PARKING REQUIREMENTS AND THE URBAN TRANSECT:
A CASE STUDY OF MIAMI, FLORIDA'S FORM-BASED CODE

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EXECUTIVE SUMMARY

There is a growing recognition of the negative effects of rapid suburbanization, also known as urban sprawl, that has dominated the development of urban areas for the last several decades. Many suburbs suffer from a lack of nearby services, a characterless urban form, and a dependence on automobiles for travel. To address these issues, urban planners, architects, developers, and policy makers have considered encouraging a new type of urban growth that focuses on including a variety of housing types and services in complete and compact neighborhoods. This movement, known as New Urbanism or Smart Growth, also suggests that building these communities will reduce dependence on automobiles by make it convenient to walk or bike between destinations and making public transit more viable. To create these communities, some urban planners are considering form-based codes to guide and regulate development. Form-based codes are a method of regulating development to achieve a specific urban form. Form-based codes create a predictable public realm by primarily controlling physical form, with a lesser focus on land use. This is in contrast to existing development regulations, known as zoning ordinances, which typically focus on land use with fewer controls on form.

While form-based codes attempt to address urban sprawl and automobile dependency through land use regulations, urban planners also recognize the need to consider transportation policies in tandem with land use. Similar to how land use regulations impact how transportation decisions are made, transportation policies also impact the urban form. Since the 1920s, transportation policies have aimed to create infrastructure to support the automobile, including wide streets and large parking lots.

Of all the changes in urban areas since the dawn of the automobile era, parking to support automobile use has arguably had the greatest impact. Prior to the 1920s, all "parking" for horses, carriages, and vehicles was taken care of by curb space. This meant most of the land in urban areas was devoted to stores, workplaces, residences, and parks. With the proliferation of the automobile, traffic congestion on urban streets became a major concern. Many turned to off-street parking lots to accommodate the growing demand to park vehicles and reduce traffic congestion. As parking lots proved to be successful measures to improve traffic congestion on urban streets, the rise of urban areas dominated by parking began to take hold. Large parking lots to support the desire of Americans to drive ultimately separated destinations further and further apart until automobile use became more of a necessity than a luxury. To accommodate the increased use of automobiles and maintain free-flowing traffic, cities mandated that large amounts of parking spaces be included as part of developments. This has further impacted the development of cities, creating an automobile-oriented development that coincides with urban sprawl.

It is clear that to address all of the negative effects of urban sprawl and automobile dependency both land use and transportation aspects must be considered. Some urban planners may hail form-based codes as a great opportunity to reshape our communities to alleviate the negative impacts of the automobile. However, for these new codes to effectively reduce urban sprawl and automobile dependency, transportation policies must support this goal. In particular, parking for vehicles is a vital part of addressing these issues. "Parking most of all...makes auto use convenient. Without places to park, driving remains [a] most inconvenient" form of travel (Jakle & Sculle, 2004, 17). Therefore, this study focuses on parking requirements

in form-based codes. These parking policies are evaluated based on the solutions suggested by contemporary urban designers and transportation planners to slow the continuance of the auto-dependency cycle and minimize its negative impacts.

This study particularly focuses on the parking policies in the City of Miami's proposed Miami 21 form-based code. The Miami 21 form-based code is chosen as a case study because it is one of the first city-wide form-based codes in the United States, it will replace a conventional zoning ordinance, and it applies to a major, rapidly growing American metropolis. Miami's form-based code is primarily based on Duany Plater-Zyberk and Company's *SmartCode*. Therefore, this study evaluates both the Miami 21 form-based code and Duany Plater-Zyberk's *SmartCode*. This study also considers input from Daniel Parolek, Karen Parolek, and Paul Crawford's *Form-Based Codes*, which is a guide for planners, designers, municipalities, and developers on form-based codes.

Ultimately, this study finds that the parking policies in the Miami 21 form-based code and Duany Plater-Zyberk's *SmartCode* do not offer a greatly different approach to parking than conventional zoning ordinances. The findings in this study show that these form-based codes have not fully embraced solutions from parking critics to address the issues of urban sprawl and automobile dependency. Both codes include some marginal improvements to existing parking policies, but there is much room for improvement to include some of the more progressive solutions proposed by critics of existing excesses in parking requirements to reduce automobile dependency. This study recommends that future form-based codes integrate more progressive parking policy solutions to reduce automobile dependency and urban sprawl.

Beyond the scope of this study, it is recommended that future studies examine parking policies in other form-based codes, research the use of parking based on the urban context, price, and use to supplement existing parking studies solely aggregated by use, and investigate the potential for integrating parking demand management measures into parking policies and form-based codes.

INTRODUCTION

There is no doubt that Americans like to drive their automobiles, and enjoy the comforts and convenience they provide. In 2008, Americans drove 2.9 trillion miles, almost double the 1.5 trillion miles traveled in 1980 (FHWA, 2009; FHWA, 1997). As a culture of "hurried people...always on the move," prizing "life's conveniences" and looking to "doing things efficiently with minimal cost," automobiles enable and embody the desire of Americans to pursue this lifestyle. (Jakle & Sculle, 2004, 17).

Few would have predicted that the "horseless carriage" of the turn of the 20th Century would become so prevalent, or could have imagined its enormous impact on American urban development and culture. Now 100 years later, the "automobile has become the nation's prime instrument of geographic mobility" (Jakle & Sculle, 2004, 245). The dominance of the automobile has drastically changed the American landscape, transforming older central business districts and prompting new sprawling developments to accommodate the added space it requires (Jakle & Sculle, 2004, 93).

For the advances in mobility and convenience the automobile has brought, there have also been several negative effects. Many have asked "When did we stop building neighborhoods where kids can ride their bikes to school?" and "Why can't new subdivisions be more like the older neighborhoods that people love?" (Parolek et al., 2008, 1). With an urban landscape shaped around automobile use, the presence of walkable neighborhoods with unique character has steadily decreased.

With growing concern and understanding of global climate change, the greenhouse gas emissions associated with automobile use has also become disconcerting. In 2007, one-third of

the greenhouse gas emissions in the United States were related to transportation (EPA, 2009, ES-8). Of the transportation-related emissions, nearly 60 percent were the result of gasoline consumption for personal vehicle use (EPA, 2009, ES-8). This means that one-fifth of the U.S.'s greenhouse gas emissions are attributable to the driving habits of everyday Americans. To reduce vehicle emissions, policy makers are enacting regulations to improve vehicle fuel efficiency, lessen fuel carbon content, and reduce overall vehicle use, measured in vehicle miles traveled (VMT) (Ewing, Bartholomew, Winkelman, Walters, & Chen, 2008, 17). Until recently, most of the federal and state energy and climate policies have been focused on technological advances in vehicles and fuels, while rarely addressing VMT (Ewing et al., 2008, 17). However, there is growing recognition that "even with more stringent standards for vehicles and fuels...transportation related emissions still would far exceed target levels...because of the growth in VMT" (Ewing et al., 2008, 43).

To reduce the amount of driving and VMT, urban planners and policy makers acknowledge the importance of increasing walking, bicycling, and use of public transportation as alternatives. However, since the U.S. Census began keeping records of means of transportation for commuting in 1960, the proportion of trips by automobile has steadily increased, while the proportion of trips by all other alternatives, such as walking, bicycling, and public transit, have generally declined (U.S. Census, 2000; U.S. Census, 2008b). See Table 1.

Table 1: Means of Transportation for Workers – U.S. Census

Mode	1960	1970	1980	1990	2000
Car, Truck or Van:	63.98%	77.71%	84.10%	86.55%	87.88%
Drove Alone	[A]	[A]	64.37%	73.19%	75.70%
Carpooled	[A]	[A]	19.73%	13.36%	12.19%
Public Transportation:	12.07%	8.86%	6.39%	5.27%	4.73%
Bus or Trolley Bus	8.23%	5.52%	4.06%	2.99%	2.50%
Streetcar or Trolley Car	[B]	[B]	[B]	0.07%	0.06%
Subway or elevated	3.84%	2.30%	1.58%	1.53%	1.47%
Railroad	[C]	0.65%	0.57%	0.50%	0.51%
Ferryboat	[D]	[D]	[D]	0.03%	0.03%
Taxicab	[D]	0.39%	0.17%	0.16%	0.16%
Motorcycle	[D]	[D]	0.43%	0.21%	0.11%
Bicycle	[D]	[D]	0.48%	0.41%	0.38%
Walked	9.92%	7.40%	5.60%	3.90%	2.93%
Other Means	2.51%	2.53%	0.73%	0.70%	0.70%
Worked at Home	7.21%	3.49%	2.26%	2.96%	3.26%
Not Reported	4.30%	N/A	N/A	N/A	N/A

[A] – 1960 and 1970 Census did not separate "Car, Truck or Van" into "Drive Alone" and "Carpool"

[B] – 1960 – 1980 Census combined "Bus or Trolley Bus" and "Streetcar or Trolley Car" into "Bus or Streetcar"

[C] – 1960 – Railroad included in "Railroad, Subway or Elevated"

[D] – Included in "Other Means"

While this only shows the mode of transportation for work trips, typically modes other than driving tend to be represented even more for commute travel than any other trip purpose. This means that the increase in auto use for work trips has almost certainly coincided with an increase in driving for all types of trips. The increase in auto use over public transportation and walking since 1960 is of particular concern since the population of the United States has consistently become more urban over the same time frame. In 1960, the U.S. had an urban population of approximately 130 million people, or 70 percent of the total population (United Nations, 2007). By 2000, the U.S. urban population grew to over 225 million, or almost 80 percent of the total population (United Nations, 2007). Characteristically, the rural population is

more dependent on automobiles than urban dwellers due to the fewer transportation options and farther distances between origins and destinations. In particular, the greater conglomeration of uses in urban areas typically has made walking and public transportation more viable for the urban population. However, despite an increasingly urban population, more urban forms of transportation—public transportation, bicycling, and walking—still declined greatly between 1960 and 2000. This indicates that our urban areas in particular have been designed around automobile use to the detriment of other transportation modes. This presents a major challenge to reduce driving, VMT, and greenhouse gas emissions.

The primary force in the early rise of automobile use was the level of convenience it provides. In addition to the car, an adequate street and highway network and a sufficient supply of parking are necessary to create a completely convenient mode of travel. Of these three aspects, "it is parking most of all that makes auto use convenient. Without places to park, driving remains most inconvenient" (Jakle & Sculle, 2004, 17). Donald Shoup (2005a) notes that "regardless of how fuel efficient our cars are or how little pollution they emit, we will always need somewhere to park them, and the average car spends about 95 percent of its life parked" (p. 6). However, the transformation of the urban landscape to accommodate the automobile through wider streets and larger parking lots has occurred at the expense of walkable, bikable, and transit-oriented communities (Jakle & Sculle, 2004, 17). This has led to a use of automobiles, not as a matter of convenience, but necessity. Since parking is vital for automobile use, the combination of a desire to drive and a need to drive propels the demand for parking even more. The abundant supply of parking to accommodate cars expands the amount of space required to serve automobiles, separating destinations even further apart. This, in turn,

increases the reliance on automobiles for all types of travel. Therefore, a generous parking supply becomes part of a "cycle that leads to increased automobile dependency" (Litman, 2008, 8). The "abundant parking supply increases vehicle use and urban sprawl, causing parking demand and parking supply to ratchet further upward" (Litman, 2008, 8). Rather than an instrument of liberation and freedom, for most Americans the automobile has become a necessity in an urban landscape built around driving.

As this cycle shows, parking "affects both transportation and land use" (Shoup, 2005a, 3). As parking becomes more abundant, vehicle use increases and land uses are spread further apart. Furthermore, as more parking is required, more land is dedicated to storing cars rather than other, potentially more valuable uses. While parking plays such a vital role, "its effects are often overlooked or misunderstood" (Shoup, 2005a, 3). Despite its major impact on transportation and the built environment, parking is frequently "something everybody expects but nobody wants to think about" (Jakle & Sculle, 2004, 187). Even the American Planning Association's (APA) *Growing Smart Legislative Guidebook: Model Statutes for Planning and the Management of Change*, which is described as leaving "no stone unturned" and perfecting the "array of planning tools," does not address parking (Pierce, 2002). This is so despite the fact that the APA Planning Advisory Service receives more questions about parking requirements than any other topic (Shoup, 2005a, 29). In particular, most municipalities require uses to provide a minimum number of parking spaces. Vinit Mukhija and Donald Shoup (2006) argue that these "minimum parking requirements...would not be needed if they did not increase the parking supply beyond what the market would provide" (p. 297). While many people recognize urban problems such as congestion, pollution, decay, and sprawl, few connect the role parking

policies play with these problems (Shoup, 2005a, 3). This project studies parking policies as an integral part to address these urban problems.

Complicating the matter, parking is often "one of the most difficult and politically explosive issues to deal with" (Epstein, 2001, 3). Everyone has an opinion on parking, whether it is auto-users accustomed to abundant, free, and convenient parking or pedestrian, bicycle, and transit advocates who argue for less parking to create more walkable, bikable, and transit-friendly developments. Neighborhood and business interests vary from place to place. Residents may be worried about cars overflowing into their neighborhoods if not enough parking is provided (Correa, 2009). At the same time, neighborhood preservationists may be concerned about additional parking disrupting the character of a historic, pedestrian-friendly area. Businesses may be apprehensive about lack of accessibility if parking is reduced (Jakle & Sculle, 2004, 193). Yet an overabundance of parking may concern property owners about reduced property values. These various interests demonstrate that when planners address parking policies, they may not have the freedom to exercise professional judgment so much as respond to political pressure (Shoup, 1997, 12).

Another major influence on overall vehicle use, and therefore VMT, is land use. As noted earlier, land use and transportation are inherently connected, as evidenced by the transformation of the American landscape to accommodate the automobile that started in the 1920s. Through designing urban areas for the automobile, destinations have been placed further and further apart, decreasing the convenience of walking, bicycling, and use of public transit (Mukhika & Shoup, 2006, 296). Recognizing the close relationship between land use and transportation, some planners, designers, and policy makers are advocating the development

of compact, mixed-use urban areas to reverse the sprawling effect of the automobile. This approach, commonly associated with the New Urbanism or Smart Growth movements, primarily focuses on land use patterns and neighborhood design to decrease auto use and VMT (Boarnet & Crane, 2001, 172). Using statistics from the U.S. Census, New Urbanists note that more compact, densely developed urban areas exhibit reduced automobile use compared to more sparsely developed, single-purpose areas. To encourage the development of compact, mixed-use built environments, some new urbanist and smart growth supporters advocate new approaches to regulating development. Form-based codes, a set of land use regulations that primarily regulates building form with less focus on use, is particularly garnering attention from many planners and policy makers (Parolek, Parolek, & Crawford, 2008, 4). Given that land use and transportation are integrally connected, this study specifically researches parking policies in form-based codes, and whether these policies are actively discouraging or encouraging auto use.

BACKGROUND

History of Land Use Regulation

Land use regulations are tools typically used by local jurisdictions to direct and regulate existing and future development. One of the most common types of land use regulations is zoning codes. Today, zoning is often used as a means to implement a municipality's comprehensive plans. However, the practice of implementing land use regulations actually predates the comprehensive planning process.

Prior to the existence of formal land use regulations, "homeowners and homebuilders relied on a web of informal agreements, mutual understandings, and ad hoc resort to the law to enforce the patterns that zoning later dictated" (Fischel, 2001, 6). For example, private covenants between land owners would limit the type of uses adjacent property owner's could develop (Fluck, 1986, 328). If a land owner constructed uses that constituted nuisance to adjacent landowners, traditional nuisance laws took effect. However, several changes in cities and transportation ultimately set the stage for formal regulations on land use.

By the 1800s, the impact of the Industrial Revolution had become a primary force in the development of cities. Many industries located near rivers, oceans, and railroads for energy and freight transportation. Therefore, many cities were also located along these bodies of water and transportation corridors. Initially, the "rich tended to live closest to their jobs since long walks were irksome as well as time consuming" or used horse-drawn carriages to carry them to homes at the edge of the city (Fischel, 2001, 4). However, as cities became more crowded, health concerns became a huge issue, and the proximity of noxious, industrial uses encouraged those that could afford it to find housing outside the heart of cities.

The "development of electric-powered street railroads in the 1880s made it possible for urban workers to live in exclusively residential districts and commute daily to their jobs in the city" (Fischel, 2001, 5). In these "streetcar suburbs," "land use patterns in the pre-zoning era did not mix apartments and commercial establishments with single family and duplex homes" (Fischel, 2001, 6). Since streetcars "did not carry large amounts of freight," only "less-noxious commercial development, such as retail stores, was pulled out of the central city. Heavy industry remained concentrated around wharves and railheads" (Fischel, 2001, 6). Meanwhile, apartment houses were "almost always built near [streetcar lines] to take greatest advantage of the convenience they offered tenants" (Fischel, 2001, 6). This made neighborhoods immediately adjacent to streetcar lines "rather mixed," and allowed builders of "one and two-family homes to avoid these areas" (Fischel, 2001, 6). In other words, "control over the location of streetcar lines...was a substitute for zoning" at least in the suburbs (Fischel, 2001, 6).

However, the advent of the motor truck and motor bus "undermined the security of suburban, single-family residences" (Fischel, 2001, 7). The motor truck "liberated heavy industry from close proximity to downtown railroad stations and docks" allowing "manufacturers to take advantage of lower-cost land in residential districts" (Fischel, 2001, 7). The motor bus "likewise liberated apartment developers from close proximity to the trolley tracks" (Fischel, 2001, 7). These developments during the 1910s and 1920s set the stage for the adoption of formal land use regulations.

The First Zoning Regulations

Zoning regulations originated "as a means of protecting the health and safety of people in major cities" (Meck et al., 2000, 343). Zoning also addressed the "increasing interdependence

of urban land-use that arose after the dawn of the twentieth century," and directly filled the "need to deal with incompatible uses by means other than traditional nuisance law and private covenants" (Fischel, 2001, 4). The legal authority to adopt zoning regulations is directly tied to the municipality's police power to protect the public health, safety, and welfare of its residents (Talbert, 2008, 1). The earliest land use regulations were aimed at avoiding or minimizing the "worst consequences of uncontrolled development and noxious land uses" (Parolek et al., 2008, 6). For example, early land use controls included building separation and setback requirements to contain fires and ensure light and air filtration (Meck, Wack, & Zimet, 2000, 343). Building height restrictions were implemented to ensure "firefighters could reach the upper floors" (Meck et al., 2000, 343). These early land use controls also "separated smoke-producing industry from residential uses," beginning the practice of "separating 'incompatible' land uses" (Parolek et al., 2008, 6).

In 1904, Los Angeles became the first city to enact land use zoning that regulated the future land use of property (Parolek et al., 2008, 7). In 1916, New York City implemented the "first comprehensive zoning ordinance" that "covered the entire city and controlled land use, building heights, and building setbacks in one set of regulations" (Meck et al., 2000, 344). New York's zoning regulations ensured the separation of incompatible uses by dividing the city into four use zones and restricting industrial activity to one zone (Meck et al., 2000, 344). Building heights were regulated as a multiple of street width, "with yards, courts, and other open spaces...regulated according to building height" (Meck et al., 2000, 344). New York's comprehensive zoning ordinance was justified "based on an exhaustive study" that showed streets were congested with traffic, "buildings were clustered too close together and positioned

so that sunlight could not reach into them," and conflicts were occurring from noise, odor, dust, and the presence of non-residential uses in residential neighborhoods (Meck et al., 2000, 344). While New York's highest state court upheld New York City's zoning ordinance in a case in 1920, the constitutionality of comprehensive zoning ordinances was not validated nationally until the 1926 U.S. Supreme Court case, *Village of Euclid v. Ambler Realty Company*, more commonly referred to as Euclid versus Ambler. While New York is a major central city where the public health and safety benefits were easily tied to zoning regulations, the Village of Euclid was one of several smaller municipalities to adopt a zoning ordinance in the 1920s.

Euclid versus Ambler

The case of Euclid versus Ambler pitted the Village of Euclid, Ohio against the Ambler Realty Company. The Village of Euclid, Ohio, located at the outskirts of Cleveland along Lake Erie, was incorporated in 1903, and at the time of the case in 1920s, was predominantly farmland, although "it was clear that the Cleveland metropolis was expanding toward the village" (Fluck, 1986, 326). In November 1922, Euclid's municipal council unanimously adopted an ordinance "establishing the comprehensive zoning of all land uses throughout the entire village" (Fluck, 1986, 328). Between 1911 and 1922, the Ambler Realty Company assembled a 68-acre, undeveloped tract in Euclid. This tract was zoned consistently with the "general pattern of districting in the village" with the land adjacent to the railroad zoned for industrial and the remainder zoned for two-family house (Fluck, 1986, 328). However, Ambler protested the zoning and dismissed a rezone compromise. Ambler pursued a lawsuit that "sought a declaration of the zoning ordinance's invalidity" (Fluck, 1986, 328).

In January 1924, the district court judge hearing the case ruled in favor of Ambler, noting a pair of Supreme Court decisions that clearly limited police power legislation. The judge concluded that, based on these Supreme Court decisions, Euclid's zoning ordinance constituted a taking of the plaintiff's (Ambler) property without due process of law (Fluck, 1986, 330). Euclid appealed the decision directly to the U.S. Supreme Court.

Two years after the district court's decision, the U.S. Supreme Court heard the Euclid v. Ambler case. The central argument of James Metzenbaum, Euclid's legal defense, was that the "widespread adoption of zoning by communities across the country was itself an indication of the reasonableness of zoning" (Fluck, 1986, 330). The two-year delay also "enabled Metzenbaum to make an additional telling argument—the trend in the state courts was now more clearly favoring the constitutionality of zoning" (Fluck, 1986, 330). In addition to the New York case (discussed in the previous section), the Ohio Supreme Court "upheld the Cincinnati zoning ordinance on May 19, 1925 in *Pritz v. Messer*" (Fluck, 1986, 330). Ambler countered by arguing that the zoning ordinance "greatly diminished the value of Ambler's property" (Fluck, 1986, 330). Ambler also argued that "the municipal power to zone disrupted the metropolitan real estate market" and that "it was impossible for public officials and planners to understand the complex natural process of community development to the degree necessary to justify public regulation" (Fluck, 1986, 330-331).

After an initial oral argument in January 1926 and a reargument in October of the same year, the Supreme Court delivered its opinion "sustaining the Euclid zoning ordinance as a valid exercise of the police power under the U.S. Constitution" (Fluck, 1986, 333). In delivering the opinion of the Court, Justice Sutherland stated "the segregation of residential, business, and

industrial buildings will make it easier to provide fire apparatus...increase the safety and security of home life...prevent street accidents...[and] decrease noise and other conditions which produce or intensify nervous disorders" (Fluck, 1986, 334). Moreover, the Court's opinion also stated "the development of detached house sections is greatly retarded by the coming of apartment houses," justifying the zoning of land to segregate multi-family housing from single-family detached housing (Fluck, 1986, 334). In reference to this case, comprehensive zoning became frequently referred to as "Euclidean zoning."

Euclidean Zoning

The *Euclid v. Ambler* decision occurred at a time when the number of adopted comprehensive zoning ordinances skyrocketed. In 1922, the year the Village of Euclid adopted its zoning ordinance, the number of zoned municipalities jumped from 76 to 178 (Parolek et al, 2008, 8). By the time the *Euclid v. Ambler* decision was handed down in 1926, 567 local municipalities had adopted zoning ordinances (Parolek et al, 2008, 8). At the end of 1929, three years after the *Euclid* decision, 862 municipalities had adopted zoning ordinances (Parolek et al, 2008, 8).

The Village of Euclid, Ohio's comprehensive zoning ordinance created six land use zoning districts: single-family house, two-family house, apartment house, local retail or wholesale, commercial, and industrial (Fluck, 1986, 328). Euclid's zoning ordinance, like many early zoning ordinances, was "pyramidal, or cumulative, which means [it] permitted 'higher,' less intensive uses—such as residences—in the 'lower' zones that allowed more intensive uses—such as commercial uses" (Meck et al., 2000, 350). In other words, in Euclid's zoning ordinance, all uses allowed in a single-family house zone were allowed in all six zones, but those

uses allowed in an industrial zone were limited to the industrial zone. However, over time, zoning ordinances became more exclusive, or limiting each zoning district to a set of permitted land uses (Meck et al., 2000, 350). For example, these exclusive zoning ordinances would not allow residential development in an exclusive industrial district. The justification for exclusive zoning is to preserve industrial or commercial areas for "future development and forestall future conflicts with residential uses" (Meck et al., 2000, 350). The preservation of industrial or commercially zoned land for industrial or commercial uses is especially vital "when industrial [or commercial] facilities need to expand" (Meck et al., 2000, 350). This exclusive separation of uses is the most commonly associated characteristic of Euclidean zoning.

Effects of Euclidean Zoning

The separation of uses promoted by zoning ordinances reduced the interaction of incompatible uses and thus reduced potential conflicts with noise, health, and safety. However, it also placed an inherent, protected value for certain land uses, most notably the single-family house. Even the Supreme Court's opinion in *Euclid v. Ambler* called the apartment house a "mere parasite, constructed in order to take advantage of the residential character of the district," and that the development of detached residences would be "greatly retarded by the coming of apartment houses," let alone commercial or industrial developments (Fluck, 1986, 334).

While preserving industrial and commercial areas from potential conflicts with residential uses, the implementation of exclusive zoning ordinances further segregated uses. Although Euclidean zoning limited the negatives associated with incompatible uses adjacent to

each other, many of the accessibility benefits of placing employment, retail, entertainment, and residences in proximity to each other were lost as well.

The practice of exclusive zoning also has exclusionary effects. Some zoning codes are intentionally designed to "keep out low- and moderate-income residents" by requiring large minimum lot sizes, prohibiting multifamily housing and mobile homes, and refusing "to zone adequate amounts of land for higher-density single- and multi-family housing" (Meck et al., 2000, 357). Some of these exclusionary provisions are the result of benign purposes—maintaining an "area's low-density rural character," for example (Meck et al., 2000, 357).

Moreover, contemporary zoning regulations can be "bureaucratic, overly detailed, and resistant to administrative reform" (Meck et al., 2000, 357). The list of permitted uses for a zoning district may be "so narrowly drawn that a conditional use permit (and a hearing) are required for most changes of use" (Meck et al., 2000, 357). These criticisms of zoning have prompted several modifications to zoning regulations over the years.

