

CERTAIN-TEED PRODUCTS CORP.
Pipe Technical Division
Plant Data
Pipe Machine Program
J. C. Jackson

IN DUPLICATE

Ambler R&D

December 12, 1962

Ambler

Mr. R. L. Lanz

R&D Pilot Pipe Machine

R. A. Schneider - sp

The following are my comments on the proposed program under the headings of the report.

B. 6.

Particle size distribution may be important. We have a suspicion that a small fraction of large grains of silica may be very detrimental to tool life. We cannot account for the differences of tool life in all the plants. Other factors naturally may be stronger grain structure, shape of grains, strength of bond to cement, etc. I believe this will have to be investigated so that we can show up better specs or additionally air separate or others to be able to standardize on tools, cutting speeds, tool cost, etc.

B. 8.

We are presently thinking about using a silica from the very pure Santa Anna occurrence, ground in Waco and delivered at \$9.50/ton approximately in Hillsboro.

C. 7.

Plants seem to stress that flocculant improved quantity and quality of the pipe. I just wonder if quality is improved not on account of the flocculant but because our present vat design has a separating effect on the fibers prevented by the flocculant. This possibly can be achieved by different vat operation as I indicated in the Dallas meeting.

If flocculant bunches the fiber, we certainly do not employ fiber as efficiently as possible. We want uniform fiber distribution similar to a good paper.

C. 11.

Investigations on pipe machine results with fibers having essentially no dust may be important. There is a possibility that the asbestos dust has a similar electric potential as the fibers and prevents the proper adhesion of the cement to the asbestos fibers.

If this is so, then we should have the fibers air separated either at the mills or at the plants. How this would be effected in the plants on a mixture I do not know.

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D. 3.

Results on Hillsboro fines are different from the original samples as changes were made some time in August to get a coarser, freer draining product.

D. 4.

Not all plants weigh the fines. St. Louis uses the shovel weighing system.

D. 5.

The opinion of Hillsboro can be disregarded as at that time densities were low due to many other causes from poor operating practices.

D. 7.

As Hillsboro fines are air separated, I cannot see that they can have hard particles.

E. 1.

The use of Separan in the vats has been discontinued in Hillsboro since November 1962.

E. 3.

Separan is used in Hillsboro in the savall at a rate of approximately 1/8 lb./ton with very good results.

E. 7.

Our present inflow and throughflow in machine is excessively turbulent. Decrease of this should improve effect of flocculants.

F. 4.

Hillsboro O. R. ring fishmouthing has been found since the report was issued to be due to causes beyond control of the plant.

II. 3.

A fiber fluffer (Moody) is available in the market. It was specifically designed to open the densely packed fiber in paper bags.

II. 5.

All plants use a closed air system on the willows.

II. 7.

Essentially all fiber blending and mixing systems are identical except No. 1 machine in St. Louis, also Ambler and St. Louis do not have preblenders. Hillsboro system has been shown to be satisfactory on present cycles to eleven ton output.

Comments of St. Louis on screw conveyors and bucket elevators are based on experience gained with improperly selected equipment. Use of these devices, properly selected as for Hillsboro, can be very satisfactory.

III. 3.

Hillsboro block-ups are corrected. As indicated, Hillsboro system is good for eleven tons of pressure pipe. Ambler system still has some capacity left, the others are at the limit. There are, however, other bottlenecks, such as mandrel handling, curing, autoclaving, etc.

III.4.(stock)

Consistency controller has been reported by me in Dallas meeting. Suggest first use in Santa Clara and also in pilot machine.

III. 5.

Recirculation Rate Plant 57 is grossly exaggerated (probably half the amount indicated).

III. 6.

Hillsboro block-ups were corrected with proper operating procedures.

IV. 2.

Nomenclature of waters should be identical. White water is same as clear savall water. At Plant 57 overflow dirty water savall also is white water.

IV. 4.

We should be uniform with description of water. We should also stop differentiating the different showers by manufacturer's name. For instance,

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Broughton's can be had in different nozzle size and strokes. In Hillsboro we made reciprocating showers with needle showers which is principle used in our other showers except for size orifice.

Showers should be classified as follows:

- I. Operation
 - A. Stationary
 - B. Reciprocating
 - 1. Stroke inches
 - 2. No strokes per min.
- II. Nozzles
 - A. Fan type
 - B. Needle type
 - C. Others
- III. Size
 - A. .093"
 - B. .031"
 - C. Others
- IV. Water Pressure at Shower Inlet
- V. Size of Shower Pipe I. D.
- VI. Distance between Nozzles

IV. 5.

Savall of Dorr type in Hillsboro as clear now as cone savalls.

IV. 6.

Closed water system is definitely superior if we can ever find a way to use .031" needle reciprocating showers spaced 6" with white water. Advantage is the absence of the terrific problem of disposal, stream pollution, etc. Other problems may be saturation with certain chemicals detrimental to good pipe. We should strive to close the systems more and more.

IV. 10.

Hillsboro boiler tube trouble was caused by inattention to water treatment which has been specifically designed for Hillsboro water.

V. 5. d.

Hillsboro now uses water on Vickery. Without water, top felt gets dirty and Vickery vacuum boxes wear out in a few months.

V. 7.

Steep angle to No. 2 vat has been eliminated at Hillsboro.

VI. 6.

Importance is stressed to keep ends of stripe in felt even. The whole stripe should be straight across.

VI. 9.

It is very important that cylinders are always run in the same direction otherwise cylinder wire gets loose.

VII. 5. d.

I do not consider a very tight pipe a sign of bad roll-up. This in my opinion is the best pipe.

VII. 7.

Air lancing in Hillsboro is now in a calender equipped with a top press roll. Satisfactory.

VII. 11.

What Hillsboro remarked is as Maloney would say "for the birds".

VIII. Hillsboro

Due to changes in operation, this does not apply.

PLANT DATA
QUESTIONNAIRE

CERTAIN-FEED PRODUCTS CORP.
PIPE TECHNICAL DIV.
PLANT DATA

Plant No. _____ Location _____ Manager _____

Raw Materials:

A. Cement

1. Supplier _____
2. Physical & Chemical Analysis: Yes _____ No _____
Where available _____
3. Open or closed circuit grinding: Yes _____ No _____ ? _____
4. How cement is handled _____

5. Temperature: Silo _____ °F, Plant Silo _____ °F, Storage _____ °F.
6. (a) Do you measure surface area: Yes _____ No. _____
(b) If yes, typical values _____
(c) If no, do you consider this important: Yes _____ No _____.
7. How is cement purchased, by whom, who's responsible.

8. Why is particular cement good or bad: _____

9. Testing and control of cement: _____

10. Are there any provisions for moisture control: Yes _____ No _____

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(a) If yes, typical values _____

(b) If no, do you consider this important: Yes ____ No ____

11. Specific problems _____

B. Silica

1. Supplier: _____

2. Physical & Chemical Analysis: Yes ____ No ____.

Where available _____

3. Open or closed circuit grinding: Yes ____ No ____

4. How silica is handled: _____

5. (a) Do you measure surface area: Yes ____ No ____.

(b) If yes, typical values & variability: _____ + _____

(c) If no, do you consider this important: Yes ____ No. ____

(d) Mesh: _____

(e) Particle size distribution: Available ____ Not avail. ____

6. Experience with different mesh silica: A. _____

B. Effect on autoclaving operation _____

7. How is silica purchased, by whom, who's responsible.

8. Specific problems _____

C. Asbestos Fiber

1. Blue fiber: Why do you use blue fiber _____

Least amount that can be used _____

Could you run without blue: Yes _____ No _____ If Yes,

How _____

2. General opinion of various grades of fiber: _____

3. If you had choice, what fiber would you pick; why: _____

_____.

4. How does dust content of fiber effect operation: _____

_____.

5. (a) Range of fiber usage _____% to _____%.

(b) Effect of high fiber content _____

(c) Effect of low fiber content _____

6. How do fiber quotas influence operation: _____

_____.

7. How does flocculant effect fiber usage: _____

_____.

8. (a) What means are employed to control fiber: _____

_____.

(b) Does surface area offer any advantages _____

_____.

9. Aware of any other fiber useful in pipe but not presently
using: _____.

10. Do purchasing specifications cover quality of fiber _____

_____.

11. Specific problems: _____

_____.

D. A/C Fines

1. Source of fines: _____.
2. Preparation of fines: Method _____

Control _____
_____.
3. Do you measure particle size distribution: Yes ____ No ____.
If yes, _____ + _____.
4. (a) How are fines metered out _____
(b) Where are they introduced _____
_____.
5. (a) General opinion regarding effect of fines on product _____

(b) What criteria is used to evaluate product _____
_____.
6. Preferred method of preparing fines _____
_____.

7. Specific problems _____

_____.

B. Chemical Additives

1. What do you presently use _____.

2. Where is it added _____ What percentage _____
_____ How is it controlled _____.

3. What does it do for you: in machine operation _____

in savall system _____
_____ in product _____
_____.

4. What would you like it to do for you _____
_____.

5. Are there any other types you want investigated _____
_____.

6. How do additives effect film thickness, water content, vacuum
requirements _____

_____.

7. Specific problems and comments _____

F. Rubber Rings

1. Method of storage, location, temperature, etc:

2. How is inventory controlled (re-order points, etc.)

3. General comments, suggestions & opinion of lubricant:

4. Specific problems: _____

Fiber Preparation - Flow Diagram

1. Are you satisfied with present method of opening fibers:

Yes _____ No _____ If not, why _____

2. Are you interested in new methods of opening fibers _____

3. Could the mines supply more open fiber _____

4. General comment on preparing fibers separately or as a blend

5. Willow Operation:

Speed _____ Rate of Feed _____ No. Hairpins Possible _____

No. Hairpins used _____. Changeover Cycle _____

Sluggers _____ Misc. _____

6. Mixing cycles _____

7. Specific problems & comments _____

Primary Mixing & Stock Preparation

Primary Mixing:

1. Type of Mixer _____ Size _____
Relationship of Batch-Size/HP input _____.
2. Batch Size _____ Through Put _____
Mixing Cycle _____ Feed Rate _____.
3. General Comments & Problems _____

4. Changeover times for product mix _____.

Stock Preparation:

1. How _____
_____.
2. Percent solids _____ Makeup Water _____

Mixing: Type _____ Cycle _____ Agitation _____
3. Cement-Water Contact Times _____

4. Method of measuring and controlling stock _____

_____.
5. Quantity of stock being recirculated _____

Method of addition of virgin stock _____
_____.

6. Specific problems & comments _____

_____.

Water System:

(i.e. white water, dirty water, shower water, fresh water)

1. Fresh Water

- (a) Source _____
(b) Where is it added _____
(c) Amount added _____
(d) pH _____ Hardness _____ Chemical Analysis: Yes ___ No ___
(e) Is makeup pretreated _____ How _____.

2. White Water

- (a) Source _____
(b) Where is it used _____
(c) Amount generated _____
(d) Percent Solids _____

3. Dirty Water

- (a) Source _____
(b) Where is it used _____
(c) Amount generated _____
(d) Percent Solids _____

4. Shower Water

- (a) Source _____
- (b) Where is it used _____
- (c) Amount used _____
- (d) Type of showers _____
- (e) Shower water pressure & temperature _____
- (f) Cleaning of showers _____
- _____
- _____

5. Savall System - General Comments

6. Effect of open or closed system on Machine Operation & Benefits of Each Method.

7. Does water Source Contributed to Felt & Screen Plug up

8. Vacuum System Water

- (a) Source _____
- (b) Where is it returned _____
- (c) Comments _____

9. (a) How is Waste water & material disposed of: _____

(b) How Much _____

(c) Where _____

(d) Control _____

(e) Program for stream pollution _____

10. Specific problem areas _____

Machine Operation:

1. Speeds in General: (i.e. felt, agitator, Schneider Liner, etc.)

2. Pumps in General: (i.e. type, speed, hp., etc.)

3. Vacuum:

(a) Where located _____

(b) How much _____

(c) What type control _____

(d) How is it measured _____

(e) Type of box _____

4. Agitators

(a) Where located _____

(b) What type _____

(c) Speed _____

(d) Direction _____

(e) Hp. requirements _____

5. Comments on Vickery Cleaner

6. Comments on operating temperatures _____

7. Couch roll. (Type, diameter, angle, pressure)

8. Cylinders (Diameter, wire size & mesh size, deckling etc.)

9. (a) Stock distribution to vat and within vat _____

(b) Overflow Heights _____

- L). Stock consistency - Comments on control, monitoring, etc.

11. Comments on Manner in which various stocks run _____

12. Comments on pickup at cylinders, usual problems and corrective measures.

13. Water content in film and/or pipe during operation.

14. Condition of savall during startup and during normal operation.

15. General comments on piping & valving _____

16. Specific problems _____

Felts

TOP

BOTTOM

- | | | |
|------------------------------------|-------|-------|
| 1. Supplier | _____ | _____ |
| 2. Type | _____ | _____ |
| 3. Cost | _____ | _____ |
| 4. Life | _____ | _____ |
| 5. Reason for Removal | _____ | _____ |
| 6. Comment on breaking in new felt | _____ | |
| | _____ | |
| 7. Comment on running the felt | _____ | |
| | _____ | |
| | _____ | |
| 8. Comment on cleaning the felt | _____ | |
| | _____ | |
| | _____ | |
| 9. Comment on felt type | _____ | |
| | _____ | |
| | _____ | |

10. Top Felt Function - Sheepsfoot Roll

11. How to determine when felt is no longer usable

12. Specific Problems

Rollup Operation:

1. Comment on pressure-thickness control

2. Are typical P vs. T curves available: Yes _____ No _____

3. Weight of beam _____.

4. Comment on relationship between top & bottom felt speeds.

5. Signs of bad rollup - Causes, corrective measures.

6. Rate of buildup _____

7. Comment on Air-Lance Operations _____

8. Discussion of mandrels; type, cleaning, cost, etc.

9. Comment on calendaring operation _____

10. Discuss breaking section loose _____

11. Specific problems _____

Curing:

1. Through Put Rate _____
2. Number of Passes _____
3. Dwell Time _____
4. Ambient Conditions by Zone
Zone _____
Zone _____
Zone _____
5. Type of Travel Through Tunnel _____

6. Effect of Diameter & Thickener _____

7. Method of Control _____

8. Moisture content in and out _____

9. Theory & Recommendations _____

10. Physical Criteria for Judgement _____

11. Specific Problems _____

Autoclaving:

1. Discuss method & conditions prior to autoclaving _____

2. Discuss Loading Methods _____

3. Operation:
 - (a) Cycle _____
 - (b) Buildup Time _____
 - (c) Constant Period _____
 - (d) Blown Down _____
 - (e) Purge _____
 - (f) Control _____
 - (g) Quality of Steam _____
4. Typical curves available: Yes _____ No _____.
5. Effect of Load _____

Finishing:

1. Discuss finishing operation (i.e. feed rate, saw blades, speeds
chuck pressures, techniques, tool life).

Miscellaneous:

1. Flow Diagram Available: Yes _____ No _____.

2. _____

_____.

3. _____

_____.

4. _____

_____.

5. _____

_____.

PLANT DATA
ANSWERS

CERTAIN-TEED PRODUCTS CORP.
Pipe Technical Div.
Plant Data

<u>Plant No.</u>	<u>Location</u>	<u>Manager</u>
56	Santa Clara	Angstadt
57	Hillsboro	Gear
58	Ambler	Lander
59	St. Louis	Maloney

I. Raw Materials

A. Cement

(1) Plant Supplier

56	Ideal
57	Trinity (Div. of General Portland)
58	Lehigh, National
59	Missouri Portland

(2) Physical and chemical analyses are generally available from the cement supplier on a per silo basis. This information is utilized by Quality Control as a control media to check conformance to specification and as a means of detecting material. Deviations likely to result in poor performance.

