DC's Marble Ceiling:
Urban Height and Its Regulation in Washington, DC

by

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ABSTRACT

Washington, DC has a unique urban form that is the result of a century-old law. Through the narrow lens of DC's height limit, I survey a range of topics related to urban height, starting with a review of its history of regulation, highlighting society's tenuous relationship with tall buildings. Placing DC into this broader context shows that its height limit has little to do with monumentality and was very similar to height regulations across America in the early 20th century. Because of its unique governance and economy, DC's height limit has remained in place and its meaning has changed, making it a tradition of urban form rooted in its anachronistic and distinctive nature. The contemporary implications of the limit on DC's form and real estate market are a central business district that is essentially built out to a very unique mid-rise form and secondary centers have had more trouble developing and competing with neighboring jurisdictions. Using density and height measurements to compare DC to other jurisdictions shows that downtown DC takes up about twice as much land as it would if it did not have the height restriction.

The analysis contributes to the literature by tying the initial impetus behind DC's height limit to its trajectory over time and current state. The investigation also takes a novel approach to examining densities, looking at both employment and residential density. Finally, it uses a novel approach for measuring and comparing heights across cities. The thesis ends with recommendations that the canvas of height created by the limit be used for new monuments, tha the core be allocated height up to 160 feet, and that commercial areas outside the core be allowed heights up to 200 feet. These would preserve the monumental nature of DC while allowing for additional density and funding for initiatives that could serve the residents of DC.

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EXECUTIVE SUMMARY

This thesis grew out of a fascination with the form of Washington, DC that is so manifestly different from that of other cities. I was interested in both how the form developed through regulation as well as the urban implications of limiting height so stringently. As its form is a direct consequence of a single piece of century-old legislation, is there an opportunity to update it to help form a better place? I took the approach of examining a particular city through the narrow lens of height. Within this focus, I survey a range of topics related to height, from its history to regulation to the spatial and economic impacts.

Chapter 2 provides a brief history of urban height's awkward advance. From stone temples to medieval cathedrals, tall structures were limited to a few hundred feet because of the compressive limitations of stone. Height was the domain of the spiritual. This symbolic meaning of height was forever changed in the late 19th century, as commercial skyscrapers arose thanks to advances in building technology and urbanization. Both Chicago and New York grew fantastically upwards while other cities also developed tall buildings to a lesser extent.

As concerns grew about public health and welfare, including air and light obstruction, infrastructure stress, and fire safety as well as a negative impact on nearby land values, many U.S. cities began implementing height limits. They were modeled on European limits, which had developed over centuries as a means of preserving air and light. As time went on, the pressure of development, the evolution of more advanced regulations via zoning and FAR restrictions, and the competition with the suburbs caused many of these limits to fall, either explicitly through a change in the law or implicitly through the allowance of variances. In the 1960s and 70s, the tallest buildings in New York, Chicago, San Francisco, Baltimore, Boston, Phoenix, Detroit, and Pittsburgh were built, which Chicago's Sears

Tower taking the title of world's tallest building. More recently, the rest of the world has entered the race for height, with the worlds tallest buildings arising in Asia and the Middle East, while the U.S. has remained on the sidelines, with a few notable exceptions, such as the planned Freedom Tower/1 World Trade Center.

As cities experienced cycles of upward growth, critics of high rises, especially from the architectural realm, argued that they were dehumanizing, ugly, and terrible to be in and around. At the same time, skylines have captured the imagination of many, from filmmakers to mayors, encouraging some such as Boston's Mayor Menino to try and build an incredibly tall building as a means to promote his city (and his legacy). The discussion of skyscrapers, though, had little contemporary relevance given their lack of construction, until the events of September 11. After the World Trade Towers fell, critics of skyscrapers found a new rationale for opposing them: security. What the future holds for skyscrapers in America is unclear, though they were already declining in production before 9/11. Skyscrapers embody a type of ambivalence rooted in both awe and fear. They ascended in American cities in fits and spurts reflecting the influence of both of these factors, as well as the cyclical real estate markets that allowed them to arise.

Into this ambivalence fits DC, as explored in Chapter 3. Between the traditional European model of low-rise density and the American model of a high rise commercial core sits Washington, DC. With its medium-rise commercial core, DC has a unique urban form that arose in response to its height regulations. Implemented in reaction to a 165 foot tall apartment building in a residential neighborhood, the height limit was similar to those of many other cities of the time. It limited residential buildings to 90 feet and commercial buildings to 130 feet, but based the maximum height on the width of adjacent streets. Most of downtown DC is allowed to rise to 110 or 130 feet. During the period when the height restriction was added and changed (1896-1910), DC was little more than townhouses with a few buildings over a hundred feet. As the nature of the federal government changed and the economy of DC grew, so did the need for space.

As with other cities, mid-century witnessed a renewed interest in urban height, with some arguing for an adjustment of DC's building height limits up to 250 feet in some cases. Other cities, with the power to govern themselves also had the power to adjust their height regime. Any changes to

the height limit had to go through Congress. Yet while Congress tinkered with the urban form through Urban Renewal and urban highways, it never adjusted the Height Act of 1910. Having survived to the 1970s, the height limit has become a strong symbol for a city that seeks to exude power and tradition (not an easy task for a city of just 200 years). Even as real estate pressure has built in the last few decades, the limit has received relatively little attention.

Chapter 4 explores how DC's height-restricted growth has impacted the market and form of the City. The downtown core has been mostly built to the binding limit with commercial office buildings. The higher rents can be afforded by law firms and lobbying organizations that seek to capitalize on the value of a downtown DC address. In the core, the buildings create canyons of height that lead down L'Enfant's wide streets. From the ground the form is unlike any other city, both in its uniformity and in its relatively low height. Because offices are more valuable, the core is almost entirely commercial, creating a 9-5 downtown that is abandoned most of the rest of the time. While this is not much different than other cities, the height limit has pushed downtown outwards, as research predicts. Some have argued that this spread is efficient, but it seems to have cost DC the vibrancy of dense townhome neighborhoods in favor of a vast single-use district. In addition, the literature predicts such spread increases the cost of traveling around the city.

Meanwhile, the limit has not helped grow the secondary centers, which must compete with the neighboring suburbs. They have been slow to develop. But recently, many have seen increased development, especially residential. Given the market turmoil, it is questionable what the future is for these markets. Even so, they represent the last available land for the District and the prospect of their build out in the next generation deserves some attention.

Examining quantitative measurements, Chapter 5 explores some of the implications of DC's building height limit. Comparing the residential and employment density of DC's central business district, which is height restricted, to various cities around the world shows that DC is not an outlier on any measure, even when controlling for population. Looking at a number of cities using zip codes rather than concentric rings shows that employment density is always much more concentrated in the center, but no city is actually monocentric. DC seems to exhibit some unique secondary

peaks of density just outside of the core, propelled primarily by residential density. This analysis is promising because it measures both employment and residential densities, and does so in a relative manner (the amount of concentration in the region) making comparisons possible.

"Activity centers", which are areas defined by the regional government for transportation planning, provide a more ideal geography for measuring density because their boundaries correspond to areas of intensity. These activity centers have both residential and employment density data and show the same secondary peaks as the previous analysis but more dramatically for both employment and residential density. These areas are all served by the Metro, underlining its importance in spreading development from DC to areas without limits. The only other comparable data is for Baltimore, which does not have the same secondary peaks.

Density hints at implications of the height limit, but it was possible to quantify and compare the heights of various city centers using cuts from Google Earth's database of 3D buildings. Measuring 100 foot planar cuts for 7 cities shows a consistent pattern of height for cities, regardless of their history of height limits or regulatory regime. The only outlier is DC. Using the average distribution of height and applying it to DC, assuming the same total built square footage shows that DC would take up about half as much area. Using metropolitan population to predict height and land coverage provides similar results, indicating that the height limit has simply spread the downtown area out, as theorized in Chapter 4.

Given the findings of the previous chapters, Chapter 6 offers three suggestions for adjusting DC's height policies. The first, more of an attitudinal change than a formal policy change, is to allow or rather encourage monuments to rise above the 130 foot ceiling, which has created a canvas for monumentality. In a city already crowded by monuments, memorials, and museums, this could allow for new ones to be more spread about the city while commanding more attention. Second, a small amount of extra height (up to 160 feet everywhere except Pennsylvania Avenue and K Street with limits up to 180-200 feet) should be allocated for the center city in order to capitalize on its cache and high rents. Over time, as it continues to redevelop, the extra value could be used to improve transit, for example. Third, the secondary centers should have higher limits based on their proximity to the core up to 200 feet. These new limits would still preserve DC's medium rise nature, while ensuring

long-term growth and revenues and less monotonous and lifeless downtown experiences.

In order to implement these changes, a new overlay would be applied to the current as-of-right heights with additional height auctioned off. Policymakers could choose to restrict the geography or type of additional height to encourage economic development. In addition, historic or low buildings should be allowed to sell their extra height in auctions in order to help preserve their buildings as well as create a more textured urban environment. An auction would also help preserve transparency and provide the greatest amount of benefit, by way of extra revenues for the District, which would reach into the billions.

DC represents a unique end of the height debate in the United States and serves as a reminder of a past era of concerns about tall buildings. It has shown that air and light can be pleasant but can be at the cost of of urban vitality as the office core spreads and as the secondary core has trouble competing. It can also be at a growing fiscal cost as the building envelope is built out. Given an understanding of what urban height means, my suggestions seek to balance what has become a tradition and value in DC with the fiscal and urban opportunities presented by additional height.

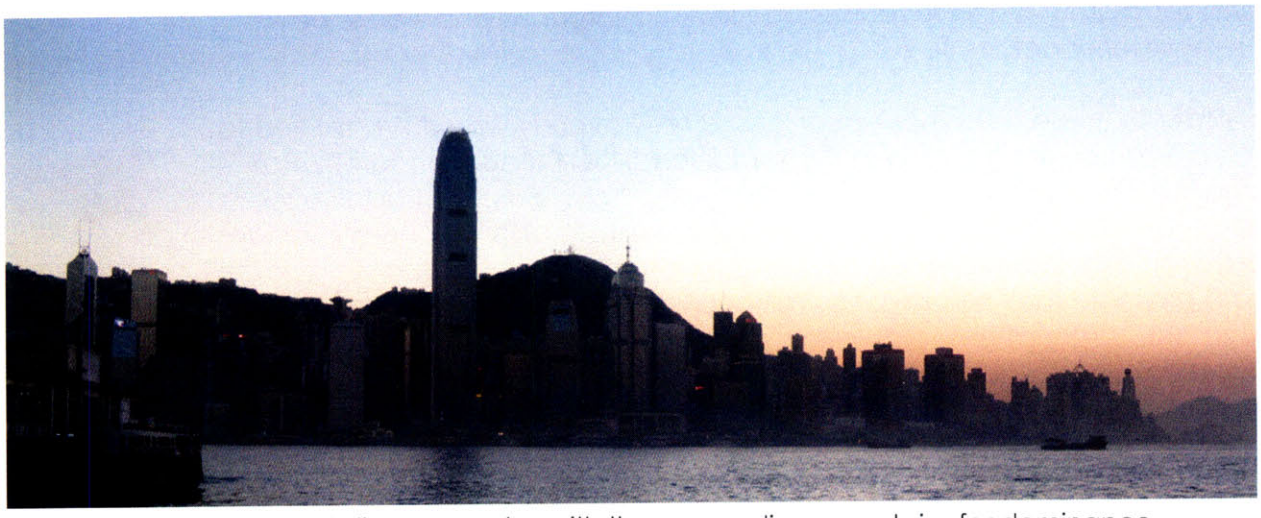

figure 1-1. Hong Kong's skyline competes with the surrounding mountains for dominance

figure 1-2. The unique urban nature of downtown DC caused by its height restrictions.

CHAPTER 1

SUCH GREAT HEIGHTS

"The sky is the daily bread of the eyes." - Ralph Waldo Emerson

We are captivated by the sky. Whether as children yearning for the freedom of birds or adults enjoying a sunset, the empyrean embodies a deep connection between man and nature. Humans discovered the ability to overcome gravity and join the heavens only in the past 150 years and even with flight, the experience was temporary: the passengers must return to terra firma at some point. It is only with skyscrapers (and perhaps space stations) that humans could move skyward and remain there as long as desired. Tall buildings are beguiling both in person and from afar, and perhaps there is no more iconic image of a city than the silhouette of tall buildings against the sky, competing for the dominion of the sky (see figure 1-1).

At its simplest, this investigation seeks to answer the question of how a city interacts with its sky. It is through the outlier of Washington, DC that I hope to shed light not only on DC's peculiar situation, but also, potentially on how height manifests itself more generally in the urban context. No other major American city has succeeded in taming its skyline as has Washington, DC. Its height limit has created a unique downtown urban form (see figures 1-2 and 1-3). As one critic has pointed out "Washington, which is full of new development, may turn out to be both the last of the old-style environmental cities and a prototype for the future."[1] The following is a story of how it became the anachronism it is and what this portends for its future.

figure 1-2. Looking north down 11th Street NW from Pennsylvania Ave NW.

In order to understand DC's experience I explore the physical, economic, and political forces behind the height of a city.

There are innumerable ways to describe the urban condition, so I am focusing on one element: height. Cities are often described from the perspective of transport, architectural, social, and economic lenses. A focus on height allows those to be addressed tangentially. I could start with questions of quality of life, economic vitality and social justice, which require deducing how major issues such as economy and education as well as more ethereal issues of psychology and tastes could address any particular goal. Instead I seek to work inductively from the single variable of height to see how it relates to some of these issues, while acknowledging that height alone is unlikely to address a particular urban problem or question. In DC's context, height is a particularly important variable because it is controlled solely by legislation. While an act of Congress is by no means a simple exercise, it is more comprehensible than elements such as educational outcomes or

quality of life. By extension, if the current regime is not optimal, prescribing a course of action for change and improvement is relatively simple.

Height is valuable to understand because the image of a city, especially by outsiders, is one of a skyline. Height is the visual embodiment of urban economies and the power and value of cities. It arises out of the economies of agglomeration that create more demand for a given area than there is earth. In cities such as New York, where Manhattan is geographically constrained, this pushes demand, and buildings, even higher. What then, are the other ramifications of capping height, especially in a city like DC that is constrained in size?

Height limits represent the collision of economic, political and physical forces within a society. Economic and political stability allowed certain societies to construct major buildings and structures, such as the pyramids or Gothic cathedrals, which had to battle the physical power of gravity. The economic power and innovation of the Industrial Revolution upset this physical limit with technological innovations of steel, electricity, and elevators combined with mass urbanization as skyscrapers ascended in many American cities in second half of the 19th century. Yet this would be countered by the political winds of the Progressive Era, which sought to ameliorate some of the ills created by the Industrial Revolution. While many cities would later find a compromise with economic power in the form of zoning, DC has remained constrained by turn of the 20th century building regulations.

Each of these forces has a related dichotomy that had influenced DC's path. Physically, the height limit begs the question of whether we are best served by urban places that grow up versus out. Because its height limit is unique among major cities, DC illustrates the economic tension between aggregation (economies of scale) versus congestion caused by over-concentration. Politically, the tension arising from its role as seat of the federal

government while also striving for local "Home Rule" causes differing views of exactly what DC and its skyline should be. While these three forces will constantly come into play throughout this investigation, the details of building design, regulatory details and econometric modeling are dealt with in an unfortunately cursory manner, given the nature of this work. Instead, I hope to paint a broad picture of how height limits formed, why they have persisted and what they mean for the city of today and of the future.

Given all of the issues faced by humanity and cities, height limits may seem bland and unimportant. I was not particularly interested in the topic until I visited Mumbai, India for an urban design studio. It was in this sprawling, dense, miasmatic city that I witnessed so viscerally how regulations can profoundly impact a city. The astoundingly low FAR limit of 1.33 and the draconian building regulations create a city which has an almost palpable pressure upwards, but which is both relatively low and massive. Mumbai illustrates what happens when height, which is the relief valve for a city, is plugged. The implications of Mumbai's regulations are easier to understand and quantify than DC's, but the principle is the same.

This investigation focuses on the United States context, and especially Washington, DC. However, it would be a blatant omission to fail to mention the incredible high rises ascending throughout other parts of the world, especially the Middle East and East Asia (see figure 1-4). These areas dominate the world in terms of tallest buildings, and the competition continues. In fact, much of the contemporary literature on and interest in skyscrapers comes from these countries. Yet, the context and economies of these cities differs greatly from those of the economies of more developed and stable cities in the U.S. As will be shown, even the Empire State Building penciled out a competitive return. Taipei 101 for example, existing in the middle of a low-rise district, seems to defy the economic logic of spatial structure and land value.

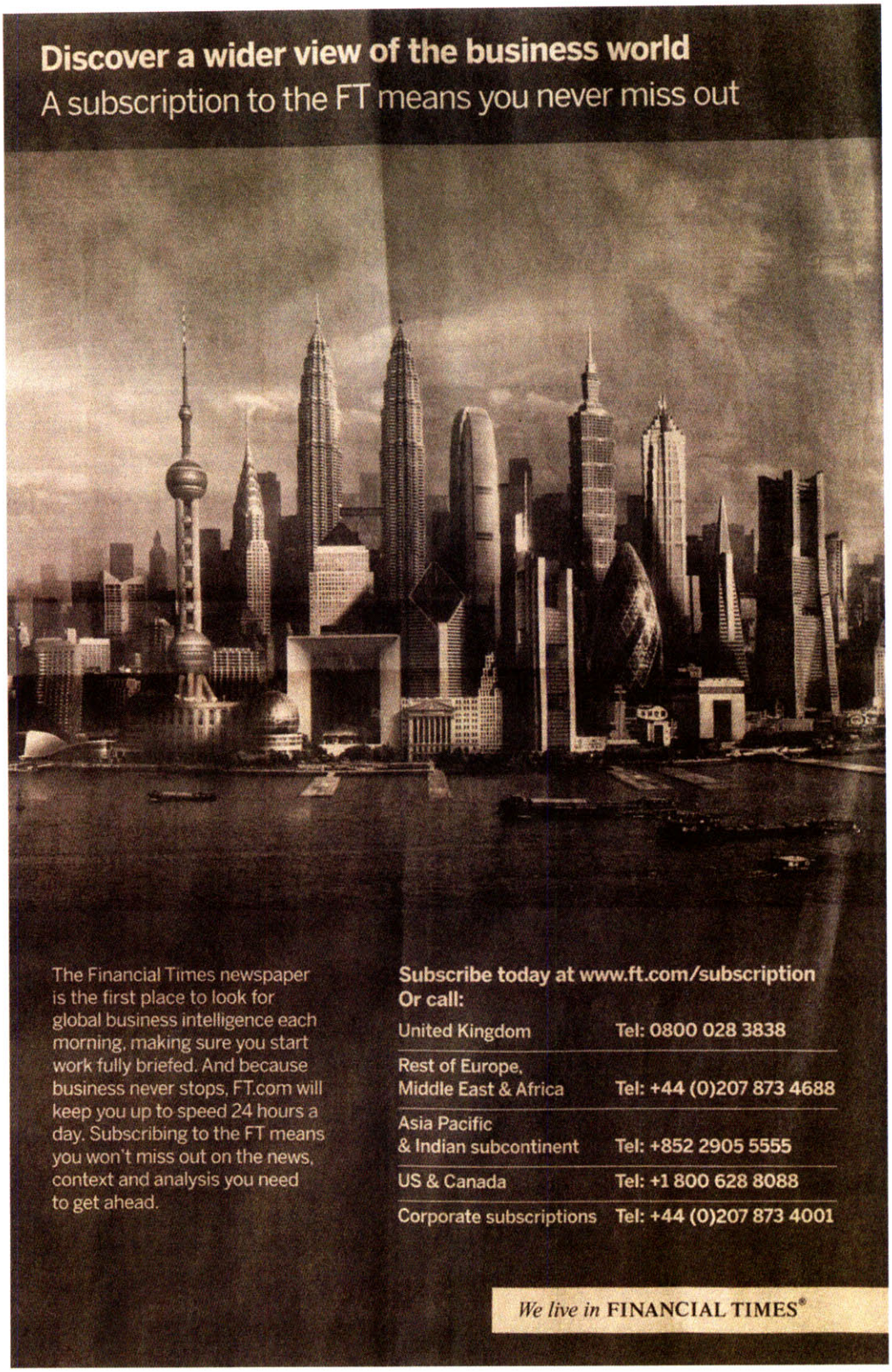

figure 1-4. Skyscrapers as symbols of international business strength. We live in Financial (and skyscraper) Times.
(Source: *Financial Times*, February 11, 2009, pg. 8)

To appreciate DC's situation and attempt to address its future, this investigation will examine height and DC through various perspectives. Chapter 2 will review the history of urban height and its regulation, highlighting society's tenuous relationship with tall buildings. Chapter 3 will place D.C. into this broader context, showing that the height limit's inception had little to do with monumentality and was very similar to height regulations across America in the early 20th century. Because of its unique governance and economy, DC's height limit has remained in place and its meaning has changed, making it a tradition of urban form rooted in its anachronistic and unique nature. Chapter 4 explores the contemporary implications of the limit on DC's form and real estate market, finding that while the core is essentially built out to a very unique mid-rise form, the secondary centers have had more trouble developing and competing with neighboring jurisdictions. Chapter 5 continues the exploration using density and height measurements to compare DC to other jurisdictions to show that downtown DC takes up about twice as much land as it would if it did not have the height restriction.

These analyses contribute to the literature by tying the initial impetus behind DC's height limit to its trajectory over time and its current state. The analysis also takes a nuanced approach to examining densities, looking at both employment and residential density. Finally, it uses a novel approach for measuring and comparing heights across cities. The final chapter recommends that the canvas of height created be used to for new monuments. In addition, the core should be allocated height up to 160 feet, with other commercial areas outside the core allowed heights up to 200 feet. These would preserve the monumental nature of DC while allowing for additional density and funding for initiatives that could serve the residents and visitors of DC. In order to begin formulating what should be done, the following chapter begins the investigation with a brief overview of urban height and skyscrapers.

CHAPTER 1 NOTES

1. Barnett, J. (2004). "What a height limit does for a city." *Planning* 70(2): 14-15.

figure 2-1. Wall-E's skyscrapers and trashscapers (Copyright Pixar 2008)

CHAPTER 2

HEIGHT: MIGHT AND FRIGHT

> "And they said, Go to, let us build us a city and a tower, whose top may reach unto heaven; and let us make us a name, lest we be scattered abroad upon the face of the whole earth." - Genesis 11:4.

Washington, DC's unique urban form embodies society's ambivalent relationship to urban height. This paradox of tall buildings is well captured in the movie *Wall-E*. Its opening sequence begins in outer space. As a song about traveling to the city from the musical *Hello Dolly* plays in the background, the camera makes its own trip to the city. After zooming through a thick layer of orbiting satellites then over mountains of trash and landscapes of smokestacks, the city appears on the horizon. It is a familiar urban silhouette, with tall buildings piercing the sky. In a gesture toward a vision of the future, the skyscrapers exhibit contemporary conical and tapering tops, rather than the rectilinear caps seen on older buildings.

As the camera zooms closer, though, it becomes clear that the tallest structures are not really structures at all, but neatly laid bricks of detritus reaching to the heavens. Interspersed between these towers of trash are the skyscrapers that we expected, evidently defeated in the battle for preeminence (see figure 2-1). The camera angle shifts from a fly-through to a fly-over where it becomes difficult to differentiate the detritus from the development. Wall-E, a trash compactor programmed to neatly stack garbage, is like the steel or elevator that allowed for skyscrapers: both technological advances opened up the skies for human needs. To some they represent

an invaluable advance, while to others they represent technology gone awry.

The rivalry between human ingenuity and height is not a wholly modern phenomenon, as it appeared very notably over 4,000 years ago in ancient Babylon. According to the Biblical story, human knowledge and technology progressed to the point at which the Babylonians could build up into the skies. Hoping to prevent horizontal sprawl, the Babylonians, united in their quest by a single language, ascended toward God's dominion. However, the progress of mortals came too close to rivaling the power of God, so he divided their communications and ingenuity by forcing different languages upon them, then destroying their tower.

The forces of technological efficiency and metaphysical balance exhibited in both *Wall-E* and Babylon represent the dichotomies around which the discussion of height revolve. Tall buildings vividly present the artificial encroachment upon nature required by humans in their quest to advance. Yet they also represent a widespread symbol of societal progress. Urbanization, the path toward economic growth, requires horizontal distance to be overcome, and skyscrapers are an answer to this quandary. In this debate over height, the logos of efficiency must contend with the pathos of humanity. This continuing debate has yet to be resolved at the urban level, but Washington, DC serves as a unique study in the United States because it has stringently kept heights low, allowing the exceptions of symbolic structures, representing the ethos of civic ideals, such as the Washington Monument, the Capitol, and the National Cathedral to stand out.

There have been many histories of skyscrapers and skylines so this chapter is by no means a comprehensive history of urban height. *The City Shaped* by Kostof is a historical primer on the development and portrayal of city skylines. Fogelson, meanwhile, writes the most sweeping account of urban height in the U.S. from the industrial revolution to the Great Depression in his

book *Downtown*. And Willis in *Form Follows Finance* documents the evolution of skyscrapers in both New York and Chicago. Using these texts as a foundation, the remainder of this chapter serves as a brief overview of urban height, with an eye toward how it fits within DC's context.

GRAVITY-DEFINED DIVINE HEIGHTS

Until just over a century ago, gravity defined form and function of buildings. Perhaps because of gravity's power over human will and intelligence, the sky was the domain of God. While technological constraints kept their buildings low, where inhabitants did invest heavily in tall structures, these structures were religious. The Egyptian pyramids were engineering marvels, serving as final resting grounds for rulers. Similarly, the temples of Latin America and East Asia were by far the tallest structures in their day and served religious purposes. All of these buildings were built of stone and their height subject to the multiplicative force of gravity. This limited their height and, most importantly, their usable space, given the need for a thicker base to support higher structures. The breakthrough of the towers and naves of the medieval churches, which sought proximity to God and took centuries to construct was their ability to allow light in and achieve soaring heights.

As local communes and governments gained power through the medieval period, power over the skies shifted from the divine to the civic. "Where pride was at stake, cities built tall," notes Ford, with town halls rising to rival the church steeples.[1] This period also saw a rivalry for the skies between the public and private as wealthy families built towers in parts of Italy, France, and Germany.[2] San Gimignano and Bologna are famous for the baronial residential towers constructed as means of protection and as symbols of power, as the rich merchants could gaze down out at those below them.[3] These private encroachers upon the public skyline, seen as a rival to civic authority, were often destroyed or truncated by political rivals.[4] Despite this battle for the skies, the skylines of Medieval European cities, with their towers and campaniles, were often used to promote cities, through both

image and verse.[5]

Leon Krier terms the traditional skyline, dominated by church steeples and civic structures, *Res Publica*. Filling in between the major *Res Publica* structures, the *Res Privata* comprised buildings of lower height (see Figure 2-2).[6] While the nature of tall structures shifted from the divine to the civic, they all fell within the realm of public. In the 19th century, this shift of power within the *Res Publica* was symbolized by the Washington Monument (1884, 555 ft), which seized the title of world's tallest structure from the Cologne Cathedral in Germany.

All of these structures were made of masonry, a material which has a practical height limit, somewhere in the 500 foot range. At 585 feet, the Anaconda Smelter Stack in Montana, the tallest masonry structure in the U.S. when it was built in 1919, illustrates the limits of such height. Habitable buildings had to be much lower. For example, the walls of the first Monadnock building in Chicago (the last of the era of compressive high rises) had to be 6 feet thick at the base to support its 16 stories and 200 feet. The massive bases required to overcome the compressive forces of gravity, meant that masonry had practical height limits.

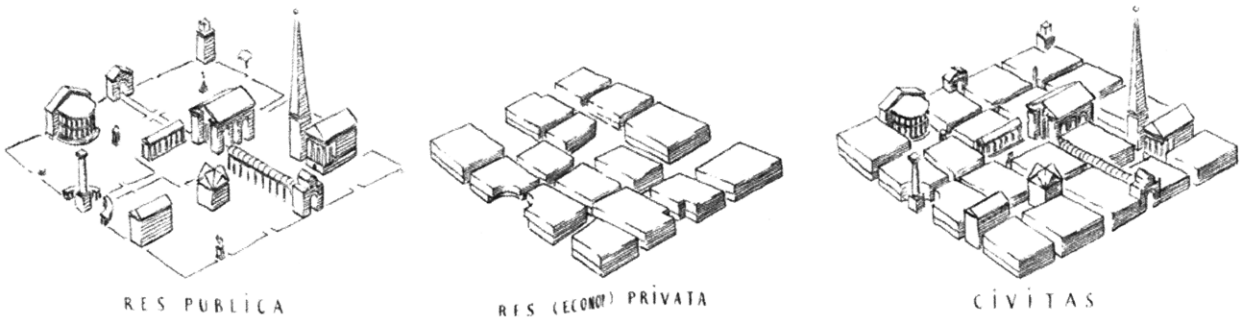

figure 2-2. *Res Publica* and *Res Privata* combined to create *Res Civitas*.
(Source: Krier 1998:40-41)

THE SKY'S THE LIMIT

The Washington Monument held the title of world's tallest structure for about five years. While it held the title, it was really a historically reflective structure, in terms of its stone material and its classical obelisk shape. In 1889, a new structure almost twice as tall would both take the title of world's tallest building and represent an interregnum era of skylines. The Eiffel Tower, at 1,089 feet, was built for the Paris Exposition of 1889 and became a monument to technology. Its form was dictated by the science of engineering, reflecting the wind forces it had to resist, and its materials illustrated that man could literally climb to new heights. At the time it was greeted with disdain and derision as well as accolades and awe. It would be the first of many symbols of urban height to evoke a varied reaction rooted in deeper ambivalence about tall structures. And while its material and form were revolutionary, it was unlike the skyscraper-strewn skylines of the future in that it was still a civic structure within the domain of *Res Publica*.

COMMERCIAL CATHEDRALS

The shift from compressive stone, concrete and brick to iron and steel was the primary technological advance allowing for humanity to exist in the sky, through the new form of building called a skyscraper. By using steel as a "birdcage" to frame a building, the walls no longer provided structural support, and no longer needed to become thicker closer to the bottom. This revolutionary advance was starkly illustrated by the difference between the first (compressive) Monadnock and its (steel framed) sibling, completed a few years later.[7] Essentially, the strength of steel opened up the opportunity to build high and do so economically. Lewis Mumford quips that "if fast transportation made the horizon the limit for urban sprawl, the new methods of construction made the 'sky the limit,' as gamblers loved to say."[8]

This new method of construction was not the only building technology necessary for the expansion upward. Tall buildings are of little use if one must

climb flights of stairs to reach his destination. While Mumford mentions the power of horizontal transportation, it was vertical transport, in the form of electric elevators that allowed people to access upper heights with ease. Rem Koolhas in his musings on New York's skyscrapers wrote, "Otis's apparatus recovers the uncounted planes that have been floating in the thin air of speculation and reveals their superiority in a metropolitan paradox: the greater the distance from the earth, the closer the communication with what remains of nature (i.e. light and air)."[9] The elevator allowed height to host habitable space, moving beyond simply structures and monuments. It opened up the skies to human colonization.

Complementing these building technology developments were other industrial revolution-era advances ranging from mass transportation to economic production that unleashed urbanization and American corporations. Electricity and light bulbs helped light early skyscrapers, even though they were still designed to ensure natural light penetrated into the interior. City infrastructure that delivered electricity and water and removed waste allowed for a much greater intensity of land use. Modern finance and corporate structuring enabled the huge outlays of funds required to construct skyscrapers, which were predominately speculative ventures.[10] Together these fueled demand for downtown areas to a point at which building upwards was feasible and necessary.

Together, these advances meant that the limits of structures were no longer constrained by gravity. Engineers near the turn of the century asserted that "there is no structural difficulty attached to the safe and efficient design of buildings of essentially unlimited height."[11] An inseparable component of the changes in the late 19th century was modern capitalism, so when the limits of masonry were surpassed, Eiffel Towers were not what came to dominate urban height, but rather it was the office building, the "cathedral of commerce."[12]

In the United States, and especially in New York City, monumentalism and monetization coalesced to create skylines of skyscrapers. In other words the Res Publica sank under the new heights that could be achieved by private skyscrapers. Instead of singular monuments towering over cities, as had been with ancient temples, medieval cathedrals, the Washington Monument, or the Eiffel Tower, skyscrapers could and would proliferate, forever altering both the skyline and society's interaction with the sky. As vertical space could be monetized by office buildings, height no longer became a function of the laws of gravity, but one of the law of the market: demand and return on capital determined the maximum feasible height. Willis shows that the height of the Empire State Building was determined by profit maximization with an expected return of 12.6% for an 80 story building versus 11.6% for a 55 story building.[13] In 1930, Clark and Kingston wrote *The Skyscraper: A Study in the Economic Height of Modern Office Buildings,* which found a fictional building in New York City to be most economic at 75 feet.[14] Height, in other words, became a residual of market calculations.

Some argue that it was not just market calculations, but also marketing calculations that aided in the development of skyscrapers. Ford notes that companies such as Metropolitan Life used images of their Manhattan skyscraper to reassure policyholders in the middle of the country that if they had problems, there would always be a place to go.[15] But Willis presents the most compelling case that most all tall buildings were speculative, that is, not owned by large companies, but rather built by developers to be leased.[16] Those that were built by companies were often only partially owner-occupied and the buildings were seen first and foremost as a real estate investment, just as any other investment.

Tall office buildings, responding to market demand, started to dominate the skyline and the downtown landscape across the United States. Unlike European cities, which were relatively low but more spread out, downtown U.S. cities, maturing in an era of technological advance, became tall and

more compact. Yet as these skyscrapers arose, fear of these new structures meant that the skyline of *Res Publica* would not be ceded to *Res Privata* without a fight.

SAVING OUR CITIES

> "Probably no question before the public today is of more interest and importance to the dwellers in our American cities than the current controversy over the regulation and limitation of building heights. Certainly it is difficult to think of any public issue whose decision, whether in the one direction or the other, is likely to exert so important an influence upon so any phases of the average urban dweller's daily life" - Clark and Kingston. *The Skyscraper.* 1930. pg. 1

The story of urban height in the U.S., as it is a story of societal ambivalence, is tied not only to the ascendant office building but also the reciprocal regulatory regimes. In New York City, the famous steeple of Trinity Church, a notable structure in the skyline, steadily shrank in the skyline as taller office buildings came to surround it.[17] A British visitor noted that "these houses of business reduce to insignificance the houses of worship."[18] As private structures shot upwards past Krier's *Res Publica*, the backlash against tall buildings also grew in the U.S.[19]

A vigorous debate ignited about the value of skyscrapers and their place in society. This dispute over urban height was waged in architectural, planning, engineering and public health arenas. Such discontent, epitomizing humanity's tenuous place between respecting and dominating nature, would spill into the hall of legislatures as opponents sought to prevent tall buildings using a potent tool for harnessing capitalism: the law.

Building height regulations were not a novel idea, as many European cities, including London and Paris, had height limits dating from the 17th and 18th centuries. Based on the notion of "ancient lights," which maintained that property owners had the right to a certain amount of natural light,

the regulations predated skyscrapers and limited the height of buildings to below heights to which masonry could be practically built.[20] Because the height limits were so low that every building's height was binding, they also preserved or developed the aesthetic of a "sacred skyline," where the urban vistas were marked by even rooflines.[21] Iconic views down Haussmann's Parisian boulevards, in which the buildings vary in style, but not in height captures this aesthetic, which was common in both Europe and America at the time.

