

**CONTINUOUS EVALUATION OF  
CORRUGATING MEDIUM**

**Project 1108-17**

**Report 89**

**A Progress Report**

**to**

**FOURDRINIER KRAFT BOARD INSTITUTE, INC.**

**July 1, 1961**

CODE LETTERS FOR REPORT 89, CONTINUOUS EVALUATION OF  
CORRUGATING MEDIUM, PROJECT 1108-17

Company - Mill	Machine No.	Code Letter
The Chesapeake Corporation - West Point	1	--
Continental Can Company, Inc. - Hopewell	1	B
- Hodge	1	P
Crown Zellerbach Corporation - Baltimore	1	T
- Baltimore	2	M
- Bogalusa	4	N
- Lebanon	2	F
International Paper Company - Bastrop	1	K
- Bastrop	2	--
- Georgetown	1	U
- Georgetown	2	--
The Mead Corporation - Harriman	1	D
- Knoxville	1	J
- Lynchburg	2	A
- Sylva	1	S
St. Regis Container Corporation Mill Division - Coshocton	1	O
Weyerhaeuser Company, North Carolina Div. - Plymouth	3	E
Olin Mathieson Chemical Corporation - Monroe	1	--
- Monroe	2	--
Owens-Illinois Glass Company - Tomahawk	1	L
- Tomahawk	2	C
- Tomahawk	3	I
- Big Island	1	--
- Big Island	2	--
- Big Island	3	G
St. Joe Paper Company - Port St. Joe	1	Q
Union Bag-Camp Paper Corporation - Savannah	2	H
West Virginia Pulp and Paper Company - Covington	6	R
- Covington	7	--
- Charleston	--	--

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

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# THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

## CONTINUOUS EVALUATION OF CORRUGATING MEDIUM

### INTRODUCTION

During the month of June, one hundred and six rolls of corrugating medium were selected from the production of twenty-one machines and submitted to The Institute of Paper Chemistry for evaluation. A tabulation of the number of rolls submitted from each machine is given in Table I.

Each sample of corrugating medium was evaluated for basis weight, caliper, Concora flat crush, H. and D. flat crush on single-faced board, and runnability. Runnability was measured by corrugating each roll under standardized conditions on the Institute's corrugator into A-flute board at 600 feet per minute with minimum tension. If unsatisfactory runnability occurred at this speed, the corrugator was slowed down in increments of 25 f.p.m. until satisfactory runnability was obtained--i.e., no ruptured flutes. If the medium fabricated satisfactorily at 600 f.p.m. with minimum tension, further runs were made at higher tensions to determine when cracking occurred. The higher tensions used were 0.5 lb. per inch, 1.0 lb. per inch, and 1.5 lb. per inch.

Flat crush was determined on the single-faced board obtained at a speed of 600 f.p.m. with minimum tension. The flat crush results, in addition to supplying information about quality, will provide data which may be useful in studying the relationship between Concora flat crush and combined board flat crush for each participant's medium.

TABLE I

NUMBER OF ROLLS OF CORRUGATING MEDIUM SUBMITTED  
FOR EVALUATION FROM EACH MACHINE

Machine Code	Number of Rolls
A	4
B	5
C	6
D	6
E	6
F	6
G	6
H	8
I	6
J	4
K	6
L	6
M	6
N	5
O	4
P	1
Q	4
R	4
S	2
T	6
U	<u>5</u>
Total	106

TABLE II  
SUMMARY OF CURRENT MACHINE AVERAGES  
June, 1961

Mill Code	Basis Weight, lb.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.
A	26.9	10.0	34.9	32.9
B	27.8	10.8	39.9	38.4
C	26.4	10.0	36.9	34.6
D	28.0	10.9	36.5	33.6
E	26.5	9.7	37.1	35.5
F	26.6	9.6	36.2	34.2
G	27.0	10.6	36.0	33.8
H	26.6	9.2	37.4	34.2
I	27.6	10.6	37.8	35.7
J	27.0	11.5	35.1	34.1
K	27.0	10.7	38.1	35.3
L	27.0	10.0	36.9	35.5
M	29.0	10.0	38.0	36.4
N	26.1	9.3	33.6	32.1
O	28.9	10.7	37.0	34.7
P	25.9	8.8	36.0	36.9
Q	29.0	9.4	37.1	32.6
R	27.1	10.2	35.1	31.6
S	27.4	9.9	38.1	37.5
T	27.8	9.6	32.4	29.0
U	27.1	10.2	37.2	35.1
Current F.K.I. Average	27.3	10.1	36.5	34.5
Cumulative F.K.I. Average	27.4	10.3	36.4	33.4
F.K.I. Index, %	99.7	97.8	100.5	103.1

