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AN ANALYSIS OF THE CAUSES AND CONSEQUENCES
OF URBAN SPRAWL IN THE LAS VEGAS VALLEY

by

Robert Schmidt

Bachelor of Arts
University of Nevada, Las Vegas
1995

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A dissertation submitted in partial fulfillment
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in

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ABSTRACT

An Analysis
Of the Causes and Consequences
of Urban Sprawl on the Las Vegas Valley

by

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Sprawl, as an urban form, has been vociferously attacked by some social scientists as an inefficient and ineffective form urban form which contributes (if not directly causes) to a variety of social ills, it has been embraced by other social scientists as a positive force in today's urban form. This paper examines the two major theoretical approaches to the causes and consequences of sprawl by conducting a case study of the impact of sprawl on the Las Vegas community. The validity of the major arguments for and against sprawl will be evaluated in the context of the empirical evidence available today. The research should prove valuable in assisting local officials in developing land-use and social policy.
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CHAPTER 1

THEORETICAL BACKGROUND

Nowhere may there be more science in the service of ideology as there is in the "scientific" discussion of "sprawl." Utilizing a diverse set of quantitative and qualitative methods and operating under the auspices of "scientific analysis," scholars of numerous disciplines have presented arguments for and against sprawl. Proponents of sprawl argue for "freedom of choice" and "property rights", while sprawl opponents use arguments laced with "environmental protection" and "racial equality." Understanding sprawl and its possible causes and consequences requires a clearer understanding of the assumptions, values, propositions and underlying urban economic and geographical theories which create the arguments for and against sprawl.

The traditional approach to urban economics and geography which has emerged since World War II takes for its organizing concepts certain statistical regularities regarding city size, function, and spatial organization which have been observed for many years. These include Walter Christallers' central place theory, first proposed in 1933, George Zipf's rank-size rule, presented in 1949, and Colin Clark's negative exponential density relationship, circa 1950 (Christaller 1966; Singer 1936; Clark 1951). These properties, expressing descriptively the distributional characteristics of population, were combined with
the postwar, neoclassical economic analysis of location in two separate but related ways. On one hand, the economics of location combined with Clark's distance-density ratio to articulate a two-dimensional analysis of intraurban spatial deployment which was dependent upon transport cost considerations (Alonso 1964; Wingo 1961; Muth 1969). On the other, this essentially horizontal view of economic spatial organization has been modified over the years to include non-economic considerations, but only in a limited way (Mills 1972; Bourne 1971; Chapin and Weiss 1962; Goodall 1972).

Three limitations of traditional socio-economic models of urban form should be mentioned at this time. First, virtually every mainstream approach to urban land use follows Von Thunen by hypothesizing the primal role of the historical city center in organizing urban space. In recent years attempts have been made to overcome this limitation, because evidence exists that Von Thunen's model may not even explain the use of agricultural land under modern conditions of urbanization (Sinclair 1967). Second, there is a core reliance in conventional economic thought on the importance of technology, especially in terms of communication and transportation costs, in determining changes in the value of land. This principle has also been attacked from within the mainstream tradition in a limited way (Leven 1978). Finally, conventional approaches ignore the most fundamental aspect of land value: its social nature. Conventional thought subscribes to an equilibrium theory, which assumes the absence of externalities. Considering the complex, dense nature of urban life, this has always been an unreasonable assumption.
The problem of externalities was also recently addressed by traditionalists within the context of attempting to understand urban growth problems (Bourne 1971). Again this discussion was limited in its analysis and implications. In short, two observations can be made about traditional views of sprawl in urban science at this time: (1) There is ample evidence from within this tradition to cause one to question its explanatory paradigm, and (2) although traditionalists address these shortcomings, they do so in limited ways.

The evidence suggests that around 1960 a significant change in the social formation of U.S. society began to manifest itself materially in settlement space. This does not necessarily mean that such changes occurred that year. In fact, it is presently apparent that qualitative transformations in the structure of American society have been occurring since the late nineteenth century, although these accelerated their impact after World War. Three major transformations of capitalism have occurred.

In the first transformation we have witnessed was the rise of the corporate-bureaucratic form, which has brought American business enterprise under the domination of multi-product, multi-plant, multinational corporations (Chandler 1977; Holland 1976; Hymer 1979). This change is characterized by the global integration of the capitalist system, by an international division of labor (Frobel, Heinrichs, and Kreye 1980) and finance, and by the growing concentration of industry, exemplified by the increased frequency of business and banking mergers since 1950 (Zeitlin 1970; Heilbroner 1965; Minty and Cohen 1972; Wallerstein 1979; Baumol 1959; Berle and Means 1932; Means
The second transformation involves the structural role of the interventionist state as an everyday participant in economic activity and as a supporter of capitalist relations of production through spending, regulatory, and legislative policies. The perception of this change has evolved from early work on the Keynesian connection to present-day analyses of the fiscal crisis and the socialization of capital (Lerner 1944; Klein 1947; Dillard 1948; Crosser 1960; Baran and Sweezy 1966; Mandel 1975, Castells 1980; O'Connor 1973; Hirsch 1981; Holloway and Picciotto 1979; Crouch 1979).

The third transformation concerns the rise in importance of knowledge and technology as organized forces of production in capital-intensive enterprise. On the one hand, studies in this area point to the organized and accelerated way in which a knowledge "industry" is now articulated with economic activity (Rosenberg 1972; Silk 1960; Mansfield 1968; Mandel 1975). On the other hand, this transformation has been assessed as altering the economic structure itself, especially by shifting labor force needs to white-collar jobs and information processing and away from blue-collar, manual laborers (Carter 1970; Gillman 1957; Poulantzas 1976; Bock and Dunlop 1970, Fuchs 1968; Singelmann 1977; Braverman 1974; Blau and Duncan 1967; Gartner and Reissman 1974).

These fundamental transformations have affected spatial morphology in a variety of ways, including the promotion of suburbanization (Walker 1981;
Gottdiener 1977), the transformation of agriculture into agribusiness (Hightower 1975; Shover 1976); the rise of the inter-regional shift to the sunbelt (Stemlieb and Hughes 1975; Watkins and Perry 1977); and the restructuring of the central city environment Smith 1984). It is the last two aspects that I will address at this time.

The mainstream ideological position can be summed up by an early observation of Robert Park's: "The city is an externally organized unit in space produced by laws of its own" (Park, Burgess, and McKenzie 1925:4). The social production of space (Lefebvre 1974) perspective which I utilize rejects this view and seeks to replace it with an understanding of the ways in which settlement space forms are structured by forces from the larger system of social organization. There are other key interactive processes with purely local origins that play themselves out within urban environments, and it is equally important to appreciate their role in generating socio-spatial patterns. These, however, are produced by needs that have little to do with places as such and are more affected by the systemic processes operating everywhere—that is, in rural and suburban as well as urban environments.

Sprawl and deconcentration are often inter-related. Conventional analysts explain deconcentration by following the implications of the ecological model. Accordingly, early deconcentration occurred because the use of commuter railways in cities and, later, the automobile promoted the separation of residence from work and also from shops. This in turn led to the spatial differentiation of the city in terms of economic and cultural functions. Territorial displacement of
the relatively wealthy, due to the ease of commutation between jobs and residences, resulted in income segregation between the poorer stratum of the population, who remained near the city center, and the more affluent, who moved to the outer reaches of the metropolis. This then led to a functional reorganization of the cities and towns within the region.

Following the work of Gras (1922) and McKenzie (1933), urban ecologists sought to analyze the expansion of the metropolitan region primarily in terms of population migration. The hallmark of such work is that it attempts to fix the shift in the demographic center of gravity from the central city to the suburbs around the 1920s, that is, during the decade when widespread use of the automobile became a reality in the United States (Hawley 1956; Thompson 1947; Schnore 1957). As Berry and Kasarda have indicated, this early work failed to correct for the ability of cities to annex their suburban areas, thus hiding suburbanization which took place at an earlier time (1977:162).

Following the techniques devised by Schnore (1962), recent studies have attempted to correct for annexation. Subsequent analysis which controls for this effect indicates that centrifugal dispersal of the population has been occurring since at least the turn of the century, that is, well before the mass production of the automobile. As Berry and Kasarda note, "When the distribution of population increase is adjusted for annexation, however, faster rates of growth in the suburban ring are shown to have occurred in every decade since 1900 for every regional grouping" (1977:186). A more enlightened ecological analysis of the data which control for annexation revealed that only since the 1920s and
1930s have the suburbs gained population in an absolute way when compared to cities. Prior to that period, the suburbanization that occurred was hidden from researchers by the ability of cities to enlarge their own political boundaries. This implies that, while technology may still prove to be one explanatory factor, ecologists have always had reason to doubt their own paradigm and look beyond it for important variables in the production of urban form.

A second measure of the alleged effect of the automobile, said by Hawley to have occurred since 1920, is deconcentration, or the progressive lowering of population density across the metropolitan region, especially within the central city (1981:61). According to Berry and Kasarda again, however, "Not until the 1950 decade do density reductions appear for any age cohorts of central cities" (1977:191). Since these density reductions are restricted primarily to the older cities, short-distance technology cannot be the cause of deconcentration. The ecological theory of metropolitan expansion also fails to explain the source and causes of population influx to central cities, which had to have sustained their densities during the decades since 1920, when suburbanization accelerated.

As all urban historians know, many more millions of people passed through our metropolises than is revealed by a static look at the total population of these centers. Since World War II, for example, there has been an extraordinary population exchange between whites and such minority groups as blacks within central city borders. Much of the urban restructuring brought about by the changes in the types of people living in central cities has been ignored by most scholars, except through static, descriptive analyses of census data.
According to many authors, such movement—like sprawl—can be explained by the exercise of preference, which creates a market demand. Berry and Gillard (1977) cite popular preference for small towns and lower urban densities as causing population change. They fail to discuss, however, involuntary pressures such as government policies, corporate restructuring, job relocations, and the like, which have shaped the preferences of people to move despite a desire to remain where they originally lived.

In short, the restructuring of metropolitan regions involves forces and modes of social change more complex than the few causal factors considered by ecological theory. This approach also displays a certain insensitivity to the social costs produced by uncoordinated urban restructuring. In fact, as the material from Berry and Kasarda suggests, the traditional explanation of deconcentration in terms of ecological theory has always been extremely weak, even according to its own research results.

The heightened interest in “urban sprawl” is in large part a convergence of two other evolving public concerns. One, a concern with the quality of the natural environment—the quality of air, water, land, wilderness areas, and other resources. The other is a concern with the development of our urban communities—with all the matters coming under the rubric of more traditional city planning, but recently refocused to a special concern for the human beings in the city. The quality of life of all the people who are clustering into urban communities is clearly influenced by what happens to both the natural and man-made environments in direct relationship with each other.
For many years social scientists have attempted to model the spatial structure of cities, and more recently their evolving form. These models incorporate the common forces and trends which are affecting all cities, including population growth, urbanization, and counter-urbanization, changing household size, class differences, increasing affluence, the evolving economic structure, and improving communications. However, it is not to be expected that these general trends will be seen in their pure form in every city, since the background or context for the operation of these common forces will be different.

Communities rarely operate on a uniform plane, but with a particular physical geography, economic structure, rank in the urban system, proximity to other urban centers, existence or otherwise of historic areas and favored residential districts, cultural predispositions, ethnic compositions and levels of income and material progress. Of importance also is the form of government and the extent of public intervention in the planning of the community including policies towards growth, economic development, housing and transportation. These considerations will vary from community to community.

This study is limited to the Las Vegas Valley with a special emphasis on the City of Las Vegas. Analytical models developed by the proponents and opponents of sprawl inform this study. Models provide a guide to the general forces affecting cities rather than a blueprint for their spatial structure.

Since many of these models emanated from studies of Eastern and Midwestern American cities they provoke strong reactions from, both proponents of sprawl and residents of Southwestern communities, who argue that cities of
the American Southwest are unusual due to the influence of environmental, economic and historical factors (Burtenshaw 1991). And among Southwestern communities, Las Vegas is particularly unique. Despite being stigmatized by its main industry, it has grown to a metropolis of over 1,000,000 residents. While the city has many of the attendant problems of high-growth metropolitan sunbelt communities, it processes over 35,000,000 visitors every year. It has been, and continues to be, a highly segregated community. The majority of the "open space" is managed by the federal government.
CHAPTER 2

INTRODUCTION

This sprawl implications study is intended to examine the theoretical underpinnings of the arguments for and against sprawl development, using the Las Vegas Valley as a case study. Additionally, this study is also intended to aid elected officials, their staff members, and concerned citizens of the valley in assessing the probable consequences of continued sprawl within the metropolitan area on the City of Las Vegas. Chapter 1 of this text provides the reader with a broad theoretical background on sprawl. The general context within which sprawl is argued both economically and sociologically are reviewed in this section.

In chapter 2 of this text I provide an outline of this study, which consists of (1) a discussion of the definitions of sprawl; (2) situating the Las Vegas community; and (3) an introduction of vital considerations and assumptions critical in evaluating the implications of sprawl on the quality of life within the Las Vegas Valley.

Chapter 3 provides a framework of the major theoretical arguments that either justify or condemn the spread of sprawl in urban America. Chapter 4 provides a brief history of development and growth in Las Vegas.

This section includes a brief social and economic history of the area and
an overview of major land use trends. Chapter 5 reviews the historical and current trends in urban densities, zoning and land use.

Chapter 6 analyzes the relationship between growth and sprawl on the social well-being of Las Vegas residents, the relationships of those residents to each other and to their governments, and the general residential land use patterns created by the style in which residential consumers choose to live.

Chapter 7 analyzes the effects of sprawl on the natural environment of the Las Vegas area: the status of its natural inhabitants, air quality, and the availability and conservation of the local water supplies.

Chapter 8 examines the impact of the transportation system on sprawl. Due to the significant arguments concerning the alleged impacts of sprawl on public transportation, this chapter is lengthy and complex.

Chapter 9 considers the impact of sprawl on the community's infrastructure expenses. The chapter focuses on (1) transportation, (2) water availability and use, (3) wastewater and flood control, and (4) schools.

The final chapter summarize the findings and describes policy options for the future. This chapter examines the different methods used to manage sprawl, and the different consequences they are likely to yield. The section also discusses the legal and political constraints under which the City of Las Vegas, as one member of the valley's various governments, must determine its land use patterns and enable city policy-makers to achieve their goals.
Sprawl Controversies

The term "sprawl" generates controversy among many urban planners and social scientists. Some consider the term derogatory and too critical of current land use patterns, maintaining that the spread of residential subdivisions reflects the desires of consumers. They see efforts to provide higher density housing as a strategy that has been rejected by most households. Surveys cited by proponents of sprawl development indicate that 70% to 80% of Americans express a strong preference for owning a single-family home. Other surveys show that most Americans, regardless of where they now live, at least claim to prefer living in small towns, rural areas, and suburbs rather than larger central cities. Urban planners and other professionals, according to this argument, should not be allowed to impose housing standard on residential consumers.

The urbanization of cities is also seen by many urban analysts as a manifestation of technological forces. Urban ecologist W. Parker Frisbie argues that deconcentration of population and industry occurred as new technology led to assembly-line techniques and improvements in intramural transportation allowed easy accessibility to all parts of the city.

Some urban researchers and policy analysts also argue that sprawl development patterns are inherently problematic. Urban America in the Eighties, for example, states that the landscape of older cities is technologically obsolete. Poly-centered (sprawl) landscape provides better support for modern technologies associated with an auto-centered transportation system and improved communications. The report suggests that low-density suburban
residential growth increases energy consumption by only three percent relative to higher-density construction practices, and may even reduce the per capita exposure to pollution since people are more spread out. The report also maintains that suburbanization provides better housing opportunities to the central-city poor.

These commonplace views assume that consumers were free to choose from several residential alternatives, that their choices reflect real preferences, and that their preferences were the independent factor in suburbanization. Suburbs can offer an escape from the city, and sometimes do provide better housing for the money. Given the lower costs of land on the urban fringe, more houses continue to be built there than elsewhere. In some communities it may be the case that sprawl is an appropriate reaction to the problems posed by environmental restrictions, rising construction costs, energy issues, and housing affordability. But what is missing in the current literature is an empirical analysis of the organizational and institutional implications of sprawl and its impact on the community as a whole. This paper seeks to begin filling that void.

There is an increasing appreciation among Las Vegas residents of the fact that, however warranted it may be on some grounds, continuous uncontrolled metropolitan growth carries with it certain obvious costs to the quality of life. The long-term growth of Las Vegas is not limited by its zoning, its general plan, its water supply, or its available land acreage. Zoning ordinances and general plans can be changed; additional water supplies can be purchased; a finite supply of land can be developed and redeveloped to intensities that are
almost infinite. But because of the city's geographical location—within a Mojave Desert basin, surrounded by three mountain ranges—its future as a community with an attractive quality of life may be in jeopardy due to continued urban sprawl. It is important to note that while our major focus is on the implications of urban sprawl on the City of Las Vegas and its residents, the physical and political landscape of the Las Vegas Valley stipulated that much of our analysis (e.g., air quality) could only be conducted on a valley-wide basis.

The overall goal is to determine the extent and impact of sprawl on the quality of life in Las Vegas. Wherever possible, these consequences are expressed quantitatively, so as to highlight the net effects, positive or negative, of sprawl. Where relevant, the distribution of these effects upon particular neighborhoods or census tracts within the city is highlighted.

Definitions

There is considerable disagreement regarding a precise definition of the term sprawl. Opponents of sprawl development find the term highly descriptive and useful in discussing the spread-out, skipped over development that occurs in most of America's 3,000 counties. Proponents of sprawl, on the other hand, consider the word pejorative. The terminology they prefer includes phrases such as "poly-centered," "low-density," "dispersed," "decentralized," and "suburban." In most cases it is not suburbanization per se the opponents of sprawl attack, but the wasteful form the pattern so often takes.

Sprawl and compact growth are terms most often used to describe two ends of the development spectrum. The forms of development most often agreed
upon as being characteristic of sprawl are: (1) scattered development that leapfrogs outward from metropolitan centers, (2) strip commercial development, or (3) large expanses of low-density or single-use development, as seen in sprawling bedroom communities. Burchell (1997) defined sprawl as a non-contiguous residential land development in the form of .25 to .50 acre lots, combined with nonresidential development with floor area ratios (the gross floor area of all buildings divided by the total lot area) of 0.20 or less. Another key phrase identified in the literature concerning sprawl development is unplanned (Duncan 1989).

Even apparently specific definitions may be questioned. Sprawl is a matter of degree. The line between scattered development (a type of sprawl) and multi-centered development (a type of compact growth) is a fine one. The difference between economically irresponsible A leapfrog development and economically efficient A discontinuous development is equally elusive. Any line meant to delineate sprawl from other forms of development may be challenged unless it is quantifiable and related to implications. The impacts that render development patterns undesirable, not the patterns themselves (Ewing 1997).

Because sprawl development implications are a matter of degree, the state of Florida's anti-sprawl rule contains sprawl indicators as well as definitions. The most important of these indicators is poor accessibility. Locating residences far from non-home activities promotes poor residential accessibility; locating non-home activities far from one another, rather than in more compact centers, promotes poor destination accessibility. Both of these problems affect
the efficiency of household travel patterns.

Using accessibility as an indicator is helpful in two ways. First, unlike simple archetypes, it recognizes that problems in real-world development patterns are a matter of degree. Second, an accessibility indicator is easily measured. Basic measures of accessibility (such as average trip length or average travel time) can be obtained from household surveys. More sophisticated measures can be derived with any conventional travel demand modeling system. The Florida Standard Urban Transportation Model Structure, for example, reports and calculates vehicle miles of travel (VMT), vehicle hours of travel (VHT), and indices for individual traffic zones to determine the measure of accessibility (Ewing 1997).

Another indicator is lack of functional open space. In their natural state open lands provide flood control, groundwater recharge, scenic views and buffer zones between incompatible land uses. When amenitized, they offer locations for the casual social interaction and recreation that gives communities a richer public life. The uniform spread of low density development makes the preservation of large open spaces physically impossible (Schneider 1970). Strip development functions as a wall of commercial uses, and the large tracts of undeveloped land left behind by leapfrog development are generally in private hands and unavailable for public use (Clawson 1962). Since it can be categorized, quantified and assessed for functional value, open space can be used as an indicator in the same way as accessibility.
Situating the Las Vegas Community

The 800 square mile Las Vegas Valley lies in the center of the 8,000 square mile expanse of Clark County, located in the Mojave Desert in the southeastern corner of Nevada. The foundation of growth for the community was laid down with the enactment of legalized gambling in 1931 and the completion of Hoover Dam in 1936. The dam assisted in local flood control, enabled a local electrical power source, provided one of the few crossings of the Colorado River, and created an essential source of water. It also served as a major tourist attraction for the region.

The Federal government controls nearly 90% (4,600,000 acres) of the land in Clark County. Only 512,000 acres are controlled or owned by private interests or local municipalities. The Las Vegas Valley's 800 square miles contain 304,500 acres of all non-federal land, of which an estimated 160,000 acres are presently undeveloped. The Bureau of Land Management (BLM), which is overseen by the US Department of the Interior, controls about 52,000 acres of this undeveloped land. The BLM can transfer or sell these properties to private parties and municipalities under certain conditions. The BLM may trade any land in the Las Vegas Valley, for example, in exchange for other properties it deems "more sensitive," such as pristine wilderness areas adjacent to National Forests; the Bureau recently traded a parcel of approximately 2,500 acres for land near Lake Tahoe. The BLM has released approximately 1,600 acres of Las Vegas Valley land per annum since 1991 (City of Las Vegas 1998).
The BLM is currently completing a plan to limit further land conversions in the Las Vegas Valley. Based on current BLM plans and Clark County land use maps, there are approximately 50,000 to 80,000 acres of undeveloped residential land at the urban fringe, within the BLM boundary, and about 10,000 to 20,000 additional acres of undeveloped land within residential areas that are already urbanized.

Cities have historically followed very different courses of growth. Some experience rapid expansion and then a slowing of growth; some never expand much; and some, like Las Vegas, do not seem to stop expanding. There is neither a single pattern that fits all cities, nor a "classic" pattern that can be used to explain growth in one place based on the growth experience of another. Moreover, there are no U.S. precedents for the Las Vegas community's five decades of sustained growth.

Until the 1990s, Las Vegas was considered a middle-sized city that was relatively self-contained. In 1980 there were 115 cities, including Las Vegas, in the urbanized continental United States that (a) contained only one central city of 50,000 to 400,000 inhabitants, and (b) were at least 20 miles from the nearest neighboring urbanized area. Only four of those 115 cities are now considered large. The City of Las Vegas has over 425,000 residents, the cities of North Las Vegas and Henderson both have well in excess of 50,000 residents. The Las Vegas Valley has a present population of 1,100,000 residents, and hosts nearly 80,000 tourists every day (City of Las Vegas Comprehensive Planning 1998).
The velocity, consistency, and longevity of growth in the Las Vegas community is often overlooked. According to US Department of Commerce, Bureau and Census figures, the Las Vegas metropolitan statistical area (MSA) is the only one in the top ten "Most Growing SMAs' Percentages" for five consecutive decades. In fact, the Las Vegas MSA has been in the top three, in terms of growth percentage, since the 1950-60 decade, when it was surpassed only by the MSAs of Fort Lauderdale-Hollywood, Florida, and Anaheim-Santa Ana-Garden Grove, California. Since that time, the Las Vegas MSA has consistently held the Census Bureau's number one growth position.

According to the US Census Bureau, the Las Vegas MSA lead the nation in domestic migration between 1990 and 1995, in terms of migration per 1,000 residents, with a rate of 196.7 per 1,000. Moreover, total Las Vegas domestic net in-migration during this period was a staggering 223,900 a number which outstretched the in-migrations of third-place Phoenix (165,400) and was second only to Atlanta (267,500). This growth has continued in spite of, or perhaps in support of, the community's highly stigmatized major industry, gaming.

The impact of gaming, particularly casino-based gaming, on Southern Nevada cannot be overstated. Gaming influences the economy, transportation patterns, local and state politics, infrastructure requirements, occupational type and job growth, land values, and subsequent land use patterns. No other state or major metropolitan community is currently as uniformly dependent on a single industry as is the state of Nevada and the Las Vegas metropolitan area. The hotel, gaming, and recreation sector of the economy employs more than 160,000
workers, over 25 % of all regional employment. The Valley's commercial core is its "Strip" of huge casino-resorts.

The Las Vegas Resort Corridor, which includes the "strip" and "downtown" Las Vegas, provides the majority of the valley's employment opportunities. In 1995, the Las Vegas Resort Corridor contained 237,000 jobs, or half of all jobs within the region. By 2020 the total number of jobs within the corridor is projected to increase by 64 % over 1995 figures to 389,000 jobs. Half of all employment in the Resort Corridor occurs along Las Vegas Boulevard: developments along this roadway include eight of the world's largest resort hotels, regional shopping malls, entertainment complexes, government centers and offices. These activities create employment centers that are among the highest in the nation (Regional Transportation Commission 1997).

The overall density of employment along Las Vegas Boulevard is expected to increase by 67 % between 1995 and 2020 from 136,454 jobs to 227,623 jobs, or 43 jobs/acre to 72 jobs/acre. Near the center of the core area, job densities approximated 56 jobs per acre in 1995 and are forecasted to reach 91 jobs per acre in the year 2020. For comparative purposes, downtown Los Angeles has approximately 95 jobs per acre with a total of 175,000 jobs. This is similar to the conditions that will occur between Sahara Avenue and Tropicana Avenue by the year 2020. This same geographical area currently exceeds both the total number of jobs and the jobs per acre that exist in the central business districts of Portland (Oregon), Sacramento, San Diego, St. Louis, Pittsburgh, Cleveland, Buffalo, and Baltimore. Current and projected job densities per acre...
along Las Vegas Boulevard are shown in Table 2-1.

Table 2-1 Current and Projected Resort Corridor Job Densities per Acre

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</thead>
<tbody>
<tr>
<td>US 95 to Charleston</td>
<td>679</td>
<td>26,532</td>
<td>39</td>
<td>5.6%</td>
<td>44,804</td>
<td>86</td>
<td>5.1%</td>
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<tr>
<td>Charleston to Sahara</td>
<td>633</td>
<td>6,225</td>
<td>10</td>
<td>1.3%</td>
<td>12,309</td>
<td>19</td>
<td>1.4%</td>
</tr>
<tr>
<td>Sahara to Desert Inn</td>
<td>474</td>
<td>25,730</td>
<td>54</td>
<td>5.4%</td>
<td>46,081</td>
<td>97</td>
<td>5.2%</td>
</tr>
<tr>
<td>Desert Inn to Flamingo</td>
<td>828</td>
<td>55,639</td>
<td>67</td>
<td>11.7%</td>
<td>75,875</td>
<td>92</td>
<td>8.8%</td>
</tr>
<tr>
<td>Flamingo to Tropicana</td>
<td>585</td>
<td>22,328</td>
<td>40</td>
<td>4.7%</td>
<td>46,754</td>
<td>86</td>
<td>5.5%</td>
</tr>
<tr>
<td>Tropicana to Sunset</td>
<td>1238</td>
<td>35,028</td>
<td>26</td>
<td>7.4%</td>
<td>37,900</td>
<td>31</td>
<td>4.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,179</strong></td>
<td><strong>139,464</strong></td>
<td><strong>43</strong></td>
<td><strong>28.7%</strong></td>
<td><strong>227,623</strong></td>
<td><strong>72</strong></td>
<td><strong>26.9%</strong></td>
</tr>
</tbody>
</table>

Source: Regional Transportation Commission RTCMIS, 1997

Legal-Political Aspects of Nevada

Though the Nevada Constitution declares Nevada a "home rule state," the required legislation for implementation was never passed by the Nevada State Legislature. "Home rule" gives cities or counties the right to establish or change governmental policies within the scope of constitutional and statutory authority to tax, spend, borrow, and create benefit districts for these purposes. Home rule is meaningful only to the extent that within the discretionary scope
certain functional, structural, or fiscal powers have been granted to local municipalities or government entities by the state. In comparison to other western states Nevada has a high degree of state mandates to local governments. Constitutionally, local governments in Nevada have limited autonomy when determining operational policies and procedures, service expansions, or revenue generation to meet current or anticipated demands. Thus, Nevada may be viewed as one of the most centralized governments in the United States (Schmidt and McGinnis 1998).

Since 1931 Nevada has annually calculated the maximum allowable revenue by which each local government is constrained, with further controls on the portion of that revenue that may be raised from property taxes. The statewide distribution of sales tax revenue to local governments is administered by the Nevada Department of Taxation. The state mandated limitation on new revenue sources has produced unbalanced local public sector resource allocations. The state's practice of "earmarking" the revenue sources of local jurisdictions serves to further reduce local government flexibility and responsiveness to complex issues such as sprawl.

Due to its sparse population, as well as its complex and delicate incorporation statutes, the state of Nevada has less than 20 incorporated cities within its 17 counties. Clark County, which has more than two-thirds of the state's population, contains four of the state's incorporated communities. As of 1996, the population of these four entities were as follows: the City of Las
Vegas, 401,700 residents; the City of North Las Vegas, 83,920 residents; the City of Henderson, 132,500 residents; and Boulder City, 14,340 residents. Additionally, unincorporated Clark County had approximately 448,200 residents. (State Demographer’s Office, 1997)

In 1950 the City of Las Vegas, with over 60% of regional residents, held a numeric superiority over its neighbors. The City retained that dominance until the 1970s, when the unincorporated county population exceeded that of the City of Las Vegas. Most recent trends suggest that the City of Henderson will become a more dominant force in local politics in the future. Cooperation and coordination between individual cities and the county governments are often strained when issues such as growth management make localized political objectives and goals more and more adversarial.

Due to the rapid growth of the southeastern corridor of the Las Vegas Valley, the City of Henderson has been able to transform itself from a low-to-middle income bedroom community bordering Las Vegas to a middle-to-high income city with the highest growth rate in the Valley.

Most importantly for purposes of this paper are the substantive change in the economic structure of the population of Henderson of the last twenty years and the projected impact on its demographic fabric over the next twenty years which can be attributed to the housing guidelines established for the community in 1997.

Since the mid-1980s, the City of Henderson has ranked among the nation’s leaders in residential construction. Between 1980 and 1990, Henderson accounted for more than 12 percent of the Countywide increase (127,311) in year-round housing units. Since 1990, total dwelling units in the City of Henderson have increased by more than 50 percent with most of the growth
occurring in single-family units.

Henderson has the highest median income in southern Nevada: $38,802. Henderson does not have a census tract with a percentage of 50 percent or more of low/moderate income people. However, Henderson residential population mix includes only 2.7% black (which is decreasing) and 8.1% Hispanic Origin. Some have suggested that this is a result of exclusionary zoning in much of Henderson.
CHAPTER 3

A THEORETICAL FRAMEWORK FOR MEASURING
THE IMPLICATIONS OF SPRAWL

Urban land use and urban architecture in the western United States have
been shaped by automobile transportation. In suburbia and in central cities, one
can find many drive-in and drive-through establishments—banks, fast food
restaurants, liquor stores, and, in Las Vegas, even wedding chapels. The low-
density sprawl of suburbia caters to automobile and truck traffic, with acres of
parking lots and miles of connecting roads. Sprawl development patterns
consume a significant amount of land when compared to high-density
development practices. This pattern has been accelerated by the increase of
suburban office parks and shopping centers. It is common practice to construct
more parking spaces at business parks than are required by local ordinance, for
example, to facilitate the marketing of these projects. The typical office park
averages 1.05 parking spaces per employee. There is twice as much floor space
per worker in suburban workplaces as in downtown settings, and over 30 %
more land area per worker in suburban than in downtown office settings. Higher
maintenance and energy consumption costs are also associated with low density
developments (Cervero 1986).

In central city areas high-rise parking garages dot the urban landscape.
Central cities, especially in the South and West, are very automobile-oriented. Indeed, most downtown areas of these central cities are merely places to drive through. Their architecture is that of a way station, not of a place to live. One study found that 59% of downtown Los Angeles was devoted to streets, parking, and similar uses; for most major cities these proportions were 40% to 55%, with the highest figures in the sunbelt. The automobile’s requirements for so many streets, parking lots, garages, repair facilities, and new and used car dealerships have remade the built environments of our cities (W.P. O’Mara and J. Casaza 1982).

The auto-centered built environment shapes and interrupts social life at home as well as in downtown business areas. Residential streets with heavy traffic flow have been found to promote much less social interaction than streets with light traffic. Wide streets busy with automobiles make it difficult for urbanites to visit neighbors in front yards, for children to play outside, and for neighboring patterns to extend across streets. Functional space open to the public, such as that used to link neighborhoods or buffer incompatible land uses, becomes increasingly scarce. Strip-center development presents barriers of commercial uses, and suburban residential development subdivides land until no open spaces or holdings reserved for community uses exist. The ultimate extrapolation of this situation is the walled and gated subdivision, where no land at all, not even street right-of-way, is public. Communities of place where neighbors interact, have a sense of belonging, and share a feeling of responsibility for one another are one of the social casualties of sprawl.
The Causes and Consequences of Sprawl

Because people perceive sprawl differently, they cite different reasons for its proliferation. Sprawl proponents, for example, view the proliferation of suburban development simply as a case of the market at work and the market seems to be working quite well. Consumers prefer outlying areas because land is inexpensive and congestion is moderate. The only sources of market failure (which might render settlement patterns inefficient) are subsidies for the automobile and local land use regulations. (Ewing, 1997)

Opponents of sprawl, on the other hand, view land markets as fraught with imperfections and external pressures. Land markets meet no basic economic requirements; single family housing is subsidized through the tax code; outlying development is subsidized through utility rate structures independent of distance from central facilities.

