BUILDING SIZE, SHAPE, AND PLACEMENT REGULATIONS:
BULK CONTROL ZONING REEXAMINED

The tremendous growth of American cities in the past hundred years has been accomplished almost completely by private action. Yet uncontrolled private builders have made the American city one of the primary examples of irrational land development. Spurred on by the profit motive, private developers have been either unaware of or unconcerned with the long-range consequences of their actions. The unplanned concentration of many people in a small area has hampered the development of public services. Congestion has created blighted areas which inevitably present grave financial problems to the city, and, more serious, cause irreparable physical and psychological injury to the human beings who must live there.

1. See Rodgers, New York Plans for the Future 53-72 (1943). Traffic congestion—expensive and time consuming—is a prime example of the city's problems. See Mumford, The Sky Line, New Yorker, Mar. 25, 1950, pp. 64, 71-2: "In the midtown area [of New York], between eleven in the morning and six in the evening, it is often quicker to walk anywhere than to take a taxi or bus. If the custom of overloading the land with twenty—and thirty-story skyscrapers persists, even walking will be reduced to the best speed one can now achieve on Broadway during the theatre rush—a mile an hour. Though there has been little construction of buildings for twenty years, the multiplication of motor-cars has been enough to bring on a creeping paralysis, and now that this congestion is being aggravated by a series of new office buildings in mid-Manhattan, the grim end is in sight. As the city nears strangulation, because of the congestion of its streets, the overcrowding of its transit lines, and the lack of off-street parking space, our builders are cheerfully tightening the hangman's noose by creating buildings that not only augment the traffic on the streets they abut but do not provide any off-street parking space for the vehicles of their occupants and visitors."

2. See Sanders & Rabuck, New City Patterns 15-21 (1946); Citizens' Housing Council, Densities in New York City 5 (1944).

From 1935-1944 valuation losses in the central business district of Boston were $132,040,000 or 24.4%, in Baltimore from 1931-1945 there was a decline of $60,000,000 or 34.3%, in Milwaukee from 1930-1944 a decline of $88,625,810 or 38.7%, and in Seattle from 1928-1944 a decline of $16,400,000 or 44.2%. American Automobile Assoc., Parking Manual 169 (Appendix II, 1946).

3. "The Committee on the Hygiene of Housing has correctly pointed out that more damage is done to the health of the children of the United States by a sense of chronic inferiority due to the consciousness of living in sub-standard dwellings than by all the defective plumbing which those dwellings may contain.

"Bad housing, as a matter of practical fact, is profoundly detrimental to health; and the existence of the slum is a health problem of outstanding significance." Winslow, Health and Housing, American Public Health Assoc., Housing for Health 9 (1941). See also Chapin, Social Effects of Good Housing, p. 140 and Britten, Brown and Altman, Certain Characteristics of Urban Housing and Their Relation to Illness and Accidents, p. 159 in the same volume and Sanders & Rabuck, New City Patterns 13 (1946).

For evidence that blighted areas are crime areas and the major source of juvenile delinquents, see Sanders & Rabuck, op. cit. supra at 12.

The plight of the prosperous is in some ways similar to that of the slum dweller. For a discussion of the lack of simple amenities such as sunlight, air and open space in the "Park Avenue slums" see Mumford, The Sky Line, New Yorker, Mar. 4, 1950, p. 64.
The city zoning ordinance attempts to solve these problems by channeling private action along lines which will develop land more rationally.\(^4\) Zoning is by no means a panacea,\(^5\) but it is one of the few available methods of controlling private action.\(^6\) Its operation, therefore, should be carefully scrutinized, and constant attempts should be made to improve its usefulness.

Zoning ordinances, in general, operate in two different ways. They regulate the use to which land is put, and they control the bulk of buildings, \(i.e.,\) the size, shape, and placement of buildings on the land. Use regulations, designed to prevent incompatible mixtures of land use, have received the lion's share of attention from courts and writers.\(^7\)Bulk regulations, on the other hand, have gone relatively unnoticed.

Bulk controls are used to achieve three similar ends: control over density of population in living and working areas, adequate daylighting of buildings, and sufficient open space around buildings for rest and recreation.\(^8\) Popula-

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4. The New York zoning ordinance of 1916 was one of the first comprehensive zoning ordinances in the United States. For an account of earlier ordinances regulating heights of buildings, open spaces and the exclusion of industry from residential areas, see COMM'N ON BUILDING DISTRICTS AND RESTRICTIONS, FINAL REPORT 59–72 (1916). The New York ordinance was, and still is, divided into three parts—height districts, area districts (yard regulations) and use districts—each covering the entire city. The more recent tendency is to place all restrictions relating to one area in a single section, thus simplifying the ordinance.

5. The main objections to zoning are that it does not go fast enough or far enough. Zoning is, of necessity, a long-range tool. Because of constitutional objections it operates only prospectively, hence it can do little toward reducing present bulk or changing existing uses. See, however, Notes, 35 Va. L. Rev. 348 (1949), 9 U. of Chi. L. Rev. 477 (1942) on the possibilities of amortizing the cost of a building which does not conform to the use regulations of a given district. The answer to this criticism of zoning ordinances, of course, is not to despair of zoning as a solution, but to get an effective ordinance on the books as soon as possible.

The second objection is more serious, namely, that zoning cannot hope to reduce congestion since this would reduce the high land values of congested areas. Constitutional objections as to taking property without compensation are then raised. Thus it is said that condemnation is the only possible alternative. See Mumford, The Sky Line, New Yorker, Mar. 25, 1950, pp. 64, 71. Till such strong measures are taken, however, zoning can still prove useful in preventing areas from becoming congested by keeping densities low and may also hope slowly to reduce building bulk in congested areas.

6. See Comments, 57 Yale L.J. 219 (1947) on the feasibility of using municipal real estate taxation as an instrument in community planning, 54 Yale L. J. 116 (1944) on the general problem of urban redevelopment, and 60 Yale L.J. 112 (1951) on recent developments in Great Britain. Slum clearance and low rent housing sponsored by the federal, state or municipal government supplant private action.

7. See Note, 35 Va. L. Rev. 348 (1949) and materials cited.

8. These purposes are usually set forth in the state enabling act permitting zoning. Other aims are also stated but they are either general statements of uncertain content or aims which are achieved by control over density, daylighting of buildings or open space. See, for example, New Jersey's formulation of the aims of zoning. "Aims of zoning; essential considerations. Such regulations shall be in accordance with a comprehensive plan and designed for one or more of the following purposes: to lessen congestion in the streets; secure safety from fire, panic and other dangers; promote health, morals or the general welfare;
tion density control is aimed at solving some of the problems of congestion. It strikes at the root of the traffic problem by preventing overconcentration. It also furnishes a sound basis for planning municipal services such as schools, sewers, and transportation lines, and provides the basic tool for organizing commercial and residential areas in more nearly self-contained neighborhoods. Daylighting of buildings and open space provisions are supplementary to density controls but no less vital, for they are also aimed at increasing the amenity of city life and, correlated with density controls, at the abolition of blighted areas.

The three ends of bulk control have not always been so clearly defined. The chief objective of early zoning ordinances, such as the New York ordinance of 1916, was to secure adequate daylighting of buildings in downtown areas and to prevent congestion by putting limits on the size of skyscrapers, then a new phenomenon. Control over population density in the various residential areas of the city, if it was considered at all, was achieved as a by-product of these regulations. Today the importance of the two has been reversed. The emphasis is now on control over the levels of density.

Courts have given a wide variety of legitimate aims for bulk regulations, e.g., protection against fire and protection of health by ensuring light and air, Welch v. Swasey, 193 Mass. 364, 79 N.E. 745 (1907), aff'd, 214 U.S. 91 (1909), affording room for lawns and trees, keeping dwellings farther from the dust, noise and fumes of the street, adding to the attractiveness and comfort of a residential district and creating a better home environment, Gorieb v. Fox, 274 U.S. 603 (1927), and preventing overtaxing of sewerage facilities, Van Duyne v. Senior, 105 N.J.L. 257, 143 Atl. 437 (1928).

