ABSTRACT

AMENDING THE BUILDING CODE OF THE CITY OF NEW YORK: EXPLORING FORCES THAT INFLUENCED CHANGE

by
Dolores Spivack

This study seeks to understand the forces that influenced changes (i.e., amendments) to the Building Code of New York City over an approximately one hundred and ten year period spanning from 1898, the year of the city's consolidation, through 2008, the year of the major code amendment following September 11, 2001. Although the emphasis is on this period, building codes specific to New York City since 1625 are researched to cultivate a broader understanding of the changes to building codes throughout the city's history. In particular, the focus is on the building issues that the amendments sought to change and the specific conditions or forces that prompted those changes. Qualitative and quantitative data analysis is performed, which demonstrates that 884 total amendments were passed between 1898 and 2008 as a result of technical, cultural, and political forces. Three complex factors are identified as being responsible for amending the building code: new materials, methods, and technologies; cultural changes in use and occupancy; and fire disasters. This finding undermines the prevailing belief that building codes are amended primarily because of fire disasters.

Throughout the history of New York City, changes in the building code usually numbered around six per year. However, this study documents that a significant spike occurred in the number of amendments promulgated in the early 1950s. In 1951 alone, the building code was amended 56 times. In addition to new material sciences, cultural changes in new uses and occupancies of buildings and new architectural styles accounted for the largest increase in amendments during this period. Fire disasters accounted for a limited number of changes to the building code and were not nearly as influential on the code amendment process as some researchers have asserted.

This study demonstrates the complex, retroactive nature of the amendment process and how specific and responsive the building code is to the minutiae of changes in construction and occupant uses. These findings contribute to a better understanding of the retroactive amendment process, allowing for the potential to begin a proactive amendment process with the goal of increasing public health, safety, and welfare.

AMENDING THE BUILDING CODE OF THE CITY OF NEW YORK: EXPLORING FORCES THAT INFLUENCED CHANGE

by
Dolores Spivack

A Dissertation
Submitted to the Faculty of
New Jersey Institute of Technology,
Rutgers, The State University of New Jersey - Newark
in Partial Fulfillment of the Requirements for the Degree of
Doctor of Philosophy in Urban Systems

College of Architecture and Design

May 2016

APPROVAL PAGE

**AMENDING THE BUILDING CODE IN NEW YORK CITY:
EXPLORING FORCES THAT INFLUENCED CHANGE**

Dolores Spivack

Dr. Gabrielle Esperdy, Dissertation Advisor | Date
Associate Professor of Architecture, College of Architecture and Design, NJIT

Dr. Jeffrey Backstrand, Committee Member | Date
Associate Professor of Practice, School of Public Affairs & Administration,
Rutgers University

Dr. Barbara A. Caldwell, Committee Member | Date
Professor & Specialty Director, Psychiatric-Mental Health, Rutgers School of Nursing

---

Dr. Michael Zetlin, Esq., Committee Member | Date
Senior Partner, Zetlin & De Chiara, LLP

BIOGRAPHICAL SKETCH

Author: Dolores Spivack

Degree: Doctor of Philosophy

Date: May 2016

Undergraduate and Graduate Education:

- Doctor of Philosophy in Urban Systems
  New Jersey Institute of Technology, Newark, NJ, 2016

- Bachelor of Architecture
  Pratt Institute, Brooklyn, NY, 1978

Major: Urban Systems

They are not monuments but footprints.

A monument only says, “At least I got this far.”

While a footprint says, “This is where I was when I moved again.”

-William Faulkner

ACKNOWLEDGEMENT

The following colleagues, committee, friends and family were essential in allowing me to write this dissertation. I am indebted ……

To the staff at the Department of Buildings who were generous in directing me toward information, both old and new. Special thanks to Charles Shelhamer who explained the history of the DOB over happy lunches of mac and cheese. Extra special thanks to Lawrence Stelter who knows all details of every building in NYC and was generous to explain them to me.

To my committee, Dr. Jeffery Backstrand, Dr. Barbara Caldwell, and Mr. Michael Zetlin, Esq., who always gave excellent comments but, more important were generous with words of support.

To my Chair, Dr. Gabrielle Esperdy, who helped me make a legible document out of the mess I too often gave her.

To my children, Michael, Anne, and Jonathan - who were toddlers when this dissertation began but who are now young adults - and who always gave me inspiration and happiness.

To my husband, Paul, who always gave me a cup of coffee or a glass of wine, depending on the time of day, endured too many takeout meals, and always thought I could do this. Thank you, thank you, thank you, Paul.

TABLE OF CONTENTS

Chapter	Page
1 INTRODUCTION…………………………………………………………..	1
1.1 Overview and Objectives…………………………………………………	1
1.1.1 Description……………………………………………………….	1
1.1.2 Approach and Contents…………………………………………..	3
1.2 Literature Review……………………………………………………...	5
1.2.1 Primary Sources……………………………………………………..	5
1.2.2 Secondary Sources……………………………………………….	6
1.3 Need and Purpose for the Study………………………………………….	11
1.4 Research Questions……………………………………………………….	12
1.5 Hypotheses………………………………………………………………..	12
1.6 Limitations………………………………………………………………..	13
1.7 Definitions of Terms……………………………………………………...	13
1.8 Research Design………………………………………………………….	15
1.8.1 Quantitative Analysis……………………………………………..	16
1.8.2 Qualitative Analysis………………………………………………	19
1.9 Conclusion………………………………………………………………..	21
2 GENERAL HISTORY OF BUILDING CODES………………………………	23
2.1 Introduction……………………………………………………………….	23
2.2 Ancient Examples……………………………………………………...	24
2.3 Examples in NYC………………………………………………………..	26

TABLE OF CONTENTS
(Continued)

Chapter		Page
2	GENERAL HISTORY OF BUILDING CODES…………………………………	23
	2.1 Introduction…………………………………………………………….	23
	2.2 Ancient Examples……………………………………………………....	24
	2.3 Examples in NYC……………………………………………………..	26
	2.3.1 Early Colonial Building Codes and Amendments……………….	28
	2.3.2 City Building Codes Written by the State……………………….	33
	2.3.3 Rogers Peet Fire……………………………………………….	37
	2.4 Other Examples………………………………………………………..	37
	2.4.1 The Great Chicago Fire………………………………………..	38
	2.4.2 San Francisco Earthquake/Fire…………………………………..	41
	2.5 Conclusion……………………………………………………………..	46
3	THE NEW YORK BUILDING CODE: 1899 AND 1915……………………..	48
	3.1 Historical Context……………………………………………………....	48
	3.1.1 Introduction……………………………………………………	48
	3.2 The 1899 Building Code………………………………………………	49
	3.2.1 Description…………………………………………………….	49
	3.2.2 Triangle Shirtwaist Factory………………………………………	54
	3.2.3 The Equitable Life Assurance Building………………………….	63
	3.2.4 The Woolworth Building…………………………………………	64
	3.3 1915 Building Code……………………………………………………	66

TABLE OF CONTENTS
(Continued)

Chapter		Page
3.3	1915 Building Code…………………………………………………………	66
3.3.1	Description………………………………………………………..	66
3.3.2	Tenements and the Building Code……………………………….	69
3.4	Conclusion………………………………………………………………..	72
4	THE NEW YORK BUILDING CODE: 1938……………………………….	73
4.1	Introduction…………………………………………………………………	73
4.2	The 1938 Building Code……………………………………………………	75
4.3	Early 1950s Edition of the 1938 Code…………………………………..	79
4.3.2	New Materials and Technologies in the Early 1950s and Amendments……………………………………………………..	87
4.3.3	Cultural Changes in the Early 1950s and Amendments…………	107
4.4	Fire Disasters……………………………………………………………..	121
4.5	Conclusion………………………………………………………………..	123
5	THE NYC BUILDING CODE: 1968 AND 2008……………………………...	125
5.1	Introduction…………………………………………………………………	125
5.2	The 1968 Building Code……………………………………………………	126
5.2.1	Description………………………………………………………..	126
5.2.2	The World Trade Center………………………………………….	133
5.3	Amendments to the 1968 Building Code…………………………………	138
5.3.1	Amendments Related to Fires…………………………………….	138
5.3.2	Amendments Related to Other Forces……………………………	142

TABLE OF CONTENTS
(Continued)

Chapter		Page
	5.3.3 Fire Disasters Without Amendments……………………………..	145
	5.4 The Amending of the 1968 Building Code……………………………….	147
	5.5 Conclusion………………………………………………………………..	148
6	CONCLUSION……………………………………………………………………	149
	6.1 Overview……………………………………………………………………….	149
	6.2 Contributions of This Study………………………………………………	155
	6.3 Recommendations for Future Studies…………………………………….	155
REFERENCES……………………………………………………………………..		158

LIST OF FIGURES

Figure		Page
1.1	Chart of major Building Code editions and amendments…………………..	18
4.1	Number of amendments divided into themes per year……………………...	80
4.2	Full page in the 1956 edition of *Architectural Graphic Standards* ………..	91
4.3	Dur-O-Wal full page-advertisement from the 1950s edition in the 1938 NYC Building Laws……………………………………………………..	92
4.4	Plasticrete Corporation advertisement from the 1950s edition in the 1938 NYC Building Laws……………………………………………………..	96
4.5	CPC Concrete Plank Company full page-advertisement from the 1950s in the 1938 NYC Building Laws……………………………………………	97
4.6	Two advertisements of concrete piles in the early 1950s edition of the 1938 NYC Building Laws……………………………………………………...	97
4.7	Advertisement of concrete aggregate in the early 1950s edition of the 1938 NYC Building Laws……………………………………………………...	98
4.8	National Gypsum Company and United States Gypsum full-page advertisements from the 1950s in the 1938 NYC Building Laws…………..	101
4.9	Images for generic gypsum drywall advertisements from the early 1950s…	102
4.10	Full-page advertisement for Sprinklers from the early 1950s in the 1938 NYC Building Laws……………………………………………………...	105
4.11	Half page in the 1956 edition of *Architectural Graphic Standards.* …….....	112

CHAPTER 1

INTRODUCTION

1.1 Overview and Objectives

1.1.1 Description

The building code is the primary tool used by architects, engineers, contractors, developers, and the general public to ensure the safety of a city's buildings for its residents and all other stakeholders. "A building code is truly is the backbone of a city," said Patricia J. Lancaster, New York City Commissioner of the Department of Buildings (DOB) in 2004.[1] The building code is a fluid document that regulates the building and maintenance of structures within a given city. The Building Code of the City of New York and its amendments shaped the City throughout its history. The forces that influenced change often changed themselves from robust to frail back to robust and were frequently confounding. The code was and continues to be constantly amended; however, because it regulates buildings that can last for centuries, prior editions of the code remain alive and enforceable and can therefore be referenced many years later. Prior Building Codes continue to be currently referenced and this gives historical studies importance. The particular building code enforced for a building corresponds to the specific code that was in effect at the time of its construction. Multiple editions of the building code, including their numerous amendments, have led to confusion in the interpretation of the code and have required the passage of additional amendments for clarification.

---

[1] Testimony of Commissioner Patricia J. Lancaster, FAIA, before the Housing & Buildings Committee of the New York City Council in support of INTRO 478 and the adoption of the International Building Code (IBC), November 30, 2004.

The building code in New York City left no architectural development in the city untouched, striving to regulate every aspect of the built environment. Amendments regulated construction and demolition of permanent and temporary buildings. As the construction methods and cultural styles of the city changed over time, the Department of Buildings responded to the changing circumstances in the environment by amending its building code.

The process of building code amendment is designed to balance the interests of various and sometimes conflicting stakeholders of owners, developers, architects, public agencies, end users, and the general public. While amendments have sometimes been drafted with an unbalanced viewpoint, the final and promulgated version usually considers multiple stakeholders and their varied viewpoints. Historically, many building code amendments have received mixed reviews, no media attention, or public outcry leading some amendments to be subsequently modified in order to assuage public concerns.

The forces that brought about changes to the building code are complex, yet consistent patterns can be traced in the amendments over time to pinpoint such forces. It is these forces that have gradually modified the way that the building code regulates and enforces the construction and demolition of the built environment.

In light of these circumstances, this dissertation explored the forces that influenced the amendment process of the Building Codes of the City of New York over the period of a century during which enormous change took place. In particular, this study considers how the amendment process of the code responded to complex factors related to cultural attitudes and new technologies, as well as to disasters associated with fire and building collapse.

1.1.2 Approach and Contents

To carry out this study of New York City (NYC) building code amendments, the history of building codes is briefly examined, followed by an in-depth exploration of NYC building codes. The amendments are tracked and categorized, and an attempt is made to identify the specific forces that brought about each amendment. It must be noted from the outset that this study is not an attempt to write the history of the technical construction methods described in building codes.

Rather, this study focuses on the building issues that the amendments sought to change and the specific conditions or forces that prompted those changes. Moreover, while the study does consider the fiscal cost of certain amendments, cost is not the primary concern since it is not included in the mission or vision statement of the DOB[2]. The DOB's priorities concerning the building code that are explored in this study include public health, safety, welfare, and compliant development.

In order to explore the complex nature of the NYC building code amendment process, this dissertation is divided into six chapters. Chapter one provides an overview of the project, including a brief literature review, and describes the study's research design. Chapter two offers a broad history of building laws dating back to Mesopotamia

[2] Mission Statement of the NYC DOB: "The New York City Department of Buildings ensures the safe and lawful use of buildings and properties by enforcing the Building Code and the Zoning Resolution. We facilitate compliant development with integrity, efficiency and professionalism."

Vision Statement of the NYC DOB: "The New York City Department of Buildings is committed to becoming a premier municipal building organization, dedicated to enhancing the quality of life for all New Yorkers and making our city a great place to live, work and build. Our knowledgeable and dedicated staff is committed to improving our performance and developing procedures that are streamlined, understandable and transparent."

in an attempt to highlight specific patterns that led succeeding cultures to update their outdated laws related to building. This broader overview provides important insight into the most common factors that influence changes in construction across various cultures, providing a foundation for understanding the psychological and intrapersonal factors of building code amendment. A history of the NYC building code follows in the second chapter, providing background for the specific amendments that are discussed in later chapters.

In the third chapter, the NYC Building Code of 1899 is discussed in detail, including the ways that it amended the prior New York State Building Code and the ensuing changes that led to the NYC Building Code of 1915. The three major fires that occurred during this period—including the Triangle Shirtwaist Factory Fire—are explored in consideration of the influence they may have had over the amendments that were passed.

In the fourth chapter, the NYC Building Code of 1938 is examined, including the unusual ways that it amended the 1915 code. The copious number of amendments passed in the span of a few years during the early 1950s is addressed, specifically related to the use of new materials and the sociocultural changes that were occurring during the mid-twentieth century. The fifth chapter explores the NYC Building Code of 1968, including specific amendments and the forces that prompted those changes, among which were several fire disasters. The example of the World Trade Center's twin towers is analyzed for amendment types. The chapter ends with the amending of the 1968 Code into the NYC 2008 Building Code, which was based on the integrated 2003 International Code (I-

Code). In particular, it considers the new protocol for the usage of the building code that was ushered in by the amendment to adopt the I-Code.

1.2 Literature Review

This section provides an overview of the history of building codes in general, including the impact of the codes on the built environment and changes to building codes. The primary sources used in this study are first briefly summarized, followed by a discussion of secondary sources related to the study topic. This review of literature lays the foundation for the study by presenting research at both the popular and scholarly level that has attempted to identify what forces influenced the litigation changes of amendments. Extant research in the area of disasters—involving buildings, ships, and planes—presents mixed assumptions regarding the forces that prompted changes in litigation. This study seeks to contribute new information regarding the forces behind changes in building litigation in order to provide further clarity on this issue.

1.2.1 Primary Sources

The primary sources for this study are the NYC building codes themselves. These include the first building code of New Netherland in 1625, Dutch and English building codes, Manhattan building codes of the 1700s, New York State building codes for the city, and NYC building codes of 1899, 1915, 1938, 1968, and 2008. The building codes promulgated since municipal consolidation in 1898 are given specific attention. This study therefore spans a time period of 110 years. Also, included as primary sources in this study are the amendments that are attached to and associated with the text of the building code.

1.2.2 Secondary Sources

Laws governing buildings for the protection of public health, safety, and welfare date back to the beginning of recorded history. The Code of Hammurabi, c. 1780 BC (Viorst, 1965), and Leviticus, c. 1446 BC, are two of the earliest and most renowned of such laws.

Over time, architectural critics have developed numerous critiques, models, and approaches for analyzing regulations of the built environment (Ben-Joseph, 2005; Kostof, 1991; Mumford, 1961). For example, in his 2005 book *The Code of the City: Standards and the Hidden Language of Place Making*, Eran Ben-Joseph posits that building codes are an obstacle to progress when localities adopt “a familiar, nationally prevalent set of recommended standards as a continuing place-making default.” (p. 74) Indeed, allowance for variety and the accommodation of local conditions is largely absent from building codes throughout history.

Existing literature on building codes encompasses a broad range of issues. Seidel (1980) addressed the anticompetitive nature of building codes, which he suggested inhibits innovation. Siegan (1976) discussed the non-existence of building codes in major cities such as Houston. In general, the adaptation of a standard building code to a specific locality or under specific conditions is achieved through amendments (Perry, 1939).

1.2.2.1 Current Research on Litigation Following Disasters. While research on the impact of disasters on litigation in general remains sparse, the work of certain scholars sheds some light on the topic. Moreover, exploring how other industries react to disasters is useful in order to understand how changes to laws are effected outside of specific building codes. One of the most dramatic structure-related disasters in the last hundred years was the sinking of the Titanic. Heyer (1995) demonstrated that regulation of lifeboats and wireless communications were upgraded as a direct result of this disaster. However, other lesser-known disasters like plane crashes result in little or no new regulation (Cobb & Primo, 2003; Glassner, 1999). Such protocols are conflicting and offer no sense of consistency in legal regulations, as we will also see in relation to architecture and the construction industry.

Regarding the construction industry's reaction to international disasters in general, literature characterizes regulation as fragmented and depicts the construction industry as a "difficult arena within which to enact structural and cultural change" (Bosher & Dainty, 2011, p. 1).

Early building codes in the United States are associated with fires, beginning as a response to the great fires that regularly swept cities in the late 1800s (Ching & Winkel, 2003). Many scholars contend that early building code amendments were promulgated in response to specific conflagrations (McClymer, 1998; Rosen, 1986). Examples of such cases include the amended building codes developed in 1875 after the Great Chicago Fire of 1871, as well as those enacted following the Great Baltimore Fire of 1904 and the Great Boston Fire of 1872 (McClymer, 1998; Rosen, 1986).

Remaining in line with studies on fire disasters and building codes in other major U.S. cities, much of the extant literature on NYC building code identifies disasters as the primary forces behind new amendments. Throughout history, many of the disasters thought to influence building code amendments in the city were fires, from the Triangle Shirtwaist Factory fire in 1911 to the September 11, 2001 World Trade Center disaster (Stein, 1962/2001; Von Drehle, 2003; Ching & Winkel, 2003, Dwyer & Flynn, 2006).

The belief that disasters are the main force behind amendments to NYC building codes has gone largely unchallenged; it is even stated in the preface of the NYC Building Code 2008 (p. iv).

Although these connections have been drawn, there is limited research that explores the relationship between fire disasters and building code amendments in depth. The most notable study addressing this issue is Leon Stein's landmark investigative report published in 1962 entitled *The Triangle Fire*. Stein asserted that, as of the date of publication of his book, the largest number of amendments to the NYC building code was passed following the Triangle fire. Whether Stein proved his assertion is a matter of debate, but his account of the fire and its aftermath presents impressive evidence in support of his conclusion. Investigative reporter David Von Drehle expanded on Stein's research in his 2003 book, *Triangle: The Fire that Changed America*, which also identifies the disaster as the major precursor of the building code amendments passed during that period.

Despite the preponderance of research supporting the connection between disasters and building code amendments, certain scholars argue that disasters have little effect on the amendment of building codes due to the influence exerted by powerful external forces such as political agendas (Rosen, 1986) or the interests of insurance companies (Demkin, 2008). Even dating as far back as 1911, forces like the media attempted to influence building laws. "No New Laws Are Needed," read the *New York Times* front-page headline on March 28, 1911 following the Triangle Shirtwaist Factory fire in a clear attempt to avoid amendments to the building code.

Regardless of the suggestions of researchers on both sides asserting that disasters either prompt or do not prompt amendments, there is little data to substantiate either claim. Moreover, there exists no research to date regarding the specific forces that influence building code changes (Colwell & Kau, 1982). This study is therefore an attempt to fill the gap in current research regarding the actual forces—disaster or otherwise—behind building code amendments.

1.2.2.2 Technical and Popular Literature on Fires and Building Codes. In addition to the limited scholarly research on building codes and fire events discussed above, there exists some technical and popular literature on the issue (Bryan, 1999). The insurance industry, in particular, has a long history of writing policies regarding building safety with the goal of protecting their insured buildings. In fact, some early building codes like the National Building Code—published in 1905 as a model code—were written by the National Board of Fire Underwriters, an insurance concern (Demkin, 2008). Even today, one of the more prolific commentators on building codes is the insurance industry, especially during disasters (Colwell & Kau, 1982). However, because of litigation concerns, the insurance industry is hesitant to comment on specific disasters. They remain eager, nevertheless, to comment on the rise of special-interest groups affecting building codes but not the amendment process itself (Muth & Wetzler, 1976).

Much of the other technical writing and research related to building codes and fires was conducted in the United States between 1970 and the mid-1980s. The National Commission on Fire Prevention and Control published the technical report *America Burning* in 1973 (NCFP, 1973). The report highlights model codes in areas of new materials and methods of construction, and also addresses specific fires. However, this report does not address building codes or amendments.

A more recent piece of technical literature is *The Fireproof Building: Technology and Public Safety in the Nineteenth-Century American City* (Wermiel, 2000). This work traces the early masonry and concrete details of fire protection systems as large cities mandated fireproof construction. It also documents the impact of building codes on the development of new technologies. However, Wermiel's work fails to examine how building codes were amended to take new technologies into account.

Popular literature has also examined the topic of building code amendments. *The Fires: How a Computer Formula, Big Ideas, and the Best of Intentions Burned Down New York City—and Determined the Future of Cities* (Flood, 2010) describes the "war years" (p. 1) of the 1970s when a series of fires swept through poor New York neighborhoods due to the intentional withdrawal of municipal fire protection. Flood's book includes NYC fire department statements regarding building design deficiencies that were later included in building code amendments.

1.2.2.3 Literature on Specific NYC Fires and Building Code Amendments. Most major fire disasters in NYC have not been investigated in relation to the building code and the amendment process. This lack of documentation, especially in the aftermath of major fires like the 23rd Street fire in 1966, remains a gap in research that this study aims to fill.

The only major disaster in recent NYC history that has been the subject of extensive investigation is the 9/11 attack on the World Trade Center. While much of this literature is related to acts of remembrance, some of it addresses the World Trade Center fires and the buildings' subsequent collapse, and even relates the events to the NYC building code. One of the most referenced works was conducted by the National Institute of Standards and Technology (NIST, 2005) and contains 42 reports describing the fire and collapse of the towers and "current building and fire codes, standards, and practices that warrant revision." (p. 12)

In summary, most of the existing literature related to building codes is specific to a certain location and time period. While some literature exists that addresses specific disasters like the Triangle fire or 9/11 disaster, its documentation related to building codes is limited to that disaster. However, no sources to date address the specific process of amending the building code or the forces that prompt those amendments. In relation to building codes, it is recognized that "the problems and challenges faced in building code regulation are neglected in studies of regulation" (McLean, 2003, p. 23).

1.3 Need and Purpose for the Study

The purpose of this study is to learn what forces have influenced and currently influence NYC building code amendments. To date, those forces remain largely unknown, whether they occur in the aftermath of a disaster (Payne, Bettman, & Schkade, 1999) or not. Contrary to popular opinion, data show that amendment numbers have spiked significantly on occasions when disasters did *not* occur. While some research has explored the amendment process following disasters, no research exists investigating the forces impacting the amendment process during periods when no disaster has occurred. This mixed method study therefore strives to gather the quantitative and qualitative data necessary to examine the forces at play that both initiate and follow the amendment process, regardless of the presence of a disaster during that time. Gathering this data will enable the development of a proactive protocol designed to better ensure the health, safety, and welfare of the public.

1.4 Research Questions

The following research questions were developed for this study:

1. What forces influenced amendments to the building code?
2. Are amendments influenced by disasters, as popular opinion holds? Or, counter-intuitively, is there little or no connection between amendments and disasters?
3. Are amendments influenced by other forces, such as new materials and technologies and socioeconomic and cultural changes?

1.5 Hypotheses

The original hypothesis proposed for this study was that fire disasters were the major influence on building code amendments. This hypothesis was subsequently rejected based on the initial qualitative data gathered for this study: Out of a total of 884 amendments that were promulgated, only a small number of significant amendments (five during the time that the 1968 Code was in effect) were directly influenced by fires. Thus, an alternative hypothesis was proposed in rejection of the original hypothesis. The alternative hypothesis states that there are other forces that influenced building code changes to a much larger extent than fires. These other forces include new materials and technologies and socioeconomic and cultural changes.

1.6 Limitations

The results of this study can only be generalized to older cities in the United States with a building stock extending back at least 100 years. Additional limitations include the following:

1. Due to the time period that this study spans, extraneous variables cannot be controlled. Such variables include time period terms for construction materials (e.g., vegetable fibers) and terms for occupancy uses (e.g., prosceniums).

2. The length of an amendment (by page count) was not considered in the amendment count. A major amendment was counted as a single amendment despite the fact that some major amendments were over fifty pages in length. Most amendments, however, were one to two pages long.

3. The role of insurance companies and cost evaluations in promoting health, safety, and welfare was not studied.

1.7 Definitions of Terms

Although the terms used in this study are common in the architecture and construction industries, definitions are provided below as a guide for the reader.

Amendment: A legal change to the building code that adds or removes parts of the document. Unless the amendment is changed, that amendment remains current; thus, an amendment promulgated in 1910 remains in effect for the building today, unless the building was substantially altered (less than 50% in a twelve-month period). If a building was code compliant in 1650 and has not been substantially altered since then, it therefore remains code compliant today (except for fire safety upgrades including alarms, egress, and signage). It is interesting to note that the major code revisions in NYC of 1899, 1915, 1938, 1968, and 2008 are written as amendments. For example, the 2008 NYC building code was an amendment to the 1968 building code and called Local Law 33 of 2007.

Since Consolidation, an amendment would begin as a local law that is voted on by the New York City Council, then, if approved, the local law is given to the Commissioner of the Buildings Department to sign, and finally to the mayor to sign. However, the 1968 Building Code gave the Buildings Commissioner the power to adopt an amendment without Council approval. (See Section 5.2 of this study.)

Building Code: A set of rules of procedures and standards of materials designed to secure uniformity and protect the public interest in such matters as building construction and public health, established usually by a public agency and commonly having the force of law in a particular jurisdiction. In addition, the building code is the minimum acceptable standard composed primarily of text that describes all construction and demolition procedures to ensure public safety and welfare. The verbal text must be interpreted for the design of three-dimensional components of a building. Architects must apply the building code to their designs to get permitted before and during any construction and demolition.

High-rise: A building of six or more stories. The International Building Code and the 2007 New York City Building Code (BC-403.1) define high-rise as a building with an occupied floor located more than 75 feet above grade. This is traditionally determined from the highest level of fire department vehicle access and has increased only slightly over time. Note: the Rogers Peet fire occurred in 1898 in a five-story building that was at the optimal height for firefighting equipment at the time. The term “high-rise” was first defined in the NYC Building Code with Local Law Number 41 of 1984.

Non-residential building: This use or occupancy group includes Assembly (Group A), Business (Group B), Factory and Industrial (Group F), Educational (Group E), High Hazard (Group H), Institutional (Group I), Mercantile (Group M), Storage (Group S), and Utility and Miscellaneous (Group U).

Residential building: "Residential Group R includes, among others, the use of a building or structure, or a portion thereof, for dwelling or sleeping purposes when not classified as Institutional Group I" (N.Y.C., N.Y., Bldg. Code § 310.1, 2008, p. 51).

1.8 Research Design

This study used a mixed method research design, combining both quantitative and qualitative approaches. While this study could be replicated in any U.S. city, NYC serves as an excellent example because, as an older urban environment, it has buildings that are representative of construction standards that were used throughout the entire country dating back to the late nineteenth century—the beginning of the time period covered in this research.

Twelve major commercial fires that occurred in NYC during the designated time period from 1899 to 2008 were chosen as case studies for this research. The first case study is the Rogers Peet fire of 1898—the first high-rise fire in NYC—and the last is the World Trade Center attack on September 11, 2001, which the New York City Department of Buildings classifies as a fire event (NIST, 2005). All of the selected fires occurred in individual buildings as opposed to conflagrations over large urban areas, such as the Chicago fire of 1871, the Boston fire of 1872, and the Baltimore fire of 1904. This made investigations of code amendment specific to buildings in lieu of covering large-scale zoning laws. Collectively, the fires span 100 years, paralleling all major building code revisions in New York City: 1899, 1915, 1938, 1968, and 2008. A detailed discussion of the quantitative and qualitative analyses performed as part of this study follows.

1.8.1 Quantitative Analysis

A quantitative analysis was conducted to determine the number of amendments passed per year during the 110-year time span from 1898—the year of the first major high-rise fire (the Rogers Peet fire) and one year after the consolidation of NYC—to 2008, seven years after the last major high-rise fire (the World Trade Center fires on 9/11) and the year of the fifth major building code change in NYC. The purpose of this quantitative data gathering was to learn whether—and to what extent—building code amendments increase after a fire disaster. The number of amendments was charted on a timeline, along with the twelve case studies of major non-residential fires in NYC during the same time period.

The notorious Triangle Fire of 1911 served as the benchmark case study for this research since it represents, to date, the largest reform of building codes ever enacted by any municipality in the entire country, with an incredibly high number of code amendments promulgated during the process (Kheel Center, 2011). The quantitative data collected confirms this finding due to the enactment of major revisions of the 1915 code.

The goal of the quantitative portion was to establish a possible relationship between a given fire and the number of amendments it may or may not have generated. In the end, no such relationships were established: The number of amendments did not increase or decrease following fire disasters.

The amendment charting yielded a finding that had never been detected before: There was an unusually large increase in the number of amendments promulgated during a single time period—that of the early 1950s. The year 1950 saw 81 amendments while 1953 saw 89 amendments, the highest number ever passed in one year to date. Unexpectedly, the highest number of amendments fell during a period when no fire disasters occurred anywhere in the city. This was much higher in comparison to the Triangle fire benchmark case—which, although it is traditionally said to have the highest number of building code amendments, saw a total of only 15 changes in 1915.[3]

From 1899 to 2008, the average number of amendments passed was approximately six per year. See Figure 1.1 for a chart of the number of amendments promulgated each year between 1898 and 2008.

[3] Other legislative changes were enacted as a result of the Triangle fire, however, such as factory reform, child labor laws, and union developments. These improvements, not related to building code amendments, may have propelled this fire event into a model of progressive reform.

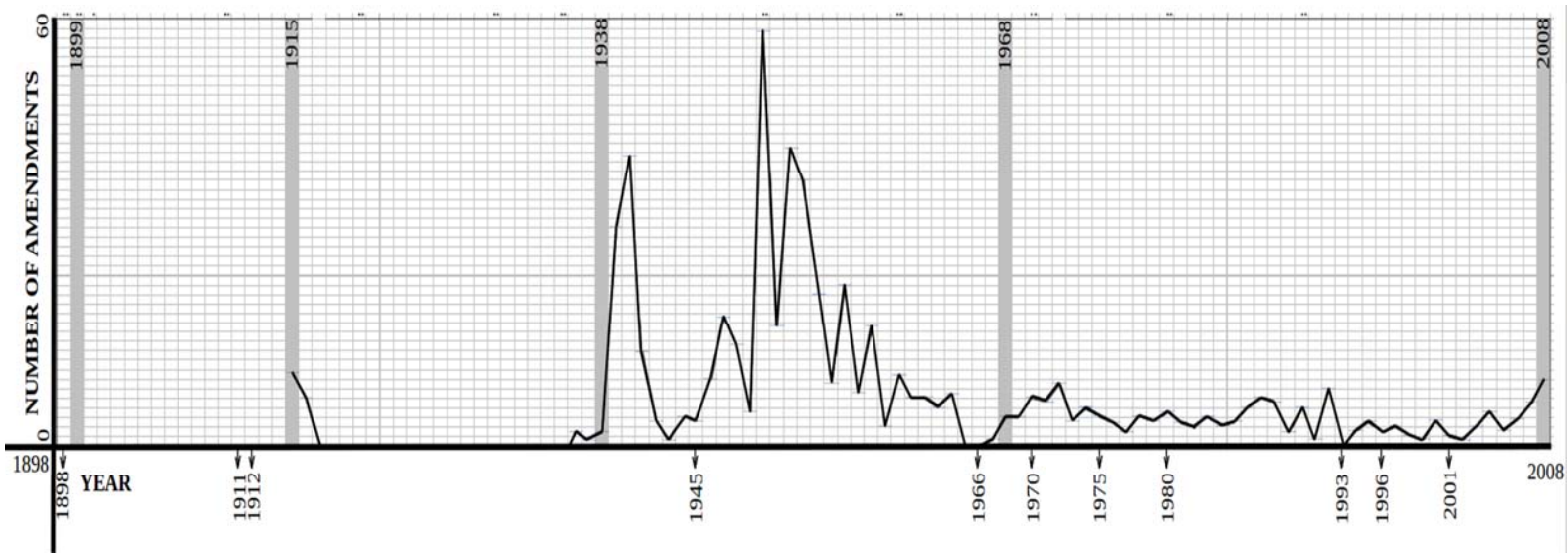


Figure 1.1 Chart of major Building Code editions and amendments. The number of amendments is represented in chart line. Gray columns represent major code editions. Fire disasters are represented at bottom of line.

1.8.2 Qualitative Analysis

Associated with the quantitative portion of this study is a qualitative body of data gathered from various archival sources. The qualitative approach for this study employed grounded theory (Strauss & Corbin, 1990, 1998) to inductively develop and build on the quantitative data collected (Glaser & Strauss, 1967). Thus, the archival sources of building code amendments were treated as data, and were themed and analyzed in order to identify major categories (Rodrigue, 2002). This study protocol is inductive in that a body of specific experiences (twelve fire events) is based on a pattern of particular occurrences (building code amendment). By grounding the analysis in raw data, other amendment triggers aside from fires were identified.

The qualitative analysis revealed that the forces prompting amendments were complex and involved multiple factors. These factors were coded into three categories: new materials and new technologies due to new architectural styles, new occupancies and new uses due to cultural changes, and amendments related to fire prevention.

Once the quantitative data were generated, qualitative annotations were added to the timeline to code the types of amendments passed. Annotations included the architectural, socioeconomic, and cultural issues in NYC during the respective time period of each amendment, as well as technical construction topics such as materials and methods and occupancies. This process followed an embedded strategy of inquiry for the collection and analysis of qualitative data (Creswell, 2003). The qualitative method deepened the insights of the research by collecting narrative data to gain additional insights into the building code amendment process (Tashakkori & Teddlie, 1998).

The type of amendment gives insight into the other forces that prompt building code changes. For example, the amendment spike of the early 1950s is related to changes in construction materials and methods as well as new uses of occupancies. The major categories of building code amendments during the early 1950s were cavity-wall specifications, high-rise structures, foundations, sidewalk sheds, welding, sprinklers, and egress issues. Specific to construction at this time was the high-rise International Style employing lighter modular assemblies of large spans of glass and cavity walls, which replaced heavy non-reinforced masonry construction. Amendments during this time paralleled the massive construction boom that transformed NYC in the post-World War II years.

Once themes were gleaned from the quantitative portion, those themes were back-tracked through the major fires and amendments from all years. Overall, there was little relationship between case studies and amendments. Of the 884 total amendments passed from 1899 to 2008, few amendments overall and only five major amendments during the 1968 Code were a direct result of a fire. These included Local Law 5 of 1973 which resulted from the 1 New York fire; Local Law 41 of 1978 which resulted from the Blue Angel fire; Local Law 16 of 1984 which resulted from the Westvaco Fire, Local Law 10 of 1999 which resulted from multiple dwelling fires, and Local Law 26 of 2004 which resulted from 9/11. While there were other amendments relating to fires, these were themed for fire prevention by construction materials, evacuation, egress paths, and signage and did not coincide with any of the case studies.

1.9 Conclusion

To summarize this chapter, in assembling coalitions of varied interests, this study showed how NYC has always remained competitive for development. As NYC's Progressive Era was replaced by the age of the bureaucrat, different voices had significant influence on the amendment process. However, throughout the history of the amendment process for building codes, there have been various interests and coalitions, well organized and influential—building trades, labor unions, construction and manufacturing firms, developers, civic organizations, financial institutions, the media, politicians, architects, engineers, and lawyers—all of whom have pushed or pulled the amendment process toward their specific interests.

NYC has always been a city of development and this has been especially so during Mayor Bloomberg's three-term administration from 2001 to 2013 when the author of this study worked as an architect for the NYC Department of Buildings. Throughout history, by giving many opposing voices near equal weight in opposing or supporting an amendment, the DOB, acting under the corresponding mayor at a particular time, orchestrated a complex dialogue. However, while this dialogue has resulted in no one interest group having complete satisfaction, rarely have all interest groups been completely satisfied. While the prime directive of the DOB amendment process remained public health, safety, and welfare, a prime directive of the mayor is to improve or at least maintain the health of the city. The NYC building code has progressively become less strict in some sections of the code with the passage of each amendment, allowing development to proceed quickly and less expensively. However, in allowing this broad coalition to amend the code on an as-needed basis, the dynamic nature of NYC is ensured in a constantly changing built environment. In gaining an understanding of the building code amendment process, it remains vital that public safety, health, and welfare not be compromised in favor of development.

