

CEMENT AND CONCRETE REFERENCE LABORATORY
PROFICIENCY SAMPLE PROGRAM

Final Report
Concrete Proficiency Samples
Number 143 and Number 144

June 2007



CCRL CEMENT AND CONCRETE
REFERENCE LABORATORY



CEMENT AND CONCRETE REFERENCE LABORATORY

AT THE
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SPONSORED BY
COMMITTEE C-1 ON CEMENT
COMMITTEE C-9 ON CONCRETE AND
CONCRETE AGGREGATES
AMERICAN SOCIETY FOR TESTING AND MATERIALS

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June 29, 2007

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

Subject: Concrete Proficiency Samples No. 143 and No. 144

Enclosed is your copy of the final report on the test results for the CCRL Concrete Proficiency Samples which were distributed in April 2007.

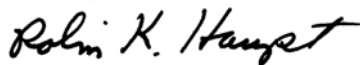
This report consists of a statistical Summary of Results, a set of general Scatter Diagrams and associated detailed information. The Table of Results with test results and ratings for your laboratory can be downloaded at our website located at: <http://ccrl.us/>.

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 November 2007.

Sincerely,



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. 143 and No. 144

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 April 2007. 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 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.

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 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. 143 and No. 144
Final Report - June 29, 2007

SUMMARY OF RESULTS

| Test | | #Labs | Sample No. 143 | | | Sample No. 144 | | |
|---------------------|---------------------|-------|----------------|-------|-------|----------------|-------|-------|
| | | | Average | S.D. | C.V. | Average | S.D. | C.V. |
| Air Cont, Volume | prcnt | 884 | 1.74 | 0.54 | 31.0 | 1.75 | 0.58 | 32.9 |
| Air Cont, Volume | prcnt | * 841 | 1.70 | 0.34 | 20.0 | 1.70 | 0.38 | 22.3 |
| Air Cont, Pressure | prcnt | 1049 | 1.7 | 0.49 | 28.3 | 1.7 | 0.50 | 29.3 |
| Air Cont, Pressure | prcnt | * 999 | 1.7 | 0.30 | 18.1 | 1.6 | 0.33 | 19.9 |
| Slump | inches | 1067 | 3.04 | 1.0 | 33.8 | 3.39 | 1.1 | 33.0 |
| Slump | inches | *1051 | 3.00 | 0.93 | 30.9 | 3.34 | 1.02 | 30.4 |
| Unit Weight | lbs/ft ² | 1059 | 150.0 | 4.0 | 2.65 | 150.2 | 3.9 | 2.63 |
| Unit Weight | lbs/ft ² | * 992 | 150.2 | 1.1 | 0.735 | 150.4 | 1.1 | 0.761 |
| Comp Str, 7 day | psi | 1058 | 4033 | 437.3 | 10.8 | 4452 | 486.8 | 10.9 |
| Comp Str, 7 day | psi | *1033 | 4047 | 363.8 | 8.99 | 4474 | 363.1 | 8.12 |
| Temperature of Conc | °F | 1066 | 77 | 6.2 | 8.09 | 76 | 5.9 | 7.80 |

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

Air Content - Volume 840 936 1182 1278 1465 1522 1543 1577 1716 1888 2081 2087 2090 2170 2344
2346 2411 2423 2430 2448 2488 2887 2954 2986 2989 3027 52 266 1359 1484 1541 1800 1842 2164
2282 2306 2333 2354 2444 3013 3071 3109 3183

