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Laboratory Evaluation of Blue Fibers
Task Force Report No. TF-84

Attached is the report covering the laboratory evaluation of Australian, Norca and "Old" and "Improved" S Blue fibers used in Transite pipe. Also included in the evaluation was KCER 3 Blue, which is understood to be a possible additional source of supply.

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LABORATORY EVALUATION OF BLUE FIBERS
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SUMMARY:

Since the screen tests on incoming shipments of Australian, Norca and S Blue show wide differences, yet these standard Blues are used interchangeably on the pipe machines, a laboratory evaluation of the Blues alone and blended was undertaken. Both Old and Improved S Blues were included in the evaluation and KCBR3, a new possible source of supply.

The results show little or no correlation between screen tests and strength or filtration of the Blue fibers as used in Transite pipe. Of the Blues tested, the KCBR 3, Australian, Old and Improved S Blues are equivalent in strength and significantly stronger than the Norca (NC300) Blue as shown by the sag cake strength. The KCBR 3 appears to be an acceptable Blue for use in Transite pipe and is a relatively clean and long Blue fiber.

PURPOSE AND SCOPE:

Due to the need of larger quantities and improved quality of Blue fibers in Transite pipe a program was started in 1951 to evaluate the various available Blue fibers. This program led to the establishment of a purchase specification for Blue fiber and the subsequent approval of additional sources of fibers. Currently being purchased and used are S Blue, NC 300 (Norca) Blue and Australian Blue. As requested by the Transite Pipe Task Force Steering Committee, a laboratory evaluation program was undertaken to compare the present standard Blue fibers.

The screen testing of incoming shipments during the past 3 years indicated the various Blue fibers to be considerably different. When blended with other fibers and used on the pipe machines, no appreciable difference in machine operation recovery or ultimate strength could be observed. The laboratory evaluation was undertaken to analysis the difference between the screen and plant results.

Included in the evaluation was KCBR 3 Blue, which is understood to be a possible additional source of supply.

PROCEDURE:A. Screen Tests:

Samples of each of the fibers in the "as received" condition and after one time hammermilling were submitted to Mr. M. S. Badollet for the following basic fiber tests.

Quebec Screen
Density
McNett
Air Analysis
Rotap

B. Filtration:

Samples as received and after one time hammermilled were run on the Thwing-Albert Drainage Tester. As a part of the sag cake procedure the filtration time of the individual Blue fibers and the blends of Blue, and Danville 4T and 6D as used in Transite pipe mixes were recorded. These filtration rates are considered more indicative of the actual filtration characteristics of the fibers as used in pipe.

C. Strength:

For the evaluation, the Blue fibers were used individually and in a blend of

30% Blue
35% Danville 4TAX
35% Danville 6D

The sag cake method was used for the comparison with each fiber and blend run at 10% furnish to 35% furnish in 5 percentage point increments. Each fiber or blend was processed once through the Christy-Norris Hammermill and mixed at the various percentages with a 0.6 to 1 combination of New Jersey silex and Pioneer National Type I portland cement. These pre-mixed dry stocks were placed in paper bags, marked and the proper weight for each sag cake weighed out of the bags. A total of 10 sag cakes for each fiber and blend of each percentage point were made. The order of making each cycle was completely randomized to minimize the effect of day to day variation. A total of 300 sag cakes were made and tested for the complete evaluation.

The data for each of the fibers and blends at each percentage point was averaged, and quadratic curves for unit strength were calculated and plotted.

As 20% furnish (approximately average for Transite pipe usage) the strength developed by each of the comparison Blue fibers was determined. Using the highest strength fiber as 100%, the relative strength developed by each of the other fibers was calculated.

RESULTS:

A. Screen Tests:

On the as received condition the Blue fibers had the following total amount retained on the +2 and +4 mesh screens.

Improved MS	10.4 oz.
KCBR 3	10.2 oz.
Old MS	9.9 oz.
Australian	8.6 oz.
Norca	7.2 oz.

On the Air Analysis the following percentages of fiber, dust and rock were obtained.

	<u>Fiber</u>	<u>Dust</u>	<u>Rock</u>
KCBR 3	96.6	1.3	2.1
Norca	84.8	12.0	3.2
Improved MS	77.1	17.9	5.0
Australian	75.9	20.7	3.4
Old MS	65.7	25.7	8.6

In the as received condition the McNett tests showed the following.

	<u>+14M</u>	<u>Cumulative +100M</u>	<u>-200M</u>
KCBR 3	85.0	89.4	8.1
Australian	73.5	79.3	19.0
Norca	66.7	81.8	12.7
Improved MS	60.4	74.6	21.1
Old MS	47.6	60.9	33.3

The above results indicate the KCBR 3 Blue to be a relatively long and clean fiber with an exceptionally small amount of dust. The overall results indicate the Old MS Blue to rate relatively low on all three of the above tests. The Norca, Improved S and Australian appear to fall somewhere between the two extremes of KCBR 3 Blue and Old MS Blue on these three screen tests.

