TOWARD A NEW METROPOLIS:
THE OPPORTUNITY TO REBUILD AMERICA

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A Discussion Paper Prepared for

The Brookings Institution Metropolitan Policy Program

December 2004

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ACKNOWLEDGMENTS

The author would like to acknowledge support for this project from the Brookings Institution Metropolitan Policy Program, the City and Regional Planning Program in the College of Architecture and the School of Public Policy in the Ivan Allen College of the Georgia Institute of Technology, and the Urban Affairs and Planning Program in the School of Public and International Affairs at the Virginia Polytechnic Institute and State University. The author gratefully acknowledges permission by the Society of Industrial and Office Realtors (SIOR), and the Council on Tall Buildings and Urban Habitat, headquartered at Lehigh University to consider, use, and manipulate their data for this report.

The Brookings Institution Program on Metropolitan Policy would like to thank the Fannie Mae Foundation, the George Gund Foundation, the Joyce Foundation, the Ford Foundation, the John D. and Catherine T. MacArthur Foundation, and the Charles Stewart Mott Foundation for their support of our work on metropolitan trends. Anthony Downs provided a detailed and thorough review of this paper.

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EXECUTIVE SUMMARY

Most American states and metropolitan areas have some idea as to the amount of growth they expect over the next several decades, based on estimates of projected demographic, household, market and industry trends. These estimates form the foundation of public policies and are vital for use in goal setting, planning, and implementation of a variety of growth and development strategies.

However, there is not a general sense of how the projected changes in demographic, household, and market trends will impact our nation's built environment—that is, how many new homes, office buildings, and other physical structures will need to be built to accommodate future growth. To that end, this paper examines a series of projected trends at the national, state, and metropolitan level to determine the estimated demand for new housing, commercial, and industrial space over the next quarter century.

In short, this paper finds that:

- **In 2030, about half of the buildings in which Americans live, work, and shop will have been built after 2000.** The nation had about 300 billion square feet of built space in 2000. By 2030, the nation will need about 427 billion square feet of built space to accommodate growth projections. About 82 billion of that will be from replacement of existing space and 131 will be new space. Thus, 50 percent of that 427 billion will have to be constructed between now and then.

- **Most of the space built between 2000 and 2030 will be residential space.** The largest component of this space will be homes. Over 100 billion square feet of new residential space will be needed by 2030. However, percentage-wise, the commercial and industrial sectors will have the most new space with over 60 percent of the space in 2030 less than 30 years old.

- **Overall, most new growth will occur in the South and the West.** There is tremendous variation in the total amount of buildings to be built between regions. In the Northeast, for example, less than 50 percent of the space in 2030 will have been built since 2000, while in the West that figure is about 87 percent, a near doubling of built space. Fast growing southern and western places—states like Nevada and Florida and metropolitan areas like Austin and Raleigh—will see the most dramatic growth.

- **Though a small component of overall growth, the projected demand for industrial space in the Midwest outpaces that of the other regions, unlike the other major land uses.** States with a strong industrial presence will see the largest amount of growth in industrial space even though other areas may witness faster growth. After California, which far outpaces the nation in terms of absolute square feet of new industrial construction, the

next four largest producers of industrial space are all Rust Belt states in the Midwest: Ohio, Michigan, Illinois, and Indiana. By 2030, 70 percent of the Midwest's industrial space will be less than 30 years old.

- **While these projections may seem overwhelming, they also demonstrate that nearly half of what will be the built environment in 2030 doesn't even exist yet, giving the current generation a vital opportunity to reshape future development.** Recent trends indicate that demand is increasing for more compact, walkable, and high quality living, entertainment, and work environments. The challenge for leaders is to create the right market, land use, and other regulatory climates to accommodate new growth in more sustainable ways.

The challenges to accommodate future development vary by region of the country. In general, Western states—like California, Washington, and Oregon—have a strong history of growth management and will need to continue to find ways to improve upon and implement existing laws and approaches. However, neighboring states like Nevada and Arizona, where explosive growth is expected to occur, will need to find their own comprehensive solutions to manage the development boom, while facing limitations on land and water. Overall, the West will not see reduced growth pressures, and will need to find innovative ways to accommodate growth on existing land, in cities and suburban areas. By contrast, the rapidly-growing South is more resistant to regulating growth and must make some important choices about the kind of economic and overall quality of life it hopes to achieve.

Although growth will not be as dramatic in the Northeast and Midwest, these places are not off the hook in needing to rethink its development future. The modest growth in the Northeast, if left unchecked, will likely disrupt the small town tranquility and abundant outdoors that define much of the quality of life, tourism, and natural resource industries of that region. For the Midwest, where state and local strategies to address patterns of sprawl and disinvestment have been uneven, the continued stagnation of cities with rapid land consumption in outlying areas will further erode the overall economic competitiveness of whole metropolitan areas.

So the question for policy makers, planners, and ordinary citizens is clear: Should we maintain the status quo in terms of development patterns, or can we envision a different pattern of growth? There may be no better time than now to plan the shape American landscape for the next generation.

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I. INTRODUCTION

In the one hundred years between 1900 and 2000, America's population shifted from being mostly rural (60 percent) to mostly urban (80 percent). Between 1960 and 2000, urbanized population grew by about 80 percent and urbanized land area grew by 130 percent resulting in urbanized land density dropping from 3,100 persons per square mile to 2,400. Between 1985 and 2001, America added 19 million housing units but 8 million or 40 percent of them were on lots of more than one acre (U.S. Census, 1985 and 2001). And while population grew about 20 percent during this period, vehicle miles traveled grew more than 50 percent.

Data from the American Housing Survey indicate that more than 3,000 square miles of land annually is converted to residential development over one acre in size.[1] If this pattern is sustained for an additional 30 years, this would equal development of land area the size of the entire state of Colorado. Unless managed wisely, much of this development could occur on prime farmland and forest land, in ecologically or environmentally sensitive areas, and perhaps on hazardous landscapes. This low-density development is also the most expensive density to serve with infrastructure, which is estimated to be about $90,000 per home.[2] Between 1997 and 2001, roughly 350,000 such homes were built annually, implying a cost approaching $1 trillion in 30 years.

However, this is an unlikely scenario. Society is changing and so must its development patterns. During the 1990s, most central cities that lost population since 1950 gained residents and urbanized land density increased 15 percent (HUD, 2000). And, between 1997 and 2001, the share of new homes built on lots of one acre or larger fell to 27 percent, down almost half from the share seen between 1985 and 1997 (50 percent).[3] These small changes may be further influenced by more significant changes yet to come. For example, between 2000 and 2030, the number of people aged 65 and over will more than double (U.S. Census 2000).

More interesting are the indications that household's location preferences may be changing. There is growing evidence that the market demand for housing is shifting toward more compact forms. For example, data from the National Association of Realtors (NAR) indicate that for the first time ever sales prices of attached homes is now on par with detached homes, a strong indicator of changing market demand for higher density, owner-occupied housing (NAR, 2004). A recent survey of home buyer preferences conducted also by the NAR indicates that one-third of the respondents have a strong preference for "new urbanism" housing options and up to half may be attracted to these options once they see them (NAR, 2001). Since another third of all households have always

[1] Calculated by author from the 2001 American Housing Survey, Table 2-3. (U.S. Census, 2001).
[2] Figures updated to 2004 by the author from figures provided in Frank (1989). The figure uses only costs for a 1 acre lot; costs for a five acre fully served lot are $130,000.
[3] Calculated by author from the American Housing Survey, Table 2-3. (U.S. Census, 1997, 2001).

rented (usually apartments), indications are that half to two-thirds of the demand for housing in the next generation may be for higher density opportunities, nearly a complete reversal of trends seen in the 1970s.

Moreover, real estate tracking services advise investors to focus on centrally-located, mixed-use opportunities with multi-modal access to realize the best returns (ULI, 2004). Another recent market study found that nearly 15 million households will demand housing near transit by 2025. That's double the demand that exists today (Center for Transit-Oriented Development, 2004).

Now consider that the volume of development to be seen during the next generation will be nothing short of staggering, probably eclipsing the amount of development seen in any previous generation. In 2030, about half of all existing development will have been built after 2000. Growth-related and replacement development will be more than two-thirds of all development existing in 2000. All told, perhaps $25 trillion in new development will occur between 2000 and 2030, maybe more. In a very real sense, America's built landscape can not only be rebuilt but reshaped.

This discussion paper provides the overall numbers showing the estimated magnitude of development facing the next generation nationally, in the four major regions (Northeast, Midwest, South, and West), all 50 states and the District of Columbia, and 50 of the largest metropolitan areas. The next section reviews the methodology used to make these projections and is followed by a section presenting the overall, aggregate numbers. Then, in succession, there are sections reporting and commenting on development projections for residential, commercial and institutional, and industrial development. The last two sections offer observations about the implications for public policy and planning.

II. METHODOLOGY

As far as we can determine, this paper is the first of its kind to project development needs on a national scale as well as for states, regions, and major metropolitan areas. It is based on certain limiting assumptions, however, and we cannot of course warrant them to be precise; it is the nature of long-term projections to be subject to error. Nonetheless, it provides a starting point to think about the future in ways that many may have not. In all, three sets of development projections are made following the basic steps described below. Results of the methodology are reported in the next three sections.

A. Residential Development

Residential land uses dominate the built landscape. Where and in what configuration residential development will occur in the future is subject to debate. This report estimates the magnitude of residential development facing the next generation. The estimates of future residential dwelling unit needs are based on the following steps, which also reviews data sources and assumptions.

1. Establish baseline conditions for population and housing units. We use 2000 as the baseline. Population and housing data come from the 2000 Census for states and 50 of the largest metropolitan areas projected for 2030. (This means that Buffalo, Providence, and Rochester drop out of top-50 metro status between 2000 and 2030). From this we get average persons per housing unit, including vacant units (total population divided by total housing units).

2. Estimate units lost between 2000 and 2030. Each year, hundreds of thousands of housing units are lost to fire, natural disasters, demolitions, and other reasons. We estimate the average annual rate of loss during the 1990s by comparing units older than 10 years reported in the *American Housing Survey 1999* to total units reported in the *American Housing Survey 1989* for the nation and the four Census divisions (Northeast, Midwest, South, and West). Loss rates will certainly vary by state and metropolitan area but we believe not by much. The annual loss rate for the decade is multiplied by only the units in-place in 2000; this undercounts total potential units lost since it does not compound across the three decades but not by much, resulting in a slightly conservative figure for units lost. The loss rate we derive implies that the typical residential unit lasts about 170 years. We have no way of knowing for certain whether this is too high but we suspect it is. If it is too high, our estimates of lost units will be even more conservative. (This research was substantially completed before detailed census 2000 figures became available. Fortunately, census figures for 1990 and 2000 indicate that average annual loss rates are comparable to those used here.)

3. Estimate population in 2030. This is done by extrapolating projections to 2030 for states and 50 of the largest metropolitan areas using in part data we acquired from a national forecasting

firm.[4] The estimates assume continuation of current fertility and immigration trends. A change in national immigration policy can raise or lower the projections considerably, as can major changes in fertility rates.

4. Estimate housing units needed in 2030. This is our projected population in 2030 divided by the number of persons per housing unit in 2000. We assume that household size will not change, the relationship of seasonal to total homes will not change, and there will be no substantive change in the underlying dynamics of the housing market.[5]

5. New residential units needed. This is the total units in 2030 less total units in 2000 *plus* total units lost between 2000 and 2030.

B. Commercial and Institutional Development

Commercial and institutional development includes all building types surveyed by the Energy Information Administration of the U.S. Department of Energy, most recently in its *Commercial Buildings Energy Consumption Survey* for 1999. This survey includes buildings ranging from the smallest corner grocery to the largest institutions such as universities. It does not include industrial development (see next section). Estimating commercial and institutional space involves the following calculations steps and assumptions:

1. Estimate square feet of building space in 2000. This is calculated using the mean square feet per commercial and institutional employee from the U.S. Department of Energy's Energy Information Administration (EIA) Commercial Buildings Energy Consumption Survey for 1999 multiplied by the number of such workers in 2000 for each state and 50 of the largest metropolitan areas estimated by a commercial data source.

2. Estimate square feet lost between 2000 and 2030. There are no good estimates for this. We use a loss rate assumption calculated by the EIA for the Nonresidential Buildings Energy Consumption Survey: Characteristics of Commercial Buildings, 1983. The rate is applied annually to the square feet estimated by state and the 50 largest metropolitan areas for 2000. We do not compound the losses over time, meaning that our estimate is somewhat conservative. Using Energy Information Administration data, we estimate the typical commercial and institutional structure lasts about 75 years. This is far less than the life span of a typical residential structure. Of course the life span of buildings varies considerably with many educational institutions lasting hundreds of years and most tall buildings lasting probably well over a hundred years. On the other hand, expansive "big box" retail stores are cheaply built and designed for ease of replacement when the time comes to convert property to more intensive uses.

[4] The data used for this research were adapted from Woods and Poole Econometrics, adjusted for 2000 census data, and modified for extrapolation to 2030

[5] We do acknowledge that certain household types are changing. Traditional, nuclear, families account for a much smaller percentage of all households than they did in 1970, for example. (Frey and Berube, 2002).

3. Estimate commercial and institutional employment in 2030. We extrapolate nonfarm and non-industrial employment projections to 2030 for states and 50 of the largest metropolitan areas we acquired in part from a national forecasting firm. Implicit is the assumption that there will be no major shifts in economic conditions that are not already anticipated.

4. Estimate square feet needed in 2030. For this, we multiply the square feet per commercial and institutional worker in 1999 by such workers projected in 2030. It is assumed that square feet per worker will not change during the period 2000 to 2030, and neither will their distribution.

5. New commercial and institutional square feet needed. This is square feet needed in 2030 less square feet in 2000 plus square feet lost between 2000 and 2030.

C. Industrial Development

Demand for industrial development is much more subject to changes in technology and markets than residential or commercial and institutional development. Manufacturing jobs peaked in 1980 with 21.9 million workers accounting for 20.4 percent of all jobs.[6] In the second quarter of 2004, manufacturing accounted for only 14.4 million of an estimated 138.8 million jobs, or just 10.4 percent (Bureau of Labor Statistics, 2004). Moreover, the location of industrial jobs has shifted dramatically from Northern central cities and nearby urban areas to "exurban" locations in all regions (Nelson and others, 1995). As manufacturing has become more automated the amount of space per worker has increased, since fewer workers but more machines are needed to produce more goods. Although in some ways it may be the least predictable of all major land uses, it is also the smallest in future development needs. No federal agency collects data on industrial square feet, so estimating it involves the following calculations and assumptions:

1. Estimate square feet of building space in 2000. The Society of Industrial and Office Realtors provided us with data on industrial space as of 2000. We divided this figure by the number of industrial workers in 2000 based on data from the U.S. Department of Commerce, Bureau of Economic Analysis to come up with industrial square feet per worker. We multiplied this by the number of such workers in each state and each of the 50 largest metropolitan areas.

