

Influence of Highways on Selection of Six Industrial Locations

DONALD J. BOWERSOX, Highway Traffic Safety Center, and Department of Marketing and Transportation, Michigan State University, East Lansing, Mich.

Extensive industrial development adjacent to new highway facilities stimulated this pilot inquiry regarding the priority placed on highways by industrial firms during plant location. A plant located adjacent to a major highway enjoys economical movement of raw materials and finished products, as well as the added convenience of increased labor mobility. In addition, there are indications that these firms may enjoy advertising and public relations benefits from selecting locations near heavily traveled traffic arteries.

Representatives of six industrial firms currently located adjacent to free access roads were interviewed regarding the importance placed upon general highway benefits, advertising benefits and public relations benefits when selecting new plant locations. With full realization that universal generalizations cannot be based on a sample of six firms, the following is a brief summary of conclusions.

The general influence of highways on the selection of plant sites is considered as important but not critical. The firms realized the need for highway facilities, but placed little priority on specific types of facilities during site selection. Little research was completed concerning potential economics from locating adjacent to highways offering specific services. If the road was paved and in good condition, it was judged adequate.

The advertising benefits resulting from location obtained little consideration. The factor was viewed as an extra benefit that could be realized at almost any location. Some difference in the value placed on the advertising factor was indicated between firms serving industrial and consumer markets.

The influence of public relations resulting from location adjacent to highway construction is vague. Considerable doubt was expressed concerning the value of attempting to locate in order to realize this benefit. Beyond doubt, this is not a factor in location. The benefits that can be realized appear to be independent of the type of road to which the plant is adjacent. The results of this pilot study indicate that the typical firm does not fully appreciate the total economic impact of modern highways on business operations.

● **POST WORLD WAR II** America has been characterized by industries forming, expanding, relocating and dying. New plants are constantly constructed or occupied by firms at "selected" locations in order to take advantage of radically shifting markets, lower processing costs, lower transit costs, or intangible factors offered by specific

locations. Experience has pointed out that plants can no longer be located by intuition. Selection of a location which offers the proper mix of cost, competitive, and intangible factors can often become the decisive factor between proliferation or failure of a firm. A large number of available vacant plants clearly points out that the days of making money "in spite of yourself" are at least temporarily a thing of the past. In Michigan alone, 292 plants were listed as vacant in early 1958 (1).

Critical among the factors which must be considered when selecting a plant site are the transportation facilities that are available at each location. The economic spectrum of manufacturing consists of raw materials on one hand, and the geographic locales of potential demand for finished products on the other (2). Plant location deals with this whole spectrum, whereas transportation consists of a system by which the two extremities of the spectrum can be united. There are five principal modes of transportation available to manufacturing firms—rail, water, air, highway, and pipeline. The broad subject under consideration in this pilot report is highway transportation. Specifically, the influence of highways on industrial location will be discussed.

During 1957-1958 the author conducted a study of plant location procedures used by six industrial firms located in Michigan. The objective of that study was to obtain some insight regarding the similarity of theoretical procedures suggested for solving plant location problems; and the actual procedures used by firms facing location choices. To ascertain a standard of comparison, locational theory was reviewed and reorganized into a procedural model which was in turn labeled "Applied Theory". An empirical inquiry was then completed to determine the degree of similarity between applied theory and the actual procedure practiced. During this study the primary emphasis was placed on procedure rather than individual locational factors determined critical by each firm.

One exception was made to the decision to concentrate strictly on procedure. As a secondary objective of the empirical investigation, each firm interviewed was asked several questions pertaining to the importance placed on potential highway benefits during the selection of plant sites. This secondary objective was intended to serve as a pilot inquiry into several relationships between highways and industrial location. This report presents a complete finding of these highway inquiries.

HIGHWAYS AND INDUSTRIAL LOCATION

Highways provide the basic facilities on which the majority of raw materials and finished products move to and from industry. In 1958, motor carriers provided 260 billion ton-miles of service. Between 1940 and 1958 truck ton-miles increased from 62 billion ton-miles to 260 billion. In 1958 this ton-mile figure represented 74.5 billion road miles (3). In addition, there is reason to believe that the completion of the integrated highway system now under construction will witness an increase in the annual use of truck transportation. For example, a survey of grocery wholesalers, concerning methods of receiving groceries at the warehouse, supports this assumption. This survey, completed in 1955, pointed out that shipments were equally divided between rail and motor truck, although the proportion of receipts by motor truck has been increasing substantially during the last two decades (4). This trend is further substantiated by interviews with traffic managers at several large food chain distribution centers. These managers report that currently over 70 percent of inbound freight is arriving by motor truck.

Finally, one merely has to look at the increase in total motor truck registrations from 1904 to 1958 to substantiate these trends. The truck increased in aggregate numbers from just over 6 thousand in 1904 to over 10.5 million in 1958 (3, p. 2).

Two basic considerations in plant location also support this trend toward increased use of truck transportation. First, markets have become a primary locational factor in most industries, generally overshadowing other influential factors. Increased freight rates since the end of World War II have forced firms to seek market orientated locations which offer a relatively short haul to the market. Two principles of rate structure support a market orientation: (a) transfer rates on finished products are normally higher than those of raw materials, and (b) generally, the greater the dis-

tance the higher the total transportation cost. At least one is safe in saying—other things being nearly equal—the normal preference will be to select a location in close proximity to the major sources of potential demand.

