CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Reinforcing Bar Proficiency Samples
Number 23 and Number 24

September 2017

CCRL
Cement and Concrete
Reference Laboratory

www.ccrl.us

September 25, 2017

TO: Participants in the CCRL Reinforcing Bar Proficiency Sample Program

SUBJECT: Final Report for Reinforcing Bar Proficiency Samples No. 23 and No. 24

Following is the report for the current pair of CCRL Reinforcing Bar Proficiency Samples which were distributed in July 2017. Sample No. 23 and Sample No. 24 were ASTM A615, Grade 60, #6 bars. The two samples were from the different mills.

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/.

Note: Laboratory ratings were suppressed for the measurement of gap. The minimum data entry validation for these test results was set at 0.180". After reviewing the test results for Sample No. 23 it appears that this validation limit may have been set too high and may have prevented the data entry of valid test results.

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 2018.

Sincerely,

Robin K. Haupt

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

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. 23 and No. 24

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 2017. 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, and gap (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. In the case of bars with ribs, a gap is the width of the ribs. For bars with two ribs the summation of gaps was requested (sum of the two rib widths). Some laboratories may have reported a single rib width or the average of the two rib widths as the gap.

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.

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. Laboratory Ratings are calculated using the unrounded values for average and standard deviation.

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 merely shows whether the result reported was greater or less than the average obtained.

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

In 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.

CCRL PROFICIENCY SAMPLE PROGRAM

Reinforcing Bar Proficiency Samples No. 23 and No. 24

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SUMMARY OF RESULTS

Test (unit)	#Labs	Sample No.23 Average	S.D.	C.V.	Sample No. 24 Average	S.D.	C.V.
Weight per Unit Length (**lb/ft**)							
	149	1.496	0.255	17.04	1.490	0.424	28.44
	*136	1.480	0.003	0.20	1.433	0.006	0.43
* Labs Eliminated - 1, 8, 21, 28, 52, 421, 1539, 2221, 2951, 2960, 3244, 3280, 3947							
Average Spacing (**inch**)							
	148	0.476	0.084	17.6	0.497	0.022	4.3
	*132	0.469	0.006	1.3	0.499	0.008	1.6
* Labs Eliminated - 2, 7, 22, 26, 28, 52, 451, 474, 477, 640, 1044, 2422, 2951, 3245, 3541, 3659							
Average Height (**inch**)							
	148	0.062	0.047	76.7	0.056	0.051	91.8
	*141	0.055	0.004	6.4	0.049	0.003	5.9
* Labs Eliminated - 52, 1030, 1540, 1612, 2420, 3054, 4117							
Gap (**inch**)							
	145	0.224	0.051	23	0.355	0.055	16
	*134	0.216	0.034	16	0.356	0.045	13
* Labs Eliminated - 43, 52, 823, 1265, 1822, 2149, 2221, 3054, 3280, 4022, 4031							
Tensile Strength (**psi**)							
	156	104325	9749	9.3	101222	12041	11.9
	*140	105560	1260	1.2	102963	1412	1.4
* Labs Eliminated - 15, 51, 52, 477, 1453, 1790, 1959, 2115, 2146, 2420, 2994, 3245, 3659, 3744, 4063, 4117							
Yield Strength (**psi**)							
	156	63448	6208	9.8	63291	6150	9.7
	*142	64164	1298	2	64009	1302	2
* Labs Eliminated - 15, 46, 51, 280, 1453, 1785, 1959, 2115, 2146, 2420, 2994, 3245, 3659, 4117							

