Socioeconomic Reactions to Highway Development

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ABSTRACT

A research project is described that used a case study methodology to examine the social and economic effects of highway improvements on the areas immediately adjacent to the highways. Using secondary data supported by interviews with key personnel and on-site observations, before and after comparisons were made for impact and control groups. Controls for other external factors were also used. Some frequent and consistent socioeconomic changes occurred in the impact areas. The effects were much stronger very close to the highways and did not necessarily result in decreases to neighborhood attractiveness. This indicates that active analysis of socioeconomic consequences and use of appropriate mitigative measures can substantially reduce undesirable socioeconomic consequences. No general models of change emerged because of substantial variations from site to site. The findings demonstrate the importance of including socioeconomic impact analysis in highway planning and the usefulness (and limitations) of the specific research methodology used here.

The social and economic impacts resulting from highway development have become key issues in highway planning. Disputes about the probable social and economic impacts of particular alignments have added years (and, in some cases, many years) to highway construction schedules, thereby enormously inflating highway construction costs. Even small-scale projects--those substantially less disruptive than new construction projects--sometimes involve significant controversies revolving around social and economic effects. A variety of social and economic impact assessment methodologies have been developed and disseminated. Unfortunately, these methodologies are largely theoretical and none of them has been adequately verified.

An increased ability to predict the consequences of various kinds of highway developments is needed. The reduced uncertainty of specific types of impacts will enable highway planners to prepare designs that avoid adverse consequences or to design mitigating features into the project from the beginning where adverse consequences cannot be completely avoided. The reduced uncertainty will reduce the fears of negative consequences, which are often exaggerated. This increased ability to predict and alleviate concern over adverse impacts can lead to reductions in highway construction costs by eliminating serious delays. The improved predictability will thus lead to better highway practice and better highways, less litigation (as well as less serious litigation), and fuller compliance with the National Environmental Protection Act, the Council on Environmental Quality, and other federal and state legislative provisions.

METHODOLOGY

The purpose of this study (1) was to determine empirically how the interaction of different types of highway projects with different community settings creates specific socioeconomic impacts. Although the most accurate way to identify determinants of impacts might be a series of longitudinal studies beginning at a time preceding the planning for a project and continuing past the initiation of facility operations, this approach has serious drawbacks: the cost of such research would be high and the research would have to be conducted over many years before results would be available. This study used a less costly, and substantially faster research methodology, namely, a compressed longitudinal analysis of historical data.

Using this approach, secondary data from various combinations of community and project were examined for points in time corresponding as closely as possible to five major stages of highway project development. A before and after methodology was employed to assess quantitatively differences between impact and control zones over the period of time from before the final plans to after the opening of the facility to traffic. The key elements of the methodology include the research methods, the major hypotheses, the effects to be studied, the major analytical questions to be investigated, and the process of selecting the case study sites.

Research Methods

The essential aspects of these compressed longitudinal analyses were the use of historical data, the selection of impact and control zones, measures for the different categories of impacts, and the selection of data points that represent conditions before, during, and after the construction of the highway. (The impact zone included the area traversed by the entire segment of the highway being studied and approximately 0.5 mile on either side of it. The control zone was near the impact zone but removed from direct impacts; it was not affected by another highway project, and it was similar to the impact zone in composition and characteristics of demographic, residential, and commercial trends.) Data were collected for five important points of highway project development: preknowledge, announcement of the highway plan, construction, facility opening, and stable operations (from 2 to 5 years after the beginning of operations). These data were needed to examine interim short-term changes as well as the before and after effects.

Hypotheses

For purposes of conducting the research, two hypotheses were established.

1. Highway construction would have a negative impact on neighborhood attractiveness in affected areas, and
2. As proximity to the highway increases, the extent of the negative impacts also increases.

These hypotheses were proposed because they fit some popular conceptions (or misconceptions) of the effects of highways on surrounding communities and be-

cause they can be expressed in an empirically verifiable fashion.

