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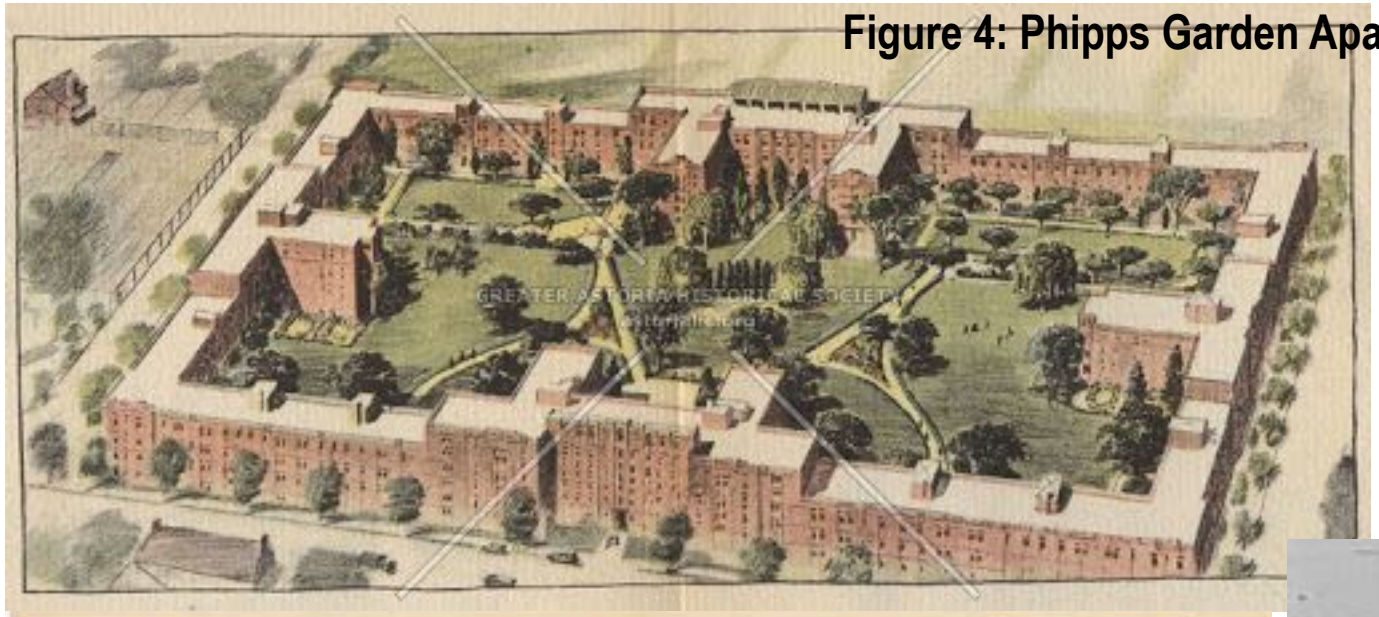
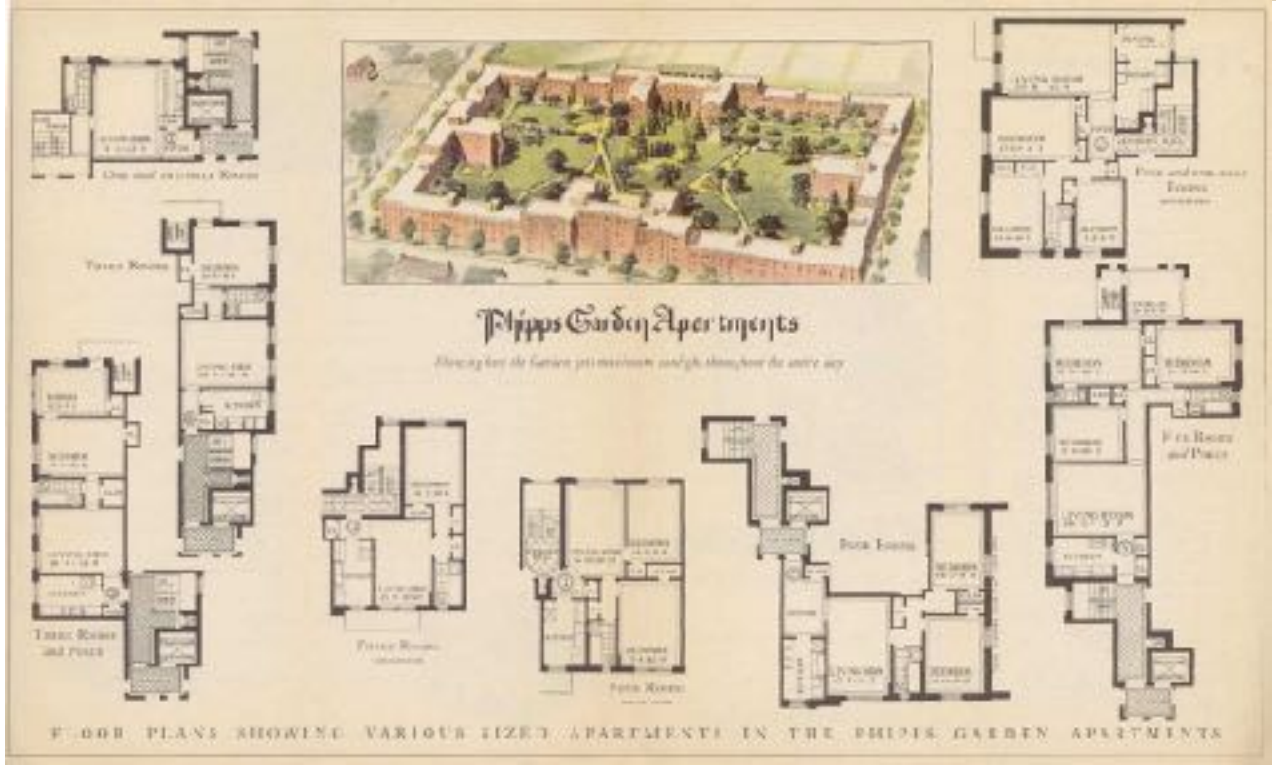
Preserving Sunlight and Daylight in New York City's Parks, Playgrounds, Public and Private Spaces: *Existing and Proposed Zoning*

Figure 4: Phipps Garden Apartments (Sunnyside, 1929)





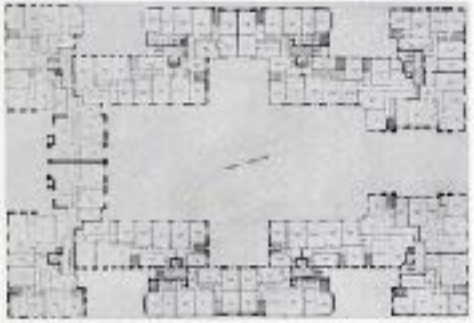


Figure 5: Grand Street Apartments (Bedford-Stuyvesant, 1929)

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- Courts
- Building Spacing

Harlem River Houses
Harlem, 1937

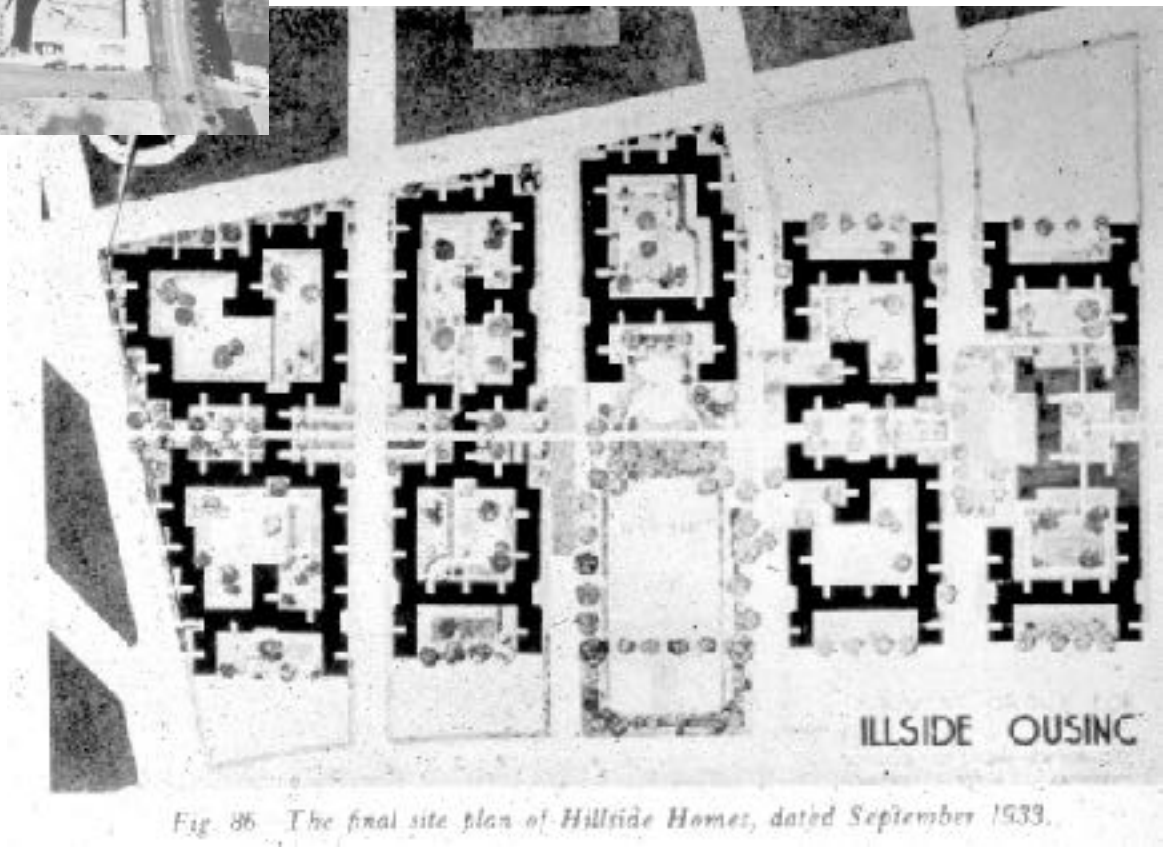

Fig. 86. The final site plan of Hillside Homes, dated September 1933.

Figure 7: Hillside Homes (Bronx, 1933)

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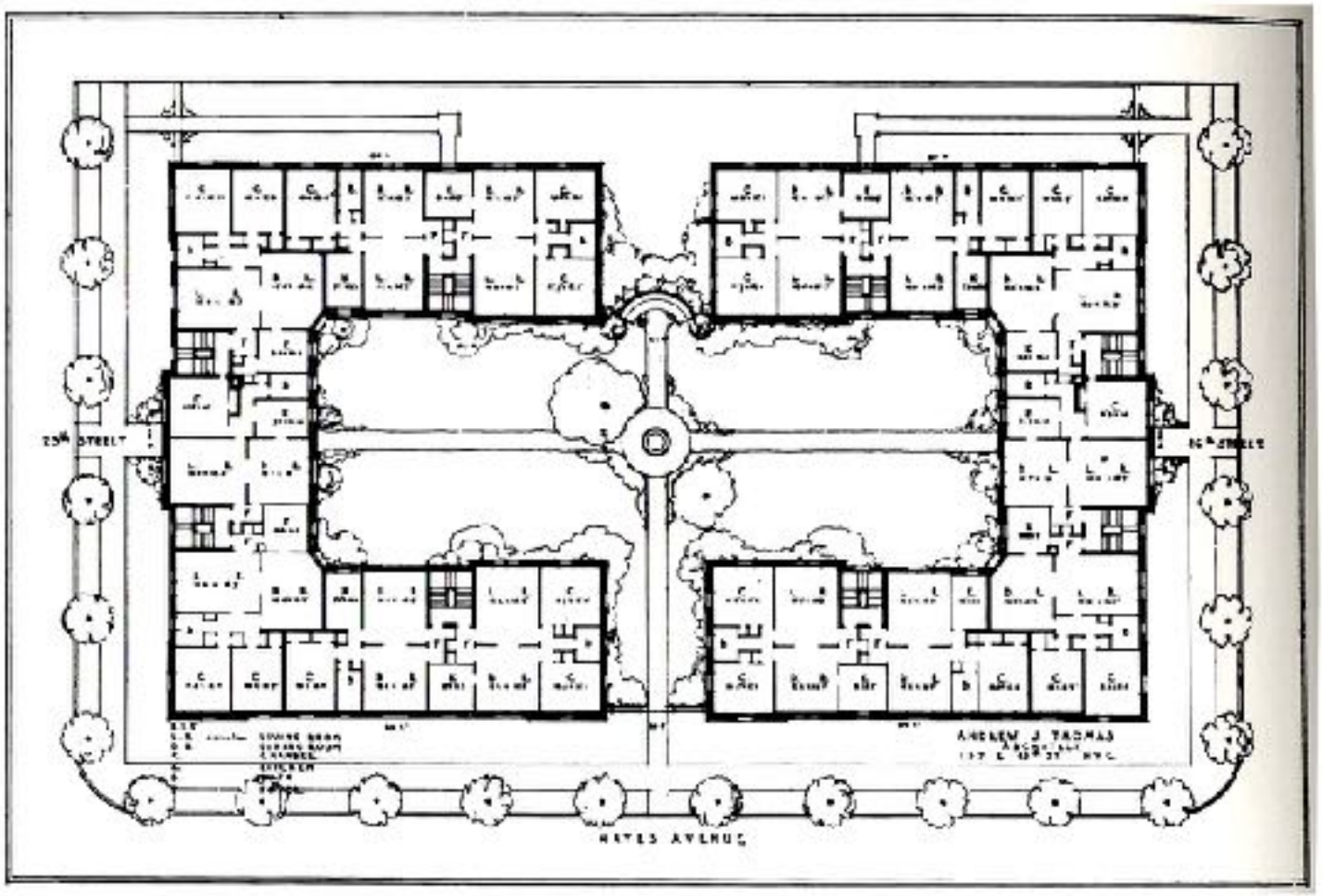

Hayes Avenue Apartments

Jackson Heights, 1922

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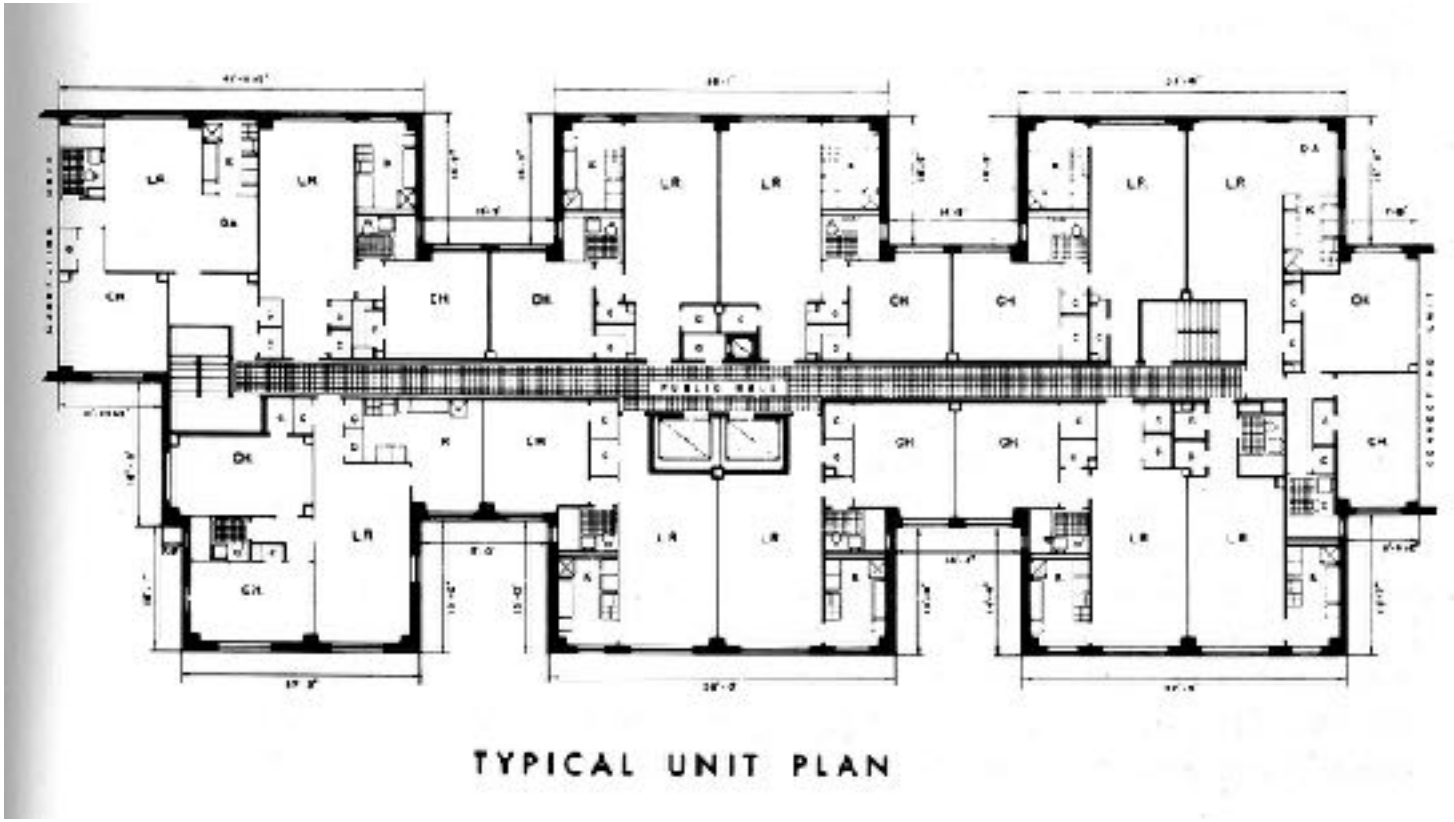

Knickerbocker Village

Lower East Side, 1936

Technical planning and environmental decisions are not only value-based…but identity based. Physical planning decisions can, and frequently do, threaten the identity and status of certain groups while enlarging the powers of others.

- *Donald Appelyard*

Form and density

Coop City, R6

Bronx, New York

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Greenwich Village, R6

Manhattan, New York

Form and density

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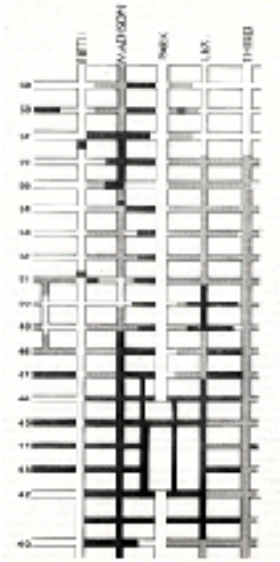
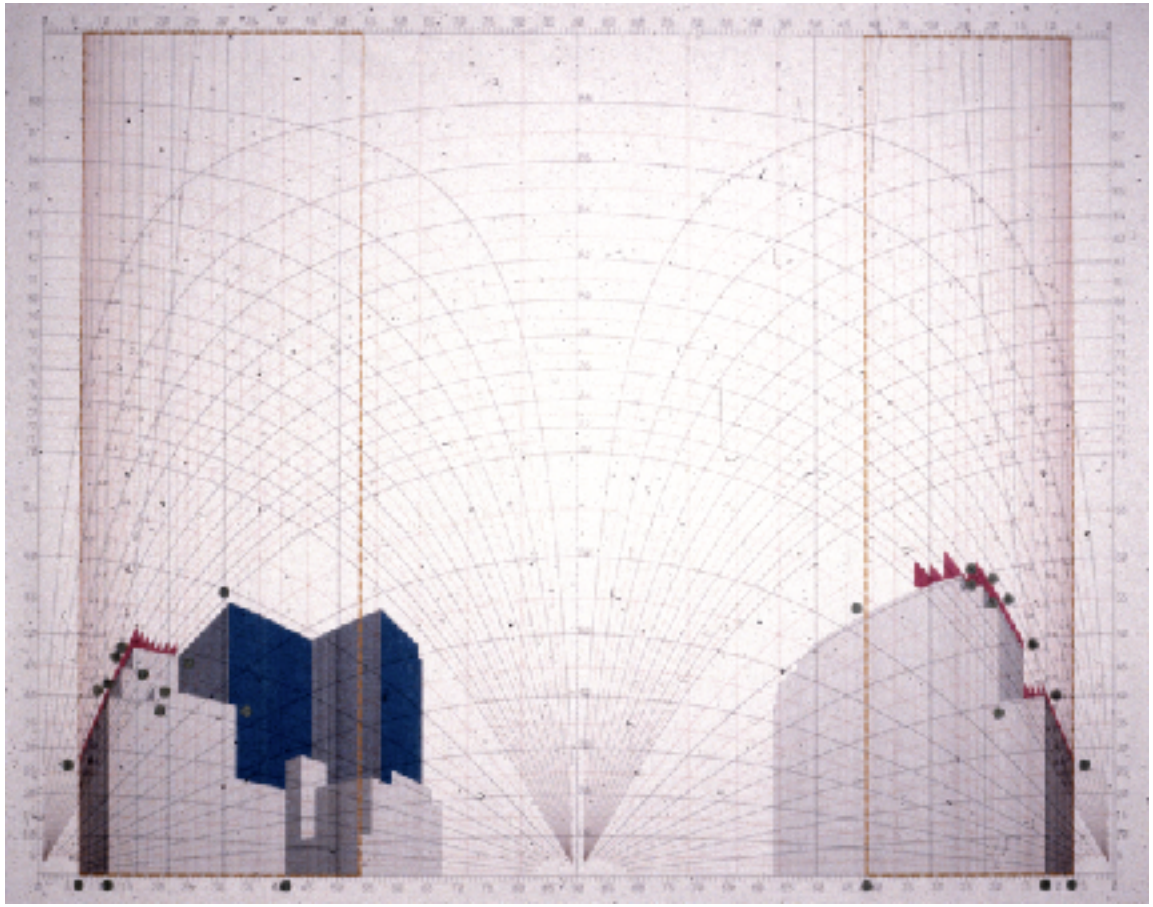


Performance-based Zoning: Daylight



Midtown Zoning
New York, New York

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lidelines for applications

ch *residential development* shall be evaluated under the scoring system set th in the guidelines of this section. *This section is comprised of four* ograms. A program consists of program elements. The programs, their spective program elements and their maximum allowable housing quality ints are set forth below.

A. Neighborhood Impact

	Maximum Allowable Housing Quality Points	
	Built-up Street District	*Non Built-up Street District*
1. Offsite Sunlight	8.0	10.0
2. Ground Floor Activity	4.9	6.0
3. Street Wall Length	3.1	5.0
4. Street Wall Height	3.1	N.A.
5. Building Height	3.1	N.A.
6. Street Trees	2.8	4.0
Total	25.0	25.0

B. Recreation Space

1. Type and Size	9.4
2. Sunlight Onsite	5.1
3. Parking	4.1
4. Planting	3.1
5. Trees	2.6
Total	25.0

C. Security and Safety

1. Density of Corridor	5.0
2. Visibility from Public Space to Elevator Doors	5.0
3. Visibility of Private Outdoor Space from the Lobby	5.0
4. Surveillance from Dwelling Units	4.4
5. Entry of Building from Parking Garage or Lot	3.1
5. Visibility of Elevator Door to Dwelling Unit Door	2.5
Total	25.0

D. Building Interior

1. Size of Dwelling Unit	4.5
2. Sunlight in Dwelling Unit	3.9
3. Window Size	3.8
4. Visual Privacy—Onsite	2.7
5. Visual Privacy—Offsite	2.7
6. Through Ventilation	2.6
7. Daylight in Public Corridors	1.8
8. Pram, Bicycle and Bulk Storage	1.6
9. Waste Storage	1.4
Total	25.0

When a *development* is located in more than one *street district*, the special regulations in Section 74-935 (Special regulations for developments in more than one street district) shall apply.

Housing Quality Program Elements

A. NEIGHBORHOOD IMPACT

1. Offsite Sunlight. To maximize sunlight on nearby *residential* and *commercial buildings* and open space as well as *public parks*, public sidewalks and public pedestrian malls.

Maximum Housing Quality Points. 8.0 *Built-up Street District*
10.0 *Non Built-up Street District*

Requirements for Full Compliance. The *proposed shadow area* shall be as small a percentage of the *maximum shadow area* as possible.

Housing Quality Point Computation.

Built-up Street District
(8.0) — (8.0) X (a/A)

Non Built-up Street District
(10.0) — (10.0) X (a/A)

where:
A = *Maximum shadow area*
a = *Proposed shadow area*

2. Ground Floor Activity. To encourage visible activity and/or public uses fronting on sidewalks or public pedestrian *streets* or easements adjacent to the site.

Maximum Housing Quality Points. 4.9 *Built-up Street District*
6.0 *Non Built-up Street District*

Requirements for Full Compliance. The total *activity surface* of the *street wall* shall be 75% of the area of the first 15'-0" height of *street wall*.

Housing Quality Point Computation.

