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# VITREOUS CHINA SANITARY WARE

## A Manufacturing Opportunity in Georgia

Prepared for  
The Georgia Department of Commerce  
Abit Massey, Director

by  
Walter Kennon  
Research Economist  
William E. Durrett  
Research Assistant



Engineering Experiment Station  
Georgia Institute of Technology  
Atlanta, Georgia

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Georgia Institute of Technology  
July, 1959

## Foreword

In this study attention is called to the opportunities that exist in Georgia for sanitary ware manufacturing. It is the result of personal contacts with men in the industry, correspondence with companies and executives at too great a distance to be reached personally, and the analysis of census data--as well as data collected from various sources. This study contains basic information on markets, competition, and the changing location pattern in the industry. It points out the opportunities that Georgia provides for further expansion of the industry.

This is the first of what we hope will be a series of studies on the ceramic industries. With the market potential, favorable gas rates, and available raw materials, Georgia is a good location for the manufacture of other ceramic products. Floor and wall tile, electrical porcelain, and missile ceramics all have possibilities for industrial development in Georgia.

Much of the research involved in the study was done as part of a series of studies made for the Georgia Department of Commerce. Since insufficient funds were available to complete and publish the study, its release was delayed until the Industrial Development Branch secured additional funds at the start of its new fiscal year.

Comments on this report and inquiries regarding more detailed and up-to-date analyses are invited.

Kenneth C. Wagner, Head  
Industrial Development Branch

## Acknowledgments

The authors are grateful to the many people in the sanitary ware industry, trade associations, and others, who gave valuable information and time in making this report possible. Without their cooperation, it would have been a much more difficult, if not an impossible, task.

We especially thank Mr. R. F. Gammans, Jr., of Georgia Sanitary Pottery, Inc., for providing information about the industry, and for a tour of his company's vitreous china ware manufacturing plant.

Various executives in Atlanta offices of national manufacturers gave valuable information which prompted the study. These include Mr. J. W. Stidham, American Radiator and Standard Sanitary Corporation; Messrs. D. H. Armstrong and W. E. Massey, Jr., Crane Company; and Mr. M. B. Wildman, Richmond Plumbing Fixtures, Inc. Mr. John A. McFarlane was especially helpful in giving information about his experiences with the sanitary ware industry.

Mr. J. A. Cleveland, American Radiator and Standard Sanitary Corporation, New York and Mr. Fred C. Akers, Crane Company, Chicago, both provided sources of data for deriving marketing and construction data. Miss Nell Lea, of the regional offices of the Bureau of Labor Statistics, and Mr. Albert E. Spivey of the F. W. Dodge Corporation supplied construction data on which the market projections are based.

We are indebted to the Atlanta Gas Light Company for data on gas rates and gas lines.

Mr. T. D. Sullivan, Manufacturers Clearing House of Illinois, Inc.; Mr. Joe Robinson, Associated Plumbing Contractors of Georgia, Inc.; and Mr. E. L. Pugh, Southern Wholesalers Association; provided addresses for the questionnaire surveys.

In addition, we appreciate the time and effort spent by the manufacturers, wholesalers, distributors, and plumbing contractors in completing questionnaires for the market survey. Without their assistance much of the basic data for this study could not have been obtained.

## Summary

Georgia, centered in a \$16 million market, provides a considerable opportunity for a vitreous china sanitary ware manufacturer. New family formations, the trend toward multiple baths, and increasing construction actively are expected to provide an even greater market for sanitary ware within the next few years. Although manufacturers in Alabama, Georgia, and South Carolina have a combined annual sales of approximately \$10 million, 80 per cent of the sanitary ware purchased in the Southeast is manufactured outside the region. A market survey shows that a Georgia-located branch of a national manufacturer can expect annual sales of around \$5 to \$8 million in the long-run, serving the six-state<sup>1/</sup> and national markets.

Georgia produces about 74 per cent of the kaolin mined in the United States. Feldspar, talc, and high-purity silica sand are also mined in the State. Ball clays may be shipped in from Tennessee and Kentucky. Moreover, Georgia's ports provide adequate facilities for importing English clays, if necessary.

Gas rates from 24 to 29 cents per 1,000 cubic feet are prevalent in the areas which produce the raw materials.

The clay deposits, major gas lines, and the source of other raw materials are shown on Map 1.

