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Designed by Zoning: Evaluating the Spatial Effects of Land Use Regulation

Author
Warren, Charles Reuben

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Designed by Zoning: Evaluating the Spatial Effects of Land Use Regulations

by

Charles Reuben Warren

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Committee in charge:

Professor Michael Southworth, Chair
Professor Fred Collignon
Professor John Quigley

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Abstract

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This research seeks to evaluate the possible causal relationship between land use or urban design regulation and subsequent built form patterns observable on the ground, using a quasi-experimental method. With increasing frequency, suburban towns and cities are investing in expensive overhauls of their General Plans and zoning ordinances based on vague promises of curbing sprawl, building a sense of place, and creating a new urbanism. However, the effectiveness of these novel codes is unknown and untested.

In part I, case cities are selected based upon their notable achievement of placemaking goals: former automobile-oriented suburbs are now pedestrian-friendly and transit-oriented, with distinguished centers of dense mixed use. They are evaluated for the extent to which explicit, anticipatory land use planning and regulation played a role in creating this outcome. In part II, case cities are selected due their adoption of Smart Growth or New Urbanist regulatory regimes. They are evaluated for the extent to which land use and built form changed in the desired directions over the subsequent ten to twenty years of development as guided by the new regime.

Findings from part I indicate that effective land use planning is indeed an requisite ingredient to successful urbanization and placemaking. Findings from part II, however, indicate that adoption of new regulatory regimes is not a predictor of success, making novel regulation, by itself, an unreliable indication that placemaking will be achieved. Finally, the research suggests a future hypothesis that it is the coupling of revised land use regulation with a continued culture of enforcement through the funding and support of planning departments and commissions that clearly predicts success in transforming suburban sprawl into urban places.

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It's a plan. Its success depends on whether we have the courage to implement it, whether we have the courage to refine it and whether we have the courage to defend it.

–David Glass, former mayor of Petaluma, California

1. Introduction

Planning begins with a vision of the future, a vision that is often embodied as a possible urban form: building masses concentrated here, open space there, quiet residential neighborhoods further out. In the contemporary United States, however, no top-down Master Architect is allowed to impose his vision unilaterally. City and community building here is a deliberative, an often messy process (Forester, 1988). So we enact comprehensive plans and enforceable regulations that seek to balance individual property rights against nuisances to our neighbors; that prescribe and proscribe certain uses in certain places but also respect equal protection; that will preserve the essence of the vision but meet with flexibility the unknown contingencies of the future.

The connection between the plans/regulations and the eventual form that a city grows into is neither clear nor easily measurable. While land use regulation contributed (along with sewage engineering, of course) to solutions for many problems of the overcrowded cities of the nineteenth century, one side effect was the widespread development of suburban sprawl. In fact, that side effect has become the main effect, as today more than 60% of American citizens and aliens reside in 'suburbs,' smaller satellite cities bound together in large metropolitan regions (Census 2000). In parallel to this demographic trend, one of the major debates in planning theory is over the costs and desirability of, as well as solutions to, suburban sprawl (Tucker 2006, Gordon and Richardson 2000).

As more planners are blaming the old tools of conventional zoning (Pendell, 1999), a host of new ideas have been put forward with the stated goal of effecting compact, urban, and more sustainable patterns of human settlement. Regulatory and policy structures such as performance zoning, transect planning, and form-based coding, are being attempted in various suburbs across the United States. These attempts are experimental because these new tools are untested. We do not yet know whether they will work to efficiently halt or reduce sprawl. We do not yet know whether they can have any effect at all on the more slippery qualitative concepts of 'urban character' or 'sense of place.' This dissertation is a preliminary step in acquiring that knowledge, taking a small sample of cities that have either already succeeded in transforming away from sprawl, or have publicly set off on that course. For those that have already succeeded, it seeks to know how much of a role new regulatory ideas played in that transformation. For those who have set off on the path, it seeks to evaluate any progress that may have been made in changes in urban form. The results offer an early picture of whether there is something to the new regulatory regimes, or if they are draining time and money from the cities that attempt them.

1.1 The Problem of Measuring Outcomes

Although it has always had tremendous implications for urban form, zoning has generally been considered a tool for rationalizing the pace and direction of urban growth. However, in the last two decades, a broad cross-section of planners, designers, and elected officials have suggested or adopted ordinances designed not to control the pace or location of development, but its shape. Notions of height, density, and setback have always been included in zoning codes, but this new generation attempts to take into account the orientation of buildings to streets and sidewalks, This research seeks to establish whether design-oriented zoning been an effective tool in (re)shaping urban form.

It is a cliché in planning schools that looking at a zoning map and an aerial photograph is the gap between what a city's leaders would like to see and what actually is. What is unknown, however, is how much effect those zoning regulations have on bringing that vision into being. This research seeks to measure that gap, as knowing its exact width can tell us a great deal about how effective the zoning code was in bringing about its intended changes. Unfortunately, it is not straightforward to attain these measurements, as only a few beyond simple population density reliably correspond to qualitative ideas of urban character (Owens, 2005). This research seeks to address the lack of rigorous quantitative evaluation of the claims to effectiveness by proponents of the new design-oriented regulatory schemes.

1.2 Questions, Approaches, and Findings

As a pattern of urban form, suburban sprawl seems easy to diagnose but difficult to define. Zoning is increasingly relied upon as a weapon for combating sprawl, but exactly how it might achieve this or how effective it may be has never been modeled or demonstrated. Proponents of zoning alternatives often accuse zoning as being a culprit and tout their own schemes as ensuring better urban form. There has been no definitive research thus far, however, to substantiate or repudiate their claims. Therefore, I am asking the following research questions: has zoning been successfully employed in curbing urban sprawl? If so, how much and in what way? Will alternative regulations have a similar or different effect? This research is significant for both practice and theory as its results inform practicing planners and private developers about the choices they make concerning zoning and addresses untested correlations and undemonstrated causations concerning the spatial effects of zoning.

1.2.1 Research Question

Because conventional (Euclidean) zoning renders illegal the urban form patters of dense mixed use that were common in the past, alternative zoning schemes are now enjoying a current vogue. While current best practices put forward mixed-use, pedestrian oriented density as the design goals cities should strive for, there is nearly unanimous agreement that Euclidean zoning, based on segregating uses, is anathema to achieving them. In terms of rigorous research, however, the role of local land use regulation in facilitating sprawl, and its supposed ability (if reengineered) to counteract it, is almost entirely unexplored. Therefore, this research centers on the question of whether or not zoning ordinances, when realigned to match Smart Growth goals, have been effective and worthwhile tools for urban design:

Research Question: Can zoning ordinances be wielded effectively to accomplish urban form goals?

A number of cities, including Hercules (Downtown/Waterfront Specific Plan, 1997) and Petaluma (General Plan, 1992) in California, have adopted alternative ("form-based") regulatory regimes. The creators of these new strategies claimed their regulations will have positive design impacts (Langdon, 1994). No study, as yet, has returned to these or similar cities to see if those claims eventually proved true or not. This research proposes to do exactly that.

Thus far, there have been no empirical demonstration of these conclusions, at least none known to the author. It is simple to identify an apparent correlation between conventional zoning and sprawl, and from there to infer that the reverse should be true: that anti-sprawl zoning will work against sprawl. The purpose of this study is to engage in a hypothesis test of the assumption that zoning does indeed have power as an urban design tool by affecting the choices of builders and designers and hence the built form patterns of cities.

1.2.2 Research Approach

This project is divided into two parallel quasi-experimental studies. The cases in Set 1 exhibit the best practices of planning in their urban form today. Transformed from automobile-oriented suburbs into pedestrian-scaled urban villages, these cities are investigated looking backward in time to see how much novel zoning policies and Smart Growth planning were involved in their creation. The cases in Set 2 are early adopters of design-oriented zoning and Smart Growth ideas, ranging in implementation from ten to twenty years ago. These cities are investigated looking forward in time to see how much change occurred in their urban form, and whether this change has been in the direction specified by plans and ordinances. If Smart Growth planning principles are present in the plans in Set 1, it establishes that regulation is very likely a requisite tool in creating urban villages. If the urban form of cities in Set 2 regularly grow more dense and create finer grain of use, it establishes that regulation is very likely a reliable tool for generating Smart Growth. I hypothesize that land use regulations have a significant impact on urban form, and that creative land use regulation is both a requisite and reliable tool for implementing Smart Growth.

1.2.3 *Research Findings*

The findings of this research indicate that novel land use regulatory schemes are requisite for achieving Smart Growth, but not reliable. Universally among the case studies of Set 1, policy interventions are present where recently created compact urbanism exists today. However, there is no identifiable pattern among Set 2, indicating that there is no correlation between the passage of Smart Growth plans and the subsequent creation of urbanism in the form and quality of the city (at least within a twenty-year horizon). This leads to the conclusion that although Smart Growth planning interventions are very likely requisite to accomplishing Smart Growth goals, such interventions are very unlikely to be reliable in and of themselves, suggesting my hypothesis is false. Among rival explanations, the best fit that the style and method of implementation, subsequent to ratification of a policy intervention, has a strong influence on the reliability, which recommends it as a new hypothesis. These conclusions suggest that further research should attempt a true experimental method to verify generalizability and a test that can verify the implementation hypothesis.

1.3 Contribution to the Field

This research adds to the body of knowledge by attempting to isolate a single land use instrument, begin to disentangle the mechanism(s) by which it is translated into built form, and possibly establish the causality of its effects. Original research in this area is needed now, due to the increasing number of people who assume zoning (and their proposed alternatives) works this way. A great of time, money, and efforts of many planners, consultants, and municipalities are devoted to zoning renovation without understanding its effects or effectiveness. Therefore, I propose this pair of quasi-experimental surveys as a first step in establishing correlation and possibly causality between changes in ordinance and changes in built form. This research constitutes a first step in building a theoretical foundation to support (or abash) these new regulatory tools. The results of the research are ambiguous, but succeed in establishing the first step. Because regulatory renovation is requisite but not reliable it is apparent that regulation is an important component in curbing sprawl. However this result also implies that regulation is neither the sole factor nor the causal one, which helps give shape and direction to further research in this area.

1.4 Organization of Dissertation

This research presents the results of a quantitative analysis using the quasi-experimental methods to select subjects and generate data. It is organized as a report of scientific analysis and follows the general outline of the scientific method. After a review of current literature and explication of the experimental method, the resulting data from each analysis is summarized. This is followed by an assessment of implications, generalizability, and limitations.

The dissertation begins with a literature review that situates this research within the present body of knowledge. The review summarizes the history of zoning from New York's ordinance in 1916 and *Euclid v Ambler* in 1926 to the current debates about the social and environmental consequences of nine decades of conventional zoning, and the possibilities of reconfiguring land use regulation to assist with contemporary planning goals. This is followed by a review of current studies that utilize similar methods to answer different questions, or utilize different methods to answer comparable questions. Also, an understanding of the quasi-experimental method is presented, which outlines the strengths and limitations of conclusions that can be reached using it.

The following chapter outlines the research design and methods for the study, as well as the criteria for case study selection. It presents the parallel studies and outlines how the combined results can be interpreted. Also reviewed are the number of possible cases, and how those that meet the selection criteria were sifted. Because the sample pool and case studies were selected based on criteria that are also variables in the study, and there is no control group, the method is quasi-experimental and the results not necessarily generalizable to the larger population of cities and their zoning regulations.

Next, the case studies are presented in detail, in order to facilitate a contextual understanding of the data and discussion that follow. Over the last twenty years, a number of general plan updates, specific plans, and major projects have been proposed and approved or abandoned. Natural population growth and regional geo-economic pressures have driven development, in spurts or consistently, and the overall shape of case city, along with the patterns within them, have changed significantly. This section summarizes the major initiatives, changes, and political battle for context when referenced in the following analyses.

The first analysis investigates the contents of plans and ordinances ratified between fifteen and twenty years ago. The cases selected embody in their urban form the best practices of Smart Growth today. Since they currently have pedestrian-scaled centers, multiple transit options, and choices in housing type, the question under investigation is whether these were called for in the plans or whether they have evolved due to some other cause, or by randomness. Each set of plans is reviewed for the presence or absence of specific Smart Growth planning principles that indicate whether these types of policies are necessary for Smart Growth to occur.

The second analysis investigates the changing shape of case cities since the enactment of Smart Growth plans. Between fifteen and twenty years ago, the case cities passed ordinances explicitly stating they intended to transform from suburban sprawl to compact urbanism. As enough time has elapsed since then, the changes in urban form should be apparent. This is measured in changes in grain, streets, housing, and since the case city has been under the new regulatory regime.

The concluding chapter summarizes the findings and infers some conclusions. This study is unable to establish a clear causal link between regulatory content and Smart Growth-type urban form patterns. However, it does show a strong correlation, suggesting that other factors or implementation styles are also a factor in creating urban form. These possibilities are considered in detail in the conclusions section. Finally, implications and directions for further research are discussed.

2. Literature Review

This investigation is located at the intersection of four places. First, it grapples with the current state of land use policy, which must be anchored into the long history of land use policy. Second, it seeks to evaluate the effectiveness of policy interventions, which has its own history. Third, it utilizes the quasi-experimental method, which has many strengths for this sort of question, but also limitations. Fourth, it attempts to measure urban form and derive meaning from it, which is a complicated subfield itself.

This literature review is divided into four sections. The first presents a brief and select overview of the major literature that marks the milestones of 100 years of evolution of land use regulation in the United States. It also reviews the alternative proposals that have come and gone, focusing finally on the design-oriented regulations popular today. The second section places this study in the literature of case study and quasi-experimental research. This literature discusses the possibilities and limitations of conclusions this type of research can arrive at, providing the foundation for findings. The third and fourth sections grapple with the difficulties involved in attempting to measure urban character. Discussing urban form is mainly a qualitative activity, and changes in its patterns are notoriously difficult to measure. The third section investigates how others have conducted morphological studies, longitudinal morphological studies, and the limitations of different types of measurements. The fourth section is about studies that have looked into discovering principles inside of plans, rates of adoption, and conformity to theory.

Zoning and land use planning is perhaps the most identifiable task that professional city planners perform. A great deal of local government concerns specific spaces and what, or what not, may be done with them (Kaiser et al, 1995). To protect the rights to private property and equal protection, however, these decisions must stem from some sort of universally applicable framework, so regulations are enacted to draw upon (Nelson, 1980). Still, zoning and other land use or aesthetic regulations do not always get communities what they want, and the debate continues about how best to govern, manage, and/or design the built environment (Healy et al, 1988).

2.1 History and Practice of Zoning

Modern American zoning began in the opening years of the twentieth century. It was adopted in piecemeal ways until New York City created a comprehensive zoning ordinance for its five boroughs in 1916 (Peterson, 2003). Congress adopted the Standard Zoning Enabling Act, giving states the option of investing their local governments with the power to zone (Linowes and Allensworth, 1975). Many cities and towns across America adopted ordinances similar to New York's, but property owners mounted a challenge based on the limitations it put on their right to do with their property as they pleased. Things came to a head when the US Supreme Court agreed to hear an appeal of Euclid v Ambler in 1926. Once the Court decided that zoning was an acceptable use of the police power, zoning maps were drawn and ordinances adopted in almost every municipal jurisdiction in America (Bassett, 1936). By the 1960s, however, it was becoming clear that quality cities could not be zoned into existence, especially as neighboring suburbs began to compete with each other. Some proposed that the problem resided with the lack of price effects on negative externalities, arguing for a system in which neighbors benefit financially from success and are compensated for nuisance (Hagman and Misczynski, 1978). Even as a host of alternative methods were put forward, zoning itself evolved into the complicated, high-stakes game of land use planning it is today (Godschalk and Kaiser, 1995).

2.1.1 Brief History of Spatial Land Use Regulations

In the second half of the nineteenth century, the Industrial Revolution began transforming the urban landscape in dramatic and unprecedented ways. Unrestricted pollution flowed from primitive chemical processes; populations exploded and streets piled high with horse manure and garbage. City planning as a profession arose as a progressive-era response to these problems, and sanitation and tenement reform were among the early victories (Veiller, 1916). It was not long before planners turned their sights on the factories that had begun transforming outlying neighborhoods of small homes. Beginning in Los Angeles in 1908, industry was restricted to specified manufacturing districts using regulations known as ‘districting’ (Peterson, 2003). In Chicago, industrial expansion was beginning threaten wealthy neighborhoods, but factory owners (some of whom lived in those neighborhoods) were not happy with efforts to limits uses of private property (King, 1986).

In its modern form, zoning was imported to America from Germany at the beginning of the twentieth century (Williams, 1915). Districting, or the bounding of areas of permitted uses, gave ‘land use planning’ its name. Benjamin Marsh, though unable to convince many attendees at the 1915 NCCP of the advantages of Frankfurt-style zoning, authored a comprehensive zoning scheme for New York City, adopted in 1916 (Weiss, 1992). At that point, the rush was on to zone the cities of America (Easterling, 1993). Zoning caught the attention of the national government as well. Secretary of Commerce Herbert Hoover lobbied for the Standard Zoning Enabling act, allowing states to quickly give their local governments the authority to zone. Soon, however, the idea would be stretched too far, and a small suburb of Cleveland, called Euclid, Ohio, would attempt to enforce zoning outside its current boundaries. The case, argued by Edward Bassett, would make its way to the US Supreme Court, and the 1926 decision on *Euclid v Ambler* would make zoning a legitimate use of the police power (Bassett, 1936). The duty of local government to protect the health and welfare of its citizenry enables it to regulate the use and development of private property.

After the *Euclid* case, ‘Euclidean’ zoning became the standard for ordinances across America, although specific terms and limits vary among jurisdictions (Fluck, 1986). It works by dividing building lots in the city along rules of use, height, and bulk. Uses are most often divided into four categories: residential, commercial, manufacturing/industrial, and institutional. These are further subdivided by density or intensity of use, with neighborhood stores and single-family homes at the low end and large offices and apartments at the high end. Euclidean zoning is also pyramidal, meaning that industry may only locate in industrial zones, but offices may be built in commercial or industrial zones, and so forth, with single-family homes at the top of the pyramid (Hagman, 1969). Since the 1960s and the master planning movement, most cities have made their zones exclusive and abandoned the pyramidal model. Some even find it necessary to protect industrial zones from residential encroachment (Bressi, 1993). To this day, standard, or Euclidean, zoning is by far the most popular method of land use and design regulation.

Today's debates over zoning and other land use regulations are centered on the shortcomings of conventional suburban development. Standard zoning has produced standard cities, and the suburban blur is the subject of much criticism (Hagman, 1977). Most Americans live in small, suburban cities as part of a larger, crowded region, and the vast majority of these cities were founded, or at least mainly developed, after *Euclid*, so the suburban blandness is "zoned in" (deNeufville, 1981). Asking residents to accept greater density has proved futile as they are primarily concerned with protecting the sense of community they have developed along with the property values that go with them (Fulton, 2005). How, then, might zoning, as a practice and as a tool for getting better cities, be reformed to discourage, instead of encouraging, suburban sprawl?

Current best practices of city planning, urban design, and real estate development propose dense, mixed-use projects as infill or redevelopment in already-urbanized areas. The values of livability and sustainability are emphasized through pedestrian-orientation, high-density housing, and ground floor retail, which combine to create interesting neighborhoods (Salkin, 1998). In most places, however, these designs are illegal. Zoning codes that segregate uses, require parking, and restrict lot coverage make such designs virtually impossible to permit without discretionary review. Developers, unwilling to take the extra risk and assume the added cost, stick to standard zoning and standard development (Booth 1996, Hinds et al 1979). In states with voter initiative, recall, and referendum, it can be very difficult for lawmakers to make risky and progressive decisions that would change the status quo (Durkee et al, 2003).

2.1.2 Alternative Regulatory Proposals

The task, then, is the rewriting of codes to reflect current ideas and practices, utilizing regulatory schemes other than Euclidean. Creating zoning regulations without regard to a general plan that formulates goals and ideals has been cited as a cause of bad development (Kent 1990). Developers are interested mainly in knowing what they are required to do to gain approval, so issues of quality would need to be quantified into zoning ordinance (Curtin and Talbert, 2003; Longtin, 1987). Zoning in the twenty-first century will have to look very different from its current practice to remain relevant (Marcus 2000). While some are seeking to reform standard zoning to reflect current practices, others think that entirely new approaches with differently structured regulations will be necessary.

Performance zoning was among the first ideas to be put forward as an alternative to Euclidean zoning. The approach seeks to directly resolve the problem of sterility associated with segregated uses by defining zones in an entirely different way (Kendig and Connor, 1980). Zoning based on performance standards enjoyed a surge in the 1980s, but many of the places that adopted it have returned to Euclidean zoning (Anonymous, 1997). A ‘performance standard’ is a direct descendent of nuisance law: it can be a maximum noise standard for a night club, a dust-emission standard for a manufacturing plant, a maximum allowable expected traffic increase for an office building. It seeks to group these nuisance creators together. For example, placing the office buildings together downtown may cumulatively generate a lot of traffic congestion at rush hour, but is also creates sufficient density for public transit (Winters and Freiden, 1997). Performance zoning has proven useful as an overlay zone but otherwise it has not been widely adopted. It is good for zoning around airports and other hazard areas, creating graduated buffer zones that determine where industry and commerce can locate (Exner and Sawchuck, 1996). This method of land use regulation seems best suited to small towns, where neighbors can enforce standards instead of bureaucrats.

Incentive zoning is conceived as a win/win situation, giving both planners and developers what they want. In exchange for extra height or bulk, projects can include a public plaza, urban greenery, or other amenity. In ultra-dense sections of Midtown Manhattan, the concrete canyons were lacking in greenery and plazas for respite from the urban rush. As developers were crowding more and more office space into the neighborhood, incentive zoning (Abrams, 1968) was revived in order to lure developers into providing for public amenity. Extra office space means additional income for developers in exchange for marginally increased maintenance costs. Some advocates of the public realm believe that relying on the private sector to provide public space is dangerous and inherently poorer, especially as private security limits ‘public’ access, keeping out the homeless or other ‘undesirable’ users (Kiefer 2001, Kayden 2000). Although pioneered in New York City but has become popular in dense central business districts across the nation. However, the financial benefits have not been as significant as proposed, and some developers have begun turning down the density benefits (Asabere and Huffman, 1997). Some public plazas are not as public as planners would have liked, and a handful have been quietly destroyed or privatized (Kayden, 2000). Some spaces are simply poorly designed and barely used. Incentive zoning requires thorough discretionary review on a case-by-case basis and the bureaucratic machinery to provide it (Porter, 1988). Despite the costs and requirements, it continues to gain popularity as a practice.

The growth control and growth management approaches attempt to regulate the pace of new development, both out into open space and intensification of existing uses and densities (Porter, 1997). Similar to the zoning logic of protecting the existing character of neighborhoods, growth management seeks to slow or halt the pace of change by limiting the annual allowance of building permits for specific uses (Porter, 1986). The city of Petaluma, California, was the first municipality to adopt a sweeping growth control measure. *Petaluma*, decided in 1975, became the legitimizing case, analogous to *Euclid* (Godschalk, 1979). Since Petaluma, growth control regulation and growth management plans have been adopted by many cities in supplement to their zoning regulations. Growth management effectively stabilize towns, but create a great number of side effects. A black market develops for building permits, which are suddenly in scarce supply, with one developer paying another not to apply (Dowall, 1978). Control measures are not always effective and slowing the pace of development (Landis et al 2002, Porter 1989). Other times it is too effective, as when growth management regulation in combination with zoning effectively halt intensification and infill (Deakin, 1988). The supply of new housing becomes restricted, and can cause rental and purchase prices to rise (Schwartz 1979, Ellickson 1977). This often causes 'leapfrog' development as developers seek land outside growth control restrictions, and natural or agricultural land disappears much faster (Lassar, 1990). A region of towns all practicing growth management will eventually cause housing to become unaffordable, but balancing growth controls on a regional level may yet allow for cities to practice growth management without having perverse effects on the local economy (Porter 1992).

Smart Growth is the current hot planning idea, and the term remains contested, so what exactly is and is not 'smart' growth cannot be clearly defined (SANDAG 2002). There are, however, a common set of basic principles underlying the Smart Growth approach, based on the idea that standard zoning is an ingredient of sprawl, and that regulation must be reorganized to discourage 'greenfield' urbanization and encourage infill, 'brownfield,' and environmentally friendly development (Benfield et al, 2001). Some planners theorize that Smart Growth can be achieved through renovating local land use regulation (Nolon 2001, Benfield et al 2001), but others argue that a regional approach to Smart Growth will be necessary (Porter 2002, Porter 1989). Because the prevalent form of American urbanism is the metropolitan region, with its multiplicity of cities, districts, and jurisdictions (Chapin, 1962), it is unlikely that planners, who are employed by one of these agencies with its own interests to defend, will voluntarily submit to regional interest (Svete, 2003). Local jurisdictions courting a tax base are unlikely to embrace infill housing and small business retail. Others, however, believe that regionalism will happen out of local necessity, as housing affordability and competition for business grow beyond the abilities of local governments (Porter, 2002). Smart Growth shows more promise than any alternative to zoning to come before it because it is gaining the support of developers (Urban Land Institute, 2000) as well as planners.

2.1.3 Alternative Design-Oriented Proposals

In addition to the regulatory schemes reviewed above, a number of design-oriented schemes have been proposed and adopted. In the 1960s, the master planning approach, which would later be known as Planned Unit Development (PUD), was touted as the answer to zoning woes. The early successes of Columbia, Maryland; Reston, Virginia; and Irvine, California led to the belief that, instead of zoning the outlying areas of existing towns, entire towns should be designed from the ground up. Laying out streets and designating land in advance of construction, so it was believed, guaranteed high quality urbanism (Bloom, 2001). Subsequent looks at the way those towns turned out, however, show that while their property values may be higher than those of their relatively unplanned neighbors, they are not all that different, qualitatively, from typical sprawl (Hill 1986, Gillette 1985, Wantuck 1983). To this day, the term 'master-planned community,' continues to be a marketing plus, but very little on the scale of Columbia or Irvine is attempted anymore. The PUD approach has been appropriated by the New Urbanists, and towns such as Seaside and Celebration display their particular design principles. The major weaknesses in the master planning approach turned out to be the lack of significant difference from zoned communities and the immensely expensive carrying cost of enough land to make such a plan and see it through (Peiser, 1984).

Design control is a form-based (as opposed to use-based) approach to shaping the built environment, springing from the ideas that it is the shape of the city that affects its workers and residents, and that quality of neighborhood can spring from quality of design (Appleyard and Jacobs, 1982). The New Urbanism is a recent design trend that challenges conventional suburban form (Katz, 1994). Community, proponents such as Philip Langdon suggest, can only grow in a hospitable environment. The cul-de-sac and strip malls of suburbia are perfect examples of inhospitability (Langdon, 1994). They argue that enforcing design control measures that emphasize narrow streets, front porches, and small-scale retail will do far more to create quality living environments (Calthorpe, 1993). This approach leads planners to draft regulations that review the shape, design, and context of development. Design control as a regulatory method is divided into guidelines, which inform architects and developers of appropriate designs, and a review process, in which an approving board enforces the guidelines, often suggesting revision. Design review boards are often subject to the personalities of the their members and deal with subjective design ideas, opening the door to bitter conflicts that do not arise under standard zoning (Nasar and Grannis, 1999). In towns with a distinct character already existent, the context is obvious and less subject to debate. For emerging suburbs, however, discretionary review of each project is a labor intensive proposition, especially as the area's 'character' emerges. With repeated appeals and revisions, it can easily degenerate into personal bickering. Effective design regulations and review procedures require an alchemy of clear, well-written regulations and professional personalities on review boards. Suggestions for revising the process include striving for clear guidelines and expanding as-of-right permitting for clearly conforming projects (Hall 1996).

The efforts of the members of the Congress of the New Urbanism (CNU) have taken regulatory form in the Transect (Duany and Talen, 2002). Transect zoning groups buildings by type instead of use, placing uses such as apartments and offices in the same zone. At the heart of the Transect is zoning by place within the city, that is, zones for central business districts, transit corridors, peripheral residential areas, etc. Most New Urbanists seek to use design control to enforce the creation of 'neotraditional' neighborhoods which mimic the urban design of the late nineteenth and early twentieth centuries (Bookout, 1992). The design codes and pattern books of places like Seaside and Celebration are excellent examples. While the principles of New Urbanism and neotraditionalism are becoming more popular, they are being embraced piecemeal instead of changing conventional development (Zimmerman, 1990). The Transect, however, is different from regulating design. It focuses on zoning by form and type, districting by location within the metropolitan realm.

2.2 Theoretical Foundations

This study attempts a quasi-experimental method of discovering effects of policy intervention as measurable in the subsequent evolution of urban form. As such, it is at the intersection of three theoretical realms: (1) attempting to model and understand causative factors of form evolution; (2) attempting to evaluate the effectiveness of policy interventions; and (3) using the quasi-experimental design as a first step to a broader survey. Consequently, the following three sections are organized by this theoretical tripod. The literature reviewed is selected for being as closely related to this study as available.

Due to the limited number of applications of Smart Growth as of 2009, it is not possible to get enough cases to perform a full, randomized experiment. As such, a quasi-experimental design is used. The structure of the quasi-experimental design is guided by a strong foundation (Yin 2008, Miles and Huberman 1994). First, the matching of patterns (in this case urban form, dealt with in more detail below) to policy interventions, is based on principles set forth by Trochim (1989), matching a number of urban form characteristics to demographic, geographic, and economic correlations. Second, this investigation consists of two studies running on parallel lines but inverse directions in time, which, if both hypotheses prove true, effectively cancels out rival hypotheses and gives a clear sense of causation (Hatfield et al, 2006).

This investigation is a longitudinal study of plans passed years ago, and the evolution of urban form thereafter. Longitudinal models of urban evolution inform a great deal of this, as they attempt to simulate the causes and show similar results to the real world. Most popular are Tiebout models based on residents relocating through an expanding sprawl until finding their personal basket of services, such as Kolo and Watson (1992). The Tiebout understanding is based on the notion that residents create demand for development based on a mobility to pursue the best basket of services (municipal services vs tax burden) to suit their personal preference. Knaap, Hopkins, and Donaghy (1998) used game theory to construct development as a dynamic game (as opposed to a discrete number-game) where players were developers (similar to Schaefer and Hopkins 1987), but also added a local government player. Agent-based modeling is just now becoming an idea to play with. Using agents to simulate pedestrian movement has been achieved by Harris and Batty. Other agent-based models have simulated automobile traffic. As of this time, none have used developers as agents, which seems like a natural next step based on Knaap et al using developers as players in a game-theory model.

Models that seek to explain form patterns as an outcome of regulatory structures. This can be done as an econometric model utilizing option theory (Fujita 1989, Capozza and Li 2001), which purport to show the geo-economic determinants of city size and shape within the region. Also this has been done as a two-limit tobit model (McMillen and McDonald, 1990), and need to summarize what that means. Also, McMillen and McDonald have gone on a “Fischel expedition,” so named because in his seminal book, Fischel formulated the approach “that zoning can usefully be thought of as a method for redistributing property rights from the owners of undeveloped land to others in the municipaliy,” according to McMillen and McDonald (2004). Their “expedition” builds on this idea by connecting the demographics and political clout of a given city’s residents to the types and varieties of regulatory schemes employed in their land use planning. Other investigations connecting patterns of urban form to policies governing them include Cervero and Landis (1995) who displayed the connection between transportation policy and subsequent land use evolution, and Robert Pendell (1999), who showed that the most regulated cities were the most sprawling, and speculated a causal link. While these studies provide guidance and structure, the author knows of no study that directly investigates Smart Growth and/or New Urbanist policy for its effectiveness in form.

2.3 Measurements of Urban Form

One important thing this study seeks to do is measure changes in the physical attributes of urban form. Understanding and communicating urban character is a notoriously qualitative endeavor (Tugend, 2007). This study relies on the efforts of others who have conducted research that establishes and tests quantitative measurements of urban form. Also, that compare the urban forms of one case to another, or many cases, that have explored the possibilities and limitations of these comparisons. Finally, it relies on studies that have attempted to measure the effects of plans, as embodied in patterns of urban form, evolving underneath that regime.

Operationalizing form is a distinct and difficult endeavor. The literature reviewed in this paragraph is about taking an essentially qualitative idea (urban character) and finding measurable things. Not only measurable, but whose difference in measurement reliably indicate a difference in quantitative character. Campoli, Humstone, and MacLean (2002) used aerial photographs to measure change and pace of development in rural areas of New England. Others have sought to pin down the elusive definition of ‘sprawl’ to something more than low-density and automobile-dependent (after all, how is that different from rural?) (Galster, Hanson, et al 2001), a debate which continues today (Frenkel and Ashkenazi 2008). Others have focused on compact urbanism, both at the fringe (Southworth, 2003a) and in the center (Clifton et al, 2008).

This section deals with studies that have implemented the above variables of form measurements comparing one area to another. Some have sought to connect this to economic forces (Wheaton, 1996). This has been done at the neighborhood scale (Jo, 2000), at the metropolitan scale (Wassmer, 2000), and national scale (Hayden, 2004). Most interesting to this investigation is the study Fulton, Pendall, et al (2001) completed, comparing metropolitan regions over time. Comparing the growth rates of geographical area and human population was brilliant, and will be copied here.

Only a handful of studies have connected the planning intervention with a measurable outcome in form. Urban regime analysis is nothing new, and attempting to understand that past has been undertaken by Stone (2005). Positing existing policy as cause, Dear (2002) investigates how changing policies have affected (or not) a change in direction. Hasse (2004) devises a set of characteristics that show whether or not new housing development is sprawling, and therefore in accordance with or contradicting the new Smart Growth policies, providing a model for this paper. The closest study in the existing literature to this dissertation is Song and Knaap's study of Portland (2004). They take Portland's policy goal (decreasing sprawl) and measure form characteristics to see if the region is, overall, moving in the right direction. However, where they look at a single metropolitan region overall (eliminating questions of overlapping local, regional, and state policies), mine seeks to tease out individual cities with highly individualized policies.

2.4 Measurements of Plans and Ordinances

A method of evaluation that has been popular is surveying the plans themselves. A large number of random samples can be generated (for example, all the municipalities in a state) and analyzed without travel expense or human subject ethics. The presence or absence of key words, principles, policy goals, or policy structures in a large sample group generates usable statistics.

Adoption of specific principles can be done with a random sample of sufficient size, as is the case of New Urbanism in [state] (Berke and Conroy, 2000), or in Illinois (Talen and Knaap, 2003). It has also been done to test the speed at which state- or federal-level mandates have been adopted at the local level (Edwards and Haines, 2007). Or, having established best practices in general terms, investigators have looked for how close local ordinances meet best-practice specifications. Marcus and Sarkissian (1986) surveyed housing ordinances, while Knaap, Song, et al (2007) surveyed street sizing.

Like the literature cited in this section, this research investigates plans and ordinances passed within a recent time frame. After establishing the principles and specifications that qualify as Smart Growth, each case in Set 1 is evaluated for the presence of absence of these principles, as explained in detail in Chapter 3.

