

Interstate Highway Interchanges as Instigators of Nonmetropolitan Development

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Although the Interstate highway system of the United States is the subject of much varied and detailed investigation, much of the inquiry performed to date suffers an inexplicable urban bias. This study focuses on the nonurban impact of the nation's premier transportation network by examining 65 nonmetropolitan interchanges in Kentucky. Six interchanges are identified as "interchange villages" that actually function as central places in their respective regions. Three of this subgroup that are stereotypical are analyzed as examples of the different functions that they perform. These newly formed towns serve as island communities of other urban places, tourism-driven service centers, or focus points of entire regions. The cyclic pattern of evolution that nonmetropolitan interchanges can be expected to follow is presented as well as a discussion of what might be in store for these previously remote and isolated interchange sites. This project fills a void in the literature because it provides an in-depth nonurban analysis based on a significantly large number of observations.

Since Congress funded construction of the Interstate and Defense Highway System in the mid-1950s, the system has significantly altered the transportation network of the United States. The impact, which has substantially modified traffic flow patterns, has also influenced land use in areas adjoining system routes. Thousands of acres of property have been removed from other uses by the structure of the highway itself, and even more land has been drawn into the realm of highway-related development by its newly acquired connection with previously distant places. The system's main purpose is to connect major metropolitan areas of the United States, but these connecting routes pass through nonmetropolitan areas lying between the nodal cities and provide the potential for direct, high-speed access to or through places that might have previously been remote and relatively inaccessible.

The type and intensity of the impact of Interstate highway construction can be expected to vary from one region to another and within regions depending on a variety of site and situational characteristics. These characteristics may be in situ (in place before construction) or a function of the highway itself. Among these characteristics are historical, social, economic, site-specific, population, and geographic variables that necessarily influence the form and function of the region's transportation network and its local impact. Along any given link of the Interstate system, access points or interchanges are likely to be places where this impact on local communities is

greatest. Interchanges are specific points at which traffic can enter or exit the Interstate highway from or onto another artery of any type. Commercial businesses such as fast-food restaurants or gasoline stations that are dependent on large threshold populations may seek to locate at high traffic volume interchanges or at interchanges near cities and towns in order to capitalize on two distinct populations. Some businesses and industries are dependent on Interstate truck traffic as clients or as shippers to move their products or raw materials and may find interchange locations cost-effective. On the other hand, residents of remote areas may build homes near an interchange to improve their accessibility to commuting opportunities. Local and state governments may use interchange locations to provide easy access to agencies and services by county or regional populations. Because Interstate highways have limited access, a single interchange may be the accessibility focus for an area of hundreds of square miles. This research focuses on the clustering of land use activity observed at certain nonmetropolitan Interstate highway interchanges and attempts to establish the need for more investigation of these newly formed nodes. In addition, a theory that attributes this recent development to new central place formation is presented. Underlying the project's purpose are a theoretical neglect of the subject and the increasing need for in-depth North American inquiries by those dedicated to land use research in nonmetropolitan areas.

LITERATURE REVIEW

Although the main purpose of most transport arteries is to connect nodal or terminal cities or points, these connecting routes pass through nonmetropolitan areas lying between them and provide the potential for interregional interaction and regional change. Not the least of the potential changes experienced by transected nonmetropolitan areas is that of an altered land use pattern. Land use changes have been documented for nearly every form of transportation that has entered nonmetropolitan America. Goodrich et al. (1, 224-225) identified the nonurban implications of canal construction in the nineteenth century:

Between the terminal points, the canal may, as the most efficient mode of transportation in the area through which it passes, stimulate local development through its power to attract economic activities that are heavily dependent upon external transport economies. The process may first begin with a concentration of commercial farming in the vicinity of the canal. If

this development is followed by significant increases in population density—as a result of migration both from within and outside of the area—a market basis for the establishment of nonagricultural activities will have been established. Villages or small towns, specializing in manufacturing operations, may follow. Such developments would cause property values in the vicinity of the canal to rise faster than in other areas, and this second increase in the real value of assets may act as a stimulant to local investment or to higher levels of consumer expenditures—effects that might well sustain a cumulative process of change within the area.

Railroads also influenced land use between larger, urban nodal points. Stilgoe (2, p. 3) writes of the railroad late in the nineteenth century:

Reaching from the very hearts of great cities across industrial zones, suburbs, small towns, and into mountain wilderness, the metropolitan corridor objectified in its unprecedented arrangement of space and structure a wholly new lifestyle. Along it flowed the forces of modernization announcing the character of the twentieth century, and abutting it sprouted new clusters of building.

