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AMERICAN SOCIETY OF
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FLOOR AREA RATIO

Grant of power. For the purpose of promoting health, safety, morals, or the general welfare of the community, the legislative body of every municipality is hereby empowered to regulate and restrict the height, number of stories, and size of buildings and other structures, the percentage of lot that may be occupied, the size of yards, courts, and other open spaces, the density of population, and the location and use of buildings, structures, and land for trade, industry, residence, or other purposes.

Municipal Zoning Enabling Act, by
E. M. Bassett and F. B. Williams,
in Model Laws for Planning Cities,
Counties, and States, Harvard City
Planning Studies, Vol. VII, 1935.

The first purpose of zoning in the United States was to control bulk. The evils of tall buildings, crowded together on land parcels too small and streets too narrow, were explored by special commissions appointed in 1913 and 1916 by the Board of Estimate and Apportionment of the City of New York and in 1923 by the Chicago Real Estate Board. Their recommendations formed the bases of the first zoning ordinances adopted in these two large cities.

New York city decided on separate use, height, and area districts. The area districts were not defined by minimum lot sizes, as might be supposed, but by minimum yard and court dimensions. Together these dimensions resulted in a limit on the percentage of lots covered by structures. When combined with a height district, a control over volume occurred. The Chicago ordinance, adopted seven years later, had only two types of districts -- use and volume. Maximum ground area of buildings and height of buildings were both specified in the volume districts.

As is well known, the approach to controlling bulk that has gained almost unanimous acceptance throughout the country is to combine height and area into one zone. The amalgamation of these two zones with use zones was a big step toward simplicity and comprehensibility; and furthermore it brought to the fore the subtle but direct relationship between building bulk and use. Drafters of zoning ordinances were forced to consider wheth-

er yard, height, and area provisions would in fact promote the purposes of a use district or be inimical to them.

Thus over the 40 odd years since the inception of zoning, the effects of building bulk on quality of residential environment, provision of municipal services, street and transportation systems, and even on the economics of land use have become more clearly understood. Along with this understanding has come a successive refinement of bulk controls. In general, the attempt has been to limit bulk in ways that will help achieve the purposes of comprehensive land use planning. For instance, an ordinance may specify per cent of lot coverage as well as size of yards in a residential zone in order to prevent building to the maximum bulk permitted by yard and height dimensions alone. Or it may limit both height of story and number of stories in a business zone to prevent vertical overcrowding, which, if widespread, taxes street capacity.

Floor area ratio is a supplementary device that under some conditions improves upon (but does not necessarily replace) the traditional means of relating bulk of building to land, to other buildings in the vicinity, and to public facilities. It permits variable dimensions within an over-all volume limit and it offers a way of predicting the ratio of persons to a unit of land in office building districts of high land use intensity.

Just when the floor area ratio bulk control first appeared in a zoning ordinance is not certain. In light of the prominence given to it in the 1950 proposal to rezone New York city (Plan for Rezoning the City of New York, Harrison, Ballard & Allen, 123 East 77th Street, New York 21), it is interesting to note that it was at least brought before the early New York commissions for consideration. Reginald P. Bolton, president of a consulting engineering firm, advocated a limitation of the amount of increase of floor area over plot area as "the best basis for limitation of excessive heights, as it would combine with the financial and physical considerations to bring about limitations of the shape of the building, to the advantage of neighbors." He believed that the limit justifiable in the public interest at that time was "nine times the gross plot area in gross interior floor areas." (Report of the Heights of Buildings Commission to the Committee on the Height, Size and Arrangement of Buildings of the Board of Estimate and Apportionment of the City of New York, December 1913.)

Whatever its origins, the floor area ratio is now gaining a place among the more traditional bulk controls. It was incorporated in the New York city zoning resolution of 1940, and is found in a number of other ordinances adopted since then.

At present, it is being acclaimed as a new and ingenious way of making zoning ordinances more flexible. Although a few proponents affirm that it can stand alone as a bulk control, most of the ordinances that employ it also retain some if not all of the ordinary devices. In this report we will examine applications of the floor area ratio to commercial, industrial, and residential zones, the details that make it appealing to planner, architect, and builder, and some of its shortcomings.

Definitions

Throughout this report, the term "bulk" appears frequently. Though a common enough word, it has a rather special meaning when used in connection with zoning. For instance, the Harrison, Ballard & Allen report defines "bulk controls" as those regulations that affect the volume, shape, and spacing of buildings on the land, distinguishing them from "use controls," which regulate "the activities permitted on the land and within buildings."

If "bulk" and "use" are defined in the zoning ordinances, these concepts are clarified. Such definitions are especially useful in determining what constitutes nonconformity. Also, they serve to warn the person who develops his property of what particular aspects of bulk come under the controlling authority of the zoning ordinance. The following examples appear in the zoning ordinance of Clarkstown, New York (1955).

Bulk. The size and shape of buildings and non-building uses; and the physical relationship of their exterior walls or their location to lot lines and other buildings or other walls of the same building; and all open spaces required in connection with a building. Bulk regulations include regulations dealing with floor area ratio, lot area, lot area per dwelling unit, lot frontage, lot width, height, required yards, courts, usable open space, spacing between buildings on a single lot, and length of buildings in a row.

Use. The term employed to refer to any purpose for which buildings or other structures or land may be occupied.

In nearly every ordinance in which it is used, a floor area ratio is obtained by the following simple formula:*

$$F A R = \frac{\text{floor area}}{\text{lot area}}$$

In practice, this ratio is constant for a zone. A floor area ratio of 1.0 means that floor area may equal lot area. FAR 5.0 means that the floor area may be up to five times as large as the lot area; and FAR 0.5 that it may be no more than half the lot area.

Though a floor area ratio affects volume, shape, and spacing of buildings on

*Planning the Neighborhood (American Public Health Association, Committee on the Hygiene of Housing, published by Public Administration Service, 1313 East 60th Street, Chicago 37) points out that the mathematical relationship of floor area ratio to building coverage and height is expressed by the following formula:

$$F = \frac{G \times S}{L} = B \times S$$

- F - Floor area ratio
- G - Ground area of building
- S - Number of stories
- L - Area of land
- B - Building coverage (ground area of building divided by area of land)

the land, it does not determine a particular shape or spacing. Rather, it permits a choice. The following diagram (Figure 1) shows three of many possibilities under FAR 1.0, 4.0, and 9.0 and demonstrates that shape, height, and arrangement on a lot may vary widely within their confines.

The floor area ratio is often described as a volume control. This description is essentially correct, but if ceiling heights vary, different volumes with the same ratio may result.

In addition to variations of space and arrangement, bulk may vary depending on how "floor area" and "lot area" are defined. Almost invariably "floor area" is a gross measure and includes uninhabitable spaces like stair wells and closets. Since the ratio by definition concerns the relation between a building and land, gross floor area is a far more accurate measure than net. "Lot area" should refer to the minimum area of a buildable parcel as permitted in the zone. For instance, the term "zoning lot" is used to mean a tract of land occupied by the principal and accessory buildings, together with open spaces and yards, having not less than the minimum area required by the ordinance for the district in which the land is situated.

A few representative definitions of "floor area" and "floor area ratio" follow.

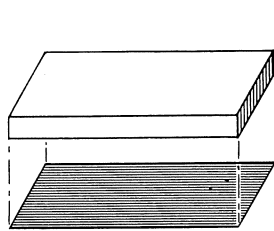
Bismarck, North Dakota (1953)

Floor area. A floor area of a building or buildings is the sum of the gross horizontal areas of the several floors of all buildings on the lot, measured from the exterior faces of exterior walls, or from the center line of walls separating two buildings. Floor area shall include the area of basements when used for residential, commercial, or industrial purposes, but need not include a basement or portion of a basement used for storage or the housing of mechanical or central heating equipment, or the basement apartment of a custodian in a multi-family dwelling, except that portion of said custodian's dwelling unit which is in excess of 50 per cent of the total basement floor area. In calculating floor area, the following need not be included:

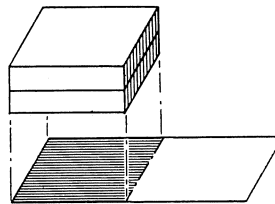
- (a) Attic space providing structural head room of less than 7 feet, 6 inches;
- (b) Uncovered steps;
- (c) Terraces, breezeways and open porches;
- (d) Automobile parking space in a basement or private garage, but not to exceed 600 square feet for single-family dwelling, 800 square feet for a two-family dwelling, and 200 square feet per car space required by the provisions of this ordinance for any other use;
- (e) Accessory off-street loading berths, but not to exceed twice the space required by the provisions of this ordinance.