3. Research Design and Case Study Selection

This section details the methods of analysis and case study selection that structure the surveys that follow. It begins with framing the research question, hypothesis, and units of analysis. Next is a discussion of how cases were identified, screened, and selected, with a brief introduction of each case and discussion of their qualifications. This is followed by detailed explication of the measurements that will be taken, first of the plans for Set 1; then of the urban forms of Set 2. Finally, the possible outcomes, the conclusions that can be reached, and their limitations as well, are explained.

3.1 Research Question and Methods

Conventional (Euclidean) zoning renders illegal the urban form patterns of dense mixed use that were common in the past and now enjoy a current vogue. The policy ideas and schools of thought that support these forms as desirable include Smart Growth, Traditional Neighborhood Development (TND, directly connected with the Congress for New Urbanism), transit-oriented development (TOD), pedestrian-oriented development (POD), pedestrian pockets, and sustainability, among others. While current best practices put forward mixed-use, pedestrian oriented density as the design goals cities should strive for, there is nearly unanimous agreement that Euclidean zoning, based on segregating uses, is anathema to achieving them. According to outspoken proponent of New Urbanism, Andres Duany, "There seems to be a growing recognition that conventional zoning schemes and the way they encourage development to separate and disperse are counterintuitive to the way in we ought to be planning and regulating urban development" (Duany and Talen, 2002). In terms of rigorous research, however, the role of local land use regulation in facilitating sprawl, and its supposed ability (if reengineered) to counteract it, is almost entirely unexplored. Therefore, this research centers on the question of whether or not zoning ordinances, when realigned to match Smart Growth goals, have been effective and worthwhile tools for urban design:

Research Question: Can zoning ordinances be wielded effectively to accomplish urban form goals?

The leap from correlation to cause is made by authors like Andres Duany, who states, "Ironically, the field of planning itself is partly to blame. Planning rigidly regulates out good (sustainable) urban form in its implementation devices—the separation and scattering of urban land uses that is endemic to the vast majority of zoning ordinances and subdivision regulations imposed throughout the US" (Duany and Talen, 2002). Leaving their claims as self-evident logical steps, Duany and Talen, like many others, then simply invert the logic. Because places with conventional zoning are sprawling, they conclude, the zoning must be at least partly to blame. Because their Transect is designed to encourage urbanism, they believe, developers will be induced into producing it. Duany and Talen claim that "the transect is a regulatory code that promotes an urban pattern that is sustainable, coherent in design, and composed of an array of livable, humane environments satisfying an a range of human needs" (Duany and Talen, 2002). However, we lack empirical tests to validate these claims and conclusions. Could it be that market forces (Thorsnes and Simons, 1999) and infrastructure planning (Kolo and Watson, 1992; Porter, 1992, 1997) encourage sprawl more powerfully than land use regulation? If so, these forces should also limit the effectiveness of anti-sprawl zoning. In evaluating Duany and Talen's claims, however, the only option currently available is for cities to purchase (at a hefty sum) and implement the Transect and see what happens.

Thus far, there have been no empirical demonstration of these conclusions, at least none known to the author. It is simple to identify an apparent correlation between conventional zoning and sprawl, and from there to infer that the reverse should be true: that anti-sprawl zoning will work against sprawl. The purpose of this study is to engage in a hypothesis test of the assumption that zoning does indeed have power as an urban design tool by affecting the choices of builders and designers and hence the built form patterns of cities.

3.1.1 Unit of Analysis

The object of study for this research is the plan, ordinance, or regulatory regime that governs the shaping of urban form. Because such ordinances are approved at the citywide level, the unit of analysis is the city or town level of government. However, most municipal corporations in the US are part of large metropolitan regions, and the city's shape is much a result of geography. The specific city's cultural geography (proximity to the central city, job locations and commute patterns) and physical geography (views and hills, waterfronts) influence who chooses to live there or build offices and stores there. It would be atypical to study a single city surrounded by agriculture or open space; therefore the cases studied are suburban in nature, and part of a larger regional fabric.

This regional reality presents a difficulty in isolating the impact of a single plan. Song and Knaap (2004) addressed this problem by taking the reverse tactic. They moved the unit of analysis up to the regional level, selected metropolitan Portland, Oregon, and addressed the cumulative effect of many policies and instruments as a single whole:

> Our intent is not to conduct a policy analysis of the impacts of a particular plan or regulations. We hold that growth management instruments in Portland are too numerous, too mutually interactive, and too difficult to date stamp to isolate the impacts of any one instrument. Instead we offer a general examination of whether Portland's suite of policy instruments implemented over an extended period have had a measurable effect on various elements of urban form.

Inverse to Song and Knaap's study, this research is intended to "isolate the impacts of any one instrument," in this case the land use ordinances, the measure what effect (if any) they have on urban form. Metropolitan regions with strong regional government, like Portland, have problems involving mutual interactivity as described above. Therefore, case studies are selected from regions with weak regional governance. In such areas, regional planning goals are nonbinding policy goals or simply a statewide requirement to produce a plan, but the details of land use planning policy and implementation are left up to the city and only the city.

3.1.2 Summary of Method

This research consists of two parallel quasi-experimental surveys. The first study identifies cases exemplifying current best practices of urban form, and looks backward in time to investigate the qualities of the plans that governed their formation. The second study inverts the variables, identifying plans exemplifying the principles of Smart Growth, and looks forward from the time of enactment to investigate the qualities of the urban forms that evolved under those plans.

The results of the observations are quantitative. For case studies set 1 (form), evaluation of the plans consists of observing the presence (or lack thereof) within the texts of policies and principles of Smart Growth. This results in a numerical measure for how many are present that can be compared to other cases in the set, enabling assessment of correlation. For case studies set 2 (plans), evaluation of urban form consists measuring patterns in the streets, lots, and buildings, and the changes in these patterns over time. This results in numerical measures that indicate relative levels of sprawl both among cases and within each case over time.

Table 3.1: Parallel Quasi-Experimental Studies

	Set 1	Set 2
Direction	Plan ← Form	Plan → Form
Time	From present looking backward	From past looking forward
Independent Variable	Form	Plan
Dependent Variable	Plan	Form
Question	The form displays best practices. What kind of plan was in place?	The plan is designed to foster best practices. How did form change subsequently?

Set 1 (best practices of form) case studies are selected for exemplifying current best practices of urban form. Here, urban form is the independent variable, and the plan's qualities dependent. As embodied in urban form, Smart Growth goals have already been achieved, so I investigate how it happened. The plan governing the period of transformation may have been encouraging or discouraging of Smart Growth policies. This desirable urban form may have grown within the guidance of or in spite of the zoning ordinances in place. It is important to establish whether Smart Growth as a form is capable of evolving without the guidance of Smart Growth as a policy.

Investigating the first set of case studies (best practices of form) will enable us to understand if an appropriate Smart Growth plan is requisite to the evolution of desirable urban form. These cases are selected precisely because the patterns of urban form are form are ‘good:’ do these patterns ever occur in circumstances without a plan that specifically seeks it? If it is found that a Smart Growth plan is place wherever desirable patterns of urban form occur, the plan can be said to be requisite for it to happen.

Set 2 (best practices of plan) case studies are selected for exemplifying Smart Growth policies as contained in the plan itself. Here, the plan is the independent variable and the subsequent patterns of urban form dependent. Having consciously and explicitly planned for Smart Growth, the urban form patterns may or may not match what the plan envisioned. A Smart Growth plan may result in smarter growth, or sprawl may occur despite the best intentions. This study is intended to establish how often the plan can effectively generate the form.

Investigating the second set of case studies (best practices of plan) will enable us to understand if a Smart Growth plan is a reliable way to guide the evolution of urban form. These cases are selected because the plan instituted was explicit in its intention to reshape the built form into something more dense and mixed, do these patterns occur following enactment or do the urban form patterns obey no observable pattern? If it is found that desirable urban form patterns follow whenever a Smart Growth plan is instituted, the plan can be considered a reliable way to shape built form.

Because this research involves two parallel quasi-experimental studies, there are four possible outcomes. Smart Growth plans may be both reliable and requisite; they may be reliable but not requisite; or requisite but not reliable; or they may be neither requisite nor reliable.

Table 3.2: Combinations of Possible Outcomes

		Possible outcomes of Study 1	
		Requisite	**Not Requisite**
Possible outcomes of Study 2	**Reliable**	Causal relationship	Plausible urban design tool
	Not Reliable	Necessary, but insufficient on its own	No relationship

If plans are both reliable and requisite, they can be considered causal, and the widespread adoption of Smart Growth policies can be counted on to change the form of cities. If plans are reliable but not requisite, then planners can be assured that advocating for Smart Growth is a worthwhile use of their time, even as urban form changes in other places without their guidance. If plans are requisite but not reliable, it informs planners that pursuing Smart Growth goals is urgent but by no means a guarantee of success. If plans are neither reliable nor requisite, then the time and effort of planners and designers to reform zoning ordinances would be better used elsewhere. Furthermore, ambiguous results are possible, rendering us unable to reach any of the above four conclusions. These interpretations and their complications are addressed in further detail in Section 3.5.

3.1.3 Hypothesis

Of the four possible outcomes outlined above, I hypothesize that the results will evidence the third possibility: plans will be found to be requisite but not reliable. If this hypothesis is correct, it implies to planners that creating and advocating alternative zoning regimes is an important and necessary step in accomplishing planning goals. However, it also implies that this is not the only essential factor and that other variables (perhaps transportation infrastructure, perhaps consumer market conditions and preferences) must also be present in order to alter urban form patterns in desired directions. Further research may be required to understand what this third variable may be so that Smart Growth urban form patterns can be generated by Smart Growth plans.

3.2 Case Study Selection

As a quasi-experimental study, case studies are selected instead of chosen at random. Each case must display specific qualities in order to be included (Yin, 2008). This research is comprised of two surveys, and each study has a specific set of qualities necessary for cases to be included. This section outlines the criteria for inclusion in each set, and then a brief summary of each selected case follows.

Case studies set 1 is made up of cities whose current urban form patterns are exemplary of those prescribed by Smart Growth principles. They each display certain built form patterns (“desired urban forms”) that are often described in qualitative terms. Each case features a dense mixed use core, efficiently supports multiple transportation alternatives, and is pedestrian friendly, at least in central areas. Within the last 20-30 years, the case city was part of the general regional suburban sprawl, although most include an older town or village center that was later surrounded by suburban growth. Since then, the area has recently transformed into the desired form outlined above. This time period is coincident with the rise of Smart Growth, so these specified cases offer the opportunity to investigate if planning and purpose was involved in their transformation.

Case studies set 2 consists of cities that publicly and explicitly adopted Smart Growth or an alternative zoning scheme, such as form-based or transact-based, within the last 10-25 years. The plan as passed in each case very publicly attempts to implement Smart Growth policies with the stated intention of causing Smart Growth form. These plans contain all or several policy structures consistent with Smart Growth: mixed use, Traditional Neighborhood Design (TND), transect zoning, form-based zoning, an Urban Growth Boundary (UGB), and others listed in detail in following sections. Each plan must be at least 10 years old to allow enough time for its effects to be apparent in subsequent development, offering the opportunity to investigate the consistency with which such plans lead to desired built form patterns.

3.2.1 Selection of Set 1 (Best Practices: Form)

The cases studies in this section represent the best practices of Smart Growth as expressed in their urban form. Each of the cases in this section are cities that were founded before World War II, although they remained small until submerged into sprawl in the great wave of suburban growth occurred that occurred from the 1960s through the 1980s. In the 1990s and 2000s, however, development has taken on a denser character. Today, these cities exhibit the best practices of Smart Growth, providing options in housing and transportation, mixing uses to create lively centers used at all times of day, and reshaping the streetscape to privilege pedestrians over drivers.

Walnut Creek, CA. Across the bay from San Francisco, Walnut Creek is the office and retail heart of Contra Costa County. Broadway Plaza, a small mall south of the traditional downtown, became the heart of massive retail expansion that began 1989. By 1999, the "retail mecca" stretched from the BART station and Target store at the north end, through the historic downtown along Locust and Walnut Streets, to Broadway Plaza at the south end (Cabantuan, 1999). Presently, central Walnut Creek contains a dense mix of offices, apartments, and stores. Recent retail development (Figure 3.2) is street-facing and pedestrian-oriented. Walnut Creek is an example of several Smart Growth principles: a mixed-use core, small blocks, choice in housing type, and regional transit access.

Figure 3.1: Walnut Creek Street Scene

Huntington Beach, CA. Southeast of Los Angeles along the Pacific Ocean, Surf City USA began as a streetcar suburb on the Pacific Electric system, but expanded to an area of 26 square miles and is mostly suburban sprawl. However, the downtown area (Figure 3.3) has been transformed by recent retail and hotel projects, creating a walkable core adjacent to the beach recreation areas. Additionally, the former Huntington Beach Mall has been redeveloped as Bella Terra, a retail hub with mixed-use elements in the plan. The most recent general plan was passed in 1996, and a major revision of the Downtown Specific Plan was passed in 2007.

Figure 3.2: Huntington Beach Street Scene

Arlington County, VA. Although a county, Arlington is similar in area size to Huntington Beach (26 square miles), and it does not contain any incorporated cities within. Part of the District of Columbia until 1846, its boundaries still reflect this. Arlington was primarily automobile-oriented suburban in character until construction of the Metro in 1976. Since then, high-density, transit-oriented development has caused population density to rise to the point where the Census bureau considers it a Central City in the Washington metropolitan region. The county has earned numerous awards for Smart Growth.

Figure 3.3: Arlington Street Scene

Robbinsville, NJ. Located in central New Jersey about 8 miles from Trenton, Robbinsville was known until 2007 as Washington Township. Over the last two decades, development has proceeded in high-density, traditional neighborhood designs. Robbinsville is known for this urban form pattern and its median home price is well above the region's. By 2007, the town had to put in growth moratoria because they were unable to provide education infrastructure sufficient to the population density (Belson, 2007).

Figure 3.4: Robbinsville Street Scene

Table 3.3: Case Qualifications, Set 1

Case	High-density residential	Mixed-use core	Pedestrian pockets	Transit links	Traditional neighborhood design
Walnut Creek	X	X	X	X	
Huntington Beach		X	X		X
Arlington	X	X	X	X	
Robbinsville	X	X	X		X

The criteria heading the columns of Table 3.3 are must identifiable on the ground. In the qualitative experience of actually being in each city, is there a mixed-use core that is pleasantly pedestrian, already, today? Cases with a sufficient number of these qualities, as shown in Table 3.3, are selected.

3.2.2 Selection of Set 2 (Best Practices: Plan)

The case studies in this section represent the best plans, composed of policies recommended by Smart Growth principles. Each of the case studies in this survey are nodes in a larger region of suburban sprawl. When each case city passed its Smart Growth plan, its citizens aspired to transform their sprawling city into a model of urbanism. For each case to be selected, this plan must have been passed between 10 and 25 years ago, providing sufficient time to evaluate if the plan's design proscriptions have trickled down into subsequent development.

Flower Mound, TX. An affluent suburb north of Dallas, Flower Mound was typical of the automobile-oriented sprawl surrounding Dallas and Ft Worth. However, in 1999, the Town Council approved the SMARTGrowth plan, seeking to preserve open space, foster a sense of place, and more efficiently build infrastructure.

Suffolk, VA. Suffolk is the fastest-growing city in the Virginia Beach-Norfolk-Hampton Roads metropolitan region. The city passed the Unified Development Ordinance (UDO) in 1999 and amended it in 2001. The ordinance identifies the Smart Growth by name, and includes principles such as infill development and seeks to reconnect the street grid. Much of the city's area is covered by the Great Dismal Swamp, a critical wetlands habitat that the Smart Growth plan seeks to preserve.

Huntersville, NC. A thriving suburb north of Charlotte, Huntersville is within Mecklenburg County, one of American's fastest-growing (Census 2000). The completion of the beltway (Interstate 485) created a major interchange (with Interstate 77) at Huntersville's southern end, and with it, pressure for growth. Its comprehensive plan, passed in 1988, and amended in 2005, set forth guidelines for pedestrian-scaled neotraditional development and infill in its traditional downtown (Town of Huntersville, 2005).

Petaluma, CA. Part of the San Francisco Bay Area, Petaluma is a city of approximately 60,000. One of the earliest pioneers of growth management planning in the 1970s, the city was also among the first to institute a UGB. The first Smart Growth plan was enacted in 1992; the latest version was revised in 2003. Petaluma has been lauded as a Smart Growth policy leader by organizations such as the Greenbelt Alliance (Young, 2006).

Table 3.4: Case Qualifications, Set 2

Case	Infill development	Preservation of open space	Mixed-use	Placemaking or community character	Traditional neighborhood design
Flower Mound		X	X	X	
Suffolk	X	X	X	X	X
Huntersville	X		X		X
Petaluma	X	X	X	X	

The items listed in this table must be found in the governing plans, as published and ratified within the specified time-frame of 15-20 years ago. They may or may not exist today as a physical urban quality; what is important for selection to this set is their presence in the plans.

3.3 Measurements: Case Studies on Form

In the first of the two quasi-experimental studies, cases are selected because the patterns of built form as they exist today are exemplary of Smart Growth principles, so the plans that governed their development are tested for their adherence to Smart Growth policies. As the plan is the object to be measured, the evaluation is based on the presence or absence of various policy prescriptions, zoning patterns and styles, and procedural mechanisms that are intended to produce Smart Growth. This is a similar method to that used by Talen and Knaap (2003) in their survey of plans in Illinois. Talen and Knaap had a set of policy designs they used as a checklist.

Some of the policies were spatial, such as zones and boundaries, while others were processes, such as design review:

> The assessment to the degree to which regional and spatial policies are in use by jurisdictions in the study was made by cataloging the existence of the following smart growth policies: cluster zoning, open-space zoning, urban growth boundary or urban service boundary, public transit, environmental overlay districting, scenic preservation zoning, agricultural protection or conservation zoning, and infill development… [In addition,] The following process-oriented policies were inventoried: design review; incentive zoning: impact fees waivers, floor area ratio credits; impact fees exactions, or dedications; performance standards or point systems; PUD ordinances; and special-use or conditional-use permit requirements.

This method provides an excellent model for evaluation of plans, although some of the specific items on this list are of questionable value. PUD ordinances, for example, have been used many times to produce sprawl and only a handful of times (so far) to produce traditional neighborhood design. The content of the PUD is vitally important and ignoring this can skew the results of this type of study. On the other hand, urban growth boundaries and infill development are unequivocally compatible with Smart Growth and make excellent measurements of the plans themselves. Some, but not all, of the measurements utilized by Talen and Knaap are used in this study.

The following sections describe the data types that will be used in the study and their sources, along with a detailed list of measurements I use to assess how exemplary of Smart Growth policies are the plans governing this set of cases. While Smart Growth is generally against sprawl as an urban form, it is a specific set of policies and goals that focus on the already-built form and sometimes ignore sprawl altogether. Therefore, the types of policies that may present in the case study plans are subdivided into two categories: specifically Smart Growth and generally anti-sprawl. This procedure is more of an organizational tool for tracking results than it is meant to be an argument on the subtleties of Smart Growth policies.

3.3.1 Data Sources

Data sources for this part of the analysis are primarily the plans themselves. Each plan is retrieved from public records, and the contents evaluated according the measures laid out in the following two subsections. To supplement, the journalistic record in local and regional papers recording the design, proposal, debate, passage, and implementation of the plan provides perspective and understanding of how the pieces were formed, as well as what may have been left out. In such cases where participants are available and willing, interviews may also inform the research, shedding light on the intentions of the planners.

3.3.2 Smart Growth Elements in Plan

This section lists the five measures of Smart Growth compliance looked for within the plans governing the case studies of Set 1 (best practices: form). These measurements are nominal, taking into account whether items fitting the descriptions below are present or not (1=yes; 0=no). As there are five plan elements described below, the highest possible score for this category is 5. That score indicates that the plan is highly attuned to Smart Growth principles, while a score of 0 indicates the opposite.

Mixed-use zones. The principal criticism of zoning is that segregating uses promote sprawl. Revised zoning plans with Smart Growth goals make provisions for mixed-use zones, whether by requiring first-floor retail or by allowing adjacent uses from a number of categories.

Range of housing opportunities. A plan displaying Smart Growth principles will include increases in single family attached, multi-family, and other housing types aside from single family detached. Ideally, these housing types will be situated near important nodes, in the core, or close to transit opportunities.

Traditional neighborhood design or similar PUD. Traditional neighborhood design (TND) is specifically associated with New Urbanism and an east-coast, Cape Cod-style aesthetic (Bookout, 1992), but is otherwise congruent with Smart Growth principles. TND regulation prescribes small blocks, usable sidewalks, compact urbanization, and dense mixed-use cores.

Design review. Although sometimes instituted for aesthetic purposes, design review is also used to assure that new developments are street-facing, integrated into the neighborhood, and meets goals for a pedestrian friendly right-of-way. Cases where more than just aesthetic continuity is considered are in line with Smart Growth.

Variety of transportation choices. Sprawl is well known for being exclusively automobile-oriented. Smart Growth policies include reoriented land use to take into account multiple transportation forms (including walking) not only for existing neighborhoods but also future development nodes.

3.3.3 Sprawl-Slowing Elements in Plan

This section lists the five measures of general ant-sprawl principles looked for within the plans governing the case studies of Set 1 (best practices: form). Similar to the section above, these measurements are nominal, and the highest possible score for this category is 5.That score indicates that the plan is explicitly anti-sprawl in its language and structure, while a score of 0 indicates the opposite.

Urban growth boundary. A general urban growth boundary (UGB) is sometimes used to stop leapfrog development. Creating an outer zone where development is not allowed (at least until the next redefinition of the UGB) is intended to make sprawling development at the fringe financially unfeasible.

Infill development. As a complement to UGBs which discourage development on the fringe, infill development policies encourage growth on vacant and underutilized parcels, as well as densification and/or adaptive reuse of existing buildings closer to city centers.

Preservation open space, farmland, and critical environmental areas. Although UGBs seek to preserve open space generally, additional anti-sprawl policies can be put into place that recognize the value of open space, prime farmland, and critical environmental areas such as wetlands by specifically recognizing their value and protecting them from urban encroachment.

Cluster zoning. Cluster zoning seeks to preserve open space and create compact development by requiring that areas of development be separated and surrounded by significant, contiguous open space.

Impact fees. Another method of encouraging infill development and discouraging development on greenfields is to add environmental impact fees and/or infrastructure extension fees to projects on the fringe.

3.4 Measurements: Case Studies on Plan

In the second of the two quasi-experimental studies, cases are selected because the plans that governed their development exemplary in their adherence to Smart Growth policies. The patterns of built form as they existed when the plan was passed are compared to the built form patterns as they exist today are tested to see how closely they have come to embody Smart Growth principles. As the patterns of form are to be measured, the evaluation accounts for trends of the overall patterns of form moving over time, away from sprawl and toward Smart Growth. This is a similar method to that used by John Hasse (2004) in his proposed for the assessment of new subdivisions. The "best practices" of built form were operationalized by Hasse. His "geospatial measures for objectively analyzing new developments for characteristics of sprawl" consists of the following twelve elements:

> (1) land use density, (2) leapfrog development, (3) segregated land use development, (4) development that is inconsistent with regional planning, (5) highway strip development, (6) new road network efficiency, (7) alternative transportation accessibility, (8) accessibility to important community nodes, (9) loss of important land resources (such as wetlands, prime farmland, and endangered habitat), (10) encroachment upon sensitive, preserved open space, (11) excessive per unit impervious surface coverage, and (12) growth trajectory.

Some of these proposed measurements make sense in the context of this research while others do not. Hasse's indicators are specifically designed to be applied to new subdivisions in their proposal stages, while my task is to deal with the entire city after building is complete. Those measurements that do work in this context have been operationalized in the same manner as Hasse did in his study.

The following sections detail the list of measurements to be used, preceded by a brief description of the data sources that will enable the taking of these measurements within GIS. The dimensions are grouped into four categories based upon the type of pattern they seek to measure: grain of different land uses, comparative growth rates that suggest sprawl, patterns based on street layout and design, and patterns based on lot size and layout.

Spatial Measurement	Units	Direction if plan is effective
Distance to nearest different use	Miles	⇓
Size of single-use zones	Acres	⇓
Leapfrog development	Number of projects	⇓
Geographic growth to population growth	Index ratio	⇓
Multi-family units to single-family units	Multi-family units per single-family units	⇑
Linear commercial zones	Length to width ratio	⇓
Ratio of cul-de-sacs to connected blocks	Cul-de-sacs per intersection	⇓
Pedestrian access to important nodes	Miles	⇓
Sidewalks	Square meters	⇑
Median lot size	Acres	⇓
Lot width vs depth	Length to width ratio	⇓
Street frontage per resident	Meters	⇓

3.4.1 Data Sources

Data sources for this section are Sanborn maps from the current year as well as the relevant time period(s) in which the Smart Growth plan was debated and passed. These are sourced from local archives. In addition, digital aerial orthophotography is used, which is available free from services such as Google Earth and Microsoft Virtual Earth, with additional historical photos being added every day. Finally, any digital GIS data that may be available, including zoning maps, parcel data, and street files is also gathered in order to facilitate the measurements described in the following section.

3.4.2 Grain

This subset of measures is within the arena of grain. Grain is a descriptive term referring to what a land use map looks like when compact, pedestrian-oriented urbanism is in place—the colors on the map appear to be ‘grainy,’ as illustrated in Figure 3.6. Large areas of segregated use, when viewed on a use map, has a relatively coarse grain. Sprawl is generally recognized in cases with highly segregated land uses that require an automobile to span the distances between. The measurements outlined below seek to convey an overall sense of grain for comparison of the same city over time as well among other cities.

Distance to nearest different use. Grain is defined in terms of the mixture of land uses, and a straightforward measurement of this is the average distance from any given point to the nearest area of different use. Within GIS, the centroid of each parcel forms the set of given points. Each centroid can be encoded with the use type of the parcel it represents, and then a search is made from its nearest to the next, until one with a different use is located. Repeated for each centroid, this generates a large number of distances. The average of these distances is an indicator of grain; the larger the distance, the courser the grain. When automated in GIS, this process may be time-consuming for the computer but not labor intensive for the operator.

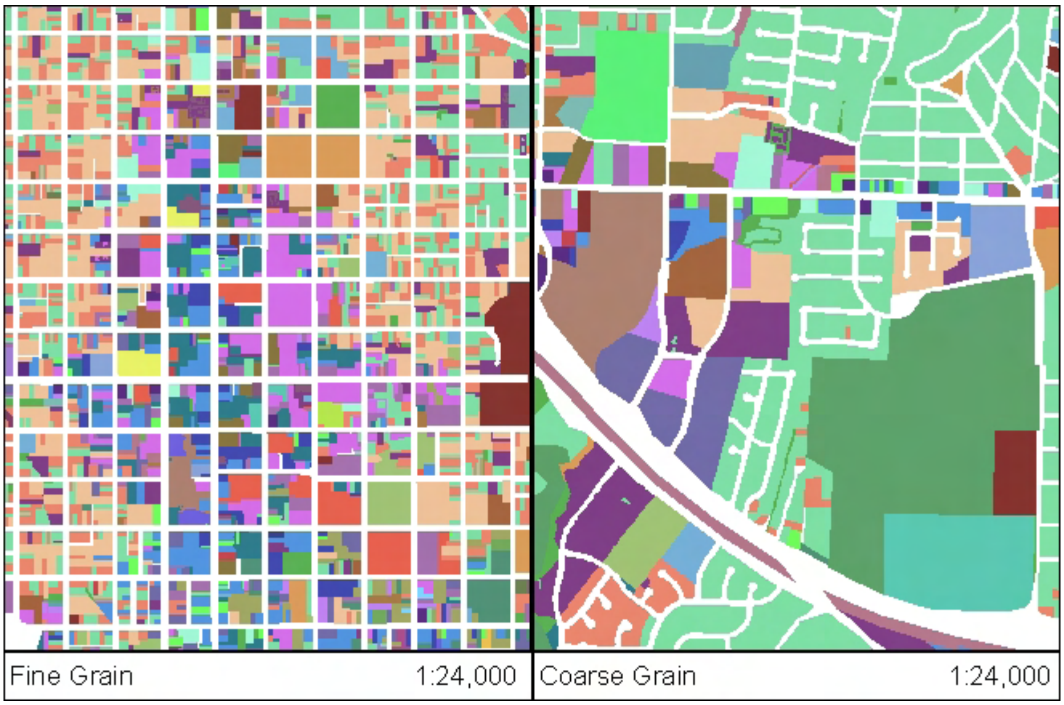


Figure 3.5: Grain of Use Illustration

Size of single-use zones. In a low-grain city, retail, commercial, and industrial zones are likely to be contiguous as well as large in size. In high grain cities, uses are more frequently separated from each other by small and intervening other uses. To illustrate, many recently developed suburbs have large and designated business parks, while in older cities, offices are mixed in with retail and residential parcels in a more 'speckled' pattern. This can be measured within GIS by merging all adjacent parcels of same use into a single polygon. The count of these polygons, as well as their average size, are indicators of grain: the fewer separate polygons and the larger their average size, the coarser the grain of the study area.

Leapfrog development. Leapfrog development is often considered a symptom of sprawl; analytically, detecting its presence in GIS is similar in method to measuring grain. Instead of multiple use types used in the "Size of Single-Use Zones" measurement, here there are only two types: developed land and open space (for the purposes of this measurement, plazas, parks, and other designed ‘open space’ is counted as developed land). These creates a checkerboard of contiguous zones of developed/open. A perfectly sprawl-free city would have a single zone of development surrounded by a ‘background’ of open space. A greater number discontiguous sectors of developed land indicates a greater amount of sprawl.

3.4.3 Sprawl ratios

Some qualities of sprawl are based on growth rates; even the word “sprawl” implies an action of reaching out. The three ratios presented here attempt to take into account that growth, and the specific type of spread that is endemic to sprawl.

Geographic growth to population growth ratio. This straightforward measurement compares the annualized percent rate of urban development (by hectare) to the annualized percent rate of population growth over the same period of time. However, a single ratio reflecting the time period between now and the year is insufficient. A third data point from 10-20 years before the new zoning ordinance was enacted is necessary in addition to one now and one from the year of enactment. This allows us to set a baseline of previous sprawl rate; if the city has managed to lower that sprawl rate since passing the plan, it can be considered less sprawling (Fulton, 2001).

Multi-family (MF) to single family (SF) dwelling units ratio. In any growing city, the absolute number of housing units is expected to increase, both in multi-family and single family categories. However, in sprawling areas, single family units grow at a faster pace than multi-family units. In areas undergoing densification, the reverse should be true, with multi-family units replacing or at least outpacing single-family units. Therefore, a decrease in this ratio from baseline year indicates densification, while in increase in this ratio indicates continued sprawl.

Linear commercial zones. A significant indicator of automobile-oriented development is commercial strips. Commercial parcels, when merged together in GIS to create single zone, can be measured for the ratio of zone depth to zone width. Pedestrian-oriented retail tends to cluster in small-radius circular-like shapes in order to minimize distance from one store to another, and so will have a width-to-depth ratio closer to 1:1. In strip zones, that ratio will tend to increase as width expands far beyond depth. Even in high-density environments, such as San Pablo Avenue in Berkeley or Ventura Boulevard in Lost Angeles, strip commercial is automobile-scaled and primarily accessed by car. The higher the ratio, the more sprawl is indicated.

3.4.4 Street patterns

The measurements in this section concern the length, width, and design of streets. As the main public spaces and transportation corridors of cities, the design and layout of streets is crucial to the movement of people. Street designs and layouts that accommodate the automobile to the exclusion of other transportation options are a distinct symptom of sprawl. Narrower streets with shorter blocks and wider sidewalks are more in keeping with Smart Growth principles. The following three measurements quantify the overall quality of pedestrian-friendliness in the street system.

Ratio of cul-de-sacs to connected streets. Cul-de-sacs are popular among consumers because they carry very little traffic. However, this traffic is displaced to major thru arteries, contributing to traffic congestion that is endemic to sprawl. Smart Growth principles include more connected street grids, and a city successfully achieving Smart Growth should see an increase in the number of thru blocks relative to the cul-de-sacs already built.

Pedestrian access to important nodes. Adjacent is not necessarily accessible: when it comes to sprawl, some residential units share a backyard wall with the rear of a retail center. Even so, access to those stores may be more than a half-mile walk out the front door, through the subdivision's single exit, and along a wide, pedestrian-hostile arterial to a major signalized intersection. Taking a sufficient random sample, the GIS, utilizing Network Analyst, can calculate the average distance a pedestrian must travel to reach an important node. The higher the average distance, the more the city is sprawling.

Street width and sidewalks. Narrower streets are more pedestrian-friendly, and sidewalks are critical to encouraging walking as an alternative mode of transit. Assessing the average width of streets is not easily done with the GIS line data that will be used for other measurements. In this study, the width of key streets in town centers is estimated using aerial photography. "Key streets" is defined as those that lead to or front retail districts or major shopping centers.

3.4.5 Lot patterns

The measurements in this section are based on size qualities and form patterns of the lots as laid out within the city. Limitations based on lot size have a strong effect on housing design and density. More sprawl is characterized by larger lots with single houses and wide street frontage. Cities actively reducing sprawl should see a decrease in these quantities over time (Jo, 2000).

Median lot size. Increasing density requires a combination of larger lots (for large apartment buildings) and smaller lots (for denser single-family units). Since the vast majority of individual lots are devoted to residential use, the addition of high-density single family units and smaller multi-family (2 to 6 units) in pursuit of Smart Growth will cause the median lot size to decrease over time.

Lot width vs depth. Narrow lots are a key to pedestrian-friendliness and one of the most immediately visible qualities of Traditional Neighborhood Design (TND). Limited street frontage causes a block to have more visual interest and the pace of walking to feel faster and more interesting for the pedestrian. The overall ratio of width to depth should increase toward depth as more infill development and lot subdivision occurs.

Street frontage per resident. As more multifamily residential is developed, the amount of street frontage per resident should decrease substantially. A sprawling quasi-rural area would have very high street frontage (feet) per resident. This measurement is taken by doubling the total length of streets (doubled because there is frontage on both sides of the street) and dividing by the total estimated population of that year.

3.5 Conclusions

This section outlines the methods used to interpret the quantitative results of both analyses. The first set of case studies (best practices of form) evaluates if plans are requisite to achieving Smart Growth. The second set of case studies (best practices of plans) evaluates if Smart Growth planning is a reliable way to guide urban form into desired patterns. Combining the results of these two parallel studies creates four possible combinations of results: requisite and reliable (causation), requisite but not reliable (positive correlation), reliable but not requisite (negative correlation), or neither requisite nor reliable (no relationship). First, the terms requisite and reliable are defined in more detail than in Section 3.1; then the implications of the four possible outcomes of this research are outlined. Finally, there is a brief restatement of my hypothesis.

