

CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report

Concrete Proficiency Samples

Number 189 and Number 190

December 2018



CCRL
Cement and Concrete
Reference Laboratory

www.ccril.us



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Cement and Concrete
Reference Laboratory

www.ccrl.us

December 20, 2018

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

SUBJECT: Concrete Proficiency Samples No. 189 and No. 190

Enclosed is your copy of the final report on the test results for the CCRL Concrete Proficiency Samples which were distributed in October 2018.

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 April 2019.

Sincerely,

Kent Niedzielski
Program Manager, Proficiency Sample Program
Cement and Concrete Reference Laboratory

To: Participants in the CCRL Concrete Proficiency Sample Program

FROM: Kent Niedzielski, Program Manager, Proficiency Sample Program

SUBJECT: Explanation of Final Report on Results of Tests on Portland Cement Concrete Proficiency Samples No. 189 and No. 190

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 August 2018. This material includes a statistical Summary of Results, and a set of general Scatter Diagrams. If your laboratory was a participant in this program a Table of Laboratory Results (lab data and ratings) for your laboratory 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.

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.*

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 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

Proficiency Samples No. 189 and No. 190

Final Report – December 20, 2018

SUMMARY OF RESULTS

Sample No. 189

Sample No. 190

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
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Air Content - Volumetric Method (percent)

1258	2.34	0.54	23	2.98	0.63	21
*1229	2.30	0.45	20	2.95	0.57	19

* Labs Eliminated - 4, 40, 43, 1027, 1168, 1215, 1352, 1401, 1418, 1785, 1995, 2250, 2355, 2372, 2515, 2961, 3098, 3224, 3239, 3450, 3529, 3704, 3766, 3781, 3842, 3900, 4074, 4126, 4192

Air Content - Pressure Method (percent)

1462	2.3	0.53	23	2.9	0.60	20
*1427	2.2	0.43	19	2.9	0.53	18

* Labs Eliminated - 40, 604, 795, 828, 1168, 1215, 1352, 1418, 1519, 1767, 1785, 1995, 2250, 2311, 2372, 2509, 2515, 2961, 3028, 3098, 3224, 3529, 3704, 3722, 3781, 3857, 3867, 3886, 3900, 3922, 3950, 4028, 4074, 4126, 4192

Slump of Concrete (inch)

1471	3.73	1.27	34	3.89	1.16	30
*1449	3.68	1.18	32	3.86	1.10	28

* Labs Eliminated - 757, 1563, 1615, 1670, 2139, 2165, 2721, 2961, 3003, 3489, 3570, 3649, 3706, 3722, 3842, 4074, 4126, 4172, 4242, 4317, 4333, 4368

Unit Weight of Concrete (lb/ft³)

1469	151.6	3.0	2.0	150.7	2.8	1.9
*1448	151.8	1.6	1.1	150.8	1.7	1.1

* Labs Eliminated - 95, 636, 753, 990, 1037, 1147, 1287, 1563, 1903, 2149, 3166, 3570, 3781, 3794, 3905, 4058, 4140, 4172, 4198, 4238, 4355

Density of Compressive Strength Specimen (lb/ft³)

1341	153	2.0	1.3	152	1.9	1.2
*1310	153	1.5	1.0	152	1.5	1.0

* Labs Eliminated - 207, 376, 604, 636, 1139, 1154, 1484, 2023, 2161, 2372, 2398, 2497, 3046, 3069, 3266, 3344, 3570, 3589, 3619, 3659, 3758, 3759, 3781, 3794, 3900, 4028, 4069, 4140, 4198, 4329, 4348

Compressive Strength 4 x 8 - 7 day (psi)

1207	4854	450	9.3	4755	406	8.5
*1177	4892	334	6.8	4782	319	6.7

* Labs Eliminated - 804, 920, 923, 1330, 1418, 1519, 1859, 1991, 2372, 2420, 2501, 2511, 2515, 2719, 2974, 3171, 3435, 3706, 3722, 3755, 3781, 3849, 3857, 3955, 4074, 4140, 4192, 4198, 4238, 4317

CCRL PROFICIENCY SAMPLE PROGRAM

Proficiency Samples No. 189 and No. 190

Final Report – December 20, 2018

SUMMARY OF RESULTS

Sample No. 189

Sample No. 190

Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
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Compressive Strength 6 x 12 - 7 day (psi)

