

CEMENT AND CONCRETE REFERENCE LABORATORY
PROFICIENCY SAMPLE PROGRAM

Final Report
Concrete Proficiency Samples
Number 137 and Number 138

February 2006

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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February 13, 2006

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

SUBJECT: Concrete Proficiency Samples No. 137 and No. 138

Enclosed is your copy of the final report on the test results for the CCRL Concrete Proficiency Samples which were distributed in November 2005.

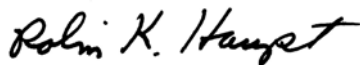
This report consists of a statistical Summary of Results, a set of general Scatter Diagrams and associated detailed information. The Table of Results with test results and ratings for your laboratory can be downloaded at our website located at: <http://ccrl.us/>.

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 March 2006.

Sincerely,



Robin K. Haupt
Supervisor, Proficiency Sample Programs
Cement and Concrete Reference Laboratory
Materials and Construction Research Division
Building and Fire Research Laboratory

Enclosure

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. 137 and No. 138

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 2005. 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. 137 and No. 138
Final Report - February 8, 2006

SUMMARY OF RESULTS

Test	#Labs	Sample No. 137				Sample No. 138		
		Average	S.D.	C.V.	Average	S.D.	C.V.	
Air Cont, Volume	prcnt 808	2.44	0.83	33.9	3.72	1.03	27.7	
Air Cont, Volume	prcnt *782	2.42	0.65	26.9	3.73	0.87	23.4	
Air Cont, Pressure	prcnt 969	2.5	0.73	29.5	3.9	0.92	24.0	
Air Cont, Pressure	prcnt *947	2.4	0.59	24.4	3.8	0.86	22.6	
Slump	inch 985	3.82	1.4	35.7	2.80	1.2	42.6	
Slump	inch *970	3.78	1.3	34.5	2.74	1.1	39.2	
Unit Weight	lb/ft ² 980	156.1	4.9	3.14	153.8	4.8	3.14	
Unit Weight	lb/ft ² *939	156.6	2.0	1.30	154.2	2.0	1.32	
Comp Str 7 day	psi 983	4575	455.7	9.96	4573	430.0	9.40	
Comp Str 7 day	psi *965	4583	429.3	9.37	4594	384.3	8.37	
Temperature of Con	° F 986	70	6.4	9.21	69	6.4	9.24	

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

Air Content, Volume 173 1008 1067 1140 1182 1278 1359 1446 1660 1703 1740 1790 1919
1991 2027 2049 2053 2222 2256 2285 2328 2411 2444 2472 2989 3000

