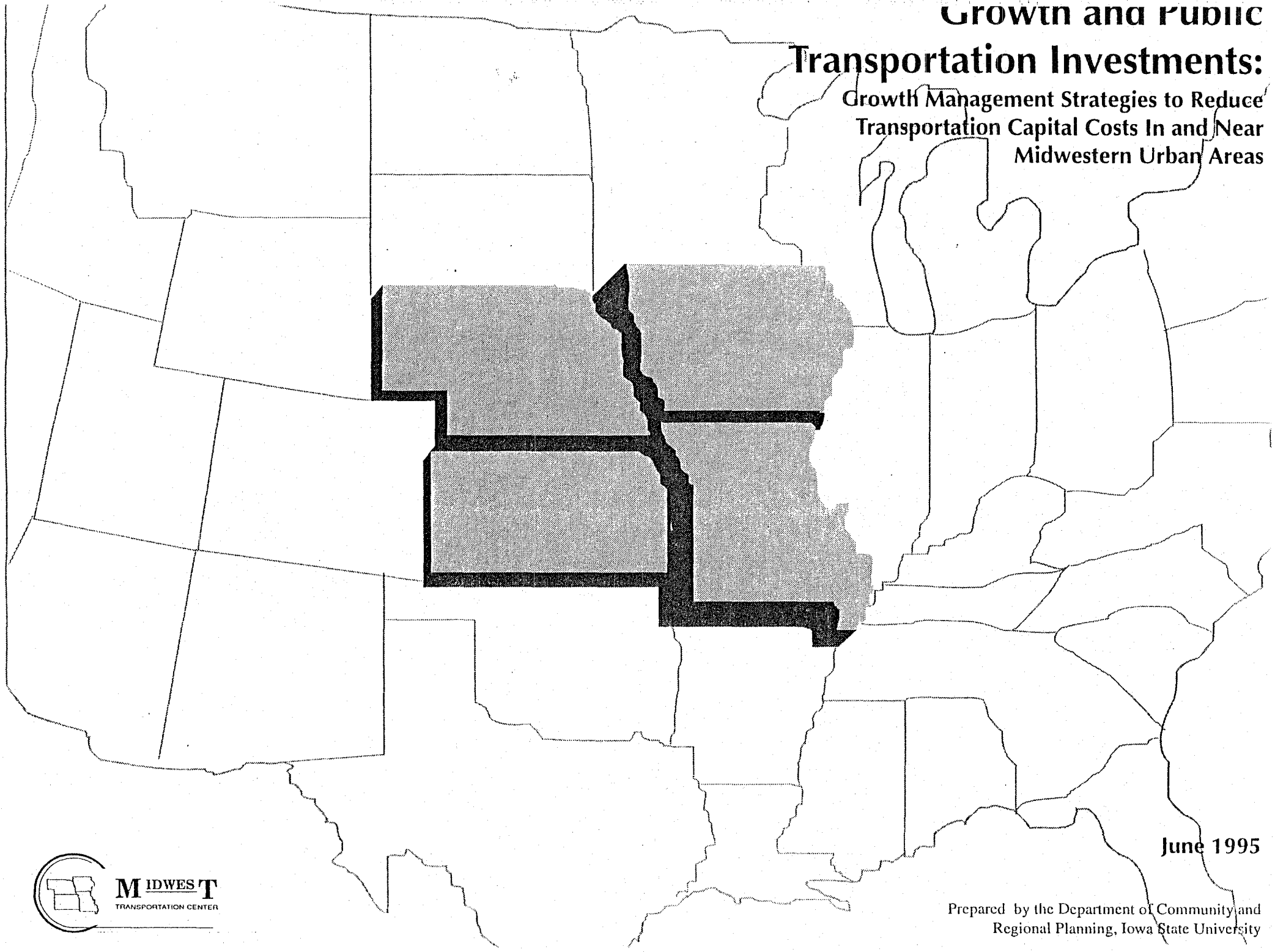

Growth and Public Transportation Investments:

Growth Management Strategies to Reduce Transportation Capital Costs In and Near Midwestern Urban Areas

June 1995

MIDWEST TRANSPORTATION CENTER

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Chapter I: Introduction

Transportation and land-use are interdependent, inter-active systems. Land-use patterns shape local transportation demand, but transportation systems in turn influence land-use patterns. Thus, in attempting to satisfy transportation demand created by existing land-use patterns, transportation planners directly, if not always consciously or intentionally, influence future land-use patterns.

This study examines that complex interrelationship. It consists of five parts:

- a case-study comparison of Lincoln, Nebraska, and Des Moines, Iowa, two midsize state capitals located 200 miles apart on Interstate 80 (Chapter 2)
- a learning comparison of six hypothetical case studies, showing different patterns of decisions and different results (Chapter 3)
- a discussion of the growth management tools that local governments can use to influence the land-use patterns that define transportation demand (Chapter 4)
- a legal analysis of the feasibility of those techniques in the Midwestern states of Iowa, Missouri, Nebraska and Kansas (Appendix A) and
- a review of the literature on this subject (Appendix B).

This is applied research. The knowledge shared in this report already exists in other forms. The purpose of this study was three-fold: first, to compile this body of knowledge; second, to apply this body of knowledge to the context of midsize cities in the Midwest; and, third, to make this knowledge accessible both to transportation planners and to public officials who make key decisions about land use.

The compilation of the body of knowledge is mostly contained in Appendix B, the literature review. It is a relatively comprehensive review that includes both theory and practice, both historic and contemporary findings.

Applying this knowledge in the Midwest occurs in two different contexts. First is the case study of Lincoln and Des Moines, two state capitals of roughly similar size but radically different urban form and radically different patterns of transportation demand. The examination of the differences between these two regions goes to the heart of this study and illustrates the importance of growth management and inter-active transportation and land-use planning in this context.

The second piece of that is the discussion of basic growth management tools in Chapter 4 and the legal analysis in Appendix A, which generally supports the use of most of these tools in the four Midwestern states included in the analysis.

The importance of this work extends well beyond the two cities in the comparison and even beyond the four states included in the legal analysis. The fact is that the land-use planning and implementation programs in most of the U.S. are far more like those of communities in Nebraska and Iowa than they are like the well-publicized but unusual programs of a handful of Florida and California communities—states that have experienced periods of extraordinary growth and states that have responded to that growth with legislative initiatives that change the context of both planning and implementation. Thus, while California, Florida, Oregon, Washington, Maryland and other coastal states have changed their basic planning laws, the laws in Idaho, Alabama, Indiana, and Arizona remain very similar to those in the four states analyzed in this study. Further, the planning and transportation issues in communities like Peoria, Illinois, Pueblo, Colorado, and Paducah, Kentucky, are likely to be much more similar to those of Des Moines and/or Lincoln than to those of some of the rapidly-growing coastal communities which are often the subject of major planning studies.

The target audience for this handbook includes elected officials, planning commissioners, transportation commission members, and interested citizens, as well as the professionals who serve them. Thus, while the appendices provide the technical references that professionals will want from a report like this, the

main body of the handbook is intended to be equally accessible to any interested member of the target audience. The case study comparison in Chapter 2 uses common-sense techniques of comparison that should be meaningful even to those without a strong background in quantitative analysis. The alternative scenarios used as the basis of Chapter 3 are intended to provide self-directed learning opportunities for the reader. The advisory committee members (listed on the credits page) contributed very significantly to the selection and development of the scenarios.

Funding for this project came from the U.S. Department of Transportation, through the Midwest Transportation Center, and from the Iowa Department of Transportation. Key participants in the project were faculty and student in the Department of Community and Regional Planning at Iowa State University, with the assistance of an advisory board, listed on the credits page before this introduction.

This is the final and most complete product of this research project, but it certainly is not the only one. The *Journal of Planning Literature* published the literature review from this study in its November 1994 issue. Analysis from this study contributed directly to examples used in a planning Advisory Service Report prepared by the principal investigator for the American Planning Association. Titled *Planning, Growth and Public Facilities: a Primer for Public Facilities*, it appeared in 1994 as No. 447 in the PAS report series. Interestingly, that report was cited by the Lincoln/Lancaster County Planning Department in a letter to the author as a significant influence in the preparation and adoption of the new Lincoln City/Lancaster County 1994 Comprehensive Plan; that region was, of course, one of the two included in the case study comparison for this report.

The principal investigator presented much of the analysis and many of the lessons of this study at an Advanced Planning Commissioners training session sponsored by the Nebraska Planning and Zoning Association and the Mid-South Planning and Zoning Institute at the University of Memphis, both in the spring of 1995.

As with most complex planning problems, there are no easy solutions to the ones faced by cities with overloaded freeway systems. This report does not offer a comprehensive solution or even a comprehensive plan for a solution to those problems. What it offers is the learning from the literature, the learning from two Midwestern case studies, and the analysis of the author, with help from those cited on the credits page. It is intended as a learning tool. Ultimately, difficult decisions are best made by those who are most familiar with the facts and who have the responsibility both to make the decisions and to live with them once made. If this report helps to inform that process for the many local officials and state transportation officials who make decisions about our metropolitan areas, then it will have served its purpose.

Author's note: As of July 1995, Eric Damian Kelly, the principal investigator and author, became Dean of the College of Architecture and Planning at Ball State University. Although the work on this report related entirely to his affiliation with Iowa State University, which should be credited in any reference to it, future contact with the author should be directed to Dr. Kelly at the College of Architecture and Planning, Ball State University, Muncie, IN 47306, phone 317-285-5861, fax 317-285-3726.

Chapter II: A Tale of Two Cities: Des Moines, Iowa, and Lincoln, Nebraska

This chapter compares the urban form and transportation patterns of Des Moines, Iowa, and Lincoln, Nebraska. The cities are similar in many ways. They are both state capitals. Both are midsize cities, Des Moines with a 1990 population of 193,187 and Lincoln with a 1990 population of 191,972. Both are located along Interstate 80, a little less than 200 miles apart.

There are radical differences, however. Lincoln literally has no suburbs. It is its own urbanized area and it contains most of the population of the one-county Metropolitan Statistical Area. Des Moines has roughly two dozen suburbs and exurbs, with 17 other incorporated cities in Polk County alone and several others within easy commuting range in Dallas and Warren Counties. More important for this study, the local traffic patterns on the interstate highways through the two communities are radically different. Commuting traffic on the interstate system through Des Moines continues to grow, leading to a current proposal for an expansion of the main interstate highway through Des Moines (I-235, locally called the MacVicar Freeway) at a cost of hundreds of millions of dollars. In contrast, traffic counts on I-80 at most points in Lincoln are actually lower than the counts on I-80 at either end of the city. Thus, Lincoln and the Nebraska Department of Roads are not faced with the same sort of costly and disruptive highway-building proposals that Des Moines and the Iowa Department of Transportation must consider.

This study does not and cannot possibly demonstrate absolute causes and effects. Urban form and the related transportation patterns evolve together, as the literature review in Appendix B suggests. Transportation networks clearly influence urban form, but changing urban form also influences transportation patterns. The significant metropolitan control that Lincoln enjoys and that Des Moines lacks is clearly an important factor in the difference in growth patterns. It is not the purpose of this study to suggest that Lincoln is likely to face the problems that Des Moines faces or that Des Moines can suddenly become more like Lincoln. It is, however, the purpose of this study to suggest that state transportation officials (and those who provide their budgets) as well as local government officials can gain a great deal physically and fiscally by attempting to emulate more of the Lincoln model than the Des Moines one.

Population Patterns

The population patterns of the two areas indicate the similarities and the differences:

Table 2.1 Des Moines Metropolitan Population Trends, 1950-90.

Year	1950	1960	1970	1980	1990
City	177,965	208,982	200,587	191,003	193,187
Metropolitan Area	187,853	233,313	243,361	250,369	272,067
Metro Counties*	249,671	290,438	312,215	332,683	356,895

* Polk (includes Des Moines), Warren, and Dallas

Sources: Bureau of the Census, 1950, *Characteristics of the Population, Iowa*, Tables 10 and 12; 1960, *Characteristics of the Population, Iowa*, Table 13; 1970, *Characteristics of the Population, Iowa*, Table 16; 1980, *Characteristics of the Population, Iowa*, Table 14; 1990, *Population and Housing, Summary Tape File 1C*, General Profile.

The "metro counties" figure in this table is not entirely meaningful. The metropolitan area extends only into eastern Dallas County and northern Polk County, with the rest of those counties remaining largely rural. It is interesting to note, however, that eight-nine percent (89%) of the metropolitan population remained in Des Moines as late as 1960 and that even by 1970 eighty-two percent (82%) of it was in the city. Crucial decisions in the 1960s and 1970s, described below, clearly accelerated the rush to the suburbs. By 1990, only

seventy percent (70%) of the population was in the city, and the city itself continued to experience out-migration.

Lincoln provides a significant contrast. The city is literally the metropolitan area. Thus, one hundred percent of the population of the metro area continues to live in the city.

Table 2.2
Lincoln Population Trends

Year	1950	1960	1970	1980	1990
City	98,884	128,521	149,518	171,932	191,972
Metropolitan Area	98,884	128,521	149,518	171,932	191,972
County	119,742	155,272	167,972	192,884	213,641

Sources: Bureau of the Census, 1950, *Characteristics of the Population, Nebraska,* Tables 10 and 12; 1960, *Characteristics of the Population, Nebraska,* Table 13; 1970, *Characteristics of the Population, Nebraska,* Table 16; 1980, *Characteristics of the Population, Nebraska,* Table 14; 1990, *Population and Housing, Summary Tape File 1C,* General Profile.

The impact of these trends on urban form has been dramatic. Table 2.3 shows the population trends for the urbanized areas of the two cities. The urbanized area is slightly different from the metropolitan area for a complex metropolitan area like Des Moines. Although less commonly-used in public discussions, the figures for urbanized areas here are important because they provide a basis for computing the density of the built-up area of the Des Moines metropolitan area to serve as a basis for comparison to Lincoln, where the city limits, the metropolitan area and the urbanized area are coterminous.

Table 2.3 Population Trends, Des Moines and Lincoln Urbanized Areas, 1950-90.

Year	1950	1960	1970	1980	1990
Lincoln	99,509	136,220	153,443	173,550	192,558
Des Moines	199,934	241,115	255,824	267,192	293,666

Sources: Bureau of the Census, 1950, *Characteristics of the Population, Iowa and Nebraska,* Table 10; 1960, *Characteristics of the Population, Iowa and Nebraska,* Table 13; 1970, *Characteristics of the Population, Iowa and Nebraska,* Table 16; 1980, *Characteristics of the Population, Iowa and Nebraska,* Table 14; 1990, *Population and Housing, Summary Tape File 1C,* General Profile.

Table 2.4 shows the trends in land area of the urbanized, or built-up, areas of the two communities. Again, the figure is more significant for Des Moines than for Lincoln, where the urbanized area is defined by the city limits.

In Table 2.5, the population trends and land area trends for the two urbanized areas are indexed to a base of 1950 = 100, thus providing an easy comparison of the rate of population growth in the two urbanized areas and the related expansions of their respective land areas.

Although Lincoln was already more dense and thus more compact than Des Moines in 1950 (see Table 2.6 below and discussion there), the difference became more pronounced in the 1950s. During that period, Lincoln's urbanized area expanded by slightly less than its population, while the percentage increase in urbanized area around Des Moines was double the rate of population growth. That doubling ratio for Des Moines continued in the 1960s. The 1960s saw a major annexation to Lincoln, reflecting rapid continued growth and clearly laying the base for future growth; the urbanized area actually expanded by 50 percent in that decade. In the 1970s, the rate of increase of the urbanized area around Des Moines slowed, but that was clearly a function of reduced population growth (the population growth rate of the urbanized area during that decade was only 4.4 percent, or less than a half percent a year, reflecting hard economic times in the state. Lincoln added nearly another twenty-five percent to its land area in the 1970s, but its growth continued at a more rapid rate than Des Moines' during that decade.

The rate of population growth in the Des Moines area increased during the 1980s, adding 10 percent, or more than double the rate of increase in the previous decade. The land area of the urbanized area, however, increased even more rapidly, adding thirty percent to the land base.

What does all that mean? It means that the Des Moines area sprawled, in the most literal sense of the word. Table 2.6 shows that sprawl in different terms—the number of persons per square mile of urbanized area. Lincoln was a relatively dense city for its size in 1950. The fact that its density has decreased somewhat is not surprising. That is in part a function of family size. As family size has shrunk, fewer people have occupied each dwelling unit, resulting in lower population densities in existing areas, even without reductions in the density of new development. The reduction in family size over that period has been a trend nationally, not just in this community. The Des Moines area, which has at all times been larger and thus would typically be expected to be somewhat more dense, started at a lower density and has steadily decreased in density, as the increase in urbanized (which includes suburbanized) land area has far outstripped population growth.

Table 2.4 Land Areas, Des Moines and Lincoln Urbanized Areas, 1950-90.

Year	1950	1960	1970	1980	1990
Lincoln	26.4	35.0	52.1	64.0	64.4
Des Moines	67.6	95.6	109.1	122.0	159.7

Sources: Bureau of the Census, 1950, *Characteristics of the Population, Number of Inhabitants, United States,* Table 17; 1960, *Characteristics of the Population, Number of Inhabitants, United States,* Table 22; 1970, *Characteristics of the Population, Number of Inhabitants, United States,* Table 20; 1980, *Characteristics of the Population, Number of Inhabitants, United States,* Table 34; 1990, *Population and Housing Unit Counts, Iowa and Nebraska,* Table 23.

Table 2.5 Trends in population and land area for Lincoln and Des Moines urbanized areas, with 1950=100 for each series.

Year	1950	1960	1970	1980	1990
Des Moines					
Population	100	121	128	134	147
Land Area	100	141	161	180	236
Lincoln					
Population	100	137	154	174	194
Land Area	100	133	197	242	244

Sources: Bureau of the Census, 1950, *Characteristics of the Population, Number of Inhabitants, United States,* Table 17; 1960, *Characteristics of the Population, Number of Inhabitants, United States,* Table 22; 1970, *Characteristics of the Population, Number of Inhabitants, United States,* Table 20; 1980, *Characteristics of the Population, Number of Inhabitants, United States,* Table 34; 1990, *Population and Housing Unit Counts, Iowa and Nebraska,* Table 23.

Table 2.6 Population densities, persons per square mile, Des Moines and Lincoln Urbanized Areas, 1950-90.

Year	1950	1960	1970	1980	1990
Lincoln	3769	3892	2945	2712	2990
Des Moines	2958	2522	2345	2190	1839

Sources: Bureau of the Census, 1950, *Characteristics of the Population, Number of Inhabitants, United States*, Table 17; 1960, *Characteristics of the Population, Number of Inhabitants, United States*, Table 22; 1970, *Characteristics of the Population, Number of Inhabitants, United States*, Table 20; 1980, *Characteristics of the Population, Number of Inhabitants, United States*, Table 34; 1990, *Population and Housing Unit Counts, Iowa and Nebraska*, Table 23.

Examination of additional census data helps to understand at least some of the factors involved in that sprawl. As Table 2.7 shows, Lincoln has continuously had a smaller percentage of the population living in one-family structures than has Des Moines. That difference of about 4 percent would amount to a difference of 3200 or more households who are in duplexes or apartments in Lincoln who might be statistically expected to occupy single-family homes in Des Moines; having 3200 families living at even a moderate density of 6 dwelling units per acre rather than 3 would result in a difference of some 530 acres of developed land, which is less than one percent of the land area of the city. Thus, although there is a statistically significant difference between the two in the mix of residential structures, it is not enough to explain the much more significant density difference.

Table 2.7 Number of One-family Structures as Percentage of Total Residential Units, Des Moines and Lincoln (city limits), 1960-90.

	1960	1970	1980	1990
Des Moines	74.9	***	67.6	69.9
Lincoln	68.9	69.2	65.0	65.6

Sources: Bureau of the Census, 1960, *Population and Housing*, Des Moines MSA and Lincoln MSA, Tables H-1; — , 1970, *Population and Housing*, Des Moines MSA and Lincoln MSA, Tables H-1 and H-2; — , 1980, *Population and Housing*, Des Moines MSA and Lincoln MSA, Tables H-7; — , 1990, *Population and Housing* , Des Moines MSA and Lincoln MSA, Summary Tape File 1C, General Profile

The difference is not explained by larger families. As Table 2.8 shows, occupancy patterns throughout the relevant period are fairly similar, and it is Des Moines, not Lincoln, that has slightly larger household sizes, a fact which would tend to increase the density of population in Des Moines.

Thus, the real difference between the two is not a simple demographic one—it is one that involves land-use and planning. Lincoln is a more densely settled city. Clearly a land-use inventory would be likely to find not only a smaller proportion of single-family residences in Lincoln (as reflected in the census) but also smaller lot sizes for those residences and fewer vacant lots or parcels in established areas. There is no evidence that Lincoln has tried to force people onto smaller lots or into denser patterns of living. It is clear that the planning and growth management emphasis of the city has effectively placed a higher relative value on land and on its efficient use. The result is a development pattern that is more efficient from a public services perspective.

Although the differences in density within the urbanized areas are significant indeed, the exurban development is equally significant. In Lancaster County (Lincoln), ten percent (10%) of the population resided outside the City in 1990. In that same year, twenty-three percent (23%) of the metropolitan county population of the Des Moines area lived outside the Metropolitan Statistical Area. That exurban development is the part of sprawl that consumes the most land and that places the greatest load on the transportation system in total miles

traveled.

In short, the Des Moines metropolitan area is more sprawling than that of Lincoln in two ways. First, the urbanized area itself is less dense. Second, a much higher proportion of people in the metropolitan area counties of the Des Moines area living in the exurban parts of those counties that in the Lincoln area.

Factors influencing urban form

As the discussion above illustrates, Lincoln's urban form has remained relatively compact and contiguous. In contrast, the urban form of Des Moines is anything but compact and contiguous. It has sprawled enormously but not regularly. Rather than radiating out from the center in expanding circles, as simple economics would suggest (see the literature review in Appendix B), most of the sprawl has gone west (see Figures A through E above). There appear to be three basic factors that explain that sprawl: the pattern of highways; a long-range plan for regional sewage treatment, adopted in 1976; and annexation policies of the City of Des Moines.

Clearly the pattern of highways, formed by the combination of:

- I-80 from the north and I-35 from the east joining to go around the 1970s urbanized area on the north and west, splitting again near the southwest corner of the then-urbanized area; and

- I-235, locally called the MacVicar Freeway, creating a somewhat-diagonal route across the southern part of the urbanized area essentially between the two locations where I-80 and I-35 merge and split;

offers a significant explanation of the urban form. By 1990, the continuing sprawl to the west had completely filled the western section of the oval created by the roads, and population continued to expand along major transportation routes outside the oval. The only large undeveloped areas remaining within that oval by 1990 are lands with severe flooding and other environmental problems. By the date of this report, actual development has gone well beyond that oval to the west, northwest and southwest, leading to a major upgrading of U.S. 6 to the West, which is likely to facilitate even more western-exurban commuting and development.

It is important to note, however, that this strong urban development pattern was significantly reinforced by the sewer service boundary established in 1976 for the Metro sewer system, which serves the city and most of its suburban areas (see Figure D). That boundary was established under the Areawide Wastewater Treatment Management Planning provisions of Section 208 of the Federal Water Pollution Control Act Amendments of 1972. Although long-forgotten by many planners and public officials, the boundaries established under that planning process have continued to shape sewer service areas and thus to shape the urban form of metropolitan areas around the country. Clearly the southern expansion beyond the main transportation arteries is largely explained by the easy access of sewer facilities. Although the availability of public services will continue to be a significant factor in determining urban form, the actual boundaries established

Table 2.8 Persons per household, Des Moines and Lincoln Urbanized Areas, 1950-80.

	1950	1960	1970	1980	1990
Des Moines	3.08	3.06	2.94	2.54	2.50
Lincoln	2.99	3.05	2.86	2.47	2.44

Sources: Bureau of the Census, 1950, *Characteristics of the Population, Iowa and Nebraska*, Tables 10 ; — , 1960, *Characteristics of the Population, Iowa and Nebraska*, Tables 13; — , 1970, *Characteristics of the Population, Iowa and Nebraska*, Tables 16; — , 1980, *Characteristics of the Population, Iowa and Nebraska*, Tables 14; — , 1990, *Population and Housing, Iowa and Nebraska*, Summary Tape File 1C, General Profile

Figures A-E: Des Moines, Iowa Development 1950-1990

Figure A. - 1950

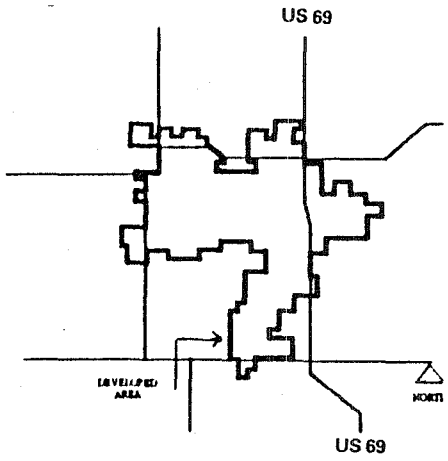


Figure B. - 1960

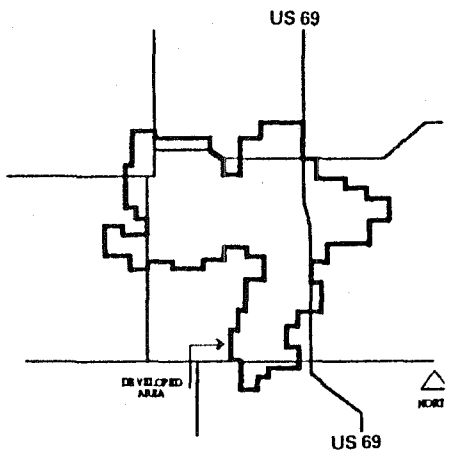


Figure C. - 1970

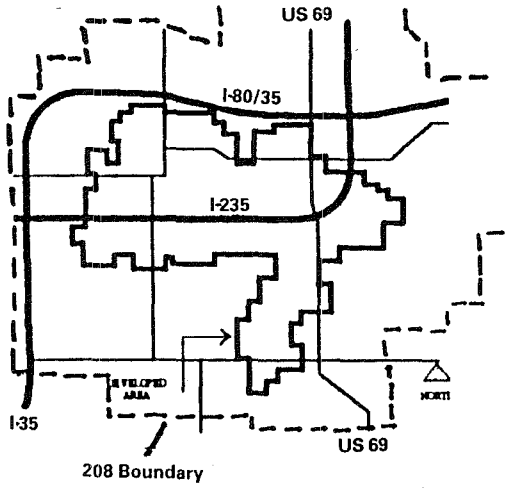


Figure D. - 1980

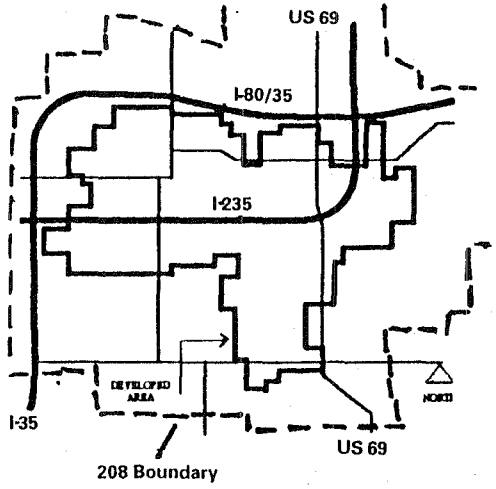
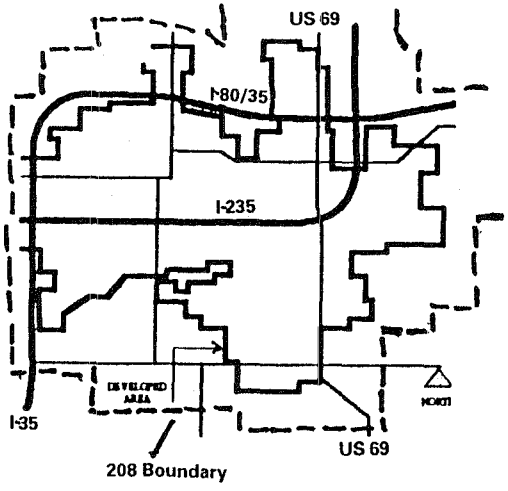


Figure E. - 1990



Figures F-J: Lincoln, Nebraska Development 1950-1990

Figure F. - 1950

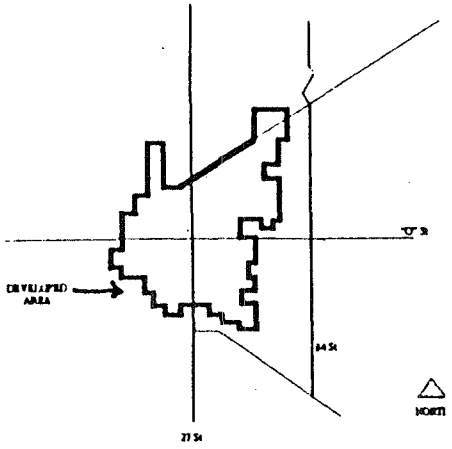


Figure G. - 1960

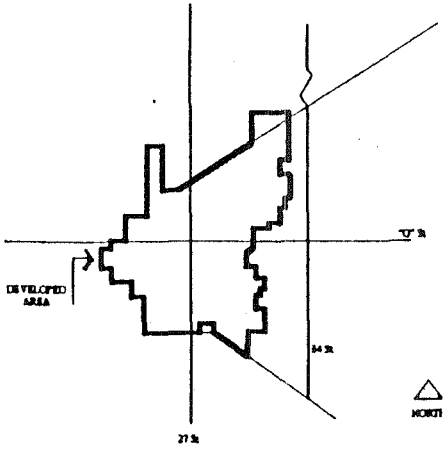


Figure H. - 1970

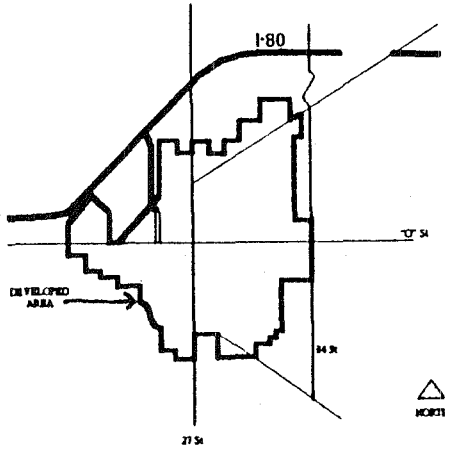


Figure I. - 1980

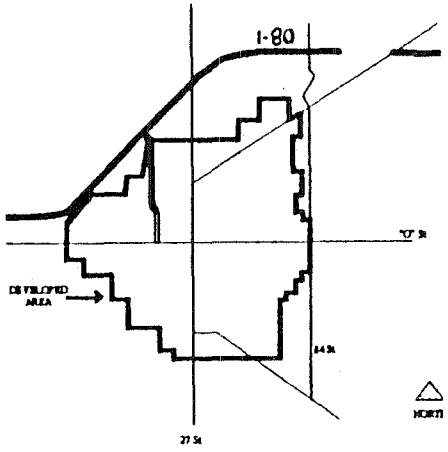
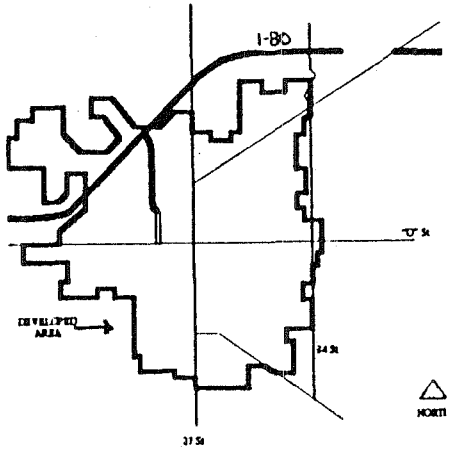


Figure J. - 1990



under Section 208 will become less significant over time, in part because of the elimination of federal funding for sewage treatment, a significant enforcement lever to make such planning work.

