Reflections on Concepts for Impact Research

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The economic effects or impacts of highway improvements have received an increasing share of research in the area of transportation and location in recent years. Although substantial progress has been made toward identification and measurement of changes which follow highway additions, much remains to be done in explaining how and why these changes occur and who or what groups are affected and how. It is believed that the explanation of highway impacts and their incidence can be aided by taking a look at certain essentially conceptual questions which should be dealt with in the planning stage of nearly every highway economic impact study. This paper discusses and offers tentative answers to the following four questions which the authors have found troublesome: (1) What fundamentally is meant by impact, and how and why should impacts be traced? (2) Is there a valid and theoretically defensible distinction between redistributive effects and benefits? (3) How should the area of impact for highway economic studies be defined? (4) What constitutes an appropriate time span for inclusion in the study of economic impacts?

The main purpose of this paper is to show that the kinds of impact studies made should depend on the answers to these questions and that the studies which are suggested by the view adopted here may well prove to be more fruitful than those of the past.

ECONOMIC IMPACT of highway improvements consists of modifications or alterations of the structure of the economic system. Such modifications or alterations may take a number of forms and may be indirect as well as direct; they also vary as to timing and intensity. Some become immediately apparent and may be of either short- or long-run duration. Others become apparent only after a considerable length of time, but in the long run may be equally as significant for planning and policy decisions. Certainly, full assessment of the way in which highway improvements can or do modify the economic system depends on the explicit analysis of the characteristics of that system and its component parts.

There are inherent dangers in approaching highway economic impact research in a manner abstracted from the economic system unless careful attention is given to the general economic setting of the particular study.

For example, a recent handbook for highway impact research designed as a guide for systematic investigation includes the following statement:

The important effect that location has on land use can hardly be overemphasized. Utilization of land depends in an important way on the location of the land with respect to markets or to the use which is made of surrounding land. The importance of location on land use with respect to markets is illustrated by the fact that land areas of like productive capacity located at different distances from market may be put to different uses. Since the cost of transportation—a key factor in determining land use—ordinarily increases with distance, land sites near a market usually have a comparative advantage over sites farther away.
This, of course, is a capsule explanation of a general principle in location theory applied to a developing economy.

Inasmuch as transportation improvements or refinements are being studied in the context of a developed economy, it is necessary to examine the foregoing statement carefully to avoid being misled. Inferentially the authors of the quotation draw on agriculture as an example of location with respect to markets, further, the statement is so worded that the supporting illustration appears to draw on spatial-transportation relationships in a developing economy with a transportation system inadequate for settlement and economic development. In such a period the quality of transportation is a critical factor in determining the value of land for productive use and the distribution of economic activities, because the greater the imperfection of a transportation system, the more important is the effect "that location has on land use." Within a setting of this type, transportation improvements lead to significant changes in comparative advantage and thus may effect substantial redistributions of economic activity. Even here, however, transportation improvements work to destroy the relative importance of situs. (Situs is defined as position or situation in the sense of position within a network or system in a spatial context.)

Today highway improvements are effected in a developed economy which has an extensive transportation system and where improvements continue to whittle away at spatial imperfections and further reduce the value of situs. But one should no longer expect gargantuan dislocations because of improvements providing access to land of greater productive capability. The economy is no longer primarily agricultural. Transportation improvements seldom open rich and untapped farm land for productive use. In addition and more important, as the economy swings further from concentration of productive effort in agriculture the greater is the separation of firms from land. The farm firm is identical with land, but this is not the case with most nonagricultural firms—particularly in manufacturing. But, even in agriculture, adjustments are encumbered by institutions and modified by market imperfections that appear to have little to do with spatial relationships. Nonspatial relationships, moreover, seem to be of even greater importance in nonagricultural industries. Perhaps more research emphasis should be placed on the essentially nonspatial implications of the changes or modifications of the economic system resulting from highway developments. These are likely to be just as important in terms of programing and finance as the rearrangement of activity in space. Of course, it is recognized that both spatial and nonspatial effects of highways are interrelated.

The effects of highway additions on the efficiency of the economic system are not ignored by highway impact studies inasmuch as they have important implications for finance and programing. Furthermore, the influence of better roads on the efficiency of the economy as a whole is fundamental to the determination of benefits and disbenefits. If the effects on the efficiency and capacity of the economic system are accepted as important parts of economic impact of highways (as they are here), then the focus of some measurements of highway influence currently being made might profitably be altered, and additional variables be studied. This becomes clear when the way in which the highway system may contribute to economic efficiency is considered.