CCRL PROFICIENCY SAMPLE PROGRAM

Reinforcing Bar Proficiency Samples No. 23 and No. 24

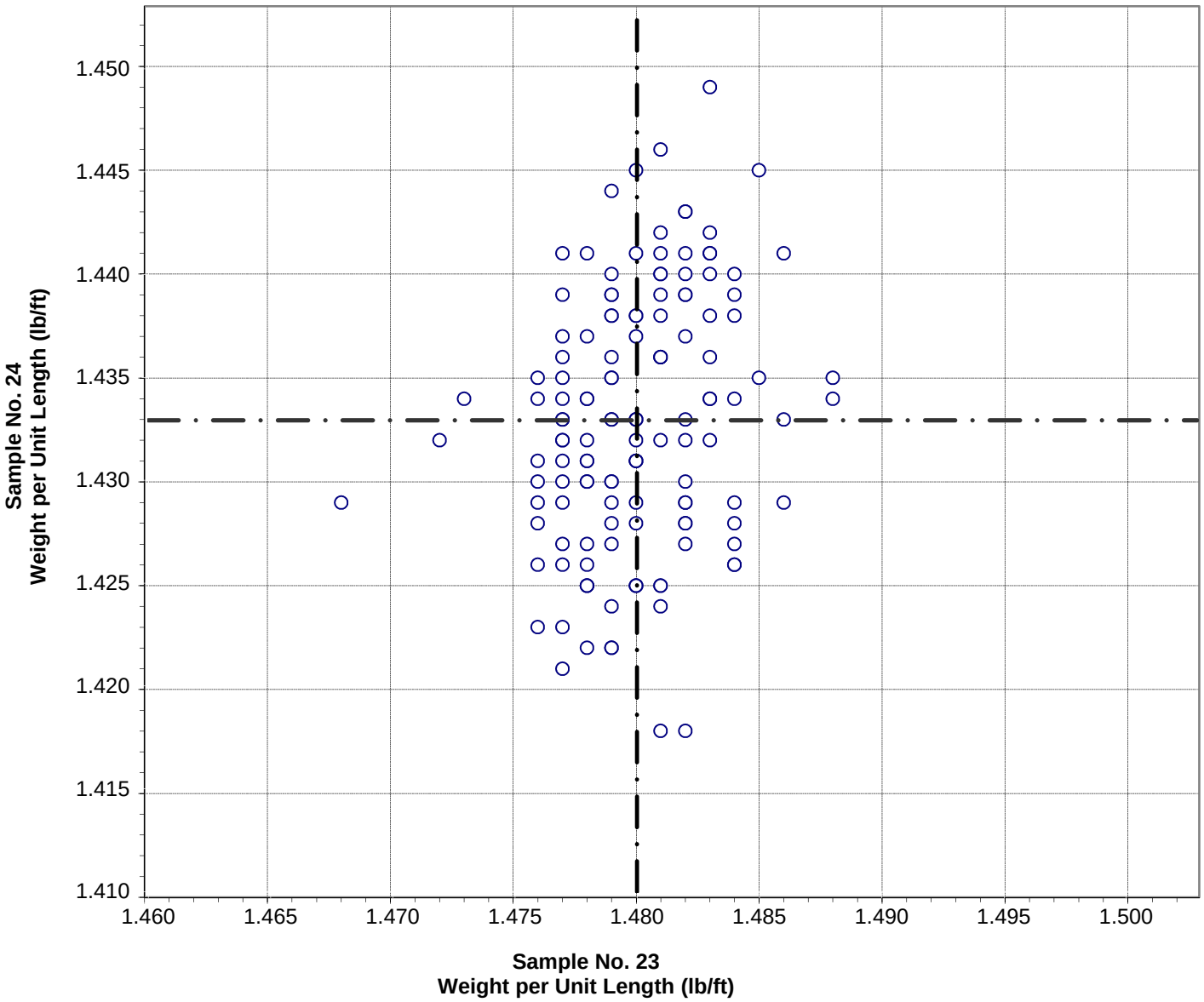
Final Report – September 25 2017

SUMMARY OF RESULTS

		Sample No.23			Sample No. 24		
Test (unit)	#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Elongation (**percent**)							
	154	16.6	1.27	7.7	15.2	1.20	7.9
	*147	16.7	0.86	5.2	15.4	0.89	5.8

* Labs Eliminated - 7, 28, 33, 1577, 1822, 3280, 3659

CCRL Proficiency Sample Program
Weight per Unit Length
REINFORCING BAR Samples No. 23 and No. 24