Modifications to Euclidean Zoning

A few of the modifications to the comprehensive, Euclidean zoning ordinance include performance zoning, incentive-based zoning, planned unit developments (PUDs), and overlays. In the 1960s and 70s, performance zoning offered "increased flexibility in the number and types of land uses allowed in various zones by focusing on their effects on their surroundings and adjacent land uses as a basis for determining whether they could be allowed in specific zones" (Parolek et al., 2008, 8). Incentive-based zoning was geared towards encouraging developers to construct "specific uses in particular locations where they would be of advantage to the city"

through incentives such as increased residential density, building heights, or lot coverage (Parolek et al., 2008, 8).

PUDs "allow more leeway in the application of the zoning ordinance to a tract of land" (Meck et al., 2000, 357-358). PUD regulations may "allow mixed uses, flexibility in the placement of buildings, and relaxation of development standards" and "fixes the nature and location of uses and buildings on the entire site" (Meck et al., 2000, 358). This allows for the development of sites with a variety of compatible uses with an improved site design, preserved amenities, and reduced infrastructure costs (Meck et al., 2000, 358).

Overlay zones "provide an additional layer of development standards to address special land use needs" (Meck et al., 2000, 359). For example, "historic preservation regulations are usually administered through overlay districts," (Meck et al., 2000, 359). To allow for mixed-use developments, some cities adopt a mixed-use overlay zone (Meck et al., 2000, 361). While conventional zoning codes strictly segregate land uses, a mixed-use overlay zone allows multiple, compatible uses to exist on one site. Segregating land uses often results in single purpose districts that are "devoid of activity during certain times of the day and therefore isolated from the watchful eyes of the public and more vulnerable to crime" (Meck et al., 2000, 360). Furthermore, the conventional Euclidean zoning promotes "dependence on the automobile by distancing residences from amenities and businesses" (Meck et al., 2000, 360). Alternatively, mixed-use areas are "higher-intensity nodes that are less susceptible to crime because of the presence of human activity and that are supportive of—and compatible with—the more intensive activity found around transportation hubs" (Meck et al., 2000, 361).

While many of these modifications to exclusive Euclidean zoning have addressed some of its negative effects, it has often come at the expense of creating an even more complicated regulatory system (Parolek et al., 2008, 8). Moreover, "many communities remain dissatisfied with the character and quality of the places that conventional zoning has fostered" (Parolek et al., 2008, 9). In response, some planners and architects advocate for a "complete overhaul of the existing zoning system," proposing to implement "form-based codes" to guide development as an alternative to conventional zoning (Parolek et al., 2008, 9).

Form-Based Codes

Form-based codes "look at communities more in terms of variations in scale and intensity of development than in differences in land uses" (Parolek et al., 2008, 9). Therefore, they are a "method of regulating development to achieve a specific urban form" that primarily controls the "physical form with a lesser focus on land use" (Parolek et al., 2008, 4). By regulating form over use, form-based codes can encourage mixed-use development while remaining sensitive to the adjacent built environment. This is in contrast to Euclidean zoning which primarily controls land use and promotes separating uses (Parolek et al., 2008, 6)

Supporters of form-based codes believe these codes provide the tools necessary to facilitate sustainable, "smart growth" type developments that current conventional zoning regulations are lacking (Parolek et al., 2008, 9). Advocates of form-based codes argue that by setting regulations based on building character, scale, and intensity, form-based codes can "help revitalize downtowns, create economically vital commercial areas that attract pedestrians," and "protect the existing character and quality of particular places" (Parolek et al., 2008, 9).

Form-based codes are "vision-based and prescriptive," meaning that they require the community to "create a detailed vision at the start of the coding process" and set specific guidelines for development to follow (Parolek et al., 2008, 11). Since the emphasis is more on physical form than land use, form-based codes frequently are broken into different transect zones, typically ranging from a natural or rural zone to an urban core zone (Parolek et al., 2008, 18-20). Form-based codes are designed to be "holistic, addressing both private and public space design to create a whole place, including buildings, streets, sidewalks, parks, and parking" (Parolek et al., 2008, 11).

Transect Zones

The concept of the transect is commonly used in ecology. Ecological transects describe changes in habitat over changing topography or distance from a water body. The concept, as applied in land use planning, defines an urban-to-rural transect as a series of zones that transition from sparse rural land use to a dense urban core. Each zone contains a similar transition from its edge to the center. Duany Plater-Zyberk and Company included the concept of the transect into their recommended planning code, *SmartCode* (DPZ, 2009b).

A major feature of transect planning is that it incorporates a variety of residential and commercial uses into a single neighborhood. A typical neighborhood could consist of a commercial area (with a bank, general store, pub and coffee shop) and apartments. Moving outwards from the center, residential density would gradually decrease starting with apartments to townhouses to fully detached houses. The central area would be accessible by transit and ideally be within walking distance from any point in the neighborhood.

Transect planning therefore contrasts with Euclidean zoning and suburban development. In the latter, large areas are dedicated to a single purpose, such as housing, office or shopping that foster separation and long distances between land uses. By contrast, the transect decreases the necessity for long-distance travel between uses.

The Transect has six zones that range from rural to urban. It begins with two that are entirely rural in character: the Natural zone (T1) which represents areas protected in perpetuity; and the Rural zone (T2), that is, areas of high environmental or scenic quality that are not preserved, but may be considered for preservation. The transition zone between countryside and town is called the Edge, which encompasses the most rural part of the neighborhood, and the countryside just beyond. The Edge, or the Sub-urban zone (T3) has primarily single family homes. Although the Sub-urban zone is the most purely residential zone, it can have some mixed-use, such as civic buildings. Educational institutions may be appropriate for this area. Next comes the General Urban zone (T4), which is the largest zone in most neighborhoods. The General Urban zone is primarily residential, but more urban in character with somewhat higher density with a mix of housing types and uses. At the urban end of the spectrum are two zones which are primarily mixed use: the Urban Center zone (T5), which can be a small neighborhood center or a larger town center, with the latter serving more than one neighborhood; and the Urban Core zone (T6), which serves the region. The Core is the most urban zone and is akin to the central business district (New Urban News, 2000; DPZ, 2009b).

The Establishment of Parking Requirements

The automobile came on the scene at the beginning of the twentieth century as "sporting devices, machines for the amusement of the well-to-do" (Jakle & Sculle, 2004, 19). At

the time, only the wealthy could afford automobiles, and motorists could park their cars at curbside where they formerly tethered their carriage and horses (Shoup, 2005a, 1). It was initially assumed that "motor-powered vehicles would merely replace horse-drawn vehicles" (Jakle & Sculle, 2004, 19). Few suspected that the car would become affordable and widely available to a growing middle-class, or that the number of registered automobiles in the United States would surge to 8 million by 1920 and 23 million by 1930 (Jakle & Sculle, 2004, 19). With the number of vehicles skyrocketing, there was no longer enough space at the curb "for everyone to park whenever and wherever they wanted" (Shoup, 2005a, 1). Traffic congestion ensued as drivers were forced to circle in vain looking for an empty space to park their cars (Shoup, 2005a, 1).

History of Parking Requirements

The scarcity of curbside parking space in the central business districts of big cities and small towns combined with side-street parking bans and a huge demand for parking space forced drivers to look for off-street parking opportunities. Under these circumstances, the parking lot became such a logical idea that "business entrepreneurs in a host of cities must have simultaneously brought the innovation to the fore" (Jakle & Sculle, 2004, 48). The first parking lots began to appear in the 1910s, as commercial parking companies capitalized on the high demand and low supply for parking (Jakle & Sculle, 48). With traffic congestion from circling automobiles clogging city streets and developers failing to provide sufficient off-street parking, local governments were forced to address the parking shortage. In 1923, Columbus, Ohio became the first city in the United States to incorporate off-street parking requirements in its zoning code (Jakle & Sculle, 2004, 77). By 1949, some 185 American cities adopted minimum

parking requirements for a variety of land uses ranging from apartment houses to office buildings to theaters (Jakle & Sculle, 2004, 77). These parking requirements call for developers to provide off-street parking as part of their developments.

Parking requirements were initially advertised as means to minimize traffic congestion and "became widely accepted as a preventive approach for achieving planned and orderly development" (Jakle & Sculle, 2004, 78). Minimum parking requirements became a "popular land use regulation" that satisfies people's desire for cars and their "need to park them somewhere" (Shoup, 1997, 12). One mayor stated: "We consider zoning for parking our greatest advance.... It is working out exceptionally well, far better than we had expected" (as cited in Shoup, 2005a, 2). Off-street parking requirements spread rapidly during the late 1940s, fueled by their success in reducing traffic congestion and satisfying the public's desire for free parking (Shoup, 1997, 12). Over time, the primary goal of parking requirements has shifted from minimizing traffic congestion to providing sufficient off-street parking space (often free) to meet the demand created by various uses and activities (Shoup, 2005a, 21).

How Parking Requirements are Determined

Theoretically, cities create parking requirements for each land use "to provide enough off-street space to accommodate the recurrent peak-parking demands" (Shoup, 1997, 4). These minimum parking requirements are generally different for every land use type, and ideally are determined by observing parking demand for that type of use. However, critics note that "requirements often seem pulled out of thin air or based on studies that are poorly conceived" (Shoup, 2005a, 13). Carol Gould (2003) asserts that "parking requirements in most zoning regulations are not founded on an empirical analysis of what any land use will require to meet

patrons' needs, but appear to have been 'handed down' from one community to another" (p. 11). Rather than conducting site-specific analyses, most urban planners copy other cities' requirements or refer to national surveys, increasing the likelihood for mistakes to be repeated (Shoup, 2005a, 26). Given the widespread use of similar parking requirements with little empirical analysis, critics of current parking practices claim that "most parking requirements amount to little more than a collective hunch" (Shoup, 2005a, 28).

Parking Requirements and Zoning Regulations

Coincidently, as American cities were increasingly facing problems with parking shortage and traffic congestion, comprehensive zoning was being validated by the courts in the *Euclid v. Ambler* case. As more and more cities adopted zoning codes to regulate existing and future development, they indirectly addressed traffic congestion by affecting population densities and trip generation (Jakle & Sculle, 2004, 76). Additionally, the proliferation of zoning codes also gave local governments a mechanism to implement minimum parking requirements. In its early success in reducing traffic congestion, minimum off-street parking requirements became an integral part of most cities' zoning codes. Today, most parking requirements are written in local municipal zoning codes and determined by land use.

PROBLEM STATEMENT

The widespread popularity of zoning codes and minimum parking requirements throughout the United States in the 1940s laid the foundation for an automobile oriented culture. After World War II ended, a combination of several factors ultimately led to the proliferation of automobile use and an automobile dominated landscape. Higher household incomes, cheap fuel, and free parking supported the increased use of automobiles. Zoning and parking requirements encouraged the separation of uses, which increased the need for automobiles to travel and decreased the viability of walking, bicycling, and using transit.

Although zoning and minimum parking requirements existed prior to World War II, the Great Depression and rationing to support the war effort greatly hindered their full effects. An "unprecedented demand for housing (with the single-family home being the common dream)" at the end of World War II combined with a zoning system that separated all uses set the stage for large, exclusively residential areas on the urban fringe (Parolek et al., 2008, 8). These major residential enclaves, such as Levittown, were built in weeks with thousands of homes but without the commercial services and workplaces communities prior to these developments enjoyed. The rapid development of single-purpose areas at the behest of Euclidean zoning combined with an expanded roadway network and plentiful parking supply created an urban fabric increasingly developed around the use of automobiles. With destinations spread further and further apart, automobiles became transportation necessities for travel between workplaces, homes, stores, and services. As automobiles became more of a need than a luxury for travel, additional roadways and parking were required to meet the large volume of cars. Thus the automobile dependency cycle was born.

Effect of Minimum Parking Requirements

Early parking requirements reduced traffic congestion that threatened to clog city streets by providing off-street space for the newfangled automobile. Its initial success in alleviating traffic led to their permanence in zoning regulations across the country. While parking requirements improved the traffic congestion situation of early 20th Century cities, few foresaw that providing parking to accommodate the demand for automobile storage would ultimately lead to the abundance of free parking lots that now dominate the urban landscape. Current parking practices result in "economically excessive parking supply, increased automobile traffic, and more dispersed destinations, contributing to various economic, social, and environmental problems" (Litman, 2008, 26).

Conventional parking policies for the last half-century have frequently set required parking minimums that are based on peak parking demand. This has resulted in an overabundance of free parking, and encouraged automobile use while hindering other modes of transportation. The abundance of free parking eases accessibility for automobiles while placing uses further apart from one another, which decreases accessibility for pedestrians, bicyclists, and transit users. This adds to the automobile-dependency cycle, encouraging automobile use while marginalizing other transportation modes.

Studies show that the "generous parking capacity required" by minimum parking requirements "often goes unused" (Shoup, 1997, 4). An Urban Land Institute study on suburban retail centers found that parking requirements "leave at least half of all spaces vacant for 40 percent of the time a shopping center is open for business" (Shoup, 1997, 4). Moreover, other studies show that peak parking demand at office parks "average only 47 percent of capacity,

and that no office park had a peak parking demand greater than 60 percent of capacity" (Shoup, 1997, 4). This generous supply of parking resulting from minimum parking requirements exacerbates the demand for cars (Shoup, 2005a, 129). As minimum parking requirements increase the supply of parking, they create "a self perpetuating cycle in which increasing the supply of parking leads to increased demand" (Mukhija & Shoup, 2006, 297).

Furthermore, the large area dedicated to parking expands "the distances between destinations [and] undermines walkability" (Mukhija & Shoup, 2006, 296). In addition to separating uses, the abundance of parking degrades the quality of the pedestrian environment. This further hinders walking since "the distance people are prepared to walk is dependent on the quality of the walking environment" (Knoflacher, 2006, 392). "In a car-free environment, people accept walking distances that are more than 70 percent longer than in a car-oriented environment" (Knoflacher, 2006, 392). In addition to the increased distance between destinations, the space devoted to parking typically creates large voids in the built environment. This is particularly detrimental in the central business districts of major cities and small towns alike. Whereas visitors to central cities prefer a "dense downtown" that offers a "park once" and "walk around to shop, dine, and go to a movie or the theater" experience, "off street parking requirements reduce density because each building has its own, unshared parking that is often unavailable to the public" (Shoup, 2005b, 36). Ultimately, this all continues the auto-dependency cycle and places walking, bicycling, and public transit use at a disadvantage.

Parking Requirements and Costs to Society

Minimum parking requirements also have major cost implications. By requiring an abundance of parking that exceeds the "peak parking demand," minimum parking requirements increase parking supply to the point where it frequently must be free. Yet parking can cost a significant sum of money to construct. The cost to construct a parking lot often differs based on the price of land, which varies by location (Shoup, 2005a, 185). However, it is reasonable to assume that parking lots and structures range in cost from about $10,000 a space to $40,000 a space, depending on the location (Shoup, 2005a, 187).

While this initial cost to construct the required parking often falls on the developer, the cost is often passed down to tenants, homeowners, and consumers through higher leases, housing prices, and price of goods (Shoup, 2005a, 2). Therefore, "even people who don't own a car have to pay for 'free' parking" (Shoup, 2005a, 2). In fact, the "parking requirements based on the demand for free parking can easily provide parking subsidies that are more than double the cost of gasoline used for driving to and from the required parking" (Shoup, 1999, 311). By this standard, the impact fees implicit in parking requirements dwarf the impact fees for all other public purposes combined (Shoup, 1999, 318). Moreover, there are the external costs of a parking space, including the cost of additional congestion and emissions created by accommodating automobiles with abundant parking (Shoup, 2005a, 194-197).

Addressing the Parking Supply Problem

Where early parking requirements were established to reduce traffic congestion in the 1920s, planners are recognizing that while "minimum parking requirements...imply that parking is a problem only when there is not enough of it," clearly "too much parking also creates

problems" (Mukhija & Shoup, 2006, 298). As mentioned, the separation of uses encourages driving to the detriment of other modes of travel, which results in increased greenhouse gas emissions and diminished quality of urban areas.

Recognizing this impact, several cities have instituted parking maximums, particularly in central business districts, to minimize the detrimental effects of a large parking supply. Central cities including Boston, New York, Chicago, Minneapolis, Raleigh, San Francisco, Seattle, and Portland have in some form set maximum limits on parking to reduce their visual and environmental impacts on the local community. Even smaller towns such as Carmel on the Monterey Peninsula of California have parking maximums to encourage walkability and transit use, which are hindered by a large parking supply. Parking supply restrictions also free up "land for other purposes" and lower maintenance costs (CCAP, 2007, 98). To manage parking demand so that it does not exceed these maximums, many of these cities combine these parking policies with parking pricing to discourage driving and encourage other modes of transportation. The Center for Clean Air Policy notes that "these management policies ensure the appropriate supply of parking for a given area by neither subsidizing nor otherwise encouraging the building of excess parking spaces" (CCAP, 2007, 98). Therefore, "parking pricing and supply restrictions are two methods...to deter personal vehicle use, especially single occupancy vehicle use, in areas with easily accessed transit alternatives" (CCAP, 2007, 98).

"When designed in conjunction with other land use and pricing measures, parking pricing policies are one of the most effective ways to reduce VMT, congestion and air pollution" (CCAP, 2007, 98). Parking maximums and pricing reduce driving, congestion, and greenhouse gas emissions by shifting the "mode split...away from automobile use as more transportation

choices become cost competitive" (CCAP, 2007, 98). According to the Center for Clean Air Policy, these parking policies result in a "site-level VMT reduction of 15-30%" (CCAP, 2007, 98). To highlight the importance and impact of these policies, this overall reduction in VMT and associated greenhouse gas emissions is greater than many other transportation and land use policies to reduce driving, including improving transit service, providing light-rail or bus-rapid-transit corridors, and transit-oriented development (CCAP, 2007, 8-9).

Addressing the Urban Landscape

There is no doubt that accommodating the automobile has drastically changed the built environment in urban areas across the country. Minimum parking requirements have contributed to this transformation by calling for large areas to be devoted to parking rather than other uses. Moreover, as many designers and architects will note, minimum parking requirements compromise overall design by forcing them to "shoehorn a building into the space remaining after the parking requirement has been satisfied" (Mukhija & Shoup, 2006, 296). Therefore, "reducing or removing parking requirements can make better design possible" (Mukhija & Shoup, 2006, 296).

However, minimum parking requirements are not solely to blame for the alteration to the urban landscape. Even before minimum parking requirements were established, commercial store owners began to recognize that "in the future, the locations which we pick will be those which assure us of ample parking space for customers" (as cited in Jakle & Sculle, 2004, 193). In fact, "parking, clearly visible from the car and easily accessible, was an incentive" (Jakle & Sculle, 2004, 193). An increase in the dominance of automobiles combined with the demand for available and convenient parking led to the creation of large, visible parking lots,

which greatly altered the appearance of urban areas. Moreover, the separation of uses brought about by Euclidean zoning, further increased the need to drive by placing destinations further apart.

To address these issues, planners, architects, policy makers, and developers have recognized the importance of compact, mixed-use development in urban areas. To encourage this type of development, cities have adopted mixed-use overlay zones or form-based codes. These land use measures allow multiple, compatible uses to be located above, below, or adjacent to one another. By placing multiple uses in proximity to each other, it reduces the distance between destinations, making walking, bicycling, and public transit use more viable.

Parking and Form-Based Codes

Similar to conventional use-based zoning codes, most parking policies currently determine parking requirements by use, disregarding the urban context of the site. In doing so, many jurisdictions apply the same minimum off-street parking requirements for retail space in a suburban area adjacent to a freeway and retail space in a traditional urban neighborhood adjacent to offices, apartments, and transit service, even though the demand for automobile use would be higher in the suburban context.

Some cities attempt to correct this imbalance by creating additional use-based zones or overlay zones for different urban contexts. However, this typically leads to lengthy zoning ordinances with multiple zones for specific areas and select uses. This can be confusing even for the most adept planner, citizen, or developer attempting to decipher the code. Since many form-based codes are written based on the transect, or an increasing intensity in the urban

landscape, they provide the opportunity to administer parking based primarily on the urban form rather than on use.

To reduce automobile-dependency, maximum parking limits have been set through conventional zoning codes, for instance in San Francisco, New York, and Portland. Likewise, form-based codes have been adopted in many cities from Florida to California, including such jurisdictions as Sarasota County, Florida; Montgomery, Alabama; and Santa Ana, California. However, the literature is devoid of studies about the integration of parking policies into form-based codes. This study particularly evaluates how parking policies are modified based on urban context and proximity to transit and other uses rather than the existing practice of requiring it for individual uses.

STATEMENT OF PURPOSE

New urbanists and advocates for Smart Growth and traditional neighborhood development recognize the negative impact of automobile use on the urban environment, and propose to more strictly guide the form of development using form-based codes to reduce this impact and encourage transportation alternatives. Transportation planners acknowledge the damaging effects of over-providing automobile infrastructure to the detriment of other modes of travel, and pursue the use of travel demand measures to reduce auto use. Both groups acknowledge the destructive pattern of automobile dependency on our natural and built environments and social communities. This study examines how well the land use and urban design strategies proposed by land use planners in form based codes are incorporating new and realistic transportation strategies to combat automobile dependency. Specifically, this study focuses on parking policies in form-based codes, and evaluates their potential in reducing automobile dependency in this new genre of land use regulations.

These objectives are achieved by evaluating if municipalities are adjusting parking requirements based on the form and context of the built environment. The study also evaluates whether parking policies are adjusted for availability of transportation alternatives, including proximity to transit. This project analyzes the parking requirements in form-based codes based on the solutions suggested by contemporary urban designers and transportation planners to slow the continuance of the auto-dependency cycle and minimize its negative impacts.

DEFINITION OF TERMS

The following terms are used throughout this report. Since several of these terms may be used in different contexts, it is prudent to define them as used in this study.

Central Business District: The traditional commercial center of most cities. In many cities, this area is frequently referred to as "Downtown."

Cumulative Zoning: A type of zoning ordinance that allows "less intensive" uses in zones designated for "more intensive" uses. The least intensive urban use tends to be single-family homes, whereas the most intensive land use tends to be industrial. Therefore, in a purely cumulative zoning ordinance, it is permissible for a single-family residence to locate in an industrial zone, but it is not permissible for a manufacturing facility to locate in a single-family residential zone. Also see Euclidean Zoning and Zoning Ordinance.

Euclidean Zoning: A type of zoning ordinance that typically separates land into use-based zones. For example, these types of ordinances usually include zones specific for each general land use category, such as a zone specific for only single-family residences. Also see Cumulative Zoning and Zoning Ordinance.

Form-Based Code: A method of regulating development to achieve a specific urban form. Form-based codes create a predictable public realm by primarily controlling physical form, with a lesser focus on land use, through city or county regulations (Parolek et al, 2008, 4).

Greenhouse Gases: Atmospheric gases that increase the amount of heat retained by the Earth's atmosphere. These include carbon dioxide (CO_2), methane (CH_4), nitrogen oxides (NO_x), and chlorofluorocarbons (CFCs).

Land Use: Any type of activity, function, or purpose a property may be used for. General land use categories include residential, commercial, industrial, and government (or public facilities). More specific land uses include retail, restaurants, single-family homes, warehouses, offices, and parks.

Maximum Parking Limits: The maximum number of parking spaces a development is allowed to provide.

Minimum Parking Requirements: The minimum number of parking spaces required to be provided by a given development. This is typically included in a zoning ordinance, and varies by the type of land use.

New Urbanism: An urban design movement aimed at creating compact, mixed-use developments that support use of public transit and walking, and contain a range of housing and jobs. Also see Smart Growth.

Public Transit: Any form of mass transportation, including buses, streetcars, light rail trains, subways and elevated trains (also known as heavy rail trains), and people movers.

Smart Growth: An urban planning movement advocating the development of compact, mixed-use areas that support use of public transit and walking as an alternative to urban sprawl. Also see New Urbanism.

Transect: A geographical cross-section revealing a sequence of physical environments. In reference to the urban metropolis, a transect refers to the varying level of intensity in the physical and social character of different urban contexts (DPZ, 2009b, vi).

Urban Sprawl: A term used to describe the pattern of development typically consisting of large lot single-family neighborhoods at the fringe of an urban area. This type of development typically requires automobiles to travel any distance due to the lack of transportation options and distant services, workplaces, and recreation venues.

Vehicle Miles Traveled (VMT): A measurement for the total number of miles driven by vehicles.

Zoning Ordinance: A method to regulate development by dividing a jurisdiction into multiple, use-based zones. Zoning ordinances typically include policies that regulate the allowed uses on a property, the size and shape of buildings, and standards for site amenities, such as parking for cars and landscaping.

METHODOLOGY

This project evaluates the parking policies proposed to be used in form-based codes, specifically studying Duany Plater-Zyberk's SmartCode (Version 9.2) and the Miami 21 form-based code as case studies. Miami is selected for its recent proposal for a city-wide form-based code based on the urban transect. These policies are compared to "best practices" in parking policies that are suggested by academics and practitioners and are implemented in certain major metropolitan areas. The study procedure is outlined in the following subsections.

Literature Review

The research began with a review of available literature on zoning regulations, form-based codes and parking policies. The literature includes history, critiques and recommendations for parking practices, and implementation of form-based codes. The documents consists of journal and newspaper articles, books, and online resources by notable researchers and organizations in the transportation, land use, and urban design fields.

Review of Miami's Form Based Code

This study primarily focuses on the Miami 21 planning project as a case study. The crux of Miami 21 is the proposed city-wide form-based code to replace the existing Euclidean zoning ordinance. In January 2009, the final draft of the form-based code was released, and as of June 2009, it has yet to be adopted by the local governing body. This study's review of the form-based code focuses on evaluating the parking requirements found in Article 4 of the final draft. It also included looking over other articles in the proposed code, such as guidelines for development, permitted uses, and general standards for development.