Detailed results are shown in Table I, page 5 of the Appendix.

B. Filtration Tests:

Based on the Thwing-Albert Drainage Tests on the fibers one time hammermilled the Australian and Norca were similar in filtration rates and slightly faster than the Old or Improved S Blues. The KCBR 3 Blue had the slowest filtration characteristics of the fibers tested.

When combined with cement and silica, the filtration rates as measured by the sag cake method showed the Australian, Norca, KCBR 3 and Improved S Blues to be similar at 25% fiber furnish and slightly faster than the old MS Blue.

Tables II and III, pages 6 and 7, and Charts I and II, pages 8 and 9 of the Appendix show the detailed results.

RESULTS: (Cont'd)C. Strength:

Based on sag cake strength only at the normally used percentage furnish in Transite pipe (20%) the Blue fibers had the following unit strengths.

	<u>Unit Strength</u>	<u>Per Cent of Highest Strength</u>
Old MS Blue	4100	100
Improved	4070	99
Australian	3950	96
KCBR 3	3900	95
Norca	3400	83

Within the limits of the test method the first four of the above fibers are considered to be equivalent in strength. The Norca Blue is significantly lower.

Similar strength results were obtained on blends containing 30% Blue, 35% 4TAX, 35% 6D.

Detailed results can be found in Tables II and III, pages 6 and 7, and Charts III and IV, pages 10 and 11 of the Appendix.

CONCLUSIONS:

Based on this evaluation and the samples used:

1. There appears to be little or no correlation between screen test results and strength or filtration of Blue fibers as used in Transite pipe.
2. Considering fiber length, strength and filtration characteristics, KCBR 3, Improved MS, Australian and Old MS Blue are similar as used in Transite pipe, with the KCBR 3 grading the best of the four due to its high fiber, low dust content.
3. Although grading relatively high on the McNett Screen and Air Analysis, the Norca (NC 300) Blue appear to be the least desirable of those Blue fibers tested for use in Transite Pipe.

TABLE I
FIBER ANALYSES*

Fiber	Treatment	Quebec Screen oz.				Air Analysis Per Cent			Density		Ro-Tap, Per Cent Retained											
		2M	4M	10M	Pan	Fiber	Dust	Rock	Loose	Press	1.050"	.742"	.525"	.371"	3M	4M	6M	8M	10M	20M	35M	Pan
Improved M.S. Blue "Old" M.S. Blue Australian Blue Norca Blue KCB-R3	As Rec'd	5.6	4.8	3.5	2.1	77.1	17.9	5.0	4.2	7.7	0	3.6	35.0	12.8	12.9	6.4	6.0	2.5	5.2	8.1	3.1	4.4
	As Rec'd	1.4	8.5	3.0	3.1	65.7	25.7	8.6	6.6	10.9	0	Tr.	1.5	44.6	8.0	10.1	7.7	2.8	4.5	7.1	3.6	10.1
	As Rec'd	0.3	8.3	6.8	0.6	75.9	20.7	3.4	9.4	11.7	0	0	7.6	4.7	14.2	22.7	15.9	8.2	10.6	10.1	2.3	3.7
	As Rec'd	0	7.2	7.0	1.8	84.8	12.0	3.2	7.4	9.9	0	0	0	5.4	6.2	30.3	11.6	6.6	11.6	16.6	7.2	4.5
	As Rec'd	1.6	8.6	5.8	0	96.6	1.3	2.1	6.2	10.2	0	0	5.0	31.5	7.2	19.8	13.0	7.0	7.5	6.4	1.0	1.5
Improved M.S. Blue "Old" M.S. Blue Australian Blue Norca Blue KCB-R3	x1 Hammer	13.6	1.1	0.6	0.7	85.5	9.3	5.2	1.8	4.4	82.6	2.1	3.9	2.6	2.3	1.2	.6	.3	.5	1.4	1.0	1.5
	x1 Hammer	8.9	4.1	1.3	1.7	82.9	9.6	7.5	2.8	5.7	7.3	5.8	36.8	27.5	6.1	3.5	2.2	.6	1.1	2.2	1.8	5.1
	x1 Hammer	11.0	2.7	1.8	0.5	85.8	12.0	2.2	2.2	3.4	37.8	9.6	17.2	16.8	4.2	3.2	2.9	1.0	2.0	2.8	1.2	1.4
	x1 Hammer	6.3	7.2	1.5	1.0	90.7	5.0	4.3	2.3	3.5	0	.7	55.6	21.4	4.2	6.0	2.5	.9	1.5	2.5	1.6	3.1
	x1 Hammer	13.3	1.7	0.8	0.2	97.4	1.0	1.6	1.5	4.5	93.4	0.5	0.4	1.1	1.1	1.1	.7	.3	.4	.5	.2	.3