2. Estimate square feet lost. There is even less good information on loss rates for industrial space than for other development types. We resorted to using an opinion contained in a report prepared for the National Association of Industrial and Office Properties: "According to the NAIOP membership and other sources, opinions on the rate of industrial obsolescence range from a conservative 50-year estimate . . . to a useful life as low as 25 years for some type of space," (Birch and others, 1989). The assumption used here is the more conservative 50-year useful life, not compounded. Industrial space has the lowest life span of buildings of all major land uses considered and, consequently, has the highest rates of

[6] (Department of Commerce, 1993) table 647.

replacement among all major land uses. However, it is also the sector that is growing the least in terms of employment and space needs.

3. Estimate industrial employment in 2030. Similar to our estimate for commercial and industrial workers, we extrapolated projections of industrial workers to 2030 using data we acquired in part from a national forecasting firm for each state and 50 of the largest metropolitan areas. Although we concede there may be more volatility in industrial employment and associated projections than for other development, we note that because its share of total employment is small and projected to fall further by 2030 any major fluctuations in industrial employment will have a small overall effect on projections of total development needs.

4. Estimate square feet space needed in 2030. This is calculated simply as the square feet per industrial worker for 2000 times the projected industrial employment in 2030. We assume that square feet per worker will not change during the period 2000 to 2030.

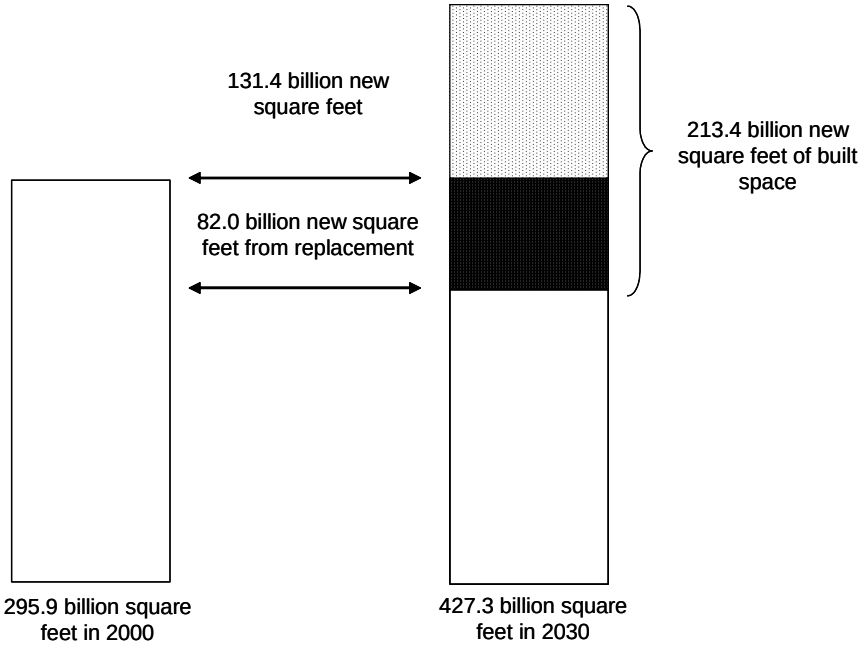
5. New industrial square feet needed. This is calculated as industrial square feet needed in 2030 less square feet available in 2000 *plus* square feet lost between 2000 ad 2030.

No effort has been made to refine the projections for individual types of development, nor are there adjustments for conditions specific to metropolitan areas. We believe the figures give a reasonable indication of the order of magnitude of development that will be experienced between 2000 and 2030. These projections can certainly be refined for specific applications.

III. ESTIMATES AND PROJECTIONS OF FUTURE GROWTH

Overall, we find that total built space in this country will grow from an estimated 295.9 billion square feet in 2000 to 427.3 billion in 2030. This increase in 131.4 billion square feet is in addition to the 82.0 billion square feet that will need to be replaced. Thus, new space built may total 213.4 billion square feet - about 72.1 percent of the space existing in 2000 (Figure 1).

Figure 1. Amount of Square Feet of Built Space: 2000 and 2030



Source: Author's Calculations

In other words, in 2030 half of the built landscape will not have even existed in 2000. Assuming a modest $100 per square foot, new construction will come to about $20 trillion.[7] Add another 25 percent for infrastructure costs and the total estimated investment in development between 2000 and 2030 is $25 trillion, maybe more.

For the most part, development in the South and West will outpace the nation, together growing from 160.5 billion to 251.5 billion square feet (Table 1). Including replaced space, about 136.3 billion square feet of new space will be constructed, which is equivalent to about 84.9 percent of all space existing in 2000 or about 54.2 percent of all development seen in 2030. Changing less rapidly will be the Northeast and Midwest, together growing from 135.3 to 175.7 billion square feet. At 77.2 billion square feet, new space will be equivalent to more than half (57.0 percent) of space in 2000 and is estimated to be about 43.9 percent of all space projected in 2030.

[7] The projections used in this report are based on current trends, technology, demographics, and consumer preferences using secondary data sources. They are not intended to be precise and are certainly not to be relied upon for investment or related decisions.

Table 1. Summary of Total Development Needs: 2000–2030

Geographic Area	Total Square Feet Estimated 2000[a]	Total Square Feet Estimated 2030[b]	New & Replaced Square Feet[c]	Percent Total Square Feet in 2030 Built After 2000[d]	New Square Feet as Percent of Square Feet in 2030[e]
Nation	295,874,358	427,250,696	213,449,209	72.1%	50.0%
Northeast	60,418,404	75,097,600	29,659,046	49.1%	39.5%
Midwest	74,917,390	100,621,685	47,537,211	63.5%	47.2%
South	100,609,817	156,757,456	84,436,442	83.9%	53.9%
West	59,928,747	94,773,955	51,816,510	86.5%	54.7%
Northeast and Midwest	135,335,794	175,719,285	77,196,257	57.0%	43.9%
South and West	160,538,564	251,531,411	136,252,952	84.9%	54.2%

Source: Author's calculations. Notes for the table calculations can be found in the appendix.

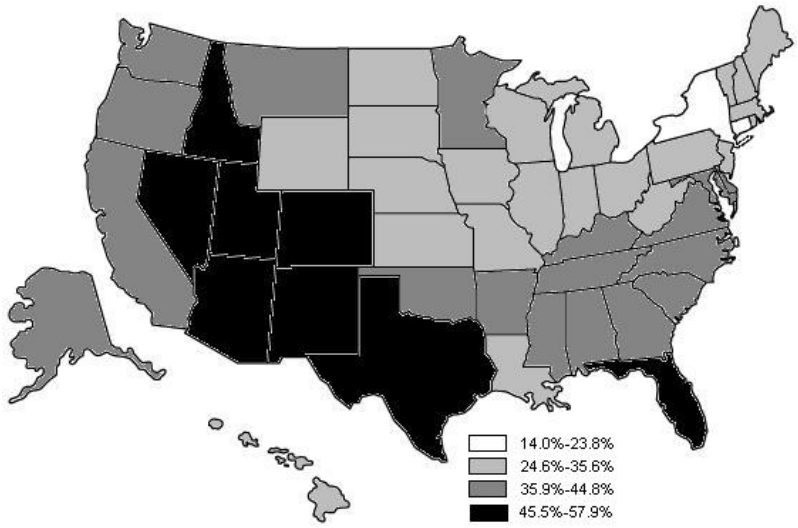
The figures cited above are calculations for all types of development—residential, commercial and institutional, and industrial combined. Let us now turn to the individual development categories.

A. Residential Development

In 2000, the nation had 115.9 million residential units. Based on our calculations, we estimate there will be about 154.8 million units in 2030. About 38.8 million units will be needed to accommodate new population. An additional 20.1 million existing units will be lost. So, this nation will need to build about 58.9 million new units between 2000 and 2030. This is more than half the number of units in place in 2000. Looking at this from another perspective, about 38.1 percent of all residential units that will exist in the U.S. in 2030 will be built after 2000.

As can be clearly seen in Map 1, there is considerable variation between the regions. The Northeast will see, by far, the least amount of change. Table 2 shows that the 6.4 million units built will be nearly one- third (29.2 percent) of the units in-place in 2000 (22.1 million). The South and West will see the greatest change. In the South, the 25.7 million new units seen by 2030 will be about 42.8 percent of the units in-place. More impressive is that in the West new units built will be more than two-thirds (66.2 percent) of the number of units in-place in 2000.

Map 1. New Residential Units as a Percent of all Units in 2030



Among the states, the greatest growth in residential units will be in Nevada because of rapid growth on a relatively small base. In Nevada, more units will be built between 2000 and 2030 than existed in 2000. Arizona will see the second fastest rate of growth with the construction of nearly 2.1 million new units, or about as many units that currently exist in the state today. The states with the largest projected number of new housing units are California, Florida, and Texas, and they will collectively see 18.7 million units built between 2000 and 2030 or about two-thirds of the 27.7 million units that existed in 2000. In those states, 44.8 percent of all units projected in 2030 (40.7 million) will be built between 2000 and then.

The dichotomy in growth between the Northeast and Midwest compared to the South and West is also seen clearly among the largest metropolitan areas. In the South and West, almost all metropolitan areas will see half as many homes built by 2030 as existed in 2000; only five metropolitan areas in the Midwest have this distinction, and none in the Northeast. However, in sheer numbers, the Los Angeles metropolitan area will add the most number of units, 2.8 million (50.1 percent of those existing in 2000), ahead of New York at 2.6 million (31.6 percent of those existing in 2000). The only other metropolitan area projected to add more than 2 million units is Washington (Table 3).

Table 2. Residential Unit Demand by Nation, Regions, and States Ranked by the Percent of Housing Units in 2030 built since 2000

Geographic Area	Housing Units 2000	Housing Units 2030	Growth-Related Units	Units Lost 2000–2030	New Housing Units Needed 2000–2030	Percent New Units Built After 2000	Percent New Housing Units 2030
United States	115,904,641	154,756,268	38,851,627	20,087,433	58,939,060	50.9%	38.1%
West	24,378,020	35,922,057	11,544,037	4,584,774	16,128,808	66.2%	44.9%
South	42,382,546	60,173,882	17,791,336	7,953,582	25,744,922	60.7%	42.8%
Midwest	26,963,635	33,026,601	6,062,966	4,695,716	10,758,682	39.9%	32.6%
Northeast	22,180,440	25,594,225	3,413,785	3,052,917	6,466,703	29.2%	25.3%
Top 10 States							
1. Nevada	827,457	1,596,484	769,027	155,620	924,646	111.7%	57.9%
2. Arizona	2,189,189	3,863,065	1,673,876	411,721	2,085,596	95.3%	54.0%
3. Utah	768,594	1,326,928	558,334	144,549	702,883	91.5%	53.0%
4. Florida	7,302,947	11,396,531	4,093,584	1,373,465	5,467,049	74.9%	48.0%
5. Idaho	527,824	818,873	291,049	99,268	390,317	73.9%	47.7%
6. Colorado	1,808,037	2,792,037	984,000	340,038	1,324,038	73.2%	47.4%
7. Texas	8,157,575	12,457,257	4,299,682	1,534,195	5,833,877	71.5%	46.8%
8. New Mexico	780,579	1,162,857	382,278	146,803	529,081	67.8%	45.5%
9. Oregon	1,452,709	2,135,376	682,667	273,211	955,878	65.8%	44.8%
10. Washington	2,451,075	3,579,681	1,128,606	460,974	1,589,579	64.9%	44.4%
Bottom 10 States							
42. Iowa	1,232,511	1,413,117	180,606	214,642	395,247	32.1%	28.0%
43. Maine	651,901	779,991	128,090	89,728	217,817	33.4%	27.9%
44. North Dakota	289,677	331,898	42,221	50,447	92,668	32.0%	27.9%
45. Massachusetts	2,621,989	3,041,642	419,653	360,891	780,544	29.8%	25.7%
46. West Virginia	844,623	919,991	75,368	158,848	234,216	27.7%	25.5%
47. Rhode Island	439,837	503,068	63,231	60,539	123,771	28.1%	24.6%
48. New York	7,679,307	8,686,396	1,007,089	1,056,980	2,064,069	26.9%	23.8%
49. Connecticut	1,385,975	1,559,652	173,677	190,766	364,443	26.3%	23.4%
50. Pennsylvania	5,249,750	5,871,569	621,819	722,576	1,344,395	25.6%	22.9%
51. Dist. Columbia	274,845	259,585	-15,260	51,690	36,431	13.3%	14.0%

Source: Author's calculations. The full table can be found in the appendix.

Table 3. Residential Development Change by 50 Largest Metropolitan Areas in 2030 Ranked by the Percent of Housing Units in 2030 built since 2000

Metropolitan Area (CMSA/ MSA)	Housing Units 2000 (000s)b	Housing Units 2030 (000s)e	Growth-Related Units (000s)f	Units Lost 2000-2030 (000s)h	New Housing Units Needed 2000–2030 (000s)i	Percent New Units Built After 2000j	Percent New Housing Units 2030k
Top 10 Metro Areas							
1. Las Vegas	656	1,343	687	123	810	123.5%	60.3%
2. Austin	496	983	487	93	580	116.9%	59.0%
3. Phoenix	1,331	2,417	1,086	250	1,336	100.4%	55.3%
4. West Palm Beach	556	980	424	105	529	95.1%	54.0%
5. Orlando	684	1,204	520	129	649	94.9%	53.9%
6. Raleigh-Durham	496	838	342	93	435	87.7%	51.9%
7. Dallas-Fort Worth CMSA	2,031	3,344	1,313	382	1,695	83.5%	50.7%
8. Salt Lake City	456	748	292	86	378	82.9%	50.5%
9. Sacramento CMSA	715	1,161	446	134	580	81.1%	50.0%
10. Charlotte	616	991	375	116	491	79.7%	49.5%
Bottom 10 Metro Areas							
40. Chicago CMSA	3,486	4,335	849	607	1,456	41.8%	33.6%
41. New Orleans	556	652	96	105	201	36.2%	30.8%
42. Milwaukee CMSA	693	814	121	121	242	34.9%	29.7%
43. Boston	2,417	2,870	453	333	786	32.5%	27.4%
44. St. Louis	1,093	1,257	164	190	354	32.4%	28.2%
45. New York CMSA	8,175	9,635	1,460	1,125	2,585	31.6%	26.8%
46. Detroit CMSA	2,208	2,512	304	385	689	31.2%	27.4%
47. Philadelphia CMSA	2,540	2,950	410	350	760	29.9%	25.8%
48. Cleveland CMSA	1,246	1,338	92	217	309	24.8%	23.1%
49. Hartford	483	512	29	67	95	19.7%	18.6%
50. Pittsburgh	1,046	1,069	23	144	167	16.0%	15.6%

Source: Author's calculations. Notes for the table calculations and the full table can be found in the appendix. All areas are MSAs unless otherwise indicated.

In order to make these figures more meaningful we attempted to estimate the square feet of new residential development constructed between 2000 and 2030. Unfortunately, comparable data on existing square feet and square feet of new construction for the states and metropolitan areas are not available. Such data do exist, however, for the nation as a whole and the four regions. We were thus able to estimate residential square feet for these geographic units in the following way:

First, we collected housing data from the 2000 Census. This gave us owner-occupied and renter housing figures, along with vacancies. We apportioned vacant units proportionately based on tenure. We then estimated existing square feet by multiplying square feet per owner- and renter-occupied units from the *American Housing Survey 2001* to the housing units in 2000. This gave us an overall estimate for the nation and the regions.