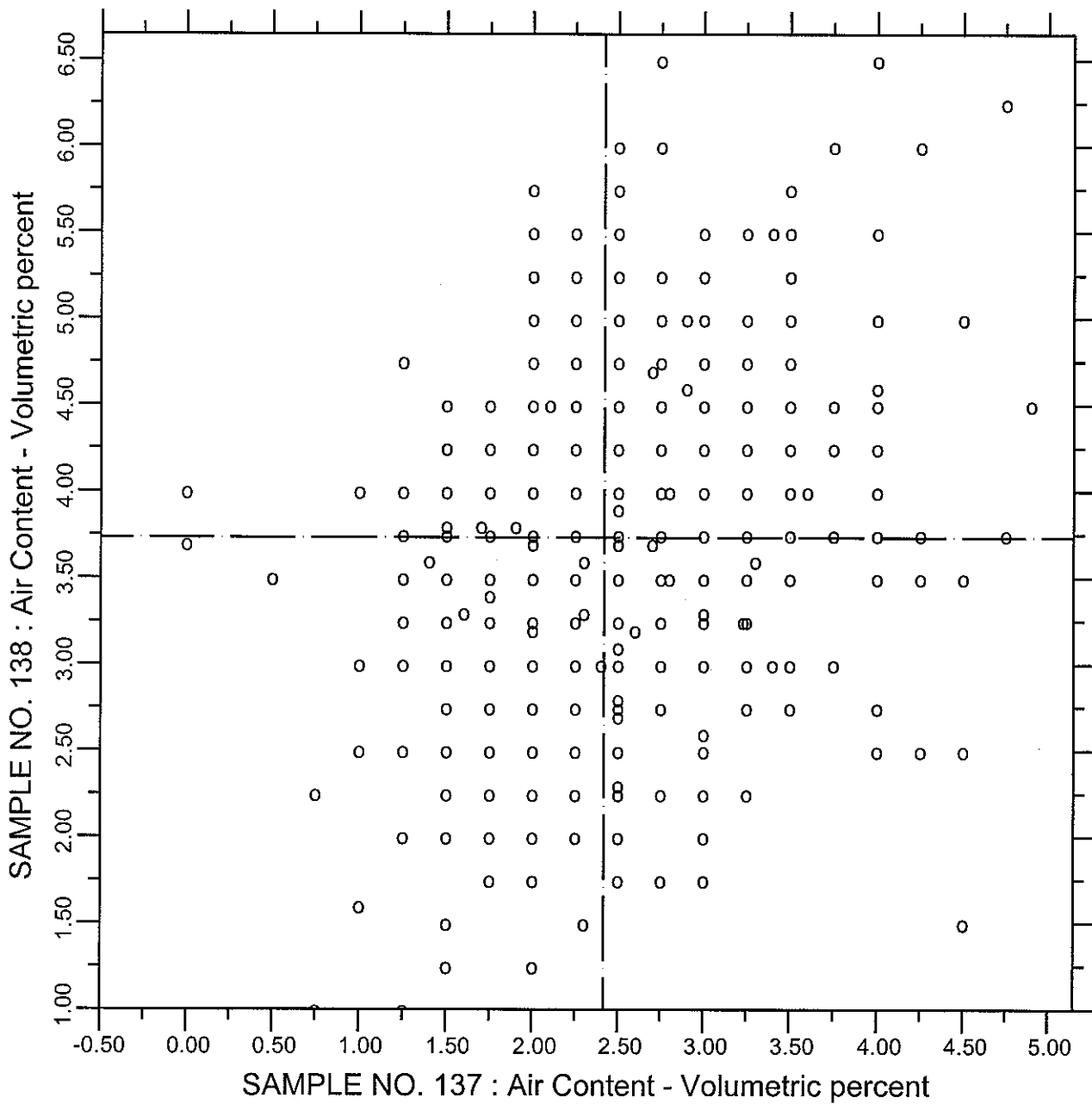
Air Content, Pressure 20 173 1008 1067 1140 1359 1379 1417 1446 1514 1703 1740 1790 1919
1991 2053 2210 2285 2286 2319 2411 2960

Slump 8 376 513 1173 1307 1506 1590 1747 1767 1784 2201 2219 2393 2936 3040

Unit Weight 185 1086 1173 1186 1419 1772 2300 2302 273 447 802 918 1008 1352 1359
1417 1428 1442 1520 1632 1730 1791 1924 1995 2057 2066 2071 2122 2124 2131 2155
2205 2277 2346 2377 2400 2431 2470 2950 2956 2987

Compressive Strength 513 795 829 897 928 1067 1391 1419 1547 1632 1767 1821 1885 1892 2122
2285 2399 2438

CCRL PROFICIENCY SAMPLE PROGRAM
 Air Content - Volumetric Method
 CONCRETE SAMPLES NO. 137 & NO. 138



