

**CEMENT AND CONCRETE REFERENCE LABORATORY**  
**PROFICIENCY SAMPLE PROGRAM**

**Final Report**  
**Reinforcing Bar Proficiency Samples**  
**Number 9 and Number 10**

October 2010



September 30, 2010

**To: Participants in the CCRL Reinforcing Bar Proficiency Sample Program**

**SUBJECT: Final Report for Reinforcing Bar Proficiency Samples No. 9 and No. 10**

Following is the report for the current pair of CCRL Reinforcing Bar Proficiency Samples which were distributed in July 2010. Sample No. 9 and Sample No. 10 were ASTM A615, Grade 60, #7 bars. The two samples were from different mills.

**Gap Measurement** - No laboratory ratings were reported for this test. Test results reported for gap included both gap (single rib) and summation of gaps (two ribs). For this set of samples the summation of gaps was requested. For informational purposes, an attempt was made to separate the test results into two groups, gap (single rib) and summation of gaps (two ribs).

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 2011.

Sincerely,

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. 9 and No. 10**

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 2010. 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 62<sup>nd</sup> 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 rib. For bars with two ribs a majority of laboratories are reporting the average of the two gaps or just one gap. Some laboratories are reporting a total of the two gaps.

### **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.

<b><u>Ratings</u></b>	<b><u>Range (Number of Standard Deviations)</u></b>	<b><u>Number (Per 100) of Laboratories achieving the rating</u></b> <sup>1</sup>
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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<sup>1</sup>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. 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  $\pm 1$  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 Samples No. 9 and No. 10  
Final Report - October 1, 2010