Parking Requirement Comparison

To determine changes in parking policies, a few parking requirements are evaluated in addition to the Miami 21 form-based code. Miami's current zoning ordinance, Duany Plater-Zyberk & Company's *SmartCode* and Daniel Parolek, Karen Parolek, and Paul Crawford's *Form-Based Codes* are used to compare to the Miami 21 form-based code. Miami's current zoning ordinance represents a typical Euclidean zoning code, and is ideal to compare how the parking requirements change from the existing code to the proposed form-based code. Miami 21's form-based code is based on Duany Plater-Zyberk and Company's *SmartCode*, which is also used as the template for several form-based codes across the country. This makes it ideal for determining the changes in parking practices in form-based coding as well as revealing the modifications the City of Miami made to the *SmartCode* to adapt it to local conditions. Parolek, Parolek, and Crawford's *Form-Based Codes* book is a comprehensive guide on form-based codes. As a major reference for form-based codes that is not connected to the Miami 21 code, it provides a third-party perspective.

The parking policies in each of these codes were compiled into a table for comparison. Since the way the parking requirements are determined vary by code, some refinement was necessary to make appropriate comparisons. This data is compiled in Table 2.

Assessment of Parking Policies in Form Based Codes

This study includes a general assessment of the parking policies in form-based codes, and the extent to which they modify parking requirements to address urban form. The

evaluation is based on critiques and recommendations acquired through the review of applicable literature and innovative policies adopted in other municipalities.

Recommendations

From the assessment, recommendations are made to enhance parking policies in form-based codes. The report also includes recommendations for future studies to further refine this project's findings by evaluating other form-based codes and conducting an expanded analysis of parking policies.

CASE STUDY – MIAMI, FLORIDA

Background

Miami is located on the Atlantic coastline of southern Florida, and is the primary central city in South Florida. With 5,414,772 people, the Miami metropolitan area is the largest in Florida and the seventh largest in the country (U.S. Census, 2008a). The City of Miami is the largest city in the metropolitan area with a population of 409,719 people (U.S. Census, 2007). It is the second largest city in Florida and the 43rd largest city in the country.

Miami also has a diverse population with large ethnic minority populations. Latinos are the largest ethnic group comprising of two-thirds of the City's population. African-Americans make up 20 percent of Miami's population, Caucasians make up 10 percent, and the remainder is Asian, Native American, or other races.

Miami has a rapidly growing urban core of major skyscrapers. Of the 55 buildings in Miami over 400 feet in height, 40 have been completed since 2004 and 30 have been completed in the last two years (Emporis, 2009). Moreover, Miami has several unique neighborhoods, including Little Havana west of Downtown, Little Haiti on the northern edge of the city, and Coconut Grove on the southern edge of the city.

Miami is served by Miami-Dade Transit, a multimodal public transportation service including the Metrobus, Metrorail, and Metromover. Metrobus is a countywide bus service offering, local, limited-stop, and express service. Metrorail is an elevated, grade-separated heavy rail line that connects downtown with Hialeah and Medley to the northwest and Dadeland and South Miami to the southwest. The Metromover is a people-mover system serving downtown Miami with three loops—a downtown inner loop, and two outer loops with

one connecting downtown with the Bricknell Financial District to the south and one connecting downtown with the Omni Center to the north.

Zoning and Parking History

The first proposal for comprehensive city planning in Miami occurred in February 1915. City Councilman H.G. Ralston "called attention [to] the manner in which the city is now spreading out, the platting of new additions without any idea of conformity to streets in the older sections" (City of Miami, 2009b). Despite Ralston's concerns about new growth not conforming with existing development, the Council ultimately decided not to pursue a comprehensive citywide plan. The Miami Daily Metropolis article reporting on the story stated "though Miami is growing with great rapidity, necessitating the frequent opening of new additions, it will continue to grow in a haphazard, 'hodge-podge' way" (City of Miami, 2009b).

In 1922, the Miami Chamber of Commerce published an "article on zoning, which strongly endorsed the creation of a zoning code in Miami" (City of Miami, 2009b). By 1929, Miami Mayor C.H. Reeder considered a zoning ordinance as "'one of the most important propositions confronting the Commission'" (City of Miami, 2009b). On August 8, 1934, the City of Miami adopted the city's first zoning ordinance. "The ordinance was amended about 5,000 times during its 26-year existence," ultimately creating a "hodge-podge, meaningless ordinance" (City of Miami, 2009b).

In 1960, a new zoning ordinance was adopted to replace the original 1934 ordinance. The new comprehensive zoning ordinance "rezoned the entire City, divided the City into nine sections, and affected over 30,000 properties. The ordinance contained many new rules regulating form and types of buildings, as well as uses." Perhaps due to the massive change,

"hundreds of people objected to the new plan" (City of Miami, 2009b). In 1982, yet another zoning ordinance was adopted to replace the 1960 comprehensive zoning ordinance. The new regulations, known as "Zoning Ordinance 9500," "introduced the concept of mixed use and its innovative approach received an award by the Gold Coast Chapter of the American Planning Association (APA)" (City of Miami, 2009b). As an award winning ordinance, it "was used as a mode for many other cities" (City of Miami, 2009b). However, Zoning Ordinance 9500 was "a huge undertaking," taking eight years to write. Despite "acclaim and high regard by fellow planning professionals, 9500 was widely regarded by residents and developers as incomprehensible when it was first introduced" (City of Miami, 2009b).

In 1990, the current "Zoning Ordinance 11000" was adopted to replace Zoning Ordinance 9500. The primary impetus in adopting 11000 to replace 9500 was to "simplify the ordinance and address issues with parking and setbacks for residential homes" (City of Miami, 2009b). Miami's Zoning Ordinance 11000 "increased parking requirements for new apartments and doubled the minimum lot size to handle extra parking" (City of Miami, 2009b). It also "revived a provision that allowed developers to raze abutting residential property to provide for additional parking for their businesses" (City of Miami, 2009b). Over the last 19 years, it "has been amended innumerable times and has become a hodge-podge without regard for smart growth and quality of life" (City of Miami, 2009b). The City has determined that the "amendments and variances to the code have demonstrated the need for a complete overhaul of the outdated regulations which fail to address the current and future needs of the City as a whole" (City of Miami, 2009b).

Miami Zoning Ordinance 11000

The Miami Zoning Ordinance 11000 covers the following general land use types:

- Conservation
- Parks, Recreation and Open Space
- Government and Institutional
- Residential
- Commercial
- Office
- Central Business District
- Industrial

It is generally a cumulative Euclidean zoning ordinance, meaning that it designates districts by permitted land use categories, but mostly allows "less intensive uses in zones that allow more intensive uses" (Meck et al., 2000, 350). For example, the types of uses permitted in an R-1: Single-Family Residential zone are also permitted in the more intensive R-2, R-3, and R-4 zones, which allow multi-family residences. This also extends beyond general use categories. For example, the uses permitted in an R-4 multifamily residential zone are also permitted in O (Office) and C-1 (Commercial) zones. There are some exclusive zoning characteristics in the 11000 Ordinance. For example, the G/I (Government and Institutional) Zone is generally reserved for government or public uses, or uses to support those primary uses. Moreover, some of the zones for more "intensive uses" include a list of exceptions from the less intensive zones, limiting some of the uses that carry over.

Overall, this type of cumulative zoning system is rare in contemporary zoning ordinances. Most Euclidean zoning ordinances today are more exclusive; for example, preserving commercial land for only commercial development to prevent future conflicts with less intensive uses that may enter. However, it does yield some benefits by generally allowing

the development of residential uses within the same zone as non-residential uses, potentially reducing the distance between residences and service and workplace destinations.

Within the zoning ordinance, very specific types of uses are described for each zone. For example, permitted uses in the C-1 (Commercial Limited) Zone range from clinics to television broadcasting studios to leather goods to cigar manufacturing (hand process) to jewelry stores; but pawnshops are specifically noted as not permitted. Likewise, the parking requirements for each zone also include a list of fairly specific uses. For example, in residential zones, there are different parking requirements for a single-family dwelling unit, child care, and nursing homes. There are even different parking requirements based on the number of bedrooms in a multifamily unit—requiring one space for one-bedroom units, two spaces for two- or three-bedroom units, and three spaces for four- or more bedroom units. In commercial zones, there are different parking requirements for barber and beauty shops, bible study classes, meeting halls, restaurants, and discount membership merchandisers.

These details in addressing many specific types of uses are very typical of a Euclidean zoning code. Since Euclidean zoning is use based, it must try to address all types of uses, even those that rarely come up. To accommodate all these details, Euclidean zoning often must be amended many times over, becoming long and complicated. As noted earlier, the numerous amendments and variances adopted over the lifetime of Miami's Zoning Ordinance 11000 has "demonstrated the need for a complete overhaul of the outdated regulations which fail to address the current and future needs of the City as a whole" (City of Miami, 2009b). In response, the City is pursuing "Miami 21," a "holistic approach to land use and urban planning"

that will replace the existing Zoning Ordinance 11000 with a form-based code (City of Miami, 2009b).

Miami 21 – Form-Based Code

The form-based code currently being considered by the City of Miami is based on Duany Plater-Zyberk's SmartCode. Duany Plater-Zyberk & Company is an urban planning, architecture, and design firm led by principals Andres Duany and Elizabeth Plater-Zyberk, two co-founders of the Congress for New Urbanism (DPZ, 2009a). The SmartCode was originally released by Duany Plater-Zyberk & Company in 2003, and has been modified several times over. It is designed to be an "integrated land development ordinance" folding "zoning, subdivision regulations, urban design, public works standards and basic architectural controls into one compact document" (SmartCode Central, 2009). As an "open source" document, the SmartCode is "available for use without charges or licensing fees," and is "meant to be locally customized by professional planners, architects, and attorneys," "ideally with the participation of...local citizens" (SmartCode Central, 2009; DPZ, 2009b, iv).

The SmartCode "is a transect-based code" (DPZ, 2009b, vi). The transect in an urban context is a gradient of urban form that ranges from natural settings to urban core. The SmartCode is divided into six transect zones: Natural (T1), Rural (T2), Sub-urban (T3), General Urban (T4), Urban Center (T5), and Urban Core (T6). In addition, the SmartCode includes a "Civic Zone" for civic buildings and/or civic spaces and "Special Districts" for "areas with buildings that by their function, disposition, or configuration cannot, or should not, conform to one or more of the six normative transect zones" (DPZ, 2009b, xi). The Miami 21 form-based code is based on and includes these transect zones and its own special districts.

The Miami 21 form-based code has yet to be adopted as of June 2009, but a final draft of the code was released in January 2009. The code includes five of the six transects in the Smart Code: Natural (T1), Sub-urban (T3), General Urban (T4), Urban Center (T5), and Urban Core (T6). The Sub-urban through Urban core transect zones are further divided into three categories: Restricted, Limited, and Open. As the names imply, the areas under the Restricted category have fewer allowed uses whereas the Open category has more allowed uses. For example, in a T4-R (General Urban-Restricted) zone, all office and commercial uses are prohibited, but in a T4-O (General Urban-Open) zone, offices, entertainment establishments, food service establishments, and general commercial uses are all allowed by right (City of Miami, 2009a, IV.6). Despite the changes in permitted uses between the three categories, the parking requirements within a transect zone are the same for all categories. For example, the parking requirements for a principal dwelling unit in T5 – Residential remains the same for Restricted, Limited, and Open.

The Urban Core (T6) transect is even further divided by density and maximum height levels into six different zones: T6-8, T6-12, T6-24, T6-36, T6-60, and T6-80. The number attached to the zone refers to the height limit for that zone. For example, in T6-8, the maximum height is 8 stories, while in T6-36, the maximum height is 36 stories. Similarly, there are increases in allowed floor-lot ratio (FLR) as the code allows increases in height. For example, in the T6-12 transect, the maximum FLR is 8, while in a T6-80 zone, the maximum FLR is 24.

The Miami 21 form-based code also has three civic zones and three district zones. The civic zones include Civic Spaces/Parks (CS), Civic Institution (CI), and Civic Institution – Health District (CIHD). The three district zones are Work Place (D1), Industrial (D2), and Marine (D3).

When taking all these transect, civic, and district zones proposed in the Miami 21 form-based code, they geographically match closely with existing use-based zones in the current Miami Zoning Ordinance 11000. For example, those areas currently zoned R-2 are proposed to be in the T3-O (Sub-urban Open) zones. Likewise, those areas currently zoned C-1 are generally closely matched with areas proposed to be under T6-8-O transect zoning. The areas currently zoned CS (Conservation) are proposed to be in the T1 (Natural) zone under the Miami 21 form-based code. Primarily because Miami is already built out, the new regulations need to generally match existing development. These similarities as the city transitions to the form-based code indicates that the new code will generally preserve the character of existing neighborhoods by matching areas closely with similar regulations under the current Zoning Ordinance 11000. See Figure 1 and Figure 2.

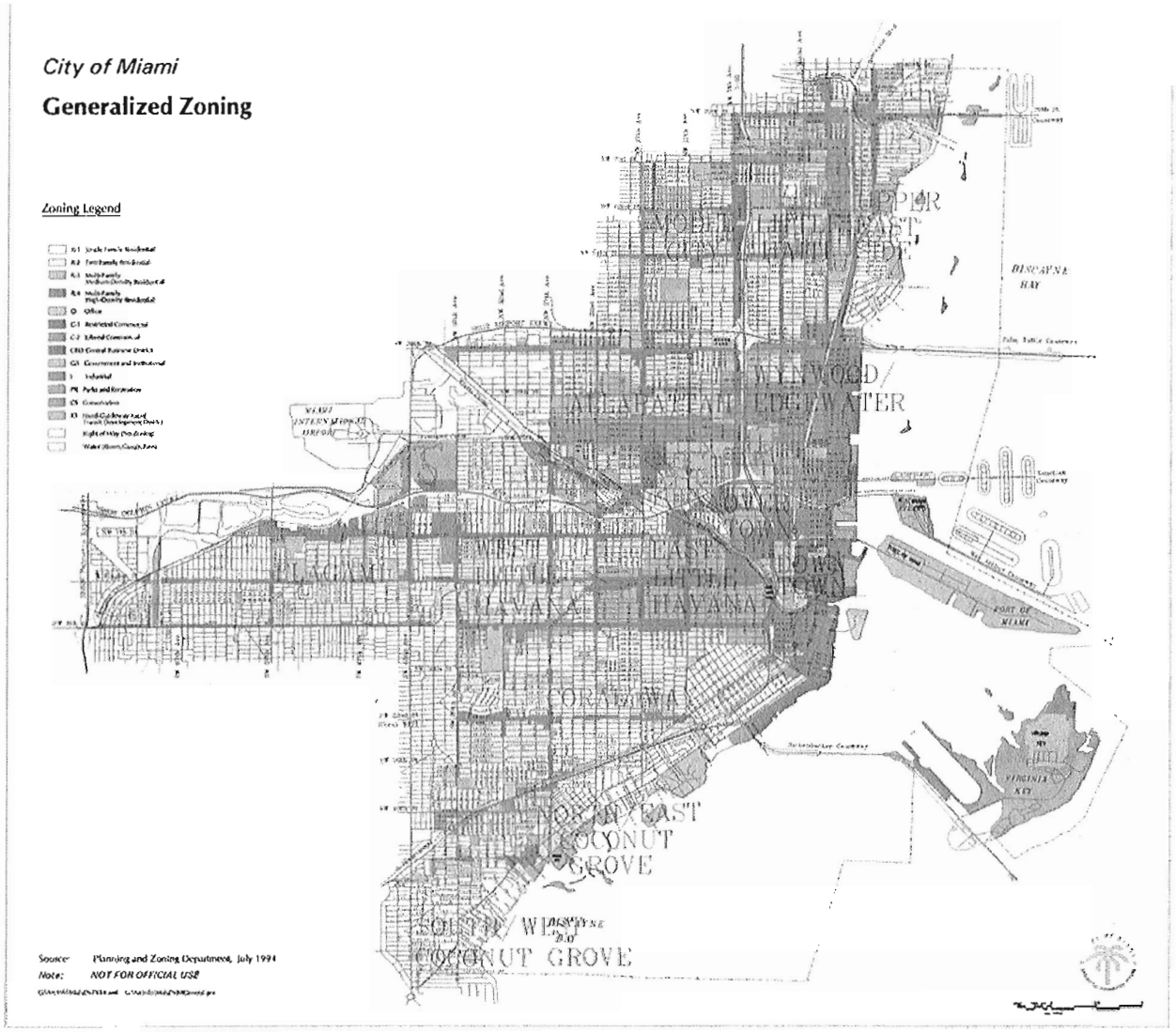

Figure 1: City of Miami Zoning Map - Zoning Ordinance 11000

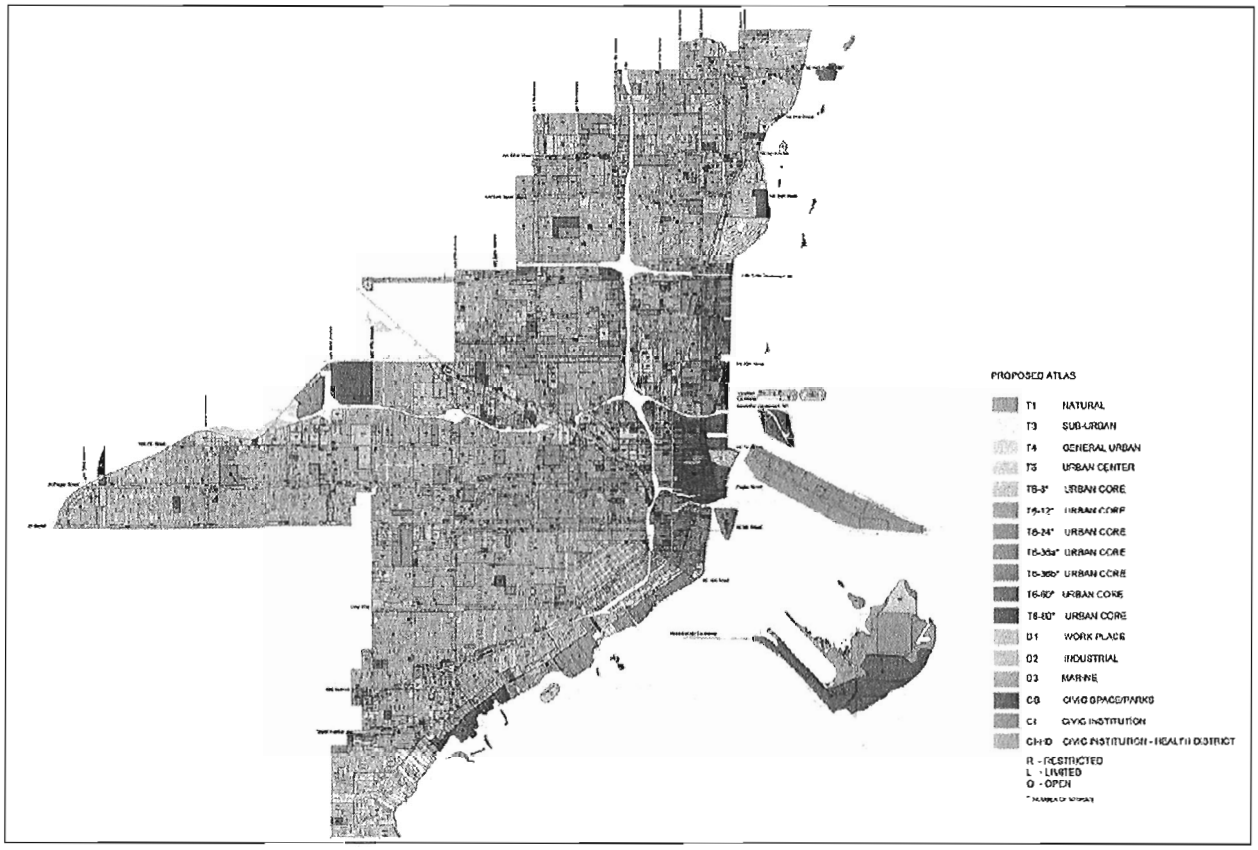

Figure 2: City of Miami Zoning Map - Miami 21 Form-Based Code

Similar to the existing zoning ordinance, Miami 21 does not allow commercial or office uses in T3 or in T4-R zones. This means these areas will remain completely residential, just like most Euclidean zoning codes that separate residential areas. As noted, this is probably done to preserve existing residential neighborhoods, but in doing so, it side-steps the issue of auto-dependency created by the separation of uses. However, it demonstrates that there are not major, transformational shifts or changes that will occur as the result of the new code. Nevertheless, the new code does place fewer restrictions on improving the mix of uses and provides more prescriptive guidelines for the form of future development. This includes the design of buildings to include pedestrian-scale architecture and restricting the location of

parking away from the front of the property. Such measures will encourage an improved urban landscape that combats the effect the automobile has had on the urban form of Miami.

Since the form-based code is strongly tied to the existing zoning, it is worth investigating how much the parking policies will change from the Miami Zoning Ordinance 11000 to the new Miami 21 form-based code. City of Miami city planner, Dakota Hendon, noted that one of the desires for the City with the form-based code is to reduce the amount of parking (personal communication, June 9, 2009). The comparison of the parking requirements is shown in Table 2 in the following section.

General Evaluation of Parking Requirement Comparisons

Table 2 compares the parking requirements proposed for the Miami 21 form-based code with the existing Zoning Ordinance 11000, Duany Plater-Zyberk & Company's SmartCode version 9.2, and recommendations in Daniel Parolek, Karen Parolek, and Paul Crawford's *Form-Based Codes*. The table is created to simplify comparisons between codes that individually focus differently on: use vs. area type; the units in which parking requirements are stated; and regulatory objectives. Therefore, certain adaptations were necessary to facilitate the comparison.

The parking requirements in Table 2 from the existing Miami Zoning Ordinance 11000 involved some refinement to compare to the three form-based codes. First of all, the parking requirements in each use-based zone of the Ordinance 11000 are highly specified by use. For example, in a commercial zone, the parking calculation for a general retail store differs from a restaurant, which also differs from a barber shop, even though all three uses are permitted in the zone. Therefore, the values provided in Table 2 had to be generalized. For example, for

residential uses, the parking requirement shown in Table 2 for the Miami Zoning Ordinance 11000 is for the typical type of dwelling associated with the zone—single-family dwelling unit for R-1, multifamily units for R-3 and R-4. For commercial and office zones, Table 2 lists the requirement for "other non-residential uses." This is the type of generalization that enabled the comparison between the existing Zoning Ordinance 11000 and the form-based codes.

The parking requirements in the existing ordinance also had to be adapted to the transect zoning. As noted earlier, the current Zoning Ordinance 11000 is focused on use, not the urban transect of Sub-urban, General Urban, Urban Center, and Urban Core. Therefore, the numbers shown in Table 2 are based roughly on how each zone matches with related transect zoning being proposed in Miami 21. For example, since R-1 and R-2 are generally related to the T3 transect, the parking requirements for dwelling units in R-1 and R-2 are shown under Sub-urban Residential. Similarly, the current CBD zone is generally related to the T6-80 transect zone, and therefore is shown under Urban Core. It is important to note that some do not exactly match up. For example, the existing C-1 zones are proposed to be in a variety of transects, ranging from T4-O to T6-8. Therefore, when comparing the requirements from the existing Miami Zoning Ordinance 11000 to those proposed in the Miami 21 form-based code, the numbers in Table 2 can be used to draw general conclusions. However, a more specific comparison is difficult to do on the city-wide level since certain zones in the existing zoning ordinance do not always match up with the same transect zoning. However, specific conclusions can be ascertained on an area or site level basis by comparing an area or parcel's parking requirements under the existing ordinance and its new requirements in the proposed form-based code.

It is also important to note that the parking requirements in *Form-Based Codes* only disaggregate parking policies for commercial supply, residential supply, public parking, design, and management. Therefore, the parking requirements for "commercial supply" are applied for both commercial and office.

It is important to be cognizant of the backdrop of each of these four codes. Miami's Zoning Ordinance 11000 is currently being implemented, and was written specifically to accommodate more parking. The Miami 21 form-based code is in its final draft form, and has been shaped by political and community input. Duany Plater-Zyberk & Company's SmartCode is written as a template code for cities to implement. Alternatively, the numbers proposed in Parolek, Parolek, and Crawford's Form-Based Codes are determined based on a progressive set of logical steps that assumes uses are close enough for a "park-once" mentality in all urban zones (T4 – T6), and that multiple modes of transportation, including walking and transit, are viable and used in urban centers (T5 – T6) (Parolek et al, 2008, 51). It should also be noted that, as a template, the SmartCode is meant to serve as a starting point for local municipalities to adapt to their local characteristics and constituents.

Transportation planners agree that "nothing is more useful...than collecting actual local parking data, or data from a comparable location" to determine parking requirements (Parolek et al., 2008, 51). This is particularly important when looking at the parking requirements for the SmartCode and those proposed in *Form-Based Codes* in Table 2. Neither of these codes is for a specific locality, and is designed to be used as general guidelines that are modified to match local conditions. Therefore, the proposed numbers in the parking requirements for these codes should also be taken as general guidelines that ought to be calibrated for each municipality. For

example, where the proposed maximum of two spaces per 1000 SF for an Urban Center (T5) transect in Parolek et al's *Form-Based Codes* may be appropriate for one city based on parking studies, it may be too high or too low for others.

Furthermore, the definitions of each urban transect zone may vary by locality and by perspective of the codes' authors. For example, one city may include areas that are highly urbanized with wide sidewalks, frequent transit service, and mid-rise, mixed-use buildings in an "Urban Center" or T5 transect zone, whereas some cities may view an "Urban Center" as the transect for commercial centers that may be heavily auto-oriented. Furthermore, one city may consider a "Sub-urban" T3 transect to include only single-family residences on relatively large lots, while some cities may include small neighborhood commercial uses and all types of single-family dwelling units, such as zero-lot line and small-lot single-family developments. These are moderately different types of urban form that different places may view as the "same" transect zone. Since the Miami 21 form-based code is based on Duany Plater-Zyberk's SmartCode, the type of urban form planned for in each transect may be relatively compatible between the two. However, comparing the type of urban form in these two form-based codes with Parolek, Parolek, and Crawford's *Form-Based Codes* may prove more challenging, since the authors of *Form-Based Codes* may have a different perspective on what constitutes each transect. Neither is inherently right or wrong, but the different vision of the urban transect makes it a non-direct comparison.

Nevertheless, Table 2 provides a good enough comparison to be suitable for the purpose of this study. One can evaluate if the requirements are significantly different between the old and new sets of codes.

