GOVERNMENT OF THE DISTRICT OF COLUMBIA
OFFICE OF PLANNING

Office of the Director

MEMORANDUM

DATE: August 30, 2002

TO: District of Columbia Zoning Commission

THROUGH: Andrew Altman, Director OP
Ellen McCarthy, Deputy Director OP

FROM: David J. McGettigan, AICP

SUBJECT: Proposed Action – Definition of Building Height

ZONING COMMISSION
District of Columbia
Case 02-35
Exhibit 1

Summary

The Office of Planning proposes a minor text amendment to clarify ambiguous wording in the definition of building height. According to the current definition in the Zoning Regulations, building height is the vertical distance measured from the level of the curb opposite the middle of the front of the building to the highest point of the roof or parapet. Unspoken in this definition is the implication that the curb sits on the ground. However, a small number of past interpretations have considered curbs on elevated roadways, (e.g., bridges and overpasses) to be used as the point of measurement. This issue became a subject of discussion during the Station Place case (ZC #01-09) in which the applicant claimed a measuring point from the H Street Overpass. The Zoning Commission did not concur with the applicant in the case, but also did not present a definitive determination. The issue has surfaced again in relation to the development of the air rights over the Union Station rail yards. By adding clarifying language into the definition of building height, this issue, which significantly impacts the development of these air rights, can be resolved.

Recommended Action:

The Office of Planning recommends that the Zoning Commission take a proposed action to change the definition of building height in 11DCMR §199.1 to read as follows:

> **Building, height of** - the vertical distance measured from the level of the curb opposite the middle of the front of the building to the highest point of the roof or parapet. **The term curb shall refer to a curb at grade. In the case of a property fronting on a street that is elevated above grade, the height of the building shall be measured from the natural grade at the middle of the front of the building to the highest point of the roof or parapet.**

ZONING COMMISSION
District of Columbia
CASE NO.02-35
EXHIBIT NO.1

The remainder of the definition will remain unchanged.

Background

Control of building height in the District of Columbia began in 1791 when President Washington issued a regulation requiring all buildings to be no taller than 40 feet. He also required that buildings along avenues be a minimum of 35 feet in height. This act faded away in the early 1800's. The issue was not addressed again in public record until 1894 when the Board of Commissioners of the District of Columbia approved a regulation limiting the height of buildings. These regulations were later incorporated into public law by Congress in the Building Height Act of 1899. Though records indicate that Senator McMillan intended to revise the Building Height Act of 1899 in 1902, it was not revised until 1910.

This brief history of height controls is necessary to show the source of the District's current definition of height. When this definition was created, there were no elevated roadways. It was implicit at the time that measurements were to be taken from ground level to the top of the building because all sidewalks were located on the ground. When ramps, overpasses and bridges began to proliferate with the dawning of the automobile age, sidewalks and curbs became parts of elevated structures as well. The definition of height fell into ambiguity as a result.

This ambiguity has fueled debate over the years. Citizens' groups fought this interpretation in various ways, even bringing the issue before Congress in 1994, claiming the District was violating the Height Act of 1910. Other development practices relating to height which have caused controversy include:

- Connecting new construction to adjacent existing buildings to claim frontage on a wider street by expanding the meaning of the term "front of the building";
- Stretching the roof, architectural embellishment, and penthouse definitions to get additional usable space on rooftops by creative interpretation of the word "roof" and the term "mechanical equipment";
- Buildings constructed on lots that slope steeply away from the street that exceed height limits in the rear; and,
- Carefully designing buildings with berms and retaining walls in the front to get additional height.

Many have protested in the past to the Commission that these generous interpretations are impacting the character of their neighborhoods. To the extent these interpretations permit greater height as a matter-of-right, it reduces the need for developers to seek height relief through a variance or PUD process, both of which would permit a case by case review of the impact of the additional height on adjacent property and the latter of which would provide for public benefits and amenities to compensate for the impact of the additional height on light and air.

The issue of how to measure height surfaced again during Zoning Commission consideration of the Station Place PUD. Citing precedent, the developer claimed that the height could be measured from the nearby overpass. Reviewers, including the Office of Planning, the Commission of Fine Arts, the National Capital Planning Commission, the Zoning Administrator, and the Zoning Commission itself, questioned this interpretation. The issue was left unresolved when the Zoning Commission granted height relief as part of the Station Place PUD.

Comprehensive Plan

The Comprehensive Plan discusses height in several areas. In the Urban Design Element:

707.2 The policies established in support of the built environment objective are as follows:

(a) Strengthen and enhance the physical image and symbolic qualities of the District that establish its character as the Nation's Capital;

(b) Maintain and enhance the horizontal character of buildings within the District and retain and enforce An Act To regulate the height of buildings in the District of Columbia, approved June 1, 1910 (36 Stat. 452, D.C. Code § 5-401 *et seq.*) ("Height Act"), as the guiding design principle for protecting the skyline;

(c) Retain the current maximum limit in accordance with the Height Act, in order to reinforce the "horizontal" urban quality of the District but, in order to encourage a more detailed articulation of building roof lines and facades, consider adding parapets, cornices, and other architectural embellishments to the list of features allowed to project above the limit established by the Zoning Regulations. (Title 11 DCMR) but within the limit established by the Height Act

708 BUILDINGS

708.1 The buildings objective is to encourage developments which respond to the horizontal skyline of the District so as to maintain its low-scale image and contribute to the enhancement of the District's character.

708.2 The policies established in support of the buildings are as follows:

(a) Design residential, commercial, and all other buildings to complement or enhance the physical character of the District; and

(b) Design buildings to include the use of appropriate arrangements of building materials, height, scale, massing, and buffering to complement the immediate region.

Also in the Historic Preservation Element:

804.1(k) Continue to protect the historic horizontal character of the National Capital by limiting building heights in accordance with An Act To regulate the height of buildings in the District of Columbia, approved June 1, 1910 (36 Stat. 452; D.C. Code § 5-401 *et seq.*).

The Ward 6 Element 1703.1(u) recommends the following action to implement the objectives and policies of the Plan:

> Require any building located directly adjacent to the H Street Overpass to measure its allowable height (from street level to parapet and permissible penthouses) from the existing grade of Second Street, N.E., or First Street, N.E., and not from any part of the Overpass itself.

Therefore, the proposed clarification of the measurement point for height is not inconsistent with the goals and objectives of the Comprehensive Plan.

Zoning Analysis

Zoning controls the building height for many reasons; initially the main concern was fire safety. However, even Washington's regulations, which principally addressed fire safety by limiting building heights to 40 feet and requiring all structures be constructed of brick and stone, required buildings along avenues to be a minimum of 35 feet, a purely urban design consideration. In the Lewis Report, building height limitations were introduced into the zoning regulations to further the Federal Interest in the control of building height, provide compatibility with residential development, provide adequate light and air and to reduce traffic congestion (through control of bulk and density).

Building height controls in the current regulations protect the character of the various zoning districts, support the Building Height Act of 1910 and provide for adequate light and air. The generous interpretations that have been given to developers previously have created matter-of-right developments that do not fit in the character of their zoning district. Review of these developments in a PUD process could mitigate negative impacts of the extra height.

The Office of Planning proposes that the Zoning Commission clarify and reaffirm the intent of the Building Height Act of 1910 and the Zoning Regulations to regulate the height of buildings from the ground and not from an artificially created measuring point. The simplest wording change is to add the following clarification:

> The term curb shall refer to a curb at grade. In the case of a property fronting on a street that is elevated above grade, the height of the building shall be measured from the natural grade at the middle of the front of the building to the highest point of the roof or parapet.

This provides clarification and does not introduce any new terms not currently used in the definition. If further clarification of the term "natural grade" is necessary the following definition could be used:

> Natural Grade – the undisturbed ground level formed without human intervention or, where the undisturbed ground level cannot be ascertained because of an existing building or structure, the undisturbed existing grade.

This further emphasizes that building height should be measured from the ground and not from an artificial grade.

Strategic Analysis

In evaluating zoning text amendments it is useful to see how other jurisdictions handle the issue. The following table shows some zoning definitions for building height.

Jurisdiction	Matter-of-Right Zone
West Vancouver, British Columbia	The vertical distance measured from the lower of average natural grade or average finished grade.
Montgomery Co., Maryland	The vertical distance measured from the level of approved street grade opposite the middle of the front of a building to the highest point of roof surface of a flat roof; to the deck line of a mansard floor; and [***5] to the mean height level between eaves and ridge of a gable, hip or gambrel roof; except, that if a building is located on a terrace, the height above the street grade may be increased by the height of the terrace . . .
Prince William Co., Virginia	The vertical distance from grade to the highest point of the roof for flat roofs; to the deck line of mansard roofs; and to the average height between the eaves and the ridge for gable, hip, or gambrel roofs. This term shall mean a reference plane representing the average elevation of finished ground level adjoining the building or structure at all exterior walls or surfaces.

As can be seen from the list above a variety of definitions are used, but in all cases buildings are measured from the ground. The Office of Planning feels that the changes proposed are in line with what is done in other jurisdictions.

Recommendation

The Office of Planning recommends that the Zoning Commission take a proposed action to change the definition of building height in 11DCMR §199.1 to read as follows:

> **Building, height of** - the vertical distance measured from the level of the curb opposite the middle of the front of the building to the highest point of the roof or parapet. **The term curb shall refer to a curb at grade. In the case of a property fronting on a street that is elevated above grade, the height of the building shall be measured from the natural grade at the middle of the front of the building to the highest point of the roof or parapet.**
>
> In those districts in which the height of building is limited to forty feet (40 ft.), the height of the building may be measured from the finished grade level at the middle of the front of the building to the ceiling of the top story.
>
> In those districts in which the height of the building is limited to sixty feet (60 ft.), in the case of a building located upon a terrace, the height of building may be measured from the top of the terrace to the highest point of the roof or parapet, but the allowance for terrace height shall not exceed five feet (5 ft.).
>
> Where a building is removed from all lot lines by a distance equal to its proposed height above grade, the height of building shall be measured from the natural grade at the middle of the front of the building to the highest point of the roof or parapet.

If a building fronts on more than one (1) street, any front may be used to determine the maximum height of the building; but the basis for the height of the building shall be determined by the width of the street selected as the front of the building.

In those districts in which the height of building is permitted to be ninety feet (90 ft.) or greater, the height of buildings shall be measured to the highest point of the roof excluding parapets not exceeding three feet (3 ft.) in height.

Attachments:

1. Selected Regulations Regarding Building Height
2. Relevant Discussion of Building Height
3. Excerpts from the Lewis Report
4. West Vancouver Building Height Info

Selected Regulations Regarding Building Height

11DCMR – Zoning Regulations

Building, height of - ***the vertical distance measured from the level of the curb opposite the middle of the front of the building to the highest point of the roof or parapet.*** In those districts in which the height of building is limited to forty feet (40 ft.), the height of the building may be measured from the finished grade level at the middle of the front of the building to the ceiling of the top story. In those districts in which the height of the building is limited to sixty feet (60 ft.), in the case of a building located upon a terrace, the height of building may be measured from the top of the terrace to the highest point of the roof or parapet, but the allowance for terrace height shall not exceed five feet (5 ft.). Where a building is removed from all lot lines by a distance equal to its proposed height above grade, the height of building shall be measured from the natural grade at the middle of the front of the building to the highest point of the roof or parapet. If a building fronts on more than one (1) street, any front may be used to determine the maximum height of the building; but the basis for the height of the building shall be determined by the width of the street selected as the front of the building. In those districts in which the height of building is permitted to be ninety feet (90 ft.) or greater, the height of buildings shall be measured to the highest point of the roof excluding parapets not exceeding three feet (3 ft.) in height. (33 DCR 3979)

DC Code

§ 6-601.07. Measurement of building height; parapet walls.

For the purposes of this subchapter the height of buildings shall be measured from the level of the sidewalk opposite the middle of the front of the building to the highest point of the roof. If the building has more than 1 front, the height shall be measured from the elevation of the sidewalk opposite the middle of the front that will permit of the greater height. No parapet walls shall extend above the limit of height, except on nonfireproof dwellings where a parapet wall or balustrade of a height not exceeding 4 feet will be permitted above the limit of height of building permitted under this subchapter. (This section of the DC Code replicates the Height Act of 1910)

DC Construction Code – 1999 Supplement

107.15 Zoning Compliance Review Data: The applicant shall provide to the Zoning Division of the Department not less than four (4) copies of plans drawn to a scale indicated numerically as well as depicted graphically, showing orientation of the property as to true North, and the following:

1. The shape, dimensions and topography of the lot to be built upon, in sufficient detail to allow determination of **heights above existing and proposed finished grade** of all proposed structures, so as to allow determination of compliance with pertinent height limitations of Title 11 DCMR, Zoning Regulations.

Comprehensive Plan

The Comprehensive Plan, Ward 6 Element 1703.1(u) recommends the following action to implement the objectives and policies of the Plan:

Require any building located directly adjacent to the H Street Overpass to measure its allowable height (from street level to parapet and permissible penthouses) from the existing grade of Second Street, N.E., or First Street, N.E., and not from any part of the Overpass itself

Relevant Discussion of Building Height

Memo, dated Nov. 8, 2001 from Whayne Quin and Steve Sher of Holland & Knight to the Zoning Commission

Therefore, the height may or shall be measured from the curb on the H Street overpass, which is the only existing curb on that street.

This reading of the Regulations and the Act is consistent with prior interpretation and rulings by the Zoning Administrator and the District. In 1985 and again in 1988, the Zoning Administrators concurred in the conclusion that the height could be measured from the curb in front of the building on H Street, which was determined to be approximately elevation 70... In its report on the large tract review of a development proposed in 1989, the Office of Planning noted that the height of the buildings was to be measured from a point along the overpass...This, with respect to the property at issue, there are consistent rulings indicating that the height may be measured from the overpass. The District has also applied the same ruling to buildings constructed on the west side of the overpass adjacent to 1st Street, N.E. The building at 750 1st Street, N.E. fronts on both H and 1st Streets, was built from the overpass and eleven stories above grade on 1st Street. The building at 810 1st Street, NE, likewise fronts on both H and 1st Streets, was built as a matter-of-right in the C-3-C District and has a height of ninety feet measured from the overpass. Phase II of the building built at 810 1st Street, NE has a height of ninety feet measured from the overpass and eleven stories above grade on 1st Street...Accordingly, all previous interpretations of the Regulation allowed the height to be measured from the curb on the overpass.

Recent comments regarding Station Place height measurement from the Commission of Fine Arts

CHAIRMAN BROWN: This allows us to address this question of height, which I think is really egregious. Your last slide and the several ones that show the view from Columbus Circle show in foreshortening what the total silhouette of this building will be by using the casuistry of datum that is not the surface and actually in your own presentation you call it an overpass. It's a bridge, and you talked about the parking lot as being a surface parking. That's the surface.

