Transportation Investment and Urban Land Use Patterns

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TRANSPORTATION INVESTMENT POLICY AND URBAN LAND USE PATTERNS
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PREFACE

Since the end of World War II, the United States has invested heavily and steadily in its urban highways. Many contend that while these highways have increased mobility for most travelers, they have also contributed to land use patterns that create a series of problems. By extending the distance that one can travel in a specified period of time, these highways have contributed to the rapid outward movement of low-density residential areas. Over time, as people make more and longer trips, many urban highways have become congested, and longer commuting times and degraded air quality have ensued.

Questions are now being asked about how to change urban development trends to lead to cities that feature better circulation and more efficient land use patterns. When new transportation projects are contemplated, it is becoming more common for planners to consider how emerging land use patterns would be affected if these projects were to go forward. Would the proposed highway project actually improve the quality of life of the area’s residents?

The research question we have sought to address in this monograph is, “Are there useful insights in traditional land economics that can guide us in developing a framework for assessing the probable effects on land use patterns within growing urban areas of specific types of transportation investments?” The short answer to this question, we have concluded, is “yes.” Accordingly, we have devised a reasonably simple framework for predicting the influence that a specific type of transportation investment would have on land use patterns, under varying local conditions. Turning the question around, we have tried to design the framework so it can help answer a different but related question: “If a community knows the general type of overall land use pattern (referred to as “urban form”) it would like, is it possible to identify the sorts of transportation investments that would encourage it?” Our conclusion is that this, too, is possible.

In this monograph we review the economic forces that contribute to the way cities’ land use patterns evolve. We then focus on transportation investments as one of the key forces affecting these patterns. The framework we then present enables planners to match specific types of transportation investments with the sorts of land uses that would benefit most from them. In this way it becomes possible to predict the types of land uses that may reasonably be expected to evolve at various locations within the city. We stress the importance of having a consensus within the city as to the general type of urban form that is preferred, so that the objective
OF A PARTICULAR INVESTMENT IS NOT IN QUESTION. FINALLY, WE OFFER SEVERAL PRACTICAL RECOMMENDATIONS FOR USING TRANSPORTATION INVESTMENTS AS A POSITIVE FORCE TO HELP ACHIEVE THIS DESIRED URBAN FORM.

RESEARCH FOR THIS PROJECT WAS CARRIED OUT AT THE UNIVERSITY OF IOWA PUBLIC POLICY CENTER. FUNDING WAS PROVIDED BY THE IOWA DEPARTMENT OF TRANSPORTATION, OFFICE OF SYSTEMS PLANNING. THE RESEARCH TEAM HAS BENEFITED GREATLY FROM ITS COLLABORATION WITH A 13-PERSON TECHNICAL ADVISORY COMMITTEE. EARLY IN THE RESEARCH, MEMBERS OF THIS COMMITTEE HELPED US FOCUS THE ISSUES TO BE ADDRESSED AND PROVIDED US WITH GUIDANCE AS WE WORKED TO VALIDATE THE FRAMEWORK, BASED ON OBSERVABLE DYNAMICS IN GROWING METROPOLITAN AREAS OF IOWA.
ACKNOWLEDGMENTS

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Steve Bowman of the Iowa DOT served as project monitor. He was an interested, enthusiastic contact person who offered a number of ideas to improve the products of our research. He and two colleagues in the Office of Systems Planning, John Hey and Stan Peterson, also have our appreciation for discussing the concept of this research early on and reviewing this monograph later. Don Ward, Director of the Office, deserves the credit for making this research happen, and he was a superb client—thoughtful and knowledgeable about our topic of using transportation investments to influence land use patterns.

Members of our 13-person technical advisory committee are listed on the next page. They are a diverse mix of public officials and private developers. All took a serious interest in this research and, through their lively and thoughtful discussions, stimulated our thinking. While they offered their own perspectives, it always was clear that their primary interest is in promoting the sort of urban development that will enhance the quality of life of Iowans. We are extremely grateful for their participation and contributions.

Two students played important roles in this project. Shauna Benshoff, a graduate student in Urban and Regional Planning, helped us evaluate the literature on land use-transportation interrelationships. Kyle Kroner, also a graduate student in Urban and Regional Planning, assisted us by creating the land-value-surface graphics presented in Chapter 5. Both were great to work with and materially contributed to the successful completion of this research. We wish them the best as they begin their careers as transportation planners.

Finally, we gratefully acknowledge the contributions made by our colleagues at the Public Policy Center. The Center’s administrative assistant, Kathy Holeton, kept close track of our resources and helped us in innumerable other ways. Teresa Lopes, the Center’s editor, not only ensured that the text is accessible to a broad audience and developed most of the graphics, she was a constant source of support and encouragement.

With real appreciation, we acknowledge the many and diverse contributions of these people.
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CHAPTER 1
INTRODUCTION

The current trend in the United States is for cities of all sizes, as they increase in population and economic activity, to spread outward in a low-density, land-intensive pattern. As urban densities have been falling, the distances people have to travel have been increasing. Lower-density development has led to a very different configuration of land uses and has changed the general shape or form of urban areas in a way that many doubt is sustainable in the long run.

Policy makers now have two options. One is to continue with past practices regarding urban development, which generally means accommodating incremental growth in line with observed demand and providing infrastructure as necessary to enable such development to occur. Alternatively, urban policy makers can search for ways to guide development toward more desirable patterns of land use and associated activity. Of course, what constitutes desirable urban form is inherently subjective, and the residents of any given community must ultimately decide how they would like to see their city grow and develop.

OBJECTIVE OF THE MONOGRAPH

The objective of this monograph is to help make the second option a viable choice. More specifically, we explore how alternative transportation investments can be used to influence urban growth patterns in ways that people living in the area would prefer. Thus, the first requirement for this approach is for a certain level of consensus to be achieved as to how residents want their community to evolve. Only then can appropriate policies, including those pertaining to transportation investments, be adopted.

This monograph is rooted in the premise that a key determinant of the value of a parcel of land is its accessibility. Urban location theory suggests that relatively valuable parcels will tend to be developed more intensively and used for purposes that can generate income sufficient to enable their owners to outbid others whose intended uses might also benefit by the accessibility these parcels afford. Alternative transportation investments will differ in terms of the spatial nature of the accessibility provided to different land parcels. In this way, such investments can substantially influence land use patterns, and hence, the way a community evolves.
To what types of urban form might a community aspire? What sorts of transportation investments would help it move closer to one type or another? Following a discussion of the conceptual underpinnings of the economic linkages between transportation, accessibility, and land use, we explore two stereotypical types of urban form—polycentric and corridor—and consider the sorts of transportation investments that would facilitate their development. We also consider the possible effects on urban form of a bypass highway around a smaller community. These illustrative examples are intended to highlight the power of transportation investments as formative mechanisms to produce the sort of spatial structure a community’s residents desire.

In short, the monograph is intended to assist planners when contemplating two interrelated questions:

- What land use patterns would be encouraged if a particular transportation investment were to be made within the city?
- What types of transportation investments would be advisable to help achieve a desired land use pattern?

We need to stress that this monograph cannot offer a completely deterministic approach to addressing either question. Giuliano (1995, p. 327) observed that two inevitable problems interfere with our ability to forecast the land use impacts of transportation investments. First, the investment may be only one of a series of changes occurring simultaneously. Even looking back at the effects of transportation investments in various cities, it often is difficult to ascertain how much of the observed change in land use was due to these investments and how much resulted from other dynamics. Second, the interactions between transportation investments and land use patterns occur over an extended period of time. One must wait up to 20 to 30 years to fully assess how land use patterns evolve following such investments.

The two problems also interact. During the several decades following the transportation investment, significant changes in the regional economy, the demographic structure, and consumer preferences very well may take place. It is impossible to separate the effects of these changes from those of the transportation project.

Our approach to dealing with the inevitable uncertainty of exactly how a specific transportation investment would affect a particular community contains three interconnected elements:

- Develop a conceptual framework that is well-grounded in land economics;
· Apply this framework to several stereotypical situations and estimate the effects of different transportation investment strategies over a 30-year time frame; and

· Present vignettes (very brief case studies) taken from U.S. cities that illustrate actual effects that are consistent with our stereotypical applications.

While this approach, like any other, cannot eliminate the above problems, it can help clarify the land market dynamics that are likely to result from changes in accessibility brought about by different types of transportation investments. In turn, this clarification will help planners address the two fundamental questions posed above.

OVERVIEW OF THE CHAPTERS

In Chapter 2 we explore the forces affecting urban growth patterns and the role of transportation investments in changing the way urban land markets function. We begin with basic urban location theory and the distribution of land uses in a simple monocentric city. Then we add the complexity of other activity centers to more accurately represent the modern city. We examine two general types of urban form—the polycentric city and the corridor or star-shaped city—and consider the types of transportation facilities that would encourage each. Finally, we expand our analysis to include various other factors that influence urban form, factors that one must take into account when using transportation investments to help move a city toward a desired spatial structure.

Chapter 3 focuses on the institutional aspects of urban development. We contemplate the pressures bearing on land use decisions in modern cities and the role played by federal policies and programs. We then examine local planning practices and capacities, inter-jurisdictional competition, and consistency of plans within a given metropolitan area. We stress the importance of a strong commitment to comprehensive planning and long-term developmental goals. It makes little sense to try to use transportation investments as a tool for achieving development goals until these goals are well understood and endorsed by a strong majority of local residents.

We bring together conceptual and institutional elements in Chapter 4. In this chapter we develop a practical predictive framework for assessing how a particular transportation investment would affect the evolving form of a city, as well as what sorts of investments would be most effective in moving it toward a desired type of urban form. We offer a basic land use supply and demand model that enables us to match a series of land use categories with the sorts of
Transportation facilities that generally will provide the appropriate level and type of access. Our contention is that planners should consider the land use incentives created by various transportation investments and not focus only on the traditional system performance measures related to efficient traffic flow.

In Chapter 5 we apply the concepts presented in the preceding chapters to three hypothetical situations. In each case a particular type of transportation investment is made in the year 2000, and the effects on urban form are extrapolated ten and 30 years into the future. In the first application, an urban bypass is constructed past a small community. In the second, a growing city upgrades several radial arterials to move toward a corridor-oriented or star-shaped city. The third application is an alternative to the second; in this case the same city chooses to evolve toward a polycentric form by building high-capacity urban highways between activity centers.

We distill our findings and recommendations in Chapter 6. A series of suggestions is offered to maximize the ability of transportation investments to serve as a positive force in moving a city to the land use patterns its residents believe are desirable.
CHAPTER 2
TRANSPORTATION’S INFLUENCE ON LAND USE

We begin with the premise that urban growth is fundamentally a good thing. As communities increase in economic activity, they create more opportunities for people, both as members of the labor force and as consumers of goods and services. Yet, urban growth can contribute to certain problems, such as traffic congestion, air quality degradation, high costs for public services, and social and economic segregation. It is not inevitable that such negative consequences accompany urban growth and development; good planning can ameliorate these consequences. The key to good planning is to find ways to maximize the positive effects of growth, while working to minimize the less desirable effects.

It would be an overstatement to contend that enlightened transportation policy alone can assure that a community will develop in a way that produces few adverse effects and creates a highly desirable living environment. We do maintain, however, that if a community can reach a reasonable degree of consensus as to how it wishes to develop, both functionally and spatially, transportation policy can be a highly effective tool in helping it move toward this form of development.

The fundamental way in which transportation policy can be used to influence urban development patterns is by changing the relative accessibility of different areas of the community. As we discuss in this chapter, areas with comparatively good accessibility will tend to attract more capital-intensive activities because the potential for obtaining a good rate of return on one’s investment is particularly good in these locations. In simple terms, transportation projects affect urban form through a four-step process:

1) Initially, transportation projects can reduce the cost of travel between various pairs of locations within the community. Generally, planners think of transportation costs as having three main components: travel time costs, crash costs, and vehicle operating costs.

2) By reducing one or more of these cost components, such projects change the relative levels of accessibility of certain locations from other points within and outside of the community. That is, people can travel to these locations more cheaply than to otherwise comparable places. Similarly,
GOODS CAN BE SHIPPED TO AND FROM THESE LOCATIONS LESS EXPENSIVELY.

3) THE LAND MADE MORE ACCESSIBLE HAS A GREATER CAPACITY TO SUPPORT PROFITABLE BUSINESS ACTIVITY BECAUSE IT COSTS LESS TO DO BUSINESS THERE, GIVEN THAT TRANSPORTATION IS AN IMPORTANT COST COMPONENT OF MOST BUSINESSES. BUSINESSES WISHING TO MAXIMIZE THEIR PROFITS WILL COMPETE FOR THESE ACCESSIBLE LOCATIONS. REDUCED TRANSPORTATION COSTS ARE THUS CAPITALIZED INTO HIGHER LAND VALUES BECAUSE THE BENEFITING AREA IS MORE CAPABLE OF ENGENDERING PROFITABLE ECONOMIC ACTIVITY. THE TYPES OF BUSINESSES THAT WILL TEND TO OUTBID OTHERS FOR RELATIVELY HIGH-ACCESSIBILITY SITES INCLUDE RETAIL AND OFFICE FUNCTIONS THAT NEED GOOD ACCESS TO CUSTOMERS AND THAT CAN PACK A LARGE AMOUNT OF ACTIVITY INTO LIMITED AMOUNTS OF LAND BY BUILDING TALL BUILDINGS. ACTIVITIES LESS ABLE TO COMPETE FOR HIGH-ACCESSIBILITY SITES INCLUDE LARGE-LOT SINGLE-FAMILY HOUSING, LARGE MANUFACTURING PLANTS, AND AGRICULTURE.

4) OVER TIME, LOCATIONS WITHIN THE URBAN AREA THAT ARE MADE MORE ACCESSIBLE THROUGH TRANSPORTATION PROJECTS WILL BECOME INTENSELY DEVELOPED, AND LAND USES THAT ARE LESS ABLE TO COMPETE FOR MORE VALUABLE SITES WILL BE RELEGATED TO THE PERIPHERY OF THE URBAN AREA. RELATIVELY INTENSE DEVELOPMENT WILL TAKE PLACE ALONG MAJOR TRANSPORTATION ROUTES, DUE TO THE ACCESSIBILITY THESE ROUTES AFFORD.

STARTING POINT: DETERMINE WHAT IS DESIRABLE

THE IMPORTANT POINT HERE IS THAT BY CAREFULLY SELECTING TRANSPORTATION PROJECTS, A COMMUNITY CAN INFLUENCE LAND MARKETS IN SUCH A WAY AS TO ENCOURAGE A DESIRABLE URBAN FORM. THIS MONOGRAPH MAKES NO ATTEMPT TO DEFINE WHAT THIS DESIRABLE FORM MAY BE; THAT MUST BE DECIDED BY EACH COMMUNITY’S RESIDENTS. OUR OBJECTIVE IS TO ILLUSTRATE SEVERAL DIFFERENT TYPES OF URBAN FORM AND SHOW HOW THEY CAN BE PURSUED IN PART THROUGH TRANSPORTATION INVESTMENTS.

HOW CITIES DEVELOP

THE UNDERPINNINGS OF THE APPROACH WE SUGGEST FOR USING TRANSPORTATION INVESTMENTS AS A MEANS OF GUIDING URBAN DEVELOPMENT PATTERNS LIE IN LAND ECONOMICS, PARTICULARLY IN THE MARKET FORCES THAT INFLUENCE ECONOMIC ACTIVITY TO LOCATE IN ONE PLACE RATHER THAN ANOTHER. WE BEGIN BY DISCUSSING SEVERAL GENERAL TYPES OF MARKET
forces and then discuss the specific effects of transportation in shaping a city.

**Scale economies**

Scale economies mean that up to a certain point, the per-unit cost of producing a good will fall as more units are produced. Consider a case where a business produces 1,000 units of a particular good each month. The business has a variety of support staff, including administrative staff, material procurement specialists, and logistical experts, among others. If the business were to expand its production capacity to 2,000 units per month without adding many support staff, the cost per unit produced would be substantially lower.

All industries have scale economies to some level of production, and these economies are exhausted at very different levels, depending on the aggregate amount of demand and the nature of what the industry produces. Industries that exhaust their scale economies at very small quantities of production (e.g., building handcrafted furniture) are more likely to be found in smaller communities, where they can be close to those who wish to purchase their goods or services and can thereby minimize transportation costs. On the other hand, industries that must produce large quantities of a good to exhaust their scale economies (e.g., manufacturing jetliners) are likely to be found in larger metropolitan areas, where they can benefit from the many industries that supply the factors of production they require.

Highly specialized industries, the demand for whose goods is very low on a per-capita basis, need to locate where sufficient demand exists for them to be viable. Thus, such specialized industries generally locate in larger cities where the total market demand is likely to be greater. The more specialized an industry, the more likely it is to locate in a large urban area where it can maximize whatever scale economies may exist. In contrast, non-specialized industries such as retail sales of non-durable goods like food tend to locate nearly everywhere; as a result, their market areas tend to be quite small. Within a given city, then, there are likely to be relatively few highly specialized industries serving a large trade area, along with numerous industries that produce non-specialized goods and services serving comparatively small trade areas, perhaps only a few city blocks. The city may have hundreds of neighborhood grocery stores but only one sales outlet for Ferrari cars.

**Agglomeration economies**

As distinct from scale economies, agglomeration economies pertain to the cost advantages for businesses of sharing suppliers of essential goods and services or sharing customers (Quigley 1998;
Ciccone and Hall 1996). If, for example, a series of businesses share the services of an accounting firm or an advertising consultant, each business eliminates the need to have these capabilities in-house, thereby lowering its operating costs. Industries that are likely to benefit from agglomeration economies tend to locate in larger cities and in parts of the city where the shared support capabilities or suppliers are readily available. Within these metro areas, agglomeration economies are most likely to be found in locations where businesses can benefit from proximity to the various industries that supply the factors of production that they need to have readily available.