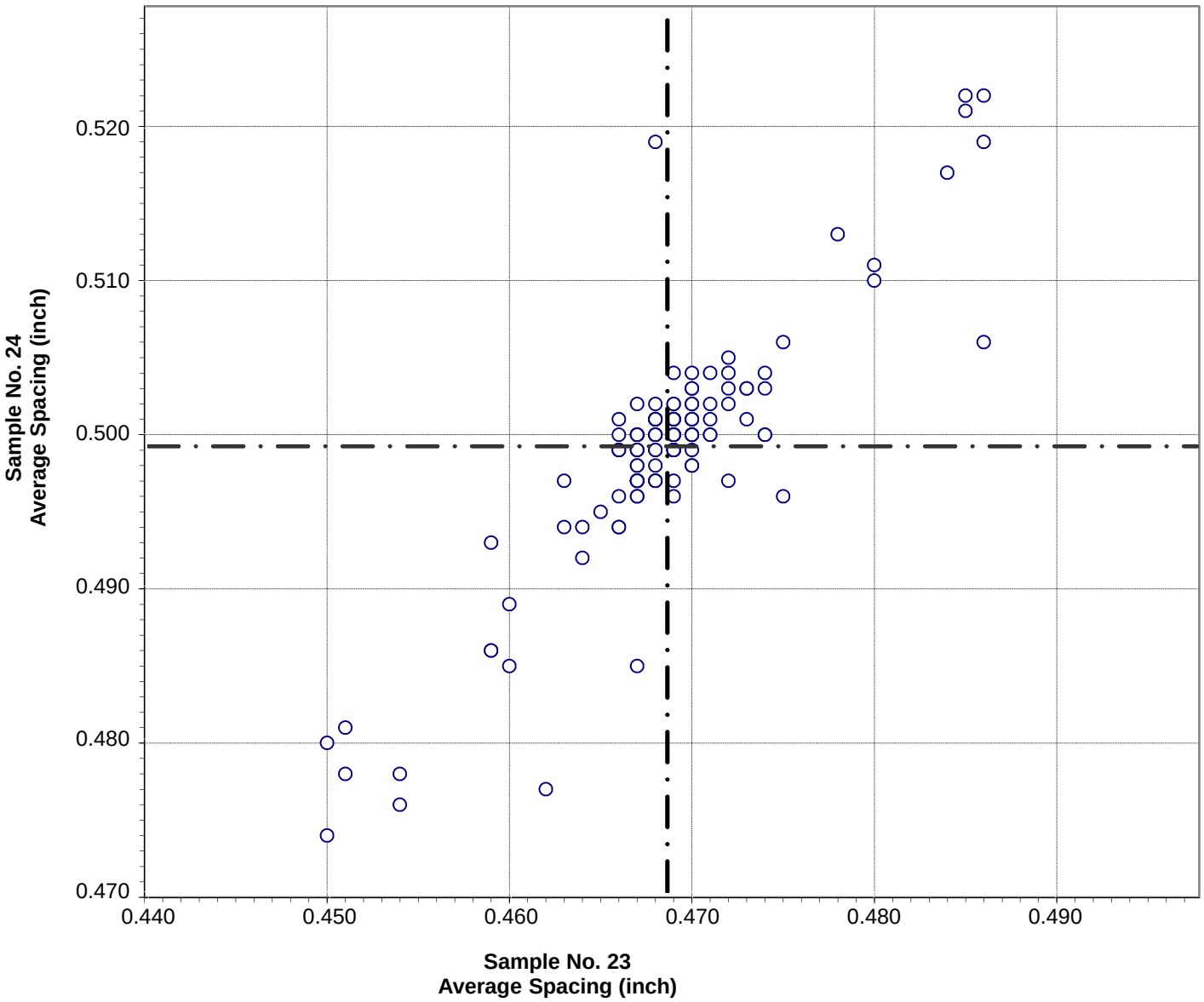


Test No. 1010 Weight per Unit Length 136 Points

Sample No. 23	Ave	1.480	S.D.	0.003	C.V. 0.20
Sample No. 24	Ave	1.433	S.D.	0.006	C.V. 0.43

Labs Eliminated: 1, 8, 21, 28, 52, 421, 1539, 2221, 2951, 2960, 3244, 3280, 3947

CCRL Proficiency Sample Program
Average Spacing
REINFORCING BAR Samples No. 23 and No. 24