And if we pass on any advice to the Zoning Commission, I think it would be a very dangerous precedent for us to sit still for a developer using an additional 30 feet of highway overpass as an kind of credible ground plane from which the maximum allowable height of the building should be measured. (September 20, 2001)

From the transcript of the Zoning Commission Public Meeting for Station Place

COMMISSIONER MAY: I have one other question, and it has to do with the paragraphs in the proposed order, 135, 136, regarding the measurement of building height and how that is done, and frankly, we've been back and forth on the subject a number of times now, and I would like to have this clarified for our purposes. I never quite bought into the notion that we were measuring -- we could measure the height of the building from the height of the overpass that passes by the building, and that seems to be -- I guess the fact that it was testified to is not the issue; it's whether we agree to that. And maybe it's elsewhere in the order that we actually speak on this subject.

...
COMMISSIONER MAY: And then 137 basically states that we find Mr. Sher's arguments persuasive with regard to measuring the building height, and I'm not sure that I do. So what does the rest of the Zoning Commission think?
COMMISSIONER PARSONS: I guess the problem is that the building height remained the same even if they measured from F, right?
COMMISSIONER MAY: I think it's within the allowable –
COMMISSIONER PARSONS: Right.
COMMISSIONER MAY: -- for the PUD, as I recall. Is that correct? OP, do you recall?
MR. McGETTIGAN: Yes. With a PUD, you're allowed to go up to 130, I believe.
COMMISSIONER PARSONS: So we really didn't spend a lot of time in the hearing on this because of the fact that it wasn't the sole point of measurement, as I remember it.
COMMISSIONER MAY: Right. It was measured every which way, and so long as it complied with the PUD, which is what was presented to us, I guess -- I mean, I didn't have a problem with -- it was not an issue for the discussion.
COMMISSIONER PARSONS: Right. So now you're worried about the precedent of saying, yes, we agree with that.
COMMISSIONER MAY: Yes.
COMMISSIONER PARSONS: Any time you've got a bridge, keep measuring. How about the Whitehurst Freeway? That works, too, right? I'm kidding. For the record, I'm kidding. Very much I'm kidding. Well, that's a dilemma. I'm glad you brought that up because who knows where this might crop up again? Because I had the same concern that you are now expressing, but we didn't do anything about it.
COMMISSIONER MAY: I would prefer that the language stayed exactly what we've discussed here, that -- I don't know whether we say that we do not find the arguments persuasive, but that we saw no need to enter that particular debate or resolve that issue, simply that it falls within the limits of the zone with the PUD.
VICE CHAIRMAN HOOD: I'm just sitting here thinking. It seems like every time that issue comes up, it's something different, and I'm just trying to figure out what has been done in the past, because it seems like it changes.
COMMISSIONER MAY: Do staff have any idea what has occurred in the past?
MR. BASTIDA: The staff believes that the safest way to go would say that it falls within the height of the PUD.
COMMISSIONER MAY: Okay. But back to the issue of previous cases.
MR. BASTIDA: Yes, that's what usually has been the norm.
COMMISSIONER MAY: So we've avoided it in the past.
MR. BASTIDA: Yes and no, but the area was much clear-cut than in this instance, because if you adopt the language as proposed, then you are establishing a way to measure the height, and maybe in another case it will not be as clean-cut as it appears here.
VICE CHAIRMAN HOOD: So, Commissioner May, if I understand you correctly, you're saying that we will incorporate in either 136 or -37 that we do not find Mr. Sher's arguments persuasive -- no reflection if he's listening -- and proceed in that manner, so that may leave us kind of open for further cases.
COMMISSIONER MAY: Well, I think we would have to state -- if we're not going to make a decision about the issue, then I think that we would have to state that we express

no opinion on Mr. Sher's arguments but simply find that the building as measured from F Street falls within the limits of the PUD as it has been proposed. So we approve the PUD and make no opinion about how to measure building height since no matter how you do it, it works.
COMMISSIONER PARSONS: That's good. I agree.
VICE CHAIRMAN HOOD: Got a consensus? We will go with that. Is that okay, Mr. Bergstein?
MR. BERGSTEIN: Yes.
MR. BASTIDA: Basically, we are leaving also the legal latitude to do it in a fashion that expresses the opinion of the Commission.
VICE CHAIRMAN HOOD: Okay. Thank you.
COMMISSIONER PARSONS: And you will do that about Number 137, somewhere in that --
MR. BERGSTEIN: We will just say in essence that because if you measured from F Street, it falls within the guidelines. There is no need at this point to address the -- to create the precedent that in essence Mr. Sher is inviting us to do.

From the transcript of a hearing before the Committee on The District of Columbia, House of Representatives, One Hundred Third Congress, second session on H.R. 4242, to enforce the law regulating the height of buildings in the District of Columbia, April 26, 1994, the Hon. Pete Stark, Chairman.

MR. MASZAK (DC Assistant Corporation Counsel). The District of Columbia has for 84 years enforced the Height Act in a manner consistent with the zoning regulations and in a manner consistent with prior administrative practice.

THE CHAIRMAN. The zoning regulations have nothing to do with it. You just said with the Height Act. I don't care about the District zoning regulations. If you will, counsel the District zoning regulations don't have anything to do with the 1910 Act. They don't make any difference. There is a 1910 Height Act.
You guys can zone anything you want. You can build anything. You can build a concert hall or you can build an apartment or your can build an ice skating rink. I don't care what you decide in your zoning. It can't go above a certain height.
So it doesn't make any difference. All I am suggesting is that just because the District has done something for a long time is no excuse for it to continue. The District is in violation of several Federal court orders and we don't intend to let that continue. The District is going broke. We would rather that didn't continue. So a history of inattention to a law hardly justifies it from continuing to ignore a law, and that is perhaps what we are talking about today.

From "A New Zoning Plan for the District of Columbia" by Harold M. Lewis (1956)
(T)he height of buildings and other structures in Washington should be regulated as a separate characteristic, rather than included in a common control of bulk or density. Height is a factor of compatibility; not the key to compatibility, but one factor. All authorities accept the principle that the height of a structure is a proper subject of public interest and control. The question is how best to establish and administer the control of height of buildings and structures. Here, there is need for the application of discretion,

because there are "good" high buildings, as well as "bad" high buildings. For example, few people object to the United Nations Building in New York at its present height and yet nearly everyone objects to the power station stacks near it at the same height. But height and use taken together begin to establish the "character" of a development which is the real, although seldom named, subject of zoning control.

A GUIDELINE TO ZONING BYLAW BUILDING HEIGHT REGULATIONS

west vancouver

THE WATERFRONT COMMUNITY

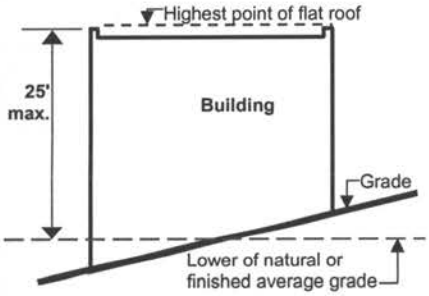
THIS BROCHURE IS INTENDED TO GIVE GENERAL GUIDELINES FOR THE PRELIMINARY PREPARATION OF PLANS FOR SINGLE FAMILY AND DUPLEX DWELLINGS IN ACCORDANCE WITH THE WEST VANCOUVER ZONING BYLAW 2200, 1968, AS AMENDED. REGULATIONS CAN VARY WITH LOT CONDITIONS AND CONSTRAINTS. THE ZONING BYLAW MUST BE REFERRED TO FOR EXACT REGULATIONS PRIOR TO PREPARATION OF DETAILED PLANS FOR BUILDING PERMIT APPLICATION.

This **BUILDING HEIGHT** is the vertical distance measured from the **lower** of average natural grade or average finished grade.

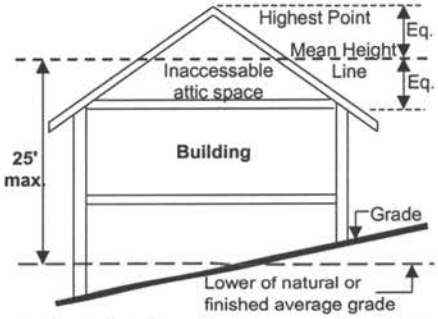
AVERAGE NATURAL GRADE is the average existing grade elevation (prior to any regrading, or construction), calculated around the perimeter of the building or structure at or directly below its outermost exterior walls, but excluding uncovered decks, patios, stairs, and outdoor swimming pools.

AVERAGE FINISHED GRADE is the average grade elevation around the building's perimeter (exclusive of minor planters or mounding of soil) with any proposed changes to natural grade due to construction, placement of fill, or removal of soil. Average Grade calculation is further described on Page 3.

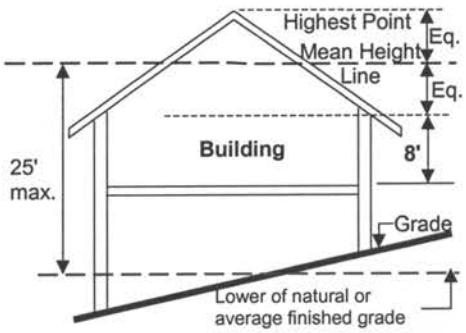
MAXIMUM BUILDING HEIGHT is **25' for all Single Family (R.S.) Zones (except R.S.6, where the allowable height is 8 metres) and the R.T.1 Duplex Zone**, measured from the lower of average natural or average finished grade, to:



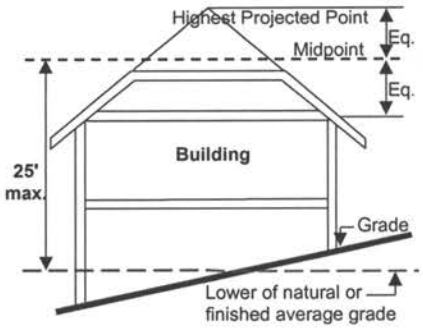
i) the highest point of a building with a flat roof;



ii) the mean height line between the highest point of the building and the ceiling immediately below for buildings with pitched roofs and attic space;



iii) the mean height line between the peak and a point 8' above the immediate floor below for buildings with pitched roofs without ceilings; or



iv) for roofs composed of a combination of pitched and flat elements, to the highest point of the flat roof **OR** to the midpoint of the "projected" peak of the pitched roof, whichever is higher.

SKYLIGHTS over 2 feet in height are included in height calculations (as per a pitched roof).

All **MECHANICAL EQUIPMENT**, except solar heating panels, when located on a roof, must be enclosed or screened from view.

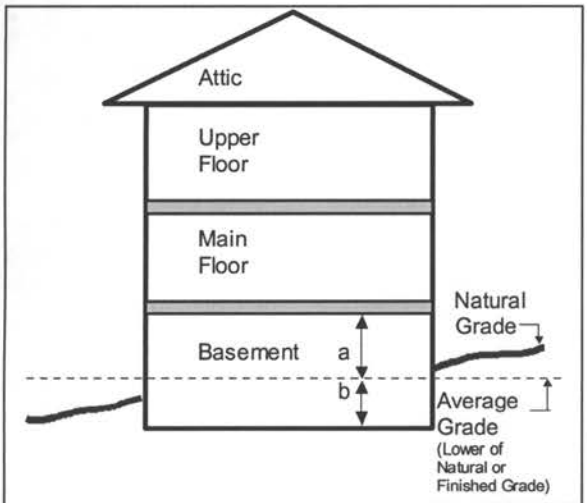
OTHER STRUCTURES such as retaining walls, above-grade swimming pools, free-standing antennas, etc. have height measured to the highest point of the structure.

R.T.2 ZONED PROPERTIES have height measured from the average finished grade along either the front or rear wall, whichever grade is higher, to the highest point of the roof.

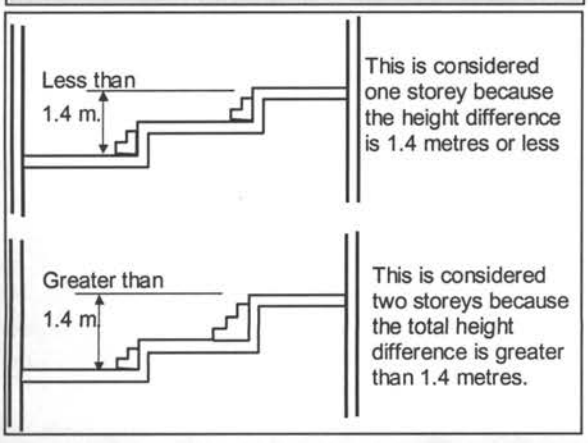
CAULFEILD LAND USE CONTRACT AREA: Specific provisions apply to height in this area. For regulations and a description of how to calculate height, refer to Schedule "B" of the Contract.

NUMBER OF STOREYS:

A **STOREY** is the space between two floors or between the floor and the roof above, and is often referred to as a "level" (the upper level), or a "floor" (the main floor). All single family and duplex zoned properties permit a principal building of two storeys plus a basement.



If 'b' is less than 12", then the storey is not a basement, but is considered the first storey.



You can only count one storey of your house as being a basement. To be defined as a basement, the floor of the storey must be at least 12" below the lower of average natural or finished grade. If the distance from the top of the floor to the average grade level is less than 12", then the storey is not a basement, but is considered the "first storey".

The level is called a **CRAWL SPACE** if the height from the top of dirt or floor to the bottom of the floor joist above is less than 1.8 meters (5'-11").

An **ATTIC** is **not** considered a storey if it is inaccessible and is obstructed with permanent structural members such as roof trusses, or if it has a height from floor or top of ceiling joist to the exterior roof surface of less than 1.7 meters (5'-7") over all of its area.

SPLIT-LEVEL DESIGNS can be considered a single storey if the floor levels are within 1.4 meters (4'-7") vertical of each another. If the height difference between the floor levels is greater than 1.4 meters, the levels are considered separate storeys.

AVERAGE GRADE CALCULATIONS:

Average Grade calculations are required in order to determine:

- height of a building (except in the R.T.2 zone); and
- percentage of basement area to be included in floor area ratio calculations.

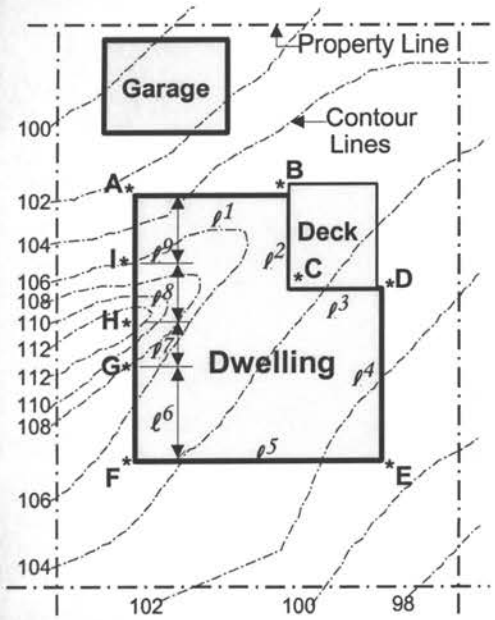
To determine average grade, calculate the average natural **and** the average finished grade elevations as measured around the perimeter of the building or structure at or directly below the exterior walls (excluding accessory buildings, exterior decks, patios, minor planters or soil mounding, uncovered swimming pools, and on-grade stairs).

The lower of average natural or average finished grade will be used in calculations.

