An Investigation of Some Economic Effects of Two Kentucky Bypasses: The Methodology

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● HIGHWAY BYPASS studies are of recent origin, most of them being undertaken as a result of the vastly expanded highway modernization program and of the interest of Congress in an equitable means of financing this program. Bypass facilities may yield benefits to groups other than motor vehicle users. By reducing travel time to various points in the area where they are located and to other areas, these facilities are often credited with value increases on nearby land. By attracting a large stream of through and sometimes local traffic, the bypass can create excellent business opportunities in the general vicinity of the highway.

The Bureau of Business Research, University of Kentucky, has recently completed a study of two Kentucky bypasses: the Northern Belt Line in Lexington and the Watterson Expressway in Louisville (1). The study afforded an opportunity of comparing two bypasses built at approximately the same time, the first of which provided free access; the second, limited access. (The type of access control appears to be an important factor in determining the nature of increments in land value due to the facility. If the effects of the belt line are compared with those of the limited-access Watterson Expressway in Louisville, the following is revealed: (a) the belt line was responsible for the conversion of relatively more land to a higher use than was the expressway; (b) the positive influence of the belt line has been largely confined to commercial and industrial property within ¼ mi of the facility; the expressway seems to have definitely augmented land values as far away as 2 or 3 mi; and (c) with respect to the highway-affected land which has had a similar type land-use history since the preconstruction period (1940-46), the expressway apparently has had a more positive effect.) It represented an effort primarily to determine the influence of these two facilities on land values and land use. Besides attempting to measure land use and land value changes, the researchers made a serious effort to discover why the changes occurred. Because the development of literature on approaches to such problems was limited, considerable attention was devoted to methodology.

It is appropriate in investigations of this kind to employ several different methods of attack in order to shed light on as many facets of the problem as practicable. Inasmuch as no technique without rather serious defects has yet been devised for determining precisely the effect of a new or improved highway on land values and land use, it is particularly appropriate to try every method which offers hope of even partial success. It is impossible to identify and quantify all the factors affecting values and use because the effects are the product of a multitude of simultaneously operating factors. Thus, the difficulty of imputing events precisely to the various causes is great.

The first task in conducting the study was to compile general background information concerning the urban area which the facilities bypassed. The general characteristics of a community and its economic activity, among other factors, can influence the type and magnitude of effects imparted by a new highway. Such information is helpful in predicting the probable extent and rapidity of residential growth, commercialization, and industrialization in the general vicinity of the new highway and the resultant changes in traffic patterns. It also helps to explain the particular influence of the highway on land value and land use which occurs.

The researchers realized early in the investigation that the economic impact of a new highway undoubtedly varies widely among highways and depends on numerous factors. Therefore, an awareness of the general circumstances and events relative to

the specific highway examined was important to the impact analysis. For instance, examination of dates and events pertaining to the Lexington bypass disclosed that the original plan was to control access to the facility. However, in order to avoid trouble promised by adamant property owners, including serious delay and much higher right-of-way costs, the Department of Highways dropped plans for the limited-access feature. The local planning and zoning commission attempted to require service roads as a condition of granting business or industrial zoning. This attempt was thwarted by the opposition of the county fiscal court (the county board of Fayette County) and the commission's lack of legal authority to enforce compliance. Some 80 commercial and industrial firms have thus far located adjacent to the bypass. The property of most of these firms abuts the highway right-of-way, and thus they have direct access to the facility.

It is clear that benefits received by property owners and businessmen have been gained to a considerable extent at the expense of the motorist. The lack of access control and the mingling of through and local traffic have contributed to an atrocious accident rate. The congestion has resulted in considerable diminution of benefits to users of the highway. Conditions on the bypass will almost certainly limit the effectiveness of the whole circumferential route—of which the bypass was the first section—even though access will be controlled on all other sections of the route.

Four major techniques were used to derive information on the land-value and land-use effects of the bypasses. They are the survery-control area comparison, multiple regression analysis, the case study method, and a new technique, the projected land use-value relationship approach. These approaches will each be discussed separately.

SURVEY-CONTROL AREA COMPARISON

The survey-control area comparison is a method of estimating the influence of the highway on the value of nearby land. (This is undoubtedly the most common technique used to isolate the influence of a highway on land values.) Ideally, the procedure would be as follows: An area near the facility is selected for study. A similar area is found which is far enough removed from the highway as to have been unaffected by it. In theory the two areas should have been exactly alike in all respects before the highway was built and any difference since that time should be attributable to the influence of the highway. The real estate sales data are obtained for the two areas for a period both before and after the highway was built. The change from the "before" period to the "after" period in the control area is compared with that for the survey (highway) area, and the effect of the highway is revealed. For example, if on the average, property values increase from $1,000 an acre in the "before" period to $2,000 in the "after" period in the control area and from $1,000 to $3,000 in the survey area, the result of the highway was to increase land values $1,000. The rationale is cast in terms of an ideal situation. Relative to actual practice it represents a goal which can never be reached but only approached. No two areas are alike in all respects, therefore, it is desirable to have more than one control area for each survey area. Unique variables are present in each area which result in varying amounts of change in real estate value.

