CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Concrete Proficiency Samples
Number 171 and Number 172

June 2014

CCRL CEMENT AN D CONCRETE REFERENCE LABORATORY

CCRL
Cement and Concrete
Reference Laboratory

www.ccrl.us

June 16, 2014

TO: Participants in the CCRL Portland Cement Concrete Proficiency Sample Program

SUBJECT: Concrete Proficiency Samples No. 171 and No. 172

Enclosed is your copy of the final report on the test results for the CCRL Concrete Proficiency Samples which were distributed in April 2014.

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 viewed and printed 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 materials 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 Proficiency Samples will be distributed in October 2014.

Sincerely,

Robin K. Haupt

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

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TO: Participants in the CCRL Concrete Proficiency Sample Program

FROM: Robin K. Haupt, Supervisor, PSP

SUBJECT: Explanation of Final Report on Results of Tests on Portland Cement Concrete Proficiency Samples No. 171 and No. 172

This letter, and the material included with it, constitutes the final report and summary of results for the current pair of Concrete Proficiency Samples that were distributed in April 2014. This material includes a statistical Summary of Results, and a set of general Scatter Diagrams. If your laboratory was a participate in this program a Table of Laboratory Results (lab data and ratings) for your laboratory data 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.

Table of Results

Each laboratory receives an individualized Table of Results that contains laboratory test results and ratings. Each line of the test information shows the test title and the reporting unit in the first two columns. After that it lists in order, the laboratory's test 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 temperature of concrete.

The ratings for each 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 indicates whether the result reported was greater or less than the average obtained.

[1] Youden, 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.*

In cases where some laboratories' results are eliminated, averages, standard deviations, coefficients of variation, and the ratings of the remaining 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

The Summary of Results provides 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 invalid and 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. 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. 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 Proficiency Samples No. 171 and No. 172

Final Report
June 18, 2014

SUMMARY OF RESULTS

		Sample No.171			Sample No. 172		
Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Air Content - Volumetric Method (percent)							
	1167	2.16	0.51	23	2.53	0.50	20
	*1138	2.14	0.43	20	2.52	0.43	17
* Labs Eliminated - 3, 595, 604, 946, 1103, 1120, 1333, 1505, 1987, 2045, 2132, 2285, 2398, 2452, 2509, 2694, 2989, 3038, 3067, 3131, 3477, 3529, 3542, 3566, 3704, 3834, 3836, 3884, 3926							
Air Content - Pressure Method (percent)							
	1381	2.2	0.46	20	2.6	0.49	18
	*1354	2.2	0.38	17	2.6	0.41	16
* Labs Eliminated - 3, 31, 997, 1039, 1103, 1120, 1270, 1474, 1505, 1854, 2207, 2268, 2366, 2398, 2410, 2509, 3038, 3131, 3529, 3542, 3566, 3704, 3767, 3797, 3836, 3874, 3884							
Slump of Concrete (inch)							
	1388	3.07	1.19	39	2.86	1.03	36
	*1358	3.01	1.09	36	2.79	0.91	32
* Labs Eliminated - 997, 1241, 1356, 1374, 1560, 1593, 1594, 1837, 2045, 2208, 2354, 2384, 2387, 2400, 2941, 3048, 3169, 3270, 3536, 3545, 3589, 3676, 3684, 3766, 3797, 3842, 3849, 3865, 3894, 3905							
Unit Weight of Concrete (lb/ft³)							
	1381	145.4	2.2	1.5	144.8	2.2	1.5
	*1322	145.4	1.1	0.8	144.8	1.2	0.8
* Labs Eliminated - 4, 188, 447, 595, 751, 756, 849, 956, 997, 1067, 1070, 1200, 1310, 1372, 1418, 1446, 1465, 1508, 1537, 1563, 1570, 1580, 1595, 1669, 1740, 1799, 1981, 2009, 2052, 2053, 2101, 2287, 2398, 2472, 2497, 2509, 2568, 2631, 2673, 2874, 2893, 2966, 3037, 3131, 3151, 3243, 3313, 3474, 3489, 3520, 3531, 3548, 3728, 3781, 3783, 3816, 3836, 3884, 3907							
Density of Compressive Strength Specimen (lb/ft³)							
	1136	146	3.9	2.7	145	3.9	2.7
	*1086	146	1.3	0.9	146	1.4	0.9
* Labs Eliminated - 33, 202, 207, 523, 956, 1154, 1210, 1247, 1307, 1372, 1446, 1471, 1508, 1551, 1596, 1669, 1799, 1876, 1979, 2030, 2123, 2130, 2287, 2314, 2365, 2509, 2631, 2686, 2975, 3038, 3039, 3131, 3199, 3378, 3412, 3448, 3474, 3529, 3592, 3597, 3675, 3755, 3758, 3781, 3782, 3821, 3856, 3860, 3864, 3884							