(3) There is a general lack of information at plant level regarding the manufacturing techniques employed by the cement supplier. Santa Clara stated that Ideal has a dry process, Hillsboro says that Trinity utilizes a wet process, and St. Louis was fairly certain that Missouri Portland employs open circuit grinding. This was the content of information available.

(4) With one exception (St. Louis) cement is trucked in and pneumatically unloaded. The proximity of the supplier in St. Louis allows for direct air transport between plants. Periodic replacement of bends in the pneumatic lines is a minor maintenance problem.

(5) Temperature:

<u>Plant</u>	<u>Supplier's Silo, °F.</u>	<u>Plant Silo, °F.</u>
56	No Data	-----*
57	No Data	40-80° Winter/140-150° Summer
58	No Data	-----*
59	No Data	-----*

* Quality Control records should be available, but not during tour. Temperatures are taken rather infrequently; usually when problems are expected in the cement.

- (6) All plants concede that the surface area of the cement is important, however only two, Ambler and Hillsboro, periodically measure it. Hillsboro reported a value of 3300 ± 50 sq. cm./gm. (Blaine Method) while Ambler's data can be secured from Quality Control. St. Louis indicated that the surface area should be controlled within a specified range and this was the supplier's responsibility. St. Louis and Santa Clara were in agreement that cement was less of a problem today than 10 years ago and in general do not blame their troubles on the cement.
- (7) Cement is normally ordered by the general foreman or plant manager utilizing the specifications established by Quality Control. In the case of multiple suppliers the source is alternated weekly.
- (8) Why a particular cement is good or bad appears to be a question which the plant personnel are unable to answer. St. Louis contends that cement is one of the most stable elements in the pipe operation while Santa Clara firmly believes that past performance is the only true indication of a cement's merit. On the other hand, Hillsboro is convinced that machine operation and product strength are intimately related to cement variability. Ambler is cognizant of cement differences; however, they are not in a position to correlate these differences with performance.
- (9) All plants agree to some extent that testing and control of cement at the plant level is not adequate. The biggest question is whether the benefits derived will warrant the additional cost. Plant personnel would welcome additional information on cement. Hillsboro has problems which are typical. They have observed during testing that a one hour difference exists between the initial and final set realized with Trinity and Universal Atlas cements. (i.e. U.A. has a longer set time). This longer set appears to result in softer pipe which is prone to board marks, pullouts and dents. Additionally they have had considerable trouble with U.A. cements causing premature blinding of the cylinder screens.

- (10) None of the plants have provisions for moisture control even though they consider this to be important. Santa Clara reported that occasionally during the winter time condensate within the silo causes the cement to ball.
- (11) None of the plants was experiencing trouble with their present source of supply. Hillsboro was desirous of establishing a second source of supply. Each plant was in agreement that the cement presently used might not be the best available; however, the only criteria for judging at this time must of necessity be past performance. St. Louis commented that at one time they suspected that too fine a grind contributed to rough bores. They have not been able to substantiate this opinion of late.

B. Silica

- (1)

<u>Plant</u>	<u>Supplier</u>
56	Del Monte
57	Penna. Glass Sand Corp., Silica Prod. Co
58	National Glass Sand Corp.
59	Penna. Glass Sand Corp.
- (2) Physical and chemical analyses are available from Quality Control.
- (3) Little if any information is available at plant level regarding the manufacturing techniques employed by the silica supplier.
- (4) Ambler and Santa Clara have their silica delivered by truck; St. Louis and Hillsboro used hopper bottom cars. All four employ pneumatic means to unload into silos.
- (5) Santa Clara and St. Louis do not presently measure surface area of silica. Hillsboro and Ambler do. They are obtaining values of 4000 ± 400 sq. cm/gm. (Blaine). All plants consider this information to be valuable but they are not quite sure how valuable. Each plant has standardized on silica which measures 90 per cent through 200 mesh. Measurements are normally taken by means of a wet screen analysis. All plants are also in agreement that they do not know of any information on particle size distribution or are they aware of whether this information is available. Hillsboro raised a question as to the necessity of maintaining the

*A supplier in 1963
with 100% purity*

-4-

*Particular size distribution
may be important to local life*

purity at 98.5 per cent. This was prompted by local circumstances in that they have no suppliers in Texas and they are forced to pay a premium for acceptable material. They would like to know whether material at the 95 per cent purity level would be acceptable.

(6) None of the plants have had much experience with different mesh silicas. They would be interested in information relating to what benefits might be gained in product quality, machine operation and autoclaving cycle. St. Louis did comment that years before when the Dalmine Process was used for the manufacture of pipe the use of 140 mesh silica caused the screen to fill up. Ambler would like to have information relating product density to mesh size.

(7) Silica is purchased in the same manner as cement.

(8) General problems at the various plants are:

a. Hillsboro

- 1 - High material cost (high freight) caused by remote suppliers.
- 2 - How much importance is attached to maintaining color (whiteness) in the product?
- 3 - Difficulty in securing data from the supplier.

b. Santa Clara

- 1 - Only one reliable supplier which results in occasional interruption of supply because of equipment renewal at the source.

c. St. Louis

- 1 - Dissatisfied with present delivery times (3 to 8 days). Have considered truck delivery but the higher unit cost may not be justifiable. Any savings incurred would be indirect.

d. Ambler

- 1 - Occasional problem with moisture in silo. This usually causes difficulties during weighing operation.

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C. Asbestos Fiber

- (1) All plants contend that the major reason for using blue fiber is to aid filtration. St. Louis implied that historical precedent must not be overlooked as a minor but significant reason for its use. While all plants were reluctant to estimate the least amount of blue that could be used, they did concede that it would be possible to run without blue at a sacrifice in production rate. Hillsboro guesstimated that the lower limit might be 20 per cent, however the other plants felt that the quantity and quality of other fibers present would dictate the lower limit to be set on blue fiber. Santa Clara reported that they had in the past run with 10 to 30 per cent blue fiber in the furnish. St. Louis claimed that difficulty with pipe bore would result from the wetter film attributed to lower blue fiber contents.
- (2) Inexpensive short grade fibers with good filtering properties were the unanimous selection of all the plants as the most acceptable fiber type for the manufacture of pipe. Long fibers resulted in frequent complaints of roping and fiber clusters. These include Cassiar A/C, C&G 3 and Griqualand A. Several of the plants noted that frequent cleaning of the impeller on the recirculation pump was a must when using fibers that tend to rope. St. Louis did comment, however, that they did not think they could run on all shorts, rather they anticipated that it would be necessary to maintain a balance between long and short grade fibers. None of the plants were very happy with Bells S4K claiming that its soft, talcous nature caused poor filtration. Ambler stated that of all the fibers, Blue was graded poorest and exhibited a wide range of properties. While satisfied with Griqualand A, they claimed Griqualand RM gave rough bores.
- (3) Given a choice the plants had the following comments regarding the fibers they would select:
 - a. Hillsboro - They would throw out Cassiar AC, Griqualand A and Bell S4K. They would limit and possibly eliminate the use of C&G 3. They would prefer to use Cassiar.AK, AX and AS. The cleaner nature of the Cassiars to some extent influences their choice.

- b. Santa Clara - They voiced no comment since they felt they were compelled to use what they were given regardless of their preferences.
- c. St. Louis - In terms of money and effectiveness they would choose Cassiar AK. Their next choice would be Cassiar AX and AC. These choices they felt were prejudiced by cost. Ignoring cost they would prefer a combination of C&G 3 and 4 and TAC. They have a definite liking for African fibers.
- d. Ambler - Their preference was for C&G 5, Cassiar AX, AK and AS.

(4) Hillsboro, St. Louis and Ambler, while convinced dust plays an important role during the machine operation, they are not quite sure to what extent this may be detrimental. Santa Clara was more specific. They stated that the fiber dust content created a mess; tearing the cyclone to pieces and in general causing poor filtration. They were especially concerned with the rock and dust content associated with blue fiber. All of the plant managers could see no reason why we paid for material (dust) which should be left at the mines.

(5) Range of fiber usage

<u>Plant</u>	<u>Percent*</u>	
	<u>Min.</u>	<u>to Max.</u>
56	10	25**
57	9.8	16.2
58	12.3	16.7
59	11	17

* Not counting fiber in fines.

** Not much above 20 per cent.

In general the plants agree that high fiber content would give better operation and a superior product. Less telescoping would be observed and more beam pressure could be applied. On the other hand, free filtration would be impeded and production slower. Water removal would be a problem and attaining desired densities might be quite difficult. St. Louis is interested in the effect of fiber content on the ability of pipe to hold its shape, especially large diameter, thin walled pipe.

Hillsboro felt that building sewer might run better with a greater amount of a low value fiber. The plants generally conceded that low fiber content improved filtration and resulted in higher production rates. St. Louis added, however, that water removal at the nip was inhibited. Ambler and Santa Clara also mentioned that pickup would be more difficult and overall operation poorer. Santa Clara pointed out that machining would be difficult and tool life shorter. They seconded Hillsboro's suggestion that the total fiber content should be increased by substituting shorter fibers. St. Louis would be interested in improved means for making fittings from cheap furnishes. It was also suggested that the manufacture of 4 inch 1500 building sewer could be improved. Delamination is quite prevalent.

- (6) The general consensus of the plant managers is that the fiber quotas make for troublesome and cumbersome operation. Since they have no choice, the quota usually becomes the blend and consequently they must compromise with a furnish which is less than optimum. Santa Clara stated that they never use less than one-half bag of fiber. The principle being - "use it up and switch."
- (7) There are some discrepancies regarding the effect of flocculant upon fiber usage. Ambler claims it does reduce fiber usage and estimated a savings of \$20,000 for last year. They added that water circulation was increased.

Hillsboro needs more data, however they believe fiber savings will be realized along with increased filtration and higher product densities.

St. Louis and Santa Clara, however, do not think that the flocculant influences fiber content claiming that the real benefits are derived from better machine operation, higher production rates and better overall pipe quality. ?

- (8) In discussing means to control fiber, it was evident that differences of opinion do exist. Ambler keeps a close check on the amount and sequence of fibers prepared each shift. Hairpins are changed on a regular schedule and buoyancy is checked daily. They were not certain a measure of surface area would be of any help, however they are trying a freeness tester.

St. Louis has been without the services of a good Quality Control man for some time and as a result, they are not exercising any specific control other than submitting samples to Ambler Quality Control on a monthly basis.

Santa Clara stated that they completely ignore R&D data preferring to rely on trial and error as a basis for fiber acceptability. They felt real progress would be made if the flexibility of the fibers could be improved. They had no feelings regarding the use of surface area as a control feature. A regular turnover of hairpins is utilized as a means of controlling preparation. They try to process the same week after week by running so long on one side of the pins, so long on the other side, then throwing the whole lot out.

Hillsboro on the other hand felt that up to date data on relative strength was essential. They have implicit faith in R&D data and use it as a basis for operation. They perform periodic checks on buoyancy, however their Quality Control personnel would like to know more about the theoretical aspects of the test since they are not sure how to use the data they accumulate. They were undecided on the benefits to be derived from surface area data.

- (9) The plants are not aware of any other fiber which might be useful in pipe. Santa Clara and St. Louis suggested that Amosite might be investigated, although they feel that it would be too brittle.
- (10) As far as the plants know, purchasing specifications do not cover fiber quality. Even though the plants practice control measures on as received fiber, they generally feel that the present setup could be improved. The blues in particular were said to vary considerably. St. Louis generally summed up the managers' feelings when they stated they would favor tighter specs only if they were in a position to do something about it.
- (11) None of the plants was experiencing specific problems with fiber, however all voiced the opinion that fiber variability could be reduced, contamination decreased and material handling and mixing

equipment improved. Santa Clara's biggest difficulty centered on their attempts at blending long blues. They want the cheapest fibers they can get and they will make them work. Hillsboro also complained about fiber roping. They along with Ambler indicated that fiber conveyance could be improved. St. Louis needs more shorts for building sewer and air duct.

D. A/C Fines

- (1) The primary source of fines is as follows:

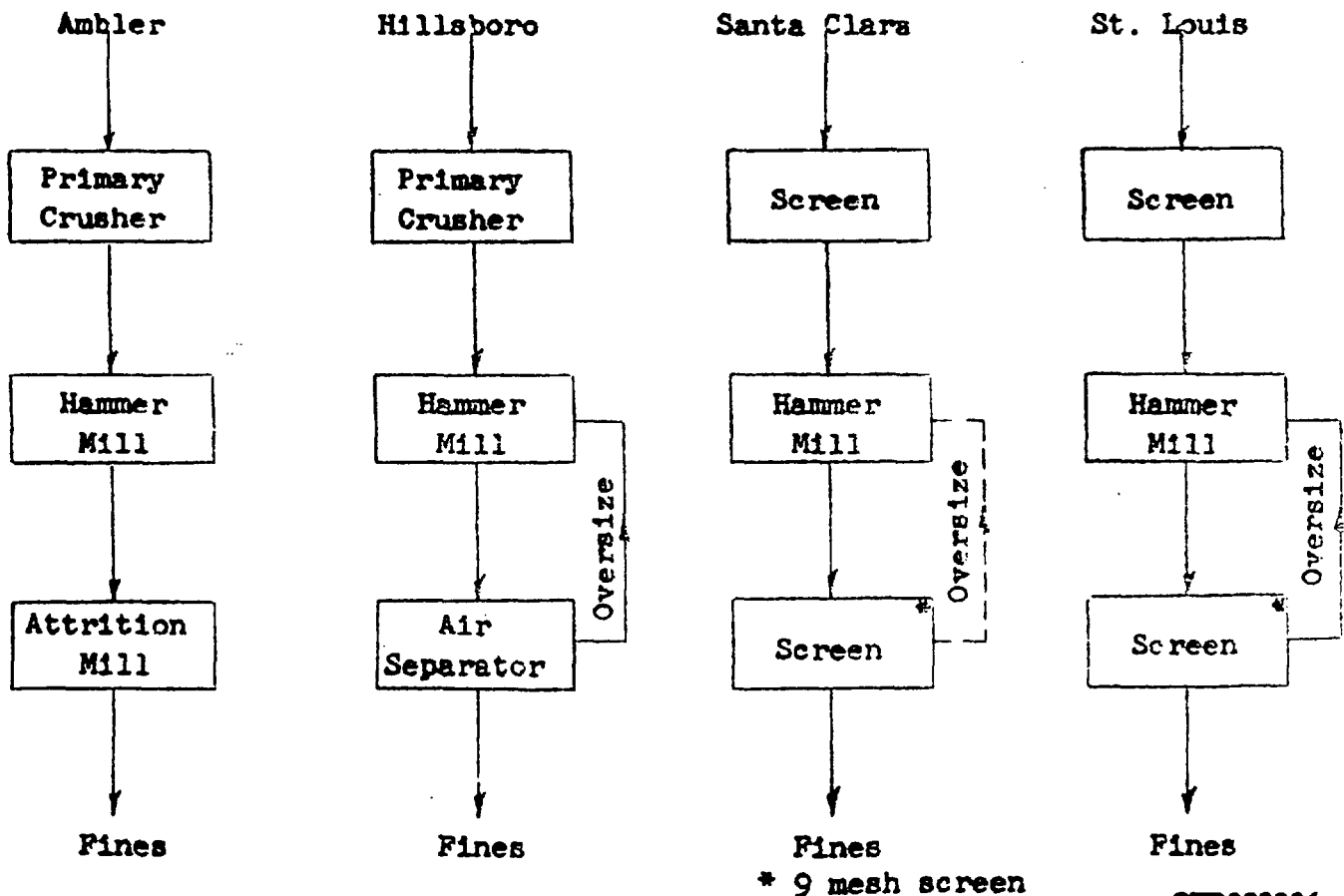
Ambler: Lathe turnings, hard scrap

Hillsboro: Hard waste, lathe turnings

St. Louis: Lathe turnings

Santa Clara: No effort to save any particular material; pick up what scrap is available when fines must be prepared.

