

TABLE OF CONTENTS

Page	
1	Foreword
2	New Product Contribution to Division Sales and Profits
3	1968 Market Performance of New Products
4	Summary
7	Distribution of 1968 Investment in Gypsum Research
8-12	New Product Section
8	Radiant Heat Panel
10	Pictures - Radiant Heat Panels
11	Molded Grainboard
11	Gypsum Fire Door Filler
12	New Joint Treatment Method
12-15	Improved Product Section
13	5/8" Type X Firestop
13	Gypsum Filler For Joint System
15	Hard End Wallboard
15	Joint System Formula Improvements
16-17	Sales Service Section
16	One Hour Dens-Cote Partition
16	Hill Rom Partition
16	Angeles Partition
16	Paper Tape For Dens-Cote System
18	Industry Section
18	Gypsum Association and A.S.T.M.
19	Patent Section
20	Prospects for 1969

F O R E W O R D

This is the semiannual report of the Gypsum Division Research Department for the period of July through December 1968. We have reported annual as well as semiannual results since this is the year end. As in the past, we have used profits generated by products developed through research as the chief measure of our performance. This does not include cost reductions or sales increases coming from research. Both of these are reported in the year in which they occur but not thereafter. The percent contribution of new products to the profits of the Division dropped slightly in 1968. This was due to sharply lower profits on Ready Mix and Triple Duty which were brought about by the market preparation for the Chicago and Marietta Joint System plants. We are confident that this is a temporary hesitation in the trend of an increasing new product contribution to Division results. This upward trend is shown by the graph on the next page. The 1968 return on our investment in gypsum research was -

$$\frac{\text{1968 Profits From New Products Developed Since 1961}}{\text{*Investment In Research Since 1961}} =$$

$$\frac{\$618,340}{\$1,150,000} = 53.8\%.$$

* Does not include capital investments.

A summary of 1968 activities, a detailed account of the last six month's research activities and the prospects for 1969 are included in this report.

1968 MARKET PERFORMANCE OF PRODUCTS DEVELOPED THROUGH RESEARCH

Unit	Product	Sales Volume	List Sales	Gross Profit
MSF	Dens-Cote Base (all)	22,184	886,890	226,264
MSF	Tile Backer Board	6,575	490,300	218,960
MSF	1/4" Sound Deadening Board	5,575	171,177	40,272
MSF	Radiant Heat Panels	7.8	2,910	1,020
Tons	One Day Joint Compound	270	34,255	2,441
Pails	Ready Mix	308,691	1,030,007	46,900
Tons	Triple Duty	5,874	809,777	42,505
Tons	Grabit	143.5	18,504	5,108
Tons	Bestex A	1,208	158,005	1,747
Tons	Bestex B	46	7,330	(1,819)
Tons	Bestex C	287	46,660	(5,493)
Tons	Bestex D	37	6,925	1,644
Tons	Dens-Cote Plaster	3,196	174,331	28,614
Rolls	Dens-Cote Tape	6,737	14,961	3,123
Tons	Ram Process Plaster	99.5	8,998	4,924
Tons	Denscal HP	170	9,767	2,144
			$3,870,797	$618,354

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S U M M A R Y

RESEARCH BUDGET

$238,000 was budgeted for gypsum research in 1968. We overspent by $10,000 because of higher than expected pilot plant development costs in conjunction with molded grainboard. The chart on page 7 shows the distribution of the investment in gypsum research. A budget of $247,000 has been approved for 1969.

NEW PRODUCT DEVELOPMENT

1. An all out effort on the radiant heat panel project has enabled us to progress to the point of having a limited number of panels available from Wilmington by January 1. In February we expect to be continuously producing panels on a profitable basis.

2. The new grainboard belt has just arrived in Brunswick and some other equipment revisions have been completed. We are at the final stage in determining whether molded grainboard can be manufactured and marketed economically.

