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Zoning For and Against Sprawl: The Case for Form-Based Codes

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ABSTRACT *Despite widespread recognition of the dual problems of sprawl and conventional zoning, the specific nature of the relationship between sprawl and zoning is not well specified. In part this is because aggregate and economic analyses of sprawl and zoning miss the larger point that zoning has a significant detrimental impact on urban pattern and form at the local scale. In addition, little systematic research has been done on the contrast between conventional zoning and coding reform efforts such as form-based codes. This paper uses a localized analysis of the relationship between zoning and sprawl to answer two main questions: how does zoning contribute to sprawl, and how do form-based codes attempt to mitigate it? The paper also includes a descriptive analysis of the current status of form-based code efforts in the US.*

Introduction

Urban scholars have invested heavily in the study of sprawl. Researchers have spent decades measuring and defining sprawl (Freihage et al. 2001), quantifying its costs and effects (Burchell et al. 2005; Hirschhorn 2005; Williamson 2010), and unravelling its underlying causes (Glaeser and Kahn 2003; Burchfield et al. 2006). Sprawl has been implicated as a factor in some of the most serious problems facing American society, including global warming (Gonzalez 2009), social inequity (Squires 2002; Pendall 2000), environmental degradation (Benfield, Terris, and Vorsanger 2001; Ewing 2005), and public health problems (Frumkin 2004).

In tandem with the dislike of sprawl, conventional zoning has been despised by planners for more than 50 years now. Since the 1960s, leading planners have been writing forcefully about the failed experiment that was zoning. There was Reps's *Requiem for Zoning* (1964), Babcock's *The Zoning Game* (1966), Mandelker's *The Zoning Dilemma* (1971), and Siegan's *Land Use without Zoning* (1972). Carl Feiss asked whether planners had been "lulled into a coma of mass acceptance" of an "incomprehensible" tool that was fostering "unlimited sprawl" (1961, 121–122). Siegan asked whether land was being regulated "merely for the sake of regulation", apparently because people must be assuming that even if zoning was "unreasonable, inequitable, and irrational", it was better than nothing (1972, 21).

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Somehow, in these investigations of the dual problems of sprawl and zoning, the specific nature of the relationship has been somewhat obscured. In fact, researchers seem somewhat mixed in their interpretation of the impact of zoning on sprawl. The prevailing view is that the ability to control sprawl "is virtually non-existent despite occasional but short lived successes through planning instruments such as green belts" (Batty, Xie, and Sun 1999). Some economists have argued that sprawl is "not the result of explicit government policies or bad urban planning, but rather the inexorable product of car-based living" (Glaeser and Kahn 2003). The diagnosis of sprawl is that it is a result of "growing population, rising incomes, and falling commuting costs", not zoning, and since "ugly development cannot be banned", the best we can hope for is that zoning be leveraged to channel land use "toward more aesthetic concerns" (Brueckner 2000, 161). Sprawl has been viewed as a fact of urbanization, wherein its relationship to zoning is "ambiguous" (Bruegmann 2005, 107; see also Peiser 2001).

These conclusions—that there is no clear relationship between sprawl and zoning, or that it is less important than many other factors, or that in any case it cannot be controlled—miss a larger point: that zoning has a significant detrimental impact on urban pattern and form at the local scale. To some degree, the ambiguity toward zoning's role in sprawl may be curtailed by a definition of sprawl as something that occurs only at the periphery of an urban area. However, if sprawl is defined as "low-density, noncontiguous, automobile dependent" development (Bengston, Fletcher, and Nelson 2004, 271) then sprawl can occur anywhere, even in the very heart of a city.

The recognition that sprawl occurs anywhere and everywhere is important because it underlies the importance of zoning reform in sprawl mitigation. Without this connection, attempts to reform zoning through efforts like form-based codes (FBCs) seem trivial, merely about "aesthetics", and largely incapable of changing sprawl patterns. FBCs emerged in the 1980s as a way to counter sprawl. They are defined by proponents as codes that "use physical form, rather than separation of land uses, as their organizing principle. They foster predictable results in the built environment and a high quality public realm" (Form-Based Codes Institute, n.d.; see also Parolek, Parolek, and Crawford 2008; Katz 2004). In short, FBCs are believed to be an important antidote to sprawl.

This paper uses a localized analysis of the relationship between zoning[1] and sprawl to answer two main questions: how does zoning contribute to sprawl, and how do form-based codes attempt to mitigate it? Sprawl is defined as disconnected, automobile-dependent, land-consumptive, environmentally degrading, single-use, homogeneous, inaccessible development, with a low-quality, poorly conceived public realm. The antithesis of sprawl is defined as compact urban form that encourages pedestrian activity and minimizes environmental degradation; encourages social, economic, and land use diversity as opposed to homogeneity; connects uses and functions; has a high-quality public realm that provides opportunities for interaction and exchange; offers equitable access to goods, services, and facilities; and protects environmental and human health.

The purpose of this paper is to show how—at least hypothetically—FBCs are meant to achieve a more predictable, space-defining urban form and, potentially, a better-quality urbanism. That there are many other factors involved in counteracting sprawl is not disputed, nor is it claimed that FBCs are a magic bullet. Instead, the aim of this paper is to provide a theoretical explanation for

how, exactly, a renewed approach to coding is supposed to help mitigate sprawl. In what ways is the translation between code and intended effect fundamentally different between conventional zoning and FBCs? Explicit examples show some of these differences.

To highlight the difference between zoning "for" and zoning "against" sprawl, the paper develops and explains a typology that shows these effects. Large-scale quantified and aggregate analyses of zoning miss these important connections. Looking at the effects of zoning "on the ground", it is argued that the mitigation of these conditions via zoning is an important aspect of addressing sprawl. The reform of zoning via FBCs is intended to reverse these negative effects, which is again shown using explicit, localized examples. While FBCs are certainly not the only way to address the issue, they constitute one possible approach.

This paper adds to the literature on sprawl by detailing the effects of zoning and contrasting those effects with an alternative model, the form-based code. Rather than debating whether FBCs are a positive development, or whether they are having an impact, the aim is to shed light on the approach. How, exactly, is zoning for sprawl different from zoning against it? To put FBC efforts in context, an analysis is made of the current status of FBCs, where they have been adopted, and what kinds of developments have been constructed using them. Despite the potential of FBCs to address sprawl in important ways, it can be seen that FBCs are still a rarity.

Background

Researchers have drawn connections between sprawl and a host of regulations and policies: housing policy, transportation regulations, federal expenditures, water policy, and immigration, to name a few (Wiewel and Persky 2002; Wolch et al. 2004; Frece 2008). For decades now, there have been thorough explorations of the inefficiencies, social inequities, and added costs of conventional zoning codes (Dowall 1984; Levine 2005). Zoning has been deemed anything but sustainable: it "guarantees the maximum consumption of units of time, energy, hardware, and land for the execution of the daily functions of the whole of society" (Krier 2009, 103).