Figure 1

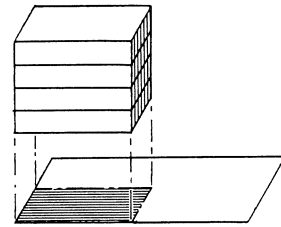
Illustrations of Floor Area Ratios



100 % LOT COVERED

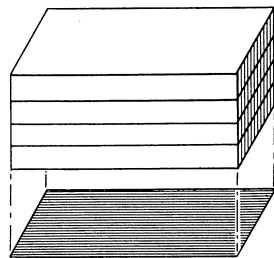


50 % LOT COVERED

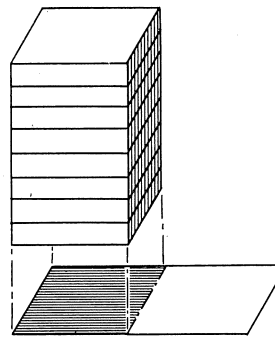


25 % LOT COVERED

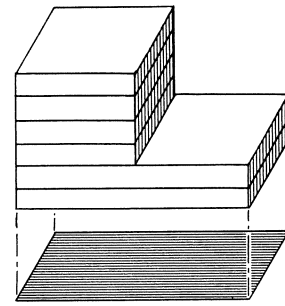
F.A.R. 1.0



100 % LOT COVERED

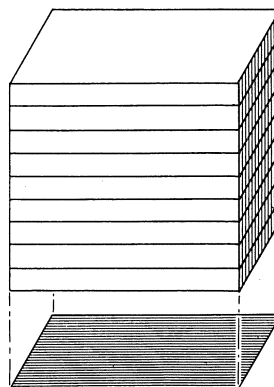


50 % LOT COVERED

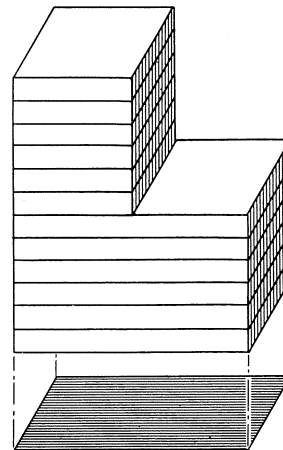


100 % LOT COVERED
(COMBINATION)

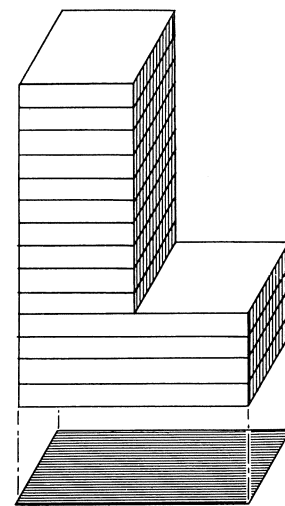
F.A.R. 4.0



100 % LOT COVERED



100 % LOT COVERED (COMBINATIONS)



F.A.R. 9.0

Source: A New Zoning Plan for the District of Columbia. Harold M. Lewis, 1956.

Floor area ratio. The floor area of the building or buildings on a zoning lot, divided by the area of that zoning lot.

Chicago (1957)

Floor area (for determining floor area ratio). For the purpose of determining the floor area ratio, the "floor area" of a building is the sum of the gross horizontal areas of the several floors of the building measured from the exterior faces of the exterior walls or from the center line of walls separating two buildings. The "floor area" of a building shall include basement floor area when more than one-half of the basement height is above the established curb level or above the finished lot grade level where curb level has not been established, elevator shafts and stairwells at each floor, floor space used for mechanical equipment -- except equipment, open or enclosed, located on the roof -- penthouses, attic space having headroom of seven feet, ten inches or more, interior balconies and mezzanines, and enclosed porches, and floor area devoted to accessory uses. However, any space devoted to off-street parking or loading shall not be included in "floor area".

Floor area ratio (FAR). The "floor area ratio" of the building or buildings on any zoning lot is the floor area of the building or buildings on that zoning lot divided by the area of such zoning lot, or, in the case of planned developments, by the net site area.

Clarkstown, New York (1955)

Floor area. The sum of the gross horizontal areas of every floor of a building, measured from the exterior faces of exterior walls or from the center line of party or common walls separating two buildings, including (a) basement space; (b) attic space, whether or not a floor has been laid, over which there is structural headroom of 7½ feet or more; (c) floor space used for mechanical equipment, with structural headroom of 7½ feet or more; (d) elevator shafts and stair wells at each floor; (e) roofed porches, breezeways, interior balconies and mezzanines, penthouses, and (f) any roofed-over space such as a garage or carport for off-street parking accessory to a single-family or two-family dwelling, not located in a cellar. Regardless of the internal arrangement of a building it shall be deemed to have at least one floor for each 20 feet of height or fraction thereof. However, floor area does not include: (a) cellar space (except that cellar space used for a retail sales use shall be included for the purposes of calculating Art. 6 requirements of such use for accessory off-street parking spaces and accessory off-street loading berths); (b) elevator and stair bulkheads, accessory water tanks, and cooling towers; (c) terraces, unroofed open porches, and steps; and (d) enclosed off-street parking spaces

and loading berths, accessory to any use, other than a single-family or two-family dwelling.

Floor area ratio. The floor area in square feet of all buildings on a lot, divided by the area of such lot in square feet.

Washington, D. C. (proposed 1957)

Gross floor area: the sum of the gross horizontal areas of the several floors of all buildings on the lot, measured from the exterior faces of exterior walls or from the center line of walls separating two buildings.

In particular, the gross floor area of a building or buildings shall include basements, elevator shafts and stair wells at each story, floor space used for mechanical equipment (with structural headroom of six feet, six inches or more), penthouses, attic space (whether or not a floor has actually been laid, providing structural headroom of six feet, six inches or more), and interior balconies and mezzanines, but shall exclude all cellars and any basement space devoted to parking of automobiles.

Floor area ratio: a figure which expresses the total gross floor area as a multiple of the area of the lot. This figure is determined by dividing the gross floor area of all buildings on a lot by the area of that lot.

Advantages Claimed for Floor Area Ratio

The biggest single claim made for the floor area ratio is that it adds "flexibility" to a zoning ordinance. This word needs a closer look because it is often used uncritically, on the assumption that "flexibility" in itself is a good thing. A standard dictionary gives several meanings, among them, "capable of being adapted, modified, or molded; plastic, pliant;" and "ready to yield to influence." Another is "readily adjustable to changing conditions."

Zoning, as has often been pointed out, is concerned with minimal considerations -- that is, the least that can be done to secure the goals of the zoning ordinance. If this is true, then what is the defensible basis for deviating from any one of them?

One answer is that it may be a fallacy to assume that there is only one set of conditions that will serve zoning purposes. The argument for flexibility is that if the several variables are shifted around a bit, the net effect on general welfare considerations may turn out to be the same. And in the meantime, the individual is given choice and room to experiment. Thus, if the ratio of floor area to lot area is the only consideration, there is no reason to make the zoning regulations so "rigid" that only one kind of floor arrangement can result.

In most situations, however, other factors must also be considered. Since these vary among the principal use zones, they will be considered individually in the sections that follow.

Other advantages often pointed out as being unusual to the ratio are these: it applies equally to all types of structures; it applies "with equity" to lots of different sizes; it takes into account the possibility of more than one structure on a lot; it applies directly to the building and does not depend on the variable factor of occupancy; it allows greater variety in architectural design; it gives a quick measure of the capacity of buildings -- a convenience to both builders and public agencies; it removes the inducement to squeeze extra stories into the permitted volume of a building; and it makes the utilization of new construction methods more feasible than under traditional controls.

In examining the present use of the floor area ratio it should always be kept in mind that though the idea dates back some years, in practice it is a new and relatively untried device. What we are discussing is its present stage of development.

What Ratios?

Although it is reasonable to be guided by what other cities and counties are doing in deciding on some of the minimum zoning requirements, it would probably be a mistake to rely to the same degree on floor area ratio provisions adopted by other jurisdictions. Intensity of land development determines the character of a city and the load on public utilities and services almost as much as the uses to which it is put. Therefore, it is necessary to first have an abstract idea of the desirable limits of building intensity before the controls themselves are drawn up. The floor area ratios suitable for any given community are those that will achieve, or help achieve, the desired intensity of use.

The following examples are given only to illustrate the range of floor area ratios in effect in, or recommended for, a few communities. It cannot be emphasized too strongly that in each case other controls designed to regulate the volume, shape, and spacing of buildings on the land also prevail.