Built-up Street District
(4.9) (b/B)

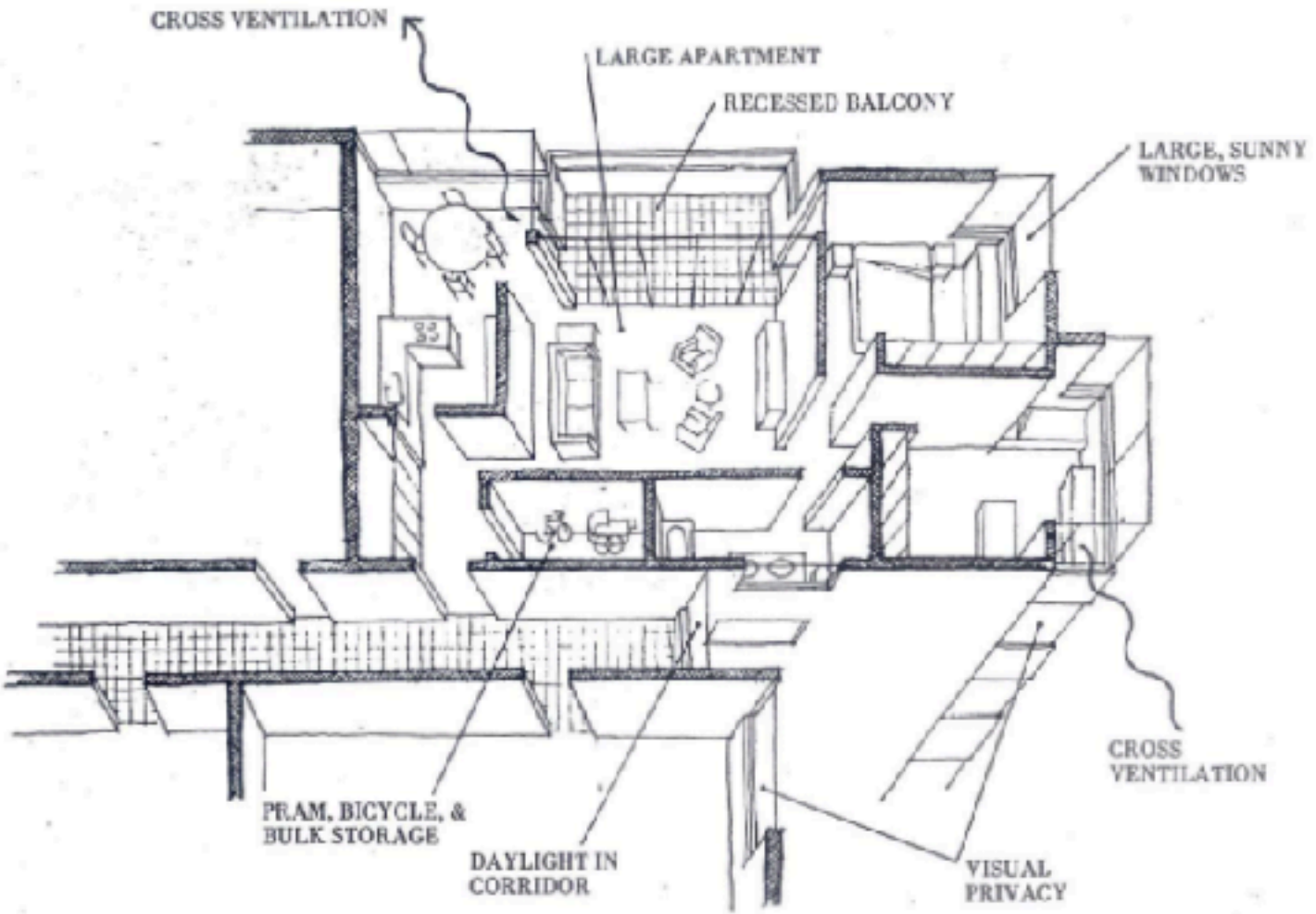
Non Built-up Street District
(6.0) (b/B)

where:
B = C (Length of *street line*, see program element #3) X 15'-0" X .7
b = Total square feet of *activity surface*

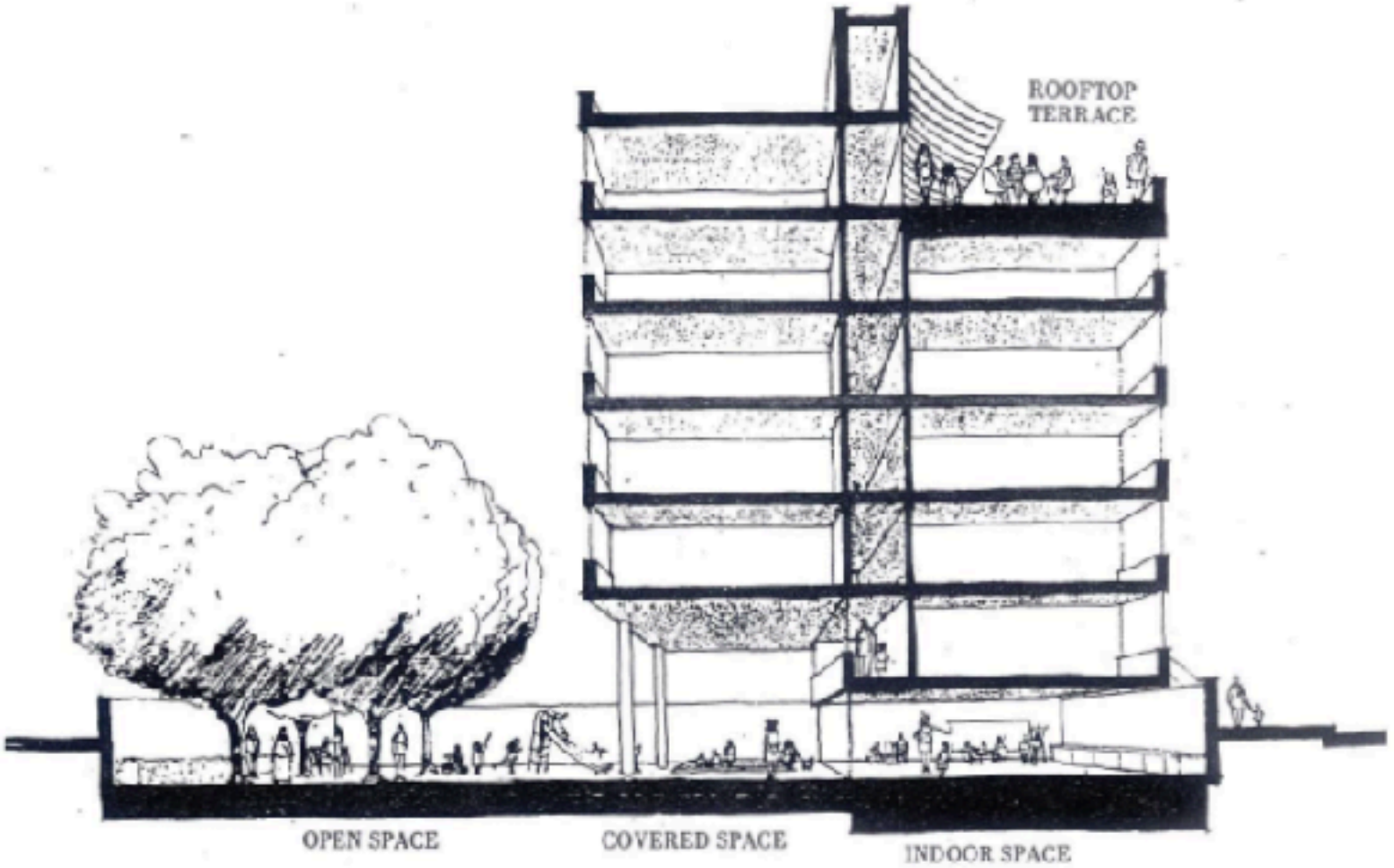
Special Conditions.

i. In *Commercial Districts* which have an R10 equivalent or C1 or C2 Districts governed by R10 district regulations for any *zoning lots* which have *wide street* frontage in excess of 50 feet, at least 50% of such *wide street* frontage shall be occupied by *commercial uses* allowed by the District Regulations. Walls which are not transparent shall be decoratively treated. The height of signage shall reflect the prevailing height of signage on adjoining and adjacent *zoning lots*.

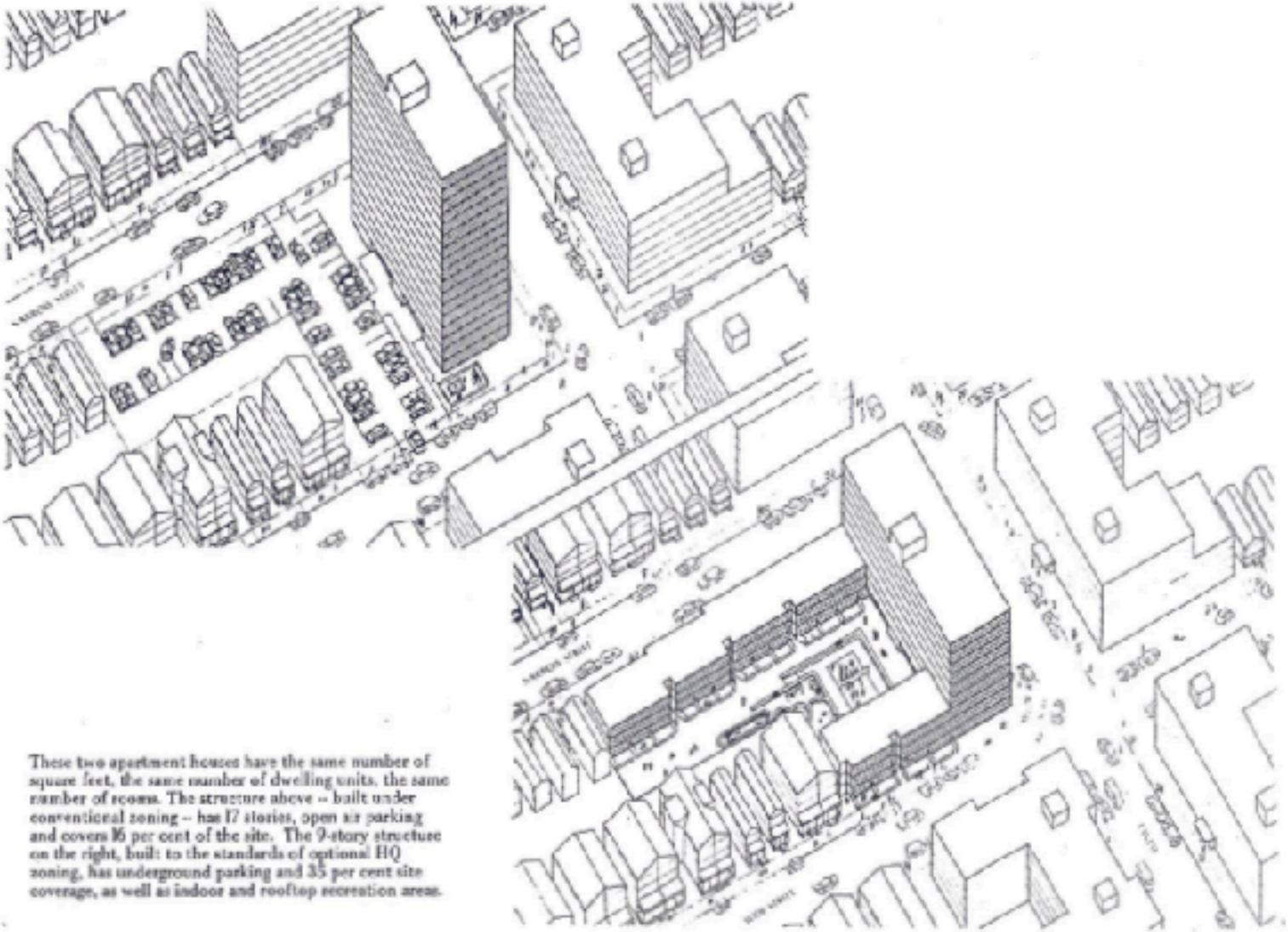
ii. For *zoning lots* or portions of *zoning lots* directly opposite highways, highway access ramps or sites zoned for manufacturing or auto related uses; 'b' equals 'B'.



Housing Quality codifies many generally accepted characteristics of desirable apartments. Some of the elements that would be encouraged are illustrated above.



The open space requirement of existing zoning allows half of the "open space" to be devoted to parking. In the remaining area, not even the seating shown in the drawing on the opposite page is necessary. Under HQ, open space gives way to recreation space, which may be indoors and on rooftops as well as outdoors. All recreation areas would have to be appropriatedly furnished with seats, trees or equipment (above).



These two apartment houses have the same number of square feet, the same number of dwelling units, the same number of rooms. The structure above -- built under conventional zoning -- has 17 stories, open air parking and covers 16 per cent of the site. The 9-story structure on the right, built to the standards of optional HQ zoning, has underground parking and 35 per cent site coverage, as well as indoor and rooftop recreation areas.

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Draft Generic Environmental Impact Statement

Views of Alternative Conceptual Plans at the same density

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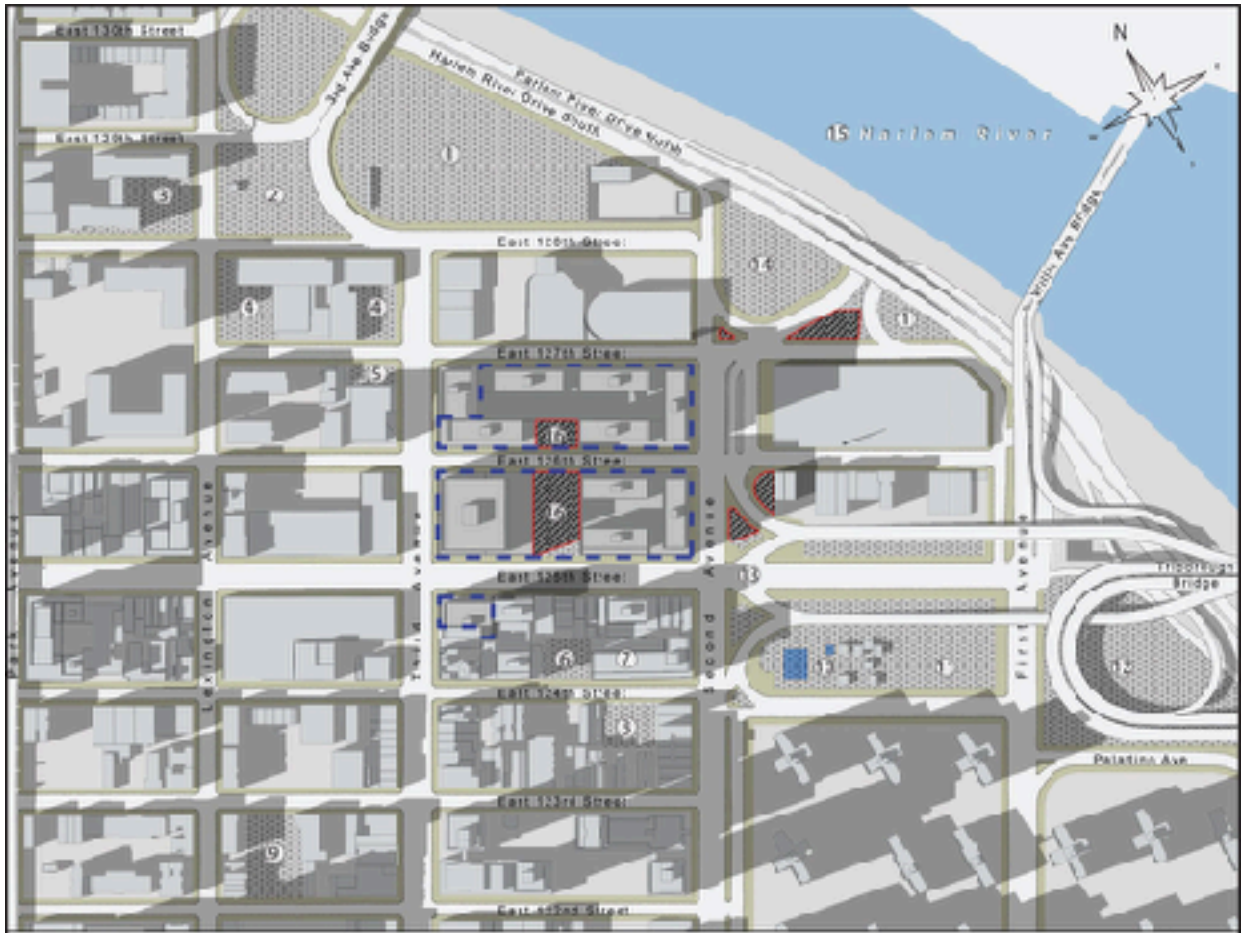

Shadow Analysis of the Proposed Conceptual Plan

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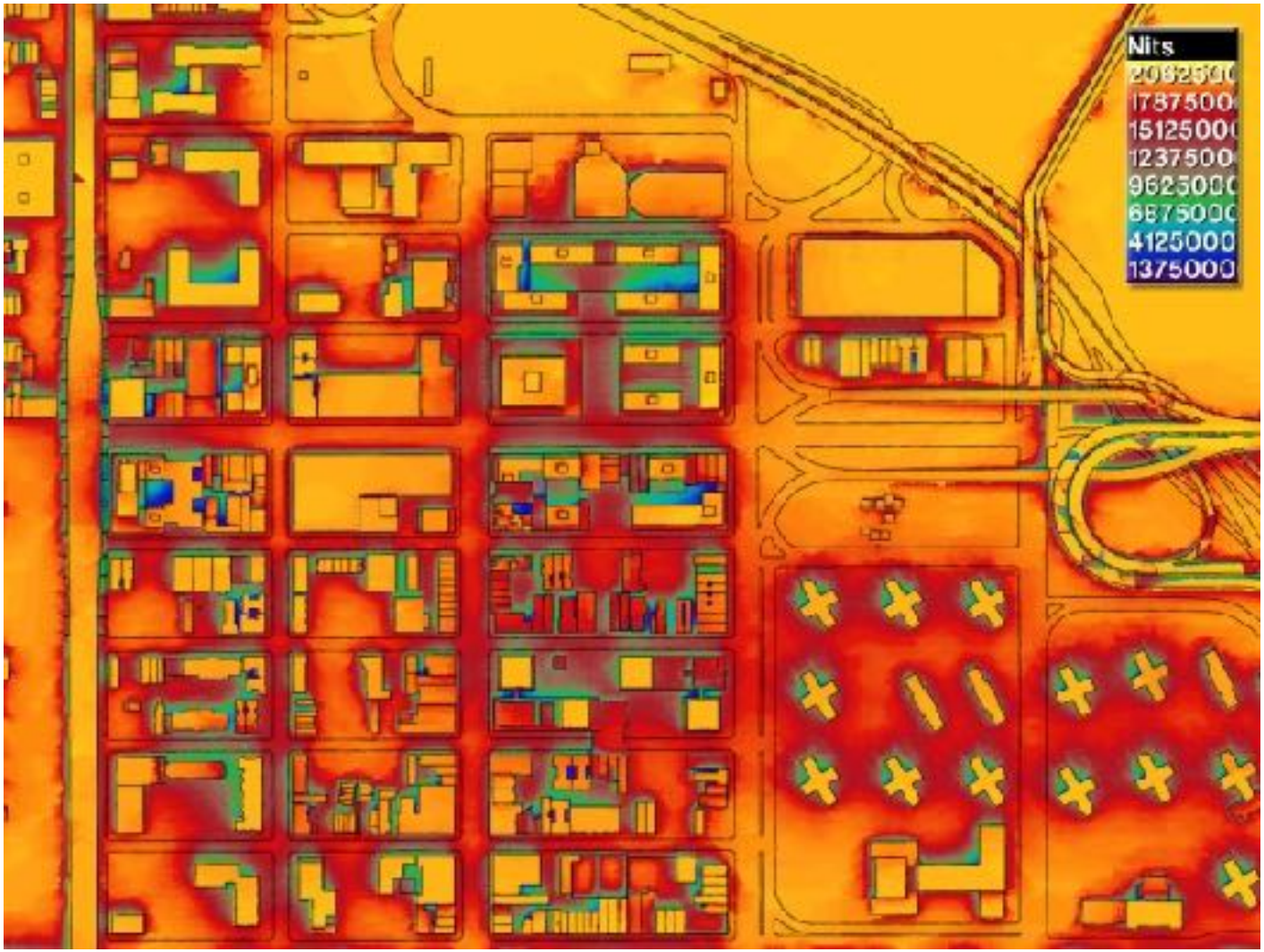

125th Street Generic EIS: Radiance (Daylight + Sunlight)

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Preserving Sunlight in New York City's Parks: A Zoning Proposal

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TABLE 1. Refined Study Inventory*
New York City Parks Distributed by Zoning Districts and Park Types[b]

Borough	No. of Parks by Residential Zoning Districts (or commercial equivalent) R1-R5	R6-R10	Total
Bronx	65	168	233
Brooklyn	196	258	374
Manhattan	0	233	233
Queens	324	68	392
Staten Island	100	0	100
New York City	625	707	1,332

Park Type[b]	No. of Parks in or Adjacent to R6 to R10 Zoning Districts (or commercial equivalent) R6-R7	R8-R9	R10 & Higher	Total[c]
A. Small Parks				
Triangles	117	15	13	[145]
Sitting Areas	99	4	3	[96]
Community Parks	68	10	13	[81]
Civic Plazas	5	5	3	[11]
Miscellaneous	16	2	0	[18]
Subtotal	225	31	32	[251]
B. Playgrounds & Recreation Areas	281	30	5	[316]
C. Neighborhood Parks	60	14	9	[83]
D. Major Parks	23	6	2	[51]
E. Regional Parks	4	1	1	[6]
Total	593	85	49	[+727]

*Derived from the "Park Property and Facility List" (8 December 1978), prepared by the New York City Department of Parks and Recreation (DPR). Of the 1,948 properties under the jurisdiction of the DPR, 1,732 are public parks and open spaces. The other 216 properties, excluded from this refined study inventory, are listed and noted in the DPR inventory as green strips/center plots/malls, parking fields, indoor facilities (pools, recreation centers, museums, theaters), and parkways/drives without recreation designation.

[a] Parks are categorized by zoning districts as identified in the New York City Zoning Resolution (1990). Parks in or adjacent to each residential zoning district category (or their commercial equivalents) of R1-R5 and R6-R10 are counted in the R6-R10 category.

[b] Park types are described in the text and are modified from categories used by the DPR.

[c] Several parks are in or adjacent to one or more zoning districts and have been counted in each; totals are, therefore, shown in brackets to emphasize that these figures are illustrative rather than precise counts.

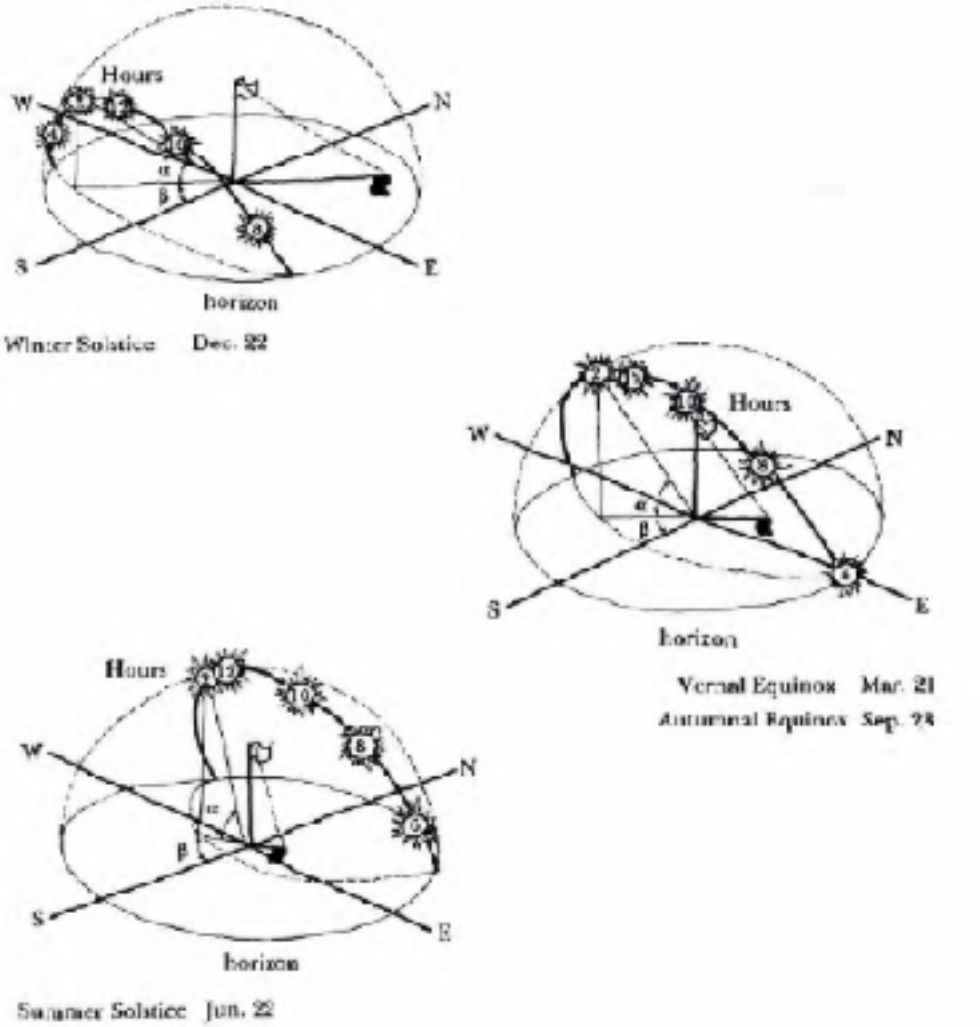

FIGURE 4. Sun Paths for Winter Solstice, Equinox, and Summer Solstice

The sun's position relative to a specific geographic location changes over the course of the day and year. These changes in the sun's path may be described in terms of altitude (α) and bearing (β) angles for any date and hour. In the diagrams shown here, shadows cast by the pennant at 2:00 PM illustrate the effect of seasonal changes. Modified from *Architectural Graphic Standards*, John Wiley & Sons, Inc.

