Do Minimum-Lot-Size Regulations Limit Housing Supply in Texas?

M. Nolan Gray and Salim Furth

MERCATUS RESEARCH

MERCATUS CENTER
George Mason University
3434 Washington Blvd., 4th Floor, Arlington, Virginia 22201
www.mercatus.org

M. Nolan Gray and Salim Furth. "Do Minimum-Lot-Size Regulations Limit Housing Supply in Texas?" Mercatus Research, Mercatus Center at George Mason University, Arlington, VA, May 2019.

ABSTRACT

Minimum lot sizes regulate the density of housing in almost all American municipalities. Our findings suggest that even moderate lot size minimums in rapidly growing Texas suburbs constrain density. Market outcomes are consistent with strong demand for single-family detached housing units built on lots of 5,000 to 7,000 square feet, a lot size rarely allowed by local zoning laws. The four suburban cities we examine depart frequently from their written zoning codes in order to offer such lots, approving noncompliant subdivisions and making extensive use of customized regulation for planned unit developments. Scholars agree that large-lot zoning as practiced in exclusionary coastal jurisdictions is a binding constraint on density. We go further: even modest minimum lot sizes in automobile-oriented suburbs are less dense than Americans want.

JEL codes: R380, R140, R310

Keywords: zoning, subdivision regulation, suburban development, lot size, minimum lot size, minimum lot area, housing

Originally published May 1, 2019. Revised May 6, 2019.

This paper can be accessed at https://www.mercatus.org/publications/urban-economics/do-minimum-lot-size-regulations-limit-housing-supply-texas

The most salient land use regulation in US suburban contexts is minimum lot size. A mainstay of contemporary zoning and subdivision ordinances, the rules that govern minimum lot size condition new housing development on the lots being larger than a certain size. For example, if a municipality enforces a minimum lot size of 9,000 square feet for a detached single-family house, it will not routinely issue the permits necessary to build a house on any lot smaller than 9,000 square feet. Particularly for large subdivisions where developers are breaking up one large lot into many smaller lots, this minimum standard may be an important consideration.

Despite the ubiquity of these rules, the question of whether they are binding on development is understudied. Do minimum-lot-size rules actually force developers to build houses on lots larger than what the market might otherwise support? Or do they merely reflect market demand? In this paper, we report our finding that minimum lot sizes are binding constraints on suburban growth even in some of the most pro-growth suburbs in the United States.

The cities we study are characterized by cheap, abundant land and topography approaching the “featureless plain” of economic models. Texas suburbs are known for their pro-growth regulatory stance. If one were looking for places in high-demand American metros where minimum lot sizes did not bind, Round Rock, Pflugerville, Frisco, and Pearland, Texas, would be prime candidates.

In three of these cities, we find that there are concentrations of lots close to the minimum lot size of most cities’ densest single-family detached residential zone, that many lots are built below their designated minimum lot sizes, and that many lots in flexible planned unit developments (PUDs) fall below the relevant minimum standard. The exception is Pearland, which has zoning designations with minimum lot sizes of 5,000 and 6,000 square feet, the two smallest in our study, and does not have a large concentration of lot sizes near those limits.

There are in every city, to be sure, many subdivisions where lot sizes are above the minimum lot size. However, even if the median or average lot is unbound, the total density and character of each suburb might be quite different if there were no lot-size minimums, or if they were set to match Pearland's 5,000-square-foot minimum lot size.

We conclude that even some of the most lightly regulated American suburbs are a product of regulatory decisions as well as market feasibility. These Texas cities should be applauded for their relatively promarket regulatory stance and the resulting affordability of housing, but scholars should understand these cities as practicing growth accommodation within substantive constraints.

MINIMUM LOT SIZES

A minimum-lot-size regulation is a requirement that every individual parcel of land in the regulated area be equal to or greater than a specified square footage. Such requirements are imposed almost everywhere in America. Even areas without zoning, such as Houston, have long banned the creation of small lots.[1]

Minimum-lot-size regulations do not generally affect legacy lots. Furthermore, exceptions to minimum-lot-size rules are often granted by a variance, especially when the deviation is small. In our data, we find many lots that are within a few square feet of the zoned minimum. Lots smaller than the minimum are referred to as "noncompliant," but they generally face no penalty or disadvantage.

Lot sizes are irregular even in subdivisions with rows of apparently identical houses. In a subdivision that hews closely to the minimum lot size, one typically finds that lots fronting straight, interior streets are all close in size, while corner and edge lots are often substantially larger. Slight irregularities—a curve in the road or a drainage ditch—can easily add several percent to the size of a lot. We choose 110 percent of the minimum lot size as the cutoff below which lots are likely to be bound by zoning. That is, if the zoned minimum lot size had been lower, a large proportion of these lots probably would have been smaller. By contrast, when we observe a lot substantially larger than the zoned minimum, we have no reason to believe it would have been smaller if the zoned minimum had been lower.

WHY STUDY CONSTRAINTS IN PRO-GROWTH CITIES?

In an extensive study of large-lot zoning, Paul Boudreaux chronicles its harms. His subsection headings include the following:

1. Bernard Siegan, *Land Use without Zoning* (Lexington, MA: Lexington Books, 1972).

1. Large-lot zoning increases the cost of housing.
2. Large-lot zoning adversely affects people other than the suburb's existing homeowners.
3. Large-lot zoning exacerbates social segregation.
4. Large-lot zoning harms the environment by spurring sprawl.[2]

Scholars agree that such limits to residential density in high-demand cities on the East and West Coasts are driving up prices.[3]

In this paper, we make an argument *a fortiori*. Instead of investigating whether a regulation defining a minimum lot area of 80,000 square feet in Sharon, Massachusetts, is binding, we investigate a 6,500-square-foot minimum in Round Rock, Texas. If minimum lot sizes are binding in Round Rock (median housing price $278,200), they are binding in Sharon (median housing price $551,600), too.[4]

The four cities we consider are clearly pro-growth. Unlike zoning regimes in the Northeast and California, land use regulation at the urban fringe in Texas seems designed to accommodate, and perhaps steer, rapid development rather than prevent it. Unconsidered in this paper are multifamily, townhouse, and multiuse zoning of developable land, which Robert C. Ellickson shows are far more prevalent in suburban Austin than in Silicon Valley or suburban New Haven.[5] Suburban Texas is building more houses for more people than are suburban locales almost anywhere else in the country.

Why might cities that welcome growth constrain it at the same time? They may view their work as an example of what William Fischel calls "good-housekeeping" zoning, under the presumption that a planned city functions more smoothly than an organic one.[6] They may zone to maximize net revenue. They may maintain regulation so that they can offer regulatory relief as a bargaining chip to developers, gaining concessions or creative control via PUDs. Finally, light-touch regulation may be the development-maximizing policy in

2. Paul Boudreaux, "Lotting Large: The Phenomenon of Minimum Lot Size Laws," *Maine Law Review* 68, no. 1 (2016): 1.
3. Raven Molloy, "The Effect of Housing Supply Regulation on Housing Affordability: A Review," *Regional Science and Urban Economics* (forthcoming); Joseph Gyourko and Raven Molloy, "Regulation and Housing Supply," in *Handbook of Urban and Regional Economics,* vol. 5, ed. Gilles Duranton, J. Vernon Henderson, and William C. Strange (Amsterdam: Elsevier, 2015), 1289–1337; Salim Furth, "Housing Supply in the 2010s" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, February 2019).
4. Median housing price estimates are from Zillow.com, accessed February 25, 2019.
5. Robert C. Ellickson, "The Zoning Strait-Jacket: Evidence from the Silicon Valley, Greater New Haven, and Greater Austin" (working paper, Stanford Law and Economics Seminar, Stanford, CA, November 2018).
6. William Fischel, *Zoning Rules!* (Cambridge, MA: Lincoln Institute of Land Policy, 2015), xiii.

a political equilibrium where current residents can revolt at the ballot box if growth is too rapid, too dense, too affordable, or too ugly for their tastes.