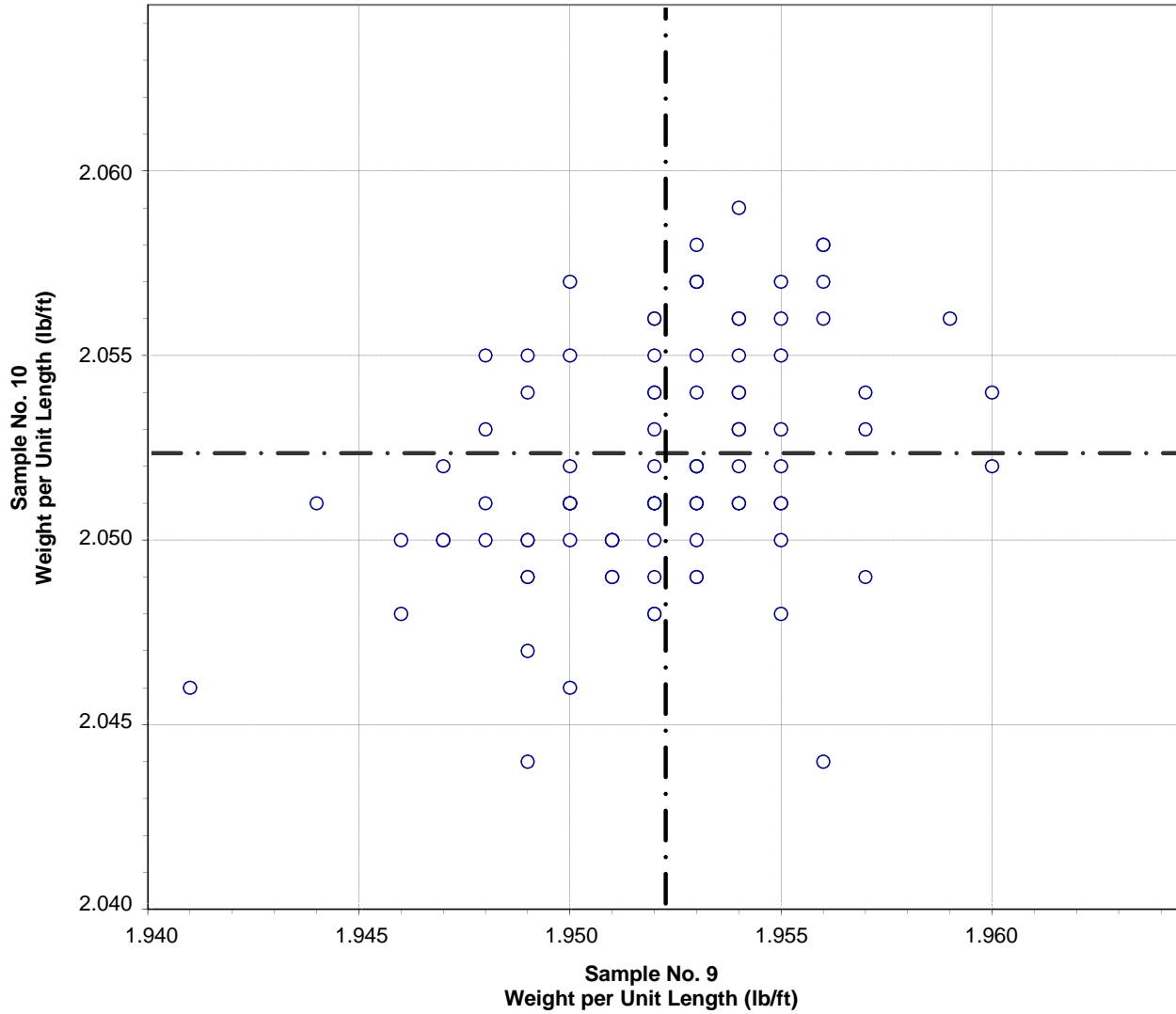
SUMMARY OF RESULTS

			Sample No. 9			Sample No. 10		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Weight per Length	lb/ft	108	1.946	0.34	185	2.046	0.36	185
Weight per Length	lb/ft	* 98	1.952	0.003	0.17	2.052	0.003	0.17
Average Spacing	inch	104	0.534	0.034	6.3	0.552	0.027	4.8
Average Spacing	inch	* 101	0.538	0.020	3.6	0.555	0.020	3.6
Average Height	inch	103	0.052	0.007	13	0.054	0.004	14
Average Height	inch	* 101	0.052	0.004	6.9	0.054	0.004	7.9
<b>GAP</b>								
Gap - All Data	inch	102	0.231	0.078	34	0.193	0.067	35
Gap - Single Rib		58	0.168	0.018	10	0.142	0.022	16
Gap - Summation Two Rib		44	0.314	0.036	12	0.259	0.044	17
Tensile Strength	psi	113	104108	13003	12	106285	9492	8.9
Tensile Strength	psi	* 105	105941	1248	1.2	107382	1118	1.0
Yield Strength	psi	113	65351	5974	9.1	66663	6113	9.2
Yield Strength	psi	* 109	65883	1579	2.4	67516	1623	2.4
Elongation	prcnt	111	14.9	1.3	9.1	17.0	1.4	8.0
Elongation	prcnt	* 110	14.8	1.0	7.0	16.9	1.0	6.2

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

Weight per Unit Length 14 447 1189 21 1284 2115 16 70 783 2420  
Average Spacing 1189 5 2109  
Average Height 1785 1959  
Tensile Strength 1 16 2 70 1026 2019 51 2115  
Yield Strength 1 2 16 21  
Elongation 1540

**CCRL Proficiency Sample Program  
Weight per Unit Length  
REINFORCING BAR Samples No. 9 and No. 10**



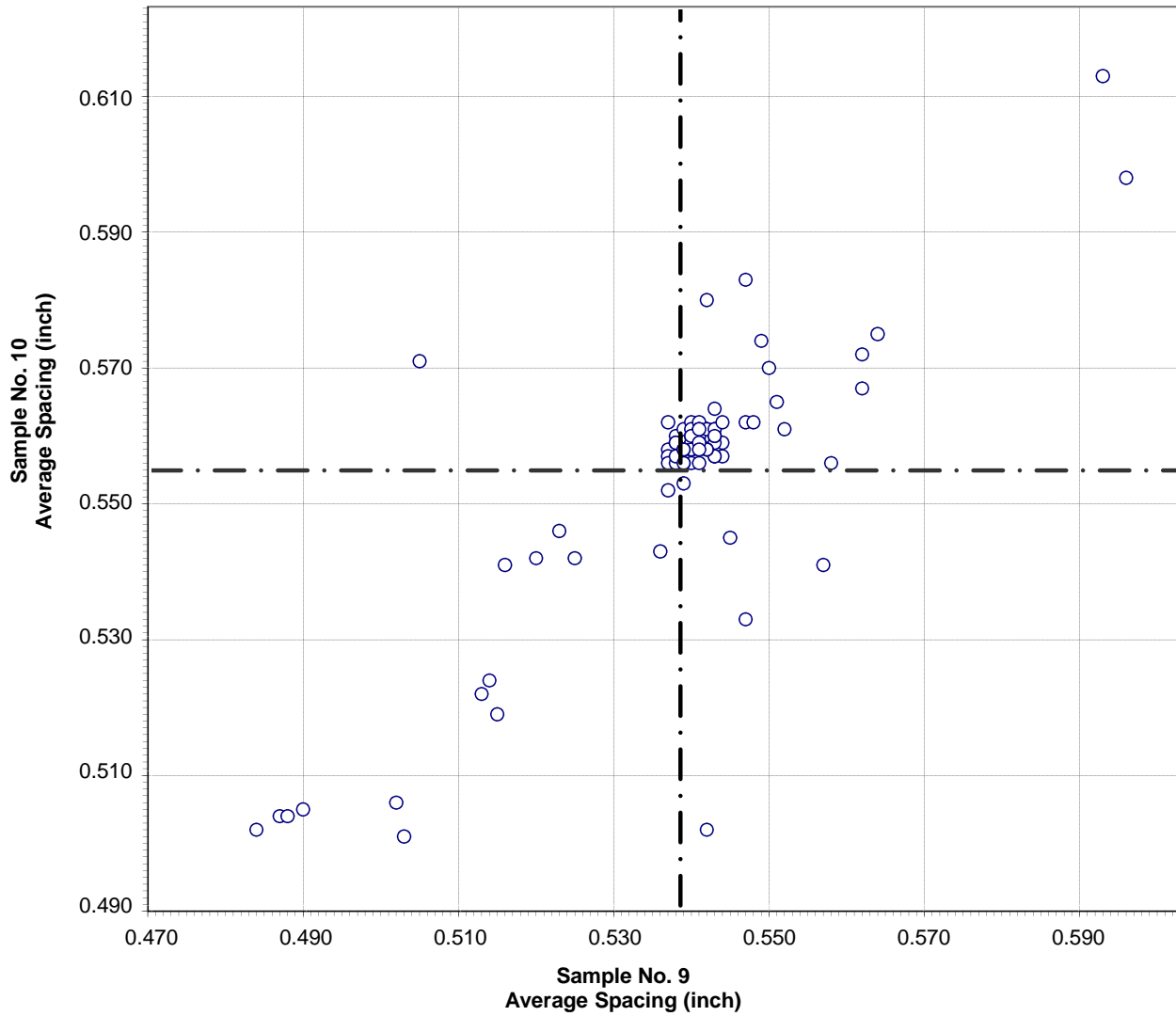
**Test No. 1010      Weight per Unit Length      97 Points**