"Snob zoning"—the use of bulk regulations to create exclusive residential districts—has had a mixed reception with the courts. Some have declared such regulations void, while others have upheld them if some "reasonable basis" could be found. See Note, 50 Col. L. Rev. 202, 204–7 (1950). Lot area requirements of two acres per family have been upheld in New York State, Dilliard v. Village of North Hills, 276 App. Div. 969, 94 N.Y.S. 2d 715 (2d Dep't 1950). Some cities permit even larger areas. See also the discussion of minimum cost and minimum floor area requirements infra note 29.

Planned neighborhoods have long been the goal of planners and sociologists who feel that individuals should live in some definite community smaller than the city. Density control is vital in order to keep the neighborhood at the optimum size, to allow enough open area for light, air and recreation and to avoid overloading the neighborhood community facilities. See American Public Health Assoc., Planning the Neighborhood, Chap. VI (1948); Gropius, Rebuilding our Communities (1945).

Regulations providing control over density, daylighting of buildings and open space will not achieve these aims single-handedly, of course. They must be correlated with sound use regulations which will prevent the mixture of incompatible land uses, such as dwellings in industrial areas, and allow mixed land uses, such as small shopping centers in residential areas, when they are in fact compatible.

in residential areas. Daylighting and open space regulations in residential and downtown areas are still needed, however, for general density control does not assure adequate daylight or sufficient open space.

The devices available to achieve these ends have also changed radically. Height limitation, set-back, and yard requirements were usually the sole means of regulating the building's shape, volume, and placement on the land in early zoning ordinances. Since then, a sharpening of the goals has led to the refinement of old techniques and the development of new ones. Furthermore, large scale housing projects, built in disregard of street and lot lines on which many controls were based, has hastened the development of additional new techniques.

Yet despite these new techniques, few zoning ordinances have been effective in achieving density control, adequate daylighting of buildings, and sufficient open space. There are two basic reasons for this. Many zoning ordinances are based on unrealistic estimates of the city's needs and growth. Moreover, numerous cities have either failed to adopt the newer, more refined controls, or they have utilized recent techniques which have undesirable by-products. If these two difficulties can be overcome, zoning ordinances regulating the size, shape, and placement of buildings can become a positive force in guiding city growth.

**Estimating the City's Needs**

The first essential for effective bulk control is a factual assessment of the city, both present and future. Without such an assessment bulk controls may be either too stringent, thus preventing natural growth, or too loose, thus exercising little or no control. In the past, zoning ordinances have erred on the side of too little rather than too much control. In New York

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12. Set-back regulations require that a building, after rising from the street or lot line a certain distance, must be set back from that line at a certain ratio, for example, one foot for each additional three feet of height. For a discussion of set-back regulations, see page 514 infra.

13. Yard requirements specify the amount of space which must be set aside for front, side and rear yards.


15. Optimism, fear of court disapproval and lack of planning techniques characterized early ordinances. Optimism has been largely dispelled; immigration laws have been tightened and the birth rate is declining. In addition most cities are growing at a diminished rate, if they are growing at all. SIXTEENTH CENSUS OF THE U.S.: 1940, POPULATION, vol. 1, p. 32. Fear of court disapproval is not the obstacle it once was. Courts have become accustomed to zoning ordinances and are increasingly cognizant of the part they play in attempting to solve pressing city problems. Planning techniques have been developed to a point where planners can make accurate forecasts of the city's growth in the future.

The belief that every town should become another New York also seems to be disappearing. West Orange, New Jersey, for example, through the Board of Commissioners and the Planning Board, unanimously rejected a proposal to rezone the city to permit a 5,300-family garden apartment project although there would have been a substantial re-
City before 1944, for example, dwellings accommodating 77,000,000 persons could have been built in exclusively residential areas without violating the zoning ordinance. Today, however, more and more cities are basing their zoning ordinances on plans which accurately forecast the city's growth. Levels of density can thus be set throughout the city which will control future expansion.

The job of setting desirable levels of density for each part of the city is not easy. Maximum permissible densities according to health experts must be established. The future population growth of the city and the best places to accommodate it must be considered, as well as the existing population and building bulk in the area, present congestion, population and building trends, proximity to working areas, transportation facilities, land...
values, and at least the minimal requirements for daylighting buildings and open space.\textsuperscript{21}

The figures finally arrived at through this study cannot be accepted unequivocally. American cities do not compensate the owner for restrictions imposed on his land,\textsuperscript{22} and therefore courts may regard any restrictive ordinance as a "taking of property without due process of law." Courts confronted with this problem have drawn a vague line based on "reason."\textsuperscript{23}

\textsuperscript{21} The need for sunlight, light pleasant rooms and open space for recreation is a fact on which everyone agrees, but the formulation of exact standards has been hampered by lack of means of measuring the precise amount necessary. The American Public Health Association (hereinafter referred to as APHA) recommends as a goal for daylighting of all new housing that at least half of the habitable rooms of every dwelling unit receive direct sunlight for one hour or more during midday (between 10 a.m. and 2 p.m.) at the winter solstice. As the sun is then at its lowest height, the penetration specified will assure sunlight in all seasons. \textit{American Public Health Assoc., Planning The Neighborhood} 29 (1948). The spacing of buildings will thus depend on the degree of latitude where the city is located. In New York, it has been calculated that for the lowest window in a building to receive any sunlight at all during the winter months the distance to the next building south must be at least twice the height of that building (the height of the sun at noon on December 21 in New York is 26\textdegree{}2 degrees, thus buildings cast a shadow twice their height). \textit{Citizens' Housing Council, Densities in New York City} 66-8 (1944). For a discussion of studies made on the amount of daylight necessary, as contrasted with direct sunlight, and the conclusion that anything less than this 2-1 height-spacing ratio would be inadequate at the New York City latitude, see \textit{Citizens' Housing Council, op. cit. supra}, at 68-73. Few zoning ordinances today approach these standards in high density areas.

Standards of open space as recommended by the APHA begin with a maximum building coverage of 30\%. Thus 70\% of the net residential land is open space devoted to various uses. For buildings of 6 stories the recommended coverage is 25\%, for 9 stories, 20\%, and for 13 stories, 17\%. \textit{American Public Health Assoc., Planning The Neighborhood} 39 (1948). These recommendations are considerably more strict than regulations in zoning ordinances today. Maximums range up to 90\%. See note 67 \textit{infra}. In the Soviet Union, coverages in superblocks, the basic unit of planning, range from 16 to 35\%. \textit{Sanders & Rabuck, New City Patterns} 109 (1946). London has taken a slightly different approach by placing the emphasis on public parks and open spaces. Density requirements necessarily provide some open space around dwellings, but additional open spaces of 7 acres per 1,000 population are said to be necessary. Because the central areas of London do not permit this at the present time, it is recommended that 4 acres of open space per 1,000 persons be set aside there and an additional 3 acres be set aside in the lower density areas farther from the center of the city. \textit{Forshaw & Abercrombie, County of London Plan} 1943, 37, 45 (1944).

\textsuperscript{22} Great Britain has recently adopted a different policy in order to implement their comprehensive rebuilding program. See Comment, 60 \textit{Yale L. J.} 112 (1951).

\textsuperscript{23} See, \textit{e.g.}, the case of Dilliard v. North Hills, 276 App. Div. 969, 94 N.Y.S.2d 715 (2d Dep't 1949) where the Appellate Division of the New York Supreme Court found that a requirement of two acres of land per family was reasonable, while the trial court found that it was unreasonable. 195 Misc. 875, 91 N.Y.S.2d 542 (1949). Also compare Thompson v. City of Carrollton, 211 S.W.2d 970 (Tex. Civ. App. 1948) (minimum floor area of 900 square feet per family upheld) \textit{with} Seneďsky v. City of Huntington Woods, 307 Mich. 728, 12 N.W.2d 387 (1943) (minimum floor area of 1,300 square feet per family held unreasonable), \textit{and} Frischkorn Construction Co. v. Lambert, 315 Mich. 556, 24 N.W.2d 209 (1946) (minimum cubic content of house of 14,000 cubic feet held unreasonable).
Cases attacking zoning limitations as excessively restrictive have not been numerous in the past, however, because the variance procedure permits Zoning Boards to waive the requirements when an "undue hardship" is imposed on the owner.\textsuperscript{24} In addition, ordinances have permitted such high densities and narrow yards that few owners have complained. However, as cities set levels of density near the expected maximum and open spaces around buildings are increased to provide adequate daylighting of buildings and area for recreation, attacks on zoning restrictions as "unreasonable" may be expected to increase. How far courts will go in upholding the figures set in zoning ordinances will depend on the relative strength of owner interests on the one hand and the climate of public opinion favoring less intense use of the land and a rational city plan on the other. So far, courts have shown a healthy respect for the figures arrived at after careful research and planning.\textsuperscript{25}

**A Study in Techniques**

The use of accurate fact-finding and forecasting to set levels of density highlights the need for effective bulk control techniques. In the past, density figures were so optimistic and yard and open space provisions so small that owners and builders rarely felt the bite of zoning ordinances. Today, however, bulk zoning ordinances can and should be based on accurate estimates of density. When they are, control techniques will actually restrain private action. Defects inherent in the techniques will thus become more apparent and will hamper effective control.

