Ed. Kruger's report.

Use of structural face tiles as promoted in Iowa is a possibility in expanding market in small houses and farm buildings.

Both product and sales promotion in this state are inferior. Product is inferior chiefly in regard to variety of types.

#

calls concrete "cement" on p. 29.

#

Supply of "high heat duty refractories" appears much larger than when Kruger wrote report. These clays will not compete with high alumina Missouri clays, but clays of Kansas type are used in Mo. for fire clay bricks. Kansas fireclays have properties which make them more suitable for some uses than Mo. clays, particularly high strength, resistance to abrasion, and penetration, i.e. low absorption.

Chemical stoneware, electrical stoneware, and similar special products are a possibility.

THE OUTLOOK FOR KANSAS CLAY PRODUCTS INDUSTRIES

by

Edward V. Krugor
B. S. Bus., University of Kansas, 1939

Submitted to the Department of Economics and the Faculty of the Graduate School of the University of Kansas in partial fulfillment of the requirements for the degree of Master of Business Administration.

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For the department

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PREFACE

In the Spring of 1939 the Legislature of the State of Kansas, in sympathy with other measures taken in support of a state wide industrialization and developmental program instituted at that time, granted $5000 to be used for five fellowships under the direction of the University of Kansas. This paper was written under the authority of one of these fellowships established to study the outlook for Kansas clay product industries.

The State Geological Survey of Kansas has been investigating clay deposits of the central and north central sections of the State, and is convinced that these new deposits offer opportunites for commercial exploitation. According to their tentative opinion, the deposits are of such extent and quality that they offer raw materials which would support plants with products ranging in type from pottery to fire brick. This study attempts to answer the question: "How many and how great are the marketing possibilities for products of plants of this nature."

This study is, of necessity, an incomplete answer to the question. It is the writer's hope, however, that the material presented has laid the ground work for more detailed study, and that certain conclusions drawn are worthy of consideration.

A classification of the field of coverage of the term clay products, upon the basis of use of the manufactured material, presents a division similar to the following schedule which is suggested as an adequate, if perhaps incomplete, outline of all practical uses for the newly discovered clay deposits of Kansas.

A. Building materials
   1. Exterior surfaces - face brick, tile, terra cotta, and so forth.
   2. Foundations and supports - common brick and tile.
   3. Interior purposes - interior, wall, and floor tile.
   4. Items of use permanently attached to building structures - sanitary ware, sewer pipe, and so forth.

B. Pottery - utility and artistic wares

C. Heat resistant materials
   1. Firebrick - subject to direct heat
   2. Insulators - subject to indirect heat

The suggested grouping does not include various important uses of clay such as electrical insulators, paper and rubber filler, or specific products made wholly or in part of clay. It does cover, however, the field as concerns the most common and extensive types of industrial plants utilizing clay as a raw material.

In the following paper consideration is given to each of the above main divisions. An attempt is made to analyze the possibilities of inducing concerns of each given type to locate in Kansas and, in case they should do so, to examine the probabilities of their being able to carry on profitable operations.

I wish to express my appreciation to all the many individuals both within and without the clay products industry who have given of their time and effort in the furtherance of this study.

Especially do I wish to admit my indebtedness to Mr. Brian O'Brian of Buffalo; to Mr. H. B. Gilkeson of Wichita; and to Mr. Fred LaFountain of Kansas City, Missouri, for their special contributions. I am very grateful to Dean Frank T. Stockton for his guidance of the project and to Margaret S. Stockton for her editing and critical analysis of the subject matter.

Edward Krugor

Lawrence, Kansas
May 20, 1940

Section I

The Economics of Location

The general principles governing the location of an industry can be so simply stated as to be axiomatic. It is a commonplace that an industry tends to locate where, in the aggregate, it has the maximum potential market within its reach and the minimum costs of production and transportation to the ultimate consumers. It is likewise obvious that minimum cost is fundamental in determining the market within reach, and that the existence of a market sufficient to support production is the final absolute determinant in any question of the location of productive effort. However simple this statement of the principles of location may be, its application probably provides the first test for management and since no one location is normally superior in all respects in every case the position finally chosen represents a compromise. The essential considerations vary from industry to industry, and even within a given industry from period to period as techniques and economic conditions undergo change. A study of the elements which influence the decision as to the geographical site of a firm can be termed the "economics of location". The following section is presented in partial exposition of the controlling considerations in determining the location of structural clay product plants.

The principal products of the structural clay industry, so far as their production in Kansas is concerned, are common, vitrified, and face brick, and hollow partition load-bearing tile. The production of common brick, always the major item of the industry,[1]

(1) WPA National Research Project - Productivity and Employment in Selected Industries.

although subject to influences which are not encountered in the manufacture of the other principal commodities, is sufficiently representative of the industry as a whole as to make valuable the following cost schedule. It is presented not so much as a cost study directly applicable to Kansas conditions, but rather as a basis for further discussion and as an indication of the relative importance of the various costs of operation. The table is taken from a WPA - National Research Project.(2)

Cost per Thousand Common Brick for Six Brick and Tile Plants(a)
1935

Total	$9.89
Total manufacturing	6.25
Labor operation and indirect	3.30
Raw material and supplies	0.38
Fuel for burning	1.03
Overhead	1.37
Other manufacturing expense	0.17
Power	1.52
Administrative	1.03
Selling	0.41
Other	0.68

(a) Two large-, two medium-, and two small-sized plants.

From the above schedule it is apparent that labor, raw material, fuel, and possibly power costs are elements which tend to be closely allied with the location of the productive facilities. However, closer study tends to indicate that the expenditures listed under power are, for the most part, electrical energy charges. Since it is evident that, because of the importance of transportation in the brick industry, any firm will tend to locate relatively close to

(2) Ibid p 145

some urban center, it follows that, in large measure, the influence of power costs in determining the site of a given firm can be neglected. Consequently, the three elements of raw material, labor, and fuel form the nucleus of a discussion of the "economics of location."

Raw Materials

Every state in the nation reports the production of some structural clay products to the Department of Commerce, and workable clay is so abundant that some writers term it an ubiquity.(3) This is not to say, however, that variations in the clays are not important since the quality of deposits everywhere is not the same. Although it is possible for manufacturers of common brick to use almost any common clay which is available, the fact remains that suitable clay for face and vitrified brick and tile must often pass rather rigid tests and that, at times, the quality of available clay deposits has given one territory a decided advantage over another.(4) For example, Ohio tile can be shipped into the eastern markets in direct competition with local products which sell at low prices because the eastern tile are made from inferior shale and surface clay of that region.(4a) Certain clays are more suitable than others for machine work and, as presented in the NRA code hearings in 1933,

(3) Locklin, D.P., Economics of Transportation, Business Publications, Inc. 1938 p 121

(4) The Department of the Interior I.C. 6155 July 1929 p 20; Almost any clay that will mold easily and burn hard at a fairly low temperature (usually below cone1 or about 2100° F) will do for making common brick.--The Physical requirements of face brick clay are (1) Uniform color in burning (2) Freedom from warping or splitting, (3) Absence of soluble salts, and (4) Sufficient hardness, and low absorption when burned at a low temperature.

(4a) WPA - National Research Project - supra - p 62

this difference can affect production as much as 100% due to lack of uniformity in plasticity alone.(5) Again, certain clays "fire" at different temperatures and require different length firing periods. For example, in the Chicago area the high carbon content in some clays permits firing in 48 hours, while other clays require 6 days.(6) Emphasis is given to the color of the finished product in the face brick industry today. In Kansas it is claimed that the demand for buff brick in preference to the red, which is the principal local product, has brought about the importation of out-of-state products which has further depressed the local face brick industry. The ability of certain clays to take salt glazes and various enamels accounts for the centralization of production and for the broad market enjoyed by the ceramic and salt glazed products. It likewise explains why the southern deposits of buff clays in this country are used to make buff brick, unglazed tile, and so forth, while the glazed and enameled items are shipped from the Upper Ohio Valley. The WPA - National Research Project referred to above found a noticeable increase in the size of the individual plants which produced a product demanding a special clay over those producing common brick. As is apparent, this is partly explained by the influence of the raw materials as a factor of location of production and partly as a reflection of transportation costs, since the more expensive products permit higher freight charges and hence enjoy a broader market.

The most fundamental aspect of the influence of raw material on location is that it is a final determinant of the type of commodity

(5) Ibid p 63
(6) Ibid p 63

which can be produced, but the raw material costs are not a large percentage of the expenses of making a given structural clay product. In any given territory a clay peculiarly suitable for a certain product is usually so wide-spread in the district that competition of land owners for royalties and the low sale value of the clay bearing land for other purposes combine to make the major cost of raw materials the expenditures necessary for their extraction. Again, at least to a certain degree, the handicaps or limitations of a raw material can be overcome by additional costs in other directions. Thus, "flashing a kiln" or the burning of the product in the presence of certain chemicals can produce variations in color in commodities for which the same basic clay has been used. In any given section the decision to utilize one deposit over another usually tends to turn in terms of accessability, size of the deposits, character and uniformity, over-burden, drainage, water supply, and power connections.

In summary, the importance of raw material in the location of structural clay product plants is that of a "do or don't" situation. A certain type of production can be carried on, if a suitable clay exists, but the cost of the raw material as a percentage of the total costs of production will not be large. Raw materials may locate an industry in a given area, but other elements will determine the specific site to be developed.

Labor Costs:

In 1935 in the six plants investigated by the WPA for which the information is presented above the labor costs approximated 1/3 the

total production expenses. However, in considering the effect of labor upon the location of clay plants, analysis of the actual work involved suggests that quantity and not quality of the labor demanded accounts for this significant fraction. Generally the plants employ a few highly skilled workers and a comparatively large number of common laborers.(7) With the exception of a few positions, unskilled labor can soon be adapted to modern brick machine operations.(8) In fact, during the shortage of labor and the attraction of clay workers into other industries following the World War, certain eastern manufacturers were successful in transporting Negroes from southern districts to meet the shortage.(9) Thus the demand for labor in general rather than for workers of particular skill or training makes the labor factor in production of secondary importance in the location of a given firm.(10) Moreover, the tendency toward mechanization of production in brick plants as an economy measure has been so pronounced and effective(10a) that there is good reason to believe that, in the future, production will be even less dependent than now upon a specialized or a particular quantity of labor.