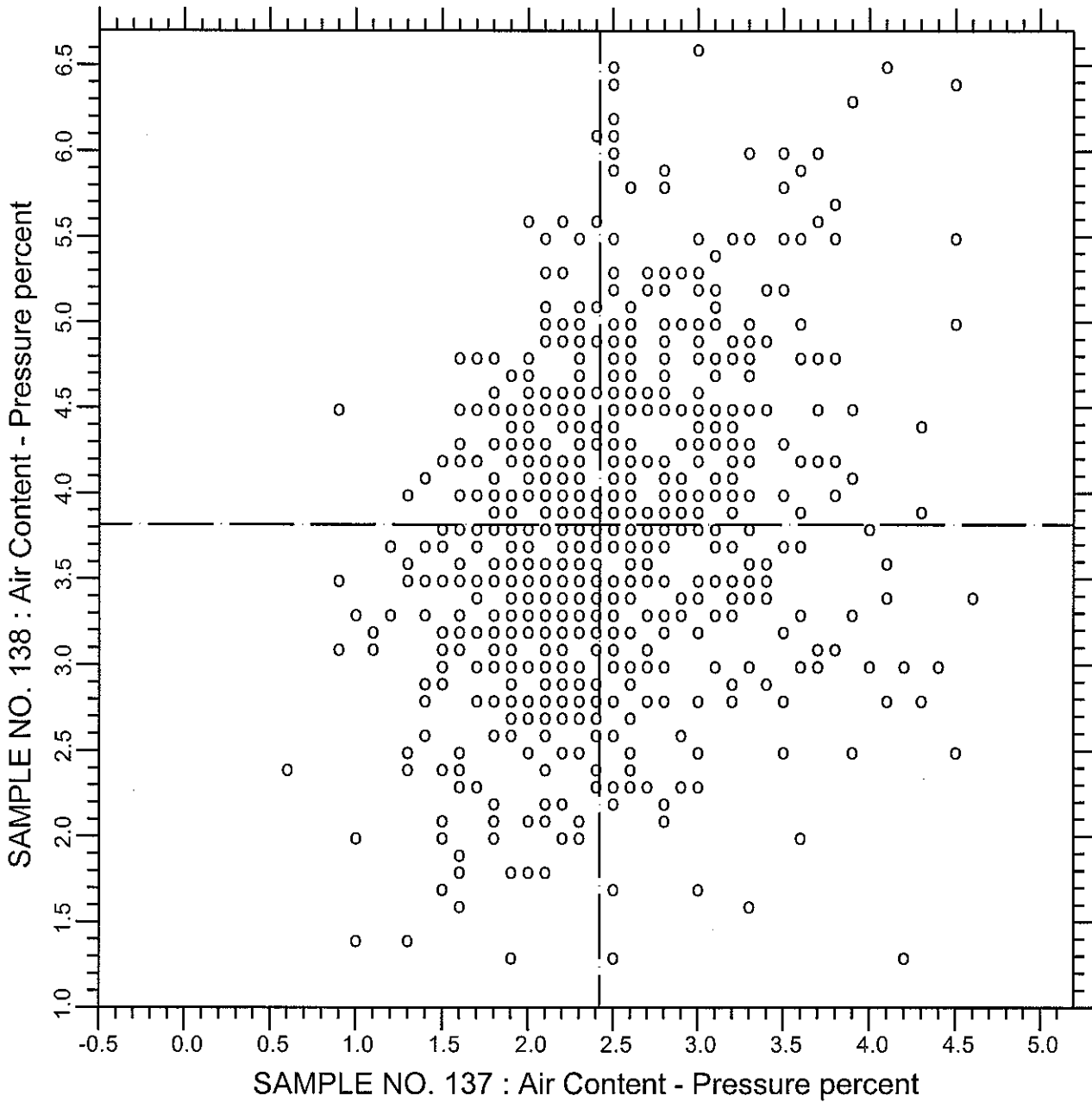
TEST NO.1 Air Content - Volumetric 782 POINTS

SAMPLE NO. 137 AVE 2.419 S.D. 0.65 C.V. 26.9

SAMPLE NO. 138 AVE 3.733 S.D. 0.87 C.V. 23.4

LABS ELIMINATED 173 1008 1067 1140 1182 1278 1359 1446 1660 1703
 1740 1790 1919 1991 2027 2049 2053 2222 2256 2285 2328 2411 2444
 2472 2989 3000

CCRL PROFICIENCY SAMPLE PROGRAM
 Air Content - Pressure Method
 CONCRETE SAMPLES NO. 137 & NO. 138



