CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Concrete Proficiency Samples
Number 149 and Number 150

January 2009

CCRL CEMENT AND CONCRETE REFERENCE LABORATORY

CCRL
Cement and Concrete
Reference Laboratory

www.ccrl.us

January 12, 2009

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

SUBJECT: Concrete Proficiency Samples No. 149 and No. 150

Enclosed is your copy of the final report on the test results for the CCRL Concrete Proficiency Samples which were distributed in November 2008.

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 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 April 2009.

Sincerely,

Robin K. Haupt

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

Attachment

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. 149 and No. 150

This letter, and the material included with it, constitute the final report, and summary of results for the current pair of Concrete Proficiency Samples, which were distributed in November 2008. 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 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 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. 149 and No. 150
Final Report - January 12, 2008

SUMMARY OF RESULTS

Test		#Labs	Sample No. 149 Average	S.D.	C.V.	Sample No. 150 Average	S.D.	C.V.
Air Cont, Volume	%	902	1.21	0.46	38.1	1.56	0.48	30.6
Air Cont, Volume	%	* 869	1.19	0.37	31.3	1.54	0.36	23.5
Air Cont, Pressure	%	1078	1.2	0.55	46.9	1.5	0.43	28.2
Air Cont, Pressure	%	*1021	1.1	0.30	26.8	1.5	0.29	20.0
Slump	inches	1087	3.31	1.2	37.2	3.54	1.1	31.8
Slump	inches	*1080	3.30	1.2	36.7	3.52	1.1	30.7
Unit Weight	lbs/ft^3	1084	151.3	2.9	1.95	150.8	2.9	1.90
Unit Weight	lbs/ft^3	*1037	151.3	1.1	0.756	150.8	1.2	0.771
Compressive Strength, 7 day, 6 x 12 inch specimens								
Comp Strength	psi	584	4176	327.9	7.85	4203	394.9	9.40
Comp Strength	psi	* 578	4177	307.8	7.37	4208	365.0	8.68
Compressive Strength, 7 day, 4 x 8 inch specimens								
Comp Strength	psi	501	4557	447.8	9.83	4612	455.2	9.87
Comp Strength	psi	* 489	4586	383.0	8.35	4627	418.5	9.04
Temperature of Conc	°F	944	70	6.5	9.30	70	6.5	9.35

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

Air Content - Volumetric 12 72 397 472 640 867 1196 1200 1278 1372 1451 1535 1580 1777 1780 1852 2062 2193 2273 2274 2346 2403 2445 2494 2686 2812 2989 3087 3109 3201 3205 3206 3377

Air Content - Pressure 12 72 188 212 397 513 640 672 867 1008 1196 1200 1852 2062 2273 2274 2346 2445 2812 2923 3067 3083 3087 3131 3201 3205 3206 3239 18 849 1003 1194 1287 1359 1372 1410 1509 1660 1749 1777 1784 2053 2063 2115 2136 2250 2302 2311 2399 2423 2686 2855 2941 3204 3295 3362 3377

