



CCD1: Construction Code Determination Form

Must be typewritten.

DEPT BLDGS Job No. 121275707



Scan Code ESHS9042318

Do not use this form for Zoning Resolution determination requests - use ZRD1 form

1 Location Information Required for all requests on filed applications.

House No(s) 2461

Street Name Broadway

Borough Manhattan

Block 01239

Lot 0010

BIN 1033583

CB No. 107

2 Applicant Information Required for all requests on filed applications.

Last Name Chen

First Name Eran

Middle Initial

Business Name ODA- Architecture LPC

Business Telephone (646) 478-7455

Business Address 250 Park Avenue South Third Floor

Business Fax

City New York

State NY

Zip 10003

Mobile Telephone

E-Mail eran@oda-architecture.com

License Number 036207

License Type ☐ P.E.

☒ R.A.

☐ RLA

☐ Elevator (Co) Director

DOB PENS ID # (if available)

3 Attendee Information Required if different from Applicant in Section 2 or no Applicant.

Relationship to the property: ☐ Attorney ☒ Filing Representative (Class 2) ☐ Other

Last Name GO/AK/NAT/PAO/TOW/IS

First Name JO/HO/PET/BR/AR

Middle Initial

Business Name JM ZONING

Business Telephone (212) 964-4464

Business Address 299 BROADWAY, SUITE 1100

Business Fax (775) 628-3726

City NEW YORK

State NY

Zip 10007

Mobile Telephone On

E-Mail DETERMINATIONS@JM License/Registration # (if P.E./R.A./R.L.A./Attorney/Lic.(Co)Director) 001185

4 Nature of Request Required for all requests. Only one request may be submitted per form.

Determination request is for: ☒ Determination ☐ Predetermination

Determination request issued to: ☒ Borough Commissioner's Office (Initial) ☐ Technical Affairs (Appeal) ☐ Elevators

Job associated with this request? ☒ Yes (provide job # / doc # / obj # / examiner name below) ☐ No

Job #. 121275707

Document # 01

Objection #:

Examiner: Xiao Fu Lin

Has this request or a similar one been previously denied? ☒ Yes (attach all denied request form(s) and attachment(s)) ☐ No

Enter short description of Technical Topic (5 words or less): Cantilever Fire Analysis

Construction Code (if applicable): ☒ 2014 Code ☐ 2008 Code ☐ 1968 Code ☐ Prior to 1968 Code

Enter All Control #(s) for related CCD1/ZRD1 requests:

Request for 1-3 family dwelling? ☐ Yes ☒ No For HPD Affordable Housing? ☐ Yes ☒ No Fee Exempt per 28-112.1? ☐ Yes ☒ No

Zoning District(s): C4-6A

MDL:

Zoning Overlay(s):

BBs:

Special District(s):

Other:

ZR Section:

Code Section: BC 705.12

Rule #:

TPPN, Memo:

Indicate all Buildings Department officials that you have previously reviewed this issue with (if any):

☐ Borough Commissioner

☐ Code & Zoning Specialist

☐ General Counsel's Office

☐ Deputy Borough Commissioner

☐ Chief Plan Examiner

☐ Elevators

☐ Other

ADMINISTRATIVE USE ONLY	
Control #:	Code Section: BC 705.12
Appointment Scheduled With:	
Comments:	
Review Team Members:	
Reviewed By:	APPROVED WITH CONDITIONS
	Date

CCD1: Construction Code Determination Form

PAGE 2

5	Description of Request (utilize page 3/Section 7 if additional space is needed to properly describe this request)
<p>This is a request for:</p> <p><input checked="" type="checkbox"/> Interpretation or clarification</p> <p><input type="checkbox"/> Variation of Building Code or Rules per § 28-103.3 (please state in detail the practical difficulty that is specific to this project, and provide the analysis as to equally safe alternative, as per NYC Charter Section 645(b)(2))</p> <p><input type="checkbox"/> Variation of Multiple Dwelling Law (MDL) § 277.16 for Article 7B Buildings (please state in detail the practical difficulty that is specific to this project and provide the analysis as to equally safe alternative, as per NYC Charter Section 645(b)(2))</p> <p><i>NOTE: Variations of any other MDL provisions must be filed with the Board of Standards and Appeals (BSA) per MDL § 310.</i></p>	

Please itemize all attachments, including plans/sketches, submitted with this form. (**attachment may not be larger than 11" x 17"**)
 If request is based on a plan examiner objection, type in the applicable objection text exactly as it appears on the Objection sheet and include a copy of the Objection sheet in the submitted Pdf.
 The above referenced application is being filed to construct a new nineteen (19) story mixed use building at 2461 Broadway. The building shall be constructed in accordance with construction classification 1B. From the proposed eighth through nineteenth floor, we are proposing to cantilever the building above an adjacent building (2465 Broadway). Please note that both buildings shall be part of the same zoning lot. The adjacent building (2465 Broadway), is an existing three (3) story and mezzanine, B-business occupancy building, with an active sprinkler and fire alarm. Please see attached copy of TCO 100795917T049.

The determination is being submitted to confirm the acceptance of the proposed cantilever, as required by BC 705.12.

BC 705.12 states "Portions of a building cantilevered over existing buildings. Where a portion of a building is cantilevered over an adjacent building or tax lot by a horizontal distance greater than 1 foot (305 mm), the cantilevered portions shall be protected with construction that conforms to a fire engineering analysis acceptable to the commissioner that conforms to Section 705.12.1. In no case shall the protection for structural elements and horizontal assemblies be less than required for the construction class of the building. In no case shall the fire resistance rating of exterior walls and the limitations for openings be less than required for a lot line condition pursuant to Table 705.8, including Note m.


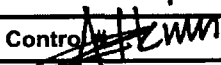
BC 705.12.1 Analysis. The analysis shall demonstrate that all portions of the building that cantilever will withstand the anticipated effects of a design fire in accordance with generally accepted fire engineering principles with respect to at least all of the following building elements:

1. The structural supports and frame of the cantilevered portion of the building,
2. The underside projecting assemblies of the cantilevered portion of the building; and
3. The exterior walls and openings on all sides of the cantilevered portion of the building".

For the newly proposed cantilever, the following is being proposed:

- The structural support and frame for the cantilever portion shall be rated with a 2 hour assembly.
- The underside of the cantilevered portion shall be constructed with a 2 hour rated assembly.
- Enclosed is an analysis prepared, as required by BC 705.12.1, showing that the cantilever will withstand the anticipated effects of a design

NOTE: Department of Buildings Determination will be issued on the CCD1 Response Form

6	Statements and Signature Required for all requests (If Attorney, include 'Esquire' or 'Esq.' in signature)	
<p>I hereby state that all of the above information is correct and complete to the best of my knowledge. Falsification of any statement is a misdemeanor and is punishable by a fine or imprisonment, or both. It is unlawful to give to a City employee, or for a City employee to accept, any benefit, monetary or otherwise, either as a gratuity for properly performing the job or in exchange for special consideration. Violation is punishable by imprisonment or fine, or both.</p> <div style="text-align: center;">  <p>Azmi Zahed Atkins, RA Code & Zoning Specialist</p> </div>		<p>Name (please print)</p> <p>Eran Chen</p>
		<p>Signature</p> <p style="text-align: right;">Date</p> <p style="text-align: right;">04/18/18</p>
		<p>P.E. / R.A. Seal (apply seal, then sign and date over seal – not required for Attorneys on unfilled applications)</p>
ADMINISTRATIVE USE ONLY	Control 	
Reviewed By:	<p>APPROVED</p> <p>WITH CONDITIONS</p> <p>06/13/19 Page 3 of 63 Control No 58938</p>	Date:

01/18

CCD1: Construction Code Determination Form

PAGE 3

7 Description of Request (use this section if additional space is required for description)

fire in accordance with generally accepted fire engineering principles.

Please accept as stated above.

Attached Items:

- 1)RP602 - Approved by DOF on 6/9/17.
- 2)TCO 100795917T049 - 2465 Broadway.
- 3)Fire Analysis and Fire Analysis Peer review letter
- 4)Architectural drawings demonstrating proposed cantilever conditions with proposed fire rating compliance.



NOTE: Department of Buildings Determination will be issued on the CCD1 Response Form

8 Statements and Signature Required for all requests (If Attorney, include 'Esquire' or 'Esq.' in signature)

I hereby state that all of the above information is correct and complete to the best of my knowledge. Falsification of any statement is a misdemeanor and is punishable by a fine or imprisonment, or both. It is unlawful to give to a City employee, or for a City employee to accept, any benefit, monetary or otherwise, either as a gratuity for properly performing the job or in exchange for special consideration. Violation is punishable by imprisonment or fine, or both.