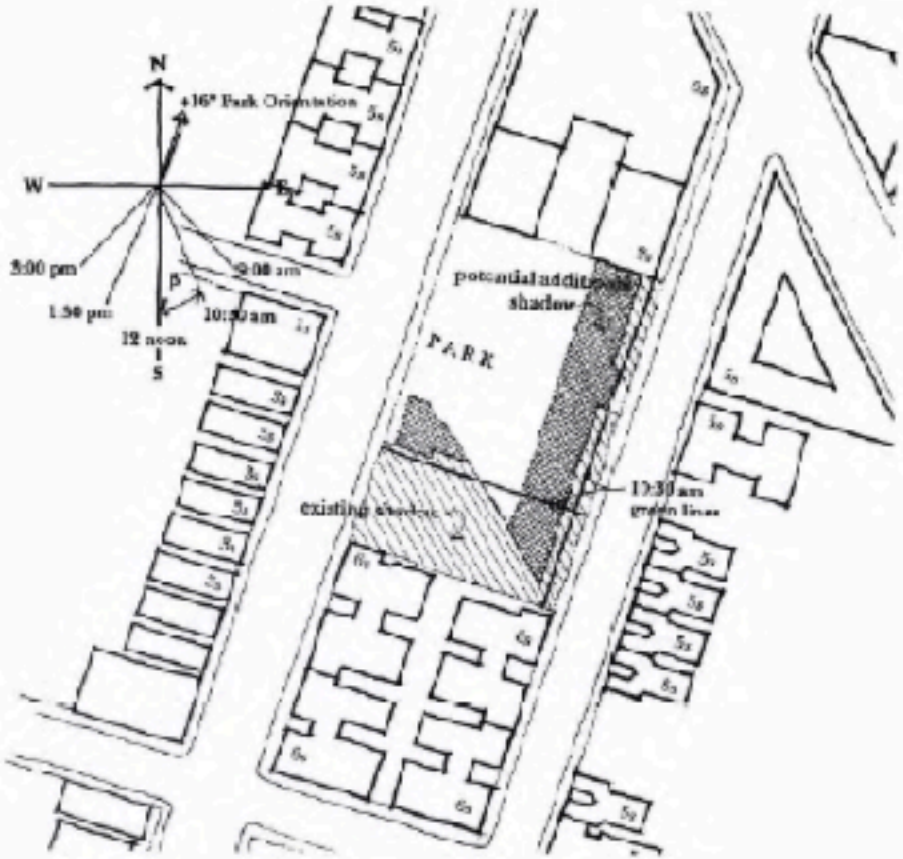

FIGURE 1. Existing Shadow on a Park Compared with Additional Shadow Possible in Absence of Solar Access Regulations

Diagram contrasts existing shadow (hatching) on a park with potential additional shadow from future development (cross-hatching) under present zoning regulations. The proposed solar access regulations would establish a minimum sunlight standard limiting the amount of new shadow that can be added to a park to an *average of the existing shadow* (termed a 'green line'), thereby protecting current sunlight conditions. In this and other illustrations, the compass shows the park's orientation and the sun angles (p) used in the study; and 5s, 5s 6s, etc., indicates the number of stories of the depicted buildings.

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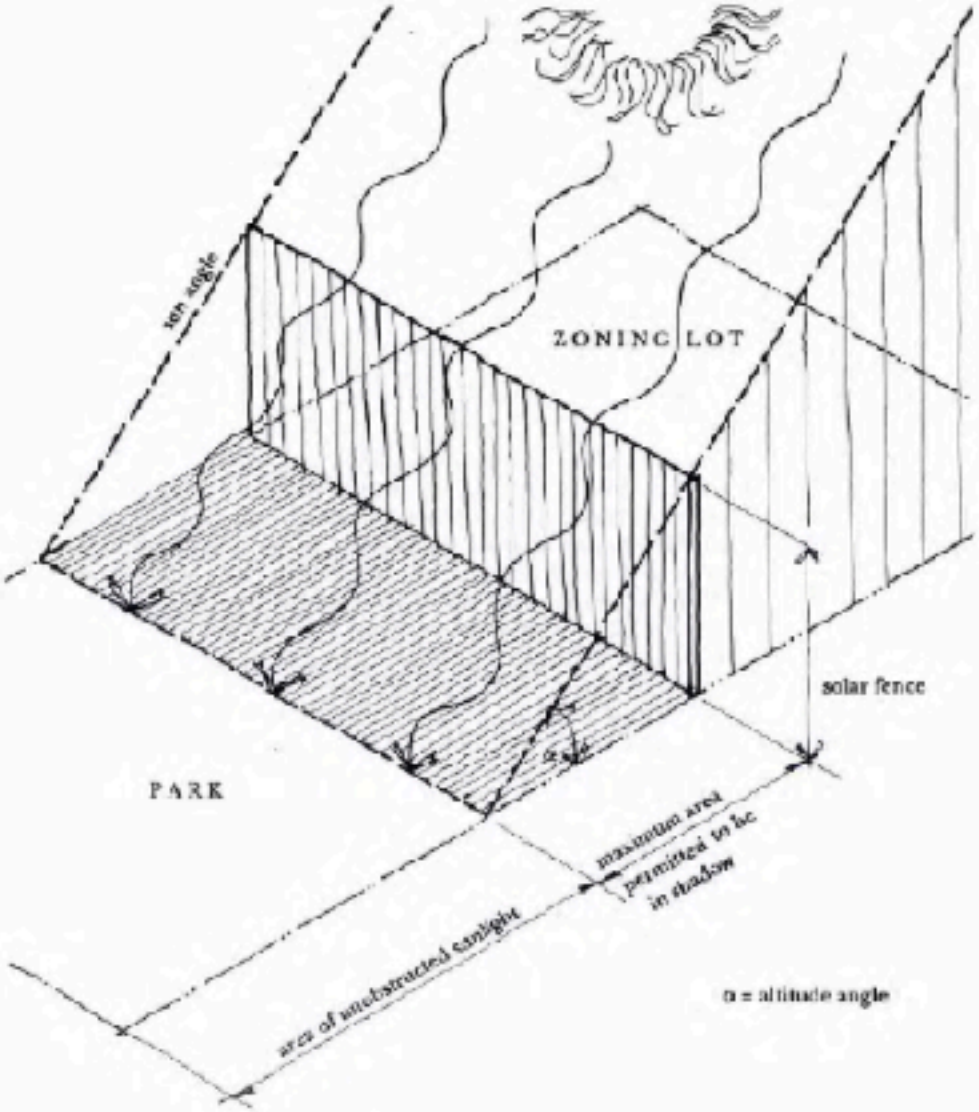

FIGURE 3. "Solar Fence" as a Regulatory Approach to Solar Access

Diagram illustrates concept of an imaginary boundary fence (the "solar fence") that defines extent to which new development may cast shadows on a park. For a given time of day and year, the solar fence determines the extent of unobstructed sunlight that falls on the park. From this one can develop an imaginary plane that the building may not penetrate if it is to avoid casting a shadow on the park beyond that permitted.

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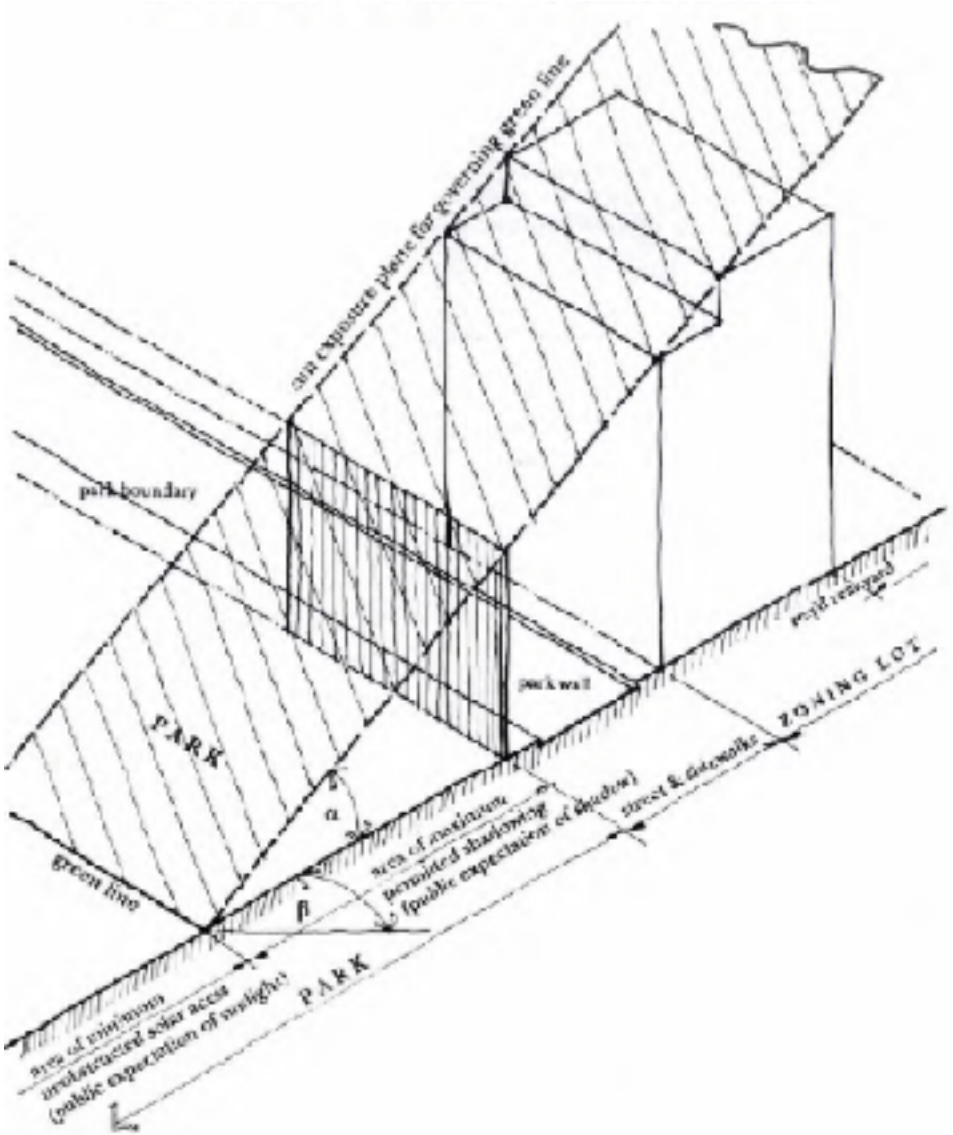

FIGURE 16. Bulk Envelope Generated by Green Lines

A bulk envelope may be developed from a sun exposure plane derived from the governing green line and its associated altitude (α) and bearing (β) angles

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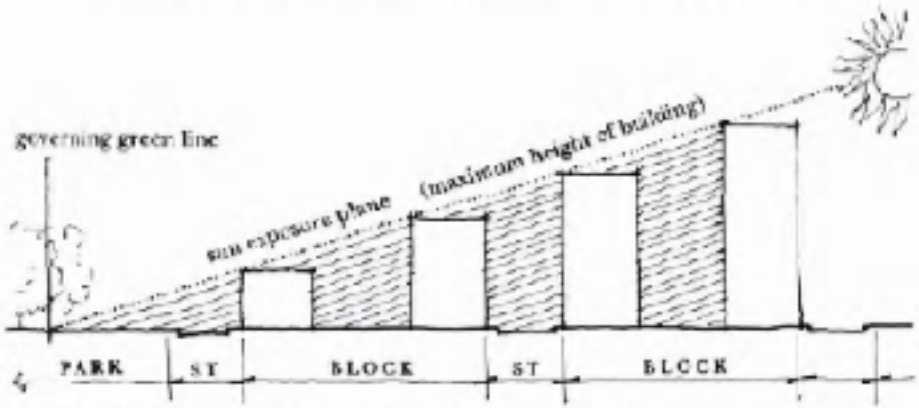

FIGURE 17. Effect of Sun Exposure Planes on Surrounding Park Context

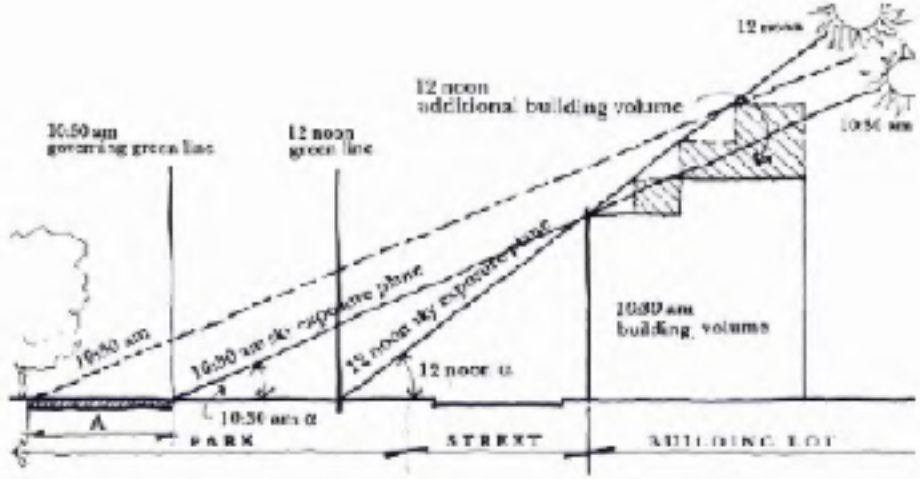

FIGURE 18. Why Longest Shadow Always Governs in Prescriptive Method

In Figure 17, the sun exposure plane progressively restricts the height of new development (and, consequently, potential shadow impacts) around the park. In Figure 18, the governing green line (a function of the lowest sun angle (α), and therefore the deepest potential shadow penetration of the park permitted by new development) yields the most restrictive building envelope of all the green lines affecting an individual parcel and the maximum bulk envelope that will comply with the minimum sunlight expectation for the park. While the building shown casts shadows on the park at both 10:30 am and 12 noon, the additional portion of the building that might be accommodated under the 12 noon envelope (hatched area) would cast a shadow that exceeds (by the distance 'A') the maximum shadow impact allowed at 10:30 am.

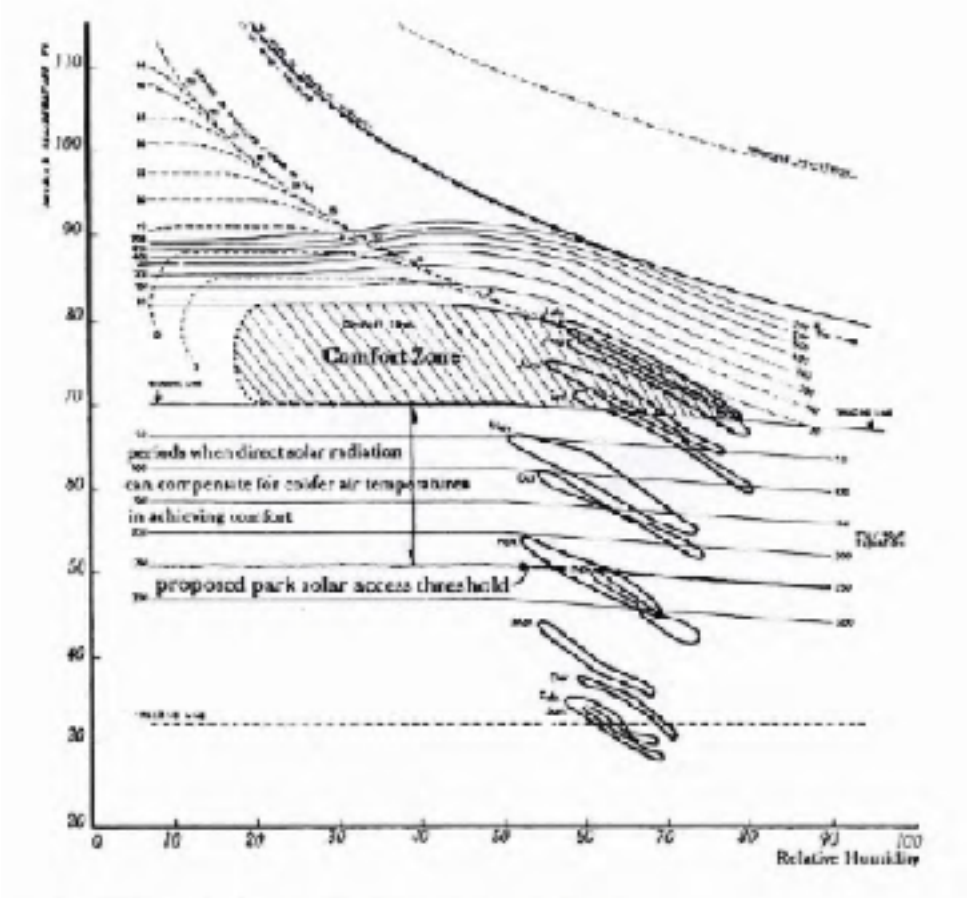

FIGURE 5. Typical Bioclimatic Patterns for New York City

A bioclimatic chart relates climatic elements like temperature, humidity, and wind to the degree of comfort or discomfort an individual experiences in a given environment. The shaded area in the center of the chart depicts the idealized "comfort zone" for the human body—the combination of climatic elements we normally consider comfortable and desirable outdoors. When conditions fall outside the comfort zone, compensatory climatic elements are required in order to feel comfortable, such as a light breeze or shade on a hot summer day. The closed curves indicate the typical monthly climatic conditions for the New York City area. As the chart illustrates, direct solar radiation counteracts cool temperatures in achieving outdoor comfort in the early spring and late fall. Modified from: *Design with Climate*, Victor Olgyay, Princeton University Press, 1963.

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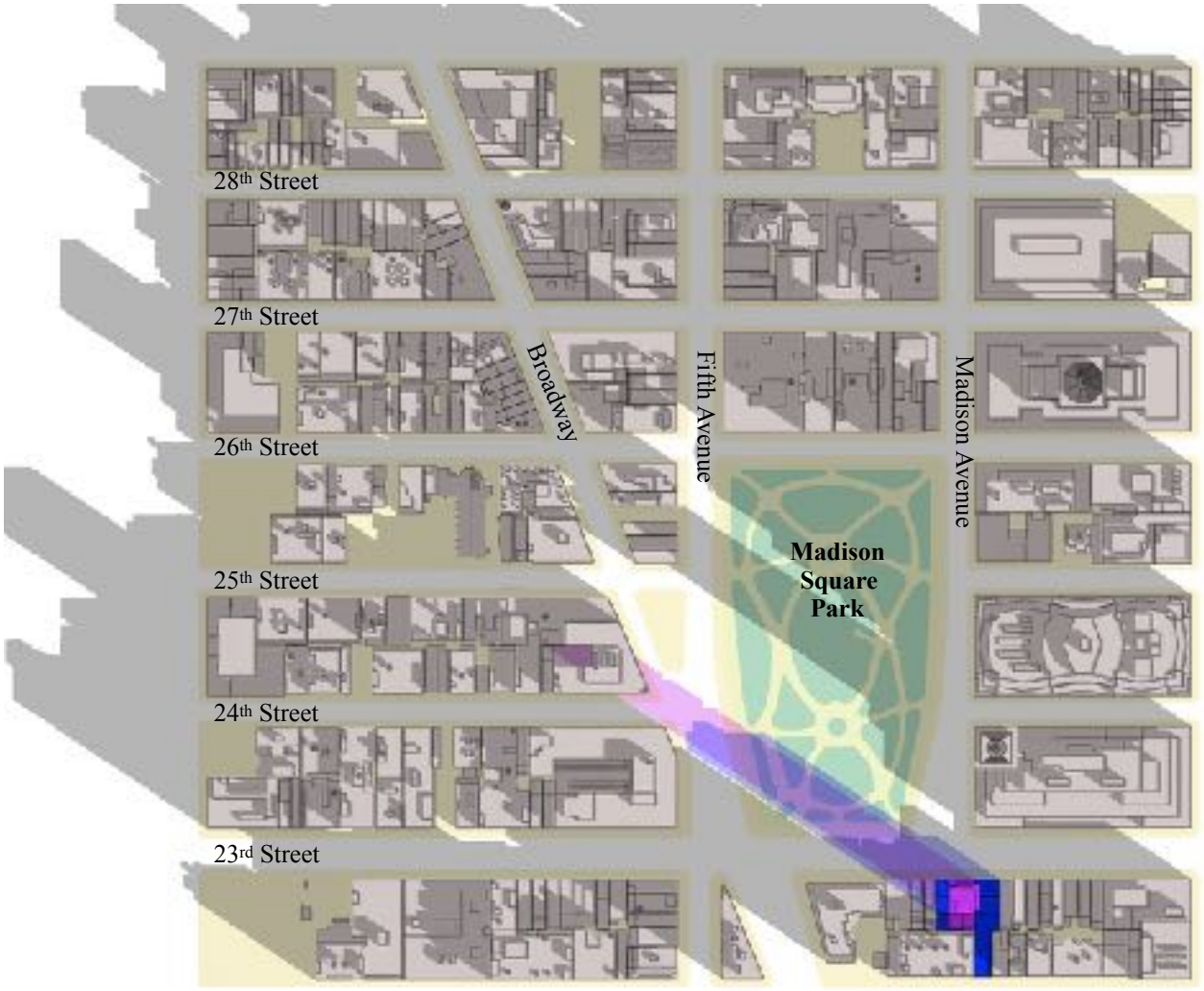
Shadow Comparison

10:00 am



New Shadows

Proposed Building
Proposed and Alternative
Alternative Building

Existing Shadows

Shadows Within Existing Shadows

Proposed Building
Proposed and Alternative
Alternative Building

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Shadow Comparison

11:00 am

New Shadows

Proposed Building
Proposed and Alternative
Alternative Building

Existing Shadows

Shadows Within Existing Shadows

Proposed Building
Proposed and Alternative
Alternative Building

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Shadow Comparison

12:00 pm

New Shadows

Proposed Building
Proposed and Alternative
Alternative Building

Existing Shadows

Shadows Within Existing Shadows

Proposed Building
Proposed and Alternative
Alternative Building

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Shadow Comparison

1:00 pm

New Shadows

Proposed Building
Proposed and Alternative
Alternative Building

Existing Shadows

Shadows Within Existing Shadows

Proposed Building
Proposed and Alternative
Alternative Building

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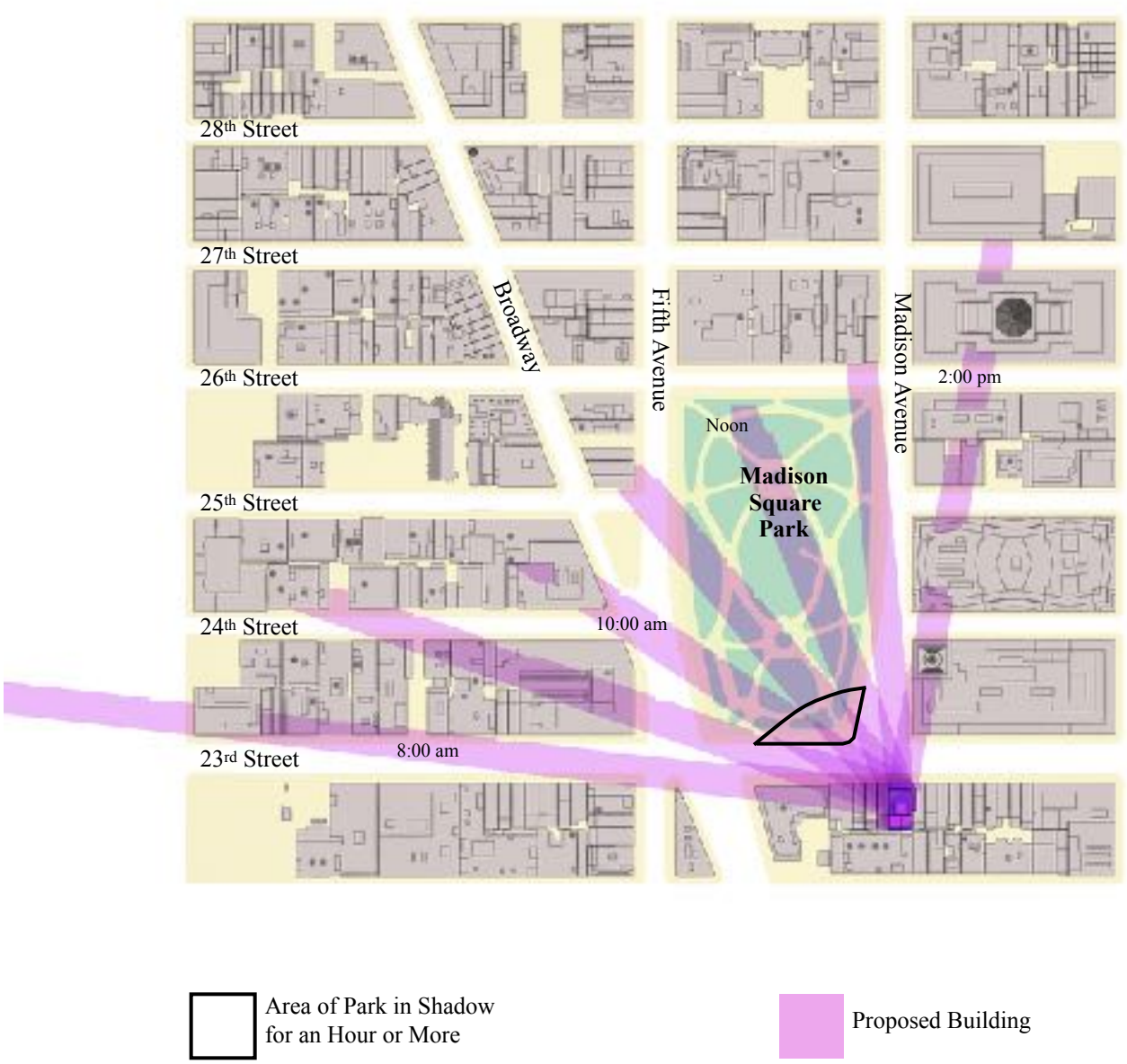
Shadow Sweep –

