

# Highway Bypasses, Natural Barriers and Community Growth in Michigan

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● ACCELERATED highway construction activity around the country has spurred increased interest in the economic and social impacts of highway improvement. One area of interest which has undergone extensive investigation is the economic impacts of bypasses on business activity in bypassed communities. A sizeable body of evidence has been developed supporting the premise that business activity in such a community will generally not be adversely affected. This is a logical conclusion, and is consistent with present theories of community function. However, business activity is only one economic area, and bypasses have effects on other parts of the community economic structure. Many of these effects are equally important, although they are more difficult to measure. One such impact is the economic use of land as a result of the physical expansion of a community.

There is a current design cliché often used as a motto, "form follows function." It also applies to the physical form or patterns of a community. But as an artist or designer is limited to the forms attainable with his materials, so is a community limited by its physical and economic environment.

Numerous geographers and economists have developed economic models of community growth or design based on strict assumptions. Von Thünen (1) and Burgess et al. (2) worked with concentric zones of development although in different times and within distinctly different frameworks. Star patterns based on transportation were introduced as modifications of concentric patterns affected by differences in transportation. Other variations in form are the result of variations in terrain and the occurrence of other physical elements such as rivers and lakes.

Such physical barriers are important, and the frictions or obstacles they present modify simple models of form. Natural physical barriers are not the only barriers to community growth; constructed physical units may have many barrier-like qualities. Railroad rights-of-way and marshalling yards are examples. Highways, too, may act as physical barriers to growth, particularly for a small community because a small community is basically one operating unit. This does not imply that growth will be retarded in total, but that growth in a particular direction may be stymied.

If a bypass is constructed around a small community, a new and important physical element is introduced into the community's environment. If a relocated highway bypassing a community formerly traversed it, the relationship between the community and the highway is significantly altered.

The coincidence of natural physical barriers to growth and a highway bypass in the complex of a small community implies problems for the town; the observation of such instances provides useful insights into the problems.

## METHODOLOGY AND SOURCES OF INFORMATION

An enumeration was made of small (that is, population under 3,000) communities in southern Michigan covered by geological survey information. Communities were rated as (a) having natural physical barriers to growth, (b) not having natural physical

barriers to growth, or (c) not having an important natural physical barrier to growth. The purpose of this approach was to isolate the effects of barriers and to evaluate the importance of community size as a mitigating factor. Where barriers are listed as "not important", the two following general classifications were developed: (a) the barrier was too small to be important or (b) the barrier has been crossed and development has occurred on the opposite side. Estimates of the presence or absence of barriers involved judgments based on the survey map's physical information and the growth patterns shown by cultural symbols. From this information an estimate was made of the importance and extent of natural physical barriers to community growth.

The interaction of highway bypasses and natural physical barriers is illustrated by reference to two small communities in Shiawassee County in south central Michigan. The discussion of the community growth of the two cases studies is based on geological survey data, agricultural land use determined by field survey, sequential community growth patterns as determined by field studies, and interpretation of aerial photographs.

### EXTENT AND NATURE OF PHYSICAL BARRIERS IN MICHIGAN

The most common physical barriers in Michigan are lakes, river valleys, flood plains, swamps or marshes, and large areas of organic soil. Extreme slopes are also barriers, but are relatively less common. Mine tailings are quasi-natural barriers found primarily in the upper peninsula. But other associated pits commonly left by gravel quarries, limestone quarries, and strip mines are found scattered around the state. Rock outcroppings are relatively scarce. Areas of poorly-drained heavy soils are found in some areas of the southern peninsula.

The importance of barriers stems from two basic problems which are presented by them. The first problem is difficult or costly construction. This is true of extreme slopes, mine tailings, rock outcroppings, and swamps or marshes. Organic soils or poorly-drained heavy inorganic soils present problems in construction, as well as the additional problems of difficulty in disposing of septic effluent and providing a supply of safe water for domestic use.

The second major problem is one of physical or spatial isolation if development hurdles a barrier. River valleys, flood plains, marshes, lakes, and railroad rights-of-way all may be crossed and development can take place, but this development is spatially separated from the original growth.

It was possible to determine whether or not there were natural physical barriers to growth for 218 southern Michigan communities with population less than 3,000. Of the 218 communities, 123 were considered to have natural physical barriers to growth around them. In 31 cases it was determined that natural physical barriers were not important; that is, either they had been crossed (mainly by larger communities) or they were too small to be significant.