It is customary to speak of highway rebuilding and additions as "improvements." The word "improvements" is frequently interpreted in an engineering sense, but it also has economic meaning. From the point of view of the economic system, a highway addition would only be referred to as an "improvement" if it increased economic efficiency and/or capacity. The mechanisms through which efficiencies may result fall generally into three categories. (a) transportation efficiencies within a given distribution of economic activities, (b) efficiencies gained by changing the distribution of activities, or (c) a combination of (a) and (b).

Transportation Efficiencies with a Given Distribution of Economic Activity

Transportation efficiencies within a given distribution of economic activity involve operating economies caused by reduced transportation costs (including operating costs of vehicles, insurance of goods and vehicles, storage in transit, maintenance, etc.).
Such economies free resources for further productive use and can be regarded as raising either the effective resource base or real income even though frictional or technological unemployment of resources may result.

**Efficiencies as a Result of Redistribution of Economic Activity**

Efficiencies resulting from the rearrangement of economic activity may be much more involved than creation of efficiencies within a given distribution of activities. New and better roads may change the distribution of comparative advantage. The response may take the form of a shift in business location, change in market size or structure, or concentration or dispersion of economic function by location or by firm.

Analysis of the mechanism by which activity distribution is reorganized necessitates consideration of transportation and land as site within a theoretical framework. Basically land and transportation can be considered as subject to derived or secondary demands, because both are productive factors employed in the creation of time and place utilities. The time and place pressure of primary demands for possession of a product are reflected in the derived demands for transportation and land resources utilized in the production and distribution of that product.

However, this tie between the derived demands for land and transportation complicates analysis because results or effects of transportation improvements often appear to be causal. In talking of increases in the supply of land resulting from transportation improvements, Wendt recently stated: "In some sense, it can even be argued that increases in demand appear to bring about the increases in supply, rather than to follow." (2) It probably can be argued that increases in demand appear to bring about increases in supply in every sense.

Clarification of this point requires examination of some of the determinants of the physical supply of land. There is a limited number of sites which offers a particular "time-place" value to economic activity; the less stringent the "time-place" requirements are, the more sites there will be which more or less meet those requirements. Transportation is in a degree a substitute for "time-place" attributes of land because these attributes can be provided by movement, if it is economically feasible. Transportation improvements, to the extent that they facilitate movement and decrease its cost, work in general to reduce the urgency of the "time-place" situs requirement of land.

The type of transportation improvement effected by derived demands will modify land use by reducing unit transportation cost and/or increasing the ubiquity of transportation inputs of given quality. If the transportation improvement created as a response to derived demand increases economic capacity, it may increase the aggregate value of land. If it does not increase economic capacity, it does not increase aggregate land value. Rather, it only varies the form and distribution of land use and hence the distribution of land values. This does not suggest that aggregate land values cannot rise after transportation improvements are effected; they can. However, the rise is ascribable to the same pressures which led to the creation of the transportation improvement. In the absence of growth pressure, improved transportation can be expected to decrease aggregate land values.

The conclusion which follows logically from the relation of land and transportation as factors of production influenced by derived demands is that, because they are both complements and substitutes in production and distribution, a response to derived demand for better transportation necessarily involves a corollary response in land use. Obviously then, the isolation of the effects of a new or improved highway on the basis of quantified changes in only land use and value is tenuous.

Changes in economic form are of equal importance because efficiencies of an organizational nature are possible, and dislocations of an economic nature which raise questions in light of other overt policies are to be expected. To assess such changes one needs to know the form of the change, who is involved, and what modifications in economic organization and structure result. It is necessary to relate changes to characteristics of firm and activity organization and operation because economies effected may be due to altered scale of operation and firm integration.
Economies of scale and related economies may result from gaining control of specific land assets enhanced by changes in comparative advantage. But, for productive activities, advantages may be spread over a large area and not concentrated in a few sites. Economies of scale stemming from land assets enhanced by changes in comparative advantage are most likely to be found in activities for which there is a close tie between access to a new facility and access to a market or markets. These firms, in general, would be retail outlets whose market comes to them. Such firms must be readily accessible from a facility. The range of choice which is offered a retail market, of course, is extremely wide, and the relevant range is determined by such factors as knowledge of alternatives and the importance of relative convenience of alternatives. Highway service businesses are most sensitive to changes in market location resulting from highway relocations because convenience ranks very high for motorists and inflicts a self-imposed restriction on the range of alternatives. Equally important, knowledge of the availability of service alternatives is greatly affected by what motorists can see on or from the facility.