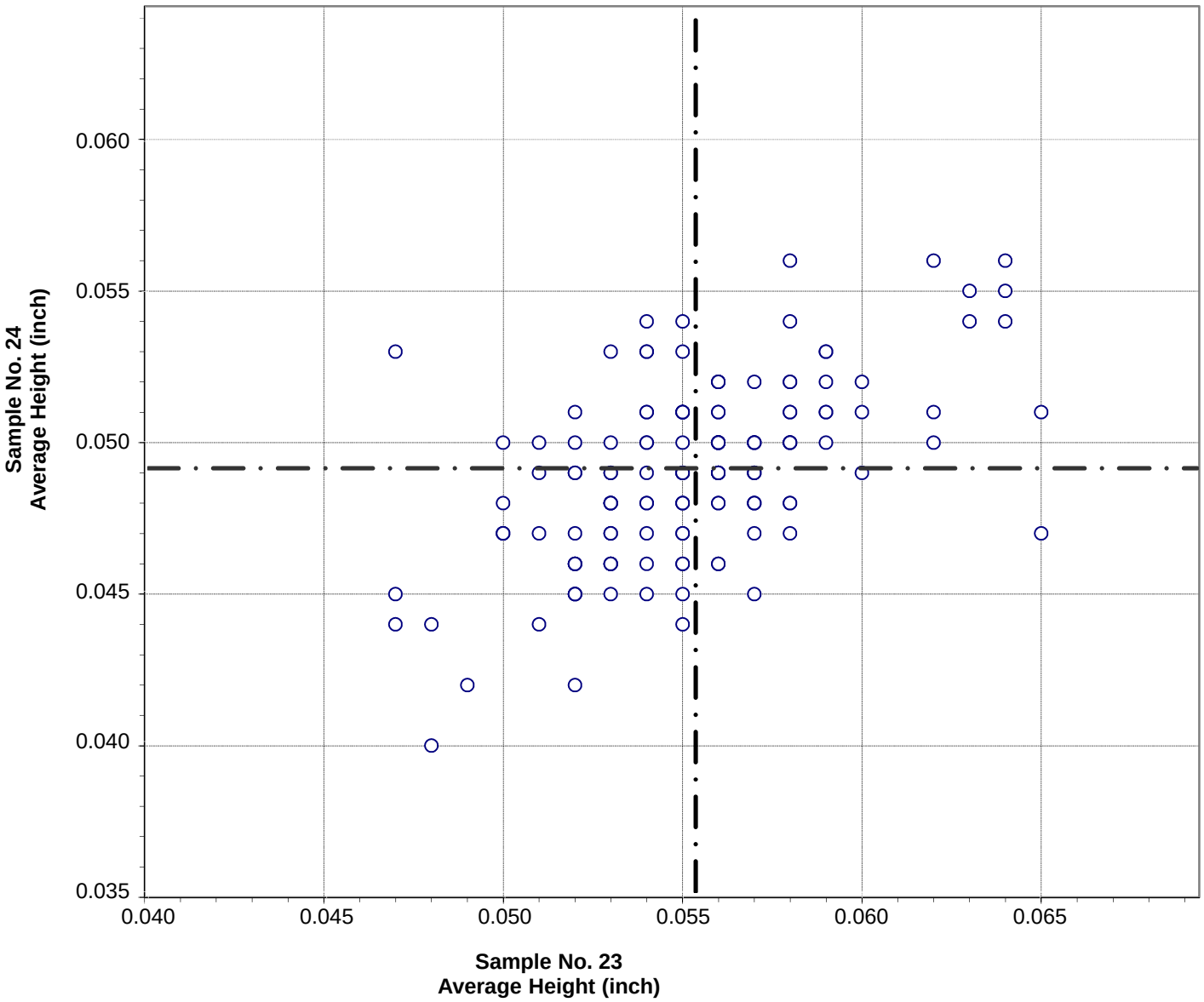


Test No. 1020 Average Spacing 132 Points

Sample No. 23	Ave	0.469	S.D.	0.006	C.V. 1.3
Sample No. 24	Ave	0.499	S.D.	0.008	C.V. 1.6

Labs Eliminated: 2, 7, 22, 26, 28, 52, 451, 474, 477, 640, 1044, 2422, 2951, 3245, 3541, 3659

CCRL Proficiency Sample Program
Average Height
REINFORCING BAR Samples No. 23 and No. 24

