The Case for the Adaptive Code

Understanding the Conventional Regulatory Framework of 20th Century Cities, and how we can achieve better outcomes by embracing a new paradigm in the 21st Century.

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August 2012

What is a city?

A city is a center of human activity. On a micro level, a city is a random collection of individuals living in self interest, relatively unconcerned with how the city functions as a whole. From a macro perspective, however, a city becomes an organism in itself, with its own personality, its own habits, its own reputation. Each city is unique. Indianapolis, Austin, and San Francisco have roughly the same number of residents, but differ dramatically due to geographical, cultural and historical factors. Every day the populations of these cities change. Some people move away, and some people move in, yet the identity of the city remains the same. Without knowing every person in Indianapolis, Austin, and San Francisco, we can still get a sense of the identity of the city.

Cities are essential to society, as they are the centers of commerce, ingenuity, and culture. They are the hubs of the economy, the engines that drive the county and the world forward. Within a city, advancements in technology, changes in global and local trends, and countless other factors influence where people live, where businesses are located, and how the city performs as a whole. As these factors change, cities must adapt in order to survive.

Throughout history, cities tended to be small and mostly organic - that is to say there was little energy invested in managing the growth or operation of most villages, towns and cities. The pace of change was slow, and people didn't tend to notice it very much.

The world is a different place today. There are more and larger cities today than there ever were in the past, and they're growing (and therefore changing) more rapidly than at any time in the past. Along with this explosion in urbanization, we've also seen a dramatic rise in the power and reach of government to manage and direct growth and change in the city. Today change tends to be highly regulated and managed.

20th Century Regulation in Cities

Since the early 1900’s, US cities have tended to be very proactive in regulating change. American cities adopted numerous regulations throughout the century to control physical growth and development. These regulations typically started as broad, flexible rules; becoming more

and more detailed, specific, and inflexible over time. This micro-managerial stance evolved as a reaction to the unprecedented pace of change in the 20th Century city, as an attempt to ensure that the city's evolution improved rather than detracted from its citizens' quality of life.

Zoning, the most widely used development regulation, became common practice in cities and towns across the United States after the U.S. Supreme Court case Village of Euclid v. Ambler Realty Co. In deciding this case, the court found that it was valid for municipal governments to regulate the allocation of land uses throughout a municipality in order to maintain the character of neighborhoods. For the first time, the land use of a given property could be explicitly controlled by the local government.

Euclidean zoning codes began simply as a means of protecting people from harmful developments such as factories that emitted high levels of pollution. This simple goal has had some successful outcomes, as many residential neighborhoods were better protected from the negative health impacts of industrial pollution and heavy automobile traffic.

However, through the years, cities have been adding layers of complication to their land use regulations, while at the same time the negative externalities caused by commercial and industrial development have decreased dramatically. Today, many cities have pages and pages of antiquated rules and restrictions that do little to improve health and safety.

The Conventional Regulatory Framework

Regulations in American cities vary widely, but there are five regulatory tools that are ubiquitous in virtually every municipality. They are:

1. Zoning

Euclidean zoning codes are the most common "base" regulation in US cities. These codes are used to control what land use can occur on every property in the city. The major land use categories are typically residential, commercial, industrial, agricultural, and open space. Many cities further subdivide these basic types into many shades of distinction - for instance: large lot single-family houses vs. small lot single-family houses vs. duplexes vs. townhomes. Most of the time these codes discourage building different land uses in close proximity to each other, and especially prohibit combining multiple land uses on a single property.

2. Subdivision Requirements

The process of subdividing large pieces of land into smaller lots is called subdividing. A subdivision is created by the recording of a legal description of the lots and blocks of the subdivision, called a plat. Most cities have specific rules (called subdivision requirements) for the size and shape of lots, blocks, streets, and buildings, which are enforced in the platting process.

These most common rules are: minimum lot sizes, setbacks (rules stating that nothing can be built within a certain distance of the edge of the property line), minimum driveway sizes and spacing, minimum width and design speed for streets, minimum curb radii for intersections.

3. Conventional Traffic Hierarchy

In most cities, streets are required to follow a hierarchical pattern with three major types of roads: local streets, collector streets, and arterial streets. Typically, local streets are not allowed to be “through” streets, meaning they cannot be straight, cannot travel very far, and cannot connect to any major roads. Instead, local streets are connected to collector streets, which are an “in-between” road type designed to funnel traffic from local streets onto arterials. Arterials are large, high capacity, fairly straight streets that cross long distances.

Most of the time the traffic hierarchy is linked to a city’s zoning map. Commercial and Industrial uses are zoned along the arterials, while local streets are strictly for single-family use. Collector streets often do not provide direct access to any use, but when they do have direct access it tends to be schools or multifamily development.

4. Parking Requirements

Off-Street Parking Requirements are rules that require property owners to build parking lots of a certain sized based on the land use of the building or buildings on a property. Historically these requirements were set arbitrarily, with most cities adjusting their rules every so often to be more similar to the rules of other nearby municipalities.

5. Detention / Impervious Cover Requirements

Most cities limit the amount of impervious cover allowed on a property, meaning essentially the percentage of a property that can be paved or built on. The purpose of these rules is to maintain open land where water can soak into the ground instead of running off as surface water. Most cities also require development provide detention ditches or ponds for holding surface water runoff from roofs and pavement.

Direct Consequences of the Conventional Regulatory Framework

The most immediate problem with the status quo of regulation in cities is this: much of what is legal and easy to develop is low-quality, short-lived, unloved, and economically unsustainable; while much of what is high-quality, long-lived, much loved, and economically vibrant is illegal to build.