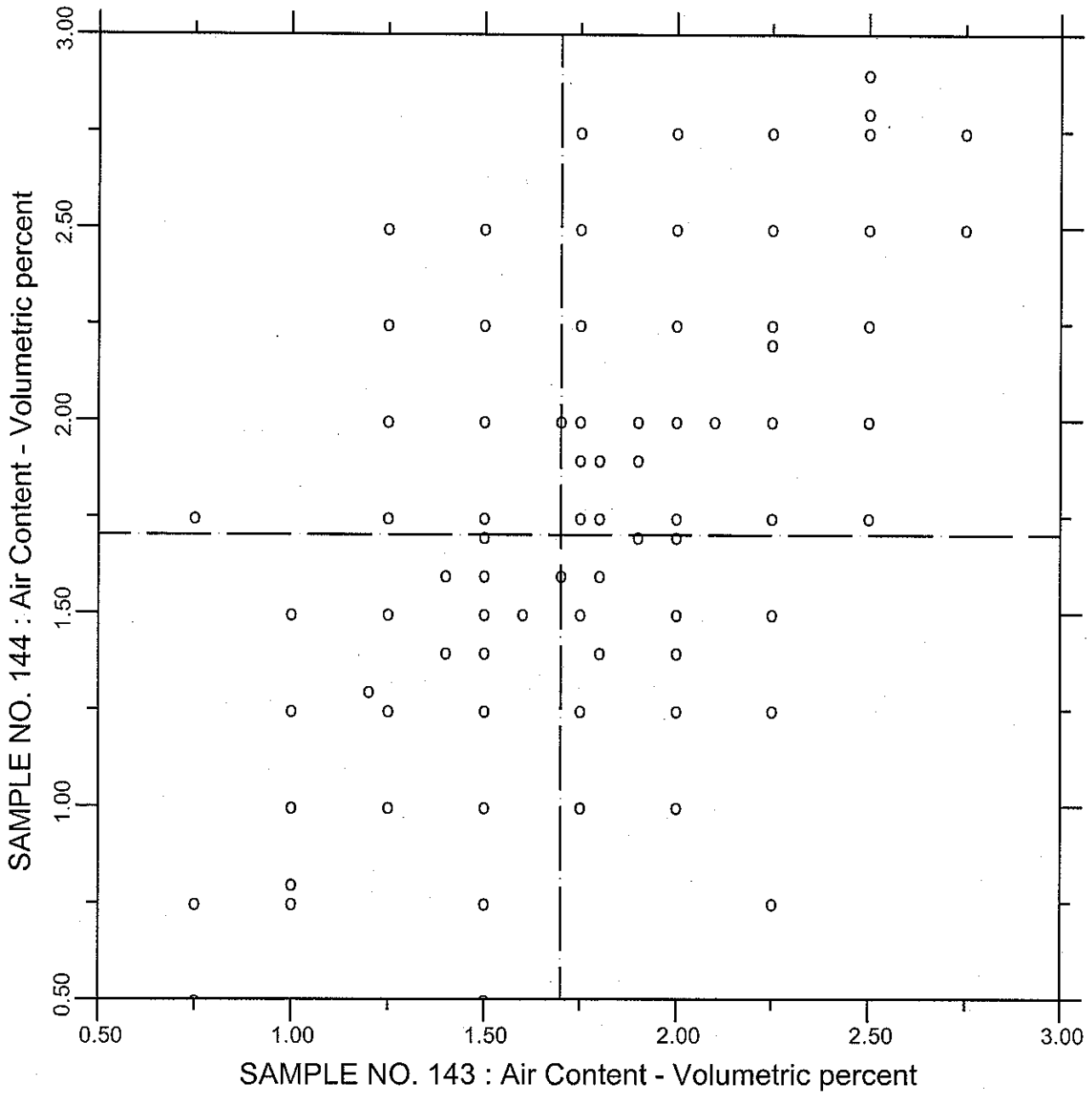
Air Content - Pressure 918 1465 1543 2041 2090 2164 2170 2222 2265 2344 2346 2358 2411 2423 2430
2444 2488 2887 2951 3109 3141 3181 728 757 898 988 1158 1186 1287 1410 1455 1552 1564 1565
1681 1784 1792 1800 1809 1842 1906 2076 2107 2169 2248 2282 2354 2621 3142 3183

Slump 51 951 1565 1642 1772 1784 1809 1914 2054 2090 2164 2347 2354 2393 3007 3087

