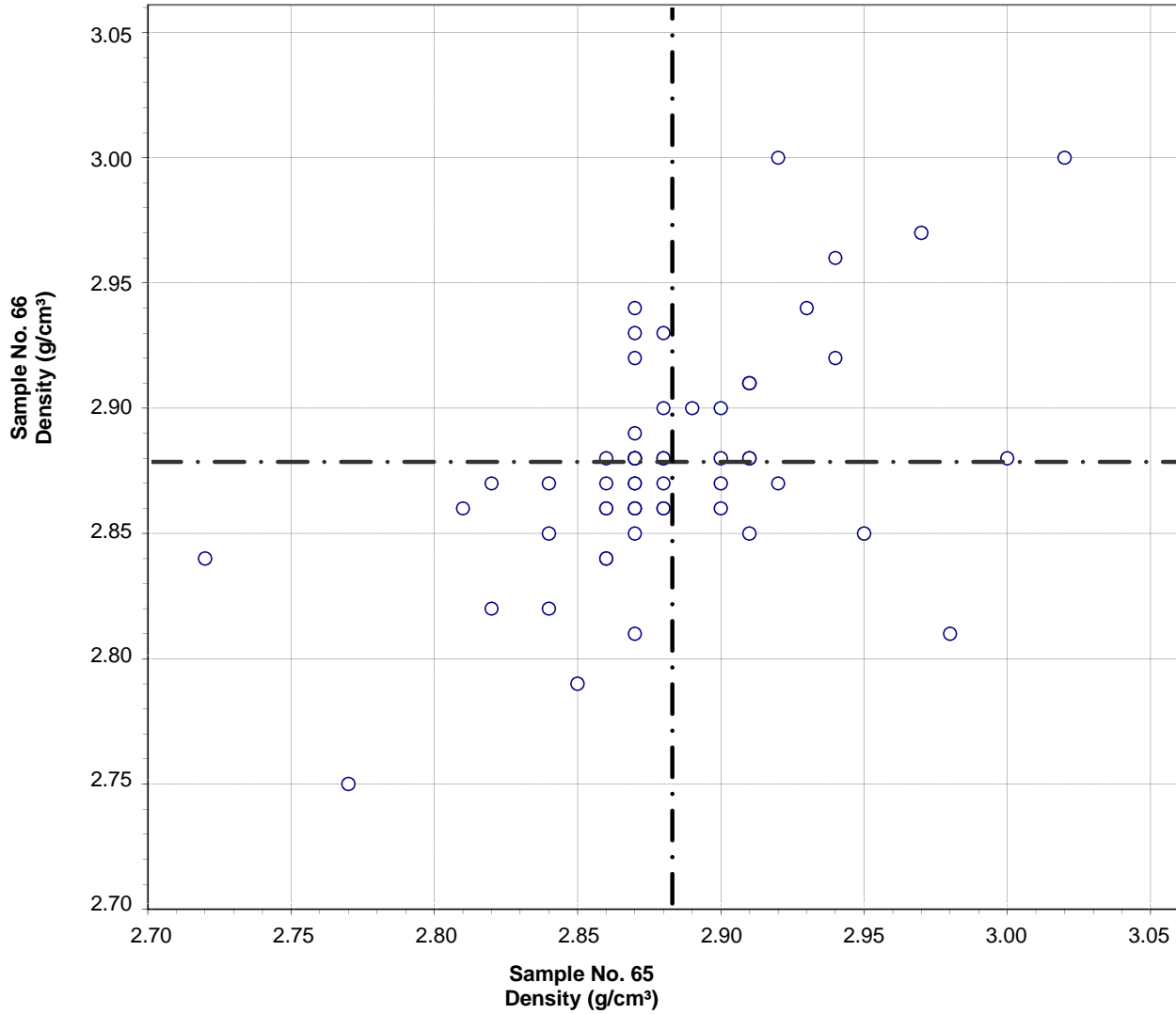


Test No. 281 Fineness - 45µm Sieve Retained 64 Points

Sample No. 65 Ave 5.55 S.D. 0.78 C.V. 14.1
 Sample No. 66 Ave 4.82 S.D. 0.71 C.V. 14.7