CHAPTER 2

GENERAL HISTORY OF BUILDING CODES

2.1 Introduction

This chapter provides selected examples of early building codes. These examples begin with the four societies in the Ancient Near East that were the earliest to write such laws. The laws developed by the Sumerians, the oldest of these societies, formed the basis for laws in the other three societies. This practice offers the earliest evidence of adopting a law and amending it to meet the needs of the new society. Laws relating to the construction of buildings were determined by the issues of importance for a society based on the specific era and locale in order to ensure public safety. This transition documents the first recorded situation for identifying forces that influenced the change of laws regulating buildings.

This chapter continues by tracing the early building codes of NYC from the Colonial Era of the Dutch and the English to the consolidation of the five boroughs, from 1625 to 1898. The case of NYC demonstrates the manner in which the regulatory aftereffects of catastrophe often interact with a U.S. city's complex history to lay the foundation for a change in building code. A thorough examination of the effects of major fire disasters in three United States cities follows in an effort to explore the potential relationship between early building code amendments and fire disasters. These fires occurred in NYC, Chicago, and San Francisco, respectively. Following each fire disaster, the building codes for these respective cities were not immediately altered to a significant degree. The force that amended the building code in Chicago was the influence of insurance companies, while the force that transformed the building code in San Francisco was its overall suspension of the code during a period of rapid growth and development. Disasters, which scholars (Ben-Joseph, 2005; Ching & Winkel, 2003) believe to be the main force that influenced change in building codes, were not evidenced at this time.

2.2 Ancient Examples

This section explores the origin of amending a modern building code through an examination of common themes in ancient building laws. The topics of these laws, which were changed from one society through other societies, were the regulation of land ownership, proper construction methods, and penalties for non-conformance. Details were addressed such as mold and fire prevention.

Evidence of building codes began with the earliest written laws in Mesopotamia. Historians document the succession of law creation from one ancient society to another. Hammurabi to the Hittites to Mosaic Law, as each society adopted and transformed the other's laws based on its own local needs (Biberfeld, 1948).

The earliest written law discovered to date was that of Ur-Nammu, c. 2050 BCE (Roth, 1995) and this law set a base from which future laws could be formed. Of thirty-two sections of the Ur-Nammu Law, three sections related to the use of agricultural land and the penal compensation required for improper use of the land. An example of the law was the following: If a man had let an arable field to another man for cultivation, but he did not cultivate it, turning it into wasteland, he shall measure out three kur of barley per iku of field.

Societies in close local proximity to one another often assimilated each other's laws and then amended them by adding additional sections (Saggs, 1962/1988). Such was the case with the Code of Hammurabi, c. 1750 BCE that added directly to the Ur-Nammu Law, by additions that dictated the quality of construction (Roth, 1995). Of the 282 sections of the Code of Hammurabi, five sections dealt with buildings. The main topics were improper construction that caused collapse and an increased level of compensation for public safety. An example of the law was the following: If a builder has built a house for a man, and has not keyed his work, and the wall has fallen, that builder shall make that wall firm at his own expense.

In 1595 BCE, the Hittite army attacked Babylon and assumed power. As a result, Old Hittite laws from 1650–1500 BCE contained some sections that bear a resemblance to those in the Code of Hammurabi, which were subsequently preserved in the New Hittite laws of 1500–1180 BCE (Johns, 1987). Of the 200 sections, four related to buildings. Of these, three sections dealt with fire prevention and the fourth dealt with the theft of building materials. An example of the law was the following: A free man sets fire to a house. He shall rebuild [the house]. And whatever perished in the house-whether it is persons, cattle or sheep, he shall make compensation for it.

The Mosaic Law, c. 1450 BCE, also had sections related to buildings that were directives to regulate public safety (Alter, 2004; Biberfeld, 1948). These biblical passages are specific for the first written instances of mold remediation and parapet installation. Leviticus 14:37-39 reads,

> *And if he sees the affliction and , look, the affliction is in the walls of the house, greenish or reddish hollows that seem lower than the wall, the priest shall go out of the house to the entrance of the house an sequester the house seven days.* (NKJV)

Deuteronomy 22:8 reads “*When you build a new house, you shall make a parapet for your roof, that you not put bloodguilt in your house should someone fall from it.*”

The change of laws from one society to the laws of another society can plausibly suggest the first incidence of amendments. All of the laws in these ancient societies related to the proper use of land, proper construction for public health and safety, compensation and penalties.

The following section transitions into a discussion of the building codes in the United States. This begins with an exploration of early building laws during the Colonial Era in Fort Amsterdam, the settlement that would eventually become NYC.

2.3 Examples in NYC

Transitions of Building Codes from the early settlement of Fort Amsterdam through the Dutch and English settlements demonstrate a progression of change in areas of public safety and health by mandating specific materials, sanitation measures, and proactive fire prevention measures. Laws governing buildings from the earliest settlement were used as a base with regulations added by succeeding settlements. As long as the local governments wrote and enforced building codes, such as in Colonial Era, building laws were robust in nature. However, in 1798, New York State assumed responsibility for writing the Building Code and amendments for Manhattan and Brooklyn, and enforcement of the Code was given over to the City. At this time, the Building Code became insufficient to properly protect the public. A major fire in Manhattan, as well as in two other cities in the United States demonstrated that in the late nineteenth century, amending the Building Code in response to a fire disaster did not increase the strength of the Code. Amending the Building Code as a result of these three major fires decreased regulations and compromised public safety.

Building Codes for NYC have historically been written to regulate construction and demolition for the health, safety, and welfare of the public. The NYC building code has always been comprised of laws adopted by the city that specify the acceptable uses for buildings, structures, and premises, and the minimally acceptable standard of care during demolition and construction of buildings. While NYC has had a building code since 1625, this study concentrates on the building code since the consolidation of all of the city's boroughs in 1898. However, it is useful to examine the earlier building laws and practices that paved the way for the establishment of the current NYC Building Code.

Historic building codes remain relevant and applicable today for two reasons. First, it is often the case that buildings have not been substantially altered since the earlier laws were enacted, except for minimum modifications to incorporate essential safety upgrades. This practice is possible since the code in effect at the time of permit governs the building even if the building dates back to the 1600s. Second, current building codes are usually assembled from prior codes—a protocol that has been standard for as long as building codes had existed. As such, the intent behind these early regulations is of concern. An example of a regulation that remains in effect for NYC buildings that date back to the 1600s is that mandating the materials required for certain construction assemblies, such as roofs, chimneys, and egress exists. These historic building codes are called "prior codes" and they remain significant today because they govern the majority of the almost one million buildings in NYC. In an effort to provide context for these prior codes, the following section addresses early Colonial Era building laws which were later amended into the current NYC Building Code.

2.3.1 Early Colonial Building Codes and Amendments

The building codes that were instituted during the Colonial Era in the area known today as NYC are explored in this section in order to lay the foundation for the modern NYC Building Codes examined in this study. The 1625 Code of New Netherland was the first building code in the region to mandate new practical and proactive uses, such as lot layouts, and the utilization of new materials specific to the wilderness, such as wooden roofing. It is important to note that the 1625 building code was written without mentioning fires or disasters. The precursor of NYC, Fort Amsterdam in New Netherland actually implemented the first documented building regulations in the Western Hemisphere, entitled the "Special Instructions for Cryn Fredericksz Regarding the laying out of the fort." The document was decreed by the directors of the Dutch West India Company on April 22, 1625 (Phelps-Stokes, 1928).

The aforementioned instructions were, in effect, a law that mandated construction elements of buildings for the health, safety, and welfare of the public. The instructions, the 1625 Code of New Netherland, further mandated that the surveyor must regulate all construction.

> *All of which we desire to have observed without any alteration, unless some evident mistakes have been committed herein, which may be duly corrected by the Commissary, the surveyor, and the Council, provided they advise us of the reasons for such change. (McGoldrick, Graubard, & Horowitz, 1944, p. 88)*

This stated that the surveyor had the power to enforce the law as it related to buildings. The instructions included regulations to promote good health like the requirement that water be drained away from buildings into prescribed areas. Other safety requirements decreed the placement of exit doors at distances, and *"the storage of munitions of war, arms, powder, lead, and other things"* (p. 89) at prescribed distances away from residences. Given that the code was written by a trading company, it focused heavily on the regulation of local materials, as well as rapid future growth, and safe construction to prevent shoddy development (Fisher, 2008). Specific materials were specified: *"As to the roof-covering, care shall be taken to find out what is the most serviceable material. If no thatch, straw, or anything else can be found, wooden shingles will have to be taken at first."* (p. 94) The more durable material, wood, was mandated by law. Construction assemblies were prescribed for the roof: "Wooden gutters may be hung under it to prevent the drip." (p. 90) Sizes of lots were specified to be exactly 25 feet by 35 feet. Specific sizes and less-desirable lots were specified for certain uses, such as "20 feet in width and extending in depth 40 feet, to the ramparts, where single persons, such as sailors and others, may be lodged." (p. 92) It is significant to note that the 25-foot lot size remained in the all the future NYC Codes. Materials and land usage of this first law governing buildings set a base from which future laws could be changed or amended. Examples of buildings in NYC today that were constructed under the ordinances of the historic code of 1625 include the 1652 Pieter Claesen Wyckoff house in Brooklyn and the 1656 Lent-Riker-Smith Homestead in East Elmhurst, Queens. These houses remain code-compliant to the 1625 Law.

On July 4, 1647, the Dutch at Fort Amsterdam passed the *"Ordinance appointing building surveyors and regulating improvement of lots,"* which amended and strengthened the prior 1625 Code. The surveyors were given broad authority to prevent "disorderliness" by mandating that owners of houses stop extending their lots and constructing pigpens and privies along the streets, setting out to *"hinder all improper and irregular constructions, fences, palisades, posts, rails, etc."* (McGoldrick et al., 1944, p. 42). The code required "subjects" to obtain the consent of the building surveyors to construct any buildings or fences. Finally, if property was not improved within nine months, such unimproved lots would *"devolve"* into the ownership of others (Gehring, 1991, pp. 11–12). In general, the 1647 Ordinance focused on regulation and enforcement of such mandates for public safety:

> *Whereas we see and notice by experience the previous disorderliness and continued daily practice in the building and erecting of houses; in the extending of their lots far beyond the survey; in the construction of pigpens and privies along the highways and streets; in neglecting and omitting to build properly on granted lots;…..we hereby authorize and empower to disapprove of and, in the future, to hinder all improper and irregular constructions, fences, palisades, posts, rails, etc. …..Likewise, we want to have each and every one, who has heretofore received any lots warned and notified to improve their lots properly within nine months from now with good and suitable domiciles according to the ordinance…. Thus done in court session in Fort Amsterdam, the 25th of July 1647. (p. 64)*

This 1647 Law amended the 1625 to a stricter enforcement standard and became more specific in penalties for construction on another’s property.

In 1648, these regulations were updated to include aspects of fire prevention, which included the prohibition of new construction of wooden and plastered chimneys, and mandated regular inspections by fire-masters of existing chimneys made of such materials (Gehring, 1991). In 1657, sanitation was expanded to prohibit rubbish and filth from being thrown into the streets or canals (Koren & Bisesi, 2002). Again the law was amended to include specific instructions for fire prevention and public safety measures.

In 1664, the Dutch surrendered New Amsterdam to the British, who immediately renamed the settlement New York. This meant that building, sanitary, and fire regulations were thus altered to reflect British law. The ensuing Duke of York’s Laws, 1665–1715, put forth regulations related to public and military storage to ensure public safety (McGoldrick et al., 1944). This history reinforces the pattern that those who wrote building codes were concerned with materials and methods of construction as aspects of civic welfare. Moreover, when threat of fire became a concern during this period, the building code acted as a proactive mandate, not the result of a disaster.

> *Every Town shall be provided of a Sufficient ware house and a Safe convenient place thereunto Adjoyning [sic] for keeping Powder and Ammunitiion [sic]; under the penalty of ten Pounds and the Constable and Overseers shall provide and maintain for a General Stock to the use of the Town in Case of necessity……If any Person or Persons whatsoever shall set on fire any dwelling House Church or store house to that purpose shall set on fire any Out House,*

Barne [sic], Stable Stack of Hay, Corne [sic] or wood …..He shall be Commited [sic] to Prison. (p. 71)

The Duke of York's Laws stated that regulation of hazardous materials and the enforcement of such regulation related to fire hazards was a mandated duty and if not adhered to was punished.

Under British law, the city continued to amend its building code for the enforcement of lot sizes and fire protection. Although no major fires occurred, these changes offered a substantial improvement in public safety, demonstrating a proactive approach to the amendment process. In 1683, a block and lot plan was amended from the prior code. To ensure that buildings were constructed within lot lines, owners were required to obtain a certificate of approval from the constable prior to construction. In 1703 and in 1731, laws regarding building were passed concerning the public safety of hazardous materials such as pitch, tar, and turpentine. On January 1, 1766, the building code was amended into The Colonial Laws of New York, which included laws dictating specific materials like stone and brick for exterior walls and slate or tile for roofs, as well as their enforcement in the use of such materials. Roofs of existing buildings were required to comply with the law when the roof was replaced. However, a shortage of slate required that the law be amended in 1775, allowing wood roofing shingles when the buildings met size limitations.

In addition to requiring the use of specific materials, The Colonial Laws of New York amended the prior code to include fire districts. A fire district was and continues to be defined as a geographical area for which the control of occupancy groups and the construction of buildings was subject to regulation for fire prevention and firefighting.

The colonial legislature specified such fire districts by mandating that new buildings constructed south of present-day Foley Square "to the Southward of Fresh water" be constructed of fire-retardant materials.

The Great Fire of 1776 destroyed some 25% of the approximately 450 buildings in New York City at the time. This fire was during the city's occupation during the Revolutionary War. Despite this disaster, increased fire districts were not added to the code until the mapping of the 1811 grid in Manhattan when the districts were expanded. Subsequently in 1813, fire districts expanded to encompass all streets south of Canal Street, and the city appointed surveyors to enforce regulations. By 1833, fire districts again expanded, this time to 14th Street. In 1835, a fire destroyed 700 buildings in lower Manhattan, and in 1845, another fire destroyed 300 buildings. It is important to note that, because of these significant fire disasters, building laws and their amendments did change in response to fire disasters. The increase in the number of fire districts provided a robust strengthening of the Building Code.

2.3.2 City Building Codes Written by the State

The evolution in the jurisdiction over building regulations in NYC is examined in this section. The ability of the Building Codes promulgated from 1798 to the consolidation of the five boroughs did not sufficiently provide for public health, safety and welfare. As one Building Code was amended into the next, the strength of the Code was not increased and often was decreased.

Since the Colonial Era, control over building regulations in NYC has changed hands several times. Enforcement and development of the Building Code became the purview of different entities. From 1798 to 1860, the Fire Department of the City of New

York enforced the NYC Building Code. During this period, New York State developed and amended the building code for the cities of Manhattan and Brooklyn. In 1860, the Fire Department relinquished the enforcement of the building code to the newly established NYC Department of Buildings.

For almost one hundred years (from 1798 to 1897), New York State was responsible for writing and amending the building code for NYC. The disastrous NYC fires of 1835 and 1845, both of which occurred south of Wall Street, prompted amendments to the building code for expanded fire districts. Chapter 84 of the Laws of New York State 1849 stated that the 1849 Building Code extended the fire district across Manhattan from the Hudson to the East River at 32nd Street. Chapter 188 of the Laws of New York State 1856 stated that the 1856 Building Code took fire districts to 42nd Street.

On April 17, 1860, NY State enacted the 1860 NYC Building Code. the first comprehensive building law that can be said to resemble a modern building code for New York City. Chapter 470 of the Laws of New York State 1860 stated that the Building Code provided standards for walls, floors, foundations, roofs, windows, columns, beams, girders, arches, masonry, iron, wood, heating systems, steam pipes, and fireproof coverings for iron structural elements. This 1860 Code was more rigorous than the previous codes, and was also highly debated. Fire egress was a prominent issue addressed in the code that prompted debate. In particular, the 1860 Code included an amendment mandating fire escapes on all tenement buildings—becoming the first such law in the entire nation to address fire escapes (Kane, 1981). Owners objected to the increased cost and the possible physical impossibility of installing fire-escapes.

The greater part of the 1860 code amendments, written by the state, related to the empirical design of buildings, an approach which utilizes a template for architectural design in lieu of engineering or mathematical design. Empirical design was less time consuming and faster because of the omission of engineering calculations. Empirical designs were taken from manuals to be mixed and matched by architects. Amendments that included empirical design allowed buildings of up to five and six stories to be quickly and economically constructed. However, enforcement of the Code changed on June 1, 1860, when the position of Superintendent of Buildings was created, which was embedded in the NYC Fire Department. Also in 1860, the first city building inspectors were appointed to enforce the new building code. This new bureaucracy caused administrative confusion for enforcement when amendments were passed at the state level for a city government. In 1862, a further division in responsibility occurred. The Department for the Survey and Inspection of Buildings became independent of the fire department.

With the administrative changes for the enforcement segment of the Building Code, compliance with the Code became unclear. The development segment of the Code, which was the purview of the State, was weak because of the disconnect of site-specific conditions particular to NYC. An example was fire-escapes. At this time, fire-escapes were often simply ladders made of wood nailed to the façades of buildings without regard to egress paths (André, 2006). The 1862 NYC Building Code mandated seemingly adequate fire-proofed egress but defaulted to wood fire ladders as noted in the following section of the 1862 Code:

> *§25. In all dwelling houses which are built for the residence of more than eight families, there shall be a fireproof stairs, in a brick or stone or fireproof building, attached to the exterior walls, and all the rooms on every story must communicate by doors; or if the fireproof stairs are not built as above, then there must be fireproof balconies on each story on the outside of the building, connected by fireproof stairs, and all the rooms on every story must communicate by doors. If the buildings are not built with either the stairs or balconies as above specified, then they must be built fireproof throughout. All ladders or stairs from upper stories to scuttle or roofs of any building, shall, if movable, be of iron; and if not movable, may be of wood; and all scuttles shall be not less than three feet by two feet. (p. 33).*

The above code section proved weak and detrimental to public safety. The State amended the Code for fire-escapes in the city in 1866, 1871, and again in 1892 to a more rigorous standard.

Administrative confusion persisted surrounding the Department of Buildings from the 1860s to the consolidation of the five boroughs in 1898. It changed names and merged with and separated from other agencies countless times during this period.[4] New York State did not restore regulation and enforcement of the building code back to the city until 1899, after consolidation of the five boroughs.

---

[4] In 1870, the Department for the Survey and Inspection of Buildings shortened its name to the Department of Buildings (DOB). However, in 1880, the DOB was merged back into the Fire Department and became the Bureau of Inspection of Buildings. The Bureau became an independent agency again in 1892, but in 1901, it was placed under the auspices of the five borough presidents with separate Bureaus of Buildings in each borough.

The Building Codes written by New York State for the city was written initially in 1860 and amended three times, in 1866, 1871, and in 1892. These codes were weak because of the split in enforcement and development.

2.3.3 Rogers Peet Fire

A major fire that occurred in the city at this time was the Rogers Peet Fire. The NYC Fire Department considered this the first high-rise fire in the city. On Sunday, December 4, 1898, a fire ignited in the cellar of 260 Broadway, the Rogers Peet Building (c. 1863). With boilers in full force and clothing in storage that provided fuel, the fire spread through the wood floors and roof and ignited the adjacent Home Life Insurance Company Building at 254 Broadway (c. 1894). All five stories of the Rogers Peet Building collapsed two days later. The upper floors of the sixteen-story Home Life Building were gutted, repaired, and the building stands today.

The Rogers Peet Building was constructed of stone and mortar veneer with masonry back-up and wood floors in compliance with the 1860 Building Code. The Home Life Building, in comparison, was a steel skeleton frame with marble cladding, concrete terra-cotta floors, but windows with wood frames. Even though it was considered a fireproofed building, flames spread quickly through the wood windows and through the elevator shafts that acted like a flue pulling flames upward. The construction deficiencies of wood floors and windows with wood frames would significantly contribute to the fatalities in the Triangle Shirtwaist Factory Fire twelve years later. Most importantly, the 1892 Building Code was not amended to address outstanding construction deficiencies noted from the Rogers Peet Fire.

2.4 Other Examples

This section discusses two other major fire disasters from the same era as the Rogers Peet Fire. Both the following fires and the Rodgers Peet Fire did not result in amending their respective building codes. This finding challenges the assertion that the "origins of the codes we use today lie in the great fires that swept American cities regularly" (Ching & Winkel, 2003, p. 2). In the following examples, the building codes were downgraded as a result of the fires. The building codes for both cities were eventually amended, but only after substantial rebuilding in wood, which was the primary caused the spread of fire. Both the following examples suggest a weak motivation to amend building codes to a more robust standard.

2.4.1 The Great Chicago Fire

Similar to NYC during the 1800s, many American cities suffered from devastating conflagrations, the largest of which was the Great Chicago Fire. As a result of this fire, Chicago amended its building codes in response to forces outside of its municipal government. Yet, the amendments were only a fraction of those that were originally proposed, and many of them were promulgated too late to be most effective. Major fires occurred during this era in Chicago in 1871, Boston in 1872, again in Chicago in 1875, and in Baltimore in 1904. The forces that amended the building codes in each of these cities are quite similar, so it may be understood that the history of building code in Chicago was echoed in Boston and Baltimore. Each of these cities eventually achieved upgraded building code amendments but "not without undertaking far-reaching political reform and not without their having spent many frustrating decades trying unsuccessfully to make the improvements earlier" (Rosen, 1986, p. 4). Amending the Building Code to a higher standard for public safety was difficult, even in the aftermath of a major fire disaster.

On the evening of October 8, 1971, a fire started in a wooden barn owned by the O'Leary family of Chicago. Legend has it that an angry, un-milked cow knocked over an oil lamp. Dry, windy conditions spread the fire for twenty-seven hours through the city's wooden streets, wooden sidewalks, wooden bridges, and wooden buildings. Three hundred lives were lost. Four square miles of city, including 18,000 buildings, were destroyed. The flames demolished the waterworks building with its wooden mansard roof, thus disabling the Fire Department. The blaze continued to burn unrestrained until a rainstorm finally extinguished the flames. One third of the city's property value was lost, of which only one half was insured. Even the new fireproof cast iron buildings burned down when fire melted the exposed iron.

One week after the fire, the city began to discuss making buildings safer and better constructed than they were before the fire, in addition to improving the water system. An impending election placed into office a majority from the newly formed political party, the Fire Proof ticket, on the Board of Aldermen. However, two groups fought over different approaches to amend the building code. The first group, consisting of primarily middle and upper income individuals, wanted a ban on all wood construction. This ban included prohibiting the common practice of "house moving" (Rosen, 1986, p. 98) which involved moving a wooden house. Wealthier owners of well-constructed buildings were often blackmailed by real estate speculators who moved wooden "tinder boxes next door. Speculators wanted to diminish the value of owners' properties. The second group, consisting of primarily lower income, working class individuals, wanted a partial ban on wood construction. This group depended on wood construction for building and owning their own homes. By building on land that was leased, homeowners were able to move their wooden houses to more affordable land as needed in order to safeguard their investment. To Chicago's workers, wooden homes were more desirable than masonry homes because they were less expensive to move.

Ultimately, the working class group won. The Board of Alderman accumulated a "stupendous pile" (Rosen, 1986, p. 105) of amendments as stated in the *Chicago Tribune*, January 18, 1872. The amendments to the building code that stipulated regulations associated with fire prevention. The new code allowed wood frame buildings in most of the city, but prohibited them from a small section of the city where the new fire limit zone was located. A fire limit zone is an area where all new construction must be built of fire-resistive materials, such as masonry. This zone ran along the Chicago River and became the Central Business District. The fire limit zone was enlarged following the Great Chicago Fire, at the same time that wood construction was prohibited. However, within the expanded fire limit zone, amendments still allowed many forms of wood construction, such as the relocation, alteration, and improvement of existing frame structures. Thus, the building code allowed house moving, as well as repairs to burnt wood structures in the fire limit zone, as well as in all other areas of the city.

In addition, the newly promulgated amendments following the fire allowed fire-resistive masonry construction to include the construction of combustible assemblies such as flammable felt and tar roofs, wooden cornices, window frames, and other wooden exterior work. Construction of wooden sheds and outhouses, wooden sidewalks, and wooden streets was still permitted throughout the city. Thus, in spite of the newly amended building code, Chicago was rebuilt in mostly wood. In addition to the allowance of continued wood construction, these new amendments contained no provisions for enforcement. As a result, individuals continued to build wooden buildings, wooden streets, and wooden sidewalks throughout the city, even in the new fire limit zone. The building code amendments following the 1871 fire thus embodied a laissez-faire downgrading of the code at the expense of public safety.

Considering the weak nature of the code amendments following the Great Chicago Fire, it is not surprising that another large fire occurred in Chicago in July 1874 that followed the same path as the 1871 fire. Eight hundred buildings over fifty acres were destroyed. After this second large fire, insurance companies threatened a boycott on all policies. The insurance industry was thus the force that ultimately compelled the city to improve and strengthen the building code (Rosen, 1986).

Another major fire disaster that occurred in the city of San Francisco is discussed in the next section.

2.4.2 San Francisco Earthquake/Fire

As this study has found, forces that influence amendments to a building code are often more complex than a fire disaster and extend beyond the need to regulate new materials and new technologies. Following the San Francisco Great Earthquake and Fire of 1906, the force that prompted amendments to the building code was the city's desire to rebuild quickly in an effort to restore it to its original state before the fire. Following the fire, building code amendments were passed that downgraded the strength of the code in favor of quickly rebuilding the city.

San Francisco was a thriving city at the beginning of the twentieth century, consisting primarily of buildings under seven stories in height that were constructed of wood frame. The wooden buildings were dense and the streets of the city were laid out in narrow grid patterns. The physical constraints of the city—high density of buildings in relatively narrow streets—facilitated the spread of fires and posed a major challenge to firefighting.

The San Francisco Great Earthquake and Fire was one of the worst urban disasters of the twentieth century and is considered the most serious conflagration in American history (Smith, 2005). The earthquake that caused the fire struck on April 18, 1906. Fire resulted from severed electrical and gas lines and collapsed chimneys, and burned for four days over five square miles. There were over 3,000 fatalities, and the residential and commercial centers of the city were destroyed. More than half of the city's population of 400,000 residents ended up homeless.

In addition to San Francisco's physical devastation, the municipal government was weak, corrupt, and unable to commence emergency services in the wake of the disaster. In response to the government's weak state, a committee of business and civic leaders was formed the day of the earthquake to replace the municipal administration. One of the first actions of the committee was to insist that this disaster be called a fire, not an earthquake. The renaming was for insurance purposes, as it would enable the flow of funds to the city for rebuilding. At the time, insurance companies covered fires, not earthquakes (Hansen & Condon, 1989). The committee continued to make critical decisions regarding the city's building code throughout the rebuilding process over the next three years.

One of the committee’s main decisions involved infrastructure and city planning. Prior to the disaster in 1904, the city had commissioned architect Daniel H. Burnham to design a city plan with diagonal boulevards supplemented by highways. The committee had the option to implement this new city plan following the devastation of the fire, which would have been the ideal opportunity for rebuilding the layout of the city. However, the committee rejected Burnham’s boulevard plan, deciding to reconstruct the city to its previous grid plan. Its priority was to immediately restore essential city services, which would have been further delayed had the new city plan been implemented. The following statement by engineer, John Galloway, of the committee characterized the mentality behind the rebuilding process, “What San Francisco needs is the cheapest buildings possible in which business can be done, to ensure the community enough to eat” (Fradkin, 2005, p. 196). As such, expediency took precedence over all other concerns. While the boulevard plan had several advantages, as it would have facilitated transportation for firefighting apparatuses and the new boulevards and highways would have served as fire buffers to curtail the spread of fire, these issues were not of main concern to the committee.

The committee decided in favor of rebuilding the existing urban layout in lieu of a new design for two reasons. First, eminent domain for assembling land lots was deemed too difficult since the city did not have the power to condemn unsafe buildings. Thus, large parcels of land needed for infrastructure could not be amassed for the new city plan. Second, the committee was concerned with assuring an adequate supply of water for future firefighting, as the existing water supply was destroyed in the fire. The existing pumps for water were housed in a wooden building in the center of the city.

Unfortunately, the committee ultimately rendered future firefighting more difficult by deciding not to replan the city.

Following the fire, San Francisco decided to omit new construction from the building code. Any new building to be constructed did not require a permit and thus, did not need to be constructed to any Building Code. G. Hansen and E. Condon’s assessment of the rebuilding of San Francisco coincides with that of many other historians in regards to the code, building code standards were actually reduced from those in effect before the Great Fire. One important example of reduced code following the fire was the failure to mandate incombustible materials of masonry for part walls and the allowance of new construction to be made of all wood assemblies. Although masonry has long been considered the best inhibitor of fire for construction assemblies, it is more time consuming than construction with wood, it requires more semi-skilled labor, and it is more costly. Even though lumber prices doubled after the earthquake, the city still opted to rebuild mostly of wood (Douty, 1977). Another rationale for this decision aside from expediency was that wood is more flexible than brick construction and would respond better in the event of another earthquake.

In addition to omitting fire-resistive construction from the building code, the city also waived building permits for one-story temporary wooden buildings. The permit process is directly related to building codes since building design must conform to the building code before a permit is issued to begin construction. Waivers of permits allowed rebuilding to commence quickly and to continue without adherence to any building codes, which jeopardized the public safety that building codes are meant to maintain. The engineer, John Galloway, a member of committee of 50 in San Francisco (Fradkin, 2005) described this unconventional rebuilding process in the following quote:

> *The fire district of incombustible buildings was not significantly enlarged . . . nor was the building code greatly strengthened. . . . Rather than being prescribed by law, individual architects, engineers and their clients acted on their own to include or exclude safety features in the new structures. (p. 243)*

This allowed unregulated construction. The unpermitted one-story temporary wooden buildings quickly became two- and three-story permanent buildings constructed of wood; these structures remained unpermitted and were not built to the minimum standards of the building code.[5] Many of these same unpermitted buildings remain standing today with grandfathered permits but without the safety of code compliant fire-retardant construction assemblies such as masonry party walls. Unfortunately, the extent of unpermitted construction during the rebuilding process is not known since title records were burned, which made it impossible to account for the amount of new construction in the three years of rebuilding.

Amending the building code to weaken regulations in 1906 continues to have potentially unsafe consequences for San Francisco. Many of the rebuilt wooden buildings from the aftermath of the 1906 Great Fire have been landmarked and are still occupied. Since the city "overlooked or reduced the requirements to meet code… many of the buildings now standing in the city have wind loads, and floor and roof loads, that have been reduced by as much as 50 percent" (Smith, 2005, p.271). This poses substantial risks for any future earthquake or fire disasters in the city.

---

[5] "Insurance companies have predicted that in an earthquake similar to that of 1906, as many as 48,000 buildings would be destroyed in the ensuing fires unless the city could dispatch 142 engine companies—100 more than the city has to date" (Smith, 2005, p. 271).

In 1909, San Francisco amended its building code to include stricter construction assemblies. However, this new code did not include retroactive measures. By this time, the city was already rebuilt and all existing buildings were allowed to remain. San Francisco did not amend its building code to include masonry assemblies for fire protection in new construction until 1926. Seismic provisions were not added to the building code for new construction until even later when the 1933 Riley Act mandated such regulations.

While the relaxed building code following San Francisco's Great Fire enabled the city's swift rebuilding in three years, it was at the cost of public safety. San Francisco is similar to NYC in that many remaining buildings in both cities today are built to historic and less stringent building codes, and they therefore continue to compromise public safety. Both NYC and San Francisco have rejected a new, stricter building code that was proposed following a fire disaster. For NYC, the amending of the building code to a reduced strength occurred following the Triangle Shirtwaist Factory Fire of 1911, which is detailed in chapter three.

2.5 Conclusion

Amending laws governing the construction and demolition of buildings can be documented throughout history, beginning with ancient societies. The primary concern behind such laws dating back to ancient times was public health, safety, and welfare. Although this issue remained a principal concern in the early days of New Netherland, New Amsterdam, Manhattan and Brooklyn, it was at times compromised by other interests, as demonstrated by not amending the building code following the major fire in the Rodgers Peet Building. Failure to amend the 1892 Building Code of NYC was echoed in two other major fires of the time in Chicago and in San Francisco. Similar circumstances leading to the NYC Triangle Fire are examined in the following chapter.

CHAPTER 3

THE NEW YORK BUILDING CODE: 1899 AND 1915

3.1 Historical Context

3.1.1 Introduction

As discussed in earlier chapters, the forces that have influenced amendments to the NYC Building Code are diverse and complex in nature, and are not limited to fire disasters. Even in the extreme cases of devastating fires like The Triangle Factory Fire, the forces that influenced building code amendments were much more complicated than a simple response to fire disasters. This chapter discusses the various forces that influenced amendments to the city's 1899 and 1915 Building Codes. In particular, this chapter discusses how the human factors of self-confidence influenced amendments to the 1899 Building Code. The forces that influenced 1915 Building Code amendments are also explored, including public lobbying for safety, sanitary conditions, and increased enforcement, as well as professional lobbying for the new technologies associated with the high-rise building.

While the 1899 Code and the 1915 Code are separate and different, they are often discussed as one entity. The 1899 Code was the first Building Code written by the newly consolidated City. The 1899 Code was taken almost entirely from the prior City Code written by New York State specifically for the City. The 1899 Code was weak in both technical and enforcement requirements. In contrast, the 1915 Code was robust, possibly as a reaction to disasters, such as the Triangle Fire. The 1915 Code was the first Code completely written by the City specifically for the City.

3.2 The 1899 Building Code

3.2.1 Description

New York City's first Building Code was established in 1899 following the 1898 consolidation of all five NYC boroughs. Prior to this time, New York State played an integral role in the building code and amendment process for the city, as it wrote building codes for all of the independent boroughs in the state. As a newly consolidated city, however, many residents felt that NYC needed its own code that was written by the city for the city. Upon examining the circumstances surrounding the establishment of the 1899 Building Code, it becomes clear that the driving force behind the amendment process during that era was residents' pride in a new city. At the time of consolidation, New York City became "a self-confident city" (Homberger, 1994, p. 115). The city was beginning to project a strong sense of identity upon the rest of the country. Unlike later amendments, the new 1899 Building Code had little to do with new materials, new technologies, or disaster events.

Regarding the consolidation of all five boroughs into the City of Greater New York, the citizens of Manhattan and Brooklyn, as well as businessmen, professionals, and the Chamber of Commerce were "lukewarm", "apprehensive about the future", and embedded in "honest graft" as George Lankevich in his 2002 book, *New York City: A Short History*, (p.129) stated. He adds that the incumbent, Mayor Strong, said consolidation would be a "funeral service" for New York. Edwin G. Burrows and M. Wallace in their 1999 book, *Gotham: A History of New York City to 1898*, describe the creation of the new City's Charter Commission "to please home rulers" by placing prior laws into the purview of the new city. Burrows and Wallace further state that "Housing reformers applauded the charter's call for a commission to establish a uniform building code for all five boroughs." (p. 1234)

An article in *The New York Times* by M. W. Desmond in 1899 titled "What the New Building Code Actually Is" explained that the Code took the building law out of the hands of Albany politicians, made it a home-rule affair, and confided its future destiny to the local Municipal Assembly. During the late nineteenth century, state governments and state courts supervised cities and strictly limited their powers, and NYC was no exception. States had a distrust of cities, a conviction that cities were governed by riffraff, and were suspect of immigrant voters. However, reformers wanted to reorganize local governments with authority centralized in the hands of the mayor so voters would be able to hold the mayor directly accountable for the city's overall governance (Judd & Swanstrom, 2002). In addition, services provided at city level increased in importance as city governments began to assume public responsibilities, such as NYC assuming its own Building Code.

Desmond's article continued to detail that whatever amendment or correction the code needs can be secured very much better here in New York City, under the eyes of our architects, builders, and others directly concerned than 200 miles up the Hudson from country legislators. Desmond's article reflected the sentiments of many city residents whose confidence lay in the city administrators rather than state bureaucrats located at a distance from the city who were likely unfamiliar with the reality and needs of such a large and burgeoning metropolis. Edwin G. Burrows and Mike Wallace stated that the new laws satisfied city legislators "by shifting the right" (p. 1234) to govern themselves from the state to the city, and this attitude included the building code.

Although the 1899 Building Code was titled as a law separate from the prior 1892 Code, most of the 1899 Code was taken - word for word - from the 1892 Code. The 1899 Code was called a revision, as indicated on the title page of the 1899 Code that included the notation “Words printed in italics show parts of former law embraced in present revision.” (p. 1) This study suggests that the protocol of the promulgation of the 1899 Code was similar to the protocol of an amendment.

One of many reform groups, the Charity Organization Society, opposed the passage of the 1899 Code because this philanthropic group felt that the Code did not adequately address the deplorable conditions in the city’s tenements. However, the force that overpowered this reform group was what the business man terms the practical conditions of capital, interest-charges, rents, wages, and affairs of life.[6] The real estate interests insisted on no upgrades to the Code. One force that influenced the promulgation of the 1899 Building Code was the desire by the business community to maintain the Building Code in the status quo.