CCRL PROFICIENCY SAMPLE PROGRAM

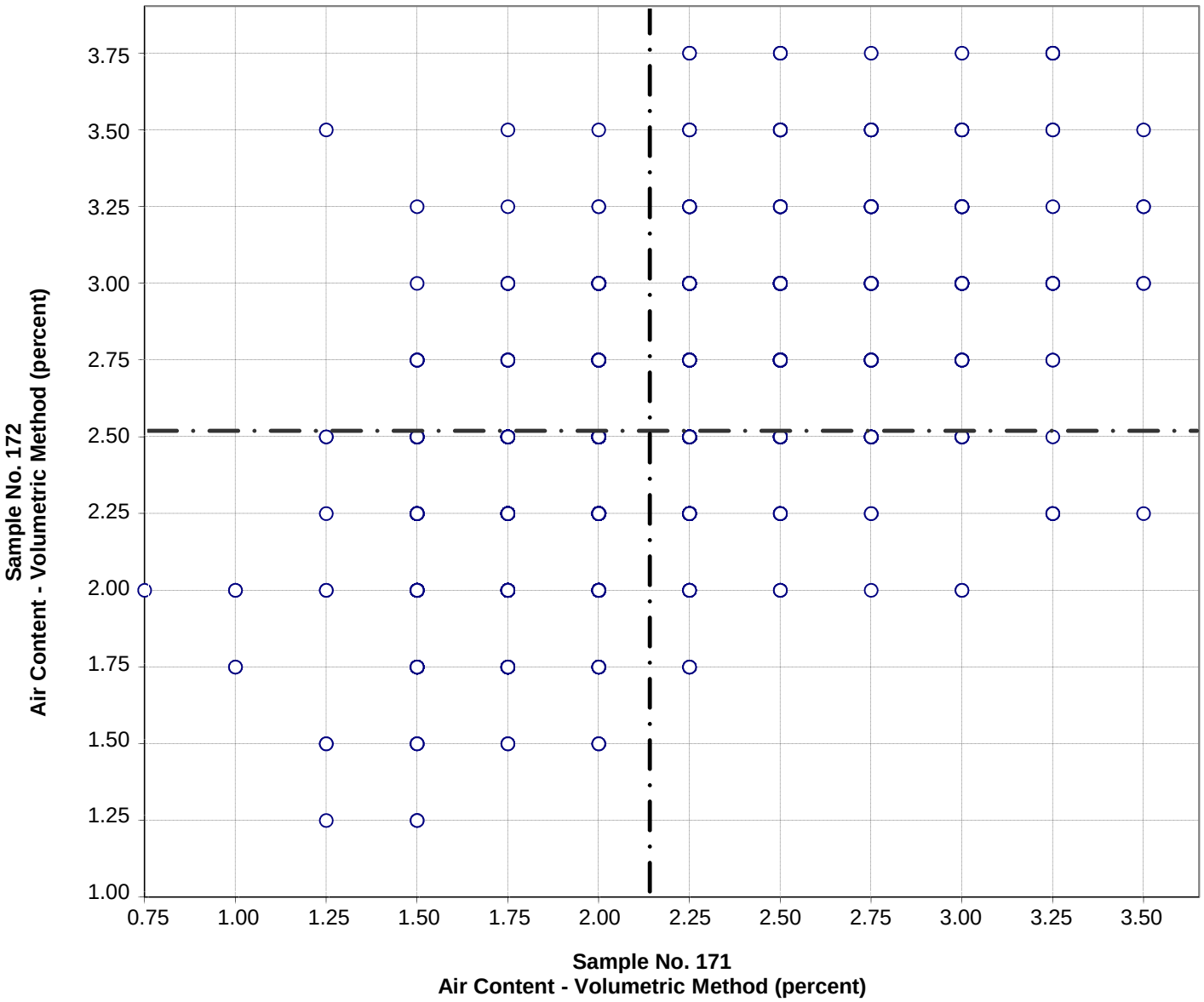
Concrete Proficiency Samples No. 171 and No. 172

Final Report
June 18, 2014

SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.171 Average	S.D.	C.V.	Sample No. 172 Average	S.D.	C.V.
Compressive Strength 4 x 8 - 7 day (psi)							
	982	4427	353	8.0	4694	410	8.7
	*964	4430	297	6.7	4699	343	7.3
* Labs Eliminated - 4, 537, 1168, 1210, 1372, 1456, 1709, 2268, 2452, 2509, 2895, 3508, 3544, 3718, 3742, 3795, 3884, 3894							
Compressive Strength 6 x 12 - 7 day (psi)							
	404	4099	308	7.5	4312	349	8.1
	*400	4110	287	7.0	4329	303	7.0
* Labs Eliminated - 1649, 3474, 3657, 3902							
Temperature of Concrete (°F)							
	1385	76	6	8.0	77	6	7.8
No Labs Eliminated for This Test							

CCRL Proficiency Sample Program
Air Content - Volumetric Method
CONCRETE Samples No. 171 and No. 172