The second consideration is space. Space requirements as a prerequisite to efficient operation have stimulated a mass movement of industry to the suburban areas. Only where land is available at a "realistic" price can horizontal one-story factories, which offset the necessary economies of operation, be constructed.

Both of these considerations in turn mean that trucks can assume a greater role in the distribution of finished products to the market. In the first case, location in close proximity to the market means that trucks can satisfy most outbound transfer requirements. In the second, new plants are located at a point distant enough from thier market to require transportation services of a motor carrier on a regular basis. In both cases the services offered by motor truck transportation become desirable—the haul is relatively short and the convenience of speed and service is at a premium. And, of course, almost without saying—economical operation of trucking facilities depends on adequate highway access from plant to market. As will be elaborated on at a later point, the case studies presented in this report support these basic trends in plant location.

The influence of highways does not end with the transportation of materials and products. Along with the need for quick and economical transportation to the market, as well as a constant and economical flow of raw materials, the accessibility of labor is another reason for locating in close proximity to major roads. One California firm feels that location adjacent to a freeway had made selection of desirable personnel less difficult. Prior to freeway construction, prospective employees living some distance from the plant were reluctant to travel long distances to work (5).

Advertising and more desirable public relations are two additional benefits that some firms feel result from location near highways. The fact that some companies consider that highways possess immeasurable advertising value is pointed out by a plant survey conducted in California. That survey attempted to ascertain the benefits enjoyed by firms which had selected a location adjacent to a freeway. Six of the nine plants located on the Santa Ana Freeway reported such locations are an asset to business from an advertising standpoint (5, p. 6). Firms located adjacent to the Massachusetts Route 128 development also indicated an advertising and prestige value realized from their highway locations (6).

Desirable public relations resulting from a highway location have been pointed out by the observations of a chemical manufacturer. He reported a two-fold beneficial effect from his recent location on a major road: (a) the prestige of his company was increased by the image developed among the large number of people that pass his plant each day, and (b) securing employees became easier because people like to become identified with a well-known compay (7).

One writer ably summarizes the total relationship between plant locations and the benefits offered by good highways (8). "Industry spends millions for new plants, which have to be placed where they can easily be reached by workers and suppliers, and in addition will have ready access to the markets. It is only economically sound that industry desires to locate on the vast conveyor belt that lies before us." Previous research dictates that the major benefits of increased acreage, movement of raw materials and finished products, and convenience of labor mobility, resulting from location in close proximity to highways be accepted as relevant. Without question all locations offer some type of highway improvement, but not all highway improvements offer the same locational benefits. In this study the objective is to ascertain some insight into the consideration given to these highway benefits when selecting plant sites. Were these factors considered when selecting a location? In addition to general locational influences, some indication is desired regarding the importance placed on advertising and/or public relations benefits during site selection. If considered, what priority is placed on selecting a location which provides these benefits?

In the following several objectives are accomplished. First, a few examples of industrial development adjacent to new highway construction are reviewed. This discussion provides some insight regarding the way industry has been attracted to land

made available by new highway development. Second, the interview results are presented in case study form. Each case is introduced with a brief discussion of the firm under observation. This is designed to give the reader a feel for the firm considered. Next, a discussion of the influence attributed to highways when selecting plant sites is reported. Answers to specific questions regarding advertising and public relations are discussed. In the fourth part conclusions regarding all facets under consideration are presented. These conclusions do not take the form of verified generalizations but rather give some indication of relative value placed on highway factors by these six firms. All six firms currently operate plants located adjacent to free access highways; all but one are adjacent to two- or three-lane roads open to traffic for a number of years. Last, a few suggestions for an additional inquiry resulting from this examination are presented for the reader's consideration. An appendix contains the methodology used. The firm selection procedure and the interview outline are presented in detail.

SOME EXAMPLES OF INDUSTRIAL DEVELOPMENT IN THE AREA OF NEW HIGHWAY CONSTRUCTION

Numerous examples can be found to support the statement—where major highways are constructed, industry often mushrooms. Such extensive industrial development indicates that land values increase and industry is attracted to new locations made available for plant sites. Whether land is provided in the form of an organized industrial park or merely large tracts of land on the fringe of the city, new industry will be attracted if other locational requirements can be reasonably met.

Route 128

The "magic semi-circle" is one good example of a highway improvement which has attracted extensive industrial development. Located near Boston, Mass., the land adjacent to Route 128 has experienced amazing industrial growth. Route 128 extends for about 60 mi on the easterly side of Boston. Highway construction is a combination of partial and limited-access facility. While parts of the "magic semi-circle" were completed as early as 1936, extensive industrial development did not take place until after World War II. From 1947 until 1955, 28 new plants owned by 25 different companies were constructed in the area (9). More than 100 million dollars has been invested in these new industrial plants (8). Land which at one time represented undeveloped suburban area now demands premium industrial prices.

