

Highways as a Factor in Industrial Location

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•THIS PAPER is based on some of the more significant findings of a two-year research project conducted by the Department of Research and Transport Economics of the American Trucking Associations as a project of the ATA Foundation which is the informational and educational arm for supplier cooperation with the trucking industry. The study was sponsored by one of the foundation members, the Rockwell-Standard Corp. of Pittsburgh, Pa. Research and writing of the report was handled by James F. McCarthy, a consultant in ATA's Research Department.

The study was conducted in three phases. The first step turned to the immediate past for a review of findings on population movement, redistribution of industry, latest industrial technological trends requiring greater flexibility in the movement of employees and goods, and other related matters. Secondly, the study conducted field trips in representative states for an on-the-spot observation of today's industrial development process in action. Thirdly, the study conducted a questionnaire survey of manufacturing plants, distribution centers, and research and development facilities to determine, among other things, the type of establishments moving, where they were locating, and the role of modern highways in determining their location. This paper covers certain results of the questionnaire survey, the statistical heart of the study.

All 50 states now have departments charged with promoting industrial development. All are quick to report new industry locating within their borders, plants expanding, etc. From such reports a list of about 5,200 establishments was developed, including a wide cross-section of manufacturing, wholesale and warehousing establishments functioning as distribution centers and a number of research and development firms.

Each of the firms had made one or more of the following moves during the period from mid-1955 through the end of 1959: (a) begun business for the first time, (b) opened a new branch plant, (c) moved to a new location, and (d) expanded an old location. The period from mid-1955 through the end of December 1959 was selected so that the moves would be relatively recent, yet far enough in the recent past to enable plant managers to evaluate operations in the new location.

Of the potential mailing list of approximately 5,200 establishments, 1,050 questionnaires were found to be undeliverable, either because of insufficient address (as was the case with 686 questionnaires) or because the establishments had gone out of business (as was the case with 364 or 7 percent). There remained a survey universe of 4,150 establishments. A first mailing and a single follow-up to nonrespondents produced a combined response of 1,498 questionnaires, or slightly over 36 percent—an extremely good response rate for surveys of this type. Among the 1,498 returned questionnaires, about nine percent were judged to be nonresponsive for purposes of tabulation within the framework of the survey. There remained 1,363 replies on which survey findings were based.

Key questions in the survey contained a list of 13 factors commonly considered in plant location decisions. These were availability of suitable land, proximity to markets, availability of raw materials, abundant water supply, proximity to good highways, availability of rail service, proximity of related industry, abundant labor supply, favorable tax structure (state or local), existence of building at site, favorable leasing or financing, nearby vocational training facilities, and community's cultural-recrea-

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tional assets. Each recipient was asked to select the five most important of these factors in the selection of the site for the plant to which the particular questionnaire had been directed.

Another question asked the establishment's employment and nearly all respondents answered it, enabling results to be weighted in terms of employment. The questionnaire also asked the location of the establishment, whether in the city, the suburbs or a small town or rural area. A second location question, directed to establishments having moved, asked whether the former location had been in the city, suburbs, small town or rural area.

Four specific transportation questions were included. One asked the percentage of inbound and outbound freight moving by truck. A second question, relative only to truck freight, asked for percentages, both inbound and outbound, moving by private truck and by for-hire carriage. Often more than five factors are vitally important in plant location decisions. Thus, for those respondents not checking "proximity to good highways" among the 13 factors, a question was included to determine whether the highway factor was, nevertheless, critical in the plant location decision. A fourth transportation question asked if the plant had a rail siding and those plants which had moved were asked whether the former location had a rail siding.

Three areas of the questionnaire invited essay-type answers. Respondents could elaborate on the plant location factors generally, on the highway factor, in particular, and on factors to which they would give additional emphasis in future plant location decisions.

Replies were coded according to the Federal Government's Standard Industrial Classification (SIC). In all, 44 major SIC groups were represented, 22 of these with from 20 to 167 respondents each. All but 60 of the respondents fell within these 22 major SIC groups and separate analyses were made of each of these groups. The remaining 60 fell within the 22 other SIC groups and were lumped together to form a miscellaneous category.

Before examining survey results, we should look quickly at some of the SIC groups represented most heavily in the survey response. The chemical and allied products group, for example, was represented by 167 respondents, the fabricated metal products group by 133, machinery (except electrical) by 113, food and kindred products by 104, electrical machinery by 96, stone-clay-glass products by 76, apparel by 66, transportation equipment by 65, and paper and allied products by 57. Other representation included the wholesale trade group by 55, textile mill products by 50, primary metal industry by 49, furniture by 42, lumber and wood products (except furniture) by 35, rubber and miscellaneous plastics products by 33, warehousing by 27, printing and publishing by 27, athletic equipment, jewelry, etc., by 20, and professional, scientific and controlling instruments, leather, research and development and petroleum refining by 20 each.