Socioeconomic Effects

This methodology separates obvious effects directly caused by right-of-way acquisition and displacement (such as declines in the number of housing units) from community responses triggered by highway-related activities (such as the value of the remaining housing units). This is based on the proposition that the reactions and responses of the community as a whole constitute the most useful indicator of the influence of the highway on the neighborhoods immediately adjacent. Substantial documentation (2-6) has been published on the effects experienced by those individuals and establishments displaced by the land acquisition necessary to obtain the right-of-way for the highway, and a substantial body of literature and legislation deals with compensating them (7-9).

Such community reactions and responses change the relative attractiveness of neighborhoods adjacent to the highway--positively or negatively--by either attracting or discouraging present and potential users of the neighborhood. To make neighborhood attractiveness a measurable concept, this study focused on individual components described in other studies (10-17) as

- Demographic changes,
- Housing market conditions,
- Business vitality,
- The use of local facilities, and
- Land use changes.

The first two were used as the key indicators because they are more representative of an assessment or aggregation of attitudes, because data for them were more readily available, and because changes in a particular direction were more readily categorized as positive or negative.

Residents of the area immediately surrounding the highway (the impact zone) can express their ultimate reactions to the direct effects of highway construction through two types of behavior: "voting with their feet" (they either choose to stay or they move away) and maintaining (or not maintaining) their properties. These behavior patterns, if large enough, will result in observable changes in the

- Average length of time people live in the area,
- Population composition (e.g., percentages of young, old, black, and poor),
- Percentage of dwellings that are owner occupied,
- Percentage of dwelling stock that is vacant,
- Percentage of dwelling stock that is substandard,
- Percentage of dwelling stock that is overcrowded, and
- Relative prices of housing and other buildings in the affected area relative to prices elsewhere.

The third step in the process is thus the reaction of the community as a whole to the changes occurring adjacent to the highway. These reactions take the form of the relative attractiveness of the impacted area vis-à-vis similar areas and find their expression in changes such as the

- Relative prices for housing and other buildings, and
- Percentages of land devoted to particular uses.

Figure 1 illustrates the change process.

The overall effect of these changes on the areas surrounding the highway is not obvious. On the one hand, properties adjacent to the highway may become less desirable because of increased noise and air