The future of highway 128 appears to be one of continuous growth. Here we observe examples of firms which preferred locations in close proximity to a major road. The reader who is interested in obtaining additional information regarding Route 128 is referred to a number of publications reporting a large-scale study completed by representatives of the Massachusetts Institute of Technology (10). The objective of this study was to investigate all basic factors underlying social and economic changes that have taken place along the highway.

New York Thruway

The land recently made available by the New York Thruway has been used for similar industrial development. The first section of this highway was opened in 1954. Despite the short period of operation, major enterprises have earmarked some 150 million dollars for new or improved plants along the Thruway (11). These industries will have a 100 thousand dollar annual payroll and will employ 30 thousand persons (11). This basic industrial development has set off a beneficial stimulant to the construction of other businesses which will add prosperity to New York State for years to come. In New York, as in Massachusetts, land values have increased substantially since the new highway was completed. Recently 12½ acres of 21-acre parcel of land sold for 150 thousand dollars. In 1951, the total parcel was sold for 15 thousand dollars (11, p. 5).

East Shore Freeway

Another equally outstanding example of industrial development on land made avail-

able by new construction is reported in Alameda County, California (12). An area along the east shore freeway consisting of 7.5 mi was selected for intensive study. The objective of this study was to provide a testing ground to determine the economic effect of freeways on industry. This study pointed out that while only 9 percent of the total industrial acreage in Alameda County was included in the study area, 43.1 percent of the total expenditure for new industrial construction was invested in the study area (12, p. 2). Many additional comparisons are reported which clearly point out the manner in which industry was attracted to this area. Land values reported in this California study show an upward trend. Land selling at an average price of less than one thousand dollars per acre in 1941 was sold at plus 10 thousand in 1953 (12, p. 7).

Pennsylvania and Ohio Turnpikes

The areas adjacent to the well-established Pennsylvania Turnpike and the newer Ohio Turnpike have experienced this same phenomenal infiltration of industry. In Ohio, a 60 million dollar tractor plant was erected adjacent to the new road. This plant will eventually employ over 1,500 persons (8, p. 84).

These few examples of industrial development could easily be expanded to include a discussion of the Connecticut Turnpike, Massachusetts east-west toll road, and numerous other developments found in almost all states. Unquestionably construction of a new highway through undeveloped land provides additional area to be considered as plant sites. Current studies point out that this land is extensively used almost as soon as it becomes available.

EMPIRICAL CASE STUDIES

Information obtained during research is reported in this section. The objective is to relate the importance attributed to particular aspects of highways during industrial site selection. To present interview results in an unbiased manner, no attempt is made to generalize on the information reported at this point. Each of the six case studies is developed in two general parts.

The case is introduced with a brief discussion of general information regarding the firm under observation. Data concerning the product manufactured, size of firm, markets served, and other items peculiar to the individual firm are reported. This introduction is intended to give the reader a feel for the firm and an understanding of the events leading up to the locational problem.

In the second part of each case study, a discussion of the influence attributed to highways during site selection is presented. Answers to specific questions regarding advertising and public relations are also reported.

Two shortcomings of the empirical approach as used in this study warrant mention. With the exception of Firm C, during which interview two representatives were present, only one person was interviewed regarding each case. Use of this single interview approach allows inclusion of the biases of the individual interviewed. To some immeasurable extent, this shortcoming was minimized by interviewing the one person who was primarily responsible for selection of the site. In two cases a plant location consultant was interviewed. The untested assumption is made that the individual would be most likely to express the viewpoints of the firm.

The second shortcoming evolves from the elapsed time since a location decision was made. Depending on the retention abilities of particular individuals, as well as the resultant success of the decision, the factors leading to site selection may be distorted. Two checks were used to hold the second shortcoming to a minimum. First, only firms located subsequent to 1950 were selected for observation. This reduced the span of time between location and observation to a relatively short period. Second, the general validity of interview results was checked against information obtained from the Michigan Economic Development Department. This provided some standard by which to evaluate interview results. In all cases, the person interviewed readily recalled the location events and the general information checked with that obtained from the Department. The actual amount of intentional and unintentional bias presented in the case studies remains an unknown ingredient.

Each case study is labeled in reference to the size classification. (See Appendix for complete discussion of size classifications. Basically, firms are classified on the basis of number of location decisions rather than total dollar sales or number of employees.) This provides the reader with some insight regarding the frequency of location problems confronted by the various firms.

Firm A—Small-Size Firm

The first case is that of a small firm which owns and operates two plants. The firm manufactures delicate electronic instruments. At the present time the product is manually assembled; no automatic equipment has been developed which can meet the necessary product specifications. The firm normally experiences a high product rejection rate which is attributed to human error, component defects, and extreme vulnerability to dirt particles during product assembly.

All production undertaken is on a work order request to specifications established by the customer. The typical customer-manufactured consumer-branded items which use Firm A's product have a vital component in the finished product.

After three years of operation, increased business volume forced the owner to again expand manufacturing facilities. A branch plant was located 50 mi from the main operation. Both plants now employ a combined total of 150 full-time employees.