In the United States, building height regulations were more reactionary, often implemented after skyscrapers had been constructed. Their appearance was based on two major factors: public welfare and real estate market protection. Aesthetic considerations may have been an underlying motivation, but rarely was any concept of urban design used to promote or preserve height regulations. Concerns about the salubrity of urban environment were one of many causes raised by Progressive Era reformers in reaction to the Industrial Revolution. As tall buildings started to rise in the urban environment, concerns of their effect on public welfare encouraged various cities to enact height limits. Most visibly, the buildings blocked out fresh air and light, which were so valuable in the miasmatic urban environment. In addition to European notions of ancient lights, sunlight was thought to be antiseptic, so the longer shadows cast by tall buildings were thought to be a menace to public health on the street and in neighboring buildings.[22]

During the late 19th century, urban fires were a major concern. The fear that tall buildings could create or intensify conflagrations because their upper floors were unreachable by firefighters' ladders fueled some proponent of height limits. These included architects, fire chiefs, as well as insurance companies.[23] Ironically, Chicago's 1871 fire cleared prime downtown land, making it easier to build skyscrapers in the following decades.

The other primary public welfare concern regarding skyscrapers was their density. Given the amount of people that could be packed into a piece of real estate, height limit proponents worried that these buildings would worsen an already miserable traffic condition on many city streets. Traffic was part of broader concern over the density and compactness of the downtown.[24] Opponents of tall buildings felt in general that height meant a more compact and crowded downtown, while limiting it would encourage a less concentrated, and more efficient city. Meanwhile proponents pointed to the efficiencies of concentration an agglomeration of tall buildings as reasons for allowing for tall buildings.[25]

Concerns about tall buildings based on public health were often the loudest, but it was those related to the real estate market itself that were powerful in City Halls. Many property owners feared that their land values would decline if a skyscraper were built adjacent to their land, depriving it of light and air. Others who owned property just outside the center city hoped to encourage geographically dispersed development through lower buildings. The debate on the efficiency of tall and compact city centers versus squat and expansive downtowns has yet to be resolved, but as will be investigated, DC offers an uncommon example of the latter by which to compare to the tall form that has come to dominate U.S. cities.

Skyscraper owners themselves sometimes pushed for height limits. Having already built tall buildings, they stood to benefit from restrictions upon others. In addition, tall buildings tended to be constructed at the end of building booms, when rents and projected demand were optimistically high. Given the time-lag between financing and construction completion, these buildings would often come online in the middle of a downturn, further flooding the market with space and pushing rents even lower. Chicago raised and lowered it height limit 7 times, usually in reaction to market pressures and gluts, respectively. The story of Chicago's bouncing height limits is tied intimately to the over- or under-supply of space.[26]

As skyscrapers arose or threatened to rise in cities throughout the United States, a number of major cities enacted height regulations. As Comey showed in 1912, many of them were similar to European ideals based on street width, although they were all significantly higher than European limits:

Height Limits in American Cities as of 1912 [27]

Baltimore .....175 ft
Boston.....125 ft - business
.....80-100 ft - residential
Buffalo .....4 times building's horizontal dimension
Chicago .....200 ft
Cleveland .....200 ft/2.5 times street width
Denver.....12 stories
Los Angeles.....150 ft + 30 ft mansard roof
Portland.....160 feet/12 stories
Providence.....120 ft + roof structures - non-fireproof buildings
St. Louis .....250 ft - office buildings facing three streets
.....150 ft/2.5 times street width - other buildings
San Diego.....150 ft
San Francisco .....102 ft

Height Limits in European Cities as of 1912

London .....80 ft/street width
Berlin .....72 ft/street width
Frankfurt.....59-66 ft/street width
Paris.....1-1.5 times street width (39-66 ft)
Zurich .....39 ft - public squares
.....51 ft/street width

THE FALL OF HEIGHT RESTRICTIONS

Regulating the height of buildings was the forerunner of modern comprehensive zoning as it was the debate over height that helped push through New York's landmark zoning ordinance. This shift would fundamentally alter the meaning and strength of height limits in American cities. In the early

20th century, opponents of tall buildings sought to set a national precedent by imposing a limit in New York America's largest and most iconic city. Instead of the typical height limits, however, New York in 1916, codified a comprehensive zoning plan, wherein height became one of many factors regulated by the government.[28] The new regulations comprised a number of zones, with various limits related to the width of the street and the type of neighborhood. In downtown Manhattan this height restriction became secondary to the envelope restriction, as buildings could exceed the height limit on 25% of their lot area (see figure 2-3).[29]

This building envelope restriction evolved into more flexible density limits based on floor to area ratios (FARs). The density of built area could be controlled by allowing for a certain amount of built space based on the size of the lot. An FAR of 1 would allow for a building to have as much square footage as the size of the parcel. This could be a low building that takes up the entire lot or a taller building with a smaller footprint. FAR regulations allowed for cities to control overall built density while allowing owners and developers some degree of flexibility and has become the predominate driver of form in most cities. They tend to allow for a greater degree of freedom in building design, creating a range of buildings and a variegated skyline. In part because of this, visualizing and understanding how FAR limits impact built form, is not as simple as with height limits, as Allen Jacobs found when attempting to write height and bulk limits in San Francisco in the 1960s.[30] FAR regulations do address many of the same concerns as height limits, such as congestion, light, air, and infrastructure stress. So, in DC, where height limits have remained the predominate driver of form, they embody more specific and narrow ideals about good form.

New York City adopted this FAR-based regulation in its 1961 rezoning.[31] Other cities began shifting to this type of regulatory regime and by mid-century, few cities had height restrictions that would completely ban tall buildings. Los Angeles dropped its height limit in 1957 and San Francisco allowed for

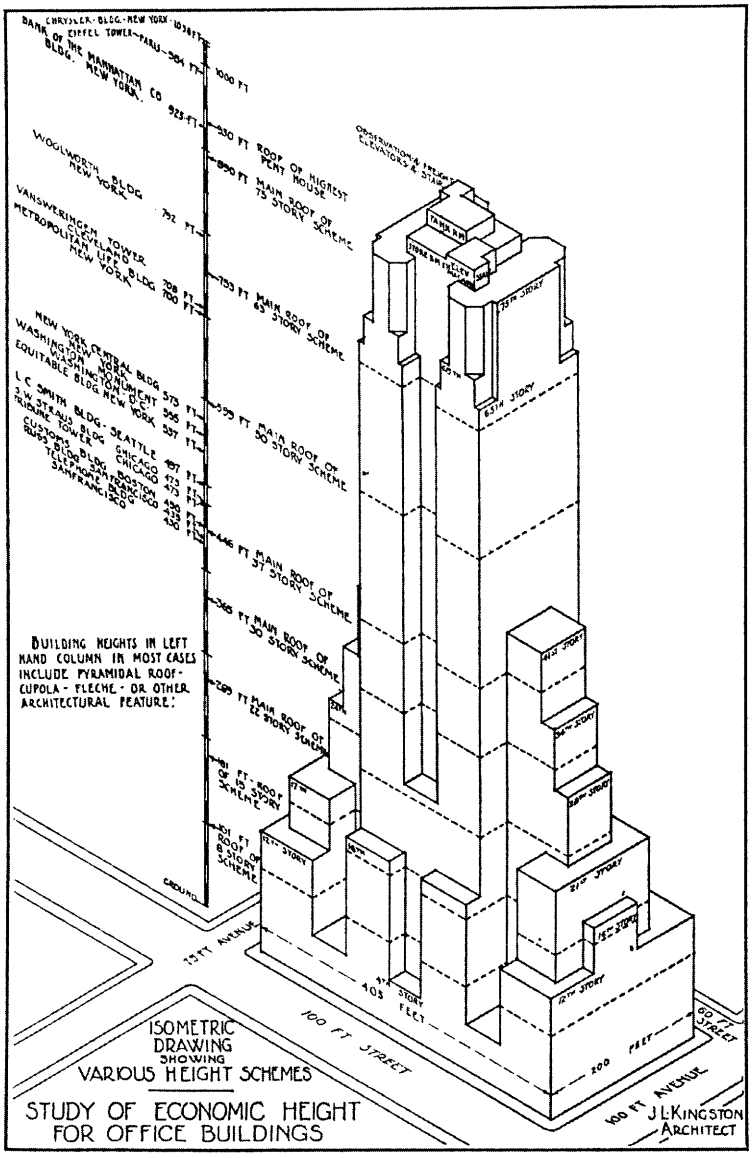

figure 2-3. Skyscraper building envelope in New York City (Source: Clark and Kingston, 1930:86)

much taller buildings in 1967. Philadelphia's famous gentleman's agreement, in which developers agreed not to build above William Penn's statue on top of Philadelphia City Hall, was breached in 1987.[32]

The change in urban regulations combined with advances in air circulation and lighting technology transformed the skyscraper. This second era of tall buildings was embraced by some Modernists. As invoked by Le Courbusier's imagery, skyscrapers were often seen as an answer to urban ills, through for "towers in the park." Whereas previously, tall buildings were the province of the commercial sector, modernists saw them as a solution to urban housing problems. Urban renewal in the United States often replaced low-rise residential neighborhoods with mid- to high-rise buildings. Because many of these ended up as public housing, the image of residential living in tall buildings was gravely damaged.

A renewed race for height ignited in the 1960s and 1970s, as the world's next batch of tallest buildings arose. In New York City, the World Trade Center Towers (1972-3, 1362 and 1368 feet) and in Chicago, the Sears Tower (1974, 1730 feet), still the tallest building in the U.S., arose. The tallest buildings in San Francisco, Baltimore, Boston, Phoenix, Detroit, and Pittsburgh were built in this era of skyscrapers. This new wave of office towers, made possible by technological advances and declining concerns about air and light in the urban environment, was also in many cases a sign of city interests seeking to overcome or deny urban decline through visible signs of importance and value. Non-record breaking tall buildings continued to sprout up throughout the country in the 1980s, including in suburban and exurban areas.

The history of urban height regulations in the U.S. represents an evolution in which tall buildings and the needs of urban populations and the urban environment were negotiated over decades. European cities, however, have had a more strained relationship with urban height.[33] Cities centers were lower and more historic and roads were narrower and more irregular. Europe's comparatively lower urban height limits helped create the type of dense, mixed-use environment epitomized by Paris. So as skyscrapers arose in the later 19th and early 20th centuries in the U.S., the skyline of European cities changed little. Yet after World War II, with the rise of

Modernism, skyscrapers began to appear. Unlike in the U.S., they often arose along the outer edge of the City, where historic constraints were not as great. The errant highrise in the core would often elicit fierce opposition: the Tour Montparnasse in Paris (689 feet, 1972) was responsible for a ban on high-rise construction. This was 60 years after the same type of action-reaction sequence occurred in many U.S. cities.

In both London and Paris, debates about tall buildings continue. Both have lower profiles than many American cities, but they both also have more high-rise structures than D.C. proper. Perhaps because they serve the dual capacity as business and political capitals they must accommodate businesses within the context of an historic city fabric. La Defense in Paris and Canary Wharf in London both represent efforts to allow for height in order to be competitive, and might be compared to the Rosslyn corridor in DC. In Paris, the debate continues to rage about height, in part because its regulation can be shaped by the French President. While it would seem that in such an historic city, height limits would be sacred, leaders such as Georges Pompidou, who sought to promote Paris as a city of growth, allowed for the construction of modern high rises in the 1960s and 70s. The sputtering of upward growth has continued, with the construction or proposal of tall buildings eliciting backlashes and bans ever since.[34]

CITY SKIES TODAY

As Kostof puts it, "the skyscraper as it has existed for 100 years *is* tradition now."[35] Certainly, there are still debates about heights in certain areas, especially near residential neighborhoods. But the kind of blanket fear of heights, as manifested by the height limits of the turn of the 20th century has given way to more complex regulations, of which height is often just one component, with the notable exception of Washington, DC.

Perhaps this is because the variegated skyline of a city has become a symbol of power and venerated by city officials and promoters, as evidenced by

Boston Mayor Menino's initiative to construct a 1,000 foot tall building in downtown Boston. 70 years before, Franklin Roosevelt as the Governor of New York told the New York Board of Trade in 1930 that "you have just cause for pride in what you have achieved-the tall, slim buildings standing clear against the sky..." The modern promotion of cities based on the skyliconography continues the technique begun in the Medieval Period, even if the nature of the skylines is vastly different.

New York's skyline has inspired many. A young Ayn Rand, upon immigrating to the U.S. in 1926 said, "there was one skyscraper that stood out ablaze like the finger of God, and it seemed to me that the greatest symbol of free man."[36] This image would inspire her book *The Fountainhead*. As one early 20th century critic put it, "every American city and town that aspires metropolitan importance wants to have at least one skyscraper-one that can be illustrated on a picture postcard and sent far and wide as an evidence of modernity and a go-ahead spirit."[37] This fascination still exists today (see figure 2-4).

While tall buildings have gained a general acceptance over the last century, there have been critics urban height. Some early architectural critics bristled at the anarchic way in which skyscrapers broke through the traditional sacred heights. Among the most vocal was Schulyer, who called New York's skyline a "horribly jagged sierra."[38] Lewis Mumford's notion of transportation opening up the skies was preceded with a rant on tall buildings and the changing regulations that made them possible:

> But the radical mistakes that were first made in the promotion of skyscrapers are now universal, partly through a relaxation of overstringent controls, partly through commercial pressure, partly through fashionable imitation, partly through the architect's desire to exploit new technological facilities.[39]

Willis argues that architects actually played little role in the decision to create skyscrapers, but Mumford is correct about the other factors which

figure 2-4. Men in cities still dream of skyscrapers (and fragrances). (Source: *Wired Magazine*, March 2009)

allowed for tall buildings. Some architects found tall buildings dehumanizing because urban height fell within the realm of commerce. They felt that the sacred skyline that was maintained by forces of nature was breached not by human progress but by human greed, which some architects aided and abetted. In 1977, Blake aptly described the sentiment in *Form Follows Fiasco*:

> Every modern architect not obsessed with the need to document his manhood in public has known, from the beginning of his time, the skyscraper is the death of cities. He has known (women architects are rarely as enamored of skyscrapers as men are) that skyscrapers destroy human interaction, that they cause enormous congestion at the ground-floor levels of cities, and that they tend to drive out smaller-scale - human-scale - buildings through economic pressure by raising neighboring land values and real estate taxes, and thus forcing low-rise neighbors to sell out to high-rise developers.[40]

Such comments were neither the first to make such phallic comparisons nor to claim such urban destruction. In fact, most every contemporary argument harkens back to the early debate on skyscrapers. It is surprising that in decades of development of skyscrapers such claims have been neither verified nor refuted. Perhaps because skyscrapers have become so acceptable, proponents of urban height no longer feel the need to address opponents.

Blake also mentions some of the difficulties caused by skyscrapers at the pedestrian level, including wind tunnels, unpleasant public spaces, and shadows. Apart from the last item, the others are functions of poor design rather than an inherent trait of skyscrapers. But Blake's concerns do point to the tension between the skyline from afar that inspired Ayn Rand and the experience from below or inside.

While opponents of tall buildings may be motivated by idealism or bitterness at having lost control of urban form, contemporary architectural discussion does adumbrate a deeper psychological and spiritual discontent

about the meaning and value of height. This unease underlies the longevity of DC's height limit as well as the dystopic opening scenes of *Wall-E*. It originates in our ability to overcome the powerful force of gravity and inhabit the skies. Richard Sennett writes:

> The religious height of the medieval city was sacred because it pointed up to the kingdom of God; it was both physical and spiritual in orientation. Were a medieval builder transported in a time machine to a modern skyscraper, he would find it profoundly, disturbingly profane, the sanctity of the vertical dimension contaminated simply by becoming instantly accessible...Skyscraper height lacks the symbolic value either of the Japanese house or the medieval church.[41]

Urban height still raises mixed emotions because, contrary to Sennett's assertion, tall buildings are not devoid symbolic value. Rather they are potent symbols of the commercial growth, power, and dominance of the urban sky (over religious or other cultural institutions, much to Sennett's dismay). Even today, skyscrapers remain one of the most visible and sustained symbols of the profound influence of the industrial revolution on cities.

GROUNDSCRAPERS

Perhaps seeking to move beyond the symbolism of industry, some architects have extolled the virtue of the groundscraper. Architect Charles Jencks coined the term, employing the gendered discussion of skyscrapers to say "there is now a female response to all the upright members: the groundscraper has arrived, the undulating body buildings that hugs the earth, and tries to be green."[42] These short buildings with large footprints and open floor plans have been described as skyscrapers on their sides. While some groundscrapers appeared in the 1960s and 70s, starting in the 1980s their form found a raison d'etre: high-tech enterprises and financial services, which could use the open floor plans for large technology or trading rooms.[43] The term appears most often in references to London, where officials have sought to accommodate and attract financial outfits.[44] Yet

because the discussion exists primarily in the architecture and design fields, the economic realities of height are rarely addressed. Groundscrapers appear where land values are low enough to allow them, so their existence is less about an aversion to height and more about the contemporary trend of developing large areas of real estate to gain maximum return. Rather than in opposition to skyscrapers, groundscrapers seems to be in opposition to small-scale, small block development.

While the form appears not to have caught on for high technology and finance office space (it seems that financial firms preferred the masculine and showy tower), it could very well be resurrected to apply to the urban form of DC. It seems strange that the notion of groundscraper has not been applied to DC, given that its downtown is made up of 10-12 story, large footprint office buildings. Rather than as a reaction to some contemporary need for space, though, it has occurred as a result of its height limit combined with the nature of L'Enfant's large blocks. Opponents of urban height and proponents of skyscrapers would do well to further examine DC's situation.

POST 9/11 REACTION

With the terrorist attacks of September 11, some very visceral fears of tall buildings were played before Americans on live newscasts. A recent study shows that leasing rates declined in the tallest buildings in Chicago as a result of the fear created by the terrorist attacks.[45] Yet Charney has noted that as the age of record breaking skyscrapers had passed in the U.S., the effect of the tragedy on new construction is unclear. In an argument that harkens back to the early days of skyscraper studies, he points out that super skyscrapers are limited more by real estate forces than by short-term fears.[46] And if looking outside the birthplace of the tall buildings, the era of super skyscrapers is still going strong in the Middle East and Asia.

Still the tragic terrorist attack provided opponents of urban height a novel

reason to oppose skyscrapers: national security. Six days after the attack Kunstler and Salingaros wrote a piece entitled "The End of Tall Buildings, which proclaimed "with the [September 11 attacks] comes a sobering reassessment of America's (and the World's) infatuation with skyscrapers. We feel very strongly that the disaster should not only be blamed on the terrorist action, but that this horrible event exposes an underlying malaise with the built environment."[47]

Leon Krier, the proponent of *Res Publica* wrote that "the tragic events of September 11 affect our general perception and thinking about tall or low buildings for both psychological and practical reasons."[48] He argued that if the World Trade Center had been his ideal height of four stories, it would have taken 160 planes rather than two to destroy the same space. On the other hand, if the Pentagon were in a tall building, he argued that the resultant human tragedy and national security damage would have been catastrophic.

These concerns have been little heeded by those still developing the tallest buildings in the world in Asia and the Middle East. Even in the U.S. tall buildings continue to rise, with the imminent redevelopment of the World Trade Center site a prime example. But these concerns are especially appropriate given the discussion of Washington, DC, which is always incredibly wary of security threats. While the height limit predates any thought of such disasters, imagining extremely tall towers in the Nation's Capital given September 11 is difficult.

HEIGHT: NEITHER FRIEND NOR FOE

While American society more or less accepts skyscrapers as part of the urban skyline, it is an ambivalent embrace of the the structures. The conflicted feelings are evident in cinematic depictions of cities, such as *Wall-E, Blade Runner* or *Metropolis*, where a dystopic future is marked by imposing, dark structures lining city streets. These skyscrapers represent the dehumanizing

trajectory of progress. On the other hand, representations of urban skylines abound and visits to places such as the Empire State Building are popular among tourists, as well as the occasional giant ape. Just as the emotional reactions to agglomerations of tall buildings varies, so do the practical recommendations on how to address urban height. The status quo is to provide some degree of regulation based on density and adjacencies, but to allow owners to build when and what they please within these general guidelines. Some modern critics, such as Kostof, seek to ensure that skyscrapers and skylines develop within a realm more controlled by the public: "Like the communes of Tuscany which took charge of their city-form in the later Middle Ages and shaped it to reflect their governance, their political and social priorities, so it is given us to do the same."[49] Perhaps the lack of a designed skyline itself represents modern civic and political priorities. Because it represents a unique physical form in which the skies were not the limit, Washington, DC provides the best American test of Kostof's assertion. Its urban height has become stringently regulated and the lack of tall buildings itself a symbol of the values and monumentality of the National Capital. The history, implications and potential futures of this marble ceiling comprise the remainder of this investigation.

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figure 3-1. Chicago in the 1920s
(Source: Willis 1995:21)

figure 3-2. Washington, DC today

CHAPTER 3

DC: FROM ARCHETYPE TO ANACHRONISM

> "That no building shall be erected, altered, or raised in the District of Columbia in any manner so as to exceed in height above the sidewalk the width of the street, avenue, or highway in its front, increased by 20 feet...No building shall be erected, altered, or raised in any manner as to exceed the height of one hundred and thirty feet on a business street or avenue...except on the north side of Pennsylvania avenue between First and Fifteenth streets, northwest, where an extreme height of one hundred and sixty feet will be permitted." -Statute 36, Chapter 263, pg. 452 "An Act To regulate the height of buildings in the District of Columbia."[1]

The height limit in DC is full of folklore, which pervades even journalistic and scholarly accounts of the City. The height limit was never based upon the U.S. Capitol Dome or Washington Monument and has always been significantly lower. It is not based on the elevation of the ground, but is rather relative to the sidewalk, so a building on a hill can be as tall as one at a lower point (as elegantly illustrated by the National Cathedral, see figure 6-1). The most thorough account of DC's building height limit is a 1976 Congressional Report, which is used throughout the following chapter and is the most authoritative text on its history. Despite the research, which greatly informs this chapter, the report has not helped alleviate broad myths of the regulation.

HISTORY OF THE HEIGHT LIMIT

> "Now, why should we in Washington, when we are seeking to make it "the city beautiful," raise the height of the buildings more?" - Congressman Stafford, 1910 hearing.[2]

The District of Columbia was born of political compromise over the seat of power in the newly formed federal republic. Because of mutual fears and suspicions about locating it in Philadelphia or New York, then the largest cities, a new city would be created closer to the southern colonies. Washington, as it would later become known, would be unlike the capital of Europe which stood as both the political and financial seats. From the beginning, the industry of the nation's capitol was to be the government. Similarly, by carving the District out of the states of Virginia and Maryland (though Virginia's portion would be retrocessed as Arlington County in 1846) the government would be free of state influence and free to exert the power it needed over the real property required in furtherance of federal governance.

DC was explicitly conceived and designed to embody the ideals of a new country. Locating it on mostly vacant land allowed George Washington, Thomas Jefferson, and the designer Pierre L'Enfant to start with a physical *tabula rasa* to impose a city that would have a political *tabula rasa*. L'Enfant's plan differed greatly from the regular grid of contemporaneous and future American cities, with their focus on capital and infinite expansion. Instead it would consist of an irregular grid with radiating avenues influenced by Baroque notions of harmonics which centered around the triangle of the Capitol, the White House and the future Washington Monument.[3] L'Enfant was fired (or resigned) prior to the completion of the original plan, which allowed Thomas Jefferson, who favored a regular grid, to simplify but not completely revise the plan.

L'Enfant's plan reflected the natural topography of the region, with Florida Avenue following a natural geographic ridge and the Capitol set on a hill in order to dominate vistas. Yet there is no mention of his thoughts on the vertical built element of the City. Thomas Jefferson did feel that height should be restricted, as reflected in one of the first regulations imposed on the City. It set not only a maximum height, but also a minimum height for the major avenues: "That the wall of no house [is] to be higher than forty feet to the roof, in any part of the city; nor shall any be lower than thirty-five feet on any of the avenues."[4] These regulations fell into desuetude given the slow development of the City.[5]

During its first century, DC emerged as relatively a small city of townhomes. Given the size of the federal government during the 19th century, the City was in no way comparable to the commercial centers of Philadelphia, New York, or even the more proximate Baltimore. Three to four story townhomes hosted families and businesses alike, with a small sign often the only way to tell one from another.[6]

The ramifications of building technology discussed in the previous chapter arrived in DC, though considerably later and not in the form of tall commercial buildings. Instead, reflecting DC's still small economy, the first tall buildings were public-oriented: the U.S. Capitol (dome completed in 1863 at 289 feet), Healy Hall at Georgetown University (1879 at 200 feet) and the Washington Monument (1884 at 555 feet).

Yet when a non-public structure was finally built, it was not a commercial office building as in most other cities, but an apartment building in Dupont Circle, a residential area just north and west of the White House. The Cairo Apartments, a 14 story steel-framed apartment building, which at 165 feet towered over the townhomes in Dupont Circle, was completed in 1896 (see Figures 3-3 and 3-4). Because no laws existed to prevent its construction, as the building arose above the townhouses below, it caused an

figure 3-3. The Cairo Apartments
(Source: NCinDC 2008 from flickr.com)

figure 3-4. The Cairo Apartments in context of Dupont Circle
(Source: NCinDC 2008 from flickr.com)

immediate outcry and started in motion the push for height limits in the District. Even before its opening day, the District Commission, the group of men appointed by Congress to oversee and manage DC (essentially its unelected city council), had received enough complaints about the building to act. While they were unable to reverse the construction of the Cairo, the commission did enact regulations limiting buildings to heights no wider than adjacent streets with maximum heights of 90 feet on residential streets and 100 feet on commercial streets. The commissioners used Berlin's regulations as a guide in fashioning their rules.

These regulations were greeted with approbation in the press, with a general

consensus that they would preserve the health and beauty of the nation's capitol. The *Washington Evening Star* wrote at the time that "it was all right for high buildings in commercial cities where there was little room, but here in Washington, where there was ample space, [District Commissioner Truesdell] did not see the necessity for such high structures."[7] These regulations, based on the notion of DC as an open, noncommercial city, served as the foundation upon which future legislation would build.

In 1899, Congress, apparently in response to citizen demands, enacted the first height legislation for DC. The new limits, not too different from the Commission's regulations, were based on both the type of street and the combustibility of the buildings. Residential buildings could be no taller than 40 feet or 3 stories if they were timber, 60 feet or 5 stories if they were combustible and 90 feet for noncombustible buildings on residential streets. Combustible commercial buildings were limited to 75 feet, while noncombustible buildings could be built to 110 feet unless they were on a 160 foot wide avenue or commercial street, where they could reach 130 feet.

The changes in this law, which distinguish between combustible and noncombustible buildings signal that fire was of primary concern. In the House report, the fire chief stated that it was impossible to fight fires in buildings taller than 85 feet, which is why combustible buildings could not exceed 75 feet in height. Even so, the notion of a fireproof or non-combustible building is a bit strange, given that fires could occur at any height, even if the structure itself were fireproof. The report acknowledges this, referring to fires at the Home Life Insurance Company and the Postal Telegraph Company buildings. Despite the assertion of the fallacy of fireproof buildings, the legislation allowed buildings to exceed the practical 85 foot firefighting limit if they were "noncombustible."[8]

In addition to fire, supporters of this bill were concerned about buildings blocking light and air. Chimney smoke, it was feared, would not disperse

well with tall buildings. Yet because smoke arose from residential buildings, this concern did not apply to commercial streets and buildings. Additionally, supporters were concerned about the life cycle of iron and steel, especially "electrolytic action" which might degrade the frame unbeknownst to the owners and occupants.[9] Yet instead of preventing such buildings or studying the concerns further, the legislation allowed such buildings to rise to heights of 130 feet.

In the end, the upper height limits seem to be based not on any researched ideal, but rather on traditions and precedents. The law was derived from similar restrictions in place in Chicago and Boston at the time. Yet while Chicago's height limit was a reaction against overbuilding and a protection of current tall buildings, DC's was imposed on a market in which overbuilding was not a concern.[10] As with the 1896 regulation, this law was likely a proactive measure to protect the City. Despite the discussion of fire and structural concerns, the legislation seems to mark a predominately aesthetic and visceral concern about height, the kind that still underlies our ambivalent attitudes toward skyscrapers.

Between this 1899 legislation and modifications in 1910, a few other tall buildings arose, including the Willard Hotel, the Folger Building, 1400 New York Avenue, and the Munsey Trust Building, all just a few blocks east of the White House.[11] The Washington Star's 1896 comments about the lack of demand to build upwards in DC were borne out by the lack of much construction during this period. Even so, in 1910, Congress decided to adjust the height limits, modifying the limit to be 20 feet over the widest adjacent street up to 130 feet on a commercial streets (see Figures 3-5 and 3-6). A notable allowance was made for the northern blocks of Pennsylvania Avenue NW, between the Capitol and the White House where buildings could rise to 160 feet. This exception is reminiscent of the 1899 Act's allowance for taller buildings along avenues.

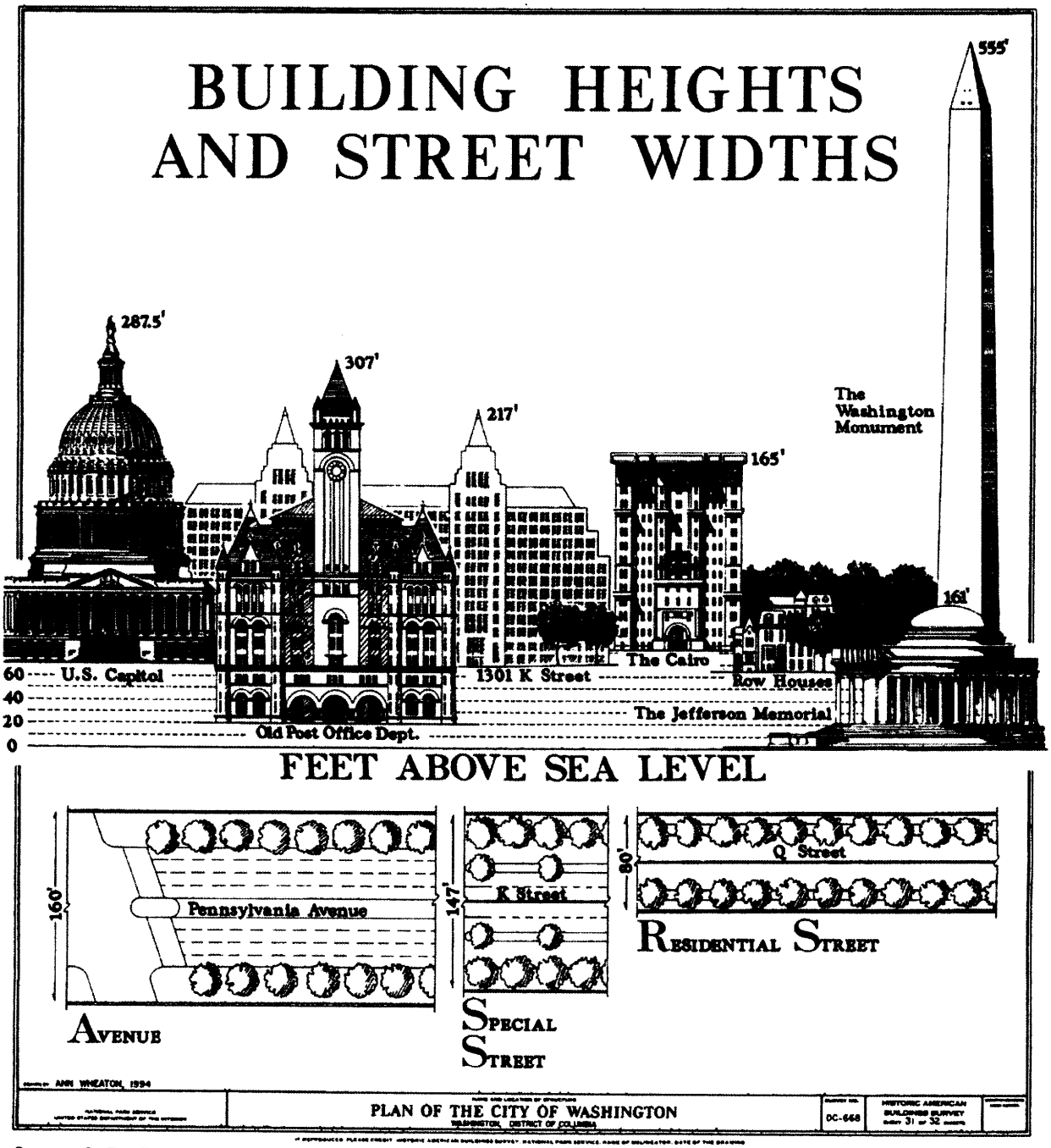


figure 3-5. Illustration of various DC buildings and street widths. 1301 K Street (1 Franklin Square) has towers that exceed the limit which are decorative and do not represent usable space. (Source: Wheaton 1994)

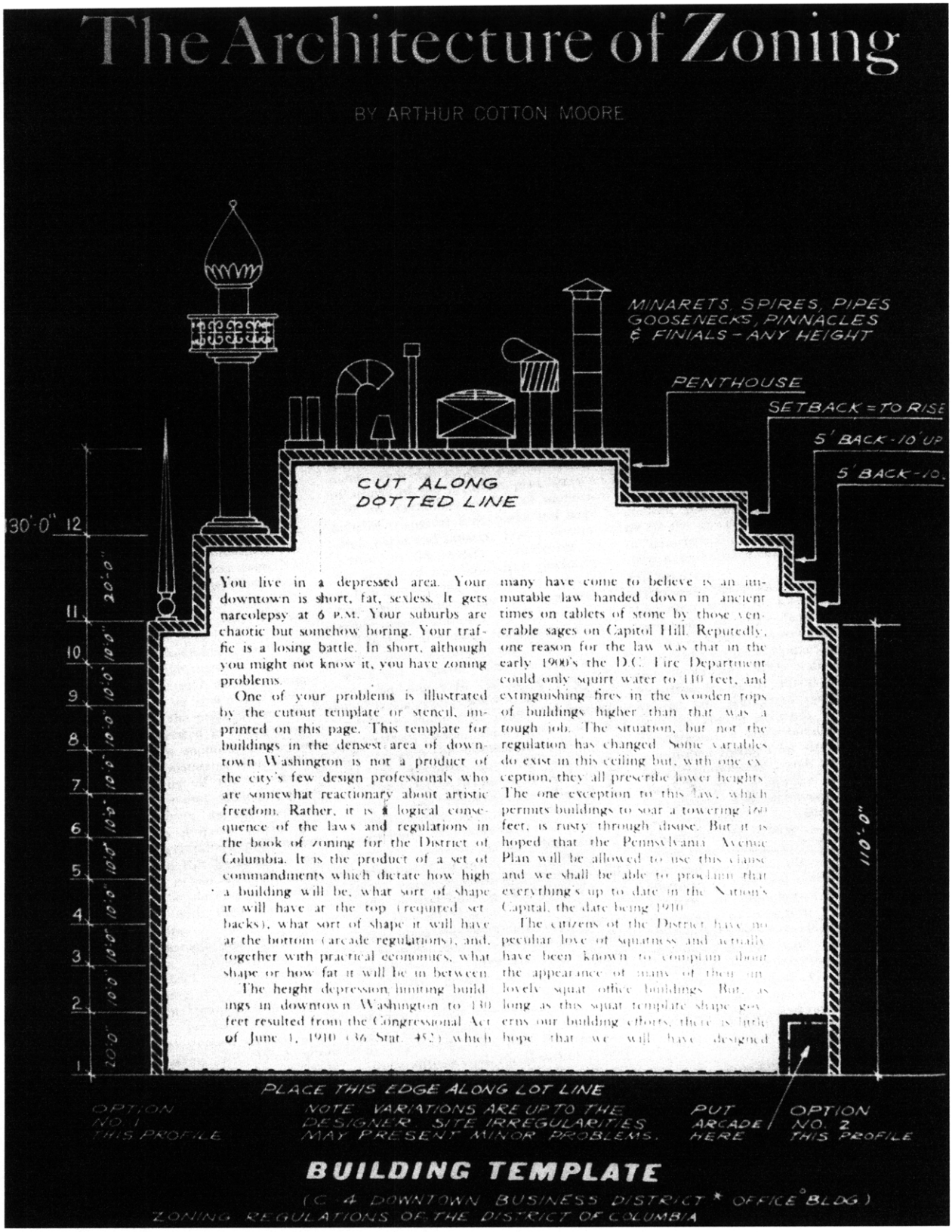


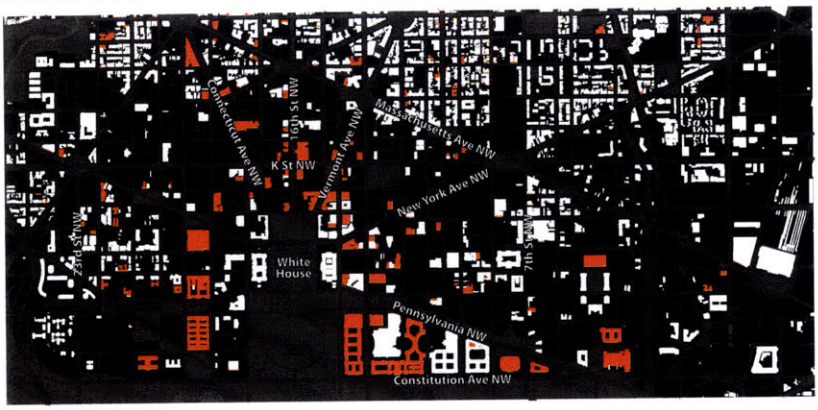
figure 3-6. Illustration of the height limit regulations. It was created by a well-known architect for The Washingtonian Magazine in the1960s when they were a topic of popular discussion. (Source: Moore 1966)

On June 1, 1910, William Howard Taft signed into law the Building Heights Act. At the time it was not materially different from height limits of other cities or even the height law that preceded it. Yet, unlike similar laws in other American cities, it would, over the course of the century, become the predominate driver of urban form in downtown DC. Perhaps this is why, despite the fact that the legislation made only a few modifications to the previous version, much of the folklore of DC's building height limit revolves around that 1910 Act. Ending the era of continuous modifications of the limit, it marked the shift from policy adjustment to sacred policy.[12]

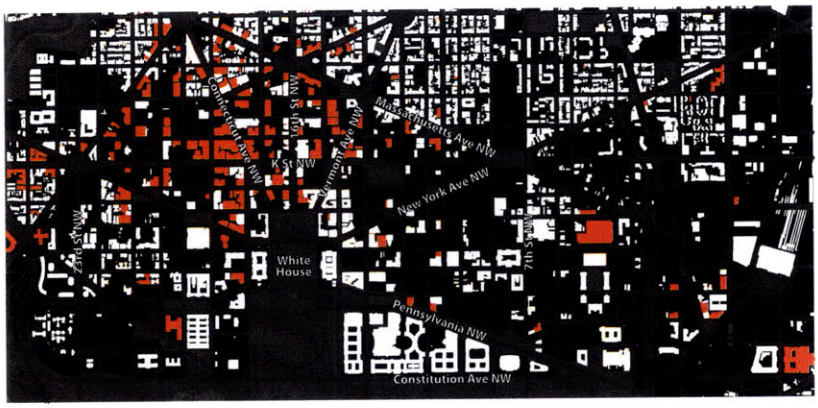
Trajectory

The impact of the height regulation on the built form and aesthetics of the City has changed dramatically since it was enacted. When signed into law, and even during the its first 50 years of existence, the height limit had minimal impact on the built form of DC, perhaps preventing a few tall buildings from being built. But since the middle of the 20th century, major changes in the structure of DC's economy affected the built form of the City. At the time the 1899 legislation was passed, the federal budget represented 3.6% of America's GDP, while in 2008, it was 20.9%.[13] As the federal government grew, so did Washington, DC. Not only did the City have to accommodate more federal employees, but also the secondary and tertiary industries that supported and interacted with the federal government such as law firms and trade associations.