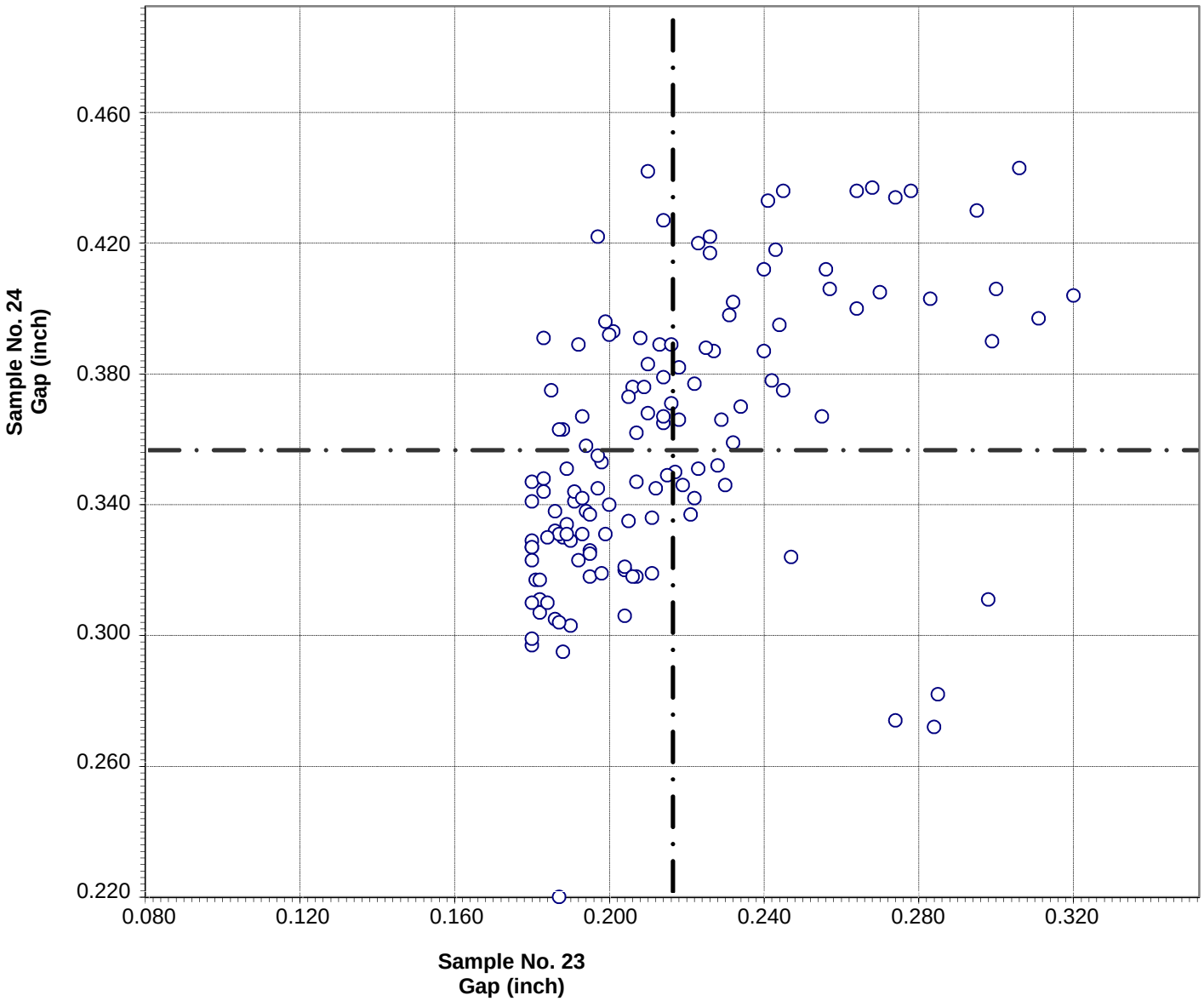


Test No. 1030 Average Height 141 Points

Sample No. 23	Ave	0.055	S.D.	0.004	C.V. 6.4
Sample No. 24	Ave	0.049	S.D.	0.003	C.V. 5.9