Proposed Building

November 1
8:00 am –
2:00 pm



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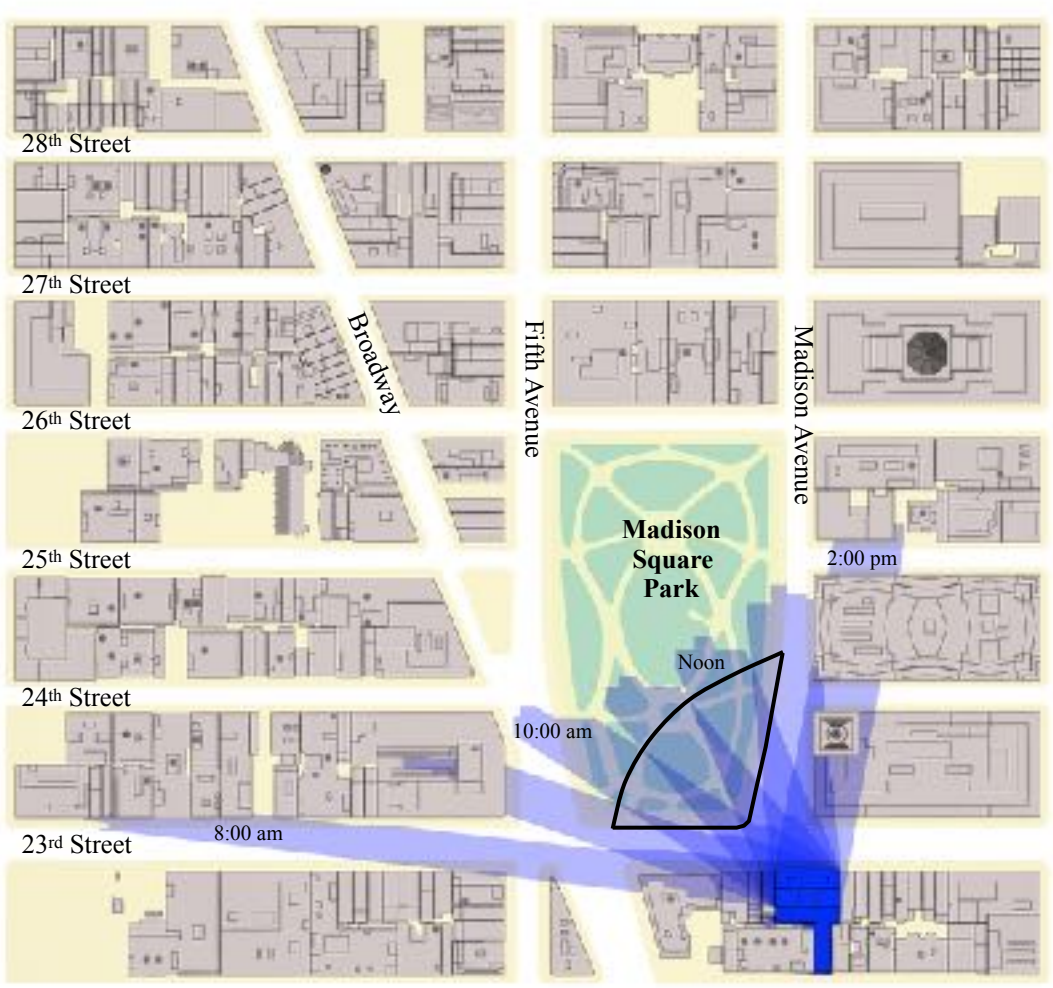
Shadow Sweep –

Alternative Building

November 1
8:00 am –
2:00 pm



Area of Park in Shadow for an Hour or More

Alternative Building

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Shadow Sweep – Comparison

November 1
8:00 am –
2:00 pm

Area of Park in Shadow for an Hour or More

Proposed Building
Proposed and Alternative
Alternative Building

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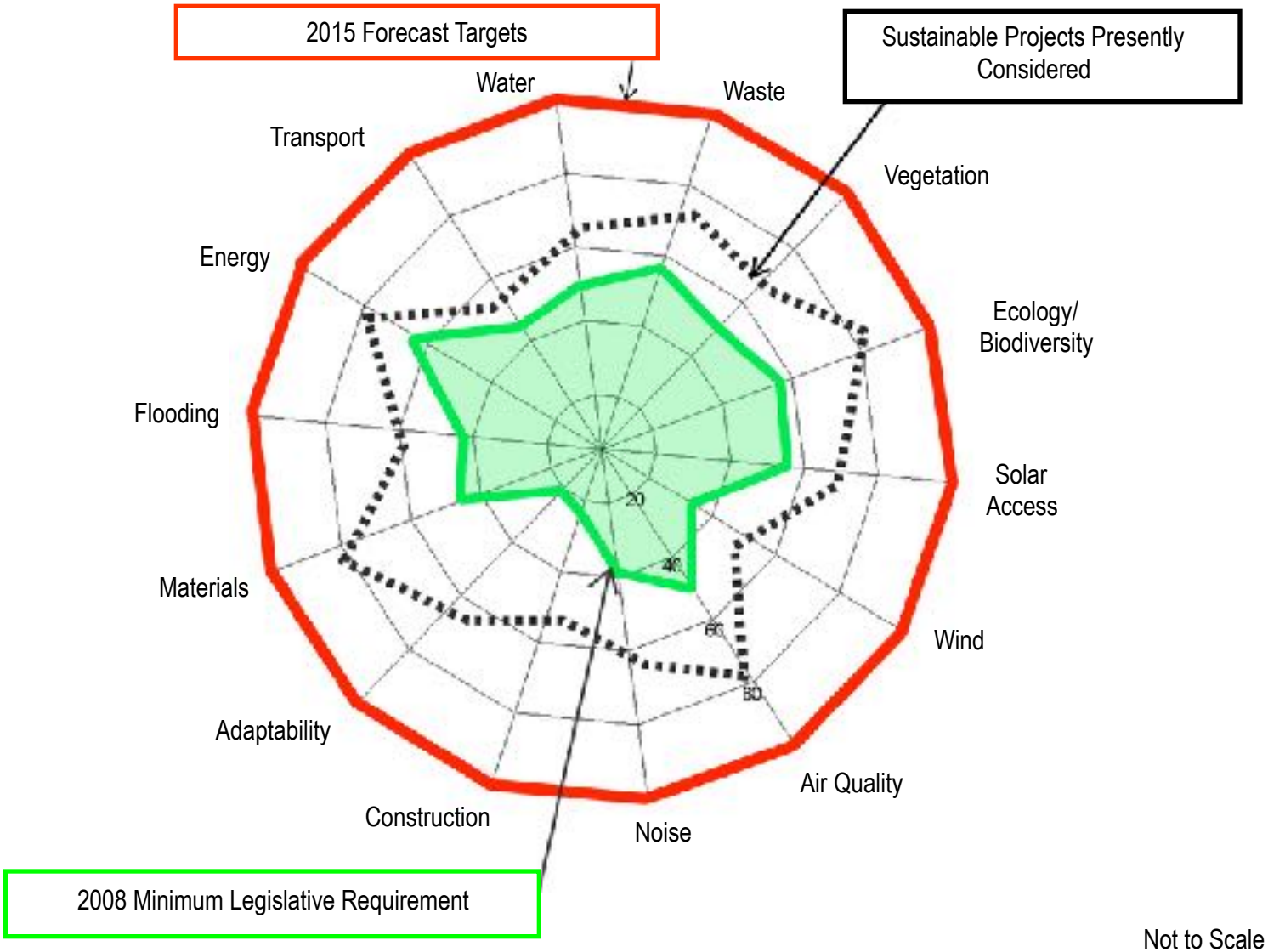
Environmental Targets: Beyond Minimum



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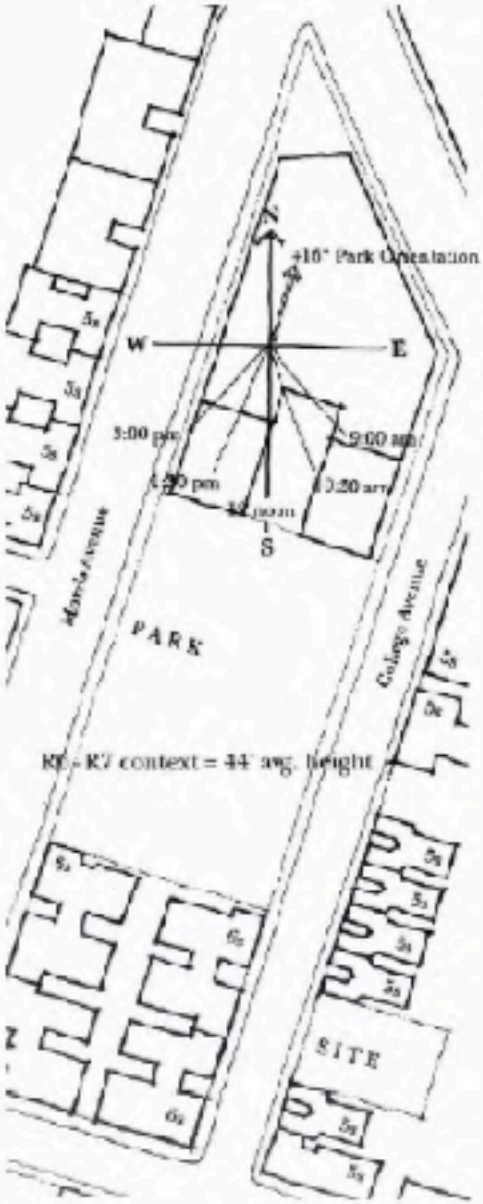


STEP 2a

Determine the orientation of the park and adjacent street grid. From the table to be provided in the zoning text, find the orientation of J.H.S. 22 relative to true north. J.H.S. 22 is 16 degrees east of true north. Draw true north on the Sanborn map that includes the park and its neighboring built context.

STEP 2b

Draw the sun bearing angles. On the north arrow, draw the sun (bearing) angles for each of the five regulated times (9:00 am, 10:30 am, 12 noon, 1:30 pm, and 5:00 pm) for the winter solstice. Because of the site's relative location on the easterly side of the park, the controlling time intervals are 9:00 am, 10:30 am, and 12 noon.

STEP 3

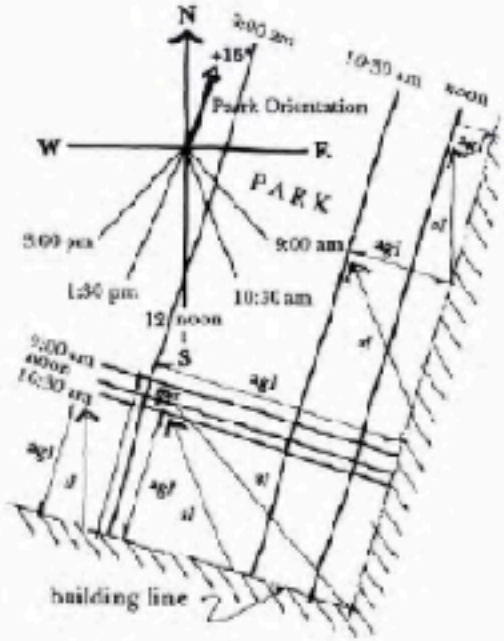
Determine from the "menu" of tables the base green lines for the R6-R7 outer-borough context. This table applies to all outer-borough parks with an R6-R7 context. Based on average shadow length (sl), the base green lines (gl) would be given for the relative eastern, southern, and western sides of a park.

East side:

9:00 am	sl = 182 ft	gl = 122 ft.
10:30 am	sl = 105 ft.	gl = 40 ft.
12 noon	sl = 90 ft	gl = 0 ft.

South side:

9:00 am	sl = 182 ft	gl = 135 ft.
10:30 am	sl = 105 ft.	gl = 97 ft.
12 noon	sl = 90 ft	gl = 90 ft.



STEP 4

Determine the park-specific green lines. Using the orientation factor in the table, adjust the basic green lines according to the actual orientation of the park—15 degrees east of north for J.H.S. 22. This results in the adjusted green lines (agl) for each relevant side of the park. The green lines (generalized shadow penetration depths) are measured from the edges of the park and assume buildings located at the park lot lines. The width of intervening streets will, where appropriate, be subtracted from the green lines in Step 5.

East side:

9:00 am	sl = 182 ft	agl = 154 ft.
10:30 am	sl = 105 ft.	agl = 65 ft.
12 noon	sl = 90 ft	agl = 25 ft.

South side:

9:00 am	sl = 182 ft	agl = 97 ft.
10:30 am	sl = 105 ft.	agl = 82 ft.
12 noon	sl = 90 ft	agl = 87 ft.

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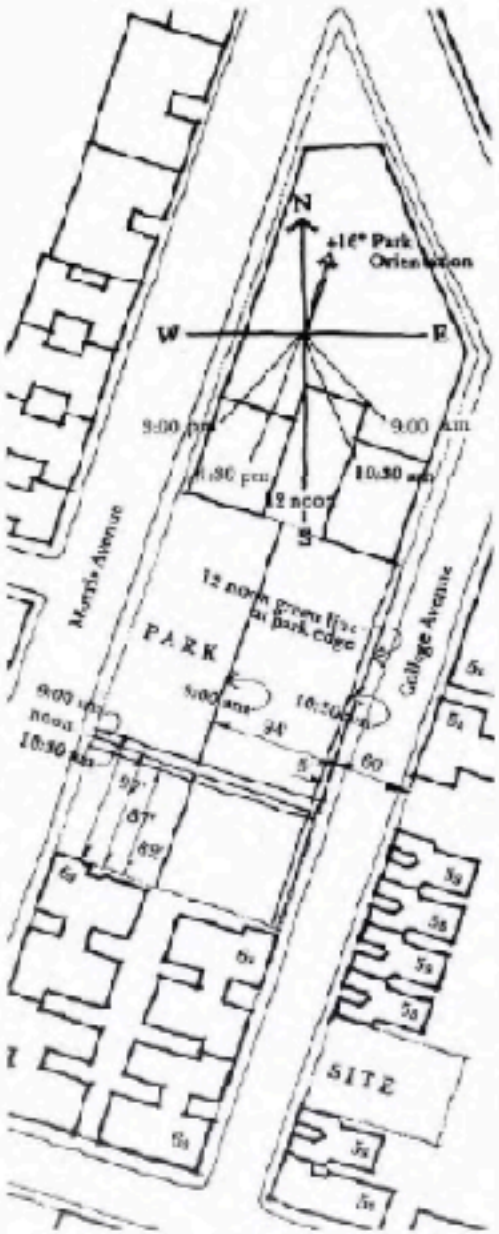

STEP 5

Adjust for intervening streets. Correct the green lines for intervening streets by subtracting 50 feet for College Avenue from the morning shadows. If the adjusted green line (agl; shadow penetration depth) in those instances where there is an intervening street is less than the street width (sw), assume that the green line at that interval is located at the edge or lot line of the park. This will be the case for the 12 noon green line.

The resulting green lines, by relative side of the park, are:

Easterly side (morning shadows):

9:00 am	154 ft. (agl) – 60 ft. (sw) = 94 ft.
10:30 am	65 ft. (agl) – 60 ft. (sw) = 5 ft.
12 noon	25 ft. (agl) – 60 ft. (sw) = -35 ft. [move to park lot line]

Southerly side:
[unchanged, since there are no intervening streets]

9:00 am	97 ft. (agl)
10:30 am	82 ft. (agl)
12 noon	87 ft. (agl)

With the adjusted green lines determined, draw them on the Sanborn map. These adjusted green lines are now the standard of solar access for the park. They will be used to determine compliance by describing the maximum allowable solar access zoning envelope for the prescriptive compliance evaluation method, and the baseline solar access standards under the performance method.

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TABLE 1. Refined Study Inventory*
New York City Parks Distributed by Zoning Districts and Park Types[b]

Borough	No. of Parks by Residential Zoning Districts (or commercial equivalent) R1-R5	R6-R10	Total
Bronx	65	168	233
Brooklyn	196	258	374
Manhattan	0	233	233
Queens	324	68	392
Staten Island	100	0	100
New York City	625	707	1,332

Park Type[b]	No. of Parks in or Adjacent to R6 to R10 Zoning Districts (or commercial equivalent) R6-R7	R8-R9	R10 & Higher	Total[c]
A. Small Parks				
Triangles	117	15	13	[145]
Sitting Areas	99	4	3	[96]
Community Parks	68	10	13	[81]
Civic Plazas	5	5	3	[11]
Miscellaneous	16	2	0	[18]
Subtotal	225	31	32	[251]
B. Playgrounds & Recreation Areas	281	30	5	[316]
C. Neighborhood Parks	60	14	9	[83]
D. Major Parks	23	6	2	[51]
E. Regional Parks	4	1	1	[6]
Total	593	85	49	[+727]

*Derived from the "Park Property and Facility List" (8 December 1978), prepared by the New York City Department of Parks and Recreation (DPR). Of the 1,948 properties under the jurisdiction of the DPR, 1,732 are public parks and open spaces. The other 216 properties, excluded from this refined study inventory, are listed and noted in the DPR inventory as green strips/center plots/malls, parking fields, indoor facilities (pools, recreation centers, museums, theaters), and parkways/drives without recreation designation.

[a] Parks are categorized by zoning districts as identified in the New York City Zoning Resolution (1990). Parks in or adjacent to each residential zoning district category (or their commercial equivalents) of R1-R5 and R6-R10 are counted in the R6-R10 category.

[b] Park types are described in the text and are modified from categories used by the DPR.

[c] Several parks are in or adjacent to one or more zoning districts and have been counted in each; totals are, therefore, shown in brackets to emphasize that these figures are illustrative rather than precise counts.

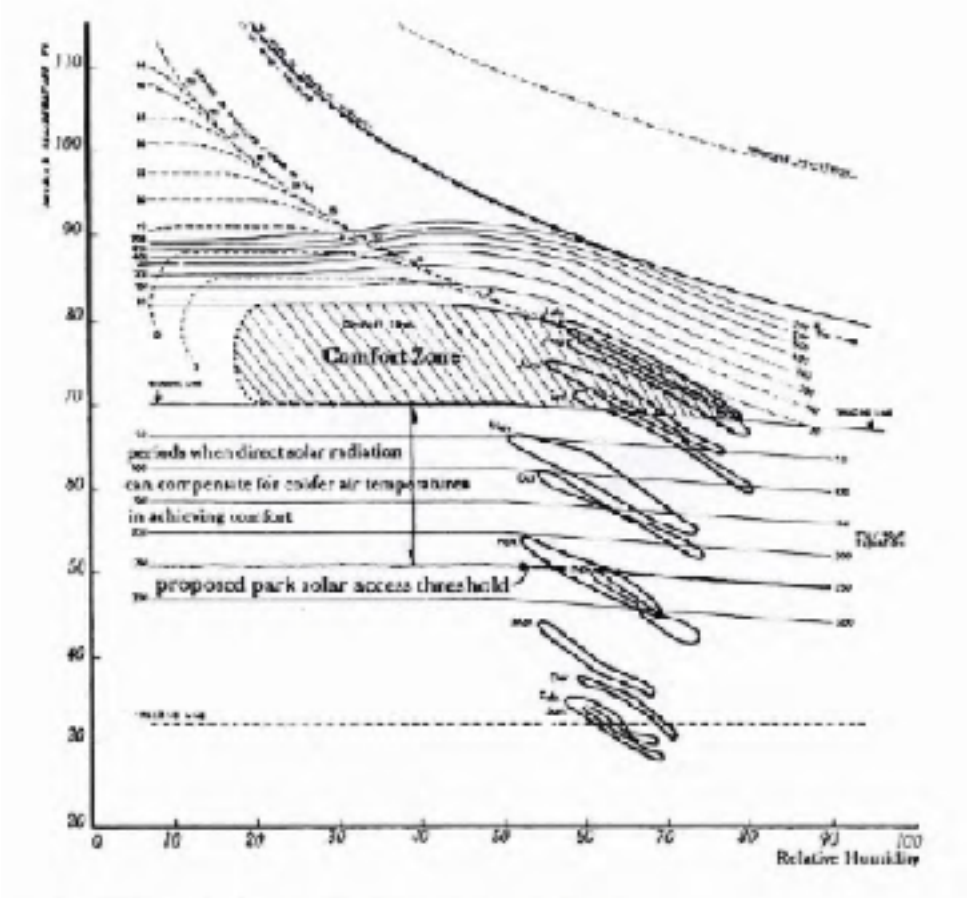

FIGURE 5. Typical Bioclimatic Patterns for New York City

A bioclimatic chart relates climatic elements like temperature, humidity, and wind to the degree of comfort or discomfort an individual experiences in a given environment. The shaded area in the center of the chart depicts the idealized "comfort zone" for the human body—the combination of climatic elements we normally consider comfortable and desirable outdoors. When conditions fall outside the comfort zone, compensatory climatic elements are required in order to feel comfortable, such as a light breeze or shade on a hot summer day. The closed curves indicate the typical monthly climatic conditions for the New York City area. As the chart illustrates, direct solar radiation counteracts cool temperatures in achieving outdoor comfort in the early spring and late fall. Modified from: *Design with Climate*, Victor Olgyay, Princeton University Press, 1963.

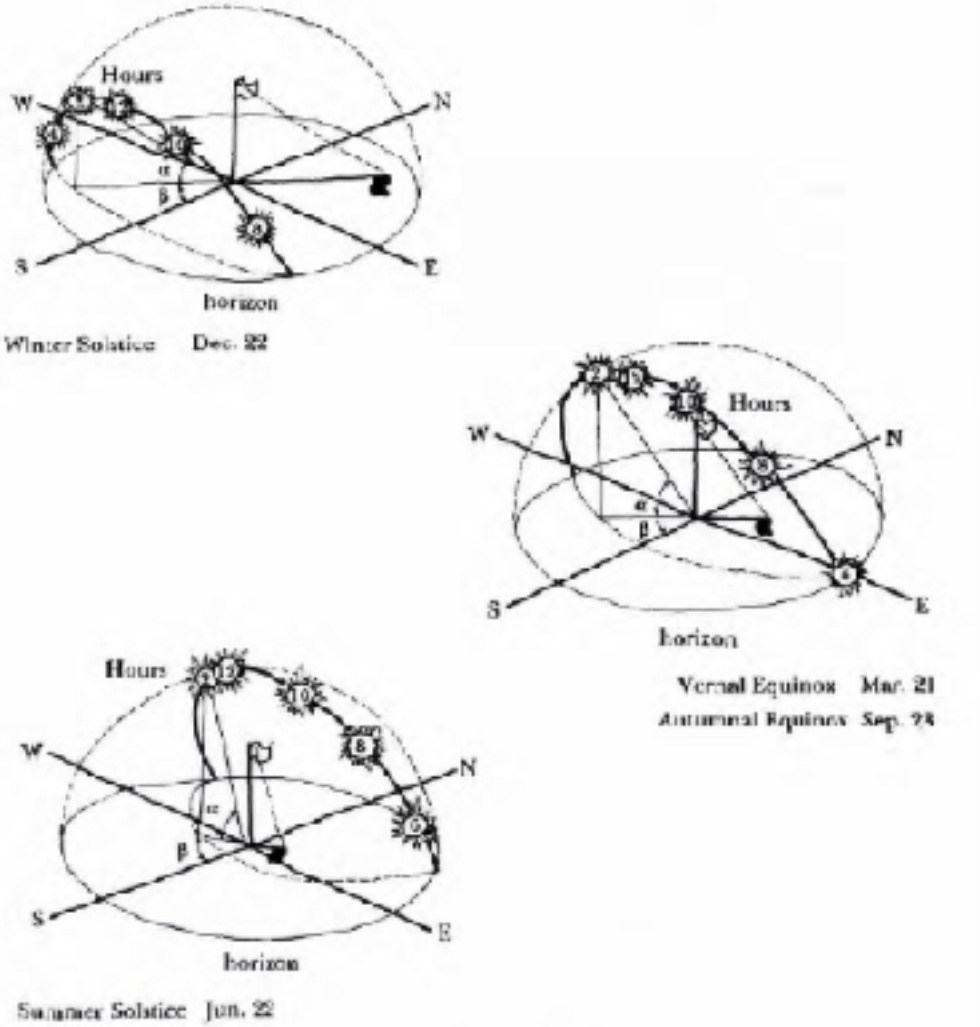

FIGURE 4. Sun Paths for Winter Solstice, Equinox, and Summer Solstice

The sun's position relative to a specific geographic location changes over the course of the day and year. These changes in the sun's path may be described in terms of altitude (α) and bearing (β) angles for any date and hour. In the diagrams shown here, shadows cast by the pennant at 2:00 PM illustrate the effect of seasonal changes. Modified from *Architectural Graphic Standards*, John Wiley & Sons, Inc.