Economists who study the effects of zoning on sprawl have tended to focus on land and housing prices (Fischel 1990). The conclusions from these analyses are mixed, and depend on the extent of zoning control involved, the degree of zoning enforcement, the parameters of the regulatory process, and the regional context (Knaap et al. 1999; Pogodzinski and Sass, 1991). Many economists take the view that zoning follows the market and is essentially a way to protect landowners from change (McMillan and McDonald 1991a, 1991b, 1993; Thorson 1996). In this light, zoning is seen as the embodiment of Madisonian "plans of oppression" (Mcdonald and Mcmillen 2004, 343), driven by principles of exclusion and protection of self-interest.

In these kinds of analyses, the linkage between sprawl and zoning is aggregated. While studies have consistently shown that zoning correlates with lower urban density and sprawl (Pendall 1999; Shen 1996; Feitelson 1993; Levine 1999; Knaap et al. 2007), and there is significant research uncovering and contrasting "the laws of sprawl" and "the laws of smart growth" (Wickersham 2006, 26; Talen and Knaap 2003), few studies have made these connections in a way that links zoning rules to their on-the-ground effects. In this context, it is

difficult to evaluate the impact and meaning of zoning reform efforts such as form-based coding because there is very little data to work with, making an aggregate analysis of effects problematic.

Architects and urban designers have approached the study of codes in a much different way, often evaluating zoning in a broad historical and cultural context (Ben-Joseph and Szold 2004; Davis 1999; Talen 2012). There have been critiques of the ways in which some aspects of zoning create problems for placemaking, such as the floor-area ratio, overzoning for commercial development, and the fragmentation created by planned unit development zoning (Barnett 1992, 2010). Southworth and Ben-Joseph chronicled the negative effects of street standards in *Streets and the Shaping of Towns and Cities* (2003) and showed how residential street standards became institutionalized in the US in the 1930s when the Federal Housing Administration adopted standards in conjunction with its lending activities.

Urban designers have long been interested in the "invisible hand" of planning law and its effect on place (Lai 1988; Punter 1999; Marshall 2011; Talen 2012), exploring how policies "shape" cities in books like *Laws of the Landscape* (Nivola 1999). Scholars in the US have become particularly interested in understanding how it came to be that planning regulations are so universally despised. One reason is the way in which evolving public goals have been awkwardly grafted onto old regulatory methods (Ben-Joseph 2005). Others have focused on the political manoeuvring (often with unfortunate outcomes) of zoning adoption and change (Schwieterman and Caspall 2006).

Smart-growth proponents and New Urbanists have been particularly vocal about the effect of rules on the built environment, drawing the attention of planners to codes and how they affect urban pattern and form. Three publications have documented the rise of form-based codes specifically: *Smart Growth Zoning Codes: A Resource Guide* (Tracy 2004), *Codifying New Urbanism: How to Reform Municipal Land Development Regulations* (Congress for the New Urbanism 2004), and *Form-Based Codes: A Guide for Planners, Urban Designers, Municipalities, and Developers* (Parolek, Parolek, and Crawford 2008). Morris's *Smart Codes* (2009) documents the way in which codes can be used to implement the goals of smart growth, often by way of a more form-based approach. Recent books have also explored how sprawl can be reversed, retrofitted, or repaired through coding reform (Tachieva 2010; Dunham-Jones and Williamson 2008; Freilich 2010).

Whether termed a "form-based code" or not, the emphasis on form, pattern, and mixed use pervades all code reform efforts of the last two decades (Tracy 2004; Morris 2009). There are "traditional neighbourhood development" ordinances, mixed-use and live/work codes, transit-oriented development ordinances, transit area codes, transect-based codes, smart-growth codes, sustainable codes, transit-supportive codes, urbanist codes, and green-building codes of various stripes (Morris 1996; Crawford 2004; Clarion Inc. 2008). Groups like the US Green Building Council (http://www.usgbc.org/) and the Development Center for Appropriate Technology (http://www.dcat.net/) are trying to reform existing codes to be more "sustainable", which, in terms of regulating the built environment, essentially means the elevation of form and pattern over use as a guiding principle.[2]

Zoning and Sprawl: Five Dimensions

This investigation focuses on the effects of zoning and, to a lesser extent, subdivision regulations. Of course, there are many other rules that affect sprawl, especially financing rules, utility regulations, deed restrictions, impact fees, and federal laws. But the relationship between zoning and sprawl is of particular relevance to urban planning, and understanding the connection should be a fundamental concern given planning's professional jurisdiction over zoning. To make these effects clear, a typology has been used consisting of five categories: pattern, dimension, homogeneity, separation, and enclosure. These categories are not exhaustive, but they do cover the most significant ways in which zoning contributes to sprawl. Examples have been selected from the Phoenix region, as well as other locations in the US, to document these explicit and unambiguous effects.

Pattern

First, and perhaps most obviously, zoning promotes a random and disorganized pattern of land use. This complexity is exemplified by the zoning ordinance for Phoenix, Arizona, with its hundreds of amendments—246 of them since 1990. The complexity lies both in the content, with its hundreds of amendments, and in the pattern of its zones. Phoenix's zoning map is a complex array of hundreds of different zoning categories (Figure 1). There are approximately 264 zones, the result of a variety of overlaid permutations—for example, the PCD (planned community district) zone over the R1-6 zone. Most cities in the US employ a similar complexity.

This pattern has become significantly more complex over time. Figures 2 and 3 show how the number and pattern of zones changed for one section of downtown Phoenix between 1930 and 2004. The increase in the number and complexity of zones was due to a variety of ad hoc decisions. Over time, the relationship between residential and non-residential zones became unpatterned. Zones were modified to fit unique conditions and owner requests, and the pattern of residential zones—especially its relationship to commercial zoning—no longer seemed to follow any particular spatial relationship. The area developed as a hodge-podge of building types and uses, from corporate office towers to single-family homes.

Whether or not pattern is considered in some meaningful way is essential to the analysis of American zoning. It underscores how zoning contributes to sprawl, since these unpatterned distributions can contribute to inefficiencies in land use. Highly organized patterning can also contribute to sprawl (in the case of homogeneity, below)—the question is what *kind* of pattern is being created. Changes to zoning ordinances over the course of the twentieth century show that zoning pattern became a seemingly random distribution of zones, with no meaningful set of principles guiding the distribution. There are many examples of this phenomenon, such as residential zones adjacent to eight-lane freeways, and public amenities surrounded by low-density, single-family zoning. In most cases, a more appropriate spatial pattern would put open space or more resilient uses adjacent to freeways, and higher-intensity land uses adjacent to public amenities.

