CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Reinforcing Bar Proficiency Samples
Number 1 and Number 2

December 2006

CCRL CEMENT AND CONCRETE
REFERENCE LABORATORY

CEMENT AND CONCRETE REFERENCE LABORATORY

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December 29, 2006

To: Participants in the CCRL Reinforcing Bar Proficiency Sample Program

Subject: Final Report for Reinforcing Bar Proficiency Samples No. 1 and No. 2

Following is the report for the current pair of CCRL Reinforcing Bar Proficiency Samples which were distributed in July 2006.

This report consists of a statistical Summary of Results, a set of general Scatter Diagrams, and associated detailed information. The Table of Results with individualized information for laboratory can be downloaded at our website located at: http://www.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 reinforcing bar 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 Reinforcing Bar Proficiency Samples will be distributed in July 2007.

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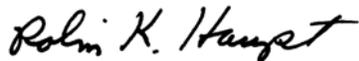
Robin K. Haupt
Supervisor, Proficiency Sample Programs
Cement and Concrete Reference Laboratory
Materials and Construction Research Division
Building and Fire Research Laboratory

Enclosure

To: Participants in the CCRL Reinforcing Bar Proficiency Sample Program

From: Robin K. Haupt, Supervisor, PSP

Subject: Explanation of Final Report on Results of Tests on Reinforcing Bar Proficiency Samples No. 1 and No. 2

This letter, and the material included with it, constitute the final report, and summary of results for the current pair of Reinforcing Bar Proficiency Samples, which were distributed in July 2006 This material includes a Table of Results for Individual laboratory data, a statistical Summary of Results, and a set of general scatter diagrams. Your unique laboratory number is displayed at the top of the Individual Table of Results.

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.

The test results for average spacing, gap, and average height (more evident before outlying test result were removed) displayed a rather wide distribution which can be seen in the scatter diagrams. If your test results were eliminated or located in the "tails" of the distribution you should review your procedure for determining these results.

Laboratory Ratings

Each laboratory receives an individualized Laboratory Ratings. Each line of the ratings shows the test title and the reporting unit in the first two columns. After that it lists in order, the laboratory's 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 some test results. These results were gathered for information at the request of consulting ASTM Committee member.

The ratings for the 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

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[1]Youden, W.J., "Statistical Aspects of the Cement Testing Program", *Proceedings of the American Society for testing and Materials Volume 59*, 1959.

The sign of the rating merely shows whether the result reported was greater or less than the average obtained. n cases where some laboratories' results are eliminated, averages, standard deviations, coefficients of variation, and the ratings of the other 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, 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 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. Elimination of these outlying results may 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.

SUMMARY OF RESULTS

				Sample No. 1			Sample No. 2	
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Weight per Length lb/ft		72	1.972	0.047	2.38	1.977	0.046	2.32
Weight per Length lb/ft	*	65	1.969	0.0054	0.276	1.970	0.0060	0.305
Average Spacing inch		70	0.542	0.070	12.9	0.541	0.071	13.1
Average Spacing inch	*	62	0.561	0.018	3.18	0.561	0.018	3.16
Average Height inch		70	0.460	3.3	721	0.460	3.3	723
Average Height inch	*	63	0.059	0.0046	7.84	0.058	0.0051	8.75
Gap inch		69	0.186	0.074	39.9	0.186	0.080	42.8
Gap inch	*	66	0.177	0.062	35.3	0.175	0.060	34.2
Tensile Strength psi		78	99159	8079.6	8.15	99306	8110.7	8.17
Tensile Strength psi	*	72	99197	1767.0	1.78	99375	1652.1	1.66
Yield Strength psi		78	62862	6294.8	10.0	63209	6584.8	10.4
Yield Strength psi	*	68	62439	1035.3	1.66	62524	1192.4	1.91
Elongation prcnt		78	15.4	1.3	8.30	15.5	1.1	7.22

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

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Weight per Unit Length	21 634 646 22 783 1777 2420
Average Spacing	51 552 22 52 47 783 823 1895
Average Height	8 51 52 783 451 1602 1777
Gap	640 34 646
Tensile Strength	19 518 20 640 1785 1991
Yield Strength	8 19 518 48 640 646 1785 20 1991 2994

