Visualizing Density
Higher Density Catalog Images, 9.1–134.5 units per acre

Julie Campoli and Alex S. MacLean

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Abstract

In the realm of community planning and land development, “density” is an often used but rarely understood term. The physical density of a development project can be measured in numerical terms, but such a measurement fails to convey the look and feel of density. Measured density is often very different than perceived density. This difference causes confusion in the community planning process and in the review of development proposals.

Visualizing Density, a catalog of aerial photographs, helps bridge the gap between measured and perceived densities. It includes hundreds of photographs of old and new neighborhoods around the country, and conveys both the measured and perceived density of each. These photographs help viewers translate density numbers into mental images. They also demonstrate how site design affects the perception of density. Neighborhoods at similar densities are juxtaposed to show how various design approaches can create places with dramatically different physical character.

About the Authors

Julie Campoli is principal of Terra Firma Urban Design, a land planning and landscape architecture firm specializing in compact growth. She is co-author, with Elizabeth Humstone and Alex MacLean, of *Above & Beyond: Visualizing Change in Small Towns and Rural Areas.*

Contact information:
Terra Firma Urban Design
23 Ledgemere Street
Burlington, VT 05401
Phone: 802-865-0024
E-mail: julie.campoli@verizon.net

Alex S. MacLean's firm, Landslides, specializes in illustrative aerial photography. His other books include *Look at the Land: Aerial Reflections on America*, and *Taking Measures Across the American Landscape.*

Contact information:
Landslides
33 Richdale St., Suite #105
Cambridge, MA 02140
Phone: 617-497-9400
E-mail: alex@landslides.com
Web: http://www.landslides.com/

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Introduction

The Density Problem

After years of sprawl and urban dis-investment, Smart Growth initiatives are gaining momentum across the country. Policies that encourage development in existing communities are being written and enacted at the federal, state, and local levels. California recently passed three bills intended to curb suburban sprawl, encourage urban infill and help localities pursue Smart Growth. Maryland's Smart Growth legislation allows the state government to direct its programs and funding to channel growth into designated areas and away from rural land. Cities such as Austin, Phoenix, San Francisco, and Richmond, Virginia have instituted programs promoting infill development as a strategy of Smart Growth. But although Smart Growth as a concept is embraced by many, one tenet of the Smart Growth approach—infill development in a compact pattern—is often challenged or rejected at the implementation stage. Frequently, the reason is that a community has trouble accepting the high density numbers associated with compact development.

Like many communities, Asheville, North Carolina recognizes the benefits of Smart Growth. In an effort to promote affordable housing and land preservation, the town recently altered its zoning regulations. It established a "density bonus" provision, allowing for greater density in planned unit developments. With a density bonus, developers could build more units on less land, leaving a significant portion of a site open. But the first time a developer attempted to take advantage of the new bonus, with a 34-unit affordable housing project, the city rejected the application for increased density. The project was affordable, fit within the context of an existing neighborhood, and was designed to leave one third of the parcel untouched, yet the City Council agreed with the many residents who testified that the proposed development was "too dense." The bonus was denied, reducing the possible density from 10 units per acre to 5, and leaving the nonprofit developer without a viable project.[1]

This scenario is played out often as compact development projects are presented to local planning boards. The public accepts infill development as an idea, but balks at the reality, perceiving proposed densities to be too high. The aversion to density runs even deeper in communities whose land use regulations mandate low densities. And in places where density standards are set relatively high, backlash sentiment is common. This year, a property rights group in Oregon sponsored a bill to limit density, by abolishing Metro guidelines under which local governments set density standards. Although the

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[1] Sarzynski, Brian. 2002. "A Defining Moment? Dunn Blocks Affordable Housing Initiative." *Mountain Xpress* 8; N.28 (February 26) p.14.

referendum failed, it was placed on the ballot with 50,000 signatures.[2] Clearly the association between a high quality life and a large residential lot, articulated by one of the bill's supporters, is a sentiment shared by many Oregon residents.

In many cases a broader fear of growth or change lies behind the complaint that a project is "too dense." General concerns about the impacts of an increased population often lead opponents to the conclusion that density equals overcrowding. This problem is exacerbated when people have no visual information to dispel negative mental images of dense development. While planners have techniques to measure density, they have few tools to convey what density numbers look like as they are translated into real living places.

The Need for a Visualization Tool

At this point, there are few resources available to individuals and communities struggling with the density problem. While there is published work addressing the topic of density measures, there is little information on the role of design and the perception of density.

Books and articles on Smart Growth and New Urbanism often state the desirability and benefits of density but don't specifically address the problem of measured vs. perceived density. Handbooks illustrating best development practices sometimes go a step further by including density figures for selected projects. The National Association of Realtors recently commissioned a visual preference survey to gauge the market's support for Smart Growth.[3] Although the presentation includes images of high and low-density neighborhoods, measures for each are not provided. Some literature offers visual examples of built projects at varying density levels. One recent book, *Density by Design* (Urban Land Institute) presents 14 case studies of high-density residential projects. The Design Advisor, a website sponsored by the Department of Housing and Urban Development provides the same information for more numerous examples, limited to affordable housing projects.[4] Another resource available on the Internet is a Powerpoint presentation assembled by Civitas.[5] It also illustrates density through the use of case

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2 "Portland Neighborhood Density Standards on Ballot for May 21." 2002. Smart Growth Online http://www.smartgrowth.org/news/bystate.asp?state=Or&res=1152, based on an article in *The Oregonian* (April 28).