- (2) Method of preparing fines.



With the exception of Hillsboro, which utilizes air separation, none of the plants practices any control worth mentioning.

- (3) No attempt is being made to determine particle size distribution at any of the plants. Hillsboro has on occasion made a screen analysis using the RoTap apparatus. Their results were not in agreement with values previously supplied by R&D and Engineering. Ambler uses a calibrated thumb to avoid "tomato seeds" in the fines' product.

- made or shovel full*
(4) At ~~all~~ the plants the fines are metered out by weight and introduced into the system at the cement scale or screw. The exception is Hillsboro where the fines are placed in the bucket elevator that handles cement and silica to the primary mixer. In general, the accuracy with which this material is controlled is not great.

Weighted and

- (5) The general opinion regarding the effect of fines on the product was quite diverse. Hillsboro thought they were "not worth a damn" and at values above six (6) per cent, the density suffered. They stated that at low fiber percentages they might be of some help but in general the addition of fines was detrimental to filtration. *The preparation has been reduced.*

Santa Clara sided with Hillsboro in that they also felt that fines were of no help. They suggested that the only real advantage to be gained from using them would be to cheapen the furnish.

St. Louis on the contrary was in favor of using fines and if they had a choice, they would continue to use them. They contended that fines improved filtration and gave more uniform coverage on the cylinder wire. Their machine operators believe that better overall operation results from using fines. They did feel, however, that an effectiveness of 5 was not really realized. At present they are using 20 per cent in building sewer.

Ambler stated that in addition to reducing cost, real benefits were derived from improved filtration and better overall machine operation.

All of the plants used product strength and density along with machine operation as criteria for evaluating the effect of fines in A/C pipe.

- (6) The plants with the exception of Santa Clara would pick the Hillsboro setup as the preferred method for fines preparation. (i.e. air classification). St. Louis felt that screens were inefficient and too susceptible to blinding. Hillsboro reported they were satisfied with the present setup. The initial trouble they experienced with the hopper discharge has been overcome with the installation of a new live bottom.

If it was not for building sewer, Santa Clara would throw out all fines. They did concede, however, that the inclusion of fines in the furnish did help in air lancing thin wall material.

- (7) Hillsboro is not experiencing any specific problems with A/C fines, although they did mention that hard particles are always bothersome. Santa Clara did not comment when questioned about specific problem areas.

from view 2

St. Louis has serious waste disposal problems and is rapidly running out of room. This is tied to the lack of adequate grinding facilities for waste pipe. They presently use a bulldozer to crush pipe.

Ambler feels that the present fines are too coarse and uneven in particle size. They showed concern over the reliability and variability of supply, pointing out that fines were essential for manufacturing building sewer. Mention was also made of the relative merits of recovering only the fiber.

E. Chemical Additives

- (1) Chemical additives presently in service at the various plants are:

Hillsboro - Separan NP-10
Santa Clara - Separan NP-10
St. Louis - Jaguar 550
Ambler - *

had at present in vats

* Note: At time of inquiry Ambler was having difficulties with the recently installed two vat system and they had suspended use of any flocculant. Prior to this time (one vat system) they were using Separan.

St. Louis felt they had inconclusive evidence regarding the use of Separan, due to improper metering of material.

- (2) All of the plants add the flocculant to the system at the back of the spreader trough via the makeup water. Usage at each plant is as follows:

*Hillsboro
to Savalls
now.*

Hillsboro	1/8 to 3/16 lb/ton
Santa Clara	3/16 lb/ton
St. Louis	0.75 lb/ton
Ambler	0.8 lb/ton (1 vat operation)

Constant volume or metering pumps are universally used for control.

- (3) Benefits in machine operation derived from using flocculant were generally conceded to be improved filtration and faster, smoother production rates.

Ambler, Hillsboro, and Santa Clara reported cleaner savalls when using chemical additives. St. Louis has always had a clean savall and can see no improvement with the addition of flocculant. More specifically, Ambler has noted a reduction in the solids content of the overflow, Hillsboro claimed that the solids are returned to the system quicker and Santa Clara indicated that the entire system is cleaner. Santa Clara cautioned that it is not advisable to use flocculant when the machine is not running.

*Start of
with
machine*

Each of the plants said that better product quality resulted from using flocculant. St. Louis added that it extended trouble-free tonnage (i.e. extended felt life).

- (4) The plants suggested other benefits which a chemical additive might provide. These include:

Hillsboro - an aid to water removal on felt.
Santa Clara - consistency control.
St. Louis - aid to keeping bores cleaner and smoother.

- (5) Other worthwhile additives suggested for investigation include:

- Ambler - wet strength agents similar to those used in paper industry.
- St. Louis - no specific materials but always open to new ideas.
- Santa Clara - has only looked at two types (Jaguar and Separan); thinks we should look at all of them.
- Hillsboro - everything and anything; would like to have optimum but are afraid to try new types. Experience with Aerofloc has shown that it is much harder to control.

(6) The plants were in accord that flocculant increases film thickness and gives a more uniform ply. Hillsboro contends that water removal at the vacuum box is improved. Generally lower water contents were reported by all the plants, however none indicated that the vacuum requirements were reduced. Ambler added that higher speeds and pressure could be employed.

(7) Specific problems or questions regarding the use of flocculant were:

- Hillsboro - would like to know the optimum technique and location for adding flocculant to system. Also they are interested in the performance in each of the vats for a two vat machine. What effect flocculant has on the press operation and the vacuum boxes was desired.
- Ambler - at the time of tour they were having difficulty with using flocculant in a two vat operation and they were interested in information related to effect caused by different consistencies in each vat and their relationship to each other.
- St. Louis - They stated that better equipment was needed to regulate the addition of small amounts. Information is also desired on the proximity of the insertion point to the cylinder vat.

*Less maintenance on equipment
to cut with improve the use
of these areas*

Santa Clara - They went on record that they are always open to practical suggestions and added they were not satisfied with the present setup. Where the flocculant is added is tricky and although they have tried other methods (i.e. sprays, shower pipes, etc.), the results have not been satisfactory. They are convinced that it should be added at a spot as close as possible to the point of use. Consequently they feel improvements can be made. However, they did caution that unless used properly and reliability is established, more harm than good could result from random changes

F. Rubber Rings

- (1) Storage conditions for rubber rings at the plant are:

Ambler - Open bins located in cool, dark portion of plant. Temperature is somewhat lower than ambient.

St. Louis - Open bins in separate room within plant area. Temperature is slightly lower than ambient and uncontrolled.

Santa Clara - Stored in open bins at front of plant. Ambient temperature normally encountered. Reported large turnover.

Hillsboro - Stored in bins in air conditioned room.

- (2) Planning and inventory personnel or the office manager control ring inventory either by set maximum and minimum control points or storage requirement limitations.
- (3) The plants are presently satisfied with Methocel as a lubricant. There are no major problems, however several comments are worthy of note. St. Louis has one individual who does all of the adhesive mixing. They premix all of the material prior to use and contrary to the specifications, it works well. Encrustation of the Methocel on pre-belled pipe in the yard has made it difficult to determine whether fishmouthing has occurred.

Santa Clara mentioned that the addition of soap (i.e. approximately 2 quarts of soap to 50 gallons of adhesive) to the Methocel is definitely beneficial in terms of assembly effort.

Hillsboro complained that the application of the Methocel in the plant was sloppy and contributed to slippery conditions. They also mentioned that they were hearing reports from the field that the lubricant was hard on the men's hands. These complaints seemed to be localized in the Texas area.

- (4) With the exception of Hillsboro, none of the plants were experiencing specific problems with the rubber rings or lubricant. Hillsboro was having fish-mouthing problems with OR rings on 4", 6" and 8" pipe.

II. Fiber Preparation

1. Each of the plants agreed that improvements could be made in the present method of opening fibers and they are open to practical suggestions.
2. While not particularly familiar with other specific techniques the plants are interested in new methods of opening fiber.
3. The plants were quite doubtful that the mines would be able to supply more open fiber. St. Louis and Hillsboro would like to see some improvement made in the blues. Several people mentioned a fluffer as a way of breaking up fiber wads to improve the blending operation.
4. Under the present setup for preparing fibers the plants concede that some of the fibers are being worked too much and others too little, and it would be desirable to prepare the individual fibers, especially the blues. However, they feel that if the fibers were prepared in this fashion it would be impossible to blend them at a later stage.

5. Willow Operation

<u>Plant</u>	<u>56</u>	<u>57</u>	<u>58</u>	<u>59</u>
Speed, RPM	1175	4800 (?)	1200	1180
Rate of Feed, lbs/min.	67	64	65	70
No. Hairpins Possible	--- 48	48	48	48
No. Hairpins Used	18	18	24	18
Changeover Cycle	Complete Set @ 2 Wks.	1 Flight @ 2 Wks.	1 Flight @ 1 Wk.	Complete Set @ 4 Wks. then every 2 Wks.
Sluggers	None	None	None	6 (Top)

-16-
Same as other plants
Now 24 pins

Miscellaneous

At Hillsboro it was noted that the willows were running quite hot. This could conceivably be attributed to the high ambient temperatures and the closed system on air recirculation. Santa Clara stated that using sluggers resulted in additional preparation which they thought was already too great. They felt that increased production was more essential. St. Louis defended the use of sluggers on the basis that it eliminated hairpin breakage. They added that a fan blade was utilized in every position on the bottom. Ambler commented on the advisability of having a vibration shutoff in case of accidental inclusion of scrap.

Same as others

6. The plants reported that the fiber mixing cycle depended on the rate of usage at the machine and consequently varied according to what was being run. Normally the munsons are run half full with the fiber charged on a sequential batch basis.

7. Specific problems and comments on fiber preparation were:

Ambler - Would like to have more information on mixing as a whole.

Hillsboro - The present setup is a closed, clean system in which weights can be controlled. It may be necessary to change filling and dump cycle times to increase output. As it is now, you must wait on slowest cycle (e.g. fiber slow on discharge, cement slow on fill).

good for 11 tons output

Santa Clara - Building sewer runs so slow that fiber fluffs in munsons. As a result, mixing cycle is regulated and discontinuous. All other furnishes are mixed continuously.

Some improvement should be made in the munsons to reduce the maintenance now required

St. Louis - They are interested in improving the fiber batching operation on No. 1 machine and they cautioned that they are reaching the limit on No. 2 machine mixing system. Space limitations in and about the fiber batching areas makes it necessary for them to intermix bags of fibers on the pallets. This results in higher labor costs.

excess for treated fiber

(In general they commented that screw conveyors and bucket elevators are poor means for transporting fiber, particularly treated fiber (quote "for the birds").

III. Primary Mixing & Stock Preparation

Primary Mixing

1. <u>Plant</u>	<u>Type of Mixer</u>	<u>Size</u>
56	Munson	200 cu.ft.
	Munson	300 cu.ft.
57	Munson	200 cu.ft.
	Munson	300 cu.ft.
58	Munson	120 cu.ft.
	Ribbon Mixer	----
59	Munson	200 cu.ft.
	Ribbon Mixer	----

The plants did not think that there was any significant relationship between batch size and horsepower input since the units are run half full and they could not re-collect any instances where the munsons drew more than a normal power load.

2. <u>Plant</u>	<u>Batch Size</u>	<u>Thru Put</u>	<u>Mixing Cycle</u>	<u>Feed Rate</u>
56	2300	On Demand	On Demand	On Demand
57	1975	On Demand	On Demand	On Demand
58	----	On Demand	On Demand	On Demand
59	2200	On Demand	On Demand	On Demand

At the
cyclone
corrected

-18-

3. Problems with the primary mixing system are mainly mechanical. Santa Clara mentioned minor maintenance problems with the small munsons, usually the flights. Hillsboro reported occasional block ups between the willow mill and the cyclone. Plugging of the rotor valve has also been a minor problem with the trouble always occurring at the tail end of a batch.

All of the plants think that the mixing system has not kept pace with the production rate pointing out that the limiting capacity of the mixing system is being rapidly approached.

W2 know
want to
do to
increase
turnover

4. Changeover times for product mix was reported to be from 15 to 120 minutes depending on whether the furnish effectiveness was being increased or decreased. The time required is mainly dependent on purging the wet portion of undesirable furnish rather than the dry mix system.

Stock Preparation

1. At Hillsboro and Santa Clara stock is prepared in a wetting screw which discharges directly into the recirculation pump pit. Ambler and the No. 2 machine at St. Louis use a semi-wet screw which discharges into a stock chest and subsequently to the recirculation pit. The No. 1 machine at St. Louis differs from the No. 2 machine in that the discharge from the stock chest goes directly to the cylinder vat. Those plants still utilizing a stock chest run with as little material in the chest as possible and generally expressed a desire to eliminate it completely.
2. Water for stock makeup comes from the bottom of the dirty water savall at Hillsboro and Santa Clara. St. Louis and Ambler use white water in semi-wet screw and dirty water in makeup tank or recirculation pit. All plants depend on the system (i.e. wetting screws, stock chest, recirculation pump) to effect intimate blending of dry furnish and water. Little information as to per cent solids at this stage was available. Ambler guessed 12 to 18 per cent.
3. All of the plants contended that the cement-water contact time was low, in the neighborhood of 5 to 15 minutes. Based on the system sizes observed and the consistency of the stock and the output per hour reported, there exists some doubt as to the validity of the times reported.

CTD029910

4. Rollup time is the basic means for controlling stock consistency at all plant locations. Santa Clara felt there was definite need for a controller with high reliability and simple operation and maintenance to measure and control stock consistency. Hillsboro employs a rheostat to speed up or slow down discharge of solids to wetting screw.

5. The quantity of stock reported as being recirculated at each plant was as follows:

<u>Plant</u>	<u>Recirculation Rate, GPM</u>
56	? (Large Amount)
57	up to 4000 GPM
58	at least 50%
59	? (Large Amount)

The method of addition of virgin stock was covered under item No. 1 - Stock Preparation.

6. Specific comments and problems brought up by the plants were:

Ambler - Would like to know more about what changes are occurring in the stock and machine operation at any given instance. They felt a step in this direction would be a reliable measure and control of consistency.

St. Louis - They are most desirous of eliminating the stock chest on No. 1 machine.

Santa Clara - They mentioned that a consistent, uniform overflow was essential to a good pipe profile or shape. In discussing the wetting screw they added that almost all of the water going to the machine is added at the screw. Time and again they stressed the need for rugged, low maintenance controls and systems.

Hillsboro - They are interested in the time-constant concept. That is, they would like to know how long does it take for material (in all phases of the operation) to get where it is going and what actual or implied changes are occurring at any one time. Along these same lines they felt that improvement could be made in making a more uniform stock which would help to smooth out consistency deviations during rollup. They reported block-ups of the wet feed screw. Mention was also made of varying the head in the recirculation pit to control tight pipe and to regulate cement hydration time. The stock con-

Corrected

CTD029911

sistency in the vats was estimated at 6 to 10 per cent solids with the solids in the distribution trough running from 0.5 to 1 per cent higher.