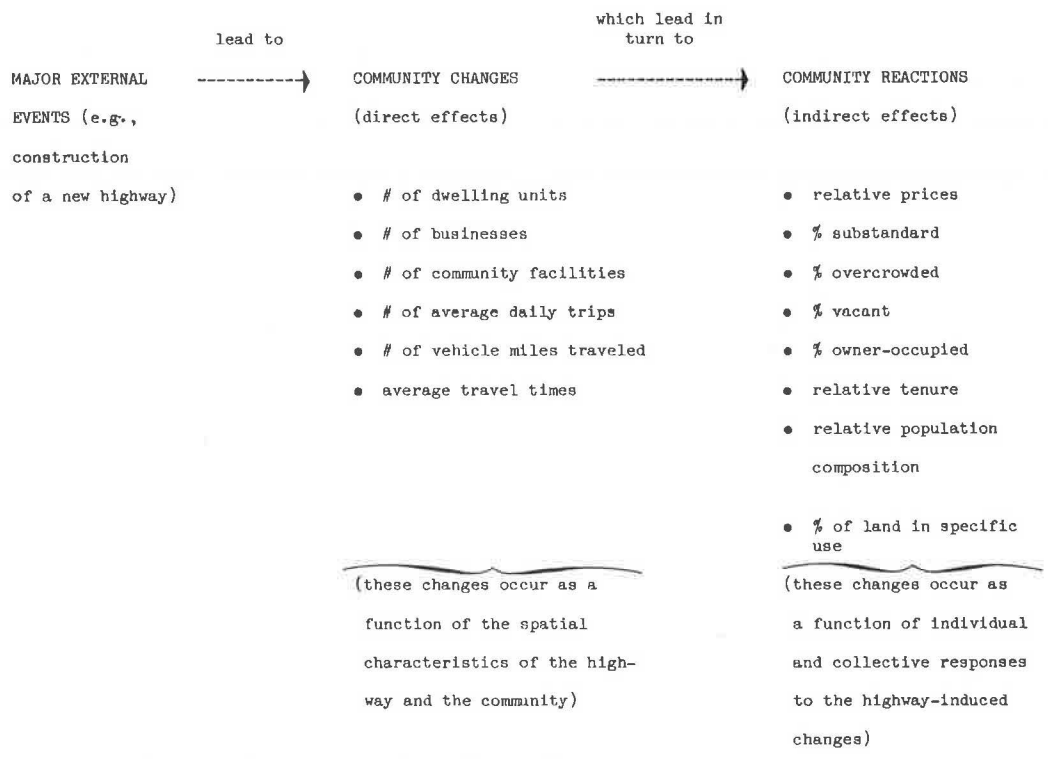

FIGURE 1 The urban change process: direct effects and community reactions.

pollution, and their relative prices will fall. On the other hand, areas of increased accessibility should be relatively more valuable, and their relative prices should rise. How these factors counterbalance is the subject of this research.

Major Analytical Questions

The analysis of the changes over time focused on the following key questions:

1. What was the attractiveness of the impact community before the highway was constructed?
2. What, if any, were the changes in the neighborhood's characteristics over time?
3. What, if any, changes can be linked to specific highway development stages?
4. What, if any, changes were unique to the remaining impact community?
5. What, if any, other factors (besides construction of the highway) were unique to the remaining impact community during the study periods?
6. To what extent are those changes, which are unique to the remaining impact community, attributable to the highway?

The ways in which specific impact variables could be expected to change, if the proposed hypotheses were correct, are given in Table 1. For example, based on the hypothesis that highways decrease neighborhood attractiveness, a decline in population in areas adjacent to highways would be expected to be even greater (proportionally) than the general decline in population that has been occurring in older central cities. Similarly, a slower increase in rents and in house values would be expected in the impact areas than in urban areas in general if the hypotheses were true as stated. The directions of expected changes for the other variables are also shown in the table. How they actually change at specific sites helped to determine the validity of the hypotheses proposed.

Case Studies

Potential candidates for case studies were identified by reviewing environmental impact statements, highway litigation involving potential socioeconomic impacts, and all other urban highway construction projects during the 1960s and 1970s. These reviews identified 16 sites and from these, case studies were conducted in Baltimore, Cleveland, Hartford, Wichita, and Wilmington. All of these cases involved the construction of new limited-access freeways through densely developed portions of urban areas. A portion of Pittsburgh was also briefly studied as an example of the effects on commercial activity created by an automobile-restricted zone. An example of a bypass around a small town was investigated but not pursued because of a lack of measurable impacts.

Summary

There were three major components to the substantive basis of this examination of the social and economic impacts of highways:

1. An overall view of the sequence and processes by which changes occur,
2. A list of specific measures by which the types and amounts of changes may be measured, and
3. A set of hypotheses that help establish expectations about how the specific impact categories will change.

Although this theoretical framework could be made operational through a variety of research methodologies, these impacts were viewed retrospectively by compressed longitudinal analysis at specific sites.

Any retrospective historical overview obviously misses many of the immediate details of impacts and resulting changes. When contrasted with a resident observer methodology (18) or in-depth interviews with persons in the area (19), compressed longitudinal analysis appears to overlook much of the disruption, discomfort, and even anguish at a personal level that has been shown to result when social and economic attributes of an urban area change in response to major changes in the area's physical structure.

Yet, it can be argued that the personal, social, and psychological effects that are not directly measurable by the compressed longitudinal analyses would, if they were so strongly positive or negative, influence observable variables. Effects of extreme intensity would either cause people to leave the affected area or attract them to it. They would show up in measures of changes in the relative quality of affected areas compared to similar but nonaffected areas or to the urban area as a whole; these changes, if significantly large, should be correlated with changes in transportation that occur and the preexisting characteristics of the community.