Often the pattern of single-family zoning is a mystery. Figure 4 shows the pattern of minimum lot sizes for different varieties of single-family zones in the

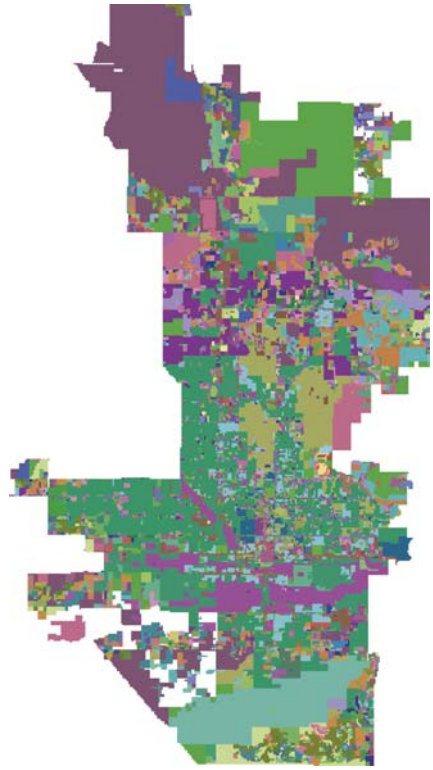
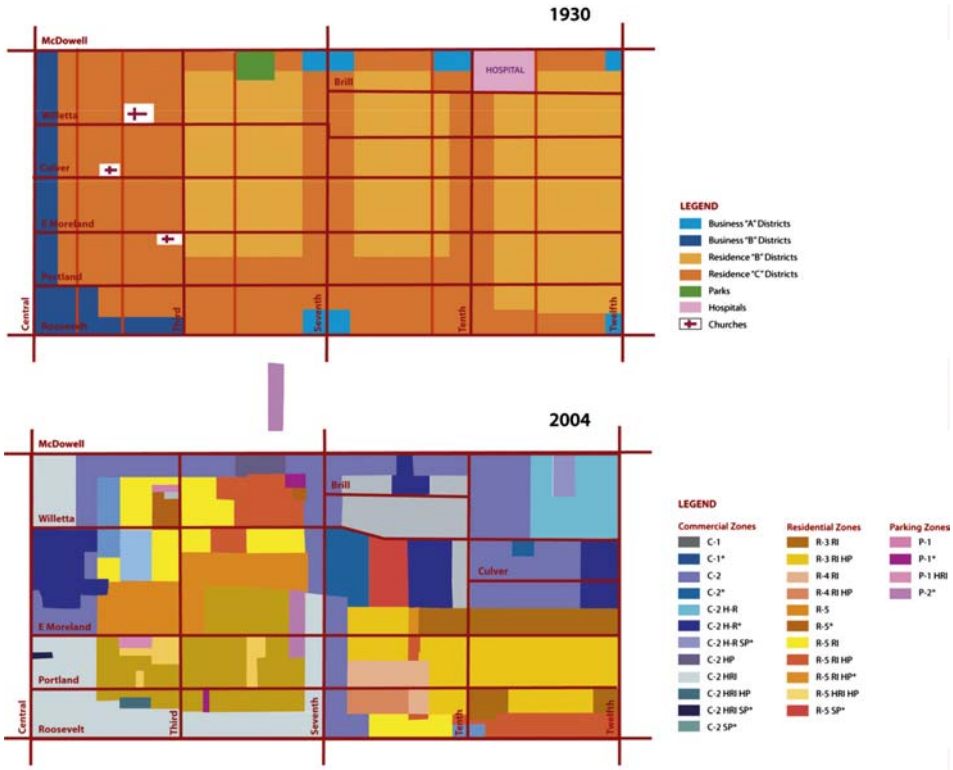


Figure 1. The zoning map of Phoenix: 264 zoning permutations. *Source*: City of Phoenix (n.d.).

northern part of Phoenix—a spatial pattern from very low density (three acres per unit) to four or five units per acre. The arrangement doesn't follow a clear spatial logic in which the densest places would be closer to services and amenities. Instead, the rules for minimum lot size seem to create a pattern in which fairly large lot sizes are closer in, toward more urbanized places with higher levels of services and facilities. Often, patterns of multifamily, single-family, and commercial zoning don't appear to follow any meaningful pattern: any zone can be adjacent to any other zone. Density differences are not organized into any kind of logical progression—for example, where denser housing would be located closer to a main street.

Zoning pattern can play a strong role in maximizing access, particularly in terms of prioritizing access for people most in need. One example is people who don't have outdoor living space—i.e. who live in apartments. In areas defined by sprawl, the relationship between proximity and need is often in reverse. For example, Figure 5 shows an area zoned as single-family residential surrounding a park in Phoenix. Rules limit building intensity around this park by setting maximum allowable densities, maximum building coverages, and maximum building heights. Only low-density single-family housing is permitted near this public open space—guaranteeing limits on the ability of apartment dwellers to access it. A more appropriate spatial logic—the opposite of sprawl—would put apartment dwellers closer to the park. Not only would this give more people better access to an essential public amenity, it would have the added benefit of increasing park usage, which could have important health and safety effects.



Figures 2 and 3. Zoning in 1930 vs. 2004 for a section of the downtown area of Phoenix.

Dimension

Another linkage between sprawl and zoning concerns requirements for particular dimensions—i.e., size, how it has changed over time, and how it is regulated. In conventional zoning, a minimum unit size is required, which means not only that a smaller, more affordable unit is made difficult but that an accessory unit of, for example, 500 square feet cannot be accommodated. Rules in support of compact

Figure 4. Minimum lot size requirements, from 3 acres per unit (light shading) to 5 units per acre (dark shading).

Figure 5. Existing pattern of zones around a park in north central Phoenix.

development (as opposed to sprawl) would call for a maximum, not a minimum, lot size and unit size. Conventional zoning requires the opposite, where low density is ensured through maximum units per acre, minimum lot size per unit, minimum street frontage per unit (thus making units behind the main structure infeasible), frontyard setbacks that eliminate the possibility of additional units on a lot, sideyards that eliminate the possibility of row houses and duplexes, and the requirement that each unit have a separate driveway.

There has been a gradual expansion of zoning's requirements in terms of unit and lot dimensions. In older cities, lots could be very narrow, such as the 16-foot lots permitted in Washington, D.C., which created a very compact urban form in places like Georgetown. Cleveland, Ohio, permitted 25-by-110-foot lots in its older sections, along with a street right-of-way of 55 feet. Forty-foot lots were common by 1929 in much of the US. These dimensions have expanded considerably. Figure 6, for example, shows that between 1948 and 2005 zoning involved an expansion of minimum lot size requirements for multifamily units in Tempe, Arizona. The change might seem modest for a single lot, but these rule changes have cumulative effects: spreading the city out, increasing car dependence and land consumption, and ultimately reducing both the possibility of walkable access and the viability of public transit.

Manifestations of lot size rules can be significant. In one quarter-mile-square area, the permitting of 25-foot-wide lots can yield 480 dwellings, while a requirement for 75-foot-wide lots will yield only about 70 dwellings. The cumulative effect of these variations in required zoning dimensions can mean the difference between sprawl and walkable urbanism.

It has been difficult to retroactively reduce the size requirements that expanded under zoning over the course of the twentieth century. For example, Phoenix created a "residential infill" overlay zone in downtown areas to try to stimulate infill development in more central locations—which makes sense from a spatial-pattern point of view, but the requirements of the zone seem more suburban than urban. One problem is that the R-I (Residential Infill) district overlays the existing requirements of four other types of residential zones. The district is meant "to encourage new multifamily development within the central portion of Phoenix", because the city wants to encourage development "for people to live and work downtown", resulting in "greater use … of existing under-utilized public facilities and services". This is laudable, but the minimum lot area requirements of the R-I zone were forced to inherit a previous set of dimensions. Subdivided lots must be at least 6000 square feet and at least 60 by 94 feet—significantly larger than the lots in many older cities. Units in the combined R-3/RI zone must have 2000 sq. ft. of lot area per dwelling.