A substantial shift of traffic to a new facility from several existing roads or streets may concentrate traffic volume and enable a highway service business to acquire economies of scale which otherwise would not be possible. If, for example, the new facility is a bypass, expressway, or interstate highway, it may lead to separation of the market for highway services by separating traffic by length of trip, origin and destination of vehicles, and trip purpose. Efficiencies of the economic system as a whole may be gained to the extent that such service businesses are able to specialize in separate segments of the highway service business and thereby gain operating efficiencies. A great many more examples of a specific hypothetical nature could be listed such as the following: (a) chain restaurants can benefit from large-scale purchase of provisions, (b) multiple-unit operations can purchase standardized fixtures at lower unit cost, and (c) franchise chains may be able to secure capital easily and at favorable rates of interest. The point emphasized here is that possible economies of an organizational nature may be facilitated by spatial redistribution, and their identification requires more than the measurement of changes in landed assets because such efficiencies accrue to a firm.

In other cases retail firms may benefit from market shifts as a result of highway improvements which have nothing to do with access to a particular site. An example is the change in the structure or organization of markets due to secondary road improvement in rural areas. Here, road improvements can lead to concentration of retail activity in the larger rural centers; and, potentially, this could entail the replacement of locally owned and operated establishments by chain outlets—particularly grocery stores.

Plants which serve a geographically extensive market usually do not require a site on a particular traffic stream (aside from the advertising or public relations aspect of such locations). Access to markets and to sources of supply even in such cases are important, but specific site value is a function of general transportation efficiency rather than of access to a particular highway facility.

The larger the market served by a firm, the more latitude it has in choice of location; the more efficient and universal the transportation system, the less important is position within the system and the spatial market structure. (Market in the singular is, naturally, a little misleading. One speaks of a nationwide market, but even this has concentrations and differentiated characteristics. A firm serving a "large market" serves in truth a number of markets.) As the transportation system continues to be expanded and refined, the less important is "location"; and, as the economic system continues to industrialize, the greater will be the separation between the producing firm and land. (In this context it should be noted that as the economy continues to mature, a larger and larger portion of national income takes the form of services. Thus, services are important and will continue to grow in importance, and there are, as mentioned, distinct differences in location criteria between firms producing services and those producing goods.) This may lead to the dispersion of activities that are now concentrated because of transportation advantages or it may mean concentration of dispersed activities or both. Presumably such changes are motivated by the desire of
firms to achieve operating economies, but they are not necessarily synonymous with over-all economic efficiency. Such changes should be viewed as increasing the efficiency of firms, but also should be considered from the viewpoint of institutional arrangements. What effect do changes, if any, in institutional arrangements have on the mobility of productive factors, cyclical stability, price leadership, bargaining power, and other facets of the organization of activity which contribute to economic efficiency, capacity, and stability.

Hence, increased emphasis on the qualitative aspects of change is suggested. These are important and valid distinctions between firm and land, individual and group, and political units and economic area. Highway economic impact research could well focus more attention on the changing relationships among firm, industry, and economic region and among markets for products and services.

REDISTRIBUTIVE EFFECTS AND BENEFITS

The impact of improvements in and additions to highway facilities are not neutral in their effects on people, and it is only natural that one important aspect of highway impact studies has been the attempted isolations of gains and losses, benefits and disbenefits. Many of the highway bypass studies have had the expressed objective of providing factual data which could be used by highway officials in answering questions of what benefit or harm will be done to a bypassed community; because, in attempting to remove through traffic from the business areas of small communities, state highway departments have run into opposition from merchants and other special interest groups objecting to the construction of bypass routes. A common question asked in these studies is whether or not the advantages of a bypass to the community as a whole outweigh possible losses to business.

