How the Height of Buildings Act Impacts Development in Washington, D.C.

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Abstract

This article examines how the Height of Buildings Act influences development patterns in Washington, D.C. First, it establishes that the act is a binding development constraint in central D.C. Second, it illustrates that development in Washington, D.C., is less concentrated and less intense in the city center than it is in the comparable city of Philadelphia, Pennsylvania. Third, it shows that the population density in Washington, D.C., sprawls farther from the city center than does the population in Philadelphia. This article aligns with the prevailing urban economic literature regarding the consequences of building height limits.

Introduction

By limiting the density of urban development, building height limits can prevent the supply of real estate from meeting demand (Glaeser, Gyourko, and Saks, 2005). Because real estate demand is often greatest in the city center, height limits are especially consequential in the downtown area (Ahlfeldt and McMillen, 2018; Albouy, Ehrlich, and Shin, 2018; Brueckner and Singh, 2020). Downtown height limits significantly increase real estate prices in the city center and shift development toward outlying areas, increasing commuting costs (Bertaud and Brueckner, 2005; Brueckner and Sridhar, 2012; Ding, 2013).

Perhaps the most notorious height limit is the Height of Buildings Act of 1910, a federal law that restricts building heights in Washington, D.C. (hereafter, D.C.), on the basis of street width.[1] This article illustrates how the Height Act constrains density in Downtown D.C. by comparing development patterns in D.C. with those in Philadelphia, Pennsylvania.

[1] Buildings can rise to the width of the street plus 20 feet on commercial streets, up to 130 feet, and rise to the width of the street on residential streets, up to 90 feet. The Height Act allows heights up to 160 feet for buildings on Pennsylvania Avenue between the White House and the Capitol Building, but the federal government owns most lots in this area (*An Act to Regulate the Height of Buildings in the District of Columbia*. 1910. Public Law 61–196).

The Height Act Constrains Development in Downtown Washington, D.C.

The Height Act is the primary density restriction in central D.C., referred to as the "Height Act Area"[2] (Dogan, 2024). To assess whether the Height Act acts as a binding development constraint, exhibit 1 illustrates the remaining development potential in the Height Act Area, including an inset map highlighting the Height Act Area in relation to the city at large.[3]

Using the D.C. Government's Common Ownership Lots spatial layer (Open Data DC, 2022b), exhibit 1 shades lots that still contain development potential under the Height Act in dark blue. Overlaying the Buildings 3D spatial layer (Open Data DC, 2022a), exhibit 1 displays lot area that is already built to 100 feet in light pink with a hashed pattern.[4] Focusing on privately-owned, developable lots, the analysis excludes government-owned lots, university campuses, and historically preserved property.[5] To analyze how the Height Act affects the spatial distribution of new development, exhibit 1 overlays a heat map of buildings built after 2000, weighted by their square footage.[6]

[2] Throughout most of the city, D.C.'s zoning code limits buildings to even lower heights than the Height Act does, either directly through height restrictions or through floor-area-ratio restrictions (Open Data DC, 2017). The Height Act only meaningfully restricts development in zones that do not set additional height and floor-area-ratio (FAR) restrictions. Under the 2016 zoning code, these zones consist of D-4-R, D-5, D-5-R, D-6, D-6-R, D-7, and D-8, defining the current "Height Act Area" (Open Data DC, 2017, 2016). Under the 1958 zoning code, these zones consisted only of C-4, DD/C-4, and DD/C-5, establishing this article's definition of "Downtown" (DC Office of Zoning, n.d.).

[3] Previous studies have used diverse methods to confirm that height limits constrain building heights below market demand in the District of Columbia. Trueblood (2009) employed a similar spatial approach of comparing building heights with D.C.'s zoning limits in his analysis of the Height Act, whereas more recent economic approaches have found evidence of below-market heights through inflated rent prices (Eriksen and Orlando, 2021) and deflated land values (Brueckner and Singh, 2020).