To expedite your Building Permit application, the following information should be submitted:

- ☑ original B.C.L.S. topography plans for our records;
- ☑ a prepared topography plan showing ground levels around the proposed building and the proposed dwelling, to scale (see illustration below);
- ☑ finished and natural grades at all building corners and changes of slope on both the site plan and elevation drawings;
- ☑ calculations for **both** average natural and average finished grade;
- ☑ average grade elevations and permitted maximum height elevations on all building sections and facades; and
- ☑ all floor, upper ceiling height and top of roof elevations on section(s), using the same datum as the submitted survey.

Use only one system of measurement for grade elevations and dimensions - either all metric or all imperial.



EXAMPLE: To calculate average grade elevation:

Elevation	X	Length = *x*	Example:
(A+B)÷2	X	ℓ1= **x1**	(102.5+105.0)÷2 X 30'=3112.50
(B+C)÷2	X	ℓ2= **x2**	(105.0+104.5)÷2 X 20'=2095.00
(C+D)÷2	X	ℓ3= **x3**	(104.5+103.0)÷2 X 20'=2075.00
(D+E)÷2	X	ℓ4= **x4**	(103.0+100.5)÷2 X 35'=3561.25
(E+F)÷2	X	ℓ5= **x5**	(100.5+105.0)÷2 X 50'=5137.50
(F +G)÷2	X	ℓ6= **x6**	(105.0+108.0)÷2 X 20'=2130.00
(G+H)÷2	X	ℓ7= **x7**	(108.0+113.5)÷2 X 10'=1107.50
(H+I)÷2	X	ℓ8= **x8**	(113.5+106.0)÷2 X 10'=1097.50
(I+A)÷2	X	ℓ9= **x9**	(106.0+102.5)÷2 X 15'=1563.75
TOTAL:		ℓ_t x_t	**210' 21880**

AVERAGE GRADE = $x_t \div \ell_t$ = 21880.0÷210'=<u>104.19'</u>

Calculations for **both** natural and finished grade are required. The **<u>lower</u>** of these will be used in building height and floor area ratio calculations.

A GUIDELINE TO HIGHEST BUILDING FACE ENVELOPE REGULATIONS

west vancouver

THE WATERFRONT COMMUNITY

THIS BROCHURE IS INTENDED TO GIVE GENERAL GUIDELINES FOR THE PRELIMINARY PREPARATION OF PLANS FOR SINGLE FAMILY AND DUPLEX DWELLINGS IN ACCORDANCE WITH THE WEST VANCOUVER ZONING BYLAW 2200, 1968, AS AMENDED. REGULATIONS CAN VARY WITH LOT CONDITIONS AND CONSTRAINTS. THE ZONING BYLAW MUST BE REFERRED TO FOR EXACT REGULATIONS PRIOR TO PREPARATION OF DETAILED PLANS FOR BUILDING PERMIT APPLICATION.

This regulation is intended to reduce apparent building size and to encourage variety in elevation design by preventing flat 3 storey building facades. It is distinct from and in addition to Building Height regulations as described in the GUIDELINE TO BUILDING HEIGHT REGULATIONS Brochure.

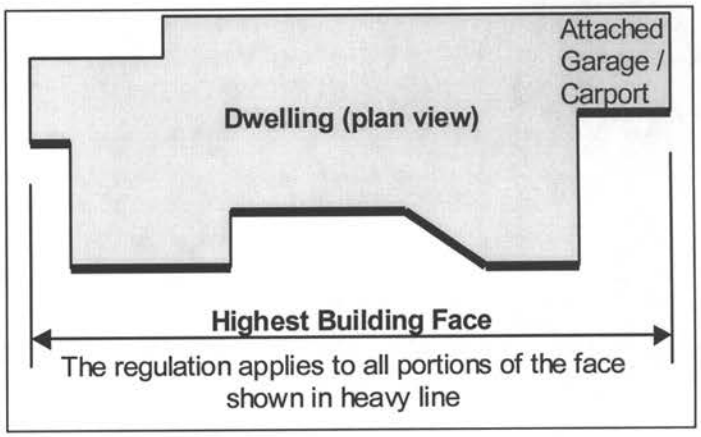
The Highest Building Face Envelope regulation applies to all single family (R.S.) and duplex (R.T.) zoned properties, other than R.S.1, R.S.9 and R.T.3. It applies only to one elevation on the house - the Highest Building Face.

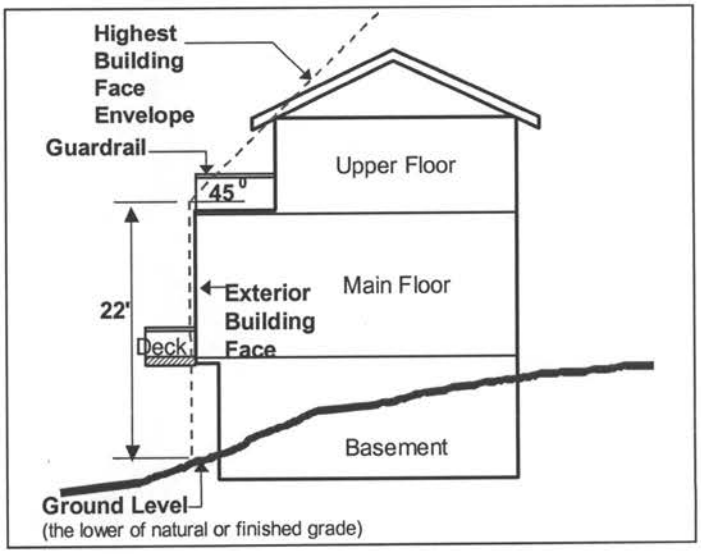
HIGHEST BUILDING FACE:

In order to apply this regulation, you must first determine which of the building's facades is the Highest Building Face. This is the building elevation which has the greatest height differential between:

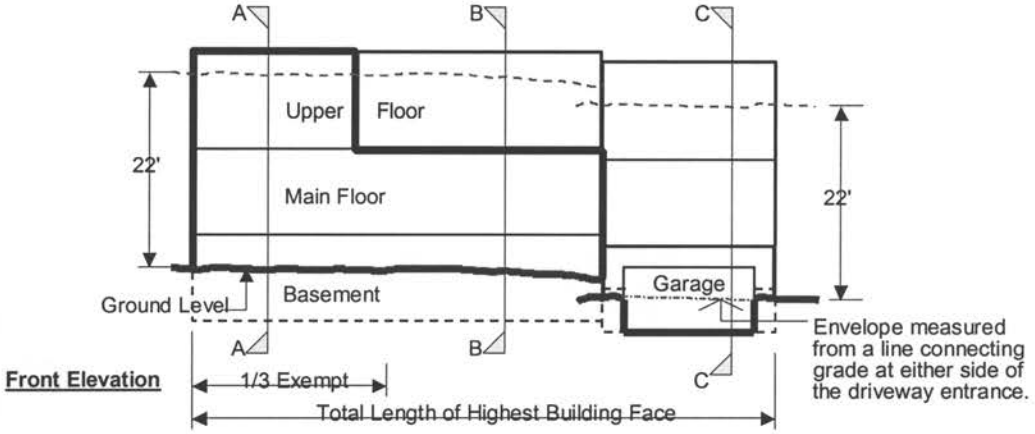
- the average eave or parapet level and
- ground level - the **lower** of average natural or finished grade at each point along the (projected) exterior building face, excluding exterior decks, guard rails required by the building code, eaves and other decorative features not enclosing the interior of the dwelling. Ground level in front of a garage door is defined as a line joining the ground level at each side of the door.

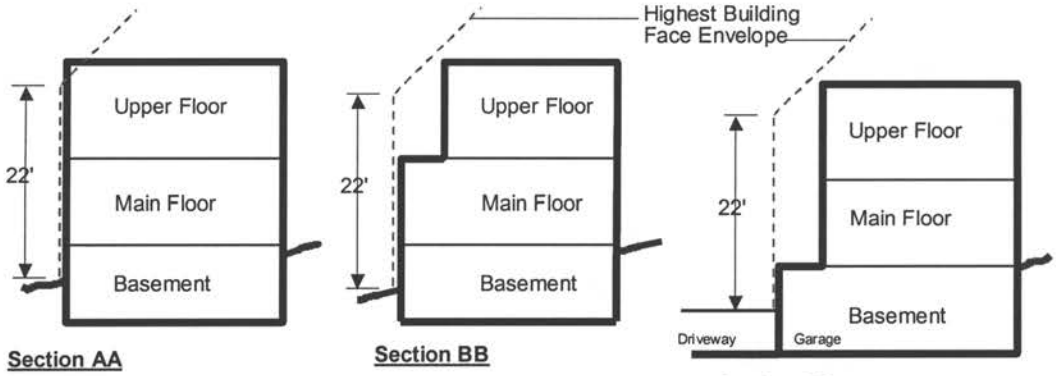
The Highest Building Face is, therefore, usually the facade at "down-hill", side of the property, but is not always the face with the most exposed area.





The **HIGHEST BUILDING FACE ENVELOPE** is established by drawing a series of lines up 22' from ground level (lower of natural or finished) at each point along the exterior building face, and then in towards the building at a 45° angle. A series of simple cross sections at each change of ground level elevation may be required to determine conformance.





Section AA
Non-conforming, but within the 1/3 exemption area.

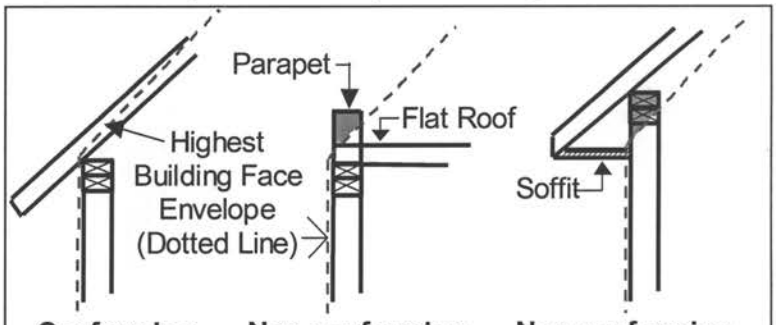
Section BB
Conforming - Upper storey set back from main level.

Section CC Conforming.

EXEMPTIONS:

- This regulation does **not** apply to houses in the R.S.1, R.S.9 and R.T.3 zones.
- 1/3 of the length of the building face can be exempt from this regulation. Different parts of the building face can be exempted, provided that the sum of their lengths does not exceed 1/3 of the total length of the elevation.
- Roof eaves, decks, decorative features, and the pitched roof portion of gable ends and dormers are exempt.
- Any portion of the roof structure above the top plate is exempt from this calculation.

  For clarification, the top plate of the wall must be within the envelope. The addition of a soffit does not alter this requirement.



Non-conforming areas exceeding Highest Building Face Envelope are shown shaded.

AMENDING BYLAW	DEFINED TERM	DEFINITION	REFER TO:
	Gasoline station, Full-service	a *building* or *structure* or use of a *site* for the principal purpose of retailing gasoline and associated petroleum products and in supplying goods and services essential to the normal operation of *automobiles*, excluding body work and auto painting, but shall not mean a *garage* or a *self-service gasoline station*.	
	Gasoline station, Self-service	a *building* or *structure* or use of a *site* for the principal purpose of retailing gasoline which the customer dispenses to his or her own *automobile* without the assistance of a service station employee, by means of a fuel dispensing apparatus which is installed in such a manner that no fuel may be dispensed until a control panel has been set by the licenced operator or competent employee, or any other method whereby the customer is normally and routinely encouraged or expected to autonomously dispense fuel.	
	Grade, Average finished	the average of the *finished grade* as measured around the perimeter of a *building* or *structure*.	21-+++
	Grade, Average natural	the average of the *natural grade* as measured around the perimeter of a *building* or *structure*.	21-+++
	Grade, Finished	the final ground surface after development, excluding: – artifice such as minor planters or mounding of soil, and – *window wells* with a clear width measured out from the wall of less than 2 feet.	++-+++
	Grade, Natural	the undisturbed ground level formed without human intervention or, where the undisturbed ground level cannot be ascertained because of an existing *building* or *structure*, the undisturbed existing grade.	++-+++
	Height	the vertical distance measurement of a *building* or *structure*.	21-+++
	Highest building face	the *building* plan elevation (of the four *building* plan elevations - front, rear, both sides) which has the greatest vertical distance between the highest average eave or parapet on the elevation and the lower of the average finished or *average natural grade* along the base of that *building* elevation.	21-+++
	Highest building face envelope	a three dimensional envelope, within which the entire *building* must be situated.	21-+++
	Home based business	any trade, business, profession, homecraft, or other occupation carried on for remuneration, gain or otherwise in a *dwelling*, but which is a secondary use to the principal use as a dwelling.	21-+++

PART 2

Division 1 - General Regulations for all Zones

Subdivision 1 - Calculations

AMENDING BYLAW	NUMBER	REGULATION

21-201 Average Grade

201.1 *Average grade* (natural and finished) is measured around the perimeter of the *building* or *structure* at or directly below the outermost projection of the exterior walls, excluding:

- *accessory buildings*,
- exterior decks,
- patios,
- minor planters or soil mounding,
- uncovered swimming pools, and
- on-grade stairs.

201.2 The lower of *average natural grade* and *average finished grade* will be used in *building height* and *floor area ratio* calculations.

201.3 To calculate the *average grade* for a *building*:

1. for each section of wall around the *building*, multiply the *average grade* elevation (natural or finished) along the length of the wall section by the length of the wall section.
2. add the resulting numbers for each section of wall.
3. divide this number by the total perimeter wall length of the *building*.

This will be the *average grade*, natural or finished.

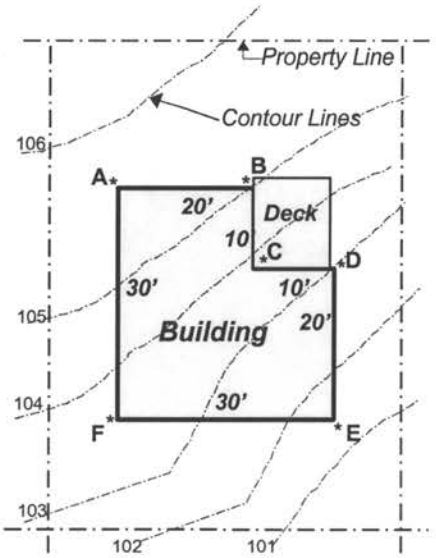
Separate calculations are required if there is a significant natural or constructed change in elevation or grade slope along the length of a wall.

201.4 Example:

Wall Section Average grade	X	Length = xt
A-B 105.5+105.0 ÷2	X	20' = 2105
B-C 105.0+104.0 ÷2	X	10' = 1045
C-D 104.0+103.0 ÷2	X	10' = 1035
D-E 103.0+101.5 ÷2	X	20' = 2045
E.F 101.5+103.5 ÷2	X	30' = 3075
F-A 103.5+105.5 ÷2	X	30' = 3135
total =		120' = 12440

Average grade = xt ÷ perimeter length

12,440 ÷ 120 = **103.67'**



All diagrams are for illustrative purposes only – where there is a discrepancy between any diagram and any text within this Bylaw, the text shall prevail.