Highway Influence.—The owner of Firm A placed little emphasis on the influence of highways in selecting his plant sites. Although the plant is located on a major highway, this was not a prime locational requirement. The owner indicated that adequate roads were necessary to transfer workers, but other than satisfying transfer requirements, highways contributed little to the over-all specifications. He stated that his product is normally shipped by parcel post. If necessary, an entire week's production could readily fit in the trunk of an automobile. On the other hand, raw materials are all shipped in by truck. From this point of view, motor truck transportation does play a primary role in this firm's operation. Nevertheless, this factor was not considered when selecting a location.

Potential advertising which could result from location in close proximity to the highway was not considered. In discussion of the advertising influence, the owner felt it would benefit his particular firm very little. In selection of his location, no consideration was given to the public relations benefits. During the interview the owner of the firm expressed no opinion regarding public relations or community prestige resulting from location on a well-traveled road. In total, the owner of Firm A gave very little consideration to the highway factor in selecting the site for his new plant.

Firm B—Small-Size Firm

The second firm studied operates three plants. Two of the plants have been in operation for a number of years; the third plant is currently under construction. Although small in terms of number of plants, this company is considered as relatively large within the industry. The new plant under construction will employ 200 people when completed.

The product manufactured is a basic ingredient in the construction industry. Consumers vary from industrial firms to individual customers. All consumers purchase the finished product from retail stores or from wholesale construction suppliers. The market served covers a small geographical area, but has a very high population density per square mile. Within the market, sales are made to a variety of different customers.

Highway Influence.—In selection of the final site, location in close proximity to a major highway was considered as a primary prerequisite. The firm estimated that 75 percent of the finished product would be shipped to the market via truck. The site purchased is bound on one side by a major highway. The person interviewed stated that no consideration had been given to advantages gained by locating adjacent to the highway. Benefits of advertising and potential public relations were not considered when deciding where on the site the plant would be constructed. This lack of consideration is supported by the fact that the actual plant will be three-quarters of a mile from

the major highway and not visible to passing traffic. No opinion was voiced concerning the benefits of advertising or potential community prestige that could have resulted from construction adjacent to the highway.

Firm C—Medium-Size Firm

Firm C has participated in two recent plant locations. One plant represents an expansion of facilities. The other plant was constructed to modernize an outdated plant. In total, five plants are owned and operated by the corporation. The products manufactured are all in the electronics field. Firm C's finished product is a vital component of a variety of different products sold to industrial and consumer's markets. The product is purchased by customers located in extremely varied geographical areas. Major customers are appliance firms, power equipment manufacturers, and the government.

Highway Influence.—Location on a highway is one requirement the potential site must meet. Whereas rail is used to transport raw materials, trucking is a major method of moving the fabricated parts from the stamping plant to the final assembly plant. For potential use, rail facilities are required at all plant locations. At present, these facilities are not used at the assembly plant.

In reference to the advertising question, the executive interviewed replied that it was immaterial in site selection. His firm, serving an industrial market, would benefit very little from potential advertising. No consideration was given to resultant public relations received from highway proximity. The opinion was expressed that the local population will find you regardless of where you are located, and will measure the desirability of employment from labor relations and working conditions, rather than appearance. Location on a back road is satisfactory if it can meet all other transportation requirements.

Firm D—Medium-Size Firm

Established shortly after 1910, this company has experienced steady growth at a moderate rate. Manufacturing capacity has steadily increased since the company was formed. At the present time, five plants are owned and operated by the firm.

The products manufactured by Firm D are primarily used for the packaging of customers' products. Firm D sells to a number of different customers. With the exception of a few standard items, products are manufactured to the consumer's specifications. At the present time, over 1,000 people are employed.

The five company plants are decentralized over a large geographical area. Each plant serves markets which are in close proximity to the plant. Both the weight of the raw materials and the finished product require that transportation costs be minimized.

Highway Influence.—The new finishing and assembly plant is located on a major highway. A direct route from the primary manufacturing operation facilitates movement of semi-finished products via truck to the assembly plant. One of the major advantages of the new location is the network of roads which provides ready access to the major markets. Location on a main highway was considered a prime requirement of the new site.

In selection of a plant, no consideration was given to increased advertising or beneficial public relations that could result from location in close proximity to a major highway. No opinion was voiced during the interview concerning these potential benefits.

Firm E—Large-Size Firm

The first large firm studied is one of the largest corporations in the United States. Corporation E has a staff department which is responsible for selecting the specific site at which the new plants will be located. This department has participated in the location of 33 major plants, in all parts of the United States, within the last 15 years.

Firm E treats the location of each plant as strictly a custom operation. This is necessary in order to assure proper consideration of all facets peculiar to each particular plant. Yet, in selection of each location, there are basic principles which are followed in obtaining the specific site. These principles serve as a guide to determine which department is responsible for each step in the selection procedure. One principle

of interest to this study is the general site specifications desired for each plant. The typical site must contain approximately 200 acres of land with a four-lane highway on one side, and a main line railroad on the other.

Highway Influence. —In the words of the executive interviewed, highway influence in location selection is becoming "bigger and bigger." As noted earlier, the typical site selected by the firm was a four-lane highway on one of the long sides of the site. If possible, the firm also desires to have secondary roads located at each end of the site. One major plant was located at a specific site because a promise was made to construct a major intersection at the corner of the lot, which would provide exceptionally good access to the plant.