Analysis of Parking Requirements in Miami 21

Miami 21 vs. SmartCode

From Table 2, it is clear that the parking requirements in the Miami 21 form-based code are based on the SmartCode. This is confirmed by City of Miami planner, Dakota Hendon (personal communication, June 9, 2009). Table 2 shows that the Miami 21 form-based code and the SmartCode have the same parking requirements for residential uses in the Sub-urban and General Urban transects, for office uses in the General Urban transect, and for commercial in the Urban Center and Urban Core transects. Moreover, both the Miami 21 code and the SmartCode include the exact same table for shared parking reductions. One of the differences between the two codes can be explained by political and community pressure. Due to fears of parked cars from multifamily residences overflowing into adjacent neighborhoods, local residents wanted to increase the 1 space per dwelling unit proposed by the SmartCode for the Urban Center (T5) and Urban Core (T6) transects (D. Hendon, personal communication, June 9, 2009).

Miami 21 vs. Miami Zoning Ordinance 11000

The parking requirements in Miami 21 also do not deviate much from the current Miami Zoning Ordinance 11000. The parking requirement for office uses increases slightly from 2.86 spaces per 1000 square feet to 3 spaces per 1000 square feet. Meanwhile, the parking requirement for general commercial uses decreases slightly from 3.3 spaces per 1000 square feet to 3 spaces per 1000 square feet. One notable change is for multifamily residential parking requirements, where the new Miami 21 code provides one uniform per dwelling unit requirement rather than differentiating between a one-, two-, three-, or four-bedroom units. (Continued on Page 54)

Table 2: Parking Requirement Comparison

Zoning/District		Miami 21 (Form-Based Code)	Miami Zoning Ordinance 11000 (Euclidean Zoning)	Smart Code (version 9.2)	*Form-Based Codes*
Sub-urban (T3)	Commercial	N/A	10 spaces per 1000 SF for restaurants, bars, etc.; 4 spaces per 1000 SF of discount retail; 3.3 spaces per 1000 SF for all other	4 spaces per 1000 SF	No greater than 4 spaces per 1000 SF
	Office	N/A	2.86 spaces per 1000 SF	3 spaces per 1000 SF	No greater than 4 spaces per 1000 SF
	Residential	2 spaces per dwelling unit	2 spaces per dwelling unit	2 spaces per dwelling unit	May be appropriate, but not necessary
General Urban (T4)	Commercial	3 spaces per 1000 SF	See Suburban Commercial	4 spaces per 1000 SF	No greater than 2 spaces per 1000 SF
	Office	3 spaces per 1000 SF	2.86 spaces per 1000 SF	3 spaces per 1000 SF	No greater than 2 spaces per 1000 SF
	Residential	1.5 spaces per dwelling unit	1 space per 1-bed unit; 2 spaces per 2-3-bed unit; 3 spaces per 4-bed unit	1.5 spaces per dwelling unit	No greater than 1 space per unit
Urban Center (T5)	Commercial	3 spaces per 1000 SF	See Suburban Commercial	3 spaces per 1000 SF	No greater than 2 spaces per 1000 SF
	Office	3 spaces per 1000 SF	2.86 spaces per 1000 SF	2 spaces per 1000 SF	No greater than 2 spaces per 1000 SF
	Residential	1.5 spaces per dwelling unit	1 space per 1-bed unit; 2 spaces per 2-3-bed unit; 3 spaces per 4-bed unit	1 space per dwelling unit	No greater than 1 space per unit
Urban Core (T6)	Commercial	3 spaces per 1000 SF	1 space per 1000 SF	3 spaces per 1000 SF	Max of 1 space per 1000 SF; require shared parking
	Office	T6-24, T6-36: 1 space per 800 SF T6-60, T6-80: 1 space per 1000 SF	1 space per 1000 SF over 10,000 SF	2 spaces per 1000 SF	Max of 1 space per 1000 SF; require shared parking
	Residential	1.5 spaces per dwelling unit	1 space per dwelling unit	1 space per dwelling unit	Max of 1 space per unit; require unbundled cost
	Comments	All requirements are minimums	All requirements are minimums	From Duany Plater-Zyberk	From Parolek et al. (2008) *Form Based Codes*, pp. 52-53

(Continued from Page 52) As noted in the previous paragraph, this change generated some concern among local residents (D. Hendon, personal communication, June 9, 2009). Another major difference is in the parking requirements for the Urban Core (T6) transect with the existing requirements in the CBD zone. The T6 zone requires considerably more parking than the existing CBD zone, as shown in Table 2. The T6 zone does cover a larger area than the existing CBD zone, including parcels along corridors in more suburban areas, which may explain the higher parking requirement. However, there is no differentiation in parking requirements for development in a T6-80 or T6-60 zone, which are proposed for the same general area as the existing CBD zone, and the T6-8 and T6-12 zones which are along corridors in more suburban contexts. The proposed reductions for shared parking and proximity to transit will reduce parking requirements in T6 zones where the CBD zone is currently applied since these areas are more likely to have shared parking and be close to transit. However, even with these reductions, the parking requirements in Miami 21 for the T6-60 and T6-80 will likely be greater than the existing requirements in the CBD zone.

Miami 21 vs. *Form-Based Codes*

Of the four codes compared in Table 2, the parking requirements in Parolek, Parolek, and Crawford's *Form-Based Codes* deviates the most from the Miami 21 form-based code. While the Miami 21 form-based code, the *SmartCode*, and the existing Miami Zoning Ordinance 11000 exclusively include parking minimums, the parking policies in the *Form-Based Codes* guidebook also suggest parking maximums, required shared parking, and unbundled parking. The policies in *Form-Based Codes* also include the greatest decrease in parking from the Sub-urban (T3) zone to the Urban Core (T6) zone.

The differences between the Miami 21 form-based code and the requirements suggested in *Form-Based Codes* is noticeable for every transect. For example, while the Miami 21 form-based code includes a minimum of 3 spaces per 1000 square feet for both commercial and office uses in the General Urban (T4) and Urban Center (T5) transect zones, the *Form-Based Codes* authors suggest that a "minimum, if any, should be aggregated for all nonresidential uses and no greater than 2 spaces per 1000 square feet" (Parolek et al., 2008, 52). For these transect zones, *Form-Based Codes* also suggests that "in lieu fees [be] allowed," there be "no minimum for uses under 5000 square feet," "shared parking should be required or encouraged," and maximums should be considered for non-shared parking (Parolek et al., 2008, 52). The Miami 21 form-based code does not include any of these provisions, and the minimum is 1 space per 1000 square feet greater than that suggested in *Form-Based Codes*. While 1 space per 1000 square feet may not seem like much, this would be a difference of 50 parking spaces for a 50,000 square foot grocery store. These 50 spaces take up approximately 17,000 square feet, one-third the size of the store.

Another notable difference is in the Urban Core (T6) transect. While Miami 21 includes parking minimums for all uses, *Form-Based Codes* suggests "no minimum requirements" for all uses, and recommends maximums set "as part of [a] traffic management strategy" (Parolek et al., 2008, 52). Moreover, *Form-Based Codes* "requires all parking be shared" for commercial uses, and "requires [the] cost of parking to be unbundled from [the] cost of housing" for residential uses (Parolek et al., 2008, 52).

Progressive Provisions of Miami 21's Parking Requirements

Beyond the minimum parking requirements summarized in Table 2, the Miami 21 form-based code includes certain progressive provisions that address the oversupply of parking. First of all, it acknowledges the potential for shared parking among multiple uses, and provides an easy to understand matrix to determine the parking reduction for constructing a shared parking area (See Appendix A). It does not mandate shared parking, but it provides developers an incentive to reduce the area devoted to parking by providing a shared lot for multiple uses in one centralized location rather than multiple private lots.

Second, it allows parking reductions for projects that have close access to transit. Developments in the Urban Center (T5) or Urban Core (T6) transects that are within a quarter-mile of a transit corridor or a half-mile of a transit-oriented development (TOD) are eligible to reduce the amount of required parking by 30 percent. A transit corridor is defined as a "mass transit route with designated transit vehicle(s) operating at an average 10 minute or less headway Monday through Friday between the hours of 7am through 7pm" (City of Miami, 2009a, I.27). This means that transit service is frequent enough during the weekdays that it should be convenient and attractive for those living along these corridors to use public transportation as an alternative to driving. Moreover, parking is not required for all residential developments within 1,000 feet of a Metrorail or Metromover transit station in the T6-60 and T6-80 (Urban Core) transect zones. This almost exclusively applies to multifamily residences in downtown, where the T6-60 and T6-80 zones are located.

Critiques of Miami 21's Parking Requirements

The parking requirements in the Final Draft of the Miami 21 form-based code also has several areas that can be improved, based on the literature and existing best practices from municipalities across the country. For example, with the exception of a slight decrease in residential minimums from the Sub-urban (T3) to General Urban (T4) transects, the parking requirements do not decrease in the more urban transect zones. One would expect parking demand to be lower in more urban transects since these areas should be characterized by a closer proximity and greater conglomeration of destinations and more frequent transit service. The allowed 30 percent reduction in minimum parking requirements for areas that are close to transit will help decrease the amount of parking in the Urban Center (T5) and Urban Core (T6) transects, but the reduction still generates parking requirements that are higher than desired for urban areas with access to transit.

Also, several progressive parking measures currently being implemented in other cities are not included in the Miami 21 form-based code. For example, there is no provision to unbundle the price of parking from housing. For most cities, "parking requirements bundle the cost of parking spaces into the cost of dwelling units, and therefore shift the cost of parking a car into the cost of renting or owning a home—making cars more affordable but housing more expensive" (Shoup, 2005a, 141). Particularly in areas where affordable housing is an issue, separating parking from dwelling units and pricing each separately can "make housing cheaper for those who think a second parking space (or even a first one) isn't worth the extra cost" (Shoup, 2005a, 560). This gives residents the freedom to choose how many parking spaces they are willing to pay for. The City of San Francisco mandates that "all off-street parking spaces

accessory to residential uses in new structures of 10 dwelling units or more...be leased or sold separately from the rental or purchase fees for dwelling units for the life of the dwelling units" (City of San Francisco, 2009, Article 1.5, Sec. 167). However, such a provision is not included in the Miami 21 form-based code.

While the Miami 21 form-based code includes provisions to reduce parking through shared parking, it does not require shared parking as suggested in Parolek, Parolek, and Crawford's *Form-Based Codes*. Such requirements could reduce the total amount of parking, and allow the more efficient use of parking throughout the day by creating centralized public parking areas rather than smaller, private lots serving individual uses. The parking policies in the Miami 21 form-based code does allow for off-site parking and allows developers to enter agreements with the City Attorney to lease from an existing parking area nearby; however creating parking benefit districts and permitting in-lieu fees as an alternative to providing private off-street parking can more efficiently utilize parking and reduce the total amount of parking. Miami 21 does not specifically include provisions for the establishment of in-lieu parking fees and parking benefit or parking management districts. In-lieu parking fees can reduce the number of smaller private lots by allowing developers to pay fees that go towards the construction of shared public parking lots and improvement of local transportation infrastructure. Currently, the City of Miami does have two parking management trusts established in Coconut Grove and the Design District where in-lieu fees are an option (D. Hendon, personal communication, June 9, 2009). Adoption and implementation of the Miami 21 form-based code presents an opportunity to expand the concept of parking management districts to other parts of the city as well.

While the current Miami Zoning Ordinance 11000 includes an inherent provision that exempts smaller offices in the Central Business District (CBD) zone from providing parking, the proposed Miami 21 form-based code does not include a similar exemption. Specifically, the current CBD zone requires one space per 1,000 square feet of gross floor area over 10,000 square feet for office uses. This inherently exempts any office development less than 10,000 square feet from providing parking, and is consistent with proposals in Parolek, Parolek, and Crawford's *Form-Based Codes* to not have minimum parking requirements for smaller land uses. However, the final draft of the Miami 21 code does not include any provision that exempts smaller land uses from providing parking in the Urban Core (T6) transect.

As noted earlier, parking maximums are another progressive parking policy measure that several cities are implementing in areas with a mix of uses and are well served by transit to protect the character of neighborhoods and mitigate the negative affects of large parking lots. While Downtown Miami is well served by the Metrorail, Metromover, and Metrobus public transportation systems, the Miami 21 form-based code sets required parking minimums rather than maximum parking limits. It should be noted that the City of Miami's City Code Section 14-182 does include parking maximums for downtown. However, these numbers are approximately equal to the minimum parking requirements in the Sub-urban (T3) and General Urban (T4) transects (City of Miami, 2009c). See Table 3 and Table 4 for comparisons.

Table 3 shows that the parking maximums for Downtown Miami are almost identical to the existing and proposed minimum parking requirements in the more suburban areas of Miami. While it is beneficial for the downtown to have a parking maximum, setting the maximum roughly equal to the parking found in suburban areas does little to discourage

driving, lessen the negative impacts of large parking areas in a central business district, and encourage alternative transportation.

Table 3: Parking Comparison: Downtown Maximums vs. Suburban Minimums

Zoning (Use)	Downtown Parking Maximums (Miami City Code)	Current Parking Requirements (Zoning Ordinance 11000)	Proposed Parking Requirements (Miami 21)
Parking Policies Shown	Table in Miami City Code Section 14-182	Commercial: C-1 Office: O Residential: R-1, R-2	Commercial & Office: General Urban (T4) Residential: Sub-urban (T3)
Commercial	Retail: 3.33 spaces per 1000 SF Restaurant: 10 spaces per 1000 SF	Retail: 3.33 spaces per 1000 SF Restaurant: 10 spaces per 1000 SF	3 spaces per 1000 SF
Office	CBD*: 1.67 spaces per 1000 SF Other: 2.5 spaces per 1000 SF	2.86 space per 1000 SF	3 spaces per 1000 SF
Residential	2 spaces per dwelling unit	2 space per dwelling unit	2 spaces per dwelling unit
Comments	* - only for offices in the CBD-1 zoning district	C-1, O, and R-1, R-2 zones are all found outside of the Downtown Miami	T3 and T4 transects are in suburban settings outside Downtown Miami

The Miami 21 form-based code has an opportunity to include a parking maximum based on the urban transect that fits a downtown setting. However, as shown in Table 4, the proposed Miami 21 form-based code sets minimum parking requirements that are greater than existing minimums for the central business district and does not reduce the high parking maximums established in the existing City Code.

Table 4: Parking Requirements in Downtown Miami

Zoning (Use)		Parking Maximums (Miami City Code)	Current Parking Requirements (Ordinance 11000)	Proposed Parking Requirements (Miami 21)
Central Business District	Commercial	Retail: 3.33 spaces per 1000 SF Restaurant: 10 spaces per 1000 SF	1 space per 1000 SF	3 spaces per 1000 SF
	Office	CBD*: 1.67 spaces per 1000 SF Other: 2.5 spaces per 1000 SF	1 space per 1000 SF over 10,000 SF	1 space per 1000 SF
	Residential	2 spaces per dwelling unit	1 space per dwelling unit	1.5 spaces per dwelling unit
	Comments	* - only for offices in the CBD-1 zoning district	Minimums for the current CBD zone	Minimums for the proposed T6-60 and T6-80 transect zones

General Observations

In general, there are minimal parking policy changes in the Miami 21 form-based code. Lower minimum requirements or the establishment of appropriate parking maximums in existing, compact urban neighborhoods would protect the existing character of these areas and encourage the development of context sensitive development that promotes walkability. Yet, the proposed parking requirements in the Miami 21 form-based code still includes relatively high minimums even in the more urban transects.

This is partially a critique of Duany Plater-Zyberk's SmartCode that Miami 21 is based on. The SmartCode, as shown in Table 2, does not reduce parking requirements much even in the more urban transects. Considering the level of public transportation service in its urban core and the rapid construction of multiple high-rises in its downtown, parking requirements in at least the Urban Core (T6) transect for Miami could be lower. In particular, fewer parking spaces in the urban core would support market-level parking pricing, public transportation, and walking. This would reduce greenhouse gases, air pollution, and the urban degradation that occurs due to parking lots creating characterless voids and increasing auto-use, which deteriorates the urban street life.

CONCLUSION & RECOMMENDATIONS

Concluding Observations

In order to make walking, bicycling, and use of public transportation more viable and reduce automobile dependency, land use regulations and transportation policies should work in conjunction with one another to be effective. Land use regulations that support the development of compact-mixed use areas may encourage more walking by placing uses closer together; however, if transportation policies continue to provide wide streets and plentiful parking, automobile use will still dominate at the expense of a walkable environment. Likewise, transportation policies that reduce parking and narrow streets without a reliable and effective public transportation service and land use policies to encourage compact mixed-use development will ultimately cause more congestion rather than significantly increase walking, bicycling, and transit use. The most effective way to transform the urban environment into a place not dominated by the automobile requires a comprehensive approach. Land use policies should support context-based developments that include compact, mixed-use development in appropriate areas. These must be combined with efforts to provide convenient and interconnected transit service that serves densely developed nodes and centers. This all ought to be reinforced by parking policies that provide an amount of parking that the market can support through pricing mechanisms for a set supply. This amount of parking should particularly be sensitive to its urban context, and the level of walkability and public transportation service that are provided in that context.

Form-based codes provide the opportunity to establish context-based parking requirements that are easily applied. While Euclidean zoning can include progressive parking

policies, such as parking maximums and reduced requirements near transit and in downtown settings, these are written in a zoning code that primarily focuses on use. This means that potentially the zoning for suburban strip mall would be the same as a traditional main street or downtown plaza. Separating parking requirements within the same zone for different contexts in a Euclidean zoning ordinance creates excess language to clearly define where the different parking requirements would apply. Even if a city decided instead to create separate zones for different contexts, the number of zones or overlay zones in the zoning code could become quite large. Either way, the municipality is saddled with a long, complex, and complicated zoning ordinance. Meanwhile, form-based codes are built upon the urban transect and inherently are defined by context.

Recognizing this potential benefit, the City of Miami has decided to replace its existing Euclidean zoning code with a form-based code. While there are several beneficial steps taken by the proposed form-based code, Miami has not harnessed the opportunity to completely revise its approach towards parking policies to the fullest extent. The form-based code expands areas where parking requirements are reduced due to proximity to transit and addresses the impact of parking on the urban streetscape by prescriptively regulating where parking can be located. However, parking requirements generally do not decrease when progressing towards more urban contexts, which would be expected in context-sensitive parking requirements. This indicates that to maintain the character of its urban centers and urban core but retain auto-dependent levels of parking, very large, private parking structures will be required. Given the additional cost of parking structures over surface parking lots, this essentially backs developers

into a corner where their only option is to provide the expensive parking on a project by project basis.

The inherent requirement of parking structures as a result of prescriptive form guidelines and high parking requirements is something to be aware of in all form-based codes and smart growth efforts. These developments may save land devoted to parking by limiting the area where it can be built, but by encouraging density and requiring the same proportion of parking, it must be provided in more expensive parking structures. Moreover, although the abundant parking may not come in the form of a parking lot, it ultimately still fully supports auto use, compromising the goal of reduced auto dependency.

Existing parking policies are described as amounting to little more than a collective hunch and strictly focused on land use with little consideration for urban form (Shoup, 2005a, 28). Moreover, they are typically focused on providing supply than managing demand. This study focused on integrating parking supply policies that more closely match demand based on urban form and land use. Future studies should examine this connection further as well as investigate the potential to further reduce supply through integrating parking demand management strategies into parking policies.

Recommendations

For Form-Based Codes

Form-based codes provide the ideal opportunity to provide a more appropriate amount of parking by more accurately determining requirements by urban context and use. However, Table 2 shows that the parking requirements in both the *SmartCode* and the Miami 21 form-

based code are fairly consistent with the requirements in Miami's Zoning Ordinance 11000, a Euclidean zoning ordinance. It is unknown how the parking requirements in Miami's Zoning Ordinance 11000 are determined, however they are comparable to parking policies in other Euclidean zoning ordinances, which are known to over-supply parking by over-estimating parking demand. Future form-based codes should take the opportunity to conduct more thorough studies of parking demand, taking the urban transect, land use, and pricing into consideration. From these studies, more appropriate parking requirements should be established based on the urban context and use.

It is logical that the more urban transect zones—Urban Center (T5) and Urban Core (T6)—should have lower parking requirements than the less urban transect zones. This is possible because of higher levels of transit access and the more walkable environments that the density of uses creates. In both the *SmartCode* and Miami 21 form-based code, parking requirements gradually decrease when progressing from the Sub-urban (T3) zone to the Urban Core (T6) zone. However, in both of these codes, the decrease is so small that it seems like parking would still be over-supplied in most circumstances. Moreover, while some cities set parking maximums in their urban cores to encourage transit and walking and limit the impact of automobiles on the urban form, neither the *SmartCode* nor Miami 21 include a parking maximum for the Urban Core (T6) zone. Therefore, future form-based codes should reduce parking requirements or set parking maximums in the more urban transect zones. These should be based on the actual demand for parking that considers mode shifts to alternative modes that are enabled and the potential for shared parking between complementary uses.

Requirements should also be determined with the express objective of minimizing the negative impacts on the urban form in these zones from accommodating the automobile.

For Miami 21

In the Miami 21 form-based code, the City has chosen to separate the Urban Core (T6) transect zone into several different zones that represent everything from corridors on the outskirts of the City to the central business district. Particularly in these corridors that border existing single-family and two-family residential neighborhoods, members of the community and commissioners representing these communities are concerned about parking overflowing into the neighborhoods. However, in the central business district that is well-served by transit and is separated from lower-density neighborhoods, the same parking requirements for the Urban Core (T6) zoning in corridors generally apply. Therefore, Miami 21 should include separate parking requirements in the Urban Core (T6) zone. There should be lower parking requirements and/or a parking maximum set for the higher density T6 zones (T6-60 and T6-80).

Furthermore, the current parking maximums for Downtown Miami are extraordinarily high—approximately equal to the minimum requirements found in the existing zones in suburban areas. Moreover, these parking maximums are not found in the zoning code like all the other parking requirements, but in the City Code in a section specific for Downtown Miami. Since all other parking requirements will be found in the Miami 21 form-based code, the parking maximums should be integrated into the Miami 21 form-based code. The parking maximums should also be revisited and adjusted to encourage walking, bicycling, and transit use as alternatives to driving. This will reduce automobile dependency and limit its effects where it is most damaging—the urban core.

Another progressive provision Miami 21 could include is a requirement to unbundle the cost of parking from the cost of housing in the Urban Core (T6) transect zone. This will reduce the cost of housing and more accurately reflect the cost of parking. Miami 21 should also include a provision for priced parking as an option to reduce parking requirements. This reduction is justified by the reduced demand created through pricing. As suggested in Parolek et al. *Form-Based Codes* (2008), Miami 21 should also require shared parking in the urban transect zones (Urban Core and possibly Urban Center). This will reduce the overall amount of parking by more efficiently using the provided spaces throughout the day.

Further Study

Beyond the scope of this study, there are many opportunities to explore this topic further. Suggestions for further study include examining parking policies in other form-based codes, researching the use of parking based on the urban context, price, and use to supplement existing parking studies solely aggregated by use, and investigating the potential for integrating parking demand management measures into parking policies and form-based codes.

There are several cities across the country that have adopted form-based codes in only parts of their jurisdictions as part of master plans or specific plans. While Miami was chosen for this study for pursuing a city-wide form-based code, other form-based codes should be evaluated to examine if other cities have integrated more progressive parking policies into form-based codes. Moreover, future studies can investigate the effects of these policies to determine if the parking supply is decreasing, auto-use is declining, and greenhouse gas emissions are being reduced. With multiple case studies, a comparative study can examine best

practices in parking policies that are integrated into form-based codes and provide suggestions for best practices that should be incorporated in the future.

The Institute of Transportation Engineers (ITE) only provides parking generation numbers based on specific land use types in its *Parking Generation Manual*. Since historically cities have determined parking requirements based on land use, this has frequently been used as a tool to set parking policies. However, with form-based codes founded on the urban transect, it is difficult to base parking policies in form-based codes on this existing industry standard. Considering that some critics already see these studies as woefully incomplete by mostly examining parking demand in suburban areas with abundant free parking, future parking studies should examine variations in parking demand by urban context (Shoup, 2003, 4). Although potentially more complicated, future studies examining parking generation through a matrix of several situational inputs can directly inform parking policies for form-based codes. These inputs can include, but are not limited to the urban form or urban context, price, as well as land use.

There are several other major aspects that factor into parking demand, including proximity to transit, the effectiveness and convenience of the public transit system, local demographics, and community values. These only further display the depth and complexity of parking, and why no two sites let alone no two cities will be exactly alike in their demand for parking. Future studies on these aspects can be conducted at a regional or local level to further refine parking policies to specifically fit each municipality and for integration into future form-based codes.

Future studies can also evaluate the effect of parking demand management strategies, including commuter vouchers, priced parking, and carpool parking policies, on the demand for parking. These strategies should be evaluated for their effectiveness in reducing parking demand, and should be considered for integration into parking policies.

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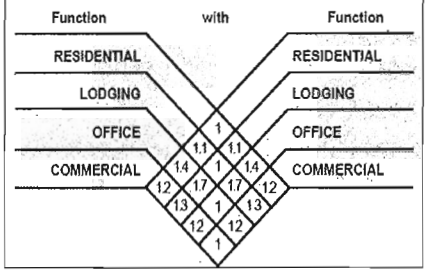
APPENDIX A: MIAMI 21 PROVISIONS FOR SHARED PARKING

MIAMI 21 **ARTICLE 4. TABLE 5 BUILDING FUNCTION: PARKING AND LOADING**

PUBLIC HEARING-FIRST READING 2009

SHARED PARKING STANDARDS

SHARING FACTOR



The shared Parking Standards Table provides the method for calculating shared parking for buildings with more than one Use type. It refers to the parking requirements that appear in Table 4.

The parking required for any two Functions on a Lot is calculated by dividing the number of spaces required by the lesser of the two uses by the appropriate factor from this Table and adding the result to the greater use parking requirement.

For instance: for a building with a Residential Use requiring 100 spaces and a Commercial Use requiring 20 spaces, the 20 spaces divided by the sharing factor of 1.2 would reduce the total requirement to 100 plus 16 spaces. For uses not indicated in this chart on a mixed use lot a sharing factor of 1.1 shall be allowed. Additional sharing is allowed by Warrant.