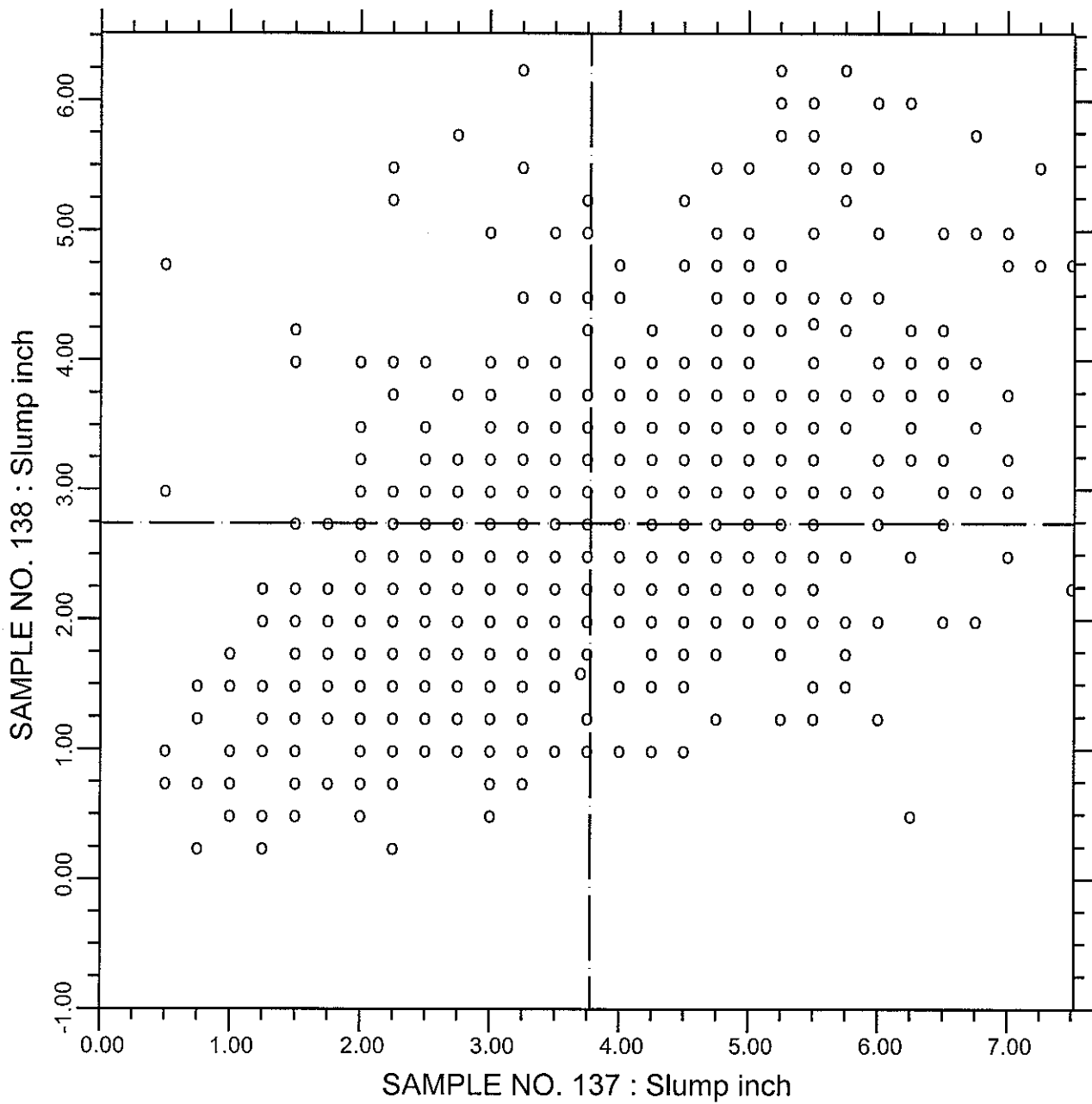
TEST NO.6 Air Content - Pressure 947 POINTS

SAMPLE NO. 137 AVE 2.421 S.D. 0.59 C.V. 24.4

SAMPLE NO. 138 AVE 3.817 S.D. 0.86 C.V. 22.6

LABS ELIMINATED 20 173 1008 1067 1140 1359 1379 1417 1446 1514 1703
 1740 1790 1919 1991 2053 2210 2285 2286 2319 2411 2960

CCRL PROFICIENCY SAMPLE PROGRAM
Slump of Concrete
CONCRETE SAMPLES NO. 137 & NO. 138