Second, using data from the *American Housing Survey 1999* and *American Housing Survey 1989*, we estimated average rates of loss per decade for the nation and the regions. We used this information to estimate square feet lost over the 30-year period 2000 to 2030.

Third, we then estimated square feet of new units to be constructed based on the average size of owner- and renter-occupied units constructed during the past four years based the *American Housing Survey 2001*. Although housing unit size has been increasing steadily over the past few decades, we assume future units will be equivalent in size to units building between 1997 and 2001. Our figures are thus probably conservative.

Finally, this simplistic calculation approach allowed us to estimate existing (2000), lost, new, and projected (2030) residential space.

Table 4 reports the results. More than 108 billion square feet of residential space will be built between 2000 and 2030 which is 61.5% of the space that existed in 2000 (176.7 billion square feet). About 42.7 percent of all residential square feet seen in 2030 will be built after 2000, assuming no further increases in average house size.

In the Northeast and Midwest new residential square feet will be about 42.5 percent of the residential space in 2000 representing about a third (33.5 percent) of all such space seen in 2030. The story is much different in the South and West, however, where new residential construction will be about 77.0 percent of the square feet present in 2000 and will approach half (48.7 percent) of the space projected for 2030. These two regions will see about 75 billion square feet of new residential square feet by 2030—again, assuming no change in the size of newly constructed homes.

Table 4. Residential Square Feet For Nation and Regions: 2000-2030

Geographic Area	Square Feet 2000 (000s)[a]	Square Feet 2030 (000s)[b]	Total Growth-Related & Replaced Square Feet (000s)[c]	Percent Total Square Feet Built After 2000[d]	Percent of 2030 Square Feet Built Since 2000[e]
United States	176,746,943	254,700,875	108,732,700	61.5%	42.7%
West	36,192,991	58,389,682	29,003,507	80.1%	49.7%
South	61,238,186	95,761,419	46,040,299	75.2%	48.1%
Midwest	42,121,732	55,264,713	20,478,480	48.6%	37.1%
Northeast	37,194,034	45,285,061	13,210,414	35.5%	29.2%
Northeast and Midwest	79,315,766	100,549,774	33,688,894	42.5%	33.5%
South and West	97,431,177	154,151,101	75,043,806	77.0%	48.7%

Source: Author's calculations. Notes for the table calculations can be found in the appendix.

B. Commercial and Institutional Development

For the nation as a whole, between 2000 and 2030 about 96.4 billion square feet of commercial and institutional square feet will be built, nearly as much as existed in 2000 (106.7 billion square feet). The Northeast and Midwest will see the least amount of change but newly built space in these regions will still come to 72.6. and 85.0 percent, respectively, of all commercial and institutional space in 2000.

Indeed, more than half of all commercial and institutional space projected for 2030 will be built after 2000. The South and West will see the greatest change with new commercial and institutional square feet. Overall, nearly two-thirds of the commercial and institutional square feet projected for 2030 in the South and West will be built after 2000. In both regions, the amount of new space built between 2000 and 2030 will be as much as existed on the ground in 2000.

As with residential development because of its small base, the state projected to have the largest rate of change in commercial and institutional development will be in Nevada where new space will be about 137.6 percent of that existing in 2000, and 70.0 percent of all such space projected for 2030. Arizona will have the second largest percentage change; it will see construction of about 2.2 billion square feet of commercial and institutional space or 131.8 percent of the square feet we estimate was in-place in 2000. This will be about 69.1 percent of all square feet projected for 2030. The states with the largest projected growth—California, Florida, Texas—combined will add about 25 billion square feet of commercial and institutional square feet. See Table 5.

On the metropolitan level, Table 6 shows that, as with the figures for residential development, there is a substantial difference in projected development of commercial and institutional space between places in the Northeast and Midwest compared to the South and West.

However, in stark contrast to the residential figures, half of the top metropolitan areas will need to build as much or more commercial and industrial space as existed on the ground in 2000. Ten of the 12 metropolitan areas with more than 2 million residents in 2000 that will see the largest change in commercial and institutional square feet space are located in the South and West. Finally, although the New York metropolitan areas ranks last in terms of the percentage of new space built after 2000, it ranks first in terms of the sheer volume of new space projected to be constructed—nearly 6 billion.

Table 5. Commercial and Institutional Square Feet Demand for Nation, Regions and State Ranked by the Percentage of Square Feet in 2030 Built Since 2000

Geographic Area	Estimated Square Feet in 2000 (000s)	Square Feet Needed 2030 (000s)	New & Replaced Square Feet (000s)	Percent Total Square Feet Built After 2000	New Square Feet as Percent of All Square Feet in 2030
United States	106,784,896	159,327,980	96,431,677	90.3%	60.5%
South	36,249,955	57,580,040	36,228,817	99.9%	62.9%
West	21,571,253	33,961,697	21,256,228	98.5%	62.6%
Midwest	27,407,296	39,431,917	23,289,021	85.0%	59.1%
Northeast	21,556,392	28,354,326	15,657,611	72.6%	55.2%
Top 10 States					
1. Nevada	775,324	1,523,379	1,066,713	137.6%	70.0%
2. Arizona	1,668,568	3,182,366	2,199,579	131.8%	69.1%
3. Utah	806,278	1,488,003	1,013,105	125.7%	68.1%
4. Florida	5,965,855	10,132,535	6,618,646	110.9%	65.3%
5. Idaho	414,194	693,517	449,557	108.5%	64.8%
6. Texas	7,580,685	12,572,490	8,107,467	106.9%	64.5%
7. South Carolina	1,352,400	2,237,095	1,440,531	106.5%	64.4%
8. North Carolina	2,817,500	4,641,630	2,982,123	105.8%	64.2%
9. Colorado	1,716,473	2,768,909	1,757,906	102.4%	63.5%
10. Tennessee	2,084,145	3,344,775	2,117,214	101.6%	63.3%
Bottom 10 States					
42. Illinois	5,341,525	7,456,127	4,309,969	80.7%	57.8%
43. Maine	509,652	701,844	401,659	78.8%	57.2%
44. New Jersey	3,363,360	4,580,004	2,598,985	77.3%	56.7%
45. Massachusetts	2,859,714	3,855,852	2,171,480	75.9%	56.3%
46. Pennsylvania	4,639,206	6,241,950	3,509,458	75.6%	56.2%
47. Rhode Island	389,532	523,380	293,946	75.5%	56.2%
48. Connecticut	1,444,872	1,937,364	1,086,334	75.2%	56.1%
49. Hawaii	463,573	594,022	320,978	69.2%	54.0%
50. New York	7,583,004	9,381,372	4,914,983	64.8%	52.4%
51. Dist of Columbia	553,035	594,895	269,157	48.7%	45.2%

Source: Author's calculations. The full table can be found in the appendix.

Table 6. Commercial and Institutional Square Feet Demand by 50 Largest Metropolitan Statistical Areas in 2030 Ranked by the Percentage of Square Feet in 2030 Built Since 2000

Metropolitan Area (MSA/CMSA)	Estimated Square Feet in 2000 (000s)	Square Feet Needed 2030 (000s)	New & Replaced Square Feet (000s)	Percent Total Square Feet Built After 2000	New Square Feet as Percent of Square Feet in 2030
Top 10 Metro Areas					
1. Las Vegas	573,386	1,205,732	868,008	151.4%	72.0%
2. Austin	545,790	1,145,515	824,045	151.0%	71.9%
3. Phoenix	1,157,090	2,266,275	1,584,749	137.0%	69.9%
4. Orlando	741,405	1,409,555	972,867	131.2%	69.0%
5. West Palm Beach	429,065	792,925	540,206	125.9%	68.1%
6. Raleigh-Durham	536,935	955,535	639,280	119.1%	66.9%
7. Charlotte	618,240	1,093,995	729,852	118.1%	66.7%
8. Salt Lake City	535,062	941,886	626,734	117.1%	66.5%
9. Nashville	564,305	980,490	648,114	114.9%	66.1%
10. Sacramento, CMSA	652,982	1,129,821	745,215	114.1%	66.0%
Bottom 10 Metro Areas					
41. Chicago, CMSA	4,064,144	5,699,155	3,305,374	81.3%	58.0%
42. Milwaukee, CMSA	778,533	1,081,143	622,587	80.0%	57.6%
43. Detroit, CMSA	2,193,464	3,032,519	1,740,569	79.4%	57.4%
44. Boston, CMSA	2,758,470	3,776,916	2,152,177	78.0%	57.0%
45. New Orleans	523,250	704,375	396,181	75.7%	56.2%
46. Philadelphia, CMSA	2,516,514	3,378,804	1,896,577	75.4%	56.1%
47. Cleveland, CMSA	1,274,630	1,701,952	951,195	74.6%	55.9%
48. Pittsburgh	950,664	1,235,520	675,579	71.1%	54.7%
49. New York, CMSA	8,637,486	10,972,104	5,884,625	68.1%	53.6%
50. Hartford	561,132	710,015	379,509	67.6%	53.5%

Source: Author's calculations. The full table can be found in the appendix. All areas are MSAs unless otherwise indicated.

In many ways the location and scale of commercial and institutional development has perhaps the greatest potential to reshape America's future urban form. This can happen for two reasons. First, it is the most flexible because on the whole it has a relatively short life span. Newly built projects in many suburban areas are easily replaced within a generation or less as markets change. What will replace it? Perhaps more intensive development because the location is probably reasonably central to markets, and transportation and infrastructure can support more intensive uses.

This leads to the second reason. There is a gradual but growing acceptance of the benefits of mixing residential with commercial and institutional development. Niche markets offering mixed uses, such as intown redevelopment projects and projects patterned after the "new urbanism," appear to be growing. The combination of flexibility in construction and acceptance of mixed uses may lead to different development patterns than witnessed since the end of World War II. Whether this trend will be accelerated by market forces or planning policies, or both, is subject to speculation.

C. Industrial Development

Lastly, for the nation as a whole, between 2000 and 2030 about 8.3 billion square feet of industrial square footage will be built: 67.1 percent of the 12.3 billion square feet present in 2000. Unlike the other major land uses, however, projections of industrial space demand for the Midwest will outpace the other regions. The Midwest will see growth-related and replaced industrial space coming to 70.0 percent of the industrial square feet existing in 2000 (3.8 billion new square feet compared to 5.4 billion existing square feet); 63.6 percent of industrial space projected in 2030 will be built between 2000 and then. The West will see new industrial square feet being about 71.9 percent of all such space existing in 2000; 64.3 percent of the industrial square feet projected for 2030 will be built between 2000 and then. The South has a surprisingly large amount of this kind of space, although the region is not typically seen as industrial.

States with a strong industrial presence will see the largest amount of growth even though other areas may witness faster growth. After California, which far outpaces the nation in terms of new construction, the next four states are all Rust Belt states in the Midwest: Ohio, Michigan, Illinois, and Indiana. As Table 7 shows, the places with the fastest growth all rank low with respect to overall number of workers as well as total square feet needed.

Similarly, although some metropolitan areas will appear to see substantial growth in industrial space, the volume of new space is decidedly in established industrial centers. For example, as seen in Table 8, the four leaders in growth rates are projected to be Austin (105.9 percent growth with 44.4 million new square feet), Sacramento (105.2 percent and 40.0 million square feet), Las Vegas (98.5 percent and 15.7 million square feet), and Salt Lake City (93.7 percent and 51.1 million square feet). But growth in industrial space in these metropolitan areas will be dwarfed by the sheer volume of square feet to be built in such manufacturing centers as Cleveland (76.8 percent change with 208.4 million square feet), Los Angeles (63.9 percent and 426.6 million square feet), Detroit (62.3 percent and 309.5 million square feet), and Chicago (61.4 percent and 395.8 million square feet).

Perhaps more so than most other land uses, manufacturing is not likely to be mixed with residential land uses. Manufacturing processes, their need for extensive land areas, traffic, and other features often make manufacturing land uses incompatible with residential and many types of commercial and institutional land uses. Still, it is possible that some industrial development in the future may be mixed with other land uses. Even if it does not, its share of total development will be quite small relative to residential and commercial/institutional development.

Table 7. Industrial Square Feet Demand for Nation, Regions, and States Ranked by the Percent of Square Feet in 2030 built since 2000

Geographic Area	Estimated Square Feet in 2000 (000s)	Square Feet Needed 2030 (000s)	New & Replaced Square Feet (000s)	Percent Total Square Feet Built After 2000	New Square Feet as Percent of Square Feet in 2030
United States	12,342,519	13,221,841	8,284,832	67.1%	62.7%
West	2,164,503	2,422,576	1,556,775	71.9%	64.3%
Midwest	5,388,362	5,925,055	3,769,710	70.0%	63.6%
South	3,121,676	3,415,997	2,167,326	69.4%	63.4%
Northeast	1,667,978	1,458,213	791,021	47.4%	54.2%
Top 10 States					
1. Nevada	28,811	42,910	31,386	108.9%	73.1%
2. North Dakota	23,218	33,934	24,647	106.2%	72.6%
3. Utah	85,820	119,535	85,207	99.3%	71.3%
4. Wyoming	47,329	65,189	46,257	97.7%	71.0%
5. South Dakota	8,582	11,647	8,214	95.7%	70.5%
6. Idaho	50,879	66,817	46,465	91.3%	69.5%
7. Nebraska	109,839	138,415	94,479	86.0%	68.3%
8. Arizona	137,925	171,027	115,857	84.0%	67.7%
9. Arkansas	196,460	239,324	160,740	81.8%	67.2%
10. Kansas	130,152	158,253	106,192	81.6%	67.1%
Bottom 10 States					
42. Delaware	41,905	39,440	22,678	54.1%	57.5%
43. West Virginia	30,073	28,101	16,072	53.4%	57.2%
44. Pennsylvania	470,869	439,936	251,588	53.4%	57.2%
45. Maine	46,154	42,717	24,255	52.6%	56.8%
46. Hawaii	12,260	11,034	6,130	50.0%	55.6%
47. Massachusetts	218,495	190,999	103,601	47.4%	54.2%
48. New Jersey	232,243	193,945	101,048	43.5%	52.1%
49. New York	448,774	373,160	193,650	43.2%	51.9%
50. Connecticut	37,316	29,951	15,025	40.3%	50.2%
51. Rhode Island	133,603	106,981	53,540	40.1%	50.0%

Source: Author's calculations. The full table can be found in the appendix.