(7) Ibid p 66
(8) Chute p 12
(9) Ibid Note #7
(10) The writer suggests that the conditions of employment of the average worker in a brick plant cannot help but lead to the conclusion that only unskilled or seasonal workers would be interested. An extreme example in Kansas was the case of an employee who had worked for upward of 25 years for a given firm (probably not average over 10-10½ months per year) and at the present time receives about five months work per year at a little over $100 per month.
(10a) WPA National Research Project - Productivity and Employment in Selected Industries.

Fuel:

The importance of fuel in the clay products industry is determined by the quantity which is demanded to obtain and retain the high temperatures necessary in successful firing. In the use of coal, for instance, examples of the quantities consumed in the firing operation range from 288 pounds per thousand brick where pulverized coal was used in a continuous kiln to 1500 pounds per thousand brick where the fuel in its natural condition was consumed in ordinary periodic kilns.(11) That cheap fuel has been an important factor in the establishment of plants in Ohio, Indiana, and southern Illinois, and that cheap coal is one of the reasons for Ohio's present supremacy in brick and tile manufacture can not be denied.

It is axiomatic to say that the existence of a fuel supply is fundamental to the establishment of structural clay production, yet interesting situations are found where both natural gas or oil and coal exist but, for a time, only one fuel is used to the exclusion of the others. In the presence of all three types of fuel, the choice of one is often based on considerations other than the relative costs of the fuels. For instance, coal in a given locality may be cheaper per thousand brick than natural gas or oil, yet the cheaper labor costs with the latter fuels and the greater percentage of first run brick resulting from better heat control will dictate that gas or oil be used. The WPA Report found that labor needed in firing was cut 75% in one instance, and in another that the per cent of first run brick average 97 with the use of oils as compared with

(11) Quoted in WPA National Research Project from Brick and Clay Record Feb. 10, 1920, p 322-5

75 under firing with coal.(12) In general, oil rather than natural gas has been used in common brick production, but the gas, because it is especially susceptible to temperature control, has found more extensive use in the vitrified, face, and firebrick plants. The modern tunnel kilns, which are used extensively in the fire brick industry, employ natural gas as a very convenient as well as efficient fuel. In other branches of the clay industry, such as the production of utility pottery and art ware, the use of gas tends to dominate, especially in the larger and more modern plants. This is due in part to the cleanliness and convenience of the fuel, in part to the ease with which it furnishes the required heat control, and in part to the fact that its use avoids the danger of discoloration of the product which sometimes results from the use of coal or oil.

The importance of proximity of production to the source of fuel is marked in the case of the use of coal, since transportation costs can easily exceed the value of the coal at the mine. For example, ~~it is a known fact that~~ coal used in Philadelphia is brought from western Pennsylvania at transportation charges exceeding the original cost of the fuel. This in part explains the "cheap" coal for plants in the Ohio Valley where the necessary coal and clay are often found in the same pit. Likewise, it explains in part the extensive clay product industry of Texas where abundant natural gas is available without extensive transportation investments. As will be indicated later, proximity to a suitable fuel played an important part

(12) WPA National Research Project - Mechanization in the Brick Industry p 55 quoting from proceedings before the Industrial Appeals Board of NIRA (Feb. 11, 1935) and Brick and Clay Record, Nov. 15, 1922.

in early brick production in Kansas.

In conclusion, it is suggested that as determinants of the exact location, costs per unit of fuel were much more important in earlier periods than they are at the present time. The pronounced developments in kilns have been significant in this respect: the recent improvements and the acceptance of earlier known improvements have brought about the introduction of the down-draft for the up-draft kilns, the use of tunnel and continuous kilns, the use of stokers where the firing is done with coal, compressed air instead of steam atomizers for oil burners, the use of the Hinter system for continuous operation of beehive units, and so forth. Although a number of these improvements permit the realization of substantial savings only at or near maximum production, the fact remains that producers are given a greater choice of locations through a tendency toward a lessening of the importance of strict proximity to fuel supplies.

Transportation:

The effect of transportation charges upon the location of structural clay plants is indicated in an Interstate Commerce Commission study made in 1930.(13) Here it was found that the freight revenue received by Class I Railroads for the carriage of common brick approximated 26.52% of the average wholesale price of the brick at point of destination. The extreme weight of structural clay products in relation to their value explains to a marked degree the tendency of brick and tile plants to remain local industries. The extent of the tendency is shown from data collected in the ad-

(13) Locklin, D. P., supra p 102

ministration of the Kansas Port-of-Entry law.(14) Here it was found that the average haul on brick and tile moving into Kansas by truck during the month of May, 1934, was 88 miles. As will be shown later, the tendency of operators to use truck instead of railroad facilities during the last few years leads to the conclusion that this mileage figure is significant, although there is an inclination to believe that it is too low a distance scale. A significant statement before the ICC is found in the following testimony that "Probably not over 15% of the common brick movement is interstate."(14a) Numerous examples show the extensive productive capacities which have been developed to serve rather distant markets through the influence of low freight schedules. Thus, in the early history of the United States, a large number of building brick were imported from England, especially into the Southern States, since such traffic was used as ship ballast and moved at a very low rate.(15) The present Hudson Valley development, one of the three largest brick producing areas in the United States, is greatly facilitated by the low water carriage tariffs into New York City where 69.8% of the entire state production is consumed.(16)

That the increase in freight rates on structural clay products in recent years has had a marked effect in promoting new developments and in stifling old production areas is not to be denied. Although the extent of this effect as an isolated influence is hard to

(14) Ibid p 763
(14a) Brief #14617 before ICC: Acme Brick Co. et al (November, 1930)
(15) Chute p 80
(16) Fifteenth Census of the U.S.: 1930 Construction Industry

~~is hard to~~ determine, the attempts of producers to combat the handicap present an interesting picture. One method which was tried, because of increasing shipping costs and the inherent inability of brick to stand transportation, was the consolidation of ownership of plants and the abandonment of certain facilities in order to avoid cross hauls in serving a given market. In all some five undertakings of this nature assumed outstanding prominence; one of which, because it was and is a Mid-West firm, is of especial interest.

In 1926(17) the present United Brick and Tile Company merged some 32 plants in Iowa, Kansas, Missouri, and Oklahoma which were producing all types of brick and tile. At least five of the plants were immediately dismantled, largely in order to meet the transportation problem by a diversification of plants and products and by elimination of cross freights in serving the scattered market. It is a common knowledge that this merger has had some serious difficulties, but to what extent transportation costs have contributed to these difficulties is not known.

The following schedule is presented to show United's efforts to achieve shipping savings through the use of motor truck haulage.

(17) WPA - National Research Project - Productivity and Employment in selected industries. Brick and Tile p 19 - Quoted from Brick and Clay Record Jan. 19, 1926 which described the action as the "biggest merger ever consummated in the clay products industry."

Table II: Statement showing total shipments of clay products from the Kansas Plants of the United Brick and Tile Co. and shipments by Railroads compared to those by truck.(18)

Year	Tons shipped	Tons by Railroad	Tons by Truck	% by Railroad	% by Truck
1929	116,905	105,313	11,592	90%	10%
1930	80,371	73,922	6,449	91	9
1931	29,687	24,616	5,071	82	18
1932	11,600	9,201	2,579	77	23
1933	11,496	7,645	3,851	66	34
1934	18,321	10,880	7,441	59	41
1935	19,913	10,443	9,470	52	48
1936	33,358	20,256	13,102	60	40
1937 (1st 10 months)	23,845	14,145	9,700	59	41

(The above plants are located at Topeka, Iola, Wichita, Buffville, Weir City, Pittsburg, Coffeyville, Cherryvale, and Independence, Kansas. The average truck hauld for the year 1937 was about 75 miles.)

The above schedule clearly indicates that a significant shift from railroad to motor carriage took place during the period covered, but the reason for the change is not given. It may have been due to the fact that railroad charges on carload shipments exceeded the motor rates, i.e. that the shift was nothing more than an economy measure. It is possible, however, that the reduced demand for clay products during those years (from 116,906 tons in 1929 to 25,845 in 1936) resulted in smaller orders which, because of higher rail rates on L.C.L. shipments or because of the "direct-to-job" delivery service afforded by trucks, made that method of shipping more desirable.

Relative to the importance of transportation problems on the

(18) Docket 17831 Exhibit 34 before Kansas Corporation Commission. Author's note: The plants enumerated as being covered are so listed as to cover all shipments since 1929; at the present time most of these plants are inoperative if not in actual state of abandonment.

location of structural clay product plants, the writer wishes to present a schedule of the shipments of another brick company which has an organization similar in many respects to that of the United Brick and Tile Company mentioned above. The Acme Brick Company operates 13 plants in Texas, Oklahoma, and Arkansas. In Oklahoma the railroad rates remained unchanged from 1925 to 1937, except for the emergency charges levied in the early years of the depression. In Arkansas the railroads, recognizing the rising importance of motor carriers, received ICC sanction for rate reductions to meet this competition.

The following table gives the per cent of shipments from the Oklahoma and Arkansas plants of the Acme company which moved by rail and truck during the representative month of June in the indicated years. Prior to 1929 there was relatively little brick and tile tonnage moved by truck in either state.

Table III: Statement showing percentage of shipments of the Acme Brick Company moving by rail and truck.(19)

	Oklahoma		Arkansas	
	Railroad	Truck	Railroad	Truck
1929	93%	7%	98%	2%
1932	55	45	78	22
1935	40	60	88	12
1936	23.5	76.5	89	11
1937	18.5	81.5	87.5	12.5

The foregoing data shows that in Oklahoma, where railroad rates were not lowered during the eight year period, the percentage of shipments of the Acme Brick Company moving by rail declined from 93 to 18.5. In Arkansas, where the railroads were admittedly attempting

(19) Brief from Fifteen Per Cent Case, 1937; Ex Parte #128 before I.C.C. p 20

to meet motor carrier competition, the percentage of Acme shipments by rail declined only 10.5 from 98 to 87.5. These data tend to indicate that the widespread shift of brick shipments from rail to motor carriers was a direct economy measure. The conclusion is presented that it was the direct differential in tariff rates charged by railroads as compared to trucks, rather than the convenience, "direct-to-job" delivery, and other characteristics of the latter agencies which caused the shift in methods of transportation.