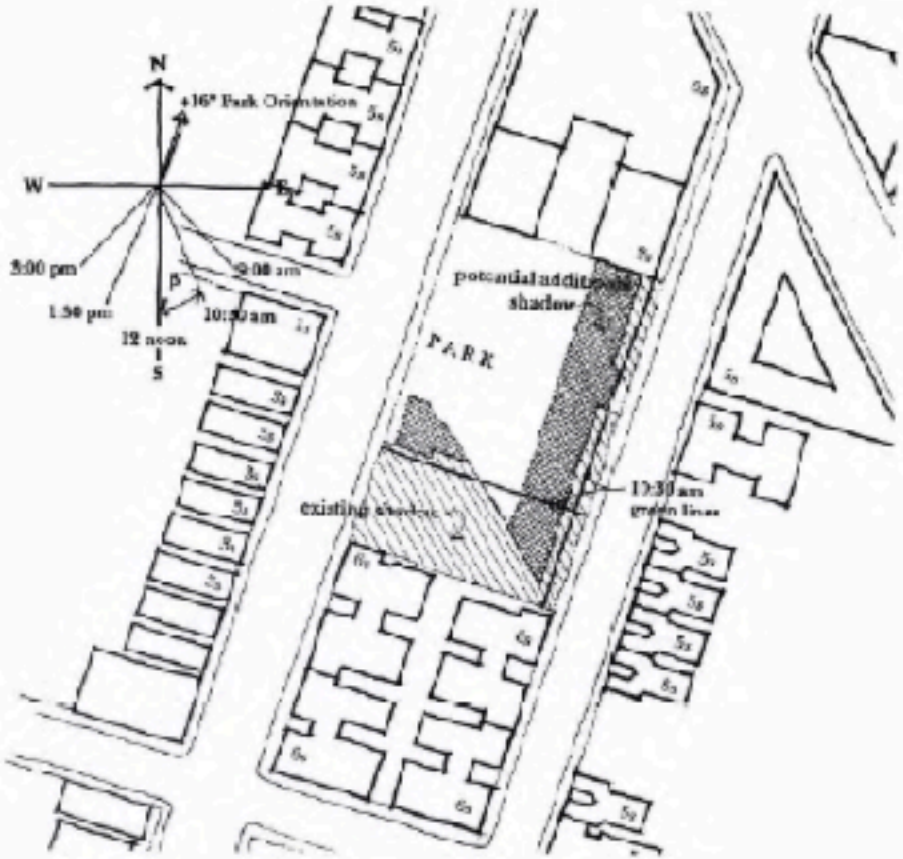

FIGURE 1. Existing Shadow on a Park Compared with Additional Shadow Possible in Absence of Solar Access Regulations

Diagram contrasts existing shadow (hatching) on a park with potential additional shadow from future development (cross-hatching) under present zoning regulations. The proposed solar access regulations would establish a minimum sunlight standard limiting the amount of new shadow that can be added to a park to an *average of the existing shadow* (termed a 'green line'), thereby protecting current sunlight conditions. In this and other illustrations, the compass shows the park's orientation and the sun angles (p) used in the study; and 5s, 5s 6s, etc., indicates the number of stories of the depicted buildings.

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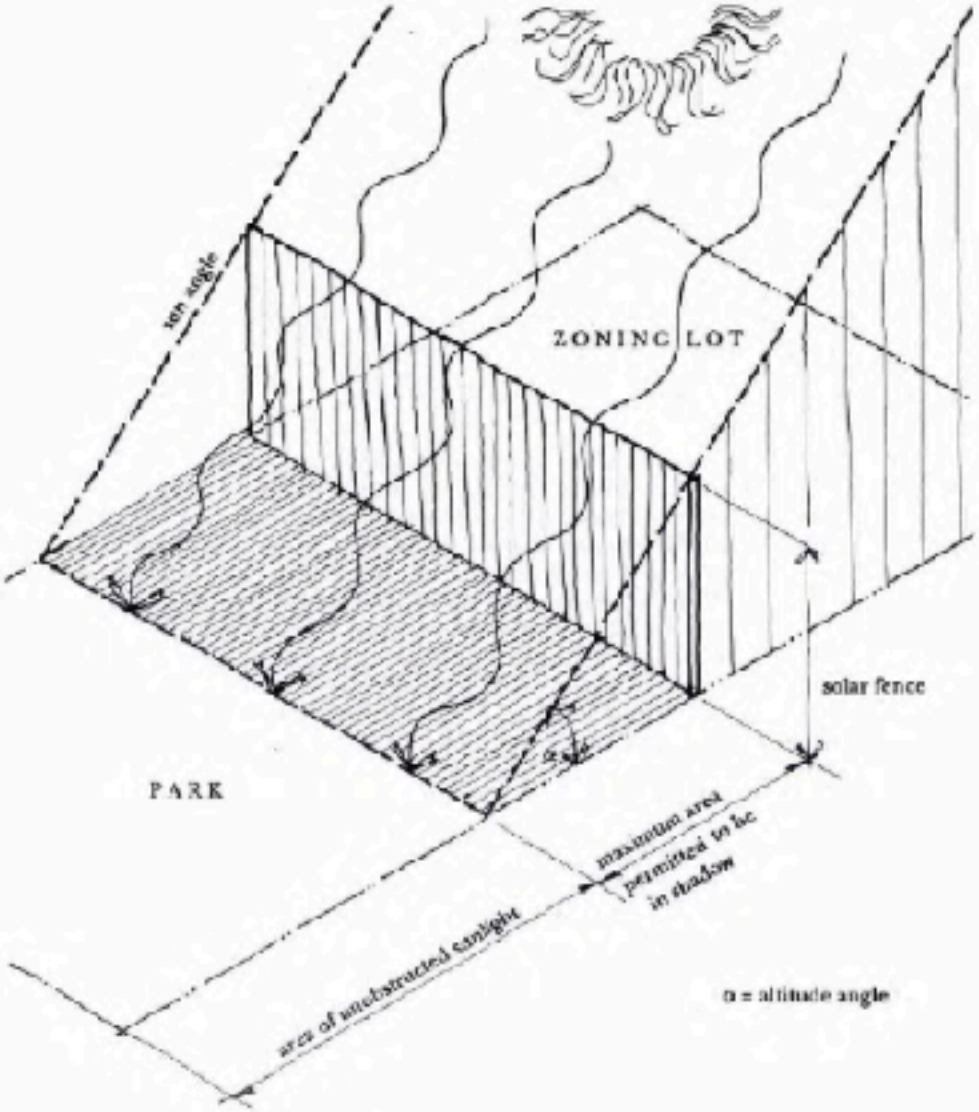

FIGURE 3. "Solar Fence" as a Regulatory Approach to Solar Access

Diagram illustrates concept of an imaginary boundary fence (the "solar fence") that defines extent to which new development may cast shadows on a park. For a given time of day and year, the solar fence determines the extent of unobstructed sunlight that falls on the park. From this one can develop an imaginary plane that the building may not penetrate if it is to avoid casting a shadow on the park beyond that permitted.

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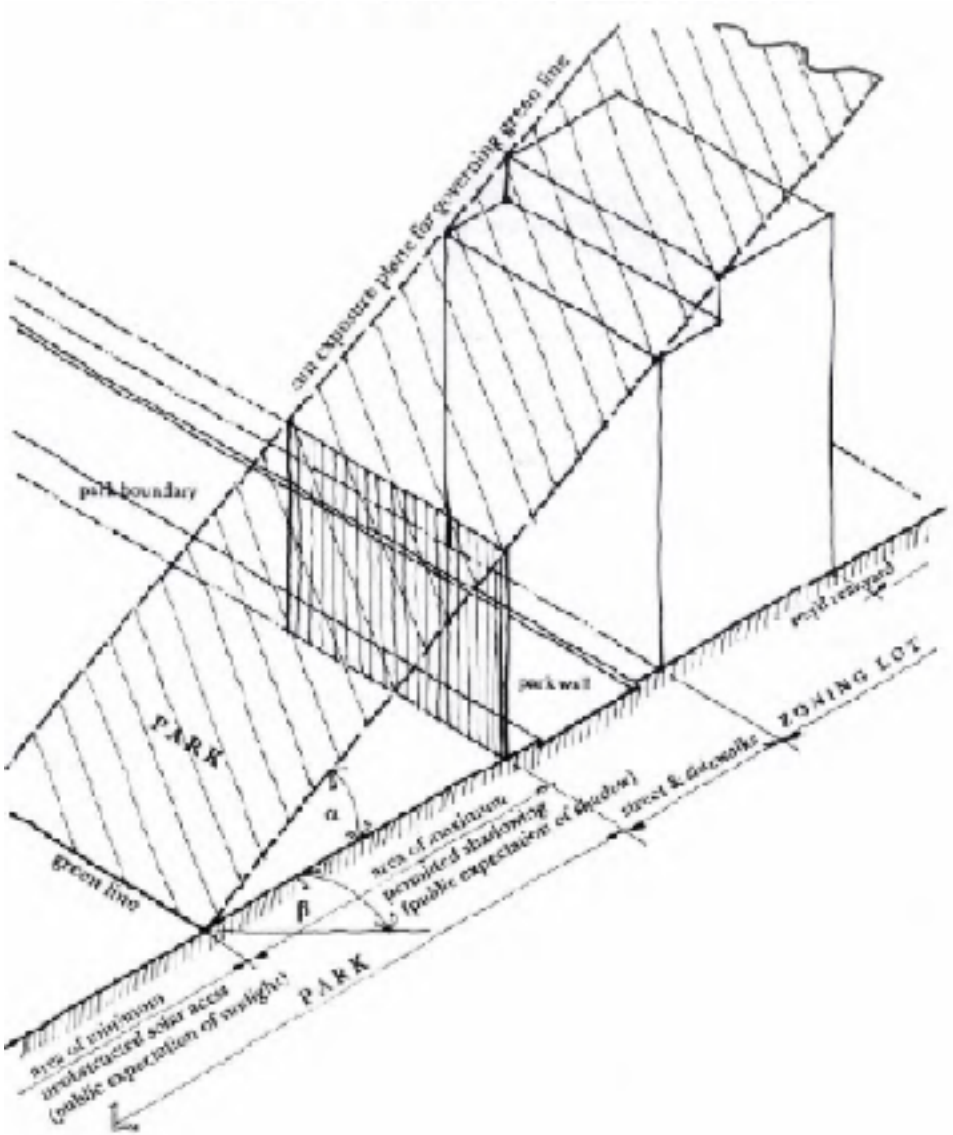

FIGURE 16. Bulk Envelope Generated by Green Lines

A bulk envelope may be developed from a sun exposure plane derived from the governing green line and its associated altitude (α) and bearing (β) angles

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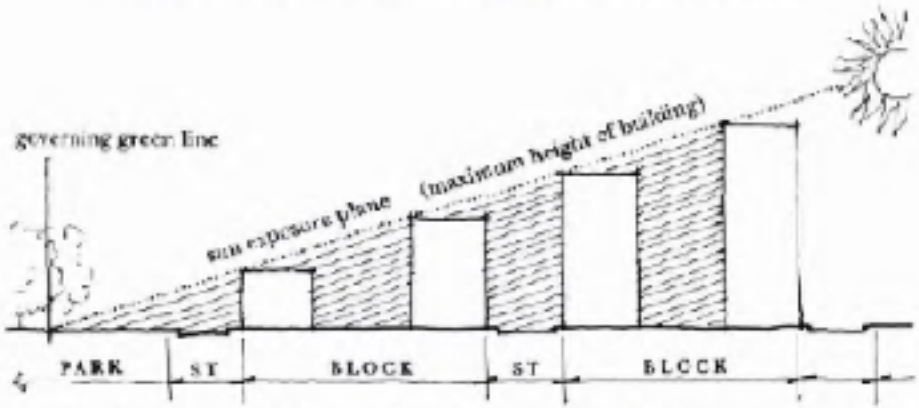

FIGURE 17. Effect of Sun Exposure Planes on Surrounding Park Context

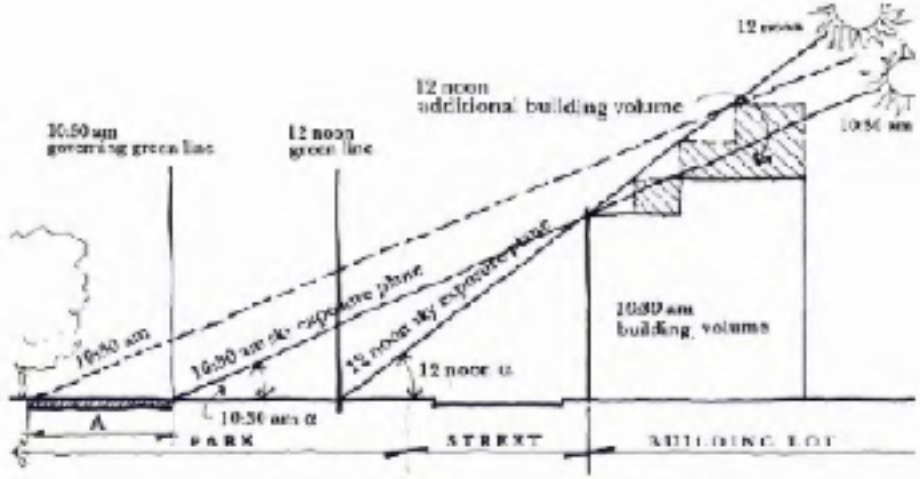

FIGURE 18. Why Longest Shadow Always Governs in Prescriptive Method

In Figure 17, the sun exposure plane progressively restricts the height of new development (and, consequently, potential shadow impacts) around the park. In Figure 18, the governing green line (a function of the lowest sun angle (α), and therefore the deepest potential shadow penetration of the park permitted by new development) yields the most restrictive building envelope of all the green lines affecting an individual parcel and the maximum bulk envelope that will comply with the minimum sunlight expectation for the park. While the building shown casts shadows on the park at both 10:30 am and 12 noon, the additional portion of the building that might be accommodated under the 12 noon envelope (hatched area) would cast a shadow that exceeds (by the distance 'A') the maximum shadow impact allowed at 10:30 am.

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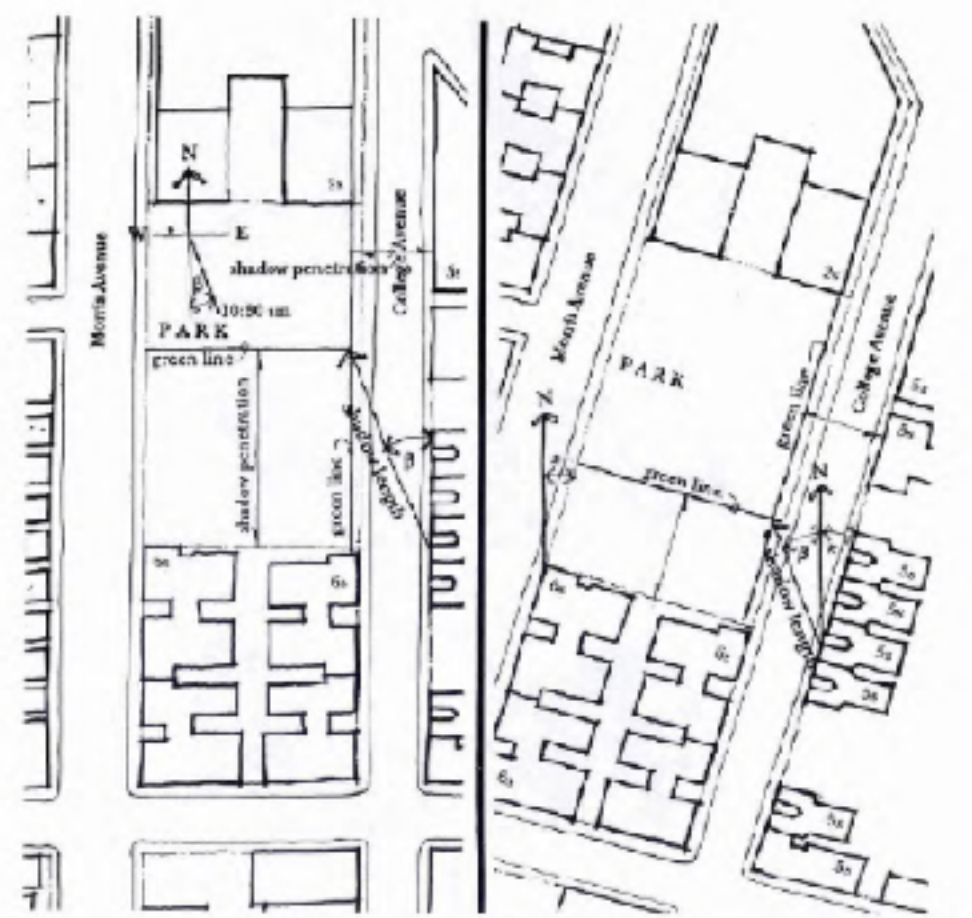

FIGURE 7. Green Lines "Self Adjust" to Site-Specific Conditions

The green lines are based on the average shadow penetration into a park by a representative context of buildings for a given zoning density. While this dimension is the same for each park (since buildings of the same height cast shadows of the same length), the average shadow length may be adjusted by trigonometric relationships to the park-specific street grid orientation (θ) in order to determine the perpendicular (adjusted) shadow length. Further adjustments for intervening streets and yards yields the shadow penetration for the specific park.

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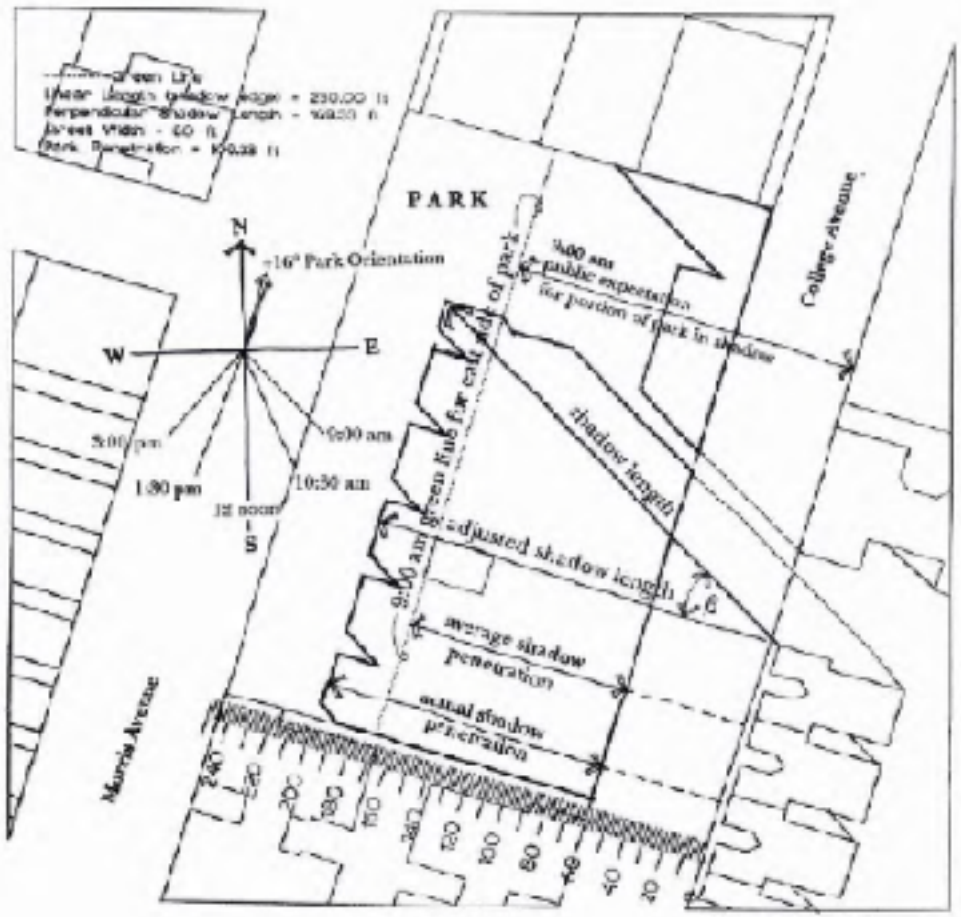

FIGURE 15. Actual Shadow Penetration Compared with Average Shadow Penetration ("Green Line")

Diagram compares the average shadow penetration—the "green line"—with the actual shadow penetration of the J.H.S. 22 playground for buildings on the east side of the park at the winter solstice. Note that the shadow length is determined by the buildings' position relative to the sun while the *adjusted* shadow length is determined in relation to the street grid. Intervening streets or yards buffer the park from shadow impacts.