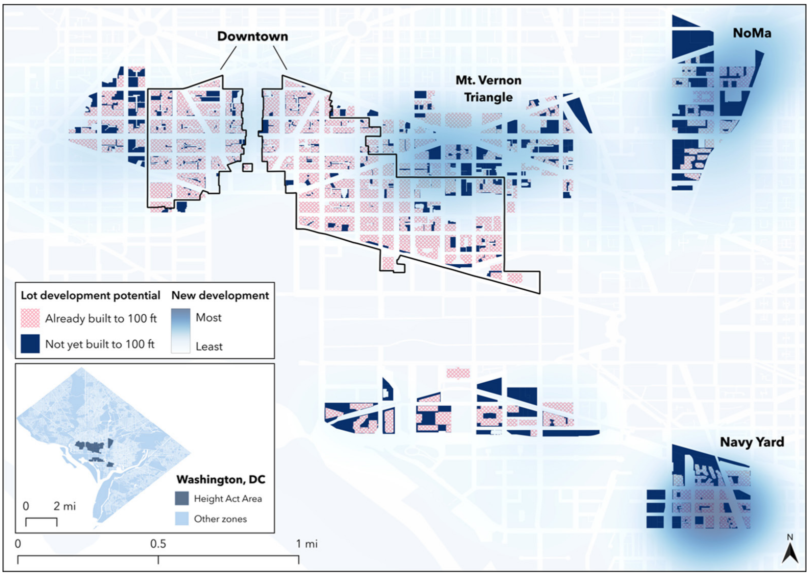
[4] As the maximum height allowed under the Height Act depends on street width, 100 feet is a reasonable estimate of the maximum height permitted on a typical street within the Height Act Area. Although the Height Act allows buildings on wider streets to reach as high as 130 feet, it would not make economic sense to redevelop an existing 100-foot building to achieve this height. The analysis conservatively uses the median, as opposed to the maximum, height of each building to prevent spires and antennas from biasing the height upward.

[5] The study excludes lots owned by foreign governments, the U.S. Government, the D.C. Government, the D.C. Housing Authority, Washington Metropolitan Area Transit Authority, and Consolidated Rail Corporation, as noted in the D.C. Government's Common Ownership Lots spatial layer (Open Data DC, 2022b). The analysis also overlays the D.C. Government's University and College Campuses spatial layer (Open Data DC, 2023d) to exclude college campuses and the Historic Preservation Easements (Open Data DC, 2021b) and Historic Landmarks (Open Data DC, 2020) spatial layers to exclude historically preserved property.

[6] The heat map analyzes lots whose primary building was built after 2000, as specified by "AYB" in the D.C. Government's Computer Assisted Mass Appraisal—Commercial (Open Data DC, 2023b) and Computer Assisted Mass Appraisal—Residential (Open Data DC, 2023c) datasets. Building square footage is sourced from Gross Living Area in the same datasets. Appraisal data are joined with the Common Ownership Lots spatial layer (Open Data DC, 2022b) to perform a quartic kernel density estimation with a 600-meter (0.37-mile) radius of influence.

Exhibit 1

Remaining Development Potential in the Height Act Area



ft = feet. mi = mile. NoMa = North of Massachusetts Avenue.
Sources: DC Office of Zoning, n.d.; Open Data DC, 2023a, 2023b, 2023c, 2023d, 2022a, 2022b, 2021b, 2020, 2016

Exhibit 1 reveals that virtually every lot in the Downtown neighborhood (outlined in black) is already built to the maximum height allowed under the Height Act. This map indicates that the Height Act prevents Downtown D.C. from densifying further. As additional evidence, the heat map shows that Downtown has received minimal new development during the past 2 decades. Instead, D.C.'s new development has concentrated in neighborhoods surrounding Downtown that contain greater development potential.

Visualizing the Spatial Distribution of Development in Washington, D.C., and Philadelphia, Pennsylvania