Stilgoe specifically addresses the significance of interchanges by referring to the “crossing-zone commercialism” occurring there. An attribute of this planned nonmetropolitan development was the “standardization” of the nonurban landscape. Additional influences were evident with the concentration of buildings and activity at an intersection as the most visible change—that involving a community’s land use.

In the early twentieth century, interurban railways influenced nonmetropolitan areas between and around cities. These short-lived predecessors of the truck and automobile also resulted in rural land use change. The electric interurbans also concentrated their effect at nodes. In addition, Hilton and Due (1964) observed that “their [the interurban railroads’] principal influence was, clearly, in conditioning the rural population to a greatly increased mobility that was fully realized only with the general acceptance of the automobile” (3, p. 117). Although this mode of transportation was limited in its impact, it did generate the same propensity for land use change at stops along its routes as did larger transport facilities.

No mode of transportation has altered nonmetropolitan land use more than the automobile. From the advent of Henry Ford’s family car to the implementation of high-speed, limited-access freeways, automobile transportation has continually reshaped urban and nonurban places. Again, intersections or interchanges are recognized as the points at which the impact of the artery is greatest. Erickson and Gentry refer to the concentrations of development at interchanges as “nucleations” (4). Although their analysis is of an urban environment, the concept of highly concentrated spatial influence is applicable elsewhere. Perhaps nowhere is this concept more visible than at nonmetropolitan Interstate highway interchanges where thousands of automobiles daily come in contact with formerly isolated rural communities.

Interstate highway interchanges have been analyzed by a wide array of researchers and from an equally broad set of perspectives. Further examination of the literature reveals that a large majority of land use change studies were performed when the Interstate system was in its infancy. For example, Garrison studied the supply of and the demand for land at interchanges in 1961 (5). He focused on the availability of

property and a hypothetical need that might eventually come to be for it. He did not address specific potential uses for interchange property other than those generally associated with increasing urban growth. Another popular topic of the period was the planning aspect of interchange development. Walsh (6), Flaherty (7), and Thiel (8) wrote on the need for land use planning around interchanges. The utility of land near interchanges for specific purposes was also identified during the 1960s. Kiley (9) studied highways as one factor in industrial location, and Graybeal and Gifford (10) evaluated the impact of new uses on the value of land near interchanges. Kiley found nonmetropolitan highways to be critical albeit necessary elements in the decision to relocate an industrial facility to a nonurban place. Graybeal and Gifford modeled the increasing land values associated with new transport systems, further evidence of the local impact of highways. The commercial attractiveness of interchanges has been and continues to be a popular research topic among those interested in Interstate-induced change. Both Mason and Moore (11) and Kovacik (12) have identified Interstate highway interchanges as prime sites for commercial activity. Traffic generation and traffic pattern alteration have been studied by Babcock and Khasnabis (13) and by Deen (14), respectively. The overwhelming conclusion of these studies is that change in an area’s transportation system necessarily results in more and often widespread change. In addition to these examples of interchange analysis, researchers of the 1960s attempted with little success to model different aspects of Interstate highway influence using a variety of methods and modeling techniques.

Early on, Cribbins et al. (15) assessed the economic impact of Interstate routes on both land value and use. After studying five sections of highway totaling 57 mi, they concluded “that the controlled-access facilities under investigation have done little to stimulate or depress surrounding property values and development. . . .” Two economists, Ashley and Berard (16), surveyed 66 interchanges along I-94 across Michigan to measure the “benefits” accruing at each site. They classified and analyzed each interchange according to location (urban, rural, etc.), type (full, partial, and closed), economic value, and number of real estate transactions generated. Findings revealed that interchange location and type influenced potential development. In concluding this qualitative analysis, the authors write (16, p. 58):

A basic principle of real estate activity is change, and probably the most dynamic example of this principle is found in the interchange area.

The limited-access freeway has broken the mold of the old highway commercial pattern. It concentrates development rather than diffuses it and, consequently, allows investment in more lavish improvements. It has given a permanency to investments that never existed before in the history of highways.

Their findings further illustrate the importance and influence of interchanges, particularly those located in areas that are easily changed. The writings of Ashley and Berard substantiate the need for further work as they emphasize the unique and innate ability that interchanges have for generating change.