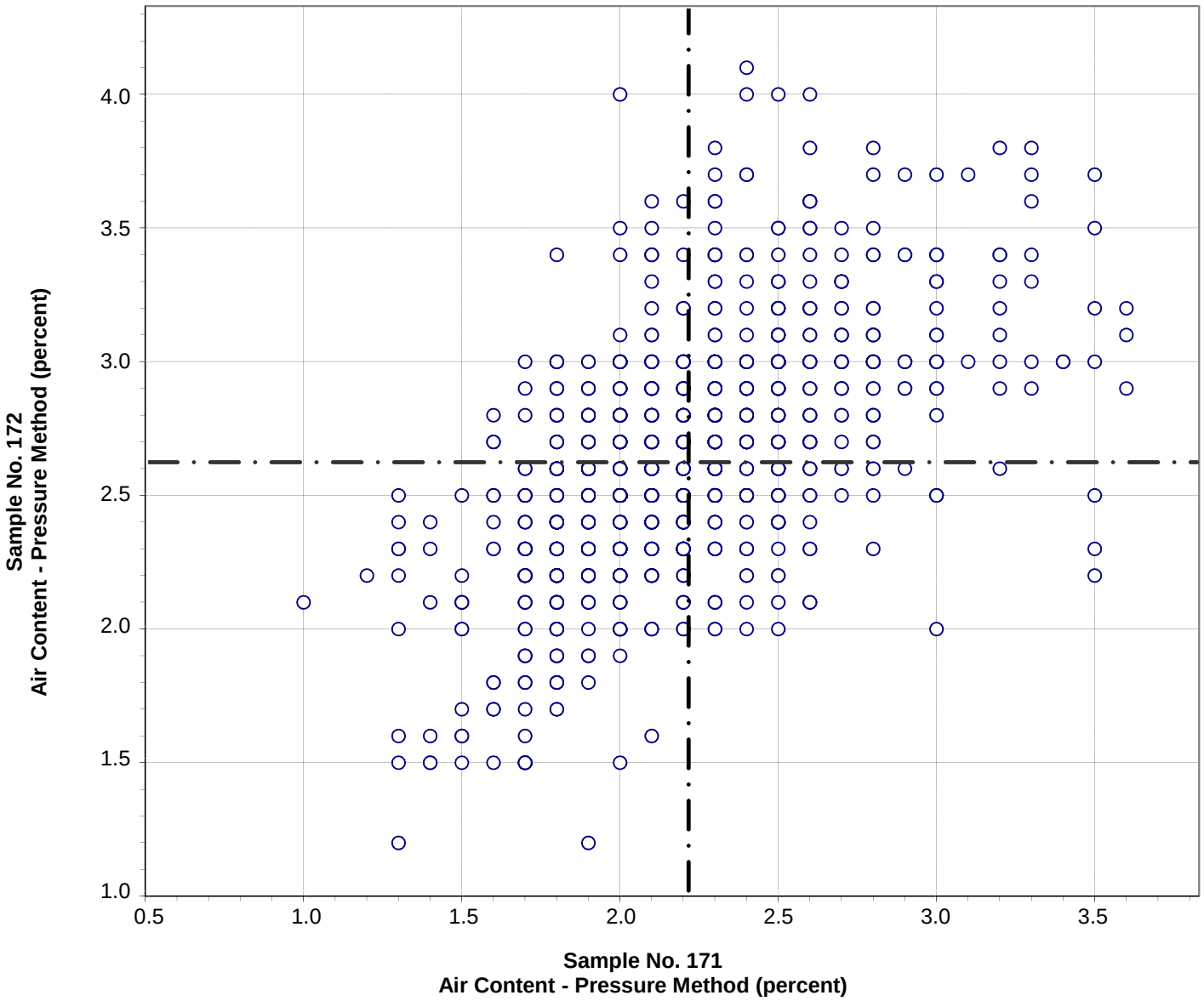
Test No. 1 Air Content - Volumetric Method 1135 Points

Sample No. 171 Ave 2.14 S.D. 0.43 C.V. 20
Sample No. 172 Ave 2.52 S.D. 0.43 C.V. 17

Labs Eliminated: 3, 595, 604, 946, 1103, 1120, 1333, 1505, 1987, 2045, 2132, 2285, 2398, 2452, 2509, 2694, 2989, 3038, 3067, 3131, 3477, 3529, 3542, 3566, 3704, 3834, 3836, 3884, 3926

Labs off Diagram: 2409, 2951, 3675

CCRL Proficiency Sample Program
Air Content - Pressure Method
CONCRETE Samples No. 171 and No. 172