PARKING REQUIREMENTS AND THE URBAN TRANSECT:
A CASE STUDY OF MIAMI, FLORIDA'S FORM-BASED CODE

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EXECUTIVE SUMMARY

There is a growing recognition of the negative effects of rapid suburbanization, also known as urban sprawl, that has dominated the development of urban areas for the last several decades. Many suburbs suffer from a lack of nearby services, a characterless urban form, and a dependence on automobiles for travel. To address these issues, urban planners, architects, developers, and policy makers have considered encouraging a new type of urban growth that focuses on including a variety of housing types and services in complete and compact neighborhoods. This movement, known as New Urbanism or Smart Growth, also suggests that building these communities will reduce dependence on automobiles by make it convenient to walk or bike between destinations and making public transit more viable. To create these communities, some urban planners are considering form-based codes to guide and regulate development. Form-based codes are a method of regulating development to achieve a specific urban form. Form-based codes create a predictable public realm by primarily controlling physical form, with a lesser focus on land use. This is in contrast to existing development regulations, known as zoning ordinances, which typically focus on land use with fewer controls on form.

While form-based codes attempt to address urban sprawl and automobile dependency through land use regulations, urban planners also recognize the need to consider transportation policies in tandem with land use. Similar to how land use regulations impact how transportation decisions are made, transportation policies also impact the urban form. Since the 1920s, transportation policies have aimed to create infrastructure to support the automobile, including wide streets and large parking lots.

Of all the changes in urban areas since the dawn of the automobile era, parking to support automobile use has arguably had the greatest impact. Prior to the 1920s, all "parking" for horses, carriages, and vehicles was taken care of by curb space. This meant most of the land in urban areas was devoted to stores, workplaces, residences, and parks. With the proliferation of the automobile, traffic congestion on urban streets became a major concern. Many turned to off-street parking lots to accommodate the growing demand to park vehicles and reduce traffic congestion. As parking lots proved to be successful measures to improve traffic congestion on urban streets, the rise of urban areas dominated by parking began to take hold. Large parking lots to support the desire of Americans to drive ultimately separated destinations further and further apart until automobile use became more of a necessity than a luxury. To accommodate the increased use of automobiles and maintain free-flowing traffic, cities mandated that large amounts of parking spaces be included as part of developments. This has further impacted the development of cities, creating an automobile-oriented development that coincides with urban sprawl.

It is clear that to address all of the negative effects of urban sprawl and automobile dependency both land use and transportation aspects must be considered. Some urban planners may hail form-based codes as a great opportunity to reshape our communities to alleviate the negative impacts of the automobile. However, for these new codes to effectively reduce urban sprawl and automobile dependency, transportation policies must support this goal. In particular, parking for vehicles is a vital part of addressing these issues. "Parking most of all...makes auto use convenient. Without places to park, driving remains [a] most inconvenient" form of travel (Jakle & Sculle, 2004, 17). Therefore, this study focuses on parking requirements

in form-based codes. These parking policies are evaluated based on the solutions suggested by contemporary urban designers and transportation planners to slow the continuance of the auto-dependency cycle and minimize its negative impacts.

This study particularly focuses on the parking policies in the City of Miami's proposed Miami 21 form-based code. The Miami 21 form-based code is chosen as a case study because it is one of the first city-wide form-based codes in the United States, it will replace a conventional zoning ordinance, and it applies to a major, rapidly growing American metropolis. Miami's form-based code is primarily based on Duany Plater-Zyberk and Company's *SmartCode*. Therefore, this study evaluates both the Miami 21 form-based code and Duany Plater-Zyberk's *SmartCode*. This study also considers input from Daniel Parolek, Karen Parolek, and Paul Crawford's *Form-Based Codes*, which is a guide for planners, designers, municipalities, and developers on form-based codes.

Ultimately, this study finds that the parking policies in the Miami 21 form-based code and Duany Plater-Zyberk's *SmartCode* do not offer a greatly different approach to parking than conventional zoning ordinances. The findings in this study show that these form-based codes have not fully embraced solutions from parking critics to address the issues of urban sprawl and automobile dependency. Both codes include some marginal improvements to existing parking policies, but there is much room for improvement to include some of the more progressive solutions proposed by critics of existing excesses in parking requirements to reduce automobile dependency. This study recommends that future form-based codes integrate more progressive parking policy solutions to reduce automobile dependency and urban sprawl.

Beyond the scope of this study, it is recommended that future studies examine parking policies in other form-based codes, research the use of parking based on the urban context, price, and use to supplement existing parking studies solely aggregated by use, and investigate the potential for integrating parking demand management measures into parking policies and form-based codes.

INTRODUCTION

There is no doubt that Americans like to drive their automobiles, and enjoy the comforts and convenience they provide. In 2008, Americans drove 2.9 trillion miles, almost double the 1.5 trillion miles traveled in 1980 (FHWA, 2009; FHWA, 1997). As a culture of "hurried people...always on the move," prizing "life's conveniences" and looking to "doing things efficiently with minimal cost," automobiles enable and embody the desire of Americans to pursue this lifestyle. (Jakle & Sculle, 2004, 17).

Few would have predicted that the "horseless carriage" of the turn of the 20th Century would become so prevalent, or could have imagined its enormous impact on American urban development and culture. Now 100 years later, the "automobile has become the nation's prime instrument of geographic mobility" (Jakle & Sculle, 2004, 245). The dominance of the automobile has drastically changed the American landscape, transforming older central business districts and prompting new sprawling developments to accommodate the added space it requires (Jakle & Sculle, 2004, 93).

For the advances in mobility and convenience the automobile has brought, there have also been several negative effects. Many have asked "When did we stop building neighborhoods where kids can ride their bikes to school?" and "Why can't new subdivisions be more like the older neighborhoods that people love?" (Parolek et al., 2008, 1). With an urban landscape shaped around automobile use, the presence of walkable neighborhoods with unique character has steadily decreased.

With growing concern and understanding of global climate change, the greenhouse gas emissions associated with automobile use has also become disconcerting. In 2007, one-third of

the greenhouse gas emissions in the United States were related to transportation (EPA, 2009, ES-8). Of the transportation-related emissions, nearly 60 percent were the result of gasoline consumption for personal vehicle use (EPA, 2009, ES-8). This means that one-fifth of the U.S.'s greenhouse gas emissions are attributable to the driving habits of everyday Americans. To reduce vehicle emissions, policy makers are enacting regulations to improve vehicle fuel efficiency, lessen fuel carbon content, and reduce overall vehicle use, measured in vehicle miles traveled (VMT) (Ewing, Bartholomew, Winkelman, Walters, & Chen, 2008, 17). Until recently, most of the federal and state energy and climate policies have been focused on technological advances in vehicles and fuels, while rarely addressing VMT (Ewing et al., 2008, 17). However, there is growing recognition that "even with more stringent standards for vehicles and fuels...transportation related emissions still would far exceed target levels...because of the growth in VMT" (Ewing et al., 2008, 43).

To reduce the amount of driving and VMT, urban planners and policy makers acknowledge the importance of increasing walking, bicycling, and use of public transportation as alternatives. However, since the U.S. Census began keeping records of means of transportation for commuting in 1960, the proportion of trips by automobile has steadily increased, while the proportion of trips by all other alternatives, such as walking, bicycling, and public transit, have generally declined (U.S. Census, 2000; U.S. Census, 2008b). See Table 1.

Table 1: Means of Transportation for Workers – U.S. Census

Mode	1960	1970	1980	1990	2000
Car, Truck or Van:	63.98%	77.71%	84.10%	86.55%	87.88%
Drove Alone	[A]	[A]	64.37%	73.19%	75.70%
Carpooled	[A]	[A]	19.73%	13.36%	12.19%
Public Transportation:	12.07%	8.86%	6.39%	5.27%	4.73%
Bus or Trolley Bus	8.23%	5.52%	4.06%	2.99%	2.50%
Streetcar or Trolley Car	[B]	[B]	[B]	0.07%	0.06%
Subway or elevated	3.84%	2.30%	1.58%	1.53%	1.47%
Railroad	[C]	0.65%	0.57%	0.50%	0.51%
Ferryboat	[D]	[D]	[D]	0.03%	0.03%
Taxicab	[D]	0.39%	0.17%	0.16%	0.16%
Motorcycle	[D]	[D]	0.43%	0.21%	0.11%
Bicycle	[D]	[D]	0.48%	0.41%	0.38%
Walked	9.92%	7.40%	5.60%	3.90%	2.93%
Other Means	2.51%	2.53%	0.73%	0.70%	0.70%
Worked at Home	7.21%	3.49%	2.26%	2.96%	3.26%
Not Reported	4.30%	N/A	N/A	N/A	N/A

[A] – 1960 and 1970 Census did not separate "Car, Truck or Van" into "Drive Alone" and "Carpool"

[B] – 1960 – 1980 Census combined "Bus or Trolley Bus" and "Streetcar or Trolley Car" into "Bus or Streetcar"

[C] – 1960 – Railroad included in "Railroad, Subway or Elevated"

[D] – Included in "Other Means"

While this only shows the mode of transportation for work trips, typically modes other than driving tend to be represented even more for commute travel than any other trip purpose. This means that the increase in auto use for work trips has almost certainly coincided with an increase in driving for all types of trips. The increase in auto use over public transportation and walking since 1960 is of particular concern since the population of the United States has consistently become more urban over the same time frame. In 1960, the U.S. had an urban population of approximately 130 million people, or 70 percent of the total population (United Nations, 2007). By 2000, the U.S. urban population grew to over 225 million, or almost 80 percent of the total population (United Nations, 2007). Characteristically, the rural population is

more dependent on automobiles than urban dwellers due to the fewer transportation options and farther distances between origins and destinations. In particular, the greater conglomeration of uses in urban areas typically has made walking and public transportation more viable for the urban population. However, despite an increasingly urban population, more urban forms of transportation—public transportation, bicycling, and walking—still declined greatly between 1960 and 2000. This indicates that our urban areas in particular have been designed around automobile use to the detriment of other transportation modes. This presents a major challenge to reduce driving, VMT, and greenhouse gas emissions.

The primary force in the early rise of automobile use was the level of convenience it provides. In addition to the car, an adequate street and highway network and a sufficient supply of parking are necessary to create a completely convenient mode of travel. Of these three aspects, "it is parking most of all that makes auto use convenient. Without places to park, driving remains most inconvenient" (Jakle & Sculle, 2004, 17). Donald Shoup (2005a) notes that "regardless of how fuel efficient our cars are or how little pollution they emit, we will always need somewhere to park them, and the average car spends about 95 percent of its life parked" (p. 6). However, the transformation of the urban landscape to accommodate the automobile through wider streets and larger parking lots has occurred at the expense of walkable, bikable, and transit-oriented communities (Jakle & Sculle, 2004, 17). This has led to a use of automobiles, not as a matter of convenience, but necessity. Since parking is vital for automobile use, the combination of a desire to drive and a need to drive propels the demand for parking even more. The abundant supply of parking to accommodate cars expands the amount of space required to serve automobiles, separating destinations even further apart. This, in turn,

increases the reliance on automobiles for all types of travel. Therefore, a generous parking supply becomes part of a "cycle that leads to increased automobile dependency" (Litman, 2008, 8). The "abundant parking supply increases vehicle use and urban sprawl, causing parking demand and parking supply to ratchet further upward" (Litman, 2008, 8). Rather than an instrument of liberation and freedom, for most Americans the automobile has become a necessity in an urban landscape built around driving.

As this cycle shows, parking "affects both transportation and land use" (Shoup, 2005a, 3). As parking becomes more abundant, vehicle use increases and land uses are spread further apart. Furthermore, as more parking is required, more land is dedicated to storing cars rather than other, potentially more valuable uses. While parking plays such a vital role, "its effects are often overlooked or misunderstood" (Shoup, 2005a, 3). Despite its major impact on transportation and the built environment, parking is frequently "something everybody expects but nobody wants to think about" (Jakle & Sculle, 2004, 187). Even the American Planning Association's (APA) *Growing Smart Legislative Guidebook: Model Statutes for Planning and the Management of Change*, which is described as leaving "no stone unturned" and perfecting the "array of planning tools," does not address parking (Pierce, 2002). This is so despite the fact that the APA Planning Advisory Service receives more questions about parking requirements than any other topic (Shoup, 2005a, 29). In particular, most municipalities require uses to provide a minimum number of parking spaces. Vinit Mukhija and Donald Shoup (2006) argue that these "minimum parking requirements...would not be needed if they did not increase the parking supply beyond what the market would provide" (p. 297). While many people recognize urban problems such as congestion, pollution, decay, and sprawl, few connect the role parking

policies play with these problems (Shoup, 2005a, 3). This project studies parking policies as an integral part to address these urban problems.

Complicating the matter, parking is often "one of the most difficult and politically explosive issues to deal with" (Epstein, 2001, 3). Everyone has an opinion on parking, whether it is auto-users accustomed to abundant, free, and convenient parking or pedestrian, bicycle, and transit advocates who argue for less parking to create more walkable, bikable, and transit-friendly developments. Neighborhood and business interests vary from place to place. Residents may be worried about cars overflowing into their neighborhoods if not enough parking is provided (Correa, 2009). At the same time, neighborhood preservationists may be concerned about additional parking disrupting the character of a historic, pedestrian-friendly area. Businesses may be apprehensive about lack of accessibility if parking is reduced (Jakle & Sculle, 2004, 193). Yet an overabundance of parking may concern property owners about reduced property values. These various interests demonstrate that when planners address parking policies, they may not have the freedom to exercise professional judgment so much as respond to political pressure (Shoup, 1997, 12).

Another major influence on overall vehicle use, and therefore VMT, is land use. As noted earlier, land use and transportation are inherently connected, as evidenced by the transformation of the American landscape to accommodate the automobile that started in the 1920s. Through designing urban areas for the automobile, destinations have been placed further and further apart, decreasing the convenience of walking, bicycling, and use of public transit (Mukhika & Shoup, 2006, 296). Recognizing the close relationship between land use and transportation, some planners, designers, and policy makers are advocating the development

of compact, mixed-use urban areas to reverse the sprawling effect of the automobile. This approach, commonly associated with the New Urbanism or Smart Growth movements, primarily focuses on land use patterns and neighborhood design to decrease auto use and VMT (Boarnet & Crane, 2001, 172). Using statistics from the U.S. Census, New Urbanists note that more compact, densely developed urban areas exhibit reduced automobile use compared to more sparsely developed, single-purpose areas. To encourage the development of compact, mixed-use built environments, some new urbanist and smart growth supporters advocate new approaches to regulating development. Form-based codes, a set of land use regulations that primarily regulates building form with less focus on use, is particularly garnering attention from many planners and policy makers (Parolek, Parolek, & Crawford, 2008, 4). Given that land use and transportation are integrally connected, this study specifically researches parking policies in form-based codes, and whether these policies are actively discouraging or encouraging auto use.

BACKGROUND

History of Land Use Regulation

Land use regulations are tools typically used by local jurisdictions to direct and regulate existing and future development. One of the most common types of land use regulations is zoning codes. Today, zoning is often used as a means to implement a municipality's comprehensive plans. However, the practice of implementing land use regulations actually predates the comprehensive planning process.

Prior to the existence of formal land use regulations, "homeowners and homebuilders relied on a web of informal agreements, mutual understandings, and ad hoc resort to the law to enforce the patterns that zoning later dictated" (Fischel, 2001, 6). For example, private covenants between land owners would limit the type of uses adjacent property owner's could develop (Fluck, 1986, 328). If a land owner constructed uses that constituted nuisance to adjacent landowners, traditional nuisance laws took effect. However, several changes in cities and transportation ultimately set the stage for formal regulations on land use.

By the 1800s, the impact of the Industrial Revolution had become a primary force in the development of cities. Many industries located near rivers, oceans, and railroads for energy and freight transportation. Therefore, many cities were also located along these bodies of water and transportation corridors. Initially, the "rich tended to live closest to their jobs since long walks were irksome as well as time consuming" or used horse-drawn carriages to carry them to homes at the edge of the city (Fischel, 2001, 4). However, as cities became more crowded, health concerns became a huge issue, and the proximity of noxious, industrial uses encouraged those that could afford it to find housing outside the heart of cities.

The "development of electric-powered street railroads in the 1880s made it possible for urban workers to live in exclusively residential districts and commute daily to their jobs in the city" (Fischel, 2001, 5). In these "streetcar suburbs," "land use patterns in the pre-zoning era did not mix apartments and commercial establishments with single family and duplex homes" (Fischel, 2001, 6). Since streetcars "did not carry large amounts of freight," only "less-noxious commercial development, such as retail stores, was pulled out of the central city. Heavy industry remained concentrated around wharves and railheads" (Fischel, 2001, 6). Meanwhile, apartment houses were "almost always built near [streetcar lines] to take greatest advantage of the convenience they offered tenants" (Fischel, 2001, 6). This made neighborhoods immediately adjacent to streetcar lines "rather mixed," and allowed builders of "one and two-family homes to avoid these areas" (Fischel, 2001, 6). In other words, "control over the location of streetcar lines...was a substitute for zoning" at least in the suburbs (Fischel, 2001, 6).

However, the advent of the motor truck and motor bus "undermined the security of suburban, single-family residences" (Fischel, 2001, 7). The motor truck "liberated heavy industry from close proximity to downtown railroad stations and docks" allowing "manufacturers to take advantage of lower-cost land in residential districts" (Fischel, 2001, 7). The motor bus "likewise liberated apartment developers from close proximity to the trolley tracks" (Fischel, 2001, 7). These developments during the 1910s and 1920s set the stage for the adoption of formal land use regulations.

The First Zoning Regulations

Zoning regulations originated "as a means of protecting the health and safety of people in major cities" (Meck et al., 2000, 343). Zoning also addressed the "increasing interdependence

of urban land-use that arose after the dawn of the twentieth century," and directly filled the "need to deal with incompatible uses by means other than traditional nuisance law and private covenants" (Fischel, 2001, 4). The legal authority to adopt zoning regulations is directly tied to the municipality's police power to protect the public health, safety, and welfare of its residents (Talbert, 2008, 1). The earliest land use regulations were aimed at avoiding or minimizing the "worst consequences of uncontrolled development and noxious land uses" (Parolek et al., 2008, 6). For example, early land use controls included building separation and setback requirements to contain fires and ensure light and air filtration (Meck, Wack, & Zimet, 2000, 343). Building height restrictions were implemented to ensure "firefighters could reach the upper floors" (Meck et al., 2000, 343). These early land use controls also "separated smoke-producing industry from residential uses," beginning the practice of "separating 'incompatible' land uses" (Parolek et al., 2008, 6).

In 1904, Los Angeles became the first city to enact land use zoning that regulated the future land use of property (Parolek et al., 2008, 7). In 1916, New York City implemented the "first comprehensive zoning ordinance" that "covered the entire city and controlled land use, building heights, and building setbacks in one set of regulations" (Meck et al., 2000, 344). New York's zoning regulations ensured the separation of incompatible uses by dividing the city into four use zones and restricting industrial activity to one zone (Meck et al., 2000, 344). Building heights were regulated as a multiple of street width, "with yards, courts, and other open spaces...regulated according to building height" (Meck et al., 2000, 344). New York's comprehensive zoning ordinance was justified "based on an exhaustive study" that showed streets were congested with traffic, "buildings were clustered too close together and positioned

so that sunlight could not reach into them," and conflicts were occurring from noise, odor, dust, and the presence of non-residential uses in residential neighborhoods (Meck et al., 2000, 344). While New York's highest state court upheld New York City's zoning ordinance in a case in 1920, the constitutionality of comprehensive zoning ordinances was not validated nationally until the 1926 U.S. Supreme Court case, *Village of Euclid v. Ambler Realty Company*, more commonly referred to as Euclid versus Ambler. While New York is a major central city where the public health and safety benefits were easily tied to zoning regulations, the Village of Euclid was one of several smaller municipalities to adopt a zoning ordinance in the 1920s.

Euclid versus Ambler

The case of Euclid versus Ambler pitted the Village of Euclid, Ohio against the Ambler Realty Company. The Village of Euclid, Ohio, located at the outskirts of Cleveland along Lake Erie, was incorporated in 1903, and at the time of the case in 1920s, was predominantly farmland, although "it was clear that the Cleveland metropolis was expanding toward the village" (Fluck, 1986, 326). In November 1922, Euclid's municipal council unanimously adopted an ordinance "establishing the comprehensive zoning of all land uses throughout the entire village" (Fluck, 1986, 328). Between 1911 and 1922, the Ambler Realty Company assembled a 68-acre, undeveloped tract in Euclid. This tract was zoned consistently with the "general pattern of districting in the village" with the land adjacent to the railroad zoned for industrial and the remainder zoned for two-family house (Fluck, 1986, 328). However, Ambler protested the zoning and dismissed a rezone compromise. Ambler pursued a lawsuit that "sought a declaration of the zoning ordinance's invalidity" (Fluck, 1986, 328).

In January 1924, the district court judge hearing the case ruled in favor of Ambler, noting a pair of Supreme Court decisions that clearly limited police power legislation. The judge concluded that, based on these Supreme Court decisions, Euclid's zoning ordinance constituted a taking of the plaintiff's (Ambler) property without due process of law (Fluck, 1986, 330). Euclid appealed the decision directly to the U.S. Supreme Court.

Two years after the district court's decision, the U.S. Supreme Court heard the Euclid v. Ambler case. The central argument of James Metzenbaum, Euclid's legal defense, was that the "widespread adoption of zoning by communities across the country was itself an indication of the reasonableness of zoning" (Fluck, 1986, 330). The two-year delay also "enabled Metzenbaum to make an additional telling argument—the trend in the state courts was now more clearly favoring the constitutionality of zoning" (Fluck, 1986, 330). In addition to the New York case (discussed in the previous section), the Ohio Supreme Court "upheld the Cincinnati zoning ordinance on May 19, 1925 in *Pritz v. Messer*" (Fluck, 1986, 330). Ambler countered by arguing that the zoning ordinance "greatly diminished the value of Ambler's property" (Fluck, 1986, 330). Ambler also argued that "the municipal power to zone disrupted the metropolitan real estate market" and that "it was impossible for public officials and planners to understand the complex natural process of community development to the degree necessary to justify public regulation" (Fluck, 1986, 330-331).

After an initial oral argument in January 1926 and a reargument in October of the same year, the Supreme Court delivered its opinion "sustaining the Euclid zoning ordinance as a valid exercise of the police power under the U.S. Constitution" (Fluck, 1986, 333). In delivering the opinion of the Court, Justice Sutherland stated "the segregation of residential, business, and

industrial buildings will make it easier to provide fire apparatus...increase the safety and security of home life...prevent street accidents...[and] decrease noise and other conditions which produce or intensify nervous disorders" (Fluck, 1986, 334). Moreover, the Court's opinion also stated "the development of detached house sections is greatly retarded by the coming of apartment houses," justifying the zoning of land to segregate multi-family housing from single-family detached housing (Fluck, 1986, 334). In reference to this case, comprehensive zoning became frequently referred to as "Euclidean zoning."

Euclidean Zoning

The *Euclid v. Ambler* decision occurred at a time when the number of adopted comprehensive zoning ordinances skyrocketed. In 1922, the year the Village of Euclid adopted its zoning ordinance, the number of zoned municipalities jumped from 76 to 178 (Parolek et al, 2008, 8). By the time the *Euclid v. Ambler* decision was handed down in 1926, 567 local municipalities had adopted zoning ordinances (Parolek et al, 2008, 8). At the end of 1929, three years after the *Euclid* decision, 862 municipalities had adopted zoning ordinances (Parolek et al, 2008, 8).

The Village of Euclid, Ohio's comprehensive zoning ordinance created six land use zoning districts: single-family house, two-family house, apartment house, local retail or wholesale, commercial, and industrial (Fluck, 1986, 328). Euclid's zoning ordinance, like many early zoning ordinances, was "pyramidal, or cumulative, which means [it] permitted 'higher,' less intensive uses—such as residences—in the 'lower' zones that allowed more intensive uses—such as commercial uses" (Meck et al., 2000, 350). In other words, in Euclid's zoning ordinance, all uses allowed in a single-family house zone were allowed in all six zones, but those

uses allowed in an industrial zone were limited to the industrial zone. However, over time, zoning ordinances became more exclusive, or limiting each zoning district to a set of permitted land uses (Meck et al., 2000, 350). For example, these exclusive zoning ordinances would not allow residential development in an exclusive industrial district. The justification for exclusive zoning is to preserve industrial or commercial areas for "future development and forestall future conflicts with residential uses" (Meck et al., 2000, 350). The preservation of industrial or commercially zoned land for industrial or commercial uses is especially vital "when industrial [or commercial] facilities need to expand" (Meck et al., 2000, 350). This exclusive separation of uses is the most commonly associated characteristic of Euclidean zoning.

Effects of Euclidean Zoning

The separation of uses promoted by zoning ordinances reduced the interaction of incompatible uses and thus reduced potential conflicts with noise, health, and safety. However, it also placed an inherent, protected value for certain land uses, most notably the single-family house. Even the Supreme Court's opinion in *Euclid v. Ambler* called the apartment house a "mere parasite, constructed in order to take advantage of the residential character of the district," and that the development of detached residences would be "greatly retarded by the coming of apartment houses," let alone commercial or industrial developments (Fluck, 1986, 334).

While preserving industrial and commercial areas from potential conflicts with residential uses, the implementation of exclusive zoning ordinances further segregated uses. Although Euclidean zoning limited the negatives associated with incompatible uses adjacent to

each other, many of the accessibility benefits of placing employment, retail, entertainment, and residences in proximity to each other were lost as well.

The practice of exclusive zoning also has exclusionary effects. Some zoning codes are intentionally designed to "keep out low- and moderate-income residents" by requiring large minimum lot sizes, prohibiting multifamily housing and mobile homes, and refusing "to zone adequate amounts of land for higher-density single- and multi-family housing" (Meck et al., 2000, 357). Some of these exclusionary provisions are the result of benign purposes—maintaining an "area's low-density rural character," for example (Meck et al., 2000, 357).

Moreover, contemporary zoning regulations can be "bureaucratic, overly detailed, and resistant to administrative reform" (Meck et al., 2000, 357). The list of permitted uses for a zoning district may be "so narrowly drawn that a conditional use permit (and a hearing) are required for most changes of use" (Meck et al., 2000, 357). These criticisms of zoning have prompted several modifications to zoning regulations over the years.