Bismarck, North Dakota

<u>Zone</u>	<u>Description</u>	<u>Single-story</u>	<u>More than one story</u>
R-7*	Single-family	0.30	0.40
R-3.5*	Single- and two-family	0.35	0.45
R-2.5*	Same, on lots platted prior to 1940	0.35	0.50
RM*	Multi-family and similar high density	0.40	1.20
CA	Neighborhood business	0.75	1.50
CB	Central business district	1.00	5.00
CC	Shopping center	0.25	0.35
MA	Heavy commercial and non-nuisance industries	1.00	2.00
MB	Same, which may create some nuisance	0.30	0.60
P	Public use, mainly public education	0.30	1.00

<u>Zone</u>	<u>Description</u>	<u>Single-story</u>	<u>More than one story</u>
A	Agricultural	0.30	0.40
A-20	Limited agriculture	0.30	0.40

*In computing floor area ratio and ground coverage, 200 square feet shall be added to the actual area of the buildings for each car space required by this ordinance, if such space is not furnished within a building.

Chicago

<u>Zone type</u>	<u>Number of sub-types</u>	<u>Basic floor area ratio</u>
Residence	8	0.5 - 10.0
Business	7	1.2 - 16.0
Commercial	4	1.2 - 16.0
Manufacturing	3	1.2 - 7.0

Clarkstown, New York

<u>Zone</u>	<u>Description</u>	<u>Floor area ratio</u>
RA	Single-family	0.10
RA-1	Single-family	0.15
R-1	Single-family	0.20
R-2	One-, two-family	0.30
SC	Summer colony	0.30
RO	Residential-professional	0.20
LS	Local business	0.30 (uses permitted in R-2)
		1.00 (business uses)
C-1	General business	0.30 (uses permitted in SC)
		2.00 (business uses)
C-2	Highway business	0.30
M-1	Light manufacturing	0.50
M-2	General manufacturing	0.50

Denver, Colorado (1957)

<u>Zone</u>	<u>Description</u>	<u>Maximum gross floor area in structures (multiple of a zone lot)</u>
R-0	Quiet, low-density residential	none
R-1	Quiet, low-density residential	none
R-2	Medium-density residential	none
R-3	High-density residential	3
R-4	Very high and highest-density residential	4
B-1	Office	1

<u>Zone</u>	<u>Description</u>	<u>Maximum gross floor area in structures (multiple of a zone lot)</u>
B-2	Neighborhood convenience goods	1
B-3	Convenience goods (driving distance)	1
B-4	General retail, strip development	2
B-5	General retail, high concentration	10
I-0	Light industry, bordering residential land	$\frac{1}{2}$
I-1	Industry, with controls to protect bordering residential land	2
I-2	Industry	none
O-1	Open land, agricultural, airports	none
P-1	Parking	none
B-6	Business and warehousing	3

New York (proposed 1952)

<u>Zone type</u>	<u>Number of sub-types</u>	<u>Range of FAR</u>
Residence	9	0.50 - 10.00
Commercial	16	0.80 - 15.00
Manufacturing	9	2.00 - 15.00

Vancouver, British Columbia (1956)

<u>Districts</u>	<u>Basic floor space ratio</u>
One-family; two-family; and multiple dwelling (garden apartment)	0.45
Multiple dwelling -- Low-density	0.75
Medium-density	1.30
High-density	3.0
Commercial -- Local	1.20
Suburban	3.0
Medium-density	5.0
General	(other bulk controls)
Light industry; heavy industry	5.0

In all of the preceding examples except Denver, a floor area ratio is assigned to all zones. In Denver, however, low- and medium-density residential zones and the general industrial zone are not regulated in this way. In the proposed Philadelphia zoning ordinance, floor area ratios commence in the group dwelling district. (See also Table 2, page 20.) In Dearborn, Michigan (1953), a limit on gross floor area, ranging from one and one-half

to ten times the area of the lot, is placed on buildings in the three business zones only.

In other words, the floor area ratio is used in these ordinances mainly in zones of high building intensity, and where, for one reason or another, a control different from what prevails in the rest of the ordinance is desired. The sections that follow will point out the advantages and disadvantages of its use in various types of zones.

COMMERCIAL ZONES

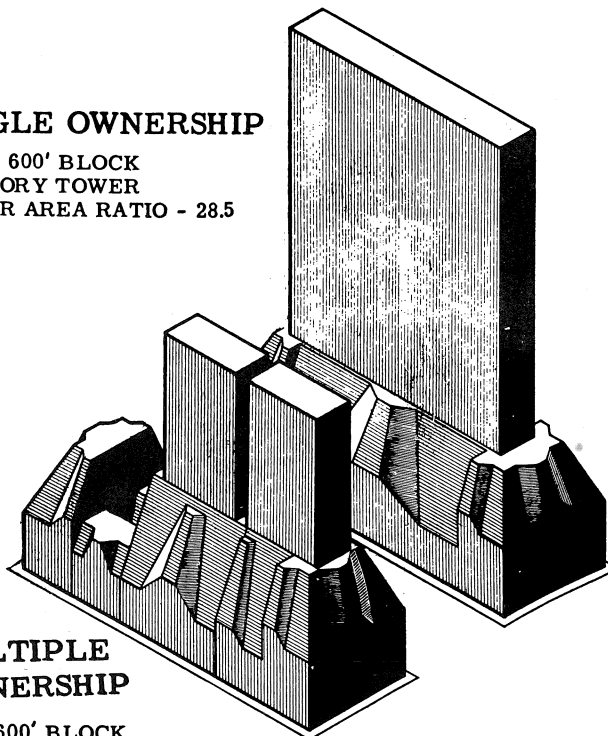
The floor area ratio promises to be most useful in central business districts and in other zones of high land use intensity where office buildings, stores, hotels, and tall apartment houses are often intermixed. In these areas the advantages inherent in the device seem to operate most effectively.

Chief among them is the flexibility offered to the designer of a building. The old bulk controls are often thought of as creating an "envelope" beyond which the structure cannot extend. The diagram to the right shows, for instance, the bulk envelope of one business zone under the existing New York zoning resolution. Few other ordinances encourage an extreme "wedding cake" appearance. But whether a maximum height only is prescribed, or whether the New York system is used, the tendency is to build to the limits permitted -- especially the lower stories -- because high land values demand that as much of the cubic area as possible be turned into rentable floor space.

If we think of the traditional bulk controls as creating a rigid envelope, we can think of the floor area ratio as creating an envelope having

SINGLE OWNERSHIP

200' x 600' BLOCK
70-STORY TOWER
FLOOR AREA RATIO - 28.5



MULTIPLE OWNERSHIP

200' x 600' BLOCK
45-STORY TOWERS
FLOOR AREA RATIO - 190

PERMITTED DEVELOPMENT

Source: Plan for Rezoning the City of New York. Harrison, Ballard & Allen, 1950.

expansible dimensions. The flexibility of floor arrangement under controls that limit gross floor area but not height -- except indirectly -- has been shown in Figure 1.

One of the first steps in determining what floor area ratios are appropriate for a downtown business district is to decide whether height limits are desired. Though an ultimate practical height limit results from any given ratio, the result may be higher than warranted for other reasons. For instance, maximum height limits may be set by a fire district. Or a prominent government building, such as the Capitol in the District of Columbia or the state capitol in Oklahoma City, may determine the top limit. On the other hand, a maximum building height may be desired simply because of the character of the city. For instance, the council of a village in Illinois, where no building exceeded 45 feet high, turned down an amendment to permit a height of 85 feet -- an eminence that would have dominated the community and eventually changed its appearance.

The height question having been settled, the next decision is that which deals with the quantitative value of the ratio itself. In a downtown district perhaps the most important consideration affecting maximum bulk is the traffic (both vehicular and pedestrian) generated by development.

The minimum number of persons who will arrive and leave an office building can be determined fairly accurately if a measure of floor space per office worker is known. Though a survey in any particular case may show more or less, a figure of 200 square feet of gross floor area per worker is often taken as a base. Also to be considered is the number of persons arriving to do business with the firms located in office buildings. It is not likely that at any one time it would exceed (or even approach) the peak number of workers, but the actual situation should be determined.

The traffic generating capacity of department stores -- another major use in downtown business districts -- is not so easily calculated. However, George B. Ford, in his book Building Height, Bulk, and Form (Harvard City Planning Studies, Vol. II; 1931), observed that "the interesting fact is that the street and transit traffic congestion caused by department stores or theaters is anywhere from two to five times as great as that caused by office buildings or loft buildings; and, what is more, this latter kind of congestion is spread more or less uniformly over a number of hours during the day instead of being concentrated at two or three short peaks."