CCRL PROFICIENCY SAMPLE PROGRAM
Weight per Unit Length
REINFORCING BAR SAMPLES NO. 1 & NO. 2
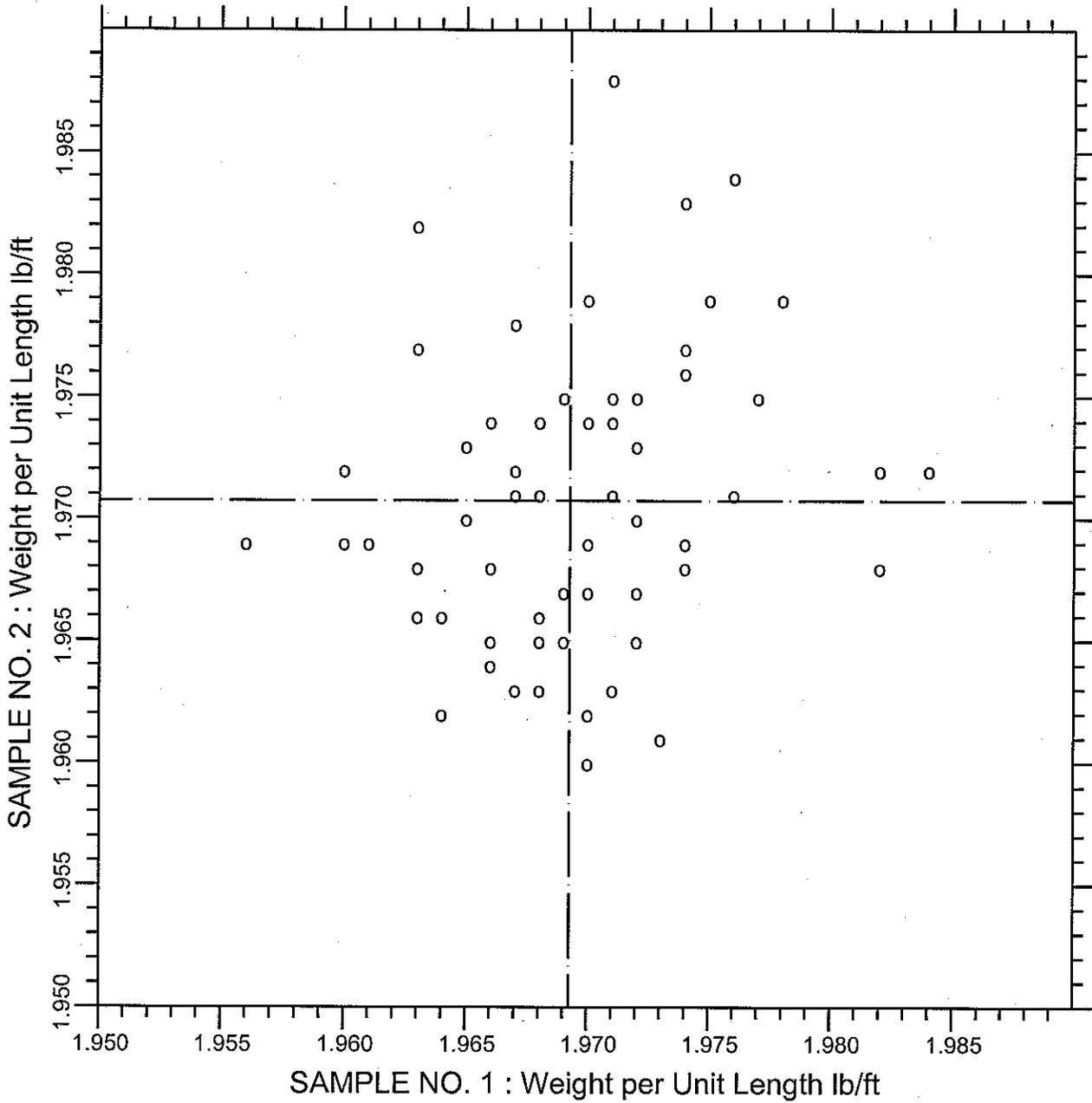
TEST NO.1010   Weight per Unit Length   65 POINTS

SAMPLE NO. 1   AVE   1.96926   S.D. 0.0054   C.V. 0.276
SAMPLE NO. 2   AVE   1.97074   S.D. 0.0060   C.V. 0.305
LABS ELIMINATED 21 634 646 22 783 1777 2420