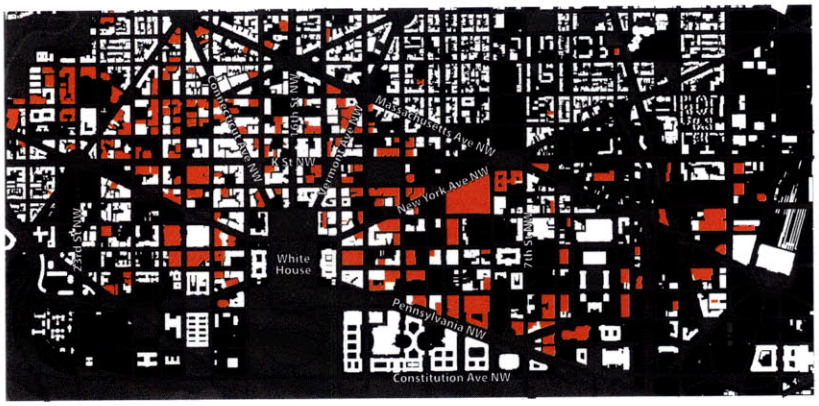
The result was a steady increase in the construction of buildings reaching the height limit (see figure 3-7). At the time the height limit was enacted, the major concentration of height was around the White House, along corridors both East (15th Street NW and Pennsylvania Avenue NW) and West (17th Street NW). The traditional downtown of small shops centered on 7th Street NW also had some tall buildings, including a few government structures. For the most part, the City was one of townhomes, the regulations in effect creating variegated vistas along L'Enfant's streets (see figure 3-8).



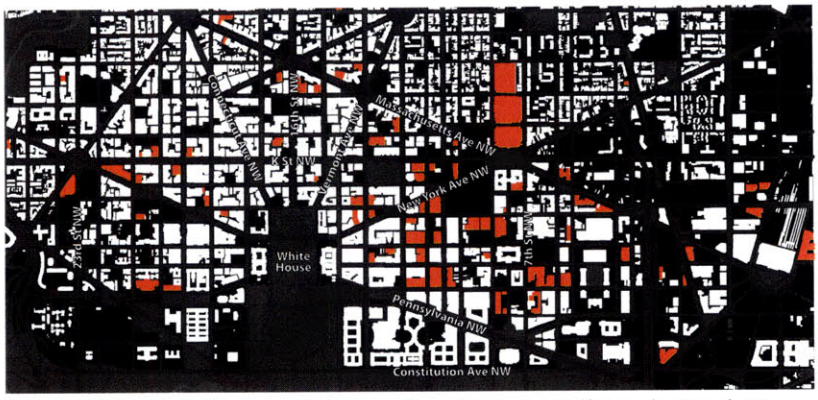
1910-1950



1950-1970



1970-1990



1990-2005

figure 3-7. Buildings built to zoning limit over time, based on year built (does not include major renovation).

Through the Great Depression, New Deal and both World Wars, DC's core expanded upwards relatively little, with most of the tall building dominated by federal buildings. By 1950, Federal Triangle, between Pennsylvania Avenue and Constitution Avenue was mostly built out with buildings at or close to the binding limit. Public buildings also reached the height limit westwards, toward Foggy Bottom. Private tall buildings continued to radiate outward from the White House, mostly to the east, but also a bit northwards, toward what has become known as the Golden Triangle.

Post-War through Urban Experimentation

Between 1950 and 1970, the growth of DC's private economy is evident in its built form. During this time, binding buildings proliferated, most all of

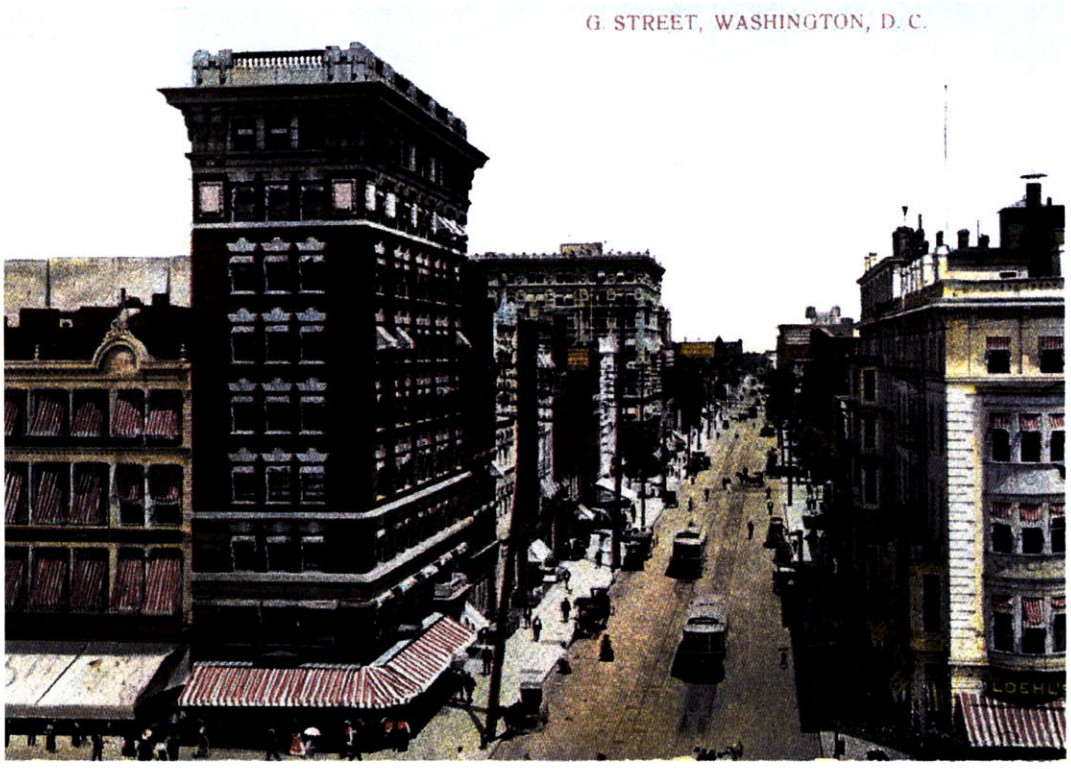


figure 3-8. Postcard from the early 20th Century looking down G Street NW.

which were private office buildings. Radiating about a half mile northward in a 90 degree arc from the White House, office buildings arose where there were previously townhomes. Development was relatively scattered within this area, likely representing the need to assemble sites for tall buildings, but also adumbrating the more spread out downtown that DC would develop. By 1970, downtown DC was a hybrid of its original low-rise urban form and the height-restricted downtown buildings.

As this binding limit was becoming evident in the form of DC, the era of renewed interest in tall buildings gripped the rest of the country. It is no coincidence that in the same 1965 issue that *Architectural Forum* covered plans for Chicago's newest super skyscraper, the 1100 foot tall John Hancock Center, it discussed a recent report commissioned by the National Capital Planning Commission that examined the aesthetics of increasing DC's height limit. "The Washington Skyline Study" as it was known, was a report by architect Chlothiel Smith that marked a departure from previous studies. Between 1928 and 1967, this was the only of nine major height limit planning studies that examined or advocated for additional height. Those that did address problems with the limit such as NCPC's 1967 recommendations for the Comprehensive Plan (which were adopted) asserted that the 1910 Height Act allowed too much density.[14]

With the growth of downtown DC, as well as an impending subway system, "The Washington Skyline Study" was the first to examine what a raised height limit might mean for the City. It was notable for its examination of how height interacts with the L'Enfant plan not just in the core, but throughout the City. It was also the first to study how additional height might actually help emphasize the monumental core of DC and provide a relief to the growing monotony of downtown. By increasing the height allowance to 250 feet in certain nodes, including Dupont circle, it hoped to emphasize vistas and create vertical gates to the core.[15]

The Skyline Study was emblematic of a broader trend in the 1960s and early 70s, which was the period of greatest reconsideration of the height limit. Seven times between 1964 and 1971 Congress introduced legislation relaxing the limits in the 1910 Act, but no proposal ever made it out of committee. Perhaps most importantly, in 1971 a Zoning Commission study recommended raising the height in certain areas to 250 feet.

While other American cities lost their strict height limits by this time, DC's would survive unchanged. Although there was discussion, the very American ambivalence toward height resulted in a general disavowal of the Skyline Study and other attempts to raise the limit. While some argued that the height limit helps to protect federal buildings and monuments, in reality they are protected more by L'Enfant's plan with its vistas than by height limits. After all, it is difficult to see through a building whether it is one or one hundred stories tall.

Part of this reaction was based on an aesthetic preference for lower buildings. The reaction as with Commissioner Turesdell's in the previous century, was also likely the result of market perceptoin. Downtown's expansion upwards between 1950 and 1970 comprised predominately office buildings west of Vermont Avenue, avoiding the eastern side of downtown. While the expansion moved westward, the original downtown area to the east, around 7th street, degenerated. The steady decline along the older core of small commercial and residential along 7th Street was most viscerally illustrated by the 1968 riots, which hollowed out the area. Even as upward pressure was evident in certain areas, the market demand for additional height downtown seemed low. The argument, which continues today, is two-fold: that there is plenty of room to expand horizontally and that there is not really enough demand to build upwards. In the 1970s with urban decline, this held particular weight.

Growth Explosion

The era between the failed Zoning Commission recommendation (1971) and the federally-imposed Financial Control Board (1995) over local finances due to near bankruptcy saw the most intense amount of building to the height limit. While the federal government's employment shrank in the 1980s, commercial expansion continued, fueled by a push for the federal government to lease private space, higher federal government standards for square footage per employee and growing government contracting.[16] In addition, the growing prevalence of air conditioning and fluorescent light allowed DC's buildings to make up for their lack of height through deeper buildings with more interior space. Such large-footprint buildings fit well into L'Enfant's large blocks. Finally, the opening of the DC Metro in 1976 only magnified the pressure on downtown real estate.

The result of these forces on the urban fabric was the erection of private buildings to the height limit in an arc from the White House of about a half-mile in all directions, except to the south because of the National Mall. The Golden Triangle completed its transformation from townhomes to offices at the binding height. Development continued to push westward toward Foggy Bottom, northwards toward Dupont, and in a break from previous eras, eastwards toward the traditional downtown. In addition, Pennsylvania Avenue filled out to the North in the period due to the efforts of the Pennsylvania Avenue Development Corporation.

Despite this pressure and filling out, discussion of the height limit during the 1980s, and 90s focused predominately on implementation and interpretation. Congressional hearings and reports helped clarify the history and implementation of the limit, while urban design and zoning studies reaffirmed the importance of the horizontality of the City. This was likely related to the major shift in DC governance in 1973 when Congress granted Home Rule, setting up a locally elected government consisting of DC Council and

a Mayor. Despite delegating most authority for local governance to the new District government, the federal government retained control and oversight over the limit.

There was a precipitous drop in the number of buildings built in the late 1990s, likely due to the financial uncertainly of the District and the imposition of the Financial Control Board. But by the time the board was disbanded in 2001, construction had picked up again. This most recent era of building will be discussed in further detail in the following chapters which examine the current state of DC's market and the impacts of the height limit on the City.

An Anachronism

As Washington's regulations remained unchanged, most other cities dropped their strict height limits by the 1970s, with the notable case of Philadelphia, which held out until 1987. These cities felt the pressure of suburbanization from the 1950s on and had political interests that sought to ensure urban growth and prosperity. DC enacted many mid-century innovations such as urban highways and urban renewal, but it did not follow other cities in amending its height limit.

How did the height limit survive in DC where it fell in other cities? In their influential analysis of urban economies, Logan and Molotch outline the conflict between the "exchange value" of real estate, as studied by economists and the "use value" as experienced by those who actually inhabit a home. Their "growth machine" theory posits that groups such as developers, real estate agents, bankers and newspaper owners will encourage state intervention, such as large-scale redevelopment, in which they will benefit, often at the cost of those who simply have a use value interest in their home.[17]

In DC, this growth machine was not as strong as in most other cities, in large part due to the primacy of the federal government at the time. Both the banking and real estate development industries were less developed than in other cities, weakening interests that would typically promote urban growth and development. Even if they were as powerful, they faced a federal government with very different interests, as opposed to a municipal or state government that desired growth and development. At the same time, the federal government provided a secure and growing demand for space and business. Why would developers and owners bite the hand that fed them? In other words, the dichotomy between use and exchange value was less prominent due to the hegemonic influence of the federal government.

The survival of the limit marked a drastic departure from the typical policy feedback loop that allows policies to be revised over time, as seen in the evolving height and density restrictions in other major cities, especially New York and Chicago. Having weathered threats in the era of urban policy experimentation, the essence and underlying meaning of the legislation shifted. No longer were air and safety a concern, and even light became a secondary benefit.

The Height of Buildings Act graduated to become part of the tradition and mythology of DC. Unlike the European capitals, which had rich histories of over a millennium, DC was only 150 years old, for which most of that time it was little more than a large town. In the same way that the radiating avenues and marble neoclassical government buildings sought to exude a maturity about the City even before it was a mature city, the height limit became a tangible illustration DC's importance as a capital city.

DC's height limit as it was reached and filled in through the 1970s represented the symbolism, importance, and power of the federal government. It differentiated cities of capital, with their cathedrals of commerce from

this city of governance with its sacred skyline. There would be no skyscrapers piercing the skyline, exuding their commercial value, executives looking down over the City below as did the barons of San Gimignano. Most cities' skylines represent a meritocracy of urban form: those that are successful can afford to go up. Such an ethos seems inappropriate in a governing city, in which the primary value is ostensibly not the dollar but the vote. An equality of height viscerally (some might argue misleadingly) translates into an equality of power. Except of course, for that one structure from where the laws originate, the Capitol, which is one of the tallest buildings at one of the highest points in the core.

Given the mythology and newfound symbolism of the limit, Congress retained control of the height limit in 1973's Home Rule legislation. It built automatic review for all District legislation into its Home Rule Act, which could have been a mechanism to ensure the federal height limit was not violated. By keeping the height limit in the federal code, Congress showed the value it placed on height limits, and the degree to which it saw its role as protector of the symbolism of the Nation's Capital.

But it was not just the federal government that prevented the Height Act from adjusting. To the nation and the world, Washington, DC is the center of American political life and policymaking and a capital city of monuments and museums. To those who live in and around Washington, it represents a place to live and work. While there are some points of constant tension, such as voting rights, other aspects of this duality, such as the height limit exert countervailing forces. While some residents see the issue as one of overbearing federal governance, others enjoy the lower feeling of the City. Apart from the symbolism of the limit, many residents and visitors find the scale to be more amenable than other downtowns. So even if it were within the domain of the local government, it in unclear whether the height limit has become too sacred to lift.

Downtown DC is the product of a turn of the 19th century plan and a turn of the 20th century elevation regime. As the following chapters will show, understanding and evaluating the result involves placing these historical factors into the framework of a turn of the 21th century real estate market.

CHAPTER 3 NOTES

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2. Ibid.
3. Passonneau, J. (2004). *Washington through two centuries : a history in maps and images*. New York, Monacelli Press.
4. "Acts of Congress in Relation to the District of Columbia." (1791). from "Building height limitations : staff report for the Committee on the District of Columbia." (1976)
5. "Building height limitations : staff report for the Committee on the District of Columbia." (1976)
6. Passonneau, J. (2004).
7. As quoted in "Building height limitations : staff report for the Committee on the District of Columbia." (1976) 16.
8. Ibid. 22.
9. Ibid.
10. Willis, C. (1995). *Form follows finance: skyscrapers and skylines in New York and Chicago*. Princeton: Princeton Architectural Press.
11. "http://www.emporis.com/." (2008).
12. There would be 7 modifications after the 1910 legislation, all of which were minor exceptions or adjustments.

    "Building height limitations : staff report for the Committee on the District of Columbia." (1976)
13. "http://www.usgovernmentspending.com." (2009).
14. National Capital Planning Commission. (1991). "Draft of Monumental Core Data. Summary: Background on 1910 Height Act Issues, Circa 1930-1980."
15. Bailey, J. (1965). "Does Washington need a skyline: an affirmative study receives a unanimously negative reaction." *The Architectural Forum* 122(2): 32-35.
16. Delta Associates. (2005). "DC Office Study." from http://www.downtowndc.org/news/reports/dc_office_study_2005.
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figure 4-1. Washington, DC's trench-like streets

Chapter 4

Unintended Consequences

> "In typical American fashion, Washington will be-in fact already is-the world's highest low city, a weird distinction comparable to that of being the tallest midget on earth." James Bailey, Architectural Digest. 1965.

If the skyline of modern New York City served as the archetype for the trash-scrapers of the movie *Wall-E*, then perhaps the contemporary streetscape and skyline of DC is best reflected in a more retro space movie: *Star Wars* (see figure 4-1). At the same time as the form of DC began taking solidifying under the height limit, this 1977 epic space opera included a final scene in which the protagonists have to navigate their spaceships through the Death Star, a man made space station the size of a moon, to destroy it. Winding their way through the surface of the Death Star, one is reminded of walking the streets of downtown DC, as the canyons that the ships navigate are almost as wide are they are deep, giving it proportions similar to the DC form. The walls of the antagonist space station, which seem to continue on forever, are reminiscent of the today's DC streetscape, with its boxy office buildings lining L'Enfant's straight, wide streets.

Having traced the history of urban height and the history of DC as it relates to its z-axis, this chapter explicates the impacts of the height limit over time, most of which were unforeseen. After an overview of the literature on the costs and benefits of restricting height, observations of DC's current situation will begin to draw connections between the trajectory of the height

limit and its impact on the spatial and economic disposition of the City. The next chapter continues the analysis by quantitatively examining density and height in DC as compared to other cities.

IMPACTS OF HEIGHT REGULATION

As with any regulatory action, there are likely costs imposed by the height limit. Yet, when the limit was passed in 1910 and there were very few buildings at or near the height cap, the economic costs of the limit must have seemed minor, if they were perceived at all. As the core has developed to the limit, though, the economic impacts are likely to become more acute. Research on the costs and implications of height limits and related density limits is not voluminous but can help shed light on some of the theoretical impacts of such regulations. Economic literature in particular focuses on costs and deadweight losses due to regulations.

Because height limits are no longer a primary driver of form in most cities, there are far fewer studies on the costs of height restrictions than there are on more general land use regulations in residential areas. Even so, the general effects might be the same. Quigley and Rosenthal provide a study of the literature on the costs of land use regulation.[1] Most studies focus on residential areas, examining the effects of "exclusionary" zoning, which are regulations used predominately by suburban communities to protect land values and control the type of development (and perhaps the type of resident) in the area. Because of difficulties in gathering accurate pricing data as well as problems in quantifying regulations, the authors find it hard to draw general conclusions, but do find some pertinent trends among the research. A number of studies show that more land use regulation causes the price of housing to increase. The net effect on land prices is difficult to ascertain because of the countervailing effects of a decreased supply combined with less valuable land per acre.

The difficulties encountered in measuring the impact of regulation on housing, are equally as problematic in determining the effect of height restrictions on other land and structure prices. In DC, the height limit restricts the overall supply of building space, making it more expensive per land area. Whether this makes rent per area of land (and net land value) more expensive depends on demand. Empirically measuring the impact without a plethora of data that can address the complexities of price and demand over time is impossible. But there are a few studies which examine height restrictions and provide results similar to those that studied the impacts of land use regulation on housing.

Bertaud and Brueckner show normatively and empirically that FAR restrictions, which are a more general version of height limits, result in additional horizontal expansion of a city.[2] By assuming that residents at the edge of a city pay the same for housing, they can then measure the utility cost of density restrictions and horizontal spread solely in terms of additional transportation costs. Both a simulation and an empirical measure in Bangalore, India showed an increased cost of about 1.5-4.5% of household income. They argue that the rationale for restricting density based on infrastructure stress is hard to justify because while it lowers the need for infrastructure at the center, density limits require additional infrastructure on the outskirts as the city expands outward. The marginal costs of additional capacity in the center and that new infrastructure on the edges are difficult to measure and compare.

Arnott and MacKinnon use a general equilibrium model to show that the welfare impact of height restrictions upon residents is relatively small and could be beneficial if height limits create a better distribution of utility.[3] Their model shows that landlords gain from height restrictions, though Bertaud and Breckner estimate that this gain is less than the loss to the welfare of residents in general. The model predicts that where height restrictions are binding, land rents are lower, while they are higher outside of the

binding area. It also shows that nonbinding buildings under a height limit are demolished sooner than otherwise, as the value of capturing the extra height is high.

While the previous studies focus on the effects on residential prices and assume all employment is in the center of the city, Sullivan extends the equilibrium model to examine the effect on labor demand in both the CBD and suburbs.[4] The model finds that a height limit in the CBD reduces wages in the entire area, reduces total employment, increases the area of suburbs, decreases the area of the CBD, increases land values in the suburbs, and decreases CBD land rent. The unique finding is that the area of the CBD is smaller, due to a loss of economies of aggregation caused by the height restriction. Generally height restrictions shift production and residences to the suburbs.

IMPACTS OF TALL BUILDINGS

The economic literature finds that restrictions on the market, including height and density regulations, likely have a negative overall impact. The literature on the social impacts of building height generally points the other way, tying height to a number of problems. At the very least, it shows that tall buildings are no more beneficial than low buildings. Newman's *Defensible Space* is one of the more prominent examples of studies tying high rises to negative outcomes, such as crime.[5] Yet, as Gifford's review of literature shows, there are studies that tie tall building to increased morbidity, lower rates of socialization, lower satisfaction rates, and decreased quality of living for children.[6] In many cases there are studies that show no effect. How can there be such broad disagreement?

There are a number of conceptual and practical difficulties in measuring the social impact of tall buildings. Cooperman provides a review of the various problems, most of which relate to a lack of random selection.[7] Residents of tall buildings are often self-selected or, in the case of public

housing, selected by others, to live there. Because many studies focus on high-rise public housing living, they cannot determine the extent to which a tall building as opposed to socioeconomic status determine negative outcomes. He proposes a network analysis approach to overcome these problems, but it appears to never have been implemented. Gifford's more recent review acknowledges this, concluding of the problems related to tall building "a few may be caused by the building form itself, but many are moderated by non-architectural factors."[8] It concludes with a call for more well-designed studies, but notes that the interest in the general topic has waned in recent years and is much lower than in the 1970s.

As with the economic literature, most of the literature on the human impact of tall buildings focuses on residential tall buildings, providing little sense of what the costs or benefits of tall office buildings might be. It is difficult, then to apply these studies to DC's situation. Even those 9-12 story buildings in DC which are residential may not be considered "high rises" in some of the studies. Since most of these are newer buildings, which likely have a different demographic makeup than those of tall buildings in many of the studies, the literature is not particularly relevant. But it is important to keep in mind if ever considering advocating additional residential buildings or raising the limit.

DC's Market Today

Because urban markets and social interactions are so complex, the effects of height restrictions are very difficult to determine. Correlations are possible to observe, but determining that height is the cause of a particular phenomenon, whether increased rents or increased morbidity is often not possible. Given the general contours of the literature on height and height restrictions, the next two chapters seek to examine DC's height from various observational and comparative perspectives to determine what the consequences of the height limit have been upon the urban market, the physical construction of the City and its spatial distribution. While the same

problems of causality will present themselves, when the observations are combined it is possible to make plausible arguments about the implications of the limit. Using these observations and hypotheses combined with the historical knowledge of the previous chapters, the final chapter will propose how the height limit should be treated today. A brief overview of the nature of Washington, DC's current economy is necessary before delving into the details of its spatial and market structure.

DC's raison d'etre is the public sector and governance, a departure from the typical private market competition of other cities in the United States. The District was created in part so it would not have to take sides among the natural competition of the cities in the early republic. It is similar to a single industry town, like the old mill towns of the Northeast, manufacturing towns of the midwest or resort towns such as Las Vegas and Orlando. The crucial difference is that its single industry is much less prone to decline. Even after the Reagan-era cuts to the federal government, the DC economy still expanded in large part due to increased government contracting activities and increased employee space requirements for federal agencies.[9]

The entire metropolitan area derives much of its economic engine from the federal government, with the stability of and reliance on the federal government especially pronounced in the District itself. Yet with the explosion of growth in the last 50 years, this reliance has declined, pushing DC and the metropolitan area to compete with other cities for economic growth. Assuming that the District is only the province of the federal government would relegate discussion of the height limit to aesthetic values.

While these aesthetic values are important, there is a need for analytical examination of the economic and spatial implications of height and its restriction on a city. In much of the recent debate, the non-aesthetic implications of the limit are predominately a matter of supposition and projection.

To address the need for a greater degree of analytical understanding, this analysis focuses on market and economic implications. It assumes that DC does and should compete with other cities as well as other centers in the metropolitan area, while acknowledging that DC exists in a unique political situation. Some options that would be acceptable in any other city in the U.S. are impossibilities, at least in the foreseeable future, in DC. Given this understanding of the broad economic situation, an examination of DC's real estate market will begin to put the height limit, as it affects the City today, into context.

PHYSICAL MARKET SECTORS

The previous chapter focused on describing the evolution of the core because that is where the binding height limit has historically been most evident. Yet there are really three categories of areas that exhibit different responses to the limit:

1. the downtown core, or central business district
2. secondary central markets, mostly surrounding the downtown core
3. primarily residential markets that make up a majority of the District of Columbia's land use

The unusual nature of the height limit is most evident in the first two areas, where buildings tend to reach the commercial binding limit of between 110 and 160 feet. These areas are usually zoned C-4 or C-5 where the federal height regulation and zoning limit are the same. There are buildings outside these zones that are built to the federal height limit based on zoning relief, special zoning, and planned unit development, mostly in the C-3-C, 90 foot high zone. This analysis focuses on these three commercial zones rather than the residential zones which allow at most 90 feet (see figure 4-2 for a map of the areas of focus). Such an analysis would be very different, focusing primarily on housing and desirable residential neighborhoods. Even though the impetus of the height limit was residential, its impact is most visibly seen in the commercial core. And while commercial buildings

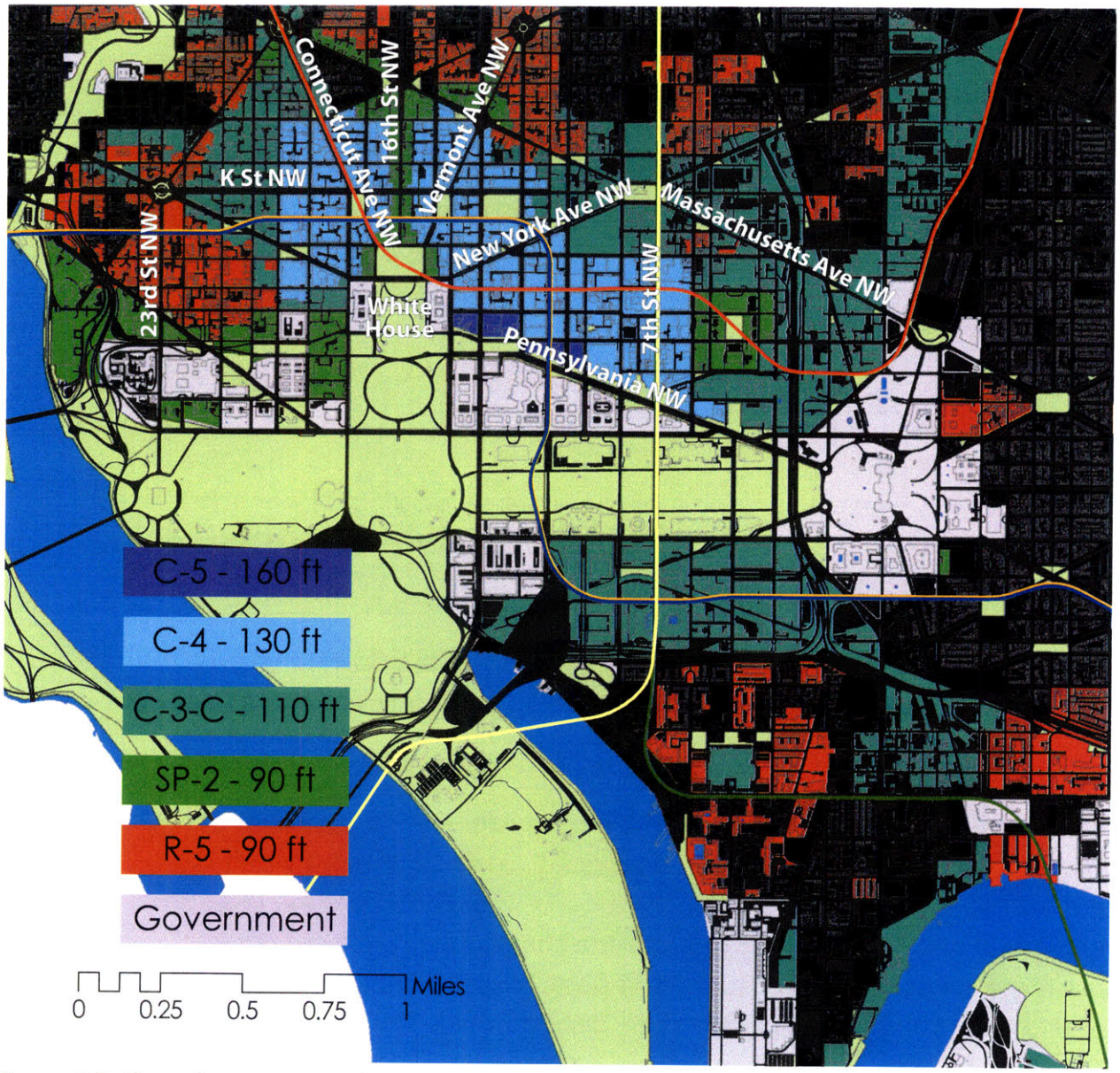

figure 4-2. Downtown area zoning. The focus areas will be the commercial areas in blue and green

are restricted in residential zones, residential buildings can be constructed in commercial zones (so-called hierarchical zoning), and show up in a few of the areas studied.

The first area, DC's downtown core, which consists of the West End/Foggy Bottom, Central Downtown, and the East End/Chinatown behaves in a unique manner because of its proximity to the halls of the federal government (see figure 4-3). Few other addresses in the country convey the same access to power as do those along K Street or Pennsylvania Avenue. The market for these downtown offices, which includes law firms, professional associations, lobbying firms, media outlets, and accounting firms, exhibits a high inelasticity of demand and can bear extremely high rents for the value of location.

This market is surrounded by a ring of historic townhomes that are part of the third category of DC's market sectors. Starting to the west and proceeding clockwise to the east are the neighborhoods of Foggy Bottom/Georgetown, Dupont Circle, Logan Circle, Shaw/Mount Vernon, Eckington, and Capitol Hill. Southwest to the south used to be a neighborhood of townhouses, but was completely demolished in an Urban Renewal scheme in the 1950s and 60s. It left a major physical and psychological scar on the City, contributing to the end of large-scale appropriation of townhome neighborhoods for downtown office buildings. Building height, zoning and historical constraints on the neighborhoods immediately surrounding the central core remain, creating an effective barrier to the growth of 110-160 foot tall buildings. So as the primary core has grown, the importance of other commercially-zoned zones, located in the secondary core, has also grown.