The architectural and development industries in the area received New York City’s new 1899 Building Code with little enthusiasm. Desmond’s article in *The New York Times* acknowledged that the first fact that one must take hold of firmly is that the Building Code, the new one, is essentially no new thing. The code was very similar to the previous New York State codes of 1882, 1885, 1887, and 1889 that were written by the state specifically for the five individual boroughs. The title page of the 1899 code states that the words in italics show parts of former law embraced in present revision.

---

[6] The editor of the Real Estate Record and Guide for *The New York Times*, H. W. Desmond wrote describing the clash between reform groups and business interests in his article “What the New Building Code Actually Is” published on December 10, 1899. Desmond’s article was quoted multiple times in this chapter.

These italic sections comprise about half of the text, which was taken directly from prior state codes. On the first page of the 1899 Building Code, moreover, it states that the code had

> *been taken bodily from the building law contained in the New York City Consolidation Act (L. 1882, CH. 410), §§ 505-514, as amended by L. 1892, chapter 275, and with slight changes due to the altered situation consequent upon consolidation, incorporated in the code. (p. 1)*

The rest of the text is made up of paraphrased passages adapted primarily from prior state codes.

Desmond continued his description of the 1899 code by stating that the new code was substantially the building law of 1892, under which the city had lived and under which architects and builders had worked peaceably and successfully for years. While the 1899 Building Code legally amended prior state codes into a city code, it was simply a restatement of the prior codes. The 1899 Code did not address new materials, new technologies, or disasters.

The 1899 Building Code was a restatement of prior codes and did not address the specific and current problems of public safety for the city. Occupancies, such as tenements, remained unregulated. The headline, “Building Code Attached”, in *The New York Times* on September 21, 1899 demanded more from the code. Another article, on September 13, 1899, had the headline that the Building Code was adopted, and a sub-headline that stated the Code was a steal and a fraud, and brands every one who had to do with it a criminal.

Instead of allowing for new materials or technologies, the technical aspects of the 1899 code were written as a prescriptive code providing specific directives for common assemblies. This meant that the text of the code prescribed—or described—how common material assemblies were to be constructed. This approach was in line with previous state codes upon which the 1899 code was based. An example can be seen from the following 1899 section, § 59, “No wood floor beams or wood roof beams used in any building, hereafter erected, shall be of a less thickness than three inches.” (p. 30) Desmond wrote that the new code would specifically command the use of particular materials in a particular way. The technical sections of the 1899 Building Code provided no guidance or regulation for new materials and engineering that began to emerge at this time.

The enforcement section of the 1899 code was significantly downgraded in its amendments from previous codes. This occurred mainly through shifts in the bureaucratic structure of the NYC Building Department. Responsibility for enforcement was not only weakened by a change in leadership. At the time that the code was established, the Superintendent of Buildings was replaced by the new position of Commissioner of Buildings. Desmond wrote of the power behind this position by stating that the Building Department had always possessed a large measure of discretion, and the new code delegates less power to the Commissioner of Buildings than was formerly possessed by the Superintendent of Buildings. Amending the 1899 Building Code to a weakened enforcement led to compromises in public safety. An example of weakened enforcement was in Section §150, Violations and Penalties. The new Commissioner of Buildings did not have the ability to increase fines that were established decades earlier in prior codes.

The 1899 Building Code remains in force today and continues to be enforced for existing buildings that were constructed in accordance with this code and have not been substantially altered since. The new building code made an attempt to keep up with new technologies and new materials. Desmond's statement in *The New York Times* testifies to the need for the code to permit at any moment the use of any adequate novelty or material. One such novelty was the Woolworth Building that will be discussed later in this chapter. The Woolworth Building was designed as a sixty-story high-rise and was built to the 1899 Building Code, although the code was written specifically for five- and six-story buildings. The Woolworth Building utilized the new and novel technology of the high-rise with existing materials used in new ways. This building's construction was not addressed by amending the 1899 Building Code. The 1899 Code did not keep up with new and novel designs.

3.2.2 Triangle Shirtwaist Factory

The Triangle Shirtwaist Factory Fire of 1911**,** considered to be one of the worst fires in history, is the disaster that brought about the greatest number of building code amendments in any American city to date (Stein, 1962/2001; Von Drehle, 2003). The main force that influenced amending the building code was the concern over public safety that emerged as a result of the fire. Public safety was very much steeped in the Progressive Era of the time. Progressivism was a new political movement. The Progressive platform incorporated the new fields of social work and socially conscious politics to support reform to abolish unsafe working environments and filthy housing. The Progressives supported protection for workers, trade unions, and the vote for women. Nancy Schrom Dye states in her 1981 book, *As Equals and Sisters: Feminism, the Labor*

Movement and the Women's Trade Union League of New York, the Triangle Fire galvanized the Progressives specifically toward reforms in the built environment.

The amendments that emerged following the Triangle Fire were promulgated in the 1915 Building Code. They were primarily related to stricter assemblies of existing materials rather than new materials or new technologies. However, most of the 1915 amendments were reduced in stringency by later amendments promulgated in the 1938 Building Code.

The Triangle Shirtwaist Factory was located on the top three floors of the Asch Building, which was built in 1901.[7] The building is a ten-story tan brick and terra cotta masonry loft with wood floor construction and a floor area of 10,000 square feet. The original building was designed to be 135 feet in height. Had it been 15 feet taller, it would have been constructed with concrete floors instead of wood floors, and windows, doors, and door frames made with metal coverings instead of made of just wood. The NYC Landmarks Preservation Commission's Designation Report was written in 2003 when the exterior of the building was declared a New York City landmark. The Report stated that even with all the wood assemblies, the building was considered fire-proof at the time, and it was advertised as such, especially to insurance companies.[8]

The Asch Building was built to the 1899 Building Code and was deemed code compliant. The design had two interior stair exits and one fire escape leading to a second floor skylight despite the fact that the Building Code required three exit stairs. Upon final inspection, the Buildings Department plan examiner decided to consider a fire escape as a

[7] As of the date of writing, the Asch Building was occupied by New York University and was known as the Brown Building.
[8] NYC Landmarks Preservation Commission, Designation Report, March 25, 2003, List 346PL-2128, Brown Building (originally Asch Building) by Harris, G. This report documents the building construction as fire-proofed per the 1899 Building Code.

third exit stair. This exit design was initially regarded as problematic, however. Upon first plan examination, the Buildings Department representative rejected the design for having an insufficient means of egress (stairs and/or fire escape), writing that the fire escape “must lead to something more substantial than a skylight.” The following 1899 NYC Building Code citation states the requirement of two “lines of stairs” plus an additional “line of stairs” for the extra “5,000 feet of area”:

> *Stairs, number regulated by area of building.*
>
> *§75. In any building hereafter erected to be used as a store, factory, hotel or lodging-house, covering a lot area exceeding 2,500 feet and not exceeding 5,000 feet, there shall be provided at least two continuous lines of stairs remote from each other; and every such building shall have at least one continuous line of stairs for each 5,000 feet of lot area covered, or part thereof, in excess of that required for 5,000 feet of area. (p. 37)*

The initial plan examiner’s objection to the rear fire escape was eventually waived, enabling the building to be constructed with two stairs and one fire escape. The designed fire escape did not lead to ground level or to a means of exit to a street, nor was it constructed sturdily. Unfortunately, the 1899 Building Code did not stipulate that a fire escape must direct occupants to a safe area or specify how much weight a fire escape must be able to support. The events and causes of the fire are discussed in the next section in relation to the amendments that ensued following the disaster.

3.2.2.1 The Fire and Amendments. On Saturday, March 25, 1911 a fire occurred on the top three floors of the Asch Building, resulting in 146 fatalities. Most of the victims were young immigrant women—50 of whom jumped out of the windows during the blaze. The fire reached five alarms and received extensive press coverage. The factory and its conditions—characterized as dangerous, overcrowded, and unsanitary—were vilified during this time of Progressive Era values. The printed media kept this tragedy under public scrutiny. One newspaper, the New York *Evening Journal* repeatedly published on its front page the drawing of a gallows with the caption, "This Ought To Fit Somebody; Who Is He?" (p. 114) Responsibility was impossible to determine for specific building conditions. For example, the Acting Building Superintendent Albert Ludwig said he had insisted that there was "no law governing the dimensions of the stairways. They needed only to be "of a size we consider sufficient." (p. 120) The outraged Progressives found voice in Lillian D. Wald, a member of the Joint Board of Sanitary Control (Stein, 1962/2001). She said:

> *The conditions as they now exist are hideous and damnable. Our investigations have shown that there are hundreds of buildings which invite disaster just as much as did the Asch structure. The crux of the situation is that there is no direct responsibility. Divided, always divided! The responsibility rests nowhere! (p. 121)*

As investigators discovered, even though the Asch Building was built to code, the maintenance of the building was insufficient. Since a building code is typically designed to regulate new buildings instead of existing buildings, the issue of maintenance was not addressed in the 1899 Building Code. Fighting the fire proved particularly challenging due to the following issues resulting from insufficient maintenance; the interior fire-hose had rotted and the valve on the standpipe (emergency water supply to extinguish fires) had rusted shut (Greenwald, 2002).[9] To date, contemporary NYC Building Code fails to adequately address the maintenance of existing buildings.

Evacuating the building also proved difficult for a multitude of reasons. The first was the exit doors. One of two interior exits had a locked doorway, which violated code. This locked doorway resulted in a major loss of life in the Triangle Fire, which could have been easily remedied by existing panic hardware at the time. Given that the locked door was the only noncompliant issue in the building, it therefore became the focus of the prosecution in the criminal trial following the fire. The panic hardware on exit doors that was already available during that time was a safer alternative to locking doors with a key. Panic hardware allows occupants to exit a building through a set of fire-rated doors, which will generally sound an alarm, while the doors remain locked from the outside. Carl Prinzler developed the first piece of panic hardware called the Von Duprin Panic Device as a result of the Iroquois Theater Fire in Chicago in 1903. Although labor unions advocated for the use of panic devices following the Triangle Fire, the technology was not officially incorporated into the NYC Building Code until 1968.

During the fire, the second interior exit stair quickly became enflamed when a barrel of machine oil exploded. The courtyard fire escape then became the only means of evacuation. However, the fire escape did not have a drop ladder, was only 17 inches in width, and most importantly, was not structurally sound enough to hold the weight of the women trying to escape the fire (Greenwald, 2002). As a result, the fire escape buckled and collapsed. As mentioned previously, the design of the fire escape was compliant with the 1899 Building Code, despite the fact that it evacuated persons onto a second floor

[9] The connection between the Progressive Era in New York City and the conditions of buildings is documented specifically for factories and tenements.

skylight and thus did not facilitate their exit out of the building. An article, "The Factory Girl's Danger", by Miriam Finn Scott published in the magazine *The Outlook* on April 15, 1911, condemned the city's poor building codes, stating, "The ultimate blame must be traced back to the inadequate building laws, and thence to an indifference or un-awakened public that allowed such laws to be passed and to continue in existence" (p. 817). Amending the 1899 Building Code to a higher standard of public safety became a goal for an angered city. The required design of fire escapes and egress routes from fire escapes was subsequently amended in the 1915 Building Code, stipulating that they must lead to a separate and safe refuge area.

Another reason that evacuation was difficult during the fire was that no fire drills had ever been organized at the factory. The lack of practice and knowledge regarding what to do in the event of a disaster was compounded by communication challenges. Most employees spoke English as a second language—the majority of the women's first language was Yiddish, Italian, or Russian. This lack of fire drills and difficulty communicating proved disastrous during the fire—a situation when every second matters. Fire drills were later mandated by NY State law and amended into NYC building codes, but not until the 1938 Building Code.

Other amendments passed to the 1915 code as a result of the Triangle Fire addressed issues including sprinklers, exit-door swings, wooden window frames, increased width of exit stairs, alarm systems, open elevator shafts, locked exits, narrow exits, and fire inspections. The majority of these amendments were passed as a result of public lobbying for building laws that better protected public safety. One such amendment incorporated into the 1915 Building Code (§152 [c]) relates to the required number of exit stairs for a building the size of the Asch Building. It mandated that new buildings of this size have a total of four exit stairs:

> *§152. Exits. 1. Kind. Every building hereafter erected shall have one or more exits as required in this section, consisting of interior or exterior stairs, fire towers, or horizontal exits, constructed and arranged as specified in this article, with the necessary hallways and doorways….*
>
> *c. From floor areas. Every other floor area above or below the ground floor shall have at least one interior stairway or fire towers connected thereto. Every such floor area shall have at least one additional exit when it exceeds two thousand five hundred square feet in area. (p. 38)*

Despite this amendment of stricter exit requirements that was incorporated into the 1915 code, the 1938 code subsequently decreased the stringency of egress requirements. While the 1938 Building Code is discussed more completely in chapter 4 of this study, it is important to discuss the 1938 amendments relating to egress stairs in this section. In the 1938 code, the number of required exit stairs for factories became regulated under the Labor Law. However, since work-rooms were considered other occupancies, the number of exit stairs required was determined by the number of people occupying the space. The following citation reveals the updated 1938 code:

> *§ C26-273.0 Required Exits.-a. Kinds of required exits.-*
>
> *(6.1.2.2.2). 2 Required Exits from the Ground Floor – Unless otherwise provided, every ground floor area having direct exit by doorways to a street and having an aggregate area exceeding twenty-five hundred square feet or an occupancy of*

more than seventy-five persons shall have at least two means of egress. (Rheinstein, Van Wleck, & Prince, 1938) (p. 154)

As demonstrated, this requirement of two exit stairs is less strict than both the 1915 Building Code that required a total of four exit stairs and the 1899 Building Code that required a total of three exit stairs. Moreover, this diminished requirement has remained in place through the 1968 and the 2008 Building Codes. The logic in decreasing the number of required exit stairs was that sprinkler systems were available and usually mandated by that time. Sprinkler systems can suppress a fire to allow evacuation, but only if the sprinkler system is functional and continues to operate throughout the evacuation period.

Another result of the Triangle fire were amendments to other laws outside of the building code that the state passed in response to public outcry over the disaster. These included child labor laws, the right to unionize, prohibiting smoking in factories, overtime regulations for a 50 hour work week, waste removal, prohibiting smoking near combustible goods, sanitary conditions, new wage scales, and arbitration for grievances. These notable legislation changes demonstrate that the effects of the Triangle fire were indeed far reaching and had a hand in changing America, as David Von Drehle suggested in *Triangle: The Fire That Changed America.* But, most changes were not in amending the building code but in other areas of legislation. Moreover, Leon Stein argued that this fire disaster resulted in the largest number of litigation changes because the media continued to place it in the public eye, thus causing mounting public pressure that influenced legal amendments, including those to the building code.

3.2.2.2 Amendments for Sprinklers. Another issue that was addressed as part of the amendment process following the Triangle fire was the regulation of sprinklers. While major sprinkler amendments like those passed after the Triangle fire were directly related to fire disasters, the inclusion of sprinkler amendments was often discouraged by owners, developers, and contractors. At the time of the Triangle Fire, the supposedly fireproof Asch Building did not have sprinklers, yet it remained in compliance with the NYC Building Code. Sprinklers were not addressed in the 1899 Building Code, although a few buildings at that time did incorporate sprinklers into their design. The 1915 Building Code amended the 1899 Building Code to mandate sprinklers, but only in occupancies such as *"theatres and other places of amusements"* (§524.2). At this time, many safety concerns were the purview of insurance companies, which preferred to insure high-risk companies for high premiums which gave the companies higher profits (Stein, 1962/2001). This protocol often prevented the inclusion of sprinklers.

The issue of including sprinklers in factories continued to be debated for decades following the Triangle fire. Instead of directly addressing sprinkler use in factories, the 1938 Building Code referenced New York State Labor Law mandating the inclusion of sprinklers in manufacturing buildings. In 1960, however, the New York State legislature (N. Y. Exc. Law §378: NY Code) sought to reduce the use of sprinklers in factory buildings. A protest was immediately organized by outraged labor union leaders including David Dubinsky of the International Ladies Garment Workers Union (ILGWU) in coordination with an equally outraged NYC Fire Department and Leon Stein, author of *The Triangle Fire*. The protest took place on March 25, 1961, the fiftieth anniversary of the Triangle fire. It was the first public event held at the site of the fire and was marked by a parade, memorials, and speeches attended by Eleanor Roosevelt, Frances Perkins, and twelve survivors of the fire. Because of this protest, the sprinkler reduction law was never passed.

3.2.3 The Equitable Life Assurance Building

The 1912 fire that occurred in the Equitable Life Assurance Building further demonstrated the need to change the 1899 Building Code. Even though the Equitable fire was given less printed media coverage than the Triangle fire, the Equitable fire is said to have prompted the amending of the 1899 Building Code that brought about the 1915 Building Code, as well as to have “stimulated” the promulgation of the nation’s first zoning ordinance. The 1916 Zoning Law of New York City (Dupré, 1996).

Ten months after the Triangle Fire, the Equitable Life Assurance Fire occurred, resulting in eight fatalities including two firefighters. It began in the basement, similar to the Rodgers Peet Fire. The building in which the fire took place was constructed in 1870 and was the first to have passenger elevators (hydraulic) designed by Elisha Otis. The elevator shafts were open construction, meaning that they were not fire-resistant masonry construction. As a result, the fire spread quickly through open elevator shafts that acted as flues. The building burned for more than 36 hours before its collapse. Following the fire, a new forty-story Equitable Life Assurance Building was built on the same site and completed in 1915. Although the new building was built to the 1899 Building Code, an upgraded solid masonry shaft construction was used. Solid masonry construction was amended into the 1915 Building Code because open elevator shafts were the cause of the fire in the previous building (Bernard, 2014).

A new section on masonry shaft construction for elevators was amended into Section §373.2, *Open Shafts*, of the 1915 Building Code. It mandated that new or substantially altered buildings have open shafts made of masonry or re-enforced concrete and are closed with fire doors. This requirement remained in the 1938 Building Code § C26-663.0 (b), but was rescinded by an amendment in the 1968 Building Code as well as the 2008 Building Code to allow for drywall elevator shafts.

3.2.4 The Woolworth Building

Before the 1899 Building Code could be amended, the plans for the Woolworth Building (c. 1913) came before the Buildings Department to be permitted for construction. The Woolworth Building, regarded today as a significant architectural icon—known as the Cathedral of Commerce, was designed with a steel skeleton structure. The steel structure was a traditional configuration of posts and beams engineered to a height of 792 feet. The engineering calculations for the steel skeleton were similar to the standard engineering practices of a six story building, except ten times higher. *"From a purely technological standpoint however the Woolworth Building was a conservative design, reflecting the restrictive stipulations of New York's 1899 building code"* (Fenske, 2008, p. 182). *Engineering Record* in 1912 stated the building had few if any absolutely new features of importance. The only engineering innovation of the Woolworth Building was its height. However, the 1899 Code addressed high-rise construction up to a height of 150 feet and only in the context of solid masonry bearing walls. For a building the height of the

Woolworth design, the exterior bearing walls would have been required to be an absurd thickness of eight feet.[10]

To permit the Woolworth Building, the Department of Buildings had to defer to excessive structural duplication. The steel skeleton structure as well as the exterior masonry structure had to independently support the building, thus providing two separate means of structure. Although the building would be structurally stable to support wind and live loads with just the steel skeleton or just the terra-cotta masonry-bearing walls, it was constructed with both. Gail Fenske in her 2008 book, *The Skyscraper and the City: the Woolworth Building and the Making of Modern New York*, described the debate over the excessive structure between the engineer, Gunvald Aus, and the architect, Cass Gilbert, as follows:

> *Aus, in contrast to Gilbert, strongly criticized the Woolworth Building's structural redundancies and wasteful conservatism, publically calling attention to its absence of structural engineering economy. This he blamed on the 1899 New York City building code's excessively high figures for wind loads and live loads. (2008, p. 201)*

Historians Landau and Condit in their 1996 book, *Rise of the New York Skyscraper: 1865-1913,* concurred that during that era, the DOB preferred the insurance of high safety factors, explaining that other engineers called New York's building code archaic and urged that it be amended. A new technology, such as high-rise construction, was a significant force that ultimately prompted the amending of the 1899 Building Code into the 1915 Building Code.

---

[10] 1899 Building Code Section §33, Increased thickness of walls for buildings more than one hundred and five feet in depth.

3.3 1915 Building Code

3.3.1 Description

Between the 1899 and 1915 Building Codes, no amendments were added to the NYC Building Code. The 1899 code remained in effect for over a decade despite public protest calling for increased public safety assurances, including a new building code, following building disasters such as the Triangle Fire and tenement collapses. Professional protest during this same period also called for amendments to the building code, in this case to address new technology such as the high-rise construction embodied in new buildings like the Woolworth Building. As a result of both public and professional interests, the 1899 Building Code was finally amended in 1915. The 1915 Building Code was titled "City of New York, Code of Ordinances, Chapter 5, Building Code, amended by ordinance adopted December 14, 1915, effective March 14, 1916."

The vast majority of buildings in NYC at the turn of the century—as well as today—are structures under six stories at 75 feet in height. The 1899 Building Code was well suited to regulate these buildings. When architects began to design higher buildings, such as the 57 stories (792 feet) of the Woolworth Building, the existing code did not address such high-rise designs. Therefore, new high-rise technologies during the early twentieth century called for amendments to the code.

The new 1915 code was extremely strict in prescriptive technology regulations as well as enforcement. Approximately 95% of the 1899 code was amended to produce the 1915 code, resulting in the largest revision of a building code in NYC history to date. In addition to amending nearly the entirety of the code, 17 separate amendments in 1915 and 12 separate amendments in 1916 were subsequently added and functioned as clarifications to the 1915 Code. Following the clarifying amendments, no new amendments were passed through 1935. Three amendments were promulgated in 1936, and another in 1937. The entire 1915 Code was then amended in 1938.

Some of the changes incorporated into the new 1915 Building Code have been directly attributed to the 1911 Triangle shirtwaist Factory Fire, such as fire-resistive doors and window frames, increased stair widths, outward swinging door swings and fire alarms. Most of the amendments in the 1915 Building Code were influenced by a need to address new technologies during a boom in city building. The building boom consisted of both high-rise and low-rise construction. The notable high-rises constructed during the time included the Flatiron (Fuller) Building, completed in 1902, and the Metropolitan Life Insurance Tower, completed in 1909. However, most of the construction during the boom consisted of masonry bearing wall tenements four or five stories in height. These buildings were originally of robust construction and many are still occupied today. The structural system was simple, empirical, and stable to last one hundred years. The construction details for masonry bearing wall buildings were illustrated in construction manuals during the early twentieth century as well as in the first edition of *Architectural Graphic Standards*. The same construction standards prevail today and are in current building codes.

During this same period, the need to house a rapidly growing and impoverished immigrant population resulted in tenement conditions that became unsanitary, overcrowded, and unsafe. Construction of common tenements became non-compliant to the 1899 Building Code as shortcuts were used in materials and workmanship. The

Building Code required more enforcement measures. Due to the building boom of the early twentieth century, the Buildings Department was unable to keep up with proper enforcement of the building code for proper construction of such buildings. Collapse of tenements became a frequent occurrence, as media coverage from that time demonstrates. Headline after headline in *The New York Times* testified to the growing issue of poor safety standards in tenement buildings. An April 8, 1905 headline read that bad material, bad work, worthless inspection was the substance of expert's report on collapsed buildings. Code provisions were ignored, structures were inadequate to support loads at any time, and architects' supervision was demanded. In the first paragraph of the article, the reporter attributed the collapse of twenty-three tenement buildings to violations of the Building Code. Even though the 1899 Building Code was technically sufficient for the structure of six-story tenement buildings, enforcement was lacking. Public outcry demanded the Building Code be amended.

Subsequent *New York Times* articles condemned the poor enforcement of the NYC Building Code. A February 25, 1908 headline read that incompetent city inspections were blamed for collapses. The public, represented by the jury, found both the city officials and the 1899 Building Code substandard. While public pressure lead to amendments increasing enforcement measures for construction standards of tenements in the 1915 code, the mandate was only for new construction and did not apply to buildings that were already standing. Thus, it did little to address the numerous tenement buildings that were in already poor condition before the promulgation of the new 1915 Building Code. The issue of tenements and building code is examined in more detail in the following section.

3.3.2 Tenements and the Building Code

Concerns over the safety of tenement buildings in NYC had existed well before the construction boom of the early twentieth century. The poor condition of such buildings had been a public safety and health problem in the city since the mid-nineteenth century. However, New York City's Building Code did not address public safety sufficiently until it was amended in 1915.

Tenements—originally called tenant housing—were initially regarded as a solution to city overcrowding as early as the 1850s. Issues of public safety, such as overcrowding and sanitary conditions, were not addressed in the Building Code written by the state. From 1798 to 1860, The Building Code was written by New York State for the New York City where the state regulated the writing and enforcement of the Building Code for the city. After 1860, the state yielded enforcement of the Building Code to the city, but the state continued to write the Building Code for the city and did so until 1899[11]. To address the problems of tenements, New York State amended the Building Code for the city by writing the New York State Tenement House Act of 1867 and referencing it into the 1871 NYC Building Code.

The New York State Tenement House Act of 1867 amended some issues of public safety into the Building Code. The Act mandated standards for light and air and prohibited habitation in cellars that were often damp, dark, and not ventilated. Habitation in basements was allowed because basements had some light and air. Habitation in basements instead of cellars was an improvement in public safety and welfare for

---

[11] New York City took over the enforcement of the State Building Code at the same time that William Megear "Boss" (1823 – 1878) began to take control of city government. Leo Hershkowitz's 1977 book, *Tweed's New York: Another Look*, discusses Tweed, the city corruption by the Democratic machine, and legislative powers returned to the city.

building tenants. The building code defined cellars at 50% or more below grade and they were prohibited from housing dwelling units; basements were defined as less than 50% above grade and were allowed to house dwelling units. The Tenement House Act also mandated the inclusion of windows in rooms. However, builders got around this requirement by constructing interior windows connecting one interior room to another interior room (Burrows & Wallace, 1999). Thus, no fresh air or natural light was provided which made the interior environment unhealthy with dark, damp, and stagnant conditions. Because enforcement was weak, the 1867 act proved a failure since many of its mandates were ignored by builders and went unenforced by the city.

In 1879, the magazine *Plumbing and Sanitation Engineer* held a design competition for an improved tenement design. The magazine published the winning design by the architect James Ware. His design, which was a response to the inadequacies of the Tenement House Act of 1867, was a compromise between health standards and economy in construction (Golway, 2002). This new act restricted the square footage of a building on its lot and mandated the elimination of dark rooms. These restrictions gave rise to the dumbbell design of the old-law tenement that included three-foot shafts with windows opening into the shaft, thus allowing some air and light into the tenements. Unfortunately, this new design proved an utter failure as the air shafts became filled with garbage and bile water and also acted as a flue during fires. By incorporating this design into the code, the Tenement Act of 1879 was a worse failure than the 1867 act.

The rise of immigrant populations in NYC at the end of the nineteenth century increased overcrowding to degrading and unsanitary extremes, as Jacob Riis documented in his 1890 book, *How the Other Half Lives.* The New York State Tenement House Act of 1901 amended the Building Code of 1899 to include the design of the new-law tenement, buildings that provided a courtyard, a window in each bedroom, running water, and a toilet in each dwelling unit (Homberger, 1994). The entire building could cover only seventy per cent of the lot with the remaining thirty per cent left for open space. The 1901 Act strengthened the 1899 building code. For example, stair risers and treads in residences were regulated for the first time under this Act.

The original 1899 Building Code did not address tenement conditions, but instead referenced Chapter XIX of the NYC Charter, Title 1 of the Department of Health for health concerns. Moreover, enforcement of the 1899 Building Code was particularly weak in relation to the enforcement of structural concerns, as evidenced by the frequent collapse of tenements. Both the Buildings Department and the Health Department were charged with regulating safety and health in tenements. The administration of the departments were poorly organized and combined with weak enforcement, tenement conditions did not improve. Public protest by members of the Progressive Movement demanded the passage of state laws to address tenement conditions. In response to this mounting public pressure, the 1899 Building Code was amended to reference the New York State Tenement House Act of 1901 in order to adequately address tenement conditions. Subsequently, the 1915 Building Code was amended in 1929 to reference the New York State Multiple Dwelling Law to further safeguard tenement housing in the city. This law established uniform standards for all tenements and apartment buildings, including high-rise residential buildings (McGoldrick et al., 1944). The New York State Multiple Dwelling Law currently remains in effect and has been referenced in all the NYC Building Codes since its promulgation.

3.4 Conclusion

This chapter discussed the promulgation of the new 1899 Building Code for NYC, including how and why the new code was established through an adaptation of the state codes that had been previously enforced in the city. The primary force that influenced amending this new code was the human emotion of pride. This chapter then examined the circumstances surrounding the notorious Triangle fire and the public protest that ensued against the conditions that caused the fire. This public pressure played a major role in amending the NYC 1899 Building Code into the 1915 code. However, professional pressure to amend the building code in response to new technologies like high-rise buildings and elevator shaft construction was also an influential force behind the amendments. The specific amendments to the 1899 code that were incorporated into the 1915 code were discussed, as well as the history of tenement construction enforcement and NYC Building Code. The next chapter discusses why the 1915 Code was downgraded by subsequent amendments.

CHAPTER 4

THE NEW YORK BUILDING CODE: 1938

4.1 Introduction

The purpose of this chapter is to examine what forces influenced building code amendments in New York City between the promulgation of the amended 1938 Building Code and 1967, when a new code went into effect. In particular, this chapter focuses on the amendments passed to the 1938 code during the early 1950s. During this time, amendments were passed at an unusually high rate that has never been seen before or since, as of the date of writing. In fact, the number of amendments passed during this period was at a rate of almost one per week.

The titles of the unusually high number of amendments passed were placed into themes, thereby directing investigation toward the forces that prompted the amendments. This revealed patterns of new materials and methods (such as welding structural steel and improved processes for reinforced concrete), cultural changes that prompted new occupancy uses, and proactive fire-resistive measures. Few fire disasters occurred during this time and no amendments were promulgated as a result.

Given that the nation was recovering from the Great Depression and World War II during the era covered in this chapter, another force that influenced the promulgation of the 1938 Building Code was a push to support the lagging construction industry in NYC. This was especially evident in the area of housing—which was much needed at the time—as seen in the construction of both public housing developments and one- and two-family developments. Subsequent amendments in the early 1950s were promulgated in response to three categories. In order of the largest numbers promulgated, these included:

new materials and methods of construction, new occupancy uses due to cultural and socioeconomic changes in both the city and the country, and fire prevention.

Advertisements for new materials and methods were incorporated into the building code for the first time in the early 1950s editions of the 1938 code, with the exception of some minor advertisements that appeared in the 1892 code.[12] In general, the advertisements in these new 1950s editions presented private companies that manufactured new construction materials. They were placed within the body of the building code text adjacent to the code sections to which they applied. These advertisements appeared to serve a need to inform the design and construction industries of the fact that the Department of Buildings permitted use of these advertised new materials. To date, no subsequent NYC Building Code edition has included advertisements.

It is important to note that disasters involving fires and building collapse did not occur with frequency in the years directly before the 1938 code was passed. This study therefore found that none of the corresponding amendments coincided with a fire disaster. The 1938 Building Code still remains in effect today for buildings built up until 1967 that have not been substantially altered. All amendments—with the exception of a few that were rescinded—also remain in effect. In the following section, details regarding the 1938 Building Code are presented.

[12] The advertisements included in the 1892 code were primarily for real estate and attorneys, with only a few for construction materials. Instead of being placed adjacent to code text, as was the case in the 1950s editions, the 1892 advertisements were placed in the front and back of the building code text.

4.2 The 1938 Building Code

By 1938, the construction industry was ready for a new building code. A convergence of events and phenomena—including recovery from the Great Depression, new materials and technologies, and advanced engineering—led to amendments of most sections of the 1915 Building Code. In particular, the 1938 Building Code needed to address the new construction techniques and technologies that were in constant development. These included new ways of using existing materials, as well as uses of new materials themselves. These new technologies required the development of an entirely new way to write a code for the performance of material assemblies.

The 1938 code was written to a less strict standard than the prior 1915 code. Possible reasons were a backlash against the strict 1915 Building Code as described in Chapter 3 of this study. Amendments rescinded many strict code sections, allowing for quicker construction times and less materials. This approach to building code amendment helped stimulate the economy during the Great Depression. Despite the less stringent code, safety was not compromised given the advances in engineering that had been made by that time.

The 1938 code took a different approach than prior codes. For example, while the 1915 code was prescriptive, the 1938 code was performance based. Instead of restricting materials to those specifically listed in prior codes, the 1938 code permitted other materials to be specified if such materials could pass standard mandated tests and thresholds for fire resistance and structural loads. One example of prescriptive versus performance codes is the use of wooden floor joists. Earlier codes prescribed wood joists that were 3 inches wide by 20 feet long by 10 inches deep. The 1938 code only mandated that floor joists "perform" by resisting loads of 150 pounds per square foot. In this new code, wood was not prescribed as the required material—any material other than wood could be used as long as the material performed to code (Rheinstein et al., 1938).[13] Thus, assemblies using materials in new ways could easily be considered code compliant. For example, plan examiners in the Buildings Department could now approve the use of concrete joists. This shift in the code is reflected in the following quote printed in the article, "Building Methods Told to Officials" published in *The New York Times* on April 2, 1936:

> *New methods of construction expected to stimulate building were described at yesterday's sessions of the twenty-first annual convention of the Building Officials Conference of America at the Hotel New Yorker. Pre-cast concrete joist floors, air-conditioning and fusion welding for structural steel work were among the topics. (p. 48)*

The above quote stated that construction was "expected to stimulate building," pointing to the socioeconomic impetus behind changing the building code. Since the Great Depression had stalled the construction industry, downgrading code requirements was one approach utilized by city administrators to stimulate construction jobs and boost the economy. An article titled "Aldermen Hold Up New Building Code" published in *The New York Times* on January 1, 1936 (p. 6) detailed specific structural downgrades for loading and columns. It explained that the 1938 code reduced stress requirements for buildings over six stories by downgrading bearing strength for columns by 25%. The code thus downgraded the structural strength of a building by 51% because the masonry

[13] Subsequent NYC codes continued to be performance based, including the 1968, 2008, and 2014 codes. They thus include materials that are not used in a traditional method or have not yet been invented.

structural bulk of nineteenth century buildings were being replaced by new construction materials such as welded steel. The amending of the building code into a performance code made lighter buildings compliant but only with fireproofing additions such as sprinklers and the filling of assembly gaps/openings.

However, downgrading the 1938 code did not make a building unsafe because empirical designs—including those found in building trade manuals—began to be replaced by new, engineered designs. During the early twentieth century, building engineering became a more advanced and exact science and thus allowed for more efficient use of materials. This was especially true of skyscraper engineering, which was effectively mandated under the 1915 code. Most buildings erected to the 1915 code were approximately six stories and were empirically designed; as a result, those buildings were addressed by that code. In contrast, during this time, high-rise construction was engineered - not empirically constructed - but not addressed by the 1915 code. High-rise construction was still safe because it was engineered to a standard above the building code. Examples of such high-rises are the Chrysler Building (c. 1930) and the Empire State Building (c. 1931), which were both built to the 1915 Building Code and were properly and safely engineered. If these high-rises were empirically designed to the 1915 Code, their outside masonry walls would have been approximately ten feet wide, too bulky to be economically viable for rentable space.

Compared to the high-rise construction, buildings of approximately six stories or less that were not engineered and built to empirical structural standards were those of most concern: due to a lack of enforcement, they often proved hazardous, high risk, and subject to collapse. These buildings, as well as buildings up to nine stories in height, were addressed in the 1938 code. At this time, seven-, eight- and nine-story public housing projects were beginning to be designed and managed by the New York City Housing Authority (NYCHA). Changes related to these types of buildings are noted in the article entitled "New Building Code Passes Aldermen After 4-Year Wait" published in *The New York Times* on July 21, 1937 (p. 1). This article described in detail how the 1938 code would allow new types of fire protection that differed from the more expensive features required under the prior code. This change was particularly aimed at NYCHA developments that began to be constructed in the mid-1930s.[14] The article also described how downgrading certain construction elements were designed to encourage increased construction of lower-priced housing projects since it allowed for the building of nine-story apartments. An example of this downgrading can be seen in the decision to allow kalamein doors to be used in fire-rated assemblies. Kalamein doors—made of wood with a thin sheet of metal covering them—were a more economical alternative to the hollow metal doors that were in use at the time, despite the fact that they were not as effective.[15]

A performance-based approach, combined with the need to lessen the stringency of the code by depending on advanced engineering, guided the writing of the 1938 Building Code. When he signed the new code, Mayor Fiorello La Guardia acknowledged that additional amendments would likely be required at a later date in order to adequately address different conditions. *The New York Times* published the article entitled "La

---

[14] NYCHA public housing projects began to be constructed in 1936 and expanded with the Wagner-Steagall Act in 1937 to today's 330 projects in NYC.

[15] Hollow metal doors were beginning to be manufactured to a standardized fire rating of three-quarters of an hour, one hour, and two hours. At this time, hollow metal doors were constructed of 18 and 20 U.S. standard gauge (0.2989 and 0.269). Kalamein doors were less robust and lacked a standardized fire rating. Kalamein doors were constructed of 26 U.S. standard gauge (0.01875 inch). Kalamein doors typically had many and separate pieces of steel that combined with a thinner gauge of steel made a weak fire-rated door (Ramsey & Sleeper, 1936). Kalamein wood doors were allowed to remain in buildings not substantially altered until the 1980s.

Guardia to Sign New Building Code" on July 22, 1937 (p. 27) stating that the mayor believed the only way to find defects in the 1938 code was to treat the code as an experiment from which they would eventually learn how it needed to be amended. This subsequent amendment to the 1938 Building Code definitely occurred. To date, the largest number of amendments passed were to the 1938 Building Code in the two decades that followed.