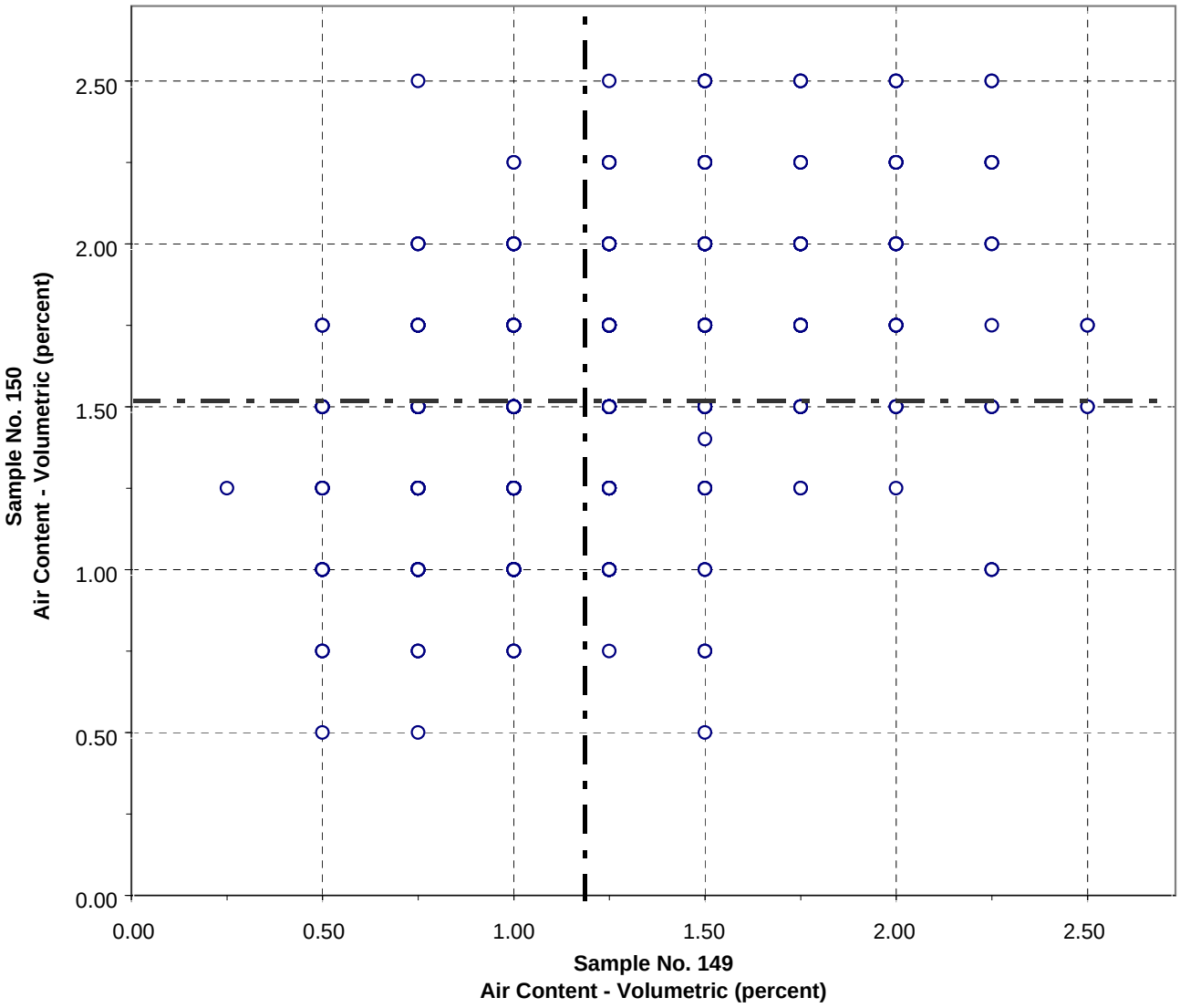
Slump of Concrete 19 1372 2399 2404 3260 3295 3373

Unit Weight of Concrete 997 1561 1713 2140 2420 2874 3138 3308 72 268 293 533 795 896 1070 1173 1210 1379 1486 1865 1900 2030 2033 2132 2185 2216 2274 2346 2364 2399 2404 2438 2550 2559 2923 2941 2981 2989 3037 3083 3131 3147 3191 3206 3347 3377 3392

Compressive Strength (6x12) 640 1665 2044 2136 2399 3377

Compressive Strength (4x8) 397 471 595 1560 1800 2052 2346 3053 3083 3194 3288 3319

CCRL Proficiency Sample Program
Air Content - Volumetric Method
CONCRETE Samples No. 149 and No. 150