The secondary areas are as much defined by psychology of proximity to power as they are by any physical boundaries. The band of areas, moving counterclockwise from the Potomac, includes Southwest/Waterfront, Near

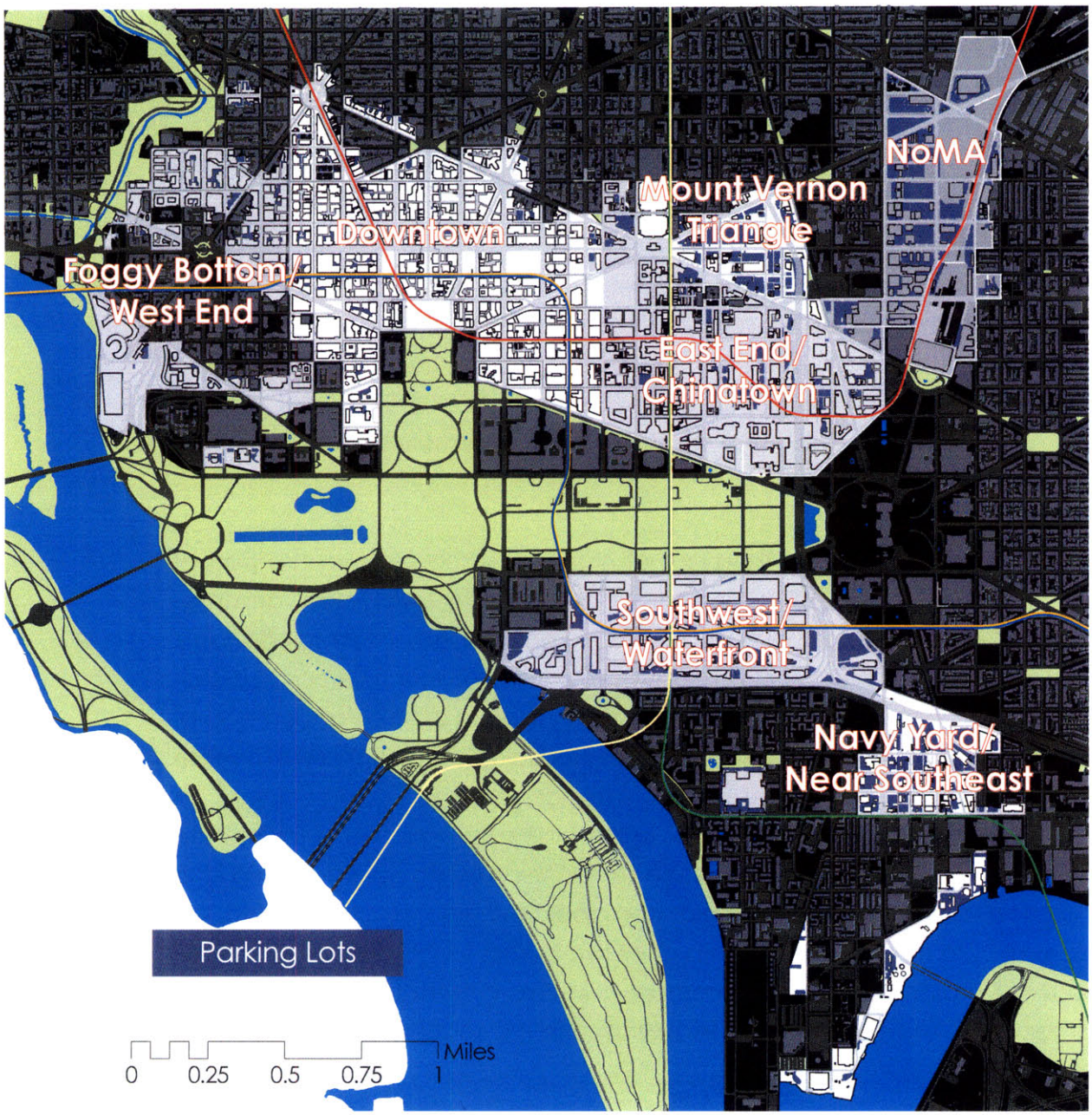

figure 4-3. Commercially zoned areas in focus markets

Southeast/Navy Yard, NoMA, and Mount Vernon Triangle (see figure 4-3). With the exception of Mount Vernon Triangle, all are physically separated from the core by the national mall, the Southeast-Southwest Freeway or I-395. Yet all have DC Metrorail stations that are no more than a few stops away from the core.

BUILD OUT

The question of whether height is really needed in DC dates back to the first building height regulations. At the time, when DC was still a sleepy town of townhomes surrounded by large swathes of open space, placing a cap of 90-130 feet on commercial buildings was not seen as market-distorting given the lack of demand. Even today, some point to the undeveloped sections secondary markets as evidence that the demand for space is, to date, insufficient to warrant any taller buildings. If DC's market has not utilized the space it has, the thinking goes, why would more space through taller buildings be necessary?

These secondary central markets are marked by lower real estate values than the central core, recent growth, and a significant commercial market. While the core is the prestigious location in the metro area with no rival, the secondary markets compete more directly with surrounding markets, depending on both price and amenity considerations to attract businesses.[10] The relationship between these markets and those in nearby Virginia and Maryland will be quantitatively addressed in the next chapter, but it is telling that while areas such as Rosslyn and Bethesda boomed with buildings higher than DC's limit starting in the 1970s, the more proximate secondary markets remained comparatively underdeveloped.

The demand curves for DC office space varies from a high inelasticity of demand by law firm and lobbyists who need to locate close to power to nonprofits and other small businesses that have a more elastic demand.

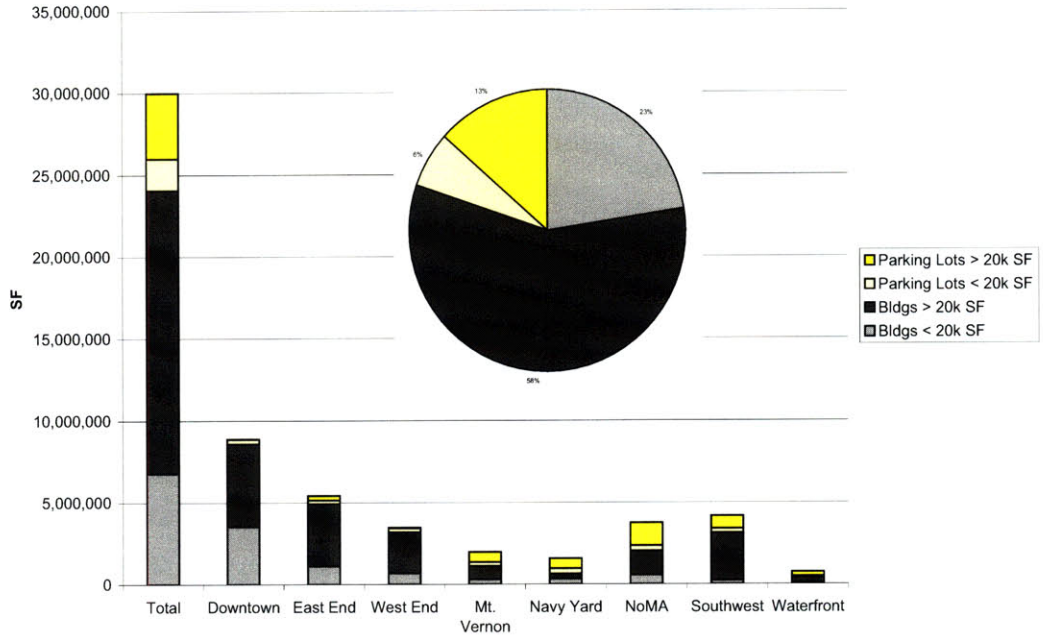

figure 4-4. DC's available height by square footage of land

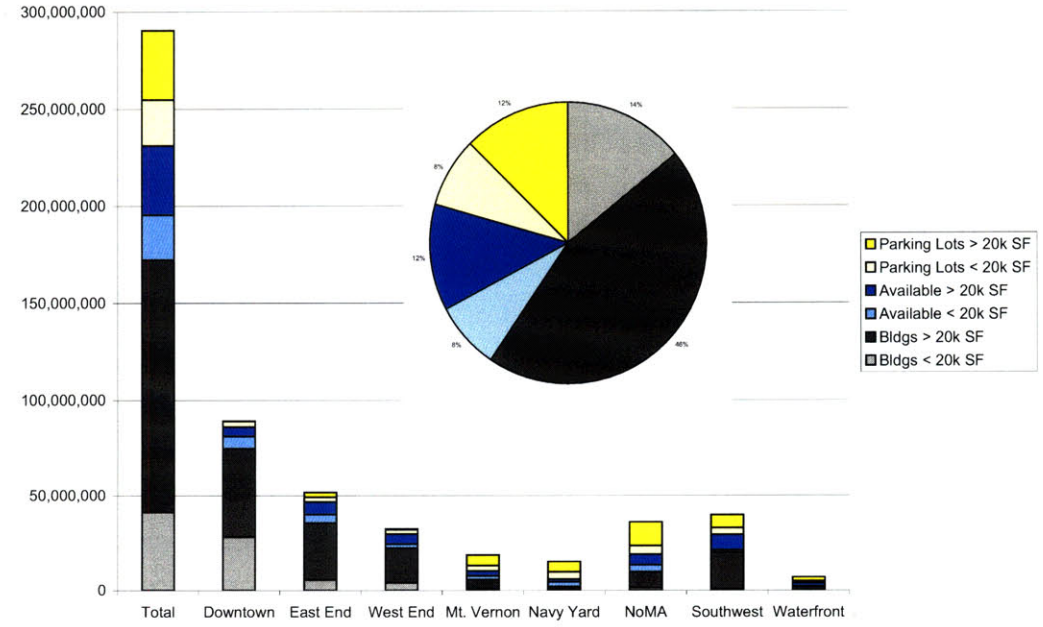

figure 4-5. DC's available height by estimated building area

Analyzing the two DC commercial market types by how much floor area is still available under the limit illustrates that the core is mostly built out, indicating high demand, while the secondary markets are still developing (see figures 4-4 through 4-7).

Available land is usually banked as surface parking and only lots of a certain size (assuming about 20,000 square feet) could support a tall building (see figure 4-3 for a map of parking lots and Appendix 3 for numbers). Given absorption rates provided by the Downtown Business Improvement District it will take about 16 years before the entirety of the downtown commercial areas will be built out to the height limits. Urban build out will spell significant problems for both the local government and the downtown as whole, as it slows tax growth, makes development much more difficult and puts DC at a competitive disadvantage with the surrounding activity centers. While the discussion to this point has focused on DC proper, in reality its height limit interacts with the broader metropolitan area, and especially the adjacent activity centers.

DC METROPOLITAN AREA

Much as there are three types of markets within DC, where there is the rigid height limit, there are three primary types of markets when comparing the height limit within the metro area:

1. DC centers
2. adjacent activity centers
3. suburban centers

The DC centers include the downtown core and secondary markets previously discussed which are subject to the height limit. Around this core, are adjacent semi-urban centers across the Potomac in Virginia or in nearby Maryland. The last market comprises the suburban or tertiary centers such as Tyson's Corner, which are less directly competitive with the core of DC. All three of these areas will be a part of the density and activity analysis in

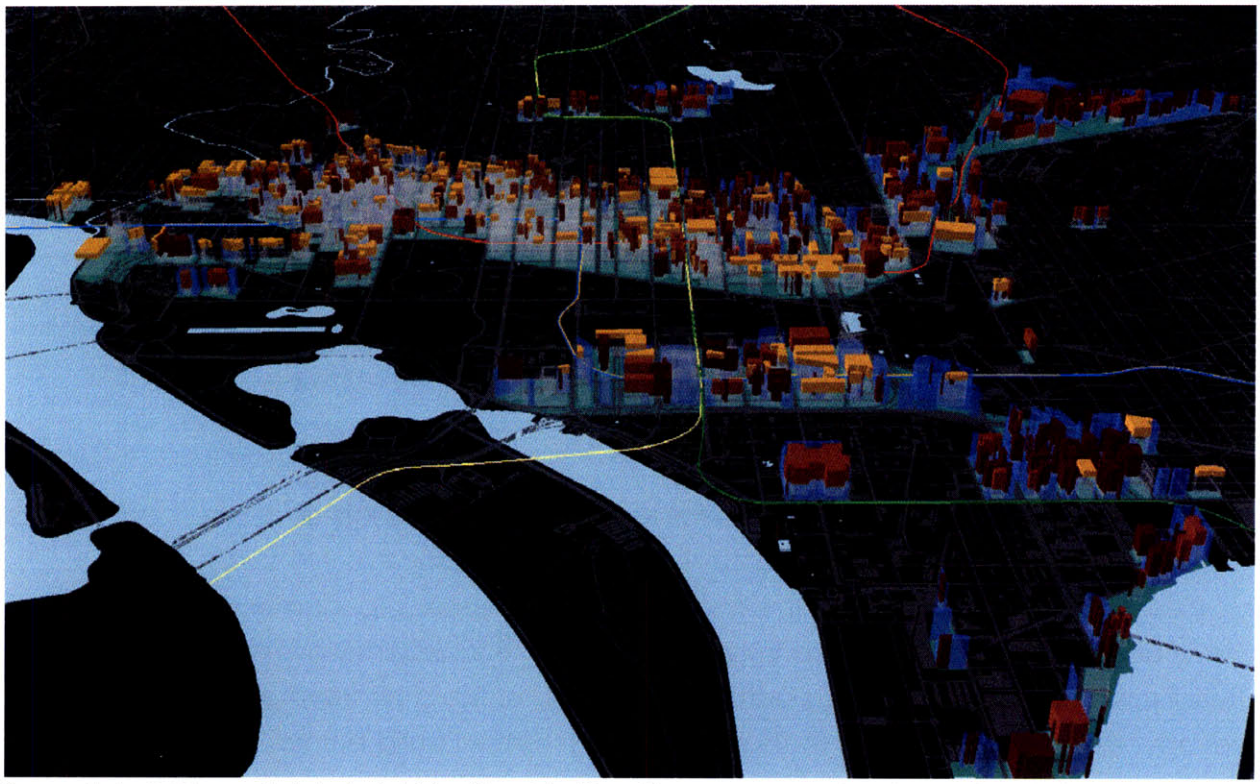

figure 4-6. DC's available height looking North, with oranges and reds marking height above buildings and blue marking parking lots

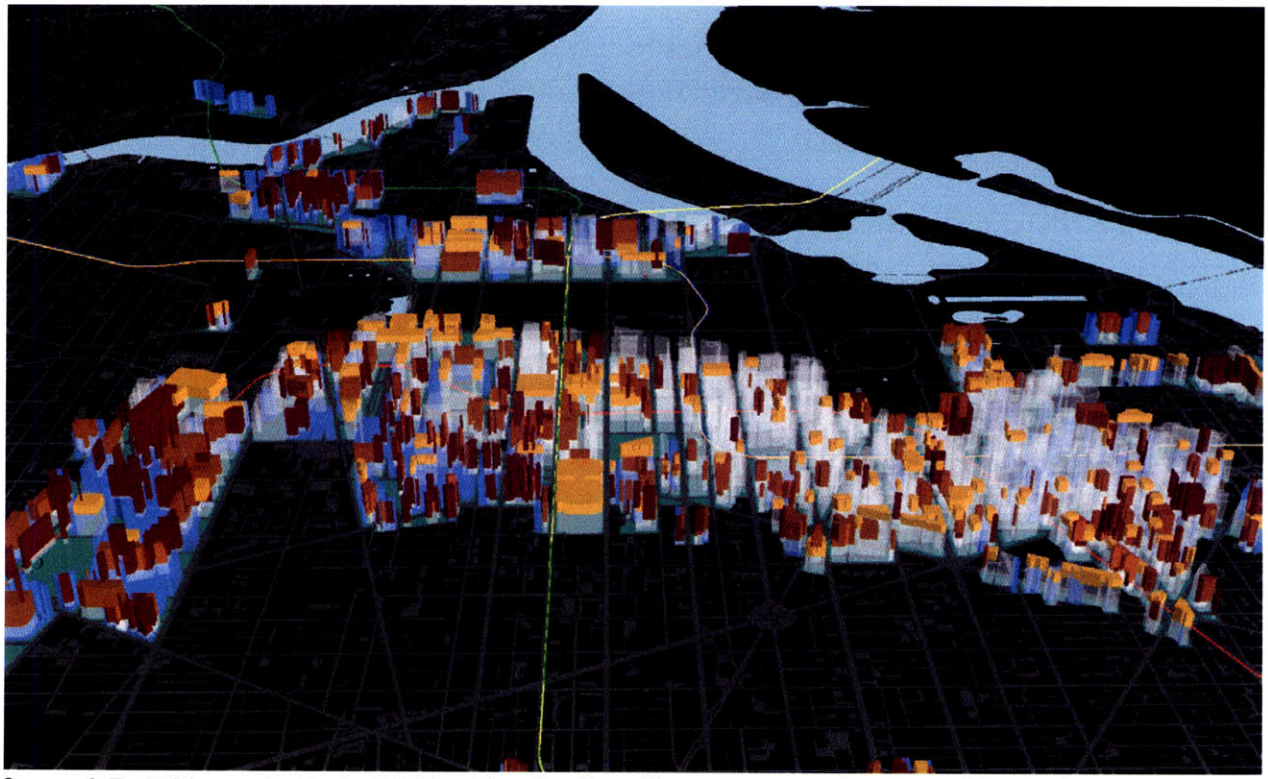

figure 4-7. DC's available height looking South, with oranges and reds marking height above buildings and blue marking parking lots

the following chapter.

Because of their proximity by road and rail, the semi-urban centers compete directly with the height-restricted core of DC and offer points of comparison for analyses of height in the next chapter. Christopher Leinberger, an expert at the Brookings Institution, has argued that in the last 60 years, DC has lost some potential rental space to these areas.[11] Rosslyn and the Ballston Corridor in Arlington are of particular interest for they contain buildings that exceed DC's height limit and are within eyeshot of the Capitol and White House. This area has 5 buildings over 300 feet tall and more than 100 buildings taller than 13 stories, which is approximately the building height in DC.[12] Even outside of this area of significant height, the subcenters of Crystal City and Alexandria in Virginia and Silver Spring and Bethesda in Maryland each contain more than 25 buildings that are 13 stories or taller. All of these areas developed significant height and density in the last 30 years, much later than DC's height restriction. All of them grew up around DC Metrorail stations.

RECENT MARKET TRENDS

Though the rate at which buildings hit the binding limits in the last decade was lower than in previous periods, construction of binding buildings continued on the east and west outskirts of the central core. Much of the development was focused to the east, around the traditional downtown core of 7th Street NW, helping to revitalize a previously troubled real estate market. To the west, George Washington University continued to fuel the development of Foggy Bottom, though the tension between low-rise townhomes and growing height-limit buildings was most evident in this neighborhood.

Recently the secondary central markets, with the build out of the core and real estate boom, began developing rapidly. The relatively low land values became an asset, with both residential and commercial buildings rising to the limit. Office buildings are still arising in all of the neighborhoods, with

rents comparable to surrounding jurisdictions. Within the past few years, each of these markets, except Southwest, created business improvement districts, as major commercial buildings began entering the market. In addition, binding residential buildings began popping up in area such as Mount Vernon Triangle, Near Southeast, and Southwest. Residences, after all, are less likely to value this psychological connection to power.

Southwest DC is different from the other submarkets in that it is heavily residential, with both townhouses and multifamily apartment buildings constructed in the 1960s. Unlike the other residential neighborhoods that act as boundaries, Southwest is not historic and is not as dense, allowing for a greater degree of redevelopment and growth. Already there are major redevelopment efforts underway in Southwest, so it is only a matter of time until that neighborhood too has a critical mass of commercial space and its own business improvement district.

RESIDENTIAL IN THE CENTER CITY

While some have pointed to DC's zoning as a reason for the historic concentration of offices downtown, zoning and the Height of Buildings Act allow for multifamily buildings in commercials districts. Until recent years, it was just uneconomical to build residential instead of commercial. After all, an office worker uses much less space than an average individual at home. But the economics began shifting, especially on the perimeter of the core and in secondary central markets, with a proliferation of residential buildings built to the limits. With this shift, the implications of the height limit are broader than just the commercial market, and could begin to impact politically-valuable topics such as affordable housing. The competition between residential and commercial space and the way in which the height limit interacts with these will be discussed further in the next chapter.

Since much of the growth in the 2000s was residential, the recent housing

and economic collapse has adversely affected construction and growth. There are still a number of residential and commercial buildings rising to the limit, but the occupancy of completed buildings is relatively low, so the addition of more office and residential space combined with a broader economic malaise, will likely only dampen the market further. It is now difficult to say whether and to what degree the market is overbuilt and how long it may take to recover. Perhaps even more questionable is the role of residential tall buildings in the urban core. Were they anomalies or will their construction resume once the market recovers? It is difficult enough to understand the current market, much less speculate on the future construction of binding buildings. While this investigation takes a longer perspective, given that in the past a reason for retaining the existing rules was lack of market demand, the reality of today's market plays a role in any discussion of change.

IMPACT ON THE CORE

The height limit applies to both the core and secondary markets in the same manner, yet it impacts them in distinct ways. DC's economy is blessed by the symbolic value of power, and its core has developed to capacity in response to this. In this area, the economic impact is predominately through the opportunity costs, while there are noneconomic costs such as the loss of historic core and townhouses as well as the creation of a massive area of office-dominated land.

Arnott and Makinnon predict that where height limits are imposed on only part of a market, those buildings that are not built to the limit are demolished earlier, while those above the binding height are preserved longer that usual.[13] As there were very few buildings above the limit when it was imposed in DC, most of the impact has been on the large-scale demolition of downtown buildings below the limit. Especially through the 1970s, entire blocks of townhouses or 3-5 story buildings were torn down to be replaced by binding office buildings. Since the 1980s, efforts have been

figures 4-8. Historic buildings near Gallery Place

made to preserve more of the historic stock, often through so-called "facadectomies" wherein the bricks that make up the facade are preserved, while the remainder of the building is minimally preserved or totally demolished. This phenomenon is seen mostly in the areas that have developed more recently to the east of 13th street (see figures 3-2 and 4-8). Even where facades are preserved, the nature of the expanding downtown has changed greatly from a residential and mixed-use core to one of predominately office.

As shown in Chapter 3, the history of urban height is marked by an ambivalence rooted in a tension between market and psychological forces. So no observation is complete unless it actually discusses the very physical implications of height that elicit the psychological reactions. How then, does DC's height restriction manifest itself on the urban scale? Most informal

discussions of the height limit focus on this visceral question, as the pedestrian-level implications of the height limit are the easiest type of impact to understand.

Downtown DC today, as mentioned, is primarily built out to the zoning and height limit regulations, representing the century-old ideal of "an orderly city of horizontality" with its sacred skyline.[14] Most all buildings are between 110 and 160 feet tall. As mentioned previously, many are relatively massive structures and take up 100% of the lot area, with an FAR of 10-12. Even where alleys run inside the block, allowing for smaller buildings, the buildings still feel heavy because they are built to the lot line. The small gap of the alleys does little to break up the feeling of mass.

There are a few exceptions to the walls of buildings of incessantly similar heights, including a few historic structures. Apart from the historic "preservation" buildings, some buildings attempt to add architectural flourishes such as towers (which are exempt from the limit) to help break up the monotony. One Franklin Square is a notable example, given that it is the length of a large city block and fronts the Franklin Square park, allowing for unobstructed views from a number of directions (see figure 6-1). More recent residential buildings have had the luxury of creating undulating exterior walls to help moderate the feeling of massiveness.

This orderliness has been described as boring and difficult to deal with architecturally. "Standing shoulder to shoulder [Washington's buildings] differ in design, but are monotonously similar in bulk" wrote one architectural critic 45 years ago.[15] The buildings that arise in the building envelope constricted on one end by the height limit and pushed on the other by economic realities can be described as challenging architectural puzzles as well as bland boxy tedium. One DC planning official joked that DC is where the best architects go to do their worst work. Robert Sponseller, a DC architect, opined that "shorter buildings and wider streets are the architectural

equivalent of stepping into the batter's box with two strike against them."[16] Yet others have found the constraints challenging, forcing a creativity in design of both the interior and exterior.[17]

The downtown DC model, because lot coverage can be 100%, avoids some of the dead space created by the plaza phase of skyscrapers, wherein the skyscraper would be a tower surrounded by a stark open space. Engagement with the street, which has been compared to Paris, can improve the pedestrian experience.[18] Engagement is aided by the economic realities of parking. Because above-ground space is so limited and valuable, typical buildings contain underground parking structures and there are no above-ground parking structures. This helps create more potential areas of engagement with the pedestrian. As DC architect Michael Wynn Stanley put it, because of its lower heights, "Washington has a far better living standard, and environmental standard in its urban fabric."[19]

Despite the potential to have engaged streets, DC suffers from the same "office ghetto" symptoms that afflict many American downtowns. As a 1965 Washingtonian magazine article so colorfully put it, "You live in a depressed area. Your downtown is short, fat, sexless. It gets narcolepsy at 6 p.m."[20] While retail options and street engagement abound during the hours of 8 to 6 each weekday, for the remainder of the time, the area is mostly deserted and shops are closed. This is less true on the eastern, western, and northern extents of the downtown core, near Chinatown/Penn Quarter, Foggy Bottom/Georgetown, and Dupont Circle, respectively. It is no coincidence that these are the places marked by greater mixed use and residential options. Still, like most downtowns, what was once a thriving retail center is now a predominately single-use district of offices.

In addition to the experience of a pedestrian walking around the central core, the height limit affects the perception of the City from a greater distance. Whether walking around the White House or driving in from the

figure 4-9. The tall buildings of Rosslyn beyond DC's low buildings

highway, DC's profile is very different from other major American cities. From the mall or in and around the core, the profile is one of a consistent mass. The straight, wide streets seem to emphasize the consistency of the height, as if an exercise in perspective and vanishing points. From the highway, the City seems to be large block pierced by the needles of the Washington Monument, Capitol Dome and Old Post Office. In part because they are so spread apart, they lack the sense of power conveyed by skyscrapers in most major American cities. Even though it's buildings are twice as high, some find this regularity in height reminiscent of Paris or other beloved European cities.

IMPACT ON SECONDARY CENTERS

The effects on the secondary centers are rather different and more economic in nature. As mentioned in the previous chapter, these areas are much less developed than the central core, even as areas further away and outside the height limit have developed rapidly. This is certainly due to

figure 4-10. Real estate executives in Rosslyn who are proud of the unobstructed view of DC from their newest 300 foot building
(Source: Real Estate Bisnow 2009)

a number of factors, but the height limit has likely impeded their development.

Psychologically, the height limits prevent visual connections to the core. Even though many of the submarkets are very close to downtown, they are not considered prime locations. Whereas tall buildings in Rosslyn have the added prestige of viewscapes over the monuments and to the Capitol Dome (see figures 4-9 and 4-10) those even in NoMA at 9 to 11 stories hardly get that. They are seen as less desirable secondary markets in part because they cannot see the power corridors.

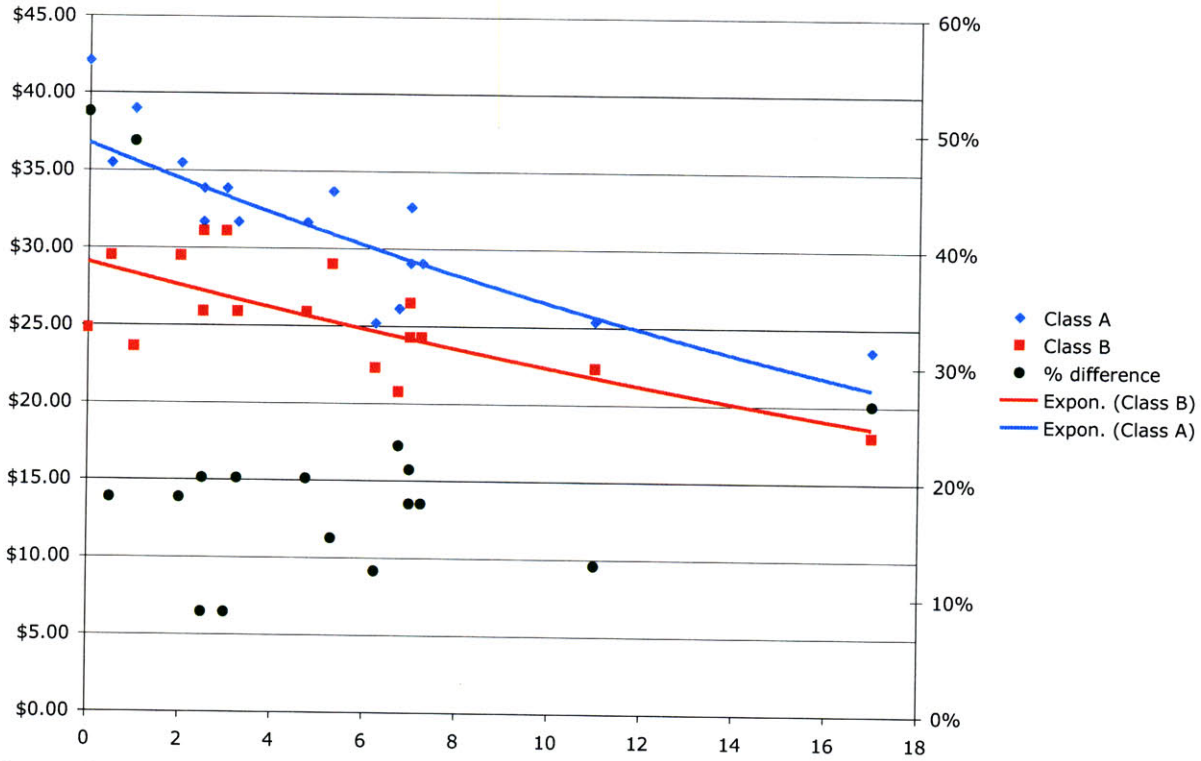

figure 4-11. Commercial rent prices in DC by distance and percentage difference.

In addition to the psychological is the economic impact. The core and the secondary markets exhibit a much greater difference between Class A and Class B rents than the rest of the region (see figure 4-11). Utilizing submarket data from an office market study, both these markets exhibit an almost 50% difference between the top office rents and those of less desirable space. This is almost twice as much as the next areas whose difference ranges from 9-27%. Such a rent premium highlights the very high demand for office space in the core compared to anywhere else in the region. It shows just how the secondary centers compete directly with centers in surrounding jurisdictions, which do not have a height restriction.

PLAN VERSUS ELEVATION

Whereas L'Enfant's plan was forward-looking and accused of a grandiosity inappropriate for DC at the time, the height limit was exactly the opposite: a reactionary move meant to preserve the existing state and prevent certain types of innovation. L'Enfant created a complex plan rooted in irregular harmonics, whereas the height limit was a simple rule that created regularity in height. L'Enfant was dreaming of the future while the framers of the height restrictions were fearful of the present.

Yet there has never been an effort to determine the best vertical compliment to L'Enfant's plan, especially given how much buildings have changed since the turn of the 19th century. Compared to other cities, L'Enfant's wide streets could in theory accommodate taller buildings, given that wider streets allow for more light and air. New York's streets and alleys comprise about 35% of its total land, while in DC, the percentage is almost twice as high, at 65%. If federal parks and reservations located in urban area are included, this proportion would be even higher allowing for both tall buildings and light.[21]

The best opportunity to formally consider how modern buildings fit into L'Enfant's plan was the 1901 McMillan Commission. Yet it was relatively silent on tall buildings and height limitations. It only addressed private buildings adjacent to federal interests (a small portion of the downtown core). Witold Rybczynski has postulated that there was an implied desire to limit height, given the lack of tall buildings in the plan, the commission's veneration of Paris, and the involvement of Daniel Burnham, who had no tall buildings in his famous plan for Chicago.[22] If Paris was indeed the ideal model, with its low, dense, mixed-use buildings creating a unique urbanity, then perhaps the height limit was set too high, losing both urbanity and architecture.

With the silence of the commission, height limits that were passed essentially on a rule of thumb became the norm. Little could policymakers at the turn of the 20th century imagine what DC has become, with its massive, low downtown. Little could they have expected the massive economic and real estate shifts that would occur in DC. What is left now is a market that is almost built out in the core and growing unsteadily in the secondary central areas, as they compete with the surrounding activity centers. The next chapter seeks to understand how urban height and its restriction impacts both the spatial and economic situation in DC through a number of quantitative comparisons at various scales.

CHAPTER 4 NOTES

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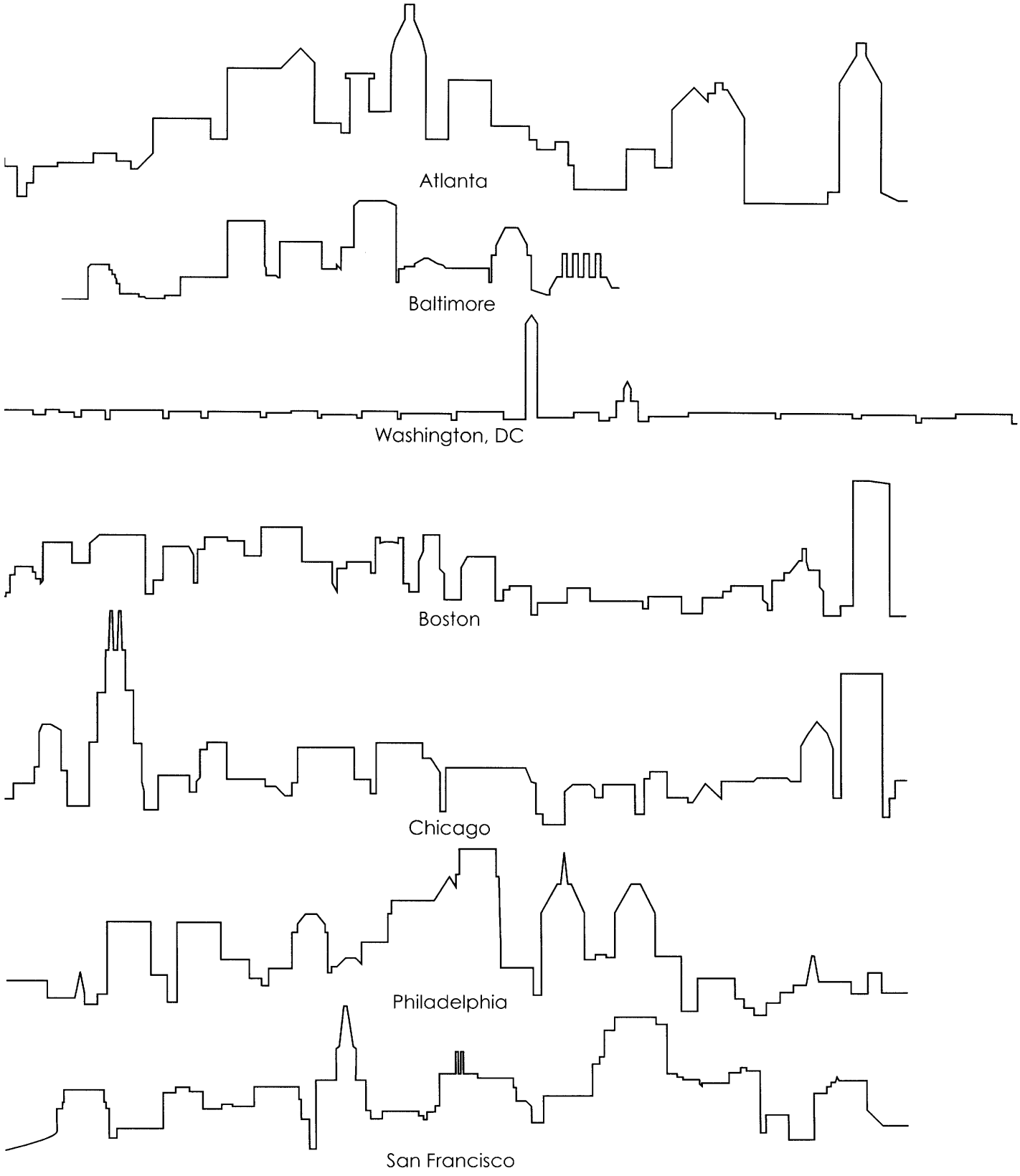
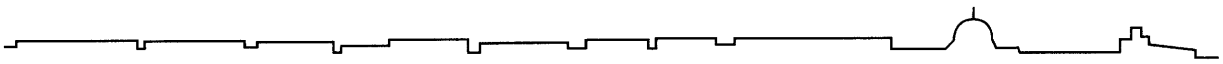


figure 5-1. City skylines (scale approximate)

CHAPTER 5

UP OR OUT



While the previous chapters described DC's height qualitatively, this chapter seeks to better understand DC's height through quantitative comparisons. Economic analysis offers a starting point for conceptualizing the impact of height restrictions. Two dimensional spatial analysis can explain why centers and CBDs develop, as well as the implications of regulating them. Using both normative and empirical literature that deals with the distribution of monocentric and polycentric cities, it will be possible to compare DC to predicted outcomes and other cities to shed light on what degree the height limit may affect the layout of the physical city.