Of the 218 communities studied, 145 were located on a state or U.S. highway. Eighty-seven of these 145 communities were considered to have natural physical barriers to growth around them. Barriers were too small to be significant or had been crossed by 22 of the communities studied.

One significant point is that of the 123 communities having natural barriers all but five had barriers of water or were water-associated; for example, flood plains, river valleys, lakes or marshes.

The frequency of water or water-connected barriers is not surprising. Most of Michigan has interrupted drainage patterns due to glacial action, and streams, lakes, flood plains, swamps, and marshes are common. If communities were dropped at random in Michigan, we would probably expect one-half of them to land where water would in some way be a barrier to their growth. Inasmuch as Michigan communities were not dropped at random, of course, but to some degree purposefully located, their location near or on water is even less surprising.

The early importance of water as a means of transportation determined the location of many early settlements on streams that were more or less navigable. Prime locations were portages, fords, or river junctions. Another early use of water was for

motive power for sawmills and gristmills. Locations were thus selected also on smaller streams, and the conditions necessary for developing a mill race and a pond usually meant that natural physical barriers would be present.

How important the nature of physical barriers can be to community growth when decisions are made to locate bypasses can be discerned in Figure 1. The St. Joseph River has proved to be a definite barrier to Mendon's southward growth. Highway M-60 now goes through Mendon, constantly staying north of the St. Joseph River, and its wide valley and flood plain. If one were to plan a bypass around Mendon for M-60, it would be reasonable to assume that the bypass would lie north of the town. The St. Joseph River would be a handicap for highway construction as well as a barrier for the community's growth. This is an important point; in almost every situation where a bypass and natural barriers are found the bypass and the natural barrier will be on

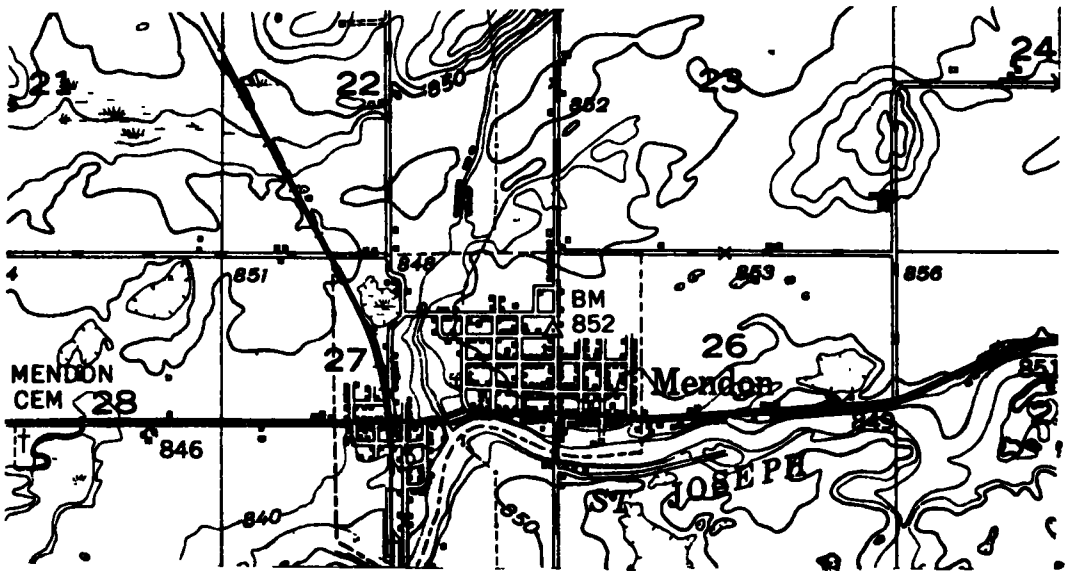


Figure 1. Village of Mendon, St. Joseph County, Mich.

opposite sides of the community. Constriction to some degree is almost a foregone conclusion. In the case of Mendon what type of growth could one expect?

If the highway were a controlled-access facility, Mendon would have two physical barriers to overcome. If the facility provided free access, development would eventually take place along the bypass and local traffic, turning movements, agitation for speed controls and traffic signals would soon negate many of the advantages provided to motorists by a bypass.