The other obvious determinant in the shaping of urban form relates to annexation policies. Some of the differences are historic, going back decades to the creation of forms of government in the states. In Nebraska, primary class cities (which basically means Lincoln) have the authority to annex second-class cities and villages. Thus, Lincoln has had an enforcement tool available to help prevent the evolution of suburbs on its fringes. In Iowa, there is no such power. There are currently 18 municipalities in Polk County, and most of those have existed throughout the period of this study (Johnston, Clive, Pleasant Hill, and Urbandale are relatively new). Thus, part of the destiny of these areas was created by early settlement patterns and early legislative enactments regarding local governments.

Some of the important decisions, however, are more recent. Lincoln has continued to annex territory as necessary. Des Moines stopped annexing.

Table 2.9 Land areas, square miles, Des Moines and Lincoln (cities only), 1950-90.

Year	1950	1960	1970	1980	1990
Lincoln	23.8	25.40	49.30	60.00	63.30
Des Moines	54.9	64.50	63.20	66.10	75.30

Sources: Bureau of the Census, 1950, *Characteristics of the Population, Number of Inhabitants, United States,* Table 17; 1960, *Characteristics of the Population, Number of Inhabitants, United States,* Table 22; 1970, *Characteristics of the Population, Number of Inhabitants, United States,* Table 20; 1980, *Characteristics of the Population, Number of Inhabitants, United States,* Table 34; 1990, *Population and Housing Unit Counts, Iowa and Nebraska,* Table 23.

In a critical growth period, from 1960 to 1980, Des Moines increased its land area by less than 4 percent. During that time, the population of the metropolitan area grew by a little more than 10 percent. Although that conservative annexation policy might seem to have made sense in light of the relatively slow growth rate, annexation can be either proactive or reactive. Des Moines appears to have been reactive, responding only to immediate population pressure. During the same period, Lincoln was proactive, increasing its territory by 80 percent during a period when its own population increase was only 25 percent.

That dramatic increase in land area through annexation provided Lincoln with the land needed for the increased growth of the 1980s, when the city's population grew by about 12 percent. In contrast, much of the Des Moines regional population growth took place in the suburbs. The City of Des Moines actually lost about 9 percent of its population from 1960 to 1980, meaning that the suburbs were growing much more rapidly than the metropolitan area as a whole. The city recovered about 1 percent of that loss during the 1980s. Much of the lost population and the new growth went to the western suburbs that aggressively annexed property through this period.

Although more than sixty-seven percent (67%) of the urbanized area was within the Des Moines city limits in 1960, by 1990 that had shrunk to forty-seven percent (47%). Almost all of the expansion was west of the center of the urbanized area, along the routes of the interstate highways. Grimes and Johnston are located generally north and west of the center of Des Moines, with access from I-80 and 35 (the northern loop of the freeways). Urbandale straddles the northwest part of that loop, West Des Moines straddles the southwest part of that loop (and extends south beyond that), and Clive extends in a long finger between the two west-bound interstate highways. Of the significantly-evolving suburbs, only Pleasant Hill is east of the central area. The land area in the five dominant western suburbs (Clive, Grimes, Johnston, Urbandale and West Des Moines) was 54.6 square miles by 1990, roughly three quarters the size of Des Moines, or about one-third of the total urbanized area. Those cities continued to expand significantly early in the 1990s, as Iowa enjoyed good economic growth and lower interest rates multiplied the impacts of that economic expansion on land development.

Considered from a different perspective, the suburbs essentially made up for Des Moines' decision not to annex territory for 20 years. That clearly was a major additional factor contributing to suburban sprawl in the Des Moines metropolitan region.

Table 2.10 Population and land areas, Des Moines and major suburbs, 1960, 1990.

	1960		1990	
	Population	Land Area (square miles)	Population	Land Area (square miles)
Clive	752	N/A	7,462	4.80
Des Moines	208,982	64.50	193,187	75.30
Grimes	582	N/A	2,653	7.00
Johnston	0	0	4,702	14.20
Pleasant Hill	397	N/A	3,671	4.90
Urbandale	5,821	4.20	23,500	10.70
West Des Moines	11,949	17.30	31,702	17.90
Urbanized Area (total)	241,115	95.60	293,666	159.70

Source: Bureau of the Census, 1962, *County and City Data Book*, Table A-2; 1970, *Characteristics of the Population*, Table 6; 1990, *Population and Housing Unit Counts*, Table 23.

Transportation Implications

Although there are many similarities between Lincoln and Des Moines (noted at the beginning of this chapter), their transportation patterns are as different as—and directly related to—their population and development patterns. In Des Moines, the freeways are overloaded with commuters and there is significant pressure for expensive major expansions. In Lincoln, commuters travel to work other ways, although the freeway runs along the edge of the city. The relationship of the interstate route to the city is remarkably similar to that of the I-80/35 combination to the City of Des Moines, with both skirting the major urbanized area on the north and then gradually turning south to the west of the city, coming to an alignment in line with that of the central axis of the city.

In Lincoln, traffic on I-80 at the eastern edge of the city (84th Street) amounts to 21,300 average daily trips. At the west edge, it totals 23,200 average daily trips. Traffic on most intervening segments is actually LOWER than either of those figures, indicating that much of the traffic on the road is destination traffic to or from Lincoln, using the interstate highway as exactly that—or at least as an intercity highway. The only segment on which the traffic volumes are higher than at the edges of the city is from Salt Valley Roadway to Cornhusker Highway, where there are 28,300 average daily

trips. Cornhusker Highway, or U.S. Highway 6, provides access from northeast Lincoln to the west central part of the city, near the airport (an old air base) and is a dominant local commuter road with average daily traffic counts of more than 35,000 on some segments. Although Salt Valley Roadway carries much smaller traffic loads (8,000 to 10,000), that one segment of I-80 provides an important link between those two local commuter and commercial routes.[1]

In general, however, traffic in Lincoln is relatively well-distributed around the grid, with major arterials on the grid carrying up to 20,000 trips per day (or more in some instances) and many segments carrying 10,000 or more.[2]

The circumstances in Des Moines are quite different. The analysis is also more complex, and a table is useful to understand that.

Table 2.11 Traffic loads, selected locations on Interstate highways around Des Moines, Iowa, 1992.

Interstate location	Average Daily Trips	Imputed Through Traffic
I-35 at south edge (south limits of West Des Moines)	21,000	
I-35 at north edge (north limits of Ankeny)	22,100	
I-35 average		21,550
I-80 at west edge (west line of Polk County)	28,100	
I-80 at east edge (Iowa 945 and Co. Rd S 14)	29,100	
I-80 average		28,600

Source: Iowa Department of Transportation. 1993. "Volume of Traffic on the Primary Road System: 1992." "Estimated through traffic" computed by the author by averaging loads on same road at each end of city.[3]

Traffic flow into and out of Des Moines both directions on I-35 averages about 21,550 trips per day. Traffic flow into and out of Des Moines both directions on I-80 averages about 28,600 trips per day. These figures give a good idea of the net number of through trips that could be expected without regard to commuting. Obviously this is a macro view of "through trips" rather than an origin-destination analysis of them, because it clearly includes some trips with trip-ends in Des Moines. The point, however, is that, without commuting trips, one would expect the traffic on the interstate highways in Des Moines to be less than or equal to the imputed through traffic. As described above, the traffic loads in Lincoln are actually lower than the imputed through trips, reflecting the fact that there are more trips with one end in Lincoln and one out of the metro area than there are commuting trips on most of that road.

In Des Moines, the situation is radically different. Although some trips clearly do begin and end in the Des Moines urbanized area, there are so many commuting trips that traffic loads on the interstate highways through the city are far greater than the imputed through traffic.

The average loads along the I-35/I-80 alignment are in the range of 40,000 or more, going as high as 46,900 at the border between Urbandale and Clive along the western part of the route and again at the East limits of Urbandale along the northern part of the route. The patterns here are actually consistent with those along I-80 through Lincoln, which has a similar alignment in relation to the city. The loads are somewhat less than the imputed or expected through traffic. The big difference comes when the MacVicar Freeway (I-235), running through the heart of the metro area, is included. Average daily trips on that road exceed 80,000 trips per day on more than 3.5 miles of the road and actually exceed 90,000 trips near its middle (42nd Street, near the western edge of Des Moines). The only segments below 50,000 are at its ends.

Taking the highest traffic load on I-235 (90,100 trips at 42nd

Street) and the highest load on I35/80 (46,900 at two locations) produces a total average daily load for both roads of 137,000 trips. Comparing that to the imputed or expected through traffic of about 50,000 trips indicates that sixty-three percent (63%) of the trips on these two roads are commuting or other local trips. This stands in stark contrast to Lincoln, where a similar calculation actually yields a negative percentage, because the in-town traffic is less than the traffic at either side of the city.

For traffic planners, the circumstances are even worse than these calculations suggest. Although through trips are likely to be distributed fairly evenly over the day and early evening hours, with some actually occurring overnight, commuting trips are almost all peak-hour trips. Handling 137,000 average daily trips when half or more of them are peak-hour trips requires far more lane-miles than handling the same number of average daily trips with little or no peak difference. Thus, the traffic patterns in Des Moines do not indicate simply that the metro area requires 2.7 times as many lane miles to handle 2.7 times as much traffic as Lincoln; rather, the city may need 4 or 5 times as many lane miles of freeway as Lincoln to handle 2.7 times as much average daily traffic, because so much of that traffic is on the road at peak hours.

There is one other indicator that relates to all this and that is the "journey to work." According to the census, the average journey to work in the Des Moines metro area is 17.9 minutes; in the Lincoln metro area, the average is 16.2 minutes. One might expect a greater difference between the two areas. The Lincoln metro area has only about two-thirds the population of the Des Moines metro area, and it is much more compact. The reason that commuting in Lincoln takes almost as long as it does in Des Moines is clearly that people commute on city streets and on state highways that are not limited-access. They stop at stoplights. They wait for people to turn. They spread their trips over the grid and thus keep the system in relative equilibrium. They are undoubtedly traveling at slower speeds and thus traveling shorter average distances than commuters in Des Moines. There are clearly many busy streets at rush hour, but none with anything approaching the traffic volume on the MacVicar.

As the findings of the literature review (Appendix B) suggest, the journey to work influences people's decisions about housing. That in itself undoubtedly has contributed to keeping Lincoln relatively compact. Without the ease of commuting on a major freeway that provides rapid access to the far exurbs, Lincolnites prefer to buy property closer in that keeps them within the average journey to work or within their own tolerance, based on the patterns reflected in that figure. To look at it differently, the existence of the MacVicar has made it attractive for residents of the Des Moines region to choose to live in locations that are a good bit farther west than they would choose if they had to use the street system to commute. That explanation does not, of course, produce a solution to the transportation planning problems in Des Moines; suddenly ripping up the MacVicar and thrusting central Iowans onto the street grid to commute, even with improvements to that grid, would be exceedingly disruptive. Land-use patterns have been established based on the availability of that roadway. Had it not existed, however, different expectations would have led to different buying decisions, leading in turn to different land-development patterns.

Analysis and Conclusion

The conclusion is simple. With I-35/80 and I-235 through the Des Moines area, Iowa Department of Transportation officials are providing interstate freeways as a major element in serving local traffic needs. In contrast, with I-80 through Lincoln, Nebraska Department of Roads officials are primarily providing access to intercity transportation. Which is better public policy, or whether they are equally valid but suited to different contexts, is an issue to be addressed by public officials and the

citizens who elected them, not by scholars. Thus, this finding implies no value judgment. It is simply a finding, with its implications to be considered by others.

Clearly the sewer service boundaries established for the metropolitan sewer service area in Des Moines played a key role in determining its current urban form. The fact that the City of Des Moines chose not to annex territory while its suburbs annexed aggressively is another important factor in the shape of the Des Moines metropolitan area. Lincoln has benefited not only from effective planning but also from a state law that makes the evolution of suburbs near Lincoln extremely unlikely.

Perhaps most important, however is the central finding of this chapter—the reason that the Iowa Department of Transportation now faces the need to widen the MacVicar Freeway at great expense is because earlier officials at IDOT decided to build the MacVicar Freeway. That decision was a major contributor to the current urban form of the Des Moines metropolitan area, and that urban form in turn has created the demand for expansion of the MacVicar. The urban form and transportation pattern of Lincoln, Nebraska, a neighboring state capital, shows that there were, and to some extent still are, valid policy alternatives.

What lessons can be learned from this?

For Lincoln, "Keep up the good work!!" The 1994 Lincoln City-Lancaster County Comprehensive Plan suggests that public officials plan to do so. It is interesting to note that a senior planner there informed the author of this report that a related report by the author (*Planning, Growth and Public Facilities;* see bibliography to literature review) influenced public officials in Lincoln and Lancaster County in adopting the new plan.

For Des Moines and officials of the Iowa Department of Transportation, the lessons are more complex and a good bit less clear. It is not possible to turn back the clock in Des Moines and to invent a city with an urban form like that of Lincoln. It might not be desirable to do so even if it were possible. On the other hand, one can learn from history. If there is one clear piece of learning from this history lesson, it is that improving traffic flow from Des Moines to its western suburbs will not solve the traffic problem over the long-run. It will simply contribute to additional westward expansion and additional demand for additional traffic improvements. The migration of some jobs westward may mitigate traffic load on the MacVicar somewhat, but as the discussion in the literature review indicates, people working there are likely to live all over the metropolitan area.

One possible approach in the Des Moines area would be to develop a comprehensive set of state and local policies to encourage relatively complete development of vacant land within and near the existing highway loop before there is significant further westward expansion. That would require effective growth management programs of local governments, but it would also suggest the rethinking of some IDOT policies, such as the further westward widening of U.S. 6 into Dallas County.

None of that is to suggest that the freeway is the problem. The automobile and, more specifically, the desire of U.S. residents to drive it everywhere is the real problem. Tony Downs has discussed that phenomenon in much of his writing, most notably *Stuck in Traffic* (see literature review in Appendix B and citation there). IDOT simply tries to satisfy that consumer demand. Thus, the moral lesson regarding traffic and urban sprawl is really one for the motoring public.

There is also a practical lesson there for IDOT and planners in the metropolitan area. The lesson for them and transportation planners in other communities is fairly clear. If you want your city or region to look like the Des Moines metropolitan area, with heavy commuting loads on the interstate highways, relatively low densities and sprawling suburbs, freeze the

boundaries of the central city, establish utility service boundaries that go far beyond it, and build major freeways to the growing suburbs. If you want to look like the Lincoln metropolitan area, annex to the central city the land necessary for development, attempt to limit utility services to that area, and develop an integrated grid of public streets to serve local commuting needs; most important, do not ask (or encourage) state officials to improve the interstate highway system through town to provide improved commuting.

[1] All traffic data from City of Lincoln Transportation Department 1995, 1994 24-hour traffic volumes (stapled).

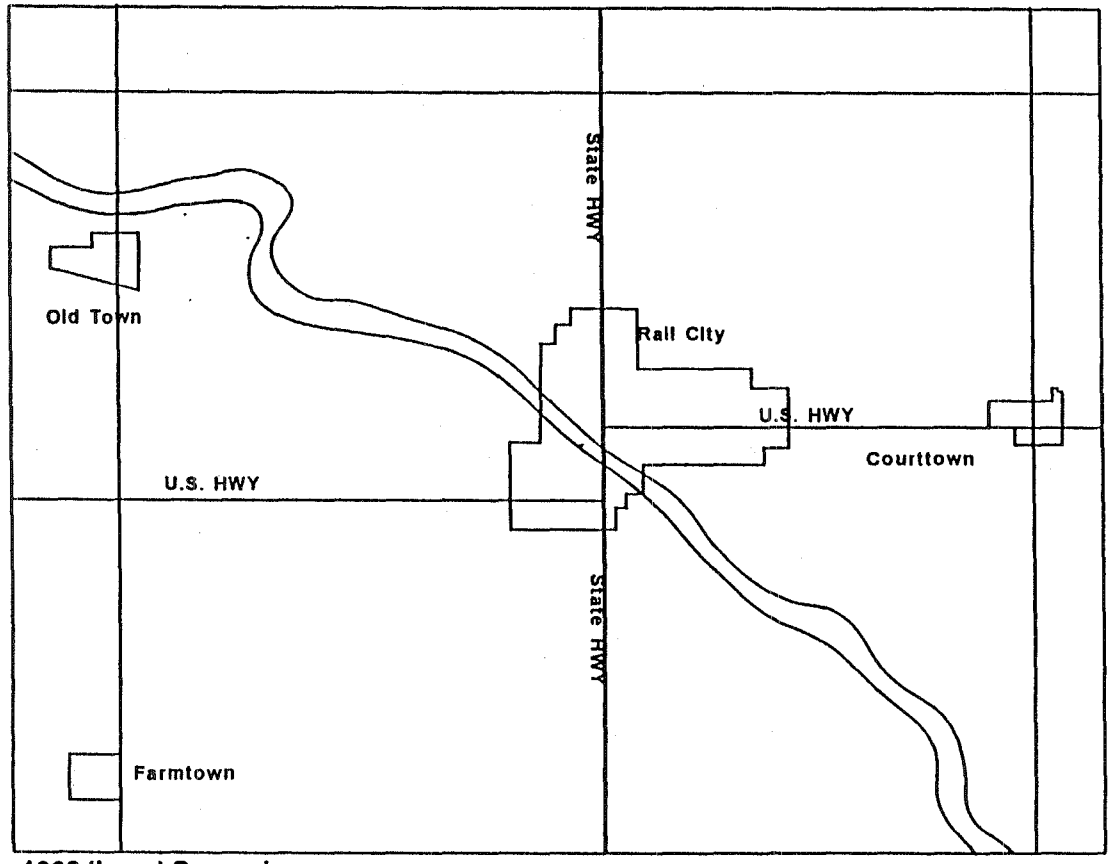
[2] Ibid.

[3] This is a gross over-simplification in origin-destination terms, but in straight statistical traffic analysis, it is perfectly valid. At worst, it overestimates through traffic. Typical traffic loads on I-80 further west are in the 14,000 to 17,000 range, and to the east are fairly consistently in the 21,000 to 22,000 range all the way to the Illinois line. Loads on I-35 further north decrease with distance from Des Moines, dropping below 17,000 past Ames and U.S. 30 and below 12,000 past U.S. 20. Loads on I-35 further south decrease even more rapidly, falling below 12,000 at Indianola and below 9,000 by the Missouri line. Thus, estimating through trips of 50,000 per day is high and clearly includes a number of Des Moines-destination and origin trips in all directions (a fact that is more clearly illustrated with the Lincoln figures). In short, this methodology at worst over-states through trips and understates the commuting problem in Des Moines.

Illustration of Growth Impacts

This chapter illustrates how planning, growth management and transportation decisions interact to influence urban form. Six separate scenarios show different combinations of public decisions and the secondary (and, in some cases, tertiary) impacts of those decisions.

The scenarios use a small metropolitan area centered around Rail City, which appears in the middle of the maps. Rail City is the dominant employment center. Courttown, to the east of Rail City, and Old Town, to the northwest, are older communities, but Rail City has dominated the region's economy since the railroad closed its station in Old Town in the 1920s. The only other significant settlement in the area is Farmtown, located in the southwest portion of the map. A major U.S. highway (four-lane, not divided through this area) serves the area from east to west. A state highway intersects with it at Rail City, reinforcing its status as a regional transportation hub. The other roads on the map are county highways. A river flows through the area from northwest to southeast. There is a major wetlands area along the river to the southeast of Rail City. The land to the south of Rail City and also northwest of the river is the best agricultural land in the region.



1960 (base) Scenario

Scenario I: Too Many Decision-Makers

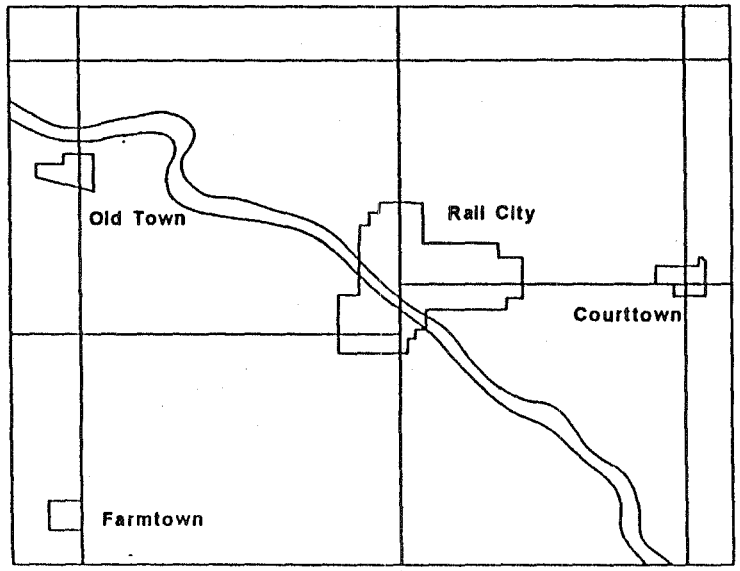
This scenario shows the impacts of construction on an interstate highway, generally following the route of the north-south state highway. There are interchanges built to the north and southwest of Rail City. Construction on the highway was completed in the early 1960s. The land to the south of Rail City and northwest of the river is the best agricultural land in the region.

By 1970, growth in Rail City had focused around the two interchanges, thus stretching the city into an elongated, irregular pattern. Not all of the new development around the interchanges represented growth. Some of it simply represented a shifting of commercial activities, particularly those oriented toward the highway, to the locations of the two interchanges. The sewer and water service necessary to serve those new commercial nodes in turn attracted other development to those areas. There was little change in any of the other three communities during this period.

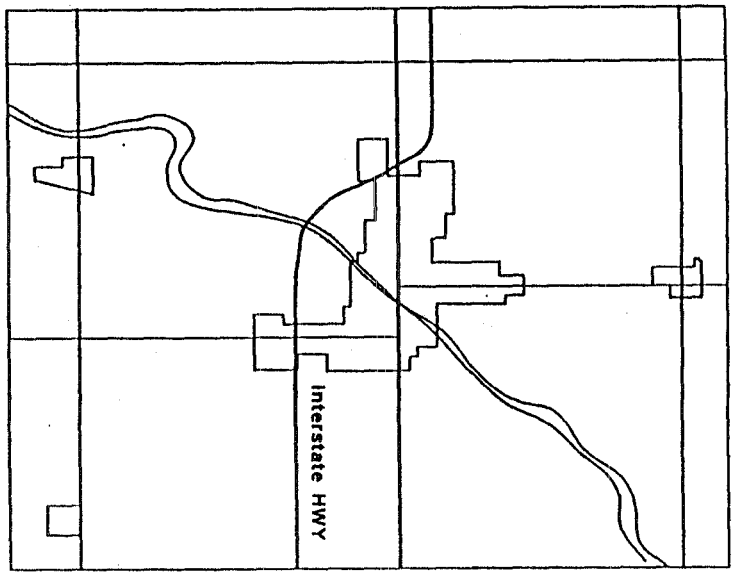
In 1974, Rail City built a new sewage treatment plan southeast of the city, to ensure that continuing growth would all be at higher elevations than the plant, thus permitting the full use of gravity flow for the system. Sewage reaches the plant through a major interceptor sewer following the river slightly to its south. As the 1980 map shows, growth patterns began to follow the new interceptor sewer line to the southeast of the city, while there was continued growth around the two highway interchanges. In 1976, the school district decided to build a new high school. It was able to "save taxpayers money" by paying only $500,000 for a new school site east of the northern extension of Rail City; alternative sites closer to town would have cost more than $1,500,000. Rail City then extended sewer and water service, as well as an arterial road, to the site at a cost of a little more than $2,000,000.

In 1978, the state department of transportation announced plans to upgrade the East-West U.S. highway from Courttown to Rail City. Construction was scheduled to begin in 1981. In anticipation of that link there was a small amount of westward expansion of Courttown. In 1979, a major new factory located west of the northern part of Rail City. Rail City also extended sewer and water service to that site; the company built its own access road.

By 1990, development in Rail City had expanded to the southeast all the way to the new sewer plant and to the north to



1960 (base) Scenario

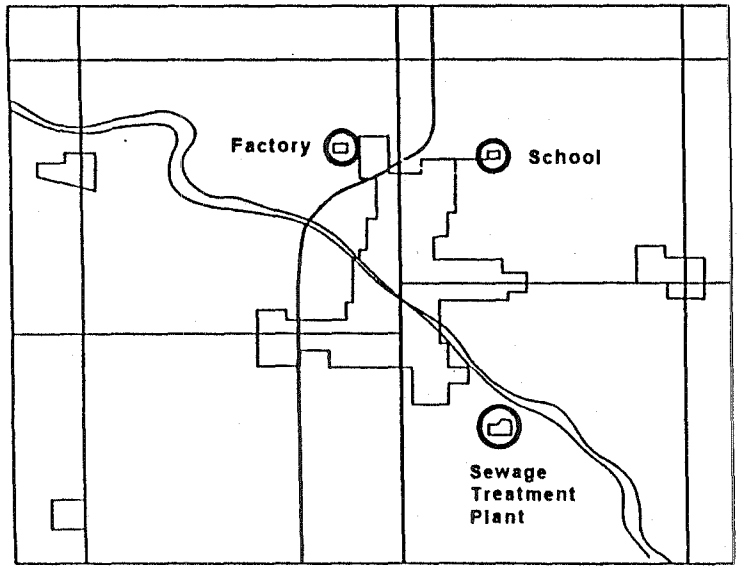


1970 Scenario

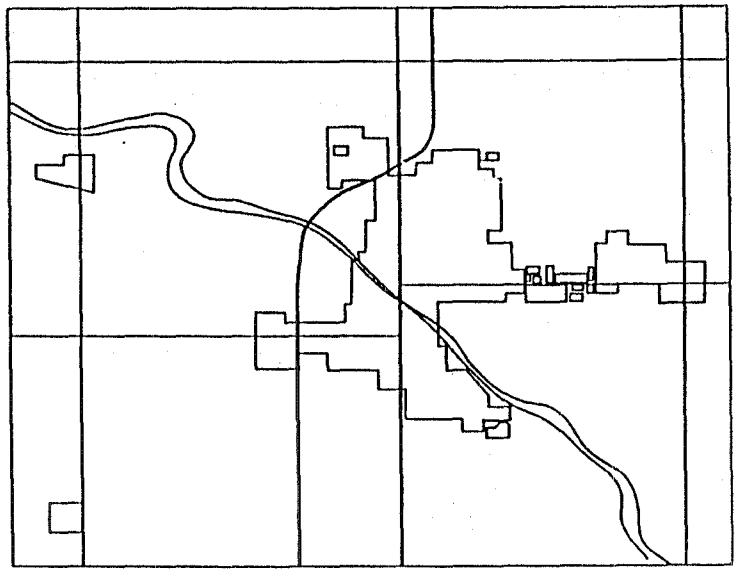
surround the new factory; much of the new development in that area was light industrial. Courttown began to grow significantly to the west because of the good access to the new Rail City employment centers via the interstate link. The remaining open land between Rail City and Courttown along the existing U.S. highway filled with commercial development, including a factory outlet mall and a mega-store operated by one of the giant discount chains. The northern part of Rail City continued to expand to the east toward the school, although the school remained outside of the city with all urban students being bused to the remote location.

