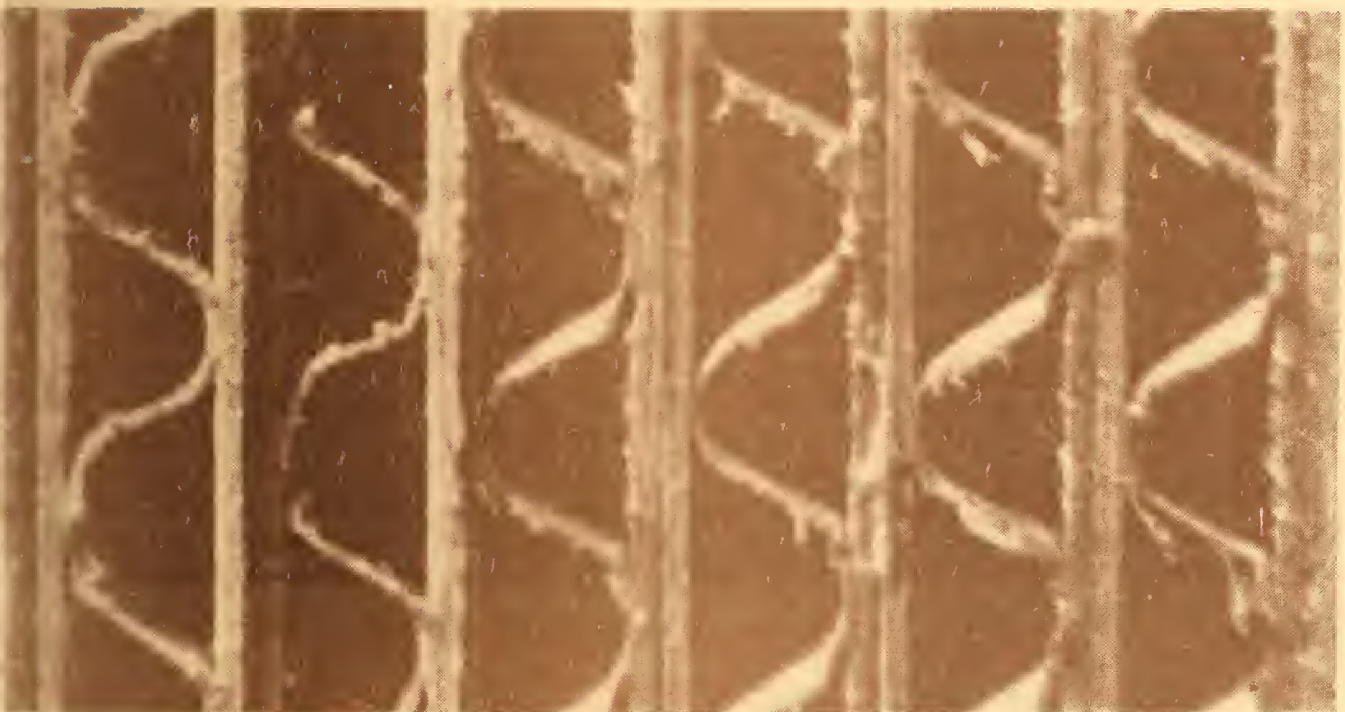
NBSIR 79-1359

CONTAINER BOARD

report no. 108

September 1978



NBS Collaborative Reference Program for Containerboard

Fourdrinier Kraft Board Group
American Paper Institute, Inc.
and U.S. Department of Commerce, National Bureau of Standards

NBS COLLABORATIVE REFERENCE PROGRAMS

TAPPI Paper and Board (6 times per year)

- Bursting strength
- Tearing strength
- Tensile breaking strength
- Elongation to break
- Tensile energy absorption
- Folding endurance
- Stiffness
- Air resistance
- Grammage
- Smoothness
- Surface pick strength
- K & N ink absorption
- pH
- Opacity
- Blue reflectance (brightness)
- Specular gloss, 75°
- Thickness
- Concora (flat crush)
- Ring crush

FKBG-API Containerboard (48 times per year)

- Mullen burst of linerboard
- Concora test of medium

MCCA Color and Appearance (4 times per year)

- Gloss at 60°
- Color and color difference
- Retroreflectivity

Rubber (4 times per year)

- Tensile strength, ultimate elongation and tensile stress
- Hardness
- Mooney viscosity
- Vulcanization properties

ASTM Textiles (3 times per year)

- Flammability (FF3-71 and FF5-74)

ASTM Cement (2 times per year)

- Chemical (11 chemical components)
- Physical (8 characteristics)

AASHTO Bituminous

- Asphalt cement (2 times per year)
- Cutbacks (once a year)

Collaborative Reference Programs
B360 Polymer Building
National Bureau of Standards
Washington, D.C. 20234

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CONTAINER BOARD

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IBSIR 79-1359

Introduction

The Collaborative Reference Program for Containerboard is sponsored by the Fourdrinier Kraft Board Group (FKBG) of the American Institute of Paper, Inc., with the cooperation of the Technical Association of the Pulp and Paper Industry (TAPPI) and the Collaborative Testing Services, Inc. In this program, samples of three weights of liner-board, nominally 26 lb, 42 lb, and 69 lb and of corrugating medium (26 lb) are randomized separately from uniform narrow rolls and packaged for distribution to the participants. Each month, sufficient test material for four weekly tests, the material for each consisting of 20 test pieces of 42 lb board and 20 test pieces of 26 or 69 lb board, the latter in alternate months, is mailed to participants for Mullen bursting strength, or for each week five sheets of corrugating medium, each sheet for four tests of Concora flat crush strength. The participants return their test results to NBS for analysis and receive two monthly reports from NBS: a "preliminary" (individualized report) comparing a laboratory's results with the industrial mean, and a longer report (as illustrated by this report) showing the data from all participants.