271	4441	344	7.7	4423	336	7.6
*267	4453	310	7.0	4427	298	6.7

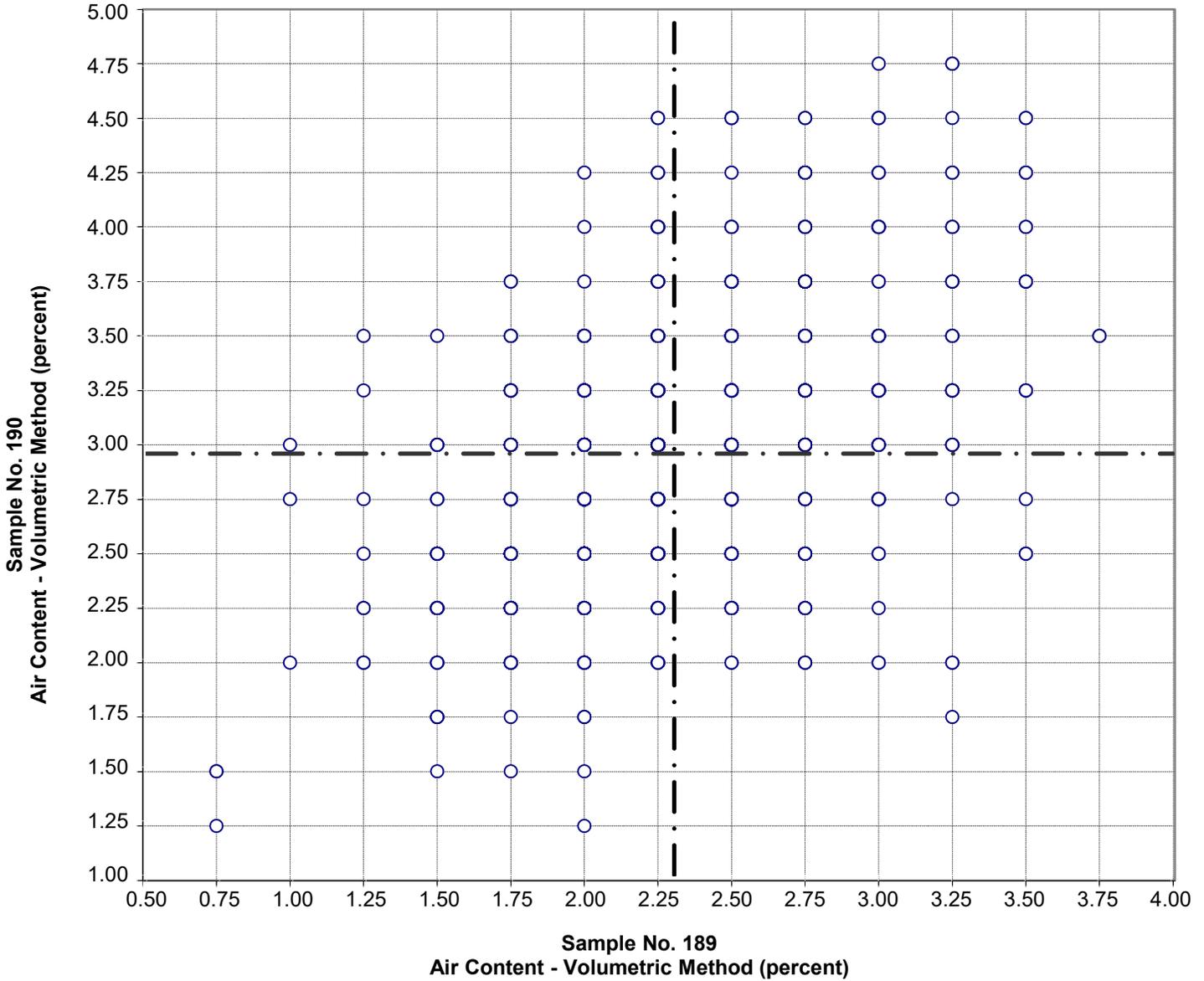
* Labs Eliminated - 1607, 2237, 3178, 4172

Temperature of Concrete (°F)

1469	71	6	9.1	69	6	9.0
*1448	70	6	8.4	69	6	8.4

* Labs Eliminated - 471, 896, 1434, 1501, 1520, 1721, 1792, 2062, 2106, 2240, 2401, 2803, 2997, 3032, 3344, 3421, 3789, 3961, 4171, 4243, 4355