Of the four possible causes of studies examined here (1) consumer preference, (2) technological innovation, (3) subsidies and (4) public and quasi public goods the first two are market-driven and emphasized by the Gordon and Richardson study The Case for Suburban Development. The others are related to what Reid Ewing, in his work, terms instances of "market failure".

Consumer Preference

Development patterns are a matter of choice; no one type is inherently more right or more wrong than another. A basic argument for current development patterns is that sprawl is driven by the attraction of inexpensive land on metropolitan fringes, which lures both households and businesses. This makes
sprawl an efficient distributor of economic activities in the micro sense (Muller 1981). Opponents of suburban sprawl claim this apparent benefit is actually short-term in nature, and fewer would select it if the full public costs were made explicit to the population. They label sprawl a "build now, pay later" pattern of land use (Michigan Society of Planning Officials 1995). Critics also argue that local government policies encourage sprawl through zoning and subdivision ordinances which reflect the desires of their citizens for unlimited automobile use, distancing themselves from the fiscal and social problems of older core areas, neighborhoods which provide schooling and appropriate socialization for the young, and attractive property taxes.

A 1995 report sponsored in part by Bank of America, Beyond Sprawl: New Patterns of Growth to Fit the New California, states that the majority of the state's residents choose to live in large metropolitan areas, although most of them reside in politically independent suburban jurisdictions. This issue of choice was a significant factor in the report's conclusion, which called for a consistent set of land use policies that would discourage sprawl development on the metropolitan fringe.

In their response to that report, USC economists Peter Gordon and Harry Richardson (1996) claim suburbanization is a more accurate reflection of the population's preferences. They cite numerous surveys that show strong preferences for suburban living. Gordon adds that the strongest poll is what people are doing— the choices they are making in the marketplace. The preference for single-family detached homes has been successfully tested in the
crucible of the free market, whereas most suggested compact growth systems would rely instead on government enforcement. Imposing development systems through central planning "command and control" mandates is the antithesis of the market system and an abridgment of the consumer's freedom to choose (Gordon and Richardson 1996).

A rebuttal to the Gordon and Richardson paper agrees that Americans prefer single-family detached dwellings, but adds that most could do without "the rest of the suburban package." Given a more complete set of choices than those offered by Gordon and Richardson, compact development is an attractive option that more than holds its own in the marketplace. Suburban living ranks low in residential preference surveys. Given the choice between low and medium-to-high densities, home buyers split almost evenly. Given the choice between mixed- and single-use areas, consumers are again evenly divided. Consumers offered the choice between compact commercial centers and commercial strips favor compact centers by a wide margin (Ewing 1997).

Technological Innovation

Commercial development has often followed residential development to fringe areas. However, some opponents of sprawl claim that technological advances encourage low-density patterns. Advances in communications (such as the Internet) eliminate many daily commutes, allowing individuals and small businesses to locate in distant suburbs and travel back to older urban centers only when necessary. Since this trend could put more pressure on fringe lands, Beyond Sprawl suggests government policy and private practice should use
telecommunications to reinforce existing communities rather than further
dissipating them (Bank of America 1995).

Sprawl proponents argue that these same technological advances have
decreased the benefits of high population density. Since most commuting is now
suburb to suburb, the use of less crowded suburban highways takes congestion
pressures off traditional downtowns. According to Moore’s Law, information
processing capabilities double about every 18 months; technology is rendering
compact cities obsolete, so trying to use those same technologies to “combat
sprawl” doesn’t make sense (Gordon and Richardson 1996).

Stating that modern telecommunications render geography irrelevant
might be an exaggeration. Agglomeration economies remain concentrated in
metropolitan activity centers. Although they are losing market share, downtowns
still house five to ten times as much office space as suburban centers.
Telecommunications innovations have resulted in the dispersion of many back-
office activities, but others remain highly centralized. Though highly important,
electronic communications may always be imperfect substitutes for face-to-face
exchanges (Ewing 1997).

Subsidies

Any discussion of sprawl turns to the issue of government subsidies.
Opponents of sprawl most frequently address subsidies they say are designed to
support an unlimited use of the automobile. The hidden costs of sprawl include
building and maintaining roads and other infrastructure improvements needed to
serve distant suburbs. Automobile use has been encouraged since the 1950s by
government-financed road construction programs, and for the most part external costs of automobile use (e.g. air pollution) have never been the direct financial responsibility of the individual motorist. Automobile subsidies have traditionally fueled suburban growth and remain in place today (Bank of America 1995). Proponents of high-density compact development claim that suburbanization would not exist without public support of infrastructure and highway costs.

Gordon and Richardson argue that when Federal, state and local expenditures for highways and parking are measured against the alternative of public transit, roadway subsidies recover a higher percentage of expenditures. Highway spending on all three government levels were $66.5 billion in 1991, with $53.8 billion in revenues for an 81% recovery. Spending on the same levels for public transit was $20.8 billion, with revenues of $8.8 billion for a recovery of 42%. On a per-passenger-mile basis the auto subsidy was .54 cent, while the transit subsidy was 54 times as large at 29.42 cents. In addition, transit subsidies are growing at a faster rate. According to 1994 U.S. Department of Transportation data, the transit subsidy per passenger-mile for the year 1981 was only 33 times as large as the auto subsidy (Gordon and Richardson 1996).

In response to the common claim that an implicit subsidy gives auto users a "free ride" in terms of pollution, congestion, and parking, Gordon and Richardson cite Environmental Defense Fund "suggestions" to calculate that accepting this argument would add 3.6 cents for pollution costs and 7.5 cents for congestion costs to the per passenger mile costs. If an additional 11 cents is added per passenger mile to cover parking for Los Angeles commuters,
automobile subsidies produce an overall government cost of 22 cents per mile—still lower than the 29.42 cent per passenger mile subsidy for public transit (Gordon and Richardson 1996).

Consumer preference and technological advances help explain suburbanization and decentralization, but fail to explain the extent of dispersal, the absence of mixed land uses, and the consumption of fragile lands that characterize sprawl. Of all the subsidies related to sprawl, those for the highway system are by far the greatest (Raup 1975; OTA 1995, 193-218). If motorists had to cover the full costs of auto use they would opt for residential, work, shopping and other locations that require significantly less travel. Drivers in the United States bear only a fraction of the full costs, unlike Europe, where gasoline prices are about three times higher. The 22 cents per passenger mile subsidy cited by Gordon and Richardson would require an added gas tax of $6.60 per gallon to internalize air pollution, congestion and parking costs. Also, without referring to the theory by name, Gordon and Richardson invoke the “Theory of the Second Best” when they suggest that large auto subsidies are somehow neutralized by large transit subsidies (Ewing 1997).

Public and Quasi Public Goods

Every home buyer purchases attributes, some specific to the house itself and some to its environs. Ideally, many residential and environmental attributes are public, in the sense that one resident’s consumption has no effect on another and no resident can be denied access. These public goods are often undersupplied by the private market because of the “free rider” problem. Worth
is not ascertainable, and beneficiaries cannot be charged for the value they receive. The best example of problematic public goods is open space. While it can enhance property values, open space tends to be under supplied because land owners cannot capture its full value (Ewing 1997). While the aesthetic benefits of looking at open space are easily perceived by many people, each may understate his or her individual willingness to pay for such benefits. A collective arrangement may be needed to overcome this free rider problem when beneficiaries are numerous (Fischel 1985).

The Fiscal Costs of Sprawl

Fiscal implications are the public costs versus revenues associated with land development. This section will define and describe formulas for evaluating the fiscal implications of sprawl. The four key fiscal impact areas that will be reviewed are (1) transportation costs, (2) energy consumption, (3) capital infrastructure expenditures, and (4) operation and maintenance costs.

Transportation (VMT) Costs

One of the major "costs" of suburban growth is time lost commuting to work and other locations. Many Californians, for example, now spend an hour or more per day in their vehicles, and that number continues to rise. Commute times for residents of Alameda and Contra Costa counties increased an average of 13% between 1980 and 1990 (Bank of America 1995).

Proponents of sprawl argue that jobs follow people to the suburbs, and sprawl is therefore the dominant mechanism for the reduction of congestion. Most commutes are now suburb-to-suburb, which actually results in a shorter drive. If
there is an increase in average commuting distances, it is more than offset by faster travel speeds (Gordon and Richardson 1995).

But such transportation arguments emphasize density over other land use variables. Households living in areas of high accessibility spend about 40 minutes less per day traveling by vehicle, generating a much lower annual vehicle miles of travel (VMT). These savings are almost entirely due to shorter auto trips; the land-use variable that proves significant is regional accessibility (Ewing et al. 1994; Ewing 1995b). According to Ewing, Gordon and Richardson also err in their reliance on highly aggregate data and the use of macro travel statistics to draw inferences about micro travel behavior. By the end of the 1980s, commute times were significantly longer in the suburbs. This suggests that decentralization cannot actually raise average travel speeds enough to compensate for longer trips. Ewing also cites numerous studies that link rising densities to shorter drive times, an increase in transit and walk mode share, and a drop in vehicle trip rates, all of which translate into lower VMT.

Energy Consumption

Supporters of suburban development point to a global "energy glut" the weakness of the OPEC cartel, and the low real price of gasoline as evidence that the energy implications of sprawl are insignificant. Consistently low fuel prices, however, rely on optimal global conditions, including the political stability of the Persian Gulf.

The relationship of energy consumption to urban form parallels that of travel to urban form. Though vehicles operate less fuel-efficiently in congested
areas, per capita fuel consumption is much lower in central cities because people drive so much less (Newman and Kenworthy 1988).

As urban areas grow, however, central cities become less and less accessible to development on the periphery. Eventually, the emergence of other centers is beneficial from the standpoint of transportation and energy. When energy studies include polycentric development as an alternative, it emerges as the preferred pattern for settlement, even above monocentric development (Small 1980; Haines 1986).

**Infrastructure Capital Costs**

A strong argument against sprawl development is that public support of two under-utilized infrastructures: a new one that is not being fully used in rural areas under development, and an old one being abandoned in and around core metropolitan areas. Local governments are often forced to forgo maintenance and the provision of anything other than growth related infrastructure. The most significant cost in any infrastructure projection is roads. In several studies, road costs under compact growth development are reduced anywhere from 40% (Duncan 1989) to 76% (Burchell 1992). No other areas appear to achieve similar savings. School infrastructure costs under compact growth, for instance, vary from 93% (Duncan 1989) to 99% (Burchell 1992) of the costs under current development patterns.

Studies that report savings on infrastructure costs as population densities rise make sense. Infrastructure costs are amortized over more units at higher densities, engaging an economics of scale. Proponents of sprawl argue that
such studies are too theoretical. They claim that studies of actual public spending per capita show that public spending dips initially, but quickly rises with density (Ladd 1992).

The difference in study results may be explained by differences in cost estimations. Cost of sprawl studies concentrate on infrastructure costs; public spending studies concentrate on public service costs. More importantly, the two types of studies relate to different types of government output cost of sprawl studies to intermediate output, and public service studies to final output. At higher densities, there are savings on intermediate outputs such as lane miles of street. But the cost of producing a final output may be high enough to offset those savings. Increased density may require more traffic lights, for example, or more traffic control officers to achieve a given level of safety or flow (Ladd 1992).

Within the normal range of densities, per capita infrastructure cost usually fall as densities rise. There could be some exceptions, however, at the density extremes. At very low densities, septic systems, open drainage, and rural street cross sections may cause the cost function to turn downward. At very high densities, the special needs of high-rise structures may cause the cost function to turn upward.

Density, however, may not be the most important land-use variable. There may be little cross-subsidy (and therefore inefficiency) in one compact density pattern versus another (Frank 1989, 41-2; Avin 1993, 5). According to sprawl opponents, the same cannot be said of leapfrog or strip commercial
development. Bypassing tracts of land well-suited for residential development, opponents argue, greatly increases both public and private costs. The residents of outlying areas incurred these increases in the form of higher travel costs, since they presumably paid less for land than they would have at a more accessible site. The remaining costs were defrayed by other consumers and taxpayers in the area who ended up subsidizing sprawl (Archer 1973).

Public Service (O & M) Costs

Fiscal impacts are the public costs versus the public revenues associated with land development (Burchell and Listokin 1978). Some public costs associated with new land use include services to new residents, workers and school children; public revenues come from property taxes levied on the buildings these people occupy, as well as non-tax and intergovernmental sources.

A 1992 New Jersey study by Burchell used a fiscal model to view the effects of current versus compact development. The Rutgers fiscal impact model estimated the number of people, employees, and students that would be attracted by development under different development scenarios and projected future costs versus revenues. At the regional and state levels, population and employment projections did not vary between alternatives. At the municipal level there were significant differences. In the scenarios analyzed for compact growth, urban communities with slack service capacity received more growth than rural areas with lesser amounts of public service infrastructure. The
reduced infrastructure provision and the potentially reduced annual maintenance on this infrastructure led to more positive fiscal implications for compact growth.

The Burchell study in New Jersey found the following: by containing population and jobs in already developed areas and by creating or expanding centers in newly developing areas, the State Plan (compact growth) offered an annual $112 million (2%) fiscal advantage to municipalities. This advantage reflects the ability under the managed growth scenario to draw on usable excess operating capacity in already developed areas as well as efficiencies of service delivery. For instance, fewer lane/miles of local roads would have to be built under the compact growth alternative, thus saving municipal public works maintenance and debt service costs. Public school districts would realize a $286 million (or 2%) annual financial advantage under the State Plan, again a reflection of drawing on usable excess public school operating capacity and other service and fiscal efficiencies realized due to the redirection of population via compact growth. Thus, municipal and school district providers of public services could reduce costs by approximately $400 million annually under compact development, while supplying similar quality services.

Under current development, the State’s school district would require 288,000 pupil spaces to the year 2010 (365,000 gross need less 77,000 usable excess spaces); for compact development, the need was a somewhat lower 278,000 pupil spaces, reflecting some excess space in central locations. If new space had to be built to accommodate all new students, costs of new school
facilities would be approximately $5.3 billion under current development trends and $5.1 billion under compact development. Thus, $200 million [3%] is potentially saved when excess capacity in closer-in areas is utilized by compact growth (Burchell 1992b).

Overall public operating costs are influenced more by the type of residential and nonresidential development than they are by the specific development pattern; therefore fiscal implications and the technique that estimates them, fiscal analysis, require special attention. Costs to service people, workers, and school children vary with the size of the facility constructed and with the wealth of the district (Burchell, Listokin, and Dolphin 1993). Larger residential and nonresidential facilities cost a jurisdiction more and wealthier jurisdictions tend to spend more. The form of growth (compact growth versus current development patterns) does not impact public service costs to the degree that structure type, size, and location do.

It is necessary to examine whether the fiscal impacts of various types of land use are the product of current development trends or compact growth. Generally, some types of land uses are better than others from a fiscal perspective. Nonresidential land uses have been shown to be superior; more standard forms of residential land uses, inferior (Burchell and Listokin 1994a). The fiscal impact hierarchy extends from research office parks at the top to mobile homes at the bottom. Somewhere in the middle are open-space lands or undeveloped and unimproved property.
The hierarchy takes both costs and revenues into account. It shows which land uses, after all costs and revenues are considered, are more profitable. It also accounts for the number of districts for which revenues are generated as opposed to the number of districts in which costs occur. In the case of nonresidential uses, costs occur primarily in one district (municipal) while revenues are generated for two districts (municipal and school). Position in the fiscal impact hierarchy depends on type of unit (reflecting size or intensity of use) within both residential and nonresidential classifications. Position also depends on the service district where it is being viewed. Often, retail facilities or age-restricted housing may be unprofitable in the municipal service jurisdiction, yet both might be assets in the school district. On the other hand, a garden condominium may be significantly positive in the school district yet barely positive in the municipal jurisdiction. (Burchell and Listokin 1994a). For the most part, although the amount of surplus or deficit for a particular land use may vary from district to district, its relative position on the fiscal hierarchy often does not vary.

Environmental Considerations

Traditionally, many economists are not concerned about resource consumption levels in the United States because real prices of oil, farmland, and other appropriable resources are still relatively low. They also assume technological advances will allow indefinite economic growth. Natural and man-made capital serve as substitutes for each other, and the amount of man-made
capital is the only constraint on development. This paradigm is sometimes called "empty world" economics.

The alternative viewpoint states that natural capital is limited, and natural and man-made capital are complements rather than substitutes. Society must learn to live on the annual income derived from exhausting the stock of natural assets. Development must be sustainable economically, ecologically and socially. These different world views influence different assessments regarding the fiscal costs of sprawl relative to (1) land consumption, (2) air pollution, and (3) the impact of habitat loss on biodiversity.

Land Consumption

The primary concern about sprawl development, when most Americans are satisfied with its results, is cost. Cost must be measured not just in terms of capital expenditures but also in terms of resource depletion. Perhaps the least quantified cost of sprawl is its impact on natural resource consumption. Land in the United States is being consumed at triple the rate of household formation; agricultural land, forest and fragile lands are decreasing at comparable reciprocal rates (Landis 1995).

Sprawl is perceived to have damaged California agriculture, most significantly in the permanent loss of the agricultural land it consumes in that state (Bank of America 1995). In terms of agricultural land alone, however, suburbanization may have less impact than sprawl opponents claim. Since 1960, land has been absorbed at a rate of .9 to 1.3 million acres a year, of which about
one-third was from cropland or high-quality pasture. Abandonment of cropland by growers due to overproduction, market conditions, and other factors accounts for the loss of more acreage than the urbanization of cropland (Gordon and Richardson 1996). Ewing argues that rural-urban land conversion is more often the result of: (1) the effects of urban spillover, which can make nearby farming operations less profitable and cause farmers to disinvest; (2) the "impermanence syndrome" that causes farmers to abandon operations in anticipation of urban development; and (3) the substitution of marginally productive farmland for prime farmland lost to urbanization (Ewing 1997).

The issue of natural area consumption is more relevant. Not only does sprawl consume more land in total than compact development, it leaves little or no land in its unimproved state. Proponents of compact growth frequently cite a 1992 Rutgers University impact assessment of a 20-year development projection that compared the two development scenarios of sprawl and compact growth. The overall land drawdown of the compact growth scenario was 60% less than that of the sprawl scenario; at the same time, the compact growth scenario preserved an additional 30,000 acres of fragile lands and 42,000 acres of prime agricultural land (Burchell 1992).

Air Pollution

Richardson has argued that advances in vehicle emission control technology will eventually solve our air quality problems (Richardson 1993). But 128 million people, or about half all Americans, now live in urban areas that

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exceed one or more federal air quality standards for carbon monoxide, ozone, or nitrogen dioxide. Even new emission control mandates and reductions in hydrocarbons will fall far short of federal air quality standards by the year 2010. Growth of VMT and vehicle trips will wipe out gains achieved through stricter auto emission controls (Ewing 1997).

Like fuel consumption, vehicle emissions increase with VMT and decrease with average operating speed (up to about 50 mph for carbon monoxide and hydrocarbons, and to 35 mph for nitrogen oxides; carbon dioxide emissions track fuel use exactly). This gives compact development an advantage over sprawl. The edge is diminished by the fixed hydrocarbon emissions associated with cold "starts and hot soaks"; these are produced every time a vehicle is used, no matter how little it is driven (Ewing 1997).

**Biodiversity and Habitat Loss**

The consumption of fragile lands is one example of sprawl's intangible costs. Loss of natural areas is a classic case of public goods being undervalued by private property owners. The public goods include (1) stormwater management, (2) groundwater recharge, and (3) water pollution control. Biodiversity becomes an issue because fragmented ecosystems cannot support the most imperiled species, which usually need large, undisturbed areas to survive. This often leaves habitat only for generalist species, which are already abundant to begin with. Because there is little market value in any of these attributes of public goods, private property owners understandably discount
public purposes in their land-use decisions (Ewing 1997). The loss to society, however, is real. (For an overview of natural resource valuation, see Lipton and Wellman 1995.) Our nation's most valuable natural areas are now protected by environmental regulations for exactly this reason.

Social Costs

The abandonment of core metropolitan areas is one characteristic of sprawl that even its proponents find hard to dismiss. The migration of homeowners and businesses outward from older metropolitan areas leaves behind the buildings and under-utilized infrastructure of the aging core and those residents who, because of income, employment obligations or exclusionary zoning, cannot follow upper-income residents to the suburbs.

Discouraging "leapfrog" development reduces sprawl's impact on central cities and downtowns by promoting both a more efficient utilization of land at the metropolitan fringe and the reuse of land in already developed areas. In California, proponents of this approach are calling for more effective public policies to remove barriers to compact growth (Bank of America 1995).

Sprawl proponents maintain that declining sectors often seek remedies from the political system, and that "rent-seeking"—a process by which those with a stake in reviving downtowns get generous subsidies or special privileges from the public sector—"is the natural enemy of... buoyant economic growth." They claim that the political nature of many such investments is illustrated by their across-the-board failure to revitalize declining downtowns. Many new downtown
projects can be seen as disasters, their main effect a fiscal drain that further weakens the cities they are supposed to save (Gordon and Richardson 1995).

Gordon and Richardson dismiss cities as economic losers in the competition for jobs, a position only makes economic sense if there is no relationship between central cities and suburbs. Gordon and Richardson also ignore external spillover effects, in this case the effect of central city decline on the surrounding suburbs. Cities remain the centers of culture, law, and other higher-order place functions; they remain premier locations for finance, legal, advertising and other industries; and they remain key intake points for immigrants with entrepreneurial talent (Ewing 1997).

As for downtown renewal programs, national experience has been mixed. There are apparent failures such as Los Angeles, the case Gordon and Richardson cite, but many downtowns have made successful comebacks. Downtown and neighborhood building booms are documented in Downtown, Inc-- How America Rebuilds Cities (Frieden and Sagalyn 1989; Frieden 1989).

Compact growth proponents see the residents of central cities and older suburbs as the biggest losers in the process of sprawl development. By luring middle-class residents away from older neighborhoods, sprawl creates destructive economic segregation and robs those neighborhoods of the social stability that will keep them viable (Bank of America 1995).

The supporters of suburban growth, on the other hand, claim the compact growth rationale stems from the mistaken assumptions that existing suburban
land-use patterns are inequitable; suburban areas are racially segregated; and measures to improve compactness would improve equity. They argue that U.S. Census data from 1990 shows that 30.3% of suburban residents earn less than $25,000 per year as compared to 46.8% of central city residents; that the nonwhite population share in many suburban communities is high; that the link between interventions to promote higher density development and improvements in equity is obscure at best; and that poor people are excluded from expensive residential neighborhoods not because of exclusionary zoning but because they cannot afford them (Gordon and Richardson 1995).

Ewing argues that Gordon and Richardson fail to acknowledge the psychic and social costs of sprawl. These costs are intangible, but just as real as travel costs or the loss of fragile lands. Popenoe (1979) identifies sprawl with two types of psychic costs: deprivation of access and environmental deprivation. Deprivation of access results in negative impacts on the young, elderly and poor; in a sprawling suburban area, those who cannot drive have limited access to community facilities, services, and even employment. Environmental deprivation is more subtle. Popenoe defines it as the absence of elements that provide activity and stimulation. The physical uniformity of sprawl and the lack of neighborly interaction are both sources of environmental deprivation. The modern metropolis has communities of interest by the thousands, but strong communities of place, where neighbors interact, are becoming harder to find. Communities of place are a casualty of sprawl. Residents of both master-
planned communities and mixed land use communities have a greater sense of
community than those of sprawling suburbs (Glynn 1981; Nasar and Julian
1995).

Political Fragmentation

One of the most serious problems facing American cities today is political
fragmentation and its related problem of sprawl in the rural-urban fringe. An
increasing proportion of our population dwells in metropolitan areas which are
not growing as single cities but as agglomerations made up of a hierarchy of
different political units. A central city is normally surrounded by a variety of
suburbs, some incorporated, some not. The actual built-up portion of this
metropolis is known as the urbanized area. In some cases the incorporated and
unincorporated areas belong to different counties or even to different states.
Each of these political units exercises jurisdiction within its area and generally
such jurisdictions overlap. Taxes are generally a city and county matter.
Utilities such as power, water, sewage, and transportation may be shared.

The process of sprawl is directly related to this political fragmentation.
Increasingly, people attempt to escape the crowded conditions of the central city
and move to the suburbs where the automobile still gives them access to work.
This demand for suburban land has resulted in land speculation and uneven
development. Owing to relatively low taxes on undeveloped land, owners or
investors often hold their land until the price has reached a desired height for
speculative development. This causes the land immediately outside the built-up
area of a city to be unavailable, due to high price or other restrictions, and
developers to leapfrog to the cheaper areas where isolated subdivisions are
established on land that should remain open. Speculation practices have
created an "artificial" scarcity of land that is reflected by the many vacant parcels
existing in central cities and their surrounding areas. Most of this land is outside
the central city, and regulations for the control of this speculation-fostered
growth vary depending on the responsible political unit. The resulting pattern of
development is referred to as urban sprawl, i.e., a gradual sprawl of structures,
especially houses, over the landscape with varying degrees of organization.
Sprawl in an improvement on the congestion of early industrial cities, and the
future city will undoubtedly reflect the dispersal influence of the automobile and
truce. However, the argument with sprawl is not against the dispersal trend but
against the way it is carried out haphazardly, with little planning of land use, and
unnecessary expenses for land due to speculation and leapfrog growth.

The American urban fringe, therefore, presents the picture of a partial
urban landscape, with urban areas separated by rural patches, all of them
bearing little relation to each other. In incorporated areas, much "leapfrogging"
is facilitated by construction of trunk utility lines to all parts of the undeveloped
area, thereby prematurely committing this land to urban use and causing
speculation. On the other hand, the "underbounded" nature of the American city
means that much of the sprawl occurs on unincorporated county land where
wells and septic tanks are permitted, increasing health hazards and the
scattering of residences. Under such a pattern of irregular development, the urbanized area has been extended much further than is necessary and only the construction of expensive arterial highways has permitted some degree of organization in terms of the journey-to-work. Regardless of whether the city or the county is the responsible political unit, the cost of municipal services is multiplied under such a loose pattern of land development.

A close relationship exists, therefore, between political urban fragmentation and sprawl. However, fragmentation has both advantages and disadvantages for the urban region.

The primary advantage of political fragmentation includes the possibility of local communities controlling their own affairs. In spite of waste involved in the overlapping jurisdictions of a fragmented metropolis, suburban residents often feel that control from the central city would rob them of the option to make decisions which are best for their communities. Furthermore, they are presumably in the best position to evaluate and solve their own problems. In addition to this "democratic" reason for fragmentation is that of self-interest. Residents of these outlying suburbs generally pay lower taxes than do the inhabitants of the central city, and they dislike any alteration of this situation. At the present time, they may actually share in certain services of central cities, e.g., transport and shopping facilities, without paying for them. Only within the last ten years have some cities levied payroll taxes on people who work there but live in the suburbs.
The disadvantages of fragmentation are more easily pointed out. Perhaps most obvious is the fact that the natural community of interest that exists in the urbanized area is broken up. For example, the provision of services for the various political entities within the metropolitan area is unequal.

The central city has the greatest burden in terms of utilities and other municipal services since normally the greatest area is involved; when people move to the suburbs, the supporting revenue base declines and the per capita share of government cost increases for those who remain. On the other hand, many small suburbs, especially those of the purely "bedroom community" type without diversified means of economic support, have problems in providing services for their own inhabitants. Houses costing under $100,000, for example, do not usually pay enough in taxes to support all the services their occupants demand, particularly schools, utilities, and park areas.

Suburbs resolve the problem by levying abnormally high property taxes, or by attempting to broaden the tax base, e.g., attracting industry. Under the circumstances of political fragmentation with tax base inequality, a series of metropolitan services would be efficient in terms of operation, but the suburbs refuse to give up their rights of "home rule". Other disadvantages of fragmentation include the loss of civic leaders, who move to the suburbs, and the overloading of central city facilities by suburban users. Broadly speaking, fragmentation produces a variety of inequalities for all, and planning is inhibited.

Perhaps the major disadvantage of political fragmentation in the American
urban area is the American urban area is the lack of comprehensive planning covering jointly both central city and the expanding rural-urban fringe. Limiting urban sprawl is almost impossible since each of the separate fringe units may have a different approach to developing and servicing a large area of low-density housing. No comprehensive plan normally exists for coordinating various land uses in the fringe with each other and with uses in the central city. Such uses may be broken down into two categories as follows:

- **New land uses:** hierarchy of residential subdivisions and shopping centers; freeways; industrial districts; airports

- **Mixed land uses:** strip commercial activities along transport routes; regional utilities such as transportation, sewage, and power; quarries; old industrial and residential tracts; rural-nonfarm homes; farms

The incompatibility of these land uses in the growing fringe portion of the metropolitan area can be solved only by a joint approach characteristic of planning. When fragmentation predominates, the trend is for each urban unit in the fringe to develop its own functional diversification, whereas regional specialization might be more economical in terms of space and costs to the taxpayer.

What can be done about political fragmentation? Perhaps the most
common approach is annexation (Bain, 1963). In contrast to many European
cities, American cities are underbounded, i.e., the political boundary lags behind
the growth of the built-up area, which accounts for the variety of political units
developing in the suburbs. Each state has a law permitting a central city to
annex other political area on the assumption that the core city has the greater
ability to provide services for the residents. The recent growth of many cities by
annexation of unincorporated areas has been common but this method of
solving political fragmentation is not practical when bordering communities are
already incorporated or when they lie in a different state.

Even after use of the annexation process, therefore, a metropolitan area
may embrace several political units with overlapping jurisdictions. In some
cases certain services are handled throughout the area by a special district, e.g.,
the Sanitary District of Chicago handles sewage for the Cook County population.
Another method of handling services within a metropolitan area is consolidation
of city and county as in the cases of New York City and Philadelphia. This
method involves the combining of certain services for city and county, e.g.,
police, health, and welfare. However, even though the efficiency of municipal
operations is improved, consolidation as yet has not yet solved the problem of
fragmentation.

Perhaps the most publicized approach to the problem of political
fragmentation is the metropolitan federation as it exists in Toronto, Canada.
Under this system, called metro, six different units (formerly thirteen) in this
metropolitan area of more than 2 million inhabitants have integrated their regional and local services. Responsibilities for assessment, borrowing, and major highways are under the Metropolitan Council while local communities still handle police, fire protection, and tax collection. Most major services such as planning, parks and recreation, water supply, sewage disposal, and welfare are shared between council and local municipalities. A quasi-independent group—the Toronto Transit Commission has exclusive control over all forms of public transportation. In the first ten years of the Metro experiment both advantages and disadvantages to this method of handling metropolitan fragmentation were demonstrated. Primary among the accomplishments were the establishment of a strong basis of support for the concept by inclusion of local officials on the Council and the carrying out of solid public works projects in water, sewage, and school construction, utilizing the powers of assessment and capital borrowing. Real crises in these regional services for the metropolitan area were solved through metro with the physical evidence apparent for all to see. Coordination of municipal transportation was also carried out so that Toronto now has one of the foremost metropolitan transit systems in North America. The paradox of the Metro solution is, however, that if such central power is given to metropolitan government to attack problems of social reform on an area basis, local participation and creative diversity may be reduced.

Planners conclude today that the rise of larger metropolitan areas has made purely local government obsolete. The size of today's urban area and its
intricate internal relationships seem to require a graduated form of government which would involve both centralization and decentralization. A larger regional body would do certain things in organizing and servicing the area while smaller units would provide services such as recreation and education.

Reducing political fragmentation of the urban area through such methods as annexation, creation of special districts, consolidation, federation, or new forms of government would at least provide a regulatory body with control over an entire housing area. Theoretically, the rational organization of internal urban space could be improved. Whether or not this would reduce sprawl remains to be tested, as the causes of this phenomenon are as much economic as political.

Hypothesis Formulation

There are numerous hypothesis that one could formulate based upon the theoretical perspectives presented above. However, an extensive knowledge of the community's history, topography, and political economy allow one to eliminate the vast majority of these. The literature on sprawl coupled with an understanding of the community compels this analysis to consider the following six hypothesis:

Hypotheses 1: Sprawl in the Las Vegas Valley has resulted in increased segregation of races and/or socioeconomic classes. One reason for this is that the residential location of low-income households is more sensitive to employment opportunities and housing costs than that of higher-income
Hypothesis 2: Sprawl in the Las Vegas Valley has resulted in an increase in the demand for increased services at the fringe. This can be seen in the fact that residential location of high-income families is sensitive to municipal finance concerns, such as service quality and tax rates.

Hypothesis 3: Sprawl in the Las Vegas Valley is exacerbated by exclusionary zoning practices. These restrictive density zoning ordinances in suburban communities operate to exclude low-income families as well.