Studies of this nature most often have been comparative "before construction" and "after construction" studies of land values and use, business receipts, and industrial development; and they have shown that numerous changes have followed highway improvements or additions. In general, however, they have been less successful in determining the nature and incidence of benefit or disbenefit than they have been in determining the magnitude of change in the variables studied. It is believed that this is the result of concentrating effort mainly on statistical methods of determining the magnitude of change with insufficient development of hypotheses for assessing the relation of change to benefit.

The successful relation of change to benefit depends first on the development of a clear concept of what is meant by benefit. Benefit can be defined in a number of ways depending on the point of view, as well as the point of reference in time and space. Disagreement on what is to be regarded as benefit and in what context, can lead to no small amount of confusion. One dimension of this confusion is illustrated in studies which focus on whether or not the advantages of a bypass to the community as a whole outweigh possible losses to local business. Implicitly a restricted definition of benefit seems to be adopted. It is restricted in at least three ways. (1) The criteria of judgment are largely short run (frequently 5 yr or less). (2) Data availability often restricts the area considered to unrealistic boundaries (at least in a market area sense). (3) Certain important factors whose assessment seems essential in the consideration of net benefits are missing. A limited concept of benefit is entirely reasonable provided the concept is clearly spelled out and logically follows from the research objectives. Otherwise, confusion, inconclusive research results, and frustration of sponsoring agencies are probable.

It might even be argued that bypass studies, as well as other studies of the impact of particular road sections, are not fundamentally concerned with benefit but are focused on the equally important subject of economic dislocation. Their primary aim is to collect and evaluate evidence about the nature of economic dislocation (reduced business receipts, historically) and to assess its severity. These studies are valid and useful in aiding adjustment to changes which have occurred or are likely to occur. They may also have important implications for programming and design, but they are subject to misinterpretation. In the extreme case, they have been viewed as a basis
for bypass justification. Can a bypass or any other particular road section financed by the public be justified on the basis of what it does or does not do to land values and business receipts in a bypassed community? (For that matter, are increased land values and/or business receipts necessarily valid indicators of benefit for the "community"?) The answer is no, unless such effects are weighed against the designed effects of the bypass and other corollary effects elsewhere. Changes in business receipts associated with the opening of a bypass can be either positive or negative as far as the community is concerned and yet not figure in aggregate social cost or benefit at all. The same can be said of land value and land-use changes. Justification of a bypass or any other improvement calls for full assessment of social benefit as opposed to social cost—in the sense developed by the Federal Inter-Agency River Basin Committee (3).

The difficulty of accurately assessing the primary, secondary and associated costs and benefits of a public improvement is well known. Nevertheless, progress toward application of cost-benefit relationships to highway economic impact research might be facilitated by distinguishing between net and relative benefits. The effects of highway improvements which increase the economic efficiency and/or the economic capacity of the system as a whole should be considered net benefits. Effects which are the redistribution of economic activity or economic values from one place to another are, until proved otherwise, only relative benefits. Because some balance of gain and loss is involved in relative gains, changes in form, redistribution of activity and of economic values, such variations may well be thought of as the redistributive effects of highway improvement. Of course, redistributive effects may result in increased efficiency or capacity. Nevertheless, the term benefit is best left to mean net benefits derived from these and other changes.

Pertinence of Net Benefits

Net benefits have major pertinence for programing and finance, and determination of net benefits seems essential to development of an equitable system for financing highway programs and for weighing the value of program alternatives. The mechanism by which net benefits come about as a result of a road improvement has already been discussed.

Research aimed at providing factual information for programing and finance is faced with the responsibility of determining the magnitude and particularly the incidence of benefits effected by changes in economic capacity and/or efficiency. In either case there may be efficiencies in the form of reduced operating costs for firms which directly bear costs of transportation (even though these costs can be and are passed on). If economic activity is redistributed, other efficiencies may be created by changing the patterns of control over assets. Such changes, for example, could lead to economies of scale or the reverse. But efficiencies or diseconomies of either type do not accrue at this time wholly to land but substantially to firms and thus will, in general, not be adequately reflected in land values—even though new sites used by affected firms may increase in value.