Fortunately the courts have permitted cities to experiment with many different techniques. They have declared invalid only those techniques which were not encompassed in the state enabling act \textsuperscript{26} or had no relation to the legitimate aims of zoning. For example, racial zoning,\textsuperscript{27} minimum

\textsuperscript{24} Zoning Boards and courts, when appeals have been carried to them, have been lenient with property owners—perhaps too lenient, for a lax policy long pursued can vitiate the aims of the zoning ordinance. Most zoning cases that come to the courts concern the refusals by Zoning Boards to grant variances, since this is an easier line of attack than an argument that the whole ordinance is invalid. For typical cases see Wadell v. Bd. of Zoning Appeals, 136 Conn. 1, 68 A.2d 152 (1949) (variance granted so that school could be built on part of the area of a prescribed side yard), Moore v. City of Lexington, 309 Ky. 671, 218 S.W.2d 7 (1948) (variance not granted for an additional residence in a back yard), Appeal of Elkins Park Improvement Ass'n, 361 Pa. 322, 64 A.2d 783 (1949) (discussed in note 70 infra).


\textsuperscript{26} See Brown v. Board of Appeals, 327 Ill. 644, 159 N.E. 225 (1927) (minimum height restrictions not within the enabling act); 122 Main St. Corp. v. City of Brockton, 323 Mass. 646, 84 N.E.2d 13 (1949) (same) and City of Stuttgart v. Strait, 212 Ark. 126, 205 S.W.2d 35 (1947) (failure to comply with statutory procedure). For an account of New Jersey's early difficulties with enabling acts which finally culminated in a constitutional amendment, see Bassett, Zoning 15–9 (1940).

\textsuperscript{27} Buchanan v. Warley, 245 U.S. 60 (1917). The issue is by no means dead, however, see Racial Zoning Again, American City, Nov. 1950, p. 137.
height regulations,\textsuperscript{28} minimum cost requirements,\textsuperscript{29} and architectural conformity restrictions \textsuperscript{30} have been struck down. Since controls over daylighting, density, and open space do not come within this ban, the legality of bulk control techniques presents no serious problem.\textsuperscript{31}

Many zoning ordinances employ only one or two techniques to secure the three-fold aim of bulk control. While it is true that a method designed to achieve one purpose—for example, density control—will probably have some effect on lighting of buildings and open space, its effect may be purely fortuitous.\textsuperscript{32} Since no one method of control can serve all ends adequately, it is advisable to discuss the techniques according to the ends they are designed to achieve.

\textsuperscript{28} See, \textit{e.g.}, Brookdale Homes v. Johnson, 123 N.J.L. 602, 10 A.2d 477 (Sup. Ct. 1940), aff'd, 126 N.J.L. 516, 19 A.2d 866 (1941); State \textit{ex rel.} Sale v. Stahlman, 81 W.Va. 335, 94 S.E. 497 (1917).

\textsuperscript{29} Stein v. Long Branch, 2 N.J. Misc. 121 (Sup. Ct. 1924).

Regulation of minimum building size is, in effect, a regulation of minimum cost and is used more often. The courts have split on the legality of these restrictions, holding that in particular circumstances they are permissible, and in others they were not. See cases cited in note 23 supra. See also Lionshead Lake Inc. v. Wayne Township, 8 N.J. Super. 468, 73 A.2d 287 (1950), rev'd 9 N.J. Super. 83, 74 A.2d 609 (1950) (trial judge summarily found regulation analogous to minimum cost requirements and unreasonable, appellate court reversed and remanded for trial on question of reasonableness); Flower Hill Bldg. Corp. v. Village of Flower Hill, \textit{Misc.-}, 100 N.Y.S.2d 903 (1950) (requirement of 1800 square feet of livable floor area per family upheld). This decision is severely criticized in American City, March 1951, p. 129.

\textsuperscript{30} See, \textit{e.g.}, West Palm Beach v. State \textit{ex rel.} Duffey, 158 Fla. 863, 30 So.2d 491 (1947) where an ordinance requiring the completed appearance of every new building to be substantially the same as adjacent structures was held unconstitutional. In this area, however, no generalizations are possible. Although the courts seem fairly unanimous in voiding the few architectural control ordinances which have been brought to their attention, cities continue to use them. See Rick, \textit{Architectural Control in San Diego}, American City, Sept. 1948, p. 113, AMERICAN SOCIETY OF PLANNING OFFICIALS, \textit{ARCHITECTURAL CONTROL} (1941); and the MADISON, N. J. \textit{ZONING ORDINANCE} § 10(m): "In passing on any application for a permit, the Zoning Officer shall give consideration to the suitability of design and type of construction of the proposed building or structure in relation to its district and the immediate neighborhood of its site; and if it be so markedly incongruous with the character of said neighborhood as to be seriously detrimental to the value of adjacent or nearby property or to involve exceptional risks of traffic congestion or public safety, the Zoning Officer shall refer the application to the Board of Adjustment. If said Board shall concur in the opinion of the Zoning Officer, it shall order him to refuse the permit." And compare AMERICAN PUBLIC HEALTH ASSOC., \textit{HOUSING FOR HEALTH} 205 (1941): "It is obvious that matters of taste cannot be crystallized in quantitative terms, but the desire for beauty is a fundamental urge whose satisfaction is essential to healthy living in the full sense of the term."

\textsuperscript{31} See note 8 supra.

This, of course, does not mean that any control which can be rationalized as a density control will be upheld if its real aim is entirely different. For example, the use of a minimum floor area requirement ostensibly as a density control but in reality as an exclusionary instrument would have difficulties before the courts. See notes 23 and 29 supra.

\textsuperscript{32} "It must be recognized that density figures, no matter how accurately computed, are but a crude index of the design quality of a site plan. Being rigid mathematical ratios for relatively large areas, they cannot properly reflect all factors of design. For example,
Density Controls

There are several basic methods of regulating density: control of the maximum building shape through spacing controls, control of the number of people on the land, and control over the volume or floor area of the building.

Building Shape Controls. Regulating the shape of the building by prescribing its outside limits is the oldest and most common—but least satisfactory—control over density. The chief techniques are the height, set-back, and yard and court regulations. Although these regulations were originally designed to secure daylighting of buildings, they still remain the only density control in downtown areas in most American cities.

The height limitation may be stated as a specific number of feet, stories, or multiples of the street width which the building can rise at the street or lot lines. Higher buildings may be permitted if, above this height, the building is “set-back” from the front or rear building lines. In the most crowded areas the set-back ratio might require a one foot horizontal set-back for each four foot increase in height; in less crowded areas the ratio might be one foot back for each half-foot increase in height. The set-back regulation has fostered the distinctive pyramid effect of many buildings in downtown New York and other large cities. Many cities permit buildings to go even higher than the set-backs allow if the tower occupies only a certain percent of the land, for example, 20%, and is a stated number of feet from all lot lines. In many cities the height of towers is unlimited.

33. See page 508 supra.

New York City is the leading example. Building bulk in commercial areas of the city is still regulated by the ordinance of 1916 as amended. Compare CLEVELAND ZONING ORDINANCE §§ 981–33, 34, 39, 42 (passed in 1949); LOS ANGELES COMPREHENSIVE ZONING PLAN §§ 12.15–20. Cleveland and Los Angeles apply only these requirements to commercial buildings but have lot area requirements for residences erected in commercial and industrial districts.

