

NYSERDA RetrofitNY
Market Characterization Study:
Building Stock Assessment
and Architectural Profiles of
Predominant New York State
Multifamily Building Types

Addendum to Report 20-20 | Report Number 20-20a | August 2020

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Addendum Report to Report 20-20

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Notice

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Abstract

New York State’s ambitious energy and retrofit goals toward decarbonization require the development of novel approaches and technologies for integration in the State’s existing building stock. This Addendum focuses on characterizing an additional building type representing a significant amount of Gross Square Footage (GSF) as a percentage of New York State multifamily housing stock. For all work completed, the methodology included the following: (1) analysis of previously collected building data provided by New York State Energy Research and Development Authority (NYSERDA), and (2) categorization of low- and mid-rise buildings into major types by major features, including: vintage of original construction, exterior wall structure, cladding material, gross square footage, number of stories, and envelope area. In addition, random samples of photographic documentation were studied to verify details of records in the list data provided and to confirm visual details found in architectural standards and other historical documentation. The initial results of the main study include detailed architectural profiles of seven major multifamily building types, with further description regarding predominant construction trends and styles in each type. This addendum includes detailed architectural information on an eighth type, which was defined in accordance with building characteristics previously established in the main report, and which constitutes a significant area (over 450 million square feet) of postwar residential buildings primarily found in the New York City area.

Keywords

Multifamily housing, envelope, enclosure, retrofit, façade, historical buildings, postwar

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Acronyms, and Abbreviations, and Definitions

Affordable Housing:	Housing in which at least 25% of building households earn less than or equal to 80% of Area Median Income.
Dwelling Unit (DU):	This refers to an apartment, typically rental unit in multifamily buildings, irrespective of size or number of rooms.
Gross Square Footage (GSF):	This refers to total horizontal building area, including circulation and service space in addition to leasable or occupied space.
Low-Rise Building:	Building with one to three stories.
Mid-Rise Building:	Building with four to seven stories.
High-Rise Building:	Building with eight or more stories.
New York State (NYS):	All counties in New York State, including the five boroughs of New York City.
New York City (NYC):	The five boroughs of New York City (New York, Bronx, Queens, Kings, Richmond).

1 Introduction

This document is an addendum to the report titled NYSERDA RetrofitNY Market Characterization Study: Building Stock Assessment and Architectural Profiles of Predominant New York State Multifamily Building Types. It serves to examine an eighth building type: the mid-rise, postwar vintage, which should be added to the seven considered in the main report. Although totaling fewer buildings than the others, Type 8, characterized below, represents a significant percentage of total building square footage in the New York State market. Information in this document is similar in depth and detail to the information given on Types 1 through 7 described in the main report. Below is a revised summary table inclusive of Type 8.

Table 1. Summary Characteristics of Predominant New York State Multifamily Building Types

Segment Description	Vintage	Pre-1940		1940 - 1978		1979 - 2006		1940-1978
	Building Height (Stories)	1 to 3	4 to 7	1 to 3	1 to 3	1 to 3	4 to 7	
Segment Characteristics	Count, MF Bldgs in NYS ²	396,343	46,258	171,793	84,792			6,124
	% MF Bldgs in NYS ³	38.67%	4.51%	16.76%	8.27%			1.00%
	Total Floor Area ⁴ (GSF)	1,160,883,262	1,248,583,402	2,683,558,039	1,112,456,713			454,292,018
	Total Exterior Wall Area ⁵ (SF)	1,164,243,036	534,264,627	700,535,956	355,906,065			200,716,697
	Type	1	2	3	4	5	6	7
Structural Material	Masonry	Wood Frame	Masonry	Wood Frame	Masonry	Wood Frame	Masonry	Concrete and steel
Cladding Materials	Brick, stone, stucco	Brick veneer, wood, stucco	Brick, stone, stucco	Brick veneer, wood, stucco	Brick, stone, stucco	Brick veneer, wood, stucco	Brick, stone, stucco	Brick, concrete
Number of Stories	3	3	4 to 7	3	3	3	3	4 to 7
Average Bldg Floor Area (GSF)	2,400 - 6,000	1,200 - 4,800	4,800 - 45,000	9,000 - 10,800; 100,000 or more for complexes	9,000 - 10,800; 100,000 or more for complexes	14,400 - 22,500; 100,000 or more for complexes	14,400 - 22,500; 100,000 or more for complexes	40,000 - 75,000; large complexes can reach several million
Average Envelope Area (SF)	1,400 - 7,200	3,500 - 6,000	2,700 - 24,000	9,100 - 10,500; 75,000 or more for complexes	9,100 - 10,500; 75,000 or more for complexes	11,200 - 14,000; 75,000 or more for complexes	11,200 - 14,000; 75,000 or more for complexes	20,000 - 30,000; large complexes can be in the millions
Width (FT)	20 - 40	20 - 40	30 - 90	100 - 120	100 - 120	120 - 150	120 - 150	These buildings are not typically rectangular
Depth (FT)	40 - 50	30 - 40	40 - 70	30	30	40 - 50	40 - 50	
Height (FT)	35	35 - 40 ⁵	45 - 75	35	35	35	35	
# Units	2 to 4	2 to 4	4 to 45	10 to 20 per building; up to 200 for complexes	10 to 20 per building; up to 200 for complexes	10 to 20 per building; up to 200 for complexes	10 to 20 per building; up to 200 for complexes	Predominantly 50+ and commonly 200+ for large complexes
Unit Area (GSF)	500 - 1,600	500 - 1,600	500 - 1,600	500 - 1600	500 - 1600	800 - 2000	800 - 2000	500-1600
WWR (%)	10 to 20	10 to 20	10 to 20	10 to 15	10 to 15	10 to 15	10 to 20	10 to 15
R-value, Wall	2 to 4	3 to 5	2 to 5	6 to 7	3 to 5	10 to 12	12 to 15	3 to 5
R-value, Roof	2 to 4	1 to 2	2 to 4	3 to 4	2 to 4	4 to 5	22 to 24	2 to 4

Notes:

1. Average characteristics of predominant types within each segment, based on summary statistics (Tables 13 + 14) and analysis of individual building records
2. From Table 8
3. From Table 9
4. From Table 10
5. Height assumed to the ridge line (top of pitched roof)

2 Data Sources and Data Accuracy

As with the main report, this document refers to data compiled by ICF International as part of their report titled New York Residential Building Stock and Energy Cost Analysis, submitted to New York State Energy Research and Development Authority (NYSERDA) on December 22, 2017. Initial analysis of this segment suggested a relatively small building count for four to seven story buildings built between 1940 and 1978. However, further review of data showed the building type might comprise a significant amount of floor area compared to other segments (Table 2).