Lessons Learned:

- *Intersections on interstate were primary locations for new growth early in this scenario. Intersections should be placed in logical locations for growth and local plans should then address growth implications of those locations.*
- *Upgrading arterial highway encouraged additional development along it. Bypass or upgrade with limited access are possible alternatives. The major point is to consider the land-use implications of upgrading the road.*
- *School board kept school taxes down but actually cost taxpayers more money by choosing site that was "cheap" because it had no services. School planning should be coordinated with community planning.*
- *Sewer plant was located to ensure gravity flow. Growth then followed interceptor sewer line, probably down floodplain. Planning for sewers should also include consideration of possible secondary impacts. Growth in this area may ultimately require additional road improvements.*
- *Extending services to new factory provided additional new growth corridor. This is a lesson in tertiary impacts. The proposed location for the factory led to a service expansion that influenced other growth patterns. Those patterns may or may not have been acceptable from a community or transportation perspective but those issues should be considered in planning.*



1980 Scenario



1990 Scenario

Scenario 2: Growth and the Airport

This scenario includes the same interstate highway as the previous one. It also illustrates the impacts of a different form of public works investment. In this scenario, Rail City decided to build a new airport southeast of town in 1968. By 1970 the new airport was open and operating, but with access only by local roads. A new access road from the interstate highway was on the five-year plan. The city extended major sewer and water lines to the airport at the time that it was built. New development in the 1960s focused around the interchanges on the new interstate highway system. The land to the south of Rail City and northwest of the river is the best agricultural land in the region.

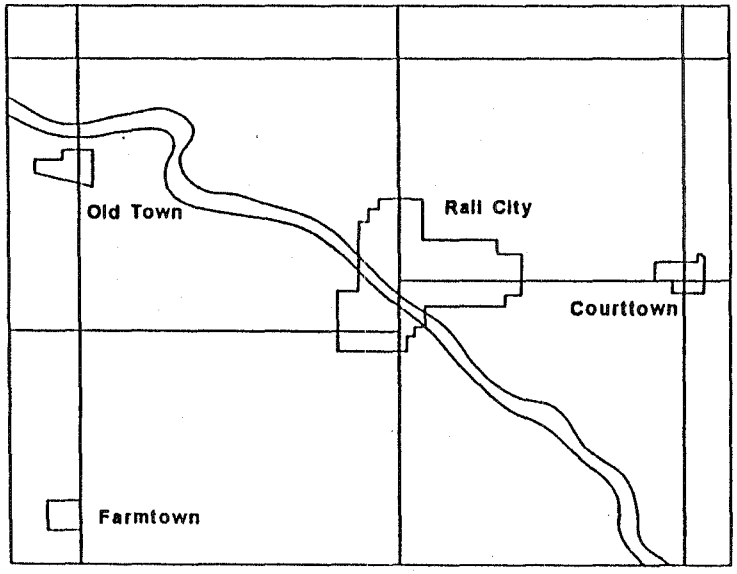
The new road to the airport was completed in 1972. As in the previous scenario, the city also completed a new sewage treatment plant southeast of the main part of the city and relatively near the new airport. This combination of factors thus provided the area around the airport with excellent sewer, water and access—the prime requisites for new development. Not surprisingly, the southeastern part of Rail City thus boomed during the 1970s, creating land-use conflicts between the airport and its new neighbors, many of whom apparently did not notice the airport until they moved in and tried to sleep or hold parties on their decks.

By 1990, development completely surrounded the airport (which had been built in a relatively remote location in 1968). Thus precluding opportunities for expansion and increasing both the number of noise complaints and the statistical risks of a disaster resulting from an accident.

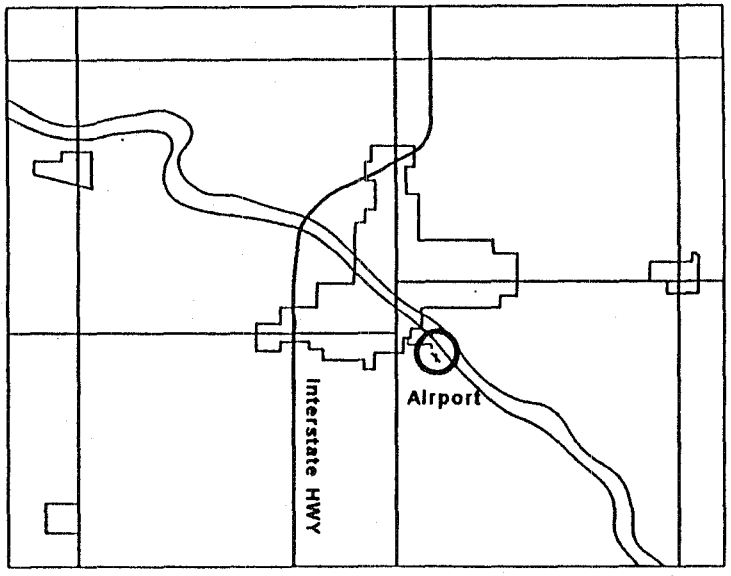
Note in this scenario that the growth-influencing impacts of the public infrastructure investments around Rail City are so great that there has been little change in Courttown, Old Town or Farm Town.

Lessons Learned

- *Airports need infrastructure. That infrastructure may attract growth that is incompatible with the airport. "Right-sizing" sewer and water lines or using a well and package treatment plant to serve the airport and its immediate needs (a hotel or two and some auxiliary services) limits the risk of this type of*

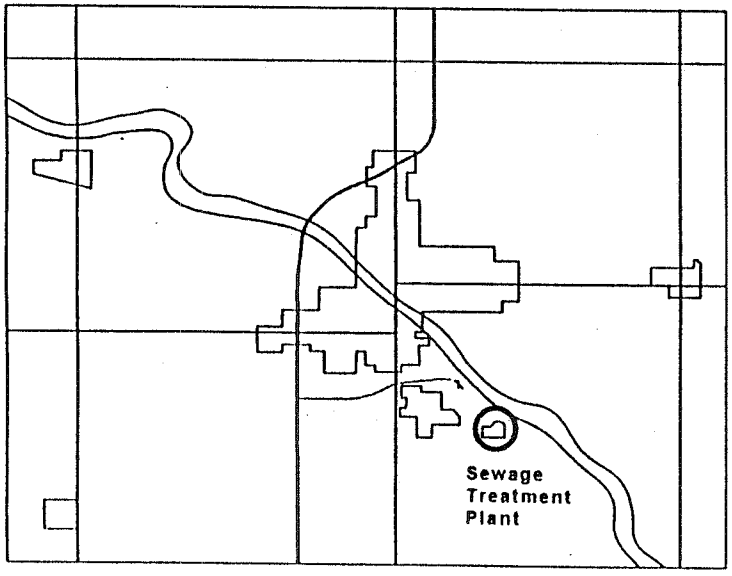


1960 (base) Scenario

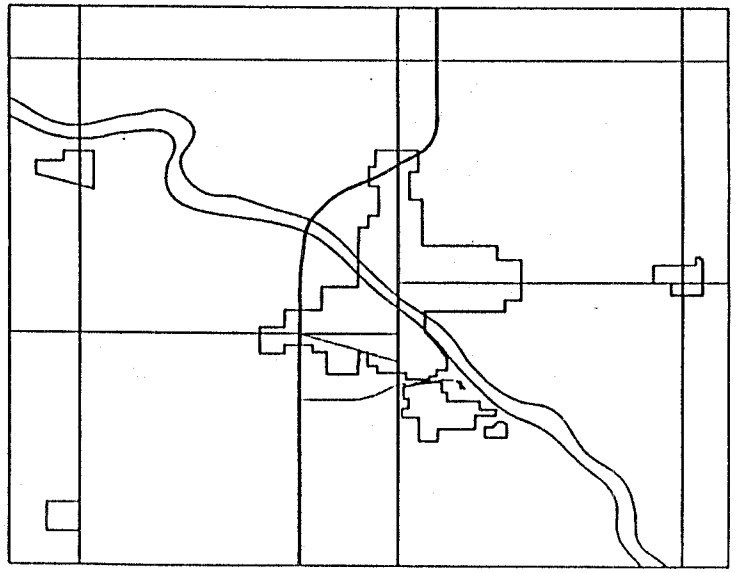


1970 Scenario

scenario. Access roads to a new airport in a remote location should generally have limited access. Public ownership of accessible sites along them should be seriously considered.



1990 Scenario



1990 Scenario

Scenario 3: The Beltway

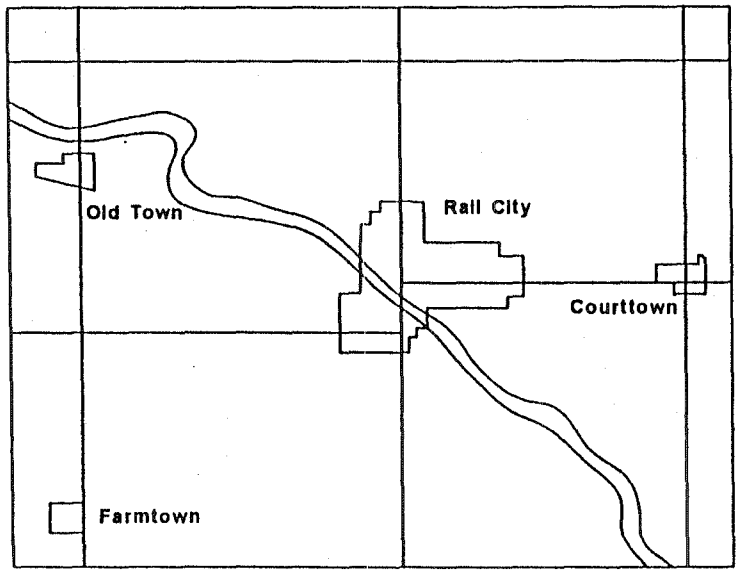
This scenario demonstrates a far different growth pattern for the region. As part of a long-range plan to create a beltway around Rail City, the state department of transportation proposed a divided loop road off the interstate system, going around Rail City to the east and providing improved access to Courttown. By 1970, growth remained focused as it had in the other two scenarios, around the two interchanges on the interstate highway system. The land to the south of Rail City and northwest of the river is the best agricultural land in the region.

By 1980, the transportation department had completed the northern portion of the beltway, thus opening Courttown in particular to better access. Development in Courttown moved westward, toward Rail City, and somewhat southward to the end of the new beltway.

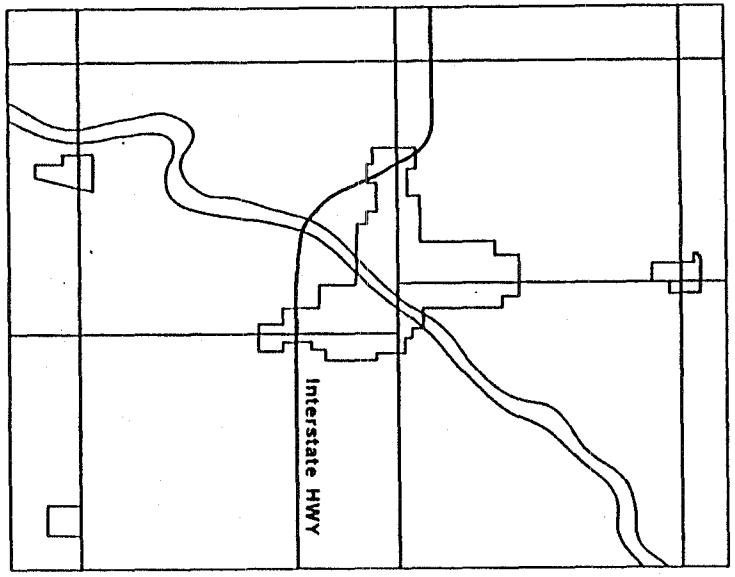
By 1990, development pressures in the southern part of Courttown had become so great that the state found it necessary to add a diagonal roadway from the southern part of Courttown back to a point near central Rail City, thus relieving congestion along the new beltway. Because the rest of the beltway remained unbuilt, development stayed focused north and east of Rail City.

Lessons Learned:

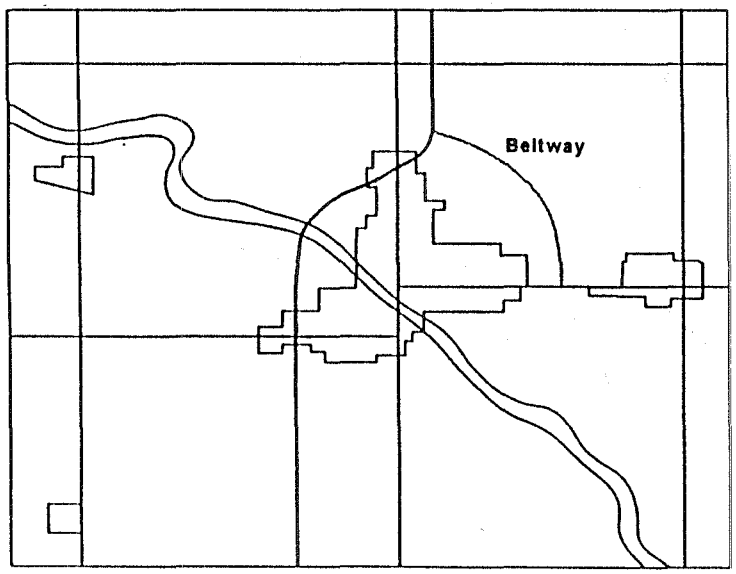
- *Beltways influence growth. One of the great ironies of beltways is that they may facilitate development that then creates a demand for other transportation routes. That may occur because the new development exceeds the capacity of the beltway. In other cases, like this one, the beltway may make an area appear convenient for development, but subsequent orgin-destination studies may indicate that most trips from that development want a more direct, or radial, route back to the center of regional activity.*



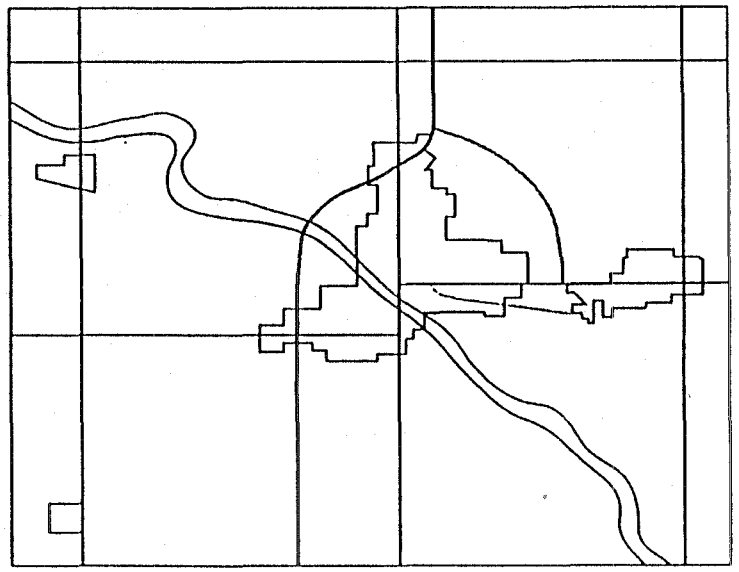
1960 (base) Scenario



1970 Scenario



1980 Scenario



1990 Scenario

Scenario 4: Growth Boundary

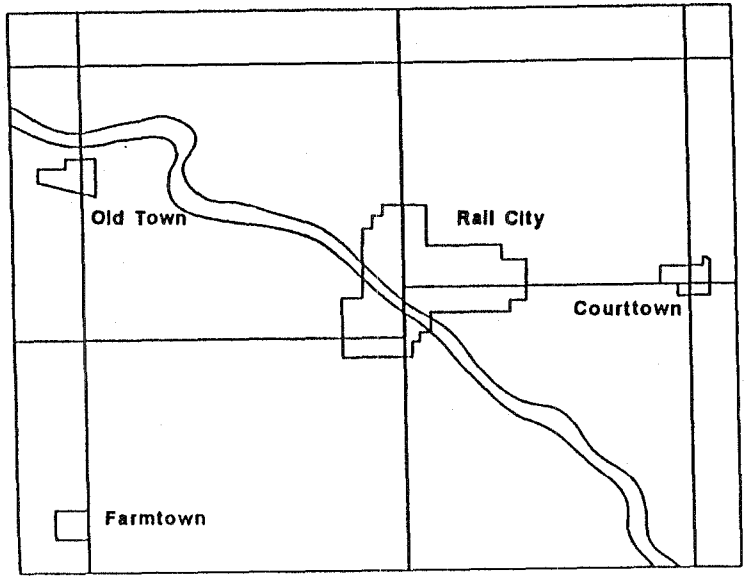
By 1970, growth in Rail City had focused around the two interchanges, thus stretching the city into an elongated, irregular pattern. Not all of the new development around the interchanges represented growth. Some of it simply represented a shifting of commercial activities, particularly those oriented toward the highway, to the locations of the two interchanges. The sewer and water service necessary to serve those new commercial nodes in turn attracted other development to those areas. There was little change in any of the other three communities during this period (same as Scenario 1).

In 1972, citizens of Rail City became concerned about urban sprawl and passed a citizen initiative that established an urban growth boundary, roughly along the current south boundary of the city, following the west boundary of the city past the south interchange and then following the north-south interstate to the north edge of the city; from there, it followed a squared-off version of the city's boundary on the north and east.

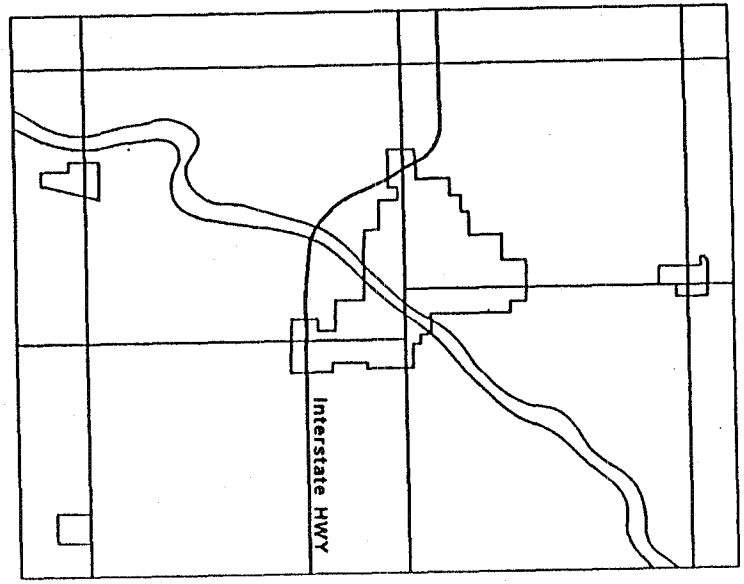
After 1972, there was limited additional development in Rail City, most of it industrial and most of it along the interestate highway. Land costs within the urban growth boundary increased dramatically, making residential development of that land impracticable. Residential development outside the urban growth boundary was essentially impossible because of the lack of services.

Courttown and Old Town, thus enjoyed major residential booms and expanded significantly, generally toward Rail City. By 1980, Courttown had grown to the eastern boundary of Rail City and Old Town had expanded significantly toward Rail City. The state department of transportation had improved the highway between Rail City and Courttown to four-lane divided roadway. Because of the high cost of acquiring right-of-way in the developing area, it was not possible to make the improved roadway a limited-access one.

In 1982, Old Town's sewage treatment plant reached capacity. City officials decided that expansions would be too expensive and consented to a moratorium imposed by the state environmental department. There was thus no further growth in Old Town after



1980 (base) Scenario



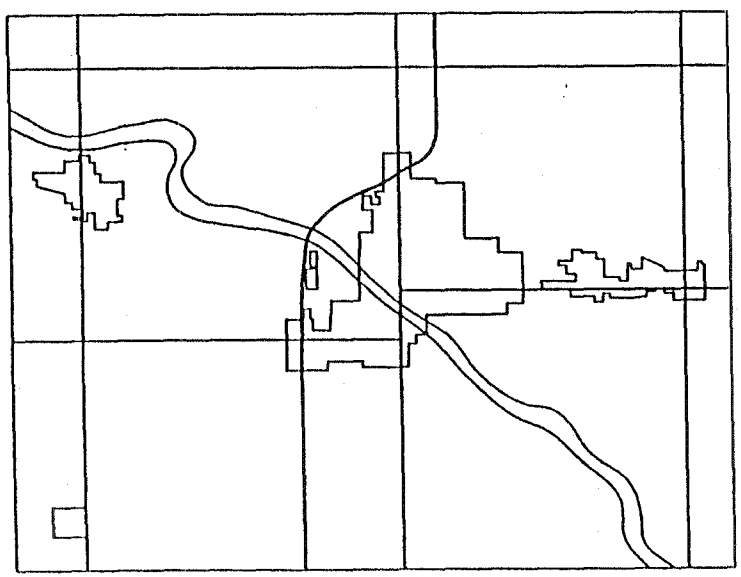
1970 Scenario

1982. From that time, Farmtown began to expand, growing generally north along the county road. The Department of Transportation extended the four-lane divided section of the U.S. highway to the intersection with the county road from Farmtown. In 1988, the county highway department widened the road to four lanes, from Farmtown to the U.S. highway.

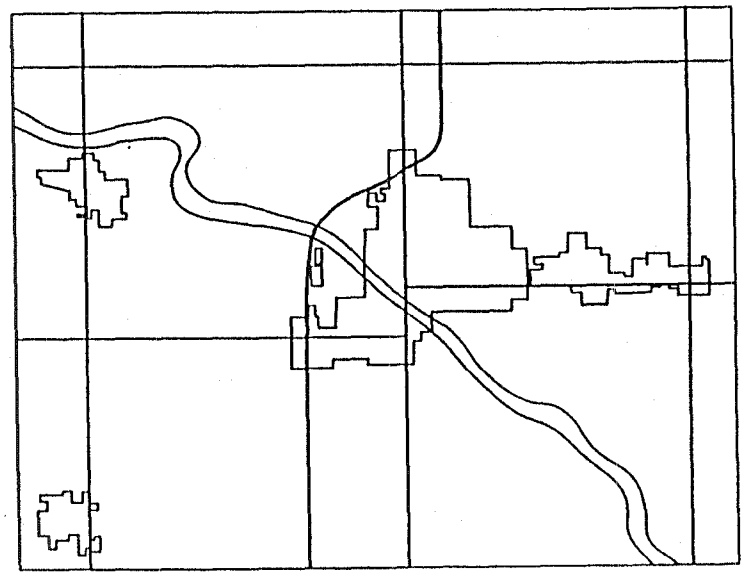
By 1990, Farmtown had grown nearly as large as Old Town. There had been some additional expansion in Courttown, also. Development continued to fill in the urban growth boundary around Rail City, but most new development was in the other communities.

Lessons Learned:

- *An urban growth boundary may amount to an urban growth bumper, effectively diverting growth from the community with the boundary to other communities. If those other communites are logical locations for growth, that may be a very positive result. In this case, as in many others, the jobs and the major infrastructure are in Rail City and that is probably the best location for growth. Because the jobs remain in Rail City even after adoption of the urban growth boundary, there is a significant increase in commuting and a resulting increase in demand for road construction as a result of this short-sighted, rather selfish policy of Rail City.*



1980 Scenario



1990 Scenario

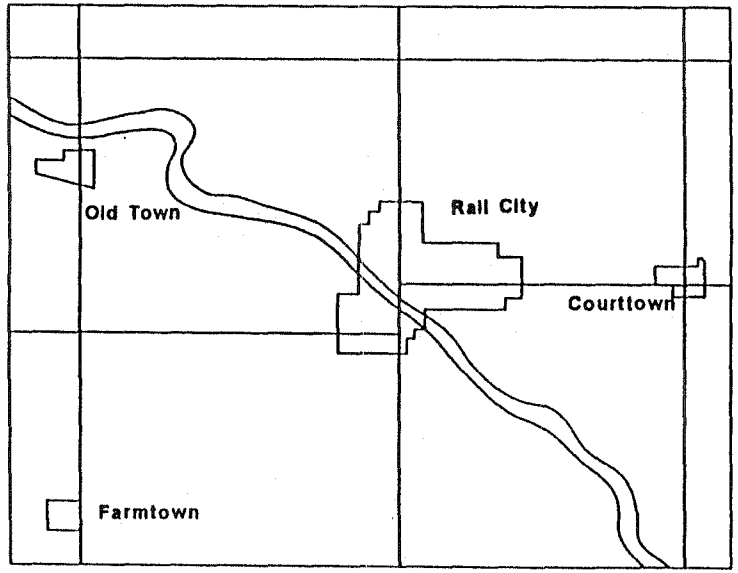
Scenario 5: Magnets for Development in the Floodplain

As part of a long-range plan to create a beltway around Rail City, the state transportation department proposed a divided loop road off the interstate system, going around Rail City to the east and providing improved access to Courttown. By 1970, growth remained focused as it had in the previous scenario, around the two interchanges on the interstate highway system.

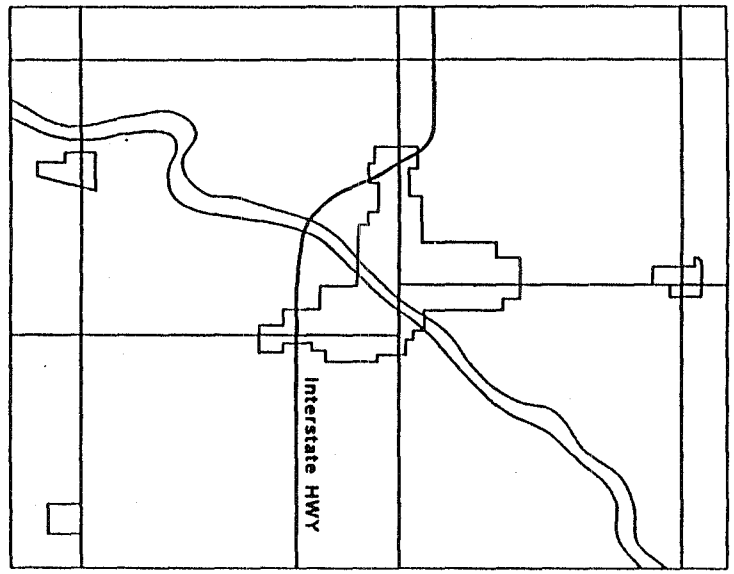
By 1980, the transportation department had completed the northern portion of the beltway, thus opening Courttown in particular to better access. Development in Courttown moved westward, toward Rail City, and somewhat southward to the end of the new beltway (same as Scenario 3 to this point). In 1980, Rail City adopted an Adequate Public Facilities policy, requiring that all new development have a specified level of service for sewer, water, stormwater, fire, parts and schools. There is good sewer, water and stormwater service throughout the city and within a short distance of the city limits except to the south, where the city limt boundary represents the lowest elevation that can be served by the current sewage treatment plant.

In 1982, Rail City built a new fire station in the southeast courner of the city. By 1983, there were petitions for annexation for all of the land north of the south boundaryof the city on the west side of the river and for some of the land north of that boundary on the east side of the river. Those petitions were approved and the area began to develop. In 1988, Rail City was hit with a devastating flood. More than a hundred homes along the river in the newly-annexed areas of the city are wiped out by the flooding. They were located outside the designated 100-year floodplain. Some skeptics questioned the floodplain mapping, since farmers in the area remember that land being under water as recently as 1965, only 20 years earlier.