Homogeneity

Zoning notoriously promotes single-use subdivisions. These homogeneous, car-dependent development types might be a product of consumer preference, but they are legitimated and supported by zoning. In these vast residential neighbourhoods, stores and mixed-use buildings are not permitted. The ubiquitous American subdivision is therefore not just single family, it is also single use. There is little variation in unit type, and uniformity in terms of pattern and form is often required.

In many areas, zoning still vigorously blocks the mixing of housing types. The most common rules include: only one family per lot; no single-family attached housing; all lots must have street frontage (which means no bungalow courts, mews, or courtyard housing); no duplexes on corner lots; no density increases on lots adjacent to commercial zones; and no transitional zones or mid-block zoning-district lines (which would rationalize higher densities in locations closer to services).

While there is now the occasional "mixed-use district" or overlay zone, for the most part, residential areas are zoned to be strictly residential. The Phoenix zoning code (in tandem with the Phoenix Subdivision Ordinance) explains that the purpose of "residence districts", which comprise most of the city, is "to preserve these areas from the distractions and adverse impacts which can result from immediate association with nonresidential uses". Here uses other than residences are labelled "distractions", rather than essentials that satisfy the requirements of daily life. While each dwelling unit is to be guaranteed "access to ... vehicular and pedestrian circulation systems" and the ability to "pursue residential activities with reasonable access to open space, and streets or roads", there is no consideration of what might be at the end of that road, or what residences are connected to—apart from open space. The only non-residential categories explicitly mentioned as needing to be accessible are "light and air", "open space", and "a variety of outdoor areas" (Section 608, "Residence Districts", of the City of Phoenix (n.d.) zoning code). The underlying assumption is that everyone has the time to assemble what they need for daily life from far-flung destinations. Neither can daily life be carried out on the premises, in home occupations or accessory buildings, as these uses are severely constrained in the Phoenix code. For example, accessory buildings in residence districts have the same yard requirements as main buildings, meaning that the property owner will need a large yard to accommodate an additional unit. There is to be no selling of products or services.

Sometimes single-family zones are placed adjacent to commercial uses, but since the commercial uses have no particular neighbourhood orientation, the notion of "mixed use" is somewhat irrelevant. For example, a commercial zone permitting a car dealership may be located adjacent to a single-family zone, a form of heterogeneity that has no likely benefit for either use. With no attention paid to the regulation of form (which is important to support use integration), and no requirements regarding the neighbourhood-serving value of the commercial use, the adjacency of commercial and residential is not likely to have a positive effect.

Conventional zoning typically provides no support for the successful integration of land use. Without attention to form, zones that might allow land use diversity through a special permitting process are unlikely to succeed. Figure 7 shows this situation in Urbana, Illinois. The B-3 commercial zone allows multifamily dwellings with a special use permit, but almost none have been developed. In part this is because the city wants to maximize revenues from commercial use, but there is also the problem of neighbourhood opposition to multifamily dwellings (which might be alleviated, to some degree at least, through the regulation of form). The resulting "mix" is not particularly functional: single-family housing adjacent to large-format commercial structures, and multifamily housing isolated by open space.

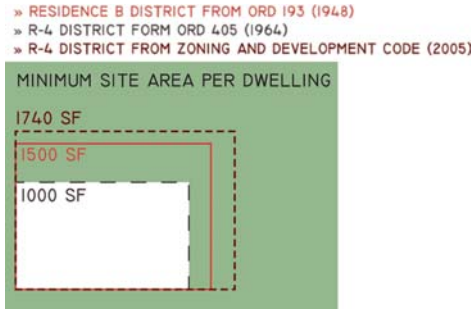


Figure 6. Changes in multi-family residential zoning in the R-4 district (originally the B district) in Tempe, Arizona.

Figure 7. B-3 zoning in Urbana, Illinois.

Separation

Separation—which can also be viewed as the absence of connectivity—is often a by-product more of subdivision regulation than of zoning. For example, subdivision regulations that allow long, straight streets have the effect of prioritizing car traffic over pedestrian movement. The code used in Gilbert, Arizona, shown in Box 1, provides an example. Contrary to the needs of pedestrian access, the emphasis is on avoiding "unnecessary ingress or egress", which limits connectivity. Main arterials in Gilbert have commercial uses on the corners, but the rest of the street has no function other than to move traffic. Most parcels do not face the main street.

The parking requirements contained in zoning ordinances are a primary instigator of separation. Typical parking rules require one parking space for every 250 sq. ft. of commercial floor area. But perhaps more importantly, there is also an absence of rules that might be used to mitigate negative effects, such as prohibiting parking between the building and the street, setting parking maximums, limiting the size of surface parking lots, requiring shared parking credits (where there are distinctly different hours of operation), and allowing the substitution of on-street parking counts for required parking. Instead, zoning ordinances most often fail to prohibit parking from being the defining feature of a commercial area. This is even the situation in many American cites, where, in the

Box 1. Block requirements in Gilbert, Arizona.

Section 9.22 Block design.

A. *Block length*. No block shall be longer than one thousand five hundred (1,500) feet. Where a subdivision adjoins a major thoroughfare, the greater dimensions of the blocks shall front or back upon such major thoroughfare to avoid unnecessary ingress or egress.

Source: Gilbert, Arizona (2011, 13).

very core of a downtown, a stadium, a convention centre, and acres of vacant land may take up prime locations. There are no rules preventing these vacancies, despite the social and economic importance of centrally located land.

Figure 8 is an area that was laid out according to Gilbert, Arizona's, subdivision regulations. The separations created are the result of several problems. First, there are weak limits on block orientation and length. There is only a stipulation that no block shall be longer than 1500 feet, and cul-de-sacs can be up to 600 feet long. The result is a development composed of winding streets and cul-de-sacs that only increase the amount of impervious surface. Second, under "Landscape and open space criteria", this rule applies: "Opportunities for non-motorized access (e.g., horse, pedestrian and bicycle) between adjacent land uses should be provided wherever appropriate." In other words, connectivity is not required, and is therefore easily ignored. Another example of rules that block connectivity is street standards, like the ones shown in Table 1 for Pima County, Arizona, that mandate minimum segment lengths, prohibit direct access from the street (therefore mandating that the street remain an automobile-only domain), and recommend "low" system continuity for local streets.

Also working to limit connectivity (and spread development) are rules related to landscape buffering and water filtration. Unsightly retention ponds, which have the effect of separating development, are the result of on-site storm-water management requirements. Instead of filtering water through parks and other types of civic open spaces, unusable retention ponds disrupt connectivity and waste open space. In places where a more dense form of urbanism would be beneficial, green buffers and "visible" storm-water management may be counter-productive (see Low 2010). Section 800 of the 2006 Prince William County Design and Construction Standards Manual, "Buffer Areas, Landscaping, and Tree Cover Requirements", shown in Tables 2 and 3, provides a good example of how rules enforce separation. The county requires that every use be buffered from every other use—a recipe for sprawl. A particular problem is the isolation of multifamily apartment complexes from all other kinds of land uses (including single-family), which follows in the tradition of treating multifamily housing as a potential nuisance to be kept separate from single-family homes (see Larco 2009).