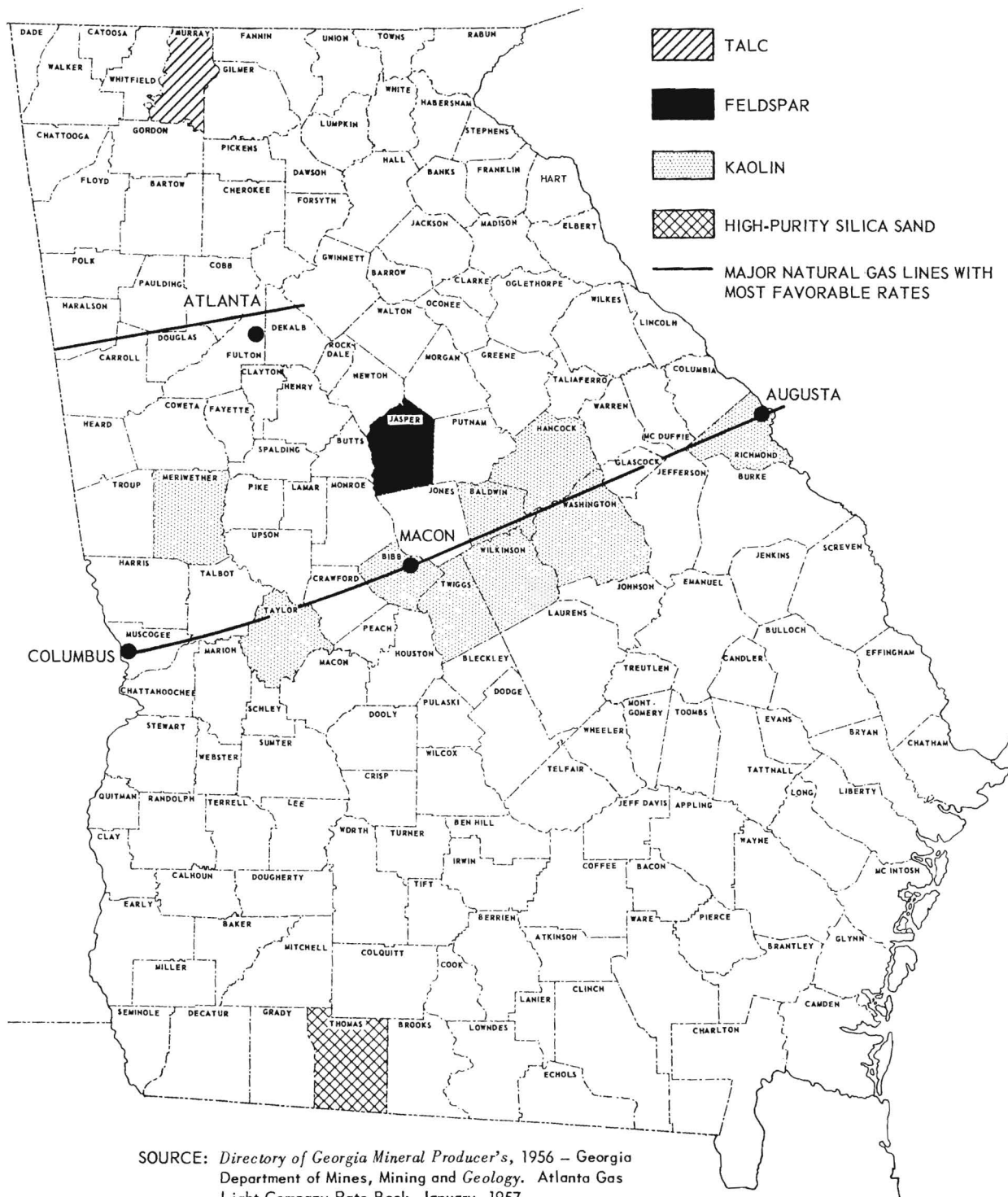
Furthermore, a fitting manufacturer, Bridgeport Brass, is locating in Moultrie, Georgia. This nearby fitting supplier will be advantageous to a vitreous china ware manufacturer.

There is a good labor supply, not only of rank and file workers but of highly trained engineers. Georgia Tech graduates about 20 ceramic engineers per year, and has a research staff and facilities available for technical consultation.

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<sup>1/</sup> Alabama, Florida, Georgia, North Carolina, South Carolina, and Tennessee.

MAP 1  
PRODUCING AREAS OF VITREOUS CHINA SANITARY WARE RAW MATERIALS AND  
MAJOR NATURAL GAS LINES IN GEORGIA



SOURCE: *Directory of Georgia Mineral Producer's*, 1956 - Georgia Department of Mines, Mining and Geology. Atlanta Gas Light Company Rate Book, January, 1957.

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## INTRODUCTION

Since the ceramic industry is shifting geographically toward new and growing markets, a general market and economic survey of the industry was made to determine some of the most likely prospects for Georgia's expanding economy. Sanitary ware is one of the products of the ceramics industry with an attractive potential for further development. Although Georgia is located in the center of an expanding southeastern market for sanitary ware, about four-fifths of the total used is imported from other regions.

This report is primarily intended for the large companies of the industry and is an analysis of the opportunities that exist in Georgia for a branch plant. The facilities of a large company are needed to adequately meet the economic opportunities of the region. A number of companies might well be interested since the industry is one of large industrial giants. The four largest companies account for 65 per cent of national sales; eight of the largest companies supply 83 per cent of the product, while 20 of the largest supply 98 per cent.<sup>1/</sup>

Although sanitary ware is manufactured in both vitreous china and metal base, vitreous china has the greater opportunity in Georgia. This report is concerned exclusively with vitreous china ware as a part of the ceramics industry and does not cover metal base which is more closely related to metal-working.

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<sup>1/</sup> Concentration in American Industry, Report of the Subcommittee on Antitrust and Monopoly to the Committee on the Judiciary. U. S. Senate. U. S. Government Printing Office, Washington, 1957.

## I. THE NATIONAL AND SIX-STATE MARKETS

The southeastern market for vitreous china sanitary ware is estimated at \$15.9 million for 1960, \$18.1 million for 1965, and \$20.2 million for 1970. Forecasts are not made beyond 1970 because the forecasting method gives estimates which seem too conservative in view of the rapidly expanding economy. This is especially true when the growing construction industry and the increased family formations are considered. The report's estimates are based on statistical analysis of published data.

### National Sales

Data on vitreous china plumbing fixture sales for the United States are available for the years 1946 through 1957 from several sources.