By 1990, the flooded area had been rebuilt and the entire southeast corner of the city had been squared off. The area between the west city limits and the interstate highway hadalso filled in. The eastern boundary north of the U.S. highways had also been squared off. There was limited additional development in Courttown, generally following the route of the beltway, and



1960 (base) Scenario

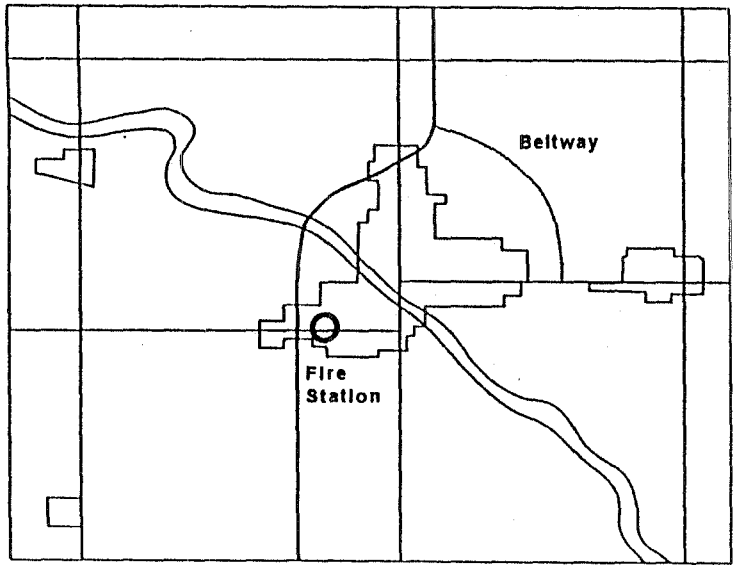


1970 Scenario

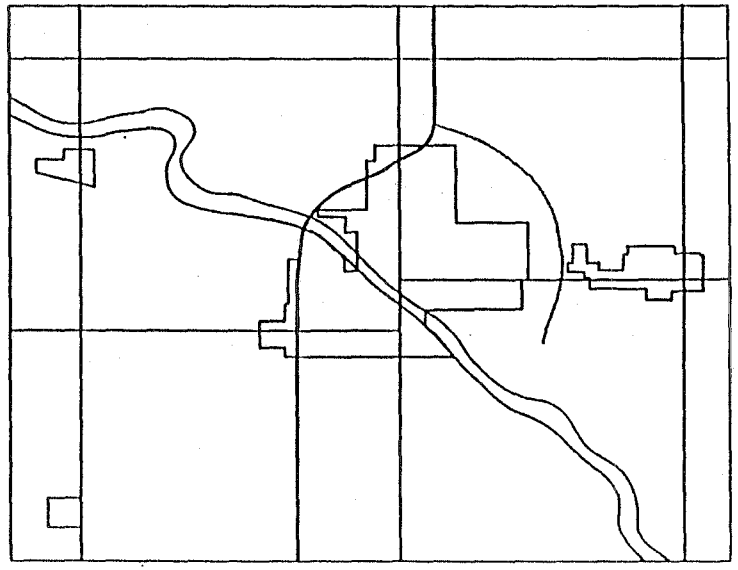
none in Old Town or Farmtown. The beltway has not been completed to the south.

Lessons Learned:

- *The availability of services is so important to development that it tends to overwhelm all other planning and regulatory tools. In this case, it was possible to meet the "adequate public facilities" standards in areas that happened to be close to the river, so developers built close to the river. The best way to avoid this scenario is to avoid providing public services too close to areas that should not be developed. The city should probably have placed the new fire station elsewhere and, again, it should have considered "right-sizing" sewer and water lines in the northwest and southeast quadrants to serve a limited amount of development out of the floodplain.*



1980 Scenario



1990 Scenario

Scenario 6: Planning Works

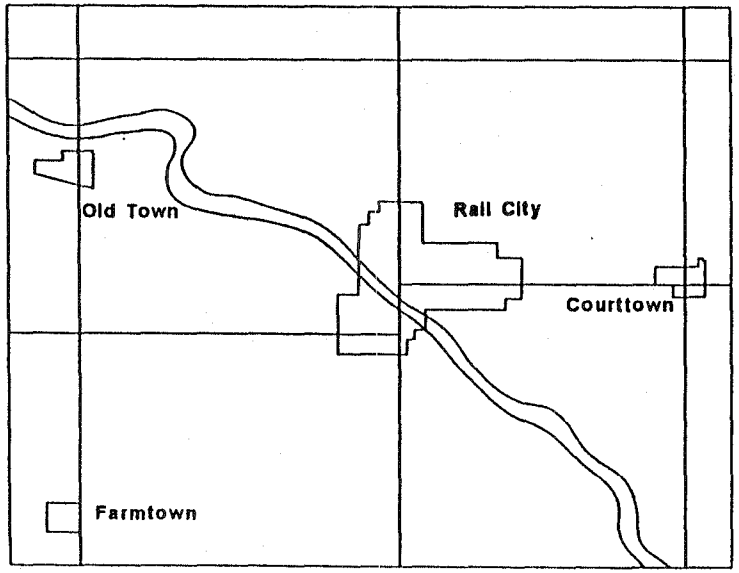
As part of a long-range plan to create a beltway around Rail City, the state transportation department proposed a divided loop road off the interstate system, going around Rail City to the east and providing improved access to Courttown. In 1968, in response to the proposal, Rail City adopted a long-range capital improvements program to provide sewer, water, sotrmwater and other critical public services in the area generally north and east of the city. The program identified floodways and included a policy against providing services in or near the floodways. The city began a process of annexing that territory and had annexed all of it by 1970. It also adopted an adequate public facilities policy.

By 1970, growth in Rail City remained focused primarily around the two highway interchanges. However, it was beginning to expand to the north and east. A new fire station serving the northeast quadrant was completed in 1973. In 1975, the school district completed new elementary and middle schools in the same area. By 1976, the northern portion of the beltway was complete.

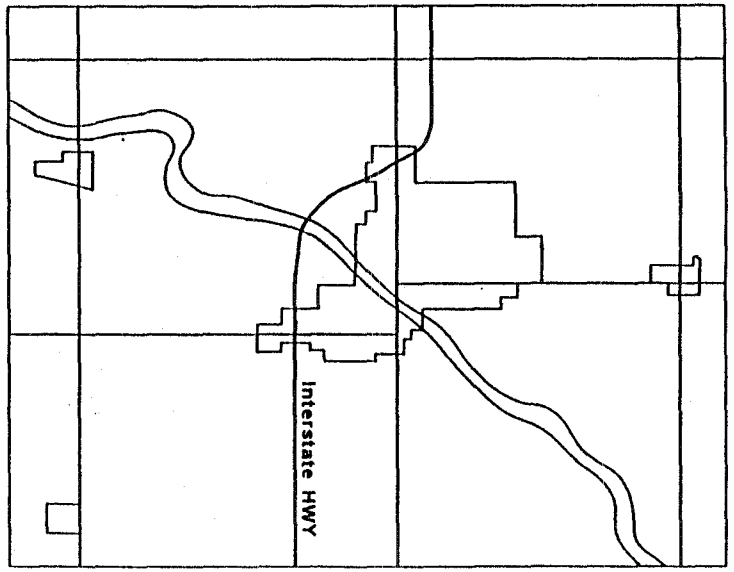
By 1980, Rail City had filled all of the land between its west boundary and the interstate highway. Its eastern boundary was large, squared off and the city occupied about two thirds of the land within the norther loop of the beltway. Courttown had also expanded somewhat into that area.

In 1988, a devastating flood went through Rail City. Although it caused some damage in older parts of the city, it flowed freely through farmland northwest and southeast of the city and damaged nothing built after 1965.

By 1990, Rail City had occupied most of the land inside the beltway and had expanded somewhat north of the beltway. Courttown's western boundary was now square and filled the rest of the land inside the beltway. The southern boundaries of the cities remained unchanged, as did the western boundary of Rail City. In late 1990, officials of Rail City, Courttown, the county and the Department of Transportation met to begin a long-range capital improvements program tied to the construction of the southern segment of the beltway. Because it has not had to spend additional highway money in the area since the construction of the



1960 (base) Scenario

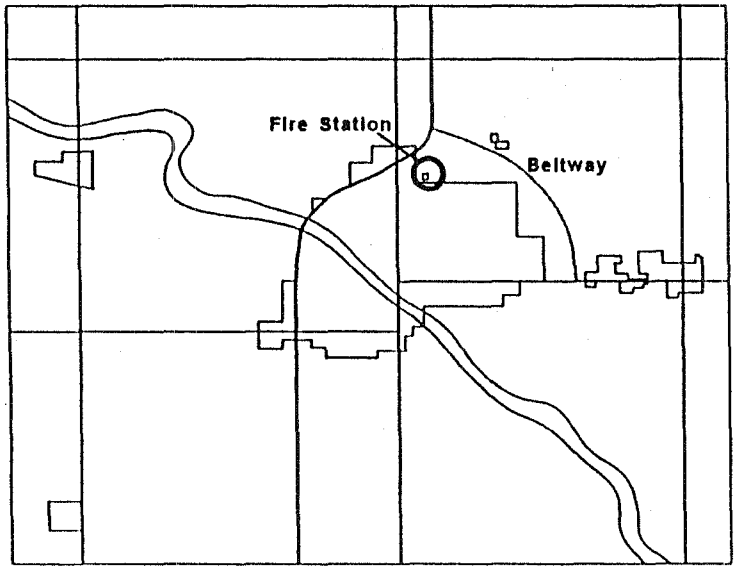


1970 Scenario

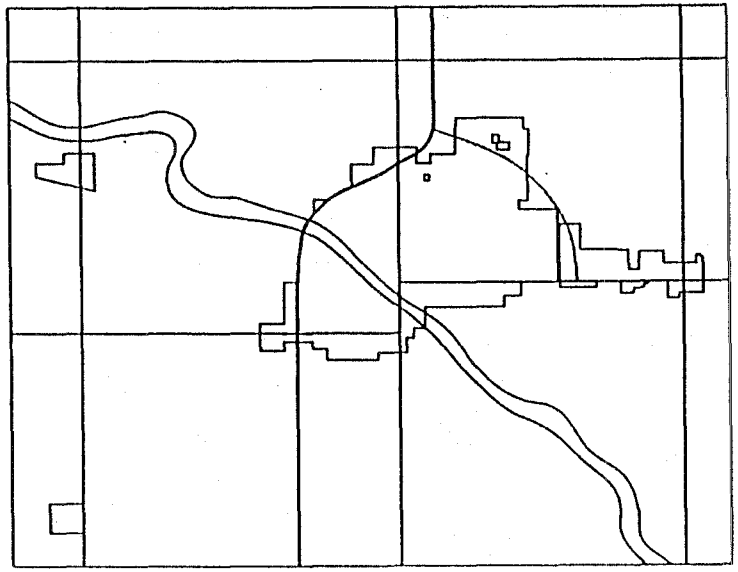
northern portion of the beltway, the Department of Transportation will make this new road a high priority.

Lessons Learned:

- *Planning works. In this case, Rail City's planning complemented the existing transportation network. New infrastructure provided by the city was designed to serve the areas also served easily by the interstate.*
- *Good public planning kept major infrastructure investments out of the floodplain.*
- *The city and the school district cooperated in making coordinated public investments in planned growth areas.*
- *The city avoided artificial controls like urban growth boundaries and focused on the coordinated planning of public facilities and land-uses.*
- *The compact and contiguous pattern of development limited the need for new highway investment, because new development occurred near existing public and private services.*



1980 Scenario



1990 Scenario

Conclusion

The next chapter describes a variety of techniques that the communities involved in these scenarios might have used to manage the direction and timing of growth.

Although most of the techniques are useful to a well-planned community, probably the most important lesson of this chapter is that the construction of public facilities has more influence on growth patterns than almost anything else. If the construction of highways, sewer lines, water lines and schools are carefully planned and coordinated, the result will be a reasonably compact and contiguous pattern of development that is efficient to serve with transportation and other public facilities. It is also a pattern of development that minimizes commuting, a tendency which not only reduces transportation costs but which generally improves the quality of life. The compact and contiguous form of development also generally encourages new residential development near existing shopping, recreation and other private services in the community, further creating a sense of community and enhancing the quality of life. Again, all of that also tends to reduce the need to drive, which reduces the demand on transportation facilities, which reduces public expenditures on transportation.

Thus, of all the techniques discussed in the next chapter, careful planning of the **construction of public facilities** and implementation of an **adequate public facilities** program are the most effective tools in influencing urban form. For reasons illustrated in this chapter and described in more detail in the next and in the literature review, urban growth boundaries may actually be counter-productive from a regional perspective. The other techniques discussed are useful and some, such as **zoning, subdivision regulations,** and some forms of **exactions**, are essential to the implementation of effective community planning. By themselves or even in combination, however, they do not address the fundamental issues of urban form and transportation efficiency nearly as effectively as the careful planning of new public facilities.

The theme of this handbook is that communities and state transportation departments both benefit from coordinated planning and implementation efforts. This chapter presents techniques that local governments and others can use to implement coordinated planning efforts.

The techniques outlined in this chapter address two separate but related issues. One is the coordination of growth with existing infrastructure. A Maryland study suggested that the state might save three billion dollars over the next couple of decades simply by ensuring that new development took place near existing highways, sewers and other major infrastructure investments. At a different level, it is easy to understand that if a new industry locates in town along an existing highway on a site with existing utilities, it will produce more net benefit to the town than if the town government must build a new road for it or extend sewer and water lines to it. Several of the techniques presented in this chapter encourage development near existing roads and other infrastructure.

The other issue addressed by techniques in this chapter is the need for greater predictability for highway planners. Highway planning is based on projected traffic, which in turn depends on projected development. If highway planners know how much development will take place where and when, they can plan effectively to serve that development with highways. Some of the techniques discussed in this chapter give a local government far more influence over the quantity and direction of growth than most local governments have had in the past. Local governments can use that influence to create predictability in growth patterns. That predictability, in turn, greatly improves the effectiveness of planning for such local improvements as schools, major streets and sewers, as well as for state highways.

This chapter presents techniques that local governments can use to manage growth. It presents the most commonly-used techniques first, to establish a framework, and goes on to a number of other techniques that may be useful in particular circumstances.

Zoning Regulations

Program Description

Zoning is a technique of land-use control that is in common use by local governments throughout the United States. It is based on the simple premise of dividing the community into districts (or zones) and then establishing different regulations within each district. Zoning regulations typically address three principal sets of issues:

- the **use** of land, falling generally in the major categories of residential, commercial, industrial, and agricultural. In larger cities, those categories may be broken down into a number of sub-categories, usually based on intensity or impact of the use.

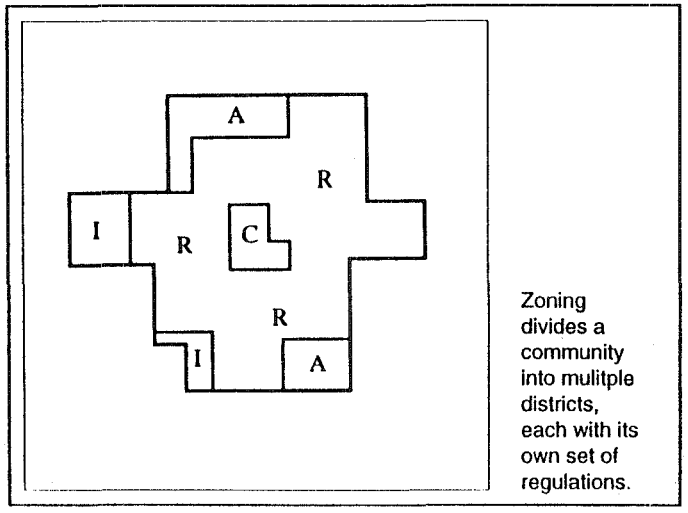
- the **intensity** of the use of land, ranging from the number of dwelling units per acre (sometimes established indirectly through minimum lot sizes) to the nature of the commercial or industrial activity.

• the **bulk** of that use, a set of regulations that addresses building heights, setbacks from lot lines (also called "yard" requirements, as in frontyard or sideyard), and other dimensional requirements designed to ensure some reasonable harmony among the mass of buildings in a district.

Regulations on use, bulk and intensity are uniform within a district, thus creating a form of harmony and compatibility within the district.

Program Control

The local governing body—city council, board of county supervisors or commissioners, or other local term—establishes zoning, with the advice of an appointed commission that is usually called the planning and zoning commission.



Zoning divides a community into mulitple districts, each with its own set of regulations.

Zoning should be "in accordance with a comprehensive plan," a document often created by the planning and zoning commission. Although midwestern states do not enforce the legal mandate for consistency between the planning and the zoning ordinance as rigorously as do courts in some other states, good practice still suggests a reasonable degree of consistency. Thus, to some extent the zoning is controlled by the separate planning process.

Effects on Growth

Zoning is not a very effective tool for managing growth, for several reasons. First, zoning in most communities offers no real predictability. Because all land must receive some zoning designation and most city or town zoning designations imply some form of development, an examination of a zoning map in a typical community would suggest that development will take place on vacant ground on all sides of town. Obviously, that will not occur evenly or simultaneously. Thus, to rely on the zoning map as a method for predicting when and where growth will take place is risky at best.

Further, zoning does not deal very well with change. Zoning undeveloped property is often little more than a guessing game. The people who developed the zoning technique some eighty years ago were primarily concerned with protecting established neighborhoods from unwanted and incompatible change. It works well for that. Deciding how to zone an existing neighborhood of single-family homes on half-acre lots is not difficult. However, deciding how to zone some adjacent, vacant property that also fronts on the highway is considerably more difficult. Perhaps more single-family zoning would be appropriate, with the houses nearest the highway backing up to it. Perhaps apartments make more sense, with only parking lots along the highway. Perhaps a small

community shopping center would work well at that location. Any of those choices could be acceptable, but the community must pick one. There is a good chance that, whatever it picks, the landowner will ultimately propose something else. That may occur 20 or 30 years after the zoning has first attached to the property. By then the highway may have been widened to four lanes, or it may have been largely abandoned in favor of a by-pass. Thus, the factors that influenced the original zoning may change before the property develops. For those and other reasons, it is often both necessary and appropriate for a local government to grant a zoning change, or rezoning, to a proposed development. The fact that the zoning of undeveloped land may change, however, makes the zoning map an almost useless tool for predicting the type, timing and intensity of future growth at a particular site and, thus, an almost useless tool for planning major infrastructure.

Zoning, however, does have one important use in infrastructure planning. If the zoning of an area is reasonably-clearly established, zoning does provide predictability for the amount of development. Thus, if a 100-acre site has been rezoned to allow residential development at 4 units to the acre and 75 single-family units have already been built there, it would be quite reasonable for transportation planners to predict that there will be 400 single-family homes located in that area within a reasonable planning horizon. That is exactly the kind of information that transportation planners need to predict the number of vehicular trips likely to come in and out of that area each day, which is the basis of most transportation planning.

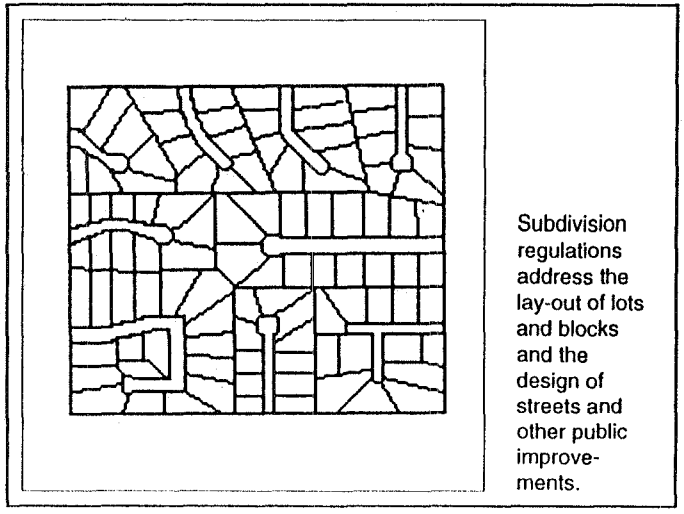
Subdivision Regulations

Program Description

The regulation of subdivisions is nearly as common as zoning regulation in communities today. Some counties that have not adopted zoning nevertheless regulate subdivisions.

Subdivision regulations are public techniques used to control the division of a tract of land into individual building lots. Although subdivision regulations sometimes affect other types of land transactions, the focus of the regulations is on the developer who turns raw land into sites for homes, apartments or businesses. Typical subdivision regulations accomplish three separate goals for the local government:

- **Coordination of public facility plans.** Almost anyone can think of a street "intersection" someplace that really has a little jog in it, meaning that it is necessary to make a left turn and then a quick right (or a right turn and then a quick left) in order to keep going straight on the same street. Modern subdivi-



Subdivision regulations address the lay-out of lots and blocks and the design of streets and other public improvements.

sion regulations require coordination of the plans for public facilities in a new development to ensure that continuous streets connect in straight intersections, without dog legs, and that sewer, water, storm sewer and other public facilities for the new development connect to the public systems in appropriate ways and appropriate locations.

• **Provision of on-site public facilities.** Almost all local governments use subdivision regulations to require that a developer of a new project provide all of the internal streets, paving, curb and gutter, sewer lines, water lines, and other public improvements necessary to serve homes and businesses within the development. This portion of the regulations usually stops at the boundary of the development. Some local governments also require that developers install some improvements outside the subdivision, a topic that is discussed next, under "Exactions."

• **Accurate mapping.** A key step in the subdivision process is the approval and filing of the subdivision plat. That plat relates the location of each lot in the subdivision to an engineered and accepted system of property location within the community. That avoids most boundary disputes in developed areas and also provides local governments with a method for accurately mapping both private property and public facilities within the community. The boundaries of land that have not been through the subdivision process may appear to be very clear when described in a deed, but locating them on the face of the earth is often problematic. The rigorous engineering and surveying requirements in the subdivision review process resolves any questions about boundary locations.

It is important to realize that some developments are exempt from subdivision regulation. By law, very small subdivisions (creating only 1 or 2 new lots) are exempt from such regulations in most states. Of more significance is the fact that a large development that does not involve dividing the property is exempt from subdivision regulation in many communities. Thus, in a community where the division of a four-acre tract into four lots for individual houses is subject to subdivision regulation, the construction of an industrial plan, a 50-unit apartment house or a strip mall on an existing parcel of land may effectively be exempt from such regulations.

Program Control

In most states, regulation of subdivisions is under the control of the planning and zoning commission, often simply called the planning commission. However, that is not as simple as it may sound. Because most subdivisions create new streets and because most of these streets are dedicated (given) to the public, there is a transfer of land in the subdivision process. Because only the governing body can accept land transfers for most local govern-

ments, most subdivision plats also receive review by the governing body—the board of county commissioners or supervisors, or the city council. Although technically the only issue before that body in most situations is the question of whether to accept or reject the land dedication, many governing bodies effectively act as the final review authority on subdivisions.

Effects on Growth

The requirement for the installation of public facilities and the coordination of the provision of those facilities with the plans of the larger community generally ensures that there is at least some consideration given to the issue of public facilities at this stage of the review process. However, under most state laws and under the practice of most local governments, it is entirely possible to build a large new subdivision at the end of a long gravel road, as long as the developer provides paved roads and other necessary improvements within the subdivision.

Subdivision of land, however, does make the future activity on the land more predictable and thus facilitates infrastructure planning. Once a fifty-acre property has been subdivided into half-acre lots and zoned for residential use, it is unlikely that there will be more than one hundred homes there any time in the foreseeable future. That improves the knowledge base that highway planners can use to plan future needs.

It is also important to note that in some communities, a "master street plan" or transportation element of a master plan may identify the future locations of arterial streets and even major collectors. When someone proposes to develop land containing part of the projected route of such a road, the community may use the subdivision process to require that the developer align the subdivision's streets with the future needs of the city and that the developer dedicate part or all of the right-of-way necessary to extend the planned road through that property. This technique has rarely been used for acquiring rights-of-way for highways, although the language of the state laws is broad enough to create the opportunity to use it in that way. Although it is probably not fair to require the developer of a small parcel to dedicate a highway-width right-of-way, it may be reasonable to ask that the developer dedicate part of that right-of-way (perhaps the amount that would be required for a collector street along the same route), with the state buying the rest. Further, it seems eminently reasonable to require that the developer plan around the proposed highway, just as the developer would plan around a proposed collector or arterial street along the same alignment. By working together, state transportation planners and local officials thus have the opportunity to use this program of local regulation as a tool for the protection and acquisition of right-of-way for the state transportation system.

Exactions and Impact Fees

Program Description

The previous section gave the example of a modern, fully-improved subdivision at the end of an unimproved gravel road. The placement of new subdivisions on

substandard roads or far from existing parks and schools has led some local governments to require that developers of such projects provide or contribute to the cost of off-site facilities and improvements—items that are usually outside the boundaries of the subdivision but that are essential to making that subdivision a part of the community. Such exactions may include requirements to pave the road in the first example, perhaps all the way back to town; to extend sewer, storm sewer or water lines to the development; to provide turning lanes, traffic signals or other street improvements to handle increased traffic loads from the new development, or to provide land for future schools and parks.

Obviously, requiting a particular developer to pave two or three miles of gravel road out to a new subdivision may seem a little harsh, particularly when all of the other landowners along that newly-paved section of road can then take advantage of the improvements without contributing to their cost. Thus, more and more communities that impose some form of exaction are doing so through "impact fees" that are used to pro-rate the cost of something like the road paving project among all of those who use the improvements. Impact fees are typically collected at the time of the issuance of building permits. Thus, under impact fees, a farmer with land along the newly-paved road would not be asked to contribute to its cost, but all subdividers whose projects connected into the road probably would be. Impact fees also offer a method to collect money from many developments for large projects like building new schools or locally-funded highway interchanges.

Although some local governments view exactions and impact fees as a magical way of meeting costly community needs without imposing taxes, developers typically oppose exactions and impact fees and often challenge them in court; the court decisions have been mixed, although well-designed impact fee systems are now generally upheld. Although several states have adopted enabling legislation specifically for impact fees, there are a number of court decisions from throughout the country (including the midwest) upholding exactions even in the absence of specific enabling legislation. There is some merit to the argument of developers that exactions contribute to increased housing costs. Thus, a community considering the use of this technique should study the issue carefully. If the choices are between a well-designed impact fee system and a lack of facilities to serve new growth, local officials may find that the development community will actually support the implementation of such a system, provided that developers have some participation in its design.

Program Control

Exactions and impact fees are established by local governing bodies under their general regulatory authority. They are sometimes included in subdivision regulations but more typically today are adopted as separate ordinances or regulations.

There are three separate control issues involving exactions, however. One is the question of who creates

the system of exactions. That is always the governing body. A second question is who controls the amount or the nature of the exaction. The fairest systems contain formulas or other clear standards so that there is no question about what is due—the developer submitting an application knows that there will be a fee of $500 per dwelling unit or that it will be necessary to pave the road leading up to the project. However, many systems involve negotiated exactions. That means that everyone involved in the review of a proposed project may have a hand in imposing conditions on the project that amount to exactions. Because such systems are not predictable, developers do not like them. There is also a great risk of unfairness under such systems, treating different applicants differently because there is no consistently-enforced set of rules.

The third issue is who controls the use of the exactions, particularly in the case of impact fees. If the developer simply paves a road or installs an extra traffic light, this is not an issue. However, if the developer pays a fee, someone has to decide where the money goes. The law is quite clear nationally that impact fees and other cash exactions must actually be used for the purpose for which they were levied. Thus, they are usually kept in a separate fund (a kind of account in government accounting) for use in paving a particular roads or for use in expanding the road system in a particular part of the city. Such funds generally remain under the control of the local governing body. However, where the facility itself is to be controlled by a school board, a park board or other public entity, the funds are sometimes turned over to that entity upon collection.

Effects on Growth

If a community adopts a uniform, community-wide program of exactions, there will be no particular effect on growth.

However, if a community requires that a developer upgrade substandard facilities leading to a site or extend facilities like water and sewer lines back to the nearest connection point with the public system, or if the community imposes higher fees on projects for which such off-site improvements will be necessary, the program of exactions will encourage new development around existing facilities. That optimizes the use of existing facilities and reduces or delays the need to extend highways, sewers and other major facilities into new areas. When used in this way, exactions or impact fees can have a major, beneficial effect on community growth patterns.

Annexation Policies

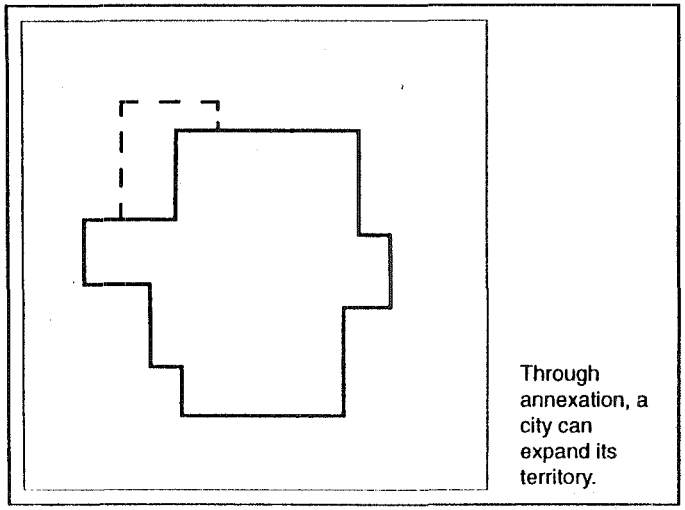
Program Description

Annexation is the technique by which municipalities in most states can expand their boundaries. As the material in Appendix B indicates, the procedures for annexation vary enormously even among the four states that are the focus of this handbook. However, there are some common principles.

Annexation can always be initiated by the

landowner(s). In some cases, a municipality can initiate an "involuntary" annexation. The process always requires the approval of the governing body of the municipality, because the municipality is essentially taking on new obligations by taking on new territory.