4.3 Early 1950s Edition of the 1938 Code

As mentioned previously, the early 1950s edition of the 1938 code contained an unusually large number of amendments. This study found that, since 1936 and every year to date, amendments have been passed to the various editions of the NYC Building Codes. The average number of amendments passed each year was approximately six. However, this changed drastically in the early 1950s. Amendments were promulgated to the 1938 Building Code at an unprecedented rate, amounting to almost one amendment per week (see Figure 4.1). Of the 262 amendments promulgated from 1950 through 1955, the overwhelming majority of amendments were related to new materials and technologies and new occupancy uses. Such a large number of amendments is unprecedented in the history of NYC to date. This unusually large spike in amendments can be explained by exploring the circumstances and events surrounding the construction and design industries during the early 1950s.

AMENDMENT THEMES BY YEAR								
New Material/Technology								Total
	Cavity wall		3		2			5
	Concrete		2	6	2			10
	Gaps	2	3	3		2		10
	Gypsum	2	4	1			1	8
	Sprinklers				1	39	3	43
	Steel		17		3		5	25
New Occupancy Uses								
	Egress/Public Assembly		10	2	2	3	4	21
	Elevators	2	25	2	5			34
	Escalators		6	3	1			10
	Movies/TV			2	1	3		6
	Theatres				22	3	1	26
	1-& 2-Family		2	2	3	3	7	17
	Car/Garage				1	3	1	5
	Utilities	1	6	1	10	1	7	26
	Miscellaneous*				1	2	3	6
	Operational			2	2	2	2	8
Year		1950	1951	1952	1953	1954	1955	
Total		7	79	24	56	62	34	262

Figure 4.1 Number of amendments divided into themes per year. Miscellaneous contains amendment topics that occurred less than twice a year and less than three times between 1950 and 1955. Topics included ceiling lighting, glass in exit doors, and soil bearing weight.

From 1938 to 1967, the DOB Commissioner issued “Interdepartmental Memorandums” and “Memoranda of Interpretations of Building Laws” to all five Borough Superintendents in an effort to clarify sections of the 1938 Building Code. While not carrying the force of law behind them, these memos clarified sections that had not been foreseen in the original passage of the code. These memos were a quicker alternative to amendments since they did not require the lengthy process of obtaining City Council approval. Memos were usually one page in length and were issued once every three months on average. However, 13 Memoranda were issued in 1954 and 19 were issued in 1955. In these memos, the commissioner documented answers to specific questions received from architects, builders, and manufacturers that had been posed to the DOB borough commissioners and then brought before the commissioner for general discussion. The memos were made available to the public, although they were not published. They were copied to various architectural, engineering, and construction organizations, although those organizations were not specifically identified.

The "Resume of Minutes and Decisions" summarized meetings that were attended by Borough Superintendents and were generally held in Commissioner Bernard J. Gilroy's office once a month. Three to 13 separate conditions were documented for each meeting in these unpublished notes. Decisions were only available for meetings in 1950 and 1951, as well as two meetings in 1952. Decisions were communicated by word to the construction industry by DOB borough superintendents. Decisions typically answered questions that were borough specific and asked by various parties such as owners, manufacturers, architects, and contractors.[16]

The decade of the 1950s, which Wakefield characterized as being "known for the 'Silent Generation'" and "dismissed as dull and boring, a time of quiet acquiescence to the status quo" in the United States, did not capture the spirit of the early 1950s in New York City (1992, p. 2). Life in New York during this decade was a contrast to the rest of the conformist-minded nation. NYC experienced a period of nascent unrest during which the social values and culture of society would encourage a transformation that would

[16]As an example, the "Resume of Minutes and Decisions" dated January 5, 1950 had a total of five decisions. The answers ranged from welded steel inspections asked for by the NYC Department of Education, the use of precast concrete panels asked for by the manufacturer, occupancy type of post offices asked by a DOB commissioner, separation between garage and storage use (asked by unknown party), and if fences could be placed on property lines that was asked by owners of residential low rise developments. The last decision stated "in view of the undesirability of accepting these requests, the Superintendents should not encourage them

unleash the revolutionary fervor of the sixties (Hollings, 2008). The changes of the 1950s in New York City were embryonic and centered in local neighborhoods as diverse as Greenwich Village and suburban Queens. “Community politics in the 1950s were part of this simmering ‘crisis of liberalism,’ which [had] permeated the history of northern metropolitan areas since World War II” (Murray, 2003, p. 12). Specifically for suburban-like communities in Queens, residential owners were vocal in expecting the City to “help them build a healthy living environment.” (p. 13)[17] It is presumed that the large number of amendments promulgated in the early 1950s that were related to one- and two-family houses that regulated development for public health, safety, and welfare were influenced by the request for a healthy living environment.

There were four cultural conditions in particular that affected amendments during the 1950s: a building boom, the new academic field of materials science, the development of modularity of construction assemblies to shorten construction times, and a need to inform architects and engineers of new and compliant materials. These conditions determined how new materials were regulated by the NYC Building Code, an issue that is explored in detail in the next section. First, however, a brief background is provided on each of these four conditions.

Following a lag in large-scale construction during the years of the Great Depression and WWII when few buildings were designed, the 1950s saw an unprecedented building boom that ushered in radically new designs in architecture and engineering. During this period, office buildings in NYC alone added 58 million square

[17] Suburban expansion in Queens is further discussed to explain the growing resentment that local residents felt toward New York City politicians. Tensions are detailed between the Queens community activists, who were primarily women, and city policy makers: “That the NYC government failed to meet the residents’ expectations ultimately weakened their faith in responsible and rational liberalism” (Murray, 2003, p. 13).

feet of office space—totaling more than the next largest 22 U.S. cities combined (Lankevich, 1998). These high-profile, high-rise buildings—designed and built in the International Style—stood in stark contrast to the pre-1938 low-rise buildings of solid masonry bearing wall construction (Huxtable, 2008). Examples of this new style of office building include the Lever House (c. 1952) and the Seagram Building (c. 1958). Such buildings were designed using new assemblies of curtain walls and welded structural steel construction. Aside from office buildings, other innovative buildings were designed and constructed using new reinforced concrete methods; notable Modernist examples include the Guggenheim Museum, Lincoln Center, and the United Nations General Assembly.

Also during this period, areas that were regarded as slums in NYC were demolished to make room for needed housing (Lankevich, 1998). The public housing constructed at this time—including large housing projects such as the Vladeck Houses and the Fort Green Houses—consisted mainly of mid-rises built using the new technique of cavity-wall construction. It was imperative for the NYC Building Code to address these new and emerging construction techniques.

Another development during this era was the emergence of materials science as academic and professional disciplines.[18] These burgeoning areas of interest stemmed at least partially from the popularity of building designs that used new materials and existing materials in new ways. Prior to the 1950s, the study of materials was primarily confined to metals. However, as new materials and new methods of using existing

---

[18] Prior to the 1950s, engineering schools had departments of metallurgy; however, as the use of materials increased in variety the academic discipline expanded to include other materials such as concrete, glass, and plastics. Northwestern University instituted the first Materials Science Department in 1955 (Martin, 2015).

materials were incorporated into construction assemblies, the field of metallurgy expanded beyond metals and became known as materials science (Wermiel, 2000). Examples of other materials used in construction at this time were plastics, float glass in large panels, and reinforced concrete. Updates to building codes via amendments were therefore needed in order to keep pace with the compliance and enforcement of usage of such new materials that were entering the construction industry at an unprecedented rate. In 1951, five amendments were passed for metals of brass and copper pipes. Additives in concrete were also addressed in two amendments in 1951 for vermiculite (a natural mineral used as a fire retardant that protects structural steel, which was later replaced by asbestos) and in two amendments in 1953 for fly ash (the residue generated by coal combustion that was added to concrete mixtures in lieu of or in addition to cement).

Another condition that led to additional building code amendments was the development of modular assemblies of materials, which proliferated during this period in order to decrease construction time in light of the massive construction projects underway. Examples are the use of gypsum drywall in lieu of hand-trawled plaster and lumber in the nominal dimension of two inches by four inches (2 x 4s). The use of four-by-eight feet sheets of gypsum drywall and four-by-eight sheets of plywood remains a common module. This dimension corresponded to the eight-foot height requirement for dwelling units and commercial space in prior building codes. Construction material manufactures adapted their products to conform to building codes. Most importantly, premade modules of gypsum drywall replaced wall assemblies of masonry and plaster for fire ratings. Gypsum drywall began to perform two uses: serving both as partitions that were quickly constructed and as fire rating between spaces. This diversification of materials required updated guidelines through changes to the building code.

A need for architects to become better informed regarding compliant materials and methods was another issue addressed by building code amendments. The use of new materials and new technologies was possibly the most critical issue that the building code amended during the 1950s. Architects at this time were designing buildings made of new assemblies and new materials. However, the architectural profession suffered during the 1930s and 1940s as a result of the Great Depression and World War II, respectively. During the 1930s, the architectural profession experienced a 90% decline in commissions. The New Deal provided work for architects as draftsmen but altered their terms of practice from creativity to pragmatism.[19] During the war years of the 1940s, restrictions on non-military buildings again limited commissions. Many such commissions were awarded to engineers—who were perceived as robust and grounded in science and mathematics —rather than artistic architects. Architects across the country lacked both a strong national organization and respected industry journals to guide the development of their profession. Instead, architects depended on a shifting number of less reliable and less informative commercial magazines, such as the *Octagon.*

Architects' limited pragmatic experience due to diminished construction work combined with a lack of professional journals to guide them resulted in their lack of skills in new construction methods, including the use of new technologies (Shanken, 2009). This limited professional experience carried into the 1950s when architects were

[19] The Public Works Administration and the Works Progress Administration provided work for architects. The Supervising Architects Office of the U.S. became the largest architectural office in the world, but architectural commissions from that office were inhibited in creativity, such as the use of new materials, by governmental constraints (Shanken, 2009).

designing new buildings with new materials during the biggest building boom to date in NYC's history. These circumstances suggested that architects required guidance that extended beyond the text of the existing building code. However, in lieu of promulgating actual amendments, this information was given in the form of advertisements, which are discussed later in this chapter.

The convergence of these four conditions—the building boom, the new fields of materials science, modular designs to shorten construction times, and the need for architects to become better informed about new methods and materials—appears to be at least partially responsible for the unprecedented number of amendments promulgated during the early 1950s. The following section explores the amendments that were promulgated specifically in response to new materials and technologies during this period.

4.3.2 New Materials and Technologies in the Early 1950s and Amendments

As mentioned previously, new architectural designs that emerged during this era, such as Modernism, required new materials and new technologies. Even though the 1938 Building Code was performance based, it could not anticipate the large quantity of new materials and the new uses for existing materials.

The building boom of the 1950s encompassed construction of several different types of buildings that made use of new materials and techniques. These included commercial high-rise buildings engineered with welded structural steel, and two types of residential buildings. The first were mid-rise public housing designed with reinforced concrete slabs that made up part of the city's "urban renewal" program, and the second were one- and two-family houses. Both types of housing were built using new technologies of cavity-wall construction with gypsum drywall. The new materials used in these different types of construction projects that were amended into the building code during this era are detailed alphabetically in the following sections (see also Figure 4.1).

4.3.2.1 Cavity wall construction. Cavity wall construction began in the 1930s but expanded greatly in the early 1950s with a variety of new mechanical tie attachments. Before cavity walls, all exterior walls were solid masonry bearing walls, meaning that they were made of solid brick or stone veneer with block or terra cotta structural backup. Walls built of this material could only be constructed economically to a height of about five or six stories, or up to 75 feet. Beyond that height, the masonry load bearing walls become too thick to be economically viable. Prior to 1950, if masonry buildings were constructed higher than 75 feet, the masonry was too bulky, requiring it to be mechanically attached to structural steel with expensive clamps.

Cavity walls were designed as a solution that enables economical construction of buildings. A cavity wall is much thinner than a masonry bearing wall. A cavity is constructed of brick or stone veneer mechanically tied onto a backup of sheathing made of wood or terra cotta, with an air space or cavity left between the veneer brick and the backup. This assembly was faster, used less manpower, and was more economical to construct since less material was used. Moreover, there is no material cheaper than the air inside a cavity. The expensive and bulky clamps used in masonry bearing walls were also replaced by thin metal ties, which were more economical.

Due to the decreased thickness of exterior walls resulting from this new construction method, water infiltration had to be controlled. As a solution, cavity wall construction directed the water through the cavity to the outside of the exterior walls through the design of weep holes and flashing. Heat loss also had to be controlled in response to the decreased thickness of exterior walls. In lieu of insulation, the cavity itself provided a control of heat transfer by convection. Not only was warmer air was able to travel upward in the cavity, but the still air of the cavity provided a modest degree of insulation.

Although cavity wall construction was the construction of choice, information was needed from the DOB in regards to the compliant usage of mechanical tie attachments. Mechanical tie attachments replaced masonry attachments that connected veneer masonry to backup masonry, connecting veneer face brick or stone to a structural backup with a cavity of air between. If ties are improperly constructed, the face brick will delaminate and collapse.

Because of ease of assembly as well as efficient water management and heat transfer, the new cavity walls became increasingly popular. With the construction boom of the 1950s, cavity wall construction was used with even more frequency, as it was incorporated into both low-rise and high-rise housing, as well as commercial buildings. Everything from commercial uses, one- and two-story frame houses, and large housing complexes such as NYCHA’s Vladeck Houses and the Fort Green Houses made use of the cavity wall. This new technology was not adequately addressed in the 1938 Building Code, however.

This increased usage in the early 1950s, as well the issues associated with cavity walls—including flashing techniques, weep holes for water management, and movement of material differentials—urgently required amendments to the building code in order to communicate to architects and the construction industry what was proper cavity wall construction. In the early 1950s, five amendments related to cavity wall construction were promulgated (see Figure 4.1). One amendment was Local Law 9 of 1951, entitled “To amend the Administrative Code of the City of New York in relation to frame construction outside of the fire limits.” This amendment regulated cavity wall construction in relation to fire-rated assemblies in the outer boroughs. Another amendment was Local Law 197 of 1951 that regulated the thickness of walls of hollow masonry, particularly the backup used in cavity walls.

In addition to the amendments passed related to cavity wall construction, the DOB distributed other clarifications in the forms of Interdepartmental Memorandums and Minutes and Decisions. The principal topics that they addressed were mechanical attachments in cavity walls that were approved by the DOB, as well as other cavity wall features such as water management controls. Two memos (dated December 8, 1950 and June 9, 1955) were distributed to borough DOB offices and copied to architectural and engineering organizations (organizations were identified in memos only as “architects” and “engineers”). Four Decisions (all dated in 1950) documented meetings between the commissioner and borough superintendents in response to cavity wall questions posed to them by industry professionals. Two Decisions were specifically related to cavity walls in NYCHA public housing.

Further explanations of cavity walls specifically related to the NYC Building Code were included in two other significant publications. The first was the 1956 edition of *Architectural Graphic Standards*, which was the national reference guide for architects and anyone in the construction industry (see Figure 4.2). The second encompassed advertisements included within the body of the Building Code (see Figure 4.3 - 4.8).

In the 1956 edition of *Architectural Graphic Standards*, much attention was devoted to cavity wall construction. An entire page was titled “Wall Thicknesses: NY City Code,” which detailed the evolution from masonry bearing walls to cavity walls and how the NYC Building Code interpreted this construction (see Figure 4.2). The mention of a specific municipal code in a national reference publication is exceptional and occurred for only one other building component in this edition (see theatre seating, section 4.3.3.1).

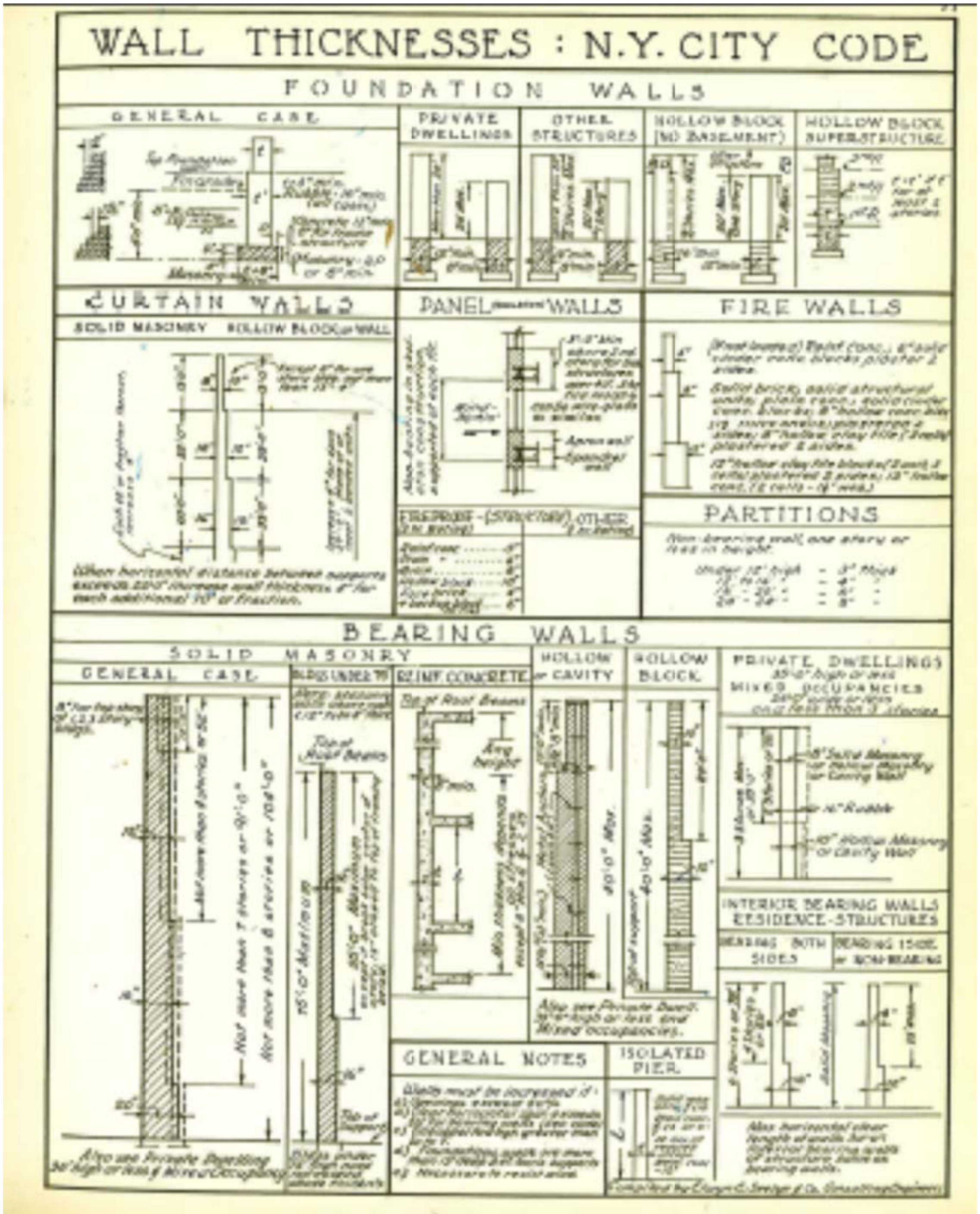
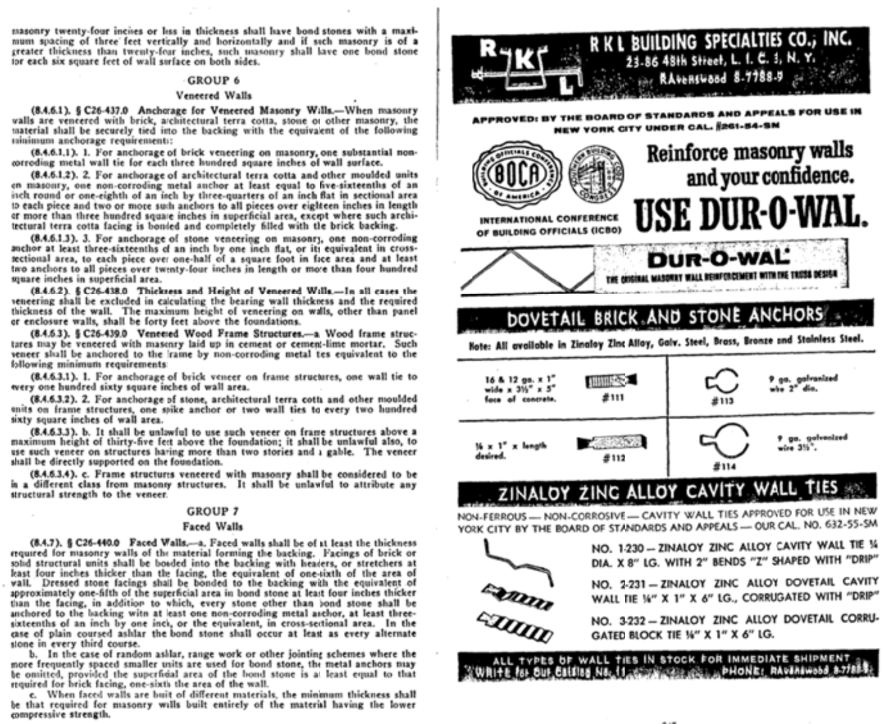


Figure 4.2 Full page in the 1956 edition of *Architectural Graphic Standards.*
Source: Ramsey & Sleeper, 1956, p. 71

Providing another communication for approved cavity wall construction was the advertisement in the text of the building code for mechanical attachments in cavity walls manufactured by Dur-O-Wal (see Figure 4.3). Here, a private company advertised metal attachments called "cavity-wall ties approved for use in New York City by the Board of Standards and Appeals." Dur-O-Wal also advertised "Zinaloy," their trademark for a zinc alloy used in the making of the company's mechanical anchors. This advertisement was placed in Sub-Article 4, Masonry Construction, § C26-412.0, so as to be easily viewed by individuals referencing code compliance for masonry anchors.



masonry twenty-four inches or less in thickness shall have bond stones with a maximum spacing of three feet vertically and horizontally and if such masonry is of a greater thickness than twenty-four inches, such masonry shall have one bond stone for each six square feet of wall surface on both sides.

GROUP 6

Veneered Walls

(8.4.6.1). § C26-437.0 Anchorage for Veneered Masonry Walls.—When masonry walls are veneered with brick, architectural terra cotta, stone or other masonry, the material shall be securely tied into the backing with the equivalent of the following minimum anchorage requirements:

(8.4.6.1.1). 1. For anchorage of brick veneering on masonry, one substantial non-corroding metal wall tie for each three hundred square inches of wall surface.

(8.4.6.1.2). 2. For anchorage of architectural terra cotta and other moulded units on masonry, one non-corroding metal anchor at least equal to five-sixteenths of an inch round or one-eighth of an inch by three-quarters of an inch flat in sectional area to each piece and two or more such anchors to all pieces over eighteen inches in length or more than three hundred square inches in superficial area, except where such architectural terra cotta facing is bonded and completely filled with the brick backing.

(8.4.6.1.3). 3. For anchorage of stone veneering on masonry, one non-corroding anchor at least three-sixteenths of an inch by one inch flat, or its equivalent in cross-sectional area, to each piece over one-half of a square foot in face area and at least two anchors to all pieces over twenty-four inches in length or more than four hundred square inches in superficial area.

(8.4.6.2). § C26-438.0 Thickness and Height of Veneered Walls.—In all cases the veneering shall be excluded in calculating the bearing wall thickness and the required thickness of the wall. The maximum height of veneering on walls, other than panel or enclosure walls, shall be forty feet above the foundations.

(8.4.6.3). § C26-439.0 Veneered Wood Frame Structures.—a. Wood frame structures may be veneered with masonry laid up in cement or cement-lime mortar. Such veneer shall be anchored to the frame by non-corroding metal ties equivalent to the following minimum requirements:

(8.4.6.3.1). 1. For anchorage of brick veneer on frame structures, one wall tie to every one hundred sixty square inches of wall area.

(8.4.6.3.2). 2. For anchorage of stone, architectural terra cotta and other moulded units on frame structures, one spike anchor or two wall ties to every two hundred sixty square inches of wall area.

(8.4.6.3.3). b. It shall be unlawful to use such veneer on frame structures above a maximum height of thirty-five feet above the foundation; it shall be unlawful also, to use such veneer on structures having more than two stories and a gable. The veneer shall be directly supported on the foundation.

(8.4.6.3.4). c. Frame structures veneered with masonry shall be considered to be in a different class from masonry structures. It shall be unlawful to attribute any structural strength to the veneer.

GROUP 7

Faced Walls

(8.4.7). § C26-440.0 Faced Walls.—a. Faced walls shall be of at least the thickness required for masonry walls of the material forming the backing. Facings of brick or solid structural units shall be bonded into the backing with headers, or stretchers at least four inches thicker than the facing, the equivalent of one-sixth of the area of wall. Dressed stone facings shall be bonded to the backing with the equivalent of approximately one-fifth of the superficial area in bond stone at least four inches thicker than the facing, in addition to which, every stone other than bond stone shall be anchored to the backing with at least one non-corroding metal anchor, at least three-sixteenths of an inch by one inch, or the equivalent, in cross-sectional area. In the case of plain coursed ashlar the bond stone shall occur at least as every alternate stone in every third course.

b. In the case of random ashlar, range work or other jointing schemes where the more frequently spaced smaller units are used for bond stone, the metal anchors may be omitted, provided the superficial area of the bond stone is at least equal to that required for brick facing, one-sixth the area of the wall.

c. When faced walls are built of different materials, the minimum thickness shall be that required for masonry walls built entirely of the material having the lower compressive strength.

Figure 4.3 Dur-O-Wal full page-advertisement from the 1950s edition in the 1938 NYC Building Laws.
Source: Administrative Building Code with Amendments to December, 1968, pp. 246–247

As demonstrated in this section, the force that influenced amending the code for cavity walls, as well as the creation of additional guidance through national publications and advertisements in the building code, was the need to communicate information about specific new materials (various mechanical ties) and methods (weep holes, flashing) that complied with the building code.

4.3.2.2 Concrete. Reinforced concrete construction became popular during the early 1950s. Although first regulated in the 1915 Building Code, reinforced concrete continued to employ improved methods of formwork, aggregate control, and additives such as plastics to improve viscosity and agents to control curing (Hornbostel & Hornung, 1974). Two main methods for concrete construction—reinforced concrete slab construction and reinforced concrete plank modular units—were beginning to be constructed in the 1950s. Both new uses employed materials science in their engineering.

Reinforced slabs were a speedier and more economical method of construction than steel. Slabs had the added benefit of allowing balconies to be included as a preferred yet inexpensive feature for housing complexes. Balconies were a cantilevered extension of the concrete floor slab and thus were economical to construct because they did not require the moment connections that were needed with steel. Reinforced concrete planks also represented a new use of an existing material. Planks were manufactured in modular units. Given that manufacturing took place in a factory location instead of onsite, it offered a high degree of control for the quality of concrete cure conditions and the load calculations, quicker assembly time, and quicker construction time onsite.

Since many architects were unfamiliar with concrete assemblies, amendments to the building code provided much needed information regarding their approved uses. Examples of amendments passed in the early 1950s include Local Law 84 of 1953 that regulated aggregates for reinforced concrete, Local Law 136 of 1952 that addressed concrete working stress, and Local Law 141 of 1952 that addressed reinforced concrete columns.

Between 1951 and 1953, ten amendments related to concrete were promulgated (see Figure 4.1). These amendments provided needed thresholds for architects and engineers designing buildings with this new material. For example, LL141/52 addressed concrete columns in buildings such as the Solomon R. Guggenheim Museum that was originally designed in 1945 but was substantially revised and not permitted by the DOB until May 23, 1956. The DOB objected to the structural stability of Frank Lloyd Wright's original reinforced concrete shell. Wright engaged the engineer Jacob Feld who added thin fan-like columns as additional support to the shell.[20]

In addition to the amendments, the DOB distributed further clarifications regarding concrete in four Memos and four Decisions. Further information for new uses of concrete was included in advertisements inserted into the body of the building code (see Figure 4.1). The principal topics addressed in the memos and advertisements included working stress, reinforced concrete slab and foundation piles, and new aggregate mixtures of concrete. This information suggested a need for the DOB to communicate to the NYC construction industry what new material technology was compliant to the building code.

While amendments focused on major concerns related to concrete, Memos and Decisions focused on answering specific questions regarding concrete that had been posed to the DOB. Five Memos and four Decisions addressed these questions, which

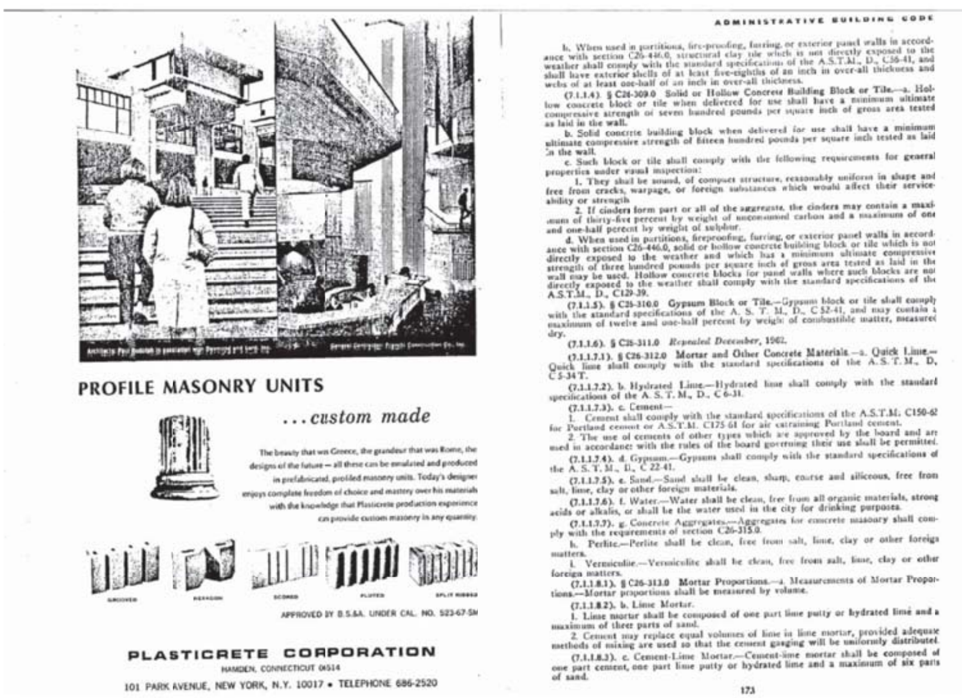
[20] Robert Stern described the permitting process for the structure of the Guggenheim Museum in his book, *New York 1960: Architecture and Urbanism Between the Second World War and the Bicentennial* (1997, pp. 807–820). The Guggenheim columns were an inverted tapering shape of reinforced concrete that swelled to thirty-two feet at the top.

covered issues such as the following: whether modular reinforced concrete planks would be allowed for retaining walls, whether new aggregate mixtures of concrete would adequately fireproof structural steel, and whether reinforced concrete balconies used as public halls would be considered for fire egress. One example of discussions was documented in the Memo dated November 9, 1953. In the Memo, the architectural firm Harrison and Abramowitz, together with NYCHA representatives, requested and received information on the use of reinforced concrete balconies.

Architects and the construction industry were not alone in requesting information from the DOB. In *The New York Times* article, Amendment Eases Building Code Bill, dated March 25, 1949, Bronx State Senator, Paul Fino, called for amending the code by encouraging the use of modern methods, devices, materials and techniques, some of which are outlawed by obsolete or unnecessarily complex provisions of local building codes. In particular, Fino’s bill reverberated concerns about amending the building code to include new types of concrete products. The bill was not promulgated because, in the ensuing six years, the DOB promulgated 262 amendments, most related to Fino’s concerns.

To supplement DOB amendments, Memos and Decisions, advertisements for concrete products were included in the early 1950s editions of the 1938 Building Code. Five full-page advertisements were placed adjacent to the corresponding code section. It is not known if the private companies paid for their advertisements to be included in the code. One advertising example was for modular reinforced concrete units made by the Plasticrete Corporation located in Connecticut. The advertisement publicized a new adaptation of existing concrete that entailed adding various mixtures of plastics to the concrete to improve uniformity, lower cost, and accelerate manufacturing. The advertisement appeared in Article 8, Mortar and Other Concrete Materials of the 1938 code, and facilitated specification of this product by architects. Specifically, Plasticrete was advertised in the text of the building code as being approved for use in NYC by the NYC Board of Standards and Appeals (BSA; see Figure 4.4). Approval by the BSA was an enormous advantage in advertising this product.

In another example, the Concrete Plank Company, Inc. (CPC) advertised prefabricated concrete planks of various sizes, thicknesses, and loads (see Figure 4.4). Other examples were two advertisements for concrete piles (see Figures 4.5 and 4.6), and another for aggregates (see Figure 4.7).



ADMINISTRATIVE BUILDING CODE

h. When used in partitions, fire-proofing, furring, or exterior panel walls in accordance with section C26-446.0, structural clay tile which is not directly exposed to the weather shall comply with the standard specifications of the A.S.T.M., D., C56-41, and shall have exterior shells of at least five-eighths of an inch in over-all thickness and webs of at least one-half of an inch in over-all thickness.

(7.1.1.4). § C26-309.0 **Solid or Hollow Concrete Building Block or Tile.**—a. Hollow concrete block or tile when delivered for use shall have a minimum ultimate compressive strength of seven hundred pounds per square inch of gross area tested as laid in the wall.

b. Solid concrete building block when delivered for use shall have a minimum ultimate compressive strength of fifteen hundred pounds per square inch tested as laid in the wall.

c. Such block or tile shall comply with the following requirements for general properties under visual inspection:

1. They shall be sound, of compact structure, reasonably uniform in shape and free from cracks, warpage, or foreign substances which would affect their serviceability or strength.

2. If cinders form part or all of the aggregate, the cinders may contain a maximum of thirty-five percent by weight of unconsumed carbon and a maximum of one and one-half percent by weight of sulphur.

d. When used in partitions, fireproofing, furring, or exterior panel walls in accordance with section C26-446.0, solid or hollow concrete building block or tile which is not directly exposed to the weather and which has a minimum ultimate compressive strength of three hundred pounds per square inch of gross area tested as laid in the wall may be used. Hollow concrete blocks for panel walls where such blocks are not directly exposed to the weather shall comply with the standard specifications of the A.S.T.M., D., C129-39.

(7.1.1.5). § C26-310.0 **Gypsum Block or Tile.**—Gypsum block or tile shall comply with the standard specifications of the A. S. T. M., D., C 52-41, and may contain a maximum of twelve and one-half percent by weight of combustible matter, measured dry.

(7.1.1.6). § C26-311.0 *Repealed December, 1962.*

(7.1.1.7.1). § C26-312.0 **Mortar and Other Concrete Materials.**—a. Quick Lime.—Quick lime shall comply with the standard specifications of the A. S. T. M., D, C 5-34 T.

(7.1.1.7.2). b. Hydrated Lime.—Hydrated lime shall comply with the standard specifications of the A. S. T. M., D., C 6-31.

(7.1.1.7.3). c. Cement—

1. Cement shall comply with the standard specifications of the A.S.T.M. C150-62 for Portland cement or A.S.T.M. C175-61 for air entraining Portland cement.

2. The use of cements of other types which are approved by the board and are used in accordance with the rules of the board governing their use shall be permitted.

(7.1.1.7.4). d. Gypsum.—Gypsum shall comply with the standard specifications of the A. S. T. M., D., C 22-41.

(7.1.1.7.5). e. Sand.—Sand shall be clean, sharp, course and siliceous, free from salt, lime, clay or other foreign materials.

(7.1.1.7.6). f. Water.—Water shall be clean, free from all organic materials, strong acids or alkalis, or shall be the water used in the city for drinking purposes.

(7.1.1.7.7). g. Concrete Aggregates.—Aggregates for concrete masonry shall comply with the requirements of section C26-315.0.

h. Perlite.—Perlite shall be clean, free from salt, lime, clay or other foreign matters.

i. Vermiculite.—Vermiculite shall be clean, free from salt, lime, clay or other foreign matters.

(7.1.1.8.1). § C26-313.0 **Mortar Proportions.**—a. Measurements of Mortar Proportions.—Mortar proportions shall be measured by volume.

(7.1.1.8.2). b. Lime Mortar.