Because of the limits of data, regression analysis to determine correlation and potentially causation was infeasible for the analysis. Instead, it seeks to illuminate clear trends and deviations from expectations by comparing the data to other cities when possible, by comparing it to what normative economics would predict, and by simply observing how the pattern relates to the built and regulatory environment. This is done in large part because there is no base of research or data from which to embark upon more rigorous analyses. As such the following sections seek to uncover patterns of urban height in DC and other U.S. cities. After reviewing the major concepts behind economic spatial distribution theory, DC's situation will be analyzed first using density as an analog for height. Looking at various measures of density and comparing it to other cities and within the DC metropolitan area, there are hints that the height limit shifts some density to surrounding activity centers. Then, DC's height profile is compared to that

of other cities, using available data on building heights in seven American cities. This analysis illustrates the degree to which DC is an outlier of urban height.

SPATIAL DISTRIBUTION THEORY

Von Thunen, writing in 1826, was the first to relate economic theories to realities of spatial distribution, as he theorized an equation of yield production on a piece of agricultural land.[1] It took over a century for these concepts to be adapted to the urban environment by Alonso, Mills, and Muth, who began relating transportation costs to residential distribution.[2] Assuming a monocentric city, in which there is a single central business district with all or most of the employment surrounded by rings of housing, the models show decreasing bid-rent curves or land rent values (and increasing transportation costs) as the distance from the CBD increases, until the land rent value for the urbanized area is equal to that of the surrounding agricultural land. Population density or the density gradient follows a similar pattern, wherein those who live closer substitute costly land for structure.[3]

The appeal of this model is its simplicity, which is why it serves as a generic model for conceptualizing a city. Indeed, much of the economic literature uses this model as a framework for analysis. Even though it makes assumptions such as monocentricity, linearity, and static population and income, the models have proven robust and the general ideas underlie much of the following analysis.[4]

There are three major shortcomings of an economic framework that relate to understanding heights. First, there is not yet a framework for understanding the interaction of residential and commercial space, which are simply seen as competitors in the classic models. Because of this, it was difficult reconciling the literature on firm location decisions with that on housing locations and spatial distribution.[5] Using granular employment and residential

densities in zip codes begins to address this, but zip codes are not an ideal geography for comparison. Transportation planning, however, has utilized so-called activity centers as a tool for broad metropolitan planning, which allow for conceptualizing both centers of commerce and housing. Their delineation in both Baltimore and Washington, DC will illustrate how high intensity office and housing activity is distributed.

Second, economies of agglomeration are much better understood than diseconomies of congestion. Cities are based on the value created by aggregation including lower transaction costs, shared labor pools, and shared information. Yet, this value could be less than costs if there is too much activity and congestion. Perhaps then, DC's limit on height helps distribute activity more evenly, therefore preventing overconcentration of intensity. Arnott et al discuss this dilemma and show that, for the most part, there is no model with which to optimize this balance.[6] If there were, height limits could be one of the tools for doing so, though so could density.

Third, and most directly related to this investigation, while the economic framework does describe density (almost always in terms of population density), it does not often deal with height, and never in an empirical way. Some economic studies on the cost of height limits chart a normative height to distance curve, but offer no way of measuring height.[7] One of the biggest hurdles to attempting to analyze height across cities to see how DC differs was creating a measure of height. This analysis will present a method of conceptualizing, measuring, and comparing heights across cities in hopes of better understanding the height or z-axis of a city, especially DC. Before addressing height directly, it is valuable to discuss density, which has a history of analysis and collection.

DENSITY

Height data is not widely available, a shortcoming which will be addressed

in a later section. However, density information is widely available and analyzed in the spatial literature so it offers the best starting point for comparing cities, as will be shown below. Density can represent many ideas in spatial analysis. A sociologist or economist might be interested in population density, while a developer or planner might be most interested in density of built area, and a transportation analyst most interested in employment density. There are three predominate measurements of density.

Employment density represents the number of jobs in a given location, while population density is either the number of people or number of households in an area. Unfortunately, since the amount of space that one takes up in employment is not equal to the space that an individual or household utilizes at home, comparing the two is difficult. In downtowns, where most employment is in offices, an employee takes up about 15% of the space of a household. By multiplying each density by the average space used, it is possible to approximate built area density. But since space used varies by country, city, and even submarket, attempting to create a hybrid density is very difficult.

Another, more universally comparable density is built area density, of which foor to area ratios (FARs) are a common measure. An FAR of five means that the area of the building is five times the area of the lot. FAR can also use other measurements of area as the denominator, including the lot plus the area to the midpoint of adjacent streets, or when looking at larger areas, it could include the entire area, inclusive of streets and public spaces. This study is primarily concerned with overall built area density, but for density analysis will use population and employment densities due to availability of data.

In a simple model, where all buildings are all simple extrusions of their footprint, built space is simply footprint times height. Therefore density is:

built density: $d = (f * h) / A$
employment or population density: $d = ((f * h)/s) / A$

where d is density, f is footprint, h is height, s is average space occupied by an employee or resident and A is area.

By assuming that footprints do not vary, it is possible to utilize density as a proxy for height. Empirical density is typically postulated to decrease over distance exponentially (see for example Bertuad and Malpezzi), given economies of agglomeration and transportation costs. This shape also relates to the downward sloping bid-rent curve, given that the higher the land rents, the greater the necessity to trade land for structure in order to pay for the land costs. Demand for a space increases the land rent through increased potential cash flow for more built area manifested by higher density and height at that location. The density curve should also correlate to its height profile, as to fit more space in a given area. There is but one direction to go: up. So, by comparing densities of Washington, DC to other major cities, some with height limits and others without, it might be possible to get a sense of whether or not limits have a direct impact on the City.

The following analyses compare densities across and within cities to determine if DC is an outlier due to its height restriction. First, a simple comparison of the employment and population densities for the central business districts of a number of cities will help show if Washington, DC has lost out on potential density. But since this does not account for how density is more broadly distributed the second analysis examines population density gradients within metropolitan areas. Finally, addressing shortcomings with simple density gradients, comparing densities within the DC metropolitan

area using granular densities and activity centers will refine the analysis.

DENSITY COMPARISONS

Hypothetically, the low height limit in DC limits the density of the City, especially downtown where the limits are binding. One simple analysis involves comparing the downtown density of Washington, DC to other cities. If the density is in line with other cities, then perhaps the jobs and people take up more ground area in lieu of colonizing the urban atmosphere, leaving overall built space unaffected.

Looking solely at central business densities, DC does not stand out on any particular front. It has a relatively low population density, but not one that is greatly different than other U.S. cities. It does have a high job density in its downtown core, which indicates that the height limits do not necessarily have an impact on overall space. In fact, places like London and Paris, which have more stringent height limits, exhibit more core density than other cities without such limits. Also evident in the following charts is the very different nature of downtowns in North America, with high job densities and low population densities, compared to Europe.[8]

CBD Residential Density

(residents per hectare)

1.	Paris	179.7
2.	Boston	71.2
3.	Frankfurt	65.5
4.	London	63
5.	Toronto	51.1
6.	Chicago	30.3
7.	**Washington**	**27.3**
8.	Melbourne	27.1
9.	Vancouver	25.6
10.	Sydney	20.8
11.	Canberra	0.5

CBD Employment Density

(jobs per hectare)

1.	Toronto	927
2.	Chicago	921
3.	Melbourne	734.2
4.	**Washington**	**688.5**
5.	Frankfurt	498.9
6.	London	423.7
7.	Sydney	422.2
8.	Paris	369.6
9.	Vancouver	308.6
10.	Boston	297.5
11.	Canberra	28

CBD Employment/Residential Density

1.	Canberra	54.9
2.	Chicago	30.4
3.	Melbourne	27.1
4.	**Washington**	**25.2**
5.	Sydney	20.3
6.	Toronto	18.1
7.	Vancouver	12
8.	Frankfurt	7.6
9.	London	6.7
10.	Boston	4.2
11.	Paris	2.1

Controlling for metropolitan area (MSA) population helps to reduce the influence of overall population on the density of the core, creating a better comparison. Below are residential and employment densities divided by metropolitan population. Once again, DC is not an outlier and actually exhibits a higher per capita employment density than other cities, including even Chicago. Paris and London present well-known instances of height regulation in capital cities and are often used as references when discussing DC's height limit. When controlling for metropolitan population, their relative densities fall, with population density much lower than other cities.

CBD Population Density/ 1,000,000 MSA Residents

1.	Frankfurt	103.25
2.	Boston	25.49
3.	Toronto	22.45
4.	Paris	16.85
5.	Vancouver	16.59
6.	London	9.43
7.	Melbourne	8.96
8.	**Washington**	**7.67**
9.	Sydney	5.88
10.	Chicago	4.17
11.	Canberra	1.81

CBD Employment Density/ 1,000,000 MSA Residents

1.	Frankfurt	786.47
2.	Toronto	407.33
3.	Melbourne	242.88
4.	Vancouver	200.01
5.	**Washington**	**193.42**
6.	Chicago	126.84
7.	Sydney	119.30
8.	Boston	106.49
9.	Canberra	101.13
10.	London	63.43
11.	Paris	34.67

When controlling for population, there is relatively little correlation between overall population and the various measures of densities, highlighting the unique nature of each city. Part of this may be due to difficulties in defining the central business district in many different contexts. The comparisons, with their focus on the core, also fail to account for variations in density within a metropolitan region. Rather than explaining height, these comparisons may be best suited to situate DC in relationship to other cities.

DENSITY GRADIENT COMPARSIONS

Looking simply at the downtown areas may miss broader metropolitan area impacts, so it is worth supplementing the previous analysis with comparisons of density gradients, or density over distance. Bertaud and Malpezzi calculate the population density gradients for a number of metropolitan regions across the globe to illustrate the spatial distribution and intensity of cities. The analysis shows that most every city is fairly well represented by a negative exponential function for population density.[10]

Bertaud and Malpezzi examine the role of regulation in shaping a city's form. To measure this, they create a three-tiered variable for regulation. Most U.S. cities are categorized in the first tier, as market-oriented while those with both strong planning and market economies, including Warsaw and San Francisco, are in the second tier. In the third tier are cities whose planning regimes work against the market and include Moscow, Johannesburg and Brasilia. Washington, DC is considered to be part of the first category, which makes sense given that except for the height limit, the metropolitan area's regulatory regime differs little from most other cities in the U.S. Using regression analysis, they find that regulatory regimes profoundly affect urban form and can greatly distort it from the optimal form postulated by economics and observed in most cities. In some cities, such as Moscow, Johannesburg, and Brasilia, the extreme regulation has actually inverted the density curve.[11]

Apart from the extreme cases involving strict regulation, the negative exponential function shows other trends. Close examination of the population density gradients does show that it often reaches a peak outside the center city. Of the 49 observations, 28 exhibit the highest densities outside the center, usually a few kilometers outside the CBD. Many major U.S. and European cities, including Chicago, San Francisco, Paris, London, and Washington, DC, exhibit this gradient. The noncentered peak likely relates to the nature of the core as an employment center, but without comparative employment densities, it is impossible to compare various cities and see if this is indeed the case or whether other factors might be at work.

The analysis shows that DC is not greatly different from other cities, with a downward sloping population density gradient. DC does not exhibit the type of curve seen in cities with moderate or extreme regulation. Even so, perhaps the regulation impacts the spatial distribution in more nuanced ways.

The density analysis by Bertaud and Malpezzi's assumes monocentricity. This allows for a simplification of analysis by collapsing two-dimensional location into a one-dimensional distance variable. Doing so smoothes out other intensity centers by counting them in rings with areas of lower intensity. For example, if a subcenter is located 3 miles from the center city but most of the other area in the 3 mile ring is substantially less dense, then the overall density will be lower. By using concentric rings, the greater the distance for the city, the greater area of the ring (and hence the denominator), so the lower the density, even if there are subcenters. While they embark on a more ambitious analysis of dispersion through analysis of a 3-dimensional solid where the x- and y-axes are location and the z-axis is density, apart from dispersion numbers reached, they do not provide data or visualizations of enough cities to compare.

Analyzing DC assuming monocentric rings is problematic. Unlike the cases

of Moscow, Johannesburg and Brasilia, the limits are not placed on the region, but rather on one small area. So, parts of Virginia of particular density are in rings closer to the CBD than other parts of DC under the limit. This makes it difficult to differentiate between the metropolitan areas that are affected by height restrictions and those that are not. And by omitting employment densities, it is difficult to get a sense of the nature and density of overall built space, which is the variable most related to height.

Examining cities through the lens of urban height raises a number of questions about the state of research and quantitative and spatial analysis of cities. Much of the literature on spatial distribution of cities, and in fact much of the practice of urban planning, focuses on residential densities as a tool for illuminating various aspects of cities. Residential density, however, fails to account for the reality that most people spend a good portion of their waking hours away from their home. Employment density, then is a complementary measure, but is rarely used or discussed. Mills conducts one of the few investigations that provides a study of employment and population gradients.[12] This is likely due to two factors. First, much of the literature assumes a monocentric city, with employment located in the center. There are more recent analyses that look into polycentric cities, but most fail to examine both residential and employment density concurrently. This is likely due to the second and more important factor: lack of data. There is very little data on employment at the sub-city level and that which does exist often does not match the boundaries or geographies of census data.

Granular Density Gradients

Density gradient analyses use concentric rings measured from the central core through which data is analyzed. This method is good for overall metropolitan structure, but can miss areas of agglomeration within rings that are predominately low density. The following analysis utilizes zip code areas to create densities of both employment and population and test

whether DC's height restriction markedly affects its density distribution. Ideally, smaller areas, such as census tracts would be used, but employment data is not available at that level of detail.

By comparing the number of residents and jobs within a zip code compared to the amount in the metro area, it is possible to create a measure by which to compare densities to each other within and across metropolitan areas. By this measure, if a zip code has a measurement of 1, its density of employment or population per acre is the same as the metro area's as a whole. If it is less than one, it is less dense and if it is greater than 1, it is more dense than the total metropolitan area.

As Appendix 1 shows, all cities show a much higher concentration of employment than residential, with some cities such as Atlanta exhibiting relatively dispersed population densities. DC's exhibits the employment bulge outside of the center, but the residential bulge is not as prominent. An analysis that examines areas with high residential and employment densities could show whether residential density is indeed valuable for a vibrant urban environment. The major shortcoming of this analysis is that zip codes do not necessarily correlate to the areas of intensity and most areas are not very dense. The following analysis seeks to overcome this by looking only at activity centers. Unfortunately, the only available data is for DC and Baltimore, so comparisons are not very robust.

ACTIVITY CENTER GRADIENTS

Activity centers are nodes of intensity within a region that represent subcenters.[13] A density gradient that accounts for only these subcenters removes areas of lower density that make comparisons difficult. This will help illustrate whether height limits have helped push some built area outside of DC or whether it is just spread out within the limits of the District.

Data from the Metropolian Washington Council of Governments (COG)

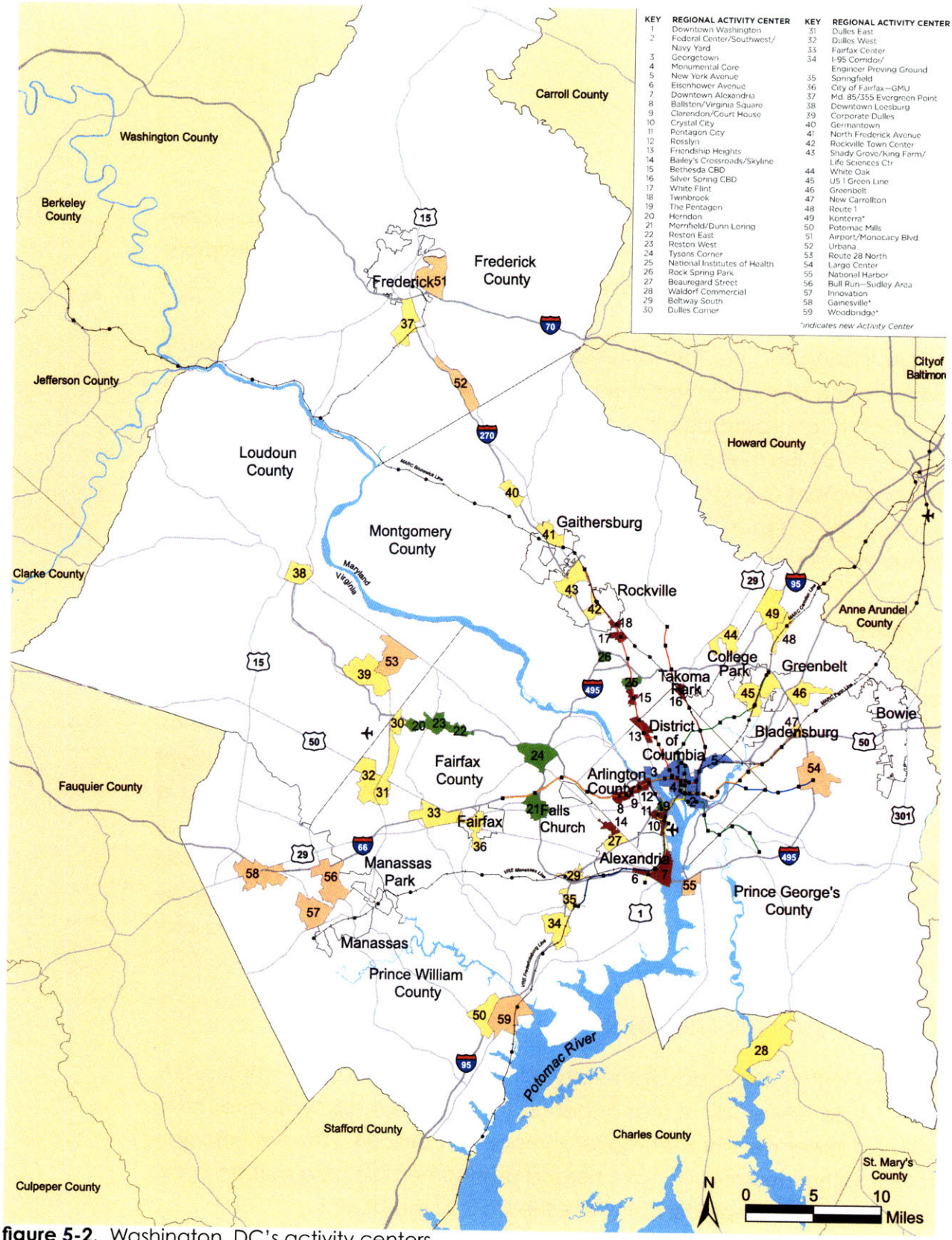


figure 5-2. Washington, DC's activity centers
(source: Metropolitan Washington Council of Governments, 2007)

offers a comparison for densities of activity centers (see figure 5-2).[14] These activity centers are defined by the categories of DC Core, Mixed-Use Centers, Employment Centers, Suburban Employment Centers, and Emerging Employment centers. Predominately nodes of employment, they do include higher density population centers, especially closer to the CBD. The delineation of boundaries for any center may affect particular numbers and results, but the borders appear to follow activity centers fairly well. This analysis is rooted in a polycentric conception of the city. Given that most major U.S. cities have subcenters and "edge cities" which is where height and density manifest themselves, such an analysis is warranted and can help remove low-intensity development which could skew results.

The residential and employment density charts are illustrated in figures 5-3 and 5-4. As in Bertaud and Malpezzi's analysis household density in DC has a peak outside the center. While the peaks in their analysis was often only one observation, this peak includes six activity centers outside of the height limit that are denser than any centers within the limit. This may be made up for in part by employment density, which is by far highest in the CBD. Even so, there is a significant secondary peak of areas outside the limit, which includes many of the areas that exhibited high population densities.

These areas of higher density consist of Mixed-Use Centers located just outside of the District border and free of the height limit. When discussing the impact of DC's building height limit, the most common example to density suppression and lost opportunity costs is the area of Virginia just across the Potomac, including Rosslyn and Crystal City. Both have buildings much taller than 160 feet and they provide a clearly contrasting skyline to that of DC (see figure 4-10). Buildings in Maryland centers of Silver Spring and Bethesda are generally not higher than DC's height limit, likely reflecting their relative distance from the downtown core. While more evident in the case of tall buildings in Rosslyn and Crystal City, the charts illustrate the likelihood that these neighborhood centers are gaining some density, especially

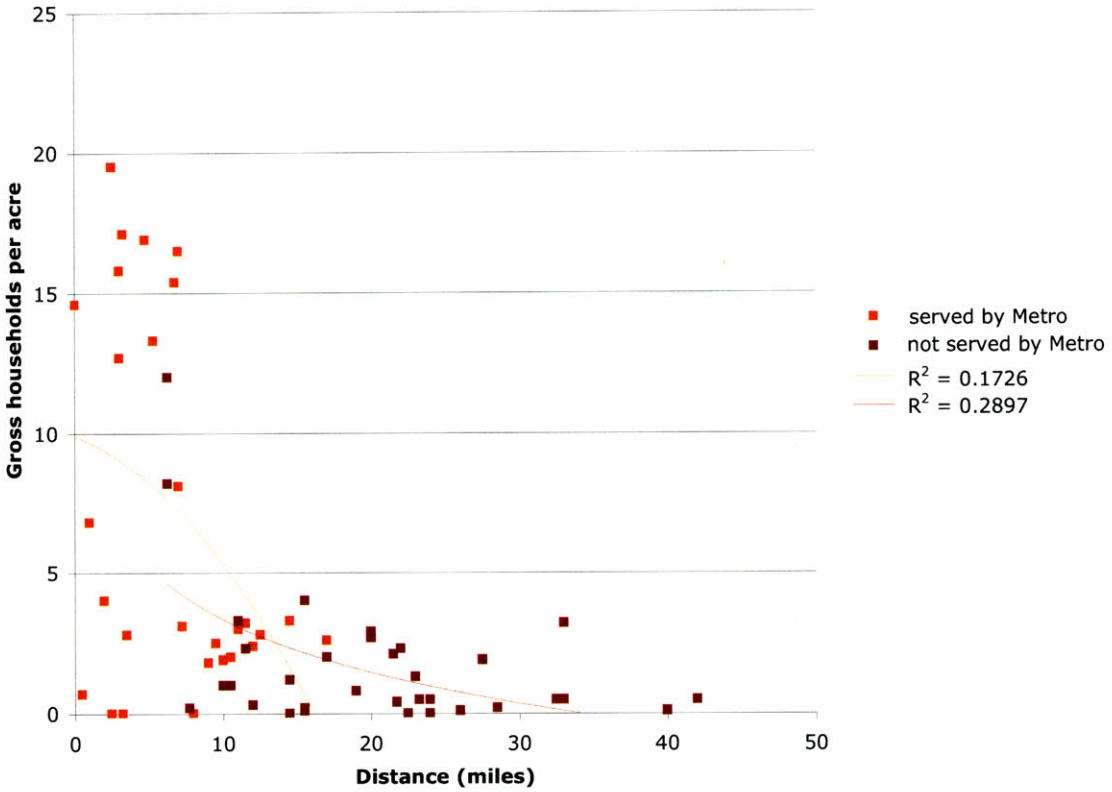


figure 5-3. DC's 2005 activity center-based residential density gradient based on Metrorail service (orange) or not (red)
(Source data: Metropolitan Washington Council of Governments 2007)

in terms of residential density, from the suppression of DC's market.

In addition to the height limit, there are other factors that may underlie these observations. Most downtown U.S. cities have witnessed a decline of population, as households have decentralized to the suburbs. In addition, the Metro system in DC has allowed close-in suburbs to benefit from the core of DC without the same type of federal, infrastructural or tax burdens as DC. As the figures 5-5 and 5-6 show, if areas with Metro access are removed, the graph looks astoundingly similar to Baltimore's gradients. Clearly the Metro allows for more density in areas outside of the core, but it should also push the density of the core even higher, given its central

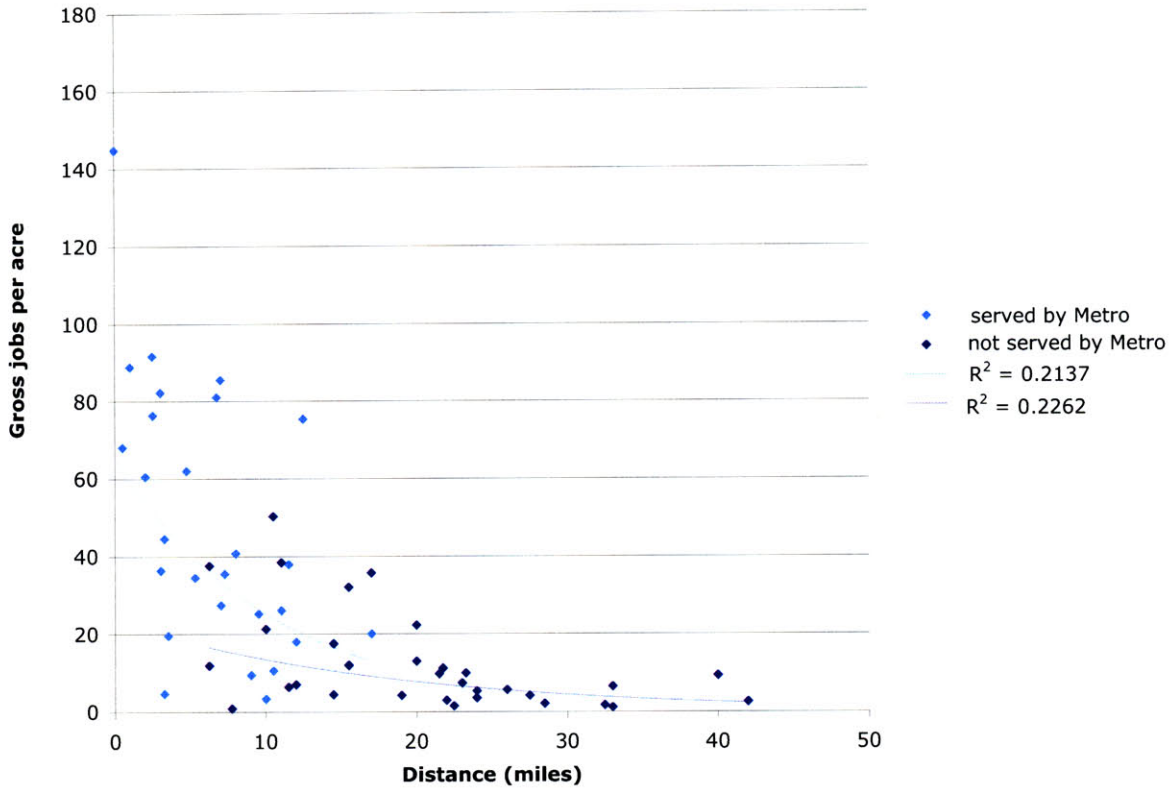


figure 5-4. DC's 2005 activity center-based employment density gradient based on Metrorail service (light blue) or not (blue)
(Source data: Metropolitan Washington Council of Governments 2007)

location. Given that the core Baltimore has an even higher employment density than the core of DC, it seems reasonable that the limit could very well have suppressed density. Employment has not decentralized as dramatically as household density, making it easier to attribute the difference to the height limit.

Comparing density or population density gradients provides little evidence that the DC height limit greatly skews the spatial layout of the metropolitan area. This could be because the suburbs make up the majority of the metropolitan area, helping to smooth out the gradient. By using more detailed

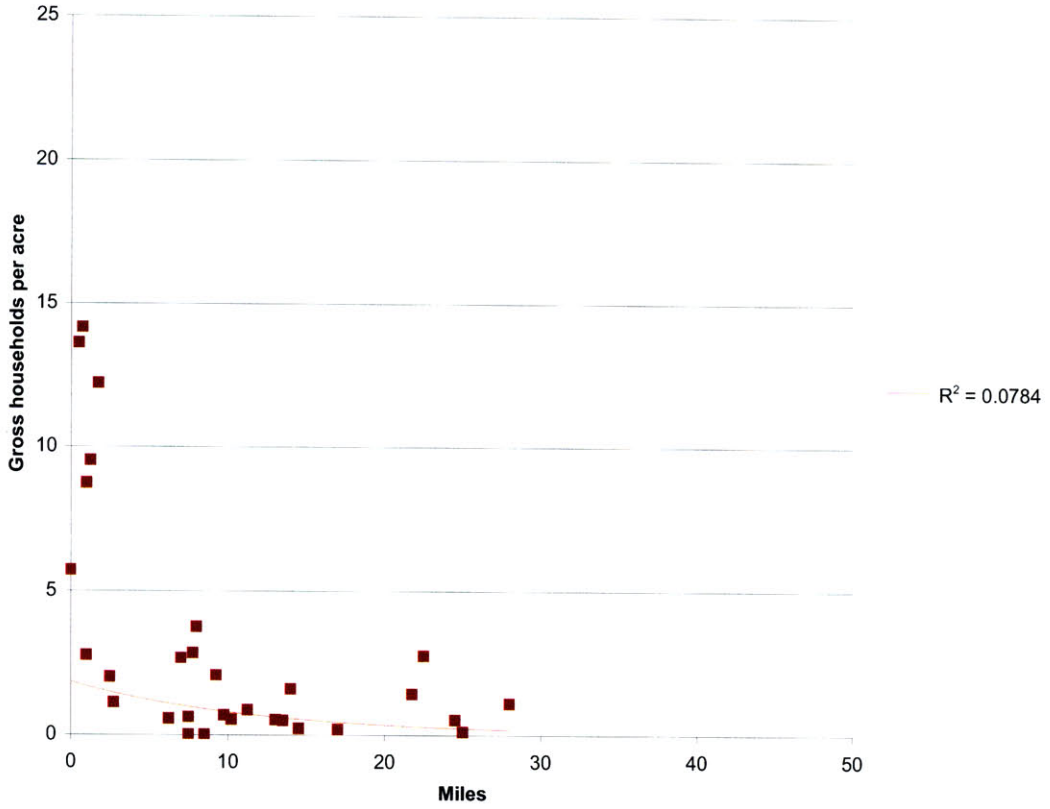


figure 5-5. Baltimore's 2004 activity center-based residential density gradient (Source data: Baltimore Metropolitan Council 2004)

activity center analysis, however, there are signs that the height limit has limited potential density downtown especially employment density. In other words, the downtown market could likely handle additional density, with additional height within the same spatial envelope that currently exists.

Yet density cannot tell the entire story because it is not directly related to height. The assumption that footprints do not vary based on height is not completely valid. In many cities, including New York after its rezoning effort in the 1960s, skyscrapers are allowed if they have large plazas and smaller footprints than otherwise. More generally, FAR limits make height a function

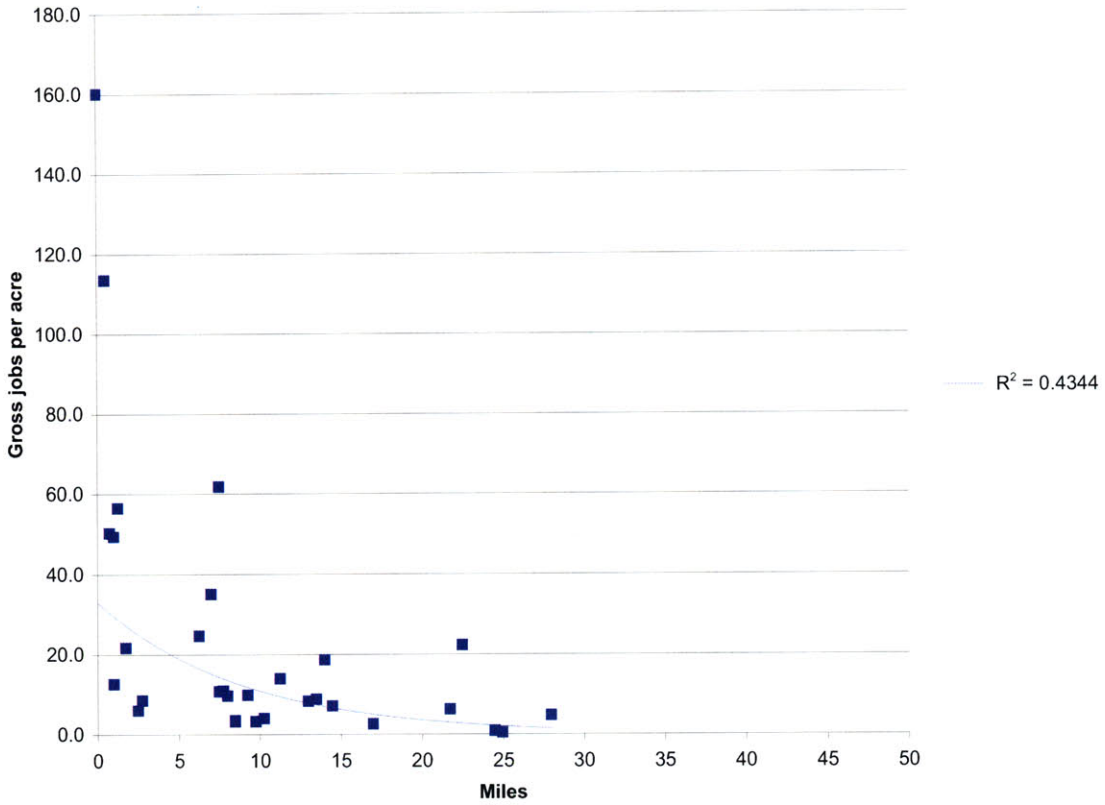


figure 5-6. Baltimore's 2004 activity center-based employment density gradient (Source data: Baltimore Metropolitan Council 2004)

of the area, rather than an independent function of some exogenous variable. Because of this, when studying height, the analysis of density must be complimented by a more detailed analysis of height directly. The following section seeks to do so, utilizing approximations of gross floor area available due to recent advances in technology.