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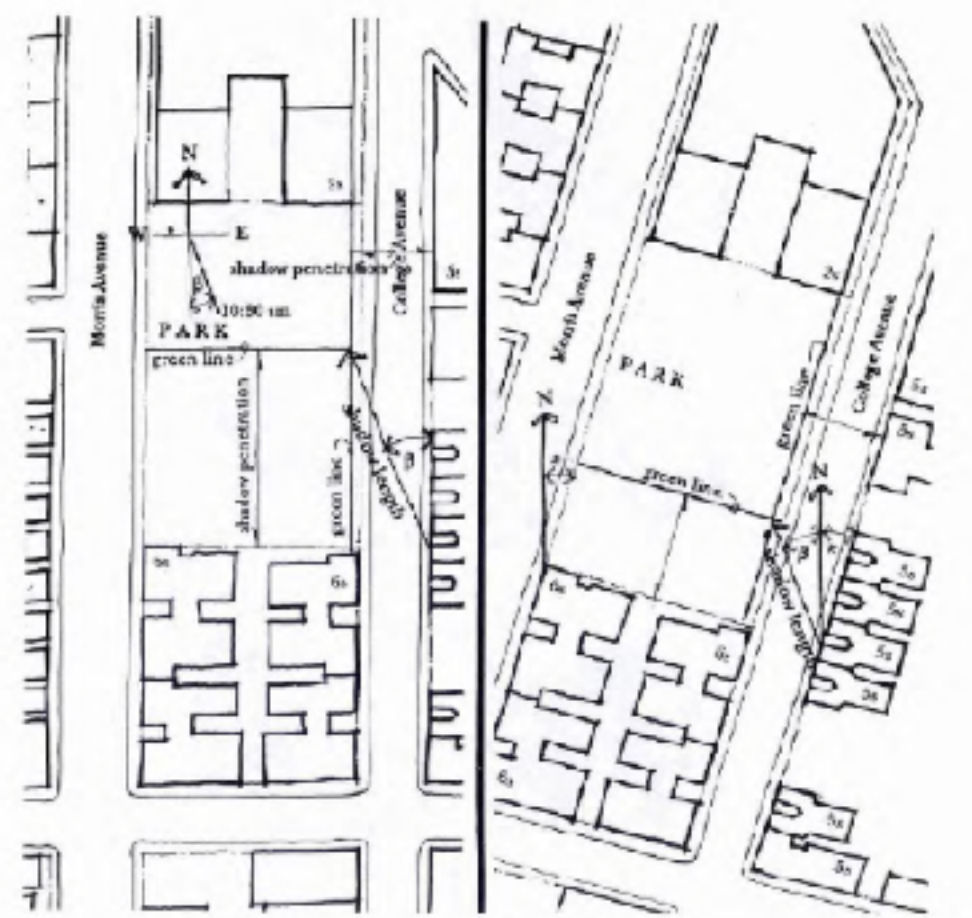

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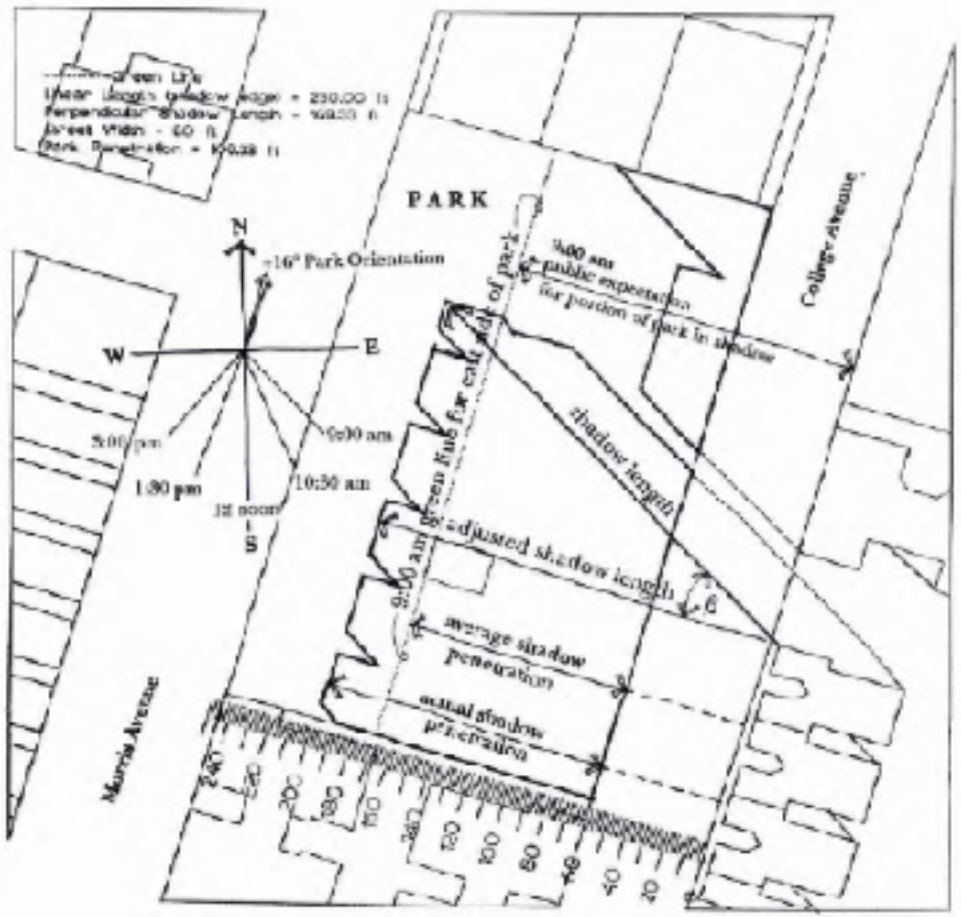

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Shadow Comparison

8:00 am

New Shadows

Proposed Building
Proposed and Alternative
Alternative Building

Existing Shadows

Shadows Within Existing Shadows

Proposed Building
Proposed and Alternative
Alternative Building

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Shadow Comparison

9:00 am

New Shadows

Proposed Building
Proposed and Alternative
Alternative Building

Existing Shadows

Shadows Within Existing Shadows

Proposed Building
Proposed and Alternative
Alternative Building

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Shadow Comparison

2:00 pm

New Shadows

Proposed Building
Proposed and Alternative
Alternative Building

Existing Shadows

Shadows Within Existing Shadows

Proposed Building
Proposed and Alternative
Alternative Building

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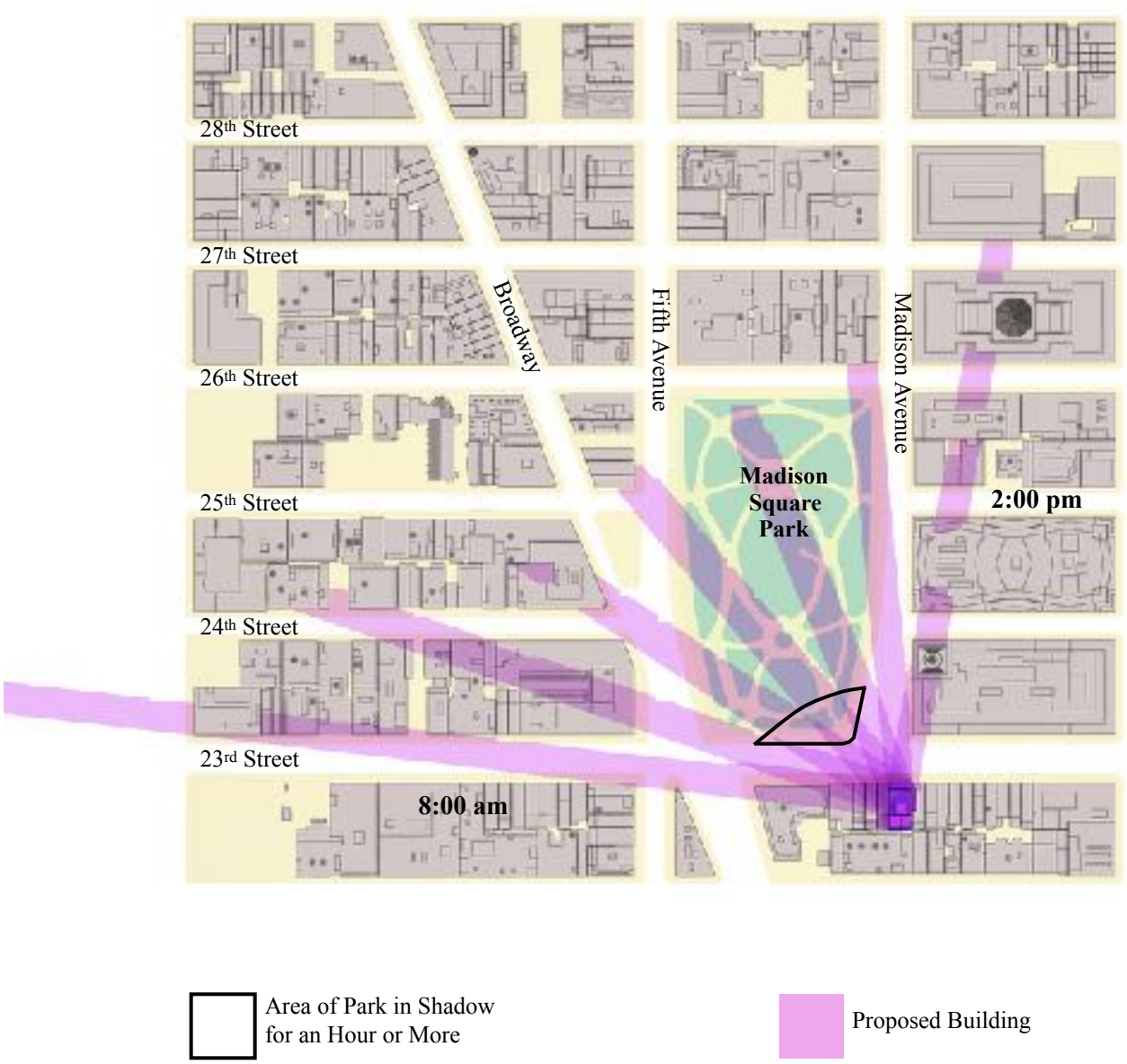
Shadow Sweep –

Proposed Building

8:00 am –
2:00 pm



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Shadow Sweep – Comparison

8:00 am –
2:00 pm

Area of Park in Shadow for an Hour or More

Proposed Building
Proposed and Alternative
Alternative Building

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Shadow Sweep –

Alternative Building

December 21
8:00 am –
2:00 pm

This can best be explained by the accompanying diagram (Fig. 18). The azimuth, or altitude of the sun in the sky, is higher at 12 noon than at 10:30 am. If the less restrictive green line (12 noon) and corresponding sun exposure plane were to define the building envelope, the additional setback floors would cast a shadow at 10:30 am that would exceed the 10:30 am green line. The sunlight expectation for that park at that hour would be diminished and the standard exceeded, although the same building setbacks would conform to the 12 noon green line.

Performance Method

Because the generalizations that make the prescriptive method simple to use may in some cases cause excessively restrictive results, it is possible to extend the analysis of a building site by proceeding to the performance method. In this method, both proposed shadows and shadows from existing buildings that extend beyond the green lines are modeled, allowing the architect to more precisely fit the zoning envelope to the development site (proposed shadows may overlay existing shadows). Doing so may yield greater development potential for the site without diminishing the sunlight standard. The method can be performed manually, using the information supplied in the regulations, or by computer.

This approach would determine not a single worst-case green line for the site as a whole (the result one gets with the prescriptive method), but a green line for each portion of the site. Different portions of the development site would have different height restrictions based on the applicable green lines and the corresponding altitude of the sun.

Although this flexibility, together with the fact that overlaying existing shadows would be permitted, may in some cases offer somewhat more square footage on a site than would the prescriptive method, development would still have to remain within the relevant green lines and within any existing shadows that extend into the park beyond the green lines. The ability to achieve a precisely defined building envelope resides in this concept of *performance*, whereby the applicant must prove, using a standardized format, that the proposed building "performs"—i.e., conforms to the standards.

An Example

The best way to explain the regulations is by applying them to an actual situation. The example used is Junior High School 22, a playground and adjoining schoolyard in the Bronx that was one of the representative parks in the study.

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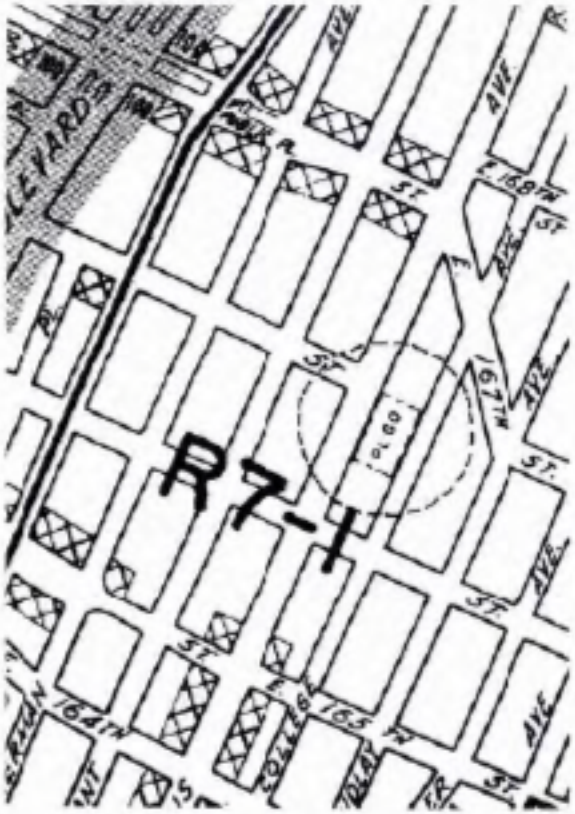
The neighborhood around J.H.S 22 is typical of an outer borough R6-R7 built context, consisting of a mix of 3-, 4-, and 5-story buildings, the majority of which were built before World War II. The park, in zoning terms, is a through-lot (going from street to street) with existing buildings built to both the southerly and northerly lot lines. In addition, the bordering streets vary in width. In contrast to conventional zoning practice, the actual recorded street width is used for this example. (Conventional zoning practice typically distinguishes only between "wide" streets—those at least 75 feet wide—and "narrow" streets—those narrower than 75 feet.) The winter solstice is employed for the example to illustrate the most restrictive case. We recommend that November 1 be used in setting the actual green line standards, since it marks the period over which the regulations have their greatest potential for extending park use.

The green lines used in this example are based on the built context for the lower-density R6-R7 parks examined in this study. The street wall heights around this limited sample range from 30 to 44 feet. Because the sample is too small to generalize from, the example employs the weighted average of street wall heights around J.H.S 22, 44 feet. This figure is by no means definitive.

The first series of steps outlined below (Steps 1 through 6) are common to both the prescriptive and performance methods. These initial steps result in the determination of the green lines for the J.H.S 22 playground, which would determine the maximum zoning envelope for the site used in this example. The hypothetical site is located on the easterly side of the playground across the street and slightly south of the playground's southerly boundary. The commonality of the green lines to both methods allows the user to decide which method is most suitable for determining the maximum zoning envelope for the site being evaluated.



STEP 1a

Determine the applicability of the solar access zoning regulations. The J.H.S. 22 playground would be listed in the Zoning Resolution as one of the parks around which new development must comply with the solar access regulations.

STEP 1b

Determine which of the four generalized park contexts is applicable to the development site. In this case the entire area around J.H.S. 22 is mapped R7-1, the low-density, outer-borough context. The contextual zoning equivalent for the R7-1 zone is the contextual R7 narrow street density and height and setback regulations, which, for the purposes of this example, assume an average streetwall height of 44 feet.

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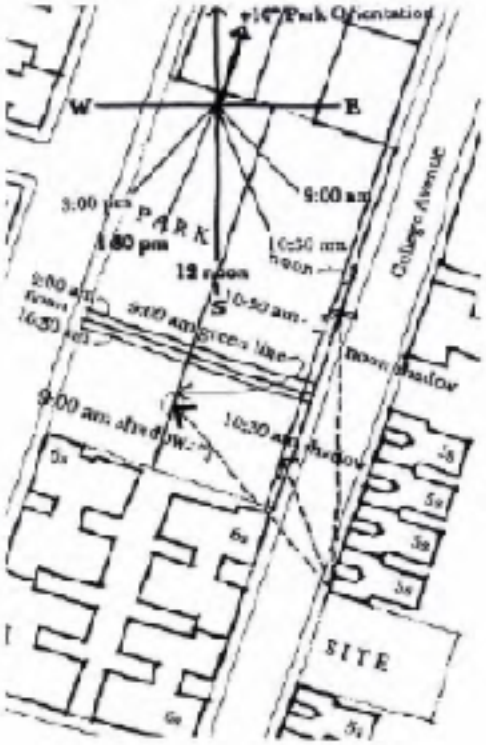
STEP 6



Determine the governing green line. Find on the Sanborn map the development lot to be evaluated for compliance. Using the sun angle diagram (Step 2b), project the sun (bearing, angle for 9:00 am, 10:30 am, and 12 noon from the corner of the lot that determines the leading edge of the shadow, in this case the northerly corner of the street lot line on College Avenue. The projection of the corner of the development lot intersects the 9:00 am, 10:30 am, and 12 noon adjusted green lines. The 9:00 am green line governs; it has the greatest shadow penetration into the park because the sun is lower in the sky at 9:00 am than at 10:30 am or 12 noon.

A user electing the prescriptive method would determine the park sun exposure plane for the 9:00 am green line. The same 9:00 am green line also serves as the point of entry for the performance method. Both methods are described below.

Prescriptive Method: Next Steps

The prescriptive method uses basic trigonometry to construct a sun exposure plane. As with the traditional sky exposure plane already a part of common zoning practice, the sun exposure plane must be normal to the development lot's street lot line and rise uniformly above the development lot. Steps 7 through 11 below translate the green line and the sun's bearing angle and altitude into the sun exposure plane for the governing time interval, in this case 9:00 am at the winter solstice.

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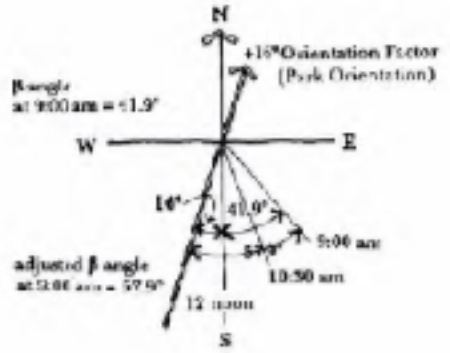

STEP 7

Determine the adjusted bearing angle. Having established in Step 6 that the worst-case condition for this site is at 9:00 am, determine the adjusted bearing angle (β) by adding the orientation factor (park orientation of 16°, per Step 4) to the bearing angle (β) for 9:00 am at the solstice (41.9°). The bearing angle (β) of the sun has now been adjusted to the specific orientation of the park (41° + 16° = 57.9°).

STEP 8

Determine the height of the "park wall." Enter the adjusted bearing angle (β) and the adjusted green line distance at 9:00 am from Step 4 into the park wall formula. The park wall is the height of a theoretical wall at the park line that would cast a shadow to the green line. Using basic trigonometric relationships, solve for the height of the park wall, which is determined by the altitude of the sun (angle α = 13.6°) and the penetration of the 9:00 am shadow into the park (94 feet).

$$x = \frac{\text{green line penetration distance}}{\text{adjusted sun bearing angle (β)}}$$

$$x = \frac{94}{\text{SIN } 57.9^\circ} = 111'$$

park wall height =
x [tangent of altitude angle (α)]

park wall height = 111 (TAN 13.6°)

park wall height = 26.9'

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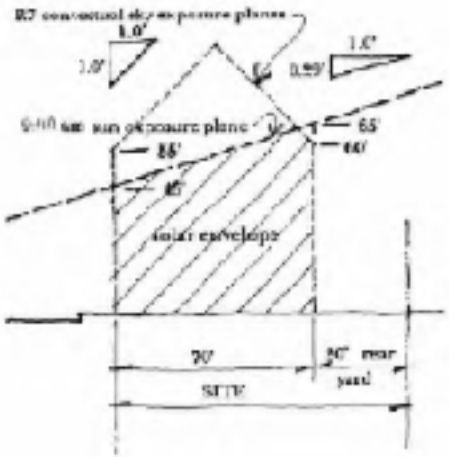

STEP 11

Compare the building envelope that meets the solar access standard with that allowed under the R7 contextual zone. In this instance, the sun exposure plane is more restrictive than the sky exposure plane and would therefore govern, with the exception of the rear sky exposure plane, which is more restrictive.

Performance Method: Next Steps

The prescriptive method of compliance for the lot being evaluated is regulated by the 9.00 am green line, which results in a 45-foot-high streetwall (approximately four stories) at the lot line with an additional story setback from the streetwall. Because the 9.00 am shadow from the site would hypothetically project across the six-story buildings located along the southerly park lot line and a portion of the five-story building to the north, it is likely that the shadow will fall within the shadows of the taller existing buildings. If this proves to be the case, the height of the site's streetwall can probably increase by one or two stories, as long the site's shadows stay within the shadows of the taller existing buildings. In order to check if there is a potential for an expanded zoning envelope based on existing 9:00 am shadows which exceed the 9:00 am green line, the user would employ the performance method outlined below (Steps 12 through 14).

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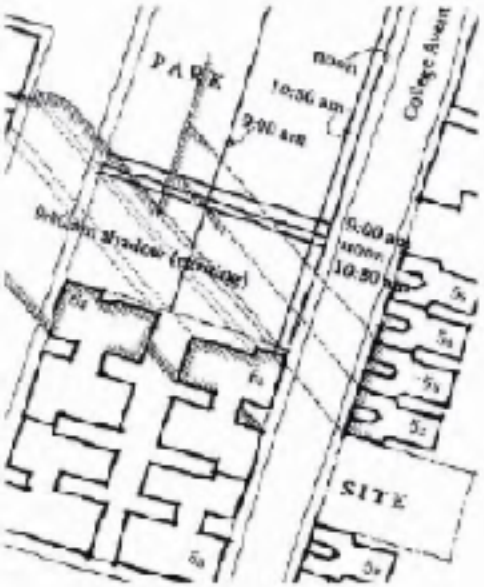
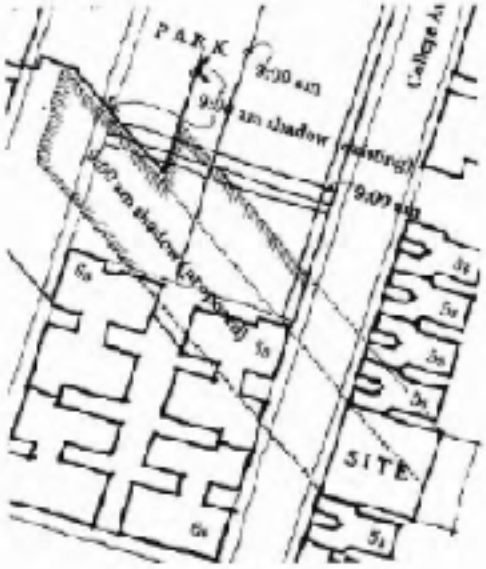
STEP 12



Cast shadows from existing buildings. Begin by casting the 9:00 am shadow for the five-story building adjacent to the site and the two six-story buildings which border the park to the south. These 9:00 am shadows exceed the 9:00 am green lines and extend as far as the street bed of Morris Avenue.

STEP 13



Fitting the site's shadows into the existing shadows. After allowing 30 feet for the site's required rear yard, project the hypothetical shadow lines from the corners of the potential building volume until they intersect the corresponding 9:00 am shadows cast by the existing five- and six-story buildings. The resulting shadow, which falls within the larger existing shadow, is the maximum allowable shadow that can be cast by a building on the site. Although this shadow exceeds the 9:00 am green line, by falling within the area of existing shadows it does not increase the actual shadowing of the park.

STEP 14

Determine the solar zoning envelope. Using the azimuth angles (the angle that determines the height of the sun in the sky) supplied in the prescriptive method regulations, calculate the adjusted allowable height of the streetwall for the site. In this case the adjusted streetwall height is 80 feet, or about eight stories. The maximum streetwall height allowed by the Quality Housing regulations for a site in an R7 district on a narrow street is 55 feet, or five to six stories, which can be accommodated within the performance method zoning envelope. The underlying contextual envelope governs in this instance because the existing shadow already has deprived the park of sunlight at that location. The performance method accommodates to the park-specific sunlight expectation.

Observations on the Example

In this instance, the performance method, by more closely modeling the zoning envelope to *actual* rather than *generalized* expectations of sunlighting, has resulted in a less restrictive envelope than allowed by the prescriptive method alone. Had the southern boundary of the site been aligned with the southerly park lot line, the prescriptive and performance methods would have produced almost identical solar envelopes because the green lines, in the absence of longer existing shadows, would have governed. Had the site been further north on the block, the site might have not been affected by the solar access regulations at all, or perhaps only a portion of the site might have been affected by the 9:00 am green line, indicating that under the performance method, the remaining portion of the site would be regulated by the underlying R7 contextual zoning regulations. Had the site been further away from the park, for example, on the other side of the block used in the example, the solar access regulations would probably not have pertained, although in less uniform or higher density situations, the regulations may have a wider relevancy than the example indicates.

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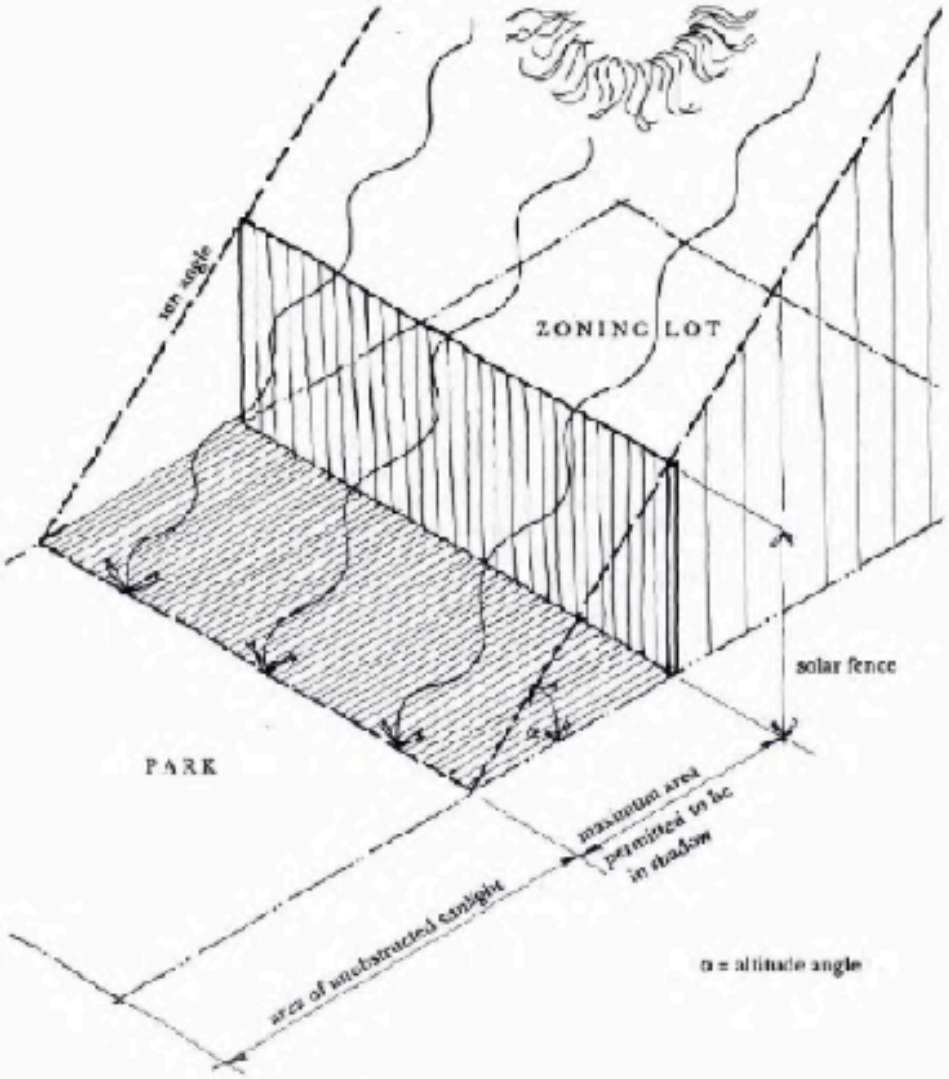

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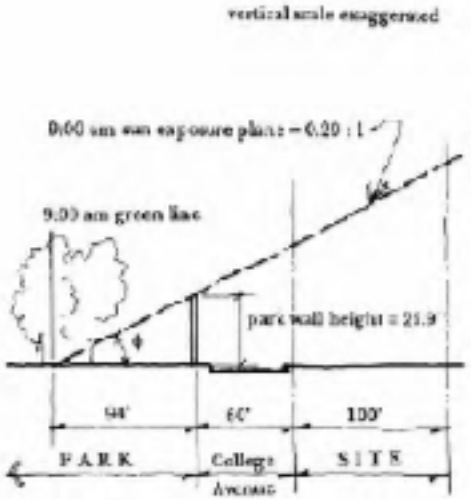


STEP 9

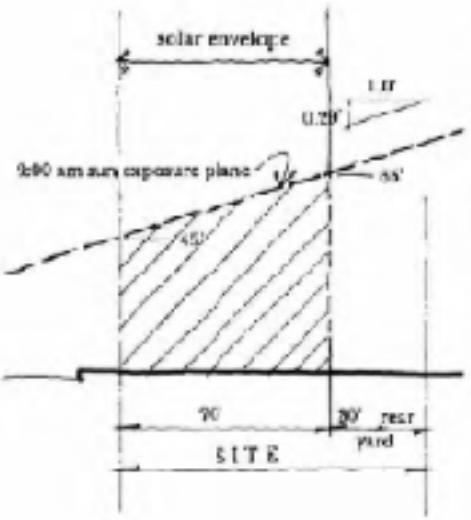
Determine the sun exposure plane for the governing green line (in this case, 9:00 am). The sun exposure plane is similar, in concept, to both the sky exposure plane of traditional zoning and the solar fence. It is a uniform inclined plane projected from the governing green line over the development site. This angle (ϕ) is expressed as a slope or ratio of vertical distance (v) to horizontal distance (h), or $v:h$ where $h = 1$.

$$\text{sun exposure plane} = \frac{\text{park wall height}}{\text{green line}} : 1$$

$$= \frac{27.3}{94} : 1$$

$$= 0.29 : 1$$

which may be expressed as 0.29 feet vertically for every 1 foot horizontally



STEP 10

Establish the solar envelope for the site. Determine the maximum height of the front wall of a proposed building at the lot line. Having calculated the sun exposure plane as a ratio of the vertical rise per increment of horizontal distance, the height of the building at the lot line is the distance at 9:00 am from the green line to the site's lot line multiplied by the vertical rise (0.29), which is about four stories (≈45 feet). The same procedure is repeated for the maximum height of the rear building wall, about 65 feet. The area under the sun exposure plane and delineated by both the street and rear building walls is the solar envelope.