Summary

There are three major considerations in any decision relating to location of a structural clay products plant. The influence of the availability of raw materials is that of an absolute determinant. The production of a given type brick is not feasible without a suitable clay since the transportation for any appreciable distance of the raw clay used in the manufacture of the ordinary structural clay products is prohibited by the charges for carriage. Fuel expenditures represent an important part of the total costs of production and, consequently, nearness to a suitable cheap fuel is a prerequisite to the successful location of such a firm. Transportation costs, because of the heavy weight in comparison to value for the common structural clay products, assume a marked importance.

Section II

The Structural Clay Products Industry in Kansas

In the late nineteenth century there existed in Kansas a fortunate combination of factors conducive to the development of structural clay product plants which, for the most part, were interested in common and face brick manufacture. The development was concentrated in the southeast section of the state and gradually thinned out to the north and west along the state boundaries. This district, which is often referred to as the "Gas Belt", at one time had such an abundance of natural gas that an inexhaustible supply was claimed. Although the hope was to prove disappointing, the optimism of the 1890's had a decided effect upon the promotion of the brick industry and of other types of production dependent upon, or influenced in location by, cheap fuel. It was not at all uncommon in the "development period" for a brick plant, as well as many another type of firm, to have its own private gas wells.

In close proximity to the gas fields were found large deposits of shale which burned into superior quality bricks. Although most of the clay in the area is of a red burning nature, there is a formation underlying the coal seams of the extreme eastern section which fires to a buff color. At the present time the Weir plant, which is the only one using the latter formation, is in a far better financial position than are other plants of the state which are limited to the red material. However, the better financial position of the Weir plant as compared to that of other Kansas units is not a reflection upon the quality of the red burning shales being used by the latter

concerns. Rather, this difference is a resultant, at least in part of the ownership of the Weir plant by the United Brick and Tile Company. United's marketing contacts naturally support heavy tonnage from the Weir plant, which is their only location in Kansas capable of producing buff products.

A third important element which contributed to expansion was the condition of the market for clay products during this early period. Kansas was developing, the entire mid-western section was developing, and Kansas plants were "early comers" in the field. Not only was the local demand for bricks so great that relatively small towns could support a brick yard, but also the existence of favorable railroad rates permitted the marketing of brick throughout the mid-western area. For years Southeastern Kansas brick plants supplied heavy tonnage to Texas, Oklahoma, Northern Kansas, Southern Nebraska; they furnished almost all the common bricks used in Kansas City, Missouri, the greater part of the brick in Western Missouri, and probably one-half of the common brick that was used in the state of Iowa.(22) It is said that these plants made shipments for government reservation buildings in New Mexico, and to other destinations ranging from Memphis to Duluth. Due to the fact that the productive capacity of plants in adjoining states was not expanded so rapidly as the demand for brick and tile increased, an impetus was given to the Kansas firms and for several years they found a ready market for their product. It must be noted also that, during those early years,

(22) Testimony John J Amos of Humboldt Brick and Tile Company ICC Docket #14617 et al - Brief on Behalf of the Kansas State Board of Administration

of prosperity, cement had not yet become a serious competitor for clay products. That such competition did develop will be discussed later.

A fourth contribution to the early expansion of the industry in Kansas must be mentioned, since it had a significant effect. It has been said, by men who were pioneers in the development, that the "mushroom" growth and the subsequent failures were brought about in no small part by the promoters and selling agents for brick plant equipment. Since there were numerous successful brick plants operating in the area, Kansas became a fertile field for their activities and they promoted the establishment of many plants which began operations without adequate planning and preparation.(23) Although such promotional schemes may not provide a satisfactory explanation of the over-expansion which took place, undoubtedly they contributed to it. The fact remains that, with an abundant supply of good clay, extensive deposits of natural gas, and a large local as well as surrounding foreign market, the ground work existed upon which was built a productive capacity which could not be, or at least was not to be , supported in the following years.

Tables IV and V show the value of common, face, and vitrified brick production in the State of Kansas for the interval between 1905 and 1936. The all-time high for common brick production (which is the mainstay of the structural clay products) was reached in 1906, the same year for which the value for common brick in the nation as a whole reached the peak of 61 million dollars with a production of 10

(23) At one time over 60 plants in Kansas Reported to the Department of Commerce surveys. Some towns such as Cherryvale had as many as six plants operating at one time.

billion brick. For that year the value of common brick in Kansas reach 1 1/3 million dollars with upward of 314 million brick being produced. Production decreased from 1906 until the boom of 1925, when Kansas production was approximately 45% below that of 1906 (in value) and when, over the nation as a whole, the quantity of production was fully 25% below that of the earlier year. In 1936 the value of common brick produced in Kansas was 12% of the 1906 value, and today the Kansas Brick and Tile Manufacturers Association estimated that is present production is carried on at about 20% capacity.(24) The number of Kansas plants reporting to the Department of Commerce has decreased from 68 in 1905 to 9 in 1939. Current publications in the field lead one to believe that a similar reduction in the number of plants has occurred in the industry as a whole.

A government survey is presented in Table VI in illustration of the growth and decline of national production.(25)

Table VI: Summary Data fro Establishments Whose Major Products are Brick and Tile, 1849 - 1935 (a)
(Dollars in thousands)

Year	Number of Establishments	Average number of Wage earners	Wages	Value of Products
1849	1,603	11,949	$ 4,235	$ 6,611
1869	3,182	30,347	11,085	30,328
1889	5,828	65,020	29,709	67,771
1909	4,215	76,528	37,139	92,777
1925	1,528	57,652	70,993	179,519
1929	1,307	48,076	55,465	139,000
1935	708	17,156	12,101	33,818

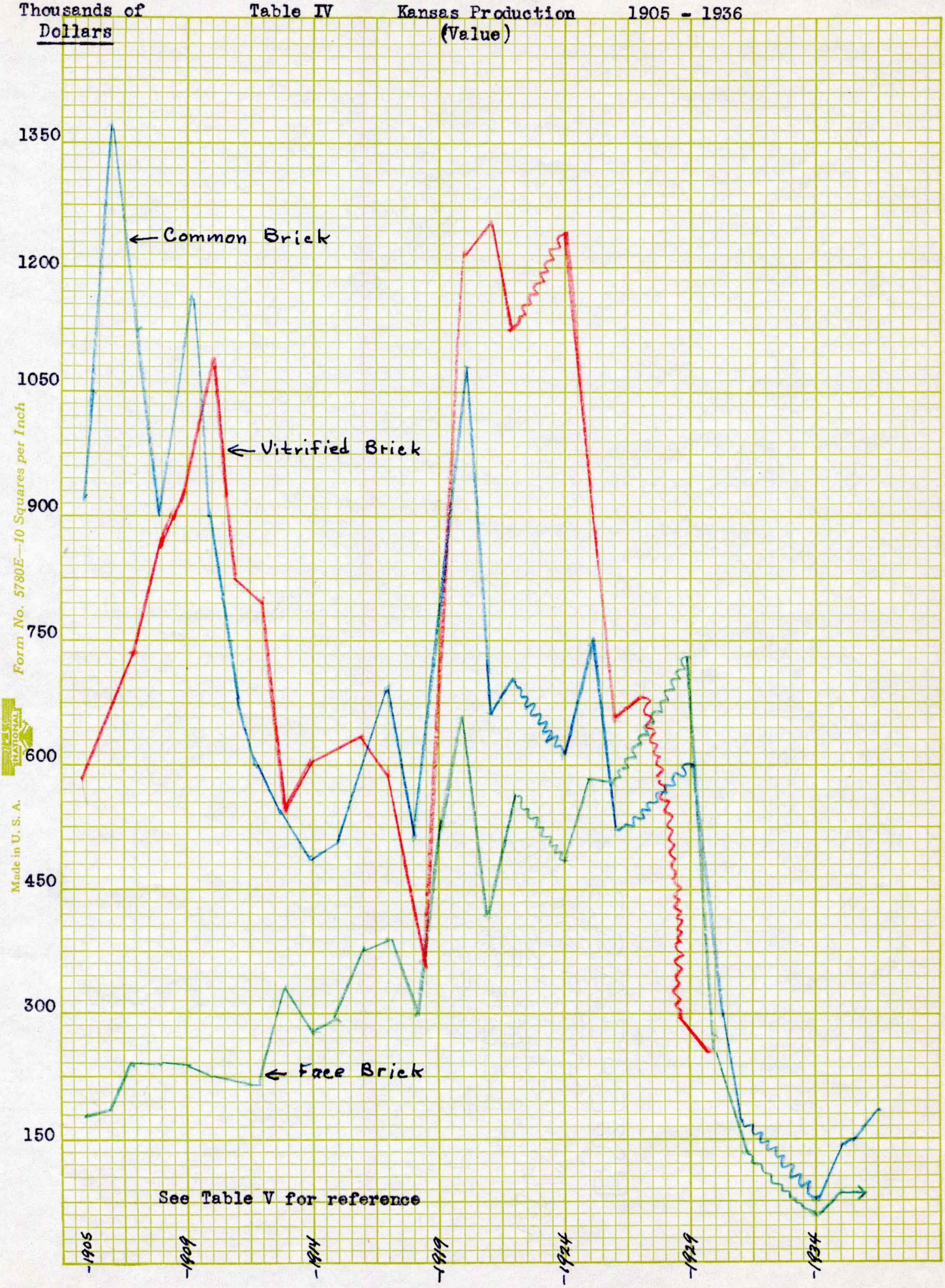
(a) Census of Manufactuors data

(24) Letter to the writer dated July 26, 1939 from Mr. W. E. Ihlse, Secretary Kansas Brick and Tile Manufacturers Association.

(25) WPA National Research Project - Productivity and Employment in Selected Industries: Brick and Tile. p 12

Thousands of Dollars

Table IV Kansas Production 1905 - 1936 (Value)



See Table V for reference

Table V: Production in Kansas by years, type of product, quantity and/or value.