The first case studies set (best practices of form) seeks to establish whether or not the urban form patterns that exist today were guided by plans that included policies explicitly designed to achieve that kind of form. If the case forms universally come from plans that are deliberately sprawl-busting, they can be considered requisite to achieving desirable urban form. If Smart Growth plans are present in some cases but not others, plans cannot be considered requisite, but perhaps there is a third variable that causes (or helps to cause, in tandem with Smart Growth plans) these patterns of built form. If Smart Growth plans are not present in any cases, it is a powerful indicator that this form of urbanism is not related to the zoning scheme or planners' plans.

The second case studies set (best practices of plans) seeks to establish whether or not the Smart Growth policies included in plans and ordinances were followed by the establishment of intended patterns of urban forms. If the plans created forms that are sprawl-reduced, they can be considered reliable in producing the urban form patterns planners desired. If the desirable urban form patterns are present in some cases but not others, plans cannot be considered reliable, possibly because other variables are interceding and preventing desired patterns from forming. If no desirable urban form patterns evolve following the passage of a Smart Growth plan, it lends some support to Pendell's hypothesis that zoning regulations (of any kind) contribute to sprawl (Pendell, 1999).

If plans are reliable and requisite, there is a good case to be made for causation. When phenomenon A always happens after phenomenon B, and never in any other circumstances, phenomenon A can be said to be causal (Hatfield et al, 2006). However, because this research is quasi-experimental and not fully experimental, this finding would be at best preliminary. The further research suggested from this conclusion is a full-scale experimental study to determine if reliability and requisiteness can be confirmed for a random sample.

If plans are reliable but not requisite, then alternative zoning schemes are worth time and effort in situations where other helpful factors are not already present. If this is the case, it suggests further research to investigate what other ways in addition to land use regulation desirable urban forms might be achieved. Understanding what other variables might cause the desired urban form patterns will be helpful to properly identify when the time and expense of a zoning overhaul is not appropriate.

If plans are requisite but not reliable, they become a necessary ingredient in an incomplete recipe. This is only the first step in understanding how Smart Growth plans get translated into Smart Growth forms, but an important and fundamental step. Further research would be needed to understand the other variables, so that eventually practicing planners may have an effective tool to reliably create desired urban form patterns.

If plans are neither requisite nor reliable, then zoning should be abandoned as an urban design tool. Whatever form types they may be looking for—sprawl, Smart Growth, TND, or the next fashion to come along—reconfiguring the zoning ordinances is not an effective method to achieve it. Zoning may be a contributing factor to the form of sprawl, but its ability to control and direct that form is extremely limited and it cannot be assumed to be a design tool any longer.

Of the four possible outcomes outlined above, I hypothesize that the results will evidence the that Smart Growth principles are both reliable and requisite in the transformation of automobile oriented suburbs into pedestrian-oriented urban centers. As Pendell (1999) has shown that conventional zoning likely has a causal relationship with sprawl, land use regulation probably has the influence to combat, or at least slow, sprawl.

4. Case Studies Detail

Using the quasi-experimental method, the cases for these studies were selected based either on qualities of their current patterns of urban form or on planning actions taken fifteen to twenty years ago. While the previous chapter's discussion of methods introduced the cases selected and reasons for their inclusion, this chapter presents them in greater detail, explaining the geographic and historical context for the measurements evaluated in subsequent chapters.

The first set of case studies are selected because their present-day patterns of urban form represent the best examples of the goals of Smart Growth. They have identifiable core(s) and periphery; dense, mixed-use, and walkable downtowns; contain a wide range of housing options and densities; and support multiple modes of transportation, including pedestrian, bicycle, bus, and sometimes rail. Walnut Creek in Northern California and Huntington Beach in Southern California have developed into regional retail and office hubs. Arlington, Virginia, is the quintessential example of transit-oriented development (Cervero, 2004). Robbinsville (née Washington Township) near Trenton, New Jersey, has successfully raised property values and interest its commercial zones after construction of neotraditional neighborhoods at its new Town Center.

The second set of case studies are selected because they were early adopters of Smart Growth principles into their general plans, specific plans, and/or zoning ordinances, with the stated goal of creating urbanism where it did not yet exist, or was very limited. Flower Mound, Texas, faced explosive growth in the 1990s and continued pressure to sprawl as part of the Dallas-Ft Worth metroplex. Suffolk, a town in Virginia, merged with surrounding Nansemond County in an attempt to create a regional government entity capable of preserving agricultural and open space while funneling growth into existing towns. Huntersville, north of Charlotte, became an attractive commuter suburb upon completion of Interstate 77, and is further enhanced by its proximity to the new beltway (Interstate 485). Petaluma, California, is accessible to employment centers in San Francisco and Walnut Creek, but sought to preserve its surrounding farmland and (as distinct from nearby suburbs) non-sprawling character.

4.1 Best Practices: Form

The cases studies in this section are selected due to their exemplary form as it exists on the ground today. As Smart Growth principles become more popular in planning theory and increasingly implemented in the field, these cases are often cited as examples of the Smart Growth goals being pursued. Although their older nuclei may contain a traditional downtown, each of these cases became auto-dependent and single-family dominant as they merged into the suburban sprawl of their surrounding metropolitan regions, generally in the 1960s or 1970s. In the last 20-30 years, the old 'urban village' cores have been expanded into a coherent whole, transforming once-typical suburbs into shining examples of new urbanity.

In this study, the independent variable (and basis of case selection) is the form patterns of the cities, while the dependent variable is the type of plans (if any) implemented on the path to creating this form. Cases were located in planning literature where they were cited for being tangible illustrations of difficult-to-describe qualitative ideals (Crawford et al 2004, Cervero et al 2004, Smart Growth Network 2009).

4.1.1 Walnut Creek, California

Walnut Creek is located near San Francisco and Oakland, and is a major regional employment and retail hub for the East Bay (Alameda and Contra Costa Counties). Its established hub is shop-lined Main Street, but the construction of the Broadway Plaza mall in 1967 allowed Walnut Creek to dominate retail in the region by attracting major national luxury chains. In addition, its Golden Triangle of office campuses has benefited from height and growth limits in San Francisco, combined with the decline of Oakland's reputation, to absorb demand for office space. The mission of the city (City of Walnut Creek, 1981) has been to link these three nodes, along with a BART station, into a coherent core, as well as adding high-density residential components.

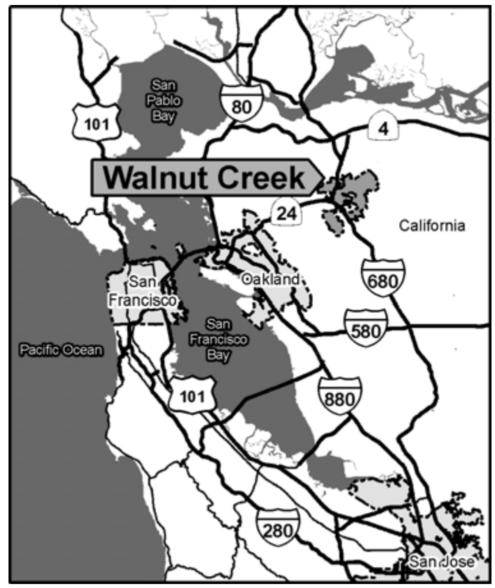


Figure 4.1: Locator Map, Walnut Creek

Walnut Creek has used a number of specific plans to transform its downtown, and these plans get very specific. Alma Avenue, one of the oldest subdivisions in the city, consisted of small single-family homes that were eventually isolated by the widening of the adjacent freeway interchange (Interstate 680 with State Route 24). The city's specific plan called for the redevelopment of the single family homes into high-density multi-

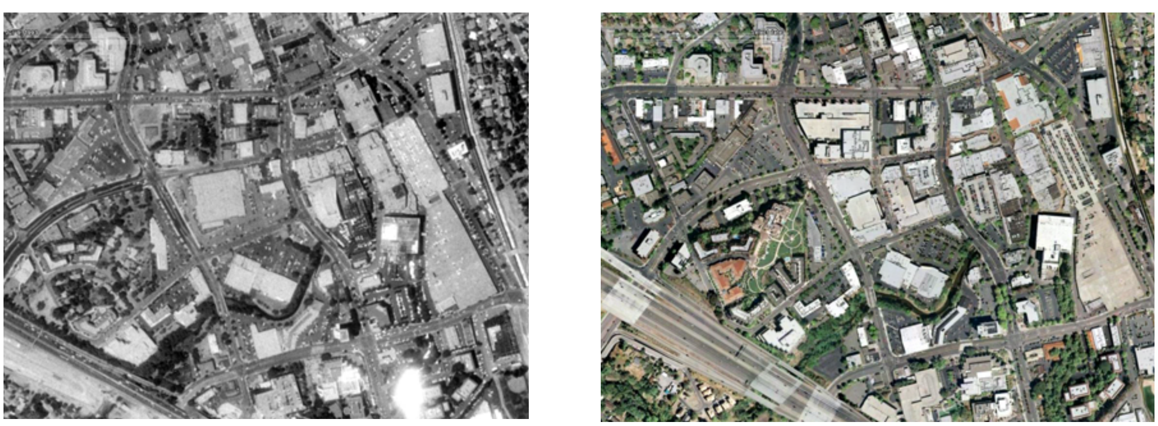


Figure 4.2: Central Walnut Creek, 1995 and 2009

family units and expansion of a small park into a pedestrian corridor connecting the new apartments to nearby offices (City of Walnut Creek, 1985). The Locust Street Extension Specific Plan went so far as to specify the layout, height, and massing of building in addition to the city's extension of Locust Street one block further south (Sasaki Associates, 1996).

Retail is the economic engine of downtown Walnut Creek. The economic booms of the 1990s (technology companies sought office space in Walnut Creek) and the 2000s (multi-family residences were developed and sold at record pace) engendered consumer spending growth that allowed Walnut Creek to further expand its retail space. The Pedestrian Retail Zone (connecting Main Street to Broadway Plaza) expanded from 12 store spaces in 1999 to 46 in 2009 (Cabanatuan, 1999). Walnut Creek competes with central San Francisco, Palo Alto, and San Jose as a super-regional retail hub, outshining nearer neighbors Oakland, Pleasanton, and Concord.

4.1.2 Huntington Beach, California

Huntington Beach is an oceanfront community in Orange County, California, incorporated in 1909. Like many suburban cities, it experienced explosive low-density growth in the decades following the Second World War, building out to its borders with neighboring suburbs and dwarfing the old Main Street-centered downtown. Large automobile-oriented strip centers lining Beach Boulevard, capped by the Huntington Beach Mall at the northern end, became the center of retail life in Huntington Beach.

Figure 4.3: Locator Map, Huntington Beach

Huntington Beach sought to reverse the suburbanization trend with the passage of the first downtown specific plan in 1985 (City of Huntington Beach, 1985). The initial plan called for the renovation of the first two blocks of Main Street, along with the beach and fishing pier area across Pacific Coast Highway. Upon successful completion of large office/retail buildings, four successive specific plans have been drafted, implemented, and superseded, with the current (fifth) version pending approval in late 2009.

Downtown is a very popular tourist destination that competes directly with Third Street in Santa Monica. However, residential units have been slow in coming to Main Street, even during the condo boom of the 2000s. The majority of residential growth has been single-family residential on developable lots near, but not in, downtown, as opposed to mixed-use condominiums above residential. These new single-family homes are very high density, made so more by sky-high oceanfront land values more than planning policy interventions.

The lifespan of the Huntington Beach Mall ran its course, and it closed in 2004. Although Beach Boulevard's retail strip remains active (particularly car dealerships and national big-box chains), the mall was redeveloped into Bella Terra, a lifestyle center with plans for residential uses as well (Barboza, 2008). However, Bella Terra is on the northern border of Huntington Beach, not connected to its pedestrian downtown.

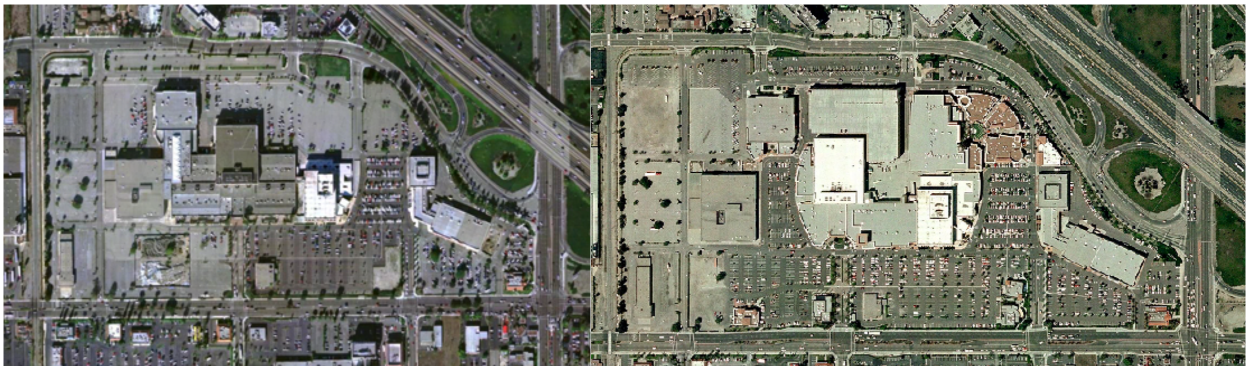


Figure 4.4: Huntington Beach Mall (1995) and Bella Terra (2009)

4.1.3 Arlington, Virginia

Arlington is run by a county government under the Virginia Constitution and contains 26 square miles of land. Formerly part of the District of Columbia, and known as Alexandria County, it was retroceded to Virginia in 1847. Per Virginia law, cities must withdraw from their governing counties upon incorporation, so when the city of Alexandria left in 1852, the name eventually was changed to Arlington county in 1930. When the Washington Metro system was proposed, Arlington County was one of its biggest supporters (County of Arlington, 2009) and the Rosslyn-Ballston corridor (now the Orange Line) was one of the first segments opened to service. Arlington benefits from its immediate proximity to Washington's downtown and Federal Triangle, with rail transit making Arlington a reasonable commute option for workers in the capital city, as well as a proximate location for back-office departments.

Figure 4.5: Locator Map, Arlington

The transformation of Arlington from sleepy, automobile-oriented suburb to high-density transit oriented community was dramatic. The population density in the 1980 census was [number] (Census 1980), but by 2000 had reached 7,995 people per square mile (Appendix B). Three major factors contributed to this growth: 1) height restrictions in the District of Columbia that limit the amount of office space that can be built near the Capital and White House; 2) the Metro Orange and Blue lines creating efficient transit options to and between the Pentagon and central Washington; and 3) specific transit-oriented plans and subsequent development adjacent to the Metro stations.

The Rosslyn-Ballston Metro corridor (Orange Line) was opened in 1979, followed by a four-station extension to Vienna, VA in 1986. Politically, Arlington's support for rail transit, as opposed to Georgetown's opposition, is well-documented (Cervero et al, 2004). Low density in northern Arlington, and the lack of an already-developed historical core (such as Georgetown or Old Town Alexandria) made the area's potential for growth larger and more attractive. Arlington began assigning station areas as high-density zones immediately following opening, most notably in Rosslyn. Periodic revisions came in 1983, 1987, 1990, 1996, and 2000. From 1979 to 1987, the county used PUD to redevelop immediately adjacent. Only in the 1990 zoning update do notable Smart Growth terminology appear, such as the "urban village" designation (County of Arlington, 2009).

Figure 4.6: Courthouse Square (Arlington) 2000 and 2009

Arlington's 1996 General Plan has been cited as an excellent example of incorporating TOD development. It is clear that advanced and intentional planning and enforcement greatly contributed to the transformation of Arlington. By 2005, Arlington was ranked first most walkable city by the American Pediatric Association (County of Arlington, 2009).

4.1.4 Robbinsville, New Jersey

Robbinsville is located in the greater Philadelphia metropolitan region, a suburb of Trenton in central New Jersey. Originally Washington Township (one of seven Washingtons in the New Jersey alone), Robbinsville took its name from one of its older subdivisions in order to avoid confusion (Schweber, 2007). The township was recognized by Smart Growth organizations after facilitating the creation of Town Center, a very dense neotraditional community on a large greenfield area adjacent to the town's busiest intersection of Federal Highway 130 and State Route 33.

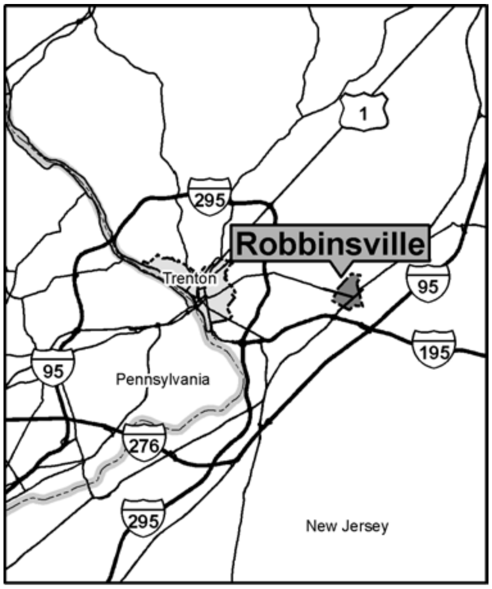


Figure 4.7: Locator Map, Robbinsville

The Town Center development opened in 2001 with a $40,000 "smart growth" grant from the state of New Jersey. It is the major reason for inclusion in this case study. Due to cutbacks by the New Jersey Department of Transportation, Robbinsville has been unable to put in place necessary traffic calming on Route 33 in order to create the commercial center they envisioned. This has led to a loss of anticipated sales and commercial property taxes, which has in turn stressed educational and civil infrastructure burdened by increased density (Strauss, 2005).

Figure 4.8: Town Center, Robbinsville

Results have been decidedly mixed. Town Center is popular and its units have sold quickly, and land values have risen relative to other Trenton suburbs. However, infrastructure, particularly schools and sewers, were overwhelmed by the sharp increase brought on by high-density land use (Bensen, 2007). Developable lots near Town Center have been placed into eminent domain in an attempt to curb population growth until funding for and improvement of infrastructure can be accomplished (Heavens, 2007). As of 2009, Robbinsville is a strange hybrid, mostly a conventional suburb with some agricultural land on the fringes, but featuring a new and difficult-to-absorb high-density TND in its center.

4.2 Best Practices: Plan

The case studies in this section are showcases of the Smart Growth planning movement. As best practices of planning principles spread from theory into practice, an increasing number of cities, towns, and counties are adopting Smart Growth plans with great fanfare and expectations. This study seeks to determine if these plans have been effective in reaching Smart Growth goals. For the cases studied, adoption of Smart Growth plan took place between 1990 and 1995, allowing

15-20 years of subsequent development to elapse so the effects (if any) of the plan can be evaluated.

In this study, the independent variable, and requirement for selection, is the type of plan instituted, while the dependent variable is the subsequent changes in urban form patterns. Therefore, cases have been located using Smart Growth awards (Crawford et al 2005, Smart Growth Network 2009) or mention as best new plans in previous literature (Cervero et al, 2006).

4.2.1 Flower Mound, Texas

The town of Flower Mound is a suburb of Dallas, located in Denton County on the northern shore of Grapevine Lake. It is named for a prominent 12.5 acre mound covered by wildflowers, believed to be an artifact of Native American culture (Town of Flower Mound, 2009b). Like most cities in the Dallas-Fort Worth metroplex, Flower Mound was mainly agricultural land until extensive suburban expansion followed the Second World War. During the 1990s, Flower Mound experienced drastic growth, estimated by the Census Bureau to be 226.54% over the ten years between the censuses (Town of Flower Mound, 2009a). This tripling (from ~15,000 to ~50,000 residents) led to the passage of the "SMARTGrowth Management Plan" in 1999. Growth management concerns cited were typical of rapidly suburbanizing areas: disappearance of agricultural land; impact on traffic, sewers, and schools; drastic change of character from rural to generic suburban (Town of Flower Mound, 2009a).

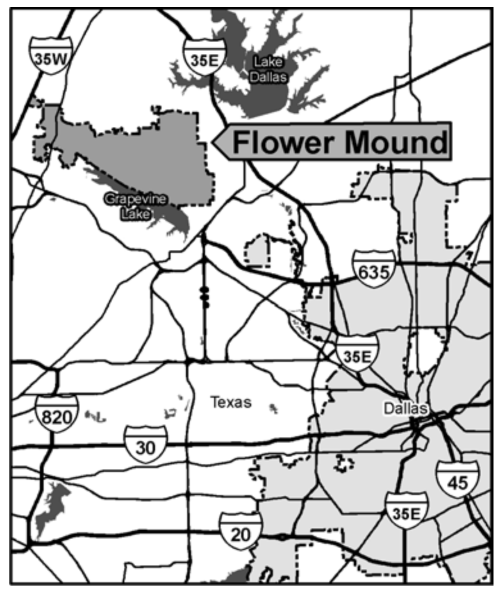


Figure 4.9: Locator Map, Flower Mound

Although Flower Mound's SMARTGrowth program pays lip service to Smart Growth principles, it is in content and practice a convent-ional suburban growth management plan. They mention "trails providing pedestrian access be-tween residential neighborhoods and schools and retail areas" (Town of Flower Mound, 2009a), but there is no mixed-use town center under development. Primary use continues to be single-family, automobile-oriented in its scale and design, and agricultural land, though officially placed on hold, has been developed despite that.

4.2.2 Suffolk, Virginia

Suffolk, Virginia is on the western fringe of the Norfolk-Hampton Roads-Virginia Beach metropolitan region, which is America's oldest and Virginia's largest. The current boundaries of the City of Suffolk are the result of a 1974 merger of the town of Suffolk and surrounding

Nansemond County. This heritage leads to a strange mix of civic characters: the central town, still known as Suffolk; older, satellite towns such as Crittendon and Whaleyville; large tracts of rural land; and the protected wetlands of the Great Dismal Swamp. Competition for resources between the central city and outlying areas continues to be a divisive issue in civic government (Williams, 2007).

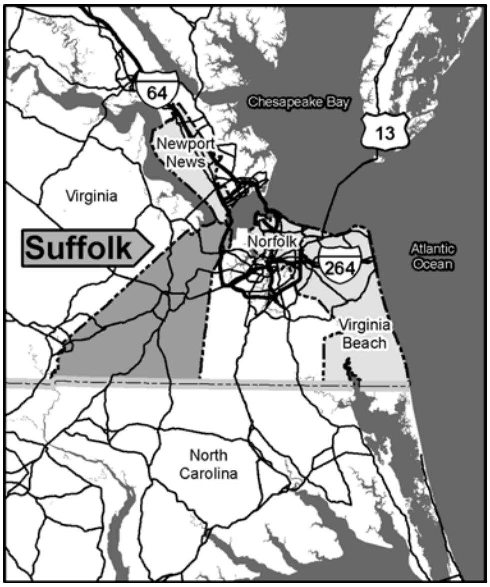


Figure 4.10: Locator Map, Suffolk

Because of the diverse and competing cities, towns, and rural crossroads contained within Suffolk's boundaries, creation of General Plans is a complicated process. For the purposes of this study, specific area plans generated for the traditional boundaries of the old town of Suffolk are examined. Prepared by Urban Design Associates, the CBD-specific plan recommends extension of streets and construction of major downtown nodes to serve as assets around which to attract infill development.

Suffolk has also instituted plans for its northern section, which is under the most growth pressure due to its proximity to Norfolk. Despite these efforts, northern Suffolk continues to grow fastest. Suffolk's planning history is one of tension between its urban and rural areas, seeking to balance growth, economic development, and resources between them (Williams, 2007).

4.2.3 Huntersville, North Carolina

Huntersville is a suburb north of Charlotte, North Carolina. Mecklenburg County, which contains them both, was one of the fastest-growing counties in the US from 1990 to 2000 (Census 2000). A freight rail line runs through downtown Huntersville, and Mecklenburg County is considering it for commuter rail service to central Charlotte on the proposed North Line (Harrison, 2009). With the completion of Interstate 77, Huntersville's location 12 miles from central Charlotte made it an ideal commuter suburb, and growth has continued since then. The completion of the northern

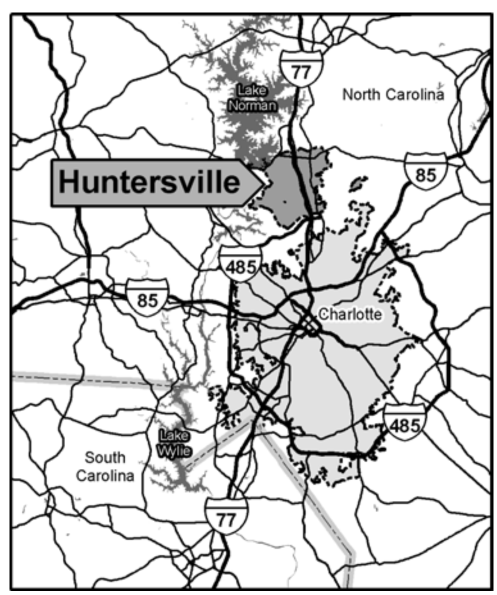


Figure 4.11: Locator Map, Huntersville

section of Charlotte's beltway (Interstate 485) at the southern edge of Huntersville will decrease travel times and likely increase demand.

In 1996, Huntersville approved permits for a TND called Vermillion, a residential subdivision in the neotraditional mode designed by Duany-Plater-Zyberk (DPZ). In their report, DPZ suggested a possible infill design for downtown (City of Suffolk, 2005). In 1999, Huntersville acquired the defunct Anchor Mill, a very large parcel downtown, and DPZ submitted a very dense, downtown mixed-use proposal in response to the RFP for redevelopment. Although it was considered "the winner," the plan was never ratified or instituted. The current governing plan for the Downtown Area Master Plan, completed by the town in 2005 (City of Suffolk, 2005).

Figure 4.12: Neotraditional Development "Vermillion", Huntersville

In addition to Vermillion, several other neotraditional neighborhoods have been built in Huntersville. A mile and a half west of downtown, near the interchange of Interstate 77 with Gilead Road (the main road to/from downtown) is the neotraditional development of Rosewood. Four miles to the north, Birkdale Village is a neotraditional community with retail adjacent to the arterial Sam Furr Road and high-density residential with pedestrian access just behind it. Just opposite Interstate 77 on Sam Furr Road is a conventional big-box center with automobile-oriented low-rise office space, also built after 2000.

Huntersville represents something of a Smart Growth contradiction, as it is developing multiple neotraditional neighborhoods, but on greenfield land, separated from each other, and connected only by conventional automobile-oriented strip highways. Meanwhile, increased road connectivity, block shortening, and infill development lag in downtown.

4.2.4 Petaluma, California

Petaluma, located in Sonoma County north of San Francisco, is famous in California for being a planning pioneer. The first city on the west coast to attempt growth management and urban growth boundaries, Petaluma is now embracing the Smart Growth movement. Petaluma began as a riverfront settlement, connected by the tidal Petaluma River to San Francisco Bay. Its economy was based on transporting goods from the surrounding farmland to gold-rush boomtowns accessible by the Sacramento River. After completion of the Golden Gate Bridge and extension of the Redwood Freeway (US 101) north through Marin County, Petaluma faced growth pressure as an attractive commuter suburb.

Petaluma's relationship with urban planning is long and storied. As the first to adopt a growth management strategy, it was often at the center of court battles testing the policy's constitutionality (Harris, 1988). Successful implementation of growth management has prevented surrounding areas from being developed, which mostly remain in agricultural use or protected wetlands. Petaluma has shown its willingness to experiment with planning policy by implementing an urban growth boundary (a policy generally applied at the metropolitan level), extensive use of planned unit development (PUD), and mixed-use zoning (Meck and Retzlaff, 2008). While Petaluma has successfully limited leapfrog development and its rate of geographic growth, new neighborhoods have been conventionally suburban, automobile-scaled with cul-de-sacs and big-box retail (Lewis, 2001). Petaluma's latest act of planning pioneering is to embrace Smart Growth policies and principles in an effort to preserve its distinctive historical downtown and prevent sprawl in the agricultural areas surrounding the city (Young, 2006).

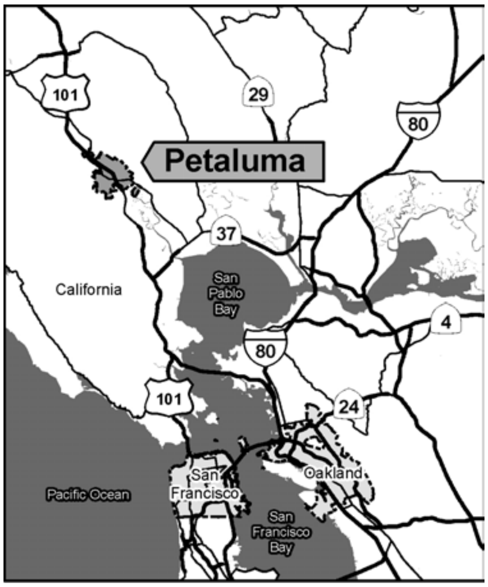


Figure 4.13: Locator Map, Petaluma

5. Analysis of Plan Contents

Chapter 5 contains the analysis of the first set of cases. The goal of the first study is to determine whether the desired outcomes are the result of regulatory procedures, other market or geographic circumstances, or simply random chance. The cases in this study are selected because their current urban form patterns (the outcomes of the last 15-20 years of urban development and evolution) embody the desired traits specified by Smart Growth principles. These cases are analyzed for the presence of in-common regulatory and/or other planning interventions that may provide an explanation for these outcomes, which would prove correct the hypothesis that regulatory interventions are requisite to transform suburban sprawl into urban communities. It is also possible that non-policy factors, such as accidents of geography or circumstances of infrastructure (natural or cultural features that consistently generate demand for growth, proximity and accessibility to CBD, position in metropolitan transit network, etc) that would indicate a third factor is causing the apparent correlation. Finally, the null hypothesis is indicated if there is no commonality, suggesting that Smart Growth outcomes are not correlated at all with the implementation of Smart Growth policy nor with any other identifiable geographic or infrastructure factor.

This chapter is organized around a set of Smart Growth policy principles as outlined in Chapter 3. For each principle, each of the four case studies (Arlington, Walnut Creek, Robbinsville, and Huntington Beach) are investigated for the presence or absence of regulations, ordinances, or policies that directly and/or explicitly address that principle as a planning, policy, and urban form goal. The source material for such regulations, ordinances, and policies is the successive revisions of general plans, specific plans, zoning ordinances, from the last twenty years (1989 to 2009) in each city or town. Explicit mention and use of Smart Growth principles in the planning literature indicates that current patterns of urban form are those that were envisioned and pursued (as opposed to accidentally produced while intending to preserve the automobile-oriented status quo). Absence of this suggests that geography, infrastructure, market forces, or even simple randomness are better explanations for current urban form.

5.1 Smart Growth

The term “Smart Growth” has become an umbrella term for planning principles that are the inverse of suburban sprawl: compact development, pedestrian orientation, mixed-use, multiple housing types and other hallmarks of traditional pre-war urbanism (Smart Growth Network, 2009). It is a highly politicized and contested term, especially to urbanists who are uncertain that suburban sprawl is “dumb growth” (Gordon and Richardson, 1998 & 2000). However, it is an identifiable group of planning principles and associated patterns of urban form, and as such is the subject of this analysis.

The set of measurements in Section 5.1, are directly associated with Smart Growth as constructed by its national network of advocacy groups (Smart Growth Network, 2009). They are: the inclusion and expansion of mixed-use zones; expanded variety of housing type, size, pricing, and opportunity; traditional neighborhood design (TND) as advocated by the Congress for the New Urbanism (2007); design review of relationship to the street, civic concinnity[1], and transit-friendliness; and expanded transportation choices beyond the automobile to accommodate and encourage pedestrians, bicycles, bus, and rail transit.

Table 5.1: Inclusion of Smart Growth Principles in Plans

	Walnut Creek	Huntington Beach	Arlington	Robbinsville
Mixed-use zones	+	+	+	
Housing opportunity	+		+	+
Traditional neighborhood design				+
Design review	+	+	+	
Transportation choices	+		+	

Each + in the above table indicates that the Smart Growth principle has been applied or included in the planning legislation and documents by the case city within the last 20 years. These measurements are binary because the unit of analysis in this part of the study is the plan as published, meaning that text, policy, and/or ordinance that fits these principles is either present or not. While not all principles are mentioned, addressed, and implemented in all cases, every city has made use of some Smart Growth policy on its way to achieving its goals.

5.1.1 Mixed-use zones

Mixed-use zoning is somewhat of an oxymoron, as it seeks to encourage through zoning an urban form pattern which preceded zoning law, and may be a cause in the reduction of mixed-use areas nationwide (Pendell, 1999). The separation of uses is the very DNA of zoning, so trying to reintegrate them via regulation at first seems odd. However, a great deal of progress has been made in verifying the legality of statutes in the courts that specify FAR, building envelope, and call for first-floor retail without specifying use (Lindgren and Mattas, 2003; Duany, Speck, and Lydon, 2009). As first-floor, street-front retail is a hallmark of urbanism, most cases include mixed-use or special specific PUD project boundaries with the intention of improving the pedestrian environment through mixing uses.

[1] The term "civic concinnity" is defined by Michael Childs as emphasizing that "the independent designers of the parts of the city should also compose how those parts of the city should also compose how those parts add to the whole of the town" (Childs, 2009).

In Walnut Creek, mixed-use zones are found only in the Golden Triangle, in close proximity to the BART station, with the goal of connecting the existing core to the train station. The 1989 General Plan describes it as “intended to encourage a combination of high intensity office and residential uses, with ground floor retail shops” (City of Walnut Creek, 1989). Although Walnut Creek’s retail core (Main Street to Broadway Plaza) is well-known as a walkable neighborhood, it is actually not a mixed-use area (it is zoned for retail alone). Office workers and nearby residents must cross multi-lane arterials such as Mount Diablo Boulevard to access retail. Since passage of the 1989 plan, only one mixed-use project has been built, indicating that Walnut Creek’s reputation as pedestrian-friendly is not connected mixed-use urban streets.

The original downtown core of Huntington Beach is built on 117 blocks on a traditional grid with small blocks and alleys. Of these, 14 blocks are zoned “Downtown Core Mixed-Use” and two are zoned “Visitor-Serving Mixed use” according the Downtown Specific Plan (City of Huntington Beach, 1994). Twelve of these blocks line either side of Main Street, moving up the first six blocks from Pacific Coast Highway and the main points of beach access. As a result, other than Main Street and a handful of cross streets, there are no mixed-use zones or developments outside a small area of downtown. In that small area of downtown, however, a significant transformation into mixed-use with office and residential above retail has been successfully pursued (Silva 2008, Aragon 2007). Huntington Beach’s downtown transformation can be seen as purposeful and premeditated, as recorded in its successive Downtown Specific Plans.