Twark (17) attempted to model economic development at 100 nonurban interchange sites on Pennsylvania Interstate highways. He developed three models of a static nature to

describe the "equilibrium state" of economic development in the "neighborhood" of a given interchange. Twark measured traffic volume, local topography, interchange age, and distance to the nearest urban center as independent variables. The analysis falls short of the author's original goal of constructing a predictive model for Interstate highway interchanges but provides insight into the interchange development process. Twark recognized that the eventual outcome of his analysis was limited by his use of a small number of study variables because other factors that he omitted must influence if not determine development. More important, the timing of his analysis prevented its success. The author states that the "relative newness" of the Interstate system is the "single most important factor in preventing the development of an appropriate model at this time (1967). . . ." Interstate highway construction began in 1956.

Much of the inquiry directed toward Interstate highway interchanges to date suffers an inexplicable urban or suburban bias (4, 18, 19). This prejudice against nonmetropolitan areas exists in part because of the system's orientation toward cities (most cities with more than 50,000 inhabitants are linked) and because urban highways directly influence more people and are more highly visible to the general population including researchers. In the literature, Interstate highway interchanges are recognized as focal points at which access to the system is possible and the impact of the network on the community is greatest. Urban interchanges have been characterized by their ability to alter traffic flow and patterns, stimulate commercial activity, displace and recreate housing opportunities, and influence industrial location decisions. Conversely, nonmetropolitan interchanges have been viewed as isolated rural crossroads, oases for passers-by, and access points to nearby small towns or tourist attractions. In opposition to traditional theory, this investigation elevates the importance of nonmetropolitan Interstate highway interchanges and their role in fostering local and regional change. In addition, three case studies are provided that strengthen the notion that certain interchanges perform definite functions as central places. The ideas central to this inquiry are that (a) some nonmetropolitan interchange-related development is multifunctional in that it serves the local community as well as the Interstate population and (b) a portion of these dual-purpose intersection communities are actually examples of a new type of urban place, an interchange village. The existence of urban and suburban interchange "clusters" and "nucleations" is well documented, and it follows that nonmetropolitan centers of activity will eventually surface to meet the demands of rural residents and those attempting to gain access to more remote rural areas. A few investigations center on nonurban interchanges (17, 20, 21), but most are dated because they were performed during construction when, instead of a network, the Interstate highway system was a scattered array of unconnected transport links. Nonmetropolitan interchanges carry many of the attributes of their urban counterparts (improved access and high visibility), yet they have gone virtually unnoticed in recent interchange analyses.

METHODOLOGY

The primary goal of this project is to evaluate a number of

nonmetropolitan Interstate highway interchanges and to identify evidence of local central place formation. In an effort to accomplish the task it was necessary and informative to (a) identify the presence of the Interstate highway system in an area, (b) define and measure the amount of local development at interchanges along certain nonmetropolitan links of the system, and (c) search for evidence that some highly developed interchanges actually function as central places.

Kentucky is ideal for such an investigation because it is transected by five widely representative Interstate highways of different type, age, and direction (Figure 1). The state is known for its regionality and provides researchers with examples of how interchanges evolve under different spatial circumstances. Local Interstate highway construction began in Jefferson County during 1956, the year of the system's birth. Since then, large parts of the state have been incorporated into the network. I-24 passes through Paducah connecting Nashville, Tennessee, with I-57 to the west. Louisville, Elizabethtown, and Bowling Green lie along I-65 between Indianapolis, Indiana, and Nashville. Louisville, Kentucky's largest urban area, also serves as a terminal point for I-71 from Columbus and Cincinnati, Ohio. I-64 passes through Ashland, Lexington, Frankfort, and Louisville as it connects Charleston, West Virginia, and St. Louis, Missouri. Central Kentucky is further connected to southern Ohio by I-75 that passes through Lexington and Richmond in route to Knoxville, Tennessee.

Total Interstate surface has grown to 1,187 km since construction began in the state in 1956, and current annual vehicle kilometers exceed 9 billion. The Interstate system makes up only 1.1 percent of Kentucky's total highway mileage but carries 23 percent of the traffic (a figure almost identical to that of the entire system). Each highway crosses a nonmetropolitan area in route to larger urban places—St. Louis, Cincinnati, Nashville, or Knoxville. Forty counties and each of Kentucky's major cities are incorporated into the national Interstate network. Each link of the system through Kentucky contains nonmetropolitan interchanges: points at which the system's impact is greatest and most visible and that permit local access, facilitate interregional travel, and provide increased access to a variety of goods and services not only for interstate travelers but for local residents as well. Sixty-five nonmetropolitan interchanges scattered across Kentucky exhibit varying degrees of associated development and consequent influence on surrounding regions.