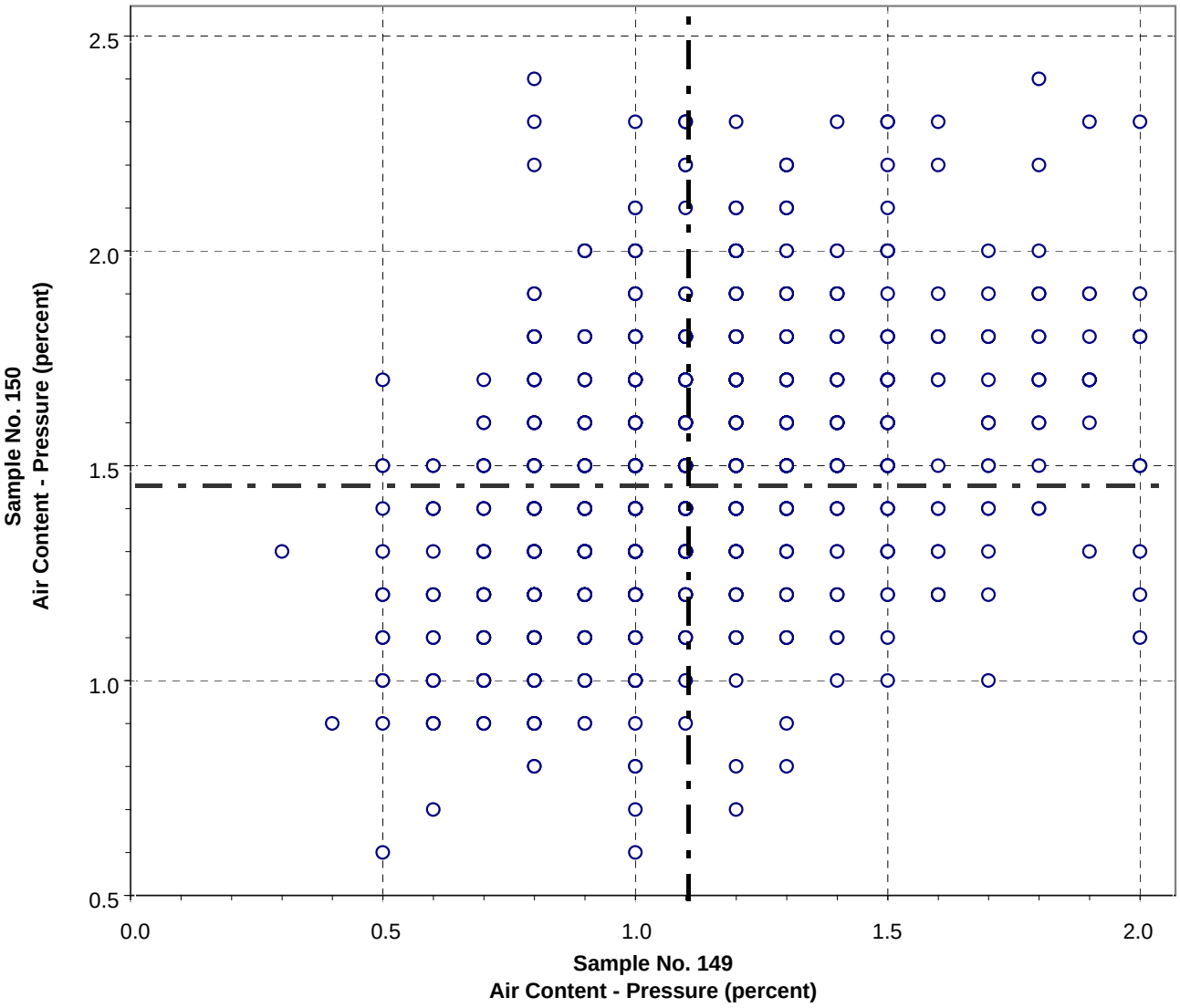
Test No. 1 Air Content - Volumetric Method 865 Points

Sample No. 149	Ave	1.19	S.D.	0.37	C.V.	31.3
Sample No. 150	Ave	1.54	S.D.	0.36	C.V.	23.5

Labs eliminated: 12, 72, 397, 472, 640, 867, 1196, 1200, 1278, 1372, 1451, 1535, 1580, 1777, 1780, 1852, 2062, 2193, 2273, 2274, 2346, 2403, 2445, 2494, 2686, 2812, 2989, 3087, 3109, 3201, 3205, 3206, 3377

Labs off Diagram: 2250, 2855, 3204, 3239

CCRL Proficiency Sample Program
Air Content - Pressure Method
CONCRETE Samples No. 149 and No. 150