The scope of this paper is limited to describing the zoning as enacted and evaluating whether the minimum lot sizes set by the cities constrain the developers' scope of action. Our contention is not that regulation is adding drastically to the prices of houses in suburban Texas but rather that it is influencing, or even determining, the built form of the suburbs.

We cannot identify what type of housing would be built in a less regulated market. Nor is regulation the only public policy that influences suburban form: provision of roads and utilities is vital, and federal mortgage subsidies favor single-family houses (including townhouses) over condominiums or rental properties.

Nor do we evaluate whether rezoning from agricultural to residential use is a binding or costly constraint on development. It certainly may be: Texas cities have a duty to serve annexed areas by providing sewer and water connections,[7] so if a city finds provision of those services uneconomical, it can avoid further development.[8] Even if cities offer a steady flow of land zoned for growth, they can thereby determine the location of each successive wave of development and give rezoned greenfield property owners stronger bargaining positions vis-à-vis potential developers by constraining supply.

THEORY AND LITERATURE

The monocentric model of urban growth was built up by William Alonso, Edwin S. Mills, and Richard F. Muth, and is best elucidated by Gilles Duranton and Diego Puga.[9] In the standard monocentric model, without land use regulation, builders combine land and capital inputs to produce housing. The cost of commuting to the central business district (CBD) imposes a spatial equilibrium. In equilibrium, "the construction industry" builds "with a lower capital to land ratio further away from the CBD," resulting in "larger gardens and properties with fewer stories."[10]

7. Provision of Services to Annexed Area, Texas Loc. Gov't Code Ann. § 43.056, accessed April 3, 2019.
8. Texas cities have power over nearby unincorporated land both legally and pragmatically. Legally, they exercise some land use authority in their extraterritorial jurisdiction. Pragmatically, the city's water and sewer mains are often the only economical option for development in dry regions.
9. William Alonso, *Location and Land Use: Toward a General Theory of Land Rent* (Cambridge, MA: Harvard University Press, 1964); Edwin S. Mills, "An Aggregative Model of Resource Allocation in a Metropolitan Area," *American Economic Review* 57, no. 2 (1967): 197–210; Richard F. Muth, *Cities and Housing: The Spatial Pattern of Urban Residential Land Use* (Chicago: University of Chicago Press, 1969); Gilles Duranton and Diego Puga, "Urban Land Use," in *Handbook of Urban and Regional Economics*, vol. 5, ed. Gilles Duranton, J. Vernon Henderson, and William C. Strange (Amsterdam: Elsevier, 2015), 467–560.
10. Duranton and Puga, "Urban Land Use," 10.

The model could be reframed to focus on the household's tradeoff between consumption of land and consumption of housing. Where land is cheap—furthest from the CBD—we expect households to consume relatively more land.

The four suburbs considered here are all at the urban fringe of their metro areas. They include extensive unimproved land, and most of their growth has occurred in the past few decades. Theory predicts that, relative to interior places in their metros developed at the same time, suburbs will have less dense development. Thus, a given minimum lot size will be less likely to bind.

Peter F. Colwell and Tim Scheu warn that depth regulations implicit in subdivision rules about the minimum distance between streets may dominate minimum-lot-size rules.[11] Similarly, James R. White calculates an implicit minimum legal lot size for each lot in his data, since subdivisions typically divide land equally among house lots rather than leaving an unplatted remainder.[12] In our data, these complications appear to be less important: Texas subdivisions tend to be quite large (so the remainders are small), and the municipalities surveyed either do not set minimum block depths or enforce a minimum depth of only 200 feet.

Several previous papers have attempted to measure whether or how tightly minimum lot sizes bind in different contexts. One should not forget that any such study, including our own, has limited external validity across time or space.

White notes that some previous papers inaccurately characterized minimum-lot-size regulations as nonbinding because the regulations could be overcome through variances.[13] Such constraints may be fairly cheap to overcome, but they are nonetheless binding.

White and others have used land prices to measure the degree of constraint posed by minimum lot sizes, accounting at the same time for the fact that subdivision costs rise as lot size falls. White analyzes transactions of 226 vacant lots in Ramapo, New York, from 1977 to 1980 and finds that the price per acre of a quarter-acre lot is 73 percent higher than the price per acre of a one-acre lot.[14]

Hans Isakson examines 359 sales of vacant land in Black Hawk County, Iowa, from 1980 to 2000 and finds that a 35-acre rural minimum lot size was binding but a 9,000-square-foot minimum lot size in the county's urban areas was nonbinding.[15]

11. Peter F. Colwell and Tim Scheu, "Optimal Lot Size and Configuration," *Journal of Urban Economics* 26, no. 1 (1989): 90–109.
12. James R. White, "Large Lot Zoning and Subdivision Costs: A Test," *Journal of Urban Economics* 23, no. 3 (1988): 370–84.
13. White, "Large Lot Zoning and Subdivision Costs."
14. White, "Large Lot Zoning and Subdivision Costs."
15. Hans Isakson, "Analysis of the Effects of Large Lot Zoning," *Journal of Real Estate Research* 26, no. 4 (2004): 397–416.

The present paper is most similar to that of Elizabeth Kopits, Virginia McConnell, and Daniel Miles, which compares average lot sizes to minimum lot sizes in suburban Maryland counties from 1970 to 2005.[16] The authors find that average lot size is larger than the minimum in most cases. This does not, however, imply that the minimum rarely binds: if some lots are bound and built exactly at the minimum and others are unbound and built above the minimum, the average will be above the minimum.

For a better method, we look to analogous investigations on the binding effect of minimum parking requirements. Analyses by Donald Shoup and by Simon McDonnell, Josiah Madar, and Vicki Been interpret the clustering of observed parking provision in developments at the minimum legal level as evidence that parking minimums bind.[17] For example, if a municipality requires one parking space per 400 square feet of commercial floor area, and a large share of new developments either barely meets this standard or pursues variances to be exempted from the standard, this may be interpreted as evidence that the minimum parking requirement is binding, thereby forcing more parking construction than might otherwise occur. As discussed below, we employed a similar method in finding evidence for the binding effect of minimum lot size.

A few papers have treated minimum lot sizes as political choices in systems of competing suburbs. Paul D. Gottlieb and his coauthors use 1995–1996 zoning in 83 New Jersey suburbs as a growth determinant and find that land zoned for small lots is undersupplied and land zoned for large lots is oversupplied.[18] Jeffrey Zabel and Maurice Dalton investigate whether Massachusetts towns with rarer combinations of educational quality and job accessibility had greater monopoly power that they could exercise through zoning.[19] Using single-family house transactions from 1986 to 2007, the authors find that increasing minimum lot sizes on developable land in a town from 0.2 acres to 1.0 acres increases the prices of the town's existing houses by about 10 percent, with the effect phasing in over a decade or more.