Table 2. Characterization of Type 8 from Original Report

Vintage	Building Height	Unit Cut	NY Upstate				NYC				NYS			
			MF Bldg #	MF Bldg %	Bldg Area (GSF)	Bldg Area %	MF Bldg #	MF Bldg %	Bldg Area (GSF)	Bldg Area %	MF Bldg #	MF Bldg %	Bldg Area (GSF)	Bldg Area %
1940 - 1978	Mid-Rise	Single	0	0.0%	0	0.0%	9	0.0%	90,133	0.0%	9	0.0%	90,133	0.0%
		2 - 4 units	62	0.0%	1,041,000	0.2%	223	0.0%	1,087,387	0.0%	285	0.0%	2,128,387	0.0%
		>= 5 units	473	0.2%	18,478,244	3.1%	6763	1.2%	2,441,859,163	25.3%	7236	0.9%	2,460,337,407	24.0%
			535		19,519,244		6,995		2,443,036,683		7,530		2,462,555,927	

Figure 1. A Six-Story Building in a 40-Unit Complex: 785 Schenk Avenue in Brooklyn, NY

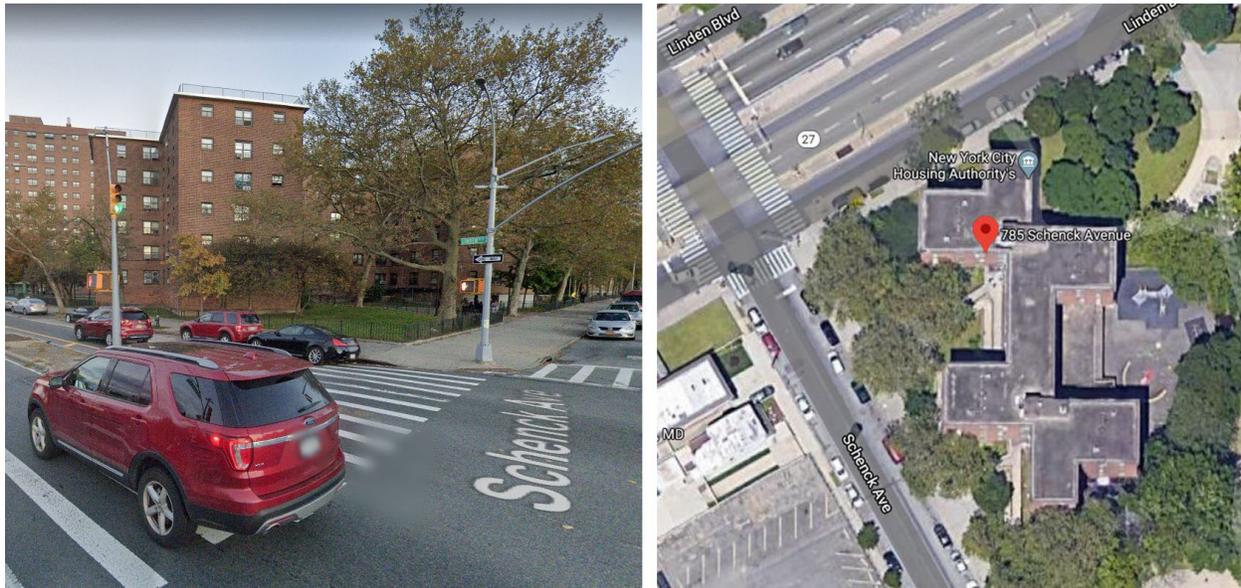


Table 3. Examples of Multibuilding Complexes with Erroneously Reported Building Floor Area

Address	City	Borough	Zip Code	Affordable	Building Count	Building Area	Floor Count	Unit Count	Owner Name
785 SCHENCK AVE	NEW YORK	BROOKLYN	11207	Affordable	40	3,117,306	6	72	NYCHA
604 CLINTON ST	NEW YORK	BROOKLYN	11231	Affordable	32	2,728,410	6	114	NYCHA
3403 21 ST	ASTORIA	QUEENS	11106	Affordable	31	2,197,500	6	96	NYCHA
80 GOLD ST	NEW YORK	MANHATTAN	10038	Affordable	9	2,155,492	6	184	SOUTHBRIDGE TOWERS IN
2985 AVE X	NEW YORK	BROOKLYN	11235	Affordable	35	2,104,000	6	60	NYCHA
90 PALADINO AVE	NEW YORK	MANHATTAN	10035	Affordable	22	1,981,410	7	54	NYCHA
452 MARCY AVE	NEW YORK	BROOKLYN	11206	Affordable	28	1,636,248	6	48	NYCHA
2595 3 AVE	NEW YORK	BRONX	10451	Affordable	15	1,624,100	6	48	NYCHA
284 ROCKAWAY PKWY	NEW YORK	BROOKLYN	11212	Market	12	1,622,073	6	52	
1055 ROSEDALE AVE	NEW YORK	BRONX	10472	Affordable	31	1,503,770	7	54	NYCHA

To arrive at an accurate assessment of the large floor area represented by this type, a significant number of discrepancies had to be corrected for first. Entries for large multibuilding complexes often erroneously attribute the floor area for the entire complex to an individual building. For example, the floor area of the six-story building at 785 Schenck Avenue in Brooklyn is reported as 3,000,000 square feet (sf)—a value that likely represents the total floor area of the entire 40-building complex (Table 3). These errors are compounded by the practice of duplicating records for properties containing multiple buildings on a single lot (described on page 11 of the main report). When erroneous records are duplicated, the reported floor area increases proportionately.

Figure 2. Plot of Building Count versus Building Area

The comparison shows the correlation of larger building count with larger building area.

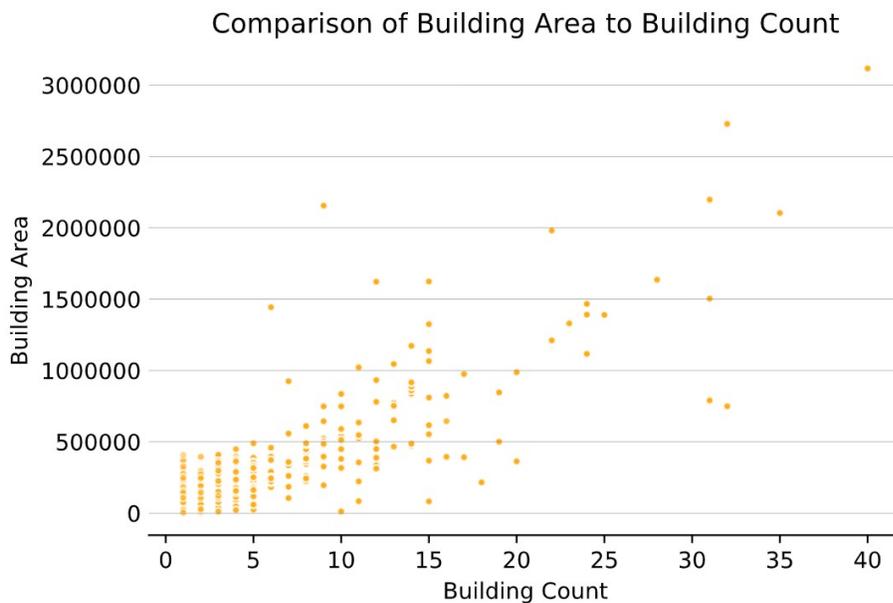
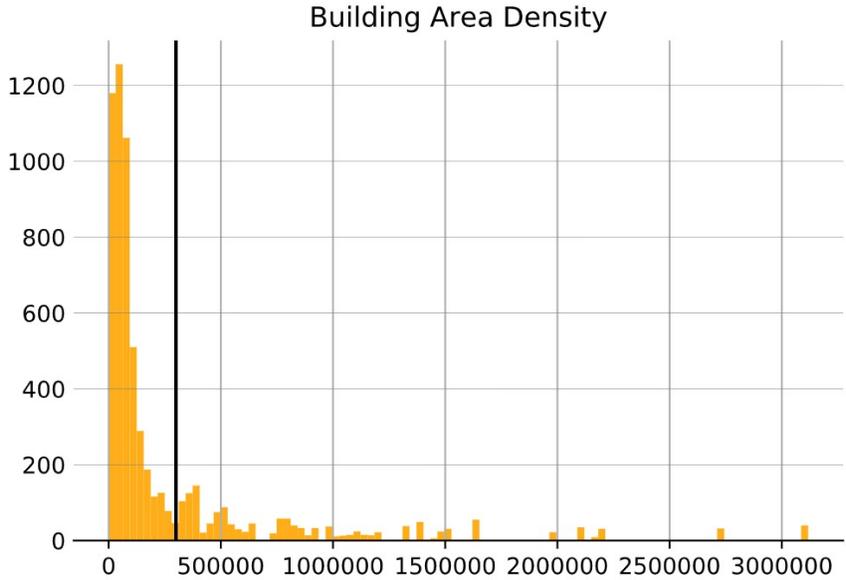


Figure 3. Plot of Building Area versus Building Count, Building Area Density

The below chart shows an inflection point at 300,000 square feet.