If cost reductions are passed on in the form of lower prices or increased wages, the gain in efficiency may benefit a large segment of the economy and lose its identity for purposes of specific taxation. To the extent that this happens, there appears to be every justification for using general fund money to finance highway improvements. This conclusion can be viewed as of general value at any political level. This view is mentioned by Garrison in a section of his recent book (4) when he states:

It should, however, be recognized that many "nonuser" benefits are already subject to general taxation at various political levels.
As an example, Garrison (4, pp. 20-21) says: "A miniature example will serve to illustrate the phenomenon of transferred benefits. A road is improved from the city into a suburban area and costs of driving from residential sites in the suburban area to the city and back are markedly reduced. These are vehicular benefits and results from demand for better transportation. In real cases, benefits are not generally captured by tolls on the facility set at rates which exactly capture the savings of each user; rather, the lower cost of vehicular transit is reflected in inflated property values in the area served by the highways." In Garrison's microcosm transferred benefits are already subject to general taxation, and any possible real estate depreciation elsewhere disguised or undisguised also is included in tax policy. The degree to which this is accurately measured will depend upon reliable appraisal for assessment. To be specific an owner selling an appreciated property is subject to a capital gains tax, which is a source of general fund revenue. Property owners will pay increased property taxes which are also sources of general fund revenue. Owners elsewhere will receive obvious tax breaks for depreciated property through capital losses or reduced assessments if the loss is identifiable; if secular growth disguises the loss, it also disguises the tax break.

If such gains in efficiency are not passed on in higher prices, there are fiscal implications. (1) In the case of user operating gains, it would be logical to tax the user efficiencies for highway construction. Note that this suggests a broader concept of user taxation based on user gain as well as incremental cost. (2) In the case of operating cost reductions due to economies of scale, which are not directly tied to a reduction in transportation costs but result from realignment of the market structure, it would appear that net nonuser benefits could be touched only through a special profits tax, which would be highly selective and very possibly discriminatory.

Redistributive Effects and Economic Dislocations

Reductions in the value of situs, as discussed before, imply spatial changes in the location of economic activity, dispersion of some activities and the simultaneous concentration of others may be expected. But spatial changes are not the only modifications in the structure of the economic system to be expected. Redistribution of economic activities, of values of assets in land, and of incomes means that firms, organizations, operations, and people will be variously affected by highway improvements. For example, redistribution of assets in land and income from land can imply concentration of economic power within an industry or activity group or, of course, the converse.

The spread of economic effects—the so-called impact area—would be determined by which persons or firms are involved in possible adjustments. The time span involved in adjusting to changed spatial economies (or indeed if there is any adjustment to spatial economies) will depend on the structure of the activities affected and characteristics of firms and institutions comprising the activity. As an example of the differential aspects of impact over time, a short-run period of loss in income which is a part of a long-run eventual growth in income in an area may mean that people or firms other than those which absorb the effects of the loss realize benefits from the long-run growth. The implications of such changes need to be explored.

These concepts suggest a possible new focus for the study of highway economic impacts. Studies of redistributive effects which have the objective of assessing net benefits fail for two reasons: (1) they may not be providing measures of net benefit, and (2) they may be leaving untapped a vast area of research which has nothing to do with benefits related to finance or justification. This is the area of economic dislocation, structural change, and system revision which, apart from the aspect of net benefits to the economy, may be relevant to policy at all levels of government.

Redistributive effects which involve such changes as income distribution, economic power, and bargaining power have direct pertinency because such corollary effects should be viewed in the light of other public policies and programs. The object, of course, is determination of the compatibility of such side effects with expressed goals of other policies. In addition, such effects may indicate the need for personal or group action in the private sector of the economy in line with anticipated changes.
With questions about relative change in mind, several types of studies can be suggested. The following are but a few of the more likely possibilities.

1. Industrial development studies could consider not only employment statistics, but also effects of developments on the distribution of income, the relation of a new industry's wages to existing wage levels in the area and for similar employment elsewhere, the type of firm involved, degree of seasonality of the operation, sensitivity to cyclical fluctuations, employment of men or women, and the relationship of its employment to the local labor pool. If, for example, in an area of surplus labor and depressed economic conditions, a new manufacturing plant is located employing a small number of people, analysis does not end with a statement of its existence and a recounting of the number of jobs involved. Possibly such development could retard outward migration of people from the area by offering them the hope of greater future development which may not materialize. If, in truth, outward migration is basic to the solution of the area's economic problems, can isolated industrial development be considered a benefit? Such a hypothetical example is extreme, but it is designed to indicate one fundamental problematic approach.