Regional data on sanitary ware sales are not available. However, sanitary ware sales are closely related to construction activity. A correlation indicates that approximately six-tenths of a cent of every residential construction dollar, and two-tenths of a cent of every non-residential construction dollar are spent for vitreous china sanitary ware. By relying upon this relationship between sanitary sales and residential and non-residential construction, forecasts can be made and the six-state market estimated.<sup>1/</sup>

### National Forecasts

National residential and non-residential construction can be forecast by the method outlined in Appendix B. The results are as follows:

<u>Year</u>	<u>Residential (\$1,000,000)</u>	<u>Non-Residential (\$1,000,000)</u>
1960	\$20,400	\$16,457
1965	23,300	19,231
1970	26,300	20,900

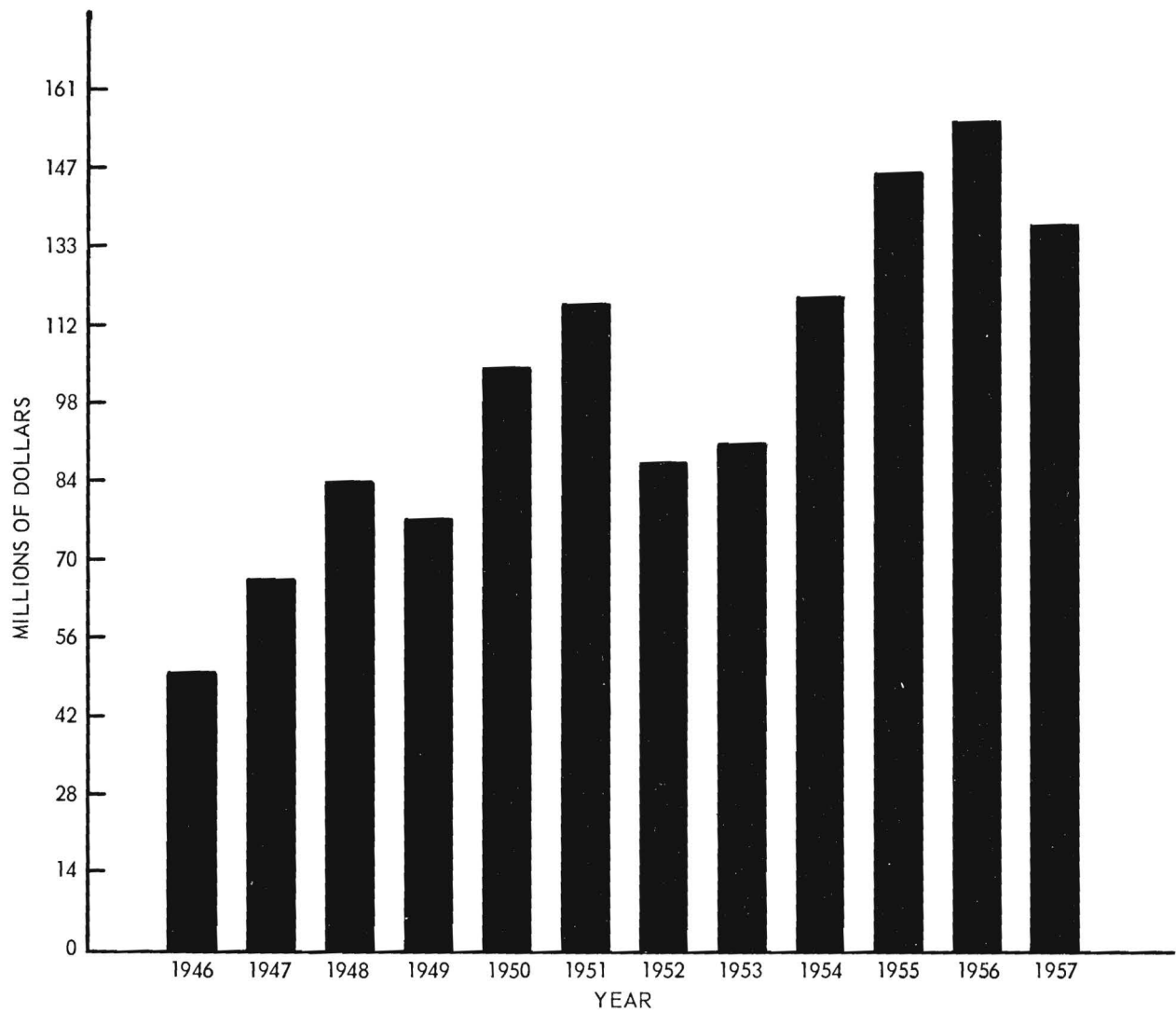
### The Regional Market

In view of the fact that 80 per cent of the vitreous china sanitary ware purchased in the six-state region comes from other regions, a manufacturer can reasonably expect to capture some of this market. Although more distant

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<sup>1/</sup> The technical details of this relationship are found in Appendix A.

CHART 1  
TOTAL UNITED STATES VITREOUS CHINA SANITARY WARE SALES FOR THE  
PERIOD 1946 THROUGH 1957



SOURCES: *Stanford Research Bulletin,*  
*Census of Manufacturers,*  
*Annual Survey of Manufacturers,*  
*Facts for Industry.*

markets can be reached, the six-state market<sup>1/</sup> will probably be the supporting market.

Although sanitary ware sales data are not available by state or region, construction expenditures by state are available.<sup>2/</sup> The percentages of state to total United States construction expenditures are as follows:

Alabama	1.0%
Florida	5.0
Georgia	1.5
North Carolina	1.0
South Carolina	0.5
Tennessee	1.0
Total	10.0%

These percentages vary from year to year, but the ones presented here are typical. There is no discernible upward trend. That is, although the dollar amount of the market for sanitary ware in the Southeast is increasing, the proportion of the market to the national total is constant. Therefore, these state percentages can be used to estimate the future regional market from the national total.