FINDINGS

Results of the Case Studies

Baltimore

The Baltimore case study involves the construction

TABLE 1 Hypothetical Changes in Neighborhood Attractiveness Resulting from Highway Construction

Neighborhood Attractiveness Indicators	General Central City Trends	Expected Trends in Each Impact Area Relative to the Rest of the Urban Area[a]
Total population	Decrease	Greater decrease
Percent minority	Substantial increase	Greater increase
Number of housing units	Decrease	Greater decrease
Percent vacant	Slight increase	Greater increase
Percent substandard	Decrease	Smaller decrease
Percent owner occupied	Slight decrease	Greater decrease
Percent overcrowded	Substantial decrease	Smaller decrease or even an increase
Median rent	Increase	Smaller increase
Median house value	Increase	Smaller increase
Change in land use	Mixed	(Not obvious)
Change in land use intensity	Mixed	(Not obvious)

[a]Based on the hypothesis that highways decrease neighborhood attractiveness in the impact areas.

of a major freeway that was to link the central business district (CBD) with the western suburbs. The segment directly to the west of the case study area, however, has been removed from the Interstate system plan so the facility may never serve the projected volumes of traffic.

All Baltimore transportation plans since the early 1940s had included a route through the impact area as one element of an overall transportation network. The impact area was seriously depressed and dilapidated before the construction of the highway. Construction began in 1973 and ended in 1978.

Based on the block-level analysis, the highway may have improved rather than depressed the surrounding community. This could be due to the initially deteriorated character of the impact zone. It could also be due to the extremely large investments in urban renewal, rehabilitation, and capital improvements throughout Baltimore--including both the impact zone and the control zone--during this period.

Cleveland

The Northwest-Clark Freeway, designated as I-90W, cut through a high-density, low-income, mixed land use area on Cleveland's west side. The demographic and housing characteristics of the study area, which has served as a port of entry for immigrants to the city, were somewhat more attractive than the city as a whole in 1960 than after highway construction.

Early acquisition of properties for hardship cases began in 1964. In 1975 a final statement of negative declaration of impacts paved the way for initial construction activities later that year. The eight-lane facility was opened to traffic in late 1978.

Blocks in the impact zone showed a deterioration in neighborhood attractiveness in contrast to the control zone and the city as a whole. Much of this decline appears to be attributable to the highway. The attractiveness of the neighborhoods adjacent to the highway declined in total population, number of housing units, percent vacant, percent substandard, rent receipts, and house values. The Cleveland case supports the premise that highway construction has negative effects on the surrounding area.

Hartford

Hartford's 3.3-mile section of I-84, known as the Yankee Expressway, spans the entire east-west width of the city. At most points, the highway is equidistant from the northern and southern borders. I-84 generally follows the alignment of an existing railroad and the course of the Park River. An east-west highway along this alignment has been in Hartford's transportation plans since the 1940s. Construction on I-84 began in 1962 and ended in 1972.

Hartford had lost one-sixth of its 1960 population by 1980, with most of the loss occurring in the 1970s. At the same time, the black population more than doubled to a total of 34 percent. The total housing stock declined; some housing market conditions improved while others worsened. The neighborhoods in the impact zone were the traditional points of entry into the city for successive waves of immigrants, forming a blue collar area of lower income groups. Recent urban renewal activities and other developments have attracted pockets of higher income population into the renovated downtown area south of I-84.

Because the railroad tracks along which the highway was built served as a social and economic dividing line within Hartford, the block-level analysis of highway impacts was performed separately for areas north and south of the highway. During the study period, in the area north of the highway, the attractiveness of neighborhoods closer to the highway became more positive. Population declined, but the percent of substandard housing also declined and rents and house values increased.

There were almost no significant differences between the southern impact and control zones. The only change south of the highway related to distance from the highway was house value; it appeared that proximity to the highway suppressed the increase in house values that was occurring south of the highway because of upgrading, renovation, and code enforcements during the construction period. After construction, there were no significant differences between the changes in the southern impact and control groups.