Unit Weight 1125 1645 2000 2005 2302 14 21 715 788 1158 1196 1453 1465 1543 1552 1721 2008
2058 2090 2130 2164 2169 2181 2215 2259 2287 2289 2319 2423 2488 2621 2887 2961 3007 3027 3109
636 642 896 950 952 962 1200 1287 1307 1551 1632 1636 1643 1663 1747 1765 2088 2126 2170 2230
2333 2346 2347 2358 2411 2986 2996 3016 3069 3121 3163

Compressive Strength 76 211 1070 1314 1824 1993 2054 2090 2248 2268 2354 2992 981 1287 1410 1543
2071 2136 2164 2224 2298 2369 2887 3054 3072

CCRL PROFICIENCY SAMPLE PROGRAM
 Air Content - Volumetric Method
 CONCRETE SAMPLES NO. 143 & NO. 144



TEST NO.1 Air Content - Volumetric 841 POINTS

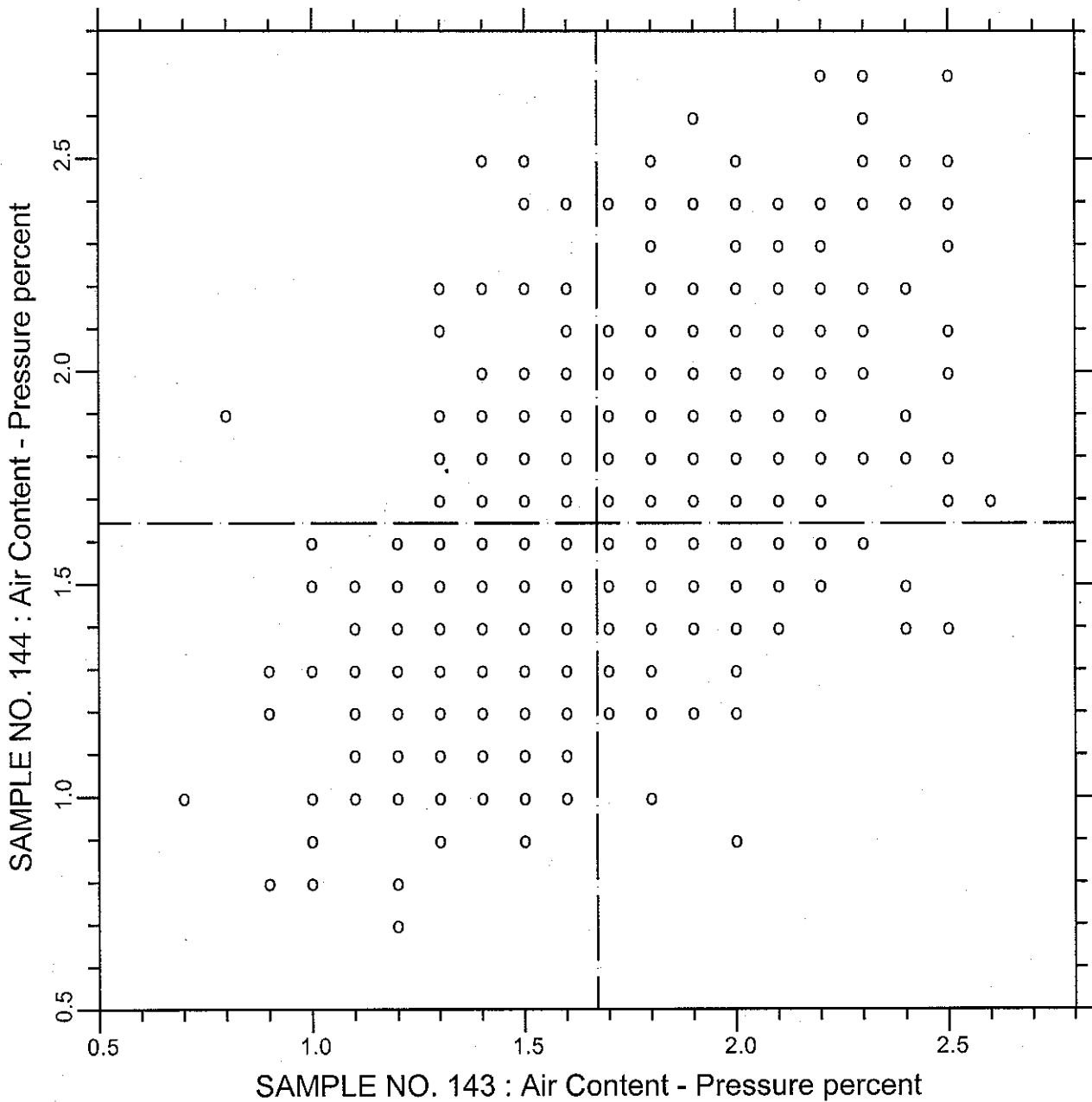
SAMPLE NO. 143 AVE 1.700 S.D. 0.34 C.V. 20.0