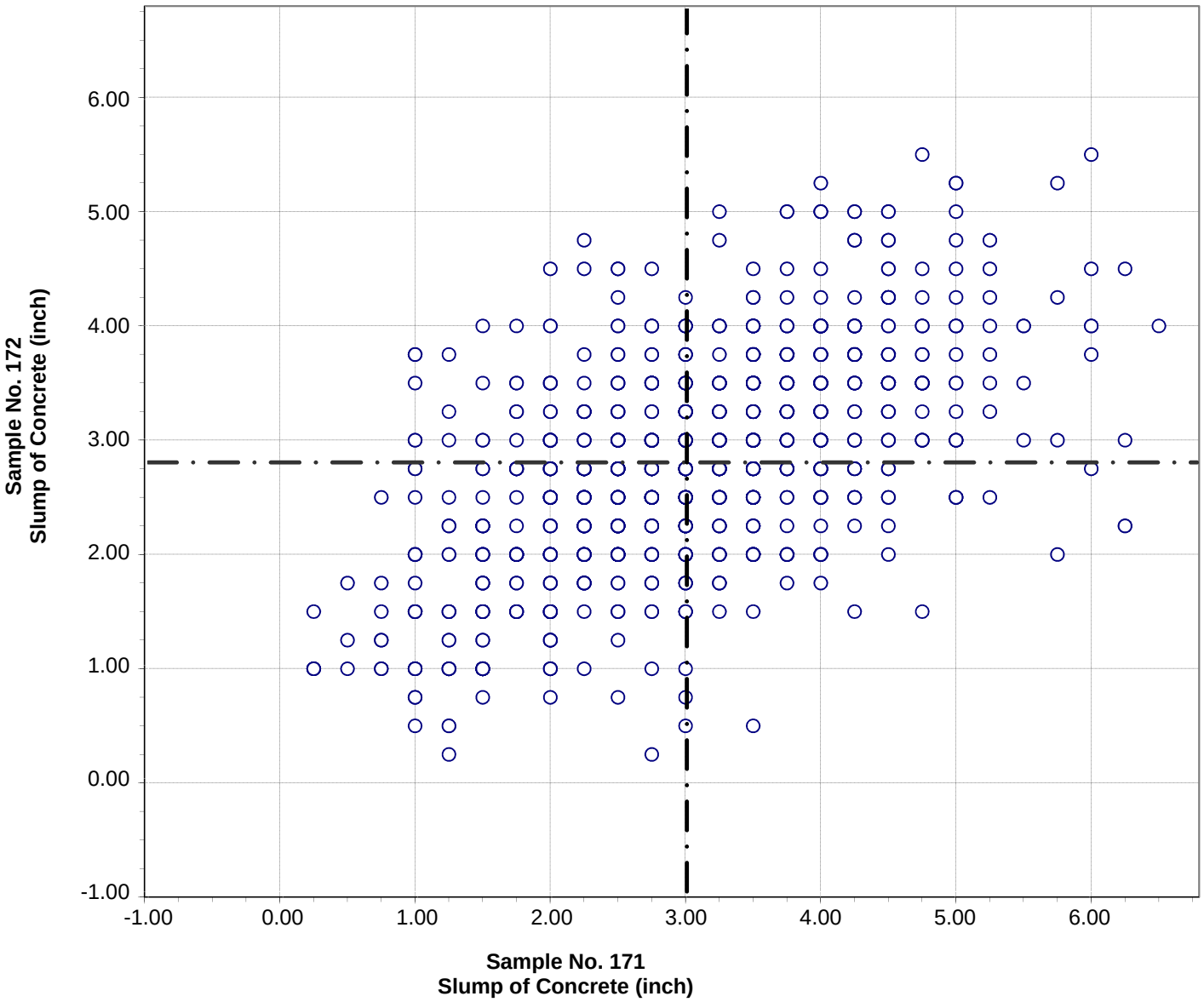


Test No. 6 Air Content - Pressure Method 1354 Points

Sample No. 171	Ave	2.2	S.D.	0.38	C.V. 17
Sample No. 172	Ave	2.6	S.D.	0.41	C.V. 16

Labs Eliminated: 3, 31, 997, 1039, 1103, 1120, 1270, 1474, 1505, 1854, 2207, 2268, 2366, 2398, 2410, 2509, 3038, 3131, 3529, 3542, 3566, 3704, 3767, 3797, 3836, 3874, 3884

CCRL Proficiency Sample Program
Slump of Concrete
CONCRETE Samples No. 171 and No. 172