Hypothesis 4: Sprawl in the Las Vegas Valley negatively impacts the existing city core because the distribution of employment opportunities in a metropolitan area.

Hypothesis 5: Sprawl in the Las Vegas Valley has had a negative impact on the quality of the environment. More specifically, it has degraded the bioregion by decreasing the natural habitat, impounding the water, degrading the natural "washes" and perhaps most significantly contributed to an increase in air pollution through an increase in the vehicles miles traveled (VMT).

Hypothesis 6: Sprawl in the Las Vegas Valley has resulted in an increase in infrastructure expense for schools, roads, and utilities.

The remaining chapters will examine the "evidence" which supports or controverts these hypothesis.
CHAPTER 4

LAS VEGAS HISTORICAL DEVELOPMENT
and
DEMOGRAPHICS

Nevada and Las Vegas have become synonymous with gambling worldwide. Prior to development of gaming-based tourism, the economy of Nevada depended almost exclusively on the boom/bust cycle of mining and the largesse of various federal projects. Nevada’s gambling history predates its statehood; the discovery of the Comstock Lode in 1859 made gambling an integral part of the state’s boomtown atmosphere, as gambling hall owners set up shop in response to the sudden demand created by gold and silver strikes (Ezell 1960).

In 1861, the legislature of the Nevada Territory made all forms of gambling illegal. This prohibition was adopted in 1864 by the newly-formed State of Nevada, but in 1869 the state legislature reversed its policy and legalized a number of games upon which it levied taxes. Taking another turn, Nevada banned all gambling in 1909. Enforcement of this prohibition over the next 22 years was sporadic at best, in part because gambling was almost an institution.

Gaming made a national comeback in the 1920s and 1930s, and was officially sanctioned by the state of Nevada in 1931. This can be attributed both to the political power wielded by certain gaming entrepreneurs of the day, the
recreational activities associated with the historical mining company town, and a tacit acknowledgment of gaming's potential as a source of revenue in a limited economy (Ezell 1960).

The 1930s were a turning point for Clark County and the state of Nevada's economy and social structure. The decade marked the first effective break from the state’s dependence on mining as the basis of its economy. Legalized gaming was restored and divorce laws were liberated in an attempt to build "tourism". The construction of the Boulder Dam provided a massive infusion of capital, much needed water and electrical power and the engineering marvel that would attract tourists. They were also developments which would exacerbate segregationist mentalities and policies throughout the community.

Much of the current land use patterns so prevalent today had their genesis in the 1930s. Clear patterns of spatial segregation that came into existence in the 1930s remain today. This chapter provides a brief overview of the historical development of the community with a special emphasis on residential segregation patterns and an overview of the current demographic profile of the community today.

In the early 1800's there was one route connecting Southern California with the east, the Spanish Trail. In 1829, Antonio Amlijo's party made an important deviation from the established route. A young scout named Rafael Rivera pushed westward rather than following the river, passing through unexplored desert land, and came upon the lush, green oasis that would become known as Las Vegas—"The Meadows"—to future travelers along the new,
shorter path of the Spanish Trail. For the next 20 years Las Vegas was a welcome stop for those making the journey west (Haller 1979).

The United States took possession of the area after the Mexican War, and the first attempt at establishing a permanent settlement in the Valley was by Mormon missionaries in the late 1840s. Las Vegas was a vital link along the former Spanish Trail, which had become a wagon route. The Mormon Fort is still standing, located at what is now Las Vegas Boulevard and Washington Avenue. After the Mormons abandoned the fort, Octavius Decatur Gass bought the land and turned it into the Las Vegas Ranch, occasionally welcoming the travelers who used the wagon route (Chafetz 1960).

By the early 1900s, Las Vegas was fairly well established as a farm and ranch town. In 1905, due once again to its location and abundance of water, Las Vegas was chosen as a rest and supply stop by the railroad. The railroad put Las Vegas on the map, and was the town’s principal industry for the next 25 years; it was also the reason for early development along Fremont Street, where saloons, hotels, and various shops sprang up (Chafetz 1960).

Las Vegas became a city on May 15, 1905, when "Clark's Las Vegas Townsite" — 110 acres of land between Stewart on the north, 5th Street (Las Vegas Blvd.) on the east, Garces Avenue to the south, and Main Street to the west— was auctioned off. The City was governed as part of Lincoln County until 1909, when it became the seat for the newly established Clark County. Las Vegas was incorporated and adopted its first charter on March 16, 1911. At the time of incorporation the City encompassed 12,275 acres (19.18 square mules),
and had approximately 800 inhabitants, less than one percent of the state's total population (Haller 1979).

The City of Las Vegas was literally and figuratively shaped by the railroad, its first dominant industry. The rail line coming in from Salt Lake City aligned the downtown area at an angle that caused the streets to run in northeast-southwest and northwest-southeast directions, as opposed to the traditional north-south and east-west pattern; because of the railroad station and shops, the downtown area developed on the land between Stewart and Garces on the north and south, and 5th Street (Las Vegas Boulevard) and Main Street on the east and west. Housing was scattered throughout the townsite, but was most dense in the southern portion.

The impact of the railroad began to diminish in the 1920s. Without its financial support, the City fell into a depression. In 1931, two events occurred that would forever change the face of Nevada and the City of Las Vegas. The first was the legalization of gambling, on March 19, 1931; the second was the beginning of construction on Hoover (Boulder) Dam. The influx of construction workers, and eventually tourists, gave the valley's economy a much needed boost.

Prior to the construction of the Boulder Dam at the height of the Depression, the Las Vegas community was almost exclusively white with a minor but important Japanese population. In fact the federal censuses between 1890 through 1930 report fewer than 700 blacks in the state of Nevada. Thousands of mainly job-seekers (mainly "Southerners") trekked to southern Nevada seeking
work at the dam or in various secondary construction projects. Those who were hired on the dam project needed housing and services close to the construction site. The federal government met this need by subsidizing the building of Boulder City, some thirty miles to the southeast of the City of Las Vegas.

As the City's population grew, other subdivisions were developed. Most of the homes in these developments were small "cottage" types which housed the working men and their families. Demand for housing increased dramatically when the construction of Hoover Dam began. Some of the workers settled in the subdivision named for the dam (Boulder, at the time) located on the east side of town near Boulder Highway (Moehring 1989).

The prospect of the employment at the dam also brought about a black emigrant population. Blacks, however did not benefit directly from the construction of the Boulder Dam. Blacks who came to Nevada to find a job at the dam were discouraged from waiting for openings. At its employment peak in 1934, the dam project provided more than 5,200 jobs with fewer than 30 being held by blacks or other minorities. Spatial segregation was further complicated by the appearance of many segregationist Southerners in the Boulder Dam work force and the erection of the all-white town of Boulder City which housed those workers. The practice of segregation spread to most public accommodations and public facilities. Even the city and county jails housed prisoners on a segregated basis (Fitzgerald 1981).

By 1934, Las Vegas blacks were concentrated in a two block area bounded on the South by Stewart Street and just opposite blocks Sixteen (the
block for brothels) and Seventeen. There were even a few black-owned businesses in downtown Las Vegas. The communities of both Boulder City and North Las Vegas barred residence to blacks, the effect was to drive them into the McWilliams Townsite. As both the black population grew and implications of racial segregation of the valley grew the predominantly black community originally known as the McWilliams Townsite became known as the "Westside", in reference to its position relative to the Union Pacific Railroad tracks which run through Las Vegas (Fitzgerald 1981).

The population of Clark County grew rapidly throughout the early 1930s as the local economy expanded due to a variety of New Deal Public Work Authority (PWA) projects, including Hoover Dam, a public golf course, a fish hatchery, public schools, and the War Memorial Building. But the departure of thousands of dam workers and their families, coupled with a reduction of New Deal funding in 1937, slowed the Las Vegas economy. Local promoters turned their focus to the obvious alternative choice for economic salvation—tourism—since, as the "gateway to Boulder Dam" Las Vegas was already attracting some 300,000 visitors annually (Moehring 1989).

Prior to the election of reform mayor Fletcher Brown in 1938, Los Angeles was the gaming capital of the southwestern United States. Although illegal, gaming flourished in the southern California metropolis. Brown declared war on gambling and subsequently forced the city's casino management expertise to Las Vegas, where it was welcomed. Most notable among the newcomers to Nevada was local casino operator and Los Angeles Police Department Captain
and Vice Squad Commander Guy McAfee, who opened the Pair-O-Dice Club on Highway 91, just south of Las Vegas, on a stretch of road he referred to as "the Strip" (Haller 1979).

By the 1940s, the City was still relatively small at 19 square miles. The development of hotel/casino properties along "the Strip" in the unincorporated county to the south brought development to the southern part of town as well. These areas—the Huntridge and Park Place Additions—boasted much larger and more opulent homes than were previously built in the City. The downtown area was becoming the casino and commerce center of town, and many of its residents took their new-found prosperity to newer subdivisions. As neighborhoods grew, commercial and retail businesses also expanded. Businesses began to appear along Las Vegas Boulevard and Charleston, providing goods and services to many of the people who made their living along Fremont Street. The western portion of Las Vegas was largely undeveloped desert and ranch property until well into the 1960s.

By 1940 Las Vegas had grown to a population of 8,422, and the outbreak of World War II brought the defense industry to the valley. The isolated location, along with plentiful water and inexpensive energy, made Las Vegas an ideal site for military and defense-related industries. Eventually, the War Department would stimulate the local economy through an expansion of the gunnery range (now Nellis Air Force Base), the Nevada Test Site, and the Basic Magnesium Complex (Moehring 1989).

The war years also shaped the modern political, economic and social
structure of Las Vegas. The need for cooper and magnesium during the Second World War had an immense impact on modern Clark County's political configuration. In July 1941, the government decided to build the Basic Magnesium operations on 2,800 acres of desert between Las Vegas and the Boulder Dam. Announcement of the plant's construction came within a month of the release of Executive Order 8802, which banned racial discrimination in the workplace of federal contractors (Fitzgerald 1981).

The black population expanded greatly in the 1940s with the construction and operation of the Basic Magnesium plant. Due to extraction and processing considerations, two separate plants were required. This led to severe logistical problems for the existing communities within Clark County.

In 1940 the population of Clark County was 16,384. The two new plants would require over 13,000 employees and their families. Because of their distance from Las Vegas and the need for new housing the townsite of Henderson was created. It was initially to be more populous than the City of Las Vegas (Fitzgerald 1981).

Blacks who worked at the plants were confined to "a section of the northeast side of the highway called Carver Park...White workers lived in Victory Village and in the newly constructed Huntridge section of Las Vegas." Carver Park, a federally funded housing project included 324 residential units (Coughtry 1988). All Black employees of the Basic Magnesium plants were eligible to live at the project. But despite the superiority of its facilities and the general shortage of adequate housing for Blacks in Clark County most of the Basic
Magnesium black employees opted for life on the Westside. This may be attributed to the inexpensive cost and broader social life available on the Westside compared to the isolated Carver Park (Fitzgerald 1981).

The Westside soon became a mix of permanent dwellings and crude shacks, shanties and tents. The new black immigrants, who came principally from northeastern Louisiana (Tallulah) and southcentral Arkansas (Fordyce) were used to sub-human living conditions and a system of strict segregation. Many had experienced these conditions in the South and along the trek that often took them first to the lumber mills of Arizona before their arrival in Nevada. The fact that so many of the newcomers were recruited by relatives probably helped mollify tensions in the stressed accommodations of the Westside (Moehring 1989).

Although gaming did not constitute a major industry in Clark County until after World War II, McAfee's "Strip" began its expansion to the "Strip" of today in 1940, when hotelier Tommy Hull built the El Rancho Vegas on a tract of land just south of the city. Hull, an experienced financial manager, was simply avoiding the higher taxes of Las Vegas while securing low cost and spacious grounds for his gaming-based resort. The El Rancho attracted the interest of several other entrepreneurs, and triggered a mild building boom along the Strip. The most notable addition was the Flamingo, which opened in 1947. Although it is now widely accepted as fact that this casino was financed by organized crime, the importance of the Flamingo cannot be overstated. It was the first true European-style resort in Nevada, one that could compete in opulence with any
establishment in Miami Beach, Havana or Monte Carlo. The Flamingo established the thematic approach now embraced by all the major Strip properties (Moehring 1989).

The financial success of the Flamingo, under the experienced management of former El Rancho hotelier Charles Resnick and casino operator Gus Greenbaum of Meyer Lansky's Phoenix operations, inspired others to enter the Las Vegas market in the 1950s. New Strip casinos such as the Thunderbird and Desert Inn boasted a level of opulence designed to match or exceed that of the Flamingo.

Downtown Las Vegas also expanded following the War, with the addition of such notable casinos as the Golden Nugget and the Mint. Additionally, Benny Binion, an experienced casino operator, converted the old Apache Club and Eldorado Club into the high-stakes Horshoe, where gamblers could wager up to $15,000 on a single bet in 1951—the equivalent of about $100,000 if measured in 1998 dollars (Moehring 1989).

In 1956, the City of Las Vegas annexed in one square mile of land, its first such addition since incorporation 45 years earlier. By 1960, Las Vegas was 25 square miles and had a population of 64,405, over 22 percent of Nevada's total population; Clark County had a population of 127,016 (Moehring 1989).

During the 1960s, corporations began building and/or buying casino properties. Gambling had become "gaming" and was starting the transition to legitimate business. The Las Vegas economy remained strong and the population increased to 164,674 by 1980. Clark County, meanwhile, had grown...
The expansion of the Las Vegas Strip from 1945 to 1958 was financed largely by entrepreneurs and mobsters. As one author argues, "Since conventional sources were stingy with the capital necessary to build casinos and resorts, mobsters from all over the country financed construction, and installed their own front men, managers, and workers... If it hadn't [been financed by the mob]," Carl Stokes writes, "Las Vegas would doubtlessly look today like Dresden after World War II... " (Johnson 1977). During the 1950s, when the highly publicized Kefauver hearings on organized crime inspired a wave of crackdowns in Florida, New Orleans and elsewhere, numerous professional gamblers and a host of other organized crime activities migrated to Nevada. This migration, a series of racebook scandals, and a rash of gangland violence finally forced the Nevada legislature to take action against a potential criminal element in gaming.

Anxious to avoid any further guilt by association, Nevada state legislators enacted a set of sweeping reforms which included new requirements for licensure within the gaming industry. The Nevada Tax Commission was empowered to investigate, monitor, and license all applicants. In 1955 the state legislature further tightened Nevada gaming regulations by creating the Gaming Control Board. This agency was designed to assist the Tax Commission with investigation and enforcement. In 1959 a single Gaming Commission was created, independent of the Tax Commission, to make all policy and determine all enforcement regarding gaming practices (Moehring 1989).
was mixed. Many considered the state of Nevada remained a bastion of segregation throughout the 1950s and 1960s. Discrimination by both public agencies and private individuals was so blatant as to earn Nevada the label of the "Mississippi of the West". The schools in Las Vegas remained in de facto segregation until 1972 (Rusco 1991).

The millionaire industrialists Howard Hughes and Kirk Kerkorian were the major force behind many of the changes undergone by the Clark County gaming industry during the 1960s. They influenced the creation of patterns that would eventually become the foundation of the gaming industry as it exists today. When Howard Hughes made his foray into gaming in the 1960s he was already the major private landowner in Clark County, having purchased some 40,000 acres there in the early 1940s to create an aerospace center in Las Vegas. His name and reputation brought a much-needed respectability to Nevada's gaming industry, and by 1968 he would be the largest casino operator in the state. Kirk Kerkorian entered the casino business in 1967, when he acquired the Flamingo Hotel and Casino (Moehring 1989).

Because casino gaming in Nevada proved highly profitable in the 1960s and 1970s, a level of expansion was financed out of retained earnings. Access to other sources of funding, such as the Teamster's pension funds, allowed the industry to pursue more projects through debt financing. Still, it seems clear that the amount of expansion that took place throughout the industry in Nevada prior to the 1970s was considerably less than it would have been were capital available from traditional financial markets. This indicates that the performance
of gaming revenues in Nevada was affected more by supply factors than by market demand, at least until the early 1980s. This is reflected in the annual growth rate of Nevada gaming revenues, adjusted for inflation, as compared to the annual growth rate of real gross national product (GNP). From 1960 through 1979 the growth rate of real gross gaming revenues, as reported by the Nevada Gaming Control Board, exceeded that of the real GNP, as reported by the US Department of Commerce, every year, averaging an 8.0 percent annual growth compared to real GNP average growth of 3.7 percent (Moehring 1989).

The mid-1980s saw a period of unprecedented growth. Annual population increases averaging nearly seven percent caused the population to almost double between 1985 and 1995, from 186,380 to 368,360, a 97.6 percent increase. Clark County's population grew from 562,280 to 1,036,180, an increase of 84.3 percent (US Census 1990).

The late 1960s, 1970s and early 1980s finally began to bring about a change in the civil rights and housing options for blacks as well as other minorities (mainly Asians and Latinos) in Las Vegas. Intuition suggests that the struggle still continues today, perhaps at a much more subtle level. Through federal and state statute and directives individual discrimination in housing has been criminalized since the mid-1960s. Institutionalized discrimination and segregation in housing and employment has been much more problematic issues for federal and state agencies, particularly to the extent that the agencies themselves are involved either directly or indirectly with the causes (Rusco 1991).
Las Vegas Today

The 1990s saw a period of unprecedented growth in Las Vegas. The northwest area was experiencing a population growth of 25 percent annually. Local experts estimate that more than 200 subdivisions have been developed since 1990. The master-planned community of Summerlin is the largest; when completed in 1999 it will have more than 100,000 residents and 40,000 dwellings. Summerlin and its neighbors, the Lakes and Peccole Ranch, provide commercial and office space as well. Companies such as Citibank, Bank of America and Household Finance have located in Las Vegas. The 497-acre Las Vegas Technology Center to the north serves as a base of operations for Sierra Health Services, the University of Nevada School of Medicine, American Medicorp and numerous smaller firms.

More than 425,000 people call the City of Las Vegas home. Because of its phenomenal growth, the city has become a melting pot of different ethnic groups, cultures and lifestyles. According to the 1990 U.S. Census, just over 10 percent of Las Vegas residents were born outside the United States. Minority groups have grown from 23.4 percent of the total population in 1980 to 27.9 percent. In spite of Las Vegas' great diversity, the city remains remarkably similar to the rest of the United States. The median age of Las Vegas residents has increased 9.4 percent from 29.8 years of age in 1980 to 32.6 percent years of age in 1990. Over the same period of time, the nation overall increased 9.3 percent, from 30.0 years of age to 32.8 years of age. Las Vegas' share of residents above the age of 65, however, increased at more than twice the rate of
the national average. Over 86 percent of all residents live in one of four household types: married couples with children (22.5%); married without children (25.7%); single persons living alone (26.2%); and female, single parent households (12%) (US Census 1990).

The City of Las Vegas is an "L" shaped city of 93 square miles, measuring more than 20 miles from its most northern point to its farthest eastern point. The most common feature in Las Vegas is vacant land; more than 34 percent of the land in the City is undeveloped. Slightly over half of all vacant land (53 percent) is in the northwest. In other areas of the City, vacant land tends to be of the infill variety.

Residential development is most intense in the east and central planning areas; over 50 percent of the land use in these areas is designated residential. In the west and northwest, residential development is lower at 35 and 21 percent respectively. However, these two areas have seen the most development in the past five years, accounting for over 90 percent of the city's population growth during that time (CLV Comprehensive Planning 1998).

Commercial development is most intense in the downtown area and along the I-15 corridor. As the City expanded westward, commercial development, office, and Industrial/Communications/Transportation/Utilities (ICTU) space has begun to appear in the Summerlin, Lakes/Pecos Ranch, and Desert Shore areas. Throughout the City, general commercial and service commercial appear primarily along transportation corridors. There are some areas of mixed usages, such as the Las Vegas High School neighborhood, where homes have been
converted to professional office space. A mixed use unique to Las Vegas is
general commercial and tourist commercial mixed with residential, which occurs
in the areas near Arizona Charlie's Hotel/Casino and the Santa Fe Hotel/Casino

The Las Vegas economy relies heavily on service industries, which
account for 46 percent of total Las Vegas metropolitan statistical area (MSA)
employment. Of that, 58.4 percent is in hotel/gaming and recreation (HGR)
services. More than 28 percent of the total work force is employed in hotel,
gaming and recreation segments (HGR). Las Vegas has attempted to diversify
its economy to become less reliant on HGR. The manufacturing sector, though
relatively small, has grown by 88 percent since 1990, compared with zero to
negative growth nationally. The construction industry, which responds to growth,
has shown employment gains of 34 percent since 1990 (CLV Comprehensive
Planning 1998).

For the most part, unemployment in the city has remained below the
national rate. This is partly due to the resilience gaming has shown to national
recessions (with the exception of the early 1980s), and expansion in
hotel/casinos. Local experts calculate that each new hotel room creates one new
job within the hotel and one and one-half jobs outside, for a net gain of 2.5; this
multiplier creates demand for businesses that support the hotels as well as
businesses to support the growing population. The development of new hotel
properties has been the driving force behind recent residential and commercial
development.
According to the 1980 U.S. Census, Las Vegas was a city of 258,295 people. Between 1980 and 1990, the City experienced a population increase of 57 percent, with an annual increase averaging 4.6 percent. The majority of the population growth is taking place in the west and northwest; given the location of these areas relative to downtown, city services and job centers, continued growth could present logistical and transportation problems in the future. Population in the more established central and eastern areas has remained relatively stable, showing small increases.

The population density in Las Vegas increased slightly during the 1980s, going from 4.65 persons per acre to 4.92 persons per acre. The east and central areas have densities twice as high as the city average, while the west is slightly lower due to vacant land. The rapidly developing northwest is significantly lower than the average because vacant land comprises 63 percent of its total area.

Over the past few decades, Las Vegas household composition has shifted away from "traditional" families with children to households of married couples with no children and single persons living alone. The trends have contributed to a lower persons per household ratio. Las Vegas has an average household size of 2.55 persons, approximately the same as the County and State. The west planning area has the lowest persons per household, yet has the second most households designated married couples with children, indicating that those who do have children have fewer. The central and east areas are similar to city totals in persons per household, averaging 2.5 and 2.6 respectively. Larger families are found in the northwest, where 33 percent of the households are married with
children, contributing to the average of 3.1 persons per household. Married couples without children are increasing; the numbers are particularly high in the west and northwest, where more than 30 percent of the households fall into this category. Single-person households are increasing at the greatest rate and are currently the most frequently occurring. More than 26 percent of all households are single person households. The largest percentage of this household type occurs in the east (32.7 percent) and central (27.9 percent) areas. Single parent females with related children make up 8.2 percent of the households in the city. The central planning area has the greatest occurrence of this type of household (10.2 percent), while the northwest has the lowest (5.2 percent) (CLV Comprehensive Planning 1998).

Las Vegas is slowly becoming more ethnically and culturally diverse. Over 10 percent of Las Vegas residents were born in a foreign country, and more than 75 percent of Las Vegas residents were born in a different state. These factors combine to give Las Vegas a diverse, multi-cultural makeup. For the purpose of this study, groups are categorized as White, Black, American Indian, Asian, and Hispanic.

During the 1980s, there were significant increases in the number and share of Hispanic and Asian populations. Hispanics increased in share during that time from 7.8 percent to 12.5 percent. Asians went from a 2.0 percent share to 3.4 percent. Black population increased from 20,866 to 28,897, but the share decreased, going from 12.7 percent of total population to 11.1 percent. The east planning area has the greatest share of Hispanics and Asians, 22.7 percent and
5.2 percent respectively, and the lowest White population (61.4 percent). The central planning area had the greatest share of black population, 19.7 percent. The west and northwest planning areas have the highest share of White population, both over 85 percent (CLV Comprehensive Planning 1998).

According to the U.S. Bureau of the Census, there are slightly fewer males than females nationwide, 49 percent to 51 percent; in Las Vegas, 50.6 percent of the population is male. Clark County and the State of Nevada have a higher share of females, 50.7 and 50.8 percent respectively.

Las Vegas is aging. In 1970, 5.7 percent of the population was over the age of 65. By 1990, the over-65 age category had increased to 10.3 percent. However, the median age for the City of Las Vegas (32.6) is younger than Clark County (33.1), Nevada (33.3), and the United States (32.8). The increase in age is due in part to an increase in elderly migration, and also the aging of the local baby boomers. The share of population of those under the age of 18 decreased from 27.9 percent in 1980 to 24.8 percent in 1990. The increase in overall population, however, means there are still a significant number of school-age children in the city; while these proportions may decrease, the number of children should continue to rise. Population and share should continue to increase for the over-65 population, due to the desirability of Las Vegas as a retirement spot and the development of more senior-oriented communities.

According to the 1990 U.S. Bureau of Census figures, 76.3 percent of Las Vegas residents over the age of 25 have a high school diploma or higher, and 13.4 percent have a four-year college degree or higher. Clark County and the
State of Nevada are slightly higher in each of the two categories. Both Las Vegas and Clark County improved somewhat between 1980 and 1990 in both categories. School-age children in the City of Las Vegas attend class in the Clark County School District, the county's only school district and one of the largest in the country. During the 1980s, enrollment in schools in the City of Las Vegas increased 27.2 percent, going from 34,399 to 43,733 (CLV Comprehensive Planning 1998).

Between 1990 and 1996, the City of Las Vegas grew at an average annual rate of 7.27 percent. The majority of this growth took place in the west and northwest, where growth rates exceeded 20 percent. The eastern area witnessed slight growth rates between 0 and 2 percent, while the central area ranged from no growth to slight declines. The declines were primarily due to a change in housing units from residential to office or commercial uses. To support this rapid increase in population, 40,000 housing units were developed at an average annual rate of 5.33 percent. Seventy percent of the units developed were single-family. According to an annual postal survey, the single family and multi-family vacancies remained high during this period, often exceeding 98 percent.

In 1996, the City of Las Vegas had 157,777 housing units. Of those, 95,608 were single-family and 62,169 were multi-family. Apartment units comprise 67 percent (41,625) of the multi-family units, condominiums make up 21 percent (13,114), and the remainder are multiplex units. The majority of multi-family units are in small complexes. Fifty percent of the multi-family complexes...
have fewer than 10 units per structure, 21 percent have between 10 and 19 units, 14 percent have between 20 and 49 units, and 15 percent have more than 50 units.

The 1990 U.S. census reports that 70 percent of the housing units are owner occupied, with a median monthly payment of $801. The remaining 30 percent of the housing units are renter occupied, with a median monthly payment of $490.

According to the Center for Business and Economic Research (CBER) at the University of Nevada, Las Vegas, the median monthly mortgage payment in 1995 was $930, while the median monthly rental payment was $812. According to 1996 County Assessor's data, housing values range from $60,000 to $120,000 in the eastern portion of the city. In the central portion of the city, housing values range from $60,000 to $120,000, with pockets of homes exceeding $140,000 (some of which are over $1,000,000). The west and northwest areas have newer homes ranging from $80,000 to over $140,000. In 1995, according to a CBER report, the median price of a new home was $123,000, the average size was 1,566 sq. ft., and the median home buyer's income was $46,119.
CHAPTER 5

URBAN DENSITIES, ZONING and LAND USE

It is impossible to discuss sprawl without examining population density.

Land use and zoning. Sprawl, by all definitions involves “low-density residential” land uses. This chapter reviews urban densities historically and locally; zoning as a process and its role in sprawl; and current land patterns in the Las Vegas community.

Historical Residential Density

In the ancient city of Uruk, about 3000 BC, covered more than 1100 acres with an average residential density of about 60 persons per acre. Another study of the ancient city of Ur a city covering 2500 acres with a density of 300 persons per acre (Adams 1960). At the height of the Roman Empire, Rome was believed to have a density as high as 180 persons per acre (Jones 1974). Densities have been estimated for as many as 92 medieval European cities. The median density was approximately 45.

The measurements were made at various dates between 1348 and 1550, namely, after the first attacks of the Black Plague—earlier densities were probably higher (Russell 1958). Some Eighteenth Century estimates include Leyden 130, Liege115, and Rome 120. Smaller towns sometimes but by no means always showed lower density. Sheffield in the United Kingdom had a
density of 400 persons per acre in 1800, 220 in 1850, rising again to 270 in 1901 (Brutenkus 1971). A general review of average urban standards in Europe gave 100 persons per acre up to 1850, 75 in 1900, and 48 in 1950 (Brutenkus 1971).

We demand more social space as our economies advance. Thijsse, of the School of Social Science at The Hague estimates the "best pattern" for settlements in the modern world is 35 persons per acre (70 persons per acre in a residential area covering half the area of the city, with the remaining half being used for industrial, commercial, and recreational purposes.). If however people live in detached houses (a comparative rarity in the Netherlands), density will have to fall to between 8 and 15 (Thijsse 1967).

These averages however have concealed some areas of very high densities, such as still prevail in many large cities in poorer countries and developed Asia. Densities in London districts have regularly exceeded 350 persons per acre, while the most densely populated part of Brooklyn exceeded 200 in 1930 (Hoover 1971). Such densities may be supported by communities which possess the wealth and technology to construct skyscrapers. A density of over 1200 persons per acre has been recorded for some parts of Hong Kong (Hughes 1951).

Historically, with few exceptions, densities are high near the center of a metropolitan area, and a fall off in accordance with a negative exponential function of distance from the center (Clark 1951).

The distribution of people between high and low density residences is influenced by their incomes, present and expected work places, the age and
number of children, and also by many elements of personal choice, their comparative taste for open life or for city amenities, and the strength of their comparative dislikes for travel on the one hand and for increased pollution, noise and crime of the city on the other.

Residential density in southern Nevada is generally measured in dwelling units per acre. For comparative purposes, we can easily convert this measure by multiplying it by 2.67 which is approximate persons per household in the community. Nationwide, suburban communities vary immensely typically average from two to five dwelling units per gross acre (although some residential units are ten to twenty times greater).

The density of residential development within the Las Vegas valley varies approximately 0.6 dwellings (or 1.6 persons) per acre to 18 dwelling units (or 48 persons) per acre in the urbanized community. Current design planning guidelines vary significantly between jurisdictions within the valley ranging from Henderson’s city-wide average of 2.45 dwellings (6.5 persons) per acre and the City of Las Vegas’ actual 1.5 to 6.4 dwellings (or 4 to 17.1 persons) per acre. A comparison of densities for residentially-zoned land in Henderson and the City of Las Vegas planning areas follows:
Table 5-1 Projected Dwelling Units By Planning Area for the City of Henderson

<table>
<thead>
<tr>
<th>Planning Area</th>
<th>Acres</th>
<th>Units</th>
<th>Units/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Mountain</td>
<td>3,115</td>
<td>3,358</td>
<td>1.14</td>
</tr>
<tr>
<td>Calico Ridge</td>
<td>2,063</td>
<td>1,504</td>
<td>0.73</td>
</tr>
<tr>
<td>Foothills</td>
<td>4,356</td>
<td>2,360</td>
<td>0.54</td>
</tr>
<tr>
<td>Green Valley</td>
<td>2,790</td>
<td>16,011</td>
<td>5.74</td>
</tr>
<tr>
<td>Green Valley South</td>
<td>5,218</td>
<td>20,605</td>
<td>3.95</td>
</tr>
<tr>
<td>Highland Hills</td>
<td>1,356</td>
<td>5,935</td>
<td>4.38</td>
</tr>
<tr>
<td>MacDonald Ranch</td>
<td>4,219</td>
<td>11,402</td>
<td>2.70</td>
</tr>
<tr>
<td>Mission Hills</td>
<td>1,425</td>
<td>2,170</td>
<td>1.52</td>
</tr>
<tr>
<td>Paradise Hills</td>
<td>1,298</td>
<td>2,410</td>
<td>0.54</td>
</tr>
<tr>
<td>Pittman</td>
<td>2,343</td>
<td>3,622</td>
<td>1.54</td>
</tr>
<tr>
<td>River Mountain</td>
<td>3,115</td>
<td>1,916</td>
<td>0.62</td>
</tr>
<tr>
<td>Sky Harbor</td>
<td>3,087</td>
<td>5,556</td>
<td>1.80</td>
</tr>
<tr>
<td>The Lake</td>
<td>2,328</td>
<td>6,773</td>
<td>2.91</td>
</tr>
<tr>
<td>Townsite</td>
<td>737</td>
<td>4,066</td>
<td>5.52</td>
</tr>
<tr>
<td>Valley View</td>
<td>1,570</td>
<td>8,974</td>
<td>5.72</td>
</tr>
<tr>
<td>Witney Ranch</td>
<td>2,212</td>
<td>4,361</td>
<td>1.97</td>
</tr>
<tr>
<td>TOTAL</td>
<td>41,232</td>
<td>101,203</td>
<td>2.45</td>
</tr>
</tbody>
</table>

Source: City of Henderson Design Guidelines 1998

Table 5-2 Actual Dwelling Units By Planning Area for the City of Las Vegas

<table>
<thead>
<tr>
<th>Planning Area</th>
<th>Acres</th>
<th>Units</th>
<th>Units/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>5,908</td>
<td>37,982</td>
<td>6.43</td>
</tr>
<tr>
<td>Central</td>
<td>9,015</td>
<td>36,620</td>
<td>4.06</td>
</tr>
<tr>
<td>West</td>
<td>15,875</td>
<td>56,467</td>
<td>3.56</td>
</tr>
<tr>
<td>Northwest</td>
<td>17,670</td>
<td>26,708</td>
<td>1.51</td>
</tr>
<tr>
<td>Total</td>
<td>48,468</td>
<td>157,777</td>
<td>3.26</td>
</tr>
</tbody>
</table>

Source: City of Las Vegas Comprehensive Planning (1998b)

What is clear from the above is that the City of Las Vegas has a higher
actual residential unit density than Henderson plans to in the future. More importantly as the City of Las Vegas’ west and northwest planning areas “fill in” the overall City of Las Vegas residential density should exceed 4 dwelling units per acre or 50% higher than that of Henderson.