TEST NO.2

Slump

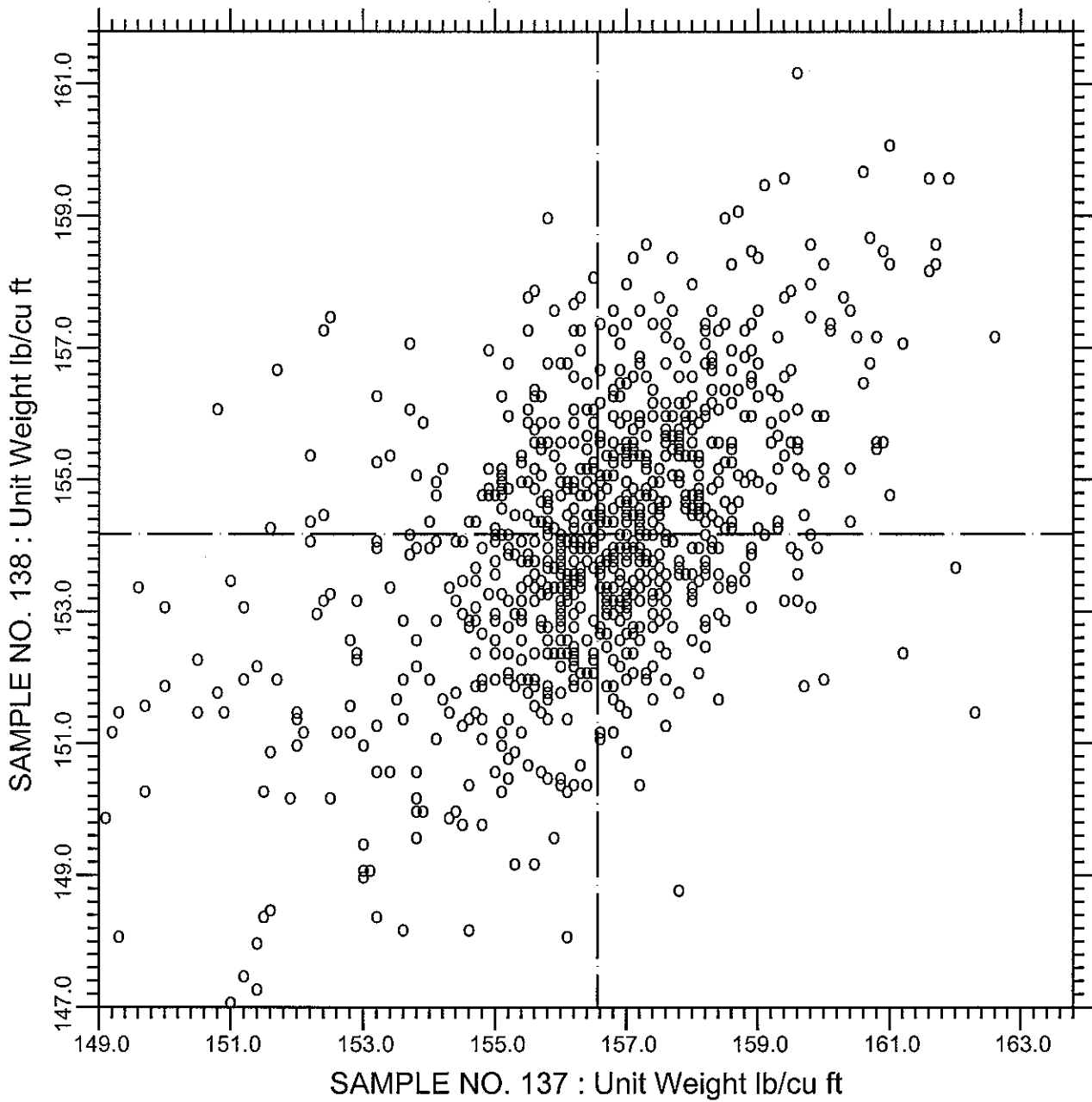
970 POINTS

SAMPLE NO. 137 AVE 3.776 S.D. 1.3 C.V. 34.5

SAMPLE NO. 138 AVE 2.739 S.D. 1.1 C.V. 39.2

LABS ELIMINATED 8 376 513 1173 1307 1506 1590 1747 1767 1784 2201
2219 2393 2936 3040

CCRL PROFICIENCY SAMPLE PROGRAM
 Unit Weight of Concrete
 CONCRETE SAMPLES NO. 137 & NO. 138