Name (please print)

Eran Chen

Signature

Date

04/18/19



Azmi Zahed Atkins, RA
Code & Zoning Specialist

P.E. / R.A. Seal (apply seal, then sign and date over seal – not required for Attorneys on unfiled applications)

ADMINISTRATIVE USE ONLY

Control #: **58938**

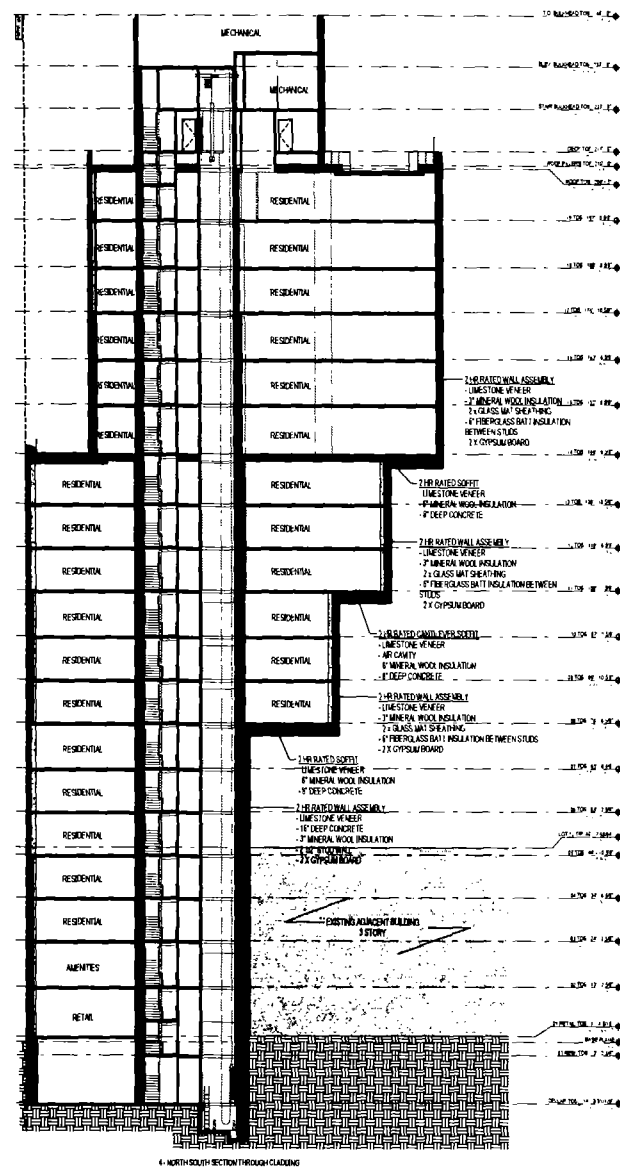
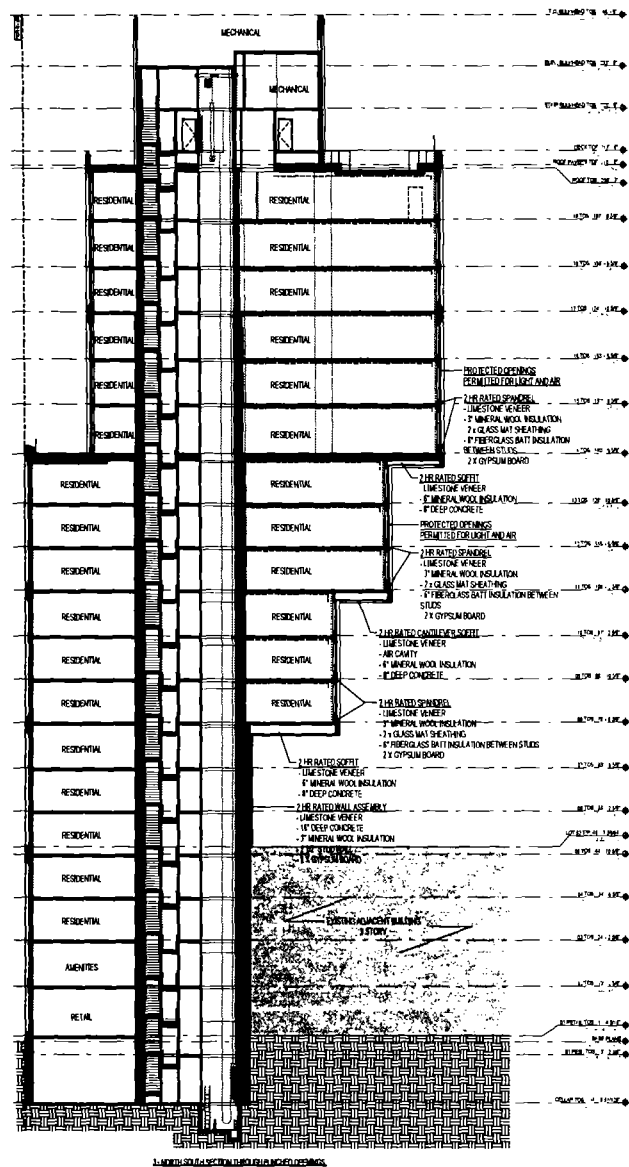
Reviewed By:

**APPROVED
WITH CONDITIONS**

Date:

06/13/19
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Control No. 58938

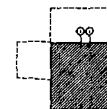
01/18



2461 BROADWAY CONDOMINIUM
CCD1
SCALE
04/09/19

CANTILEVER - RATINGS

58938



ZRD1/CCD1 Response Form

Location Information (To be completed by a Buildings Department official if applicable)

House No(s) 2461

Street Name Broadway

Borough Manhattan

Block 1239

Lot 10

BIN 1033583

Job No. 121275707

DETERMINATION (To be completed by a Buildings Department official)

Request has been: ☐ Approved ☐ Denied ☒ Approved with conditions

Follow-up appointment required? ☐ Yes ☒ No

Primary Zoning Resolution or Code Section(s): 2014 BC BC 601 & 602, BC 705.12.2,

Other secondary Zoning Resolution or Code Section(s):

Control Number: 58938

Comments:

The proposed new 19 story predominantly residential building of Class 1B construction classification is located in the C4-6A and Special Enhanced Commercial district (EC3). Applicant is proposing to cantilever a portion of the NB from the 8th through 19th floors above the adjacent 3 story office building at 2465 Broadway. Applicant requests acceptance of the proposed cantilever via commissioners approvals as required in compliance to 2014 BC 705.12.

The request to review and deem acceptable the proposed cantilever of new building over existing building on the same zoning lot, is hereby approved with the following conditions:

1. The Borough plan examiner shall confirm that the fire-resistance rating requirements indicated on the submitted Construction Documents, for the building elements, are in conformance with 2014 NYC Building Code Sections 601 and 602 for type I-B construction.
2. In accordance with the 2014 NYC Building Code section 705.12.2, the applicant shall submit to the department an approval from the Fire Department that the proposed cantilever complies with applicable provisions of the New York City Fire Code with respect to access to buildings and roofs.

The proposed window openings along the cantilevered portions are being reviewed under a separate CCD1 # 58937, and shall not be deemed as reviewed / approved under this CCD1 request.

This CCD1/ZRD1 is approved ONLY for the specific request and conditions as noted above. The attached plans / documentation have not been reviewed beyond the context of the specific request and shall not be deemed as having been reviewed and approved in accordance with applicable Zoning Resolution, Building and other Codes. DOB examiner shall verify that plans filed, comply with all the conditions of approval.

Note: If approved determination is not scanned or micro filmed, it will be deemed invalid.

Name of Authorized Reviewer (please print): Azmi Zahed-Atkins, RA

Title (please print): Code & Zoning Specialist, Manhattan Borough

Authorized Signature:

Date:

Issuers: write signature, date, and time on each page of the approved forms; and attach this form.

Note: Determination will expire if construction does not start within 12 months of issuance.