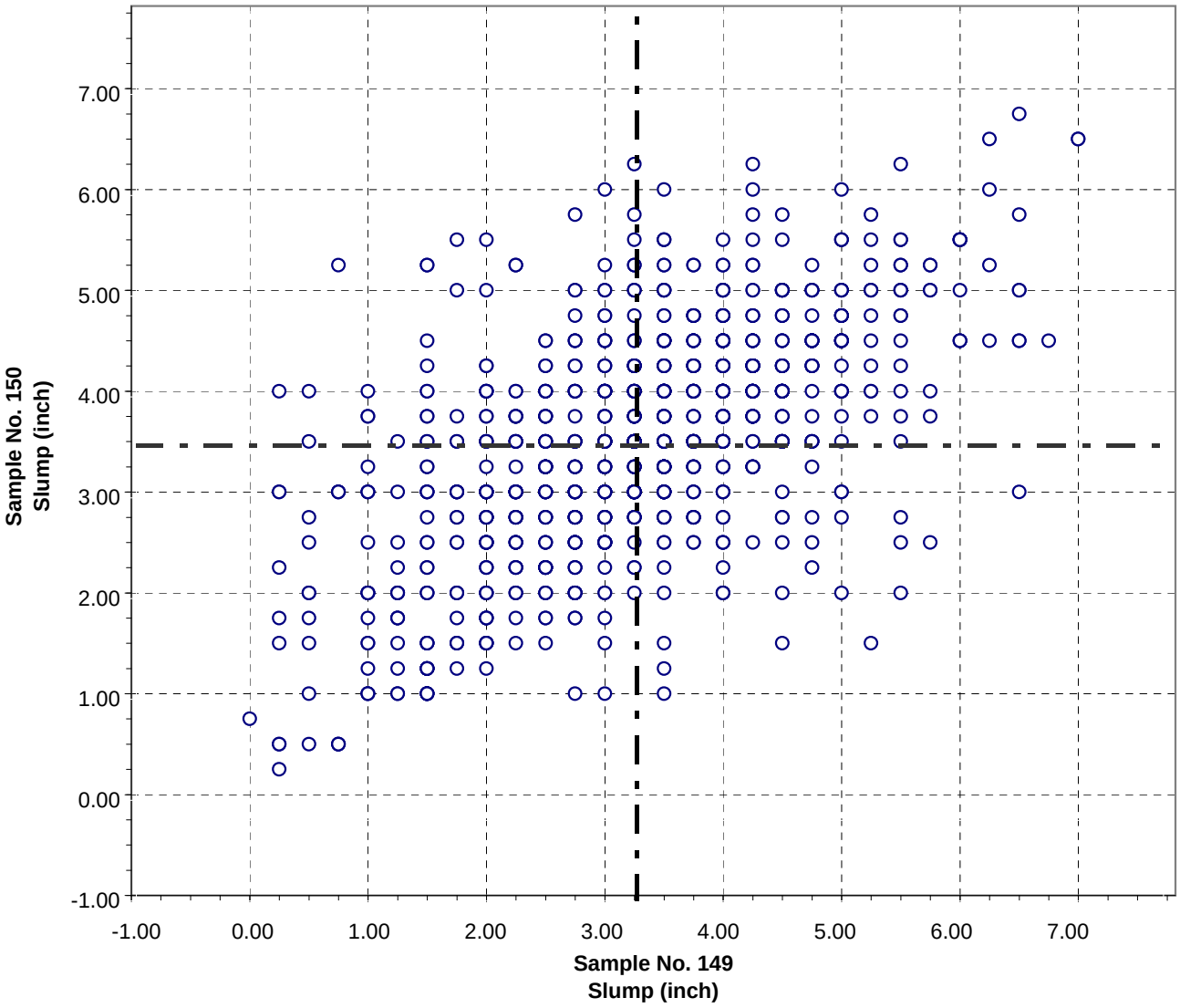
Test No. 6 Air Content - Pressure Method 1018 Points

Sample No. 149	Ave	1.1	S.D.	0.30	C.V.	26.8
Sample No. 150	Ave	1.5	S.D.	0.29	C.V.	20.0

Labs eliminated: See SUMMARY OF RESULTS page for list of labs.

Labs off Diagram: 1455, 1821, 3199

CCRL Proficiency Sample Program
Slump of Concrete
CONCRETE Samples No. 149 and No. 150