3 A summary of the public's responses as well as the visual presentation are available through the Association's web site. Both were created by A. Nelessen Associates. http://www.realtors.org/SmartGrowth2.nsf/Pages/housingpreference?OpenDocument.

4 www.designadvisor.org. This is a very useful resource for affordable housing developers and advocates. It was created for H.U.D. by Deane Evans.

5 Presented at a planning commissioners workshop, May 11, 2002, by Civitas, an urban design firm. A PDF file of the Power Point presentation can be downloaded at the firm's website. http://www.civitasinc.com/downloads/Density.pdf.

study examples. Each of these sources stress the crucial role design plays in overcoming the opposition to density, but the number and variety of sites is limited.

A few organizations are addressing the density problem with projects that are still in the production stage. The California Local Government Commission has developed a presentation that promotes high-density development through the use of case study examples.[6] As a follow-up to the Design Advisor, HUD is currently funding a project called "Demystifying Density, " a more comprehensive look at density issues as they relate to community development and affordable housing.

For those setting policy, writing zoning regulations, designing and developing new neighborhoods, and reviewing development proposals, there is no comprehensive collection of images available that would inform the discussion of density levels. This project offers a catalog that will meet that need. It provides visual information that can help people form more accurate mental images of residential developments at various densities. Moving beyond the individual projects featured in the current literature, it examines whole neighborhoods—illustrating their urban structure as well as their density. The role of design in determining the perception of density has been stressed in previous work, but the Visualizing Density Catalog makes the relationship between design and density clearer. It features a broad array of housing in many different configurations, demonstrating that living closer together can take many forms. With visual tools such as this, the *density* problem can be viewed as a *design* problem, shifting the public's (and regulators') concerns away from density numbers and toward appropriate design approaches. This may result in a better-informed and more productive discussion of Smart Growth projects in many communities, and increase the chances for their success.

The Catalog

What It Is

The Density Catalog is a collection of over 300 aerial photographs showing more than 80 neighborhoods in locations across the country. Four photographs of each location are usually included. The images are arranged by density level, measured as dwelling units per acre. The catalog is arranged on a continuum from low density (less than one unit per acre) to high density (134 units per acre). The purpose is to increase the reader's familiarity with density numbers as they relate to neighborhood form, and to enable viewers to visualize different design approaches to achieve density.

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[6] A CD of the California Local Government Commission's presentation on density will be available soon through their web site, www.lgc.org.

Approach

Focus on Form

The catalog specifically illustrates the physical form of residential density. It shows how the basic building blocks of neighborhoods (streets, buildings, and open spaces) are arranged to create a wide variety of living environments. Our approach is to demonstrate how altering these components affects both density and physical character.

We feature an array of street patterns, building types, and open spaces in the catalog, demonstrating how the manipulation of these components creates endless variations on neighborhood form. The alignment of streets and arrangement of houses on those streets determine how property is subdivided which, in turn, affects density. Gridiron, curvilinear, and cul-de-sac street patterns each form a different subdivision framework. The catalog illustrates how these street patterns, and their many subcategories, shape building parcels and outdoor spaces. An assortment of building types such as single-family homes, duplexes, townhouses, and apartments, in a range of sizes and styles, is featured in the catalog to show how the design of buildings contributes to density and character. Also included are diverse examples of open space, from formal promenades and squares to wooded stream corridors, illustrating the many ways that outdoor space can be allocated in residential settings. And we have been careful to show the larger geographical context within which each neighborhood rests. Context plays a key role in the quality of any living environment.

The catalog can be used to promote compact development by showcasing positive examples of high-density neighborhoods. But it is important to note the limitations of what is primarily a visual analysis. We did not examine the social or economic conditions of any of the neighborhoods. Opposition to density, although often cloaked in concerns about scale or form, can be based on other factors that affect residential quality of life. Overcoming fear of density requires a multi-pronged approach that addresses the potential impacts of increased population such as noise, traffic, school crowding, etc.

Objective Format

The Density Catalog is meant to provide an impartial view of various design approaches at various densities. Our intention is not to promote one approach over another but to show that there are many ways to design neighborhoods and meet density goals, letting the viewer decide which is preferable. We took an objective approach to the selection and presentation of images. This is reflected in the catalog. The format is consistent throughout, with each site given equal weight. Communities using this visual tool will decide for themselves which neighborhoods are appealing and which design approaches to pursue.

