# Graduated Density Zoning

*Donald Shoup*

*One of the firmest premises of redevelopment is the need for public action to deal with the practical problems of urban land assembly: many small parcels, fragmented ownership, and balkanized derivative interests, all of which hinder spontaneous market-driven transformations.*

Lynne Sagalyn, 2007

**Abstract**

The difficulty of assembling sites large enough to redevelop at higher density can impede regeneration in city centers and accelerate suburban sprawl onto large sites already in single ownership. One promising new planning strategy to encourage voluntary land assembly is graduated density zoning, which allows higher density on larger sites. This strategy can increase the incentive for owners to cooperate in a land assembly that creates higher land values. Graduated density zoning will not eliminate the incentive to hold out, but it can create a new fear of being left out. Holdouts who are left with sites that cannot be combined with enough contiguous properties to trigger higher density lose a valuable economic opportunity. This article examines the difficulty of assembling land for infill development, and explains graduated density zoning as a way to encourage voluntary land assembly. Finally, it presents the results of graduated density zoning in practice.

***Keywords:*** *land assembly; transaction costs; infill development; zoning; urban design*

The success of infill development often depends on the ability to assemble land. Dense development requires large parcels of buildable land, yet in the places where redevelopment is needed most, such as declining neighborhoods in central cities, large parcels of land are often hard to find. So redevelopment pivots on land assembly, but land assembly is no easy task. The many small parcels of land with different owners create problems of cooperation and coordination. A developer might attempt to buy enough parcels to create a suitable site, but if some owners hold out from a land assembly hoping to be last to sell (and therefore able to command a higher price), the land remains fragmented and the redevelopment is stymied. The developers and their resources go elsewhere.

The traditional solution to the holdout problem is eminent domain, but this has always been controversial. The urban renewal programs of the 1950s and 1960s relied heavily—sometimes callously—on eminent domain, and many urban renewal projects produced results far worse than the problems they were intended to solve. Urban renewal tarnished the reputations of both redevelopment and eminent domain, and in 2005 they got another dose of bad publicity when the U.S. Supreme Court ruled in *Kelo v. City of New London*. In that decision, the Court affirmed the power of a city to condemn property for resale to a private developer, but was strongly divided on the issue, as Justice O'Connor made clear in her dissent:

> For who among us can say she already makes the most productive or attractive possible use of her property? The specter of condemnation hangs over all property. Nothing is to prevent the State from replacing any Motel 6 with a Ritz-Carlton, any home with a shopping mall, or any farm with a factory.[1]

State legislatures have responded to *Kelo* by limiting the use of eminent domain for redevelopment. Shigley (2007, 13) reports, "By the time state legislatures had concluded their 2006 sessions, 35 states had enacted some kind of eminent domain reform, most often aimed at limiting or prohibiting the use of eminent domain for economic purposes."[2] Florida's Amendment 8, for example, passed in November 2006, "prohibits the transfer of private property taken by eminent domain to another private entity unless three-fifths of both houses of the state legislature pass a law allowing the transfer" (Shigley 2007, 14).

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State courts have also limited the use of eminent domain. In *City of Norwood v. Horney* in 2006, for example, the Ohio Supreme Court limited cities' power to condemn property for resale to a developer.[3] Norwood, Ohio, had used eminent domain to convert a neighborhood of about seventy homes into a $125-million retail and office development that would provide more jobs and produce higher tax revenues. One displaced Norwood homeowner who had been reduced to living in the basement of her daughter's home in another state rejoiced after the ruling and said, "No one should be forced to sell just because a city says a neighborhood isn't rich enough to stay" (Huffstutter 2006).[4]

Eminent domain is under attack but land assembly remains an important issue. Nelson and Lang (2007, 6) say, "Land assembly is perhaps the single biggest obstacle to central city redevelopment because the land is often divided into relatively small parcels with multiple owners." Shigley (2007, 14) describes this obstacle to land assembly in Florida:

> Florida has a number of very old cities, and some of them are crowded with dilapidated buildings on tiny lots. In addition, the state is crisscrossed with antiquated subdivisions drawn up during the first half of the 20th century that do not come close to meeting today's standards. Often, eminent domain is the only way to assemble usable plots of land in these downtowns or antiquated subdivisions.

Philadelphia faces similar difficulties:

> Land assembly for reuse and redevelopment is critical to the stabilization and rebuilding of Philadelphia's neighborhoods. Although Philadelphia has nearly 60,000 vacant parcels, few are large enough to support significant commercial, industrial, or residential development. (Philadelphia Neighborhood Transformation Initiative, n.d.)

The same problems occur in other countries. In Britain, for example, Fitz-Gerald (1990, 80) says that when public–private partnerships have been established to foster urban regeneration, "The biggest single contribution the public sector may make is usually that of land assembly."[5]

The need for land assembly and the limits on eminent domain put planners in an awkward position. Can cities assemble land for infill development without resorting to eminent domain? Fortunately, a promising new planning strategy for land assembly has emerged: graduated density zoning that allows higher density on larger sites. I will first examine the difficulty of land assembly as an impediment to infill development, and then explain graduated density zoning as a way to address this problem. Finally, I will present the results of graduated density zoning in practice.

## ▶ The Difficulty of Land Assembly

If subdividing land into smaller parcels and assembling it into larger parcels were costless transactions, the price of land per unit of area would not depend on a site's size. Because both subdivision and assembly *are* costly, however, no one will subdivide land unless its parts are worth more than the whole, or assemble land unless the whole is worth more than its parts. When the transaction costs of assembly exceed those of subdivision, there is a bias toward fragmentation and a tendency toward what Parisi (2002) terms entropy in the land market.[6]

By limiting the supply of large sites, the difficulty and cost of land assembly can increase the price per unit of area for larger sites. In a study of residential land in Chicago, for example, Colwell and Munneke (1999) found higher prices per square foot for larger sites in the city center. Tabuchi (1996) and Lin and Evans (2000) also found higher land prices for larger sites in Osaka, Japan, and Taipei, Taiwan. Higher prices for larger sites create an economic incentive to assemble contiguous parcels, but where the transaction costs of land assembly are high, the larger sites can become prohibitively expensive for redevelopment.

While the high cost of land assembly reduces the supply of large sites, economies of scale in development increase the demand for them. The semifixed costs of entitlements, environmental impact reports, tract maps, zoning appeals, and the like may not be much greater for a larger project than for a smaller one. Because a larger site eliminates some setbacks required between smaller parcels, the buildable area can increase faster than a site's size. A larger site may also accommodate a Planned Unit Development in which the developer can arrange the lot sizes, setbacks, and building placement to improve the design and maximize the value of the entire project, subject to the overall density limitations (Mandelker 2007). A larger project can also include courtyards, swimming pools, and other amenities that are hard to provide in lot-by-lot development. Land assembly can thus, in some cases, allow better design, more amenities, and a lower cost per dwelling unit.

### A Design Exercise

To see the advantages of land assembly, put yourself in the shoes of an architecture or urban design student given the following assignment:

> Design a residential building with a net density of fifty-four units per acre on a lot that is 50 feet wide and 130 feet deep. The required setbacks are 5 feet on the sides of the building, and 15 feet at the front and back. The parking requirement is 2.25 spaces per dwelling unit. Then repeat the assignment for a lot that is 100 feet wide. How does increasing the width of the lot affect the architecture of the building, the economics of the development, and the urban design of the street?

Students quickly see that the footprint of the building on the double lot is nine thousand square feet, which is one thousand square feet (13 percent) greater than eight thousand square feet for two buildings if the two lots had been developed separately with ten feet of setbacks between them (figure 1).[7]

Why choose a density of fifty-four units per acre for the example? In Los Angeles, the R3 Multiple Dwelling Zone requires a minimum of eight hundred square feet of land per dwelling unit, which is equivalent to a maximum density of fifty-four units per acre (43,560 ÷ 800), and many other cities have a similar zoning category.[8] On a lot that is 50 feet wide and 130 feet deep (6,500 square feet), the R3 zone allows eight units (6,500 ÷ 800). For an eight-unit building, Los Angeles requires eighteen parking spaces (8 × 2.25). The cost of providing the required parking often reduces the number of dwelling units that can be built on a small site. For example, figure 2 shows a new four-story, seven-unit apartment building on a 50 × 130 foot lot. The underground garage could not provide the eighteen parking spaces required for eight units, and the sixteen spaces squeezed on one parking level (see figure 3) limited the building to only seven apartments (16 ÷ 2.25), which is equivalent to forty-seven units per acre.[9]