Consider the classic “Main St.” at the heart of many cities and towns. You know the place: it’s in the old part of town where there are square blocks, lots of old buildings with antique stores, cafes, and small offices. It’s usually the place where City Hall is located, and may be where the town holds festivals and parades. Where these historic places are intact they are almost always prosperous and loved by the surrounding community. **And in nearly every city in America that kind of development is completely illegal today.**

Why would Main St. be illegal? To understand, let’s look back at the top five most common regulations in American Cities:

1. Zoning

One of the defining characteristics of a typical “Main Street” is the presence of two and three story buildings with cafes, shops, galleries etc. on the ground floor and offices or apartments upstairs. Under Euclidean Zoning this mix of land uses is illegal.

While some cities have begun to add a “Mixed-Use” category to their zoning code, these rarely allow new development to be flexible, adaptable, and change in use over time as the buildings in the historic area were allowed to do.

2. Subdivision Requirements

The typical “Main Street” lot is 25’ wide and 80-100’ deep. Most cities have a minimum lot width of 50’ and a minimum area of 5,000 square feet, meaning the smallest allowable lot is 50’x100’.

The “Main Street” building usually is built all the way to the edges of its lot, meaning the storefront sits directly beside the sidewalk (often with a canopy overhanging the sidewalk), and the building is touching side-by-side with its neighbors. Most subdivision regulations call for a 15’-20’ front setback and at least a 5’ side setback on all new lots.

These two provisions make it physically impossible to create new “Main St.” buildings.

3. Conventional Street Hierarchy

Another common feature of an historic Main St. is on-street parking. Main Streets tend to be major roads leading to the center of the city. Under the conventional hierarchy these roads would be considered “Arterials”. However, Arterial roads normally require a minimum of two lanes each direction with a center turn lane, a minimum speed limit of 40-45 MPH, and do not allow on-street parking or buildings near the street. These features are quite different from and incompatible with the Main St. retail environment.

Further complicating matters, most Main Street areas are part of an area with many small streets and small blocks. These tight, grid-like networks allow large volumes of traffic to flow in and out of the Main Street area without any one street having to carry too much load. However, this pattern does not match the Conventional Street Hierarchy; in most cities it would be illegal to build a new development with a grid-like street pattern.

4. Parking Requirements

Most Main Street buildings occupy their entire lot. They don’t have any parking lot on their land, instead they rely on on-street parking, shared parking lots that serve the entire Main Street area, and people who arrive by walking, biking, or public transit. Sharing parking enables great flexibility for these businesses. A single parking lot can easily serve a coffee shop in the morning, electronics store during the day, restaurant in the early evening, and bar at night. If each of these buildings had separate parking lots they would be empty for large portions of the day.

However, most cities require all new developments to come with a large parking lot on the same property as the building. In most situations the parking area is required to be about 4x larger

than the building area, which forces individual buildings to be spread apart with parking lots in front of and in between the buildings. Therefore, the Main Street pattern -- shops lining the sidewalk with shared parking located elsewhere -- would be illegal.

5. Detention / Impervious Cover Requirements

As mentioned previously, most Main Street buildings occupy their entire lot. This means that when it rains the water runs off from the building and into the storm sewer. Most cities now require all developments to include a certain amount of open ground for water to soak into, to reduce runoff. They also require each building to provide ditches or ponds to collect rainwater and hold or “detain” it during a storm, to limit the flow of rainwater into the storm sewer system.

As with parking, these rules eliminate the possibility of sharing a detention pond or impervious cover among multiple properties. Coupled with the requirement to provide large parking lots (which are the chief cause of excess water runoff), these requirements mean that every new building must be spread far apart from every other with land set aside for handling stormwater *on each property*. These requirements make a small-scale, compact retail street with shared infrastructure illegal.

Big-Picture Consequences of the Conventional Regulatory Framework

If the entire effect of the conventional regulatory framework was to make the traditional American building pattern illegal, that would be reason enough to change it. However, after nearly a century of observation, researchers have concluded that there are a number of other serious social, environmental, and economic consequences of our typical regulatory framework:

The Primary Problem: Automobile Dependence

In many neighborhoods throughout the U.S., people’s homes are miles from the nearest grocery store, coffee shop, school or office. These neighborhoods were not built this way by accident or by choice, but by requirement. Zoning laws make it illegal to develop a new neighborhood with anything other than housing within walking distance. Beyond keeping non-residential uses away from neighborhoods, most zoning laws require separation of *all* land uses (retail, office, civic, etc.), meaning almost nothing is allowed to be built in close proximity to anything different from itself.

With an environment intentionally divided into large, separated, homogeneous pods, people must drive long distances to reach any destination. This means that walking, biking, or taking transit is very impractical, and so for the most part the only people who do it are those who have no choice.

There are many unacceptable consequences of automobile dependence:

First and foremost, it is an issue of fundamental freedom. Is it just for the city to *require by law* that driving is the only way a citizen may move about? Most Americans would say “no, it isn’t.” And yet, that is the exact effect our development regulations (zoning in particular) have

had on our cities.

Second, it is an economic issue. Depending on automobiles for transportation means individuals have no way to avoid the cost of owning and operating a car. The cost of car ownership can be thought of as Minimum Participatory Consumption. In other words, if you don't have enough money to at least own and operate a car, you aren't able to truly be part of the economy. This is a large part of the reason generational poverty in America did not exist prior to the automobile era. If a low income family did not need a car to reach the places they needed to go, they could save thousands of dollars each year, which could help lift them out of poverty.

Third, it is a social issue. Children, the elderly, and all others who cannot drive have less freedom. Children are less autonomous than previous generations, as there are hardly any activities near within walking or biking distance. Parents are forced to be chauffeurs, and families need two incomes to pay for the suburban lifestyle, thus the option of having one parent as a homemaker focused on raising the children is no longer available.

