

Highway Interchange Area Development

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Interchange research accomplished or sponsored by state highway and planning agencies has provided tentative findings on several aspects of the interchange problem. For example, some combination of land-use controls involving both the police power and eminent domain appears to be needed to guide interchange development in most areas. Local initiative should be relied on to the greatest extent possible, though state action will no doubt be needed in some instances. For rural interchange areas without land-use planning which are threatened with land uses generating more traffic than an interchange can handle, state action could be taken (e. g., by denying additional driveways onto state highways near the interchange). Guidance for development in interchange areas can also be encouraged by state highway agencies and others making available to local planning authorities those facts needed to act in local interchange planning situations (e. g., trip-generating characteristics of varying land uses, land uses compatible with the interchange and with one another, or interchanges experiencing fast growth). Several states are already providing much relevant information by means of brochures, movies, and speakers, but much additional research is needed on such matters as traffic characteristics of various land uses, traffic assignment, user service needs at interchanges, and ways of implementing known data.

•LAND-USE PROBLEMS are directly related to the amount and rate of land development. In this country the fast pace of land development is apparent, and land-use problems are becoming more numerous and serious. These problems result primarily from an increasing population, a rising standard of living, and an increasingly complex society (1, 11).

AN OPPORTUNITY AND A PROBLEM

Land-use problems in areas near the interchanges of controlled-access highways are especially numerous and intense. Interchange areas are not ordinary places; because of their special advantages of accessibility, they tend to attract more economic activities than areas not served by an interchange. This constitutes both an opportunity and a potential problem. There is almost universal agreement that the opportunity for economic development offered by interchanges should be used. Interchanges can open up new areas for sound economic growth, revive the economic vigor of places needing economic revival, and perhaps even form the nucleus for a new kind of community. However, this development needs guidance if it is to continue to be economically sound over a period of time and the interchange is to operate as planned.

Changes in land use after a highway is built, such as in ribbon developments, may impair the usefulness of the highway. The goal for interchange area planning is to take advantage of the opportunity for economic development and at the same time guide or even restrain economic development that may be incompatible with the interchange or with other development in the interchange area.

GUIDANCE FOR INTERCHANGE DEVELOPMENT

Considerable attention has been given to land-development problems and opportunities in interchange areas. For example, several planning groups and at least 17 state highway departments in cooperation with the U.S. Bureau of Public Roads have either conducted or sponsored research to find ways to maximize opportunities for economic development and to avoid land-use problems in interchange areas (see Appendix). Some of these studies involve analysis of all aspects of the interchange problem; others have been concerned only with certain aspects of this matter, such as the amount of space needed for highway-oriented businesses in interchange areas. This paper describes some of the more promising findings and recommendations from studies completed so far, offers a few suggestions for dealing with interchange matters, and calls attention to aspects of the interchange problem that appear to need additional research effort.

Highlighting the Interchange Problem

The nature and seriousness of the interchange development problem have been highlighted effectively during the past 4 years or so by a number of individuals and organizations. One writer has described the freeway program as an "unqualified success with the exception of the interchange areas. . ." (2). Another has likened freeways to people, suggesting that they both pass through youth, maturity, and finally, old age. But interchanges reach the age of senility, he claims, more from the growth of traffic volumes than from the passage of time (3, pp. 22-23, 35).

The economic problem unsightly interchanges may pose for local areas, as well as the opportunity interchanges afford for economic betterment, has often been highlighted. A half dozen states have issued booklets calling attention to this valuable economic asset. To take proper advantage of an interchange, according to one account, planning must keep pace with economic development. If planning lags, the resulting development may be haphazard and poorly conceived. However, there is no need to "overplan for development, beyond any possible potential" (4). Interchanges are the "New Four Corners" (5) or "Your New Front Door" (6) and "you cannot afford anymore to show your cluttered backyards, your garbage patches to America" (7). So reads the literature intended to focus enough attention on the interchange development problem to cause something to be done about it.

One of the most successful efforts to highlight the interchange problem has been the 1961 Highway Research Board symposium "Land Use and Development at Highway Interchanges" (40). The papers presented at that session have not only caused a great deal of attention to be given to the highway interchange land-use problem, but also have provided an analysis of several aspects of the problem which still seems appropriate, for example, the description and evaluation of controls, the description of the land to be demanded and supplied at interchanges, and the need for user services.

A Complex Problem

The complexity of the causes of the interchange problem is demonstrated by the fact that some interchanges with little economic development nearby are congested, whereas others handle traffic satisfactorily even though they are surrounded by development. One of the most baffling aspects of this problem appears to be the varying amounts of traffic generated some distance away but relying on the interchange for access. If it were not for the remotely generated traffic, the interchange problem could be solved by permitting only those land uses in the area served by the interchange which will not generate more traffic than the interchange can handle. Actually, this itself is a formidable problem, since it necessitates accurate traffic-generating characteristics and information about the portion of traffic generated near the interchange which does not use the interchange.

A fairly common hypothesis of most interchange studies appears to have been that interchange areas without some publicly enforced form of land-use planning are likely to develop in an undesirable way from the point of view of economics, aesthetics, and traffic generation. This hypothesis appears to be still generally valid, but the fact that it often does not apply indicates how complex this problem is. In a study in Texas,

for example, Adkins failed to find any serious interchange problem in areas without land-use controls, that is, at interchanges subject only to market restraints. The Texas experience has caused some speculation concerning the possibility that the free market may work satisfactorily, that land uses able to afford to be near interchanges will be suitable for those interchanges (8). In evaluating the Texas experience—that is, absence of congestion—the effect of frontage or service roads needs to be kept in mind. For example,

in Houston, where there is no zoning ordinance and the Gulf Freeway is solidly lined with commercial and industrial uses, congestion at intersections was noticeably absent, even under the most heavy conditions of use. This might be partially attributed to the fact that this freeway, like many of those in Texas, has continuous collector-distributor roadways on either side of it which take a portion of the total transportation corridor demand. (9, p. 44)

Interchange problems are also complicated by the need to balance needs of different highway users. For example, one of the most commonly suggested ways of easing traffic congestion problems at interchanges is to limit access for some distance along the feeder road. But for highway users desiring to leave the highway only far enough to obtain food and fuel, such access control simply lengthens the distance they must travel for this service (10).

To discern the true relationship between the elements of this complex interchange problem, several researchers have resorted to simulation models, for example, in research completed or under way at the University of Washington, Pennsylvania State University, University of West Virginia, and the University of Virginia. Variables analyzed in an attempt to predict development at interchange areas have included population of the nearest urban place, population of the interchange area, traffic on the feeder road, age of the interchange, freeway capacity, land area available, and a number of characteristics of the land. Some of the models have been concerned only with a limited part of the whole interchange situation, such as predicting need for service stations or motels. An adequate testing of these models as yet has not been possible because of the lack of information, especially traffic and land-use data in sufficient detail, and population data for the appropriate areas. Researchers at Pennsylvania State University appear to be making good progress toward obtaining suitable data for verifying their model of 23 variables.

Development Controls Available

That there may be problems in attempting to control economic development by public decree was obvious at least as early as 1763 when King George III attempted to arrest the westward movement in America by forbidding settlements beyond the sources of rivers flowing into the Atlantic (11, p. 16). But problems of difficult enforcement have not kept land-use controls from being used. In fact, the adoption of land-use planning measures has increased significantly in recent years. At the present time, over 90 percent of the 1,355 cities with more than 10,000 people have an official planning agency (12).