CCRL PROFICIENCY SAMPLE PROGRAM
Average Spacing
REINFORCING BAR SAMPLES NO. 1 & NO. 2
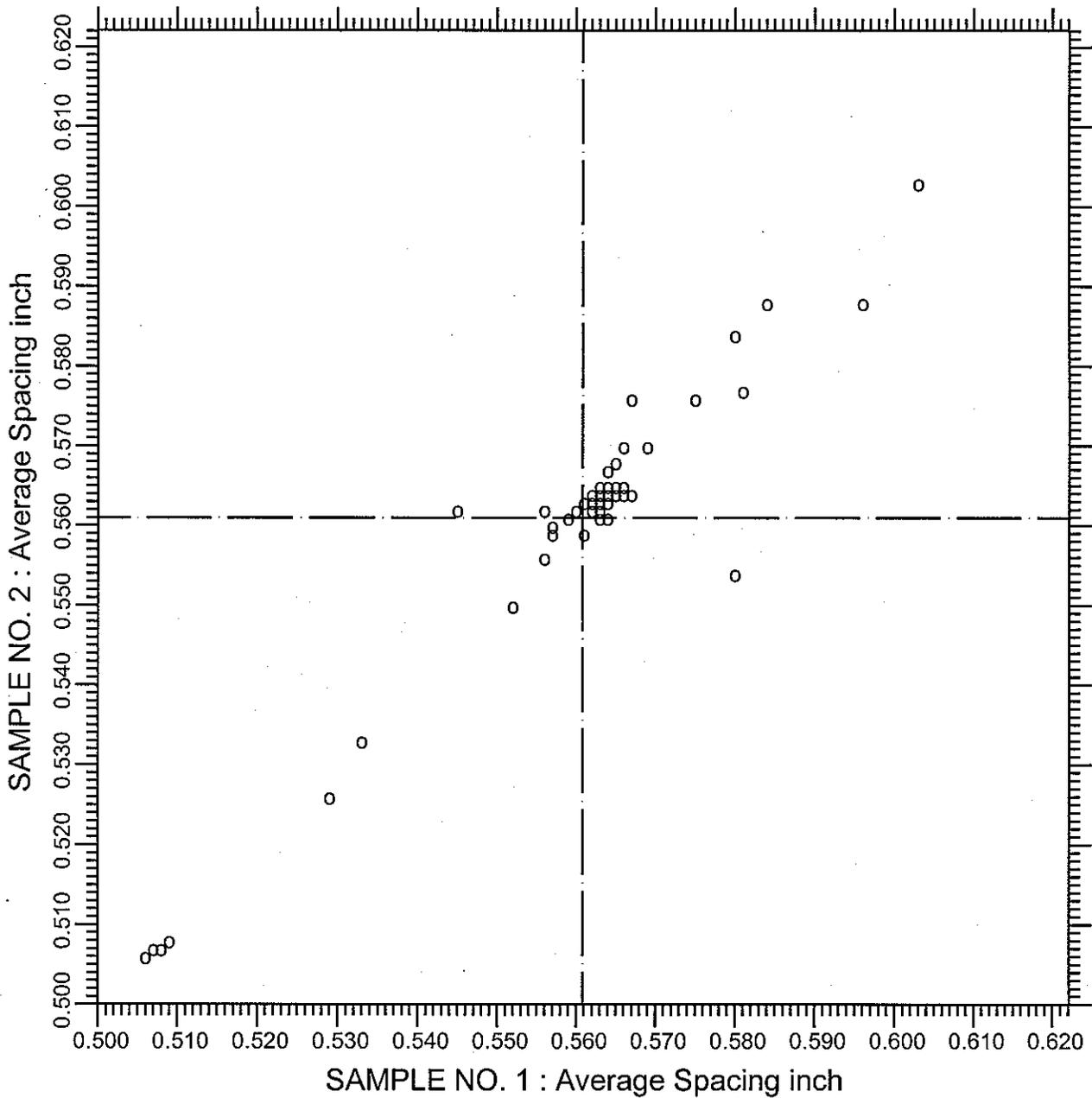
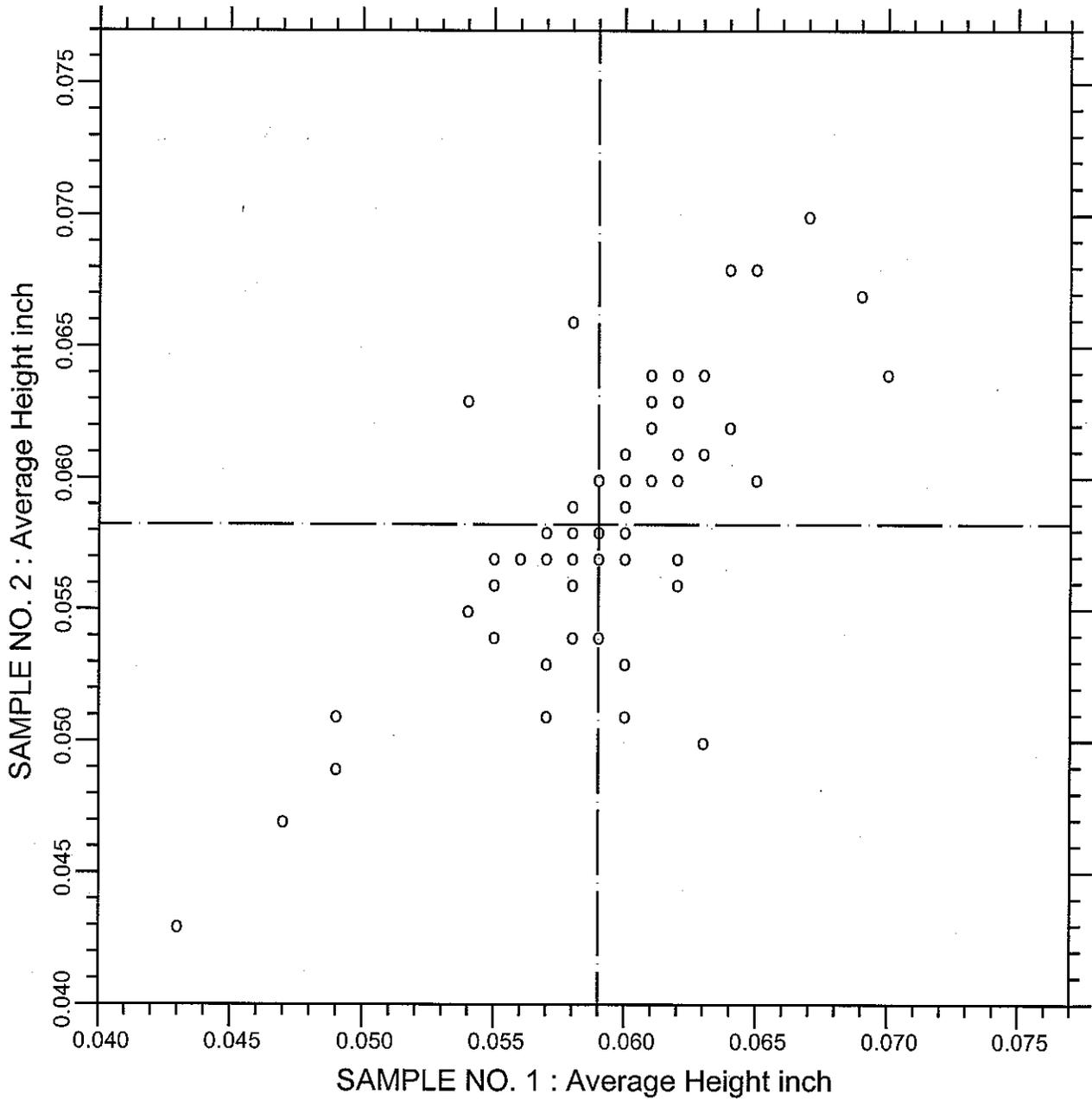TEST NO.1020   Average Spacing   62 POINTS