Table 8. Industrial Square Feet Demand for 50 Largest Metropolitan Statistical Areas Ranked by the Percent of Square Feet in 2030 built since 2000

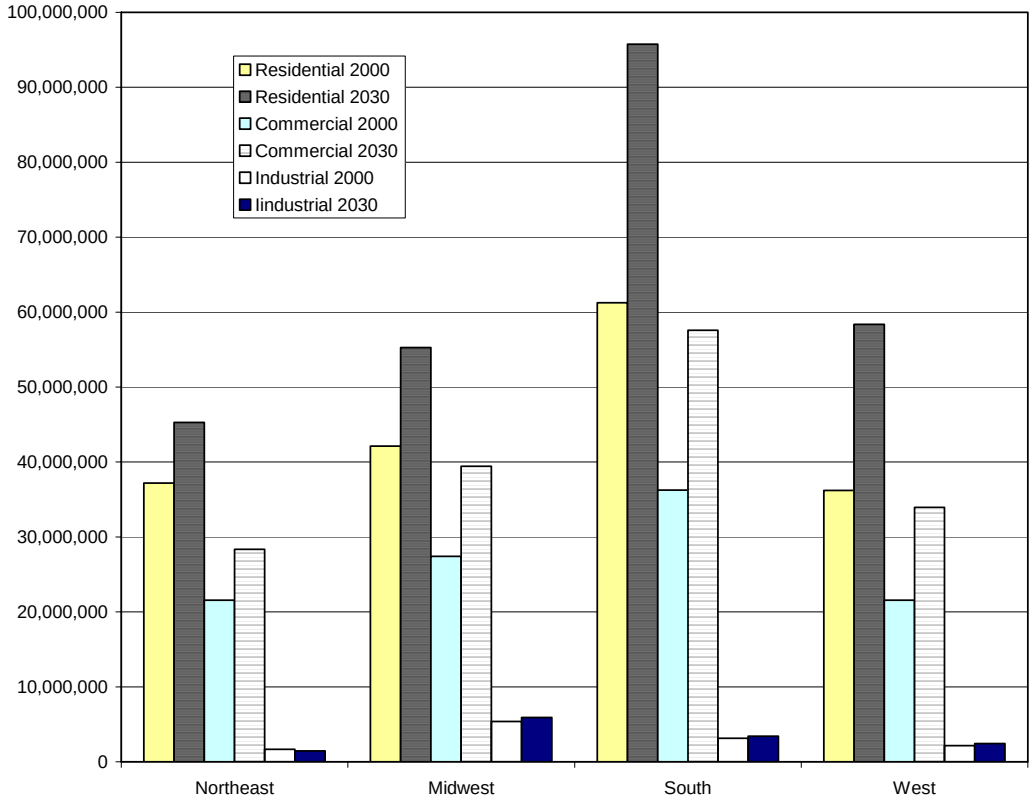
Metropolitan Area	Estimated Square Feet in 2000 (000s)[c]	Square Feet Needed 2030 (000s)[g]	New & Replaced Square Feet (000s)[h]	Percentage Percent Total Square Feet Built After 2000[i]	New Square Feet as Percent of Square Feet in 2030[j]
Top 10 Metro Areas					
1. Austin	41,905	61,132	44,370	105.9%	72.6%
2. Sacramento, CMSA	38,006	55,170	39,968	105.2%	72.4%
3. Las Vegas	15,938	22,068	15,693	98.5%	71.1%
4. Salt Lake City	54,557	72,947	51,124	93.7%	70.1%
5. Houston, CMSA	117,827	157,267	110,136	93.5%	70.0%
6. Phoenix	106,049	134,247	91,827	86.6%	68.4%
7. Portland, CMSA	106,662	132,408	89,743	84.1%	67.8%
8. Oklahoma City	28,594	34,510	23,072	80.7%	66.9%
9. Grand Rapids	148,238	178,600	119,305	80.5%	66.8%
10. West Palm Beach	17,197	20,706	13,827	80.4%	66.8%
Bottom 10 Metro Areas					
41. Kansas City	97,337	95,551	56,616	58.2%	59.3%
42. Louisville	44,370	43,384	25,636	57.8%	59.1%
43. Greenville	59,653	56,202	32,341	54.2%	57.5%
44. Columbus	85,728	80,370	46,079	53.8%	57.3%
45. Boston, CMSA	224,387	203,274	113,519	50.6%	55.8%
46. Philadelphia, CMSA	183,143	162,521	89,264	48.7%	54.9%
47. Pittsburgh	69,231	60,884	33,192	47.9%	54.5%
48. St. Louis	174,135	147,345	77,691	44.6%	52.7%
49. Hartford	45,663	35,322	17,056	43.3%	52.0%
50. New York, CMSA	480,689	381,016	188,740	39.3%	49.5%

Source: Author's calculations. Notes for the table calculations and the full table can be found in the appendix. All areas are MSAs unless otherwise indicated.

IV. DISCUSSION OF THE TRENDS AND FINDINGS

Where will all this new construction go? At first impression, one might expect that most of the 213.4 billion square feet in new construction will go into "greenfield" locations such as farms, forests, and other open spaces. That is what the trend from the 1990s implies. Assuming 5,000 residential and 10,000 nonresidential square feet per acre, we would need to develop about 35 million acres of land, about the same trend estimated earlier.[8] In some parts of the nation, such as the Northeast and parts of the Midwest, it is possible that abandoned development will not be *re*placed but *dis*placed farther out as appears to be occurring in many lagging areas. In rapidly growing areas of the South, central locations may be revitalizing but substantial shares of all new development occur in ever-distant locations, as in Atlanta, Charlotte, Nashville, and other regions.

Figure 2. Total Square Feet, by Category, 2000 and 2030



Some of these patterns will certainly continue. However, it is clear that much more will be redirected inward or into more compact, mixed-use suburban developments.

[8] The 5,000–10,000 estimate is typical low-density suburban standard. It implies two residential units per acre and a commercial development floor-area-ration of about 0.20 to 0.25. The 35 million acres is calculated as 112 billion square feet of residential space divided by 5,000 square feet per acre plus 105 billion square feet of nonresidential space divided by 10,000 square feet per acre, rounded up.

That rationale is based in emerging trends rooted in demographic changes combined with commercial and institutional market signals. How much of the expected new development will be in conventional "sprawl" is difficult to say for certain, but our guess is not more than half and maybe only a quarter to one-third. While sprawl will continue, it will not dominate the market as it has for the past half-century. Instead, pressure will be put on central cities (albeit not all of them), older suburbs, and second-tier suburbs that have large amounts of under-utilized land.

One challenge facing these areas is where to put new development. Certainly some of it will go on by-passed, vacant land and others on redeveloped sites but, what might be surprising to some is that, a very large share (maybe most of it) could go on surface parking lots. Studies by the Urban Land Institute (ULI) indicate that suburban America is probably "over-parked" by about one-third; that is, we have about one-third more parking spaces around office buildings, shopping centers, institutional centers and the like than is needed (ULI, 1999).

For example, in a metropolitan area of about 2 million people (such as Cincinnati, Orlando, Portland, and Sacramento) there will be about 1 million people working in single-level or low-rise locations with associated surface parking. They work in about 800 million square feet of space. A typical parking ratio, dictated by local zoning standards, calls for about 4 stalls per 1,000 square feet of space, resulting in about 3.2 million parking spaces in these sample metropolitan areas. According to ULI, about one-third (or over one million) of those spaces are not needed. Assuming 400 square feet per parking stall the excess parking area comes to about 400 million square feet which is nearly 10,000 acres or 15 square miles.[9] At a floor-area-ratio of 1.010 and adjusting for new parking demands associated with new development (at lower rates reflective of ULI studies), up to a quarter of metropolitan Orlando's, and third of metropolitan Portland's and Sacramento's, and all of metropolitan Cincinnati's future development needs could be met on just this over-parked land.

We may also see acceleration of redevelopment in some cases. For example, the U.S. Department of Energy reports that the average age of buildings devoted to food sales is 19.5 years and that for retail space other than enclosed malls is 24.5 years. (EIA, 2002) With nearly 6 billion square feet devoted to these two building types in 2000, it is conceivable that most of it will be replaced by 2030, and some of it twice over.

Industrial development is more problematic. Modern industrial processes are mostly linear requiring low-rise buildings. They also tend to require remote areas in part for the land prices and in part to be away from potential conflicts with urban development. It is conceivable that much of the 7 billion square feet in industrial space that will need to be replaced and the 1 billion in new square feet needed to meet growth will occur away from where they presently exist. Some become brownfields. The redevelopment of abandoned industrial sites will likely continue to be a challenge for local governments. New industrial construction locating farther out will certainly stimulate

[9] A typical stall measures 8 to 9 feet by 18 to 20 feet. Parking lot access lanes, buffer areas, and the like double this area.

[10] For a 40,000 square foot site this means a structure of 40,000 square feet would be built on it. Allowing for setbacks, the building would be low-rise, just two or there floors.

population growth and associated residential, office, retail, and institutional development. In terms of the overall scheme of new construction, industrial development will be very small – maybe less than 4 percent – but its impact on communities beyond the suburban fringe may be significant especially considering spin-off development.

The wild card in reshaping development patterns is new residential construction. More of it appears headed to central cities, downtowns, and suburban mixed-use developments than seen in the past but no one really knows whether this trend will continue or accelerate, or even become a significant factor. As noted earlier, changing demographics especially among the elderly may reorient housing markets; their number will double between 2000 and 2030, hitting 70 million by then. This will be the fastest growing segment of the housing market. With about 25 million new elderly households (assuming about 1.4 persons per elderly household), it will account for about half of the 40 million new households projected between 2000 and 2030.

Meeting this housing need wisely can do a lot to reshape the built landscape. For example, if only 10 percent of these elderly households could occupy "accessory dwelling units", 4 million new housing units need not be constructed (in the conventional sense) and an area of land larger than Los Angeles would not have to be developed.[11]

Another housing need to meet relates to immigrant households. In the 1990's 9.1 million immigrants arrived legally in the United States, joined by millions who entered illegally (Lindsay and Singer, 2003). Location and housing choices of immigrants may not be as expected. For example, while among all first-time home-buyers 46 percent chose central city locations, only a little more than a third of immigrant households did; indeed, first-time buyers among immigrants tended to choose suburban locations (60 percent). On the whole, immigrant first-time buyers had larger families than native-born (3.87 to 2.75), purchased smaller homes (1,326 square feet to 1,400), and had fewer square feet per person (368 to 550). On the other hand, compared to native born first-time buyers, proportionately few foreign-born first-time buyers tend largely to locate outside metropolitan areas (4 percent to 22 percent) (Drew, 2002). A recent study by Brookings confirms this pattern for all immigrant households as a whole. In 2000, more immigrants in metropolitan areas lived in suburbs than cities, and their growth rates there exceeded those in the cities. Most notably, immigrants in sunbelt states are far more likely to live in the suburbs than in central cities (Singer, 2004).

States may become more active in managing future development patterns and minimizing negative effects of exclusionary zoning for their own statewide well-being. Twin pressures are at work. The recession of the first decade of the 21st Century is robbing states of fiscal resources needed to meet growing needs. One cause of fiscal distress is low-density development patterns that cost more to serve than moderately dense ones (Burchell, 2002) There is a growing body of literature suggesting that growth management leading to higher density development patterns improve prospects for economic development (Cervero, 2000; Nelson and Peterman, 2000; Muro and Puentes, 2004). Fiscal burdens and economic development may be better served with more

[11] Assuming 10 units per acre as the alternative average density for such households.

compact development patterns than observed since World War II. With so much new construction to come, the current generation has an opportunity to improve fiscal and economic conditions for the next.

Government can, however, accommodate these changing trends. Consider the example of Arlington County, Virginia. In 1990 its population was about 171,000 and employment about 197,000. At nearly 7,000 people per square mile for its 25 square mile area, conventional wisdom was that it was built out. By 2002, however, its population had grown to 192,000 and employment to 200,000. We estimate that in 2030 its population will be about 220,000 and employment 240,000. What's happening? The county is working with neighborhood groups and developers to choreograph a combination of transit-oriented infill, redevelopment, and brownfield development while preserving the integrity of stable neighborhoods, protecting sensitive landscapes, and maintaining open spaces. Arlington's efforts have won it an award for excellence by the Urban Land Institute and, in 2002, the Environmental Protection Agency's "smart growth" award in 2003.

Can the example of Arlington County be replicated? Probably in some places. To do so, we must begin with an appreciation of the magnitude of growth that is about to occur. The hope is that readers may grasp opportunities to shape imminent development into something better than would occur otherwise. The figures may be staggering but they are based on reasonably conservative estimates using conservative assumptions. It is possible and perhaps likely that more development will be seen than estimated but the overall magnitude of change will not.

V. IMPLICATIONS FOR THE NEW METROPOLIS AND CONCLUSION

For those who worry that the horse is out of the barn when it comes to shaping the future, this report should give pause. Rebuilding the already built landscape will be challenging and in some respects the deck of cards are stacked against it. For one thing, major federal, state, and local policies, spending programs, and tax expenditures fundamentally shape growth in metropolitan areas. Taken together these policies facilitate the decentralization of metropolitan areas and provide business barriers and impediments to redevelopment and reinvestment (Katz, 2002).

On the other hand, the opportunity cannot be denied. With new development in 2030 projected to be two-thirds or more of all existing development, the opportunity exists now to rebuild the built landscape in ways that improve the nation's quality of life.

What can be done now to facilitate this?

Let us consider the plight facing a major metropolitan area: Washington-Baltimore. This metropolitan area is projected to grow from 7.6 million in 2000 to 10.6 million people in 2030. Its employment will grow from 4.4 million to 6.4 million workers. Total nonresidential development will grow from 3.6 billion square feet to 5.2 billion. Total new nonresidential construction will equal all that existed in 2000. Taken as a whole, about 60 percent of development seen in 2030 will be built after 2000. Where will it go? That question can be answered through the following process:

1. Detailed, long-term projections of all development needs. This is the stuff of planning but all too often ignored. Such projections must include not only urban and built-up parts of metropolitan areas but also nearby exurban areas. The projections need to consider the range of changing demographic and market characteristics and to the extent possible the role of changing transportation technology in connecting land uses. A minimum 20 year time period is recommended. Some metropolitan areas are now engaging in 40 year planning horizons.

2. Inventories and assessments of current land use patterns and development potential. This exercise should identify areas that have large amounts of vacant or underutilized land, and areas where existing development is likely to become economically or functionally obsolete during the planning horizon. Special attention should be paid to finding opportunities where future development needs may be accommodated.

3. Public engagement in the projection, inventory, and assessment processes so the magnitude of the challenge ahead is broadly understood. This process should also include education as to the fiscal, environmental, and social impacts of alternative development patterns.

4. Visioning and goal setting to establish the desired form of metropolitan-wide development and land use interactions. Consensus from all stakeholders is the desired end of the goal setting process, but it should come only after the data, analysis, and educational processes are

completed.

5. Preparation of a metropolitan-wide framework plan for land uses and facilities designed to give general direction to all jurisdictions on how to manage the next generation of development.

6. Negotiation among all jurisdictions to create a contract by which all jurisdictions agree to do their fair share in meeting future metropolitan demands. This process may include tax base sharing, regional asset sharing (such as cultural centers and open spaces), low- and moderate-income housing allocations, and other measures designed to equitably distribute regional benefits and burdens. The negotiations should include provisions for mediating disputes and a system of incentives to reward jurisdictions that meet their targets. It should also include provisions for updating the framework and related plans periodically. Planners like to recommend five-year periods but the reality is that the magnitude of public engagement plus costs makes a ten-year cycle more realistic.

7. Benchmarking and evaluation of progress towards targets contained in the framework and related plans conducted regularly, perhaps annually but no later than every five years. This information can gauge the extent to which development allocation targets are being met and to identify impediments to meeting desired development patterns and their reasons.