When property has been annexed, it falls under full municipal control. In all states, the municipality can then begin collecting taxes from that territory. In Iowa only, the new tax burden is offset somewhat by a reduction in the local services portion of county property taxes. After annexation, the property will fall under municipal zoning and subdivision regulation and be subject to municipal exactions and other forms of regulation described here. That is a bigger change in some states than in others. In some states, certain municipal regulations apply to property within a specified distance of the city limits; thus, some property being annexed may already have been under municipal zoning and/or subdivision control.



Through annexation, a city can expand its territory.

Program Control

The municipal governing has a significant amount of control over annexation. No annexation can take place without its approval. However, many types of annexation also require other approvals, ranging from the landowner, to residents of the territory, residents of the city, and, again in Iowa alone, to a state commission. The one body that has little or no control over annexation is the county, which loses a good deal of control over the property after annexation.

Effects on Growth

Annexation implies development. In some cases that development may not take place for many years. However, as a practical matter, a community should not annex land unless it intends or expects for it to develop and unless it is fully prepared to provide the services necessary to support that development. In a growing metropolitan area, it is not unusual to see annexation wars, in which several suburbs compete to annex land before their neighbors do. The result is often excessive annexation by one or more of those communities. The impacts can be devastating, particularly to a small community that is suddenly faced with trying to provide services to newly-annexed territory on all sides. Even with exactions and impact fees, growth never really pays its own way over the short-run.

It is critical to understand the subtle ways in which annexation leads to development pressures. A municipality cannot in good conscience zone land for agricultural use and hope that it will not develop. That is entirely inconsistent with the purposes of annexation. Over the long-run, a municipality cannot deny full public services to land that has been annexed. Sometimes the pressures are legal, but sometimes they are simply equitable pressures—the desire of local officials to be fair and to treat all landowners within the city limits somewhat alike.

Sometimes the pressures are simply political—with landowner-voters lobbying effectively for services for the land on which they are paying municipal taxes.

If a local government annexes far more land than the market is likely to demand for new development in the foreseeable future, the problem becomes worse, not better. The effect of over-annexation in such cases is typically to see new development scattered at low densities throughout the annexed territory. It is not necessary to review the detailed studies of the subject to understand that it will be far more expensive for local officials (and the state transportation department) to serve the residents of one thousand new homes scattered in a dozen projects spread over ten thousand acres of annexed territory than to serve those same thousand homes concentrated on two or three hundred acres in one area of town. Over-annexation may not change the growth rate of the community, but it is very likely to change the pattern of growth from a managed and manageable one to a sprawling one that is extraordinarily expensive for anyone to serve.

Construction of Public Facilities

Program Description

For reasons discussed in much more depth in the literature review, Appendix A, the construction of a highway or other major public facility is likely to have more impact on the growth patterns of a region than any other single public action.

As explained in the appendix, the reasons are not complicated. Most people who buy homes buy them from developers or from homebuilders who buy lots from developers. Developers, being generally rational business people, seek to minimize their costs. They can best do so by using as many existing public facilities as possible, thus reducing the possibility of having to build additional facilities.

Highways are particularly influential in this process, because a new highway generally improves the access to a particular area of the community. Because most people measure their commuting and other regular travel in minutes rather than miles, the improvement in accessibility makes some land "closer" to jobs or homes or shopping than it was before the road was built. That immediately makes that land more attractive to consumers and thus more attractive for development.

One of the major problems that communities face in managing growth is the fact that decisions to build highways or sewer lines are usually treated as just that—decisions to build public works projects. They are really decisions to shape the future form of the community. Instead of being based strictly on a combination of projected loads, engineering considerations, and cost-benefit comparisons, such decisions should be based on broad community planning considerations.

Program Control

Another problem with this significant factor in growth management is that there are so many different decision-makers. The state transportation department locates new

state and federal highways and their interchanges. The county locates new county roads that may become arterials linking a nearby city to the state road system. Cities and other municipalities also build major arterials.

Although some municipalities are wise enough and/or fortunate enough to control their own sewer and water systems and thus to manage them, in many communities either or both of those systems is controlled by a separate district or by a somewhat autonomous local board. Even where the municipality controls those major facilities, in most states it is fairly easy for a developer or a group of residents to create a special district or a private utility that can be an alternative provider of such services on the fringe of town. A sewer line built by a special district can have just as much impact on the shape of growth as one built by the municipal government.

There are other players in this game. Schools also play a role in shaping a community, and the decisions to locate schools are generally controlled by elected school boards with little input from other governmental entities. A drainage or flood control district may control stormwater facilities that are essential to development in some areas.

The multiplicity of players can lead to contradictory and/or counter-productive accumulated decisions. Only through coordinated plans can these multiple decision-makers plan facilities in a way that reinforces logical growth patterns.

Effects on Growth

In the Midwest, growth follows highways and sewers. In arid states, where it is difficult to get water but easy to find dry land in which to install septic tanks, growth is more likely to follow highways and water lines. Schools, parks and other facilities also have some impacts on growth patterns.

The effects vary enormously. Part of the growth pattern of any community can almost always be traced to highway patterns. Where those patterns are reinforced with sewer and other public services, those may be the primary determinants of future urban form. Where, however, the highway runs east and west through town and the new sewer plant has been located far south of town along the river, the two major influences may pull in different directions and partly neutralize each other. If water depends mostly on gravity flow and thus comes from the north (upstream) side of town and the school board has decided to buy land to the northwest where land is cheap (because there are no services and thus no developers are interested), the effects may be lost in the confusion.

If, on the other hand, the state improves the highway leading to the airport three miles from town and the city extends sewer service to it to encourage industrial development around it, the sewer line and the highway will be magnets for development not only at the airport but along the entire three-mile route. If that is land on which the city wants to encourage development, such an effect is beneficial. If, on the other hand, such land is

floodplain or prime agricultural land or is far from the new shopping center and new high school, such an effect may be harmful to the community.

There is no simple, generalizable rule to address these issues—except for all of the agencies involved to attempt to coordinate their planning efforts.

Adequate Public Facilities Regulations

Program Description

Adequate public facilities (APF) controls are the simplest and most widely-accepted of modern growth management techniques. A basic APF regulation can be very simple:

No new subdivision plat or other development application shall be approved unless the approving body finds that all necessary sewer, water, transportation, and other public facilities serving the development either are available and have adequate capacity to serve the proposed development on the date of approval or, under approved and budgeted capital improvements programs, will be available on or before the date necessary to serve the proposed development.

This fills a gap left in subdivision regulation. Subdivision regulations control development of the subdivision itself. As indicated above, some subdivision regulations contain exaction requirements for off-site facilities, but even that does not ensure that such facilities are actually available or that they are adequate.

Requiring a finding that a new development will have adequate water for drinking and for fire-fighting, that adequate treatment capacity will be available for its sewage, and that the road network in the area will be adequate to handle the traffic are very logical requirements to impose on new developments—just as logical as the requirements that such improvements within the subdivision be installed by the developer. As a matter of fact, such requirements are so logical that many local officials assume that such requirements exist in their own local regulations. Although adequate public facility regulations are becoming increasingly common, most local governments in most states do not have them.

The example of an APF regulation given above is somewhat over-simplified. Such a regulation can be implemented only if the local government also adopts "service standards" specifying what "adequate" means. Adequate sewage treatment facilities should generally mean facilities that will handle the type and quantity of sewage generated and treat it in accordance with federal and state regulations. However, other standards involve some judgment calls. Must water service be adequate just for drinking, in which case a four-inch service line may suffice, or must it also provide adequate pressure for fire-fighting? Are roads adequate only if they are free-flowing 24 hours per day, or is some delay at intersections acceptable during rush hour? Most local public works departments already have such standards in their current engineering plans, but it is important to incorporate them into an adequate public facilities regulatory mechanism.

Program Control

Adequate public facilities controls are adopted as an ordinance or a regulation by the local governing body. Florida now mandates such controls statewide and a few other states have similar requirements for particular local governments or particular types of development. However, in most states, this matter remains entirely under local control. Because the basic standards relate so clearly to the protection of the public health and safety, there should be no need for express enabling legislation to support such a requirement.

Effects on Growth

The effects of APF regulations on growth are dramatic. Such regulations will force most new development to take place around existing and planned facilities. Some developers may be willing to extend a particular service to a site that otherwise has services in order to comply with APF standards (for example, extending a water line to a site that already has good access and connection to a major interceptor sewer line), but, under such a program, no rational developer will choose a site with no services if there are serviceable sites available. The effect of such a program is to make development reasonably compact and to keep it contiguous to existing development, both of which help to reduce both the capital and maintenance costs of providing public services to development. It also facilitates planning public facilities like highways and sewers, because new facilities obviously should be targeted for the same areas in which other services exist or are planned.

If a local government does only one thing to better manage its growth and infrastructure planning, it should be to adopt an adequate public facilities regulation.

Urban Growth Boundaries

Program Description

An urban growth boundary is just what it sounds like—a boundary within which a city attempts to keep future growth. It may be the same as the city limits, or it may go out as far as extra-territorial jurisdiction provided to the city, such as the two-mile extra-territorial subdivision jurisdiction in Iowa. If it is carefully planned and based on the developability of land and the capacity of the community to serve, it will probably deviate from both of those. Because it should be influenced by water and sewer service, it will probably follow ridgelines and may incorporate all of one or more drainage basins. Because it should be influenced by accessibility, it may extend further from the core along highways than in other areas.

An urban growth boundary may be used to establish zoning districts, using only agricultural and low-density rural districts outside the boundary and urban and suburban ones inside it. However, because the urban growth boundary often goes beyond the geographical jurisdiction of the city, the most effective means of enforcing it is often through water and sewer extension policies. The state can also help to reinforce its effectiveness by planning major transportation improvements within it and avoiding improvements to roads that would facili-

tate commuting from outside the boundary.

Program Control

A city (or sometimes a group of cities acting together) usually establishes the boundary. However, effective implementation of the policy discouraging urban growth outside the boundary will probably require a great deal of cooperation from the county. Oregon's state law has strong provisions reinforcing local efforts to contain growth within such a boundary. Laws limiting the establishment or expansion of competing sewer and water systems outside of such a boundary would help to make the technique work in other states.

Effects on Growth

The effects of an urban growth boundary on growth are mixed. If the boundary is too tight—that is, so near to the existing urban area that there is room for only a small amount of new growth—economic pressures will probably cause growth to leapfrog outside the boundary, thus creating worse sprawl problems than if the boundary did not exist. If the boundary is established to allow 20 or more years of growth within it, it will have relatively little effect on growth patterns for the first few years—development will be contained within it, but it will sprawl all over the relatively large area contained within the boundary. During the middle of the planning period, development will begin to become relatively compact and efficient. By the end of the period, if the boundary is not adjusted several years in advance, that boundary will become too tight and development will begin to leapfrog outside of it.

An urban growth boundary is an ideal planning mechanism for providing sewer and water service, where geography (elevation and drainage basin) are as important as distance in determining serviceability. To the extent that it is used as a guide for extending sewer and water service, it is a very effective technique. However, it does not address the problems of sprawl early in the planning period and does not provide a solid basis for transportation planing. Although establishing an urban growth boundary is certainly better than having no growth management technique at all, it is an overly-simple solution to a complicated problem.

Phased Growth Programs

Program Description

A phased-growth program phases growth in the community, usually by geographical area. Typically such a program is based on the availability of public facilities, encouraging development first in those areas with the best availability of public facilities. Such a program may also be used to phase development away from sensitive lands, such as floodplains, or to encourage infill and redevelopment in older areas of the community.

A phased-growth program is usually adopted as a separate local regulation that controls the issuance of new development approvals, such as those granted through the subdivision review process.

Program Control

Because a minimum density requirement would be implemented through zoning, the program control is exactly the same as under zoning.

Effect on Growth

The purpose of a minimum density requirement is to ensure that land that is developed is used efficiently, thus presumably preserving other land in non-developed uses. For example, if the demand for new housing in a particular community is 200 units over the next year, that demand could be satisfied on 50 acres with a minimum density of 4 dwelling units per acre but could require 200 acres at a density of 1 unit per acre. The difference, 150 acres, would presumably be left undeveloped.

Such a program makes particularly good sense in areas with substantial public facility investments, to ensure that those investments are fully utilized. Thus, the local government might establish maximum densities based on use of 95 percent of the capacity of available systems and minimum densities based on use of 80 percent of that capacity; although eighty percent is not optimal, it is far better than 60 percent or 40 percent, figures that can result when an area prepared for high intensity use develops at a far lower intensity. This is in a sense another type of phasing program, ensuring that land being developed is optimally developed before additional development takes place elsewhere.

Bibliography

The following publications contain more detailed descriptions of how the programs described above work; many contain more detailed recommendations for implementing such a program locally. Starred items are available from The Planners Bookstore, 1313 East 60th Street, Chicago IL 60637. Phone orders (with a credit card) to 312-955-9100.

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*Brevard, Joseph H. *Capital facilities planning.* Chicago: Planners Press, 1985. [on construction of public facilities]

Brower, David J., David W. Owens, Ronald Rosenberg, Ira Botvinick, and Michael Mandel. Urban growth management through development timing. New York: Praeger Publishers, 1976. [on rate-of-growth programs]

Carson, John M., Goldie W. Rivkin, and Malcolm D. Rivkin. *Community growth and water resources policy.* New York: Praeger Publishers, 1973. [on construction of public facilities]

*Easley, V. Gail. *Staying inside the lines: urban growth boundaries.* Planning Advisory Service, 440. Chicago: American Planning Association, 1992. [on urban growth boundaries]

*Frank, James E., and Robert M. Rhodes, eds. *Development exactions.* Chicago: Planners Press, 1987. [on exactions]

Hamill, Samuel M., Jr., John C. Keene, David N. Kinsey, and Roger K. Lewis. *The growth management handbook: a primer for citizen and government planners.* Princeton: Middlesex Somerset Mercer Regional Council, 1989. [on all regulatory programs]

*Kelly, Eric Damian. *Managing community growth: policies, techniques and impacts.* Westport, CT: Praeger, 1993. [on all programs]

*Kelly, Eric Damian. *Planning, growth and public facilities: a primer for public officials.* Planning Advisory Service Reports, 447. Chicago: American Planning Association, 1993. [on all programs, with an emphasis on adequate public facilities regulations, construction of public facilities, and coordinated planning efforts]

Ketcham, Paul, and Scot Siegel. *Managing growth to promote affordable housing: revisiting Oregon's goal 10.* Portland: 1000 Friends of Oregon, 1991. study sponsored jointly by 1000 Friends of Oregon and The Home Builders Association of Metropolitan Portland. [on minimum densities]

*Nelson, Arthur C., ed. *Development impact fees: policy rationale, practice, theory and issues.* Chicago: Planners Press, 1988. [on exactions and impact fees]

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Sengstock, Frank S. *Annexation: a solution to the metropolitan area problem.* Buffalo: William S. Hein & Co., Inc., 1985. Reprint of original 1960 University of Michigan Law School publication. [on annexation policies]

*So, Frank S., and Judith Getzels, eds. *The practice of local government planning.* 2nd ed. Washington: International City Management Association, 1988. [on zoning regulations and subdivision regulations]

Tabors, Richard D., Michael H. Shapiro, and Peter P. Rogers. *Land use and the pipe: planning for sewerage.* Lexington: Lexington Books, 1976. [on construction of public facilities]

Urban Systems Research & Engineering Inc. *The growth shapers: the land use impacts of infrastructure investments. Supt. of Docs. No. 041-011-00029-7.* Washington: Council on Environmental Quality, 1976. [on construction of public facilities]

Appendix A: Legal Opportunities and Constraints by State

Most of the growth management techiques described in this report must be implemented by local governments. The ability of local governments to adopt such techniques is controlled by state law..

This appendix provides an easy reference for local governments in the study area states (Iowa, Kansas, Missouri, and Nebraska) to use in determining whether they have the authority to use these techniques.

The techniques analyzed in this appendix are the same techniques that are described in the text. There is very little difference among the states in the authority to use techniques based on traditional zoning and subdivision controls, because the states have very similar enabling acts on those matters. In contrast, on such matters as annexation there are great differences among the states--as the "tale of two cities," discussing Des Moines, Iowa, and Lincoln, Nebraska, so graphically illustrates.

Using the table is simple. The techniques are listed down the left side of the table on the next page and the states are listed across the top. If there is an S or a C in the cell that marks the intersection between the law of a particular state and an identified technique, that means that there is [S]tatutory or [C]ase law that supports the use of the technique in that state. The number in parentheses following the letter directs the user to one of the numbered notes, which provides a specific case or statutory citation and a brief summary of the law.

A blank cell does not necessarily mean that a local government cannot use a technique. It simply means that there is no clear legal authority to do so and that a local government must look to its home rule or other general authority as the basis for using that technique.

Local governments should, of course, consult their own legal advisors before actually adopting any of these techniques. Although prepared by legal scholars, this appendix is attended as an educational and reference guide only. It is not intended as specific legal advice.

	Iowa	Kansas	Missouri	Nebraska
Zoning	S(1)	S(8)	S(15)	S(22)
Subdivision Regulation	S(2)	S(9)	S(16)	S(23)
Planning Commission review of public projects		S(10)	S(17)	S(24) C(24)
Impact Fees		S(11)	S(18)	S(25)
Other Exactions	S(3)	S(12)	S(19) C(19)	S(26)
Adequate public facilities programs	S(4)			
Phased-growth programs				
Rate-of-growth programs				
Local control of annexation	S(5)	S(13) C(13)	S(20)	S(27)
Capital Improvements programs	S(6)	S(14)		S(28)
Land acquisition for general public purposes	S(7)	S(15)	S(21)	S(29)

S=Statutory authorization
C=Case Law authority

Notes on Iowa:

Note on home rule in Iowa. In article 3, §§ 38A and 39A, Iowa's constitution grants cities and counties, respectively, home rule over "local affairs and government", and requires that local ordinances be "not inconsistent with the laws of the general assembly". Sections 331.301 and 364.1, Iowa Code, further specify the home rule powers of counties and cities, respectively, by authorizing local government to "exercise any power and perform any function it deems appropriate to protect and preserve the rights, privileges, and property of the [city or county] or of its residents, and to preserve and improve the peace, safety, health, welfare, comfort, and convenience of its residents."

Iowa's constitution provides, however, that within the sphere of local affairs local government is not restricted to powers expressly granted by the legislature: §§ 38A and 39A of article 3 both declare in identical language that "[t]he proposition or rule of law that a municipal corporation [or county or joint county-municipal corporation government] possesses and can exercise only those powers granted in express words is not a part of the law of this state."

1. Zoning:
Chapter 414, Iowa Code, provides authority for zoning by municipalities. The statute authorizes extraterritorial zoning by municipalities (§ 414.23). Chapter 358A, Iowa Code, provides authority for zoning by counties.

2. Subdivision regulation:
Chapter 409A, Iowa Code, provides the authority for subdivision regulation by both municipalities and counties. The statute includes extraterritorial control of subdivisions by municipalities (§ 409A.9).

3. Other exactions:
Section 409A.8, Iowa Code, authorizes municipal and county governing bodies to require that subdividers install public improvements. Sections 409A.11.1 and 409A.19, Iowa Code, provide authority for subdividers to dedicate land to the public for streets, alleys, walkways, parks, open space, school property or other public uses.

4. [maybe] Adequate public facilities programs:
Section 409A.8, Iowa Code, requires that municipal and county governing bodies "give consideration to the possible burden on public improvements...when reviewing [a] proposed subdivision".

5. Local control of annexation:
Chapter 368, Iowa Code, establishes two procedures for annexation: (1) by owners' application to annexing city; (2) by petition to state authorities and subsequent local election. Descriptions of these procedures follow.

By owners' application: When "[a]ll the owners of land in a territory adjoining a city" submit an "application" for annexation to that city's council, and when the council by resolution approves the application, the annexation is accomplished (see sec. 368.7). However, if the territory to be annexed is within 3 miles of the boundaries of another city of at least 15,000 in population, then Iowa's City Development Board must also approve the proposed annexation (see secs. 368.7; 368.1.12).

By petition and election: Chapter 368, Division III, Iowa Code, establishes a City Development Board to regulate all annexations not accomplished by the application procedure just described. Under the statute, a city council, a county board of supervisors, a regional planning authority, or 5% of the "qualified electors of a city or territory involved in the proposal" may file a petition for annexation of territory to a given city with Iowa's City Development Board (*see* § 368.11). The Board itself may also initiate annexation proceedings (*see* § 368.13). If the Board does not dismiss a petition (*see* § 368.12), the Board must appoint a committee including local representatives which shall hold public hearings on the proposed annexation (*see* §§ 368.14-368.15). If the committee finds the annexation to be in the public interest, the committee must approve the annexation (*see* § 368.16; *see also* §§ 368.17 (grounds for committee disapproval), 368.18 (authority to amend petition or plan)). Thereupon, the Board must schedule a special local election, in which "qualified electors of the territory and of the city may vote", and in which "a majority of the total number of persons voting" may approve the proposed annexation (*see* § 368.19).

6. Capital improvement programs:
In cities: Chapter 384, Division II, Iowa Code ("Budgeting and Accounting"), establishes a state "city finance committee" (§ 384.13) to draw up "guidelines for...the preparation of capital improvement plans by cities". Under the statute, the committee may require each city with over

2000 inhabitants to adopt, after a public hearing, "a capital improvement plan for a five-year period" (§ 384.15.3).

In counties: Chapter 333A, Iowa Code, establishes a state "county finance committee" (§ 333A.2) to draw up "guidelines for...the preparation of capital improvement plans" (§ 333A.4.2).

In rural cities and counties: Sections 15.281-15.288, Iowa Code, establish a "Rural Community 2000 Program" to assist communities and rural areas with low- and no-interest financing for infrastructure and housing. Cities and counties that apply for grants or loans must submit, among other things, "[a] capital improvement program" (§ 15.284.2.b).

7. Land acquisition for general public purposes:
By counties and municipalities: Constitutional and statutory grants of legislative home rule may authorize cities and counties to acquire land for general public purposes (*see* Art. 3, § 38A, Iowa const. (municipal home rule), § 39A, Iowa const. (county home rule), § 331.301, Iowa code (county home rule), § 364.1 (municipal home rule)).
But as the following notes indicate, open space preservation is largely a matter of statewide concern in Iowa.

Note on Missouri River Preservation and Land Use Authority: Chapter 108B, Iowa Code, establishes the Missouri River Preservation and Land Use Authority and assigns it the "mission" to prepare environmental, greenbelt and recreational plans for the river valley, to develop land-acquisition plans to implement the environmental, greenbelt and recreational plans, and to buy land from "willing sellers" (§ 108B.2.2 (Authority's "mission"); § 108B.2.5 (purchases from "willing sellers" only)).

Note on acquisition of conservation easements: Chapter 111D, Iowa code, authorizes cities, city agencies, county conservation boards and various state departments to acquire conservation easements by all means excepting condemnation.

Note on Iowa Department of Natural Resources (DNR)'s statewide open space program: Chapter 111E, Iowa code, directs DNR to identify significant open space in the state (including greenbelts), prepare a statewide plan for protecting and/or acquiring such lands, and to acquire parcels pursuant to the statewide plan upon its approval by the general assembly. Section 111E.2.1.c(1) authorizes DNR to "[a]ccept applications for funding assistance from federal agencies, other state agencies, regional organizations, county conservation boards, city park and recreation agencies, and private organizations with an interest in open spaces". Section 306D.2, Iowa code, obliges Iowa's Department of Transportation (DOT) to coordinate its long-range scenic highways plan with DNR's open space plan if the general assembly has approved it. (Similarly, § 314.24, Iowa code, obliges DOT to avoid damage to parks, greenbelts, etc., by pursuing "reasonable alternatives" if they entail "no significantly greater cost".)

Note on Iowa Dep't of Transportation (DOT)'s State Recreational Trail Plan and Program: Chapter 111F, Iowa code, authorizes the state Department of Transportation (DOT) to develop a long-range plan for recreational trails and to acquire parcels pursuant to that plan.

Other relevant statutory provisions:

County protection of agricultural land: Chapter 176B, Iowa Code, establishes Land Preservation and Use Commissions in all counties and authorizes those Commissions to prepare land use inventories and land preservation and use plans. Chapter 176B also authorizes county boards, upon petition by owners of farmland and after notice and hearings, to adopt ordinances designating the owner's farmland an "agricultural area" if it meets statutory requirements for them. Upon recordation, such areas are protected from special assessments for public services levied on the basis of frontage, acreage or value, from lawsuits charging that farms or farm operations are nuisances. In addition the Iowa Department of Natural Resources shall assign such areas priority in diverting or withdrawing water from available water resources.

Metropolitan or Regional Planning Commissions: Chapter 28I, Iowa code, authorizes local governing bodies to establish joint planning commissions. Such joint planning commissions need not supplant city or county planning commissions (*see* §§ 28I.4-28I.7).

Community Commonwealth Government: Sections 331.260-331.263, Iowa code, authorize counties to unite with contiguous counties or with cities or towns within those counties or within contiguous counties to establish a new, regional political subdivision to deliver

specified city services (member cities retain responsibility for those services not delegated to the county commonwealth).

Capitol Planning Commission: Chapter 18A, Iowa code, establishes this commission but does not confer upon it powers to regulate urban land use (*see* § 18A.3, on the commission's duties to supervise building and adornment on state capitol grounds).

Notes on Kansas:

Note on home rule in Kansas.

Municipal home rule: In article 12, § 5, Kansas's constitution grants cities home rule over "their local affairs and government, including the levying of taxes, excises, fees, charges and other exactions except when and as the levying of any tax, excise, fee, charge or other exaction is limited or prohibited by enactment of the legislature applicable uniformly to all cities of the same class" (art. 12 § 5(b)). Kansas' constitution provides, however, that grants of power to cities be "liberally construed for the purpose of giving to cities the largest measure of self-government" (art. 12 § 5(d)). *County home rule:* In section 19-101, Kansas code, Kansas' legislature grants counties "the powers of home rule to determine their local affairs and government" (§ 19-101). *Statutory grants of basic powers:* §§ 12-101 and 19-101, Kansas code, grant cities and counties their basic powers, including the powers to "[p]urchase or receive, by bequest or gift, and hold, real and personal property for the use of the city" (§ 12-101) or "to purchase and hold real and personal estate for the use of the county" (§ 19-101).

Note on the classification of cities in Kansas. Kansas cities are divided into three classes, as permitted by the state constitution (*see* Art. 12, § 5(b), Kansas const.). But all cities enjoy constitutional home rule powers (*see* Art. 12, § 5, Kansas const.). (1) *First class cities:* Cities of the "first class" are cities that have attained a population of over 15,000 and have certified that fact to the governor of the state, who must "thereupon by public proclamation declare such city to be a city of the first class" (*see* § 13-101, Kansas code). A city may choose not to certify to the governor that it has attained a population above 15,000; if so, the city remains a second class city (*id.*). (2) *Second class cities:* Cities of the "second class" are cities acting as second class cities by virtue of former acts, or cities that have attained a population of over 2,000 but under 15,000 and have certified that fact to the governor of the state, who must then "declare, by public proclamation, such city subject to the provisions of [state law regulating second class cities]" (*see* § 14-101, Kansas code). A city may choose not to certify to the governor that it has attained a population above 2,000 but under 15,000; if so, the city remains a third class city (*id.*). A second class city whose population drops below 2,000 may, by a majority vote, choose to be a city of the third class (*see* § 14-901, Kansas code). (3) *Third class cities:* Cities of the "third class" are cities so designated by earlier law or cities having populations under 2,000 and not previously organized as second class cities (*see* § 15-101, Kansas code).

8. Zoning:

§§ 12-741 to 12-768, Kansas Code, enable cities and counties to plan, zone and adopt subdivision regulations. §§ 12-715b to 12-715d, Kansas Code, authorize extraterritorial zoning by cities. §§ 19-2956 to 19-2966, Kansas Code, enable counties designated as urban areas under the provisions of § 19-2654 to plan, zone and adopt subdivision regulations. Finally, §§ 19-2950 to 19-2955, Kansas Code, authorize zoning by improvement districts.

9. Subdivision regulation:

§§ 12-749 to 12-752, Kansas Code, authorize subdivision regulations by cities and counties. The statute allows extraterritorial control of subdivisions by municipalities (§§ 12-749, 12-750). In addition, §2-520a(f)), the city must observe the notice, hearing and plan requirements imposed by statute (*see* §§ 12-520a to 12-520b). Moreover, a city must seek county approval for annexations of land not contiguous to the city (*see* § 12-520c) and for annexations that do not meet the "conditions" set by section 12-520 (*see* § 12-521 (detailing procedural and substantive standards for county approvals of such annexations). In reviewing city petitions to annex territory, county boards act quasi-judicially. City of Topeka v. Shawnee County Bd. of County Comm'rs, 1993 Kan. LEXIS 12, *15 (Kan., Jan. 22, 1993) (construing § 12-521, as amended in 1987); *see also id.* at *16-*17 (courts reviewing a county board's determination must ask whether it rests on substantial evidence). Where, however, land to be annexed may be annexed under Kansas law and all the owners of that land consent to annexation, other cities have no standing to challenge the annexation in court. City of [illegible]

Overland Park, 777 P.2d 830 (Kan. 1989).