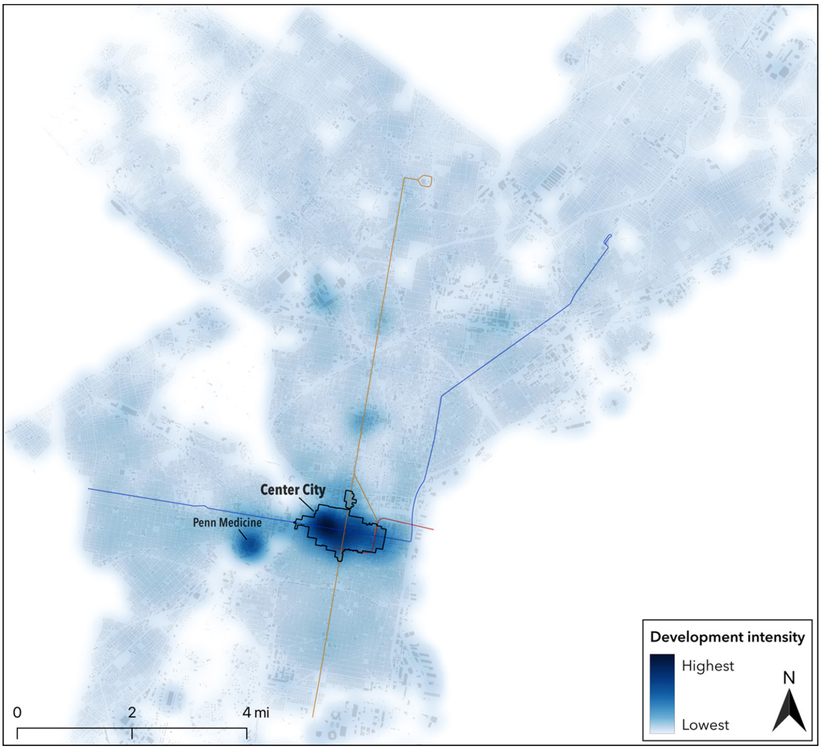
Having established that the Height Act constrains development in Downtown D.C., this section compares the spatial distribution of development in D.C. with its nearest similarly sized city, Philadelphia, Pennsylvania. The D.C. and Philadelphia metropolitan statistical areas contain approximately the same population (U.S. Census Bureau, 2020b) and produce comparable levels of economic output (U.S. Bureau of Economic Analysis, 2020). Accordingly, a reasonable assumption is that their downtowns would exhibit similar development intensity in the absence of height restrictions. However, Philadelphia permits skyscrapers and high-intensity development in its downtown, whereas D.C. does not.[7]

[7] This article defines Center City using the Center City District Boundary spatial layer (OpenDataPhilly, 2015). Center City contains a mix of commercial mixed-use (CMX)-4 and CMX-5 zoning. Within the densest part of Center City, an FAR of 16 is allowed by-right, increasing to an FAR of 35 when including maximum density bonus incentives. An FAR of 35 permits a 70-story skyscraper that covers one-half its lot (Philadelphia City Planning Commission, 2022: 34).

Building off Dogan (2024), exhibits 2a and 2b use building-level data to produce a heat map of development intensity in Philadelphia, Pennsylvania, and Washington, D.C., respectively.[8] A given location's heat map value is determined by a quartic kernel density estimation, which considers the quantity of building volume within a 600-meter (0.37-mile) radius of that location. Darker areas of the maps represent the areas with greater development density. Metro lines and building footprints are overlaid for perspective.[9]

Exhibit 2a

Development Intensity Heat Map: Philadelphia, Pennsylvania



mi = mile.

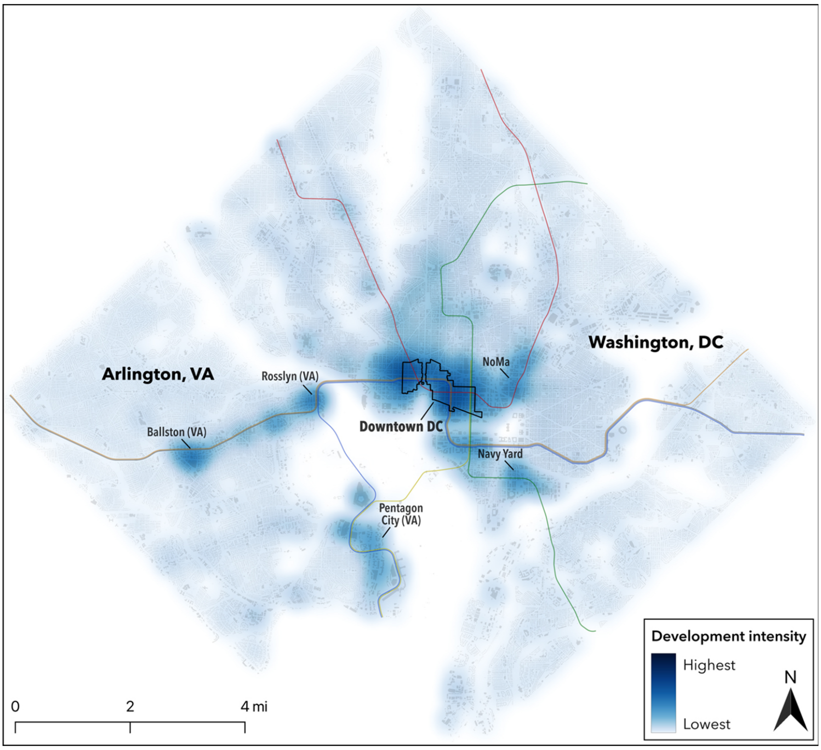
Sources: NJGIN Open Data, 2018; OpenDataPhilly, 2018, 2015, 2012; SEPTA Open Data, 2022