Sample No. 9    Ave 1.952    S.D. 0.003    C.V. 0.17  
 Sample No. 10    Ave 2.052    S.D. 0.003    C.V. 0.17

Labs eliminated: 14, 447, 1189, 21, 1284, 2115, 16, 70, 783, 2420

Labs off Diagram: 231

**CCRL Proficiency Sample Program  
Average Spacing  
REINFORCING BAR Samples No. 9 and No. 10**



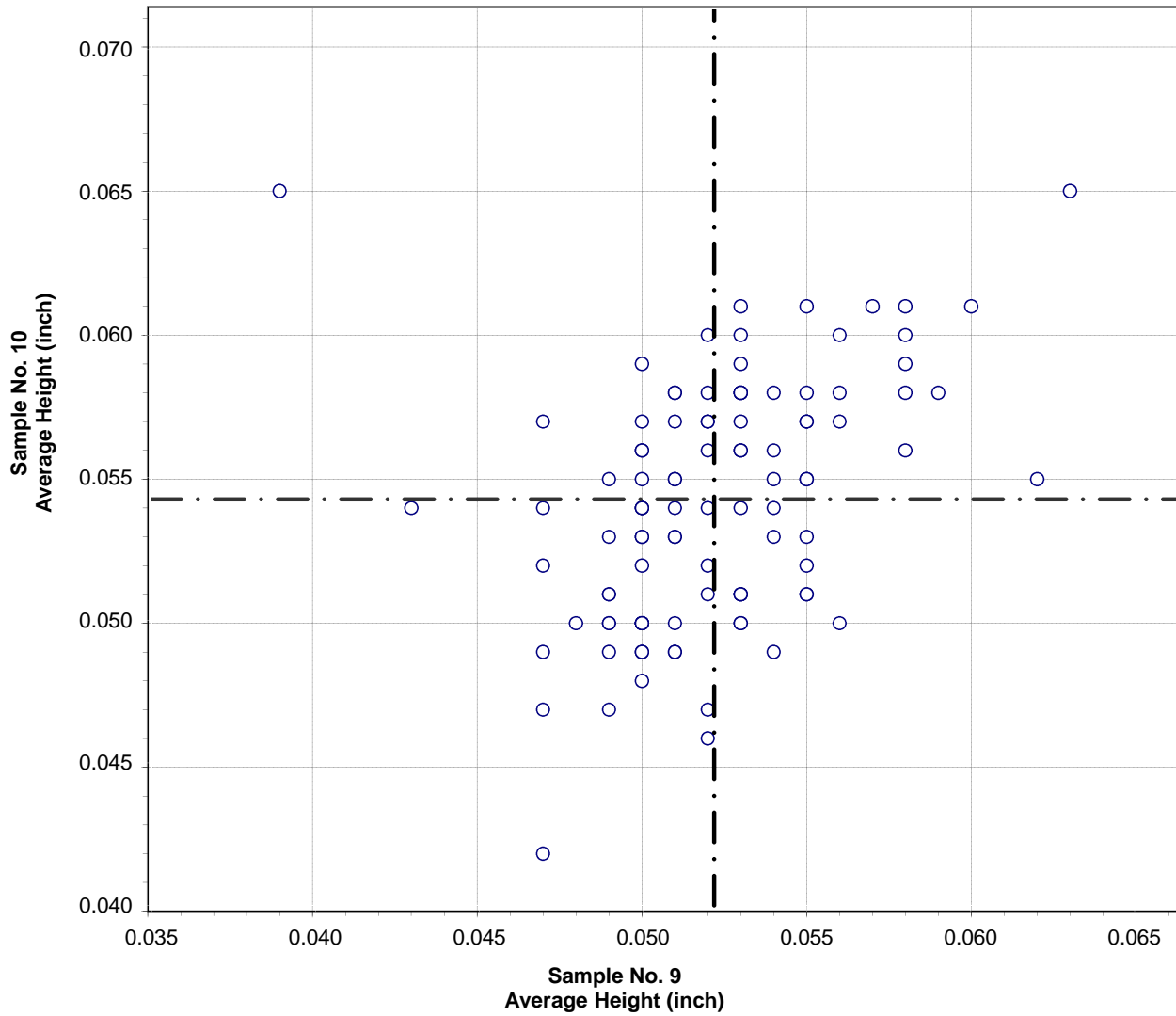
**Test No. 1020      Average Spacing      99 Points**

Sample No. 9    Ave 0.538    S.D. 0.020    C.V. 3.6  
 Sample No. 10    Ave 0.555    S.D. 0.020    C.V. 3.6