Jeffrey Horlick

Jeffrey Horlick, Administrator
Collaborative Reference Programs

Office of Testing Laboratory
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January 17, 1979

TABLE OF CONTENTS

EXPLANATION OF TABLES

Each table shows laboratory test results for Mullen bursting strength of linerboard or Concora flat crush strength of corrugating medium. The data are divided into three time spans. On the left of each table is an analysis for each week of the month. In the center is cumulative data for the month and on the right is cumulative data for up to 16 weeks.

Conservative statistical tests have been used in excluding extreme data from the analyses. Thus, where the mean (average) for one laboratory is compared with the average for many laboratories, limits have been used that would exclude only one laboratory in a hundred if all laboratories followed exactly the same testing procedure. Consequently, laboratories receiving "X" flags should review their testing procedures, instrument calibration, and control processes. Similar conservative criteria were used in flagging within-laboratory standard deviations and other statistics.

	LAB			MEANS THIS MONTH		
WEEKLY VALUES:	CODE	V	WK-1	WK-2	WK-3	WK-4

LAB CODE - Confidential laboratory identification number known only to the participant and the Collaborative Reference Program staff.

V - Code for indicating instrument type, units used, and any other variation in test procedure or conditions. A '+' in this column means a non-standard variation. Data marked '+' are not included in the combined averages for all laboratories. (see page 4).

MEANS THIS MONTH - For each laboratory each weekly mean is the average of individual test determinations, usually an average of 20 determinations.

FLAGS (following means and standard deviations) -

X - Data excluded from an AV MEAN or average standard deviation because value deviated from the AV MEAN or average standard deviation by more than 2.576 times the appropriate standard deviation. A laboratory following the prescribed test method could obtain such an extreme value by chance only one time in a hundred. Corrective action is almost certainly required.

* - Data included in the CUMULATIVE AV MEAN but the value deviated from this mean by more than 1.960 and less that 2.576 times the SD CUM MEAN. A laboratory following the prescribed test method could obtain such an extreme value by chance only one time in twenty. Corrective action may be desired.

S - This is a warning to the laboratory but does not affect inclusion or exclusion of the laboratory's results from the corresponding AV MEAN. This flag indicates an extremely high or low within-laboratory standard deviation (SDR, not shown) that could occur by chance only one time in a hundred if the laboratory is following the prescribed test method.

AV MEAN - (at bottom of table) - The average for the indicated week of the means for all laboratories, except those laboratories marked '+' in column V and those means marked with an 'X'.

SDR - (not shown) - The standard deviation of within-laboratory measurements; i.e., the Standard Deviation of the Replicate measurements made at one time in one laboratory on one package of test pieces.

AV SDR - The average for the indicated week of the SDR's of all the laboratories, except those omitted from the AV MEAN. Also an extremely high or low SDR as compared with the AV SDR based on the remaining laboratories is omitted from the AV SDR and the letter 'S' is placed after the laboratory mean for that week. The AV SDR is an index of the within-laboratory precision for repeated measurements; i.e., a measure of the ability of an average laboratory to repeat its results over a short period of time. It includes measurement error and sample variation.

SD LABS - For each week the standard deviation of the means about the AV MEAN for that week after omitting those means marked with an 'X' or noted '+' in column V. The SD LABS is an index of the among-laboratory precision of the test method as applied by the participating laboratories; i.e., a measure of the ability of laboratories to get comparable results.

NO. INCL - The number of laboratory means included in the AV MEAN for that week.

NO. OMIT - The number of laboratory means reported but omitted from AV MEAN because of non-standard equipment, environment or procedure ('+' in column V) or because of extreme results (X following mean).

NOT RCD - The number of laboratories failing to report data on time or in usable form for this week (but who reported data for at least one of the other weeks of this month), or who received test pieces from a different sample of material and whose data therefore are shown in another table of this report.

SD SHTS - (Concora only) The average for the indicated week of the among-sheet within-laboratory standard deviations. The SD SHTS is an index primarily of the variability among sheets.

VALUES THIS MONTH:	THIS MONTH MEAN	SDR	SDWKS

MEAN - The average for the indicated laboratory of the reported weekly MEANS THIS MONTH.

SDR - The average for the indicated laboratory of the weekly SDRs for the current month.

SDWKS - For the indicated laboratory, the standard deviation among the laboratory's weekly MEANS THIS MONTH (including those means marked with an 'X').

CUMULATIVE VALUES:	CUMULATIVE MEAN	SDR	SDWKS	WKS

MEAN - The average for the indicated laboratory of all its weekly means for the number of weeks indicated, including those for the current month. An '*' or 'X' following this CUMULATIVE MEAN indicates the laboratory is running consistently low or high. (See above for explanation of these flags).

SDR - The average for the indicated laboratory of the weekly SDRs for the indicated number of weeks.

SDWKS - For the indicated laboratory, the standard deviation among the laboratory's weekly means (including those means marked with an 'X'). SDWKS is an index of the week to week precision; i.e., a measure of the ability of a laboratory to repeat its results from week to week.

WKS - Number of weeks for which usable results have been reported by that laboratory. At most, 16 weeks of data are included.