2. The scope of land value studies can be fruitfully broadened. Measurements of increases in land values are a small part of the changes inherent in a spatial redistribution of asset values. What firms or types of operations will control land the value of which has been enhanced as opposed to land the value of which is impaired? What differences in market concentration have been effected? Have markets been separated as a result of improvements in highway facilities? What do these changed market patterns mean in terms of local distribution of income? How have bargaining positions, firm integration, and concentration of economic power been affected? Has the redistribution of activity affected tax bases? Does the redistribution of activity require changes in day-to-day government services? Does the change imply necessary revision of long-term programs, for example, capital improvements (not only quantity, but type and location)? Does such spatial change demand increased long-range planning activity and revision of supporting zoning and subdivision controls? The list is long, but certainly the end is nowhere in sight.

3. Business activity studies should continue to expand beyond concern with changes in gross receipts. Changes in gross receipts answer a few questions, but in addition raise further questions. What types of activity are involved? Do chain groceries, for example, supersede locally owned operations? Does such a change in retailing mean an increase in real income for consumers because of lower prices? Could a shift of purchases of consumer durables from rural service centers to regional centers do the same? Can such effects be traced to transportation improvements?

4. Some studies should also be made of the effects of distribution of activity and population among governmental units of varying size inasmuch as the effects on tax bases and cost of governmental services are important. From such studies one could evaluate the changing need for ad hoc units of government drawn on economic regional bases or on the predicted need for shifting costs among units of government.

5. Bypass dislocation studies could include a general as well as a case study approach. Communities could be classified according to whether a highway improvement changes the basic economic enterprise of the area, and the bases for such classification should be represented as the important study variables. For example, if a rural service center becomes a suburban satellite community, to what degree does survival of commercial interests and continuation of present ownership and operations depend on the local merchants' adaptability to change, their recognition of change, and their capital position? It may depend on new local residents identifying themselves with the community. Such factors may well be a function of the rate of growth. Rapid growth may preclude or hinder the identification of new residents with the community. Also rapid growth may make it difficult for local merchants to adapt their merchandising practices to the new market, and thus they may lose it to branch operations of firms from the metropolitan center. Highway improvements, in an agricultural area, for example, may not change the basic economy, but some service communities may still decline. Such effects may merely represent an acceleration of an existing trend toward
regional efficiency and the maintenance of only those service centers that have con-
tinued to adapt.

The analysis and prediction of impacts require prior classification of areas and
hypotheses about them—not simple measurement and conclusions which merely re-
capitulate data. The few preceding examples illustrate some directions in which re-
search efforts could well be pushed, and indicate that local studies should be viewed
as extremely important because of their relevance to existing or potential local prob-
lems. Such studies can be used in aiding individuals and groups in their attempts to
cope with change. Revision and re-examination of policy at all levels of government
certainly should be directly involved with impact research. Results of programs and
policies cannot be construed as amoral; and side effects cannot be dismissed as as-
sumedly minor disruptions resulting from progress.

Attention can effectively be focused on "nondesigned" or side effects of the highway
program to promote reasonable adjustment to changed conditions and economic dis-
locations by providing useful information for guiding decisions and reduction of adverse
results.

DELINEATION OF IMPACT AREA

The meaningful delineation of an impact area for research purposes is an important
conceptual concern. In addition, manageable delineation is a necessary development
of methodology within a conceptual framework. Adopting the concepts of impact sug-
gested in the preceding discussion necessitates re-examination of the manner in which
these interrelated problems have been handled. Methodological systems typically
have been constructed by using distance from a highway facility or from points of ac-
cess to a facility and appear to have been largely designed to test functional relation-
ships between business receipts or land values and distance or access distance from a
highway.

Historically, many impact studies have been focused on land use and land values;
and researchers have characteristically constructed systems by which the delineation
of impact areas could be effected by using bands, zones, tiers, strata, etc. Although
such studies sometimes show such a functional relationship between access and the
study variables, attempts to integrate such relationships with market structure and
organization are less common. Perhaps this is impossible under such conditions, for
market relationships obviously are not based simply on distance or even access distance
from a given facility. It is true that the economic impact of new or improved facilities
does have special significant implications for patterns of form, but the use of essen-
tially arbitrary systems of bands and zones appears to be an inadequate guide for eval-
uating the market implications of the observations.