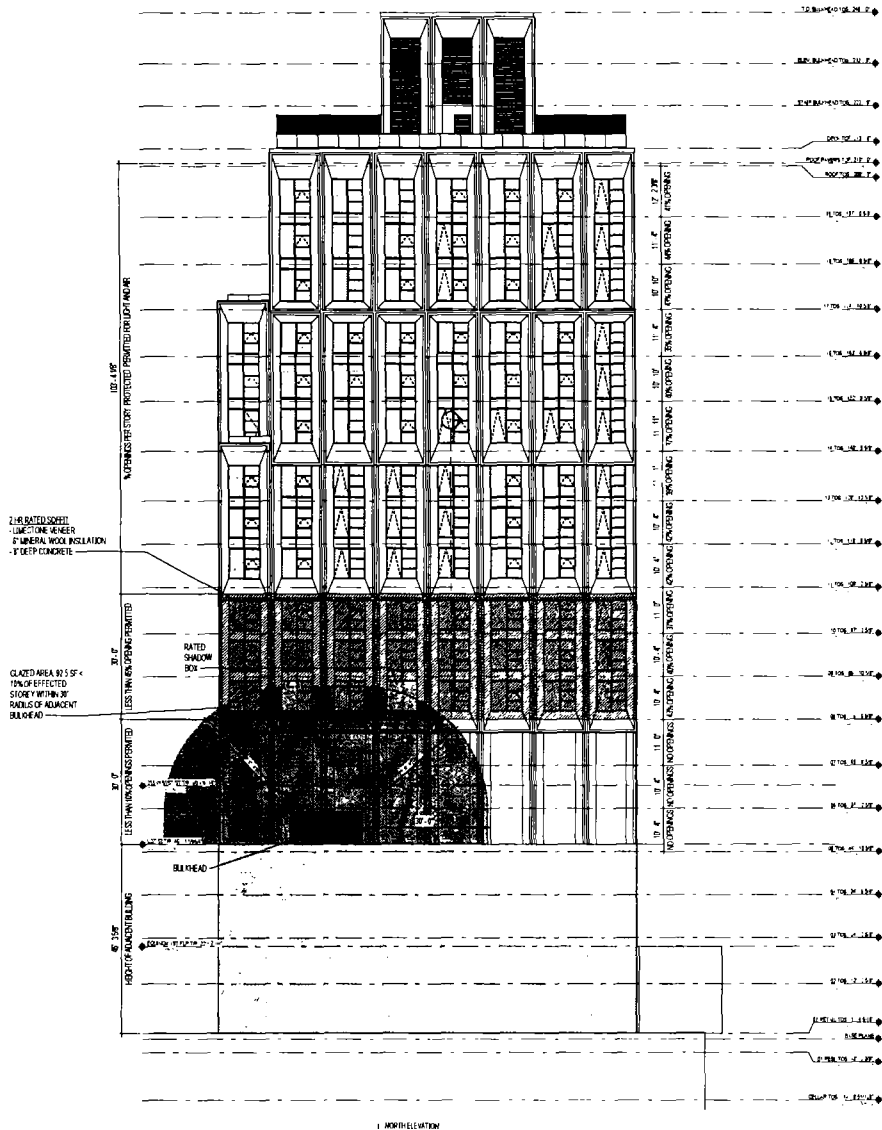
APPROVED WITH CONDITIONS

06/13/19

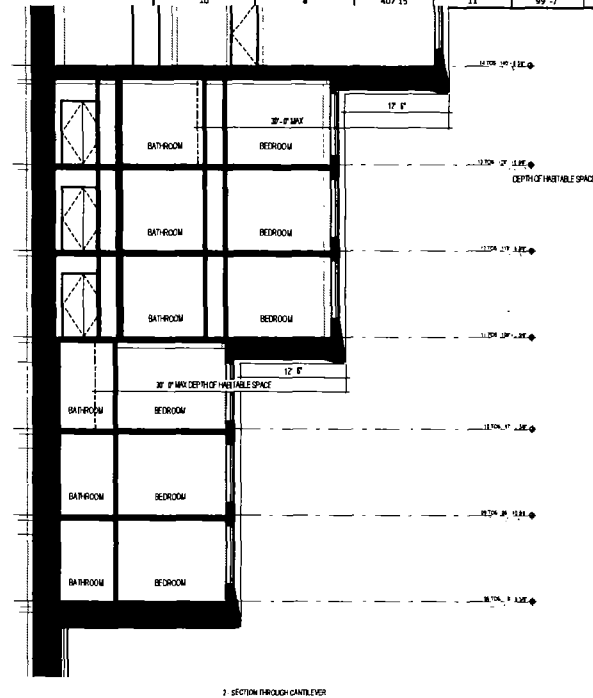
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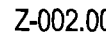
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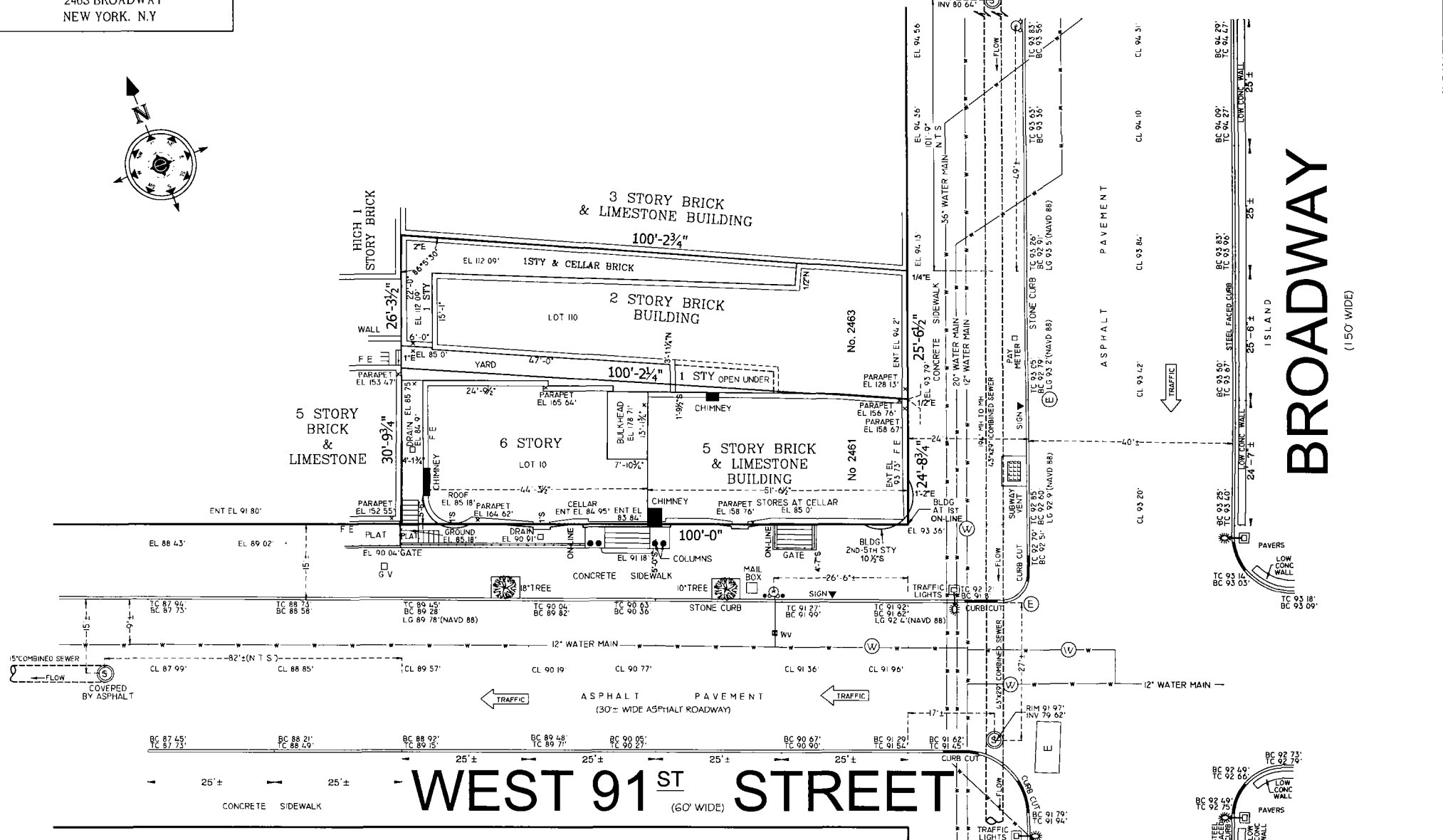
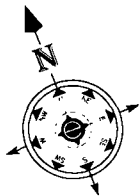
Floor	Number of Openings	Opening Area (sq ft)	Story Height (ft)	Story Width (ft)	Wall Area of Story (sq ft)	% Opening	% Permitted
1	0	0	0	0	0	0	0%
2	0	0	0	0	0	0	0%
3	0	0	0	0	0	0	0%
4	0	0	0	0	0	0	0%
5	0	0	0	0	0	0	10%
6	0	0	0	0	0	0	10%
7	0	0	0	0	0	0	10%
8	8	422.05	10' - 4"	99' - 7"	1,029.03	41%	45%
8 (437 Area Neighbor)	3	92.5	10' - 4"	99' - 7"	1,029.03	9%	10%
9	8	412.12	10' - 4"	99' - 7"	1,029.03	40%	45%
10	8	407.15	11'	99' - 7"	1,095.42	37%	45%



2 BASE PLANE ELEVATION
2417 SCALE 1" = 16'



2461 BROADWAY
2463 BROADWAY
NEW YORK, N.Y.



DATE	DESCRIPTION
MAY 3, 2017	ARCHITECTURAL SURVEY
MAY 10, 2017	ADD WATER & SEWER
OCT 10, 2017	ADD ELEVATIONS

BLOCK _____ 1239
 LOT _____ 10 & 110
 SECTION _____ 4
 COUNTY _____ NEW YORK
 DWG BY _____ A. G.
 CHKD BY _____ J. A.
 SCALE _____ 1"= 12'

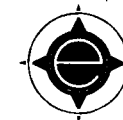
NOTE: Unauthorized alterations or additions to this survey map is a violation of section 7209 of the New York State education law. Copies of this survey map not bearing the land surveyor's inked seal or embossed seal shall not be considered to be a valid true copy. Guarantees and certifications indicated herein shall run only to the person for whom the survey is prepared, and on his behalf to the title company, governmental agency and lending institution listed herein, and to the assignees of the lending institution. Guarantees or certification are not transferable to additional institutions or subsequent owners.