GRAND AVERAGES:	GRAND AVERAGES THIS MONTH	CUMULATIVE 12 WEEKS

THIS MONTH - Averages for the four weeks of the quantities shown to the left.

CUMULATIVE - Averages for the indicated number of weeks, including the four weeks of the current month.

AV SDWKS - The average of the SDWKS for all laboratories excluding those marked '+' in column V or with an 'X' following the corresponding THIS MONTH or CUMULATIVE MEAN or SDWKS.

SD CUM MEAN - The larger of either (1) the standard deviation of the CUMULATIVE MEANS about the average CUMULATIVE MEAN after omitting those CUMULATIVE MEANS marked with an 'X' or with a '+' in column V, or (2) the CUMULATIVE SD LABS divided by the square root of the number of weeks cumulated. The former will be appreciably larger than the latter only when there are persistent systematic differences among the laboratories.

INSTRUMENT CODES

FOR

MULLEN BURST TESTERS
(Column V)

Code	Description
A	Model A, Manual Clamp
H	Model AH, Hydraulic Clamp
I	Model A, Hydraulic Clamp added
J	Jumbo, Hand Clamp, Hand Driven
M	Model AH, Hydraulic Clamp, Transducer
R	Model A, Air Clamp added
X	Other Model, Please Describe Instrument Make and Model

If an incorrect instrument code has been assigned to your laboratory, please inform us.

Use of Average Mean as a Reference Standard

A large supply of linerboard in three weights was randomized and placed in sealed packages ready for shipment. The supply for each weight of board was divided into several narrow "rolls" or cross-machine "positions" of a larger roll, and each position was separately randomized. Each package contains test pieces from one position only. The position is designated by the number following the letter in the code marked on the package. Thus 42H 1 indicates that this package contains 42 lb board from position 1 of lot H. Samples from the first position are distributed until exhausted, then from the second position, and so forth for each weight of board. Thus for short periods of time (several weeks to months), the samples that the participants test are from the same position of a lot, and for a longer period from the same lot.

The three weights of linerboard distributed in this program may be used as reference standards. The best reference values are the cumulative grand AV MEANs in the latest reports. These values are given at the bottom right of each table. For each weight of board, comparisons should be made first for measurements made on the same position, i.e., for checking your current measurement, use grand AV MEANs that have the same position code as on the packages being tested. The position is shown in the upper left corner of the table. If no report is yet available on the current position, grand AV MEANs from previously tested positions of the same lot may be used as approximate reference values.

Similarly a large supply of a 26 lb corrugating medium was randomized, after dividing into several narrow rolls or positions. The above discussion for linerboard also applies to the corrugating medium.

We are currently using the third lot of linerboard and the third lot of corrugating medium:

Lot	Material	Codes	Used
1	linerboard	A,B,C	October 1969 - April 1973
2	linerboard	D,E,F	September 1972 - September 1976
3	linerboard	G,H,I	October 1976 -
1	corrugating medium	(A)	May 1973 - March 1976
2	corrugating medium	B	April 1976 - February 1977
3	corrugating medium	C	March 1977 -