#### Regional Forecasts

Future sanitary ware sales by each state can therefore be estimated. From the projection of construction, the total for the United States is estimated; from the relationship between construction and sanitary ware sales, total national sanitary ware sales are calculated; and finally, from the proportion of the region to the total United States, regional sanitary ware sales are predicted. The forecasts are summarized in Table 1.

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<sup>1/</sup> Alabama, Florida, Georgia, North Carolina, South Carolina, and Tennessee.

<sup>2/</sup> Construction Review, Bureau of Labor Statistics. For the period, 1939-1952, there is a detailed analysis of construction by state and by type of construction. After 1952 building permits by state are available.

Table 1

PROJECTIONS OF TOTAL U. S. CONSTRUCTION AND ESTIMATED SANITARY WARE  
SALES FOR THE SIX-STATE REGION

(\$1,000,000)

	<u>1960</u>	<u>1965</u>	<u>1970</u>
U. S. Construction:			
Residential	\$20,400	\$23,300	\$26,300
Non-Residential	16,457	19,231	20,900
 Total U. S. Vitreous China Sanitary Ware Sales Estimated	 \$ 159.0	 \$ 181.2	 \$ 202.2
 Sales Estimated for the Six-State Region			
Alabama	\$ 1.6	\$ 1.8	\$ 2.0
Florida	7.9	9.1	10.1
Georgia	2.4	2.7	3.1
North Carolina	1.6	1.8	2.0
South Carolina	0.8	0.9	1.0
Tennessee	<u>1.6</u>	<u>1.8</u>	<u>2.0</u>
Totals	\$ 15.9	\$ 18.1	\$ 20.2

## II. ESTIMATED SALES FOR A MANUFACTURER LOCATING IN GEORGIA

There are several factors which determine the sales volume, or market share, that a manufacturer can expect, including customer preferences, distribution costs, and product quality. However, from an analysis of the market share of two companies, one outside the region and the other in the region, some reasonable estimated penetration of the six-state and national markets can be determined.

In the sanitary ware industry the normal, or expected, penetration is difficult to estimate because most of the companies selling nationally not only sell vitreous china sanitary ware, but also a wide variety of other industrial products, such as valves, enameled metal plumbing fixtures, and plumbing supplies of all kinds. Since their sales are not analyzed by product, they cannot be compared with the national sales of vitreous china sanitary ware for an estimate of penetration. However, one medium-sized manufacturer's sales are compared with those for the national total. This company, located outside the region, distributes nationally, and sells vitreous china ware exclusively. An analysis of the company's sales from 1949 through 1957 indicates that its average annual penetration of the national market was around 10 per cent. Certainly, from this analysis it is deemed that a 10 per cent market share is the maximum that can be expected by a Georgia located branch serving the six-state and national markets.

### Regional Sales

The market forecasts for the six-state region are \$15.9 million, \$18.1 million, and \$20.2 million for 1960, 1965, and 1970. By applying the maximum market share (10 per cent), a branch plant in Georgia can reasonably expect annual sales of around \$1,600,000 in the immediate market period. Sales of \$1,800,000 and \$2,000,000 represent the short-run and long-run period estimates.

### Total Company Sales

But these forecasts do not include the sales that can be expected from the total national market by a company locating in Georgia. One plant in the six-state region, which is a branch of one of the leading national manufacturers, has about a 4 per cent share of the national market. Likewise, a Georgia-located branch of a national manufacturer might attain a similar penetration in the long-run. To be conservative, sales are estimated at various

penetrations of 10 per cent and less of the six-state and national markets as shown in Table 2.

From the analysis of the market penetrations of the regional and national companies it is estimated that a vitreous china sanitary ware manufacturer in Georgia can expect sales of around \$5 to \$8 million from the national and six-state markets. This, of course, is based upon the assumption that the plant is a branch of a national manufacturer with established marketing channels.

Table 2

ESTIMATED SALES FOR A VITREOUS CHINA SANITARY WARE MANUFACTURER LOCATED IN GEORGIA SERVING THE NATIONAL AND SIX-STATE MARKETS

	<u>1960</u>	<u>1965</u>	<u>1970</u>
Total National Market	\$159,000,000	\$181,200,000	\$202,200,000
Sales at Various Penetrations			
10%	\$ 15,900,000	\$ 18,120,000	\$ 20,220,000
9	14,310,000	16,308,000	18,198,000
8	12,720,000	14,496,000	16,176,000
7	11,130,000	12,684,000	14,154,000
6	9,540,000	10,872,000	12,132,000
5	7,950,000	9,060,000	10,110,000
4	6,360,000	7,248,000	8,088,000
3	4,770,000	5,436,000	6,066,000
2	3,180,000	3,624,000	4,044,000
1	1,590,000	1,812,000	2,022,000

These sales estimates are conservative because they are based upon the historic relation between construction expenditures and sanitary ware sales. Yet there is evidence that this historic pattern is changing. There is an increase in the demand for more than one bathroom in moderate priced homes, as well as in the number of higher-priced homes with a bath to each bedroom.

### III. COMPETITION

The most recent census reports indicate that there are 38 manufacturers of vitreous china sanitary ware in the United States. Most of these plants are located in the midwestern and eastern regions. This situation is due to a combination of factors, including the pattern of settlement of skilled craftsmen immigrating to this country in the early decades of its history, and the availability of suitable raw materials. However, manufacturing has shifted geographically in recent years because substantial markets have developed in other regions, and distribution costs have risen. These factors have precipitated a change in the locational pattern of the industry.