HEIGHT ANALYSIS

As mentioned previously one of the major difficulties in analyzing height is actually measuring it in a given area such that it is comparable. This is a problem of both conceptualization and accessibility of data. Because

heights can vary greatly over small areas, average building heights could undercount the perceived height of an area. For example, a city with a few tall buildings and a number of open blocks could theoretically have the same height as a built out mid-rise area. Yet taking only the tallest buildings risks overcounting outliers. Beyond conceptualizing height, actually collecting data on building height is another major barrier. Some cities, including Washington, DC have robust GIS data with building height, such as number of floors or LIDAR-based building heights. This data, however, is not universally available. And gathering comparable GIS data for various cities would require an amount of time and analysis beyond the scope of this thesis. The Sanborn company does offer datasets for many cities that include three dimensional models of the downtown areas, but the information costs many thousands of dollars per city. Given these hurdles in measuring and conceptualizing heights, it is not surprising that there are few analyses dedicated to one of the most unique aspects of cities.

Recent advances in retail technology, namely Google Earth and Adobe Photoshop, make it possible both measure and analyze height in cities across the U.S. Google Earth supplements its detailed three-dimensional database of notable buildings with Sanborn's comprehensive database of urban buildings. While access to the underlying data is not available, it is possible to create opaque planes and raise them to the desired heights to obscure everything but the buildings that are higher than that plane. By taking a number of these planar sections of cities then analyzing the images in Photoshop, it is possible to count both the square footage and (less accurately) the number of buildings that reach the given height.

First, this analysis compares central cities across the United State to DC to determine how much DC's height limit makes its form deviate from normal cities. Second, it examines the height profile of metro DC in greater detail to get a sense of how much height is pushed out of the District boundary and how DC's height profile might look otherwise. These analysis will help

spatialize the effect of DC's regulations and inform policy.

COMPARATIVE NATIONAL HEIGHTS

By taking 100, 200, 300, 400, and 500 foot height sections it is possible to compare a number of cities. These include similar cities along the Eastern seaboard, such as Baltimore, Philadelphia and Boston as well as regional hubs including Atlanta, Chicago and San Francisco. Many of these cities once limited height, though all since have replaced those regulations, as discussed in Chapter 2. The cities represent a variety of economic types and states, from post-industrial urban areas to booming sunbelt cities. Their varied spatial layouts is exhibited especially at the higher cuts (see figure 5-7).

As each cut provides the amount of square footage at or above that height, simply counting the amount of square footage in each cut will provide a cumulative count of space at each height (see figure 5-8). It is striking how the verticality of various cities follows a very similar negative exponential pattern across the country, with the exception of Washington, DC. Much as density declines with outward movement, so the density of floor space declines at it moves skyward. Like density gradients, the height analysis simplifies three dimensional space into a two dimensional model to create a generalized argument. Rather than analyzing the spatial distribution within a central core, it shows the overall built space at a given height in order to create intra- and inter-city comparisons. That the vertical axis of a city follows a similar pattern to the horizontal axis is not surprising, but has also never been observed or described before.

DC exhibits about as much square footage at 100 feet as does Chicago, both of which have twice as much as the next cities. Clearly since DC was unable to build up, it built out. Figure 5-9 shows the results when first removing the cumulative aspect, counting only buildings that are in the given 100 foot height area, then dividing this by metropolitan population.

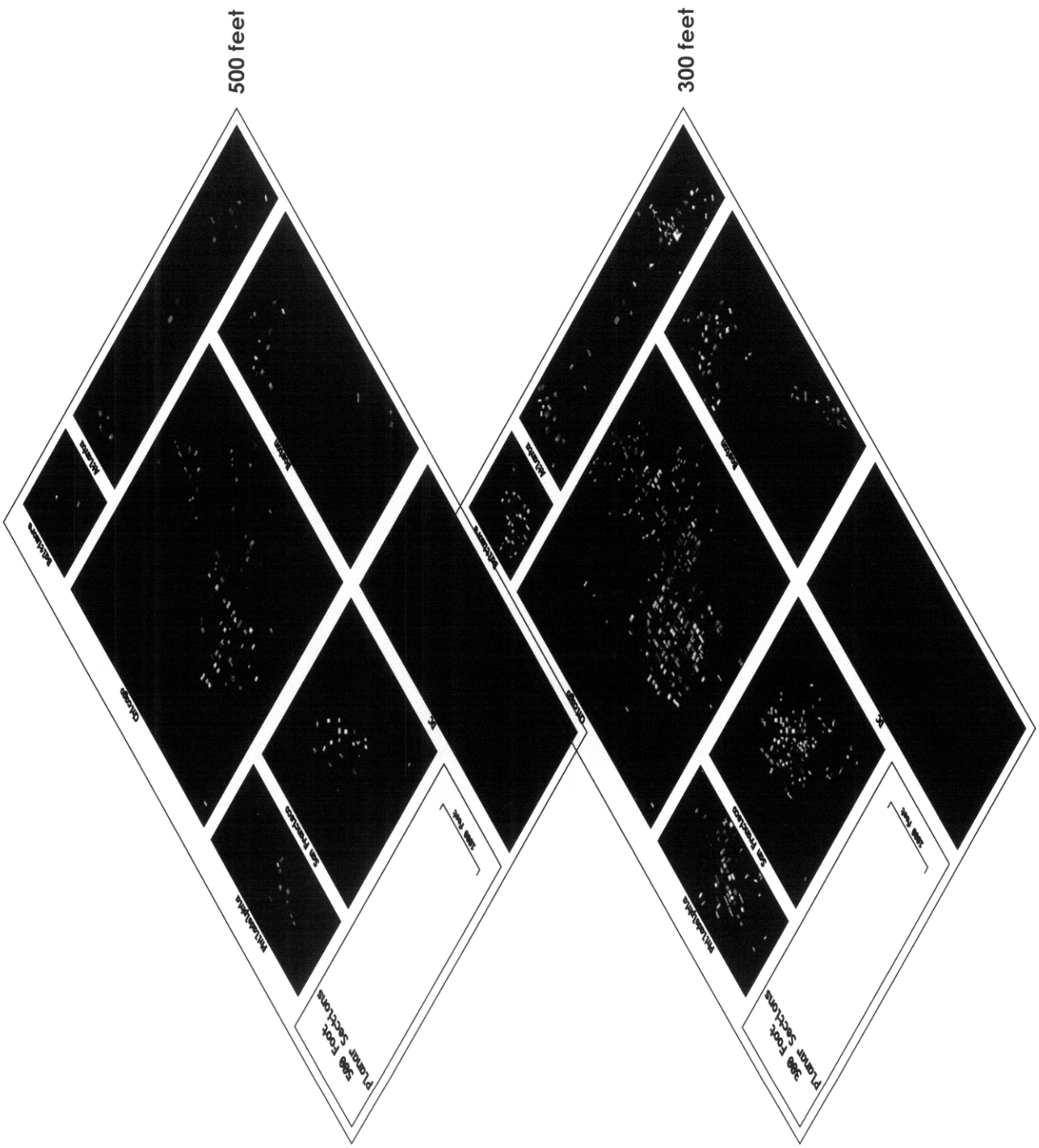
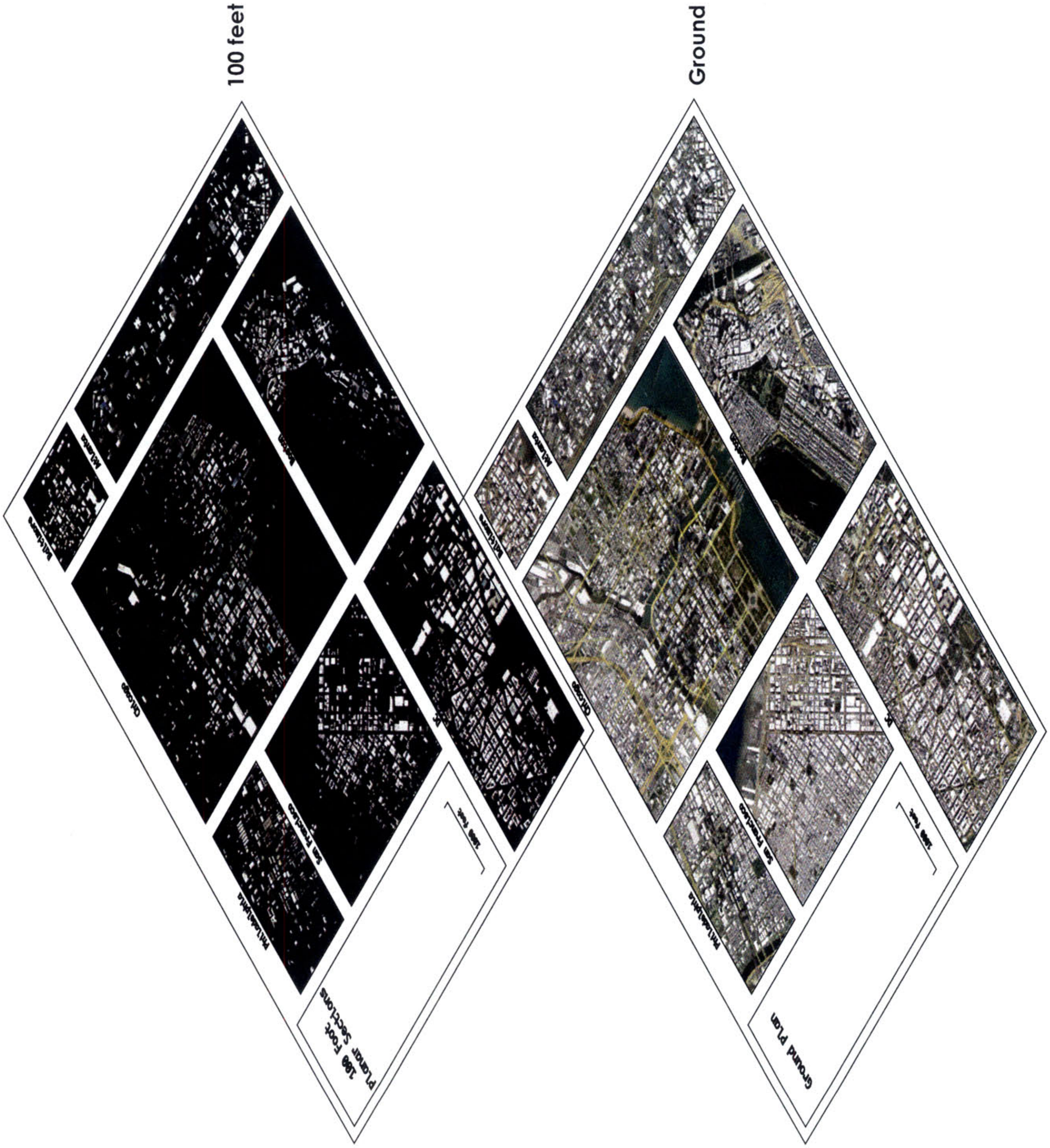


figure 5-7. Cutting cities at 200 foot intervals. For more detailed images see Appendix 2. (Source data: Google Earth, 2009)


100 feet
Ground

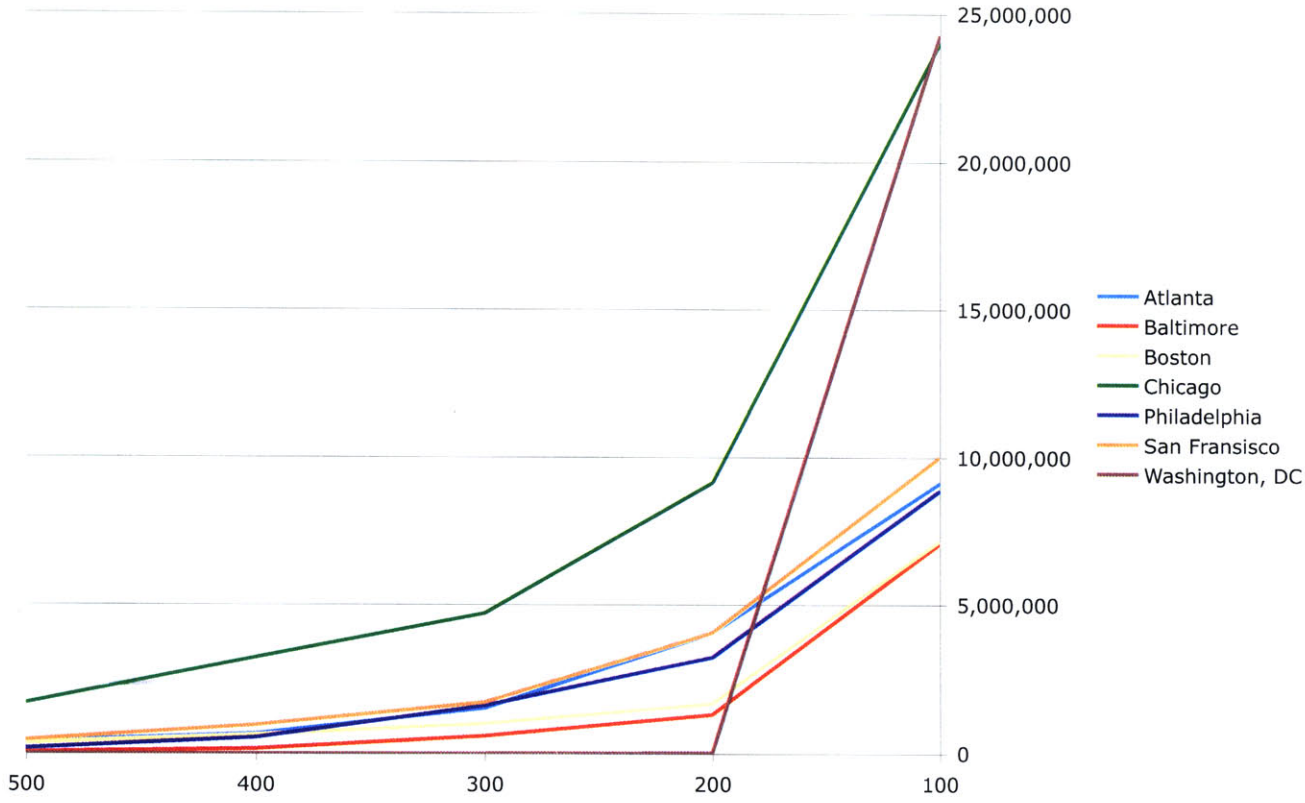


figure 5-8. Total building footprint at each height (cumulative).

Metropolitan population is used, as in the original density analysis, since the central core is really a function of the metro area. Chicago falls in line with the others, which have an exponentially declining curve, while DC becomes a much greater outlier, with a very high initial reading that goes then hovers near zero starting at the 200 foot cut. This chart shows the importance of buildings in the given height range to the city. Baltimore, for example has a high proportion of 100-200 foot buildings given its population, but is not as prominent over 200 feet. Atlanta, on the other hand, has almost the opposite height profile, fewer relative 100-200 foot buildings but a moderate amount of buildings over 200 feet.

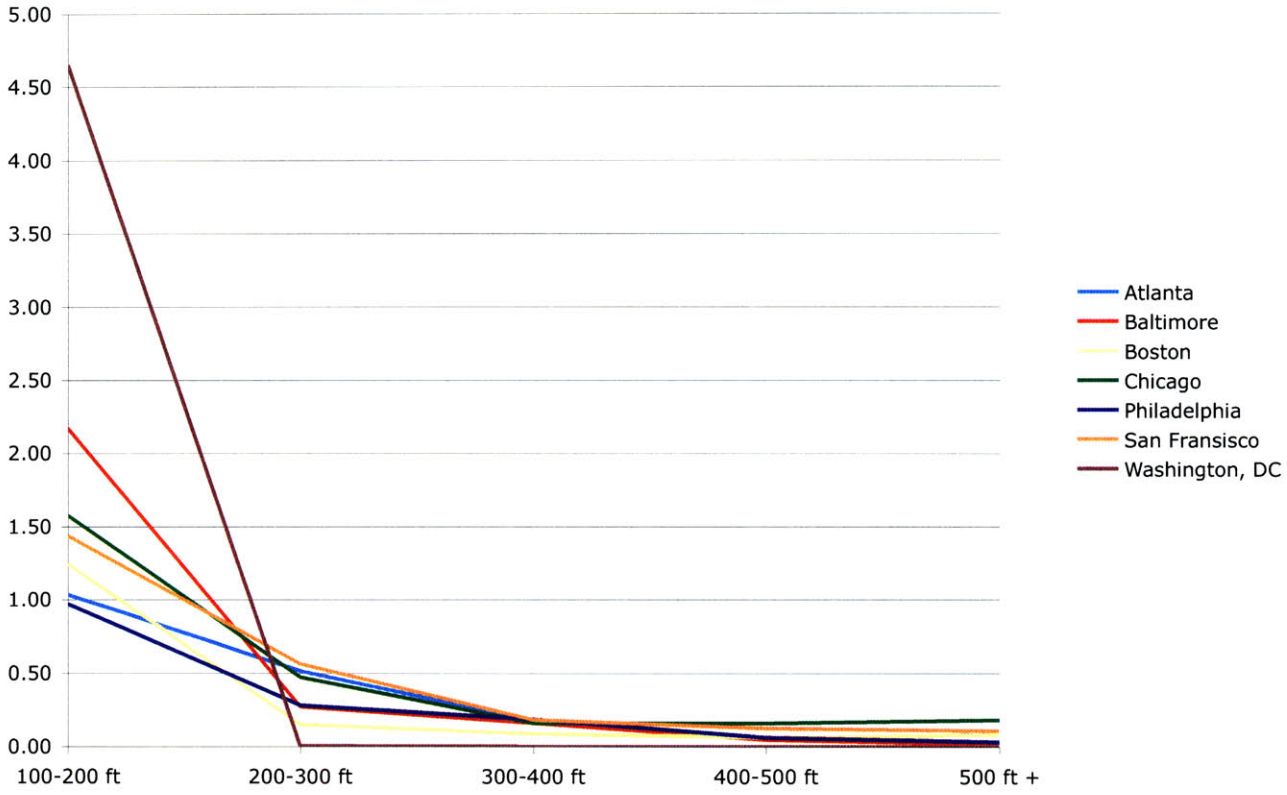


figure 5-9. The total footprints of building in the given height tranches divided by the metropolitan population

The final analysis, shown in figure 5-10 makes assumptions about the height and size of buildings in each tranche to estimate the percentage of total building square footage contributed by buildings in each tranche. In other words, it shows how much each range of building height contributes to the whole of tall buildings. It only counts buildings over 100 feet, assumes buildings with 12 foot floors on average and average footprint of about 27,000 square feet.[15] Its conclusions mirror those of the previous analysis, with DC exhibiting 99.8% of its height in the 100-200 foot category. Baltimore, the next lowest city, exhibits about 67% of its height in this category, with Atlanta at only 35%. While the cities all converge with height, the divergence at 500 feet plus is likely due to the fact that this tranche is open-ended, rather

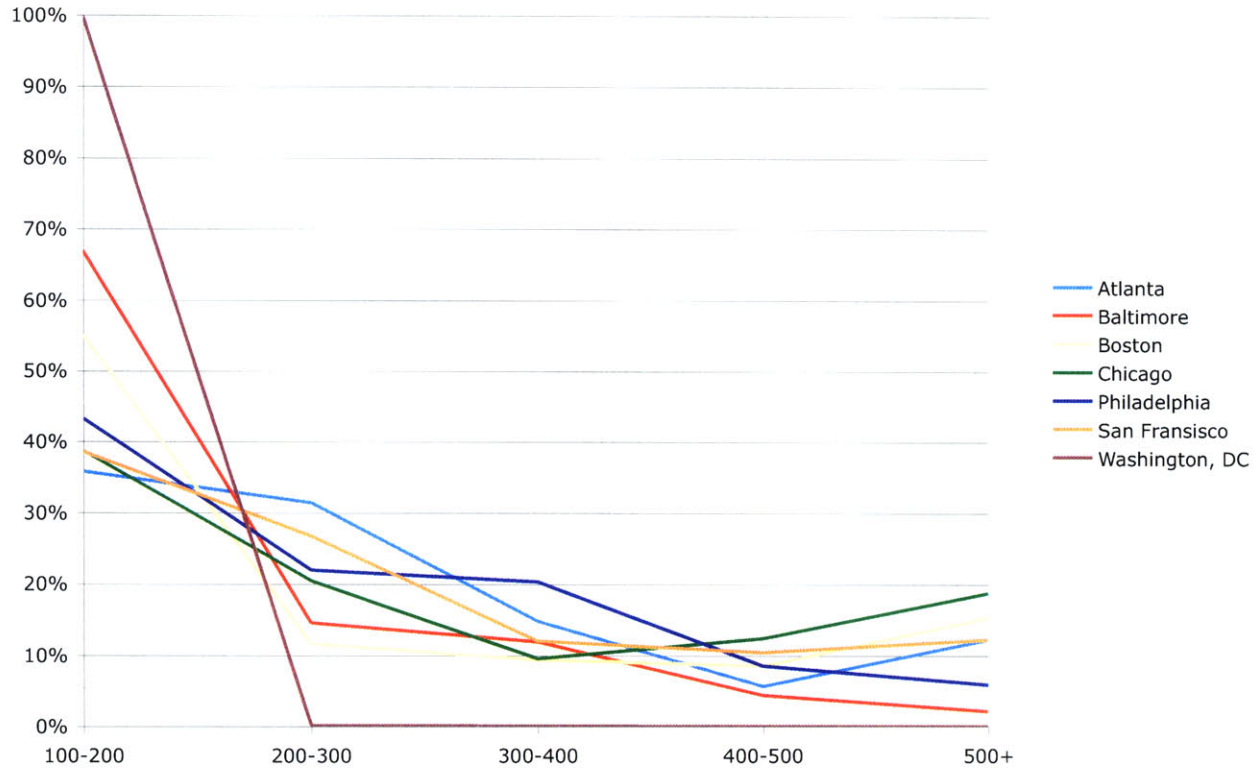


figure 5-10. Estimated building square footage for buildings at each height range

than the 100 foot spread of the others. These assumptions show that DC has a comparatively large amount of total square footage over 100 feet high.

Square Footage in Buildings over 100 Feet Tall (estimated):

1.	Chicago	499 million square feet
2.	**Washington, DC**	**219 million square feet**
3.	San Francisco	201 million square feet
4.	Atlanta	185 million square feet
5.	Philadelphia	169 million square feet
6.	Boston	130 million square feet
7.	Baltimore	112 million square feet

Square Footage over 100 Feet per (MSA) Capita (estimated):

1.	San Francisco	48.32
2.	**Washington, DC**	**41.97**
3.	Atlanta	37.52
4.	Baltimore	42.17
5.	Chicago	52.85
6.	Boston	29.36
7.	Philadelphia	29.08

DC, despite its low profile, also has a large amount of building square footage over 100 feet per capita. There are two likely explanations for this. First, it contains many national museums and public buildings, which serve audiences broader than the metro area. Whereas measurements of density discriminate by office or residential, this analysis is indifferent to the type of space, so includes everything from residential to monumental. Second, perhaps the assumptions overemphasize lower buildings. Additional tests could help to verify whether the assumptions skewed the value and size of tall buildings.

In most cases of height, DC is at one extreme or other. Taken in concert with the density analysis, these show that DC is able to exhibit normal densities because of its large amount of low buildings per capita.

METROPOLITAN HEIGHTS

As with the density analysis, it is important to take into account the regional incarnations of height. Because the Google Earth data only includes the Ballston corridor to Rosslyn in Virginia and none of Maryland, it is impossible to take planar sections as done previously. The company Emporis offers a database of tall buildings throughout the metro area, and for cities across the globe. While not all the buildings have height data, they all have number of floors, with the average floor in the region about 12 feet high.

Including Arlington is practical, given its proximity to DC, and is also historically

valid, given that Arlington used to be part of the District of Columbia. Yet it does not substantially change DC's height curve, which is still much steeper than other cities (see figure 5-11). It seems that the pressure on DC pushes development out horizontally, including beyond the borders of DC. Vertically, the limit might push development up more outside the borders, but not in a way that would make the area comparable to other downtowns. In other words, there is not an equal and opposite reaction.

This describes the past, so even if the limits were eliminated now, the curves would not revert to the mean curve in the forseeable future, especially since buildings are durable and DC has already spread out horizontally. Any changes would have to adapt to the built environment and real estate market that exists, topics which the next section address in order to understand potential policy changes.

This analysis quantifies something that is apparent to any visitor to DC: its skyline is unique. Yet behind the lack of height is a great deal of moderate-rise buildings. While clearly DC is an outlier, the similarity of the height curves of other cities is surprising. This regularity can be used to speculate on DC's urban form without the limit.

Speculating About DC's Heights

The comparative height and density measurements allow for the creation of a speculative picture of what DC may look like had it followed the course of every other major American city. Testing these against the predicted outcomes of the height limit can show how theories are borne out in a complex reality and help shape suggestions on whether and how the height limit could be better. Because of the similar nature of the height curves across cities, the following analysis will start with examining DC's opportunity costs vis-a-vis potential height.

This is done by taking the average distribution of the footprints of buildings

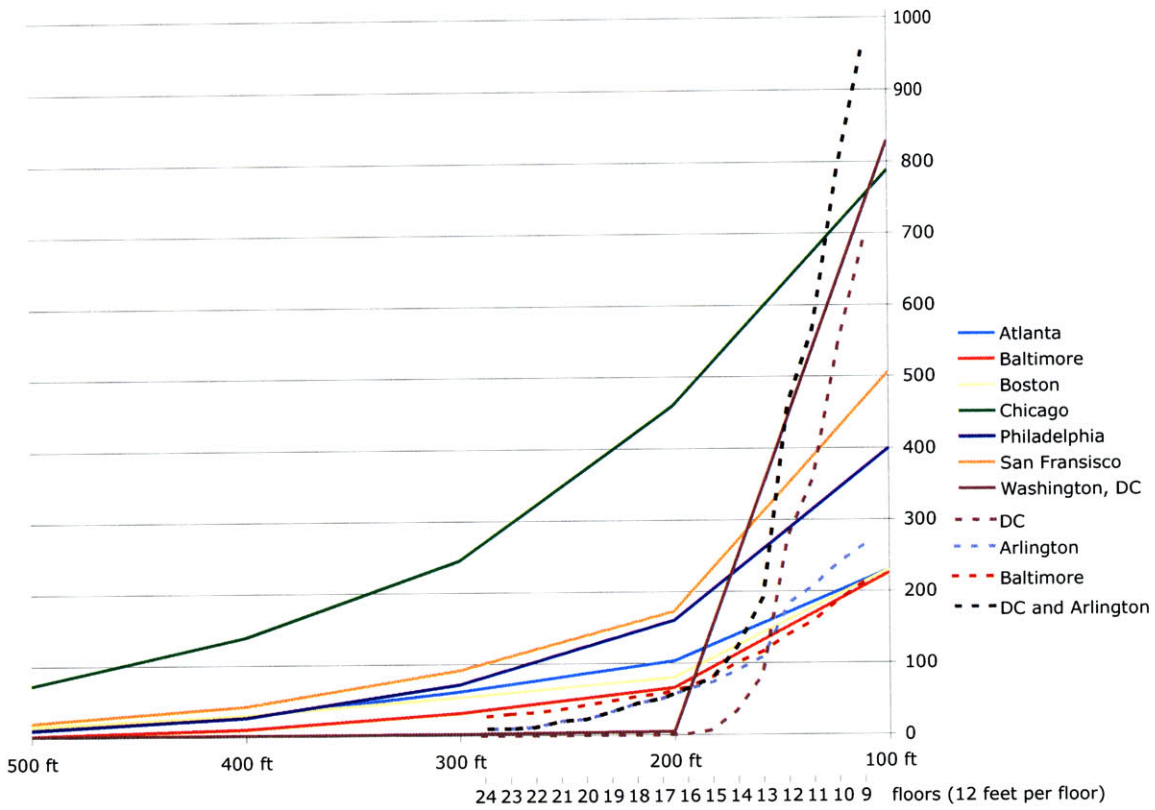


figure 5-11. Comparison of number of buildings based on two different analyses. Adding Arlington to DC's curve makes little difference.

whose heights are in each 100 foot tranche, for all cities except DC. The results are summarized below, with the number representing the amount of land area taken up by buildings in each tranche divided by the amount of land area taken up by all buildings over 100 feet.

Average Footprint Distribution by Height*

100-200 feet	47%
200-300 feet	21%
300-400 feet	13%
400-500 feet	11%
over 500 feet	8%

*does not include Washington, DC

DC Footprint Distribution by Height

100-200 feet	98.8%
200-300 feet	0.2%
300-400 feet	0%
400-500 feet	0%
over 500 feet	0%

This can be used as a test of if and how much the height limit has pushed development outward. When compared to predicted outcomes based on population, it can also show whether the current situation has resulted in less building space in the central core.

Making the assumption that DC keeps the same amount of estimated building square footage, how much land area would its buildings take up if it reflected the height profile of the typical American city? DC has estimated total building area over 100 feet of 218 million square feet, so given the assumptions on floor height, the amount of land taken up by each tranche would be (in millions of square feet) 7.8, 2.0, 0.9, 0.4, and 0.4, for a total of 11.6 million square feet. This is less than half of the 24.3 million square feet of building footprint that exists now (see figure 5-12).

Using DC metro area's population to predict its height profile given the averages of other cities shows a very similar distribution, with about a total of 11 million square feet covered. This curve is very similar to the speculative curve based on the total built space DC has now, showing that these measures are probably reasonable. It also implies that DC would have about the same amount of built space as it does in the height restricted reality. These finding show that the core of DC would likely take up considerably less land area if it had no height limits.

Clearly the height limit has encouraged a more spread out downtown area, which is in line with economic predictions. Yet the implications on its economy and urban environment are not clear. On one hand, it may better help distribute traffic among more streets and metro stations and allow for more adequate parking per square foot in the core. Yet it also works against the natural economies of agglomeration, potentially creating more traffic as people need to travel further distances to do the same amount of work. An extreme comparison is to Mumbai, which has extremely low FARs of about 1.3-1.5 in its downtown on the theory that a spread out

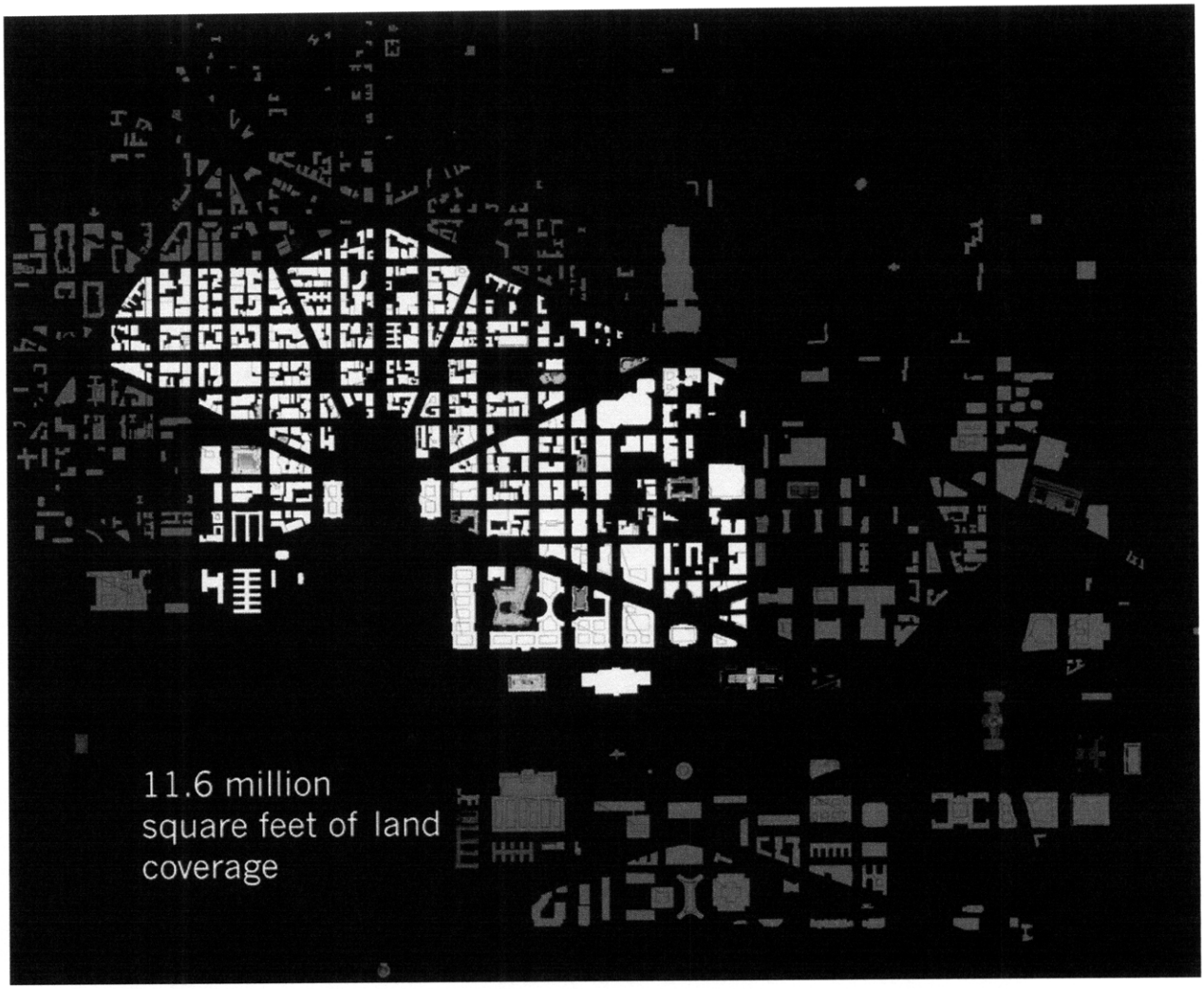


figure 5-12. Using the average height distributions for other cities, based on its metropolitan population and total amount of built space, DC would be take up about half as much built space. The speculated land area, marked in white, as compared to the current downtown core, in grey and white.

downtown is better for traffic and infrastructure. As Bertaud and Bruekner show, limiting density increases transport costs as residents must move farther out to achieve the same housing costs. Given the more limited area of downtown DC, this highlights the conceptual difficulties of sorting out economies of agglomeration versus those of congestion.

More easily observable are the impacts on the urban form. If the space that the commercial downtown overtook was predominately empty land, then the spreading out of business may make little difference to the overall composition of the City. In reality, the expanding downtown overtook townhouse neighborhoods. They crowded out the residential areas that likely had residential densities similar to those of the contemporary Dupont Circle or Capitol Hill, both of which are vibrant mixed-use areas very different from the dense, but single use office district represented by most of the downtown core. So while horizontal expansion may have spread out offices, it did so at the cost of the traditional, dense fabric of DC. Whether the efficiencies of large office buildings could be reconciled with the traditional fabric provides an intriguing counterfactual.

CONCLUSION

Examining cities through the lens of height has illustrated some important findings for both DC and American cities in general. Density, while an oft-used measure in planning and economic literature is fraught with problems of measurement. Residential density is relatively widely available at a number of different scales, but only accounts for a portion of the urban realm. Employment density data below the city level is not widely available and that which is does not tend to match the geographies of population density. Creating comparable geographies that can be used across cities could help economists, planners, and officials better understand the workings of their cities on many fronts, of which height is one factor.

Measuring height in central cities shows a surprisingly similar relationship across cities. Just as the amount of built space decreases as one moves horizontally away from a city, so does it decrease as one moves vertically upwards. Comparing DC to the regular trends exhibited by the other cities illustrates that DC has about the total amount of built space as any city of its size should, but spread out over twice the built area, a finding not illustrated by simply examining density alone. Given these findings, the next chapter will seek reconcile how the current urban form can be modified to both fit into the historical tradition that has developed while also allowing for a release of development pressure and the creation of a vibrant city.