Arlington has made the most extensive use of mixed-use zoning for the longest period of time. It first appears in their land use revision of 1983, and expands into three density tiers by 1987. The highest category, designated Coordinated Mixed Use Development District, has an “allowable up to 6.0 FAR with office not more than 3.0 FAR” (County of Arlington, 2009). This is a novel way of encouraging mixed use through density bonuses as opposed direct specification (eg, retail on the first floor). It has engendered some interesting vertical arrangements (residential above office) but also horizontal arrangement (separate office and residential with their own elevator shafts going up the same tower).

In the neotraditional developments of Robbinsvile, retail and residential areas are adjacent and pedestrian-accessible, but uses are not mixed, which is not unusual for TND (Southworth, 1997).Mixed-use does not appear in the planning documents in Robbinsville. Mixed-use zoning is used in 3 of 4 cases; however, only Arlington has used it extensively and effectively. Huntington Beach has made effective changes in use mixture, but only in a very limited area of its traditional downtown. And though the opportunity is provided for in Walnut Creek, development has not occurred in zones where it is permitted. As an urbanization tool, mixed-use zoning seems to be widely applied but rarely.

5.1.2 *Housing opportunities*

Alternative housing opportunities is considered a central tenet of Smart Growth because so much of suburban sprawl is based on the detached single-family home. Racial and political issues, in conjunction with mortgage and financial policy in the United States has generated race and class barriers associated with single-family home ownership (Gastler, Hanson et al, 2001). Therefore, it is necessary to provide a wider array of housing types in order to accommodate the broader workforce necessary for thriving urbanism (Langdon, 1994).

Walnut Creek makes provisions for the construction of high-density multi-family housing at the borders of the core, but has never initiated the addition of residential to existing or new buildings in the Pedestrian Retail heart of the core. Instead of waiting for market demand and developers to bring projects downtown, the City initiated specific plans such as Alma Avenue and East Mount Diablo Boulevard to define the scope of multi-family projects and then solicit developers for already-entitled bids (Alma Avenue Specific Plan, 1987; East Mount Diablo Specific Plan, 1999). These multi-family projects are in Walnut Creek’s central core, but constructed peripherally to its office and retail center. The majority of Walnut Creek’s population lives in multi-family units (Appendix B), indicating that the housing market has driven the expansion of housing opportunity more than planning intervention.

Housing regulations in central Huntington Beach specify multi-family residential for the few remaining unbuilt parcels within ¼ mile from Main Street (City of Huntington Beach, 1994). However, a key to the traditional downtown’s neighborhood character is its alleys, with garages facing the rear, providing walkability and increased street parking. The City is careful to specify that any remodeling and/or infill development maintain this arrangement (City of Huntington Beach, 1999). The city remains mainly single-family home oriented, and its urban character stems more from the tightly packed houses on small lots (a consequence of coastal land values) than a vibrant mix of housing types generated in accordance with regulatory measures, suggesting, as with Walnut Creek, that market forces are the stronger cause.

Arlington’s initial transit-oriented housing plans called for some medium-density development near Metro stations, but broader market forces intervened. The condo boom of the 1990s and the real estate bubble of the 2000s led to the development of much more residential and far less office than called for in the early land use plans of 1987 and 1990. Again, in this case the housing market became a driver for multi-family unit construction than planning policy.

Housing diversity is an essential ingredient in TND, and Robbinsville’s success has been directly attributed to its (unique for the metro area) wide selection (Strauss, 2005). However, like most of Robbinsville’s agenda, housing diversity is contained within TND policy, and so is addressed in Section 5.1.3.

The presence of residential density and diversity is a major driver of pedestrian traffic, retail vitality, and the elusive quality of urbanism (Jacobs, 1961). Therefore, it is popular to include in

Smart Growth regulations provisions that planners hope will lead to construction of multi-family units. However, many multi-family units were constructed during the 2000s across the United States because of the confluence of economic, financial, and consumer trends (known as the ‘condo boom’). It is unlikely that zoning and planning regulations were causal, creating the increase in housing diversity. However, increasing areas where multi-family construction was permitted allowed the case cities to take advantage of a market cycle in which developers were eager to construct multi-family housing.

5.1.3 Traditional neighborhoods

Traditional neighborhood development (TND) is a detailed and complicated method of regulating development, and therefore a costly, slow, and difficult way to generate urbanization (Preston 1998, Stewart 2003). It is generally ineffective in changing existing neighborhoods, and so requires greenfield land to build on (Gutfreund, 2004). In this study, only the Robbinsville case had sufficient vacant land to utilize TND as a major step toward transforming its suburban character.

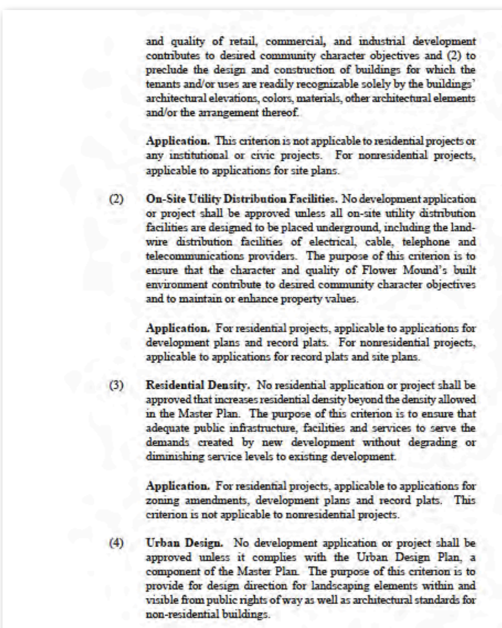
Robbinsville Township happened to have greenfield land available adjacent to its busiest intersection (US 130 and NJ 33) and decided to pursue a TND strategy. It had a retail component (taking advantage of traffic on Route 33) and an adjacent residential area. Small, connected blocks, wide sidewalks, and direct pedestrian access to schools and parks. Concern and controversy accompanied the project, due to concern about the strain on infrastructure (Graham et al, 1999a; Graham et al, 1999c). The first phase TND, known as Town Center, was completed in 2003 with decidedly mixed results: home values are high and the waiting list is long, but the strain on infrastructure has become reality (Belson, 2007). Overall, Robbinsville has become known as a ‘different’ community from conventional suburban sprawl, and the establishment of this reputation is clearly due to pursuit of TND regulation and development strategy since the late 1990s.

5.1.4 Design review

By specifying design guidelines at the plan and ordinance level, or sometimes at the specific planning level, cities place themselves in the position to review architectural designs for compliance, civic concinnity, and some intangible design elements that contribute to urban character. This extends beyond numerical requirements such as FAR or setback and height requirements and into the subjective, qualitative realm of aesthetics. However, qualities that extend beyond the building and embrace civic concinnity must be validated by the town. Some of the case plans present detailed and illustrated requirements to developers, which helps make it clear what is needed to earn approval.

Walnut Creek's General Plan includes a sub-element (optional under California law) on building design to control the "character and form" the overall city takes. It is comprised of 15 policy programs which range in detail from height minimums and maximums to broader subjective terms such as "consider urban design strategies to improve pedestrian circulation" and "encourage renovation of historic structures which retains and/or reveals historic elements." The General Plan and Zoning Ordinance do not specify the placement and massing of buildings within parcels, even in the Pedestrian Retail category, which is "intended to provide an array of retail and personal services that are accessed by people on foot" but stops short of specifying building up front/parking in the rear of other such specifications. However, this type of detail is usually addressed in the specific planning process, exemplified by the Locust Street Extension Plan, which has many detailed, to-scale architectural drawings and renderings obtained from professional architects at considerable expense to the city (City of Walnut Creek, 1994).

While there is no design element in Huntington Beach's General Plan, the Downtown Specific Plan is extremely specific in its addressing of design guidelines. Arrangement of buildings and masses, parking lot screening, placement of service and loading areas, signage, and civic concinnity are outlined in detail (City of Huntington Beach, 1994). The section is printed in full color with extensive illustrations and diagrams, making it clear what is required to pass thru the design review process. Figure 5.1 is a comparative illustration between Huntington Beach's extensively visual and illustrated design guidelines on the right and Flower Mound's entirely text-based descriptions on the left:



and quality of retail, commercial, and industrial development contributes to desired community character objectives and (2) to preclude the design and construction of buildings for which the tenants and/or uses are readily recognizable solely by the buildings' architectural elevations, colors, materials, other architectural elements and/or the arrangement thereof.

Application. This criterion is not applicable to residential projects or any institutional or civic projects. For nonresidential projects, applicable to applications for site plans.

(2) **On-Site Utility Distribution Facilities.** No development application or project shall be approved unless all on-site utility distribution facilities are designed to be placed underground, including the land-wire distribution facilities of electrical, cable, telephone and telecommunications providers. The purpose of this criterion is to ensure that the character and quality of Flower Mound's built environment contribute to desired community character objectives and to maintain or enhance property values.

Application. For residential projects, applicable to applications for development plans and record plats. For nonresidential projects, applicable to applications for record plats and site plans.

(3) **Residential Density.** No residential application or project shall be approved that increases residential density beyond the density allowed in the Master Plan. The purpose of this criterion is to ensure that adequate public infrastructure, facilities and services to serve the demands created by new development without degrading or diminishing service levels to existing development.

Application. For residential projects, applicable to applications for zoning amendments, development plans and record plats. This criterion is not applicable to nonresidential projects.

(4) **Urban Design.** No development application or project shall be approved unless it complies with the Urban Design Plan, a component of the Master Plan. The purpose of this criterion is to provide for design direction for landscaping elements within and visible from public rights of way as well as architectural standards for non-residential buildings.

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1) Proportions that are historically related to the selected architectural style should be achieved.
2) The characteristic proportions of traditional facades should be reflected in new infill development.
3) Entries should be proportional to the overall building massing.
4) Proportion and scale are important in the design of arches and columns. Careful attention should be given to the ratio of height, width, and depth of arches to emphasize strength and balance.
5) The relationship between the height of a column and its mass or thickness should be visually consistent with the weight of the overhead structure the column supports.

Proportion and scale are important in the design of arches and columns

Chapter 4

4.2.3.4. Continuity

Continuity among individual buildings in the area contributes to community identity, levels of pedestrian activity, and economic vitality. Commercial street facade rhythm helps to visually tie the downtown streets together.

1) Design solutions should take into account the physical scale of the area and adjacent buildings.
2) Infill buildings that are much wider than the existing facades should be broken down into a series of appropriately proportioned structural bays or components.

Continuity among individual buildings is important to creating a pleasing streetscape

Figure 5.1: Comparison of Design Guidelines, Flower Mound and Huntington Beach

The inclusion of multiple visual depictions of design guidelines and concepts is clearly valuable to developers, architects, and designers who plan and design using visual media. Among the cases, Huntington Beach has made the most extensive and effective use of design review policies and processes.

Arlington's guidelines do not have a specific design review. However, some high-density zones in residential, commercial, and mixed are designated "coordinated development" and require that the county be a co-designer in the development process (County of Arlington, 1994). Major high-rise projects immediately adjacent to Metro stations have been designed, approved, and completed with the county as partner in the process. Market trends have also played in a role in design, as most of Arlington's new housing, office, and retail developments do not vary from aesthetic trends in the Northeast during this time period.

Because TND is a design-based regulatory method, design review becomes redundant to the (Duany and Plater-Zyberk, 2006), and no specific review process was instituted in Robbinsville. Its central neotraditional areas are designed through its TND regulations while other developments do not require aesthetic approval. Whether formalized in ordinance or not, all cases engage in design review or design partnership on at least major projects. Major projects set the tone for the rest of core area, and most other developments take their cues from them (Childs, 2009). Design review is a hands-on, process-oriented method of directly directing the form infill and redevelopment take, and makes it one of the most universally applied methods in this survey.

5.1.5 Transportation choices

Providing alternate modes of transportation, and increasing density around transit stations, is a key ingredient of Smart Growth. Numerous volumes have been written about the transportation-land use connection (Cervero and Landis, 1995). Transportation by automobile is unavailable to children, the elderly, and the disabled. Remaking the urban environment to ease and/or encourage the use of pedestrian, bicycle, bus, and rail modes of transportation are considered essential However, bus and rail transit are not under the control of the case cities, which are situated in broad regions. Two cases, Walnut Creek and Arlington, are connected to heavy rail transit systems, but only Arlington has successfully integrated rail transit into its growth patterns. Robbinsville and Huntington Beach have regional bus access, but do not have high-frequency or rapid bus service. All of the cases mention increasing pedestrian friendliness, especially in their cores, but none of the cases mention bicycling as a transit option or include a bicycle network plan.

Walnut Creek's plans have, since its construction in 1986, envisioned surrounding the BART station with mixed-use, mainly high-density residential. However, the focus continues to be the Pedestrian Retail core and the Golden Triangle office buildings one mile to the south. The North

Main Street Specific Plan (City of Walnut Creek, 2001) presented design ideas on integrating the BART station area to the cores, but have not been ratified or executed. While rail transit would seem to be an obvious contributor to urbanization, in the case of Walnut Creek it has neither been the locus of development by virtue of its own existence, nor a focus of civic policy as a tool for urbanization.

Huntington Beach has not included any transportation policies in its planning documents. Although OCTA bus service runs along its major arterials, Main Street has no transit hub or special service. Additionally, the density of parking garages in the downtown area show clearly that, despite design elements to make Main Street pedestrian-friendly, automobiles continue to be the expected mode of transportation in and around Huntington Beach. No bicycle plan or design policy on bicycle lanes exists yet.

Similar to Huntington Beach, Robbinsville continues to be automobile-oriented outside the TND development at Town Center. Initial plans called for a pedestrian-accessible retail area in the buffer zone between Town Center and the busy Route 33. However, Robbinsville's traffic-calming proposals are contingent upon construction of an auto bypass for Route 33, but so far the New Jersey Department of Transportation has declined to construct it. Although freight rail lines run through Robbinsville parallel to Route 130, there is no passenger service. The nearest commuter rail is 3 miles away on the Trenton-New York line; Robbinsville does not provide shuttle or bus service to/from the station.

Arlington is the great exception on alternative transportation; it has Metro as the centerpiece of its transformation and its tool for generating demand. Although Arlington is smallest in land area of all the counties served by Metro, it has more stops than any other (County of Arlington, 2009). Long before Arlington reached its current urban densities, it relied on the transit stations to justify high density development and attract residents. Along Wilson and Clarendon Boulevards, transit-oriented development has been instrumental, and the county argued for and won a large number of stations very close together, different from commuter rail-style of the Red Line in Maryland. Without its geographic position on the Metro rail system, Arlington acknowledge it would have been unable to successfully accomplish its urban transformation (County of Arlington, 2009).

Although it is often assumed that multi-modal transportation plays a critical role in stimulating Smart Growth, it is not at all universal in these cases. Arlington clearly made it the centerpiece; however, Walnut Creek's densification did not occur next to its BART station, and the city continues to wrestle with ways to integrate it into the retail core. Huntington Beach is in a metropolitan region known for auto-dependence, but seems to have rebuilt its traditional streetcar-patterned core without reintroducing rail choices. Robbinsville, in the heart of the Northeast Corridor, is in a region famed for its transportation networks and choices, has created popular Smart Growth with auto-accessibility alone. Therefore, it is not possible to conclude that transportation choices are requisite to creating Smart Growth, implying that suburban cities without transit stops or in regions with no rail systems may yet be able to accomplish it.

5.2 Sprawl Slowing

In addition to the more-or-less 'official' Smart Growth policies organized by the Smart Growth Network and analyzed in Section 5.1, there are less popular or less well-known policy interventions that have the goal of sprawl-busting. These 'sprawl-slowing' measures are examined in section 5.2. While they are not necessarily under the Smart Growth umbrella, they are nonetheless tools proposed policy tools that might help achieve desired outcomes. They include: the establishment and enforcement of an urban growth boundary; financial or approval incentives to increase infill development; acquisition and protection of open space; cluster zoning; and the levying of impact fees or concessions.

Table 5.2: Inclusion of Sprawl-Slowing Principles in Plans

	Walnut Creek	Huntington Beach	Arlington	Robbinsville
Urban growth boundary				
Infill development	+	+	+	+
Open space preservation	+		+	+
Cluster zoning				
Impact fees and concessions		+		

Each + in the above table indicates that the sprawl-slowing concept has been applied or included in the planning legislation and documents by the case city within the last 20 years. As in Table 5.1, these measurements are binary because text in a plan is either present or not. Unlike more heavily promoted and currently discussed Smart Growth principles, these less conventional measures are less popular among the case studies.

5.2.1 Urban growth boundary

The urban growth boundary (UGB) has been used as a regulatory attempt to prohibit growth on the fringe and so preserve agricultural uses, and as a side-effect, cause infill in existing neighborhoods (Marin, 2007). The most famous and well-studied UGB surrounds the Portland metropolitan region (Song and Knaap, 2004), but at the regional level is outside the scope of this study. A UGB policy is not present in any of the cases, but there is a significant possibility that this is result of the case study selection method, as each case is required to be in a larger metropolitan region yet free from metro-level policy intervention like Portland's. Arlington and Huntington Beach have reached buildout and Walnut Creek's open space is state parkland, leaving only Robbinsville as a candidate. UGBs tend to be metropolitan-level policy, or to be more useful for stand-alone cities on the fringes nearly surrounded by agricultural land (Payne, 2007). The case cities have all achieved urbanized form patterns without the use of UGBs.

5.2.2 Infill development

Policies that encourage infill development through economic incentives and approval process simplifications are touted as frequently as transportation choices as a necessary method of controlling sprawl. For the purposes of this study, infill planning policy consists of upzoning and economic or approval-process incentives designed to make it faster, cheaper, and easier to develop on vacant or underutilized parcels in the core, as opposed to greenfield parcels on the periphery (Steinacker, 2000). Certainly, a great deal of infill development has occurred in each of the cases, as it is necessary to transform a suburban area into an urban community, which it turn was required in their selection. However, the measurement in this section is whether planning policy and legislation has been explicitly and specifically geared toward facilitating and expanding infill development.

Walnut Creek has succeeded in generating infill development, but not through approval and economic incentives. While revisions to the General Plan and zoning ordinance have increased available building envelopes in the downtown core (City of Walnut Creek, 1984), actual infill development has only been achieved via specific plans such as Alma Avenue (1985) and East Mount Diablo Boulevard (2001). The greatest amount of active participation by city, and the single largest infill project, came with the Locust Street Extension Specific Plan (2000). Infill development that has occurred in Walnut Creek has been the result of design-oriented specific planning instead of incentive-based planning policies.

As Huntington Beach reaches build-out, infill planning will be its only option if the city is to encourage and accommodate continued growth. The city has embraced this future by creating redevelopment zones in accordance with California state law, offering to rebate some of the tax increments as an economic incentive to builders (City of Huntington Beach, 1996). The defunct Huntington Beach Mall has been redeveloped recently as lifestyle center Bella Vista and has land set aside for future multi-family residential units (Barboza, 2008). However, the center is far from any pedestrian-oriented node and adjacent to the San Diego Freeway; with the end of the condo boom, even the city’s incentives are unlikely to be enough to lure a developer. The densification of Main Street and the Pier recreational area has been done in accordance with the successive Downtown Specific Plans (City of Huntington Beach, 2004).

Arlington County has been well settled for centuries, but the transition from rural to suburban occurred, as is typical, after World War II. All of its agricultural land was lost by 1961 (County of Arlington, 2009), so infill development has been its de facto method of growth throughout its Smart Growth transformation, beginning the mid-1970s. Without any need to shift the economic balance between infill and greenfield developments, Arlington has not utilized infill policy or incentives. Instead, the county's economic development concerns have been coextensive with the pursuit of infill development.

Robbinsville was criticized for building Town Center on greenfield land (Graham et al, 1996b). However, the fields were in the geographic center of the township, and at the intersection of two major highways. It seems this space should be, despite not being developed previously, a target for development near the center, and indeed has become the new center.

Channeling development into upzoned and redevelopment areas is not universal among these cases, as Robbinsville selected a central agricultural area to become its new Town Center. However, the allowance of increased densities and the encouragement of redevelopment is present in all the plans of the cases here studied.

5.2.3 Preservation of open space

Placing open space under hold, direct protection, or public ownership, is effective in curbing sprawl because it removes development rights from land that might otherwise be threatened by increasing market demand. In the cases studied, public ownership seems to be the universal method of keeping open space undeveloped. Passing ownership up to the state or federal level is also popular, doubtless because it provides budget relief.

Walnut Creek's sphere of influence includes Mt Diablo State Park and the Shell Ridge and Lime Ridge Regional Open Spaces, passing ownership and cost of maintenance to the state of California and Contra Costa County. Huntington Beach's open spaces are either ecologically sensitive wetlands or Pacific oceanfront; both are under the control and supervision of the California Coastal Commission and the California State Park System. Huntington Beach has placed these areas outside its Sphere of Influence and therefore avoids jurisdiction over them. Arlington's main open space assets are the Potomac River and the Chesapeake & Ohio Canal. Its largest parcel of open space is the Arlington National Cemetery, a national park. As in Walnut Creek and Huntington Beach, all open spaces are owned by the state or federal government.

Robbinsville is the only case in this study with considerable open space still in private hands; most of it agricultural. Accordingly, conservation plans make up multiple sections of the General Plan, in addition to two appendices. However, the emphasis is on protecting land with high environmental sensitivity as opposed to agricultural uses. Therefore, plans attempt to regulate externalities, such as fertilizer and pollution runoff, flooding, and wetland water quality. What is noticeably not emphasized is limiting growth on agricultural land (Township of Washington, 1996). Protection of environmentally sensitive land is laudably important in Robbinsville; however open space preservation for the purpose of urbanization and urban form is not a priority.

Most of the case studies have very little developable land left, so remaining open space is not under threat from sprawl. This land tends to be owned by county, state, and federal governments, set aside as parkland or natural areas, and administered by others that the case cities. However, the case of Robbinsville provides and exception that merits further consideration. Without this case, it would be possible to propose that urbanization can only occur at or near build-out, that regulatory power is helpless to halt the conversion of agricultural or grazing land into suburban housing tracts, suggesting that Thornses and Simons (1999) are correct in concluding from their study that only when land runs out will development turn inward toward densification. However, Robbinsville prevents this generalization, suggesting instead that redirecting the type of development that occurs on greenfield land can be influential in creating urbanization without the necessary squeeze on available land.

5.2.4 Cluster zoning

Cluster zoning is not a tool used by any of the cases in this group. Perhaps this is because it is an anti-sprawl tool more applicable to rural areas than to rapidly urbanizing suburbs. As proposed by Randall Arendt (1996), cluster zoning suggests that housing in rural areas should be clustered in small portions of an enormous shared parcel, instead of 2-5 acres minimum lot size. All the cases in this set, however, continue to use individual parcel zoning instead.

5.2.5 Impact fees and concessions

The levying of impact fees and financial concessions is the inverse of creating economic incentives for infill development. The construction of additional power, water, and sewer infrastructure is necessary for sprawl and inefficiently used by low density residential. Transferring this cost to developers may cause them to reconsider infill as a less expensive option (Mansures, 2009).

Walnut Creek and Huntington Beach are reaching build-out; their remaining open spaces are environmentally sensitive, non-developable, and state-owned. In theory, no further extensions of sewage or street infrastructure will be necessary. Additional infill residential units could impact schools, but California law requires Mello-Roos financing, so impact fees are not written into the planning and zoning ordinances (Fulton, 2005). Likewise, Arlington does not utilize greenfield impact fees, with no developable land left. The most massive projects are undertaken in partnership with the county, and directed toward the Metro stops to minimize traffic impact, where impact fees would be counterproductive. Additionally, the county's purposeful pursuit of Smart Growth strategies was matched by an early push to ready infrastructure (particularly sewage) for increased density. Robbinsville did not include an impact fee structure in its TND code, and has come to regret it, as the popularity of Town Center among young families has strained its school and recreational facilities (Strauss 2005, Belson 2007, Heavens 2007).

In the cases studied, impact fees do not seem to be necessary to generate Smart Growth, but they are wise to have in place in order to accommodate its arrival. Rapid transformation of urban form and quick densification require that services and infrastructure be expanded. Impact fees have shown to be a good way to escape the chicken-egg problem of having the resources to expand infrastructure before it is dramatically impacted by infill and Smart Growth, but as the pace of growth is set by the market. However, without developable land on the periphery to assess fees upon, it can be detrimental to promoting infill by charging impact fees. The case cities have avoided this policy.

5.3 Requisiteness

Sections 5.1 and 5.2 reviewed the results of the survey of plans that made up the case studies of successful outcomes. This section analyzes across cases to spot trends and commonalities. First is a review of the policy ideas grouped as ‘Smart Growth.’ Second is a review of the policies designated ‘sprawl slowing.’ Finally, I attempt to answer the overall question of whether Smart Growth plans are requisite to accomplishing Smart Growth goals. Those policy points that are universal to all four cases are strongly suggested to be important points in achieving suburban urbanization goals.

5.3.1 Results: Policies associated with successful outcomes

In the category of Smart Growth tools, diverse housing styles are the universal tool. Mixed-use zones or more-specific TND are also widely used. Design review is sometimes present, but the automobile continues to be the dominant transportation concern.

Mixed-use zones are a popular method of encouraging urbanization. The ones that work (Huntington Beach and Arlington) require the mixture of uses (such as demanding retail on the first floor of both office and multi-family residential) (City of Huntington Beach, 2009). In Walnut Creek and Robbinsville, the mixing of uses in designated zones is permitted but not required, and actual mixed-use development has appeared in only a handful of these zones, while most of them remain in single use as the option was declined.

Housing opportunity is the central tool in generating urbanized cores. Multi-family housing, in the form of condominiums (owner-occupied) and apartments (renter-occupied) create the necessary density and diversity to drive retail and office demand. American mortgage policies that prioritize single-family homes have well-known racial and class side effects that result in homogenous neighborhoods (Bobo, 2001). New-construction rental and condo units attract a more diverse, yet still affluent, set of residents and bring density necessary to stimulate retail development (Garde, 2004), which then can attract office development (Garreau, 1991). Without the encouragement of multi-family housing, urbanization is not possible.

Traditional neighborhood development is stricter than mixed-use requirements and is more expensive and complicated to institute and enforce. However, in the case of Robbinsville, the Town Center TND was the single project that jump-started a revolution. While not the most popular tool, it clearly can be useful. Design review is only present in a single case (Walnut Creek), although the TND policies in Robbinsville require design review inclusive in the ‘traditional’ part. Design review is a tricky idea because ‘design’ can refer to the layout of buildings and massing relative to street, parking, and open areas, or to the aesthetic qualities of architecture. Because civic governments prefer to stay out of subjective debates about aesthetic quality, design review is a generally avoided policy choice.

Surprisingly, transportation choices are absent from these successful cities, demonstrating that success can be achieved even if an urbanizing city does not have access to a rail network. Although Walnut Creek contains a BART station, development near it is not designated for high-density residential, and no pedestrian connection to the core retail and residential areas exist. Although Arlington’s density is made possible by its multiple Metro stations, there are no clear policies in its plans or ordinances referring to bus, shuttle, or pedestrian multi-modal access expanding the options provided by heavy rail stations. And though ‘pedestrian’ is technically a transportation choice, no explicit mention beyond the vague ‘pedestrian-friendly’ or ‘-scaled’ or ‘-oriented’ is ever developed into a distinct, multi-modal transportation design.

Infill development is the most universal sprawl-slowing tool applied by the case cities. Creating larger building envelopes expands the ‘available space’ and ‘potential density’ that buildings may eventually achieve. Encouraging infill is ‘friendlier’ as it is a carrot instead of a stick, placing local government in an allied instead of adversarial position with developers.

5.3.2 Conclusion: Requisite

We can conclude from these observations that incorporating Smart Growth concepts into general plans and zoning ordinance is a requisite ingredient in successful urbanization. Room (opportunity) within the ordinance can be created by enlarging building envelopes, creating density bonuses, and enacting design guidelines that decrease parking lots, sideyards, and other wasted space downtown. However, plans and ordinances by themselves are not self-enforcing. They can be disregarded entirely, left unenforced, or die from a thousand cuts of easily earned variances. This survey of these four successful case studies shows that successful examples have indeed had Smart Growth plans in place, but coupled them with a political culture of enforcement and incentive.

The first mandatory ingredient is the creation of opportunity for infill and/or redevelopment in the core area. Opportunity is created in three ways 1) clarity of rules in the plan and ordinance; 2) direct economic incentives that increase profit margins relative to a non-incentivized zone; and 3) speedy of-right approval for conforming to desired infill designs. This requires a clear definition in the general plan of the exact boundaries of the ‘core area’ (Walnut Creek), ‘downtown’ (Huntington Beach), ‘transit corridor’ (Arlington), or ‘town center’ (Robbinsville). Developers need to be able to quickly determine whether a given parcel qualifies for increased density or other incentives designated for the core. Once the boundaries are designated, incentives such as density minimums, density bonuses, tax abatements, mixed-use designations, or clear design guidelines. Without these ‘carrots’, a cheaper greenfield parcel on the fringe will bring greater profit margins for the same construction, being as the land is cheaper, making fighting over the plan’s restrictions an affordable battle. The case study plans discussed in detail above work because the code is clear and easily understood by developers, and the ‘carrots’ of increased density, tax/fee relief, and speedier (thus less costly) approval can be input directly and quantitatively into a spreadsheet where the profit is obvious. For the translation of ‘opportunity’ (defined here as increased building envelopes in the core) into physical built outcomes, moving from ‘vision,’ ‘plan,’ or ‘ordinance’ into a direct calculation of profit (relative between an incentivized parcel to a greenfield parcel) is a necessary stop to get developer’s attention. The clarity and concision of plan’s boundaries, goals, bonuses, and limitations, that they can be easily read and monetized by developers, is key to the expression of Smart Growth goals within general plans, specific plans, and zoning ordinances.

However, no plan, once in place, is so legally airtight and quantitatively balanced that it alone moves development in the right direction. The presence of “political will” is evidenced by investing the planning department and planning commission with the ownership, funds, and clout to carry out the vision. Ownership means that planning professionals and commissioners buy into the goals established by the plan and sticking by its tenets. Instead of making variances easy to win, planners in Huntington Beach make the process difficult and expensive for developers, while speeding through those that conform (Barboza, 2008). Funding provided by the city to was paramount to the Andronico’s redevelopment/Locust Street extension in Walnut Creek. It was the city that paid the architects and planning consultants to draft a detailed plan and proposed design showing the developer very clearly what the city wanted. With this proposal in hand (and delivered free of cost) the developer’s architect quickly created a conforming design and it was built (City of Walnut Creek, 1985). Walnut Creek’s decision to spend limited local government funds on an expensive and very detailed specific plan reflects a political culture that makes plan enforcement a very high priority. Lending the planning department and commission clout is done by a city council and/or other elected officials backing the commission’s decisions. If the planning commission is well-funded and dedicated to plan enforcement, but can be easily overturned by a vacillating city council, urbanization will fail. In Arlington, one developer observed, “if the planning commission decides, it’s basically a done deal; the council almost always backs them” (County of Arlington, 2009). This is an ideal example of enforcing the plan from the professionals thru the councils. In other words, in each of these cases, enforcement was built into the political atmosphere of the civic governments. Enthusiasm for a recently passed general plan or vision can fade quickly; a permanent government cultural of plan ownership and enforcement is also required.

The long-term coalescing of carrots and sticks into a stable and predictable proposal and approval culture becomes a self-reinforcing feedback loop. In Arlington, the local governments were able to make opportunity (very high densities and very large building envelopes) work with developers (housing bubble, bull market for condos) to make a stable culture of approval and construction. The clearly delineated zones and the permissions within them made it easy for developers to value parcels, understand building maximums, and thus to calculate their profits. Once the train was moving, density kept increasing, and critical mass was reached for successful urbanization. The general plan and zoning code did not alone create this culture, although the legal permissions for mixed-use and increased density were an indispensable foundation. Tilting the economic playing field consistently and steadfastly in accordance with the vision is the key to success.

6. Analysis of Urban Form

This chapter presents an analysis of the results of the second set of case studies. In this set, cases were selected because the city or town adopted an explicitly anti-sprawl, Smart Growth-oriented regulatory regime between 15 and 20 years ago, a time-frame sufficient for effects to become apparent in the built form. Since adoption of a new regulatory regimes the subject city's growth trajectory has either moved away from further sprawl, or perhaps the attempt to control sprawl been unable to reign in continued spreading of development or discourage inefficient, sub-urban patterns of urban form. Measurements are taken, with 'after' measurements from current data (2009) and 'before' measurements from data at or around the time of adoption, depending on availability. This study is intended to establish whether planning and regulation is a reliable way to combat sprawl—if Smart Growth regulation dependably leads to increased urbanism, as is its stated intent.

As described in Chapter 3, there are 12 measurements of physical patterns of urban form, grouped into 4 themes: grain, sprawl ratios, streets, and lots. Grain refers to patterns of land use, building size, and building age in which a high degree of mixture ('fine grain') indicates urbanism while a low degree of mixture ('coarse grain') is suggestive of large, suburban single-family housing tracts and retail power centers. Cities successfully pursuing Smart Growth should show increasing fineness of grain. Sprawl ratios refers to the changing relationship between two types of options (such as multi-family housing vs single-family housing), and successfully implemented Smart Growth would be indicated by decreasingly drastic ratios (closer to an even balance). Street patterns investigate the interconnectedness of the transportation network by measuring indicators such as block length, sidewalks, and intersections. Decreasing measurements (shorter blocks, less cul-de-sacs) are indicative of increasing urbanism. Finally, lot patterns indicate the density of use and intensity of housing. Shrinking and narrowing lots, along with less public space per person (ie, more people sharing the same space), are decreasing indicators.

6.1 Grain

New Smart Growth regulation in the case cities does not show a pattern of effectiveness or reliability in measurements related to grain of use. Increasing fineness of grain would be indicated by consistent negative percentage change in the three measurements of distance to different use, size of contiguous zones, and number leapfrog developments. The results, however, show large positive percentage change or very small negative percentage change, as summarized in Table 6.1:

Table 6.1: Measurements of Grain

		Distance to Nearest Different Use	Average Size of Single-Use Zones	Leapfrog Development
		Miles	Acres	Projects
Flower Mound				
	1996	0.64	210.32	9
	2009	0.78	212.46	16
	Change	22.28%	1.02%	77.78%
Suffolk				
	1994	1.50	662.37	6
	2009	1.94	676.86	3
	Change	29.19%	2.19%	-50.00%
Petaluma				
	1993	0.50	84.22	0
	2009	0.50	83.82	0
	Change	-0.32%	-0.48%	0.00%
Huntersville				
	1994	0.90	127.39	4
	2009	0.89	106.40	2
	Change	-0.93%	-16.48%	-50.00%
Walnut Creek (Control Case)				
	1989	0.16	15.84	0
	2009	0.15	14.66	0
	Change	-8.09%	-7.49%	0.00%

The results of the grain analysis, shown in percentage change, display no discernable pattern or significant correlation between the implementation of Smart Growth policy and increasing urbanization (which would be indicated in the above table by decreasing coarseness).