**CCRL Proficiency Sample Program
Air Content - Volumetric Method
CONCRETE Samples No. 189 and No. 190**

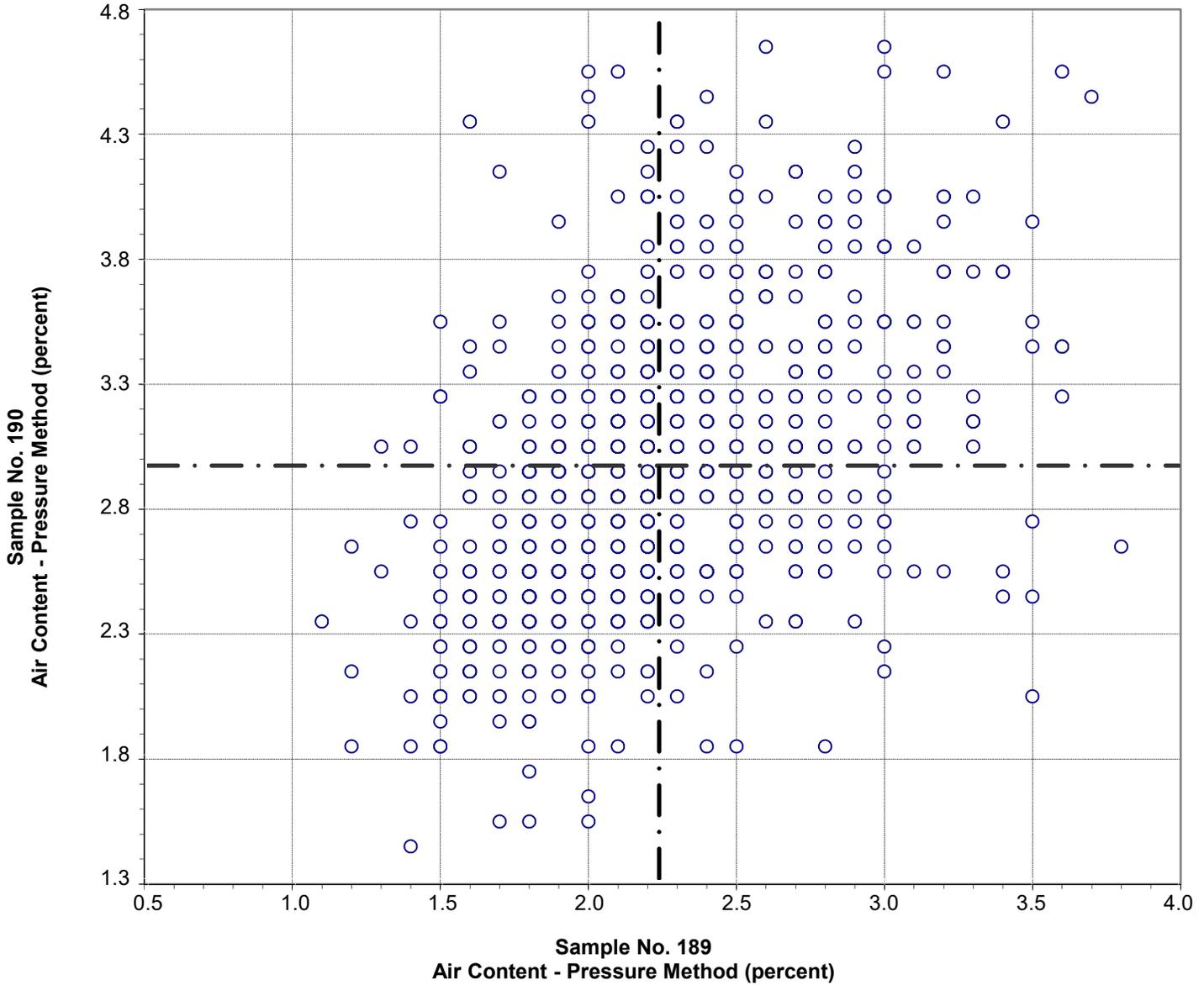


Test No. 1 Air Content - Volumetric Method 1229 Points

Sample No. 189	Ave 2.30	S.D. 0.45	C.V. 20
Sample No. 190	Ave 2.95	S.D. 0.57	C.V. 19

Labs Eliminated: 4, 40, 43, 1027, 1168, 1215, 1352, 1401, 1418, 1785, 1995, 2250, 2355, 2372, 2515, 2961, 3098, 3224, 3239, 3450, 3529, 3704, 3766, 3781, 3842, 3900, 4074, 4126, 4192