Labs eliminated: 1189, 5, 2109

Labs off Diagram: 1284, 3245

**CCRL Proficiency Sample Program  
Average Height  
REINFORCING BAR Samples No. 9 and No. 10**



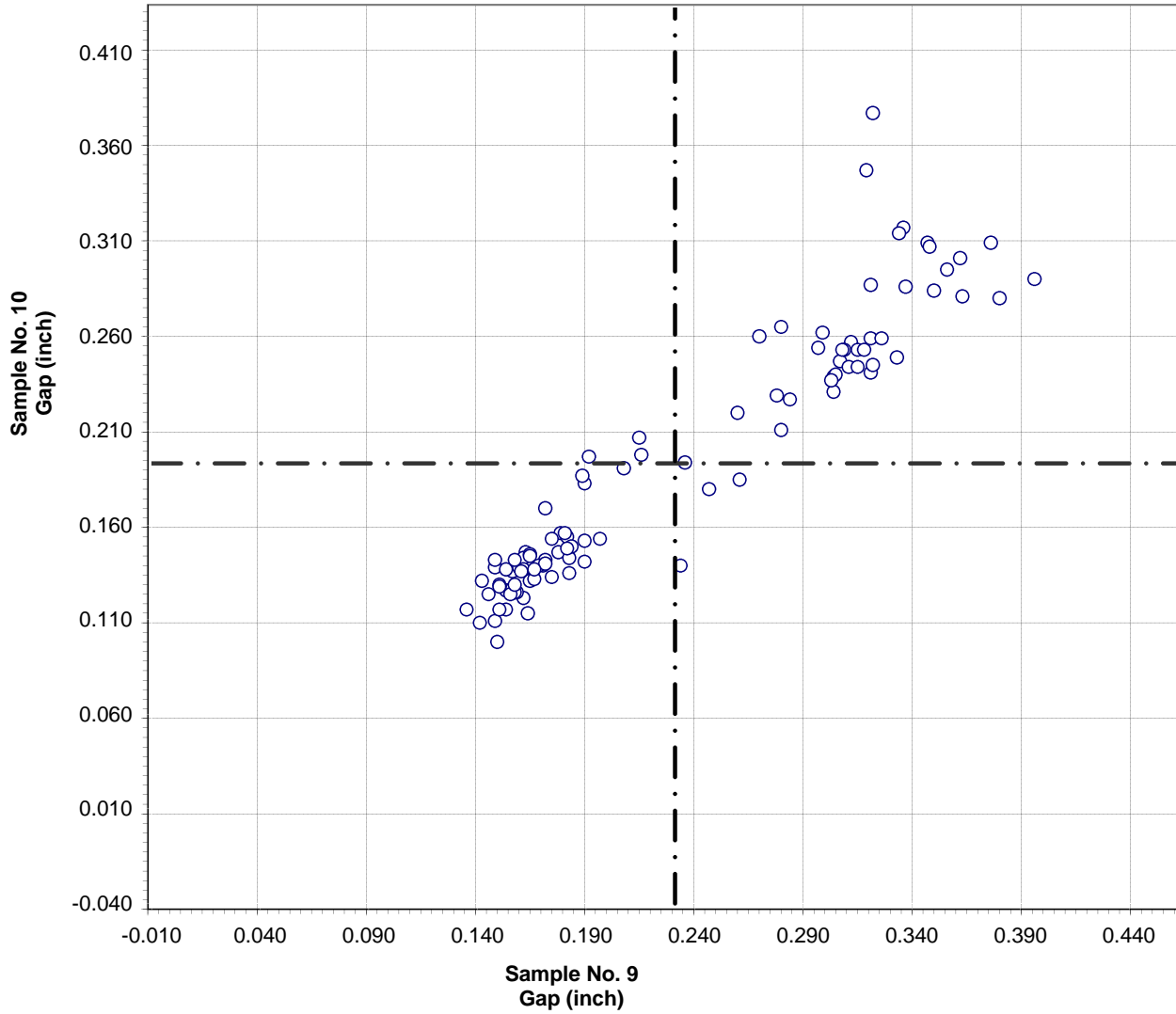
**Test No. 1030      Average Height      101 Points**

Sample No. 9    Ave 0.052    S.D. 0.004    C.V. 6.9  
 Sample No. 10    Ave 0.054    S.D. 0.004    C.V. 7.9