Further evidence of this phenomenon is illustrated by comparing building area to the number of buildings on the lot. Normally, we would not expect to see a correlation between building size and building count. This is the case for smaller building counts. However, larger building counts do appear to be correlated with larger building areas—an unexpected result suggesting that these values represent the total floor area of the complex, not the area of an individual building (Figure 2).

Plotting the overall distribution of building area suggests that abnormal values for floor area begin at 300,000 sf, as indicated by the black line in Figure 3. This is an upper limit for the floor area of an individual mid-rise building, resulting in a floor plate of 43,000–50,000 sf for a six- to seven-story building. This threshold also represents an inflection point in the data. Below 300,000 sf, the number of buildings in the data set decreases as floor area increases, an expected result reflecting fewer instances of very large buildings. Above 300,000 sf, this pattern reverses, suggesting potential errors within the data. To resolve these errors, the floor area for buildings with greater than 300,000 sf was divided by the number of buildings on the lot. These entries were not removed from the data set.

In addition to modifying building area values above 300,000 sf, outliers were removed from the data set for the purpose of ensuring data quality when calculating average building characteristics. A conservative approach of three standard deviations from the mean was used to remove extreme entries. In addition,

individual records were checked manually (by counting buildings, number of floors, and measuring footprints) and deleted when major errors were detected. Data cleaning reduced the number of entries to 6125 from 6685 (560 entries, or 8% of the data set were removed).

Table 4 reflects the revised characterization of the postwar, mid-rise segment, after the errors described above were corrected and outliers removed. This shows that while both the number of multifamily buildings and their corresponding floor area for Type 8 may be significantly lower than what the data sets seemed to initially indicate, they still represent a significant portion of built space in New York State. While the 6,124 buildings that fall into this category represent only 0.75% of all New York State’s multifamily buildings, they total over 454 million gross square feet, or 5.5% of all multifamily floor area in the State. Table 4 includes an excerpt of the revised count and floor area of Type 8 after data cleaning. The complete table is included in Appendix 2: Revised Count and Floor Area of Types 1 through 8.

Table 4. Revised Characterization of Type 8 after Data Cleaning

Vintage	Building Height	Unit Cut	NY Upstate				NYC				NYS			
			MF Bldg #	MF Bldg %	Bldg Area (GSF)	Bldg Area %	MF Bldg #	MF Bldg %	Bldg Area (GSF)	Bldg Area %	MF Bldg #	MF Bldg %	Bldg Area (GSF)	Bldg Area %
1940 - 1978	Mid-Rise	Single	0	0.0%	0	0.0%	9	0.0%	90,133	0.0%	9	0.0%	90,133	0.0%
		2 - 4 units	60	0.0%	1,036,500	0.2%	140	0.0%	870,121	0.0%	200	0.0%	1,906,621	0.0%
		>= 5 units	406	0.2%	13,929,266	2.3%	5,509	1.0%	438,365,998	5.7%	5,915	0.7%	452,295,264	5.5%
			466		14,965,766		5,658		439,326,252		6,124	0.75%	454,292,018	5.50%

2.1 Segment Characteristics

The majority of postwar, mid-rise buildings in Type 8 are located in the five boroughs of New York City. About 33% of these buildings are affordable, defined as housing in which at least 25% of building households earn less than or equal to 80% of the Area Median Income (Table 5). About 60% of the affordable buildings, representing about 84,000,000 sf of floor area, are owned by the New York City Housing Authority, or NYCHA (Table 6).

Table 5. Affordable versus Market-Rate Housing in Type 8

		Unit Cut	Affordable				Market-Rate			
			Bldg #	Bldg %	Area (GSF)	Area (%)	Bldg #	Bldg %	Area (GSF)	Area (%)
1940 - 1978	Mid-Rise	Single	0	0.00%	0	0.00%	9	0.15%	90,133	0.02%
		2 - 4 units	2	0.03%	14,600	0.00%	198	3.23%	1,892,021	0.42%
		>= 5 units	1,994	32.56%	147,852,007	32.55%	3,921	64.03%	304,443,258	67.01%
					147,866,607	32.55%			306,425,412	67.45%

Table 6. Percentage of Housing Owned by the New York City Housing Authority (NYCHA)

	Bldg #	Bldg %	Area (GSF)	Area (%)
Affordable	1,996	32.59%	147,866,607	27.42%
NYCHA	1,198	19.56%	84,944,769	15.75%
Market-Rate	4,128	67.41%	306,425,411	56.83%
	6,124		539,236,787	

In contrast to prewar, mid-rise buildings, which are typically individual buildings on urban infill lots, postwar, mid-rise buildings are often part of multibuilding complexes on lots that occupy one or more entire city blocks. These buildings were typically built in the modernist “towers in the park” style, in which buildings are set back from the street and surrounded by green space. The number of buildings per complex ranges from one to 32, with an average (mean) of four to six buildings per complex (Table 7). Because they are not built to the lot line, buildings in complexes were often designed with non-rectangular floor plans, described in detail below. Estimates of the facade area in Table 8, based on assumptions described in the main report, are likely undercounts due to the variety of complex building plan configurations present in this segment.

Table 7. Characterization of Multibuilding Complexes in Type 8

	Number of Multi-Bldg Complexes			Number of Bldgs on Lot			Total Floor Area (GSF)		
	1 bldg	2 to 4 bldgs	>= 5 bldgs	Min	Max	Average	1 bldg	2 to 4 bldgs	>= 5 bldgs
Affordable	180	81	96	1	31	3.7 (5.7 in NYCHA)		14,600 (100% NYCHA)	147,852,000 (57% NYCHA)
Market-Rate	2,620	273	45	1	32	1.2	90,133	1,892,021	304,443,257
Total	2,800	354	141				90,133	1,906,621	452,295,257

Table 8. Estimated Facade Area in Type 8

Vintage	Building Height	Unit Cut	NY Upstate		NYC		NYS	
			Facade Area %	Facade Area (GSF)	Facade Area %	Facade Area (GSF)	Facade Area %	Facade Area (GSF)
1940 - 1978	Mid-Rise	Single	0.00%		0.03%	65,102	0.03%	65,102
		2 - 4 units	0.25%	507,612	0.38%	758,572	0.63%	1,266,184
		>= 5 units	2.73%	5,476,325	96.61%	193,909,086	99.34%	199,385,411
				5,983,937		194,732,760	200,716,697	

2.2 Average Building Characteristics

Table 9. Average Building Characteristics in Type 8

Vintage	Building Height	Unit Cut	Building Count			Avg Bldg Area (GSF)			Avg Facade Area (sf)		
			NYC	NY	NYS	NYC	NY	NYS	NYC	NY	NYS
1940 - 1978	Mid-Rise	Single	9		9	3560		3,560	4296		4,300
		2-4	140	60	200	4486	7800	5,160	4822	6480	5,191
		5-9	259	125	384	7850	9500	8,375	6562	7018	6,787
		10-19	259	103	362	14475	12100	12,900	9600	7920	8,800
		20-49	1,600	74	1,674	41835	36500	41,814	24246	14541	23,000
		50+	3,391	104	3,495	72145	75950	72,360	27788	24171	27,661

Vintage	Building Height	Unit Cut	Avg Bldg Footprint (sf)			Avg # Du			Avg DU Area (sf)		
			NYC	NY	NYS	NYC	NY	NYS	NYC	NY	NYS
1940 - 1978	Mid-Rise	Single	890		890	1		1	3560		3,560
		2-4	1112	1950	1,243	4	3	4	1534	2500	1,650
		5-9	1802	2375	1,965	8	7	7	1075	1357	1,182
		10-19	3027	3000	3,000	13	15	15	956	833	900
		20-49	7000	7170	7,000	37	35	36	1042	1043	1,000
		50+	11832	14271	11,833	73	75	73	967	988	966

Table 9 includes information on the average (median) characteristics of buildings in Type 8, including building area (GSF), building footprint (SF), estimated facade area, number of dwelling units, and dwelling unit area.