In Las Vegas, an interest in population density is likely to turn shortly to an interest in zoning. What is fascinating about zoning is that it is so widely criticized in the planning profession and at the same time given such limited attention in planning texts. Zoning is sometimes pictured as just one of the many tools available to planners; it is seldom viewed as one of the more effective of these tools. It is, in fact, often considered to be ineffective and, perhaps more importantly, counterproductive. But this assessment should not lead observers to the conclusion that zoning is powerless or that zoning has no meaning. On the contrary, zoning is perhaps the most significant power in the hands of our local governmental authorities. One can think of few local public activities that are as important, particularly in terms of its effects on the community.

The communities of the Las Vegas Valley all have general or comprehensive plans which discuss land uses. However, it is not the plan that determines how land will be used it is the zoning. Zoning comes first, and planning is placed in a subordinate position; this is true in a number of different ways.

Technically, zoning is a land-use control, like subdivision regulations and the official map. Zoning is one of the means that governments use to regulate private land and building development within their jurisdictions. It is an example
of the exercise of the police power of the state, which is usually delegated to
local governments. Typically states adopt enabling legislation permitting
municipalities and perhaps other local governments to perform zoning function.
Ultimately, zoning is made law through the adoption of zoning ordinance by the
local government, and it is the local government that becomes the administering
unit.

There are five general categories of land-use in the zoning ordinances:
residential (Single family and multi-family), commercial, industrial, public (public,
quasi-public, & open space) and streets. As time has passed, there has been a
tendency for communities to develop additional categories and to subdivide the
existing categories into a number of classes with more specific stipulations and
refinements. Zoning customarily has required highly structured and
predetermined layout patterns as well as separation of residential densities.

Zoning has been implicated in urban sprawl. It is argued that the
separation of housing and work increases a community's reliance on
automobiles and therefore contributes to sprawl. According to Kunstler and

"What zoning produces is urban sprawl, which must be understood as the
product of a particular set of instructions. Its chief characteristics are strict
separation of human activities, mandatory driving to get from one activity
to another, and huge supplies of free parking. After all, the basic idea of
zoning is that every activity demands a separate zone of its own. For
people to live around shopping would be harmful and indecent. Better not
even to allow them within walking distance of it."

Land uses are described by both type and density. Eisner (1993) examined urban land uses from 1939-1985 and calculated the percentage of each land use in selected urban areas.

Eisner estimated that a typical urban area consisted of the following:

**Table 5-3 Typical American Urban Land Uses**

<table>
<thead>
<tr>
<th>Land Use Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>35 to 39%</td>
</tr>
<tr>
<td>Commercial</td>
<td>4.8 to 5.0 %</td>
</tr>
<tr>
<td>Industrial</td>
<td>10 to 11 %</td>
</tr>
<tr>
<td>Public et al</td>
<td>10 to 18 %</td>
</tr>
<tr>
<td>Streets &amp; Right-of-Way</td>
<td>20 to 26 %</td>
</tr>
</tbody>
</table>

Source: Eisner 1993

Zoning is essentially a middle, upper-middle, and upper-class matter. Zoning has traditionally been a homeowner's matter. Regardless of what zoning may be in theory, in practice it has become the chief means of isolating and protecting the single-family residence (Babcock 1966).

One might ask what we are protecting the single-family home from. The answer is that we are protecting it from virtually any land use that is the most vocal and powerful of the single-family residents consider undesirable. This includes industrial uses, most if not all commercial uses, high-density residential uses and low-density apartment units, certain kinds of public uses and facilities, and most importantly, low and affordable housing.
It has been claimed that affordable housing for low and moderate income housing (particularly that which is associated by government subsidies) is feared because of its purported negative impact on current housing values. Yet, studies consistently show that this claim is unsubstantiated (Puryear and Hayes 1990). Upper and middle class neighborhoods are commonly organized to make sure that zoning is in place to protect their single family areas from this type of subsidized housing.

Zoning determines the basic pattern of development in the community, and subdivision controls must work within the general frame established by zoning. Zoning determines the fundamental pattern of use of private land, designating minimum lot sizes, maximum densities, building setbacks, height limitations, minimum house sizes, off-street parking requirements, and permitted general uses. It is important to realize that it is zoning ordinances that are used to isolate middle income and upper-income single family neighborhoods from the poor.

McCandless (1967) found that many government officials believe that high-income residents and high-priced housing puts less pressure on community services and tax levels than alternative residential patterns. Since, traditionally, local governments draw more revenues from the property tax than any other single source, property values must be taken into account. In addition, it is contended that higher density residential development is likely to mean that families with more children will come to the community, putting an increased strain on public schools, which in most of America consumes the majority of the
property tax dollars. Even in 1967, McCandless found no officials who hinted that land-use policy might be shaped to exclude blacks, lower-income minorities, or to maintain certain a economic class level.

Exclusionary zoning practices (e.g., barring multi-family residences) often contribute significantly to inefficient transportation systems. Inefficient land use can contribute to inefficient mass transit. Low density cannot produce sufficient public transportation ridership to justify mass transit system expansion. In the case of the Las Vegas Valley this is clearly demonstrated in the Table 5-4 below. The table demonstrates the number of potential mass transit riders available within a range of zoning districts in Title 29 of the Clark County's Zoning Ordinance. Ridership potential is based upon the number of dwelling units within a quarter mile of each bus stop. Potential ridership is then determined by the average number of people per household divided by the number of dwelling units. This chart clearly demonstrates why major public subsidies may be required to construct and maintain transit systems which will operate in Las Vegas' largely single-family residential communities.
### Table 5-4 Potential Ridership Per Zoning District

<table>
<thead>
<tr>
<th>Zoning District</th>
<th>Dwelling Units</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Spaces (O-S)</td>
<td>5.92</td>
<td>15.8</td>
</tr>
<tr>
<td>Rural Open Land (R-U)</td>
<td>14.8</td>
<td>39.5</td>
</tr>
<tr>
<td>Residential Agriculture (R-A)</td>
<td>29.6</td>
<td>79.0</td>
</tr>
<tr>
<td>Rural Estates Residential (R-E)</td>
<td>59.2</td>
<td>158.0</td>
</tr>
<tr>
<td>Suburban Estates Residential (R-D)</td>
<td>88.8</td>
<td>237.0</td>
</tr>
<tr>
<td>Single Family Residential (R-1)</td>
<td>118.4</td>
<td>316.1</td>
</tr>
<tr>
<td>Single Family Residential (R-1A)</td>
<td>148.0</td>
<td>395.1</td>
</tr>
<tr>
<td>Mobile Home Residential (R-T)</td>
<td>148.0</td>
<td>395.1</td>
</tr>
<tr>
<td>Medium Density Residential (R-2)</td>
<td>236.8</td>
<td>632.3</td>
</tr>
<tr>
<td>Multiple Family Residential (R-3)</td>
<td>532.8</td>
<td>1,422.6</td>
</tr>
<tr>
<td>Mobile Home Park (T-C)</td>
<td>532.8</td>
<td>1,422.6</td>
</tr>
<tr>
<td>High Density Multiple Family Residential (R-4)</td>
<td>740.0</td>
<td>1,975.8</td>
</tr>
<tr>
<td>Apartment Residential (R-5)</td>
<td>1,480.0</td>
<td>3,951.8</td>
</tr>
</tbody>
</table>

Source: Clark County Department of Comprehensive Planning & State of Nevada Demographer's Office

The Las Vegas community is often compared with other western "new" American cities. The following table compares single-family/multi-family ratios of several southwestern metropolitan areas:
Table 5-5  
1995 Southwestern Single Family/Multi-Family Housing Ratio Comparisons

<table>
<thead>
<tr>
<th>Area</th>
<th>Total Units</th>
<th>Single Family</th>
<th>Multi-Family</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Las Vegas Metro</td>
<td>284,632</td>
<td>155,741</td>
<td>128,891</td>
<td>45.3%</td>
</tr>
<tr>
<td>Las Vegas</td>
<td>105,585</td>
<td>59,303</td>
<td>46,282</td>
<td>43.8%</td>
</tr>
<tr>
<td>North Las Vegas</td>
<td>14,653</td>
<td>9,139</td>
<td>5,514</td>
<td>37.6%</td>
</tr>
<tr>
<td>Henderson</td>
<td>23,589</td>
<td>16,576</td>
<td>7,013</td>
<td>29.7%</td>
</tr>
<tr>
<td>Phoenix Metro</td>
<td>854,418</td>
<td>574,052</td>
<td>280,366</td>
<td>32.8%</td>
</tr>
<tr>
<td>Tempe</td>
<td>57,963</td>
<td>32,817</td>
<td>25,146</td>
<td>43.4%</td>
</tr>
<tr>
<td>Phoenix</td>
<td>397,325</td>
<td>256,617</td>
<td>140,708</td>
<td>35.4%</td>
</tr>
<tr>
<td>Scottsdale</td>
<td>67,349</td>
<td>44,120</td>
<td>23,229</td>
<td>34.5%</td>
</tr>
</tbody>
</table>

Southern California

<table>
<thead>
<tr>
<th>Area</th>
<th>Total Units</th>
<th>Single Family</th>
<th>Multi-Family</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaheim</td>
<td>87,727</td>
<td>46,293</td>
<td>41,434</td>
<td>47.2%</td>
</tr>
<tr>
<td>Irvine</td>
<td>40,899</td>
<td>28,460</td>
<td>12,439</td>
<td>30.4%</td>
</tr>
<tr>
<td>San Bernadino</td>
<td>53,809</td>
<td>35,100</td>
<td>18,709</td>
<td>34.8%</td>
</tr>
<tr>
<td>Riverside</td>
<td>77,325</td>
<td>53,674</td>
<td>23,651</td>
<td>30.6%</td>
</tr>
<tr>
<td>San Diego</td>
<td>420,812</td>
<td>241,074</td>
<td>179,738</td>
<td>42.7%</td>
</tr>
</tbody>
</table>

The above data might suggest that (with the notable exception of Henderson) the Las Vegas Valley is very similar to other major southwestern communities in residential land use. However, to better examine the impact of housing mix on the community, one must also examine the community's total land-use patterns.
Harris (1992) suggests that in facilitating the metropolitan complex of the next millennium involves a changing land mix. Compared to Eisner (1993), nationally, Harris sees an increasing percentage of the commercial (mainly localized retail) and public/open space (mainly greenbelts and parks) categories with a corresponding decrease in the industrial land use needs of America's large cities. As can be seen from the table below, both Eisner's current land mix use profile and Harris' proposed land use mix profile are substantially different from that of the Las Vegas Valley.

Table 5-6 Land Use Profiles

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Eisner</th>
<th>Harris</th>
<th>Las Vegas Valley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>35 to 39%</td>
<td>48%</td>
<td>61%</td>
</tr>
<tr>
<td>Commercial</td>
<td>4 to 5%</td>
<td>10%</td>
<td>18%</td>
</tr>
<tr>
<td>Industrial</td>
<td>10 to 18%</td>
<td>7%</td>
<td>10%</td>
</tr>
<tr>
<td>Public/Open Space</td>
<td>10 to 18%</td>
<td>32%</td>
<td>9%</td>
</tr>
</tbody>
</table>

The Las Vegas Valley's variance from these two profiles are a result of the structure of the local economy (which is service-based and the lack of any substantial manufacturing base); the community's historical failure to provide for adequate public/open space such as parks; and community's large number of commercial "retail operations" (e.g., convenience stores, bars and other establishments which provide local gaming). Also complicating the urban form of the Las Vegas Valley is the explosion of the master-planned community.
The movement toward master-planned communities (MPCs) in the southwestern United States is an outcome of the outgrowth of increased planning activities within metropolitan communities; consolidation in the real estate development industry; and a reaction by developers to exclusionary zoning practices within "new" American cities.

The American MPC is based upon a long established European model. During the Industrial Revolution of Great Britain, mass migration toward cities resulted in an increasing strain on infrastructures. In reaction to this sudden industrialization and urbanization, factories began to build housing nearby to assure a steady stream of workers. To alleviate a housing shortage in post-World War II London, developers could have built subdivisions, but residents still would have to commute to London to work compounding traffic congestion and air pollution. Instead, outside London, eight "new towns" were built, each with its own employment, social and recreational opportunities.

By the early 1950s, urban migration, also had become a concern in the United States. In response, a handful of American developers studied the "new town" model and found it to be a reasonable alternative to subdivision development.

In MPCs, community associations charge a monthly fee to oversee the collective interests of residents. One of their functions is to create and enforce covenants, conditions, and restrictions (CC&Rs)—guidelines designed to ensure continuity throughout a particular community. CC&Rs seek to eliminate typical neighborhood issues such as house color, lawns left barren or trash abandoned.
on curbs. Most residents accept these restrictions because they believe that they ensure property values and reduce neighborhood conflicts.

The Las Vegas Valley is filled with MPCs. In fact, the largest MPC in the country—Howard Hughes Summerlin—is in the City Las Vegas. Summerlin is part of the 40,000 acres that Howard Hughes acquired in northwest Las Vegas in the 1950s. The mixed use community occupies nearly 36 miles and includes 30 distinct neighborhoods. At build-out, Summerlin will be home to 160,000 residents.

In southwest Henderson, Del Webb Corporation is developing a 4,800 acre MPC called Anthem. Sun City Anthem, designed for upper-middle and upper class seniors (aged 55 years and older) will encompass nearly 3,300 of these acres.

As can be seen from the table below, MPCs now account for over 37% of the residential development of the City of Las Vegas. Perhaps more startling is the fact that over 80% of the forecasted five year residential growth in the Las Vegas Valley are MPCs.
Table 5-7 City of Las Vegas MPCs

<table>
<thead>
<tr>
<th>Name</th>
<th>Square Feet</th>
<th>Total Acres</th>
<th>Square Miles</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durango 40</td>
<td>1,804,975</td>
<td>41.44</td>
<td>0.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Spring Mountain Ranch</td>
<td>15,509,044</td>
<td>356.04</td>
<td>0.56</td>
<td>1.0</td>
</tr>
<tr>
<td>Pine Meadows</td>
<td>4,894,573</td>
<td>112.38</td>
<td>0.18</td>
<td>1.0</td>
</tr>
<tr>
<td>Mountain Spa</td>
<td>27,882,437</td>
<td>635.50</td>
<td>0.99</td>
<td>0.0</td>
</tr>
<tr>
<td>Elkhorn Ranch</td>
<td>22,469,308</td>
<td>515.82</td>
<td>0.81</td>
<td>70.0</td>
</tr>
<tr>
<td>Painted Desert</td>
<td>20,016,857</td>
<td>459.52</td>
<td>0.72</td>
<td>95.0</td>
</tr>
<tr>
<td>Los Prados</td>
<td>22,148,341</td>
<td>508.46</td>
<td>0.79</td>
<td>98.0</td>
</tr>
<tr>
<td>Rancho Alta Mira</td>
<td>14,722,898</td>
<td>337.99</td>
<td>0.53</td>
<td>100.0</td>
</tr>
<tr>
<td>Lone Mountain</td>
<td>32,344,817</td>
<td>742.53</td>
<td>1.16</td>
<td>1.0</td>
</tr>
<tr>
<td>Summerlin (Existing)</td>
<td>239,804,188</td>
<td>5,505.15</td>
<td>8.80</td>
<td>80.0</td>
</tr>
<tr>
<td>Summerlin (Future)</td>
<td>387,357,562</td>
<td>8,892.51</td>
<td>13.89</td>
<td>0.0</td>
</tr>
<tr>
<td>Sun City</td>
<td>84,883,303</td>
<td>1,943.80</td>
<td>3.04</td>
<td>80.0</td>
</tr>
<tr>
<td>Desert Shores</td>
<td>29,650,468</td>
<td>680.68</td>
<td>1.08</td>
<td>99.0</td>
</tr>
<tr>
<td>South Shores</td>
<td>14,107,413</td>
<td>323.88</td>
<td>0.51</td>
<td>100.0</td>
</tr>
<tr>
<td>Peccole Ranch</td>
<td>81,787,560</td>
<td>1,418.45</td>
<td>2.22</td>
<td>50.0</td>
</tr>
<tr>
<td>Canyon Gate</td>
<td>15,366,338</td>
<td>352.76</td>
<td>0.55</td>
<td>85.0</td>
</tr>
<tr>
<td>The Lakes</td>
<td>55,899,343</td>
<td>1,283.27</td>
<td>2.01</td>
<td>98.0</td>
</tr>
<tr>
<td>MPC Totals</td>
<td>1,050,228,034</td>
<td>24,109.94</td>
<td>37.67</td>
<td></td>
</tr>
</tbody>
</table>

MPCs as % of City 34.49

Source: Richard Wassum CLV Comprehensive Planning Department 1998

The City of Las Vegas, with the exception of Summerlin, the "Northwest Area" and some scattered infill parcels is predominantly built out. Until recently, the "Northwest Area had been the hottest real estate submarket in the valley. This trend is beginning to shift, the southwestern submarket (Henderson area) has been outperforming the northwest. The current trend pushing development to the southern portions of the valley is thought by many in the development
community to be the wave of the future in the Las Vegas Valley. Some believe that the southern boundary of the metropolitan area will continue to be pushed southward toward California along Interstate 15. There are several reasons for these trends. The south has more MPCs, more "programmed" open space, land availability, generally lower land costs and lower citizen opposition to growth.

This increased growth in single-family residential MPCs at the fringe of the Las Vegas Valley has resulted in an increasing concentration of poor and low-income minorities at the core of the urban area (most notably the Cities of Las Vegas and North Las Vegas). This is due to several reasons, including the increasing median price of housing in the MPCs; private and public investment decisions made by members of the real estate investment and development industry; bank lending policy; the continued concentration of low-income and affordable housing within center of the City of Las Vegas; the community's history of individual and institutional racism (see Chapter 4 of this text); and the fragmented and exclusionary planning and zoning policies and practices in the Las Vegas Valley's communities. Without regional public policy intervention, these trends, which have been in existence for decades are expected to continue resulting in an ever increasing segregation between the rich and poor citizens of the Las Vegas Valley.
CHAPTER 6

SOCIAL and POLITICAL ISSUES

Several non-economic factors, arise in the debate over urban densities and sprawl. These factors ultimately return to the underlying political economy assumptions or biases of the scholar or lobbyist. These factors are most often termed "social" or political" because they may affect the "consequences" of sprawl on the "society" at large.

This chapter reviews the most common social issues implicated in discussions on sprawl. More specifically, this chapter will examine (1) sociological perspectives on the consequences of increased urban population densities; (2) the theoretical arguments surrounding the implications of sprawl on affordable housing, segregation and racism; and (3) an examination of the social implications of sprawl in the Las Vegas Valley.

Opponents of sprawl (e.g., Downs 1994) invariably focus on the structural (segregation) implications of sprawl which have been complicated by the exodus of manufacturing jobs from the inner city. Proponents (e.g., Gordon and Richardson 1995) suggest that other "confounding" processes are at work. In either case, the social, political and economic functions of neighborhoods are generally interwoven in sprawl arguments.

One of the main functions of neighborhoods is youth socialization...
(Hunter 1974): the transmission of the predominant group's norms, values, and acceptable behavioral patterns in the young. There is evidence that socialization through local spatial neighborhoods has declined in significance as patterns of social interaction have become more spatially diffuse (Wellman 1972). However, it is equally clear that close-knit geographic communities remain. The point is that, the influence of neighbors on the development of youth can range from negligible to overwhelming, depending on the particular residential context in which youth are exposed. The way some groups of concerned parents fight the movement of "undesirable" households into their neighborhoods provides testimony to their belief in the potent role of neighborhood socialization.

Another social function of neighborhoods is information transmission. If, for example, more neighborhood residents are employed, they are more likely to be sources of information about job vacancies for their unemployed neighbors. If more are on welfare, they are more likely to be sources of information about how that benefits. (Holzer 1988).

Urban sprawl's potential relationship with urban employment and housing patterns requires an understanding of the development and expansion of urban decay in America's metropolitan communities.

Sociological Perspectives on Urban Density

For centuries the crowding of people into cities was doubtless harmful to existence. Packing people together into unsanitary houses in dirty cities raised death rates. Furthermore, as cities grew to unprecedented sizes in nineteenth
century Europe, death struck unevenly within the population. Mortality went
down faster for the better off, leaving slums as the places where lower income
people were crowded into areas "with their sickening odor of disease, vice and
crime" (Weber 1899:414).

When early students of the effects of urbanization analyzed population
crowding or overcrowding they had a relatively simple concept of density—the
number of people per room, or per block, or per square mile. Thus Weber
quotes the 1891 census of England, "regarding as overcrowded all the ordinary
tenements that had more than two occupants to a room, bedrooms and sifting
rooms included" (Weber 1899:416). The prescription for all the ill effects of
overcrowding was fairly straightforward as far as Weber was concerned. "The
requirement of a definite amount of air space to each occupant of a room will
prevent some of the worst evils of overcrowding; plenty of water, good paving,
drainage, etc. will render the sanitary conditions good."

Crime and vice are also often believed to be linked to urban life and, as a
matter of fact, crime rates are higher in cities than in the countryside, at least in
the United States. But what is it about urban density that might lead to
differences in social behavior between urban and rural settlements? To examine
this question, one must analyze the notion of population density.

The simplest definition of population density is essentially the ratio of
people to physical space. As more and more people occupy a given area, the
density increases and it becomes therefore relatively more crowded. Several
early twentieth century scholars examined the relationship between "crowded"
conditions and social behavior.

In a 1905 essay Georg Simmel, suggested that the result of crowding was an "intensification of nervous stimulation" (1905: 48), which produced stress and, in turn, was adapted to by people reacting with their heads rather than their hearts. "This means that urban dwellers tend to become intellectual, rational, calculating, and emotionally distant from one another" (Fischer 1976: 30). Here were the early murmurs of the urbanism concept—that the crowding of people into cities changes behaviors concept often expressed in negative tones.

Perhaps the most famous expression of the negative consequences of the city is Louis Wirth's paper "Urbanism as a Way of Life" (1938), in which he argued that urbanism will result in isolation and the disorganization of social life. Density, Wirth argued, encourages impersonality and leads to people exploiting one another. For two decades there was little questioning of Wirth's thesis and, as Hawley has put it, "in one short paper, Wirth determined the interpretation of density for an entire generation of social scientists" (1972: 524). The idea that increased population density had harmful side effects lay idle for a while, but it was revived with considerable enthusiasm in the 1960s following a report by Calhoun on the behavior of rats under crowded conditions.

Calhoun's study can be summarized by noting that among his rats, crowding led to the disruption of important social functions and to social disorganization. Related to these changes in social behavior were signs of physical stress, such as changes in the hormonal system that made it difficult for females to bring pregnancies to term and care for their young. Other studies
have shown that not only rats, but monkeys, hares, shrews, fish, elephants, and house mice also tend to respond to higher density by reducing fertility (Gaile, Gove, and McPherson 1972).

Research in humans has suggested that at the group level there may be some fairly predictable consequences of increasing population density. For example, Mayhew and Levinger note that a violent interaction can be expected to increase as population increases; “the opportunity structure for murder, robbery, and aggravated assault increases at an increasing rate with aggregate size” (Mayhew and Levinger 1976:98). There are more people with whom to have conflict, an increasingly small proportion of people over whom we exercise direct social control. Increasing size leads to greater superficiality and to more transitory human interaction, that is, greater anonymity. Mayhew and Levinger point out that “since humans are by nature finite organisms with a finite amount of time to devote to the total stream of incoming signals, it is necessarily the case that the average amount of time they can devote to an increasing volume of contacts ... is a decreasing function of aggregate size. This will occur by chance alone” (1976: 100).

Choldin (1978) reviewed the literature on density and its effects and concluded that “when social structural differences among neighborhoods are considered (held constant), population density does appear to make a trivial difference in predicting pathology rates” (1978:109).

A not uncommon problem in urban planning concerns the proper level of population density for which to plan. Certainly various levels of density have
Various costs and various advantages.

Within traditional sociology there are two major theoretical strands which inform population density questions. Each strand is based on the writings of one of the founding fathers of modern classical sociology and each has fairly vigorous present day adherents. The consequences presumed by these two traditions are, however, rather different. On the one hand functionalists, following a Durkheimian point of view, see high population density, along with high population size, as a prerequisite for the development of division of labor (Durkheim 1960). On the other hand, behaviorally-oriented followers of Simmel stress the psychological-and even physiological strain in the frequent stimulation and interaction concomitant and dense living (Simmel 1957).

The Durkheimian position has received theoretical and empirical elaboration in the development of central place theory. This theory argues that a certain number of consumers are necessary within a given radius of a center for the support of a specific good or service (Losch 1954). Whether a specific good or service becomes a central one, then, depends upon population density of the area in question, that is, upon whether it will find a sufficient number of consumers within its range. Later developments in this theory suggest it may apply to the distribution of cities in space (Carol 1960).

Early sociological research on urban density in America (Chicago) focused on correlations between population density and several dependent variables (Hauser 1958). These included (a) infant births per live births; (b) age standardized deaths; (c) tuberculosis cases; and (d) age standardized public
This research suggested that all but one of the variables showed a positive correlation with population density. That is, the higher the density the higher the rates. The exception to this rule was the overall death rate which showed no appreciable association with density.

These findings suggested that increased density has a deleterious effect on the population. Initially these results were used to support the Simmelian strand of sociological thought. However, to assume that this effect is caused by increased stress was and is a long logical leap. In fact, only a moderate acquaintance with cities would suggest an alternative explanation. People of lower socioeconomic status—people more likely, irrespective of density, to score higher on all of the rates investigated tended to live closer to the center of the city than do persons of higher economic status.

This early research also documented that population density declined in a regular way as one moved outward from the city center. These facts suggested that socioeconomic status may be a confounding the relationships. Another variable which may have been confounding the relationship is quality of housing, which also has an association with density and with each of the rates.

Although suburbia has become a legendary part of American society, suburbanization was disproportionately engaged by whites until the 1970s. For example, in 1970 in 15 large areas studied by Farley (1976), 58% of the whites lived in the suburbs compared with 17% of the nonwhites. Since the 1930s the proportion of whites living in central cities has declined steadily and the
proportion of African-Americans has risen steeply (Schnore, Andre, and Sharp 1976); the African-American population underwent a very rapid urbanization at the same time that whites were suburbanizing.

The segregation of people into different neighborhoods on the basis of different social characteristics (such as ethnicity, occupation, or income) is a fairly common feature of human society (Farley 1976; Zlaff 1973). However, in the United States residential segregation by race is much more intense than segregation by any other category. For example, Farley (1976) has demonstrated that in both predominantly white and predominantly African, American areas there is a fair amount of residential segregation by education, occupation, and income—whether you look at central cities or suburbs.

Residential segregation of blacks in the United States has been called an "American apartheid system" (Massey and Denton 1993), and the maintenance of this pattern until fairly recently has been explained by Farley and Frey (1994), as being due to the following factors: (1) mortgage lending policies were discriminatory; (2) African-Americans who sought housing in white areas faced intimidation and violence similar to that occurring during World War I; (3) after World War II, suburbs developed strategies for keeping African-Americans out; and (4) federally sponsored public housing encouraged segregation in many cities.

Of course, the United States in the late 1990s is not the same as it was earlier in the century. For one thing, the 1968 Fair Housing Act now has had more than three decades to work, and the 1965 change in the Immigration Act
have also diversified the ethnic structure of the country. The data suggest that Asians and Hispanics have a greater propensity or ability to suburbanize than do African-Americans (Denton and Massey 1991; Logan and Alba 1993; Logan 1996), and that the slower rate of suburbanization of African-Americans continue to be the result of discrimination on the part of whites. It appears that whites generally do not object to African-American neighbors of the same income and education, but larger numbers are seen as threatening (Clark 1991).

Demographic components of suburbanization do not explain residential segregation; they merely point to its existence. The explanations are essentially social in nature, and one of the prevailing ones is based on the notion that "status rankings are operationalized in society through the imposition of social distance" (Berry 1976:249). In race relations, the social status of African-Americans has been historically lower than that of whites. This status ranking used to be maintained symbolically by such devices as uniforms, separate facilities, and so forth, which was obvious enough to allow social distance even though African-Americans and whites lived in close proximity to each other. However, as African-Americans left the South and moved into industrial urban settings, many of those negative status symbols were also left behind. As a result, spatial segregation serves as a means of maintaining social distance "where 'etiquette'-the recognition of social distance symbols-breaks down" (Berry 1976:249). Thus as African-Americans have improved in education, income, and occupational status, whites have maintained social distance by means of residential segregation facilitated by suburbanization.
Massey has suggested that the spatial isolation of poverty and especially of low income blacks portends future community instability and violence in America. However, there is some evidence that a trend toward desegregation does exist and it appears to be related to a westerly drift of population and the increasing suburbanization and "sprawl" taking place in the south and west (Frey and Farley 1996). Comparing data from the 1980 and 1990 censuses, Farley and Frey (1994) have concluded that the largest decreases in segregation scores by residential area have occurred in the more recently built suburbs of southern and western metropolitan areas. One can see, for example in Table 9-1 that the most segregated metropolitan areas of in 1990 tended to be in the Rustbelt cities of the natural north, whereas the lowest scores tended to be in the smaller metropolitan areas of the west and south. I have calculated the score for Las Vegas. It is clearly counter to other western communities. One might immediately wonder about the implications of this highly "segregated" score. I will examine the reasons for this phenomena later in this chapter.
Table 6-1 Residential Segregation of African-Americans in the USA

<table>
<thead>
<tr>
<th>City, State</th>
<th>African-Americans</th>
<th>Race</th>
<th>Metropolitan Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gary, IN</td>
<td>91%</td>
<td></td>
<td>Charlotteville, VA</td>
</tr>
<tr>
<td>Detroit, MI</td>
<td>89%</td>
<td></td>
<td>Danville, VA</td>
</tr>
<tr>
<td>Chicago, IL</td>
<td>87%</td>
<td></td>
<td>Killeen, TX</td>
</tr>
<tr>
<td>Cleveland, OH</td>
<td>86%</td>
<td></td>
<td>San Jose, CA</td>
</tr>
<tr>
<td>Buffalo, NY</td>
<td>84%</td>
<td></td>
<td>Tucson, AZ</td>
</tr>
<tr>
<td>Flint, MI</td>
<td>84%</td>
<td></td>
<td>Honolulu, HI</td>
</tr>
<tr>
<td>Milwaukee, WI</td>
<td>84%</td>
<td></td>
<td>Anaheim, CA</td>
</tr>
<tr>
<td>Saginaw, MI</td>
<td>84%</td>
<td></td>
<td>Cheyenne, WY</td>
</tr>
<tr>
<td>Newark, NJ</td>
<td>83%</td>
<td></td>
<td>Ft. Walton Beach, FL</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>82%</td>
<td></td>
<td>Clarksville, IN</td>
</tr>
<tr>
<td>St. Louis, MO</td>
<td>81%</td>
<td></td>
<td>Lawrence, KS</td>
</tr>
<tr>
<td>Ft. Meyers, FL</td>
<td>81%</td>
<td></td>
<td>Fayetteville, NC</td>
</tr>
<tr>
<td>Sarasota, FL</td>
<td>80%</td>
<td></td>
<td>Anchorage, AL</td>
</tr>
<tr>
<td>Indianapolis, IN</td>
<td>80%</td>
<td></td>
<td>Lawton, OK</td>
</tr>
<tr>
<td>Cincinnati, OH</td>
<td>80%</td>
<td></td>
<td>Jacksonville, NC</td>
</tr>
<tr>
<td>Las Vegas</td>
<td>68%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Segregation score is measured as the percent of African-Americans in the metropolitan area who would have to move to another census block in order to achieve residential balance by race throughout the metropolitan area.

Source: Adapted from R. Farley and W. H. Frey, 1994, “Changes in the segregation of whites from blacks during the 1980s: Small steps toward a more integrated society,” American Sociological Review 59: 23-45; Table 1.
One does not have to be a sociologist to assert that if a community of poverty produces illness, poor education, negative attitudes, poor work habits, and low productivity, it is sure eventually to cause problems for the community as a whole. Inasmuch as urban poverty is closely associated with collapsing and devaluated housing, streets, bridges, utility systems, and other components of the infrastructure, it also symbolizes (and results from) a huge drag on productivity. These problems go far beyond urban poverty and sprawl, but they are closely connected to it.