#### States Supplying the Six-State Region

Map 2 shows the states supplying the six-state market with vitreous china sanitary ware, and the relative amounts they provide. Over 70 per cent of the plumbing fixtures purchased in the southeastern market are manufactured in the Middle Atlantic and East North Central regions, including Indiana, New Jersey, and surrounding states. New Jersey supplies 18 per cent of the total, Wisconsin and Pennsylvania supply 15 per cent each, with 22 per cent supplied by the remaining states in the two regions. These plants are, for the most part, the large, full-line manufacturers, which serve the national market.

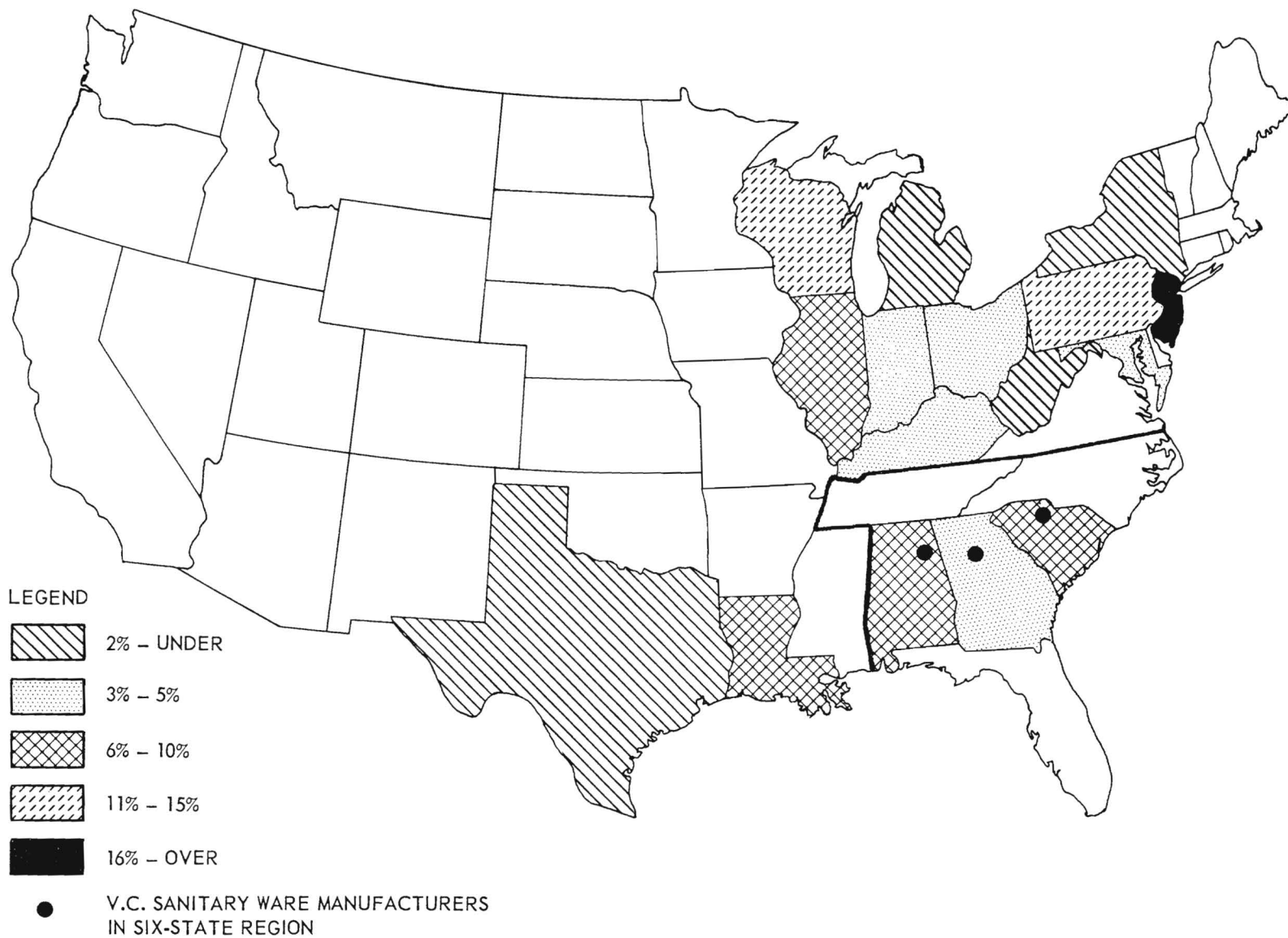
There are 15 plants located in the South and West. Nine of these are locally-owned manufacturers, selling to the low-to-medium price range market. The other six are branches of national manufacturers selling in all price ranges. Around 10 per cent of the six-state market is supplied from manufacturers in Louisiana, Texas, Kentucky, and West Virginia.

Indiana, Ohio, Maryland, and Kentucky each supply the six-state market with as much vitreous china sanitary ware as does Georgia.

This means that approximately 80 per cent of the sanitary ware purchased in the six-state market is shipped rather long distances from other regions. This indicates an extreme imbalance between the location of manufacturing source and the six-state market. In freight costs alone, which are usually paid by the manufacturer, there would be considerable cost savings in having a branch of a national manufacturer located in Georgia. These costs, in the range of 3 to 8 per cent of the total cost, are about five times as much on the finished product as on raw materials.