Survey findings indicate that on the question involving the 13 plant location factors, those mentioned most frequently were, in this order, proximity to good highways, abundant labor supply, availability of suitable land, and proximity to markets. Of course, mention of the highway proximity factor involved many considerations. On the basis of essay-type replies, respondents mentioning the highway factor had in mind transportation of goods, of employees and of customers in addition to the advertising value of highway exposure. Nevertheless, the importance attached to the highway factor reveals a very significant trend in present-day plant location.

What comes quickly to mind from this particular survey result is the relationship between the four plant location factors found dominant in the survey and the findings now coming from highway impact studies and other research showing the growing importance of highways as industrial development magnets, the rise of the market factor in plant location, and the growing need for larger parcels of land to accommodate the new beauty and functional design concepts of modern plant construction.

Other plant location factors are important, of course. Depending on the type of establishment, at least six other location factors—rail service, raw materials, favorable state and local tax structure, favorable leasing financing, abundant water supply, and proximity of related industry—show up well, but their importance varies sharply

from industry to industry, whereas the importance of the top four—highways, labor, land, and markets—remains consistent throughout most of the broad band of industry represented in the survey response.

The ranking of plant location factors in each industrial group is covered in detail in the complete survey report, but few examples should be considered here. The highway factor was first or tied for first in 11 of the 22 SIC groups. It was first in furniture, printing and publishing, chemicals, petroleum refining and related industry, fabricated metal products, machinery, miscellaneous manufacturing and wholesale trade. It was tied for first with the labor factor in the rubber and transportation equipment groups, and with the land factor in the research and development group. The highway factor was ranked second by the food, textile, apparel, leather, stone-clay-glass, electrical equipment and warehousing groups. The labor factor, second in the national survey, was first in the textile, apparel, wood and lumber products, leather and electrical machinery groups. The land factor, third in the national survey, was first in primary metals and warehousing. It falls no lower than sixth and this is only in one instance—the stone-clay-glass group. The market factor, fourth in the national ranking, was first in the food and stone-clay-glass groups, second in wholesale, third in chemicals, petroleum, rubber, fabricated metal products, transportation equipment, scientific instruments, miscellaneous manufacturing and warehousing. Its lowest rank was seventh and this in only two groups, apparel and research and development.

Some plant location factors vary sharply in importance from one industry to another. On a frequency-of-mention basis, among all respondents, the factor "availability of rail service" ranked fifth in the national survey. But the rail factor ranged in importance from first to eleventh place. "Availability of raw materials" is another example of a plant location factor varying widely in importance from industry to industry. Ranked sixth in the national survey, the raw material factor ranged from a tie for first place with the rail factor in the lumber and wood products group to thirteenth place in the research and development group. As the size of establishments increases, measured by employment, the plant location factors of land, labor, rail, water, and proximity to related industry assume greater importance.

Further analysis of survey results show certain industries to be more heavily transportation oriented in their plant location decisions. These are industries in which both the highway and rail factor were given heavy emphasis, e. g., printing and publishing, wholesale trade, fabricated metal products, furniture, stone-clay-glass, and warehousing.

Where are today's plants being built? Survey results reflected a pronounced outward movement of industry. More than 48 percent of survey respondents reported present locations in small towns or rural areas. More than 24 percent were in cities; more than 26 percent reported locations in suburbs. Eighteen of the 22 industrial groups reported more plants in small town or rural locations than in either suburbs or city. The only exceptions were in the heavily market-oriented printing and publishing, warehousing, food, and wholesale groups. Dramatic evidence of this outward movement was found in miscellaneous manufacturing, electrical equipment, machinery, rubber, fabricated metal products, research and development, furniture, and transportation equipment.

The full study, in both its tables and text, shows how respondents in each industry group are distributed in city, suburban, or small town or rural area location. The degree of concentration in small town or rural area, for example, ranges from 75 percent in the leather and leather products group to 22 percent in the wholesale trade group. Among those reporting suburban locations, the concentration ranges from 44 percent in the case of the wholesale trade group to 8 percent of the textile mill respondents. The heaviest concentration in city locations was reported by the printing and publishing group (42 percent). The lowest, 15 percent, was reported by the leather group.

Although all industries covered can be assumed to have undergone some type of building program from mid-1955 through the end of 1959, they were asked specifically whether they had moved from another location. About half said they had. The 611 who

had moved reported both their present and former location. From these replies comes further evidence of the outward movement of industry. Here we are dealing with any one of nine possible directional moves: from city to city, city to suburbs, city to small town or rural area, suburbs to city, suburbs to suburbs, etc.