Growth also might, in either case, be forced across the St. Joseph River; this would increase the cost of community services and interrupt the continuity of community growth.

Effects such as these are not merely hypothetical. They are observable, tangible effects. Examples can be found and as more bypasses are completed, additional cases, unfortunately, will occur. Two such illustrations were found in central Michigan where sufficient time had passed since the construction of bypasses to allow a valid assessment of the effects of constriction between a bypass and a natural barrier.

## TWO CASE STUDIES IN COMMUNITY GROWTH

Perry

The village of Perry is located in southwestern Shiawassee County, 25 mi northeast of Lansing, and 12 mi south of Owosso. The original location of the community was at the intersection of the Grand Trunk and Western Railroad and State Highway 47, an old state road first surveyed and constructed in the 1860's.

As a functioning rural service center, Perry has been active, and until the 1940's maintained stockyards adjacent to the railroad right-of-way. In the late 1800's and early 1900's, two small industries employing some home labor were located in the community, but the concentration of economic activity in larger population centers led to their decline and finally their demise.

Perry is now within driving distance of Lansing and is slowly becoming more of a satellite community than a rural service center. Much of village life remains, however, and many area residents work in service industries supplying the surrounding agricultural area.

Most of Perry's residential area as well as its commercial center lies south of the Grand Trunk railroad. Because growth here, however, is limited by heavy soils to the south and east, a second development area began north of the railroad.

In the mid 1930's, highway M-78 was constructed connecting Lansing and Flint to provide a good road link between these two industrial centers previously reached only by circuitous routes. This highway bypassed Perry as it did the other small communities between Lansing and Flint, with the exception of Swartz Creek.

The highway bypassed Perry to the north,  $\frac{1}{4}$  mi from the northern fringe, and only slightly over  $\frac{1}{2}$  mi from the commercial area. The original facility was a two-lane highway and one which carried a substantial amount of commercial traffic between Lansing and Owosso, Saginaw and Lansing, Lansing and Flint, and Lansing and Port Huron.

At the present time, only three businesses are located at the junction of M-47 and M-78, known locally as "Perry Corners." These three are of types normally considered attracted to transient trade, a restaurant, a tavern, and a restaurant-gasoline combination. As can be seen in Figure 2, only a few residences have been constructed directly fronting on M-78. Heavy traffic probably acted as a deterrent as did separation from the pulse of community activity. Some development has occurred across M-78, but in numbers this is small. Also being very recent, it probably reflects satellite development from Lansing and possibly should be disassociated from the community's trends.