Figure 8. Residential development in Gilbert, Arizona. *Source*: USDA-FSA-APFO Aerial Photography Field Office, National Agriculture Imagery Program 2007.

Table 1. Pima County, Arizona, subdivision and development street standards.

Parameter	Local street	Residential collector	Major collector
Mandatory criteria			
Volume (vehicles/day)	<1,000	1,000–2,500	2,500–10,000
Segment length (miles)	<1/4	1/4–1	1–3
Design speed (mph)	25	25–30	40
Direct access to property	Yes	No[a]	No
Recommended criteria			
Major terminus	Collector or local street	Arterial or major collector	Arterial
Minor terminus	Local street or turnaround	Residential collector or local street	Arterial, residential, or major collector
System continuity	Low	Medium	High

Notes: [a] Direct access to property can be provided if the maximum segment length is limited to 1/4 mile *and* the design speed is 25 mph.
Source: Pima County, AZ (2005).

Enclosure

Finally, zoning plays a role in limiting the degree to which open space can be spatially defined, therefore limiting the ability to create "enclosure"—an essential aspect of walkable streets and compact urban form. Generous setback rules guarantee weak intersections with no spatial definition, and thus no opportunity to create the "outdoor room". The effects are easily seen at the intersection of suburban arterials. Often buildings are regulated as objects within space, not as elements that define space. The effect of Gilbert, Arizona's code, shown in Figure 9, is a good example. The rules state that the intersections of arterials, because of their

Table 2. Buffer requirements in Prince William County, Virginia.

	Adjoining existing use/development											
Proposed use/development	1	2	3	4	5	6	7	8	9	10	11	12
Single-family detached		A	B	B	B	D	B	C	B	C	C	C
Single-family attached	B	A		B	B	D	B	C	B	C	C	C
Multifamily	B	B	B		B	D	A	C	B	C	C	C
Institutional (e.g. schools, church, library)	B	B	B	B		D	A	A	A	B	C	C
Public recreational use	D	D	D	D	D		D	D	D	D	D	D
Care facilities (e.g. nursing home)	B	B	B	A	A	D		D	A	B	C	C
Public facilities (e.g. pump station, treatment plant)	C	C	C	C	A	D	D		D	D	D	D
Office	B	B	B	B	A	D	A	D		D	B	B
Commercial/retail	C	C	C	C	B	D	B	D	D		A	B
Light industrial	C	C	C	C	C	D	C	D	B	A		A
Heavy industrial	C	C	C	C	C	D	C	D	B	B	A	

Note: A, B, C: buffer in accordance with "Buffer area width and plant requirements"; D: determined on a case-by-case basis, depending on the activity.
Source: Prince William County, VA (2006).

Table 3. Buffer area width and plant requirements in Prince William County, Virginia.

Type	Width (feet)	Plant units per 100 ft. of right of way or property line
A	15	50
B	30	100
C	50	200
D	Case by case, minimum 15′	Based on approved width

Source: Prince William County, VA (2006).

"importance" and because they serve as "major focal points of activity in the community", require a 250-by-50-foot landscape buffer along the street frontage. Important intersections, in other words, are to be hidden and shielded with "landscape", providing no opportunity for spatial enclosure. Buildings are an encumbrance, not a mark of importance. The figure shows a "neighbourhood convenience" zone (lower right) that, on the plus side, requires that "parking shall not be allowed to encroach in the setback". However, what *is* required is a triangular landscaped area, "thirty-three feet from the intersection of the curb lines" (Gilbert, Arizona 2011, 103).

The possibility of spatial definition was eroded in the 1930s when uniform street standards ended concern for the relationship between street width, street length, and building height. Prior to that time, the relationship between building height and street width was considered essential, and was generally in the range of 1:1 to 1:2. Now, rules are concerned not with height-to-width enclosure concerns, but with the allowed width-to-length ratio of street segments. In Pima County, for example, the allowed ratio of 1:38 (Pima County 2005) creates long streets that prioritize traffic flow and limit the relevance of enclosure. Since no termination or deflection point is required (only a cross street), streets are allowed to continue on indefinitely. A more obvious problem is the number of lanes constructed, and the required travel lane widths, which range from 12 to 14 feet. All of this creates an additional strain on enclosure.

Figure 9. An intersection in Gilbert, Arizona. *Source*: USDA-FSA-APFO Aerial Photography Field Office, National Agriculture Imagery Program 2007.

Rules about curb radii can also affect enclosure. In the 1920s, the required curb radius in platting regulations was often between 5 and 10 feet, and, together with street widths in the range of 40 feet or less, the rules created a relatively compact urban form. Now, curb radius requirements in suburban areas can be 30 feet or more, creating a very different and much more car-oriented environment, even in an area that is zoned exclusively residential. Curb rules in commercial areas can be significantly greater. In Tampa, Florida, the requirement of a 50-foot curb radius for commercial driveways (Table 4) widens intersections and contributes to a more dispersed urban form. Note that the requirements for driveways in Tampa are wider than the requirements for street intersections in the 1920s.

Buffer-yard and setback rules in zoning and subdivision ordinances mean that buildings are pushed further apart, weakening the relevance of a frontage requirement and obliterating the need for a uniform building line, which is essential for enclosure. (Note that utility easements can work similarly, acting like a setback rule if they prohibit improvements on the ground above; see Slone and Goldstein [2008].) Setback rules and building heights from Gilbert's Land Development Code, listed in Table 5, provide an example of how the idea of enclosure becomes irrelevant under rules for deep setbacks and low building heights. In addition, the code states that in commercial zones "landscape area shall not be encumbered by parking areas, buildings, driveways or other improvements" and that "a minimum twenty-foot wide landscape strip shall be established along all major arterial streets". Of course, these requirements are partly for the purpose of providing, within the public right-of-way, filtration acreage for storm-water management (discussed under "Separation", above). An issue to be considered is whether rules that undermine enclosure, and therefore walkable urbanism, should be considered an environmentally sound strategy.

Zoning Against Sprawl: Form-Based Codes

These sprawl-inducing zoning and subdivision rules create localized effects that, in aggregate, present a significant barrier to compact, walkable urban form. This recognition has produced a counter-reaction in which zoning is now being

Table 4. Curb radius rules in Tampa, Florida.

			Driveway length (feet)	
Type of street being accessed	Type of street intersecting	Minimum corner radius (feet)	Residential	Commercial or industrial
Local	Local	15	25	30
Local	Collector	25	25	30
Local	Minor/principal arterial	25	25	30
Collector	Local	25	35	40
Collector	Collector	35	35	40
Collector	Minor/principal arterial	35	35	40
Minor/principal arterial	Local	25	50	50
Minor/principal arterial	Collector	35	50	50
Minor/principal arterial	Minor/principal arterial	35	50	50

Source: Tampa, FL (N.d.).

Table 5. Setback rules in Gilbert, Arizona.