SAMPLE NO. 1   AVE 0.5608   S.D. 0.018   C.V. 3.18
SAMPLE NO. 2   AVE 0.5610   S.D. 0.018   C.V. 3.16
LABS ELIMINATED 51 552 22 52 47 783 823 1895

CCRL PROFICIENCY SAMPLE PROGRAM
Average Height
REINFORCING BAR SAMPLES NO. 1 & NO. 2

TEST NO.1030   Average Height   63 POINTS
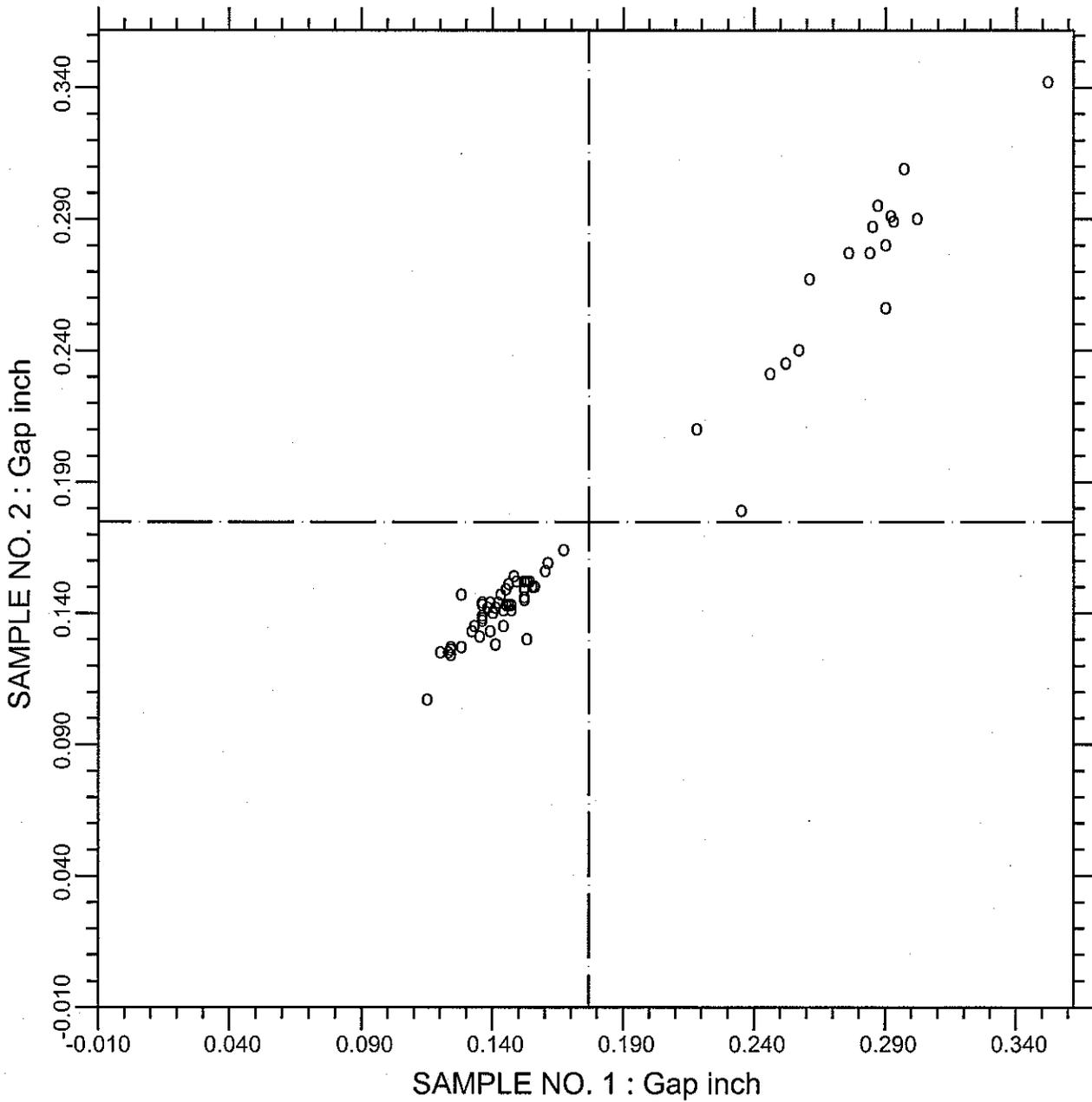
SAMPLE NO. 1   AVE   0.05900   S.D.   0.0046   C.V.   7.84
SAMPLE NO. 2   AVE   0.05824   S.D.   0.0051   C.V.   8.75
LABS ELIMINATED   8 51 52 783 451 1602 1777