REPORT NO. 108
BURSTING STRENGTH (MULLEN), PSI

LAB CODE	V	MEANS THIS MONTH WK-1	WK-2	WK-3	WK-4	THIS MONTH MEAN	SDR	SDWKS	CUMULATIVE MEAN	SDR	SDWKS	WKS
100	H	122.9	124.0	124.8	122.4	123.6	6.6	1.1	123.7	7.9	1.5	10
101	H	118.6	120.3	120.1	119.2	119.5	7.0	.8	119.4	8.0	.8	10
102	H	122.2	118.9	121.4	121.6	121.0	7.9	1.4	121.5	7.8	1.2	8
103	I	116.0	116.3	116.9	112.8X	115.5	6.7	1.9	118.6	7.9	3.6	10
107	A	126.7	128.1	126.5	123.1	126.1	6.5	2.1	126.2	7.0	2.0	10
108	M	124.7S	127.9	125.8	124.9	125.8	10.8	1.5	124.2	10.0	2.5	10
109	H		122.1	121.3	119.1	120.8	9.6	1.6	120.8	9.6	1.6	3
110	M	120.4	116.1	119.5	118.0	118.5	8.5	1.9	122.3	8.5	3.8	9
111	M	122.2	122.7	121.8	120.8	121.9	9.5	.8	122.9	9.6	1.5	10
112	H	121.9	119.2	118.9	117.8	119.5	7.8	1.8	119.1	8.0	1.7	10
113	R	121.0	121.4	121.8	120.4	121.2	6.4	.6	120.3	6.9	1.2	10
114	A	126.4	121.5	128.6	132.3X	127.2	7.8	4.5	123.5	8.3	4.3	10
115	R	114.5	114.7	115.0	112.4XS	114.2X	4.5	1.2	114.4*	5.6X	2.6	10
116	H	119.0	120.8	119.5	117.1	119.1	8.7	1.5	119.4	8.6	1.3	10
117	H	119.0	120.5	112.9	116.4	117.2	9.0	3.3	118.8	8.6	3.3	10
119	H	125.5		117.2	116.9	119.9	8.4	4.9	121.7	8.3	5.9X	9
120	R	118.0	118.0	119.9	117.6	118.4	8.2	1.0	119.5	9.2	2.0	10
121	M	126.2	129.0	124.0	121.1	125.1	10.7	3.3	127.4	10.3	2.9	10
123	R	124.7	122.3	122.1	125.0	123.6	10.2	1.6	125.0	10.0	3.1	7
125	I	127.7	128.8	124.2	125.3	126.5	7.4	2.1	124.9	7.4	3.2	10
127	H	120.7	121.7	120.8	121.0	121.1	7.9	.5	121.0	7.3	.7	9
128	H	122.3	118.0	125.1	118.8	121.0	9.8	3.3	121.4	9.7	2.9	10
129	R	119.4	117.4	118.4	119.9S	118.8	6.0	1.1	121.3	6.4	3.2	10
130	H	123.7S	125.0		124.2	124.3	8.8	.7	123.2	8.9	2.3	9
131	R	127.2S	128.2	124.6	121.0	125.3	11.2	3.2	124.6	11.4X	3.1	10
133	A	120.5	122.6	124.7	127.2	123.8	7.7	2.9	124.4	7.3	2.2	8
136	H	116.9	115.0	129.9	123.4	121.3	6.4	6.8	116.9	7.4	9.2X	10
137	H	119.5	119.3	116.4	121.0	119.1	10.2	1.9	118.9	10.6	1.9	10
138	H	129.5	126.6	123.7	127.6	126.8	8.7	2.4	128.9*	9.5	4.3	10
139	R	127.4	119.3	124.7	117.8	122.3	9.0	4.5	120.4	8.6	5.3	10
140	H	123.4	121.9	121.6	126.2	123.3	7.0	2.1	122.0	6.6	2.1	10
141	H	120.1	120.1	120.8	119.0	120.0	6.0	.7	119.5	6.0	.8	10
142	A	125.7	121.6	122.4	124.5	123.6	9.4	1.9	124.8	8.3	4.0	10
143	H	122.1	122.0	122.8	123.3	122.6	8.4	.6	122.2	8.7	1.0	9
145	H	107.5XS	124.5	113.2		115.1	8.3	8.6	115.9*	6.8	6.0X	7
147	H	121.1	117.0	118.4	120.5	119.2	9.1	1.9	120.8	9.5	2.1	10
149	H		128.6	127.9	130.1S	128.9	10.8	1.1	128.5*	9.1	2.6	9
159	H	123.6S	119.6	125.1	122.4	122.7	9.9	2.3	123.8	9.2	3.3	10
161	*X	125.2S	123.8	125.1	121.6	123.9	9.6	1.7	125.4	9.9	2.8	10
163	H	124.3S	118.5	118.8	120.1	120.4	6.5	2.7	122.3	7.3	2.8	10
165	R	122.6	120.2	124.0		122.3	8.7	1.9	123.3	8.4	1.6	9
166	H	119.2	116.6	117.8	121.7	118.8	9.6	2.2	119.6	9.1	2.0	10
167	H	122.6	122.7	123.5	126.8	123.9	8.4	2.0	119.7	7.7	5.0	10
169	I	117.8	126.8	123.8	119.9	122.1	9.8	4.0	120.3	9.2	3.8	10
171	H	117.9	117.1	122.3	116.0	118.3	9.0	2.8	118.1	9.0	2.3	10
172	H	127.5	131.4	126.1	121.9	126.7	8.7	3.9	127.0	8.3	2.9	10
173	H	118.0	124.9	122.4	123.7	122.3	7.9	3.0	122.4	7.7	3.6	10
174	H	124.7	124.2	126.7	124.9	125.1	9.1	1.1	127.2	9.1	3.4	10
175	H	128.2	119.4	114.5	122.3	121.1	9.1	5.7	126.2	8.7	5.9X	10
176	H	120.9	121.4	122.1	121.2	121.4	7.9	.5	123.7	9.3	3.6	10
177	H	116.9S		109.9X	111.8X	112.9X	6.3	3.6	112.6X	7.0	5.6	9
184	H	125.3			122.8	124.1	8.8	1.8	125.6	9.3	2.1	8
186	I	121.7	121.2	123.5	121.8	122.0	8.5	1.0	121.0	7.7	1.5	10
188	I	122.6	121.7	121.2	120.0	121.4	7.4	1.1	121.2	7.4	1.4	10
274	H	122.5	122.3	122.8	122.7	122.6	7.3	.2	122.1	7.1	.6	10

LINERBOARD 42H8 — COLLABORATIVE REFERENCE PROGRAM — SEPTEMBER 1978

REPORT NO. 108

BURSTING STRENGTH (MULLEN), PSI

LAB		MEANS THIS MONTH				THIS MONTH			CUMULATIVE			
CODE	V	WK-1	WK-2	WK-3	WK-4	MEAN	SDR	SDWKS	MEAN	SDR	SDWKS	WKS
283	H	120.2	120.5	120.8	121.8	120.8	5.3	.7	121.4	5.2X	1.0	10
287	A	131.9XS	132.0	132.1X	128.8	131.2X	10.5	1.6	129.4*	10.0	3.7	10
327	M	118.1	116.8	118.2	120.7	118.5	7.6	1.6	118.5	7.6	1.6	4
350	H	120.6	122.4	120.9	123.5	121.8	9.7	1.4	119.9	9.7	2.4	10
553	M	125.4	128.3	126.1	124.3	126.0	8.1	1.7	123.9	8.8	2.6	9
562	A	130.9	132.3	120.9	118.0	125.5	8.3	7.1	128.3	8.7	5.1	10
568	I	127.2	130.7	128.0	126.3	128.1	8.9	1.9	126.8	8.6	2.7	10
569	A	122.7	124.4	121.1	124.4	123.2	7.6	1.6	122.4	7.9	2.5	8
590	*X	125.5	130.2	132.9X	137.1X	131.4X	5.6	4.9	134.5X	4.5X	6.7X	10
658	H	108.9X	114.7	108.6X	108.1X	110.1X	9.1	3.1	111.9X	8.4	4.5	8