6.1.1 Distance to nearest different use

This measurement is the average distance from any given point within the case city or town to the nearest point of a different land use. Land uses are generalized into eight categories, regardless of density: Single-family residential, Multi-family residential, Retail, Commercial (office or R&D), Industrial, Civic (public, religious, educational), Mixed-uses, and Recreational open space (not including agriculture or inaccessible land). Any pair of categories can be a match (ie, single-family house to school, store to office, apartment to park, etc). If grain of land use is growing finer, the average straight-line distance to a different use should be decreasing.

As evidenced in Table 6.1, the results are mixed. Flower Mound and Suffolk significant increasing sprawl, with large positive changes. This indicates that areas of growth have been far from their cities' cores, and this growth has been mainly residential. Single-family residential produces a large number of lots, and each of these lots has a long straight-line distance to the office/retail/apartment cores, causing the averages to move up. Although refining grain of use is a Smart Growth goal, Flower Mound and Suffolk have not translated Smart Growth policy into increasingly fine grain. Huntersville and Petaluma, however, show a minimal decrease in the average distance to a different use. In Huntersville, retail zones have been integrated into the neotraditional greenfield developments. Fringe and leapfrog growth have not been curbed, but the inclusion of retail zones with new residential has prevented the distance-to-different measurement from growing significantly. In Petaluma, growth has been adjacent to already-built areas and included suburban neighborhood-center retail (Figure 6.2), so the average distance-to-different has diminished slightly, but not significantly. In the cases studied, Smart Growth regulation has had a minimal impact on decreasing the distance to a different use, implying that regulation is not effective or reliable in increasing the fineness of grain in terms of land use.

Figure 6.1: Recent Neighborhood Retail, Petaluma

6.1.2 Size of single-use zones

The size of contiguous zones of a single use is another indicator of grain. With suburban sprawl, vast areas of housing tracks, big-box retail surrounding huge parking lots, and sprawling office campuses mean that each contiguous zone of a particular use will be very large in acreage. In an urban community, small chunks of office and high-street retail are distributed among housing that mixes multi-family and single-family in a fine grain, so contiguous zones of single use are small, broken up by different neighbors.

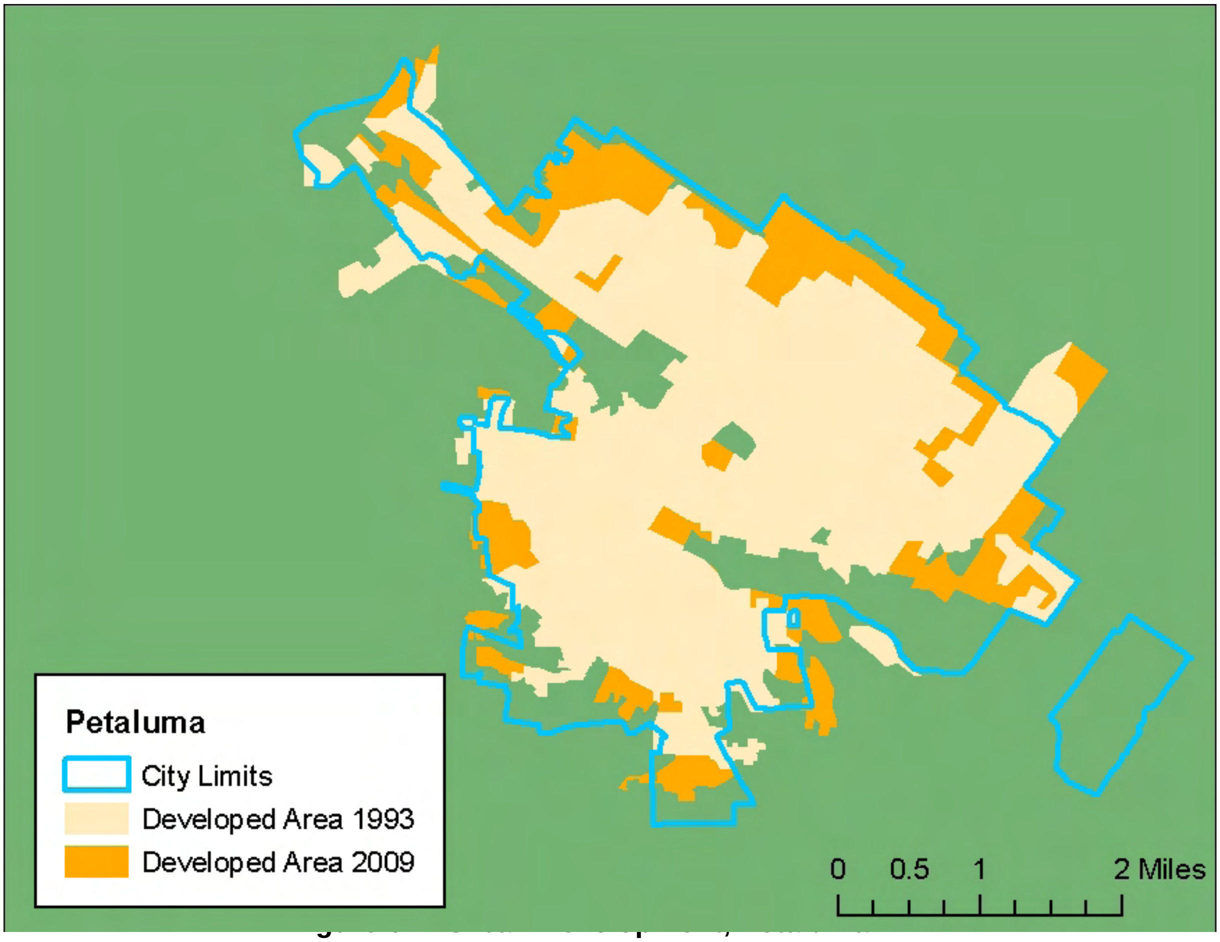
Among the cases, Huntersville is only city that has increased the fineness of its grain. Although agricultural land and open land in Huntersville continues to be developed in a sprawling fashion, unlike the other three cases, new residential tracts governed by the new regulatory regime is markedly different than previous housing tracts. Although built on greenfield land and not contiguous to each other, new residential communities are built in the neotraditional manner and includes pedestrian-accessible retail nearby. New communities are dense and mix multi-family residential with single-family, unlike the other three cases, which have built large single-family tracts. In Huntersville, partial Smart Growth has been achieved: new neighborhoods are dense, mixed, pedestrian-oriented, and have neighborhood retail attached; unfortunately, these neighborhoods are new instead of infill, and office development has remained conventionally sprawling, along with increasing strip retail along Statesville Road. In the other cases, the size of contiguous use zones is steady or increasing, as new residential is built on the periphery that is not adjacent to or broken up by other uses.

Tiny increases have occurred in Flower Mound and Suffolk, where new housing tracts closely resemble their predecessors in size and style. Growth on Petaluma’s fringe has been limited and similarly residential to Flower Mound and Suffolk; however, this has been countered by successful infill along its formerly industrial riverfront, moving the indicator down slightly. Regulation is equally unreliable at shrinking or cutting up contiguous zones as it is in lowering the distance to a different use (these measurements are directly related to each other).

6.1.3 Leapfrog development

Leapfrog development is often attacked by planners and urbanists as a highly inefficient mode of urban expansion (Hayden 2004, Kunstler 1993, Langdon 1994). A ‘leapfrog’ is an area of new development that is non-contiguous to areas already developed, separated from the existing town or city by agricultural land or open space. Unfortunately, in this study, the number of countable leapfrogs are small, resulting in very large fluctuations when calculating percentage change (see Table 6.1). However, a geographic analysis and visual depictions in maps makes the situation abundantly clear.

The first illustration is Petaluma (Figure 6.1), which has successfully limited growth to areas immediately adjacent to its already-developed zones. It functions as the control case for comparison to the other three cases in this study. Development over the last 16 years is depicted in dark orange. It shows growth directly adjacent and expanding upon areas developed up to 1993, which is itself a single, nearly-contiguous shape.



Petaluma is an illustration of non-leapfrog, contiguous growth. In a case with much leapfrog development, both the pre-Smart Growth development (sand-colored), and post-ratification development (dark orange) areas will appear as small, separated specks instead of a single polygon like Petaluma. Figures 6.2 (Flower Mound), 6.3 (Huntersville) show this speckled pattern that indicates high leapfrog development. Figure 6.4 (Suffolk) shows contiguous growth up until 1994, but more speckled leapfrog growth since then, particularly in the northeast corner, adjacent to Norfolk and most subject to growth pressure.

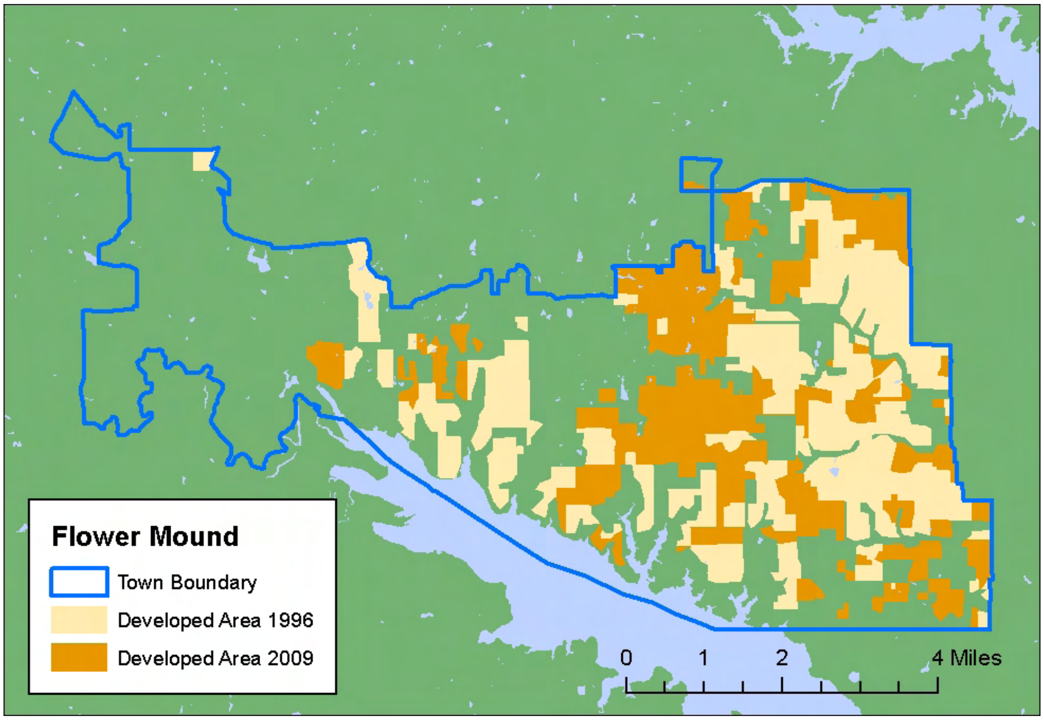


Figure 6.3: Urban Development, Flower Mound

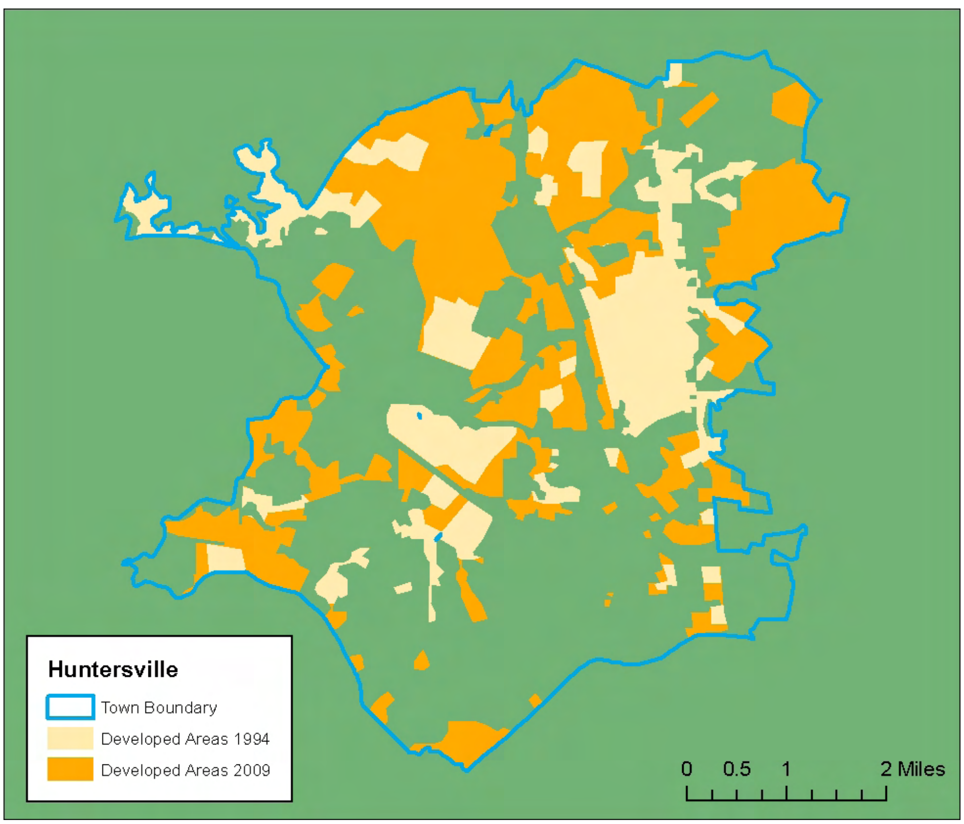


Figure 6.4: Urban Development, Huntersville

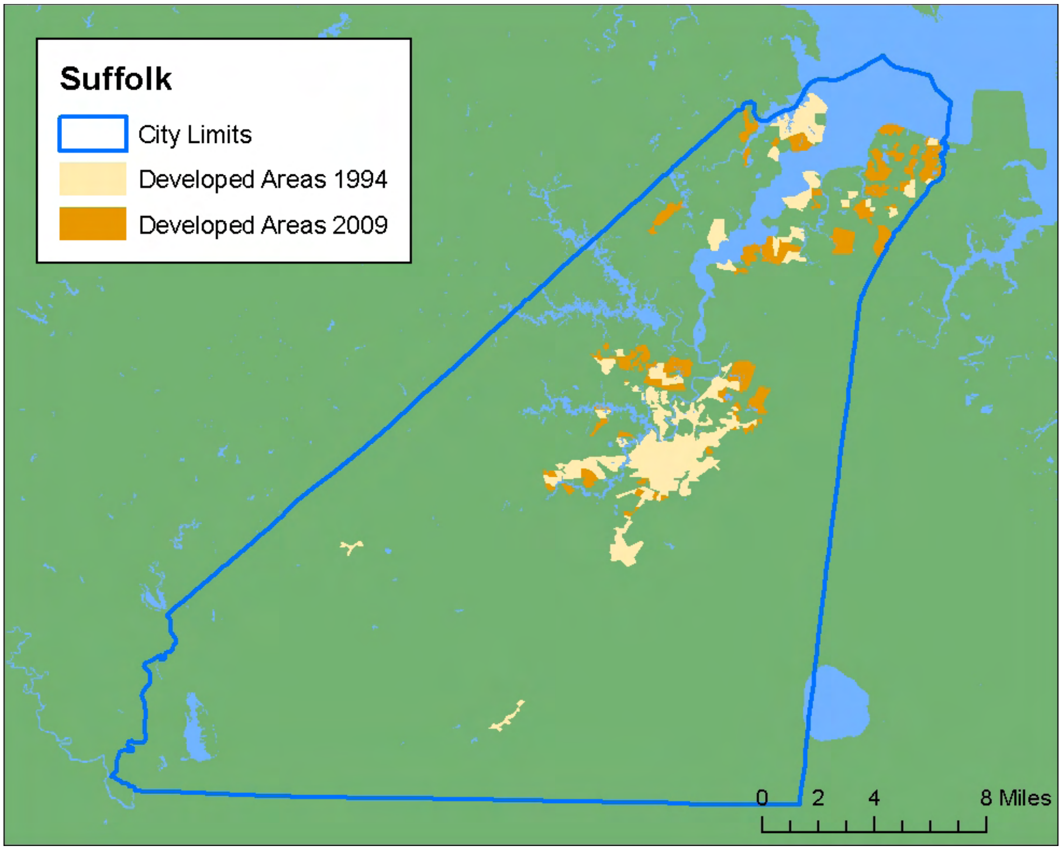


Figure 6.5: Urban Development, Suffolk

In Flower Mound and Huntersville, a new Smart Growth regulatory regime was unable to change or slow the pattern of leapfrog development already present. However, Suffolk was more like Petaluma, in that its urban growth was mostly contiguous around the four central towns (Suffolk, Crittenden, Holland, and Whaleyville) that made up Nansemond County and is now the City of Suffolk. Unfortunately, growth since 1994 has been discontiguous and leapfroggy, mainly near central Suffolk and in the once-agricultural areas bordering Norfolk. The implementation of Smart Growth regulation shows no significant correlation to the reduction of leapfrog developments, even in cities with a past pattern of contiguous development.

6.2 Sprawl Ratios

Smart Growth regulations have been inconsistently effective in halting or slowing the sprawling growth of the case cities. Effectiveness of regulation would be indicated in decreases in Fulton's Sprawl Ratio (Fulton, 2001), increases in multi-family units relative to single-family units, and decreases in the linearity (automobile-oriented 'strip'-ness) of retail areas. However, measurements indicate that effectiveness is nowhere near universal, as summarized in Table 6.2:

Table 6.2: Measurements of Sprawl Ratios

		Sprawl Ratio	Multi-family to Single-family Ratio	Linearity of Commercial Zones
		% Geographic Growth / % Population Growth	MF Units per SF Unit	Width/Length (m)
Flower Mound				
	1996	230	0.04	2.43
	2009	120	0.04	5.62
	Change	-47.77%	-11.50%	131.25%
Suffolk				
	1994	18	0.22	0.86
	2009	31	0.21	0.91
	Change	73.26%	-4.82%	6.06%
Petaluma				
	1993	1	0.31	0.58
	2009	73	0.31	0.50
	Change	14321.92%	-0.35%	-14.64%
Huntersville				
	1994	115	0.30	1.88
	2009	107	0.32	2.44
	Change	-6.95%	6.12%	29.65%
Walnut Creek				
	1989	53	1.61	2.5
	2009	29	1.62	2.26
	Change	-46.67%	1.03%	-9.74%

The results of the sprawl ratio analysis, shown above in percentage change, display no pattern or significant correlation between the implementation of Smart Growth policy and increasing urbanization (which would be indicated in the above table by decreasing ratios).

6.2.1 Area growth to population growth

The ratio comparing a city's geographic growth to its population growth was first proposed by William Fulton (2001) and quickly became one of the universal measurements of sprawl (Dear, 2002). If geographic growth outpaces population growth, overall density is moving downward, and sprawl is increasing. If both growth rates are equal, the ratio index is 100. An index of 130 indicates that geographic expansion is moving 30% faster than population growth (sprawling), while an index of 70 indicates that geographic expansion is moving at 70% the rate of population growth (densification). This study compares the index for annualized population growth rates from Census 1990 to Census 2000, and then from Census 2000 to current-year (2009) Census estimates. If the ratification and implementation of Smart Growth policy has been effective, the rate of geographic expansion in the 2000s should be slower than in the 1990s, relative to population growth.

An index over 100 implies that geographic growth has been outpacing population growth (sprawling). This is the case in Flower Mound and Huntersville, but, while their indices remain above 100, those indices are moving downward. These cases were the most sprawling before institution of a Smart Growth regime, so it is perhaps premature to expect a dramatic inversion of growth rates so quickly. In Suffolk, population growth has been outpacing area growth, indicating that density is increasing there. This may be a misleading statistic, however, because most of Suffolk (formerly Nansemond County) is rural, so suburban sprawl is a relative densification. Suburban growth on the Norfolk border has outpaced urban infill in central Suffolk.

Petaluma is an extreme exception with this indicator. Its growth rates for both geography and population are very closely linked and highly controlled, the result of a long legacy of growth controls (Young, 2006). These infinitesimal growth rates result in dramatic fluctuations when measured on a percentage basis, rendering this particular indicator ineffectual in this instance. Overall, it seems that regulation is generally effective in bending the growth curve in the desired direction, lowering the sprawl ratio relative to a baseline. It cannot be argued that it is universally reliable, however, in causing the geographic and population growth rates to invert.

6.2.2 Multifamily units to single-family units

The vast majority of households in the United States dwell in single-family, detached homes (Census 2000), so it is expected, particularly when studying suburban cases, that the majority of land and housing units be devoted to single-family homes. However, introducing and increasing multi-family units is essential, because this both expands the price range of homes in the area and increases the likelihood of renting occupants, which in turn leads to a much greater diversity of residents and economic classes. This diversity of people and purpose is essential to building the complexity that generates the emergent properties of urbanism (Jacobs 1961, Johnson 2002). The ratio of multi-family units to single-family should increase if Smart Growth policies are effective.

None of the cases in this section have matched the housing mixes of the 'successful' cases reviewed in Chapter 5. Flower Mound, Suffolk, Petaluma, and Huntersville are, typical to the rest of America, majority single-family housing cities. Although single-family use still takes up the majority of land area, in Walnut Creek only an estimated 38.05% of households are in single-family detached homes, with Arlington down to an estimated 28.64% (Appendix B). Arriving at the inflection point where multi-family units outnumber single-family units is an important milestone in the urbanization process. However, multi-family units continue to make up only a sliver of the available units in this set of case studies: in Suffolk 78.95% of housing units are single-family detached, in Flower Mound 93.54%, Huntersville 72.71%, and Petaluma 72.64% (Appendix B). Only in Huntersville is the pace of multi-family unit construction exceeding that of single-family units, implying that the other cases are trending away from urbanization. Although Smart Growth regulatory regimes call for a greater mix of housing, these cases that have instituted such regulations have been unable to make any drastic impact on their housing mixes.

6.2.3 Linearity of retail zones

Retail areas tend to grow according to the type of transportation used to access them. If accessed by pedestrians, they grow compactly, along parallel blocks and side streets. If accessed by automobiles, they tend to expand linearly, stretching along an arterial highway and forming a 'strip' of retail (Misonzhnik, 2007). Measuring the linearity (ratio of length to width) shows whether retail zones are stretching along an automobile-oriented strip (increasing) or clustering around pedestrian centers (decreasing). Where Smart Growth policies call for pedestrian-oriented downtown retail, pedestrian-oriented squarer retail areas should grow faster under regulatory encouragement than limited and discouraged automobile-oriented strip areas, causing the overall measurement of linearity to decrease.

With the exception of Petaluma, retail zones have been growing increasingly linear, suggesting automobile-oriented sprawling growth. Flower Mound, being too new to have ever had a traditional, pre-automobile downtown, has a retail core at the intersection of Cross Timbers Road and Long Prairie Road. Its main tenants are national big-box retail chains such as Kohl's, Domino's Pizza and Quizno's subs, in single-story buildings fronted by 300 feet of parking lot. Recent expansion has continued eastward along Cross Timbers Road, with even more vacant land held in reserve for future retail east of Morriss Road. Suffolk's retail has grown on the north side of the Nansemond River, along North Main Street. The south side of the river is the traditional downtown; however, more big-box strip retail has been constructed on the north side than infill retail or mixed-use on the south side. Huntersville has similarly expanded its big-box choices along Statesville Road with increasing linearity, foregoing infill at the intersection of Gilead Road and Main Street, its traditional downtown core, even though its general plan specifies the opposite (Town of Huntersville, 1999). For the last 15-20 years, big-box has been the prevalent mode of new retail development across the United States, and regulation in the case cities has not been stronger than that trend.

However, it is not impossible to go against that trend, as cases from Set 1 demonstrate in both their urban form and, as indicated by analysis in Chapter 5, their planning policies. Walnut Creek and Huntington Beach have both expanded and intensified their downtown retail cores in a pedestrian-oriented mode (Cabanatuan 1999, Silva 2008). Petaluma has also succeeded in this, focusing on its mixed-use downtown and restricting the growth of its automobile-oriented outlet center on its periphery, bringing the linearity of its retail zones down by 30% (Table 6.2). Given these case studies, however, there is no evidence to conclude that regulatory renovation is a related factor in decreasing the linearity of retail zones.

6.3 Street Patterns

Smart Growth regulations have been consistently effective in altering the street patterns of the case cities. Effectiveness of regulation would be indicated in decreases in cul-de-sacs relative to connected blocks, in the average pedestrian walking distance to important nodes such as schools and shopping centers, and increases in the amount of sidewalks (both length, as in additional street miles, and width, increasing room for sidewalk sales and cafes, etc). In most case, percentage change over the 15-20 year time horizon is moving in the desired directions, as summarized in Table 6.3:

Table 6.3: Measurements of Street Patterns

		Cul-de-Sacs to Intersections Ratio	Pedestrian Distance	Sidewalks
		Cul-de-sacs per Intersection	Miles	Square Meters
Flower Mound				
	1996	0.72	1.27	428,646
	2009	0.64	2.69	647,458
	Change	-11.71%	111.08%	51.05%
Suffolk				
	1994	0.83	3.99	27,144
	2009	0.86	4.29	28,992
	Change	3.66%	7.04%	6.81%
Petaluma				
	1993	0.53	1.01	51,093
	2009	0.55	0.98	51,882
	Change	3.24%	-2.70%	1.54%

	Cul-de-Sacs to Intersections Ratio	Pedestrian Distance	Sidewalks
	Cul-de-sacs per Intersection	Miles	Square Meters
Huntersville			
1994	0.70	1.29	39,024
2009	0.66	1.24	43,900
Change	-5.47%	-3.81%	12.49%
Walnut Creek			
1989	0.27	0.86	457,616
2009	0.27	0.86	488,123
Change	-0.07%	-0.36%	6.67%

The results of the street patterns analysis, shown above in percentage change, display strong consistency and significant correlation between the implementation of Smart Growth policy and increasing urbanization (which would be indicated in the above table by decreasing ratios).

6.3.1 Cul-de-sacs to intersections ratio

Cul-de-sacs are one of the hallmarks of suburban sprawl (Hayden, 2004) while the frequency of intersections and thru blocks is an indicator of urban patterns of form (Southworth and Ben-Joseph, 1996). The advantages of an interconnected street grid, shown by Vernez-Moudon (1992), have been incorporated into Smart Growth principles and policy. Adding streets, connecting former cul-de-sacs into thru blocks, and slowing or stopping the construction of new "loops-and-lollipops" suburban tracts would cause the ratio of cul-de-sacs to intersections to fall. If case cities have successfully implemented policy goals, analysis would result in negative percentage changes.

Petaluma's traditional downtown illustrates an interconnected street grid with a minimal amount of cul-de-sacs. This was the most prevalent form of street layout from the original Spanish colonies up until the 1920s, when the automobile began to enable and encourage alternative layouts (Morris, 1996). Cul-de-sacs became popular in the 1960s and 1970s as a way to discourage automobile traffic as a safety measure for local children (Hayden, 2004). As a basis of comparison, Petaluma's grid shows high interconnectivity:

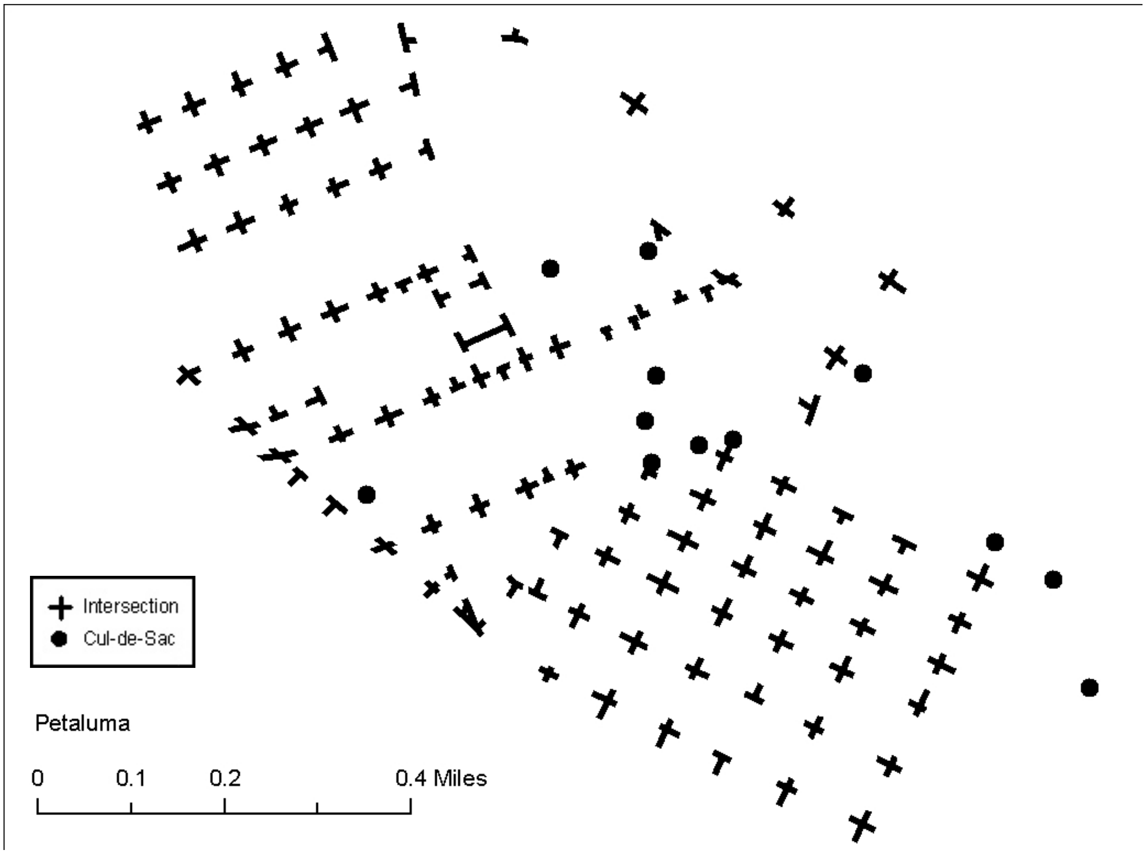


Figure 6.6: Intersections and Cul-de-Sacs, Petaluma

Although the street grid in downtown Petaluma is highly interconnected, expansion neighborhoods recently built around the periphery are conventionally suburban and filled with cul-de-sacs, causing the ratio of cul-de-sacs to intersections to rise. This is a somewhat schizophrenic situation, in which policy clearly calls for preservation of its urban character while loops and lollipops grow on the periphery.

Huntersville shows a peculiar mix of types, illustrated in Figure 6.7. In the eastern half of the map, the traditional downtown street grid shows closely related intersections with few cul-de-sacs. In the southwest quadrant of the map, the sparse intersections of the suburban office campus are visible. In the northwest quadrant, one of the recently developed neotraditional communities has more intersections and smaller blocks than downtown:

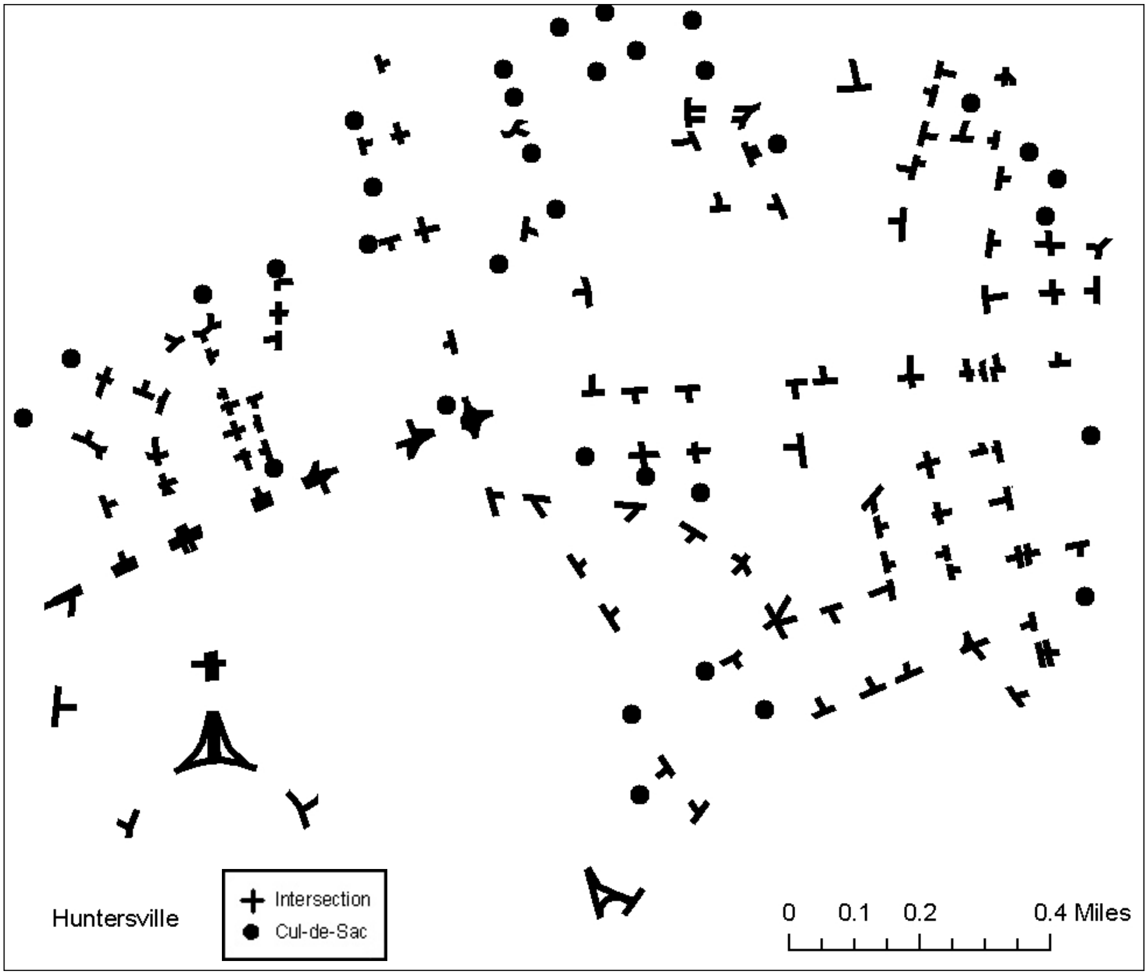


Figure 6.7: Intersections and Cul-de-Sacs, Huntersville

Huntersville's recent development has been in the form of neotraditional communities, with small, interconnected blocks, pedestrian access, and adjacent neighborhood retail. Although it has not followed through on its plan to add streets and infill to its downtown (Town of Huntersville, 2005), growth on the periphery has avoided cul-de-sacs, and its ratio has decreased, making it a successful case in this category.

Flower Mound shows the most dramatic change in cul-de-sac-to-intersection ratio, which would at first glance imply it is dramatically changing its form. While it is true that the vast majority of recent street construction has been thru blocks, this measurement exposes a weakness in the method rather than signaling success in Flower Mound.