3. The development of a gypsum fire door has been resumed. One of the problems has been to get test doors made for evaluation. The acquisition of Curtis Door should provide the means for getting over this hurdle. We need a lightweight gypsum block which will have the necessary physical properties and still be within our cost limits.

4. A completely new joint finishing technique has been discovered by Don Klus. It involves the use of a synthetic resin which has sufficient integral strength to eliminate the need for a reinforcing tape. As with most breakthroughs, much remains to be done to make the method practical for the contractor and profitable for Georgia-Pacific.

IMPROVEMENT OF EXISTING PRODUCTS

1. An unsuccessful fire test was turned into a favorable result when Ray Hinkel persuaded Underwriters' to grant us a type x 5/8" Firestop by interpolating from the test which failed. The board which U.L. has extended to us will save the company $95,500 based on the sales of 5/8" Firestop in 1968. This formula will then be made available to our licensees for a $2000 base fee and the standard royalty rate.

2. Based on our development and field test experience, an air separator will be installed at Acme to furnish a fine ground gypsum filler for ready mix. The substitution of fine ground gypsum for limestone will save 11¢ per five gallon pail or $6,600 based on next years projected ready mix sales at Acme. If Acme is successful, a ready mix plant at Sigurd will be proposed. Sigurd is already making some textures with gypsum as the filler. The primary objective is the new business to be gained by having joint system available on the West Coast.

3. The hard end wallboard project has been discontinued because it did not create any spontaneous enthusiasm from the field and because the plant seemed to be unable to keep the process operating continuously.

SALES SERVICE

1. The one hour rating for the Dens-Cote/metal stud system was achieved. This is the rating Sales has been so anxious for us to get.

2. At the request of Marketing, a paper tape joint reinforcement method has been developed for the Dens-Cote system. This will be another alternative application for us to promote.

3. Pilot fire tests were made on partitions for Hill Rom Corporation and Angeles Metal Systems. These were requested by Marketing on the basis of developing future Firestop sales.

been to get some doors made so they can be tested. The acquisition of Curtis Door has provided us with a means for getting test doors made and will reciprocate by developing a low cost fire door for Curtis to sell along with their regular doors.

Some progress has also been made in formulating a fire door material. The use of Denscal as opposed to molding plaster requires less resin reinforcing in the foam and results in a lower raw material cost. It has also been found that a finer cell structure produced by higher speed agitation of the slurry will give greater strength at the same density. A number of fire door slabs will be cast using the new techniques and sent to Curtis. We will also ship some 1/4" sound deadening board which will be used to make a hollow core fire door. Doors will be made from both products and shipped to Tigard for testing.

Thus far, we have tested one competitive fire door (1 hour rated) in comparison with a layer of gypsum filler. Our filler performed significantly better in temperature transmission than the door with Kaylo (calcium silicate) filler. We have not yet run the hose stream portion of the test, but we can't conduct a fair test until we can make some doors with our filler material.

4. New Joint Treatment Method

It has been found that some epoxy and polyester synthetic resins are as strong as paper joint tape, even in thin applications. Sample joints have been made and found to be stronger than the board in many cases. This will be a major breakthrough if these resins can be adapted to the joint treatment application. A patent search did not reveal any prior art, so it appears that we may be able to get a patent. This project was delayed to permit work on manufacturing equipment for the radiant heat panel. We will resume this development as soon as possible. Evaluation of different resins, formulation to improve application properties and evaluation of methods of application will be the major areas of investigation.

IMPROVED PRODUCTS SECTION

1. Type X 5/8" Firestop

In the first half of 1968 a 5/8" board weighing 2275 lbs and containing 4 lbs of glass fiber/M and 20 lbs of raw vermiculite was tested on wood studs in an effort to get an hour rating. The test lasted only 57½ minutes. Subsequently, a series of tests were conducted here on the pilot furnace using various Firestop formulas at various weights and with varying quantities of raw vermiculite. We came to the conclusion that we would have a difficult time passing the test regardless what changes were made.