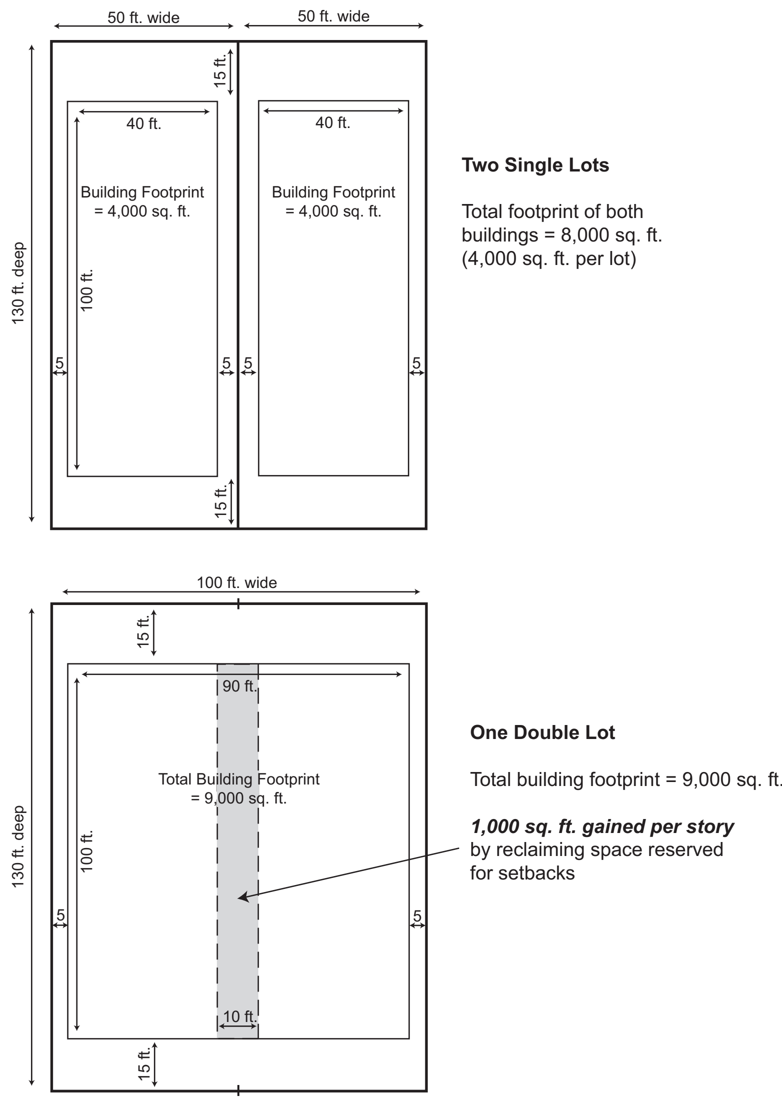


*Figure 1.* *Land assembly increases the buildable area.*

Figure 4 shows another apartment building on the same block. A developer assembled two 50-foot-wide lots and built a four-story, sixteen-unit building on a 100 × 130 foot lot (a density of fifty-four units per acre). The developer could build all of the sixteen units allowed by the zoning because structured parking is more efficient on larger sites, and the underground garage could provide the required thirty-six parking spaces (16 × 2.25). The larger building on the double lot occupies more of its site than does the smaller building on the single lot (which is also visible on the left in figure 4). The double lot achieves further economies of scale because the sixteen-unit building has one elevator and two stairwells, the same as the seven-unit building on the single lot.[10] The driveway, curb cut and entrance steps take up a smaller share of the frontage for the wider lot, leaving more space for landscaping. In this case, land assembly led to better urban design, cost savings, and a 14 percent increase in density.[11]

## Holdouts and the Tragedy of the Anticommons

Paradoxically, the economic rewards of land assembly make it difficult to accomplish. If larger sites are worth more per square foot, owners may hold out from a land assembly because they hope to own the last parcel needed for the assembled site. Once in this position, they can then bargain for a higher price. Raymond Vernon (1959, 53) described this problem:

> As the city developed, most of its land was cut up in small parcels and covered with durable structures of one kind or another. The problem of assembling these sites, in the absence of some type of condemnation power, required a planning horizon of many years and a willingness to risk the possibility of price gouging by the last holdout.

***Figure 2.*** *Seven-unit apartment building on a 50 × 130 foot lot (47 units per acre).*

***Figure 3.*** *Tandem compact parking space in underground garage.*

***Figure 4.*** *Sixteen-unit apartment building on a 100 × 130 foot lot (54 units per acre).*

If multiple owners must sell their property before redevelopment can proceed, each can halt the process by refusing to sell. The result can be what Heller (1998, 622–26) calls the tragedy of the *anticommons*: "When too many owners hold such rights of exclusion, the resource is prone to underuse—the tragedy of the anticommons . . . resources can become stuck in low-value uses." Owners may hold out because they have what environmental psychologists call place attachment and value their property at more than its market price, or they may strategically hold out for a higher price.[12] Fennell (2004a, 928–29) explains how excessive fragmentation of land can create a tragedy of the anticommons, and says that one holdout can "destroy the surplus that would otherwise be enjoyed by the would-be assembler and all of the other fragment holders who are now precluded from engaging in mutually beneficial trades."[13]

Suppose, for example, five contiguous properties are needed as the site for a redevelopment project. Suppose also that assembling the properties will double their total value. If each property is worth $500,000 before assembly, the sum of their individual values is $2.5 million. Because assembly doubles the land value, the assembled site is worth $5 million. If four owners sell their properties for $500,000 apiece and the fifth property is essential to complete the site, the fifth owner can bargain for a share of the $2.5 million gain from assembly. Assembling the first four properties thus increases the value of the fifth property not yet acquired. The opportunity for the last seller to capture part of the gain from assembly creates the incentive for all owners to hold out to be that last seller. If several properties must be assembled to create a development site, and every owner sees the potential to hold out for a high price, land assembly becomes difficult or even impossible.[14]

Using a bargaining model, Miceli and Segerson (2007) explain how, without eminent domain, holdouts from a land assembly can delay or prevent redevelopment.[15] Farris (2001) also explains how the time and effort necessary to assemble land are barriers to infill development. Because single-lot development does not attract large developers who can take advantage of economies of scale, the inability to assemble urban land can then lead to suburban sprawl onto larger greenfield sites already in single ownership.[16]

Eckart (1985) uses game theory to analyze the bargaining that occurs when a developer is trying to assemble fragmented land for redevelopment. In the model, the developer buys either all the needed land or none at all. Every owner, no matter how small his or her share of the site, can jeopardize the project by demanding a prohibitive price. When the owners form a coalition to negotiate with the developer, they can increase the expected value of the bargain by moderating their individual asking prices. Holdouts who demand prohibitive prices can stymie development and reduce the rewards for everyone, while cooperation can produce larger rewards for everyone.[17]

The holdout problem is further complicated when the size of a development can vary. Suppose that, despite a few holdouts, a smaller project is still feasible. If the completed project will improve its neighborhood, it can increase the value of the properties held out. The expectation that an infill development will increase the value of adjacent properties may lead all owners to demand higher prices, and thus make the land assembly unprofitable. O'Flaherty (1994) uses game theory to analyze land assembly for a development that will benefit the adjacent properties, and shows that the neighborhood benefits of a project can make assembling the site for it even more difficult.[18]

If land assembly is successful, infill development on large sites can revitalize the city center. Perhaps the most dramatic example of central city land assembly and redevelopment is Rockefeller Center, which Holden (1944, 242) described as "one of the greatest real estate enterprises ever organized without governmental aid." The three-block site extends from 48th Street to 51st Street between Fifth and Sixth Avenues. John D. Rockefeller leased most of the site from Columbia University, but Columbia did not own any of the land fronting Sixth Avenue. The top panel of figure 5 shows the state of the land assembly in 1929, and Rockefeller had acquired all but two of the properties on Sixth Avenue by the time construction began in 1930. The bottom panel shows how a three-story holdout at the corner of Sixth Avenue and West 50th Street cuts into the footprint of the seventy-story RCA Building.[19] Rockefeller succeeded by building around a few holdouts, but many other potential infill projects fail to be built because strategic holdouts block the necessary land assembly.[20]

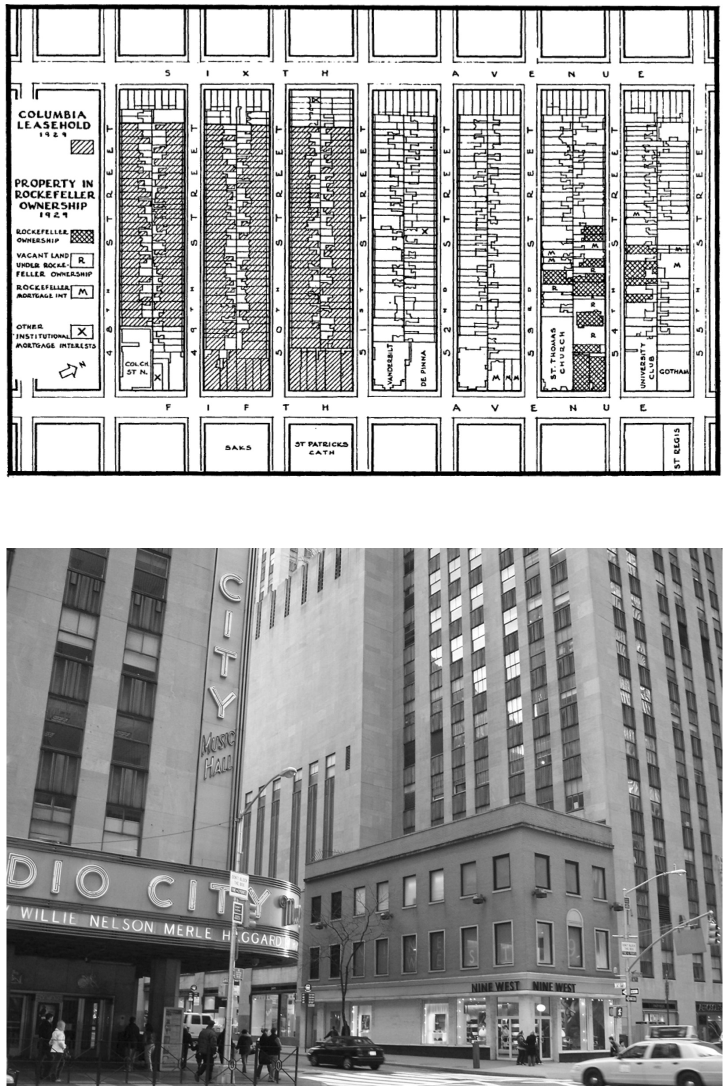


*Figure 5.* *Land assembly for Rockefeller Center.*
*(Top) Property in Rockefeller ownership in 1929.*
*(Bottom) A holdout at the corner of Sixth Avenue and 50th Street.*