To gain perspective on economic impacts, delineation of impact areas should be
based more on hypothesized adjustments within a market and among markets. The
spatial effects of highway improvements are conditioned by spatial extent of affected
markets and their structural organization. In turn, such characteristics will vary
from activity to activity and from economic region to economic region depending on the
evolution of operational forms.

It should be apparent that research objectives are fundamental agents in conditioning
the determination of "impact area." In a study of land values and land use, the purpose
of the research will certainly modify the extent of the market included. For example,
studies of residential land use and land values can be undertaken for a number of pur-
poses, each suggesting a different view of "impact area." Some examples are studies of
effects on the structure of a neighborhood, relative development within a segment of
a community, over-all community development, a segment of the residential construc-
tion industry, firm relationships and organizations within the residential construction
industry, the tax bases of political units, and the demand for government services of
political units.

There does not appear to be any one delineation of an impact area which is best.
Indeed, it may even be necessary to adopt different definitions in the same study. A
definition used to isolate highway influence on adjustments in one market may be inad-
equate and erroneous for another. For instance, a bypass around a rural service center affects a great many markets all of which probably have different geographical boundaries. For study purposes, market boundaries must be determined and market organization described, because adjustments resulting from highway improvements take place within the boundaries, alter the boundaries, or both. Thus, the spatial extent of affected markets should as much be study variables as the more detailed aspects of the adjustments called forth. The markets affected must be at least hypothetically determined and should serve as the basis for delimiting impact areas.

It is recognized that the market area approach poses formidable methodological and data problems. Two studies are currently under way in Kentucky which it is hoped will contribute to the solution of some of these problems. One of these studies, an investigation of the impact of secondary road improvements, is essentially a market study. The secondary roads study is concerned with changes in retail markets, farm commodity markets, and wholesale distribution as the result of secondary road improvements in eastern Kentucky over a 10-yr period.

Focused as it is on markets, the secondary roads study in essence does not use impact or control areas at all. The impact area is in fact a major study variable, and there will in all probability be many impact areas as measured by market changes.

An example of the complexity of the types of market changes encountered, is the effect of upgrading the surface of rural secondary roads on the simplest type of elementary service center—the open-country general store. As would be expected, the noticeable result is a reduction in the number of such "centers." The second effect is a reduction in the number of functions which those that remain perform. The result of the first two effects is a concentration of convenience "functions" which were originally widely dispersed. The type of concentration effected varies, however, depending on the stage of development of the road network in the areas served by the original centers. Simplifying greatly, one could say that moving from dirt to graded gravel surfaces provokes a retrenchment involving the opening of a similar, but more centrally located, open-country center. Additional surface improvements lead to greater concentrations and further decreases in the functions of the remaining centers.

Such changes involve a great many corollary retail and wholesale market adjustments because the simple elementary centers, being general stores, originally handled many commodities; and concentration bringing or enhancing specialization affects the various commodity markets in different ways. Thus, a simple primary adjustment involves diverse secondary adjustments.

The principal sources of data are personal interviews with owners or operators of all retail or service businesses in the area studied and interviews with a stratified sample of farm operators. This it is hoped will allow a reconstruction of location patterns, tracing of changes in merchandizing, shifting of function, and determination of shopping patterns as influenced by roads.

The second study is a long-range examination of the impact of one of the first sections of Interstate 75 to be built in Kentucky. It was initiated before construction began and will not be completed until some time after the road is open to traffic. It is expected that the study will incorporate and build on methods and findings of the secondary roads project as they have a bearing on the impact area problem. The whole road structure of northern Kentucky, the general setting of this study, suggests that the new highway will profoundly influence traffic patterns at considerable distances, in some cases up to 50 mi or more, from the facility itself. Such a broad area cannot be dealt with in a strictly spatial way but observed shifts in certain important markets can be studied. It is anticipated that one of the most important will be a shift in the labor markets of Cincinnati, Ohio, and Lexington, Kentucky. As in the secondary roads study, market areas and the spatial extent of market areas will be study variables.

RELEVANT TIME PERIODS FOR INCLUSION IN IMPACT STUDIES

Another concept of vital importance theoretically and pragmatically to highway researchers is the determination of a relevant time period within which to assess the impacts of highway improvements. Just as it is important to discuss impact area in terms
of an economic activity, so it is necessary to discuss time in terms of economic activities and requisite adjustments, because the time period studied should be related to adjustment periods for the economic activities surveyed.