CHAPTER 5 NOTES

1. Von Thünen, J. H. and P. Hall (1966). *Isolated state*. Pergamon Press.
2. Alonso, W. (1964). *Location and land use; toward a general theory of land rent.* Cambridge, Harvard University Press.

   Muth, R. F. (1969). *Cities and housing; the spatial pattern of urban residential land use*. Chicago, University of Chicago Press.
3. Arnott, R. and J. G. MacKinnon (1976). "Measuring the costs of height restrictions with a general equilibrium model." *Institute for Economic Research,* Queen's University.
4. Fujita, M. (1989). *Urban economic theory : land use and city size*. Cambridge [Cambridgeshire] ; New York, Cambridge University Press.

   Bertaud, A. and S. Malpezzi (1999). "The spatial distribution of population in 35 World Cities: the role of markets, planning and topography." *The Center for urban land and economic research*, The University of Wisconsin.

   Mills, E. S. (1972). "Studies in the Structure of the Urban Economy."
5. Systems analysis does seek to reconcile housing and firm location, but has not gained much attention in the economic literature. See Batty, M. and P. Longley (1994). *Fractal cities: a geometry of form and function*. Academic Press Professional, Inc. San Diego, CA, USA.
6. Arnott, R. and J. G. MacKinnon (1976).
7. Ibid.

   Bogart, W. T. (1998). *The economics of cities and suburbs.* Prentice Hall.
8. Boston seems to be an outlier, in part because the definition of the CBD includes some residential neighborhoods such as Back Bay and Beacon Hill.
9. Newman, P. and J. R. Kenworthy (1992). *Cities and automobile dependence : a sourcebook*. Aldershot, Hants., England, Avebury Technical.

10. Bertaud, A. and S. Malpezzi (1999).
11. Bertaud, A. and B. Renaud (1997). "Socialist cities without land markets." *Journal of Urban Economics* 41(1): 137-51.
12. Mills, E. S. (1972). *Studies in the Structure of the Urban Economy.*
13. Casello, J. and T. Smith (2006). "Transportation Activity Centers for Urban Transportation Analysis." *Journal of Urban Planning and Development* 132(4): 247-57.
14. Metropolitan Washington Council of Governments. (2007). Metropolitan Washington Regional Activity Centers. from http://www.mwcog.org/planning/planning/activitycenters/.

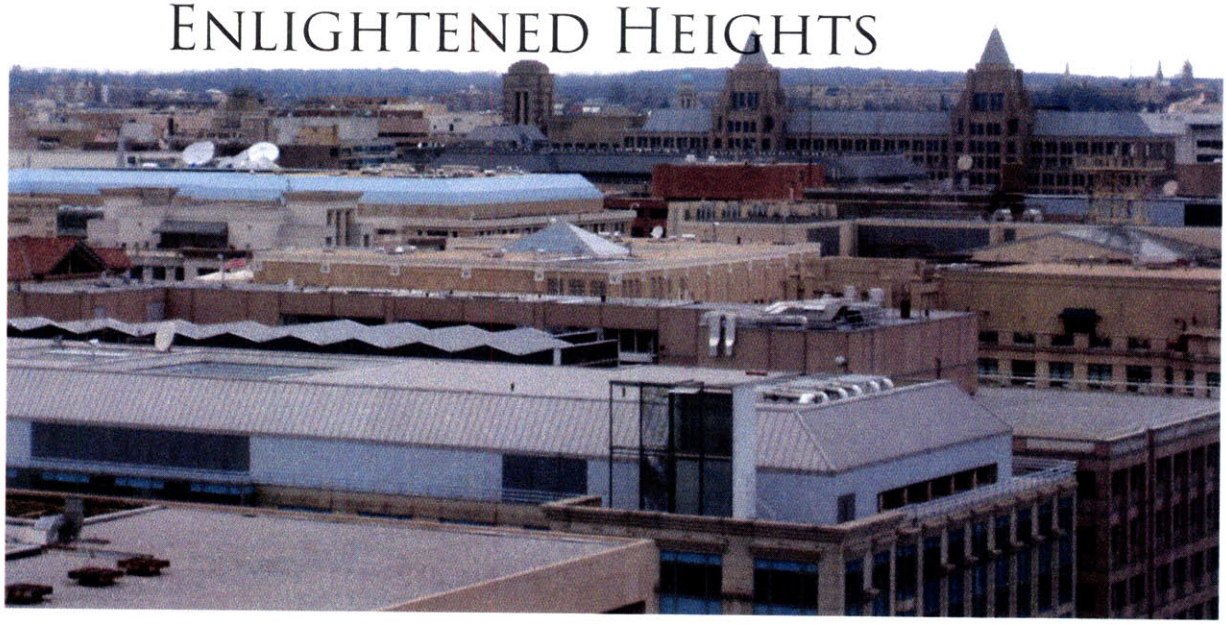
This activity center analysis was made possible by data collected by regional organizations in furtherance of transportation planning. Yet the data is of great value beyond that portion of urban planning. As illustrated, it can be used to compare and conceptualize urban economies in furtherance of other goals, such as economic development.

15. While buildings in the 100-200 ft range were assumed to be 13 stories, in DC they were assumed to be 9 stories, given the height limit.

figure 6-1. DC's skyline with One Franklin Square to the right and the National Cathedral in the background left

Chapter 6

Enlightened Heights



Given all this information, all these interpretations, and all of this analysis, what is the essence of the building height limit? Julian Beinart, a professor at MIT has likened cities to consciousness, saying that neuroscientists have mapped the functioning of the brain and can read the firing of neurons. Despite this technical knowledge, they still cannot explain consciousness. Cities, like consciousness, are the sum total of millions of aggregated parts. Different angles can explain different components, whether political, economic, or physical, but when one steps back, trying to explain the sum whole, the city, is impossible. Even a single aspect of the city, its height, seems to follows this describable yet enigmatic model. The previous chapters examined the height limit through history, real estate, spatial and economic lenses, but were unable to create a singular picture of what it means to the city. Perhaps because of its complexity, DC's height limit seems to be almost a matter of faith. Ideas and beliefs are based on incredibly subjective views, in part because there is no singular objective answer.

What follows are my personal opinions on what the District may be able to do to become a better place, to improve without destroying what makes it special. Unlike the policy papers I wrote as an undergraduate, I do not seek to convince policymakers to implement these thoughts, but rather offer them as someone who has spent months reviewing in detail what the height limits mean to DC. For that reason, this chapter is as much synthesis based on months of research as it is commentary born of years of observation living, working, and playing in the District. I believe that the height limit can become more sensitive to the needs of a city and its inhabitants, without destroying the character that has developed and that do so in a politically realistic manner. It has created a unique opportunity to address both the monumental and the economic.

Chapter 2 illustrated that society's views on urban height are mixed, perhaps nowhere more so than in Washington, DC. As discussed in Chapter 3, the height limit in DC has become something of a sacred cow. Its value as mythology differentiates it from other American cities and, to supporters, gives it a more humane feel. There has never been a popular uprising against the limit because it is not immediately felt by residents, especially when there are larger issues such as voting rights, crime, and education to address. Therefore, even if it was the most meritorious idea, advocating for the removal of height limits in the commercial centers would be foolish. There is an important political and symbolic value to DC's height limit as it currently manifests itself in the core.

Accepting the general contours of limited buildings heights in the core does not preclude changes of law and attitude to take advantage of opportunities provided by height in the District. Quite to the contrary, breaking the marble ceiling in strategic ways could both enhance the monumental nature of DC and contribute to economic development. As San Francisco recognized in the 1960s, the skyline represents a part of the city that can be used to improve the underlying economic situation while also shaping

the image of a city. The latter is incredibly potent in the Nation's Capital, so to preserve the tradition of the height limit, major disruptions to the skyline should come not from the commercial but from the monumental component of the City. Creating a truly monumental skyline could set DC apart from other cities while still acknowledging the value of an urban skyline. At the same time, carefully relieving the strict cap on commercial heights could help to invigorate the core, both economically and socially. These two approaches combined would create a better place without deviating from what is acceptable in a city of sacred heights.

PRINCIPLES OF CHANGE

Before delving into the specifics of the proposals, it is important to recognize the meaning of change and lay out principles to guide any adjustments to what has become a tradition. Based on the investigation of previous chapters, the type of improvements by which modifications should be judged include economic value and fiscal situation, quality of space and place, and the image of the City through its skyline. While determining the precise value of marginal height is beyond the scope of this study, previous chapters show that there is opportunity cost to restricted height and therefore value to be captured by additional height. As the time horizon expands and DC continues to grow, this value becomes greater. So any additional height allowance creates additional value for the private owner. Capturing this value for the public good must be a consideration.

The struggle for urban vitality in downtown DC is not particularly unusual for American downtowns and is certainly not entirely due to the height limit. Yet the height limit has created a much greater area of office-only core which lacks much life after 6 pm. Relieving height should contribute to the quality of downtown places and spaces, by increasing and diversifying their usage throughout the day. Finally, changing the height regime should improve the image of DC currently manifested by its rather uninspiring skyline.

Reconciling these goals with DC's current form is a challenge that any proposal must address. The history and politics of the District of Columbia's height limit have helped illuminate the tradition of DC's mid-rise form. Yet traditions, serving as a connection between the present and the past, are not immutable. Terming DC's form a tradition does not relegate it to a future of exactly the same. Just as in Europe, where tall buildings have been experimented with, so should DC work to adapt its regulations to create better places while maintaining a connection to the traditions of the past.

Tradition of urban form, even more than other traditions, takes longer to change, as the physical environment changes at a rate slower than human perception can register. Proposals for change in urban form must address the process of change. Cities, made of very durable buildings, change slowly, especially in areas with little developable land, such as DC's core. Bertaud and Malpezzi address the durability of cities with a metaphor to clay.[1] In the short run, they note, cities are putty-clay, meaning they are initially formless, but as real estate develops, it hardens into clay, making it very hard to change. In the long run, however, the market is more like putty-putty. It is initially formless, but over time, as buildings wear and depreciate, its form can be reshaped with much lower costs. This seems appropriate with the caveat that infrastructure is unlikely to shift over time, so later putties are more circumscribed and less malleable than initial form. As it relates to the height limit, allowing height in the short run will not have an immediate impact upon the market. Change requires vision beyond today or even this generation. The Washington Skyline Study, although a bit extreme, looked 200 years into the future. As buildings continue to redevelop in the core and the market continues to grow in the secondary centers, additional height will slowly reshape the form of the City. If done right, it could prove immensely beneficial to the City and its residents.

To successfully plan for the future, a proposal must account for the unique nature of DC's current spatial form. The discussion in Chapter 2 and analysis

in Chapter 5 showed that most cities have generally grown up then out. DC's form, like cake batter slowly filling up the pan, has spread out as a result of the height limit. Covering about twice as much land area as otherwise, DC's core is close to reaching the edge of the pan and must rise to continue to grow. This creates the opportunity to shape the nature of form.

On the practical side, some of the proposals below would require an act of the federal government to adjust the Height of Buildings Act of 1910. While this would be a major undertaking, the current situation looks more favorable to such action than previously. Given the political changes in the Executive and Legislative Branches of the federal government, the prospect of more leeway for self-rule in DC is real. Because some of the proposals would encourage economic development, it could also serve as one way of making up for the structural deficit caused by the federal government, something that the current Congress and President seem to be more receptive to. Certainly adjustments would take energy and money in a time when there are more popular issues of federal-DC governance such as voting rights, gun control, and gay marriage. Rather than being a zero-sum game whereby lobbying for one effort means a proportional decrease in other efforts, it seems that all of these issues could help raise a general awareness in Congress and improve lines of communications, making it easier to address all of them. And whereas the other issues are primarily focused on the residents, height limits are an issue that could help galvanize the business and nonprofit communities. The present situation is conducive to initiate a drive for ideal heights in the District.

A MARBLE SKYLINE - MONUMENTAL HEIGHTS

Proponents of the height limit exclaim its ability to emphasize the monumental nature of the City. Yet, since most of the major public buildings and monuments are no taller than the limit, it is really L'Enfant's plan that allows for scenic vistas. The Washington Monument, Capitol dome, and tower of

figure 6-2. DC"s skyline with the Church of the Immaculate Conception in the background

the Old Post Office break the ceiling in the downtown core, with the spires of the Church of the Immaculate Conception and the National Cathedral arising in the distance (see figures 6-1 and 6-2).[2] Since the advent of height regulation in the District, there have been no major monumental structures built significantly above the limit. This in part reflects the original intention of the limit as a regulation to protect the health, safety, value and quality of urban life. But as its justification has shifted toward one of protecting monumentality, there has been little to no discussion of actually utilizing the canvas created by the limit.

The lack of discussion is not for lack of monumental plans. In 1996 the National Capital Planning Commission released a report "Extending the Legacy: Planning America's Capital for the 21st Century", in response to

the growing list of monuments and museums which said:

> "with the opening of the National Museum of the American Indian in 2002, the McMillan Plan for the Mall will be complete. From the foot of the Capitol to the steps of the Lincoln Memorial, all of the choice memorial sites will have been assigned. Yet lack of space has not dammed the flood of requests. Over the next 50 years, Washington may have to accommodate another dozen museums and up to 60 new memorials and monuments."[3]

The plan calls for an extension of the monumental core east and south along East and South Capitol Streets and better utilization of other federal lands adjacent to the mall. Just as the commercial core DC has oozed horizontally due to the height limit, so should its monumental core.

Such horizontal thinking misses a major opportunity. If the pressure of the commercial core cannot be released through vertical construction, the pressure of monumental core should be. A primary rationale for the height limit is its ability to protect and preserve monumental nature, so the height limit should be used to actually enable and improve that very nature. While the most recent memorials have often succumbed to design by commission, creating sprawling landscapes, there is the opportunity to create buildings and structures that are significant and identifiable from afar. From simple but significant towers on buildings, such as that on the Old Post Office, to stand alone structures such as the recent Air Force Memorial in Arlington, the skyline could become a symbol of monumentality.

Rather than undercutting the current notable monumentally high structures, namely the Washington Monument and Capitol Dome, the creation of taller structures could compliment them. It seems unlikely that anything would be built to rival the 555 foot height Washington Monument, but there is still a 400 foot range between the height restriction and the monument's height that could be utilized. Structures of 200-300 feet could help enliven the City's skyline as well as encourage the type of monumentality that has

evaded the core for the last century.

Tall monumental structures need not exist only in and around the mall. Because of the geometry of L'Enfant's plan, there are a myriad of parks shaped in triangles, squares and circles that could host tall monumental structures, relieving some pressure from the mall while still attracting attention for their ability to rise above the marble ceiling. Federal law need not change to accommodate such structures, as many would be the type of towers and architectural flourishes not covered under the limit. Even for towers that could have occupied space, such as the tower of the Old Post Office, if they were constructed by the federal government, the law would be easier to adjust.

Some may decry the possibility of monumental towers and structures as imperial or Soviet or some other such undemocratic propaganda. Reconciling the nature of monumentalism with representative democracy is a much deeper question that requires an exploration of what the architecture of democracy is and whether it can accommodate massive marble monuments. Without delving into such a debate, it is safe to observe that height is not inherently the problem as the World War II memorial has no height yet evokes Soviet-style triumphalism with its massive scale and iconography.

If treated carefully, monumental heights could significantly contribute to the experience of the District of Columbia while also relieving some of the pressure the create ever-more monuments, museums, and memorials. The void of the skyline as it stands represents a missed opportunity. Taking advantage of it for the purposes of monumentality would fit both with the current nature of the height limit and the desire to maintain a unique skyline in DC. But there is more opportunity in the void than simply the federal monumental interests. In fact, the real opportunity lies in the ability to use the implications of the height limit to advance local economic development and

urban vitality.

COMMERCIAL HEIGHTS

> "If the lid is left on the buildings heights...it is only a matter of time before Washington fills up its zoning envelope with more of the same."
> James Bailey, Architectural Forum 1965.

Some commentators in the recent debate on height limits argue that the very real prospect of downtown DC building out to the height limit will inevitably result in revisiting the 1910 Height Act. As shown in Chapter 4, build out is already a reality in the downtown core and likely less than a generation away in the secondary centers of DC. Yet, as with its neoclassical marble structures, the height limit in DC represents one of few traditions that the relatively young city can see and feel. There is an opportunity, rooted in the reality of build out, to reevaluate the height limit so as to provide economic gains and shape a stronger urban core while preserving the mid-rise, "sacred skyline" of downtown. After laying out my general proposal, I will propose mechanisms of implementation to capture maximum value and shape a vibrant downtown.

As the height limit has contributed to the creation of a high-demand core and lower-demand secondary centers, its should be treated differently in these two areas. A small addition of height to the core would provide a source of additional funds for the local government, while maintaining the character of downtown and encouraging the horizontal spread to the secondary centers. Height in the secondary centers could be greatly relieved, based on the distance from the core, so as to encourage new development and better absorb future demand. The following sections explore this proposal more thoroughly.

ADDITIONAL HEIGHT IN THE CORE AND SECONDARY CENTERS

Allowing a small amount of additional height in the core should be done on practical grounds. It is a market with high demand and one that is nearly built out. Taking advantage of the restriction by relieving it slightly would be a powerful economic development tool that could greatly improve the quality of the District without damaging the mid-rise nature of downtown that people and the federal government seem to enjoy. Currently most buildings in the core rise 110 to 130 feet plus any stepbacks or roof structures. Still, there are areas surrounding the core which have height limits of 90 feet. Many buildings in these areas rise higher than 90 feet due to zoning relief, so the 90 foot zoning creates a tool by which the District can gain concessions for additional height. Using regulation as a tool of negotiation and leverage will be more fully addressed later, but there are more efficient and beneficial methods of achieving goals than through ad hoc relief. As such, it is suggested that all of downtown be allowed to rise to 160 feet, with the same provision for stepbacks and roof structures. The areas to include in this height regime would be the C-4 and C-3-C, and C-2-C zones, as well as a few M and SP zoning areas whose maximum zoning heights range from 90-130 feet. These are the same areas analyzed for the build out in Chapter 4. The proposal would allow for an additional 47 million square feet of space in the core, assuming the caveats discussed below. This is a 32% increase over the current total buildable area of about 143 million potential square feet in the study area, of which 133 million are already built (see Appendix 3 for details).[4]

Two exceptions should be granted to this general height relief. First, the C-2-C zone along 16th Street NW, which has historically had lower heights, should stay at 90 feet. While in terms of urban design, this would be a wonderful place to raise the heights above the rest in order to emphasize the northern approach to the White House, tradition should maintain the lower height here. In addition, 16th Street NW, while routed through the

downtown core, quickly leads into residential areas. Low heights which are markedly different from other areas in the core could actually serve as a symbolic connection of power to regular people. Currently, such a differential is not easily perceivable because the allowable height difference between this and nearby zones is only 20 feet at most.

The other exception should be the major, 160 foot wide roads, namely K Street NW and Pennsylvania Avenue. L'Enfant's plan created extremely wide streets throughout the National Capital and the widest of these present an opportunity to preserve the mid-rise nature of DC while taking advantage of the light and air provided by very large rights-of-way. Pennsylvania Avenue in particular must continue to be set apart from the rest of downtown. Its current special status in the Height Act came about not as part of a plan to emphasize the street, but because a certain landowner along the north side of the street was interested in building taller at the time the act was working its way through Congress. When a lawmaker wrote in an amendment to allow for this 160 foot building, it upset enough people such that negotiations created an entire zone along the north side of the street with higher limits.[5] Pennsylvania Avenue, having been shaped by President Kennedy's vision for it as America's monumental street, represents an place where height could be used to continue striving for such an ideal. Because it is as monumental as it is commercial should be considered for the type of major height relief discussed in the previous section. Building heights of 180-200 feet and even taller towers along Pennsylvania Avenue could further enhance the symbolic and visual connection between the White House and the Capitol.

Whereas most downtowns are tallest at their centers, DC could have height surrounding the core, creating other areas of intensity. It has already begun to develop this way given the existing buildings in Arlington and the natural hills to the north. Such an urban "bowl" has been discussed in various urban design proposals, but height was usually not allocated inside the borders

of the District, likely because of the Height Act. Allowing additional height based on the proximity of the secondary centers to the core could be done sensitively, so as not detract from the mid-rise nature of DC. I propose allowing buildings of 175 feet or about 14 stories in Mount Vernon Square and Southwest, 190 feet or about 15 stories in NoMa, and 200 feet or 16 stories in Waterfront and Near Southeast. Given that the tallest buildings in Rosslyn are 30 stories and over 350 feet, these additions are not particularly dramatic, but could help free up additional space under the height limit and contribute to the vibrancy of these areas by allowing for additional density. The heights would remain low enough to allow for monumental structures to demand prominence on the horizon, as suggested previously. Meanwhile, it would free up an additional 53 million square feet, a 44% increase over the current 120 million potential built square footage in these markets, of which 40 million is built (see Appendix 3).

Overall these proposals would allow for 100 million additional square feet in all of downtown, for a total of 365 million potential built square feet. Given that there are approximately 164 million square feet built, this would allow for plenty of space for the next few generations. The proposal seeks to utilize heights in a more sophisticated manner so as to emphasize certain monumental aspects of the core while also subtly reinforcing the natural urban bowl that exists. At the same time, from the pedestrian level, the additional height will not greatly disturb DC's mid-rise status. The potential additional height allowed by both the core and secondary center proposals is illustrated in figure 6-3.

While not addressed in the previous analyses, commercial centers within DC but outside of the core also deserve to have revised height limits. Areas such as those around Florida Market in Northeast, Friendship Heights in Northwest, or Anacostia Gateway in Southeast could all benefit from height relief in the same way the secondary centers do. Heights of up to 200 feet, and perhaps even more in areas such as Anacostia Gateway across the

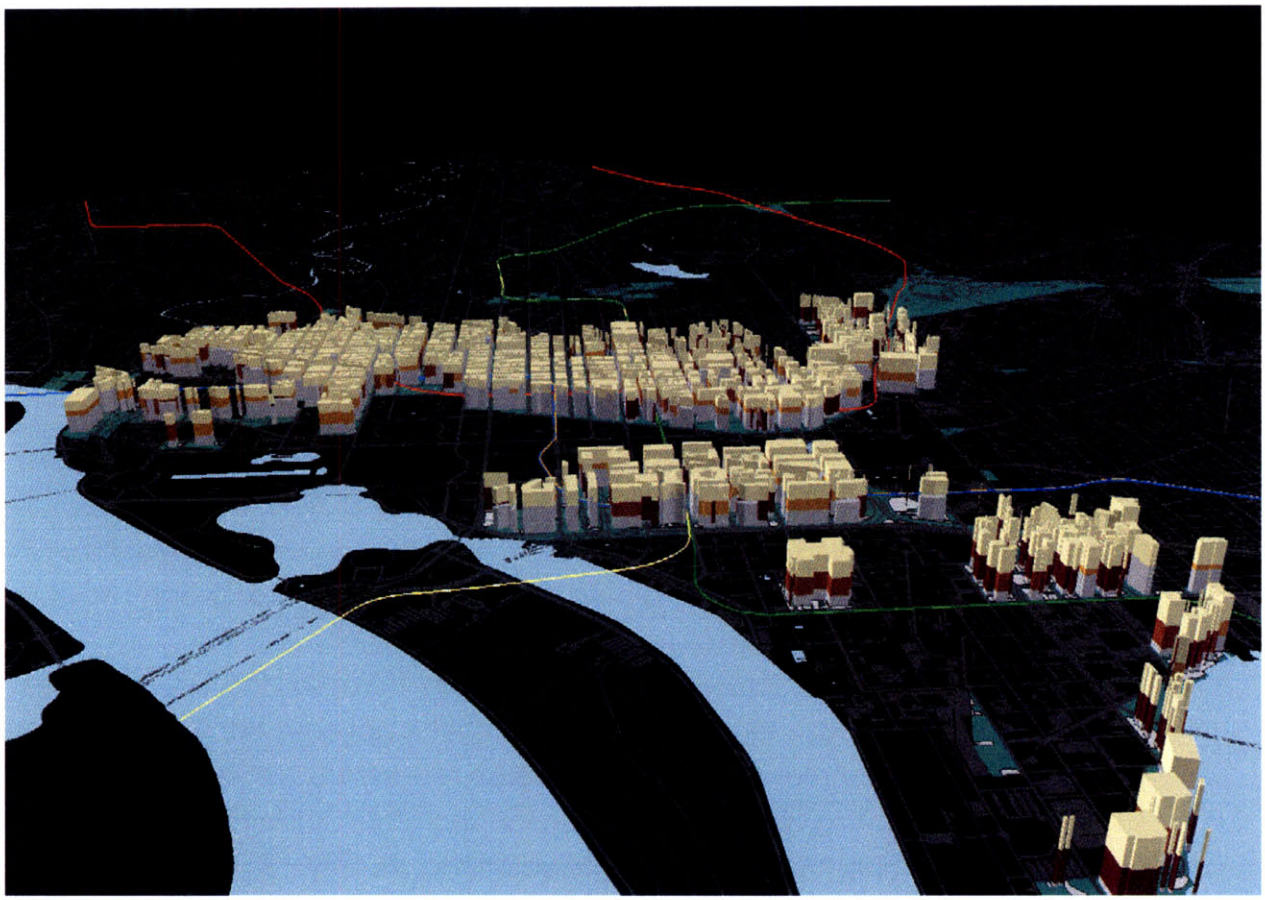


figure 6-3. The creme colored volumes represent additional height gained by my proposals.

Anacostia River, could serve the areas and the District well. While neighborhood opposition might be more pronounced in some due to their proximity to residential enclaves, their existence and potential for improved economic opportunities should not be ignored. Given these recommendations for the various commercial areas in DC, the following sections will examine potential benefits from the changes as well as mechanisms for adjusting the height limits and capturing the additional value of doing so.

INCREASED PUBLIC FUNDS

The value of these changes is difficult to quantify given the limits of measuring demand and any response to additional supply. A 2003 study commissioned by the D.C. government showed that allowing buildings up to 160 feet in the C-3-C, C-4, and C-5 zones could result in an additional $345 million a year in property tax revenues and $890 million in overall tax benefits.[6] With additional height in secondary centers, the numbers would be higher. Given that the District's property tax revenues were $1.78 billion and total tax revenues were $5.33 billion, these additional funds are significant.[7] The estimates should be thought of as degree of magnitude estimates, as they do not take into account demand, simply using current prices to impute future value. The demand for additional heights in downtown, especially in the medium and long term, promises continual growth for space allowing for additional growth of tax receipts.

The act of allowing for additional space also increases the value of land. Most of this increase should be captured by the government for it would be an act of government that would increase real estate values. A major difficulty in estimating additional value in the short term is the tension between freeing up supply and planning for additional density. A large amount of potential area would be available in the central core, perhaps attracting demand that would have gone to the secondary markets. Would additional height in these areas actually result in taller buildings? Absent an increase of available space in the core, it appears that additional height would be used in these markets. A drive along the Southeast-Southwest Freeway shows a number of tall residential buildings arising in Near Southeast, even since the 2005 data that was used to analyze the market. Office buildings built to the limit are popping up in NoMA, especially since 2005. Plans are being made for Waterfront and the Waterside Mall in Southwest is currently undergoing redevelopment, with binding buildings currently under construction. Even with the downturn, these markets seem well positioned to soak up excess demand from the core, especially since all are

well served by Metro. Through a carefully crafted auction of height in both the core and secondary centers, the market can be encouraged to move toward these areas, while still allowing demand to articulate itself. This idea is explored in the following section.

ALLOCATING AND CAPTURING VALUE

Increasing the height allowance for the core should be considered over the long-term, allowing height to slowly build up to keep up with demand and prevent a flood of space on the market. In many cities, height is achieved in a incremental ad hoc manner. A common regime includes relatively strict height limits with relief if certain goals are met. In Boston, despite the skyline, the as-of-right height limit is still close to that of Washington DC. Owners must go to the City to ask for relief, offering some sort of public concessions in order to gain the private benefit. A similar system is also present in Rosslyn, Virginia, home to the tallest buildings in the DC Metropolitan Area.[8] Height through ad hoc dealing is what Loukaitou-Sideris and Banerjee call "urban design by privatization and negotiation" and seems to work in cities that have less rigid height limits than DC.[9]

Such ad hoc negotiation can lend itself to abuse as well as a real difficulty in measuring the public benefits. Plazas, which were often concessions for the public good provided by developers of high rises in Los Angeles and New York, have become of little public value over time. Even in DC, the Planned Unit Development process allows for zoning variances on a project by project basis, involving individual hearings and decisions. Changes to DC's regime offer an opportunity to carefully raise height limits systematically. Current height limits would remain as-of-right, while the proposed limits would represent an overlay. Height would be auctioned off at regular periods, with the amount auctioned based on perceived demand. This would put all owners at an equal footing and prevent abuse. Depending on the desired goals, height could be auctioned generally, or could be restricted to certain areas. For example, if policymakers seek to encourage

the development of the new Ballpark Area near the Navy Yard, height allowances could be auctioned for that particular area. Auctions would allow additional height to be built in line with demand. If demand does not exist for height at the time, then it is simply not auctioned. Still the playing field is transparent, and developers and owners will know ahead of time the potential height of their property, both as-of-right and by auction. This means that some of the additional value would be impounded into the value of the land going to current owners, but the auction would maximize the amount of additional value captured.

Auctioning height also ensures that the public benefits are clearly articulated in monetary terms. This allows for priorities, such as improving the quality of the urban space and life, to be funded transparently. Funding better transit options downtown, such as the proposed streetcar along H Street NW, would not only improve the quality of the area, but also add to its value. A major issue in the District, outside the scope of this investigation, is its historically troubled education system. Funds could be used to improve schools or neighborhood facilities, especially in the core. This in turn would improve the appeal of the District, especially for the type of residents who have fled the city for the suburbs in the last half-century.

IMPROVED DENSITY MIX AND URBAN VITALITY

Addressing the goal of increased revenues through additional height is simpler than dealing with the less tangible value of improving the quality and vibrancy of the area. Because in most areas, office space is more valuable than residential space, there is a tension between leveraging the demand for office space to raise additional public funds and creating a better mix of residential and employment density that could lead to a more vibrant downtown. Most downtowns, as was shown, have very high concentrations of employment, with DC serving as an extreme example. While this concentration is economically beneficial, it acts to deaden the urban vitality of areas which consist solely of office buildings. In DC, this area of office

use is especially large because of the height limit. An increased mix of residential to commercial densities could create better downtown spaces, increasing the overall appeal and value of the core in the long run.

With the relaxation of the height limits, there is an opportunity to shape and reshape the nature of downtown. Whereas many cities seek to use FAR limits in combination with zoning to shape development, DC offers an opportunity to introduce regulations that are even more flexible than FAR limits. As discussed in the last chapter, the notion of density is often conceptualized and measured in terms of either residential density or density of built area (FAR). Yet what really creates complex urban spaces tends to be a mix of both residential and employment densities, which create constant and varied use of space. Overlaying density mix requirements on new height limits offers a chance to begin to address the lack of various densities and resultant lack of vitality seen in the central core. It could also prevent the same from happening the secondary centers.

Regulating density away from the market direction could lower the economic gains of additional height including additional revenues captured by the government, however. On one extreme, any additional density gained from height could be limited to residential which would limit economic gains, while on the other, allowing the market to determine mix would likely result in most or all of additional density to be employment density and maximize economic gain. Any regulation would ideally be somewhere in between, recognizing that the market is articulating the value of economies of agglomeration which have been restricted and which height relief proposal seeks to address.

The secondary centers are better positioned than the core to achieve higher employment to residential density ratios. They have both the available space and the right real estate price to support residential, as seen especially to the south in Near Southeast. They could build upon the model

seen on the eastern, northern, and western edges of the core, where there is a mix of residential and employment density. Areas such as Foggy Bottom/Georgetown, Dupont Circle and Chinatown all have vibrant day and night use. These are also areas where historic preservation, later office development, and lower market values have combined to allow for such mix. Density mix regulations could help ensure that new urban development exhibits this vibrant mix, especially in areas that may trend toward new office ghettos, such as NoMA.

HISTORIC PRESERVATION

Greater heights should allow for relief when buildings, of new and old vintage, are rehabilitated and redeveloped over time. They should not, however, allow the mistakes of the original height limit in clearing entire blocks and historic buildings so that the most profitable building envelope could be encompassed. Low buildings, such as churches and historic townhouses in areas like Chinatown and Mount Vernon Triangle would occupy more valuable land, feeling greater pressure to redevelop. Even currently tall buildings that would be granted additional height, such as the historic Willard Hotel at Pennsylvania Avenue and 15th Street NW, might feel pressure to redevelop. In addition to the current historic preservation regime, which has preserved some of the feeling of the old DC in the Chinatown and East End area, tradable air rights, of the type found in New York City, could be allocated in order to protect and preserve old structures. In this way, owners could sell some of the rights above their buildings to developers looking for additional height in other areas, in lieu of the public auction. This would relieve the pressure of additional height and provide funds to protect and preserve historic buildings. It would also add to the quality of the urban fabric, allowing for a variety of building types and heights, as compared to the monotonous office boxes of similar vintage currently existing in downtown. Such a scheme would reduce somewhat the funds collected by the government, as the value would flow to the owners of lower buildings, but it is likely worth the cost of preserving buildings and

preserving complex and authentic urban spaces.

IMPLEMENTATION

I have made the case for updating the limits based on a deeper understanding of their impacts on the City and have provided an outline of how this could be done. Yet actually proposing changes would require a deeper understanding of particular markets and the implications of raising limits. Examining each submarket in terms of existing height, potential height (including historic buildings and parking lots), and market trends would be necessary. As important is the opinion of current residents and nearby neighbors. Some residents would likely support additional density and vitality over time. Others would be opposed to additional development, especially if it included buildings significantly taller than currently allowed. Policymakers should stress the long-term nature of any adjustment, explaining its importance for ensuring continued growth and improved quality of life in the District. In addition, they could provide short- to medium-term controls to ensure that sensitive areas are not the first to be granted additional height.

Just as realizing a more sophisticated height regime would take generations, actually passing and implementing the changes is not a short-term prospect. Currently the DC Office of Planning is revisiting its Comprehensive Plan, a task that takes years and guides zoning. Though this opportunity to address the height proposals has passed, changes to the height limit are not out of realm of reality, it may just take a more prolonged campaign. Garnering the support of organized groups that would benefit from a new regime, such as business associations and real estate interests would be a major step toward a successful effort. Because of the restricted target areas and still relatively low limits of 200 feet in certain areas, the proposal would have few losers. At the same time, through the auction mechanism and creation of additional competitive space in DC, it could tangibly and significantly benefit the residents of, workers in, and visitors to the District.

CONCLUSION

This investigation sought to provide a broad background to urban height, its restrictions, and DC's very interesting case. As such, it examined height and its regulation from a number of different angles and perspectives: historic, political, economic, geographic, demographic, and design. Some of these have garnered more attention than others, but few have been examined solely through the lens of height.

These analyses contribute to the literature by tying the initial impetus behind DC's height limit to its trajectory over time and its current state. It also took a novel approach to examining densities, looking at both employment and residential density. An improved understanding of the relationship between the various types of density and height could be one step toward better understanding both urban congestion and vitality. Relatedly, an improved model, perhaps in the vein of systems dynamics, that addresses the trade off between agglomeration and congestion could help policymakers, planners, and real estate interests strive for the optimal mix. Finally, a novel approach was formulated for measuring and comparing heights across cities. Quantifying height can help further our understanding the z-axis of urban areas, which impact not only their form, but also their economy and vitality. Tall buildings are a product of cities and their economies. While this investigation sought to illuminate this unique relationship through the case of Washington, DC, there are still plenty of avenues open for further investigation and elucidation.