Fourth, it is a national security issue. The U.S. has tenuous relationships with many oil rich nations. If the US were less dependent on foreign oil it would have much greater freedom to stay out of conflicts abroad. Instead, the US economy depends on the US military being actively deployed to protect US energy interests overseas.

Fifth it is a health and safety issue. There are several health and safety issues stemming from automobile dependence:

1. Relying on cars for every trip means people hardly walk at all when traveling to their destinations. The Centers for Disease Control have demonstrated a significant historical correlation between the decrease in daily walking and rise of obesity in the United States.

2. People living near freeways and high volume corridors are substantially more at risk to develop respiratory diseases stemming from vehicle emissions.

3. More people die in car accidents every year (45,000+) than died the the Vietnam War. More people are injured in car accidents every year (2,575,000) than all the wars the US has ever fought in. Driving anywhere poses a safety risk, but this risk is substantially greater in suburban developments with the traditional hierarchical street pattern. A 2011 study of 24 California cities found a 30 percent higher rate of severe injury and a 50 percent higher chance of dying in cities dominated by sparsely connected culs-de-sac compared with cities with dense, connected street networks.

The primary method of enabling transportation choice is to make walkable neighborhoods legal again. By simply giving people the freedom to build walkable places we would set ourselves on a path to ending our dependence on the automobile.

Secondary Problems

There are a number of other impacts of the Conventional Regulatory Framework, many of which are interrelated with the primary problem of automobile dependence:

Static, Unadaptable Neighborhoods

Neighborhoods that consist entirely of residential units are at risk of becoming into economic or social wastelands. Private homes do not offer anything of value to anyone except the residents of the home and their close friends. They do not provide services or offer employment. Residential-only neighborhoods also provide no few locations for social interaction. There are no cafes, bars, restaurants or small shops for people to meet in a casual, neutral setting.

While these bedroom communities may function for a generation or two, when consumer preferences for housing changes they will steadily decline. If other outside factors (such as proximity of employment) don't change to add new value to the neighborhood, the steady decline can eventually lead to abandonment, condemnation, and rampant crime. This pattern has been experienced in inner city neighborhoods and first-ring suburbs in virtually every American city, and there's no evidence to suggest that the pattern would not eventually repeat itself in many of today's outlying tract housing developments.

Parking Problems

The minimum parking requirements that exist in many cities cause a variety of problems in addition to the prevention of traditional "Main Street" development.

First, parking requirements are not necessary to ensure supply, as developers are pressured to provide adequate parking by market demand. If a business needs parking spaces for its customers, it will find a way to provide them, or go out of business, without any influence from the government. Forcing developers to adhere to a blanket one-size-fits-all requirement that does not take location and demand into account, we force businesses to dedicate valuable space to barren concrete that is often underused and unnecessary.

Second, cities routinely require developers to include far more parking than the market demands. These spaces are not cheap. Surface parking typically costs $3 - $6,000 per space, structured parking costs about $20,000, and underground parking can cost $50,000 per space. The cost of these parking structures is rarely passed directly to the motorists, but instead is spread to everyone in the form of higher prices for goods and higher rents for tenants.

Lastly, off-street parking lots tend to be unattractive dead space that disrupts the urban environment and can depress nearby property values. Many parking structures front the sidewalks with blank walls, creating an uninteresting and unsafe pedestrian environment.

Environmental Degradation

The standardized, spread out residential neighborhoods our codes require result in development extending far into natural and agricultural land. New development in these areas destroys wildlife habitats, removes valuable farm land near cities, and creates a significant obligation for expensive basic services.

Additionally, the outward expansion removes carbon sinks (like forests) and increases the number of cars on the road and the number of miles those cars are traveling. All of these factors increase local air pollution, and collectively add to atmospheric carbon.

Whether you accept the hypothesis of Global Warming or not, the scientific fact of increased atmospheric carbon is indisputable. Frankly, we don't know what the long term effect of our changing atmospheric chemistry will be, but the conservative position should be that we like the atmosphere the way it has been in the past, and would rather not risk changing it now.

Traffic

Everyone hates sitting in traffic, but unfortunately many Americans are forced to spend hours in the car everyday instead of at work or with their families. Drivers in America's 52 largest cities spend an average of 198 hours commuting each year. If you assume 16 hours awake in a day, that means the average American spends more than 12 days per year driving to and from work. Drivers in Nashville, TN have it the worst: they spend, on average, 284 hours per year commuting, which works out to almost 18 days spent in the car every year just getting to work.

We are spending precious time and money sitting in traffic, and most Americans have no alternative. Because their offices are not allowed to be near their neighborhoods, long distance car trips are required.

Public Safety

Overly rigid setback requirements remove all connection between the public right of way and the building. Healthy sidewalks need interaction with the buildings that line them, both for safety and vibrancy. Empty, unseen sidewalks are intimidating environments, and offer criminals an ideal location to operate illicitly. Sidewalks with "eyes on the street" discourage antisocial behavior and keep sidewalks safe.

Reduced Entrepreneurship

In the Conventional Regulatory Framework, two interrelated restrictions strongly limit the ability of new businesses to form. First, zoning limits the commercial use of property to a small number of major arterials. Second, the conventional traffic hierarchy results in any street other than an arterial being unviable for commercial development, even if a zoning variance was granted.

The result of these regulations is a significant reduction of the supply of commercially viable land, and with reduced supply comes increased price. This is why it is so common to see the same chain restaurants over and over again in the newer suburban markets, but far less common to see a successful local business pop up in that environment - to get started the business must compete with McDonald's and Target for viable locations.

In contrast, the traditional grid-like pattern is democratic, any given street could be a viable location for a small business. The evidence of this is easy to see in older neighborhoods built up before zoning and the hierarchical traffic pattern were enforced. Neighborhoods like this remain the primary incubator environment for small businesses in cities today.