"The Negro problem looked at in one way is but the old world questions of ignorance, poverty, crime, and the dislike of the stranger. On the other hand, it is a mistake to think that attacking each of these questions single-handed without reference to the others will settle the matter: a combination of social problems is far more than a matter of mere addiction- the combination itself is a problem" (DuBois [1899], 1967: 385).

Shakespeare's words to "gild refined gold, to paint the lily, to throw a perfume on the violet' describe overkill, waste of effort, needless work. When economists John Kain and Joseph Persky delivered their "Gilded Ghetto" paper at the first research meeting of the newly formed Economic Development Administration, in early 1967, the assembled researchers and policymakers hooted and jeered. (Kain 1993). Kain had written earlier that "the only efficient and satisfactory long run -solution to ghetto problems [would be] suburbanization of the Negro population" (Kain, 1968:20). Although Kain and Persky endorsed income transfers to meet the "immediate needs of ghetto residents," they wrote
in favor of weakening "the ties" and "the geographic dominance of the ghetto." A central problem, they felt, was that mere existence of the ghetto posed "serious implications ... for the metropolis as a whole" and that many harmful problems affecting blacks directly were "dependent for much of their adverse impact on the very existence of the ghetto." They were joined in their support for decentralization by many other influential persons, among them urban researcher and writer Anthony Downs and NAACP labor secretary Herbert Hill (Goldsmith 1974: 19; Kain and Persky 1969: 3, 23).

Debates over questions regarding the location of relief, the bad influences of the ghetto on its residents, and the efficacy of ghetto economic development programs to stimulate business investment have continued every since. A widely read early response was by Peter Labrie, in The Review of Black Political Economy. Labrie argued that, where there existed heavy demand for unskilled labor, information about jobs would arrive from the suburbs to the ghetto, and although transportation to work from the ghetto to the suburbs would be costly in terms of time and money, this, too, was not an insurmountable problem (Labrie, 1970-1971). Many who thought the spatial-mismatch hypothesis far too simple, claimed that job losses were caused mainly by generally high levels of unemployment and racial discrimination.

We might leave these national "spatial-mismatch" debates to the historian, but those who propose policy still argue actively (Wilson 1991). Researchers question what the most important location issues are, so as to decide whether public programs should support job growth in the ghetto,
transportation access -to the suburbs, or migration (from the ghettos to the suburbs). Nationally, the debates about policy and causation circle around several familiar observations: many jobs that require few skills and little education have disappeared, notably with the demise of manufacturing industries; these job losses have been pronounced in central cities; ghetto residents previously depended on these industries for jobs; these residents lack access for suburban jobs for want of adequate transportation; and in any case their skills and education do not meet the higher requirements of large numbers of jobs in the service and high-tech sectors, both in central cities and in suburbs (Goldsmith and Blakely 1992). Yet as we have seen, although the Las Vegas Valley has established "ghettos" it does not suffer from the traditional national "causes" of ghettoization (e.g., loss of low and semi-skilled jobs) listed above.

Underlying the analysis of the impact of sprawl on urban decay and ghettoization is the central question in all this debate, nationally, is quite simple: Does where you live have a major affect on your chance of finding out about, being offered, getting to, or holding a job? Specifically, how much is a potential employee getting harmed (in job search, initial employment, performance, and retention) by the fact that she or he lives in a ghetto. It turns out that the answers are complex and our analysis suggests localized. On the hand, one sort of research into specific costs that can be attributed to ghetto residence comes up with inconclusive or even negative results. That is, some investigations show that, when people move from the ghetto to the suburbs, or that transportation access is expanded, job search performance improves only
Another sort of research suggests that it matters a fair amount: Networks of information about jobs are extremely thin in ghettos, so ghetto residents do not 'find out about jobs; and potential employers have been found to discriminate against young job applicants simply because they fill out forms giving a "bad" address. As recently as 1991, William J. Wilson prominently reasserted his claim of "a growing mismatch between the location of employment and residence in the inner city," and his collaborators found evidence that living in the suburbs ('all other things being equal) enhanced the likelihood that a poor person would find a job (Wilson 1991; Rosenbaum and Popkin 1991).

Gottdiener has argued that nationally, ghetto problems in the United States result from three kinds of forces: political hostility toward cities, deterioration of the central-city economy, and institutional and personal acts of racism. Ghetto (and broader central-city) economic problems were created, literally put into place, by 40 years of state and federal hostility to cities (Gottdiener 1985).

According to Gottdiener (1985) this mainly unconscious hostility took the form of pro-suburban, anti-urban imbalances in subsidies for highways, unfair tax giveaways on housing, and a peculiar kind of fiscal relief for wealthy suburbs, exactly during and after the period when millions of African Americans migrated to the cities. A prime example of this phenomena was the Interstate Highway program, which provided federal funding to build 41,000 miles of freeways and probably the largest physical infrastructure project in history.
This country's largest intervention into housing markets also came after World War II, in the form of Federal Housing Administration loan guarantees, which lowered the cost of borrowing money to build and buy homes, and in the form of an income-tax deduction for interest payments on home mortgages, a tax expenditure that now runs to a subsidy of about $80 billion a year (Goldsmith and Muhammad, 1992).

Together with expanding auto firms, industries producing steel, rubber tires, and ancillary products, highways and houses gave form to 40 years of economic boom.

But the boom eventually left cities behind. The highway system not only built the suburbs, but it devastated the centers of cities, cutting giant slashes across them. The housing programs were restricted by law to segregated neighborhoods for white buyers. Insurance company leaders and mortgage bankers further pushed poor city neighborhoods down as they drew red lines and green lines on their maps to prevent the issuance of fire insurance or the granting of mortgages.

According to many opponents of sprawl the result is metropolitan Balkanization. It would be logical, they argue, that the jurisdiction of city government expands as the city or metropolis grows, so that the beneficiaries of growth and adjustment pay its costs. However, they argue, in the postwar boom exactly the opposite happened. Instead, political and fiscal jurisdictions multiplied and separated, so those families who moved out beyond the cities borders also escaped responsibility for paying the bills. People from the
suburbs continued to use downtown cultural facilities, such as libraries, universities, and concert halls, as well as the central business districts, but they avoided taxation. They forgot entirely about the costs. It is the costs with which cities- and of course the nation in the final analysis- are burdened today. As Kenneth Clark, said of ghetto residents in 1965:

"The society knows... that if human beings are confined in ghetto compounds of our cities, and are subjected to criminally inferior education, pervasive economic and job discrimination, committed to houses unfit for human habitation, subjected to unspeakable conditions of municipal services... that such human beings are not likely to be responsive to appeals to be lawful, to be respectful, to be concerned with property of others" (The 1968 Report 1968:300).

In the 1960's and early 1970's, when great attention was last paid to the problems of ghetto economies, one main theme was echoed over and over again by the most prescient analysts: If ghetto conditions were to improve, there was a need for jobs, jobs, jobs. From across the political spectrum- Daniel Patrick Moynihan, Peter Labrie, Bennett Harrison, and Kenneth Clark, for example there were reminders that, without job growth, satisfactory conditions in the ghettos would be impossible to achieve.

"Indeed, there seems to be no argument in the literature to counter the
position that aggregate demand for black employment must be increased dramatically... The only arguments are whether and how this is to be done" (Goldsmith 1974: 20).

That was written in 1974, but it is just as true in 1998. The reverse is equally true: If jobs are lost, conditions will get worse.

There are two main sources of jobs: the private economy and public employment. In the 1980's ghetto poverty increased, especially in the big industrial cities of the manufacturing belt. Why? "Because [this region] experienced massive industrial reconstruction and loss of blue-collar jobs," a mainstay for black (and white) working class incomes (Wilson 1991: 465). Black unemployment is regularly about twice as high as white unemployment, and it increases about 2 percentage points while unemployment increases 1 point. Compounding employment declines in the private economy, public employment also shrunk, a catastrophe for African Americans, who have relied on public sector for job growth in the last decades (Wilson 1991).

Racial discrimination still plays an enormously negative role in the social experience of nearly every black American: It is an essential ingredient in the organization of schools, in the composition of neighborhoods, and in the arrangements of everyday life.

For this analysis, the economic effects of institutional racism matter most. Since about 1980 there has been much controversy in the social science literature about whether racism mattered any longer in the economy, but by the
end of the decade researchers began producing consistent findings. Even in business decisions regarding entry-level job offers—where economist Gary Becker’s theories about competitive market forces promoting nondiscriminatory behavior should most strongly apply—racial prejudice appears to play a large part.

"Our interviewers at Chicago-area business show that employers view inner-city workers, especially black men, as unstable, uncooperative, dishonest, and uneducated. Race is an important factor in hiring decisions. But it is not race alone: rather it is a race in a complex interaction with employee’s perceptions of class and space, or inner-city residence" (Kirshenman and Neckerman 1991: 204).

For those black workers lucky enough to get jobs, the difficulties are not over. As Thomas Boston has shown, race-related earnings differentials result from discrimination at three stages of the labor market. At the final and most widely understood stage, minority workers on average get less pay for the same jobs. Even after accounting for differences in age, education, region, job experience, family size, and other factors, wages in many occupations are lower for African Americans than for whites. One stage earlier, and of more consequence, discrimination unfairly reduces incomes by limiting access of minority workers to preferred lines of industry, where jobs are better and higher paying. Worse yet, at the first state of labor allocation, inside industrial sectors,
African Americans are, "disproportionately concentrated among low-paying occupations" even after controlling "for job-related attributes, age, and other demographic differences" (Boston 1988: 73-87).

Proponents of sprawl claim that although there is now a growing consensus that skill demands have indeed increased (see Bailey 1991), the evidence on skill upgrading on black employment and joblessness is at best ambiguous (for a thorough review, see Moss and Tilly 1991). But whatever the verdict of the empirical assessments, the skills mismatch hypothesis suffers from a logical fallacy. As Peterson and Vroman note, "if employers are looking for better educated workers, and the lack of jobs in the manufacturing sector explains the pressure on black employment, what accounts for the strong demand for Hispanic workers, who on average have less schooling and fewer skills"? (Peterson and Vroman 1992:12; emphasis in the original).

The contrasting fates of black and Hispanic, mainly immigrant workers, suggest that other processes may be at work. One possibility is that the influx of immigrants may lead to the displacement of black and other low-skill native groups. The bulk of econometric research, mainly consisting of estimates of the censuses, provides little support for this hypothesis, showing that immigrants have scant impact on black earnings, unemployment, or labor force participation (Borjas 1990). One problem is simply that these findings fail to answer the question posed by Peterson and Vroman, as they provide no explanation of why the experiences of low-skilled blacks and Hispanics should be so different. Moreover, there is evidence, of different kinds, suggesting that the conventional
wisdom may underestimate the potential for immigrant competition. A paper by Katz, Borjas, and Freeman (1992) making use of a different methodology and newer data, shows that immigration has accounted for a large increase in the supply of low-skilled labor, in turn, depressing the earnings of high-school educated labor.

Anthony Downs has argued that sprawl exacerbates the practice of restriction of multifamily housing through exclusionary zoning. He further asserts that this practice is one of the most serious obstacles to the development of affordable housing in America (Downs 1991).

Affordable housing is generally defined as housing that is affordable to individuals at or below 80% of median income. This is the applicable definition for the purposes of this text. According to the US Department of Housing and Urban Development (HUD), a household has a housing cost burden when housing costs, including utilities, exceed 30% of gross household income.

The problem of exclusion in housing is in large part a matter of economics. Given enough money, most individuals could overcome the most exclusionary local zoning systems. Some metropolitan areas such as Portland and Minneapolis-St. Paul have undertaken actions to respond to Downs' argument. The region will benefit from the effect of those actions if they provide increased opportunities for those who may otherwise lack them. However, if the effect of the change is to force families accustomed to (or attempting to become) living in single-family houses to move into apartments, the benefits are less clear and the social costs may be significant.
Some housing policies, however, are aimed specifically at "affordable" housing. Public housing is an example. In public housing, the available supply has not come close to meeting the need; thousands remain on the waiting lists for public housing in different cities and counties throughout the nation and Nevada. One often hears the argument that only if the government would step up its commitment to public housing in the community we could go a long way toward overcoming the housing problem. We are told that what is needed is more money. This line of reasoning has to be questioned. Although more public housing assistance is needed and is currently being provided (public housing stats in the early 1990's are up over the levels of the 1980's) it is not certain that the pace of affordable housing starts could be appreciably increased under almost any circumstances.

The reason for this assessment lies in neighborhood resistance to housing for low-income persons, including public housing. This resistance commonly finds its way into city and county governing bodies where it is translated into public policy. This problem will not likely subside as public housing officials seek to disperse public housing throughout the community and integrate it with middle-income housing, although the problem may get worse. In any event, local objections to particular sites for housing pose at least as much as an obstacle as a lack of funds or the absence of sufficient government commitment.

Although public housing authorities are usually technically independent of the local general-purpose city or county government, this independence by no
means assures freedom to determine the location of public housing. The city or county government may influence or dictate decisions about the location of public housing sites by putting pressure on the housing authority to reverse location decisions (the housing authority board is typically appointed by the chief executive and/or governing body of the general-purpose government); by withholding needed zoning for public housing (the location of public housing may require a zoning change, which is general-purpose government responsibility); or by refusing to approve the acquisition of the land for public housing. Middle-income neighborhood interests, opposed to the proposed location of public housing in their area, not uncommonly press city and county officials to veto housing authority decisions on particular sites. Community resistance to housing for the poor has reached staggering proportions.

Urban renewal programs have several objectives. One is to provide housing to those who need it (this is an objective of the national legislation, which includes the urban renewal program.) Urban renewal in the main has not helped the cause of low-income housing and has often helped reduce the supply of housing for the poor and increase it for the middle-income groups. Nationally, urban renewal typically has razed the residences of the poor and replaced them with housing that can only be afforded by the wealthy or middle-class-range families.

Many attempts have been made to extend the benefits of the HUD programs and federal loan guarantee principle to low-income groups. Other efforts are being made to provide better housing for the poor. But in the main
these programs have been singularly been unsuccessful. They have been unable to overcome the forces that are keeping low- and moderately-income housing from being constructed, and being constructed where it is needed. To a certain extent, the common criticism of the federal programs, especially of HUD, is valid, as federal administrative procedures and practices obviously have slowed down whatever process has been made in this area.

The question remains, why have the various housing policies failed? The answer seems clear: the problem is in the community. Community regulations and practices make it hard to construct any kind of low-income housing project. The existence of land-use control and development control power in local government has given many residents they have the right to dictate who (in terms of race, religion, and economic class) will be permitted to live in their community and the specific kind of housing he shall have. In a broader sense, the presence of community governments operating according to the principle of majority rule has given suburban residents the idea they have an inherent right to determine what new residents, if any, will be allowed to move into the community. The fact of the matter is that if existing residents do not want a certain economic or racial group living in their neighborhood, they are encouraged by land-use and development controls to exclude them. The way these controls have been used in the recent past has been responsible to this.

In the view of present land development controls and their use, it is clear that not all the money in the world will build low-income housing in many suburbs. The federal government can pour additional billions into its different
housing programs, but it is doubtful whether this would have much effect in the suburbs. As suggested, it is in the suburbs that low- and moderate-income housing is so greatly needed, and it is the suburbs that typically contain the vacant and non-urbanized land that could be used for new housing.

As long as communities resist low- and moderate-income residents, all the new legislation Washington could conceivably pass will not be likely to achieve the desired objective. This is why new legislation is not apt to succeed where present laws have failed. Basically, the peg will not fit into the hole— that is, the federal peg will not fit into the community hole. The most expensive and refined peg will not do the job if it does not fit, and so far it has not.

Community opposition to low- and moderate-income housing is commonly manifest in zoning calling for single family residential development only— especially zoning of the more exclusionary variety. Developers wishing to construct lower-income housing projects have to apply for a rezoning under such circumstances; this gives localities an effective veto. Privately built lower-income housing, unlike public housing, does not have to receive the government’s blessing per se, but, being private, it must be placed on appropriately zoned land. Zoning then becomes the base of the community’s power to exclude power to exclude housing for those less advantaged that the existing residents.

Local governments cannot, of course, oppose low-income housing projects because they are for low-income groups— this would probably be in violation of the federal and state constitutions and would furthermore project a
bad image. What happens is that communities oppose the projects on other
grounds, at least for the record, finding that the new housing would place an
excessive burden on the schools, that the street network will not accommodate
the additional traffic, that community facilities are insufficient, that no public
transportation exists to serve the prospective new residents, and so on. In fact,
any reason other than that the new residents would be poor and perhaps black
is trotted to the fore. In this manner, the localities of the nation are using land
controls in an economically and racially discriminatory fashion. Everyone knows
it; no one, if sufficiently pressed, would argue otherwise.

The irony of this is that so many suburbs favor the idea of housing for low
income groups. "We support in principle" is the common ring. Suburban
planners, elected officials, and citizens group leaders publicly proclaim their
desire to serve all economic classes, to provide housing for all income groups;
they heartily endorse the doctrine of low- and moderate-income (some limit the
endorsement to moderate-income) housing. But what happens when they are
confronted with a specific proposal? The answer is easy--they oppose it. The
explanation may be that the particular proposal was a bad one, or that it was at
the wrong location or the wrong time.

Why so many in the suburbs insist on supporting low-income housing in
principle and then turn around and oppose it in practice is not entirely clear. It
may have something to do with the image that they wish to foster. In any event,
the situation is not good, for it gives well-meaning people the impression that
there is the chance to get low-income housing approved when there is not; it
often diverts attention from the real problem until it is too late. We have to find another alternative.

The Las Vegas Valley

As discussed earlier in Chapter 4, the Las Vegas Valley has a history of institutional and individual racism dating back to the 1930s. A latent feature of this behavior can be seen in the current entrenched geographical concentration of minorities in Clark County.

In terms of racial composition and economic attainment, the West Las Vegas (1990 census tracts 2.01, 3.02, and portions of census tracts 3.01, 34.01, and 35) area differs greatly from the City of Las Vegas and Clark County. In fact, over 78% of West Las Vegas residents are black; these nearly 13,000 residents account for over 41% of the black population in the City of Las Vegas. By way of contrast, blacks comprise approximately 11.5% of the City of Las Vegas' population, and only 9.5% of the Clark County's population (US Census 1990).

These statistics are more disconcerting if one considers evaluates the demographic dynamics of the community. West Las Vegas' population is relatively static. The area experienced a 1.4% decline in population in total residents between 1970 and 1990. Conversely, the City of Las Vegas' overall population grew by over 100% during the same period (US Census 1970, 1990).

Although West Las Vegas accounts for only about 5% of the City of Las Vegas' overall population, nearly half (48%) of all conventional public housing is
located in West Las Vegas. In 1994, the unemployment rate for West Las Vegas stood at nearly 17% (nearly 26% for census tract 3.02), while the overall City of Las Vegas unemployment rate stood at 6.6% (City of Las Vegas 1994).

The City of Las Vegas has acknowledged its role in this creating and maintaining the current situation in the following quote from the "West Las Vegas Plan (1994):

"Previous City policies located a great number of public housing developments in a small geographic area and this neighborhood has had to deal with the implications ever since. There is not another area in the City which has such a saturation of public housing" (City of Las Vegas 1994: 51).

Due to their demographic make-up, the demands for increasing the supply of affordable housing falls mainly on the cities of North Las Vegas and Las Vegas and their respective politicians and housing authorities. The City of Las Vegas' lack of affordable housing has been growing more acute throughout the last decade. This can be most easily seen in the rental sector of the housing market. Even though median household income in the City of Las Vegas increased by nearly two-thirds (66%) between 1980 and 1990, median contract rental costs increased by over 87% (HUD 1995: 23, 86; US Census 1980, 1990).

In 1990, the median household income for white City of Las Vegas residents was $32,139; for black residents $20,989; and for Asian/Pacific
Islanders it was $30,863 (US Census 1990).

The relationship between poverty, minorities and residential patterns in Las Vegas can be clearly seen in the following maps which identify median household income by census tract and minority population by census tract. It is important to note that the extremely low and very low income households bear the most severe housing cost burdens.

Assisting in the perpetuation of the historical segregation of minority individuals and families in the Las Vegas Valley are several economic and socio-political trends. As discussed in previous chapters of this text, these trends include, (a) the lack of a commitment to and execution of the development of affordable housing throughout the valley; (b) the explosive growth of the master planned community concept in the valley particularly at the fringe; (c) the subsidization of core transportation services to the resort corridor; (d) local zoning patterns; and (e) the lack of appropriate region-wide initiatives and balance in addressing the housing problems of the community’s needy.

As with many other researchers in this field, I am reluctant to conclude that sprawl automatically adversely affects inner-city blacks, though the results of this analysis have certainly pushed me in that direction. But I would be the first to note that the findings from recent studies are by no means clear cut and a case can be made both for and against sprawl.

A political economy perspective may be used to redress inequities in urban development. This perspective takes account of the decisions and activities of urban institutions that govern spatial patterns. In particular, it
uncovers the workings of metropolitan growth coalitions that are the engineers of urban development. A first step toward intervening in the spatial development processes is determining the institutions, actors, and decisions that shape place.

Yet, as the empirical case in this chapter suggest, actual intervention in development activities requires more than simply describing the actors that are behind seemingly uncontrollable urban forces. As the battle over the Las Vegas Valley's governance structure continues, applying a political economy perspective means opening up decision making processes and seeking a greater popular voice in development decisions in that matter. Employing a political economy perspective to engage social change is ultimately political because it is geared toward democratizing development processes. It is directed at creating an informed public who have available a complete account of the costs and benefits associated with development.

New theoretical developments in the urban field indicate that features of the urban landscape that were previously thought to be "natural" or "inevitable" are now seen as being contingent upon specific actions made by specific actors and institutions.

Further research is needed to better understand which actors and institutions are important in influencing urban development in the Las Vegas Valley, how these actions and behaviors are constrained by broader social forces, and where other organizations, institutions, and individuals might best intervene to change some of the most damaging consequences of the current development process. To the extent that this research agenda is successful,
practitioners will gain a better understanding of how more equitable urban development can be achieved.
CHAPTER 7

ENVIRONMENTAL IMPLICATIONS OF SPRAWL

The problems of man-made environment are diagnosed in different ways, depending on our perception of the urban physical world which we have created. Those who have protested at what they perceive to be the despoliation of an environment, looted in search for natural resources or wealth, have often joined forces with those who have criticized the effects of rapid urbanization expressed in the physical and social realities of our industrial cities. The physical effects are tangible and immediate; they are readily appreciated by the proverbial man in the street.

In Las Vegas, the diagnosis of causes—why the environment is like it is and the way in which it is changing—has been a relatively neglected field of study, with the result that problems of the physical environment have often been tackled in a piecemeal and fragmented fashion. Once diagnosis of causes leads to the view that the physical results of our activities are fashioned by our social and economic system and its predominant values, we can begin to fashion more effective policies to remedy perceived ills.

Sprawl has been implicated as a cause, a consequence and a cure for a variety of local and global environmental ills (Burchell 1992, Gordon and Richardson 1996, Ewing 1997). The analysis suggests that these variations in
findings reflect not only the respective author’s biases, but also variations in the temporal and topographical nature of the data used in the analysis. This chapter examines three major local environmental characteristics implicated in sprawl: (1) Natural habitat and endangered species; (2) Air quality; and (3) Water availability and usage and wastewater.

Natural Habitat and Endangered Species

Nevada lies in the Basin and Range region. This landscape is typified by north-south mountain ranges separated by broad alluvial valleys. The valley is physically separated from the rest of the county by the Spring, Black and Sheep Mountain Ranges. Most of the Las Vegas Valley’s watershed drains into the Colorado River. Vegetation in this geography is the usual species mixture of the Mojave Desert. The bases of the mountains are roughly 3,000 to 4,000 feet with high peaks exceeding 9,000 feet. Springs occur in nearly all the mountains, with local seepage maintaining perennially moist soils. However, surface waters seldom travel above ground more than a few meters from the spring source. Many springs have been altered for wildlife and other needs leaving no natural aquatic system intact.

The climate of the Las Vegas Valley is arid, continental desert. Mean annual rainfall is 4.6 inches at low elevation (3,000 feet) to 11.5 inches at elevations above 7,000 feet. Enormous fluctuations in rainfall characterize desert regions. Typically, 60% of precipitation falls between September and late March. The entire region is characterized by large daily ranges in air temperature. Average winter temperatures in the lowlands may go to the 30’s (F) at night. Average summer maximums are in
The composition of the mountain ranges surrounding the Valley is composed of late Precambrian and Paleozoic sedimentary rocks. The calcareous mountains have high ridges and jagged peaks, weathering to sands, silts and clays. Most of the soils are mixtures of sands, silts, clays, and rock fragments, with little organic matter.

Natural vegetation includes communities of shrubs or shrubs and infrequent small trees. Only playas are without noticeable vegetation. The seasons of greatest physiological activity are fall-winter-spring, with summer being a period of apparent dormancy. Due to human intrusion the landscape and its vegetation have been modified greatly, and unfortunately the recovery of vegetation in the Mojave desert is exceedingly slow. There has been rapid and substantive introduction of non-native species into the Valley. Over 12% of the total flora in Clark County is now comprised of exotic species, mostly Eurasian. Many of these invaders are widespread.

Clark County's 8,000 square miles have been inventoried for wildlife species. Wildlife species include large game species, smaller carnivores, rodents, reptiles, birds and bats. The only federally listed "Threatened and Endangered species" known in the Valley is the desert tortoise (*gophens agassizii*). Desert Tortoise habitat occurs below 4,000 feet in the Mojave Desert. A Federal Category 2 plant known to occur in the Las Vegas Valley is the Merriam bearpaw poppy (*Arctomecom merriam*) (Clark County Planning Department 1997).
The Las Vegas Valley air and watershed coincides with United States Geological Survey's Hydrographic Basin 212. This area includes the City of Las Vegas, the City of North Las Vegas, and the City of Henderson. The remainder of the hydrographic basin is comprised of unincorporated areas of Clark County. The Las Vegas Valley is situated on the edge of the Mojave Desert and experiences an arid climate typical of the southern Mojave Desert. Due to the "rain shadow" effect of the Sierra Nevada Range and Spring Mountains to the west, moisture associated with storms originating off the Pacific Ocean rarely reaches the valley. Dry air masses move over the valley, resulting in clear to partly cloudy skies. In an average year, the sun shines 85% of the time. Temperatures range from an average daily maximum in July of 104 degrees, to an average daily maximum in January of 56 degrees. Average daily minimum temperatures range from 33 degrees in January, to 75 degrees in July. Winters are generally mild and summers hot.

Air Quality

Over 128 million people, about half of all Americans, now live in urban areas that exceed one or more federal air quality standards for carbon monoxide, ozone, or nitrogen dioxide. There is now a near-consensus within the scientific community that carbon dioxide buildup in the atmosphere is causing a global climate change, and that the long-term effects may be catastrophic. Worldwide emissions are expected to rise by one-third between now and 2015. The United States produces more carbon dioxide than any other nation, and transportation accounts for a large and growing share of our total (EPA 1993).
Unprecedented growth and development has seriously impacted air quality in the Las Vegas valley. Although there has been significant progress in enforcing air pollution control regulations over the past two years—19 violations of national ambient air quality standards were recorded in 1997, for example, down from 49 such events in 1996—much remains to be accomplished. Wind-blown dust and visible urban haze remain problematic, and are issues of public concern.

The Clark County Conservation District (CCCD) is charged with the task of identifying and meeting the resource conservation needs of the residents of Clark County. A primary focus of the CCCD is the preservation of air quality. The State of Nevada also has a major role in air quality in the Las Vegas Valley. The Nevada Division of Environmental Protection (NDEP) also plays an important role in Clark County air quality. NDEP regulates stationary sources of air pollution such as power plants. The Department of Motor Vehicles is responsible for smog check inspections and maintenance programs designed to reduce pollution from motor vehicle exhaust. The Nevada Division of Agriculture regulates properties and components of motor vehicle fuels such as vapor pressure (Clark County Conservation District 1997).

Efforts have been made to protect and improve air quality in the Las Vegas Valley, but problems remain. The air pollutants of concern in the Las Vegas Valley include: carbon monoxide, particulate matter less than 10 microns, particulate matter less than 2.5 microns, visual air quality, ammonia, ozone, and nitrogen oxide. Penalties for releasing these pollutants, particularly...
particulate, have increased substantially over the last year. Table 7-1 summarizes the current status of air quality in the Las Vegas Valley as of January 1998.

Table 7-1. EPA Air Quality Standards

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Health Effects</th>
<th>EPA Standard</th>
<th>Clark County Levels</th>
<th>In Compliance</th>
<th>CCHD Control Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>Lowers oxygen in the blood</td>
<td>9 ppm (8 hour average)</td>
<td>Exceeded std. 1 time in 1996</td>
<td>No</td>
<td>Oxygenated fuel program</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>Impairs lungs, causes bronchitis, and pneumonia; lowers resistance to respiratory infections</td>
<td>.053 PPM (annual average)</td>
<td>See Ozone (nitrogen dioxide is converted to ozone in the atmosphere)</td>
<td>Yes</td>
<td>See Ozone</td>
</tr>
<tr>
<td>Ozone</td>
<td>Exposure reduces lung function during exercise</td>
<td>120 parts per billion (1 hour average)</td>
<td>100 to 110</td>
<td>Yes</td>
<td>Vapor recovery at gasoline stations; chlorine emissions limitations; volatile organic compound reductions</td>
</tr>
<tr>
<td>Dust (PM 10)</td>
<td>Aggravation of existing respiratory disease</td>
<td>50 micrograms per cubic meter</td>
<td>51</td>
<td>No</td>
<td>Dust abatement at construction sites; paving of unpaved roads</td>
</tr>
</tbody>
</table>

Source: Clark County Health District 1998

The 1990 Clean Air Act amendments (CAA) redefined the national air pollution abatement framework and established policies to carry out air quality
planning and control activities. Mandates by the CAAA affect the Las Vegas Valley in many ways (Clark County Comprehensive Planning 1995).

Las Vegas Valley is classified by the EPA as a "moderate non-attainment area for CO air pollution and the Las Vegas Valley's air quality as "serious" (Clark County Health District 1998). The new designation requires that the Las Vegas Valley reach the health standard for carbon monoxide by December 31, 2000.

The valley has never exceeded the EPA's one-hour standard; that is, the air has never contained more than 35 parts per million (ppm) of carbon monoxide for a one-hour average. The EPA's eight-hour CO standard (more than 9 ppm for an eight-hour average), however, has been exceeded on a seasonal basis. During the winter months, local inversions stagnate air masses and trap pollutants. Evening buildup of pollutants has caused exceedance violations of the CO eight-hour quality standard in a limited area surrounding the East Charleston monitoring station.

During the winter of November 1994 to February 1995, the Las Vegas Valley experienced 8 "unhealthful days" for carbon monoxide (CO). All were recorded at the East Charleston station. The other monitoring stations reported unhealthful episodes in this period. A day is classified as "unhealthful" when monitoring indicates that carbon monoxide levels are between 100 (8.7 ppm) and 113 (9.4 ppm) on the pollution standard index, as defined by EPA standards. When levels exceed 113 PSI, the national ambient air quality standard is violated. This condition is referred to as an "exceedance." Three of
the 8 unhealthful days in 1994 exceeded the National Ambient Air Quality Standards (NAAQS).

Results of the Las Vegas Valley 1988 base year CO emissions inventory for stationary point, area, on-road mobile, and non-road mobile source categories are shown in Table 7-2, below.

Table 7-2. Peak Season Carbon Monoxide Emissions by Source

<table>
<thead>
<tr>
<th>Source</th>
<th>Emissions (in tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On-road mobile sources</td>
<td>85.80</td>
</tr>
<tr>
<td>2. Stationary sources</td>
<td>7.50</td>
</tr>
<tr>
<td>3. Off-road mobile sources</td>
<td>4.50</td>
</tr>
<tr>
<td>4. Area Sources</td>
<td>2.20</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Clark County Comprehensive Planning 1986.

The CCCD estimates that ninety-six (96%) percent of the carbon monoxide comes from gasoline cars and trucks, the majority from 50,000 to 70,000 "high emitters".

Over 85% of CO emissions in the Las Vegas Valley in 1988 were produced by on-road motor vehicles. Off-road mobile sources contributed nearly 5% more of the total. Point and area sources including emissions from fires, McCarran Airport, and lawn and garden equipment, accounted for the remaining 10% of the total emissions. On-road mobile sources include passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles, and motorcycles. Strategies for reducing CO emissions from on-road motor vehicles include the
requirement for Oxygenated Fuels (2.7%) and Reduced Reid Vapor Pressure (RVP), which limits vapor pressure of gasoline during the winter (Clark County Comprehensive Planning 1995).

The EPA requires all PM10 emission sources to be included in the inventory if they contribute significantly to an annual or 24-hour violation of the national standard. Five major sources contribute to PM10 emissions within the Las Vegas Valley, including:

(1) Stationary (point or stack) emissions from industrial, commercial, and residential locations, such as aggregate processing facilities and residential wood burning

(2) Area-wide (fugitive dust or non-point) emissions from construction activities and other forms of land disturbance

(3) Mobile emissions from automobiles, trucks, boats, and lawn equipment

(4) Dust from paved and unpaved roads; and prescribed and accidental fires

(5) Natural or background emissions from physical and climatological conditions (Clark County Comprehensive Planning 1997b).
Table 7-3 shows the 1995 emission inventory for sources of PM10 within the Las Vegas Valley Non-Attainment Area, including natural background conditions. Table 7-4 shows PM10 emission projections by source category for calendar year 2001.