IV. Water System

1. Fresh Water

Plant: No. 56
Source: Borough of Santa Clara
Where Added: Broughton Showers
Amount Added: Approximately 42 GPM.
pH: 7.4
Hardness: 226 ppm as CaCO_3
Chemical Analysis Available: Yes
Is makeup treated: No

Plant: No. 57
Source: City of Hillsboro
Where Added: Ditch to Settling Basin
Amount Added: ? - Controlled each shift by testing alkalinity of system. Try to keep alkalinity about 1200 ppm as CaCO_3 . Values over 1800 ppm @ CaCO_3 results in soft sloppy pipe.

pH: 7.8 to 8.4
Hardness: -----
Chemical Analysis Available: Yes
Is makeup treated: No. (only in settling basin).

Plant: No. 58
Source: K&M Plant 1 Reservoir
Where Added: Savall System, Broughton Showers
Amount Added: 25 to 50 GPM.
pH: -----
Hardness: ----
Chemical Analysis Available: No
Is makeup treated: No

Plant: No. 59
Source: City of St. Louis
Where Added: Fill tanks, broughton showers, pump seals
Amount Added: ----
pH: 6
Hardness: 114 ppm as CaCO_3
Chemical Analysis Available: Yes
Is makeup treated: No

2. White Water

Plant: No. 56
Source: Top of Clear Savall
Where Used: Felt Showers
Amount Generated: --- (.093" cat eye nozzle)
Percent Solids: ----

Plant: No. 57
Source: Overflow Dirty Water Savall *Clear water Savall*
Where Used: Felt and cylinder Showers, Vickery Cleaner,
Vacuum Boxes.
Amount Generated: ----
Percent Solids: ----

Plant: No. 58
Source: Clear Water Savall
Where Used: Mixing Screw, Felt Showers
Amount Generated: ----
Percent Solids: ? (guesstimate 0.2%)

Plant: No. 59
Source: White Water Savall
Where Used: Wetting Screw, Felt Showers, wash down &
Circulated through Vacuum Boxes.
Amount Generated: ----
Percent Solids; ----

3. Dirty Water

Plant: No. 56
Where Used: Semi-wet Screw *not checking with write up*
Amount Generated: ----
Percent Solids: ----

Plant: No. 57
Source: Bottoms of Savall
Where Used: Wetting Screw & Makeup Water
Amount Generated: Less than 500 GPM
Percent Solids: ----

Plant: No. 58
Source: Cylinder Discharge to Savalls
Where Used: Makeup
Amount Generated: 800 GPM to Savall
Percent Solids: 1.2

Plant: No. 59
Source: Dirty Water Savall
Where Used: Recirculation Pump @ #1 Makeup Tank @ #2
Amount Generated: ----
Percent Solids: ----

4. Shower Water:

Plant: No. 56
Source: Fresh Water and White Water
Where Used: Fresh Water used in Broughton Showers White
Water used in Felt Showers.

Amount Used: ----
Type of Showers: Broughton for Cylinders.
Pipe with Cat-Eye Nozzles for Felts.
Shower Pressure: Broughton @ 100 psig & 60°F.
& Temperature: Cat Eye @ 60 to 75 psig & 90°F.
Shower Cleaning Cycle: Broughton only when plugged.
Cat-Eye builds up on outside and is
cleaned several times each shift.

Plant: No. 57
Source: Shower Savall
Where Used: Felt and Cylinder Showers
Amount Used: ----
Type of Showers: Straight Stream Showers with 0.093"
opening for cylinders. Cat-Eye shower
with fan-type 0.093" opening for felts.
Shower Pressure
& Temperature: Both showers @ 100 psig & 95 to 105°F.
An appropriation has been approved for
a 250 psig felt shower.
Shower Cleaning Cycle: Quite a bit of cleaning, at least
several times each shift.

Plant: No. 58
Source: Fresh Water & White Water
Where Used: Fresh water used for cylinders and felt
rinse, white water for felt cleaning.
Amount Used: ----
Type of Showers: Broughton for fresh water systems.
Pipes with cat-eye nozzles for white
water systems.
Shower Pressure
& Temperature: Both showers @ 100 psig. Fresh water
@ approximately 80°F. White water
similar to temperature of system, 100
to 105°F.
Shower Cleaning Cycle: Broughton Showers cleaned only
when plugged. White water showers
cleaned once per week, screens cleaned
daily.

Plant: No. 59

Source: Fresh Water and White Water

Where Used: Fresh Water used for Cylinder, White Water for Felts.

Amount Used: ----

Type of Showers: Broughton for Cylinders, Cat-Eye Nozzles in pipe for Felt Cleaning. Cat-Eye Nozzle has 0.093" opening.

Shower Pressure

& Temperature: Broughton @ 100 psig & 90 to 100°F. Cat-Eye Showers @ 40 to 55 psig @ 90°F.

Shower Cleaning Cycle: Felt Showers cleaned two times each shift, the Broughton shower once each shift. Both are given good cleaning once every 24 hours.

5. When questioned about the Savall system, all of the plants stated that the conventional cone type Savall did a better job of clarifying the top water. The major disadvantage seems to be that they are harder to clean. St. Louis wondered whether or not the water system was too big. Hillsboro complained that they were required to heat all their water in a tank located outdoors and this was quite time-consuming and uneconomical during the winter. They also questioned the feasibility of using this same tank for water treatment purposes. Santa Clara recommended the use of rubber hose on the savall discharge to prevent block-ups.
6. The relative merits of operating with an open or closed system was discussed with the plants. Santa Clara had no comment since they had never operated with a closed system. Hillsboro said there were no benefits to a closed system other than water conservation and were much in favor of an open system claiming a supply of good, fresh water improves the operation. Ambler reported that prior to using the Broughton showers they operated with a closed system and foaming in the Savalls was prevalent. The magnitude of foam seems to change with the seasons of the year and was particularly bad for one to two shifts following a felt change. They concluded by stating that the Broughton showers virtually eliminated this foaming condition. St. Louis said an open system created a problem in maintaining water temperatures. Since it does not take them longer than one hour to saturate a fresh water system with respect to alkalinity, they felt the use of additional fresh water would only tax further the already inadequate heating media.

*for the
Hillsboro*

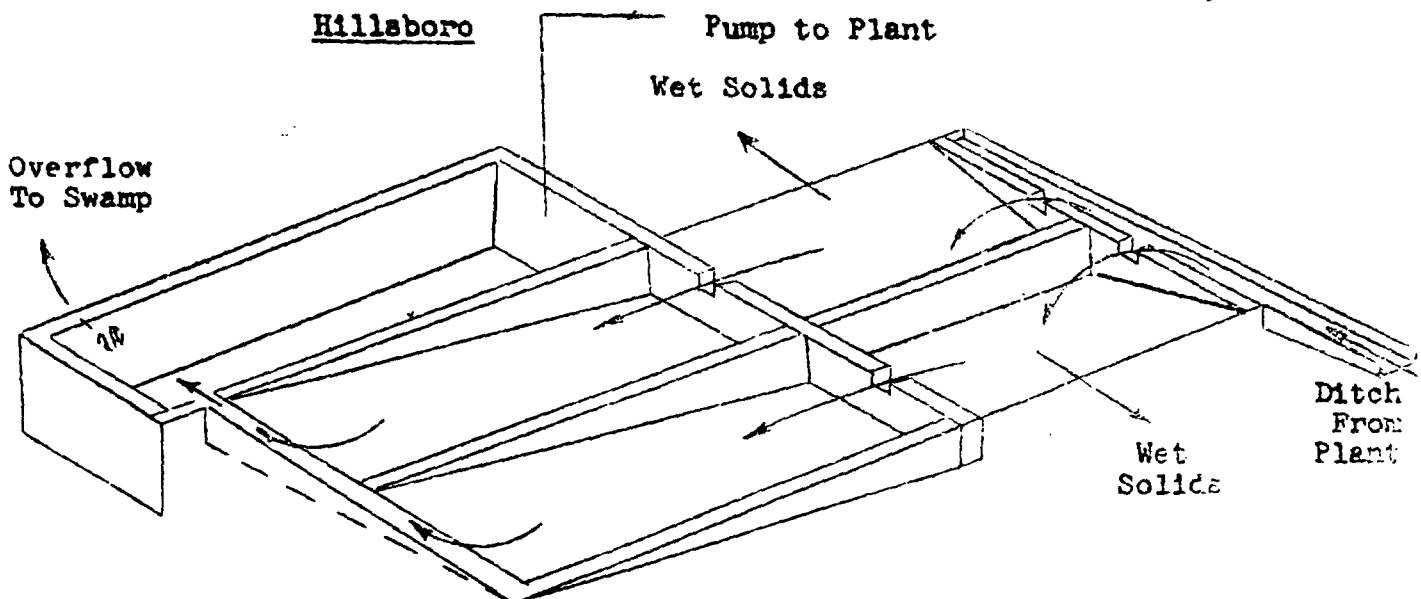
it does if fresh water has carbonate

7. St. Louis stated that the water source does not contribute to felt and screen plug up. Ambler suspected that it did, Santa Clara had no doubt that it contributes and Hillsboro was firmly convinced that it did. Ambler would like to know more about the composition of the material that builds up on the rolls, screens and felt. They have had problems removing this material in the past.

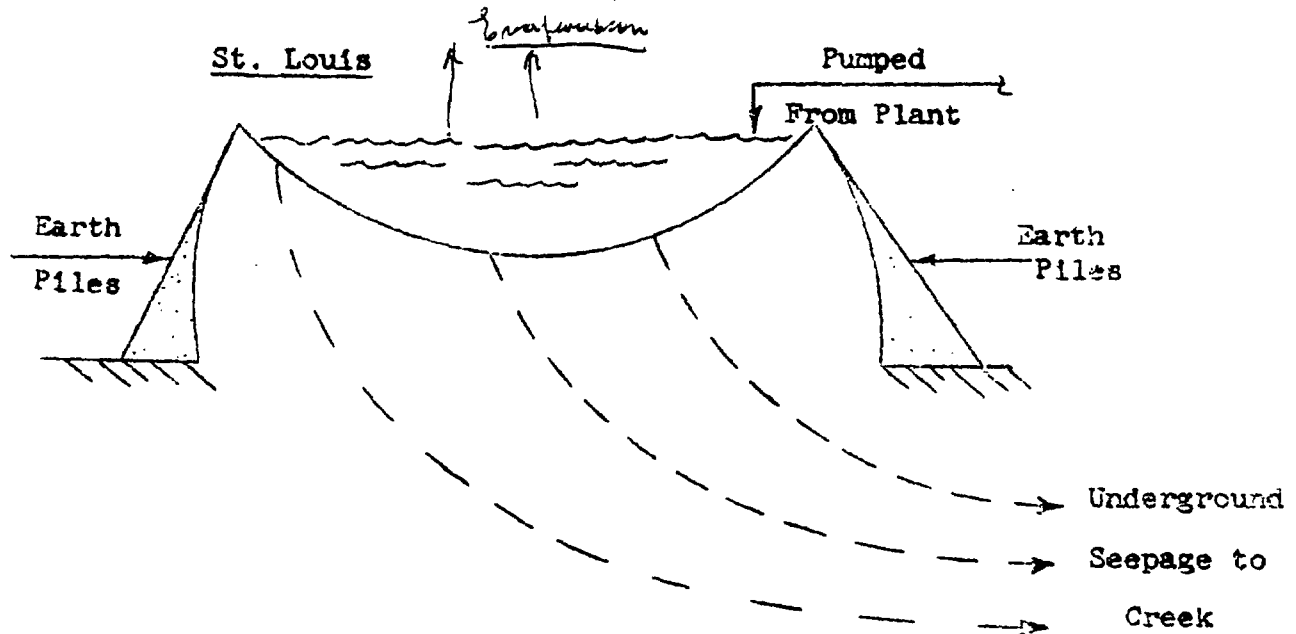
8. Vacuum System Water

With the exception of Hillsboro which uses lake water, the plants use fresh water for the seal on the vacuum pumps. This water is normally not returned to the system. The water which is extracted from the felt along with white water which the plants use to keep the vacuum boxes clean (i.e. by continual flushing) is returned to the dirty savall. Hillsboro stated that the tail pumps and lines to the separators are too small. ~~Rubens was reported as using diaphragm pumps for this service.~~ St. Louis also indicated that additional work should be done on separators and improved means for maintaining the vacuum seal.

9. The wet waste disposal facilities at the various plants are schematically shown below. Comments on their operation and merit are included in the notes.

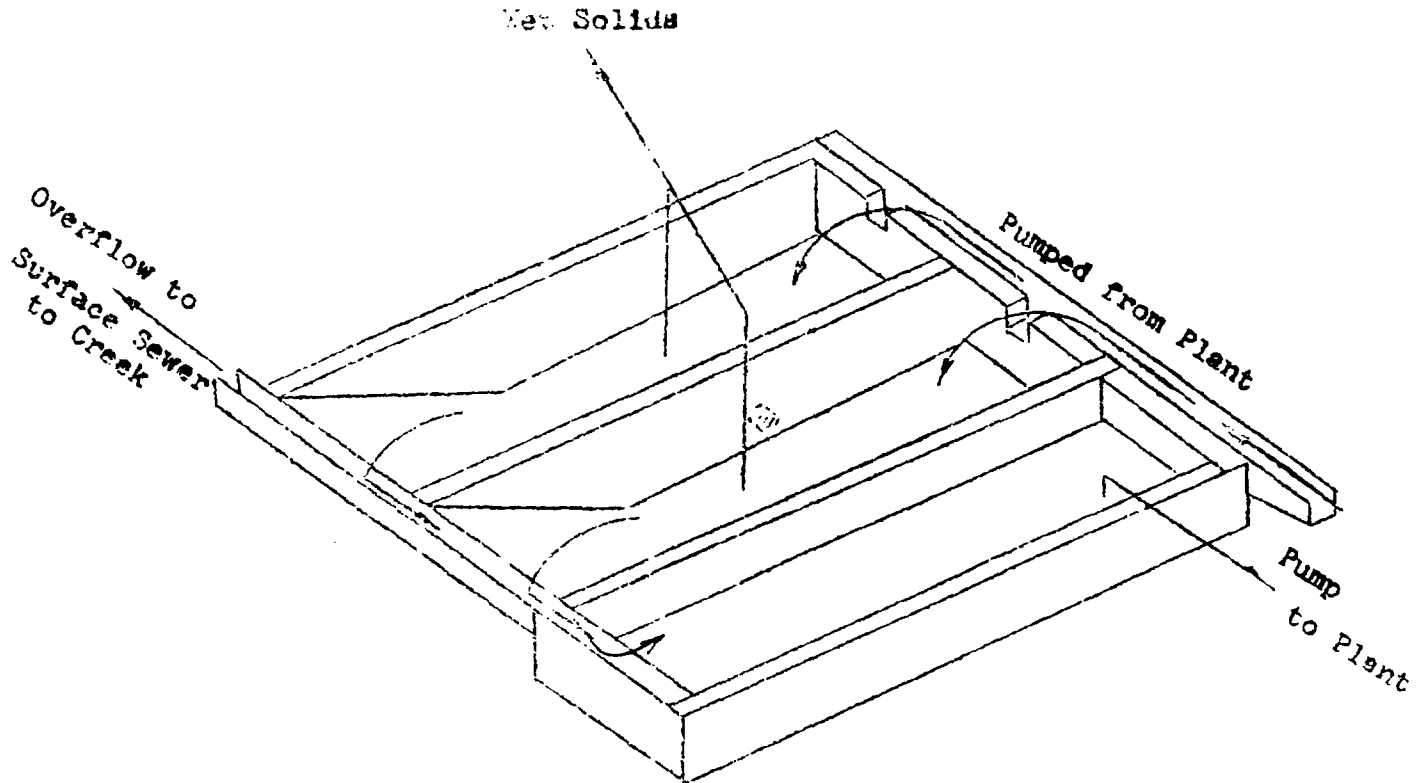


Spillage to the drainage ditch feeding the settling basins depends on the alkalinity of the system. Normally the spillage is continuous and amounts to approximately 35 GPM. When one half of the disposal system is filled, it is taken off stream and the surface water pumped into the other based which has remained in operation. The wet solids are then removed by means of a front end loader and trucked to a quarry two miles away. Hillsboro stated that they were planning to put in earth retention dams to further dry the solids prior to removal. At present they have no formal stream pollution program even though the state of Texas does have pollution laws. Some question was raised as to whether solids entrained and dissolved in the water overflowing to the swamp might be detrimental to cattle. They are not sure whether further treatment is required.