Modifications to Euclidean Zoning

A few of the modifications to the comprehensive, Euclidean zoning ordinance include performance zoning, incentive-based zoning, planned unit developments (PUDs), and overlays. In the 1960s and 70s, performance zoning offered "increased flexibility in the number and types of land uses allowed in various zones by focusing on their effects on their surroundings and adjacent land uses as a basis for determining whether they could be allowed in specific zones" (Parolek et al., 2008, 8). Incentive-based zoning was geared towards encouraging developers to construct "specific uses in particular locations where they would be of advantage to the city"

through incentives such as increased residential density, building heights, or lot coverage (Parolek et al., 2008, 8).

PUDs "allow more leeway in the application of the zoning ordinance to a tract of land" (Meck et al., 2000, 357-358). PUD regulations may "allow mixed uses, flexibility in the placement of buildings, and relaxation of development standards" and "fixes the nature and location of uses and buildings on the entire site" (Meck et al., 2000, 358). This allows for the development of sites with a variety of compatible uses with an improved site design, preserved amenities, and reduced infrastructure costs (Meck et al., 2000, 358).

Overlay zones "provide an additional layer of development standards to address special land use needs" (Meck et al., 2000, 359). For example, "historic preservation regulations are usually administered through overlay districts," (Meck et al., 2000, 359). To allow for mixed-use developments, some cities adopt a mixed-use overlay zone (Meck et al., 2000, 361). While conventional zoning codes strictly segregate land uses, a mixed-use overlay zone allows multiple, compatible uses to exist on one site. Segregating land uses often results in single purpose districts that are "devoid of activity during certain times of the day and therefore isolated from the watchful eyes of the public and more vulnerable to crime" (Meck et al., 2000, 360). Furthermore, the conventional Euclidean zoning promotes "dependence on the automobile by distancing residences from amenities and businesses" (Meck et al., 2000, 360). Alternatively, mixed-use areas are "higher-intensity nodes that are less susceptible to crime because of the presence of human activity and that are supportive of—and compatible with—the more intensive activity found around transportation hubs" (Meck et al., 2000, 361).

While many of these modifications to exclusive Euclidean zoning have addressed some of its negative effects, it has often come at the expense of creating an even more complicated regulatory system (Parolek et al., 2008, 8). Moreover, "many communities remain dissatisfied with the character and quality of the places that conventional zoning has fostered" (Parolek et al., 2008, 9). In response, some planners and architects advocate for a "complete overhaul of the existing zoning system," proposing to implement "form-based codes" to guide development as an alternative to conventional zoning (Parolek et al., 2008, 9).

Form-Based Codes

Form-based codes "look at communities more in terms of variations in scale and intensity of development than in differences in land uses" (Parolek et al., 2008, 9). Therefore, they are a "method of regulating development to achieve a specific urban form" that primarily controls the "physical form with a lesser focus on land use" (Parolek et al., 2008, 4). By regulating form over use, form-based codes can encourage mixed-use development while remaining sensitive to the adjacent built environment. This is in contrast to Euclidean zoning which primarily controls land use and promotes separating uses (Parolek et al., 2008, 6)

Supporters of form-based codes believe these codes provide the tools necessary to facilitate sustainable, "smart growth" type developments that current conventional zoning regulations are lacking (Parolek et al., 2008, 9). Advocates of form-based codes argue that by setting regulations based on building character, scale, and intensity, form-based codes can "help revitalize downtowns, create economically vital commercial areas that attract pedestrians," and "protect the existing character and quality of particular places" (Parolek et al., 2008, 9).

Form-based codes are "vision-based and prescriptive," meaning that they require the community to "create a detailed vision at the start of the coding process" and set specific guidelines for development to follow (Parolek et al., 2008, 11). Since the emphasis is more on physical form than land use, form-based codes frequently are broken into different transect zones, typically ranging from a natural or rural zone to an urban core zone (Parolek et al., 2008, 18-20). Form-based codes are designed to be "holistic, addressing both private and public space design to create a whole place, including buildings, streets, sidewalks, parks, and parking" (Parolek et al., 2008, 11).

Transect Zones

The concept of the transect is commonly used in ecology. Ecological transects describe changes in habitat over changing topography or distance from a water body. The concept, as applied in land use planning, defines an urban-to-rural transect as a series of zones that transition from sparse rural land use to a dense urban core. Each zone contains a similar transition from its edge to the center. Duany Plater-Zyberk and Company included the concept of the transect into their recommended planning code, *SmartCode* (DPZ, 2009b).

A major feature of transect planning is that it incorporates a variety of residential and commercial uses into a single neighborhood. A typical neighborhood could consist of a commercial area (with a bank, general store, pub and coffee shop) and apartments. Moving outwards from the center, residential density would gradually decrease starting with apartments to townhouses to fully detached houses. The central area would be accessible by transit and ideally be within walking distance from any point in the neighborhood.

Transect planning therefore contrasts with Euclidean zoning and suburban development. In the latter, large areas are dedicated to a single purpose, such as housing, office or shopping that foster separation and long distances between land uses. By contrast, the transect decreases the necessity for long-distance travel between uses.

The Transect has six zones that range from rural to urban. It begins with two that are entirely rural in character: the Natural zone (T1) which represents areas protected in perpetuity; and the Rural zone (T2), that is, areas of high environmental or scenic quality that are not preserved, but may be considered for preservation. The transition zone between countryside and town is called the Edge, which encompasses the most rural part of the neighborhood, and the countryside just beyond. The Edge, or the Sub-urban zone (T3) has primarily single family homes. Although the Sub-urban zone is the most purely residential zone, it can have some mixed-use, such as civic buildings. Educational institutions may be appropriate for this area. Next comes the General Urban zone (T4), which is the largest zone in most neighborhoods. The General Urban zone is primarily residential, but more urban in character with somewhat higher density with a mix of housing types and uses. At the urban end of the spectrum are two zones which are primarily mixed use: the Urban Center zone (T5), which can be a small neighborhood center or a larger town center, with the latter serving more than one neighborhood; and the Urban Core zone (T6), which serves the region. The Core is the most urban zone and is akin to the central business district (New Urban News, 2000; DPZ, 2009b).

The Establishment of Parking Requirements

The automobile came on the scene at the beginning of the twentieth century as "sporting devices, machines for the amusement of the well-to-do" (Jakle & Sculle, 2004, 19). At

the time, only the wealthy could afford automobiles, and motorists could park their cars at curbside where they formerly tethered their carriage and horses (Shoup, 2005a, 1). It was initially assumed that "motor-powered vehicles would merely replace horse-drawn vehicles" (Jakle & Sculle, 2004, 19). Few suspected that the car would become affordable and widely available to a growing middle-class, or that the number of registered automobiles in the United States would surge to 8 million by 1920 and 23 million by 1930 (Jakle & Sculle, 2004, 19). With the number of vehicles skyrocketing, there was no longer enough space at the curb "for everyone to park whenever and wherever they wanted" (Shoup, 2005a, 1). Traffic congestion ensued as drivers were forced to circle in vain looking for an empty space to park their cars (Shoup, 2005a, 1).

History of Parking Requirements

The scarcity of curbside parking space in the central business districts of big cities and small towns combined with side-street parking bans and a huge demand for parking space forced drivers to look for off-street parking opportunities. Under these circumstances, the parking lot became such a logical idea that "business entrepreneurs in a host of cities must have simultaneously brought the innovation to the fore" (Jakle & Sculle, 2004, 48). The first parking lots began to appear in the 1910s, as commercial parking companies capitalized on the high demand and low supply for parking (Jakle & Sculle, 48). With traffic congestion from circling automobiles clogging city streets and developers failing to provide sufficient off-street parking, local governments were forced to address the parking shortage. In 1923, Columbus, Ohio became the first city in the United States to incorporate off-street parking requirements in its zoning code (Jakle & Sculle, 2004, 77). By 1949, some 185 American cities adopted minimum

parking requirements for a variety of land uses ranging from apartment houses to office buildings to theaters (Jakle & Sculle, 2004, 77). These parking requirements call for developers to provide off-street parking as part of their developments.

Parking requirements were initially advertised as means to minimize traffic congestion and "became widely accepted as a preventive approach for achieving planned and orderly development" (Jakle & Sculle, 2004, 78). Minimum parking requirements became a "popular land use regulation" that satisfies people's desire for cars and their "need to park them somewhere" (Shoup, 1997, 12). One mayor stated: "We consider zoning for parking our greatest advance.... It is working out exceptionally well, far better than we had expected" (as cited in Shoup, 2005a, 2). Off-street parking requirements spread rapidly during the late 1940s, fueled by their success in reducing traffic congestion and satisfying the public's desire for free parking (Shoup, 1997, 12). Over time, the primary goal of parking requirements has shifted from minimizing traffic congestion to providing sufficient off-street parking space (often free) to meet the demand created by various uses and activities (Shoup, 2005a, 21).

How Parking Requirements are Determined

Theoretically, cities create parking requirements for each land use "to provide enough off-street space to accommodate the recurrent peak-parking demands" (Shoup, 1997, 4). These minimum parking requirements are generally different for every land use type, and ideally are determined by observing parking demand for that type of use. However, critics note that "requirements often seem pulled out of thin air or based on studies that are poorly conceived" (Shoup, 2005a, 13). Carol Gould (2003) asserts that "parking requirements in most zoning regulations are not founded on an empirical analysis of what any land use will require to meet

patrons' needs, but appear to have been 'handed down' from one community to another" (p. 11). Rather than conducting site-specific analyses, most urban planners copy other cities' requirements or refer to national surveys, increasing the likelihood for mistakes to be repeated (Shoup, 2005a, 26). Given the widespread use of similar parking requirements with little empirical analysis, critics of current parking practices claim that "most parking requirements amount to little more than a collective hunch" (Shoup, 2005a, 28).

Parking Requirements and Zoning Regulations

Coincidently, as American cities were increasingly facing problems with parking shortage and traffic congestion, comprehensive zoning was being validated by the courts in the *Euclid v. Ambler* case. As more and more cities adopted zoning codes to regulate existing and future development, they indirectly addressed traffic congestion by affecting population densities and trip generation (Jakle & Sculle, 2004, 76). Additionally, the proliferation of zoning codes also gave local governments a mechanism to implement minimum parking requirements. In its early success in reducing traffic congestion, minimum off-street parking requirements became an integral part of most cities' zoning codes. Today, most parking requirements are written in local municipal zoning codes and determined by land use.

PROBLEM STATEMENT

The widespread popularity of zoning codes and minimum parking requirements throughout the United States in the 1940s laid the foundation for an automobile oriented culture. After World War II ended, a combination of several factors ultimately led to the proliferation of automobile use and an automobile dominated landscape. Higher household incomes, cheap fuel, and free parking supported the increased use of automobiles. Zoning and parking requirements encouraged the separation of uses, which increased the need for automobiles to travel and decreased the viability of walking, bicycling, and using transit.

Although zoning and minimum parking requirements existed prior to World War II, the Great Depression and rationing to support the war effort greatly hindered their full effects. An "unprecedented demand for housing (with the single-family home being the common dream)" at the end of World War II combined with a zoning system that separated all uses set the stage for large, exclusively residential areas on the urban fringe (Parolek et al., 2008, 8). These major residential enclaves, such as Levittown, were built in weeks with thousands of homes but without the commercial services and workplaces communities prior to these developments enjoyed. The rapid development of single-purpose areas at the behest of Euclidean zoning combined with an expanded roadway network and plentiful parking supply created an urban fabric increasingly developed around the use of automobiles. With destinations spread further and further apart, automobiles became transportation necessities for travel between workplaces, homes, stores, and services. As automobiles became more of a need than a luxury for travel, additional roadways and parking were required to meet the large volume of cars. Thus the automobile dependency cycle was born.

Effect of Minimum Parking Requirements

Early parking requirements reduced traffic congestion that threatened to clog city streets by providing off-street space for the newfangled automobile. Its initial success in alleviating traffic led to their permanence in zoning regulations across the country. While parking requirements improved the traffic congestion situation of early 20th Century cities, few foresaw that providing parking to accommodate the demand for automobile storage would ultimately lead to the abundance of free parking lots that now dominate the urban landscape. Current parking practices result in "economically excessive parking supply, increased automobile traffic, and more dispersed destinations, contributing to various economic, social, and environmental problems" (Litman, 2008, 26).

Conventional parking policies for the last half-century have frequently set required parking minimums that are based on peak parking demand. This has resulted in an overabundance of free parking, and encouraged automobile use while hindering other modes of transportation. The abundance of free parking eases accessibility for automobiles while placing uses further apart from one another, which decreases accessibility for pedestrians, bicyclists, and transit users. This adds to the automobile-dependency cycle, encouraging automobile use while marginalizing other transportation modes.

Studies show that the "generous parking capacity required" by minimum parking requirements "often goes unused" (Shoup, 1997, 4). An Urban Land Institute study on suburban retail centers found that parking requirements "leave at least half of all spaces vacant for 40 percent of the time a shopping center is open for business" (Shoup, 1997, 4). Moreover, other studies show that peak parking demand at office parks "average only 47 percent of capacity,

and that no office park had a peak parking demand greater than 60 percent of capacity" (Shoup, 1997, 4). This generous supply of parking resulting from minimum parking requirements exacerbates the demand for cars (Shoup, 2005a, 129). As minimum parking requirements increase the supply of parking, they create "a self perpetuating cycle in which increasing the supply of parking leads to increased demand" (Mukhija & Shoup, 2006, 297).

Furthermore, the large area dedicated to parking expands "the distances between destinations [and] undermines walkability" (Mukhija & Shoup, 2006, 296). In addition to separating uses, the abundance of parking degrades the quality of the pedestrian environment. This further hinders walking since "the distance people are prepared to walk is dependent on the quality of the walking environment" (Knoflacher, 2006, 392). "In a car-free environment, people accept walking distances that are more than 70 percent longer than in a car-oriented environment" (Knoflacher, 2006, 392). In addition to the increased distance between destinations, the space devoted to parking typically creates large voids in the built environment. This is particularly detrimental in the central business districts of major cities and small towns alike. Whereas visitors to central cities prefer a "dense downtown" that offers a "park once" and "walk around to shop, dine, and go to a movie or the theater" experience, "off street parking requirements reduce density because each building has its own, unshared parking that is often unavailable to the public" (Shoup, 2005b, 36). Ultimately, this all continues the auto-dependency cycle and places walking, bicycling, and public transit use at a disadvantage.

Parking Requirements and Costs to Society

Minimum parking requirements also have major cost implications. By requiring an abundance of parking that exceeds the "peak parking demand," minimum parking requirements increase parking supply to the point where it frequently must be free. Yet parking can cost a significant sum of money to construct. The cost to construct a parking lot often differs based on the price of land, which varies by location (Shoup, 2005a, 185). However, it is reasonable to assume that parking lots and structures range in cost from about $10,000 a space to $40,000 a space, depending on the location (Shoup, 2005a, 187).

While this initial cost to construct the required parking often falls on the developer, the cost is often passed down to tenants, homeowners, and consumers through higher leases, housing prices, and price of goods (Shoup, 2005a, 2). Therefore, "even people who don't own a car have to pay for 'free' parking" (Shoup, 2005a, 2). In fact, the "parking requirements based on the demand for free parking can easily provide parking subsidies that are more than double the cost of gasoline used for driving to and from the required parking" (Shoup, 1999, 311). By this standard, the impact fees implicit in parking requirements dwarf the impact fees for all other public purposes combined (Shoup, 1999, 318). Moreover, there are the external costs of a parking space, including the cost of additional congestion and emissions created by accommodating automobiles with abundant parking (Shoup, 2005a, 194-197).

Addressing the Parking Supply Problem

Where early parking requirements were established to reduce traffic congestion in the 1920s, planners are recognizing that while "minimum parking requirements...imply that parking is a problem only when there is not enough of it," clearly "too much parking also creates

problems" (Mukhija & Shoup, 2006, 298). As mentioned, the separation of uses encourages driving to the detriment of other modes of travel, which results in increased greenhouse gas emissions and diminished quality of urban areas.

Recognizing this impact, several cities have instituted parking maximums, particularly in central business districts, to minimize the detrimental effects of a large parking supply. Central cities including Boston, New York, Chicago, Minneapolis, Raleigh, San Francisco, Seattle, and Portland have in some form set maximum limits on parking to reduce their visual and environmental impacts on the local community. Even smaller towns such as Carmel on the Monterey Peninsula of California have parking maximums to encourage walkability and transit use, which are hindered by a large parking supply. Parking supply restrictions also free up "land for other purposes" and lower maintenance costs (CCAP, 2007, 98). To manage parking demand so that it does not exceed these maximums, many of these cities combine these parking policies with parking pricing to discourage driving and encourage other modes of transportation. The Center for Clean Air Policy notes that "these management policies ensure the appropriate supply of parking for a given area by neither subsidizing nor otherwise encouraging the building of excess parking spaces" (CCAP, 2007, 98). Therefore, "parking pricing and supply restrictions are two methods...to deter personal vehicle use, especially single occupancy vehicle use, in areas with easily accessed transit alternatives" (CCAP, 2007, 98).

"When designed in conjunction with other land use and pricing measures, parking pricing policies are one of the most effective ways to reduce VMT, congestion and air pollution" (CCAP, 2007, 98). Parking maximums and pricing reduce driving, congestion, and greenhouse gas emissions by shifting the "mode split...away from automobile use as more transportation

choices become cost competitive" (CCAP, 2007, 98). According to the Center for Clean Air Policy, these parking policies result in a "site-level VMT reduction of 15-30%" (CCAP, 2007, 98). To highlight the importance and impact of these policies, this overall reduction in VMT and associated greenhouse gas emissions is greater than many other transportation and land use policies to reduce driving, including improving transit service, providing light-rail or bus-rapid-transit corridors, and transit-oriented development (CCAP, 2007, 8-9).

Addressing the Urban Landscape

There is no doubt that accommodating the automobile has drastically changed the built environment in urban areas across the country. Minimum parking requirements have contributed to this transformation by calling for large areas to be devoted to parking rather than other uses. Moreover, as many designers and architects will note, minimum parking requirements compromise overall design by forcing them to "shoehorn a building into the space remaining after the parking requirement has been satisfied" (Mukhija & Shoup, 2006, 296). Therefore, "reducing or removing parking requirements can make better design possible" (Mukhija & Shoup, 2006, 296).

However, minimum parking requirements are not solely to blame for the alteration to the urban landscape. Even before minimum parking requirements were established, commercial store owners began to recognize that "in the future, the locations which we pick will be those which assure us of ample parking space for customers" (as cited in Jakle & Sculle, 2004, 193). In fact, "parking, clearly visible from the car and easily accessible, was an incentive" (Jakle & Sculle, 2004, 193). An increase in the dominance of automobiles combined with the demand for available and convenient parking led to the creation of large, visible parking lots,

which greatly altered the appearance of urban areas. Moreover, the separation of uses brought about by Euclidean zoning, further increased the need to drive by placing destinations further apart.

To address these issues, planners, architects, policy makers, and developers have recognized the importance of compact, mixed-use development in urban areas. To encourage this type of development, cities have adopted mixed-use overlay zones or form-based codes. These land use measures allow multiple, compatible uses to be located above, below, or adjacent to one another. By placing multiple uses in proximity to each other, it reduces the distance between destinations, making walking, bicycling, and public transit use more viable.

Parking and Form-Based Codes

Similar to conventional use-based zoning codes, most parking policies currently determine parking requirements by use, disregarding the urban context of the site. In doing so, many jurisdictions apply the same minimum off-street parking requirements for retail space in a suburban area adjacent to a freeway and retail space in a traditional urban neighborhood adjacent to offices, apartments, and transit service, even though the demand for automobile use would be higher in the suburban context.

Some cities attempt to correct this imbalance by creating additional use-based zones or overlay zones for different urban contexts. However, this typically leads to lengthy zoning ordinances with multiple zones for specific areas and select uses. This can be confusing even for the most adept planner, citizen, or developer attempting to decipher the code. Since many form-based codes are written based on the transect, or an increasing intensity in the urban

landscape, they provide the opportunity to administer parking based primarily on the urban form rather than on use.

To reduce automobile-dependency, maximum parking limits have been set through conventional zoning codes, for instance in San Francisco, New York, and Portland. Likewise, form-based codes have been adopted in many cities from Florida to California, including such jurisdictions as Sarasota County, Florida; Montgomery, Alabama; and Santa Ana, California. However, the literature is devoid of studies about the integration of parking policies into form-based codes. This study particularly evaluates how parking policies are modified based on urban context and proximity to transit and other uses rather than the existing practice of requiring it for individual uses.

STATEMENT OF PURPOSE

New urbanists and advocates for Smart Growth and traditional neighborhood development recognize the negative impact of automobile use on the urban environment, and propose to more strictly guide the form of development using form-based codes to reduce this impact and encourage transportation alternatives. Transportation planners acknowledge the damaging effects of over-providing automobile infrastructure to the detriment of other modes of travel, and pursue the use of travel demand measures to reduce auto use. Both groups acknowledge the destructive pattern of automobile dependency on our natural and built environments and social communities. This study examines how well the land use and urban design strategies proposed by land use planners in form based codes are incorporating new and realistic transportation strategies to combat automobile dependency. Specifically, this study focuses on parking policies in form-based codes, and evaluates their potential in reducing automobile dependency in this new genre of land use regulations.

These objectives are achieved by evaluating if municipalities are adjusting parking requirements based on the form and context of the built environment. The study also evaluates whether parking policies are adjusted for availability of transportation alternatives, including proximity to transit. This project analyzes the parking requirements in form-based codes based on the solutions suggested by contemporary urban designers and transportation planners to slow the continuance of the auto-dependency cycle and minimize its negative impacts.

DEFINITION OF TERMS

The following terms are used throughout this report. Since several of these terms may be used in different contexts, it is prudent to define them as used in this study.

Central Business District: The traditional commercial center of most cities. In many cities, this area is frequently referred to as "Downtown."

Cumulative Zoning: A type of zoning ordinance that allows "less intensive" uses in zones designated for "more intensive" uses. The least intensive urban use tends to be single-family homes, whereas the most intensive land use tends to be industrial. Therefore, in a purely cumulative zoning ordinance, it is permissible for a single-family residence to locate in an industrial zone, but it is not permissible for a manufacturing facility to locate in a single-family residential zone. Also see Euclidean Zoning and Zoning Ordinance.

Euclidean Zoning: A type of zoning ordinance that typically separates land into use-based zones. For example, these types of ordinances usually include zones specific for each general land use category, such as a zone specific for only single-family residences. Also see Cumulative Zoning and Zoning Ordinance.

Form-Based Code: A method of regulating development to achieve a specific urban form. Form-based codes create a predictable public realm by primarily controlling physical form, with a lesser focus on land use, through city or county regulations (Parolek et al, 2008, 4).

Greenhouse Gases: Atmospheric gases that increase the amount of heat retained by the Earth's atmosphere. These include carbon dioxide (CO_2), methane (CH_4), nitrogen oxides (NO_x), and chlorofluorocarbons (CFCs).

Land Use: Any type of activity, function, or purpose a property may be used for. General land use categories include residential, commercial, industrial, and government (or public facilities). More specific land uses include retail, restaurants, single-family homes, warehouses, offices, and parks.

Maximum Parking Limits: The maximum number of parking spaces a development is allowed to provide.

Minimum Parking Requirements: The minimum number of parking spaces required to be provided by a given development. This is typically included in a zoning ordinance, and varies by the type of land use.

New Urbanism: An urban design movement aimed at creating compact, mixed-use developments that support use of public transit and walking, and contain a range of housing and jobs. Also see Smart Growth.

Public Transit: Any form of mass transportation, including buses, streetcars, light rail trains, subways and elevated trains (also known as heavy rail trains), and people movers.

Smart Growth: An urban planning movement advocating the development of compact, mixed-use areas that support use of public transit and walking as an alternative to urban sprawl. Also see New Urbanism.

Transect: A geographical cross-section revealing a sequence of physical environments. In reference to the urban metropolis, a transect refers to the varying level of intensity in the physical and social character of different urban contexts (DPZ, 2009b, vi).

Urban Sprawl: A term used to describe the pattern of development typically consisting of large lot single-family neighborhoods at the fringe of an urban area. This type of development typically requires automobiles to travel any distance due to the lack of transportation options and distant services, workplaces, and recreation venues.

Vehicle Miles Traveled (VMT): A measurement for the total number of miles driven by vehicles.

Zoning Ordinance: A method to regulate development by dividing a jurisdiction into multiple, use-based zones. Zoning ordinances typically include policies that regulate the allowed uses on a property, the size and shape of buildings, and standards for site amenities, such as parking for cars and landscaping.

METHODOLOGY

This project evaluates the parking policies proposed to be used in form-based codes, specifically studying Duany Plater-Zyberk's SmartCode (Version 9.2) and the Miami 21 form-based code as case studies. Miami is selected for its recent proposal for a city-wide form-based code based on the urban transect. These policies are compared to "best practices" in parking policies that are suggested by academics and practitioners and are implemented in certain major metropolitan areas. The study procedure is outlined in the following subsections.

Literature Review

The research began with a review of available literature on zoning regulations, form-based codes and parking policies. The literature includes history, critiques and recommendations for parking practices, and implementation of form-based codes. The documents consists of journal and newspaper articles, books, and online resources by notable researchers and organizations in the transportation, land use, and urban design fields.

Review of Miami's Form Based Code

This study primarily focuses on the Miami 21 planning project as a case study. The crux of Miami 21 is the proposed city-wide form-based code to replace the existing Euclidean zoning ordinance. In January 2009, the final draft of the form-based code was released, and as of June 2009, it has yet to be adopted by the local governing body. This study's review of the form-based code focuses on evaluating the parking requirements found in Article 4 of the final draft. It also included looking over other articles in the proposed code, such as guidelines for development, permitted uses, and general standards for development.