**CCRL Proficiency Sample Program
Air Content - Pressure Method
CONCRETE Samples No. 189 and No. 190**

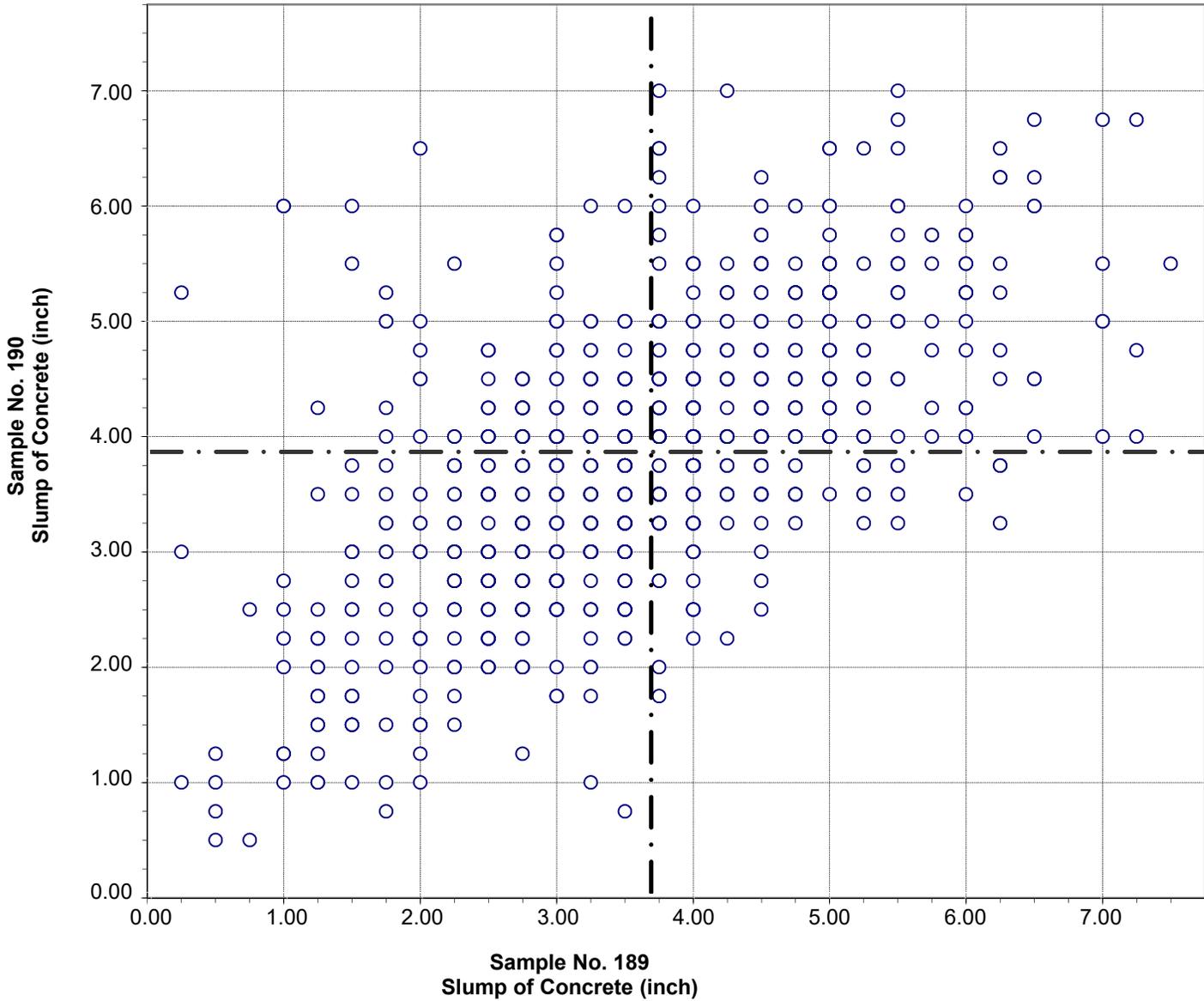


Test No. 6 Air Content - Pressure Method 1427 Points

Sample No. 189	Ave 2.2	S.D. 0.43	C.V. 19
Sample No. 190	Ave 2.9	S.D. 0.53	C.V. 18

Labs Eliminated: 40, 604, 795, 828, 1168, 1215, 1352, 1418, 1519, 1767, 1785, 1995, 2250, 2311, 2372, 2509, 2515, 2961, 3028, 3098, 3224, 3529, 3704, 3722, 3781, 3857, 3867, 3886, 3900, 3922, 3950, 4028, 4074, 4126, 4192