Labs Eliminated: 52, 1030, 1540, 1612, 2420, 3054, 4117

CCRL Proficiency Sample Program
Gap
REINFORCING BAR Samples No. 23 and No. 24



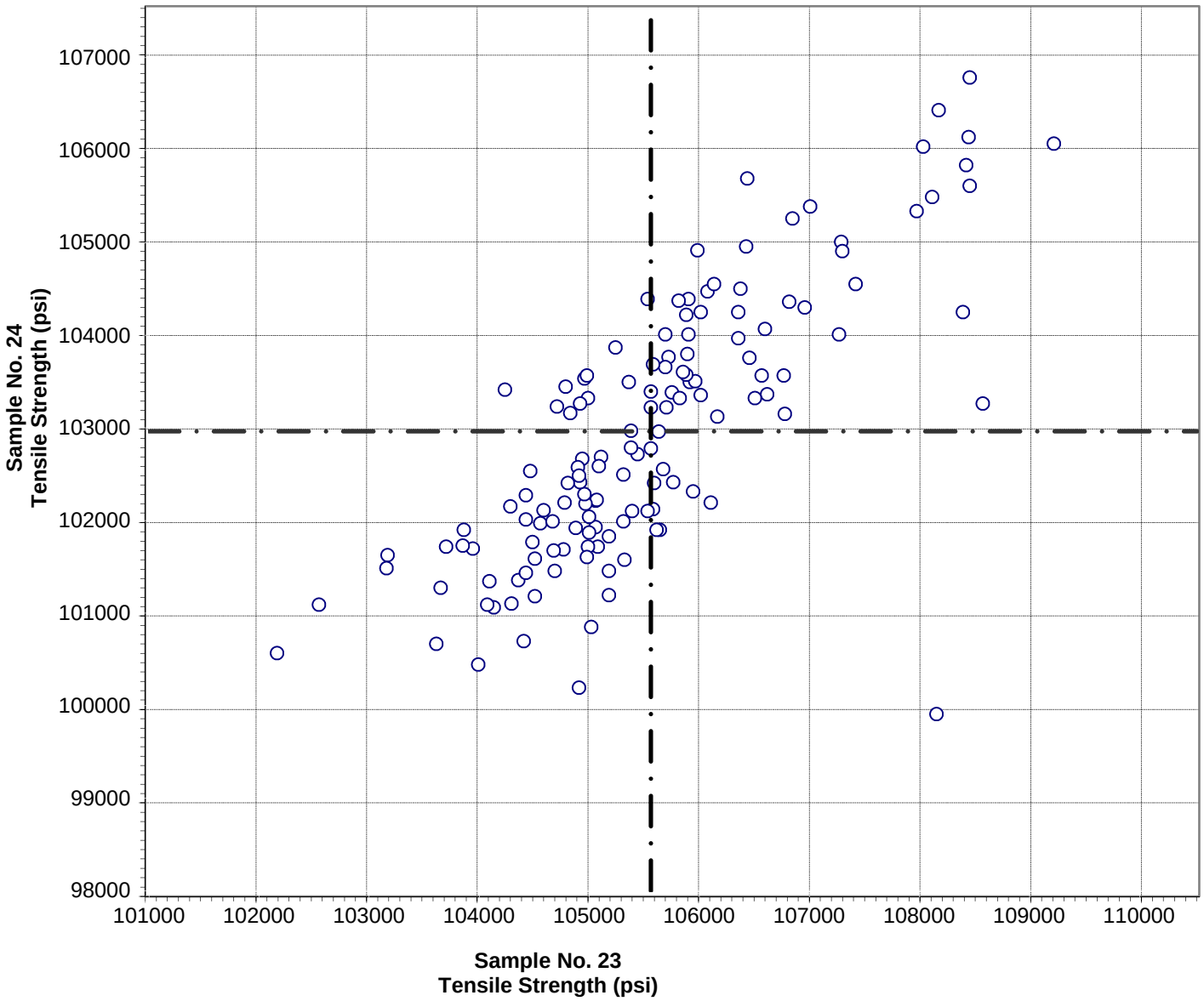
Test No. 1040 Gap 132 Points

Sample No. 23	Ave	0.216	S.D.	0.034	C.V. 16
Sample No. 24	Ave	0.356	S.D.	0.045	C.V. 13

Labs Eliminated: 43, 52, 823, 1265, 1822, 2149, 2221, 3054, 3280, 4022, 4031

Labs off Diagram: 634, 2420

CCRL Proficiency Sample Program
Tensile Strength
REINFORCING BAR Samples No. 23 and No. 24