Labs eliminated: 1785, 1959



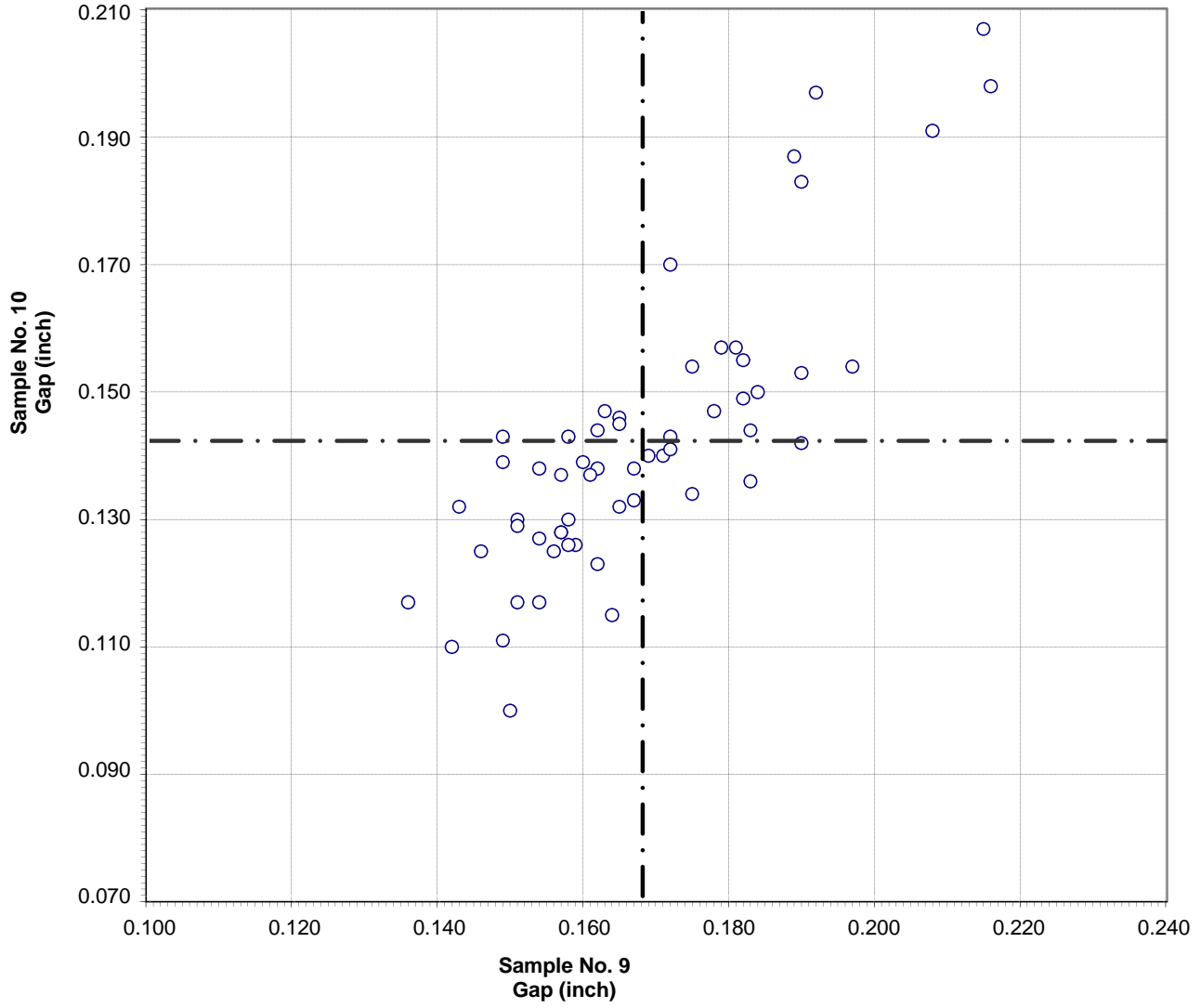
**CCRL Proficiency Sample Program**  
**Gap - All Data**  
**REINFORCING BAR Samples No. 9 and No. 10**



Test No. 1040      Gap - All Data      102 Points

Sample No. 9	Ave 0.231	S.D. 0.078	C.V. 34
Sample No. 10	Ave 0.193	S.D. 0.067	C.V. 35