[8] Philadelphia's building data are sourced from the Philadelphia Government's Building Footprints spatial layer (OpenDataPhilly, 2018). The District's building data are sourced from the D.C. Government's Building Footprints (Open Data DC, 2023a) and Buildings 3D (Open Data DC, 2022a) spatial layers. Arlington's building data are sourced from the Arlington Government's Building Height Polygons spatial layer (Arlington County, VA GIS Mapping Center, 2023). Building volume for all cities is calculated by multiplying a building's height by its area. To avoid the influence of building spires and antennas, approximate height is used for Philadelphia, producing conservatively low estimates. Because the height of Philadelphia's tallest building, the Comcast Technology Center, is missing in Philadelphia's building footprint data, this analysis sources the occupied height of this building from the Council on Tall Buildings and Urban Habitat (n.d.). Since completing the analysis, the Buildings 3D (Open Data DC, 2022a) spatial layer is no longer available on Open Data DC.

[9] Philadelphia's metro lines are sourced from the Highspeed Lines spatial layer (SEPTA Open Data, 2022) and the Port Authority Transit Corporation (PATCO) Speedline spatial layer (NJGIN Open Data, 2018). D.C.'s and Arlington's metro lines are sourced from the Metro Lines Regional (Open Data DC, 2024a) spatial layer. Metro lines are clipped to the geographic boundaries of each jurisdiction using government boundary spatial layers (Arlington County, VA GIS Mapping Center, 2024b; Open Data DC, 2024b; OpenDataPhilly, 2012).

Exhibit 2b

Development Intensity Heat Map: Washington, D.C., and Arlington, Virginia



mi. = mile. NoMa = North of Massachusetts Avenue.
Sources: Arlington County, VA GIS Mapping Center, 2024b, 2023; DC Office of Zoning, n.d.; Open Data DC, 2024a, 2024b, 2023a, 2022a

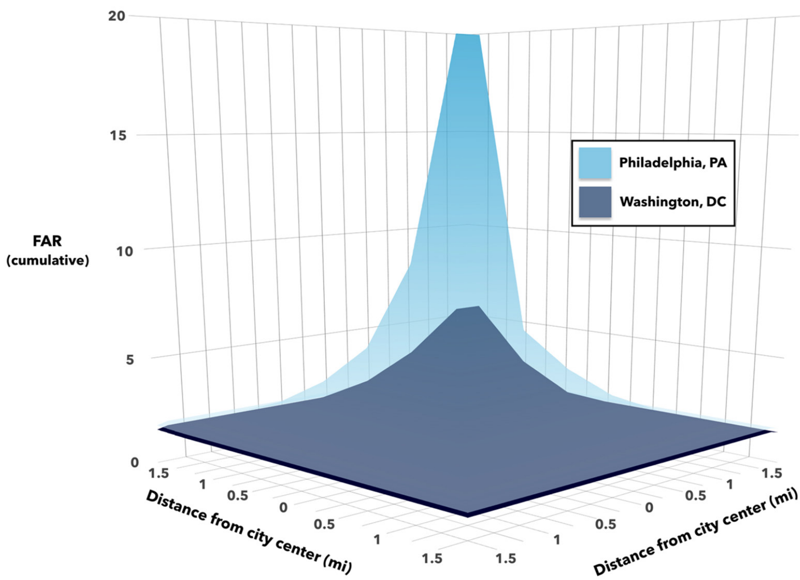
Exhibit 2a reveals that development intensity in Philadelphia is exponentially higher in Center City than elsewhere. By contrast, exhibit 2b shows that development intensity in D.C. is similar between Downtown and its surrounding neighborhoods and those along the Metro lines in neighboring Arlington, Virginia.[10] Consequently, the intensity of development in Center City Philadelphia significantly exceeds that in Downtown D.C.