TEST NO.3 Unit Weight 938 POINTS

SAMPLE NO. 137 AVE 156.561 S.D. 2.0 C.V. 1.30

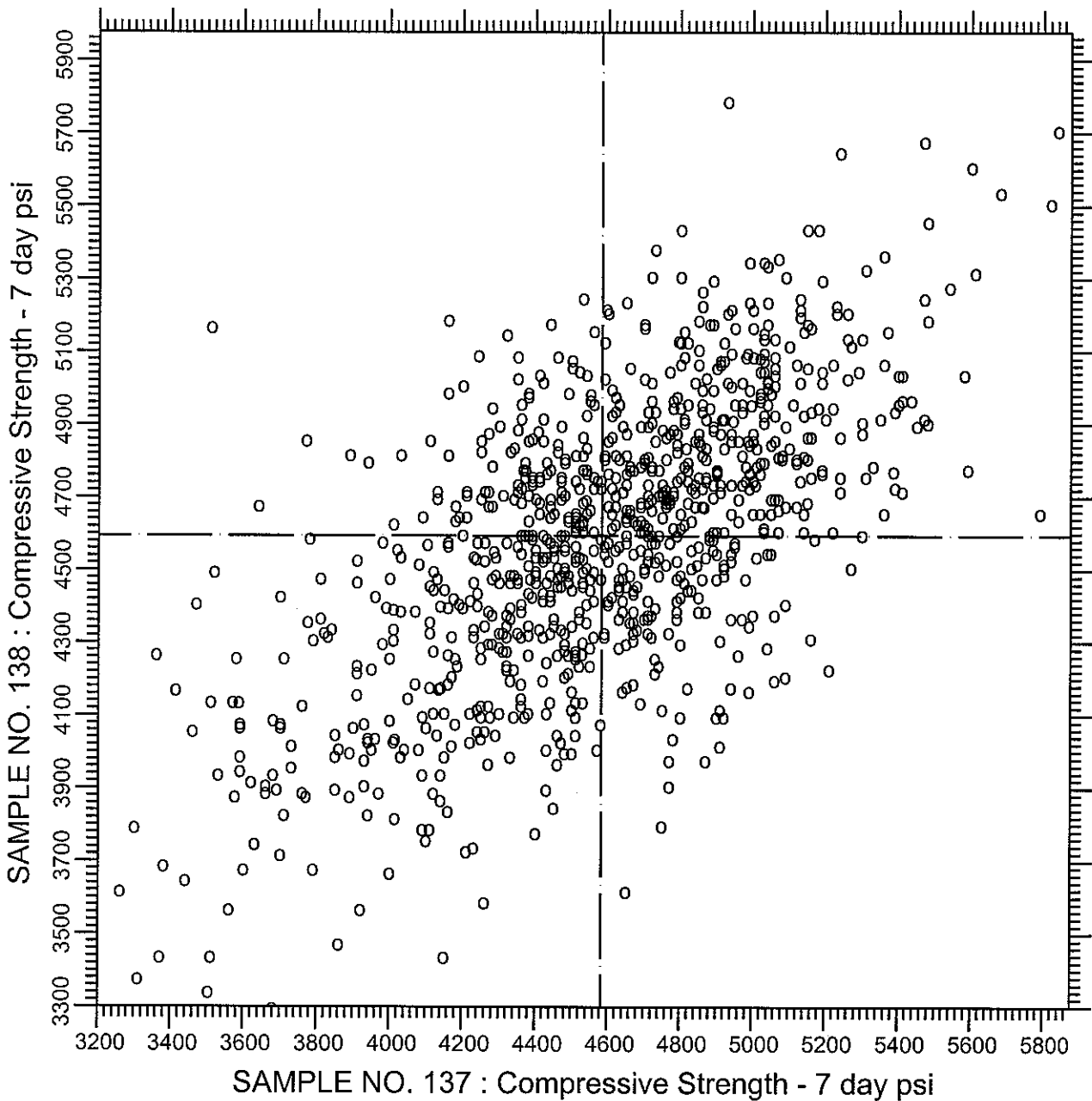
SAMPLE NO. 138 AVE 154.176 S.D. 2.0 C.V. 1.32

LABS ELIMINATED

See SUMMARY OF RESULTS page for list of labs.

LABS OFF DIAGRAM 35

CCRL PROFICIENCY SAMPLE PROGRAM
Compressive Strength - 7 day
CONCRETE SAMPLES NO. 137 & NO. 138