By its nature, aerial photography offers a detached viewpoint. It also reveals urban form in a very effective way. Although there is truth in the phrase “God is in the details,” our intent here was to highlight not the street level details of neighborhoods, but the big picture. With aerial photography, the viewer is forced to look at more substantial elements of form. From the air, we can see the relationship between buildings, the size of

yards, and the structure of green spaces. We can also see quite easily what lies beyond each neighborhood. This view not only offers an understanding of how the place might be put together but how it might be connected to something larger. And it is this larger view that is often needed in community planning discussions.

Method

Site Selection

We sought examples for the catalog that would represent various contexts, regions, densities and design approaches. Our selections were chosen from rural, exurban, suburban and urban areas. We photographed downtown neighborhoods, inner-ring and later suburbs, small villages, tourist centers, resort towns, interstate interchange developments, trailer parks, and retirement communities. We used existing photographs from the Landslides collection to supplement our field photography. Our intention was to represent the full range of densities found in American communities. We succeeded in finding examples from .5 units/acre up to 134 units/acre. To date the catalog features examples from the southeast, midwest and northeast regions of the U.S. We hope to add examples from other areas of the country in a later phase of the project.

We were careful to include a diversity of design approaches. We searched for examples in three categories: historical, conventional, and neo-traditional. Historical models are those built before the widespread use of the automobile. They are characterized by interconnected street patterns and a pedestrian orientation. Neighborhoods within Colonial settlements, 19th century grids, streetcar suburbs, company towns, and early planned communities are considered subcategories of this design approach. A second type, the conventional model, is characterized by an auto-oriented pattern and lack of pedestrian connections. We found conventional examples in the subdivisions and planned-unit developments of post-war suburbs, interstate nodes and other recently developed areas. A third category is the alternative design approach of neo-traditional or New Urbanist neighborhoods. Like historical models, they feature interconnected streets and pedestrian orientation. Unlike the older examples, these planned communities and infill projects were built under contemporary development conditions, subject to modern building codes, zoning regulations, and transportation systems. These three categories, historical, conventional, and neo-traditional, represent the three main approaches to American residential site planning.

Calculating Density

Our goal was to compare densities of the selected neighborhoods. We considered the various methods for measuring density: units per acre, persons-per-square mile, floor area ratio (FAR). We chose units per acre for several reasons. First, it fit the scale of our analysis. Persons-per-square mile was too gross a measurement for representation at the block and neighborhood level. Second, it fit the scope of the project. FAR was too detailed for a study emphasizing a broad sample of many sites. The amount of data collection required for each site would limit the catalog to a handful of neighborhoods. In addition, units-per-acre is a density measurement that is commonly used in local zoning

and in the review of development projects. It is familiar and understandable to the average person.

Using the 2000 Census[7] and a street mapping software program[8], we measured the density in units per acre for each site. With online access to Census 2000 data, calculating density proved a relatively straightforward task (see Appendix A for a step-by-step description of the process). Once block level data were downloaded, we divided the number of housing units by the acreage of the selected areas to determine a unit per acre number.

Challenges / Issues

Defining a Density Measure

In municipal planning, residential density is typically expressed in housing units per acre and measured as "net" or "gross." "Net density" refers to the number of units per acre on land devoted to residential facilities. While it includes driveways, private yards and ancillary structures, it does not include public rights of way and park land. "Gross density" means the density of a given area, including infrastructure such as streets, sidewalks and public spaces.[9]

Our intention was to illustrate neighborhoods close-up, at the street and block level. But, lacking right-of-way and parcel line data, we were unable calculate a net density ratio for the sites. Our land measurement tool was somewhat coarse and did not distinguish between land within and land outside of the right-of-way. So, although some of the smaller sites include only residential uses, our measurement is technically defined as gross rather than net.

Defining the Area

Density numbers can vary widely based on how one draws the boundaries of the area studied. For example, extending the boundaries of a site to include more nonresidential uses would affect the units-to-land ratio. A mixed-use urban neighborhood would have a lower density than one that is primarily residential.

The two neighborhoods might have a similar form and physical capacity for density, but very different levels of measured density. Another example is a planned-unit

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[7] Census 2000 data is available online at http://factfinder.census.gov/servlet/BasicFactsServlet?_lang=en

[8] We used *Street Atlas USA*, available from DeLorme (www.delorme.com). The program provides a land measurement function that made calculation of acreage simple and fast. Other programs such as GIS mapping programs perform the same task.

[9] Alexander, Ernest R. 1993. "Density Measures: A Review and Analysis." *Journal of Architectural and Planning Research* 10:3 (Autumn) p.186.

development, which, despite dense groupings of buildings, might have a very low density if it sits within a large tract of shared open space that is included in the calculation. Some of this ambiguity is eliminated by aerial photography. From the air, the viewer can see the amount of unbuilt space and, in many cases, get a sense of nonresidential uses. To further limit the distorting effect of mixed-use, we focused on neighborhoods that are primarily residential and avoided areas with a wide mix of uses such as central business districts and commercial corridors.

Since density numbers vary according to the boundaries of the area measured, it was important to clearly mark those boundaries. We highlighted a photograph from each set to delineate the limits of the site. The viewer can easily see what is inside or outside the area measured. This provides a greater understanding of why a density number might be high or low.