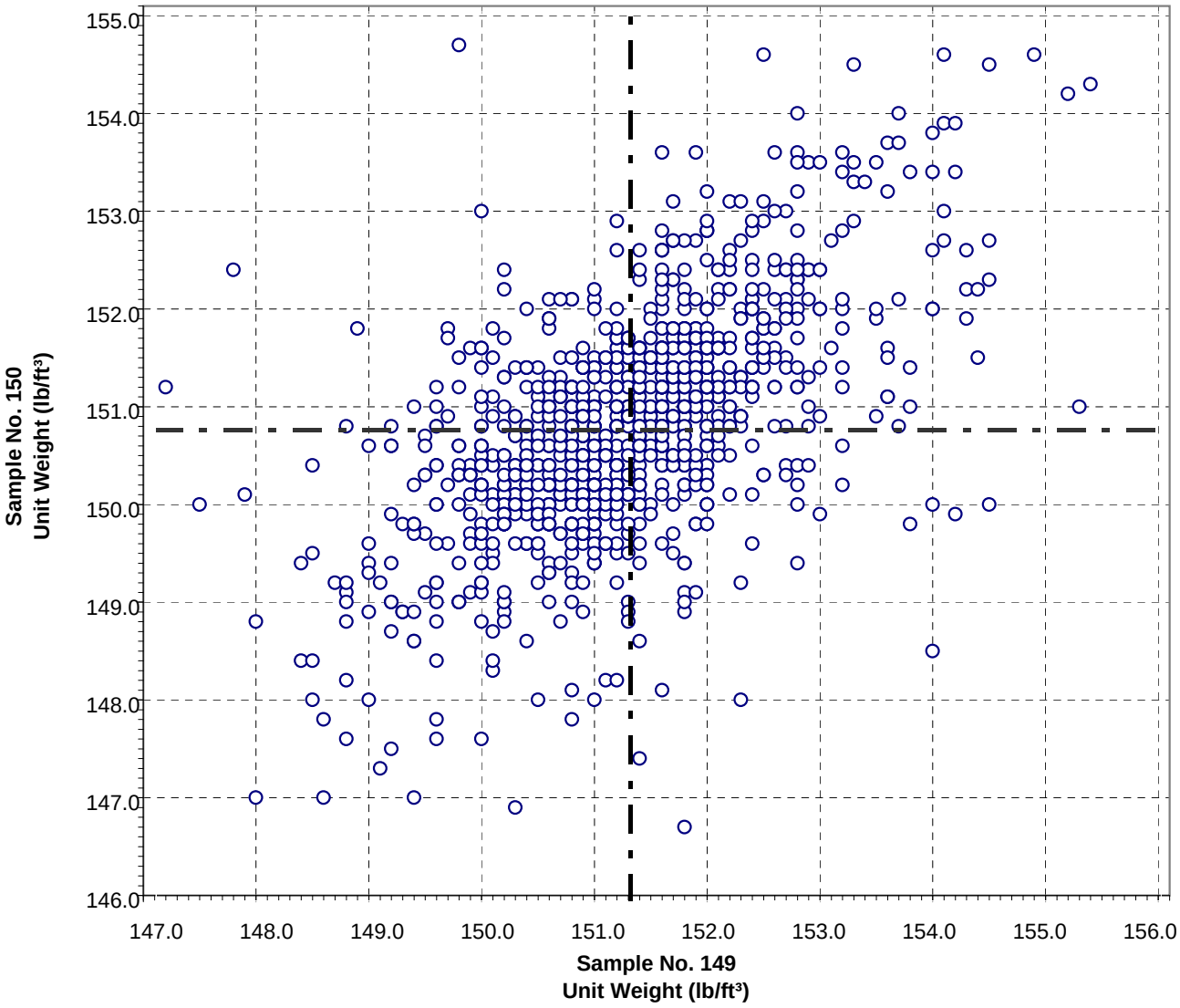


Test No. 2 Slump of Concrete 1080 Points

Sample No. 149	Ave	3.30	S.D.	1.2	C.V.	36.7
Sample No. 150	Ave	3.52	S.D.	1.1	C.V.	30.7

Labs eliminated: 19, 1372, 2399, 2404, 3260, 3295, 3373

CCRL Proficiency Sample Program
Unit Weight of Concrete
CONCRETE Samples No. 149 and No. 150