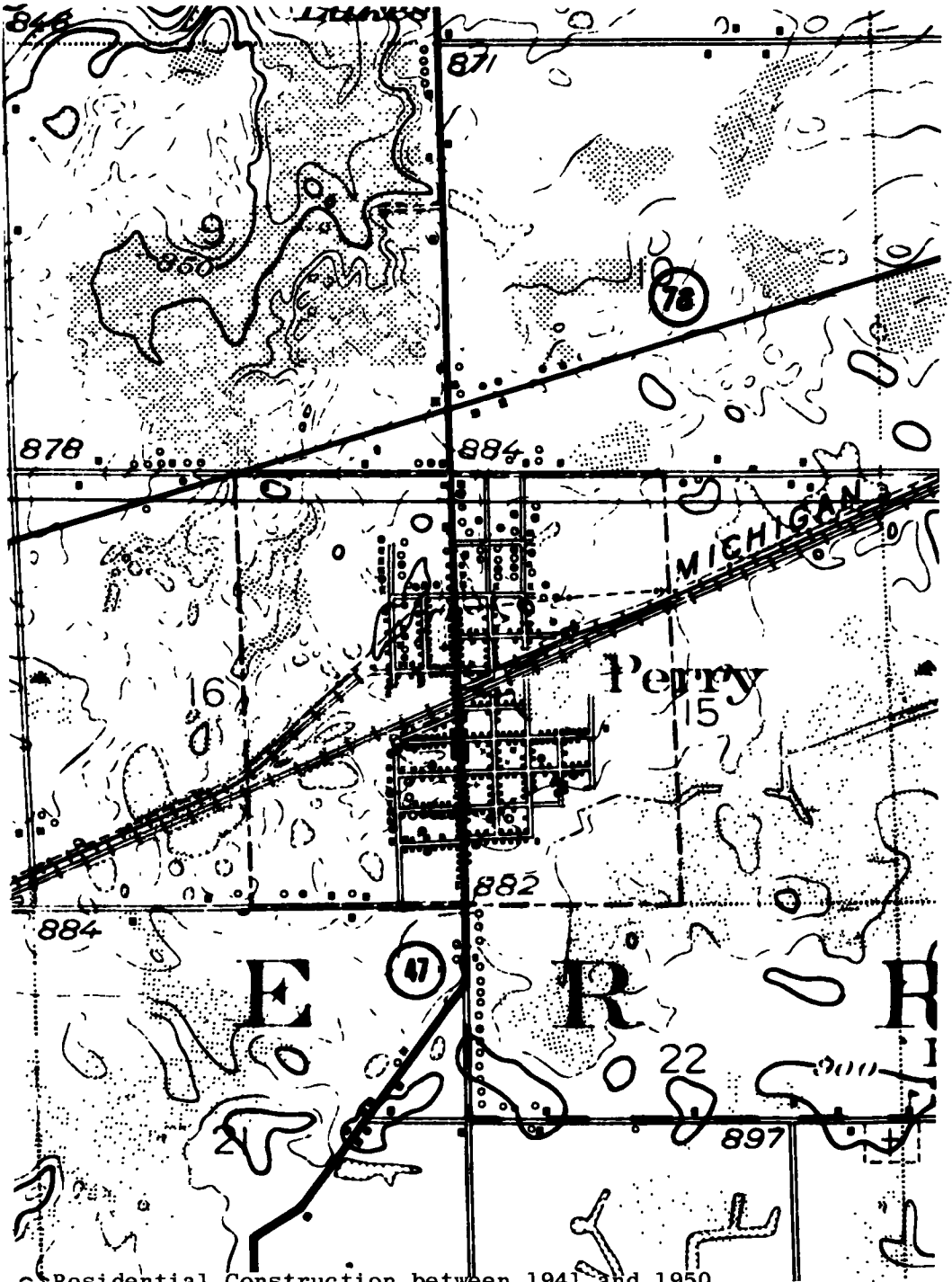
Basically Perry has continued to expand within its central area. Recently, however, the limiting conditions placed by nature around Perry's core have become actively important, and growth in the last three years has been restricted to the following alternatives: (a) locate on M-78, (b) locate across M-78, or (c) locate south of Perry across a belt of organic soil.

The choice apparently was to move south across the organic soil. Development here is separated from the community, but not as much as if it were on M-78 or across M-78. Some development fronts on M-47, but M-47 south of Perry is lightly traveled.

Development in this area is potentially limited due to soil conditions making construction difficult at any distance from the road. Also, interior land is being isolated by frontage development, making its future use difficult. Future development must be moved farther away from Perry, and the incomplete road system in the area will hinder other than further fragmentation and decentralization.

Growth concentrated in any one area would tend to be more orderly and efficient in the use of available land. Plats would be larger and would make use of interior lands also, instead of highway frontage alone.

Future service costs for the area will also be higher than for more compact and coordinated development. Visiting patterns and other social aspects of the community may also be disrupted and change (not necessarily equated with good) may prematurely come to the community.



- Residential Construction between 1941 and 1950
- Residential Construction between 1951 and 1958

Figure 2. Residential growth, Village of Perry, 1941-58. Shaded area indicates agricultural land removed from crop production due to physical limitations.

Decentralized and disorganized growth in many directions probably would not have occurred if the area north of Perry pre-empted by M-78 had been available for community development. Note the growth in the area south of the east-west road below M-78. It is reasonable to expect that expansion would have continued north with interior lands adjacent to the intersection being developed.

A real problem has developed for Perry because of constriction between a state highway and a series of extensive natural physical barriers. Movement of the highway further north when originally constructed would probably have aided both the town and the highway. The community's growth would have been more compact and orderly and less development would have occurred on the highway, decreasing turning movements and entrances and exits at slow speeds onto and from residential drives.