To an increasing degree the intensity of commercial construction is determined by the capacity of the transportation system to bring customers to and from stores. When the private automobile is the dominant means of transportation, the intensity of development is low because of the need to provide off-street parking.

A modern shopping center that depends on the private automobile to bring all customers will provide four, five, or six times as much parking space as there is retail sales space -- or sometimes even more parking area. If all the lot except for the ground actually covered by the building is given

to parking, a 4:1 ratio gives a floor area ratio of 0.20; 5:1 gives FAR 0.17; and 6:1 gives FAR 0.14. These ratios are far below anything practical for a central business district.

One shopping center, which had about 35 per cent of its customers arriving by public transit, was able to furnish sufficient private auto storage with about 1:1 ratio. This corresponds roughly to a floor area ratio of 0.50.

While this report makes no recommendations as to standards, an approach to a determination of proper intensity of development in the downtown area (and an estimate of a reasonable floor area ratio) can be made by considering the entire central business district as a shopping area and working with the ratios of public to private auto transportation and the total auto storage facilities of the central business district.

Furthermore, the relation between a public transportation system and density in downtown areas is reciprocal. If the transit system consists only of buses, which may travel four miles an hour on business streets or at top efficiency carry only 1,200 persons a lane each hour, it would be unreasonable to encourage construction of buildings with large gross floor areas. If, on the other hand, the downtown section is served by a subway with a capacity of 40,000 persons a lane per hour, large-bulk buildings will be less likely to cause congestion. In other words, greater density -- and hence greater bulk and higher buildings -- is feasible with greater transit capacity.

A still further factor that affects desirable bulk -- and hence the desirable floor area ratio -- is the physical relation of buildings to each other and to the street. It will be recalled that the height districts in the original New York city zoning ordinance were based on street widths. In a "one and one-half times district," for instance, buildings could not be erected to a height "in excess of one and one-half times the width of the street." Increases were, of course, permitted commensurate with a setback from the street. The purpose was to prevent tall buildings from blocking light and air from streets and from other buildings.

The Harrison, Ballard & Allen report proposed a maximum floor area ratio of 15.0, which, it is suggested, will "hold down the bulk and further congestion to what may still be an economic level for the builder and owner. The mapping of this highest bulk district is confined to locations where property values and existing building bulks demand a high floor area ratio figure."

The floor area ratios of some of the extremely high-bulk buildings erected in New York city are: Tishman Building -- 18.0; Equitable Life Assurance Society Building -- 17.0; Western Union Building -- 18.0; 505 Park Avenue (59th Street) -- 19.0; 100 Park Avenue -- 20.0; Empire State Building -- 32.0. The Port of New York Authority building has a floor area ratio of 15.0, and Rockefeller Center 11.9.

To determine suitable floor area ratios for business districts in Washington, D. C., Harold M. Lewis made a survey of existing bulk patterns. (See A New Zoning Plan for the District of Columbia, 1956.) Thirty-eight blocks in

typical commercial zoning districts were selected at random. It was discovered that in no case did the developed floor area ratio even approach that permitted under the ordinance. A portion of the findings -- those that deal with the downtown district -- are reproduced in the table below.

COMPARISON OF EXISTING AND PERMITTED DENSITIES IN SELECTED COMMERCIAL BLOCKS

Square Number	Zoning District	Site area, sq. ft.	Ground floor area	Per cent coverage	Floor area, sq. ft.	Developed floor area ratio	Permitted floor area ratio	Per cent built up	Average intensity of development
75	110-D First 90-D Commercial	57,797	39,720	68.7	138,290	2.39	12.88	18.6	
163	110-D First 90-D Commercial	132,515	83,085	62.7	406,320	3.06	9.49	32.2	
168	110-D First 90-D Commercial	110,828	97,137	87.6	634,290	5.72	10.57	54.0	
183	90-D First Commercial	153,021	86,420	56.4	227,910	1.49	7.40	20.2	
220	110-D First Commercial	106,126	91,124	85.8	478,164	4.50	11.13	40.7	
247	110-D First 90-D Commercial	148,987	75,860	50.9	218,540	1.47	9.50	15.5	
253	110-D First Commercial	127,008	110,000	86.5	482,031	3.78	10.56	35.8	
320	110-D First Commercial	51,506	48,621	94.4	186,734	3.62	10.26	35.3	
343	110-D First Commercial	55,996	22,653	40.5	60,847	1.08	11.70	9.2	
453	110-D First 90-D Second Commercial	129,573	81,680	63.0	221,780	1.71	8.04	21.2	
456	110-D Second 90-D Commercial	163,556	131,360	80.3	592,065	3.61	10.89	33.2	
485	90-D First Commercial	50,618	33,300	65.6	92,220	1.82	7.44	24.4	
488	90-D First Commercial	61,151	45,920	75.0	124,520	2.03	7.44	27.3	
623	90-D First Commercial	198,183	128,530	64.5	296,200	1.49	7.34	20.2	

27.6%

te: The last two columns refer to the percentage of permitted development bulk.

This realistic appraisal of development trends, plus the "need for tailoring the bulk of traffic generating facilities to traffic capacity in the downtown area," plus federal interest in limiting height of all roof structures to 150 feet in order to assure the dominance of the Capitol and the Washington Monument, led to the conclusion that new zoning controls should aim at an average building density of not more than FAR 4.0. However, it was recognized that since many of the remaining parcels were too small for full bulk development or would have economic uses in low-bulk structures, the individual owner should, on occasion, be permitted to build higher than average bulk buildings. Therefore, it was concluded that FAR 7.0 was a "reasonable compromise between the need for control of density and the need for a FAR gain sufficient to offset the cost of assembling small plots and tear-

ing down old buildings."* Figure 2 is a comparison of an average block as presently developed, the same block built to FAR 4.5 (which would be an average development under a maximum FAR 7.0), and the same block at FAR 9.0, as presently permitted.

After examining the parking and traffic generating potential of industrial and other types of business areas in the District, the following ratios were proposed as "reasonable in relation to their effect on adjoining areas and to the high density district at the center of the city":

Major outlying centers adjacent to the central business district
-- FAR 4.0 plus FAR 1.0 for parking

Major outlying centers away from the central business district
-- FAR 3.0 plus FAR 1.0 for parking

Community business centers -- FAR 2.0

Small neighborhood centers -- FAR 0.5

Heavy commercial and light manufacturing areas -- FAR 3.0

General industrial areas -- FAR 4.0

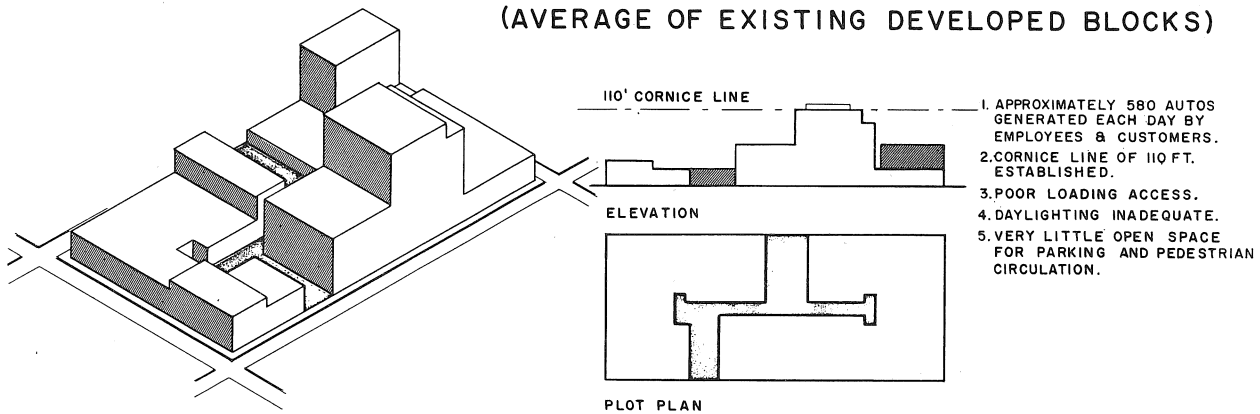
Premiums. If under a given floor area ratio ground floors and streets gain in light and air when a building is high and narrow rather than low and broad, can still greater gains be made by extending the process? That gains can be made is the theory behind the premiums offered under the Chicago and the proposed Philadelphia zoning ordinances. If open area additional to that resulting from a basic floor area ratio is provided, height may be greater than that permitted under the basic ratio. In other words, increased open space at the ground level or on the lower floors of a building compensates for and justifies an increase in total floor area.**

*In commercial districts, the floor area ratio may be increased if interior parking is furnished. In the G-4 district, for example, FAR 3.5 is the limit for apartment houses with no enclosed parking above ground; an additional FAR 1.0 is given for enclosed parking, making a total FAR of 4.5. Other uses are permitted FAR 7.0, plus 2.0 for enclosed parking, making a total of FAR 9.0.