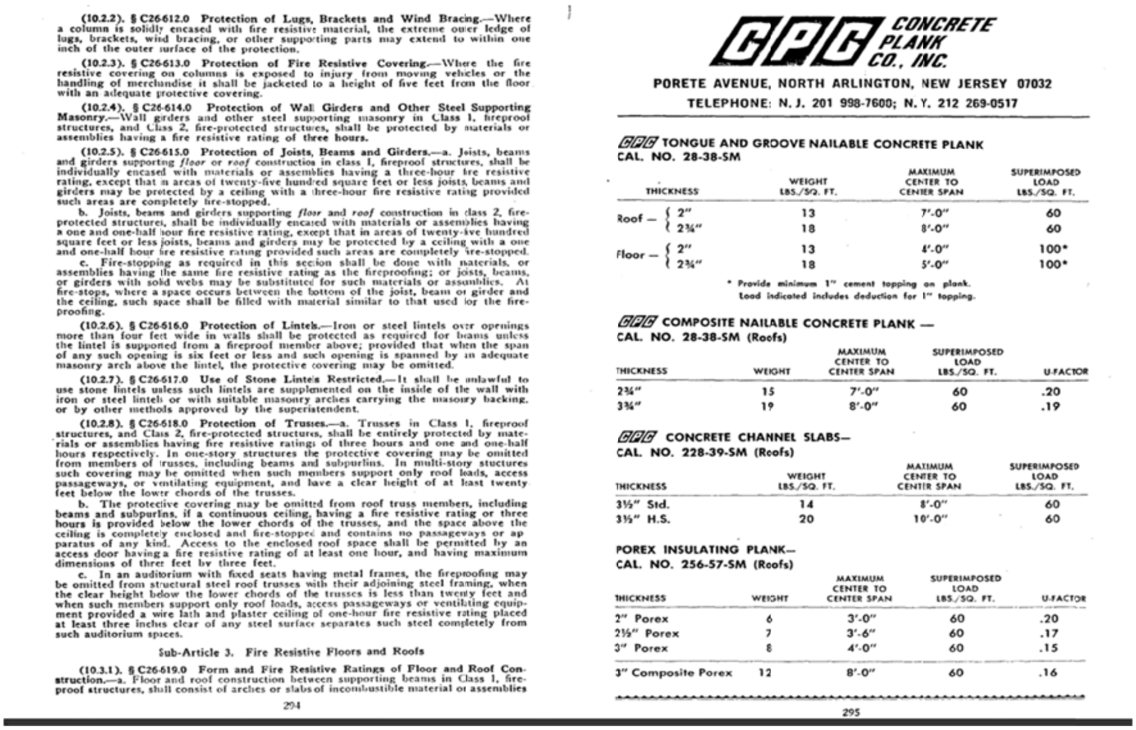
1. Lime mortar shall be composed of one part lime putty or hydrated lime and a maximum of three parts of sand.

2. Cement may replace equal volumes of lime in lime mortar, provided adequate methods of mixing are used so that the cement gaging will be uniformly distributed.

(7.1.1.8.3). c. Cement-Lime Mortar.—Cement-lime mortar shall be composed of one part cement, one part lime putty or hydrated lime and a maximum of six parts of sand.

173

Figure 4.4 Plasticrete Corporation advertisement from the 1950s edition in the 1938 NYC Building Laws.
Source: Administrative Building Code with Amendments to December, 1968, pp. 172–173.



(10.2.2). § C26-612.0 **Protection of Lugs, Brackets and Wind Bracing.**—Where a column is solidly encased with fire resistive material, the extreme outer ledge of lugs, brackets, wind bracing, or other supporting parts may extend to within one inch of the outer surface of the protection.

(10.2.3). § C26-613.0 **Protection of Fire Resistive Covering.**—Where the fire resistive covering on columns is exposed to injury from moving vehicles or the handling of merchandise it shall be jacketed to a height of five feet from the floor with an adequate protective covering.

(10.2.4). § C26-614.0 **Protection of Wall Girders and Other Steel Supporting Masonry.**—Wall girders and other steel supporting masonry in Class 1, fireproof structures, and Class 2, fire-protected structures, shall be protected by materials or assemblies having a fire resistive rating of three hours.

(10.2.5). § C26-615.0 **Protection of Joists, Beams and Girders.**—a. Joists, beams and girders supporting *floor* or *roof* construction in class 1, fireproof structures, shall be individually encased with materials or assemblies having a three-hour fire resistive rating, except that in areas of twenty-five hundred square feet or less joists, beams and girders may be protected by a ceiling with a three-hour fire resistive rating provided such areas are completely fire-stopped.

b. Joists, beams and girders supporting *floor* and *roof* construction in class 2, fire-protected structures, shall be individually encased with materials or assemblies having a one and one-half hour fire resistive rating, except that in areas of twenty-five hundred square feet or less joists, beams and girders may be protected by a ceiling with a one and one-half hour fire resistive rating provided such areas are completely fire-stopped.

c. Fire-stopping as required in this section shall be done with materials, or assemblies having the same fire resistive rating as the fireproofing; or joists, beams, or girders with solid webs may be substituted for such materials or assemblies. At fire-stops, where a space occurs between the bottom of the joist, beam or girder and the ceiling, such space shall be filled with material similar to that used for the fire-proofing.

(10.2.6). § C26-616.0 **Protection of Lintels.**—Iron or steel lintels over openings more than four feet wide in walls shall be protected as required for beams unless the lintel is supported from a fireproof member above; provided that when the span of any such opening is six feet or less and such opening is spanned by an adequate masonry arch above the lintel, the protective covering may be omitted.

(10.2.7). § C26-617.0 **Use of Stone Lintels Restricted.**—It shall be unlawful to use stone lintels unless such lintels are supplemented on the inside of the wall with iron or steel lintels or with suitable masonry arches carrying the masonry backing, or by other methods approved by the superintendent.

(10.2.8). § C26-618.0 **Protection of Trusses.**—a. Trusses in Class 1, fireproof structures, and Class 2, fire-protected structures, shall be entirely protected by materials or assemblies having fire resistive ratings of three hours and one and one-half hours respectively. In one-story structures the protective covering may be omitted from members of trusses, including beams and subpurlins. In multi-story stuctures such covering may be omitted when such members support only roof loads, access passageways, or ventilating equipment, and have a clear height of at least twenty feet below the lower chords of the trusses.

b. The protective covering may be omitted from roof truss members, including beams and subpurlins, if a continuous ceiling, having a fire resistive rating or three hours is provided below the lower chords of the trusses, and the space above the ceiling is completely enclosed and fire-stopped and contains no passageways or apparatus of any kind. Access to the enclosed roof space shall be permitted by an access door having a fire resistive rating of at least one hour, and having maximum dimensions of three feet by three feet.

c. In an auditorium with fixed seats having metal frames, the fireproofing may be omitted from structural steel roof trusses with their adjoining steel framing, when the clear height below the lower chords of the trusses is less than twenty feet and when such members support only roof loads, access passageways or ventilating equipment provided a wire lath and plaster ceiling of one-hour fire resistive rating placed at least three inches clear of any steel surface separates such steel completely from such auditorium spaces.

Sub-Article 3. Fire Resistive Floors and Roofs

(10.3.1). § C26-619.0 **Form and Fire Resistive Ratings of Floor and Roof Construction.**—a. Floor and roof construction between supporting beams in Class 1, fireproof structures, shall consist of arches or slabs of incombustible material or assemblies

294

CPC TONGUE AND GROOVE NAILABLE CONCRETE PLANK
CAL. NO. 28-38-SM

THICKNESS		WEIGHT LBS./SQ. FT.	MAXIMUM CENTER TO CENTER SPAN	SUPERIMPOSED LOAD LBS./SQ. FT.
Roof —	2″	13	7′-0″	60
	2¾″	18	8′-0″	60
Floor —	2″	13	4′-0″	100*
	2¾″	18	5′-0″	100*

* Provide minimum 1″ cement topping on plank.
Load indicated includes deduction for 1″ topping.

CPC COMPOSITE NAILABLE CONCRETE PLANK —
CAL. NO. 28-38-SM (Roofs)

THICKNESS	WEIGHT	MAXIMUM CENTER TO CENTER SPAN	SUPERIMPOSED LOAD LBS./SQ. FT.	U-FACTOR
2¾″	15	7′-0″	60	.20
3¾″	19	8′-0″	60	.19

CPC CONCRETE CHANNEL SLABS—
CAL. NO. 228-39-SM (Roofs)

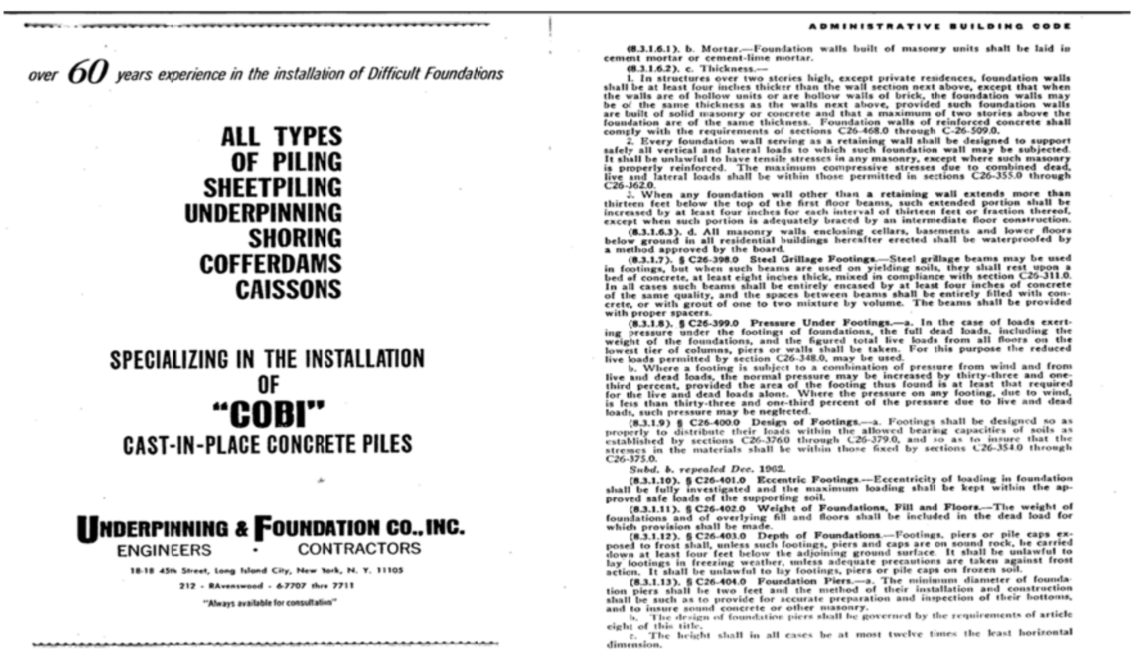
THICKNESS	WEIGHT LBS./SQ. FT.	MAXIMUM CENTER TO CENTER SPAN	SUPERIMPOSED LOAD LBS./SQ. FT.
3½″ Std.	14	8′-0″	60
3½″ H.S.	20	10′-0″	60

POREX INSULATING PLANK—
CAL. NO. 256-57-SM (Roofs)

THICKNESS	WEIGHT	MAXIMUM CENTER TO CENTER SPAN	SUPERIMPOSED LOAD LBS./SQ. FT.	U-FACTOR
2″ Porex	6	3′-0″	60	.20
2½″ Porex	7	3′-6″	60	.17
3″ Porex	8	4′-0″	60	.15
3″ Composite Porex	12	8′-0″	60	.16

295

Figure 4.5 CPC Concrete Plank Company full page-advertisement from the 1950s in the 1938 NYC Building Laws.
Source: Administrative Building Code with Amendments to December, 1968, pp. 294–295.



ADMINISTRATIVE BUILDING CODE

(8.3.1.6.1). b. Mortar.—Foundation walls built of masonry units shall be laid in cement mortar or cement-lime mortar.

(8.3.1.6.2). c. Thickness.—

1. In structures over two stories high, except private residences, foundation walls shall be at least four inches thicker than the wall section next above, except that when the walls are of hollow units or are hollow walls of brick, the foundation walls may be of the same thickness as the walls next above, provided such foundation walls are built of solid masonry or concrete and that a maximum of two stories above the foundation are of the same thickness. Foundation walls of reinforced concrete shall comply with the requirements of sections C26-468.0 through C-26-509.0.

2. Every foundation wall serving as a retaining wall shall be designed to support safely all vertical and lateral loads to which such foundation wall may be subjected. It shall be unlawful to have tensile stresses in any masonry, except where such masonry is properly reinforced. The maximum compressive stresses due to combined dead, live and lateral loads shall be within those permitted in sections C26-355.0 through C26-362.0.

3. When any foundation wall other than a retaining wall extends more than thirteen feet below the top of the first floor beams, such extended portion shall be increased by at least four inches for each interval of thirteen feet or fraction thereof, except when such portion is adequately braced by an intermediate floor construction.

(8.3.1.6.3). d. All masonry walls enclosing cellars, basements and lower floors below ground in all residential buildings hereafter erected shall be waterproofed by a method approved by the board.

(8.3.1.7). § C26-398.0 **Steel Grillage Footings.**—Steel grillage beams may be used in footings, but when such beams are used on yielding soils, they shall rest upon a bed of concrete, at least eight inches thick, mixed in compliance with section C26-311.0. In all cases such beams shall be entirely encased by at least four inches of concrete of the same quality, and the spaces between beams shall be entirely filled with concrete, or with grout of one to two mixture by volume. The beams shall be provided with proper spacers.

(8.3.1.8). § C26-399.0 **Pressure Under Footings.**—a. In the case of loads exerting pressure under the footings of foundations, the full dead loads, including the weight of the foundations, and the figured total live loads from all floors on the lowest tier of columns, piers or walls shall be taken. For this purpose the reduced live loads permitted by section C26-348.0, may be used.

b. Where a footing is subject to a combination of pressure from wind and from live and dead loads, the normal pressure may be increased by thirty-three and one-third percent, provided the area of the footing thus found is at least that required for the live and dead loads alone. Where the pressure on any footing, due to wind, is less than thirty-three and one-third percent of the pressure due to live and dead loads, such pressure may be neglected.

(8.3.1.9) § C26-400.0 **Design of Footings.**—a. Footings shall be designed so as properly to distribute their loads within the allowed bearing capacities of soils as established by sections C26-376.0 through C26-379.0, and so as to insure that the stresses in the materials shall be within those fixed by sections C26-354.0 through C26-375.0.

Subd. b. repealed Dec. 1962.

(8.3.1.10). § C26-401.0 **Eccentric Footings.**—Eccentricity of loading in foundation shall be fully investigated and the maximum loading shall be kept within the approved safe loads of the supporting soil.

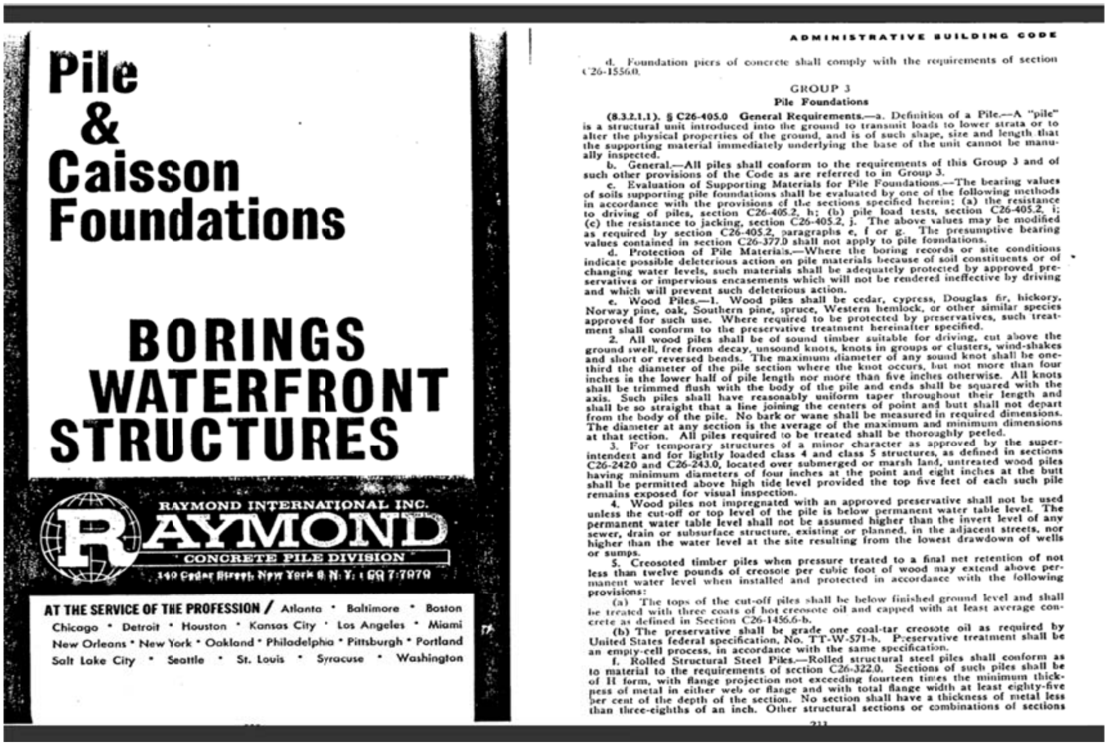
(8.3.1.11). § C26-402.0 **Weight of Foundations, Fill and Floors.**—The weight of foundations and of overlying fill and floors shall be included in the dead load for which provision shall be made.

(8.3.1.12). § C26-403.0 **Depth of Foundations.**—Footings, piers or pile caps exposed to frost shall, unless such footings, piers and caps are on sound rock, be carried down at least four feet below the adjoining ground surface. It shall be unlawful to lay footings in freezing weather, unless adequate precautions are taken against frost action. It shall be unlawful to lay footings, piers or pile caps on frozen soil.

(8.3.1.13). § C26-404.0 **Foundation Piers.**—a. The minimum diameter of foundation piers shall be two feet and the method of their installation and construction shall be such as to provide for accurate preparation and inspection of their bottoms, and to insure sound concrete or other masonry.

b. The design of foundation piers shall be governed by the requirements of article eight of this title.

c. The height shall in all cases be at most twelve times the least horizontal dimension.



Pile
&
Caisson
Foundations

BORINGS
WATERFRONT
STRUCTURES

RAYMOND INTERNATIONAL INC.
RAYMOND
CONCRETE PILE DIVISION
140 Cedar Street, New York 6, N. Y. : CO 7-7070

AT THE SERVICE OF THE PROFESSION / Atlanta • Baltimore • Boston
Chicago • Detroit • Houston • Kansas City • Los Angeles • Miami
New Orleans • New York • Oakland • Philadelphia • Pittsburgh • Portland
Salt Lake City • Seattle • St. Louis • Syracuse • Washington

ADMINISTRATIVE BUILDING CODE

d. Foundation piers of concrete shall comply with the requirements of section C26-1556.0.

GROUP 3

Pile Foundations

(8.3.2.1.1). § C26-405.0 General Requirements.—a. Definition of a Pile.—A "pile" is a structural unit introduced into the ground to transmit loads to lower strata or to alter the physical properties of the ground, and is of such shape, size and length that the supporting material immediately underlying the base of the unit cannot be manually inspected.

b. General.—All piles shall conform to the requirements of this Group 3 and of such other provisions of the Code as are referred to in Group 3.

c. Evaluation of Supporting Materials for Pile Foundations.—The bearing values of soils supporting pile foundations shall be evaluated by one of the following methods in accordance with the provisions of the sections specified herein: (a) the resistance to driving of piles, section C26-405.2, h; (b) pile load tests, section C26-405.2, i; (c) the resistance to jacking, section C26-405.2, j. The above values may be modified as required by section C26-405.2, paragraphs e, f or g. The presumptive bearing values contained in section C26-377.0 shall not apply to pile foundations.

d. Protection of Pile Materials.—Where the boring records or site conditions indicate possible deleterious action on pile materials because of soil constituents or of changing water levels, such materials shall be adequately protected by approved preservatives or impervious encasements which will not be rendered ineffective by driving and which will prevent such deleterious action.

e. Wood Piles.—1. Wood piles shall be cedar, cypress, Douglas fir, hickory, Norway pine, oak, Southern pine, spruce, Western hemlock, or other similar species approved for such use. Where required to be protected by preservatives, such treatment shall conform to the preservative treatment hereinafter specified.

2. All wood piles shall be of sound timber suitable for driving, cut above the ground swell, free from decay, unsound knots, knots in groups or clusters, wind-shakes and short or reversed bends. The maximum diameter of any sound knot shall be one-third the diameter of the pile section where the knot occurs, but not more than four inches in the lower half of pile length nor more than five inches otherwise. All knots shall be trimmed flush with the body of the pile and ends shall be squared with the axis. Such piles shall have reasonably uniform taper throughout their length and shall be so straight that a line joining the centers of point and butt shall not depart from the body of the pile. No bark or wane shall be measured in required dimensions. The diameter at any section is the average of the maximum and minimum dimensions at that section. All piles required to be treated shall be thoroughly peeled.

3. For temporary structures of a minor character as approved by the superintendent and for lightly loaded class 4 and class 5 structures, as defined in sections C26-2420 and C26-243.0, located over submerged or marsh land, untreated wood piles having minimum diameters of four inches at the point and eight inches at the butt shall be permitted above high tide level provided the top five feet of each such pile remains exposed for visual inspection.

4. Wood piles not impregnated with an approved preservative shall not be used unless the cut-off or top level of the pile is below permanent water table level. The permanent water table level shall not be assumed higher than the invert level of any sewer, drain or subsurface structure, existing or planned, in the adjacent streets, nor higher than the water level at the site resulting from the lowest drawdown of wells or sumps.

5. Creosoted timber piles when pressure treated to a final net retention of not less than twelve pounds of creosote per cubic foot of wood may extend above permanent water level when installed and protected in accordance with the following provisions:

(a) The tops of the cut-off piles shall be below finished ground level and shall be treated with three coats of hot creosote oil and capped with at least average concrete as defined in Section C26-1456.6-b.

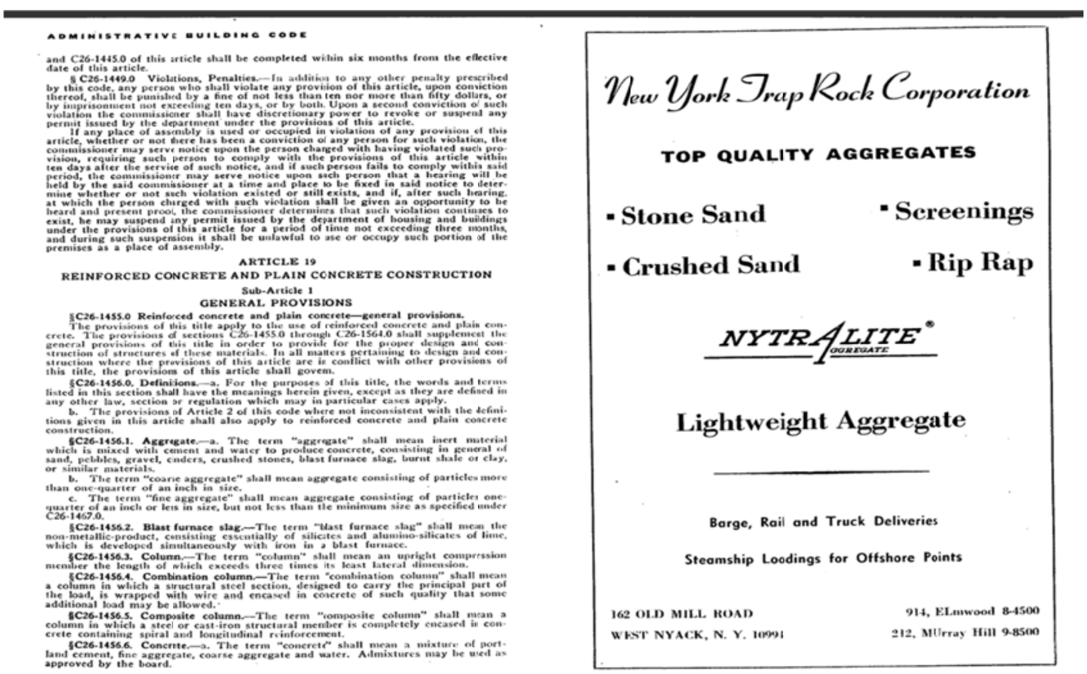
(b) The preservative shall be grade one coal-tar creosote oil as required by United States federal specification, No. TT-W-571-b. Preservative treatment shall be an empty-cell process, in accordance with the same specification.

f. Rolled Structural Steel Piles.—Rolled structural steel piles shall conform as to material to the requirements of section C26-322.0. Sections of such piles shall be of H form, with flange projection not exceeding fourteen times the minimum thickness of metal in either web or flange and with total flange width at least eighty-five per cent of the depth of the section. No section shall have a thickness of metal less than three-eighths of an inch. Other structural sections or combinations of sections

211

Figure 4.6 Two advertisements of concrete piles in the early 1950s edition of the 1938 NYC Building Laws.

Source: Administrative Building Code with Amendments to December, 1968, pp. 230–231 and pp. 232–233.



ADMINISTRATIVE BUILDING CODE

and C26-1445.0 of this article shall be completed within six months from the effective date of this article.

§ C26-1449.0 Violations, Penalties.—In addition to any other penalty prescribed by this code, any person who shall violate any provision of this article, upon conviction thereof, shall be punished by a fine of not less than ten nor more than fifty dollars, or by imprisonment not exceeding ten days, or by both. Upon a second conviction of such violation the commissioner shall have discretionary power to revoke or suspend any permit issued by the department under the provisions of this article.

If any place of assembly is used or occupied in violation of any provision of this article, whether or not there has been a conviction of any person for such violation, the commissioner may serve notice upon the person charged with having violated such provision, requiring such person to comply with the provisions of this article within ten days after the service of such notice, and if such person fails to comply within said period, the commissioner may serve notice upon such person that a hearing will be held by the said commissioner at a time and place to be fixed in said notice to determine whether or not such violation existed or still exists, and if, after such hearing, at which the person charged with such violation shall be given an opportunity to be heard and present proof, the commissioner determines that such violation continues to exist, he may suspend any permit issued by the department of housing and buildings under the provisions of this article for a period of time not exceeding three months, and during such suspension it shall be unlawful to use or occupy such portion of the premises as a place of assembly.

ARTICLE 19

REINFORCED CONCRETE AND PLAIN CONCRETE CONSTRUCTION

Sub-Article 1

GENERAL PROVISIONS

§C26-1455.0 Reinforced concrete and plain concrete—general provisions.

The provisions of this title apply to the use of reinforced concrete and plain concrete. The provisions of sections C26-1455.0 through C26-1564.0 shall supplement the general provisions of this title in order to provide for the proper design and construction of structures of these materials. In all matters pertaining to design and construction where the provisions of this article are in conflict with other provisions of this title, the provisions of this article shall govern.

§C26-1456.0. Definitions.—a. For the purposes of this title, the words and terms listed in this section shall have the meanings herein given, except as they are defined in any other law, section or regulation which may in particular cases apply.

b. The provisions of Article 2 of this code where not inconsistent with the definitions given in this article shall also apply to reinforced concrete and plain concrete construction.

§C26-1456.1. Aggregate.—a. The term "aggregate" shall mean inert material which is mixed with cement and water to produce concrete, consisting in general of sand, pebbles, gravel, cinders, crushed stones, blast furnace slag, burnt shale or clay, or similar materials.

b. The term "coarse aggregate" shall mean aggregate consisting of particles more than one-quarter of an inch in size.

c. The term "fine aggregate" shall mean aggregate consisting of particles one-quarter of an inch or less in size, but not less than the minimum size as specified under C26-1467.0.

§C26-1456.2. Blast furnace slag.—The term "blast furnace slag" shall mean the non-metallic-product, consisting essentially of silicates and alumino-silicates of lime, which is developed simultaneously with iron in a blast furnace.

§C26-1456.3. Column.—The term "column" shall mean an upright compression member the length of which exceeds three times its least lateral dimension.

§C26-1456.4. Combination column.—The term "combination column" shall mean a column in which a structural steel section, designed to carry the principal part of the load, is wrapped with wire and encased in concrete of such quality that some additional load may be allowed.

§C26-1456.5. Composite column.—The term "composite column" shall mean a column in which a steel or cast-iron structural member is completely encased in concrete containing spiral and longitudinal reinforcement.

§C26-1456.6. Concrete.—a. The term "concrete" shall mean a mixture of portland cement, fine aggregate, coarse aggregate and water. Admixtures may be used as approved by the board.

New York Trap Rock Corporation

TOP QUALITY AGGREGATES

• Stone Sand • Screenings
• Crushed Sand • Rip Rap

NYTRALITE®
AGGREGATE

Lightweight Aggregate

Barge, Rail and Truck Deliveries

Steamship Loadings for Offshore Points

162 OLD MILL ROAD
WEST NYACK, N. Y. 10994

914, ELmwood 8-4500
212, MUrray Hill 9-8500

Figure 4.7 Advertisement of concrete aggregate in the early 1950s edition of the 1938 NYC Building Laws.

Source: Administrative Building Code with Amendments to December, 1968, pp. 484–485.

4.3.2.3 Gypsum Drywall for Fireproofing Construction Gaps.[21] As buildings increased in height, it became necessary to lighten their weight. In the earlier heavy masonry bearing wall construction, fire-resistive properties were an added benefit to the robust heft of the exterior wall assembly. Thick masonry walls not only held up the building, but also provided a substantial barrier that prevented the spread of fire and smoke. Thus the masonry walls performed the double function of structural support and fire prevention. As buildings got lighter and the use of masonry was reduced, however, fire resistance had to be accomplished with alternative construction assemblies. Gypsum plaster that was trawled onto a backup of wood lath or masonry represented a lightweight and fire-resistive alternative to masonry. This plaster was applied or trawled on by hand in multiple layers, providing fire proofing for steel, egress stairs, shafts, and partitions. Despite its obvious advantages, this method was labor intensive, time consuming, and required master plasterers (Hornbostel & Hornung, 1974).

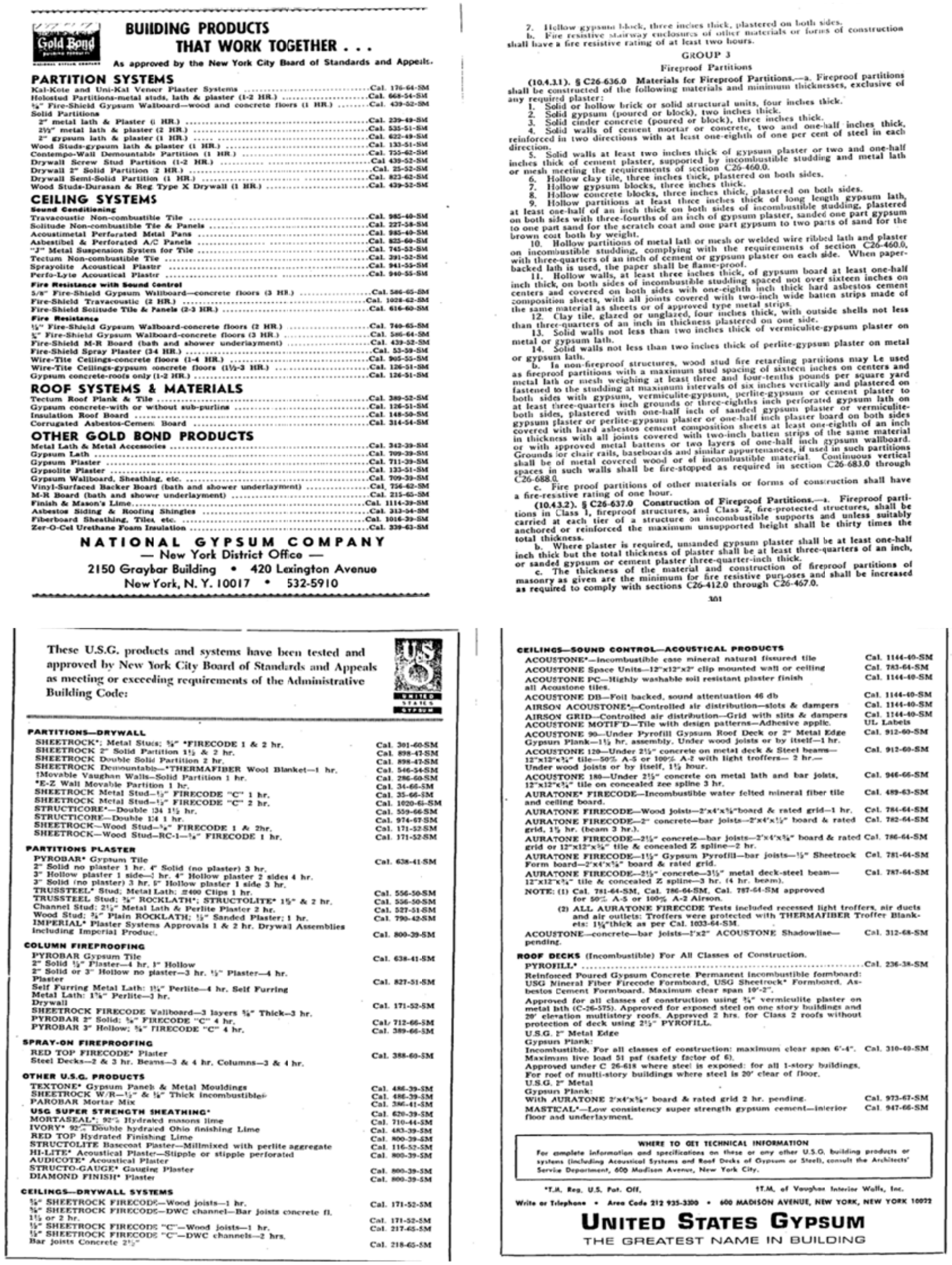
Around the same time, efforts to reduce costs and labor as well as to increase quality control positioned gypsum drywall board as the preferred method of construction. Also called sheetrock or rock, gypsum drywall board was manufactured offsite in modular four-by-eight foot sheets of various thicknesses. Semi-skilled carpenters could install standard size sheets quickly and easily. The most important characteristic that made gypsum drywall boards popular was their fire-resistive property in both structural steel encasement and partition assemblies. These fire-resistive properties depended upon installations with no gaps, which needed to be mandated by the DOB.

---

[21] In this study, gypsum products such as wall boards together with issues of gaps that are small openings in construction assemblies are discussed together (see Figure 4.1).

Between 1950 and 1954, ten amendments for gypsum products and eight amendments for gaps were promulgated. The topics addressed in regards to gypsum drywall included fireproofing, substitutions for hand-trawled plaster, and gypsum additives like vermiculite. The fire-resistive qualities of gypsum depended on fire-stopping materials that were constantly appearing on the marketplace, which required information from the DOB as to which products were code compliant (Dunn, 1988). Moreover, amendments to the code also mandated that construction gaps should be filled with approved new fire-stopping materials like foams and sprays or hand-applied plaster. In addition to the amendments, the DOB distributed four Memos and three Decisions, which approved new products such as Gristcrete, as well as approving specific areas of application for materials in elevator shafts, egress stairs, and rated ceilings.

To provide further information on gypsum drywall, three full pages of the 1950s edition of the code were devoted to advertisements for gypsum drywall boards by two companies: the National Gypsum Company and United States Gypsum (now USG Corporation). Positioned between the advertisements was the text of the building code section on Fireproof Partitions, §C26-636.0. The advertisements included the statement, "These U.S.G. products and systems have been tested and approved by the New York City Board of Standards and Appeals as meeting or exceeding requirements of the Administrative Building Code" (see Figure 4.5). Since architects generally reference the building code when materials are specified for a project, they would likely see the advertisements for this new material when researching partition products in the code text. The advertisements specifically served to inform architects that specific products were approved by the DOB. One thing to note is that the wording and look of the advertisements were similar to the building code sections. This approach to advertising is in contrast to advertisements in trade magazines that do not look like the code. As can be seen from Figure 4.9. The drywall brands, National Gypsum Company and United States Gypsum, marketed their products in a similar format to drywall sections of the Building Code. In addition, the Building Code text on drywall was printed in between both advertisements.



Gold Bond

BUILDING PRODUCTS THAT WORK TOGETHER . . .

As approved by the New York City Board of Standards and Appeals.

PARTITION SYSTEMS

Kal-Kote and Uni-Kal Veneer Plaster Systems .... Cal. 176-64-SM
Holostud Partitions-metal studs, lath & plaster (1-2 HR.) .... Cal. 668-54-SM
⅝" Fire-Shield Gypsum Wallboard—wood and concrete floors (1 HR.) .... Cal. 439-52-SM
Solid Partitions
2" metal lath & Plaster (1 HR.) .... Cal. 239-49-SM
2½" metal lath & plaster (2 HR.) .... Cal. 535-51-SM
2" gypsum lath & plaster (1 HR.) .... Cal. 622-49-SM
Wood Studs-gypsum lath & plaster (1 HR.) .... Cal. 133-51-SM
Contempo-Wall Demountable Partition (1 HR.) .... Cal. 755-62-SM
Drywall Screw Stud Partition (1-2 HR.) .... Cal 439-52-SM
Drywall 2" Solid Partition (2 HR.) .... Cal. 25-52-SM
Drywall Semi-Solid Partition (1 HR.) .... Cal. 823-62-SM
Wood Studs-Durasan & Reg. Type X Drywall (1 HR.) .... Cal. 439-52-SM

CEILING SYSTEMS

Sound Conditioning
Travacoustic Non-combustible Tile .... Cal. 985-40-SM
Solitude Non-combustible Tile & Panels .... Cal. 227-58-SM
Acoustimetal Perforated Metal Pans .... Cal. 985-40-SM
Asbestibel & Perforated A/C Panels .... Cal. 825-60-SM
"J" Metal Suspension System for Tile .... Cal. 745-52-SM
Tectum Non-combustible Tile .... Cal. 391-52-SM
Sprayolite Acoustical Plaster .... Cal. 941-55-SM
Perfo-Lyte Acoustical Plaster .... Cal. 940-55-SM

Fire Resistance with Sound Control
5/8" Fire-Shield Gypsum Wallboard—concrete floors (3 HR.) .... Cal. 586-65-SM
Fire-Shield Travacoustic (2 HR.) .... Cal. 1028-62-SM
Fire-Shield Solitude Tile & Panels (2-3 HR.) .... Cal. 616-60-SM

Fire Resistance
½" Fire-Shield Gypsum Wallboard-concrete floors (2 HR.) .... Cal. 740-65-SM
⅝" Fire-Shield Gypsum Wallboard-concrete floors (3 HR.) .... Cal. 586-64-SM
Fire-Shield M-R Board (bath and shower underlayment) .... Cal. 439-52-SM
Fire-Shield Spray Plaster (3-4 HR.) .... Cal. 53-59-SM
Wire-Tite Ceilings-concrete floors (1-4 HR.) .... Cal. 905-55-SM
Wire-Tite Ceilings-gypsum concrete floors (1½-3 HR.) .... Cal. 126-51-SM
Gypsum concrete-roofs only (1-2 HR.) .... Cal. 126-51-SM

ROOF SYSTEMS & MATERIALS

Tectum Roof Plank & Tile .... Cal. 389-52-SM
Gypsum concrete-with or without sub-purlins .... Cal. 126-51-SM
Insulation Roof Board .... Cal. 148-50-SM
Corrugated Asbestos-Cement Board .... Cal. 314-54-SM

OTHER GOLD BOND PRODUCTS

Metal Lath & Metal Accessories .... Cal. 342-39-SM
Gypsum Lath .... Cal. 709-39-SM
Gypsum Plaster .... Cal. 711-39-SM
Gypsolite Plaster .... Cal. 133-51-SM
Gypsum Wallboard, Sheathing, etc. .... Cal. 709-39-SM
Vinyl-Surfaced Backer Board (bath and shower underlayment) .... Cal. 756-62-SM
M-R Board (bath and shower underlayment) .... Cal. 215-65-SM
Finish & Mason's Lime .... Cal. 1114-39-SM
Asbestos Siding & Roofing Shingles .... Cal. 313-54-SM
Fiberboard Sheathing, Tiles, etc. .... Cal. 1016-39-SM
Zer-O-Cel Urethane Foam Insulation .... Cal. 339-63-SM

NATIONAL GYPSUM COMPANY
— New York District Office —
2150 Graybar Building • 420 Lexington Avenue
New York, N. Y. 10017 • 532-5910

7. Hollow gypsum block, three inches thick, plastered on both sides.
b. Fire resistive stairway enclosures of other materials or forms of construction shall have a fire resistive rating of at least two hours.