Alternatives to the Conventional Regulatory Framework

Given the problems with the Conventional Regulatory Framework, it should come as no surprise that a number of alternatives have been suggested and even implemented. The two most prominent variations are:

Form-Based Codes

In general, form-based codes seek to regulate the built environment by form rather than by use. Zoning is still the mechanism of regulation, but instead of a zone district being limited to "residential" uses, it might be limited to "small buildings, not covering more than 50% of their lot, not taller than 30'."

The most significant examples of form-based coding in the United States are Miami, FL and El Paso, TX, both of which recently significantly overhauled their zoning codes to incorporate a form-based approach.

These standards often allow much greater flexibility with regards to land use. The greatest strength of these codes is predictability: once a zone is established, in theory any development that follows the prescribed form will be easily approved and permitted. However, depending on the strictness of the standards, they may also be perceived as 'overbearing' in that they dictate the look and feel of development.

Performance-Based Codes

In general, performance-based codes seek to set criteria or 'goals' that a development project must meet. Typically there is a point system, where projects must meet a certain number of points from a menu of options (like providing public amenities or affordable housing) in order to be built.

The most significant example of performance-based coding in the United States is Houston, TX, which is the only major US city to never adopt land-use based zoning.

These codes theoretically allow great flexibility for developers, as there are few pre-determined requirements for any particular property. However, these codes require significant discretional oversight from municipal governments, and as a result they can be very unpredictable.

The Dilemma of Cities

The Conventional Regulatory Framework and all its variations are implemented by well-meaning governments trying to resolve legitimate challenges. However, the history of the 20th Century shows us that outcomes of this regulatory system have been significantly more negative than positive.

There are two fundamental flaws at the heart of the Conventional Regulatory Framework:

First, it is designed to produce a specific kind of built environment served exclusively by automobiles. As we have established above this is the primary factor in many of the most harmful side-effects of the conventional regulatory framework.

Second, and much more insidious, the Conventional Regulatory Framework is inherently inflexible to the inevitable environmental, economic, and technological changes that occur over time. This results in a constant need for variances, as well as frequent revisions, amendments, and add-ons to City Ordinance, each one bringing with it a protracted and politically controversial public process.

For example, The City of Los Angeles recently allocated $11 million for the overhaul of its grossly outdated and burdensome zoning code, which was last updated in 1946. During this period, the code has grown from a manageable document of 84 pages to over 600 pages containing layer upon layer of new zones, entitlements, overlays, or property-specific development limitations. As a result, the code is now a confusing mess, frustrating developers and planners alike. This problem is not specific to Los Angeles, as cities across the country face similar challenges in continually updating and amending their development ordinances.

The challenge is, this process of continuous exemption, amendment, and revision to the law is not how government usually works. Governments pass laws, and those laws tend to stay on the books mostly unchallenged and unchanged for a generation, sometimes many generations.

So the Dilemma of Cities is quite vexing:

Given the incredible complexity and constant change taking place in cities, how can cities respond? More specifically, what kind of response would be beneficial, and how can a slow changing municipal government keep up with the rapid pace of change in a city?

More serious still, given the number and severity of unintended consequences we've seen from the regulatory model of the 20th Century, **should cities continue to regulate development at all?**

The case for regulation

Much of the regulation today is based on responses to very serious problems that were prevalent in urban areas in the early 1900's. At that time, the solutions made sense, as each regulation addressed a specific problem in its own way. Let's revisit the most common types of regulation and uncover why they were originally implemented:

1. Zoning

In the early 1900's, cities were teeming with heavy industrial factories. Designating different parts of the city for different land uses protected residents from factories that emitted toxic pollution. By ensuring that residental areas were far away from dirty and dangerous industrial buildings, people enjoyed cleaner, quieter, and safer environment.

2. Subdivision Requirements

In the early 1900's cities were growing rapidly, and developers eager to maximize profit were building out every square inch of their land as rentable space. This had a strongly negative impact on the amount of sunlight on the street and in the residential units. In response, cities used setback requirements and minimum lot size standards to ensure that more open space was left for sunlight and air circulation to reach the street.

3. Conventional Street Hierarchy

Starting in the late 1920's, a top priority of City Planning Departments was to reconfigure the city to enable cars to travel at higher and higher speeds. New development was required to follow a hierarchical street pattern, which funnels traffic from small, disconnected neighborhood street to collector street, and from collector streets to large arterial streets. The large arterials have far fewer intersections, and therefore allow long runs of high speed traffic. Most suburban development today continues this pattern with wide, high speed arterials carrying a high volumes of cars.

4. Parking Requirements

Cities in the early 1900's did not have parking lots, sidewalks, or traffic lanes. Instead, all streets were just wide (often unpaved) open spaces, where pedestrians, bicyclists, horses, carriages, trolleys, and eventually cars roamed free. Horse riders had historically been able to dismount and leave their horse in the street, and so early automobile drivers behaved the same way, simply pulling to the side and leaving their car when they wanted to go inside a building. As the number of cars increased, however, more and more severe traffic jams formed when people double and triple parked, completely blocking the street with parked cars around popular destinations.

Initially there were few traffic police, no marked lanes, little or no formal on-street parking spaces. Cities began to address the problem of traffic jams by designating the middle of the road for through traffic and restricting parking to the side. However, as the number of cars continued to increase, there eventually was not enough curbside space for all the cars, and motorists would commonly circle around the block they wanted to park at over and over until they could take a parking spot someone else was leaving. The circling, or "cruising" motorists were creating a second generation of traffic jams.

This was a problem of supply and demand -- there was too much demand for on-street parking and not enough supply. Paid private parking lots and garages started popping up to solve this problem, but as long as parking on-street remained free, few of these off-street parking lots were viable.