Exhibit 3 compares aggregate central city building volume by measuring the cumulative FAR, the total square footage of building space per square footage of land, by the distance from the densest part of each city. Exhibit 3 calculates FAR first by summing the total building volume within 200-meter (0.12-mile) radius increments from the city center. The analysis then divides this volume by an estimated height of a building floor, 3.14 meters (10.3 feet), to convert volume into square footage. Lastly, the analysis divides the square footage of building space by the square footage of land implied by the circle's radius. Exhibit 3 visualizes cumulative FAR in 3D, plotting Philadelphia in light blue and Washington, D.C. in dark blue.

[10] Although Arlington, Virginia's urban centers, such as Rosslyn and Crystal City, permit significantly taller buildings than D.C.'s Height Act allows, they are limited to an FAR of 10, effectively equivalent to central D.C. (Arlington County, Virginia, n.d.).

Exhibit 3

3D Visualization of Cumulative FAR: Washington, D.C., vs. Philadelphia, Pennsylvania



FAR = floor area ratio. mi = mile.

Note: The X and Y axis labels are based in Cartesian coordinates using metric units but are converted to radial distances using imperial units for enhanced visual interpretability. Graphic produced with the R Plotly package.

Sources: Open Data DC, 2023a, 2022a; OpenDataPhilly, 2018; Sievert, 2020

Exhibit 3 illustrates that Philadelphia's city center contains multiple times more floor area than D.C.'s. Moving away from the city center, cumulative FAR levels begin to equalize, as neighborhoods surrounding Downtown D.C. are denser than those in Philadelphia. Nevertheless, Philadelphia maintains a consistently higher cumulative FAR than D.C. within 1.5 miles of its city center, driven by the spike in Center City.

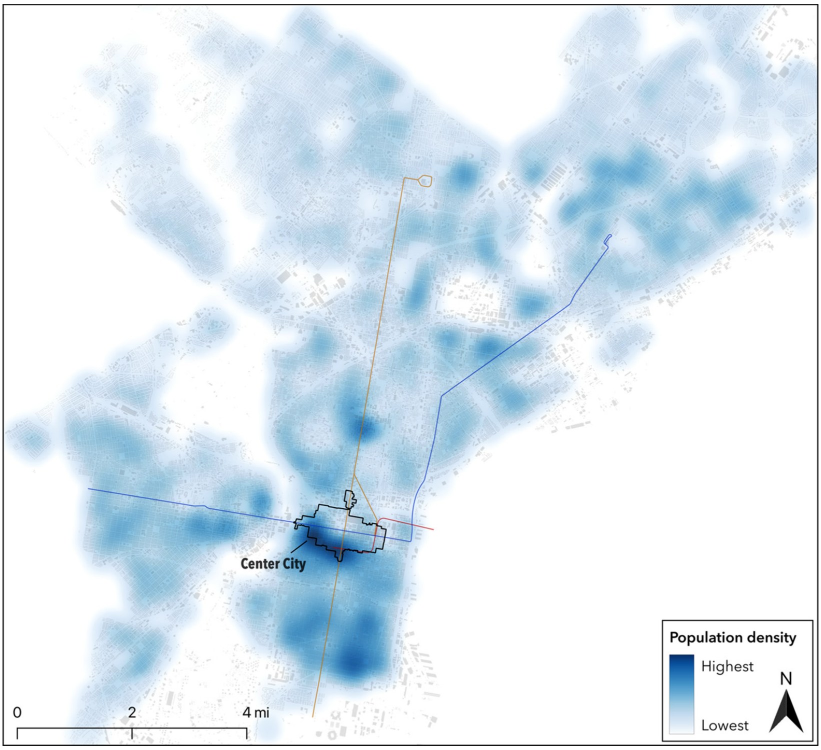
Mapping Population Density in Washington, D.C., and Philadelphia, Pennsylvania

Ultimately, the distribution of development within a city affects where residents live. Although D.C. and Philadelphia have similar population densities (U.S. Census Bureau, 2020a), they are distributed differently within each city. Exhibit 4 compares the population density of D.C. with that of Philadelphia using block-level census data.[11] The heat map considers the population within 600 meters (0.37 mile) of each block using a quartic kernel density estimation, capturing a precise picture of population density that cannot be achieved using spatially grouped units such as census tracts.