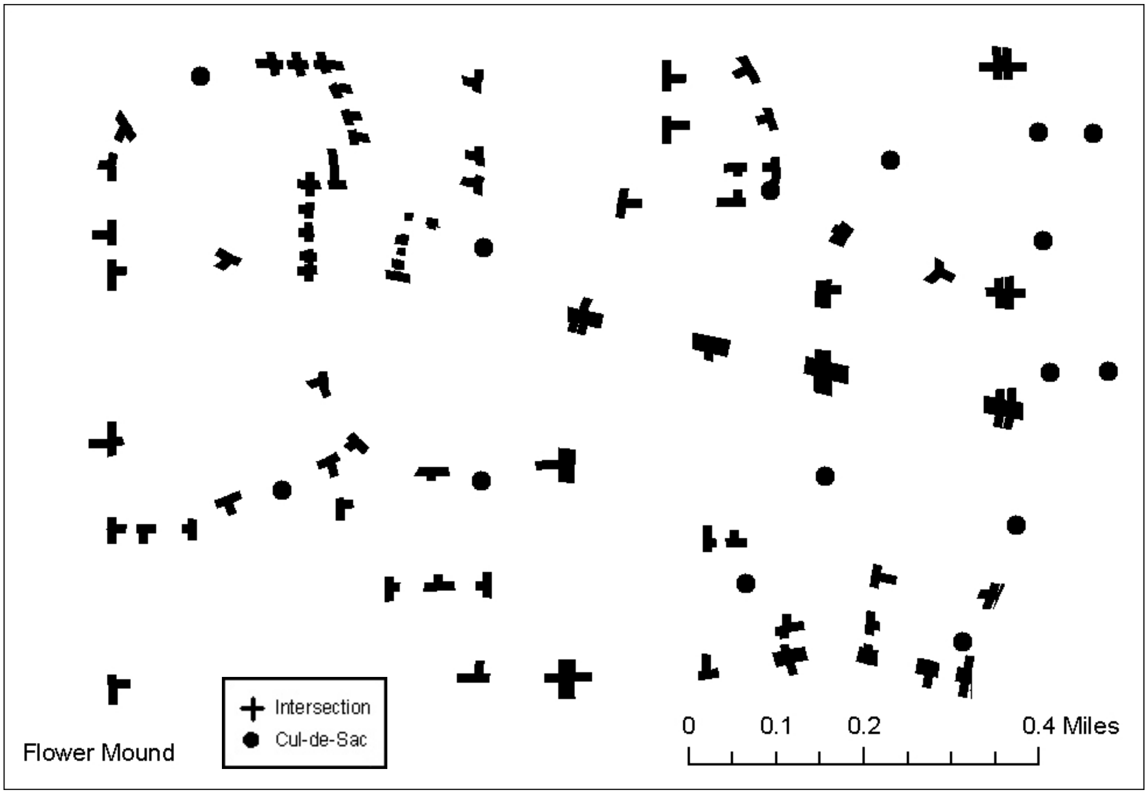


Figure 6.8: Intersections and Cul-de-Sacs, Flower Mound

Flower Mound's recent development has been conventionally suburban, except in the case of cul-de-sacs. While nearly all streets eventually curl around to an intersection and create a thru block, these new housing tracts have a distinctively anti-pedestrian pattern with one or two entrances accessing large arterials:

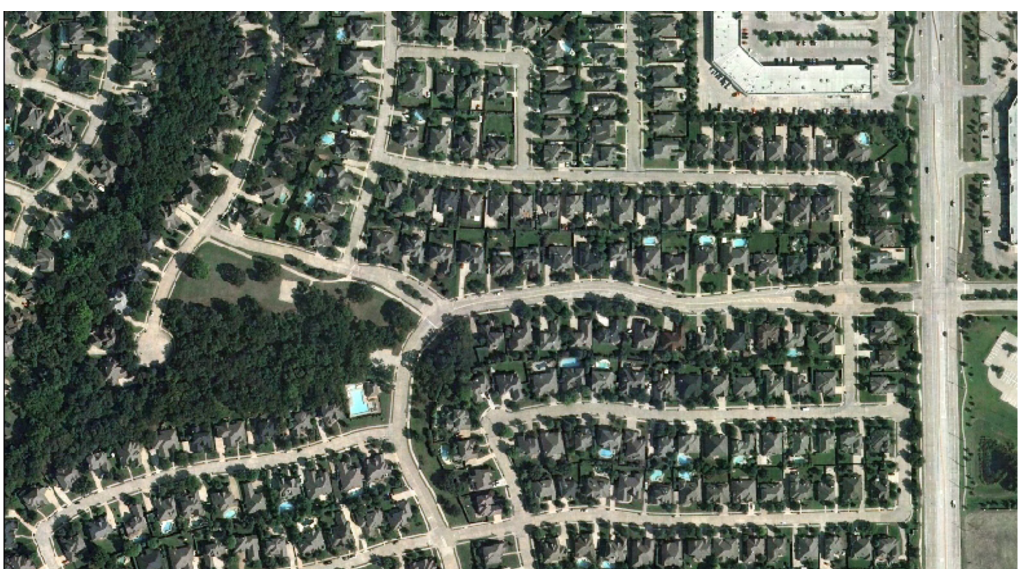


Figure 6.9: Conventional Suburban Development without Cul-de-Sacs

As is clear in Figure 6.9, the new tracts are in effect single giant cul-de-sacs, even though they are made up of many new intersections. In Table 6.3, it appears as though a large, interconnected, pedestrian-friendly street grid is growing in Flower Mound. However, the new style of suburban tracts simply avoid cul-de-sacs without increasing accessibility or pedestrian orientation.

Suffolk presents a unique case because its natural features make the creation of an interconnected street grid difficult. The winding tributaries of the Nansemond River, ravines eroded through the high ground, and the bordering wetlands of the Great Dismal Swamp make irregular patterns of buildable high ground. In Figure 6.10, the intersections of central Suffolk are connected, but cordoned off into separate clusters:

Figure 6.10: Intersections and Cul-de-Sacs, Suffolk

Part of Suffolk's downtown plan is to increase street connectivity among the central neighborhoods, but that has so far not been realized. Construction of cul-de-sac streets in Suffolk's outer areas has outpaced increasing the connectivity of streets within Suffolk's towns.

Overall, extension of streets or construction of new blocks in central areas is infrequent. New development on the fringes creates the vast majority of new intersections and cul-de-sacs, so change from baseline is controlled by the style of new neighborhood development. In Huntersville, new construction in the neotraditional style has increased thru blocks and intersections. This measurement, however, is not effective in capturing the changing character of a city. While it is perhaps good news that cul-de-sacs have passed out of fashion, the case of Flower Mound shows that conventional suburban sprawl can continue in their absence. Therefore, it cannot be concluded that effective policy intervention is responsible for change in the cul-de-sac-to-intersection ratio.

6.3.2 Pedestrian distance to important nodes

Reorienting patterns of urban form to cater to the pedestrian, away from the automobile driver, is a tentpole concept in the transformation from suburban to urban. Andres Duany, vocal New Urbanist planner, famously noted that "adjacency is not accessibility," as many suburban retail centers are fenced off and blocked by private backyards, forcing pedestrians to walk around a large, automobile-scaled block instead of directly accessing a store (Duany and Plater-Zyberk, 2006). Increasing mixture of uses and connectivity of the street grid should lead to shorter distances, on average, for pedestrians to access schools, shopping, and recreation. If cities are effectively urbanizing and implementing Smart Growth policy, the average distance should decrease.

Pedestrian distance is effectively falling in Huntersville, holding steady in Petaluma, and Suffolk registers a small uptick. This is congruent with each of their form patterns: Huntersville has paired its residential development with adjacent retail; Petaluma's geographic expansion has been very limited; and Suffolk's rural character generates a very high average distance.

In Flower Mound, however, average pedestrian distance has doubled. Significant residential development at the west end of town (illustrated in Figure 6.3) has not been followed by retail, educational, or recreational development. These new residents must travel to the town center for schools, employment, recreation, and shopping opportunities. Far-flung residential growth without other uses and housing types is the very definition of sprawl, challenging Flower Mound's use of the term 'Smart Growth' to define its policies.

6.3.3 Sidewalks

Sidewalks are essential in creating pedestrian-friendliness by providing pedestrians a space safe from automobiles in which to interact with the urban environment (Jacobs, 1961). However, sidewalks themselves are not necessarily enough; on overlarge, automobile-scaled blocks or adjacent to multilane arterials, they are often in place but unused (Whyte, 1988). For this analysis, the amount of sidewalk is estimated based on the total street miles in the city (doubled, for each side of the street) and multiplied by the percent of streets with sidewalks as estimated by random sample. All cases are consistently increasing the amount of sidewalk: some are accomplishing this by laying sidewalk along with new street miles, while others are adding or widening sidewalks in existing cores.

Although it is the least pedestrian-friendly in its layout and growth, Flower Mound has sidewalks along nearly every street, small or large. These sidewalks are separated from the carriageway by 10 feet or more, providing some refuge on busier streets, but also greatly adding to the width of the right-of-way, taking away from the 'urban-ness' of the streetscape. In Flower Mound, sidewalk growth has been commensurate with additional street miles, implying that sidewalks are growing along with new residential tracts instead of increasing in width or intensity near the core. In Flower Mound, sidewalks along wide, long-block suburban streets are in fashion, if not in use.

Figure 6.11: Sidewalk and Carriageway, Flower Mound

From this analysis, it is possible to conclude that Smart Growth policy is able to consistently deliver additional sidewalks, but not possible to know if these sidewalks are actively contributing to increasing complexity and urbanization on the street level. Sidewalks, without other form patterns associated with urbanism (short blocks, connected street grid, narrow rights-of-way) are growing, but this does not necessarily indicate an increase in urbanism.

6.4 Lot Patterns

Smart Growth regulations have been minimally effective in changing patterns of residential lot size and shape. Urban environments tend to feature smaller, narrower, and deeper lots, along with smaller setbacks and easements that contribute to an urban fabric (Wassmer, 2000). Effectiveness of regulation would be indicated in decreases in median lot size but also with increases in the depth and narrowness of lots. This result is indicated by a larger difference between average lot width to average lot depth, and by less street frontage per resident (narrowness). However, measurements indicate that effective results display no discernable pattern, as summarized in Table 6.4:

Table 6.4: Measurements of Lot Patterns

		Median Residential Lot Size	Lot Width to Depth Ratio	Street Frontage Per Resident
		Acres	Width/Length (m)	Meters per Person
Flower Mound				
	1996	0.44	0.54	0.91
	2009	0.42	0.71	1.22
	Change	-3.81%	30.64%	33.33%
Suffolk				
	1994	4.44	1.31	9.81
	2009	3.14	1.02	7.21
	Change	-29.31%	-22.09%	-26.54%
Petaluma				
	1993	0.41	0.34	4.89
	2009	0.41	0.39	4.71
	Change	-0.05%	13.60%	-3.68%
Huntersville				
	1994	0.91	0.34	6.49
	2009	0.78	0.39	5.86
	Change	-13.90%	13.60%	-9.73%
Walnut Creek				
	1989	16.21	0.73	14
	2009	14.73	0.72	13
	Change	-9.17%	-1.25%	-5.71%

The results of the lots patterns analysis, shown above in percentage change, display no pattern or significant correlation between the implementation of Smart Growth policy and increasing urbanization (which would be indicated in the above table by decreasing ratios).

6.4.1 Median lot size

Urban residential lots tend to be smaller, narrower, and deeper than their suburban counterparts (Wassmer, 2000). Construction of neotraditional developments or subdivision of core neighborhood lots, both indicators of urbanization, would cause median lot size to fall. Inversely, construction of large-lot McMansion subdivisions would increase the median lot size. If the

Smart Growth policy interventions have been effective, the median size of a residential lot should be shrinking.

The median can be slow change in slow-growing cases where the great majority of residential lots are already built. In Petaluma, where growth management has long been in place, new lots are smaller, but too few to create a significant decrease. Suffolk represents the most dramatic change in median lot size as the older large-lot rural areas begin to be outnumbered by drastically smaller lots in the expanding residential suburbs of Norfolk. Lot size in Flower Mound has also decreased, but not very much, which could be as attributable to economic and land value considerations as Flower Mound grows as it could be to a policy intervention. Huntersville, however, displays real policy-driven success in reducing lot sizes. Nearly all new residential construction has been in neotraditional tracts with lots significantly smaller than the conventional sprawl surrounding them. In all of these cases, lot sizes have decreased, but in only one case is the decreasing both significant and clearly the result of changing planning policy.

6.4.2 Lot width vs depth

Similar to the linearity measurement of retail zones discussed in Section 6.2.3, measuring the elongation of the rectangularity (narrowing width and growing depth) of residential lots indicates the density and urbanism of a neighborhood or city (Vernez-Moudon, 2007). The ratio of width to depth should be decreasing if residential lots are indeed getting deeper and narrower.

Lots have gotten noticeably narrower across the board, a trend not explicitly specified in plans, subdivision regulations, or zoning ordinances (except in Huntersville, where it is designated in neotraditional design regulations). However, many other forces act on lot size: as land values grow, narrower lots become an economic necessity for homebuilders to earn a profit. Broader trends in the consumer market have also affected lot size, including declining credit markets, and the growing popularity of front porches (Baker, 2008).

6.4.3 Street frontage per resident

As density increases, more people utilize the same streets, leading to a decrease in the amount of street available per resident. Therefore, decreasing street frontage per resident is an indicator of increasing density and urbanism (Jo, 2000). The estimated total population is divided by double (doubled for each side of the street) total street length. If planning policy is having the intended effect, this measurement will be decreasing.

Street frontage per resident is decreasing in all case studies except for Flower Mound, where street growth outpaces population growth. The most walkable new neighborhoods are the neotraditional clusters in Huntersville, where small lots and multi-family units cause more people to share the streetspace. In Petaluma and Suffolk, the population is growing faster than the streets, which has caused this measurement to move slightly downward. Flower Mound's continued low-density expansion is the sole exception, signaling that it is sprawling instead of achieving Smart Growth.

6.5 Reliability

The goals and designs of a planning vision, ratified into ordinance and regulation, should, after fifteen to twenty years elapse, be apparent in the changing built form and urban character of a city. Earlier discussions have focused on various measurements and patterns that (where successfully useful) indicate the direction and degree of evolving urban form. This section presents analysis across cases to identify trends and commonalities. If there is strong consistency between the adoption of Smart Growth policy and associated, measurable changes in built form patterns, it would be evidence that policy interventions are effective in altering form over time. With this analysis, I consider the evidence of whether Smart Growth plans are a consistently reliable tool for accomplishing Smart Growth goals.

6.5.1 Results: changes in urban form

The case city of Walnut Creek was selected to the first set of cases because its urban form patterns are consistently displaying changes in the right direction. While the discussion of results in Chapter 5 confirms that these changes followed planning measures that envisioned them, it is used in this section as a control case. This provides a baseline for measurements, establishing the direction and speed of change that one would expect to see in a successful case. However, results from the four test cases are decidedly mixed and display no clear correlation between policy and form. Flower Mound is the least successful in implementing Smart Growth goals, with two-thirds of indicators suggesting the suburban sprawl is continuing, slowing minimally. Suffolk's indicators are likewise mixed. While half the indicators suggest movement in the right direction. Suffolk's increasing density seems to be more from rural-to-suburban transition than suburban-to-urban. Petaluma and Huntersville are the most successful cases, with 75% of measurements indicating that form patterns have moved toward urbanism. In Petaluma, active planning is longstanding culture, and it continues to maintain its traditional urban character. Huntersville, transitioning from suburban sprawl to neotraditional sprawl, displays the clearest connection between policy and from.

Table 6.5: Case Overview

	Flower Mound	Suffolk	Petaluma	Huntersville	Walnut Creek (Control)
Grain					
Distance to different	+22.28%	+29.19%	-0.32%	-0.93%	-8.09%
Size of single use zones	+1.02%	+2.19%	-0.48%	-16.48%	-7.49%
Leapfrog development	+77.78%	-50.00%	0.00%	-50.00%	0.00%
Sprawl					
Area growth to population	-47.77%	+73.26%	N/A	-6.95%	-46.67%
Multi-family to single-family	-11.50%	-4.82%	-0.35%	+6.12%	+1.03%
Linearity of retail zones	+131.25%	+6.06%	-14.64%	+29.65%	-9.74%
Streets					
Cul-de-sacs to intersections	-11.71%	+3.66%	+3.24%	-5.47%	-0.07%
Pedestrian distance	+111.08%	-7.04%	-2.70%	3.81%	-0.36%
Sidewalk expansion	+51.05%	+6.81%	+1.54%	+12.49%	+6.67%
Lots					
Median residential lot size	-3.81%	-29.31%	-0.05%	-13.90%	-9.17%
Lot width vs depth	+30.64%	-22.09%	13.60%	13.60%	-1.25%
Streetfront per resident	+33.33%	-26.54%	-3.68%	-9.73%	-5.71%

Desired direction   Wrong direction

Table 6.5 provides of an overview of analytical results. When read horizontally, it shows if an indicator of urban form is regularly affected by planning policy. In this study, expanding sidewalks and reducing lot sizes are the only indicators that consistently change in cities that institute Smart Growth policies. When read vertically, the table shows which cases are more or less consistently reducing sprawl. The control case of Walnut Creek indicates that cities successfully implementing Smart Growth policy should consistently display it with these measurements. While no case shows universal improvement, it is immediately apparent that the relative success of the cases vary immensely. This wide variation indicates—in either direction—that there is no clear consistency or correlation between policy and results.

Of the four cases, Flower Mound has been the least successful in implementing Smart Growth principles. Although their plan is titled SMARTCode, its contents contain little mention of Smart Growth principles, and does not set them as goals for planning vision. Eighteen years later, measurements indicate the recent growth of Flower Mound has been more conventionally suburban than urbanist Smart Growth. This case shows how easily the term 'Smart Growth' can be re-appropriated with little adherence to the policy principles normally associated with the term. Smart Growth organizations may not look too closely when listing cities such as Flower Mound as participants in the movement (Smart Growth Network, 2009).

Suffolk is unique among the test cities because of its large rural areas in addition to the more typical mix of traditional towns and conventional suburbs. While the merger of the city and county, and the institution of the master plan, were done in preparation for massive growth, it does not seem to have arrived. There has been very little infill development downtown, greenfield growth has been contained to the northern areas bordering Norfolk, and agricultural land and rural areas have been preserved. Suffolk remains mainly automobile-oriented, in keeping with its mostly-rural character, and movement toward densification has been from rural to suburban. Greater economic forces affecting the Norfolk-Virginia Beach region will have more impact on future growth, and it will take another cycle to see if Suffolk implements its Smart Growth plans or ignores them.

Solidification of earlier patterns in Petaluma reflects the culture of control of its vision. Petaluma has succeeded in attracting mixed-use housing and retail development to its downtown. It also succeeded in repelling developer attempts to circumvent its growth boundary (Payne, 2007). By most indicators (75% of them), Petaluma continues to maintain the urban character of its downtown, limit suburban growth on the periphery, and preserve surrounding agricultural land. This is not, however, a major transformation, but the evolution of older planning practices toward current notions of best practice.

Huntersville is a major transformation, the most remarkable case, and the best illustration of changes in urban form directly related to successful planning policy. However, it is a strange case as its downtown core has only seen modest infill and only a couple of the called-for additional street connections have been built. On the periphery, conventional sprawl has been replaced by neotraditional sprawl. The new neighborhoods have small blocks, adjacent retail, and dense housing, but they have been constructed on greenfield land and are connected to other neighborhoods only by automobile-scaled arterials and distances. The result is less-dumb growth perhaps, but it is still occurring on the periphery, devouring agricultural land.

6.5.2 Conclusion: Not Reliable

All case cities in this set have instituted Smart Growth planning policies, but not all of them have successfully transformed their urban form in accordance with Smart Growth goals. Only one case can be shown to have successfully intensified its downtown and controlled growth on the periphery: Petaluma, which has a long history of planning intervention and enforcement. Two cases, Suffolk and Huntersville, outlined visions of an urbanized and enshrined it in plan and ordinance. They have made some measurable progress in achieving it, but continue to expand geographically at a sprawling rate. One case, Flower Mound, used the term ‘Smart Growth’ in the loosest possible definition, and continues to develop its conventional suburban character into its agricultural zones, making no real progress toward Smart Growth goals at all.

The ambiguity of these results suggest that a rival explanation may be more descriptive than the hypothesis put forward at the beginning of this investigation. However, the geographic, economic, and morphologic diversity of the cases make rival explanations difficult to assert. Only some of the success cases have rail stations, and Petaluma does not, so the supply of regional transit has no correlation. Although Petaluma and Huntersville are both promoting regional rail transit in their regions (Prado 2008, Harrison 2009), it is still in the uncertain future and has not affected their built form yet. Geographic position within the metro area is not correlated either; Arlington is directly adjacent to the central city, but Walnut Creek is separated by a bay and mountain ridge, even if it is still a regional node. Petaluma remains isolated, surrounded by agricultural land. Both Huntersville and Flower Mound are close enough to the central city to benefit from regional demand; in fact, it was their rapid growth that precipitated planning in the first place. Unfortunately, there is no consistent geographic feature that might serve as an explanation.

Petaluma’s success at implementing its Smart Growth goals may be explained as predestined: its long history of planning success prefigures its current ability to translate policy into form. However, the case of Huntersville undermines this explanation, as it has successfully pivoted from conventional regulation and subdivision to creating neotraditional communities, with no previous culture of progressive planning. Huntersville and Petaluma have in common a feature that the less successful examples of Suffolk and Flower Mound do not display: the value they place on the plan’s goals, the willingness to implement them. Although Petaluma’s planning culture has been in place far longer, it seems that even a younger culture of implementation, such as is beginning to establish itself in Huntersville, is effective. Although all cases in this set have implemented similar planning techniques to those successes in the first case, not all of their results match the first set’s successes. This lack of correlation implies that integrating Smart Growth principles into plans is no guarantee of success: therefore regulation is not a reliable tool, by itself, to curb sprawl and cause infill urbanization.

7. Conclusions

Based on the analysis of data, it is my conclusion that the policy intervention is a necessary component (requisite), but not the only important factor in combating sprawl (not reliable). There is not sufficient evidence in the data to support the hypothesis that Smart Growth-oriented land use regulation is both requisite and reliable. Therefore, plausible rival explanations must be addressed, leading suggestions for further research along with a revised hypothesis for additional testing.

The opening sections of this chapter address threats to validity and rival explanations, focusing on the robustness and limitations of the generalizibility of conclusions that can (and cannot) be reached. Later sections summarize the implications of the research: the ambiguous results suggest that a rival explanation best fit for causation, with implementation style being a major untested factor in this study. Finally, ideas for further research are considered: a fully experimental method to verify generalized conclusions, and a revised hypothesis seeking to isolate and test the implementation rival explanation.

7.1 Threats to Validity

Because of the small sample size and quasi-experimental nature of the studies, it is necessary to address the argument that the policy interventions are having an effect as opposed to none at all. By concluding that policy interventions are requisite, one raises the possibility of a type 1 (“false positive”) error. While the quasi-experimental method precludes both resorting to statistical significance to test for this possibility and therefore the generalizability of results (Yin, 2008), some threats to the validity of this investigation can still be addressed. Two of those threats are the null hypothesis and investigator bias.

The null hypothesis suggests that the intervention is meaningless, instead due to random circumstance. While this is generally tested by statistical signifcance, the limited number of cases makes that type of verification meaningless. In fact, the cases in Set 1 are rare, and noted for their rarity. Real-world examples of Smart Growth, outside of older, pre-automobile cities, are difficult to come by (Smart Growth Network 2009, Crawford et al 2004). Atypicality, however, does not preclude randomness. Along with their rarity, this study has found the consistent application of planning policy interventions, repeatedly and over a period of many years. With such a small case candidate pool to begin with, the likelihood of choosing at least one sample with no policy interventions is far larger that the likelihood of having accidentally chosen the few purposefully created examples of Smart Growth. The universality of this, together with the rarity of their occurrence, suggests that chance alone is an unlikely explanation.

The cases in Set 2 do not show a significant pattern, and the null hypothesis is likely more correct than the initial hypothesis of this investigation.

Of course, the cases were not randomly taken from a sample pool; they were carefully selected. It is possible that the selection process included an unconscious bias toward cases that would likely bear out the hypothesis. The cases, however, were selected using a rigorous process. A wide variety of geographical locations from all parts of the United States are represented. Cases range in population size from 15,000 people to 200,000. They occupy varying parts of their urban regions, some connected to transit networks but not others, some closer to their central cities and some further. There can be no experimental reactivity in the field, as the case cities cannot be conscious of their being investigated. One hopes that the rigorous selection process, as outlined in Chapter 3, was sufficient in preventing investigator bias from destroying the validity of the sample cases.

7.2 Rival Explanations

Second, it is important to address my argument as to why I believe that the policy interventions are the cause, as opposed to other possible factors. The two studies are designed to cancel out rival hypotheses: the significant rival hypothesis of Set 1 is tested by Set 2, and vice versa. However, the cases of Set 2 do not display a significant pattern or correlation, rendering the results ambiguous. Rival explanations must therefore be addressed and considered.

A ***direct rival*** explanation suggests that another interventions (suspect 2) is responsible for the outcomes, as opposed to the tested intervention (suspect 1) (Yin, 2008). A number of other suspects are present in the land use arena. More powerful influences and circumstances might include geography; it may be the physical position of a case that places it in selection. Geography influences transportation infrastructure, which in turns influences land use (Cervero and Landis, 1994). State and regional policies overlap with ‘home rule’ (Bosselman and Callies, 1979), which may overpower any local attempts at controlling form. However, there are factors among these direct rivals that are consistently present in the cases.

A ***comingled rival*** suggests that other interventions and the target intervention caused the result. There is argument for this in the transportation-land use argument. Efficient transit networks exist in the Walnut Creek and Arlington cases, but not in Huntington Beach or Robbinsville. Petaluma and Flower Mound are on flat, mostly agricultural land; Suffolk is cut through with ravines and wetlands; Huntersville is hilly. Some are crossed by Interstates, others not. The selected cases in each set vary geographically, politically, and infrastructurally so widely that no other explanation is comingled with enough consistency to imply it is a factor.

A ***super rival*** hypothesis explains that larger currents in broader social and economic forces are responsible for the results, and that intervention would make no difference either direction. The time frame of samples is from 1989 or so. The last twenty years saw two major economic booms: the tech bubble of the 1990s and the housing bubble of the 2000s. In both, new construction in commercial, retail, and residential sectors was widespread and created great change. In the housing bubble in particular, co-ops, condominiums, and other forms of multifamily ownership were underwritten financially more than ever before, finally giving competition to the single family house (Baker, 2008). Generational changes in housing and lifestyle preference are also occurring; the return to cities as a viable place to live, work, and raise children is changing the consumer-driven market. To address this societal explanation, however, one must once again consider the rarity of urban villages in the surburbs, and the inability of most cases in Set 2 to redirect their growth from sprawl toward Smart Growth. If the housing boom were responsible, many suburbs would be less sprawling, particularly those with Smart Growth planning policy in place. The research shows, however, that not even all those purposefully attempting Smart Growth grew more compactly.

With an ***implementation rival***, the style of implementing intervention is more important than the content of the intervention. While the original hypothesis of this research has been disproved, the implementation rival remains a viable explanation. The consistency of planning and implementation is plain for the cases in Set 1; the cases in Set 2 seem to succeed or fail in their stated planning goals based on the planning culture present. This rival explanation cannot be discounted. However, since it is untested in this investigation, it must be reserved for further research.

7.3 Requisiteness and Reliability

This investigation seeks to test the causal relationship between alternative forms of land use regulation and the urban form patterns of compact, pedestrian-friendly, urban development. It does not establish a causal link, but shows some correlation between planning policy and urban form.

Results of Study 1 clearly show that places which embody and exemplify the best practices of Smart Growth are extremely likely to have some mix of Smart Growth policy interventions in its recent history. While the sample pool is not definitive, it indicates that it is unlikely that many counter-examples exist, although it does not absolutely refute it. Cities that successfully have invested time, money, and energy into revising planning policies to be more aligned to Smart Growth principles.

The results of Study 2 do not show that every place that ratifies Smart Growth policy interventions necessarily goes on to embody best practices. A myriad of factors stand between ratification and implementation: succeeding elected officials and planning commissioners may not be as committed to the plan, developers seek exemptions and variances, consumer preferences render Smart Growth development unprofitable. The words ‘Smart Growth’ can be applied to policies that are more conventionally sprawling in nature. Ratifying a zoning revision is no guarantee of success.

Results that show that innovative zoning and land use regulation is a requisite, but not reliable, tool in shaping urban form. This implies that municipal governments seeking compact development are well advised to seriously consider revamping their zoning ordinances and other land use regulations to be more in line with Smart Growth principles. However, this investment alone is not sufficient to effect a transformation; cities that have attempted do not show a pattern of successful transformation of urban form. These combined conclusions strongly suggest that the implementation rival discussed above is the best explanation to fit the data and analytical results: the implementation of the planning intervention may matter as much, if not more than, as the content of the new policies.

7.4 Coda

While this investigation has shown that there is some connection between policy and urban form, the the ambiguous results and quasi-experimental design limit the implications of the results. The small sample is non-generalizable; further research is necessary. More definitive results can be obtained from a follow-up survey with a larger, randomly selected sample population, for a truly experimental method. Second, the implementation rival is, on the basis of this survery, still viable, and should form the hypothesis of the next study.

In the case of Petaluma, the culture of control predates the commencement of the study period. Petaluma is famous for being the first city to pursue growth control (Schwartz, 1979) and among the first to implement a UGB (Young, 2006). This does not mean, however, that this culture cannot be created, grown, and nurtured in a place where it does not yet exist. The political will to revamp a general plan and zoning ordinance signals a start. This research clearly shows that they are not a panacea, however, although some land use consultants pitch them this way (Downs and Costa, 2005). Perhaps if those selling expensive ordinance revamps could package a reliable political culture, their products would live up to their promises.

The epigram that heads this dissertation is a quote from David Glass, a former mayor of Petaluma and veteran of a political culture of rigorous enforcement and implementation. He notes that “success depends on whether we have the courage to implement it, whether we have the courage to refine it and whether we have the courage to defend it” (Crawford et al, 2004). Perhaps the secret to Smart Growth lies in implementation—but further research is necessary.