Proposed zoning classification	Minimum building setback (feet)	Maximum building height (feet)
N-S, Neighborhood Service	40	15
NCC, Neighborhood Convenience	40	15
C-1, Light Commercial[a]	100	30
C-2, General Commercial[a]	100	30
PSC-1, Planned Neighborhood Shopping Center[a]	100	30
PSC-2, Planned Shopping Center[a]	100	30
I-B, Industrial Buffer	75	30
I-I, Garden Industry	[Not allowed adjacent to residential]	
I-2, Light Industry	[Not allowed adjacent to residential]	
I-3, General Industry	[Not allowed adjacent to residential]	
R-2, Two-Family Duplex Residential	100	36
R-3, Multi-Family	100	36
R-4, Multi-Family	100	36

Notes: [a] Not allowed adjacent to R1-20 or larger lots
Source: Town of Gilbert, AZ (2000).

reconceptualized as something that ought to be "form based" as a way of counteracting sprawl. Table 6 summarizes the ways form-based codes are believed to be capable of producing very different outcomes from conventional (Euclidean) zoning.

Duany and Plater-Zyberk's 1982 master-planned community of Seaside, Florida, was the first modern application of this approach (Krieger 1991). Petaluma, California, which had experimented with code innovation in the 1960s, was the first city to adopt a transect-based SmartCode, a type of FBC, in 2003.

Table 6. Miami 21: contrasting outcomes of conventional (Euclidean) zoning vs. form-based codes.

Outcomes of Euclidean zoning	Outcomes of form-based codes
Suburban sprawl	Zoning areas with greater intensity
Bedroom communities	Mixed-use zones
Automobile-dependent, unsustainable development patterns characterized by long commuting distances, more trips per day for daily tasks, environmental degradation, large streets built only for cars, lack of public places, separation of industry outside the city	More transitional zones created by emphasis placed on form rather than use
Excess parking	A more predictable physical result based on prescriptive standards (state what you want) rather than proscriptive standards (state what you don't want)
Extreme, often unnatural, segregation of uses	A zoning code that is proactive rather than reactive
Necessary creation of special districts to address areas which require mixed uses or other zoning configurations outside the standard "uses"	Codes and regulations that are easier to read for citizens and are more predictable

Source: City of Miami, FL (n.d.).

Miami, Florida, was the first large American city to adopt a form-based code, in 2010. Denver, Colorado, became the second. Other large cities like Baltimore, Dallas, Houston, and Orlando are in the process of adopting form-based codes (Steuteville 2010; Borys and Talen 2010).

At the state level, the goal of fundamentally transforming development regulations in favour of form-based coding has been promoted for almost 15 years. The governor of Maryland, Parris Glendening, held a conference in 1999 on the theme of rehabilitating codes, proposing a "smart growth model ordinance" as well as a new building code. Since then, FBCs have taken on their own complexity, where cities now merge FBCs with priority areas or overlay zones, or create hybrid zones that have some form-based emphasis mixed in with conventional use-based coding. The result may be a mixture, as in New York City, where two types of rules are enforced: contextual, where buildings define space, and non-contextual, where they simply exist within it (New York City Department of City Planning 2011).

Because of these variations, it has been difficult to track the progress of form-based coding. The codes may be optional overlays, floating zones, district regulations, or FBC-type requirements appended to existing design standards. The codes may be project-specific and apply only to a station area, a central business district, or a section of a street, or they may apply to a neighbourhood, a section of town, or an entire city or region. They may be hybrid codes, in which form-based coding requirements are added to a conventional zoning code.

Despite these complications, it is important to understand how form-based codes—which are a type of zoning—are intended to counteract sprawl. Again, it is important to emphasize that FBCs should not be seen as the antidote to sprawl. Instead, they can be conceived as one possible approach to mitigating some of the negative (i.e. sprawl-inducing) effects of zoning.

FBCs are now being adopted to achieve, it is hoped, a more predictable, space-defining urban form, and potentially, a better-quality urbanism. But how do these ideas counteract sprawl? Table 7 lists some examples of the ways in which this might occur: specifically, how FBCs are attempting to reverse or mitigate the five sprawl-inducing problems attributed to zoning discussed in the previous section.

First, FBCs try to reinstate a meaningful spatial pattern of zones by varying regulations based on locational intensity, ranging from more rural to more urban qualities (the specific approach is known as transect-based coding; however, FBCs make use of intensity patterns with or without transect terminology; see Duany, Sorlein, and Wright [2008] and Duany and Talen [2002]). This attention to pattern is readily seen in the regulating plans of FBCs, which are essentially zoning maps. One example is provided in Figure 10. Higher-intensity zones line the commercial street, while less intense zones transition, sequentially, away from the commercial area.

Second, FBCs tend to incorporate smaller dimensions than conventional codes. These requirements are keyed to location, where smaller unit sizes, street widths, and lot area requirements are associated with zones "closer in"—i.e. in more urbanized locations. Table 7 includes the example of Miami 21, which allows lot sizes as small as 16 ft. with rear vehicular access and 50 ft. widths in more suburban areas—significantly smaller lot dimensions than many contemporary zoning codes.

Third, FBCs address homogeneity by aiming for a much greater diversity of land uses within a smaller number of zones. Often zones have a land use designation that is "restricted, limited, or open", which coincides with a

Table 7. Zoning against sprawl: FBC examples.

Issue	How remedied by FBC	Example/URL
Pattern	Regulating plans arrange zones in which higher densities and intensities of land use are located closer to centralized nodes and/or public amenities	Regulating Plan, Benicia, California: Zones are allocated in a sequence, from higher to lesser intensity and complexity. http://www.formbasedcodes.org/files/BeniciaCA_DMU_FBC(2).pdf http://www.miami21.org/final_code_AsAdoptedMay2010.asp
Dimension	Smaller lot sizes and widths in more urban zones	Miami 21: In the more urban zone of T5, lot size and width can be 1200 sq. ft. and 16 ft. with rear vehicular access; the more rural T3 suburban zone allows 5,000 sq. ft. lots and 50 ft. minimum lot width.
Homogeneity	A mixture of uses is allowed in each zone, with some restrictions	Central Hercules FBC: "The City expects a mix of allowed uses to occur in all neighborhoods and blocks. The City will require a mix of uses within buildings along Main Street and the Four Lane Avenue. The City will not require particular uses nor a particular distribution of uses, but will require the integration of residential and commercial uses." http://www.formbasedcodes.org/files/CentralHerculesFBC.pdf
Homogeneity	Much smaller number of land use categories	Fort Myers Beach Land Development Code: Land uses assigned to six categories (residential, lodging, office, retail, marine, civic); within each use group, allowable land use is restricted, limited or open. http://www.formbasedcodes.org/land-development-code
Separation	Rules for buffers, paving, water channelling, water storage, and water filtration vary based on location—whether more rural or more urban	Riparian and wetland buffers smartcode module: "Transect Zones manifest a range of natural and urban conditions. In case of conflict, the natural environment shall have priority in the more rural zones (T1–T3) and the built environment shall have priority in the more urban zones (T4–T6)." http://www.transect.org/modules.html
Separation	Surface parking lots fronting streets are prohibited; number of required off-street spaces greatly reduced	Columbia Pike FBC: Sites under 20,000 sq. ft. have no minimum parking requirements; 1 space per 1,000 sq. ft. shall be provided as shared parking. http://www.arlingtonva.us/departments/CPHD/forums/columbia/current/CPHDForumsColumbiaCurrentCurrentStatus.aspx