SAMPLE NO. 144 AVE 1.703 S.D. 0.38 C.V. 22.3

LABS ELIMINATED

See SUMMARY OF RESULTS page for list of labs.

CCRL PROFICIENCY SAMPLE PROGRAM
 Air Content - Pressure Method
 CONCRETE SAMPLES NO. 143 & NO. 144



TEST NO.6

Air Content - Pressure

999 POINTS

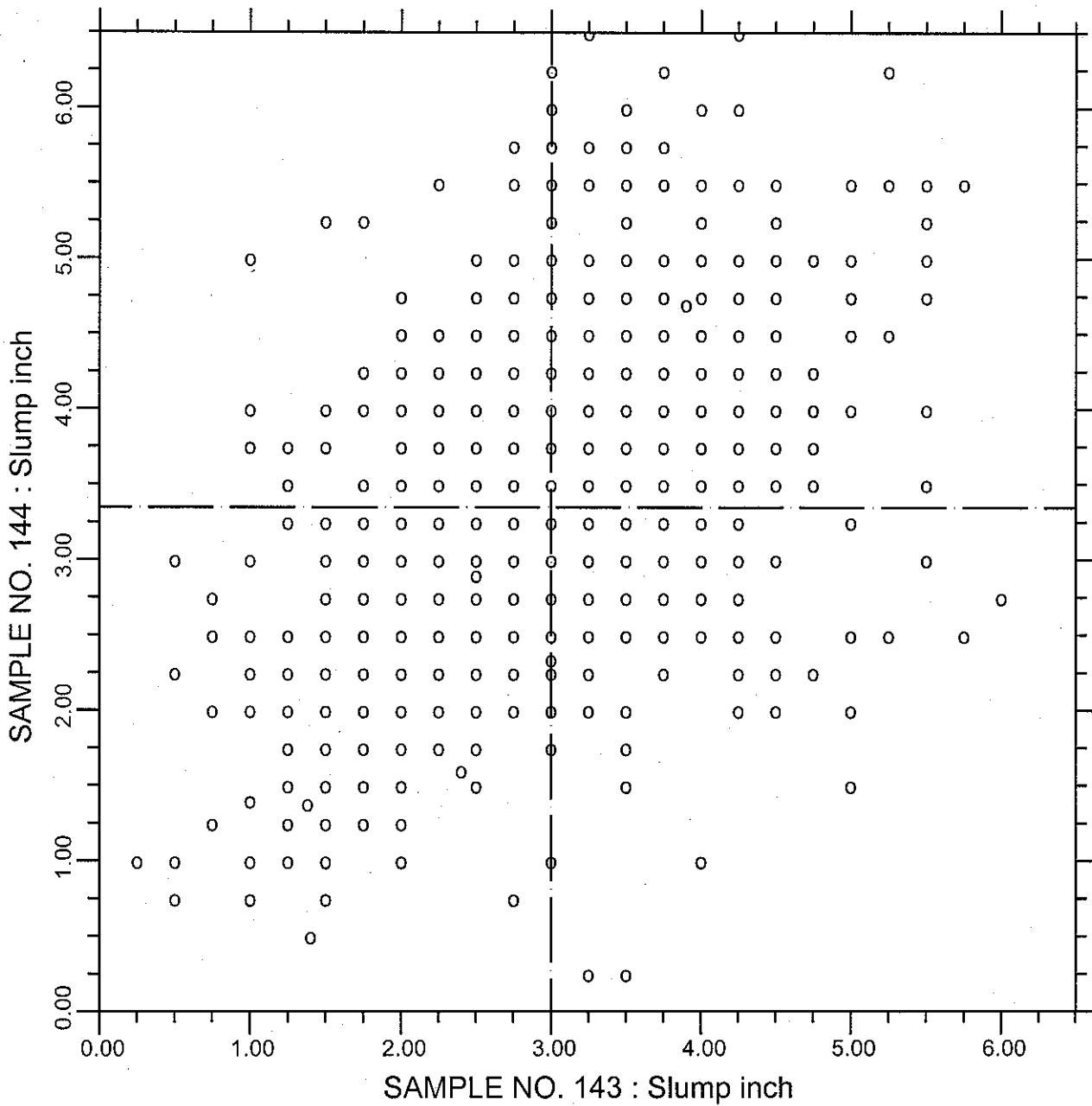
SAMPLE NO. 143 AVE 1.6726 S.D. 0.30 C.V. 18.1