2.3 Detailed Architectural Profile: Type 8 (1940–1978, Four- to Seven-Story Masonry)

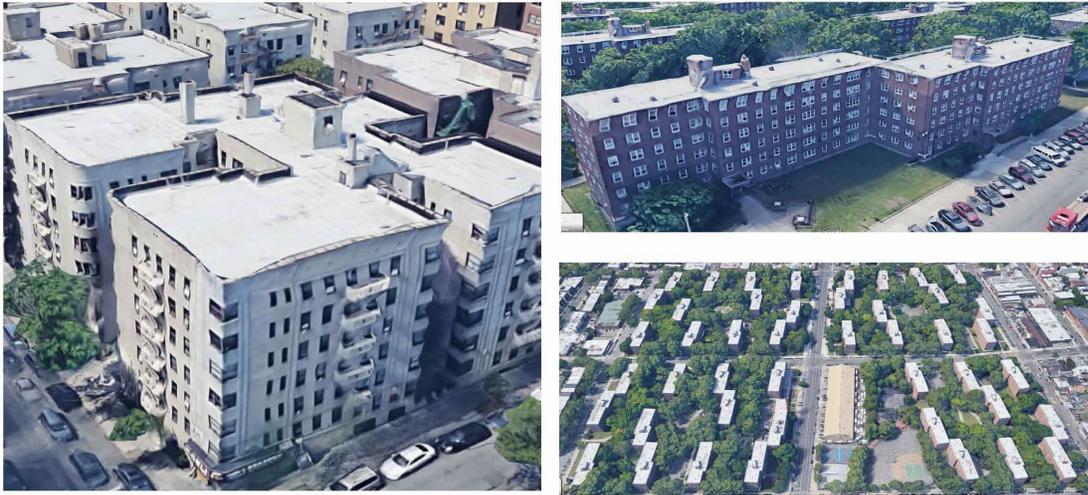
Type 8 consists of buildings of four to seven stories in height built between 1940 and 1978 whose primary structural system is reinforced concrete or steel with masonry infill exterior walls. During this period, due to technological advances in structural and cladding systems, brick was used primarily for exterior cladding in buildings over three stories rather than for structural support. Foundations were of reinforced concrete, and the post-and-beam structural system could be reinforced concrete or steel. Face or veneer brick was layered in front of concrete masonry, frequently without insulation or an air gap. Interior finishes included plaster and lath, gypsum board, or wood paneling.

Buildings in this type are aesthetically similar to low-rise masonry buildings of the same period, as described in Type 5; however, there are key differences that distinguish the larger buildings as a separate type. Firstly, the buildings tend to have substantially larger footprints and overall square footage for their height. Often seen in block or bar geometries with indentations in plan to meet light and air, access, and egress requirements for each apartment, buildings in this type are frequently arranged as double-loaded corridors with highly regular, repetitive glazing configurations. Roofs are consistently flat built-up systems with mechanical rooms mounted close to the center to align with vertical mechanical chases.

Low parapets typically surround the roofs. Elaborate cornices, as seen in the lower-height types, are not typically present. Cladding is overwhelmingly brick masonry.

Figure 4. Examples of Representative Sub-Types in Type 8

LEFT: Infill block building. RIGHT: Freestanding bar building.



Address		917 SHERIDAN AVE	Address		3503 12 ST
Date of Construction		1941	Date of Construction		1960
No. of Buildings		1	No. of Buildings		Not given; between 24-40 by visual check
SF (Area)		16836.66667	SF (Area)		16033
Total Bldg Area?		101020	Total Bldg Area?		96200
No. of Units		99	No. of Units		96
No. of Stories		6	No. of Stories		6
Typical Unit Size		50-100 Units	Typical Unit Size		20-49 Units
County		BRONX	County		QUEENS
Affordable		Market	Affordable		Affordable
Information from Visual Check	Structure	Steel and Concrete	Information from Visual Check	Structure	Steel and Concrete
	Cladding	Stone		Cladding	Brick
	Notes			Notes	~2 dozen similar adjacent buildings, likely part of same complex

The majority of buildings in this type are found downstate in New York County and the surrounding counties of Queens, Kings, and the Bronx, comprising the five boroughs of New York City. In many examples, complexes of buildings of this type are sited on large aggregated lots containing multiple similar, if not identical, buildings that are freestanding or partially attached to one another. Examples of both types are seen in NYCHA’s Ravenswood Houses in Queens (35-03 12th St), on the right in Figure 1. As mentioned, buildings in this type were often designed as “towers in the park,” and were not built to the lot line, as was seen in many of the prewar examples. Each block or bar ranges in average width from 100–150 ft and in depth from approximately 40–50 ft. Heights range from approximately 40–70 ft. Plan configurations of freestanding buildings are often non-rectangular, ranging from

U- or X-shapes to triangular star or hub-and-spoke arrangements. The average building dimensions cited above apply equally to projects with non-rectangular plans. However, buildings with non-rectangular plan geometry will typically have greater floor and facade area for the same overall building dimensions. Table 1 outlines the parameters for typical rectangular buildings in Type 8.

Type 8 building are typically characterized by minimal ornamentation. Many buildings fall in the affordable classification, which is associated with simple façade configurations and economical construction. However, regardless of affordable or market classification, there is often virtually no ornament, in contrast to the prewar buildings. The exception to this is the frequent presence of balconies and fire escapes, specifically on market-rate buildings. An image array demonstrating the range of ornamentation, façade, and plan configurations can be seen in Figure 5. In the figures that follow are a series of standard construction details showing multiple possible configurations of exterior enclosure assemblies for this type, from industry standards and building material institutes.

Table 10. Key Characteristics Representative of Type 8 Buildings

	W (FT)	D (FT)	H (FT)	NO. OF STORIES	FAÇADE AREA (PER BLDG)	GSF (PER BLDG)	NO. OF BUILDINGS (COMPLEX)	TOTAL FAÇADE AREA (COMPLEX)	TOTAL GSF (COMPLEX)
LOW END	100	40	40	4	11200	16000	1	11200	16000
HIGH END	150	50	70	7	28000	52500	35	980000	1837500

Figure 5. Representative Examples Demonstrating the Range of Type 8 Variation



Address		917 SHERIDAN AVE		Address		3503 12 ST		Address		750 CROES AVE	
Date of Construction		1941		Date of Construction		1960		Date of Construction		1953	
No. of Buildings		1		No. of Buildings		Not given; between 24-40 by visual check (see photo, above)		No. of Buildings		1	
SF (Area)		16836.66667		SF (Area)		16033		SF (Area)		10183	
Total Bldg Area?		101020		Total Bldg Area?		96200		Total Bldg Area?		61100	
No. of Units		99		No. of Units		96		No. of Units		58	
No. of Stories		6		No. of Stories		6		No. of Stories		6	
Typical Unit Size		50-100 Units		Typical Unit Size		20-49 Units		Typical Unit Size		50-100 Units	
County		BRONX		County		QUEENS		County		BRONX	
Affordable		Market		Affordable		Affordable		Affordable		Affordable	
Information from Visual Check	Structure	Steel and Concrete		Information from Visual Check	Structure	Steel and Concrete		Information from Visual Check	Structure	Steel and Concrete	
	Cladding	Stone			Cladding	Brick			Cladding	Brick	
	Notes				Notes	~2 dozen similar adjacent buildings, likely part of same complex			Notes		