	WK-1	WK-2	WK-3	WK-4	GRAND AVERAGES	THIS MONTH	CUMULATIVE 10 WEEKS
AV MEAN	122.4	122.2	121.9	121.9	AV MEAN	122.1	122.3
AV SDR	7.8	8.2	8.2	8.7	AV SDR	8.2	8.3
SD LABS	3.6	4.5	3.7	3.2	SD LABS	3.8	3.9
NO. INCL	58	60	58	56	NO. INCL	58.0	59.7
NO. OMIT	5	2	5	7	AV SDWKS	2.3	2.5
NOT RCD	2	3	2	2	SD CUM MEAN		3.1

REPORT NO. 108

BURSTING STRENGTH (MULLEN), PSI

LAB		MEANS THIS MONTH				THIS MONTH			CUMULATIVE			
CODE	V	WK-1	WK-2	WK-3	WK-4	MEAN	SDR	SDWKS	MEAN	SDR	SDWKS	WKS
100	H	156.4	161.8	163.9		160.7	12.6	3.8	159.9	12.3	3.4	7
101	H	155.6	160.4	159.8		158.6	13.2	2.6	157.1	14.5	2.1	7
102	H	159.2	162.2	160.8		160.7	11.1	1.5	160.8	9.9	1.4	5
103	I	150.3	151.7	159.4		153.8	17.6	4.9	157.1	16.2	6.7	7
107	A	159.7	170.6	165.2		165.2	10.5	5.4	161.0	14.1	6.0	7
108	M	155.8	155.9	152.0		154.6	15.8	2.2	158.5	16.5	4.8	7
109	H		159.3	158.0		158.6	14.3	.9	158.2	13.5	1.0	3
110	M	137.6X	149.8	152.9		146.8X	14.5	8.1	151.6*	14.6	8.7X	5
111	M	152.1	154.9	161.7		156.2	16.7	5.0	156.1	15.9	4.3	7
112	H	143.8X	154.9	143.4X		147.4X	12.4	6.5	152.9	13.1	7.2	7
113	R	154.4	156.2	155.3		155.3	11.1	.9	157.1	11.7	2.0	7
114	A	155.8	151.6	167.5		158.3	10.2	8.2	156.9	13.3	5.1	7
115	R	156.4S	151.9	146.7		151.7	15.3	4.9	151.7	12.7	4.1	7
116	H	169.1	168.0	169.8		169.0X	16.5	.9	161.5	12.4	7.0	7
117	H	156.3	155.5	148.0		153.3	11.6	4.6	155.4	10.6	3.7	7
119	H	163.2		159.8		161.5	16.2	2.4	160.0	13.6	6.3	5
120	R	155.0	171.7	150.0		158.9	16.3	11.4	160.2	14.8	6.8	7
121	M	165.9	168.2	160.2		164.8	19.0	4.1	164.8	17.9	3.1	7
123	R	162.1	156.2	162.8		160.4	15.3	3.6	160.4	15.3	3.6	3
125	I	161.5	154.9	157.4		158.0	13.2	3.4	158.0	13.5	2.2	7
127	H	155.5	158.2	154.9		156.2	10.4	1.7	155.6	9.2	1.7	6
128	H	155.5	156.5	159.3		157.1	13.1	1.9	158.3	14.0	2.0	7
129	R	153.0	147.2	140.7X		147.0X	12.5	6.1	153.6	11.9	9.6X	6
130	H	158.9	157.6			158.3	17.4	.9	158.4	18.0	2.8	6
131	R	159.9	179.5X	161.8		167.1	18.1	10.8	167.3*	19.6	6.6	7
133	A	154.8	158.7	151.0		154.8	13.7	3.8	155.0	16.1	2.7	7
136	H	153.6	153.5	153.0		153.4	15.8	.3	153.4	13.8	3.2	7
137	H	163.9	161.5	154.9S		160.1	20.2	4.7	160.6	19.8X	3.0	7
138	H	169.3	163.0	150.6		161.0	17.5	9.5	163.1	16.5	6.0	7
139	R	154.9	159.7	157.0		157.2	16.4	2.4	159.7	15.5	3.0	7
140	H	157.4	153.3	154.8		155.2	11.3	2.1	154.1	10.9	3.0	7
141	H	157.8	158.3	158.3S		158.1	7.9	.3	157.8	9.5	.9	7
142	A	164.1	162.8	162.8		163.3	14.2	.8	163.0	14.0	3.1	7
143	H	158.0	157.2	157.1		157.4	15.4	.5	157.4	14.5	.6	6
145	H	159.3	154.5	160.3		158.1	12.6	3.1	156.7	13.4	3.2	6
147	H	155.3	164.3	156.4		158.7	13.6	4.9	158.2	15.6	3.1	7
149	H		162.5	159.2		160.8	15.1	2.3	164.3	16.4	3.8	6
159	H	157.6	159.1	152.3		156.4	15.4	3.6	156.3	15.0	2.8	7
161	*X	155.3	166.7	159.1		160.4	18.1	5.8	162.5	17.8	4.8	7
163	H	154.1	157.6	158.7		156.8	18.3	2.4	156.2	16.8	3.3	7
165	R	155.6	162.7	166.1		161.5	12.8	5.4	158.7	13.5	4.4	7
166	H	162.2	165.4	169.7		165.8	14.7	3.7	164.2	14.5	3.6	7
167	H	168.7	165.2	161.8		165.2	13.5	3.4	164.1	10.5	5.1	7
169	I	155.4	154.0	153.4		154.3	18.7	1.0	152.9	15.6	4.0	6
171	H	161.2	153.5	157.4		157.4	17.2	3.8	157.9	17.7	2.6	7
172	H	161.5	159.4	170.8X		163.9	18.3	6.0	163.4	17.5	5.1	7
173	H	164.0	160.4	158.5		161.0	11.0	2.8	161.5	12.8	2.8	7
174	H	161.0	159.5	150.6		157.0	15.3	5.6	161.7	14.0	7.2	7
175	H	164.2	158.9	152.3		158.5	15.9	6.0	162.5	15.7	6.3	7
176	H	160.5	166.4	161.6		162.8	13.7	3.1	161.4	14.2	4.2	7
177	H	168.3		157.8		163.0	10.0	7.4	156.6	11.2	6.3	6
184	H	159.0				159.0	18.3		160.5	15.2	4.0	5
186	I	155.3	157.0	161.1		157.8	14.4	3.0	156.4	14.0	2.5	7
188	I	154.7	150.3	153.2		152.7	11.8	2.2	154.5	12.1	2.1	7
274	H	158.1	158.7	157.8		158.2	12.1	.5	158.5	11.1	.4	7