Cities can use eminent domain to acquire holdouts that block infill redevelopment, but the increasing political opposition to eminent domain has led legal scholars to speculate about new ways to assemble land. Heller and Hills (2008, 1469) have proposed Land Assembly Districts "with the power, by a majority vote, to approve or disapprove the sale of the neighborhood to a developer or municipality seeking to consolidate the land in a single parcel." Eminent domain would go forward only if a majority in the neighborhood voted for it. Lehavi and Licht (2007) have proposed Special Purpose Development Corporations with the power of eminent domain; the owners whose property is condemned could choose either compensation under current eminent domain law or shares in the redevelopment corporation proportionate to each owner's property contribution. These new institutions would improve the way cities use eminent domain to promote land assembly for redevelopment, but would not eliminate the need for it.

Can cities achieve land assembly for redevelopment without resorting to eminent domain? Graduated density zoning that allows higher density on larger sites is a promising new way to encourage *voluntary* land assembly for urban redevelopment.

## ▶ Graduated Density Zoning

Suppose a city has built a rail transit line and wants to increase density around the stations. Transit-oriented development would require sites larger than the existing parcels, which are zoned for low density. The existing properties are small and in poor condition, but many owners either oppose higher density or are holding out for higher prices, and the city does not want to use eminent domain to assemble the land. Although persuading owners to agree to voluntary land assembly may seem politically impossible, creative use of zoning incentives may change the owners' minds. Consider the incentives created by allowing higher densities for larger sites.

## Higher Densities for Larger Sites

The city can keep the existing low-density zoning for sites of less than a given size (such as one acre) but allow multifamily housing at higher density (such as fifty units per acre) on sites of an acre or more. Higher density (and thus a higher land value) is possible if—and only if—a developer can assemble contiguous properties that sum to at least an acre. If the value of land for development at fifty units per acre greatly exceeds the value of the existing properties in their current uses, owners have a new economic incentive to sell for redevelopment. Similarly, developers have a new economic incentive to buy a collection of contiguous properties. Allowing higher density on larger sites may thus stimulate spontaneous land assembly.

Let's return to the example of five properties that can be assembled into a redevelopment site with a capital gain of $2.5 million. Each property is one-fifth of an acre. If the zoning requires at least a one-acre site for development at fifty units per acre, five contiguous owners must cooperate before anyone can rebuild at higher density. In contrast, with conventional zoning of fifty units per acre regardless of the site size, a developer with one-fifth of an acre can demolish one house and build ten dwelling units. Graduated density can thus provide some protection from developers who want to buy one lot and build out-of-scale condominiums or apartment buildings. Yet at the same time, the minimum one-acre site required for development at higher density could encourage owners to cooperate in a land assembly because they would share a large capital gain.

Asami (1987, 234) explains that groups of landowners will compete with one another if a developer has available several "alternative ensembles of land parcels which could each fulfill his land development requirements. In other words, there is generally more than one collection of landowners with whom the developer may choose to bargain." If graduated density zoning covered an area large enough to foster competition among several collections of owners whose assembled land would each trigger higher density, the power of holdouts would decline and the incentive to cooperate would increase. Cooperation among the original owners combined with competition among potential developers can shift much of the assembly's capital gains to the original owners.

Land assembly also occurs with conventional zoning, of course, but graduated density can transform the bargaining. It will give owners more information about the benefits of land assembly and will reduce the reward for acting independently compared with forming a coalition. Graduated density zoning will not eliminate the incentive to hold out, but it can create a new fear of being *left out*. If holdouts are left with sites that cannot be combined with enough contiguous land to trigger higher density, they lose a valuable economic opportunity. Zoning that is contingent on site size can thus reduce the likelihood of scattered redevelopment on small sites and increase the incentive for owners to cooperate in assembling larger sites that create higher values.[21]

New Urbanist form-based zoning differs substantially from conventional zoning, but form-based zoning can also include a graduated density component. A city with form-based zoning can, for example, reward land assembly by allowing additional height for buildings on larger sites within a zone (such as the Urban Center Zone), or by reclassifying the site into a denser zone.

Graduated density zoning will not reduce owners' sentimental attachments to their homes, but the higher property values as part of an assembled site will increase both the ability to buy a better replacement home and the opportunity cost of holding out. Perhaps nothing would have induced Susette Kelo to sell at a reasonable price, but graduated density can at least increase the likelihood of voluntary land assembly. Graduated density may become a new planning option in cases where eminent domain has been considered the only way to assemble land. Cities will no longer have to choose between using eminent domain and accepting the likelihood that holdouts will block redevelopment.

Owners who participate in a land assembly will not have to live with redevelopment next door because they will have cashed out and moved away. Redevelopment will always upset some remaining neighbors, but the voluntary nature of land assembly under graduated density zoning may increase political support (and reduce opposition) within the development site itself. As described below, the City of Simi Valley set thirteen acres as the threshold for higher density, and a developer quickly assembled a thirty-acre site for redevelopment. Most owners bought into the redevelopment of their neighborhood because they received the resulting capital gains.

## The Financial Benefits of Graduated Density

A numerical example can illustrate the financial benefits of graduated density. Table 1 presents a hypothetical scenario of land values as a function of site area with both fixed and graduated density zoning. Column 1 shows the site area, which ranges from 0.2 acres to 1.4 acres. Columns 2 and 3 show the number of dwelling units and the land value of the sites when the zoning allows five dwelling units per acre. Single-family homes occupy fifth-of-an-acre sites, and the residual land value is $50 per square foot for any size site if there are no economies of scale in single-family housing construction (see figure 6).[22]

Columns 4 and 5 show the number of units and value for the sites with fixed-density zoning that allows fifty dwelling units per acre whatever the site size. The land value for multifamily housing ranges from $100 per square foot for a 0.2-acre site to $200 per square foot for sites of an acre or more. The land value is assumed to increase with the site size because of economies of scale in development, such as more efficient parking garages on larger sites. No further economies of scale are assumed for sites

**Table 1.**
**Land value as a function of zoning and site area.**

| | *Fixed Density* | | | | *Graduated Density* | |
|---|---|---|---|---|---|---|
| | *Zoning Independent of Site Area* | | | | *5 DU/Acre for Sites < 1 Acre* | |
| *Area* | *5 DU/Acre* | | *50 DU/Acre* | | *50 DU/Acre for Sites ≥ 1 Acre* | |
| *Acres* (1) | *Units* (2) | *$/Sq. Ft.* (3) | *Units* (4) | *$/Sq. Ft.* (5) | *Units* (6) | *$/Sq. Ft.* (7) |
| 0.2 | 1 | $50 | 10 | $100 | 1 | $50 |
| 0.4 | 2 | $50 | 20 | $125 | 2 | $50 |
| 0.6 | 3 | $50 | 30 | $150 | 3 | $50 |
| **0.8** | **4** | **$50** | **40** | **$175** | **4** | **$50** |
| **1.0** | **5** | **$50** | **50** | **$200** | **50** | **$200** |
| 1.2 | 6 | $50 | 60 | $200 | 60 | $200 |
| 1.4 | 7 | $50 | 70 | $200 | 70 | $200 |

Note: DU = dwelling units.

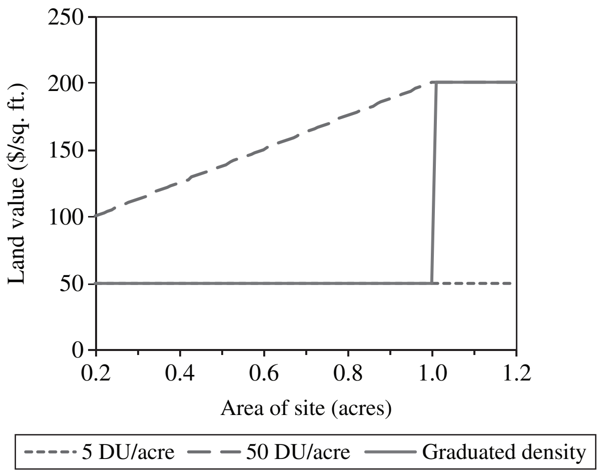


***Figure 6.*** *Site size determines land value.*

larger than an acre.[23] Developers can build multifamily housing on small sites if they cannot assemble larger and more efficient sites. In this example, building ten condominium units rather than a single house on a 0.2-acre site doubles the land value.