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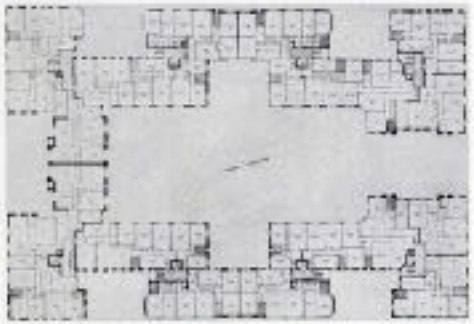

- Courts
- Building Spacing

Amalgamated Houses

Lower East Side, 1933

Hillside Homes

Bronx, 1933

- **Courts**

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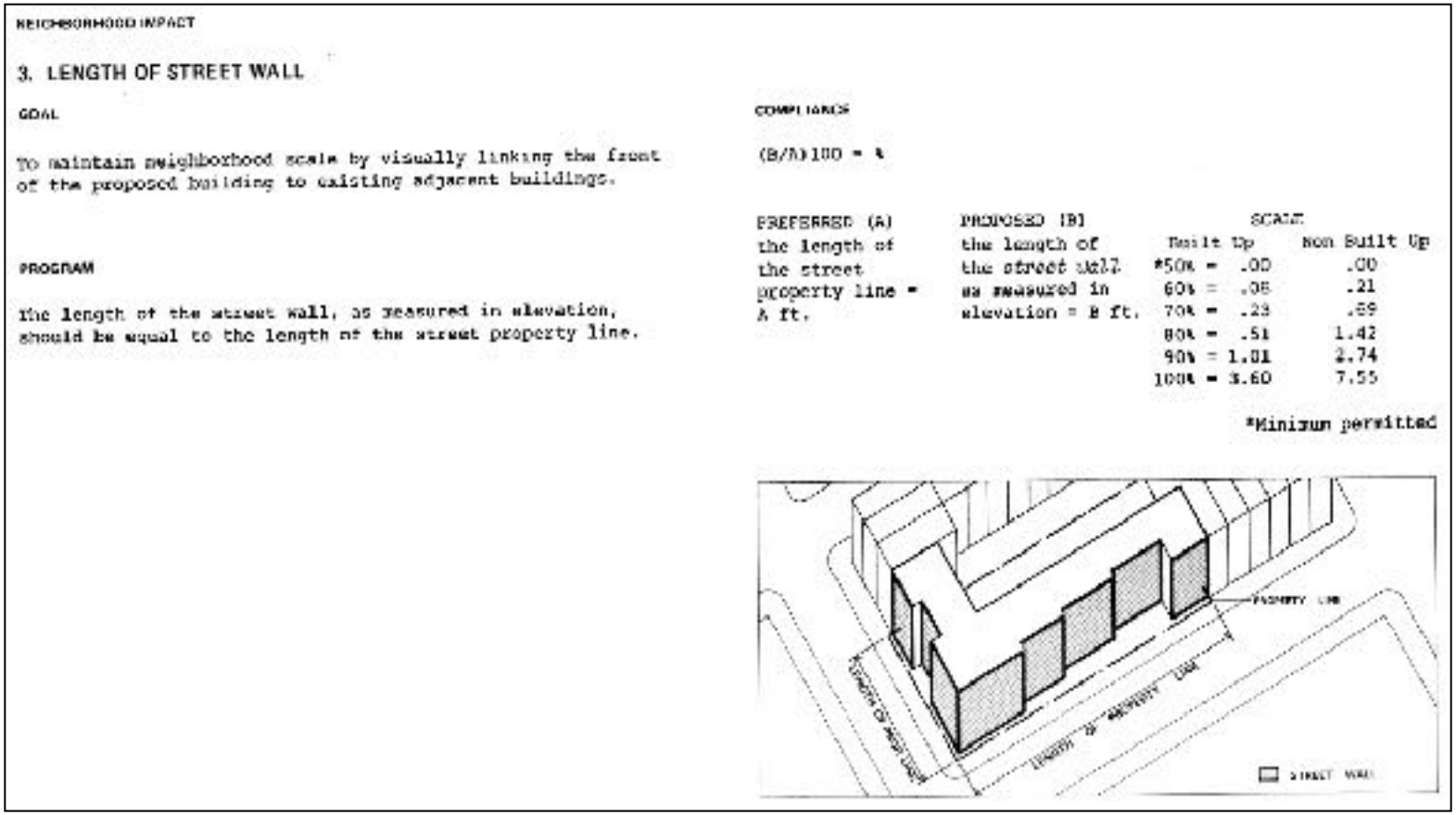
What beauty is I know not, but it depends on many things.

Albrecht Durer

Performance-based Zoning

Daylight Performance *(Midtown Zoning New York, New York)*



NEIGHBORHOOD IMPACT

3. LENGTH OF STREET WALL

GOAL

To maintain neighborhood scale by visually linking the front of the proposed building to existing adjacent buildings.

PROGRAM

The length of the street wall, as measured in elevation, should be equal to the length of the street property line.

COMPLIANCE

(B/A)100 = %

PREFERRED (A) the length of the street property line = A ft.

PROPOSED (B) the length of the street wall as measured in elevation = B ft.

SCALE	Built Up	Non Built Up
*50% =	.00	.00
60% =	.06	.21
70% =	.23	.89
80% =	.51	1.42
90% =	1.01	2.74
100% =	3.60	7.55

*Minimum permitted

Street Wall

Housing Quality Program

New York City

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NEIGHBORHOOD IMPACT

6. HEIGHT OF STREET WALL

GOAL

To maintain neighborhood scale by matching the height of the portion of the new building facing the street to the height of surrounding buildings.

PROGRAM

The height of the *street wall* of the proposed development should equal the median height of the *street wall* of the existing buildings within the *street district* and on the same side of the street.

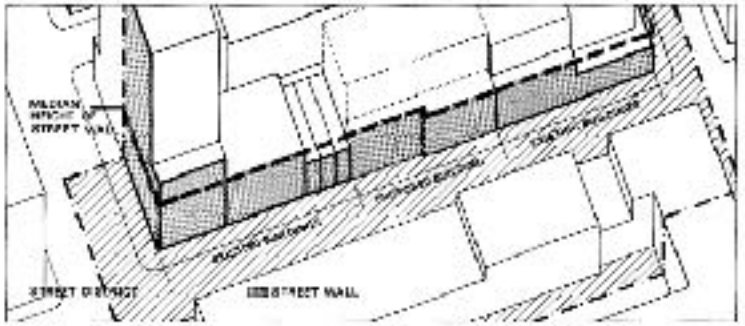
- If more than 20% of the *neighborhood grid squares* on that side of the street and within the same *street district* are not built upon, the computation of the median shall be enlarged to include all buildings in the *street district*.
- Determine the median height of the existing *street wall* by computing the median height of only those *neighborhood grid squares* which are built up and have no other built up *grid squares* between them and the street in a perpendicular direction to the street property line.
- The average height of the proposed *street wall* is determined in the same way as the height of the existing *street wall*.
- Grid squares less than 50% built upon shall be regarded as non built upon and shall not be computed.
- A roof height of the *street wall* may be excluded from this computation provided it makes an angle of no more than 45° with the ground.

COMPLIANCE

(A/B)100 = %: when the proposed *street wall* height is more than the existing *street wall* height
(B/A)100 = %: when the proposed *street wall* height is less than the existing *street wall* height

PREFERRED (A)	PROPOSED (B)	SCALE	
		Built Up	Non Built Up
median height of the existing *street wall* is A ft.	average height of the proposed development's *street wall* is B ft.	*50% = .00	
		60% = .31	
		70% = .63	NOT
		80% = 1.13	APPLICABLE
		90% = 2.03	
		100% = 3.05	

*Minimum permitted



Street Wall Height

Housing Quality Program

New York City

SECURITY & SAFETY

2. VISIBILITY OF PRIVATE OUTDOOR SPACE FROM LOBBY

GOAL

To make *private outdoor space* visible from the *lobby*.

PROGRAM

All private open space should be visible from the *threshold point* of the *lobby* vestibule.

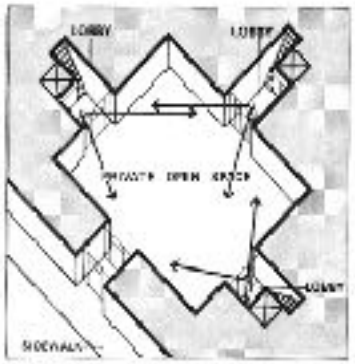
- When more than one *private outdoor space lobby* opens onto *private outdoor space*, visibility should be computed as the average visibility for each *lobby*.
- Permanent structures 5'-0" high are obstructions and render the area behind them invisible.
- Apartments which exit directly into *private open space* are in 100% compliance. When a development contains apartments which exit directly into *private open space* and apartments which exit through a *lobby*, a weighted average (based on the number of apartments in each type) shall be computed to find overall compliance.
- For *private outdoor space* which is not entered onto from lobbies (i.e. - roofing *recreation space*) the entry point to that space shall be considered to be a *lobby* provided it connects directly to an elevator or, in the case of a non-elevator building, a general circulation stairway.

COMPLIANCE

(B/A)100 = %

PREFERRED (A)	PROPOSED (B)	SCALE
A = sq. ft. of *private outdoor space*	B = sq. ft. of *private outdoor space* visible from *lobby*	*50% = .00 60% = .77 70% = 1.53 80% = 2.31 90% = 3.90

*Minimum permitted



Security and Safety

Housing Quality Program

New York City

Neighborhood Impact

The six elements grouped under Neighborhood Impact are designed to ensure continuity. Neighborhoods may change in character or even scale but should not be torn apart by assertive, insensitive and isolated structures whose occupants are regarded as intruders. By tying the height of a new apartment building to that of surrounding buildings, this program opens the way for gradual and non-disruptive transitions.

"Street districts" establish the context for determining the height of the new buildings. City children play naturally within the boundaries of street districts: i.e., continuous rows of buildings ended by wider streets.

Slightly different values are given to Neighborhood Impact elements when the street district is largely vacant or "non-built up."[v]

	Built Up Neighborhood
Off-site sunlight: minimizes the effect of shadows cast by the new building on adjoining properties	6.0
Street wall length: relates the front of the new building to the facades of its neighbors	3.1
Ground floor activity: encourages visual activity facing the street	4.9
Street wall height: uses setbacks to integrate a new building into a district where adjoining buildings are of different sizes	3.1
Building height: regulates the average height of a project so it conforms to the median height of adjacent buildings	3.1
Street trees: assures shaded and attractive sidewalks	2.8
Total	25.0

Recreation Space

This program is at once more specific and less restrictive than conventional zoning. Instead of undifferentiated open space, half of which may be used for parking in R3 to R9 districts, HQ zoning calls for distinct recreation areas with facilities for adult use, child use, mixed use and free use. Recreation spaces would reflect the tenant population, whose nature can be readily projected from a breakdown of apartments according to size. HQ zoning would allow recreation spaces to be located on roofs, in covered or weather-protected areas and, exempt from the floor area count, indoors; conventional zoning restricts open space to ground level or a roof no more than 23 feet above ground.

Adult recreation spaces could consist of solariums, non-basement laundry rooms, craft shops, meeting rooms and gymnasiums. Child use spaces could be either indoors or outdoors. A typical free use space would be a rooftop terrace. Mixed use space for both adults and children would include basketball courts and swimming pools.

	Points
Type and size: lists the requirements for the different recreation spaces, including minimum sizes	9.4
Sunlight access: ensures that as much outdoor space as possible receives sunlight between 9 a.m. and 3 p.m. during the equinox	5.5
Parking: encourages enclosed and underground parking	4.1
Planting: provides landscaping within outdoor recreation areas and as buffers between such areas and other uses	3.1
Trees: specifies the preferred total inches of tree diameter in recreation areas	2.9
Total	25.0

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Security and Safety

The design of an apartment building can discourage crime and vandalism by opening up to maximum surveillance those public areas vulnerable to trespassing -- elevator entrances, lobbies and corridors -- and by making it easier for occupants to recognize their neighbors and identify outsiders. The guidelines aim at ensuring high visibility and creating a sense of intimacy.

In addition, weight is given to the presence of round the clock doormen.

	Points
Density of public corridor: limits the number of rooms per corridor in order to facilitate recognition among neighbors	5.0
Visibility from public space to elevator doors: makes it possible to see the elevator waiting area from the sidewalk	5.0
Visibility of private outdoor space from the lobby: establishes criteria for visual surveillance of tenants' outdoor space	5.0
Surveillance from apartments: concentrates the elderly and other stay-at-homes on lower floors in order to maximize surveillance of outdoor space	4.4
Entry of building from parking garage or lot: forbids direct access into a building from an uncontrolled point	3.1
Visibility from elevator door to apartment door: secures visibility of all apartment entries from the elevator door	2.5
Total	25.0

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Shadow Area, Proposed

"Proposed shadow area" is the area of land which is offsite and in the shadow of the proposed *development*. The area of *streets* (excluding sidewalks), land under water, manufacturing districts and C8 Districts which lie within the shadow of the proposed *development* shall not be included in the *proposed shadow area*. Measurements shall be taken at 9 A.M., 12 Noon and 3 P.M. during the equinox. All land shall be considered vacant.

The required azimuths (angle of the sun in plan) are 1) 57 degrees east of south at 9 A.M., 2) 0 degrees south at Noon and, 3) 57 degrees west of south at 3 P.M. The formula for the shadow lengths is 1.5 times the *building* height at 9 A.M. and 3 P.M. and .3 times the *building* height at 12 Noon. Land which is in the *proposed shadow area* during more than one time period shall be counted separately for each time period.

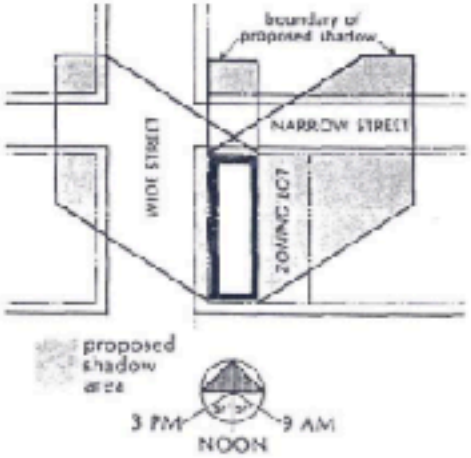

Illustration of Proposed Shadow Area

Street District

A "street district" is an area surrounding the *zoning lot*. The length of the *street district* is determined by extending the centerline of the *street* on which the *zoning lot* fronts from each *side lot line* to the intersection of the centerline of a *street* of equal or greater width. In no case, however, shall the length of a *street district* from one side lot line be greater than 1,200 feet. The depth of the *street district* is equal to the distance between the centerlines of the blocks on either side of the *street* on which the *zoning lot* fronts. If the centerline of a block is greater than 100 feet from the street line a 100 foot depth shall be used. There shall be a *street district* for every *street* fronting on a site. If a portion of the *zoning lot* does not fall within any *street district* the boundary of the most contiguous *street district* shall be extended to include only that portion of the *zoning lot*.

Illustration of Street District

Street District, Built Up

A "built up street district" is a *street district* in which 20% or more of its area is covered by *buildings*. The area of any *streets* or *public parks* which fall within the boundaries of the *street district* shall be ignored for purposes of this computation. The *zoning lot* containing the proposed *development* as well as any *buildings* scheduled for clearance under a designated urban renewal plan shall be considered vacant except for any portion of such land which contains an existing *building* or *buildings* scheduled to remain as part of the proposed *development* or urban renewal plan.

Street District, Non Built Up

A "non built up street district" is a *street district* which has less than 20% of its area covered by *buildings*. For purposes of this computation the area of any *streets* or *public parks* which fall within the boundaries of the *street district* shall be ignored. The *zoning lot* containing the proposed *development* as well as any *buildings* scheduled for clearance under a designated urban renewal plan shall be considered vacant except for any portion of such land which contains an existing *building* or *buildings* scheduled to remain as part of the proposed *development* or urban renewal plan.

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Shadow Sweep – Comparison

March 21
9:00 am –
2:00 pm

Area of Park in Shadow for an Hour or More

Proposed Building
Proposed and Alternative
Alternative Building

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Shadow Sweep – Comparison

March 21
9:00 am –
2:00 pm

Area of Park in Shadow for an Hour or More

Proposed Building
Proposed and Alternative
Alternative Building

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Shadow Sweep –

Proposed Building

March 21
9:00 am –
2:00 pm

Area of Park in Shadow for an Hour or More

Proposed Building

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Shadow Sweep – Alternative Building

March 21
9:00 am –
2:00 pm

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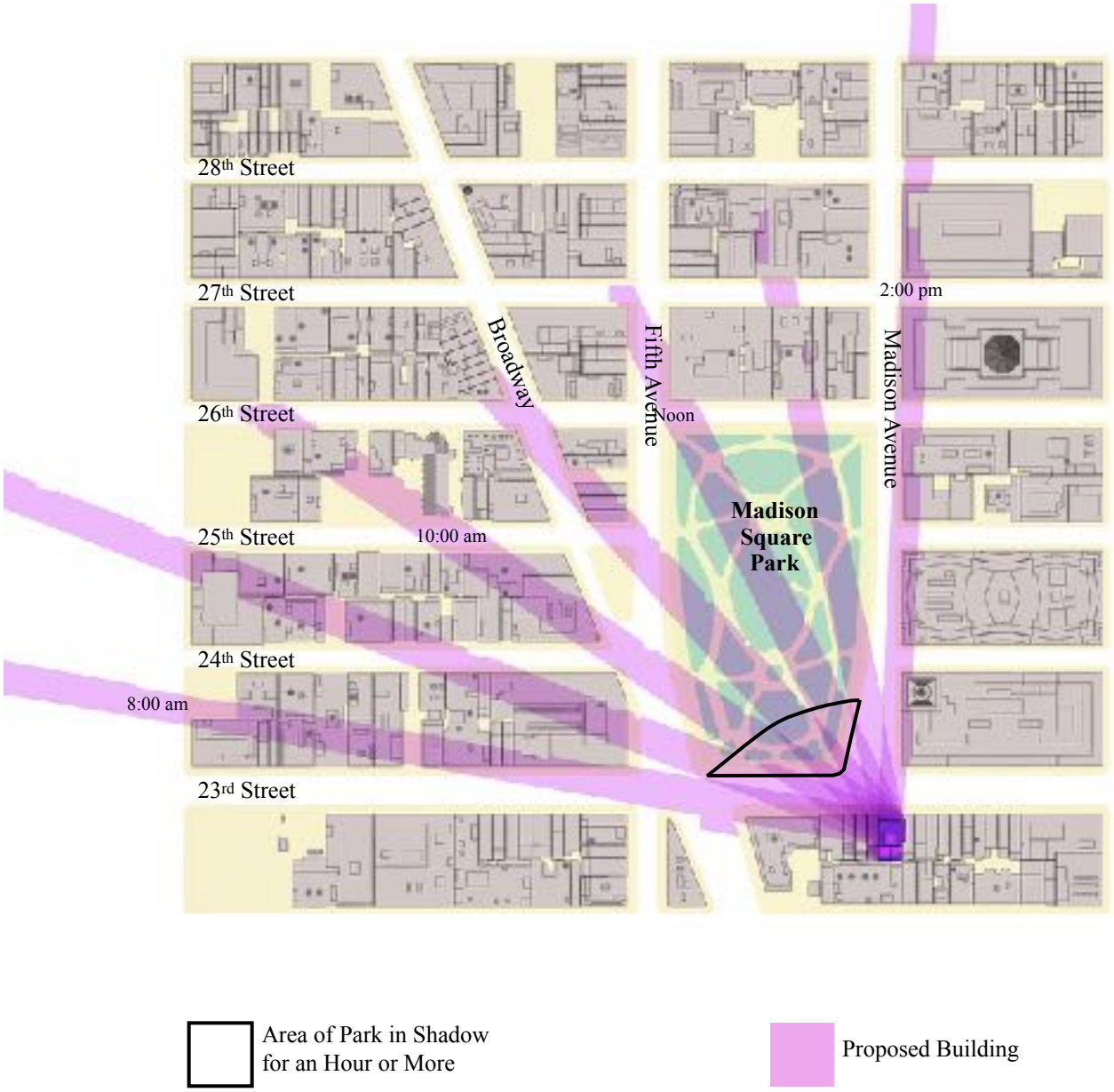
Shadow Sweep –

Proposed Building

December 21
8:00 am –
2:00 pm



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Shadow Sweep –

Alternative Building

December 21
8:00 am –
2:00 pm

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Shadow Sweep – Comparison

December 21
8:00 am –
2:00 pm

Area of Park in Shadow for an Hour or More

Proposed Building
Proposed and Alternative
Alternative Building

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Shadow Sweep –

Alternative Building

8:00 am –
2:00 pm

Area of Park in Shadow for an Hour or More

Alternative Building

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Shadow Sweep –

Proposed Building

December 21
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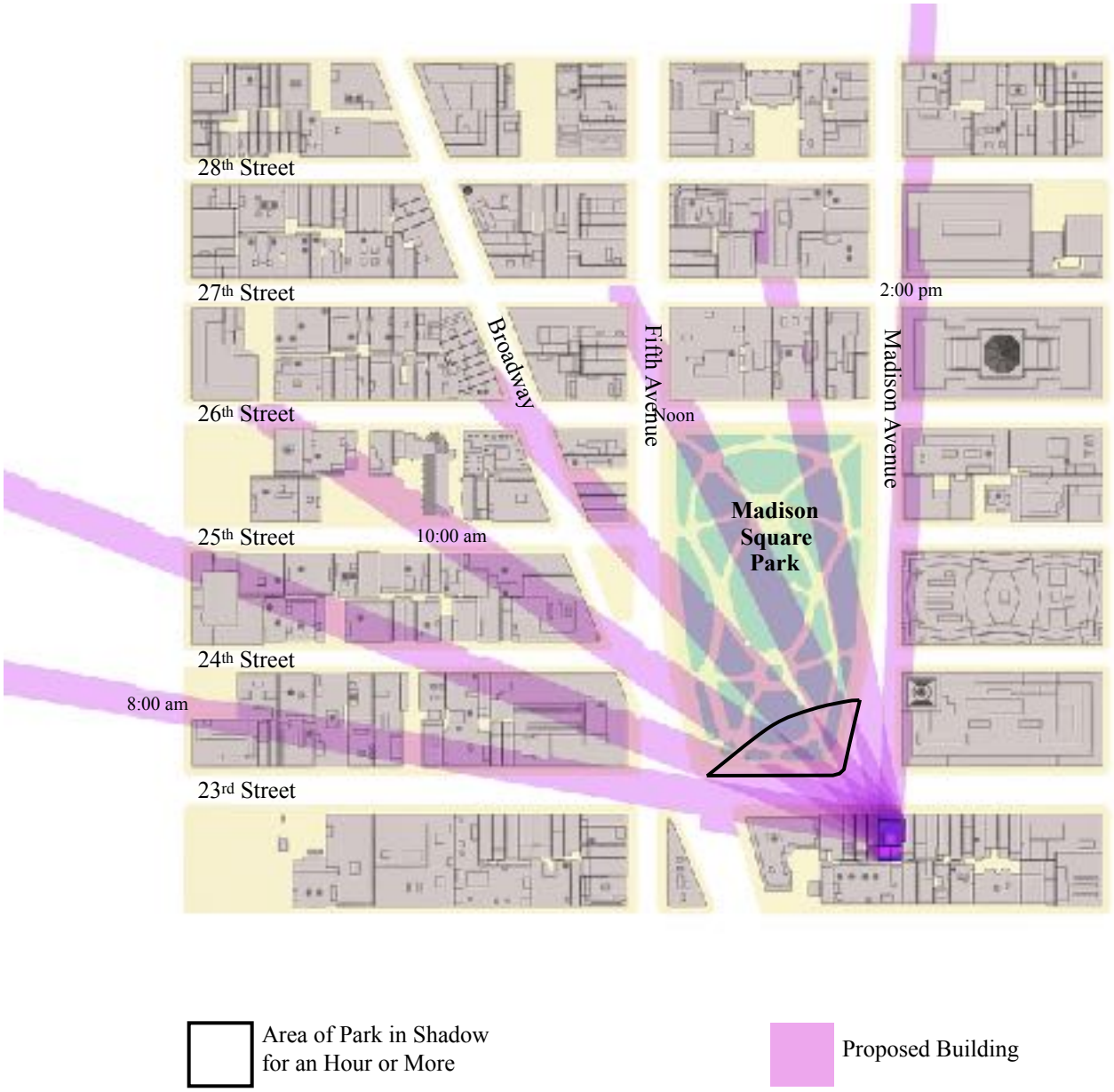