CAUTION:

- 1) Before performing any digging or drilling on this site, it is required that subsurface services including the underground mains be marked and identified by the utility involved in compliance with industrial code 63 of New York State
- 2) All elevations refer to North America Vertical Datum of 1988 (NAVD 88 Datum)
- 3) Survey is not for title purposes
- 4) Watermain are shown per NYC DEP maps and their locations are approximate

B of 63
58938

EMPIRE STATE
LAYOUT, INC.



2209 WETTRICK ROAD
NITE 202
WETTRICK NY 13766

MANHATTAN OFFICE
TEL 212 868 1000

[illegible]



Certificate of Occupancy

CO Number: 100795917T050

This certifies that the premises described herein conforms substantially to the approved plans and specifications and to the requirements of all applicable laws, rules and regulations for the uses and occupancies specified. No change of use or occupancy shall be made unless a new Certificate of Occupancy is issued. *This document or a copy shall be available for inspection at the building at all reasonable times.*

A.	Borough: Manhattan	Block Number: 01239	Certificate Type: Temporary
	Address: 2465 BROADWAY	Lot Number(s): 52	Effective Date: 10/03/2016
	Building Identification Number (BIN): 1033599	Building Type: Altered	Expiration Date: 01/01/2017
<i>For zoning lot metes & bounds, please see BISWeb.</i>			
B.	Construction classification: 1	(Prior to 1968 Code)	
	Building Occupancy Group classification: C	(1968 Code)	
	Multiple Dwelling Law Classification: None		
	No. of stories: 3	Height in feet: 39	No. of dwelling units: 0
C.	Fire Protection Equipment: None associated with this filing.		
D.	Type and number of open spaces: None associated with this filing.		
E.	This Certificate is issued with the following legal limitations:		
	Easement(s) - Recording Info: EGRESS EASEMENT BETWEEN 2465 AND 2473 BROADWAY		
Outstanding requirements for obtaining Final Certificate of Occupancy:			
There are 4 outstanding requirements. Please refer to BISWeb for further detail.			
Borough Comments: None			

Borough Commissioner

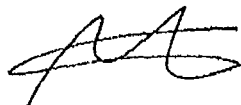
Commissioner

DOCUMENT CONTINUES ON NEXT PAGE

Certificate of Occupancy

CO Number: 100795917T050

Permissible Use and Occupancy						
All Building Code occupancy group designations are 1968 designations, except RES, COM, or PUB which are 1938 Building Code occupancy group designations.						
Floor From To	Maximum persons permitted	Live load lbs per sq. ft.	Building Code occupancy group	Dwelling or Rooming Units	Zoning use group	Description of use
CEL		OG	COM		9	STORAGE, MECHANICAL/UTILITY ROOMS, LAUNDRY ROOM
001	70	120	COM		9	PHYSICAL CULTURE ESTABLISHMENT
END OF SECTION						



Borough Commissioner



Commissioner

Cantilever Fire Engineering Analysis

**2461 Broadway
New York, New York**

FIRE PROTECTION ENGINEER OF RECORD:

KEVIN D. MORIN, PE
LICENSE NO. 084640

**CODE CONSULTANTS
PROFESSIONAL ENGINEERS, PC**
215 WEST 40TH ST., 10TH FLOOR
NEW YORK, NY 10018
PHONE: 212-216-9596
CORPORATE CERTIFICATE OF AUTHORITY
NO. 41955

Warning: It is a violation of the New York State Education Law, Article 145, Section 7209 for any person, unless acting under the direction of a licensed Professional Engineer, to alter this document in any way.

Prepared by:

Code Consultants Professional Engineers, PC
215 West 40th Street, 10th Floor
New York, NY 10018
212-216-9596

Project No. 181720.54.000

April 25, 2019

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The Fire Protection and Life Safety Experts



**CODE CONSULTANTS
PROFESSIONAL ENGINEERS, PC**

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Section I

The Fire Protection and Life Safety Experts



**CODE CONSULTANTS
PROFESSIONAL ENGINEERS, PC**

I. Introduction and Project Description

The project is a new nineteen story condominium building located at 2461 Broadway in New York City. The building will be classified as a Residential Group R-2 occupancy in accordance with the 2014 New York City Building Code, with retail on the ground floor and exercise facilities on the second floor. Portions of the building will cantilever over an adjacent existing building at the 8th, 11th, and 14th floors. The separation distance between the cantilevered portion of the new building and the existing building roof will range from approximately 36 feet to approximately 100 feet.

It will be necessary for the project design to be in accordance with the requirements of the codes, standards and regulations adopted and enforced by the City of New York listed below:

- 2014 New York City Building Code (NYCBC);
- 2014 New York City Fire Code (NYCFC);
- NYC DOB Buildings Bulletin 2017-014; and
- NYC DOB Buildings Bulletin 2015-017.

Code Consultants Professional Engineers, PC (CCPE) has been retained by AARE Broadway Investors LLC to analyze the cantilever and to perform a fire engineering analysis in accordance with Section 705.12 of the 2014 NYCBC and NYC DOB Buildings Bulletin 2017-014 for buildings that cantilever over an adjacent building.

This report outlines the required level of protection for exposed structural members and components of the façade that are cantilevered over the adjacent building and serves as documentation of the fire engineering analysis required by the code. The scope of this report is limited to only the cantilevered portion of the building, and the minimum fire protection features necessary based on the fire engineering analysis documented herein. In no case are the fire-resistance ratings of the exterior walls and the number of openings permitted to be less than required by NYCBC Chapter 6, Table 705.8, and Buildings Bulletin 2015-017.

Based on the results of the analysis documented in this report, it is the professional opinion of Code Consultants Professional Engineers, PC. that the fire protection and life safety concepts outlined in this analysis will provide a level of safety equal, if not superior, to that intended by the applicable codes.

Section II

The Fire Protection and Life Safety Experts



**CODE CONSULTANTS
PROFESSIONAL ENGINEERS, PC**

II. Fire Study Requirement

Section 705.12 of the NYCBC states "... the cantilevered portions of a building shall be protected with construction that conforms to a fire engineering analysis acceptable to the commissioner..." The Computational Fluid Dynamics (CFD) model created for this analysis is intended to address the following criteria set forth in Section 705.12.1.1 of the NYCBC, which requires the following:

- The simulated fire scenario shall run until burn-out with no intervention of the fire department or any fire suppression system;
- All interior vertical compartmentation, including the entrances to stairways, are removed from the CFD model; and
- The fuel load results in the maximum fire size achievable with optimal ventilation.

Section 705.12.1 of the NYCBC requires the fire engineering analysis address the exposure to the following cantilevered building elements;

- Frame;
- Structural supports;
- Underside of projecting assemblies;
- All exterior walls and openings on all sides.

Additionally, the cantilever must adhere with applicable provisions of the NYCFC with respect to access to the building and its roof for fire department personnel.

Section III



III. Analysis Methodology

The requirements for a fire engineering analysis for cantilevered portions of a building are specified in the NYCBC and in NYC DOB Buildings Bulletin 2017-014.

A. Engineering Method.

The effects of a potential catastrophic fire from the building below the cantilever were modeled using the computational fluid dynamics (CFD) computer fire model Fire Dynamics Simulator (FDS) that was developed by the Building and Fire Research Laboratory at the National Institute of Standards and Technology (NIST).

FDS is a CFD model specifically developed and validated for various fire applications. In a cantilever analysis, FDS is being used to calculate the adiabatic surface temperature (AST) and net heat flux (NHF) exposures to the building based on large fires on the uppermost floor of the building below. Accordingly, FDS is being relied on to accurately calculate:

- Plume Temperature;
- Surface Temperature; and
- Heat Flux.