At this point in time the coin-operated parking meter was not yet available, so the option of charging a fee for on-street parking to limit over-consumption and increase turnover of parking spaces was unfeasible. Instead cities adopted requirements that new development provide large free parking lots. In suburban areas these parking lots became part of the design of new neighborhoods. In older cities, this meant that in order for one business to expand or remodel

they had to buy one of the buildings next door, tear it down, and make it into a parking lot.

Interestingly, the coin-operated parking meter was invented in the late 1930's, less than 10 years after most cities began requiring the allocation of free surface parking lots by private property owners. Had the parking meter been available sooner the entire problem might have been easily solved by the free market without the off-street parking requirement ever taking hold.

5. Detention / Impervious Cover Requirements

Detention and Impervious Cover requirements are a later addition to the Conventional Regulatory Framework. Watershed quality issues became a mainstream concern in the 1960's and 70's, along with an increased interest and awareness of all environmental issues at the same time. At the same time, the developed area of cities increased exponentially as the first generation of suburbs were built in the 1950's and 60's. The increase in impervious surface led to increased flash flooding events in downstream areas, many of which had never flooded before the new development was built.

The concern about runoff quality and flash flooding led most cities to adopt requirements for developments to leave drainage ditches and detention basins on site to contain rainwater and temporarily store it during rain events, releasing it over time at approximately the same rate that the site had shed water before it was developed.

Good intentions lost in time

It's easy to understand the original concerns of 20th Century cities, and why they felt the early codes they were introducing would solve the problems they were facing. Many of the regulatory measures undertaken in the early 20th century had initially positive results, which reinforced the conviction of the city officials at the time that they were doing the right thing.

However, about a century has past since these requirements were established. In that time the issues facing cities have changed, and many of the problems that common municipal regulations were intended to solve are no longer present. Further, as our knowledge of science has increased, we now have a better understanding of the root causes of the problems cities must face, and more tools with which to combat these problems.

We face crisis today because as the problems facing cities changed, and as the side effects of the early regulations became evident, the cities did not revisit their regulatory approach. Instead, they doubled down on the old rules. They added exceptions, they added new provisions, new layers, new wrinkles. They followed a philosophy that said: "if a little bit of management made things better, more management will make things better still."

Cities have been following these policies long enough that they have become the status quo for government officials and the general public. In many places the idea of deviating from the conventional regulatory framework would be considered unthinkable. Yet, if we look at the reasons many of these regulations were adopted in the first place, and recognize that many of these reason no longer exist, why should we not step back and re-evaluate our policies?

As we've seen, micromanaging the city based on these early 20th Century problems are now, in most instances, doing more harm than good. We need to start over with a clean slate, and formulate a new regulatory framework and philosophy of governance for the 21st Century.

Criteria for Beneficial Regulation

For a regulatory framework to succeed in cities it must meet two criteria. First, the new regulatory framework must carefully differentiate *real, solvable* problems from *perceived or unsolvable* problems. It must only address the real and solvable problems, and resist political pressure to "do something" about problems the city cannot solve.

Second, the framework needs to be designed to last at least 100 years. This means it should not be designed to focus primarily on short-term issues, but rather on the long-term evolution of the city. The framework should be durable, composed more of universal and timeless principles than narrow present details.

City governments should guide development in a way that allows the free market to thrive while minimizing negative impacts on city residents. By looking at the city from a macro perspective, as a "messy, complex and emergent" entity, city governments can promote healthy, thriving communities. When discussing the numerous ideas and purposes of individuals who constitute a city, acclaimed urban theorist Jane Jacobs writes,

"The main responsibility of city planning and design should be to develop—insofar as public policy and action can do so—cities that are congenial places for this great range of unofficial plans, ideas and opportunities to flourish, along with the flourishing of the public enterprises."

Coming up with a regulatory framework that meets this criteria is clearly a challenge, one that at first glance seems quite overwhelming. Fortunately, new fields of science have emerged in the past generation that offer us compelling insight on where to start.

20th vs. 21st Century Science

In the 20th Century, the core principle of science was **reductionism**, an approach which says that if we can reduce something down to its simplest parts, and understand those parts, then we can understand the entire larger system. While this approach powered the discoveries of the industrial age, in the 20th Century scientists began to find the limit of the reductionist approach. For instance, while a scientist could observe a single water molecule, and describe its future motion based on specific energy inputs, scientists have had great difficulty modeling tropical storms. A tropical storm is an emergent behavior of water molecules, meaning it is a behavior that occurs when huge numbers of water molecules interact, but which would not be predicted by the study of individual water molecules.

Scientists have discovered that phenomena like tropical storms are **complex**, which specifically means that while each individual interaction between the agents (water molecules) in the system is consistent and predictable, to model the behavior of the entire system you would have to know the exact state of every molecule in the system and every molecule that would interact

with the system in the future. Any mistake or missing information would result in an inaccurate prediction. Scientists have concluded that even given a theoretical all-powerful computer it would still be impossible to capture a complete snapshot of all the information necessary to construct an accurate model that could correctly predict the future behavior of the system.

Instead, a new science of **complexity** is emerging. Complexity science acknowledges that certain phenomena are irreducible, meaning they cannot be fully known. Complexity science asks the question, “If we can’t know everything about a complex system, how much *can* we know about it?” And, fortunately for us, it turns out that when we embrace complexity there is a lot of useful knowledge we can glean regarding complex systems.

Most importantly, Complex Systems may not be absolutely predictable, but the behavior they exhibit still tends to follow certain patterns. We can observe these patterns, and after a time we can observe useful probabilities that tell us not *exactly* what a system will do, but what it is *most likely* to do.