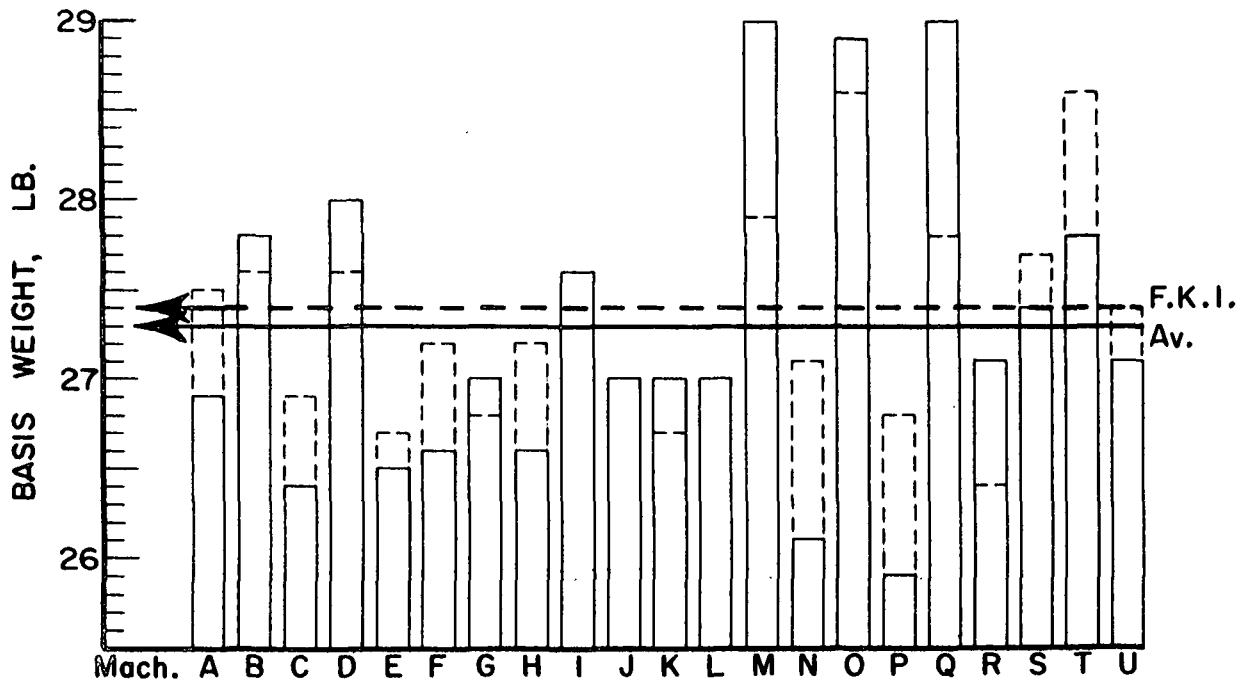


Figure 1. Comparison of Basis Weight Results for June, 1961

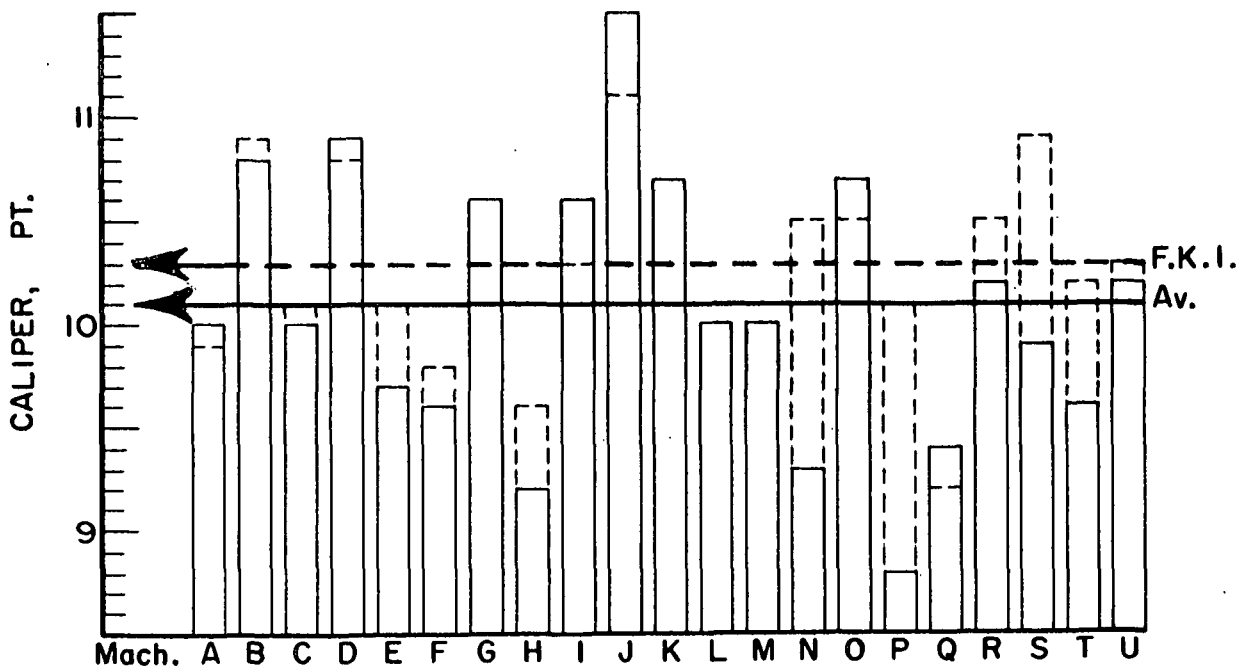


Figure 2. Comparison of Caliper Results for June, 1961

————— Current machine average  
 - - - - - Cumulative machine average



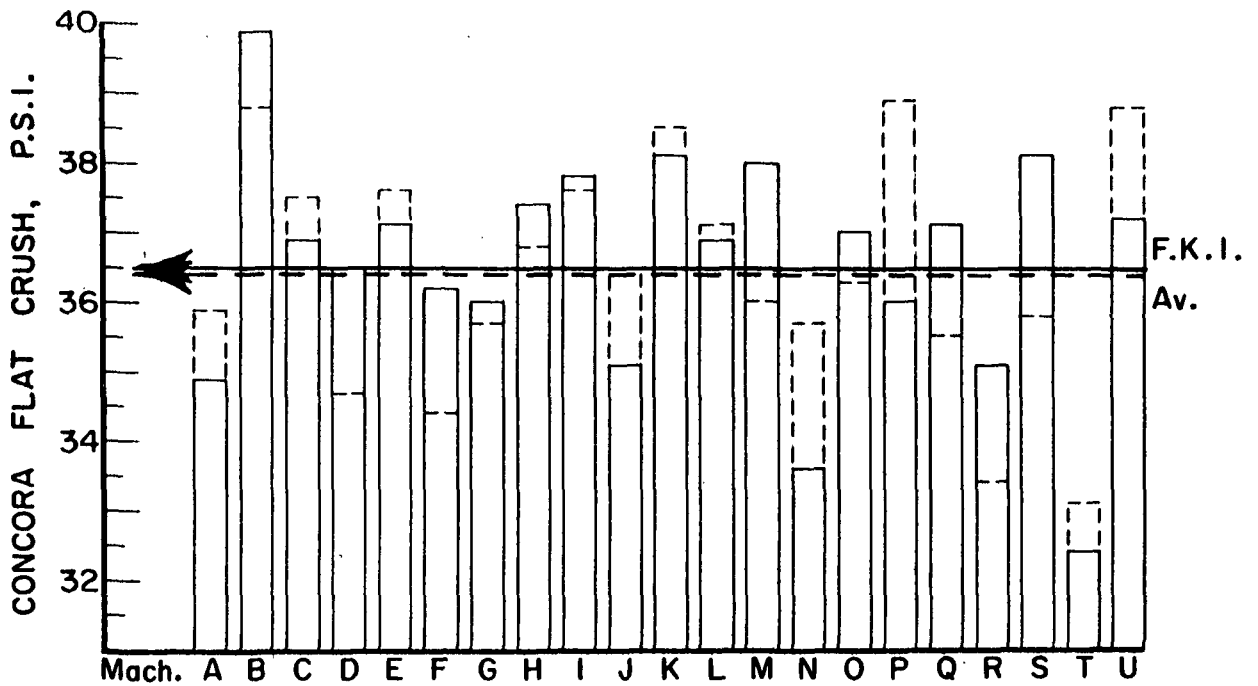


Figure 3. Comparison of Concora Flat Crush Results for June, 1961

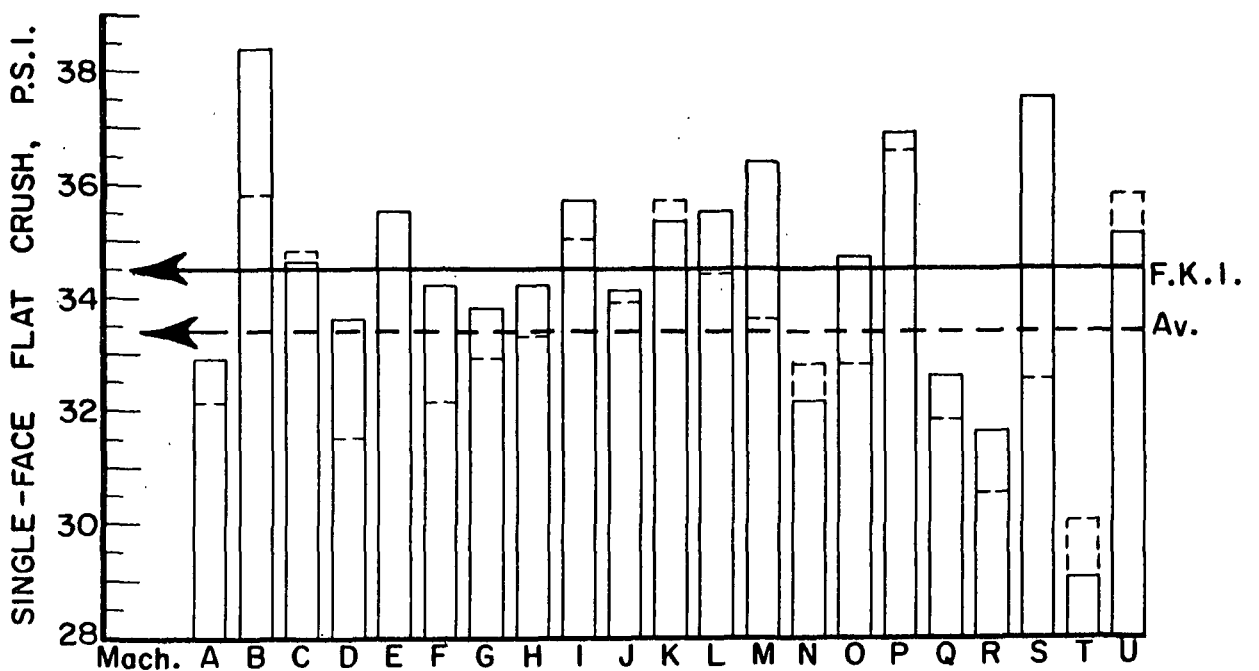


Figure 4. Comparison of Single-Face Flat Crush Results for June, 1961

————— Current machine average  
 - - - - - Cumulative machine average

The average test results obtained on the rolls of corrugating medium submitted by each participant (current machine average) are shown in Table II and graphically presented in Fig. 1 to 4. In addition to a comparison of the test data obtained for the various machines, Table II also presents the current F.K.I. averages, cumulative F.K.I. averages, and the F.K.I. indexes. The current F.K.I. average is the average of test results for all machines participating in the study during the current month. The cumulative F.K.I. average is based on the results for the previous twelve-month period excluding the result for the current period. The F.K.I. index is obtained as follows:

$$\frac{\text{current F.K.I. average}}{\text{cumulative F.K.I. average}} \times 100 = \text{F.K.I. index (\%)}$$

The F.K.I. index provides a ready means of comparing the current quality with previous results. An index greater than 100% indicates that current quality is higher than the average result for the previous twelve periods; an index below 100% indicates that current quality is lower than the average result for the previous twelve periods.

The test results obtained on the sample lots submitted from the production of each of the machines are shown in Tables III through XXIII for Machines A through U, respectively. The maximum, minimum, and average test results obtained on each sample lot are shown for all tests except basis weight for which only the average is shown; in addition, the over-all average result for all sample lots submitted from a given machine is shown for each test. The latter over-all averages are reported as "current machine averages." A cumulative machine average is also shown and is calculated by averaging the current machine averages for the previous twelve periods (excluding the current period). Also shown for each machine in Tables III to

XXIII are the machine factor and machine index which are defined as follows:

$$\frac{\text{current machine average}}{\text{cumulative machine average}} \times 100 = \text{machine factor (\%)}$$