Wichita

The I-135 north-south route through Wichita follows the alignment of a storm runoff canal and thus has been called the Canal Route. Land was acquired over a 12-year period from 1962 to 1974; the project was under construction from 1974 to 1979. The project included development of a hike and bike trail and the acquisition of additional parkland to replace some taken for the right-of-way. The impact area was comprised predominantly of single-family homes, one-half of which were owner occupied. The neighborhood attractiveness indicators for the area were similar to the averages for the city as a whole.

Neither the impact group nor the control group showed a change in demographic or housing market indicators from before to after the highway. Based on analyses at the tract and block level, the highway appears to have had no impact whatsoever--either positive or negative--on the relative neighborhood attractiveness of adjacent communities. One suspects that this was probably due to the felicitous location of the highway along the drainage canal, which already separated existing neighborhoods; it might also have been influenced by the joint development of the hike and bike trail and the parkland substitution. This was the only case study to emphasize the avoidance of substantial socioeconomic impacts in the route location process and the only site to mitigate consequences by emphasizing and implementing joint development.

Wilmington

I-95, linking Baltimore and Philadelphia, was constructed through a high-density, lower-income section of Wilmington. It was one of the first federal-aid Interstate highways; plans were completed in 1957 and property acquisition began in 1958. Because of funding and scheduling problems, acquisition and construction were halted for long periods of time and the complete route through Wilmington was not opened until late 1968.

The impact area was considered somewhat dilapidated in the 1950s, with some blight, overcrowding, and lack of facilities. There were numerous strong ethnic neighborhoods in the area bisected by the right-of-way. The impact area reflected the problems of Wilmington as a whole, which included a substantial loss of population, a significant decline in industrial activity, and some dramatic changes in the composition of the population.

Between 1950 and 1970 the differences in the changes between impact and control zones were significant for seven of the nine descriptors of neigh-

borhood attractiveness: total population, percent minority, number of housing units, percent owner occupied, percent substandard, percent vacant, and rent. Most of the differences in the rates of change were associated with distance from the highway; the more unattractive conditions were generally closer to the highway. The highway appears to have made conditions worse in an already declining area.

In assessing the Wilmington case study, it is important to note that it substantially predates the other case studies. Therefore, the highway development process for this case was significantly different from the other cases, particularly with regard to public participation in the planning process and the procedures used and compensation paid for relocation. In addition, Wilmington's low-cost housing stock was significantly affected by a massive urban renewal project to the east of the CBD and by riots in the late 1960s. Even with these caveats and external influences in mind, however, it appears that the highway adversely affected the attractiveness of adjacent blocks.

Overall Conclusions

The following conclusions were drawn from a look at all changes in impact variables over all the case studies examined:

- General patterns or models are secondary to site-to-site variations.
- Decreases in neighborhood attractiveness do not necessarily occur.
- Fewer changes occur during interim time periods, but they are more often negative.
- Some frequent and consistent changes occurred.
- Distance from the highway has a strong effect.
- Distance-related changes show specific patterns.
- Block-level analyses show more effects.
- There are problems with the use of secondary data.

These conclusions are described in detail below.

General Patterns or Models Are Secondary to Site-to-Site Variations

Looking at the case studies as a whole, there are substantial variations in the size and direction of effects from site to site. The patterns of influence exerted by the highway construction process were much stronger within a site, however, than the overall influence of a specific impact or aggregations of impact categories.

Table 2 gives specific changes on a site-by-site basis. The strongest patterns in the table are vertical, which means that there is more consistency to the direction of effects within a particular site than there is for a particular neighborhood attractiveness indicator across sites. This implies the possibility of interactions among the indicators at a particular site so that the relative changes tend to reinforce each other. If the patterns indicated here are valid at other sites, it will be difficult to develop cross-site predictive indicators unless some underlying theme (such as the location of the right-of-way along neighborhood boundaries rather than through neighborhoods) is found. The data in the table indicate a large number of negative effects at some sites, basically positive effects at other sites, and essentially no effects in the remaining sites. This indicates that there are apparently large possibilities of either creating or mitigating social and economic consequences at particular sites, depending on the skills of local planners and other factors.