Similarly, businesses that share customers find it beneficial to cluster together. In the case of retail stores, sales of each business will increase because customers save travel time and expense by shopping in the shared retail district or shopping center. A variation of this effect is seen when businesses offering competing products (e.g., furniture stores or auto dealerships) have increased sales when located near one another because customers are attracted by the broader choice and can more easily compare products and prices.

A modern twist to the importance of agglomeration economies is the increasing emphasis on “just-in-time” (JIT) inventory techniques. As Doeringer and Terkla (1995, pp. 226–227) observe, this trend encourages suppliers and their buyers to locate near each other. Boarnet and Haughwout (2000, p. 7) add that by clustering together, these firms are in a better position to share industry-specific information about markets and production processes that can help make them more competitive.

**Economic forces and location**

Economies of scale and agglomeration economies exert considerable influence in terms of how businesses select their locations. Scale economies lead large, more specialized industries to locate in major cities where there is greater demand for their products. The more important factor in explaining location within a city, however, is agglomeration economies. Businesses’ inclination to locate near the suppliers and customers they share explains the greater demand for land at locations where this clustering can occur. It is most likely to be seen at locations with especially good accessibility, such as central business districts.
Land Value and Location

Production theory tells us that the economic value of any commodity or service is determined by its capacity to generate net income (i.e., income net of costs). A critical factor in the ability of land at a given location within a city to generate net income is transportation costs. In essentially all industries, transportation is a significant factor of production. If a particular location within a city enables a business to have lower transportation costs than other locations, it facilitates higher net income. The specific sorts of locations that enable less to be spent on transportation vary with the type of industry. For example, a heavy manufacturing industry may minimize transportation costs by locating near a rail line or a harbor. An office-based industry may minimize transportation costs by locating in the central business district (CBD) or near a freeway interchange. These locations enable a business to be in proximity to the businesses that it buys from or sells to; such locations also allow good accessibility to workers.

Monocentric Urban Model. A monocentric urban area is one that develops around a single business district. Many nineteenth century cities in the United States had this type of urban form. The basis for this development pattern lies in several economic factors (Muth 1969; Mills and Hamilton 1989; Moore and Thornes 1994):

· Cities grew near ports, canals, and railroad stations, as manufacturers and merchants sought out locations with good access to sources of raw materials and markets.

· Growth of the city could be attributed to the distinct locational advantage afforded by proximity to some central import or export node.

· Businesses that provided services to manufacturers tended to locate near the factories, and workers would locate their residences as close as possible to the sources of employment, with retailers following them.

Given these beginnings, the environment for competition for land among alternative activities was established. The industry able to outbid the others will occupy a particular location it finds desirable. In a monocentric city, the CBD affords a comparatively high level of accessibility to other parts of the city. Retail businesses are likely to outbid most other land uses near the city center because the density of potential customers is great and retail sales can generate a comparatively large amount of income per square unit of area. For office-based businesses, a central location is important due to its need for access to workers, customers, and other businesses with which it interacts.
Importantly, office businesses manage to pack a great deal of economic activity into a small amount of valuable (because it is so accessible) land in the CBD by occupying tall buildings. The tall buildings make the land even more valuable because they allow still more businesses and services to locate there and become easily accessible.

At this point, it is useful to introduce the basic concept of bid-rent curves, which are a manifestation of land-rent theory; they were first formalized by Alonzo (1964). (“Rent” in this usage implies income-generating capacity.) Moving outward from the CBD, the ability of retail businesses or office-based industries to operate in a profitable manner is reduced, due to diminished access to the economic activity found at the city center. Thus, the maximum these businesses would be willing and able to pay for land decreases with distance from the CBD. The rate at which land values for a specific type of land use diminish as distance from the city center increases is called the “bid-rent curve.” Each type of land use has a unique bid-rent curve, as Figure 2–1 suggests. An important aspect of bid-rent curves is that they represent the trade-off between higher land costs for accessible locations and higher transportation costs at locations farther away from clusters of activity, most particularly the CBD.

In Figure 2–1, from the center of the city out to point A, retail land uses dominate; from point A to point B, the principal land use is office functions; from point B to point C, mixed commercial land uses are predominant; and beyond point C to the edge of the city at point D, the main land use is residential.

Notice the relative flatness of the single-family residential bid-rent curve in Figure 2–1. Because single-family residential developments are comparatively land intensive, with a significant amount of land devoted to each residence, it is generally cost-prohibitive for this land use to locate near the city center. Also, the transportation costs of most households’ travel to the CBD or to other major activity centers is not as much of a concern to them as are the amenities to be found on the urban periphery. The result is that owners of single-family housing tend not to be willing to compete with more intensive land uses for high-land-cost locations near the city center. Interestingly, lower-income households often out-bid higher-income households for land in such locations. This is because apartment buildings and small-lot housing mean that far more low-income households are found per unit of land. Collectively they are able to outbid less intensive land uses, such as large-lot single-family residential.
Figure 2-1. Bid-rent curves for different types of land use

To generalize a bit more, each type of land use has a bid-rent curve that has an intercept (representing the maximum bid to locate at the city center) and a slope. The slope represents the trade-off in willingness to pay (1) for land with a certain level of accessibility to the city center and (2) the transportation costs from that land parcel to the center of urban activity. Land uses that depend on agglomeration economies and personal interaction (office-based industries and specialized retail sales) are likely to outbid other uses near the urban center, as are uses that are able to pack a great deal of activity onto a given parcel of land (by building vertically). For these land uses, willingness to pay drops off quite quickly as distance from the CBD increases because the potential for agglomeration economies and face-to-face contact diminishes. With less competition for land farther out, the price of land decreases, and so it may be used less intensively. Certain other land uses, such as single-family residential, large-scale manufacturing, and agriculture require considerable land area, so they seek land that is comparatively inexpensive. Especially in the case of manufacturing and agriculture, access to the city center is not especially important. Nourse (1968, p. 117) suggests that the slope of the bid-rent curve for any given land use is determined by three factors. The bid-rent curve is steeper

- the greater the cost per unit of output for maintaining contact with the center;
- the larger the number of units of output produced per square foot of space; and
- the less readily other factors can be substituted for land as its price increases.
In Figure 2–1, at any given distance from the city center, some type of land use will tend to have the highest bid-rent; it is this land use that will then outbid other uses and occupy land at this location. Worth noting is that if through improvements to transportation systems, such as urban highways and passenger rail, the cost of travel (primarily the amount of travel time) falls, the general effect is to flatten the bid-rent curves for most industries.

The power of land-rent theory

Land-rent theory is the best single explanation of how transportation investments can affect urban form. It stresses that transportation costs are an important cost component of virtually all industries. Locations that minimize transportation costs are worth more, so competing industries bid what they can for such locations. Those industries that are willing and able to bid the most for any given location will occupy it. Industries want to use as little as possible of very costly (highly accessible) locations, so they build tall buildings that minimize the “footprint.” The cheaper the cost of transportation, the less variability there will be in land prices, and the more scattered development will be. This is because bid-rent curves become flatter along higher-capacity, higher-speed facilities.

Figure 2–2 depicts the bid-rent surface that results from spinning the overall bid-rent gradient (highest bid-rent curve at any given distance from the city center) around the city center. In effect, the surface represents the value of land at different distances from the city center; the value, of course, decreases as one moves outward, due to higher transportation costs. In this very simple representation, no account is taken of the differing levels of accessibility, and hence of the slopes of the bid-rent gradients in different directions from the city center. In other words, for this bid-rent surface to materialize, equal accessibility would have to exist in all directions from the city center. It is instructive to compare this graphic with Figures 2–4 and 2–5, where transportation facilities provide different levels of accessibility at various locations within the city.
Polycentric urban model. A modern variation of the application of bid-rent curves to explain urban development patterns is the polycentric model, where in addition to the CBD, there are other centers of activity. Garreau (1991) and Giuliano and Small (1991) among others have provided evidence that increasingly, modern cities are becoming characterized by multiple employment centers. The same economic forces are at work as in the simple model explaining the placement of land uses in the monocentric city. Several dynamics, however, precipitate the emergence of other centers of economic activity across the urban landscape.

- Manufacturing plants that ship their products out of the urban area via rail or truck do not need the same level of accessibility to the city center that they might have in the classic city located near a port or the intersection of major rail lines. Rather, modern plants are more likely to locate near the major transportation facilities upon which they depend; they also want good access to workers, most of whom live outside of the city center. Finally, modern plants are highly land intensive, largely due to the emergence of one-story assembly-line technologies.

- The combination of major urban highways and the outward movement of manufacturing plants has encouraged households to seek locations farther out from the city center. Such locations offer good access to many types of jobs, the cost of land is lower, and modern highways allow reasonably short travel times in to the CBD.

- Shopping centers locate near the intersection of major urban highways at the urban edge. Such locations are generally close to many households, the urban highways serving them allow access from several directions, and land is comparatively inexpensive. Low-cost land is an important consideration because shopping centers tend to be highly land intensive.
Some types of office-based industries may choose to locate in modern facilities near the intersection of urban highways some distance from the city center. Especially with the emergence of modern communications technology, traditional agglomeration economies that made location near the city center valuable may not be as great for some businesses. Proximity to workers' residences and lower land costs (and hence rental rates) may outweigh the economic advantages of CBD locations.

The combined effect of these dynamics has been to make non-CBD land with particularly good access more valuable (though probably not as valuable as land in the CBD). As we discussed earlier, valuable land tends to be used quite intensively, as users of such land substitute capital (as in the CBD, taller buildings).

Eventually, a series of activity centers emerge at major interchanges. While none of these centers approaches the level of development found in the CBD, the intensity of land use is appreciably greater than in surrounding areas. Farther out, modern, single-story manufacturing plants will locate near such major transportation facilities as interstate highways and rail lines. Other supporting facilities will locate nearby, including suppliers and worker-serving businesses such as restaurants, branch banks, and discount retail stores. The point is that as activity centers emerge, they attract more development, and bid-rent curves radiating from them become significantly higher than they were before the activity center existed. It is noteworthy that Seattle's metropolitan development plan to the year 2020 is heavily based on a hierarchy of 14 urban centers (Puget Sound Regional Council 1995).

Figure 2–3 depicts the influence of such centers on the bid-rent curves of different industries and on the overall bid-rent gradient (the highest bid-rent curve at any given distance from the city center). Spinning the bid-rent gradient around, using the city center as the pivot point, a bid-rent surface is defined. Figure 2–4 shows how such a surface might be configured if there were several sizable centers, as well as the still-dominant CBD. A bid-rent surface is a fairly basic but useful image of urban form. High points on the urban landscape indicate locations where the land is comparatively valuable, and more intense land use can be anticipated at these locations. This means that buildings will tend to be taller, with less open space around them, and that land-intensive uses such as single-family-detached housing rarely will be found at such locations.
It is interesting to note that Figure 2–4 resembles the distribution of tall buildings in a modern city. This similarity helps validate the basic tenant of bid-rent theory—owners of especially accessible and thus valuable land attempt to maximize the intensity of their use of this land. They primarily do this in two ways—they leave very few open spaces, and they build relatively tall buildings.

**Corridor urban model.** The axial or corridor model (Balchin and Kieve 1985, p. 44) is a variation of the basic monocentric model to describe urban development on the basis of a trade-off between land and transportation costs. The corridor model posits that as a city grows outward from the CBD, small radiating streets are developed into larger arterials and highways. Because land along such facilities has comparatively good access to distant points within the urban area, this land acquires a higher value. Consistent with the other two models of urban growth, this more valuable land tends to be developed rather intensively by land uses that are willing and able to pay the higher land costs. Frank (2000, p. 10) argued that the...
DENSIFICATION OF DEVELOPMENT ALONG MAJOR TRANSPORTATION CORRIDORS AND THE PROVISION OF A HIGH QUALITY OF TRANSIT SERVICE ALONG THEM CAN HELP ATTENUATE THE VEHICLE MILES TRAVELED BY AUTOS.

FIGURE 2–5 SHOWS A BID-RENT SURFACE WITH A GENERALIZED CORRIDOR DEVELOPMENT PATTERN. THE CURVED LINES IN THE GRAPHIC REPRESENT CONTOURS OF EQUAL LAND VALUE, WITH HIGHER VALUES NEARER TO THE CITY CENTER. MAJOR RADIAL ROADWAYS “PULL” HIGHER LAND VALUES OUTWARD ALONG THEM. STATED DIFFERENTLY, THE BID-RENT CURVES FOR VARIOUS LAND USES ARE FLATTENED ALONG THESE MAJOR ROADWAYS BECAUSE TRANSPORTATION COSTS ARE REDUCED. OVERALL BID-RENT GRADIENTS BETWEEN THESE RADIAL ARTERIALS ARE NOT AFFECTED MUCH, SO THEY ARE NOT FLATTENED SIGNIFICANTLY. THE RESULT IS A STAR-SHAPED PATTERN OF LAND USE. AS WITH THE MONOCENTRIC CITY, THE BEST OVERALL ACCESSIBILITY IS FOUND IN OR NEAR THE CITY CENTER, SO THE CBD WILL DOMINATE IN THIS MODEL AS WELL—OFFICES AND SPECIALIZED RETAIL STORES THAT THRIVE ON SCALE AND AGGLOMERATION ECONOMIES WILL LOCATE IN THE CBD. OTHER RETAIL STORES, MULTI-FAMILY HOUSING, AND SMALLER INDUSTRIAL BUSINESSES WILL COMPETE FOR LOCATIONS ALONG THE RADIAL ARTERIALS AND HIGHWAYS. THE LAND ALONG MAJOR CORRIDORS WILL BE DEVELOPED INTENSIVELY, WITH COMPATIBLE USES IN PROXIMITY, TO TAKE ADVANTAGE OF AGGLOMERATION ECONOMIES.

![Figure 2–5. Bid-rent surface with a CBD and a corridor urban development pattern](image)

REALITY: A BLEND OF THE MODELS. THE FOREGOING THREE MODELS OF URBAN GROWTH AND DEVELOPMENT ARE BASED ON THE GENERAL TENANTS OF LAND-RENT THEORY. LOOKING AT MODERN U.S. CITIES, IT IS EASY TO SEE EXAMPLES WHERE LAND USE PATTERNS FOLLOW THE THREE GENERAL MODELS.

- SMALLER CITIES WITH A STRONG PRESENCE OF FINANCIAL, INSURANCE, AND REAL ESTATE (FIRE) OR OTHER OFFICE-BASED INDUSTRIES MAY HAVE CHARACTERISTICS OF THE MONOCENTRIC CITY—A PARTICULARLY DOMINANT CBD—BECAUSE OF THE KEY ROLE PLAYED BY FACE-TO-FACE INTERACTION AND AGGLOMERATION ECONOMIES (STATE COLLEGE, PENNSYLVANIA, IS AN EXAMPLE; SEE COULSON [1991]).
Polycentric cities include those that have circumferential (loop) highways surrounding them (e.g., Minneapolis-St. Paul and Atlanta). The intersections of these highways and radial highways or arterials constitute points of comparatively good accessibility from locations across the urban area. It is at these points of good overall accessibility that specialized centers tend to emerge. Depending on the topography, industry mix of the city, and the general nature of development in the particular sector of the city, the centers will specialize in office functions, retail, multiple-family housing, or certain forms of manufacturing.

Cities that historically have had strong radial roads (e.g., Detroit and Chicago) have tended to take on a star shape, as the radial facilities were upgraded into major highways. The respective corridors develop uniquely, some becoming commercial strips and others evolving into densely developed housing areas, with the densities falling off as one moves farther from the corridor.

**Blending the models**

While the purest examples of monocentric cities are likely to be smaller ones, with limited outward growth, the vast majority of larger U.S. cities have elements of both polycentric and corridor development patterns. It is easy to find cities with intense development along radial corridors and major activity centers where these corridors intersect with circumferential highways or through-passing interstate highways.

**Implications for Transportation Planning**

The foregoing discussion of urban growth and spatial development highlights the critical importance of transportation investment. Land-rent theory tells us that by increasing access to various locations within and near an urban area, such investments can substantially influence the spatial pattern of land uses, and thus urban form. So far, we have stressed the strategic value of the intersections of major urban highways. Moore and Thorsnes (1994, p. 20) emphasize that these intersections have many of the same characteristics as the central core of the classic monocentric city—they provide a high level of access to most other parts of the urban area and to the surrounding region. A corollary is that the area around an activity center will tend to develop in a fashion similar to
the area surrounding the CBD, with several types of land uses competing for locations with good access to the activity center. By improving the transportation systems serving a given activity center, it is possible to encourage its further growth, as the bid-rent gradient radiating from it will tend to become flatter and thus the land around it more affordable. Stated a bit differently, the level of investment made in roads, transit, and other facilities serving the activity center will substantially influence its longer-term development.

**Transportation investments as a policy tool**

The important point is that transportation investments can be used as a significant policy tool in shaping land use patterns and, ultimately, urban form. By increasing the relative accessibility of specific locations, urban development or redevelopment can to a degree be channeled to these locations. Strategic locations that are afforded especially good regional access will become prime sites for concentrations of activities that benefit from agglomeration economies, such as office-based industries and specialized retail stores, as well as more expensive multi-family housing and hotels. Turning the land use–transportation relationship around, the approach we are suggesting can be applied to estimate the likely effects on urban form of a particular transportation project that is under consideration. One can then contemplate the question of whether the project would contribute to the sort of urban form to which the community aspires.

**Relationship with other development factors**

While transportation investments can play a key role in shaping a city’s form, they do so by interacting with other factors, often in complex ways. Figure 2–6 is a schematic showing how transportation policy directives intermingle with other forces to influence the land use patterns of a growing city. On the left, Boxes 1, 2 and 3 represent three major types of external considerations: (1) federal policy mandates, (2) local political forces, and (3) physical circumstances. Federal policies (Box 1) require compliance with a series of environmental, social, and economic regulations, which increasingly are determining which projects can be carried out. Particularly when federal funds are used to complete a
TRANSPORTATION PROJECT, FULL CONSIDERATION OF VARIOUS IMPACTS IS ESSENTIAL.