21-202 Basement Storey

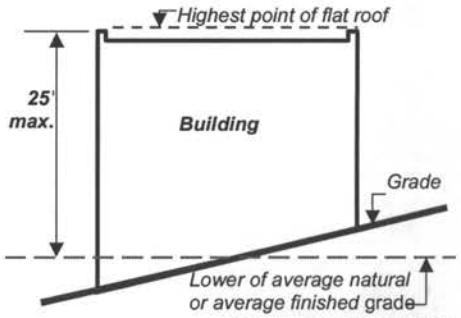
202.1 In determining the number of *storeys* of a *building* or *structure*, one *basement storey* is exempted, unless the *basement* is used for commercial or industrial purposes.

21-203 Building or Structure Height

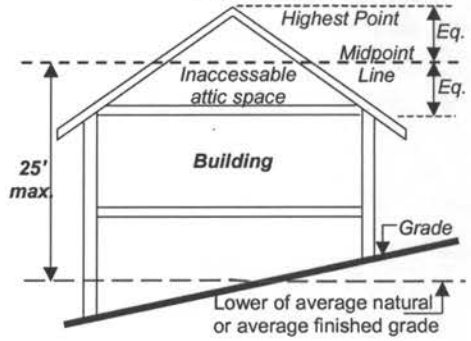
203.1 *Height* is measured from the lower of *average natural grade* or *average finished grade* (see Section 31-203).

203.2 *Height* is measured up to:

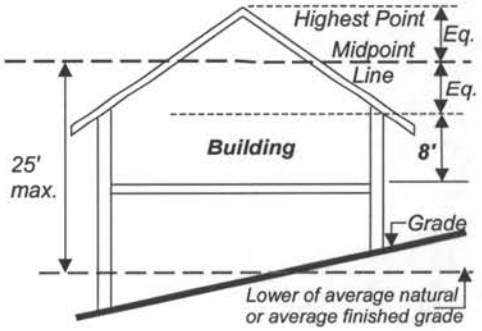
- the highest point of a *building* with a flat roof (i.e. to top of the highest of the roof finish, parapet, roof deck railing, etc.);



- the midpoint between the highest point of the *building* and the ceiling immediately below on *buildings* with pitched roofs;



- the mean *height* line between the highest point of the *building* and a point eight feet above the immediate floor below on *buildings* with pitched roofs without ceilings; or



- the highest point of all other *structures*.

203.3 In calculating *height*, mechanical equipment and enclosures, and skylights over 2 feet in *height* shall be included.

All diagrams are for illustrative purposes only – where there is a discrepancy between any diagram and any text within this Bylaw, the text shall prevail.

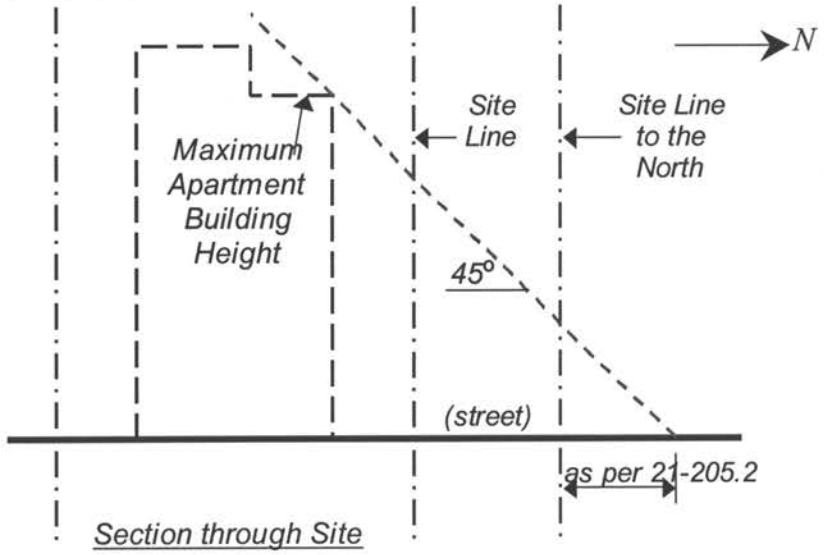
21-204 Building Height Grade Line

204.1 Within the R.M 1 and R.M 2 (*Multiple dwelling Zones* 1 and 2) only, no portion of an *apartment building* which is greater in *height* than 3 *storeys* or 30 feet shall project beyond the *Building Height* Grade Line.

204.2 *Building Height* Grade Line is drawn at an angle of 45° to the horizontal and in towards the *apartment building* in a due south direction from all points along the nearest of the following lines of any residentially *zoned site* or *sites* immediately to the north, whether or not a *street* or a *lane* intervenes:

- a line extending across the full width of the *site*, parallel to and 25 feet from the front line of a *site*; or
- a line extending across the full width of the *site*, parallel to and at a distance equal to the required *rear yard* depth from the rear line of a *site*; or
- a line extending across the full depth of the *site*, not less than 5 feet from the side line of a *site.*

204.3



21-205 Floor Area Ratio - Other Than Single Dwelling And Duplex Dwelling

205.1 *Floor area ratio* shall include:

- the total floor area of all of *storeys*, measured to the exterior faces of the *building* or *buildings*, including hallways, elevator shafts and stairwells at each floor level
- *accessory buildings*
- any floor area not specifically excluded.

Single-Family Houses

The present minimum lot sizes in the zoning regulations are:

5,000 square feet for detached houses;
2,500 square feet for semi-detached houses;
2,000 square feet for row houses; and
no limit on those built in apartment districts.

It would appear to be prudent, in view of the APHA recommended 3,650 square-foot minimum for semi-detached houses, to improve the present standard of 2,500 square feet for such dwellings. A standard of 3,000 would provide for a much better level of air circulation and open space at very little increase in land cost, and allow for more adequate side yards than at present (see Figure 10). It is recommended that the other minimum lot standards be continued, but that two new one-family districts be created. One would provide for large detached-house lots of not less than 7,500 square feet each. The other would be a row house district which would require a minimum lot area of 1,800 square feet and allow conversion for two or three families; this would permit up to 43 families per acre (1,000 square feet of lot per family) maximum occupancy for those converted to multiple units.

Summary

In general, the present zoning regulations have not provided for adequate standards of living environment. This has led to some abuses of development privileges which have depreciated the housing amenities of tenants, and lowered the quality of neighborhoods. In accordance with the development policy used as a basis for rezoning and described under Section VII, the Land Use Plan, and the recommendations of the American Public Health Association, future residential development in Washington should be built at the highest standards of environmental quality which the economic resources of the people and the civic responsibility of the developers will allow. There are already a great number of low standard houses in Washington and a great many depressed neighborhoods (about 45 out of 137). If the trend toward blight and slums is to be arrested, all new construction must be the kind that will encourage the continued residence of the most sensitive and scrupulous elements of the population.

These same principles apply to the standards for commercial building construction, dealt with in the following section, with the additional need of providing adequately for the remarkably rapid growth of automobile travel.

IV. HEIGHT AND BULK OF COMMERCIAL BUILDINGS

The introductory section has indicated the nature of the height restrictions imposed by the Congress on buildings in the District of Columbia. In addition to these, the Zoning Commission was empowered by Congress in 1920 (and again in 1938) to write further restrictions on height, as well as to regulate areas covered by buildings and the uses of land and buildings.

Together these three controls regulate the density or intensity of land use by determining the bulk of the buildings permitted and the type of activity for which they may be used. It will be obvious from the descriptive material which follows that a very high intensity of use, over disproportionately large areas of land, were allowed by the regulations subsequently prepared by the Zoning Commission. But before a discussion of the controls is started, it should be made clear that although in the past height control was necessarily a part of the bulk control, this need not be so. Under the floor area ratio type of control explained in the preceding section on Residential Density, the density of development can be controlled independently of height. Hence the height of buildings may be regulated separately and for different reasons than those lying behind the bulk controls.

This section is to review the existing height and bulk controls and the effect which they have had on the development of the city, make clear the purposes for which controls are instituted, and recommend suitable techniques and levels of control in the commercial districts proposed for the revised regulations.

EXISTING HEIGHT CONTROLS

The restrictions imposed under the zoning regulations (as opposed to Congressional control in the Act of 1910) used different methods in applying height restrictions and reduced the height to which buildings could be built on most properties in the city. The height districts employed were the 40-, 60-, 90-, and 110-foot districts. Amendments to the zoning regulations which have accumulated through the years have narrowed the difference between the Act of 1910 and the zoning regulations, particularly in the downtown area. The change of the 110-foot district to a 130-foot district occurred between 1926 and 1928. Another exception of considerable significance in raising permitted heights was added in 1930. Buildings in the "60-C" district were permitted to be raised to 90 feet provided lot occupancy was reduced.[1] The 160-foot height strip along Pennsylvania Avenue provided for in the Act of 1910, however, has not been utilized.

[1] Section XIII, paragraph 12 of the existing regulations.

Regulations in the "110-D" District

Because of the difference between methods of control, there are many properties on which the limits under the Act of 1910 are more restrictive than under the zoning regulation. This is illustrated by the accompanying Figure 15 which shows the controlling heights on street frontages in the Central Business District of Washington. The complex pattern which shows in the illustration arises from the following provisions of the regulations:

(1) The Act of 1910 limits heights to the width of the street plus 20 feet. Hence, on streets of 85-foot width (7th, part of 8th, 9th, 10th, and 12th), only 105 feet is permitted. Only two streets are narrower than this: D Street (70 feet) and G (Grant) Place (40 feet), permitting 90 feet and 60 feet, respectively.

(2) The zoning regulations permit heights of 110 feet *except* where the street is 110 feet or more in width, where buildings may be carried up to 130 feet (which is the maximum permitted by the Act of 1910 over most of the area). Hence, on streets of 100-foot and 90-foot width (E, F, G, H, I, L, and part of 8th), just 110 feet are allowed, but on those of 110 feet or more in width (11th, 13th, 14th, 15th, 17th, 19th, and K Streets, New York Avenue, Pennsylvania Avenue, Vermont Avenue, and Connecticut Avenue), buildings may be built which reach 130 feet.

(3) The Act of 1910 provides that frontage on public squares is controlled by the width of the widest street entering the square. Hence, for example, the Eye Street frontage on Franklin Square is permitted 130-foot heights although Eye Street is only 90 feet wide.

(4) Corner lots are governed by the widest abutting street in the Act of 1910, but a corner lot is not limited as to depth along the narrower street. Hence, the distance down the narrower streets, to which buildings of greater heights are permitted, depends on the size of the lot which can be assembled including the corner. The map shows the existing corner lots but these can be changed at the will of an owner.

(5) Certain exceptions have been permitted: two by the Congress and one by the Zoning Commission. Congress, by amendment of the Act of 1910, has allowed the Press Building at 14th and F Streets, and an addition to the Raleigh Hotel on 12th Street, to be built above the usual limits. The Zoning Commission, in effect, created a special district for the Homer property on 13th, F, and G Streets. This allowed 130 feet without any of the setback provisions which apply to the 110-foot district in general.

(6) The zoning regulations provide that, generally, alley lots may be built up to a height equal to the width of the alley. Under certain circumstances, however, a lower or higher height may be permitted.

The confusion and complexity of the height controls in this area is more apparent than real, even though there appears to be little logic in some of the variations in the zoning controls.

It is often asserted that it is difficult for a property owner or his architect to know how high a building can be on a given property. This is certainly a great exaggeration, as there is no problem presented by either set of regulations that cannot be solved by high-school geometry applied to a few items of information available to any property owner. An owner of downtown property can afford to spend some time or hire an expert on this matter and it is too much to expect that the regulations on such a complex matter should be expressed in nursery rimes. The property owners will have to recognize that any regulation which actually regulates something is going to require a little thought in its applications.

It is also claimed, perhaps with more justice, that sometimes a building must be designed several times before it can be decided how many stories can be developed under the height (once it is determined).

There is a simple answer to this latter problem: that is to include a maximum permitted number of stories in the regulations. This provision appeared in the District zoning regulations for the 110-foot height district (12 stories) until 1952, at which time it was removed, apparently at the behest of the builder of the Wyatt Building. This building was built illegally to a height of 13 stories and was granted a certificate of occupancy only on condition that the equivalent of one story be kept vacant. The maximum story height provisions are still in effect in the other height districts. The Act of 1910 provides a story height limit in residential districts, but not in commercial.

However, the majority of builders and architects appear to be opposed to a story limit in the downtown district, and since other interested groups do not appear to be particularly attached to it, the proposal has been dropped from the final version of the proposed revised regulations. Permitting an unlimited number of stories under a rigid height limit encourages the builder to squeeze ceiling heights within the building when the height limit is a determinant of bulk. But this difficulty is obviated by the FAR control of bulk. Thus the proposed regulations will not act to promote low ceilings and dark rooms as the present regulations do. They will also relieve the architect from the cut-and-try method of designing buildings to squeeze the last square foot of building into a rigid envelope prescribed by height ceilings and lot lines.

Light in the Streets – The street width relationship was originally conceived as a measure to prevent the development of dark canyons on the narrower streets. In their