Address		155 WORTMAN AVE		Address		4006 VERNON BLVD		Address		3500 SNYDER AVE	
Date of Construction		1973		Date of Construction		1969		Date of Construction		1957	
No. of Buildings		1		No. of Buildings		1		No. of Buildings		1	
SF (Area)		10175		SF (Area)		12800		SF (Area)		10311.66667	
Total Bldg Area?		81000		Total Bldg Area?		74400		Total Bldg Area?		213500	
No. of Units		64		No. of Units		90		No. of Units		126	
No. of Stories		8		No. of Stories		6		No. of Stories		6	
Typical Unit Size		50-100 Units		Typical Unit Size		20-49 Units		Typical Unit Size		101+ Units	
County		BROOKLYN		County		QUEENS		County		BROOKLYN	
Affordable		Affordable		Affordable		Affordable		Affordable		Market	
Information from Visual Check	Structure	Steel and Concrete		Information from Visual Check	Structure	Steel and Concrete		Information from Visual Check	Structure	Steel and Concrete	
	Cladding	Brick			Cladding	Brick			Cladding	Brick	
	Notes				Notes	~2 dozen similar adjacent buildings, likely part of same complex			Notes		



Address		2055 SEAGIRT BLVD		Address		100 N MADISON ST		Address		2105 ROCKAWAY PRWY	
Date of Construction		1952		Date of Construction		1974		Date of Construction		1963	
No. of Buildings		1		No. of Buildings		1		No. of Buildings		1	
SF (Area)		53764		SF (Area)		14271.42857		SF (Area)		9400	
Total Bldg Area?		322584		Total Bldg Area?		99900		Total Bldg Area?		75200	
No. of Units		134		No. of Units		101		No. of Units		70	
No. of Stories		6		No. of Stories		7		No. of Stories		8	
Typical Unit Size		20-49 Units		Typical Unit Size		101+ Units		Typical Unit Size		50-100 Units	
County		QUEENS		County		QUEENS		County		BROOKLYN	
Affordable		Market		Affordable		Market		Affordable		Affordable	
Information from Visual Check	Structure	Steel and Concrete		Information from Visual Check	Structure	Steel and Concrete		Information from Visual Check	Structure	Steel and Concrete	
	Cladding	Brick			Cladding	Brick			Cladding	Brick	
	Notes				Notes	~2 dozen similar adjacent buildings, likely part of same complex			Notes		

Figure 6. Examples of Reinforced Concrete and Steel Floor Assemblies

Source: AGS, 1956 (TOP) and 1970 (BOTTOM).

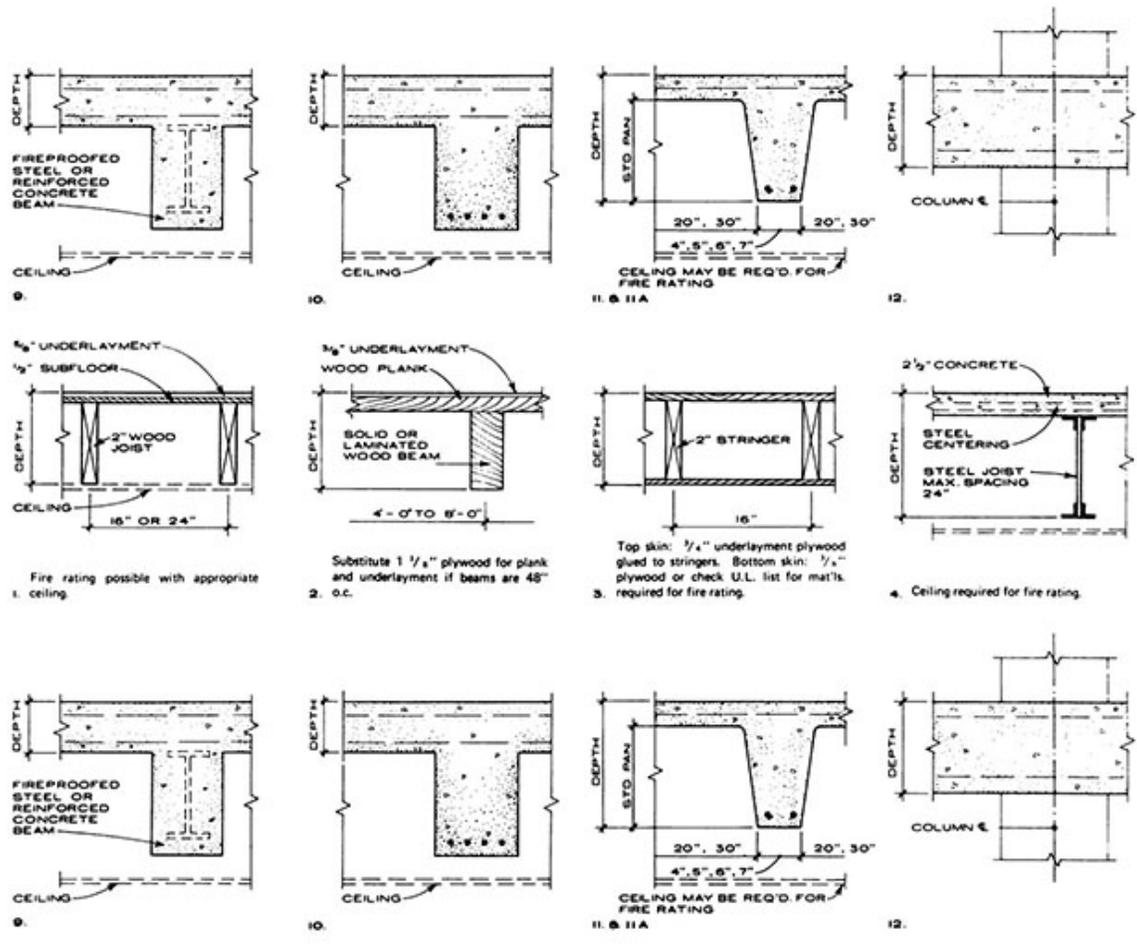
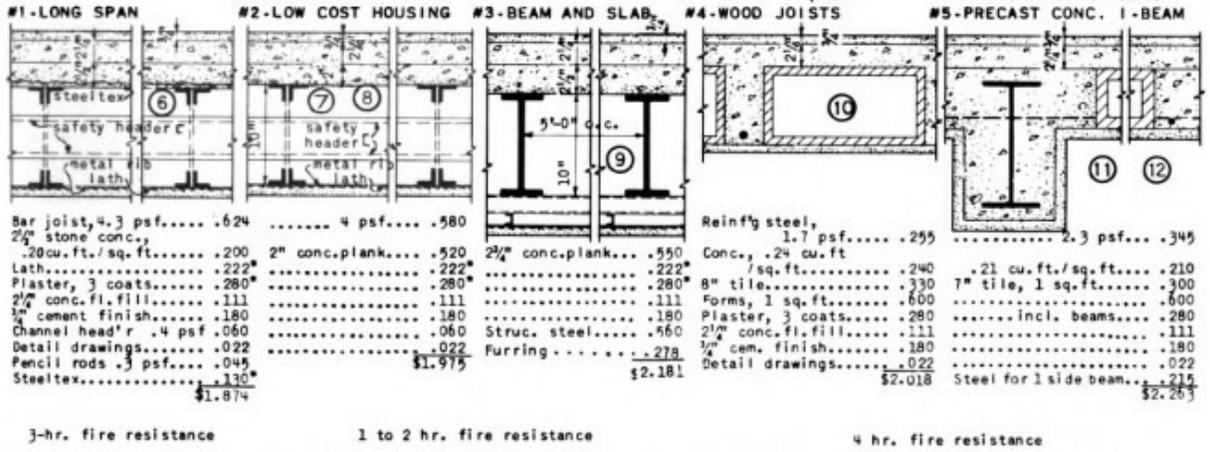


Figure 7. Masonry Wall Details: Technical Notes on Brick Construction

Brick Institute of America, 1963.