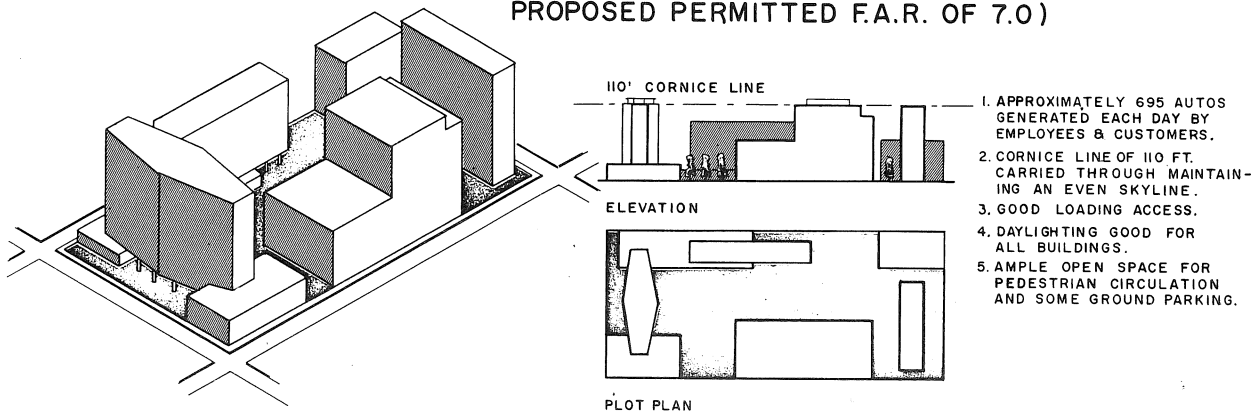
**There is some evidence that the transfer of floor space from the lower to upper floors is profitable. Studies of office buildings in New York city show that square-foot rental rates increase, on the average, about one per cent per story, using the third, fourth, or fifth floor as base. The ground and second stories are "taxpayers" and are reliable income floors. Speaking of these, Mr. Ford (in Building Bulk, Height, and Form comments: "In any case, it is most obvious that light and outlook command a marked premium, and that anything which will bring more of the upper light and openness down into the lower stories will correspondingly increase their rental value. In other words, it is practicable to make a considerable sacrifice in building bulk in the lower stories, provided a sufficient proportion of it is added to the tower."

Figure 2

**AN EXISTING DOWNTOWN BLOCK BUILT TO AN F.A.R. OF 3.0
(AVERAGE OF EXISTING DEVELOPED BLOCKS)**



**SAME BLOCK BUILT TO AN F.A.R. OF 4.5
(AS MIGHT BE BUILT FROM THE
PROPOSED PERMITTED F.A.R. OF 7.0)**



**SAME BLOCK BUILT TO AN F.A.R. OF 9.0
(UNDER PRESENT PERMITTED
F.A.R. OF 13.0 AND NO SETBACK)**

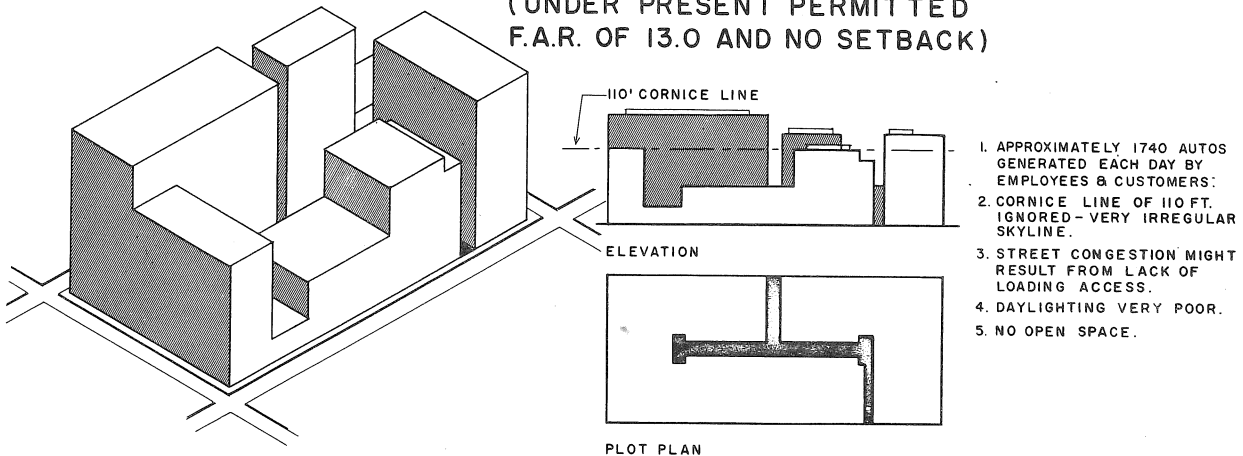


FIGURE 20. Comparison of Existing Development on a Typical Downtown Block with That Likely Under Proposed Regulations and That Likely Under Present Zoning Contrals and Elimination of Setback Requirement

Source: A New Zoning Plan for the District of Columbia. Harold M. Lewis, 1956.

Under both the Chicago ordinance and the Philadelphia proposal, premiums are given for arcades, setbacks, and plazas. Philadelphia also gives a premium for open-air interior courts; Chicago gives more weight than Philadelphia does to covered arcades.

In Philadelphia, these premiums are granted in several types of districts; in Chicago, they apply only to the commercial zones of highest building density or bulk. However, Chicago grants another premium if the parcel adjoins or is across the street from "a public open space which is at least five acres in area and of a depth perpendicular to such front or side lot line of not less than 200 feet." This type of premium applies in all general residence districts, all business districts, all commercial districts, and all but the "heavy" manufacturing districts.

The details of premiums granted in the Chicago ordinance as they apply to central business districts are reproduced in Table 1.

A summary of the premiums that would be granted under the Philadelphia proposal is shown in Table 2, which is reproduced from a booklet prepared by the Citizens Council on City Planning (1717 Sansom Street, Philadelphia 3). Details of the increased floor area permitted in the C4 Commercial District for additional open area, as displayed in the ordinance proposal, constitute Figure 3.

Other comparisons of the two sets of provisions are made in an article by Richard A. Miller, "A Key to Open Cities," in Architectural Forum, February 1958.

INDUSTRIAL ZONES

As a bulk determinant, the floor area ratio is probably less useful in industrial areas than in any other type of use district. Although modern plants have many characteristics in common, these characteristics are not necessarily uniform within a zone. This is so because industrial zones are classified mainly on the basis of the "nuisance" characteristics of manufacturing processes.

To illustrate: a "light" industrial zone requires nonnuisance industries and ample distance between plants and accessory uses on the one hand and surrounding residential areas on the other. It also has, desirably, a low structural density or per cent of the total land covered by structures. These characteristics can be achieved by other bulk controls -- chiefly yards and per cent of lot coverage. Because most plants built today are no more than one story high, maximum height limits do not restrict plant design in the same way as they restrict office building design. Consequently, there is little incentive to go higher than what is permitted by the ordinance.

As a control of employment density (persons per acre) in industrial zones, the floor area ratio is a fairly ineffective device. Unlike office buildings and stores, the ratio of persons to a unit of floor area is highly variable within a zone. It was found during the course of the Chicago rezoning studies, for instance, that a plant with a floor area of 10,000