The problem is not that easily resolved, however, for in this case there are some difficulties involved in moving M-78 much further north, particularly west of M-47. These topographic problems mean, of course, increased cost. A policy problem now arises. What is more important, presenting the description of orderly community growth or preventing increased cost of construction? Increased costs of construction may at least be estimated. The social and economic costs of disorderly community growth, fringe disintegration, and the cost of reduced highway efficiency due to forced frontage residential development is another matter.

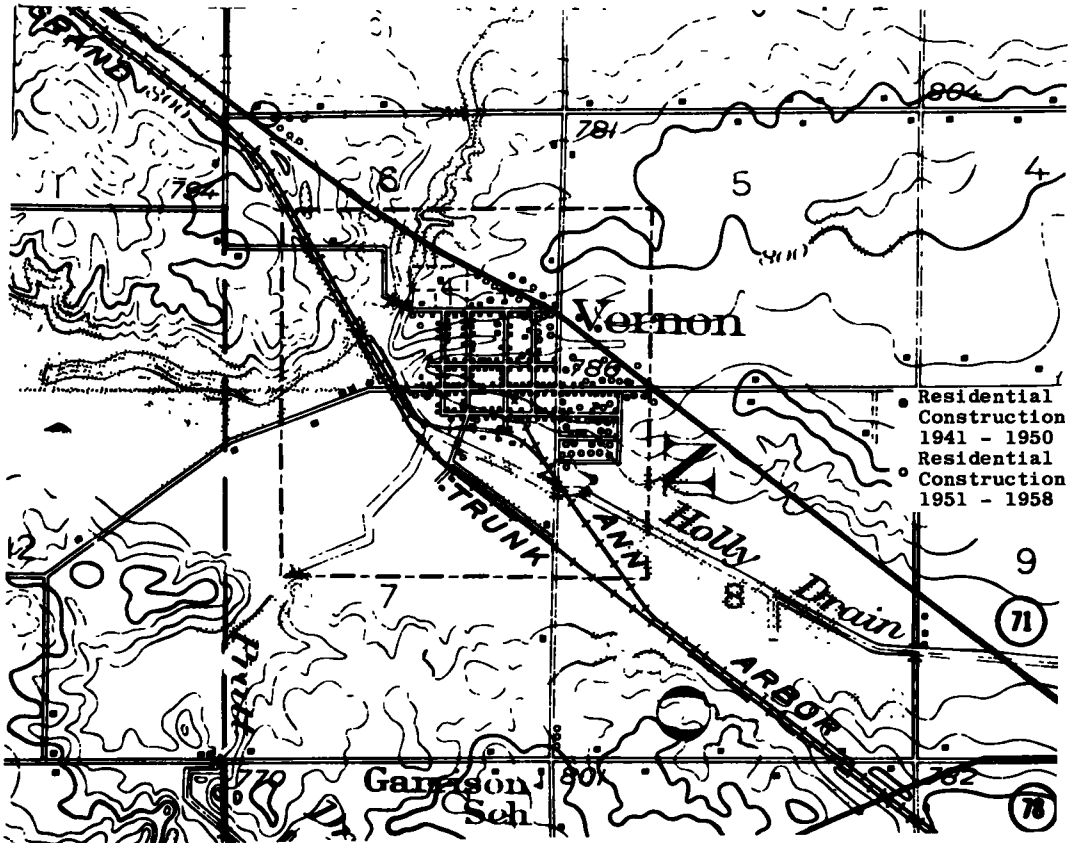


Figure 3. Residential development, Village of Vernon, 1941-58. Shaded area indicates agricultural land removed from crop production due to physical limitations.

## Vernon

Vernon is located in eastern Shiawassee County between Owosso and Durand. A small rural service center, Vernon is located in a good agricultural area, and the community has enjoyed a steady growth.

In the middle thirties in conjunction with the construction of M-78, M-71 was constructed connecting M-78 west of Durand with M-21 and M-47 at Owosso. When this route was constructed, Vernon was bypassed to the northeast, and as is evident in Figure 3 the route passed very close to the fringe of Vernon's growth.

From the growth pattern (Fig. 3) it is evident that growth from Vernon has spilled onto frontage property abutting M-71. The reasons for this are fairly obvious.

As indicated in Figure 3, the Shiawassee River Valley and flood plain, tight contour, and railroad rights-of-way severely hinder growth to the west and northwest. Holly Drain, the railroads, and an extensive belt of heavy soils deter southward growth. After the available land suitable for development within the bounds of these barriers is used, only the northeast is left for growth.