MAP 2  
STATES SUPPLYING THE SIX-STATE MARKET WITH VITREOUS CHINA  
SANITARY WARE AND PER CENT OF TOTAL



### Regional Manufacturers

Within the six-state region there are three manufacturers of vitreous china sanitary ware. (See Map 2.) One is a small, independent company; two are branches of national manufacturers. The total annual sales of the three firms is around \$10 million. These regional plants supply only 20 per cent of the vitreous china sanitary ware purchased in the region. Undoubtedly they sell outside the region, probably due to the markets to be served with their range of product quality and price. However, to assume an extreme position, even if they are operating at a combined total peak capacity of around \$12 million in 1960 and all their sales come from the six-state market, almost \$4 million of vitreous china sanitary ware would have to be imported from manufacturers in other regions.

Of course, no manufacturer can expect to capture all of the volume that is purchased from other regions. However, in view of the fact that over four-fifths of the vitreous china sanitary ware is manufactured outside the region, it is evident that there is sufficient sales potential in the six-state market for a branch plant in Georgia.

#### IV. GEORGIA'S RESOURCES

Besides being centered in a \$16 million market for vitreous china sanitary ware, Georgia offers a potential manufacturer additional advantages. Among these are favorable gas rates, suitable raw materials, a readily available labor supply, technical assistance, a new fitting manufacturer, and adequate distribution and transportation facilities.

##### Natural Gas

Map 3 shows the locating of the major natural gas lines in the State. The gas rates on these lines are the lowest of any east of Mississippi. Atlanta, Columbus, Macon, and Augusta especially have good rates, ranging from 24 to 29 cents per 1,000 cubic feet, depending on the volume used. For the large quantities required for vitreous china sanitary ware manufacturing, an even lower rate can be negotiated. In terms of fuel, a location in Georgia is very favorable.

##### Raw Materials

Georgia is the major source of kaolin. About 74 per cent of all kaolin mined in the United States comes from Georgia; much is shipped long distances to other regions for vitreous china sanitary ware manufacturing.<sup>1/</sup> Not only is this type of clay plentiful, but it is located in those same low-gas-rate areas. (See Map 3.)

High-purity silica sand, which can be ground into potter's flint, is produced in Thomas County. Talc and feldspar are produced in Murray and Jasper counties, with additional sources of feldspar in western North Carolina.

Ball clays are produced in Tennessee and Kentucky. For a company that uses English clays, Georgia provides excellent port facilities for importing raw materials.