Columns 6 and 7 show the number of units and value for the same sites with graduated density zoning. For sites smaller than an acre, the zoning allows only five dwelling units per acre, which is the single-family density, and the land value is $50 per square foot. For sites of an acre or more, however, the zoning allows fifty units per acre, and this density yields a value of $200 per square foot. The minimum site size that triggers higher density can be set either higher or lower in response to the character of the surrounding neighborhood, economies of scale in development, adequacy of public infrastructure, urban design criteria, politics, and other factors.

In commercial areas where zoning regulates density by the floor-to-area ratio (FAR), the allowed density could be related to either the area or the frontage of the site:

$$\text{Allowed FAR} = a + b \times (\text{area or front feet of the site})$$

This formula allows a higher FAR on larger sites, up to a maximum. On older commercial corridors with narrow lots, for example, developers might assemble wider lots for infill projects, perhaps with retail below and offices or housing above.

## A Sliding Scale for Graduated Density

Establishing a reasonable relationship between site size and allowed density will undoubtedly be a challenge. Using a fixed size to trigger the higher density means that land assembly is rewarded only if a developer can assemble a site of at least that size. An arbitrary minimum size could thus increase the value of holding out if a developer needs a specific additional parcel to trigger higher density for the remainder of a site that is being assembled. To avoid creating this strategic incentive to hold out, a city can employ a sliding scale of increasing density rather than a sharp increase at a fixed size. For example, the allowed residential density could be related to the area of the site in this way:

$$\text{Allowed Dwelling Units per Acre} = a + b \times (\text{area of site})$$

where $a$ is the base density and $b$ is the factor linking density to the area of the site up to a maximum density. For example, suppose $a = 5$, $b = 45$, and the density is capped for sites above one acre. This formula yields fifty dwelling units per acre on a site that is one acre or larger (as in table 1).

Table 2 highlights the differences in the number of dwelling units allowed by fixed-density zoning and by two kinds

**Table 2.**
**Total dwelling units as a function of zoning and site area.**

| | *Fixed Density* | | *Graduated Density* | | | |
|---|---|---|---|---|---|---|
| | | | *Abrupt* | | *Sliding* | |
| *Area* Acres (1) | *Density* Units/Acre (2) | *Units* Units (3) = (1) × (2) | *Density* Units/Acre (4) | *Units* Units (5) = (1) × (4) | *Density* Units/Acre (6) | *Units* Units (7) = (1) × (6) |
| 0.2 | 50 | 10 | 5 | 1 | 14 | 3 |
| 0.4 | 50 | 20 | 5 | 2 | 23 | 9 |
| 0.6 | 50 | 30 | 5 | 3 | 32 | 19 |
| **0.8** | **50** | **40** | **5** | **4** | **41** | **33** |
| **1.0** | **50** | **50** | **50** | **50** | **50** | **50** |
| 1.2 | 50 | 60 | 50 | 60 | 50 | 60 |
| 1.4 | 50 | 70 | 50 | 70 | 50 | 70 |

Note: Column 6: Density = 5 + 45 × Area, for Area ≤ 1 acre. Column 7: Units = Area × Density = Area × (5 + 45 × Area) = 5 × Area + 45 × Area$^2$.

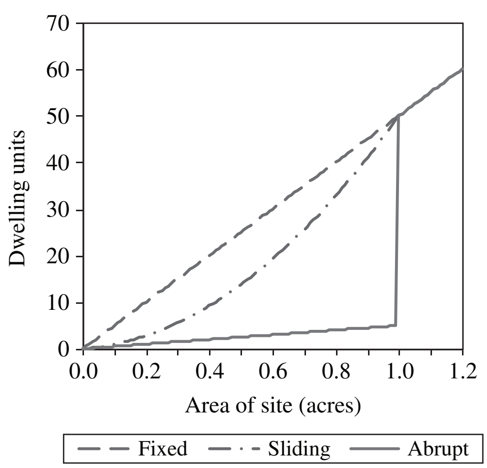


***Figure 7.*** *Site size determines total dwelling units.*

of graduated density zoning—abrupt and sliding scale. Column 1 shows the site area, and column 2 shows the density allowed by conventional zoning with a fixed rate of fifty units per acre. Column 3 shows the number of dwelling units allowed on the site, which is the product of the site area multiplied by fifty units per acre; with fixed density, the number of units increases in linear proportion to the site area (see figure 7).

Columns 4 and 5 show the same relations for the graduated density example previously explained in table 1. The density is five units per acre for sites smaller than one acre, and fifty units per acre for sites of an acre or more. The number of dwelling units thus jumps abruptly from four on a 0.8-acre site to fifty on a 1-acre site (column 5).

Columns 6 and 7 show how these relations change if the density increases according to a sliding scale, whereby the dwelling units per acre = 5 + 45 × (area of site). The number of dwelling units on the site is the product of the site area multiplied by the density. Because the density increases with the site area, the number of dwelling units increases with the square of the site area. As a result, the number of dwelling units on the site increases at an increasing rate, up to one acre.

When compared with fixed density, the sliding scale of density reduces the incentive to redevelop smaller sites and increases the incentive to assemble land to redevelop larger sites. On a 0.2-acre site, the fixed density of fifty units per acre allows ten units (column 3), while the sliding density allows only three units (column 7). On the other hand, increasing the site size from 0.8 acre to 1 acre allows ten more units with fixed density and seventeen more units with sliding density. With abrupt graduated density, increasing the site size from 0.8 acre to 1 acre allows forty-six more units (column 5). Compared with the abrupt graduated density, the sliding scale thus reduces the bargaining power of a potential holdout whose land would be necessary to assemble a 1-acre site.

With a sliding scale of density, if one owner holds out for strategic purposes, a smaller project can proceed with a lower density.[24] The option to proceed with a smaller project can thus reduce the reward for holding out, especially if the holdout is then left with a site that cannot be part of another successful assembly. In this example, an owner who holds out hoping to sell the last 0.2-acre parcel that would allow seventeen more units on an assembled acre of land may be left with a site zoned for only three units.

Complicated formulas that include the area and/or the frontage of a site can be used to determine density, but the idea is simple: allow higher density on larger sites where a city wants to support land assembly. Even if the underlying formula is complex, the zoning code can show the allowed density in a simple table. Table 3 shows the allowed density derived from columns 1 and 6 in table 2.

For graduated density zoning to provide a substantial incentive for land assembly, the base density for small sites

**Table 3.**
**Allowed density**

| *Site area (acres)* | *Density (DU/acre)* |
|---|---|
| Less than 0.2 | 5 |
| 0.2–0.39 | 14 |
| 0.4–0.59 | 23 |
| 0.6–0.79 | 32 |
| 0.8–0.99 | 41 |
| 1 or more | 50 |

must be low and the density bonus for larger sites must be high. If developers don't want to build more than what the zoning already allows, a density bonus for larger sites is moot, and will provide no incentive to assemble land. Similarly, if the density allowed on small sites is lower than developers want but the city offers only a small bonus for larger sites, the incentive to assemble land will be small. But if the base density is much lower than developers want and the city offers a substantial density bonus for larger sites, then graduated density zoning will provide a large incentive for land assembly.

By changing the politics and economics of land assembly, graduated density zoning can change the pattern of development. The next section considers how graduated density zoning can affect the supply of housing, attitudes toward density, and historic preservation.

## ▶ Effects of Graduated Density Zoning

A city can use graduated density to encourage the assembly of a specific site that it would like to see redeveloped, or to pursue broader goals, such as increasing the housing supply. Graduated density may be especially useful in dealing with a shortage of housing that has been created by a shortage of building permits.

### Supply of Housing

Glaeser and Gyourko (2002, 2003) argue that high housing prices typically result not from a shortage of land but from of a shortage of building permits. Zoning and other land-use controls, they say, help explain why the price of housing often far exceeds its cost of construction. To examine this question, they analyzed the relationship between housing prices and lot sizes while controlling for several other factors such as the number of bedrooms and bathrooms. They found that even in cities with high land values, the market value of a house on a fifteen-thousand-square-foot lot is only slightly higher than the value of the same house on a ten-thousand-square-foot lot (Glaeser and Gyourko 2003, 35). They conclude that an urban lot derives most of its value from the right to build housing on it, and argue that low-density zoning, by restricting the number of building permits, has increased housing prices far above construction costs.

Why do cities zone for low density if higher density would yield higher land values? Glaeser, Gyourko, and Saks (2005) argue that homeowners who prefer low density have gained more political power and influence to block new higher-density projects. Future residents who would live in new housing are unorganized, unrepresented, and politically powerless. Many developers want to build more housing than the current zoning allows, and their requests for upzoning indirectly represent the demand for new housing. Nevertheless, cities restrict the number of building permits below the level that land economics would predict. Glaeser, Gyourko, and Saks (2005, 8–9) conclude, "The evidence points to a man-made scarcity of housing in the sense that the housing supply has been constrained by government regulations as opposed to fundamental geographic limitations."