Although other human activities (e.g. airplane exhaust, agricultural activities, various cooking methods, off-road vehicle exhaust, and lawn-care equipment) that may produce PM10 emissions, emissions from these sources are considered *de minimis* (Clark County Comprehensive Planning 1997b). These emissions can be disregarded for control measure implementation due to: (1) their minimal impact on the monitoring concentrations and (2) their inadequate cost-effectiveness for PM10 emission reductions. The urban portion of the Las Vegas Valley covers an area roughly 500 square miles in size. Fugitive dust dominates the PM10 emission inventory for the valley. Major sources of dust are construction activities, unpaved roads, and disturbed vacant land.
Table 7-3. 1995 Emission Inventory: Sources of PM10 Las Vegas Valley Non-Attainment Area

Source Category Valley-Wide Emissions During Calendar Year 1995-% Contribution

<table>
<thead>
<tr>
<th>Source Category</th>
<th>Valley-Wide Emissions</th>
<th>% Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Construction activities (dust)</td>
<td>38,849</td>
<td>39.9%</td>
</tr>
<tr>
<td>2. Natural background (dust)</td>
<td>31,414</td>
<td>36.0%</td>
</tr>
<tr>
<td>3. Paved road dust</td>
<td>6,759</td>
<td>7.7%</td>
</tr>
<tr>
<td>4. Unpaved road dust</td>
<td>6,142</td>
<td>7.1%</td>
</tr>
<tr>
<td>5. Disturbed vacant land (dust)</td>
<td>4,944</td>
<td>5.7%</td>
</tr>
<tr>
<td>6. Stationary sources</td>
<td>1,855</td>
<td>2.1%</td>
</tr>
<tr>
<td>7. On-road exhaust, brake and tire wear</td>
<td>823</td>
<td>0.9%</td>
</tr>
<tr>
<td>8. Residential wood combustion</td>
<td>309</td>
<td>0.4%</td>
</tr>
<tr>
<td>9. Off-road racing (dust)</td>
<td>166</td>
<td>0.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>87,261</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

Source: Clark County Comprehensive Planning 1997b.
Table 7-4 provides PM10 emission projections by source category for calendar year 2001 (Clark County Comprehensive Planning 1997b). December 2001 is the Las Vegas Valley's attainment date. A projected emission inventory for this time-frame is therefore needed to determine whether attainment has been achieved. The emission projections listed in Table 7-2 do not account for any new PM10 control strategies that have been implemented since 1995. The year 2001 emission projections incorporate activity levels that reflect projected population growth of 4% to 6% annually (Clark County Comprehensive Planning 1997b).
Table 7-4. Projected 2001 Emission Inventory for Sources of PM10, Las Vegas Valley Non-Attainment Area

<table>
<thead>
<tr>
<th>Source Category</th>
<th>Valley-Wide Emissions</th>
<th>% Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Natural background (dust)</td>
<td>31,414</td>
<td>33.0%</td>
</tr>
<tr>
<td>2. Construction activities</td>
<td>44,384</td>
<td>46.5%</td>
</tr>
<tr>
<td>(dust)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Paved road dust</td>
<td>8,659</td>
<td>9.1%</td>
</tr>
<tr>
<td>4. Disturbed vacant land</td>
<td>5,520</td>
<td>5.8%</td>
</tr>
<tr>
<td>(dust)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Unpaved road dust</td>
<td>2,103</td>
<td>2.2%</td>
</tr>
<tr>
<td>6. Stationary sources</td>
<td>1,999</td>
<td>2.1%</td>
</tr>
<tr>
<td>7. On-road exhaust, brake and tire wear</td>
<td>724</td>
<td>0.8%</td>
</tr>
<tr>
<td>8. Off-road racing (dust)</td>
<td>166</td>
<td>0.2%</td>
</tr>
<tr>
<td>9. Residential wood</td>
<td>367</td>
<td>.04%</td>
</tr>
<tr>
<td>combustion</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>93,316</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

Source: Clark County Comprehensive Planning 1996.

Under the Clean Air Acts Amendments (CAAAs), regional areas are classified by degrees as attainment or non-attainment for compliance with
NAAQS. When the CAAA was amended in 1990, the Las Vegas Valley was classified as a moderate non-attainment area. Those regions that are in non-attainment status must implement a series of programs to achieve attainment and reduce PM10 pollution. Recognizing that each regional area has its own particular set of problems in achieving attainment status, the federal government set a policy in which each state would be responsible for developing their own implementation plans for PM10.

Due to its classification as a moderate nonattainment area, Clark County developed a Moderate Area Implementation Plan (SIP) in 1991. However, control measures contained in the 1991 SIP were not sufficient to attain PM10 air quality standards. In early 1993, the EPA reclassified the Las Vegas Valley to a "serious" non-attainment area for PM10. In 1994, the Clark County Board of Commissioners submitted a new PM10 air quality plan to the EPA. In August 1997 a PM10 Attainment Demonstration Plan for the Las Vegas Valley was submitted to the EPA for review and approval. It included several new control measures to mitigate PM emissions. (Clark County Health District 1998). This report did not include any measures that were directly related to higher density land use or sprawl.

Ozone is naturally created in the upper atmosphere to provide a protective layer above the earth which blocks certain harmful sun rays. However, ozone, at the ground level is a major air pollutant. It is produced through a series of chemical reactions. Because of the various ingredients needed to form ozone, the creation of ground-based ozone is dependent on the time of day,
meteorological conditions, and the amount of various primary ingredients.

Ozone has been found to create biochemical changes, morphological changes, genetic defects, and an accelerated aging process in humans. Ozone has an adverse effect on human health and on materials and vegetation.

The ability to reduce ozone is contingent upon the removal of nitric oxides (NOX) and hydrocarbons as well as other volatile compounds (VOCs). Both NOX and VOCs are primarily emitted by motor vehicles. Other sources which contribute significantly are electric power plants, gasoline stations, and petroleum, paint and solvent industries.

The federal government has implemented several measures to reduce ozone levels. These include the use of alternative fuel requirements for governmental car fleets; the requirement of gasoline stations to incorporate vapor recovery nozzles; and additional requirements on automobile manufacturers to reduce tailpipe emissions.

The State of Nevada requires government vehicle fleets in excess of 10 vehicles to convert their vehicles to alternative fuels. The State has also adopted vehicle smog checks.

The Clark County Board of County Commissioners adopted the Clean Air Action Plan in 1992 and an amended version in 1995 which outlines numerous strategies to mitigate ozone emissions. These include enhanced vehicle inspection programs, oxygenated gasoline requirements; improved vehicle emission programs; increased and enhanced mass transit; adoption of a multi-level transportation demand management program; roadway improvements; and
enhanced traffic signalization systems.

Sprawl and Air Quality

The interrelationship between transportation and sprawl, and the resulting impact on air quality, warrant close examination. There appears to little debate over the assertion that increasing commercial development and high-traffic areas can lead to increased traffic congestion, resulting in an increase in pollutant concentration. The impact on air quality attributed to transportation related sprawl as isolated as a result of land-use patterns is examined in Chapter 6 of this text.

As we will see in Chapter 8 addressing the future air quality consequences associated with growth and/or sprawl and increasing (VMTs) in the Las Vegas valley non-attainment area would require a coordinated and cooperative technical approach(s) involving both the public and private sectors.

In terms of discharges to the air it would appear that several changes in direction are required. First, a denser urban form than that currently, will help to reduce the energy demand for housing, while at the same time reducing dependence on motorized individual transport for commuting and other trips. It is unlikely that such changes will occur by following the present piecemeal approach change to in the Las Vegas Valley, while simultaneously the ignoring the deep problems posed by poverty and rapid population growth in the community. It is likely, however, that an integrated approach to the problem will produce better results.

Water Availability & Use, and Wastewater

Normally, water availability and use and wastewater (sewage treatment) are
not discussed relative to sprawl with the notable exception of the potential correlation between sprawl and increased public infrastructure expense for these services (Burchell 1992, Gordon and Richardson 1996). However, in Las Vegas, the initial examination of the possible link between water/wastewater usage and sprawl required a clearer understanding of the inter-relationship of several attributes of the water and wastewater processes unique to the community's desert setting.

Water availability is a complex and vital issue in the Las Vegas Valley. Like all urban areas which can only exist with an "impounded" supply of water, effective and efficient use of this limited resource is crucial to the continued existence of the Las Vegas Valley's water supply. To understand water supply issues in the Las Vegas metropolitan area, one must understand groundwater and surface water conditions. There are two basic groundwater aquifers in the valley: (1) the principal aquifer; and (2) a shallow aquifer.

Rainfall and snowmelt in the mountain ranges, mainly the Spring Mountains, recharge the principal aquifer. Most wells in the Las Vegas Valley are drilled into the principal aquifer, located 70 to 200 meters (230 to 660 feet) below the land surface (Donovan 1996). A second aquifer, referred to as the shallow aquifer, exists up to 50 feet below the land surface in the urbanized area of the Las Vegas Valley. The source of the water in the shallow aquifer is mainly from the over-irrigation of lawns. It is estimated that groundwater use accounts for 15% of annual water use in the Las Vegas Valley. The Las Vegas Water District only uses groundwater during the months of May through September, when it accounts for
33% of total water use.

As described earlier in this chapter, Las Vegas has a landscape that is unable to absorb precipitation. Most of the precipitation runs off and cannot filter into the ground. Million-dollar floods have been a result of summer rainstorms. Summer thunderstorms dump large amounts of water on a small area in the valley. Channels or washes that convey storm water often cannot handle large amounts of water, and flooding occurs.

Lake Mead was created from the building of Hoover Dam. Secondary to the impounding of the Colorado River waters into Lake Mead, the Colorado River Commission was formed in order to allocate the water resources of Lake Mead among the states and Mexico that share the lower Colorado River. The state of Nevada was granted an allocation of 300,000 acre-feet per year. (An acre-foot is the volume of water that would cover a one-acre area with one foot of water.) Currently, the Southern Nevada Water Authority (SNWA), which manages this resource, consumes more than this allotment. (Colorado River Commission 1996).

The SNWA actually pumps more than its 300,000 acre-feet per year (AFY) allocation because of a concept known as “return flow credits.” Under an agreement with the US Department of Interior, return flow credits are given for any water returned to Lake Mead. The primary mechanism for returning unused water to the Colorado River is through wastewater treatment facility discharge that flows into Lake Mead via Las Vegas Wash. The Clark County Sanitation District, City of Henderson Sanitation District, and City of Las Vegas Sanitation District all discharge wastewater into Lake Mead via the Las Vegas Wash. In 1996, 135,641
acre-feet of water were discharged into the Colorado River for return flow credits (SNWA 1997a). It is projected that 160,678 acre-feet of water will be returned to the Colorado River in the year 2000 (SNWA 1997a).

The valley's principal aquifer volume is being reduced at an extremely high rate. During the summer, when water consumption is high, the aquifer is drawn on at rates faster than it can naturally recharge. The SNWA is unable to provide enough water from the Colorado River for the Las Vegas Valley in the summer months, due to an insufficient conveyance system from Lake Mead pumping facility to the Valley. In order to supply ample water in the summer, the SNWA depends on groundwater. The principal aquifer is drawn on by many of the municipal and residential well owners. In response to large amounts of water removed from the aquifer, the Las Vegas Valley Water District began an artificial recharge program in 1988. The program decreases the demand on the conveyance system from the Colorado River in the summer, when more water is used for lawns. In the winter, when there is less demand for lawn watering, water is pumped from Lake Mead into the ground for future use.

Another potential source of non-potable water for irrigation use is the perched shallow aquifer. The water in the shallow aquifer is mostly imported Colorado River water that is applied for landscape irrigation. Although the quality of the water in the shallow groundwater aquifer is poor and does not meet water quality standards for drinking water, this water can be used to a certain extent for irrigation. The reuse of the shallow groundwater aquifer can help alleviate the demand on the deeper aquifer that is used for drinking water, as well as the water
allocation from the Colorado River. The SNWA estimates that it can use up to 10,000 AFY of the shallow groundwater aquifer by the year 2000 (SNWA 1997b).

It is important to understand local water usage since so much of the local water supply is used for turf watering, and residential landscaping (e.g., turf size and type) is often directly related to residential lot size and residential density is in turn directly related to sprawl.

In 1995, the SNWA and U.S. Bureau of Reclamation funded a $15 million xeriscape study. The purpose of the study was to determine: (1) the amount of water saved by xeriscape landscaping and (2) the cost of installing xeriscaping. As a result of the study, in 1996 the SNWA compiled a comparison of landscaping techniques. Water use and costs were carefully examined. Table 7-5, below, summarizes the landscape comparison. Estimated water use and cost assumes an average irrigation system, drip irrigation, proper maintenance, proper water management, and an indoor water use of 5,000 gallons per month. The landscaping area is 4,035 square feet.
Table 7-5. Landscaping Techniques, Water Use, and Water Cost

<table>
<thead>
<tr>
<th>Landscaping</th>
<th>Water Use (gallons per month)</th>
<th>Water Cost (per month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Turf w/ Tall Fescue</td>
<td>476,671</td>
<td>$875.48</td>
</tr>
<tr>
<td>Full Turf w/ Bermuda</td>
<td>378,113</td>
<td>$673.84</td>
</tr>
<tr>
<td>Turf 47%, Plants 53% w/ Tall Fescue</td>
<td>292,640</td>
<td>$493.39</td>
</tr>
<tr>
<td>Plants w/ No Turf</td>
<td>115,618</td>
<td>$181.82</td>
</tr>
</tbody>
</table>

Source: SNWA 1997c.

The classic economic rule of supply and demand states that as supply goes down and demand goes up, a commodity’s price will increase. This rule historically has not applied to water in the Las Vegas Valley or elsewhere throughout the country. The SNWA (1997b) is assessing the “price elasticity,” of water within the valley. The SNWA has set a conservation goal of a 26.5% reduction in per capita water use for the year 2000. (SNWA 1997c).

In an effort to reduce water consumption, the City of Las Vegas has recently introduced residential turf restrictions. These together with increased residential densities and the reduction of “sprawl” are expected to decrease water
concentration.

The Southern Nevada Water Authority (SNWA) limits each of the entities using its water (such as the Las Vegas Water District and the City of Henderson) to a certain volume of treated wastewater. The total amount of water that all of the entities can reuse is 21,800 AFY. If an entity of the SNWA reuses more than its threshold amount, the amount of Colorado River water allocated to that entity will be decreased to compensate for the lack of return flow credits to the Colorado River. Each of the entities agreed on the threshold limits in the 1991 SNWA Cooperative Agreement (SNWA 1997c).

As of 1997, wastewater was reused primarily for non-drinking-water purposes, such as landscape irrigation and power plant cooling water (SNWA 1997b). The Clark County Sanitation District currently supplies over 6,000 AFY of treated wastewater to power plants and golf courses. All golf courses in the City of Henderson use treated wastewater for irrigation. The City of Henderson Sanitation District reused 3,500 AFY of treated wastewater in 1996, and has a potential for providing 11,200 AFY to golf courses, parks, and schools. The City of Las Vegas has a facility that can supply 10,000 AFY of treated wastewater for potential use on golf courses, schools, and parks. More facilities are planned as treated water becomes increasingly necessary.

With low-density, rapid population growth in the metropolitan area, treatment and disposal of wastewater must be considered. Increased discharge of treated wastewater has the potential to affect water quality in Las Vegas Wash, Las Vegas Bay, and Lake Mead. Many options are being considered to handle added
wastewater.

A major question facing the sanitation districts is whether Las Vegas Wash, Las Vegas Bay, and Lake Mead can handle the increasing amount of water being discharged by treatment facilities. The quality of Lake Mead’s water is of concern to the Las Vegas area, since a great amount of the Valley’s drinking water is drawn about 6 miles downstream from where treated wastewater enters the lake.

Water, Wastewater & Sprawl

It is clear that the physical environment of the Las Vegas Valley has been substantially changed by human intervention. In addition to polluting the air, introduction of foreign species into the Mojave habitat, we have impounded the waters of the Colorado River and polluted the much of the groundwater. But the question remains, what impact if any does sprawl play in the quality and use of the region’s water?

Even though the City of Las Vegas has recently enacted an ordinance limiting the use of turf in residential landscaping, currently most single family residences employ turf rather than alternative desert landscaping. Lower density residential housing (sprawl) increases nominal lot sizes and subsequently turf. This in turn has lead to increased water usage and wastewater generation. The preliminary analysis suggests that there appears to be a minor correlation between water/wastewater usage and residential density.
CHAPTER 8

THE TRANSPORTATION IMPLICATIONS OF SPRAWL

The correlation between sprawl and transportation is perhaps the most cited relationship by both proponents and opponents of sprawl (Muller 1981; Gordon and Richardson 1996; Ewing 1997; Rickaby 1981; Bank of America 1995; Duncan 1992; Raup 1975; Fischel 1985; Newman and Kenworthy 1988; Ladd 1992; Burchell 1992).

Most of these arguments center around the use of the automobile in traveling to and from work. Opponents of sprawl argue that sprawl results in excess automobile usage (in terms of vehicle miles traveled); increased traffic congestion; increased air pollution; and increased need for infrastructure costs for additional roads, highways and parking lots.

For example, Rickaby (1987) argues that sprawl increases inefficient travel times and therefore results in excess energy consumption versus compact growth alternatives. The 1995 Bank of America report, Beyond Sprawl, laments that sprawl is responsible for productivity losses secondary to time lost commuting. Another opponent of sprawl, Anthony Downs (1989), claims that sprawl results in excessive and inefficient automobile travel. Burchell (1992) demonstrates through a number of "applied models" that sprawl consistently results in excess infrastructure costs for roads and highways.
Environmentalist based anti-sprawl arguments also assert that a direct quantifiable and functional relationship exists between the severity of air pollution and the operation of gasoline-powered motor vehicles. In summary, the greater the number of vehicles on the road and miles driven at any given point in time, the more local air quality is degraded. Therefore increased sprawl it is argued results in increased air pollution.

Proponents of sprawl argue that suburbanization has been the dominant and most successful congestion reduction mechanism in America over the last thirty years. According to Gordon and Richardson in Beyond Sprawl (1996), industry moves to the suburbs following the labor force. This results in most commuting now being suburb-to-suburb. This allows many workers to enjoy shorter work trips. They cite the National Personal Transportation Study showing some increase in average commuting distances, but that these were offset by faster travel speeds.

This chapter provides a discussion of the role of the automobile in America and the premises of the “transportation-technology-urban form rule”; the current transportation system in the Las Vegas Valley (More specifically, the local analysis will include (1) Mobility and traffic congestion; (2) existing system performance; (3) future traffic demand estimates and; (4) the validity of the national “transportation” arguments for and against sprawl given the current trends in Las Vegas Valley’s growth.

Transportation-Technology-Urban Form Rule

It is possible to view the decentralization of population, employment, retail
and office activities from the urban core as but the latest episode in interactions between transportation technology and urban form dating from the onset of the Industrial Revolution (Gillespie 1980). Consequently, domestic and international variations in the rates and magnitudes of decentralization, and in car ownership and public transportation trends, may be attributed to symbiotic relationships between high car ownership and low density, decentralized land uses, and between high-density development and high public transportation usage. Thus, it is sometimes claimed that the densities and ages of Eastern cities favor public transportation operations, whereas lower density Sunbelt metropolises, such as Las Vegas, are dominated by car transport.

The conventional views are, however, should be subjected to critical scrutiny. First, it is very difficult to extricate and assess the impacts of transportation developments on decentralization from the effects of other factors working in the same direction (Brotchie 1985). Inability to hold these other variables constant may confound an analysis (for example, Dasgupta, Frost and Spence 1985), and may explain why various case studies differ in their conclusions about transportation's influences on land use development patterns (Hall 1985). Gillespie (1990) claims that transport developments have only passive impacts, reducing the constraints of spatial separation and thereby making possible for greater decentralization, which has been activated by, for example, preferences for suburban living. Yet this remains an untested and perhaps untestable, hypothesis.
Secondly, there are exceptions to the transportation-technology-urban
form rule. Hall and Hass-Klau (1985) present some evidence to suggest that
British cities had higher average residential densities than German cities in the
inter-war years; yet it was the British rather than the German tram systems which
went into what later proved to be irreversible decline at that time. Nowadays,
why should British cities have both lower car ownership and lower investment in
public transportation systems than some of their French and German
counterparts? To answer such questions Yago (1994) has probed the
underlying economic political forces that shape transportation and urban policy-
making. By starting with his explanation of the rise of mass car ownership and
the decline of urban public transportation, the stage is set for discussing the
historical differences in urban transport between cities.

Car ownership growth in the United States was rapid between 1918 and
1929, but was subsequently slowed by the economic depression of the 1930s
and checked by the Second World War, before resuming an upward trajectory
after 1945. For the largest United States cities urban rail (streetcar/tram and
local rail) patronage peaked in 1908 (Yago 1984), but national statistics (Gray
and Hoel 1979) indicated a first peak around 1920 (1926 for bus and rail).
Patronage then declined as road based public and private traffic increased. The
Second World War abruptly, but temporarily, reversed rail transit’s decline and
accelerated the growth of bus patronage to a peak in 1946. This was followed
by a dramatic and uninterrupted decline in bus and rail patronage until the early
1970s, when federally-aided investment in public transportation eventually
started to reverse this fall slightly. Althshule (1979) emphasizes the importance of post-war federal housing, rather than highway, policies in promoting substantial suburbanization, thereby creating conditions ripe for car ownership growth and the demise of public transportation.

Explaining the differences between American and Western European transportation development, Yago (1984) highlights three key factors in American development which supported the automobile. First, in the United States, the longer survival of competitive capitalism allowed the earlier, unchallenged emergence of a powerful pro-highway lobby of car, oil and rubber corporations, which promoted the early growth of mass consumer car markets, and which sought to undermine rail transit by financing competing bus operations.

Secondly, unlike much of high unionized European car industry which resisted the introduction of assembly-line mechanization, the United States embraced this technology and utilized cheap and unorganized immigrant labor to produce inexpensive vehicles.

Lastly, electrification and expansion of the urban railways were pursued for private profits from services and land and property speculation. Unlike Europe, in America, consumer demands for public ownership of urban transport were circumvented by removing transportation issues from the local political process.

Since the 1960s there has been recognition internationally that urban transportation planning and operations should be performed for sensibly
defined metropolitan areas. The institutional arrangements for achieving this vary between nations and cities. Interest in such structures in the United States arise from the Federal government's assertion that integration, rather than fragmentation, of metropolitan political control offers better prospects for the regeneration of core cities.

The federal government has required local political jurisdictions to cooperate over transportation planning issues as a condition for receiving Federal grants since 1962 (Wiener 1979). A continuing, comprehensive, and cooperative (3C) planning process was stipulated by the 1962 Federal Highway Act. This was followed by, for example, the 1968 Inter-government Co-operations Act with the establishment of "A-95 Clearinghouses" to insure the compatibility of Federally aided projects within comprehensive plans. The 1973 Federal Highway Act went further by making funds available to metropolitan planning organizations (MPOs) for comprehensive transportation planning activities, which were guided by the UMTA (Urban Mass Transit Administration) and FHWA (Federal Highway Administration) regulations issued in 1975. The FHWA has directly linked air quality standards and automobile emissions. MPOs are now required by law to integrate the National Ambient Air Quality Standards (NAAQS) into the transportation planning process of each region. Failure to meet NAAQS can result in reductions in transportation dollars. The Regional Transportation Commission serves as the MPO in the Las Vegas Valley.
Transportation in the Las Vegas Valley

Much of the data in this section was obtained from two key studies that were used to formulate the valley's transportation plan into the next century. The Resort Corridor Major Investment Study and the US 95 Major Investment Study (US 95 MIS), conducted by the Regional Transportation Commission (RTC) and Nevada Department of Transportation (NDOT) respectively, were designed to identify improvements for the two most congested regions in the Las Vegas Valley.

The concepts of mobility and congestion are generally used to describe the adequacy of a transportation system. In the Las Vegas valley, there are two major modes of transportation available to travelers: private or commercial vehicles, and public transit. These modes are interrelated in terms of performance as they both share the same infrastructure— the street network.

Mobility is most easily understood as the ease and speed with which travelers can move about, considering both the movements within the individual mode and the availability of mobility options. Mobility is most often measured in terms of supply and demand. In the case of the roadway system, supply refers to the amount of lane miles and intersection capacity available, while demand refers to the number of vehicles operated on the roadway system. The public transit system (CAT) supply is quantified by the transit capacity or rolling stock available, and demand is quantified by the number of travelers who ride the bus. Overall mode choice is a function of the availability of the various modes of travel, and the attractiveness and convenience of each mode relative to the
others. Mobility measures that combine the concepts of supply and demand as they relate to the Las Vegas valley include level of service of the transportation system, transit vehicle load, and occurrence and duration of peak traffic utilization periods.

Congestion can be defined as the level at which transportation system performance is no longer acceptable due to traffic interface. Acceptable performance can vary by transportation facility, area type, and time of day. The degree of unacceptability will vary from one locale to another. What is considered acceptable by a new resident moving from the Los Angeles area may differ greatly from what is considered acceptable by a long-term Las Vegas valley resident.

Congestion in the Las Vegas valley results from the high demand for the various modes available, mainly private vehicles traveling on the limited capacity of the roadway system. For a variety of reasons, the single-occupancy private automobile is the preferred mode of transportation throughout the Las Vegas valley; not only do valley residents drive almost everywhere, they almost always do so alone (Regional Transportation Commission 1995). As more travelers choose to travel in private automobiles, congestion is caused by this demand exceeding the supply of lane miles and intersection capacity. The high volume of private vehicles tends to constrain and limit transit operations; conversely, private vehicles are often constrained by CAT operations at bus stops. At high volume stops, long dwell times required to board and exit buses delays both transit and private vehicle traffic.
Accessibility is another quantifiable measure of mobility. One of the strongest arguments cited by opponents of sprawl development is the reduced burden that a more compact growth pattern places on existing roadways (for example Bank of America 1995). Poor accessibility is one of the most important indicators associated with sprawl development. Poor residential accessibility is caused by residences being located far from out-of-home activities; poor destination accessibility is a result of out-of-home activities being far from one another. Two types of accessibility limitations affect the efficiency of travel patterns in the Las Vegas metropolitan area. Specifically, vehicle miles of travel (VMT) and vehicle hours of travel (VHT) are both increased, and they in turn impact the volume/capacity (v/c) ratio of major arterials throughout the Las Vegas valley.

Several studies (for example Ewing 1997; Burchell 1992; Duncan 1992; Rickaby 198) point to a strong link between increased density and an overall reduction in VMT. In one Florida study, households living in the most accessible locations drive about 40 minutes less per day than those living in the least accessible locations, thus generating hundreds of fewer vehicle hours per year. The savings are due almost entirely to shorter auto trips rather than to shifts to other modes (Ewing et al. 1994; Ewing 1995b).

Recent evidence (Gordon and Richardson 1996) suggests that the decentralization of businesses and households may not raise average travel speeds enough to compensate for the longer trips that are necessary. As densities rise in compact growth scenarios, on the other hand, trips get shorter,
transit and walk mode shares increase, and vehicle trip rates drop. By various estimates, doubling urban density results in a 25-30 percent drop in VMT, or a slightly smaller reduction when the effects of other variables are controlled (Holtzclaw 1994, 6-8 and 21). In all major urban area simulations done since 1990, the failure to achieve some improvement in the accessibility of housing to jobs results in increased VMT over the projection periods. The greatest magnitudes of VMT reduction, in contrast, were associated with locating new housing closer to existing job centers; in most instances, the greatest VMT reductions occur when housing is located along transit corridors that improve access to major employment centers. This is a most important consideration when evaluating sprawl in context of the current and future growth of the Las Vegas Valley.

The Las Vegas metropolitan area is served by two major freeways: Interstate 15 crosses the valley roughly from northeast to southwest, and US 95 runs roughly from northwest to southeast. Interstate 215, the Las Vegas Beltway, is completed, under design, or under construction throughout the valley. Major arterial streets are generally oriented in a north-south and an east-west direction on a one-mile grid. Minor arterial streets are generally laid out on a grid system similar to major arterial streets, but tend to be highly discontinuous throughout the area due to disjointed development that often results in so-called "sawtooth" street patterns.

The relationship between supply (capacity) and demand (traffic volume) is an important element in evaluating the performance of the transportation system.
Roadway system performance is usually measured in terms of volume/capacity \((v/c)\), the ratio of demand flow-rate to capacity for a given region. Capacity is defined as the maximum number of vehicle miles of travel that the system can accommodate, or the maximum number of vehicles that have a reasonable expectation of passing over a given point for a given time period under prevailing roadway and traffic conditions. When the volume of traffic approaches the capacity of a roadway, congestion results.

The RTC estimated in 1995 that the entire Las Vegas valley roadway network had a capacity of approximately 35 million vehicle miles of travel (VMT) per day. The current demand, or daily VMT, on the overall system was estimated to be about 18 million. These estimates include all freeways, ramps, arterials, collectors, and local streets. The major roadways, including freeways and major and minor arterials, account for most of the VMT. These are the facilities where congestion is greatest. The RTC estimated actual daily VMT on freeways and arterials to be 13 million miles, as shown in Table 8-1.
<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Daily VMT</th>
<th>Daily Available Capacity</th>
<th>Volume/Capacity Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Arterial</td>
<td>4,672,300</td>
<td>6,835,600</td>
<td>0.68</td>
</tr>
<tr>
<td>Minor Arterial</td>
<td>4,305,300</td>
<td>8,882,300</td>
<td>0.49</td>
</tr>
<tr>
<td>Freeway</td>
<td>4,274,200</td>
<td>8,483,200</td>
<td>0.50</td>
</tr>
<tr>
<td>Total</td>
<td>13,251,800</td>
<td>24,181,200</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Source: RTC 1995a

Roadway traffic is not evenly distributed throughout the day. The largest volumes of traffic normally occur during morning and evening peak hours, at times that correspond to work commuting hours. The peak hour is defined as the 60-minute period within the peak time during which traffic volumes are at their highest. The PM, or afternoon peak hour, is the basis for analysis of identified congestion levels. Based on 1995 data, the Las Vegas valley area wide peak hour traffic volume takes up approximately 78 percent of available hourly capacity (peak hour v/c = 0.78), with Resort Corridor peak hour traffic volume at 85 percent of available capacity. Table 6-2 lists the v/c ratios for all areas of the Las Vegas valley.
Table 8-2 Peak Hour Volume/Capacity Ratios for Las Vegas Valley

<table>
<thead>
<tr>
<th>Corridors</th>
<th>Peak Hour Volume/Capacity Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest</td>
<td>0.59</td>
</tr>
<tr>
<td>Northeast</td>
<td>0.52</td>
</tr>
<tr>
<td>Northeast Central</td>
<td>0.64</td>
</tr>
<tr>
<td>Resort Corridor</td>
<td>0.85</td>
</tr>
<tr>
<td>Southeast Central</td>
<td>0.61</td>
</tr>
<tr>
<td>Southwest</td>
<td>0.31</td>
</tr>
<tr>
<td>Southeast</td>
<td>0.45</td>
</tr>
<tr>
<td>West Central</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Source: RTC 1996a

Future Traffic Demand Estimates

In order to estimate future traffic demand conditions in the Las Vegas valley, the RTC operates and maintains the TRANPLAN computer traffic forecasting model. TRANPLAN projects future traffic volumes on the entire freeway and arterial street network. The output from the model is used to identify transportation capacity shortfalls for long-term improvement plans. Between 1995 and 2015, an 82 percent increase in capacity is programmed for the major arterial streets and freeways in the Las Vegas valley. During the same time period, TRANPLAN projects an 83 percent increase in vehicle miles of travel (RTC 1995a).

While this data would tend to indicate that arterial street and freeway capacity increases will keep pace with traffic volume increases on an area-wide basis, many of the capacity enhancements will take place in locations where...
residential, commercial, industrial or resort development has recently occurred or is planned for the near future. This new growth initiates the construction of transportation improvements in areas with low levels of land-use activity, where transportation facilities were previously unnecessary. In areas where land use intensities are currently the greatest and continuing to expand, the transportation network is essentially in place. In most cases, the transportation network is essentially at a build-out condition, with right-of-way maximized. Travel demands in these areas are increasing at a substantial rate, however, due to the increase in high trip-generating land uses such as hotel-casino properties.

Table 8-3 shows the relationship between the projected growth in vehicle miles of travel and the increase in daily capacity of the major arterial streets in Las Vegas over the next 20 years. The capacity increase is the result of $602 million in improvements programmed for arterial streets over the 1995-2015 planning horizon.