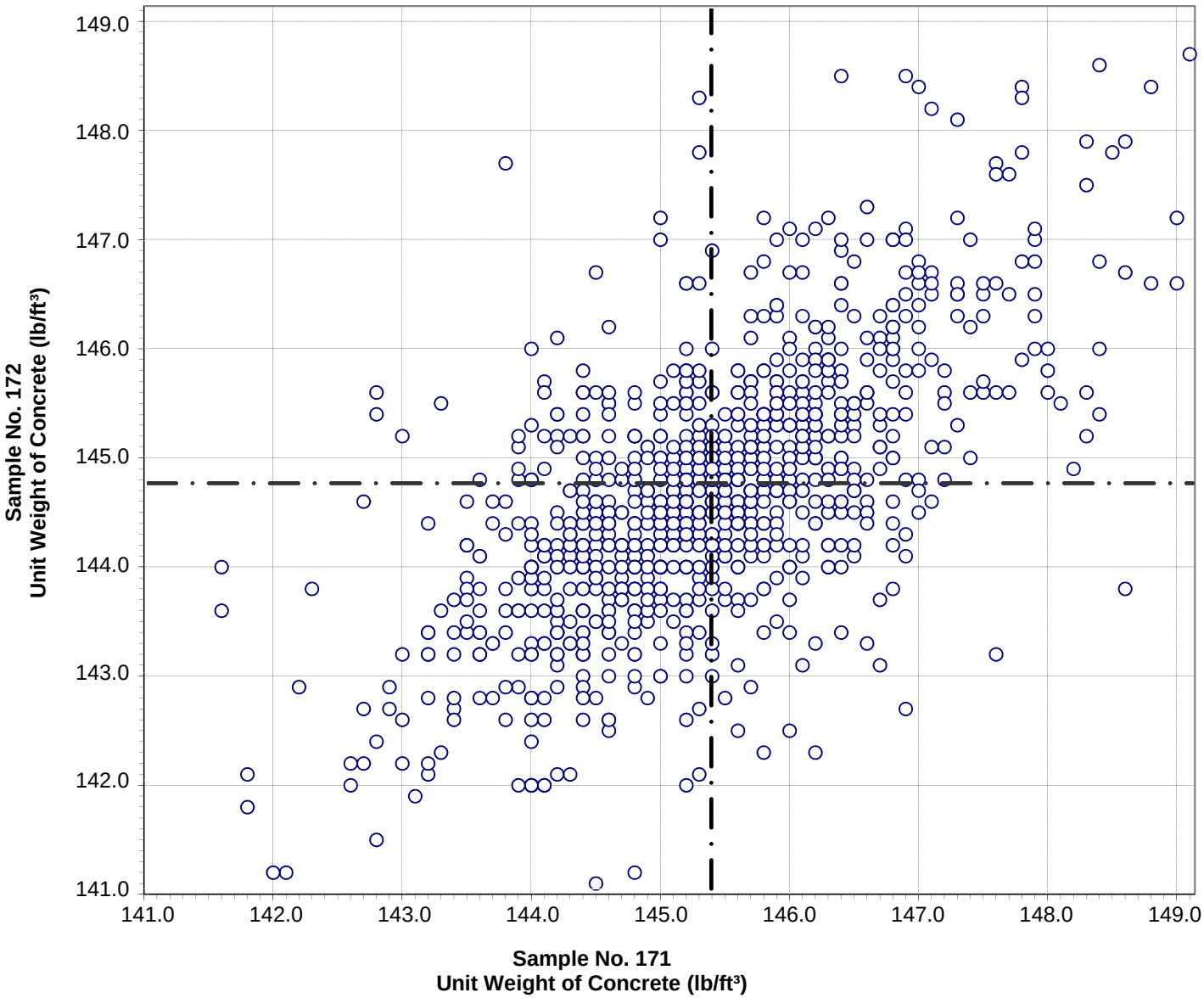


Test No. 2 Slump of Concrete 1358 Points

Sample No. 171	Ave	3.01	S.D.	1.09	C.V. 36
Sample No. 172	Ave	2.79	S.D.	0.91	C.V. 32

Labs Eliminated: 997, 1241, 1356, 1374, 1560, 1593, 1594, 1837, 2045, 2208, 2354, 2384, 2387, 2400, 2941, 3048, 3169, 3270, 3536, 3545, 3589, 3676, 3684, 3766, 3797, 3842, 3849, 3865, 3894, 3905

CCRL Proficiency Sample Program
Unit Weight of Concrete
CONCRETE Samples No. 171 and No. 172



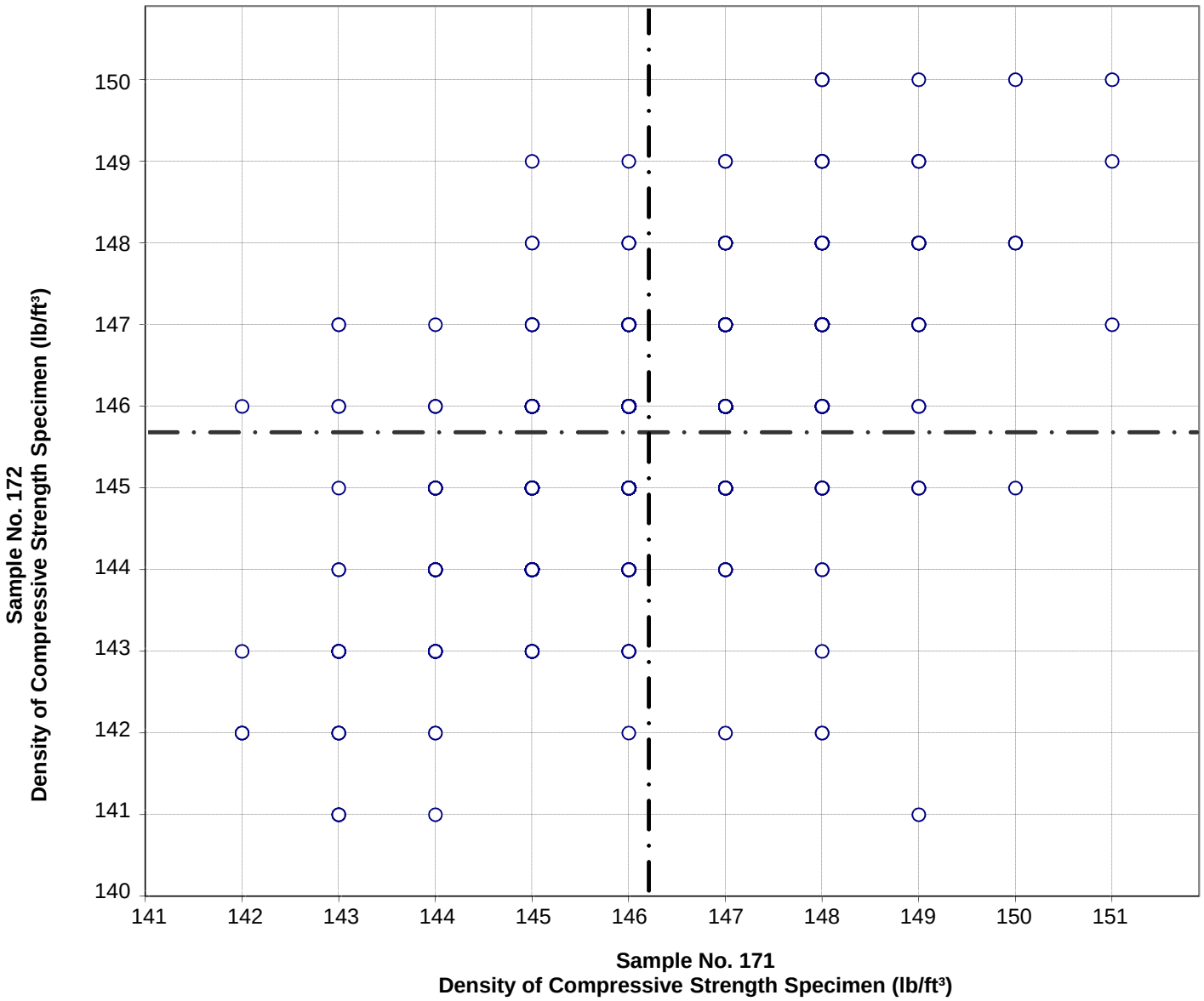
Test No. 3 Unit Weight of Concrete 1317 Points