Controls available to guide land development in interchange areas have been surveyed on a number of occasions. A 1960 survey by the Pennsylvania Department of Highways revealed that in the 36 states from which responses were received, there was little land-use protection provided explicitly for interchanges beyond extending access control between 100 and 1,000 ft along the feeder road (13). In a 1961 survey of the protection provided at interchanges, only 17 states reported using some access control on feeder roads (14, pp. 21-58). Twenty-two states indicated that they had no interchange protection planned or in effect. In several cases, the nonurban nature of the state was cited as a reason for not providing measures to guide interchange development.

Variations in land-use controls available in urban and rural areas were also shown by responses to a recent survey of counties conducted by the American Association of State Highway Officials and the National Association of County Officials. Twenty-five pertinent questions were asked on such land-use control techniques as zoning, subdivision regulations, driveway controls, setbacks, access regulations near interchanges, building codes, and mapped highway ordinance, and information was provided on the number of counties responding affirmatively to the questions. For urban counties, affirmative responses were about 43 percent, compared with about 22 percent for the rural counties (15). As might be expected, the 1,200 counties through which the Interstate System passes have more of the selected land-use control measures available than the 1,800 non-Interstate counties. Favorable responses for Interstate counties were 27 percent, compared with 20 percent for non-Interstate counties. Variations between Interstate and non-Interstate counties and urban and rural counties are indicated in Table 1.

TABLE 1
LAND-USE CONTROLS AVAILABLE

| State | Counties Responding Affirmatively to 25 Selected Questions (%) | | | |
|--------|--|----------------------------------|--------------------|-------|
| | All Counties | Interstate Counties ^a | | |
| | | All | Urban ^b | Rural |
| Ala. | 13 | 14 | 26 | 11 |
| Ariz. | 29 | 32 | 72 | 23 |
| Calif. | 58 | 64 | 81 | 58 |
| Colo. | 28 | 36 | 55 | 28 |
| Fla. | 35 | 38 | 52 | 28 |
| Ga. | 18 | 26 | 66 | 18 |
| Idaho | 14 | 22 | 41 | 16 |
| Ill. | 22 | 29 | 51 | 21 |
| Ind. | 25 | 35 | 45 | 32 |
| Iowa | 19 | 27 | 37 | 24 |
| Kan. | 16 | 30 | 55 | 23 |
| Ky. | 14 | 19 | 42 | 16 |
| Md. | 45 | 54 | 60 | 50 |
| Mich. | 25 | 28 | 30 | 25 |
| Minn. | 22 | 26 | 34 | 24 |
| Miss. | 11 | 16 | 32 | 14 |
| Mo. | 11 | 17 | 40 | 9 |
| Neb. | 5 | 18 | 44 | 8 |
| Nev. | 35 | 40 | 54 | 35 |
| N. J. | 31 | 31 | 31 | 29 |
| N. Y. | 19 | 24 | 28 | 21 |
| N. C. | 10 | 9 | 23 | 4 |
| Ohio | 31 | 40 | 59 | 34 |
| Ore. | 35 | 39 | 63 | 31 |
| Pa. | 18 | 19 | 31 | 15 |
| S. C. | 5 | 8 | 37 | 2 |
| S. D. | 10 | 9 | 19 | 6 |
| Tenn. | 13 | 20 | 61 | 15 |
| Tex. | 10 | 13 | 17 | 10 |
| Utah | 30 | 31 | 58 | 22 |
| Va. | 28 | 34 | 64 | 30 |
| Wash. | 48 | 51 | 64 | 45 |
| Wis. | 22 | 33 | 40 | 28 |
| Wyo. | 7 | 7 | 9 | 5 |
| Avg. | 22.4 | 27.6 | 44.7 | 22.3 |
| Median | 20 | 27 | 43 | 22 |

^aInterstate counties are those crossed by or adjacent to an Interstate highway.

^bUrban Counties are those which: (a) are part of a standard metropolitan statistical area, (b) had a 1960 population of 100,000 or more and showed an increase of 50 percent or more from 1950 to 1960, (c) had a population increase of 100 percent or more from 1950 to 1960, or (d) in 1960 were 70 percent or more urbanized (higher percent than typical for the United States).

TABLE 2
LAND-USE CONTROLS AVAILABLE
TO COUNTIES

| State | Rank ^a | | | |
|--------|-------------------|---------------------|-------|-------|
| | All Counties | Interstate Counties | | |
| | | All | Urban | Rural |
| Calif. | 1 | 1 | 1 | 1 |
| Wash. | 2 | 3 | 4 | 3 |
| Md. | 3 | 2 | 8 | 2 |
| Nev. | 4 | 5 | 13 | 4 |
| Ore. | 5 | 6 | 6 | 7 |
| Fla. | 6 | 7 | 14 | 11 |
| Ohio | 7 | 4 | 9 | 5 |
| N. J. | 8 | 13 | 26 | 9 |
| Utah | 9 | 14 | 10 | 18 |
| Ariz. | 10 | 12 | 2 | 16 |
| Colo. | 11 | 8 | 11 | 10 |
| Va. | 12 | 10 | 5 | 8 |
| Ind. | 13 | 9 | 16 | 6 |
| Mich. | 14 | 18 | 28 | 13 |
| Wis. | 15 | 11 | 20 | 12 |
| Ill. | 16 | 17 | 15 | 19 |
| Minn. | 17 | 20 | 24 | 15 |
| Iowa | 18 | 16 | 22 | 14 |
| N. Y. | 19 | 21 | 29 | 20 |
| Ga. | 20 | 19 | 3 | 21 |
| Pa. | 21 | 25 | 27 | 25 |
| Kan. | 22 | 15 | 12 | 17 |
| Idaho | 23 | 22 | 19 | 23 |
| Ky. | 24 | 24 | 18 | 22 |
| Tenn. | 25 | 23 | 7 | 24 |
| Ala. | 26 | 29 | 30 | 27 |
| Mo. | 27 | 27 | 21 | 29 |
| Miss. | 28 | 28 | 25 | 26 |
| Tex. | 29 | 30 | 33 | 28 |
| N. C. | 30 | 31 | 31 | 33 |
| S. D. | 31 | 32 | 32 | 31 |
| Wyo. | 32 | 34 | 34 | 32 |
| Neb. | 33 | 26 | 17 | 30 |
| S. C. | 34 | 33 | 23 | 34 |

^aThe rankings indicate for each state the relative number of affirmative responses which counties made to 25 selected questions on the availability of land-use controls.

districts to guide development and highway strip zoning. In a few states, such measures have been enacted or are now receiving serious consideration.

A standard feature of any plan to provide land-use controls by means of interchange districts, strip zoning, or other state action is to use local initiative to the greatest extent possible. This can be done in several different ways: by excluding local areas or interchange districts from statewide zoning if local planning of development is deemed satisfactory; by changing local control only to the extent of referring rezoning questions to a state agency; by giving local governments a specified period of time to zone or provide other land-use control in interchange areas; or by leaving zoning matters generally to localities except where local practice and state interests are clearly incompatible.

To combine state leadership with local initiative, local interests need to be taken into consideration as soon as possible. Highway plans are much more likely to be respected locally if they have been made a part of the local land-use plans. This has been shown to be the case in a number of locations. In Duluth, Minn., for example, several interchanges of I-35 have been integrated with local planning, and local streets have become frontage roads along a portion of the system. Coordinated planning of this type, with city planners sharing in the decisions on location and alignment, seems likely to continue to receive local support for orderly development in the interchange area. Other areas where effective coordination of interchange and local planning have been reported

include Illinois and Tulsa, Okla. The coordination in Tulsa has resulted in a fairly general acceptance of driveway plans approved and administered jointly by the local planning commission and the State highway department (16). In Illinois, highway and local development plans have been proposed (by Barton-Aschman Associates) for selected interchange areas intended to maximize opportunities for local development and also to facilitate service for highway travelers.