The advertising potential of locating in close proximity to a major highway is considered as one of the reasons for the prerequisite of a four-lane highway. Considerable doubt was expressed concerning the direct value of such advertising. Indirectly, the firm feels their product image is increased by such locations.

Likewise, the public relations aspect of highway location is considered in determining the site specifications. The firm does not feel that such locations develop among the public the attitude of a good place to work. They do feel that over-all public relations are increased by construction of desirable plants.

Firm F—Large-Size Firm

The second example of a large firm involves a location problem that was stimulated by forces of expansion, modernization, and decentralization. Faced with the need for modernization, the firm decided to expand facilities used for the production of a relatively new product. The decision to decentralize resulted from the influence of a new managerial policy. As a first step in implementing this policy the decision was made to seek a location that was geographically separate from existing facilities, Firm F manufactures a series of parts which are basic components in the products of a number of different industries. With the exception of a few replacement parts, all production is sold to an industrial market. In total, twelve plants are owned and operated by Firm F. The plant relocation, studied in the case, specialized in the production of one product. This product has gained market acceptance rapidly. Increased production has made this item one of the major product lines of Firm F. This particular product is almost totally sold to the automotive industry. Other manufacturers of transportation equipment do use the product, but their orders represent a small percentage of total production. As a result of the concentration of the automotive industry in a few states more than 90 percent of this product line is sold in a small geographical area. Production is normally undertaken on a work order request. Although the basic product performs the same function for all customers, modifications are needed for each type of vehicle.

Highway Influence. —Firm F places substantial weight on the highway facilities available in each community. In evaluation of various sites, only those which had ready access to at least one major highway were considered. All shipments to and from the new plant used trucking facilities. Similar to the assembly plant located by Firm C, Firm F's new plant has rail facilities available which are not presently used. The person interviewed stated: "This was only smart business—future developments may make rail transportation a primary means of distribution."

Firm F did not consider the benefits of potential advertising when selecting their site. During discussion that followed the advertising question, the executive interviewed expressed the opinion that this is not influential to firms selling in an industrial market.

Consideration was given to public relations when planning how construction would be undertaken on the selected site. The plant is well landscaped and parking lots are placed close to employee entrances to increase the attractiveness of the new plant. Firm F did not feel that location had to be adjacent to the major highway. As a matter of fact, Firm F's new plant faces on a secondary road, one-fourth of a mile from the major highway.

OBSERVATIONS

General Highway Influence

1. With the exception of Firm A, all firms studied felt that location in close proximity to a major highway was necessary. These firms would not consider locations that did not offer adequate highway facilities.
2. Specific requirements concerning desired types of highway facilities were established by only one firm. Firm E stated in its specifications that it was necessary for a four-lane highway to border one side of any potential site.
3. Each plant studied is located on or near a major U.S. highway. Firms B and F are the only companies that are not directly adjacent to a major road.
4. Only Firm B cannot be seen by passing traffic.
5. With the exception of Firm A's finished product, truck transportation is one of the major means of distribution. Consensus of opinion was that this mode of transportation will increase in importance during future years.
6. All firms received some raw materials via truck.
7. Consideration given to highway influence and selection of sites did not vary according to the number of location problems confronted by the firm. No relationship was observed between the volume of business and the consideration given to highway influence.

Advertising and Public Relations Influence

1. Advertising benefits resulting from location in close proximity to a major highway were not considered by five of the six firms studied.
2. Firm E did consider advertising when establishing site specifications. Some doubt was expressed by this firm regarding the direct value of this type of advertising.
3. The two firms serving a consumer market reacted differently to the benefits of advertising. Firm E gave attention to this influence when establishing specifications; Firm B did not. When completed, Firm B's plant will not be visible to passing traffic.
4. Firms B and D expressed no opinion regarding possible advertising benefits that could have been realized.
5. Firms A, C, and F expressed the opinion that serving an industrial market made consideration of the advertising factor unnecessary.
6. Two firms gave consideration to the public relations aspects of location. Firm E considered this factor during establishment of specifications. Firm F gave some consideration during positioning of the plant on the selected site.
7. Three firms, A, B, and D, did not express opinions regarding public relation benefits.
8. Firms E and F felt that some desirable public relations result from location in close proximity to highways. Firm F indicated that this benefit could be realized without location on a major road.
9. Firm C feels that benefits from public relations result from factors other than location on a major road. If your firm offers a desirable place to work, people will find you regardless of your location.
10. Although the two firms considering public relations benefits happened to be the firms which participated in the largest number of location problems, no relationship between size and consideration can be inferred. Each gave the problem consideration from different viewpoints. Consequently, no relationship is observed between frequency and value placed upon advertising or public relation influence.

CONCLUSIONS

The influence of highway facilities on the selection of these six plant sites was considered as important but not critical. Each firm gave some consideration to selecting a location in close proximity to a major road. Motor transportation occupies a constantly increasing role in the economic activities of firms studied. As such, the person responsible for locating the plant realized the need for some adequate highway facility.