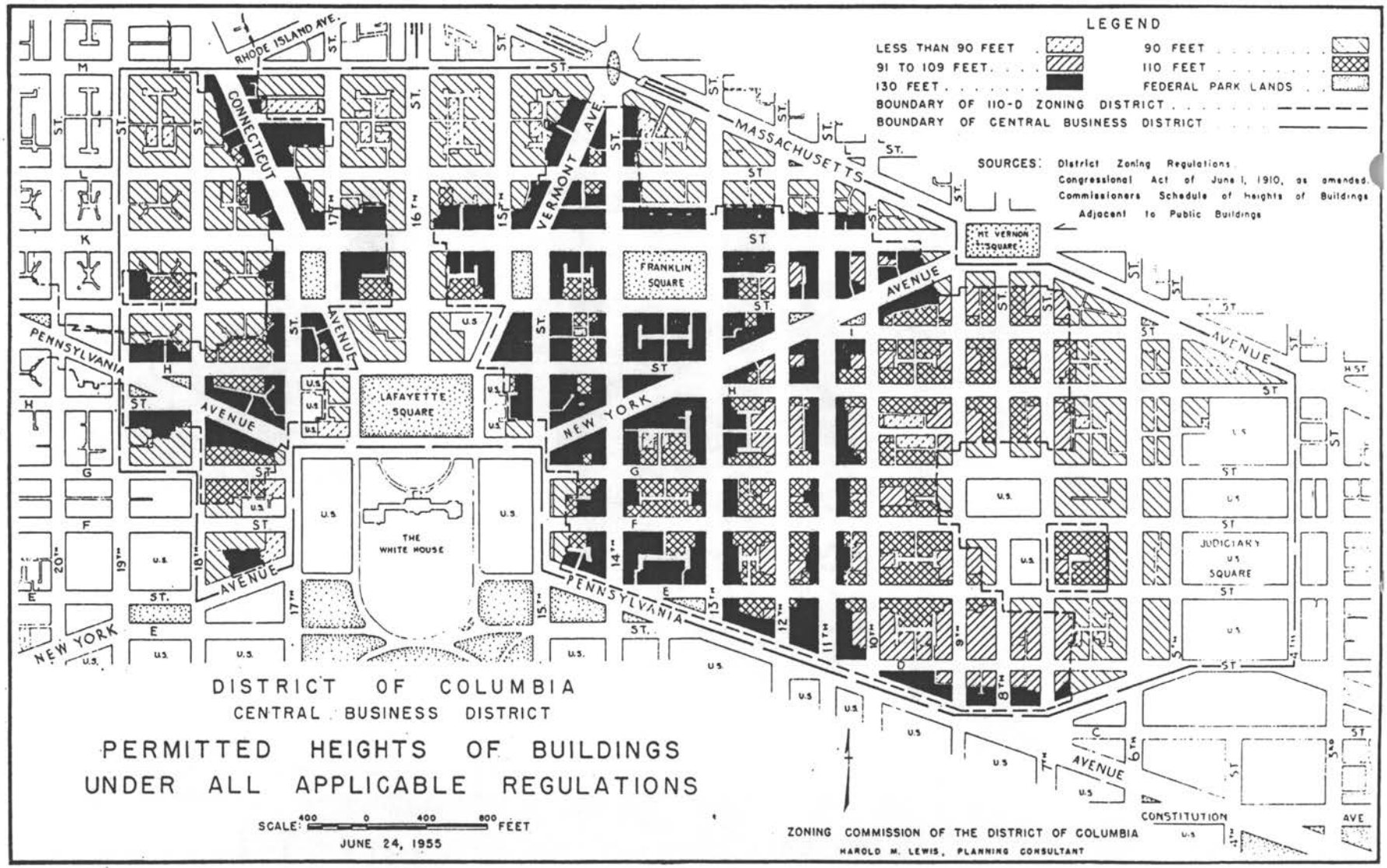

LEGEND
LESS THAN 90 FEET
91 TO 109 FEET.
130 FEET.
90 FEET
110 FEET
FEDERAL PARK LANDS
BOUNDARY OF 110-D ZONING DISTRICT
BOUNDARY OF CENTRAL BUSINESS DISTRICT
SOURCES: District Zoning Regulations.
Congressional Act of June 1, 1910, as amended.
Commissioners Schedule of heights of Buildings Adjacent to Public Buildings
RHODE ISLAND AVE.
CONNECTICUT
VERMONT AVE.
MASSACHUSETTS
FRANKLIN SQUARE
MT. VERNON SQUARE
PENNSYLVANIA AVENUE
LAFAYETTE SQUARE
NEW YORK AVENUE
THE WHITE HOUSE
JUDICIARY SQUARE
CONSTITUTION AVE
DISTRICT OF COLUMBIA
CENTRAL BUSINESS DISTRICT
PERMITTED HEIGHTS OF BUILDINGS
UNDER ALL APPLICABLE REGULATIONS
SCALE: 400 0 400 800 FEET
JUNE 24, 1955
ZONING COMMISSION OF THE DISTRICT OF COLUMBIA
HAROLD M. LEWIS, PLANNING CONSULTANT

FIGURE 15

present form, the street width provisions of the Act of 1910 preserve for various widths of street very nearly the same angle of light obstruction of the top of the building front at the street line from the center of the street. This is true for streets up to 110 feet in width. Beyond that width the angle decreases because there is an absolute height ceiling regardless of street width.

The geometry of the street-width provisions is shown in the upper diagram in Figure 16. The angle varies between 69°20′ on a 60-foot street and 67°4′ on a 110-foot street. The diagram also shows the setback required for buildings of more than 110-foot height under the existing zoning regulations.

The existing zoning regulations do not relate height to street width. Hence, the permitted angle of light obstruction would vary widely on the streets of varying width if in each height district only the zoning regulations applied. The one exception to this rule is the case of the 130-foot heights permitted in the 110-foot zone wherever the street is 110 feet wide. In this case, the setback required is such (one-half of the height) as to make the additional height almost invisible from the center of the street, so that it makes no change in the angle permitted. (See Fig. 16.)

Thus the zoning regulations provide two sub-districts within the 110-foot district and the Act of 1910 provides a half-dozen more based on street width. The combination of the zoning regulations and the Act of 1910, in which the most restrictive provision of either determines actual angle of light obstruction, forms a rather complicated picture. For the "110-D" district on streets up to 90 feet in width the Act of 1910 governs height and, therefore, angle of light obstruction (about 68 degrees). At this point, the zoned height limit of 110 feet is reached and the angle falls off until, when the street is 110 feet wide, it is 63 degrees. On streets wider than this, the angle is measured to the top of the setback. On K Street (147 feet wide), for example, the angle is 58 degrees, with a little of the penthouse showing above the cornice line. Additional penthouses for mechanical equipment are permitted, but they are required to be set back by a distance equal to their height, or an angle of 45 degrees from a horizontal plane at the cornice. Hence, they cannot be seen from the center of the street when they are developed on top of high buildings.

It appears that the various regulations have enforced an inconsistent height control on the downtown area, as reference to the map in Figure 15 will show. The "110-D" district actually permits heights ranging from 60 to 130 feet. Proposals have been made to remove the street width features of the Act of 1910 and insert a direct control of the angle of light obstruction in the zoning regulations, thus permitting a consistent control of height.

Penthouses and Water Tanks – In the retail area on F and G Streets east of 14th Street, penthouses holding elevator equipment, smokestacks, air-conditioning equipment, ducts, and cooling towers, and water sprinkler system tanks on the tops of buildings become an unpleasant feature of the skyline as seen from the street, because so little of the street frontage is occupied by tall buildings.

These miscellaneous objects are common to the whole downtown area and can be seen from afar, or from the upper floors of high buildings. The present height regulations do not encourage any attempt to improve this appearance by enclosing the whole within a neat penthouse, or within the walls of the building itself.

The zoning regulations permit elevator penthouses, stacks, ornamental towers, and domes, etc., but do not permit sprinkler tanks, water towers or air-conditioning equipment in excess of 130 feet, although all accessory structures are permitted above the height limit in lower height districts. This applies to buildings built after December 1, 1944; for buildings existing prior to that date such equipment can extend above 130 feet above the street upon approval of the Board of Zoning Adjustment.

The Act of 1910 gives the Commissioners permission to allow "spires, towers, domes, minarets, pinnacles, penthouses over elevator shafts, ventilation shafts, chimneys, smokestacks and fire sprinkler tanks" to be placed above any limit prescribed, provided that penthouses, ventilating shafts, and tanks be set back by their height from the edge of the roof.

The heights established by these structures form a plane about 15 feet above the maximum height limit for habitable spaces in the densely built-up area around the White House, although certain buildings have penthouses of much greater height.

Proposals have been made that the builder be permitted, in effect, to build up around the miscellaneous penthouses already allowed, to 150 feet, thus developing a more pleasing skyline without, it is claimed, materially raising it. This was accompanied by proposals with respect to the angle of light obstruction (and street width rule) which would have permitted such heights to be built directly on the street line on most downtown streets.

Without an amendment to the Act of 1910, this proposal could apply only to the strip along Pennsylvania Avenue. But it is felt that a boost of 20 feet in the limit of habitable construction and removal of all setback requirements would too obviously violate the spirit of the Congressional interest in height controls over the city. It would be more in keeping with the spirit of the Congressional controls to supplement them, as recommended below, with an upper limit for roof structures other than stacks so as to prevent the development of imposing monuments above the existing level.[2]

[2] The tallest building in the city (other than the Capitol and the old Post Office) is the Tower Building at 14th and K Streets. This building has a 47-foot pyramidal structure housing elevator machinery and smokestacks on top of the 13 stories of offices built within the height limit. In this case the builder went to great expense to enclose the miscellaneous functional forms of the usual roof-furniture in an unnecessarily large, non-functional monument which is not in keeping with the spirit of the system of height limitations.

Areas Fronting on Federal Parks and Buildings

The Commissioners' Schedule of Heights of Buildings Adjacent to Public Buildings was authorized (it is believed) in 1902 and has been added to from time to time. There are now several additions which should be made to protect the federal interest.

Pennsylvania Avenue – Pennsylvania Avenue west of 9th Street was not a great boulevard in L'Enfant's plan for Washington. To the east of 9th Street, however, it is shown at 160-foot width, and forms part of the route between the "Federal House" and a "church intended for national purposes" which was to be located on the site now occupied by the Civil Service Commission building. It is doubtful if he saw it as a commercial center of the city. Thus, the 160-foot building height on Pennsylvania Avenue was originally provided for when the old Post Office Building was the major government edifice in the area and the business center of the city still occupied both sides of this street between 1st and 14th Streets. Since then, the Federal Triangle has been completed with buildings of 90 feet at the cornice, and a large area on the north side of the Avenue has been acquired and cleared for the Civic Center group of District Government buildings, also at a comparatively low height.

Only three buildings were built to great heights in the period from 1910 to 1920 in the remaining area: the Munsey Building, the Willard Hotel, and the Raleigh Hotel. Only two have been built since 1920: the addition to the Raleigh and a new office building of 130-foot height at 13th Street and Pennsylvania Avenue.

It is possible, however, under the present regulations, to build up a dominating front of buildings along Pennsylvania Avenue that would completely change this situation.

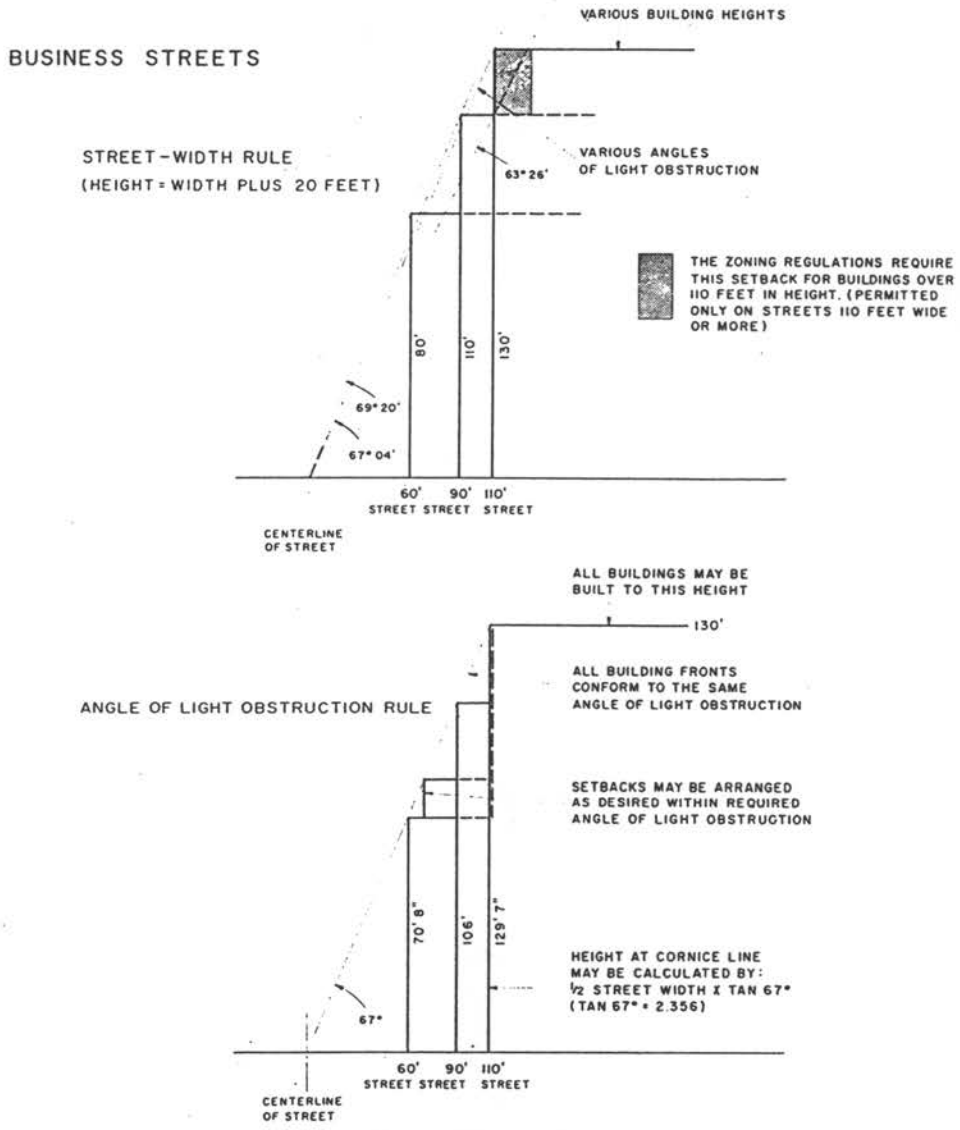


FIGURE 16. Diagram Showing Relation of Angle of Light Obstruction Control to a Control Based on Street Width

If the zoning height limit were raised to conform to the Congressional limit, a very great disparity of building mass could be achieved.

It is contemplated that the old Post Office building will be removed eventually, and the Federal Triangle completed. In this event, the original basis for the 160-foot height zone will be gone. Pennsylvania Avenue should, therefore, be given the same status as other streets facing major public buildings.

The various blocks of Pennsylvania Avenue should be added to the Commissioners' Schedule with heights for cornice and setbacks appropriate to the height of the Federal Triangle buildings opposite. Some adjustments upward could be made in the case of the two blocks between 13th and 15th Streets, since they face the Federal Triangle across an open space which is twice the normal width of the street.

The Capitol Area – In contrast to the Pennsylvania Avenue area, there is a complete control over buildings immediately adjacent to major federal buildings around the Capitol. However, the other phase of the Congressional interest in height controls, i.e., that there be no building mass or individual building of sufficient height to compete with the Capitol, do not seem to be very well satisfied by the present Congressional regulations.

This can be tested by preparing profiles from topographic maps, and placing outlines of buildings possible under the regulations at the appropriate points on the profiles. Thus, buildings 130 feet in height could have been built on East Capitol Street, Maryland Avenue, N. E., and on Pennsylvania Avenue, S. E., which would be visible over the Capitol roof from the Mall and Pennsylvania Avenue, were it not for the zoning regulations. Seen from the south (from the South Capitol Street bridge, for instance) or north (from Union Station or New Jersey Avenue, N. W.) these buildings would present distracting elements in the composition created by the Capitol Hill development.

The land to the south and west of the Capitol is lower in elevation to the extent that buildings of the same height would not compete with the Capitol. Canal Street, for example, is about 80 feet below the level of the ground on which the Capitol is built.[3] The same is true to a lesser degree in the area northwest of the Capitol. Here the base of the 89-foot high Acacia Insurance Building on Louisiana Avenue is 60 feet below the level of the Capitol Hill. Since the rise in the ground to the northwest is very gentle, a height above sea level equal to that of the base of the Capitol is not reached until one crosses M Street, a distance of more than a mile.

For these topographical reasons, a height restriction designed to prevent the erection of buildings which would dominate the Capitol, or form a discordant background for it when seen from a distance, would apply as a significantly inhibiting restriction only to the area of Capitol Hill. The Commissioners' Schedule could be utilized for this purpose since existing or contemplated public buildings now reach eastward over the brow of the hill. An extension of the principle of the list could be made to cover buildings further east on the main streets which might affect the Capitol without requiring any change in authorization of the schedule.

Other Federal Developments – Expansion of the government office building development west and north of the White House is now contemplated. Several other major buildings scattered around the Central Business Area of the city have received no protection. The schedule should be brought up to date with respect to these developments.