Labs eliminated: 99, 176, 413

**CCRL Proficiency Sample Program
Density
MASONRY CEMENT Samples No. 65 and No. 66**

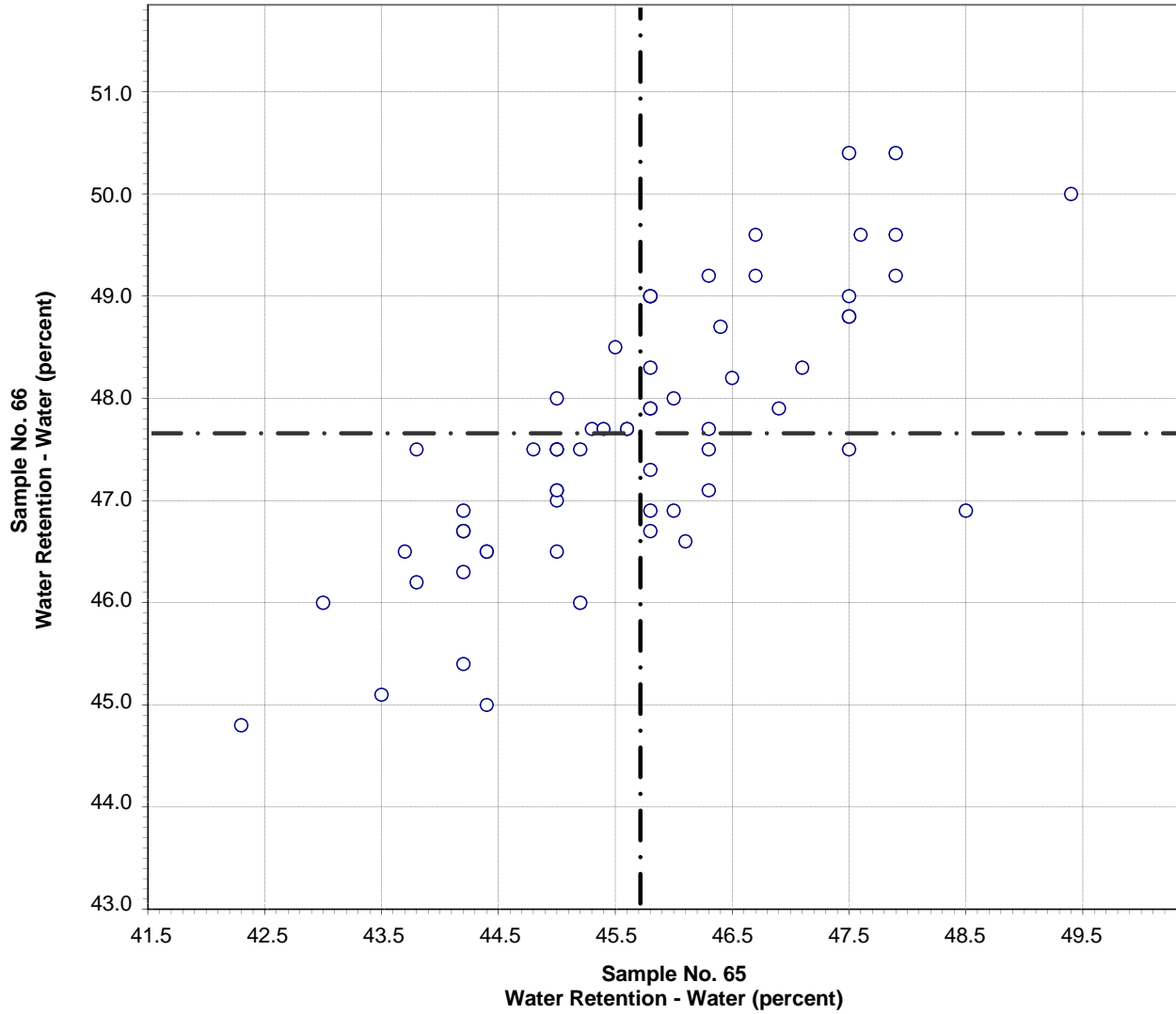


Test No. 310 Density 59 Points

| | | | |
|---------------|----------|-----------|----------|
| Sample No. 65 | Ave 2.88 | S.D. 0.05 | C.V. 1.7 |
| Sample No. 66 | Ave 2.88 | S.D. 0.04 | C.V. 1.6 |