Regardless of this awareness, the firms studied did not place a high priority on selecting a site which rendered access to a specific type of highway facility. With the exception of one firm, highway prerequisites to guide site selection were not established. Little if any attention was given to potential benefits from location in close proximity to specific types of improvement. If the road was paved and in good condition, it was judged adequate. This is supported by the fact that none of the firms rejected a site because of an inadequacy of roads. If all other locational factors were determined satisfactory, the highway facility was always adequate.

Potential advertising benefits obtained from location adjacent to highways was not important in site selection. If considered, advertising was viewed as an extra benefit which could be realized at almost any location. There is some indication that firms serving an industrial market, place less value on advertising than firms serving a consumers market. Only one firm directly considered advertising prior to site selection. The remainder of firms placed no weight on advertising during the selection process. For the most part, the study indicates the firms were not aware of potential benefits, and even after consideration felt advertising was not a prime consideration.

The influence of public relations benefits resulting from location adjacent to a highway was not considered. During interviewing, considerable doubt was expressed concerning the value of attempting to locate in order to realize such benefits. Beyond doubt this was not a factor in location. Most firms felt that those benefits which can be realized are independent of the type of roads to which the plant is adjacent.

The results of this inquiry viewed in perspective of extensive industrial development adjacent to major roads, reported earlier, raises some interesting points. Numerous examples of firms attracted to the most modern of highway facilities were noted. In this study firms were observed that appeared indifferent to types of highway construction—firms which gave low priority to highways during site selection. Is it a fact that for "most" firms one type of road construction offers equal locational advantages as all other types of construction? Or, does this indicate the typical firm does not fully understand the impact that a proper highway can have on business activities?

This brief pilot study cannot answer these questions, but it does provide insights. Only one firm established prerequisites for highway facilities. During or prior to site selection, little attention was given to potential costs resulting from traffic flows, ease of access, seasonal weight restrictions, safety, etc. In addition, no studies were conducted concerning the advantages of locating near limited-access roads. None of the firms conducted studies to determine the economic feasibility of locating in order to make use of modern toll road facilities near the southern part of the state. In total, it appears little attention was directed toward analysis of highway benefits.

All of the foregoing factors indicate that the typical firm may not fully appreciate the impact of modern highways on business operations. As the integrated highway system now under construction is completed, the mass of location alternatives will increase. Although it is possible that inadequate roads will rarely cause a community to be rejected by a firm, it is a fact that highway facilities can render one location economic advantages over alternatives.

As business competition increases in the future, selecting the proper site which offers potential savings in daily operation may very possibly help determine firm longevity. In the past, the individual firm has historically been confronted with the problem of effecting closure between the point of manufacturing and the point of final product distribution. In other words, initially the problem of "getting the fruit to market" occupied the position of first concern to the individual firm. Faced with rising cost patterns, the firm of our future economy will constantly have to adjust marketing and distribution efforts to reduce costs and improve market flow efficiency. The profit potential of a specific operation is directly related to ascertaining if product distribution costs too much. The selection of a proper location establishes the environment from which the firm must meet competitive challenges. It is a decision which the firm must live with for a considerable period of time. With full realization of the potential dangers of a poor location decision—the executive finds in relocation a seldom veiled opportunity. In essence, it is an opportunity rarely available to most firms. It is an opportunity to gain an advantage over competitors. It is the opportu-

nity to place new life in the firm. Full realization of the impact of cost determinates, such as improper vs proper highways will determine the duration and extent of the competitive advantage obtained by relocation. The results of this pilot inquiry indicate that five of the six firms studied did not fully appreciate the impact of at least one cost determinate—highway facilities.

SUGGESTIONS FOR ADDITIONAL RESEARCH

In the spirit of a pilot inquiry, the final results can represent nothing more than insights into researchable problems. Thus, the final objective is to relate the findings of this pilot study with other research in order to suggest future research problems. This is accomplished for each of the areas considered in the pilot study—general highway influence, advertising, and public relations.

General Highway Influence

The basic necessity for locating in close proximity to a major highway is important for most firms. Additional study concerning the benefits that can be realized from location adjacent to different types of highway construction appears beneficial. As noted in this pilot study only one firm specified that a four-lane highway was desirable. Industrial development research reviewed earlier pointed out that substantial developments have taken place in close proximity to limited-access roads. Additional inquiry is necessary into "why" some firms attract to such locations while others do not. Where do firms which select locations adjacent to limited-access facilities obtain information concerning the availability of such sites? Did they consider alternative sites adjacent to other types of roads? On what quantitative factors did they base their decision to locate along limited-access facilities? And possibly more important, how substantial a geographical move did they make to enjoy these highway benefits?

The Massachusetts Route 128 study made considerable insight into the answers of the foregoing. It is interesting to note that companies representing 55 percent of the investment on Route 128 considered only a Route 128 location or another suburban Boston site (6, p. 36). Additionally, it is important that research and development firms, probably among the most "foot loose" in the American economy, considered the widest variety of sites when selecting a location (6, p. 36). These two conclusions when viewed in perspective of this pilot study indicate that the majority of firms may have one or two primary locational factors, such as labor, raw materials or markets, which limit their location alternatives to a very narrow geographical area. This fact is supported by the research of Greenhut and Smykay (13). Accepting this premise, the average firm is restricted to a few geographical alternatives in selecting a least-cost location and, consequently, the question of highway facilities may be a localized problem. Therefore, locating adjacent to a limited-access road or any other type of road may simply be dictated by the availability of such facilities in the specified area.