In a different vein, local political forces (Box 2) substantially influence how transportation investments are directed, and thus how they affect urban form. If a community favors growth and is willing to spend public funds to help foster it, a more expensive transportation program is likely. The preferences of neighborhood organizations, the public’s feelings toward environmental issues, and the role played by special interests (e.g., downtown boosters, residential developers, and major employers) also temper the way in which a city evolves and how the differential access brought about by transportation projects will affect urban form.

Physical attributes (Box 3) influence land use patterns in several complementary ways. Topography greatly affects which types of land use are feasible in various locations, and major features such as rivers and lakes affect the time en route between locations within the city and, hence, accessibility. These features essentially distort the simpler land-rent concepts discussed earlier.

Public policies (Box 4) are the formal manifestation of local political forces. Such policies can include the comprehensive plan (see Chapter 3), zoning, annexation, and capital improvement programs to build infrastructure. Public policies affect land development both directly and indirectly by altering the spatial

Figure 2–6. Intertwining factors influencing land use patterns
DISTRIBUTION OF ACCESSIBILITY THROUGH THE TRANSPORTATION INVESTMENT
CHOICES THAT ARE MADE.

Economic forces (Box 5) are principally based on (1) the strength of
the local economy, (2) consumer preferences, and (3) the land value–
transportation cost trade-off discussed earlier in this chapter.
Clearly, if the economy is robust, the pressures for growth will be
stronger and the capacity will be greater to build transportation
infrastructure in the interest of fostering and channeling land
development. If consumers prefer downtown high-rise living, the
nature of growth will be different than if they prefer large-lot
single-family housing. Further, if consumers encourage
gentrification of older areas near the CBD for restaurants and
shops, the resulting land use patterns will be different than if they
do not. Finally, as we have discussed, the economic forces that lead
to agglomeration economies and higher land values where access to
the city center and other areas of the city are greatest have a major
effect on a city’s land use patterns.

That said, the magnitude of agglomeration economies and the level
of land values near the city center depend to some degree on the
nature of the local economy. If the city has a strong office-oriented
sector (e.g., many insurance, finance, real estate, and printing and
publishing businesses), the potential for agglomeration economies is
relatively great. On the other hand, if the local economy is largely
based on manufacturing, a flatter rent gradient and a more
dispersed urban form may emerge, as land-intensive plants are built
on the urban fringe with suppliers to these plants located nearby.

Box 6 pertains to transportation policy directives that in turn are
the product of two forces—federal mandates (Box 1) and local
political forces (Box 2). Among the key federal mandates and policies
that influence local transportation policy are: (1) environmental
regulations largely contained in the National Environmental Policy
Act of 1969 (NEPA), (2) accessibility requirements for the disabled
as specified by the Americans with Disabilities Act of 1990 (ADA), (3)
protection of low-income populations and minority populations in
the Federal-Aid Highway Act of 1970 and Executive Order 12898 on
Environmental Justice signed by President Clinton in 1994, and (4)
funding priorities reflected in the Transportation Equity Act for

Local political forces affect the availability of transportation
services, such as public transit, streets and roads, and parking.
Depending on the local political culture, a city may be relatively
auto-oriented, have a strong commitment to transit and perhaps to
non-motorized transportation, be inclined to invest in facilities
freely, or avoid growth-supporting investments. Together with
mandates and policies from higher levels of governments, these
LOCAL POLITICAL LEANINGS HEAVILY INFLUENCE TRANSPORTATION POLICY DIRECTIVES.

This brings us to the two boxes to the right in Figure 2–6. Box 7, transportation investments, is the product of transportation policy directives (Box 6), local public policies (Box 4), and economic forces (Box 5). Regarding the city’s road system, transportation investments may consist of road widening, new roads, highway interchanges, urban bypasses, and parking facilities. Other types of transportation changes may be salient, as well, including improvements that facilitate pedestrian and bicycle travel and trips by transit.

Perhaps the most important connection in the figure is the curved line between transportation investments (Box 7) and land use patterns (Box 8). Transportation investments heavily influence emerging land use patterns, just as land use patterns, existing and planned, greatly affect the sorts of transportation investments that are needed and possible (this duality and complexity of influence suggests that a curved line connecting Boxes 7 and 8 is appropriate). Stated differently, a series of road investments can affect relative accessibility and hence urban form, and if a city knows what sort of urban form it aspires to (e.g., polycentric, clustered, high density, corridor, or stressing mixed-use patterns), it can use transportation investments as an important tool to help it achieve this urban form.

CONCLUSION

Transportation investments are a critically important tool for helping cities to achieve a desired urban form in the long-term. As Boarnet and Haughwout (2000, p.12) concluded, “the evidence suggests that highways influence land prices, population and employment changes.” Yet, a host of economic, institutional, and physical forces temper the sorts of changes that are possible and the effect these changes bring about. Perhaps it was this tempering effect that Giuliano (1989, p. 151) observed when she concluded that transportation cost differentials may often affect land use patterns to a lesser extent than location theory predicts. Thus, the economic relationships developed earlier in this chapter, whereby land costs are driven by accessibility, always will be bolstered or retarded by the policies and mandates of higher governments, local political preferences, and other external forces. It is not sufficient, then, to understand the economics of travel costs and location and thus the influence of transportation projects, but this is as good a place as any to begin. That has been the objective of this chapter. In the next chapter, institutional forces that enhance or confound economic relationships are considered.
CHAPTER 3
LOCAL PREFERENCES AND LAND USE PLANNING

The access-based concept developed in this monograph is intended to help a community use transportation investments as a tool in pursuing a desired urban spatial structure, or urban form. It follows that the community must have a clear sense of the general urban form to which it aspires. Only then can it use transportation investments to alter the relative accessibility of different locations to positively influence the urban land market in pursuit of that form.

In this chapter we explore how local values blend with policy initiatives at all levels of government to influence the way urban land use patterns evolve. This influence is important because for transportation investments to be a positive force shaping urban form, it is crucial that the community have a reasonable level of consensus as to what “desirable” urban form means. Lacking this consensus, a community runs the risk of responding to a host of potentially conflicting and confounding opportunities and forces.

THE CONTEXT OF LAND USE DECISIONS

One cultural tradition looms over any land use discussion: most people place great importance on land ownership. Given this tradition and the pluralistic nature of our society, people vary in how much land regulation they will tolerate (Reilly 1996, p. 188). Depending on the prevailing social and political environment, a community may regulate and plan land use actively or more passively. Some cities follow relatively laissez-faire policies; they set in place only a few general types of zoning designations (e.g., residential, commercial, and industrial) and readily grant rezoning and variance requests. Other cities (even some in close proximity to laissez-faire cities) are more directive, with complicated city plans and zoning schemes using upwards of 25 different land designations from which they seldom deviate.

As a result of different policies and local preferences, land use patterns vary widely from city to city, often making it difficult for regional or state agencies to predict the long-term land use consequences of transportation investments (Johnson 1989, p. 2). Despite the difficulty it imposes on the planning process, many believe that local control over land use is beneficial in that it creates a system of physically and socially distinctive communities.
WHERE PEOPLE ARE FREE TO SELECT THEIR LIVING ENVIRONMENT (Beatly 1994, p. 208). NUMEROUS CITIES CURRENTLY ENACT VARIOUS LAND USE ORDINANCES SPECIFICALLY TO CREATE OR PRESERVE A CERTAIN TYPE OF URBAN ENVIRONMENT.

THROUGHOUT THIS MONOGRAPH, WE EMPHASIZE THAT LAND USE POLICIES AND TRANSPORTATION INVESTMENTS CAN ALTER THE VALUE OF LAND PARCELS BY AFFECTING THE LEVEL OF ACCESS PROVIDED. ONE IMPLICATION IS THAT GROUPS WITH DIFFERENT GOALS—SUCH AS INDUSTRY LOBBYISTS, INTEREST GROUPS, AND CITIZENS—OFTEN ATTEMPT TO SWAY LOCAL POLICIES, RESOURCE ALLOCATION, AND EVEN DAY-TO-DAY DECISIONS AFFECTING BOTH LAND USE AND TRANSPORTATION. IN THIS SETTING, BOTH PUBLIC OFFICIALS AND PRIVATE CITIZENS NEGOTIATE A HOST OF LAND USE DECISIONS WITHIN A COMMUNITY. FURTHER, VARIOUS LEVELS OF GOVERNMENT HAVE DIFFERENT PLANNING AND DECISION-MAKING RESPONSIBILITIES. REGIONAL AND STATE GOVERNMENTS OFTEN ARE RESPONSIBLE FOR MAJOR TRANSPORTATION INVESTMENTS (FREeways AND EXPRESSWAYS), WHILE MUNICIPAL GOVERNMENTS ENACT ZONING ORDINANCES (HOW THEY REGULATE LAND IS PRESCRIBED BY STATE LAW, HOWEVER). IT ALSO IS THE CASE THAT MANY AGENCIES, DEPARTMENTS, AND DIVISIONS WITHIN THE SAME LEVEL OF GOVERNMENT MAKE INDEPENDENT POLICY DECISIONS AND PLANS THAT SIGNIFICANTLY INFLUENCE LAND USE AND TRANSPORTATION OUTCOMES (Lighthizer 1996, p. 180). IN SHORT, DECISIONS REGARDING LAND USE AND TRANSPORTATION INVESTMENTS INVOLVE A DIVERSE ARRAY OF AGENCIES WITH OVERLAPPING RESPONSIBILITIES.

THIS CHAPTER BEGINS WITH A DISCUSSION OF HOW FEDERAL POLICIES INDIRECTLY PROMOTE OR DISCOURAGE CERTAIN TYPES OF LAND USE THROUGH VARIOUS PROGRAMS, INCLUDING THOSE THAT INCREASE TRANSPORTATION INVESTMENT. FOLLOWING THE DISCUSSION OF FEDERAL POLICY IS AN INSTITUTIONAL ANALYSIS OF PLANNING IN IOWA: HOW DEVELOPERS, PRIVATE CITIZENS, COMMUNITY GROUPS, AND GOVERNMENTS INTERACT DURING DECISION-MAKING. THE THIRD SECTION OF THIS CHAPTER DISCUSSES COMPREHENSIVE PLANNING AS A MEANS TO FOSTER INTERAGENCY COORDINATION AND ENABLE LONG-TERM DEVELOPMENT MANAGEMENT.

FEDERAL POLICY AND URBAN FORM

AS WITH MANY SOCIETAL CHANGES, FEDERAL INTERVENTION IN URBAN FORM HAS DEVELOPED INCREMENTALLY. THE PUBLIC POLICIES THAT TODAY INFLUENCE URBAN FORM WERE PASSED MANY YEARS APART AND DURING DIFFERENT FEDERAL ADMINISTRATIONS. CRITICS ASSERT THAT FEDERAL AID FOR HIGHWAY CONSTRUCTION, HOUSING SUBSIDIES GRANTED TO SUBURBAN DEVELOPMENT, AND EVEN SOME ENVIRONMENTAL REGULATIONS HAVE LED TO LOW-DENSITY PATTERNS OF RESIDENTIAL AND COMMERCIAL DEVELOPMENT. ALTHOUGH MANY FEDERAL POLICIES IMPACT URBAN AREAS, WE CONCENTRATE ON TRANSPORTATION POLICIES THAT HAVE INFLUENCED THE NATURE OF MODERN URBAN GROWTH.
Federal policy and local planning

In the planning literature, there are two divergent positions about the federal government's influence on urban form:

· Positive: Low-density development is due to the preference of most people for single-family-detached housing and travel by auto. Because this preference is reflected in voting behavior, Congress has responded to expressed public desires and has set in place policies that facilitate lower-density housing and auto travel.¹

· Negative: Low-density development promotes excessive auto use, energy consumption, and air pollution; encourages inefficient spending on infrastructure and public services; exacerbates loss of resource lands; has a negative impact on central cities and their CBDs; and deprives those who do not drive of access. If consumers were made aware of these drawbacks and given viable, attractive alternatives supported by a shift in federal policy, it would be possible to alter the current trend in urban form.

Which of these assertions is most valid remains a topic of debate. The discussion of policy influences on local development, however, is crucial to our analysis of land use and transportation for at least two reasons:

· Attempts to guide new development by relying solely on transportation investments are likely to fail without corresponding consideration for the roles played by development density and land use policy.

· Low-density residential development is an important part of the culture that planners must work within when creating local plans. Planners who hope to shape urban form using land use controls and transportation investments will have to contend with federal incentives that favor the preference for low-density development (e.g., tax deductions for home mortgage interest).

Much urban land has already been allotted to low-density development, regardless of what type of development occurs in the future. State, regional, and local planners must consider existing land uses when they envision the future of an urban area. Ample evidence exists that low-density development has occurred largely

¹ For an elaboration of this point, see Gordon and Richardson (1997) or Gordon and Richardson (1999).
BECAUSE MANY PEOPLE PREFER SINGLE-FAMILY-DETACHED HOMES AND AUTO TRAVEL.

THE ROLE OF URBAN FREEWAYS

Enacted in 1956, years after Fannie Mae and other federal housing initiatives, the Interstate Highway Act launched a prodigious highway building effort resulting in high-speed, limited-access freeways passing through and encircling metropolitan areas. Such urban freeways generally have reduced the spatial advantage of the traditional central city described in Chapter 2 (Müller 1986, p. 43; Meyer and Gomez-Ibanez 1981, p. 104).

The criterion for travel and locational decision-making in a network is the time—not necessarily the distance—required for a trip. As metropolitan areas have spread outward, the original city center has become difficult to reach from the urban fringe. Meanwhile, by making fringe areas accessible, urban freeways have allowed travel to increasingly flow between points on the periphery of the urban area (Müller 1986, p. 43; Burby et al. 1997, p. 210) and flattened the bid-rent gradient.

Combined with subsidized housing, freeways have served to offer both residents and businesses much better access to destinations throughout the urban area. The series of maps in Figures 3–1 and 3–2 illustrates this type of movement to the urban fringe in the Omaha and Council Bluffs metro area in Nebraska and Iowa. Figure 3–1A shows the backbone street layout for the metro area in 1964; the area is dotted with four-lane road segments, but only the city center has a complete network of four-lane streets. In 1964, Interstate 680 around the metro area was not yet complete.

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2 Quantitative profiles of growth in other urban areas in Iowa are contained in Schweitzer (2000).
By 1980 (Figure 3–1B), three interstate highways (I-29, I-680, and I-80) enveloped the metro area, linked by major north-south and east-west four-lane arterial roads, making all areas of the city accessible by auto. Once they became accessible by a freeway, the
Edges of the metro area grew increasingly less dependent on the center. The edges are still physically linked to the center, but are connected to all other parts of the area as well, and such access promotes growth on the edge of the metro area (see Downs 1994, p. 191). In time, multiple commercial centers have developed that serve the more dispersed residential locations.

Figure 3–2 spans outward to show how the completion of the circumferential freeway network in Council Bluffs and Omaha opened opportunities for residential and commercial growth, especially to the west of Omaha along Interstate 680. The darkened circles represent the number of acres of single family homes, while the empty circles show the growth of employment. The pattern of residential and employment location during the decade from 1980 to 1990 is evident—freeways opened the metro area to the west, and the majority of new housing and employment followed, predominantly in the west and south.

![Figure 3–2. Employment change and acres of new single family housing, 1980–1990, Omaha/Council Bluffs metropolitan area](image)

**Source:** Metropolitan Area Planning Agency, Omaha

**Note:** Heavy lines denote urban freeways and expressways.
TRANSPORTATION STRATEGIES AND LAND USE

Now that freeways are an established part of the urban form, some contend that prospective investments in urban transportation facilities will make only small changes in overall metropolitan travel times or in the amount of readily accessible and developable land (Zovanyi 1998, p. 73; Fischel 1990). Even when transportation does influence land development, its impact will likely be on a limited or local scale. Over time, however, such incremental changes in urban form do accumulate. Transportation strategies, therefore, are effective only when coordinated with other planning efforts such as comprehensive planning.

LOCAL INSTITUTIONS AND DEVELOPMENT MANAGEMENT

Iowa, like many states, has a strong tradition of home rule where city governments are generally free to create their own procedures, institutions, and plans. Except for programs that require state and federal funds, cities in Iowa are, for example, able to establish land use policies that reflect local preferences. Such independence provides opportunities—cities can pursue a distinct variety of urban form, and local citizens often feel that local government is more responsive to their needs than regional or state governments (Dean 1996, p. 147).

Differences among nearby communities, however, may confound both local and regional land use plans and goals. Because home rule allows cities to evolve independently of statewide control, cities vary in:

· planning goals,
· planning capacity; and
· operational planning definitions.

DIFFERENCES IN PLANNING GOALS

For regional and state-level planners, accommodating the divergent goals and policies of each municipality within a metropolitan area can be a challenge. Given the diversity of planning goals among jurisdictions, it is inevitable that the transportation projects pursued by state and regional agencies will act to promote some local developmental goals much more than others.
Table 3–1 includes a small sample of land use planning goals taken verbatim from the comprehensive plans of two neighboring eastern Iowa cities, Coralville and Iowa City. Coralville’s goals of promoting growth and property rights are likely to lead to different consequences for state or regional transportation projects than does Iowa City’s goal of discouraging urban sprawl.

**Table 3–1. Sample planning goals**

<table>
<thead>
<tr>
<th>Coralville</th>
<th>Iowa City</th>
</tr>
</thead>
<tbody>
<tr>
<td>· Promote and support the continued growth of the community.</td>
<td>· Focus urban growth; use the city’s extraterritorial review powers to discourage urban sprawl.</td>
</tr>
<tr>
<td>· Protect and promote property rights and property values.</td>
<td>· Foster strong community neighborhoods with a mix of housing, churches, schools, recreational facilities, commercial areas, and historic landmarks.</td>
</tr>
</tbody>
</table>

Sources: The Lewis Group 1992, p. 34, and City of Iowa City 1997, p. 47.