One of the biggest problems with any land-use control plan involving states is that of forming a staff large enough and experienced enough to make it work. It may be advisable for states to assume responsibility for those aspects of interchange control with which they have had experience, such as the extension of access control along the feeder road, and to provide information and leadership to enable local land-use control authorities to do their job more effectively. Relevant information includes early word about route locations, traffic forecasts, design capacities, and trip-generating characteristics of different land uses. Elements of leadership that can be supplied include a clear understanding of the intended purpose of a highway in a particular area—for example, for tourist travel or commuting, or to bypass urban traffic congestion—and ways that localities can maximize the opportunities afforded by nearby highway facilities. In some instances (e.g., Alabama and Pennsylvania), this leadership has been

provided in part by state university spokesmen, especially from universities involved in analyzing the economic opportunities afforded by nearby highways.

Eminent Domain and Police Power. —As in the matter of which level of government should administer land-use controls, the type of controls that might be most appropriate for interchange areas has received a great deal of attention. Of all the legal techniques available, only the power of eminent domain and the police power have received much use along highways. Up to the present time the police power has, of course, been used more than the power of eminent domain to guide development in interchange areas.

The police power, involving a reasonable regulation of property with no payment to the owner, is exercised through such measures as zoning, subdivision regulations, mapped streets, setbacks, and driveway controls. Of these, zoning is the most common and best known.

The problems and shortcomings of zoning are fairly well known. In brief, zoning is generally not able to withstand economic pressure very long. Zoning has been likened (17, p. 25) to weeds in a garden requiring "constant attention which is difficult to sustain over a long period of time. . . . Zoning is vulnerable to review, change, and pressure from special interests."

These zoning problems have been well documented. For example, in the AASHO-NACO survey, Montgomery, Prince Georges, and Howard Counties, three fast-growing counties in Maryland which are crossed by an Interstate highway, appear to have nearly all of the land-use controls about which the questionnaire inquires. But the existence of these controls has not safeguarded areas in these counties from land-development problems. That these problems may be fairly common is suggested by a University of Washington study, as well as by other studies. Information concerning the disposition of rezoning applications from some 41 municipalities during the survey period shows that an applicant for a rezoning had a 61 to 80 percent chance of getting what he wants in the first application. The study found that "the situation is similar for rezoning activity adjacent to or near interchanges in six cities and counties studied in detail through field work." This problem of rezoning is, of course, only a part of the overall problem. Fully as important as this is the problem of inadequate enforcement of zoning and other land-use control measures. As the Washington University study (17, pp. 10-23) stated, typically, building departments and planning staffs do not make systematic checks of land use against the zoning map. Public prosecutors act only when requested to do so either by the administrative unit concerned or by a complaining citizen.

Experience in New Orleans and Philadelphia shows a similar pattern of zoning appeals and exceptions. Of 963 cases studied in a recent year in New Orleans, 90 percent were granted. Of 256 cases heard in Philadelphia, only 47 were refused. It is interesting to note that for the 30 persons appearing in person, the appeals each took an average 18 minutes compared with 3½ minutes for those absent (11).

The advantages of zoning are also fairly obvious. It can slow the pace of development until more intensive measures can be provided, and it can affect the density of development. Zoning can also be especially effective in helping to stabilize land use following redevelopment.

Subdivision regulations, another police power, are also being used to a considerable extent, though not as widely as zoning. The utility of subdivision regulations appears to stem largely from the fact that these regulations affect developers at a time when they are still able to make changes in the subdivision and then pass any increased cost along to the buyers.

The power of eminent domain, involving the payment of public money for certain property rights, can also be effective for controlling land use. For purposes of land-use control, the power of eminent domain involves such techniques as development rights, easements, purchase and leaseback, and excess condemnation. The primary advantage of these methods of controlling land use appears to be the simple enforcement. Since an agreement by which landowners transfer redevelopment or other rights has the power of a contract, violations of these rights are not likely to occur.

The main disadvantage of controlling land use by means of eminent domain is the high cost. For example, costs for redevelopment have been found to range from 13 to 84 percent of the market value in fee simple along portions of the Mississippi River

Parkway in Wisconsin and along some parts of the Natchez-Trace Parkway in the South (17, p. 37). And an easement forbidding high-rise apartments on a 47-acre site along the Potomac River adjacent to Washington, D. C., was valued at \$750,000 by a jury, even though the cost of the property in fee was only \$650,000 a short time before (18). There appears to be general agreement that when the cost of purchasing certain rights to control the use of the land approaches the cost of purchasing the property in fee, it is preferable for the public agency to purchase the property outright; later, if all or part of the property is sold, development can be controlled by some means such as restrictive covenants.

A package containing both police power and eminent domain techniques appears to be the best answer for guiding economic development near interchanges. For example, Horwood suggests a package with zoning, land redesign, and the acquisition of access rights. Acquisition of access rights is ordinarily less expensive than most other eminent domain techniques of land-use control, but can be effective if used carefully. For example, access rights can be purchased only for industrial or other uses considered potentially hazardous to interchange traffic capacity, and still leave the landowner free to develop the land with some other use. An example of an apparently successful combination of the police power and eminent domain has been reported in Tennessee where, if a building permit is requested that would interfere with future highway building, the land involved is acquired by the highway agency (19). Such a fusion of police power controls and eminent domain appears to offer optimum protection for both the public interest and the private property owners' rights.

Certain land-use controls which are being adapted from other situations may also offer some help for the interchange problem. For example, studies in Minnesota and Illinois have proposed that only those uses which require a highway location should be permitted to be in such locations. This concept has a precedent, among other places, in "Waterfront Districts" which recognizes a harbor or similar facility as a natural resource in which the community has a vested interest. In the same way, an Interstate highway could be recognized as a transportation resource in which the whole community has an interest (20). Another possible approach which is not new is to use development performance standards to limit the amount of traffic permitted by large traffic generators, for example, along the lines of the standards now employed to determine when establishments exceed permitted levels of smoke, sewage, odors, or noise.

Priorities for Interchanges

The job of providing land-use planning for all interchange areas seems almost overwhelming. Like most formidable jobs, however, it becomes manageable when approached one part at a time. If the parts of the interchange problem are to be considered in logical order, suburban interchanges near the fringes of urban centers appear to deserve attention first. These interchanges are more likely to undergo uncoordinated development of land than interchanges in urban or rural areas. In rural areas, land development problems can be expected to be fairly mild. Urban interchanges, on the other hand, may feel some pressure for economic development; however, these urban interchange areas are more likely to have general land-use controls available and to have the use of more of the surrounding land already fixed.

A study in Georgia has demonstrated the usefulness of a system of priorities for focusing attention on the interchanges which need solutions first. This study analyzes interchanges according to their location (urban, rural, suburban) and the type of crossroad (primary, secondary, etc.), and develops a priority system to indicate just how critical the need is for county planning. Counties in Priority 1 are those which have portions of the Interstate completed or due for completion by 1965 and which have unincorporated areas not subject to planning commissions. Priority 2 generally includes those counties which will not have a portion of the Interstate System completed until after 1965. Priority 3 includes those counties which have programs deemed adequate for controlling land use. The need for fast action in the interchange problem is suggested by the fact that 50 percent of the 58 Georgia counties through which the Interstate Highway System passes have been placed in Priority 1, that is, with an Interstate

highway but without adequate land-use planning protection. Only 10 percent of the 58 counties were judged to have adequate land-use control programs (21, pp. 83-88). Figures 2 and 3 show the priorities assigned to Georgia counties crossed by the Interstate System and Georgia counties with planning commissions.