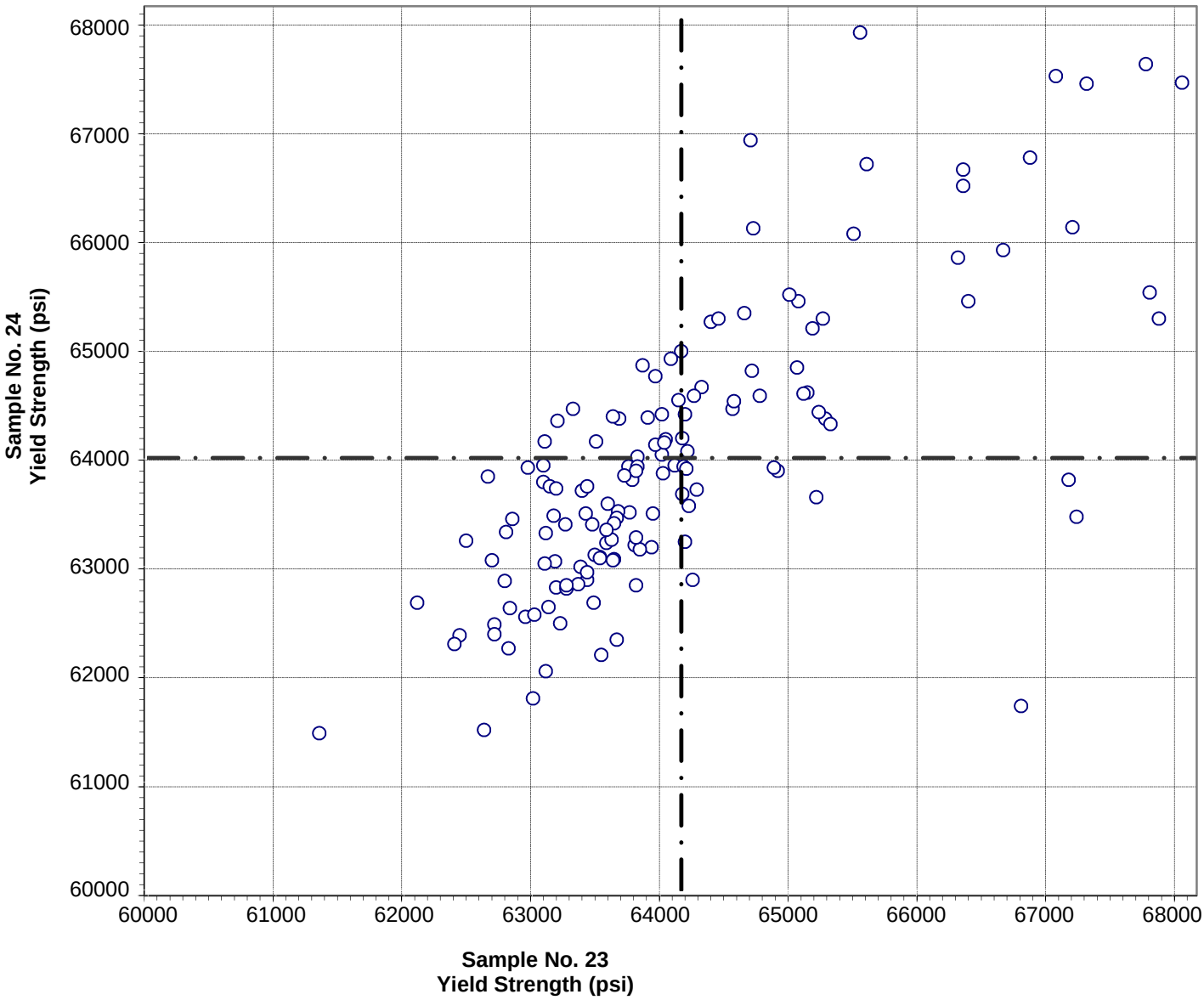


Test No. 1050 Tensile Strength 140 Points

Sample No. 23	Ave	105560	S.D.	1260	C.V. 1.2
Sample No. 24	Ave	102963	S.D.	1412	C.V. 1.4

Labs Eliminated: 15, 51, 52, 477, 1453, 1790, 1959, 2115, 2146, 2420, 2994, 3245, 3659, 3744, 4063, 4117

CCRL Proficiency Sample Program
Yield Strength
REINFORCING BAR Samples No. 23 and No. 24