Sample No. 171	Ave	145.4	S.D.	1.1	C.V.	0.8
Sample No. 172	Ave	144.8	S.D.	1.2	C.V.	0.8

Labs Eliminated: See SUMMARY OF RESULTS page for lists of labs

Labs off Diagram: 33, 946, 2366, 2431, 3604

CCRL Proficiency Sample Program
Density of Compressive Strength Specimen
CONCRETE Samples No. 171 and No. 172

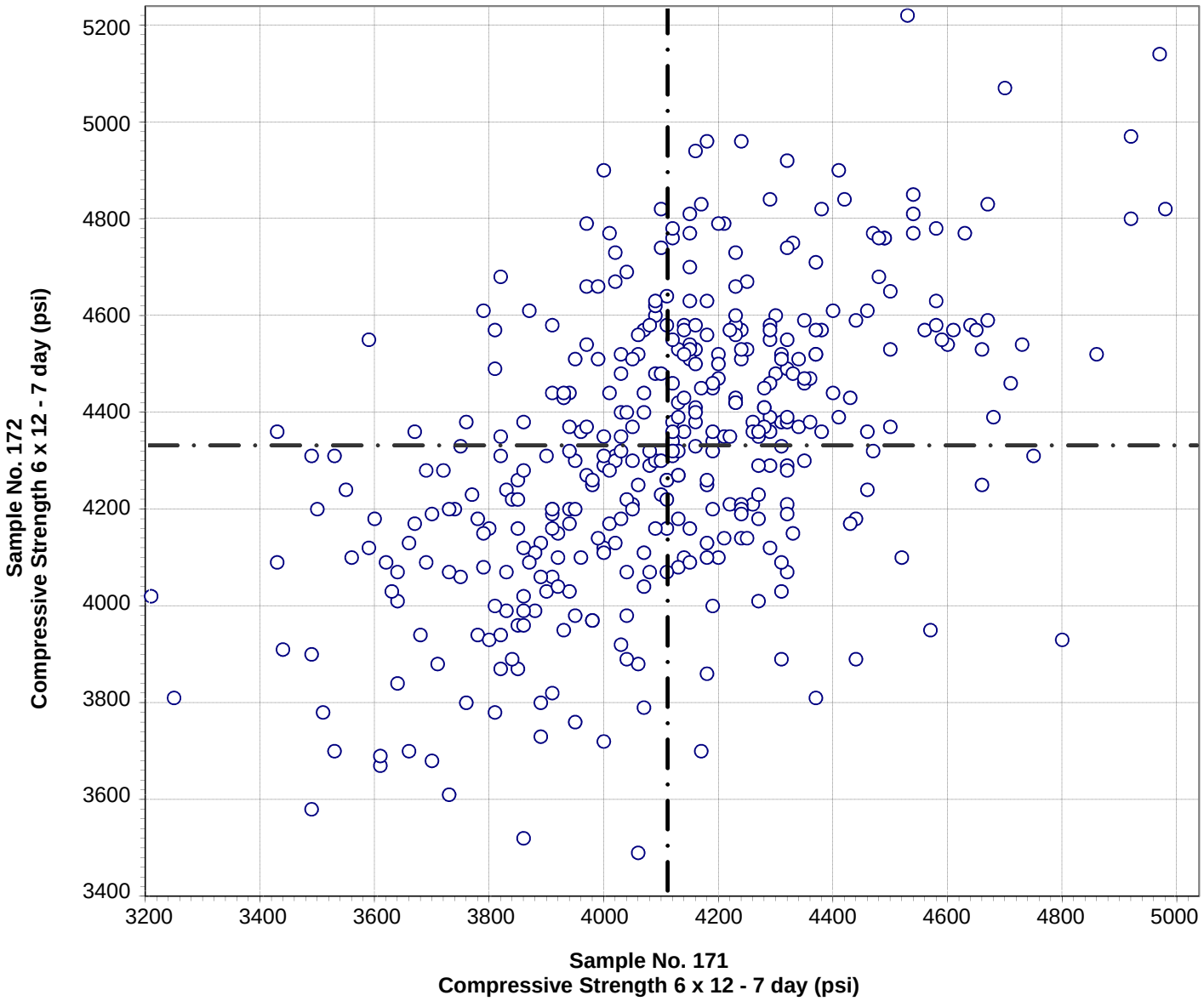


Test No. 7 Density of Compressive Strength Specimen 1086 Points

Sample No. 171	Ave	146	S.D.	1.3	C.V.	0.9
Sample No. 172	Ave	146	S.D.	1.4	C.V.	0.9