Ray Hinkel was able to convince U.L. that they should extend a 5/8" type x formula based on our unsuccessful test and the competitive tests that have been run. We proposed to let U.L. choose the weight and thickness limitations and Underwriters' agreed to conduct a study for no more than $500. Another fire test would cost over $2000, so we made application for the study after having assurance that U.L. would extend a board with reasonable specifications. The study was completed and we now have U.L. approval for a 5/8" type x board with the same formula we tested, but with 2375 lbs minimum weight and 0.615" minimum caliper. We could have gotten a 2350 lbs weight minimum, but the minimum caliper would have been 0.630". It was felt that it would be less restrictive to accept the extra 25 lbs than the increase in thickness.

The lower raw material cost will more than make up for the higher minimum weight, so we will change over to the 5/8" type x formula. We do not expect to get much demand for the 5/8" type xxx, so it will only be manufactured on special order. The transition to the type x formula will begin to take place in January 1969.

2. Gypsum Filler For Joint System

a. Ready Mix

Field trials were conducted on a ready mix with fine ground gypsum replacing limestone as the main filler. To have been able to make a direct substitution would have saved 17¢ per five gallon pail. Unfortunately,

the substitution of gypsum for limestone did not result in a satisfactory end product, so other formula changes were necessary. After the other changes which were deemed necessary, there is still an 11¢ per pail savings. It is our opinion that the gypsum formula is superior to the old limestone formula. The favorable field trials in Portland, Seattle, Dallas and Omaha seem to confirm that we have a satisfactory product. Some of the trials were made with an air separated gypsum and indicate that this material will be as good as the ground gypsum used in the initial trials. Acme will install the air separator which came from New Orleans. As soon as we have the fine gypsum available, we will begin making the transition at Acme. If their experience is good, we will recommend a ready mix plant at Sigurd using gypsum as the filler.

b. Textures

Two textures, Bestex A (no aggregate) and Bestex D (vermiculite aggregate), have been formulated using a gypsum filler. The gypsum used in the textures is regular landplaster since it is not necessary to have a special fine grind. Field tests have been only moderately successful, so reformulation is underway to make the refinements which will render the products acceptable. A number of competitors are furnishing a texture with expanded polystyrene. This aggregate has some advantages (it is white and is very lightweight), but special equipment is required to expand and grind the polystyrene. Our objective is to evaluate the texture market by making the vermiculite texture available before investing in equipment to use polystyrene. We have purchased enough raw materials at Sigurd to make 5 tons of texture which will be used for the market testing.

c. Other Joint System Products

Investigation is underway to develop Triple Duty, All Purpose and Laminating Compound formulas with gypsum. These formulas, along with the others, will be limited to Acme and Sigurd since it is cheaper to use limestone at the other manufacturing locations.

3. Hard End Wallboard

We applied resin to both ends of several million square feet of board at Acme. During this time nothing was said to see what reaction would come from the field. Much to our surprise, we did not receive any comment from the field other than a couple complaints when the boards stuck together. We received even more complaints from the plant because of their inability to keep the end sprays functioning. In view of the lack of enthusiasm from both Sales and Manufacturing, it has been decided to abandon the hard end project.

4. Joint System Formula Improvements

Thirty different emulsions were evaluated as alternate binders for ready mix. These were boiled down to four. One, Union Carbide W-130, was field tested and has been added to the approved list. Another, Monsanto TS-85, is ready for field testing. Two others appear to be satisfactory, but field trials will have to be arranged. Purchasing likes to have a number of alternate sources for such raw materials so they can bargain for the best possible price. However, our inability to get field trials has stymied complete evaluation of these alternate sources.

Another vinyl adhesive from Monsanto called RS-6319 has been found. This adhesive is a particularly effective binder and offers water resistance which is something the other vinyls lack. Some experimental work is being done to see if this adhesive can be used to improve our Triple Duty and One Day joint compounds. We can especially stand some better working properties for One Day and if the decoration problem can be solved, we might even be able to increase the sales of the product.