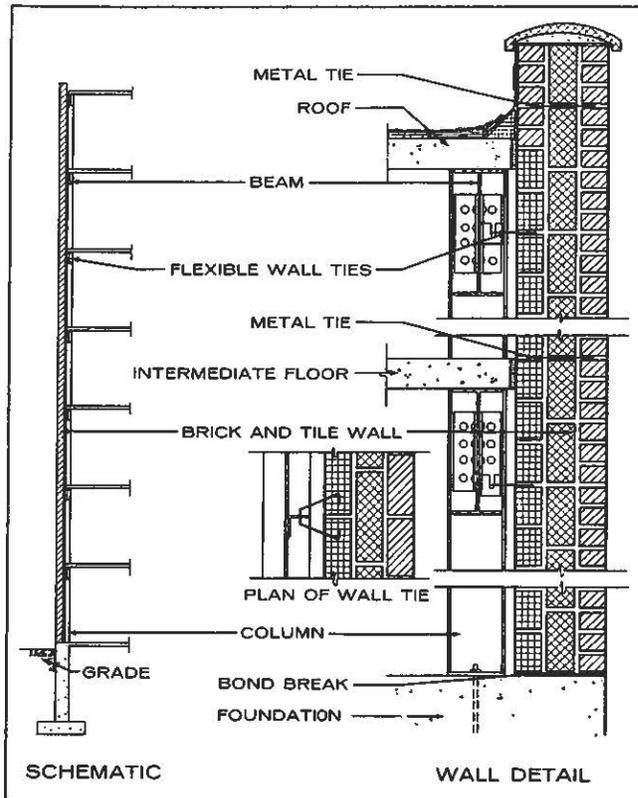


FIG. 1

Wall Supported on Foundation

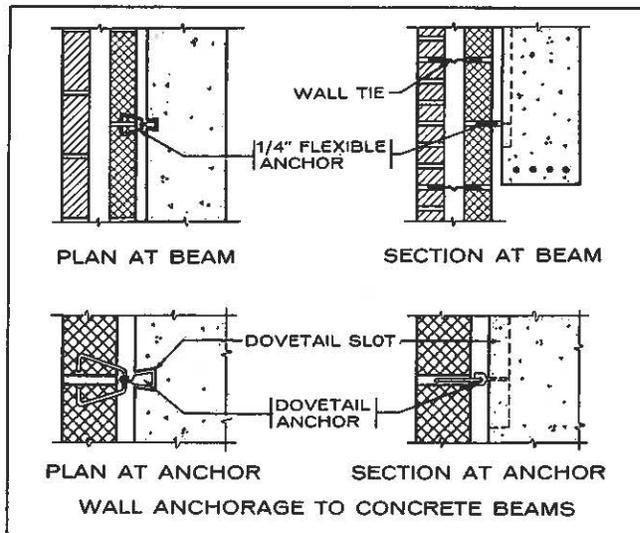


FIG. 2a

Flexible Anchorage to Beams

Figure 8. Masonry Wall Details, 1963: Technical Notes on Brick Construction

Brick Institute of America, 1963.

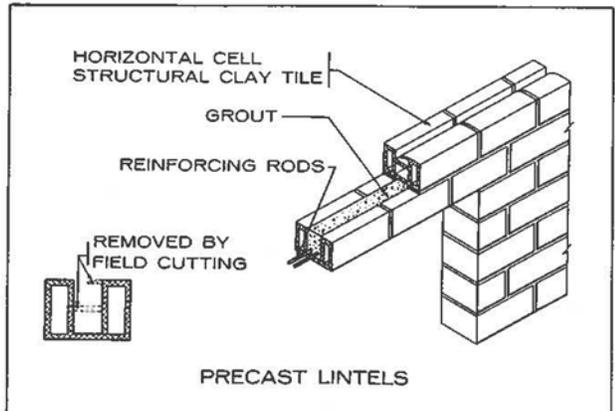
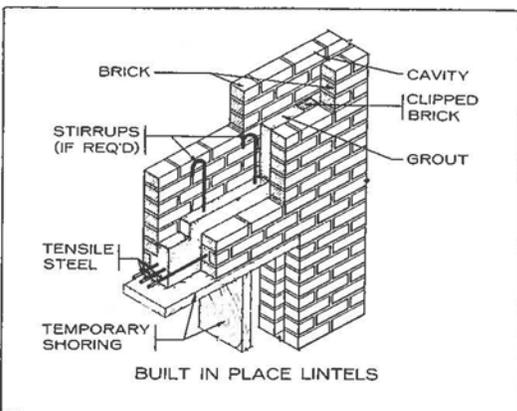
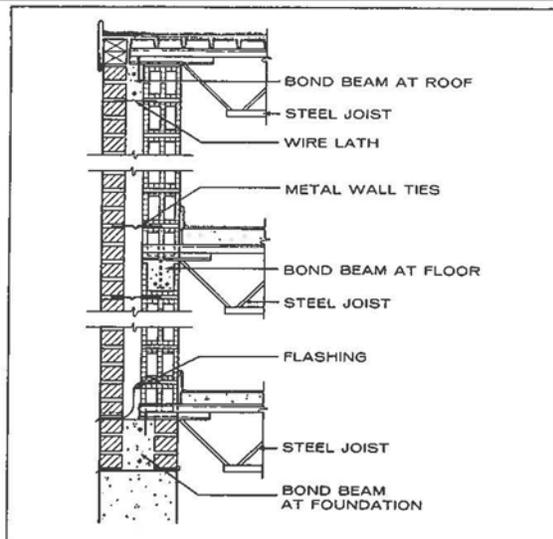
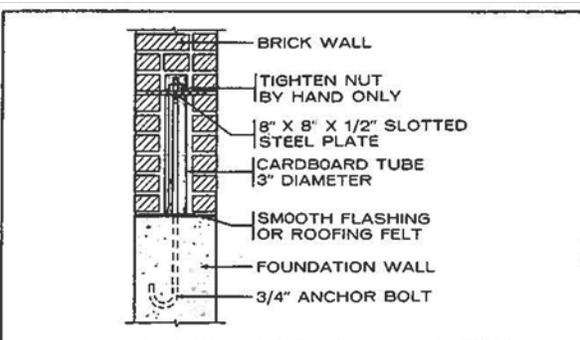
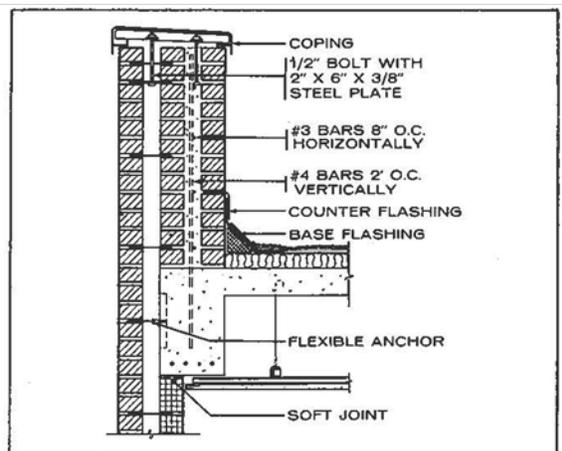
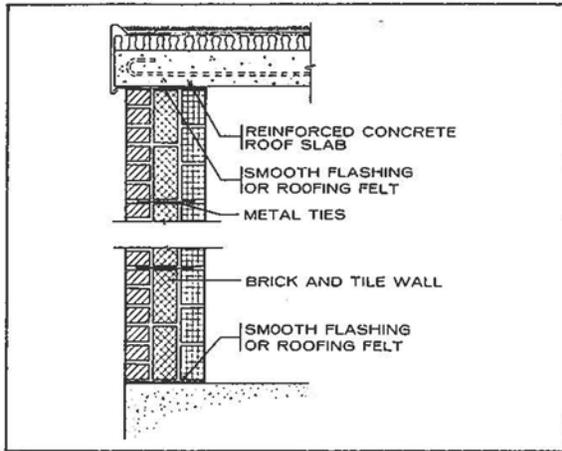


Figure 9. Masonry Details, 1964: Technical Notes on Brick Construction

Structural Clay Products Institute, 1964.