Labs Eliminated: 33, 202, 207, 523, 956, 1154, 1210, 1247, 1307, 1372, 1446, 1471, 1508, 1551, 1596, 1669, 1799, 1876, 1979, 2030, 2123, 2130, 2287, 2314, 2365, 2509, 2631, 2686, 2975, 3038, 3039, 3131, 3199, 3378, 3412, 3448, 3474, 3529, 3592, 3597, 3675, 3755, 3758, 3781, 3782, 3821, 3856, 3860, 3864, 3884

CCRL Proficiency Sample Program
Compressive Strength 6 x 12 - 7 day
CONCRETE Samples No. 171 and No. 172



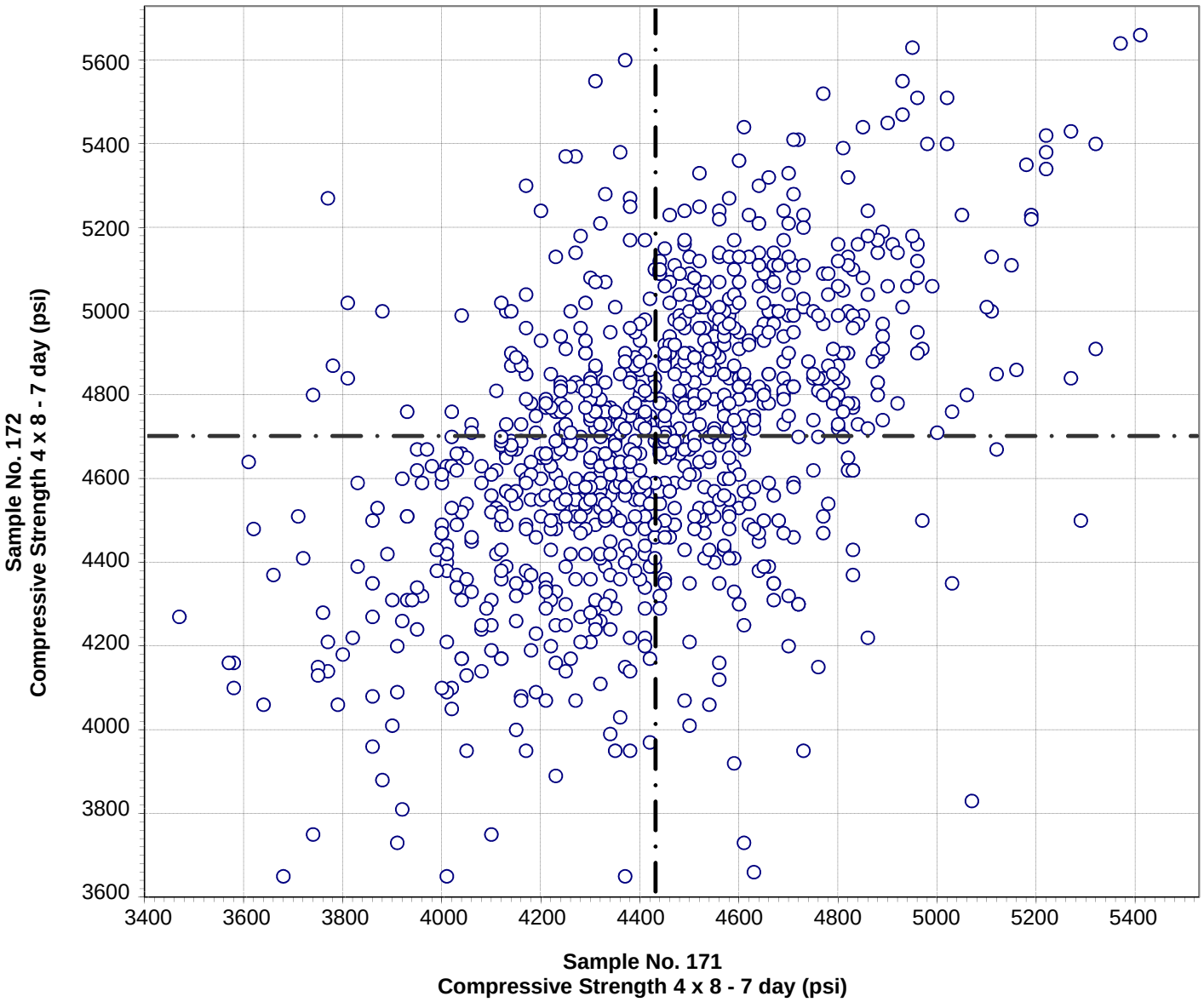
Test No. 4 Compressive Strength 6 x 12 - 7 day 397 Points