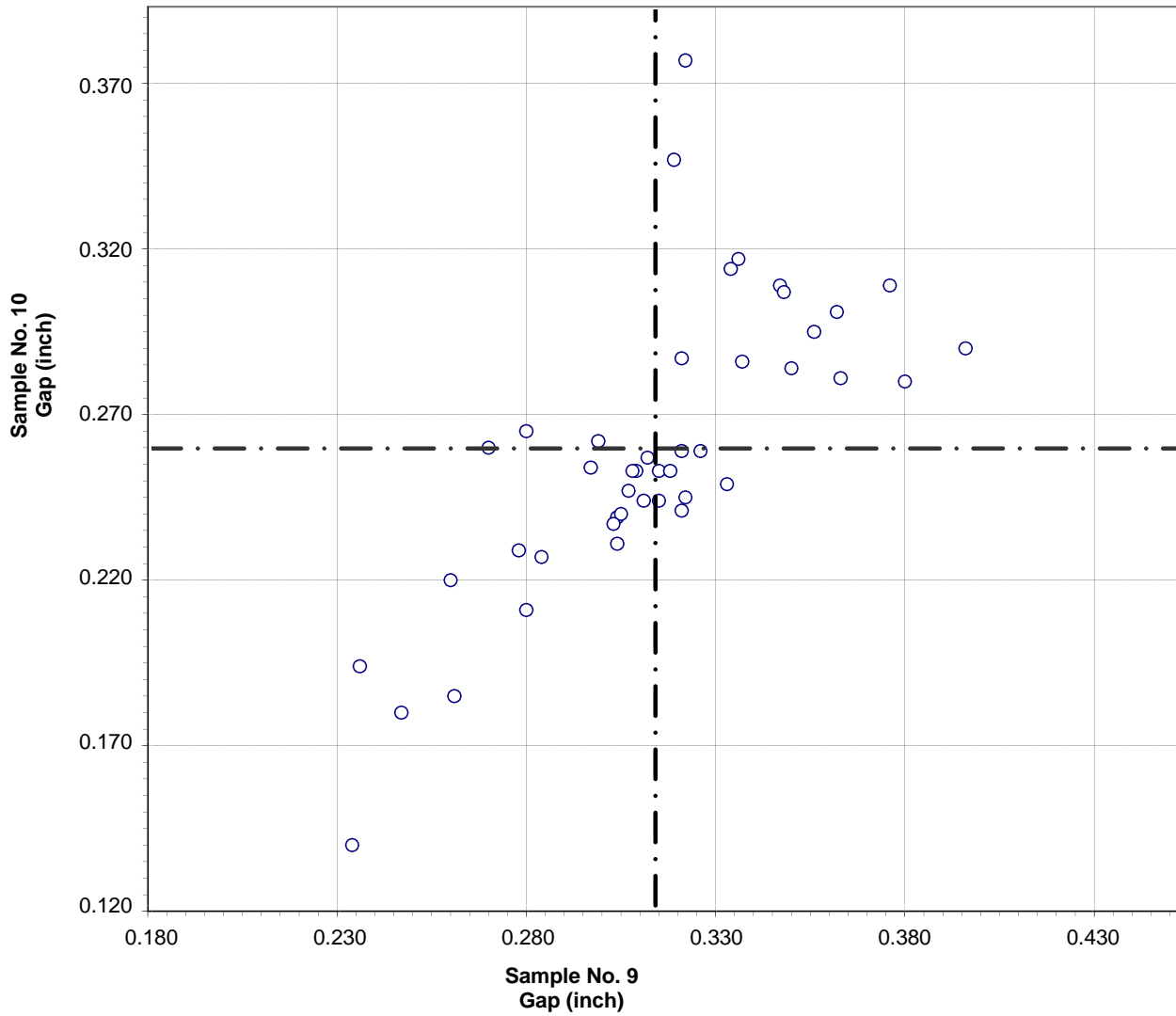
**CCRL Proficiency Sample Program**  
**Gap - Single Rib**  
**REINFORCING BAR Samples No. 9 and No. 10**



Test No. 1040      Gap - Single Rib      58 Points

Sample No. 9	Ave 0.168	S.D. 0.018	C.V. 11
Sample No. 10	Ave 0.142	S.D. 0.022	C.V. 16

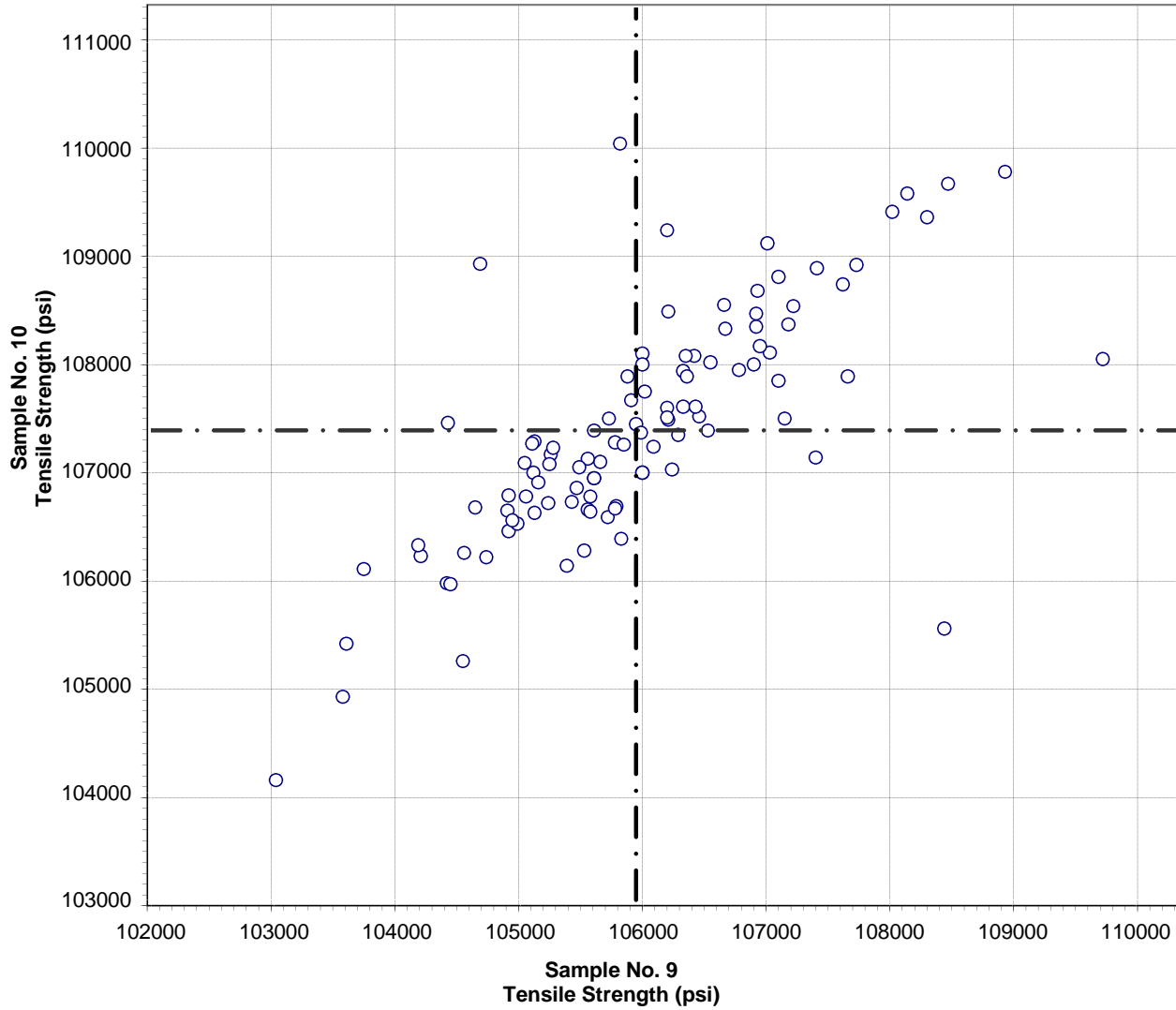
**CCRL Proficiency Sample Program  
 Gap - Summation Two Ribs  
 REINFORCING BAR Samples No. 9 and No. 10**