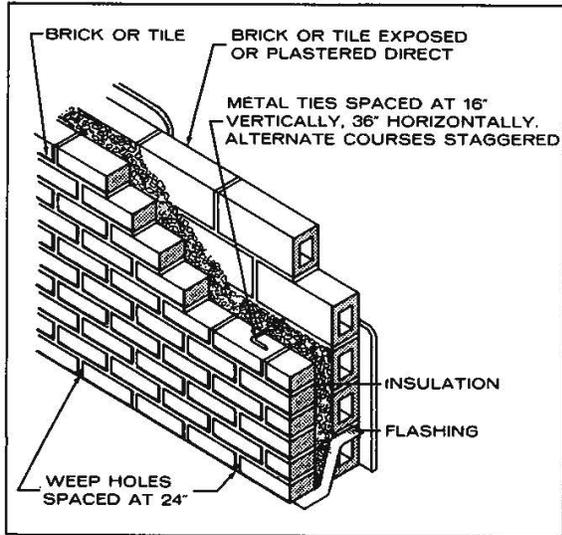
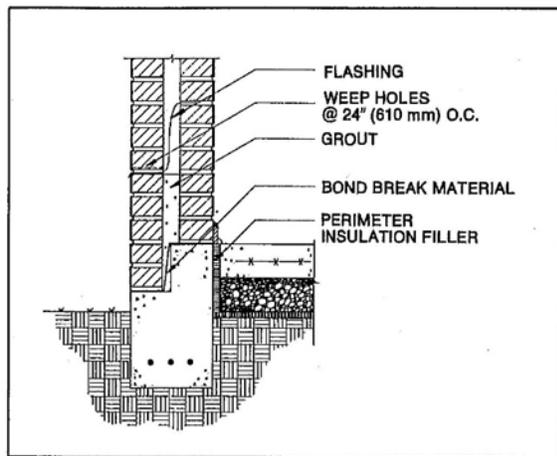
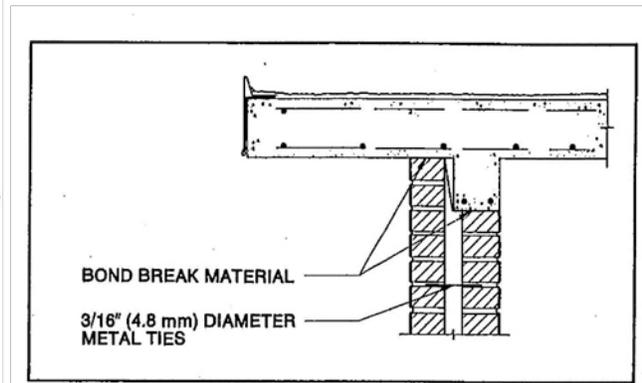


Figure 10. Concrete Masonry Details: Technical Notes on Brick Construction

Brick Institute of America, 1978.



Foundation Detail



Concrete Roof Slab Detail

3 Conclusion

While Type 8 represents a relatively small number of buildings concentrated in the five boroughs of New York City, buildings in this segment are promising candidates for high-performance retrofits.

Data suggest that this typology represents a large amount of floor and facade area as compared to other building types in New York State. Type 8 buildings are relatively large and often found in complexes with multiple buildings of similar or identical design. Some complexes may have a common owner (such as the New York City Housing Authority), which could facilitate implementation of retrofits across an entire portfolio of buildings.

Masonry facades in Type 8 are often unornamented and not built to the lot line, simplifying logistics of installing exterior retrofits. Exterior walls in this type are also unlikely to be insulated, improving the cost-benefit impact of retrofit measures.

Finally, the large proportion of affordable housing in Type 8 represents an opportunity to address equity issues by improving the quality and resilience of housing serving vulnerable populations.

Appendix A. Random Sampling of Type 8 Properties

Random Sampling of Type 8 Properties in the Market: Characteristics of Data														
Board #	Address	Year of Construction	Total # of Units	Number of Occupied	Total Area (sq. ft.)	No. of Units	No. of Stories	Total # of Units	County	# of Stories	Information from Board Group			Key City Photo, Google Street
											Structure	Material	Notes	
Board #1	6235 S. HUNTERS ST	1941	0	7773-8333	73000	44	6	53-100 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #2	149 H. BENTLEY AVE	1921	0	11553-11113	20000	14	6	20-40 Units	DECATUR	Market	Steel and Concrete	Exile	Remnants of original structure in east wing of commercial building.	
Board #3	245 S. 42ND ST. DECATUR	1941	0	13732	8700	28	6	53-100 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #4	75 E. WOODS ST	1943	0	1148	42200	22	5	20-40 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #5	38 S. 23RD ST	1942	0	5322	25500	25	6	20-40 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #6	125 W. 125th St	1941	0	1948	4500	2	4	2 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #7	100 S. 100th St	1951	0	2000-10250	10000	6	7	5 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #8	7521 13th St	1921	0	6923-7333	42700	42	6	20-40 Units	DECATUR	Market	Steel and Concrete	Exile	2 stories taller than other buildings. Brick part of original complex.	
Board #9	1015 15th AVE DECATUR	1951	0	1813-1945	8000	24	7	53-100 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #10	104 16th AVE	1923	0	492	2400	2	2	2 Units	DECATUR	Market	Steel and Concrete	Exile	Appears to have had exterior facade materials removed and replaced with brick.	
Board #11	240 S. HUNTERS AVE	1924	0	1542	13000	28	6	53-100 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #12	4013 TURNER BLVD	1953	0	13411	74000	22	6	20-40 Units	DECATUR	Market	Steel and Concrete	Exile	2 1/2 stories tall, original building. Brick part of original complex.	
Board #13	36 S. 20th St	1957	0	5990	27500	22	5	20-40 Units	DECATUR	Market	Concrete	Exile	Appears to have been built prior to 1957	
Board #14	31 CORNELIUS ST	1941	0	1292	9485	22	5	20-40 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #15	100 15th AVE DECATUR	1953	0	2973	9000	15	6	10-10 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #16	315 GENESEE ST	1921	0	5325	51000	15	7	20-40 Units	DECATUR	Market	Steel and Concrete	Exile	No other info on this complex from this date	
Board #17	155 WOODRIDGE AVE	1921	0	1045	10000	14	8	53-100 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #18	144 S. 2nd	1943	0	2460	5800	5	4	20-40 Units	DECATUR	Market	Steel and Concrete	Exile	Looks to have been built 1940s; some date may refer to construction.	
Board #19	1115 W. LINDSEY ST	1921	0	10463-11017	10000	12	6	53-100 Units	DECATUR	Market	Steel and Concrete	Exile		
Board #20	22 10th St	1943	0	4736	25000	22	6	20-40 Units	DECATUR	Market	Steel and Concrete	Exile		