The question of which characteristics or factors need to be approximately the same to insure a valid comparison is a difficult one. This is to a certain extent a matter of judgment. It also depends in part on the type of land use involved. Ordinarily, the predominant use near a contemplated bypass location is agricultural. There are certain factors which are of prime importance in determining the present and future value of such land and thus should be roughly equal in both the survey and control areas before the highway was built. These factors can perhaps be summarized by the expression "potential for development." Some of the most important factors which determine the potential for development are accessibility to the central business district, size of parcels, existence of a railroad or major highway nearby, presense or absence of blighting influence, and direction of urban growth. Any dissimilarity between the control area and the survey area after the highway is built should be due to the facility and not to other causes. For instance, if farm land in both the survey area and the

control area is converted to a higher use, land development cost should be approximately equal or, at least, should be known in order that account can be taken of differences between the two areas in this respect. In summary, the control area approach requires the acceptance of a control area which is sufficiently similar to the survey area in important economic and geographic aspects, or in which the differences can be quantitatively isolated, but which is negligibly affected by the highway being investigated.

The control area should be chosen with extreme care and only after a thorough examination of similarities and differences between the survey area and possible control areas. Even then, the results should be viewed only as approximations.

CASE STUDY METHOD

The nature of economic effects which may be sustained by an individual enterprise is not disclosed in generalizations concerning the over-all impact of the highway. The former, however, is relevant to an understanding of the total impact. The case approach deals with a rather detailed analysis of events and persons involved in transactions which concern selected parcels affected by the highway facility. (This approach appears to have been largely ignored by highway economics researchers. At least, it has generally not been set out explicitly. An exception is a study of industrial and commercial development along Route 128 near Boston (2).) An examination of selected cases with emphasis on their relationship to the highway is useful not only in providing information and background of an institutional nature, but also in indicating the variety and extent of significant relationships attributable to the highway.

Cases may be selected by various criteria. Suggestions from individuals with considerable interest in and knowledge of the local situation are important bases for selection. In some instances, it was suggested that the particular enterprise appeared to have sustained significant economic impact attributable to the highway. In other instances, location of a plant was of such general importance to the urban area that an inquiry into possible relationships between the bypass and the plant location seemed warranted.

A case study of the IBM electric typewriter plant location along the Lexington bypass revealed that (a) in all probability IBM would not have located in Lexington in the absense of this highway facility, (b) approximately 700 relatively high-income persons were transferred from its other plants to the Lexington location, and (c) several small industries located in Lexington primarily to serve IBM. The economic activity generated in Lexington by IBM, traced through its various ramifications, is quite substantial.

MULTIPLE REGRESSION ANALYSIS

Multiple regression analysis (3, 4) was used in instances in which appropriate control areas could not be found and in certain instances as a check on the results of the survey-control area method. The rationale of the multiple regression method applied to isolating the effect of a new highway on land values is as follows: changes in land values near a new highway result from many different factors, one of which, presumably, is the highway. Ideally, all factors which influence the value of land other than the absence or presence of the facility should be isolated and assigned constant values. Then the remaining effect is that of the highway. In practice, of course, it is not possible to take into account all relevant factors. A common procedure is to select those variables which a priori appear to have the most significant effect on land values, test them by partial correlation, and use the most significant ones.

Data for all variables to be used are collected for a period of years before and after highway construction. The dependent variable is land values. The independent variable of principal interest—the highway—presents great difficulty. In the regression analysis, the variable must be represented quantitatively, and yet it is essentially a qualitative characteristic. Unless a meaningful quantitative representation of the highway variable can be established, the regression analysis is of limited usefulness. One scheme is to represent the "before" period by zero and the "after" period by one.

This is sufficient to yield a correlation coefficient but it is generally not a satisfactory approximation of the amount of increase or decrease in land values attributable to a new highway. Much research will be required before any numerical representation can be used with confidence.

In the multiple regression procedure, logical interpretation of the results is extremely important. In the Louisville study, for example, this procedure was used for an area in which the land was converted from agricultural to residential use. A high coefficient of correlation was obtained, indicating that some 70 percent of the increase in land values which took place was attributable to the bypass. In this case, however, the result was misleading. The area was purchased for residential development considerably prior to the announcement that the particular facility would be built. The high correlation coefficient doubtless reflects this conversion of land to a higher use. Thus, the association of variables measured by correlation analysis is suggestive, but the importance causal relationships must be sought out by a logical examination of the associations. Otherwise, erroneous conclusions are likely.

PROJECTED LAND USE-VALUE RELATIONSHIP APPROACH

Constructing a new highway on unimproved land near a growing urban area may result in changes in the trend of land utilization for the area. For example, land which most probably would have been developed for residential purposes is used commercially instead. The new highway may also be responsible for an acceleration or deceleration in the conversion of land to the "destined" use. For example, land which probably would have become residential actually is converted to residential use but at an earlier or a later date than would otherwise have been the case.