As noted in the FDS Validation guide, the plume temperature, surface temperature, and heat flux equations have all been validated by comparing FDS calculations to actual experimental data. The FDS Validation Guide is available at <https://pages.nist.gov/fds-smv/manuals.html>.

FDS solves a form of the fundamental equations of fluid motion (the Navier-Stokes equations) to calculate conditions from a fire. This requires the creation of a 3-dimensional computer model of the building and the surrounding volume. A CFD model works by dividing the space into multiple regions or cells. The equations describing the motion of fire gases are solved for each cell and the combination of the results for all the cells in the model creates a solution that describes the motion of fire gases around the building. CFD models, such as FDS, require extensive computer resources and must be run on multiple high-powered computer workstations.

Figure 1 below shows the 3-dimensional computer model created for the 2461 Broadway project. The interior walls, floors, and ceilings of both buildings were constructed as inert objects with no heat transfer to the interior or exterior surfaces. Therefore, all heat is transferred through the exterior wall openings (windows). This represents a worst-case exposure to the exposed cantilevered components, as any radiative transfer through the roof deck would be minimal. The red area represents the location of the design fire.

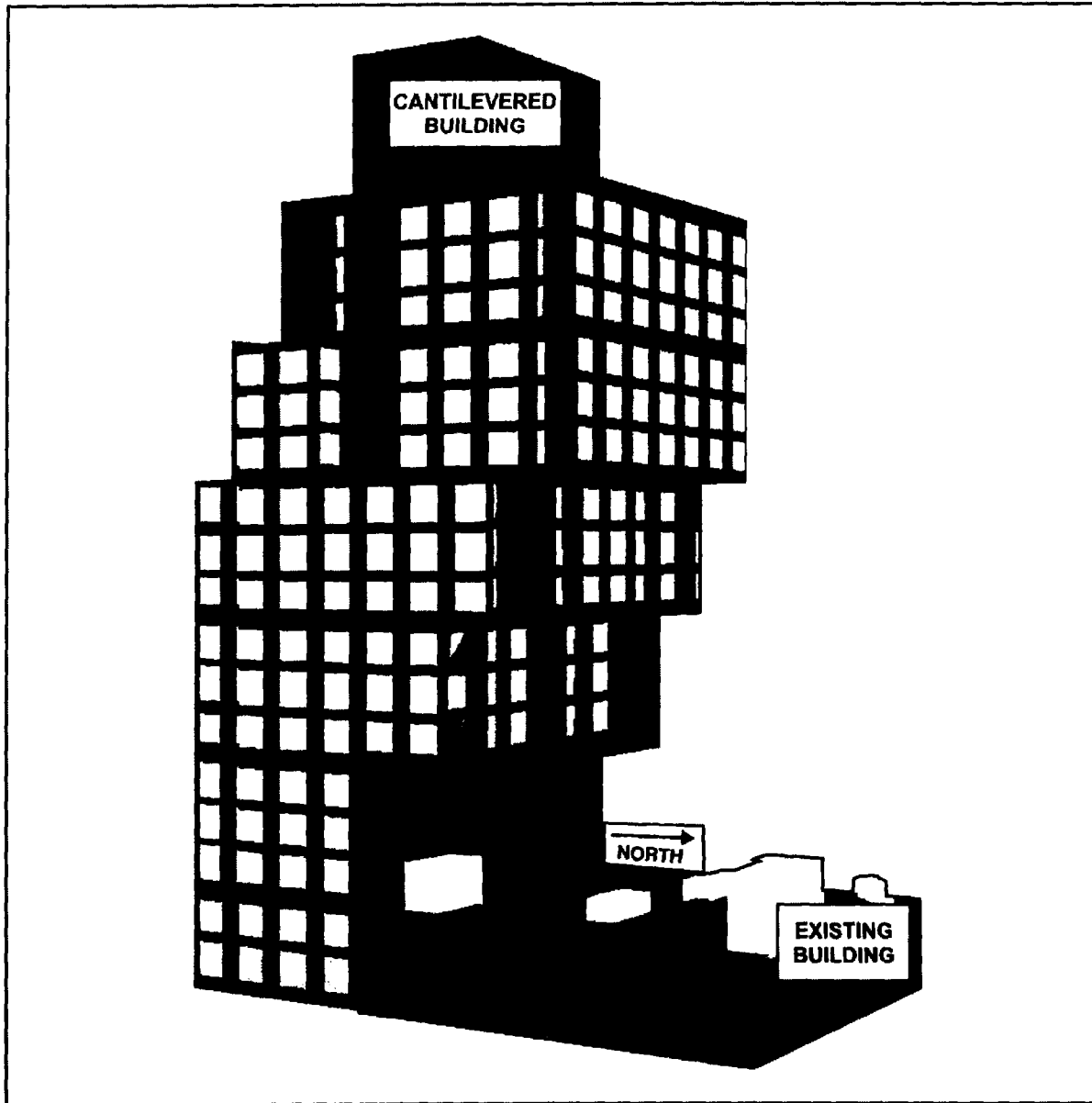


Figure 1: FDS Model

B. Design Fire

As outlined in Buildings Bulletin 2017-014 Section IV (g), the applicable design scenario is dependent on the construction materials of the building below the cantilever. In accordance with the Certificate of Occupancy (CO Number 100795917T042), the building located below the 2461 Broadway cantilever has a I-C Classification under the 1968 Building Code, which indicates its "walls, exit ways, shafts, structural members, floors, and roofs are constructed of noncombustible materials and assemblies" (1968 NYCBC). This means that the building below the 2461 Broadway

cantilever has a non-combustible rooftop and will be treated as such for this study. Additionally, in accordance with 1968 NYCBC Table 3-4 for Class I-C construction, the existing Equinox roof must be at least 1-hour rated because the roof is located less than 20-feet above the floor below, and all penetrations must be protected in accordance with 1968 NYCBC Section 27-343. Therefore, failure of the roof or roof penetrations is not anticipated during the 30-minute burn out scenario.

The building is three stories above grade, 39-feet in height, and is occupied by an Equinox Fitness Club on uppermost floor. Although the CO does not identify the existence of any active fire protection systems, job filings dated in 2019 indicate that automatic sprinkler and fire alarm systems are installed.

A survey of the existing roof and all rooftop equipment was conducted for this project by Empire State Layout and is included as Appendix B to this report. The rooftop equipment includes several small HVAC units that do not represent a significant fuel source. Therefore, a fire on the uppermost floor of the adjacent building below the cantilever (3rd floor) represents the more conservative design fire condition.

In accordance with Buildings Bulletin 2017-014 Section IV (g)(2), all interior vertical compartmentation was removed (meaning vertical construction elements such as walls and doors) to create an entirely open floor plan. For cantilevers over non-combustible roofs, where the design fire scenario consists of a fire in an enclosed space, the heat release rate can be calculated using the SFPE Handbook of Fire Protection Engineering. As the applicable edition of SFPE Handbook is not specified, the 5th edition was used because it is the most current version.

In accordance with Buildings Bulletin 2017-014 Section IV (d), optimal ventilation to fuel the fire within the existing building must be provided. To ensure optimal ventilation and that the simulated fire is not ventilation-limited, the maximum fire size achievable was calculated based on the exterior wall openings in lieu of determining the fuel load density based on the occupancy of the building. Therefore, it was assumed that all exterior openings in the upper most floor failed during the fire scenario. To calculate the heat release rate under these conditions, equations 5.25 and 5.26 of the SFPE Handbook 5th Edition were used as shown below:

$$Q = 1560A_oH_o^{\frac{1}{2}} = 1560 * (A_{o, Facade A} + A_{o, Facade B} + A_{o, Facade C}) * H_o^{\frac{1}{2}}$$
$$Q = 1560 * (45.4m^2 + 12.5m^2 + 16.5m^2) * (1.9m)^{\frac{1}{2}} = 160 MW$$

To accurately apply equations 5.25 and 5.26 from the SFPE Handbook, the respective ventilation areas were taken from the total exterior opening areas on each façade only. Any horizontal openings (floor openings) within the existing building were not included because they do not contribute to the area allowing for burning gases to escape the building. The opening areas were calculated as shown below in Tables 1-3 and are based on the dimensions of the exterior wall

openings provided by Empire Layout, Inc and dated February 7, 2019. A survey was conducted of the as-built conditions and is provided as an appendix to this report.