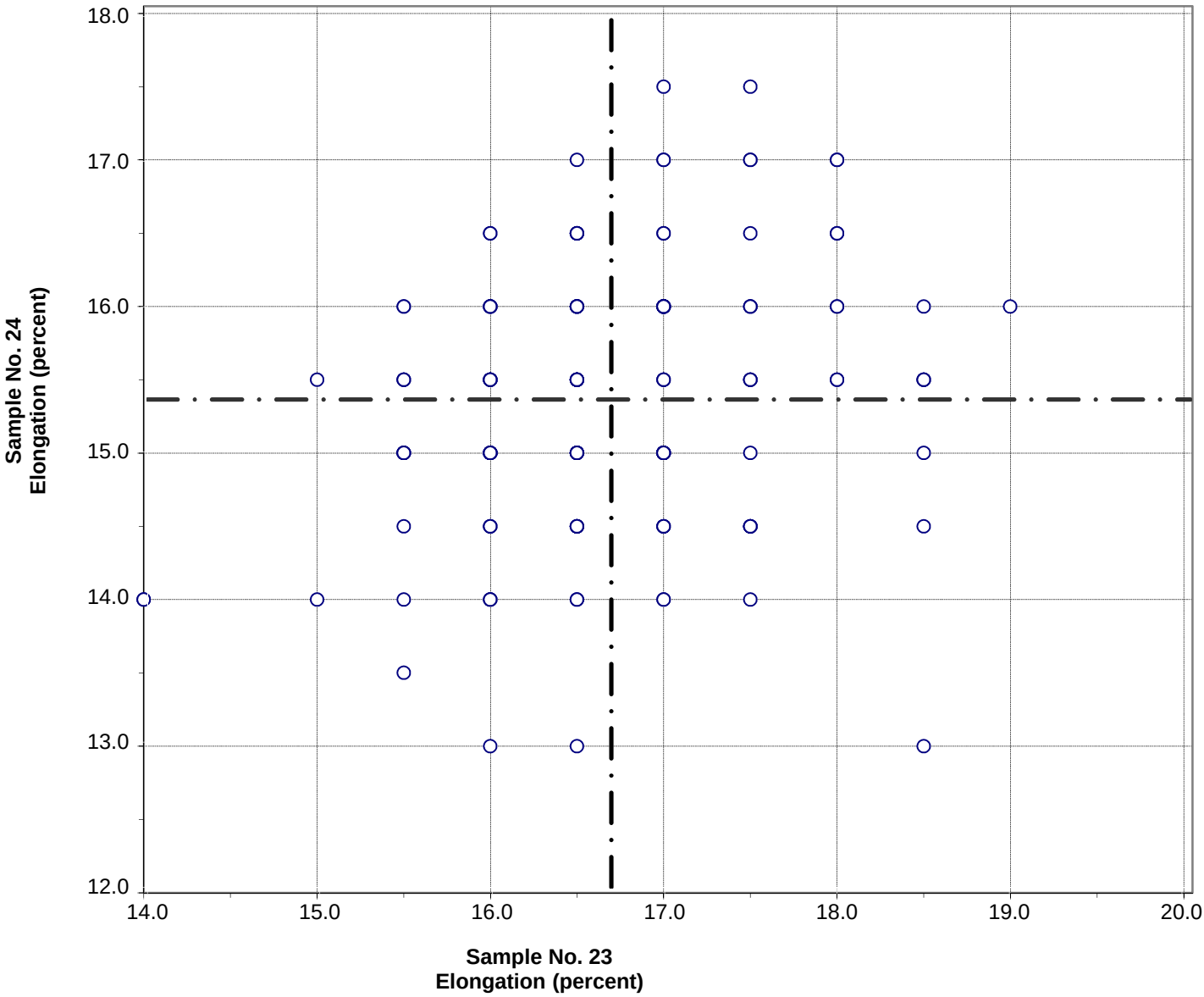


Test No. 1060 Yield Strength 142 Points

Sample No. 23	Ave 64164	S.D. 1298	C.V. 2
Sample No. 24	Ave 64009	S.D. 1302	C.V. 2

Labs Eliminated: 15, 46, 51, 280, 1453, 1785, 1959, 2115, 2146, 2420, 2994, 3245, 3659, 4117

CCRL Proficiency Sample Program
Elongation
REINFORCING BAR Samples No. 23 and No. 24



Test No. 1070 Elongation 147 Points

Sample No. 23	Ave	16.7	S.D.	0.86	C.V. 5.2
Sample No. 24	Ave	15.4	S.D.	0.89	C.V. 5.8

Labs Eliminated: 7, 28, 33, 1577, 1822, 3280, 3659