Often these probabilities are accurate enough that we can have a very good idea about the near future behavior of a system, with our uncertainty increasing over time. Revisiting our example of tropical storms, scientists know enough about these storms now that while they cannot predict where or how strong they will be in a week, they can mostly predict the next few hours, make a good guess about the next day, and determine a reasonably accurate range of likely conditions for several more days into the future.

Complex Adaptive Systems

There is a special kind of complex system that is particularly important in the field of biology: the Complex *Adaptive* System (CAS). Like every complex system, a CAS is composed of a dynamic network of interacting parts. Unlike other complex systems, Complex Adaptive Systems are made of components that self-organize; they perceive the conditions around them and change their behavior in response.

There are many examples of Complex Adaptive Systems in nature. Among the most interesting are insect colonies, like ant and termite mounds. When we study a termite mound, we find a structure that is incredibly strong and efficient, that creates steady airflow and maintains a near-constant interior temperature, and that can be easily repaired when damaged.

It would appear that these systems must be designed by brilliant architects. And yet, there are no master-termites that design the structure and oversee its construction. The mound is created by the individual termites, acting essentially without intelligence of any kind. The individual termites follow a very small number of simple behaviors, like “when hungry, wander around until you find edible wood,” and, “when full, go back to the nest.” The elegant mound structure emerges unexpectedly from the collective effect of these individual agents’ actions.

Complex Adaptive Systems have certain key characteristics, including:

Emergence: agents in the system are unpredictable and interact in apparently random ways. Patterns emerge from these interactions, and the agents react to these patterns.

Self-Organizing: there is no hierarchy of command and control, no planning or managing, the system continuously reorganizes itself to adapt.

Sub-optimization: complex adaptive systems do not need to be perfect to thrive.

Simple Rules: the rules governing the system are quite simple, even when the emerging patterns are rich and complex. For instance, all the rivers and lakes and waterfalls in the world operate on one simple rule: water always finds its own level.

Diversity: the greater the variety in the system the stronger and more stable it is.

Edge of Chaos: a system in equilibrium cannot adapt and will die, a system in chaos ceases to function. The most productive system lives on the edge of chaos, with maximum variety and creativity creating new possibilities.

Cities as Complex Adaptive Systems

Once we understand Complex Adaptive Systems, it's easy to see that a City is a CAS, with citizens as the agents in the system. At the micro level, the city is a man getting off work and driving home on the freeway, a woman walking down the sidewalk towards a bookstore, and two college students riding their bikes to a coffee shop. Nothing about their actions gives any thought to the form of the city as a whole, but the patterns and pulse of the city emerges from their collective behavior.

Looking at Cities as Complex Adaptive Systems has already resulted in scientific breakthroughs. For instance, researchers at the University of Central London studied the 2011 London Riots and found that their geographic emergence mirrored the pattern of a leopard's spots. Given the large body of knowledge concerning leopard spot patterns, they created a computer model that would apply the same formula to a map of London. Surprisingly enough, they found that this model predicted with useful accuracy the locations where riots would emerge. The truth is, **scientists have no idea *why* this works**, but it *does* work. If we can be humble and accept that we can't always know everything, then we can make great progress in solving complex problems.

Let's revisit the characteristics of a complex adaptive system in cities:

Emergence: People in a city have different motivations, different values, and different habits, and it is impossible to predict the action of any one person. Based on the actions of the entire city, however, we can observe patterns at the city level, and people then react to these patterns.

Self-Organizing: Medieval towns frequently formed at or near crossroads with little or no governmental oversight. And yet, the cities they built were efficient and durable, and many of them are still largely intact and thriving today.

Sub-optimization: Consider the best, most vibrant neighborhoods in your region. Is every building and every land use perfect? Probably not. There's probably a few ugly buildings you wish would be painted a different color, a vacant shop or building here and there waiting for its next occupant, and a few struggling businesses or foreclosed homes. Each of those individual properties and circumstances could be better, but they don't have to be. The neighborhood, and the city, can thrive in spite of suboptimal components.

Diversity: The healthiest urban neighborhoods have a mix of uses. They are neighborhoods that support residences, jobs, restaurants, bars, parks, stores, and more, so that at any given time of day people are using and occupying the public spaces.

Edge of Chaos: Cities are never complete. People's needs change, so cities need to change to accommodate these new needs. Just when a city has met and satisfied a growing need, that need changes, or a new need appears, and the city must adjust again.

There is one characteristic that you'll notice is missing: simple rules. Simple rules are rare in today's cities, but if we want to embrace Complexity in cities, we should be seeking to identify the simple rules that would allow maximum self-organization and diversity, embracing freedom and experimentation (edge of chaos) while resisting total chaos. Unlike most regulation in today's cities, simple rules should stand on their own without needing layers of revisions and amendments.

The Adaptive Code

We call our effort to identify the simple, essential rules for cities "the Adaptive Code." The Adaptive Code is meant to be a model code, a regulatory framework for a hypothetical city which serves as an example for real world cities to draw inspiration from, or adjust and adopt for themselves.

The Adaptive Code is a relatively radical departure from existing codes, first and foremost because it does not assume the existence of a wise and impartial city planning authority, and it does not presume to predict or control the course of future development in the city.

Instead, the purpose of the Adaptive Code is to create and protect a vibrant and efficient public realm, to protect fundamental property rights, and to prevent individuals harming one another.

In the following sections we will explain in more detail what the Adaptive Code does and does not regulate.

What the Adaptive Code does not regulate

The Adaptive Code is minimalistic. Taking a minimalist approach to coding means that when regulating an activity is not essential to the health and welfare of the city, or when a straightforward and equitable regulation cannot be formulated, that the activity should not be regulated. The biggest difference between the Adaptive Code and other codes is the relative lack of regulatory scope in the Adaptive Code compared to far-reaching conventional codes.