Table 1

B6-6 AND B6-7 RESTRICTED CENTRAL BUSINESS DISTRICTS	B7-5 TO B7-7 GENERAL CENTRAL BUSINESS DISTRICTS	B6-6 AND B6-7 RESTRICTED CENTRAL BUSINESS DISTRICTS	B7-5 TO B7-7 GENERAL CENTRAL BUSINESS DISTRICTS
<p>3 Maximum Floor Area Ratio—B6 Districts</p> <p>In a B6-6 District, the floor area ratio shall not exceed 12.0 except as provided in paragraphs (3) and (4) hereinafter.</p> <p>In a B6-7 District, the floor area ratio shall not exceed 16.0 except as provided in paragraphs (3) and (5) hereinafter.</p> <p>Where the front or side lot line of a zoning lot adjoins a public open space which is at least five acres in area and of a depth perpendicular to such front or side lot line of not less than 200 feet, the floor area ratio for such zoning lot may be increased by 15 per cent.</p> <p>Where building floors which come within the permissible floor area ratio limits established under paragraphs (1) or (3) of this Section are set back from one or more lot lines, floor area ratio premiums may be added to such permissible floor area ratio in accordance with each one of the following:</p> <p>a. On any zoning lot where the first story above grade is set back at least 20 feet from a public street for the entire frontage of the lot on such street, a premium of 1.5 for each such street may be added to the permissible floor area ratio, provided that the lot area within such 20 feet of the street shall be suitably paved and/or landscaped and otherwise unobstructed except for columns or piers supporting upper stories or a roof. However, if, in addition to the first story, all other stories above grade shall be so set back for at least 20 feet, such premium may</p>	<p>8.5-7 Maximum Floor Area Ratio—B7 Districts</p> <p>(1) In a B7-5 District, the floor area ratio shall not exceed 7.0, except as provided in paragraph (4) hereinafter.</p> <p>(2) In a B7-6 District, the floor area ratio shall not exceed 12.0, except as provided in paragraphs (4) and (5) hereinafter.</p> <p>(3) In a B7-7 District, the floor area ratio shall not exceed 16.0 except as provided in paragraphs (4) and (6) hereinafter.</p> <p>(4) Where the front or side lot line of a zoning lot adjoins a public open space which is at least five acres in area and of a depth perpendicular to such front or side lot line of not less than 200 feet, the floor area ratio for such zoning lot may be increased by 15 per cent.</p> <p>(5) Where building floors which come within the permissible floor area ratio limits established under paragraphs (2) or (4) of this Section are set back from one or more lot lines, floor area ratio premiums may be added to such permissible floor area ratio in accordance with each one of the following:</p> <p>a. On any zoning lot where the first story above grade is set back at least 20 feet from a public street for the entire frontage of the lot on such street, a premium of 1.5 for each such street may be added to the permissible floor area ratio, provided that the lot area within such 20 feet of the street shall be suitably paved and/or landscaped and otherwise unobstructed except for columns or piers supporting upper stories or a roof. However, if,</p>	<p>8.5-6 Maximum Floor Area Ratio—B6 Districts (continued)</p> <p>be increased to 2.0 for each street.</p> <p>b. On any zoning lot when the building from ground level up is set back from one or more lot lines, a premium equal to two times the open area of the lot at ground level divided by the gross lot area may be added to the permissible floor area ratio — where such open area shall include all lot area at ground level open directly to the sky and extending between exterior building walls and lot lines for a distance of at least eight feet.</p> <p>c. On any zoning lot, for each floor above the ground floor which is set back from one or more lot lines a premium equal to 0.3 times the open area of the lot at the level of such floor divided by the gross lot area may be added to the permissible floor area ratio — where such open area shall include all area open directly to the sky and extending between exterior building walls and lot lines in a horizontal plane containing the subject floor for a distance of at least eight feet.</p> <p>(5) Where building floors which come within the permissible floor area ratio limits established under paragraphs (2) or (3) of this Section are set back from one or more lot lines, floor area ratio premiums may be added to such permissible floor area ratio in accordance with each one of the following:</p>	<p>8.5-7 Maximum Floor Area Ratio—B7 Districts (continued)</p> <p>in addition to the first story, all other stories above grade shall be so set back for at least 20 feet, such premium may be increased to 2.0 for each street.</p> <p>b. On any zoning lot when the building from ground level up is set back from one or more lot lines, a premium equal to two times the open area of the lot at ground level divided by the gross lot area may be added to the permissible floor area ratio — where such open area shall include all lot area at ground level open directly to the sky and extending between exterior building walls and lot lines for a distance of at least eight feet.</p> <p>c. On any zoning lot, for each floor above the ground floor which is set back from one or more lot lines a premium equal to 0.3 times the open area of the lot at the level of such floor divided by the gross lot area may be added to the permissible floor area ratio — where such open area shall include all area open directly to the sky and extending between exterior building walls and lot lines in a horizontal plane containing the subject floor for a distance of at least eight feet.</p> <p>(6) Where building floors which come within the permissible floor area ratio limits established under paragraphs (3) or (4) of this Section are set back from one or more lot lines,</p>

r area ratio provisions, central business districts, Chicago zoning ordinance (1957)

B6-6 AND B6-7 RESTRICTED CENTRAL BUSINESS DISTRICTS	B7-5 TO B7-7 GENERAL CENTRAL BUSINESS DISTRICTS	B6-6 AND B6-7 RESTRICTED CENTRAL BUSINESS DISTRICTS	B7-5 TO B7-7 GENERAL CENTRAL BUSINESS DISTRICTS
<p>8.5-6 Maximum Floor Area Ratio—B6 Districts (continued)</p> <p>a. On any zoning lot where the first story above grade is set back at least 20 feet from a public street for the entire frontage of the lot on such street, a premium of 2.0 for each such street may be added to the permissible floor area ratio, provided that the lot area within such 20 feet of the street shall be suitably paved and/or landscaped and otherwise unobstructed except for columns or piers supporting upper stories or a roof. However, if, in addition to the first story, all other stories above grade shall be so set back for at least 20 feet, such premium may be increased to 2.5 for each street.</p> <p>b. On any zoning lot when the building from ground level up is set back from one or more lot lines, a premium equal to two and one-half times the open area of the lot at ground level divided by the gross lot area may be added to the permissible floor area ratio—where such open area shall include all lot area at ground level open directly to the sky and extending</p>	<p>8.5-7 Maximum Floor Area Ratio—B7 Districts (continued)</p> <p>floor area ratio premiums may be added to such permissible floor area ratio in accordance with each one of the following:</p> <p>a. On any zoning lot where the first story above grade is set back at least 20 feet from a public street for the entire frontage of the lot on such street, a premium of 2.0 for each such street may be added to the permissible floor area ratio, provided that the lot area within such 20 feet of the street shall be suitably paved and/or landscaped and otherwise unobstructed except for columns or piers supporting upper stories or a roof. However, if, in addition to the first story, all other stories above grade shall be so set back for at least 20 feet, such premium may be increased to 2.5 for each street.</p> <p>b. On any zoning lot when the building from ground level up is set back from one or more lot lines, a premium equal to two and one-half times the open area of the lot at ground level divided by the gross lot area may be added to the permissible floor</p>	<p>8.5-6 Maximum Floor Area Ratio—B6 Districts (continued)</p> <p>between exterior building walls and lot lines for a distance of at least eight feet.</p> <p>c. On any zoning lot, for each floor above the ground floor which is set back from one or more lot lines, a premium equal to 0.4 times the open area of the lot at the level of such floor divided by the gross lot area may be added to the permissible floor area ratio—where such open area shall include all area open directly to the sky and extending between exterior building walls and lot lines in a horizontal plane containing the subject floor for a distance of at least eight feet.</p> <p>(6) No floors exceeding the floor area ratio limits established in paragraphs (1), (2), or (3) of this Section and added to a building by virtue of unused basic floor area ratio or by virtue of floor area ratio premiums shall in turn serve as a basis for creating additional premiums.</p>	<p>8.5-7 Maximum Floor Area Ratio—B7 Districts (continued)</p> <p>area ratio—where open area shall include all lot area at ground level open directly to the sky and extending between exterior building walls and lot lines for a distance of at least eight feet.</p> <p>c. On any zoning lot each floor above ground floor which is set back from one or more lot lines, a premium equal to 0.4 times the open area of the lot at the level of such floor divided by the gross lot area may be added to the permissible floor area ratio—where such open area shall include all area open directly to the sky and extending between exterior building walls and lot lines in a horizontal plane containing the subject floor for a distance of at least eight feet.</p> <p>(7) No floors exceeding the floor area ratio limits established in paragraphs (2), (3), or (4) of this Section and added to a building by virtue of unused basic floor area ratio or by virtue of floor area ratio premiums shall in turn serve as a basis for creating additional premiums.</p>