Parking Requirement Comparison

To determine changes in parking policies, a few parking requirements are evaluated in addition to the Miami 21 form-based code. Miami's current zoning ordinance, Duany Plater-Zyberk & Company's *SmartCode* and Daniel Parolek, Karen Parolek, and Paul Crawford's *Form-Based Codes* are used to compare to the Miami 21 form-based code. Miami's current zoning ordinance represents a typical Euclidean zoning code, and is ideal to compare how the parking requirements change from the existing code to the proposed form-based code. Miami 21's form-based code is based on Duany Plater-Zyberk and Company's *SmartCode*, which is also used as the template for several form-based codes across the country. This makes it ideal for determining the changes in parking practices in form-based coding as well as revealing the modifications the City of Miami made to the *SmartCode* to adapt it to local conditions. Parolek, Parolek, and Crawford's *Form-Based Codes* book is a comprehensive guide on form-based codes. As a major reference for form-based codes that is not connected to the Miami 21 code, it provides a third-party perspective.

The parking policies in each of these codes were compiled into a table for comparison. Since the way the parking requirements are determined vary by code, some refinement was necessary to make appropriate comparisons. This data is compiled in Table 2.

Assessment of Parking Policies in Form Based Codes

This study includes a general assessment of the parking policies in form-based codes, and the extent to which they modify parking requirements to address urban form. The

evaluation is based on critiques and recommendations acquired through the review of applicable literature and innovative policies adopted in other municipalities.

Recommendations

From the assessment, recommendations are made to enhance parking policies in form-based codes. The report also includes recommendations for future studies to further refine this project's findings by evaluating other form-based codes and conducting an expanded analysis of parking policies.

CASE STUDY – MIAMI, FLORIDA

Background

Miami is located on the Atlantic coastline of southern Florida, and is the primary central city in South Florida. With 5,414,772 people, the Miami metropolitan area is the largest in Florida and the seventh largest in the country (U.S. Census, 2008a). The City of Miami is the largest city in the metropolitan area with a population of 409,719 people (U.S. Census, 2007). It is the second largest city in Florida and the 43rd largest city in the country.

Miami also has a diverse population with large ethnic minority populations. Latinos are the largest ethnic group comprising of two-thirds of the City's population. African-Americans make up 20 percent of Miami's population, Caucasians make up 10 percent, and the remainder is Asian, Native American, or other races.

Miami has a rapidly growing urban core of major skyscrapers. Of the 55 buildings in Miami over 400 feet in height, 40 have been completed since 2004 and 30 have been completed in the last two years (Emporis, 2009). Moreover, Miami has several unique neighborhoods, including Little Havana west of Downtown, Little Haiti on the northern edge of the city, and Coconut Grove on the southern edge of the city.

Miami is served by Miami-Dade Transit, a multimodal public transportation service including the Metrobus, Metrorail, and Metromover. Metrobus is a countywide bus service offering, local, limited-stop, and express service. Metrorail is an elevated, grade-separated heavy rail line that connects downtown with Hialeah and Medley to the northwest and Dadeland and South Miami to the southwest. The Metromover is a people-mover system serving downtown Miami with three loops—a downtown inner loop, and two outer loops with

one connecting downtown with the Bricknell Financial District to the south and one connecting downtown with the Omni Center to the north.

Zoning and Parking History

The first proposal for comprehensive city planning in Miami occurred in February 1915. City Councilman H.G. Ralston "called attention [to] the manner in which the city is now spreading out, the platting of new additions without any idea of conformity to streets in the older sections" (City of Miami, 2009b). Despite Ralston's concerns about new growth not conforming with existing development, the Council ultimately decided not to pursue a comprehensive citywide plan. The Miami Daily Metropolis article reporting on the story stated "though Miami is growing with great rapidity, necessitating the frequent opening of new additions, it will continue to grow in a haphazard, 'hodge-podge' way" (City of Miami, 2009b).

In 1922, the Miami Chamber of Commerce published an "article on zoning, which strongly endorsed the creation of a zoning code in Miami" (City of Miami, 2009b). By 1929, Miami Mayor C.H. Reeder considered a zoning ordinance as "'one of the most important propositions confronting the Commission'" (City of Miami, 2009b). On August 8, 1934, the City of Miami adopted the city's first zoning ordinance. "The ordinance was amended about 5,000 times during its 26-year existence," ultimately creating a "hodge-podge, meaningless ordinance" (City of Miami, 2009b).

In 1960, a new zoning ordinance was adopted to replace the original 1934 ordinance. The new comprehensive zoning ordinance "rezoned the entire City, divided the City into nine sections, and affected over 30,000 properties. The ordinance contained many new rules regulating form and types of buildings, as well as uses." Perhaps due to the massive change,

"hundreds of people objected to the new plan" (City of Miami, 2009b). In 1982, yet another zoning ordinance was adopted to replace the 1960 comprehensive zoning ordinance. The new regulations, known as "Zoning Ordinance 9500," "introduced the concept of mixed use and its innovative approach received an award by the Gold Coast Chapter of the American Planning Association (APA)" (City of Miami, 2009b). As an award winning ordinance, it "was used as a mode for many other cities" (City of Miami, 2009b). However, Zoning Ordinance 9500 was "a huge undertaking," taking eight years to write. Despite "acclaim and high regard by fellow planning professionals, 9500 was widely regarded by residents and developers as incomprehensible when it was first introduced" (City of Miami, 2009b).

In 1990, the current "Zoning Ordinance 11000" was adopted to replace Zoning Ordinance 9500. The primary impetus in adopting 11000 to replace 9500 was to "simplify the ordinance and address issues with parking and setbacks for residential homes" (City of Miami, 2009b). Miami's Zoning Ordinance 11000 "increased parking requirements for new apartments and doubled the minimum lot size to handle extra parking" (City of Miami, 2009b). It also "revived a provision that allowed developers to raze abutting residential property to provide for additional parking for their businesses" (City of Miami, 2009b). Over the last 19 years, it "has been amended innumerable times and has become a hodge-podge without regard for smart growth and quality of life" (City of Miami, 2009b). The City has determined that the "amendments and variances to the code have demonstrated the need for a complete overhaul of the outdated regulations which fail to address the current and future needs of the City as a whole" (City of Miami, 2009b).

Miami Zoning Ordinance 11000

The Miami Zoning Ordinance 11000 covers the following general land use types:

- Conservation
- Parks, Recreation and Open Space
- Government and Institutional
- Residential
- Commercial
- Office
- Central Business District
- Industrial

It is generally a cumulative Euclidean zoning ordinance, meaning that it designates districts by permitted land use categories, but mostly allows "less intensive uses in zones that allow more intensive uses" (Meck et al., 2000, 350). For example, the types of uses permitted in an R-1: Single-Family Residential zone are also permitted in the more intensive R-2, R-3, and R-4 zones, which allow multi-family residences. This also extends beyond general use categories. For example, the uses permitted in an R-4 multifamily residential zone are also permitted in O (Office) and C-1 (Commercial) zones. There are some exclusive zoning characteristics in the 11000 Ordinance. For example, the G/I (Government and Institutional) Zone is generally reserved for government or public uses, or uses to support those primary uses. Moreover, some of the zones for more "intensive uses" include a list of exceptions from the less intensive zones, limiting some of the uses that carry over.

Overall, this type of cumulative zoning system is rare in contemporary zoning ordinances. Most Euclidean zoning ordinances today are more exclusive; for example, preserving commercial land for only commercial development to prevent future conflicts with less intensive uses that may enter. However, it does yield some benefits by generally allowing

the development of residential uses within the same zone as non-residential uses, potentially reducing the distance between residences and service and workplace destinations.

Within the zoning ordinance, very specific types of uses are described for each zone. For example, permitted uses in the C-1 (Commercial Limited) Zone range from clinics to television broadcasting studios to leather goods to cigar manufacturing (hand process) to jewelry stores; but pawnshops are specifically noted as not permitted. Likewise, the parking requirements for each zone also include a list of fairly specific uses. For example, in residential zones, there are different parking requirements for a single-family dwelling unit, child care, and nursing homes. There are even different parking requirements based on the number of bedrooms in a multifamily unit—requiring one space for one-bedroom units, two spaces for two- or three-bedroom units, and three spaces for four- or more bedroom units. In commercial zones, there are different parking requirements for barber and beauty shops, bible study classes, meeting halls, restaurants, and discount membership merchandisers.

These details in addressing many specific types of uses are very typical of a Euclidean zoning code. Since Euclidean zoning is use based, it must try to address all types of uses, even those that rarely come up. To accommodate all these details, Euclidean zoning often must be amended many times over, becoming long and complicated. As noted earlier, the numerous amendments and variances adopted over the lifetime of Miami's Zoning Ordinance 11000 has "demonstrated the need for a complete overhaul of the outdated regulations which fail to address the current and future needs of the City as a whole" (City of Miami, 2009b). In response, the City is pursuing "Miami 21," a "holistic approach to land use and urban planning"

that will replace the existing Zoning Ordinance 11000 with a form-based code (City of Miami, 2009b).

Miami 21 – Form-Based Code

The form-based code currently being considered by the City of Miami is based on Duany Plater-Zyberk's SmartCode. Duany Plater-Zyberk & Company is an urban planning, architecture, and design firm led by principals Andres Duany and Elizabeth Plater-Zyberk, two co-founders of the Congress for New Urbanism (DPZ, 2009a). The SmartCode was originally released by Duany Plater-Zyberk & Company in 2003, and has been modified several times over. It is designed to be an "integrated land development ordinance" folding "zoning, subdivision regulations, urban design, public works standards and basic architectural controls into one compact document" (SmartCode Central, 2009). As an "open source" document, the SmartCode is "available for use without charges or licensing fees," and is "meant to be locally customized by professional planners, architects, and attorneys," "ideally with the participation of...local citizens" (SmartCode Central, 2009; DPZ, 2009b, iv).

The SmartCode "is a transect-based code" (DPZ, 2009b, vi). The transect in an urban context is a gradient of urban form that ranges from natural settings to urban core. The SmartCode is divided into six transect zones: Natural (T1), Rural (T2), Sub-urban (T3), General Urban (T4), Urban Center (T5), and Urban Core (T6). In addition, the SmartCode includes a "Civic Zone" for civic buildings and/or civic spaces and "Special Districts" for "areas with buildings that by their function, disposition, or configuration cannot, or should not, conform to one or more of the six normative transect zones" (DPZ, 2009b, xi). The Miami 21 form-based code is based on and includes these transect zones and its own special districts.

The Miami 21 form-based code has yet to be adopted as of June 2009, but a final draft of the code was released in January 2009. The code includes five of the six transects in the Smart Code: Natural (T1), Sub-urban (T3), General Urban (T4), Urban Center (T5), and Urban Core (T6). The Sub-urban through Urban core transect zones are further divided into three categories: Restricted, Limited, and Open. As the names imply, the areas under the Restricted category have fewer allowed uses whereas the Open category has more allowed uses. For example, in a T4-R (General Urban-Restricted) zone, all office and commercial uses are prohibited, but in a T4-O (General Urban-Open) zone, offices, entertainment establishments, food service establishments, and general commercial uses are all allowed by right (City of Miami, 2009a, IV.6). Despite the changes in permitted uses between the three categories, the parking requirements within a transect zone are the same for all categories. For example, the parking requirements for a principal dwelling unit in T5 – Residential remains the same for Restricted, Limited, and Open.

The Urban Core (T6) transect is even further divided by density and maximum height levels into six different zones: T6-8, T6-12, T6-24, T6-36, T6-60, and T6-80. The number attached to the zone refers to the height limit for that zone. For example, in T6-8, the maximum height is 8 stories, while in T6-36, the maximum height is 36 stories. Similarly, there are increases in allowed floor-lot ratio (FLR) as the code allows increases in height. For example, in the T6-12 transect, the maximum FLR is 8, while in a T6-80 zone, the maximum FLR is 24.

The Miami 21 form-based code also has three civic zones and three district zones. The civic zones include Civic Spaces/Parks (CS), Civic Institution (CI), and Civic Institution – Health District (CIHD). The three district zones are Work Place (D1), Industrial (D2), and Marine (D3).

When taking all these transect, civic, and district zones proposed in the Miami 21 form-based code, they geographically match closely with existing use-based zones in the current Miami Zoning Ordinance 11000. For example, those areas currently zoned R-2 are proposed to be in the T3-O (Sub-urban Open) zones. Likewise, those areas currently zoned C-1 are generally closely matched with areas proposed to be under T6-8-O transect zoning. The areas currently zoned CS (Conservation) are proposed to be in the T1 (Natural) zone under the Miami 21 form-based code. Primarily because Miami is already built out, the new regulations need to generally match existing development. These similarities as the city transitions to the form-based code indicates that the new code will generally preserve the character of existing neighborhoods by matching areas closely with similar regulations under the current Zoning Ordinance 11000. See Figure 1 and Figure 2.

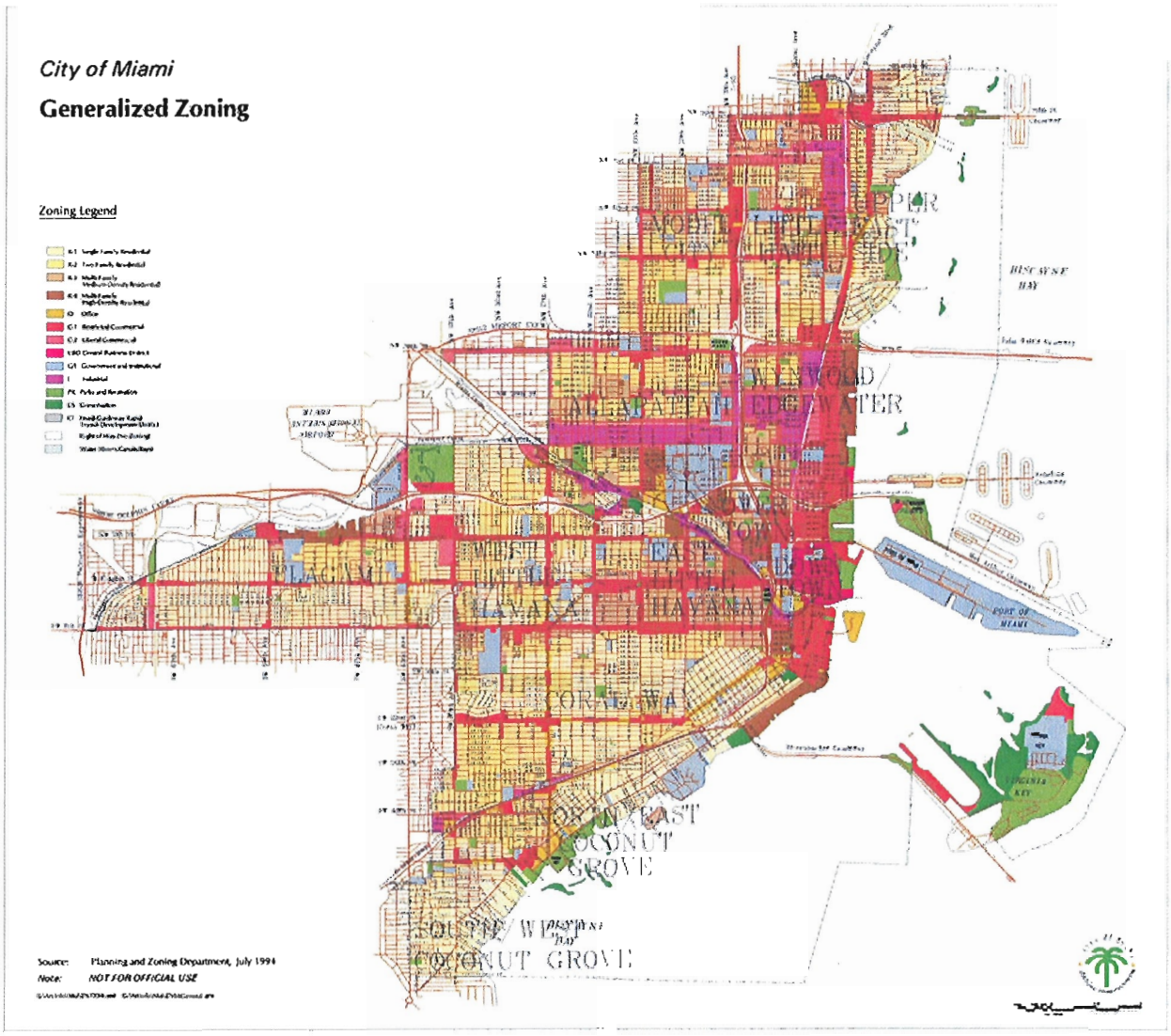

Figure 1: City of Miami Zoning Map - Zoning Ordinance 11000

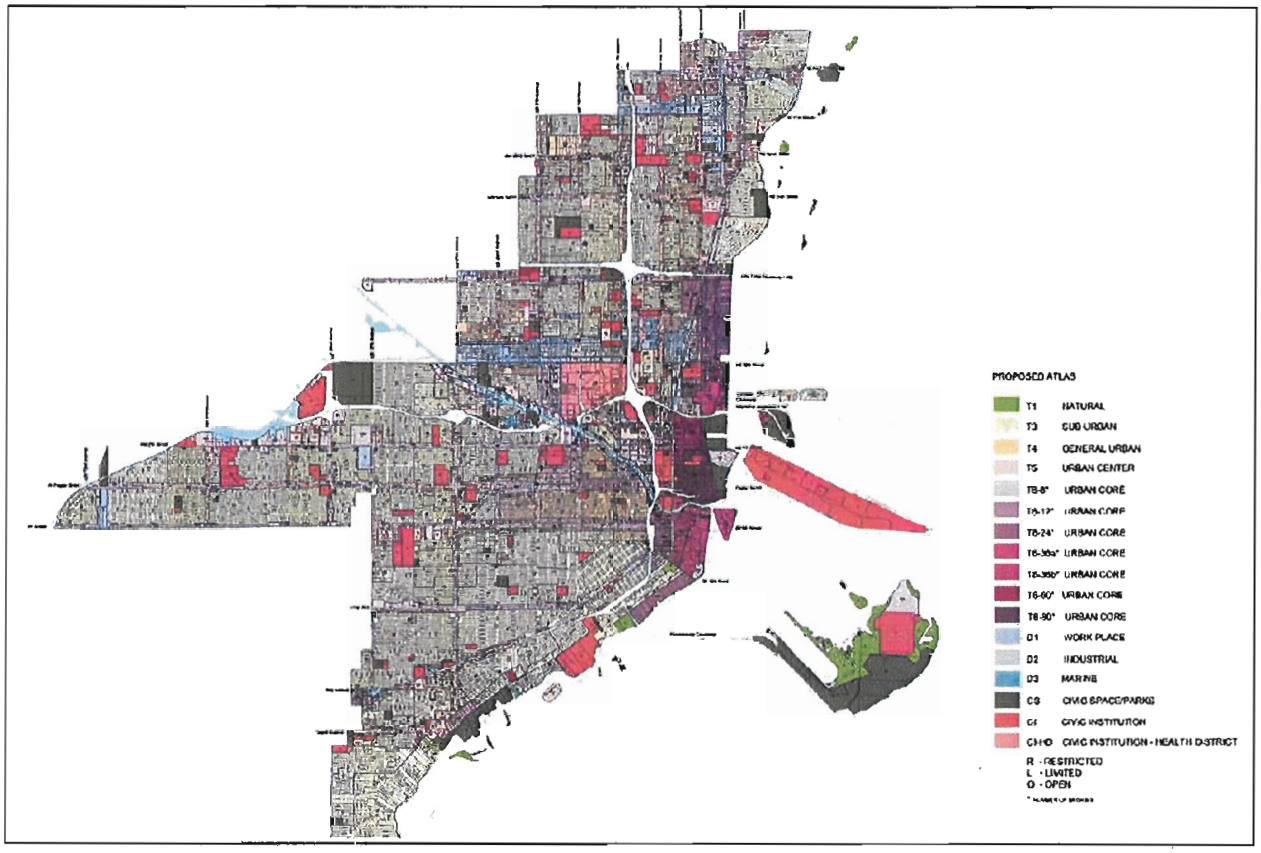

Figure 2: City of Miami Zoning Map - Miami 21 Form-Based Code

Similar to the existing zoning ordinance, Miami 21 does not allow commercial or office uses in T3 or in T4-R zones. This means these areas will remain completely residential, just like most Euclidean zoning codes that separate residential areas. As noted, this is probably done to preserve existing residential neighborhoods, but in doing so, it side-steps the issue of auto-dependency created by the separation of uses. However, it demonstrates that there are not major, transformational shifts or changes that will occur as the result of the new code. Nevertheless, the new code does place fewer restrictions on improving the mix of uses and provides more prescriptive guidelines for the form of future development. This includes the design of buildings to include pedestrian-scale architecture and restricting the location of

parking away from the front of the property. Such measures will encourage an improved urban landscape that combats the effect the automobile has had on the urban form of Miami.

Since the form-based code is strongly tied to the existing zoning, it is worth investigating how much the parking policies will change from the Miami Zoning Ordinance 11000 to the new Miami 21 form-based code. City of Miami city planner, Dakota Hendon, noted that one of the desires for the City with the form-based code is to reduce the amount of parking (personal communication, June 9, 2009). The comparison of the parking requirements is shown in Table 2 in the following section.

General Evaluation of Parking Requirement Comparisons

Table 2 compares the parking requirements proposed for the Miami 21 form-based code with the existing Zoning Ordinance 11000, Duany Plater-Zyberk & Company's SmartCode version 9.2, and recommendations in Daniel Parolek, Karen Parolek, and Paul Crawford's *Form-Based Codes*. The table is created to simplify comparisons between codes that individually focus differently on: use vs. area type; the units in which parking requirements are stated; and regulatory objectives. Therefore, certain adaptations were necessary to facilitate the comparison.

The parking requirements in Table 2 from the existing Miami Zoning Ordinance 11000 involved some refinement to compare to the three form-based codes. First of all, the parking requirements in each use-based zone of the Ordinance 11000 are highly specified by use. For example, in a commercial zone, the parking calculation for a general retail store differs from a restaurant, which also differs from a barber shop, even though all three uses are permitted in the zone. Therefore, the values provided in Table 2 had to be generalized. For example, for

residential uses, the parking requirement shown in Table 2 for the Miami Zoning Ordinance 11000 is for the typical type of dwelling associated with the zone—single-family dwelling unit for R-1, multifamily units for R-3 and R-4. For commercial and office zones, Table 2 lists the requirement for "other non-residential uses." This is the type of generalization that enabled the comparison between the existing Zoning Ordinance 11000 and the form-based codes.

The parking requirements in the existing ordinance also had to be adapted to the transect zoning. As noted earlier, the current Zoning Ordinance 11000 is focused on use, not the urban transect of Sub-urban, General Urban, Urban Center, and Urban Core. Therefore, the numbers shown in Table 2 are based roughly on how each zone matches with related transect zoning being proposed in Miami 21. For example, since R-1 and R-2 are generally related to the T3 transect, the parking requirements for dwelling units in R-1 and R-2 are shown under Sub-urban Residential. Similarly, the current CBD zone is generally related to the T6-80 transect zone, and therefore is shown under Urban Core. It is important to note that some do not exactly match up. For example, the existing C-1 zones are proposed to be in a variety of transects, ranging from T4-O to T6-8. Therefore, when comparing the requirements from the existing Miami Zoning Ordinance 11000 to those proposed in the Miami 21 form-based code, the numbers in Table 2 can be used to draw general conclusions. However, a more specific comparison is difficult to do on the city-wide level since certain zones in the existing zoning ordinance do not always match up with the same transect zoning. However, specific conclusions can be ascertained on an area or site level basis by comparing an area or parcel's parking requirements under the existing ordinance and its new requirements in the proposed form-based code.

It is also important to note that the parking requirements in *Form-Based Codes* only disaggregate parking policies for commercial supply, residential supply, public parking, design, and management. Therefore, the parking requirements for "commercial supply" are applied for both commercial and office.

It is important to be cognizant of the backdrop of each of these four codes. Miami's Zoning Ordinance 11000 is currently being implemented, and was written specifically to accommodate more parking. The Miami 21 form-based code is in its final draft form, and has been shaped by political and community input. Duany Plater-Zyberk & Company's SmartCode is written as a template code for cities to implement. Alternatively, the numbers proposed in Parolek, Parolek, and Crawford's Form-Based Codes are determined based on a progressive set of logical steps that assumes uses are close enough for a "park-once" mentality in all urban zones (T4 – T6), and that multiple modes of transportation, including walking and transit, are viable and used in urban centers (T5 – T6) (Parolek et al, 2008, 51). It should also be noted that, as a template, the SmartCode is meant to serve as a starting point for local municipalities to adapt to their local characteristics and constituents.

Transportation planners agree that "nothing is more useful...than collecting actual local parking data, or data from a comparable location" to determine parking requirements (Parolek et al., 2008, 51). This is particularly important when looking at the parking requirements for the SmartCode and those proposed in *Form-Based Codes* in Table 2. Neither of these codes is for a specific locality, and is designed to be used as general guidelines that are modified to match local conditions. Therefore, the proposed numbers in the parking requirements for these codes should also be taken as general guidelines that ought to be calibrated for each municipality. For

example, where the proposed maximum of two spaces per 1000 SF for an Urban Center (T5) transect in Parolek et al's *Form-Based Codes* may be appropriate for one city based on parking studies, it may be too high or too low for others.

Furthermore, the definitions of each urban transect zone may vary by locality and by perspective of the codes' authors. For example, one city may include areas that are highly urbanized with wide sidewalks, frequent transit service, and mid-rise, mixed-use buildings in an "Urban Center" or T5 transect zone, whereas some cities may view an "Urban Center" as the transect for commercial centers that may be heavily auto-oriented. Furthermore, one city may consider a "Sub-urban" T3 transect to include only single-family residences on relatively large lots, while some cities may include small neighborhood commercial uses and all types of single-family dwelling units, such as zero-lot line and small-lot single-family developments. These are moderately different types of urban form that different places may view as the "same" transect zone. Since the Miami 21 form-based code is based on Duany Plater-Zyberk's SmartCode, the type of urban form planned for in each transect may be relatively compatible between the two. However, comparing the type of urban form in these two form-based codes with Parolek, Parolek, and Crawford's *Form-Based Codes* may prove more challenging, since the authors of *Form-Based Codes* may have a different perspective on what constitutes each transect. Neither is inherently right or wrong, but the different vision of the urban transect makes it a non-direct comparison.

Nevertheless, Table 2 provides a good enough comparison to be suitable for the purpose of this study. One can evaluate if the requirements are significantly different between the old and new sets of codes.