8. Technical assistance to local governments in the form of data collection and analysis, model land use regulatory codes, financial assistance such as through bundled infrastructure financing bonds, support in securing state and federal funds, and other services designed to help meet metropolitan development objectives.

9. Development of metropolitan-based funding mechanisms to improve the chances for meeting desired development patterns. These mechanisms can help pay for such metropolitan-wide services as infrastructure, open space, affordable housing, transportation, and cultural and public facilities.

Doing all this is hard work. Is it worth it, especially since real change won't be seen for many years? Noted Philadelphia city planner and urban theorist Edmund Bacon observed that it takes a generation to realize the benefits of good planning. The plan for metropolitan Portland, which many believe has become one of America's most livable large metropolitan areas, was crafted a generation ago. A "New Metropolis" that is more sustainable and generates more benefits to more people is within grasp. The data contained in this report can help to provide a foundation to reshape America's metropolitan areas in a generation.

APPENDIX TABLES

(**Readers' note**: For ease of comparison, the appendix tables are numbered to reflect their abbreviated appearance in the text, e.g. Appendix Table 2 is the full version of Table 2.)

Appendix Table 2. Residential Unit Demand by Nation, Regions, and States Ranked by the Percent of Housing Units in 2030 built since 2000

Geographic Area	Region	Population 2000[a]	Housing Units 2000[b]	Units Per Person 2000[c]	Population 2030[d]	Housing Units 2030[e]	Growth-Related Units[f]	Annual Loss Rate[g]	Units Lost 2000–2030[h]	New Housing Units Needed 2000-2030[i]	Percent New Units Built After 2000[j]	Percent New Housing Units 2030[k]
United States		281,421,906	115,904,641	0.4119	375,755,479	154,756,268	38,851,627	0.58%	20,087,433	58,939,060	50.90%	38.10%
West	W	63,197,932	24,378,020	0.386	92,769,372	35,922,057	11,544,037	0.63%	4,584,774	16,128,808	66.2%	44.9%
South	S	100,236,820	42,382,546	0.423	142,417,277	60,173,882	17,791,336	0.63%	7,953,582	25,744,922	60.7%	42.8%
Midwest	MW	64,392,776	26,963,635	0.419	78,842,607	33,026,601	6,062,966	0.58%	4,695,716	10,758,682	39.9%	32.6%
Northeast	NE	53,594,378	22,180,440	0.414	61,833,333	25,594,225	3,413,785	0.46%	3,052,917	6,466,703	29.2%	25.3%
1. Nevada	W	1,998,257	827,457	0.414	3,855,408	1,596,484	769,027	0.63%	155,620	924,646	111.7%	57.9%
2. Arizona	W	5,130,632	2,189,189	0.427	9,053,564	3,863,065	1,673,876	0.63%	411,721	2,085,596	95.3%	54.0%
3. Utah	W	2,233,169	768,594	0.344	3,855,421	1,326,928	558,334	0.63%	144,549	702,883	91.5%	53.0%
4. Florida	S	15,982,378	7,302,947	0.457	24,941,118	11,396,531	4,093,584	0.63%	1,373,465	5,467,049	74.9%	48.0%
5. Idaho	W	1,293,953	527,824	0.408	2,007,456	818,873	291,049	0.63%	99,268	390,317	73.9%	47.7%
6. Colorado	W	4,301,261	1,808,037	0.420	6,642,166	2,792,037	984,000	0.63%	340,038	1,324,038	73.2%	47.4%
7. Texas	S	20,851,820	8,157,575	0.391	31,842,364	12,457,257	4,299,682	0.63%	1,534,195	5,833,877	71.5%	46.8%
8. New Mexico	W	1,819,046	780,579	0.429	2,709,899	1,162,857	382,278	0.63%	146,803	529,081	67.8%	45.5%
9. Oregon	W	3,421,399	1,452,709	0.425	5,029,206	2,135,376	682,667	0.63%	273,211	955,878	65.8%	44.8%
10. Washington	W	5,894,121	2,451,075	0.416	8,608,089	3,579,681	1,128,606	0.63%	460,974	1,589,579	64.9%	44.4%
11. Georgia	S	8,186,453	3,281,737	0.401	11,857,569	4,753,392	1,471,655	0.63%	617,196	2,088,852	63.7%	43.9%
12. N Carolina	S	8,049,313	3,523,944	0.438	11,638,771	5,095,389	1,571,445	0.63%	662,748	2,234,193	63.4%	43.8%
13. Tennessee	S	5,689,283	2,439,443	0.429	7,982,886	3,422,891	983,448	0.63%	458,786	1,442,234	59.1%	42.1%
14. S Carolina	S	4,012,012	1,753,670	0.437	5,623,704	2,458,148	704,478	0.63%	329,813	1,034,291	59.0%	42.1%
15. Virginia	S	7,078,515	2,904,192	0.410	9,822,514	4,030,007	1,125,815	0.63%	546,191	1,672,007	57.6%	41.5%
16. California	W	33,871,648	12,214,549	0.361	46,806,172	16,878,904	4,664,355	0.63%	2,297,190	6,961,545	57.0%	41.2%
17. Delaware	S	783,600	343,072	0.438	1,082,083	473,752	130,680	0.63%	64,552	195,202	56.9%	41.2%
18. Alaska	W	626,932	260,978	0.416	855,427	356,095	95,117	0.63%	49,082	144,199	55.3%	40.5%
19. Arkansas	S	2,673,400	1,173,043	0.439	3,640,665	1,597,463	424,420	0.63%	220,614	645,034	55.0%	40.4%
20. Montana	W	902,195	412,633	0.457	1,228,041	561,664	149,031	0.63%	77,604	226,635	54.9%	40.4%
21. Minnesota	MW	4,919,479	2,065,946	0.420	6,742,736	2,831,627	765,681	0.58%	359,784	1,125,465	54.5%	39.7%
22. Maryland	S	5,296,486	2,145,283	0.405	7,132,574	2,888,970	743,687	0.63%	403,463	1,147,150	53.5%	39.7%
23. Alabama	S	4,447,100	1,963,711	0.442	5,713,896	2,523,092	559,381	0.63%	369,315	928,696	47.3%	36.8%
24. Oklahoma	S	3,450,654	1,514,400	0.439	4,433,320	1,945,666	431,266	0.63%	284,813	716,079	47.3%	36.8%
25. Mississippi	S	2,844,658	1,161,953	0.408	3,630,168	1,482,809	320,856	0.63%	218,529	539,384	46.4%	36.4%
26. Kentucky	S	4,041,769	1,750,927	0.433	5,122,215	2,218,985	468,058	0.63%	329,297	797,355	45.5%	35.9%

Geographic Area	Region	Population 2000[a]	Housing Units 2000[b]	Units Per Person 2000[c]	Population 2030[d]	Housing Units 2030[e]	Growth-Related Units[f]	Annual Loss Rate[g]	Units Lost 2000–2030[h]	New Housing Units Needed 2000-2030[i]	Percent New Units Built After 2000[j]	Percent New Housing Units 2030[k]
27. New Hampshire	NE	1,235,786	547,024	0.443	1,655,560	732,838	185,814	0.46%	75,292	261,107	47.7%	35.6%
28. Wisconsin	MW	5,363,675	2,321,144	0.433	6,831,376	2,956,296	635,152	0.58%	404,227	1,039,379	44.8%	35.2%
29. Missouri	MW	5,595,211	2,442,017	0.436	7,121,659	3,108,232	666,215	0.58%	425,277	1,091,492	44.7%	35.1%
30. Indiana	MW	6,080,485	2,532,319	0.416	7,707,060	3,209,733	677,414	0.58%	441,003	1,118,417	44.2%	34.8%
31. Hawaii	W	1,211,537	460,542	0.380	1,506,936	572,832	112,290	0.63%	86,614	198,904	43.2%	34.7%
32. South Dakota	MW	754,844	323,208	0.428	951,912	407,588	84,380	0.58%	56,287	140,667	43.5%	34.5%
33. Nebraska	MW	1,711,263	722,668	0.422	2,157,585	911,150	188,482	0.58%	125,853	314,335	43.5%	34.5%
34. Wyoming	W	493,782	223,854	0.453	611,587	277,261	53,407	0.63%	42,100	95,507	42.7%	34.4%
35. Kansas	MW	2,688,418	1,131,200	0.421	3,356,966	1,412,504	281,304	0.58%	196,998	478,302	42.3%	33.9%
36. Louisiana	S	4,468,976	1,847,181	0.413	5,443,425	2,249,954	402,773	0.63%	347,399	750,173	40.6%	33.3%
37. Vermont	NE	608,827	294,382	0.484	776,469	375,441	81,059	0.46%	40,519	121,578	41.3%	32.4%
38. Michigan	MW	9,938,444	4,234,279	0.426	11,962,676	5,096,704	862,425	0.58%	737,400	1,599,825	37.8%	31.4%
39. Illinois	MW	12,419,293	4,885,615	0.393	14,861,169	5,846,223	960,608	0.58%	850,830	1,811,438	37.1%	31.0%
40. New Jersey	NE	8,414,350	3,310,275	0.393	10,278,451	4,043,628	733,353	0.46%	455,626	1,188,979	35.9%	29.4%
41. Ohio	MW	11,353,140	4,783,051	0.421	13,058,534	5,501,529	718,478	0.58%	832,968	1,551,447	32.4%	28.2%
42. Iowa	MW	2,926,324	1,232,511	0.421	3,355,132	1,413,117	180,606	0.58%	214,642	395,247	32.1%	28.0%
43. Maine	NE	1,274,923	651,901	0.511	1,525,428	779,991	128,090	0.46%	89,728	217,817	33.4%	27.9%
44. North Dakota	MW	642,200	289,677	0.451	735,802	331,898	42,221	0.58%	50,447	92,668	32.0%	27.9%
45. Massachusetts	NE	6,349,097	2,621,989	0.413	7,365,279	3,041,642	419,653	0.46%	360,891	780,544	29.8%	25.7%
46. West Virginia	S	1,808,344	844,623	0.467	1,969,707	919,991	75,368	0.63%	158,848	234,216	27.7%	25.5%
47. Rhode Island	NE	1,048,319	439,837	0.420	1,199,026	503,068	63,231	0.46%	60,539	123,771	28.1%	24.6%
48. New York	NE	18,976,457	7,679,307	0.405	21,465,090	8,686,396	1,007,089	0.46%	1,056,980	2,064,069	26.9%	23.8%
49. Connecticut	NE	3,405,565	1,385,975	0.407	3,832,318	1,559,652	173,677	0.46%	190,766	364,443	26.3%	23.4%
50. Pennsylvania	NE	12,281,054	5,249,750	0.427	13,735,712	5,871,569	621,819	0.46%	722,576	1,344,395	25.6%	22.9%
51. Dist. Columbia	S	572,059	274,845	0.480	540,298	259,585	-15,260	0.63%	51,690	36,431	13.3%	14.0%

Source: Author's calculations. Notes for the table calculations follows the appendix..

Appendix Table 3. Residential Development Change by 50 Largest Metropolitan Areas in 2030 Ranked by the Percent of Housing Units in 2030 built since 2000

Metropolitan Area (CMSA/ MSA)	Region	Population 2000(000s)[a]	Housing Units 2000 (000s)[b]	Units Per Person 2000[c]	Population 2030(000s)[d]	Housing Units 2030 (000s)[e]	Growth-Related Units (000s)[f]	Annual Loss Rate[g]	Units Lost 2000-2030 (000s)[h]	New Housing Units Needed 2000–2030[i]	Percent New Units Built After 2000[j]	Percent New Housing Units 2030[k]
1. Las Vegas	W	1,563	656	0.42	3,200	1,343	687	0.63%	123	810	123.5%	60.3%
2. Austin	S	1,250	496	0.397	2,478	983	487	0.63%	93	580	116.9%	59.0%
3. Phoenix	W	3,252	1,331	0.409	5,906	2,417	1,086	0.63%	250	1,336	100.4%	55.3%
4. West Palm Beach	S	1,131	556	0.492	1,994	980	424	0.63%	105	529	95.1%	54.0%
5. Orlando	S	1,645	684	0.416	2,896	1,204	520	0.63%	129	649	94.9%	53.9%
6. Raleigh-Durham	S	1,188	496	0.418	2,008	838	342	0.63%	93	435	87.7%	51.9%
7. Dallas-Fort Worth CMSA	S	5,222	2,031	0.389	8,599	3,344	1,313	0.63%	382	1,695	83.5%	50.7%
8. Salt Lake City	W	1,334	456	0.342	2,187	748	292	0.63%	86	378	82.9%	50.5%
9. Sacramento CMSA	W	1,797	715	0.398	2,918	1,161	446	0.63%	134	580	81.1%	50.0%
10. Charlotte	S	1,499	616	0.411	2,411	991	375	0.63%	116	491	79.7%	49.5%
11. Nashville	S	1,231	509	0.413	1,964	812	303	0.63%	96	399	78.4%	49.1%
12. Tucson	W	844	367	0.435	1,342	584	217	0.63%	69	286	77.9%	49.0%
13. Atlanta	S	4,112	1,590	0.387	6,540	2,529	939	0.63%	299	1,238	77.9%	49.0%
14. Jacksonville	S	1,100	467	0.425	1,725	732	265	0.63%	88	353	75.6%	48.2%
15. Houston CMSA	S	4,670	1,778	0.381	7,273	2,769	991	0.63%	334	1,325	74.5%	47.9%
16. Portland CMSA	W	2,265	919	0.406	3,468	1,407	488	0.63%	173	661	71.9%	47.0%
17. Denver CMSA	W	2,582	1,043	0.404	3,926	1,586	543	0.63%	196	739	70.9%	46.6%
18. San Diego	W	2,814	1,040	0.37	4,256	1,573	533	0.63%	196	729	70.1%	46.3%
19. Fresno	W	923	311	0.337	1,391	469	158	0.63%	58	216	69.5%	46.1%
20. San Antonio	S	1,592	600	0.377	2,398	904	304	0.63%	113	417	69.5%	46.1%
21. Miami CMSA	S	3,876	1,593	0.411	5,743	2,360	767	0.63%	300	1,067	67.0%	45.2%
22. Minneapolis-St. Paul	MW	2,969	1,170	0.394	4,387	1,729	559	0.58%	204	763	65.2%	44.1%
23. Tampa-St. Petersburg	S	2,396	1,144	0.477	3,491	1,667	523	0.63%	215	738	64.5%	44.3%
24. Seattle CMSA	W	3,555	1,467	0.413	5,148	2,124	657	0.63%	276	933	63.6%	43.9%
25. Grand Rapids	MW	1,089	423	0.388	1,584	615	192	0.58%	74	266	62.9%	43.3%
26. Greenville	S	962	411	0.427	1,354	578	167	0.63%	77	244	59.4%	42.2%
27. Columbus	MW	1,540	653	0.424	2,187	927	274	0.58%	114	388	59.4%	41.9%
28. Washington-Baltimore CMSA	S	7,608	3,894	0.512	10,637	5,444	1,550	0.63%	732	2,282	58.6%	41.9%
29. Indianapolis	MW	1,607	681	0.424	2,241	950	269	0.58%	119	388	57.0%	40.8%
30. Richmond	S	997	448	0.449	1,378	619	171	0.63%	84	255	56.9%	41.2%
31. San Francisco CMSA	W	7,039	2,651	0.377	9,678	3,645	994	0.63%	499	1,493	56.3%	41.0%
32. Memphis	S	1,136	455	0.401	1,547	620	165	0.63%	86	251	55.2%	40.5%
33. Kansas City	MW	1,776	741	0.417	2,433	1,015	274	0.58%	129	403	54.4%	39.7%
34. Greensboro-W. Salem	S	1,252	536	0.428	1,695	726	190	0.63%	101	291	54.3%	40.1%
35. Norfolk-Virginia Beach	S	1,570	682	0.434	2,076	902	220	0.63%	128	348	51.0%	38.6%
36. Oklahoma City	S	1,083	466	0.43	1,426	614	148	0.63%	88	236	50.6%	38.4%
37. Los Angeles CMSA	W	16,374	5,678	0.347	21,490	7,452	1,774	0.63%	1,068	2,842	50.1%	38.1%
38. Cincinnati CMSA	MW	1,979	821	0.415	2,519	1,045	224	0.58%	143	367	44.7%	35.1%