PROPOSED PREMIUMS and BASIC FLOOR AREAS

DISTRICT	PREMIUMS		BASIC FLOOR AREA
	Additional Square Feet Permitted in Building for 1 Square Foot of Open Area at Ground Level	Additional Square Feet Permitted in Building for 1 Square Foot of Building Set-back Above Ground Level	
RESIDENTIAL DISTRICT "R-14" Set-backs (including required yards) from: Street, 50 ft. wide or greater Street less than 50 ft. wide Rear lot line, not a street Open Arcade at least 10 ft. wide Open Area separated by arcade: if it abuts a street 50 ft. wide or greater if it abuts a street less than 50 ft. wide Other Open Areas not abutting a street	2.0 1.0 0.7 0.3 2.0 1.0 0.6	0.5 for any type of set-back at 1st or 2nd story roof level	150%
RESIDENTIAL DISTRICT "R-15" Set-backs (including required yards) from: Street, 50 ft. wide or greater* Street less than 50 ft. wide* Rear lot line, not a street Open Arcade at least 10 ft. wide Open Area separated by arcade at least 15 ft. wide: if it abuts a street 50 ft. wide or greater if it abuts a street less than 50 ft. wide Other Open Areas not abutting a street	4.0 2.0 1.0 0.3 4.0 2.0 0.6	0.5 for any type of set-back at 1st or 2nd story roof level	350%
CENTER CITY DISTRICTS: RESIDENTIAL DISTRICT "R-16" COMMERCIAL DISTRICT "C-4" INDUSTRIAL DISTRICT "L-4" If on a street 60 ft. wide or greater, for each foot wider than 60 ft. Set-backs (including required yards) from: Street, 50 ft. wide or greater* Street less than 50 ft. wide* Rear lot line, not a street Open Arcade at least 10 ft. wide Open Area separated by arcade at least 10 ft. wide: if it abuts a street 50 ft. wide or greater if it abuts a street less than 50 ft. wide Other Open Areas not abutting a street	5% of lot area 15.0 10.0 10.0 7.5 15.0 10.0 5.0	5.0 for any type of set-back above ground level up to a height of 40'	500% 500% 500%

*The set-back must be a minimum of 10 ft. before the premium applies

Source: Proposed Bulk Controls, Citizens Council on City Planning, Philadelphia; 1958.

BASIC FLOOR AREA

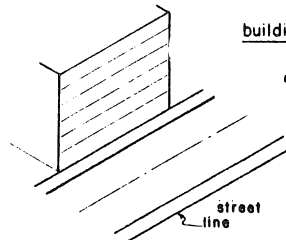
500% OF LOT AREA

ADDITIONAL FLOOR AREA

INCREASED FLOOR AREA
permitted for

BUILDINGS FACING WIDE STREET
&
OPEN AREAS
at ground level (including required yards
above ground level (maximum height 40

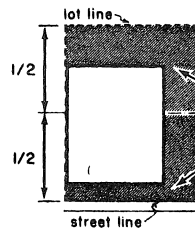
BUILDINGS FACING WIDE STREETS



buildings facing streets more than 60 ft. wide

additional floor area =
5% of lot area per foot of street
width greater than 60

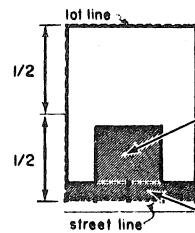
OPEN AREA AT GROUND LEVEL



buildings constructed back from
rear lot line (maximum distance 1/2 lot depth)
street lines (minimum distance 10 ft. maximum
distance 1/2 lot depth)

streets 50 ft. or more in width - 15.0 sq. ft.
streets less than 50 ft. in width - 10.0 sq. ft.

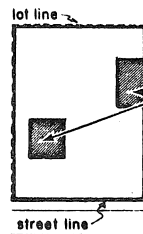
additional floor a
/sq. ft. of open a



buildings constructed with open arcades 10 ft.
or more in width

open area separated from street line by
open arcade (minimum distance 10 ft. maximum
distance 1/2 lot depth)

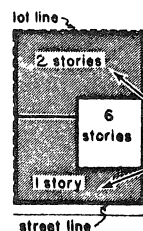
streets 50 ft. or more in width - 15.0 sq. ft.
streets less than 50 ft. in width - 10.0 sq. ft.
open arcade abutting a sidewalk - 7.5 sq. ft.



buildings constructed with other open
areas not abutting a street line

- 5.0 sq. ft.

OPEN AREA ABOVE GROUND LEVEL



buildings constructed with open areas
above ground level
not higher than 40 ft.

- 5.0 sq. ft.

Source: Proposed Comprehensive
Revision to the Zoning Ordinance
of the City of Philadelphia,
Zoning Advisory Commission; 1957.

square feet located on a lot of 200,000 square feet might employ as few as three or as many as 600 workers.

Among the so-called heavy industries, differences in floor space per employee may be considerable. For instance, an aluminum sheet mill may have more than 2,000 square feet of floor area per employee, while an aircraft manufacturing plant may have less than 300 square feet of floor area per employee. (See Space for Industry by Dorothy A. Muncy; Urban Land Institute, 1737 K Street, N. W., Washington 6, D. C.; 1954.)

In recommending an industrial zone location, the amount and kind of traffic generated are nearly as important as nuisance characteristics. Here the floor area ratio is virtually useless as a control in preventing congestion. According to Jack C. Smith in a paper, "Progress in Performance Standards for Zoning" (Planning 1954, American Society of Planning Officials), bulk controls and other methods were considered in the Chicago pre-zoning studies and rejected for these reasons:

(1) a simple limitation on either total size of employment or gross lot area is futile, since ten small plants occupying a block can generate as much traffic as can one large plant occupying the entire block; (2) bulk controls, while indirectly limiting concentrations of workers through limitations on the bulk of buildings, do not effectively limit the concentration of workers within the permitted floor space. Some types of industrial operations typically employ as many as 175 workers an acre even in new buildings of comparatively low bulk. When such concentrations occur in areas where street and transit capacities are comparatively low, serious problems inevitably result. Ironically, such high densities usually occur in the industries that are otherwise good neighbors to residential zones.

Mr. Smith goes on to say that the only effective control appears to be a direct limitation on the density of employment (the number of workers an acre) because such a control will effectively spread out the focus of traffic generation. "The values of such a regulation will be principally to deter high-density industries from locating in problem areas and to serve as an effective legal yardstick in cases where over-expansion has resulted in serious traffic problems."

Apparently the only purpose of a floor area ratio in industrial zones is to supplement other types of bulk controls. Even in this respect its usefulness seems limited. Because plant managers on the whole do not want buildings that are more than one story high, the advantages of flexibility so attractive in commercial zones do not pertain. If, for reasons of compatibility with surrounding uses, it were thought desirable to establish a constant ratio between gross floor area and gross land area, a floor area ratio control might be useful in achieving this result -- especially if there are accessory buildings.

Furthermore, many industrial operations in typical "heavy industrial districts" do not have floor areas as such. For instance, grain elevators, petroleum refineries, and gravity-flow processes. A floor area ratio is a meaningless type of bulk control over such operations.

However, in industrial zones that are close to the central business district, floor area ratio controls may have the same applications and advantages as in the downtown section proper. The proposed comprehensive revision of the Philadelphia zoning ordinance would establish a new limited industrial district to accommodate loft industrial establishments in central locations. According to the summary of the proposed ordinance, this district, unlike other limited industrial districts, "permits a full range of commercial uses, and hence is particularly appropriate for center city." Bulk is similar to that permitted for commercial and apartment buildings in central locations and is controlled by a limit on floor area.

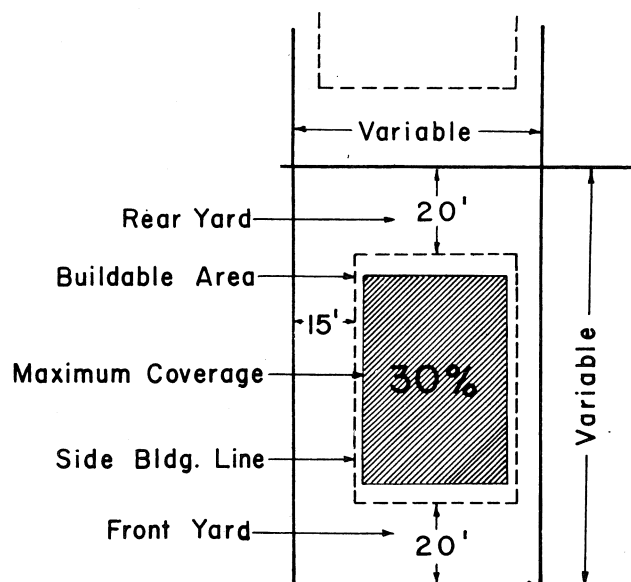
RESIDENTIAL ZONES

Keeping in mind the purposes of bulk controls, what additional advantages has floor area ratio to offer in residential zones? To approach an answer to this question low-density and high-density uses will be considered separately.

In one- and two-family zones, the use of the floor area ratio seems to be rather limited. Without going into the well established justifications for yard requirements, we can see that along with maximum height limits they establish a volume control. If to these dimensions is added maximum lot coverage, we get a result that has the same effect as a floor area ratio in that, when combined, they establish a constant ratio between volume of buildings and area of land. (See diagram.) In addition, they insure a minimum separation between buildings, which does not necessarily follow from the floor area ratio control alone.