Façade A	Width (ft)	Height (ft)	Area (ft ²)	Area (m ²)
Window 1	3.646	6.083	22.179	2.06
Window 2	14.583	6.083	88.715	8.24
Window 3	14.667	6.083	89.222	8.29
Window 4	14.615	6.083	88.905	8.26
Window 5	14.594	6.083	88.779	8.25
Window 6	14.594	6.083	88.779	8.25
Window 7	3.604	6.083	21.925	2.04
Total:			488.50	45.4

Table 1: West façade exterior opening area

Façade B	Width (ft)	Height (ft)	Area (ft ²)	Area (m ²)
Window 1	2.948	6.375	18.793	1.75
Window 2	4.552	6.375	29.020	2.70
Window 3	4.510	6.375	28.754	2.67
Window 4	4.500	6.375	28.688	2.67
Window 5	4.563	6.375	29.086	2.70
Total:			134.34	12.5

Table 2: East façade exterior opening area

Façade C	Width (ft)	Height (ft)	Area (ft ²)	Area (m ²)
Window 1	4.760	6.417	30.546	2.84
Window 2	4.760	6.417	30.546	2.84
Window 3	4.563	6.417	29.276	2.72
Window 4	4.625	6.417	29.677	2.76
Window 5	4.542	6.417	29.142	2.71
Window 6	4.500	6.417	28.875	2.68
Total:			178.06	16.5

Table 3: Interior façade exterior opening area

Based on the area of the upper-most floor (3rd Floor) of the adjacent building shown in Figure 2, the resulting heat release rate per unit area was calculated as approximately 186.3 kW/m². Although 186.3 kW/m² is less than common fuel load densities such as 500 kW/m² for combustible roofs or 400 kW/m² for business occupancies in non-combustible buildings, it is the maximum fire size permitted by the existing building's exterior openings (i.e. ventilation). Additionally, a 20% safety factor was not applied to the fuel load density because it is the maximum fire size permitted

by the available ventilation. Increasing the fuel load density would result in a ventilation limited fire and would not comply with Buildings Bulletin 2017-014 Section IV (d).

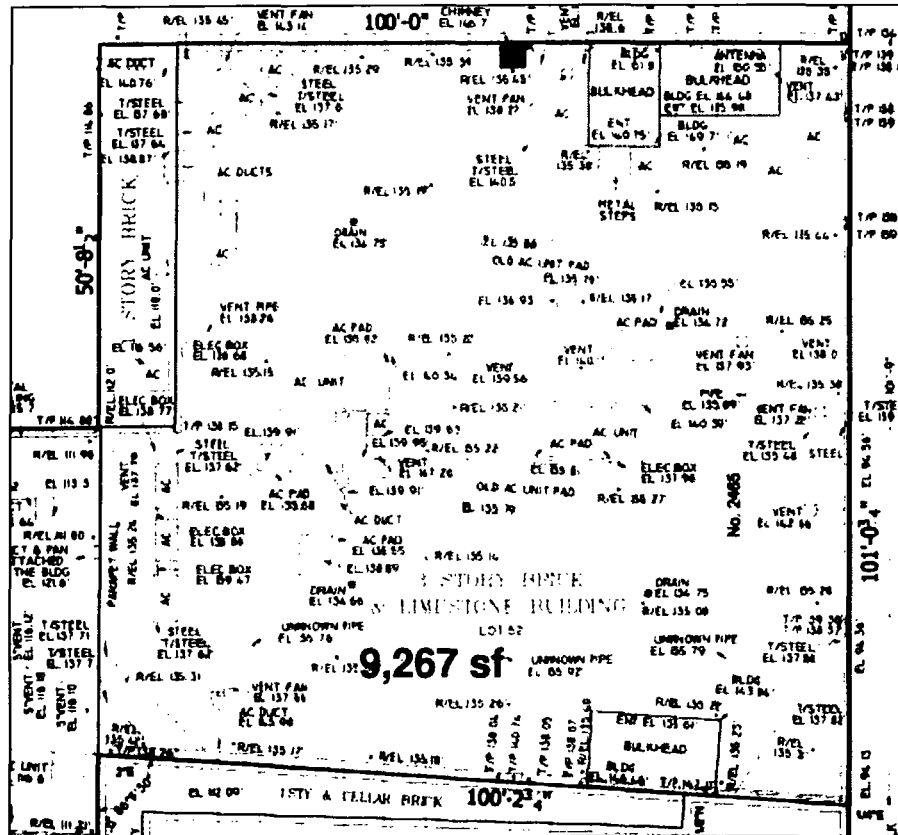


Figure 2: Area top view of the building underneath the 2461 Broadway cantilever

$$HRR_{PUA} = \frac{160,403.6 \text{ kW}}{9,267 \text{ ft.}^2} = \frac{160,403.6 \text{ kW}}{860.9 \text{ m}^2} = 186.3 \text{ kW/m}^2$$

The design fire scenario assumes no intervention by building fire sprinkler systems or fire department operations and burns for 30 minutes. Based on the area of the fire floor ceiling used in this analysis, this results in a total heat release rate of approximately 150 MW. As indicated in Figure 3 below, the heat release rate reaches a steady-state peak heat release rate of approximately 150 MW for the full 30-minute duration. The difference between the calculated and resulting fire size can be attributed to the rounding associated with FDS.

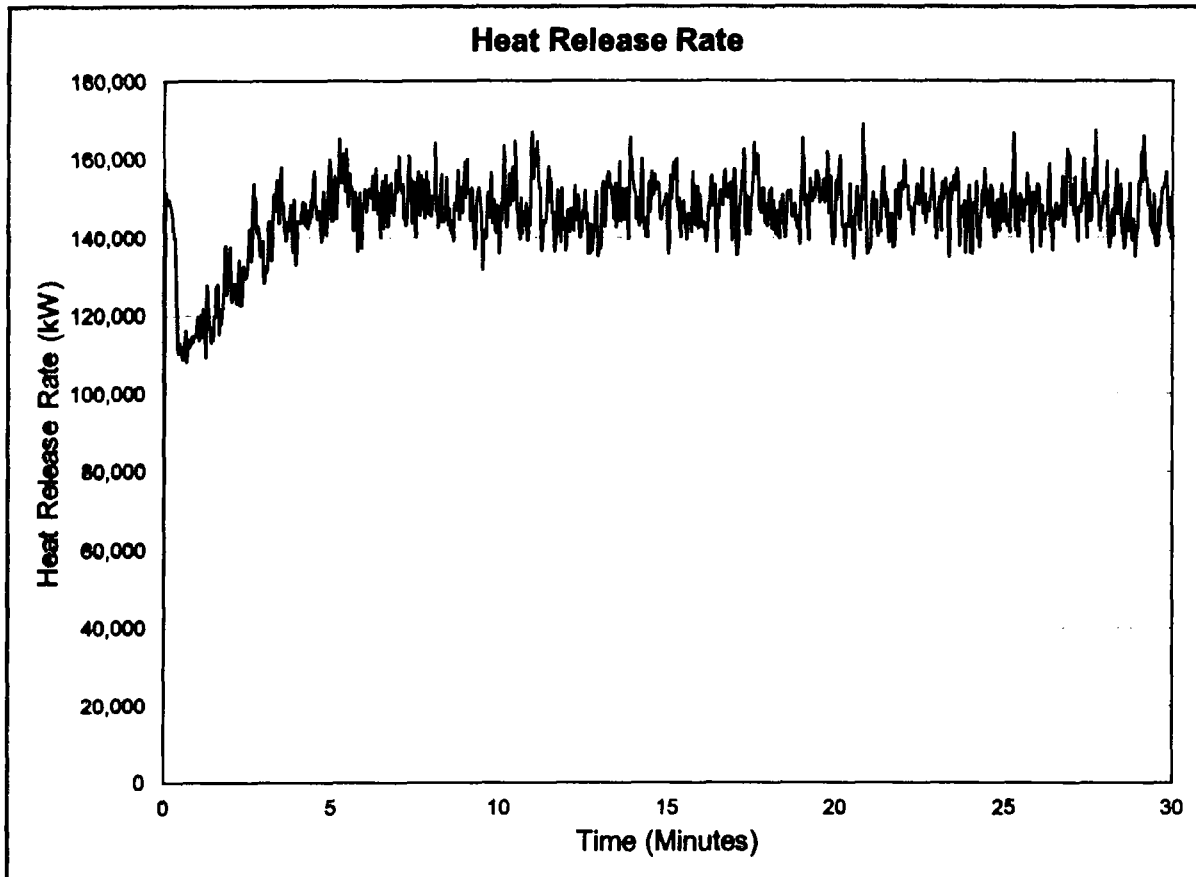


Figure 3: Heat Release Rate

The fuel properties used in the analysis consist of a blend of polyurethane and wood products, yielding a high heat of combustion and high predicted temperatures providing a conservative analysis. The table below shows the properties used in the analysis.