The differences between two municipalities such as these can create a special problem for state agencies that work with local communities on a project-by-project basis. If, for example, the state department of transportation (DOT) were considering the pros and cons of implementing an improvement in a metropolitan area where one community does not want to grow rapidly while an adjoining one does, almost any decision that the DOT makes will support one community’s goals but be inconsistent with those of the other. Even if the DOT were not to build the hypothetical project immediately, some degree of development might occur despite poor access if people were attracted to the area and willing to tolerate inconvenient travel, at least in the short run. Eventually, conditions on existing roads could become less safe and more congested, and pressure would be applied to the DOT to improve the road in the interest of safety.

**Local attitudes towards growth**

Communities plan in order to maintain or develop a particular environment. Some communities actively court growth while others do not; nearly all policies and projects that have regional transportation consequences will favor one growth policy over another. At the state planning level in Iowa, weighing the desirability of one community’s planning goals...
DIFFERENCES IN PLANNING CAPACITY

Some communities (even large municipalities) do not have a formal, comprehensive plan or any one document that the city council or staff can use to guide development decisions. City planners may depend on area or district plans, or decisions may be made based on the merits of each individual project. In such situations, state and regional planners have little to go on when trying to evaluate the likely long-term land use consequences of major changes to transportation facilities.

Having a comprehensive plan, area plan, or growth management plan may increase the guidance available to state and local planners, but realistically, local decision-makers often must modify adopted plans as they contemplate emerging development choices. Figure 3–3 lays out a general grouping of both formal and informal participants in local policy decision making, as well as the major responsibilities they may have in a city’s land use and development decisions. The figure is by necessity conceptual and generalized. Some communities have no formal decision-makers besides the mayor and city council and no professional planning staff. Some larger cities may have a number of city boards, but rely on consulting firms to do planning and infrastructure design.

By designing subdivisions, requesting rezonings, variances, or special exceptions, and making development plans, land developers may also influence the decisions of city councils and boards. Members of the community, such as neighborhood residents or environmental groups, can change plans or even halt projects by raising opposition. Private businesses, such as engineering consultants and utility companies, may also constrain city development decisions by the design and implementation of facilities and infrastructure.

The balance of power among these groups contributes to an area’s planning capacity—its ability to create and enforce plans. Planning capacity also depends on:

· A city’s tax base and economic health,

· The professionalism and knowledge base of city staff, and

· The diversity of the city’s population.
Local planning capacity is an important factor in predicting the eventual land use consequences of a transportation investment. Even with a conscientious staff and city council, cities that crave development to help boost the local economy usually are not in the position to rigidly enforce their city plans. In order to attract development, cities compete with each other and with unincorporated areas within counties for growth-producing economic activity. Even if cities are ostensibly able to table competition for a time in the interest of transportation route continuity or other necessities, underlying remnants of such competition will often remain to undermine comprehensive land use and transportation planning.

Interjurisdictional competition and infrastructure costs

Cities and counties frequently seek to strengthen their tax bases, and the temptation to modify existing plans or to grant rezoning requests (or other exceptions) to create opportunities for growth can be strong. Even if a city government strives to manage or constrain certain land use patterns, it runs the risk that development capital will flow to a neighboring municipality or out of the metro area entirely. Thus, by not accommodating new development, cities risk not only losing the property taxes new residential development would generate but also find themselves providing transportation and other services to those who work in the city but live (and pay property taxes) elsewhere.
### Formal city decision makers

#### Elected decision makers
- Mayor/City council
  - create and amend city code
  - adopt/approve city plans
  - decide rezoning requests

#### Quasi-judicial city boards
- Board of Adjustment
  - variances
  - special exceptions
- Building Board of Appeals
  - appeals to inspector decisions
  - appeals to zoning enforcement

#### Formal city advisory bodies
- Planning and Zoning Commission
  - land use recommendations
  - street recommendations
- Comprehensive planning (visioning)
  - make recommendations (both general and specific) about comprehensive plan
  - envision policy direction for city
- Environmental committees
  - oversee designated areas
  - suggest environmental agenda
- Other
  - economic development
  - design review

### Informal city decision makers

#### City staff
- City manager/Administrator
  - acts as executive officer
  - manages all city operations
- Planning
  - subdivision review
  - land use planning
  - zoning recommendations
  - adjustment/variance recommendations
  - plan development
  - neighborhood services
- Engineering/Public works
  - traffic management
  - road and bridge design
  - sewers and water facilities/lines
- City Attorney’s Office
  - subdivision review
  - enforcement in courts
- Housing and building inspection
  - building/parking inspection
  - zoning enforcement
- Other service providers
  - school board
  - parks and recreation
  - transit
- Land development interests
- Homebuyers/Businesses
- Land developers
- Banks/Lenders
- Real estate agents

#### Community groups
- Local environmental and civil rights groups
- Neighborhood residents
- Chamber of Commerce

#### Private infrastructure providers
- Electric utility company
- Natural gas utility company

#### Private infrastructure designers
- Engineering consultants
- Planning consultants

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**Figure 3-3. Local land use planning decision-makers**
INTERJURISDICTIONAL COMPETITION AND INCREMENTAL DEVELOPMENT

Because of their dependence on property taxes for the majority of their revenues, cities and counties occasionally modify or ignore existing plans to accommodate development. Such modifications during the day-to-day crunch of local decision-making cause incremental changes in urban form that are difficult for regional or state agencies to predict when formulating transportation plans.

If one of the regional planning goals in the state of Iowa is to better plan metropolitan growth, state agencies must be able to clarify their role in local interjurisdictional competition to guide state and regional planners when making project decisions.

DIFFERENCES IN LAND USE DESIGNATIONS

Among communities that have and enforce comprehensive plans, land use designations are not standard for all cities. For instance, in West Des Moines, a high-density residential land use designation means 12 to 18(+) housing units per acre (City of West Des Moines 1995, p. 8–2), whereas in Sioux City, the same designation means 15 to 20 units per acre on average (Camiros, Ltd. et al. 1994, p. 40).

Perhaps the widest variation in designations occurs with commercial land uses. For some cities, any non-industrial activity ranging from office buildings to convenience stores to boutiques falls under the designation “commercial,” even though the land uses may have very different traffic-generation consequences. Other cities separate commercial uses by activity (e.g., shopping versus office space) and by retail trade capture area (e.g., regional, community, or neighborhood).

The difference in land use designations from community to community has frustrated regional planners attempting to create comprehensive land use maps for the metropolitan area or databases that could facilitate regional transportation planning. In order to construct their plans, planners have had two less-than-optimal choices. The first option is to construct a metro-area map using the land use designations of each individual city, even though these definitions vary from city to city. Alternatively, regional land use maps could designate aggregate land uses based on broadly defined categories (e.g., residential, commercial, or industrial). With this
APPROACH, WHAT IS GAINED IN CONSISTENCY MAY BE LOST IN A LACK OF ACCURACY.

SOME REGIONAL PLANNING AGENCIES ARE ALREADY USING AERIAL PHOTOGRAPHY TO UPDATE THE LAND USE MAPS FOR THEIR MEMBER JURISDICTIONS. THE REGIONAL PLANNING STAFF AT THE METROPOLITAN AREA PLANNING AGENCY (MAPA) SERVING COUNCIL BLUFFS AND OMHAKEE HAPS AN UPDATED LAND USE PLAN FOR EACH JURISDICTION AND USES AERIAL PHOTOS EVERY THREE YEARS FOR UPDATES. CURRENTLY, HOWEVER, MAPA USES THIS INFORMATION FOR FORECASTING PURPOSES RATHER THAN LAND USE PLANNING.

OVERCOMING DIFFERENCES IN LAND USE DESIGNATIONS

DIFFERENT ZONING DESIGNATIONS FROM ONE COMMUNITY TO ANOTHER ARE AN OBSTACLE TO COORDINATED REGIONAL LAND USE AND TRANSPORTATION PLANNING. FURTHER, ZONING MAPS MAY CONTAIN ERRORS THAT INHIBIT AN UNDERSTANDING OF ACTUAL LAND USE. SATELLITE REMOTE SENSING, DIGITAL IMAGE PROCESSING, AND GEOGRAPHIC INFORMATION SYSTEMS PROVIDE AN OPPORTUNITY TO CREATE COMPREHENSIVE REGIONAL LAND USE MAPS AND DATABASES THAT ARE ACCURATE AND EASY TO UPDATE (CHRISTIANSEN 1996, P. 286). ANOTHER USEFUL SOURCE OF RELEVANT DATA MAY BE THE CENSUS TRANSPORTATION PLANNING PACKAGE (CTPP) (SEE HTTP://WWW.MCS.COM/~BERWYNED/CENSUS/). SUCH LAND USE DATA WOULD BE ESPECIALLY USEFUL TO STATE AND REGIONAL PLANNERS IF IT WERE AVAILABLE BY ELECTRONIC QUERY OR COULD BE DOWNLOADED FROM A SINGLE LOCATION.

THE NEED FOR A COMMITMENT TO PLANNING

DEVELOPING A COMPREHENSIVE PLAN THAT IS ABLE TO GUIDE THE EVOLUTION OF URBAN FORM REQUIRES A SERIOUS COMMITMENT ON THE PART OF PLANNERS, ELECTED OFFICIALS, AND OTHER PARTICIPANTS IN THE LAND DEVELOPMENT PROCESS. ANYTHING SHORT OF THIS COMMITMENT WILL SEVERELY RESTRICT THE ABILITY OF TRANSPORTATION INVESTMENTS AND OTHER PLANNING ACTIVITIES TO ENCOURAGE A DESIRED URBAN FORM. ALEXANDER (1985) HAS WARNED THAT PLANNERS OFTEN HAVE DIFFICULTY

3 WHILE REMOTE SENSING TECHNOLOGY IS NOT YET AS WIDELY AVAILABLE (OR AFFORDABLE) AS AERIAL PHOTOGRAPHY, REMOTE SENSING OFFERS SEVERAL ADVANTAGES OVER SUCH PHOTOGRAPHS. ONE ADVANTAGE IS EASE OF USE: INTERPRETING THE CONTENTS OF AERIAL PHOTOS CAN BE TRICKY, BUT THE VIDEO OUTPUT FROM REMOTE SENSING IS EASIER TO DELINEATE. ANOTHER ADVANTAGE IS THAT REMOTE SENSING CAN COVER A WIDE AREA QUICKLY. AS A RESULT, UPDATING MAPS IS EASIER FOR COUNTY AND CITY PLANNERS WITH REMOTE SENSING THAN WITH AERIAL PHOTOGRAPHY.
IMPLEMENTING COMPREHENSIVE PLANS BECAUSE THE DIRECTIONS TAKEN DURING THE PLANNING PHASE OF URBAN DEVELOPMENT ARE NOT FOLLOWED WHEN DEVELOPMENT ACTUALLY OCCURS. FOUR DECADES AGO, LINDBLOM (1959) ASSERTED THAT GOVERNMENTS APPROACH LAND USE DECISIONS INCREMENTALLY RATHER THAN COMPREHENSIVELY, TO THE DETRIMENT OF ORDERLY LONGER-TERM DEVELOPMENT. ALTSHULER (1965), BANFIELD AND MEYERSON (1955), AND CATANESI (1974) HAVE MAINTAINED THAT THE DIVIDENDS FROM COMPREHENSIVE PLANNING OCCUR SO FAR INTO THE FUTURE THAT THEY ARE DIFFICULT FOR DECISION-MAKERS TO ENVISION OR FULLY UNDERSTAND.

TO BE SURE, THE POLITICAL AND FINANCIAL COSTS OF LIMITING GROWTH OR INCREASING DEVELOPMENT COSTS (BY USING IMPACT FEES OR IMPOSING DESIGN STANDARDS) ARE IMMEDIATE (BURBY ET AL. 1997, P. 97). UNLIKE PLANNING, DEVELOPMENT MANAGEMENT IS THE IMPLEMENTATION OF LAND USE REGULATIONS; IT INCLUDES ACTIVITIES SUCH AS ESTABLISHING ZONING ORDINANCES, BUILDING CODES, AND OTHER CITY POLICIES THAT ENFORCE DEVELOPMENT STANDARDS (BURBY ET AL. 1997, P. 13). PLANS MAY GUIDE DEVELOPMENT MANAGEMENT, BUT IT OFTEN OCCURS WITHOUT REFERENCE TO EXISTING PLANS. IT IS WORTH STRESSING THAT PLANS DO NOT ENSURE PREDICTABLE OR DESIRABLE LAND USES UNLESS BOTH PLANNERS AND DECISION-MAKERS COMMIT TO USING THOSE PLANS TO GUIDE DEVELOPMENT MANAGEMENT DECISIONS.

### Planning and Development Management

Planning theorists debate the efficacy of comprehensive planning in the ultimate determination of urban form for a variety of reasons. Yet during focus group discussions and interviews, planners in Iowa identified comprehensive planning as an important tool they use when making land use recommendations. Planners in different localities placed differing levels of emphasis on the importance of comprehensive land use and transportation systems planning. In short, some communities in Iowa (e.g., West Des Moines and Iowa City) consult their plans when making development management decisions, while other communities rely either on area plans or make land use decisions on a project-by-project basis.

One point is clear: it is impossible for state agencies to predict the outcome of their policies and projects (beyond the general understanding that a large, new facility in an undeveloped area creates the potential for new development).
If local areas do not have and enforce land use plans. Plans do little good unless they are used, and using plans requires the commitment of both local planners and elected decision-makers.

All of this said, the benefits of a serious commitment to local comprehensive planning include

- Increasing the technical planning knowledge of local government decision-makers;
- Educating local citizens about planning issues throughout a metro area;
- Spurring involvement on the part of political constituencies outside of government; drawing attention to problems that previously were ignored or unknown; and
- Increasing the likelihood that local officials will consider the most appropriate land uses when making individual land use decisions (Burby et al. 1997, p. 100).
Case analysis: Comprehensive planning in Iowa

Many of the Iowa plans reviewed for the preparation of this monograph contained excellent examples of clear goals, measurable objectives, and action-oriented policies. The plan for Coralville, Iowa, for instance, not only defines goals and objectives but also specifies who is responsible for meeting each objective. An example follows.

Goal: It shall be a goal of the City of Coralville, Iowa, to meet the diverse transportation needs of its residents through safe, efficient, and functional street systems; economical public transit and a well developed system of sidewalks, multi-purpose trails, and bike routes.

Objective: It shall be an objective of the City of Coralville, Iowa, for its Transit Director to implement programs to increase ridership by at least two percent per year without an increase in expenses (The Lewis Group 1992 p. 34).

West Des Moines provides another example of clearly stated goals and policies. Unlike Coralville, West Des Moines uses policies to guide day-to-day planning decisions and to make sure that decisions coincide with the goals stated in the comprehensive plan:

Goal: To provide for orderly growth and development of the city without compromising the existing sense of community (City of West Des Moines 1995, p. 5–8).

Policy: The City shall manage future growth and encourage high quality development along the I–35 and I–80 corridors through zoning and development regulations (p. 5–9).

West Des Moines and Coralville provide two examples of strongly stated goals and missions. We found that communities in Iowa that possessed updated comprehensive plans tended to have high-quality plans. Unfortunately, some major metropolitan areas in Iowa either have not updated their comprehensive plans since the early 1980s or have no comprehensive plan at all.
DIMENSIONS OF PLAN QUALITY

Local decision-makers are far more likely to take either comprehensive or area plans seriously if these plans are professional, good quality efforts. While opinions vary as to what constitutes a “good” plan, two key elements are likely to differentiate plans that are followed from those that remain on the shelf.

- Clearly presented information on social, economic, environmental, and land use conditions specific to the area that explains particular community resources and needs. This information sets a context for choices facing the community.

- Unambiguously stated goals, policies, and objectives that address specific needs of the community. It is vital that they all be internally consistent, as well as consistent with regional plans. Well-articulated and consistent policies and objectives lend accountability to a comprehensive plan.

Regarding consistency, Table 3–2 defines three levels of planning consistency pertinent to land use and transportation planning. More than any of the other components of plan quality, the consistency of local plans with the community’s developmental goals and the policies of neighboring jurisdictions is the crux of integrating local land uses into state and regional transportation projects (Porter 1991). Without consistency, the projects and plans of different agencies are unlikely to produce the urban form desired by the leaders and residents of a community.

Table 3–2. Types of plan consistency

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical consistency</td>
<td>Local plans are consistent with state goals, policies, and plans.</td>
</tr>
<tr>
<td>Horizontal consistency</td>
<td>Local community plans coordinate with those of neighboring local governments</td>
</tr>
<tr>
<td>Local internal consistency</td>
<td>Local development regulations (e.g., the zoning ordinance) and decisions are consistent with comprehensive plans.</td>
</tr>
</tbody>
</table>

Planning consistency
Local areas that create and enforce comprehensive plans can substantially influence the evolving urban form in their communities. If, however, local plans conflict with state plans, the plans of neighboring communities, or the community’s own policies, they are unlikely to prove an effective means for bringing about the land use patterns a community desires.

Some Iowa communities have already sought regional consistency in their daily development-management decisions. For instance, the Metropolitan Area Planning Organization (MAPA) staff in Omaha and Council Bluffs make recommendations from a regional perspective to the development review committees in the cites of Bellevue and Omaha. Staff at the Bi-State Regional Commission serving the Quad Cities area provides similar guidance to some of their member jurisdictions, performing reviews from a regional viewpoint.

Nationally, state growth-management policies have attempted to ensure plan consistency by mandating local comprehensive planning. Research shows that state comprehensive planning mandates (as part of state growth-management plans) do indeed induce communities to prepare comprehensive plans; researchers have also found that these plans are likely to be better quality plans than those existing prior to the state mandate (Burby et al. 1997, p. 104).