**Test No. 1040      Gap - Summation Two Ribs      44 Points**

Sample No. 9    Ave 0.314    S.D. 0.037    C.V. 12  
 Sample No. 10    Ave 0.259    S.D. 0.044    C.V. 17

**CCRL Proficiency Sample Program  
Tensile Strength  
REINFORCING BAR Samples No. 9 and No. 10**



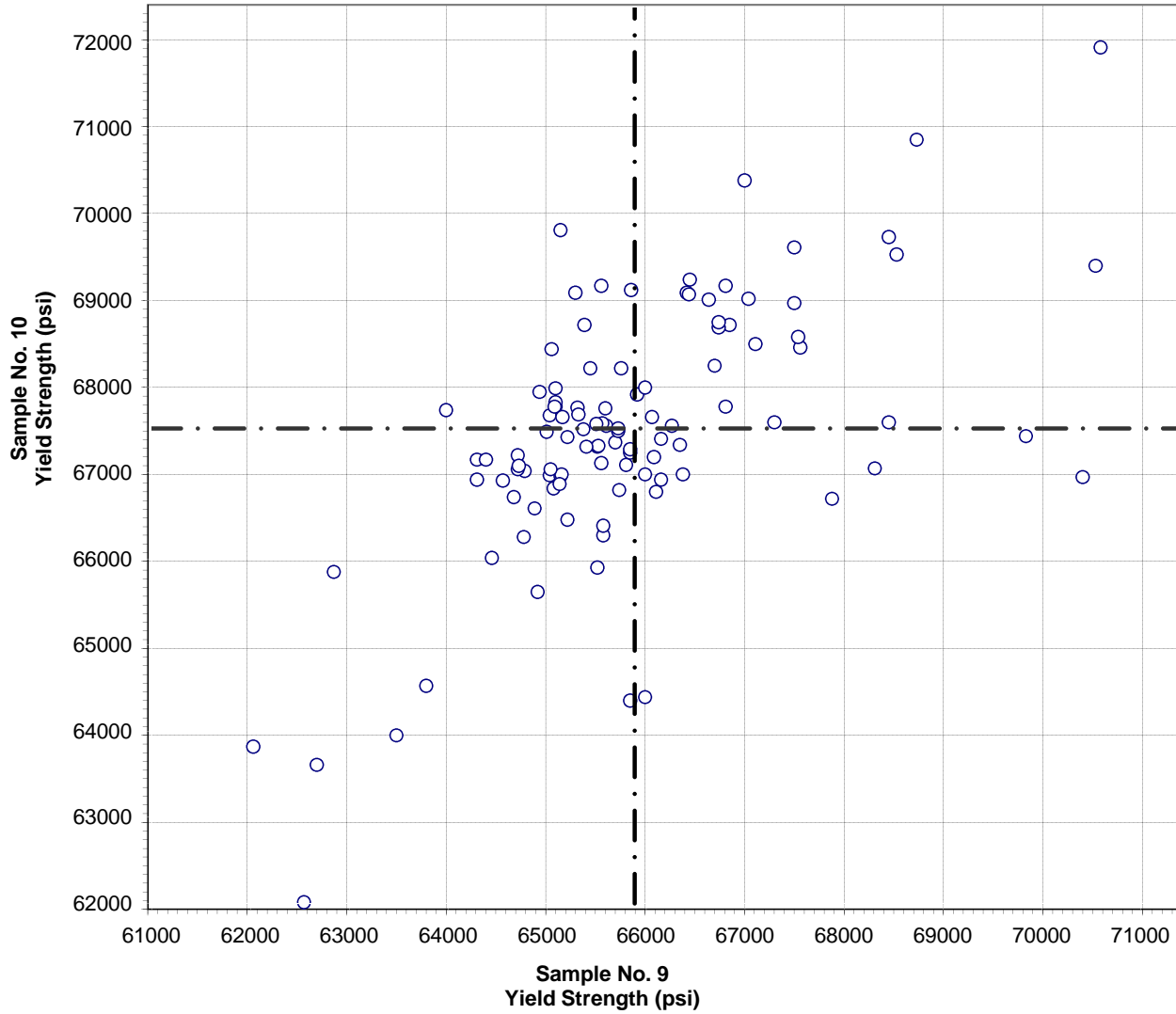
**Test No. 1050      Tensile Strength      104 Points**