Metropolitan Area (CMSA/ MSA)	Region	Population 2000(000s)[a]	Housing Units 2000 (000s)[b]	Units Per Person 2000[c]	Population 2030(000s)[d]	Housing Units 2030 (000s)[e]	Growth-Related Units (000s)[f]	Annual Loss Rate[g]	Units Lost 2000-2030 (000s)[h]	New Housing Units Needed 2000–2030[i]	Percent New Units Built After 2000[j]	Percent New Housing Units 2030[k]
39. Louisville	S	1,026	438	0.427	1,289	550	112	0.63%	82	194	44.3%	35.3%
40. Chicago CMSA	MW	9,158	3,486	0.381	11,388	4,335	849	0.58%	607	1,456	41.8%	33.6%
41. New Orleans	S	1,338	556	0.416	1,570	652	96	0.63%	105	201	36.2%	30.8%
42. Milwaukee CMSA	MW	1,690	693	0.41	1,986	814	121	0.58%	121	242	34.9%	29.7%
43. Boston	NE	5,819	2,417	0.399	7,193	2,870	453	0.46%	333	786	32.5%	27.4%
44. St. Louis	MW	2,604	1,093	0.42	2,995	1,257	164	0.58%	190	354	32.4%	28.2%
45. New York CMSA	NE	21,104	8,175	0.387	24,873	9,635	1,460	0.46%	1,125	2,585	31.6%	26.8%
46. Detroit CMSA	MW	5,456	2,208	0.405	6,206	2,512	304	0.58%	385	689	31.2%	27.4%
47. Philadelphia CMSA	NE	6,188	2,540	0.41	7,188	2,950	410	0.46%	350	760	29.9%	25.8%
48. Cleveland CMSA	MW	2,946	1,246	0.423	3,164	1,338	92	0.58%	217	309	24.8%	23.1%
49. Hartford	NE	1,183	483	0.408	1,253	512	29	0.46%	67	95	19.7%	18.6%
50. Pittsburgh	NE	2,359	1,046	0.443	2,411	1,069	23	0.46%	144	167	16.0%	15.6%

Source: Author's calculations. Notes for the table calculations follow the appendix.

The Cincinnati, Louisville and Philadelphia metropolitan areas extend slightly into other census-defined regions. The designations above reflect the primary region. All areas are MSAs unless otherwise indicated.

Appendix Table 5. Commercial and Institutional Square Feet Demand for Nation, Regions, and States Ranked by the Percentage of Square Feet in 2030 Built Since 2000.

Geographic Area	Region	Workers 2000 (000s)[a]	Square Feet Per Worker[b]	Estimated Square Feet in 2000 (000s)[c]	Average Annual Rate of Loss[d]	Estimated Loss 2000-2030 (000s)[e]	Workers 2030 (000s)[f]	Square Feet Needed 2030 (000s)[g]	New & Replaced Square Feet (000s)[h]	Percent Total Square Feet Built After 2000[i]	New Square Feet as Percent of All Square Feet in 2030[j]
United States		129,312	826	106,784,896	1.37%	43,888,593	193,657	159,327,980	96,431,677	90.3%	60.5%
South	S	45,031	805	36,249,955	1.37%	14,898,732	71,528	57,580,040	36,228,817	99.9%	62.9%
West	W	29,269	737	21,571,253	1.37%	8,865,784	46,081	33,961,697	21,256,228	98.5%	62.6%
Midwest	MW	29,888	917	27,407,296	1.37%	11,264,400	43,001	39,431,917	23,289,021	85.0%	59.1%
Northeast	NE	25,124	858	21,556,392	1.37%	8,859,677	33,047	28,354,326	15,657,611	72.6%	55.2%
1. Nevada	W	1,052	737	775,324	1.37%	318,658	2,067	1,523,379	1,066,713	137.6%	70.0%
2. Arizona	W	2,264	737	1,668,568	1.37%	685,781	4,318	3,182,366	2,199,579	131.8%	69.1%
3. Utah	W	1,094	737	806,278	1.37%	331,380	2,019	1,488,003	1,013,105	125.7%	68.1%
4. Florida	S	7,411	805	5,965,855	1.37%	2,451,966	12,587	10,132,535	6,618,646	110.9%	65.3%
5. Idaho	W	562	737	414,194	1.37%	170,234	941	693,517	449,557	108.5%	64.8%
6. Texas	S	9,417	805	7,580,685	1.37%	3,115,662	15,618	12,572,490	8,107,467	106.9%	64.5%
7. South Carolina	S	1,680	805	1,352,400	1.37%	555,836	2,779	2,237,095	1,440,531	106.5%	64.4%
8. North Carolina	S	3,500	805	2,817,500	1.37%	1,157,993	5,766	4,641,630	2,982,123	105.8%	64.2%
9. Colorado	W	2,329	737	1,716,473	1.37%	705,470	3,757	2,768,909	1,757,906	102.4%	63.5%
10. Tennessee	S	2,589	805	2,084,145	1.37%	856,584	4,155	3,344,775	2,117,214	101.6%	63.3%
11. Georgia	S	3,724	805	2,997,820	1.37%	1,232,104	5,948	4,788,140	3,022,424	100.8%	63.1%
12. New Mexico	W	794	737	585,178	1.37%	240,508	1,263	930,831	586,161	100.2%	63.0%
13. Oregon	W	1,606	737	1,183,622	1.37%	486,469	2,552	1,880,824	1,183,671	100.0%	62.9%
14. Washington	W	2,724	737	2,007,588	1.37%	825,119	4,311	3,177,207	1,994,738	99.4%	62.8%
15. Arkansas	S	1,046	805	842,030	1.37%	346,074	1,637	1,317,785	821,829	97.6%	62.4%
16. South Dakota	MW	382	917	350,294	1.37%	143,971	593	543,781	337,458	96.3%	62.1%
17. Virginia	S	3,426	805	2,757,930	1.37%	1,133,509	5,263	4,236,715	2,612,294	94.7%	61.7%
18. Mississippi	S	1,057	805	850,885	1.37%	349,714	1,617	1,301,685	800,514	94.1%	61.5%
19. Minnesota	MW	2,562	917	2,349,354	1.37%	965,584	3,908	3,583,636	2,199,866	93.6%	61.4%

Geographic Area	Region	Workers 2000 (000s)[a]	Square Feet Per Worker[b]	Estimated Square Feet in 2000 (000s)[c]	Average Annual Rate of Loss[d]	Estimated Loss 2000-2030 (000s)[e]	Workers 2030 (000s)[f]	Square Feet Needed 2030 (000s)[g]	New & Replaced Square Feet (000s)[h]	Percent Total Square Feet Built After 2000[i]	New Square Feet as Percent of All Square Feet in 2030[j]
20. Kentucky	S	1,650	805	1,328,250	1.37%	545,911	2,498	2,010,890	1,228,551	92.5%	61.1%
21. Delaware	S	393	805	316,365	1.37%	130,026	592	476,560	290,221	91.7%	60.9%
22. Montana	W	440	737	324,280	1.37%	133,279	661	487,157	296,156	91.3%	60.8%
23. New Hampshire	NE	596	858	511,368	1.37%	210,172	893	766,194	464,998	90.9%	60.7%
24. California	W	15,222	737	11,218,614	1.37%	4,610,850	22,592	16,650,304	10,042,540	89.5%	60.3%
25. Alabama	S	1,768	805	1,423,240	1.37%	584,952	2,622	2,110,710	1,272,422	89.4%	60.3%
26. Indiana	MW	2,632	917	2,413,544	1.37%	991,967	3,871	3,549,707	2,128,130	88.2%	60.0%
27. West Virginia	S	691	805	556,255	1.37%	228,621	1,014	816,270	488,636	87.8%	59.9%
28. Wisconsin	MW	2,468	917	2,263,156	1.37%	930,157	3,619	3,318,623	1,985,624	87.7%	59.8%
29. Maryland	S	2,607	805	2,098,635	1.37%	862,539	3,801	3,059,805	1,823,709	86.9%	59.6%
30. Oklahoma	S	1,502	805	1,209,110	1.37%	496,944	2,189	1,762,145	1,049,979	86.8%	59.6%
31. Kansas	MW	1,320	917	1,210,440	1.37%	497,491	1,920	1,760,640	1,047,691	86.6%	59.5%
32. Missouri	MW	2,687	917	2,463,979	1.37%	1,012,695	3,908	3,583,636	2,132,352	86.5%	59.5%
33. Wyoming	W	246	737	181,302	1.37%	74,515	356	262,372	155,585	85.8%	59.3%
34. Nebraska	MW	901	917	826,217	1.37%	339,575	1,300	1,192,100	705,458	85.4%	59.2%
35. Michigan	MW	4,181	917	3,833,977	1.37%	1,575,765	6,008	5,509,336	3,251,124	84.8%	59.0%
36. Louisiana	S	1,883	805	1,515,815	1.37%	623,000	2,703	2,175,915	1,283,100	84.6%	59.0%
37. Vermont	NE	298	858	255,684	1.37%	105,086	427	366,366	215,768	84.4%	58.9%
38. North Dakota	MW	338	917	309,946	1.37%	127,388	483	442,911	260,353	84.0%	58.8%
39. Alaska	W	307	737	226,259	1.37%	92,992	438	322,806	189,539	83.8%	58.7%
40. Iowa	MW	1,429	917	1,310,393	1.37%	538,572	2,023	1,855,091	1,083,270	82.7%	58.4%
41. Ohio	MW	5,163	917	4,734,471	1.37%	1,945,868	7,237	6,636,329	3,847,726	81.3%	58.0%
42. Illinois	MW	5,825	917	5,341,525	1.37%	2,195,367	8,131	7,456,127	4,309,969	80.7%	57.8%
43. Maine	NE	594	858	509,652	1.37%	209,467	818	701,844	401,659	78.8%	57.2%
44. New Jersey	NE	3,920	858	3,363,360	1.37%	1,382,341	5,338	4,580,004	2,598,985	77.3%	56.7%
45. Massachusetts	NE	3,333	858	2,859,714	1.37%	1,175,342	4,494	3,855,852	2,171,480	75.9%	56.3%
46. Pennsylvania	NE	5,407	858	4,639,206	1.37%	1,906,714	7,275	6,241,950	3,509,458	75.6%	56.2%
47. Rhode Island	NE	454	858	389,532	1.37%	160,098	610	523,380	293,946	75.5%	56.2%
48. Connecticut	NE	1,684	858	1,444,872	1.37%	593,842	2,258	1,937,364	1,086,334	75.2%	56.1%

Geographic Area	Region	Workers 2000 (000s)[a]	Square Feet Per Worker[b]	Estimated Square Feet in 2000 (000s)[c]	Average Annual Rate of Loss[d]	Estimated Loss 2000-2030 (000s)[e]	Workers 2030 (000s)[f]	Square Feet Needed 2030 (000s)[g]	New & Replaced Square Feet (000s)[h]	Percent Total Square Feet Built After 2000[i]	New Square Feet as Percent of All Square Feet in 2030[j]
49. Hawaii	W	629	737	463,573	1.37%	190,529	806	594,022	320,978	69.2%	54.0%
50. New York	NE	8,838	858	7,583,004	1.37%	3,116,615	10,934	9,381,372	4,914,983	64.8%	52.4%
51. Dist of Columbia	S	687	805	553,035	1.37%	227,297	739	594,895	269,157	48.7%	45.2%

Source: Author's calculations. Notes for the table calculations follow the appendix.

Appendix Table 6. Commercial and Institutional Square Feet Demand by 50 Largest Metropolitan Statistical Areas in 2030 Ranked by the Percentage of Square Feet in 2030 Built Since 2000.

Metropolitan Area (MSA/CMSA)	Region	Workers 2000 (000s)[a]	Square Feet Per Worker[b]	Estimated Square Feet in 2000 (000s)[c]	Average Annual Rate of Loss[d]	Estimated Loss 2000-2030 (000s)[e]	Workers 2030 (000s)[f]	Square Feet Needed 2030 (000s)[g]	New & Replaced Square Feet (000s)[h]	Percent Total Square Feet Built After 2000[i]	New Square Feet as Percent of Square Feet in 2030[j]
1. Las Vegas	W	778	737	573,386	1.37%	235,662	1,636	1,205,732	868,008	151.4%	72.0%
2. Austin	S	678	805	545,790	1.37%	224,320	1,423	1,145,515	824,045	151.0%	71.9%
3. Phoenix	W	1,570	737	1,157,090	1.37%	475,564	3,075	2,266,275	1,584,749	137.0%	69.9%
4. Orlando	S	921	805	741,405	1.37%	304,717	1,751	1,409,555	972,867	131.2%	69.0%
5. West Palm Beach	S	533	805	429,065	1.37%	176,346	985	792,925	540,206	125.9%	68.1%
6. Raleigh-Durham	S	667	805	536,935	1.37%	220,680	1,187	955,535	639,280	119.1%	66.9%
7. Charlotte	S	768	805	618,240	1.37%	254,097	1,359	1,093,995	729,852	118.1%	66.7%
8. Salt Lake City	W	726	737	535,062	1.37%	219,910	1,278	941,886	626,734	117.1%	66.5%
9. Nashville	S	701	805	564,305	1.37%	231,929	1,218	980,490	648,114	114.9%	66.1%
10. Sacramento, CMSA	W	886	737	652,982	1.37%	268,376	1,533	1,129,821	745,215	114.1%	66.0%
11. Tucson	W	362	737	266,794	1.37%	109,652	624	459,888	302,746	113.5%	65.8%
12. Dallas-Ft. Worth, CMSA	S	2,737	805	2,203,285	1.37%	905,550	4,696	3,780,280	2,482,545	112.7%	65.7%
13. San Antonio	W	763	805	614,215	1.37%	252,442	1,289	1,037,645	675,872	110.0%	65.1%
14. Atlanta	S	2,231	805	1,795,955	1.37%	738,138	3,716	2,991,380	1,933,563	107.7%	64.6%
15. Tampa-St. Petersburg	S	1,219	805	981,295	1.37%	403,312	2,029	1,633,345	1,055,362	107.5%	64.6%
16. Grand Rapids	MW	482	917	441,994	1.37%	181,660	795	729,015	468,681	106.0%	64.3%
17. Jacksonville	S	578	805	465,290	1.37%	191,234	945	760,725	486,669	104.6%	64.0%
18. San Diego	W	1,311	737	966,207	1.37%	397,111	2,143	1,579,391	1,010,295	104.6%	64.0%
19. Fresno	W	317	737	233,629	1.37%	96,022	516	380,292	242,685	103.9%	63.8%
20. Portland, CMSA	W	1,103	737	812,911	1.37%	334,106	1,795	1,322,915	844,110	103.8%	63.8%
21. Houston, CMSA	S	2,213	805	1,781,465	1.37%	732,182	3,601	2,898,805	1,849,522	103.8%	63.8%
22. Greensboro-Winston Salem	S	422	805	339,710	1.37%	139,621	685	551,425	351,336	103.4%	63.7%
23. Minneapolis-St. Paul	W	1,690	917	1,549,730	1.37%	636,939	2,668	2,446,556	1,533,765	99.0%	62.7%
24. Seattle, CMSA	MW	1,821	737	1,342,077	1.37%	551,594	2,875	2,118,875	1,328,392	99.0%	62.7%