16. Elizabeth Kopits, Virginia McConnell, and Daniel Miles, "Lot Size, Zoning, and Household Preferences: Impediments to Smart Growth?" (Discussion Paper 09-15, Resources for the Future, Washington, DC, April 2009).
17. Donald Shoup, *Parking and the City* (New York: Routledge, 2018); Simon McDonnell, Josiah Madar, and Vicki Been, "Minimum Parking Requirements and Housing Affordability in New York City," *Housing Policy Debate* 21, no. 1 (2011): 45–68.
18. Paul D. Gottlieb, Anthony O'Donnell, Thomas Rudel, Karen O'Neill, and Melanie McDermott, "Determinants of Local Housing Growth in a Multi-Jurisdictional Region, along with a Test for Nonmarket Zoning," *Journal of Housing Economics* 21, no. 4 (2012): 296–309.
19. Jeffrey Zabel and Maurice Dalton, "The Impact of Minimum Lot Size Regulations on House Prices in Eastern Massachusetts," *Regional Science and Urban Economics* 41, no. 6 (2011): 571–83.

To our knowledge, ours is one of a very few papers to specifically consider land use regulation in suburban Texas. Janet Furman Speyrer finds a 7 to 9 percent premium for houses protected by zoning or deed covenants in the Houston area.[20] Ellickson's description of land use institutions in the Austin suburbs is indispensable.[21] Many other works, such as that by Connor Harris, focus on the central cities of Texas.[22]

DATA AND METHODOLOGY

To study the question of whether minimum lot sizes are generally binding on single-family detached-housing development in Texas, we analyzed single-family lots in suburban cities. Municipalities were selected on the basis of four criteria:

1. Sample municipalities must be suburbs with between 50,000 and 200,000 residents.
2. Sample municipalities must still have greenfields remaining available for development as of 2018.
3. Sample municipalities must have at least one conventional single-family detached-housing zone with applicable minimum-lot-size rules.
4. Sample municipalities must provide a standard lot shapefile, that is, a digital map file that identifies lots that host single-family detached houses. Sample municipalities must also provide a zoning shapefile, that is, a digital zoning map that identifies minimum lot sizes for each lot. Municipalities with associated year-built data for all lots and associated subdivision shapefiles were preferred.

Data needs proved to be a major limitation on this study; only Frisco and Pflugerville fully met all four conditions. To ameliorate the problem of limited year-built data in particular, we further considered municipalities that had experienced rapid population increases in the past three decades, giving us confidence that most lots were created under the current regulatory regime. Thus we added Round Rock and Pearland, which lack year-built data but have experienced substantial recent development. In those cities, we manually removed lots that we could identify as predating the implementation of subdivision regulations.

20. Janet Furman Speyrer, "The Effect of Land-Use Restrictions on Market Values of Single-Family Homes in Houston," *Journal of Real Estate Finance and Economics* 2, no. 2 (1989): 117–30.
21. Ellickson, "The Zoning Strait-Jacket."
22. Connor Harris, *Lone Star Slowdown? How Land-Use Regulation Threatens the Future of Texas* (New York: Manhattan Institute, December 2018).

Based on these criteria, we identified four municipalities for study: Round Rock, Pflugerville, Frisco, and Pearland. Demographic and price data indicate that these four cities are quite similar.[23]

With shapefiles in hand, we extracted all detached single-family residential lots in conventional single-family zoning districts for analysis. We thus excluded townhouses, duplexes, and multifamily developments, and we separately considered lots in PUDs. The narrow scope is among this paper's limitations. Townhouses and apartments may be substitutes for small-lot single-family houses and may interact with the detached single-family market.

The very existence of PUDs implies that some regulatory relief was sought and gained: rather than building by right, the developer has chosen to negotiate with city officials to arrive at a customized set of use, bulk, and density regulations. Governments often offer this process to provide regulatory flexibility—for example, permitting lot sizes below the standard minimum—in exchange for other public benefits—for example, more open space.[24] However, we cannot consistently ascertain whether minimum lot size was one of the regulations from which relief was sought, so we did not include PUD lots in our primary analysis.

To evaluate which single-family residential lots are bound by their zoning, we developed a standard metric: lot size ratio (LSR), the ratio of actual lot size to zoned minimum lot size. Using geographic information system (GIS) tools, we calculated an actual-lot-area value for each lot and assigned a minimum-lot-size value based on the relevant zoning district. These metrics allow us to understand how actual lot sizes systematically relate to zoned minimum lot sizes. Our approach is less informative than those of White and Isakson, as we cannot evaluate the cost of a binding constraint to a landowner, but it has the advantage that it can be implemented without sales data.[25]

---

23. Non-Hispanic whites make up between 44 and 63 percent of the cities' populations. Senior citizens make up between 7 and 10 percent. All four cities grew rapidly from 2000 to 2017. Round Rock had the largest population in 2000 and grew "only" 102 percent through 2017. As a comparison, Frisco grew 426 percent. Frisco is more affluent than the other three cities, with a median household income of $117,642 (2012–2016 ACS estimate); the other cities' median household incomes were between $74,000 and $97,000 (American Community Survey and Decennial Census data, accessed February 22, 2019, via American FactFinder). Frisco stands out even more in housing prices: Zillow's single-family housing value index for Frisco was $394,400 in October 2018 (www.zillow.com/data). The indices for the other three cities were closely clustered between $245,000 and $276,000. Historical price trends show that all four cities have had modest price movements for the past few decades. The comparability of the four cities is helpful but not essential to the interpretation of our results.
24. Daniel Mandelker, "Planned Unit Developments and Master Planned Communities," in *Zoning Practice* (Chicago: American Planning Association, June 2007).
25. White, "Large Lot Zoning and Subdivision Costs"; Isakson, "Analysis of the Effects of Large Lot Zoning."

As an example, consider a 10,000-square-foot lot located in a zone with a minimum lot size of 15,000 square feet in a hypothetical city. The lot's LSR is 0.67. An identical lot located in a zone with an 8,000-square-foot minimum would have an LSR of 1.25. Let us imagine that this city's densest residential district has a minimum lot size of 5,000 square feet; we refer to this as the city's absolute minimum lot size.

We use the LSR to divide lots into four categories, based on the likelihood that the zoned minimum lot size is binding:

1. An LSR below 1.0 indicates that the actual lot size is noncompliant, that is, less than the zoned minimum lot size. This means either that the lot was platted before the current minimum lot size was imposed or that the developer was able to find some avenue of regulatory relief to satisfy market demand for smaller lots. In the latter case, the regulation is binding although the constraint was overcome.
2. We interpret an LSR between 1.0 and 1.1 as an indication that the zoned minimum lot size is most likely binding. Regulatory relief may or may not have been sought, but it was not granted.
3. We interpret an LSR between 1.1 and 1.2 as an intermediate case and a natural comparison to the 1.0–1.1 range. Some lots in a development bound by minimum lot size may well have an LSR above 1.1, but we expect that in districts where the minimum lot size binds frequently, there will be fewer lots in this range than in the 1.0–1.1 range.
4. We interpret an LSR above 1.2 as nonbinding. In these cases, developers are platting lots substantially larger than required.