	Common Brick		Vitrified Brick		Face Brick		Drain & Bldg. Tile, and Fire Proofing	Miscellaneous
	Quantity M's	Value	Quantity M's	Value	Quantity M's	Value	Value	
1905	214273	$ 917084	75826	$580695	18743	$180201	$20014	$60982
1906	314571	1376552	78199	658392	19875	187577	19694	443
1907	263887	1189263	85110	727979	24381	236876	15320	4535
1908	225820	896542	102922	862019	29477	233578	22359	19635
1909	254890	1160877	103264	932419	26170	235875	37862	4424
1910	218353	922940	116950	1089978	25814	223875	50726	81046
1911	183809	694586	85337	823505	27887	213711	51132	197867
1912	145986	584273	80906	806425	27972	215873	99121	3685
1913	122465	541741	55382	543929	39451	335940	116785	31464
1914	106930	486854	50707	594229	31079	271104	122557	122954
1915	110839	499434	47511	608599	31429	292584	189047	240104
1916	114880	596271	48704	628638	40433	380532	267333	563789
1917	105232	698452	42774	597241	37579	388355	351437	272917
1918	56977	511876	21935	364587	21400	292069	388616	124791
1919	62189	700800	32961	908834	30429	531298	816661	210021
1920	69701	1092460	42116	1217718	31463	662849	817226	236976
*1921	45874	664005	47574	1252753	20817	416805	480901	---
1922	73084	699134	49244	1126570	34313	560508	479457	---
1923								
1924	68752	613054	55576	1237853	27347	447088	505365	---
1925	85257	749392	47908	951291	37414	590895	499718	---
1926	66555	524685	39150	867172	41041	576489	411324	---
1927	---	---	36966	679643	---	---	482481	---
1928	---	---	---	---	---	---	---	---
1929	67705	606098	14412	290627	44229	730116	532969	---
1930	46267	336304	14200	251295	25206	295205	313744	---
1931	27892	170103	---	---	9825	132054	106823	---
1932	---	---	---	---	---	---	---	---
1933	---	---	---	---	---	---	---	---
1934	9253	75201	---	---	4401	53383	48155	---
1935	15497	127133	---	---	5931	80609	65589	---
1936	21049	269671	---	---	6345	84122	148082	---

Authority: U. S. Geological Survey - Non Metals 1905-1920, U. S. Department of Commerce Census of Manufactures - The Clay Product Industries: 1922, 1924, 1925, 1926, 1927, 1929, 1930, 1931, 1933, 1934, 1935, 1936, 1937. (Mr. Ruleo - Secretary of the Kansas Brick and Tile Manufacturer's Association estimates these sources to be 90% correct.)

A lack of sources of information makes any analysis of the present condition of Kansas brick plants a difficult task. Although the plants are organized into the Kansas Brick and Tile Manufacturers Association (with the exception of the Weir plant which is a United Brick and Tile Co. unit), the looseness of this organization and its purposes do not facilitate any gathering of information other than strictly confidential material which is available only to its own members. The following data are based on observations of the writer and on such figures as are published in the Biennial Census of Manufacturers reports. Since manufacturers in the field have estimated that the reports are probably 90% accurate, the material obtained from them is indicative evidence only and is presented as relative rather than absolute.

Table VII--Persons engaged in the Kansas Brick Plants

Number of establishments		Total number of persons	Proprietors and firm members	Salaried officers and employees	Wage Earners Average Number
Year	Plants				
1921	27	1270	18	111	1141
1923	29	1532	21	138	1373
1925	29	1481	5	109	1367
1927	28	1400	1	82	1317
1931	14	----	--	----	518
1933	10	----	--	24	224
1935	12	Appr. 450	--	39	410

Table VIII - General Statistics: Kansas structural clay product plants.

Year	Salaries	Wages	Paid for contract work	Cost of materials	Value of products
1921	$288,298	$1,200,145	$ 31,086	$1,403,818	$3,741,469
1923	200,330	1,583,799	11,414	1,588,008	4,425,067
1925	273,247	1,493,069	11,418	1,582,140	4,044,652
1927	177,771	1,337,382	970,275	379,419	3,005,509
1931	-------	470,000	-------	258,000	1,216,000
1933	29,000*	131,000	-------	62,000	328,000
1935	54,021	279,774	-------	205,084	965,183

* Does not include salaries of officials in case of corporation.

It is the opinion of the writer that, at the present time, the brick plants in this state do not employ more than 250 workers for six months out of the year, an opinion based upon remarks of plant operators and other individuals in the field. As stated before, present Kansas plants are not operating at much more than 20% capacity according to the estimate of the secretary of the manufacturers association.

The importance of less than capacity operations in brick production is a very significant factor. Like many other types of manufacturing, it is a very subject to the phenomena of decreasing costs and economies of near capacity production. Heavy and continuous operating schedules permit the economies of continuous kiln units, the utilization of otherwise waste heat, and the fuller use of laborers since almost full crews must be employed for the production of any amount.

No definite satisfactory information could be secured as to the mechanization of plant operations. The Census of Manufacturers reports shows that the horsepower rating of Kansas plants in 1923 was 8,026.

It increased to 9,849 in 1925; but fell back to 8,916 in 1927, when 28 plants were reported by the Census. At the present time there are only 9 plants in operating condition in the state. It would be difficult to determine accurately the present horse power rating of Kansas plants from the data available. It is known that there is a definite positive correlation between the mechanization and the productivity of plants, that there has been a decided increase in the productivity of the average firm over the years, but there are so many unknown factors which enter into any such analysis that no conclusions can be drawn.

Kansas brick plants can be segregated into three classes upon the basis of mechanization. In the first class are three plants which operate such a small part of the time and which have equipment so obsolete that remodelling of facilities would be demanded before continuous operations could be possible. In the second group appear another three plants which are in operating condition and have good mechanical equipment, but which are allowing that equipment to wear out with only the minimum repairs and replacements. These operators are delaying until better prospects invite the investment of any additional capital. The third class embraces three plants whose mechanical organization is modern and in excellent condition, and which are doing more business than those in the other two groups.

It is probable, in the writer's opinion, that a lack of mechanization has depressed Kansas plants or that any outside areas in a position to compete with them have any advantage based on mechanical details. The material which follows attempts to determine the cause

for the decline in Kansas plants, a decline discernible both in number of establishments and in per cent of capacity operations. Likewise an effort is made to analyze the factors underlying the present depression of the entire brick industry. Although our chief concern is for Kansas plants, the national aspects are given consideration since the situation obtaining in this state is inevitably influenced in large measure by conditions affecting the industry as a whole.

The most obvious reason for the great decline in the number of plants lies in the manner of their early development. A brick plant is so local an industry that a fair-sized town should be selected for a site. Its local character is determined by the fact that transportation charges on the heavy products, combined with a relatively general occurrence of clay and shale deposits, force such a geographical diversification of operations that the plants, unless they make a product which meets an individual demand, are forced to depend upon their local area for a continued market. The dependence upon local consumption is even more marked when the production of common brick constitutes the major portion of the plant's total output. Not only must the local market be fairly large, but it must be capable of expansion. Brick construction represents such a large initial investment of capital that itsuse is largely restricted to the better residences and to permanent commercial structures. Since a substantial part of the community is not and never will be potential consumers, the need for a large local area is imperative. Again, one of the chief

economics of brick is its long life, which means that the area must continue to expand since the replacement and repair uses for brick products are minimum. Sellers of these products must look to the enlargement of the existing area of consumption and to the construction of new facilities for their consumers. To complete this discussion, one further fact should be considered. The small amount of capital necessary to put a brick plant into operation makes for the establishment of numerous small concerns to satisfy any existing demand. Even the short run analysis, particularly in new areas, often indicates that the supply capacity is well above demand.

In Southeastern Kansas during the early 1900's, when plants were increasing rapidly in number and prospects were inviting, Kansas concerns enjoyed a wide marketing area. As mentioned above, their market embraced not only the immediate locale of the plants themselves but also Oklahoma, Western Missouri, Northern Kansas, Southern Nebraska, and part of Iowa. At that time transportation costs were low, as compared to the present freight rate structure, and Kansas products could stand transportation to adjoining areas. Kansas production was developed early and naturally enjoyed an advantage which disappeared rapidly as time passed. Plants were quickly developed and, as an expected reflection of the economics of the industry itself, the production of clay products soon outgrew the demand for their various uses.

Table IX presents some interesting data. The common brick production of Nebraska, Iowa, Missouri, and Oklahoma in millions of

units is shown on a common graph. The common trend in these four areas suggests a conclusion that is not to be cast aside lightly. It is the writer's opinion that the downward trends are but aspects of the declining rates of growth in the areas served; that the uniformity of trends suggests either an ability of all four areas to compete in the same market, or that the entire area tends to move economically in phase. It is probably that, in this later instance, freight rate structures offer an explanation for part of the divergency of individual curves in the early period but to an even greater extent in the 1925 period, when the trend line of Missouri's production shows an influence not felt to the same degree by the other areas. In the 1934-36 period the differentials may logically be but aspects of a common rate of repair and/or replacement applied to the differentials in amount of construction existent in the individual state markets.

Under the above conditions it was only natural that, with out of state production declining, Kansas plants should find their market in those areas likewise on a downward trend. The decline would have taken place whether or not freight schedules were raised. In any event, Kansas operators were forced to look to their more immediate vicinity for support. In the early period Eastern Kansas was an expanding industrial as well as agricultural community. Coal, lead, zinc, and oil and gas were important extractive industries which employed a number of men and, although neither the companies nor their employees were themselves, by and large, important users of structural clay products, their existence was substantial support for commercial developments which did act to this end.