<table>
<thead>
<tr>
<th>Year</th>
<th>Daily VMT</th>
<th>Daily Available Capacity</th>
<th>V/C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>4,672,300</td>
<td>6,835,600</td>
<td>0.68</td>
</tr>
<tr>
<td>2000</td>
<td>4,796,400</td>
<td>7,837,300</td>
<td>0.61</td>
</tr>
<tr>
<td>2010</td>
<td>5,703,500</td>
<td>7,666,500</td>
<td>0.74</td>
</tr>
<tr>
<td>2015</td>
<td>6,857,400</td>
<td>11,038,800</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Source: RTC 1996a

Traffic volumes on major arterial streets are projected to rise by 47
percent during the 20 year planning horizon, while the capacity of major arterial streets is projected to increase by 61 percent during that time. The actual area-wide v/c ratio will decrease slightly over the next 20 years (RTC 1995a).

Table 8-4 shows the projected growth in vehicle miles of travel and the increase in daily capacity on the Las Vegas valley freeways over the 1995-2015 planning horizon. The increases in capacity are the result of $1.131 billion in projected freeway improvements over the next 20 years.

Table 8-4 Projected Daily VMT and Available Capacity for Freeways

<table>
<thead>
<tr>
<th>Year</th>
<th>Daily VMT</th>
<th>Daily Available Capacity</th>
<th>V/C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>4,274,200</td>
<td>8,483,200</td>
<td>0.50</td>
</tr>
<tr>
<td>2000</td>
<td>5,491,400</td>
<td>10,709,800</td>
<td>0.51</td>
</tr>
<tr>
<td>2010</td>
<td>8,708,300</td>
<td>13,741,800</td>
<td>0.63</td>
</tr>
<tr>
<td>2015</td>
<td>9,546,000</td>
<td>16,822,000</td>
<td>0.57</td>
</tr>
</tbody>
</table>

Traffic volumes on the freeways are projected to increase by 123 percent during the 20-year planning horizon. The capacity of freeways is projected to increase by 98 percent. The actual area-wide freeway v/c ratio is expected to increase over the next 20 years.

Specific areas of the Las Vegas valley are under unique travel supply and demand conditions. Travel activity in the Resort Corridor is depicted in Table 8-5. Resort Corridor traffic volumes are projected to increase by 71 percent over the 1995-2015 planning horizon, while the capacity of the major streets and...
Freeways within the corridor is projected to grow by only 51 percent. Traffic volumes are projected to increase from 70 percent of available capacity in 1995 to 80 percent of available capacity in 2015. This is significantly worse than the area-wide 60 percent of available capacity that is expected to remain somewhat constant over the planning horizon.

Table 8-5 Projected Daily VMT and Available Capacity for the Resort Corridor

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Daily VMT</th>
<th>Total Daily Capacity</th>
<th>Total V/C Ratio</th>
<th>Resort Corridor Daily VMT</th>
<th>Resort Corridor Capacity</th>
<th>Resort Corridor V/C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>8,946,500</td>
<td>15,318,800</td>
<td>0.58</td>
<td>3,918,400</td>
<td>5,621,600</td>
<td>0.70</td>
</tr>
<tr>
<td>2000</td>
<td>10,287,800</td>
<td>18,547,100</td>
<td>0.55</td>
<td>4,162,200</td>
<td>6,641,800</td>
<td>0.63</td>
</tr>
<tr>
<td>2010</td>
<td>14,411,800</td>
<td>21,408,200</td>
<td>0.67</td>
<td>6,007,200</td>
<td>7,791,800</td>
<td>0.77</td>
</tr>
<tr>
<td>2015</td>
<td>16,403,400</td>
<td>27,860,800</td>
<td>0.59</td>
<td>6,703,500</td>
<td>8,515,300</td>
<td>0.79</td>
</tr>
<tr>
<td>Total Growth</td>
<td>83%</td>
<td>82%</td>
<td>71%</td>
<td>51%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: RTC 1996a

Table 8-6 depicts travel activity for the Resort Corridor and Regional Corridors. The data show that the West Central Corridor remains the most congested corridor. Despite programmed improvements, most of the other corridors also show a substantial increase in their v/c ratios. The number of severely congested miles throughout the Las Vegas valley is projected to
increase from approximately 80 in 1995 to 84 in 2000, 138 in 2010, and 173 in 2015. The number of severely congested intersections is projected to increase from approximately 73 in 1995 to about 275 in 2015. Portions of 27 major arterial streets and freeways are expected to be severely congested by 2015, with the v/c ratio exceeding 1.0. This is despite the programmed investment of $1.73 billion for major arterial and freeway capacity enhancements over the 1995-2015 planning horizon.

Table 8-6 Volume/Capacity Ratios For Resort And Regional Corridors

<table>
<thead>
<tr>
<th>Location</th>
<th>2015 Peak Hour v/c Ratio</th>
<th>Percent Increase Over 1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resort Corridor</td>
<td>0.95</td>
<td>12 %</td>
</tr>
<tr>
<td>Northwest</td>
<td>0.80</td>
<td>36 %</td>
</tr>
<tr>
<td>Northeast</td>
<td>0.68</td>
<td>31 %</td>
</tr>
<tr>
<td>Northeast Central</td>
<td>0.79</td>
<td>23 %</td>
</tr>
<tr>
<td>Southeast Central</td>
<td>0.68</td>
<td>12 %</td>
</tr>
<tr>
<td>Southwest</td>
<td>0.73</td>
<td>136 %</td>
</tr>
<tr>
<td>Southeast</td>
<td>0.47</td>
<td>4 %</td>
</tr>
<tr>
<td>West Central</td>
<td>1.13</td>
<td>31%</td>
</tr>
</tbody>
</table>

Source: RTC 1996a

Land use patterns have a significant impact on the amount of energy consumed in an area. The relationship of energy consumption to urban form parallels that of travel to urban form. Centralized development patterns consistently outperform low-density sprawl in energy studies (Haines 1986; Newman and Kenworthy 1989). Though vehicles operate with less fuel
efficiency in congested areas, per capita fuel consumption is much lower in central areas because people drive so much less (Newman and Kenworthy 1988). Polycentric development emerges as the preferred development plan when it is included as an alternative (Small 1980; Haines, 1986).

In large metropolitan areas such as the Las Vegas Valley, energy efficiency is served by concentrating development to some extent, but not to the extent of a single dominant center. Rickaby (1987) evaluated the energy implications of six settlement patterns under three energy consumption scenarios. The highly compact urban core development pattern is the most energy efficient, with at least a 20 percent reduction of total passenger miles when compared to the alternatives and a 25 percent reduction in energy consumption over the status quo. While the compact urban core with satellite towns is the second most efficient pattern, most energy savings are attributed to households. The urban village (infill) with compact urban core emerges as the better second choice, since it involves energy savings in both households and transportation relative to the status quo.

Transportation savings include energy and time, and both kinds of savings are capitalized by land. The result is higher housing costs, which can be expected in any program that creates efficiencies. Among all the alternatives schemes, urban village (infill) development with a compact urban area offers the greatest energy savings with the least increase in housing costs.

The amount of direct energy consumption in urban areas is of concern to the federal government as a national policy and is a companion goal to
improving air quality in our metropolitan areas. It is also a criterion, in addition to air quality, that will be used by the Federal Transit Authority beginning in Fiscal Year 1999 to evaluate candidate projects for federal discretionary funding. An energy analysis was conducted as part of the Resort Corridor MIS to estimate the total amount of energy that would be consumed by each of the alternatives proposed for adoption as the Resort Corridor Transportation Master Plan. This direct energy consumption, measured in BTUs, involves the energy used by vehicles operating on roadways and fixed guideways within the region. The plan selected by the RTC, which includes a Fixed Guideway Element and support bus system, offered superior performance to other alternatives with a projected reduction of up to 1.6 percent in energy needs.

Unprecedented growth and development has seriously impacted air quality in the Las Vegas valley. Although there has been significant progress in enforcing air pollution control regulations over the past two years—19 violations of national ambient air quality standards were recorded in 1997, for example, down from 49 such events in 1996—much remains to be accomplished. Wind-blow dust and visible urban haze remain problematic, and are issues of public concern. The Clark County Health District has also identified two pollutants as not meeting attainment standards as defined by the US Environmental Protection Agency: carbon monoxide and PM10. As the valley continues to grow, control strategies must be implemented in order to achieve attainment of National Ambient Air Quality Standards for these pollutants.
The land use plans of local governments also have a profound impact on air quality. The reduction of VMT associated with compact growth patterns of development has a significant effect on air quality. As with the case of fuel consumption, vehicle emissions increase VMT and decrease with average operating speed (up to about 50 mph for carbon monoxide and hydrocarbons; carbon dioxide emissions track fuel use exactly). In these terms, compact growth has an edge over sprawl development. This edge may be diminished, however, by the fixed hydrocarbon emissions associated with "cold starts" and "hot soaks." These emissions are produced any time an automobile is used, even for a short trip to a transit line or a suburban activity center (Ewing 1997).

The interrelationship between transportation and land use planning, and the resulting impact on air quality, warrant further examination. New commercial development in high-traffic areas can lead to increased congestion, resulting in a corresponding increase in pollutant concentrations. The impact of growth on air quality should be considered in long-range growth management plans as well as in land use policy decisions.

By the year 2000 there will be over 700,000 vehicles in Clark County, traveling 18.4 million miles daily. Despite a multi-billion dollar effort, transportation limitations continue to be a major concern in the valley. Various federal, state and local agencies have attempted to address these problems. Planning projections clearly indicate continued growth for the Las Vegas valley area, and transportation problems will continue to increase as well unless they are addressed on a regional basis in a multi-modal manner.
CHAPTER 9

INFRASTRUCTURE COSTS

It has been argued by numerous authors that infrastructure costs (the cost of building and maintaining such technical services as transportation networks (e.g., roads); utilities (water, wastewater and flood control); and school construction are impacted by land use patterns (e.g., Duncan 1992; Rikaby 1987; and Burchell 1992). However, the degree, direction and extent of sprawl on infrastructure costs have been subject to various interpretation.

Calculating the local effects of land development on infrastructure seems straightforward, but is actually an extremely difficult task in major metropolitan areas. Local officials often deem a new residential or commercial development responsible for the demands on infrastructure services made by the new local residents, customers, or employees that the development attracts. Presumably, if local development permission is denied, the development and population workforce growth, along with their associated infrastructure needs, will be displaced to some other community.

Growing communities, as a result, point to local development for most of the increase in local infrastructure demands. Growth may need to reach high levels, however, before land development accounts for more than half of the
increase in infrastructure demand (Hoover and Giarratani 1985).

If higher standards for infrastructure services, real income growth, and
demographic shifts increase per capita demands for infrastructure services by
2% per year, for example, then development would account for more than half
the growth in infrastructure demand in communities that were growing faster
than 2% per year.

From a regional perspective, local calculations often ignore important
infrastructure demands that overlap jurisdictional boundaries. This is particularly
true if certain local communities are attempting (perhaps inadvertently) to shift
infrastructure burdens of new development on their neighbors. The spillover
effects can be particularly acute for transportation, for example, because
motorists driving from residences in one town to shopping or employment
centers or jobs in other towns often use roads that pass through communities
that had no say in the siting of those facilities. Similarly, development may
impose costs across local boundaries by straining regional watersheds, reservoir
systems, or waste treatment facilities.

This chapter examines (a) technical considerations in evaluating
infrastructure expense on regional and local economies; (b) sprawl and the "jobs
housing imbalance"; (c) recent studies comparing the "impacts" of sprawl on
infrastructure expense; (d) local infrastructure costs and the potential
relationship between sprawl and infrastructure costs in the Las Vegas Valley.

Sprawl and land development in general are often blamed for the rising
demand for local infrastructure services. When local roads become congested
and the local water supply is overdrawn, newly built subdivisions are the most visible cause. Contrary to popular belief, sprawl proponents argue, low-density sprawl does not add significantly to infrastructure demands. A direct and immediate link exists between development and certain types of infrastructure commonly provided by local government. For example, developing a parcel of land would not be possible without access roads, water and sewer lines as well as other locally provided infrastructure. However, land development (whether compact or sprawl) is not the only "cause" of an "increasing demand for infrastructure services."

First, higher standards for the quality of infrastructure services often result in increasing infrastructure expense. For example, federal regulations adopted during the 1970s and 1980s raised standards for air quality, drinking water, sewage treatment, and solid waste disposal. The 1970 Clean Air Act Amendments, for example, forced communities to install expensive emission controls on solid waste incinerators or to close them. The Resource Conservation and Recovery Act (RCRA) of 1976 established strict controls over the design and operation of landfills and required separate hazardous waste treatment facilities. As a result, more than 70% of the 14,000 landfills operating in 1978 were closed by 1988 and 40% of the remainder closed by the mid-1990s (EPA 1995). Their replacements—safer and generally more distant landfills and waste recovery plants—tended to be more expensive.

Two additional factors that are difficult to distinguish from land development are economic growth and development change. Economic and
population growth usually leads to land development (Hoover and Giarratani 1985). As incomes grow, households usually move to larger and higher quality housing, which may require more infrastructure services. Consequently, population growth usually leads to the construction of new houses and workplaces (Hoover and Giarratani 1985).

Economic growth can contribute to the demand for infrastructure without leading to land development. As real per capita incomes increase, for example, households buy more cars, drive more miles, consume more water, and produce more sewage waste, even if they live in the same houses. Thus, regions or cities with relatively stable populations and growing per capita incomes still experience rising traffic congestion, water consumption and waste generation (Hoover and Giarratani 1985).

Population growth and demographic changes also affect the demand for infrastructure services independently of land development. The growth in automobile travel since the 1950s is the result of a rising population and also of the increasing labor force participation of women and the aging of the baby boom generation (Mills 1978). When an increasing percentage of women joined the work force, the percentage of adults commuting to work grew. The baby boom beginning in 1946 created a surge in the proportion of the population that reached driving age between the 1960s and the 1980s, which contributed to the fact that automobile ownership and travel grew faster rates than the population (Gordon 1995).

Economic growth and population changes collectively appear to have had
a powerful independent effect on national infrastructure demands in the past several decades. If land development was the primary cause of infrastructure demands, then infrastructure use would be expected to increase at the same rate as the population or the formation of new households. Highway travel, the only infrastructure demand for which historical national statistics are readily available, grew two to four times faster than population or households in the 1950s, 1960s, and 1980s, however (see Table 9-1). Even in the 1970s, the decade of two oil price shocks and slower income growth, motor vehicle travel increased more rapidly than the rate of household information. Based on these figures, land development nationally might have accounted for as little as one-fourth to one-half of the increase in driving demand in the postwar period, although this conclusion is speculative (Gordon 1995).

Some analysts argue that economic growth and demographic changes will create a smaller independent effect on per capita infrastructure demands in the future (Gordon 1995). Additional income growth may not stimulate increased driving per capita, for example, because a majority of households already own at least one car for each licensed driver. Demographic causes may not be quite as powerful because the baby boom generation now is licensed to drive and the female labor force participation rate cannot increase as rapidly as it has.
Table 9-1 AVERAGE ANNUAL INCREASES IN POPULATION, HOUSEHOLDS, AND VEHICLE MILES OF HIGHWAY TRAFFIC PERCENT

<table>
<thead>
<tr>
<th>Decade</th>
<th>Population</th>
<th>Driving Age Population</th>
<th>Households</th>
<th>VMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950s</td>
<td>1.7%</td>
<td>0.7%</td>
<td>1.0%</td>
<td>4.6%</td>
</tr>
<tr>
<td>1960s</td>
<td>1.3%</td>
<td>1.6%</td>
<td>1.8%</td>
<td>4.4%</td>
</tr>
<tr>
<td>1970s</td>
<td>1.1%</td>
<td>1.9%</td>
<td>2.5%</td>
<td>3.2%</td>
</tr>
<tr>
<td>1980s</td>
<td>1.0%</td>
<td>1.2%</td>
<td>1.6%</td>
<td>3.6%</td>
</tr>
</tbody>
</table>


Economic growth and demographic changes are likely to continue to influence infrastructure demand, however, income growth may have less effect on per capita driving but it should continue to be a powerful stimulus to demand for water, solid waste, parks, and other infrastructure services. Similarly, demographic shifts will affect infrastructure demands as more children of the baby boom generation reach driving age in the next decade.

A large scale Florida study entitled The Search for Efficient Growth analyzed case studies of actual costs (and revenues) incurred by several projects throughout the state. By grouping the development patterns into two aggregate profiles, the relative capital costs of sprawl development versus compact growth can be determined from case study information on incurred infrastructure expenses (Duncan 1992). Major costs in both cases were roads and schools, which combined represented 80 to 85 percent of all capital.
expenditures. When viewed in this fashion, the costs of compact growth were significantly less than those incurred by sprawl development. Table 9-2 shows that capital costs related to roads were reduced by over 60 percent and utility expense was reduced by nearly 40 percent under the compact growth scenario.
Table 9-2. James E. Duncan—Florida Growth Pattern Study: Capital Facility Costs Under Current Development Trends Versus Compact Growth (per dwelling unit; 1988 dollars)

<table>
<thead>
<tr>
<th>Category of Capital Costs</th>
<th>Average of Case Studies Under Current Development Trends (1)</th>
<th>Average of Case Studies Under Compact Development (2)</th>
<th>Current Development Trends Versus Compact Development Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average of Studies Under Current Development Trends (1)</td>
<td>Average of Studies Under Compact Development (2)</td>
<td>Number</td>
</tr>
<tr>
<td>Roads</td>
<td>$ 7,014</td>
<td>$ 2,784</td>
<td>(+)$4,230</td>
</tr>
<tr>
<td>Schools</td>
<td>$ 6,079</td>
<td>$ 5,623</td>
<td>(+)$ 454</td>
</tr>
<tr>
<td>Utilities</td>
<td>$ 2,187</td>
<td>$ 1,320</td>
<td>(+)$ 867</td>
</tr>
<tr>
<td>Other</td>
<td>$ 661</td>
<td>$ 672</td>
<td>(-$ 11</td>
</tr>
<tr>
<td>Total</td>
<td>$16,941</td>
<td>$10,401</td>
<td>(+)$5,540</td>
</tr>
</tbody>
</table>

Notes:

1. Current development, as defined here, includes the following patterns of "urban form" analyzed by the Florida study: "scattered," "linear," and "satellite." The capital cost figures shown in this table are averages of the Florida case studies characterized by the scattered, linear, and satellite patterns (e.g., Kendall Drive, Tampa Palms, University Boulevard, and Cantonment).

2. Compact development, as defined here, includes the following patterns of "urban form" analyzed by the Florida study: "contiguous" and "compact." The capital cost figures shown in this table are averages of the Florida case studies characterized by the contiguous and compact patterns (e.g., Countryside, Downtown Orlando, and Southpoint).

Source: The Search for Efficient Urban Growth Patterns. Report prepared for the Governor's Task Force on Urban Growth Patterns and the Florida Department of Community Affairs. (Tallahassee, FL: Department of Community Affairs 1982).
Two Rutgers studies considered the consequences to the state of New Jersey of a compact growth development strategy versus current development trends across numerous substantive dimensions. When all components of infrastructure were summed up (roads, utilities, and schools), the Rutgers impact assessment found that current development trends would necessitate a statewide infrastructure outlay of $15.6 billion from 1990 to 2010. According to the authors, compact development would reduce the necessary capital investment over the two-decade period from $15.6 billion to $14.2 billion—a savings of $1.4 billion, or just under ten percent (Table 9-3 below). In terms of transportation infrastructure, compact growth relative to sprawl development required 76 percent of the capital costs for roads (Burchell 1992).
As might be expected, findings from these major studies differ somewhat. The commonalities in the direction and order of magnitude in the findings are much stronger, however, than these individual differences. A synthesis of these findings from these three studies concludes that compact growth, relative to

| Table 9-3 New Jersey Impact Assessment: Summary of Impacts for Current Trends Versus Compact Growth |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Growth / Development Impacts (1) | Current Development Trends (1) | Compact Growth (2) | Current vs Compact Growth: % Difference |
| I. Population Growth (persons) | 520,012 | | |
| II. Household Growth (households) | 431,000 | | |
| III. Employment Growth (employees) | 653,600 | | |
| IV. Infrastructure ($ million) | | | |
| A. Roads | $2,197 | $1,630 | $567 | 25.8 |
| Local | 727 | 595 | 132 | 18.2 |
| State | 2,924 | 2,225 | 699 | 23.9 |
| Total Roads | | | | |
| B. Utilities-Water | $634 | $550 | $84 | 13.2 |
| C. Utilities-Sewer | 8,790 | 6,313 | 477 | 7.0 |
| Total Utilities | $7,424 | $6,863 | $561 | 7.8 |
| E. Schools | $5,296 | $5,123 | $173 | 3.3 |
| F. All Infrastructure (sum of A-E) | $15,844 | $14,211 | $1,433 | 9.2 |
| V. Land Consumption (Acres) | | | |
| A. Overall Land | 292,079 | 117,807 | 174,472 | 59.7 |
| B. Fragile Lands | 36,482 | 6,139 | 30,343 | 83.2 |
| C. Agricultural | 108,000 | 66,000 | 42,000 | 38.9 |
| VI. House Price | | | |
| A. Median cost 1990 | $172,567 | $162,162 | $10,405 | 6.1 |
| B. Housing Index (higher is more affordable) | 118 | 128 | 8 | 6.7 |

sprawl development, requires 75% of the infrastructure cost for roads, 85% of the infrastructure cost for utilities and 95% of the infrastructure cost for schools. It is this synthesis that is most often used by opponents of sprawl.

The possibility that the costs of leapfrog development are reduced by eventual infill is supported in part by a 1991 study by Richard B. Peiser, which compared the hypothetical costs of planned and unplanned development of a 7,500 acre tract in Houston. The housing types in both developments were similar. In the unplanned development, small housing subdivisions were built in a piece meal and uncoordinated fashion, leaving vacant land to be filled in later with commercial and other uses. In the planned development, however, housing was developed according to a master plan for the entire area, and commercial and other users were sited to minimize transportation costs and other conflicts.

Peiser estimated that capital costs for infrastructure (roads, sewers, water, and drainage) would be only 5 percent lower in the planned community than the unplanned community. Water, sewer, and drainage capital costs were estimated to be higher in the unplanned community because it failed to exploit economies of scale in service areas, pipe dimensions, or treatment facilities. Road capital costs were slightly lower in the unplanned community, however, because developers built only roads connecting their subdivisions with major highways and not roads that connected their subdivisions with others. The residents of the unplanned community had to drive farther to compensate for the lack of direct connections among subdivisions, but total transportation costs were only 3 percent lower in planned than the unplanned community.
Jobs-Housing Imbalance and Sprawl

Some planners argue that new development contributes disproportionately to the demand for infrastructure services, or the costs of meeting those demands. The argument assumes that additional development is so poorly planned or designed that unnecessary burdens are placed on the infrastructure systems. Local problems created by rapid development often are compounded, according to this view, because growth is planned without adequate attention to infrastructure requirements.

In this regard, some experts have viewed as a serious problem since the 1950s (Clark 1968). Initially, the term "sprawl" referred to at least three forms of development: (1) continuous low-density residential development on the metropolitan fringe; (2) "ribbon" low-density development along major suburban highways; and (3) development that "leapfrogs" past undeveloped land to leave a patchwork of developed and undeveloped tracts of land. Each "form" is believed to require more infrastructure than "compact" or better planned development (Burchell 1992; Duncan 1992). Continuous low-density or leapfrog development, for example, would require more miles of road or pipe to connect residences with major employment centers, sewage treatment facilities and the like than compact and contiguous development.

In the 1980s, a new concern emerged among public officials and planning organizations about the "job-housing" imbalance in urban development. While the previous examinations of sprawl focused on patterns of residential development, the new critics stressed the problems created by mismatches in
the locations of new jobs and new housing. This new criticism accentuated the need to rethink the impacts of sprawl on transportation infrastructure. For example, according to California environmental officials (Bank of America 1995) the coastal strip of Los Angeles and Orange Counties has been the location of approximately 80% of the new jobs created in the Los Angeles basin since 1970, but only 40% of the new housing. Most of the new housing has been built inland from these two counties, which, critics hypothesize, adds to the average commuting trip length and to air pollution problems in the region. The Air Quality Management Plan adopted in 1989 by the Southern California Association of Governments recommended that a larger portion of new jobs be required to located inland to reduce commuting demand and help meet ambient air quality standards.

The fundamental cause of jobs-housing imbalance is alleged to be fiscal and exclusionary zoning. Communities in the most advantageous locations tend to zone for high-income housing or commercial development and to exclude low- and moderate-income housing. The result is that low- and moderate-income household members must commute long distances from remote suburbs.

At first glance, the concerns about the jobs-housing imbalance and sprawl appear inconsistent with one another. The usual remedy for sprawl is a more compact urban form, for example, while the most feasible remedy for a job-housing imbalance, given residential sprawl, is greater job dispersal. The jobs-housing imbalance argument does not imply that development ought to be high
or low density, however, only that it ought to be heterogeneous jobs and housing types. While the old concern about sprawl attacked low density residential development on the fringes, the new concern about jobs-housing imbalance strikes at traditional patterns of job concentration (for example, the downtown) and of segregation between high- and low-income residential areas.

**Residential Density**

Most research on sprawl focused on how the density of residential neighborhoods affected the costs of providing infrastructure within them. This research typically considered the costs of local streets, sewage collection lines, water distribution pipes, storm drainage systems, and neighborhood schools. Regional links, such as arterial roads connecting the residential community with employment centers, usually were not considered.

In the 1950s, this research focused primarily on the costs of serving single-family homes on different sized lots. In the 1970s, the focus to comparisons among conventional single-family homes on grid lots, clustered single-family housing surrounded by larger open space, townhouses, walk-up and high-rise apartment buildings.

Cost comparisons are complicated by whether the standards for infrastructure improvement can or should be allowed to vary with the density of the residential neighborhood. The issue is most relevant in comparisons of neighborhood infrastructure costs for single-family residential communities with varying lot sizes. Increasing the size of the lot (or more precisely, the lot frontage) increases the length of the streets, sidewalks, sewer and water lines,
and storm drainage systems. But as lot sizes increase to one-half acre or more, the added length can be offset at least partly by economies in design. In low-density residential communities, for example, swale drainage can replace curbs and storm drains, sidewalks can be eliminated on one or both sides of the street, and narrower local streets can be built because of reduced vehicular traffic. Where soil conditions permit, large lot developments also can substitute septic systems for more expensive sewage lines to central treatment facilities. Several studies done in the 1950s concluded that, where such substitutions were permitted, the costs of neighborhood infrastructure per dwelling unit were relatively constant for single-family lots ranging from one-quarter acre to two acres or more.

As densities increase beyond three or four dwelling units per acre, neighborhood infrastructure costs decline, although the magnitude of the saving is open to dispute. Many of the analytic problems are illustrated by the widely publicized The Costs of Sprawl study done in the 1970s for the Environmental Protection Agency by the Real Estate Research Corporation (RERC).

RERC analyzed infrastructure and other costs for five prototype neighborhoods, each consisting of one thousand units of either conventional single-family homes on one-third acre grid lots, clustered single-family homes on smaller lots surrounded by open space, townhouses, walk-up apartments, or high-rises. Estimates showed that road and street systems cost 33 percent less to build and 51 percent less to maintain in a neighborhood of townhouses than a neighborhood of single-family conventional houses, for example (see table 9-5).
Utilities (water, sewer, storm drainage, gas, electricity, and telephone underground cables) cost 58 percent less to build and 30 percent less to maintain for townhouses than conventional single-family houses.

The principal problem with the RERC study is that finding meaning in the cost differences is difficult because the quality of the housing units in the different communities is not comparable. In particular, the single-family houses include private backyards, while the apartments do not, yet the acreage of public parks is the same in the different communities. Many households probably would be willing to pay the modest increases in road and utility costs to gain the larger private backyards and more open space of the low-density neighborhoods. Indeed, many of the neighborhood infrastructure costs estimated in the RERC study often are paid for by developers as part of the requirements for on-site infrastructure in large subdivisions and therefore already are reflected in the prices for housing of different densities. Where this is true, households effectively face the full costs of neighborhood infrastructure and have the option of economizing on infrastructure costs by opting for smaller and less private units in high-density neighborhoods.
Table 9-5. Profile of Five Prototype Neighborhoods of 1,000 Dwelling Units

<table>
<thead>
<tr>
<th>Profile Category</th>
<th>Single Family Conventional</th>
<th>Single Family Clustered</th>
<th>Townhouses</th>
<th>Walk-Up Apartments</th>
<th>High-Rise Apartments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses of Land</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Acres)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Areas,</td>
<td>154</td>
<td>184</td>
<td>166</td>
<td>134</td>
<td>67</td>
</tr>
<tr>
<td>Open Space,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>330</td>
<td>200</td>
<td>100</td>
<td>66</td>
<td>33</td>
</tr>
<tr>
<td>Vacant</td>
<td>16</td>
<td>16</td>
<td>34</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>400</td>
<td>300</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td>Residential Density</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Units per</td>
<td>2</td>
<td>2.5</td>
<td>3.3</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>gross acre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Units per</td>
<td>3</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>net acre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Cost/Unit (1973 $)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>3,080</td>
<td>2,661</td>
<td>2,111</td>
<td>1,464</td>
<td>801</td>
</tr>
<tr>
<td>Utilities</td>
<td>5,483</td>
<td>3,649</td>
<td>2,369</td>
<td>1,579</td>
<td>958</td>
</tr>
<tr>
<td>Total</td>
<td>8,563</td>
<td>6,310</td>
<td>4,480</td>
<td>3,043</td>
<td>1,759</td>
</tr>
<tr>
<td>Annual O&amp;M Cost/Unit (1973 $)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>37</td>
<td>28</td>
<td>18</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Utilities</td>
<td>484</td>
<td>483</td>
<td>340</td>
<td>278</td>
<td>243</td>
</tr>
<tr>
<td>Total</td>
<td>521</td>
<td>511</td>
<td>358</td>
<td>289</td>
<td>249</td>
</tr>
</tbody>
</table>


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Leapfrogging

Infrastructure costs might also increase if new residential development leapfrogs over undeveloped land so that additional roads, water and sewer lines are required to connect the development with its older neighborhoods. The Real Estate Research Corporation study addressed these concerns by estimating costs for six prototype communities of ten thousand dwelling units consisting of ten neighborhoods each.

These estimates probably overstate the added costs of leapfrog development, however, in communities that expect continued growth and eventual infill development on the vacant land. Compared with the planned communities, the sprawl communities contain substantially more vacant land that is improved or semi-improved by some road and utility access. Developing improved vacant land in the future presumably would cost less than developing unimproved land. If infill development is expected, than a portion of the added costs of leapfrogging eventually will be recouped—the cost of sprawl would be the cost of supplying some infrastructure in advance of its eventual need and would be lower the more rapidly infill was expected.

Distance to Central Facilities

A few analysts have estimated the cost impacts of increasing distance from central infrastructure facilities, such as sewage treatment plants, waste disposal facilities, and drinking water supplies. These are costs above and beyond those associated with neighborhood density, compact versus leapfrog development, and so on. Paul B. Downing, for example, extended the Real
Estate Research Corporation's analysis by estimating the added public service costs per mile of distance from centrally located facilities. For water, sewage, and storm drainage, Downing calculated that the capital cost of more piping would added approximately $500 per household (in 1973 dollars) for every mile of distance from the central plants, a substantial addition to the RERC's community utility capital costs of $958 to $5,483 per household (see table 9-5). Downing also estimated the operating cost increases for police, fire, schools, and garbage collection per mile of distance from relevant central facilities.

Downing's estimates overstated the effects of distance because they ignored potential scale economies in both pipe sizes and central treatment plants. Significant economies of scale exist in central sewage plants and water supplies, for example; otherwise linking many neighborhoods or communities to a single source of treatment or supply would not be economical. Trunk transmission line capacities also increase more than proportionately with the radius and cost of the pipe, so that a community can economize in serving more distant neighborhoods if it has the foresight to install larger trunk lines when the close-in neighborhoods are developed. Costs, in short, may be less strongly related to distance if the area can exploit these economies of scale in trunk line capacities or central plants.

**Employment Dispersal**

Relatively little research has been done on the jobs-housing imbalance. Much of the existing literature points with alarm to statistics indicating that some communities in major metropolitan areas have three to five times as many jobs
as residents, that only a small fraction of employees typically work and live in the same town, and that low-income workers often have longer commutes than more affluent employees because of the high price of housing around suburban workplaces. Theoretical simulations, not surprisingly, have shown that transportation infrastructure costs can be reduced significantly if employment is dispersed among residences in a metropolitan area instead of concentrated in a central location surrounded by residences.

Severe job-housing imbalances probably are temporary and self-correcting phenomena. Residences tend to decentralize faster than employment, as young or moderate-income households search for housing they can afford. Initially, then the residents of a newly developing suburb may have to commute long distances to find work. But employers eventually recognize the advantages of locating closer to the workforce. In time (and presumably with the approval of local planning and zoning officials), jobs follow residences. Genevieve Guiliano showed that the outlying communities in Los Angeles had low jobs-housing ratios when they were first developed, for example, but that they later increased (Guiliano 1988).