$$\frac{\text{current machine average}}{\text{cumulative F.K.I. average}} \times 100 = \text{machine index (\%)}$$

The machine factor and machine index provide a means for comparing the current machine average with either the previous results for that particular machine or with the cumulative results for all machines--i.e., the cumulative F.K.I. average.

TABLE III

SUMMARY OF TEST RESULTS FOR MACHINE A  
June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runrability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
A-1	5-24-61	5-29-61	525	26.7	9.9	9.2	9.6	37.2	31.8	35.2	35.0	31.6	33.8	1-1/2
A-2	5-24-61	5-29-61	526	26.8	10.0	9.0	9.6	35.4	33.0	34.4	35.0	32.0	33.6	1-1/2
A-3	6-13-61	6-19-61	533	27.2	10.9	10.0	10.6	36.0	34.8	35.4	32.8	29.8	31.5	1-1/2
A-4	6-13-61	6-19-61	534	26.6	10.7	9.6	10.2	37.2	33.0	34.7	34.0	30.6	32.7	1-1/2
Current Machine Average				26.9	10.0			34.9			32.9			
Cumulative Machine Average				27.5	9.9			35.9			32.1			
Machine Factor, %				97.6	100.7			97.2			102.6			
Machine Index, %				98.2	97.0			96.0			98.4			

TABLE IV

SUMMARY OF TEST RESULTS FOR MACHINE B  
June, 1961

B-1	5-16-61	5-31-61	316	26.8	10.4	10.0	10.1	43.2	35.4	39.7	39.4	36.8	38.0	1-1/2
B-2	5-24-61	6-1-61	317	27.0	10.8	10.0	10.4	41.4	39.0	39.6	40.4	38.6	39.9	1-1/2
B-3	6-2-61	6-13-61	318	27.9	10.8	10.0	10.4	43.2	39.6	41.6	42.4	39.0	40.4	1-1/2
B-4	6-8-61	6-20-61	319	28.7	11.8	11.5	11.7	40.8	37.2	39.1	37.6	35.2	36.7	1
B-5	6-12-61	6-20-61	320	28.4	11.8	10.9	11.2	40.8	37.8	39.5	37.4	36.4	36.8	1
Current Machine Average				27.8	10.8			39.9			38.4			
Cumulative Machine Average				27.6	10.9			38.8			35.8			
Machine Factor, %				100.4	98.9			102.9			107.0			
Machine Index, %				101.5	104.6			109.8			114.7			

TABLE V  
 SUMMARY OF TEST RESULTS FOR MACHINE C  
 June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runnability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
C-1	5-17-61	5-26-61	--	26.4	11.0	9.4	10.0	37.8	34.2	35.9	36.2	35.8	35.9	1
C-2	5-18-61	5-26-61	--	25.2	10.1	9.2	9.7	39.6	34.2	36.7	34.8	34.4	34.6	1
C-3	5-24-61	6-22-61	--	26.9	10.3	10.0	10.1	39.0	33.6	35.9	36.0	33.6	34.8	1
C-4	6- 8-61	6-22-61	--	26.6	10.5	9.8	10.1	39.0	36.6	37.8	35.4	33.8	34.5	1/2
C-5	6- 9-61	6-22-61	--	26.3	10.3	9.9	10.1	38.4	35.4	37.0	36.0	32.6	34.0	1
C-6	6-21-61	6-26-61	--	26.9	10.2	9.8	10.0	40.2	36.0	38.3	34.6	33.2	33.9	1-1/2
Current Machine Average				26.4			10.0			36.9			34.6	
Cumulative Machine Average				26.9			10.1			37.5			34.8	
Machine Factor, %				98.0			98.5			98.4			99.3	
Machine Index, %				96.4			96.9			101.5			103.5	