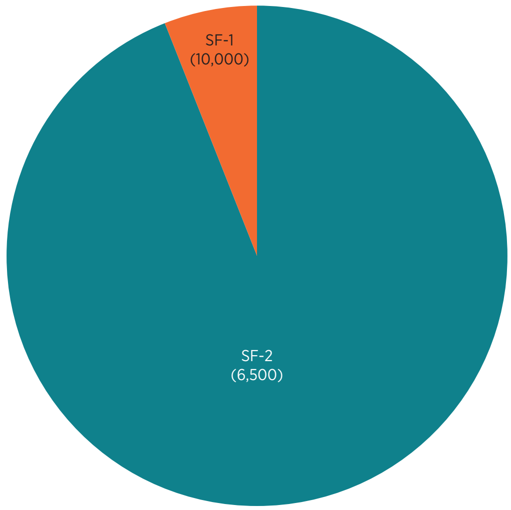
In the subsequent sections, we present our findings and interpretations for each municipality studied. The first two municipalities, Round Rock and Pflugerville, have relatively simple single-family zoning; the latter two, Frisco and Pearland, offer a more complex menu of zoning options and thus more interpretive challenges.

ROUND ROCK

Round Rock is a large northern suburb of Austin and has boomed from virtual nonexistence in 1970 (population 2,811) into a still-growing city of 123,678 in 2017.[26] While Round Rock's public data lack a year-built attribute, the city's recent

26. Decennial Census and American Community Survey data, accessed via American FactFinder, February 22, 2019.

FIGURE 1. DETACHED SINGLE-FAMILY ZONE SHARE, ROUND ROCK, TEXAS



Source: City of Round Rock, Texas, Downloadable GIS Data Warehouse, Zoning Districts (data file), available at "Geographic Information Systems (GIS)," accessed March 3, 2019, https://www.roundrocktexas.gov/departments/gis/.

growth makes it easy to isolate and remove the few lots that existed before subdivision and zoning regulation.

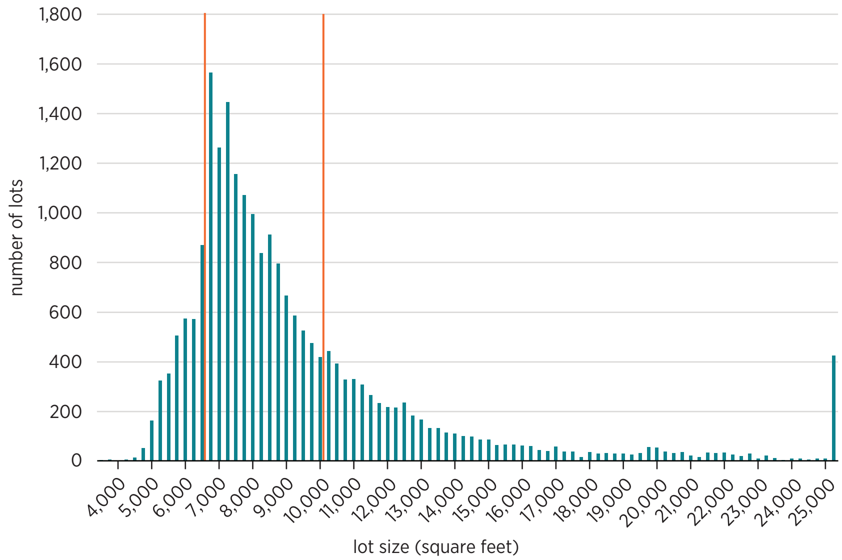
Approximately 34 percent of the zoned area of Round Rock, including PUDs, is subject to conventional single-family detached residential zoning. As of 2018, Round Rock has mapped two conventional single-family detached residential zones, one with a minimum lot size of 10,000 square feet (SF-1), the other with a minimum lot size of 6,500 square feet (SF-2).[27] The overwhelming majority (94 percent) of the area zoned for single-family detached residential development is zoned SF-2, as shown in figure 1.

The city has made extensive use of PUDs, especially since 2006. Today, 26 percent of all single-family detached-house lots in Round Rock are in a PUD. On average, PUD lots are 500 square feet smaller than those in conventional SF-2 and SF-1 zones. The increasing use of this regulatory relief mechanism is evidence that the conventional rules are binding.

A preliminary lot-size distribution histogram of conventionally zoned lots (figure 2) reveals that 14 percent are noncompliant and thus unambiguously bound. The distribution of lot sizes peaks between 6,500 and 6,750 square feet, just above the minimum lot size of 6,500 square feet. Whether this reflects a

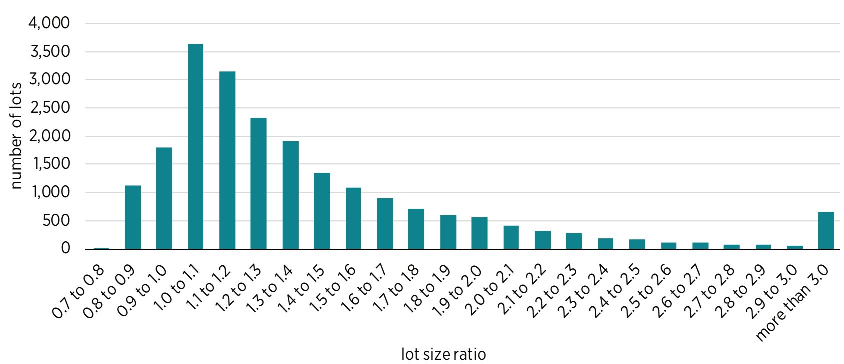
27. An earlier version of this paper incorrectly identified the minimum lot size in R-2 as 7,500 square feet. The authors thank Robert Ellickson for the correction.

FIGURE 2. ROUND ROCK, TEXAS, LOT-SIZE DISTRIBUTION AND MINIMUM LOT SIZES



Note: Orange rules represent minimum lot sizes.
Source: City of Round Rock, Texas, Downloadable GIS Data Warehouse, Parcels (data file), available at "Geographic Information Systems (GIS)," accessed March 3, 2019, https://www.roundrocktexas.gov/departments/gis/.

FIGURE 3. ROUND ROCK, TEXAS, LOT SIZE RATIO DISTRIBUTION



Source: City of Round Rock, Texas, Downloadable GIS Data Warehouse, Parcels and Zoning Districts (data files), available at "Geographic Information Systems (GIS)," accessed March 3, 2019, https://www.roundrocktexas.gov/departments/gis/.

concentration of demand or is itself a function of variance negotiations, we cannot say. A further 31 percent of lots fall within 20 percent of the zoned absolute minimum lot size, providing further evidence of constraint.

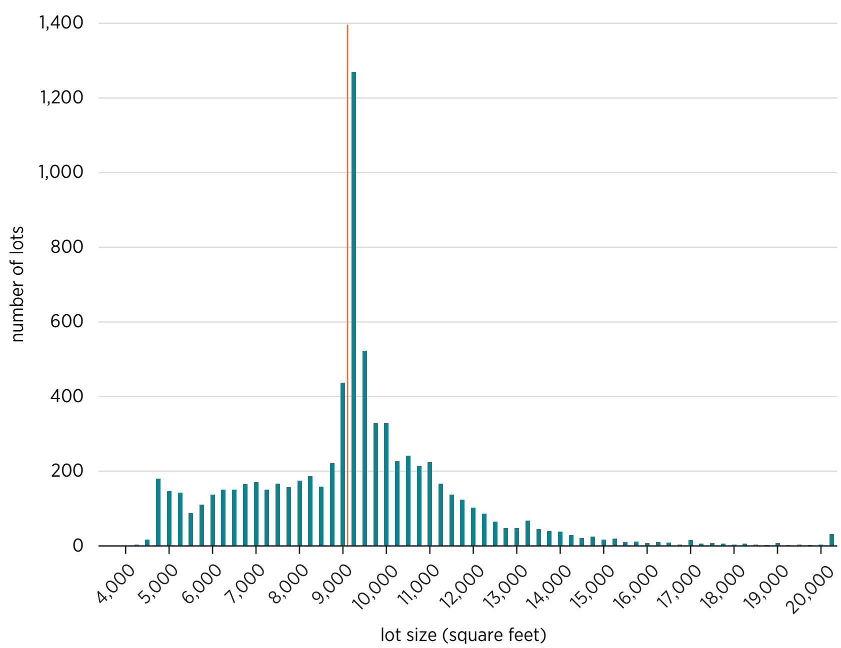
Figure 3 shows that Round Rock's LSR clusters between 1.0 and 1.1. The noncompliant lots are tightly clustered near LSR 1.0. Lots above LSR 1.2 are much less clustered, although their frequency declines steadily.