Fiber	Treatment	McBett, Per Cent					
		414M	428M	4100M	4200M	-200M	
Improved M.S. Blue	As Rec'd	60.4	7.0	7.2	4.3	21.1	
"Old" M.S. Blue	As Rec'd	47.6	5.8	7.5	5.8	33.3	
Australian Blue	As Rec'd	73.5	2.8	3.0	1.7	19.0	
Norca Blue	As Rec'd	66.7	7.0	8.1	5.5	12.7	
KCB-R3	As Rec'd	85.0	2.0	2.4	2.5	8.1	
Improved M.S. Blue	x1 Hammer	47.3	9.6	11.2	6.1	25.8	
"Old" M.S. Blue	x1 Hammer	38.5	9.0	11.7	6.7	34.1	
Australian Blue	x1 Hammer	61.2	6.3	8.1	4.2	20.2	
Norca Blue	x1 Hammer	40.2	12.7	15.7	9.0	22.4	
KCB-R3	x1 Hammer	74.4	4.0	3.7	3.7	14.2	

Note: *By Research Fiber Section.

TABLE II

Sag Cake Test Results
Individual Blue Fibers, XI Hammermilled

Average Results Represents 10 Cakes per Percentage

Identification		Operating			Physical Properties		
Fiber Kind	Per Cent Furnish	Filter Time sec.	Moisture After Filter %	Moisture After Press %	Thickness in.	Density (Dry) lb/cu ft	Modulus of Rupture (Sat.), psi
Improved Cape M.S. Blue	10	39	34.4	27.8	0.262	93.2	3000
	15	38	36.9	29.7	.277	89.7	4060
	20	32	45.8	32.8	.288	87.7	4250
	25	32	55.0	36.3	.306	84.0	3650
	30	31	62.5	39.2	.316	81.3	3430
	35	28	72.7	44.6	.338	78.4	3070
"Old" Cape M.S. Blue	10	44	33.6	26.3	.249	98.0	2900
	15	40	38.1	28.8	.259	94.3	3530
	20	42	41.1	29.5	.269	91.0	4080
	25	35	47.8	32.5	.279	89.5	4380
	30	36	52.8	34.5	.289	86.4	4360
	35	35	57.8	36.4	.296	84.8	3930
Australian Blue	10	43	33.0	27.1	.257	94.8	2850
	15	39	34.8	28.4	.271	91.1	3190
	20	36	39.2	29.1	.280	90.0	4290
	25	36	48.3	33.7	.300	85.5	4030
	30	32	50.8	35.1	.315	83.1	3700
	35	30	57.6	37.6	.329	79.9	3360
Norca Blue	10	37	38.1	29.5	.263	93.7	2650
	15	37	42.5	31.8	.281	89.3	3130
	20	33	50.5	34.7	.294	85.7	3390
	25	31	55.4	36.4	.306	83.7	3420
	30	35	67.3	40.5	.323	80.7	2820
	35	31	77.6	45.7	.344	77.9	2630
KCBR 3 Blue	10	41	41.3	28.8	.271	91.9	3360
	15	38	47.8	31.7	.284	88.8	4270
	20	37	54.1	35.1	.303	85.8	4140
	25	35	58.4	36.5	.315	84.7	3230
	30	31	63.8	39.2	.330	83.1	3150
	35	28	69.3	41.8	.344	79.8	2860

TABLE III

Sag Cake Test Results
Fiber Blends*, X 1-Hammermilled

Identification		Operating			Physical Properties		
Blue Fiber Kind in Blend	Per Cent Fiber Blend	Filter Time sec.	Moisture After Filter %	Moisture After Press %	Thickness in.	Density (Dry) lb/cu ft	Modulus of Rupture (Sat.), psi
Improved Cape M.S. Blue	10	66	38.7	27.5	0.248	96.9	2930
	15	70	42.8	28.4	.254	94.7	3710
	20	73	47.3	29.7	.258	92.7	4370
	25	74	46.0	28.8	.257	93.2	4380
	30	85	54.6	31.2	.268	90.1	4879
	35	90	58.1	32.2	.273	88.9	4750
"Old" Cape M.S. Blue	10	78	36.7	25.8	.244	98.4	2920
	15	74	41.8	28.4	.250	96.6	3760
	20	80	46.7	29.7	.253	94.5	4620
	25	84	49.7	29.8	.257	92.7	4640
	30	87	55.0	31.4	.262	91.4	4840
	35	100	60.4	32.9	.267	89.9	4900
Australian Blue	10	68	36.8	26.5	.245	98.1	2740
	15	73	41.2	28.0	.250	96.0	3710
	20	74	45.3	28.8	.256	93.8	4280
	25	83	49.5	30.3	.260	92.3	4800
	30	93	53.6	31.3	.264	91.1	4890
	35	101	57.2	31.9	.268	90.1	4880
Norca Blue	10	64	39.4	28.1	.248	96.8	2730
	15	67	44.0	29.5	.253	95.0	3560
	20	70	49.1	30.6	.259	93.2	4080
	25	77	52.4	31.1	.264	91.4	4290
	30	86	57.4	32.8	.269	90.1	4420
	35	89	60.2	33.7	.274	88.4	4670