Consistency

As noted above, densities vary according to how much land is included. A large area, containing a great deal of infrastructure and open space will have a lower density than a small area that has mostly housing. This posed a difficulty for consistency in the comparison of neighborhoods. To address this problem we grouped the images into two categories labeled "Block Density," showing site-specific areas and "Neighborhood Density," showing densities at a wider, district level. Block-level views show smaller study areas and higher density ratios. They illustrate the details of site planning such as building placement and design, indoor-outdoor relationships, and parking arrangements. Neighborhood level views show broader areas encompassing whole neighborhoods. They address larger urban design issues such as street layout and the structure of open space.

We were also challenged by the problem of using visual imagery in an objective manner. Photography provides a real opportunity for editorializing. Variables such as seasonal changes, weather and lighting conditions influence one's general impressions. For example, the warmth or "color temperature" of light varies during the course of the day, possibly lending early morning or evening photographs a rosier appeal. To many eyes, the green grass of early summer and late fall is more attractive than the brown grass of late summer and winter. It was important to take interesting and compelling pictures that draw viewers in, yet at the same time maintain a measure of objectivity. In shooting and selecting images, we tried to stay within a limited range of seasonal and atmospheric conditions to provide consistency between photographs. We were also able to provide a consistent perspective of viewpoints by shooting at the same scale and relative view angles. While some of the context and vertical shots were taken at 3000 feet elevation, most of the images were shot between 1000 and 1500, using the same lens for each viewpoint. To diminish the distorting effects of a telephoto lens, the close-up shots were taken at a steeper angle.

Street Level Photography

A key question posed by this analysis is whether to use aerial photographs alone or include street level images in the catalog. For this phase of the project, we chose to omit

ground photography. In addition to the logistical and budgetary problems presented by ground photography, there was another reason to omit it. At street level, the act of framing a photograph is more subjective. In any given neighborhood, where does one point the camera—at the building with the peeling paint or the house down the street with wisteria framing the door? Which best represents the physical character of the whole block? Focusing on one section would give a very different impression than showing another section. Since the number of photos illustrating each site is limited, it is impossible to avoid conveying a value judgment with a few shots. This problem may be overcome, however, in a later phase of the project, through the use of alternative media. Two possibilities are digital videos and animated panoramas. Moving images, embedded into digital versions of the catalog, could offer a more complete ground view that overcomes the problem of subjective editing.

How to Read the Catalog

Format

In a later phase of the project we plan to produce an interactive digital catalog in which photographs can be viewed in a variety of sequences and combinations. The graphic document accompanying this paper, however, is less dynamic. It is laid out in a set format with images arranged on a continuum of low to high densities. The first page features the lowest density of .5 units/acre. The last page shows a high of 134 units/acre. There is a clear benefit to this layout. Neighborhoods with the same or similar densities can be examined together. In many instances, sites that share a density level have strikingly different appearances. Studying these contrasting sets of images one can see how alterations in form affect how density is perceived.

Viewpoints

We include four separate vantage points for the sites: block, context, neighborhood, and vertical. The block level view is a close-up of the area measured. It allows the viewer to see into the space, revealing some of the details of building design and landscape. This view also clearly shows volumes of space created by the arrangement of buildings. One can also see how parking is accommodated and privacy is created.

Beside the block view is the context view, showing the setting within which the detail area sits. The boundary of the measured area is highlighted in yellow. This view shows the relationship between the block and the larger urban, suburban, or rural structure. It shows any nearby amenities such as natural areas, water bodies, and formal green spaces. Also visible is the site's proximity to city or village centers or its access to transportation facilities.

The vertical, or straight down view, offers two-dimensional information. This is the view that is most similar to a map. It clearly shows street patterns, block configurations, and site layout, as well as the allocation of public and private space. Because the ratio of built to open space is apparent, one gets a rough sense of density by looking at the building coverage. The vertical view is good for quantitative analysis because there is little

distortion through perspective, but it is limited, though. It lacks vertical clues such as how high the buildings are or what their facades look like.

Complementing this is the neighborhood view, which covers a similar area. It is shot at mid-range from an oblique angle. This view fills in the gaps left by vertical images. It offers a scale reference by showing the height of buildings and landscape elements. To a limited extent it reveals topography. These four separate views combine to form an overall picture of each neighborhood.

Block Density numbers show the density of a small area within a neighborhood. For many of the sites, we were able to also include a Neighborhood Density, shown in the right column. This measure indicates the density of several blocks surrounding the detail area. Because they include more open space and other uses, neighborhood densities are usually lower than block densities.

Thresholds

As residential density increases above certain thresholds, services such as public transportation become more viable. So does the potential to support a nearby elementary school, coffee shop, video store, or neighborhood market. For example, a neighborhood with a density of 7 units/acre can support bus service but the potential for multi-modal transportation jumps dramatically at a density of 15 units/acre. At this level, rail and other high capacity transit facilities become viable. (See Appendix B.) More households equal greater retail possibilities. These are the great benefits of higher density neighborhoods. We have marked some of these thresholds in the Density Catalog.