There is a danger, however, that some local governments will create comprehensive plans only to comply with state mandates, rather than using these plans as a means to achieve community-wide collaboration in determining the desired future of the urban area. If state agencies are to have some influence on local land use policies, it must be through a statewide strategy that is embraced by staff in both local and state agencies. The strategy can come from the top down, but all agency staff must have a commitment to following through during day-to-day project planning and management.

Research on growth management in other states has shown that a state’s planning mandates prove more effective when accompanied by an increase in the resources devoted to planning at the local level. Providing educational workshops, awarding grants for plan preparation, and increasing the involvement of state and regional planners in the development of local comprehensive plans and major land use planning decisions are all ways to enrich the resources available to local planners.
CONCLUSION

Interjurisdictional competition for growth opportunities, differences in land use designations, and federal policies that encourage low-density development can operate counter to a local community’s attempts to manage growth using transportation or land use policies. Left unchecked, however, the economic and institutional forces described in this chapter are likely to affect a community’s growth in rather predictable ways. Generally, they will give rise to random, widespread growth of low-density residential and commercial activity. Whether this sort of development is positive or negative depends upon whether such growth is in tune with community goals and desires. The more precisely a community can define its goals and objectives, the more likely it is that policies can be identified that can help it to reach those goals, and that transportation decisions can become a positive force in forwarding the process.

Comprehensive plans formalize a community’s goals and decisions. Such plans can guide development only if local decision-makers consult them when they consider subdivisions, annexations, zoning changes, and special exceptions. Plans must be consistent with the internal policies of the community, the plans of neighboring communities, and state plans if the local community is to successfully manage growth and development and pursue an urban form that will best enable the community’s developmental goals to be attained.
CHAPTER 4
A PREDICTIVE FRAMEWORK

Building on the concepts discussed in Chapter 2, this chapter presents a framework for evaluating transportation investments in terms of their potential for encouraging desirable land use patterns in urban areas. The framework can be applied in two different ways. Planners may use the framework to identify the kinds of transportation investments that will help achieve a desired land use pattern within a city; they also can evaluate the likely long-term impact of a proposed transportation investment on the city’s land use pattern.

ELEMENTS OF THE FRAMEWORK

Highway maintenance and improvement decisions have traditionally been based on measures that assess the overall condition, safety, and service level of road segments by comparing their physical and operating characteristics against a set of minimum design standards (Poister 1997, p. 8). For example, planners have long used the level-of-service (LOS) rating to assess a facility’s efficiency in handling traffic. LOS measures roadway performance on an A to F scale, with A representing unencumbered free-flow conditions and F representing virtual gridlock (TRB 2000, p. 1–3). For urban arterials, LOS is measured explicitly in terms of operating speed. While assessments of other types of facilities, such as collector streets, may be couched in terms such as “freedom to maneuver” and “comfort and convenience,” implicitly, operating speed is generally the key factor (Ewing 1995, p. 91).

It is reasonable that agencies concerned primarily with the safe and efficient movement of traffic would use operational measures such as speed and travel time. When, however, transportation policy is seen as a tool for shaping land use patterns, it adds a new wrinkle to the assessment process. Efficient movement of traffic must then be considered in tandem with developmental goals such as promoting the economic vitality of a central business district (CBD), attracting economic activity to a growing suburb, or increasing residential density (see Ewing 1993). A significant rethinking is called for not only in how an agency plans transportation investments, but also in how the performance of new facilities is measured. In broadening the context of performance evaluation, some researchers have suggested that the concept of accessibility can be used to evaluate
TRANSPORTATION PERFORMANCE IN ITS LARGER SOCIETAL CONTEXT (MORRIS ET AL. 1979; KOENIG 1980; EWING 1995).


ACCESSIBILITY MEASURES AND URBAN FORM

THE PROBLEM WITH MOST CURRENT ACCESSIBILITY MEASURES IS THAT THEY ARE ESSENTIALLY DESCRIPTIVE, AND ARE THEREFORE LIMITED IN THEIR USEFULNESS FOR EVALUATING INVESTMENTS IN TERMS OF LIKELY DEVELOPMENTAL EFFECTS. IN PARTICULAR, THE RELATIONSHIP BETWEEN MOST ACCESSIBILITY MEASURES CURRENTLY IN USE AND URBAN FORM IS ELUSIVE BECAUSE THESE MEASURES DO NOT INDICATE THRESHOLD LEVELS OF ACCESS THAT CAN BE USED TO PREDICT SPECIFIC LAND USE PATTERNS.
Identifying criteria for evaluating investments

In order to use transportation investments as a tool for land use planning, it is necessary to apply the concept of accessibility to predict rather than describe the relationship between such investments and emerging land use patterns. Planners need to predict how the changes in relative accessibility resulting from transportation investments are likely to alter urban land values, land uses, and developmental densities. Transportation may then be used to stimulate, support, or dampen the attractiveness of a location for particular land uses, ultimately serving to influence the emerging form of an urban area.

In Chapter 2 we discussed how land markets are constantly matching the demand for land on the part of various urban activities with an ever-changing supply of accessible land. This process is dynamic; changes in relative accessibility work with other factors to prompt changes in land use patterns. The influence of transportation investments on land use is based primarily on their ability to alter relative access. In isolating the role of transportation in shaping land use, the following conclusions from urban land rent theory can serve as the basis for identifying criteria for evaluating investments in terms of their likely developmental effects.

· The development potential, and hence value, of individual parcels of land are differentiated by relative levels of accessibility.

· The attractiveness of a parcel of land for a particular activity is the result of a tradeoff between land value (reflecting accessibility to other activities and the potential for agglomeration economies) and the costs of interaction (i.e., transportation costs and convenience).

· Location decisions are based on the comparative ability of a given type of activity to pay the cost of land at the most accessible locations.

Table 4–1 illustrates how travel impedance (constraints on the ability to move freely, such as circuitous routing, low-speed roadways, or congestion) and potential for agglomeration economies interact to influence overall accessibility of a land parcel to customers and other businesses, and hence, the likely value of this parcel. Higher travel impedance implies lower accessibility, restricting land use in such areas to activities that are locally confined or that do not require a high degree of accessibility from multiple origins throughout the metro area (Eldrige and Jones 1991). For example, a neighborhood grocery store can tolerate high
Levels of travel impedance because it relies on customers in its immediate vicinity (i.e., it has a small trade area). Likewise, the streets in a CBD may experience localized travel impedance due to congestion, but overall accessibility from multiple origins across the metro area generally is comparatively good. In the CBD, diverse businesses agglomerate to ensure access to myriad activities (e.g., a city block might host a restaurant, a bank, a dry cleaner, and a brokerage service). For agglomeration economies to occur, however, the location must have sufficiently good overall regional accessibility to attract the multiple activities that are vital to other businesses.

In already developed areas, changes in land values affect the intensity of land use (i.e., where land values are relatively high, a housing developer would be likely to build a multi-story condominium rather than single-family housing). In CBDs, more intensive land use is manifested in taller buildings, smaller office spaces, and more compact stocking of products. In effect, tall, densely arranged buildings represent a substitution of capital (cost of tall buildings) for higher-priced land. As little as possible of this expensive land is used.

<table>
<thead>
<tr>
<th>Travel Impedance</th>
<th>Agglomeration Potential</th>
<th>Overall Accessibility</th>
<th>Potential Land Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>High</td>
<td>High to moderate</td>
<td>Low to high</td>
</tr>
<tr>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate to high</td>
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<tr>
<td>Low</td>
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<td>High to moderate</td>
<td>Moderate to low</td>
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<td>Moderate to low</td>
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<td>High</td>
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<tr>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
</tr>
</tbody>
</table>

*Table 4-1. Variations in accessibility and land values*

Transportation costs and opportunities to interact with activities of interest can vary greatly within a city. The larger the share of transportation-related cost associated with a particular activity,
The stronger will be its tendency to agglomerate with its preferred set of activities. For example, a financial firm would benefit from locating near a ready supply of trained labor, an available source of common services (such as restaurants and office supplies), as well as a sufficient customer base. Based on this agglomeration tendency, the following conclusions may be drawn.

- Activities that have high rent-paying abilities and that prize access will locate close to the regional center (often the CBD).
- Activities that value accessibility but have a lower ability to pay high rents will locate at the next affordable subcenter or node.
- Activities that value local access will locate in subcenters (smaller clusters of economic activity) because such subcenters manifest a certain potential for agglomeration economies on a smaller geographic scale.

**Bid prices and land use**

Those who intend to use land for purposes that require very good access to certain types of activities will bid higher amounts for parcels that have the best access to them. For example, as a group, investors in downtown retail stores and office buildings generally outbid other businesses for the most highly accessible locations, followed by high-density housing development. Lower-density housing developments are typically relegated to the urban periphery. In numerous locations throughout the city, mixed commercial land uses frequently compete with other businesses and residences for land parcels with good access to customers.

**A supply and demand model**

We offer a framework for evaluating the land use impacts of transportation investments based on the concept of a land market in which parcels are differentiated according to a combination of travel impedance and the potential for agglomeration economies. This framework follows a simple model of supply and demand, with business and residential land uses representing the demand side of the equation (the need for accessible land) and transportation services largely differentiating the supply (accessible land) side. The demand for land is a derived demand—its value is predicated on its ability to enable income-producing activities to occur.
Transportation represents a means to an end—it helps differentiate the land parcels that are supplied in terms of their potential contribution to the productivity of an activity such as manufacturing or housing.

The following criteria identify the elements of the demand side of the equation for different land uses:

- Extent of need for local access to other activities,
- Extent of need for regional access to other activities, and
- Ability and willingness to pay for land at preferred locations.

On the other hand, transportation systems, as facilitators of the supply side of the land use equation, can be distinguished according to the extent to which they:

- Provide local access to other activities and
- Provide regional access to other activities.

Access needs and transportation investments

Each type of land use requires or at least benefits from a particular combination of transportation facilities and services. If planners and policy makers balance the access needs of desired land uses in a particular area of the city with the transportation facility likely to supply the required level of access, it is possible to influence development patterns.

Performance of transportation facilities

Transportation facilities such as highways and streets perform a dual role. They allow traffic to travel through an area of the city, and they also furnish access to specific locations within that area. From the perspective of transportation system design, a facility’s ability to provide uninterrupted traffic movement depends in part on the level of access it allows to and from adjoining land areas (AASHTO 1990. p. 96). For example, a freeway, which has very limited access, offers the highest level of mobility, with traffic often flowing at relatively high speeds. In contrast, streets in a residential area must be designed to provide direct access to numerous private driveways, and as a result, they move traffic much...
more slowly. The functional category of a transportation facility specifies the extent to which it will allow uninterrupted traffic flow. Based on its capacity and access, a very simple hierarchy of urban roadways includes:

- Freeway corridors and interchanges
- Expressways and arterial corridors (including principal and minor arterials)
- CBD streets and connectors
- Residential collector and local streets

Each of these general categories affords a different blend of mobility and access to and from land parcels. Thus, each category will have a different type of influence on land use patterns.

Freeway corridors and interchanges. Freeways cut across diverse land use settings, but because they have comparatively few access points, they do not provide a high degree of access to most individual land parcels. On the other hand, parcels that are located near exits, entrances, and interchanges generally have exceptionally good regional access.

Expressways and arterials. This category includes high-capacity urban roadways that fall between freeways and most urban streets. They have the important quality of being able to offer a greater degree of access to adjacent locations than do freeways. An urban arterial system typically provides strategic links between activity centers.

Central business district streets and connectors. Streets within the CBD usually are comparatively wide and thus are able to move large traffic volumes, albeit at comparatively low speeds. These streets often connect with arterials, expressways, or even freeways that can handle high volumes of traffic, usually giving the CBD moderate regional access.

Residential collector and local streets. Local streets provide access within and to residential areas. They are typically designed to handle low volumes of traffic and may feature traffic-calming devices such as stop signs and cul-de-sacs to keep speeds low. Collector streets gather traffic from local streets and feed it into arterial corridors, providing the link between neighborhoods and high capacity urban roadways.

Land use categories
The land use category of a given area within the city will determine its accessibility requirements. Conversely, changes in accessibility
will affect the sorts of land uses found within this area of the city. Following are six land use categories, based on their function. While generalized, these categories are sufficient for our analysis of transportation and urban form.

· **Central business districts**

· **Other major activity centers (e.g., large employers and shopping centers)**

· **Smaller commercial areas (e.g., commercial strips or smaller neighborhood shopping centers)**

· **Multi-family housing (ranging from low-income housing to upscale condominiums)**

· **Single-family housing (traditional grid street layout or modern subdivision patterns)**

· **Parks, recreation areas, and serene or natural areas**

Each of these land use environments has specific accessibility needs. An examination of these land use categories can help illuminate the transportation-land use connection.

**Central business districts (CBDs).** As the traditional center of the city, a CBD functions best when it is highly accessible to all parts of the metro area (Harvey 1992, p. 216). Because travel and locational decisions traditionally have been based on time rather than distance, CBDs in larger cities have required high-capacity freeways and expressways, and in smaller cities CBDs have needed arterials to enable passenger and freight vehicles to enter and leave with relative ease. Large volumes of traffic must be served, due to the comparative density of economic activity in the CBD.

**Other major activity centers.** Such centers include large employers and shopping centers, as well as institutional land use categories such as hospitals, universities, and sports arenas. They also include industrial complexes, such as factories, warehouses, and other freight-handling facilities (e.g., rail yards and trucking depots). Major activity centers require good access for freight and people, ideally from multiple directions. At a minimum, these centers should be in close proximity to an arterial that connects with residential areas and with highways leading to distant locations.¹

¹ Another key element in the accessibility of activity centers is ample parking. Because time, not distance, generally is the key factor in travel decisions, time wasted searching for a parking spot in a congested area must be factored into its accessibility level. While parking certainly is important, we do not directly address it in the framework developed in this study.
**Smaller commercial areas.** These areas include a variety of businesses ranging from suburban strip malls and larger grocery stores to clusters of service businesses and branch offices. Such commercial areas serve only part of an urban area, and so their accessibility requirements are more confined. In general, to be economically viable they need arterials connecting them with their service areas.

**Multi-family housing.** This category covers the range from low-income subsidized housing to upscale condominium complexes. In general, multi-family housing locates where accessibility to employment centers, shopping, and various services is good; having high-capacity roadways nearby is usually more important for this type of land use than is tranquility (Frank and Pivo 1994; Cervero and Gorham 1995).

**Single-family housing.** There are many permutations of single-family residential development, ranging from comparatively dense grids with very small yards to large-lot subdivisions with cul-de-sacs. Because of the diversity in development patterns, it is difficult to make sweeping generalizations about access requirements, other than that the preferred access usually is low-volume city streets leading to higher capacity arterials, expressways, or freeways. Good access to other activities that support the residential lifestyle (e.g., schools, parks, grocery stores, doctors’ offices, and other commercial activities) is important (Handy 1993).

**Parks, recreation areas, and serene or natural areas.** Because high traffic volumes on nearby highways can elevate noise levels and lower air quality (TRB 1995), parks and other areas where serenity and fresh air are prized are not particularly compatible with especially high-capacity transportation facilities. Yet, recreation areas need the access provided by moderate-capacity streets.

**PREDICTING THE IMPACT OF TRANSPORTATION INVESTMENTS**

The functional classification of urban roadways and the categorization of typical land uses presented above is a starting point in assessing the potential of changes in transportation systems to shape land use patterns. Table 4–2 summarizes the accessibility demands of the land use categories just discussed, as well as their concurrent abilities to pay for such access; Table 4–3 rates transportation facilities in terms of the level of accessibility they offer and the potential impact this accessibility has on land values.

| Table 4–2. Accessibility demands of land use categories and ability to pay rent |
|---------------------------------|-----------------|-----------------|
| Local                          | Regional        | Ability to pay rent |

---

45
<table>
<thead>
<tr>
<th>Land Use Category</th>
<th>Access Required</th>
<th>Access Required</th>
<th>Pay Land Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business districts</td>
<td>High</td>
<td>Moderate to high</td>
<td>High</td>
</tr>
<tr>
<td>Major Activity Centers</td>
<td>Moderate to low</td>
<td>Moderate to high</td>
<td>Moderate</td>
</tr>
<tr>
<td>Smaller Commercial Areas</td>
<td>High</td>
<td>Low to moderate</td>
<td>Low to moderate</td>
</tr>
<tr>
<td>Residential (Multi-Family)</td>
<td>High</td>
<td>Moderate</td>
<td>Low to moderate</td>
</tr>
<tr>
<td>Residential (Single-Family)</td>
<td>High</td>
<td>Moderate</td>
<td>Low to moderate</td>
</tr>
</tbody>
</table>

By matching the types of accessibility afforded by different transportation facilities with the access needs of various land use categories, it is possible to predict the likely developmental impacts of investments. For example, Table 4–3 indicates that an arterial corridor is characterized by “high” local access and “moderate to high” regional access. Moving to Table 4–2, the kinds of land uses that “match” this profile in terms of accessibility needs are business districts, single and multi-family residences and perhaps smaller commercial areas.

**Table 4–3. Level of Accessibility Associated with Transportation Facilities and Impact on Land Values**

<table>
<thead>
<tr>
<th>Facility</th>
<th>Local Access Provided</th>
<th>Regional Access Provided</th>
<th>Potential Land Value Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeways and interchanges</td>
<td>Low to moderate</td>
<td>High</td>
<td>Moderate to high</td>
</tr>
<tr>
<td>Expressways and arterial corridors</td>
<td>High</td>
<td>Moderate to high</td>
<td>Moderate to high</td>
</tr>
<tr>
<td>CBD streets and connectors</td>
<td>High</td>
<td>Low to moderate</td>
<td>Moderate to high</td>
</tr>
<tr>
<td>Residential collector and local streets</td>
<td>High</td>
<td>Low</td>
<td>Low to moderate</td>
</tr>
</tbody>
</table>

It is because arterials provide necessary access to numerous types of urban land uses that they have been instrumental in changing the shape of the traditional, monocentric urban area (Ingram 1998). While many businesses value high-profile central locations, and
therefore cluster in the CBD, smaller subcenters containing some of the activities found in the CBD form at other locations within the urban area. Particularly attractive are sites in the suburban periphery made relatively accessible by the intersection of major arterials and expressways (Heikkila et al. 1989; Pivo 1990; Guiliano and Small 1991). As a result, many metropolitan areas have become more polycentric in form, with circumferential and radial corridors connecting activity clusters throughout the urban area. A study of Los Angeles, a prime example of a widespread, multi-centered metropolis, revealed as many as 58 distinct subcenters (Gordon et al. 1986, p. 165); other studies have counted numerous such subcenters in many U.S. metropolitan areas (summarized in Cervero and Wu 1997, p. 865).