SAMPLE NO. 144 AVE 1.6433 S.D. 0.33 C.V. 19.9

LABS ELIMINATED

See SUMMARY OF RESULTS page for list of labs.

CCRL PROFICIENCY SAMPLE PROGRAM
Slump of Concrete
CONCRETE SAMPLES NO. 143 & NO. 144



TEST NO.2

Slump

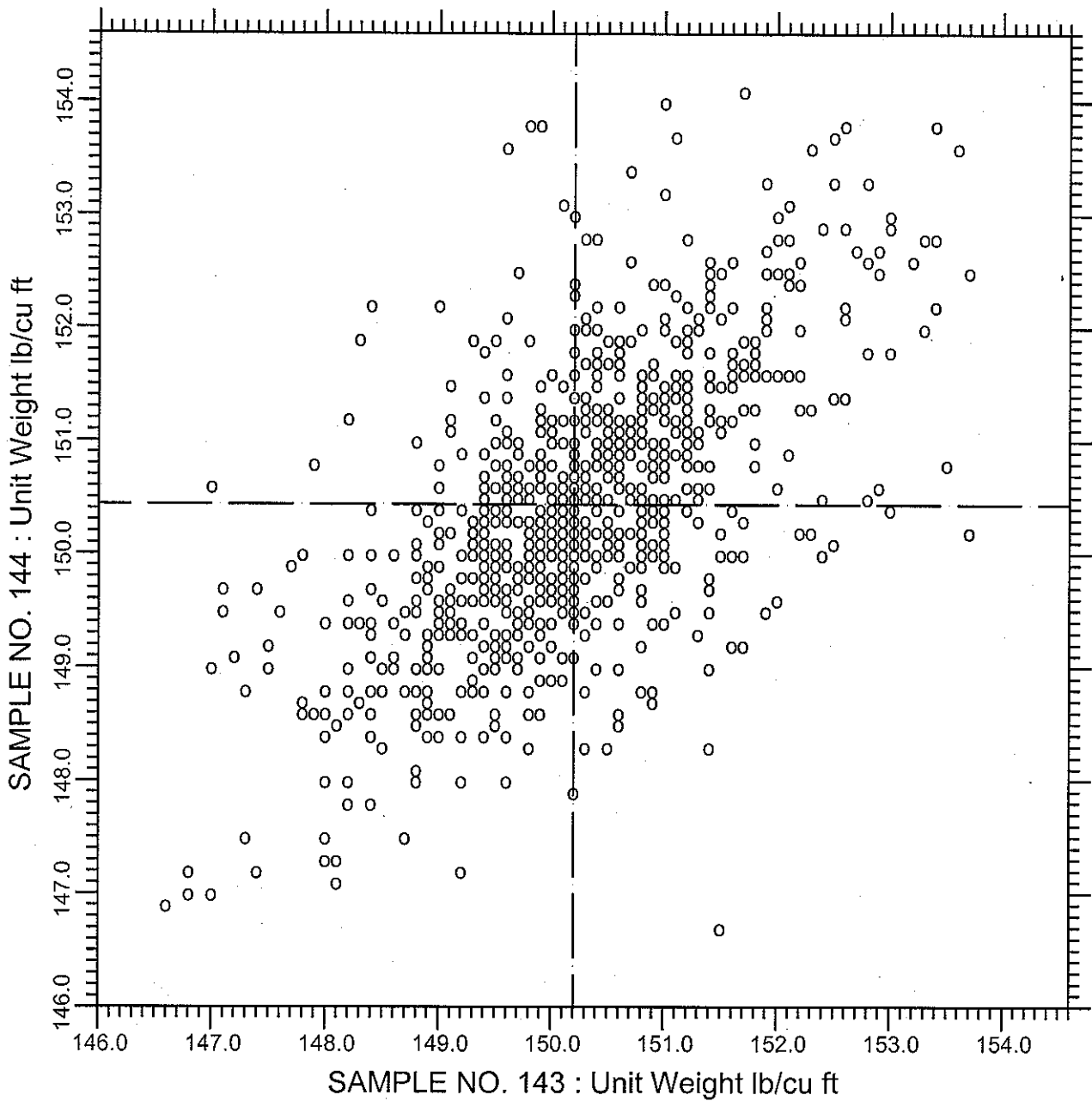
1051 POINTS

SAMPLE NO. 143 AVE 3.000 S.D. 0.93 C.V. 30.9

SAMPLE NO. 144 AVE 3.345 S.D. 1.02 C.V. 30.4

LABS ELIMINATED 51 951 1565 1642 1772 1784 1809 1914 2054 2090 2164
2347 2354 2393 3007 3087

CCRL PROFICIENCY SAMPLE PROGRAM
Unit Weight of Concrete
CONCRETE SAMPLES NO. 143 & NO. 144