34. New York, for example, is divided into eight height districts ranging from the “class two and one-half district” to the “class one-quarter district.” In the former class, which permits the highest buildings, the building can go straight up from the street to a height of 2 times the street width. It must then be set back from the street line at a ratio of one foot for each four foot increase in height. NEW YORK ZONING RESOLUTION § 8(h). In the lowest height district no building can be erected more than \( \frac{3}{4} \) times the street width at the street line, and thereafter it must be set back at a rate of two feet for each foot increase in height. Id. at Sec. 8(a). Like most other cities, New York has certain exceptions to these rules. For example, if the street is less than 50 feet wide, computations can be based on a 50-foot street, and if the street exceeds 100 feet in width, builders must assume a street width of only 100 feet. Id. at Sec. 9(a).

35. New York permits unlimited height of towers if the area of the building is less than 25% of the lot area and the tower is at least 75 feet from the middle of all streets on which it
Yard and court requirements further limit building size. While these restrictions may not apply to commercial buildings,\textsuperscript{38} residential buildings almost without exception must have some sort of yard.\textsuperscript{37} In high density areas, however, the requirements may be very small.\textsuperscript{38} In lower density districts, front, side, and rear yards are usually required.

The disadvantage of these techniques as density controls is their indirectness. It is true that a city planner, by taking into account all regulations, could determine the maximum building size for each lot in the high density areas of the city, translate this into cubic feet or square feet of floor space, and arrive at an estimate of the population allowable in any area.\textsuperscript{39} But such a process is costly, time-consuming, and difficult to manipulate. If a change in permitted density is desired, height, set-back, and yard and court requirements must be translated into density figures and translated back again on the basis of the changed density. Moreover, yard and height regulations do not control density adequately in low density areas. Since most yard requirements are relatively small—aimed at providing only daylight and open space—they do not effectively limit the building size.\textsuperscript{40}

If yard requirements were increased, thus controlling density more effectively, undesirable results would follow. The builder would lose his freedom of placing the building on the lot. Some cities have avoided this result by use of the "coverage" regulation,\textsuperscript{41} i.e., a restriction on the perfaces. NEW YORK ZONING RESOLUTION § 9(d). Cleveland and Philadelphia are two of the numerous other cities which permit unlimited towers. CLEVELAND ZONING ORDINANCE § 981–38 (provided the tower is not within one mile of an airport, does not exceed 25\% of the lot, excluding required yards, and is at least 25 feet from the lot lines); PHILADELPHIA ZONING ORDINANCE § 20(e) (provided the tower area is not more than 25\% of the lot area, is not within 25 feet of lot lines, and the width of the tower is less than half the width of the lot line toward which it faces).

36. See, e.g., LOS ANGELES COMPREHENSIVE ZONING PLAN § 12.14–C, 12.15–C, 12.16–C, 12.17–C, 12.18–C, 12.19–C (no yards necessary in buildings used either for commercial or industrial purposes, unless the building abuts a residential zone, in which case a small yard must be provided).

37. Not necessarily at the ground level, however. For example, Los Angeles provides in its "CM" Business Zone, "No yards shall be required for buildings erected and used exclusively for commercial purposes. For buildings other than those erected and used exclusively for commercial purposes, side yards and a rear yard conforming to the requirements of the "R5" Zone shall be provided and maintained at the floor level of the first story used in whole or in part for dwelling purposes." LOS ANGELES COMPREHENSIVE ZONING PLAN § 12.17–C(1).

38. See, e.g., the yard requirements for residences in Cincinnati's Business and Industrial districts—front yard: none required; side yard: 1 story—3 feet, 2 stories—6 feet, 3 stories—9 feet, etc. (but no side yards are required if non-residence users occupy lower floors); rear yards: 1 story—15 feet, 2 stories—20 feet, 3 stories—20 feet. CINCINNATI ZONING ORDINANCE § 1321(f).

39. In those cities which permit unlimited towers the planner would also have to base his figures on the expected height of buildings, considering probably building trends as well as engineering and geologic realities.

40. See note 38 supra.

41. See note 66 infra.
centage of the lot which the building can cover. The coverage requirement is superior to yard regulations as a density control, but both techniques are unsatisfactory since they are too indirect and must be correlated with a height limitation to be effective at all.

Population Controls. The second type of density control governs directly the number of people on the land. These regulations provide for a specified lot area for each family, dwelling unit, living room, or bedroom. In single family districts the requirement is stated in terms of a minimum permissible lot area. Since there can be but one family per lot the regulation is similar to the lot area per family or dwelling unit regulation in multiple dwelling districts.

Lot area figures used in zoning ordinances vary with the congestion of the district. In high density multiple dwelling districts the lot requirements may be as low as 200 square feet per family while in extremely low density residential areas it may be as large as several acres. These controls have the great advantage of telling the planner immediately the permissible density in any area, since the available lot area and the size of families or average number of persons per room can easily be learned. As a consequence, direct population controls over density have become increasingly popular in recent years.

Direct techniques, however, may have the disadvantage of affecting the type of building erected. Restrictions on the number of families or dwelling units per amount of land encourage building for large or well-to-do families to the exclusion of quarters for individuals, couples, or families of small

42. Lot area may be either "net" or "gross." See page 526 infra.

43. Oklahoma City, New Orleans, and Allentown, Pennsylvania base their controls on lot area per family. Los Angeles, Toledo and Providence, Rhode Island use lot area per dwelling unit. In city master plans, the assumption is usually made that one family uses one dwelling unit so there is very little difference between these two bases. The proposed Detroit ordinance is based on living rooms and bedrooms and the proposed San Francisco ordinance employs living rooms and bedrooms in some cases and takes the dwelling unit as the basis in others. For a summary of the advantages and disadvantages of the various bases, see Citizens' Housing Council, Densities in New York City 20–2 (1944). The requirement may also be stated in reverse, i.e., persons, families or dwelling units per acre. Cincinnati employs this method in certain multiple dwelling districts, Cincinnati Zoning Ordinance § 1311–3(a)(e) (18 families per acre in the "B" zone, 28 families per acre in the "C" zone and 30 families per acre in the "D" area). Most master plans are drawn up with persons per acre as the basis and are usually translated to families per acre on the basis of 3.6 persons per family. The draft development plan for London employs the persons per acre basis, but it may soon be changed to rooms per acre since this is considered a more "convenient" standard to work with. Report of the Town Planning Committee to the London County Council, May 23, 1949, p. 3.

44. Los Angeles shows both extremes. It requires only 200 square feet of lot area for each dwelling unit of less than three rooms in the "R5 Multiple Dwelling Zone," but in the "RA Suburban Zone" requires 20,000 square feet per dwelling unit and in the "A1 Agricultural Zone" five acres are required for a one family dwelling. Los Angeles Comprehensive Zoning Plan §§ 12.12–C(4), 12.07–C(4), 12.05–C(4). See also Lot-Size Requirements in Fifty-three Massachusetts Municipalities, American City, May 1947, p. 7.
While it may be desirable to encourage certain dwelling types in various districts throughout the city, a zoning ordinance should not be allowed to exercise unconsciously a subtle influence over building size or plans.

**Volume or Floor Area Controls.** The third general type of density control regulates the volume of floor area of the building. Since the number of people using a given amount of volume or floor area can be estimated, control over volume or floor area gives control over the number of occupants. These control devices are technically called "cubage" and "floor area ratios." Their great advantage over height, set-back, and yard and court regulations is that they control directly the size of the building, and unlike the regulations based on families and dwelling units, they can be applied to both commercial and residential buildings.

The cubage regulation, the older of the two controls, has been applied almost exclusively in commercial areas. In some regulations the permissible volume is phrased in terms of the volume of a prism the base of which is equal to the area of the lot and the height of which is based on a specific number of feet or a multiple of the street width. Other ordinances are more direct. They state simply that the permissible volume equals the area of the lot times a specific number or a multiple of the street width. Thus on a lot 100 feet by 100 feet with the height based on three times the street width, the permissible cubical content of a building fronting a 60 foot street

45. See Citizens' Housing Council, Densities in New York City 21 (1944). Such a policy might be especially harmful in view of the marked trend to smaller families, especially in urban areas. Id. at 7-8, 92-3.