TABLE VI  
 SUMMARY OF TEST RESULTS FOR MACHINE D  
 June, 1961

D-1	5-18-61	5-26-61	521	28.0	12.1	11.2	11.6	39.0	32.4	34.4	30.2	27.6	29.4	1
D-2	5-18-61	5-26-61	522	28.5	12.0	11.1	11.5	37.2	33.6	35.0	34.0	31.0	32.2	1
D-3	5-30-61	6-12-61	529	28.3	10.2	10.0	10.1	40.2	36.6	38.5	38.4	34.6	36.6	1/2
D-4	5-30-61	6-12-61	530	28.2	10.3	10.0	10.2	40.2	37.2	39.0	37.6	35.6	36.0	1
D-5	6-13-61	6-21-61	537	27.6	11.3	10.9	11.1	38.4	33.6	36.2	34.0	31.2	33.1	1
D-6	6-13-61	6-21-61	538	27.6	11.1	10.8	11.0	37.2	34.2	35.9	35.2	32.6	34.2	1
Current Machine Average				28.0			10.9			36.5			33.6	
Cumulative Machine Average				27.6			10.8			34.7			31.5	
Machine Factor, %				101.7			101.0			105.1			106.5	
Machine Index, %				102.5			105.9			100.4			100.4	

TABLE VII  
SUMMARY OF TEST RESULTS FOR MACHINE E  
June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runnability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
E-1	5- 2-61	6- 5-61	37	26.0	9.8	9.1	9.4	37.2	34.8	35.8	35.4	33.0	34.0	1
E-2	5-11-61	6- 5-61	312	26.3	9.8	9.0	9.3	37.8	34.8	36.4	36.2	35.4	35.8	1-1/2
E-3	5-15-61	6- 5-61	455	27.3	10.8	10.2	10.5	41.4	34.2	36.6	35.6	33.2	34.3	1/2
E-4	5-19-61	6- 5-61	578	25.7	9.8	9.0	9.4	41.4	36.6	38.2	36.4	33.0	34.6	1/2
E-5	5-23-61	6-21-61	701	27.0	10.0	9.2	9.7	40.2	34.8	37.3	39.2	36.6	37.6	1/2
E-6	5-25-61	6-21-61	768	26.7	10.1	9.7	9.9	41.4	36.0	38.2	38.0	35.6	36.7	1/2
Current Machine Average				26.5	9.7			37.1			35.5			
Cumulative Machine Average				26.7	10.1			37.6			35.5			
Machine Factor, %				99.4	95.8			98.5			100.0			
Machine Index, %				96.9	94.0			101.9			106.2			

TABLE VIII  
SUMMARY OF TEST RESULTS FOR MACHINE F  
June, 1961

F-1	5-15-61	5-29-61	E-1	26.8	10.2	9.3	9.8	39.6	34.2	37.6	38.0	33.2	35.9	1-1/2
F-2	5-15-61	5-29-61	E-2	26.6	9.7	9.2	9.4	37.8	34.8	36.8	34.6	32.2	33.3	1-1/2
F-3	5-15-61	5-29-61	E-3	26.5	10.2	9.3	9.8	38.4	34.2	36.1	36.6	34.0	34.9	1-1/2
F-4	5-15-61	5-29-61	E-4	26.5	9.9	9.2	9.6	36.6	32.4	34.3	36.2	32.2	33.6	1-1/2
F-5	5-15-61	5-29-61	E-5	26.8	9.7	9.1	9.3	37.8	33.6	35.8	36.6	34.2	35.3	1-1/2
F-6	5-15-61	5-29-61	E-6	26.5	10.0	9.0	9.6	40.2	34.8	36.8	32.6	31.6	32.0	1-1/2
Current Machine Average				26.6	9.6			36.2			34.2			
Cumulative Machine Average				27.2	9.8			34.4			32.1			
Machine Factor, %				98.0	97.8			105.2			106.3			
Machine Index, %				97.3	93.0			99.7			102.2			

TABLE IX

SUMMARY OF TEST RESULTS FOR MACHINE G  
June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runnability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
G-1	4- 2-61	4-24-61	275	27.3	11.3	10.8	11.0	39.0	36.0	37.7	36.0	34.4	35.4	1
G-2	4- 8-61	5- 5-61	1147	27.2	11.3	10.7	11.0	34.8	32.4	33.7	34.4	33.2	33.7	1/2
G-3	4-11-61	5- 5-61	1713	26.9	11.0	10.5	10.7	37.8	36.0	37.3	35.6	34.2	35.0	1
G-4	4-12-61	5- 5-61	2022	26.9	10.7	10.0	10.2	39.6	36.6	37.7	33.4	31.4	32.1	1
G-5	4-13-61	5-23-61	2134	26.7	10.8	10.0	10.4	34.8	33.0	33.8	34.4	32.8	33.7	1-1/2
G-6	4-21-61	5-23-61	3478	26.8	10.8	10.0	10.3	37.8	34.2	35.8	34.0	31.2	32.9	1
Current Machine Average				27.0	10.6			36.0			33.8			
Cumulative Machine Average				26.8	10.6			35.7			32.9			
Machine Factor, %				100.8	100.0			100.8			102.8			
Machine Index, %				98.7	102.9			99.0			101.1			

TABLE X

SUMMARY OF TEST RESULTS FOR MACHINE H  
June, 1961

H-1	5-17-61	5-26-61	441	26.8	9.8	9.1	9.5	43.2	35.4	39.2	38.6	34.6	36.4	Note a
H-2	5-20-61	5-26-61	442	26.8	9.6	9.0	9.3	42.0	34.2	38.5	36.2	34.6	35.5	1-1/2
H-3	5-23-61	6- 5-61	443	25.4	9.2	8.7	8.9	35.4	32.4	34.4	33.4	30.2	31.3	1-1/2
H-4	5-26-61	6- 6-61	444	26.4	9.2	8.3	8.9	36.6	33.0	35.4	34.8	32.6	33.2	1
H-5	6- 1-61	6-12-61	445	26.7	9.0	8.8	8.9	40.2	36.6	38.3	37.4	32.8	34.8	1/2
H-6	6- 3-61	6-12-61	446	25.7	9.7	9.0	9.3	40.2	34.8	37.0	34.8	32.8	33.8	Min.
H-7	6- 5-61	6-13-61	447	27.1	9.6	8.8	9.2	40.2	34.2	37.3	35.6	33.0	34.3	Min.
H-8	6- 9-61	6-15-61	448	28.0	9.7	9.1	9.4	40.8	37.2	38.8	35.6	33.4	34.5	1-1/2
Current Machine Average				26.6	9.2			37.4			34.2			
Cumulative Machine Average				27.2	9.6			36.8			33.3			
Machine Factor, %				97.7	95.9			101.6			102.9			
Machine Index, %				97.3	88.9			102.7			102.4			

<sup>a</sup> Maximum speed at which this roll could be corrugated with minimum tension was 575 f.p.m.