Metropolitan Area (MSA/CMSA)	Region	Workers 2000 (000s)[a]	Square Feet Per Worker[b]	Estimated Square Feet in 2000 (000s)[c]	Average Annual Rate of Loss[d]	Estimated Loss 2000-2030 (000s)[e]	Workers 2030 (000s)[f]	Square Feet Needed 2030 (000s)[g]	New & Replaced Square Feet (000s)[h]	Percent Total Square Feet Built After 2000[i]	New Square Feet as Percent of Square Feet in 2030[j]
25. Miami, CMSA	S	1,833	805	1,475,565	1.37%	606,457	2,887	2,324,035	1,454,927	98.6%	62.6%
26. Denver, CMSA	W	1,494	737	1,101,078	1.37%	452,543	2,341	1,725,317	1,076,782	97.8%	62.4%
27. Columbus	MW	892	917	817,964	1.37%	336,183	1,382	1,267,294	785,513	96.0%	62.0%
28. Memphis	S	610	805	491,050	1.37%	201,822	944	759,920	470,692	95.9%	61.9%
29. Indianapolis	MW	854	917	783,118	1.37%	321,861	1,314	1,204,938	743,681	95.0%	61.7%
30. Greensboro	S	585	805	470,925	1.37%	193,550	890	716,450	439,075	93.2%	61.3%
31. Louisville	S	542	805	436,310	1.37%	179,323	819	659,295	402,308	92.2%	61.0%
32. Cincinnati, CMSA	MW	971	917	890,407	1.37%	365,957	1,460	1,338,820	814,370	91.5%	60.8%
33. Kansas City	MW	985	917	903,245	1.37%	371,234	1,459	1,337,903	805,892	89.2%	60.2%
34. San Francisco, CMSA	W	3,774	737	2,781,438	1.37%	1,143,171	5,577	4,110,249	2,471,982	88.9%	60.1%
35. Norfolk-VA Beach	S	714	805	574,770	1.37%	236,230	1,047	842,835	504,295	87.7%	59.8%
36. Washington-Baltimore, CMSA	S	4,369	805	3,517,045	1.37%	1,445,505	6,377	5,133,485	3,061,945	87.1%	59.6%
37. Richmond	S	546	805	439,530	1.37%	180,647	794	639,170	380,287	86.5%	59.5%
38. Los Angeles, CMSA	W	7,208	737	5,312,296	1.37%	2,183,354	10,178	7,501,186	4,372,244	82.3%	58.3%
39. Oklahoma City	S	556	805	447,580	1.37%	183,955	782	629,510	365,885	81.7%	58.1%
40. St. Louis	MW	1,299	917	1,191,183	1.37%	489,576	1,825	1,673,525	971,918	81.6%	58.1%
41. Chicago, CMSA	MW	4,432	917	4,064,144	1.37%	1,670,363	6,215	5,699,155	3,305,374	81.3%	58.0%
42. Milwaukee, CMSA	MW	849	917	778,533	1.37%	319,977	1,179	1,081,143	622,587	80.0%	57.6%
43. Detroit, CMSA	MW	2,392	917	2,193,464	1.37%	901,514	3,307	3,032,519	1,740,569	79.4%	57.4%
44. Boston, CMSA	NE	3,215	858	2,758,470	1.37%	1,133,731	4,402	3,776,916	2,152,177	78.0%	57.0%
45. New Orleans	S	650	805	523,250	1.37%	215,056	875	704,375	396,181	75.7%	56.2%
46. Philadelphia, CMSA	NE	2,933	858	2,516,514	1.37%	1,034,287	3,938	3,378,804	1,896,577	75.4%	56.1%
47. Cleveland, CMSA	MW	1,390	917	1,274,630	1.37%	523,873	1,856	1,701,952	951,195	74.6%	55.9%
48. Pittsburgh	NE	1,108	858	950,664	1.37%	390,723	1,440	1,235,520	675,579	71.1%	54.7%
49. New York, CMSA	NE	10,067	858	8,637,486	1.37%	3,550,007	12,788	10,972,104	5,884,625	68.1%	53.6%
50. Hartford	NE	654	858	561,132	1.37%	230,625	828	710,015	379,509	67.6%	53.5%

Source: Author's calculations. Notes for the table calculations and the full table follow the appendix.

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Appendix Table 7. Industrial Square Feet Demand for Nation, Regions, and States Ranked by the Percent of Square Feet in 2030 built since 2000

Geographic Area	Region	Workers 2000 (000s)[a]	Square Feet Per Worker[b]	Estimated Square Feet in 2000 (000s)[c]	Average Annual Rate of Loss[d]	Estimated Loss 2000-2030 (000s)[e]	Workers 2030 (000s)[f]	Square Feet Needed 2030 (000s)[g]	New & Replaced Square Feet (000s)[h]	Percent Total Square Feet Built After 2000i	New Square Feet as Percent of Square Feet in 2030[j]
United States		**19,293**	**640**	**12,342,519**	**2.0%**	**7,405,510**	**20,485**	**13,221,841**	**8,284,832**	**67.1%**	**62.7%**
West	W	3,531	613	2,164,503	2.0%	1,298,702	3,952	2,422,576	1,556,775	71.9%	64.3%
Midwest	MW	6,034	893	5,388,362	2.0%	3,233,017	6,635	5,925,055	3,769,710	70.0%	63.6%
South	S	6,332	493	3,121,676	2.0%	1,873,005	6,929	3,415,997	2,167,326	69.4%	63.4%
Northeast	NE	3,396	491	1,667,978	2.0%	1,000,786	2,969	1,458,213	791,021	47.4%	54.2%
1. Nevada	W	47	613	28,811	2.0%	17,287	70	42,910	31,386	108.9%	73.1%
2. North Dakota	MW	26	893	23,218	2.0%	13,931	38	33,934	24,647	106.2%	72.6%
3. Utah	W	140	613	85,820	2.0%	51,492	195	119,535	85,207	99.3%	71.3%
4. Wyoming	W	53	893	47,329	2.0%	28,397	73	65,189	46,257	97.7%	71.0%
5. South Dakota	MW	14	613	8,582	2.0%	5,149	19	11,647	8,214	95.7%	70.5%
6. Idaho	W	83	613	50,879	2.0%	30,527	109	66,817	46,465	91.3%	69.5%
7. Nebraska	MW	123	893	109,839	2.0%	65,903	155	138,415	94,479	86.0%	68.3%
8. Arizona	W	225	613	137,925	2.0%	82,755	279	171,027	115,857	84.0%	67.7%
9. Arkansas	S	220	893	196,460	2.0%	117,876	268	239,324	160,740	81.8%	67.2%
10. Kansas	MW	264	493	130,152	2.0%	78,091	321	158,253	106,192	81.6%	67.1%
11. Minnesota	MW	460	893	410,780	2.0%	246,468	549	490,257	325,945	79.3%	66.5%
12. Oregon	W	261	613	159,993	2.0%	95,996	311	190,643	126,646	79.2%	66.4%
13. Texas	S	1,136	493	560,048	2.0%	336,029	1,351	666,043	442,024	78.9%	66.4%
14. Montana	W	193	493	95,149	2.0%	57,089	228	112,404	74,344	78.1%	66.1%
15. Oklahoma	S	218	613	133,634	2.0%	80,180	256	156,928	103,474	77.4%	65.9%
16. Colorado	W	270	893	241,110	2.0%	144,666	316	282,188	185,744	77.0%	65.8%
17. Iowa	MW	30	613	18,390	2.0%	11,034	35	21,455	14,099	76.7%	65.7%
18. Wisconsin	MW	641	893	572,413	2.0%	343,448	744	664,392	435,427	76.1%	65.5%
19. Georgia	S	614	493	302,702	2.0%	181,621	702	346,086	225,005	74.3%	65.0%
20. Kentucky	S	332	493	163,676	2.0%	98,206	375	184,875	119,405	73.0%	64.6%
21. Florida	S	516	493	254,388	2.0%	152,633	573	282,489	180,734	71.0%	64.0%
22. New Mexico	W	49	613	30,037	2.0%	18,022	54	33,102	21,087	70.2%	63.7%
23. Indiana	MW	706	893	630,458	2.0%	378,275	778	694,754	442,571	70.2%	63.7%
24. Louisiana	S	195	493	96,135	2.0%	57,681	214	105,502	67,048	69.7%	63.6%
25. Michigan	MW	251	493	123,743	2.0%	74,246	271	133,603	84,106	68.0%	63.0%
26. Mississippi	S	1,007	893	899,251	2.0%	539,551	1,085	968,905	609,205	67.7%	62.9%
27. California	W	2,036	613	1,248,068	2.0%	748,841	2,184	1,338,792	839,565	67.3%	62.7%

Geographic Area	Region	Workers 2000 (000s)[a]	Square Feet Per Worker[b]	Estimated Square Feet in 2000 (000s)[c]	Average Annual Rate of Loss[d]	Estimated Loss 2000-2030 (000s)[e]	Workers 2030 (000s)[f]	Square Feet Needed 2030 (000s)[g]	New & Replaced Square Feet (000s)[h]	Percent Total Square Feet Built After 2000[i]	New Square Feet as Percent of Square Feet in 2030[j]
28. Ohio	MW	1,129	893	1,008,197	2.0%	604,918	1,208	1,078,744	675,465	67.0%	62.6%
29. Alaska	W	16	613	9,808	2.0%	5,885	17	10,421	6,498	66.3%	62.4%
30. North Carolina	S	823	493	405,739	2.0%	243,443	868	427,924	265,628	65.5%	62.1%
31. Virginia	S	409	493	201,637	2.0%	120,982	429	211,497	130,842	64.9%	61.9%
32. Washington	W	392	613	240,296	2.0%	144,178	405	248,265	152,147	63.3%	61.3%
33. Alabama	S	525	493	258,825	2.0%	155,295	536	264,248	160,718	62.1%	60.8%
34. Illinois	MW	976	893	871,568	2.0%	522,941	996	889,428	540,801	62.0%	60.8%
35. New Hampshire	NE	379	493	186,847	2.0%	112,108	386	190,298	115,559	61.8%	60.7%
36. Tennessee	S	112	491	54,992	2.0%	32,995	114	55,974	33,977	61.8%	60.7%
37. Missouri	MW	423	893	377,739	2.0%	226,643	425	379,525	228,429	60.5%	60.2%
38. Maryland	S	13	493	6,409	2.0%	3,845	13	6,409	3,845	60.0%	60.0%
39. South Carolina	S	185	493	91,205	2.0%	54,723	183	90,219	53,737	58.9%	59.6%
40. Dist. Columbia	S	351	493	173,043	2.0%	103,826	342	168,606	99,389	57.4%	58.9%
41. Vermont	NE	52	491	25,532	2.0%	15,319	50	24,550	14,337	56.2%	58.4%
42. Delaware	S	85	493	41,905	2.0%	25,143	80	39,440	22,678	54.1%	57.5%
43. West Virginia	S	61	493	30,073	2.0%	18,044	57	28,101	16,072	53.4%	57.2%
44. Pennsylvania	NE	959	491	470,869	2.0%	282,521	896	439,936	251,588	53.4%	57.2%
45. Maine	NE	94	491	46,154	2.0%	27,692	87	42,717	24,255	52.6%	56.8%
46. Hawaii	W	20	613	12,260	2.0%	7,356	18	11,034	6,130	50.0%	55.6%
47. Massachusetts	NE	445	491	218,495	2.0%	131,097	389	190,999	103,601	47.4%	54.2%
48. New Jersey	NE	473	491	232,243	2.0%	139,346	395	193,945	101,048	43.5%	52.1%
49. New York	NE	914	491	448,774	2.0%	269,264	760	373,160	193,650	43.2%	51.9%
50. Connecticut	NE	76	491	37,316	2.0%	22,390	61	29,951	15,025	40.3%	50.2%
51. Rhode Island	NE	271	493	133,603	2.0%	80,162	217	106,981	53,540	40.1%	50.0%

Source: Author's calculations. Notes for the table calculations follow the appendix.