Priorities of a somewhat similar type have been developed in Pennsylvania, Michigan, Minnesota, and by the committee of AASHO-NACO referred to earlier. In Pennsylvania, interchanges have been listed according to whether they will occur in cities, boroughs, first class townships, or second class townships. In addition, highway locations and county planning commissions have been related to one another, e. g., by means of maps as in Figure 4. The interchange priorities system for Michigan involves redesign and reconstruction of interchanges rather than land planning in the surrounding area. It is interesting to note, though, that some of the conditions justifying redesign are matters that could have been alleviated earlier by land planning; for example, a change in nearby land use bringing a sudden jump in traffic volumes (3, p. 3).

In the Duluth, Minn., study, a priority system has also been established for land-use planning. This priority system consists of: (a) immediate actions prior to Interstate construction; (b) actions with Interstate construction; and (c) future actions (20, pp. 14, 66-69). The NACO-AASHO survey of interchanges has provided general information showing the availability of land-use planning techniques in fast growing and/or urban areas with Interstate routes, counties which might be regarded as high priority because interchange problems there are expected to be more critical than they are in rural areas.

Space Needs at Interchanges

The amount of the land made available for development at interchanges which will be used and the type of use this land will be put to appears to be the crux of the interchange problem. Garrison has estimated that by 1980 intensive land development will occur near the interchanges of large metropolitan areas but that in small urban centers the supply of land near interchanges will exceed the demand (22). Space needed for residential development is expected to exceed greatly that for the other specified uses,

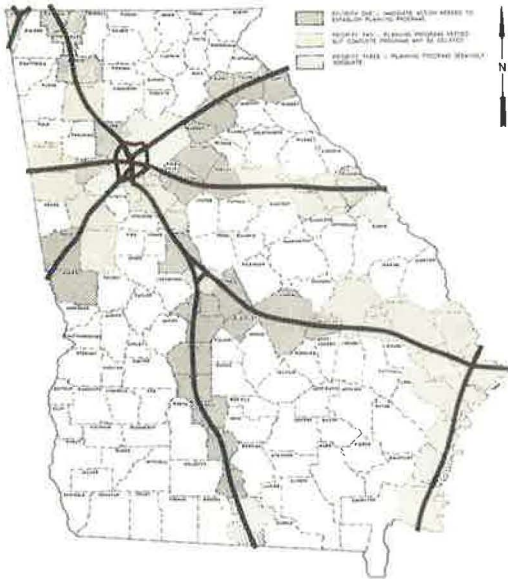


Figure 2. Priorities for county planning in Georgia for land-use planning controls along the Interstate Highway System (21).

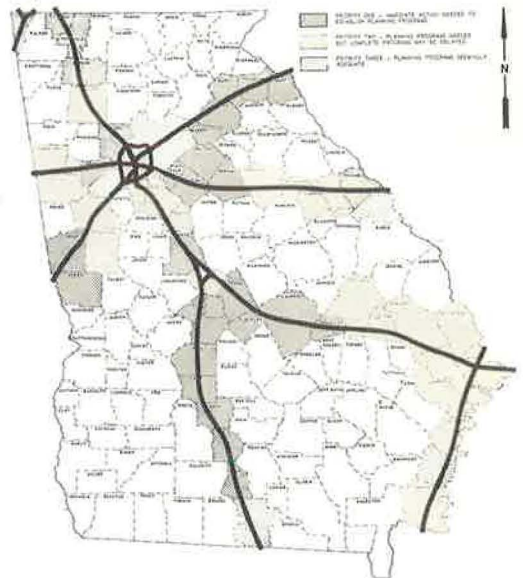


Figure 3. Counties of Georgia with official county or joint city-county planning commissions (21).

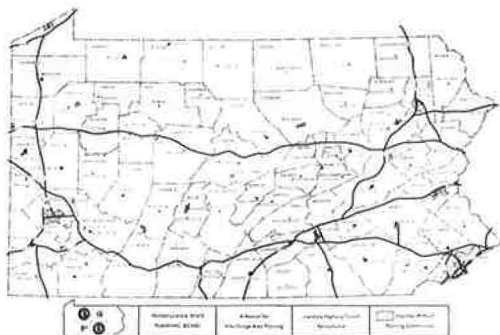


Figure 4. Interstate highways in Pennsylvania and counties without planning commissions.

industrial and shopping centers. Although the space needed for shopping centers is by far the smallest of the three uses, this use needs careful coordination with interchange plans because of the high traffic-generating characteristics of shopping centers.

Space needs for highway services in interchange areas have received special attention. For example, studies in Minnesota have related the amount of space used for highway services to the traffic volumes along the highway. Using this information and traffic projections for 1975, the study in Duluth has estimated the amount of space needed for highway service near certain interchanges. For example, an expected 45,850 average daily traffic in 1975 calls for about 4,400 lineal feet for highway service at one interchange in

Duluth (20, p. 30; 23). Pennsylvania researchers have gathered information from interchange sites concerning the relative frequency of service stations, restaurants, and motels. It was found to be 21:14:10, i. e., 21 service stations to 14 restaurants to 10 motels (24). And in a study in Wisconsin, auto service and food service were found to constitute 66 percent of all roadside establishments (14, p. 43). It is no doubt obvious that existing space allocations near interchanges can only be of limited usefulness in estimating space needs for highway services because of the apparent tendency of some oil companies to obtain more space for service stations than will be needed in the immediate future.

In addition to the amount of space devoted to highway services, it is important for interchange planning to know the preferred location of highway services relative to the interchange. Several studies have indicated that the most desired location for highway services is the first quadrant of an interchange on the right-hand side when leaving an urban area, apparently because service facilities can be reached without making left turns, even on a diamond interchange. The first quadrant on the right-hand side when approaching, rather than leaving, an urban center has also been found desirable (4, p. 13; 25).

The use of frontage roads has in some cases efficiently provided space for highway services, for example, in the Duluth area and in many areas in Texas. In some cases the frontage roads also serve as traffic reservoir areas and assist in alleviating traffic backup on exit ramps (26). A perennial problem with frontage roads is that they may magnify roadside control problems if they are used in nonurban areas where strict land-use controls are not available.

AN ANSWER FOR ALL INTERCHANGES

The bulk of the 14,000 Interstate interchanges will be in rural areas. In many of these rural interchange areas there is little land-use planning beyond crop rotation and, in fact, no agency or individual available to administer land-use planning legislation even if it were to be enacted.

Some thought has of course been given to what can be done to provide effective land-use control in the absence of land-use planning by local authorities. In some states (e. g., California and Florida), legislation has been provided for interchange districts on a limited basis. In a number of states, the state highway agency is relied on to help administer or police subdivision regulations, roadside zoning, driveway controls, or some similar land-use control measure. And more sweeping land-use control measures in rural interchange areas have been considered; for example, it has been proposed that existing land uses around interchanges be frozen by state action until an acceptable land-use plan is evolved, either by local or state action. The effect of such a freezing or fixing of existing land use would apparently be quite similar to the results of agricul-

tural zoning where this exists. Both approaches would probably dampen land development activity, as is intended.