Specifically, the Adaptive Code does not regulate the following:

1. Land Use

Micromanaging the allocation of land use in a municipality is misguided for several reasons. First and foremost, no one can see the future and accurately predict what the market will demand in a city in the future, and where developers will want to build projects that will respond to that demand. We can make reasonable guesses for the near term, but as we go further into the future these guesses become less and less accurate. Land use zoning in typical cities is not easily or rapidly changed, which means that all zoning maps end up being constantly challenged by the market, and the development industry in any given city is continuously requesting variances for even routine and non-controversial projects. This is extremely wasteful. This inefficiency, along with the many other unintended consequences we discussed previously, make land-use zoning a poor choice.

2. Parking

Regulating parking is ineffective for several reasons. First, cities consistently require too many or too few parking spaces. It is difficult if not impossible to predict how many spaces the free market will demand. Second, most cities have a citywide requirement, despite the fact that different locations have different levels of parking demand. Third, the costs of developing off-street parking fall on everyone in the form of higher rents, higher prices of goods, and other costs. People who do not drive are therefore subsidizing parking spaces for drivers. Finally, parking requirements assume that driving is always the preferred transportation mode. By requiring all new development to contain a plethora of off-street parking, cities incentivize driving over walking, biking, and using public transportation.

3. Impervious Cover

The impervious cover requirement is designed to improve stormwater management and reduce runoff, but the regulation produces the opposite effect. Requirements for buildings to take up only a small portion of their lot result in each being very large, and all buildings being very spread out. While these requirements result in less impervious cover per lot, the resulting low density development is spread out over a much larger percentage of the watershed. Water quality is a regional watershed phenomena, not a per-lot phenomena, and it needs to be addressed accordingly. The EPA has concluded that the best way to reduce per-capita watershed impacts is to increase density, and one of the best ways to increase density in a city is simply to allow density via the removal of requirements, like impervious cover limitations, that currently prohibit it.

What the Adaptive Code does regulate

The Adaptive Code embraces complexity and seeks to establish the maximum amount of liberty for citizens. However, liberty without justice is anarchy; the most productive environment is one where justice is used to protect equal opportunity for all citizens. To justice and opportunity in the City, the Adaptive Code regulates the following:

1. The Public Realm

The Adaptive Code calls for a city to maintain a high-efficiency public realm that provides equal access to property for all citizens. Above all, this means streets must be safe for all users: pedestrians, cyclists, and transit users must be on equal footing with motorists in the 21st Century city. It is no longer acceptable for us to design streets, parks, schools, post offices, libraries, and the rest of our public facilities, as though the car is the only method by which any person might travel.

The Adaptive Code also regulates the linkage between private buildings and the public right of way. Specifically, private property owners are not allowed to create frontages that are barriers to pedestrians or cyclists, nor are they allowed to leave frontages uninhabited. For example, the code would prohibit using the entire ground level of a building for parking, utilities, and blank walls; instead, all buildings would be required to have an inhabited ground floor. So, for instance, an office building could not be built with the first five levels as only a parking garage and the office tower on top of that, but instead would need to have at least a public lobby and complimentary uses like retail space along the ground floor, with parking above that, and then the office tower on top. The Adaptive Code ensures that walking and cycling are practical choices, and that public safety is maintained by the presence of eyes on the street.

Lastly, the Adaptive Code ensures that the City's Right of Way Network is highly interconnected, because the resilience of the network depends on connectivity far more than it depends on the capacity of individual segments. For instance, the Adaptive Code discourages cul-de-sacs and street closures to make super-blocks. This approach is the opposite of the Conventional Hierarchy, which mistakenly emphasizes arterial capacity over network connectivity.

2. The relationship between public infrastructure and private development

One of the most common complaints against private development is that it is "out of scale." Current residents of an area tend to view densification or intensification as an intensely negative thing. While it is unjust to limit the ability of one property owner to improve his property simply because another person isn't comfortable with change, there is in fact a good reason why many people are so resistant to intensification. In US cities it is typical for development to intensify well ahead of accompanying infrastructure, the result being significant traffic congestion.

As an example, in many large cities it is common for certain close-in neighborhoods to become highly desirable and affluent, and when prices reach a certain level for developers to look for opportunities to bring high-rise condos or apartments into what has previously been a wealthy, low intensity neighborhood with mostly single-family homes and small apartments. The Adaptive Code would not prohibit this kind of intensification, but would require that a developer pay to upgrade the supporting infrastructure to an appropriate level before receiving permission to densify a site. This would mean that it was economically feasible to gradually increase the intensity of a neighborhood from the outside edges inward over time, but that (except in very unusual circumstances where the market demand is astronomically greater than the supply) it would be economically infeasible to stick a high-rise in the middle of a low density neighborhood. In the rare case that the developer could work out the economics to develop

all the supporting infrastructure required to bring a high-rise into the middle of a lower density neighborhood, that developer would be investing millions (or hundreds of millions) of dollars in improving the public streets, sewers, and power lines throughout the entire neighborhood before he was allowed to build the high-rise.

3. Externalities

By regulating negative externalities, we don't need to regulate land use. The strictest rules in the Adaptive Code regulate the tangible impacts of one property owner on the property of another. For instance, while industrial facilities might be allowed near a neighborhood, they would have to demonstrate that there were no light, sound, or emissions impacts on the neighborhood. This would allow small-scale light industrial workshops etc. to be located in proximity to housing, but would make it impractical and therefore effectively impossible for large scale heavy industry to locate near housing. These rules solve the original problems that zoning sought to eliminate, without requiring the city to micromanage the allocation of land uses, a behavior which has done more harm than good over the past 100 years.