Los Angeles utilizes a new technique which may overcome this difficulty. Although the regulation is based on lot area per dwelling unit, the area is varied in each district according to the number of rooms. Thus in the "R4 Multiple Dwelling Zone" the requirements are 800 square feet of lot area for dwelling units of over three rooms, 600 square feet for dwelling units of three rooms and 400 square feet for apartments of less than three rooms. Los Angeles Comprehensive Zoning Plan § 12.11-C(4). The incentive to build larger apartments is thus done away with in this refined technique.

The number of persons occupying a family unit may vary considerably, however. Thus "average family size" estimates may not give a true density picture in any given area.

46. Estimates must be based on exceptionally careful study to be valid. For instance, floor area may not reflect density correctly if the planner fails to take into account the height of the building (increased height means a need for added space for interior service and circulation space), occupancy rate or the type of neighborhood (generally, the higher the income of the occupants, the more space used per person). The last consideration has prompted the APHA to recommend that an additional index of floor area per person is needed if floor area ratios are to reflect accurately the population density. American Public Health Assoc., Planning the Neighborhood 41 (1948).

47. See, e.g., Cincinnati Zoning Ordinance § 1320(h) (based on street width, set-backs also used); Oklahoma City Zoning Ordinance § 10 (same); Richmond, Calif. Zoning Ordinance § 9(C) (specific number of feet, set-backs also used).

48. See, e.g., Chicago Zoning Ordinance § 17 (the numbers multiplied by the lot area are 72, 96 and 144 depending on the district).
would be 1,800,000 cubic feet, distributable in any way so long as other regulations for light, air, and open space were compiled with. The floor area ratio, one of the newest and most popular zoning techniques, is based on the relationship between the floor space permitted in the building and the area of the lot. Thus where the floor area ratio is 1–1, the maximum permitted floor area on a 100 foot by 100 foot lot would be 10,000 square feet. Assuming no daylighting or open space regulations, a builder could construct a one story building covering the entire lot, a two story building covering one-half the lot, or a four-story building covering a quarter of the lot. Floor area ratios, which vary greatly, are an accurate indication of size: the Empire State Building, the world’s tallest (102 stories), has a floor area ratio of 25–1; A.T. & T. Headquarters in New York City (27 stories), 24–1; Stuyvesant Town, the large scale housing project on New York’s lower East Side, 3.13–1; the lowest requirement in New York’s residential district, 0.75–1. Neither cubage nor floor area ratio controls require a height limitation to achieve their purpose of controlling building size, although some cities have imposed this limitation as well. The floor area ratio has two possible advantages over cubage regulations.

49. See, however, Proposed Text For Comprehensive Revision Of The Detroit Zoning Ordinance (April 1, 1949) § 17.2 which permits towers of unlimited height above the cubage requirements and is therefore not strictly a volume control.

50. New York has used the floor area ratio in some residential districts since 1940. The proposed San Francisco ordinance uses the floor area ratio in both residential and commercial districts. In the central business area the ratio is 10–1; in the single family district it is 0.9–1. London is also experimenting with the technique, see Ministry of Town and Country Planning, Redevelopment of Central Areas 30–42 (1947).

The problem of whether “net” or “gross” area should be taken as the base arises here as it does with families and dwelling units. See page 526 infra.

“Floor area” is defined in New York City as “the sum of the gross horizontal area of the several floors of a building, including interior balconies and mezzanines but excluding garage area and basement and cellar floor areas not devoted to residence use. All horizontal dimensions are to be made between the exterior faces of walls, including the walls of roofed porches. The floor area of a building shall include the floor area of accessory buildings, except garages, on the same lot, which shall be measured in the same way.” New York Zoning Resolution § 1(u). The New York floor area requirement cannot be regarded as purely a density control, however, since it permits greater floor area on corner lots than on interior lots. See, e.g., Sec. 15(e) where the ratio is 1.9 on interior lots and 2.5 on corner lots. The differential is due to the carrying over of the influence of regulations designed to secure daylight, rather than density control.

51. See Citizens’ Housing Council, Densities in New York City 80 (1944) for a comparison of the floor area ratios in the various housing projects in New York.

52. The proposed San Francisco ordinance provides for height limitations, along with the floor area ratio requirement, in the “neighborhood shopping,” “community shopping” and “community business and service” districts, but has only the floor area requirement in the “central shopping,” “general business and service” and “general business” districts. San Francisco Proposed Comprehensive Zoning Plan (Sept. 30, 1949). The height limitation here probably is more of an aesthetic device than a bulk or daylighting control.
The latter encourage lower ceilings in order to achieve maximum usable floor space. The floor area ratio, on the other hand, permits the architect to set ceilings at the optimum height. Secondly, the floor area ratio is phrased in terms of square feet which the architect and builder are accustomed to using, especially in respect to residential buildings.

When applied to residential buildings, both cubage and floor area ratio regulations tend to encourage small apartments. The builder with a limited amount of floor area or volume available can usually get a higher return from many small apartments than a few large ones. Since density controls based on lot area per dwelling or family tend to encourage large apartments, a combination of these two regulations in one ordinance should neutralize zoning regulations as an influence on the type of dwelling constructed. The proposed San Francisco ordinance is one of the few to utilize both techniques.

When cubage and floor area regulations are applied to commercial areas, an attempt should be made to correlate building size with building use. A regulation over size alone is insufficient, for a department store may generate as much traffic congestion and drain on municipal facilities as an office building four times its size. But as yet no American cities have attempted directly to correlate use with building size in downtown areas.

**Daylighting Controls**

Even if adequate controls over density are adopted, additional controls over daylighting will be necessary. Neither the floor area and cubage lim-

53. See *Citizens' Housing Council, Densities in New York City* 21-2 (1944).
54. The two techniques are correlated in all residential districts. See *San Francisco Proposed Comprehensive Zoning Plan* (Sept. 30, 1949) §§111(D)(K), 112(D)(K), 113(D)(K), 114(D)(J), 115(D)(J), 116(D)(J).
55. Bulk is generally correlated with use in the various residential areas of the city since bulk regulations vary with the type of use district. But in downtown areas there are very many different types of buildings and businesses operating under only one or a few necessarily broad bulk regulations. The problem is to differentiate uses according to the congestion they create and then apply different bulk controls to different types of uses.

Recent well-planned off-street parking regulations indicate the type of approach necessary. These regulations are based on the amount of auto traffic a business draws. A comprehensive study would also include the amount of pedestrian traffic, truck traffic and drain on municipal facilities. The progress made so far is shown in the proposed San Francisco off-street parking regulations in the zoning ordinance.

Sec. 110(K)(2) requires a certain number of parking spaces for a variety of uses, ranging from multiple dwellings (one space for each two units) through theatres (if under 1,000 seats, one space for each 8 seats), banks, business and professional offices (one space for each 450 square feet of floor area), general retail stores of 2,500 to 20,000 square feet (two spaces, plus one for each 375 square feet above 2,500 square feet of floor area) to furniture and appliance stores, wholesale stores and service shops of more than 2,500 square feet (two spaces, plus one for each 1,000 square feet of floor area above 2,500 square feet). Similar, but less comprehensive regulations are now in effect in many American cities, see *American Automobile Assoc., Parking Manual* 81 (1946). See also, *Ministry of Town & Country Planning, Redevelopment of Central Areas* 42-3 (1947).
itations nor lot area requirements regulate the placement of the building on the land. If no further controls were adopted, buildings could be placed indiscriminately on lot lines in such a way as to interfere with the light and air on neighboring lots.

Techniques for regulating the daylighting of buildings have changed little since the first zoning ordinances. In high density commercial areas the only protection against dim streets and darkened windows are the height and set-back requirements discussed above as density controls. As daylighting controls they are direct and workable. They have not been changed because until very recently they were the best available. Their chief disadvantage is that they unduly stifle architectural freedom. In areas where the builder desires to build up to the permitted maximum, "the zoning ordinance rather than the architect designs the building." In addition, construction costs are increased by the necessity of complying with set-back requirements.