Table IX Production of Common Brick in millions by years
(Missouri, Iowa, Nebraska, and Oklahoma)

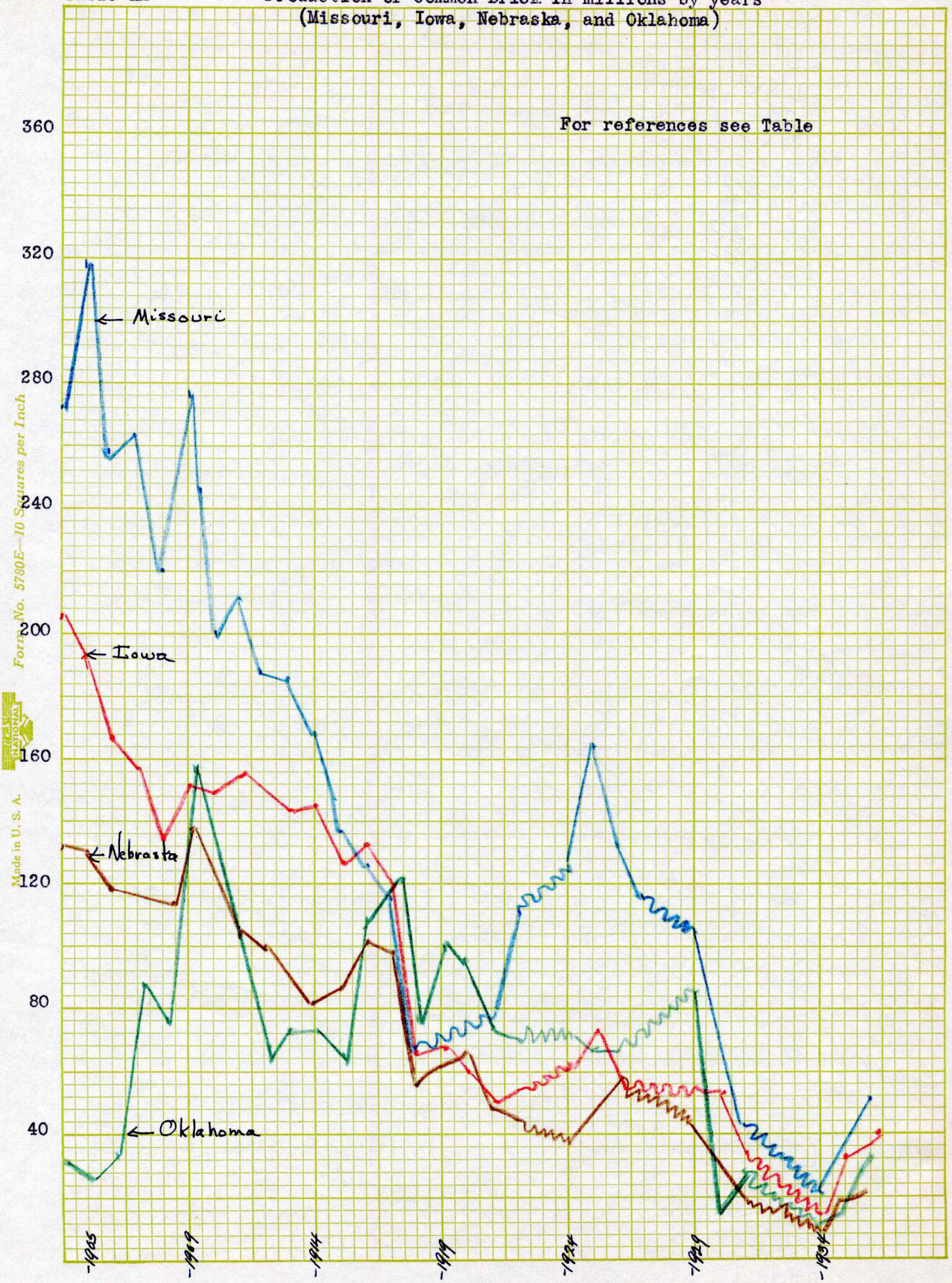


Table X gives some insight into the condition of these industries as the Kansas brick plants found themselves becoming more and more dependent upon their own vicinities for marketing areas.

Table X: Employment in Kansas Mining, 1899 to 1935(26)

Year	Average number of wage earners		
	Coal Mines	Petroleum and Gas Wells	Lead and Zinc Mines and Mills
1899	5,956	13	----
1909	12,791	1,302	848
1919	8,084	6,305	1,141
1929	3,405	----	2,710
1930	5,514	4,512	1,651
1933	4,233	----	648
1934	4,340	----	3,357
1935	4,253	----	1,335

Although a number of the early brick plants were in the nature of temporary capacities and were developed with the idea of serving a local temporary need with the subsequent dismantling of equipment, there has been too much money lost in insolvent firms to believe that permanent over development was not an important factor in forcing the restriction of facilities. In summary, the first and most obvious explanation of the present condition of Kansas structural clay product plants is that their early development was such that forced dismantling of plants and/or unused capacities was bound to occur as a function of the economics of the industry itself.

The second and perhaps most significant explanation is found in the competition to brick provided by substitute building materials. Discussion of this element is approached from two viewpoints:

(26) Bulletin of University of Kansas Vol. XXXVIII No. 4 The Kansas Labor Market by Domenico Gagliardo p 6

first, the reality of the competition offered; and second, the reactions of brick producers to the challenge. That substitute building materials have made large inroads into construction once a province of brick is obvious, but the extent of this encroachment presents an interesting series of changes which have come about in an effort to achieve cheap construction and/or, as a function of progress, to point the way to better structures. In its big uses brick is not a cheap material and, with the exception of drain tile, the structural clay industry depends upon the urban areas for consumption of its output. With the advent of more settled and densely populated urban areas, the construction of more permanent dwellings and commercial buildings naturally furnished a large demand for building brick. The demand was likewise enhanced by the requirements for fire proof structures and, at a later time, by Zoning restrictions built upon fire protection and associated needs. But, just as surely as progress to this point worked to the advantage of the brick industry, the next changes were not to prove so beneficial. As urban areas became more and more congested, the increase in land values, the increased advantages of one position over another relative to business areas, traffic movements and similar factors were associated with the natural emphasis upon multi-story construction. It was early found that, since the required thickness of brick supporting walls increased out of proportion to the increasing height of the structure, steel and cement column supports were more practical than those of common brick. With emphasis upon such construction, it was only natural that steel and cement should invade even the single story field.

Another aspect of the increase in height of buildings upon the consumption of common brick is that of the influence of appearance on the use of building materials. As a rule common brick are not uniform in color and but little attempt is made to sell them for use in structures which emphasize appearance. In the one and two story uses, common brick in walls facing alleys and in those lying next to other buildings represented little sacrifice of architectural appeal. However, as the height increased, buildings could be seen on all four sides and the use of face brick on the steel frame work was promoted. Thus the demands and uses for common brick were further decreased.

The shift in type of construction and its obvious influence upon the Kansas brick industry is strikingly illustrated by a comparison between two school buildings in Wichita whose construction dates were separated by only some twenty years. The same brick dealer handled both contracts and encountered the following experience. The first building was constructed in 1909 and used some 1 ¾ million brick; seven or eight years ago the second structure was built with the use of only 1⅓ million brick, yet its capacity was three times that of the first. Both structures in common parlance would be called "brick" buildings.

Hollow building tile, although a structural clay product and often produced by the same plant which has a common brick output, has eliminated the use of many common brick in modern structures. Hollow tile was designed originally as a fire proofing measure, but

it has been found that for partitions,[27] especially in the taller steel frame buildings, its use entails less weight on the building supports than does brick. It can be laid in place faster because of its larger size and so permits cheaper construction costs and, because of its leighter weight, the costs of transportation are reduced.

The competition of concrete substitutes is especially serious to the brick industry because their use reduces to a minimum the transportation charges included in the value of material on location. In most cases the sand and water are obtained locally and only the cement itself bears any carriage costs. The following schedule (Table XI) is taken from Docket #18202 before the Kansas Corporation Commission, and illustrates the definite advantages which cement enjoys in respect to transportation charges:

(27) WPA National Research Project - Productivity and Employment in Selected Industries: Brick and Tile p 52.

Table XI: Statement showing comparative freight charges paid per 10,000 feet of 8 " wall built in Wichita, Kansas, from different materials show below - point of origin, Chanute, Kansas (1937)

Material	Size inches	# pieces		Unit Weight Pounds	Total Weight Pounds	Freight rate cents per cwt based on Chanute, Kansas	Freight
Common Brick	2¼ x 3¾ x 8	123,200		5#	616,000	8¢	$492.80
Face brick backed up with common brick	2¼ x 3¾ x 8	72,000	Face brick	5½#	394,000	10¢	394.00
			Common "	5#	288,000	8¢	212.80
							$606.80
Clay building tile	5 x 8 x 12	21,000		16.5#	346,500	10¢	$346.50
Concrete block (cement and sand)	8 x 8 x 16	107,000		45#	481,500		
			Cement	6½#	69,550	13¢	
			Sand	38½#	411,950	Obtained locally no freight	90.42

The second aspect of this competition and the substitution of other building materials for brick is the reaction of brick producers toward the increasing danger. It has seemed to the writer, in his limited contacts with operators, that the following statement is essentially true. "Burned clay-products industries, in general, have been characterized largely by retarded industrial development and conservative management, by lack of adequate cost systems, suitable plant lay-outs or labor saving equipment, and by a more passive hostility to the growing competition from substitute products."(28) One large Texas producer of structural clay products holds "---the decreases that have occurred in ratio of burned clay products to other materials -- (are) -- due, in good measure, to the fact that no appreciable concerted effort among producers has occurred to keep the consuming public informed of the merits of their products and their practical and economical application to sound, safe, durable, and artistic construction."(29) This is probably explainable in terms of certain characteristics of the brick industry in general. Because it tends to be a local industry, to be relatively small both in terms of income and investment, and to be largely under the direction of individuals who are stockholders, the management of the majority of brick plants is carried on by so-called practical men. Usually they have been skilled in some other line of work, and their decisions as to policy are based on their own past experience rather than on technical knowledge of the industry as a whole or scientific analysis of conditions in general.

(28) Chute p 4
(29) Letter to writer dated April 10, 1940

A third factor, freight rates, should be considered in making an analysis of the present condition of Kansas brick plants, not only because it has exerted a marked influence but also because it seems to be the one factor on which all plant operators are in harmony. It is not to be denied that the rising freight tariffs have operated to limit marketing areas but, as indicated previously, it is probable that they have merely intensified the difficulties rather than created them. An industry which is local in character and whose market is logically restricted to areas not far distant is less likely to be vitally affected by transportation charges than is one which produces a product not easily duplicated. In the final analysis, the fundamental nature of brick production dictates that it should be a <u>local</u> industry and, from the long run point of view, there is a tendency toward the depression of the typical firm. However, rising freight rates have so drastically affected the market for Kansas brick plants that the following data should prove interesting.