The evidence in Round Rock is consistent with market demand for lots smaller than the absolute minimum lot size of 6,500 square feet. It also indicates that Round Rock is often willing to bend its minimum-lot-size rules through variances, PUDs, and special provisions for shifting open space. One cannot, however, conclude that the market is getting the distribution of small lot sizes that are demanded.

PFLUGERVILLE

Pflugerville, Texas, is a suburb of Austin and borders Round Rock. It is simultaneously the oldest and youngest of the cities discussed in this paper. Initially settled by Henry Pfluger Sr. in 1849, Pflugerville would remain a small farming hamlet until incorporation in 1970. Pflugerville remained small in 2000, with just 16,335 residents, before exploding to an estimated 63,359 in 2017. Outside of a small gridded street network that extends west and south from the junction of

FIGURE 4. PFLUGERVILLE, TEXAS, LOT-SIZE DISTRIBUTION AND MINIMUM LOT SIZE



Note: Orange rule represents minimum lot size.
Source: City of Pflugerville, TX, Subdivisions (data file), available at "GIS Data," accessed March 3, 2019, https://www.pflugervilletx.gov/city-government/development-services-center/planning-department/gis-services/gis-data.

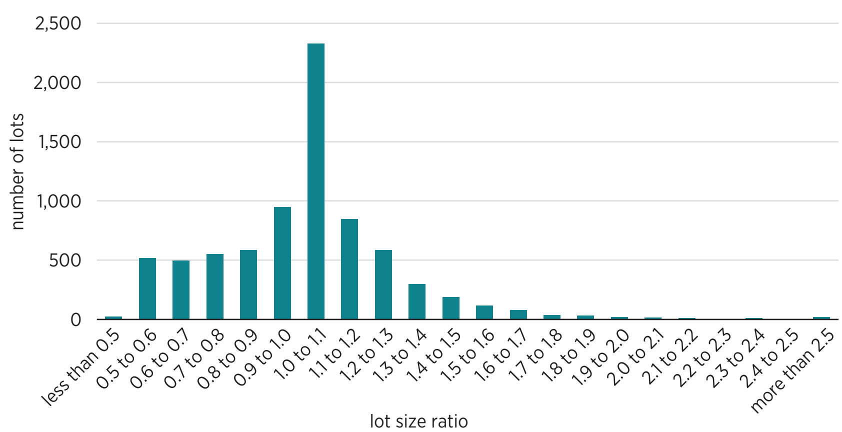
Pecan Street and Railroad Avenue, Pflugerville's housing stock is overwhelmingly characterized by single-family detached houses along winding roads and stubby cul-de-sacs.

This analysis considers only lots platted since 1993, when Pflugerville first adopted a home rule charter. Approximately 29 percent of the zoned area of Pflugerville is zoned exclusively for single-family detached residential housing. While the city has multiple zones prefixed SF, only one zone was considered in this analysis: SF-S, with a minimum lot size of 9,000 square feet. Other zones were excluded from this analysis for one of two reasons: SF-E (minimum lot size of 0.5 acres) had not been mapped at time of publication, while SF-R and SF-MU allow attached as well as detached houses and have not, in any case, been widely mapped.

A preliminary lot-size distribution analysis of Pflugerville provides stark evidence that its minimum lot size is binding (figure 4). As in Round Rock, many lots are noncompliant, falling below 9,000 square feet. The clustering of lots at the minimum is even more severe: 32 percent of all lots fall between 9,000 and 10,000 square feet. Only 19 percent of all lots can be reliably classified as unbound, with an observed lot size above 10,750 square feet. While the frequency of larger lot sizes gradually falls, a stark drop-off occurs below 4,500 square feet.

Since Pflugerville has only one zoned minimum in our analysis, the LSR histogram (figure 5) is redundant to the lot-size histogram, but it is included to facilitate comparisons among the cities. One surprising phenomenon is that Pflugerville has many lots that are as little as half the minimum size. More than 1,500 lots sport an LSR of less than 0.8. We are limited by the data in concluding

FIGURE 5. PFLUGERVILLE, TEXAS, LOT SIZE RATIO DISTRIBUTION



Source: City of Pflugerville, TX, Subdivisions and Zoning (data files), available at "GIS Data," accessed March 3, 2019, https://www.pflugervilletx.gov/city-government/development-services-center/planning-department/gis-services/gis-data.

whether this was a result of flexible site plan review, variance applications, or something else altogether.

Like Round Rock, Pflugerville has embraced PUDs. One in five detached single-family lots is now situated within a PUD. The city may use PUDs as another workaround for the binding zoned minimum lot size; the average size of a PUD lot is 8,071 square feet, almost 1,000 square feet less than the average among conventionally zoned lots. As with Round Rock, this should be interpreted as evidence that the minimum lot size enforced by SF-S binds frequently, thereby providing developers with strong incentives to negotiate for a lower minimum lot size through the PUD process.

Pflugerville has the highest absolute minimum lot size of the four cities we examined. And although 9,000 square feet is not a large lot by national standards, it clearly binds in Pflugerville. At the same time, a fifth of lots in Pflugerville are platted in excess of LSR 1.2, evidence that diverse lot sizes are demanded and supplied in the unconstrained segment of the market. The sharp drop-off in observed lot sizes below 4,750 square feet provides a glimpse at the unofficial constraints that developers encounter within the variance and discretionary review process.

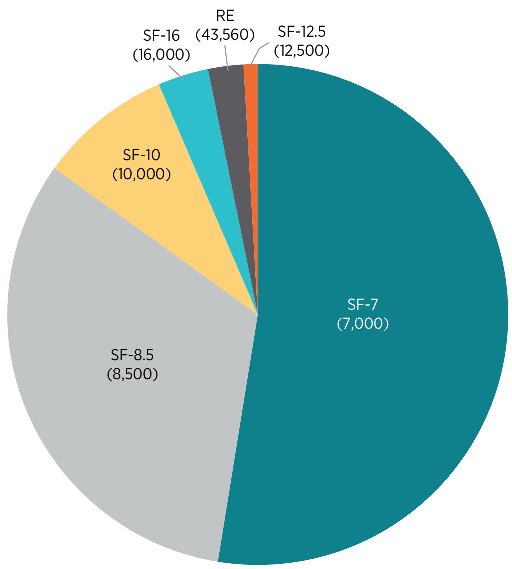
FRISCO

Frisco, Texas, is a northern suburb in the Dallas–Fort Worth metroplex. Its population grew from 736 in 1950 to 33,714 in 2000, to 116,989 in 2010, and to an estimated 177,286 in 2017. Frisco is the most affluent of our four cities. It is also the closest to being built out with an initial round of urbanization and will soon encounter the barriers to densification laid out by Harris.[28]