Findings

Our purpose was to illustrate the many ways to shape density and to enable viewers to visualize different design approaches to achieve density. As we measured the density of the sites and assembled images into a catalog, we began to see specifically *how* design accommodates density. The catalog shows the gamut. There are examples of neighborhoods where space is carefully defined and shaped, offering privacy and a sense of spaciousness. And there are others, where a lack of attention to layout and details conveys a sense of crowding. As density levels increase, personal space per capita decreases, by definition. However, as the catalog demonstrates, a sense of comfort and value can be restored through other amenities.

We set out to show what density looks like. What we found was that it doesn't reveal much about physical character. It plays a role, but what really defines and determines the character of a place is design. This is a crucial fact for communities that are planning for density. If they want their residents to buy into and buy high density housing, they must take steps to pursue good design.

Tradeoffs

Although density can offer urban services and vitality, there are drawbacks that pose a considerable challenge to designers and a potential obstacle to the widespread embrace of compact development. As density levels rise, it becomes more difficult to provide private open space or easy access to parking. Above 10 units/acre, as open space becomes more constricted, developers are faced with the question of whether to allocate this green space to the group or to individuals. Should cars be stored in multi-level structures or take up precious ground space? In order to reap the benefits of higher density, certain tradeoffs must be made. Having a sizable yard and convenient, private parking are important to the American homebuyer. What are the density levels at which these amenities disappear? How has design accommodated the desire for both? Beyond the threshold, how can one provide other amenities to compensate? Neighborhoods in the mid (10–30 units/acre) and high (30+) density ranges can offer a richer array of services but it comes at the cost of decreased personal space. Some of the catalog sites illustrate design attempts to stave off this compromise. Site design and architecture are used to maximize privacy while achieving density.

Relationship to the Ground

Private yards are part of the great appeal of the detached single-family home but they can be offered in other housing types. Attached homes such as duplexes, townhouses and row houses maintain a direct relationship between the house and the ground. Private outdoor space adjoins the front and rear of each unit. Four-plex apartment buildings can also offer a front or rear yard. From our examples we found that, depending on the design of the structure and layout of the lot, this building-ground relationship could be maintained up to a density level of approximately 24 units/acre. Very narrow Baltimore row houses, each with their own rear yard, characterized the upper end of this spectrum.

Parking

In dense, urban neighborhoods built before the car, parking is not a dominant element. But in the design of contemporary neighborhoods, the requirement of 1–2 off-street parking spaces per housing unit is a major consideration. As density increases from low to high, parking becomes more highly organized and space efficient. Designers use various strategies to provide storage for an increasing number of cars. We examined the different approaches to parking and saw a pattern, with certain strategies falling into general density ranges. There were three basic approaches to providing off-street parking: within each parcel (low density), in a shared surface lot (medium density), and in a shared structure (high density).

Parking within each individual parcel occurs in low-density neighborhoods. At <1–5 units /acre, lots are wide enough to accommodate two cars side-by-side in a driveway. At 6 units / acre and above, narrower lots dictate an alternative arrangement. Tandem parking (one car behind the other) is one solution. Another is a mid-block service alley, which offers a rear entry to the parcel where cars can be stored on a wide driveway or in a garage. It is possible to provide spaces on each parcel at higher levels. We found one

neighborhood with individual driveways and carports at a density of 16 units / acre. The tradeoff in that site plan was that the parking spaces occupied an unusually high proportion of the parcel, leaving very little room for a house or a yard.

Above 9 units / acre, parking adjacent to each unit becomes more difficult. Townhouses with garages at ground level provide an exception. In the medium density range, some developments accommodate the greater number of vehicles in off-street lots. These are often configured as standard double-loaded parking lots. More innovative layouts include parallel or diagonal parking similar to pedestrian oriented streets. Surface parking seems to be a favored solution between 9 and 22 units / acre.

Above 20 units / acre, shared, multi-level structures are necessary to meet contemporary parking demands. Garages can be found beside or below apartment buildings. A more recent trend is to wrap a parking garage with a multi-story apartment building so that it occupies an entire urban block. This moves all the parking to the interior of the block, creating a consistent street wall. It also provides even access from the units to the parking spaces.

Neighborhood Types and Their Density Ranges

In assembling the catalog by density level, it became apparent that housing types, and the neighborhoods they typically occur in, fit within certain density ranges. This is useful information to a community or developer eyeing an area for residential development. It provides an idea of which housing type or mix of types can be used to achieve a target density. It also offers a glimpse of the physical character the new neighborhood might have.

What is the upper limit in units/acre for neighborhoods that contain only single-family homes? It depends on how the streets are configured. In subdivisions with a curvilinear street pattern, densities topped out at roughly 5 units/acre, although we found one exception at 11 units/acre. Generally, the typical suburban detached, single-family home, cul-de-sac neighborhood has a density of <1 to 5 units/acre. In a more efficient gridiron street network, densities can be higher, ranging from <1 to 17. In this category, neighborhoods at the upper end of the range have very small lots and building footprints.