Height Controls in Other Commercial Areas

Since the large majority of commercial structures outside of the Central Business District are not fireproof, the real limit has been the 60-foot Congressional limit on such structures.

A few of the outermost commercial developments in the District have been zoned for the most restrictive height district available (40-foot) without restricting them in any practical way.

In general, there does not seem to be any need for more than one-story commercial structures in small neighborhood shopping districts nor more than two stories (offices over shops) in outlying community business centers. In both these types of districts, a height limit of three stories should provide for other permitted uses and still keep the districts compatible in scale with surrounding residential areas.

Larger-scale outlying commercial centers, however, can use office buildings up to 8 stories (or 90 feet) in height, comparable to the tallest apartment buildings, if, as it is hoped, there is a substantial "overflow" of employment from the congested downtown center of the city to such centers instead of to suburban areas.

The principal use of the 60- and 90-foot heights now permitted in the outlying commercial areas has been by apartment houses, which have thereby attained very high densities. It is anomalous that the present regulations thus permitted and even encouraged large residential populations in the commercial districts. The new regulations do not repeat this error.

EXISTING BULK CONTROLS

The Greeks, the Egyptians, and the Sumerians before them in 3000 B. C., knew the geometrical principle that:

$$\text{height} \times \text{width} \times \text{depth} = \text{volume (or bulk)}$$

But the zoning regulations of Washington have sturdily ig-

[3] The elevation of the platform is given as 88 feet above the Potomac River in the mimeo release distributed by the Office of the Architect of the Capitol. The height of the statue atop the dome above this level is 287 feet, that of the balustrade at the top of the dome is 217 feet. The wings of the building, forming its main roof line are only 70 feet high, making them about 90 feet, on the average, above the surrounding terrain to the east.

monotony of densely packed buildings, and providing a little extra street space for handling traffic movement.

When integral parking is offered in such high-bulk development the effect is exactly the same, with the attendant automobiles entering the street in a solid stream from one entrance instead of three or four scattered entrances. A single building on one-third of a block can consume the capacity of the street which it faces, to handle cars outbound in the rush hour.

Thus massive building concentrations sterilize their surrounding and send later developments skipping over several blocks in the direction of the high-income quarter of the city, which effect can also readily be seen on the map. By doing this, of course, the new construction soon cuts off convenient traffic access to older areas closer to the center of the city. The indefinite extension of the business district in this fashion also soon destroys whatever compactness it originally enjoyed.[10] Further discussion of these problems will be reserved for the discussion of traffic congestion below.

PURPOSES OF HEIGHT AND BULK REGULATIONS

The previous discussion of existing controls and development has already introduced most of the purposes of these controls, and pointed out some areas in which there seems to be little dispute. At the risk of some duplication, these purposes will be given a complete treatment in this section, so that a complete record will exist.

[10] The persons who emphasize the value of compactness nevertheless manage to advocate expansion of the high-bulk district farther than it has already spread.

TABLE IX

ANALYSIS OF RECENT COMMERCIAL BUILDINGS

Location	Type	Year of permit	Site area, sq. ft.	Floor area, sq. ft.	Developed floor area ratio	Permitted floor area ratio
		First Commercial 60-C				
1118 22nd Street, N.W.	Office	10/15/54	5,717	8,640	1.5	4.00
1738 7th Street, N.W.	Store	4/ 2/52	1,363	861	.63	4.00
1829 18th Street, N.W.	Store	6/16/52	2,609	1,928	.74	4.00
1344 Maryland Avenue, N.E.	Office	12/ 2/52	2,401	1,200	.5	4.00
		First Commercial 60-D				
1220 7th Street, N.W.	Store	12/22/54	1,900	2,925	1.54	4.67
1211 11th Street, N.W.	Store	5/14/54	4,140	1,580	.38	4.67
		First Commercial 90-C				
2111 E Street, N.W.	Office	3/ 3/48	4,706	12,519	2.66	6.50
2430 Pennsylvania Avenue, N.W.	Apt. & Str.	12/ 7/48	22,672	142,000	6.3	6.50
		First Commercial 90-D				
1126 16th Street, N.W.	Office	12/29/54	8,514	4,350	.51	7.40
933-935 4th Street, N.W.	Gas Sta.	5/28/54	5,648	1,125	.20	8.00
401 3rd Street, N.W.	Office	7/14/54	7,920	31,680	4.0	8.00
		Second Commercial 90-D				
1118-20 20th Street, N.W.	Auto Shop	3/10/54	4,700	912	.17	7.40
1147 20th Street, N.W.	Office	4/22/54	3,500	1,900	.54	7.40
1145 19th Street, N.W.	Off. & Str.	11/12/53	17,148	147,500	8.16	7.40[a]
		First Commercial 110-D				
1133-37 Connecticut Avenue, N.W.	Off. & Str.	8/23/48	7,541	29,842	3.9	13.52
1012 14th Street, N.W.	Office	6/11/53	6,624	76,050	11.3	13.08
1000 Vermont Avenue, N.W.	Office	12/24/48	7,463	74,388	9.9	13.52
1717 H Street, N.W.	Off. & Str.	5/22/53	35,313	328,392[b]	9.3	9.9
425 13th Street, N.W.	Off. & Str.	7/ 2/53	18,432	210,317[c]	11.8	13.52
908-10 11th Street, N.W.	Store	7/ 8/53	2,130	17,466	8.2	13.08
1700 K Street, N.W.	Office	6/28/54	11,040	140,777	12.7	13.52
1413 K Street, N.W.	Office	3/18/53	3,240	35,310	10.9	13.08
777 14th Street, N.W.	Off. & Str.	6/30/50	13,072	147,202	11.2	13.52
1632 K Street, N.W.	Office	12/13/50	2,294	12,675	5.5	13.52
1006 F Street, N.W.	Store	9/ 7/50	2,090	3,600	1.71	9.9
1731 H Street, N.W.	Office	2/ 8/49	11,154	51,985	4.6	9.9
1625 Eye Street, N.W.	Office	6/ 7/49	34,965	330,305	9.4	9.9
1304 G Street, N.W.	Store	2/ 4/48	2,374	5,500	2.3	9.9
		Second Commercial 110-D				
513 11th Street, N.W.	Store	6/20/49	2,375	4,250	1.8	13.08
500 11th Street, N.W.	Office	5/23/51	15,625	96,830	6.2	13.52

[a] The reason why the permitted floor area ratio is less than that actually developed in this case lies in the fact that the Sanborn Atlas counts as a "story" a mezzanine which is used for car parking, and the Building Department does not. This points up the need for careful definition of the term "floor area" in the new regulations.
[b] This building has, in addition, 3 underground levels of parking with a capacity of 470 cars.
[c] This and possibly other buildings have large parking garages in the above-ground floor area.

The Federal Interest

A statement of what is believed to be the essence of the interest of the Congress in control of development in Washington was given in the Introduction (page 5). Of course, the Federal Government as an employer also has an interest, identical with that of any other employer, in an efficient and livable city for its employees.

At the present time, the provisions of the Act of 1910 establish absolute controls over height in business districts at 130 feet and in residential districts at 90 feet in order to assure the continued dominance of the Capitol and the Washington Monument and to preserve a relatively even cornice line along individual streets. These limits apply to habitable space and some, but not all, of the usual roof structures. It is believed that there is no justification for asking Congress to change these limits, although there is a need for putting an upper limit on the miscellaneous roof structures.

Therefore, a maximum overall height, to include all roof structures, of 150 feet is proposed for the Central Business District.

There is an apparent inconsistency in the Congressional distinction between commercial and residential districts. Why, one might ask, should a residential building affect the skyline more than a commercial building? Although there is no evidence to show that anyone in Congress was thinking this way, there is a good reason for the distinction. The hills surrounding the center of the city are occupied by residential districts, and a 130-foot building on one of these heights would start from an altitude of as much as 200 feet above the general level of the business district and the base of the Capitol building. Seen from afar (as from the National Airport), a 130-foot apartment building (with roof structures) built on Meridian Hill would reach 350 feet above sea level and appear to be three-quarters of the height of the Washington Monument and taller than the Capitol (elevation 305 at the top of the dome). Therefore, the distinction is worth preserving, as an expression of legitimate federal interest.

The immediate surroundings of important government buildings must be controlled in detail, and hence are not a suitable object for general rules. The Commissioners' Schedule of Building Heights and the Fine Arts Commission form the proper channels for the federal interest here and should be used more fully.

The federal interest in light and air in the streets coincides with that of the private community. The Congressional control of height by street width could therefore be replaced by a zoning control if and when Congress feels that this phase of its interest would thus be adequately protected. This is desirable because the street width provisions have an unwanted by-product of limiting height and bulk erratically over the area of the business district.

The protection of light and air in the streets will be discussed further below, after other aspects of the height controls are discussed.

Compatibility with Residential Development

The commercial and industrial districts outside of the business center of the city are controlled, in general, so as to prevent the development of buildings which are incompatible with the surrounding residential development. A number of different situations are found.

Small Neighborhood Centers – These retail centers are most intimately associated with residential development. The uses permitted in them and the density permitted will be extremely restricted in order to make them acceptable as neighbors to homeowners who are jealous of the appearance of their neighborhoods. In conformity with this pattern, it is logical to permit only ground floor commercial use.

Community Business Centers – These commercial areas draw on a wider range of services at greater intensity per acre of ground than in the neighborhood centers; therefore the permitted bulk is larger. Parking requirements have been designed to force the developer to shoulder all of the parking load which he creates, since the major part of the trade for such an area will be auto-borne. The parking takes up ground floor space and necessitates putting part of the floor space above ground. A height of three stories will enable the designer, in most instances, to take advantage of the full bulk allowance, provide the necessary parking, and create an interesting design. Yet this is not out of scale with most of the residential areas that the community centers are associated with. Hence a limit of 45 feet is considered adequate. Small theater buildings and the few other special purpose buildings permitted in these centers can also be built within this height.

Major Outlying Business and Employment Centers – Several business centers now exist, and others will develop in time, which accommodate large numbers of office workers as well as retail and service businesses serving larger communities than the purely local shopping centers previously described. The business units involved will need relatively large buildings, consequently a much larger FAR will be allowed. However, parking requirements will be just as stringent so as to protect nearby residential areas. Hence, additional height must be permitted to allow the design of suitable buildings. Nevertheless, these should not be out of scale with the largest residential structures – the eight-story, 90-foot apartment buildings which are permitted in all apartment districts by exception, and in the highest density district as a matter of right. An illustration of the kind of development permitted in this district was given in Figure 6 (page 25).

Heavy Commercial and Light Manufacturing Areas – These areas occur in close association with residential development along major thoroughfares and along railroad lines. Current trends in construction for most of the uses

permitted in this district are toward one- and two-story buildings, and it is only an occasional furniture warehouse or department store distribution center which seems to justify greater heights on structural grounds. These trends are based on the freedom of movement offered by the truck and automobile, which allows the businessman to escape from paying tribute to the owners of high-priced land. A maximum height of 45 feet is proposed in these areas.

Industrial Districts – Structures requiring a greater height can be placed in the main industrial districts, where a greater height is permitted. While these are so located as to be insulated from residential areas, it is nevertheless true that they occupy some of the most conspicuous locations in the city. It is in the interest of all residents and business groups in the city that its industrial districts be as neat and inconspicuous as possible.

A height limit of 60 feet is therefore proposed for the general industrial district. This is as low as possible without interfering with the erection of many industrial structures. Specialized structures requiring greater heights for their physical usefulness can be permitted through Board of Zoning Adjustment action.

Exceptions Through Large-Scale Development Planning – For all of the commercial districts, a broad loophole in the height limits can be achieved through submission of plans for the development of large acreages to the Planning Commission. By the procedure provided in the regulations, it is contemplated that exceptions to permit dramatically tall buildings can be made where review of the whole design assures the controlling body that fundamental purposes of the zoning controls are satisfied. Redevelopment projects form another path through which the strict application of blanket height controls can be set aside in favor of a more refined system of design control.

Light and Air in the Streets and Alleys

Excessive bulk (and height) of buildings cuts off the light which would naturally fall on nearby property and public spaces such as the street and alleys. If all of the buildings in a group are tall, they will mutually exclude light from each other. If they are tall enough in relation to the street, they will reduce the total light in the street to such an extent that rooms facing upon it will require artificial light throughout the day the year around.

For Washington this is only a theoretical threat. The standards set by the Act of 1910 provide a level of light which is adequate in the most solidly built-up streets. The resulting angles of elevation were given in the preceding discussion of existing height controls. There appears to be no need to argue the value of natural light in this case, since it is accepted by the community that the present standards have produced a desirable result.

The present standards for light in the alleys and courts are much lower than for the streets, in the high density districts. The term "standards" is used figuratively in this case. On a block in the 110-D district with 110-foot streets on opposite sides of the block, the walls of 130-foot buildings facing each other across the alley may be as little as 36 feet apart. From the center of the alley, each building would form an angle of light obstruction of about 81 degrees, allowing an 18 degree arc, or 10 per cent, of the sky to be seen overhead. Therefore it would be desirable, from a human point of view, to require an angle of light obstruction from the center of the alley (or back property line where there is no alley) which approaches that which is presently accepted for the street. However, there is no convincing evidence available to show that there is damage to the health of the workers whose offices and shops have windows on the existing narrow alleys and courts. There are, in fact, thousands of persons who work in interior spaces with only artificial light and ventilation. On the other hand, office space on the upper floors of tall buildings with exterior windows commonly pay a premium rent over those that are lower and darker. This is partly due to a reduction of noise and dust, and to a traditional prestige which has become associated with "a view," as well as to the higher level of light available in such situations.

The case for an angle of light obstruction requirement in the alleys thus leans on subjective arguments for its results in terms of "pleasantness," "human scale," and "desirability." These qualities may be sacrificed in the business district at the discretion of the property owner who suffers economically if he is wrong. But they must be preserved for human habitations where residence districts adjoin commercial districts and where residential structures are permitted in commercial districts. For these circumstances special controls must be provided to ensure a minimum of light to residential rooms and prevent commercial development which puts nearby homes in a perpetual shadow.[11]

An angle of light obstruction has been recommended which approximates that provided by the Act of 1910 on business streets for the downtown business district. For the major secondary centers which will be found in association with residential areas, an angle has been recommended which approximates the 1910 Act provision for residential streets. These proposed angles also apply to alleys and lot lines when they form the boundary of an adjoining residential district. An illustration of angle of light obstruction appears in Figure 14 (page 37).

These controls duplicate but do not conflict with the Act of 1910.[12] Thus they could be adopted immediately without any change in that Act. Confusion as to which control applies has been obviated by setting the zoning control just below the smallest angle required by the equivalent provisions of the Act. The angle resulting from a street width

[11] In Washington's moist climate, wooden buildings which receive no direct sunlight are subject to "dry" rot and much more liable to termite attack.

[12] There can be no conflict in one sense of the word for the Zoning Act expressly says that the controlling rule is the one which requires the greatest restriction.

of 110 feet was 67°4′. As shown in the lower diagram in Figure 16, the proposed requirement of 67° generates a building height five inches lower on the same street. This results in a slight improvement in the light standard on most streets, and in some cases a significant improvement where it is needed most.