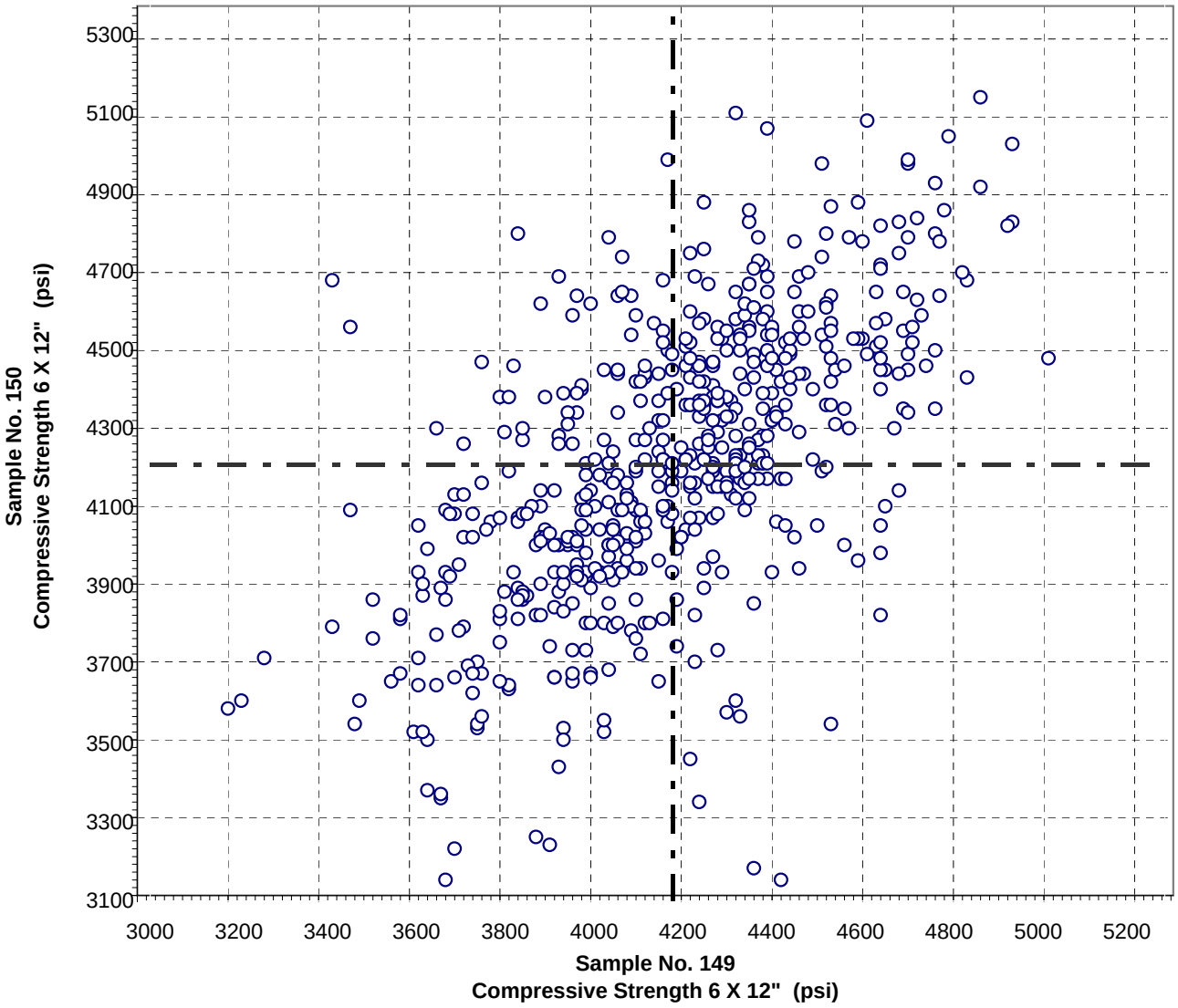


Test No. 3 Unit Weight of Concrete 1037 Points

Sample No. 149	Ave	151.3	S.D.	1.1	C.V. 0.756
Sample No. 150	Ave	150.8	S.D.	1.2	C.V. 0.771

Labs eliminated: 997, 1561, 1713, 2140, 2420, 2874, 3138, 3308, 72, 268, 293, 533, 795, 896, 1070, 1173, 1210, 1379, 1486, 1865, 1900, 2030, 2033, 2132, 2185, 2216, 2274, 2346, 2364, 2399, 2404, 2438, 2550, 2559, 2923, 2941, 2981, 2989, 3037, 3083, 3131, 3147, 3191, 3206, 3347, 3377, 3392

CCRL Proficiency Sample Program
Compressive Strength 6 X 12 - 7 day
CONCRETE Samples No. 149 and No. 150