TEST NO.3

Unit Weight

992 POINTS

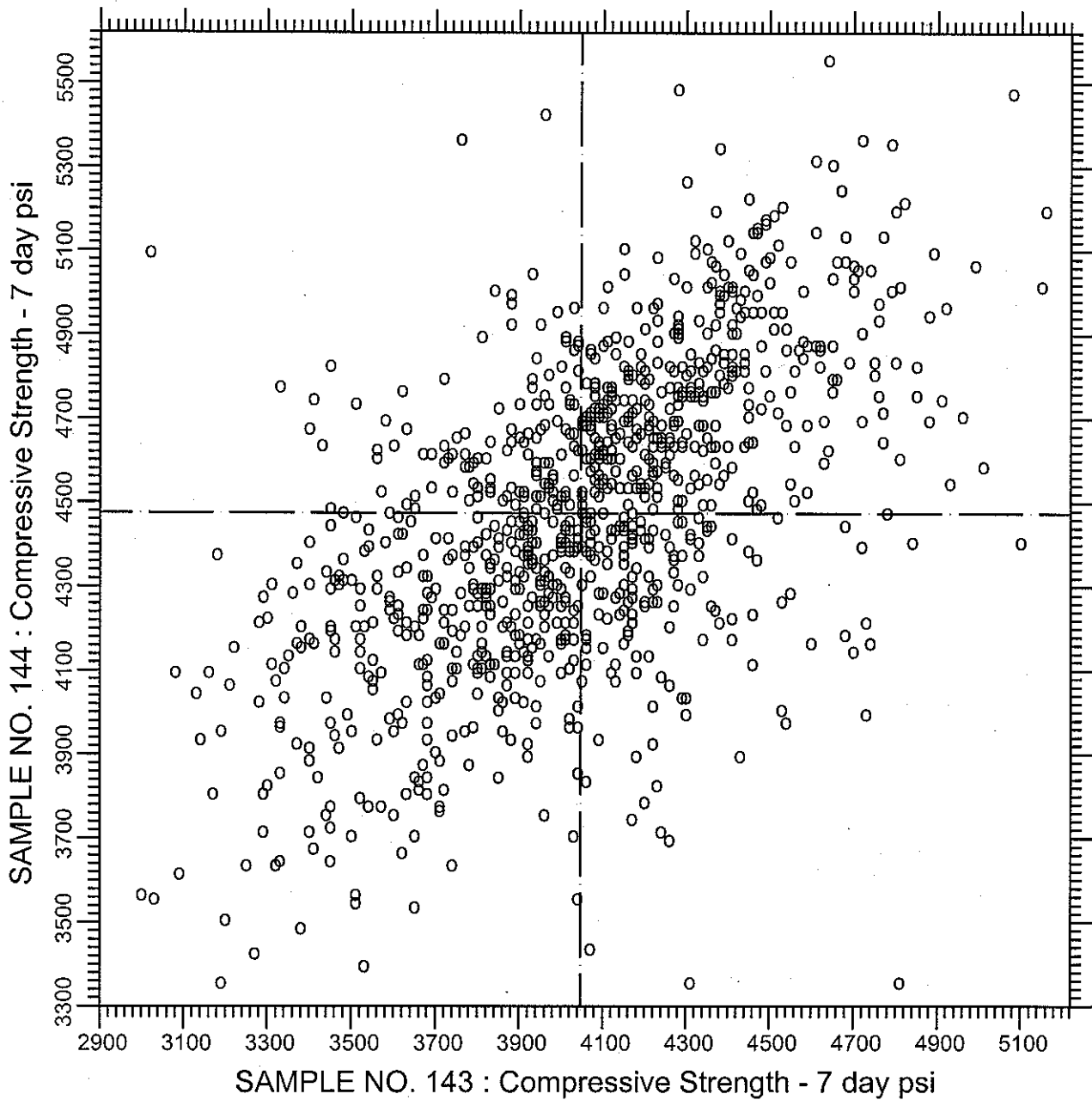
SAMPLE NO. 143 AVE 150.203 S.D. 1.1 C.V. 0.735

SAMPLE NO. 144 AVE 150.437 S.D. 1.1 C.V. 0.761

LABS ELIMINATED

See SUMMARY OF RESULTS page for list of labs.

CCRL PROFICIENCY SAMPLE PROGRAM
Compressive Strength - 7 day
CONCRETE SAMPLES NO. 143 & NO. 144