An alternative plan would be to permit economic development in interchange areas until the time when traffic volumes on the feeder road and/or at the interchange approach design volumes. When this occurs, it seems reasonable to expect highway builders to take action to prevent further deterioration at the interchange. The problem is what action to take. In the past, the situation has sometimes been permitted to get out of hand to the point where the only solution has been to redesign the interchanges. A better approach would seem to be to limit development to what the highway facility can be expected to accommodate, perhaps by permitting no additional driveways onto feeder roads within a certain distance of the interchange.

This is obviously a modest approach. It would permit localities to misplan or ignore interchanges unless the land uses nearby threatened to overwhelm the interchange with traffic. The suggestion is not worthwhile as a substitute for more adequate plans already in existence or planned. It is intended only to replace the lack of any organized approach, a situation existing in many rural interchanges at the present time.

An advantage of acting to restrain development only at those rural interchanges where traffic congestion threatens is that it would concentrate land-planning effort to those interchanges where attention is needed. Many rural interchanges may never experience any appreciable development, and it seems unrealistic to expect that a land-use plan will be developed for each interchange. Although a land-use plan in sparsely populated rural areas might be quite simple, the effort that is available for guiding roadside development probably needs to be channeled to locations urgently needing guidance.

A serious disadvantage of such a hands-off type of approach at interchanges is that it may permit some rural interchanges to develop into honky-tonk, junkyard eyesores. Because of this, more effective land-use planning should be fostered wherever this is realistic. But if past experience is any guide, land-use planning can be expected to continue to lag behind highway construction.

For urban and suburban areas, nearly any combination of these land-use control devices can provide a satisfactory solution if they can be enforced. To guide interchange development in either urban, suburban, or rural areas, the big need appears to be for more specific information. Much of this information is of a type that local authorities have a right to expect from highway builders; for example, traffic-generating characteristics of certain land uses, design capacities of highway facilities, and compatible and incompatible land uses in interchange areas. Several states, through their interchange pamphlets or manuals, movies, speakers, and other media, have provided communities with at least some of the vital information regarding such factors as driveway spacing and service roads (Fig. 5). Undoubtedly, more specific information of this type would result in more effective local planning and land-use control.

Existing land-use controls can apparently also be made to function more efficiently if better cooperation could be achieved between interested agencies. For example, at a recent rezoning to permit construction of a 16-acre amusement park and swimming pool on a busy approach road to a major highway facility, only local residents and the amusement park builders appeared. Perhaps highway builders could assume more responsibility to see that heavy traffic-generating uses do not encroach on highway facilities. Another possibility for cooperative action exists with the Federal Housing Authority. At least in a few instances, the Federal Housing Authority can apparently help prevent development on future highway right-of-way by refusing to participate in the financing.

ADDITIONAL INFORMATION NEEDED

The interchange research completed so far has obviously not provided all the



Figure 5. Desirable type of setback (39).

answers needed to solve the interchange problem. In some cases, the approaches recommended in the various studies have differed. For example, the Georgia study favored land planning primarily at the local level contrasted with the approach recommended in most studies that important responsibility for land-use planning be lodged with a state agency. One conclusion on which there appears to be complete agreement is that more needs to be learned to solve the interchange problem. One of the more obvious overall gaps is the absence of criteria and guidelines needed to apply the various legal techniques available to reach the overall goal. At the present time, there appears to be general agreement concerning the ultimate goal—orderly, properly functioning interchanges. There is also a fairly satisfactory understanding of different land-use control measures available, e. g., zoning and redevelopment rights. But the principles of desirable land-use arrangements near interchanges are still not settled, at least not completely. It is almost as if the way to plan (the legal techniques) has been learned but what to plan (the desirable arrangement of land use) is still unknown. What appears to be urgently needed now is specific information about matters such as land uses suitable for interchange locations, which uses are good neighbors in an interchange setting, trip-generating characteristics of land uses near interchanges, space needs for highway services, and ways of putting into use what research has demonstrated to be good practice.

Trip-Generation Characteristics

Most studies of interchange development involve some attempt to determine whether traffic using the interchange will be able to be accommodated. Such an analysis requires fairly specific information about trip-generating characteristics of land uses served by the interchange, what the area is that is served by the interchange, and traffic capacity of the interchange. In the past, there have been problems in getting specific information on any of these three items, including traffic assignment data (8, 9). Information now available is still far from satisfactory. For example, there is general agreement that the interchange area should be the area of origin and destination for trips using the interchange. Although this concept is pure, it is unwieldy, and some zone based on experience of typical interchanges will probably need to be used. Trip-generation characteristics of different land uses near interchanges are becoming available, at least on a fragmentary basis. Thus, although there is little specific information available concerning the trip-generating characteristics of such highway user services as service stations, motels, and eating places, experience has shown that these uses rarely have a traffic-generating pattern that conflicts with the urban work trip. In at least one study, fewer vehicles turning into service stations caused interference to traffic than was the case for restaurants, motels, residential, commercial, 15 percent interference turns for service stations vs 24 percent interference turns for other uses surveyed (27). Some of the reasons for this are no doubt obvious, e. g., open spaces around service stations, or numerous service stations so that left turns and waiting to enter can ordinarily be avoided.

Some trip-generation information pertinent to interchange planning is also available for shopping centers. For example, regional shopping centers staying open in the evenings apparently have their peak traffic around 8:00 PM (28, 29), neighborhood shopping centers appear to have their peak loads earlier in the evening (30); shopping centers need to be a substantial distance from ramp ends and they should be placed where left turns can be avoided on the trip home from work (21, pp. 39-40). Figure 6 shows a shopping center located too close to a ramp exit. Vehicles must make right turns into the parking lot in front of traffic coming from the freeway ramp. The hazards would have been substantially reduced if access had been prohibited for 500 feet beyond the end of the ramp, rather than only 240 as it was. This situation is, of course, more dangerous on exit ramps than on entrance ramps.

The urban transportation studies now under way are likely to be a useful source for traffic-generation characteristics. For interchanges at varying distances from large urban centers, it seems important to have trip-generation information by density as well as by land use. Such information from urban studies in Chicago, Pittsburgh,



Figure 6. Example of inadequate access control on a crossroad beyond end of ramp.

Detroit and the Twin Cities is summarized in Figures 7 to 11 (38). Density, or distance from downtown appears to have a fairly noticeable effect on most of the uses classified. In addition to valuable trip-generation data, the experience which urban transportation studies are developing with comprehensive planning should be useful in dealing with interchange development problems generally, including interchange areas outside urban areas. In addition, experience being gained through the Urban Renewal Administration's "Workable Programs for Community Improvement" may prove helpful in solving interchange development problems (31).

For analyzing and anticipating land-development problems at interchanges, traffic-generation characteristics for nearby land uses obviously need to be supplemented with information about the amount of traffic which actually uses the interchange and information about the percentage of crossroad traffic on the feeder road making use of

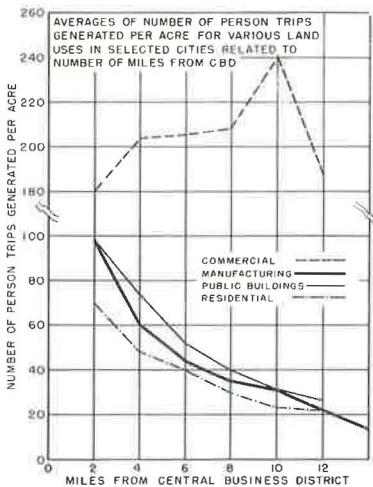


Figure 7. Averages of number of person trips generated per acre for various land uses in selected cities related to number of miles from CBD (38).