The matching approach outlined above can also be reversed; starting with a developmental goal, it is possible to identify the transportation facilities that would support and encourage a particular land use category. For example, a community might have a developmental goal of revitalizing commercial activity in the CBD. Table 4–2 indicates that business districts need “high” local access, and “moderate to high” regional access. Table 4–3 demonstrates that while CBD streets and connectors provide “high” local access, they offer “low to moderate” regional access, and are therefore not sufficient to fully satisfy the needs of business districts. To strengthen the prospects of the CBD, then, other types of facilities are needed, such as freeways and interchanges, or at least expressways, in order to assure access to the broader region.

Interaction among transportation facilities

As we blend transportation facilities with the accessibility needs of various land uses, it becomes clear that changes in the performance characteristics of these facilities can significantly influence land uses. Table 4–4 provides a brief look at possible combinations of the transportation facilities in Table 4–3 in terms of the likelihood that they will influence certain land use patterns. For example, if an interchange were to be constructed near a network of residential streets, it would increase the regional accessibility of the neighborhood, and large activity centers might begin to compete with low-order local outlets for space in the area.

Likewise, multi-family housing tends to follow freeways and expressways, but the immediate area around intersections of two or more of these major highways (which are highly accessible to much of the region) may well attract almost entirely commercial land uses. Multi-family housing is more likely to develop nearby, in locations that have good access to the major intersection but where land is less expensive. Thus, residential or commercial activity is far
MORE LIKELY TO BE A CONSEQUENCE RATHER THAN A CAUSE OF GREATER ACCESSIBILITY (HELLING 1998).

THE ROLE OF FREeways AND INTERCHANGES

Table 4–4 highlights the special role of urban freeways in shaping urban land use patterns. A freeway’s location in a region and its orientation to the CBD can impact transportation and land use relationships. Generally, radial freeways tend to improve access to the CBD and may help downtown areas (especially in larger cities) prosper. Depending on topography and other factors, however, radial corridors that serve as extensions of CBD-oriented activities can stimulate relocations of commercial activity away from the CBD (by flattening the bid-rent gradient). Circumferential freeways also substantially influence urban form, as they open up new and relatively inexpensive land for commercial and residential location (EDWARDS 1991; MOORE AND THORSNES 1994). Interchanges provide a means of moving traffic between freeways and arterial streets, so the location of such facilities can become a powerful policy tool to influence development in urban, suburban, and even rural locations.

Table 4–4. Land use impacts of investments

<table>
<thead>
<tr>
<th>Transportation investments</th>
<th>Land uses encouraged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adding freeways and interchanges connecting to residential streets</td>
<td>Business districts, large activity centers (employment, shopping, manufacturing)</td>
</tr>
<tr>
<td>Adding freeways and interchanges connecting to CBD and connector streets</td>
<td>Business districts, multi-family residential</td>
</tr>
<tr>
<td>Adding freeway interchanges connecting to collector streets</td>
<td>Large activity centers (employment, shopping, manufacturing)</td>
</tr>
</tbody>
</table>

While diverse factors influence business and household location decisions, specific variables that influence development around interchanges include:

- Availability of amenities (water and sewer),
- Local land use regulations (zoning and growth management policies),
- Local land values (highway-oriented businesses figure more prominently in the landscape of rural interchanges than around urban or suburban interchanges where land values typically support higher density uses),
- Proximity to an urban area,
· Traffic volume on intersecting roads (higher volume interchanges mean higher growth potential), and
· Presence of frontage roads (they support more intensive development) (Louis Berger and Associates 1998, p. 79).

How new facilities impact their immediate vicinities and how new development conflicts with or compliments existing activities are key issues in the transportation-land use relationship.

IDENTIFYING APPROPRIATE INVESTMENTS

Transportation policies aimed at increasing mobility as an end in itself do not necessarily satisfy a community’s accessibility needs. In the same vein, the descriptive indicators currently available to measure accessibility often fail to take into account the developmental objectives of an urban area, focusing instead on a kind of general “accessibility for accessibility’s sake.” As was stressed in Chapter 3, in order to select appropriate investments, there is a need for guidance, for a comprehensive plan to inform decision-makers about the types of access and urban form valued by the community.

Thus, an agreed upon comprehensive plan is the necessary starting point for any attempt to use transportation investments to help an urban area move toward a desired form. Such a plan should serve almost as a blueprint—a 20-year forecast of what land uses will be encouraged and what development pattern the community would like to pursue. This approach elevates the comprehensive plan from a simple collection of land use forecasts to a proactive tool to guide a community in achieving its long-term developmental goals.

When separated from local development goals, transportation investments tend to distribute a region’s economic growth unevenly along its facilities. For example, it is becoming increasingly common in major metropolitan areas for urban centers to decline as growth occurs along suburban corridors (Cervero 1984; Pivo 1990; Ingram 1998). If a local development goal is to foster the vitality of the CBD, transportation investments must be consistent with this objective. A study of the central area of Atlanta revealed that the city had sufficient capacity in terms of street, water, sewer, and communications infrastructure to provide adequate levels of service to at least 50 percent more businesses than were currently located there (Edwards 1991, p. 20). The problem appeared to be that regional access to the CBD was limited due to traffic congestion on freeways serving the district. Atlanta’s planners decided to widen certain freeways from four lanes to ten, and others from six lanes to 12, while constructing a passenger rail system. The result was a drastic reduction in recurring congestion, with travel delays...
occurring during two hours per day, down from six. As the transportation improvements were moving forward, several billion dollars worth of new office buildings were constructed in the downtown area (Edwards 1991, p. 19).

In this example, the system management goal of moving traffic quickly and safely was consistent with the developmental goal of revitalizing the urban center. When instead transportation investments are implemented without consideration for larger land use issues, unintended and unwanted impacts may result. Lafayette, Indiana, for example, is served by U.S. Highway 52, a major transportation corridor that connects both Cincinnati and Indianapolis with Chicago. In the 1950s, U.S. Highway 52 was relocated to a bypass on the east side of town. In the late 1960s, a second bypass was constructed in the form of Interstate 65, which runs parallel to U.S. Highway 52, about a mile farther east. The land use consequences could easily have been predicted by our framework: regional shopping centers have sprung up along U.S. Highway 52 and at the interchanges of I-65. Lafayette itself has not fared so well; despite an attempt to keep the CBD vital with multi-modal transportation and parking improvements, downtown Lafayette has deteriorated (Edwards 1991).

Bypasses provide an appropriate example for focusing our discussion of the link between system planning measures and the broader land use perspective, for they expose the potential conflicts at work in the transportation-land use connection. A bypass is a special type of arterial or expressway designed primarily to alleviate congestion on an existing major arterial by separating local from through traffic. Applying the relationships summarized in Table 4–3, a bypass offers high local and regional access. Depending on the way the facility circumvents local activity hubs, related land use consequences may be significant.

For example, a city that wants to ease congestion on an arterial serving its CBD has two basic choices. It can construct a highway that bypasses the intensely developed area by diverting non-local traffic around the urban periphery, or it can construct a high-capacity facility through the urban core by adding express lanes. From a system management perspective, it may appear that the cost-effective choice is to build the new bypass at the periphery where the right-of-way is likely to be cheaper. However, in diverting through traffic to sparsely developed land, the new bypass would open up such areas to development. It is likely that the newly accessible land would, for a while, maintain comparatively low land values. As a result, new businesses would be likely to locate along the bypass, while established businesses may be tempted to relocate away from the urban center. Thus, a region seeking to maintain the integrity of its CBD may find that the second option may in fact be
MORE DESIRABLE IN THE LONG RUN, EVEN THOUGH ITS SHORT-TERM CAPITAL COSTS ARE HIGHER.

CONCLUSION

Traditional system performance measures focus primarily on lowering traffic impedance, ignoring a crucial element in a location’s overall accessibility—its development potential. In order for transportation changes to serve as a tool for shaping land use patterns, this key aspect of the transportation-land use connection must be made part of the evaluation process. The framework presented here combines conventional operational measures (travel impedance) with land use characteristics to achieve a more comprehensive assessment process.

The key point is that it is possible to use transportation investments as policy levers to influence urban development. Taken together with appropriate land use controls and incentives, infrastructure investments, and other conducive initiatives, transportation projects can help a community move toward the living environment it prefers. The framework laid out in this chapter builds on the basic tenants of urban land rent theory discussed in Chapter 2.

A STRATEGIC TOOL

Two potentially contentious issues associated with transportation-related developmental effects are addressed by the framework. First, it enables transportation investments to be consistent with a community’s land use goals, minimizing potential developmental conflicts at the local level. Second, as it makes land use objectives integral to transportation system planning, it reduces the probability of “unintended” impacts, as the development likely to result from the investment is part of the impetus for that change. This not only helps make the land use impacts arising from a transportation project politically acceptable at the local level, it also serves to make the land use element in a community’s comprehensive plan more resilient to market forces. Changing land use through regulation is passive in that one can only permit or prohibit different kinds of land use; in contrast, by changing accessibility it is possible to actively stimulate or dampen the demand for and supply of land. Transportation investments thus become a strategic tool for balancing the supply and demand of accessible land.
The conceptual underpinnings of the framework create a common ground for planners and decision-makers without requiring changes on the part of existing planning institutions. The framework binds together existing institutional mechanisms—land markets, comprehensive planning, and transportation system management—to work toward a desired urban form.
CHAPTER 5
APPLICATIONS

We now apply the framework developed in Chapter 4 to assess how local transportation investment policy can influence the evolving form of a community. So far in this monograph, we have emphasized that for transportation to be a useful policy tool in pursuing a desired urban form, the community must have a clear idea of the general type of urban form it wants. Then appropriate transportation investment decisions (i.e., to build a project or forego it) can be made to help enable the community to move toward this urban form over the coming years.

We use several hypothetical application scenarios in this chapter to illustrate the possible land use impacts of different sorts of roadway investments. The application scenarios are kept relatively simple to avoid cluttering them with site-specific complicating factors. To the extent possible, we supplement these scenarios with short case analyses that discuss the effects of major roadway projects on development patterns of actual U.S. cities. These case analyses are illuminating, and they tend to verify our conceptual framework. They cannot be regarded as precise predictors of what would likely occur in a different city because, as we observe in Chapter 2, there is a host of intertwining factors that enhance or dilute the effects of the conceptual framework presented in Chapter 4. Rather, the case analyses are intended to add a measure of richness to the more generic application scenarios.

In the first application scenario, we examine the effects of adding a bypass near a hypothetical smaller community (Middleville, population 10,000) on the evolving land use patterns of that community. This scenario is offered to illustrate the impact of a major transportation project on urban form. The second and third scenarios turn the problem around to consider how a desired urban form can best be pursued through carefully selected transportation investments. We begin with the same hypothetical city in both of these application scenarios (Macroville, population 100,000), but in one case a corridor city is pursued, and in the other, the desired urban form is that of a polycentric city.

In each application scenario, the major transportation change(s) is made in the year 2000. Effects on urban form are traced over an extended time period, with snapshot perspectives of the evolving urban form provided in the near term (ten years), and at a more
Distant point in the future (30 years). By 2030 substantial changes are evident in the land use patterns of the communities represented in the three scenarios. The point of presenting these different scenarios is to demonstrate as vividly as possible how coherent transportation investment policies, coupled with consistent land use controls and incentives, can greatly influence the way a city develops spatially and functionally.

For each scenario, we present graphic representations of the community’s evolving urban form following a particular transportation investment. These stylized map representations are intended to show the changing nature of land use patterns as the influence of the investment occurs over time. The standard hues for land use types are used in the graphics: red for commercial, indigo for industrial, brown for multi-family residential, and yellow for single-family residential. Several brief case study analyses are offered to illustrate how impacts similar to those in our conceptual analyses have emerged in U.S. cities. Note that the graphic for the first scenario at a scale of one inch equals a mile is larger than that of the two other application scenarios, which have a scale of one-half inch equals a mile.

Each of the graphic representations is accompanied by a rent gradient (land-value) cross section, shown in purple. As discussed in Chapter 2, land value is highly influenced by accessibility (good access makes land more productive and thus more valuable). The graphics depicting the bid-rent gradients (Figures 2–1 and 2–3) show how transportation investments can affect the relative value of land in different locations within the urban area over time. The gradients provide a means for observing the different spatial effects likely to result from, for example, road investments that encourage a corridor versus a polycentric land use pattern.

APPLICATION 1 – CONSTRUCTING AN URBAN BYPASS

Our first illustrative application is a bypass of a smaller community. Bypasses around such communities are becoming increasingly commonplace, but their effects on emerging land use patterns remains more a matter of speculation than understanding. According to a study of bypass effects (TRB 1996, p. 4), the methods used to assess the impacts of completed bypasses are relatively ad hoc: (1) judgments gathered in unstructured interviews, (2) mail surveys to gauge the opinions of local residents, and (3) analyses of data pertaining to population, retail sales, and land values. The TRB report concluded that “theoretical bases for analyses are seldom explicitly cited” (p. 4). Also, impact studies generally have been carried out quite soon following construction of the bypass—always less than ten years afterwards. Such short time frames “are likely to yield information limited to such impacts as shifts in
BUSINESS LEVELS, TRAFFIC, AND ENVIRONMENTAL CONDITIONS” (TRB 1996, p. 5). Rarely will effects on urban form materialize that quickly.

Our objective is to apply the conceptual framework developed in Chapter 4 to a rather typical situation to draw out the economic forces of change that are likely to influence the way a smaller community would be affected by a bypass. We explore the possible effects in both ten- and 30-year time frames to consider how these economic forces might alter a community in the long run.

Middleville is an independent city (i.e., not part of a metropolitan area) with a population of 10,000 located on hypothetical U.S. Highway 8 approximately halfway between two larger cities. The highway passes through Middleville’s central business district (CBD) (see Figure 5-1a), and that section of it is known locally as Main Street. As a result, Main Street doubles as a local street and as a regional link between the two larger cities. This functional duality results in
CONFLICTS BETWEEN LOCAL AND THROUGH TRAFFIC, THE LATTER CONSISTING OF IMPATIENT TRAVELERS WHO PASS THROUGH TOWN AT THE HIGHEST POSSIBLE VELOCITY. THIS THROUGH TRAFFIC NOT ONLY INCREASES NOISE AND POLLUTION, IT PRESENTS A SERIOUS HAZARD TO CITIZENS OUT WALKING OR
attempting to access establishments located along Main Street. In recent years, development in Middleville has largely followed the highway in an east/west pattern; farther away from Main Street there are residential areas out to the edge of town.

In an effort to alleviate traffic problems, the community of Middleville decides in the year 2000 to build a bypass to divert through traffic to the urban periphery. In selecting a location for the new road segment, planners gravitate toward the relatively inexpensive undeveloped land to the north. The community, however, is concerned about the long-term effects such a facility would be likely to have on the economic viability of the business district—would diminished traffic lead to reduced business? Turning to our framework, we examine the probable results of the proposed investment at two points in the future. A glimpse of the urban development likely to accompany the construction of a bypass will allow the community to make a better-informed decision regarding the project.

Ten years after construction

By 2010 the completed bypass has achieved the primary initial transportation objective that was the impetus for its design. Heavy, loud, and polluting through traffic now diverts around the CBD to the bypass north of town. Main Street is now safer, cleaner, and more conducive to pedestrian movement. The bypass, however, has modified the area’s accessibility profile in that activities along Main Street no longer have superior access to regional traffic, one of the criteria used in our framework to differentiate land parcels. The basis for location decisions regarding land uses (the tradeoff between land cost and accessibility) has thus been altered by these changes in relative accessibility. In other words, the threshold for how many service stations and fast food restaurants can prosper along Main Street has been lowered, and some businesses needing exceptionally good access to customers and able to pay for land at locations with such access have relocated. Because the demand for land determines its value, their departure has lowered land prices along Main Street somewhat, as Figure 5-1b illustrates.

Meanwhile, the previously inexpensive land on the northern edge of the community where the bypass was constructed is becoming more productive due to a substantial gain in accessibility. As Tables 4–2 and 4–3 (pp. 44 and 45) predict, a number of activities that value moderate to good local and high regional access—but have a limited ability to pay high land costs—have sprung up along the new bypass. The types of activities that have located there include service stations, motels, and fast food restaurants. This is evident in the emergence of commercial activities along the bypass in Figure 5-1b.
Main Street, now essentially a CBD street, offers improved access to the activities ranged along it. People can stroll down and across Main Street without having to contend with interference from highway traffic. Likewise, on the bypass, regional travelers can take advantage of traveler services (refuel their vehicles and have a quick meal) and proceed to their destinations without having to reduce their speed nearly as much.

Thus, ten years after the bypass is completed, the community of Middleville experiences at least some redistribution of economic activity. Our framework explains why this particular transportation investment is likely to attract new activity. First, the introduction of a bypass changes the regional access of the land in its vicinity to “high.” Second, the facility enjoys close proximity to the remainder of the community, and thus has good access to workers and suppliers. Finally, the land adjacent to the bypass is, for the time being, relatively inexpensive—land use dictates land value, and its rent-earning capacity has not yet been fully realized. As a result, traveler-serving activities start to cluster along the bypass, and Main Street experiences some minor impacts in terms of lost business and depressed land values. With the new bypass, the area’s land use demand is spread over a larger supply of accessible land, so land values between the fringe and the CBD experience a degree of leveling.