In the survey, however, three of these directional moves accounted for about 70 percent of the total movement. Approximately 22 percent moved from one city location to another. About $23\frac{1}{2}$ percent moved from city to suburbs, and about 23 percent moved from city to small town or rural area. In short, firms reporting new locations in suburbs and in small towns or rural areas tended to come from the city. Moves in the reverse direction accounted for very little of the total. Most of the firms that did report new city locations came from other city locations, very few came from suburbs or small towns.

As expected, some of the industry groups reported more movement than others. Thus, because of the questionnaire's large response, the study was able to pinpoint certain more mobile industries—or at least industries in which plant location decisions are being made more frequently. Examples are printing and publishing, electrical machinery, machinery, fabricated metal products, miscellaneous manufacturing, warehousing, wholesale trade, scientific instruments, furniture, food and kindred products.

An interesting example of the type of detail the study presents on the movement patterns within specific industries is found in these findings on the textile mill products group: among all respondents, textile mill products ranked third on the list arranged by degree of concentration in cities. About 40 percent of these firms reported city locations, 52 percent small town or rural area locations, and only about 8 percent reported suburban locations. Almost half of the textile mill products group reported moving; among these, 71 percent reported new locations in small towns or rural areas. In short, this is one industry of traditional city concentration now moving to the small towns or rural areas.

This type of analysis shows cities losing fabricated metal products and electrical equipment plants to both suburbs and small towns and rural areas; the suburbs gaining chemical and rubber plants from the city and, to some extent, from small towns and rural areas, and the city registering gains in printing and publishing, paper and allied products, and the lumber and wood products group.

The trucking industry is, of course, particularly interested in survey findings on patterns of freight movement. To make full use of raw survey data in this area, frequency-distribution grids were constructed to show the percentage of inbound and outbound freight moving by truck. This was done not only for the response group as a whole but for each of 22 major SIC groups. Because the plants were picked at random and not from the point of view of anticipated truck use, we feel the findings on truck freight movements are powerful new indicators of just how extensive truck use is among hundreds of plants of sufficient variety to reflect freight movement patterns for a vast segment of American industry.

Some of the more significant findings from data supplied by the 1,315 respondents reporting percentages of inbound and outbound freight moving by truck are as follows: 872 plants—67 percent of the response group—shipped 90 percent or more of all outbound freight by truck; 766 plants—58 percent of the response group—received 90 percent or more of all inbound freight by truck; and 613 plants—almost half of the response group—reported receiving and shipping 90 percent of all freight, inbound and outbound, by truck.

As mentioned earlier, most findings could be weighted in terms of employment. This was true of reports on the percentages of inbound and outbound freight moving by truck. Even when this more conservative standard is used—attaching more importance to the larger establishments—results for the entire survey were as follows: 59 percent of all inbound freight was received by truck and 67 percent of all outbound freight was shipped by truck—more, in each instance, than all other transport forms combined.

Important as truck-use patterns were in this study, the rail factor was not overlooked. As mentioned previously, "availability of rail service" ranked fifth among the 13 factors on a frequency-of-mention basis and fourth when survey results were weighted for employment.

The questionnaire also asked recipients whether or not their present plant had a rail siding, and those who had moved from another location were asked whether the former location had a rail siding. About half of the survey respondents reported having rail sidings. Generally, when plants moved, they retained their same position relative to a rail siding. Those not having rail sidings at their former locations tended to select similar non-rail siding locations. Those with rail sidings tended to pick a rail siding when they moved.

It was found that slightly more moved from a non-rail siding to a rail siding than made the reverse move. At first, this might seem a little puzzling—but we believe it can be explained. Provision of a rail siding at a new plant location is only a small part of the total cost. It might just as well be provided. Also, many industrial locations have been available in proximity to rail lines on rail property which may be a residue of land owned by the railroads as a result of the land-grant days. These properties had perhaps nominal value when only the railroad was nearby, but with the construction of a new highway in the vicinity the property took on added value—it became a prime plant site, with the rail siding almost being part of the package. In fact, there have been many railroad-sponsored industrial development ads emphasizing that a proposed site had the double advantage of both railroads and good highways; pictures in the ads often show both means of transportation.

Specifically, the rail siding findings for those reporting having moved were as follows: from one non-rail siding site to another non-rail siding site, 45.6 percent; from a rail siding to a rail siding, 23.4 percent; from a non-rail siding to a rail siding, 17.0 percent; and from a rail siding to a non-rail siding site, 14.0 percent. But the fact that a plant has a rail siding does not mean today that it is using it heavily or at all. This was amply demonstrated by survey findings. For example, about one-fourth of the plants with rail sidings reported 90 percent or more of both inbound and outbound freight moving by truck.

A summary report of study findings and the complete study report on "Highways, Trucks and New Industry," published in book form, are available from the American Trucking Associations.