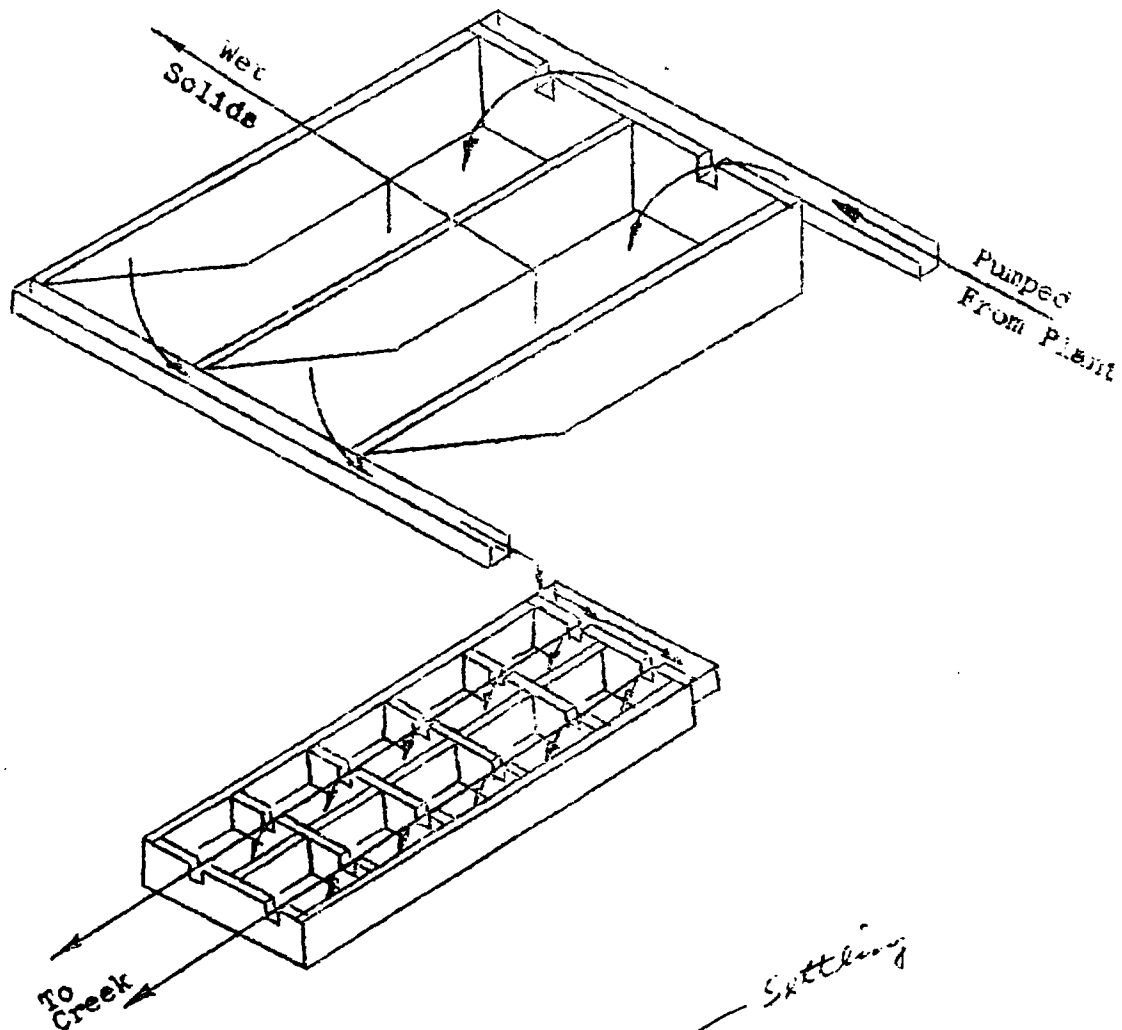
St. Louis has no specific program for stream pollution. Their disposal facility simply consists of pumping the solids-laden water to an open pond formed by earth embankments and allowing the solids to settle out. The water is either lost by evaporation or underground seepage to a nearby creek. Heavy rainfalls can cause problems. Periodic surveillance of the ditch is made to minimize solids loss.

SANTA CLARA



Waste water containing entrained and dissolved solids are pumped from the plant to the settling basins where the solids settle out and the clear overflow is directed to a clear water reservoir and then returned to the plant. Excess overflow is diverted to a surface sewer leading to a creek. The primary basins are cleaned every six months. Wet solids which are removed are spread out and allowed to dry prior to being taken to the dump. Santa Clara has no specific stream pollution program at the moment. They recommend large shallow basins as the preferred method for solids removal. In the past they have had some problems with waste acid originating upstream in the creek resulting in precipitation upon contact with the waste water effluent overflowing from the settling basins.

AMBLER



Ambler presently has no formal stream pollution program. Water with entrained and dissolved solids is pumped from the plant to either of the two primary settling basins where the bulk of the solids are dropped out. The clear overflow then passes through a series of filter beds for further clarification prior to discharging the waste water to the creek. No special treatment is involved and clarification and denuding is dependent on settling alone. The effluent

amounts to approximately 25 to 50 gpm. The basins and filter beds are periodically drained and the wet solids removed and hauled to the dump. Ambler also mentioned that a better means for drying these solids is needed. Some question was raised as to the feasibility of recovering the fiber by air flotation.

10. Other specific problems mentioned during conversations on waste disposal were as follows:

Ambler said that when the savalls are dumped, which is about once a week, they have trouble with the settling basins overflowing. Removal of the wet sludge was an annoying problem at all of the plants. Hillsboro in addition to the sludge problem has water problems in general. These problems are twofold in nature; (1) conservation of water (e.g. Rainfall = 33", Loss by evaporation = 53") and (2) chemical composition and hardness of water. The water supply was reported to have caused boiler tube trouble. Santa Clara was not experiencing any trouble with waste disposal at present. They thought a closed system would solve everything, although they were quick to admit that this is not an easy solution. St. Louis would like help in all aspects of waste disposal that includes dry as well as wet material.

*We have
higher
water
pressure*

V. Machine Operation

(1) Speeds in General:

Plant	56	57	58	59
Felt Speed, fpm	85-110	85	85	90-100
Agitator Speed, rpm	112	150-200	130	115
Schneider Liner				#1. #2.
a. Stroke, inches	18	20	18	20 24
b. Strokes/minute	18	12	16.7	13.3 15
c. No. of Paddles	5	5	7	7 7
d. Spacing, inches	--	--	12	-- --

Note: Santa Clara commenting on felt speed thought that for optimum running it was best to start a new felt fast (110 fpm) and finish low (85 fpm). This generally will increase roll-up times towards the end of felt life, however they were of the opinion that the necessity of maintaining roll-up time constant was mainly a dictate of management. In regard to the Schneider Liner with the exception of improving flex in sewer and 4 inch pressure pipe Santa Clara did not feel it was needed.

Hillsboro mentioned that the felt speed can be varied to position the slug within the pipe. They also stated that for thinner consistency stock they may reduce the agitator speed to 130 rpm (i.e. for 4 inch pipe).

Ambler said that increasing the agitator speed caused crowned pipe to flatten out. St. Louis only uses the Schneider Liner on 3 through 8 inch sizes.

- (2) No detailed information on type, speed, hp., etc. on the various pumps used throughout the plants was obtained during the plant tour. Specific questionnaires will be forwarded to the plant engineer when required.
- (3) Vacuum:

Ambler's vacuum setup consists of three boxes. The first is located prior to the first vat facing the felt face; the second is an inverted box located between the vats on the back side of the felt; the final box is located midway between the pickup and the mandrel on the back of the felt. Control is reported as not good and the vacuum drawn varies. Values are measured by means of a gage located on the main separator. The boxes are rectangular with a face plate consisting of alternating one inch slots and bars. The inverted box has smaller openings.

At St. Louis both single cylinder machines have two boxes. They are located prior to the cylinder and midway between the pickup and the mandrel. Measure and control is by gage only and the amount of vacuum drawn depends on what is being run. An average value is 12 inches of Hg. The boxes are 12 inches wide with conventional one inch openings. On machine No. 1 both boxes are tied into a vacuum pump. The situation on No. 2 machine is somewhat different. The box prior to the cylinder is connected to a blower while the second box is hooked to a vacuum pump.

The setup at Hillsboro has four vacuum boxes arranged as follows:

- a. 1 prior to no. 1 cylinder.
- b. 1 inverted box between vats.
- c. 2 boxes between pickup and mandrel.

They only use one of the boxes located between the pickup and the mandrel. Control is exercised by pinching back on a wafer valve with the resultant change

measured by a gage located on the tank and boxes. The vacuum drawn is kept below 10 inches of Hg. and varies. It is very low on a new felt and up to 10 inches of Hg. on an old felt. The vacuum drawn is moderated to prevent blinding the felt in the nip and to minimize drag likely to alter the proper top and bottom felt speed differential. Heavy chattering has resulted with high vacuums and every precaution has been taken to eliminate this condition, including singeing the felt on the back side. The vacuum boxes are 14 inches wide with a flat, slotted cover with 1-1/2 inch openings.

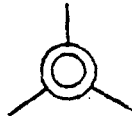
Santa Clara has a setup similar to Hillsboro with one exception. They have only one box between the pickup point and the mandrel. Control is poor and values are recorded either by a gage or a chart. Values normally run 9 inches of Hg. With the exception of the inverted box which has a semi-circular cross section, the boxes are rectangular with slotted covers. Santa Clara mentioned that the boxes are cleaned once a week.

- (4) There are two basic types of agitators in use throughout the plants. They are:

American Style



English Style



At Ambler they have two English type agitators in each vat. The direction of rotation is the same as the cylinders. They do not use the agitated weir prior to vat No. 2 but let the stock go directly from the spreader trough to the cylinder vat.

Hillsboro has two agitators per vat, one American style and one English style. The weir upstream of vat No. 2 has an American style agitator. They stated that they prefer the American style on the basis that better agitation is realized. The ends of the agitators are

shrouded for 10 inches to minimize turbulence near the ends and to prevent poor fiber distribution. A comment was dropped that precautions are taken to keep the agitators as well as the felt idler rolls in balance at all times.

St. Louis has two agitators in each vat, one agitator in the weir for No. 1 machine and two agitators in the weir for No. 2 machine. All agitators are of the American style. The vat agitators are shrouded for 8 inches on the end and clear the cylinder by approximately one-half to three-quarters of an inch.

Santa Clara has two agitators in the vats and one in the weir prior to vat No. 2. All are American in style and rotate in the same direction as the cylinders. The ends of the vat agitators are shrouded for almost 24 inches and clearance between cylinders and the agitator is one inch or less. They felt that improvement in the agitator is needed.

Several complaints were voiced against chain-driven units. The consensus of opinion was that independent or direct coupled drives performed much better. Hillsboro has already taken steps to incorporate this change on their wet machine.

(5) Comments regarding the merits of the Vickery Cleaner were as follows:

- a. Ambler - They would like to have one.
- b. Santa Clara - A very worthwhile investment which pays for itself in terms of extended felt life. As long as water plates are good the unit functions well. Replacement of these plates is frequent and maintenance costs high. Better cleaning techniques for unit are needed. Each pump system handles two units (i.e. vacuum box and cleaner).
- c. St. Louis - They reported that they can't do without them and that prior to their use the top felt got dirty when running large diameter, heavy walled pipe. The only alternative without the Vickery was to slow down. It is also helpful on small pipe and felt life in general has been greatly extended. Five shoes with a L-6 Nash pump

are used on machine No. 1 and 7 shoes with a 2-7 Nash pump on No. 2 machine. St. Louis also mentioned that the cycle of the Vickery cleaner might be speeded up.

d. Hillsboro - Hillsboro also considered the Vickery cleaner worthwhile. When using an Albany woven top felt, they found it essential; with a Hardman 100 per cent synthetic felt, they ~~can not use water~~ and employ only the vacuum portion of the unit. They commented they might like to see one tried on the bottom felt.

- (6) All of the plants operate with vat temperatures between 90° and 105°F. They maintain that the higher temperature aids filtration. Ambler added that they felt the hotter water speeds set time. At low temperatures the pipe was reported to be soft and prone to denting. St. Louis stated that 80°F. seemed to be the cut off point. None of the plants has had experience with higher temperatures. Hillsboro even though they had reservations regarding higher temperatures wants more information in this area. Specifically they were interested at what temperature you kill cement. St. Louis mentioned that operating temperatures are a real problem during winter time.
- (7) Little information on the couch roll and its optimum use was available at the plants. Physical dimensions and properties may be obtained by writing to the plant engineer. Generally they are from 15 to 16 inches in diameter and are offset 9 inches from center towards the rear end of the machine. There was interest expressed in determining the optimum angle of couch and couch roll loading. Santa Clara felt the present construction would not sustain increased loading. Hillsboro would like to have higher couch roll pressures. In addition they questioned the steep angle of contact the felt makes with the cylinder in vat No. 2 in a step down two vat arrangement. The feeling was that this was not as good an arrangement as in Santa Clara where the vats are further apart.

(8) Cylinder Data:

<u>Plant</u>	<u>56</u>	<u>57</u>	<u>58</u>	<u>59</u>
Cylinder Type	--	a. Downingtown b. English	--	--
Cylinder Diameter (inches)	32	30 to 31	32	32
Mesh Size	50/10	a. 30/10 b. 30/--	50/10	50/10

Notes: The cylinder wire is stainless steel and is usually applied by an outside vendor (e.g. Sinclair). With the exception of St. Louis, the cylinders are decked in to 13 ft. 3 inches using Pliobond. St. Louis uses Propoloid K. The difference in the American (Downingtown) and English cylinders at Hillsboro is in construction (i.e. spider & wire spacing). The English cylinders have square support rods while the Downingtown has round rods. The English cylinder has a heavier chime ring and normally retains more water. Hillsboro uses the English cylinders in No. 1 vat. Physical damage was reported as usual cause for failure.

Ambler stated that the proper mesh size is a function of machine speed. They also think vacuum cylinders ought to be looked into again. St. Louis was thinking of dropping to 40 mesh. Santa Clara felt going to 30 mesh was too much of a jump. They mentioned that previous trials with 30 mesh wire had resulted in too much drainage and excess solids going to the savall.