TABLE XI

SUMMARY OF TEST RESULTS FOR MACHINE I  
June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runnability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
I-1	5-16-61	5-26-61	--	27.4	10.7	10.1	10.3	40.2	33.0	36.7	36.6	33.0	34.4	1
I-2	5-17-61	5-26-61	--	27.5	11.0	10.2	10.7	37.8	32.4	35.9	35.0	33.2	34.6	1/2
I-3	5-23-61	5-26-61	--	28.2	11.2	10.2	10.4	43.8	37.8	40.2	41.0	36.8	38.6	1/2
I-4	5-25-61	6-22-61	--	27.3	10.9	10.3	10.7	39.0	36.0	37.9	39.4	35.0	36.4	1/2
I-5	5-26-61	6-22-61	--	28.2	11.7	10.9	11.1	40.2	35.4	37.4	38.8	34.0	36.0	Min.
I-6	6-15-61	6-22-61	--	27.1	10.4	9.9	10.1	40.2	36.6	38.5	35.2	32.2	34.4	Min.
Current Machine Average				27.6	10.6			37.8			35.7			
Cumulative Machine Average				27.6	10.3			37.6			35.0			
Machine Factor, %				100.0	102.0			100.6			100.5			
Machine Index, %				101.0	102.4			103.9			106.8			

TABLE XII

SUMMARY OF TEST RESULTS FOR MACHINE J  
June, 1961

J-1	5-31-61	6- 6-61	531	26.7	12.3	10.8	11.7	39.0	33.0	36.2	36.6	35.4	36.1	1-1/2
J-2	5-31-61	6- 6-61	532	26.7	11.9	10.9	11.4	39.6	34.2	36.7	36.6	35.2	36.0	1-1/2
J-3	6-14-61	6-21-61	539	27.2	11.8	10.9	11.4	36.6	31.8	34.0	33.0	31.8	32.2	1-1/2
J-4	6-14-61	6-21-61	540	27.4	12.0	10.8	11.4	34.2	33.0	33.6	32.4	31.6	32.2	1-1/2
Current Machine Average				27.0	11.5			35.1			34.1			
Cumulative Machine Average				27.0	11.1			36.5			33.9			
Machine Factor, %				100.0	103.0			96.3			100.4			
Machine Index, %				98.7	111.2			96.6			102.0			



TABLE XIII

SUMMARY OF TEST RESULTS FOR MACHINE K  
 June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runnability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
K-1	5-22-61	5-29-61	627	26.9	11.6	9.3	10.8	40.2	34.2	37.2	35.4	31.8	33.5	1-1/2
K-2	5-30-61	6- 5-61	628	27.1	11.2	10.4	10.8	43.2	37.2	39.1	38.0	35.0	36.1	1-1/2
K-3	6- 5-61	6-12-61	629	26.5	11.5	10.2	10.9	39.6	37.2	38.5	37.6	34.6	36.1	1-1/2
K-4	6- 9-61	6-15-61	630	26.8	10.9	10.2	10.5	41.4	36.0	38.2	37.6	33.8	35.4	1-1/2
K-5	6-12-61	6-15-61	631	26.5	10.7	10.0	10.3	37.2	35.4	36.4	37.0	33.8	35.2	1-1/2
K-6	6-16-61	6-22-61	632	28.0	11.5	10.3	11.0	40.8	37.8	39.5	37.2	34.4	35.4	1-1/2
Current Machine Average				27.0	10.7			38.1			35.3			
Cumulative Machine Average				26.7	10.7			38.5			35.7			
Machine Factor, %				100.9	100.0			99.0			98.7			
Machine Index, %				98.6	103.9			104.9			105.5			

TABLE XIV

SUMMARY OF TEST RESULTS FOR MACHINE L  
 June, 1961

L-1	5-11-61	5-18-61	--	27.5	10.9	10.0	10.4	37.2	34.8	36.0	36.2	33.2	34.8	1
L-2	5-16-61	5-26-61	--	26.0	10.0	9.6	9.8	36.6	34.2	35.3	35.4	32.8	34.2	1-1/2
L-3	5-17-61	5-26-61	--	26.7	10.5	10.0	10.1	38.4	34.8	36.1	37.0	33.6	35.3	1-1/2
L-4	5-23-61	5-26-61	--	27.1	10.1	9.8	10.0	38.4	34.8	36.2	36.6	34.0	35.6	1
L-5	5-31-61	6-22-61	--	27.0	10.0	9.4	9.9	41.4	37.2	39.4	38.4	35.0	36.6	1
L-6	6- 6-61	6-22-61	--	27.9	10.3	9.9	10.1	39.0	36.0	38.3	37.4	34.6	36.3	1-1/2
Current Machine Average				27.0	10.0			36.9			35.5			
Cumulative Machine Average				27.0	10.0			37.1			34.4			
Machine Factor, %				100.0	100.0			99.3			102.9			
Machine Index, %				98.8	97.5			101.4			106.0			

TABLE XV  
SUMMARY OF TEST RESULTS FOR MACHINE M  
June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runnability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
M-1	6-16-61	6-22-61	83	28.4	10.2	9.2	9.8	40.8	35.4	37.8	40.0	37.0	38.0	1-1/2
M-2	6-16-61	6-22-61	84	30.9	10.8	10.0	10.3	43.2	34.2	38.9	38.6	35.0	35.9	1-1/2
M-3	6-16-61	6-22-61	85	28.7	9.9	9.1	9.6	40.2	31.8	37.3	38.2	34.8	36.8	1-1/2
M-4	6-17-61	6-22-61	86	29.0	10.6	9.6	10.1	40.8	36.0	37.8	37.0	31.6	33.9	1-1/2
M-5	6-17-61	6-22-61	87	29.0	10.3	9.3	10.0	40.2	36.0	38.5	38.2	35.2	37.0	1-1/2
M-6	6-17-61	6-22-61	88	27.9	10.8	9.9	10.2	39.0	36.0	37.4	37.2	35.6	36.5	1-1/2
Current Machine Average				29.0			10.0			38.0			36.4	
Cumulative Machine Average				27.9			10.0			36.0			33.6	
Machine Factor, %				103.7			100.0			105.5			108.2	
Machine Index, %				106.0			97.1			104.4			108.7	

TABLE XVI  
SUMMARY OF TEST RESULTS FOR MACHINE N  
June, 1961

N-1	5-13-61	5-25-61	23	26.6	9.8	9.0	9.4	34.2	31.2	32.5	33.4	30.8	31.7	1-1/2
N-2	5-23-61	6-12-61	24	25.5	10.0	9.0	9.8	33.0	30.0	31.7	31.6	27.6	29.2	1
N-3	5-25-61	6-12-61	25	27.4	9.2	8.6	9.0	34.2	33.0	33.5	34.2	32.6	33.0	1/2
N-4	5-31-61	6-13-61	26	25.8	10.0	9.2	9.7	39.6	32.4	37.0	36.4	32.6	34.7	1
N-5	6- 5-61	6-26-61	27	25.4	9.0	8.5	8.8	35.4	31.2	33.6	32.8	29.8	31.9	1
Current Machine Average				26.1			9.3			33.6			32.1	
Cumulative Machine Average				27.1			10.5			35.7			32.8	
Machine Factor, %				96.4			89.0			94.3			97.9	
Machine Index, %				95.5			90.5			92.5			96.0	