Approximately 42 percent of the zoned area of Frisco is zoned exclusively for single-family detached residential. As of 2018, Frisco has mapped five such zones. The minimum-square-foot lot sizes for these zones are 7,000 (SF-7), 8,500 (SF-8.5), 10,000 (SF-10), 12,500 (SF-12.5), 16,000 (SF-16), and 43,560 square feet (RE). The zones are scattered without any obvious pattern, so it seems likely that zoning designations represent the results of negotiations between planners and developers. Half of the area zoned for detached single-family residential is zoned SF-7 (53 percent), the zone with the lowest minimum lot size (figure 6). While Frisco makes extensive use of PUD overlays, these overlays do not preempt minimum-lot-size rules, which are set by the base zoning.[29]

28. Harris, *Lone Star Slowdown?*
29. City of Frisco Zoning Ordinance 6.14.01(D)(2)(a). See https://www.friscotexas.gov/DocumentCenter/View/1487/Zoning-Ordinance-with-Summary-of-Amendments-PDF?bidId=, pages 255–56.

FIGURE 6. DETACHED SINGLE-FAMILY ZONE SHARE, FRISCO, TEXAS



Source: City of Frisco, TX, Zoning (data file), available at "GIS Data Download," accessed March 3, 2019, https://www.friscotexas.gov/176/GIS-Data-Download.

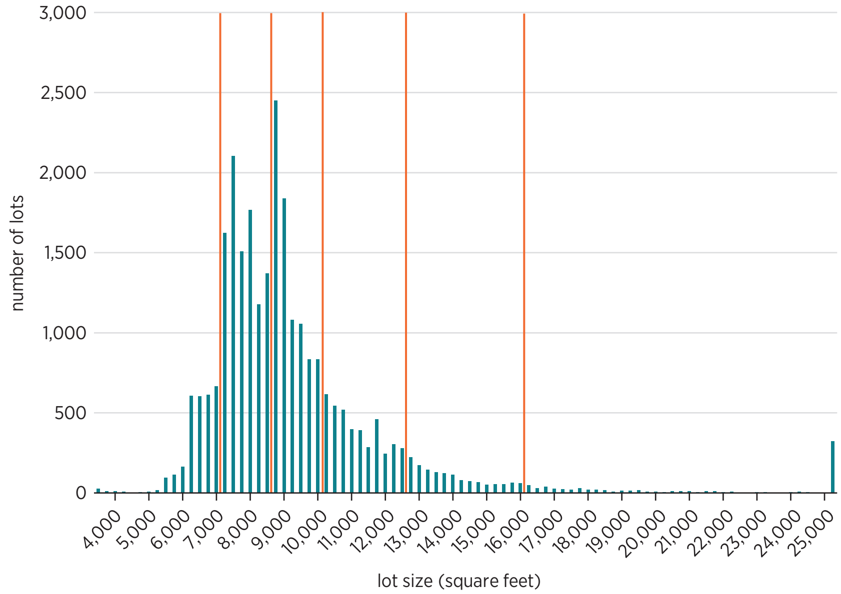
Unlike many other cities, Frisco identifies parcels as parts of broader subdivisions in published data. To mitigate the risk of incorporating preregulation parcels into this analysis, we removed any parcel not identified as part of a formal subdivision.

A preliminary lot distribution analysis of Frisco finds local peaks in lot size between 7,000 and 7,750 square feet and between 8,500 and 8,750 square feet (figure 7). Notably, this clustering occurs just above Frisco's two lowest zoned minimum lot sizes, 7,000 and 8,500 square feet. No such clustering exists around higher minimum lot sizes, including 10,000, 12,500, and 16,000 square feet. As in Pflugerville, there is a sharp drop-off in lot frequency below an apparent unofficial minimum lot size of 6,000 feet, in contrast to the gradual decline in frequency of large lots.

LSR analysis reveals two trends: First, only 14 percent of lots exhibit an LSR below 1.0, indicating noncompliant status, substantially less than in either Round Rock or Pflugerville (figure 8). Second, 32 percent of lots have an LSR between 1.0 and 1.1, and 21 percent between 1.1 and 1.2.

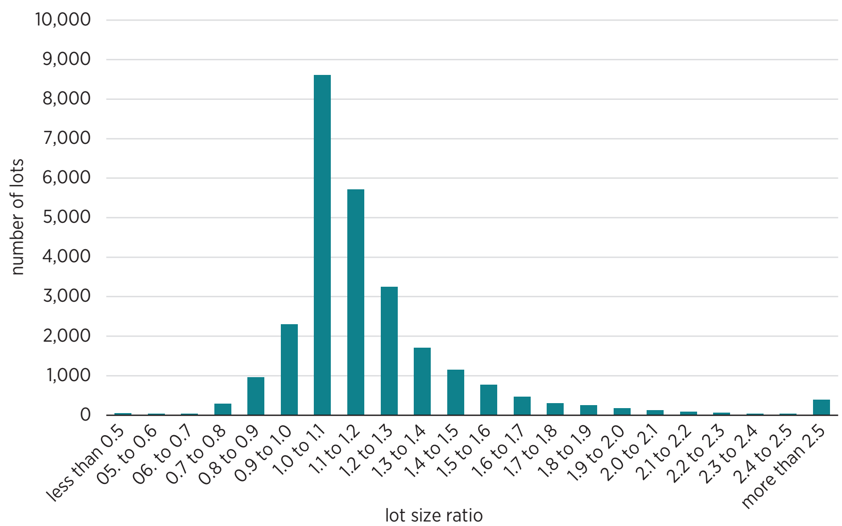
Table 1 shows that different zones follow very different patterns. SF-7 and SF-8.5 have substantial shares of noncompliant lots and declining concentrations of lots above the minimum. SF-16 is nonbinding in most cases. The case of SF-10 is unique: its lots are concentrated between 10 and 20 percent above the

FIGURE 7. FRISCO, TEXAS, LOT-SIZE DISTRIBUTION AND MINIMUM LOT SIZES



Note: Orange rules represent minimum lot sizes.
Source: City of Frisco, TX, Parcels (data file), available at "GIS Data Download," accessed March 3, 2019, https://www.friscotexas.gov/176/GIS-Data-Download.

FIGURE 8. FRISCO, TEXAS, LOT SIZE RATIO DISTRIBUTION



Source: City of Frisco, TX, Parcels and Zoning (data files), available at "GIS Data Download," accessed March 3, 2019, https://www.friscotexas.gov/176/GIS-Data-Download.

TABLE 1. FRISCO, TEXAS, ZONING DISTRICT LOT SIZE RATIOS

	Noncompliant	Within 10% of minimum	10% to 20% above minimum	Unbound
SF-7	16.4%	28.9%	21.9%	32.8%
SF-8.5	9.6%	42.2%	19.6%	28.6%
SF-10	6.4%	19.6%	30.3%	43.7%
SF-12.5	83.7%	6.1%	0.0%	10.2%
SF-16	12.1%	5.2%	0.0%	82.8%
RE	50.0%	4.2%	0.0%	45.8%

Source: City of Frisco, TX, Parcels and Zoning (data files), available at "GIS Data Download," accessed March 3, 2019, https://www.friscotexas.gov/176/GIS-Data-Download.

minimum, almost large enough to comply with SF-12.5. Meanwhile, the vast majority of SF-12.5 lots are noncompliant. There are few large lots, however: SF-12.5, SF-16, and RE collectively cover no more than 6 percent of Frisco's lots.