Fuel	Heat of Combustion (kJ/g)	Soot Yield (g/g)	CO Yield (g/g)
Wood	20	0.015	0.0045
Polyurethane (flexible foams)	28.8	0.1875	0.028
Blend (50% wood & 50% polyurethane)	24.4	0.1	0.016

The fuel properties for wood and polyurethane foams listed above are based on the fuel properties recorded in the SFPE Handbook of Fire Protection Engineering, 5th Edition.

Section IV

The Fire Protection and Life Safety Experts



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IV. Exterior Wall Requirements

The building code required fire resistance ratings and maximum permitted area of openings for exterior walls are based on the fire separation distance of the wall as outlined in NYCBC Chapter 6, Section 705.8 and Buildings Bulletin 2015-017. In addition to the building code requirements, the 2461 Broadway exterior walls must comply with the results of the cantilever fire study. It is important to note that in no case can the fire resistance rating of the exterior walls be less than required for a lot line condition. It is assumed that all the exterior walls for the 2461 Broadway project are not load-bearing.

A. Building Code Provisions

The fire separation distance is measured from the building face, at a 90-degree angle, to the closest of the following:

- The closest interior lot line;
- To the centerline of a street, an alley or public way;
- To an imaginary line between two buildings on the property.

Because certain façades of the 2461 Broadway cantilever will have a fire separation distance of zero feet, no less than a 1-hour rating is required and no openings are permitted (NYCBC Table 705.8). However, exterior wall openings on a zero lot-line condition are permitted in Group R-2 occupancies if they do not exceed 10 percent of the wall area (Buildings Bulletin 2015-017 Section IV). Such openings cannot be used to satisfy required natural light or ventilation requirements and must be protected in accordance with NYCBC Section 715 or protected by an approved water curtain using automatic sprinklers except where a practical difficulty in providing the required natural light or ventilation is demonstrated.

Where a practical difficulty in providing the required natural light or ventilation is demonstrated due to the above requirements, the borough commissioner may authorize openings in excess of 10 percent (Buildings Bulletin 2015-017 Section VI.B). Areas separated by less than 30 feet (measured in any direction and any angle to the nearest portion of such adjacent building) are not permitted to exceed 10 percent openings. However, portions of the cantilever façades that are between 30 feet but less than 60 feet from the adjacent building, the percentage of openings can be increased to 45 percent of the wall area. Exterior walls in the 2641 Broadway building located 60 feet or more from a neighboring building are permitted to have unlimited openings pending approval from the borough examiner (Buildings Bulletin 2015-017, Section V).

As indicated in Figure 4 below, the red portion of the 2461 Broadway Cantilever cannot exceed 10 percent openings and where a practical difficulty is demonstrated and approved, the yellow portion cannot exceed 45 percent openings, and the green portion can have unlimited openings as outlined above.

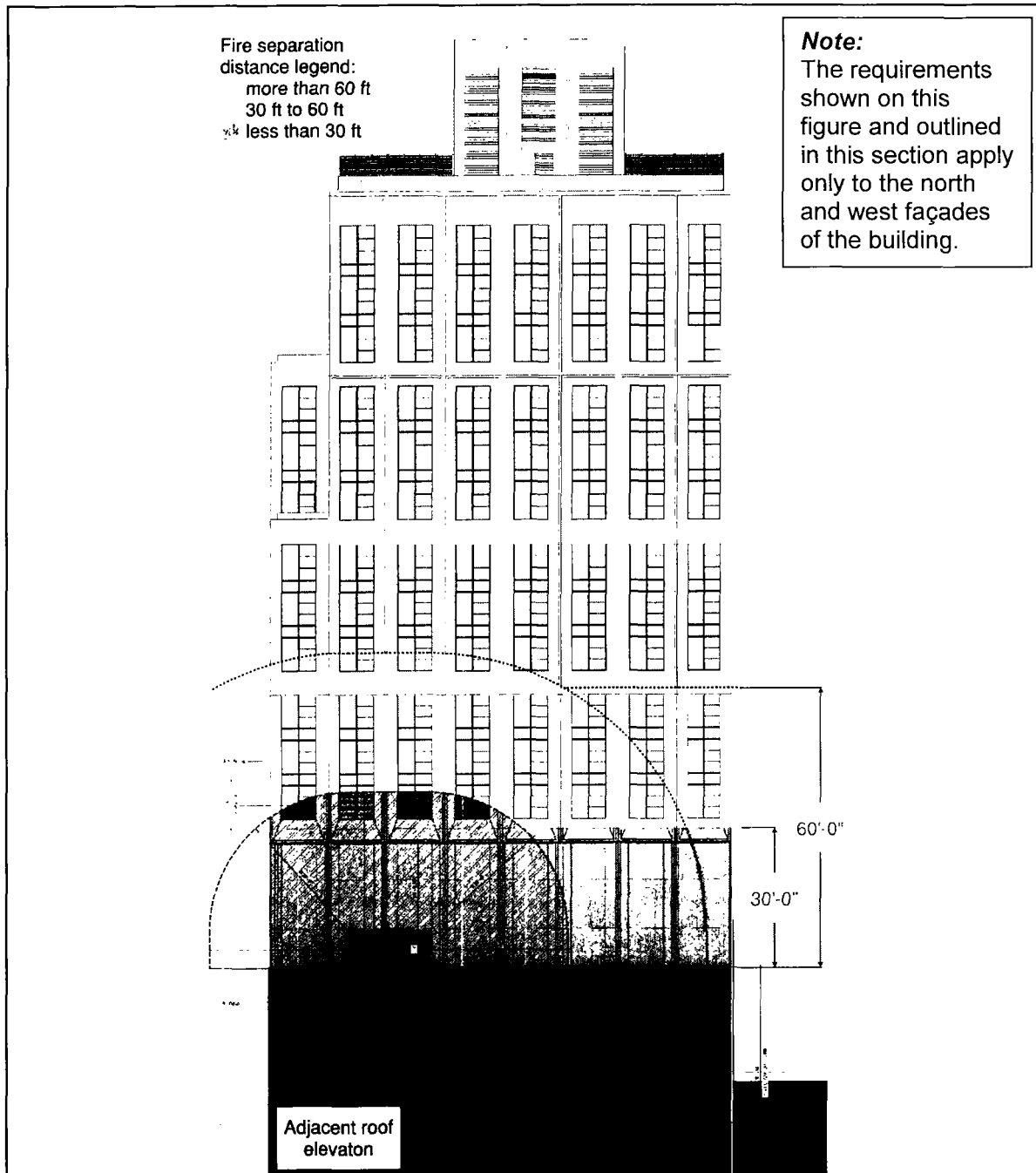


Figure 4: Exterior wall openings permitted by Buildings Bulletin 2015-17

The design team has not expressed a practical difficulty with providing the required natural light or ventilation with the permitted 10 percent exterior openings. Therefore, the exterior walls will comply with the 10 percent limitation.

B. Cantilever Acceptance Criteria

The performance criteria outlined by NYC DOB Buildings Bulletin 2017-014 for the evaluation of cantilevered buildings references ASTM E-119. ASTM E-119 tests the performance of fire-rated floor assemblies, loaded beams / columns, bearing walls, and non-bearing walls by exposing each assembly to heat from a furnace that follows a standard time-temperature curve, shown below in Figure 5. All exterior walls for the 2461 Broadway cantilever project are assumed to be non-load bearing walls.