Project #21	22 W 12 ST	1188		1257.5	2150	7	4	50 Units	MANHATTAN	Alfa Laval	Steel and Concrete	510k	
Project #22	14 WASHINGTON AVE	1285		2250	2000	5	4	24 Units		Morok	Steel and Concrete	510k	
Project #23	105 W 120 ST	1250	1	040	2302	0	4	50 Units	MANHATTAN	Alfa Laval	Steel and Concrete	510k	
Project #24	3500 S W 66th AVE	1257	1	1721.5 6607	11500	125	1	1014 Units	DUPLICATE	Morok	Steel and Concrete	510k	
Project #25	111 E 92 ST	1270	1	1690.75	11777	24	2	2349 Units	MANHATTAN	Morok	Steel and Concrete	510k	
Project #26	11050 71 RD	1297	1	11475.1	44102	133	10		DUPLICATE	Morok	Steel and Concrete	510k	
Project #27	161 W 110th ST	1345		2275	1710	2	5	54 Units		Morok	Steel and Concrete	510k	
Project #28	801 W 24th + HWY	1347	1	771.75	76125	17	5		DUPLICATE	Morok	Steel and Concrete	510k	
Project #29	750 101st AVE	1348		1128 1000	5133	65	5	50-100 Units	DUPLICATE	Alfa Laval	Steel and Concrete	510k	
Project #30	2112 S 100th HWY + HWY	1385		3410	7623	72	5	50-100 Units	DUPLICATE	Alfa Laval	Steel and Concrete	510k	
Project #31	2035 SEAGRIF BLVD	1382	1	53764	32254	134	5	2340 Units	DUPLICATE	Morok	Steel and Concrete	510k	
Project #32	7510 222 ST	1384	1	15555 6607	10000	71	5	50-100 Units	DUPLICATE	Morok	Steel and Concrete	510k	
Project #33	907 50th E AVE	1341	1	1720.5 6607	10100	59	1	50-100 Units	DUPLICATE	Morok	Steel and Concrete	510k	
Project #37	100 W MACDON ST	1375		14271 1000	35037	101	7	1014 Units		Morok	Steel and Concrete	510k	

Appendix B. Revised Count and Floor Area of Types 1 through 8

Vintage	Building Height	Unit Cut	NY Upstate				NYC				NYS			
			MF Bldg #	MF Bldg %	Bldg Area (GSF)	Bldg Area %	MF Bldg #	MF Bldg %	Bldg Area (GSF)	Bldg Area %	MF Bldg #	MF Bldg %	Bldg Area (GSF)	Bldg Area %
Pre-1940	Low-Rise	Single	84	0.0%	139,200	0.0%	113,646	19.7%	241,141,690	3.6%	113,730	13.8%	241,280,890	3.3%
		2-4	84,056	34.3%	196,109,075	33.0%	164,762	28.6%	451,715,123	6.7%	248,818	30.3%	647,824,198	8.9%
		≥5	17,220	7.0%	45,779,465	7.7%	16,575	2.9%	225,998,709	3.4%	33,795	4.1%	271,778,174	3.7%
	Mid-Rise	Single	0	0.0%	0	0.0%	164	0.0%	750,066	0.0%	164	0.0%	750,066	0.0%
		2-4	81	0.0%	728,000	0.1%	6,462	1.1%	32,707,496	0.5%	6,543	0.8%	33,435,496	0.5%
		≥5	180	0.1%	6,047,545	1.0%	39,371	6.8%	1,208,350,295	18.0%	39,551	4.8%	1,214,397,840	16.6%
	NA	Single	52	0.0%	338,520	0.1%	4	0.0%	9,268	0.0%	56	0.0%	347,788	0.0%
		2-4	11,518	4.7%	10,945,410	1.8%	107	0.0%	557,837	0.0%	11,625	1.4%	11,503,247	0.2%
		≥5	1,762	0.7%	7,338,106	1.2%	897	0.2%	154,113,694	2.3%	2,659	0.3%	161,451,800	2.2%
1940-1978	Low-Rise	Single	0	0.0%	0	0.0%	22,212	3.9%	192,014,356	2.9%	22,212	2.7%	192,014,356	2.6%
		2-4	28,446	11.6%	70,334,700	11.8%	96,710	16.8%	1,224,300,072	18.2%	125,156	15.2%	1,294,634,772	17.7%
		≥5	19,948	8.1%	64,851,816	10.9%	4,477	0.8%	178,522,010	2.7%	24,425	3.0%	243,373,826	3.3%
	Mid-Rise	Single	0	0.0%	0	0.0%	9	0.0%	90,133	0.0%	9	0.0%	90,133	0.0%
		2-4	60	0.0%	1,036,500	0.2%	140	0.0%	870,121	0.0%	200	0.0%	1,906,621	0.0%
		≥5	406	0.2%	13,929,266	2.3%	5,509	1.0%	438,365,998	6.5%	5,915	0.7%	452,295,264	6.2%
	NA	Single	0	0.0%	0	0.0%	4	0.0%	13,696	0.0%	4	0.0%	13,696	0.0%
		2-4	14,741	6.0%	14,005,451	2.4%	6,600	1.1%	205,523,499	3.1%	21,341	2.6%	219,528,950	3.0%
		≥5	10,807	4.4%	25,136,635	4.2%	5,408	0.9%	394,911,143	5.9%	16,215	2.0%	420,047,778	5.7%
1979-2006	Low-Rise	Single	134	0.1%	176,600	0.0%	9,564	1.7%	524,027,400	7.8%	9,698	1.2%	524,204,000	7.2%
		2-4	10,668	4.3%	29,738,090	5.0%	50,658	8.8%	342,279,760	5.1%	61,326	7.5%	372,017,850	5.1%
		≥5	10,374	4.2%	50,684,683	8.5%	3,394	0.6%	165,550,180	2.5%	13,768	1.7%	216,234,863	3.0%
	Mid-Rise	Single	0	0.0%	0	0.0%	108	0.0%	5,658,197	0.1%	108	0.0%	5,658,197	0.1%
		2-4	13	0.0%	291,400	0.0%	2,202	0.4%	125,450,434	1.9%	2,215	0.3%	125,741,834	1.7%
		≥5	140	0.1%	7,214,077	1.2%	3,416	0.6%	339,978,110	5.1%	3,556	0.4%	347,192,187	4.8%
	NA	2-4	15,660	6.4%	11,846,220	2.0%	6,980	1.2%	7,310,647	0.1%	22,640	2.8%	19,156,867	0.3%
		≥5	13,821	5.6%	21,827,395	3.7%	2,918	0.5%	57,057,780	0.9%	16,739	2.0%	78,885,175	1.1%
	2007-Present	Low-Rise	Single	100	0.0%	125,000	0.0%	1,742	0.3%	4,634,055	0.1%	1,842	0.2%	4,759,055
2-4			937	0.4%	3,184,975	0.5%	6,843	1.2%	53,167,204	0.8%	7,780	0.9%	56,352,179	0.8%
≥5			1,049	0.4%	7,015,946	1.2%	340	0.1%	11,272,675	0.2%	1,389	0.2%	18,288,621	0.3%
Mid-Rise		Single	0	0.0%	0	0.0%	27	0.0%	166,834	0.0%	27	0.0%	166,834	0.0%
		2-4	1	0.0%	2,200	0.0%	936	0.2%	7,605,176	0.1%	937	0.1%	7,607,376	0.1%
		≥5	32	0.0%	711,200	0.1%	2,497	0.4%	79,855,739	1.2%	2,529	0.3%	80,566,939	1.1%
NA		Single	0	0.0%	0	0.0%	20	0.0%	67,064	0.0%	20	0.0%	67,064	0.0%
		2-4	1,318	0.5%	775,667	0.1%	529	0.1%	801,001	0.0%	1,847	0.2%	1,576,668	0.0%
		≥5	1,646	0.7%	4,650,029	0.8%	778	0.1%	35,455,578	0.5%	2,424	0.3%	40,105,607	0.5%
Total			245,254	100.0%	594,963,171	100.0%	576,009	100.0%	6,710,293,040	100.0%	821,263	100.0%	7,305,256,211	100.0%

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