**CCRL Proficiency Sample Program
Slump of Concrete
CONCRETE Samples No. 189 and No. 190**

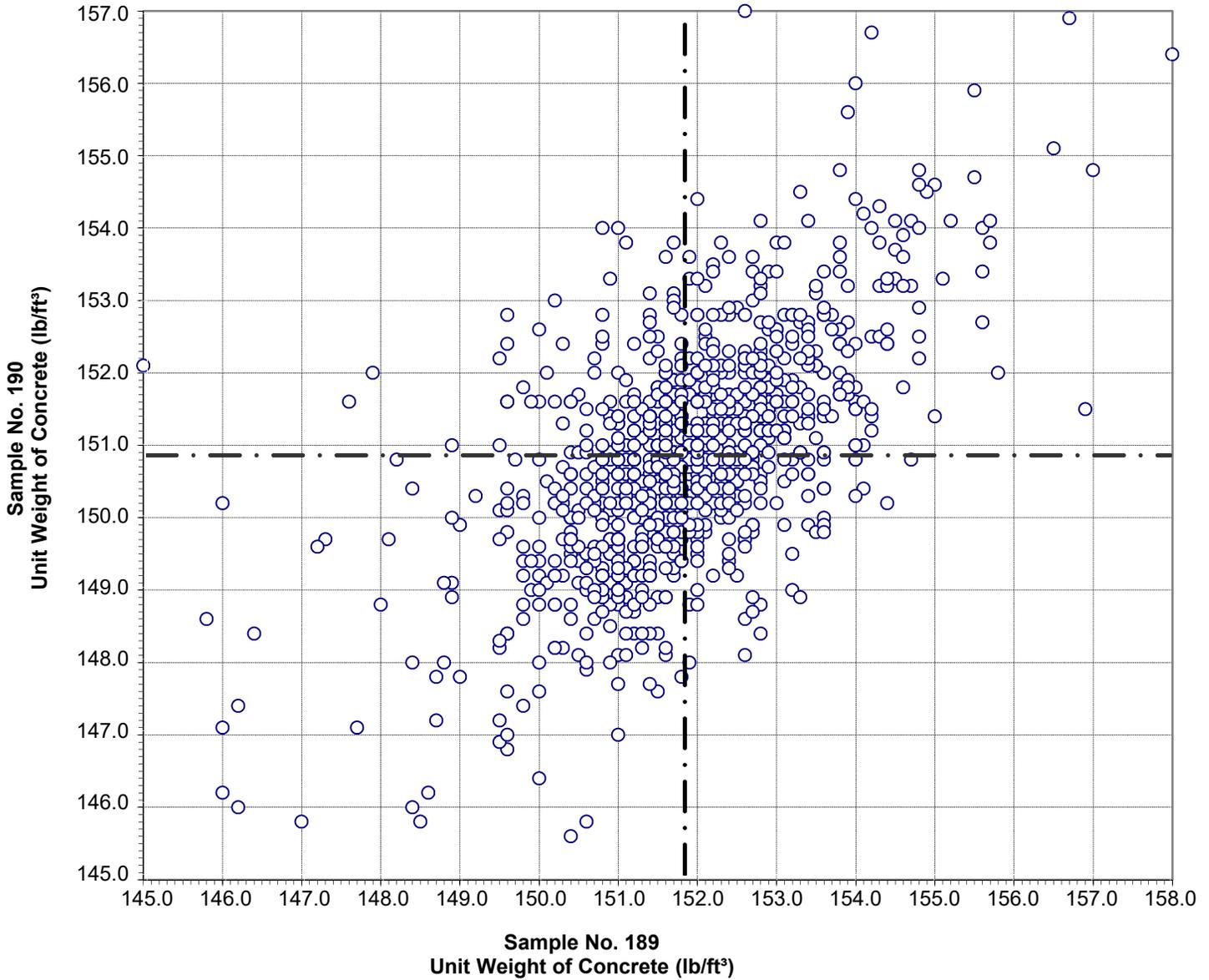


Test No. 2 Slump of Concrete 1449 Points

Sample No. 189	Ave 3.68	S.D. 1.18	C.V. 32
Sample No. 190	Ave 3.86	S.D. 1.10	C.V. 28

Labs Eliminated: 757, 1563, 1615, 1670, 2139, 2165, 2721, 2961, 3003, 3489, 3570, 3649, 3706, 3722, 3842, 4074, 4126, 4172, 4242, 4317, 4333, 4368

**CCRL Proficiency Sample Program
Unit Weight of Concrete
CONCRETE Samples No. 189 and No. 190**



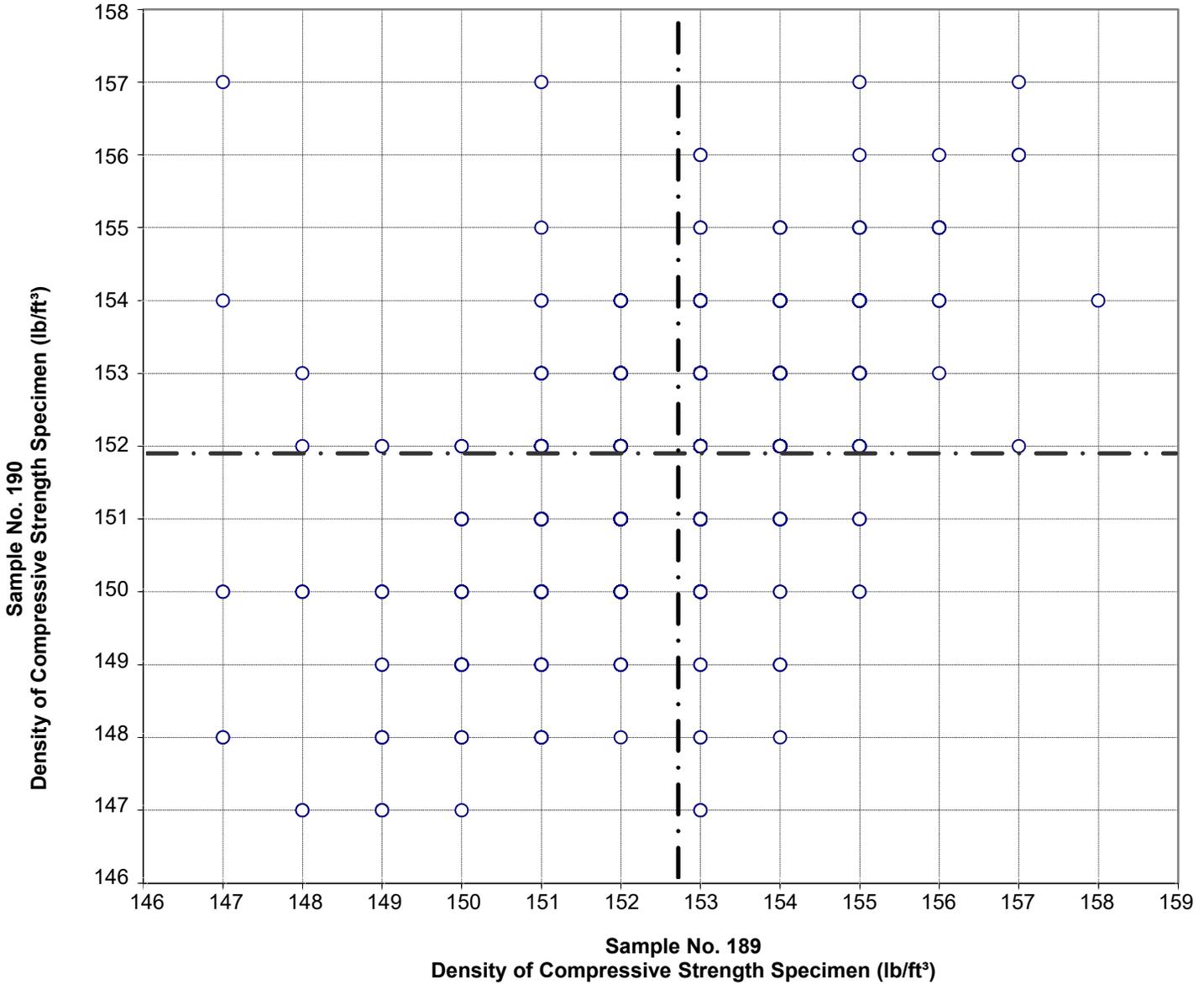
Test No. 3 Unit Weight of Concrete 1427 Points