Improving the methods of providing light and air in high density areas is difficult, for some arbitrary limit must be placed on the extent to which one building can interfere with another. One possibility is the regulation based on an "angle of light." In this regulation a line is drawn at some angle, such as 45 degrees, from a given point, such as the center of the street, toward the building which is to be restricted. The building cannot extend above this line. A light angle requirement accomplishes the same result as a set-back technique, and, like it, is a severe restriction on architects. To give architects greater freedom, the light angle might be averaged over the front of the building so as to permit one portion of the building to extend above the line if another part were correspondingly lower.

A further refinement of daylight controls has been developed for use in replanning the city of London. A standard for measuring the amount of daylight in buildings, called the "Daylight Factor," was set up. This factor is based on a ratio between the daylight available in the building and that available under an unobstructed sky. Proposed building plans are tested

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56. "Legislative regulation of buildings as contained in building codes, zoning, and other ordinances designed to protect the health, safety, and general welfare of society are one of the severest limitations under which design must operate. The severity lies in their rigidity and not in their legitimate purposes." Vermilya, The Need for Research, in Creighton, Building for Modern Man 38 (1949).

57. All controls which limit building shape may increase costs, but set-backs are considerably more expensive than the possibilities discussed later because of the roofing expense of flashing each set-back, and because interior columns must be increased or if they are not there may be an increase in sheer and moment values on the supporting girder due to concentrated load which will necessitate the use of larger steel shapes.

58. London, at present, employs the angle of light technique. The light angle required, as modified in July 1949, for enclosed courts ranges from 40 to 45 degrees and elsewhere from 40 to 56 degrees. Report of the Town Planning Committee to the London County Council, May 23, 1949, p. 7.

59. The "Daylight Factor" has been described as follows: "Absolute units, such as foot-candles, are impracticable for daylight design because of the large and often rapid
to show whether the required "Daylight Factor" has been met. This method seems preferable to all devices now employed in the United States.

In recognizing the principle that light may reach a window not only over the top of a facing building but also past the side of it, the London method gives the builder much greater freedom in placing his buildings on the lot and would permit new architectural forms not possible under existing ordinances.

In lower density areas, yard requirements are the primary regulation to ensure light and air. Usually front and rear yard requirements are adequate, but side yard requirements are often too small. If side yards are to ensure adequate daylighting they should be increased and related to the height of the building. Some ordinances now use this method.

changes in the intensity of daylight. Daylight indoors has therefore been measured as a percentage of the total light available outdoors under an unobstructed sky, and the percentage of daylight is called the Daylight Factor. A Daylight Factor of 1 per cent. means that at the point of measurement the illumination is 1 per cent. of that which would have been obtained if from that point the whole hemisphere of the sky could have been seen. The standard recommended for offices is a Daylight Factor of 1 per cent. at a distance of 12 feet from the external wall and at a height of 2 feet 9 inches above the floor." MINISTRY OF TOWN & COUNTRY PLANNING, REDEVELOPMENT OF CENTRAL AREAS 43 (1947).

60. Plans are tested against a "permissible height indicator." The design of the indicators takes account of the fact that light may reach a window either over the top of an obstruction in front of the window or from a direction to one side of the obstruction. The width of the gap at the side of the obstruction through which the light comes has been related to the steepness of the angle at which the light is descending; so that, for a given standard of daylighting, the flatter the angle of descent the less may be the width of the gap. This method of testing daylight obstruction is more realistic and gives more latitude to the architect than methods which relate only to daylight coming over uniformly high (i.e., horizontal) obstructions. The method can be applied to building plots of any size and surroundings, but its full benefits cannot be obtained on a small plot. It therefore favours redevelopment in which the daylighting requirements of all buildings within the street block have been considered as part of a single design." MINISTRY OF TOWN & COUNTRY PLANNING, REDEVELOPMENT OF CENTRAL AREA 95 (1947).

The permissible height indicators test the proposed building at various points, first in regard to the possibility that the building may interfere with buildings which exist or may later be built on neighboring sites, and secondly in regard to the obstruction of each other's daylight by buildings within the same plot. A description of the construction and use of indicators for non-residential areas is found Id., Appendix 3. Since 1947, indicators have also been developed for residential areas. See Code of Daylight Standards, Residential and Non-Residential Indicators, Yale Law Library.

61. See, e.g., PHILADELPHIA ZONING ORDINANCE § 13(6). In the "F" residential district the minimum width of side yards for multiple dwellings is 8 feet, while the height of the side of the building can rise 96 feet straight up on interior lots and can then go even higher if it is set back. Sec. 13(8)(b). See also TACOMA, WASH. ZONING ORDINANCE § 7 which evidently requires no side yards in the "Apartment House District" unless the building happens to adjoin a "residential" district.

62. New York, Los Angeles, New Orleans, Cincinnati and Allentown, Pa. are a few of the cities which increase side-yard width according to building height. Allentown also increases the width of the side yard on the basis of the length and width of the building. ALLENTOWN ZONING ORDINANCE § 6(b)(3).

The proposed San Francisco zoning ordinance increases the yards of residential buildings on the basis of the height of the building, but also increases the side yard if the length
Where a block is developed under a unified plan, however, yard controls might be relaxed to permit greater diversity and greater utilization of sunlight. A southern exposure is desirable since the sun’s winter rays penetrate the rooms deeply while the high angle of the sun in summer allows little sunlight; thus rooms are warmer in winter and cooler in summer. To take advantage of this fact builders could alternate houses between the front and rear lines on north-south streets, and on east-west streets place the buildings on the north side at the rear line. Many other variations would be possible if yard requirements were relaxed. As yet, however, zoning ordinances have permitted few departures from rigid yard requirements even in small unified developments.

Open Space

Adequate open space for rest, recreation, and some measure of privacy is also necessary for decent living. To date, open space has been largely a by-product of light and air regulations—that is, yard requirements have usually provided the only required open space. A more direct control is needed, of the yard exceeds a certain number. For example, in case the length of the side yard exceeds 40 feet, the width required by the height of the building shall be increased 1 foot for each 6 feet the yard extends more than 40 feet. San Francisco Proposed Comprehensive Zoning Plan, Sept. 30, 1949, § 116 (f). And see Cleveland Zoning Ordinance § 981-54(b)(2c).

63. See American Public Health Assoc., Planning the Neighborhood 30 (1948).

64. See, e.g., the diagram of modern vs. obsolete residential subdivisions in Allen, What Cities May Do To Stimulate the Building of New Housing, American City, Sept. 1948, p. 116–7.

65. The variations of zoning requirements permitted in large scale housing discussed at pages 524–8 infra are generally inapplicable here because the area required to make the provisions operative is too large to be applied in small unified developments. For example, New York requires a minimum of 75,000 square feet, New York Zoning Resolution § 21 (C), Cincinnati 50,000 square feet, Cincinnati Zoning Ordinance § 1311–3a, Oklahoma City, 20 acres, Oklahoma City Zoning Ordinance § 14. More important, large scale housing is generally excluded from single family districts.

San Francisco and Detroit have proposed exceptions for yards or open spaces where multiple dwelling groups are developed in a unified plan. San Francisco Proposed Comprehensive Zoning Plan, Sept. 30, 1949, § 110 (H) (side yards only); Proposed Text for Comprehensive Revision of Detroit Zoning Ordinance, Apr. 1, 1949, § 3.14 (all yards and open spaces).

Los Angeles and Richmond, California are almost alone in providing variations in front and side yard requirements where there is a unified development in a single family district. The exceptions, available whenever “an entire frontage . . . is designed and developed as a unit”, are identical in both ordinances. They provide that the front yard may be varied by not more than five feet in either direction provided the average front yard for the entire frontage is not less than the minimum front yard required in the district. Side yard requirements may be varied provided that the total combined width of the two side yards on a lot is not less than that required for lots in the districts, that no side yard shall be less than three feet, and that minimum distance between the sides of buildings shall not be less than ten feet. Los Angeles Comprehensive Zoning Plan § 12.22–C(8); Richmond Zoning Ordinance § 14–C(6).
since neither adequate density nor daylighting controls necessarily ensure sufficient open space.