TEST NO.4 Compressive Strength - 7 day 964 POINTS

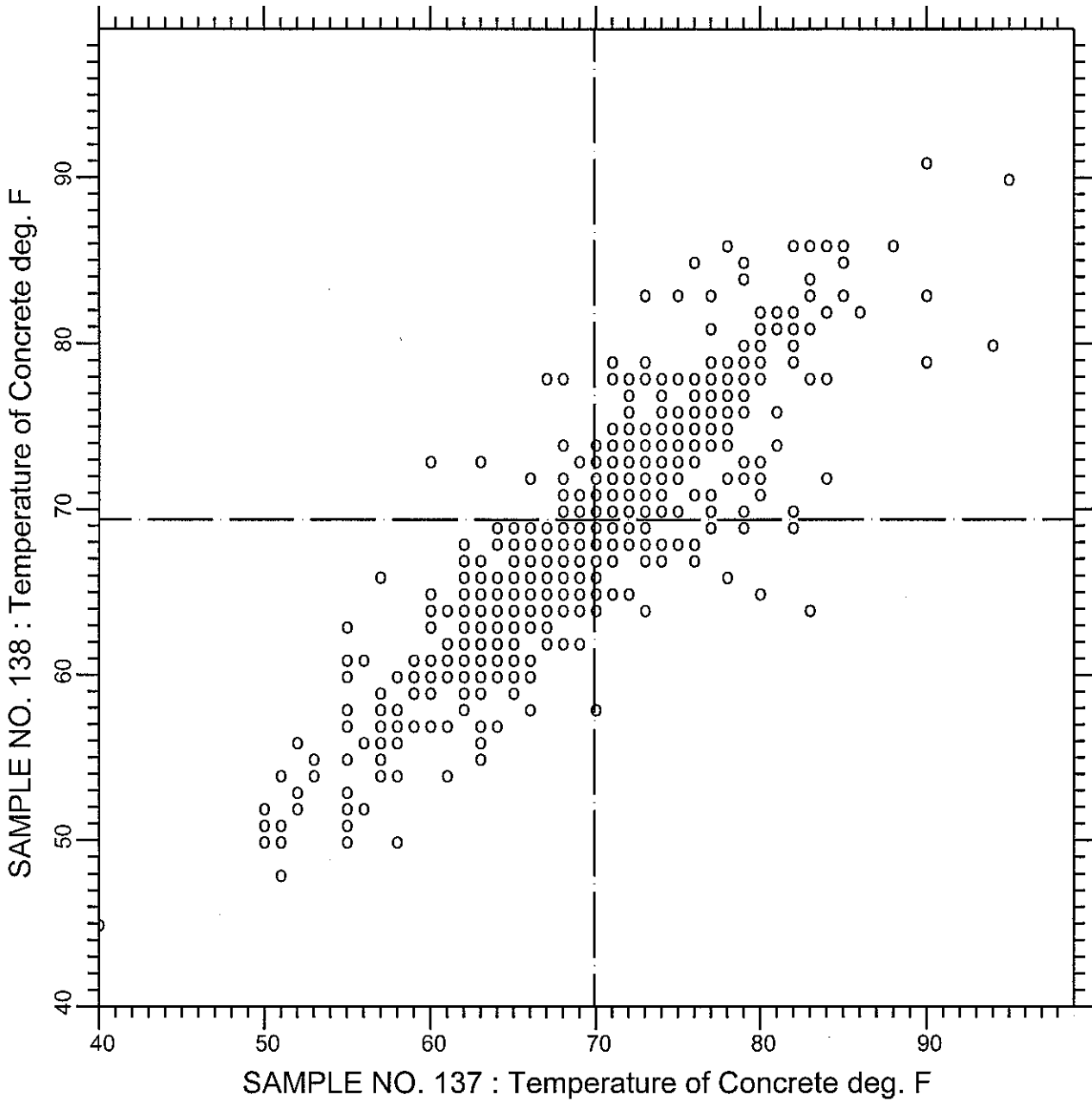
SAMPLE NO. 137 AVE 4583.2 S.D. 429.3 C.V. 9.37

SAMPLE NO. 138 AVE 4593.8 S.D. 384.3 C.V. 8.37

LABS ELIMINATED 513 795 829 897 928 1067 1391 1419 1547 1632 1767
1821 1885 1892 2122 2285 2399 2438

LABS OFF DIAGRAM 1851

CCRL PROFICIENCY SAMPLE PROGRAM
Temperature of Concrete
CONCRETE SAMPLES NO. 137 & NO. 138



TEST NO.5 Temperature of Concrete 986 POINTS

SAMPLE NO. 137 AVE 69.91 S.D. 6.4 C.V. 9.21

SAMPLE NO. 138 AVE 69.37 S.D. 6.4 C.V. 9.24