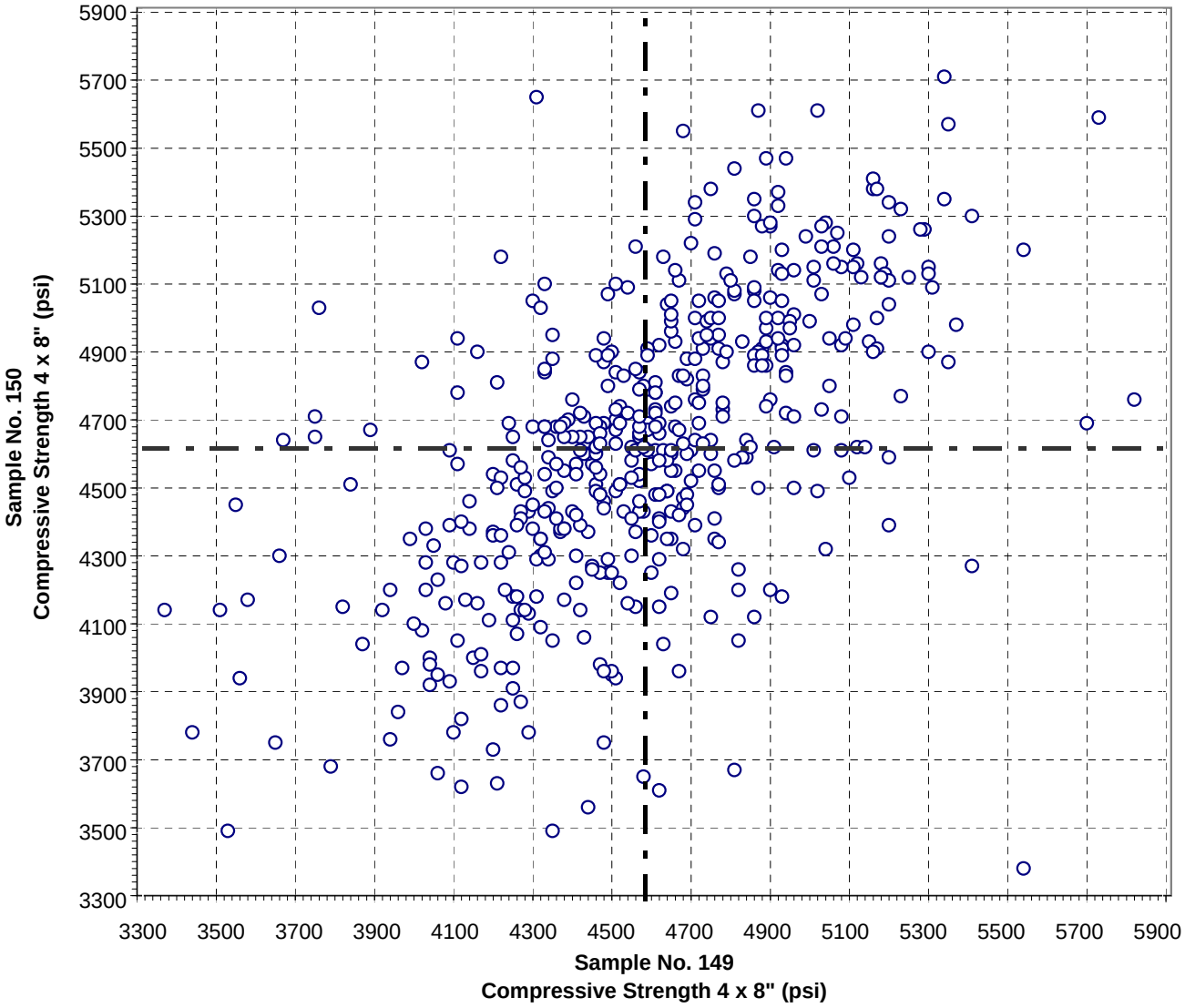
Test No. 4 Compressive Strength 6 X 12 - 7 day 576 Points

Sample No. 149	Ave	4177	S.D.	307.8	C.V. 7.37
Sample No. 150	Ave	4208	S.D.	365.0	C.V. 8.68

Labs eliminated: 640, 1665, 2044, 2136, 2399, 3377

Labs off Diagram: 997, 3206

CCRL Proficiency Sample Program
Compressive Strength 4 x 8 - 7 day
CONCRETE Samples No. 149 and No. 150