While the foregoing discussion will appear obvious to the spatial economist, the critical question remains to be answered. What are the variable costs related to these different highway facilities and to what extent do they justify an alteration of geographical location alternatives? Research designed to completely delineate the operational costs directly related to highway facilities must be accomplished to fully assess the location importance of specific types of roads.

Additionally, it must constantly be kept in mind that total least-cost concepts are only relevant within a framework of potential demand. One notes that in the Massachusetts study, commercial markets were listed as number twelve out of the fifteen locational factors influencing site selection along Route 128 (6, pp. 34-35). As early as Weber (14), later expanded by Hoover (15), and more recently substantiated by Greenhut (13), a market orientation was identified as one of the three potential location orientations available to a given firm. A complete review of the contributions of spatial economists and the impact of highways on each of these orientations appears worthwhile. Do production orientated firms view highway facilities differently than market oriented or foot-loose firms? Or to turn it around, are highways more or less important as cost determinates to firms falling within these different categories? The

hypothesis being: highways are greater cost determinates to market orientated firms. This is supported by the trends towards increased use of truck transportation by such firms, as noted previously.

Finally, the recent Third Progress Report of the Highway Cost Allocation Study (16) raises an interesting problem. It was concluded "there is little doubt that a single expressway in a fairly large metropolitan area could have a profound impact in creating new industrial sites." They then go on to indicate that this impact may have a diminishing quality. Unfortunately, this pilot study did not in any manner investigate the potentiality of a diminishing quality, but within this single observation lies the foundation for a far-reaching economic impact study.

Advertising

In the area of advertising benefits the results of this pilot study are contrary to those of other completed research. The most outstanding disagreement is with the California survey (5). Consideration of these opposing results suggest two areas for additional inquiry: (1) Study of the type of market (industrial or consumer) served may provide some insight into the value of locational advertising. No generalizations can be safely made concerning the markets served by the California firms. In this pilot study, four firms sold exclusively to an industrial market. The general hypothesis being: firms selling to a consumer market place more value on this type of locational benefit. (2) All California firms were located on limited-access roads. The Michigan firms were located on free access roads. Additional inquiry into advertising benefits resulting from location adjacent to different types of highway construction may provide some insight into the basic inconsistencies between these two studies. The studies completed thus far would support the hypothesis that: firms located adjacent to limited-access roads enjoy greater advertising benefits.

The results of the Massachusetts Route 128 study are interesting when compared to these pilot results. In Massachusetts, only a few firms anticipated the advertising benefits realized from locations adjacent to Route 128 (6, p. 38). This is in agreement with the pilot finding concerning firms in Michigan. Beyond this point, the similarity ends. The Massachusetts firms report a distinct advertising advantage while the Michigan firms do not. The reasons for this inconsistency raise some interesting research questions. Is this once again a basic difference between modern limited-access roads and older free access facilities? Do the firms adjacent to such modern facilities in fact experience such benefits or does the mass of promotional literature instill the representatives of such firms with a belief concerning such benefits. It is important to note that the majority of firms studied in Michigan didn't feel locational advertising was a benefit even after it was called to their attention. The reason given was "they served an industrial market," which leaves the question—do they really know or do they just "feel" that they receive no benefit? The modern use of roadside advertising of the sign and billboard variety would indicate that these firms do receive some type of benefit.

The fact remains that little reliable information is available concerning the advertising benefits received by firms with abutting locations. The problem of measuring advertising effectiveness is not new nor by any extent of imagination solved for advertising in general. One thing is apparent thus far—firms reporting advantages or no advantages do not have a reliable method of measuring the advertising impact; so consequently, they must generalize. It would be entirely too idealistic to simply say a measuring technique should be developed. On the other hand, the highway researcher interested in this problem can gain from the marketing and advertising research people. If substantial insights are to be accomplished, it appears the obvious place to turn is to the consumer who is supposedly influenced by such advertising, rather than to the executive for this opinion. In other words, here is one side of the picture; the challenge is now to verify these opinions.

Public Relations

Exactly what constitutes public relations benefits is somewhat nebulous. This pilot study indicates that public relations was not a locational factor for the six firms studied.

The other studies noted indicate that other firms have achieved some benefits by virtue of locations adjacent to modern facilities. Public relations as considered in the pilot study referred to something more than unrestricted access by employees. It was intended to represent a part of the corporate image as conceived by the firm's public in total and prospective employees individually. As such, segmenting the contributions of a specific location to the total community image developed may not be practical, given the costs of modern research methods, and possibly it may not be researchable. No specific suggestions regarding additional inquiry can be made from the results of the pilot study. With the benefits of hindsight, the separation of advertising and public relations from a locational viewpoint appears to be a mute question.