TABLE XVII

SUMMARY OF TEST RESULTS FOR MACHINE O  
 June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runrability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
0-1	6- 1-61	6-12-61	380	28.2	10.5	10.0	10.4	37.8	33.6	35.8	37.0	32.4	34.9	1-1/2
0-2	6- 6-61	6-12-61	381	29.8	11.0	10.3	10.7	40.2	34.8	37.4	38.2	35.2	36.4	1/2
0-3	6-14-61	6-22-61	382	28.4	11.0	10.6	10.8	38.4	36.6	37.8	36.6	32.0	34.6	1-1/2
0-4	6-15-61	6-22-61	383	29.1	11.5	10.5	11.1	39.0	35.4	36.8	35.0	30.6	33.0	1-1/2
Current Machine Average				28.9	10.7			37.0			34.7			
Cumulative Machine Average				28.6	10.5			36.3			32.8			
Machine Factor, %				100.8	101.8			101.8			105.8			
Machine Index, %				105.5	104.0			101.6			103.9			

TABLE XVIII

SUMMARY OF TEST RESULTS FOR MACHINE P  
 June, 1961

P-1	6- 9-61	6-16-61	27	25.9	9.2	8.3	8.8	36.6	35.4	36.0	37.6	36.0	36.9	1
Current Machine Average				25.9	8.8			36.0			36.9			
Cumulative Machine Average				26.8	10.1			38.9			36.6			
Machine Factor, %				96.7	87.4			92.5			100.8			
Machine Index, %				94.8	85.4			99.0			110.3			

TABLE XIX  
SUMMARY OF TEST RESULTS FOR MACHINE Q  
June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runnability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
Q-1	6-12-61	6-22-61	25	28.9	9.9	9.0	9.3	39.0	34.2	36.6	32.6	30.6	31.8	1-1/2
Q-2	6-12-61	6-22-61	26	28.7	9.9	9.0	9.3	36.6	33.6	35.6	33.6	30.4	31.8	1-1/2
Q-3	6-12-61	6-23-61	27	29.3	9.9	9.0	9.6	40.8	35.4	37.4	34.8	32.2	33.6	1-1/2
Q-4	6-12-61	6-23-61	28	29.0	10.0	9.0	9.5	39.6	36.6	38.6	34.6	31.6	33.0	1-1/2
Current Machine Average				29.0	9.4			37.1			32.6			
Cumulative Machine Average				27.8	9.2			35.5			31.8			
Machine Factor, %				104.1	101.8			104.4			102.3			
Machine Index, %				105.9	91.2			102.0			97.4			

TABLE XX  
SUMMARY OF TEST RESULTS FOR MACHINE R  
June, 1961

R-1	5-18-61	6-19-61	156	26.8	10.2	10.0	10.0	34.2	31.8	32.6	32.2	28.8	29.9	1/2
R-2	5-22-61	6-19-61	157	26.8	10.2	9.8	10.0	36.0	31.8	33.8	27.4	25.6	26.4	Min.
R-3	5-24-61	6-19-61	158	26.2	10.4	9.8	10.1	34.8	31.2	32.9	30.0	28.0	29.4	Min.
R-4	6- 2-61	6-19-61	159	28.6	10.9	10.5	10.7	43.8	37.8	41.2	43.6	39.0	40.8	1/2
Current Machine Average				27.1	10.2			35.1			31.6			
Cumulative Machine Average				26.4	10.5			33.4			30.5			
Machine Factor, %				102.6	97.2			105.1			103.7			
Machine Index, %				99.0	99.1			96.6			94.6			

TABLE XXI

SUMMARY OF TEST RESULTS FOR MACHINE S  
June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runnability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
S-1	6-7-61	6-12-61	535	27.6	10.0	9.7	10.0	41.4	36.0	38.8	39.2	36.6	37.7	1-1/2
S-2	6-7-61	6-12-61	536	27.1	10.0	9.8	9.9	40.2	34.2	37.4	39.9	33.6	37.3	1-1/2
Current Machine Average				27.4			9.9			38.1			37.5	
Cumulative Machine Average				27.7			10.9			35.8			32.5	
Machine Factor, %				98.7			91.0			106.5			115.6	
Machine Index, %				100.1			96.5			104.8			112.2	

TABLE XXII

SUMMARY OF TEST RESULTS FOR MACHINE T  
June, 1961

T-1	6-16-61	6-22-61	80	27.7	9.9	9.1	9.5	35.4	32.4	33.6	30.6	28.4	29.6	1-1/2
T-2	6-16-61	6-22-61	81	27.9	10.0	9.2	9.6	33.6	31.2	32.6	30.6	28.4	29.6	1-1/2
T-3	6-16-61	6-22-61	82	28.1	10.0	9.3	9.7	34.2	31.8	33.1	30.0	27.4	28.8	1-1/2
T-4	6-17-61	6-22-61	83	27.7	10.0	9.2	9.7	32.4	28.2	30.4	28.8	26.0	27.7	1-1/2
T-5	6-17-61	6-22-61	84	27.7	9.8	9.2	9.4	34.8	29.4	32.2	29.6	28.2	29.1	1-1/2
T-6	6-17-61	6-22-61	85	27.7	9.8	9.2	9.5	33.6	31.8	32.6	30.0	28.0	29.0	1-1/2
Current Machine Average				27.8			9.6			32.4			29.0	
Cumulative Machine Average				28.6			10.2			33.1			30.0	
Machine Factor, %				97.0			94.1			97.9			96.5	
Machine Index, %				101.6			92.7			89.2			86.6	

TABLE XXIII

SUMMARY OF TEST RESULTS FOR MACHINE U  
June, 1961

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runnability, Maximum Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	
U-1	5-18-61	6- 1-61	447	26.9	11.0	10.0	10.4	37.8	34.8	36.6	39.0	35.0	37.0	Min.
U-2	5-19-61	6- 1-61	449	27.1	10.2	9.5	9.8	39.6	33.6	37.1	35.4	32.8	34.2	1/2
U-3	5-22-61	6- 1-61	450	27.5	10.8	10.1	10.6	40.8	37.2	38.6	36.0	32.0	34.0	1/2
U-4	5-28-61	6-12-61	451	27.4	10.3	9.8	10.0	39.0	35.4	37.3	36.8	34.4	35.4	1/2
U-5	6- 8-61	6-23-61	452	26.8	10.2	10.0	10.0	39.6	34.8	36.2	39.4	32.0	35.1	1-1/2
Current Machine Average				27.1	10.2			37.2			35.1			
Cumulative Machine Average				27.4	10.3			38.8			35.8			
Machine Factor, %				98.9	98.5			95.7			98.2			
Machine Index, %				99.2	98.7			102.2			105.1			

DISCUSSION OF RESULTS

Shown below from Table II are the maximum and minimum current machine averages noted for each test during June (the current machine average is the average of the results obtained on all rolls submitted from a given machine during the current period); also given for each test is the current F.K.I. average which is determined by averaging the current machine averages and is indicative of the test level being maintained by the industry as a whole to the extent that the industry is represented by the participating machines:

	Maximum Current Machine Average	Minimum Current Machine Average	Current F.K.I. Average
Basis weight, lb.	29.0	25.9	27.3
Caliper, pt.	11.5	8.8	10.1
Concora flat crush, p.s.i. (conditioned after fluting)	39.9	32.4	36.5
Single-face flat crush, p.s.i.	38.4	29.0	34.5

The runnability data for the 106 rolls of medium evaluated during June are summarized as follows:

Runnability	Number of Rolls	Percentage of Total Rolls
Less than 600 f.p.m. with minimum tension	1	0.9
600 f.p.m. with minimum tension	7	6.6
600 f.p.m. with tension of 1/2 lb. per in.	18	17.0
600 f.p.m. with tension of 1 lb. per in.	25	23.6
600 f.p.m. with tension of 1-1/2 lb. per in.	55	51.9

In Table XXIV a comparison of Institute and mill Concora flat crush test results obtained on conditioned specimens is given for the month of June. These comparisons were initiated in Progress Report 30 and permit interested participants to submit their Concora flat crush test results to The Institute of Paper Chemistry so that comparative results may be included in the monthly reports. Data sheets for supplying this information may be obtained from the Institute. Comparisons of this kind are a helpful adjunct to other calibration procedures. It may be noted in Table XXIV that fifteen of the twenty-one participating machines are included in this comparison of Concora flat crush data. Shown in Table XXIV are the Institute and mill Concora averages for each roll included in this comparison, the difference between the roll average based on Institute data and that based on mill data, the Institute and mill averages based on all rolls included in the comparison, and the difference between these over-all averages.

The Concora flat crush data shown in Table XXIV are summarized in Part I of Table XXV where for each machine the following information is given: (1) Current machine average based on Institute data, (2) current machine average based on mill data, (3) the average difference--that is, the difference between the current machine average based on Institute data and that based on mill data and (4) the maximum difference encountered in comparing Institute and mill test averages for individual rolls. In Part II of Table XXV the average difference of Part I has been converted to per cent by dividing it by the Institute average and multiplying the result by 100. The average differences in per cent for the current report and the two preceding reports are shown. It may be seen that, for the current period,



TABLE XXIV  
 INSTITUTE AND MILL CONCORA FLAT CRUSH TEST RESULTS ON INDIVIDUAL ROLLS FOR JUNE, 1961

Foundrinier Kraft, Board Institute, Inc.  
 Project 1108-17

Machine A						Machine B						Machine C					
Code	Mill Roll No.	Date Made	Concora Flat Crush, p.s.i.			Code	Mill Roll No.	Date Made	Concora Flat Crush, p.s.i.			Code	Mill Roll No.	Date Made	Concora Flat Crush, p.s.i.		
			Institute	Mill	Difference <sup>a</sup>				Institute	Mill	Difference <sup>a</sup>				Institute	Mill	Difference <sup>a</sup>
A-1	525	5-24-61	35.2	36.7	+1.5	B-1	316	5-16-61	39.7	39.0	-0.7	C-1	--	5-17-61	35.9	37.0	+1.1
A-2	526	5-24-61	34.4	36.9	+2.5	B-2	317	5-24-61	39.6	40.0	+0.4	C-2	--	5-18-61	36.7	36.7	0.0
A-3	533	6-13-61	35.4	40.1	+4.7	B-3	318	6-2-61	41.6	39.5	-2.1	C-3	--	5-24-61	35.9	38.8	+2.9
A-4	534	6-13-61	34.7	35.1	+0.4	B-4	319	6-8-61	39.1	37.9	-1.2	C-4	--	6-8-61	37.8	37.8	0.0
						B-5	320	6-12-61	39.5	37.4	-2.1	C-5	--	6-9-61	37.0	35.4	-1.6
												C-6	--	6-21-61	38.3	37.2	-1.1
Current Machine Av.			34.9	37.2	+2.3	Current Machine Av.			39.9	38.8	-1.1	Current Machine Av.			36.9	37.2	+0.3
Machine D						Machine E						Machine G					
D-1	521	5-18-61	34.4	31.4	-3.0	E-1	37	5-2-61	35.8	38.4	+2.6	G-1	275	4-2-61	37.7	35.1	-2.6
D-2	522	5-18-61	35.0	31.9	-3.1	E-2	312	5-11-61	36.4	37.7	+1.3	G-2	1147	4-8-61	33.7	35.2	+1.5
D-3	529	5-30-61	38.5	35.4	-3.1	E-3	455	5-15-61	36.6	35.3	-1.3	G-3	1713	4-11-61	37.3	33.0	+0.7
D-4	530	5-30-61	39.0	42.5	+3.5	E-4	578	5-19-61	38.2	38.2	0.0	G-4	2022	4-12-61	37.7	34.4	-3.3
D-5	537	6-13-61	36.2	34.7	-1.5	E-5	701	5-23-61	37.3	36.0	-1.3	G-5	2134	4-13-61	33.8	36.5	+2.7
D-6	538	6-13-61	35.9	34.7	-1.2	E-6	768	5-25-61	38.2	38.9	+0.7	G-6	3478	4-21-61	35.8	34.9	-0.9
Current Machine Av.			36.5	35.1	-1.4	Current Machine Av.			37.1	37.4	+0.3	Current Machine Av.			36.0	35.7	-0.3
Machine H						Machine I						Machine J					
H-1	441	5-17-61	39.2	38.3	-0.9	I-1	--	5-16-61	36.7	38.0	+1.3	J-1	531	5-31-61	36.2	37.2	+1.0
H-2	442	5-20-61	38.5	36.2	-2.3	I-2	--	5-17-61	35.9	35.6	-0.3	J-2	532	5-31-61	36.7	36.2	-0.5
H-3	443	5-23-61	34.4	35.8	+1.4	I-3	--	5-23-61	40.2	42.5	+2.3	J-3	539	6-14-61	34.0	34.4	+0.4
H-4	444	5-26-61	35.4	38.5	+3.1	I-4	--	5-25-61	37.9	39.5	+1.6	J-4	540	6-14-61	33.6	34.8	+1.2
H-5	445	6-1-61	38.3	38.0	-0.3	I-5	--	5-26-61	37.4	37.7	+0.3						
H-6	446	6-3-61	37.0	36.8	-0.2	I-6	--	6-15-61	38.5	40.3	+1.8						
H-7	447	6-5-61	37.3	40.8	+3.5												
H-8	448	6-9-61	38.8	37.5	-1.3												
Current Machine Av.			37.4	37.7	+0.3	Current Machine Av.			37.8	38.9	+1.1	Current Machine Av.			35.1	35.6	+0.5

<sup>a</sup> This difference is the amount in p.s.i. units by which the mill result is higher or lower than the Institute result.