- (9) At all the plants stock is distributed to the vat by means of a spreader trough. Distribution is normally not good and diversion blocks or pans are utilized to avoid soft ends on the pipe. Ambler has found these are most effective when placed directly behind the cylinder for a two vat machine. Even under these circumstances control is not good and corrections must be made constantly. All of the plants were in accord that a better method is needed. Hillsboro thought slowing down everything to minimize velocity, including the weir agitator, would help. They postulated that air beat into the stock might be contributing to fiber separation through flocculation and floatation. St. Louis cautioned that slowing down the agitator speed changes the pipe profile causing the pipe to crown. Santa Clara shrouds their weir agitator, however they do not think a weir box is necessary claiming that it only collects dirt. They believe distribution problems originate prior to the weir in the spreader trough. The use of a baffled bubble at the head of the spreader trough was thought by Santa Clara to result in better uniformity.

Each of the plants reported that the height of the overflow was critical and influenced the pipe profile. The

height of the stock in the vats was from 8 to 9 inches above the shaft. Overflow over the dam varied from 1 to 1-1/2 inches. St. Louis felt that thorough studies of pipe density versus linear position along the pipe would be the first step into understanding optimum distribution patterns.

- (10) All of the plants generally agree that the present means for monitoring and controlling stock is not good. Santa Clara stated they run everything according to rollup time and considered that this would serve as a good criteria for controlling consistency. They had no preference as to the best place to locate a controller. St. Louis claimed that thin consistency gave tight pipe and that present practices on controlling consistency were by "the seat of the pants." They considered it desirable not only to measure and control consistency but in addition be able to predict likely results. They added that lower mandrel change time and reduced slug were converted to good consistency control. Hillsboro presently is using lamination thickness to control stock consistency. They try to maintain 0.050 inch, adding water if stock is too thick. Ambler was of the opinion that under present operating conditions stock consistency control was virtually non-existent.
- (11) In commenting on manner in which various stocks run Ambler stated that most changes were due to diameter rather than furnish. Santa Clara said this in another way. They felt the greatest difference was between thin walled goods and other pipe. The thin walled pipe was reported as very difficult to air lance. The visual complaint was uneven opening along the pipe length. Santa Clara thought that it was a crime to use the machine for building sewer. St. Louis reported that building sewer had to be run with thin consistency and unless the 12 second mandrel change time could be reduced, heavier consistencies were out of the question. At present St. Louis runs 6 inch and above on machine No. 2 and have had production rates up to 7 tons per hour. They can't handle smaller diameter or thin walled material on No. 2 machine and are realizing 3 tons per hour for building sewer on No. 1 machine. Hillsboro said the longer fiber stock gave more trouble with fiber blotches, roping and door reinforcement quite evident.
- (12) Pickup on the cylinders was reported by Ambler to look blotchy, ropey and coarse. What precise corrective measures can be taken to eliminate this condition they are not sure. Hillsboro also claimed that fiber clusters hurt, however they reported that they normally encounter little trouble with pickup on the cylinders. They run a heavier consistency in vat No. 1 than in

vat No. 2 with the resultant laminations for vat No. 1 equal to 0.035 inches and for vat No. 2 0.015 inches. They did report a considerable drop off problem. This was attributed to long shutdowns between mandrel changes and to losing vacuum on the inverted box. Shower fog rewetting the ply can also cause dropoff. Santa Clara said one of the biggest problems with a two vat system was the pickup of the second ply. Roll back on the No. 2 cylinder was not uncommon. A little run off is experienced but Santa Clara felt this was not critical. Santa Clara stated that the ponding of water behind the No. 2 couch roll depended on the vacuum pulled on the intermediate box and that they favored a low vacuum. Santa Clara added that vacuum cylinders were too complicated and were not needed. St. Louis with single vat machines thought most pickup problems were eliminated by keeping the cylinders clean. The Broughton showers were reported as a big help.

- (13) Ambler reported that the water content in the web varies with felt life and after the last vacuum box ran from 32 to 38 per cent. Hillsboro quoted values of 45 per cent prior to the suction box and 30 to 35 per cent after it. If two vacuum boxes were used in series values as low as 26 per cent were realized. They are presently getting 18 to 20 per cent in the pipe off the machine. They also mentioned that displacement of the anvil roll relative to the center line of the mandrel influences water content. St. Louis said that the water content in their web ran 33 to 34 per cent prior to the mandrel pickup point. Santa Clara said that the only water content that was important was that in the pipe coming off the machine. They are realizing approximately 20 per cent and would like to have it even lower. The real proof of the pudding they contend is to look at the density.
- (14) None of the plants saturate the savall system prior to start up. St. Louis reported that starting with fresh water within one hour the system is saturated. Ambler and Hillsboro also use fresh water to start. Hillsboro generally uses partially lake water and clear well water. They never use city water. Santa Clara does not use any fresh water to fill the savall system but reuses the water stored in the holding system from the previous savall discharge.
- (15) All of the plants prefer rubber hose to regular piping for use as stock lines. Little trouble was reported with piping associated with water lines, both process and shower. St. Louis mentioned that they never use elbows and Hillsboro recommended that lines be as straight as possible. All plants use as few valves as possible.

Where valves are used, Santa Clara and St. Louis found plug valves acceptable even though they are not perfect and fine control is not possible. Hillsboro reported that they have had trouble with kinks that develop in the hose carrying clear water overflow from the dirty water savall to the clear water savall. Ambler commented that in order to keep the bottom valve open on No. 1 savall, they must run a lot of material out of the unit. Ambler also mentioned that the existing vacuum system layout is very poor and the separator lines give out. They think a new system is required. On the subject of vacuum pumps and systems, Santa Clara cleans their vacuum pumps every few months with inhibited muriatic acid. Santa Clara felt that the whole field of construction materials for pumps, pipes, etc. which would not build up is a fertile development field. Presently Santa Clara spends 5 hours a week @ \$200/hr. in maintenance to insure a clean, working system.

- (16) St. Louis suggested that another area where further work is required is vat design. Hillsboro wants information on proper angle of attack for the felt during rollup and couching. They also would like more data on vat design, proper overflow heights and specific measures to improve drainage to overcome flaking. Santa Clara re-emphasized the need for continual machine improvement especially with foolproof, maintenance free equipment.

VI. Felts

- (1) to (5) Supplier, Type, Cost, Life, Reason for Removal:

AMBLER: Though Ambler has used Albany Top felts, they have gone almost exclusively to Hardman Top Felts. This is a 100 per cent nylon felt manufactured by Hardman & Son Ltd., London, England. They cost between \$800 and \$900 depending on current price per pound. The felt is good for approximately 240 hours and is usually removed because of general wear.

For the bottom felt Ambler used either a Drycor or Albany felt. Both are needled felts with the Albany containing 45 per cent synthetic and the Drycor 30 per cent. The synthetic is usually nylon. The Drycor costs from \$1100 to \$1200 with a life of 140 to 150 hours while the Albany costs approximately \$1350 and

averages 20 to 30 hrs. less. For economic reasons Ambler prefers Drycor, however they claim the Albany handles easier and shows less resistance when being driven. As with the top felt usual reason for removal is general wear.

SANTA CLARA - Santa Clara uses an Albany top and bottom felt. Both are plain woven felts. The top felt cost approximately \$900 and normally lasts 140 hrs. The bottom felt runs \$1350 and is good for 140 hrs. Replacement usually is because the felt wore out or has been damaged.

ST. LOUIS - St. Louis uses three top felt suppliers, Hardman, Draper and Albany. The Draper and Albany felts are woven and contain synthetic fiber up to 75 per cent. Costs and running hours are as follows:

Hardman	- \$ 800	- 170 hrs.
Draper	- 790	- 140 hrs.
Albany	- 760	- 80 hrs.

Usual reason for removal is that felt is worn out.

For bottom felts, St. Louis uses either a woven Albany or a needled Drycor. The Albany costs \$1050 and lasts 84 hours, whereas the Drycor costs \$1250 and runs for 120 hours. Felts usually just wear out.

HILLSBORO - The top felts at Hillsboro are either Hardman or Albany. Both are woven felts. The Hardman is 100 per cent synthetic with a needled face. Costs and running hours are as follows:

Hardman	- \$ 1000	- 220 hrs.
Albany	- \$ 1000	- 75 hrs.

Felts are replaced either because they are filled up or have worn out.

Hillsboro's bottom felt is either a Drycor or an Albany. Both felts are needled and contain synthetic fibers. The Drycor runs for 100 hours and costs \$1400. The Albany gives 100 hours and is priced at \$1300. Felts are replaced for same reasons as above.

- (6) When breaking in the new felt all the plants recommend that the felt be kept clean and reasonably free of grease. On actual startup, Hillsboro and Santa Clara wet down and run at a slightly reduced speed. St. Louis also wets down thoroughly but starts fast. Ambler starts dry at a slow speed, levels and measures the felt and then wets down using the showers. All of the plants stressed the importance of keeping the ends of the stripe even. Santa Clara also mentioned the necessity of loading the jack rolls properly. *policy sent 2-8-2*
- (7) All of the plants concur that the most singularly important factor in running a felt is maintaining the stripe even. Ambler stated some bowing will occur. Santa Clara simply said don't abuse felts in any way. St. Louis trims off excess on wide felts and Hillsboro likes to run felts as loose as the operation will permit. *For the birds, they tighten it for much*
- (8) The plants were in general agreement that better means for cleaning the felt are needed. Ambler suggested this would include the whipper. Most of the plants hesitate to try the conventional acids and washes preferring to wait for results detailing an easy, practical means. Hillsboro suggested that with the existing setup, it is necessary to recognize a dirty felt and use lots of water. They suggested higher shower pressures in range of 175 to 200 psig. They claimed a clean felt was the most essential factor to good operation. St. Louis recommended that the whippers be kept spanking, the showers unplugged and the suction boxes open to avoid premature dirty felts. They also mentioned that felts will not clean up after shutdown.
- (9) Santa Clara prefers woven type felts claiming that needed felts are good up to 60 hours then plug and are trouble from then on. They know that an acid wash helps but they are not interested because of the corrosion problem. St. Louis' preference for felt type depends on the machine in question. On machine No. 1 they prefer needled felts and on machine No. 2 a woven felt. They stated that a needled felt runs with a drier film but will plug up sooner. Ambler prefers a needled felt claiming that it cuts down telescoping and water marks and reduces ovality problems. They suggested that the cylinders be driven to prevent the face wire from slipping due to the pull exerted by the felt. Hillsboro prefers a needled felt. They stated that woven felts are horrible and cause thin wall pipe. Their theory is that more even pressure distribution is achieved with a needled felt due to the absence of

knuckles. In addition they contend a thicker felt permits more water removal. They also recommended synthetic fiber contents of 45 per cent or higher to insure adequate strength.

- (10) The consensus of opinion among the plants is that the top felt function is primarily to assist in the removal of water. Hillsboro and St. Louis added that it acts as a cushion and means for pressure distribution. St. Louis suggested that it prevents sticking and in essence might be considered a parting compound. Ambler however thought that it may contribute to pulled bores. All of the plants expressed an interest in a sheepsfoot roll.
- (11) The plants determine whether a felt is no longer usable solely by visual inspection, experience and their ability to make satisfactory pipe. A tool for measuring quantitatively the closeness of a felt would be desirable but only if the results realized could be translated to actual machine performance.
- (12) Ambler at the time was having no specific problems with felts. Santa Clara stated that grease spots resulting from installation were minor and that felts in general were damaged rather than worn out. This damage was caused by stones in the fiber and other foreign objects that get into the system. Rarely do they have trouble with wrinkling, but when they do the men must shut down the operation and run the felt until the wrinkles are out. This they do on their own time. St. Louis remarked that variability in felt size is a problem at times. They have had trouble with Albany felts narrowing down between the suction box and the press section, consequently when ordering they are liberal with felt width feeling that they can always take some off but can not add any if short. Hillsboro reported that Hardman felts while stable are always wide. They also feel that felt uniformity and stability could be improved for all suppliers.

VII. Rollup Operation

- (1) Hillsboro thinks that when the Minneapolis-Honeywell thickness controller is working it is unbeatable. However, they have had trouble with the unit. They did find that old fashioned leathers work best in the

pistons on the press roll. The hard rubber rings tried initially resulted in oil leakage.

Santa Clara while not satisfied with their present setup know how to operate it and will not consider tearing it out to evaluate a new system. The only way they thought a new system could be properly evaluated was to check it out in parallel with the existing setup. In any case they want something that is simple and requires little maintenance.

Ambler agreed that the existing setup is not the best but once thickness control is established it is not bad. They do not know of a better system to date.

St. Louis feels a lot of work can be done in this area, in particular what is the optimum pressure reduction. By starting high and ending low their densities have improved. They have increased density by upping the lower pressure. They remarked that sudden pressure buildup results in bagging and fracturing the pipe. Their general feeling was that the Askania unit does not do the job. *Out of calibration*

- (2) Typical pressure reduction curves are available from the plants.
- (3) Weight of the beam is as follows:

<u>Plant</u>	<u>Wgt. of Beam, Tons</u>
56	3.8
57	3.8
58	3.8
59	No. 1 = 4.0 No. 2 = 3.8

- (4) All of the plants stated that the top felt should lead and help the bottom felt. This ensures a tight pipe. After the first few laminations the press section should tilt towards the rear of the machine as an indicator of this overdrive. Ambler reported that on 12 inch pipe the top felt gets dirty early and the top felt amperage must be reduced to keep the felt clean. They experience no trouble with pipe below 8 inches in diameter. All agreed that more information is needed to establish the optimum speed differential. Santa Clara felt that more water could be removed by varying the angle of contact between the mandrel and the anvil roll but they thought that the stress effects would be the over-riding factor in the final decision.
- Amperage as best indicator*
- Water*

(5) The most common signs of bad rollup are:

- a. telescoping
- b. rough bore
- c. blotching, flowers and streaks
- d. very tight pipe. *NE*

*could be but
not*

The plants felt that telescoping was mainly caused by either improper pressure relief or poor water removal. St. Louis added that the ends are a good criteria for judging pipe and telescoping was the most certain sign of bad rollup.

Rough bore can also result under conditions likely to cause telescoping; in addition, Ambler mentioned that high nip moisture and too high a buoyancy are contributing factors. Santa Clara reported that they sandblast their mandrels every 100 passes to help prevent pulled bores.

St. Louis stated that blotching and flowers in the pipe indicate that the box is getting heavy and that this can result in poor rollup. Any abnormal appearance or streaks in the pipe was also reported as an indicator of poor rollup. This latter effect was usually found to be caused by dirty felts or cylinders.

why

Other indications that something is wrong are increased rollup times and pipe which is very hard to air lance and break. This latter circumstance does not mean the pipe is bad, rather that the operation is difficult.

Water marks (i.e. small cracks about 3/4 inch in length at 45° to the horizontal on the inside of the pipe) are also indicative of poor rollup.

All of the above problems were reported as being intimately connected to water removal, proper stock distribution and condition of cylinder and felt. Hillsboro also suggested that the positioning of the anvil roll was influential. Ambler remarked that they use nozzles on the deckle to get proper alignment of the plies on the mandrel.

- (6) The rate of buildup at Ambler, St. Louis and Santa Clara is controlled by rollup time as reported by Quality Control in the Making Particulars. Hillsboro has their own rollup times based on 0.050 inch lamination thickness. Ambler commented that under the present setup and rollup times handling is a problem with 4 inch pipe. (Note: Rollup times reported by Quality Control are average and vary from plant to plant).
- (7) Santa Clara felt that air lancing was a source of trouble and wished that it was unnecessary. They do not know what alternative to suggest but did express interest in electrolytic stripping.