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Appendix

EMPIRICAL METHODOLOGY

There are at least two methods of obtaining information. The first, and possibly the least difficult method, is to review and interpret all available locational case studies. Although convenient, the shortcomings of this first alternative are many. Use of prepared materials limits observations to available case studies, avails only reported information, and requires interpretation and adaptation of materials to the task at hand. In light of these noted shortcomings, this first alternative was determined as inadequate for the purposes of this study.

The second method of obtaining desirable information was to conduct field studies. The primary advantage of this method stems from control over cases studied and materials analyzed. This empirical approach was determined as the best method of obtaining information consistent with the objectives of this study.

Geographical Study Area

The geographical area selected for consideration was the State of Michigan. Michigan was selected for two reasons: (1) close proximity to industrial firms, and (2) close proximity to necessary supporting information.

The nature of the problem under consideration is relatively independent of location advantages offered by any region, state, or community. The point is emphasized that this is not a study to measure the desirability of locating a plant in Michigan. The factors under consideration are immaterial to political boundaries.

Number of Firms Studied

A sample size of six firms was selected for analysis. Analysis of six locational procedures was arbitrarily determined sufficient for the primary objective of this pilot study. A limit was placed at six firms in order to use interviews rather than questionnaires in obtaining desired information. No attempt was made to obtain a statistically representative sample of industrial firms located in Michigan. No attempt is made to generalize universal conclusions concerning highway conclusions. Rather, this study is intended to give some indication of the relative value placed on highway influences by these six firms and to suggest topics worthy of additional inquiry.

Selection of Firms

Selection of the six industrial firms to study was made with the cooperation of the Michigan Economic Development Department. No restrictions concerning type of industry, location of industry, or prior location of industry were considered in the selection. Each of the firms selected had to meet the following requirements.

1. All shall have located subsequent to 1950.
2. All shall have selected sites distinct from the land on which prior facilities were located.
3. Each of the firms selected shall have different ownership.

Through the assistance of one of the Michigan Economic Development Department's industrial agents, a list of twelve potential study prospects was obtained. Selection was based on examination of firm files and on the judgment of the industrial agent. Only those firms with a past record of cooperation in research projects were selected. Special attempt was made to select firms of various sizes. Because of the consideration applied in selection of these potential firms, a list of twelve were determined satisfactory to obtain an acceptance rate of six firms for analysis.

From this list of twelve firms, the six most desirable firms were arbitrarily selected as prospects. Selection of prospects was made in a manner which presents an array of different size firms.

Classification of Sample

The six firms selected for analysis were classified into three groups for analytical purposes. The basis of classification was number of plants operated by each of the firms. Number of plants operated was selected in order to provide some insight into the frequency of locational problems confronted by the various firms. The limits of each group are as follows:

- Category 1—Large-size firms—7 or more plants
- Category 2—Medium-size firms—4 to 6 plants
- Category 3—Small-size firms—1 to 3 plants

Each of the categories in the study contained two firms.

Method of Contact

Each of the six firms was sent a letter of introduction. The purpose of this letter was to provide information concerning the objective of the study and to solicit each firm's cooperation.

Five days after the letter had been mailed, each firm was contacted by phone to obtain their participation decision. At this time, additional information was provided as requested by the firm. Each of the firms consented to cooperate.

Interview Procedure

A personal interview was selected as a method of obtaining desired information. This decision was made primarily because the type of questions under consideration did not readily lend specific question structuring. Additional advantages of using the interviews are that the interviewer can obtain "feel" of the firm, all information can be classified on the spot, and perhaps more complete information can be obtained.

The objective of each interview was to encourage the person interviewed to express himself freely concerning general topics suggested by the interviewer. Extreme caution was exercised not to direct the interview by revealing any information aspects of the problem under consideration. Although complete conversational atmosphere was desired, some structuring of the interview was necessary to insure comparative interview results.

The actual interview used was structured on a stimulus response pattern. Each person interviewed was asked two general questions to guide the conversation. The first question stimulated the discussion concerning plant location procedure. As noted previously, the results concerning this first question were reported in an earlier study. The second question was directed at ascertaining the locational influence contributed to highway benefits. Each question was prefaced with a brief introduction to the reasons why the subject matter was being considered. Additional questions were asked if necessary to direct the progress of the interview. In all cases, these questions were structured as a request for clarification. With the help of these additional questions, all interviews remained channeled on the subject under consideration.

As a means of ascertaining the consideration given to advertising and public relations benefits, two direct questions were asked during the interviews. During the general discussion concerning highway influence, no mention was made of an advertising or public relations benefit. Until directly asked the two specific questions, the person interviewed was not aware of the interviewer's interest in these factors. In evaluating all observations and conclusions regarding advertising and public relations benefits, the reader's attention is prematurely directed to the fact that only two firms studied, sell to a consumer's market.

The highway portion of the interview followed this pattern:

1. Second general lead question preceded by a general discussion of the reason why the subject matter was being considered—in selection of the site what relevance did you place in locating in close proximity to a major highway?

2. Direction questions as needed.

3. Specific questions:

- a. Advertising—In selecting your site did you consider that potential advertising might result from location on a major highway?

- b. Public Relations—In selecting your site did you consider potential public relations that can result from a location adjacent to a major highway?