Density levels rise significantly when multi-family buildings are interspersed in a predominantly single-family neighborhood. For communities seeking higher densities with the look and feel of single-family, this can be an appealing solution. We found several sites that combined single-family houses, duplexes, accessory units, and small apartment buildings yet looked similar to lower density single-family neighborhoods. A mix of single and multi-family (1–4 units per building) can yield densities of 6 to 18 units/acre, depending on the ratio.

Where single-family homes are attached, the density numbers jump. This housing type, which includes duplexes, townhouses, and row houses, offers individual yards but saves space by sharing building walls. Although it is possible for detached homes to exist at lower levels, we found them within a range of 12–28 units/acre. Even at the upper end of

this type—Baltimore row houses and Staten Island duplexes—each unit had a private yard.

Multi-family neighborhoods, consisting of small, 2–3 story structures ranged from 8 to 40 units/acre. These include older urban neighborhoods with triple-deckers and walk-ups as well as contemporary condominium developments.

At the upper end of the spectrum, mid-rise buildings (4–10 stories), had a density range of 20–90 units/acre, and high rise structures (+10 stories) were typically above 80 units/acre.

The Role of Design in Shaping Density

Providing Amenities in Higher Density Neighborhoods

If planners and developers wish to "sell" density, it is essential to identify the amenities that make a neighborhood desirable and replicate them wherever possible. We found five qualities that recurred in the more appealing mid to high-density neighborhoods: interconnectedness, green infrastructure, public space, defined private space, and diversity. Each of these can be created through good design. A sixth factor that can increase desirability is context.

An interconnected street network makes it easy to get oriented and to navigate the terrain. It provides quick and direct pedestrian connections between blocks and access to open space.

Green infrastructure includes a network of landscaping and/or natural areas throughout the site that provides a connection to nature. It includes green features such as street trees, landscaped boulevards, riparian stream corridors, wetlands, or wooded areas.

If public space is strategically located and well articulated it can compensate for small or nonexistent yards. Public spaces such as greens, squares, plazas, or parks, can be green and landscaped or paved and urban. If they are well designed, they can increase a neighborhood's sense of identity and offer a place for socializing.

Good design can provide private, usable outdoor spaces even in the smallest lots. Through careful placement and design of buildings, accessory structures, rooftops, and landscaping, private outdoor space can be an amenity offered to many residents of higher density neighborhoods.

Diversity is another prerequisite of high quality urban neighborhoods. Variety in architectural forms, in building types, and in open spaces, prevents the deadening monotony people often associate with contemporary high-density development. Diversity can be introduced on many levels. Offering different types of housing to accommodate various incomes, and introducing nonresidential uses ensures a diverse population and more vitality. Altering building styles, and adding architectural details, provides visual

richness. At the site plan level, diversity can be instilled with a variety of lots, blocks, and public spaces.

Each of these amenities, which can be achieved through design, adds value to new neighborhoods. Another important element is not created through design but through the selection of location. In assessing the quality of residential development, context means a lot. What exists outside its boundaries plays a significant role in the livability of a development because it determines which larger services or amenities, if any, residents have easy access to. A favorably located high-density neighborhood might be considered desirable, regardless of its design qualities.

Planning for Density

Density numbers do not reveal much about physical character. We found several examples of neighborhoods that look starkly different even though they share the same density. Saying that a neighborhood has a density of say, 11 units per acre, means little, without specific information about its form. It might consist of small, detached single-family homes on small lots, a mix of single-family, duplexes and four-plexes, or a single large apartment building in a park like setting. There are many ways to achieve the same density level. One cannot make assumptions about what new growth will look like based on the allowed density of a given zone.

As they plan for growth, communities must realize that design plays a profound role in the success of compact neighborhoods. Before they even discuss density, they should engage in an extensive public dialogue to define the character of desirable growth and determine which design approaches will contribute to that character. Any discussion of residential density levels should be guided by a clear vision of what the new or redeveloped neighborhoods will look like. The Density Catalog, combined with a visual analysis of local neighborhoods and their densities, can contribute vital information to this discussion. Density measures do not reveal character and they don't determine it either. For Smart Growth to succeed, development regulations that dictate density levels should also dictate form. If a community chooses a specific design approach to mitigate the effects of higher density, it should write design guidelines or codes to ensure that new development follows that approach.

Community members may perceive a development proposal as far more dense than it actually is, and reject it on that basis. Often, what they are objecting to is not the density per se, but the character of the proposed development. But the character is largely a function of the design, not the density of the project. Careful attention to design can help communities more readily accept proposals for the higher density, compact development called for by their plans and ordinances, but are frequently modified, reduced, or scuttled in the process of review and approval.

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Appendix A: Steps for Using the Census 2000 to Calculate Density

1. On a map, define the area to be measured.

2. Identify the census tract, block group, and block number(s) for that location.

   A. Go to the geography section of the US Census web site http://factfinder.census.gov/servlet/ReferenceMapFramesetServlet?_lang=en

   B. Enter an address or zip code of the location to be measured.

   C. Use the zoom tool on the right of the map to enlarge the map to the block level. Use the right and left arrows to navigate.