St. Louis suggested that air lancing be held to a minimum. They stated that blowing too long or at too high a pressure caused the pipe to blow apart or the ends to tear out. Their recommendation is to air lance nearly parallel to the mandrel (e.g. difference of 30° or less) until you see the pipe open or detect a difference in air sound. Experience they felt was the best teacher. They concluded by saying that thin wall pipe was harder to break and the duration of air lancing was dependent on pipe size.

Hillsboro air lances in the calendar but this has not been satisfactory with tight pipe. Even so they prefer to air lance at this point.

Ambler said that all air lancing was by chance and a continual source of trouble. They feel it must be done prior to calendaring and at present air lance both ends of the pipe in the machine for 1/3 to 1/2 the circumference. They employ two signals (1. ready 2. inject) to control the timing and duration of the lancing operation.

- (8) All of the plants agreed that the present pipe operation requires too many mandrels. Ambler felt they would like to know more about sand blasting since it is costly and would like to do their own. In the case of damaged mandrels, in particular oval mandrels, they stated that it is cheaper to buy new ones than reworking the old ones. They prefer heavy walled, spuncast mandrels because of the surface obtained even though the extra weight requires more careful handling. Ambler commented that better looking bores are a result of sand blasting.

Hillsboro prefers the thick walled American mandrels to the thin walled English mandrels claiming that the latter resulted in bent pipe. Sandblasting they felt was not primarily a cleaning operation but a process improvement and maintenance item required to prevent telescoping and rough bores.

St. Louis reported that dents, out of roundness and straightness were the biggest and most frequent problems with mandrels. They use American mandrels that are 18.5 feet long. Up to 14 inches in diameter they can use mill run material, over 14 inches in diameter the machine cut surfaces are too rough and must be sanded off with a disc sander. Their sand blasting schedule is approximately every 100 passes. They stated that they have had no luck with aluminum mandrels and do not think they would take the beating that steel does.

Santa Clara remarked that roughing up the mandrel surface sure helps but they do not know exactly why. Most of the problems with mandrels they felt occurs below 6 inches in diameter in the form of bent mandrels. Santa Clara has an outside craftsman who straightens mandrels when required. Their cleaning schedule as previously noted is approximately every 100 passes. They take precautions to remove scrap A/C resulting from pulled bores during this time.

Each of the plants preferred to run with hot mandrels pointing to the fact that better operation results the second time through.

- (9) St. Louis and Ambler expressed a desire to know more about the calendaring operation since they felt present know-how was incomplete. In particular they are interested in the relationship between the spread of the rolls and mandrel diameter. Ambler presently has a 5 to 10 second calendaring cycle.

Santa Clara is satisfied with their present calendar setup. They remarked that what air lancing does not accomplish in the machine calendaring does by forcing the air bubble along the pipe length. They do not recommend holding the pipe section down during calendaring, claiming that this helps to blow the pipe.

Hillsboro feels their present setup is adequate and since they also air lance during calendaring, they feel they

should have a hold down on all sizes to minimize the duration of air lance. Presently they hold down on 4 and 6 inch sizes only. They suggested a third roll for this purpose.

The calendar rolls turn in the same direction as the machine. *Amblor*

- (10) With the exception of Hillsboro, the pipe sections are broken loose manually with a spanner wrench. With 6 and 8 inch pipe this can be done while the section is being calendared. Larger sizes are done in a V-groove trough and at St. Louis where big sizes are encountered it is really hard work and quite a problem. Hillsboro has an automated device which they said works well. They did complain that the raising and lowering of the device was too slow. Several plants indicated an interest in Hillsboro's setup.
- (11) Santa Clara said that they had no specific problems related to rollup but just keeping things in phase and moving smooth was always a problem. St. Louis stated they would like to improve their mandrel change times especially on No. 1 machine. They said they liked Hillsboro's mandrel feed and change.

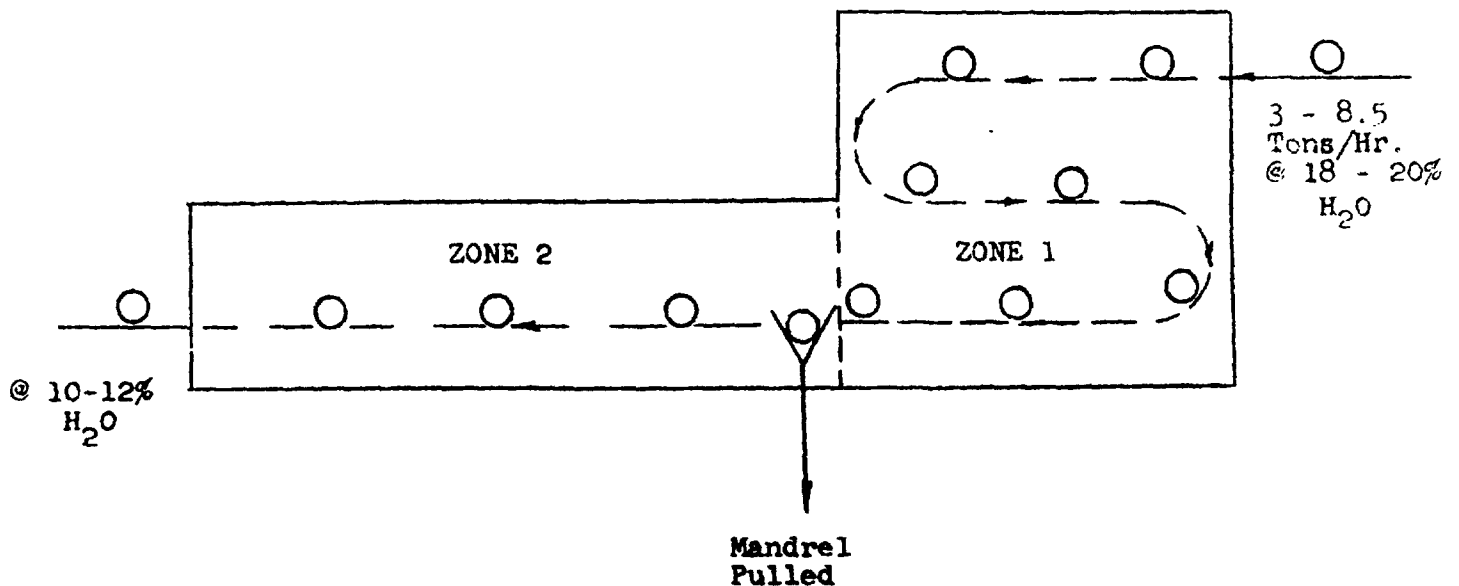
Hillsboro remarked that cement hydration time is more important than top drive in effecting tightness of the pipe. They also said that the press cylinders can cause the pipe to bump and bounce unless sufficient cushion is allowed for. *For the "Baird"*

Ambler again expressed a desire to change vacuum system as a means to improve rollup. They complained that the design of the second cylinder obstructed visual observation.

VIII. Curing

1 through 11.

SANTA CLARA

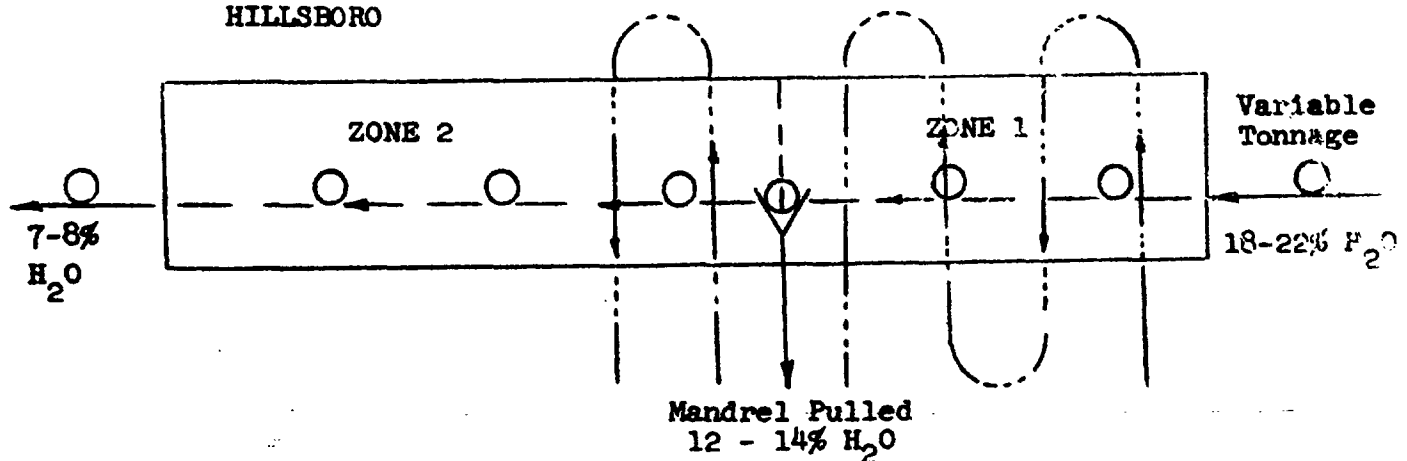


	<u>Zone 2</u>	<u>Zone 1</u>
Dwell Time, Min.	60	60
Temperature, °F.	170-175°	240-250°
Humidity	?	?
Air Flow	Parallel to Pipe	Parallel to Pipe

At Santa Clara temperature and speed through the tunnel are varied to effect the desired curing cycle. Steam at 60 psig is the heat source. They try not to dry out the pipe more than they have to, but invariably the ends do

dry out especially with thin walled goods. Even so they reported that the faster production rate on thin wall pipe usually results in a pipe that on an overall basis is not hard enough. They stated that different curing results were obtained depending on what type of pipe they run and mentioned that they have had some big low head material collapse. This they attribute to low fiber content. They have no special curing theory and pointed out that natural drying has not proved detrimental. If they had to choose they would prefer longer tunnels at lower temperatures on the premise that time is the single most important factor. They are not convinced that humidity does any good and feel that a saturated steam environment presents a lot of problems due to rusting. Their basic criteria for determining the effect of cure is hardness and ability to handle without damage. Specifically they pointed out that the transfer techniques are troublesome and most damage to the pipe occurred during the handling operations. In particular, they recommended plugging certain vulnerable sections in the autoclave trays to prevent them from flattening out while being handled by truck drivers. The plugs are removed prior to autoclaving.

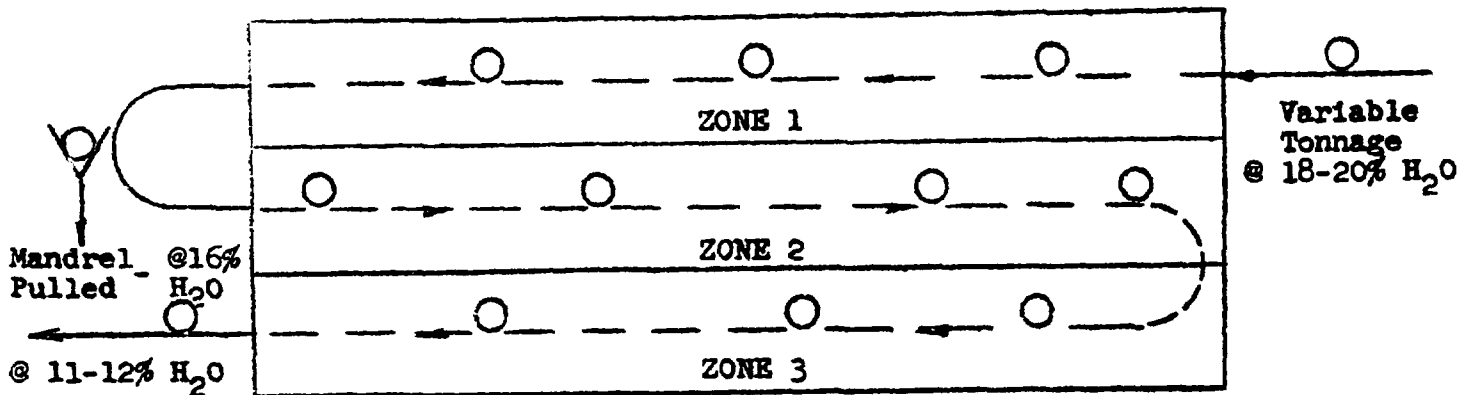
HILLSBORO



	<u>Zone 2</u>	<u>Zone 1</u>
Dwell Time, Min.	90-105	60-75
Temperature, °F.	250-260°	270-300°
Humidity	?	?
Air Flow	As Shown	As Shown

Hillsboro regulates temperature and speed to control the curing cycle. Heat is obtained from 150 psig steam and controlled for each air pass by means of partlow regulator. No control is exercised on humidity. They reported humidity values of 15 per cent in Zone 1, 20-25 per cent in the first part of Zone 2, and 40-65 per cent for the second part of Zone 2; however these values were determined by wet and dry bulb measurements and due to the elevated temperatures thought to be erroneous. The pipe does not turn going thru the tunnel. They reported that light walled pipe causes trouble because of dents picked up after the mandrel is stripped. They commented that nobody has licked the transfer points to date. They did not postulate any curing theory and requested help and information in this area. Their criteria for acceptance on cured pipe is hardness and handleability.

AMBLER

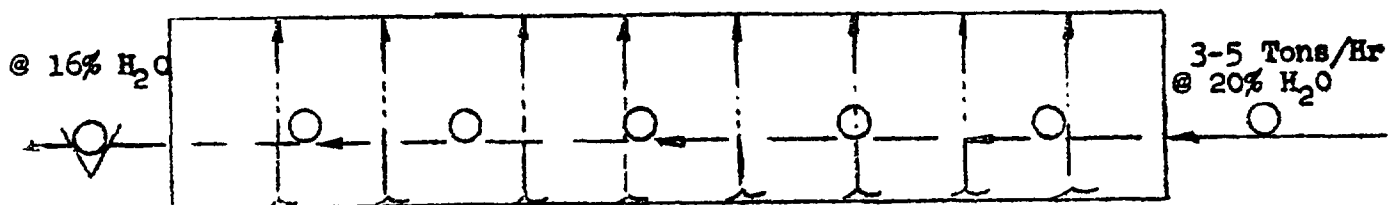


	<u>Zone 1</u>	<u>Zone 2</u>	<u>Zone 3</u>
Dwell time, Min.	75	80	80
Temperature, °F.	200-220°	170°	130°
Humidity	?	?	?
Air Flow	Parallel to Pipe	Parallel to Pipe	Parallel to Pipe

Note: Zones 2 and 3 are not physically separated.

Ambler uses conveyor speed and temperature to regulate curing cycle. Steam at 105 psig is available for heating. The pipe does not turn going through the tunnel and on the second and third pass the pipe rides on bars. This means of conveyance and the handling in general they said was hard on the pipe and resulted in dents and damaged pipe. They also stated that small diameter pipe, in particular 4 inch, was not hard enough coming out of the tunnel. They advanced no particular theory on curing but stressed the need for mechanical improvement in transfer and material handling equipment. Their criteria for judging pipe was also handleability.