Analysis of Parking Requirements in Miami 21

Miami 21 vs. SmartCode

From Table 2, it is clear that the parking requirements in the Miami 21 form-based code are based on the SmartCode. This is confirmed by City of Miami planner, Dakota Hendon (personal communication, June 9, 2009). Table 2 shows that the Miami 21 form-based code and the SmartCode have the same parking requirements for residential uses in the Sub-urban and General Urban transects, for office uses in the General Urban transect, and for commercial in the Urban Center and Urban Core transects. Moreover, both the Miami 21 code and the SmartCode include the exact same table for shared parking reductions. One of the differences between the two codes can be explained by political and community pressure. Due to fears of parked cars from multifamily residences overflowing into adjacent neighborhoods, local residents wanted to increase the 1 space per dwelling unit proposed by the SmartCode for the Urban Center (T5) and Urban Core (T6) transects (D. Hendon, personal communication, June 9, 2009).

Miami 21 vs. Miami Zoning Ordinance 11000

The parking requirements in Miami 21 also do not deviate much from the current Miami Zoning Ordinance 11000. The parking requirement for office uses increases slightly from 2.86 spaces per 1000 square feet to 3 spaces per 1000 square feet. Meanwhile, the parking requirement for general commercial uses decreases slightly from 3.3 spaces per 1000 square feet to 3 spaces per 1000 square feet. One notable change is for multifamily residential parking requirements, where the new Miami 21 code provides one uniform per dwelling unit requirement rather than differentiating between a one-, two-, three-, or four-bedroom units. (Continued on Page 54)

Table 2: Parking Requirement Comparison

Zoning/District		Miami 21 (Form-Based Code)	Miami Zoning Ordinance 11000 (Euclidean Zoning)	Smart Code (version 9.2)	*Form-Based Codes*
Sub-urban (T3)	Commercial	N/A	10 spaces per 1000 SF for restaurants, bars, etc.; 4 spaces per 1000 SF of discount retail; 3.3 spaces per 1000 SF for all other	4 spaces per 1000 SF	No greater than 4 spaces per 1000 SF
	Office	N/A	2.86 spaces per 1000 SF	3 spaces per 1000 SF	No greater than 4 spaces per 1000 SF
	Residential	2 spaces per dwelling unit	2 spaces per dwelling unit	2 spaces per dwelling unit	May be appropriate, but not necessary
General Urban (T4)	Commercial	3 spaces per 1000 SF	See Suburban Commercial	4 spaces per 1000 SF	No greater than 2 spaces per 1000 SF
	Office	3 spaces per 1000 SF	2.86 spaces per 1000 SF	3 spaces per 1000 SF	No greater than 2 spaces per 1000 SF
	Residential	1.5 spaces per dwelling unit	1 space per 1-bed unit; 2 spaces per 2-3-bed unit; 3 spaces per 4-bed unit	1.5 spaces per dwelling unit	No greater than 1 space per unit
Urban Center (T5)	Commercial	3 spaces per 1000 SF	See Suburban Commercial	3 spaces per 1000 SF	No greater than 2 spaces per 1000 SF
	Office	3 spaces per 1000 SF	2.86 spaces per 1000 SF	2 spaces per 1000 SF	No greater than 2 spaces per 1000 SF
	Residential	1.5 spaces per dwelling unit	1 space per 1-bed unit; 2 spaces per 2-3-bed unit; 3 spaces per 4-bed unit	1 space per dwelling unit	No greater than 1 space per unit
Urban Core (T6)	Commercial	3 spaces per 1000 SF	1 space per 1000 SF	3 spaces per 1000 SF	Max of 1 space per 1000 SF; require shared parking
	Office	T6-24, T6-36: 1 space per 800 SF T6-60, T6-80: 1 space per 1000 SF	1 space per 1000 SF over 10,000 SF	2 spaces per 1000 SF	Max of 1 space per 1000 SF; require shared parking
	Residential	1.5 spaces per dwelling unit	1 space per dwelling unit	1 space per dwelling unit	Max of 1 space per unit; require unbundled cost
	Comments	All requirements are minimums	All requirements are minimums	From Duany Plater-Zyberk	From Parolek et al. (2008) *Form Based Codes*, pp. 52-53

(Continued from Page 52) As noted in the previous paragraph, this change generated some concern among local residents (D. Hendon, personal communication, June 9, 2009). Another major difference is in the parking requirements for the Urban Core (T6) transect with the existing requirements in the CBD zone. The T6 zone requires considerably more parking than the existing CBD zone, as shown in Table 2. The T6 zone does cover a larger area than the existing CBD zone, including parcels along corridors in more suburban areas, which may explain the higher parking requirement. However, there is no differentiation in parking requirements for development in a T6-80 or T6-60 zone, which are proposed for the same general area as the existing CBD zone, and the T6-8 and T6-12 zones which are along corridors in more suburban contexts. The proposed reductions for shared parking and proximity to transit will reduce parking requirements in T6 zones where the CBD zone is currently applied since these areas are more likely to have shared parking and be close to transit. However, even with these reductions, the parking requirements in Miami 21 for the T6-60 and T6-80 will likely be greater than the existing requirements in the CBD zone.

Miami 21 vs. *Form-Based Codes*

Of the four codes compared in Table 2, the parking requirements in Parolek, Parolek, and Crawford's *Form-Based Codes* deviates the most from the Miami 21 form-based code. While the Miami 21 form-based code, the *SmartCode*, and the existing Miami Zoning Ordinance 11000 exclusively include parking minimums, the parking policies in the *Form-Based Codes* guidebook also suggest parking maximums, required shared parking, and unbundled parking. The policies in *Form-Based Codes* also include the greatest decrease in parking from the Sub-urban (T3) zone to the Urban Core (T6) zone.

The differences between the Miami 21 form-based code and the requirements suggested in *Form-Based Codes* is noticeable for every transect. For example, while the Miami 21 form-based code includes a minimum of 3 spaces per 1000 square feet for both commercial and office uses in the General Urban (T4) and Urban Center (T5) transect zones, the *Form-Based Codes* authors suggest that a "minimum, if any, should be aggregated for all nonresidential uses and no greater than 2 spaces per 1000 square feet" (Parolek et al., 2008, 52). For these transect zones, *Form-Based Codes* also suggests that "in lieu fees [be] allowed," there be "no minimum for uses under 5000 square feet," "shared parking should be required or encouraged," and maximums should be considered for non-shared parking (Parolek et al., 2008, 52). The Miami 21 form-based code does not include any of these provisions, and the minimum is 1 space per 1000 square feet greater than that suggested in *Form-Based Codes*. While 1 space per 1000 square feet may not seem like much, this would be a difference of 50 parking spaces for a 50,000 square foot grocery store. These 50 spaces take up approximately 17,000 square feet, one-third the size of the store.

Another notable difference is in the Urban Core (T6) transect. While Miami 21 includes parking minimums for all uses, *Form-Based Codes* suggests "no minimum requirements" for all uses, and recommends maximums set "as part of [a] traffic management strategy" (Parolek et al., 2008, 52). Moreover, *Form-Based Codes* "requires all parking be shared" for commercial uses, and "requires [the] cost of parking to be unbundled from [the] cost of housing" for residential uses (Parolek et al., 2008, 52).

Progressive Provisions of Miami 21's Parking Requirements

Beyond the minimum parking requirements summarized in Table 2, the Miami 21 form-based code includes certain progressive provisions that address the oversupply of parking. First of all, it acknowledges the potential for shared parking among multiple uses, and provides an easy to understand matrix to determine the parking reduction for constructing a shared parking area (See Appendix A). It does not mandate shared parking, but it provides developers an incentive to reduce the area devoted to parking by providing a shared lot for multiple uses in one centralized location rather than multiple private lots.

Second, it allows parking reductions for projects that have close access to transit. Developments in the Urban Center (T5) or Urban Core (T6) transects that are within a quarter-mile of a transit corridor or a half-mile of a transit-oriented development (TOD) are eligible to reduce the amount of required parking by 30 percent. A transit corridor is defined as a "mass transit route with designated transit vehicle(s) operating at an average 10 minute or less headway Monday through Friday between the hours of 7am through 7pm" (City of Miami, 2009a, I.27). This means that transit service is frequent enough during the weekdays that it should be convenient and attractive for those living along these corridors to use public transportation as an alternative to driving. Moreover, parking is not required for all residential developments within 1,000 feet of a Metrorail or Metromover transit station in the T6-60 and T6-80 (Urban Core) transect zones. This almost exclusively applies to multifamily residences in downtown, where the T6-60 and T6-80 zones are located.

Critiques of Miami 21's Parking Requirements

The parking requirements in the Final Draft of the Miami 21 form-based code also has several areas that can be improved, based on the literature and existing best practices from municipalities across the country. For example, with the exception of a slight decrease in residential minimums from the Sub-urban (T3) to General Urban (T4) transects, the parking requirements do not decrease in the more urban transect zones. One would expect parking demand to be lower in more urban transects since these areas should be characterized by a closer proximity and greater conglomeration of destinations and more frequent transit service. The allowed 30 percent reduction in minimum parking requirements for areas that are close to transit will help decrease the amount of parking in the Urban Center (T5) and Urban Core (T6) transects, but the reduction still generates parking requirements that are higher than desired for urban areas with access to transit.

Also, several progressive parking measures currently being implemented in other cities are not included in the Miami 21 form-based code. For example, there is no provision to unbundle the price of parking from housing. For most cities, "parking requirements bundle the cost of parking spaces into the cost of dwelling units, and therefore shift the cost of parking a car into the cost of renting or owning a home—making cars more affordable but housing more expensive" (Shoup, 2005a, 141). Particularly in areas where affordable housing is an issue, separating parking from dwelling units and pricing each separately can "make housing cheaper for those who think a second parking space (or even a first one) isn't worth the extra cost" (Shoup, 2005a, 560). This gives residents the freedom to choose how many parking spaces they are willing to pay for. The City of San Francisco mandates that "all off-street parking spaces

accessory to residential uses in new structures of 10 dwelling units or more...be leased or sold separately from the rental or purchase fees for dwelling units for the life of the dwelling units" (City of San Francisco, 2009, Article 1.5, Sec. 167). However, such a provision is not included in the Miami 21 form-based code.

While the Miami 21 form-based code includes provisions to reduce parking through shared parking, it does not require shared parking as suggested in Parolek, Parolek, and Crawford's *Form-Based Codes*. Such requirements could reduce the total amount of parking, and allow the more efficient use of parking throughout the day by creating centralized public parking areas rather than smaller, private lots serving individual uses. The parking policies in the Miami 21 form-based code does allow for off-site parking and allows developers to enter agreements with the City Attorney to lease from an existing parking area nearby; however creating parking benefit districts and permitting in-lieu fees as an alternative to providing private off-street parking can more efficiently utilize parking and reduce the total amount of parking. Miami 21 does not specifically include provisions for the establishment of in-lieu parking fees and parking benefit or parking management districts. In-lieu parking fees can reduce the number of smaller private lots by allowing developers to pay fees that go towards the construction of shared public parking lots and improvement of local transportation infrastructure. Currently, the City of Miami does have two parking management trusts established in Coconut Grove and the Design District where in-lieu fees are an option (D. Hendon, personal communication, June 9, 2009). Adoption and implementation of the Miami 21 form-based code presents an opportunity to expand the concept of parking management districts to other parts of the city as well.

While the current Miami Zoning Ordinance 11000 includes an inherent provision that exempts smaller offices in the Central Business District (CBD) zone from providing parking, the proposed Miami 21 form-based code does not include a similar exemption. Specifically, the current CBD zone requires one space per 1,000 square feet of gross floor area over 10,000 square feet for office uses. This inherently exempts any office development less than 10,000 square feet from providing parking, and is consistent with proposals in Parolek, Parolek, and Crawford's *Form-Based Codes* to not have minimum parking requirements for smaller land uses. However, the final draft of the Miami 21 code does not include any provision that exempts smaller land uses from providing parking in the Urban Core (T6) transect.

As noted earlier, parking maximums are another progressive parking policy measure that several cities are implementing in areas with a mix of uses and are well served by transit to protect the character of neighborhoods and mitigate the negative affects of large parking lots. While Downtown Miami is well served by the Metrorail, Metromover, and Metrobus public transportation systems, the Miami 21 form-based code sets required parking minimums rather than maximum parking limits. It should be noted that the City of Miami's City Code Section 14-182 does include parking maximums for downtown. However, these numbers are approximately equal to the minimum parking requirements in the Sub-urban (T3) and General Urban (T4) transects (City of Miami, 2009c). See Table 3 and Table 4 for comparisons.

Table 3 shows that the parking maximums for Downtown Miami are almost identical to the existing and proposed minimum parking requirements in the more suburban areas of Miami. While it is beneficial for the downtown to have a parking maximum, setting the maximum roughly equal to the parking found in suburban areas does little to discourage

driving, lessen the negative impacts of large parking areas in a central business district, and encourage alternative transportation.

Table 3: Parking Comparison: Downtown Maximums vs. Suburban Minimums

Zoning (Use)	Downtown Parking Maximums (Miami City Code)	Current Parking Requirements (Zoning Ordinance 11000)	Proposed Parking Requirements (Miami 21)
Parking Policies Shown	Table in Miami City Code Section 14-182	Commercial: C-1 Office: O Residential: R-1, R-2	Commercial & Office: General Urban (T4) Residential: Sub-urban (T3)
Commercial	Retail: 3.33 spaces per 1000 SF Restaurant: 10 spaces per 1000 SF	Retail: 3.33 spaces per 1000 SF Restaurant: 10 spaces per 1000 SF	3 spaces per 1000 SF
Office	CBD*: 1.67 spaces per 1000 SF Other: 2.5 spaces per 1000 SF	2.86 space per 1000 SF	3 spaces per 1000 SF
Residential	2 spaces per dwelling unit	2 space per dwelling unit	2 spaces per dwelling unit
Comments	* - only for offices in the CBD-1 zoning district	C-1, O, and R-1, R-2 zones are all found outside of the Downtown Miami	T3 and T4 transects are in suburban settings outside Downtown Miami

The Miami 21 form-based code has an opportunity to include a parking maximum based on the urban transect that fits a downtown setting. However, as shown in Table 4, the proposed Miami 21 form-based code sets minimum parking requirements that are greater than existing minimums for the central business district and does not reduce the high parking maximums established in the existing City Code.

Table 4: Parking Requirements in Downtown Miami

Zoning (Use)		Parking Maximums (Miami City Code)	Current Parking Requirements (Ordinance 11000)	Proposed Parking Requirements (Miami 21)
Central Business District	Commercial	Retail: 3.33 spaces per 1000 SF Restaurant: 10 spaces per 1000 SF	1 space per 1000 SF	3 spaces per 1000 SF
	Office	CBD*: 1.67 spaces per 1000 SF Other: 2.5 spaces per 1000 SF	1 space per 1000 SF over 10,000 SF	1 space per 1000 SF
	Residential	2 spaces per dwelling unit	1 space per dwelling unit	1.5 spaces per dwelling unit
Comments		* - only for offices in the CBD-1 zoning district	Minimums for the current CBD zone	Minimums for the proposed T6-60 and T6-80 transect zones

General Observations

In general, there are minimal parking policy changes in the Miami 21 form-based code. Lower minimum requirements or the establishment of appropriate parking maximums in existing, compact urban neighborhoods would protect the existing character of these areas and encourage the development of context sensitive development that promotes walkability. Yet, the proposed parking requirements in the Miami 21 form-based code still includes relatively high minimums even in the more urban transects.

This is partially a critique of Duany Plater-Zyberk's SmartCode that Miami 21 is based on. The SmartCode, as shown in Table 2, does not reduce parking requirements much even in the more urban transects. Considering the level of public transportation service in its urban core and the rapid construction of multiple high-rises in its downtown, parking requirements in at least the Urban Core (T6) transect for Miami could be lower. In particular, fewer parking spaces in the urban core would support market-level parking pricing, public transportation, and walking. This would reduce greenhouse gases, air pollution, and the urban degradation that occurs due to parking lots creating characterless voids and increasing auto-use, which deteriorates the urban street life.

CONCLUSION & RECOMMENDATIONS

Concluding Observations

In order to make walking, bicycling, and use of public transportation more viable and reduce automobile dependency, land use regulations and transportation policies should work in conjunction with one another to be effective. Land use regulations that support the development of compact-mixed use areas may encourage more walking by placing uses closer together; however, if transportation policies continue to provide wide streets and plentiful parking, automobile use will still dominate at the expense of a walkable environment. Likewise, transportation policies that reduce parking and narrow streets without a reliable and effective public transportation service and land use policies to encourage compact mixed-use development will ultimately cause more congestion rather than significantly increase walking, bicycling, and transit use. The most effective way to transform the urban environment into a place not dominated by the automobile requires a comprehensive approach. Land use policies should support context-based developments that include compact, mixed-use development in appropriate areas. These must be combined with efforts to provide convenient and interconnected transit service that serves densely developed nodes and centers. This all ought to be reinforced by parking policies that provide an amount of parking that the market can support through pricing mechanisms for a set supply. This amount of parking should particularly be sensitive to its urban context, and the level of walkability and public transportation service that are provided in that context.

Form-based codes provide the opportunity to establish context-based parking requirements that are easily applied. While Euclidean zoning can include progressive parking

policies, such as parking maximums and reduced requirements near transit and in downtown settings, these are written in a zoning code that primarily focuses on use. This means that potentially the zoning for suburban strip mall would be the same as a traditional main street or downtown plaza. Separating parking requirements within the same zone for different contexts in a Euclidean zoning ordinance creates excess language to clearly define where the different parking requirements would apply. Even if a city decided instead to create separate zones for different contexts, the number of zones or overlay zones in the zoning code could become quite large. Either way, the municipality is saddled with a long, complex, and complicated zoning ordinance. Meanwhile, form-based codes are built upon the urban transect and inherently are defined by context.

Recognizing this potential benefit, the City of Miami has decided to replace its existing Euclidean zoning code with a form-based code. While there are several beneficial steps taken by the proposed form-based code, Miami has not harnessed the opportunity to completely revise its approach towards parking policies to the fullest extent. The form-based code expands areas where parking requirements are reduced due to proximity to transit and addresses the impact of parking on the urban streetscape by prescriptively regulating where parking can be located. However, parking requirements generally do not decrease when progressing towards more urban contexts, which would be expected in context-sensitive parking requirements. This indicates that to maintain the character of its urban centers and urban core but retain auto-dependent levels of parking, very large, private parking structures will be required. Given the additional cost of parking structures over surface parking lots, this essentially backs developers

into a corner where their only option is to provide the expensive parking on a project by project basis.

The inherent requirement of parking structures as a result of prescriptive form guidelines and high parking requirements is something to be aware of in all form-based codes and smart growth efforts. These developments may save land devoted to parking by limiting the area where it can be built, but by encouraging density and requiring the same proportion of parking, it must be provided in more expensive parking structures. Moreover, although the abundant parking may not come in the form of a parking lot, it ultimately still fully supports auto use, compromising the goal of reduced auto dependency.

Existing parking policies are described as amounting to little more than a collective hunch and strictly focused on land use with little consideration for urban form (Shoup, 2005a, 28). Moreover, they are typically focused on providing supply than managing demand. This study focused on integrating parking supply policies that more closely match demand based on urban form and land use. Future studies should examine this connection further as well as investigate the potential to further reduce supply through integrating parking demand management strategies into parking policies.

Recommendations

For Form-Based Codes

Form-based codes provide the ideal opportunity to provide a more appropriate amount of parking by more accurately determining requirements by urban context and use. However, Table 2 shows that the parking requirements in both the *SmartCode* and the Miami 21 form-

based code are fairly consistent with the requirements in Miami's Zoning Ordinance 11000, a Euclidean zoning ordinance. It is unknown how the parking requirements in Miami's Zoning Ordinance 11000 are determined, however they are comparable to parking policies in other Euclidean zoning ordinances, which are known to over-supply parking by over-estimating parking demand. Future form-based codes should take the opportunity to conduct more thorough studies of parking demand, taking the urban transect, land use, and pricing into consideration. From these studies, more appropriate parking requirements should be established based on the urban context and use.

It is logical that the more urban transect zones—Urban Center (T5) and Urban Core (T6)—should have lower parking requirements than the less urban transect zones. This is possible because of higher levels of transit access and the more walkable environments that the density of uses creates. In both the *SmartCode* and Miami 21 form-based code, parking requirements gradually decrease when progressing from the Sub-urban (T3) zone to the Urban Core (T6) zone. However, in both of these codes, the decrease is so small that it seems like parking would still be over-supplied in most circumstances. Moreover, while some cities set parking maximums in their urban cores to encourage transit and walking and limit the impact of automobiles on the urban form, neither the *SmartCode* nor Miami 21 include a parking maximum for the Urban Core (T6) zone. Therefore, future form-based codes should reduce parking requirements or set parking maximums in the more urban transect zones. These should be based on the actual demand for parking that considers mode shifts to alternative modes that are enabled and the potential for shared parking between complementary uses.

Requirements should also be determined with the express objective of minimizing the negative impacts on the urban form in these zones from accommodating the automobile.

For Miami 21

In the Miami 21 form-based code, the City has chosen to separate the Urban Core (T6) transect zone into several different zones that represent everything from corridors on the outskirts of the City to the central business district. Particularly in these corridors that border existing single-family and two-family residential neighborhoods, members of the community and commissioners representing these communities are concerned about parking overflowing into the neighborhoods. However, in the central business district that is well-served by transit and is separated from lower-density neighborhoods, the same parking requirements for the Urban Core (T6) zoning in corridors generally apply. Therefore, Miami 21 should include separate parking requirements in the Urban Core (T6) zone. There should be lower parking requirements and/or a parking maximum set for the higher density T6 zones (T6-60 and T6-80).

Furthermore, the current parking maximums for Downtown Miami are extraordinarily high—approximately equal to the minimum requirements found in the existing zones in suburban areas. Moreover, these parking maximums are not found in the zoning code like all the other parking requirements, but in the City Code in a section specific for Downtown Miami. Since all other parking requirements will be found in the Miami 21 form-based code, the parking maximums should be integrated into the Miami 21 form-based code. The parking maximums should also be revisited and adjusted to encourage walking, bicycling, and transit use as alternatives to driving. This will reduce automobile dependency and limit its effects where it is most damaging—the urban core.

Another progressive provision Miami 21 could include is a requirement to unbundle the cost of parking from the cost of housing in the Urban Core (T6) transect zone. This will reduce the cost of housing and more accurately reflect the cost of parking. Miami 21 should also include a provision for priced parking as an option to reduce parking requirements. This reduction is justified by the reduced demand created through pricing. As suggested in Parolek et al. *Form-Based Codes* (2008), Miami 21 should also require shared parking in the urban transect zones (Urban Core and possibly Urban Center). This will reduce the overall amount of parking by more efficiently using the provided spaces throughout the day.

Further Study

Beyond the scope of this study, there are many opportunities to explore this topic further. Suggestions for further study include examining parking policies in other form-based codes, researching the use of parking based on the urban context, price, and use to supplement existing parking studies solely aggregated by use, and investigating the potential for integrating parking demand management measures into parking policies and form-based codes.

There are several cities across the country that have adopted form-based codes in only parts of their jurisdictions as part of master plans or specific plans. While Miami was chosen for this study for pursuing a city-wide form-based code, other form-based codes should be evaluated to examine if other cities have integrated more progressive parking policies into form-based codes. Moreover, future studies can investigate the effects of these policies to determine if the parking supply is decreasing, auto-use is declining, and greenhouse gas emissions are being reduced. With multiple case studies, a comparative study can examine best

practices in parking policies that are integrated into form-based codes and provide suggestions for best practices that should be incorporated in the future.

The Institute of Transportation Engineers (ITE) only provides parking generation numbers based on specific land use types in its *Parking Generation Manual*. Since historically cities have determined parking requirements based on land use, this has frequently been used as a tool to set parking policies. However, with form-based codes founded on the urban transect, it is difficult to base parking policies in form-based codes on this existing industry standard. Considering that some critics already see these studies as woefully incomplete by mostly examining parking demand in suburban areas with abundant free parking, future parking studies should examine variations in parking demand by urban context (Shoup, 2003, 4). Although potentially more complicated, future studies examining parking generation through a matrix of several situational inputs can directly inform parking policies for form-based codes. These inputs can include, but are not limited to the urban form or urban context, price, as well as land use.

There are several other major aspects that factor into parking demand, including proximity to transit, the effectiveness and convenience of the public transit system, local demographics, and community values. These only further display the depth and complexity of parking, and why no two sites let alone no two cities will be exactly alike in their demand for parking. Future studies on these aspects can be conducted at a regional or local level to further refine parking policies to specifically fit each municipality and for integration into future form-based codes.

Future studies can also evaluate the effect of parking demand management strategies, including commuter vouchers, priced parking, and carpool parking policies, on the demand for parking. These strategies should be evaluated for their effectiveness in reducing parking demand, and should be considered for integration into parking policies.

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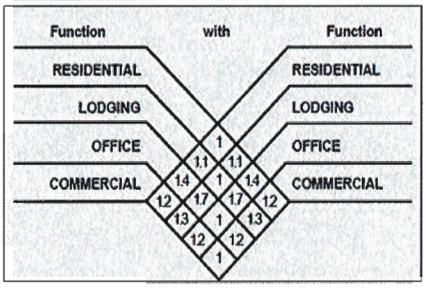
APPENDIX A: MIAMI 21 PROVISIONS FOR SHARED PARKING

MIAMI 21 — **ARTICLE 4. TABLE 5 BUILDING FUNCTION: PARKING AND LOADING**

PUBLIC HEARING-FIRST READING 2009

SHARED PARKING STANDARDS

SHARING FACTOR



The shared Parking Standards Table provides the method for calculating shared parking for buildings with more than one Use type. It refers to the parking requirements that appear in Table 4.

The parking required for any two Functions on a Lot is calculated by dividing the number of spaces required by the lesser of the two uses by the appropriate factor from this Table and adding the result to the greater use parking requirement.

For instance: for a building with a Residential Use requiring 100 spaces and a Commercial Use requiring 20 spaces, the 20 spaces divided by the sharing factor of 1.2 would reduce the total requirement to 100 plus 16 spaces. For uses not indicated in this chart on a mixed use lot a sharing factor of 1.1 shall be allowed. Additional sharing is allowed by Warrant.