CCRL PROFICIENCY SAMPLE PROGRAM
Gap
REINFORCING BAR SAMPLES NO. 1 & NO. 2

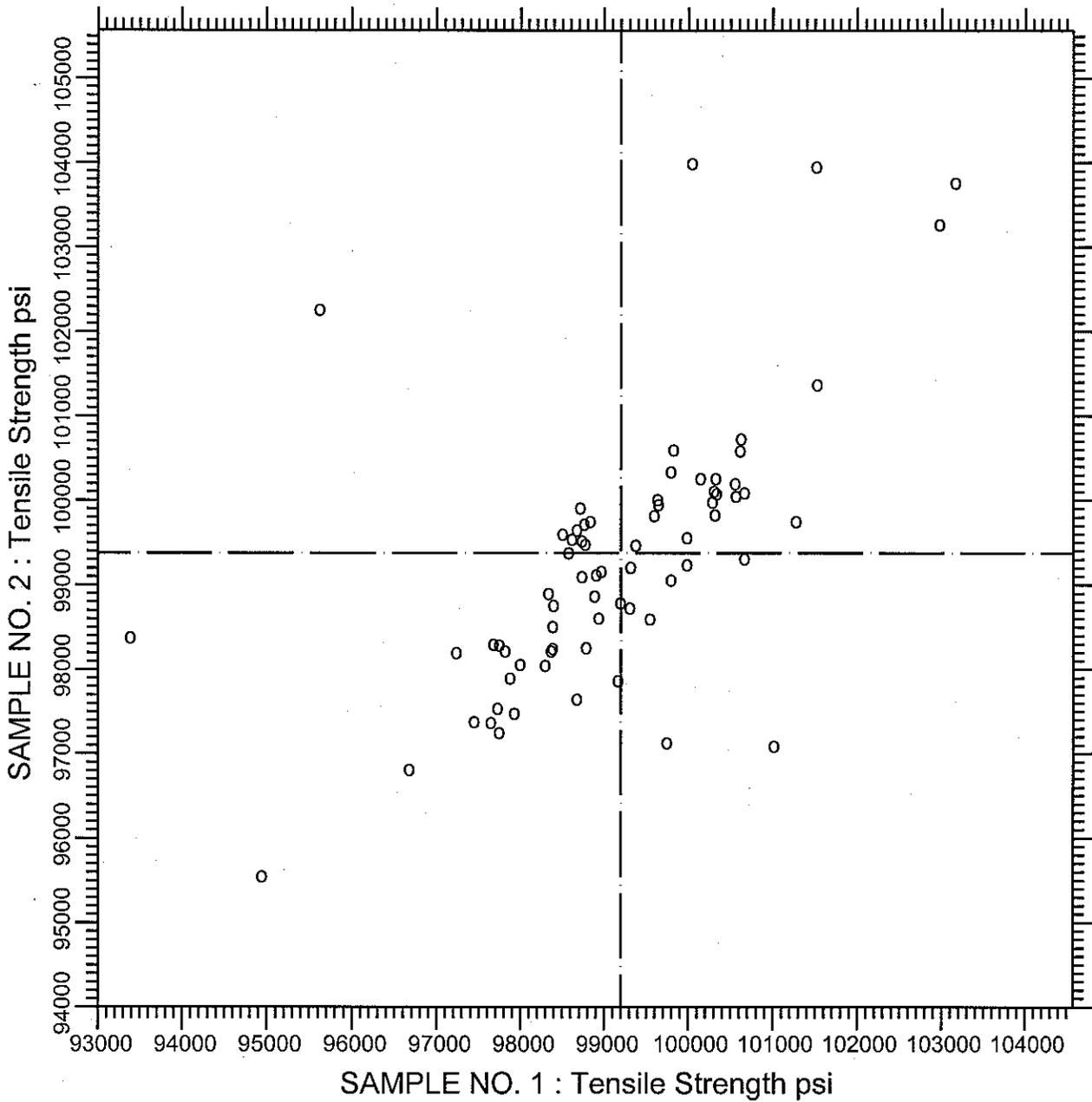TEST NO.1050   Gap   66 POINTS

SAMPLE NO. 1   AVE 0.1768   S.D. 0.062   C.V. 35.3
SAMPLE NO. 2   AVE 0.1749   S.D. 0.060   C.V. 34.2
LABS ELIMINATED 640 34 646