14. Capital improvements programs:
§ 12-747(b), Kansas code, requires that city and county comprehensive plans include recommendations on "public improvement programming based upon a determination of relative urgency". §12-748(b), Kansas Code, requires that city or county planning commissions review public facilities programs for conformity with comprehensive plans. (§§ 19-2955 to 19-2966, Kansas Code, include no comparable provision for counties designated as urban areas under the provisions of § 19-2654.) §§ 12-1,118(a) and 19-120(a) authorize cities and counties (respectively) to establish a "capital improvements fund" if they formally adopt a "capital improvement plan setting forth the[ir] public improvement and infrastructure needs...on a prioritized basis".

15. Land acquisition for general public purposes:
§ 12-101, Kansas code, grants cities the power to "[p]urchase or receive, by bequest or gift, and hold, real and personal property for the use of the city". § 19-101 grants counties the power "to purchase and hold real and personal estate for the use of the county" (§ 19-101). Under recently enacted legislation such powers include the power to acquire and hold "conservation easements" for a wide range of stated purposes: "retaining or protecting natural, scenic or open-space values of teal property, assuring its availability for agricultural, forest, recreational or open-space use, protecting natural resources, maintaining or enhancing air or water quality, or preserving the historical, architectural, archaeological or cultural aspects of real property" (An Act...enacting the uniform conservation easement act, 1992 Kan. ALS 302, *11; 1992 Kan. Sess. Laws 302; 1992 Kan. SB624).

Other relevant statutory provisions:

General planning enabling legislation: See above, note 8, on zoning enabling legislation, which is also the basic planning enabling legislation.

Extraterritorial street planning and building by first class cities: § 13-1114b, Kansas code, authorizes extraterritorial street planning and building by cities of the first class, if those cities have entered into joint transportation planning and building agreements with other local governments or the secretary of transportation under § 68-169.

Procedural and substantive controls on the establishment of special improvement districts in counties: To approve the establishment of special improvement districts, boards of county commissioners must comply with procedural and substantive requirements imposed by §§ 19-2755 to 19-2786i, Kansas code, and by § 19-270, Kansas code (special and stricter requirements for special improvement districts within three miles of any city that has adopted subdivision regulations).

Industrial districts in counties: §§ 19-3801 to 19-3821, Kansas code, authorize counties to incorporate industrial districts anywhere in the county upon petition by landowners, but require that counties secure the consent of cities if any part of a proposed district is within three miles of city limits.

Notes on Missouri:

Note on classification of Missouri counties: Missouri counties are divided into four classifications, as Missouri's constitution permits (*see* Art. VI, § 8, Missouri constitution). (1) *First classification:* The first classification "automatically" includes "[a]ll counties having an assessed valuation of four hundred fifty million dollars and over" for five consecutive years. (2) *Second classification:* The second classification "automatically" includes "[a]ll counties having an assessed valuation of three hundred million dollars and less that the assessed valuation necessary for that county to be in the first classification" for five consecutive years. (3) *Third classification:* The third classification "automatically" includes "[a]ll counties having an assessed valuation of less than the assessed valuation necessary for that county to be in the second classification". (4) *Fourth classification:* The fourth classification maintains in the second classification those counties that were in the second classification before August 13, 1988, and would have fallen into the third because of diminished assessed valuations but for this statute (*see* §§ 48.020 (quoted language), 48.030, Missouri code).

Note on classification of Missouri municipalities: Special classifications of Missouri municipalities include the following. (1) *Third-class cities:* This class includes "[a]ll cities and towns...containing three thousand or more inhabitants, which shall elect to be a city of the third class" (*see* § 72.030, Missouri code). (2) *Fourth-class cities:* This class

includes "[a]ll cities and towns...containing five hundred and less than three thousand inhabitants, and all towns existing under any special law, and having less than five hundred inhabitants which shall elect to be cities of the fourth class" (*see* § 72.040.1, Missouri code). (3) *Villages:* Villages are "[a]ll towns not now incorporated...containing less than five hundred inhabitants" (*see* § 72.050.1, Missouri code). (4) *Special charter cities:* This class included "[a]ll cities and towns...operating under charters granted directly and specially by the general assembly prior to the adoption of the constitution of 1875" (*see* § 81.010, Missouri code). (5) *Constitutional charter cities:* This class includes "[a]ny city...framing and adopting a charter for its own government, whether under the provisions of § 19, article VI of the constitution of 1945, or under the provisions of section 16 or section 20, article IX of the constitution on 1875" (*see* § 82.010, Missouri code).

Note on home rule for constitutional charter cities in Missouri: Article 6 § 19, Missouri constitution, authorizes any city having more than 5000 inhabitants or "any other incorporated city as may be provided by law" to adopt a charter form of government. Article 6 § 19(a), Missouri constitution, provides that such constitutional charter cities "shall have all powers which the general assembly of the state of Missouri has authority to confer upon any city, provided such powers are consistent with the constitution of this state and are not limited or denied either by the charter...or by statute". Article 6 § 19(a) also provides that each constitutional charter city "shall, in addition to its home rule powers, have all powers conferred by law".

Note that generally local land use regulation depends on express statutory grants of authority: Land use regulation is a state police power which local government cannot exercise unless expressly authorized to do so by the legislature. McCarty v. City of Kansas City, 671 S.W.2d 790, 793 (Mo. App. 1984).

15. Zoning:
By counties: Chapter 64, Missouri Code, authorizes zoning by all counties.

By townships: Chapter 65, Missouri Code, authorizes zoning by townships in noncharter first-class counties and in second- and third-class counties which have not adopted county planning and zoning.

By municipalities: Chapter 89, Missouri Code, authorizes zoning by all municipalities. The statute provides for extraterritorial ("peripheral") zoning by a restricted class of municipalities (*see* § 89.142.1).

16. Subdivision regulation:
By counties: Chapter 64, Missouri Code, authorizes all counties to adopt subdivision regulations (*see* §§ 64.060 to 64.070, 64.241 to 64.245, 64.580 to 64.590, 64.825 to 64.8.30).

By townships: Chapter 65, Missouri Code, authorizes the adoption of subdivision regulations by townships in noncharter first-class counties and in second- and third-class counties which have not adopted county planning and zoning (*see* § 65.667 to 65.670).

By municipalities: Chapter 89, Missouri Code, authorizes all municipalities to adopt subdivision regulations (*see* § 89.400 to 89.450).

17. Planning commission review of public projects:
In counties: Chapter 64, Missouri Code, requires review by county planning commissions of plans for projected public improvements (*see* §§ 64.050, 64.235, 64.570, 64.820).

In townships: Chapter 65, Missouri Code, requires review by township planning commission of plans for projected public improvements (*see* § 65.665).

In municipalities: Chapter 89, Missouri Code, requires review by city planning commissions of such projects (*see* § 89.380).
In all instances, governing bodies may override planning commission disapprovals of their projects.

18. [maybe: "assessment[s] [and] other method[s]"] Impact fees:
In municipalities: § 89.410.2, Missouri Code, authorizes all municipalities to use special "assessment[s] or other method[s]" to finance the municipal construction of improvements and utilities required by a proposed subdivision.

19. Other exactions:
In counties: Chapter 64, Missouri Code, enables authorities in all counties (planning commissions and/or county commissions) to require

the construction of street and utility improvements (or bonds to secure their construction) as preconditions of plat approval (*see* §§ 64.060, 64.241, 64.580, 64.825).

In townships: Chapter 65, Missouri Code, authorizes township planning commissions to require the construction of street and utility improvements (or bonds securing their construction) as preconditions of plat approval (*see* § 65.667).

In municipalities: Chapter 89, Missouri Code, enables city authorities (municipal planning commissions and/or city councils) to require the construction of street and utility improvements (or bonds securing their construction) as preconditions of plat approval (*see* § 89.410). Chapter 89 also authorizes city authorities to require dedications of land and open space for "public uses indicated on the city plan" (§ 89.410.2; *see also* Home Builders Ass'n v. City of Kansas City, 555 S.W.2d 832, 835 (Mo. 1977) ("If the requirement is within the statutory grant of powers of the municipality and if the burden cast upon the subdivider is reasonably attributable to his activity, then the requirement is permissible; if not, it is forbidden and amounts to a confiscation of private property in contravention of the constitutional prohibitions. *Insofar as the establishment of a subdivision within a city increases the recreational needs of the city, then to that extent the cost of meeting that increase in needs may reasonably be required of the subdivider.*") (emphasis in original).

20. Local control of annexation:

By all municipalities: Chapter 71, Missouri Code, authorizes annexations by all municipalities, and prescribes two procedures for such annexations. (1) The first is by concurrent municipal ordinances detaching land from one municipality and annexing that land to another, abutting municipality (*see* § 71.011). (2) The second is by ordinance, upon petition by all owners of the territory to be annexed (*see* § 71.012). Before annexing land by ordinance, however, a municipality hold a public hearing, and determine that the desired annexation is "reasonable and necessary to the proper development" of the municipality and that the municipality can furnish "normal municipal services" to the area to be annexed within a "reasonable time" (*see* § 71.012.1(2)). (3) If a party objects to an annexation sought by petition pursuant to section 71.012, then the annexing municipality must hold further hearings, make further findings, adopt an annexation ordinance, seek a declaratory judgment by the local circuit court authorizing the annexation in question, and then hold an election in which a majority of voters within the annexing municipality and a separate majority of voters within the territory to be annexed both approve the annexation (*see* § 71.012.1(3), 71.015, 71.860-71.920). The statutes provide for subsequent elections if the first fails (*see* § 71.015.1(6), § 71.015.2).

By municipalities in certain third-class counties: Chapter 72, Missouri Code, authorizes the "absorption" of one municipality by another in certain third class counties, provided the aborbing and absorbed municipalities both adopt resolutions setting forth plans of absorption and majorities of voters in both municipalities approve the plan of absorption (*see* §§ 72.300-72.350).

By municipalities in St. Louis County: Chapter 72, Missouri Code, authorizes the establishment of a Boundary Commission in St. Louis County and provides for Commission hearings on proposals and petitions for annexations and other boundary changes, their approval or disapproval by the Commission, and (in case of Commission approval) their further approval by separate majorities of voters in annexing municipalities and in the territories to be annexed (*see* §§ 72.400-72.420, esp. 72.403-72.407 (substantive and procedural standards for annexations and other boundary changes in St. Louis County)). Chapter 72 also provides for "simplified" annexations upon petition by 75% of the owners in the area to be annexed and approval by the annexing municipality and the Commission (*see* § 72.405.6). *But see* O'Reilly v. City of Hazelwood, 1993 Mo. LEXIS 28 (Mo., Mar. 23, 1993) (invalidating Boundary Comm'n law as a special law prohibited by Missouri's constitution).

By third- and fourth-class cities: Chapters 77 and 79, Missouri Code, authorize mayors and councils of third- and fourth-class cities to annex and deannex territory, with the consent of a majority of the voters in the city (*see* §§ 77.020, 79.020).

By special charter and constitutional charter cities: Chapter 81 authorizes special charter cities of 20,000 or less and chapter 82 authorizes all constitutional charter cities to annex territory by ordinance, subject to the approval of 4/7 of the voters any incorporated area to be annexed (*see* §§ 81.080, 82.090).

21. Acquisition of land for general public purposes:
By constitutional charter cities: The ability of home rule municipalities to acquire land for general public purposes depends on the charters of those cities. *See supra, Note on home rule for constitutional charter cities in Missouri*, and Article 6 §§ 19, 19(a) Missouri constitution.

Open space conservation by the state and by certain counties and cities: §§ 67.870-67.910, Missouri code, authorize acquisitions of open space by the state park board, by counties having a population over 200,00, and by counties and cities *adjoining* counties with populations over 200,000 (*see* § 67.875). State and local government may acquire "the fee, development right or restrictive covenant, conservation easement, covenant or other contractual right in land or water rights located within such counties or cities necessary or appropriate to maintain, improve, protect, limit the future use of, or otherwised conserve and properly utilize open spaces and areas within such counties or cities" (*see* § 67.880). All means of acquisition are possible: "purchase, figt, grant, bequest, devise or otherwise" (*see* § 67.880), and even eminent domain, provided the state park board or local government condemning the land first adopt *either* a resolution or order "declaring the public purpose or use" for the land being condemned *or*, after public hearing and planning agency report, "a plan for conservation of open spaces" (*see* § 67.885).

Other relevant statutory provisions:
General planning enabling legislation: See above, note 15, on zoning enabling legislation, which is also the basic planning enabling legislation. In addition, §§ 251.150-251.440, Missouri code ("State and Regional Planning and Community Development Act"), authorize the establishment of regional planning commissions to conduct comprehensive land use and transportation planning.

Notes on Nebraska:

Note on classification of Nebraska municipalities: Nebraska municipalities are divided into four classes. (1) *Metropolitan class cities:* Cities of the "metropolitan class" are cities of 300,000 inhabitants or more. § 14-101, Nebraska Code. Omaha is the only city in this category. (2) *Primary class cities:* Cities of the "primary class" are cities having more than 100,000 but less than 300,000 inhabitants. § 15-101, Nebraska Code. Lincoln is the only city in this category. (3) *First class cities:* Cities of the "first class" are cities having more than 5000 but less than 100,000 inhabitants. § 16-101, Nebraska Code. (4) *Second class cities and villages:* Cities of the "second class" are "cities, towns and villages" having more than 800 but less than 5000 inhabitants. § 17-104, Nebraska Code. "Villages" are incorporated towns or villages having not less than 100 and not more than 800 inhabitants, and also second class cities that have adopted village government. § 17-201, Nebraska Code.

Note on home rule in Nebraska: Nebraska counties have no home rule powers. Lindburg v. Bennett, 219 N.W. 851 (1928) (a county is a creature of statute and has only those powers conferred by statute). But Article XI §§ 2-5, Nebraska constitution, afford home rule powers to municipalities.

22. Zoning:
City zoning: Chapter 14, Article 4, Nebraska Code, authorizes zoning by cities of the "metropolitan class". Chapter 15, Article 9, Nebraska Code, authorizes zoning by cities of the "primary class". Chapter 19, Article 9, Nebraska Code, authorizes zoning by cities of the "first class", cities of the "second class", and "villages". The statutes authorize extraterritorial zoning of land by all cities. *See* §§ 14-418 ("metropolitan class" cities may zone 3 miles beyond city limits), 15-902 ("primary class", 3 miles), 16-901 ("first class", 2 miles), 17-1001 ("second class" cities and "villages", 1 mile). § 19-4401, Nebraska code, authorizes every city of the metropolitan, primary and first classes to include within its zoning ordinance provisions authorizing and regulating planned unit developments.

County zoning: County zoning is authorized by §§ 23-114, 23-114.03 to 23-114.05, 23-164 to 23-174.04, 23-174.08 to 23-174.09, Nebraska Code.

23. Subdivision regulations:
Subdivision regulation by cities: § 14-115, Nebraska Code, authorizes subdivision regulation by cities of the "metropolitan class", and § 14-116 authorizes extraterritorial subdivision regulation by such cities. § 15-901, Nebraska Code, authorizes subdivision regulation by cities of the "primary class", and §§ 15-901 and 15-906 authorize extraterritorial

subdivision regulation by such cities. § 19-916, Nebraska Code, authorizes subdivision regulation by cities of the "first" and "second class" and by "villages", and §§ 16-904(2) and 17-1002(3) authorize extraterritorial subdivision regulation by such cities.

Subdivision regulation by counties: §§ 23-114.01 and 23-174.03 authorize subdivision regulation by counties.

24. Planning commission review of public projects:
Project review by city planners: No Nebraska statute requires cities of the "metropolitan class" to refer their plans for public projects to city planning boards. *See* §§ 14-366 to 14-376, Nebraska Code (on city planning boards and city use of eminent domain). But Nebraska case law limits the eminent domain powers of such cities to condemnations indicated on city plans already approved by city councils. Van Patten v. City of Omaha, 94 N.W.2d 664 (Neb. 1959). § 15-1104, Nebraska Code, requires that cities of the "primary class" seek planning department approval for public projects "of a character included in the comprehensive plan" but "not yet reported on by the planning department". § 19-929(1), Nebraska Code, requires that cities of the "first" and "second class" and "villages" seek the recommendation of planning commissions (if they exist) before holding hearings or taking action of "capital improvements".

Project review by county planners: § 23-174.07, Nebraska Code, requires counties in which cities of the "primary class" are located to seek county planning department approval for public projects "of a character included in the comprehensive plan" but "not yet reported on by the planning department".

25. [maybe: really special assessment districts] Impact fees:
Cities of the metropolitan class: § 14-116, Nebraska Code, enables such cities to require the creation of "public improvement districts" to fund the construction of improvements required by a proposed subdivision within the city's extraterritorial jurisdiction.

Counties in which are located cities of the primary class:
§ 23.174.03 authorizes such counties to require the creation of "public improvement districts" to fund the construction of improvements required by a proposed subdivision.

26. Other exactions:
By cities: §§ 14-115 to 14-116, Nebraska Code, authorize cities of the "metropolitan class" to require, as preconditions of plat approval, the construction of public improvements (or bonds or contracts ensuring their construction -- extraterritorial subdivision jurisdiction only) and the dedication of land for avenues, streets and alleys. § 15-902, Nebraska Code, authorizes cities of the "primary class" to require, as preconditions of plat approval, the construction of public improvements (or bonds securing their construction) and the dedication of land for public purposes. No Nebraska statute authorizes cities of the "first" or "second class" or "villages" to require the construction of public improvements (or bonds securing their construction) as preconditions of plat approval. *See* §§ 16-901 to 16-904, 19-916 to 19-920, Nebraska Code. But §§ 16-904, 17-1003, and 19-916 authorize such cities to compel subdividers to dedicate land for avenues, streets and alleys.

By counties: § 23-174.03, Nebraska Code, authorizes counties in which are located cities of the primary class to require that subdividers dedicate land for public purposes and install improvements (or guarantee their construction with bonds). § 23-375, Nebraska Code, authorizes all counties to require that subdividers dedicate land for avenues, streets and alleys.

27. Local control of annexation:
By cities of the metropolitan class: Chapter 14, Nebraska Code, authorizes such cities of the "metropolitan class" to extend their boundaries by ordinance at any time, to any distance, and over any territory "deemed proper" (*see* § 14-117; *see generally* §§ 14-117 to 14-125). But such annexations may include no city of the first class having a population over 10,000, nor "any agricultural lands which are rural in character" (*see* § 14-117).

By cities of the primary class: Chapter 15, Nebraska Code, authorizes two procedures for annexation by cities of the "primary class" (*see generally* §§ 15-106 to 15-106.02, 15-111 to 15-118): (1) annexation by approving plats of "additions" abutting the city's corporate limits (*see* § 15.106; *see also* §§ 15.106.01 to 15.106.02 (exceptions); (2) annexation by ordinance of certain second-class cities and villages where majorities of voters have already approved "consolidation" (*see* §§ 15-111 to 15.112).

By cities of the first class: Chapter 16, Nebraska Code, authorizes cities of the "first class" to extend their boundaries by ordinance at any time, in any direction "deemed proper", and over any contiguous lands "as are urban or suburban in character" (*see* § 16-117(1); *see generally* §§ 16-117 to 16-129). But such annexations may include no "agricultural lands which are rural in character" (*see* § 16-117(1)). Further, such annexations are subject to plan, notice and hearing requirements imposed by statute (*see* § 16-117(3)-(6)). Chapter 16 also authorizes "first class" cities to annex certain cities of the "second class" and certain "villages" (*see* Nebraska note 1; *see* §§ 16-122 to 16-123).

By cities of the second class and by villages: Chapter 17, Nebraska Code, authorizes "consolidations" by adjacent cities of the "second class" and/or "villages" whose councils or trustees have adopted ordinances approving those consolidations, and where majorities of voters in each city or village have also approved them (*see* §§ 17-401 to 17-404). Chapter 17 also authorizes cities of the "second class" and "villages" to extend their boundaries by ordinance at any time, in any direction "deemed proper", and over any contiguous lands "as are urban or suburban in character" (*see* § 17-405.01; *see generally* §§ 17-405.01 to 17-405.05). But such annexations may include no "agricultural lands which are rural in character" (*see* § 17-405.01). Finally, chapter 17 authorizes cities of the "second class" and "villages" to annex land by ordinance upon submission, "by a majority of the property owners and inhabitants in number oand value of the territory" to be annexed, of written requests and accurate plats or maps (*see* § 17-405; *see also* § 17-406 (applying § 17-405 to annexations by request where cities or villages straddle county lines).

28. Capital improvements programs:
In cities: § 19-929, Nebraska code, authorizes municipal planning commissions to prepare "capital improvement program[s]" to effectuate comprehensive plans. If a planning commission exists, § 19-929 requires that city governments take no action on capital improvements before receiving the recommendation of the planning commission.

In counties: § 23-114.01(2), Nebraska code, authorizes county planning commissions to prepare "capital improvement program[s]" to effectuate comprehensive plans. If a planning commission exists, § 23-114.01(2) requires that city governments take no action on capital improvements before receiving the recommendation of the planning commission.

29. Land acquisition for general public purposes:
By cities of the metropolitan class: § 14-101, Nebraska Code, authorizes such cities "to purchase, lease, lease with option to buy, acquire by gift or devise, and hold real...property within or without the limits of the city for the use of the city". § 14-374, Nebraska Code, empowers cities of the "metropolitan class" "to acquire by gift, purchase, condemnation, or bequest, such real estate within the corporate limits and within three miles thereof as may be necessary for any public use and may later convey, lease, sell, or otherwise dispose of any real estate thus acquired and not necessary for present use or future development upon such terms as it may deem appropriate." § 14-374 enumerates such public uses as streets, waterways, parks, public buildings, but adds "all other public uses" and "reservations in, about, along, or leading to any or all of the same". However, Van Patten v. City of Omaha, 94 N.W.2d 664 (Neb. 1959), limits the application of section 14-374 to condemnations within a city plan approved by a city council.
See also § 14-366, Nebraska Code (authorizing condemnations only for certain municipal utilities, for certain enumerated public improvements (streets, parks, etc.) and for "other needed public uses or purposes authorized by this act", *i.e.*, chapter 14 on cities of the "metropolitan class", as defined by § 14-101).

By cities of the primary class: § 15-201, Nebraska Code, authorizes such cities "to purchase, lease, or otherwise acquire as authorized by their home rule charters or state statutes real estate...within or witho the limits of the city for its use for a public purpose".

By cities of the first class: § 16-201, Nebraska Code, authorizes such cities "to purchase, lease, lease with option to buy, or acquire by gift or devise and to hold real...property within or without the limits of the city...for the use of the cityt in such manner and upon such terms and conditions as may be deemed in the best interests of the city".

By cities of the second class and by villages: § 17-501, Nebraska Code, authorizes such bodies "to acquire and hold real...property within

and without the limits of the city or village, for the use of the city or village, ...and lease, lease with option to buy, or acquire by gift or devise real...property".

By counties: § 23-104(1), Nebraska Code, authorizes counties "[t]o purchase and hold the real...estate necessary for the use of the county". Note that Nebraska counties are creatures of statute and have only such powers as the legislature confers upon them. Lindburg v. Bennett, 219 N.W. 851 (1928).

Note on conservation easements: §§ 76-2,111, et seq., Nebraska code, authorize "[a]ny governmental body empowered to hold an interest in real property in this state under the laws of this state or the United States" to acquire and hold conservation easements (§ 76-2,111(3)(a)). This legislation is a version of the Uniform Conservation Easement Act (*cf.* Kansas' recently enacted version) and authorizes conservation easements for "the purpose of retaining or protecting the property in its natural, scenic, or open condition, assurin its availability for agricultural, horticultural, forest recreational, wildlife habitat, or open space use, protecting air quality, water quality, or other natural resources, or for such other conservation purpose as may qualify as a charitable contribution under the Interna Revenue Code of 1954, as amended" (§ 76-2,111(a)(1)).

Other relevant statutory provisions:

General city planning enabling legislation: § 14-373, Nebraska code, mandates city planning by "an appropriate city board of official" in cities of the metropolitan class. § 15-903, Nebraska code, requires that zoning by cities of the primary class be "in accordance with a comprehensive plan". §§ 15-1101 to 15-1106, Nebraska code, mandate the establishment of planning departments in cities of the primary class. §§ 19-901 to 19-929, Nebraska code, authorize zoning by cities of the first and second class and by villages, but requires that such zoning be undertaken only after the establishment of planning commissions and the adoption of comprehensive plans.

General county planning enabling legislation: §§ 23-114 to 23-114.05, Nebraska code, authorize zoning by counties, but require that such zoning be undertaken only after the establishment of planning commissions and the adoption of comprehensive plans. § 13-301, Nebraska code, declares that "the county government of a county that contains some or all portions of a city of the first class is strongly encouraged to prepare a comprehensive development plan that meets the requirements of § 23-114.02" and adopt zoning and subdivision regulations.

General regional development and planning enabling legislation: Nebraska recently created nine Nebraska Planning and Development Regions to assist in and coordinate planning and development efforts by local governments. 1992 Neb. ALS 573, §§ 1-7.

Appendix B: Literature Review The Transportation-Land Use Link

Transportation-Land Use Link: Literature Review

Abstract: Transportation decisions clearly affect land-use decisions, and land-use decisions clearly affect transportation systems. Urban theorists have addressed the cyclical land-use-transportation relationship for many decades, and economists have modeled it extensively. Field studies demonstrate what the economists have predicted and what many theorists have feared: that, in many ways, highways shape urban areas. Yet little of that knowledge has found its way into planning practice, and land-use planning and transportation planning remain separate decision-making processes. Now that Congress has mandated that transportation planners consider both land-use plans and the land-use impacts of their decisions, the literature of planning practice should draw on the theoretical and research literature and provide guidance to planners on how to manage the transportation-land-use cycle.

The relationship between transportation and land use is a complex one. Urban form, whether it is compact, multi-nodal, or sprawling, has an enormous impact on the type and cost of transportation systems needed to serve residents of a metropolitan area. On the other hand, the type and location of major transportation facilities greatly influences urban form. Stover and Koepke (1988) referred to the relationship as a cycle. It is intuitively easy for a planner or interested citizen to understand that suburbs that grew up around railroad stations, like those of Chicago's North Shore or Philadelphia's Main Line, are the kind of nodal-focused communities that are easiest to serve with fixed-rail transit; it is equally easy to understand the difficulty of retrofitting a fixed rail system to Los Angeles, which grew up around freeways (see, e.g., the comparison of Boston and Phoenix in Kain and Fauth 1977; see also Walbridge 1977).

Although the literature reflects a broad understanding of this complex relationship, and some of that literature dates back many decades, surprisingly little of the learning from the literature has been put into effect. Transportation planning and local "comprehensive" planning (which often really means only "future land-use" planning) continue to take place quite separately, resulting in combinations of public policies that rarely reinforce each other and that often work at cross-purposes. One of the problems with the literature on the subject is that it does not include much that is directed at mainstream planning practitioners. The literature described below includes some relatively recent urban design pieces and a handful of books directed to transportation planners. However, most of the rest of the literature is scholarly or theoretical. A few recent pieces, notably work by Anthony Downs (1992), are aimed at a broad public-policy audience but do not necessarily reach the planners who are developing local plans.

The 1991 passage of the federal Intermodal Surface Transportation Efficiency Act (ISTEA), some 45 years into the construction of the National Interstate and Defense Highway System, suggests that it is time to change all of that—time for local planners and highway engineers to work together. As state transportation and highway departments begin to implement that new law, and as urban designers revisit some "traditional" transportation and land-use relationships, it is worth reviewing the literature to see what planners and engineers can learn from past plans and field experience.

This article examines literature on this issue spanning six decades, ranging from theoretical works to case studies and practical recommendations for implementing improved planning systems. It begins with a review of philosophical examinations of the relationship, followed by a discussion of the economic principles involved in land-use and location theory. It then discusses some of the practical implications of public land-use and transportation decisions in the context of these principles and then reviews the literature most often used by those who make such decisions.

Philosophical Examinations of the Relationship

It seems important to start with an examination of basic philosophies about transportation and the city. These essays pose basic questions about the nature of the relationship. Some argue that

transportation should be made to fit the city. Their starting point is largely with cities like New York, Philadelphia, Chicago, and great world cities like London and Paris—all cities that grew up with rail commuting. The urban form of those cities is highly compact and typically oriented toward nodes of activity around railroad stations. Attempting to preserve such cities and to make others more like them is a strong argument for fixed-rail transit, for such transit is an integral part of those cities. At the other extreme is the argument that the modern city should be redesigned at lower densities around an auto-oriented transportation system. The one area of agreement in the essays is the need for better planning—planning for transportation as a system rather than as a collection of discrete elements; and coordinating transportation and land-use planning.

In a late 1950s essay entitled, Lewis Mumford (1963) warned:

> Now that motorcars are becoming universal, many people take for granted that pedestrian movement will disappear and that the railroad system will in time be abandoned; in fact, many of the proponents of highway building talk as if that day were already here, or if not, they have every intention of making it dawn quickly. The result is that we have actually crippled the motorcar, by placing on this single means of transportation the burden for every kind of travel. Neither our cars nor our highways can take such a load. This over-concentration, moreover, is rapidly destroying our cities, without leaving anything half as good in their place (p 235).