Frisco's zoning patterns offer competing interpretations. One view might be that the city seems to have a menu of zoning options from which developers can pick freely, so lots that are larger than 7,000 square feet should be considered unbound by zoning. In that view, since only 10 percent of Frisco lots are 7,700 square feet or smaller, only those should be considered tightly bound.

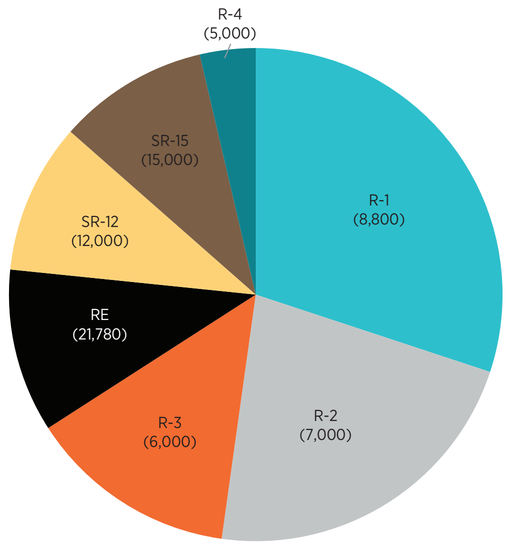
We prefer a less sanguine interpretation. Just as PUDs and noncompliant lots are heavily used in other jurisdictions to bend the rules while maintaining regulatory control, gradations of zoning can be offered to different tracts to achieve the regulators' goals or as part of negotiations with developers. The noncompliance of most SF-12.5 and RE lots certainly suggests that developers and regulators are engaging in negotiations much more complex than merely picking the minimum lot size that best fits the developers' preconceived plans.

PEARLAND

Pearland, Texas, is a suburb of Houston situated more than 14 miles from the latter's downtown. The city did not incorporate until 1960. Like the other three cities, Pearland emerged in the age of the personal automobile, with virtually all the residential development taking the form of single-family detached houses. From 2000 to 2017, Pearland's population tripled to an estimated 119,940.

Pearland enforces a conventional set of residential districts on approximately 46 percent of the zoned area of the municipality, with varying minimum lot sizes. The various zones require minimum lot sizes of 5,000 (R-4), 6,000 (R-3), 7,000 (R-2), 8,800 (R-1), 12,000 (SR-12), 15,000 (SR-15), and 21,780 (RE) square

FIGURE 9. DETACHED SINGLE-FAMILY ZONE SHARE, PEARLAND, TEXAS



Source: City of Pearland, TX, Zoning, Plats, PUD, SUP, CUP, Ordinances (data file), available at "GIS Data - (ESRI Feature Datasets)," accessed March 3, 2019, http://gis.pearlandtx.gov/web/gis-data.htm.

feet. One-third of the area zoned for detached single-family housing is zoned R-1 (32 percent), followed by R-2 (23 percent) and R-3 (14 percent) (figure 9). The R-4, SR-12, SR-15, and RE districts each constitute 10 percent or less of this area. This means that in Pearland, as in Round Rock or Pflugerville but not Frisco, developers most likely have some latitude in negotiating for minimum lot sizes.

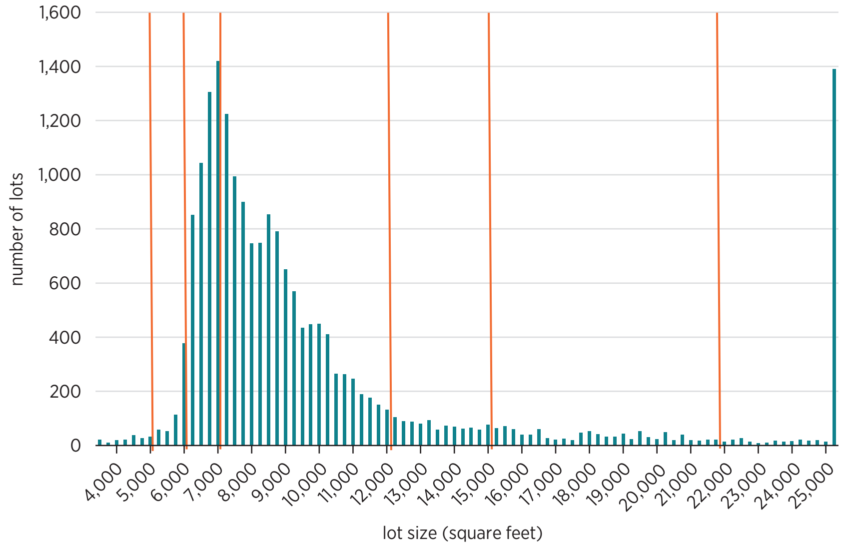
As in Frisco and Round Rock, minimum lot size is the most significant difference among Pearland's low-density residential zones. The importance of this difference is made clear by the fact that the minimum lot size is occasionally included in the zone's label as a numerical suffix. In materials highlighting the key differences between the various zones, the only standard that Pearland's development handbook explicitly mentions is the minimum lot sizes of each zone.[30]

In defiance of common thinking about designed urban form, these districts do not decrease in density as they extend out from the traditional downtown or from the border with Houston; rather, they seem to have been mapped on an ad hoc basis, producing a patchwork effect. Like other cities, Pearland has made increasing use of PUDs in recent years, though these lots have been excluded from the LSR analysis.

Figure 10 shows that Pearland's single-family lots are clustered between 6,000 and 9,000 square feet, with a particular concentration at 7,000 square

30. City of Pearland, *Development Handbook*, August 2015, www.pearlandtx.gov/home/showdocument?id=8573.

FIGURE 10. PEARLAND, TEXAS, LOT-SIZE DISTRIBUTION AND MINIMUM LOT SIZES



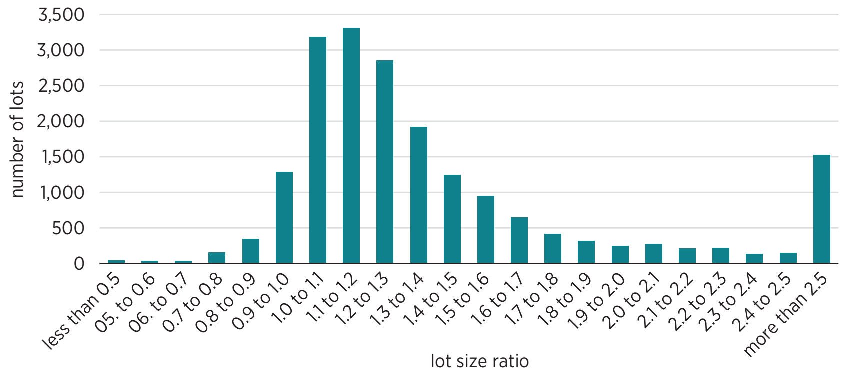
Note: Orange rules represent minimum lot sizes.
Sources: Brazoria County Appraisal District, Parcels (data file), available at "Public GIS and Property Data Downloads," accessed March 3, 2019, http://www.brazoriacad.org/gis-downloads.html; and City of Pearland, TX, Zoning, Plats, PUD, SUP, CUP, Ordinances (data file), available at "GIS Data - (ESRI Feature Datasets)," accessed March 3, 2019, http://gis.pearlandtx.gov/web/gis-data.htm.

feet, coinciding with the R-2 zoned minimum. The zoned minimum lot sizes are spread across the lot-size distribution. Here, unlike the distributions of other municipalities surveyed in this paper, there is no obvious clustering at any of the low zoned minimum lot sizes, such as R-3 (6,000 square feet) or R-4 (5,000 square feet). Furthermore, unlike any of the other municipalities surveyed, Pearland has a significant number of lots far larger than 25,000 square feet, most of which could be further subdivided into smaller lots.