At this point in time, Middleville has two choices: it can accept a diminished role for its business district as inevitable, or it can build on the comparative advantage the business district has as a place to shop and conduct business. Through zoning, signage, and promotional efforts, the community can enhance the downtown area’s image as a pleasant, perhaps quaint, and generally inviting place to be. Alleviating through traffic enables a much higher level of ambience to be achieved, and the outward movement of traveler-serving functions can actually enable a spatial differentiation of markets, to the advantage of most types of economic activity.

Thirty years after construction

By 2030 sufficient time has elapsed for Middleville’s urban form to adjust quite substantially to the changes in relative accessibility brought about by the bypass. The developmental choices faced in 2010 will have greatly influenced how the community’s land use patterns have evolved.

A passive downtown

If Middleville took no affirmative land use and marketing actions and merely waited to accept whatever land use changes might occur, much of the community’s commercial activity will have moved to the bypass. By offering moderate local access and high regional access,
Land along the bypass has become an attractive location for major activity centers such as new plants, higher volume retail facilities, and warehouses, all of which have a moderate ability to pay rent relative to the amount of land they require. As these activities moved into the area, they bid up the price of land, although it remains less costly than most locations along or near Main Street.

Once clusters along the bypass started to form, they attracted more development (agglomeration effects), which in turn provided the impetus for an extension of sewer and water utilities and construction of service roads. These changes altered the character of what had been a rural area, making it ripe for further commercial—and residential—use. Because of the low land costs, and yet reasonably good access to employment and shopping facilities, some land north of the bypass was recently converted to single-family residential use. The new neighborhoods are now attracting other community activities including schools and smaller retail businesses.

Meanwhile, 30 years after the construction of the bypass, Main Street is not the thriving business area it once was. Figure 5-1c illustrates the decline in land value and scale of activity. Several specialty shops have moved to locations near small retail centers along the bypass to take advantage of agglomeration economies. Because of the loss of accessibility to customers, businesses occupying offices on the second levels of buildings downtown are no longer able to afford the premises. There is a moderate turnover of businesses and a general sense of urban decline. Thus, while Middleville has grown and changed, attracting new activities and broadening its economic base, it did so by allowing its old business district to languish.

**An active downtown**

If, on the other hand, Middleville decided that maintaining the vitality of its CBD was a priority, it could have responded more actively to the inevitable changes brought about by the construction of the new bypass. Such an approach would have focused on containment and concentration, on making full use of existing infrastructure and safeguarding the form of the city as originally developed. Because our evaluation framework outlines the developmental consequences of transportation investment (based on relative transportation cost), it can also help a community formulate strategies to mitigate or even prevent unwanted effects.

A conventional approach to growth management would likely have involved a series of discretionary policies to restrain development at the urban periphery. Such policies might include zoning the land around the bypass for existing uses only (i.e., farming and light
COMMERCIAL) AND DELAYING THE EXPANSION OF INFRASTRUCTURE NECESSARY TO SUPPORT FURTHER DEVELOPMENT ALONG THE BYPASS. THE BYPASS WOULD CONSTITUTE A FORM OF GROWTH BOUNDARY.

Taken alone, such countervailing land use regulations and infrastructure management may or may not have worked to hold market forces at bay. Our framework highlights how these forces are likely to test discretionary policies, as the bypass inevitably worked to attract developer interest. More would have probably be required to harness the developmental pressures and channel them effectively to help achieve the desired urban form.

The emergent function of Main Street as a transportation facility could be a starting point for the development of a strategic plan to maintain the economic health of the downtown business district. The objective of the investment was to use U.S. Highway 8 and the bypass for regional access and Main Street for improved local access. In line with its function, Main Street would have to offer services different from those available on the bypass and attractive enough to motivate a sufficient number of travelers to visit the business district. This approach could take a variety of forms. The community could develop a town “theme” (for example, cultural or historic) or offer unique choices in fine dining, commercial services, or specialty shopping (e.g., antiques, crafts, or furniture). Select downtown buildings could be designated as historical sites, and redevelopment could include aesthetically landscaped areas with opportunities for family recreation and entertainment. A series of signs and billboards placed appropriately along U.S. Highway 8 as it approaches the city would then entice travelers to enter the town and provide the commerce necessary to keep Main Street viable (see Figure 5–1d).

Such strategies are more consistent with market forces and the function of Main Street than strictly ad hoc land use regulations. They produce a very different 30-year picture than the passive downtown scenario. It is likely that there would still be developmental pressures around the bypass, but if at this point a manufacturing plant or discount store were to locate along the bypass—activities that value high regional access and require large lots—it would not necessarily be at the expense of Main Street.

**Bypasses can benefit a community**

Bypasses do not need to lead to a diminished local economy. A Transportation Research Board (TRB) (1996) study of bypasses found that:

- In 93 of 98 cases, communities experienced an increase in
The amount of land devoted to commercial and industrial land uses near the existing route;
- in 47 of 50 cases, land values increased along the existing route;
- overall sales of traffic-serving businesses declined in only eight of 71 bypassed communities.

The TRB study concluded that whether or not a community became better off following the construction of a bypass was more likely to be related to underlying economic conditions and political circumstances than to the bypass, per se. Responding communities reported that positive actions they took to make the bypassed central business district viable included (1) special area designations, (2) advertising and logo identification, and (3) signage designating the existing roadway as a business route (p. 8).

Application 2 – Developing Urban Corridors

We turn now to Macroville, a city with a population of 100,000. Macroville is expected to grow steadily, but not spectacularly, over the next several decades; while generally positive about this outlook, the community is nevertheless concerned about some of the effects that often accompany development, including:
- unfocused sprawl pushing into the countryside,
- roads with reduced levels of service due to congestion, and
- economic decline of core areas.

Macroville’s current arterial system consists of several major routes feeding into the CBD (see Figure 5-2a). Central Avenue, which bisects the city east to west, has attracted sporadic commercial development along its length, as well as residential development in its immediate vicinity (multi-family housing closer to the urban core and single-family housing farther out). At the urban fringe on each side of this roadway, suburban commercial centers have sprung up—retail facilities and a conglomeration of business services. Central Avenue is experiencing a degree of congestion and has a relatively high crash rate. First Street, another CBD arterial perpendicular to Central Avenue, is manifesting similar problems and pressures as the city grows.
The city has adopted a long-range land use plan that calls for higher-density development along a few key corridors. Pursuing a corridor-oriented urban form would make Macroville relatively amenable to public transit and transportation demand management strategies (i.e., buses, light rail, or access management). By consulting Table 4–3, we see that arterials and expressways offer both high local and high regional access, conditions necessary to support numerous land use activities (business offices, small and large commercial centers, single- and multi-family housing).

Widening both Central Avenue and First Street would not only reduce immediate and future traffic problems, it also would
Encourage urban growth along these major arterials. Coupled with appropriate land use controls, these facilities can serve as the basis for corridor development, encouraging intensified land use along them, while at the same time discouraging further expansion outward into rural areas.

The city develops a comprehensive plan whereby both Central Avenue and First Street are widened from two lanes to six with raised medians and improved turning movements at intersections. The system management goal is to move traffic safely and efficiently at a reasonable speed between the suburbs and a variety of destinations in the urbanized area, while the land use goals include enhancing the vitality of the CBD and expanding transportation and employment options. Our framework can help predict the kinds of transportation and land-use opportunities these investments are likely to usher in ten and 30 years after construction.

**Ten years after construction**

By 2010, traffic along both arterials has increased substantially. Even with the increased traffic, the roadways are functioning at a level of efficiency that would have been impossible without the median installations, extra lanes, and enhanced access management introduced by the upgrade. Overall safety has improved, while the rate of crashes and the occurrence of delays and congestion have receded to acceptable levels. As was to be expected, the system improvements have impacted the area’s rent-earning capacity by reducing travel costs in the region, and the corridors’ land-use potential has evolved in response. There is now significantly more commercial development along both streets, and denser residential land use (apartment complexes, condominiums, and townhouses) immediately adjacent to them (see Figure 5-2b). Meanwhile, the land areas between the two arterials have seen an increase in low- to moderate-density residential development.

Again, Table 4–3 observes that expressways and arterials tend to foster land values that reflect the high local and regional access they provide. Central Avenue before the upgrade had diminished capacity to offer such access—congestion and delays made travel expensive both in terms of time and convenience. Now with the improved level of service, commuters can travel longer distances in the same amount of time. As a result the land parcels adjacent to the roadway have become viable locations for myriad activities. The corridor development pattern has worked to encourage more compact and contiguous development.

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**Case analysis: I-494 corridor in the Minneapolis metro area**

The I-494 corridor in the southern portion of the
Minneapolis/St. Paul metropolitan area provides a well-documented case study of long-term growth and development along a major urban corridor where community leaders sought to promote a corridor-oriented urban form (Anderson and Stephanedes 1986). Figure 5–3 depicts the seven-mile corridor, which extends from 34th Street on the east to U.S. Highway 100 on the west.

**Figure 5–3. I-494 Corridor in the Twin Cities metropolitan area**

In the 1960s, following completion of I-494, the first round of growth included building material processing plants and construction equipment dealers, both of which served the rapidly growing southern portion of the metro area. As the corridor’s strategic value became more apparent and community leaders sought ways to exploit its potential as an economic development engine, land uses changed. Two locations were first to experience rapid increases in land values—the eastern terminus, which has good access to the international airport, and the interchange of I-494 and I-35W, the main connector to the south (i.e., to Des Moines and Kansas City). By the 1970s, the interchange housed a high rent-paying office location and a large and thriving shopping center.

By 1973, the corridor had 3.2 million square feet of office space, a little less than half the amount found in the Minneapolis central business district (Baerwald 1978, p. 315). At that time, few parcels remained vacant. In the 1980s, commercial development extended along the full length of the corridor. On the west end were located office buildings, and on the eastern end was constructed the Mall of America, the largest enclosed mall in the United States (4.2 million
Midway between the CBD and the edge of the city, a more concentrated form of development—predominantly commercial uses—is evident along the improved corridors. This commercial development is flanked by new, relatively dense multi-family housing complexes. Thus, ten years after construction, it appears that the mutually supportive link between transportation and land use is working to move the city toward its desired urban form. Macroville is taking on a star shape, with its extremities extending along its major transportation routes. The improved access has contributed into the region’s potential for agglomeration economies, hastening the conversion of land uses and concentrating development within the urban area. As a consequence, it appears that the city has avoided the dispersed land pattern that often accompanies economic growth, and that it is well positioned to achieve its long-term goals.

Thirty years after construction

The trends that were taking shape ten years after the upgrade of Central Avenue and First Street are now largely realized. The star form of the city has substantially evolved, with the densely developed arterials exhibiting a good mix of retail, office, and other commercial activity intermingled with multi-family housing. As we saw in Chapter 4, by taking into account the formative role of transportation in shaping land use, our framework treats land as a heterogeneous resource, differentiated by relative levels of accessibility. By widening the two arterials, planners in effect have
introduced an accessibility differential to the region by lowering transportation costs along the improved corridors and increasing opportunities for interaction. This differential accessibility is now reflected in the area’s land values, and hence land uses.

The CBD has maintained its preeminence as the regional center because the arterials allow easy access to it; offices are able to outbid other businesses for the most accessible (and prestigious) locations, and other highly specialized financial and corporate services have moved in. Meanwhile, the radial arterials close in to the city center offer dining and entertainment opportunities to city workers both at noon and after hours.

In general, land uses in Macroville exhibit a high degree of compatibility (see Figure 5-2c). The clusters of commercial, residential, and industrial activities work synergistically to create a dynamic and functional urban form. To accommodate the extensive movements of people and goods along the corridors, Macroville has increased public transit service. The corridor form of urban development has contributed to the kind of land uses (intense, contiguous, and mixed-use development) needed to make transit a viable option. A network of bus routes able to move passengers between the residential districts adjacent to the arterials and the CBD and other destinations will help keep traffic congestion on Central Avenue and First Street to a minimum.

**APPLICATION 3 – ACHIEVING A POLYCENTRIC FORM**

Instead of pursuing a corridor-oriented urban form, Macroville could choose a different approach to using transportation investments to manage growth. In this application scenario, we show how Macroville could develop an alternate transportation policy—one that accommodates growth and discourages unfocused development by creating a polycentric urban form.

We begin with the same circumstances as in our last scenario: Macroville is experiencing declining levels of service on its major arterials, and growth pressures portend a scattered, low-density urban form (Figure 5-4a). The city’s major roadways are marked by noncontiguous development, and there are commercial centers springing up at intersections on the urban fringe. Decision-makers once again can pursue a number of transportation and land use objectives—to relieve congestion on radial routes, offer intra-urban connections between residential and commercial districts, and attract new, higher-density development. In this case, however, the city decides it can best meet its goals by channeling growth into a series of specialized nodes, while maintaining the CBD’s preeminence as the dominant employment center. It seeks to encourage a polycentric urban form through the selective provision of access. A
KEY OBJECTIVE IS TO MINIMIZE LONGER COMMUTES AND OTHER JOURNEYS (I.E., TRAVELING FROM ONE POINT ON THE URBAN FRINGE TO ANOTHER ACROSS TOWN). WHILE PROVIDING FUNCTIONAL SPECIALIZATION, THE CENTERS WILL ALSO ENABLE METRO AREA RESIDENTS TO TRAVEL SHORTER DISTANCES TO WORK, SHOP, OR BE ENTERTAINED.

WITH THIS DEVELOPMENTAL GOAL IN MIND, MACROVILLE’S PLANNERS IDENTIFY THE TRANSPORTATION SYSTEM BEST ABLE TO FOSTER THIS POLYCENTRIC TYPE OF URBAN FORM. FREEWAYS OFFER THE WIDEST SPECTRUM OF CHOICES, ALLOWING CONTROLLED ACCESS THROUGH THE STRATEGIC PLACEMENT OF INTERCHANGES. AS WE SAW IN CHAPTER 4, INTERCHANGES ALTER THE ACCESSIBILITY OF THE LAND IN THEIR VICINITY, SIGNIFICANTLY INCREASING THE REGIONAL ACCESS OF AN AREA AS THEY CONNECT WITH LOCAL STREETS AND ARTERIALS.

BY SUBSTANTIALLY INCREASING THE REGIONAL ACCESS OF DESIGNATED LOCATIONS (INTERCHANGES OF FREEWAYS AND ARTERIALS), TRANSPORTATION SERVES TO STRENGTHEN THE ECONOMIC INFLUENCE OF THESE LOCATIONS. DUE TO AN ENLARGED MARKET AREA, THE THRESHOLD FOR EVEN
very specialized goods or services is more likely to be met in the largest centers. The key point here is that by differentiating access within it, Macroville can be encouraged to evolve into a hierarchy of regional hubs. The smallest of these centers will provide services of the lowest order—for example, grocery stores and retailers of other items needed on a daily basis—and will serve only a small, local market area. Second-order centers will offer a higher level of services—shopping, employment, and education—and will encompass a number of lower-order centers in their market area. Finally, the largest centers will supply the entire metro area with specialized services such as cultural opportunities, unique retail stores, and financial and legal services. Thus, the higher the
Position of a center in the hierarchy, the larger the area it serves; with the appropriate level of accessibility, the CBD can remain the dominant center. Also, because development is a consequence, not a cause, of greater accessibility, freeways and interchanges, when properly connected with other facilities, provide fertile ground for the emergence of urban centers.

Based on a desire for a polycentric urban form, Macroville adopts a comprehensive plan that includes construction of two major circumferential freeway segments to strategically connect components of its urban system. The new facilities will first skirt the northeast and northwest quadrants of the city, and later, a southern loop will be added. These freeway segments will work to promote, maintain, and concentrate economic growth that is consistent with the community’s long-term developmental goals. Freeway location and interchange spacing, in tandem with the local market conditions and development potentials, are powerful influences affecting land use and urban development.

**Higher densities can mean fewer auto trips**

A considerable amount of research (e.g., Steiner 1994; Boarnet and Haughwout 2000) indicates that higher urban density correlates with fewer auto trips. In fact, Dunphy and Fisher (1996, p.95) concluded that a doubling of residential density results in an approximate reduction of ten to 15 percent in per-capita driving mileages. Thus, if urban centers are developed with moderate densities and mixed land uses, less internal auto travel will tend to occur within them. To the extent that the centers are relatively self contained, fewer trips between them also will take place.

**Ten years after implementation**

The northern segments of the freeway are complete and have reduced congestion on the radials significantly (see Figure 5–48). Commuters and other travelers making non-downtown-oriented trips can now quickly and easily access destinations in outlying areas. Before the new freeways were constructed, the eastern and western extremities of Central Avenue and the northern tip of First Street had reasonably good local access but only low to moderate regional access. The new freeways now afford a high level of regional access to these areas, and as a result, businesses and other higher-order commercial activities have begun to compete for land parcels in the
area. Table 4–4 (p. 46) indicates that when freeways and interchanges are combined with arterials and with residential streets, the broadest range of land uses become possible—business offices, shopping, and manufacturing centers, and multi-family and single-family housing. High-volume interchanges, like those created when freeways link with major arterials and CBD streets, offer the highest potential for agglomeration economies.

Now that a freeway intersects with Central Avenue, a cluster of economic activity has started to form at its eastern end. Office buildings and retail centers are locating in what was already a growing suburban commercial area. These activities have raised the commercial value of the land in this area, which has been reflected in the development of some multi-family housing along the southeast section of the node. Likewise, at the western tip of Central Avenue, the original commercial development has expanded along the new freeway. These activities have raised land values along Central Avenue, and in response, the small segment of single-family housing on the south side of the arterial has been converted to apartment complexes. This new residential development promotes a viable jobs-housing balance, given the area’s new and anticipated commercial expansion.