The height proposals in this concluding chapter address the three different places that comprise DC. First is the National Capital, replete with monumentality symbolizing the nature of the nation and its history. Symbols that pierce the marble ceiling will contribute to this aspect of DC and perhaps help relieve the pressure on the National Mall. Second and related, DC is place whose business is government. All sorts of private national and international organizations, as well as law firms and lobbyists exist in the

downtown core of DC, fueled by the seat of the national government. The demand from these groups has caused the core to be essentially built out. Allowing for a minimal amount of additional height, would capture this demand, with the increased value flowing toward initiatives to improve the District. Finally, DC is place where people live and other, less lucrative business is done. The secondary centers are ideal areas to capture these markets, and allowing for greater heights here could add to their value and prestige, help improve the vitality of the District as well as contribute to the long-term fiscal situation of the City. While interest groups tend to view DC as only one or two of the above places and provide opinions on the height limit based on such conceptions, a broader understanding of the nature of DC is necessary when dealing with such a complicated matter.

Additional height of three to four stories in Washington, DC could serve to improve the downtown environment and contribute financially toward improving the City. As importantly, it would serve as a relief valve on development pressure, as the core reaches complete build out. Without such relief, the fiscal and urban vitality losses to the District and the metro area will start to become even more apparent, with more expensive space, increased dispersion and greater travel costs and distances. The suggested policy change would help avoid some of these while still protecting the skyline as it stands. A few additional stories could be enough to address demand while preventing out-of-place skyscrapers in the core. In addition, small adjustments up- and downwards in strategic locations could add to the value of the urban experience and symbolism of certain monumental areas in the core.

The Nation's Capital deserves meaningful traditions as well as an excellent urban environment. This examination of DC through the lens of height has shown that it is possible to achieve these goals. The City can be a better place for visitors and residents alike, and small changes in its height regime could help to ensure that the District lives up to its unique potential.

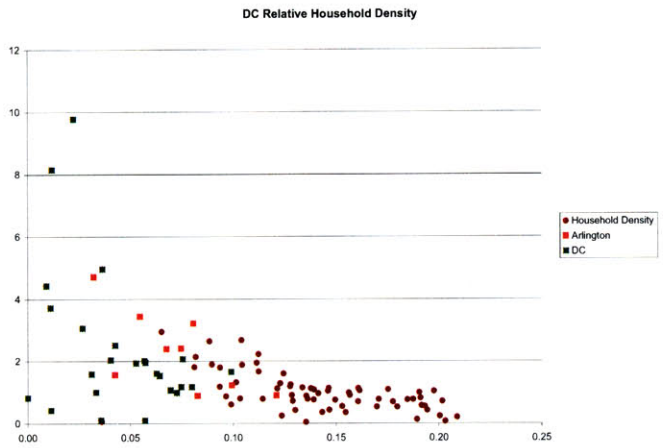
CHAPTER 6 NOTES

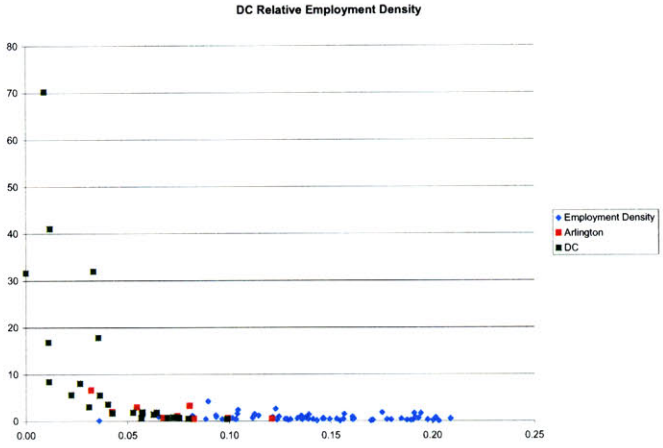
1. Bertaud, A. and S. Malpezzi (1999). "The spatial distribution of population in 35 World Cities: the role of markets, planning and topography." *The Center for urban land and economic research*, The University of Wisconsin.
2. The National Cathedral abides by the height limit, as its nave is just over 100 feet high while its towers, the tallest rising 300 feet, are exempt. The Church of the Immaculate Conception received legislative waiver for its dome.
3. National Capital Planning Commission. (1997). "Extending the Legacy: Planning America's Capital for the 21st Century." National Capital Planning Commission.
4. Counting only the air available height above buildings greater than 20,000 square feet in footprint and the potential of parking lots greater than 20,000 square feet.
5. "Building height limitations : staff report for the Committee on the District of Columbia." House of Representatives, Ninety-fourth Congress, United States Congress, House Committee on the District of Columbia. (1976).
6. Jair Lynch Company and Einhorn/Yafee/Prescott (2003). "DC Building Height Limit Study." Government of the District of Columbia, Office of the Deputy Mayor for Planning & Economic Development.
7. "Comprehensive Annual Financial Report." (2008). DC Chief Financial Officer.
8. Cook, R. S. (1980). *Zoning for downtown urban design: how cities control development.* Lexington Books.
9. Loukaitou-Sideris, A. and T. Banerjee (1998). *Urban design downtown: Poetics and politics of form*. University of California Press.

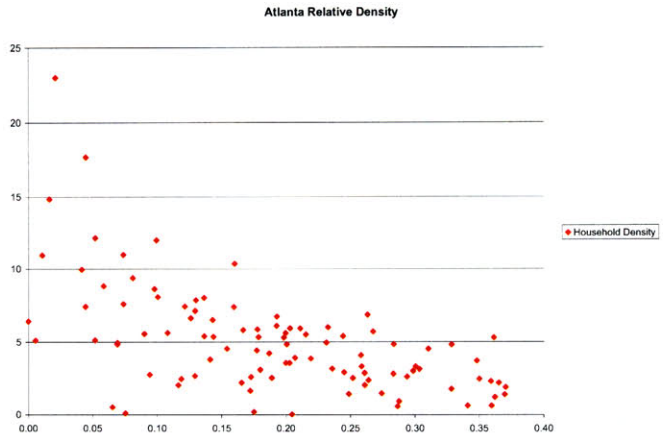
Appendix 1

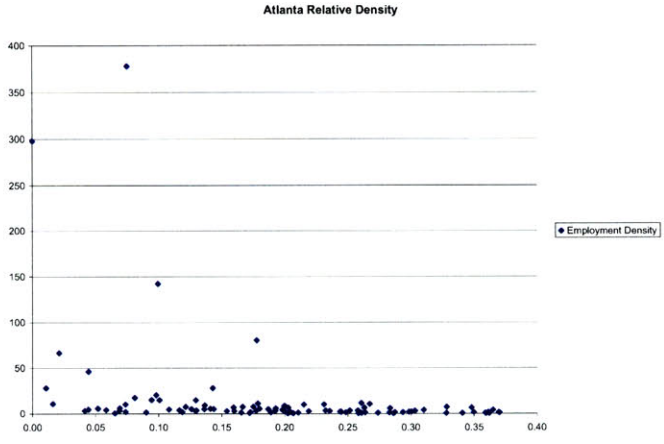
Granular Density Gradients

Source: Community Sourcebook America (2004)

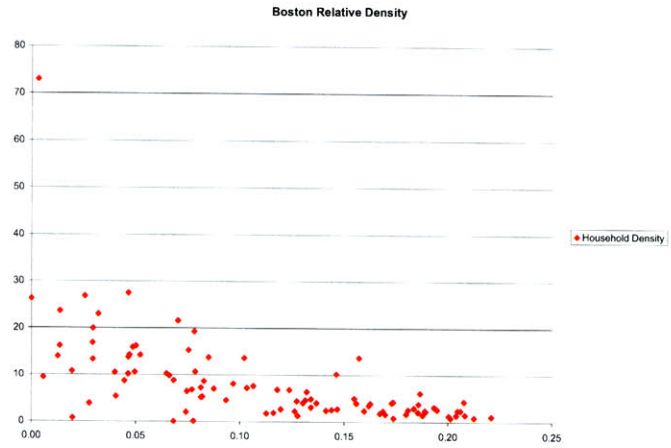


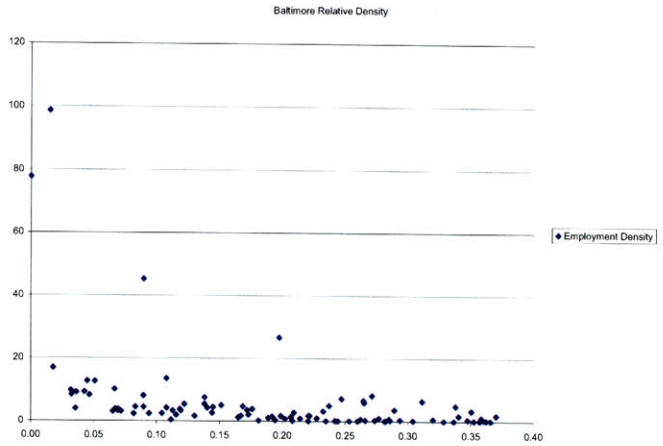


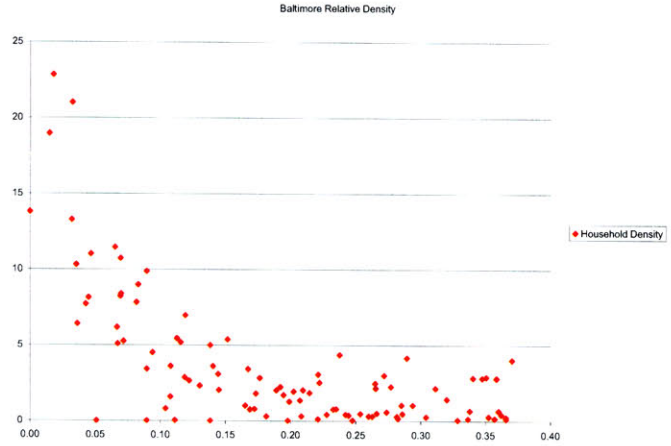


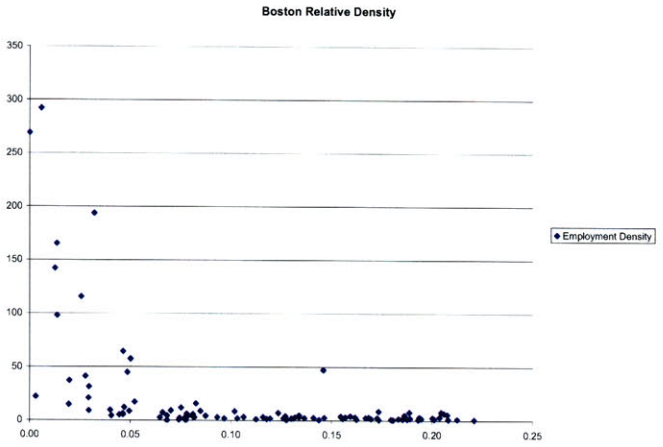


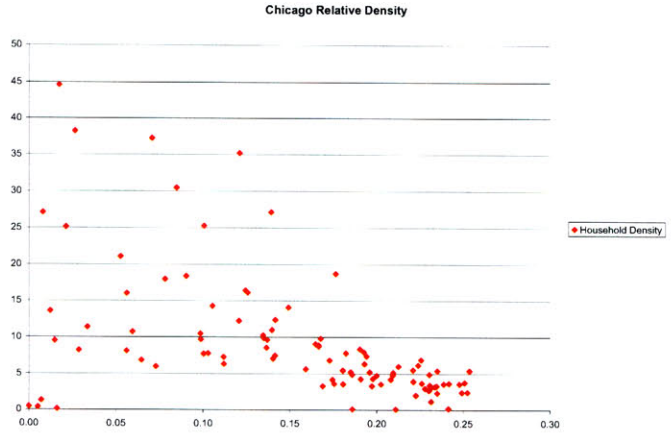
Granular Density Gradients

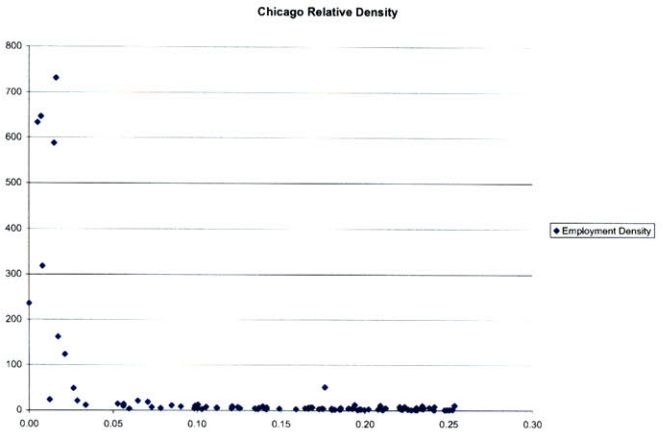


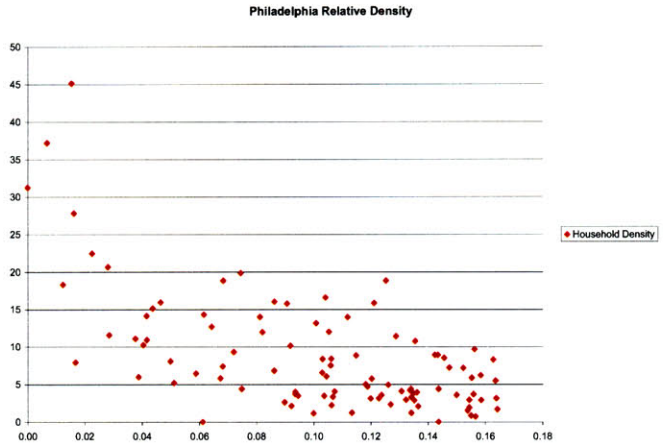


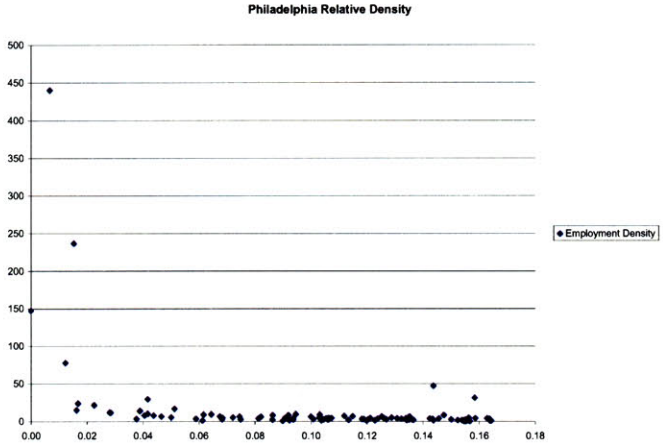


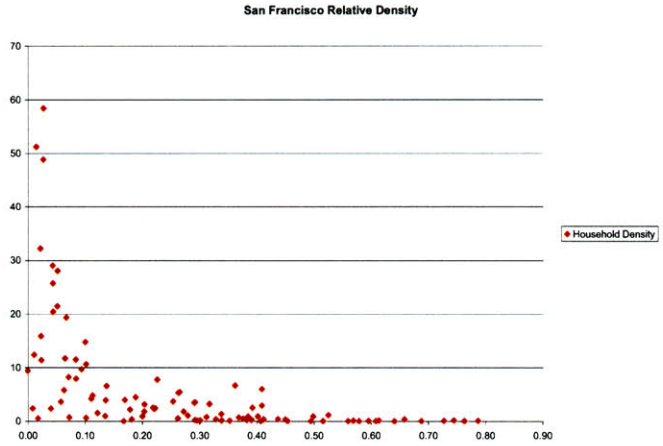


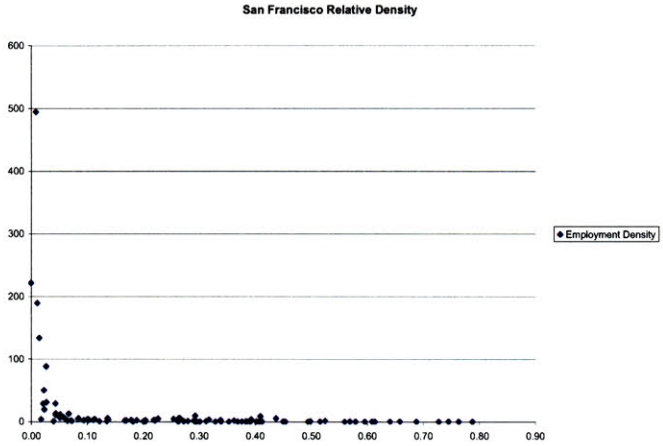





Philadelphia Relative Density
Household Density


Philadelphia Relative Density
Employment Density


San Francisco Relative Density
Household Density


San Francisco Relative Density
Employment Density

APPENDIX 2

CITY HEIGHT CUTS

Source: Google Earth.

Ground Plan

1000 feet

Philadelphia

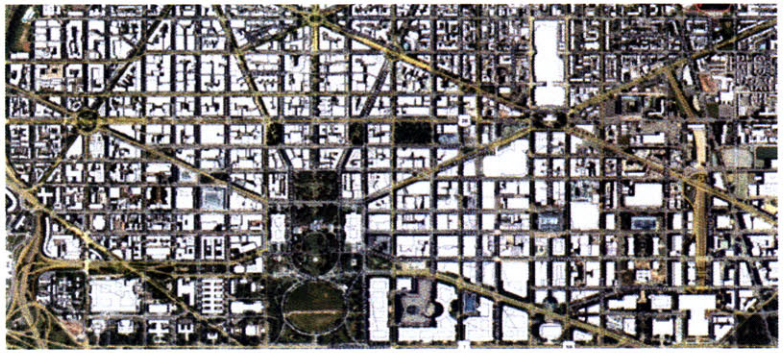
San Francisco

Chicago

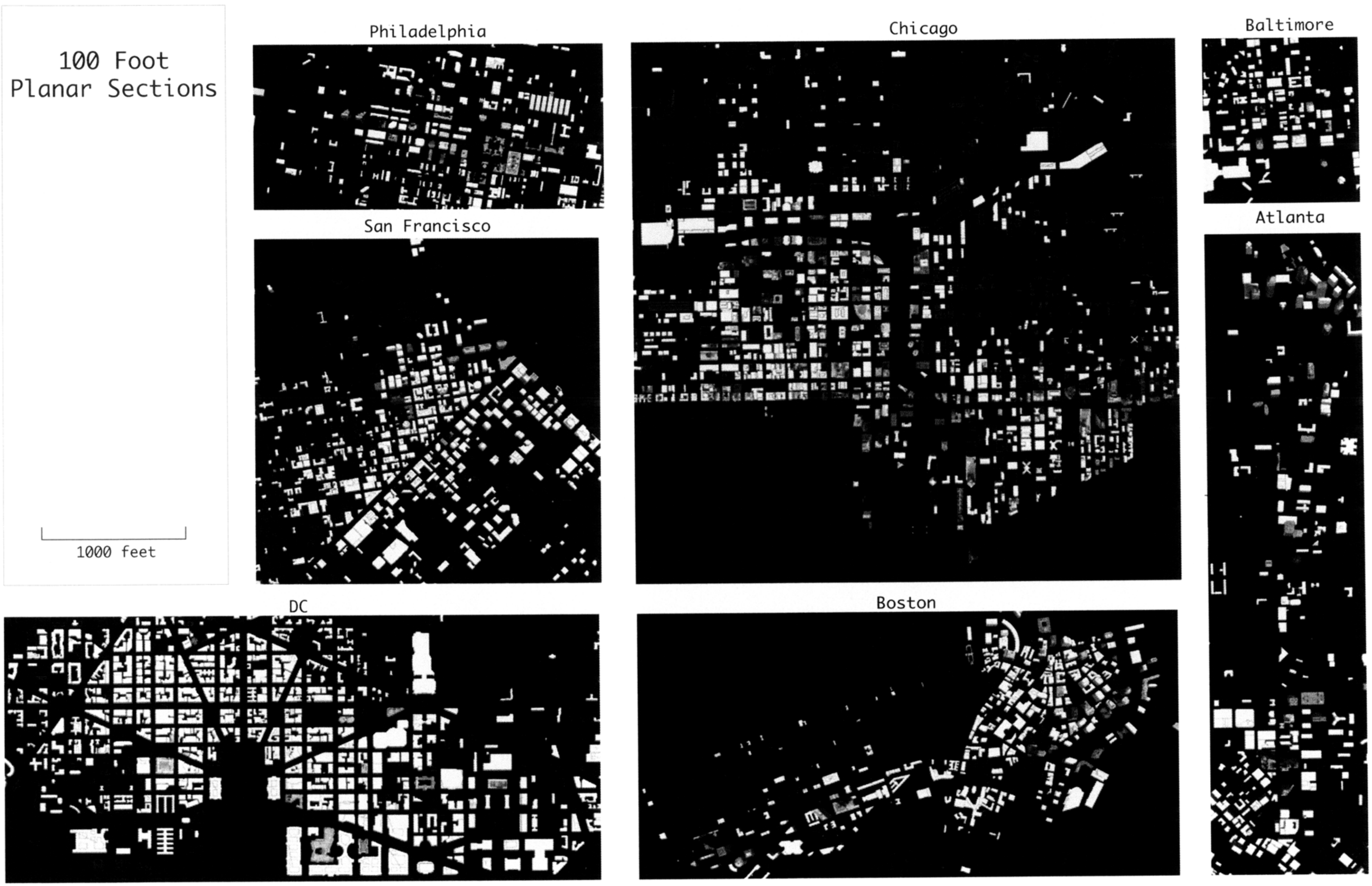
Baltimore

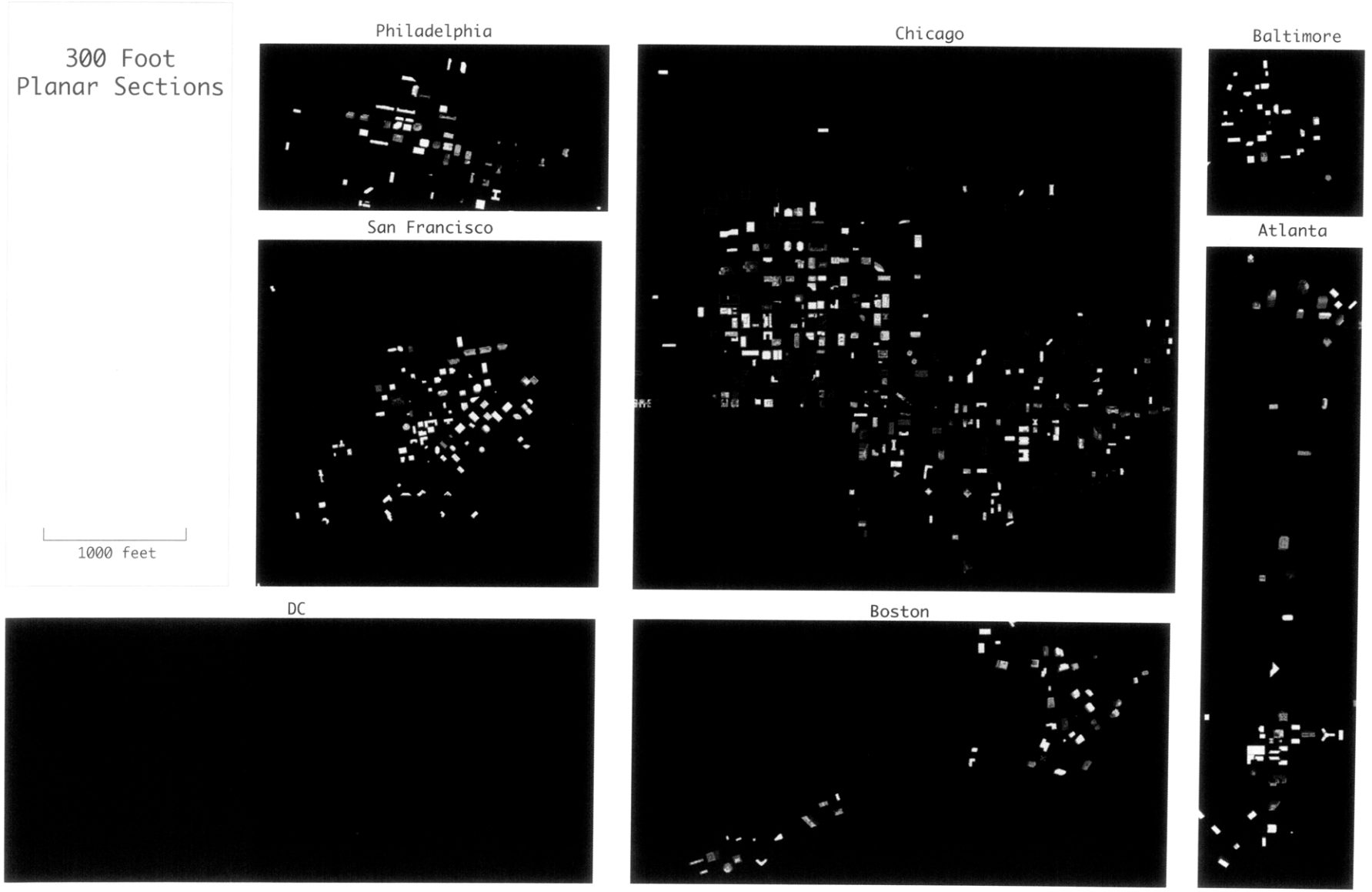
Atlanta

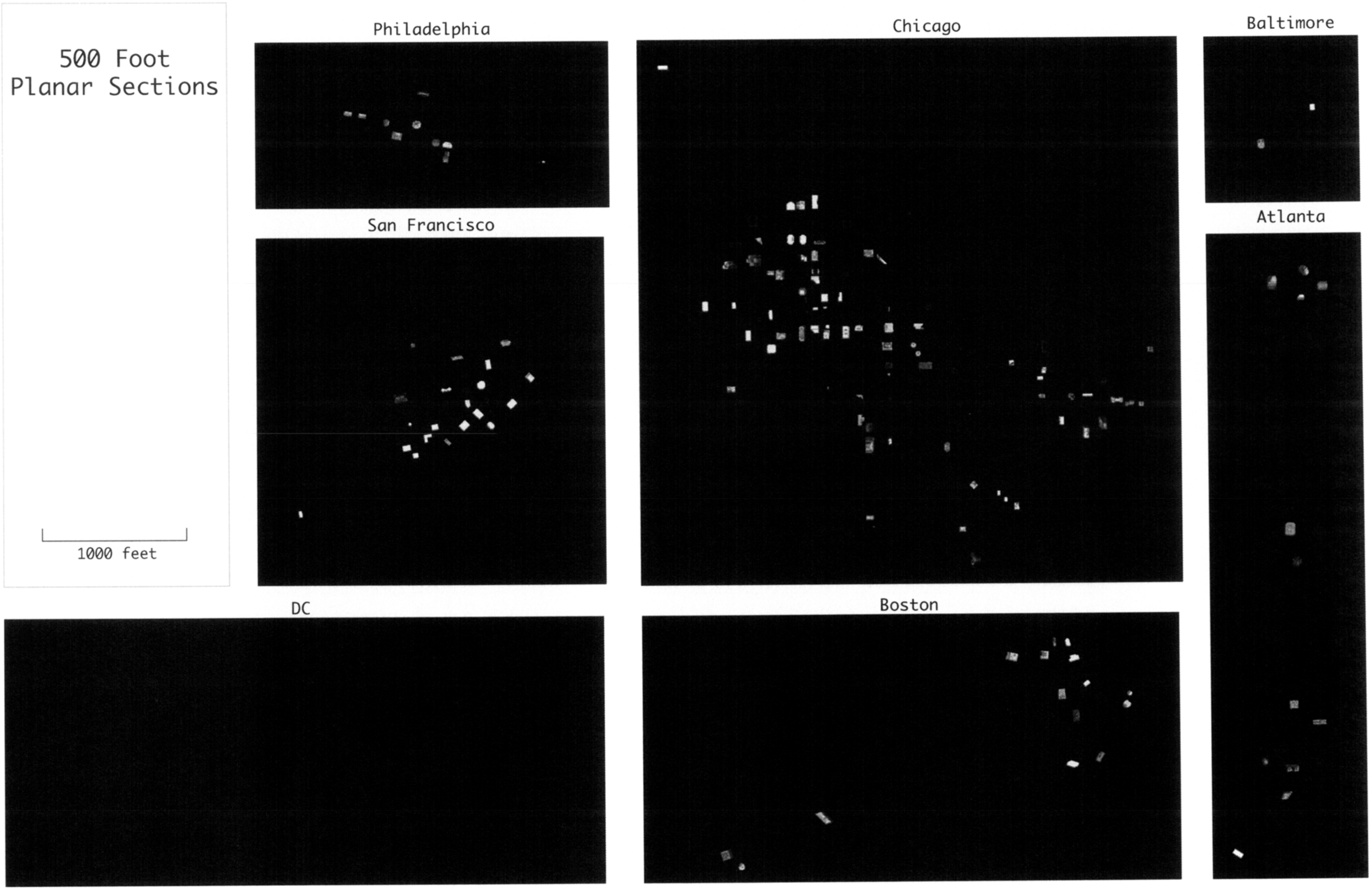
DC



Boston


100 Foot
Planar Sections
1000 feet
Philadelphia
Chicago
Baltimore
San Francisco
Atlanta
DC
Boston


300 Foot
Planar Sections
1000 feet
Philadelphia
San Francisco
Chicago
Baltimore
Atlanta
DC
Boston


500 Foot
Planar Sections
1000 feet
Philadelphia
Chicago
Baltimore
San Francisco
Atlanta
DC
Boston

Appendix 3

Space and Build Out Breakdown

	Total	Downtown	East End	West End	Mt. Vernon	Navy Yard	NoMA	Southwest	Waterfront
Applicable Area	72,781,734	20,132,138	13,579,971	7,817,715	4,023,010	3,729,601	9,902,093	11,079,174	2,518,033
All Bldgs	1,639	605	351	157	135	106	157	90	38
Land Coverage	24,060,149	8,582,949	4,931,478	3,197,875	1,125,343	634,438	2,037,328	3,128,650	422,089
Existing Volume	2,071,457,268	899,833,870	427,816,256	267,753,413	71,197,317	25,233,552	118,336,645	244,170,928	17,115,287
Est. Bldg Area	172,412,439	75,117,165	35,576,322	22,324,832	5,802,013	2,079,300	9,762,903	20,257,647	1,492,258
Available Space	58,786,720	11,135,945	11,165,957	7,467,558	4,411,267	3,761,172	9,199,910	9,208,245	2,436,667
> 20k SF Bldgs	347	136	69	53	8	8	29	39	5
Land Coverage	17,291,812	5,056,414	3,824,461	2,524,030	834,501	314,678	1,490,030	2,921,613	326,085
Exis. Volume	1,575,541,199	562,070,464	360,256,109	219,009,983	62,984,323	19,363,196	102,172,684	234,912,962	14,771,478
Est. Bldg Area	131,097,679	46,908,598	30,007,324	18,246,478	5,131,041	1,604,408	8,414,965	19,493,344	1,291,521
Available Space	35,632,631	4,707,748	6,569,122	5,289,882	2,435,831	1,287,122	5,522,123	8,083,599	1,737,204
All Pkg Lots	397	76	36	52	47	53	69	53	11
Land Coverage	5,937,023	307,099	505,113	277,167	846,897	937,929	1,710,988	1,038,217	313,613
Available Space	59,370,232	3,070,994	5,051,131	2,771,669	8,468,973	9,379,294	17,109,877	10,382,168	3,136,127
> 20k SF Pkg Lots	75	1	7	2	11	15	21	15	3
Land Coverage	3,991,090	20,223	277,592	53,158	615,464	612,116	1,390,731	771,280	250,528
Available Space	35,919,811	182,004	2,498,326	478,420	5,539,177	5,509,040	12,516,575	6,941,517	2,254,752
Avg Bldg Size	14,680	14,187	14,050	20,369	8,336	5,985	12,977	34,763	11,108
Avg FAR	1.80	2.33	2.21	2.33	1.28	0.43	0.85	1.76	0.51
Buildable Land	29,997,172	8,890,048	5,436,591	3,475,042	1,972,240	1,572,367	3,748,316	4,166,867	735,701
% Built Out	78%	100%	92%	97%	48%	23%	40%	74%	36%
Avg Height	86	105	87	84	63	40	58	78	41

> 20 SF possibility	Total	Downtown	East End	West End	Mt. Vernon	Navy Yard	NoMA	Southwest	Waterfront
new height limit		160	160	160	175	200	190	175	200
buildings	77,825,711	20,225,656	15,297,844	10,096,121	4,172,505	2,202,744	8,940,180	14,608,065	2,282,596
parking lots	22,720,496	80,891	1,110,367	212,631	3,077,320	4,284,809	8,344,384	3,856,399	1,753,696
total	100,546,207	20,306,546	16,408,211	10,308,752	7,249,825	6,487,553	17,284,563	18,464,464	4,036,292
total now	264,631,489	75,299,169	43,125,779	25,574,921	19,810,163	16,967,635	39,389,355	37,581,331	6,883,136
total then	365,177,696	95,605,716	59,533,990	35,883,672	27,059,988	23,455,188	56,673,918	56,045,795	10,919,428
percent increase	38%	27%	38%	40%	37%	38%	44%	49%	59%
total built now	172,412,439	75,117,165	35,576,322	22,324,832	5,802,013	2,079,300	9,762,903	20,257,647	1,492,258

> 20 SF possibility	Core	Secondary
buildings	45,619,621	32,206,090
parking lots	1,403,889	21,316,607
total	47,023,509	53,522,698
total now	143,999,869	120,631,620
total then	191,023,378	174,154,318
percent increase	33%	44%
total built now	133,018,319	39,394,121
absorption	5,000,000	2,000,000

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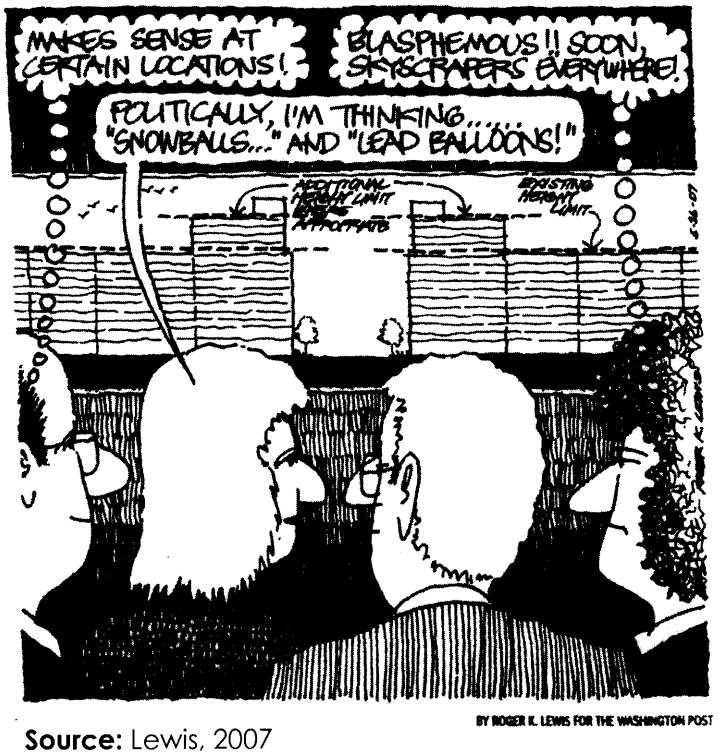

Source: Lewis, 2007