TABLE XXIV--CONTINUED

INSTITUTE AND MILL CONCORDA FLAT CRUSH TEST RESULTS ON INDIVIDUAL ROLLS FOR JUNE, 1961

Machine K						Machine L						Machine Q					
Code	Mill Roll No.	Date Made	Concorda Flat Crush, p.s.i.			Code	Mill Roll No.	Date Made	Concorda Flat Crush, p.s.i.			Code	Mill Roll No.	Date Made	Concorda Flat Crush, p.s.i.		
			Institute	Mill	Difference <sup>a</sup>				Institute	Mill	Difference <sup>a</sup>				Institute	Mill	Difference <sup>a</sup>
K-1	627	5-22-61	37.2	37.9	+0.7	L-1	--	5-11-61	36.0	35.2	-0.8	Q-1	25	6-12-61	36.6	36.0	-0.6
K-2	628	5-30-61	39.1	40.1	+1.0	L-2	--	5-16-61	35.3	38.8	+3.5	Q-2	26	6-12-61	35.6	37.0	+1.4
K-3	629	6- 5-61	38.5	37.2	-1.3	L-3	--	5-17-61	36.1	35.9	-0.2	Q-3	27	6-12-61	37.4	38.2	+0.8
K-4	630	6- 9-61	38.2	39.6	+1.4	L-4	--	5-23-61	36.2	38.2	+2.0	Q-4	28	6-12-61	38.6	38.2	-0.4
K-5	631	6-12-61	36.4	36.4	0.0	L-5	--	5-31-61	39.4	40.9	+1.5						
K-6	632	6-16-61	39.5	39.2	-0.3	L-6	--	6- 6-61	38.3	39.2	+0.9						
Current Machine Av.			38.1	38.4	+0.3	Current Machine Av.			36.9	38.0	+1.1	Current Machine Av.			37.1	37.4	+0.3
Machine R						Machine S						Machine U					
R-1	156	5-18-61	32.6	35.0	+2.4	S-1	535	6- 7-61	38.8	40.4	+1.6	U-1	447	5-18-61	36.6	39.7	+3.1
R-2	157	5-22-61	33.8	34.3	+0.5	S-2	536	6- 7-61	37.4	40.5	+3.1	U-2	449	5-19-61	37.1	37.6	+0.5
R-3	158	5-24-61	32.9	36.4	+3.5							U-3	450	5-22-61	38.6	39.0	+0.4
												U-4	451	5-28-61	37.3	37.1	-0.2
												U-5	452	6- 8-61	36.2	38.3	+2.1
Current Machine Av.			33.1	35.2	+2.1	Current Machine Av.			38.1	40.4	+2.3	Current Machine Av.			37.2	38.3	+1.1

<sup>a</sup> This difference is the amount in p.s.i. units by which the mill result is higher or lower than the Institute result.

TABLE XXIV

PART I: A COMPARATIVE SUMMARY FOR EACH MACHINE OF THE CONCORA FLAT CRUSH AVERAGES BASED ON INSTITUTE DATA AND THOSE BASED ON MILL DATA

Machine Code	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
Number of Rolls Compared	4	5	6	6	6	0	6	8	6	4	6	6	0	0	0	0	4	3	2	0	5
Concora Flat Crush, p.s.i.																					
Current Machine Av. (Institute) <sup>a</sup>	34.9	39.9	36.9	36.5	37.1	--	36.0	37.4	37.8	35.1	38.1	36.9	--	--	--	--	37.1	33.1	38.1	--	37.2
Current Machine Av. (Mill) <sup>a</sup>	37.2	38.8	37.2	35.1	37.4	--	35.7	37.7	38.9	35.6	38.4	38.0	--	--	--	--	37.4	35.2	40.4	--	38.3
Average Difference <sup>b</sup>	+2.3	-1.1	+0.3	-1.4	+0.3	--	-0.3	+0.3	+1.1	+0.5	+0.3	+1.1	--	--	--	--	+0.3	+2.1	+2.3	--	+1.1
Maximum Difference <sup>c</sup>	+4.7	-2.1	+2.9	+3.5	+2.6	--	-3.3	+3.5	+2.3	+1.2	+1.4	+3.5	--	--	--	--	+1.4	+3.5	+3.1	--	+3.1

PART II: A TABULATION FOR EACH MACHINE OF THE AVERAGE DIFFERENCE (PER CENT) BETWEEN THE CONCORA FLAT CRUSH  
 BASED ON INSTITUTE DATA AND THAT BASED ON MILL DATA

Average Difference, % <sup>d</sup>	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
Current Report (June)	+6.6	-2.8	+0.8	-3.8	+0.8	--	-0.8	+0.8	+2.9	+1.4	+0.8	+3.0	--	--	--	--	+0.8	+6.3	+6.0	--	+3.0
88th Report (May)	-1.3	+0.5	+3.0	-8.1	+1.1	--	-2.6	+4.2	+1.9	+5.7	+6.3	+1.7	--	--	--	--	+0.8	+4.4	+10.8	--	+0.8
87th Report (April)	+0.3	-3.4	+4.3	-14.9	+2.5	--	+0.3	-0.6	-0.5	+1.3	+3.7	-0.8	--	--	--	--	--	+2.0	-0.8	--	+1.0

<sup>a</sup> Comparisons based on current machine average include only those rolls for which mill data were submitted.

<sup>b</sup> Average difference is the difference between the current machine average based on Institute test results and that based on mill test results with the Institute test results used as the reference. See Table XXIV.

<sup>c</sup> Maximum difference is the greatest difference encountered in comparing Institute and mill test averages for individual rolls. See Table XXIV.

<sup>d</sup> Average difference (per cent) is computed by dividing the average difference in p.s.i. (shown above in Part I of this table) by the Institute current machine average and multiplying the result by 100.

the highest average difference of 6.6% was associated with Machine A and the lowest of 0.8% with Machines C, E, G, H, K, and Q. An average difference in excess of five per cent was noted for Machines A, R, and S.

In Table XXVI a comparison of the agreement between Institute and mill Concora flat crush data is given for the months of April, May, and June, 1961. An inspection of the percentages shown in Table XXVI indicates that agreement between Institute and mill Concora flat crush data for the current period is, on the whole, as good as, and in some cases better than, agreement for the previous two periods. In general, agreement between Institute and mill results was good for all three months for which comparative data are shown.

TABLE XXVI  
 COMPARISON BY PERIODS OF AGREEMENT BETWEEN INSTITUTE  
 AND MILL CONCORA FLAT CRUSH DATA

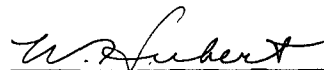
Average Percentage Difference Between Institute and Mill Concora Flat Crush Test Results <sup>a</sup>	Percentage of All Machines Included Within the Indicated Range		
	April	May	June
+ 1.0	50.0	20.0	40.0
+ 2.5	71.4	46.7	46.7
+ 5.0	92.9	73.3	80.0
+10.0	92.9	93.3	100.0 <sup>c</sup>
+14.9	100.0	100.0 <sup>b</sup>	

<sup>a</sup> The average obtained at the Institute was used as the reference in the calculation of the percentage differences.

<sup>b</sup> Maximum percentage difference was 10.8.

<sup>c</sup> Maximum percentage difference was 6.6.

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