* Fiber Blends Composed as:

	Per Cent
Blue Fiber Kind	30.0
"New Mill" 4TAX	35.0
Danville 6D20	35.0
Total	100.0

CHART I

Laboratory Evaluation of Blue Fibers
Thwing-Albert Drainage Tests

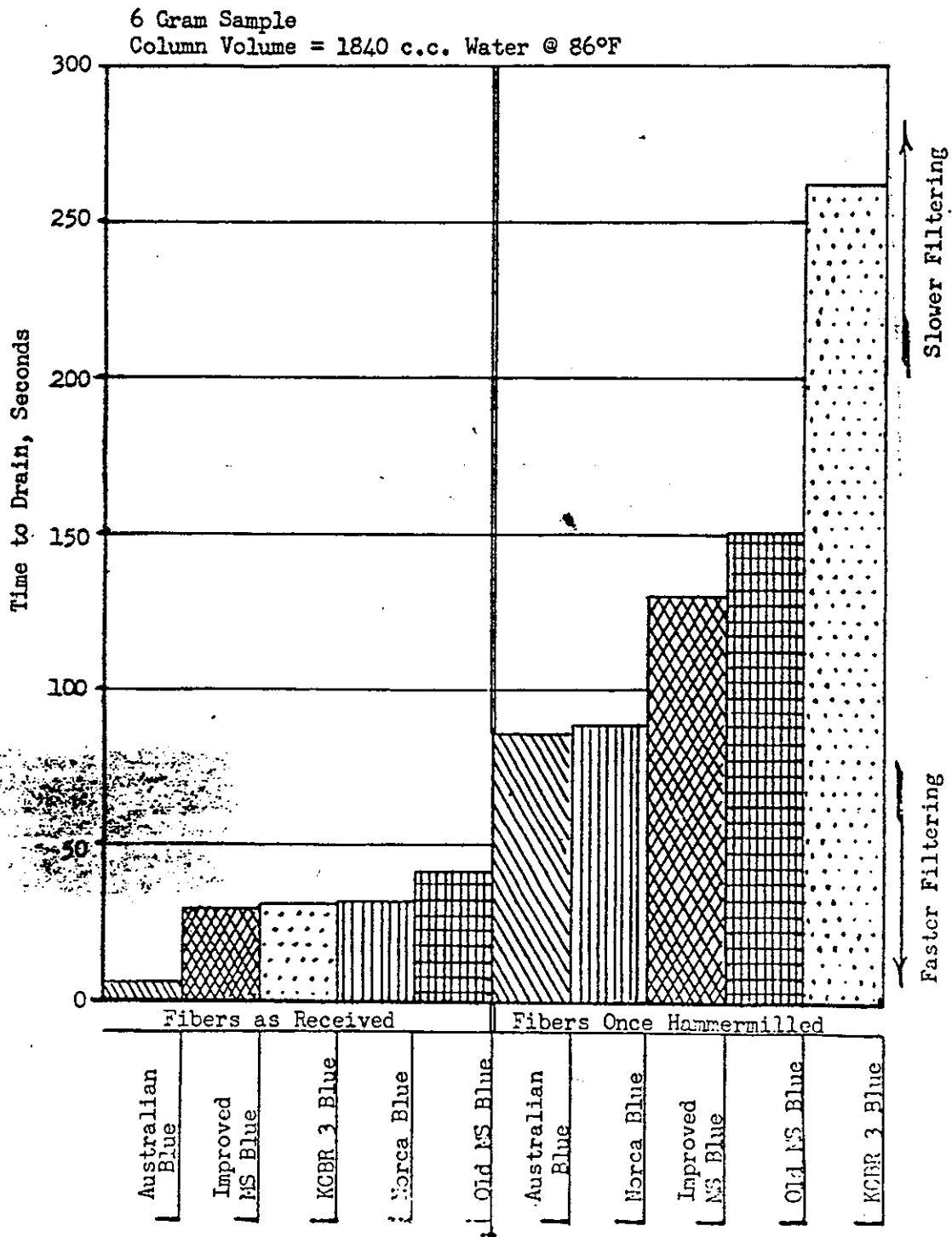


CHART II
Laboratory Evaluation of Blue Fibers
Sag Cake Filtration
Fibers One Time Hammermilled