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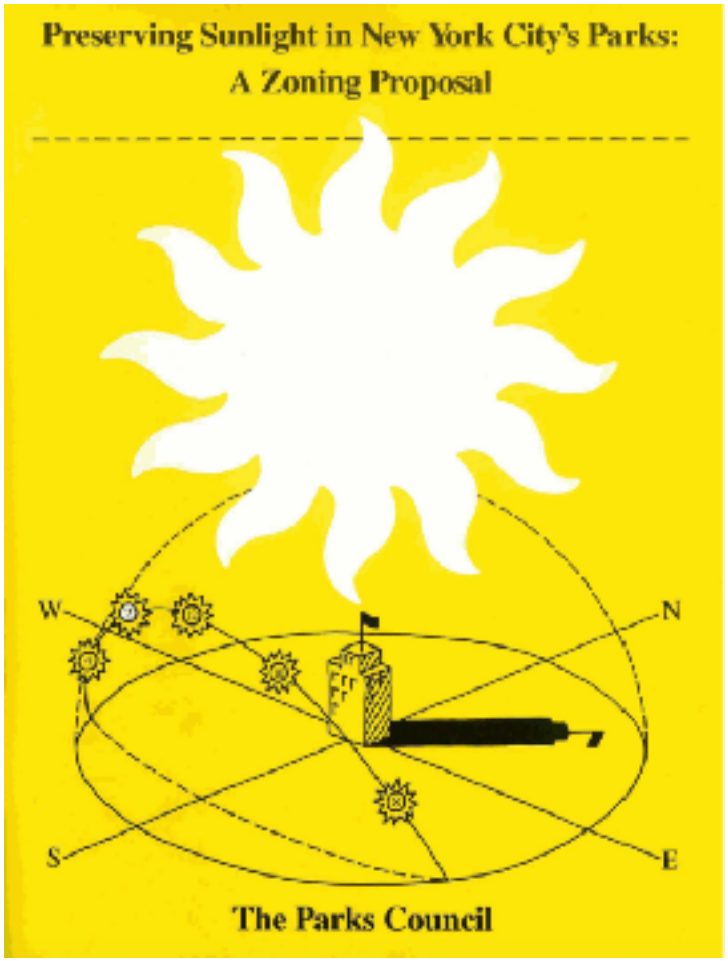
Preserving Sunlight in New York City's Parks: A Zoning Proposal



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Shadow Sweep – Comparison

December 21
8:00 am –
2:00 pm

Area of Park in Shadow for an Hour or More

Proposed Building
Proposed and Alternative
Alternative Building

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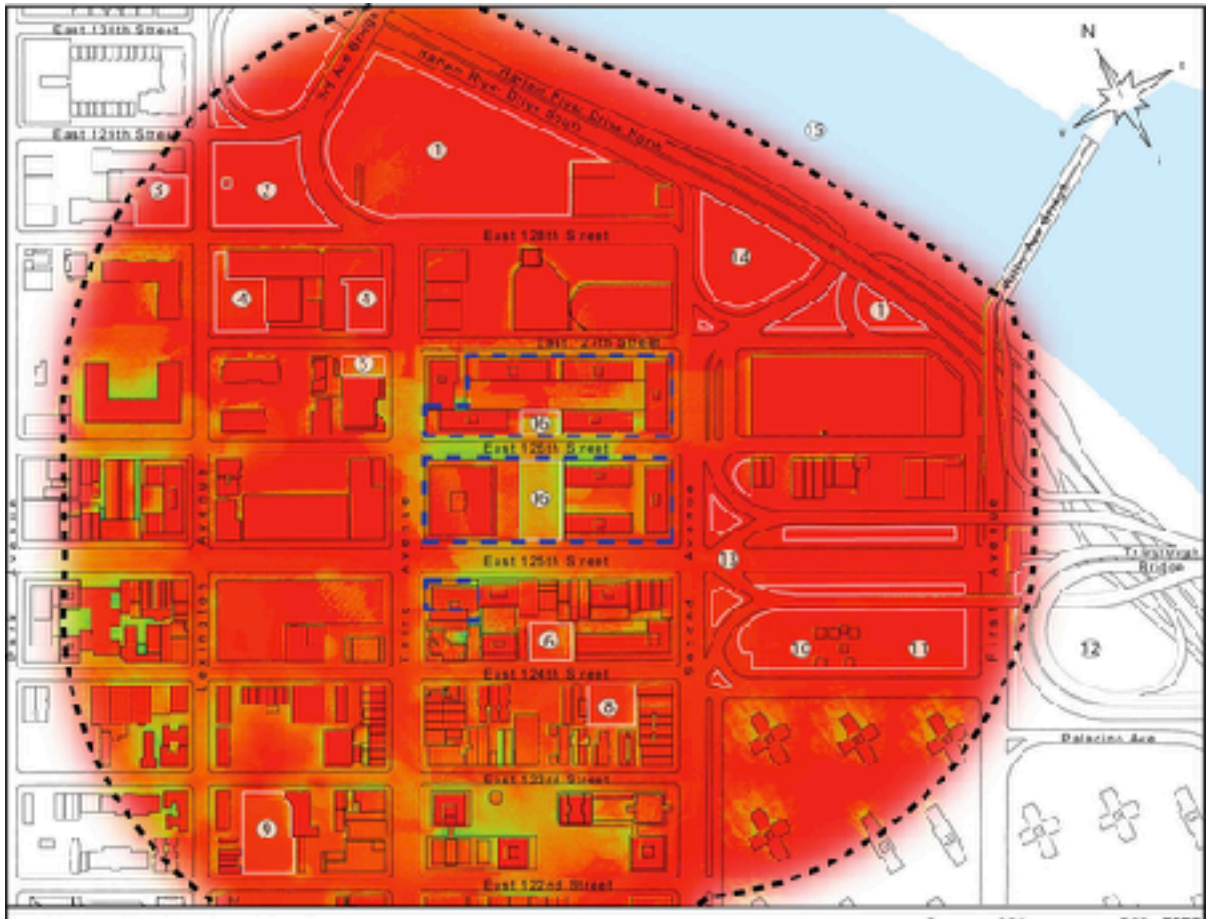

Daylight Analysis of the Proposed Conceptual Plan

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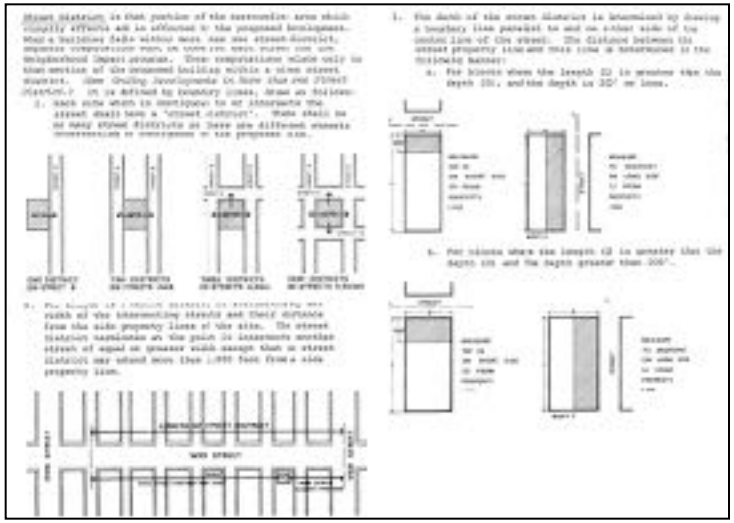
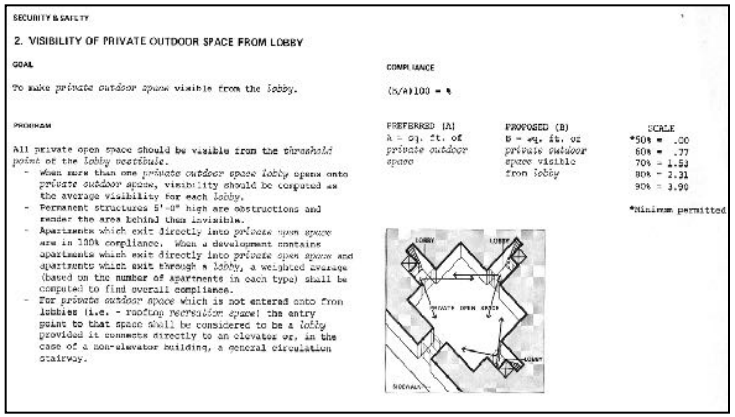
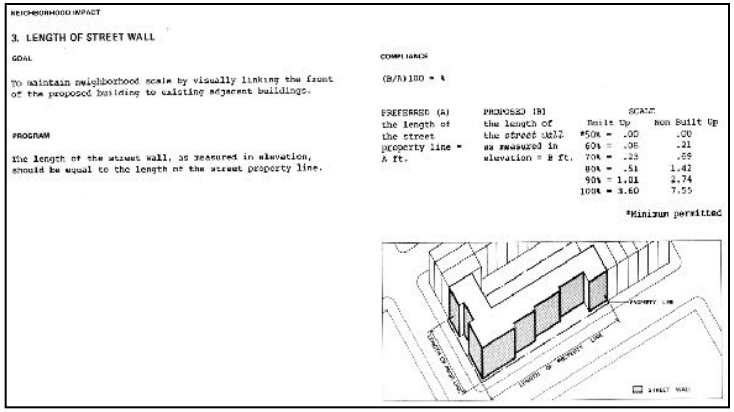


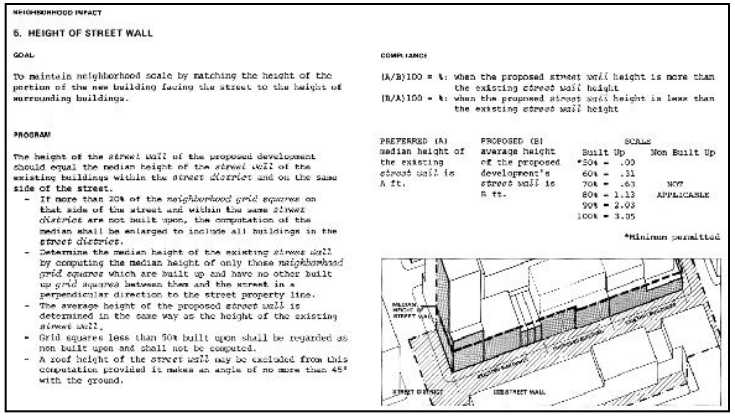
Street District



Courtyards

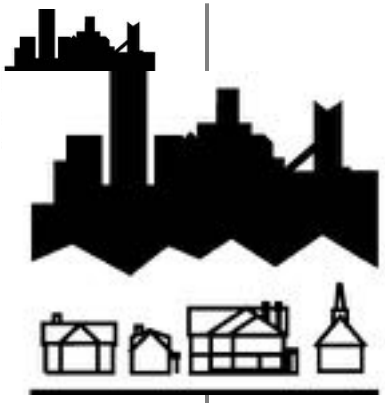


Street Wall



Street Wall Height

Housing Quality Program -- New York City Zoning



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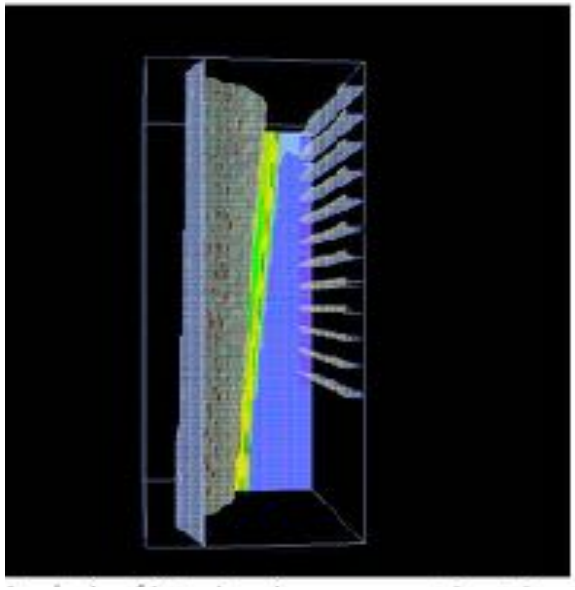
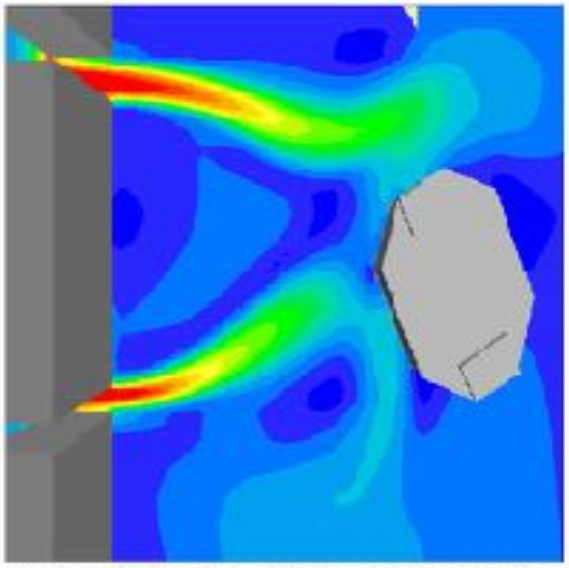
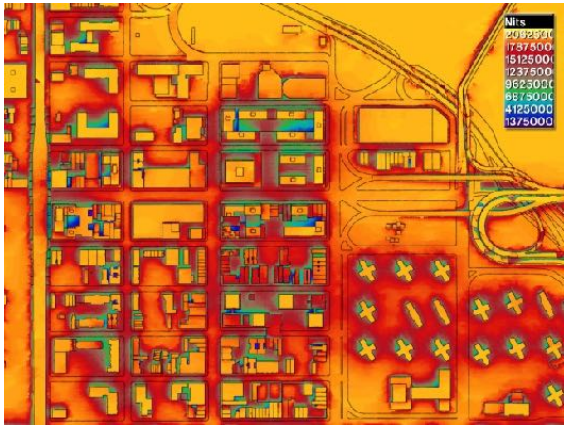


Building Air Circulation

Shadow Impacts

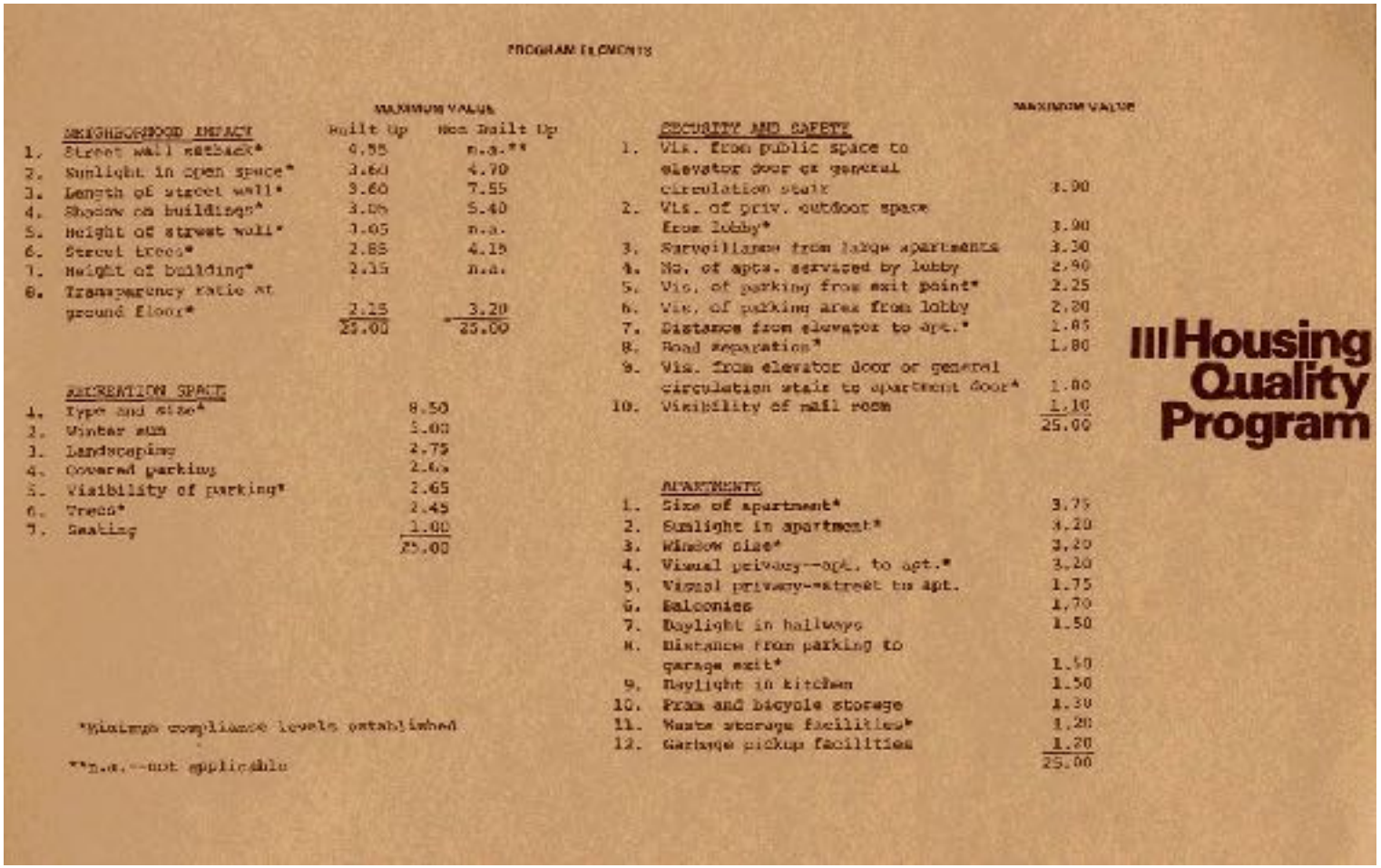
Pedestrian Level Wind





Radiance: Solar Energy

Environmental Performance



PROGRAM ELEMENTS

	NEIGHBORHOOD IMPACT	MAXIMUM VALUE Built Up	Non Built Up
1.	Street wall setback*	0.55	n.a.**
2.	Sunlight in open space*	3.60	4.70
3.	Length of street wall*	9.60	7.55
4.	Shadow on buildings*	3.05	5.40
5.	Height of street wall*	1.05	n.a.
6.	Street trees*	2.85	4.15
7.	Height of building*	2.15	n.a.
8.	Transparency ratio at ground floor*	2.15	3.20
		25.00	25.00

	RECREATION SPACE	
1.	Type and size*	8.50
2.	Winter sun	5.00
3.	Landscaping	2.75
4.	Covered parking	2.65
5.	Visibility of parking*	2.65
6.	Trees*	2.45
7.	Seating	1.00
		25.00

*Minimum compliance levels established

**n.a.--not applicable

	SECURITY AND SAFETY	MAXIMUM VALUE
1.	Vis. from public space to elevator door or general circulation stair	3.00
2.	Vis. of priv. outdoor space from lobby*	3.00
3.	Surveillance from large apartments	3.30
4.	No. of apts. serviced by lobby	2.90
5.	Vis. of parking from exit point*	2.25
6.	Vis. of parking area from lobby	2.20
7.	Distance from elevator to apt.*	1.65
8.	Road separation*	1.80
9.	Vis. from elevator door or general circulation stair to apartment door*	1.80
10.	Visibility of mail room	1.10
		25.00

	APARTMENTS	
1.	Size of apartment*	3.75
2.	Sunlight in apartment*	3.20
3.	Window size*	3.20
4.	Visual privacy--apt. to apt.*	3.20
5.	Visual privacy--street to apt.	1.75
6.	Balconies	1.70
7.	Daylight in hallways	1.50
8.	Distance from parking to garage exit*	1.50
9.	Daylight in kitchen	1.50
10.	Pram and bicycle storage	1.30
11.	Waste storage facilities*	1.20
12.	Garbage pickup facilities	1.20
		25.00

III Housing Quality Program

Measuring Performance

Housing Quality Program

New York City

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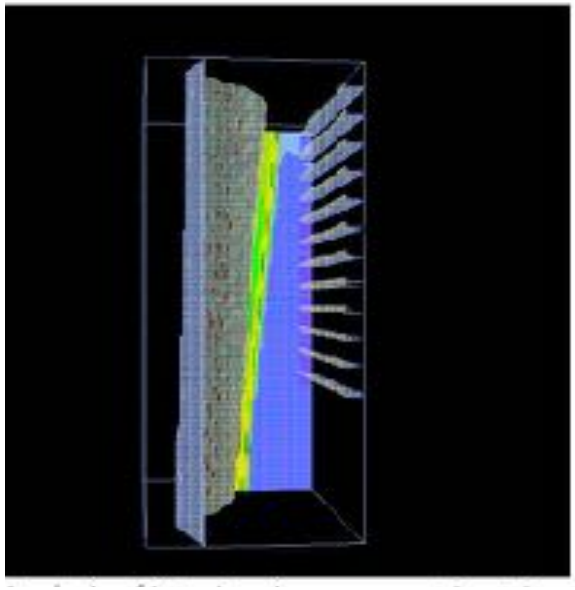
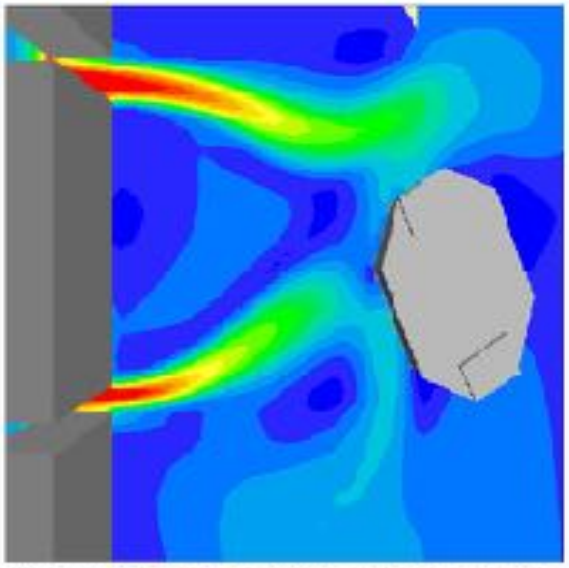
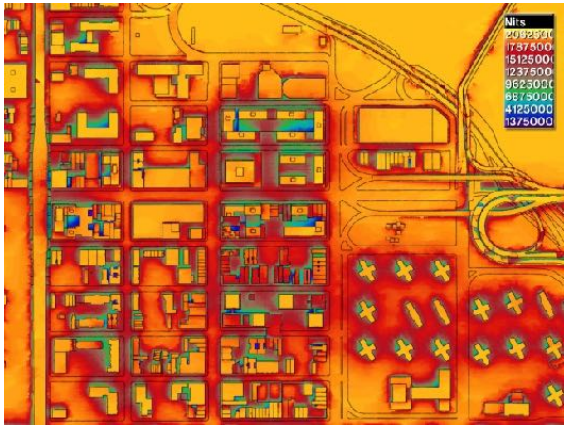


Building Air Circulation

Shadow Impacts

Pedestrian Level Wind





Radiance: Solar Energy

Environmental Performance