Sample No. 189	Ave 151.8	S.D. 1.6	C.V. 1.1
Sample No. 190	Ave 150.8	S.D. 1.7	C.V. 1.1

Labs Eliminated: 95, 636, 753, 990, 1037, 1147, 1287, 1563, 1903, 2149, 3166, 3570, 3781, 3794, 3905, 4058, 4140, 4172, 4198, 4238, 4355

Labs off Diagram: 604, 1374, 1611, 1705, 1796, 2023, 2052, 2302, 2497, 3344, 3547, 3722, 3777, 3991, 4003, 4028, 4179, 4192, 4313, 4317, 4319

**CCRL Proficiency Sample Program
Density of Compressive Strength Specimen
CONCRETE Samples No. 189 and No. 190**

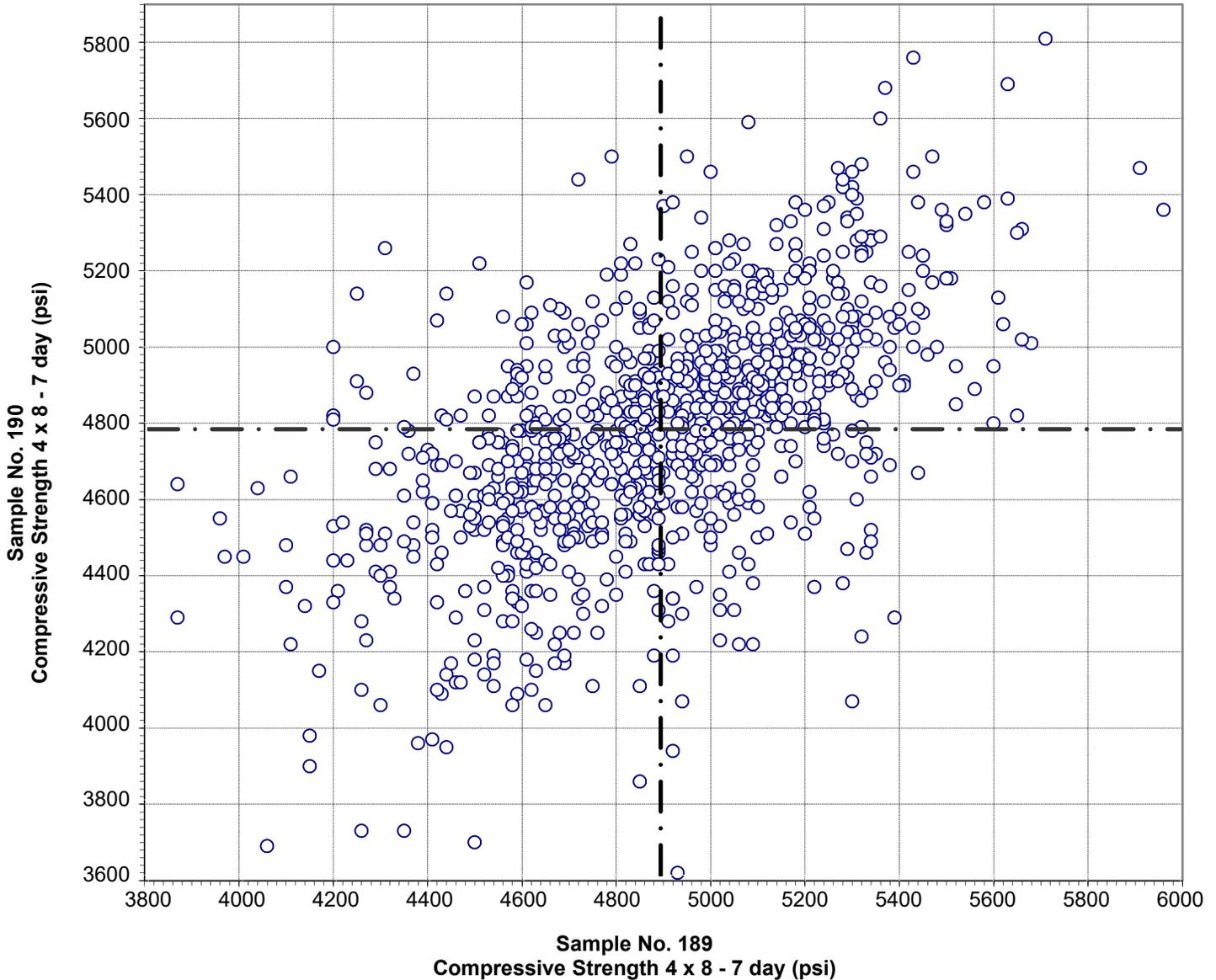


Test No. 7 Density of Compressive Strength Specimen 1310 Points

Sample No. 189	Ave 153	S.D. 1.5	C.V. 1.0
Sample No. 190	Ave 152	S.D. 1.5	C.V. 1.0