Where job-housing imbalance persists, moreover, it may reflect the preferences of businesses and households as much as zoning or other impediments. Many factors in addition to poor regional land use planning contribute to the jobs-housing imbalance and long commutes. Many businesses prefer to locate near other businesses, so, even if unconstrained by zoning, they probably would not spread themselves uniformly over a metropolitan area.
household may find selecting a residential location close to the workplaces of its members difficult because of occasional job changes or because the household has two or more employed people. Households consider a wide variety of other factors besides proximity to job sites in selecting residential location, such as distance to family and friends and preferences for certain types of neighborhoods, building types, churches, or schools. Perhaps for these reasons, residents in communities planned for greater jobs-housing balance appear to commute about as far as residents of unplanned communities.

Re redevelopment and Infill Development

The sprawl and jobs-housing imbalances literature focus primarily on the costs of building on large tracts of vacant land. A great deal of development involves building on isolated vacant lots in already built-up areas, however, or the redevelopment of existing parcels or districts to higher densities. A low-density, outlying community may be engulfed by an expanding metropolitan area, for example, and the old, large lots subdivided to make way for more units. The older buildings in a metropolitan area's central business district may be demolished to create taller structures. A shopping center or office park built only a decade or two earlier may be significantly expanded.

Accommodating such redevelopment often requires rebuilding or retrofitting existing infrastructure facilities. For example, septic systems may have to be replaced by a municipal sewage system, old water and sewer lines rebuilt with larger pipes, existing roads widened, and existing sewage and water treatments plants expanded.
Virtually no research compared the costs of rebuilding or retrofitting facilities with those of building on vacant land. Studies of leapfrog development, for example, typically focused on the added costs of building trunk lines or streets through vacant land that could be developed, but not of rebuilding facilities in already developed areas.

Retrofitting infrastructure facilities to accommodate the demands of added density is, in general, expensive. The cost of adding two new lanes to an existing two-lane road, for example, probably would far exceed the original cost of its development, especially if the area has developed in the meantime, new right-of-way is required, and existing bridges, sidewalks, and drainage systems must be rebuilt. Similarly, the cost of creating an additional unit of sewage or water carrying capacity may be much higher than the unit cost of existing capacity if the old sewage or water lines must be dug up and replaced with larger ones.

The costs of rebuilding may be reduced if the need for eventual expansion was anticipated when the initial facilities were built or if rebuilding allows the community to exploit the economies of scale present in some types of facilities. Purchasing excess right-of-way or installing oversized pipes that will not be needed for many years is costly, however, and the anticipated future demand for capacity may never develop (or it may develop much later than forecasted). As expensive as rebuilding may be, it may be less costly than rebuilding or reserving excess capacity that is not needed for a long time.

Redevelopment and development on vacant land, then have strikingly
different implications about increasing development densities. Each increment of
density and infrastructure capacity usually will be more expensive than the last if
development involves the rebuilding or infilling of existing communities to higher
densities. While higher density may provide model infrastructure savings over
low density when development occurs on vacant land, higher density may cause
disproportionate increases in infrastructure costs if the development occurs
within existing built-up areas.

Las Vegas Valley Infrastructure Costs

It is often argued that providing services to the less dense land uses can
rarely be financed by the "owners" of that land alone, thus communities (core
residents) are required to subsidize these services. This subsidy diverts funds
from other parts of the community.

These arguments usually result in creating a chasm between existing
residents and developers and new arrivals. As Anthony Downs notes:

"Another flaw in the dominant vision (urban sprawl) is its lack of
consensus about how best to finance new schools, roads, and sewage
and water systems. There is also no consensus on how to pay for
increasing the capacity of existing facilities in established areas through
which new residents will pass on their way to and from work or shopping.
The lack of consensus creates political conflicts, often resulting in gross
under funding of facilities and services. Residents of fast-growing areas
want most of the added infrastructure to be paid by newcomers through
impact fees, exactions, proffers, and permit fees. Residents regard these tactics as merely requiring newcomers to pay their fair share because they will be the main beneficiaries. Residents thus typically vote against most increases in general taxes or bonding powers to pay for expanded facilities. But developers and potential newcomers believe the entire community should share in the costs. Because existing residents benefitted from past general financing of infrastructure, and economic prosperity, which aids everyone. Finally, loading the marginal costs of growth onto new developments raises housing costs, unfairly reducing home ownership and rental properties of people with low and moderate incomes" (Downs 1994).

The question, Does growth pay for growth? , Downs argues becomes complicated when the expansion pattern is "insufficiently dense."

In addition to marginal cost growth, service provision levels are also implicated by sprawl. For example, infrastructure expense for public safety service provision such as fire and police are established based upon response time. Response times often increase with increased distance from the service provider.

Unlike much of America, the Las Vegas Valley has a relatively "young" infrastructure with most system components having average ages of less than 25 years. This, of course, is due to the substantive growth of the metropolitan area in the last ten years.
As discussed in previous chapters, the valley is currently experiencing population and employment growth which has substantially impacted the demand for infrastructure. According to a 1998 report to the Southern Nevada Strategic Planning Authority, the valley will be expending more than $3.3 billion on water and waste water capital improvement projects; over $3.5 billion on school construction; and over $4 billion in transportation improvements over the next ten years (SNSPA 1998).

Duncan (1992) and Burchell (1992) analysis suggest a substantial savings in compact growth versus sprawl. Although their findings differ slightly, a synthesis of their findings suggests that relative to sprawl development, a savings of 25% could be gained in transportation; 15% in utilities; and 5% in school infrastructure expense. Applied to the Las Vegas Valley profile over the next ten years, these percentages equate to savings of $495 million in water and wastewater capital expense; $1 billion in transportation capital expense and $175 million in school capital expense over the next ten years. On the other hand, applying Peiser’s (1991) analysis to the Las Vegas valley results in only $250 million savings over the next ten years.

A more detailed major project analysis of these three infrastructure segments suggests even less savings are available due to compact growth in the Las Vegas Valley. This is due to several factors. First, because of the topography and geology of the valley, the construction of new wastewater and water conveyance systems are less expensive than the reconstruction of current ones (Azaria 1998). This is due in large part to the natural drainage of the valley.
(the City of Las Vegas Sanitation System does not require "lift-stations") and the cost of asphalt removal and replacement as well as the cost of transportation management during reconstruction. Secondly, much of the transportation, water and wastewater improvements are necessary for the substantive (over 40 million tourists per year) visitor volumes. Lastly, the school system in the valley is "unified" and overcrowding is being experienced in schools of all ages.

Without passing judgements on the correctness, appropriateness or the cost of the planned capital investment expense of the valley, a project by project area analysis suggests that neither Burchell’s nor Duncan’s analysis applies since the vast majority of the capital improvement projects are not “distance or density” related.

Viewed regionally and locally, land development tends to be a less important cause of rising infrastructure demand than other forces, such as rising incomes or stricter standards for infrastructure services. Moreover, variations in urban form (such as sprawl or jobs-housing imbalance), appear to have modest effects on local infrastructure costs. Development often is a major cause of local infrastructure demand in two important circumstances, however: in communities experiencing rapid growth (e.g., Las Vegas) and in built-up communities where new development requires a retrofitting of the existing infrastructure systems at great cost (e.g., Las Vegas).

In sum, sprawl and low density appear to increase the burden new development imposes on infrastructure, but only slightly. The studies of residential sprawl suggest that if housing quality and amenities were held
constant, good planning could reduce infrastructure costs in residential neighborhoods by perhaps 3 to 5 percent. Similarly, the jobs-housing imbalance research suggest that severe imbalances were a self-correcting phenomenon and that limits existed to the willingness or abilities of households and businesses to locate close to one another.
CHAPTER 10

SUMMARY OF FINDINGS AND POLICY IMPLICATIONS

Any attempt to assess empirically the impact of individual and governmental decisions upon the distribution of urban residential trends and population density requires simplification of the complex economic and spatial relationships that characterize the modern urban metropolis. This research is no exception, but every attempt is made to retain at least the most essential features of those relationships.

The analysis proceeded on the assumption that the spatial distribution of households and industry in a particular urban area is the outcome of workings of the urban land market in allocating space to competing uses. For purposes of both theoretical and empirical analysis, all urban areas are segmented into numerous communities. The peculiar characteristics of each community determine the value of its sites to a land user engaged in a particular activity and, therefore theoretically, the price one is willing to bid for a site.

Those land users who value most highly a mix of characteristics found in a particular municipality will be successful in obtaining sites there. Thus, the land use pattern, as well as the price of land, is determined, with land price viewed as the equilibrating mechanism in this analysis. The land market provides a direct link between the characteristics of the local government and
the industrial and residential makeup of the municipality.

Hypothesis

Six central hypotheses are comprised in conventional analysis of sprawl. The findings of this research, while falling short of a definitive test of these hypotheses, can shed a good deal of light upon them. In this section, the relevant findings of this research with respect to each of these hypotheses are summarized.

Hypotheses 1: Sprawl in the Las Vegas Valley has resulted in increased segregation of races and/or socioeconomic classes. One reason for this is that the residential location of low-income households is more sensitive to employment opportunities and housing costs than that of higher-income households.

This study's results generally support this hypothesis. According to Orr (1975), the estimated elasticity of gross residential density with respect to employment density within the community declines monotonically (from .64 to .27) over the two lowest income classes, with no significant effect being evident for households in the top income classes. Orr also found that the pattern of the estimated elasticities with respect to accessibility to employment in other communities is less than clear. This elasticity also declines (from .95 to .44) over the lower income ranges, but is unexpectedly low (.66) for the lowest income class and high (1.06) for the highest income class. The low value for families with less than $12,000 income may merely reflect a very restricted commuting radius for these families, while the high value for families those with
the largest incomes may reflect the importance of accessibility to activities other than employment. These two anomalies notwithstanding, the overall pattern of the estimates is one of decreasing sensitivity of residential location to employment opportunities with rising income.

Likewise, low-income households in the Las Vegas Valley, seem to be more sensitive to housing costs. All three residential classes below $25,000 income exhibit a strong elasticity (between -1.59 and -2.66) with respect to rent levels (Schmidt 1996). The gross density in households in the $50,000-$75,000 range shows moderate sensitivity to the costs of home-ownership (elasticities of -0.44 and -0.78 with respect to taxes and land values), whereas neither of these variables appears to affect significantly the residential location of households in the highest income class (Schmidt 1996).

Analysis of net residential densities indicates that net density increases with accessibility, as predicted by the theoretical model, and decreases with rising income. Land costs do not significantly affect net density, holding constant other community characteristics. Thus, it appears that the influence of housing costs upon gross density by income class can legitimately be interpreted as an effect on areal shares, rather than a net density effect.

Hypothesis 2: Sprawl in the Las Vegas Valley has resulted in an increase in the demand for increased services at the fringe. This can be seen in the fact that residential location of high-income families is sensitive to municipal finance variables, such as service quality and tax rates.

The national analysis results lend some support to this hypothesis,
although certain problems of interpretation arise. The gross residential densities of households in the upper income ranges show sensitivity to expenditures on parks and recreation and tax rates nationally (Netzer 1966; Due 1961; Orr 1975). These variables were uniformly insignificant in the regression equations for the three lowest income classes. Measures of the quality of police and fire protection, water and sewers, and streets and highways yielded insignificant coefficients in all the residential density equations (Orr 1975).

The measures of service "quality" employed here are admittedly crude proxies at best. More refined indices of quality might well have yielded more significant results in some of the residential analysis. Still, the overall pattern of results lends credence to the hypothesis that these considerations weigh more heavily in the location decisions of high-income families.

Previous studies (e.g., Orr 1975) showed that education was the most important municipal service from the standpoint of residential location. All Clark County public school students are within the domain of the Clark County School District, a correlation with education in the Las Vegas Valley is problematic.

In contrast, as noted earlier, at a national level, the location decisions of low-income households seem to rest on the more purely economic factors of employment opportunities and housing costs. Indeed, there is a slight indication that educational expenditures may actually reduce the gross density of low-income households, though an increase in rent levels. The magnitude of this effect is extremely small, however.

There is, of course, a crucial problem of assigning causality in the
observed partial correlations between high-income residential densities and municipal service variables. It may well be that high quality services result from concentrations of high-income families, rather than the reverse. However one interprets these results in light of previous research, though, they indicate a concern on the part of these households with the quality of municipal services—particularly education—that may be expected to influence the location decision.

**Hypothesis 3**: Sprawl in the Las Vegas Valley is exacerbated by exclusionary zoning practices. These restrictive density zoning ordinances in suburban communities operate to exclude low-income families as well.

Early empirical studies of other metropolitan areas cast some doubt upon this hypothesis (Orr 1975). However, the historical analysis and concentration analysis presented here suggests that this hypothesis is strongly supported when applied to the Las Vegas Valley.

Orr's comparison of the estimated effect of lot size requirements alone on gross residential density by income class with the estimated effect on net densities indicates that such requirements have little influence upon the allocation of land among the income classes at the municipal level, with the exception of rather marked discrimination in favor of the very small class of households with incomes above $75,000. The principal effect of density zoning seems to be simply rather uniform reduction of net residential density in all income classes.

I have argued that this may result from a conscious zoning policy of following the market allocation of land and simply setting maximum zoned
residential densities slightly below the free market optimum. Such a policy would be facilitated by the division of the community into zones roughly corresponding to existing homogeneous socioeconomic neighborhoods, with different lot size requirements within the municipalities of the sample region. Whether residential zones are in fact drawn in this matter in an open question, and one that is beyond the scope of this study. The observed uniform reduction of residential density in all income classes below $25,000 is entirely consistent with such with such a policy (see City of Las Vegas Comprehensive Planning—planning area data).

Whether or not zoning authorities consciously act to preserve the free market allocation of land, it may be the case that in the suburban communities where it is practiced. Minimum lot zoning cannot change residential land use radically, simply because the less dense uses of the free market optimum anyway. The analysis seems to bear out this line of reasoning, since the lot size requirement seems to have marginal influences upon areal shares by income classes (with the exception of households above $75,000), even though the highest-income communities have the most stringent density zoning regulations.

*Hypothesis 4: Sprawl in the Las Vegas Valley negatively impacts the existing city core because the distribution of employment opportunities in a metropolitan area.*

Nationally, this hypothesis is supported by the historical evidence only for the category of manufacturing and wholesale employment. Nationally, the gross density of employment in these activities shows elasticities on the order of -1.3
with respect to both tax rates and land costs. These variables appear to have no significant effect upon the levels of professional, governmental, and retail employment (Orr 1975).

This differential effect of site costs among classes of industry is entirely reasonable. Manufacturing is less closely tied to local product markets than are the retail and service industries. A manufacturing firm therefore has greater freedom to locate anywhere in a wide geographic area, choosing a specific site on the basis of local cost differentials such as taxes, land prices, and labor and transport costs (Hoover and Giarratani 1986).

Direct evidence of the product market orientation of retail, professional, and governmental employment is provided by the regression results for these activities. Retail employment and professional and governmental employment are strongly influenced by gross residential density and the unique locational advantages of the central city. In addition, retail trade shows a significant sensitivity to local expenditures for streets and highways, interpreted here as a proxy for access to pedestrian and vehicular traffic (Hoover and Giarratani 1986).

Hypothesis 5: Sprawl in the Las Vegas Valley has had a negative impact on the quality of the environment. More specifically, it has degraded the bioregion by decreasing the natural habitat, impounding the water, degrading the natural "washes" and perhaps most significantly contributed to an increase in air pollution through an increase in the vehicles miles traveled (VMT).
There is little doubt that the quality of the environment in the Las Vegas Valley has deteriorated significantly over the last five decades of unprecedented growth. Clearly, air pollutants have increased as a result of increased vehicles miles traveled (VMT), increased energy consumption and land development. Additionally, the natural habitat or the desert tortoise has decreased and there has been an increase in foreign species to the detriment of native plants and animals. Moreover, water availability and quality has been adversely affected by the burgeoning human population.

Very few scholars or members of the general public would disagree with the notion that the valley’s environment needs to be improved. But before the problems of the environment can be redressed, we must focus on the “causes.” One of the causes most often cited is sprawl.

Human density of the Las Vegas Valley has varied significantly over the last 100 years and will continue to vary based upon public policy and public preferences. As has been discussed previously, opponents of sprawl are certain that it is the cause of many environmental problems, most notably, air pollution.

The environmental arguments of the opponents of sprawl in Las Vegas Valley have much support given the monocentric configuration of the Las Vegas Valley with its one core business district (the resort corridor). Environmental arguments by proponents of sprawl are rendered moot by the substantive and relatively stable jobs concentrations remaining in the resort corridor.

This analysis strongly supports the hypothesis that the air quality of the Valley has been adversely affected by the increase in VMT which has resulted
from sprawl. However, our analysis does not suggest that a reduction in sprawl will necessarily be the best alternative to reducing air pollution valley wide. More importantly, the analysis suggests that increasing population (dwelling) density in and of itself may be detrimental to certain segments of the population, most notably the lower socio-economic classes.

The natural habitat of sensitive lands is clearly degraded by sprawl. Anytime there is an expansion of the population into those areas which serve to protect or sustain the local ecosystem there is substantive reason for concern. This can be seen within the Las Vegas Valley in many areas, most notably the Las Vegas Wash. It should also be noted that impounding the Colorado River has also resulted in changes throughout the lower Colorado River ecosystems.

Environmental degradation of the Las Vegas Valley is the result of several factors, one of which is sprawl. Addressing this complex issue will require a more detailed analysis of the causes and the cost-benefit impact of alternative solutions to the current problems. Current methods of addressing sub-segments of the bio-region's environmental issues in a fragmented manner will continue to produce minimal results.

*Hypothesis 6: Sprawl in the Las Vegas Valley has resulted in an increase in infrastructure expense.*

Many studies have attributed infrastructure cost reductions to increases in population densities (e.g., Frank 1989; Burchell and Listoken 1995). This makes economic sense since infrastructure costs, some of which are fixed, are amortized over more units—"economies of scale". Gordon and Richardson
(1997) saw these studies as flawed, finding their results as purely hypothetical. Ladd (1992) found that although public spending initially dips, it quickly rises with density.

There has been little argument with the notion that infrastructure expense increases with sprawl if the community is monocentric. Since the Las Vegas Valley is monocentric, in terms of employment, national arguments supporting this hypothesis appear valid on their face. Within the normal range of urban-suburban densities, per capita infrastructure costs almost certainly fall as densities rise. However, at the density extremes there are exceptions to this notion. Additionally, as Ladd (1992) points out, at higher densities, there are savings on intermediate outputs such as lane miles of street, but given the "harshness" of the environment, the cost of producing a final output may be higher, enough to offset intermediate outputs. For example, increased density may require more traffic lights and traffic control officers to achieve a given level of traffic safety or traffic flow.

Once again, however, it is important to analyze numerous Valley specific factors before developing public policy which may reduce sprawl and the corresponding costs of infrastructure. Fiscal impacts vary considerably. Most importantly, Las Vegas Valley communities should evaluate the fiscal impacts relevant to their unique jurisdiction.

For example, the City of Las Vegas has different "levels of expense" for different types of housing, housing densities, geographical locations—relative to existing or central public facilities. In the case of the City of Las Vegas, infill
developments are generally more expensive than "new" developments. This is often caused by the additional costs of asphalt removal and replacement and traffic control during development (Azaria 1998).

**Implications for Public Policy**

The policies examined in this study are not designed to incorporate the wide range of policy variables that could influence the distribution of urban residential and economic activities. Indeed, some of the more interesting governmental policies are not empirically testable because they have no existing programs. Most arguments do include several important policy variables, and the structural relationships that they contain allow at least tentative inferences about the probable direct and indirect locational effects of other policies.

In discussing the policy implications of the results obtained here, one must understand the limitations of the data and the statistical procedures underlying these results. Although every effort was made to obtain the best possible empirical measures of the variables of interest, several variables of the model are crude proxies for their theoretical counterparts. This is especially true of the municipal service variables; service quality is a difficult concept to quantify. In addition, there are serious problems in interpreting the direction of causation in some cases, even though the estimation procedure was designed to eliminate the more severe problems of simultaneity.

Finally, all of the results are based upon a relatively small sample of data in a single urban area at one point in time. Only further longitudinal research will prove whether these results are atypical or not. With this caveat in mind,
however, it seems useful to examine various areas of public policy in the light of these tentative findings.

From various studies (e.g., WCED 1987; Enquete-Kommission 1994) it has become clear that the current level and nature of human activities are to a considerable extent incompatible with the environmental needs of current and future generations. This means that, if society does not make a transition to environmentally sustainable consumption, production and transportation, not only is the environment at stake, but also the economic prospects of future generations will be adversely affected. In this respect, one should also appreciate that future needs are likely to be much higher, because the worldwide population growth and a predicted upward shift in average wealth.

This leads to the conclusion that consumption and production processes—and most notably (but not exclusively) the embedded technology—have to change drastically in order to offer future generations at least the same opportunities as we enjoy today. The application of this "strong sustainability criterion" (Opschoor 1992; Klassen and Opschoor 1992) implies human activities should aim at the not reducing a given stock of environmental resources any further.

In this context, the notion of the "pollution bubble" is relevant. This means that pollution in a given geographical area, such as the Las Vegas basin, should not exceed a general critical threshold level. In theory, actors may only emit into the environment a level of pollution which matches the natural absorption capacity for that specific type of pollution. As soon as some activity exceeds the
agreed pollution levels, other activities in the same bubble have to reduce their pollution. In this way, it is guaranteed that the overall stock of environmental resources will remain within targeted levels.

This compensation scheme may be extended to other sectors of the economy or other locations, for example. It may take various forms (e.g., lower consumption of resources, better extraction technologies, new resources). A key element is thus that the amount of pollution should be smaller than, or equal to, the absorption capacity (or environmental utilization space") of the environment (Opschoor and Weterings 1994). In general, a shift of pollution between scale levels (local-regional-global) or types (soil-air-water) should be avoided, while irreversible effects should also be prevented. This idea leads—despite the problems of feasibility—at least to some measurable sustainability criteria.

Federal, state and Clark County regulation aims at reducing air pollution by road vehicles in various ways. Most notably by (a) setting emission reduction targets per vehicle and (b) reducing traffic congestion. Reduction in mobility growth through policies that reduce sprawl have often been mentioned as another option.

From the previous observations of the Las Vegas Valley’s air quality it should be clear that large-scale future changes are necessary for reducing the CO2 emissions and other externalities. In general, two kinds of options are available to reduce the general environmental impacts of transport (see also Enquete-Kommission 1994; Gwilliam and Gweerings 1994):
Technological Options—more specifically both an improvement (technical, managerial) of existing vehicles and modes and the introduction of new (more sustainable) technologies;

Behavioral Options—namely a modal shift towards more environmentally friendly modes and a reduction of the total mobility level.

It is clear that technological options will meet the least resistance in society, because no significant changes in behavior are necessary and the costs of “conversion” are more or less hidden from the users. Given this situation it is attractive to stimulate research and development in order to induce favorable developments. It is questionable, however, how much reduction in environmental externalities is likely to take place as a result of such technological developments (Vleugel 1995).

Behavioral options, on the other hand, may generate fierce resistance, since in that case more or less structural changes in society, e.g., lifestyle, leisure culture, social and psychological behavior, are necessary, which will affect economic efficiency and lead to—possibly prohibitively—high transaction costs. The level of these transactions costs may be lowered, however, using appropriate policy packages. Although there is much experience with “repressive” policy measures (higher use prices, traffic and parking regulations), this experience is not particularly positive. Changes in user behavior are either short-lived or even absent, and some undesirable effects might also be induced.
This calls for developing new policy tools. In recent years policy researchers (e.g., Goodard 1997; Verhoef 1997) suggest that tradeable permits may be used to change consumer and producer behavior in an environmentally more friendly direction. Tradeable permits are said to combine the positive effects of both pricing instruments and regulatory instruments, but not—or only part of—their negative side effects. So it may be part of an efficient and cost-minimizing solution strategy.

Probably no single set of governmental policies has had so pervasive an effect upon the residential distribution of the urban population as the complex of governmental interventions in the housing market. Urban renewal, public housing, rent supplements, mortgage guarantees, and preferential tax treatment of homeowners have all influenced the locational decisions of urban households. The results of this research confirm the potential locational impact of such programs. Households in all but the highest income class were found to respond to housing cost differentials, with the gross density of low-income households exhibiting elasticities with respect to rents ranging from -1.6 to -2.7. High-income households also show a significant response to the index of housing conditions. These findings indicate that public intervention in the housing market can have a very significant impact on the spatial distribution of households by income class.

Urban renewal, for example, tends to reduce the proportion of low quality, low-rent dwelling units in the central city. This reduction will, in the short run at least, raise the cost of low quality housing in the central city relative to standard
quality housing elsewhere. Given the responsiveness of low-income households to rent differentials, this may be expected to foster decentralization of the low-income population. While this may be viewed as a generally desirable outcome, it should be noted that both the low-income families who move and those who stay in the central city are made worse off in the process because the price of a major item of their consumption has increased. A second effect of the reduction in substandard dwellings resulting from urban renewal will be an increase in the number of high-income households in the central city. According to the national estimates (adjusted for inflation), a 10 percent reduction in the number of substandard dwellings would result in a 3 percent increase in the number of households with incomes above $50,000 (Orr 1975).

Attempts to improve the quality of central-city housing through code enforcement programs will have much the same locational effects as outright demolition. Code enforcement, by raising the minimum level of housing quality, increases the cost of minimum quality housing.

To the extent such programs are successful, poor families will be induced to relocate, suffering a welfare loss in the process, and high-income families will find the central city more attractive.

As we have seen in Las Vegas, concentration of public housing units in the central city will have just the opposite effects. By increasing the supply of low-cost housing, public housing tends to increase the concentration of low-income families in the central city. In fact, given the size of the rent subsidy typically involved in public housing, one would expect a virtually one-for-one
increase in low-income population in the short run, unless existing low-cost housing displaced by the project. At the same time, the rents of private low-quality units should fall, in the short run, at least.

Thus, both public housing tenants and low-income households in private housing are made better off. The response of high-income households to an increase in the stock of public housing is not ambiguously determined by the present analysis. New public housing units are, almost by definition, standard housing; thus, their construction would not affect the housing condition index employed here. However, the concentration of low-income households generated by public housing may have much the same external effects as those associated with substandard housing, resulting in a decrease in the number of high-income households willing to live in the central city.

All of this relates, of course, to public housing built in the central Las Vegas. Construction of housing projects in the suburbs suggests the possibility of decentralization of the low-income population without reducing their well-being.

Housing programs that subsidize low-income demand without explicit intervention on the supply side may also have significant locational effects. A variety of such schemes, variously characterized as rent supplements, rent certificates, housing allowances, or housing vouchers, have been proposed or enacted into legislation in the recent years. Suppose, for example, that a program were initiated that paid a specified fraction of a low-income family's rental costs. Such a subsidy would reduce intraurban rent differentials by the
same fraction, thereby lowering somewhat the financial barriers that restrict the poor to the oldest, lowest quality areas of the metropolitan housing market. One would expect such a policy to result in decentralization of the low-income population.

A more pronounced locational impact might be achieved with the so-called “housing voucher” or “rent certificate” approach. This policy would grant each family a rent voucher that private landlords could redeem at face value at the local housing authority. The recipient family would pay a specified fraction of its income for the voucher and could use it to purchase housing anywhere in the area. The terms of the subsidy are thus very much like those of the public housing formula, with two important exceptions. First, receipt of the subsidy is not tied to occupancy of a publicly owned dwelling unit. Second, the recipient would be free to supplement the voucher in order to buy housing of greater value than the face value of the voucher. Such a policy would effectively eliminate the intraurban rent differentials facing recipient families, provided that the face value of the voucher is set high enough to purchase housing in a variety of communities.

The potential of this policy for inducing decentralization of the poor is obviously much greater than under the “percentage-of-rent” subsidy described earlier, which reduces but does not eliminate rent differentials. Both alternatives would result in welfare gains to the recipients, in contrast to other policies, such as urban renewal and code enforcement, that promote decentralization.

Either type of rent supplement could be conditioned upon the recipients
occupying "standard" housing, somehow defined. Such a condition would increase the potential of the policy for promoting decentralization if standard housing is more readily available in the suburbs than in the central city. It must be emphasized, though, that imposition of this condition will result in a smaller welfare gain to those recipients who would have purchased substandard housing with an unconditional subsidy. On the other hand, the resulting reduction in demand for substandard housing should, in the short run, lower the cost of substandard housing to non-recipient households.

In the longer run, one might expect any significant reduction in the rental value of substandard housing to result in a reduction in the supply made available, through either upgrading or demolition of low-quality units. It is an open question whether most substandard units could be renovated at a reasonable annual cost of this magnitude (and, again, this is probably a generous estimate of the private returns to renovation). A demand subsidy program that significantly altered the relative demands for standard and substandard units might, however, might appreciably widen this differential. Thus, conditioning a rent supplement upon occupancy of substandard housing could have a substantial impact on renovating and upgrading.

A final area of public housing policy is that of residential density zoning. The empirical results confirm the widely held belief that density zoning encourages centralization of the poor. Such ordinances appear to have substantive impact on areal shares by income class, although they do tend to reduce net residential density. If this is the case, then the desirability of such
policies would seem to turn primarily on whether they generate sufficient external benefits, in terms of more equitable residential patterns, to compensate landowners for reduced land rents. An additional effect of density zoning, rarely discussed in the literature, is that, to the extent it reduces net residential densities, as it increases the amount of land devoted to urban use and enlarges the extent of the urban area. This effect will increase transportation costs for households living on the urban fringe. In any case, though, the distributional consequences of density zoning would seem to be largely concentrated upon the upper-income residents of suburbia, rather than extending to the low-income population of the central city.

The spatial structure of urban areas is strongly influenced by transportation costs. In terms of residential location decisions, the dominant factor in transportation cost is usually taken to be the ease and speed of commuting by private automobiles or public transportation. Highway improvements and the development of rapid transit tend to reduce the locational advantage of the central city relative to the suburbs, and result in a lower density, more dispersed residential pattern (Verhoef 1996).

The empirical estimates derived here allow at least tentative prediction of the relative impact of transportation improvements on residential location among income classes. In general, we have seen that lower-income families are more responsive than higher-income families to employment opportunities within the community. But with regard to accessibility to employment in other communities, the pattern is less clear. Over the middle income ranges, the same pattern of
decreasing response with increasing income seems to hold, ceteris paribus. Low-income households, however—those below $25,000—seem to be less responsive than middle-income families to this measure of accessibility, while very high-income households—above $75,000—are much more responsive. Moreover, changes in accessibility as a result of transportation improvements will have an indirect effect on the location of households below the $25,000 level, through their effects on rents.

In general, the tendency of improved accessibility to raise rents will offset 30 to 40 percent of the direct (positive) effect of the accessibility variable on gross residential densities in these income classes. Taking these indirect effects into account, the response to changes in accessibility appears to be smallest in the lowest income class, somewhat higher (and relatively uniform) across the next three income classes, and much higher in the highest income class. This means further reductions in transportation costs are likely to accentuate the existing economic segregation between the low-income central city and the high-income suburbs.

Aside from housing costs, the single dominant influence on the location of low-income families appears to be employment opportunities. Policies that affect either the employability of low-income workers or the employment opportunities they face may significantly affect their location decisions. Finally, the nature of the employment referral systems and social networks may have an important effect on their residential location.

Sprawl is a complex issue. It involves both individual choice and public
policy. It touches on many phases of society including those in the economic, 
social and political spheres of everyday life. Therefore, successful policies must 
address several issues simultaneously. Policies must also anticipate a variety of 
effects and must fully analyze and balance the benefits and liabilities of each 
approach.

In designing policies to deal with urban problems, then, public officials at 
all levels of government would do well to give explicit attention to the potential 
locational impacts of governmental actions.

The policy implications drawn here are necessarily qualitative and 
speculative. The framework was not designed to incorporate the entire range of 
policy issues that may affect urban location decisions within the Las Vegas 
Valley.

Most importantly, the community must address this issue from a bio-
regional standpoint. Little is to gained if individual jurisdictions act without 
consideration of their neighbors. Much is to be gained, however, if the 
communities work collectively to identify and correct those issues complicated by 
sprawl throughout the Las Vegas Valley.

This text has not attempted to trace the chronological evolution of the 
arguments for and against sprawl, nor to inventory the entire set of articles 
examining its impacts. Rather, I choose to evaluate the current set of arguments 
for their relevance and comprehensiveness with respect to two trends in the 
theory and practice of local residential development that seem pertinent in the 
present context: One calling into question the public policy prescriptions
concerning sprawl in the practice of local policy development; secondly, and more fundamentally, the questioning of the validity and distinctiveness of the body of theory which is alleged to support arguments for and against sprawl.

Arguably, the recent disenchantment with current land development approaches has more to do with pragmatic concerns than with pure ideological shifts. In development economics (as in most social sciences), the history of thought was shaped by the prevailing circumstances. So too, much of the recent questioning of the efficiency of current urban forms in creating the problems of society is rooted in immediate past experience. But there is an inescapable implication for sociological theorizing. A recognition of the failure of perceived paradigms to anticipate or to respond to problems creates an imperative for (a) a positive analysis of this failure, and (b) an agenda for revised methods of addressing perceived deficiencies.

Thus far, as one might expect, critiques have been more forthcoming than theoretical reconstructions. The epistemological challenge facing urban researchers today is to seize the offensive to participate in this needed reconstruction of urban form theory.
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