REPORT NO. 108

BURSTING STRENGTH (MULLEN), PSI

LAB CODE	V	MEANS THIS MONTH WK-1	WK-2	WK-3	WK-4	THIS MONTH MEAN	SDR	SDWKS	CUMULATIVE MEAN	SDR	SDWKS	WKS
283	H	154.9	155.3	154.6		154.9	8.0	.4	156.8	9.9	2.8	7
287	A	157.9	167.8	154.7		160.2	16.2	6.8	158.3	15.8	5.4	7
327	M	150.4	156.3	158.7		155.1	15.0	4.3	155.1	15.0	4.3	3
350	H	152.0	151.1	153.0		152.0	18.8	1.0	154.4	17.5	4.2	7
553	M	158.6	154.3	157.7		156.9	13.0	2.3	157.4	17.1	1.4	7
562	A	166.1	163.2	157.2		162.2	14.3	4.5	164.5	13.4	4.6	7
568	I	163.6	164.3	152.9		160.3	13.0	6.4	154.8	13.3	7.1	7
569	A	155.3	164.3	161.5		160.4	12.6	4.6	159.5	13.1	4.7	5
590	*X	159.9	169.5S	173.1XS		167.5	5.1	6.8	163.7	4.6X	5.6	7
658	H	167.7	168.9	157.8		164.8	16.2	6.1	164.8	16.2	6.1	3

	WK-1	WK-2	WK-3	WK-4
AV MEAN	158.8	159.0	157.7	
AV SDR	14.4	14.4	14.1	
SD LABS	4.8	5.5	5.0	
NO. INCL	59	59	58	
NO. OMIT	4	3	5	
NOT RCD	2	3	2	

GRAND AVERAGES

	THIS MONTH	CUMULATIVE 7 WEEKS
AV MEAN	158.5	158.4
AV SDR	14.3	14.2
SD LABS	5.1	4.7
NO. INCL	58.7	59.4
AV SDWKS	3.9	3.8
SD CUM MEAN		3.4

REPORT NO. 108

BURSTING STRENGTH (MULLEN), PSI

LAB		MEANS THIS MONTH				THIS MONTH			CUMULATIVE			
CODE	V	WK-1	WK-2	WK-3	WK-4	MEAN	SDR	SDWKS	MEAN	SDR	SDWKS	WKS
100	H				160.5	160.5	16.0		160.5	16.0		1
101	H				158.2	158.2	14.2		158.2	14.2		1
102	H				160.9	160.9	13.6		160.9	13.6		1
103	I				158.3	158.3	12.9		158.3	12.9		1
107	A				154.7	154.7	10.2		154.7	10.2		1
108	M				152.8	152.8	23.2		152.8	23.2		1
109	H				162.1	162.1	17.0		162.1	17.0		1
110	M				144.1X	144.1X	15.1		144.1X	15.1		1
111	M				166.8	166.8	14.0		166.8	14.0		1
112	H				159.1	159.1	13.6		159.1	13.6		1
113	R				157.1	157.1	13.8		157.1	13.8		1
114	A				163.7	163.7	12.6		163.7	12.6		1
115	R				145.4	145.4	17.9		145.4*	17.9		1
116	H				172.1	172.1	18.9		172.1*	18.9		1
117	H				150.4	150.4	17.5		150.4	17.5		1
119	H				167.9	167.9	14.9		167.9	14.9		1
120	R				150.7	150.7	18.8		150.7	18.8		1
121	M				159.2	159.2	13.4		159.2	13.4		1
123	R				162.6	162.6	18.8		162.6	18.8		1
125	I				158.8	158.8	11.1		158.8	11.1		1
127	H				161.2	161.2	9.1		161.2	9.1		1
128	H				149.0	149.0	20.3		149.0	20.3		1
129	R				150.1S	150.1	3.1		150.1	3.1X		1
130	H				157.1	157.1	19.4		157.1	19.4		1
131	R				168.8	168.8	10.5		168.8	10.5		1
133	A				148.9	148.9	11.2		148.9	11.2		1
136	H				157.7	157.7	15.4		157.7	15.4		1
137	H				160.2	160.2	19.1		160.2	19.1		1
138	H				158.9	158.9	13.7		158.9	13.7		1
139	R				157.2	157.2	15.4		157.2	15.4		1
140	H				150.5	150.5	8.0		150.5	8.0		1
141	H				157.4	157.4	10.3		157.4	10.3		1
142	A				161.9	161.9	15.2		161.9	15.2		1
143	H				159.7	159.7	17.5		159.7	17.5		1
147	H				163.1	163.1	16.5		163.1	16.5		1
149	H				159.1	159.1	18.7		159.1	18.7		1
159	H				162.3	162.3	19.1		162.3	19.1		1
161	*X				163.4	163.4	18.0		163.4	18.0		1
163	H				157.4	157.4	11.2		157.4	11.2		1
166	H				162.0	162.0	18.4		162.0	18.4		1
167	H				169.3	169.3	14.0		169.3	14.0		1
169	I				158.0	158.0	15.8		158.0	15.8		1
171	H				158.7	158.7	13.3		158.7	13.3		1
172	H				163.8	163.8	18.2		163.8	18.2		1
173	H				160.8	160.8	10.3		160.8	10.3		1
174	H				155.1	155.1	18.7		155.1	18.7		1
175	H				163.3	163.3	14.8		163.3	14.8		1
176	H				164.9	164.9	17.6		164.9	17.6		1
177	H				165.6	165.6	14.1		165.6	14.1		1
184	H				161.4	161.4	21.0		161.4	21.0		1
186	I				159.2	159.2	18.0		159.2	18.0		1
188	I				153.3	153.3	10.4		153.3	10.4		1
274	H				158.3	158.3	10.3		158.3	10.3		1
283	H				155.3	155.3	10.2		155.3	10.2		1
287	A				154.3	154.3	14.4		154.3	14.4		1