Certain effects occurred from before to after highway construction; however, this does not prove that these effects were caused by the highway, although the statistically significant differences between impact and control groups do suggest the possibility of some influence. For those instances where distance from the highway had a specific effect, the possibility of a causal linkage is much stronger.

TABLE 2 Actual Versus Expected Changes Across Sites Before and After Highway Construction

Neighborhood Attractiveness Indicators	Expected Change[a,b] in Impact Areas Relative to Control Areas	Baltimore	Cleveland	Hartford North	Hartford South	Wichita	Wilmington
Total population	Greater decrease		●	●			●
Percent minority	Greater increase	◎	●	◎			◎
Number of housing units	Greater decrease	●	●				●
Percent vacant	Greater increase		◎				◎
Percent substandard	Smaller decrease	○	●	○	○		◎
Percent owner occupied	Greater decrease	○					●
Percent overcrowded	Smaller decrease or even an increase	◎		○			
Rent	Smaller increase		◎	○			◎
House value	Smaller increase		◎	○			

Legend: ● Change occurred as expected.
○ Change occurred but was not as expected.
◯ Change was related to distance from the highway.
Blank spaces indicate that no significant change occurred.

[a] Changes for all sites are from 1960 to 1980 except Wilmington, where changes were measured from 1950 to 1970. Changes indicate statistically significant differences between impact and control groups for the specific indicators over the total time period.

[b] These are changes to be expected based on the hypothesis that the construction and operation of highways decrease the attractiveness of adjacent neighborhoods relative to the attractiveness of nonadjacent neighborhoods.

Decreases in Neighborhood Attractiveness Do Not Necessarily Occur

There is no overall support for the premise that highways decrease the neighborhood attractiveness of areas adjacent to highways, although that appears to be what happened in Cleveland and Wilmington. Similarly, no overall support was found for the premise that highways could be credited with stimulating improvements in the remaining neighborhoods, although, according to the criteria, the impact group showed more improvements than the control group in Hartford on the north side of the highway. Large-scale patterns of social change appear to have overwhelmed whatever influence the highway improvements might have had in Pittsburgh and Baltimore. In Wichita and on the south side of the highway in Hartford, there was little difference in the way the impact groups and the control groups changed. This suggests a low level of influence of these highways on the local urban dynamics. In Wichita and, to some extent, in Hartford, this lack of influence is probably attributable to the location of the right-of-way along a preexisting physical barrier. Based on the hypothesis that proximity to the highway reduces neighborhood attractiveness, events in Cleveland and Wilmington followed the expected pattern, Hartford north was contrary to the expected pattern, and Hartford south and Wichita were not influenced by the highway.

Fewer Changes Occur During Interim Time Periods, but They Are More Often Negative

The changes at each site were also examined over the various stages of the construction process. Between the before and after situations three separate stages were examined:

- Land acquisition process,
- Construction process, and
- Decade the highway was opened to traffic.

The data indicate that there were substantially more statistically significant changes over the before and after time frames than there were within any of the intermediate periods. Thus, the findings do not support either portion of the argument that there are many interim effects that are transitory: fewer changes are shown in the interim time periods than overall, and those changes that are significant tend not to go away but tend to occur over at least a 20-year time span.

Most of the changes that occurred only during interim time periods involved decreases to neighborhood attractiveness. Furthermore, about 60 percent of these changes were related to distance from the highway, whereas only 40 percent of the statistical changes over the entire study period were related to distance. Increases in overcrowding and deflated housing prices each occurred at two sites and were related to distance from the highway.

Some Frequent and Consistent Changes Occurred

Some frequent and consistent changes occurred across the sites, although not as many as expected. These consistencies, which are given in Table 3, provide some basis for developing theories about what kinds of socioeconomic changes are likely to occur when highways are built through urban areas. Of those changes that showed statistically significant differences between impact and control groups, the most frequent were changes in the percent substandard and the percent minority. The least frequent changes were percent overcrowded, percent vacant, percent owner-occupied, and house value. The most consistent changes were in total population, the number of housing units, the percent vacant, percent overcrowded, and percent substandard. The least consistent change was in percent minority.