As shown, a high proportion of recent development is on or across M-71. In 1957 the daily average twenty-four hour traffic flow on M-71 was between 3,600 to 3,800 vehicles department estimates according to Michigan State Highway. It would seem a safe assumption that development on the highway at this point has not increased the efficiency of the bypass. Further, there has been agitation for speed limits in this area and for a traffic signal at the intersection on M-71 and Vernon's main street. Future development in the area can reasonably be expected to intensify this need, and to further reduce the efficiency of traffic flow in this area.

In all probability, this difficulty could have been avoided by selecting a route skirting Vernon at a greater distance than that at which M-71 presently does. This need not be, as it is in this case, a matter of hindsight. Growth could feasibly take place in only one direction, and if this fact had been considered in the 1930's, the present situation in all probability would be much different.

A further factor which will influence Vernon's growth is the relocation of M-78, due to be constructed as a controlled access highway. The new route will be located north of the present M-78 and logically will be south of Vernon and the Shiawassee River. This will reinforce the factors causing north-eastward expansion.

## SUMMARY AND CONCLUSIONS

In the portion of southern Michigan covered by the study, natural physical barriers to community growth were found to be widely distributed and significant determinants of community growth patterns. Over 56 percent of the small communities studied were considered to have natural physical barriers adjacent to them. Of the communities on state or U.S. highways, 60 percent had natural physical barriers. Water and/or a water associated form constituted 96 percent of the natural barriers to growth.

The difficulty of bridging such barriers and the barrier-like effects of bypasses upon small communities indicated a need for careful selection of bypass routes. If communities are to grow in an orderly manner and not obviate the advantages of highway bypasses, bypass routes should be located at a considerable distance from the core of a community's primary growth. This is necessary since development on a bypass may be more easily accomplished than the crossing of most natural barriers.

It was determined that most small communities bridge natural barriers when their population has exceeded 1,200 depending on the extent of the natural barrier. This crossing or bridging apparently can be traced to two causes. They are the following: (1) In this population range, the community normally splits into two or more neighborhoods which downgrades the importance of spatial contiguity in the selection of building sites, and (2) Directional growth away from a physical barrier will become extensive enough that building sites at the fringe or across a natural barrier are equally isolated from the primary focus of the community, and an indifference point is reached with respect to the two locations.

Some evidence of (the size necessary for bridging barriers) can be gained from an examination of the data concerning barriers which were considered to be important.

In seventeen cases, this classification was selected since community growth had bridged the barrier and continued on the other side. In only two instances had barriers been bridged by communities of less than 1,000 population. In three cases, the communities had between 1,000 and 1,200 population. It is, of course, impossible to pinpoint exactly when these barriers were crossed or bridged; however, the preponderance of communities with population less than 1,200 have not bridged natural barriers. And since the majority of communities having bridged natural barriers are larger than 1,200, it seems reasonable to infer that the break normally would occur when the population has reached a number between 1,200 and 2,000.

The need for bridging varies, of course; the physical conditions vary considerably and thus one would expect considerable individual variability.

Although barriers are common, their effects in conjunction with bypasses should be considered, only if a community is growing steadily. Particularly is this true if the effective life of a non-controlled access bypass is of concern.

Some small communities in Michigan are growing, others are static, some are declining, and others are being obliterated or swallowed as functioning units by metropolitan sprawl. Michigan Department of Health population statistics provide a basis for assuming that small communities in southern Michigan probably are continuing to grow steadily, much as they did between 1940 and 1950. Population decreases in the Upper Peninsula have tapered off as a balance is reached between economic opportunities and population. In the Detroit metropolitan area, small communities are disappearing as they are engulfed by urban expansion, but as mentioned above, in most of the state, small communities are still very much alive.

The following recommendation is based upon the above deduction, and the analysis of growth data included in the study.

Bypass routes should be located at a distance from the community's fringe which will be sufficient to allow enough normal growth at existing density patterns that a population of between 1,200 and 2,000 can be accommodated. For as mentioned before, when a community reaches this size usually natural barriers no longer effectively block growth. Necessarily, each case must be determined independently as physical conditions vary greatly. Such routes would allow small communities to expand in an orderly manner and eliminate almost all community growth on a bypass.

#### ACKNOWLEDGMENTS

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