The Model

Given the principles and goals we've discussed so far, here is an outline of how the Adaptive Code would work in a city:

1. Start with a street pattern.

The City begins by creating a Master Plan that shows all the existing streets and ROWs, and a proposed street pattern for the rest of the City's jurisdiction. All new development must either extend the pre-designed pattern, or submit an alternative plan for approval that provides the same level of connectivity.

2. Establish a transect of complete street types.

The City establishes a transect of street types corresponding to different intensities of development and the required level of infrastructure to support that development. IE: the type of street that can support low density housing is much smaller than the type of street that can support large office towers. Each street type will have specific design criteria that must be met (such as width of sidewalks and size of storm sewers). The city will start with at least one pre-approved design for each type of street, and developers can submit alternative designs for approval that meet the same criteria as the default design. After any design has been approved it is added to the list of pre-approved designs that any developer can use by right.

3. Map existing streets to the transect.

The city will map all of its existing streets to the closest match on the new transect of street types. Streets that closely conform to the new standards can be grandfathered and accepted as-is. Streets that do not closely conform to one of the new standards must be reconfigured over time as adjacent land is redeveloped or they are rebuilt.

4. There may only be one street type per block segment.

Block segments run from intersection to intersection. Streets can only change up and down by one level of intensity per block segment.

5. Define appropriate building scale and disposition requirements for each street type.

The city will define simple standards that match the intensity of development to the design of the adjacent street. All future development must conform to the requirements associated with the type of street on which it is located.

6. Universal building requirements:

All buildings must have an inhabitable ground floor fronting onto any public street. Private off-street parking is not allowed to be located between the building and the public street.

7. Greenfield developments may be built at any intensity

When a developer builds a new subdivision he must provide the appropriate street type for whatever intensity of development he wishes to construct. Connecting streets on the edge of the site must be scaled within one intensity level of adjacent development.

8. Option to scale-up by right:

If the city or a developer wishes to increase the allowable intensity of development on a block face they must first upgrade the infrastructure accordingly. A developer who pays the full cost of upgrading an entire block segment to the next level of intensity gains the right to build at a higher intensity level on that block segment.

9. No parking minimums or maximums.

The city will create a non-political parking authority which will use congestion-pricing and parking meters to regulate the supply of on-street parking in such a way that there is always one space available on each block face. The city will not regulate off-street parking except to prevent it from being located in such a way that it creates a barrier for non-motorists.

10. No land-use zoning, but no externalities allowed.

Maximum noise and light levels specified for each street type by hour of day. Proximity limits for noxious uses allowed, e.g. adult-oriented businesses may be limited from building in proximity to schools.

11. Miscellaneous:

No construction will be allowed in floodplains. Similar rules may be adopted based on the specific needs of communities in different geographic conditions (ie. minimum setback from coastlines, or protection of environmentally sensitive areas), provided these rules pass a simple “true / false” test.

Conclusion

The Adaptive Code reflects a significantly different approach to regulation from the Conventional Regulatory Framework. First and foremost it seeks to return freedom to the marketplace, making the traditional American building pattern legal again. Second, it seeks to put motorists and non-motorists on equal footing, to create freedom of transportation choice. Lastly, it seeks to reconcile the tension between liberty and justice, to prevent any party from externalising negative impacts on any other with simple, predictable, and fair rules. The Adaptive Code does not attempt micromanage or pre-determine the future of a city, instead it embraces the rich complexity of the free market and focuses on creating a vibrant public realm.

We expect that any city which adopted the Adaptive Code would experience the following effects:

Short-Term

1. The amount of empty surface parking would quickly drop as property owners and developers had the freedom to use that land for more productive activities.

2. The amount of small scale infill and mixed-use development in central city locations would increase rapidly, and this increase in supply would help bring down the cost of living in urban areas.

3. The rate of new leapfrog development on the far fringes of the city would decrease.

4. The cost of development would decrease significantly as the permitting process was dramatically simplified and shortened. This would likely result in a substantial increase in the number of small-scale developers.

Mid-Term

1. Walking, cycling, and transit usage would increase as the city streets became more enjoyable places for non-motorists to be.

2. Congestion throughout the city would decrease as non-motorized transportation increased and the street network became better interconnected.

3. Inner-city neighborhoods that have been very low income, underutilized and largely vacant would steadily improve as the subsidies for fringe development were removed and the economics of redevelopment on existing infrastructure improved.

4. Increased competition in the development business would help drive the cost of real estate down.

Long-Term

1. The City's finances would steadily improve as there would be less under-utilization of infrastructure, less cost to subsidize outlying areas, and a more stable tax base.

2. The overall cost of living in the City would decrease as people had more choices for housing and transportation.

3. As more of the City's population lived in compact, walkable development, the per-capita air pollution, energy use, and vehicle miles traveled would decrease.

These changes are obviously not guaranteed, but they are reasonable predictions based on removing the regulations that are causing the opposite of these effects in most cities today.

A final point: the most important aspect of the Adaptive Code is a different philosophy than today's municipalities employ. That philosophy could be paraphrased from the Hippocratic Oath: "First, do no harm." By accepting that the city is a Complex Adaptive System that is largely self-organizing, the Municipal Government is free to *not* step in and try to solve short-term and small-scale problems that it cannot realistically or fairly fix anyway.

The City is also encouraged to take a scientific approach to governance where the most important factor in evaluating the rules are on-the-ground results. If the anticipated benefits do not materialize, or negative unintended consequences arise, the rules should be revised, replaced, or removed.

The world is not a perfect place, and no set of rules can solve all our problems. However, careful, wise, and limited governance can create an optimal environment for adaptation and bottom-up problem solving, which leads to increasing prosperity over time. This was the great insight of America's founding fathers. Given the dire challenges facing our nation at the onset of the 21st century, it is now more important than ever that we bring those timeless principles back.