By changing the politics of land assembly, graduated density zoning can increase the housing supply in markets where zoning has unduly restricted new construction. Because the minimum site size required for dense development will encourage cooperation among owners whose land is being assembled, graduated density zoning can transfer to these owners much of the gain in land value created by the higher density. The prospect of these capital gains may create political support for allowing higher density on larger sites, and thus reduce the artificial scarcity of housing.

Graduated density zoning may increase the supply of housing, but if it leads to redevelopment of sites currently occupied by older buildings with lower rents, it can reduce the supply of affordable housing. Assembling sites for new affordable housing is difficult because the limited rents cannot support high land values, and the high cost of land assembly may mean that only market-rate development can make a profit for infill projects. Cities should therefore be cautious about using graduated density zoning to assemble sites in low-income neighborhoods, even if land economics suggests it would be profitable.

Although graduated density zoning may lead to the loss of some affordable units through redevelopment, it can increase the supply of affordable housing in three ways. First, zoning disputes often delay development and reduce the supply of housing. Cities will never get much affordable housing if developers arrive at meetings with their attorneys rather than their architects, and must fight for years to get a building permit. Graduated density zoning can turn some of these legal disputes into voluntary transactions that will increase the housing supply. Second, by reducing the incentive to hold out from land assembly, graduated density zoning can accelerate recycling of land for housing. If the redevelopment rehouses more people than it displaces, the increased housing supply can reduce prices and make all housing more affordable. And third, the windfall gains created by higher density may allow cities to require developers to include some affordable housing on the assembled land without seriously reducing the incentive to build market-rate housing.

Although graduated density zoning can increase the supply of affordable housing, it may also displace some tenants if their landlords sell rental property for redevelopment. Can a city protect tenants when it uses graduated density to promote land assembly? It can if the land assembly creates sufficient capital gains. Suppose, for example, a city is considering graduated density zoning for a neighborhood of small apartment buildings on large lots. The city could allow denser development on assembled sites, but also require additional compensation for any displaced tenants. Many cities already require landlords to compensate tenants who are ousted by redevelopment, and a city could increase this required compensation if a developer requests a density bonus. If the capital gains from higher density are not great enough to support this compensation, land assembly will not be profitable and there will be no displacement. Even tenants could gain from graduated density, and increased compensation for displacement should reduce their opposition.[26] Graduated density zoning can thus increase the overlap of interests among owners, tenants, developers, and cities.

## Attitudes Toward Density

Good architecture and urban design are often difficult for high-density development on narrow lots with side-yard setbacks. When a developer shoehorns a large building onto a small lot, the neighborhood can get stuck with a jarring eyesore.[27] Who wouldn't be upset if a developer demolished the house next door and replaced it with a four-story box? This opposition to redevelopment next door creates a political barrier to upzoning for higher density.

Fortunately, introducing graduated density does *not* require upzoning. Consider a neighborhood that is zoned for fifty units per acre but remains occupied by small apartment buildings. Most owners are holding out from attempts to assemble their land for redevelopment because they expect unrealistically high prices. In this case, a city might *downzone* the area to allow fifty units per acre only on sites larger than a minimum size. This downzoning—requiring a minimum site size for development at the density previously allowed on all sites—would prohibit high density on small sites. If anti-density sentiment stems in part from opposition to overbuilding on small lots, graduated density zoning responds to this sentiment by requiring lower density on smaller sites.

Paradoxically, this downzoning could increase overall density. It would deter piecemeal redevelopment that often gives density a bad name, but would also create a new reward for land assembly and thus increase the likelihood of redevelopment on larger sites. Graduated density zoning can thus achieve two important objectives at the same time. First, requiring lower density on smaller sites will protect neighborhoods against scattered overbuilding on small sites. Second, allowing higher density on larger sites will encourage cooperation in land assembly for redevelopment.

If several adjacent owners sell their properties for a land assembly, the resulting development can to some extent internalize within one large site what would otherwise be external costs of piecemeal development on scattered sites (such as shadows, noise, and loss of privacy for the adjacent properties). Graduated density may thus reduce political opposition to redevelopment by containing otherwise external costs within a single large site. External effects (both costs and benefits) of development will remain for the surrounding area, but fewer residents will live next to new construction. People seem to care about development in proportion to its proximity to their front door, and most redevelopment on larger sites will abut streets rather than adjacent buildings.

To reduce opposition from the nearby residents, cities can establish design guidelines to ensure that new buildings do not loom over their neighborhoods. In parts of Los Angeles, for example, the zoning requires that if a multifamily project is across the street from single-family housing, each level above the first must be set back at least ten feet from the level immediately below, and 40 percent of the setback area must be landscaped.[28] This requirement creates a hanging-gardens effect for the multifamily projects, and it softens the transition from lower to higher density. Similarly, cities could establish special requirements for excellence in design on the assembled sites, so that neighbors will like what they see. Placing too many conditions on the eligibility for higher density, however, will shrink the incentives for land assembly and redevelopment.

Residents who worry about traffic congestion will understandably oppose any rezoning that generates more vehicle trips. For this reason, a city might require a developer who receives a density bonus to reduce vehicle trips to and from the site. It can, for example, require the developer to unbundle the cost of parking from the price of multifamily housing, so the separate cost of parking will deter multiple car ownership. Establishing residential permit districts can prevent the priced parking from creating spillover into the adjacent neighborhoods. If a city offers graduated density for transit-oriented development, it can also reduce the off-street parking requirements or cap the parking supply on the site.[29] In any case, when thinking about the future of cities we should not always automatically assume that free parking and free roads will govern land use planning forever. Transportation prices that reflect transportation costs may eventually allow better land use planning.

Any substantial zoning change requires an elaborate planning process that includes public consultation with affected residents, property owners, businesses, environmentalists, preservationists, and community activists. Because a proposal for graduated density would attract intense scrutiny and publicity, a city is unlikely to adopt it against strong opposition. Property owners in a neighborhood that is rezoned for grad-

*Figure 8. Waldorf-Astoria Hotel, demolished in 1929 for its site.*
Source: Courtesy of Nathan Silver.

uated density should therefore have full information about the economic incentives for assembly.[30]

## Historic Preservation

Developers sometimes demolish historic buildings that occupy large sites because this is the cheapest way to obtain a large site for a new building. In *Lost New York*, Silver (1967, 62) explains how the difficulty of land assembly has led to the demolition of historic buildings:

> The old Waldorf-Astoria met its end in a typical New York way: since the entire block was already under one ownership, it was cheaper for the builders of the future Empire State building to buy it than to try to acquire nearby property piecemeal. One of the city's most valuable buildings consequently was demolished in 1929. (see figure 8)

Few people would trade the Empire State Building for the old Waldorf-Astoria, but Silver's point is that New York could have had both. Much of the area around the Waldorf was much lower density and in disrepair. Had it been possible to assemble an adjacent block, the Empire State Building could have risen alongside, rather than in place of, the Waldorf. But instead, New Yorkers had to sacrifice a great building to get a greater one.

The Astor Hotel on Broadway between 44th and 45th Streets met a similar end (Silver 1967, 225):

> The loss of a splendid hotel like the Astor (now being replaced by an office building) is a matter for public concern in New York. The site was acquired in a single property deal, rather than expensively assembled bit by bit, and this explains why one of the most valuable buildings for blocks around is being torn down, instead of some of the shabby buildings nearby.

By easing the task of negotiating with multiple owners to assemble a collection of shabby buildings, graduated density zoning can relieve the pressure to tear down valuable buildings simply to get their large sites. A city should *not* offer higher density for larger sites on streets or on sites that it wants to preserve intact. A city should offer graduated density *only* where it wants redevelopment, and in these districts the city could require developers to preserve landmark buildings, or at least their facades, as a condition of receiving a density bonus. Graduated density zoning can thus contribute not only to neighborhood renewal but also to historic preservation.

## ► Appropriate Locations

Graduated density zoning is not appropriate everywhere because land assembly is not appropriate everywhere. Graduated density may turn out to be appropriate in only a few locations. It cannot help where large sites are already in single ownership or where there is no market for new uses. Market demand will determine where graduated density zoning can lead to assembly, but in many locations a density bonus may not be appropriate even where there is demand. Cities can require added design amenities for large developments built on assembled land, but many people prefer to live in older, smaller-scale, and finer-grained neighborhoods. Bigger is not always better, and graduated density will be appropriate only where a city wants redevelopment.

Graduated density may be especially appropriate for transit-oriented development and for older commercial strips that are ripe for reuse. In these places, cities can offer graduated density to encourage land use succession that requires assembly, demolition, and redevelopment at a higher density. Cities can further encourage land assembly by providing a database showing where vacant or underused land is available, its tax status, who owns it, and the density bonus for larger sites.[31]

In an older subdivision with small houses on large lots, many residents might welcome the prospect of graduated density if the city requires developers to help finance sidewalk repairs, street trees, and underground utilities around their projects. Infill housing might even include some ground-floor retail uses, such as a grocery store, restaurant, or day-care center. If the minimum site size for dense development were an entire block, the possibility of assembly would increase everyone's land value but no one would suffer from adjacent redevelopment next door or behind. The worst that could happen would be higher density across the street.

Gradually, the entire neighborhood might make the transition into higher density, one block at a time.