The LSR analysis is presented in figure 11. As in Frisco, noncompliant lots are uncommon. Only 9.7 percent of all lots are noncompliant, the lowest percentage in our study. And unlike any of the other cities, there is little evidence that lots are platted at the legal minimum. Only 16 percent of lots fall within 10 percent (or LSR 1.1) of their zoned minimum lot size, while 17 percent fall between LSR 1.1 and 1.2, and almost as many between LSR 1.2 and 1.3. This pattern is not consistent with binding minimum-lot-size constraints.

Table 2 shows the LSR for each zone. Pearland's smallest zoned minimum lot size, R-4, shows no evidence of having a binding effect, with 90 percent of lots falling more than 20 percent above the 5,000-square-foot minimum. In fact, despite explicitly permitting 5,000-square-foot lots, Pearland has far fewer of them than Round Rock or Pflugerville. The only evidence that Pearland's

FIGURE 11. PEARLAND, TEXAS, LOT SIZE RATIO DISTRIBUTION



Sources: Brazoria County Appraisal District, Parcels (data file), available at "Public GIS and Property Data Downloads," accessed March 3, 2019, http://www.brazoriacad.org/gis-downloads.html; and City of Pearland, TX, Zoning, Plats, PUD, SUP, CUP, Ordinances (data file), available at "GIS Data - (ESRI Feature Datasets)," accessed March 3, 2019, http://gis.pearlandtx.gov/web/gis-data.htm.

TABLE 2. PEARLAND, TEXAS, ZONING DISTRICT LOT SIZE RATIOS

	Noncompliant	Within 10% of minimum	10% to 20% above minimum	Unbound
R-4	2.3%	2.3%	5.7%	89.8%
R-3	6.2%	23.3%	23.3%	47.2%
R-2	13.3%	17.7%	17.6%	51.5%
R-1	14.1%	8.0%	12.1%	65.9%
SF-12	9.8%	4.5%	2.4%	83.4%
SF-15	1.5%	8.1%	0.6%	89.9%
RE	16.3%	2.6%	1.3%	79.7%

Sources: Brazoria County Appraisal District, Parcels (data file), available at "Public GIS and Property Data Downloads," accessed March 3, 2019, http://www.brazoriacad.org/gis-downloads.html; and City of Pearland, TX, Zoning, Plats, PUD, SUP, CUP, Ordinances (data file), available at "GIS Data - (ESRI Feature Datasets)," accessed March 3, 2019, http://gis.pearlandtx.gov/web/gis-data.htm.

zoned minimum lot sizes occasionally have a binding effect is that some lots are noncompliant.

Why might zoned minimum-lot-size rules in Pearland be less binding than those in other cities surveyed? First, Pearland offers single-family detached residential districts with low minimum lot sizes of 5,000 and 6,000 square feet. The availability of small lots in these R-4 and R-3 zones can thus accommodate some of the demand for smaller lot sizes, taking pressure off developers in other zones. Second, the neighboring City of Houston has minimum lot sizes even smaller than Pearland's and may satisfy regional demand for small lots. Finally, we have no reason to presume that demand would be the same in all four cities.

CONCLUSION

The four Texas cities surveyed in this paper display three distinct approaches to minimum-lot-size regulation. The most restrictive may be Frisco. Frisco uses several zoning districts to accommodate single-family development and is relatively stingy in allowing noncompliance. Even PUD overlays in Frisco do not exempt subdivisions from abiding by minimum-lot-size rules. Although on its face Frisco's code is less strict than Pflugerville's or Round Rock's, it is in practice more rigid.

Round Rock and Pflugerville take a different approach. They use one principal single-family zone each, but about 40 percent of conventionally zoned lots in each city are noncompliant. In addition to allowing flexibility within the single zoning designation, PUD zoning may act as a regulatory relief mechanism. In Round Rock and Pflugerville, the average sizes within PUD zones are 500 and 1,000 square feet below the absolute minimum lot size, respectively.

In Pearland, where minimum-lot-size rules appear to bind least often, the average lot size within PUD zones is 3,500 square feet above the absolute minimum lot size. In both Pearland and Frisco, it seems that the design flexibility granted by PUD review is largely focused on public service provision and design elements other than lot size. This partly reflects the aspirations for the PUD as a regulatory tool in allowing for greater design flexibility to accommodate unique and desirable development patterns. But we advise caution in using PUDs as a kludge to get around a strict zoning rule. PUDs require a long process of review as well as substantial costs related to regulatory compliance and uncertainty.[31] A more sustainable response to this binding effect is to simply reduce as-of-right zoned minimum lot sizes.

All four cities showed some evidence of a "true" minimum lot size, below which regulators or developers will rarely bend. This was most apparent in Pflugerville at 4,750 square feet and Frisco at 6,000 square feet. It can be observed, though less starkly, in Round Rock at 5,000 square feet and, surprisingly, in Pearland at 5,500 square feet.

Although we have focused on identifying constrained lots in this analysis, we also learn from the unconstrained lots. The broad distribution of unconstrained lot sizes suggests that even in a homogeneous suburban context, there is demand for a wide range of lot sizes. In no city did we note a tight concentration of lot sizes that was unrelated to a regulatory constraint. Uniformity of lot size occurs only where minimum-lot-size regulations bind.

31. Alexandra Croft Moravec, "An Analysis of Planned Unit Development (PUD) Regulations and Processes in Washington, DC: A Development Risk Management Case Study" (master's thesis, University of North Carolina, Chapel Hill, NC, 2009).

ABOUT THE AUTHORS

M. Nolan Gray is a city planner in New York City and a candidate with the American Institute of Certified Planners. In addition to doing professional planning work, he studies land use regulation, housing affordability, and urban planning theory. His writing has been regularly featured in *Market Urbanism*, *Citylab*, and *Strong Towns*. He earned his Master of City and Regional Planning at Rutgers University in 2018.

Salim Furth is a senior research fellow at the Mercatus Center at George Mason University. He studies regional, urban, and macroeconomic trends and policies. Previously, he has worked at the Heritage Foundation and Amherst College. His writing has been featured in *American Affairs*, *The City*, and *Public Discourse*, and he wrote regularly for the *Wall Street Journal* blog *Think Tank*. He earned his PhD in economics from the University of Rochester in 2011.

ABOUT THE MERCATUS CENTER AT GEORGE MASON UNIVERSITY

The Mercatus Center at George Mason University is the world's premier university source for market-oriented ideas—bridging the gap between academic ideas and real-world problems.

A university-based research center, the Mercatus Center advances knowledge about how markets work to improve people's lives by training graduate students, conducting research, and applying economics to offer solutions to society's most pressing problems.

Our mission is to generate knowledge and understanding of the institutions that affect the freedom to prosper, and to find sustainable solutions that overcome the barriers preventing individuals from living free, prosperous, and peaceful lives.

Founded in 1980, the Mercatus Center is located on George Mason University's Arlington and Fairfax campuses.