ST. LOUIS - No. 1 Machine

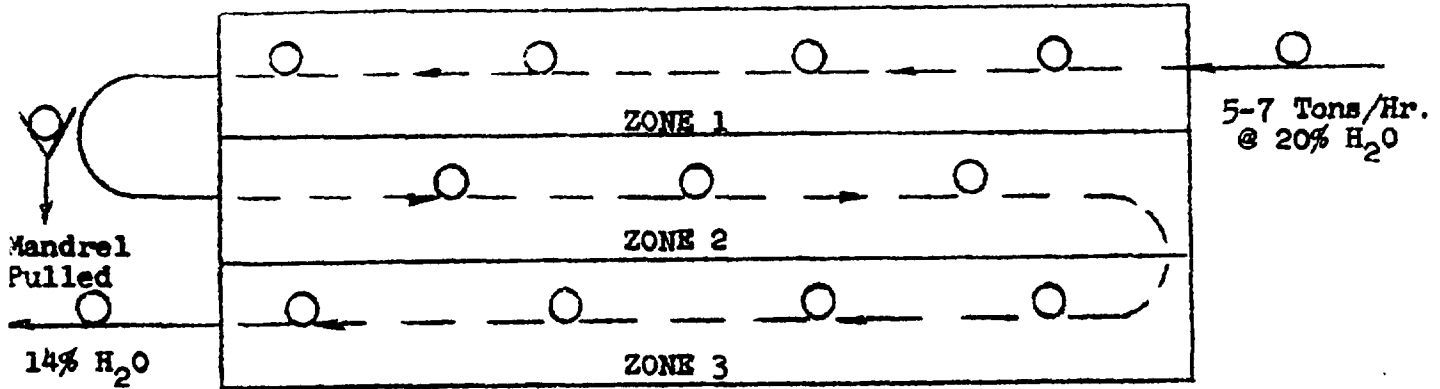


Dwell Time, Min.
Temperature, °F.
Humidity
Air Flow
Heat Source

80-90
220°
?
As Shown
Gas Fired Blowers

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No. 2 Machine



	<u>Zone 1</u>	<u>Zone 2</u>	<u>Zone 3</u>
Dwell Time, Min.	60-90	105-120	105-120
Temperature, °F.	230-Summer 190-Winter	150	Cool (120°?)
Humidity	?	?	?
Air Flow	Parallel to Pipe	Parallel to Pipe	Parallel to Pipe

Curing cycles at St. Louis are controlled by observation and resultant corrections to speed and temperature. No. 1 tunnel is gas fired and No. 2 tunnel uses 5 steam heaters on the top and 2 steam heaters on the bottom. (Note: Zones 2 and 3 are not physically separated). They supplement their heat supply by trying to keep the mandrels hot to minimize heat losses associated with heating the mandrel. Their criteria for judgement is pipe hardness and handleability and they feel that time on the mandrel is the ruling factor. They avoid too much heat claiming that the mandrel is hard to pull. This is an exception and normally they are short on heat and would like to have higher temperatures or longer tunnels. This is especially true for the small sizes and during the winter time. They did not express any specific theory on curing pipe but would like to see some sort of an accelerated cure developed.

As a sidelight they mentioned that under certain conditions of temperature and humidity they have a serious condensate problem in the plant. On some days they said it literally rains.

IX. Autoclaving

(1) and (2) Loading techniques at the various plants are as follows:

HILLSBORO:

Pipe is loaded in trays out of the curing tunnel using hairpin type hooks to prevent dents. The piled trays are then dipped to rewet prior to autoclaving. The pipe then sits from 20 minutes to 4 hours before it is autoclaved. They stated they would like to know the optimum time pipe should be held before autoclaving. Presently they are getting 16 to 17 per cent water before autoclaving.

AMBLER:

Pipe is piled on buggies directly out of the curing tunnel, rewet and then autoclaved. Interim storage is outside without plugging the pipe. They mentioned that the softer pipe resulting from higher production has reduced tray loading. They reported that they have had 8 inch sewer crack in the load.

SANTA CLARA:

Santa Clara uses an auxiliary mandrel to tenderly load pipe coming from the tunnel onto sand bottomed buggies. Vulnerable pipe sections are plugged and pieces of felt are used to prevent crowning. The buggies are stored outside and autoclaved as soon as possible, usually within one day. They mentioned that they control coupling stock age carefully.

ST. LOUIS:

Pipe is loaded directly onto cars from the curing tunnel. Those cars from No. 2 machine go directly to the autoclave tubes while pipe from No. 1 machine is held over for 8 hours prior to autoclaving. The pipe is stacked carefully to prevent distortion but the ends are not plugged. Pipe from No. 1 machine is loaded into several

cars at once to prevent collapse due to premature building up of the load. In the summer storage is outside. In the winter, pipe is left indoors to prevent the pipe from freezing and subsequently blistering during autoclaving.

(3) Autoclave Operation

<u>Plant Number</u>	<u>56</u>	<u>57</u>	<u>58</u>	<u>59</u>
a. Cycle, Hrs.	10-12	12	12	12
b. Buildup Time, Hrs.	2	1-1/2	1-1/2	1
c. At constant pressure, Hrs.	8-10	10	10	10
d. Blow Down, Hrs.	1/2	1/2	1/2	1
e. Purge	No	No	No	No
f. Control	<u>Steam Pressure Through Valve</u>			

(4) Typical Autoclave Cycle Curves are available from each plant on request.

(5) None of the plants thought that the size of the load had any effect on the autoclave cycle or cure.

X. Finishing

(1) and (2) The status of the finishing operation reported by the plants is as follows:

HILLSBORO:

They said that they had a good many problems with finishing and felt a lot of work was needed in this area. Their experience with throw away tools has been poor. In addition they stated they were costly. They have had considerable success with diamond wheels and were high on its merits. They remarked that they thought tool life depended on the wetting and setting times experienced by the material. In general they concluded that overall they were in poor shape.

ST. LOUIS:

St. Louis felt that they were in satisfactory shape as far as finishing was concerned. They were not having any particular problems with the lathe and they felt the vertical boring mill was doing the best job ever. They mentioned that all cuts were profile cuts and that ovality problems associated with air pressure on the chucks had been resolved. They were extremely happy

with the diamond wheel on the coupling cutoff stating that they were getting 89,000 cuts as compared to a previous standard of 2,000 cuts in addition to salvaging an extra coupling. They said that they did not want anything to do with throw away tools. They also wondered what was to be gained from using the pencil sharpener lathe especially since a varied product mix of large diameter would result in excessive changeover time. They did express an interest in Santa Clara's diamond core cutter even though they thought it would be too costly.

AMBLER:

Ambler was not particularly bothered by any finishing problem, however they did complain that their lathes were too light and required excessive maintenance. They said tools were an occasional problem and more information should be available on tool life. They expect to install a diamond cutting wheel in the near future.

SANTA CLARA:

Santa Clara commented that money is made and lost in the pipe machine and not the finishing department. Presently they reported that three crews in the finishing department can keep up with three shift operation. They said that other than minor mechanical problems, the lathes were generally good and the Rogers mill runs like a top. Their tool life is reasonable and the diamond wheel was doing a good job on unautoclaved material. They would like to see some improvements in the machining of the coupling O.D. and the coupling cutoff.

- (3) Ambler reported that the dust situation was under study at time of plant trip. St. Louis said their dust conditions were better than ever and finding a suitable hose to carry away chips from the fittings operation was the only specific problem they had to report. Santa Clara felt they had a dust problem on the saw which sufficient funds could easily solve. Hillsboro's overall dust control was reported as good but they were having equipment trouble, in particular the dust bags were bothersome.

XI Testing

- (1) All of the plants agreed that two bottlenecks to faster production were:

- a. time required to fill with the hydrotester setup
- b. the excessive attention required in maintaining loads for the five second dwell on the flex tester.

Santa Clara said that they were not sure they liked external heads on the hydrotester. Their major complaint was that the heads were too slow coming in.

St. Louis mentioned that stencilizing on small pipe was also a production bottleneck. They would like to see a faster, cheaper method devised.

DEVELOPMENT
RECOMMENDATIONS

CERTAIN-TEED PRODUCTS CORP.
Pipe Technical Div.
Plant Data

I. Raw Materials

A. Cement

Virtually everyone will concede that cement technology is complex and that the degree to which known fundamentals have been correlated with A/C pipe manufacture is rather incomplete. However these inadequacies would appear, at least from a practical standpoint, to be more of an academic void than a current operating problem. Each of the plants is capable of processing their present cements with acceptable results. Undoubtedly problems do and will arise from time to time which are a result of source deviations. These are normally few and far between and are best resolved by standard control procedures. The fact that significant differences in filtration rate, plasticity and water retention ability do exist between cements has not been ignored. Here again this recognized variability is best eliminated by restrictive specifications. The foregoing discussion is not meant to imply that cement can be ignored or that optimum operation has been achieved. What is meant, is that rarely can problems be solely attributed to the cement. Problems which are encountered and at first glance seem to be created by the cement have been in most instances precipitated by other factors. These factors, to cite a few, might include system temperature, water composition and contact time. On this premise it is recommended that routine cement evaluation not be conducted on the pilot pipe machine, rather experimentation should be devoted to correlating the idiosyncrasies of cement with compensating process variables. Specifically this work should be aimed at developing operating techniques and parameters for the successful processing of quicker setting cements. An ultimate objective would be to effect an improved cement cure on the mandrel. Since a development program of this type would initially entail working in areas of poor operation valuable information should be secured regarding corrective measures for existing problems. Finally this program should be supplemented by a comprehensive and comparative evaluation of the cements presently used. All physical and chemical properties should be included in this study. This work will not only serve to pull together all known and previously unknown data, but more importantly it will provide an excellent reference base for future work.

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B. Silica

No major technical effort needs to be expended on silica. The material is quite stable and relatively inexpensive and almost all considerations are by nature economical. Adequate control and restrictive specifications provide the easiest and most logical approach to potential problems.

A finer mesh silica might result in improved product quality, however any benefits derived would more than likely be offset by increased costs. A similar line of reasoning is applicable to purity levels. Since the silica requirement for autoclaving remains constant, greater quantities of less pure materials must be utilized to achieve the same results. This added material consumption tends to negate any initial cost advantage. In addition the higher percentage of impurities can only tend to increase the prevalence of uniformity complaints and frequency of product rejects.

What could be of value would be a thorough analysis and compilation of the physical and chemical properties for each of the silicas presently used. This would update existing knowledge and provide the needed background for preparing more inclusive material specifications.

C. Asbestos Fiber

Asbestos fiber represents a lucrative development field in which significant cost advantages can be realized from optimum fiber usage. Since in the manufacture of A/C pipe fiber constitutes the lion's share of the material cost common sense dictates that a continual effort must be made to derive the cheapest possible furnish consistent with good operation and acceptable product quality. Practical experience and laboratory test data account for much of what we now know about the efficient use of fiber. An economic analysis of this information determines fiber allocations which in turn are a reasonable representation of the selected furnish. While this approach is an attempt to formalize fiber selection, considerably more work needs to be done to translate existing fiber technology in terms of actual machine operation. For this reason it is recommended that the pilot pipe machine be programmed to correlate fiber properties with controllable process variables. This work should not include routine testing but should be directed at establishing physical criteria which must be met to adapt

machine operation to low cost fibers. It would be preferable if the program did not freeze machine design or operation but deliberately created problem situations. In this way those process variables which compensate for fiber deficiencies can be determined and satisfactory operation achieved. For instance, the means for economically processing slow filtering fibers might be resolved. Other possibilities include the elimination of long fibers and blue fiber along with the thorough evaluation of the benefits of chemical additives.

D. A/C Fines

Nothing fundamental needs to be done with A/C fines. While there are mixed reactions regarding the merits of fines in the final analysis they are essentially an economic measure. An ideal solution would be to eliminate them completely. Since this is not practical, it might be advisable to determine the upper limit of use for given quality levels and the most efficient means for processing resultant furnishes. In addition, specific problems or products connected to fines might be investigated. It is not recommended that any work beyond this be undertaken especially on the pilot pipe machine.

E. Chemical Additives

Chemical additives appear to be an enticing development field with unlimited potential and opportunity for significant process and product improvement. Previous work barely scratched the surface of this diversified technology and for this very reason a broad survey approach directed at evaluating the multiplicity of existing products is quite impractical. Preferably pilot machine studies with additives should be restricted to satisfying specific needs or requirements created by process studies primarily devoted to solving the basic problems related to cement, fiber, curing, etc. These studies have been outlined in other sections of this report.

F. Rubber Rings

Rubber rings and related design changes are basically a quality control or product development responsibility and do not fit into the pilot pipe machine program.

II. Fiber Preparation

In many respects fiber preparation is synonymous with efficient fiber usage. It therefore follows that any comprehensive development program must consider the impact which fiber preparation has on the overall operation. This implies that either the existing preparation techniques should be optimized or entirely new processes developed. In either case this work should be an intimate part of the pilot pipe machine program. Any detailed study should take into account three factors.

1. Faster and more efficient fiber opening.
2. Ways and means for increasing fiber throughput.
3. The required technology to blend and successfully process more open fibers.

Factor 3 could be made an integral part of the fiber studies previously mentioned while factors 1 and 2 would entail evaluating new equipment and processes. Chemical opening of fibers might be a remote possibility.

III. Primary Mixing and Stock Preparation

Presently the basic problems with the dry mixing system are mostly mechanical. Nevertheless there exists the possibility that the dry mix cycle could be the limiting factor to increased production. Consequently the pilot pipe machine program should include provisions for optimizing existing practices and developing new equipment for intimately blending at high throughput rates. Any development work in this area should be done in conjunction with fiber preparation since the opened fiber is the critical component.

Wet mix to be considered 15/7/61

Immediate attention should be given to better means for stock preparation. Existing practices for wetting the stock appear to be rather crude and intimate blending is an implied rather than an explicit operation. All mixing is a function of the total wet system and no provisions are employed to control stock uniformity. A natural outgrowth of this work should be to determine the merits of and the necessity for consistency control. If the latter answer is affirmative, the program can be expanded to encompass the evaluation, selection and placement of sensing and control equipment. This equipment should provide maximum sensitivity and reliability simply and with a minimum amount of maintenance.

IV. Water

The role which water plays in the manufacture of A/C pipe can not be ignored. Quite obviously any fresh water entering the system will quickly lose its identity and by itself will have little influence on the operation. However, the solids which are normally present in every water supply, depending on their concentration and composition, can significantly alter the system's chemical equilibrium and under certain circumstances in combination with specific cements produce detrimental solids precipitation. Water treatment may provide a solution but in general can be quite expensive, particularly when operating with an open system. This suggests that the pilot pipe machine program might attempt to determine if it is possible to operate with a closed system and what factors must be regulated to maintain a stable system. This would give some insight into the benefits of a completely saturated system and if feasible, provide an excellent solution to waste disposal problems.

V. Machine Operation

The physical operation of a pipe machine is one big question mark. If any area requires clarification and needs to be elevated to a technology, it is this one. This does not mean to imply that current operation is necessarily wrong but to emphasize the general lack of evidence or agreement to support many of the accepted practices. When considering the number of variables encountered and their involved relationships, this is not wholly unexpected. It is only with extreme difficulty that individual cause and effect can be isolated and even then there is considerable reservation whether the relationship developed will be more valid upon application than the present "seat of the pants" technology. Consequently in preference to singling out specific variables for study it is recommended that the pilot pipe machine program concentrate on the overall operation in terms of increased production and improved product quality. By natural attrition and repeated running those variables which have a significant influence on the process should evolve and adequate limitations can be placed on their operating range. Variables in question, to name a few, are felt speed, agitator speed and direction, vacuum, vat design, stock distribution, overflow heights and temperature.