Appendix Table 8. Industrial Square Feet Demand for 50 Largest Metropolitan Statistical Areas Ranked by the Percent of Square Feet in 2030 built since 2000

Metropolitan Area	Region	Workers 2000[a]	Square Feet Per Worker[b]	Estimated Square Feet in 2000 (000s)[c]	Average Annual Rate of Loss[d]	Estimated Loss 2000–2030 (000s)[e]	Workers 2030 (000s)[f]	Square Feet Needed 2030 (000s)[g]	New & Replaced Square Feet (000s)[h]	Percentage Percent Total Square Feet Built After 2000[i]	New Square Feet as Percent of Square Feet in 2030[j]
1. Austin	S	85	493	41,905	2.0%	25,143	124	61,132	44,370	105.9%	72.6%
2. Sacramento, CMSA	W	62	613	38,006	2.0%	22,804	90	55,170	39,968	105.2%	72.4%
3. Las Vegas	W	26	613	15,938	2.0%	9,563	36	22,068	15,693	98.5%	71.1%
4. Salt Lake City	W	89	613	54,557	2.0%	32,734	119	72,947	51,124	93.7%	70.1%
5. Houston, CMSA	S	239	493	117,827	2.0%	70,696	319	157,267	110,136	93.5%	70.0%
6. Phoenix	W	173	613	106,049	2.0%	63,629	219	134,247	91,827	86.6%	68.4%
7. Portland, CMSA	W	174	613	106,662	2.0%	63,997	216	132,408	89,743	84.1%	67.8%
8. Oklahoma City	S	58	493	28,594	2.0%	17,156	70	34,510	23,072	80.7%	66.9%
9. Grand Rapids	MW	166	893	148,238	2.0%	88,943	200	178,600	119,305	80.5%	66.8%
10. West Palm Beach	S	35	493	17,197	2.0%	10,318	42	20,706	13,827	80.4%	66.8%
11. Atlanta	S	236	493	116,348	2.0%	69,809	284	140,012	93,473	80.3%	66.8%
12. Tucson	W	33	613	20,229	2.0%	12,137	39	23,907	15,815	78.2%	66.2%
13. Cleveland, CMSA	MW	304	893	271,472	2.0%	162,883	355	317,015	208,426	76.8%	65.7%
14. Minneapolis-St. Paul	MW	288	893	257,184	2.0%	154,310	330	294,690	191,816	74.6%	65.1%
15. San Antonio	S	58	493	28,594	2.0%	17,156	66	32,538	21,100	73.8%	64.8%
16. Jacksonville	S	41	493	20,213	2.0%	12,128	46	22,678	14,593	72.2%	64.3%
17. Dallas-Ft. Worth, CMSA	S	377	493	185,861	2.0%	111,517	422	208,046	133,702	71.9%	64.3%
18. Raleigh-Durham	S	90	493	44,370	2.0%	26,622	100	49,300	31,552	71.1%	64.0%
19. Orlando	S	57	493	28,101	2.0%	16,861	63	31,059	19,819	70.5%	63.8%
20. San Diego	W	141	613	86,433	2.0%	51,860	155	95,015	60,442	69.9%	63.6%
21. Denver, CMSA	W	143	613	87,659	2.0%	52,595	157	96,241	61,177	69.8%	63.6%
22. Fresno	W	34	613	20,670	2.0%	12,402	37	22,681	14,413	69.7%	63.5%
23. Richmond	S	62	493	30,566	2.0%	18,340	67	33,031	20,805	68.1%	63.0%
24. Nashville	S	100	493	49,300	2.0%	29,580	107	52,751	33,031	67.0%	62.6%
25. San Francisco, CMSA	W	530	613	324,890	2.0%	194,934	566	346,958	217,002	66.8%	62.5%
26. Tampa-St. Petersburg	S	94	493	46,342	2.0%	27,805	100	49,300	30,763	66.4%	62.4%
27. Greensboro-Winston Salem	S	163	493	80,359	2.0%	48,215	171	84,303	52,159	64.9%	61.9%
28. Los Angeles	W	1,090	613	668,170	2.0%	400,902	1,132	693,916	426,648	63.9%	61.5%
29. Charlotte	S	143	493	70,499	2.0%	42,299	148	72,964	44,764	63.5%	61.4%
30. Norfolk-Virginia Beach	S	70	493	34,510	2.0%	20,706	72	35,496	21,692	62.9%	61.1%
31. Cincinnati, CMSA	MW	169	893	150,917	2.0%	90,550	173	154,489	94,122	62.4%	60.9%
32. Detroit, CMSA	MW	556	893	496,508	2.0%	297,905	569	508,117	309,514	62.3%	60.9%
33. New Orleans	S	51	493	25,143	2.0%	15,086	52	25,636	15,579	62.0%	60.8%
34. Miami	S	116	493	57,188	2.0%	34,313	118	58,174	35,299	61.7%	60.7%
35. Chicago, CMSA	MW	722	893	644,746	2.0%	386,848	732	653,676	395,778	61.4%	60.5%
36. Washington-Baltimore, CMSA	S	218	493	107,474	2.0%	64,484	220	108,460	65,470	60.9%	60.4%
37. Indianapolis	MW	130	893	116,090	2.0%	69,654	131	116,983	70,547	60.8%	60.3%
38. Milwaukee, CMSA	MW	204	893	182,172	2.0%	109,303	203	181,279	108,410	59.5%	59.8%
39. Seattle, CMSA	\W	263	613	161,219	2.0%	96,731	259	158,767	94,279	58.5%	59.4%

Metropolitan Area	Region	Workers 2000[a]	Square Feet Per Worker[b]	Estimated Square Feet in 2000 (000s)[c]	Average Annual Rate of Loss[d]	Estimated Loss 2000–2030 (000s)[e]	Workers 2030 (000s)[f]	Square Feet Needed 2030 (000s)[g]	New & Replaced Square Feet (000s)[h]	Percentage Percent Total Square Feet Built After 2000[i]	New Square Feet as Percent of Square Feet in 2030[j]
40. Memphis	S	65	493	32,045	2.0%	19,227	64	31,552	18,734	58.5%	59.4%
41. Kansas City	MW	109	893	97,337	2.0%	58,402	107	95,551	56,616	58.2%	59.3%
42. Louisville	S	90	493	44,370	2.0%	26,622	88	43,384	25,636	57.8%	59.1%
43. Greenville	S	121	493	59,653	2.0%	35,792	114	56,202	32,341	54.2%	57.5%
44. Columbus	MW	96	893	85,728	2.0%	51,437	90	80,370	46,079	53.8%	57.3%
45. Boston, CMSA	NE	457	491	224,387	2.0%	134,632	414	203,274	113,519	50.6%	55.8%
46. Philadelphia, CMSA	NE	373	491	183,143	2.0%	109,886	331	162,521	89,264	48.7%	54.9%
47. Pittsburgh	NE	141	491	69,231	2.0%	41,539	124	60,884	33,192	47.9%	54.5%
48. St. Louis	MW	195	893	174,135	2.0%	104,481	165	147,345	77,691	44.6%	52.7%
49. Hartford	NE	93	491	45,663	2.0%	27,398	72	35,322	17,056	43.3%	52.0%
50. New York, CMSA	NE	979	491	480,689	2.0%	288,413	776	381,016	188,740	39.3%	49.5%

Source: Author's calculations. Notes for the table calculations follow the appendix.

NOTES FOR TABLE CALCULATIONS

Table 1

a. Total square feet estimated 2000 is the respective sum from Tables 3, 4 and 5.
b. Total square feet estimated 2030 is the respective sum from Tables 3, 4 and 5.
c. New and replaced square feet is the respective sum from Tables 3, 4 and 5.
d. New square feet as a percent of units in 2000 is the estimated new square feet constructed 2000 to 2030 divided by square feet in 2000.
e. New square feet as a percent of units in 2030 is the estimated new square feet constructed 2000 to 2030 divided by square feet in 2030.

Tables 2 and 3 (refers to Appendix Tables)

a. Population 2000 is from Summary File 2 data for nation and for states assembled into regions from www.census.gov for the 2000 Census.
b. Housing Units 2000 is from Summary File 2 data for nation and for states assembled into regions from www.census.gov for the 2000 Census.
c. Persons Per Unit 2000 is Housing Units 2000 divided by Population 2000.
d. Population 2030 extrapolated by author from data provided by a national forecasting firm.
e. Housing Units 2030 is Persons Per Unit 2000 times Population 2030.
f. Growth-Related Units is Housing Units 2030 less Housing Units 2000.
g. Annual Average Loss Rate/attrition analysis based on U.S. Department of Housing and Urban Development and U.S. Department of Commerce, American Housing Survey, 1989 and 1999, Table 2-1. Units present in 1989 are compared to those built before 1990 surviving in 1999. Annual average loss rates estimated in this way for the nation and all regions except the West for which comparable data are anomalous (the loss rate assumed in the West is that for the South).
h. Units Lost 2000-2030 is calculated as 30 years times average annual loss rate times units in 2000.
i. New Housing Units Needed 2000-2030 is Growth-Related Units plus Units Lost 2000-2030.
j. Percent Units Build After 2000 is How Housing Units Needed 2000-2030 divided by Housing Units 2000.
k. Percent New Housing Units in 2030 is New Housing Units 2000-2030 divided by Housing Units 2030.

Table 4

a. Square feet 2000 is existing units in 2000 from Census Summary File 2 by region divided into owner- and renter-occupied units with vacant units apportioned proportionately, times median unit size for owner- and renter-occupied units established by the American Housing Survey 2001 in Tables 2-3 and 3-3 respectively.
b. Square feet 2030 is square feet in 2000 less percent units lost calculated from Table 1 plus projected growth-related and replaced units from Table 1 apportioned into owner- and renter-occupied units based on distribution reported in *American Housing Survey 2001*, times square feet per owner- and renter-occupied unit built in the past fours years in Tables 2-3 and 3-3 respectively.
c. Total Growth-Related & Replaced Square Feet (000s) is square feet in 2030 less square feet in 2000 plus square feet lost 2000 to 2030 calculated pursuant to note b.
d. New & Replaced Square Feet as Percent of 2000 is total growth-related and replaced square feet divided by square feet in 2000.
e. Percent of 2030 square feet built Since 2000 is the total growth-related and replaced square feet

divided by square feet in 2030.

Tables 5 and 6 (refers to Appendix Tables)

a. Workers 2000 (000s) is an estimated extrapolation by author based on U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 1999.
b. Square Feet Per Worker is from the U.S. Department of Energy, Energy Information Administration Office, Commercial Building Energy Survey, 1999, Table B-1. Figure includes all occupied and unoccupied space for all nonresidential and nonmanufacturing buildings.
c. Estimated square feet in 2000 (000s) is workers in 2000 times mean square feet per worker in 1999.
d. The average annual rate of loss is calculated by author based on data in U.S. Department of Energy, Energy Information Administration, Nonresidential Buildings Energy Consumption Survey: Characteristics of Commercial Buildings, 1983, July 1995, Table S-2 ("Changes in the Stock of Commercial Buildings, 1979-1983"). This is the most current information according to staff of the EIA. Figure assumes square feet lost is comparable to buildings lost on an average annual basis.
e. Estimated loss, 2000 - 2030 is the estimated square feet in 2000 times average annual rate of loss times 30 years.
f. Worker estimates for 2030 based on proprietary information acquired by the author for the period 2000 to 2025 and extrapolated to 2030.
g. Square feet needed in 2030 is the square feet per worker in 1999 times estimated workers in 2030. Assumes square feet per worker does not change.
h. New and replaced square feet is the amount of square feet estimated in 2030 less square feet estimated in 2000 plus square feet lost 2000 to 2030.
i. New as a percent of total in 2000 is the estimated new square feet constructed 2000 to 2030 divided by square feet in 2000.
j. New as a percent of total in 2030 is the estimated new square feet constructed 2000 to 2030 divided by square feet in 2030.

Tables 7 and 8 (refers to Appendix Tables)

a. Workers 2000 is an estimated extrapolation by author based on U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 1999.
b. Square feet per worker is estimated from inventory of total industrial space (including vacant space) by nation and for regions in 2000 by Society of Industrial and Office Realtors acquired by author with permission August 2001, divided by estimated workers 2000.
c. Estimated square feet in 2000 is workers in 2000 times square feet per worker in 2000.
d. Average annual rate of loss is an assumption based on David Birch, Susan MacCracken Jain, Cognetics, Inc. and Price Waterhouse for National Association of Office and Industrial Parks, America's Future Industrial Space Needs Preparing for the Year 2000, 1989, p. 39. The assumption used here is the conservative 50-year useful life (2% annually).
e. Estimated loss 2000-2030 is the estimated square feet in 2000 times average annual rate of loss times 30 years.
f. Worker estimates for 2030 based on proprietary information acquired by the author for the period 2000 to 2025 and extrapolated to 2030.
g. Square feet needed in 2020 is the square feet per worker in 2000 times estimated workers in 2030. Assumes square feet per worker does not change.
h. New and replaced square feet is square feet estimated in 2030 less square feet estimated in 2000 plus square feet lost 2000 to 2030.
i. New as a percent of total in 2000 is estimated new square feet constructed 2000 to 2030 divided by square feet in 2000.
j. New as a percent of total in 2030 is estimated new square feet constructed 2000 to 2030 divided

by square feet in 2030

REFERENCES

Birch, David and others. 1989. "America's Future Industrial Space Needs Preparing for the Year 2000. Washington: National Association of Office and Industrial Parks.

Burchell, Robert and others. 2002. *Costs of Sprawl—2000* Washington: National Academy Press.

Bureau of Economic Analysis. 1999. *Regional Economic Information System*. Department of Commerce.

Bureau of the Census. 1985. *American Housing Survey*. Department of Commerce.

_____. 1997. *American Housing Survey*. Department of Commerce.

_____. 2000. *Statistical Abstract of the United States*, 12th ed. Department of Commerce.

_____. 2000a. *Characteristics of New Housing*. Department of Commerce.

_____. 2001. *American Housing Survey*. Department of Commerce.

Bureau of Labor Statistics. 2004. "Employment Situation Summary, September 2004." Department of Labor.

Bureau of Transportation Statistics. 2002 "Transportation Indicators." Department of Transportation.

Cervero, Robert. 2000. "Efficient Urbanization: Economic Performance and the Shape of the Metropolis." Working Paper. Lincoln Institute of Land Policy.

Center For Transit-Oriented Development. 2004. "Hidden In Plain Sight: Capturing the Demand for Housing Near Transit." Oakland, CA:.

Department of Commerce. 1993. "Statistical Abstract of the United States."

Department of Housing and Urban Development. 2000. "State of the Cities."

Drew, Rachel Bogardus. 2002. "New Americans, New Homeowners: The Role and Relevance of Foreign-Born First-Time Homebuyers in the U.S. Housing Market," Joint Center for Housing Studies (Cambridge: Harvard University). Report NO2-2.

Energy Information Administration. 1983 and 1995. "Nonresidential Buildings Energy Consumption Survey." US Department of Energy.

_____. 2002. "Commercial Buildings Energy Consumption Survey." US Department of Energy.

Frank, James E. 1989. *The Costs of Alternative Development Patterns: A Review of the Literature*. Washington: Urban Land Institute.

Frey, William and Alan Berube. 2002. "City Families and Suburban Singles: An Emerging Household Story from Census 2000." Washington: Brookings Institution. Available at www.brookings.edu/metro/census/freyfamiliesexecsum.htm.

Katz, Bruce. 2002. "Smart Growth: The Future of the American Metropolis?." Washington: Brookings Institution. Available at www.brookings.edu/metro/publications/20021104katzlse2.htm

Lindsay, James and Audrey Singer. 2003. "Changing Faces: Immigrants and Diversity in the Twenty First Century," in Agenda for the Nation, Henry Aaron, James Lindsay, and Pietro Nivola, eds (Washington: Brookings Press).

Muro, Mark and Robert Puentes. 2004. "Investing in a Better Future: A Review Of The Fiscal And Competitive Advantages of Smarter Growth Development Patterns." Washington: Brookings Institution. Available at www.brookings.edu/metro/publications/200403_smartgrowth.htm.

National Association of Realtors. 2001. "Community and Housing Preference Survey." Washington.

_____. 2004. "Existing Home Sales Data." Washington. Accessed August 11, 2004. Available at www.realtor.org/research.nsf/pages/EHSPage?OpenDocument.

Nelson, Arthur C and others. 1995. "Exurban Industrialization," *Economic Development Quarterly* 9(2): 119-133.

Nelson, Arthur C., and David Peterman. 2000. “Does Growth Management Matter: The Effect of Growth Management on Economic Performance.” *Journal of Planning Education and Research* 19: 277–285.

Singer, Audrey. 2004. "The Rise of New Immigrant Gateways" (Washington: Brookings). http://www.brook.edu/urban/publications/20040301_gateways.htm.

Urban Land Institute. 1999. "Parking Requirements for Shopping Centers." Washington.

_____. 2004. "Emerging Trends in Real Estate." Washington.