CCRL PROFICIENCY SAMPLE PROGRAM
Tensile Strength
REINFORCING BAR SAMPLES NO. 1 & NO. 2

TEST NO.1050   Tensile Strength   71 POINTS
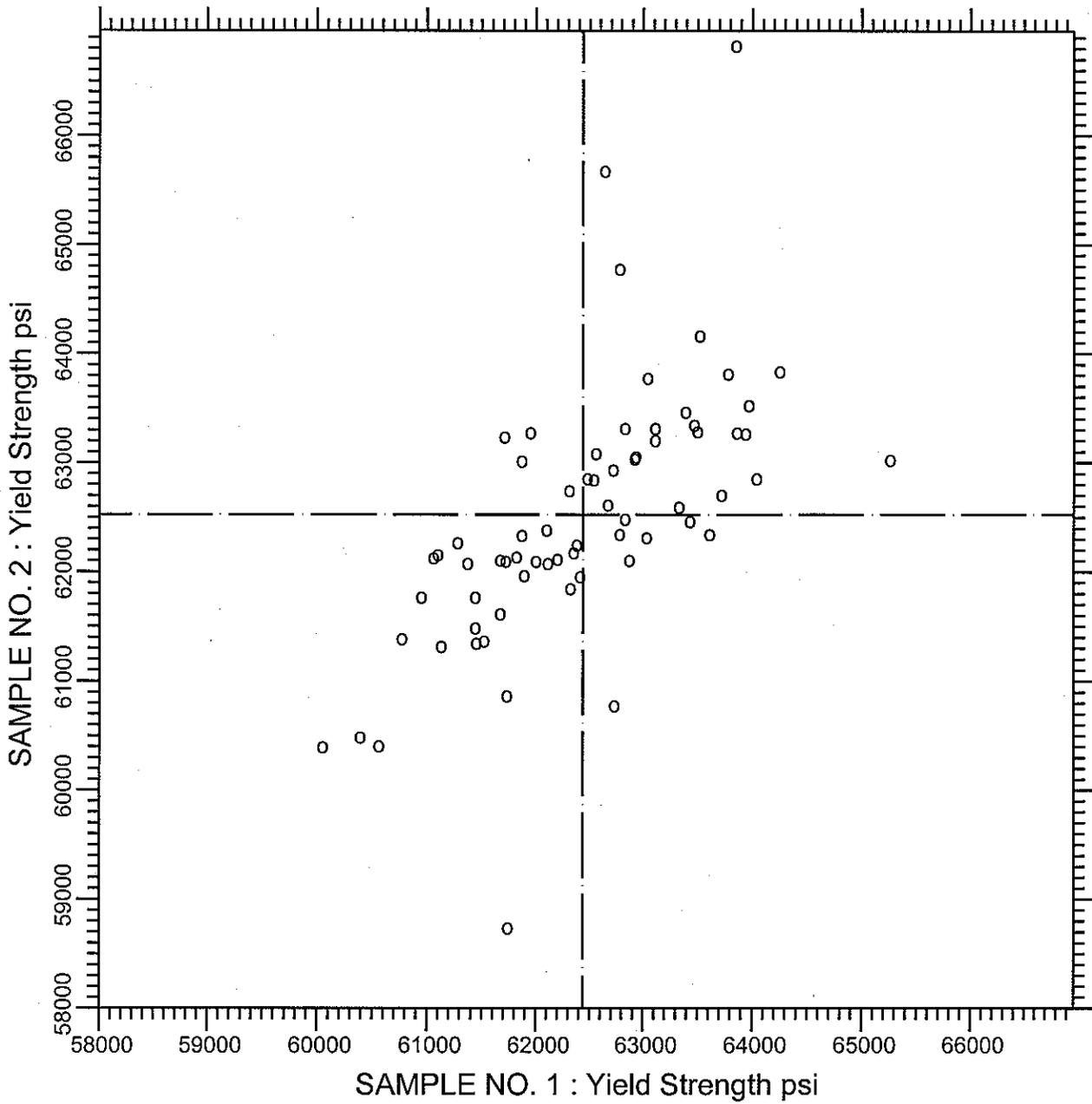
SAMPLE NO. 1   AVE 99197.0   S.D. 1767.0   C.V. 1.78
SAMPLE NO. 2   AVE 99374.6   S.D. 1652.1   C.V. 1.66
LABS ELIMINATED 19 518 20 640 1785 1991
LABS OFF DIAGRAM 48