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Appendix A: Data Tables, Analysis of Form

	Population 1990	Population 2000	Population 2009 (est)	Population 2013 (fore)
Arlington	170,997	189,453	198,513	203,763
Suffolk	52,141	63,677	83,723	96,369
Walnut Creek	61,446	64,296	65,900	34,924
Flower Mound	15,788	50,702	66,808	78,598
Huntersville	9,131	24,960	41,467	51,254
Petaluma	44,977	54,548	54,950	55,906
Robbinsville	5,915	10,275	12,261	13,338
Huntington Beach	181,519	189,594	198,025	206,127

	Acreage 1990	Acreage 2000	Acreage 2009	Boundary Sq Mi
Arlington	10,924	11,861	12,255	25.87
Suffolk	40,911	42,549	46,750	400.02
Walnut Creek	11,322	11,605	11,688	19.91
Flower Mound	2,846	17,318	23,924	40.88
Huntersville	3,194	9,568	16,346	31.15
Petaluma	4,931	4,937	4,963	13.80
Robbinsville	2,841	5,919	7,130	20.48
Huntington Beach	14,580	14,950	15,220	26.39

	Pop Growth 90-00	Pop Growth 00-09	Area Growth 90-00	Area Growth 00-99	Index 00	Index 09
Arlington	1.20%	0.60%	0.95%	0.42%	79	70
Suffolk	2.46%	3.94%	0.45%	1.23%	18	31
Walnut Creek	0.52%	0.31%	0.28%	0.09%	54	29
Flower Mound	24.57%	3.97%	56.50%	4.77%	230	120
Huntersville	19.26%	8.27%	22.17%	8.85%	115	107
Petaluma	2.36%	0.09%	0.01%	0.07%	1	73
Robbinsville	8.19%	2.42%	12.04%	2.56%	147	106
Huntington Beach	0.49%	0.56%	0.28%	0.23%	57	41

	2000 Single-Family Units	2000 Multi-Family Units	2009 Single-Family Units	2009 Multi-Family Units
Arlington	27,668	62,657	26,783	66,604
Suffolk	19,352	4,277	26,146	5,500
Walnut Creek	12,054	19,378	12,125	19,693
Flower Mound	15,800	682	19,764	755
Huntersville	7,215	2,145	12,536	3,955
Petaluma	14,760	4,647	15,022	4,713
Robbinsville	2,091	1,937	2,313	2,368
Huntington Beach	37,007	35,640	37,928	40,897

FLOWER MOUND				
Grain	1989	2009	Unit	Change
Distance to Nearest Different	0.64	0.78	miles	22.28%
Size of single use zones	210.3	212.5	acres	1.02%
Leapfrog development	9	16	projects	77.78%
Sprawl				
Geographic growth to population growth ratio	230	120		-47.77%
Multifamily units to single family units	0.04	0.04	MF unit per SF unit	-11.50%
Linearity of commercial zones	2.43	5.62	width/length (m)	131.25%
Streets				
Cul-de-saces to intersections ratio	0.72	0.64	CdeS per Intersection	-11.71%
Pedestrian distance	1.27	2.69	miles	111.08%
Sidewalks	428,646	647,458	square meters	51.05%
Lots				
Median residential lot size	0.44	0.42	acres	-3.81%
Lot width vs depth	0.54	0.71	width/length (m)	30.64%
Street frontage per resident	0.91	1.22	meters/person	33.33%

SUFFOLK				
Grain	1989	2009	Unit	Change
Distance to Nearest Different	1.50	1.94	miles	29.19%
Size of single use zones	662.4	676.9	acres	2.19%
Leapfrog development	6	3	projects	-50.00%
Sprawl				
Geographic growth to population growth ratio	0	0		#DIV/0!
Multifamily units to single family units	#DIV/0!	#DIV/0!	MF unit per SF unit	#DIV/0!
Linearity of commercial zones	0.86	0.91	width/length (m)	6.06%
Streets				
Cul-de-saces to intersections ratio	0.83	0.86	CdeS per Intersection	3.66%
Pedestrian distance	4.29	3.99	miles	-7.04%
Sidewalks	27,144	28,992	square meters	6.81%
Lots				
Median residential lot size	4.44	3.14	acres	-29.31%
Lot width vs depth	1.31	1.02	width/length (m)	-22.09%
Street frontage per resident	9.81	7.21	meters/person	-26.54%

PETALUMA				
Grain	1989	2009	Unit	Change
Distance to Nearest Different	0.50	0.50	miles	-0.32%
Size of single use zones	84.22	83.82	acres	-0.48%
Leapfrog development	0	0	projects	
Sprawl				
Geographic growth to population growth ratio	0	0		#DIV/0!
Multifamily units to single family units	#DIV/0!	#DIV/0!	MF unit per SF unit	#DIV/0!
Linearity of commercial zones	0.58	0.50	width/length (m)	-14.64%
Streets				
Cul-de-saces to intersections ratio	0.53	0.55	CdeS per Intersection	3.24%
Pedestrian distance	1.01	0.98	miles	-2.70%
Sidewalks	51,093	51,882	square meters	1.54%
Lots				
Median residential lot size	0.41	0.41	acres	-0.05%
Lot width vs depth	0.34	0.39	width/length (m)	13.60%
Street frontage per resident	4.89	4.71	meters/person	-3.68%

HUNTERSVILLE					
Grain		1989	2009	Unit	Change
	Distance to Nearest Different	0.90	0.89	miles	-0.93%
	Size of single use zones	127.39	106.40	acres	-16.48%
	Leapfrog development	4	2	projects	-50.00%
Sprawl					
	Geographic growth to population growth ratio	0	0		#DIV/0!
	Multifamily units to single family units	#DIV/0!	#DIV/0!	MF unit per SF unit	#DIV/0!
	Linearity of commercial zones	1.88	2.44	width/length (m)	29.65%
Streets					
	Cul-de-saces to intersections ratio	0.70	0.66	CdeS per Intersection	-5.47%
	Pedestrian distance	1.24	1.29	miles	3.81%
	Sidewalks	39,024	43,900	square meters	12.49%
Lots					
	Median residential lot size	0.91	0.78	acres	-13.90%
	Lot width vs depth	0.34	0.39	width/length (m)	13.60%
	Street frontage per resident	6.49	5.86	meters/person	-9.73%

WALNUT CREEK					
Grain		1989	2009	Unit	Change
	Distance to Nearest Different	0.16	0.15	miles	-8.09%
	Size of single use zones	15.84	14.66	acres	-7.49%
	Leapfrog development	0	0	projects	0.00%
Sprawl					
	Geographic growth to population growth ratio	0	0		#DIV/0!
	Multifamily units to single family units	#DIV/0!	#DIV/0!	MF unit per SF unit	#DIV/0!
	Linearity of commercial zones	2.5	2.26	width/length (m)	-9.74%
Streets					
	Cul-de-saces to intersections ratio	0.27	0.27	CdeS per Intersection	-0.07%
	Pedestrian distance	0.86	0.86	miles	-0.36%
	Sidewalks	457,616	488,123	square meters	6.67%
Lots					
	Median residential lot size	16.21	14.73	acres	-9.17%
	Lot width vs depth	0.73	0.72	width/length (m)	-1.25%
	Street frontage per resident	14.12	13.31	meters/person	-5.71%

Appendix B: US Census 2008 Demographic Estimates

U.S. Census Bureau

American FactFinder

Arlington CDP, Virginia

S2504. Physical Housing Characteristics for Occupied Housing Units

Data Set: **2006-2008 American Community Survey 3-Year Estimates**

Survey: **American Community Survey**

NOTE. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Occupied housing units	**91,125**	**+/-1,489**	**47,377**	**+/-1,250**	**43,748**	**+/-1,555**
UNITS IN STRUCTURE						
1, detached	32.5%	+/-1.2	56.6%	+/-1.7	6.4%	+/-1.0
1, attached	11.1%	+/-0.9	16.6%	+/-1.5	5.1%	+/-1.1
2 apartments	0.7%	+/-0.3	0.2%	+/-0.2	1.1%	+/-0.5
3 or 4 apartments	3.4%	+/-0.5	2.5%	+/-0.6	4.3%	+/-0.9
5 to 9 apartments	6.7%	+/-0.9	3.9%	+/-0.9	9.8%	+/-1.5
10 or more apartments	45.6%	+/-1.4	20.2%	+/-1.6	73.1%	+/-2.0
Mobile home or other type of housing	0.1%	+/-0.1	0.0%	+/-0.1	0.2%	+/-0.2
YEAR STRUCTURE BUILT						
2000 or later	8.3%	+/-0.7	5.6%	+/-0.7	11.2%	+/-1.3
1990 to 1999	9.1%	+/-0.8	7.1%	+/-0.9	11.2%	+/-1.4
1980 to 1989	11.5%	+/-0.9	11.3%	+/-1.2	11.8%	+/-1.6
1960 to 1979	23.2%	+/-1.3	16.1%	+/-1.2	30.8%	+/-2.4
1940 to 1959	38.3%	+/-1.3	45.0%	+/-1.7	31.1%	+/-2.4
1939 or earlier	9.7%	+/-0.8	15.0%	+/-1.3	3.9%	+/-0.8
ROOMS						
1 room	2.0%	+/-0.5	0.3%	+/-0.2	4.0%	+/-0.9
2 or 3 rooms	29.4%	+/-1.8	12.1%	+/-1.5	48.1%	+/-2.8
4 or 5 rooms	30.1%	+/-1.6	23.8%	+/-1.7	36.8%	+/-2.5
6 or 7 rooms	18.6%	+/-1.1	28.9%	+/-1.9	7.4%	+/-1.2
8 or more rooms	19.9%	+/-1.1	34.9%	+/-1.5	3.6%	+/-0.8
BEDROOMS						
No bedroom	2.9%	+/-0.5	0.7%	+/-0.3	5.3%	+/-1.0
1 bedroom	30.3%	+/-1.7	12.9%	+/-1.4	49.2%	+/-2.6
2 or 3 bedrooms	50.6%	+/-1.7	58.4%	+/-1.9	42.2%	+/-2.5
4 or more bedrooms	16.1%	+/-0.9	28.0%	+/-1.5	3.3%	+/-0.8
COMPLETE FACILITIES						
With complete plumbing facilities	99.7%	+/-0.2	99.8%	+/-0.1	99.5%	+/-0.5
With complete kitchen facilities	99.7%	+/-0.2	99.9%	+/-0.1	99.5%	+/-0.4
VEHICLES AVAILABLE						
No vehicle available	11.2%	+/-1.1	4.0%	+/-0.8	19.0%	+/-2.2
1 vehicle available	50.3%	+/-1.7	42.2%	+/-2.0	59.0%	+/-2.6
2 vehicles available	29.0%	+/-1.5	39.0%	+/-2.1	18.2%	+/-1.9
3 or more vehicles available	9.5%	+/-0.8	14.8%	+/-1.4	3.8%	+/-0.7
TELEPHONE SERVICE AVAILABLE						
With telephone service	97.0%	+/-0.5	98.6%	+/-0.7	95.3%	+/-0.8
HOUSE HEATING FUEL						
Utility gas	54.1%	+/-1.4	63.7%	+/-1.3	43.6%	+/-2.6
Bottled, tank, or LP gas	1.0%	+/-0.3	0.8%	+/-0.3	1.3%	+/-0.5
Electricity	41.0%	+/-1.5	32.0%	+/-1.4	50.7%	+/-2.6

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Fuel oil, kerosene, etc.	2.9%	+/-0.5	3.1%	+/-0.7	2.8%	+/-0.7
Coal or coke	0.0%	+/-0.1	0.0%	+/-0.1	0.0%	+/-0.1
All other fuels	0.4%	+/-0.2	0.3%	+/-0.2	0.7%	+/-0.4
No fuel used	0.5%	+/-0.2	0.1%	+/-0.2	0.9%	+/-0.4
PERCENT IMPUTED						
Units in structure	2.4%	(X)	(X)	(X)	(X)	(X)
Year structure built	7.2%	(X)	(X)	(X)	(X)	(X)
Rooms	5.9%	(X)	(X)	(X)	(X)	(X)
Bedrooms	1.2%	(X)	(X)	(X)	(X)	(X)
Plumbing facilities	0.6%	(X)	(X)	(X)	(X)	(X)
Kitchen facilities	1.0%	(X)	(X)	(X)	(X)	(X)
Vehicles available	0.4%	(X)	(X)	(X)	(X)	(X)
Telephone service available	0.7%	(X)	(X)	(X)	(X)	(X)
House heating fuel	3.2%	(X)	(X)	(X)	(X)	(X)

Source: U.S. Census Bureau, 2006-2008 American Community Survey

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see Accuracy of the Data). The effect of nonsampling error is not represented in these tables.

Notes:

·The percent imputed for units in structure, year structure built, rooms, bedrooms, plumbing facilities, and kitchen facilities is based on all housing units (both occupied and vacant housing units) instead of occupied housing units only.

·While the 2008 American Community Survey (ACS) data generally reflect the November 2007 Office of Management and Budget (OMB) definitions of metropolitan and micropolitan statistical areas; in certain instances the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB definitions due to differences in the effective dates of the geographic entities. The 2008 Puerto Rico Community Survey (PRCS) data generally reflect the November 2007 Office of Management and Budget (OMB) definitions of metropolitan and micropolitan statistical areas; in certain instances the names, codes, and boundaries of the principal cities shown in PRCS tables may differ from the OMB definitions due to differences in the effective dates of the geographic entities.

·Estimates of urban and rural population, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2000 data. Boundaries for urban areas have not been updated since Census 2000. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.

Explanation of Symbols:

1. An '**' entry in the margin of error column indicates that either no sample observations or too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
2. An '-' entry in the estimate column indicates that either no sample observations or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution.
3. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
4. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
5. An '***' entry in the margin of error column indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
6. An '*****' entry in the margin of error column indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.
7. An 'N' entry in the estimate and margin of error columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.
8. An '(X)' means that the estimate is not applicable or not available.

U.S. Census Bureau
American FactFinder

FACT SHEET

Arlington CDP, Virginia

2006-2008 American Community Survey 3-Year Estimates - what's this?
Data Profile Highlights:

NOTE: Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns and estimates of housing units for states and counties.

Social Characteristics - show more >>	**Estimate**	**Percent**	**U.S.**	**Margin of Error**
Average household size	2.20	(X)	2.61	+/-0.03
Average family size	3.16	(X)	3.20	+/-0.07
Population 25 years and over	152,786			+/-105
High school graduate or higher	(X)	90.8	84.5%	(X)
Bachelor's degree or higher	(X)	68.0	27.4%	(X)
Civilian veterans (civilian population 18 years and over)	16,689	10.2	10.1%	+/-1,238
With a Disability	(X)	(X)	(X)	(X)
Foreign born	49,195	24.0	12.5%	+/-2,120
Male, Now married, except separated (population 15 years and over)	38,378	44.3	52.2%	+/-1,390
Female, Now married, except separated (population 15 years and over)	36,452	42.2	48.2%	+/-1,449
Speak a language other than English at home (population 5 years and over)	58,998	30.8	19.6%	+/-2,104
Household population	200,641			+/-1,955
Group quarters population	(X)	(X)	(X)	(X)

Economic Characteristics - show more >>	**Estimate**	**Percent**	**U.S.**	**Margin of Error**
In labor force (population 16 years and over)	133,247	77.9	65.2%	+/-1,523
Mean travel time to work in minutes (workers 16 years and over)	26.1	(X)	25.3	+/-0.6
Median household income (in 2008 inflation-adjusted dollars)	96,390	(X)	52,175	+/-2,719
Median family income (in 2008 inflation-adjusted dollars)	128,132	(X)	63,211	+/-5,436
Per capita income (in 2008 inflation-adjusted dollars)	58,282	(X)	27,466	+/-1,743
Families below poverty level	(X)	4.6	9.6%	(X)
Individuals below poverty level	(X)	6.8	13.2%	(X)

Housing Characteristics - show more >>	**Estimate**	**Percent**	**U.S.**	**Margin of Error**
Total housing units	100,876			+/-889
Occupied housing units	91,125	90.3	88.0%	+/-1,489
Owner-occupied housing units	47,377	52.0	67.1%	+/-1,250
Renter-occupied housing units	43,748	48.0	32.9%	+/-1,555
Vacant housing units	9,751	9.7	12.0%	+/-1,297
Owner-occupied homes	47,377			+/-1,250
Median value (dollars)	586,200	(X)	192,400	+/-11,972
Median of selected monthly owner costs				
With a mortgage (dollars)	2,583	(X)	1,508	+/-60
Not mortgaged (dollars)	735	(X)	425	+/-23

ACS Demographic Estimates - show more >>	Estimate	Percent	U.S.	Margin of Error
Total population	204,889			*****
Male	103,235	50.4	49.3%	+/-207
Female	101,654	49.6	50.7%	+/-207
Median age (years)	37.6	(X)	36.7	+/-0.2
Under 5 years	13,102	6.4	6.9%	+/-2
18 years and over	167,976	82.0	75.5%	+/-121
65 years and over	18,742	9.1	12.6%	+/-80
One race	199,968	97.6	97.8%	+/-847
White	144,468	70.5	74.3%	+/-2,257
Black or African American	16,669	8.1	12.3%	+/-477
American Indian and Alaska Native	327	0.2	0.8%	+/-159
Asian	18,259	8.9	4.4%	+/-635
Native Hawaiian and Other Pacific Islander	78	0.0	0.1%	+/-119
Some other race	20,167	9.8	5.8%	+/-2,573
Two or more races	4,921	2.4	2.2%	+/-847
Hispanic or Latino (of any race)	32,498	15.9	15.1%	*****

Source: U.S. Census Bureau, 2006-2008 American Community Survey

Explanation of Symbols:
'***' - The median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
'*****' - The estimate is controlled. A statistical test for sampling variability is not appropriate.
'N' - Data for this geographic area cannot be displayed because the number of sample cases is too small.
'(X)' - The value is not applicable or not available.

U.S. Census Bureau
American FactFinder

Huntington Beach city, California

S2504. Physical Housing Characteristics for Occupied Housing Units

Data Set: **2006-2008 American Community Survey 3-Year Estimates**

Survey: **American Community Survey**

NOTE. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Occupied housing units	**73,032**	**+/-802**	**45,528**	**+/-1,005**	**27,504**	**+/-1,044**
UNITS IN STRUCTURE						
1, detached	51.8%	+/-1.2	73.5%	+/-1.4	16.0%	+/-2.1
1, attached	11.6%	+/-0.9	13.1%	+/-1.1	9.1%	+/-1.5
2 apartments	0.6%	+/-0.2	0.0%	+/-0.1	1.7%	+/-0.6
3 or 4 apartments	9.7%	+/-1.1	1.6%	+/-0.5	23.2%	+/-2.6
5 to 9 apartments	8.1%	+/-0.9	2.7%	+/-0.7	17.1%	+/-2.4
10 or more apartments	14.2%	+/-1.1	3.5%	+/-0.7	32.0%	+/-2.5
Mobile home or other type of housing	3.9%	+/-0.4	5.6%	+/-0.5	1.1%	+/-0.5
YEAR STRUCTURE BUILT						
2000 or later	4.4%	+/-0.5	5.6%	+/-0.7	2.4%	+/-0.9
1990 to 1999	6.9%	+/-0.8	8.2%	+/-1.1	4.6%	+/-1.2
1980 to 1989	14.3%	+/-1.0	10.9%	+/-1.0	19.9%	+/-2.3
1960 to 1979	67.7%	+/-1.4	70.2%	+/-1.6	63.6%	+/-2.8
1940 to 1959	5.5%	+/-0.7	4.5%	+/-0.9	7.3%	+/-1.6
1939 or earlier	1.2%	+/-0.3	0.5%	+/-0.3	2.2%	+/-0.7
ROOMS						
1 room	1.0%	+/-0.4	0.2%	+/-0.2	2.3%	+/-1.0
2 or 3 rooms	14.7%	+/-1.2	2.9%	+/-0.7	34.1%	+/-2.8
4 or 5 rooms	35.5%	+/-1.4	28.6%	+/-1.6	47.1%	+/-2.8
6 or 7 rooms	33.1%	+/-1.3	44.9%	+/-1.5	13.6%	+/-2.1
8 or more rooms	15.7%	+/-1.0	23.4%	+/-1.5	2.9%	+/-0.9
BEDROOMS						
No bedroom	1.2%	+/-0.4	0.2%	+/-0.2	2.8%	+/-1.0
1 bedroom	13.4%	+/-1.1	3.4%	+/-0.7	29.8%	+/-2.6
2 or 3 bedrooms	55.6%	+/-1.5	53.3%	+/-1.7	59.3%	+/-2.7
4 or more bedrooms	29.9%	+/-1.2	43.0%	+/-1.8	8.1%	+/-1.6
COMPLETE FACILITIES						
With complete plumbing facilities	99.8%	+/-0.1	99.9%	+/-0.1	99.7%	+/-0.3
With complete kitchen facilities	99.5%	+/-0.2	99.9%	+/-0.1	99.0%	+/-0.5
VEHICLES AVAILABLE						
No vehicle available	3.1%	+/-0.6	1.7%	+/-0.5	5.4%	+/-1.2
1 vehicle available	30.3%	+/-1.6	22.7%	+/-1.6	42.8%	+/-2.7
2 vehicles available	43.0%	+/-1.6	45.8%	+/-2.1	38.3%	+/-2.5
3 or more vehicles available	23.6%	+/-1.2	29.7%	+/-1.6	13.5%	+/-2.2
TELEPHONE SERVICE AVAILABLE						
With telephone service	97.2%	+/-0.5	98.9%	+/-0.4	94.4%	+/-1.2
HOUSE HEATING FUEL						
Utility gas	80.5%	+/-1.3	89.0%	+/-1.1	66.5%	+/-2.8
Bottled, tank, or LP gas	0.8%	+/-0.3	0.9%	+/-0.3	0.8%	+/-0.4
Electricity	15.6%	+/-1.1	9.0%	+/-1.0	26.4%	+/-2.4

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Fuel oil, kerosene, etc.	0.0%	+/-0.1	0.0%	+/-0.1	0.0%	+/-0.2
Coal or coke	0.0%	+/-0.1	0.0%	+/-0.1	0.0%	+/-0.2
All other fuels	0.2%	+/-0.1	0.3%	+/-0.2	0.1%	+/-0.1
No fuel used	2.9%	+/-0.7	0.8%	+/-0.3	6.3%	+/-1.8
PERCENT IMPUTED						
Units in structure	1.4%	(X)	(X)	(X)	(X)	(X)
Year structure built	11.5%	(X)	(X)	(X)	(X)	(X)
Rooms	5.8%	(X)	(X)	(X)	(X)	(X)
Bedrooms	1.3%	(X)	(X)	(X)	(X)	(X)
Plumbing facilities	0.3%	(X)	(X)	(X)	(X)	(X)
Kitchen facilities	0.9%	(X)	(X)	(X)	(X)	(X)
Vehicles available	0.4%	(X)	(X)	(X)	(X)	(X)
Telephone service available	1.0%	(X)	(X)	(X)	(X)	(X)
House heating fuel	1.8%	(X)	(X)	(X)	(X)	(X)

Source: U.S. Census Bureau, 2006-2008 American Community Survey

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see Accuracy of the Data). The effect of nonsampling error is not represented in these tables.

Notes:
·The percent imputed for units in structure, year structure built, rooms, bedrooms, plumbing facilities, and kitchen facilities is based on all housing units (both occupied and vacant housing units) instead of occupied housing units only.
·While the 2008 American Community Survey (ACS) data generally reflect the November 2007 Office of Management and Budget (OMB) definitions of metropolitan and micropolitan statistical areas; in certain instances the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB definitions due to differences in the effective dates of the geographic entities. The 2008 Puerto Rico Community Survey (PRCS) data generally reflect the November 2007 Office of Management and Budget (OMB) definitions of metropolitan and micropolitan statistical areas; in certain instances the names, codes, and boundaries of the principal cities shown in PRCS tables may differ from the OMB definitions due to differences in the effective dates of the geographic entities.
·Estimates of urban and rural population, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2000 data. Boundaries for urban areas have not been updated since Census 2000. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.

Explanation of Symbols:
1. An '**' entry in the margin of error column indicates that either no sample observations or too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
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8. An '(X)' means that the estimate is not applicable or not available.

U.S. Census Bureau
American FactFinder

FACT SHEET

Huntington Beach city, California

2006-2008 American Community Survey 3-Year Estimates - what's this?
Data Profile Highlights:

NOTE: Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns and estimates of housing units for states and counties.

Social Characteristics - show more >>	**Estimate**	**Percent**	**U.S.**	**Margin of Error**
Average household size	2.57	(X)	2.61	+/-0.04
Average family size	3.16	(X)	3.20	+/-0.05
Population 25 years and over	132,337			+/-2,164
High school graduate or higher	(X)	93.2	84.5%	(X)
Bachelor's degree or higher	(X)	40.1	27.4%	(X)
Civilian veterans (civilian population 18 years and over)	13,509	9.1	10.1%	+/-899
With a Disability	(X)	(X)	(X)	(X)
Foreign born	29,466	15.7	12.5%	+/-2,216
Male, Now married, except separated (population 15 years and over)	39,270	51.2	52.2%	+/-1,178
Female, Now married, except separated (population 15 years and over)	38,734	49.2	48.2%	+/-1,180
Speak a language other than English at home (population 5 years and over)	38,586	21.8	19.6%	+/-2,550
Household population	187,358			+/-2,996
Group quarters population	(X)	(X)	(X)	(X)

Economic Characteristics - show more >>	**Estimate**	**Percent**	**U.S.**	**Margin of Error**
In labor force (population 16 years and over)	105,602	69.0	65.2%	+/-2,475
Mean travel time to work in minutes (workers 16 years and over)	26.4	(X)	25.3	+/-0.7
Median household income (in 2008 inflation-adjusted dollars)	82,886	(X)	52,175	+/-2,152
Median family income (in 2008 inflation-adjusted dollars)	100,721	(X)	63,211	+/-2,841
Per capita income (in 2008 inflation-adjusted dollars)	42,255	(X)	27,466	+/-1,154
Families below poverty level	(X)	3.7	9.6%	(X)
Individuals below poverty level	(X)	5.9	13.2%	(X)

Housing Characteristics - show more >>	**Estimate**	**Percent**	**U.S.**	**Margin of Error**
Total housing units	77,112			+/-437
Occupied housing units	73,032	94.7	88.0%	+/-802
Owner-occupied housing units	45,528	62.3	67.1%	+/-1,005
Renter-occupied housing units	27,504	37.7	32.9%	+/-1,044
Vacant housing units	4,080	5.3	12.0%	+/-702
Owner-occupied homes	45,528			+/-1,005
Median value (dollars)	747,900	(X)	192,400	+/-14,419
Median of selected monthly owner costs				
With a mortgage (dollars)	2,716	(X)	1,508	+/-83
Not mortgaged (dollars)	477	(X)	425	+/-18

ACS Demographic Estimates - show more >>	Estimate	Percent	U.S.	Margin of Error
Total population	187,947			+/-3,096
Male	93,045	49.5	49.3%	+/-2,129
Female	94,902	50.5	50.7%	+/-2,324
Median age (years)	39.7	(X)	36.7	+/-0.6
Under 5 years	10,779	5.7	6.9%	+/-906
18 years and over	148,202	78.9	75.5%	+/-2,514
65 years and over	25,179	13.4	12.6%	+/-880
One race	182,667	97.2	97.8%	+/-2,930
White	147,155	78.3	74.3%	+/-3,560
Black or African American	1,424	0.8	12.3%	+/-446
American Indian and Alaska Native	518	0.3	0.8%	+/-215
Asian	19,636	10.4	4.4%	+/-1,586
Native Hawaiian and Other Pacific Islander	1,133	0.6	0.1%	+/-635
Some other race	12,801	6.8	5.8%	+/-2,470
Two or more races	5,280	2.8	2.2%	+/-829
Hispanic or Latino (of any race)	31,508	16.8	15.1%	+/-2,774

Source: U.S. Census Bureau, 2006-2008 American Community Survey

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The letters PDF or symbol indicate a document is in the Portable Document Format (PDF). To view the file you will need the Adobe® Acrobat® Reader, which is available for **free** from the Adobe web site.

QT-H10. **Units in Structure, Householder 65 Years and Over, and Householder Below Poverty Level: 2000**
Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
Geographic Area: **Washington township, Mercer County, New Jersey**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Subject	Number	Percent
TENURE BY UNITS IN STRUCTURE		
Owner-occupied housing units	**3,624**	**100.0**
1, detached	2,041	56.3
1, attached	1,066	29.4
2	24	0.7
3 or 4	8	0.2
5 or more	360	9.9
Mobile home	125	3.4
Boat, RV, van, etc	0	0.0
Renter-occupied housing units	**450**	**100.0**
1, detached	27	6.0
1, attached	62	13.8
2	20	4.4
3 or 4	35	7.8
5 to 9	206	45.8
10 to 19	42	9.3
20 to 49	30	6.7
50 or more	18	4.0
Mobile home	10	2.2
Boat, RV, van, etc	0	0.0
SELECTED CHARACTERISTICS OF HOUSEHOLDS WITH HOUSEHOLDER 65 YEARS AND OVER		
Occupied housing units	**577**	**100.0**
Owner occupied	531	92.0
Less than 1.01 occupants per room	577	100.0
No telephone service	0	0.0
No vehicle available	32	5.5
Below poverty level	40	6.9
With meals included in rent	0	0.0
SELECTED CHARACTERISTICS OF HOUSEHOLDS BELOW POVERTY LEVEL		
Owner-occupied housing units	**100**	**100.0**
Lacking complete plumbing facilities	0	0.0
1.01 or more occupants per room	0	0.0
Built 1939 or earlier	10	10.0
Householder 65 years and over	40	40.0
With public assistance income	0	0.0
With Social Security income	24	24.0
No telephone service	0	0.0
Renter-occupied housing units	**48**	**100.0**
Lacking complete plumbing facilities	0	0.0
1.01 or more occupants per room	0	0.0
Built 1939 or earlier	0	0.0
Householder 65 years and over	0	0.0
With public assistance income	7	14.6
With Social Security income	18	37.5
No telephone service	0	0.0

(X) Not applicable.
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices H14, H21, H32, H43, H45, H53, HCT22, HCT23, HCT24, HCT25, HCT26, and HCT27.

QT-H10. Units in Structure, Householder 65 Years and Over, and Householder Below Poverty Level: 2000

Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data

Geographic Area: **Washington township, Mercer County, New Jersey**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

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Built 1939 or earlier	10	10.0
Householder 65 years and over	40	40.0
With public assistance income	0	0.0
With Social Security income	24	24.0
No telephone service	0	0.0
Renter-occupied housing units	**48**	**100.0**
Lacking complete plumbing facilities	0	0.0
1.01 or more occupants per room	0	0.0
Built 1939 or earlier	0	0.0
Householder 65 years and over	0	0.0
With public assistance income	7	14.6
With Social Security income	18	37.5
No telephone service	0	0.0

(X) Not applicable.

Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices H14, H21, H32, H43, H45, H53, HCT22, HCT23, HCT24, HCT25, HCT26, and HCT27.

Walnut Creek city, California

S2504. Physical Housing Characteristics for Occupied Housing Units

Data Set: **2006-2008 American Community Survey 3-Year Estimates**

Survey: **American Community Survey**

NOTE. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Occupied housing units	**30,362**	**+/-542**	**21,375**	**+/-772**	**8,987**	**+/-727**
UNITS IN STRUCTURE						
1, detached	39.2%	+/-1.9	50.0%	+/-2.4	13.7%	+/-3.6
1, attached	15.4%	+/-1.7	18.7%	+/-2.1	7.7%	+/-2.3
2 apartments	2.2%	+/-0.9	1.7%	+/-0.8	3.5%	+/-2.2
3 or 4 apartments	11.2%	+/-1.7	9.5%	+/-1.9	15.5%	+/-3.3
5 to 9 apartments	10.1%	+/-1.7	9.8%	+/-1.8	10.7%	+/-3.8
10 or more apartments	21.8%	+/-1.8	10.4%	+/-1.7	48.9%	+/-5.4
Mobile home or other type of housing	0.0%	+/-0.2	0.0%	+/-0.3	0.0%	+/-0.7
YEAR STRUCTURE BUILT						
2000 or later	3.7%	+/-0.8	3.2%	+/-0.9	4.7%	+/-2.1
1990 to 1999	5.0%	+/-1.0	5.1%	+/-1.2	4.7%	+/-2.1
1980 to 1989	14.4%	+/-1.8	13.7%	+/-1.7	16.0%	+/-3.9
1960 to 1979	61.0%	+/-2.1	61.9%	+/-2.3	59.0%	+/-5.5
1940 to 1959	15.1%	+/-1.7	15.5%	+/-2.0	14.2%	+/-4.2
1939 or earlier	0.8%	+/-0.4	0.6%	+/-0.4	1.4%	+/-1.0
ROOMS						
1 room	1.1%	+/-0.7	0.3%	+/-0.5	3.1%	+/-1.9
2 or 3 rooms	15.4%	+/-1.9	6.7%	+/-1.6	36.3%	+/-4.7
4 or 5 rooms	39.7%	+/-2.3	35.9%	+/-2.6	48.7%	+/-5.4
6 or 7 rooms	26.0%	+/-2.1	33.1%	+/-2.7	9.2%	+/-3.0
8 or more rooms	17.7%	+/-1.6	24.0%	+/-2.3	2.7%	+/-1.4
BEDROOMS						
No bedroom	1.3%	+/-0.7	0.4%	+/-0.5	3.5%	+/-2.1
1 bedroom	14.9%	+/-2.0	6.1%	+/-1.4	35.8%	+/-4.8
2 or 3 bedrooms	59.7%	+/-2.4	60.9%	+/-2.5	56.6%	+/-5.2
4 or more bedrooms	24.1%	+/-1.8	32.5%	+/-2.3	4.1%	+/-1.9
COMPLETE FACILITIES						
With complete plumbing facilities	99.8%	+/-0.2	99.8%	+/-0.3	99.8%	+/-0.4
With complete kitchen facilities	99.7%	+/-0.2	100.0%	+/-0.3	99.0%	+/-0.7
VEHICLES AVAILABLE						
No vehicle available	7.4%	+/-1.6	5.5%	+/-1.5	11.9%	+/-3.7
1 vehicle available	41.8%	+/-2.3	37.0%	+/-2.3	53.1%	+/-5.3
2 vehicles available	35.2%	+/-2.2	38.5%	+/-2.5	27.4%	+/-4.9
3 or more vehicles available	15.6%	+/-1.7	19.0%	+/-2.2	7.6%	+/-2.9
TELEPHONE SERVICE AVAILABLE						
With telephone service	98.9%	+/-0.7	99.8%	+/-0.2	96.8%	+/-2.3
HOUSE HEATING FUEL						
Utility gas	N	N	74.3%	+/-2.4	57.6%	+/-4.8
Bottled, tank, or LP gas	N	N	0.6%	+/-0.4	1.0%	+/-0.8
Electricity	N	N	24.8%	+/-2.4	41.3%	+/-4.8

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Fuel oil, kerosene, etc.	N	N	0.1%	+/-0.2	0.0%	+/-0.7
Coal or coke	N	N	0.0%	+/-0.3	0.0%	+/-0.7
All other fuels	N	N	0.2%	+/-0.2	0.0%	+/-0.7
No fuel used	N	N	0.0%	+/-0.3	0.0%	+/-0.7
PERCENT IMPUTED						
Units in structure	3.2%	(X)	(X)	(X)	(X)	(X)
Year structure built	9.4%	(X)	(X)	(X)	(X)	(X)
Rooms	4.8%	(X)	(X)	(X)	(X)	(X)
Bedrooms	0.9%	(X)	(X)	(X)	(X)	(X)
Plumbing facilities	0.4%	(X)	(X)	(X)	(X)	(X)
Kitchen facilities	0.7%	(X)	(X)	(X)	(X)	(X)
Vehicles available	0.5%	(X)	(X)	(X)	(X)	(X)
Telephone service available	0.7%	(X)	(X)	(X)	(X)	(X)
House heating fuel	1.9%	(X)	(X)	(X)	(X)	(X)

Source: U.S. Census Bureau, 2006-2008 American Community Survey

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·Estimates of urban and rural population, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2000 data. Boundaries for urban areas have not been updated since Census 2000. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.