REPORT NO. 108

BURSTING STRENGTH (MULLEN), PSI

LAB CODE	V	MEANS THIS MONTH WK-1	WK-2	WK-3	WK-4	THIS MONTH MEAN	SDR	SDWKS	CUMULATIVE MEAN	SDR	SDWKS	WKS
327	M				153.4	153.4	15.5		153.4	15.5		1
350	H				153.4	153.4	16.2		153.4	16.2		1
553	M				162.7	162.7	18.7		162.7	18.7		1
562	A				152.0	152.0	16.9		152.0	16.9		1
568	I				164.7	164.7	14.7		164.7	14.7		1
569	A				167.9	167.9	13.5		167.9	13.5		1
590	*X				166.4S	166.4	4.5		166.4	4.5X		1
658	H				150.2	150.2	14.9		150.2	14.9		1

GRAND AVERAGES

	WK-1	WK-2	WK-3	WK-4		THIS MONTH	CUMULATIVE 1 WEEKS
AV MEAN				158.8	AV MEAN	158.8	158.8
AV SDR				15.1	AV SDR	15.1	15.1
SD LABS				5.7	SD LABS	5.7	5.7
NO. INCL				60	NO. INCL	60.0	60.0
NO. OMIT				3	AV SDWKS	.0	.0
NOT RCD				0	SD CUM MEAN		5.7