The "coverage" regulation, prescribing the percentage of the lot which may be covered by the building, is a step in the right direction. But since this regulation may permit the open area to contain accessory buildings, parking areas and strips too narrow for any purpose, it is not completely satisfactory. Moreover, in most cities the unit of open space does not depend on the number of persons in the building. To meet these two disadvantages an open space regulation should require a minimum amount of usable open space for each family or dwelling unit. Philadelphia and Rye, New York, have met this shortcoming by requiring that open space regulations be based on the number of families.

**Conclusion and suggestion**

An effective zoning ordinance should achieve its ends directly. Density in residential areas should be regulated by lot area per family or floor area ratio requirements or a combination of the two. Density in downtown areas should be controlled by cubic or floor area ratio techniques correlated with building use. Daylighting of buildings should be achieved in low density areas by yard regulations which permit variations in unified developments and in high density areas by a flexible daylight control. And open space regulations should require usable space based on the number of families.

With these techniques, more rational control over residential buildings is possible. It is the present practice throughout the United States to zone residential areas according to the type of building. Thus, there are single family and multiple dwelling districts. Such restrictions, though a form of

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66. Among the cities to adopt coverage regulations are New York (coverages ranging from 35% to 90%), Chicago (coverages ranging from 35% to 60%) and Seattle (coverages ranging from 35% to 90%). The proposed San Francisco ordinance also has a coverage requirement in residential areas with coverages ranging from 40% to 45%. Compare these figures with the maximum coverage of 30% recommended by the American Public Health Association, see note 20 supra. Coverage in Federal, state and city housing projects has run about 28-30%, while private builders in the "Park Avenue slum area" maintain a coverage of about 80%. City Planning Comm'n, Report on the Amendments of the Zoning Resolution of the City of New York 8 (1944).

Some cities have attempted to provide open space by use of the yard requirement. See, e.g., Allentown Zoning Ordinance § 6(b)(1) which increases the side yards on the basis of the number of families in the building. Inasmuch as this forces the builder to center his building on the lot—as the coverage regulation does not—and cuts the open space up into small areas, it is a less desirable control than the coverage requirement.

67. Philadelphia Zoning Ordinance § 9(11)(d): "Multiple dwellings shall have a minimum rear yard area of 368 square feet, and shall have an additional 100 square feet of rear yard area for each additional family more than three families."

68. Rye Zoning Ordinance § 5.4 (g): "Open space provision. Included in every lot used in whole or in part for residence there shall be a total area allotted to outdoor recreational use equal to at least 500 square feet per family, except that this may be reduced to 300 square feet per family in a Residence C or Business District."
density control, are perhaps the least rational of all, for they control by limiting the number of families who can live under one roof. Since multiple dwelling districts are usually found in the more crowded areas of the city, apartment dwellers do not enjoy the same amenities that inhabitants of single family districts do. Courts have traditionally upheld the segregation of apartments and single family houses on the basis of the evils which more congested living creates. But with the use of adequate controls over density, daylighting, and open space applicable to all types of buildings, this rationale for segregation falls. The density of the area would remain unchanged. Lot area and open space would be increased as the number of families increased, and the greater amount of open space thus created might well increase the general amenity of the neighborhood rather than decrease it. Thus there is no reason why apartment dwellers, too, should not be allowed to live in lower density areas.

**Large Scale Housing**

Both private and public large scale housing projects have become more and more popular in recent years. They should be encouraged, for they are

69. The evils which the courts have found have been varied—interference with light and air, creation of disturbing noises incident to increased traffic and business, depriving children of quiet and open spaces for play, increase in the fire hazard and the danger of the spread of infectious diseases and the fact that immoral practices are made more difficult to detect and suppress. See Note, 50 COL. L. REV. 202, 207–8 (1950).

70. See Rodgers v. Village of Tarrytown, 276 App. Div. 1019, 96 N.Y.S.2d 58 (1d Dep't 1950) appeal granted, 301 N.Y. 816, 93 N.E.2d 661 (1950) (garden apartment district created with density relatively unchanged from former standards). Contrast the approach of the court in Appeal of Elkins Park Improvement Ass'n, 361 Pa. 322, 64 A.2d 783 (1949). Elkins Park, Cheltenham Township had a zoning ordinance of the usual kind dividing the city into various districts including single family and multiple dwelling districts. The former had a lot area requirement of 7,500 square feet per family. Plans were made to construct an apartment house near the business district but in a single family area. Application was made to the Board of Adjustment requesting (1) a special exception to authorize the apartment house in the single family district, and (2) a variance to permit a lot area of less than 7,500 square feet per family. On appeal, the Supreme Court of Pennsylvania found, and appellant conceded, that the special exception should be granted because the land could not be used for single family houses and was ideally suited for apartment buildings. But the court also granted the variance which meant that the lot area requirement of 7,500 square feet per family no longer applied.

San Diego, California, allows the Zoning Committee to grant a variance “to permit more than one house on large lots in restricted zones where the lot area devoted to each proposed dwelling will meet the City's minimum requirements and comply with the standards already established in the area; . . .” SAN DIEGO ZONING ORDINANCE § 14(11).

71. Permitting apartments in the lowest density areas by dropping the use classification and using only density controls would not create a rush to build apartments in these areas. Since the builder must construct less apartments per amount of land he may still find that apartments in higher density areas are a better investment. Such a technique would, however, allow the developer with land available in a low density district to choose freely between building apartments or free-standing houses.

In addition, planned neighborhoods which include multiple dwellings would be permitted in single family areas as well as multiple dwelling districts.

72. Insurance companies have constructed many projects. Metropolitan Life is one of
one of the best ways to clear slum areas, to develop planned neighborhoods, and to achieve mass production in the housing field. But inasmuch as such projects freeze the character of a neighborhood for some 60 years and affect large numbers of people, careful attention must be paid to density, daylight, and open space requirements.

Many American zoning ordinances make no special provision for large scale housing projects. This failure has meant that these projects have been planned and built under zoning ordinances based on the gridiron pattern of development. Controls based on this pattern, such as height, set-back, and yard and court regulations, may be perfectly sensible when each owner constructs his building on a separate lot. But builders of large scale projects disregard traditional lot lines and plan the development on the basis of other, more important, factors. When this happens, regulations based on lot lines may provide no real control at all. Even strict set-back requirements permit buildings of fantastic size in the center of the superblock.

On the other hand, traditional controls may severely obstruct the development of large scale projects. Norwood Heights Improvement Association v. Mayor & City Council of Baltimore illustrates the difficulties which face owners who must build within the framework of outmoded zoning laws. A developer in Baltimore sought the approval of the Zoning Board to erect a garden apartment project. The project was to cover 9.3 acres of land, and complied with the density requirements of the districts in which it was located. There were 34 apartments in ten buildings. All buildings were two stories in height, and each had its own water, sewage, playground, and heating facilities. Each building had a separate front, sides, and back, but was connected to the other apartments in the group at the corner. The plan was

the biggest builders; when the project currently being built in California is completed Metropolitan will have provided apartments for 36,399 families in four cities at a total investment of over $300,000,000. N.Y. Times, April 23, 1950, Sec. 8, p. 1, col. 5.

In New York City, quasi-public housing, sponsored by insurance companies, banks, etc., and receiving partial tax exemptions or other help from the city, had a value in 1949 of $223,000,000 in projects completed or under construction. The Public Housing Authority in New York City started 42 projects having a total value of $540,000,000 from 1946 to 1949. Slum clearance is the aim of many of these projects. In addition, there are 322 FHA projects in the city of New York with a dollar value including homes sold of $543,796,580.

New York City Housing Authority, Housing (1949).

73. For a criticism from the neighborhood unit viewpoint of one of the latest and best thought-out projects see Gropius, Rebuilding Our Communities 22 (1947). Stuyvesant Town in New York, with a population exceeding 32,000, is criticized for having no meeting place, no nurseries, no school in the project and a population density so great that the area may some day be blighted.

74. Chief factors are the economies to be achieved by grouping such as joint facilities and lowered construction costs, and, secondly, the opportunities presented to take advantage of the lay of the land.