Summer Comfort – The heat of the summer is a far greater problem in Washington than the chill of the winter. The masses of buildings of stone and brick, and square miles of pavement of asphalt and concrete, in this as in other cities, are responsible for raising the average temperature by several degrees compared to the surrounding suburbs. They do this because they absorb the heat and light rays of the sun and re-radiate them as heat immediately and throughout the night, whereas vegetation absorbs the rays and uses part of the energy to carry on its life processes, while disposing of any excess by evaporation of water. The total effect of the city on the local climate is related to the size of its core area and movement of air through it. The presence of grass and trees in parks and along the streets, and a building pattern which facilitates the flow of air at ground level through the city will greatly mitigate the effects of the square miles of brick and asphalt on the local climate.

Washington is almost unique in its possession of parks and street trees. The regular pattern of broad streets in the downtown area facilitates the movement of air, but the narrow alleys and the traditional solid row frontage of the buildings cut off this flow from the back sides of the buildings and impede cross ventilation. Any system of regulation which will encourage the opening up of ground-level side yards and the planting of trees in side and back yards would be of advantage in this respect. The proposed system of regulation by FAR will have an incidental effect in doing this if the FAR permitted is relatively low compared to the FAR which could be squeezed into the box or "envelope" outlined by the lot lines and the height limit. If the builder is permitted to virtually fill up the envelope, he is not likely to leave any ground-level open space for pedestrian (and air) circulation within the block, parking space, and trees.

This has been done recently with great success in such well known buildings as Lever House in New York (FAR 6) and Mile-High Center in Denver, although the lesson could have been learned from Radio City (FAR 11.9) in the 1930's.[13] In these cases, shrewd property developers have used much less than the permitted FAR in creating premium-rent buildings that far exceed their "wedding-cake" contemporaries in earning power.

Long Term Values – It is notable that these same features of design result in greater efficiency in the building itself. It may also permit easier handling of off-street parking and loading facilities for both passenger cars and trucks and give the architect freedom to create dramatic and aesthetically appealing buildings.

These features have long been associated with buildings which produce high rental incomes, low costs, and long-lasting values. It is reasonable to assume that buildings built under the proposed new regulations will pay more per square foot of building and continue in profitable operation longer than the overcrowded buildings now standing. To achieve this, however, the permitted FAR must be substantially smaller than the FAR which could be built within the envelope formed by the lot lines, height limit, and angle of light obstruction. Figure 20 shows the present development of a downtown block compared to the manner in which it could be developed under the proposals made here, and to its possible development under more liberal permitted densities and height limits.

Traffic Congestion

It is obvious that the generation of traffic on the streets in a commercial area more than a few blocks square will be closely related to the amount of floor space existing in the area and the uses to which it is put. From this, an equally obvious deduction can be made that building bulk should be controlled to fit the existing or potential capacity of the street system to handle the daily peak traffic in order to prevent the development of traffic congestion. The motive behind such control is economic. Traffic congestion causes small losses of time, gasoline, and wear-and-tear on vehicles to each of thousands of individuals every day, year after year, the total of which is enormous.

The construction of new traffic facilities in a situation where congestion has already become acute, however, usually works out to equally staggering totals. When it is a matter of cutting into existing buildings, evicting going businesses and acquiring privately held land, in addition to the cost of new pavement and structures, the cost of new facilities outweighs the economic gain inherent in further concentration within a small business district of the major employing and traffic generating facilities of the city.

It has been argued that the normal workings of the free market – in land, building space, automobile and mass transit transportation, and in the related markets for goods and services – will take care of the problems in location of economic activities in such a way that the most efficient and most pleasurable pattern of city development will emerge. But to wait for the free economy to restore efficiency to the urban transportation system, it appears, is to stand by indefinitely while the losses pile up to astronomical figures.

At the present time, the city:

(a) Makes a major part of all the investments involved in city building – in particular the bridges, streets, roads, tunnels, parking spaces, etc., which make up

[13] As *Architectural Forum*, June, 1950, laments in an article describing Lever House. Lever House is not a rental building, but its owners are not philanthropists. The soap kings feel that its publicity and employee relations values are well worth the building's potential bulk that was not used.

the urban traffic system – and operates these facilities as it sees fit;

(b) It directly regulates the routes and rates of transit systems, toll charges, parking charges, auto licenses, etc.

(c) It charges for the use of all land within its jurisdiction by means of the ad valorem tax system; and

(d) It directly regulates the use of land through a system of zoning regulations.

It seems that the public authorities already have and

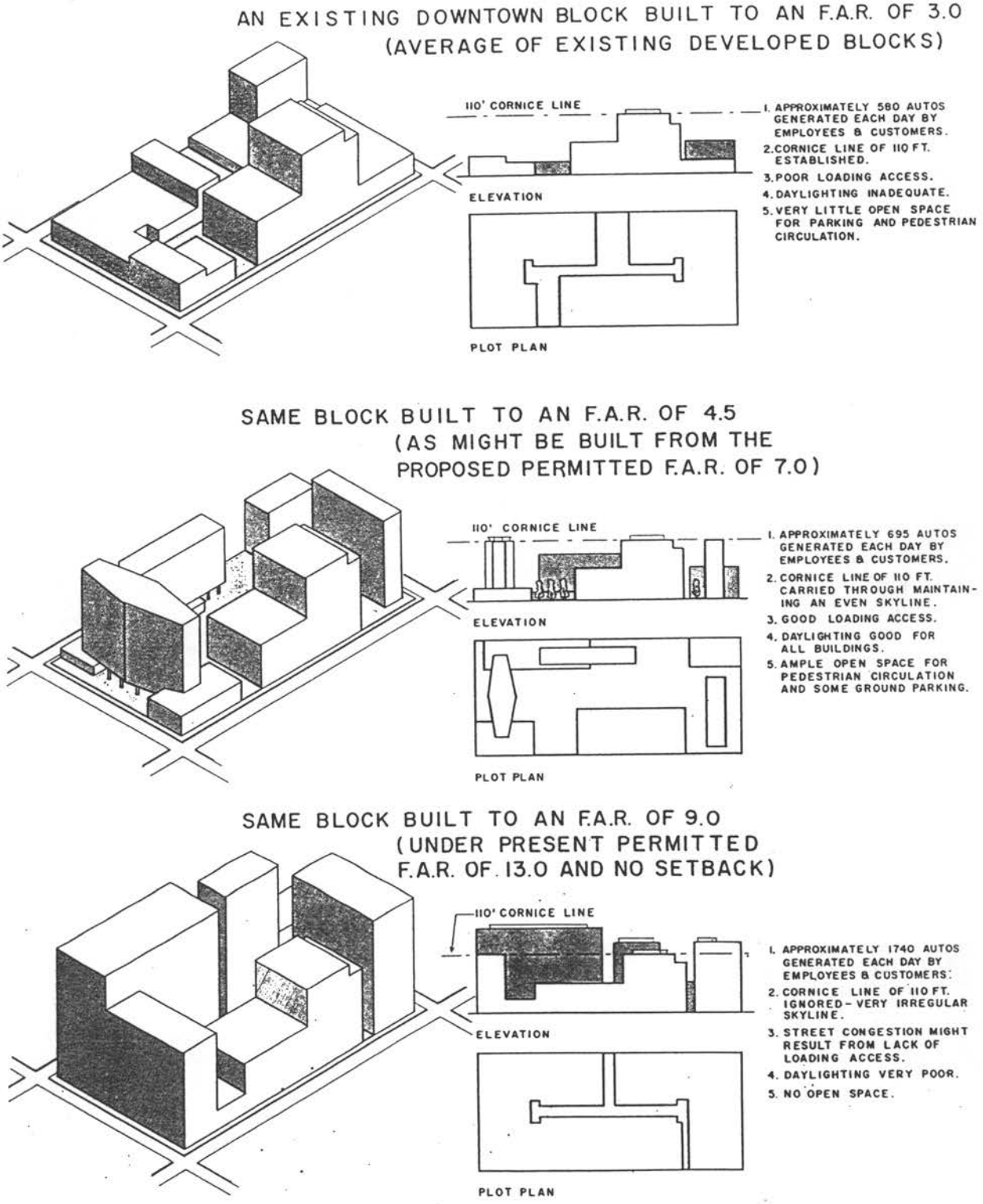


FIGURE 20. Comparison of Existing Development on a Typical Downtown Block with That Likely Under Proposed Regulations and That Likely Under Present Zoning Contrals and Elimination of Setback Requirement

exercise the powers necessary to create order out of the chaotic urban transportation system and associated traffic generating facilities. Their fault at the present time lies in their failure to apply all means at their disposal in a coordinated way to achieve a balanced system.

Relation of Traffic to Building Bulk in the Downtown Area — A traffic policy must therefore be devised for the zoning revision if it is not to continue the present directionless drifting on the question. It is believed that the need for tailoring the bulk of traffic generating facilities to traffic capacity in the downtown area offers the strongest motive for limiting the bulk of building there.

The business district is a complex organism and its relation to its supporting transportation system is by no means simple. This relation can be studied by marking off boundaries and examining the traffic flows across the "cordon" so established. The choice of boundaries becomes a difficult problem because traffic generation is found all along the radial streets and the critical point in the relation between capacity and load may be difficult to locate. Because of this, it would be best to study a number of cordons and compare the results.

It would also be useful to do this for another reason: there is more than one question of policy to be answered as to the bulk of buildings downtown. The maximum bulk of individual buildings must be determined and the total bulk of all buildings that can be permitted must be fixed.

Study of the smallest unit of the traffic problem, around a single building or group of buildings, would give an indication of what bulk of the individual building loads the streets in the immediate vicinity beyond the capacity which should reasonably be assigned to one building on a street which must serve many. Some observations on this point were made above (page 51) in connection with the map of building height development in Figure 18.

The Matomic Building cited there (FAR 9.3), can be regarded as an excessively large building in relation to the street that it faces. H Street has a practical capacity of 1,800 cars per hour and the Matomic garage accommodates 470. It will have to be admitted that four Matomics would leave H Street unavailable for any other traffic during the peak hour.

A block solidly built up after the manner of the Matomic would therefore use up one-quarter of the outbound capacity of its four bordering streets. A four-block concentration of such buildings would have its exit street capacity doubled, but the bulk of buildings would be quadrupled, hence it would use one-half of its outbound street capacity. As a business district gets bigger in area the potential bulk of buildings grows larger much faster than the number of streets crossing its edges.[14]

For this reason buildings of the scale of the Matomic must scatter over a larger area and the average density of that area must fall as it grows in worker population, so long as its transportation system is based on street traffic.

The Central Business District shown in the maps, as a whole, has an FAR of about 3. The area north of the White House to L Street, between 14th and 18th Streets, is about as densely built up now as it will ever be with an automobile transportation system, yet it has an average FAR of no more than 4.0 or 4.5. With this low density it still draws upon adjoining areas to the east and west for parking and street space. This density at the present time approaches a limit set by the self-strangulation of traffic congestion. As such it is inflicting heavy losses on the public.

The conclusion is inescapable from the evidence above that the zoning controls should aim at an average density of not more than 4.0 FAR. Since many lots are too small for full bulk development or will have economic uses in low bulk structures, the individual owner can be permitted to build higher than average bulk buildings. These should not approach the bulk of the Matomic, however, as permission to build such structures would give the owners of a few plots on the main approaches to the business district the right to make mistakes which would be disastrous for the whole district, although profitable to themselves. The same amount of floor space, distributed in smaller buildings would be much less harmful although they would add to the general density.

An FAR of 7 is a reasonable compromise between the need for control of density and the need for an FAR gain sufficient to offset the cost of assembling small plots and tearing down old buildings. Parking space built integral to the building, however, should be excepted from the floor area calculation, up to an FAR of 2 for parking, in order to encourage the provision of parking.

An illustration showing a building calculated to conform to this bulk limit and the height limits previously discussed, is given in Figure 21. This building shows graphically the reasonableness of the proposed limits. Many existing buildings in downtown Washington would be conforming under these proposals as to bulk, although not as to the parking requirements proposed in a later section. At least one successful building, the Cafritz Building (1625 Eye Street), would comply in almost all respects. Its FAR of 9.4 including several levels of parking is only slightly over the total FAR of 9 proposed here.

Total Bulk in the Downtown Area — A larger cordon located at the line of the proposed inner loop expressway has been studied and figures based thereon were given in the section on the Land Use Plan (page 26). It was pointed out there that the same 1970 street capacity could carry widely differing numbers of workers into the downtown area, depending on the proportion riding in transit vehicles. The question was left open as to what this propor-

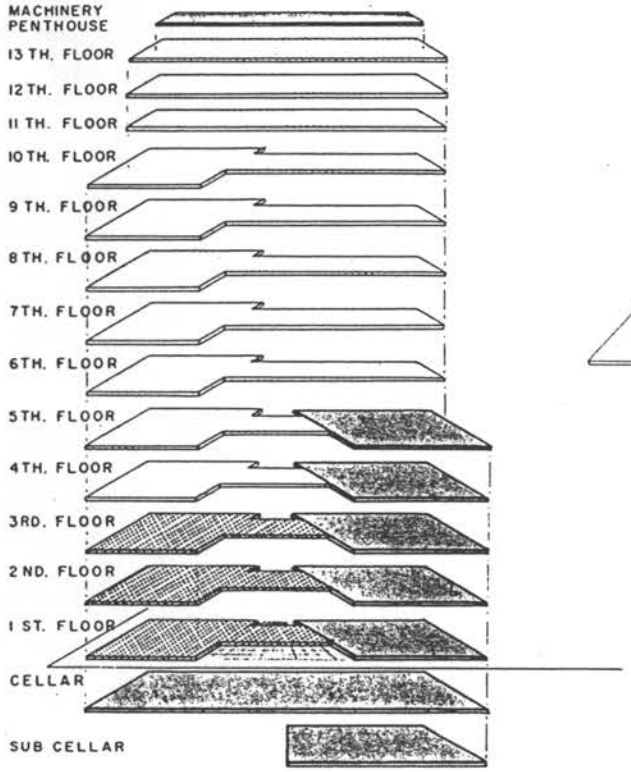
[14] The reader can verify and generalize this rule with a few diagrams. He will find that with a rectangular area in a gridiron street pattern the number of exit streets is given by the length plus the width (in blocks) plus 4; whereas the number of blocks contained is given by the length *times* the width.

tion would be. Hence, the total bulk to be allowed eventually in the downtown area cannot now be settled, but some of the things that should be considered can be discussed in a general way.