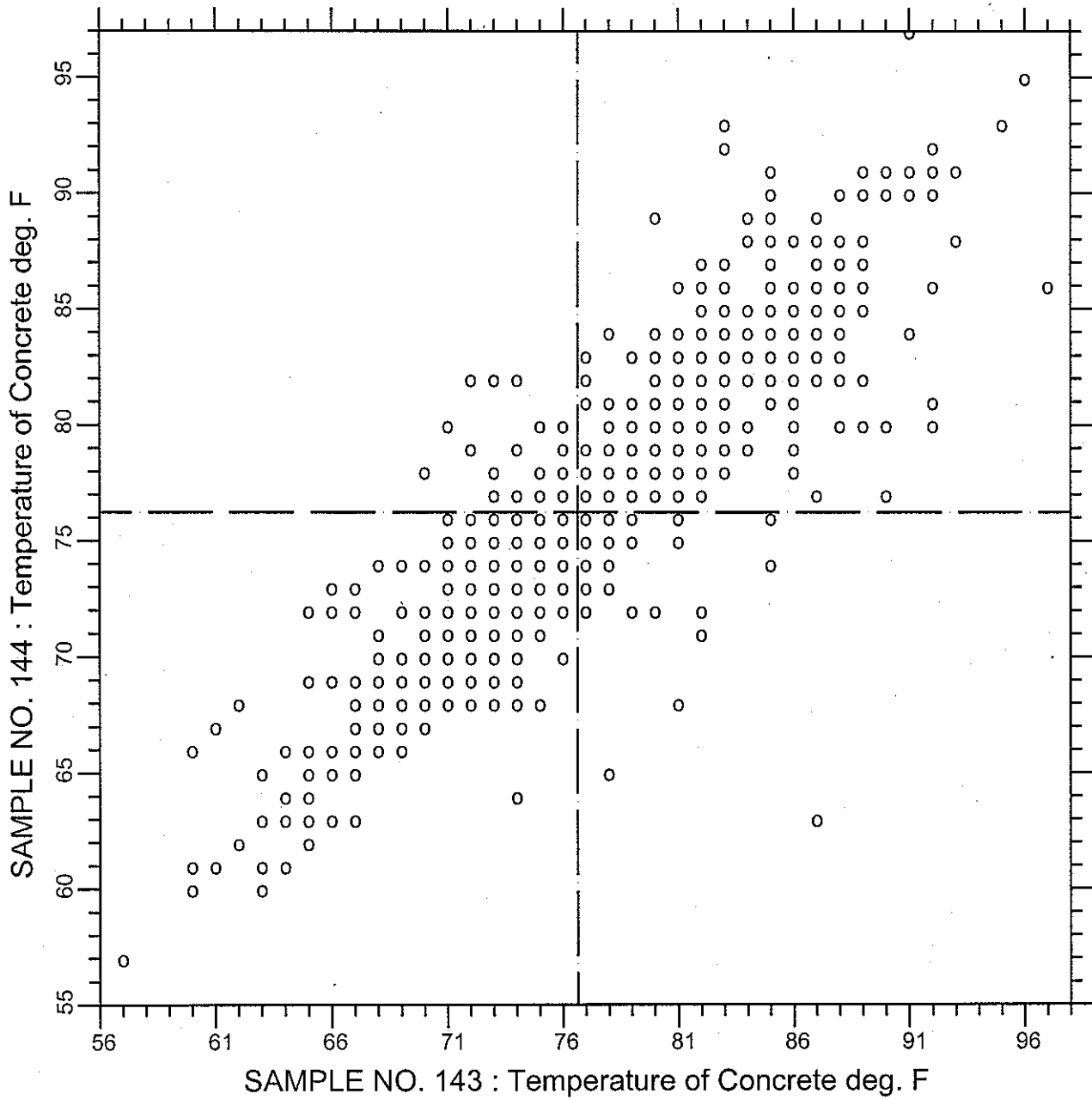
TEST NO.4 Compressive Strength - 7 day 1033 POINTS

SAMPLE NO. 143 AVE 4047.0 S.D. 363.8 C.V. 8.99

SAMPLE NO. 144 AVE 4474.2 S.D. 363.1 C.V. 8.12

LABS ELIMINATED 76 211 1070 1314 1824 1993 2054 2090 2248 2268 2354
2992 981 1287 1410 1543 2071 2136 2164 2224 2298 2369 2887 3054
3072

CCRL PROFICIENCY SAMPLE PROGRAM
 Temperature of Concrete
 CONCRETE SAMPLES NO. 143 & NO. 144



TEST NO.5 Temperature of Concrete 1066 POINTS

| | | | |
|----------------|-----------|----------|-----------|
| SAMPLE NO. 143 | AVE 76.64 | S.D. 6.2 | C.V. 8.09 |
| SAMPLE NO. 144 | AVE 76.22 | S.D. 5.9 | C.V. 7.80 |