Sample No. 9    Ave 105941    S.D. 1248    C.V. 1.2  
 Sample No. 10    Ave 107382    S.D. 1118    C.V. 1.0

Labs eliminated: 1, 16, 2, 70, 1026, 2019, 51, 2115

Labs off Diagram: 1189

**CCRL Proficiency Sample Program**  
**Yield Strength**  
**REINFORCING BAR Samples No. 9 and No. 10**



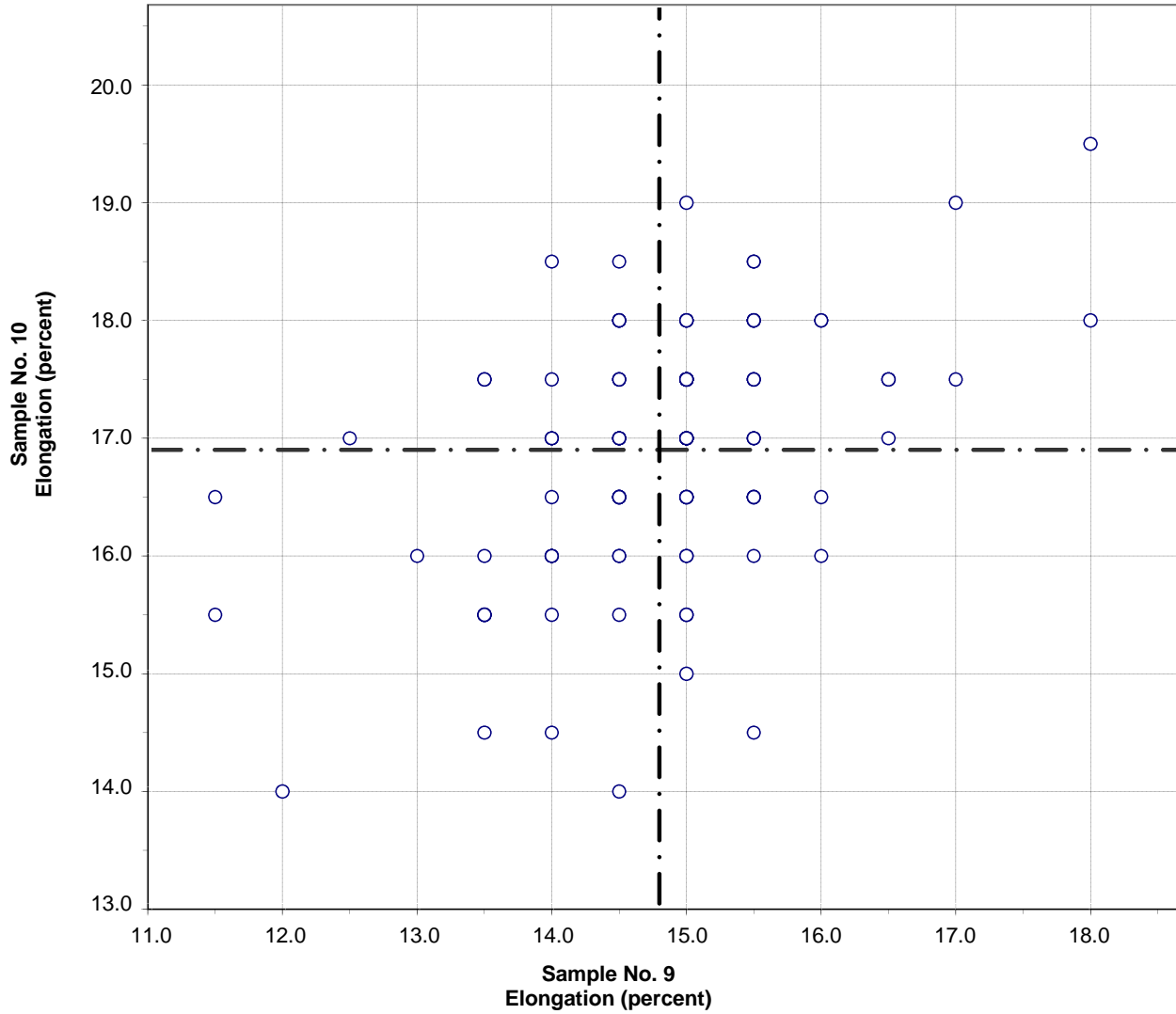
Test No. 1060      Yield Strength      107 Points

Sample No. 9    Ave 65883    S.D. 1579    C.V. 2.4  
Sample No. 10    Ave 67516    S.D. 1623    C.V. 2.4

Labs eliminated: 1, 2, 16, 21

Labs off Diagram: 2115, 446

**CCRL Proficiency Sample Program  
Elongation  
REINFORCING BAR Samples No. 9 and No. 10**



Test No. 1070      Elongation      110 Points

Sample No. 9    Ave 14.8    S.D. 1.0    C.V. 7.0  
 Sample No. 10    Ave 16.9    S.D. 1.0    C.V. 6.2

Labs eliminated: 1540