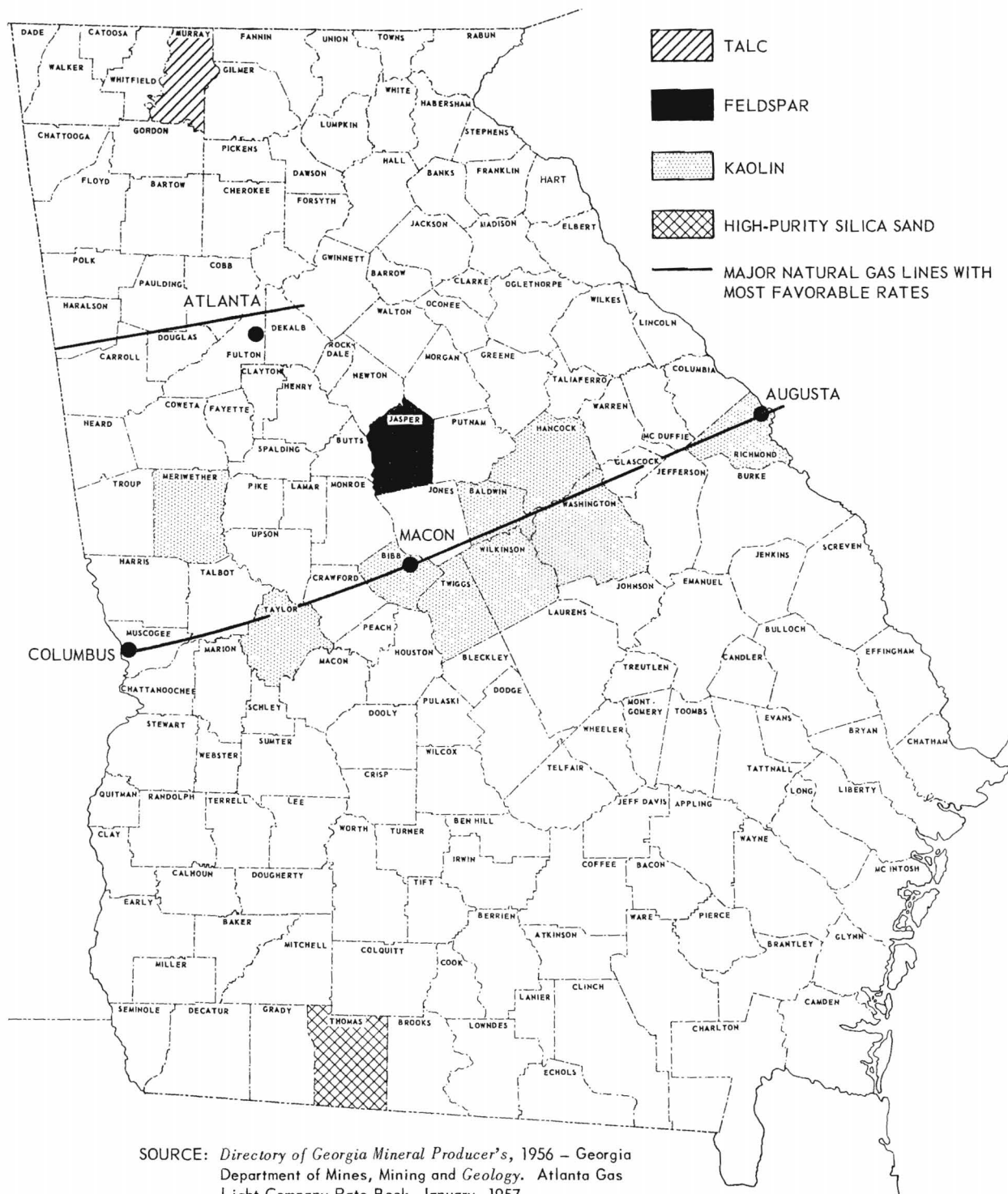
##### Labor and Technical Assistance

For the most part vitreous china sanitary ware manufacturing requires only semi-skilled and unskilled labor. Georgia's labor, with proper training, can provide the necessary skills for vitreous china sanitary ware manufacturing.

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<sup>1/</sup> 1956 Minerals Yearbook, Volume I, U. S. Department of the Interior, Bureau of Mines.

MAP 3  
PRODUCING AREAS OF VITREOUS CHINA SANITARY WARE RAW MATERIALS AND  
MAJOR NATURAL GAS LINES IN GEORGIA



The Georgia Institute of Technology graduates approximately 20 to 25 men each year in Ceramic Engineering. A survey of the alumni indicates that many graduate engineers would locate in the State if there were suitable employment opportunities. In addition to the engineering graduates, Georgia Tech has a staff of 10 to 12 ceramic engineers in research or teaching. These staff engineers and the facilities of the Engineering Experiment Station are available for research and technical consultation.

#### Valve and Fitting Supplier

Bridgeport Brass Company has recently announced that it is building a half-million dollar plant in Moultrie, Georgia. This plant will employ approximately 100 workers and should be in full operation by 1960. This fitting source should be advantageous to a potential sanitary ware manufacturer in Georgia.

#### Transportation and Distribution Facilities

Columbus, Macon, and Augusta are transportation and distribution centers in the vicinity where sanitary ware manufacturing is most feasible. These cities have adequate rail and trucking facilities for shipping of raw materials and distributing the finished product.

## APPENDICES

# APPENDIX A

Table 3

## MULTIPLE CORRELATION FOR PREDICTING VITREOUS CHINA SANITARY WARE SALES FROM CONSTRUCTION

Year	Value of Vitreous China Sanitary Ware Manufactured (million dollars)	Residential Construction (million dollars)	Non-Residential <sup>1/</sup> Construction (million dollars)
	$X_0$	$X_1$	$X_2$
1946	\$ 47.7	\$ 5,126	\$ 3,831
1947	67.2	7,735	3,951
1948	84.0	10,278	5,151
1949	77.2	10,001	5,558
1950	102.3	14,445	6,433
1951	116.1	13,124	8,897
1952	86.7	13,496	9,403
1953	92.1	14,333	10,313
1954	116.6	15,715	11,196
1955	146.7	18,971	12,223
1956	156.5	17,924	13,393
1957	136.2	17,081	14,196

<sup>1/</sup> Omitting highways, dams, and other heavy engineering construction.

Estimating Equation  $X_0 = 8.343118 + 0.0059953998 X_1 + 0.0017266874 X_2$

Standard Error of the Estimate:  
(Corrected for Degrees of Freedom) - \$ 12.327

Correlation Coefficient (R):  
(Corrected for Degrees of Freedom) - 0.9276

## APPENDIX B

### PROJECTIONS OF CONSTRUCTION ACTIVITY

For this analysis, construction was divided between residential and non-residential. Obvious non-sanitary ware users, such as highways, dams, and other heavy engineering types of construction, were omitted. Projections of construction costs can be made to forecast future sanitary ware sales through the correlation of sanitary ware to construction. For this purpose construction costs for the period 1946 through 1957 were examined. These are the most current data and are not distorted by the abnormalities of the war period. Statistical tests based upon difference analysis reveal that the data prior to this period are distorted.

Since both residential and non-residential construction data indicate an orderly growth at a declining rate, some type of a second degree logarithmic curve would seem appropriate. However, a second degree polynomial logarithmic projection proved unsatisfactory because the projection reached a maximum in 1962 and then decreased. This peak is not consistent with either theory or experience. Therefore the Gompertz and Logistic limited growth curves were used.

For residential construction none of the curves fitted by the usual mathematical procedures seemed to give a satisfactory fit and projection. Even the Gompertz, which resulted in the best fit and projection, was unsatisfactory because it resulted in a leveling off at a little more than \$20 billion in 1965 and very little future growth after that date. Yet this is contrary to family formations and other indicators of future residential construction. And this Gompertz projection was the most optimistic of all the trends fitted. Furthermore, residential construction follows a cyclical pattern not evident in non-residential construction. Therefore, since mathematically fitted curves proved unsatisfactory, the trend was projected by drawing a curve freehand but passing through the average for the data centered, and through an estimate of \$24.3 billion for 1967 as predicted by Miles L. Colean, an analyst for Architectural Forum.<sup>1/</sup>

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<sup>1/</sup> Miles L. Colean, "The Bullish Outlook for Building," Architectural Forum, February, 1958.

Substantially the same forecast was made in the following publication: The Associated General Contractors of America, Inc., "1957-1965 Construction Value Estimates," The Constructor, October, 1956.