In contrast to previous statistics concerning the market once served by Kansas plants is the present very restricted area which operators claim can be served at a profit. In the I.C.C. Docket #14617 et al, to which reference has been made, the testimony of one operator was accepted which held that Kansas plants at that time (May, 1930) could not go outside the state and sell common brick at a profit. The Port-of-Entry Administration found that in May, 1934 the average haul on shipments of common brick coming into the

state was 88 miles.(30) In I.C.C. Docket #27050 testimony was presented stating that one company at that time (Sept. 20, 1935), after a careful study of trucking costs, could truck brick up to 165 miles with contract carriers, and by their own trucks could increase that distance up to 215 miles. The writer has been told by operators that 250 miles tends to indicate the limit of their ability to compete with other producers and with other materials. Just how close that competition is in practice is indicated by testimony in I.C.C. Docket #14617 where it was held by one witness that 50 cents per thousand brick would divert a shipment to a competitor (Lafountain, Rec. 322) by another that "ten cents per thousand would divert business from him to his competitor" (O'Brian, Rec. 294) and by another that "Fifty cents a thousand brick or one cent per hundred pounds in freight rate would divert business from one plant to another." (Ames, Rec. 233).

The shift from railroad to truck carriage for production of the members of the Kansas Brick and Tile Manufacturers Association is shown in the following schedule.

Table XII

Docket #17831 (a) 12-7-37 Exhibit 35

Exhibit A
Of the Kansas Brick and Tile
Manufacturers Association

Year	Total shipments in Kansas (tons)	Tons hauled by railroad	Tons hauled by truck	% by rail	% by truck
1933	148,086	123,795	24,291	83.6%	16.4%
1934	227,937	205,769	22,168	90.3	9.7
1935	261,370	201,217	60,153	77.0	23.0
1936	535,247	393,235	142,012	73.5	26.5
1937	580,626	277,431	303,195	47.8	52.2

(a) Before the Kansas Corporation Commission

This data would show that members of the Association made a more pronounced shift to the use of truck transportation than did the United Brick and Tile Plants, which are not members of the Association. (See page 12). Bearing in mind that one of the purposes of the United Brick and Tile Company merger was the elimination of cross freight charges and that producers claim that truck transportation is proving cheaper, it would seem that such evidence tends to support a conclusion that transportation is not quite so pressing a problem to this company as it may be to members of the Association. Such a conclusion would naturally demand comparable abilities of management, freedom and opportunity to bargain with truck owners, and so forth. Nor should such analysis neglect the fact that the location of plants may give single rather than joint hauls by railroads to the one group and not to the other.

It is needless to point out in any discussion of the influence of freight tariffs on the marketing of brick that differentiation must be made between the influence of the freight charges on competition of bricks from different areas and on the competition of brick with substitute building materials. In this latter respect Table XI presented data whose importance cannot be denied. The contention that the present freight rate structures are not primarily liable for the present depressed condition of the brick industry does not hold true in respect to the influence of carriage charges in the struggle between brick and cement in their various uses. Brick producers are badly handicapped by the weight of their product in relation to its value, an inherent disadvantage which makes it extremely difficult for brick to compete with cement on

distance hauls. It is unlikely that anything short of rates amounting to a subsidy could make uniform the charges for transporting brick and cement on a competitive basis.

A fourth factor which has had an effect on the Kansas situation is one whose existence is a resultant of the foregoing and other factors, yet it requires special note because of its own effects. The marketing channels used by a company logically represent their opinion as to the most economical manner in which consumers can be contacted, yet situations appear to the observer in such a light that the short and long run effects assume distinct proportions. For example, one Kansas brick plant, under the stress of reduced markets and of intensified competition, is using practices which, in the opinion of the writer, can lead only to its detriment in the long run. The best organization for distribution of brick and similar structural clay products would seem to exist through the employment of local lumber men in those communities which do not offer sufficient market to support specialized brick dealers. Lumber dealers are in immediate contact with local building conditions, realize the best opportunities for local promotional effort, have the facilities, in the ordinary case, for display of samples and for storage and handling of incoming brick. In the last analysis they are in the best position to satisfy customers, since their agency for lumber and cement as well as brick eliminates the need for "high pressure" sales of any one material. This has been the customary procedure but, in the last few years, the decrease in the margin allowed by brick producers to the lumber dealer has forced him in self-interest, to promote, so far as possible, the sale

of lumber and other materials on which his profit is greater. The extreme example of this tendency has reduced the lumber yards as brick distributors to a position comparable to that of a "tipster". In one example known to the writer, the lumber yard operator who passes on to the given brick plant the "tip" that a certain individual is in the market for brick receives a payment in the nature of a flat bonus in case the sale is made. The lumber dealer may never even see the brick, and shipment is made direct from the brick plant to the buyer. It is needless to point out that such an arrangement is not in the best interests of the brick industry, since it is probable that "tips" are passed on by the lumber yards only when all efforts to induce the prospective builder to use wood or cement have proved futile.

In the last analysis, however, the absolute determinant of the condition of the Kansas structural clay industry is the domestic building construction. The rise and fall of brick production is merely a reflection of the rise and fall of the use of brick in construction trades. 1925 was the last real boom period in American building, and since 1925 the national structural clay production has been a fluctuation about a downward trend curve. In Kansas, especially, since a significant part of the brick consumption is in residential structures, the past years have been reflections of the aftermath of the intense activity in this type of construction during the '20's. "New residential construction has never attained the highs of the middle 20's partly because (1) consumers spent money for automobiles that would have gone for housing; (2) it has

been cheaper to pay rent than interest; and (3) the splurge of the '20's resulted in excess housing capacity.(28) Moreover, not only has the amount of construction declined but trends have been, especially in the mid-western area, toward the use of the buff face brick in preference to the red. This matter is discussed in the following section. As concerns building in general, the prophecy of renewed activity in 1940 and the years following is often heard. Assuming the materialization of such a forecast, the production of structural clay products will be stimulated in direct proportion to the amount of increase in building activity.

(28) Business Week October 28, 1939 p 27

Section III

The Market for Buff Burning Structural Clay Production of Proposed Kansas Plants

Considerable interest has been manifested in the development of Kansas plants for the production of buff burning brick, since extensive deposits of buff clay have been found in the state. Although many factors are identical in the production of both red and buff brick, it has been thought wise to discuss the possibilities for the development of buff burning products in a separate section, since the differences which exist are economically significant.

The profitable commercial development of the newly explored Kansas clay fields depends, in the last analysis, upon the potential market for the products of the proposed plants. In Section II the conclusion was presented that no opportunity exists for new red burning structural clay plants since present Kansas plants of this type can more than supply the existing market. In this section material is given in support of the writer's conclusion that an opportunity does exist for the buff products.

For purposes of analysis as concerns potential buff structural clay production, the field for use of the products is divided into two parts: the opportunities for buff face brick, and the possibilities for glazed and unglazed interior tiles. Economically these two divisions have much in common, yet they have so many differences that they are discussed individually.

The determination of the amount of buff brick being used in the Kansas area was a rather difficult project. Only five companies handle any important tonnage of buff brick in the region, but the

distribution in location of these firms and their past hesitancy to co-operate with each other made the collection of data on their total sales relatively laborious. For approximately six months the writer attempted to collect the statistics presented in Table XIII, before the consent of all the companies involved could be obtained at the same.

The determination of the buff brick now being used in the area which could be served by proposed Kansas plants was purposely limited to the territory of this state. Although there are many individuals who believe otherwise, the writer feels that this limitation is economically defensible. To the south the Acme, Elgin Butler, and Reliance brick companies, among others, are already in control of the market. In Missouri any new brick product would encounter the established marketing areas of the United Brick and Tile Company of Kansas City, Missouri, the Acme products and others from Arkansas, and, no less important, the buff brick production areas of Illinois, Indiana, and Ohio. In some cases freight charges would work to the advantage of a Kansas area, but the importance of the established marketing channels of these older companies can not be disregarded. To the north Nebraska has, in the first instance, plants already utilizing the same formations recently found to underly some of the central Kansas area and, in the second place, the market for the brick products is felt to be even less per capita than in Kansas. Colorado plants dominate the situation to the west. For buff brick the conclusion is that only in the Kansas area will any clear cut advantages exist to the benefit of possible new brick plants in the exploitation of the recently explored

clay deposits. This is not to say, however, that the Kansas City area would not prove to be an important market. Rather, the absence of available data and the importance of unfavorable factors forces the writer, in the absence of a more complete study, to limit any conclusions made to strictly tenable positions.

The five companies selling buff face brick in Kansas are the United Brick and Tile Company of Kansas City, Missouri; the Lusco Brick and Stone Company of Wichita; the Acme Brick Company of Fort Worth; the Reliance Brick Products Company of Dallas; and the Elgin Butler Brick Company of Austin. Of these five companies the first three handle by far the largest quantities. Although an attempt was made to obtain the sales of all five concerns, only the three most important were willing to co-operate with the project.

Table XIII presents the sales of buff brick in Kansas by the Acme Brick Company, United Brick and Tile Company, and the Lusco Brick and Stone Company for the years indicated.

Table XIII: Aggregate Sales of the Acme Brick, United Brick and Tile, and Lusco Brick and Stone Companies in Kansas

Year	Number of buff brick
1936	1,621,550
1937	2,211,600
1938	2,415,420
1939	1,993,350

Although Table XIII does not include the sales of the Reliance Brick Products and the Elgin Butler Brick Companies during the four year period, the error thus induced is so small that the data can be accepted as an accurate indication of the amounts of buff brick

used. There is however very little information which can be presented to substantiate the data of Table XIII other than the fact that the companies whose sales volumes are presented are in complete agreement and that their tonnage completely dominates the market in Kansas. In the interval when the writer was uncertain as to whether the figures finally collected could be obtained, it was felt that a survey of the brick used according to plans of architects concerned with construction in the state would be valuable. Accordingly a questionnaire was sent to the thirty Kansas architects who were known to have designed buildings in the region calling for the buff face brick. Of these thirty questionnaires sent out twenty-four were ultimately returned. The data from these twenty-four returns are tablulated in Table XIV.

Table XIV: Tabulation of buff brick used on buildings designed by twenty-four Kansas architects 1936 - 1939.

Year	Number of buff brick
1936	489,000
1937	1,004,500
1938	1,141,000
1939	5,124,100

Comparison of Tables XIII and XIV show very wide discrepancies which are caused by a number of factors. The reports of sellers of buff brick covered actual sales made in the given year; the questionnaire to architects asked that the figures reported dover the year in which construction on the project actually began. In the second place some construction in Kansas during the years was designed by out-of-state architects who were not canvassed by the survey.