TABLE 3 Across-Site Comparisons of Changes in Impact Areas Before and After Highway Construction

Category	Neighborhood Attractiveness Indicators	Frequency and Direction
Most frequent changes	Percent substandard	5 of 6 cases changed
	Percent minority	4 of 6 cases changed
	Total population	3 of 6 cases changed
	Number of housing units	3 of 6 cases changed
	Rent	3 of 6 cases changed
Least frequent changes	Percent overcrowded	2 of 6 cases changed
	House value	2 of 6 cases changed
	Percent vacant	2 of 6 cases changed
	Percent owner-occupied	2 of 6 cases changed
Most consistant changes	Total population	3 of 3 cases decreased
	Number of housing units	3 of 3 cases decreased
	Percent vacant	2 of 2 cases increased
	Percent over-crowded	2 of 2 cases decreased
	Percent substandard	4 of 5 cases decreased
Least consistent changes	Percent minority	2 of 4 cases increased 2 of 4 cases decreased

Although no attempt was made to have the case studies represent a statistical sample of all highway construction projects, the combination of these cases suggests that the highway construction process

1. Often results in greater than average declines in the percent of substandard housing in the impact zone;
2. Often results in significant shifts in minority populations, which have equal chances of being increased or decreased;
3. May result in greater than average decreases in total population and number of housing units; and
4. Will seldom result in greater than average increases in the percent of housing units that are vacant, greater than average decreases in the number of housing units that are overcrowded, and smaller than average increases in housing prices.

In general, it is possible to expect that the highway construction process will reduce population and housing densities in the remaining neighborhoods, will move seriously substandard housing conditions toward citywide averages but will decrease the relative marketability of residential properties in the affected areas (as evidenced by housing prices and vacancy rates). Local planners should consider whether such effects are desirable; and, if not, they should change the highway construction plans or design mitigative measures to reduce these expected impacts.

Distance from the Highway Has a Strong Effect

The research proved conclusively that the scale at which specific effects are observed is a critical issue. Effects that were found to have a significant association with distance from the highway when viewed on a block-by-block basis disappeared from

view when analyzed at the U.S. Census tract level. This suggests that the effects of the highway disappear within a very small number of blocks from the highway [which may suggest why other studies (20) have shown fewer measurable impacts]. Aggregating social and economic statistics to the level of a U.S. Census tract and then making comparisons on a tract-by-tract basis evidently masks the effects of proximity to the highway, because the scale of the analysis is too large.

Distance-Related Changes Show Specific Patterns

Of the statistically significant changes that occurred, those that were due to a strong distance-based relationship show several patterns, which are indicated in Table 2. One distinct pattern is that the distance-based effects often (although not always) involved decreases in the neighborhood attractiveness indicators for the impact zone. Another observable pattern is that within-site patterns are usually stronger than across-site variations, although the pattern of decreases in rent and percent vacant tends to occur across several sites. Otherwise, the effects that are distance-based generally follow the same patterns as all of the significant effects over time.

Block-Level Analyses Show More Effects

From these comparisons, it was concluded that the block-level analyses were much more likely to show significant changes than were the tract statistics. In addition, equations explaining the demonstrated differences in impact and control groups were much more highly associated with distance from the highway in the block-level groups than in the tract-level group. Therefore, future analyses should concentrate on block-level statistics rather than on tract-level statistics.

IMPLICATIONS FOR PLANNERS AND PRACTITIONERS

Large Socioeconomic Impacts Are Possible but Avoidable

This study showed that substantial variations in socioeconomic effects are possible from city to city. Therefore, social and economic considerations should continue to be a major criterion in the planning process while alternative alignments are being considered. From the limited number of cases investigated here, it appears that the entire range of influences on socioeconomic characteristics--from very positive through neutral to very negative--is possible and that, furthermore, the alignments that coincide with preexisting neighborhood boundaries are substantially less disruptive than rights-of-way that cut through established neighborhoods. Through consideration of such factors, it appears to be possible to avoid large negative impacts.