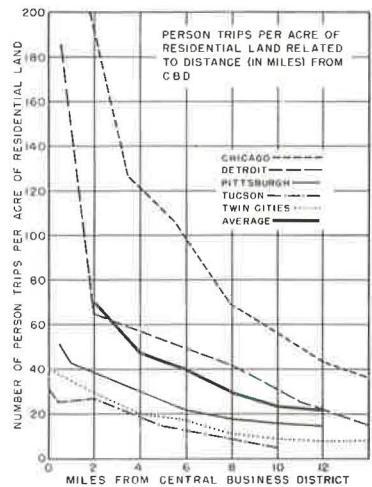


Figure 8. Person trips per acre of residential land related to distance (in miles) from CBD (38).

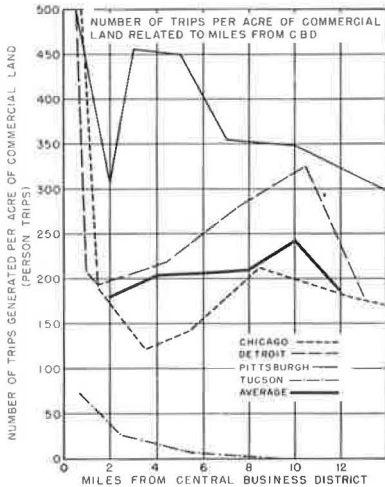


Figure 9. Number of trips per acre of commercial land related to miles from CBD (39).

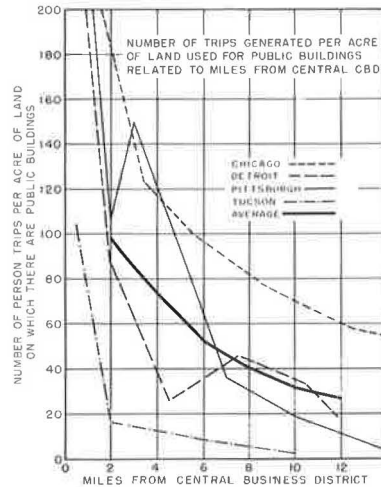


Figure 10. Average (excluding Tucson) person trips per acre of manufacturing related to miles CBD (38).

the interchange. This obviously can vary, for example, up to 100 percent if the feeder road deadends at the interchange (14, p. 47).

To spread the traffic burden at interchanges, a variety of land uses appears desirable. However, such a variety of land uses at interchange areas may create other problems, for example, the necessity for shoppers to travel some distance to reach similar type stores. This question resembles most of those referred to previously: it needs more research.

Compatible and Incompatible Uses

There is hope that many of the land-use problems arising at interchanges can be solved by excluding incompatible uses from the interchange area. The general principle of compatible and incompatible uses has, of course, been used before the time of the interchange problem. The application of this principle in interchange areas presents some problems and emphasizes the need for more research. At the present time, information available on compatible uses appears to be contradictory in some respects, no doubt because it is still incomplete.

It has long been axiomatic in city planning theory that like things belong together. For example, food wholesalers located together permit careful buyers to visit several establishments with a minimum of travel. Such highway-oriented establishments as service stations, restaurants, and motels are ordinarily regarded as compatible because they have common customers. Having such compatible uses near one another, preferably in the same quadrant of the interchange to obviate the need for crossing the interstate or the

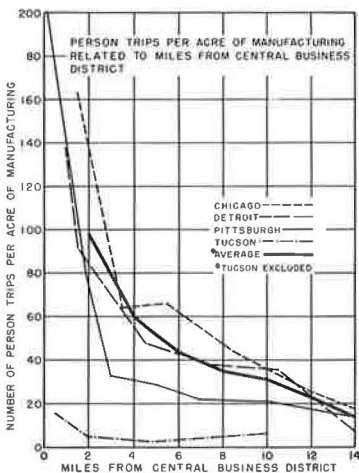


Figure 11. Number of trips generated per acre of land used for public buildings related to miles from Central CBD (39).

feeder road, seems reasonable as a goal and has been achieved in many locations.

The principle of grouping like or compatible uses together, however, may need to be applied to interchange areas with some restraint. For it is obvious that "a land use arrangement which has a variety of uses is superior to one which has segregation of uses; variety spreads the traffic burden while segregation concentrates it (32). For example, a factory and a machine shop may be compatible but their proximity to one another and to an interchange may aggravate traffic problems during the morning and evening peak traffic periods.

Research findings are already suggesting ways to reconcile these two principles, i. e., like uses are compatible but a variety of uses spreads the traffic burden. If different quadrants of an interchange are put to different uses, both principles can apparently be served. Thus, perhaps such low traffic generators as motels can be located in one quadrant and a factory, with heavy peak traffic loads, in another. Such an arrangement would not, however, accord with another concept receiving some attention at the present time, that some interchanges should specialize in highway services and others in community services.

A good deal of additional research is needed, however, to learn more about the conditions under which certain uses are compatible and incompatible. For example, the general belief that highway user service facilities are compatible may need to be revised. At one interchange, an overnight facility for horses traveling by trailer or truck has appeared. Although this is apparently a highway-oriented business, it is probably incompatible with such highway-oriented businesses as motels and restaurants. Also complicating the concept that highway-oriented businesses are compatible are the motels serving as community and convention centers as well as tourist stops. The traffic-generating characteristics of such motels no doubt differ from those of motels catering only to highway travelers.

The concept of compatibility can also be applied to compatibility between the interchange and certain types of use. Perhaps what needs to be kept in mind is that some establishments appearing at interchange locations do not need to be there and in fact may be harmful to the interchange or may be harmed by it. For example, auto junkyards, though low traffic generators, should probably be kept away from interchanges for obvious reasons. For different reasons, such uses as schools and churches may find interchange locations less desirable than others, for example, a location along a limited-access highway between interchanges with access away from the highway or by means of a frontage road. Such a location would permit the institution to realize the benefit of being on display along a modern highway, of having an easily remembered address (e. g., near a certain interchange or exit number), and of being easily accessible to neighborhood walkers. It seems fairly obvious that considerable additional experience and research are needed to learn just which uses are compatible with one another and with the highway.

Space Needs Near Interchanges

Additional research is also needed to learn whether the need for user services or other vital needs are being satisfactorily anticipated. There is general agreement that space for user services should have priority and that other uses, such as residential, should not preempt space that may be needed for highway services. So far, because of the aggressiveness of oil companies in acquiring building sites, there appears to be little if any danger of a shortage of space for service stations.

But the need for space for other highway services is not receiving adequate attention. For example, off-street parking at strategic locations near interchanges for assembling in car pools is becoming fairly common in outer suburban areas of large cities and this need should be recognized and met. At present, haphazard parking along sides of feeder roads, for example, has several bad effects: snow removal and maintenance are impeded, landscaping may be damaged, capacity may be reduced on the crossroad, and drivers' sight distances may be reduced so that the accident potential is increased. Little specific information is available on this problem. One study indicates (a) that interchanges where such parking occurs need space for about

5 to 10 cars; (b) that such parkers typically travel 30 miles to work, one-fourth of it before reaching the interchange; and (c) that the average carpool assembling at such interchanges contains 3.5 members (33). The wisdom of alleviating downtown traffic problems by encouraging such carpooling seems obvious.

Additional research effort is needed to learn generally what the future space requirements will be for such highway user services as motels and service stations. The use of traffic forecasts to estimate space needs for these highway user services needs testing. Such relatively minor problems as parking to rendezvous in carpools need to be studied to learn how this need can be anticipated, for example, by considering population densities and social and economic characteristics. Information about workable solutions to the problem should also be gathered and analyzed. For example, a few shopping centers now apparently welcome all-day parkers. This solution, though not applicable for interchanges in outer suburban areas where no shopping center parking may be available, seems promising, since commuter parking normally ends between 5 or 6 PM, before peak shopping center parking around 6 to 8 PM.