In the third place some of the Kansas designers who had construction calling for large volumes of buff brick would not answer the questionnaire. One project in particular which used approximately a half million brick is not included in Table XIV since the architects concerned failed to report that data. The last factor which is important is that a large volume of buff brick construction is not handled through architects. This volume is made up of small uses of the brick but in the aggregate the amount is significant. The explanation lies in the use of commercial plans, undesigned work by small contractors or the mason hired, and so forth. It is felt that in some of the years covered this factor may have accounted for 25% of the variance encountered.

Just how much buff brick will be used in Kansas in the future is a vital question whose answer can be little more than an opinion based on the indicative evidence available. Although the estimate can not be made with accuracy, there are a number of significant elements underlying such a forecast which can be presented.

As concerns potential buff brick plants in the state, the first consideration is that probably only a fraction of the above volume could have been obtained by any new Kansas plants had they been operating during the 1936-39 period. The quantities listed in the above table moved through established marketing channels and, to the extent that those established contacts were important, the same plants would have supplied the volume. However, a large amount of brick construction in Kansas during the last few years has used the red brick rather than the buff because the former was significantly

cheaper per thousand. If Kansas can develop local supplies of buff brick in the central and north central section of the state, it can be assumed that many projects which would otherwise use the red material could be induced to use the buff. The extent of this shift would depend on the elasticity of demand for buff brick, and on the amount of transportation charges now included in the higher price for the buff brick which is imported into the state.

Any forecast of the use of buff brick in Kansas must also consider the outlook for general construction. The United States Department of Commerce lists the following, among others, as important indices of future construction activity:(1)

"(1). Rate of increase in new families and in migration of families from one part of the country to another.

(2). Levels of production and levels of real income.

(3). Existence of efficient organizations of both public and private agencies required in extension of credit for durable goods purposes at moderate rates of interest and with soundly conceived methods for the periodic retirement of loan obligations as an offsetting factor against the annual loss of value due to depreciation and obsolescense."

An evaluation of Kansas in terms of the above factors is not likely to lead to optimistic forecasts. The trend in population in Kansas is well known, and our level of real income has declined drastically in sympathy with that of other agricultural states.

(1) Construction Activity in the U.S. 1915-37, U.S. Department of Commerce, Bureau of Foreign and Domestic Commerce, p 34-35

Kansas has the same advantages of the national home lending agencies as have other states, but it must be borne in mind that government sponsored residences are economy structures and, consequently, are not consumers of buff brick. Red face brick are cheaper to make and, in the normal location, will always sell cheaper than the buff counterpart.

Whether or not there is sufficient demand for buff brick in the Kansas area to support a brick plant is a question which the writer cannot answer. There is almost a complete lack of published matter of this nature and the writer's experience with plant operators has found a reticence on their part with regard to this topic. It is obvious, however, that not more than one buff brick plant could hope to have profitable operations. Although one can expect an increase in demand over the 1,993,350 buff brick used in Kansas in 1939, how much this increase would be with a cheaper product, and how much of the aggregate volume could be obtained by a proposed Kansas plant cannot be answered accurately. Present Kansas red brick plants seem to be, on the average, of about a 50,000 brick per day capacity. If it is assumed that a new Kansas buff plant could obtain sales of 2,000,000 brick per year, which would be unlikely, it would mean that a plant with a 12⅔ thousand brick per day capacity could be operated six months out of the year. This reasoning points directly to the importance of decreasing costs and economies of large scale production in the manufacture of face brick. Small scale operation means higher costs of production with higher retail prices; higher selling prices for the local

product decreases the ability of the local concern to compete with out-of-state capacities. The conclusion is suggested by the author that a plant can profitably operate only by combining buff brick with the production of glazed tile.

In the marketing of buff glazed interior tile a proposed Kansas plant, provided a good product could be made, would have an undeniable advantage. As stated in a previous instance, the buff clays of the South -- Arkansas, Oklahoma, and Texas -- do not make a good glazed unit. Ohio interior tile is able to move all through the mid-west and mid-southern sections of the nation. Preliminary tests of the Kansas buff clays in question indicate that it makes a superior tile which lacks the "pimpling out" defect found on even the most popular eastern products. If this be true, then Kansas production areas should be able to supply this large market in the central section of the United States. Kansas wares should logically have an advantage in Kansas, Oklahoma, Texas, New Mexico, Colorado, Nebraska, and part of Western Missouri and Iowa. Although the high selling price of glazed tile tends to lower the importance of carriage charges on sales, such advantage as would exist would be important.

If the production of glazed tile in Kansas is to compete with that of the eastern centers, it will be necessary for our production to achieve decided economies in operation in order to offset their advantages of experience in production techniques and marketing methods. That such efficiency can not be easily achieved is indicated by the following statement: "The ceramic glazed ware business has

become an important division of the clay products industry. It requires equipment, processes and techniques which are different from any other in the structural clay field; thus making of glazed brick and tile is virtually a new industry. As such it carries plenty of 'grief' particularly for the unitiated".(2)

It must likewise be emphasized that the market for glazed tile demands a broad area since uses of the product are typically small. Interior tile is used primarily in public buildings as walling for corridors, for floors, and so forth, and in residences for bathroom floors, and half walls, breakfast nooks, fireplaces, and other small uses. This restricted use of tile makes necessary wide spread marketing channels.

It is the writer's opinion that, assuming judicious management, economy of operation, and assiduous cultivation of the market, Kansas plants could utilize the new found buff deposits and could operate at a profit in the production of buff building brick and glazed tile. The two types of production would provide a background which contains favorable elements. Kansas offers an abundance of natural gas as cheap fuel, an excellent quality of raw material, and the advantages of geographical location resulting from the elimination of excessive transportation charges. It should be emphasized, however, that any such projects should be initiated on a small scale and expanded only as demand for the product was seen to justify the action.

(2) Brick and Clay Record February 1940 p 20

Section IV

The Outlook for the Production of Pottery and Heat Resistant Materials in Kansas

Pottery

The products of the pottery field may be divided into two general classes or groupings. The first class comprises all utility products for domestic use, which vary from the heavy, crudely made crocks, jars, bowls and jugs to the delicate, highly ornate dinnerware. The second class includes the pottery products considered as art ware, commodities ranging from finely made statuettes and other pieces of original design to inexpensive flower pots, ash trays, vases, and similar items. The two divisions, although exhibiting varied tendencies and reactions to economic forces by reason of the breadth of the field covered, are sufficiently related to justify treating them as a unit in regard to those factors considered of vital importance in determining the location of potteries.

Potteries in the United States have had a long and, at times, illustrious development. Many writers in the field of economic history present an interesting picture of the development of this type of production. Originally potteries were local affairs, operated by immigrant English potters who marketed their wares locally and, for the most part, produced a crude, heavy product. Throughout early American history, England was the source of "quality" ware; even today, although not to the same extent, there persists an opinion that English and other foreign pottery products are superior. This condition had important effects on domestic firms. So far as the writer can determine, the presumed inferiority of American work promoted two basic activities on the part of our own potters: they

imported English potters, English kaolins and clays, copied English designs, used English equipment, and secured a domestic tariff against foreign pottery imports. A combination of many factors in later periods has been such that American ware has been successfully "traded up".

As concerns the location of the plants, the production of pottery has been a reaction to definite economic forces. In the first instance, assuming that fuel, workable clay, and potential markets exist, developments "tend to locate in early established centers where trained potters settled, as in the valleys of the Delaware, Hudson, and Connecticut Rivers."(1) This element of a specialized labor supply has always been of basic importance and, moreover, has had a definite cumulative effect. As the potteries in a given district expand and as more and more laborers become skilled in this type of work, that area becomes even more definitely the logical region for expansion of new facilities. A number of characteristics of this type of production make the above phenomena explainable. For example, the value of pottery products in relation to the raw clay which is used in their manufacture denies any need for close geographical proximity of pottery plants and clay pits. Thus, up to the time of the World War I, American potteries still looked to England for many of their essential raw materials. This dependence upon English kaolins and ball clays owed its existence to several factors. "The early potteries in this country were generally started by Englishmen whose formulas called for English clays, and as those clays were carefully mined, of fine quality, and priced

(1) Chute, Hamilton, PhD, Marketing Burned Clay Products, Ohio State University, 1939 p 3.

about the same or little higher than domestic clays the tendency had been to continue importations. American clay producers were slow in adopting careful mining and purification methods, in persuading manufacturers to make formula adjustments, and the former predominance of imported China clays may also have been due partly to the general idea that anything imported was of far superior quality."(2) Since about 1920 there has been a definite movement in this country toward the use of domestic clays. The writer visited plants in the Upper Ohio Valley which were using kaolins from Georgia, ball clays from Kentucky and Tennessee, and Canadian feldspar. The widely scattered sources of raw material and the ability of potteries to afford the necessary transportation charges indicate how independent this type of production is of any specific clay deposits as sites for location.

A second condition, which explains the statement that potteries tend to be located economically where there exists a trained labor supply, lies in the fact that the character of the finished product permits it to bear heavy transportation costs in marketing. However for purposes of discussion, the products must be differentiated since certain of them do not possess this ability which characterizes the group as a whole. Thus, "flower pots are ordinarily sold within a local area of 50 to 75 miles, due to their low value in relation to transportation costs."(3) Stoneware seems to occupy a middle position, and some efficiently operated plants compete effectively at

(2) Minerals Yearbook 1936 - U. S. Department of Interior Bureau of Mines - p 867
(3) Chute p 7

a distance of 300 miles from the point of production.(4) With respect to the other prominent types of ware, such as hotel china, semi-vitreous products, dinnerware, and art pottery, the market is practically nationwide and a geographical location, as such, tends to offer a minimum inducement.(5) This does not imply, however, that hotel china and dinnerware plants are not highly concentrated geographically, since most of them are located in Eastern Ohio, Western Pennsylvania, and Northwestern West Virginia, with a sizeable development in California near Los Angeles.

With regard to the importance of a local fuel supply, potteries use natural gas primarily as their firing material. The availability of this fuel was an important factor in the early developments in the Ohio Valley, and the ultimate depletion of local supplies may influence the potteries, in new developments, to seek new locations. However, the existence of pipe lines from fields in the middle and southern sections of this country into the eastern area suggests that, in all probability, cheaper sources of fuel would not constitute a sufficient inducement for the development of new plant locations. The advantages of an adequate supply of trained labor, established marketing connections, and the product consciousness of the present pottery production regions would tend to outweigh the single advantage of fuel.