In most cases, enclosed off-street parking facilities are exempt from "gross floor area."

(See definitions, pages 3 to 7.) However, other accessory buildings are also covered by this definition. Hence, by using the floor area ratio device, the bulk of all principal and accessory buildings (except garages and carports) is regulated.



In summary, the effect of the floor area ratio in low-density residential areas is mainly to refine bulk controls. In this respect, its use is similar to that in industrial zones.

When we get to the high-density residential areas, on the other hand, we approach the situation that prevails in high-density commercial zones, where land is expensive, height of buildings is relatively unimportant, and where, in any event, height can be raised if space is gained at ground and lower floor levels.

In residential zones, however, the difference in type of occupancy brings other factors to the front. Being dwelling uses, apartment houses and group housing both must have access to light, sun, and air, must be separated from other uses so that noise does not disturb unduly, and must have a minimum amount of usable outdoor space. In short, they must have the amenities that go along with modern urban living. But these necessities are not guaranteed by the floor area ratio, and consequently other controls are employed in order to secure them.

Most common of these are yard provisions, which result in the bulk envelope that permits only limited variation in building design. Furthermore, it can be demonstrated that unless the minimums set for yards are sufficiently wide or deep, they do not in fact provide the amenities mentioned above.

To attain them, and at the same time to preserve the flexibility inherent in a floor area ratio, other devices have also been developed.* They are used in conjunction with each other, the theory being that the net effect achieves minimum standards. They are described only briefly here, since in ordinance form the regulations sometimes are quite complex. All derive from ideas developed in Great Britain and are described in various publications of the Ministry of Housing and Local Government (or its predecessor, the Ministry of Town and Country Planning).

Angle of Light Obstruction. The purpose of the angle of light obstruction is to insure access of light and air into streets and to front windows of buildings. Such provisions create an imaginary plane, rising diagonally from an angle at the center line of the street and leaning against the building, which is not permitted to cut into this plane. This device appears in the proposals for New York city and the District of Columbia, in the Denver zoning ordinance, and others. The diagram on page 25 is taken from the Harrison, Ballard & Allen report.

Area of Light Access. This is an unobstructed area outside of a legally required window, within an arc extending 70 degrees on each side of a line perpendicular to the building wall at the center line of the window. The

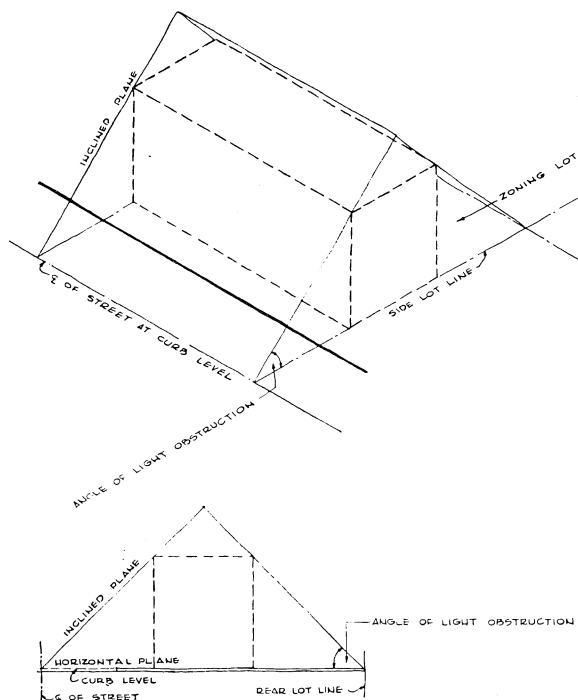
*"Angle of light obstruction" and "area of light access" are employed in nonresidence zones as well.

radius is usually a minimum of 15 feet in residential zones, though it may be as long as 60 feet in some. A specified portion of the space within this wedge remains free of buildings and other obstructions. Details vary among the several ordinances that employ this device.

Usable Open Space. Multi-family buildings may receive adequate light by means of the two devices just described and still lack outdoor living space. To be usable, outdoor areas of this type must be easily accessible to occupants, adequate in size and distribution (i.e., related to the number and kinds of people using it), and suited to the purposes for which they are intended. These purposes are described in the Harrison, Ballard & Allen report as spaces "to put up the baby's playpen or a carriage for a sleeping child; space to set out chairs on a hot night; space for older persons and convalescents to get fresh air, sunshine and cool breezes; space for hanging out clothes, for raising a few flowers; it can be seen that usable open space is simply an extension of the back yard or the front stoop to families who live in all density categories; surely not an unreasonable part of an urban standard of living."

The same report defines "usable open space" to include only that part of the ground area of a residential zoning lot:

- a. Which is devoted to outdoor recreational space, greenery, and service space for household activities (such as clothes drying), which are normally carried on outdoors, and
- b. Which conforms to the minimum dimensions prescribed . . . [in fractions of floor area and by dimensions], for the appropriate district, and
- c. Which is not devoted to private roadways open to vehicular transportation, accessory off-street parking space or accessory off-street loading berths, and
- d. In which there are no structures on the ground, except as permitted, . . . [e.g., flagpoles, open porches, balconies] and
- e. Which is unobstructed between the permitted level of the rear yard and the sky, except that not more than twenty-five per cent (25 %) of the total "usable open space" provided on



ANGLE OF LIGHT OBSTRUCTION

An acute angle at the center line of the street (or the rear lot line) between a horizontal plane at curb level and an inclined plane, rising from the center line of the street or rear lot line) and extending over the lot.

any zoning lot may be roofed, and in such case not more than fifty per cent (50 %) of the perimeter of the roofed section shall be enclosed, and

f. Which, when above grade, is structurally safe and adequately surfaced and protected, and

g. Which is accessible and available at least to all occupants of dwelling units for whose use the space is required.

Though usable open space is defined as a part of a ground area, roof spaces and balconies may be substituted, provided they meet ordinance requirements of size, freedom from obstructions, accessibility, and safety.

So far, we have been discussing the floor area ratio as a control of building bulk. Occasionally it has also been used as a density control. Given the number of families per acre and the average size of apartments in square feet, a floor area ratio can be derived. However, in attempting to control density through a zoning ordinance, the ultimate relationship sought is that between persons and land. Standards of minimum lot areas per family achieve this ratio directly without interposing data on floor area.

Even if average floor areas for different types of dwellings were known, the floor area ratio is an unreliable density control. Planning the Neighborhood points out:

. . . floor area ratios do not reflect population densities, because floor area per person varies (usually increasing as income increases). In order to measure population loads, an additional index of floor area per person should be used. This makes it possible to relate density in terms of floor area ratios to population density.

This same point is made in a slightly different way by Jack C. Smith in commenting on the Chicago zoning ordinance:

FAR alone is a very ineffective density control. When a desired pattern of population density is sought, the FAR alone can produce the desired end only if all dwelling units are built to the average size. Deviations from the average size of dwelling units and the average number of persons per dwelling unit would nullify effectuation of the density goals. For this reason in the Chicago ordinance, we used a direct density control, the lot area per dwelling unit, to supplement FAR.

Mr. Smith also points out that the floor area ratio is useless in regulating conversion within existing structures, and that lot area per dwelling unit was the method settled on in the Chicago ordinance to control excessive conversions.*

*The ordinance reads, "No existing residential building shall be converted so as to conflict with, or further conflict with, the lot area per dwelling unit requirements of the district in which such dwelling is located."

CONCLUSIONS

The floor area ratio is a refinement on traditional bulk controls. It expresses in one measure instead of several the mathematical relation between volume of building and unit of land. However, it does not in any way control the placement of that volume on the land. Therefore, if placement is a factor to be regulated, supplementary bulk devices are required.

The floor area ratio is not a cure-all. It gains value as a zoning device when the numerical value assigned to it helps achieve the purposes of the zoning ordinance and at the same time gives designers of buildings more leeway. Therefore, a low floor area ratio is not necessarily good nor a high one necessarily bad. It depends on the zone.

Insofar as gross floor area is a measure of the load on public streets and utilities and of the demand for transportation and parking space, the floor area ratio presents a means of regulating the generation of traffic and demand and of predicting future needs. Insofar as gross floor area is not a measure of population density, the floor area ratio is deficient as a control of density and as a predictive device.

Modifications of the original idea have increased its versatility. It seems likely that further refinements will extend its usefulness. However, as modifications are introduced, the ordinance provisions become more complex. The premiums, for instance, are unreasonably complex for a small town and should not be copied blindly. Also, the advantages of the floor area ratio appear to take place mainly in high-bulk zones where building height is not especially a factor. Therefore, the floor area ratio is not an unmixed blessing.

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