Techniques to Implement Interchange Planning

There appears to be some impatience with local government for failing to provide adequately for orderly development in interchange areas. But local officials cannot always be ready to supervise development suddenly brought into being by highway construction. Furthermore, the facts a local government needs to deal effectively with some of the land-use problems in interchange areas often can come only from a sophisticated regional planning operation, from urban transportation studies, or from a state highway agency.

There are, however, situations where enough is known to make it fairly clear that local land-use control would be desirable. A few of the incentives used to encourage local government to act have included: (a) state grants to localities to cover costs of administering land-use controls; (b) state highway improvements conditioned on the existence of an acceptable local land-use plan; and (c) tax relief for developers using good design, when good design can be agreed on (34).

As suggested earlier, one of the best ways to encourage local land-use planning is to provide the information and technical assistance necessary. It will no doubt also be worthwhile to illustrate and make explicit from time to time general truths about transportation and land-use relationships; for example, (a) highways sustain land values only so long as there is a reasonable balance between the capacity of the highway and the uses to which the land is being put (35) or (b) good aesthetics is good economics. Studies in Pennsylvania and Texas especially have emphasized the close relationship existing between good aesthetics and good economics, the fact that unsightly interchanges are likely to suffer in competing for the tourist trade with well-planned interchanges. In a study near Dallas, the close relationship between the high development standards and the sound economic development in one town (Richardson) was demonstrated convincingly, especially when the results were compared with other nearby towns with lower development standards (36).

Need to Quantify Data

Some of the information which has emerged from interchange research has been presented in numerical form. Such quantification, though it may have limitations, permits comparison between study findings in different locations and ultimately should facilitate certain administrative decisions. The attempt, for example, that has been made to compare redevelopment costs with the cost of acquisition in fee could obviously be useful in making a decision as to which approach to use (17, p. 37). In another analysis, the cost of not having some such device as roadside zoning was reduced to a numerical value by taking the \$0.05 of each highway dollar spent to remove structures from highway right-of-way and applying this to the \$500,000 being spent to modernize the system over a 20-year period. The resulting \$25,000 could be regarded as the cost of not having some type of land-use control to prevent structures from being erected on land to be used for highway right-of-way. Other useful types

of quantification of aspects of the interchange problem include the data on rezonings presented by Horwood and his colleagues, data which Adkins and Pendleton and others have presented on annual percentage changes of land use in interchange areas (8, p. 4-17; 37), and information associating development trends for certain areas with the number of new driveways (2, p. 70).

A Study Approach Needed

One of the useful findings from interchange studies completed so far is a fuller realization of just how complex the interchange problem is. In at least one study, the general hypothesis that there tend to be problems in interchange areas not subject to public control of land planning was not proved (8, p. 20). As noted, there are a number of instances where interchanges without land-use controls have developed with no significant traffic congestion and other interchanges with land-use controls available which have become land development and traffic problems. What is apparently needed is a case study approach, a study in depth. This will permit delineation of the area of origin and destination for the traffic using the interchange. It would help explain the extent to which land uses a considerable distance from the interchange may generate traffic which makes use of the interchange (e.g., hospitals).

Studies in the detail necessary to understand all aspects of the interchange area will apparently require considerable research effort. To assist in selecting interchange areas for studies in depth, use can be made of large-scale approaches, that is, those involving a large number of interchanges, such as aerial surveys, mailed questionnaire surveys, or land-use inventories made while driving through an interchange. Broad-scale studies of this type can also be useful in gathering information on secondary but important aspects of the interchange problem including (a) optimum distances for controlling access along the feeder road; (b) whether orderly development and a sound tax base tend to be associated with adequate land-use controls; (c) whether interchange areas tend to become specialized, for example, with tourist services, or community services; (d) how well such needs as commuter parking and highway services are being met; and (e) which interchanges are developing rapidly and are perhaps in special need of land-use planning.

SUMMARY

Interchanges present the locality in which they are located with both an opportunity and a potential problem. The economic activity which may be attracted to the interchange area can be beneficial if it develops in an orderly way. But the development may be a source of problems if it is not planned.

The interchange studies completed so far have been useful in the following ways.

1. They have focused attention on land development matters in interchange areas.
2. They have provided a priority system so that planning effort can be directed first to interchanges of critical need.
3. They have shown how complex the interchange problem is, for example, because of traffic generated in areas remote from the interchange.
4. They have analyzed land-use controls pertinent to the problem and have even suggested such new methods as licenses on a need-to-be-there basis and criteria for maximum amounts of traffic that will be permitted from certain establishments.
5. They have evaluated the effectiveness of different land-use controls in interchange areas, suggesting that eminent domain techniques are more promising than the police power.
6. They have provided guidelines for determining space availability and space needs for highway services and other uses at interchanges.

One of the shortcomings of some interchange studies completed in the past is the failure to consider what can be done in the absence of land-use planning in the interchange area. For interchange areas unprotected by local land-use planning, it seems reasonable to freeze any future development near an interchange when traffic capacities of the interchange ramps threaten to be exceeded. Such a provision could be

enforced in a number of different ways, for example, by permitting no additional drive-ways onto the feeder road near the interchange when traffic volumes approach capacity.

Additional information urgently needed includes the following:

1. Amounts and types of traffic generated by different land uses near interchanges;
2. Amount of interchange space needed for service stations, motels, and other uses;
3. Which uses are compatible and which are incompatible;
4. Whether it is good practice, as is supposed, to have similar uses, such as highway service facilities, in one quadrant of an interchange and a different use, such as industrial, in another quadrant;
5. Whether well-planned, pleasant-appearing interchanges do in fact have a better economic future than poorly planned interchanges; and
6. Whether more attention should be given to such highway needs as rest areas and signs indicating highway services.

To obtain the necessary information for interchange areas, studies in depth and of broad coverage are needed. Surveys involving a fairly large number of interchanges should be helpful in selecting interchanges for a suitable analysis in depth and would also provide information about such aspects of the problem as driveway openings near interchange ramps, and highway service facilities. As far as possible, research findings should be quantified; for example, given in percentage changes of land development, lineal feet or square feet needed for highway services, cost of controls through eminent domain procedures, or percentage of zoning appeals granted.

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Appendix

INTERCHANGE AND LAND-USE CONTROL STUDIES

Completed November 1964

Georgia.—The Georgia Institute of Technology, in cooperation with the Georgia State Highway Department and the U. S. Bureau of Public Roads, has completed a study entitled "Land Use Planning and Control on the Interstate System in Georgia." This study establishes a priority system for counties according to the need which counties have for land-use planning. Priority 1 consists of those counties without a planning commission but with an Interstate highway completed or due to be completed soon.

Illinois.—Barton-Aschman Associates, in cooperation with the Illinois Division of Highways, has prepared a study "Highways and Land Use Relationships in Interchange Areas," including supplementary reports. This study reviews pertinent interchange analysis and makes recommendations involving land-use control, design, and location matters. For land-use control, state action is recommended only when the community has "defaulted" in providing control of development in the interchange area. The study found that only 15 of 51 Interstate counties had zoning controls and that 25 percent of the 200 interchanges in Illinois have existing or potential traffic problems.