75. 60 A.2d 192 (Md. 1948). The “Improvement Association” has apparently been quite interested in other similar projects but with different success, see Norwood Heights Improvement Ass'n v. Mayor and City Council of Baltimore, 72 A.2d 1 (Md. 1950) (held, no standing to appeal); Norwood Heights Improvement Ass'n v. Mayor and City Council of Baltimore, 73 A.2d 529 (Md. 1950) (same).
challenged by a neighborhood improvement association on the basis of the Baltimore zoning ordinance requirement that each building occupy a separate lot. The Zoning Board and the lower court disagreed with the complainant, but the Maryland Court of Appeals upheld his contention. Each building was to be considered as a separate building and had to occupy a separate lot. Since the houses could not be joined, the advantages of joint service facilities and the resulting economies were lost. The project was subsequently abandoned.76

The newer controls over density, daylighting, and open space which are not geared to the gridiron pattern can prove of immense value in large scale projects. Density regulations such as the floor area ratio, permissible volume, and lot area limitations function as well here as in the standard city block system.77

One special problem arises with these density controls, however: how to compute the amount of land to be used as the area of the lot. Either the "gross site area" or the "net site area" method can be used.78 Gross site area is defined as the area of the lot plus half of the street fronting the lot. Net site area is defined as the area bounded by the lot lines without including street frontage. The latter is the concept with which owners and real estate men are more familiar and is the major method used in zoning ordinances. Either measurement is adequate when the gridiron pattern is used. Gross site area instantly tells the planner the permitted density in any area, while controls based on net site area merely require the planner to subtract the area of the streets (a figure which is easily found) from the total area to compute the permitted density.79

76. Soon after this case the Baltimore ordinance was amended to provide that garden type apartments would be permitted without meeting the lot requirement if the area of the project covered at least five acres. BALTIMORE ZONING ORDINANCE § 28(L). Subsequently a project of less than five acres was attacked on much the same basis as in the first Norwood Heights case, but the court held the project valid relying on the earlier case of Akers v. Mayor and City Council of Baltimore, 179 Md. 451, 20 A.2d 181 (1941) which the court had distinguished in the first Norwood Heights case. Windsor Hills Improvement Ass'n v. Mayor & City Council of Baltimore, 73 A.2d 531 (Md. 1950).

Even where there are special large scale housing provisions, some cities require the architect to draw in fictitious lot lines around each building or group of buildings to show that yard requirements have been complied with. This is the practice in New York City for all plans turned in to the Planning Commission. Inasmuch as yard requirements are usually minimal, this procedure serves no useful function at all.

77. Cleveland, Los Angeles, Oklahoma City and the proposed Detroit ordinance, for example, carry over their lot area per family, dwelling units or floor area ratio requirements to large scale projects. New York uses the floor area ratio in large scale housing, the same standard employed in many residential areas. Cincinnati, which employs no special control over density in standard residential areas, created a density control based on families per acre for large scale housing.

78. For a discussion of the two terms, see CITIZENS' HOUSING COUNCIL, DENSITIES IN NEW YORK CITY 13-19, 78 (1944). See SANDERS & RABUCK, NEW CITY PATTERNS 115 (1946) for tables showing equivalents between net and gross densities (10 families per net acre equals 6 families per gross acre).

79. Gross site area gives the corner lot owner an advantage over the interior lot owner.
In large scale projects, however, density figures may vary significantly depending on the base used. Where cities are laid out on the gridiron pattern, streets use from 35 to 40% of the city area. When large scale projects are planned, agreements are usually made with city authorities to route the major lines of traffic around the project area and to close the regular city streets. Feeder streets into the area are then laid out which will be sufficient for local traffic only. The resultant street area will usually be from 15–23% of the area of the superblock, making a substantial increase in land available for buildings, open space, and other uses. If density is computed with a gross site figure, the density for the area would remain unchanged, and the additional area could be used for open space. If a net site figure is used, the land saved from the streets could be used by the builder as a basis for housing more families. If the housing area were large, this figure would be great enough to affect seriously the plans made by city officials for schools, sewers, and neighborhood densities. A compromise between the two methods might be advisable. Part of the extra area might be used for additional open space, part for public buildings (as in the new Cleveland ordinance), and part by the builder (as in the proposed San Francisco ordinance).

Adequate regulations over open space in large scale projects should be geared either to lot area or number of families housed. Both the coverage and usable open space requirements meet this standard. Los Angeles uses a coverage requirement, and Cleveland utilizes a direct open space control requiring 800 square feet of "private yard" per dwelling unit. Area occupied by the main building and by the garage or other parking space is excluded.

Techniques for providing adequate light and air in large projects have been difficult to develop. Without lot lines, yard requirements—the main technique in standard blocks—are hardly adequate. There are several possible alternatives. The buildings could be separated by a minimum light angle or by a specified number of feet between them. Since the latter technique accomplishes the same result as the former and at the same time is stated in clearer terms, it is probably preferable. New York, Cincinnati, and

The former can utilize the area of two streets to increase his lot area base, thus larger buildings or more dwelling units can be constructed on corner lots.

81. CITIZENS' HOUSING COUNCIL, DENSITIES IN NEW YORK CITY 59 (1944). One specific instance is mentioned where the street area in a large scale project was reduced from 36% to 15%. Id. at 17.
82. CLEVELAND ZONING ORDINANCE § 981–44.
83. SAN FRANCISCO PROPOSED COMPREHENSIVE ZONING PLAN § 110 (I)(3) (lot area need only be 90% of the required lot area per dwelling unit in the district in which the project is located).
84. LOS ANGELES COMPREHENSIVE ZONING PLAN § 12.24–B(8) (40% excluding accessory buildings).
85. CLEVELAND ZONING ORDINANCE § 981–44. Both Cleveland and Los Angeles use these open space requirements in large scale projects, but not in the standard residential zones.
Cleveland have adopted this spacing device. But most other ordinances which deal with the question merely pass the problem on to the City Planning Commission with instructions to permit the project if light and air standards are equivalent to those in surrounding areas.

CONCLUSION

The attempt by American cities to control physical growth through zoning has been hampered by unrealistic estimates of the city’s needs and by the use of techniques which have proved either ineffective or positively harmful. New techniques are now available, however, which, if coupled with public support of planned city development, can make zoning an effective control over density, daylighting of buildings, and open space. These tools, in addition to providing improved regulation of the standard city block, are especially well suited to the bulk control problems which modern apartment and large scale housing developments present.

86. New York City Zoning Resolution § 21C (minimum distance between two buildings—not less than 6 inches per foot of height and in no case less than 20 feet), Cincinnati Zoning Ordinance § 1311-3a(a-d) (both a distance based on height and width of facing wall and an "exterior angle" control), Cleveland Zoning Ordinance § 981-55 (control based on the height of the facing wall).

The experimental London Daylight Factor and height indicators, discussed page 520 supra, would work well here and would permit more flexibility than the spacing devices.

87. See, e.g., Los Angeles Comprehensive Zoning Plan § 12.24-B(1): "Where the arrangement of buildings in a large scale housing project does not conform in all respects to the height and area regulations of the zone in which the project is located, the Commission upon application shall have authority to approve such arrangement of buildings on the site, if it finds that the plan of development is in substantial conformance with the requirements of the zone in which the project is located."

If adequate controls over density, daylighting and open space are established in all districts and made to apply to all residential buildings, the Planning Commission’s task of transposing the figures in surrounding districts to the project area will be much easier.

The use of these newer techniques will also make it easier to satisfy the vague admonitions regarding large scale projects which appear in many zoning ordinances. See, e.g., San Francisco Proposed Comprehensive Zoning Plan, Sept. 30, 1949 § 110(1). The Planning Commission is authorized to approve the project if, among other things, it finds:

"6. That the proposed development will constitute a residential environment of sustained desirability and stability; that it will be in harmony with the character of the surrounding neighborhood; that it will not produce a volume of traffic in excess of the capacity for which the access streets are designed and that the standards of open space will be at least as high as permitted or specified in this code for the district in which the proposed development is to be located.

"7. That the property adjacent to the proposed development will not be adversely affected.

"8. That the proposed development will be consistent with the intent and purpose of this code."