In strong real estate markets that can support redevelopment, graduated density will reward voluntary land assembly, and bargaining between developers and the original owners will determine who receives the capital gains. If the original owners capture most of the capital gains, they are more likely to endorse the land assembly. Where the development requires additional public infrastructure, the land value increment created by the density increment may be more than enough to finance the new infrastructure. (To the extent that the infrastructure increases the value of an assembled site, its cost will not reduce the capital gains from the assembly.) A city could, for example, require developers to dedicate the land necessary for schools and parks. Using the land value increment created by the density increment to pay for the added infrastructure that higher density makes necessary might be termed *density increment finance*, similar to tax increment finance.[32] As a result, original owners will get capital gains from land assembly, developers will get a supply of sites for infill projects, and cities will get both more housing and higher tax revenues. Creating capital gains can replace using eminent domain as the way for cities to assemble land for redevelopment.

## ► Gradual Changes

Graduated density zoning is an incremental change that does not require either planners or developers to change the way they work. Rather than declaring that a neighborhood is "blighted" to justify using eminent domain, a city can offer a density bonus for large sites. Market demand is key to the success of graduated density in encouraging land assembly, and that is one of its strengths. Assembly will not take place unless the market will support it.[33] Infill development with voluntary land assembly will be gradual rather than dramatic. Jane Jacobs (1997, 27) explained why we should favor gradual changes, and how they can add up to big improvements:

> Retrofitting means accepting what exists as a base, a given, and deliberately improving it with varied small changes. These little alterations, thought of and undertaken as opportunity offers, incrementally add up to a very significant improvement. By its very nature, this approach is economic, conserving, efficient, flexible, and responsive.

Communities will choose this retrofitting approach, Jacobs said, if they share three values:

> Belief that small improvements are worthwhile, faith that they add up, and recognition that they are all the more effective because they are not disruptive and all the more congenial because they can occur as opportunity offers and circumstance permits.

In a similar vein, Anne Whiston Spirn (1984, 10) says,

> Incremental change through small projects is often more manageable, or feasible, less daunting, and more adaptable to local needs and values. When coordinated, incremental changes can have a far-reaching effect. Solutions need not be comprehensive, but the understanding of the problem *must* be.

***Figure 9.*** *Typical house on a large lot before redevelopment.*

The voluntary, incremental nature of land assembly under graduated density zoning suggests that it may become a congenial new way to retrofit older cities with varied small changes, undertaken as opportunity offers and circumstance permits, that can add up to significant improvement.[34]

## ► Graduated Density Zoning in Practice: Kadota Fig

Simi Valley, a suburb of Los Angeles, uses graduated density zoning. The city devised it for Kadota Fig, a large-lot residential neighborhood subdivided in 1927 as the Kadota Fig Farms, complete with fig trees and facilities for pigeon farming (Aleahmad 1990, 59). In the city's 1988 General Plan, the 448-acre neighborhood was zoned for low density (up to two dwelling units per acre). Figure 9 shows a typical house in the neighborhood. Kadota Fig is centrally located and there was strong market interest in redevelopment at higher density, but the city wanted to avoid spot upzoning and piecemeal projects. Because some owners preferred their low-density, semirural lifestyle and opposed rezoning for higher density, elected officials directed planners to come up with a new approach to ease the path for redevelopment.

The city surveyed residents about their development preferences and appointed a Kadota Fig Study Committee to recommend a planning strategy for the area. The committee of residents and property owners recommended that the city should develop a specific plan for higher density in the southeast quadrant of Kadota Fig, the only portion of the study area where most owners supported upzoning. Achieving

**Table 4.**
**Graduated density zoning in the Southeast Kadota Fig Specific Plan.**

| | | *Allowed Density (Dwelling Units/Acre)* | | | |
|---|---|---|---|---|---|
| *Planning Unit* | *Area (Acres)* | *Base* | *Graduated* | *Increase* | *Threshold (Acres)* |
| 1 | 6.1 | 2.0 | — | — | — |
| 1A | 6.3 | 5.1 | 7 | 37% | 5 |
| **2** | **34.5** | **3.26** | **7** | **115%** | **13** |
| 3 | 3.7 | 15 | — | — | — |
| | 9.9 | 2.0 | — | — | — |
| 4 | 13.5 | 3.26 | 5.1 | 56% | 6 |
| | 2.6 | 2.0 | — | — | — |

Source: City of Simi Valley (1996).
Note: Graduated density zoning is available only in planning units 1A, 2, and 4. The density of fifteen units per acre in planning unit 3 is only for senior citizen housing.

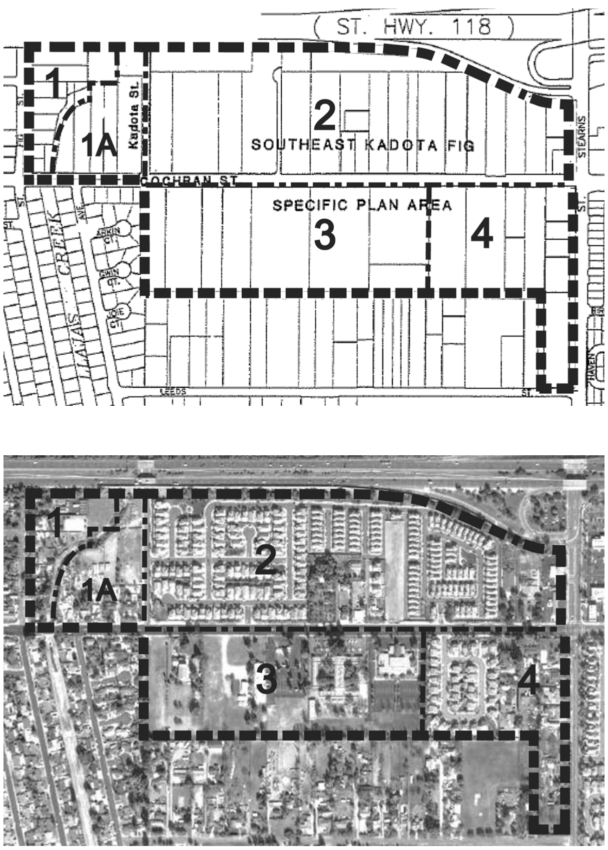


***Figure 10.*** *Kadota Fig Specific Plan Area in 1996 and 2002.*

*(Top) Kadota Fig Specific Plan Area in 1996.*

Source: City of Simi Valley, 1996.

*(Bottom) Kadota Fig Specific Plan Area in 2002.*

Source: Google Earth

higher density with good urban design would require land assembly, and to achieve this result the specific plan states:

> Cooperative planning efforts are strongly encouraged among affected property owners. Toward this end, implementation measures have been established for planning units 1, 2, and 4 which provide for potential increases in residential density based upon the size of the proposed Planned Developments.[35]

Table 4 shows these increases in residential density for larger sites.

In unit 2, for example, the base zoning allows 3.26 dwelling units per acre. If a developer can assemble a site that is thirteen acres or larger, however, the allowed density jumps to 7 units per acre. More than twice as many dwelling units can be built on an assembled site than on the same land if it were not assembled. The city adopted the specific plan in 1996, and within a year a developer had assembled eighteen parcels to create a 31-acre site in unit 2, which has the highest density bonus. By 2000, a master-planned community with two hundred single-family homes had been built on the land formerly occupied by eight single-family homes, three travel trailers, one mobile home, and various storage buildings and animal pens.[36]

In unit 4, where the density bonus is 56 percent, two parcels were assembled and developed with thirty-five single-family homes. No land assembly has occurred in unit 1A, where the density bonus is 37 percent, or in units 1 and 3, where there is no density bonus (see figure 10).

The high density in planning unit 2 required small sites, almost half with zero lot lines (one side of the house rests on the lot's boundary, creating one larger and more useful side yard than if the house were placed in the center of the lot with two small side yards). Because the garages face alleys behind the houses, garage doors do not dominate the front facades (see figures 11 and 12). The average lot size for the zero-lot-line houses is 2,850 square feet, so their *net* density is fifteen dwelling units per acre (43,560 ÷ 2,850).[37]

Because land assembly also occurs with conventional zoning, Kadota Fig might have been redeveloped if the city had simply rezoned unit 2 at a density of seven units per acre, regardless of site size. Interviews with the city's planning staff and with realtors who participated in the land assembly, however, suggest that graduated density provided a strong

***Figure 11.*** *Zero-lot-line houses after redevelopment.*

***Figure 12.*** *Garages in alleys after redevelopment.*

incentive for voluntary assembly. Only one owner refused to sell any land, three owners sold part of their land, and all the other owners sold all their land. The negotiations were far from simple, but Patti Felker-Breiner, a realtor who represented the developer, explained, "All parties involved worked together successfully considering there were 18 parcels and 32 property owners, one buyer, several attorneys, several accountants, and two brokers."[38]

Gary Seaton, the realtor who represented the sellers, emphasized that each site was worth more if developed collectively at 7 dwelling units per acre than individually at 3.26 units per acre. (This is consistent with Glaeser and Gyourko's hypothesis that the value of a site depends on the number of dwelling units allowed, not on the site's size.) Several attempts to assemble land in Kadota Fig had failed during the previous decade. In Seaton's view,

> If the city had simply rezoned the land at seven units per acre, regardless of the site size, assembling enough land to create a master-planned community would have been far more difficult. Instead the city had the foresight to double land values by doubling the allowed density if the adjacent landowners worked together to assemble their contiguous parcels.[39]

When he first learned about the contingent zoning for Kadota Fig, Seaton thought it put an undue burden on property owners when compared with rezoning all the land at seven units per acre by right. After he participated in the land assembly, however, he found the thirteen-acre minimum created an economic incentive that was the key to assembling a site large enough for a master-planned community. In his judgment, the developer paid the land price expected for development at seven units per acre. The original owners thus captured most of the capital gains from the higher density, which increased their support for the land assembly.