In an article on "Urban Sprawl," William H. Whyte, Jr. (1958) expressed concerns similar to those of Mumford:

> Under the provisions of the Federal Highway Act of 1956, some 41,000 miles of new highway are going to be laid down, and the effect, as the planners of the act have frankly declared, will be "to disperse our factories, our stores, our people; in short, to create a revolution in living habits."

The communities affected, however, have little to say about the revolution; the act puts the program entirely in the hands of state highway engineers....

But perhaps the most important feature of the new highway program will be the location of the interchanges, for these will be to the community of the future what river junctions and railroad division points were in the past. The interchanges become the nodes of new developments, and whatever ideas planners may have had for the area, the pressure of land prices can be an irresistible force for hit-or-miss development (p. 126).

Whyte was more optimistic than Mumford; he saw the possibility of good planning and coordination of transportation systems, land development, and open space protection. Like Mumford, however, he realized that the National Interstate and Defense Highway System would forever change the urban form of the United States.

Mumford did not oppose the highway system. He saw it as a valuable resource for intercity transportation but as a threat if used for commuting and other circulation within the city. Mumford advocated a "townless highway" and its corollary, the "highwayless town," which he credited to Benton MacKaye (1930). Mumford saw the highway system as a useful link between metropolitan areas, but one that should feed a city through linear arterials, rather than through "capillaries and veins." Actually, MacKaye's (1928, 1930) approach was a little different from Mumford's; he did use the term townless highway but did not refer to a highwayless town. As that semantic analysis may suggest, the issue that he addressed was the impact of development on highways, not the obverse. He was an early advocate of limited access expressways and was not at all concerned by the implications of long-range commuting, focusing only on what he saw as the benefits of such expressways:

> The lawyer's son (or daughter) who aspires to a legal career need not go and live in a large city nor in the suburbs of a large city; he (or she) is enabled, physically, to live in the real country—by private motor or community bus to be in the office promptly in the morning and back again in the village in plenty of time for supper (MacKaye 1928, 163).

MacKaye's great fear was a strip of endless development along the highway, something that he called "roadtown" (1930) and that planners today call "strip commercial." To avoid the creation of

roadtowns, he advocated a combination of limited-access expressways and communities designed like Radburn, New Jersey, with hierarchical street systems and residences facing only on the non-arterial streets. It is ironic to note that MacKaye's worst fears have been realized, despite the implementation of an extensive system of limited-access expressways and despite the fact that the hierarchical street system has replaced the grid as the preferred design of traffic engineers (Stover and Koepke 1988).

Lewis Mumford's view of the city and its relationship to the automobile is in many ways similar to that of urban designer Victor Gruen (1964), who called for "the taming of the motorcar". Gruen's ideal city included concentric beltways but no radial routes into the center of the city. His vision also incorporated pedestrian malls on Main Street, a largely-failed concept that he included in many local plans developed by his consulting firm. It is an ironic historical note that Gruen is viewed by many as the creator of a frequent destination of today's drivers—the indoor shopping mall.

In his "The Highway and the City", Mumford (1963) went on to raise a fundamental question about transportation planning:

> What's transportation for? This is a question that highway engineers apparently never ask themselves, probably because they take for granted the belief that transportation exists for the purpose of providing suitable outlets for the motorcar industry. To increase the number of cars, to enable motorists to go longer distances, to more places, at higher speeds, has become an end in itself....The purpose of transportation is to bring people or goods to places where they are needed and to concentrate the greatest variety of goods and people within a limited area, in order to widen the possibility of choice without making it necessary to travel. A good transportation system minimizes unnecessary transportation (p. 235).

Wilfred Owen eloquently made the argument for proponents of highways as the most modern and convenient form of transportation. In a much cited examination of The Metropolitan Transportation Problem (Owen [1956] 1966), he posed the broad question: "Should the city adapt to the automobile or should transport technology instead be adapted to existing patterns of urbanization?" (p 26). Although he acknowledged negative impacts of automobiles on cities, including the fact that suburbanization had simply tended to move the city's mistakes outwards, he also noted that there were many reasons besides convenience why people might rationally move outward from the city center. Factors that he cited as considerations in that decision ranged from diseconomies of scale in the hearts of large cities to the need to disperse the population in order to limit the impact of nuclear attacks; he cited Frank Lloyd Wright on the latter point.

Owen examined fixed-rail systems, buses, and automobiles as modes of urban transportation. He saw the most untapped potential in buses, although he also supported the early proposals for the addition of fixed-rail systems to the Washington and San Francisco metropolitan areas. After examining all of the options, however, he came out in favor of highways:

Only a total network of controlled-access expressways and parking facilities can provide a skeleton that will support the giant metropolis of the future. If only parts of the highway network are of satisfactory design, the skeleton is bound to collapse under the weight of the peak-hour movement attracted by expressway standards (Owen [1956] 1966, 215).

In another publication, based at least in part on The Metropolitan Transportation Problem, Owen's (1968) vision of the impact of highways on the city sounded more like that of Mumford, although with a different philosophical cast:

The big hope for moving around in urban areas is to move the urban areas themselves around. We will have to attack the congestion of moving by overcoming the congestion of living. Metropolitan mobility depends on regional planning that creates a more orderly arrangement of urban living and working....The highway program, combined with urban renewal, is offering us the chance (p. 242).

Owen's piece expressed great concern about sprawl and again suggested some form of population limits and the movement of employment centers out of the central city. He was convinced that

"the highway program itself can help to achieve the environment that is essential to its success. Highways are, in fact, one of the most potent tools of the planner. The highway system forms the skeleton of the giant metropolis" (p. 243).

Although a true believer in the highway system, Owen ([1956] 1966) was thinking far ahead of most highway advocates of the 1950s and well ahead of many transportation planners in the 1990s. Among the concepts that he advocated were the following:

- condemnation of excess right-of-way to be used for controlled commercial development along the expressways (p. 215);
- use of pricing policies, including tolls on urban expressways, to control transportation demand, particularly at peak hours (pp. 216, 218);
- pooling of financing for all metropolitan area transportation, so that highway users might "help support improved peak-hour transit service....rather than to subsidize little used rural roads" (p. 217);
- combined governance of metropolitan transportation systems, a logical corollary of the concept of pooling funding (p. 218);
- staggered hours "for working, shopping and school" (p 222); and, last but not least
- "both population limits and geographical limits...on urban development. There is increasing evidence of the need for directing more urban growth into new towns and existing smaller towns. This would seem preferable to the overcrowding that modern transportation now makes unnecessary, or to the endless sprawl that modern transport has made possible" (p 222).

In short, Owen saw many of the problems that concerned Mumford and Whyte. He simply saw more opportunities to solve them with a highway-dominated metropolitan transportation system. Interestingly, many of those were heavily dependent on good planning and regional cooperation. One of Owen's concepts may have been farther ahead of its time than others, or perhaps just wrong. He suggested that "the helicopter, convertiplane, or other direct-lift aircraft will some day furnish the transportation service necessary to spread the urban traffic load over a wider area" (Owen [1956] 1966, p. 214). The implications of helicopter suburbs is perhaps best left to a later piece.

Urban designers Arthur Gallion and Simon Eisner (1950) had made a similar argument in a classic text a decade before Owen:

> It is sometimes claimed that the motor vehicle created the congestion of cities. The opposite is true. The extent of the city was only 2 or 2˚ miles in r adius in the days of the horse-car. The electric street car expanded the radius to 5 miles with a travel time of about one-half hour each way. The automobile stretched this radius to 15 miles in the same travel time. The only relief from congestion has been possible because of the motor vehicle. It is an unplanned and obsolete street and transportation system and excessive population density that have caused congestion (p. 193).

Gallion and Eisner argued that the solution to urban congestion was to solve the parking problem entirely with surface-level, off-street parking, an approach that "would lead to a gradual balance between building floor space and open ground space. It would also lead to a gradual removal of blighted structures" (p. 201).

A decade later, a group of RAND researchers (Meyer et al. 1965) took a position much nearer that of Owen than that of Whyte and Mumford. They concluded that the dispersal of both industry and housing would have occurred with or without the convenience of the freeway system and regardless of the availability of transit. They cited both technological and economic factors in support of their conclusions. The economics were not complex. They found that workers with larger families traded increased transportation cost and time for larger homes on larger lots in the less-expensive suburbs. Also leading to dispersal were urban problems and the need of industry for sprawling, one-story assembly-line plants to replace the multi-story factories of the first half century or so of the Industrial Revolution. One of their conclusions, however, seems somewhat at variance with their

notion that the highways were incidental to the changes. By modeling the elasticity of demand, an economic concept used to measure how sensitive consumers are to price changes, they concluded that consumers were wedded to their autos—price increases did not easily influence them to switch modes of travel. Freeway convenience was clearly a major factor in people's growing attachment to the automobile and, indeed, the RAND team found that all urban transportation systems worked surprisingly well when viewed in context; they noted in particular that it was unrealistic for commuters to expect the highways to function as smoothly at peak hour as they would during the rest of the day.

In their conclusion, the RAND team, like Owen earlier, emphasized the need to manage the transportation resource, particularly highways. Like Owen, they suggested the use of tolls, with higher peak-hour charges, as a method of demand management. Like Owen, they hoped for technological improvements to improve the efficiency of highways. Some of their recommendations, such as metered access at peak hours and priority access or priority lanes for buses have now been implemented in many cities. Like Owen, they saw increased use of helicopters and other aircraft for commuting. Unlike Owen, however, they strongly opposed subsidies from highway users or others to urban transit systems.

Theoretical Analyses of the Relationship

Before turning to field studies of the relationship between transportation systems and land use, it is important to consider what those studies might show—to form a sort of minihypothesis as a context for reviewing the field studies.

In what may be the longest view of transportation and urban from, Schaeffer and Sclar (1975) offered their history of urban form, beginning with "the walking city" and then evolving to the "tracked city" and, finally, "the rubber city." They argued that a lack of transportation created the earliest cities, because people needed to be near each other, and that the relative scarcity of transportation before "the rubber city" kept cities reasonably compact and contiguous.

Basic theory about the relationship between land-use and transportation is rooted in economic concepts, which are, in turn, based on notions of consumer behavior. "The Journey to Work" in 1951, an early theoretical look at the issue by the American Society of Planning Officials (ASPO), recognized that the major issue that concerned most consumers was not the distance of their residence from where they worked but the length of time that it took them to travel that distance. The ASPO report introduced the use of "iso-time" lines, the irregular modifications of circles that transportation planners continue to use to geographically represent the travel-time relationship of different parts of the community to the center-city. That report focused on the importance of accessibility in determining land uses, with particular emphasis on new industries (employers) and new housing developments. The "journey to work" as measured by the time-based iso-time zones was presented as an important factor in determining appropriate locations for industrial and residential development. In one sense, this was an early argument for adequate public facility standards (discussed below), although the report did not go so far as to suggest that local governments go beyond zoning to control the location of new development.

A decade later, Lowdon Wingo (1961) outlined his economic model of the relationship in Transportation and Urban Land. Although the ASPO report discussed the costs of the journey to work, the emphasis there was on the length of that journey as measured by the clock. In contrast, Wingo placed the emphasis on money. He argued that a rational consumer would spend a fixed amount on the combination of transportation (commuting) and housing and that the amount "spent" on commuting would include some recognition of the value of the time spent on the journey. Four years later, a book based on substantial field research (Meyer et al. 1965) supported Wingo's theory without citing it, noting that

workers employed at high-density workplaces have an option

between higher transportation expenditures and higher housing costs and many choose to make longer and costlier work-trips from the suburbs in order to obtain more cheaply the housing and yard space they want (p. 119).

William Alonso (1964) developed a logical corollary of this theory in his frequently-cited Location and Land Use. It has been called by another theorist "the most complete and general model of urban location theory" (Mills 1972a, 67). Alonso described a model of urban land values. The important variables in the model were location of the land in relation to the center city and transportation. Alonso hypothesized that the difference in land values of various parcels would vary inversely with the transportation cost from each parcel to the center city. His model, like Wingo's, suggests that the highest values will attach to property which has the best access to the center city. It is interesting to note that Wingo's and Alonso's works were contemporaneous but independent (see discussion in Alonso 1964, p 15, note 26). Wingo cited the unpublished 1960 dissertation version of Alonso's work, and Alonso's book then cited Wingo's work.

Some time earlier, Hoover (1948) had developed a much more complex model of the local land market. It recognized that access is more important to some industries than others and that inherent qualities of land (such as soil type), may affect the value of that land to some producers (such as agriculture) and not others. Nonetheless, Hoover's model recognized the physical "transfer costs" of goods as a key factor in valuing particular sites for particular uses. He cited a Chicago report, noting that accessibility for industries had first been defined by river frontage, then by rail access, and, more recently and only in part, by truck access. Mills (1972b) also developed a more complex model of the urban land market. Like Hoover (whom he did not cite), Mills recognized that transportation was an important variable, but not the only variable, in determining land rents and thus land values. Hoover had focused on the inherent characteristics of land (based on traditional agricultural economics), but Mills emphasized production inputs and the ability to make substitutions of capital for labor, labor for capital, or capital for land (perhaps building a taller building) as key variables in determining land rents. In a separate work, Mills (1972a) discussed both Alonso's and Wingo's models in the context of his urban economic theory. He criticized both, basically on the grounds that they were too simple. The essence of the critiques is that the models are imperfect predictors of particular land values under particular circumstances. Nothing in those critiques contradicts the fundamental notion that accessibility is a key element in land value and use.

All of these models accepted accessibility essentially as an uncontrolled variable. None of them discussed (although presumably each of the authors would acknowledge) the implications for their work if accessibility were considered to be a controllable variable. Building a new radial highway from the center city to a suburb expands the boundary of the iso-time zones further out from the city along that route, thus making locations all along that route relatively more attractive for the location of residential or industrial development (ASPO 1951). Because of the increased accessibility, residences along that route will have increased value to consumers, who now must spend less commuting time (and possibly money) to reach those residences or sites of potential residences (Wingo 1961). For exactly that reason, and confirming Alonso's model, land along that route will increase in value—a fact that also recognizes the increased attractiveness of such land for development, such attractiveness being the private sector's corollary of the public sector's recognition of the increased appropriateness of development along that route.

Schaeffer and Sclar (1975) approached this economic relationship differently. They argued that "most of the benefits of urban transportation accrue not to the traveler, but to third parties such as real estate developers, retailers and employers whose land or services have become accessible through the existence of transportation" (p. 121). Therefore, their argument continued, it is not rational to require that transportation systems be user-funded, if

the traveler is considered to be the user. They urged a combination of peak-hour surcharges for using highways and of gasoline-tax subsidies for mass transit as a method of limiting the subsidies to drivers and balancing the economic impacts of highways on cities.

In a more recent effort, de la Barra (1989) has outlined a method of integrated land use and transport modeling. In it, he cited the work of Alonso, Wingo and others; he also cited other models that examine behavior without attempting to determine why it occurs, as Hoover, Wingo and other economists have done. De la Barra's model recognized the interactive nature of land use and transportation systems, with feedback loops demonstrating how a change in land use affects related transportation systems and how a change in transportation systems affects accessibility and probable future land-use decisions. His book gave examples of applications of the model to both land use and transportation planning decisions in Brazil.

Viewing the relationship from the other perspective, Pushkarev and Zupan (1977) examined what kind of development works well with fixed-rail public transit. Their findings were the following:

> • At densities between 1 and 7 dwellings per acre, transit use is minimal.
>
> • A density of 7 dwellings per acre appears to be a threshold above which transit use increases sharply.
>
> • At densities above 60 dwellings per acre, more than half the trips tend to be made by public transportation (p. 173).

This, of course, brings back full-force the chicken-egg nature of the problem. If one views public transit as desirable, it can exist only with relatively high density development. Yet, the models suggest (and studies cited below illustrate) that contemporary, highway-oriented cities are unlikely to evolve at the kinds of high densities necessary to support transit use.

There are a number of other theoretical models of the relationship between transportation and land-use, all built on basic concepts of how individuals and business-organizations make site-location decisions, all of which-comes back to basic principles of economic behavior. For the scholar particularly interested in those models, both Deakin (1991) and de la Barra (de la Barra 1989) included good bibliographies, and de la Barra summarized and compared many of the models before outlining his own. Handy's (1992) bibliography, discussed in the following section, also contains several theoretical models.

Applied Analyses of the Relationship

A 1975 study examined the impacts of public investments in infrastructure on development patterns in the Boston, Denver, Twin Cities, and Washington, D.C. (Environmental Impact Center 1975):

> A basic conclusion of this study, supported by both the literature review and the statistical analyses, is that public infrastructure investment can have an important impact on the location, type and magnitude of development, particularly for single-family homes. The strong relationship with single-family homes should be interpreted as meaning that the secondary effects are particularly strong at the urban fringe since this is where most single-family home construction has taken place over the last two decades (p. 1).

The report noted that earlier studies (those cited were unpublished local government studies) had found that "highways have little influence on single-family, low-density residential land use" (Environmental Impact Center 1975, 7). However, the studies cited were dated before major construction on the interstate highway system began, a factor that clearly caused a paradigm shift in many transportation models. By 1975, the authors concluded:

> The available evidence suggests that households and businesses prefer good access by highway, all other factors held constant. In terms of actual location, single-family housing construction has a tenuous connection to new highways, multi-family residential and commercial development appear to be influenced by highways; and the relationship of industrial development to highways is unclear (Environmental Impact Center 1975, 8).

They also found that the greatest impact of infrastructure investment occurred where there were large quantities of undevel-

oped land at a reasonable price—in other words, where developers had a choice of multiple locations in which to build. Not surprisingly, they found that the impact of such investments was significantly greater where there existing levels of access to developable areas were not good. The authors found local land-use controls to be so ineffective as not to be significant factors in most of their examples.

A year later, the Council on Environmental Quality published a slim report entitled The Growth Shapers (Urban Systems Research & Engineering 1976). This well-illustrated, 72-page report, noted,

> The link between infrastructure investments and land use changes has long been recognized in a general way, but little has been done to control the design and location of new infrastructure. Instead, the tactic has been to attempt to reduce the negative impacts of unplanned growth with tools such as zoning, subdivision controls, and local planning. These techniques often fail, particularly when land use is changing rapidly, as it often does following construction of new infrastructure. Changing the design of the infrastructure itself can be an effective additional control method, reinforcing the effectiveness of the other land use control (p. 5).

The Growth Shapers was not a scholarly report, and it attempted to prove nothing. It simply used case studies and theoretical examples to illustrate its fundamental point, which is that infrastructure investments—particularly those in highways, mass transit and sewer lines—shape the growth that occurs in metropolitan areas.

The use of the word shape is important. No one has asserted that infrastructure investment causes growth. Careful examination suggests that a lack of transportation facilities may discourage economic development in a particular area and that excellent transportation facilities may, in theory, give one region an advantage over another. However, with the well-developed highway system throughout the continental United States, it is unlikely that construction of a new road in an area that is not otherwise attractive to growth will stimulate economic development there. (Kraft et al. 1971; Forkenbrock et al. 1990). While Forkenbrock and his colleagues found that rural highways alone were unlikely to trigger economic development, Moon (1987) used case studies in Kentucky to illustrate how interstate highway interchanges reshape rural communities. A 1971 bibliography contained an examination of the planning and regulatory issues related to highway interchanges (Mason 1971), and a 1974 bibliography contained a large section of material on the same topic (Chipman et al. 1974).

The notion that highway investments shape growth within a region is entirely consistent with Alonso's model of land rents, with Hoover's model of economic location decisions and, Wingo's commuting/housing cost model. Under any of these models, a new road makes land with access to it relatively more accessible and thus more attractive to particular types of development (Hoover) or more valuable (Alonso) or simply more valuable for residential purposes (Wingo). All of this is entirely consistent with findings that new highways will not bring economic development to a stagnant area—a small change in one factor will not greatly change demand. Viewed more simply, if no one is buying, simply making land more attractive will not make it sell (see, generally, Deakin 1991).

Although *The Growth Shapers* (Urban Systems Research & Engineering 1976) was the first study of its kind directed to an audience of public officials, a number of studies of particular communities have yielded results supporting the hypothesis of the growth shapers. In the mid-1950s, Clarkstown, New York, adopted what may have been the first local-growth management program in the country when construction of the Tappan Zee Bridge brought it within convenient commuting distance of New York City; Ramapo, its more famous neighbor to the west, adopted a similar program a decade later when the completion of a New York State Thruway link further extended the convenient iso-time zones of New York City to include it (see Kelly 1993a, p. 78).

Most of the discussion in the literature concerns the relationship of automobiles, and automobile commuting, to the urban area and urban form in particular. The automobile, however, is not the

only vehicle that has changed urban land patterns. Schaeffer and Sclar (1975) argued that the truck caused earlier changes to the city than the automobile.

Before the truck, industry had to locate in the urban core or at railroad sidings. Since these sites were limited, good industrial land was scarce. With truck transport any area with serviceable roads and not too far from the core could become an acceptable site (p. 84).

Using data from Boston, they noted that several major indexes of industrial activity showed that there was a rapid shift of such activity from the core to "inner-ring" communities (within two to six miles of the core) beginning in 1914. Industrial land uses, once concentrated along railroad lines, now generally adjoin major highways. In this way, too, the highway shapes the city.

Although most of the cited studies of the impact of highways on cities rely on the evidence of experience, Nelson (1950) foresaw both that radial highways would "compound congestion" in the urban core and that they would facilitate and expedite urban flight. He argued for the "planning and rebuilding of compact and pleasant cities" (p. 122).

The notion that transportation influences growth patterns is hardly new. Philadelphia's toniest suburbs have long been referred to as "the Main Line," recognizing their location along the commuter stations of the old Pennsylvania Railroad Main Line—the transportation link that led to their development in the last part of the nineteenth century. Warner (1962) made a rigorous study of the pattern of growth from 1870 to 1900 in the Streetcar Suburbs of Boston. Like such later studies as The Growth Shapers, Warner noted that the suburban expansion was a function of the expansion of several types of infrastructure, of which transportation was probably the dominant one.

In a 1980 study, two consulting firms under contract to the U.S. Departments of Transportation and the Department of Housing and Urban Development examined the land use and urban development impacts of beltways (Payne-Maxie Consultants and Blayney-Dyett 1980). The consultants examined the impacts of beltways around Atlanta, Baltimore, Columbus, Louisville, the twin cities of Minneapolis-St. Paul, Omaha, Raleigh, and San Antonio. Their findings were the following:

- "Interstate 285 has affected the distribution and location of new development in the Atlanta SMSA....it contributed to dispersal of economic activity but was not the major factor in this process" (p 7).
- In the Baltimore area, "The counties' permissive planning posture and their competition with the city were more critical factors to stimulating suburban development than was the existence of the beltway, although its presence probably added momentum to the dispersal process" (p 9).
- "...Columbus' beltway provided regional benefits without adversely affecting the CBD because of the city's strong political leadership, which combined an aggressive annexation policy with an active commitment to downtown, as illustrated by several major tax increment and tax abatement financed renewal efforts. Coordination of transportation and land use planning, and the powerful influence of the timing and location of Interstate projects also underlie the positive impact of the beltway in the region" (p 10).
- "From a regional perspective, the [Louisville] case demonstrates growth dynamics only vaguely perceived in the comprehensive plans prepared by local officials and planning consultants" (pp 11-12).
- In the Twin Cities, "[t]he belt has had no discernible fiscal impact upon the central city, for other forces far outweighed the outward pull of the belt, and these have been partially mitigated by active community concern for the viability of the downtowns....Committed leaders of the business community working closely with city planning departments have created a successful innovative and far-reaching revitalization program for the

downtowns, particularly in Minneapolis" (p 13).

- In Omaha, the study found that highways were important, but not the beltway. "Interstate 80, running out of town to the southwest, has been a much more important focus for the growth allowed to slip out of central Omaha by very permissive land use policies. The Omaha Industrial Strip, 90 percent of which is comprised of firms previously located near downtown, has grown up over the last 30 years between I-80 and the main line of the Union Pacific Railroad. Residential suburbanization has occurred to the southwest where utilities were easily available and access to the downtown via I-80 maintained Omaha's reputation as the 'twenty-minute city'" (p 14).
- "Like Columbus, Raleigh's strong annexation policy and control over water and sewer service resulted in the retention of beltway-related activity within the city, minimizing adverse fiscal effects of outlying development" (p 15).
- "From a planning perspective, the San Antonio case study shows how highways can influence development patterns in the absence of explicit land use policies and maps, restrictive zoning regulations, and comprehensive infrastructure improvement programming" (p 17).

In sum, the study found that highways were an enormous influence on urban form. Interestingly, the success of the Raleigh and Columbus cases was not that they maintained a more compact urban form but that they were able to expand their city limits through annexation in order to keep the sprawling beltway development within the legal (and fiscal) jurisdiction of the respective city governments. Omaha illustrated the power of the combination of the growth shapers, where the availability of sewer and water reinforced the availability of transportation (there measured in time, "the twenty-minute city") to attract development to the southwest. A defect in the analysis is the authors' rather naive assumption that land use controls might overcome the economic forces unleashed by the growth shapers. The communities that succeeded in managing growth did so not through land-use controls, but through the control of sewer and water and through annexation policies; this should have alerted the authors to the possibility that land use controls are inadequate to stop these economic forces. A study published several years earlier (Clawson 1971) found that zoning was not an effective tool to direct suburban growth. That is not a particularly surprising finding, because zoning was developed as a tool to maintain established neighborhoods, not as a tool to manage the development of the suburbs (see, generally, Kelly 1988).

The beltways illustrate the changing nature of the relationship among highways, urban form, and commuting patterns. The early urban highways, like the earlier transit systems, were generally continuous routes that went through (or near) the urban core, serving lands in two directions; or they were radial routes, primarily linking the urban core with outlying areas. Beltways, which go around the urban areas generally near the fringe, are something quite different. Although they were conceived in part to divert the "interstate" part of traffic on urban freeways around the urban core, they serve another purpose as well—commuting to destinations other than to the urban core.

Planners have hoped to reduce congestion by achieving a jobs-housing balance in various subsectors of the metropolitan region; the idea is to provide people with the job opportunities near their homes and thus to reduce the need for commuting (Giuliano 1991; Cervero 1989a; see, e.g., Montgomery County Planning Board 1990). Giuliano (1991) noted that "jobs-housing balance is a new label for a planning concept that has a long history; the balanced or self-contained community...[is] one in which residents can both live and work" (p. 305). The mere transfer of employment centers out of the urban core does not solve the problem, however. Despite a large increase in suburban employment opportunities, commuting in major metropolitan areas has increased (Cervero 1989b). That is not particularly surprising, for, as Giuliano (1991)

noted, "it is not clear that living close to work is a high priority for most people" (p. 308). Giuliano found that the relationship is far more complex than it seems and thus difficult to manage. For example, different types of housing attract different kinds of people. Thus, it is necessary to balance the types of housing with the types of jobs, as well as to balance the raw numbers. Further, it is not clear that a particular municipality or even a county within a metropolitan region is necessarily the appropriate geographical unit within which to measure such a balance.

Cervero (1989b), still seeking the jobs-housing balance while acknowledging the traffic problems associated with current suburban employment centers, argued for a much more sophisticated system of managing transportation and land-use systems.

It is worth considering briefly the question of why transportation investments have an impact on land-use patterns, although the answer will be intuitively obvious to many readers. Using the twenty-minute city example suggested above, construction of a new radial highway leading out from the central city increases the supply of land that falls within a twenty-minute commuting distance; it also, of course, increases the supply of land within five minutes, ten minutes and fifteen minutes. That makes residences on the land more attractive to consumers and thus makes the land more attractive to developers and, presumably, more valuable. Stover and Koepke (1988) gave a dramatic example: from 1957 to 1970, vehicle registrations in San Diego nearly doubled; thanks to the construction of 166 miles of freeway in the same period, however, the land area within twenty peak-hour minutes of the central business district tripled (p. 3).

Because accessibility is important to housing consumers, it is important to developers. A Twin Cities study found that the availability of highway access was a checklist item that might eliminate a site from consideration by a developer early in the review process (Baerwald 1981). A late 1920s study found a positive correlation between transit access and land values in New York City (Spengler 1930). A study seventy years later found that access to mass transit in the San Francisco Bay Area of California had tangible value to consumers, and that the consumers living in the transit-oriented projects were much more likely than others to use the system (Bernick and Carroll 1991). Interestingly, although developers were satisfying consumer's demand for such projects, they apparently did not place a premium price on the land or on the units that they built on it (Bernick and Carroll 1991).

Using land in the Baltimore area, Czamanski (1966) sought to determine the effect of public investments on urban land values. He hypothesized that accessibility would be a key predictor of land values, but he used a more sophisticated concept of predictability than Alonso's model had suggested. Czamanski recognized that within a metropolitan area, there are important functions at multiple locations, ranging from shopping to employment to health care and education. He thus constructed an accessibility index to urban functions and computed that index for each of the test parcels. From his empirical analysis, he found that "the value of all types of urban land depends to a very high extent (often to the point of exclusion) upon the Accessibility Index as defined in this study" (Czamanski 1966, 211).