Labs Eliminated: 207, 376, 604, 636, 1139, 1154, 1484, 2023, 2161, 2372, 2398, 2497, 3046, 3069, 3266, 3344, 3570, 3589, 3619, 3659, 3758, 3759, 3781, 3794, 3900, 4028, 4069, 4140, 4198, 4329, 4348

**CCRL Proficiency Sample Program
Compressive Strength 4 x 8 - 7 day
CONCRETE Samples No. 189 and No. 190**



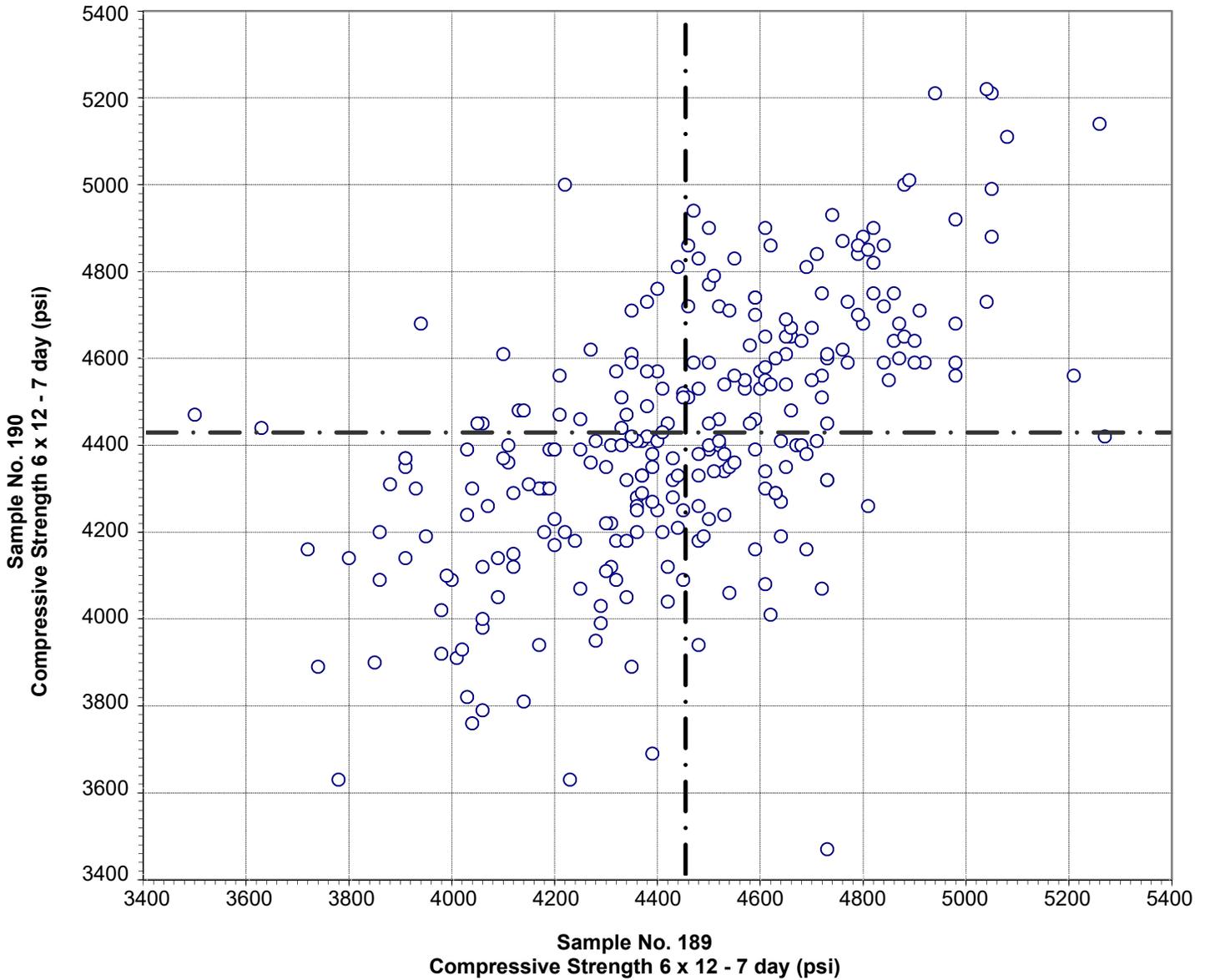
Test No. 4 Compressive Strength 4 x 8 - 7 day 1168 Points

Sample No. 189	Ave 4892	S.D. 334	C.V. 6.8
Sample No. 190	Ave 4782	S.D. 319	C.V. 6.7

Labs Eliminated: 804, 920, 923, 1330, 1418, 1519, 1859, 1991, 2372, 2420, 2501, 2511, 2515, 2719, 2974, 3171, 3435, 3706, 3722, 3755, 3781, 3849, 3857, 3955, 4074, 4140, 4192, 4198, 4238, 4317