   D. Record the tract (red text), the block group (orange), and the block numbers (yellow), as well as the name of the county (gray).

3. Download the Data.

   A. Go to the Main Menu of the US Census web site http://factfinder.census.gov/servlet/BasicFactsServlet?_lang=en

   B. You are looking for complete geographic detail to the block level, so click on "2000 Summary File 1."

   C. Check "Census 2000 Summary File 1 (SF 1) 100-Percent Data." You will see a list of links. Select "Detailed Tables."

   D. Under "Select a geographic type," select "block." Select a state, then using the information you gathered in step 2D, select a county, a tract number, and a block group number when prompted.

   E. It is worthwhile to confirm that you have entered the correct numbers by selecting a block in the "Select one or more geographic areas" window, then clicking on "Map It." A window will open with a map with several blocks, one of them highlighted. If this looks like the right area, you have entered the correct numbers.

   F. In the "Select one or more geographic areas" window, click on the block numbers you want data for and then click "Add." Click "Next."

   G. In the "Select one or more tables" window, scroll down to "H.1. Housing Units." Highlight it and click "Add." Click "Show Table."

   H. You will see a table with numbers of housing units for each block you selected.

4. Calculating the Density.

   A. Using a mapping software program or measuring by hand, determine the number of acres in the area you defined. Make sure that it corresponds to the boundaries of the US Census blocks.

   B. Divide the number units by the number of acres.

Appendix B: Density Thresholds

We were able to find a number of sources defining density thresholds for alternative transportation. Thresholds for retail services were more elusive. The following table provides a list of some alternative transportation services and their density requirements.

Density Level (In Units per Acre)	Service
4–6	Minimal bus service (appox. 1 bus / hour), subsidized Marginal multimodal potential
7–8	Intermediate bus service (30 minute headway)
9–10	Light Rail (5 min. peak headway) and feeder buses
12	Rapid transit (5 min. peak headway)
15	Frequent bus service (120 /day) High multi-modal potential

Sources:

The table is a generalization of information from two sources:

• Holtzclaw, John, "Community Characteristics Promoting Transit and Walking," (from "Using Residential Patterns and Transit To Decrease Auto Dependence and Costs"; Natural Resources Defense Council, June, 1994). The discussion of density thresholds for transit can be found at http://www.sierraclub.org/sprawl/articles/characteristics.asp. Holtzclaw cites many studies examining the relationship between density and alternative transportation.

• *Transportation Districts and Areawide Level of Service Handbook*. Systems Planning Office, Florida Department of Transportation, June 28, 2002. Available online at http://www11.myflorida.com/planning/sis/draftinggroups/CommEnv/materials/MMALOS0628.pdf. Florida sets guidelines for target density levels (among other criteria such as mixed-use and pedestrian friendliness) for officially designated multi-modal districts.

Visualizing
DENSITY

Phase One

November, 2002

A Catalog Illustrating the Density of Residential Neighborhoods

Prepared for the

Lincoln Institute of Land Policy

Julie Campoli and Alex MacLean

Visualizing Density

Lincoln Institute of Land Policy

Text to accompany this Catalog currently exists in the form of a working paper published by the Lincoln Institute of Land Policy, Novermber, 2002.

About the Authors

Julie Campoli is principal of Terra Firma Urban Design, a land planning and landscape architecture firm specializing in compact growth. She is co-author, with Elizabeth Humstone and Alex MacLean, of *Above & Beyond: Visualizing Change in Small Towns and Rural Areas*.

Contact information:
Terra Firma Urban Design
23 Ledgemere Street
Burlington, VT 05401
(802) 865-0024
julie.campoli@verizon.net

Alex S. MacLean's firm, Landslides, specializes in illustrative aerial photography. His other books include *Look at the Land: Aerial Reflections on America*, and *Taking Measures Across the American Landscape.*

Contact information:
Landslides
33 Richdale St., Suite #105
Cambridge, MA 02140
(617) 497-9400
alex@landslides.com
http://www.landslides.com/

Block Density

Seddon Island, Tampa, FL 9.1 units / acre

context

neighborhood

vertical

Neighborhood Density

10.7 units / acre

Seaside, FL 9.2 units / acre

context

vertical

10 units / acre

Tampa, FL 10.5 units / acre

context

neighborhood

vertical

Block Density

Charleston, SC 10.7 units / acre

context

neighborhood

vertical

Neighborhood Density

8.5 units / acre

11 units / acre

Kansas City, KS 11.1 units / acre

context

neighborhood

St. Johnsbury, VT 11.7 units / acre

context

neighborhood

vertical

Block Density

Columbus, NJ 11.7 units / acre

context

neighborhood

vertical

Neighborhood Density

10.2 units / acre

12 units / acre

Threshold: Rapid transit (5 min. peak headway) is possible.