No Overall Model Was Found

Although the results point to certain patterns of impacts, the variations found do not permit the establishment of predictive models for impacts using the compressed longitudinal analysis methodology and the sites studied. A similar methodology should be used to examine additional case studies so that the data base will be more predictable. Further research with a larger number of cases would provide a better indication of whether or not standard patterns of influence are present. In addition, longitudinal studies using primary data collection techniques to investigate certain issues--in particular, community cohesion--appear to be mandatory for the resolution of these issues, because secondary data collection activities cannot provide enough depth or detail to address the appropriate questions. It must be recognized, however, that further studies could confirm the true absence of general predictive models and the need to focus on mitigative strategies instead.

High Probability Impacts Exist

Certain impacts appear to be more likely to occur than others, even if not predictable mathematically. They include greater than average decreases to population and housing densities in the impacted areas as well as greater than average improvements in measures of deficient housing conditions (percent substandard and percent overcrowded) when the pre-highway neighborhood showed unusually deficient and substandard conditions, but relative declines in the housing market neighborhood attractiveness indicators of housing prices and percent vacant. The transitory changes that occur in interim time periods, but not over the entire before and after time frame, quite often involve decreased neighborhood attractiveness; this is most frequently observed in increased vacancies and overcrowding and deflated housing prices. The changes that are related to distance from the highway often involve decreases in neighborhood attractiveness, showing the negative effects of being located close to the highway. Because of substantial site-to-site variations, a good deal of caution is required in applying these trends to a particular site. Nonetheless, it may be appropriate to consider these effects to be likely unless a good case can be made that other expectations are more probable.

Proximity Is Highly Significant

The finding that distance from the highway is such a significant factor and that measurable effects drop off so quickly as distance from the highway increases may have important policy implications. In particular, such an uneven distribution of effects suggests that persons living next to the highway suffer the majority of the discomfort and other negative effects (including diminution of property values) that are associated with the overall construction and operation of highway facilities. One of the implications of these observations is that persons living next to the highway have a good case for receiving compensation for the effects they incur, because these effects are measurable, fairly intense, and their incidence is limited to a relatively small and well-defined group of households. (Although this study did not attempt to quantify that point at which the social and economic effects of the highway were no longer noticeable, it appears, in terms of the specific cases studied, that this distance is on the order of 5 to 10 blocks away from the highway.)

Analyses Should Focus on Block-Level Statistics

One of the important products of this study is the methodology that resulted for the measurement of impacts. It showed that impact analyses should be conducted on a block-by-block basis, that retrospective analyses using secondary data sources are possible, and that even though certain effects could not be

measured (e.g., actual changes in neighboring, the use of local facilities, and other measures of neighborhood social interaction), major elements of overall neighborhood attractiveness (such as vacancy rates, prices for purchases and rentals, and population trends) were found to change in ways that indicated increases or decreases in attractiveness. This methodology--including the impact categories analyzed, the concept of the community reacting to changes, the block-level perspective, and the use of testable hypotheses concerning expected impacts--can be replicated in any instance where the social and economic impacts of highways are a concern.

Additional Training Programs Are Required

In addition to further research efforts, the findings of this study support the continuation of training programs to sensitize highway planners to the social and economic consequences of their decisions. These training programs should continue to focus on the identification of social and economic impacts, measurement techniques for these impacts, and the understanding of the instances in which they occur. Until there are better predictive models of impacts, the instructional process should focus on case studies of instances of large positive impacts, large negative impacts, and no highway-related impacts. A number of the case studies used for this project would provide good examples for the instructional process.

Relocation Assistance Is Crucial

Because it has been shown that through appropriate planning techniques, the social and economic consequences of highway construction on the remaining neighborhood can be made relatively small, the needs and problems of those individuals and families actually relocated from the right-of-way should continue to be emphasized. By focusing on relocation assistance and compensation programs, the greatest amount of assistance can be provided where it is needed most to alleviate the trauma of the displacement.

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