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American FactFinder

FACT SHEET

Walnut Creek city, California

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Social Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
Average household size	2.06	(X)	2.61	+/-0.05
Average family size	2.82	(X)	3.20	+/-0.07
Population 25 years and over	48,913			+/-1,260
High school graduate or higher	(X)	96.1	84.5%	(X)
Bachelor's degree or higher	(X)	58.9	27.4%	(X)
Civilian veterans (civilian population 18 years and over)	6,173	11.5	10.1%	+/-633
With a Disability	(X)	(X)	(X)	(X)
Foreign born	11,953	18.8	12.5%	+/-1,430
Male, Now married, except separated (population 15 years and over)	14,124	55.3	52.2%	+/-648
Female, Now married, except separated (population 15 years and over)	13,689	44.7	48.2%	+/-617
Speak a language other than English at home (population 5 years and over)	13,371	21.8	19.6%	+/-1,609
Household population	62,452			+/-1,784
Group quarters population	(X)	(X)	(X)	(X)

Economic Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
In labor force (population 16 years and over)	32,567	58.8	65.2%	+/-1,351
Mean travel time to work in minutes (workers 16 years and over)	27.8	(X)	25.3	+/-1.2
Median household income (in 2008 inflation-adjusted dollars)	81,297	(X)	52,175	+/-3,606
Median family income (in 2008 inflation-adjusted dollars)	113,996	(X)	63,211	+/-7,116
Per capita income (in 2008 inflation-adjusted dollars)	53,028	(X)	27,466	+/-2,681
Families below poverty level	(X)	1.0	9.6%	(X)
Individuals below poverty level	(X)	4.2	13.2%	(X)

Housing Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
Total housing units	32,172			+/-278
Occupied housing units	30,362	94.4	88.0%	+/-542
Owner-occupied housing units	21,375	70.4	67.1%	+/-772
Renter-occupied housing units	8,987	29.6	32.9%	+/-727
Vacant housing units	1,810	5.6	12.0%	+/-516
Owner-occupied homes	21,375			+/-772
Median value (dollars)	656,400	(X)	192,400	+/-23,299
Median of selected monthly owner costs				
With a mortgage (dollars)	2,846	(X)	1,508	+/-107
Not mortgaged (dollars)	665	(X)	425	+/-66

ACS Demographic Estimates - show more >>	Estimate	Percent	U.S.	Margin of Error
Total population	63,604			+/-1,941
Male	29,131	45.8	49.3%	+/-1,424
Female	34,473	54.2	50.7%	+/-1,307
Median age (years)	48.6	(X)	36.7	+/-1.1
Under 5 years	2,151	3.4	6.9%	+/-500
18 years and over	53,731	84.5	75.5%	+/-1,523
65 years and over	16,211	25.5	12.6%	+/-691
One race	62,576	98.4	97.8%	+/-1,977
White	52,402	82.4	74.3%	+/-1,814
Black or African American	1,184	1.9	12.3%	+/-523
American Indian and Alaska Native	98	0.2	0.8%	+/-109
Asian	7,553	11.9	4.4%	+/-1,030
Native Hawaiian and Other Pacific Islander	121	0.2	0.1%	+/-121
Some other race	1,218	1.9	5.8%	+/-638
Two or more races	1,028	1.6	2.2%	+/-353
Hispanic or Latino (of any race)	3,856	6.1	15.1%	+/-849

Source: U.S. Census Bureau, 2006-2008 American Community Survey

Explanation of Symbols:
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U.S. Census Bureau
American FactFinder

Flower Mound town, Texas

S2504. Physical Housing Characteristics for Occupied Housing Units
Data Set: **2006-2008 American Community Survey 3-Year Estimates**
Survey: **American Community Survey**

NOTE. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Occupied housing units	**19,562**	**+/-354**	**18,104**	**+/-389**	**1,458**	**+/-361**
UNITS IN STRUCTURE						
1, detached	94.9%	+/-1.3	98.4%	+/-0.9	51.6%	+/-12.1
1, attached	0.9%	+/-0.6	0.5%	+/-0.4	6.0%	+/-7.7
2 apartments	0.5%	+/-0.6	0.0%	+/-0.3	6.6%	+/-8.2
3 or 4 apartments	0.4%	+/-0.5	0.0%	+/-0.3	5.1%	+/-6.1
5 to 9 apartments	0.3%	+/-0.3	0.0%	+/-0.3	4.3%	+/-4.3
10 or more apartments	1.8%	+/-0.8	0.0%	+/-0.3	24.6%	+/-9.6
Mobile home or other type of housing	1.1%	+/-0.8	1.1%	+/-0.8	1.9%	+/-3.1
YEAR STRUCTURE BUILT						
2000 or later	24.2%	+/-1.9	23.9%	+/-1.9	27.2%	+/-12.3
1990 to 1999	51.9%	+/-2.4	53.8%	+/-2.4	27.6%	+/-11.0
1980 to 1989	17.6%	+/-2.1	16.7%	+/-2.3	28.5%	+/-12.1
1960 to 1979	5.8%	+/-1.4	5.1%	+/-1.4	15.1%	+/-9.0
1940 to 1959	0.5%	+/-0.4	0.4%	+/-0.4	1.6%	+/-2.5
1939 or earlier	0.0%	+/-0.3	0.0%	+/-0.3	0.0%	+/-4.2
ROOMS						
1 room	0.2%	+/-0.2	0.1%	+/-0.2	1.3%	+/-2.1
2 or 3 rooms	1.2%	+/-0.6	0.1%	+/-0.2	15.4%	+/-8.9
4 or 5 rooms	11.6%	+/-1.9	9.2%	+/-1.8	41.5%	+/-15.0
6 or 7 rooms	28.5%	+/-3.0	28.5%	+/-2.9	28.4%	+/-11.4
8 or more rooms	58.5%	+/-2.8	62.2%	+/-2.9	13.4%	+/-7.2
BEDROOMS						
No bedroom	0.3%	+/-0.3	0.2%	+/-0.3	1.3%	+/-2.1
1 bedroom	1.1%	+/-0.6	0.0%	+/-0.3	14.5%	+/-8.1
2 or 3 bedrooms	34.9%	+/-2.7	32.6%	+/-2.8	63.2%	+/-13.0
4 or more bedrooms	63.8%	+/-2.8	67.2%	+/-2.8	21.0%	+/-11.9
COMPLETE FACILITIES						
With complete plumbing facilities	99.6%	+/-0.3	99.6%	+/-0.4	100.0%	+/-4.2
With complete kitchen facilities	99.7%	+/-0.3	99.9%	+/-0.2	97.7%	+/-1.5
VEHICLES AVAILABLE						
No vehicle available	0.6%	+/-0.4	0.5%	+/-0.4	0.8%	+/-1.3
1 vehicle available	17.4%	+/-2.0	15.0%	+/-2.2	47.5%	+/-13.8
2 vehicles available	57.4%	+/-2.9	59.2%	+/-3.0	34.6%	+/-12.8
3 or more vehicles available	24.7%	+/-2.5	25.3%	+/-2.6	17.1%	+/-10.4
TELEPHONE SERVICE AVAILABLE						
With telephone service	98.7%	+/-0.9	98.7%	+/-0.9	98.5%	+/-2.6
HOUSE HEATING FUEL						
Utility gas	N	N	N	N	N	N
Bottled, tank, or LP gas	N	N	N	N	N	N
Electricity	N	N	N	N	N	N

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Fuel oil, kerosene, etc.	N	N	N	N	N	N
Coal or coke	N	N	N	N	N	N
All other fuels	N	N	N	N	N	N
No fuel used	N	N	N	N	N	N
PERCENT IMPUTED						
Units in structure	0.2%	(X)	(X)	(X)	(X)	(X)
Year structure built	1.7%	(X)	(X)	(X)	(X)	(X)
Rooms	2.6%	(X)	(X)	(X)	(X)	(X)
Bedrooms	0.2%	(X)	(X)	(X)	(X)	(X)
Plumbing facilities	0.2%	(X)	(X)	(X)	(X)	(X)
Kitchen facilities	0.5%	(X)	(X)	(X)	(X)	(X)
Vehicles available	0.2%	(X)	(X)	(X)	(X)	(X)
Telephone service available	0.6%	(X)	(X)	(X)	(X)	(X)
House heating fuel	0.7%	(X)	(X)	(X)	(X)	(X)

Source: U.S. Census Bureau, 2006-2008 American Community Survey

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see Accuracy of the Data). The effect of nonsampling error is not represented in these tables.

Notes:

·The percent imputed for units in structure, year structure built, rooms, bedrooms, plumbing facilities, and kitchen facilities is based on all housing units (both occupied and vacant housing units) instead of occupied housing units only.

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·Estimates of urban and rural population, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2000 data. Boundaries for urban areas have not been updated since Census 2000. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.

Explanation of Symbols:

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2. An '-' entry in the estimate column indicates that either no sample observations or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution.
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U.S. Census Bureau
American FactFinder

FACT SHEET

Flower Mound town, Texas

2006-2008 American Community Survey 3-Year Estimates - what's this?
Data Profile Highlights:

NOTE: Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns and estimates of housing units for states and counties.

Social Characteristics - show more >>	**Estimate**	**Percent**	**U.S.**	**Margin of Error**
Average household size	3.35	(X)	2.61	+/-0.09
Average family size	3.64	(X)	3.20	+/-0.09
Population 25 years and over	39,227			+/-1,329
High school graduate or higher	(X)	97.0	84.5%	(X)
Bachelor's degree or higher	(X)	52.2	27.4%	(X)
Civilian veterans (civilian population 18 years and over)	4,154	9.5	10.1%	+/-592
With a Disability	(X)	(X)	(X)	(X)
Foreign born	5,945	9.0	12.5%	+/-919
Male, Now married, except separated (population 15 years and over)	15,454	68.3	52.2%	+/-616
Female, Now married, except separated (population 15 years and over)	15,354	63.2	48.2%	+/-623
Speak a language other than English at home (population 5 years and over)	N	100.0	19.6%	N
Household population	65,487			+/-1,982
Group quarters population	(X)	(X)	(X)	(X)

Economic Characteristics - show more >>	**Estimate**	**Percent**	**U.S.**	**Margin of Error**
In labor force (population 16 years and over)	33,664	73.4	65.2%	+/-1,303
Mean travel time to work in minutes (workers 16 years and over)	28.4	(X)	25.3	+/-1.3
Median household income (in 2008 inflation-adjusted dollars)	111,008	(X)	52,175	+/-3,899
Median family income (in 2008 inflation-adjusted dollars)	119,162	(X)	63,211	+/-5,045
Per capita income (in 2008 inflation-adjusted dollars)	40,847	(X)	27,466	+/-1,887
Families below poverty level	(X)	1.9	9.6%	(X)
Individuals below poverty level	(X)	2.1	13.2%	(X)

Housing Characteristics - show more >>	**Estimate**	**Percent**	**U.S.**	**Margin of Error**
Total housing units	20,056			+/-290
Occupied housing units	19,562	97.5	88.0%	+/-354
Owner-occupied housing units	18,104	92.5	67.1%	+/-389
Renter-occupied housing units	1,458	7.5	32.9%	+/-361
Vacant housing units	494	2.5	12.0%	+/-230
Owner-occupied homes	18,104			+/-389
Median value (dollars)	245,200	(X)	192,400	+/-5,699
Median of selected monthly owner costs				
With a mortgage (dollars)	2,189	(X)	1,508	+/-46
Not mortgaged (dollars)	918	(X)	425	+/-112

ACS Demographic Estimates - show more >>	Estimate	Percent	U.S.	Margin of Error
Total population	65,812			+/-2,052
Male	32,246	49.0	49.3%	+/-1,183
Female	33,566	51.0	50.7%	+/-1,438
Median age (years)	34.6	(X)	36.7	+/-0.7
Under 5 years	4,801	7.3	6.9%	+/-594
18 years and over	43,560	66.2	75.5%	+/-1,581
65 years and over	3,029	4.6	12.6%	+/-562
One race	64,210	97.6	97.8%	+/-2,037
White	56,707	86.2	74.3%	+/-1,989
Black or African American	2,065	3.1	12.3%	+/-800
American Indian and Alaska Native	89	0.1	0.8%	+/-75
Asian	4,058	6.2	4.4%	+/-866
Native Hawaiian and Other Pacific Islander	0	0.0	0.1%	+/-165
Some other race	1,291	2.0	5.8%	+/-481
Two or more races	1,602	2.4	2.2%	+/-819
Hispanic or Latino (of any race)	5,298	8.1	15.1%	+/-1,142

Source: U.S. Census Bureau, 2006-2008 American Community Survey

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U.S. Census Bureau
American FactFinder

Huntersville town, North Carolina

S2504. Physical Housing Characteristics for Occupied Housing Units

Data Set: **2006-2008 American Community Survey 3-Year Estimates**

Survey: **American Community Survey**

NOTE. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Occupied housing units	**16,868**	**+/-560**	**13,721**	**+/-606**	**3,147**	**+/-525**
UNITS IN STRUCTURE						
1, detached	80.8%	+/-2.9	94.3%	+/-1.9	22.0%	+/-6.6
1, attached	3.9%	+/-1.5	4.0%	+/-1.7	3.4%	+/-3.0
2 apartments	0.5%	+/-0.6	0.0%	+/-0.5	2.9%	+/-3.3
3 or 4 apartments	0.9%	+/-0.6	0.3%	+/-0.4	3.3%	+/-2.7
5 to 9 apartments	3.5%	+/-1.3	0.0%	+/-0.5	18.6%	+/-6.2
10 or more apartments	8.0%	+/-2.1	0.0%	+/-0.5	43.0%	+/-8.5
Mobile home or other type of housing	2.4%	+/-1.1	1.4%	+/-0.9	7.0%	+/-4.6
YEAR STRUCTURE BUILT						
2000 or later	43.4%	+/-3.0	45.7%	+/-3.1	33.7%	+/-7.9
1990 to 1999	39.2%	+/-3.0	38.4%	+/-3.2	43.0%	+/-9.4
1980 to 1989	10.0%	+/-1.5	9.3%	+/-1.5	13.0%	+/-5.7
1960 to 1979	4.8%	+/-1.6	4.8%	+/-1.6	5.2%	+/-3.5
1940 to 1959	1.8%	+/-0.9	1.0%	+/-0.8	5.2%	+/-4.3
1939 or earlier	0.7%	+/-0.6	0.9%	+/-0.7	0.0%	+/-2.0
ROOMS						
1 room	0.4%	+/-0.6	0.0%	+/-0.5	2.0%	+/-3.2
2 or 3 rooms	3.7%	+/-1.2	0.0%	+/-0.5	19.8%	+/-6.2
4 or 5 rooms	24.1%	+/-2.9	15.7%	+/-3.2	60.5%	+/-7.2
6 or 7 rooms	27.9%	+/-2.9	31.9%	+/-3.5	10.4%	+/-5.3
8 or more rooms	44.0%	+/-3.5	52.4%	+/-3.8	7.4%	+/-4.4
BEDROOMS						
No bedroom	0.4%	+/-0.6	0.0%	+/-0.5	2.0%	+/-3.2
1 bedroom	4.2%	+/-1.7	0.0%	+/-0.5	22.8%	+/-8.3
2 or 3 bedrooms	52.0%	+/-3.0	48.1%	+/-3.5	69.1%	+/-7.9
4 or more bedrooms	43.4%	+/-3.0	51.9%	+/-3.5	6.1%	+/-3.8
COMPLETE FACILITIES						
With complete plumbing facilities	99.5%	+/-0.7	99.3%	+/-0.8	100.0%	+/-2.0
With complete kitchen facilities	99.9%	+/-0.2	99.8%	+/-0.3	100.0%	+/-2.0
VEHICLES AVAILABLE						
No vehicle available	2.2%	+/-1.2	1.4%	+/-0.9	5.5%	+/-5.0
1 vehicle available	25.4%	+/-3.1	18.0%	+/-3.1	57.5%	+/-10.0
2 vehicles available	52.2%	+/-3.6	57.4%	+/-3.8	29.5%	+/-8.8
3 or more vehicles available	20.2%	+/-3.1	23.1%	+/-3.4	7.6%	+/-5.4
TELEPHONE SERVICE AVAILABLE						
With telephone service	94.4%	+/-2.0	96.8%	+/-1.8	84.2%	+/-7.2
HOUSE HEATING FUEL						
Utility gas	N	N	81.6%	+/-3.1	23.5%	+/-7.5
Bottled, tank, or LP gas	N	N	1.8%	+/-1.4	1.7%	+/-2.6
Electricity	N	N	16.0%	+/-3.1	72.7%	+/-7.2

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Fuel oil, kerosene, etc.	N	N	0.1%	+/-0.2	0.0%	+/-2.0
Coal or coke	N	N	0.0%	+/-0.5	0.0%	+/-2.0
All other fuels	N	N	0.5%	+/-0.5	2.2%	+/-3.4
No fuel used	N	N	0.0%	+/-0.5	0.0%	+/-2.0
PERCENT IMPUTED						
Units in structure	0.3%	(X)	(X)	(X)	(X)	(X)
Year structure built	2.5%	(X)	(X)	(X)	(X)	(X)
Rooms	2.6%	(X)	(X)	(X)	(X)	(X)
Bedrooms	0.6%	(X)	(X)	(X)	(X)	(X)
Plumbing facilities	0.2%	(X)	(X)	(X)	(X)	(X)
Kitchen facilities	0.3%	(X)	(X)	(X)	(X)	(X)
Vehicles available	0.2%	(X)	(X)	(X)	(X)	(X)
Telephone service available	0.3%	(X)	(X)	(X)	(X)	(X)
House heating fuel	1.7%	(X)	(X)	(X)	(X)	(X)

Source: U.S. Census Bureau, 2006-2008 American Community Survey

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Social Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
Average household size	2.65	(X)	2.61	+/-0.07
Average family size	3.13	(X)	3.20	+/-0.07
Population 25 years and over	28,583			+/-921
High school graduate or higher	(X)	94.7	84.5%	(X)
Bachelor's degree or higher	(X)	51.3	27.4%	(X)
Civilian veterans (civilian population 18 years and over)	2,389	7.7	10.1%	+/-384
With a Disability	(X)	(X)	(X)	(X)
Foreign born	3,779	8.4	12.5%	+/-722
Male, Now married, except separated (population 15 years and over)	11,265	69.1	52.2%	+/-582
Female, Now married, except separated (population 15 years and over)	10,672	65.5	48.2%	+/-484
Speak a language other than English at home (population 5 years and over)	N	100.0	19.6%	N
Household population	44,771			+/-1,468
Group quarters population	(X)	(X)	(X)	(X)

Economic Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
In labor force (population 16 years and over)	25,485	79.5	65.2%	+/-1,139
Mean travel time to work in minutes (workers 16 years and over)	25.9	(X)	25.3	+/-1.0
Median household income (in 2008 inflation-adjusted dollars)	86,210	(X)	52,175	+/-3,581
Median family income (in 2008 inflation-adjusted dollars)	97,710	(X)	63,211	+/-6,129
Per capita income (in 2008 inflation-adjusted dollars)	37,603	(X)	27,466	+/-1,826
Families below poverty level	(X)	1.9	9.6%	(X)
Individuals below poverty level	(X)	3.6	13.2%	(X)

Housing Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
Total housing units	17,720			+/-401
Occupied housing units	16,868	95.2	88.0%	+/-560
Owner-occupied housing units	13,721	81.3	67.1%	+/-606
Renter-occupied housing units	3,147	18.7	32.9%	+/-525
Vacant housing units	852	4.8	12.0%	+/-414
Owner-occupied homes	13,721			+/-606
Median value (dollars)	247,800	(X)	192,400	+/-11,270
Median of selected monthly owner costs				
With a mortgage (dollars)	1,688	(X)	1,508	+/-59
Not mortgaged (dollars)	436	(X)	425	+/-26

ACS Demographic Estimates - show more >>	Estimate	Percent	U.S.	Margin of Error
Total population	44,771			+/-1,468
Male	22,432	50.1	49.3%	+/-1,039
Female	22,339	49.9	50.7%	+/-960
Median age (years)	34.9	(X)	36.7	+/-0.7
Under 5 years	4,780	10.7	6.9%	+/-639
18 years and over	31,026	69.3	75.5%	+/-988
65 years and over	1,924	4.3	12.6%	+/-200
One race	44,406	99.2	97.8%	+/-1,477
White	37,420	83.6	74.3%	+/-1,516
Black or African American	3,670	8.2	12.3%	+/-722
American Indian and Alaska Native	119	0.3	0.8%	+/-137
Asian	1,486	3.3	4.4%	+/-388
Native Hawaiian and Other Pacific Islander	0	0.0	0.1%	+/-165
Some other race	1,711	3.8	5.8%	+/-627
Two or more races	365	0.8	2.2%	+/-218
Hispanic or Latino (of any race)	2,571	5.7	15.1%	+/-663

Source: U.S. Census Bureau, 2006-2008 American Community Survey

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Petaluma city, California

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Survey: **American Community Survey**

NOTE. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Occupied housing units	**20,876**	**+/-498**	**14,401**	**+/-606**	**6,475**	**+/-549**
UNITS IN STRUCTURE						
1, detached	74.2%	+/-2.4	88.3%	+/-2.1	42.9%	+/-5.5
1, attached	6.8%	+/-1.4	7.2%	+/-1.9	6.0%	+/-2.6
2 apartments	3.1%	+/-1.3	0.3%	+/-0.3	9.3%	+/-3.9
3 or 4 apartments	3.2%	+/-1.2	0.0%	+/-0.4	10.2%	+/-3.8
5 to 9 apartments	2.7%	+/-1.1	0.0%	+/-0.4	8.7%	+/-3.7
10 or more apartments	6.9%	+/-1.3	0.0%	+/-0.4	22.2%	+/-4.4
Mobile home or other type of housing	3.1%	+/-0.9	4.2%	+/-1.3	0.8%	+/-0.9
YEAR STRUCTURE BUILT						
2000 or later	7.5%	+/-1.3	4.8%	+/-1.3	13.4%	+/-3.0
1990 to 1999	15.5%	+/-2.1	17.1%	+/-2.5	12.1%	+/-4.1
1980 to 1989	20.1%	+/-2.8	20.9%	+/-3.1	18.2%	+/-4.8
1960 to 1979	36.6%	+/-2.7	38.1%	+/-3.0	33.4%	+/-6.6
1940 to 1959	8.8%	+/-1.6	8.9%	+/-1.7	8.4%	+/-2.9
1939 or earlier	11.4%	+/-1.6	10.1%	+/-1.9	14.3%	+/-3.4
ROOMS						
1 room	0.8%	+/-0.5	0.2%	+/-0.3	2.4%	+/-1.5
2 or 3 rooms	8.7%	+/-1.8	1.5%	+/-0.7	24.7%	+/-5.0
4 or 5 rooms	39.2%	+/-3.1	31.3%	+/-3.6	56.7%	+/-5.8
6 or 7 rooms	34.8%	+/-2.9	44.3%	+/-3.8	13.8%	+/-3.6
8 or more rooms	16.5%	+/-1.9	22.8%	+/-2.6	2.5%	+/-2.1
BEDROOMS						
No bedroom	1.3%	+/-0.8	0.2%	+/-0.3	3.7%	+/-2.3
1 bedroom	8.1%	+/-1.5	1.4%	+/-0.7	23.2%	+/-4.7
2 or 3 bedrooms	61.4%	+/-3.0	58.6%	+/-3.9	67.7%	+/-5.2
4 or more bedrooms	29.2%	+/-2.7	39.9%	+/-3.8	5.4%	+/-2.6
COMPLETE FACILITIES						
With complete plumbing facilities	99.6%	+/-0.3	99.8%	+/-0.3	99.3%	+/-0.6
With complete kitchen facilities	99.4%	+/-0.3	99.8%	+/-0.3	98.6%	+/-1.0
VEHICLES AVAILABLE						
No vehicle available	5.3%	+/-1.2	3.4%	+/-1.1	9.4%	+/-2.9
1 vehicle available	28.6%	+/-2.5	22.4%	+/-3.1	42.5%	+/-5.6
2 vehicles available	40.1%	+/-3.0	43.1%	+/-4.0	33.3%	+/-5.6
3 or more vehicles available	26.0%	+/-2.4	31.1%	+/-3.0	14.8%	+/-4.6
TELEPHONE SERVICE AVAILABLE						
With telephone service	97.9%	+/-1.2	99.8%	+/-0.3	93.8%	+/-3.6
HOUSE HEATING FUEL						
Utility gas	79.0%	+/-2.9	86.0%	+/-2.8	63.4%	+/-5.6
Bottled, tank, or LP gas	0.7%	+/-0.5	0.7%	+/-0.6	0.8%	+/-0.9
Electricity	16.4%	+/-2.4	9.7%	+/-2.3	31.1%	+/-5.5

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Fuel oil, kerosene, etc.	0.2%	+/-0.3	0.2%	+/-0.4	0.0%	+/-1.0
Coal or coke	0.0%	+/-0.3	0.0%	+/-0.4	0.0%	+/-1.0
All other fuels	3.1%	+/-1.2	3.0%	+/-1.3	3.4%	+/-2.7
No fuel used	0.7%	+/-0.5	0.3%	+/-0.4	1.4%	+/-1.4
PERCENT IMPUTED						
Units in structure	1.3%	(X)	(X)	(X)	(X)	(X)
Year structure built	7.2%	(X)	(X)	(X)	(X)	(X)
Rooms	3.8%	(X)	(X)	(X)	(X)	(X)
Bedrooms	0.6%	(X)	(X)	(X)	(X)	(X)
Plumbing facilities	0.2%	(X)	(X)	(X)	(X)	(X)
Kitchen facilities	0.7%	(X)	(X)	(X)	(X)	(X)
Vehicles available	0.5%	(X)	(X)	(X)	(X)	(X)
Telephone service available	0.4%	(X)	(X)	(X)	(X)	(X)
House heating fuel	1.8%	(X)	(X)	(X)	(X)	(X)

Source: U.S. Census Bureau, 2006-2008 American Community Survey

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see Accuracy of the Data). The effect of nonsampling error is not represented in these tables.

Notes:

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·Estimates of urban and rural population, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2000 data. Boundaries for urban areas have not been updated since Census 2000. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.

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U.S. Census Bureau
American FactFinder

FACT SHEET

Petaluma city, California

2006-2008 American Community Survey 3-Year Estimates - what's this?
Data Profile Highlights:

NOTE: Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns and estimates of housing units for states and counties.

Social Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
Average household size	2.66	(X)	2.61	+/-0.08
Average family size	3.21	(X)	3.20	+/-0.11
Population 25 years and over	38,434			+/-1,180
High school graduate or higher	(X)	87.6	84.5%	(X)
Bachelor's degree or higher	(X)	32.2	27.4%	(X)
Civilian veterans (civilian population 18 years and over)	3,780	8.9	10.1%	+/-469
With a Disability	(X)	(X)	(X)	(X)
Foreign born	10,569	18.9	12.5%	+/-1,613
Male, Now married, except separated (population 15 years and over)	12,739	57.2	52.2%	+/-706
Female, Now married, except separated (population 15 years and over)	12,336	54.6	48.2%	+/-665
Speak a language other than English at home (population 5 years and over)	13,273	25.4	19.6%	+/-1,680
Household population	55,482			+/-1,871
Group quarters population	(X)	(X)	(X)	(X)

Economic Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
In labor force (population 16 years and over)	31,710	71.7	65.2%	+/-1,284
Mean travel time to work in minutes (workers 16 years and over)	30.1	(X)	25.3	+/-1.5
Median household income (in 2008 inflation-adjusted dollars)	73,400	(X)	52,175	+/-4,210
Median family income (in 2008 inflation-adjusted dollars)	89,721	(X)	63,211	+/-5,828
Per capita income (in 2008 inflation-adjusted dollars)	34,636	(X)	27,466	+/-1,832
Families below poverty level	(X)	4.2	9.6%	(X)
Individuals below poverty level	(X)	6.7	13.2%	(X)

Housing Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
Total housing units	22,213			+/-333
Occupied housing units	20,876	94.0	88.0%	+/-498
Owner-occupied housing units	14,401	69.0	67.1%	+/-606
Renter-occupied housing units	6,475	31.0	32.9%	+/-549
Vacant housing units	1,337	6.0	12.0%	+/-374
Owner-occupied homes	14,401			+/-606
Median value (dollars)	605,200	(X)	192,400	+/-11,221
Median of selected monthly owner costs				
With a mortgage (dollars)	2,660	(X)	1,508	+/-116
Not mortgaged (dollars)	444	(X)	425	+/-41

ACS Demographic Estimates - show more >>	**Estimate**	**Percent**	**U.S.**	**Margin of Error**
Total population	55,930			+/-1,845
Male	27,924	49.9	49.3%	+/-1,302
Female	28,006	50.1	50.7%	+/-1,135
Median age (years)	39.0	(X)	36.7	+/-1.2
Under 5 years	3,595	6.4	6.9%	+/-643
18 years and over	42,760	76.5	75.5%	+/-1,430
65 years and over	6,151	11.0	12.6%	+/-531
One race	54,018	96.6	97.8%	+/-1,797
White	45,571	81.5	74.3%	+/-1,910
Black or African American	505	0.9	12.3%	+/-241
American Indian and Alaska Native	409	0.7	0.8%	+/-273
Asian	2,611	4.7	4.4%	+/-554
Native Hawaiian and Other Pacific Islander	212	0.4	0.1%	+/-171
Some other race	4,710	8.4	5.8%	+/-1,299
Two or more races	1,912	3.4	2.2%	+/-509
Hispanic or Latino (of any race)	12,022	21.5	15.1%	+/-1,851

Source: U.S. Census Bureau, 2006-2008 American Community Survey

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U.S. Census Bureau
American FactFinder

Suffolk city, Virginia

S2504. Physical Housing Characteristics for Occupied Housing Units

Data Set: **2006-2008 American Community Survey 3-Year Estimates**

Survey: **American Community Survey**

NOTE. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Occupied housing units	**30,204**	**+/-512**	**21,590**	**+/-736**	**8,614**	**+/-649**
UNITS IN STRUCTURE						
1, detached	76.6%	+/-2.1	90.2%	+/-1.7	42.6%	+/-5.4
1, attached	4.4%	+/-0.9	3.9%	+/-0.8	5.6%	+/-2.4
2 apartments	6.0%	+/-1.4	0.6%	+/-0.6	19.3%	+/-4.5
3 or 4 apartments	0.9%	+/-0.5	0.1%	+/-0.2	2.8%	+/-1.6
5 to 9 apartments	5.2%	+/-1.1	0.4%	+/-0.4	17.2%	+/-3.9
10 or more apartments	3.4%	+/-0.7	0.4%	+/-0.3	11.0%	+/-2.5
Mobile home or other type of housing	3.6%	+/-1.3	4.4%	+/-1.7	1.6%	+/-1.2
YEAR STRUCTURE BUILT						
2000 or later	24.6%	+/-1.8	26.7%	+/-2.0	19.3%	+/-4.3
1990 to 1999	20.3%	+/-1.8	22.5%	+/-2.2	14.8%	+/-4.8
1980 to 1989	13.4%	+/-1.8	11.8%	+/-1.8	17.5%	+/-4.6
1960 to 1979	22.5%	+/-1.9	23.4%	+/-2.4	20.4%	+/-4.0
1940 to 1959	11.7%	+/-1.5	10.4%	+/-1.5	15.1%	+/-3.6
1939 or earlier	7.4%	+/-1.3	5.2%	+/-1.1	12.9%	+/-3.2
ROOMS						
1 room	0.7%	+/-0.4	0.2%	+/-0.3	2.1%	+/-1.3
2 or 3 rooms	2.8%	+/-0.8	0.6%	+/-0.5	8.3%	+/-3.0
4 or 5 rooms	31.8%	+/-2.4	20.3%	+/-2.6	60.5%	+/-4.8
6 or 7 rooms	38.3%	+/-2.3	44.7%	+/-2.7	22.1%	+/-4.0
8 or more rooms	26.4%	+/-1.9	34.1%	+/-2.4	7.1%	+/-2.6
BEDROOMS						
No bedroom	0.8%	+/-0.5	0.2%	+/-0.3	2.4%	+/-1.4
1 bedroom	3.8%	+/-1.0	0.7%	+/-0.4	11.4%	+/-3.3
2 or 3 bedrooms	65.1%	+/-2.7	60.6%	+/-2.9	76.3%	+/-4.5
4 or more bedrooms	30.3%	+/-2.4	38.4%	+/-3.0	9.9%	+/-3.4
COMPLETE FACILITIES						
With complete plumbing facilities	99.9%	+/-0.1	100.0%	+/-0.3	99.6%	+/-0.4
With complete kitchen facilities	99.3%	+/-0.4	99.8%	+/-0.2	98.1%	+/-1.5
VEHICLES AVAILABLE						
No vehicle available	6.4%	+/-1.3	2.2%	+/-0.8	17.0%	+/-4.2
1 vehicle available	27.6%	+/-2.1	20.8%	+/-2.7	44.4%	+/-4.6
2 vehicles available	36.3%	+/-2.4	39.0%	+/-2.8	29.4%	+/-5.6
3 or more vehicles available	29.8%	+/-2.4	38.0%	+/-3.0	9.1%	+/-3.2
TELEPHONE SERVICE AVAILABLE						
With telephone service	93.6%	+/-1.6	97.9%	+/-1.2	82.7%	+/-5.2
HOUSE HEATING FUEL						
Utility gas	35.1%	+/-1.9	43.0%	+/-2.6	15.2%	+/-3.2
Bottled, tank, or LP gas	7.6%	+/-1.3	7.5%	+/-1.5	7.8%	+/-3.3
Electricity	46.0%	+/-2.1	37.6%	+/-3.0	66.9%	+/-4.7

Subject	Occupied housing units	Margin of Error	Owner-occupied housing units	Margin of Error	Renter-occupied housing units	Margin of Error
Fuel oil, kerosene, etc.	9.8%	+/-1.6	10.2%	+/-1.7	8.8%	+/-3.1
Coal or coke	0.0%	+/-0.2	0.0%	+/-0.3	0.0%	+/-0.7
All other fuels	1.4%	+/-0.6	1.7%	+/-0.9	0.6%	+/-0.6
No fuel used	0.2%	+/-0.3	0.0%	+/-0.3	0.7%	+/-1.0
PERCENT IMPUTED						
Units in structure	0.9%	(X)	(X)	(X)	(X)	(X)
Year structure built	15.9%	(X)	(X)	(X)	(X)	(X)
Rooms	4.8%	(X)	(X)	(X)	(X)	(X)
Bedrooms	1.8%	(X)	(X)	(X)	(X)	(X)
Plumbing facilities	1.6%	(X)	(X)	(X)	(X)	(X)
Kitchen facilities	2.3%	(X)	(X)	(X)	(X)	(X)
Vehicles available	1.4%	(X)	(X)	(X)	(X)	(X)
Telephone service available	1.7%	(X)	(X)	(X)	(X)	(X)
House heating fuel	2.6%	(X)	(X)	(X)	(X)	(X)

Source: U.S. Census Bureau, 2006-2008 American Community Survey

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Suffolk city, Virginia

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Social Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
Average household size	2.65	(X)	2.61	+/-0.04
Average family size	3.04	(X)	3.20	+/-0.08
Population 25 years and over	52,416			+/-212
High school graduate or higher	(X)	84.0	84.5%	(X)
Bachelor's degree or higher	(X)	24.0	27.4%	(X)
Civilian veterans (civilian population 18 years and over)	8,767	15.3	10.1%	+/-885
With a Disability	(X)	(X)	(X)	(X)
Foreign born	2,425	3.0	12.5%	+/-680
Male, Now married, except separated (population 15 years and over)	17,524	58.6	52.2%	+/-868
Female, Now married, except separated (population 15 years and over)	17,178	51.4	48.2%	+/-848
Speak a language other than English at home (population 5 years and over)	N	100.0	19.6%	N
Household population	79,922			+/-608
Group quarters population	(X)	(X)	(X)	(X)

Economic Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
In labor force (population 16 years and over)	42,031	68.0	65.2%	+/-846
Mean travel time to work in minutes (workers 16 years and over)	27.4	(X)	25.3	+/-1.1
Median household income (in 2008 inflation-adjusted dollars)	61,629	(X)	52,175	+/-2,009
Median family income (in 2008 inflation-adjusted dollars)	71,210	(X)	63,211	+/-3,900
Per capita income (in 2008 inflation-adjusted dollars)	27,990	(X)	27,466	+/-1,139
Families below poverty level	(X)	9.2	9.6%	(X)
Individuals below poverty level	(X)	10.3	13.2%	(X)

Housing Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error
Total housing units	32,259			+/-231
Occupied housing units	30,204	93.6	88.0%	+/-512
Owner-occupied housing units	21,590	71.5	67.1%	+/-736
Renter-occupied housing units	8,614	28.5	32.9%	+/-649
Vacant housing units	2,055	6.4	12.0%	+/-458
Owner-occupied homes	21,590			+/-736
Median value (dollars)	247,800	(X)	192,400	+/-9,774
Median of selected monthly owner costs				
With a mortgage (dollars)	1,740	(X)	1,508	+/-64
Not mortgaged (dollars)	438	(X)	425	+/-28

ACS Demographic Estimates - show more >>	Estimate	Percent	U.S.	Margin of Error
Total population	81,188			*****
Male	39,109	48.2	49.3%	+/-173
Female	42,079	51.8	50.7%	+/-173
Median age (years)	35.3	(X)	36.7	+/-0.2
Under 5 years	6,038	7.4	6.9%	+/-84
18 years and over	59,627	73.4	75.5%	+/-3
65 years and over	8,927	11.0	12.6%	+/-144
One race	79,944	98.5	97.8%	+/-432
White	44,325	54.6	74.3%	+/-337
Black or African American	32,997	40.6	12.3%	+/-557
American Indian and Alaska Native	199	0.2	0.8%	+/-138
Asian	1,128	1.4	4.4%	+/-124
Native Hawaiian and Other Pacific Islander	0	0.0	0.1%	+/-165
Some other race	1,295	1.6	5.8%	+/-642
Two or more races	1,244	1.5	2.2%	+/-432
Hispanic or Latino (of any race)	2,028	2.5	15.1%	*****

Source: U.S. Census Bureau, 2006-2008 American Community Survey

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