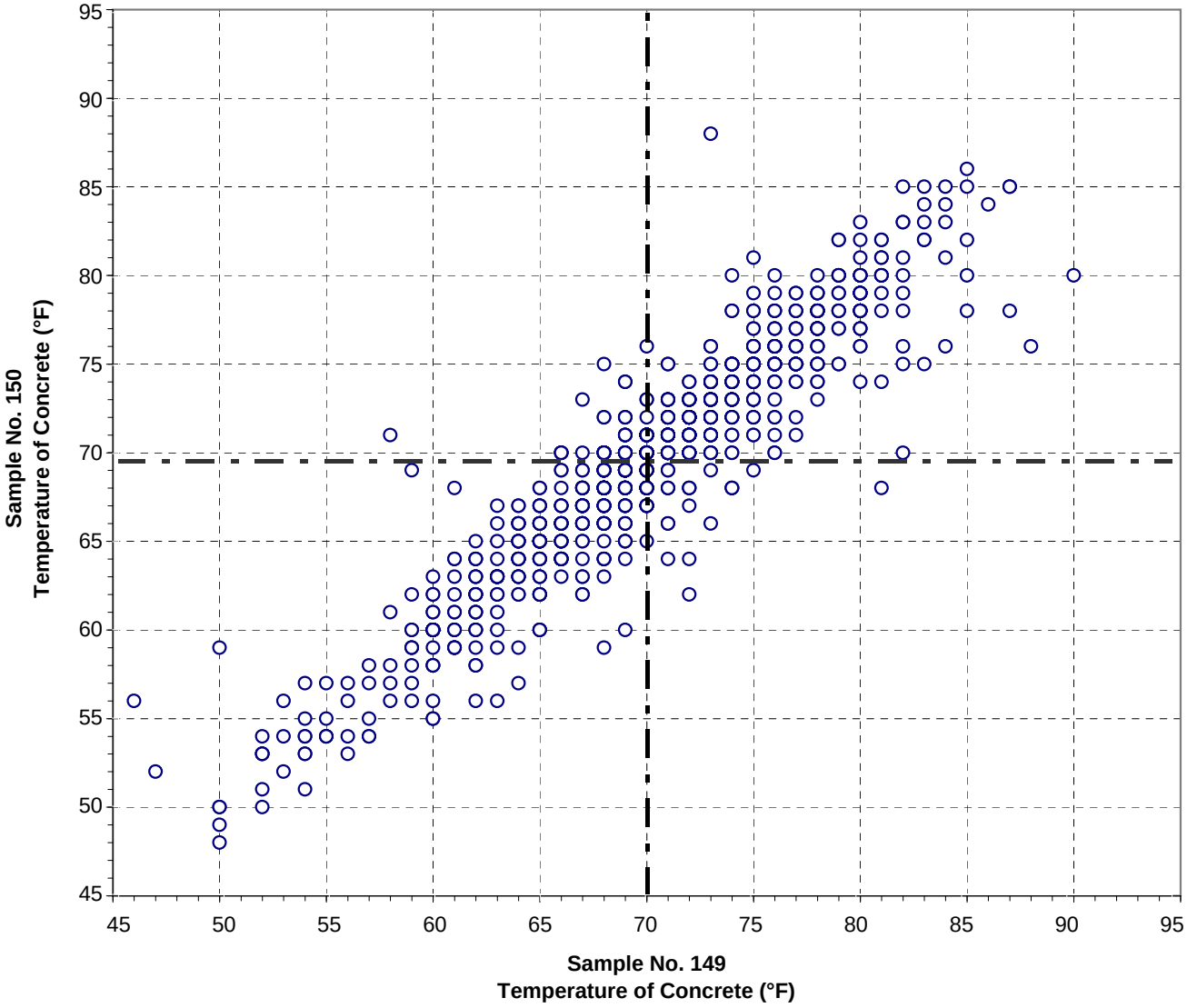
Test No. 4 Compressive Strength 4 x 8 - 7 day 488 Points

Sample No. 149	Ave	4586	S.D.	383.0	C.V. 8.35
Sample No. 150	Ave	4627	S.D.	418.5	C.V. 9.04

Labs eliminated: 397, 471, 595, 1560, 1800, 2052, 2346, 3053, 3083, 3194, 3288, 3319

Labs off Diagram: 3268

CCRL Proficiency Sample Program
Temperature of Concrete
CONCRETE Samples No. 149 and No. 150



Test No. 5 Temperature of Concrete 943 Points

Sample No. 149	Ave	70	S.D.	6.5	C.V. 9.30
Sample No. 150	Ave	70	S.D.	6.5	C.V. 9.35

Labs off Diagram: 3288