Twark (17) identified the "interchange community" as an area within 0.8 km of the Interstate highway's intersection with another road, and these 203-ha zones of maximum influence are used as individual study areas in this investigation. Structures within each of these circular study areas, which are 1.6 km in diameter, are classified according to size and function. Types and sizes of existent buildings were evaluated during prestudy field testing and grouped for simplification. The structural categories identified are (a) simple, nonresidential; (b) single-family residential; (c) multifamily residential; (d) small commercial and small institutional; (e) large commercial, large institutional, and small industrial; and (f) large industrial. Preliminary examination of recent aerial photographs and topographic maps of each interchange area facilitate further field investigation. Field tests, aerial photographs, maps, and finally fieldwork (counting and classifying structures) all work in

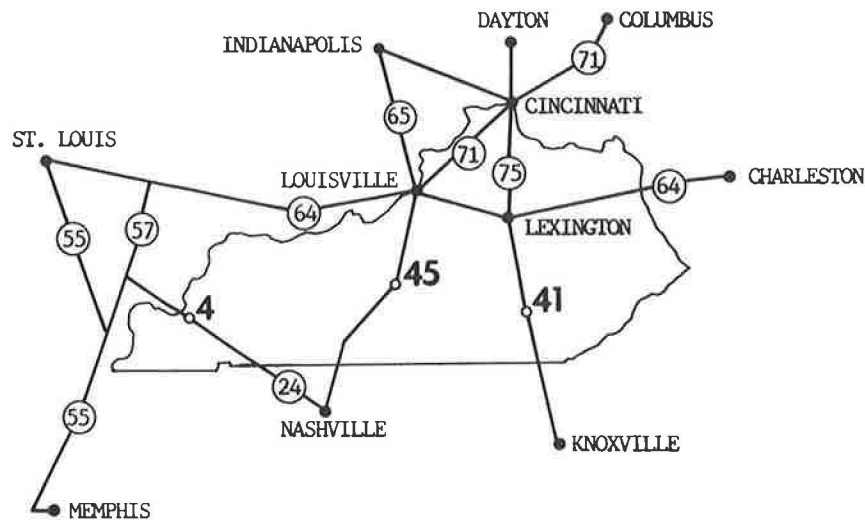


FIGURE 1 Interstate highway system through Kentucky.

conjunction to create an effective and generalizable methodology for this and future interchange projects.

RESULTS

During the summer of 1985, every building within each of the 65 study areas was counted and classified according to its use. Overall, 13,195 ha of property were field surveyed and 6,670 structures were recorded and classified. Observed types of buildings ranged from simple farm barns to multilevel regional shopping malls. Various structure types were classified according to size and ability to generate activity (Table 1).

TABLE 1 BREAKDOWN OF TYPES AND NUMBERS OF STRUCTURES AT 65 NONMETROPOLITAN INTERCHANGES

Category	Total No.	Avg No.	Percent
Simple, nonresidential	2122	32.65	10.08
Single-family residential	3083	47.43	29.29
Multifamily residential	184	2.83	3.50
Small commercial and small institutional	1077	16.57	40.94
Large commercial, large institutional, and small industrial	195	3.00	14.82
Large industrial	9	0.14	1.37
Total	6670	102.62	100.00

Aside from the surprisingly large number of structures centered around these relatively remote interchanges, the mixture of building types and functions is particularly interesting. As might be expected, a significant proportion of firms located at interchanges are transport related (service stations, restaurants, and motels) but an equally meaningful number of structures is dedicated to local, regional, or multiple functions. Functions of structures were often found to be inconsistent with those associated with through travel. For example, nonmetropolitan interchange locations were chosen by local, state, and federal government agencies for local and regional offices. Agencies such as the U.S. Bureau of Surface Mining and the Kentucky State

Police are distinctly regional in nature and serve large parts of the state from their offices placed near nonmetropolitan interchanges. Schools and churches are oriented toward smaller, local populations and also operate within several study areas.

The area around each study interchange is different; each is characterized by varying numbers and types of structures serving quite distinct purposes. However, two obviously divergent groups of nonmetropolitan interchange communities currently operate within Kentucky. A small percentage of the state's interchange areas is characterized by excessive numbers and blends of structure types and functions, and a second group of less-developed areas, which exert less influence, meets rather limited demands for fewer goods and services. When an interchange community has a diverse mixture of transport-related and community-specific establishments, its role is that of a central place, and, if that mixture is broad based and large enough in scope, the community, for all practical purposes, serves as an urban place—an "interchange village." These villages are centers of commerce and administration that furnish residents and passers-by with goods and services. They often serve as a hub, the focus of a community's religious, educational, and entertainment activities.