[11] Block-level population data for all cities are sourced from the U.S. Census Bureau (2020b). Population data are merged with census block spatial layers from each government (Arlington County, VA GIS Mapping Center, 2024a; Open Data DC, 2021a; OpenDataPhilly, 2021).

Exhibit 4a

Population Density Heat Map: Philadelphia, Pennsylvania



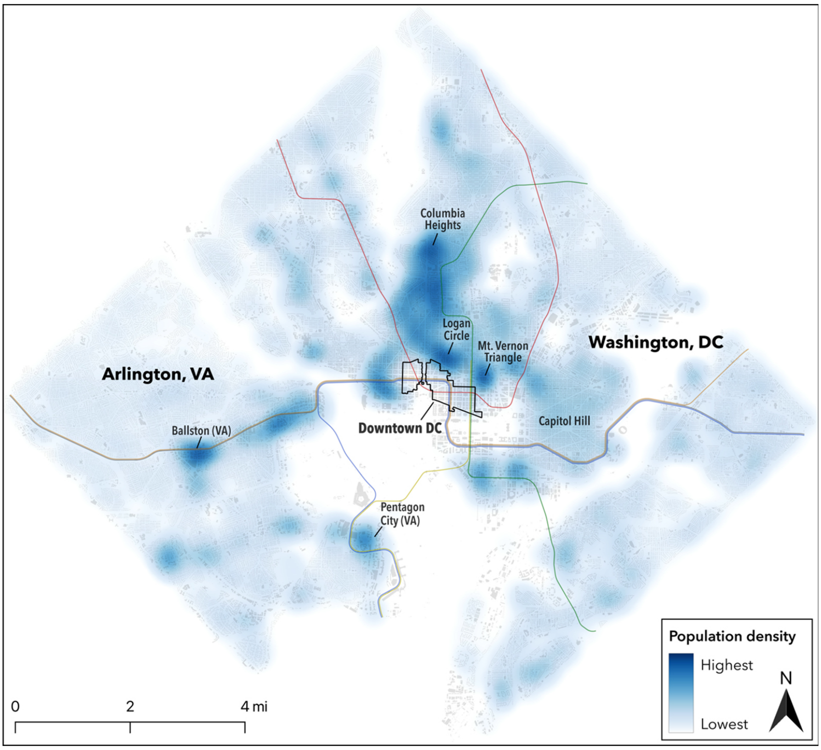
mi = mile.

Sources: NJGIN Open Data, 2018; OpenDataPhilly, 2021, 2018, 2015, 2012; SEPTA Open Data, 2022; U.S. Census Bureau, 2020b

Although residential density does not spike downtown to the same extent as commercial density, population density is still typically highest in the city center (Ahlfeldt and Barr, 2022). Exhibit 4a reveals that in Philadelphia, population density peaks in Center City near Rittenhouse Square, which is denser than any neighborhood in D.C. By contrast, exhibit 4b shows that Downtown D.C. contains extremely low population levels, with density mostly concentrated north of Downtown and along the Metro corridors in Arlington, Virginia.

Exhibit 4b

Population Density Heat Map: Washington, D.C., and Arlington, Virginia



mi = mile.

Sources: Arlington County, VA GIS Mapping Center, 2024a, 2024b, 2023; DC Office of Zoning, n.d.; Open Data DC, 2024a, 2024b, 2023a, 2021a; U.S. Census Bureau, 2020b

Conclusion

This article employed Geographic Information Systems and 3D plotting software to analyze how the Height Act affects development in Washington, D.C. Comparing the development intensity of D.C. with Philadelphia illustrates how the Height Act reduces the supply of development in Downtown D.C., where it acts as a binding constraint on growth. Consequently, D.C. residents pay steeper rents and live farther from the city center.

Methods

Maps and analyses were created using QGIS and R (R Core Team, 2024), both of which are free and open source.

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