Labs eliminated: 74

**CCRL Proficiency Sample Program
Water Retention - Water
MASONRY CEMENT Samples No. 65 and No. 66**



Test No. 330

Water Retention - Water

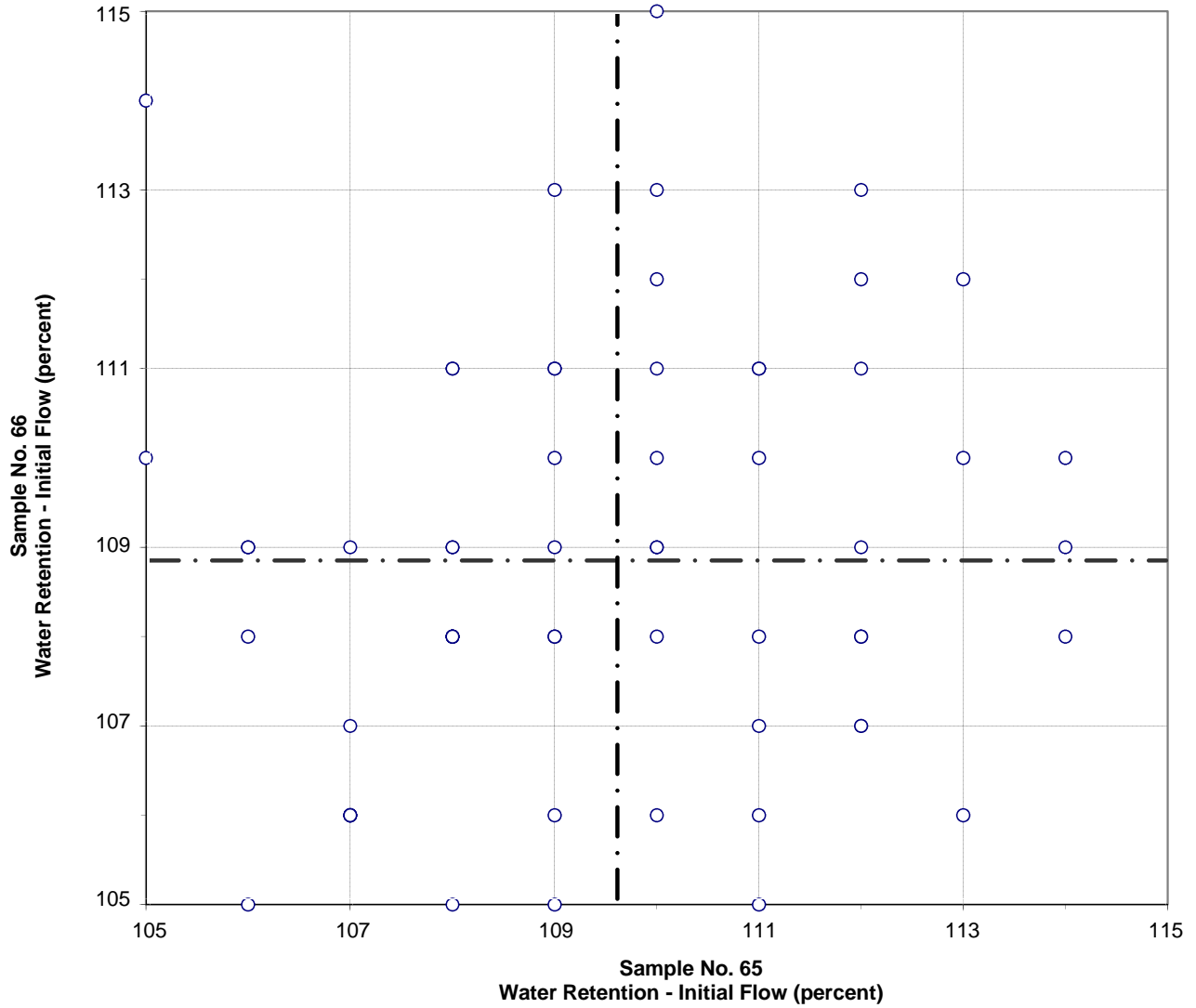
63 Points

Sample No. 65 Ave 45.7 S.D. 1.4 C.V. 3.1

Sample No. 66 Ave 47.6 S.D. 1.3 C.V. 2.7

Labs eliminated: 354

**CCRL Proficiency Sample Program
Water Retention - Initial Flow
MASONRY CEMENT Samples No. 65 and No. 66**