Six of the 65 interchanges studied qualify as interchange villages because of significantly greater concentrations of diverse development (this distinction is noticeable not only on paper but on the landscape as well). Within this smaller group of interchange villages, different functions appear to be served. Most obvious are the distinct roles of certain interchange villages as nucleations of larger urban places, centers focused on tourism, or regional hubs. The following three villages serve as examples of each functional type.

Interchange 4 (as numbered by the Federal Highway Administration) on I-24 is an example of a multifunctional interchange village. When opened to traffic in 1974, the interchange lay in rural McCracken County approximately 5 km from the city of Paducah with its population of 29,000. Aerial photographs indicate that before construction of the interchange only 53 structures existed within the study area. Fifty-two of these structures were either single-family residences or uninhabited farm barns, sheds, or garages. Currently, 247 structures lie

within this once-rural, predominantly agricultural area. The single most significant feature of this interchange village is the Kentucky Oaks Mall—the largest in the state.

Within the village, 173 structures are commercial establishments and 74 are residential or housing related. Several service stations and truck stops are located near the intersection to capture the attention of through traffic but are considerably larger than those firms located at other interchanges that rely exclusively on the superhighway for their clientele. The retail businesses of this village appear to profit by tapping two distinct populations: that of I-24 and that of the surrounding region that may or may not use the Interstate highway to gain access to newfound shopping opportunities.

Although this particular village serves western Kentucky and southern Illinois via I-24, it is accessible to the residents of Paducah on what was once a narrow rural road but has since been upgraded to meet the needs of nearby urbanites.

A regional social characteristic that enhances the village as a central place is its legal classification as a “wet” area in which the sale of alcoholic beverages is allowed. Baerwald (18) noted the influence of such zoning on suburban interchange development, but the impact of regional classification variability on nonmetropolitan communities was previously unknown. Because this interchange is the nearest location of wet restaurants and retail stores for hundreds of thousands of people, its role as a central place is amplified.

A second but quite different type of interchange village has developed near Interchange 45 in Barren County. This interchange is one of only three along the Interstate system that allow entry into Mammoth Cave National Park. Before the opening of the interchange in 1969, this was a dairy-farming area that had seven houses and twelve barns. Today, the interchange village is made up of 5 large commercial; 45 small commercial; 9 single-family; and 31 simple, uninhabited structures. Billboards located more than 35 km to the north and south of this interchange on I-65 advertise more than 1,000 motel rooms and more than 25 restaurants at this “regional convention center.” In addition to the variety of restaurants frequented by locals, the largest grocery stores in the county are conveniently situated within this new “town.” Even though Interchange 45 lies within a “dry” county, its restaurants, motels, and retail outlets flourish because of a steady stream of tourists through the village.

The developed area immediately surrounding Interchange 41 in Laurel County represents a truly regional interchange village. The interchange is formed by the intersection of I-75 and Route 80 of the Appalachian Development Highway System and was opened to traffic in 1969 in an area previously held by small tobacco farmers. The purpose of the regional Appalachian highway project was to reduce the isolation of areas such as eastern Kentucky (22). Route 80 and the other links of the Appalachian Development Highway System transect the area connecting small towns with each other, larger urban places, and the Interstate highway network.

Interchange 41 is the one point in Kentucky where the regional and national Interstate networks intersect. If the two highway projects have achieved their respective goals of regional and national connectivity, then this particular point is unique in that it allows intra- as well as interregional access. Close examination of the entities located within the village

around Interchange 41 indicates that members of both public and private sectors are aware of the advantages associated with locating there.

For example, an office complex near the interchange houses regional branches of both state and federal government agencies. In addition, a school and two churches are found within the immediate interchange area. This interchange village illustrates the wide variety of users that can be found along nonmetropolitan links of the premier transportation network of the United States (Table 2).

TABLE 2 NUMBER OF STRUCTURES BY TYPE AT INTERCHANGE 41

Type	No.
Simple, nonresidential structures	17
Single-family structures	22
Small retail firms	23
Government offices	11
Wholesale outlet stores	5
Wholesale supply firms	4
Motels with restaurants	2
Churches	2
Lumber yard	1
Large equipment sales and repair	1
Mobile home distributor	1
Milk processing factory	1
Elementary school	1
Total	91

Although designated “dry” and far from a measurable urban population or a significant tourist attraction, this interchange satisfies a different locator demand. Compared with other interchange villages that are supported by nearby urban or tourist populations, this central place is unique in that regional access is its predominant feature. Of the six interchange villages identifiable in Kentucky, two function as regional centers, three are supported by local urban populations, and one is tourist driven.