Ten years after implementation of Macroville’s comprehensive plan, there has been considerable progress toward the goal of creating a polycentric urban form. Freeways have connected three of the metro area’s suburban activity centers; these new freeways offer efficient routes to those making non-downtown-oriented trips, leaving the major arterials free to serve the CBD. Development has concentrated around the new interchanges, with the influx of regional access transforming what were small suburban centers into higher-order commercial centers. The dispersal of activity away from the CBD has thus been systematic, and the evolution of subcenters has improved rather than undermined its viability as the preeminent commercial hub.

Thirty years after implementation

A freeway loop around Macroville is now complete (see Figure 5–4c). The resulting network of roads has the capacity to keep the city’s traffic moving smoothly and to accommodate future growth. The stage has been set for the metropolitan area to develop a polycentric form—several enhanced-value land markets have evolved, centered at the various transportation system nodes. The size and spread of these centers in large part reflect the extent to which each area’s transportation resources provide regional and local access. In Macroville, interchanges at radial arterials converging on the CBD have become focal points of suburban activity.
Macroville’s CBD remains the metro area’s preeminent employment and cultural center; it has enjoyed considerable growth over the past 30 years. The new freeway links, by diverting intra-urban traffic, have served to reduce congestion on arterials to the CBD, and the resulting increase in access has encouraged development along First Street close to the downtown. Of course, land values have risen in tandem with the development potential. Growth in the city’s subcenters has enabled them to exert a gravitational pull on commercial development. Because of the limited local access afforded by the freeway segments (due to widely spaced interchanges and lack of feeder roads), commercial development along the freeways has been discouraged. Land prices adjacent to the freeways have not risen markedly, making these locations attractive for single-family residential development.

The direct influence of local access on development potential is highlighted at the two sites where the freeways intersect with arterials. The potential for agglomeration economies at these locations initially was quite low, but increased access has proven attractive to lower-order businesses that value high regional access. Meanwhile, on the southern loop, the intersection of the new freeways with First Street has similarly worked to alter the development potential of the area. Here noise and an industrial character work to keep land prices relatively low, but good regional access makes this site a favorable location for plants and warehouses.

**Case analysis: Polycentric development in the Atlanta metro area**

Atlanta’s combination of radial and circumferential freeways has created a series of nodes that are highly conducive to the development of activity centers. As some of these centers have become substantial, the metropolitan area has moved closer to a polycentric urban form. One regional node is Perimeter Center, located 12 miles north of downtown Atlanta at the interchange of I-285 and the Georgia 400 freeway (see Figure 5-5). Due to its particularly high regional access, Perimeter Center began developing as a regional retail node soon after the circumferential I-285 was completed. As the region’s economy grew, Perimeter Center became a desirable place for office buildings and corporate headquarters. By the 1980s, office development began to replace nearby retail and residential land uses, as developers of taller office buildings began to out-bid those wishing to use the land for other purposes.
As agglomeration economies at this location became stronger in the 1980s, Perimeter Center became one of the most sought after locations for corporate headquarters in the Atlanta metropolitan area. Cervero (1988a, p. 69) reported that no location in the metro area had as many national and regional offices of Fortune 500 firms. At the time he wrote, there were over 17-million square feet of office space in a two-square-mile area surrounding the interchange of I-285 and the Georgia 400 freeway.

Once Perimeter Center had developed into a major center, businesses began looking for other nodes that could provide similar regional access, but at a lower land price. Other major interchanges have offered this regional access, but have varied in terms of the level of agglomeration economies they facilitate. As Figure 5–5 indicates, today the Atlanta metropolitan region is home to about 20 established activity centers, and several more are emerging, producing a polycentric urban form. The hope is that these centers will lead to a jobs-housing balance that will require fewer
VEHICLE TRIPS, ESPECIALLY LONG COMMUTES, AND HENCE LESS PEAK-HOUR TRAFFIC CONGESTION. PRELIMINARY DATA SUGGEST THAT THE EXISTENCE OF A RETAIL COMPONENT IN AN OFFICE COMPLEX AT THE CENTER HAS REDUCED VEHICLE-TRIP RATES BY EMPLOYEES BY ABOUT EIGHT PERCENT (CERVERO 1996, P. 362).

ATLANTA IS A GOOD EXAMPLE OF AN EMERGING POLYCENTRIC URBAN FORM THAT HAS BEEN FOSTERED IN LARGE MEASURE BY URBAN FREEWAYS. THE HOPE IS THAT THE JOBS/HOUSING BALANCE A SERIES OF ACTIVITY CENTERS CAN FACILITATE WILL CONTRIBUTE TO SHORTER COMMUTE TRIPS AND LESS TRAFFIC CONGESTION THAN OTHERWISE WOULD OCCUR. IN THE INTEREST OF SUPPORTING ECONOMIC GROWTH, THE FREEWAY SYSTEM IS DESIGNED TO ENABLE EFFICIENT MOVEMENT BETWEEN ACTIVITY CENTERS. THE REAL CHALLENGE WILL BE FOR KEY FRE ways CONNECTORS TO EFFECTIVELY HANDLE THE HIGH LEVELS OF INTER-CENTER TRAFFIC THAT WILL ENSUE IF REGIONAL GROWTH PROJECTIONS PROVE ACCURATE (I-285 ALREADY CARRIES UP TO 250,000 VEHICLES PER DAY) (ATLANTA REGIONAL COMMISSION 2000A, P. 6–14).

FINALLY, DEVELOPMENT AT THE CITY’S OTHER TWO MAJOR CENTERS HAS PROCEEDED. THE NODE AT THE NORTHERN TIP OF FIRST STREET HAS BURGEONED TO BECOME A SIGNIFICANT EMPLOYMENT CENTER IN ITS OWN RIGHT. THE LAND USE PATTERN IN ITS VICINITY NOW SHOWS A GOOD MIX OF MULTI- AND SINGLE-FAMILY RESIDENTIAL DEVELOPMENT, AND COMMERCIAL ACTIVITIES ARE LOCATING ALONG THE ARTERIAL IN BOTH DIRECTIONS. IT IS LIKELY THAT IN THE NEAR FUTURE, INFILL DEVELOPMENT WILL CLOSE THE GAP ON FIRST STREET BETWEEN THIS CENTER AND THE URBAN CORE. THE CENTER AT THE WESTERN END OF CENTRAL AVENUE HAS EXHIBITED SLIGHTLY LESS GROWTH, BUT COMMERCIAL GROWTH ACROSS THE FREEWAY FROM THE ORIGINAL CLUSTER IS OCCURRING, RAISING LAND PRICES AND GROWTH POTENTIAL IN THE AREA.

AS IN OUR LAST EXAMPLE, LAND USES IN MACROVILLE EXHIBIT A HIGH DEGREE OF COMPATIBILITY BECAUSE PLANNERS HAVE TAKEN ADVANTAGE OF LOCAL ECONOMIC OPPORTUNITIES TO SYSTEMATICALLY DISTRIBUTE DEVELOPMENT IN SUCH A WAY AS TO ENCOURAGE A POLYCENTRIC URBAN FORM. THROUGH THE CONSTRUCTION OF NEW FREEWAYS AND THE STRATEGIC LOCATION OF INTERCHANGES, THE CITY HAS BEEN ABLE TO MINIMIZE DEVELOPMENTAL CONFLICTS, WITH EXISTING ACTIVITIES IN THE ORIGINAL SUBURBAN COMMERCIAL AREAS GROWING STEADILY. MACROVILLE’S EVOLVING URBAN FORM, WITH ITS HIERARCHY OF COMMERCIAL CENTERS, HAS FACILITATED THE ATTAINMENT OF THE CITY’S ORIGINAL GOALS OF PROMOTING ECONOMIC ACTIVITY IN THE SUBURBS, MAINTAINING DOWNTOWN VITALITY, AND FOSTERING JOBS-HOUSING BALANCE, WHILE AT THE SAME TIME ENABLING ITS TRANSPORTATION SYSTEM TO FUNCTION EFFECTIVELY.
Incentives to encourage polycentric development

Cervero (1988b) suggested several practical ways to augment the effects of transportation investments in encouraging the development of activity centers at strategic locations, such as at freeway interchanges, so as to reduce longer-distance travel within the metro area. These suggestions include:

- Conditional zoning—allowing a new office project only if it is located within a specified radius of a high-density residential area or retail complex;
- Incentive zoning—allowing a certain number of additional square feet of office space for every square foot of retail space the developer provides;
- Tax concessions—because mixed-use activity centers tend to place less of a burden on infrastructure and can reduce vehicle miles traveled (VMT), property tax credits can be granted to developers who diversify the activities contained in their projects; and
- Performance standards—prior to formally applying for a construction permit, a developer can be informed of how many trip ends the project will be allotted at some point in time, thus creating an incentive to mix land uses to include housing and other uses that attract fewer trips.

Conclusion

We have presented three simplified scenarios to demonstrate the fundamental ways in which local transportation investment policy can promote the land use patterns, and ultimately, urban form, that a community prefers. These scenarios illustrate how the basic framework developed in this monograph might be used to predict the potential impact of transportation decisions on land use. Land use activities (which represent the demand for access) and transportation facilities (which facilitate its supply) could be stratified into even finer components using the same theoretical rationale.

How much difference can well-coordinated transportation investments, coupled with appropriate land use incentive and controls, make in urban form? Figure 5–6 depicts land value surfaces for our hypothesized metro area of Macroville 30 years after adopting the corridor or, alternatively, the polycentric development strategy. The figure shows how the urban form that has
EMERGED VARIED QUITE DRAMATICALLY BETWEEN THE TWO STRATEGIES. WE DO NOT CONTENT THAT ONE STRATEGY IS NECESSARILY PREFERABLE TO THE OTHER. OUR OBJECTIVE IS TO DEMONSTRATE THAT IF A COMMUNITY CONSCIOUSLY SELECTS A PARTICULAR DEVELOPMENTAL STRATEGY, COORDINATED TRANSPORTATION AND LAND USE POLICIES CAN MAKE A MAJOR DIFFERENCE.

THE THREE APPLICATIONS PRESENTED IN THIS CHAPTER DIFFER IN THE WAY THEY ACCOMMODATE GROWTH, NOT IN THE EXTENT AND SCOPE OF THIS GROWTH. IN EACH CASE, THE COMMUNITY BEGAN WITH A TYPICAL URBAN-POLICY QUESTION: HOW CAN A BYPASS BE MADE TO ADVANCE LOCAL DEVELOPMENTAL OBJECTIVES; HOW CAN WE INCREASE THE DENSITY OF DEVELOPMENT ALONG DESIGNATED CORRIDORS; OR, HOW DO WE PROMOTE THE EMERGENCE OF CENTERS OUTSIDE THE URBAN CORE? IN THE USE OF TRANSPORTATION INVESTMENTS AS A LAND USE POLICY TOOL, THE APPLICATIONS HAVE ILLUSTRATED THE MUTUALLY SUPPORTIVE LINK BETWEEN LAND MARKETS, COMPREHENSIVE PLANNING, AND TRANSPORTATION MANAGEMENT TO FOSTER DESIRED URBAN FORM.

A Corridor scenario

B Polycentric scenario

Figure 5–6. Land-value surfaces of the corridor and polycentric application scenarios
CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

A broad commentary has decried the low-density, sprawling urban form that has been evolving in many cities within the United States during the past half century. To lead toward a more desirable urban form, a variety of policy remedies have been advanced, including increased reliance on non-motorized transportation, congestion pricing, more compact “new urbanism” residential land development, and greater use of public transit. The evidence to date suggests that taken alone, no single strategy has any real likelihood of achieving the type of urban form that the commentators maintain is in the public interest. Almost certainly, creating livable cities out of growing communities will require a mix of complementary strategies. One key strategy is likely to be using transportation investments to help shape urban development.

This monograph has sought to explore the economic connection between transportation investments and land use patterns—and thus urban form. We offer a framework for addressing two interrelated policy issues: (1) how future land use patterns would be affected if a particular transportation project were to be carried out and (2) what types of transportation investments should be made if a specific type of urban form is desired. The framework we present probably would be best able to predict these effects in the case of a small-to-medium-sized community that is growing at a steady pace. Larger metropolitan areas with growing perimeters also can use the framework to help guide development patterns in these districts. Changing the urban form of already developed cities is a much more difficult prospect, and must be pursued over the long term as capital stock (e.g., buildings and infrastructure) ages and is replaced. Even in these cases, however, at least marginal changes in land use can be encouraged by selective transportation investments.

The land markets of most cities are constantly in flux as accessibility patterns, public preferences, and local economies change; transportation investments always are an influencing factor in these markets.

The framework we present is rooted in urban land rent theory, which suggests that changing the relative accessibility of land parcels will in turn change their relative value. Land that is accessible lowers the transportation costs of activities that occur on it, and these costs are an important component of businesses’
expenses. Lower costs mean that the potential exists for higher profits; thus the land becomes more valuable. Comparatively valuable land tends to be used intensively because its owners want to pack as much economic activity as possible onto it. Also, the types of land uses best able to afford and benefit from different land parcels having varying degrees of accessibility will tend to outbid other uses for these parcels. It follows that by changing the relative accessibility of land parcels, it is possible to influence the type and intensity of use that will occur on them.

We are careful to acknowledge that relative accessibility is by no means the only force affecting the way in which land use patterns emerge. Land use controls (such as zoning), infrastructure investments (including sewer, water, schools, and other public facilities), physical attributes (especially topography and water features), the nature and strength of the local economy, and local political factors intermingle to substantially influence urban form. Thus, the effects of transportation investments should not be viewed in isolation, but rather as a major force influencing land markets that together with these other elements can greatly alter the way a community evolves. If the community’s decision-makers, stakeholders, and residents have a clear idea of how they want their community to develop, transportation investments can be very helpful in making their wishes a reality.

Below we recapitulate the primary conclusions of the preceding chapters. Then we offer a series of recommendations for maximizing the ability of transportation investments to influence urban form.

CONCLUSIONS

Ten principal conclusions drawn from the preceding chapters follow:

1) Accessibility and land values go hand in hand. Locations within a city with the best accessibility to and from other parts of the city and surrounding region will have the greatest value.

2) Agglomeration economies invite clustering of similar and mutually supporting activities. By sharing customers, suppliers, and necessary services, businesses can enjoy substantial cost advantages.

3) Land uses compete for the most accessible locations, and those that are able to use the land most intensively usually win out. By using relatively little land per unit of output, these uses can afford to pay more per square foot of land.

4) Urban centers often evolve in an observable hierarchy ranging from (a) larger centers that serve a wider, regional area and often provide more specialized goods and services to (b) lesser
centers that serve smaller areas and offer less specialized goods and services.

5) By mixing offices that employ many workers, commercial and retail activities, and residential development, it is possible to greatly reduce average vehicle trip lengths and congestion.

6) Transportation investments can be an effective tool for selectively varying the level and nature of accessibility (local and regional) and therefore the emerging urban form of a city.

7) Both the corridor or star-shaped urban form and the polycentric urban form can be encouraged by carefully-planned transportation investments. The key is to consciously vary relative accessibility via these investments.

8) In addition to land use controls and infrastructure policies, the transportation-land use connection is influenced by:
   - the strength of the local economy and the resulting growth rate;
   - federal policies and mandates affecting transportation investment options;
   - physical circumstances in the community, such as topography and regional location; and
   - local attitudes and preferences regarding growth, fiscal policy, the environment, and other relevant issues.

9) The urban land market forces brought about by transportation investments are most effective when other public policies affecting development are consistent with these forces.

10) It is feasible and generally good practice to relate specific transportation investments to the particular accessibility needs of land uses that are desired in each location, according to the community's adopted comprehensive plan.

Recommendations

The foregoing conclusions lead us to make five key recommendations when considering alternative transportation investments.

1) When making transportation investments, the influence these investments will have on emerging land use patterns should be acknowledged and fully considered. The question always should be asked as to whether the magnitude and nature of accessibility to various locations that would result is desirable. A related question is whether the changes to the transportation system, and thereby to relative accessibility, will contribute to preferred land use patterns. A third question that needs to be
asked is whether land availability and economic circumstances are such as to allow the transportation investment to make the desired contribution.

2) Municipalities within a metropolitan area should work toward a shared a vision for the future in terms of: a general type of development plan; the juxtaposition of employment and commercial centers relative to residential land uses; and, the density of land use.

3) Transportation projects and land use controls should always be in concert. Transportation projects alter patterns of accessibility, and land markets can either create synergy or interference. Land use controls must support the same general urban form as the transportation projects that the community selects. Appropriate allocations of space by land use type will help avoid unwanted mixtures of activities.

4) Transportation projects should follow a consistent capital improvement program. It is reasonable to mix corridor and polycentric designs in different parts of the metropolitan area. The rate of facility construction must be consistent with growth policies and economic conditions. Provision of other infrastructure should be timed to be consistent with the construction of transportation facilities.

5) Roadway investments should be considered in tandem with other options for bringing about the desired relative accessibility, and thus urban form. In most cases, regional accessibility should be considered in parallel with local accessibility, recognizing that different types of investments may be called for to achieve each type of accessibility. Local accessibility can affect business viability, and non-motorized alternatives should be given careful consideration as means for improving it. Transit access, the ability of pedestrians and bicyclists to move about, and the integrity of residential neighborhoods are important aspects of quality of life and should be taken into account whenever transportation investments are being contemplated.

The last point may be the most important. Ultimately, the reason we argue for using transportation investments as a lever for achieving the type of urban form a community desires is that doing so can improve the quality of life within that community. We have stressed that communities vary in terms of the land use patterns they may prefer, and hence the types of transportation investments that are right for them. Fully taking such preferences into account must go hand in hand with traditional analyses (such as travel time between traffic analysis zones) when planning transportation projects. Transportation facilities greatly affect the urban living
ENVIRONMENT, AND GUIDING THE COMMUNITY TOWARD THE URBAN FORM ITS RESIDENTS WANT IS A VITAL STEP TOWARD ENHANCING THEIR QUALITY OF LIFE.
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