In the opinion of the writer, Kansas can not reasonably expect any sizeable pottery developments in exploitation of the recently discovered clay deposits which form the background of this discussion. As a state, Kansas does not offer any trained labor supply

(4) Ibid - Thus Ohio and Illinois truck their stoneware into the Carolinas and compete effectively with local products of the area.

(5) The writer is acquainted with one instance where a prominent Ohio producer of an American decorative dinnerware "dumps" rejects of this production in South America.

nor any particularly convincing advantage of location, and it is doubtful that the existence of fuel and ball clays will tend to disturb the status quo of eastern producing areas. Just as American producers once looked to English ball clays, they now look to those of Kentucky and Tennessee. That these clays are of better quality and more extensive than the known Kansas deposits must be conceded; moreover, since their use is established and their values known, their potential sale is assured.

The above conclusion must, of course, be qualified by some recognition of the outlook for pottery sales. Thus, a brisk or peculiar demand might stimulate new developments which would not otherwise be considered. A combination of factors might make it highly advantageous to develop the Kansas clay deposits. An interesting suggestion has been made that this area might profitably be developed with Czechoslovakian immigrant refugee potters to produce for that American market once supplied by imports from Czechoslovakia before its recent annexation. Such a project would offer a solution for a rehabilitation problem and, at the same time would provide Kansas with a trained labor force.

Table XV shows the volume of pottery imports from Czechoslovakia:

Table XV: Imports of Pottery into the United States from Czechoslovakia(6)

Year	Value	Year	Value
1920	62,864	1926	1,045,572
1921	232,564	1927	895,346
1922	540,681	1937	599,176
1923	704,368	1938	721,667
1924	1,020,873	1939	* 424,010
1925	1,003,296		

* 1939 (January - June) Imports in 1939 from Czechoslovakia occupied by Germany included in figures for Germany.

(6) Date 1920-1927 from Chute p 290 - Summary of Tariff Information 1929; 1937 - 1939 United States Tariff Commission - received through Representative Frank Carlson, August 11, 1939

The schedule leads to a tentative conclusion that the sales of the pottery in question, had no anti-Nazi boycott been effective, probably would have ranged from a half to three quarters of a million dollars. That this aggregate is significant is obvious, but how much of such a market new developments in this area could hope to obtain is a controversial question. In the first instance, there is evidence that established potteries recognized the opportunity. The national pottery convention, which met in Washington in the late spring of 1939, was "very jubilant over the prospects in this country" following the result that "imports from (Czechoslovakia) had fallen rapidly since Germany assumed control."(7) It is suggested also that this volume of imports, moving as it did through brokerage agencies, must depend on that marketing arrangement for continued consumption by this country, if we are to approximate the quantities previously consumed. It is felt that, in all probability, these marketing channels already have taken steps to promote or to obtain pottery to replace the foreign imports. Thus, the type of vitreous art ware formerly imported from Czechoslovakia is now being made, among others, by a new manufacturing department of General Ceramics Company at its Metuchen, New Jersey, plant.(7b) Although preliminary showings of the ware by these eastern, established concerns indicate a large potential domestic market, it is felt that, as a definite opportunity for the proposed developments in Kansas, it is of doubtful value if it be the only inducement. In regard to the domestic demand for pottery products in general, the intermittent production schedules of American potteries do not indicate any unsatisfied orders for wares.

(7) Letter to writer from Representative Frank Carlson dated July 22, 1939.

(7b) Ceramic Industry November, 1939, p 25

It should be noted that the preceding conclusions apply only to "sizeable pottery developments". There is no contention advanced that one or several small hand potteries, operated and owned by one or a few persons, might not prove profitable. A hand-made item, advertised as a Kansas product, made from Kansas clay and by a Kansas pottery might find ready sales either for use or as a novelty. No doubt there are local markets, individually small but many in number, which are not being completely covered by representatives of national concerns. It is not unlikely that the more common items, such as flower pots, crock jars, and so forth, produced in the central section of Kansas could obtain all the local sales on a price basis, and could look further west to the more widely scattered demands. In any event, the small investment necessary would be commensurate with what now appears to be the opportunity, and recommendations for such developments are more defensible.

Heat Resistant Materials

One specialized section of the clay industry which is of basic importance to other types of industrial activity is the production of fire brick and heat resistant materials. The term "fireclay", which commonly denotes the materials used in this type of production, is "employed rather loosely and is not confined strictly to refractory clays, nor does it include all clays used in making refractories".(8) Although fireclays occur in all but about a dozen states and are mined in at least 30, Pennsylvania, Ohio, Missouri, Kentucky, and California together constitute over 75% of production, 1/3 of the total coming from Pennsylvania alone.

(8) Minerals Yearbook 1937 p 1259
(9) Ibid - 1260

The principal uses of fire brick and of products of the fire brick operations are in the heavy industries, yet the manufacture of refractories is even more sensitive to changes in business conditions that is that of iron and steel, and the short term swings in fire clay slaes depart violently from the general index of business activity.(10)

In location and economics of operation Chute, in his "Marketing Burned Clay Products' study, found that the production of refractories presents an interesting and varied picture. About 200 of the manufacturers of fire clay refractories are listed in the "directors of the Refractories Industry", and heavy concentrations of plants are found in Western Pennsylvania, Ohio, Eastern Missouri, along the New Jersey Coast, and in California.(11) However, of these 200 plants, the "Big Five" make probably 65% of the total production in the industry.(12) With reference to their source of raw materials, some plants, especially those producing refractory cements and mortars, are located in cities at a distance from centers of fire-clay mining, while others producing the heavier products are located in close proximity. In marketing area, some of the larger producers have a national coverage while others sell only in a limited area.(13) It is noticeable, moreover, that the manufacture of refractories centers closely around areas of iron and steel manufacture, and oil refining. Just what factors are most important in determining the location of fire brick plants and what type of economic activity is most characteristic of them is not readily apparent.

(10) Minerals Yearbook 1934 p 882
(11) Chute p 20
(12) Ibid p 156
(13) Ibid p 21

In view of the above conditions, only a few obvious elements will be presented. First, important producers of refractories tend to be highly specialized plants with extensive laboratories and experimental departments. The demands of users of the products are rigid, and the material "not only must be able to withstand high degrees of temperature but also at that high heat to resist pressure from the adjacent masonry and working load, vibration and blows from working tools, slapping action of the contents and chemical reactions with the latter, the cutting, the abrasive action of flame, flue dust, and movement of contents".(14) Industrial consumers purchase directly from the producer 85 to 90 per cent of the refractories industry, and the buying motives are not those ordinarily encountered in other branches of the clay products industry.(15) This presents the second general characteristic of refractories production, one which tends to handicap any new areas: first, firebrick and their related products in general are not sold on a price basis and indefinitely continued sales follow a satisfactory performance of the material in use. Many buyers 'pay a premium for a refractory having a longer life in service, since the labor and furnace shut-down costs of replacing refractory linings are very appreciable factors in operating costs.'(16) Thus the production of glass, for instance, finds that the expenses involved in case of lining 'burn-outs' are so much greater than any cost of refractories involved that those latter materials are bought for proved dependability rather than because of any economy of price. In the second place, characteristic of buying motives in purchase of refractories is the increasing importance of the advisory services

(14) Ibid p 19
(15) Chute p 159
(16) Ibid p 167

afforded the user by the technically trained salesmen of producers of these materials. These individuals offer expert services as a compliment of the seller, and the net result is to remove even further the element of price in the marketing of refractories.

The conclusions which the writer has drawn as to the opportunities for fire brick production can be summarized briefly. The preliminary reports of the Kansas State Geological Survey indicate only small amounts of number one fireclay and kaolins in this area; as a result, any influence of material, if that be important in location, is negligible. Of even greater importance, the extensive developments of refractory production in Missouri and Colorado deny any advantageous marketing area for potential Kansas plants. Although the extensive gas fields in the Kansas area would afford cheap fuel, it is doubtful if this fact alone would provide sufficient justification for extensive development. The existence of pipe lines at the present time permits other elements of importance to overshadow the influence of fuel deposits on location of plants using that fuel. Thus it may be concluded that Kansas offers few advantages for the extensive production of fire brick, and that the highly specialized methods essential to the marketing of refractories militate against any such action in regard to a first grade product. The following material of this section concerns second grade refractories for which extensive raw materials are found in the Kansas clay fields.

Certain individuals in this state are impressed with the possi-

ibilities of the marketing of low grade fire brick in the area, both as a primary product and as a side line to the production of other types of clay products. These individuals hold that there is a broad local market in supplying heat resistant materials as linings for small boilers, incinerators, municipal and school heating equipment, and so forth. This possibility is not denied to the same extent as is that regarding first grade firebrick, but the writer can not wholly endorse the enthusiasm in the field. The production of boiler linings as a sideline to the operation of a face brick plant, for instance, must of necessity deal with a standardized product, or at least with a very few lines. This is an important consider ation as regards the small uses of fire brick. "An important phase of refractories' marketing lies in the manufacture of various products to specifications of engineering and equipment designers, furnace builders, etc. for installation with specially designed equipment———An industrial furnace builder, similarly makes the linings for his furnaces, both original equipment and operating repairs."(17) That is to say, the market for small uses of poorer grade firebrick in furnaces and in other types of equipment is for bricks of special shapes, made for the individual heating unit, and often a subject for contract between the seller and user of the heating unit. Furthermore, in many cases the trend is away from types of equipment using fire brick and refractories - - thus diesel or other types of engines, electric motors, etc. are used in place of old steam power equipment, and electric furnaces are used where heat is required. Chute found,

(17) Chute p 158

in a questionnaire sent to 91 producers of refractories, that 20 replies were indicative of the opinion that the trend "to demand first quality firebrick products for purposes formerly satisfied by lower-grade firebrick" was important.(18) As a result, the writer feels that first grade fire brick production in Kansas, were the raw material available, has but slight opportunity, and that the market for second or lower grade refractories should be very carefully analyzed since there are many considerations which deny that any sizeable potential demand exists.

(18) Ibid p 313

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