Adjustment periods obviously will depend on the nature of the adjustment called forth and also on prevailing economic conditions. But not so obviously they will additionally depend on the ability of firms to move or expand to other locations and motivation for such movement.

One could say that the mobility of firms depends on or measures freedom of movement as influenced by a number of factors such as the following: (a) size of individual firms or units, (b) the number of units comprising an activity, (c) fragmentation or integration within an activity, (d) differential growth of units, (e) capital positions of firms or units within an activity, (f) capital rationing, (g) sources of finance, and (h) complementary roles of firms and activities.

The relationship of firm mobility to adjustment periods can be illustrated by considering the case of highway service businesses. Highway service businesses could be expected to move relatively quickly in response to highway improvements. The reason, of course, is that access to a highway is, in essence, access to market, and there is need for rapid adjustment to changed market conditions. But this rapid response characterizes the group, not individual firms. There may be great motivation to expand or move to a new location, but which firms are involved depends on differentials in ability to move to a new location. Chain operations are able to move quickly and pre-empt prime locations adjacent to the interchanges of limited-access facilities. Such firms are highly mobile and, in some cases, completely internally financed.

Others which operate by using franchises may have almost no difficulty in securing local capital for area penetration and expansion. Most, of course, employ purchase options on possible sites and may obtain several before finally selecting a permanent location. In the process, the same firms pre-empt many sites enabling them to exercise partial control over development. This is very important, because no construction may be visible at all for some time after a highway facility is completed (as driving on many new limited-access highways confirms), and clues to eventual disposition of activities may be found in option purchases.

Highway service businesses of a nonchain nature located on a superseded facility may also have great motivation to move but may not be mobile. Such firms owning business shells and the land on which they stand are much less mobile than firms leasing business shells. A firm which has been established a long time is in a different position than is a firm of recent origin. Credit sources are more firmly established, and such a firm, if successful, is less liable to be restricted by credit rationing. If a firm has amortized its investment in land and building, it may be able to secure additional capital. It also could move more easily to a new location and absorb the waiting costs involved before sale of the superseded structure than could a recently established firm.

Such differences in mobility mean that time differentials are important, not only in studying relocations, but also in studying the incidence of business failure due to economic dislocations.

In other cases, interest will be focused on changes in consumer expenditure patterns, and such changes will depend on the goods involved and the freedom of people to change their shopping patterns. Dependence on local credit, difficulties in establishing credit elsewhere, and the size of cash reserves may influence how readily people adapt to changed shopping opportunities. In addition, there are a number of subjective and personal relationships involved between merchant and customer; these and the inertia of routinized transactions also influence reactions to changed shopping opportunities.

From the foregoing examples—simplified as they are—it can be seen that a standard or standards are needed against which to compare or measure economic changes over time. Such an adjustment "timetable" or "index" probably would not be as precise as could be wished, but it would enable the placement of observed changes into a meaningful context. By necessity one may have to study "old" facilities where adjustments over time could be catalogued and the influence of institutional restrictions assessed.
Substantial progress can be made toward developing useful adjustment timetables through cataloguing the sequence and timing of changes as reported in highway economic impact studies already completed. The recently reported study of the Northern Belt Line around Lexington, Kentucky, is a case in point (5). It carefully reports and documents the sequence of development of commercial and other land uses along that free access facility. It was noted there that the initial types of development significantly influenced later land uses, not only as to location but also as to type of activity and size of enterprise. It is also interesting that small establishments oriented to traffic developed first but were later followed by numerous developments apparently little related to highway service.

This and other similar studies provide information through which the sequence and timing of developments can be assessed and consistent patterns discovered. These patterns would serve the purpose of facilitating comparison of data from completed and current studies at various times after the completion of highway additions. Comparisons from which expectation models could be developed would supplement the more widely-used before-and-after studies with or without use of control areas.

The development of adjustment timetables might also make use of industry studies which give indication of adjustment periods based on firm and industry size commitments, capital requirement and position, labor requirements, and management's views of the future.

It seems unlikely that it will be possible to avoid limiting the time period in which studies are made. But to the extent adjustment timetables by type of activity, firm, and organization can be developed, perspective will be gained on what has taken place within a specified time period.

REFERENCES