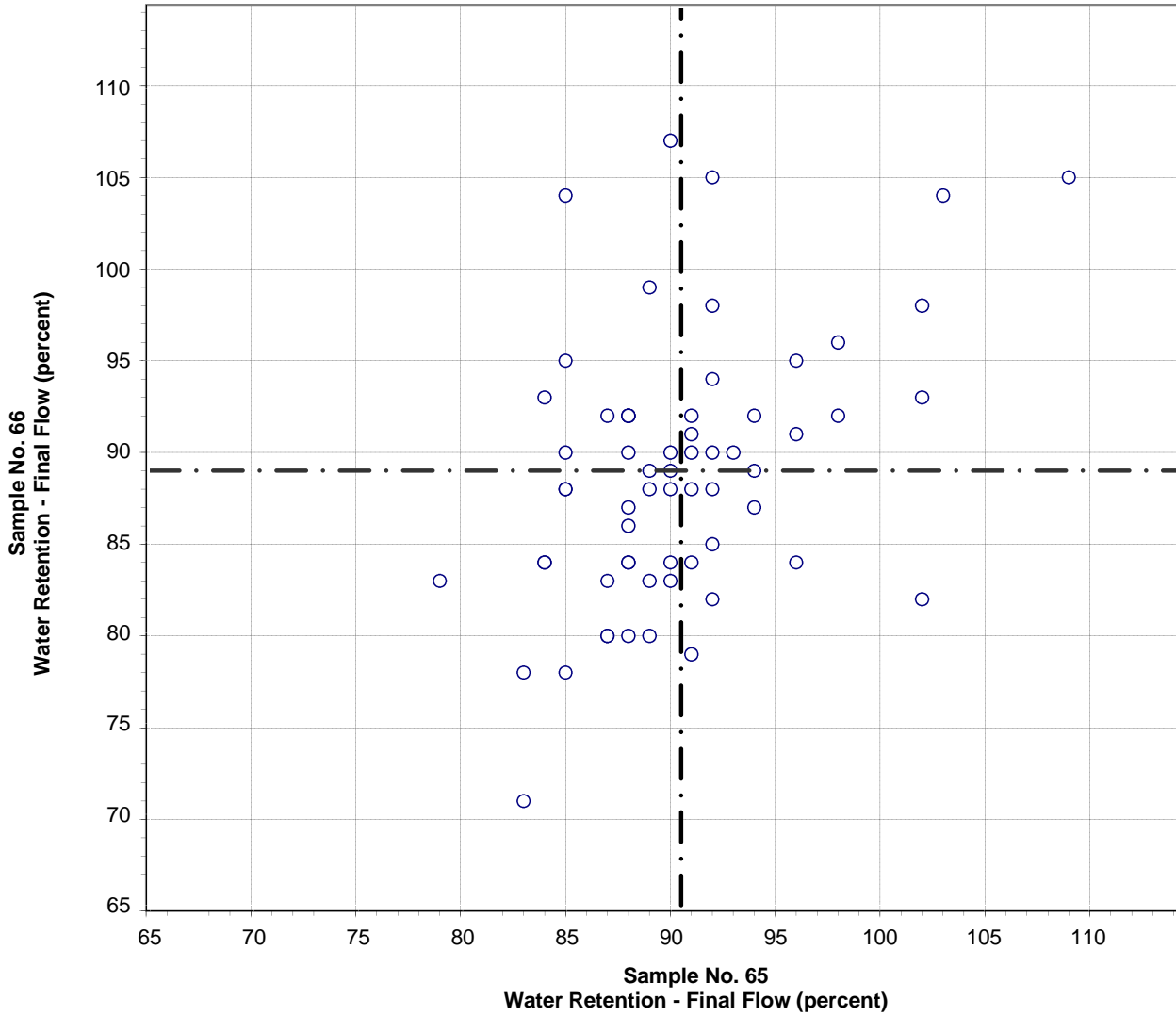


Test No. 331 Water Retention - Initial Flow 63 Points

Sample No. 65 Ave 110 S.D. 2.3 C.V. 2.1
 Sample No. 66 Ave 109 S.D. 2.4 C.V. 2.2

Labs eliminated: 93

**CCRL Proficiency Sample Program
Water Retention - Final Flow
MASONRY CEMENT Samples No. 65 and No. 66**

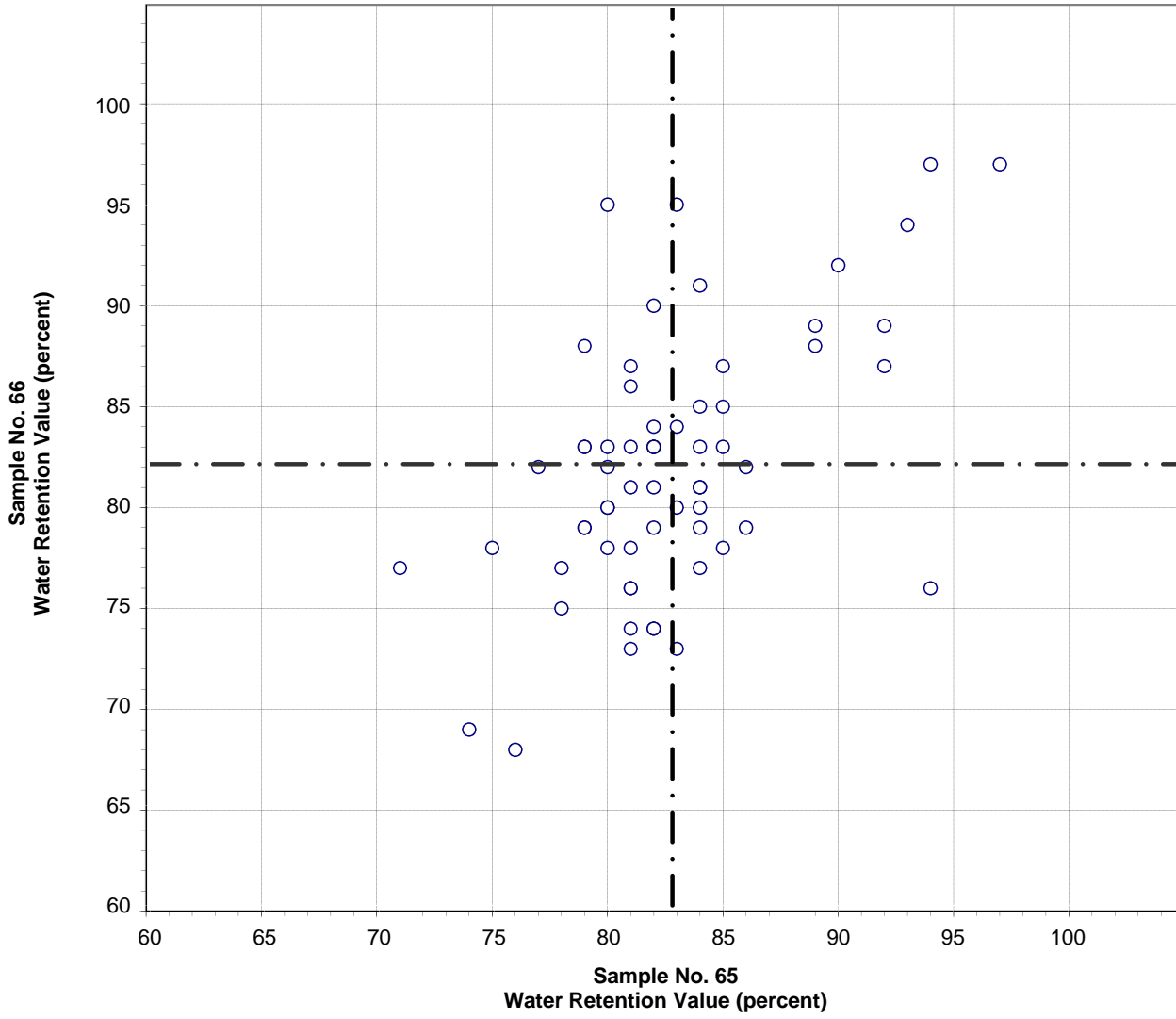


Test No. 332 Water Retention - Final Flow 63 Points

Sample No. 65 Ave 90 S.D. 5.4 C.V. 6.0
 Sample No. 66 Ave 89 S.D. 7.2 C.V. 8.1

Labs eliminated: 93

**CCRL Proficiency Sample Program
Water Retention Value
MASONRY CEMENT Samples No. 65 and No. 66**



Test No. 333 Water Retention Value 64 Points

| | | | |
|---------------|--------|----------|----------|
| Sample No. 65 | Ave 83 | S.D. 4.8 | C.V. 5.8 |
| Sample No. 66 | Ave 82 | S.D. 6.4 | C.V. 7.8 |