Total bulk allowed in the downtown area will be the product of two factors: the bulk permitted on an individual lot, and the extent of the area zoned for such bulk. The actual bulk eventually built is smaller for a number of reasons. A reasonable assumption about the relation between bulk permitted and built can be deduced from the material in statements above on bulk development. The four most densely developed squares listed in Table VIII showed the following:

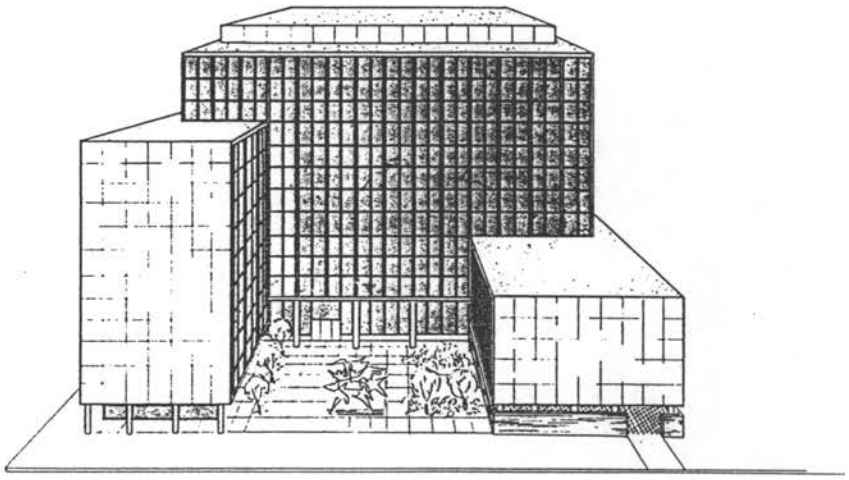
Square	*Developed FAR*	*Permitted FAR*
168	5.72	10.57
220	4.50	11.13
253	3.78	10.56
320	3.62	10.26

In only one case did the developed FAR exceed 50 per cent of the permitted FAR. For all of the blocks in the downtown area, the ratio was 27.6 per cent. If the per-

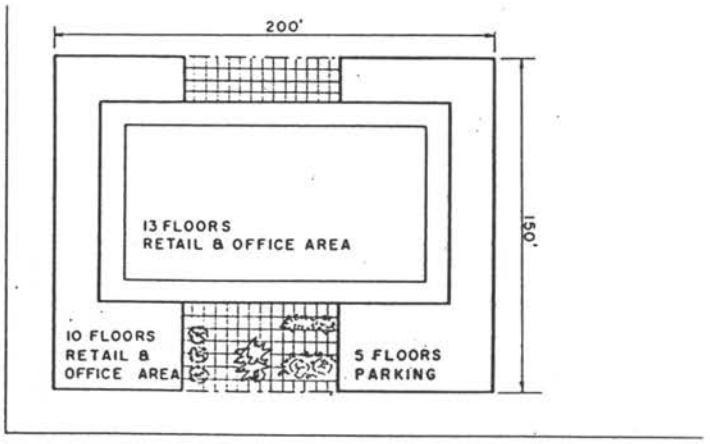


SCHEMATIC FLOOR AREA DIAGRAM

PARKING
RETAIL AREA
OFFICE AREA
MACHINERY PENTHOUSE



PERSPECTIVE



PLOT PLAN

LOT AREA		30,000 SQ.FT.
ALLOWABLE BUILDING AREA		
OFFICE & RETAIL	(F.A.R.-7)	210,000 SQ.FT.
PARKING	(F.A.R.-2)	60,000 SQ.FT.
TOTAL	(F.A.R.-9)	270,000 SQ.FT.

OFFICE AREA	164,100 SQ.FT. (274 CARS)
RETAIL AREA	44,700 SQ.FT. (76 CARS)
PARKING PROVIDED	
ABOVE GROUND	60,000 SQ.FT. (200 CARS)
BELOW GROUND	45,000 SQ.FT. (150 CARS)

FIGURE 21. Sketch of a Typical Office Building Possible Under Proposed Regulations for the Central Business District (C-4 District)

mitted bulk were lower, it is likely that the ratio would be somewhat higher than the latter, but 60 per cent seems to be a reasonable maximum. With a permitted FAR of 7, therefore, the expected development would be likely to have an average of about FAR 4.2. With this ratio, the high-density district as outlined on the proposed zoning district maps (152.5 acres of land) would provide 640 acres of work space for 102,400 workers.

The surrounding Special Purpose District shown in the proposed zoning map is very difficult to evaluate because there is no experience with such districts available. There are 169.3 acres indicated on the map. Actual commercial development will probably be quite low and it is estimated that the total number of workers would not exceed 20,300.

The other business districts within the inner loop contain a total of 267.7 acres. Developed FAR would vary considerably. An estimate of working population thus provided for gives another 70,500 workers, making a total of 193,200 for all the business areas. The government has stated its intention to maintain at least 140,000 workers in the inner loop area. Hence, the total working population comes to 333,200 under the proposed zoning. The present work force is about 321,400.

The proposed pattern of the commercial districts within the loop has been developed in relation to considerations of existing development, traffic patterns and other factors, not including the total working population likely to result. The result is lower than can be handled on the street system in 1970 with today's proportion of transit riding (40 per cent) but somewhat higher than the number (323,000) that could be accommodated if the proportion continues its present decline.

When the Zoning Commission feels that enough indication is at hand to project the future of the transit system, it can raise or lower the total work force allowed. It can adjust either the permitted bulk on an individual lot, or the boundaries of the zoning districts. The latter is to be preferred if an increase is contemplated, since bulk on the individual lot is also important to the density of traffic in the immediate area of the building.

Bulk Controls in Other Districts -- The primary concern in bulk control in the other commercial districts is similar to that on height control discussed above. Compatibility in this case means that the neighborhood, and other commercial districts in close proximity to residential areas, should not generate more parking demand than can be handled on the site or more street traffic than can be handled on the abutting streets. There are, of course, other nuisances that will be greater in relation to greater bulk. Differentiation among the several districts is required because parking and traffic and other characteristics will differ. The following densities are proposed as reasonable in relation to their effect on adjoining areas and to the height-density district at the center of the city:

(a) Major outlying centers adjacent to the Central Business District – FAR 4 plus FAR 1 for parking,

(b) Major outlying centers away from the Central Business District – FAR 3 plus FAR 1 for parking,

(c) Community business centers – FAR 2,

(d) Small neighborhood centers – FAR 0.5,

(e) Heavy commercial and light manufacturing areas – FAR 3,

(f) General industrial areas – FAR 4.

Reference back to the material given in the section on existing bulk development should convince the reader that these limits are reasonable in relation to what is being built at the present time in such areas.

V. OFF-STREET PARKING AND LOADING

This section deals with a subject of universal interest – parking of passenger cars and trucks. In approaching that subject, it is recognized that the solution of the problem involves much more than zoning but that zoning can make a substantial contribution toward a solution, especially where new buildings are concerned.

Streets are intended primarily for moving traffic and for access to abutting property. Unfortunately they are also being used, to a great extent, as garages for the storage of passenger cars. There is no longer any justification for this nor for their use for the frequent parking of heavy trucks while loading or unloading merchandise.. Space for each of these activities should be provided by the property owner off-street and, in general, on the lot where the building to be served is located. In some areas commercial parking facilities or new public parking facilities will eventually have to provide the major part of the solution, where there are now inadequate facilities to serve existing buildings.

The preceding section pointed out the relationship between traffic and the control of building bulk through zoning in the downtown area. The parking problem parallels the traffic problem. Other Federal and District agencies are working on the solution. While this section will touch on some of the general aspects, its main purpose is to determine the extent to which zoning may provide a solution of the parking problem.

Glare and Heat – Presently the District of Columbia regulations contain no provisions relative to glare or heat. While there are available adequate units for the measurement of heat (degrees of temperature, calories, B.T.U.) and glare (foot-candles), there is no over-riding reason to complicate zoning regulations with standards expressed in such units. A simple prohibition against glare or heat projection beyond the boundaries of the zoning district seems adequate.

Industrial Waste – An analysis of the several zoning ordinances which contain industrial waste standards would indicate that these standards are primarily directed at the prevention of stream pollution. It is common knowledge that stream pollution has been a major problem in the Washington area and zoning as well as any other regulations should be applied to prevent further pollution. The provision recommended is designed to accomplish this.

Vibration – "Excessive vibration" is almost universally prohibited in most zoning ordinances, with few containing numerical standards. In the absence of more objective numerical standards, the vibration provisions as recommended seem the fairest and the easiest to administer. A distinction should be drawn between intermittent vibration, as in passing trains, and sustained vibration, which can cause intolerable nuisance.

Fire and Safety – Standards to reduce fire and safety hazards are customarily related to building and fire safety codes. Since the District of Columbia has in effect, presently, detailed fire safety regulations, both in the Building Code and the Police Regulations, no attempt has been made to regulate this aspect of external effect of a use in the zoning regulations.

Electromagnetic Interference and Radioactive Emissions – These two effects have been given some consideration in a few zoning ordinances, but since there seems to be little if any problem in Washington as yet, it is not necessary for the present to establish such provisions.

Conclusions – Performance standards of sufficient definiteness have been recommended so that land use control in C-M and M Districts would be accomplished not on the basis of a permitted or prohibited use list, except for the small number of uses prohibited anywhere in the city, but regulated by determining the effect uses would have on surrounding or nearby areas. If a use can operate and at the same time comply with the standards of external effects as set forth in the respective districts, then it would be permitted regardless of the nature of the use. The performance standards would reach the hard core of the problem as to what is a nuisance, and a wide range of uses would be permitted, provided they could comply with the performance standards, and with height and bulk regulations.

Bulk of Buildings and Density of Population

The size of a building that can be erected on a specific lot in Washington has heretofore been controlled by a combination of height regulations and area regulations – the latter expressed in terms of yards, courts, setbacks, and percentage of lot occupancy. It is generally agreed that in many cases these area controls do not adequately accomplish their objectives. Putting them all in a "package" control over bulk or density itself, and relating this to new and important factors like traffic and utilities, removes the apparent arbitrariness of the older regulations and provides the enforcement system with a more meaningful index of control.

Wherever possible, the proposed regulations contain this "package" control. However, in the case of single-family dwellings and other low buildings, indirect control through requirements for yards, courts, and building setback is still utilized. As a general rule, as the use becomes more intense and the buildiugs larger, the indirect controls are abandoned in favor of the direct or "package" requirement. In Washington, however, there are special reasons why height as well as density must be regulated separately, as noted in Part 2 of this report.

Floor Area Ratio – The most promising of the direct bulk controls, and the one recommended here is the floor area ratio (FAR). This has already been described in preceding sections of this report (see page 28 and Figure 11). The FAR is the ratio between the aggregate of all floor areas of a building (based on exterior dimensions) to the area of the lot. It gives a multiple by which the permissible building floor area may be calculated from the lot area. This type of control was incorporated into the New York City Zoning Resolution in 1940, and is found in many zoning ordinances adopted within the last ten or fifteen years.

A statement of FAR gives an accurate index of population density as well as a direct control over the density of workspace within a given area (provided the index of floor area per person or floor area per dwelling unit has been established). Since the FAR can be applied to all enclosed areas, such as carports, basements, porches, and tool sheds without special additional provisions, it requires the fewest number of additional regulations. Another advantage is the fact that crowding of the lot, neighborhood, or business district can be prevented, while leaving reasonable latitude to the developer in designing his structure. Its simplicity and clarity in application to parcels of land of different size is also desirable.

In one-family developments population density can best be controlled by specifying minimum lot areas. This was first introduced in the District of Columbia by the amendments to the regulations (referred to as an "interim regulation"), adopted in December, 1955.

Height of Buildings

As noted above, the height of buildings and other structures in Washington should be regulated as a separate characteristic, rather than included in a common control of bulk

or density. Height is a factor in compatibility; not the key to compatibility, but one factor. All authorities accept the principle that the height of a structure is a proper subject of public interest and control. The question is how best to establish and administer the control of height of buildings and structures. Here, there is need for the application of discretion, because there are "good" high buildings, as well as "bad" high buildings. For example, few people object to the United Nations Building in New York at its present height and yet nearly everyone objects to the power station stacks near it at the same height. But height and use taken together begin to establish the "character" of a development which is the real, although seldom named, subject of zoning control.

The proposed regulations limit the height of buildings and other structures in terms of feet and, in some cases, also in number of stories. The Federal Act of 1910 adds additional controls in relation to street width. The angle of light obstruction is a new control that requires some additional discussion.

Angle of Light Obstruction — The angle of light obstruction (sometimes called "the light angle") is one of the newest approaches to the control of height of buildings and other structures. Actually, as will be noted below, it is an old technique dressed in a new name. The angle of light places limitations on the vertical angle within which buildings may obstruct light, thereby controlling the amount of sunlight and daylight at ground levels, assuring better air circulation, and improving light on the exterior of buildings. This angle of light may be measured from several points, the most common being from the center of the street or alley or from the lot line. The angle is drawn from the given point toward the highest point of the subject structure. How it will operate, in combination with other controls, is shown in one of the graphic diagrams appended to the text of the proposed zoning regulations.

Most architects are enthusiastic about the angle of light obstruction because it maintains light control while it permits flexibility in design of buildings and other structures. It is a direct method of accomplishing the same result as the setback technique which has been used in Washington. The system of light angle control has in some localities been refined through the principle of "averaging" the angle of light. Under this system, the angle of light may be averaged over the front of the building, thereby permitting a portion of the building to extend above the angle line, while a similar portion must be reduced by the amount the former portion exceeds the angle line. But in a city where skyscrapers are prohibited anyway, this is an unnecessary refinement.

The 1910 Act limited building heights in terms of street widths. Since for any given street and width and permitted height based thereon an angle of light can be calculated, it can be said that the 1910 Act contained an angle of light requirement, although not referred to by that name. Regulating height by the use of angle of light rather than by street width has the advantage of achieving a uniform regulation for each zoning district, thus avoiding some confusion while assuring adequate light. The angle of light system is more nearly related to light and air in the streets than the common practice of establishing a common height limitation over the whole district, since the latter does not make allowance for variations in street width. Through the use of the angle of light, a building or other structure located on any street in a district may be constructed to the maximum height permitted in the district, provided the building or other structure does not project beyond the angle of light line established for that district.

The required angle of light obstruction specified in the proposed regulations would establish a height at the street line and setback control almost identical with the height and setback regulations based on street width in the Federal Act of 1910, which would still be in effect. Figure 16 (page 42) shows, for different street widths, the height that would be permitted at the street line for the angle of light obstruction specified for the C-4 District in the proposed regulations and the manner in which the upper part of a building would have to set back where a greater overall height is permitted.

Open Spaces Around and Between Buildings

Another group of controls so closely related to the bulk of a building that they are usually included among the bulk regulations, are those which are designed to ensure adequate space around and between buildings. The proposed regulations introduce two controls which regulate the open space around and between buildings: area of light access and usable open space.

Area of Light Access — The present regulations for controlling area around buildings have gotten very complex as a result of amendments and in some respects fail to achieve their objective. It is possible, for example, to build houses with windows facing each other only ten feet apart. It is possible to build a five-story apartment with windows facing each other across a court only 8 feet 4 inches wide. Such a court could be 50 feet long from its "closed" end to its "open" end, and there could be another building only 12 feet from the "open" end. The vertical angle from the bottom floor window to the sky would be 80 degrees, in such event. The worst sort of living conditions are likely to result in such a building.

The area of light access system varies from a very complicated daylight measuring device applied to interior spaces in England to a simple sector of unobstructed space required in Denver. In the proposed New York City Zoning Resolution, a system of unobstructed sectors in three dimensions (combining the vertical angle from the window ledge to the top of the obstruction) was recommended, but in a city where unusually tall buildings are not permitted anyhow, it is possible to simplify this to a two-dimensional