(*Continued*)

Table 7. (*Continued*)

Issue	How remedied by FBC	Example/URL
Separation	Encourage use of shared driveways	Denver Commons FBC: "Wherever possible, curb cuts and driveways should be shared or common between multiple projects." http://www.formbasedcodes.org/files/Denver-CommonsDesignStandards.pdf
Separation	Limit curb cuts	Denver Commons FBC: "Development shall limit curb cuts to those areas where curb cuts are allowed as illustrated in Exhibit 3.17, Vehicular Circulation and Access. A maximum of two (2) curb cuts shall be allowed within each contiguous zone identified as allowing curb cuts." http://www.formbasedcodes.org/files/Denver-CommonsDesignStandards.pdf
Separation	Limits on maximum block size	Farmers Branch, Texas, Station Area FBC: "No BLOCK face shall have a length greater than 400 feet without an ALLEY, common drive or access easement, or PEDESTRIAN PATHWAY providing through-access to another street, ALLEY or common access easement, or STREET-SPACE." http://www.developmentexcellence.com/tools/tool.asp?ToolID=71
Enclosure	Narrower travel lane widths and turning radii	Leander, Texas, Smart Code: Travel lane width from 8 feet to 12 feet, depending on design speed; turn radii start at 5 feet. http://www.leandertx.org/pdfs/Leander%20SmartCode%208-02-05.pdf

significantly more inclusive interpretation of allowable uses. FBCs also permit a greater variety of housing unit types. Form-based codes apply frontage, setback, building type and other "form"-related rules to help successfully integrate townhomes, duplexes, and single-family residences in relatively close proximity.

Fourth, FBCs seek to promote connectivity—and therefore mitigate separation—in a number of ways. One strategy is to ensure that storm-water management and landscape buffering requirements do not undermine the needs of connectivity in more urbanized locations. In the SmartCode, for example, the ability of the natural or the built environment to take priority in development regulation is determined on the basis of transect location (i.e. whether a place is more rural or more urban in character; see Table 7). This calibration affects paving materials as well as water channelling, storage, and filtration (Low 2010). Connectivity is also addressed in FBCs by limiting parking requirements, limiting curb cuts, allowing shared driveways, and requiring that streets, paths, and routes intersect rather than dead-end. Codes might require (rather than suggest) through-block connections, coordinated bike routes, pedestrian crossings, and allowances for future street extensions.

Finally, enclosure is a primary concern of form-based coding. Spatial definition is seen as the antidote to "antisocial" rules that ignore the space-creating

Figure 10. The regulating plan of a form-based code.

qualities of buildings (Kunstler 1998, 136). FBCs address enclosure by reinstating building lines, prohibiting blank walls and requiring permeability, requiring narrower street widths and shorter turn radii, and regulating public and private frontage. There can be requirements that garages be set back further than houses and that parcels not turn their side to a main street.

FBC proponents believe that these form-related requirements will stimulate revitalization. For example, San Francisco created the Rincon Hill Downtown Residential Mixed-Use District (RH-DTR), at the southern edge of downtown San Francisco, to encourage high-density mixed-use development. A page from the code is shown in Figure 11. The code was a translation of the city's 1971 Design Plan—an attempt to recapture an urban form believed necessary for pedestrian-friendly cities. The code is proactive: active uses are required on all street frontages, 100% lot coverage is permitted, setbacks are minimal, above-ground parking is not permitted, and off-street parking is not required. To provide some light and air, setbacks are required above a given height.

Prospects

In relative terms, form-based codes are still a rarity. As of this writing, there are just over 200 adopted form-based codes in the US, with an additional 126 codes in the developmental stage. Of the adopted codes, not all are yet effective, and less than 20% can point to projects that have been built or approved under the code. The vast majority are public codes; of the codes adopted at the city, downtown, corridor, and neighbourhood scales, only 22 out of 179 (about 12%) were for private developments. All of the codes at the regional, county, and state levels are optional overlay codes. As shown in Figure 12, three states dominate form-based

coding efforts: Florida, with 32 approved codes, Texas with 25, and California with 24. Mississippi, a state with less than 3 million residents, has 10 approved codes (a result of post-Katrina revitalization efforts), while New York, with close to 20 million residents, has only 3. There are an additional 22 codes either adopted or in development outside of the US, mostly in Canada and the UK.

It is too soon to gauge the impact of these coding reform efforts. There are only 15 cities with known developments completed under their new codes, and another 24 with approved projects—most of these in small cities. As shown in Table 8, form-based coding now regulates a very small segment of urban places in the US. The percentages are even smaller when comparing incorporated cities: there are more than 19,000 incorporated cities in the US, and most likely the majority of these have zoning and subdivision regulations of the conventional (sprawl) variety. Only a small fraction—less than 1%—are now being guided by form-based coding. Thus, form-based coding is not enjoying the rush to adoption that the previous generation of codes enjoyed. Following Herbert Hoover's enabling legislation in 1924 and Supreme Court validation of comprehensive zoning in 1926, zoning had been adopted in 800 cities in the United States by 1929 (Hubbard and Hubbard 1929)—a substantial number, given that in 1930 there were just 191 cities with a population of 50,000 or more.

Still, there are clear signs that the number of cities likely to adopt form-based codes in the coming years will increase (Steuteville 2010). Here are two indications. One is the recent adoption of form-based codes in major cities. Miami and Denver are important examples, but also in the works are Baltimore, Dallas, Houston, San Antonio, and Orlando. Another indicator is that comprehensive plans are now including the intention of future form-based coding in their

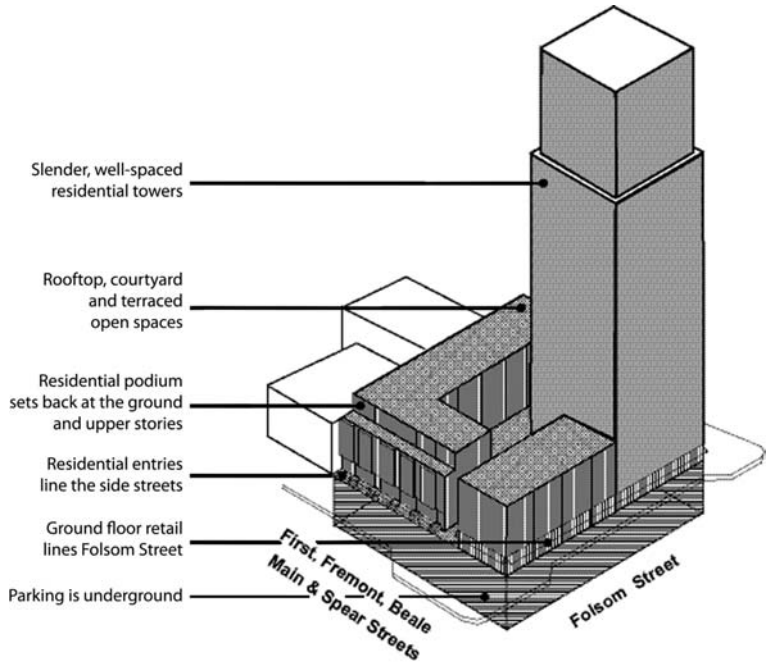


Figure 11. A page from the Rincon Hill Downtown Residential Mixed Use District, a form-based code.