Sample No. 171	Ave	4110	S.D.	287	C.V. 7.0
Sample No. 172	Ave	4329	S.D.	303	C.V. 7.0

Labs Eliminated: 1649, 3474, 3657, 3902

Labs off Diagram: 1508, 3531, 3905

CCRL Proficiency Sample Program
Compressive Strength 4 x 8 - 7 day
CONCRETE Samples No. 171 and No. 172



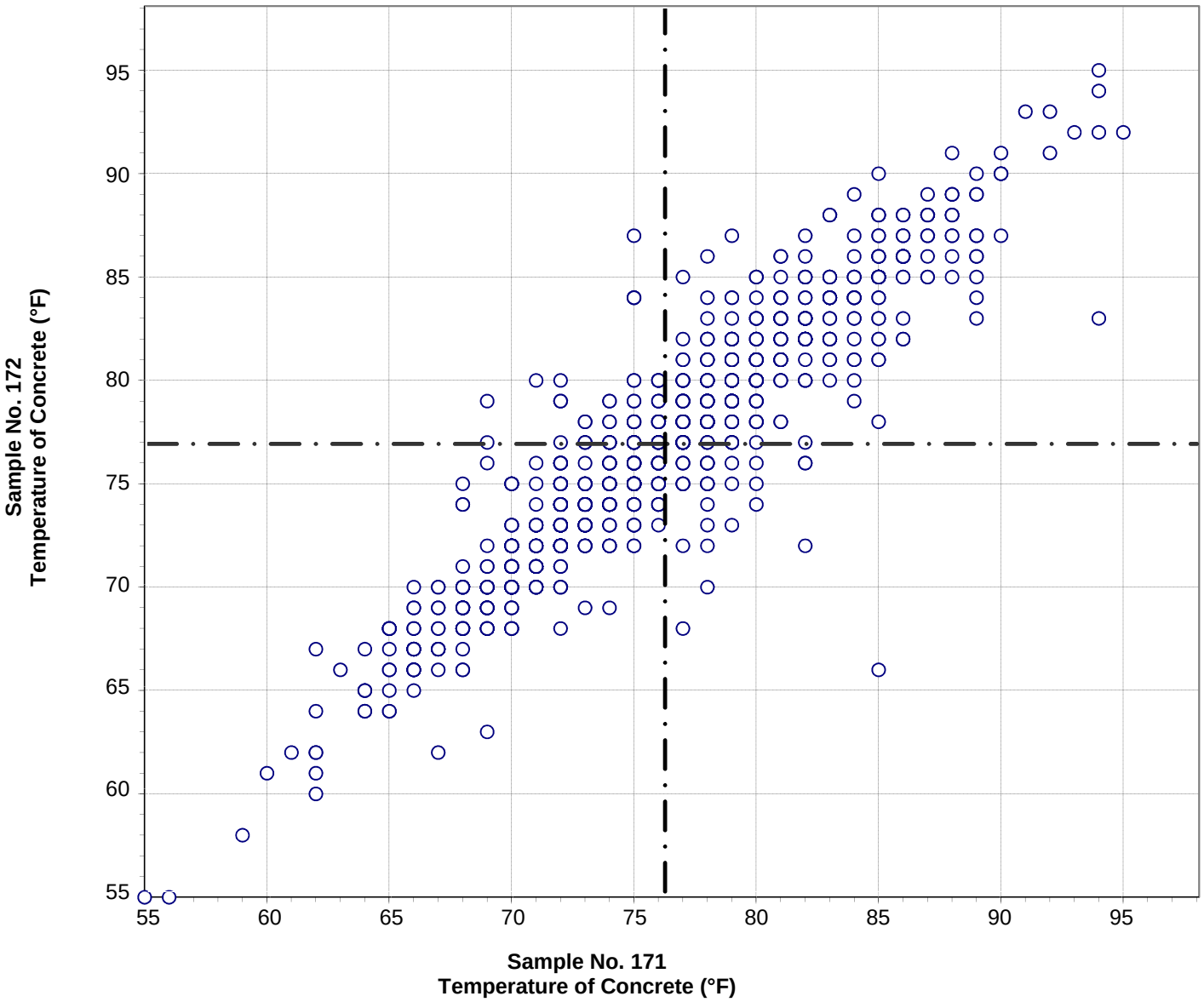
Test No. 4 Compressive Strength 4 x 8 - 7 day 957 Points

Sample No. 171	Ave	4430	S.D.	297	C.V. 6.7
Sample No. 172	Ave	4699	S.D.	343	C.V. 7.3

Labs Eliminated: 4, 537, 1168, 1210, 1372, 1456, 1709, 2268, 2452, 2509, 2895, 3508, 3544, 3718, 3742, 3795, 3884, 3894

Labs off Diagram: 3313, 951, 1318, 1551, 1892, 3785, 3895

CCRL Proficiency Sample Program
Temperature of Concrete
CONCRETE Samples No. 171 and No. 172



Test No. 5 Temperature of Concrete 1384 Points

Sample No. 171	Ave 76	S.D. 6	C.V. 8.0
Sample No. 172	Ave 77	S.D. 6	C.V. 7.8

Labs off Diagram: 552