GROUP 3
Fireproof Partitions

(10.4.3.1). § C26-636.0 Materials for Fireproof Partitions.—a. Fireproof partitions shall be constructed of the following materials and minimum thicknesses, exclusive of any required plaster:
1. Solid or hollow brick or solid structural units, four inches thick.
2. Solid gypsum (poured or block), two inches thick.
3. Solid cinder concrete (poured or block), three inches thick.
4. Solid walls of cement mortar or concrete, two and one-half inches thick, reinforced in two directions with at least one-eighth of one per cent of steel in each direction.
5. Solid walls at least two inches thick of gypsum plaster or two and one-half inches thick of cement plaster, supported by incombustible studding and metal lath or mesh meeting the requirements of section C26-460.0.
6. Hollow clay tile, three inches thick, plastered on both sides.
7. Hollow gypsum blocks, three inches thick.
8. Hollow concrete blocks, three inches thick, plastered on both sides.
9. Hollow partitions at least three inches thick of long length gypsum lath, at least one-half of an inch thick on both sides of incombustible studding, plastered on both sides with three-fourths of an inch of gypsum plaster, sanded one part gypsum to one part sand for the scratch coat and one part gypsum to two parts of sand for the brown coat both by weight.
10. Hollow partitions of metal lath or mesh or welded wire ribbed lath and plaster on incombustible studding, complying with the requirements of section C26-460.0, with three-quarters of an inch of cement or gypsum plaster on each side. When paper-backed lath is used, the paper shall be flame-proof.
11. Hollow walls, at least three inches thick, of gypsum board at least one-half inch thick, on both sides of incombustible studding spaced not over sixteen inches on centers and covered on both sides with one-eighth inch thick hard asbestos cement composition sheets, with all joints covered with two-inch wide batten strips made of the same material as sheets or of approved type metal strips.
12. Clay tile, glazed or unglazed, four inches thick, with outside shells not less than three-quarters of an inch in thickness plastered on one side.
13. Solid walls not less than two inches thick of vermiculite-gypsum plaster on metal or gypsum lath.
14. Solid walls not less than two inches thick of perlite-gypsum plaster on metal or gypsum lath.
b. In non-fireproof structures, wood stud fire retarding partitions may be used as fireproof partitions with a maximum stud spacing of sixteen inches on centers and metal lath or mesh weighing at least three and four-tenths pounds per square yard fastened to the studding at maximum intervals of six inches vertically and plastered on both sides with gypsum, vermiculite-gypsum, perlite-gypsum or cement plaster to at least three-quarters inch grounds or three-eighths inch perforated gypsum lath on both sides, plastered with one-half inch of sanded gypsum plaster or vermiculite-gypsum plaster or perlite-gypsum plaster or one-half inch plaster board on both sides covered with hard asbestos cement composition sheets at least one-eighth of an inch in thickness with all joints covered with two-inch batten strips of the same material or with approved metal battens or two layers of one-half inch gypsum wallboard. Grounds for chair rails, baseboards and similar appurtenances, if used in such partitions shall be of metal covered wood or of incombustible material. Continuous vertical spaces in such walls shall be fire-stopped as required in section C26-683.0 through C26-688.0.
c. Fire proof partitions of other materials or forms of construction shall have a fire-resistive rating of one hour.

(10.4.3.2). § C26-637.0 Construction of Fireproof Partitions.—a. Fireproof partitions in Class 1, fireproof structures, and Class 2, fire-protected structures, shall be carried at each tier of a structure on incombustible supports and unless suitably anchored or reinforced the maximum unsupported height shall be thirty times the total thickness.
b. Where plaster is required, unsanded gypsum plaster shall be at least one-half inch thick but the total thickness of plaster shall be at least three-quarters of an inch, or sanded gypsum or cement plaster three-quarter-inch thick.
c. The thickness of the material and construction of fireproof partitions of masonry as given are the minimum for fire resistive purposes and shall be increased as required to comply with sections C26-412.0 through C26-467.0.

301

These U.S.G. products and systems have been tested and approved by New York City Board of Standards and Appeals as meeting or exceeding requirements of the Administrative Building Code:

UNITED STATES GYPSUM

PARTITIONS—DRYWALL

SHEETROCK*; Metal Studs; ⅝" *FIRECODE 1 & 2 hr.	Cal. 301-60-SM
SHEETROCK 2" Solid Partition 1½ & 2 hr.	Cal. 898-47-SM
SHEETROCK Double Solid Partition 2 hr.	Cal. 898-47-SM
SHEETROCK Demountable—*THERMAFIBER Wool Blanket—1 hr.	Cal. 546-54-SM
†Movable Vaughan Walls—Solid Partition 1 hr.	Cal. 286-60-SM
*E-Z Wall Movable Partition 1 hr.	Cal. 34-66-SM
SHEETROCK Metal Stud—½" FIRECODE "C" 1 hr.	Cal. 35-66-SM
SHEETROCK Metal Stud—½" FIRECODE "C" 2 hr.	Cal. 1020-61-SM
STRUCTICORE*—Double 1¾ 1½ hr.	Cal. 559-66-SM
STRUCTICORE—Double 1¼ 1 hr.	Cal. 974-67-SM
SHEETROCK—Wood Stud—⅝" FIRECODE 1 & 2hr.	Cal. 171-52-SM
SHEETROCK—Wood Stud—RC-1—⅝" FIRECODE 1 hr.	Cal. 171-52-SM

PARTITIONS PLASTER

PYROBAR* Gypsum Tile 2" Solid no plaster 1 hr. 4" Solid (no plaster) 3 hr. 3" Hollow plaster 1 side—1 hr. 4" Hollow plaster 2 sides 4 hr. 3" Solid (no plaster) 3 hr. 6" Hollow plaster 1 side 3 hr.	Cal. 638-41-SM
TRUSSTEEL* Stud; Metal Lath; #400 Clips 1 hr.	Cal. 556-50-SM
TRUSSTEEL Stud; ⅜" ROCKLATH*; STRUCTOLITE* 1½" & 2 hr.	Cal. 556-50-SM
Channel Stud: 2½" Metal Lath & Perlite Plaster 2 hr.	Cal. 527-51-SM
Wood Stud: ⅜" Plain ROCKLATH; ½" Sanded Plaster; 1 hr.	Cal. 790-42-SM
IMPERIAL* Plaster Systems Approvals 1 & 2 hr. Drywall Assemblies including Imperial Product.	Cal. 800-39-SM

COLUMN FIREPROOFING

PYROBAR Gypsum Tile 2" Solid ½" Plaster—4 hr. 3" Hollow 2" Solid or 3" Hollow no plaster—3 hr. ½" Plaster—4 hr.	Cal. 638-41-SM
Plaster Self Furring Metal Lath: 1¼" Perlite—4 hr. Self Furring Metal Lath: 1⅞" Perlite—3 hr.	Cal. 827-51-SM
Drywall SHEETROCK FIRECODE Wallboard—3 layers ⅝" Thick—3 hr.	Cal. 171-52-SM
PYROBAR 2" Solid; ⅝" FIRECODE "C" 4 hr.	Cal. 712-66-SM
PYROBAR 3" Hollow; ⅝" FIRECODE "C" 4 hr.	Cal. 389-66-SM

SPRAY-ON FIREPROOFING

RED TOP FIRECODE* Plaster Steel Decks—2 & 3 hr. Beams—3 & 4 hr. Columns—3 & 4 hr.	Cal. 388-60-SM

OTHER U.S.G. PRODUCTS

TEXTONE* Gypsum Panels & Metal Mouldings	Cal. 486-39-SM
SHEETROCK W/R—½" & ⅝" Thick incombustible	Cal. 486-39-SM
PAROBAR Mortar Mix	Cal. 386-41-SM
USG SUPER STRENGTH SHEATHING*	Cal. 620-39-SM
MORTASEAL*; 92% Hydrated masons lime	Cal. 710-44-SM
IVORY* 92% Double hydrated Ohio finishing Lime	Cal. 483-39-SM
RED TOP Hydrated Finishing Lime	Cal. 800-39-SM
STRUCTOLITE Basecoat Plaster—Millmixed with perlite aggregate	Cal. 116-52-SM
HI-LITE* Acoustical Plaster—Stipple or stipple perforated AUDICOTE* Acoustical Plaster	Cal. 800-39-SM
STRUCTO-GAUGE* Gauging Plaster	Cal. 800-39-SM
DIAMOND FINISH* Plaster	Cal. 800-39-SM

CEILINGS—DRYWALL SYSTEMS

⅝" SHEETROCK FIRECODE—Wood joists—1 hr.	Cal. 171-52-SM
⅝" SHEETROCK FIRECODE—DWC channel—Bar joists concrete fl. 1½ or 2 hr.	Cal. 171-52-SM
½" SHEETROCK FIRECODE "C"—Wood joists—1 hr.	Cal. 217-65-SM
½" SHEETROCK FIRECODE "C"—DWC channels—2 hrs. Bar joists Concrete 2½"	Cal. 218-65-SM

CEILINGS—SOUND CONTROL—ACOUSTICAL PRODUCTS

ACOUSTONE*—Incombustible case mineral natural fissured tile	Cal. 1144-40-SM
ACOUSTONE Space Units—12"x12"x2" clip mounted wall or ceiling	Cal. 783-64-SM
ACOUSTONE PC—Highly washable soil resistant plaster finish all Acoustone tiles.	Cal. 1144-40-SM
ACOUSTONE DB—Foil backed, sound attentuation 46 db	Cal. 1144-40-SM
AIRSON ACOUSTONE*—Controlled air distribution—slots & dampers	Cal. 1144-40-SM
AIRSON GRID—Controlled air distribution—Grid with slits & dampers	Cal. 1144-40-SM
ACOUSTONE MOTIF'D—Tile with design patterns—Adhesive applic.	UL Labels
ACOUSTONE 90—Under Pyrofill Gypsum Roof Deck or 2" Metal Edge Gypsum Plank—1½ hr. assembly. Under wood joists or by itself—1 hr.	Cal. 912-60-SM
ACOUSTONE 120—Under 2½" concrete on metal deck & Steel beams—12"x12"x¾" tile—50% A-5 or 100% A-2 with light troffers— 2 hr.—Under wood joists or by itself, 1½ hour.	Cal. 912-60-SM
ACOUSTONE 180—Under 2½" concrete on metal lath and bar joists, 12"x12"x¾" tile on concealed zee spline 3 hr.	Cal. 946-66-SM
AURATONE* FIRECODE—Incombustible water felted mineral fiber tile and ceiling board.	Cal. 489-63-SM
AURATONE FIRECODE—Wood joists—2'x4'x⅝"board & rated grid—1 hr.	Cal. 784-64-SM
AURATONE FIRECODE—2" concrete—bar joists—2'x4'x½" board & rated grid, 1½ hr. (beam 3 hr.).	Cal. 782-64-SM
AURATONE FIRECODE—2½" concrete—bar joists—2'x4'x⅝" board & rated grid or 12"x12"x¾" tile & concealed Z spline—2 hr.	Cal. 786-64-SM
AURATONE FIRECODE—1½" Gypsum Pyrofill—bar joists—½" Sheetrock Form board—2'x4'x⅝" board & rated grid.	Cal. 781-64-SM
AURATONE FIRECODE—2½" concrete—3½" metal deck-steel beam—12"x12"x¾" tile & concealed Z spline—3 hr. (4 hr. beam).	Cal. 787-64-SM

NOTE: (1) Cal. 781-64-SM, Cal. 786-64-SM, Cal. 787-64-SM approved for 50% A-5 or 100% A-2 Airson.
(2) ALL AURATONE FIRECODE Tests included recessed light troffers, air ducts and air outlets: Troffers were protected with THERMAFIBER Troffer Blankets: 1¼"thick as per Cal. 1033-64-SM.

ACOUSTONE—concrete—bar joists—2'x2" ACOUSTONE Shadowline—pending.	Cal. 312-68-SM

ROOF DECKS (Incombustible) For All Classes of Construction.

PYROFILL* .... Cal. 236-38-SM

Reinforced Poured Gypsum Concrete Permanent incombustible formboard: USG Mineral Fiber Firecode Formboard, USG Sheetrock* Formboard, Asbestos Cement Formboard. Maximum clear span 10'-2".

Approved for all classes of construction using ¾" vermiculite plaster on metal lath (C-26-575). Approved for exposed steel on one story buildings and 20' elevation multistory roofs. Approved 2 hrs. for Class 2 roofs without protection of deck using 2½" PYROFILL.

U.S.G. 2" Metal Edge Gypsum Plank: Incombustible. For all classes of construction: maximum clear span 6'-4". Maximum live load 51 psf (safety factor of 6). Approved under C 26-618 where steel is exposed: for all 1-story buildings. For roof of multi-story buildings where steel is 20' clear of floor.	Cal. 310-40-SM
U.S.G. 2" Metal Gypsum Plank: With AURATONE 2'x4'x⅝" board & rated grid 2 hr. pending.	Cal. 973-67-SM
MASTICAL*—Low consistency super strength gypsum cement—interior floor and underlayment.	Cal. 947-66-SM

WHERE TO GET TECHNICAL INFORMATION
For complete information and specifications on these or any other U.S.G. building products or systems (including Acoustical Systems and Roof Decks of Gypsum or Steel), consult the Architects' Service Department, 600 Madison Avenue, New York City.

*T.M. Reg. U.S. Pat. Off. †T.M. of Vaughan Interior Walls, Inc.

Write or Telephone • Area Code 212 935-3300 • 600 MADISON AVENUE, NEW YORK, NEW YORK 10022

UNITED STATES GYPSUM
THE GREATEST NAME IN BUILDING

Figure 4.8 National Gypsum Company and United States Gypsum full-page advertisements from the 1950s in the 1938 NYC Building Laws.

Source: Administrative Building Code, pp. 300–303. Note that page, 301, is the text of the Building Code. The other three pages were advertisements.

Figure 4.9 Images for generic gypsum drywall advertisements from the early 1950s. Brand names included Celotex and Sheetrock.
Source: The Hulton Getty Picture Collection, 1950s: Decades of the 20th Century.

4.3.2.4 Sprinklers. The first practical automatic sprinkler was patented in 1874. It contained a "head" that was screwed into a threaded opening in the sprinkler pipe and sprayed water when the solder that sealed it melted in the heat of a fire. Sprinkler systems were continually improved over time in both materials and technology. With the lighter buildings designed in the 1950s, sprinklers became an essential component. Lighter buildings had less masonry to impede the spread of fire and contained more gaps or openings in gypsum assemblies that acted like flues to spread smoke and flames. It was therefore essential for buildings of the 1950s to include sprinklers (Wermiel, 2000). Given the increased usage of sprinklers in construction of this era, the DOB made a significant effort to regulate it through the promulgation of many new amendments.

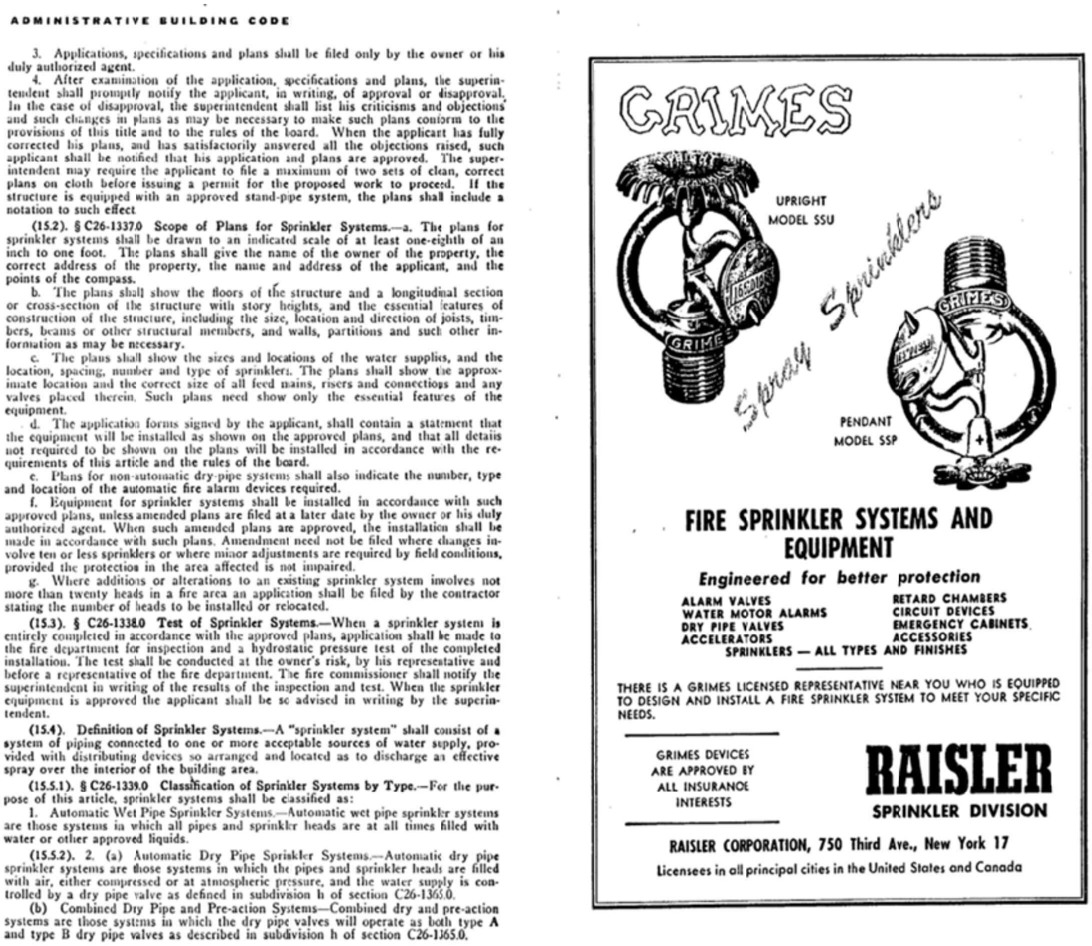
Between 1951 and 1953, an unprecedented 43 amendments were promulgated for the increased use of sprinklers, amounting to approximately one amendment every three weeks (see Figure 4.1). This was the largest number of amendments promulgated on a single theme to date. The majority of amendments addressed new advances in the technology of sprinkler products and systems that were approved by the DOB. Examples of new technologies in sprinkler developments amended into the building code were the following: fire department connections, fire pumps, frost protection, gravity tanks, hanger attachments for pipe lines, pipe and fittings systems, pressure gauges and tanks, supply lines and valve types. The remainder of amendments, that totaled four, addressed new occupancies mandated to include sprinklers such as film theatres (LL78/54) and film booths (LL104/54), department stores (LL79/54), and factories (LL103/54). Thus, the code was amended for new technologies and new occupancies.

In addition to amendments, memos were issued by the DOB to clarify the Building Code. Six memos answered questions regarding the use of sprinklers in various occupancy groups such as multiple dwellings (June 30, 1955), in nursing homes (January 30, 1955), and in cooking spaces (July 1, 1955). Other memos answered questions regarding the number of sprinkler heads on a line (July 8, 1953), the acceptability of sprinklers used in lieu of fire escapes (June 26, 1955), the positions of sprinkler heads, and approved type of heads (June 30, 1955). (Sprinkler heads are illustrated in Figure 4.10.)

In his book *Strategies of Firefighting* (2007), Deputy Chief, FDNY (Ret) Vincent Dunn described the advantage of sprinklers throughout history. He stated that sprinklers are a vital component in all occupancies and continue to be amended into more occupancy uses. Dunn, who advocated for public safety, wrote “The building code should have zero tolerance for non-sprinkled buildings. Automatic sprinklers should protect all buildings.” He further stated that new systems [sprinkler] are continually being invented but must – at least – meet the minimum standards of the building code.

Due to added construction time and costs, sprinklers were a contentious issue between competing stakeholders such as the real estate lobbies of the Building Officials & Code Administrators (BOMA), the Real Estate Board of New York (REBNY), the NYC DOB, and the NYC Fire Department. In the article published in *Fire Engineering* entitled “The Impact of Building Code Changes on Fire Service Safety” (2005), Richard Licht, director of the Alliance for Fire and Smoke Containment and Control, detailed the joint efforts of architects, building owners, and manufacturers to control and reduce construction costs related to fire prevention and sprinklers while balancing public safety. Licht wrote that while new products to sprinkler systems have been constantly manufactured, they must be approved and` regulated by the building code before being installed in buildings. The large number of amendments passed at this time suggests the code attempting to allow the state-of-the-art technology for new products that were constantly being invented. The rapid increase in new technologies for sprinkler systems that were compliant with the building code required dissemination of compliant products to architects and engineers who specified sprinkler systems.

In addition to the amendments and memos, full-page advertisements for sprinklers also appeared within the text of the building code (see Figure 4.10). The advertisement was across the page from code citations for sprinkler systems and depicted two types of sprinkler heads – upright and pendent - and the corresponding piping system that the DOB evaluated as compliant.



ADMINISTRATIVE BUILDING CODE

3. Applications, specifications and plans shall be filed only by the owner or his duly authorized agent.

4. After examination of the application, specifications and plans, the superintendent shall promptly notify the applicant, in writing, of approval or disapproval. In the case of disapproval, the superintendent shall list his criticisms and objections and such changes in plans as may be necessary to make such plans conform to the provisions of this title and to the rules of the board. When the applicant has fully corrected his plans, and has satisfactorily answered all the objections raised, such applicant shall be notified that his application and plans are approved. The superintendent may require the applicant to file a maximum of two sets of clean, correct plans on cloth before issuing a permit for the proposed work to proceed. If the structure is equipped with an approved stand-pipe system, the plans shall include a notation to such effect.

(15.2). § C26-1337.0 Scope of Plans for Sprinkler Systems.—a. The plans for sprinkler systems shall be drawn to an indicated scale of at least one-eighth of an inch to one foot. The plans shall give the name of the owner of the property, the correct address of the property, the name and address of the applicant, and the points of the compass.

b. The plans shall show the floors of the structure and a longitudinal section or cross-section of the structure with story heights, and the essential features of construction of the structure, including the size, location and direction of joists, timbers, beams or other structural members, and walls, partitions and such other information as may be necessary.

c. The plans shall show the sizes and locations of the water supplies, and the location, spacing, number and type of sprinklers. The plans shall show the approximate location and the correct size of all feed mains, risers and connections and any valves placed therein. Such plans need show only the essential features of the equipment.

d. The application forms signed by the applicant, shall contain a statement that the equipment will be installed as shown on the approved plans, and that all details not required to be shown on the plans will be installed in accordance with the requirements of this article and the rules of the board.

e. Plans for non-automatic dry-pipe systems shall also indicate the number, type and location of the automatic fire alarm devices required.

f. Equipment for sprinkler systems shall be installed in accordance with such approved plans, unless amended plans are filed at a later date by the owner or his duly authorized agent. When such amended plans are approved, the installation shall be made in accordance with such plans. Amendment need not be filed where changes involve ten or less sprinklers or where minor adjustments are required by field conditions, provided the protection in the area affected is not impaired.

g. Where additions or alterations to an existing sprinkler system involves not more than twenty heads in a fire area an application shall be filed by the contractor stating the number of heads to be installed or relocated.

(15.3). § C26-1338.0 Test of Sprinkler Systems.—When a sprinkler system is entirely completed in accordance with the approved plans, application shall be made to the fire department for inspection and a hydrostatic pressure test of the completed installation. The test shall be conducted at the owner's risk, by his representative and before a representative of the fire department. The fire commissioner shall notify the superintendent in writing of the results of the inspection and test. When the sprinkler equipment is approved the applicant shall be so advised in writing by the superintendent.

(15.4). Definition of Sprinkler Systems.—A "sprinkler system" shall consist of a system of piping connected to one or more acceptable sources of water supply, provided with distributing devices so arranged and located as to discharge an effective spray over the interior of the building area.

(15.5.1). § C26-1339.0 Classification of Sprinkler Systems by Type.—For the purpose of this article, sprinkler systems shall be classified as:

1. Automatic Wet Pipe Sprinkler Systems.—Automatic wet pipe sprinkler systems are those systems in which all pipes and sprinkler heads are at all times filled with water or other approved liquids.

(15.5.2). 2. (a) Automatic Dry Pipe Sprinkler Systems.—Automatic dry pipe sprinkler systems are those systems in which the pipes and sprinkler heads are filled with air, either compressed or at atmospheric pressure, and the water supply is controlled by a dry pipe valve as defined in subdivision h of section C26-1365.0.

(b) Combined Dry Pipe and Pre-action Systems—Combined dry and pre-action systems are those systems in which the dry pipe valves will operate as both type A and type B dry pipe valves as described in subdivision h of section C26-1365.0.

Figure 4.10 Full-page advertisement for Sprinklers from the early 1950s in the 1938 NYC Building Laws.
Source: Administrative Building Code, pp. 436–437.

The force that influenced the passage of 43 amendments related to sprinklers in the early 1950s was a need to inform the construction industry of both new and compliant technologies for sprinklers and the constantly expanding use of sprinklers in occupancies.

4.3.2.5 Structural Steel. Structural steel was an existing material that found a new method of use during this era of high-rise construction. New construction required changes to the building code that regulated allowable stress for constantly evolving designs of higher and lighter buildings, which included regulation of steel construction and glass curtain walls.[22] Steel construction was especially prominent in designs of modern architecture like the Lever House, the Seagram Building, and Lincoln Center.

Between 1951 and 1955, 25 amendments related to structural steel were promulgated (see Figure 4.1). In addition, the DOB distributed six Memos and five Decisions that provided detailed information on the new construction methods of structural steel for welding, fire protection, and allowable stress. For example, a Decision dated June 13, 1950 provided guidance on allowable stress and loads permissible for both domestic and foreign steel. Several Memos (dated July 20, 1950; November 27, 1951; and August 5, 1955) addressed fireproofing of structural steel.

Two iconic buildings exemplify the adjustments made in construction due to amendments to the building code regarding structural steel and curtain walls: Lever House (c. 1952) and the Seagram Building (c. 1958). Lever House was built before the passage of the new amendments, and the Seagram Building was built afterwards. The architect of Lever House, Gordon Bunshaft, originally designed it with full height floor-to-ceiling glass. However, the existing Building Code at the time required brick walls to the height of 30 inches above the floor and 30 inches above the finished ceiling to be built behind the glass wall to protect the steel in case of fire. The brick reduced the expanse of view glass seen from within the building.[23] By the time the Seagram Building was constructed in the late 1950s, however, the building code allowed its architect, Mies van der Rohe, to construct a building with exterior walls from floor to ceiling completely

---

[22] Although large panes of glass were installed so prolifically in high rises, they were surprisingly not addressed in the building code until much later.

[23] Opaque spandrel glass was applied to the exterior face of the brick wall, thus allowing the monolithic appearance of glass curtain wall hung from structural steel. View glass was reduced to six feet six inches from approximately eleven feet. The interior amount of view glass was not significantly greater than that in a standard masonry-clad building with standard punched windows (Stern et al., 1997, p. 53).

of glass. Without the amendments of the early 1950s, the large panes of glass in the Seagram Building—iconic of the International Style—could not have been constructed.[24]

In addition, the amendments regulated the welding of structural steel. In 1951 alone, there were nine amendments related to welding. Prior to welding, the technique for connecting structural steel members was bolting and riveting, which was used for the skeleton of earlier high rises such as the Empire State Building (c. 1930). However, the preparation phase for rivets was time consuming because it required pre-drilling holes in steel (Martin, 1999; Peurifoy, 1979). Welding was a new, quicker, and more economical alternative that enabled the connection of beams and girders to columns.

4.3.3 Cultural Changes in the Early 1950s and Amendments

In the early 1950s, cultural changes accounted for as many amendments as those that were promulgated in response to new materials. These cultural changes coincided with rapid population growth in the City and the largest sustained period of economic growth in the history of NYC. Many of the culturally influenced amendments to the 1938 code were related to new occupancy uses, particularly in response to the growing middle class population and the suburban housing boom exemplified by the boroughs of Queens, the Bronx, and Staten Island. This emerging suburban-like environment included the rapid construction of one- and two-family houses, the incorporation of new household appliances requiring utility fixtures, and increased usage of the automobile as a form of transportation (Jackson, 1985). Since the original 1938 Building Code did not address automobile issues or suburban-like developments, amendments to the building code were required to ensure adequate public safety and health. Occupancy changes related to

[24] Ibid.

public assemblies like movie theaters also accounted for a large increase in the number of amendments. These various cultural issues—including occupancy changes, one- and two-family houses, automobiles, and utility fixtures—are discussed in the following sections**.**

4.3.3.1 Occupancy Changes in Public Assemblies. One of the most significant of the various cultural forces that influenced the amendment process in the early 1950s was the need to regulate the way buildings changed to accommodate new occupancies, as well as the egress requirements for public assembly in museums, theaters, and movie houses. New and renovated designs for public assemblies demanded new information and regulation in the form of amendments to the building code.

In the early 1950s, 21 amendments related to general public assembly occupancy were promulgated (see Figure 4.1). Twenty-six additional amendments were promulgated regarding public assembly and egress specifically for Broadway theatres, with six more amendments specifically addressing movie theatres. Also, egress requirements were addressed by 34 amendments for elevators and 10 amendments for escalators. To clarify these amendments, the DOB distributed Memos (8 total) and Decisions (9 total). To provide further clarity on these changes, a visual explanation for public assembly for seating requirements specifically related to the NYC Building Code was included in *Architectural Graphic Standards 2nd edition,* the national reference guide for architects (Ramsey & Sleeper, 1936).[25]

One example of the newly designed public assembly spaces that were erected during this era was the Guggenheim Museum. The difficulties encountered as a result of the use of new egress methods in its design, among other issues, demonstrated the need to

[25] Only two references to the NYC Building Code were included in the 2nd edition of *Architectural Graphic Standards:* Fixed public seating dimensions and cavity walls.

update the building code. The museum opened in 1959, yet prior to its opening, it had been in the permitting process for 15 years. This was largely due to the fact that Frank Lloyd Wright's design did not conform to the 1938 code. The museum went through six design revisions for DOB plan exam and still failed to obtain a permit to build until the Board of Standards and Appeals (BSA) granted waivers for the new use of the ramp for egress and public assembly (Huxtable, 2008). Two other public assembly issues delayed the permitting process. The first was the inability of the code to determine occupancy limits for the interior circular ramp. Occupancy limits were determined by the square footage of the floor plan and adjacent exit paths. But in the museum, the floor plan of the ramp and the exit path were the same area. Local Law 48 of 1953 amended the determination of occupancy numbers specifically for museums. The second was determining the number of fire egress stairs. Eventually, one egress stair was redesigned in the rotunda to include wider stair treads[26] and another egress stair was added (Stern et al., 1997). No amendment was promulgated for the redesign of stairs for this concern.

Amendments for public assembly were also promulgated in relation to existing Broadway theaters. Attendance at Broadway musicals increased dramatically in the early 1950s, helped by a booming post-war economy, growing public demand, and talent centered in NYC.[27] During this golden age of the Broadway musical, 26 amendments were passed to ensure the public's safety in relation to egress conditions and seating in existing theaters that required upgrading. Many of the theater buildings, such as the

[26] Building codes determine the dimensions for widths of egress stairs by occupancy loads. For example, stairway widths must be 44 inches wide, except when serving an occupant load of less than 50 when stairways may be 36 inches wide. Treads are the horizontal part of a step and must have a minimum depth of 11 inches for egress requirements; Risers are the vertical part of a step and must have a minimum height of four inches and a maximum height of 7 inches for egress requirements.

[27] Broadway, the Great White Way, sought to regain audiences lost to both the movies and to the years of the Great Depression, succeeding with such blockbusters as *Oklahoma!, The King and I, The Sound of Music, My Fair Lady, Candide,* and *West Side Story* (Kenrick, 2008).

Lyceum (c. 1903), dated from the turn of the nineteenth century and thus required new renovations for public safety.

The Theatre Code Committee was formed in 1950 and was comprised of theatre representatives, architects, engineers, and representatives from the DOB and the Fire Department who were tasked with drafting amendments regarding seating requirements and other issues. Owners of older theatres requested building code changes to increase audience numbers by placing theatre seating above and below street level. This was an egress change that would allow valuable street level space to be rented in a retail venue. Public assembly egress was always easiest and safer if the public exited at street level grade with limited changes in floor levels, such as stairs. If theatre seating could be placed above and below grade, the number of seats could increase.

The committee also campaigned for code changes for theatres related to egress that would liberalize other building and fire department restrictions on theatres, permit the sale of liquor and relax the present regulations governing smoking. The DOB accepted all changes requested by the Theatre Code Committee except one and amended the Building Code accordingly with 26 Local Laws in the early 1950s. The one change the DOB did not accept was the sale of liquor. Local Law 120 of 1953 banned the sale of liquor in theatres.

Other amendments requested by the Theatre Code Committee were reduced seating dimensions. Smaller seat sizes, combined with fewer inches between seats and aisles, anticipated more audience numbers. However, as seating dimensions decreased and seating numbers increased, egress time would increase to unsafe limits. Greater numbers of people would result in increased difficulty in maneuvering out of the smaller seating and narrower aisles traveling towards the exits. The DOB and industry agreed on seating dimensions as stated in the amendment on minimum seating requirements, Local Law 113 of 1953 titled “A Local Law to Amend the Administrative Code of the city of New York, in relation to Seats in Special Occupancy Structures” This amendment allowed decreased seat dimensions but specified a minimum size by mandating specific rules regarding the width, height, and dimensions for fixed seating and aisles in order to avoid overcrowding as a public safety concern.

This information on theatre seating and aisle dimensions also appeared in *Architectural Graphic Standards* with specific reference to NYC theatres (see Figure 4.11), which broadcast this aspect of NYC’s Building Code to a national audience. The appearance of NYC fixed seating dimensions in a national publication suggests this NYC amendment was important as an accepted national standard. In the case of theatres, the force that influenced amending the code was the goal of increasing audience numbers while maintaining public safety.

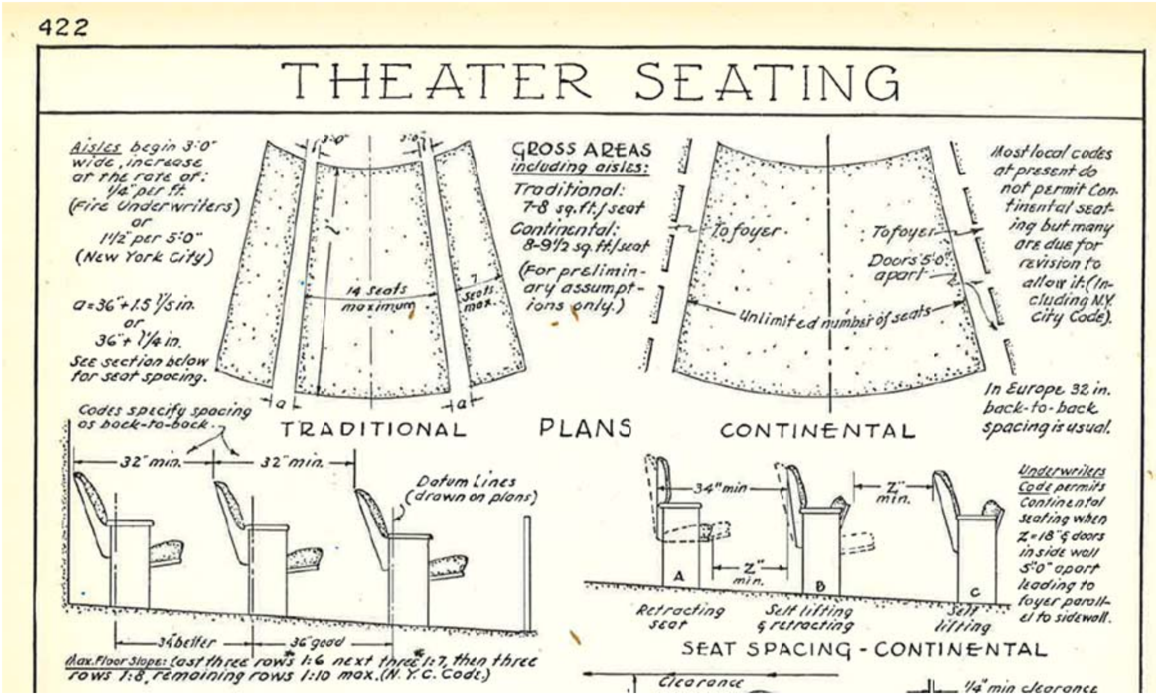


Figure 4.11 Half page in the 1956 edition of *Architectural Graphic Standards.*
Source: Ramsey & Sleeper, 1956, p. 442. Note references to the New York City Building Code were stated three times in parentheses.