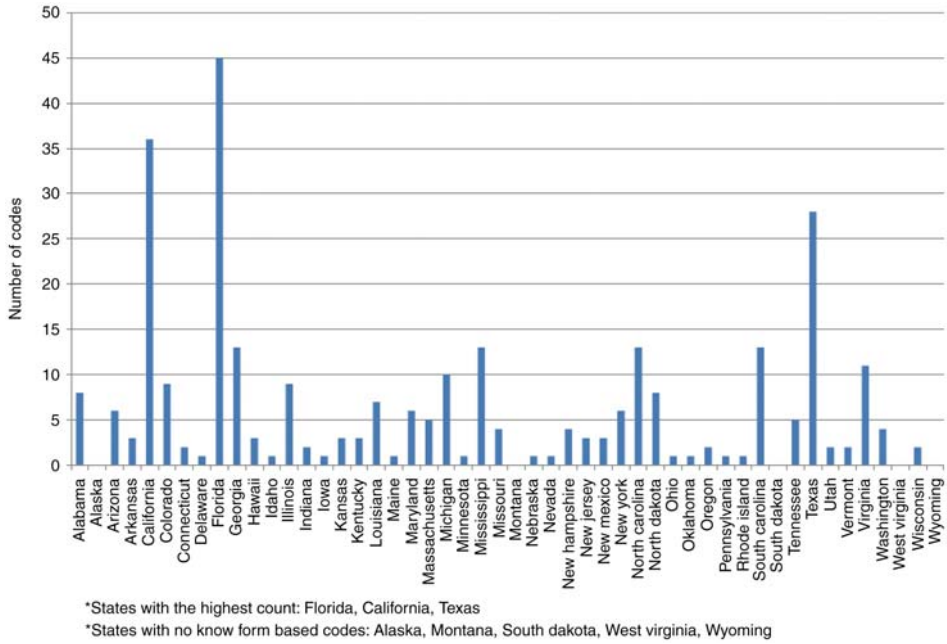


Figure 12. Locations of adopted form-based codes. *Source*: Hazel Borys, Placemakers.

implementation plans. For example, Buffalo's smart-growth comprehensive plan includes the goal of developing a mandatory form-based code to replace its current conventional zoning ordinance (Steuteville 2010).

But there are also numerous forces working against form-based coding, such as developers who view the codes as a type of down-zoning, property owners fearful of tax increases, residents fearful of density increases, and architects and planners who view FBCs as too constraining from a design point of view. One session of a 2011 American Planning Association conference was entitled "Improving Community Design without Form-Based Codes", and included the program description: "Form-based codes offer predictability, but their tight standards can create uniformity or hamper creativity" (American Planning Association 2011, 59). The resistance from designers mirrors the critique of rules that emerged in the decades following zoning's initial adoption in the 1920s: that codes were too constraining and inflexible. Carmona, Marshall, and Stevens (2006) conducted an extensive review of design codes and summarized the critiques. Among them were interference with creativity, too much focus on

Table 8. Over 200 form-based codes have been adopted.

Scale of code	Number adopted	Estimate of affected population	Percentage of US population
Sub-city or neighbourhood	93	9.5 million	3
Citywide	86	13 million	4
County/region[a]	22	16 million	5
State[a]	4	23 million	7

Notes: [a] These are model ordinances that can be implemented as optional overlay zones.

product, misplaced belief that objective criteria exist, and belief that codes can compensate for poor design skills. All of these add up to a strong reaction against any constraints on the "creative design process" (228).

Conclusion

In twenty-first-century America, there seems to be wide agreement that a new approach to the regulation of urban development is needed. Many believe that cities need to be less wasteful and more efficient, less land-consumptive and more compact, less dispiriting and more vital—and planners are looking to zoning reform to be the driver of this change. In the quest for sustainable cities, as Americans rescale, localize, and reign in or retrofit sprawl, many planners support the idea that a new approach to development regulation is necessary. At the 2011 national conference of the American Planning Association, for example, at least 10% of the conference sessions were devoted wholly or in part to coding reform.

The relationship between zoning and sprawl may be largely assumed, but economic and aggregate analyses often underplay the linkage. This paper has focused on drawing a clear distinction between the intent of zoning *for* sprawl versus zoning *against* sprawl by showing contrasts between conventional and form-based codes along five dimensions. Form-based codes are aimed at compacting urban form and diversifying land use. Conventional zoning—still in place in 99% of the US—does not share these concerns. Though rooted in past practices, form-based coding is still a relatively recent idea whose effects remain unknown. This paper has demonstrated that a significant contrast between the intended effects of these two approaches can be clearly demonstrated.

Because FBCs are a type of zoning, the rise of form-based coding is an indication that planners have resolved that zoning is a powerful tool not to be abdicated but to be transformed for better purpose. Just as zoning was seen in the Progressive Era as a powerful tool for *de*-congesting the city, FBCs are now being seen as a potentially powerful tool for *re*-concentrating it. A more widely recognized association between sprawl and zoning will motivate change, but these changes will also be motivated by very practical reasons. There is a major housing imbalance brewing: 61% of existing housing stock is in the form of single-family detached dwellings, yet two-thirds of housing demand in the coming years, fueled by millennials and baby boomers, will be in the form of one-or-two-person households (Leinberger 2008; Myers 2007). What are needed are regulations that won't get in the way of accommodating small units and compact urbanism.

In these reform efforts, much is being expected of zoning. No longer just a way to "minimize human unhappiness" (Kunstler 1998, 123), zoning is now meant to address multiple dimensions of urban life, everything from mental health, food access, housing options, and urban agriculture to bicycle use—a wide array of urban conditions that are both causes and effects of place quality. There is a recasting of rules aimed at "public health, safety, welfare, morals", or even nuisance, to now address climate change, energy use, physical activity, and an aging population. In many ways, the creation of "place"—and all that implies—is the new health-and-safety motivation.

Under this broadened set of objectives, some may wonder whether too much is being asked of this renewed type of zoning. Inflated objectives are certainly within the historical tradition of planning. In 1925, the Baltimore Board of Zoning

Appeals wrote in their annual report that zoning "ought to make our cities better places in which to live and to make of people better Americans" (24). It is unfortunate that the pronouncements and expectations about what zoning could accomplish were never subjected to evaluation with respect to whether cities were actually becoming "better places in which to live". Perhaps a more explicit realization of the difference between zoning for sprawl and zoning against sprawl will help motivate future evaluations.

Notes

1. For convenience, only the word "zoning" is used, but subdivision regulations are also included in this analysis.
2. Sustainability codes also implement a number of environmentally focused objectives, such as removing bans on solar panels, creating incentives like density bonuses for green roofs, and implementing water-conserving landscape standards.

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