Yorkship Village, Camden, NJ 12.3 units / acre

context

vertical

context

neighborhood

vertical

12.4 units / acre

Savannah, GA 12.6 units / acre

Block Density

Cambridge, MA 12.6 units / acre

Neighborhood Density

vertical

13 units / acre

Yorkship Village, Camden, NJ 13.1 units /acre

context

15 units / acre

Threshold: Frequent bus service (120 buses / day) is possible.

Pleasant View Gardens, Baltimore, MD 15 units / acre

context

vertical

Block Density

Tampa, FL 15.2 units / acre

context

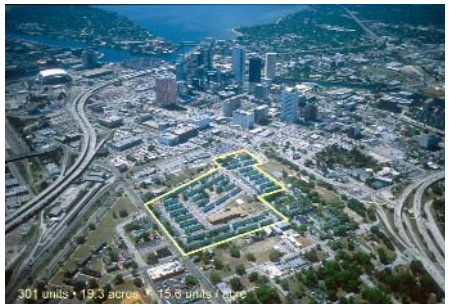
neighborhood

vertical

Neighborhood Density

7.4 units / acre

Tampa, FL 15.2 units / acre



context

neighborhood

vertical

16 units / acre

Kissimmee, FL 16.9 units / acre

context

neighborhood

vertical

Block Density

Seaside Village, Bridgeport, CT 16.9 units / 17 units / acre

context

vertical

Neighborhood Density

15.1 unit / acre

Reading, PA 17.5 units / acre

neighborhood

vertical

Seaside Village, Bridgeport, CT 17.7 units / acre

context

vertical

15.1 unit / acre

Block Density
18 units / acre

context

Neighborhood Density

neighborhood

Dorchester, MA 18.4 units / acre

19 units / acre

context

Tampa, FL 19 units / acre

21 units / acre

context

Back of the Hill, Boston, MA 21.4 units / acre

Block Density

Washington, DC 21.8 units / acre

context

neighborhood

Neighborhood Density

18.5 units / acre

23 units / acre

Beacon Hill, Boston, MA 23.2

context

vertical

49 units / acre

Baltimore, MD 23.7 units / acre

context

vertical

23.1 units / acre

Block Density

Staten Island, NY 23.7 units / acre

context

neighborhood

vertical

Neighborhood Density

16.8 units / acre

26 units / acre

Charlestown, MA 26.7 units / acre

context

neighborhood

28 units / acre

Balrimore, MD 28.6 units / acre

context

neighborhood

vertical

24 units / acre

Block Density

Staten Island, NY 28.9 units / acre

context

vertical

Neighborhood Density

16.8 units / acre

29 units / acre

Dorchester, MA 29 units / acre

context

neighborhood

vertical

Tampa, FL 29.4 units / acre

context

neighborhood

vertical

Block Density
30-39 units / acre

Neighborhood Density

Kansas Clty, MO 37.7 units / acre

context

neighborhood

vertical

South End, Boston, MA 38.1 units / acre

context

neighborhood

New Orleans, LA 38.9 units / acre

context

neighborhood

vertical

24.7 units /acre

Block Density
40-80 units / acre

Neighborhood Density

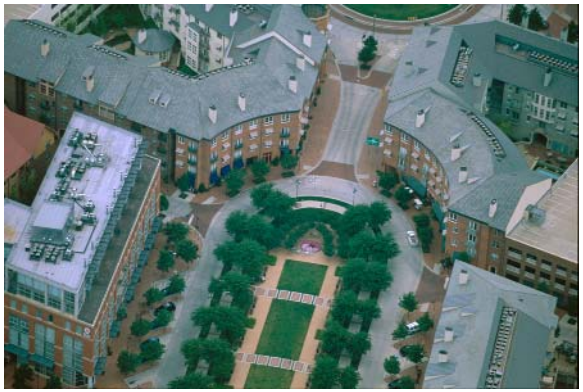
Beacon Hill, Boston, MA 52.9 units / acre

context

neighborhood

vertical

49 units / acre

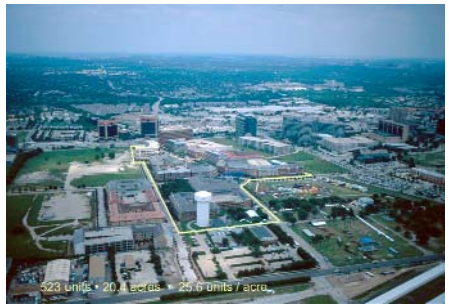


*Addison Circle, Adison, TX 55.2 units / acre**

context

neighborhood

vertical



25.6 units /acre

Back Bay, Boston, MA 69.9 units / acre

context

37.3 units / acre

Block Density

Neighborhood Density

context

Cambridge, MA 71.7 units / acre

over 80 units / acre

context

Tent City, Boston, MA 89.9 units / acre

context

neighborhood

vertical

Kansas Clty, MO 96 units / acre

Block Density

Neighborhood Density

Boston, MA 96 units / acre

context

neighborhood

* indicates recently built projects where the 2000 census count may not accurately reflect the current number of housing units