Amendments relating to theaters that were passed during this period were directed at special occupancy structures, meaning new occupancies of buildings. Documents including local laws, Memos, and Decisions demonstrate that the force that influenced amending the building code for special-occupancy structures was the need to clarify regulations ensuring public safety for new occupancies. For example, the amendment titled Local Law 118 of 1953 was specific for egress in vomitories[28] and crossovers on orchestra floors in theatres. Other amendments passed to ensure public safety and welfare in Broadway theaters related to increased ventilation via air conditioning, loading

[28] The definition of a vomitory as an emergency egress is defined in the Building Code as an exit from a balcony to a stairway by way of an intermediate floor. The term derives from the Latin, vomitorius, meaning directed paths. Vomitories were built into theaters at the turn of the century but the configuration was not compliant for public use because egress routes must lead directly to an outside space or lobby and not transgress through space such as an intermediate floor. Because vomitories were grandfathered into certificate of occupancies, they could not be removed; therefore, additional signage was required for public safety egress.

compartments for backstage equipment, dimensions for balconies, mandated guardrails, new lighting, and exit signage.

Amendments during this era also addressed movie theatres as another form of public assembly. At this time, theatres showing motion-picture films began to aggressively advertise their movies in an attempt to win back customers who had been drawn to watching television at home in increasing numbers (Sanders, 2001). The 1950s also marked an era of epic films and technological breakthroughs like Cinerama, Cinemascope, VistaVision, 3-D, and Aroma-Rama (piped-in smells through the air conditioning system). Early in the decade, six amendments related to movie theatres were promulgated (see Figure 4.1). To clarify the amendments, the DOB distributed nine Decisions as well as a Memo dated April 13, 1954 regarding the regulation of the use of flammable film in motion picture booths. The Memo also detailed the maximum wattage of the light bulb used for the motion picture machine to avoid flammable conditions.

Other local laws specific to movie theaters addressed issues related to the storage of safety materials, including flammable materials like film, cabinets for their storage, projection booths, and ventilation requirements. One of the attractions of movie theaters was air conditioning in the summer months. Many movie theaters hung out blue and silver flags with pictures of polar bears in hot weather as an attraction (Wakefield, 1992). Two amendments were promulgated in 1953 related to minimum mechanical ventilation requirements in theatres; Local Law 99 and Local Law 104. Also, a Decision dated March 16, 1950 answered a question posed to the DOB, clarifying that movie theatres and television studios were subject to the same sections of the building code for public assembly and egress as Broadway theatres. Such documents aimed at clarifying regulations ensuring public safety for new occupancies.

Amendments related to the use of elevators were also included in the local laws related to new occupancies. In the early 1950s, 34 amendments were promulgated to regulate new technologies for elevators (see Figure 4.1). The forces that influenced these amendments were the emergence of new technologies. Architects first began to incorporate elevators into buildings in 1875. The elevator enabled increases in the height of buildings, thus making the high rise a practical reality. Elevators quickly became an obligatory feature in both commercial and residential buildings as low as five stories in height (Bernard, 2014). However, elevators require a high level of regulation and enforcement, as well as constant maintenance and inspection. New designs for elevators emerged continuously during this period and thus required additional regulation. Amendments offered guidelines for new designs as well as egress limitations during emergency evacuation. Topics of elevator amendments were related to automatic doors, belts, chains, condensers, electric contacts and releases, and friction gearing and releases. Elevator amendments related to emergency events were power failure, release switches, landings, and inspections.

Amendments regarding escalator usage also emerged during this period. Between 1951 and 1953, ten amendments were promulgated specifically to regulate new technologies for escalators (see Figure 4.1). Escalators came into vogue in buildings after elevators; their primary function was in areas requiring the movement of large numbers of people, such as in retail spaces, transportation hubs, and sports stadiums. The first escalator was a novelty ride installed in Coney Island in 1896 by Jesse W. Reno, and the second, also in 1896, was placed on the Manhattan side of the Brooklyn Bridge. Macy's Herald Square store still has an Otis "L-type" escalator with wood treads that has been in operation since 1927 (Jarboe & O'Donoghue, 2007). As with elevators, new technologies and user locations for escalators required updated information through amendments. Topics of escalator amendment were handrail dimensions, sizing for treads and landings, landings, safety switches, and inspections.

4.3.3.2 One- and Two-Family Houses. The enormous growth in construction of one- and two-family houses during this period required further regulation of the building code. This increased construction was in response to the changing socioeconomic environment of NYC during this era, which is one cultural force that influenced the amendment process. New York City's suburbs lay outside Manhattan in the outer boroughs of Queens, the Bronx, and Staten Island (Murray, 2003). As the city's middle-income, predominantly white population fled from the inner city areas, the downtown area faced its demise, and industry was relocated outside the city, the suburbs became the answer to urban ills (Jackson, 1985), prompting increased construction.

Due to a thriving economy as well as the availability of mass-produced, modular building products, construction of large-scale, two-story private and cooperative developments in a suburban context were possible—especially at the edges of built-up boroughs. Examples of such construction include Bell Park Gardens (c. 1950) and Electchester (c. 1954), both located in Queens. Moreover, as large tracts of land in the outer boroughs were cleared of their former industrial, agricultural, and recreational uses, low-rise developments were built in neighborhoods such as Glen Oaks, Queens Village, Middle Village, Carroll Gardens, and Mill Basin. From 1945 to the mid 1960s, 41% of the housing stock in northeastern Queens and nearly all of Staten Island was built in a suburban context, promoting a middle-class lifestyle characterized by low buildings with side yards, backyards, and garages. Locally, Queens became known as the borough of homeowners, where child-friendly spaces, a pastoral environment, privacy, and neighborhood life made up the major features of an ideal suburban community (Murray, 2003).

In the past, NYC had always referred to the state building code, *The Residential Code of New York State* (first written in the 1940s), for guidelines on the construction of one- and two-family houses. However, the city amended its own 1938 Building Code to account for the new suburban-like environment of the 1950s, making it stricter than state code. In the early 1950s, 17 amendments related to one- and two-family houses were promulgated (see Figure 4.1). The DOB also distributed clarifications in Memos (7 total) and Decisions (9 total) regarding such housing.

The NYC local laws amending the building code were specifically related to typical suburban-like concerns—related however to the outer boroughs' higher density overlay—that were not addressed in the 1938 Building Code, which was originally written for an urban context. Topics of amendments were intrusions onto a neighboring lot of fences, storm water, chimneys, and conversions of one-family houses to multi-family residences. Issues addressed by amendments included party walls in semi-attached and attached houses, non-fireproof structures made of wood such as backyard sheds, wood frame construction, and vents for toilets in one- and two-family family houses. One amendment was Local Law 69 of 1951, which regulated existing encroachments beyond the building line such as fences, sheds, and concrete sidewalks and patios. Since houses typically had small back and side yards, they needed regulation to avoid encroachment over lot lines. Another amendment was Local Law 127 of 1953, which regulated the combining of one-family dwellings into multiple dwellings. Both of these local laws addressed concerns regarding the dense suburban-like context of the outer boroughs, where even a minimal amount of square footage was contested.

The existing building code did not address issues related to the suburban environment, but rather privileged concerns with an urban landscape. One example is a Memo dated June 17, 1950 regulating wells for water supply in the boroughs out of a concern that well structure would undermine house foundations. This would not be a concern in a city where water supply was part of the street infrastructure. Nor would well structure be a concern in a rural environment where houses were located on acres of land. This memo was an example of an attempt at addressing an issue that was not addressed in the original 1938 Code. This issue was specifically a concern for the small lot sizes in the outer boroughs, which amendments, Memos, and Decisions attempted to address during the 1950s.

4.3.3.3 Automobiles. Whether the context was urban or suburban-like, the automobile required a place to be kept. During the 1940s, the automobile became an important feature of life in NYC, both within the dense environment of Manhattan and in the suburban-like outer boroughs. The number of cars in operation increased as transportation became easier with the construction of roads such as the West Side Highway and the Brooklyn-Queens Expressway. The new middle class could afford this new status symbol, thus increasing the number of cars on the road (Jackson, 1985). Problems relating to the regulation of automobiles therefore increased as well. The 1938 code still regulated stables and did not address spaces or buildings for cars. Given that garages to store automobiles are specific occupancies, they required new regulation, thus necessitating amendments to the existing building code. As a result, five amendments related to parking facilities and buildings associated with the automobile were promulgated in the early 1950s (see Figure 4.1).

The forces that influenced these automobile-related amendments were of two types: regulation of new types of garages built in a dense environment, and typical suburban concerns regarding parking and maintenance. The DOB also distributed clarifications regarding regulations of automobile-related construction in Memos (6 total) and Decisions (7 total). These documents addressed two main issues. The first was garages in dense environments such as Manhattan, and at the ends of subway lines such as at Flushing, Queens. The second was automobile accommodations in the suburban-like context of the outer boroughs.

In 1946, the State legislature approved legislation permitting the city to finance and build parking garages. The relief of the parking problem through the construction of large-scale, publicly financed, inner-city garages became a post-war priority in midtown Manhattan (Stein, 1997). As a result, amendments were passed for the design of multilevel garages in Manhattan.[29] For example, Local Law 134 of 1953 amended the code in relation to open style parking garage structures used in the urban areas. This amendment asserted the enclosure and spandrel walls of such structures may be omitted, advising that solid partitions be excluded from exterior walls and that the interior spaces

---

[29] In addition to publicly financed garages, a number of private investors built multi-level garages on the fringes of midtown, especially near the Times Square theatre district. Because self-parking garages took up so much space, architects explored garages using elevators and rotating platforms to increase the number of cars in a garage (Stein, 1997). These new building designs required information from the DOB as to what construction was compliant.

be left permanently open to the outside. The concentration of carbon monoxide from automobiles was a fatal hazard in enclosed spaces, and with mechanical ventilation in its infancy, permanent openings in the exterior walls became essential to the safety of the public.

In Queens, Brooklyn, and Staten Island, the automobile and its accouterments were becoming predominant features that caused mounting issues requiring enforcement. As a result, amendments were promulgated to include mandates for such features as driveways, curb cuts, auto repair shops, gas stations, and garages for one car and for multiple cars.

4.3.3.4 Utility Fixtures. The increased usage of utility fixtures, particularly related to devices used for cooking and laundry, necessitated new regulations not included in the 1938 Building Code. As a result, in the early 1950s, 26 amendments related to utility fixtures were promulgated (see Figure 4.1). The DOB also distributed clarifications regarding utility fixtures in Memos (13 total) and Decisions (9 total). All of the amendments related to commercial and residential equipment for cooking and laundry. The majority of cooking and drying appliances, referred to as durable consumer goods, depended on gas since it was more economical than electricity. As a result, amendments were promulgated addressing gas pipes, valves, cutoffs, and supply lines. For example, Local Law 85 of 1953 amended the code to provide for cutoff valves for piping that conveyed gas and high pressure, as well as inspections of such valves.

Changes in usage of utility fixtures evolved at least partially in response to changes in eating practices during this era. Commercial cooking increased dramatically as restaurants and cafés increased in popularity. Wartime rationing had inhibited restaurant business in NYC, but postwar prosperity encouraged restaurant attendance (Stern et al., 1997). New and expanded cooking methods that increased utility demand proliferated, especially for processed and prepared foods. For example, deep fryers were required to cook French fries, which in turn required increased gas lines and fire protection against open flames. Residential cooking included prepared TV dinners and frozen foods (Wakefield, 1992) that depended on the increased size of refrigerators, requiring increased electrical service.

Washing machines and clothes dryers also changed during this era. Commercial laundromats expanded and residential basements in multi-family and one- and two-family houses included laundry rooms. All washing machines and dryers required dedicated electrical outlets that were mandated to be water-resistant, as well as gas lines and plumbing valves.

Utility fixtures required gas and electrical connections, especially in wet areas, which in turn made immediate regulation that extended beyond the mandates of the 1938 code essential. The regulation of new gas and electrical fixtures was therefore the force that influenced amendments.

4.4 Fire Disasters

This section addresses the two major fire disasters that occurred during the mid-1950s and explores the reasons why no amendments were passed as a result of either fire. Two major fires occurred during the years that the 1938 Building Code remained current: one at the Empire State Building in 1945, and the other at 23rd Street in 1966. Previous research asserted that most amendments were prompted by fire disasters, however the evidence shown in this chapter challenges that assertion, particularly the fact that neither of these two major fires resulted in any amendments. The years in which the largest number of amendments was promulgated did not correspond with either fire.

Following the Triangle Fire in 1911 and the Equitable Life Fire in 1912, thirty-three years elapsed before the next major fire occurred in NYC, this time at the Empire State Building. Built in 1931, the Empire State Building was code compliant to the 1915 Building Code. The building had robust fire-proofing with an exterior masonry construction of limestone and steel. Some of the building's interior partitions were constructed primarily of masonry terra cotta block and trawled plaster, thus providing additional fire-proofing. However, newer partitions were constructed of gypsum drywall boards with wood studs. While the gypsum drywall partitions were fire-retardant, there were openings or gaps where fire and smoke could filter and spread throughout the building. The spread of smoke and fire is curtailed by fire-stops, which are assemblies made of cement, plaster, or foams installed to plug any openings. Gaps in rated partitions were only beginning to be addressed in the 1950s. One amendment related to fire-stops was Local Law 4 of 1951, which regulated materials for fire protection.

On Saturday, July 28, 1945, a B-25 bomber crashed into the 78th and 79th floors of the building, spilling fuel down its stairways. Since this building utilized masonry infill of a steel skeleton, there was a high degree of redundancy in structure and fire protection, which kept fatalities (14) and injuries (26) relatively low. Most interior rated walls were made of trawled plaster over terra-cotta backup and had few openings where fire could filter through. The problem was with newer interior walls that were not properly fire-stopped. The code issue would be the rated interior partitions that were not properly fire-stopped, but the building code was not amended to upgrade fire-stops for partitions until almost a decade later. Of course, another issue was impact from the airplane. Impact-resistant partitions were not amended into the building code until 2008, after the 9/11 World Trade Center attack. This event was considered an accident and no amendments were promulgated in association with this fire.

Two decades later in 1966, the 23^{rd} Street Fire occurred in Manhattan. This fire resulted in twelve fatalities, the single worst loss of firefighter lives prior to 9/11. The mixed-use building, built in 1926, had five stories plus a cellar. It was constructed of brownstone and brick with wood floor joists. The Wonder Drug Store was at street level and the cellar illegally stored flammable liquids of lacquer and oil paints. The fire originated in the cellar storage area at 7 East 23^{nd} Street and spread to the basement of 6 East 23^{rd} Street, the Wonder Drug Store. A structural wall in the cellar had been removed without a permit, making the structure less stable. Five inches of concrete and terrazzo prevented the firefighters from feeling the heat of the fire below. Ultimately, the wood beams, measuring 3” x 14”, became weakened, resulting in the collapse of a 16 foot by 35 foot section of the first floor.

While the building was compliant with the building code when it was constructed, the basement was subsequently altered and the building stored hazardous substances without proper permitting. The building owner was thus fined for performing construction without a permit. Complying with the 1938 Building Code, or any other edition of the code, would have prevented the fire, since all NYC Building Codes mandate permits before altering a structure or storing hazardous substances. Although this building was non-compliant at the time of the fire, no amendments were passed as a result.

4.5 Conclusion

As discussed in this chapter, the new 1938 Building Code amended the prior code by incorporating many downgraded guidelines in order to facilitate development after two decades of limited construction. By the early 1950s, however, NYC experienced an increase in population and sustained economic growth, which resulted in a construction boom. At the same time, there was an emergence of new architectural aesthetics and new modes of manufacturing and installing materials such as reinforced concrete and gypsum drywall. These changes in the construction and design industries demanded new regulations and enforcement, which resulted in the highest number of amendments ever promulgated to date.

The city had an unprecedented need for commercial and residential buildings during this period, including office space and middle-income housing. These circumstances required construction methods to be quick, modular, and prefabricated to allow for rapid construction. Moreover, the emergence of the fields of materials science, along with the development of new materials and new uses of existing materials, required additional regulation in the form of amendments to the 1938 Building Code. Advertisements for new materials and methods were printed within the body of the code and were publicized as approved by the DOB in an effort to provide further guidance to architects and others in the construction industry.

The specific issues addressed by amendments also demonstrate that the building code was amended in response to cultural and socioeconomic changes resulting from the growth of the middle class and an emerging suburban lifestyle. These changes were manifested in the preponderance of one- and two-family houses in the "suburbanized" outer boroughs. The use of the automobile and the proliferation of new durable consumer goods also required regulation and enforcement through amendments in the early 1950s edition of the 1938 Building Code. New occupancy uses of public assemblies like movie theaters required additional amendments to regulate safety for egress and mechanical systems.

CHAPTER 5

THE NYC BUILDING CODE: 1968 AND 2008

5.1 Introduction

By 1968, there were copious layers of confounding and conflicting amendments that had been imposed upon the 1938 Building Code, which necessitated the establishment of a new version. The architecture and engineering community insisted on the creation of a new code to which their new building designs could comply. Additionally, the DOB and the city administration determined that four decades of amendments no longer provided clarification or guidance, but instead created loopholes and fostered confusion.[30] These circumstances thus led to the creation of the 1968 Building Code.

The amendments promulgated during the tenure of the 1968 Building Code were influenced both by new materials and technologies and by administrative and operational directives. Such directives were needed to establish protocols during the perplexing time when the DOB was almost merged into the NYC Fire Department. This chapter addresses the establishment of the 1968 Building Code, its subsequent amendments, and the resulting amendment of the 1968 Code into the 2008 Building Code. There was an average of six amendments promulgated per year during the period between 1968 and 2007. Included in these amendments was Local Law 33 of 2007 that ultimately amended the 1968 Building Code into the 2008 Building Code. The chapter begins with a discussion of the changes that were incorporated into the new 1968 Building Code, thereby amending the 1938 Building Code.

---

[30] The preface to the 2008 NYC Building Code discussed the history of Building Codes. Both these issues were listed as instrumental in leading to the revision efforts of the 1968 Building Code.

As an example, this chapter discusses the World Trade Center towers, which were originally designed to comply with the 1938 code. The design of the towers was significantly changed - and downgraded - to conform to certain amendments during the transition from the 1938 Code to the 1968 Code. In this case, the force that influenced amending the Code was a push to decrease costs.

5.2 The 1968 Building Code

The new building code was enacted by the New York City Council in 1968 and became effective on December 6 of that year. This was achieved through Local Law Number 76 for the Year 1968, which amended the 1938 Code that then became known as the Old Code. The 1968 Building Code thus became known as the New Code. This distinction was important because the Old Code remained current. During the code transition period of approximately four years, architects could choose either code with which to comply. The 1968 Code was completely revised from the prior code to include new building practices and technologies (Smith, 1973). Like the previous code, the 1968 code continued to focus on performance specifications for construction in lieu of prescriptive specifications, thus allowing for the future incorporation of assemblies that had not yet been invented.

5.2.1 Description

NYC had constructed buildings under the 1938 Building Code for the past thirty years. The amendments passed during these decades had allowed the code to remain sufficiently current for the construction of average buildings. However, an international and stylistic revolution had since taken hold, leading to the design of innovative buildings utilizing new construction techniques. Few of these new innovations could be built to compliance under the existing 1938 code. Modern design and construction was progressing too quickly for adequate regulation under the code and its amendments (Fletcher, 1996).

During the late 1950s, the Port Authority of New York and New Jersey was receptive to unconventional designs for new projects. As a bi-state agency, the Port Authority was not mandated to conform to any New York City Building Code, but as a courtesy, chose to conform. New York City Fire Department insisted on conformance. The Fire Department said they would not respond to any emergency in a building not designed to the building code (Dunn, 1988). Two buildings required waivers from the DOB for unusual structural systems. The first was Eero Saarinen's T.W.A. Terminal at Kennedy International Airport, c.1 962, required special allowances since its thin concrete design could not have been built to the 1938 code. Another construction project that failed to conform to the city's old code was Pier Luigi Nervi's Port Authority Bus Terminal, c. 1963 at the Manhattan end of the George Washington Bridge. The building's engineered reinforced concrete trusses—which were not addressed by the old code—were fortunately deemed exempt from the city's requirements (Huxtable, 1965).

In the early 1960s, NYC Mayor Robert Wagner appointed the Brooklyn Polytechnic Institute to facilitate the revision of the existing building code. The decision to request a total revision of the Building Code was always the discretion of the mayor. The decision to promulgate any revision or Local Law has always needed approval by the NYC Council. There were various stakeholders with a vested interest in the code revision process, including building trades, labor unions, construction and manufacturing firms, developers, civic organizations, financial institutions, the media, politicians, architects, engineers, and lawyers. In 1966, the Brooklyn Polytechnic Institute published their report, “Proposed Building Code for the City of New York: Final Report by the Brooklyn Polytechnic Institute of Brooklyn for the City of New York Department of Buildings”. The study was funded by the New York Building Congress, the Building Trades Employers Association, and the Investing Builders and Owners Association. These stakeholders lobbied their particular interests regarding amending the new code, but strove to consider and balance all concerns with the ultimate goal of ensuring public safety.

While the proposed new code was undergoing review, not everyone in the architectural community regarded it as a positive development. *New York Times* architectural critic Ada Louise Huxtable published a July 5, 1965 article entitled, “Revised Building Rules Could Bring Beauty to New York – or New Abuses.” In this article, Huxtable wrote that, while she was relieved that an amended building code was forthcoming, she feared that creativity is doomed to a bureaucratic death” under the new code. She continued, “The new building code proposed for the city would bring the architecture of the 20th century to New York. It could be the source of vastly improved architectural standards, or a new round of abuses by speculative builders. Huxtable’s concerns were reverberated when the draft of 1968 Code was introduced to City Council as Intro 436 on June 22, 1967. Four public hearings were held between September 27 and November 3, 1967 with over 150 speakers heard. Many organizations opposed the draft of the new Code: the American Institute of Architects New York Chapter, Architects Council of New York, and New York State Society of Professional Engineers. Design professionals requested a stronger code especially for safety concerns such as egress requirements (Stein, 2007). Many organizations supported the draft of the new Code and substantially funded the study to revise the new Code: The Investing Builders and Owners Association, The New York Building Congress, the Building Trades Employers Association, and the Mechanical Contractors Association.[31] The Department of Buildings tried to provide a balance between all stakeholders in the final version of the 1968 Code.

The New York Times article on July 9, 1965 by Glenn Fowler, "Broad Revisions of Building Code Proposed to City: Changes would Allow Wider Freedom in Architecture – Costs Would Be Cut" discussed a prominent provision in the new Code. Fowler wrote that the administrative costs of permitting a building would be cut with the passage of the new Code. He estimated that ten per cent of construction costs would be saved in administrative requirements. Decreased administration cost was a force that influenced the amending of the Old Code.

The new 1968 Building Code was promulgated on November 5, 1968 during the administration of John V. Lindsay. Local Law 76 of 1968 amended the 1938 Code into the 1968 Code. In particular, it was designed to promote new materials and methods of construction that supported new architectural styles, as well as innovative techniques and technologies like pre-stressed concrete and cable-hung structures that were generally more efficient and economical than older methods. The new code also offered flexibility and a range of practical design solutions that had previously been unknown in NYC. Since its initial promulgation, each subsequent city administration published its own edition of the 1968 Building Code with amendments. This amounted to five editions in

[31] Intro 436 and the organizations, pro and con for the new Code, were sourced from unpublished notes compiled by the NYC DOB that organized two advisory committees, the New York City Government Advisory Committee and the Industry Advisory Committee. The notes are titled, "History of the 1968 code revision effort (1961–1968)," March 28, 2006.

total under the administrations of John V. Lindsay, Abraham D. Beam, David N. Dinkins, Rudolph W. Giuliani, and Michael Bloomberg, respectively. Each edition included amendments promulgated during that administration's tenure. The number of amendments during the years that the 1968 Building Code remained in effect—from 1969 to 2007—averaged approximately six per year, with no spikes like those amendments implemented under the prior code during the early 1950s.

The main forces that influenced amendments to the 1968 Building Code were new materials and methods of construction, new operational directives from the DOB, and fires in high-rises and public assemblies. The vast majority of the 248 amendments promulgated from 1969 to 2007 were related to new materials and methods. This finding challenges the longstanding opinion—discussed in the literature review—that building codes are primarily influenced by fire disasters (Ching & Winkel, 2003; Stein, 1962/2001). The 1974 edition of the 1968 Building Code, from the Beam Administration, speaks to the influence that changes in materials and technology had on the code amendments. The preface of this edition notes that the 1938 Code, "despite many amendments, failed to keep abreast of the advances in engineering technology, use of materials and methods of construction." (p. i) This demonstrates the central role that forces such as new materials, technologies, and construction methods played in the building code amendment process. It explains that the previous code was ultimately replaced due to its failure to adequately address these powerful forces in the industry.

Thirty years later, the same concerns of the forces that influenced the amendment process - new materials, technologies, and construction methods – were restated in the preface to the 2003 edition of the 1968 Building Code in the following quote:

To facilitate the adoption of proven results of research and development in the dynamic field of construction, the Code provides that the Buildings Commissioner may adopt new standards or revise existing standards. In the past, this could only be accomplished by legislative action. Moreover, the Code further provides that equipment and materials may be accepted by the Department of Buildings based upon national reference standards and tests conducted by recognized national laboratories. (p. 3)

The administrative changes that the DOB was undergoing during this time also influenced the passage of amendments to the 1968 Building Code. A relatively equal number of amendments related to department operations were passed as those related to materials. This study identifies two main events that required new operational amendments: which were the 1967 merger of the DOB with the Housing Authority and the friction between the mayor and the DOB during the 1990s.

In 1967, the DOB and the Housing Authority merged into a superagency known as the Housing and Development Administration. The new superagency was created in an attempt to consolidate city services and thereby lower costs. In spite of these intentions, costs increased. As a result, the two agencies once again became separate entities in 1977, each with its own commissioner. Following this separation, the DOB continued responsibility for the development and enforcement of the Building Code. However, the DOB assumed responsibility from the Housing Authority for the enforcement of the Zoning Resolution, the State Municipal Dwelling Law, and aspects of the State Labor Law. The newly created Department of Housing Preservation and Development (the former Housing Authority), in turn, enforced the Housing and Maintenance Code and managed housing property acquired by the city. Many amendments were promulgated during this time to determine responsibility of each city agency.

Several decades later, the DOB struggled with bureaucratic issues in relation to the Rudolph Giuliani administration, which lasted from 1994 to 2001. A high degree of tension developed between the mayor and the DOB during this period because of bribery and corruption charges within the DOB.[32] This tension stemmed primarily from the fact that the DOB had numerous different commissioners during Giuliani's eight-year administration—more than any other period to date. Previously, a single DOB commissioner remains in office for the entire tenure of a mayor. However, under Giuliani, there were three commissioners, as well as an undetermined number of acting commissioners. They included Frank A. Luzi, PE in 1994; Joel A. Miele, Sr., PE from 1994–1996; Gaston Silva, RA from 1996–1999; and various acting commissioners from 1999–2001.

In addition to the strained operations resulting from rapidly changing DOB commissioners, Mayor Giuliani also wanted to merge all inspection and enforcement functions of the DOB into the Fire Department. The mayor made this recommendation public in April 2001, but this operational change never occurred. This recommendation is documented in *The Mayor's Weekly Column*, Archives of Rudolph W. Giuliani, titled "A blueprint for change at the Buildings Department" dated April 16, 2001. Multiple commissioners, and a possible merger of half the operations of the DOB required amendments to clarify operations and protocol. An example of the amendments passed

[32] New York City's Council: Reforming the Department of Buildings, published June 14, 2001, outlined Mayor Giuliani's task force to examine operations of the DOB. The Mayor announced that he would seek City Council approval to permanently transfer inspection and enforcement functions from the DOB to FDNY. This was not pursued because of administrative disruptions of the 9/11 attack a few months later.

that related to operations was Local Law 93 of 1994. This mandated the identification of a building's owner when a sidewalk shed permit was renewed. Previously, only a company or corporation name was required; If a permit was not renewed, as was frequently the case, a violation could not be issued as a violation required a person's name.

5.2.2 The World Trade Center

The first high-rise designed to the 1968 Building Code was the World Trade Center (WTC), c. 1972 and 1973, also known as the Twin Towers. The design of the WTC vacillated between compliance to amendments of the Old Code and the New Code. The architect, Minoru Yamasaki, together with the Port Authority, originally designed the buildings to the 1938 Code, but realized there could be more advantages if the WTC were built to the 1968 Code. The Code choice was possible because the time of permitting with the DOB fell at a transition point between both Codes. The WTC is an example of how choosing certain amendments could influence designs. This example serves to describe the importance of amendments even before their promulgation.

Since the WTC was owned by a public corporation, the Port Authority of NY and NJ, it was not subject by law to any city building code. However, at the insistence of the NYC Fire Department, the Port Authority agreed to code compliance. When Yamasaki designed its buildings in the early 1960s, the 1938 Building Code was in effect but was undergoing a major amendment process. Changes in construction materials and methods augmented by the new code amendment influenced the design of the WTC such that it was more cost effective than if it had been built to the 1938 code in effect at the time.[33]

Originally designed as a much smaller building to be located on the west side of Manhattan, the WTC was ultimately built on the west side instead. Its design morphed from a single building into two structures that were higher than any other existing building and thus doubled the rentable square footage. David Rockefeller spearheaded the plan for the WTC with the oversight of an alliance of businesses whose participation he solicited. The governor of NY at this time was Nelson Rockefeller, David Rockefeller's brother.

In May 1963, the Port Authority decided that the WTC would comply with the building code that had been in effect since 1938. However, in 1965, after the New York Building Council announced the draft of the new building code, the Port Authority altered compliance to adhere to the new code, which was amended in 1968 through Local Law Number 76 of 1968. The WTC was the first design to opt not to use any masonry in construction. In particular, the stairway construction of the WTC was changed to conform to the 1968 code, which did not include masonry in stairway assembly. Instead, stairways were built with gypsum drywall board.[34]

The 1968 code amendment enabled buildings to be constructed higher, their construction to be lighter, and included less fire protection and emergency egress requirements than the previous code. These code amendments thus allowed less costly construction for the WTC. Professor G. M. Stein (2007) described the 1938 Code as

[33] Following this precedent, the new One World Trade will not need to comply with the NYC building code. Out of courtesy and in response to pressure from the 9/11 victims' families, One World Trade will comply with the new 2008 code, which is less stringent in fire code safety than the 1968 code.

[34] The 2008 Building Code, as well as the 2014 Building Code, still allows stairways to be constructed of gypsum drywall board and use less fireproofing than the 1968 Code.

"overly safe" which allowed the 1968 Code to be amended in a "relaxed" revision. Two New York Times reporters, J. Dwyer and K. Flynn (2006), detailed the design change in the following:

> *The reason the Port Authority turned to the new code for its big project was simple: it would make the trade center much cheaper to build.…. The new code would quietly turn back some of the real estate (space mandated for escape: stairways, fire tower, and air-lock vestibules) lost to evacuation routes to the moneymaking side of the ledger. (p. 105)*

This served to turn over floor space from the safety requirements of egress to rentable square footage.

The changes in fire ratings between the old and new code offer a useful example of how code amendments influence the built environment. The 1938 code was originally written for low-rise masonry load bearing construction and subsequently amended for the heavy dense masonry of high rises. Therefore it included many redundancies in fire protection and stability. For example, it mandated the use of columns to resist collapse due to fire for four hours and to make floors resist fire for three hours. The Old Code also mandated masonry to be installed around structural steel for fire resistance. Thus, masonry had the redundant purpose of structural capacity and fire-resistance. In contrast to the redundancies of the 1938 code, the 1968 code "softened" the fire resistance of buildings (Dunn, 1995). In particular, it allowed the use of steel columns to resist collapse due to fire for three hours and to make floors resist fire for two hours. Steel columns could be encased in gypsum drywall in lieu of masonry and floor trusses could be encased in sprayed-on foam in lieu of steel joists encased in masonry. Lowering fire-resistance was possible because of the installation of sprinklers. Moreover, the 1968 code specified fire ratings in terms of performance. For example, an interior fire-rated partition must resist flames for a period of three hours, and the assembly composition can be of any material—brick, masonry, or wood with gypsum drywall and spray-on fireproofing (Dunn, 1995).[35]

In addition to enabling buildings to be constructed more inexpensively, the 1968 code also made structures more profitable to own. The WTC could rent more square footage and thus generate a greater profit. While the 1938 code required a fire tower to be constructed of solid masonry, as well as the inclusion of three additional exit stairways constructed of solid masonry and 107 square feet per floor for fire vestibules, all of these were omitted from the WTC since they were not mandated by the new 1968 code. Furthermore, the 1968 code mandated that fire-rated partitions around stairways were to have a two-hour fire resistance, instead of the three hours previously mandated in the 1938 code. This allowed the stair partitions in the WTC to be constructed of drywall—a much less sturdy material—in lieu of masonry.

Mandates for exit stairways were also much less stringent in the 1968 code than the 1938 code. In particular, the 1968 code did not amend the number of stairways required in a high rise from the 1938 code, in spite of the rapid rise in the average number of levels in high-rise buildings during this period. The new code thus continued to require only three means of egress for buildings classed as non-residential high rises. As a result, the 110-story WTC was only required to incorporate three staircases—the same number required for a six-story high rise (Dwyer & Flynn, 2006). Because of the place of

---

[35] The subsequent 2008 code reduced the fire rating even further for locations where sprinklers are installed.

assembly of the Windows on the World restaurant in the North Tower, as well as the Observation Deck on the South Tower, the WTC technically should have incorporated an additional staircase for a total of four.[36] However, a major oversight by the DOB allowed the WTC to be built with one less stairway. This oversight was not noticed at the time, and regardless, it was not legally required since the WTC did not need to comply with any city code. It is suggested that more rated egress stairs could have saved more lives in the 9/11 attack (Dwyer & Flynn, 2006; Stein, 2007).

In addition to the number of stairways, the distance between stairways was severely decreased in the 1968 code. The 1938 Code simply stated that stairways should be “remote” from each other. The 1968 Code amended that requirement, stating that stairways should be “as remote from the others as is practicable” (NYC Building Code, Subarticle 602.0, effective December 6, 1968). This allowed for more leeway since “practicable” was a subjective term that could be interpreted in different ways. Taking advantage of this less stringent code, the staircases in the WTC were closely packed into the single core at the center of the towers in an effort to further conserve rental space. The space saved by building the WTC to the 1968 Code totaled 21% (Tyson, 2002). In this example, a force that influenced the promulgation of Local Law 76 of 1968 was the desire for an increase in rentable space due to the modified design that decreased the number of egress stairs. The modified design complied with the amendment. LL76 of 1968 was not promulgated until three year later.

[36] As a comparison, the shorter Empire State Building has nine staircases at its base and six in the middle.

5.3 Amendments to the 1968 Building Code

This section examines significant amendments promulgated to the 1968 Building Code. Significant amendments were defined as such in the preface of the six editions of the 1968 Building Code that were published by the six mayoral administrations during the forty years that the 1968 Code was in effect. The 2008 New York City Building Code, on page iv of the preface, describes significant amendments as “reactions to unfortunate events rather than comprehensive revisions.” Half of the “unfortunate events” were fires, and half were the result of falling building material and carbon monoxide poisoning. Other factors also influenced amendments, such as administrative procedures, and new materials and methods. These are detailed in the following sections.

5.3.1 Amendments Related to Fires

While the overwhelming majority of amendments to the 1968 code—a total of 238—were related to either materials and methods of construction or the operational functions of the DOB, there were five amendments passed as a result of specific fires. These were all major amendments that were promulgated as a result of fires, media, public attention, and pressure from the NYC Fire Department (NYFD). The NYFD in particular had been a vocal force for the addition of sprinklers into the code, and all of the following five amendments address increased sprinkler regulations.

The first amendment, Local Law 5 of 1973 (LL5/73), was passed as a result of the fire in One New York Plaza, c.1969, on August 5, 1970. This building had only been completed for a year when the fire occurred. As a high-rise of steel frame and curtain-wall construction, it was significantly different from previous buildings of masonry bearing wall construction. The building’s construction reflected a transition in the building of high-rises away from heavy masonry towards lightweight aluminum curtain-walls that was begun in the late 1940s. This change in building methods eliminated the redundancy of structure and fire protection. Gaps and openings in construction assemblies allowed smoke and flames to spread.