The variations of actual construction above the trend are approximately equal to those below. The resulting projection is in Chart 2 and Table 4.

The Gompertz had a satisfactory fit and projection for non-residential construction. (See Chart 3.)

The projections of both residential and non-residential construction as summarized in Table 4 seem to be reasonable.

Table 4  
CONSTRUCTION IN THE UNITED STATES  
(\$1,000,000)

<u>Year</u>	<u>Residential</u>	<u>Non-Residential</u>
(Actual)		
1946	\$ 5,126	\$ 3,831
1947	7,735	3,951
1948	10,278	5,151
1949	10,001	5,558
1950	14,445	6,433
1951	13,124	8,897
1952	13,496	9,403
1953	14,333	10,313
1954	15,715	11,196
1955	18,971	12,223
1956	17,924	13,393
1957	17,081	14,196
(Forecast)		
1958	19,100	14,962
1959	19,900	15,738
1960	20,400	16,457
1961	21,000	17,118
1962	21,500	17,724
1963	22,100	18,275
1964	22,800	18,777
1965	23,300	19,231
1966	23,800	19,640
1967	24,300	20,008
1968	25,100	20,339
1969	25,800	20,635
1970	26,300	20,900

Source: Construction Review, U. S. Department of Labor  
and U. S. Department of Commerce.

Forecast by Industrial Development Branch - 3/59

CHART 2  
RESIDENTIAL CONSTRUCTION IN THE UNITED STATES

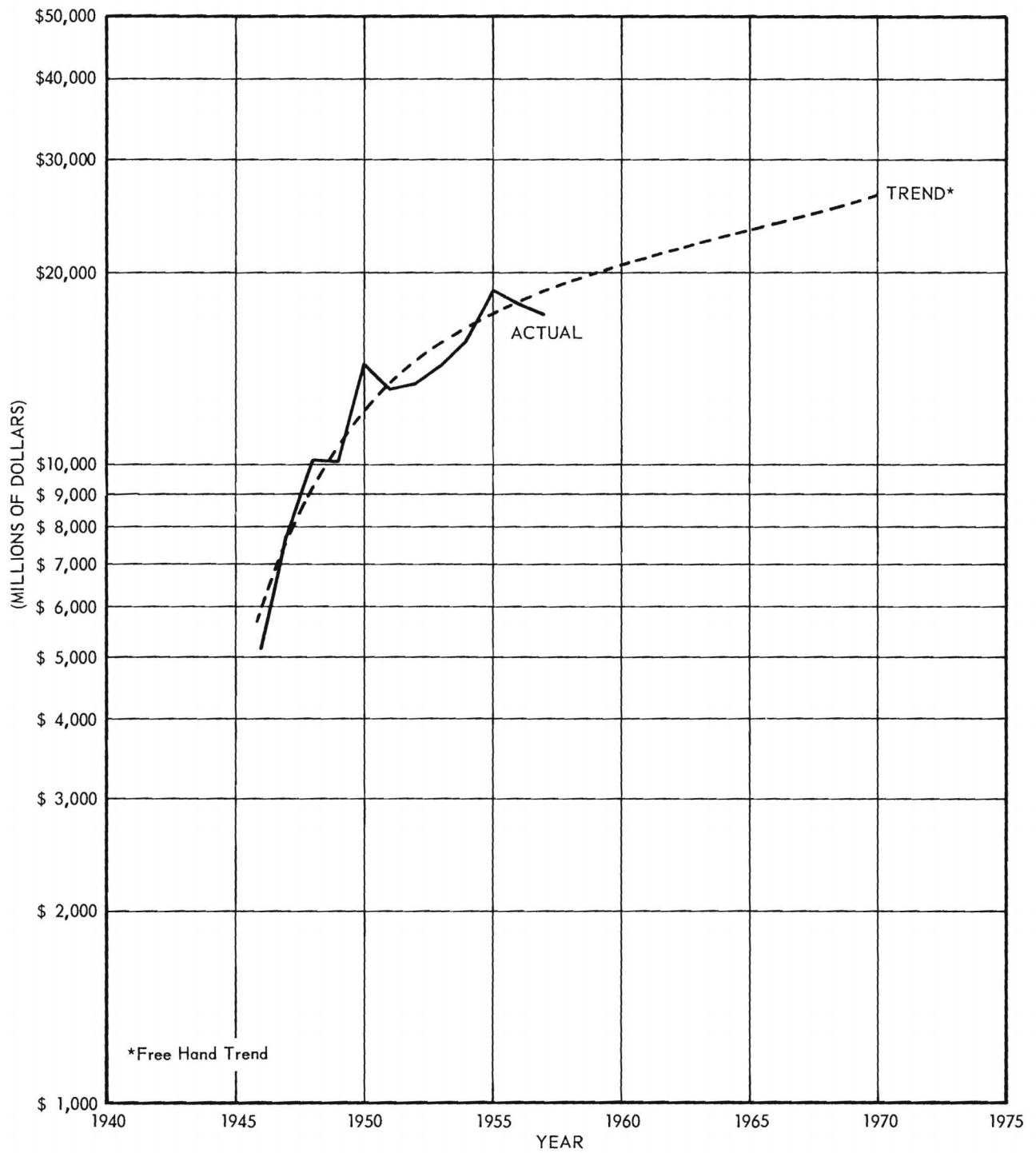


CHART 3  
NON-RESIDENTIAL CONSTRUCTION IN THE UNITED STATES