REPORT NO. 108

FLAT CRUSH STRENGTH (CONCORA), LB

LAB		MEANS THIS MONTH				THIS MONTH			CUMULATIVE			
CODE V	WK-1	WK-2	WK-3	WK-4	MEAN	SDR	SDWKS	MEAN	SDR	SDWKS	WKS
100	64.3	64.3	64.4	64.1	64.3	3.1	.1	63.7	2.9	.9	16
102	62.9	63.4	63.1	63.0	63.1	2.7	.2	63.2	2.8	.6	13
106	63.0	62.6	65.3	64.0	63.8	3.2	1.2	64.8	3.5	1.8	16
110	64.6		63.3	63.6	63.8	3.1	.7	64.2	3.1	1.4	13
113	63.6	63.7	62.6	63.2	63.3	2.8	.5	63.2	2.8	.6	16
114	59.9	60.0	59.6	59.8	59.8	2.3	.2	60.8	2.6	1.1	16
115	62.4	65.8	64.7	65.9	64.7	2.5	1.6	63.6	2.5	1.9	16
116	60.4	60.3	60.9	60.4	60.5	1.3	.3	60.8	1.5X	.4	16
119	63.8S		63.5	62.1	63.2	4.0	.9	62.6	3.2	1.8	14
120	63.5	63.2	62.8	65.2	63.7	2.9	1.1	64.7	3.0	1.2	15
125	66.4	69.1X	68.0	68.2	67.9	2.9	1.1	69.0X	3.1	1.6	16
128	61.9	62.2	62.8	61.6	62.2	2.1	.5	62.2	2.3	.7	16
136	68.4	68.0	65.9	65.6S	67.0	3.5	1.4	67.1*	3.6	1.2	16
138	63.2	66.5	66.7	65.9	65.6	3.1	1.6	66.6	3.0	1.6	16
140	64.4	61.6	61.9	62.3	62.6	3.2	1.3	62.6	3.0	1.1	16
143	63.0	62.8	62.5	62.9	62.8	2.3	.2	62.6	2.2	.7	15
161	66.1	65.9	66.2	68.1S	66.6	3.4	1.0	65.9	3.6	4.2X	16
164	58.8	59.5	59.4	58.0X	59.0	3.1	.7	62.1	2.6	2.6X	16
167	66.1	66.1	65.8	66.2	66.1	3.2	.2	65.5	2.9	2.0	16
177	64.6		65.4	64.3	64.8	3.0	.6	64.7	2.9	.8	13
188	64.7	63.5	62.7	65.1	64.0	2.4	1.1	63.4	2.3	1.4	15
237	62.8	62.8	62.5	62.2	62.6	3.3	.3	63.3	3.4	1.2	16
269	63.0	61.6	62.1	62.8	62.4	3.2	.6	61.8	2.8	.7	16
274	63.5	63.3	63.4	63.3	63.4	2.1	.1	63.6	2.1	.2	16
283	63.8	63.8	64.2	64.4	64.1	2.0	.3	63.8	2.1	.4	16
284	69.0S	62.4	61.7	63.4	64.2	3.8	3.3	64.5	3.0	2.3	16
287	63.7	64.9	67.7	67.3	65.9	3.3	1.9	65.3	3.1	1.3	16
289	58.4	62.1	57.6	60.7	59.7	2.8	2.0	56.5X	3.1	4.6X	14
292	64.1	62.8	64.8	64.3	64.0	2.4	.8	62.8	2.8	2.6X	16
327	64.1	64.4	62.9	61.9	63.3	2.4	1.2	63.3	2.6	1.2	8
350	65.8	66.8	67.1	65.2	66.3	2.5	.9	66.2	2.4	.9	16
351	58.3	61.2	61.0	63.0	60.9	2.1	1.9	61.6	1.9	1.5	16
353	64.4	64.6	61.9	65.2	64.1	3.1	1.4	63.1	3.0	1.6	16
355	62.4	61.5	63.2	61.4	62.1	2.4	.8	62.3	2.8	.8	16
357	62.7	62.4	62.6	62.5	62.6	2.7	.1	62.3	2.4	.8	16
363	61.9	61.7	60.6	60.3	61.1	2.5	.8	61.4	2.5	1.0	16
365	58.1	55.6X	58.2	60.3	58.1X	2.5	1.9	59.6*	2.6	1.8	16
367	66.8		68.2	68.1	67.7	2.8	.8	66.5	3.2	1.6	13
369	61.8	61.7	61.2	62.2	61.7	2.7	.4	62.7	2.8	1.0	16
377	65.5	65.3	64.3	62.9S	64.5	3.3	1.2	64.6	2.9	.9	15
379	63.7	62.8	62.1	63.6	63.1	3.1	.8	63.2	3.0	.7	16
381	63.1	63.2	62.8	62.9	63.0	2.2	.2	62.6	2.6	.9	15
383	62.8	63.2	64.4	63.5	63.5	3.2	.7	63.8	3.1	.9	11
385	61.9	59.8	60.0	60.3	60.5	2.9	.9	61.5	3.2	1.9	16
387	64.8	63.7	64.3	65.0	64.4	3.1	.6	63.0	3.3	1.4	15
391	61.8	59.9	57.7	57.0X	59.1	3.2	2.2	59.3*	3.0	1.9	12
393	65.0	62.6	64.9	64.5	64.3	2.1	1.1	66.3	2.4	1.9	16
395	66.0	65.9	63.9	64.7	65.1	3.4	1.0	65.9	3.1	1.7	16
397	62.7	63.0	63.0	63.0	63.0	2.5	.1	63.9	2.5	1.5	16
399	60.2	61.6	62.6	62.7	61.8	3.0	1.2	61.7	2.7	1.1	16
553	61.2	61.3	62.5	62.1	61.8	2.2	.6	62.0	2.5	.6	15
555	65.0	64.8	64.1	63.4	64.3	1.4	.7	64.4	2.1	1.4	16
562	66.8	64.6	64.0	63.5	64.8	3.2	1.5	64.0	3.3	1.0	16
568	64.5	68.2	65.8	65.7	66.1	3.2	1.5	64.5	3.0	1.8	16
578	58.3	62.2	60.8	67.6	62.2	3.1	3.9	64.0	3.4	3.7X	15

REPORT NO. 108

FLAT CRUSH STRENGTH (CONCORA), LB

LAB	MEANS THIS MONTH				THIS MONTH			CUMULATIVE			
CODE V	WK-1	WK-2	WK-3	WK-4	MEAN	SDR	SDWKS	MEAN	SDR	SDWKS	WKS
579	67.2	67.6	66.0	67.6	67.1	3.3	.7	67.3*	3.5	1.2	16
609	61.6	63.9	60.0	62.2	62.0	3.0	1.6	61.6	3.0	2.0	15

GRAND AVERAGES

	WK-1	WK-2	WK-3	WK-4
AV MEAN	63.4	63.4	63.2	63.8
AV SDR	2.8	2.8	2.8	2.6
SD LABS	2.4	2.1	2.4	2.1
NO.INCL	57	51	57	55
NO.OMIT	0	2	0	2
NOT RCD	0	4	0	0
SD SHTS	1.6	1.8	1.6	1.7

	THIS MONTH	CUMULATIVE 16 WEEKS
AV MEAN	63.4	63.5
AV SDR	2.7	2.8
SD LABS	2.3	2.2
NO.INCL	55.0	54.9
AV SDWKS	1.0	1.2
SD CUM MEAN		1.8

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15. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

Collaborative Reference Programs provide participating laboratories with the means for checking periodically the level and uniformity of their testing in comparison with that of other participating laboratories. An important by-product of the programs is the provision of realistic pictures of the state of the testing art. This is one of the periodic reports showing averages for each participant, within and between laboratory variability, and other information for participants and standards committees.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Collaborative reference program; Containerboard; Laboratory evaluation; Precision, Reference samples, Testing calibration

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