These possible changes in land use due to the highway suggest a technique which involves an analysis of the use of land for the general urban area, with emphasis on land near the highway. The object of the technique is to project—that is, to estimate based on past trends and data—the actual use that would have been made of the land if the new highway had not been built. Such evidence as that from land-use inventories and master plans, population distribution, planning and zoning activities, building permits and construction, and geographical aspects aid in projecting these trends. (For example, prior to the construction of the bypass in Lexington, the local planning and zoning commission approved two residential subdivision plats near the proposed facility. In fact, one final subdivision plat shows the bypass as the major street of the subdivision. After the facility was built commercial and industrial zoning was allowed along the highway. As a result, today the two subdivisions accommodate a variety of commercial establishments but no residences.) A comparison of probable land use projected for the area presumably affected by the highway with an inventory of actual land use at the present time should indicate the influence of the facility. The researcher undoubtedly will be handicapped in most cases by the lack of sufficient data of the right type to do a thorough job of projecting land use trends. He must, of course, make the best of what information is available. In a community in which considerable land planning is done and in which appropriate records are well-kept, the researcher's task is easier.

After determining the probable effect of the facility on land use, an attempt can be made to establish land value relationships among varying types of use (among, for example, farm, residential, commercial, and industrial land). Application of the value relationships to highway-caused land use changes would provide general indications of the highway impact on land values.

Although some aspects of the approach are obviously somewhat subjective, (that is, personal judgement is involved) the results—particularly when examined in conjunction with those obtained by other approaches—may be quite useful. The approach emphasizes the rather direct but complex relationship between land use and land values. It poses the question: if the highway had not been built at all, what use of the land in the area would have been made? (The question of the effect on land use if the highway had been built at a different location in the community can likewise be explored by this technique.) The use to which land is put, of course, determines to a large extent the value of the land.

Some examples of what was found through this approach should illustrate its usefulness. The examples refer to the Lexington bypass.

This bypass probably contributed to the restriction of postwar residential growth under way in that section of the urban area where the highway was built. It retarded or rendered undesirable the conversion of unimproved land to residential use. Some land close to the highway which most likely would have been converted to residential use actually is being employed commercially or industrially. Farm land farther away, some of which undoubtedly would have been converted to residential use, remains in agriculture. However, the facility has resulted in a net increase in residential land required for the entire area. It was estimated that almost 1,000 additional families settled in Lexington which, in the absence of the bypass, would not now be living there. Thus, the facility contributed to a rapid acceleration of residential development in the other sections of the urban area.

In 1958, of the land with 1,000 ft of the bypass, 23 percent was employed commercially and industrially and 14 percent residentially. On the basis of land-use patterns through the late 1940's and projections for the future, it is probable that commercial and industrial use would have amounted to about 5 percent and residential use to about 25 percent in the absence of the highway.

The establishment of land value relationships revealed that the value of land in parcels of one million square feet and over (23 acres) changes relatively little even though it is in the process of conversion to residential use or to commercial use. This general result was consistent with the survey-control area finding of an increase in value of about 20 percent on nearby parcels of this size attributable to the highway.

An examination of unimproved land in the general area of the highway facility as well as of similar land located elsewhere beyond the "built-up" urban area—utilizing the land use-value relationship analysis—proved interesting. Such land in the 1940-46 period (before plans for the bypass were made public) had a value of about $600 per acre in the 100,000 sq ft to 1,000,000 sq ft range. This unimproved land had a typical market value of from $900 to $2,400 per acre if it was to be used for residential purposes, the price depending on the size of the parcel sold. Residential use seemed probable for much of such outlying land, including a large section of that along the bypass, most of which was platted for residential subdivision purposes. With the construction of the bypass, the area is now near a relatively high-traffic-volume highway. With business zoning, the land has a definite commercial potential. The market value of this land if converted to small commercial parcels, now becomes from three to five times more than it would have been had it been converted to residential lots. As the commercial area becomes established, the typical market value probably increases even more, the amount of increase depending on the specific type of commerical use.

The projected land use-value relationship approach is useful also in connection with the other methods of attack. The examination necessary for projecting land use is helpful in suggesting subjects for case studies and in providing information which aids in interpreting the results of such studies. The results of projecting land use serve as a check on the appropriateness of control areas selected. For instance, assume an area near the new highway is now in commercial use. Assume, further, that the projected land-use approach suggests that in the absence of the highway, the area would be primarily in agricultural use today. The control area should, therefore, be primarily in agricultural use at the present time. In fact, an area selected for control which was mostly in commercial use would be suspect.

This approach is helpful in multiple regression analysis. For example, a regression equation or a coefficient of correlation may indicate that the highway is responsible for about 60 percent of the increase in land values which occurred in a nearby area which was converted from agricultural to industrial land. If this conversion would have occurred regardless of the new highway, then the statistical result is misleading. The projected land-use technique sheds light on whether or not the conversion to industrial use would probably have occurred in the absence of the highway. That is, it aids in the interpretation of the statistical result in the particular case.

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