Kansas.—The League of Kansas Municipalities, in cooperation with the Kansas State Highway Commission and the U. S. Bureau of Public Roads, has completed a study of land-use and planning controls entitled "Planning Tools—Theory, Law, and Practice." This is a study of the theory and application of land-use and planning controls available to local governing units for developing safe and efficient streets and highways in Kansas.

Michigan.—The Michigan State Highway Department has prepared a report, "Interchange Development Along 180 Miles of I-94" which analyzes the development occurring near 66 interchanges within 3½ year after the freeway opened. In general, the report suggests that the experience of motels and service stations near interchanges justified the high prices paid for sites near interchanges.

Minnesota.—"Highways—Opportunities and Land Use Controls, A Case Study in Duluth" is a study prepared by the Duluth Department of Research and Planning in cooperation with the Minnesota Highway Department and U. S. Bureau of Public Roads. This study investigates the possibilities for coordinating highway planning and local land-use planning. The study recommends locations for interchanges, frontage roads and service facilities (e. g., service stations and motels). It also provides guidelines for determining space needed for highway services and describes types of land-use controls that might be appropriate in interchange areas.

Mississippi.—The University of Mississippi, in cooperation with the Mississippi State Highway Department and the U. S. Bureau of Public Roads, has completed a report entitled "A Planned Interchange in a Residential Area—Some Interim Influences." This report examines the influence which a planned (but uncompleted) freeway and a full cloverleaf interchange have on residential property values.

Pennsylvania.—Pennsylvania State University, in cooperation with the Pennsylvania State Department of Highways and the U. S. Bureau of Public Roads, has completed a study entitled "Planned versus Unregulated Development in a Suburban Community—A Case Study." This study reviews the problems that arise in the absence of effective planning in a community experiencing rapid growth and describes policies and programs that local government can utilize to solve growth problems related to highway development.

Tennessee.—The Tennessee State Planning Commission, in cooperation with the Housing and Home Finance Agency, has completed a report entitled "Highway Access Areas in Tennessee," a study of problems and suggestions to plan and guide land developments at interchanges by (a) new legislation to aid local governments within existing planning jurisdictions, and (b) a cooperative program for the State to initiate and local government to assume responsibility outside of existing planning jurisdictions.

Texas.—The Texas Transportation Institute, in cooperation with the U. S. Bureau of Public Roads, has completed a report entitled "Studies of Land Development at Interchanges." This report recommends that case studies in depth should be conducted using interchange areas where the land-use problem has definitely been demonstrated.

Virginia. —The Virginia Council of Highway Investigation and Research, in cooperation with the Virginia Highway Department and the U.S. Bureau of Public Roads, has completed Progress Report No. 4 of "A Study of the Economic Effects of the Emporia Interchange, Bypass and Business Loop." This study analyzes the economic effects on business, land value, and land use in the general area of the aforementioned facilities. A further report completed, "Economic Problems Emerging as a Result of Interchange Patterns on the Interstate Highway System of Virginia," describes the need for considering nonuser effects in justifying highway improvements, for example, at an interchange. This report also presents a model and a problem solution intended to show the relationship between interchange capacity, land-use development, land-use control devices, and construction and maintenance costs. For purposes of the problem solution, values are assigned rather than being based on experience.

Washington. —The University of Washington, Transportation Research Group of the Graduate School, in cooperation with the U.S. Bureau of Public Roads, has completed five volumes, Research Reports Nos. 21 through 25, in the general area of "A Study of Land Development Problems at Freeway Interchanges." The purpose of this study is to identify the land uses competing for sites in approach areas and areas adjacent to highway interchanges, the congestion and traffic-generating characteristics of such land use, the adequacy of present controls, and future needs at freeway approaches and highway interchange areas.

Wisconsin. —The University of Wisconsin, in cooperation with the Wisconsin State Highway Commission and the U.S. Bureau of Public Roads, has completed a report entitled "A Study and Evaluation of Local Highway Planning in Wisconsin." This study recommends changes in administrative practices and in the scope, detail, and technical content of both state and local long-range highway system plans. The key is provided in this report to integrating land-use and transportation planning in Wisconsin's rapidly expanding urban areas.

The Wisconsin Department of Resource Development has completed a study entitled "The Protection and Development of Interchanges on Wisconsin's State Highway System." The findings of this study indicate that the Interstate problem should be dealt with in the context of a comprehensive plan based on economic, population, land-use, and other data, the principal elements of which are land, transportation, and public facilities and services plans.

Nationwide. —A number of state highway departments and planning agencies have issued pamphlets or manuals intended to facilitate land-use planning at interchange areas. For example, Pennsylvania has issued "A Manual for Interchange Area Development Planning," and a pamphlet entitled "A New Front Door for Your Community." Michigan has issued a pamphlet, "The New Four Corners—Interchange Areas," and Ohio has issued a pamphlet, "Interchange Area Development." These deal with such matters as desirable driveway spacing, recommended setbacks, and the close relationship between good aesthetics and good economics. These, as well as a movie on land use at interchanges produced in Michigan, suggest to communities ways to use interchanges for economic betterment.

In Progress November 1964

Maryland. —Maryland is beginning a freeway interchange control study to determine and recommend an action program to be undertaken by the State Roads Commission in cooperation with local governments: (a) to preserve and improve the capacity and safety of the major highways interchanging with the Baltimore Beltway and other existing freeways, (b) to establish design and land-use standards and policies for development of adjoining access highways for other freeways in Maryland, and (c) to evaluate the combined needs for coordinated highway and land-development design standards, in the interest of highway safety and efficiency, as well as of optimum land development in the vicinity of major highway routes.

Mississippi. —Mississippi is conducting a study entitled "Control of Development of Interchanges." The study will investigate the best methods of controlling development at interchanges in Mississippi's urban and rural areas to plan those interchanges in a

way that will minimize the effect of business and residential interference with efficient traffic flow.

Nebraska. —The Nebraska Department of Roads is in the process of collecting data on land-use changes along I-80 between Lincoln and Omaha and preparing a study on land use near interchanges.

Oklahoma. —The University of Oklahoma Center of Urban and Regional Studies, in cooperation with the Oklahoma State Highway Department, is conducting a study of land-use patterns that now exist in the vicinity of highway and expressway interchanges at selected locations in urban and rural areas in Oklahoma. The purpose of Oklahoma's "Highway Interchange and Land Use Study" is to determine how interchange location affects land use and how different land-use patterns influence the capacity of the interchange.

Pennsylvania. —The Pennsylvania State University, in cooperation with the Pennsylvania State Department of Highways, is conducting a study entitled "The Impact of Highway Improvement on Land Use, Business Enterprise, and Community Development in Selected Areas of Pennsylvania." This study includes procedures for planning and predicting growth at interchange locations, for estimating quantitative measures of the extent to which growth can be explained, and for determining how social deterrents to planning and zoning activities can be overcome. A research model is now being assembled, processed, and analyzed for use in arriving at an optimum developmental plan. The study will also include an analysis of community receptivity to planning and zoning in 20 or 25 interchange communities along major expressways.

Utah. —Utah is conducting a highway interchange and land-use control study entitled "Land Use Adjacent to Interchanges."

Vermont. —Vermont is conducting a study entitled "Interchange and Land Use" which includes a study of interchanges on I-89 and I-91.

Washington. —The Washington Department of Highways is making an inventory of interchanges for certain highway-oriented business. It is expected that the study will cover businesses within 1 mile of interchanges.

West Virginia. —The University of West Virginia, in cooperation with the West Virginia State Road Commission, is conducting a study on "Land Use and Planning Controls in West Virginia" to improve and modernize standards, practices, and procedures for land-use and planning control.