Labs off Diagram: 2142, 2686, 2857, 2966, 3219, 3344, 4034, 4264, 4305

**CCRL Proficiency Sample Program
Compressive Strength 6 x 12 - 7 day
CONCRETE Samples No. 189 and No. 190**

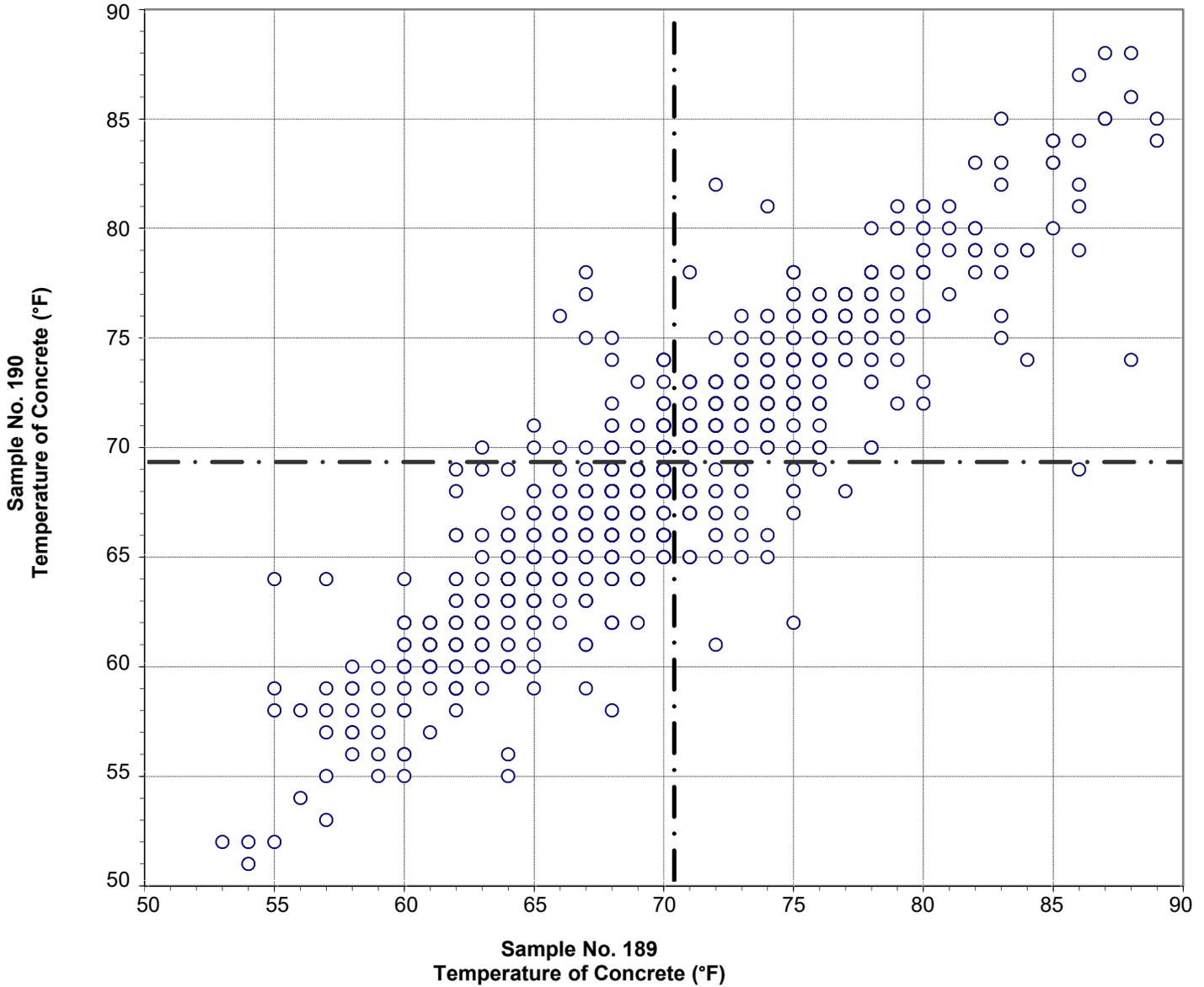


Test No. 4 Compressive Strength 6 x 12 - 7 day 267 Points

Sample No. 189	Ave 4453	S.D. 310	C.V. 7.0
Sample No. 190	Ave 4427	S.D. 298	C.V. 6.7

Labs Eliminated: 1607, 2237, 3178, 4172

**CCRL Proficiency Sample Program
Temperature of Concrete
CONCRETE Samples No. 189 and No. 190**



Test No. 5 Temperature of Concrete 1448 Points

Sample No. 189	Ave 70	S.D. 6	C.V. 8.4
Sample No. 190	Ave 69	S.D. 6	C.V. 8.4

Labs Eliminated: 471, 896, 1434, 1501, 1520, 1721, 1792, 2062, 2106, 2240, 2401, 2803, 2997, 3032, 3344, 3421, 3789, 3961, 4171, 4243, 4355