Several possible combinations of properties would have summed to at least thirteen acres and would also have blocked one or more adjacent properties from becoming part of another thirteen-acre assembly. The fear of being left out may therefore have convinced some owners to join the assembly rather than to hold out. As more properties were assembled, the possibility of becoming part of an alternative thirteen-acre assembly shrank, so the probability of being left out increased. Eventually, only one owner held out from the land assembly.[40]

The results in Kadota Fig do not prove that graduated density zoning will stimulate land assembly elsewhere. Nevertheless, the rezoning achieved what the city wanted. When compared with conventional zoning, the requirement to assemble at least thirteen acres before building at higher density probably increased the rewards to the original owners in Kadota Fig. If graduated density zoning deters strategic holdouts and thus reduces the transaction cost of assembling land, it can increase the probability of a successful redevelopment that yields higher rewards not only for the original owners but also for developers and cities.

Simi Valley crafted its graduated density ordinance to encourage land assembly in one specific location, but cities can include graduated density as a standard feature of their zoning ordinances. For example, table 5 shows a form of graduated density zoning in Glendale, California. In multifamily residential zones, the city increases the allowed density by 25 percent on lots having a width of ninety feet or greater, and increases the allowed height by one story. The goal is to improve the urban design of multifamily neighborhoods, but the effect is also to encourage land assembly. Glendale's 25 percent density bonus for a wide lot is not so dramatic as Kadota Fig's 115 percent density bonus for a large site. Nevertheless, it does show how cities can experiment with their zoning ordinances to encourage land assembly and improve urban design.

**Table 5.**
**Graduated density zoning in Glendale, California.**

| | *Allowed Density (Dwelling Units/Acre)* | | | |
|---|---|---|---|---|
| *Zone* | *Base* | *Graduated* | *Increase* | *Threshold Width* |
| R-2250 | 19.4 | 24.2 | 25% | 90 feet |
| R-1650 | 26.4 | 33.0 | 25% | 90 feet |
| R-1250 | 34.8 | 43.6 | 25% | 90 feet |
| | *Allowed Height (Stories)* | | | |
| *Zone* | *Base* | *Graduated* | *Increase* | *Threshold Width* |
| All three | 2 | 3 | 50% | 90 feet |

Source: Chapter 30.11 of the Glendale Municipal Code.
Note: R-2250 is the Medium Density Residential Zone. R-1650 is the Medium-High Residential Zone. R-1250 is the High Density Residential Zone.

Glendale offers its graduated density incentive everywhere in three multifamily zones, regardless of the existing housing stock. A more discriminating policy would be to offer a graduated density overlay zone only where a city wants to encourage land assembly for redevelopment. The graduated density overlay zones could resemble historic preservation overlay zones, and should be designed to achieve specific results in specific neighborhoods.

## ▶ Conclusion: Voluntary Land Assembly for Infill Redevelopment

After land has been subdivided and developed at low density, reassembling sites large enough to redevelop at higher density is difficult. As a result, parts of many older cities are overfragmented and underused. The land is underused in the sense that if it were assembled for redevelopment it would be worth more than enough to fully compensate all the original owners for giving up their property. The land is overfragmented in the sense that multiple ownership creates such large transaction costs for assembly that underused land is not assembled. If single-lot redevelopment is unprofitable, the difficulty of assembling land then impedes regeneration in city centers. The land assembly problem can thus delay or block the reuse of underused land in the center and accelerate sprawl onto large suburban and exurban sites already in single ownership.

Graduated density zoning is a new way to encourage voluntary land assembly for infill redevelopment. By allowing higher density on larger sites, it creates an incentive for owners to cooperate in a land assembly that can greatly increase the value of their individual properties. Graduated density zoning also has another important advantage: by requiring lower density on smaller sites, it protects older neighborhoods against out-of-scale overbuilding on single lots.

Graduated density zoning achieves the benefits of eminent domain without the coercion. The results of using graduated density zoning in Simi Valley suggest that planners have a promising new option to consider where cities want to encourage voluntary land assembly for infill development. Although this new zoning variant first appeared in a niche that was especially favorable for its success, planners can adapt it to encourage land assembly in other circumstances.[41] Graduated density zoning will doubtless work in different ways in different places, but it has the advantage of being a small, incremental change to conventional zoning. If a city does try graduated density zoning and no land is assembled, no one will lose anything. In contrast, one weakness of eminent domain is its near-irreversibility. When land is taken and a project fails, the litigation and recrimination have been for naught. Even where graduated density zoning does not work well, it will not fail badly.

In cities where market demand for infill development is strong but ownership is fragmented, graduated density zoning can help to defragment ownership and improve the land market in two ways—political and economic. First, graduated density is a regulatory giving, not a taking. The density bonus for owners who participate in a land assembly can ease the politics of rezoning for higher density. Second, the economic incentive to participate in a land assembly can speed redevelopment. Planning and the market can work together to serve both public and private interests.

Graduated density zoning relies on market incentives to assemble land, and it can convert the strategic desire to *hold* out into the fear of being *left* out. If enough owners agree to land assembly, holdouts can keep their property and the new investment in their neighborhood may even increase their property's value. But the holdouts may miss the chance for their property to become part of a site large enough to trigger higher density and even higher value. The prospect of a large windfall may convince many owners to sell out rather than hold out.

Market-based incentives cannot solve the problem of the immovable holdout, who may be a homeowner, an apartment building owner, or a commercial landlord. These holdouts may refuse to sell because they love their property, or hate developers, or dislike change; they do not respond to any feasible amount of money. In these cases, eminent domain may be the only way to complete a land assembly. No tool is ideal in every situation; sometimes you need a hammer, sometimes a screwdriver. Graduated density zoning is simply a new incentive in the planner's toolkit.

Graduated density zoning has the potential to ease both the politics of higher density and the economics of land assembly. If it encourages redevelopment in older areas, graduated density zoning can help to create more housing, jobs, public amenities, and tax revenues. It can also improve urban design, hasten central city regeneration, and slow suburban sprawl. Public planning can guide land assembly and redevelopment, but the private market will carry it out.

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## ► Notes

1. *Kelo v. New London*, 545 U. S. 469 (2005). The Supreme Court's decision and Justice O'Connor's dissent are available at www.law.cornell.edu/supct/html/04-108.ZD.html, accessed on February 6, 2008. As part of the eminent domain proceedings, New London moved Kelo's home to a new site.

2. Weinstein (2006a) explains the *Kelo* decision and the subsequent legislative and judicial reactions to it.

3. *Norwood v. Horney*, 110 Ohio St.3d 353, 2006-Ohio-3799. This decision is available at www.sconet.state.oh.us/rod/newpdf/0/2006/2006-ohio-3799.pdf (accessed February 6, 2008).

4. See also Weinstein (2006b).

5. Louw (2008) explains how land assembly practices differ among countries according to the prevailing attitudes toward land ownership, and describes the active role of municipal authorities in the Netherlands.

6. Entropy, originally a concept in thermodynamics, has been adopted in other fields as a measure of the disorder or randomness in a system. Colwell and Sirmans (1993, 784) explain that the land value per unit of area might increase within a range of site sizes because of "the relative lack of productivity of the small parcels and the existence of costs associated with land assembly."

7. The building on the single lot occupies 61.5 percent of its site, while the building on the double lot occupies 69.2 percent of its site. For a four-story building, an extra one thousand square feet of footprint adds four thousand square feet to the building's total floor area.

8. Note that fifty-four units per acre allowed in the R3 zone is the *net* density on the *lot*; the *gross* density of the *neighborhood* (including the land devoted to street, parks, schools and other public uses) is lower. The R3 zone is defined in chapter 1, section 12.10 of the Los Angeles Municipal Code.

9. The building has two apartments on three of its four floors and one larger apartment on the ground floor. It contains a total of fifteen bedrooms and bathrooms; it replaced a four-unit building that contained a total of six bedrooms and four bathrooms. Shoup (2005) discusses how parking requirements limit building size in dense areas.

10. Many people might prefer the design of the older, lower-density buildings on the block where the redevelopment shown in figures 2 and 4 took place. If the decision has been made to redevelop at higher density, however, the relevant choice is between the design of a new, higher-density building on a small lot and the design of another new building at the same density but on a larger lot. Land assembly can lead to better design not only for residents of the new building but also for the surrounding neighborhood.

11. There are fifty-four units per acre on the double-wide lot versus forty-seven units per acre on the single lot.

12. If the value of an assembled site exceeds the sum of the owners' reservation prices for selling their properties, land assembly can benefit all the owners and the assembler. (The reservation price is defined as the lowest price at which an owner will voluntarily sell an item.) Because the owners' reservation prices will in most cases exceed their properties' market values (which is why they own their properties), it is not accurate to say that land assembly is always beneficial if the value of an assembled site exceeds the sum of the *market* values of the individual properties.