CCRL PROFICIENCY SAMPLE PROGRAM
Yield Strength
REINFORCING BAR SAMPLES NO. 1 & NO. 2
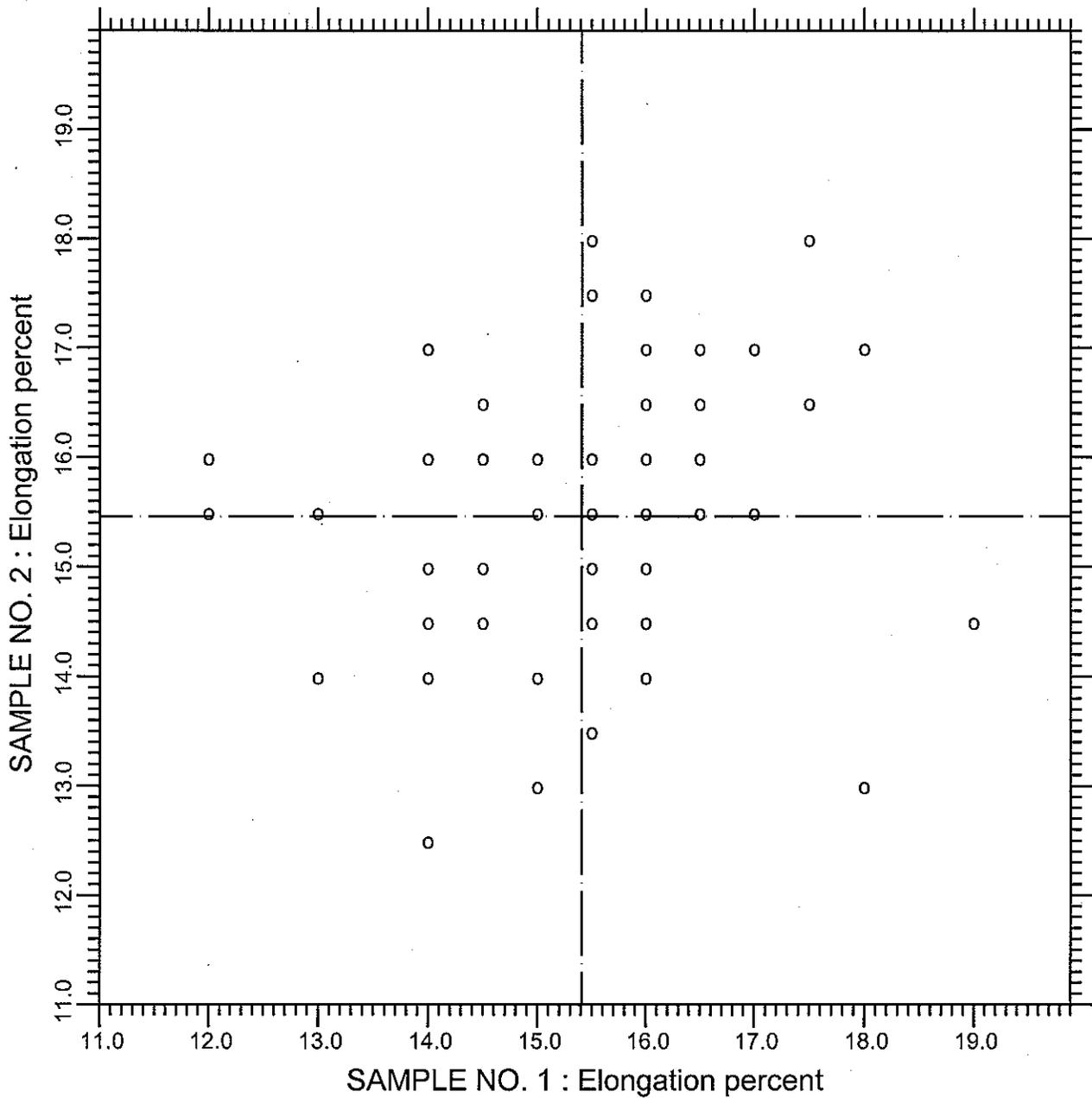

TEST NO.1060   Yield Strength   68 POINTS

SAMPLE NO. 1   AVE   62438.5   S.D.   1035.3   C.V.   1.66
SAMPLE NO. 2   AVE   62524.4   S.D.   1192.4   C.V.   1.91
LABS ELIMINATED 8 19 518 48 640 646 1785 20 1991 2994

CCRL PROFICIENCY SAMPLE PROGRAM
Elongation
REINFORCING BAR SAMPLES NO. 1 & NO. 2

SAMPLE NO. 2 : Elongation percent

SAMPLE NO. 1 : Elongation percent

TEST NO.1070   Elongation   78 POINTS

SAMPLE NO. 1   AVE 15.41   S.D. 1.3   C.V. 8.30
SAMPLE NO. 2   AVE 15.46   S.D. 1.1   C.V. 7.22