The relationship between transportation and land use is not one way. As Stover and Koepke (1988) have suggested, it is a cycle. Transportation facilities influence land-use patterns, which in turn influence transportation demand. Handy (1992) synthesized the research from a number of reports on how land use patters affect travel patterns. Among her conclusions are the following:

> • Density: Higher densities decrease the number of trips taken [per dwelling unit], the percent auto, and total energy, but decrease speed and may increase trip length....
>
> • Activity mix: the influence of the mix of activities on travel has been less extensively and less consistently explored. Studies show a weak link between land use mix within specific areas and travel patterns for these areas....
>
> • Jobs decentralization: the net impact on travel and

energy use is uncertain (p. 3).

Handy's annotated bibliography included a number of works cited here. Her general conclusions are entirely consistent with those of others mentioned (e.g., Pushkarev and Zupan 1977; Cervero 1989a), although not all agree with her conclusion that higher densities reduce the number of trips. It is important to remember that trips per acre of land will increase with higher densities, because there will be more dwelling units per acre and thus more people per acre. It is trips per dwelling unit that will presumably be reduced. However, that is not always true. One of the factors affecting such an assertion is that the occupancy of higher density dwelling units is likely to be significantly different from the occupancy of single-family detached units (see discussion of The Costs of Sprawl [Real Estate Research Corporation 1974] below, particularly the critiques by Altshuler [1977] and Windsor [1979]). To put it simply, the older people and younger people who typically occupy apartments are likely to generate fewer trips per household than are the families who typically occupy houses.

Newman and Kenworthy (1989a) expanded their earlier Australian study of the relationship between transportation systems and urban densities to include thirty-two cities from around the globe (see Newman and Kenworthy 1989b for an overlapping discussion of the data that appeared in journal form). In their study, they found a high correlation between high density and transit dependence, a finding that is hardly surprising and that reinforces the more theoretical work of Schaeffer and Sclar (1975). As a solution to the problem of automobile dependence, they suggested the reurbanization of smaller cities at densities sufficient to discourage the use of automobiles. In his review of their book, Gomez-Ibanez (1991) pointed out that correlation did not necessarily amount to causation; other factors also influence modal choices, such as incomes, gasoline prices and public policies to subsidize various means of transportation. In an earlier critique, Gordon and Richardson (1989) raised similar objections but also criticized Newman and Kenworthy's focus on the single goal of reducing gasoline consumption; Gordon and Richardson also raised the issue of the strong personal preference for the convenience of the automobile in the United States and noted that the increase in suburb-to-suburb commuting and non-work trips make it more difficult to realize Newman and Kenworthy's goal of replacing much automobile travel with trips by light rail. They ignored a key point raised by Gomez-Ibanez, which is the choice of subsidy patterns by various government agencies, and they failed to discuss how reduced highway subsidies might affect the strong personal preference for automobiles.

There have been a number of other studies of the impacts of particular facilities and a few more general studies not mentioned here. Handy (1992), Chipman, et al. (1974), and Mason (1971) all offer good bibliographies. There is, of course, fertile ground here for additional research. A 1991 symposium on "Transportation, Urban Form, and the Environment" posed more questions than answers and suggested extensive additional areas for research (Transportation Research Board 1991). The thrust of the suggestions, however, was not to question the strong link between transportation and urban form but rather to suggest a greater need to understand its details as the basis for future public policy analyses. One can, of course, wait for perfect answers before beginning to act. On the other hand one can begin to act in logical ways while continuing to analyze the issue, the typical and necessary behavior of public planners in many contexts. Some have even argued that it is impossible in so complex a society to obtain a complete set of information about any problem and that it is thus always necessary to act with imperfect knowledge (Braybrooke and Lindblom 1963). While continued research in this field is clearly desirable, this article now turns to the substantial theoretical, empirical, and anecdotal data linking transportation and land-use decisions.

Is this knowledge important?

The discussion so far has focused generally on the fact that transportation facilities and land-use influence each other. Studies discussed above show that, both in theory and in the field, different patterns of urban development are best served by different types of transportation systems. Similarly, the location and type of transportation improvements play a critical role in determining urban form. As these studies, and others cited above, indicate, the type of development facilitated by and best served by highways is suburban sprawl (see, generally, Kelly 1993a). Whereas fixed-rail systems, reinforced by appropriate land-use controls, can encourage nodal subcommunity development around railroad and transit stations, highways allow if not encourage dispersal of population and activity over a wide area. Of course, sprawl cannot be blamed entirely on highways. They have merely facilitated choices that consumers seem inclined to make. As Milwaukee County Executive David Schulz (1991) noted at a conference on research on transportation and urban form:

> I believe that those of us concerned with transportation in urban America can no longer wait for people to start to behave as we would like them to: living in compact, high density, residential development patterns; traveling short distances to work along well-defined corridors to destinations in orderly, compact business districts; using public transit in large numbers...; planning their non work travel in orderly and efficient ways; and being very socially conscious in their selection and very limited personal use of an automobile (p. 12).

What highways do is to change one of the variables in the economic formula that Wingo hypothesized and that others confirmed: they make longer commutes less time-consuming and thus less costly than they would otherwise be. Thus, when the consumer is making the choice between a more costly house and a more costly commute, the time factor in the cost of commuting is artificially reduced by the highway. Many argue that it is subsidized. As Anthony Downs (1992) has recently argued:

> The failure to confront commuters with the true social costs of their driving alone during congested periods has two other ill effects. It understates the cost of living in low-density patterns and leads to an overinvestment in highways. Both outcomes contribute to an excessive spreading out of American metropolitan areas. That raises energy costs, increases infrastructure costs, increases vehicle-miles traveled, and worsens air pollution (p. 142).

Hanson (1992) developed a detailed model of highway subsidies using figures available through reports on transportation financing in Wisconsin. Note that the amount of the subsidy is considerably greater if computed on a marginal cost basis, recognizing that peak-hour users are the most expensive users of any system and that the subsidies are thus greatest to commuters (Schaeffer and Sclar 1975, 131).

But is that a problem? If people in the United States want to live in sprawling suburbs, should public policy makers dispute that choice? Although few public officials are likely to want to try to stop sprawl as a few communities have done, there is substantial reason for public officials not to subsidize or facilitate it. The basis of that reason is economic. In a period when the nation is suffering from disinvestment in infrastructure (National Council on Public Works Improvement 1988), the additional cost of serving sprawling development is a matter of great public concern.

Does it really cost more to serve sprawling development? Definitely. The first major study to suggest such a conclusion was The Costs of Sprawl (Real Estate Research Corporation 1974), a study that was criticized at the time for weaknesses in its methodology. One of the principle defects in its comparison of the costs of providing public services to various development types was that the dwelling units in the different development types were quite different, suggesting different occupancies. Thus, the high density development with 10,000 units was cheaper to serve than the sprawling development with the same number of units in part because it would have a smaller population (see, generally,

Altshuler 1977; Windsor 1979). However, even one of the critics of the study found significant fiscal savings for roads and other public facilities in the more compact development types (Windsor 1979).

In his 1989 literature review, James Frank calculated the difference in capital costs for different types of development and development in different locations. Increasing single-family densities from 1 unit per acre to 5 units per acre reduced capital costs for streets from $12,308 per unit to $7,526 and reduced utility capital costs from $19,789 to $8,843. Capital costs for townhouses were calculated at $6,785 for roads and $6,019 for utilities. Reductions were even more dramatic for multi-family units, with multi-family units at 30 units per acre involving less than 30 percent of the capital costs for roads and about 20 percent of the capital costs for utilities of single-family units on one-acre lots (Frank 1989, 40). It is important to note that even where local government passes the increased capital costs on to developers (and probably to consumers), the local government will continue to bear the maintenance costs; and, of course, maintenance costs are higher for longer streets and utility lines serving more dispersed development.

The figures in the previous paragraph are primarily of interest to local officials, who either bear or assess to developers most of those costs. A different set of figures from Frank's synthesis should be of great interest to highway planners. He found incremental capital costs ranging from roughly $6,000 per unit up to $14,000 per unit to serve residential development in close-in but leapfrog locations five and ten miles from major urban service centers (Frank 1989, 40). That is exactly the sort of exurban development that radial highways and beltways facilitate.

The state of Florida hired a team of consultants to compare the actual capital and operating costs of existing development patterns in Florida (James Duncan and Associates et al. 1989a, 1989b). Not surprisingly, the team found significantly lower capital costs for compact and contiguous development patterns than for scattered, or exurban, development. For roadways in particular, the study team found that the state recovered a much smaller portion of its capital and operating costs from gasoline taxes and other sources for satellite and scattered residential communities than for other development types (James Duncan and Associates et al. 1989a, p 20).

A commission in Maryland used the Florida team's figures and methodology and computed some dramatic statewide figures . It computed a potential saving of 15 percent in capital costs, some $1.2 billion over 15 years, by encouraging compact and contiguous development rather than allowing the current trend of sprawl to continue (The Governor's Commission on Growth in the Chesapeake Bay Region 1991). Savings for roads alone were projected at $700 million over 15 years, or some 25 percent.

Some of the savings computed in any of these studies results from more efficient use of existing infrastructure rather than from absolute savings. If a new development takes place along a major arterial road with adequate capacity to absorb the traffic from it, the marginal capital road or highway cost for that project is arguably zero. On the other hand, if that same development is built in an area served only by a gravel road that must be upgraded or in an area with overloaded highways that will have to be widened to accommodate traffic from the project, there is a measurable marginal cost to serve that development. The Maryland study commission acknowledged that much of its projected savings resulted from such efficiencies. If such savings are possible from better use of existing facilities in a state containing portions of two congested metropolitan areas (Baltimore and Washington), then clearly there is similar potential for savings elsewhere.

Can We Use this Knowledge?

Scholars and others have been writing about the land-use transportation relationship for the better part of a century. Yet, at least in the United States, there appears to be almost a negative learning curve. As the discussion above suggests, traffic has continued to

increase, even as jobs have followed people to the suburbs. Is this an uncontrollable cycle, so rooted in personal preferences that there is little opportunity to make a difference? Clearly not.

Certainly many of the opportunities are at the federal level, in reconsidering the federal subsidy to automobile travel (see, generally, Hanson 1992 and Downs 1992). The issues involved in rethinking federal transportation policy are somewhat beyond the scope of this article, but it is important to note that ISTEA is a good step in the right direction.

There are many things that can be done at the local or metropolitan level, however. One technique that more communities are using to encourage development near existing infrastructure is an "adequate public facilities" ordinance or regulation. Called the "concurrency" requirement in Florida, such a rule requires that adequate public facilities be available to serve a new development concurrently with the construction of the project (Kelly 1993b, 1993a).

Cervero (1991) has argued that the nation needs a combination of land use initiatives that include much denser development ("densification"), mixed-use projects, a good jobs-housing balance, and pedestrian-friendly site planning in individual projects as a planning basis for reducing total automobile travel. Although acknowledging the institutional and political obstacles to accomplishing it, he, like others, urged strongly that land-use planning should guide transportation planning. Newman and Kenworthy (1989a) argued simply for reurbanization of cities at much higher densities to discourage automobile use and, presumably, encourage more ridership on light-rail systems.

Much of the work discussed here has dealt with macro-scale urban design issues—those issues that determine the general shape of urban areas and the location of economic activity within them. Micro-scale urban design is also important to this discussion, however. Certainly one of the reasons that U.S. cities have become automobile-dependent is that, through zoning, cities and suburbs alike have created residential areas that are not only relatively low-density, but they are generally zoned free of even basic retail and service businesses (for a general discussion, see Kelly [1988]). Because obtaining a loaf of bread or a clean shirt is not possible in the neighborhood, and the neighborhood has not been built at a scale that makes sense for mass transit service, residents almost have to use automobiles to handle basic errands. It is hardly surprising, then, that the places where they conduct their business are oriented toward the automobile, often in mammoth strip centers along major arterials. Local governments have reinforced those patterns with zoning that not only discourages such developments in neighborhoods but that often mandates that they take place in strips along arterials, with setbacks and off-street parking almost guaranteed to make the shopping areas hostile to pedestrians or bicyclists.

Some contemporary urban designers have argued that it is time to rethink the patterns of neighborhood development. Calthorpe (1993) has urged the creation of "transit-oriented developments." Although his developments are certainly transit oriented, theyare far more than that: they are pedestrian oriented, bicycle oriented and very human oriented. Calthorpe proposed (and he has designed) projects that recapture some of the character of pre-zoning communities, with commercial buildings fronting on sidewalks, residences above the stores, and parks and village greens integrated into neighborhood planning. He also proposed integrating transit stops into the project design and adding pedestrian overpasses to provide access across major arterials. These ideas are not new, but recognizing their value and their relationship to the transportation patterns of the city is new.

Duany and Plater-Zyberk (1991) have marketed their concept of neo-traditional town planning extensively and effectively. They focus on many of the same issues as Calthorpe, with a major difference. One of the recurring themes of their work is the importance of a non-hierarchical, grid system of roads, in contrast to the arterial-collector-local hierarchy used in many communities today. Their view of the grid is that it avoids the creation of the

kinds of arterial streets that become barriers to pedestrianism and thus keep all streets pedestrian-friendly. Although that may be true where the grid can be relatively isolated from through traffic (as it appears to be at Seaside, their landmark project in Florida), congestion on major streets leading to the heart of Chicago, Denver, Miami, Los Angeles and other cities with old grids demonstrates clearly that even in a grid, some streets may carry disproportionate shares of traffic. One of the arguments for a hierarchical street system is that it plans which streets will carry heavy traffic, rather than simply letting the traffic patterns evolve. Like Calthorpe's, Duany and Plater-Zyberk's work has emphasized communities that are pedestrian friendly and that resemble towns built when people walked many places more than they resemble today's automobile suburbs.

There are two issues in all of this that are more difficult to recognize. One issue hidden in all of the published analyses of general infrastructure costs is that coordination of the location of development and all major public facilities is crucial. If the city has a new fire station north of town, a major interceptor sewer line with excess capacity south of town and good access to a major interstate highway leading west out of town, there is no cost-effective location for growth. If all of the new investment in public facilities were concentrated in one direction, all of the entities involved in building and maintaining infrastructure and other public facilities would gain. A policy encouraging coordination of the location of infrastructure may suggest that it encourages preemptive strikes and that all other infrastructure investments should follow the locational lead of the first major one. Clearly, a coordinated and comprehensive plan is a better approach (see the next section).

The other issue is more subtle, and yet it is obvious to anyone who has worked with local planning. It simply makes more sense to encourage development in some directions rather than others. A community may want to preserve wetlands, farmland, fragile slopes or mountain vistas in a particular direction. Building infrastructure in that direction will be directly counterproductive to that effort, but building new infrastructure in other areas can reinforce the land preservation policy. When the issue is one like fragile slopes or wetlands, highway engineers and public planners are likely to agree on the reasons to avoid such areas. In other cases, however, they may not. Agricultural land is often available at reasonable cost, and it is highly buildable. Thus, it may provide an attractive routing for a major roadway. Railroads and highways have often followed rivers because the rivers provide a relatively continuous area of land that is often open or used only for marginal purposes. But by using this often inexpensive and available right-of-way, highway engineers attract development to the floodplain—an action that contravenes both federal and local policies, as well as common sense. The desire to provide good access to a new airport may also lead to providing good access to land around the airport that the airport operator would like not to see developed.

In short, major transportation facilities influence both the type of growth that takes place and the location of that growth. Even if critics like Altshuler (1979) are correct and urban form will remain decentralized no matter what is done with transportation planning, coordinated transportation and land use planning can still help to focus that decentralized development in the most appropriate locations within a metropolitan area. Focusing capital investments and development in the same areas can result in substantial fiscal benefits and land savings, as the Maryland study showed. That policy approach can also locate public and private development on land most suitable for such development, keeping it away from lands that the community wishes to preserve.

Even Owen, clearly an advocate of the highway system, recognized that the highway system should not be the exclusive means of urban transit. He expressly urged the adoption of pooled funding systems and of tolls on congested urban roadways as a method of increasing the availability of funding for urban transportation and also as a method for encouraging drivers to think

about car-pooling and other means of commuting (Owen [1956]1966, 216). A 1991 study at Northwestern University examined the market effects of various approaches to the reduction of congestion (Koppelman et al. 1991). A 1989 Brookings Institution study (Small et al. 1989) strongly recommended a new system of highway financing, based on road wear and congestion charges. The Brookings Institution study suggested the use of tolls on congested roadways and the possibility of building future auto-only roadways in urban areas, possibly financed from the tolls. The authors argued that congestion pricing could reduce peak-hour congestion by as much as 25 percent in many cities. They also argued that a rationally priced system would encourage private enterprise to help meet highway needs. A recent Urban Land Institute report (Eager 1993) cited two successful examples of congestion reduction: the Houston Mobility Project, a massive construction project including both roadway and transit system improvements; and an experiment in Curitiba, Brazil, in which high density development was focused along radial axes, which were also provided with express bus lanes.

Communities use a variety of regulations and fees in efforts to mitigate traffic impacts, particularly in the immediate area of the development. Adequate public facilities ordinances may actually preclude development in a particular location if system capacities are inadequate to handle the traffic from it (Kelly 1993a, 1993b; Freilich and White 1991). Other programs simply assess impact fees, traffic mitigation costs or site-specific fees on a development and then use the funds to improve the traffic facilities serving the site (Freilich and White 1991; Wachs 1990). None of these programs address the fundamental problem unless they are region-wide and tied to incentives to develop in appropriate locations. For example, Montgomery County, Maryland, permits traffic congestion in the areas near transit stations for two reasons—first, it recognizes that such hubs of activity are naturally congested; and, second, congestion on streets in the area may encourage more people to ride the transit system (see Kelly 1993a, chapter 9). On the other hand, as one of the referees of this article noted, such congestion may cause commuters to avoid the area—and the transit station—entirely.

Echoing Blucher's (1950) warning that the work of the traffic engineer is "inevitably doomed to fail" (p 849), the 1989 Brookings Institution study started in part from the premise that congestion-management programs cannot succeed:

> The problem is that none of these policies accounts for the latent demand for peak-period highway travel. This latent demand consists of all potential peak-period users whose trips are now diverted or deterred by congestion itself. Any policy that makes some alternative to peak highway travel more attractive will founder on its own success, because any perceptible improvement in congestion will itself attract new peak-period highway users (Small et al. 1989, 85).

Downs (1992) called this phenomenon the "triple-convergence principle". He argued that persons "who formerly (1) used alternate routes, (2) traveled at other times, or (3) used public transit" would fill any new gaps in capacity resulting from road-widening or congestion-management (p. 145). Three decades earlier, Blucher (1950) stated it more simply: "When the traffic engineer does succeed in improving the flow of traffic...invariably other people see that traffic is moving faster and more freely and decide there is room for more" (p. 849).

In arguing that better coordination of transportation and land-use planning is essential, it is important to recognize that there are significant institutional barriers to accomplishing this kind of coordination. State departments of highways and (now more commonly) departments of transportation, build region-shaping interstate highways, using a great deal of money and following federal guidelines. In metropolitan areas with fixed-rail transit systems—the one type of mass transportation that clearly plays a major role in shaping the region—those transit systems are usually operated by an independent authority of some sort. In New York and Philadelphia, the authority that operates the toll bridges also

operates part, but not all, of the fixed-rail transit system. Weiner (1986) described the structure of urban transportation planning in the United States in some detail. He also described the variety of federal policies that affect such planning when federal funding is involved, as it often is.

Further, the philosophical debate continuesover whether transportation or land-use planning comes first. Transportation planners expect to rely on projections of future land-use (Creighton 1970, esp Chapter 8), projections which may be changed significantly by the construction of a particular project. On the other hand, land-use planners need to know what the transportation network will be like to make land-use plans.

Things do not get better at the local level. Local streets and separate local bus lines are managed by a plethora of local governments, special districts, and authorities. The 1987 Census of Governments found more than 32,000 entities of local government in the nation's 115 metropolitan areas (Bureau of the Census 1988); this fact led Porter (1991) to argue at a symposium on coordinating transportation and land-use that the only hope for doing so is with effective regional governance. Clawson (1971) made a similar argument two decades earlier, as have many others. Even within a particular local government, there are at least two separate planning functions. Planning for future land use is generally a function of the planning commission and planning staff (So and Getzels 1988), while planning for public improvements such as streets and bridges is typically carried out by a combination of elected officials and staff from the finance and public works departments (Brevard 1985; So 1986; Bowyer 1993).

The simple coordination of the two systems of planning within local governments (Kelly 1993b) may be the most likely of any of these to be followed, because it is the easiest to accomplish. In a freestanding city, like Albuquerque or Lincoln, simple coordination can accomplish a lot. For the majority of U.S. metropolitan areas, however, it will accomplish little without coordination among the dozens to hundreds of cities, counties and special districts that dot their geographic regions. Owens' call for a geographically comprehensive system is critical.

Stover and Koepke (1988) proposed that land-use and transportation planning should be integrated in a four-stage planning process: very long-range planning for both land use and transportation scenarios; a twenty-year plan for major changes in infrastructure and land use; a five- to ten-year plan for capital improvements; and site design for specific improvements and developments. Their model is philosophically consistent with that of simple coordination (Kelly 1993b), but it appears to assume that there is a single decision-maker dealing with long-range plans for highways, other infrastructure and land use. Clearly that is not the case anywhere in the United States. Although most commentators at least nominally favor coordinated planning, at least one does not. Small (1985) acknowledged that "technological improvements in transportation have greatly influenced historical development of the present urban structure," but he maintained that future influences will be smaller and thus transportation planning should focus primarily on "the need to serve transport" (p. 222).

Clearly land-use and transportation planning are interdependent. It seems only logical to urge that they should thus be interconnected. Stover and Koepke's (1988) single-decision-maker model is too simple, but it at least points in the right direction. Other works cited above also provide suggestions for improving communities based on our knowledge of the transportation-land-use link.

Is this knowledge accessible to those who need it?

Decisions about the shapes of cities and the shapes of neighborhoods are made by tens of thousands of people in thousands of agencies around the country. Planning commissions, presumably with the advice of their professional staffs, make decisions about new developments that become new neighborhoods. They recommend new zoning ordinances to governing bodies. Public

works departments make decisions about the construction of new arterial and other roads, often without the advice of either their respective planning commissions or planning staffs. State transportation departments make city-shaping decisions about new urban highways and beltways, with some acknowledgment of the ISTEA mandates, it is hoped, to recognize the land-use impacts of their decisions and to coordinate them with land-use plans. This section provides a brief look at some of the literature used as reference and training material by those who make such decisions.

The classic International City Management Association (ICMA) "planners' greenbook" (So & Getzels 1988) contains a chapter on transportation planning, written by Sandra Rosenbloom, well-known among planners interested in transportation. In it, she described the difficulties of predicting the land-use impacts of transportation decisions and then traced the history of metropolitan transportation planning. She noted the institutional isolation between land-use planners and transportation planners (Rosenbloom 1988, 147) and the separation of the regional transportation planning process from local planning efforts. Nothing in the chapter gives planners any guidance on how to coordinate land-use and transportation decisions, and much of it is discouraging because of her analysis of difficulties in predicting mutual impacts. Another greenbook chapter on "General Development Plans" (Hollander et al. 1988) acknowledged the existence of transportation plans as a separate element of such broad community plans, but did not include any real discussion of the complex relationships and their implications for planning.

Two widely-used teaching texts for planners give short-shrift to the subject. Branch's (1985) Comprehensive City Planning acknowledges that "the location of transportation routes and municipal utilities shapes the use of land in cities," (p. 46), but transportation issues are discussed on a total of 4 pages of some 230 in the book. Levy's (1994) Contemporary Urban Planning, now in its third edition, has a chapter devoted to transportation planning. In it, he defined the relationship between transportation and land-use as "very much a chicken and egg situation" (p. 197) and noted that, "in the ideal case, transportation planning and land-use planning would go hand-in-hand" (p. 197). However, Levy then described a demand-responsive transportation planning system in which policy analysis is limited to the weighing of costs and benefits and the consideration of citizen concerns. Nothing in the book provides any guidance to a planner who might want to develop transportation planning and land-use planning processes that in fact go "hand in hand."

What is missing from the literature is practical advice to the planner in the trenches, telling him or her how to make transportation decisions and land-use decisions work together as mutually supportive links in a system of real comprehensive planning. Although Stover and Koepke (1988) outlined a theoretical model with a great deal of appeal, their underlying assumption of a single decisionmaker renders the model useless in practice; it remains a useful construct for researchers and theoreticians in the field. Although a recent Planners Advisory Service report has made a modest contribution to this literature (Kelly 1993b), much more is needed. The next edition of the ICMA greenbook should acknowledge this relationship throughout the chapters on both land-use and transportation planning. Teaching texts should suggest to students that they can intervene in this cycle. Teaching and reference materials for transportation planners should remind them that they are shaping cities as well as roadways. As long as transportation planning and land-use planning remain separate processes, rather than coordinated ones, or perhaps more often individual parts of a comprehensive whole, we will all remain "stuck in traffic" (see Downs 1992) far more often and for far longer periods than we should be. Better planning alone cannot fix the problem, but it can certainly make it better.

Conclusion—
Planning is the Constraint and the Opportunity

It is not difficult to recognize the problem as one of planning. A

recent report from an organization representing large developers complained, "We continue to suffer disjointed land use and transportation planning efforts" (Eager 1993, 32). The report went on to call for "synchronization of land use and transportation policy decisions (p 37). As William H. Whyte (1958) urged more than thirty-five years ago, "There can be coordination between the engineers, and if there is, the highway program will be a positive force for good land use" (p. 127).

Wilfred Owen ([1956] 1966) set forth these criteria for implementing a more successful system:

> An effective solution to the urban transportation problem, then, should meet three tests. First, it should be functionally comprehensive....Second, it should be comprehensive geographically....Third, it should be comprehensive from a planning standpoint by assuring that the transportation is used to promote community goals, and that community plans make satisfactory transportation possible.
>
> This latter test is the most important (p. 224).

That is much easier said than done. Transportation planning itself is rarely comprehensive.

To cite a good example of integrated land use and transportation planning, a 1975 study turned to Edmonton, Alberta, Canada (Schaeffer and Sclar 1975). That city combined policies of land banking, replatting, hierarchical streets and the immediate extension of transit service to new areas to create a compact and "land-managed" city.

Finally, in 1991, the Congress began to heed some of these concerns. Under the Intermodal Surface Transportation Efficiency Act, Congress has mandated that there be more planning. The act, which replaced the traditional "highway bills," represented a paradigm shift in transportation planning (Morris 1992). It requires that transportation plans now include "the likely effect of transportation policy decisions on land use and development and the consistency of transportation plans and programs with the provisions of all applicable short- and long-term land use and development plans" (Sect. 134f). Partly in response to that act, Iowa's Department of Transportation has been reorganized without the traditional highway division, so that everyone in the department is presumably working on all types of transportation. There are undoubtedly similar reorganization efforts taking place around the country.

Whether the new law and the new organizational structures are largely symbolic or whether they really begin to change the way that transportation in the United States is planned remains to be seen. However, if the present efforts fulfill the apparent congressional intent, some of the learning reflected in decades of theoretical and empirical work may begin to affect metropolitan transportation systems and the nation may begin to achieve some of the potential that Owen saw so optimistically. It is interesting to note in passing that similar discussions and analyses are taking place in the United Kingdom, where Hart (1992) found a distinct shift in the mid-1980s—a shift away from unbridled expansion of automobile capacity toward a more diverse and "sustainable" transportation system, possibly including the "compact city."

What the future of the city will be or what the city of tomorrow ought to be like are questions closely related to the provision of transportation. Transport innovation will to a large degree dictate what is possible, and the extent to which transport policy is directed to achieving urban goals will help determine what is feasible (Owen [1956] 1966, 21).

Or, as Charles Nelson argued in 1950, the answer to the question of whether highways will "promote or retard a wholesome growth....will, I am sure, depend on the extent to which expressway planning is an integral part of comprehensive planning for better organized and more livable cities" (p 123). Blucher (1950) urged, "We must have proper planning of cities so as to get a suitable relationship between home, work, school, recreation and shopping" (p 856).

The real challenge is for planners to put this knowledge to work in the field. The topic has been discussed in the literature for decades. We understand the philosophy, the economic theories,

the principles and the relationships. Certainly, as some of the critics point out, the land-use-transportation relationship is a complex and cyclical one. Thus, simplistic changes may make the problem worse rather than better. On the other hand, we can make a difference. Few would argue with Downs' (1992) assertion that too many of us spend too much time stuck in traffic. Clearly, building more highways will not solve that problem in a growing metropolitan area. Part of the solution must include a reduction of the automobile dependence of cities. That can only happen with truly comprehensive planning, that creates neighborhoods as well as metropolitan areas suited to the use of multimodal transportation systems and that simultaneously creates attractive and efficient multimodal transportation systems to serve the people living there. Congress has essentially mandated that. It is up to planners and public officials to make it work. The change must start in the textbooks, the handbooks and the classroom. The greatest need for expanded literature in this field is in the literature for the practicing planner and public official.

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