13. Defragmentation (land assembly) is often only a temporary phenomenon because in most cases the new whole is usually refragmented (subdivided) for the new uses of the site. The new fragments are usually created with self-governing institutions such as condominiums, homeowners associations, business improvement districts, and common interest developments that manage the common interests of the individual properties and maximize the value of the whole site. Fennell (2008) examines the rationale for what she calls "slicing and lumping" of land and other resources.

14. Menezes and Pitchford (2004a) use game theory to analyze the land assembly problem, and they show why strategic delays in selling land for assembly create inefficiencies in the land market. Menezes and Pitchford (2004b) show why larger gains from land assembly increase the likelihood that holdouts will create efficiency losses.

15. Fragmented ownership is typically neglected in theories of the timing of land development. Arnott (2005) and Shoup (1970) analyze the optimal timing for land development but do not consider site size or land assembly in the development decision. Establishing the fair market value in an involuntary sale is also difficult. Munch (1976) found that prices paid in eminent domain proceedings can differ systematically from the fair market value of the condemned properties. Evidence from urban renewal programs showed that high-valued properties receive more than the market value, and low-valued properties receive less than the market value.

16. Miceli and Sirmans (2007) analyze how the holdout problem can accelerate sprawl.

17. In a similar use of game theory, Strange (1995) found that in an attempted land assembly, small landowners ask a higher price per acre than large landowners do, and the probability of failing to assemble a site rises with the number of landowners involved. In a subsequent article, Helsley and Strange (1997) suggest that the amount of land any developer can assemble is a

random variable; some developers are lucky in land assembly while others are not. They extend their analysis to suggest that inefficiencies in land assembly lead to inefficient infrastructure provision, an inefficient allocation of economic activity within cities, and an inefficient distribution of cities in space.

18. Cohen (1991) analyzes the opposite case when a project built on assembled land will reduce the value of adjacent properties held out, and concludes that the external costs of the project will reduce the likelihood of holding out.

19. Alpern and Durst (1996, 35–40) describe the land assembly for Rockefeller Center. The holdout at the corner of Sixth Avenue and West 50th Street was occupied by a cigar store. Despite the few holdouts, assembly of almost three blocks allowed the designers to achieve their stated goal of "a commercial center as beautiful as possible consistent with the maximum income that could be developed" (Weisman 1951, 16).

20. Strategic holdouts are not the only impediment to land assembly. In a survey of ownership constraints on redevelopment of eighty large brownfield sites in four British cities, Adams et al. (2001) found that additional impediments were unknown or unclear ownership, divided ownership rights (such as long-term leases, restrictive covenants, or easements), and multiple ownership of individual properties. They classified the ownership constraints on redevelopment as (1) deficiencies in or limitations to ownership rights in potential development land, and (2) strategies, interests, and actions of those who hold such rights. Graduated density zoning will not directly address the first type of constraints to redevelopment, but it can create a greater incentive and more resources to overcome them. See also Adams and Hutchison (2000).

21. Krasnowiecki (1973) examines the question of whether a municipality must be "title-blind" when it establishes zoning regulations—whether land can be zoned one way because it is assembled and another way because it is fragmented. The minimum sizes for Planned Unit Developments are a precedent for graduated density zoning.

22. Residual land value is the market value of the most profitable development of the site minus all the costs of development. Adams (1994, 26–27) explains the calculation.

23. In this example, an area with sites of less than an acre can be termed "overfragmented" because assembly would increase the value of the land. Sites larger than an acre are not overfragmented because assembly does not increase their value.

24. Fennell (2004b, 974–75) analyzes the case of land assembly when a developer can build a smaller-than-intended project or can alter the physical configuration of the project by acquiring second-best parcels to substitute for the preferred parcels.

25. If the number of units allowed by the density formula is rounded to the nearest whole number, sites between 0.1 and 0.2 acres would be allowed one unit; the minimum site size for development would be 0.1 acres.

26. Where apartments have a high turnover rate, many tenants may prefer vacating early with generous compensation. The 2000 Census of Housing found that 39 percent of all renters had moved into their housing units during the previous fifteen months. This share ranged between 38 to 42 percent during the previous four decades: www.census.gov/hhes/www/housing/census/historic/movers.html (accessed February 6, 2008).

27. The result often resembles what in a different context Prince Charles termed "a monstrous carbuncle on the face of a much- loved and elegant friend" (Charles, Prince of Wales 1984).

28. Section 6.C of the Westwood Community Multi-family Specific Plan: http://cityplanning.lacity.org/complan/specplan/pdf/wwdcomm.pdf (accessed February 6, 2008).

29. Shoup (2005, chapter 19) analyzes the effects of unbundling, and Baker (2006) reports on the trend toward unbundled parking in some cities. A city could cap the parking supply for the assembled site below the number of parking spaces the city would require if all the unassembled sites were developed at their permitted density. If so, vehicle trips after land assembly should not increase above the level that would occur with piecemeal development. As a precedent, El Cerrito, California, reduces the parking requirements for commercial or mixed-use developments that consolidate smaller parcels into a larger building site (section 19.28.400.D.4 of the El Cerrito municipal code).

30. With conventional fixed-density zoning, stealth is important in land assembly so that owners won't know what is happening. Graduated density zoning can reduce the asymmetry of information between buyers and sellers in the land market. Covert assembly can become overt assembly. In a manner similar to the proposal by Heller and Hills (2008) for Land Assembly Districts, a city might adopt graduated density zoning for a district only after a majority of the affected owners and/or residents voted to approve it.

31. Neighborhood Knowledge California provides free Web-based access to data on properties and neighborhoods in Los Angeles: http://nkca.ucla.edu (accessed February 8, 2008). The California Infill Parcel Locator identifies sites in urbanized areas that are either completely vacant or have structures assessed at extremely low valuations relative to the land itself: http://infill.gisc.berkeley.edu/ (accessed February 6, 2008).

32. Sagalyn (2001, 91–95) explains how New York City used density increments to help finance the 42nd Street Development Project. Even with graduated density incentives, owners face two economic disincentives to selling their properties for land assembly: taxes on the sale, and finding suitable reinvestment opportunities. The taxes may be unavoidable, but for a reinvestment option the developer might offer original owners the choice of a mortgage, an equity share, or a physical share (such as dwelling units or commercial space) in the development. Offering the original owners a physical share of the redeveloped property resembles the practice of land readjustment, except that graduated density zoning relies on voluntary transactions while land readjustment requires, as a last resort, the ability to compel landowners to participate in a project. With land readjustment, deductions from the contributed land pay for the public infrastructure; with graduated density zoning, capital gains can pay for the infrastructure. Doebele (1982), Shoup (1983), Larsson (1993), Lin and Evans (2000), Li and Li (2007), and Hong and Needham (2007) explain land readjustment.

33. Under the urban renewal programs of the 1950s and 1960s, land assembly took place as the result of political, not economic decisions. In their analysis of the urban renewal program initiated by the Housing Act of 1949, Davis and Whinston (1961) used the Prisoner's Dilemma analogy to argue that using eminent domain to assemble land for urban renewal is economically efficient only if the value of the assembled land plus the capitalized value of the addition to property tax revenue exceeds the sum of the prices paid for the individual properties plus the other public costs and interest charges.

34. In the wrong hands at the wrong time or in the wrong place—think of Le Corbusier's *Plan Voisin* for rebuilding Paris in the 1920s, for example, or Robert Moses's superblocks in New York City in the 1950s—graduated density would be the wrong policy.

35. City of Simi Valley (1996). The Specific Plan does not describe the density bonus for larger sites as graduated density zoning. I have coined this term as a tentative name for the process.

36. In a Cluster Development (which is similar to a Planned Unit Development), Simi Valley allows a developer to build houses on smaller parcels of land and to convert the additional land that would have been used for individual building sites into shared open space for the subdivision's residents. Traditional subdivision regulations (such as lot size and setbacks) are redefined to permit a developer to preserve historic sites and natural features of the land being subdivided.

37. The development's overall *gross* density of seven units per acre is only about half the *net* density of fifteen units per acre on the residential lots because about half the development is devoted to streets and parks.

38. E-mail message from Patti Felker-Breiner of Oro Vista Real Estate, on May 17, 2007. (More than land was assembled; Patti Felker married Matt Breiner, Vice President for land assembly at Lennar Homes, the developer for whom she assembled the land.) Other than graduated density, Simi Valley did not offer any further incentives (such as tax increment finance or tax abatements) for land assembly or redevelopment in Kadota Fig.

39. Interview with Gary Seaton of NAI Capital on March 15, 2007.

40. Adams et al. (2002) distinguish between passive owners (those who take no steps to market or develop their land) and active owners (those who develop their land, enter into joint development agreements, or make their land available to others to develop). If graduated density zoning creates the fear of being left out of a successful assembly, passive owners may become active.

41. Only trial and error will show how graduated density zoning might evolve. Hastings and Adams (2005) discuss how legal institutions or the "rules of the game" evolve to reduce the transaction costs of land assembly.

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