In One New York Plaza, the fire spread through the air ventilation duct routings of the lightweight construction. Failed or absent spray-on fireproofing caused structural failure, requiring 100 beams to be replaced. There were two fatalities and 35 injuries. As a result of the fire, the 1968 Building Code was amended by Local Law 5 of 1973 (LL5/73). Despite being a significant and large amendment associated with this fire, it took three years of litigation to promulgate, including the amendment review by the NY State Supreme Court. Once it was in effect, LL5/73 allowed for the option of either compartmentalization or sprinkler installation in commercial buildings. Compartmentalization of an open area divided the space into smaller areas with fire-resistant partitions that are constructed from the floor to the underside of slab. Most construction projects employed compartmentalization since it was less costly than sprinkler installation. This amendment significantly enhanced fire safety in new and renovated office buildings over 100 feet in height. It was largely in response to the growing popularity of open office planning as a design feature that led to increased safety concerns since large open areas spread fire more rapidly. The first draft of the amendment mandated sprinklers that were considered expensive. The final amendment allowed the architect the choice of either using sprinklers or compartmentalization to impede the spread of fire and smoke. LL5/73 also mandated the appointment of a fire safety director, as well as usage of alarms and emergency communication systems.

Local Law 41 of 1978 increased fire safety in public assembly spaces. LL41/78 was promulgated as a result of the nightclub fire in the Blue Angel Nightclub of Manhattan on December 18, 1975. The DOB named this amendment the Blue Angel Law. This amendment was introduced by request of the Commissioner of the Fire Department. The building that housed the Blue Angel nightclub was made of non-fireproof construction, built to the 1915 Building Code, had no permit for nightclub occupancy, and had no sprinklers. The fire, which was of unknown origin, began in the rear stage area and caused seven fatalities and six injuries. There was no permit for public assembly as required by code, and this non-compliance by owner and lack of enforcement by the DOB was not addressed by amendment because both issues were already included in the Building Code. The amendment retroactively strengthened requirements for sprinkler and fire alarm installation and exit specifications in public assembly spaces. The retroactive component of this amendment was a significant strengthening and not often included in amendments.

Local Law 16 of 1984 strengthened fire safety in commercial buildings with the addition of sprinklers, communication systems, and elevators in readiness for the exclusive use of firefighters. This amendment is one of the longest at 53 pages. It was promulgated as a result of two types of fires; one in NYC and the other in different localities. The fire in NYC occurred in the Westvaco Building, c.1967, on June 24, 1980 that resulted in 137 injuries. The lightweight curtain wall construction of the Westvaco Building, that had no sprinklers, allowed smoke to travel through gaps in the floors and walls, generating a stack effect that intensified and pushed the flames toward firefighters. Sprinklers have been a particular point of contention in building construction due to the added expense that they represent. This amendment was promulgated at least partly in response to two hotel fires that occurred in buildings without sprinklers, despite the fact that neither occurred in NYC. Since the review of the 1968 Code, the NYC Fire Department has continued to be an advocate of the increased use of sprinklers in all types of occupancies (Dunn, 1992). The second types of fires, not in NYC, were in two hotels and both fires outraged fire departments across the country as well as the public. The MGM Grand Hotel fire, on November 21, 1980, in Las Vegas, Nevada resulted in 85 fatalities and 650 injuries. The Stouffer's Inn fire in Westchester, New York on December 4, 1980 resulted in 26 fatalities. As a result of all these fires, the 1968 Building Code was amended by Local Law 16 of 1984 for stricter use of sprinklers in all commercial occupancy groups.

Local Law 10 of 1999 expanded the installation of sprinklers for all new residential buildings with four or more units. This amendment was a result of two NYC residential fires in 1998 and from increased pressure from the NYC Fire Department (Dunn, 1992). The first occurred on December 19 and resulted in the fatalities of three firefighters. The second, on December 24, resulted in the fatalities of four civilians. Both fires, only days apart, were in apartment buildings constructed without sprinklers.

Local Law 26 of 2004 (LL26/04), "The World Trade Center Bill," was passed on June 24, 2004 to incorporate lessons learned from the September 11th attacks that resulted in the deaths of 2,752 individuals. This amendment required all high-rises office buildings over 100 feet in height without sprinklers to install sprinklers. It is a retroactive mandate requiring full compliance within fifteen years. LL26/04 allows for hardship time extensions as well as partial waivers for interior landmark designation or structural impracticability. The section on sprinklers was one of fifteen sections upgraded by this amendment to the 1968 Building Code. This amendment also addressed impact-resistant stair enclosures and elevator shafts in new high-rise office buildings, as well as the placement of photo-luminescent exit markings in stairs.

In addition to these fire-related amendments, other amendments were passed resulting primarily from different types of issues.

5.3.2 Amendments Related to Other Forces

Of the major amendments promulgated during the forty years of the 1968 Building Code, five major amendments were related to issues causing fatalities that were not fires. In particular, these disasters were associated with fatalities caused by masonry falling from an improperly maintained building, accidents during construction or demolition, or poisoning by carbon monoxide. Only one amendment was not directly related to disasters: Local Law 58 of 1987 which was related to handicapped accessibility.

Local Law 10 of 1980 (LL10/80), which was later strengthened by Local Law 11 of 1998 (LL11/98), mandated periodic inspections of façades of buildings six stories and higher. This amendment resulted from an accident when terra cotta exterior masonry fell off a building and killed Barnard College freshman, Grace Gold, in 1979. Because of the aging and lack of maintenance on buildings constructed from 1890 to 1930, masonry, especially terra-cotta, frequently cracked, loosened, and fell off buildings. NYC was the first city in the country to enact such a law. LL11/98 later enhanced LL10/80 by mandating specific requirements for building inspections, such as the hands-on inspection of a representative section of the façade from roof to curb. Both amendments continue to be regulated by the DOB’s Façade Inspection and Safety Program, where the author of this study has worked for the past three years.

Local Law 58 of 1987 incorporated significant handicapped accessibility requirements into the 1968 Building Code. This was three years before the United States Congress passed the Americans with Disability Act. This amendment was not disaster related, but was instead brought about by media attention and various advocate groups for the disabled, such as the grass roots efforts of Evan Kemp, Jr, as described in *The New York Times* article “Mandating Access for the Handicapped” written by Anthony DePalma on November 6, 1988. This article was written a year after the passage of this amendment and described the advocacy that led to the amendment passage as well as the difficulty designers had in complying with the mandated regulations.

Local Law 61 of 1987 (LL61/87) increased safety netting requirements for buildings under construction or demolition. In June of 1987 a construction beam in midtown Manhattan dislodged from a construction site and caused a pedestrian fatality. This prompted the swift passage of LL61/87 that same year. It regulated the storage of construction materials specifically related to netting requirements for loose materials in order to ensure that material and debris did not fall from buildings and injure the public.

Local Law 33 of 1991 (LL33/91) addressed the protection of the public during construction and demolition operations by strengthening the requirements for sidewalk sheds remaining in place. Sheds are mandated to be placed on sidewalks for buildings under construction as well as for buildings undergoing renovations to exterior facades. Also, buildings declared unsafe under LL10/80 were mandated to install a shed that was to remain in place until façade repairs were completed. Until this law was passed, sheds could remain in place indefinitely without explanation and with automatic renewals. As a result, these sheds, made dark enclosed spaces that discouraged pedestrians and began to attract anti-social activities, such as loitering, littering, and public urination. Sheds also prevented the visibility of commercial spaces and impeded pedestrian activity. In response to the growth of such activities involving sidewalk sheds, LL33/91 required that an architect or engineer document the condition of the building, how much work was needed, and how long the shed was required to remain. Non-compliance was subject to fines. Although this amendment was promulgated eleven years after Local Law 10 of 1980 (which significantly increased the use of sheds), both these amendments are connected and are traced back to the fatality of Grace Gold. *The New York Times*, Real Estate Section on August 4, 1991 in the article, “Postings: Curing Eyesores; New Law on Sidewalk Sheds,” detailed the amendment in relation to increased installation of sheds.

Local Law 7 of 2004 mandated the installation of carbon monoxide detectors in all designated sleeping areas such as residences, apartments, hotels, convents, dormitories, and group homes. Fatalities from carbon monoxide poisoning in 2003 and 2004 in residences in Queens and on Staten Island prompted this amendment to be promulgated. This amendment described in the article “Alarms for Detecting Carbon Monoxide” by Jay Romano on October 24, 2004 in *The New York Times*, Real Estate Section. This amendment was robust in that it mandated detectors even in one- and two-family houses which were usually exempt from multiple dwellings. Owners were required to provide detectors but tenants were to reimburse owners twenty-five dollars within one year. Tenants were responsible for maintaining detectors.

5.3.3 Fire Disasters Without Amendments

During the forty years that buildings were sanctioned by the 1968 Building Code, three major fires occurred that were not related to the passage of any amendments. Two were in commercial office buildings and one was in a nightclub. All three fires were related to the absence of sprinklers.

The Happy Land Social Club, 1959 Southern Boulevard in the Bronx, housed an illegal nightclub. A fire attributed to arson during a carnival celebration occurred on March 25, 1990. The fire resulted in 87 deaths and garnered substantial media attention. Similar to the Blue Angel Nightclub Fire fifteen years earlier, this building was constructed in 1931 and made of non-fireproof construction, built to the 1915 Building Code and compliant when originally built. However, non-compliant issues were no permit for public assembly occupancy, no fire exits, no alarms, no sprinklers, no emergency lighting, and a missing fire escape. Fines were levied on the owner, yet no amendments were passed because the building’s non-compliance was covered in the 1968 Building Code.

The Bankers Trust Company Building, originally built in 1962, and located at 280 Park Avenue, Manhattan, was constructed of two office towers built of a steel frame with lightweight metal spandrel panels and glass curtain walls. On Sunday night, January 31, 1993, a fire occurred in the west wing of the sixth, seventh, and eighth floors that were open office space without sprinklers. Fire spread through the common plenum space and involved the floor area when the ceiling collapsed. The fire progressed vertically through exterior windows and interior stair shafts. Firefighters mounted an exterior attack by water directed from aerial platforms. Fire control was only possible because the fire was on lower floors. No amendments were passed because the building was compliant to the 1938 Building Code and repairs were covered by Local Law 5 of 1973, compartmentalization or the addition of sprinklers.

Rockefeller Center, originally built in 1933 to the 1915 Building Code was constructed with a façade made of limestone in lieu of glass and metal curtain walls. However, interior shaft space was limited as it was designed for cable use in the 1930s. As the amount of communication cables and electrical conduits greatly expanded in the 1990s, the crowding of wires became a fire hazard. On October 19, 1996**, a** fire occurred in the crowded shafts where electrical cables were adjacent and thus grounded to steel beams. This overflow of current in the steel beams in the electrical closet on the fifth floor ignited four other electrical closets connected to shafts up to the tenth floor. Twelve firefighters and five civilians suffered smoke injuries. Gaps in the floors and walls funneled smoke through offices without sprinklers. Once again—as with many other fires during this era—lack of sprinklers remained a persistent problem. Again, no amendments were passed because the building was compliant to the 1915 Building Code and repairs were covered by Local Law 5 of 1973, compartmentalization or the addition of sprinklers.

5.4 The Amending of the 1968 Building Code

The necessity of a new code to replace the 1968 Building Code was suggested in the preface of the 2003 edition of that code, which is the last version of the 1968 Code published. The preface stated that amendments tried to address construction and demolition changes on an as needed basis, but asserted that a complete overhaul was needed. The 1968 code had become increasingly outdated and difficult to follow as cumbersome layers of amendments were piled on top of each other. The preface further stated that by the turn of the 21^{st} Century, the 1968 Building Code had become an antiquated, complicated tangle of provisions. The preface of the 2008 Building Code also described the difficulty of understanding, using, and designing spaces to appropriate amendments, which became layered in a confusing manner without the benefit of dating or indexing. The preface further stated that obsolete provisions remained on the books, conflicting amendments became loopholes for industry to navigate, and new technologies and construction practices that had become industry standards were noticeably absent. As this quote attests, it was particularly difficult to determine which amendments preceded or followed others, and in some cases one amendment would directly contradict another.

Local Law 33 of 2007 ultimately amended the 1968 Building Code into the 2008 Building Code. The 2008 code was a fundamental revision based on the 2003 International Building Code. The International Building Code was part of the set of construction codes that were based on the International Code Council (ICC) family of codes, also known as the I-Codes, which most of the United States references (Knecht, 2003). The 2008 Building Code of New York City became known as the New Code and all older codes became known as the Prior Codes. Amendments specific to New York City were added to the 2003 I-Code making the amended I-Code specific to New York City. One amendment mandated three-year revisions of the code to ensure that the code never again becomes outdated. The DOB amended the 2008 Building Code by Local Law 141 of 2013 into the 2014 Building Code.

5.5 Conclusion

The forces that influenced changes to the 1968 Building Code included the majority number of amendments needed to address new materials and technologies. The next highest number of amendments addressing savings in both administrative and construction costs, followed by the clarification for DOB procedures, and finally, fires. Of the 238 amendments promulgated during the forty years the 1968 Building Code was in effect, only five amendments were directly related to specific fires. These were major amendments and all addressed the installation of sprinklers. Six other major amendments were promulgated during this time and five addressed fatalities from construction or failure to properly maintain the building.

CHAPTER 6

CONCLUSION

6.1 Overview

This study explored the forces influencing the amendment process of the Building Code of New York City over the period from 1898 to 2008. The prevailing belief that building codes are amended because of disasters—specifically, fire disasters—is undermined by the findings of this study. Contrary to the assertions of previous researchers, the building code is amended as the result of a complex variety of factors. While fire disasters are one of these factors, they are not nearly as influential on the code amendment process as some researchers have asserted. This study found that 884 total amendments were passed between 1898 and 2008 as a result of technical, cultural, and political forces. Three major factors were identified that influenced the majority of building code amendments, which are listed below in descending order of the number of amendments:

- new materials, methods, and technologies
- changing cultural issues
- fire disasters

This chapter briefly reviews these factors and summarizes the main findings of this study. It also considers the contributions of this study and suggests potential directions for future research.

Given that building codes are a fluid body of laws, amendments have been added to the code text on a continual basis since 1898, the year of NYC's consolidation of the five boroughs. Code amendments actually date much farther back than 1898 to the colonial era and the settlement of Fort Amsterdam in New Netherland, which later became NYC. As discussed in chapter two, the city's building code therefore actually dates back to 1625, when the first code was established for construction in Fort Amsterdam. Specific and consistent themes for amendments have emerged in this study that have been traced back to 1625, which include public health, safety, and welfare. While these themes are present in amendments from the 1600s and 1700s, they also remain a concern for the building code in the modern era. In fact, public health, safety, and welfare continue to be priority issues in the 2008 Building Code. In order to address these principal themes, the early amendments mandated the following:

- The use of specific materials, such as roofs constructed of slate or tile shingles. If slate or tile was in short supply, wood shingles could be substituted, but thatch was not compliant.

- The incorporation of brick or stone for construction methods utilizing existing materials, such as new or rebuilt chimneys. If existing chimneys were constructed of plaster or wood, inspections were required to identify potentially unsafe conditions.

- The applications of new technologies, such as the six story use of brick for the empirical design of lateral bracing in lieu of engineered design.

- New building regulations responding to cultural changes, such as separate buildings for the public and military storage of hazardous materials.

Fire disasters were not identified as a significant force behind the amendments examined in this study. While the threat from fire disasters—as well as disasters related to building collapse—remains a theme in building code amendments, specific fire and disaster incidents did not serve as the main impetus behind the vast majority of these amendments. Twelve major fire disasters in NYC nonresidential buildings that occurred between 1898 and 2001 were investigated as case studies herein. The fires were: the Rodgers Peet Fire, the Triangle Shirtwaist Factory Fire, the Equitable Life Fire, the Empire State Building Fire, the 23rd Street Fire, the One New York Plaza Fire, the Blue

Angle Fire, the Westvaco Fire, the Happy Land Social Club Fire, the Bankers Trust Company Fire, the Rockefeller Center Fire, and the World Trade Center Fire.

It was found in the case of all of these incidents that the building code already in effect addressed fire prevention and collapse at the time that the disasters occurred, not after they occurred. However, as time passed, materials and technologies developed and culture changed, amendments were required to keep the building code relevant; the majority of amendments were promulgated to address the aforementioned forces. This clearly demonstrates that—with very few exceptions—subsequent amendments did not address these disasters, but addressed other issues. This finding is corroborated by the fact that in the case of all but one fire investigated in this study—the Triangle Shirtwaist fire of 1911—the number of amendments did not increase notably in the years immediately following the fire event. The Triangle fire—discussed in chapter three—served as the benchmark case for this study, with several amendments promulgated in its aftermath that quickly led to a major building code upgrade in 1915. This proactive response reflected in the building code was unique to the Triangle fire; such a response was not identified following any of the other major fires examined in this dissertation. Aside from the Triangle fire, only five other fire events were followed by amendments. In the case of each of these fires, only a single amendment was promulgated in response.

- Local Law 5 of 1973 followed the fire at One New York Plaza in 1970
- Local Law 41 of 1978 followed the Blue Angel fire in 1975
- Local Law 16 of 1984 followed the Westvaco Fire
- Local Law 10 of 1999 followed various multiple dwelling fires
- Local Law 26 of 2004 followed the fire in The World Trade Center in 2001

These amendments primarily addressed sprinkler installation and other egress and exit requirements that were continually subject to inadequate code regulations for commercial and residential buildings.

Following the 1915 strengthening of the building code, the majority of its more stringent measures were subsequently downgraded in the 1938 code—which remained in effect until 1968—in an effort to encourage building construction and stimulate the economy following the Great Depression and WWII. More limited requirements for egress stairs and fire-rated assemblies are examples of such downgrades. These changes were discussed in detail in chapter four. Throughout the different editions of the building code that are reviewed in this dissertation, the DOB strove to mediate between the concerns of different stakeholders. For example, while the NYC Fire Department promoted public safety, building owners and developers privileged economic concerns. As a result, the amendments that were promulgated were often a result of compromises between concerns over safety and cost.

Following the establishment of the new 1938 Building Code, this study identified an unusual spike in the number of amendments promulgated per year. Up until this point, most years averaged approximately six amendments. However, beginning in the early 1950s, more than fifteen times the average number of amendments was passed. For example, in 1953 alone, 89 amendments were promulgated. This finding was entirely unexpected, particularly due to the fact that no major fire or building collapse disasters occurred during this period. These amendments were thus analyzed and categorized in order to determine the primary themes behind this drastic increase. The themes that were identified were similar to those associated with the earlier, pre-1898 building code amendments found in this study. They included new materials and technologies associated with the construction boom and new developments in architectural design; cultural changes including a growing middle class suburban lifestyle, the increased prevalence of the automobile, and new occupancies and building uses like theaters; and, to a small degree, fire prevention. These themes were examined in detail in chapter four, but are briefly summarized below.

Construction practices changed during the early 1950s in response to new Modernist architectural styles and building trends—like increasingly larger high rises—that compelled architects to specify existing materials in new and innovative ways. Moreover, the building boom at this time led to a vast increase in the construction of office buildings, public housing, and one- and two-family housing developments. New construction methods such as cavity wall construction and gypsum drywall enabled quicker and less costly building projects. Code amendments were thus required to respond to these innovations in materials and methods.

Cultural changes resulting in new occupancies and uses of buildings were a principal theme for amendment promulgation in the 1950s. For example, amendments mandated occupancy and egress requirements for large theaters showing films and Broadway musicals. The second most common theme for amendments was changes stemming from the development of the outer boroughs, particularly the widespread use of the automobile. This required new uses of buildings—such as parking garages, gas stations, curb cuts for parking, and repair shops—which were not addressed in the 1938 code that still referenced horses and stables. Another concern during this period was current architects' lack of adequate training in pragmatic design practices. Specific amendments therefore strove to direct architects toward proper design practices, especially for new materials and technologies. In addition to the code text, direction was also provided through advertisements for new materials, methods, and occupancies that were printed within the building code alongside corresponding code sections.

Chapter 5 continued to describe new materials and technologies as forces that influenced amendments. However, a political force was added required to clarify DOB protocol in the form of amendments. After forty years of the 1968 Building Code amended to a confounding degree, the 1968 Code was amended into the 2008 Building Code. This New Code, based on the International Code, was a comprehensible and lucid text that is referenced by almost all of the United States.

As this dissertation has demonstrated, the NYC building code continues to be amended on the basis of varied and complex issues such as new materials and technologies, cultural changes including occupancy uses, and—on a limited basis—fire disasters. As the NYC DOB's mission statement recognizes, the primary concern of the building code is the health, safety, and welfare of the public during the construction, occupation, and demolition of a building. However, this study has demonstrated that this concern is at times challenged by the commercial interests of owners, developers, and other stakeholders. Unfortunately, history has proven that it can be potentially dangerous if the code's commitment to public health, safety, and welfare is compromised.

6.2 Contributions of this Study

This study has contributed new data regarding the forces behind NYC Building Code amendments. In particular, it has disproven previous researchers' assertions that the building code is primarily amended as a response to disasters—fire disasters in particular. Instead, this study's findings indicate that the building code is amended, retroactively, as a response to multiple forces including new materials and technologies, socioeconomic and cultural changes, and to a much lesser degree, fire disasters.

This study also demonstrates the complex, retroactive nature of the amendment process and how specific and responsive the building code is to the minutiae of changes in construction and occupant uses, which accounted for the greatest number of amendments during the one hundred and ten year period under study. These findings have broad implications that extend far beyond the scope of this dissertation. In particular, it should be noted that once the retroactive amendment process is fully understood, there is the potential to begin a proactive amendment process with the goal of increasing public health, safety, and welfare.

6.3 Recommendations for Future Studies

The majority of the research conducted for this study relates to nonresidential buildings. However, a similar study examining residential buildings is warranted. Further research is specifically warranted into disasters in residential buildings and the potential danger associated with residents' lack of education regarding the proper protocol for emergency response and evacuation under such circumstances. Contrary to public opinion, evacuation is not recommended for a residential building that is constructed of fire-resistive materials. Several disaster events occurring over the last few decades—including a 2014 Strand Condominium fire in Hell's Kitchen[37] investigated by this

[37] On January 5, 2014, a fire occurred in a unit on the 20th floor of this 42-story residential high-rise located at 500 West 43rd Street. Instead of remaining in place in their units, which is the recommended

author, as well as fires like the 1987 Schomburg Plaza fire[38]—have demonstrated the need for a public-address system to save the lives of residents by communicating with them regarding how to best ensure their safety.[39] Further investigation into these incidents and the related building code is needed to better document the potential weaknesses or shortcomings of current DOB protocol and the existing building code. Demonstrating such weaknesses would substantiate existing recommendations by the NYC Fire Department[40] regarding pragmatic measures that can be taken to increase public safety, including a public-address system.

---

protocol by the fire department, two residents on the 38th floor fled down a scissor fire stair. Both residents were overcome by smoke on the 31st floor and one resident died. If the residents had either remained in their units or descended a different set of stairs, there would have been no fatalities. Two-way communication with firefighters on the scene could have prevented this fatality from occurring (Schwirtz, 2014, p. A14).

[38] This 35-story high rise caught fire and claimed seven lives as a result of smoke inhalation. A report found that communication with residents could have prevented these fatalities (Schaenman, P., 1987. FEMA.).

[39] A bill requiring public-address systems in such buildings is currently before the City Council, the first step for amending the building code with a local law.

[40] Following a fire that began in the unit of actor Macaulay Culkin's family in an Upper West Side residential high rise in 1998 in which four people died from smoke inhalation, the NYC Fire Department went on record saying that a public-address system is the key to saving lives in such disasters.

REFERENCES

Aldermen hold up new building code. (1936, January 1). *New York Times*, p. 6.

Alter, R. (2004). *The five books of Moses: A translation with commentary*. New York, NY: W. W. Norton & Company, Inc.

Amendment eases building code bill. (1949, March 25). *New York Times*.

André, E. M. (2006). *Fire escapes in urban America: History and preservation.* Doctoral dissertation, University of Vermont. Retrieved http://www.uvm.edu/histpres/HPJ/AndreThesis.pdf on February 16, 2010.

Ben-Joseph, E. (2005). *The code of the city: Standards and the hidden language of place making*. Cambridge, MA: The MIT Press.

Bernard, A. (2014). *Lifted: A cultural history of the elevator*. New York, NY: New York University Press.

Biberfeld, P. (1948). *The Bible and the ancient code law: Universal Jewish history.* New York, NY: Spero Foundation.

Bosher, L., & Dainty, A. (2011). Disaster risk reduction and "built-in" resilience: Towards overarching principles from construction practice. *Disasters, 35*(1), 1–18.

Bryan, J. L. (1999). Human behavior in fire: The development and maturity of a scholarly study area. *Fire and Materials, 23*, 249–253.

Building methods told to officials. (1936, April 2). *New York Times*, p. 48.

Burrows, E., & Wallace, M. (1999). *Gotham: A history of New York City to 1898*. New York, NY: Oxford University Press.

Ching, F. D. K., & Winkel, S. R. (2003). *Building codes illustrated: A guide to understanding the international building code*. Hoboken, NJ: John Wiley & Sons.

Cobb, R. W., & Primo, D. W. (2003). *The plane truth: Airline crashes, the media, and transportation policy*. Washington, DC: The Brookings Institution.

Colwell, P. F., & Kau, J. B. (1982). The economics of building codes and standards. In M. B. Johnson (Ed.), *Resolving the housing crisis: Government policy, decontrol, and the public interest* (pp. 337 - 359). Port Vila, Vanuatu: Pacific Institute for Public Policy.

DePalma, A. (1988, November 6). Mandating access for the handicapped. *The New York Times*, Real Estate Section p. 1.

Desmond, M. W. (1899, December 10). What the new building code actually is. *The New York Times*, p. 25.

Documents relating to New Netherland 1624-1626, Henry Huntington Library, San Marino, CA. Document E, retrieved http://www.rootsweb.ancestry.com//nycoloni/huntdoce.html on August 11, 2014.

Douty, C. M. (1977). *The economics of localized disasters: The 1906 San Francisco catastrophe*. New York, NY: Arno Press.

Dunn, V. (1988). *Collapse of burning buildings: A guide to fireground safety*. Saddle Brook, NJ: PennWell Books.

Dunn, V. (1992). *Safety and survival on the fireground*. Saddle Brook, NJ: Fire Engineering Books & Videos, a Division of PennWell Publishing Company.

Dunn, V. (1996). High-rise firefighting strategies. *Fire Engineering, 8,* 32-36.

Dunn, V. (2007). *Strategies of firefighting*. Tulsa, OK: PennWell Corporation.

Dupré, J. (1996). *Skyscrapers: A history of the world's most famous and important skyscrapers*. New York, NY: Black Dog & Leventhal.

Dwyer, J., & Flynn, K. (2006). *102 minutes: The unforgettable story of the fight to survive inside the Twin Towers*. New York, NY: Henry Holt and Company, LLC.

Dye, N. S. (1981). *As equals and sisters: Feminism, the labor movement and the women's trade union league of New York*. Columbia, MO: University of Missouri Press.

Fenske, G. (2008). *The skyscraper and the city: The Woolworth building and the making of modern New York*. Chicago, IL: The University of Chicago Press.

Fisher, T. (2008). Ensuring a healthy and prosperous future. In N. B. Solomon (Ed.), *Architecture: Celebrating the past, designing the future* (pp. 86–96). New York, NY: Visual Reference Publications, Inc.

Fletcher, B. (1996). *A history of architecture* (20th ed.). Oxford, UK: Architectural Press.

Flood, J. (2010). *The fires: How a computer formula, big ideas, and the best of intentions burned down New York City—and determined the future of cities*. New York, NY: The Penguin Group.

Fowler, G. (1965, July 9). Broad revisions of building code proposed to city: Changes would allow wider freedom in architecture – costs would be cut. *The New York Times*, p. 1.

Fradkin, P. (2005). *The great earthquake and firestorms of 1906: How San Francisco nearly destroyed itself*. Berkeley, CA: University of California Press.

Gehring, C. T. (1991). *Laws and writs of appeal, 1647–1663*. Syracuse, NY: Syracuse University Press.

Giuliani, R. W. (2001, April 16). *A blueprint for change at the Buildings Department*. Archives of the Mayor's Weekly Column, Archives of Rudolph W. Giuliani. Municipal Archives, 31 Chambers Street, Room 103, NY, NY.

Glassner, B. (1999). *The culture of fear: Why Americans are afraid of the wrong things*. New York, NY: Basic Books.

Golway, T. (2002). *So others might live: History of New York's bravest*. New York, NY: Basic Books.

Greenwald, R. A. (2002). The burning building at 23 Washington Place: The Triangle Fire, workers and reformers in Progressive Era New York. *New York History, 83*(1), 55–91.

Grove, P. B. (1981). *Webster's third international dictionary, unabridged*. Springfield, MA: Merriam-Webster Inc. Publishers.

Hansen, G., & Condon, E. (1989). *Denial of disaster: The untold story and photographs of the San Francisco earthquake and fire of 1906*. Petaluma, CA: Cameron & Company.

Harris, G. (2003, March 25). Brown Building (originally Asch Building). *NYC Landmarks Preservation Commission, designation report* (List 346PL-2128). LPC: NY, NY.

Hershkowitz, L. (1977). *Tweed's New York: Another look*. Garden City, NY: Doubleday.

Heyer, P. (1995). *Titanic legacy: Disaster as media event*. Westport, CT: Praeger Publishers.

Hollings, K. (2008). *Welcome to Mars: Politics, pop culture, and weird science in 1950s America*. Berkeley, CA: North Atlantic Books.

Homberger, E. (1994). *The historical atlas of New York City: A visual celebration of nearly 400 years of New York City's history*. New York, NY: Henry Holt and Company.

Hornbostel, C., & Hornung, W. J. (1974). *Materials and methods for contemporary construction*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Huxtable, A. L. (1965, July 9). A code for the 20th century: Revised building rules could bring beauty to New York—or new abuses. *The New York Times*, p. 5.

Huxtable, A. L. (2008). *On architecture: Collected reflections on a century of change*. New York, NY: Walker and Company.

Jackson, K. T. (1985). *Crabgrass frontier: The suburbanization of the United States*. New York, NY: Oxford University Press, Inc.

Jarboe, T. L., & O'Donoghue, J. J. (2007). *Elevator & escalator rescue: A comprehensive guide*. Tulsa, OK: PennWell Corporation.

Johns, C. H. W. (1987). *Babylonian and Assyrian laws, contracts and letters*. New York, NY: The Legal Classics Library, Division of Gryphon Editions. (Reprinted from *Babylonian and Assyrian laws, contracts and letters*, by C. H. W. Johns, 1904, New York, NY: Scribner).

Judd, D. R., & Swanstrom, T. (2002). *City politics: Private power and public policy* (3rd ed.). New York, NY: Addison-Wesley Educational Publishers Inc.

Kane, J. N. (Ed.). (1981). *Famous first facts*. New York, NY: H. W. Wilson Company.

Kenrick, J. (2008). *Musical theatre: A history*. New York, NY: The Continuum International Publishing Group.

Kheel Center, Cornell University. (2008). *Remembering the 1911 Triangle Factory Fire*. Retrieved http://www.ilr.cornell.edu/trianglefire/ on October 7, 2008.

Knecht, B. (2003). Building regulations may finally shed their impenetrable language: A nationwide effort is under way to make building codes more rational and usable. *Architectural Record, 4*, 181–188.

Koren, H., & Bisesi, M. S. (2002). *Handbook of environmental health* (Vol. 1, 4th ed.). Boca Raton, FL: CRC Press.

Kostof, S. (1991). *The city shaped: Urban pattern and meaning through history*. London: Bulfinch.

La Guardia to sign new building code. (1937, July 22). *New York Times*, p. 27.

Landau, S. B., & Condit, C. W. (1996). *Rise of the New York skyscraper: 1865–1913*. New Haven, CT: Yale University Press.

Licht, R. R. (2005). The impact of building code changes on fire service safety. *Fire Engineering, 4*, 223–224.

Martin, J. D. (2015). What's in a name change? Solid state physics, condensed matter physics, and materials science. *Physics in Perspective, 17*(1), 3–32.

McClymer, J. F. (1998). *The Triangle Strike and Fire*. New York, NY: Harcourt Brace College Publishers.

McGoldrick, J., Graubard, S., & Horowitz, R. (1944). *Building regulation in New York City: A study in administrative law and procedure*. New York, NY: The Commonwealth Fund.

McLean, W. P. (2003). *Inspector discretion and industry compliance in the street-level implementation of building codes*. Doctoral dissertation, University of New Orleans. Retrieved http://scholarworks.uno.edu/td/63/ on June 23, 2010.

Mumford, L. (1961). *The city in history: Its origins, its transformations, and its prospects*. New York, NY: Harcourt, Brace & World.

Murray, S. (2003). *The progressive housewife: Community activism in suburban Queens, 1945–1965*. Philadelphia, PA: University of Pennsylvania Press.

Muth, R. F., & Wetzler, E. (1976). The effect of constraints on housing costs. *Journal of Urban Economics, 3*, 57–67.

National Commission on Fire Prevention and Control (NCFP). (1973). *America burning*. Washington, DC: U.S. Government Printing Office.

National Institute of Standards and Technology (NIST). (2005). *Federal building and fire safety investigation of the World Trade Center disaster: Final report of the National Construction Safety Team on the collapses of the World Trade Center Towers* (NIST NCSTAR 1). Washington, DC: U.S. Government Printing Office.

New building code passes aldermen after 4-year wait. (1937, July 21). *New York Times*, p. 1.

No new laws are needed. (1911, March 28). *New York Times*, p. 3.

N.Y.C., N.Y., Bldg. Code § 403.15 (2008).

N.Y.C., N.Y., Local Law 26, § 12 (2004).

Payne, J. W., Bettman, J. R., & Schkade, D. A. (1999). Measuring constructed preferences: Towards a building code. *Journal of Risk and Uncertainty, 19*(1–3), 243–270.

Perry, C. (1939). *Housing for the machine age*. New York, NY: Russell Sage Foundation.

Peurifoy, R. L. (1979). *Construction planning, equipment, and methods* (3rd ed.). New York, NY: McGraw-Hill Book Company.

Phelps-Stokes, I. N. (1928). *The iconography of Manhattan Island, 1498–1909*. New York, NY: R. H. Dodd.

Ramsey, C. G., & Sleeper, H. R. (1936). *Architectural graphic standards* (2nd ed.). New York, NY: John Wiley & Sons, Inc.

Ramsey, C. G., & Sleeper, H. R. (1951). *Architectural graphic standards for architects, engineers, decorators, builders, and draftsmen* (2nd ed.). New York, NY: John Wiley & Sons, Inc.

Rheinstein, A., Van Wleck, A. N., & Prince, H. M. (1938). *Building code and other building laws applicable to the city of New York*. New York, NY: City of New York Department of Housing and Buildings.

Romano, J. (2004, January 18). Detecting carbon monoxide. *The New York Times*, Real Estate Section, p. 1.

Rosen, C. M. (1986). *The limits of power: Great fires and the process of city growth in America*. Cambridge, UK: Cambridge University Press.

Roth, M. T. (1995). Law collections from Mesopotamia and Asia Minor. In P. Michalowski (Vol. Ed.), *Writings from the ancient world: Society of Biblical Literature* (Vol. 6). Atlanta, GA: Scholars Press.

Saggs, H. W. F. (1962). *The Babylonians: A survey of the ancient civilization of the Tigris-Euphrates Valley*. London: The Folio Society, Ltd.

Sanders, J. (2001). *Celluloid skyline: New York and the movies*. New York, NY: Knopf.

Schwirtz, M. (2014). Counterintuitive advice when you hear 'fire' in a high-rise: Stay put. *New York Times*, p. A14.

Scott, M. F. (1911, April 15). The factory girl's danger. *The Outlook*, p. 817.

Seidel, S. R. (1980). *Housing costs and government regulations: Confronting the regulatory maze*. New Brunswick, NJ: Center for Urban Policy Research, Rutgers University.

Shanken, A. M. (2009). *194X: Architecture, planning, and consumer culture in the American home front*. Minneapolis, MN: University of Minnesota Press.

Shelhamer, C. (2010, December 14). How fire disaster shaped the evolution of the New York City building code. International Code Council: Building Safety Online Journal. Retrieved http:///H//BSJ_Online/2010Dec/features/nyc_code_history.html on December 14, 2010.

Siegan, B. H. (1976). *Other people's property*. Lexington, MA: Lexington Books.

Siegel, H. (2011, July 20). Citizen Bloomberg. *Village Voice*, p. 11. http://www.villagevoice.com/news/citizen-bloomberg-6431787

Smith, D. (2005). *San Francisco is burning: The untold story of the 1906 earthquake and fires*. New York, NY: Penguin Group.

Smith, T. (Ed.). (1973). *Guide to the municipal government of the City of New York* (10th ed.). New York, NY: Meilen Press, Inc.

Stein, G. M. (2007). Doomed to re-repeat history: The Triangle Fire, the World Trade Center attack, and the importance of strong building codes. *Journal of Civil Rights and Economic Development, 21*(3), 767–795.

Stein, L. (2001). *The Triangle Fire*. Ithaca, NY: Cornell University Press. (Original work published 1962).

Stern, R. A. M., Mellins, T., & Fishman, D. (1997). *New York 1960: Architecture and urbanism between the Second World War and the bicentennial* (2nd ed.). New York, NY: The Monacelli Press.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques* (2nd ed.). Thousand Oaks, CA: Sage.

Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Thousand Oaks, CA: Sage.

Tyson, P. (2002, April 30). Twin Towers of innovation. *NOVA Online*. Retrieved http://www.pbs.org/wgbh/nova/tech/twin-towers-of-innovation.html on October 3, 2011.

Viorst, M. (1965). *The great documents of Western civilization*. New York, NY: Bantam Books.

Von Drehle, D. (2003). *Triangle: The fire that changed America*. New York, NY: Atlantic Monthly Press.

Wakefield, D. (1992). *New York in the 50s*. New York, NY: Houghton Mifflin.

Wermiel, S. E. (2000). *The fireproof building: Technology and public safety in the nineteenth-century city*. Baltimore, MD: The Johns Hopkins University Press.