Given the level and diverse nature of nonmetropolitan interchange villages, why have researchers failed to recognize the implications of these recently developed urban places? One explanation of this failure lies in the village and the way it was formed. Corsi (23) characterized nonmetropolitan interchange areas as relatively undeveloped except for a few service stations that located immediately after the interchange was constructed. Most nonurban interchanges exhibit this development pattern, but some eventually accrue other entities depending on the site and situational characteristics of the area and the interchange. Temporal examination of interchange villages reveals a patterned development process that explains the omission of such villages from modern urban thought (Figure 2).

Corsi's evaluation of spontaneous small-scale transport-related facility location is accurate, but two additional “waves” of activity appear to follow. These distinct periods of development can be characterized by the scale of investment required to set up a particular type of firm (24). After initial interchange activity, there occurs a lull in development that is followed by construction of mid-level structures. For example, motels, larger truck stops, churches, and schools often appear during

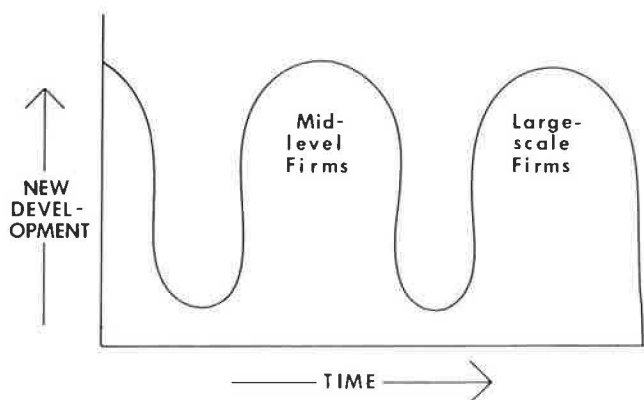


FIGURE 2 Interchange village development over time.

this intermediate period. If a third wave occurs, it is usually typified by large-scale commercial, industrial, or institutional development such as shopping malls, factories, or hospitals. Reasons for the lag in time between these periods of activity may lie in the additional time necessary to implement a larger project or to acquire more substantial quantities of capital. Developers may assume a "wait and see" attitude toward construction that involves potential traffic volume or other investor decisions. Often, the initial developmental surge that Corsi recognized is the only activity that will occur near a particular interchange. However, the second and still more infrequent third waves do occur and consequently deserve scholarly attention.

SUMMARY AND CONCLUSION

All nonmetropolitan Interstate highway interchanges are not remote crossroads, oases of traveler services, or mere access points to other places. Likewise, not all that serve as central places evolved because of local urban demands, tourist attractions, or particular regional characteristics. However, there should be little doubt that nonmetropolitan Interstate highway interchanges are more important locational factors than they once were. Multinational corporations (Toyota and General Motors) have recently announced plans to locate industrial complexes at interchanges in Kentucky and Tennessee, respectively. Officials from both firms identified the superhighways and interchanges as prime factors in their location decisions (25).

In spite of the type and quantity of existent development within interchange villages and the increasing global importance of interchange location, these areas remain largely unregulated and unaddressed by scholars and by local, state, regional, and national government officials.

Problems have arisen and will continue to arise at these points of magnified system impact. They will necessarily demand attention as they develop demands for traffic control and other services. Does interchange village morphology resemble that of many small towns where commercial and other development occurred at more important crossroads? How will already understaffed rural law enforcement agencies meet the legal needs of interchange villages? Because each of these villages exists in an area without any form of zoning or land use regulation, will conflict arise between land users with contradictory goals? How will the future infrastructure requirements

of interchange villages be met? While these and other questions remain unanswered, a new subject area for those interested in urban and central place development exists. Although the presence and circumstances of urban and suburban interchanges are quite well documented, nonmetropolitan interchange development was previously absent from the literature.

Researchers need to develop an ability to forecast interchange village evolution and to identify the triggers of this urban growth. The stage is set for future comparisons between nonmetropolitan villages and their urban counterparts. Scholars must first realize the existence of interchange villages and then focus on their patterns of occurrence as well as their generalizable morphology, if possible. This investigation identifies a new type of urban place and calls attention to the criticality of recognizing interchange villages as centers of increasing nonmetropolitan land use activity.

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