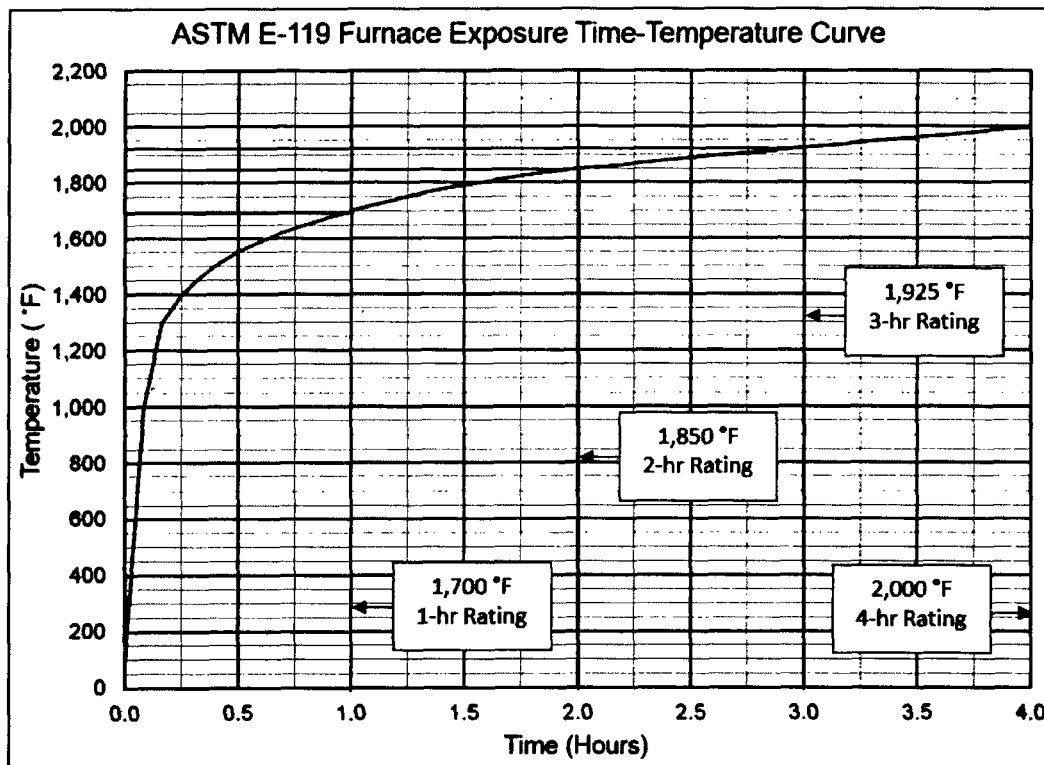


Figure 5: ASTM E-119 Time-Temperature Curve

In addition, glass windows and other openings in areas requiring a fire resistance rating must be protected. Fire window assemblies with glazing must be tested per NFPA 257 or UL 9 and swinging fire doors must be tested in accordance with NFPA 252 or UL10C; other types of assemblies such as fire shutters must be tested per NFPA 252 or UL10B (Sections 715.4 and 715.5). Protected assemblies in accordance with the above are considered exterior openings and contribute to the façade's opening limitations. However, openings protected with ASTM E-119 assemblies do not contribute to the opening limitations.

1. Adiabatic Surface Temperature

Adiabatic Surface Temperature (AST) is the maximum theoretical surface temperature calculated in FDS given the radiative and convective heat exposure. Therefore, the AST is compared to the ASTM E-119 time-temperature curve to indicate the minimum required fire resistance rating for the frame, structural supports, underside of projecting assemblies, and exterior walls of the 2461 Broadway building. The AST was recorded via devices located on the 2461 Broadway exterior walls spaced 0.25 meters by 0.25 meters apart as shown below; the green dots are representative of a single AST device.

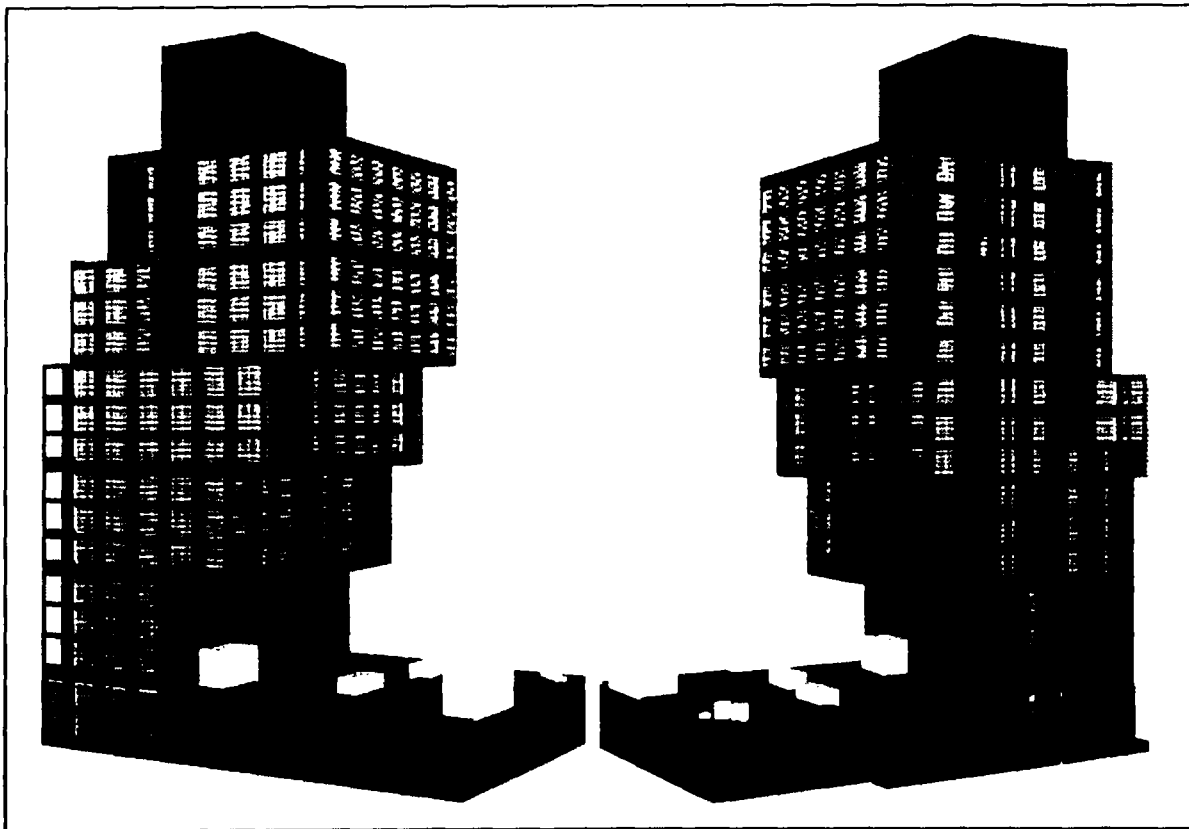


Figure 6: FDS Model Devices

For portions of the new building that are adjacent to the existing building, the AST will also be compared to a conservative value for the piloted ignition temperature of wood. At this temperature, wood exposed to an open flame will begin pyrolysis which is the first step in a combustion reaction. Wood below this temperature would not begin pyrolysis, even when exposed to piloted ignition. Although no portions of the exterior façade will be constructed of wood, this criterion yields a conservative assessment of the possibility of fire spread to the new building. The ignition temperature used in this analysis is 572°F (300°C), taken from *An Introduction to Fire Dynamics*, D Drysdale. Portions of the building

where the AST is less than this value do not require a rating due to the cantilever condition; where the AST meets or exceeds 572°F (300°C), a minimum 1-hour rating must be provided. Fire ratings may be required by other portions of the building code that regulate fire ratings, based on the fire separation distance to lot-lines.

As required by the DOB Bulletin 2017-014, a summer design condition was modeled, with an ambient temperature of 98.4°F. This temperature is provided by ASHRAE as the extreme annual design condition for a 50-year return period. Use of this temperature as the ambient condition results in increased adiabatic surface temperatures.

2. Net Heat Flux

In addition to the AST failure criteria and consistent with NYC DOB Buildings Bulletin 2017-014, a Net Heat Flux (NHF) of 16 kW/m² was used as the failure criteria for non-fire rated window openings. This value is identified in the article "Window Breakage Induced by Exterior Fires," Mowrer, which indicates "neither heat resistant ceramic glass nor tempered glass failed when exposed to heat fluxes of approximately 1.6W/cm² [16 kW/m²] ..." Additionally, the paper states that during the testing "The wood frames charred under this exposure...suggesting that failure of the window frame would likely occur before failure of the glazing". Therefore, 16 kW/m² is a conservative value for windows provided with metal frames because they would not char.

It should be noted that material properties of the exterior walls of the cantilever have not been included in the FDS analysis. By omitting material properties, the FDS default property 'INERT' is applied to the solid obstructions. This is conservative because it does not allow the solid to absorb any heat and increase in temperature. The solids remain at ambient temperature, creating a larger temperature difference between the solids and the gas, resulting in a larger heat flux.

All openings in areas exposed to a net heat flux value exceeding 16 kW/m² must be protected by an ASTM E119 or UL 263 approved assembly (NYC DOB Buildings Bulletin 2017-014), or alternate protection methods approved by DOB and FDNY. Examples of ASTM E119 or UL 263 approved assemblies include fire-resistance rated fire shutters and fire-resistance rated glazing; it is important to note that assemblies tested in accordance with either ASTM E119 or UL 263 are classified as wall assemblies and not opening protectives.

In addition to the results and requirements of this cantilever fire study, the exterior wall openings must comply with Buildings Bulletin 2015-017 for lot line windows as identified in the previous section.

C. Time Averaging

FDS uses a “mixed-is-burned” model for simulating the combustion reaction. This means that as fuel and air mix, combustion occurs when the fuel-air ratio moves within the limits of combustion. Although the heat release rate is constant, this model creates fluctuations of the heat released (and therefore fire exposure values) from each time step.

To account for brief spikes in temperature and heat flux that are a result of the mixed-is-burned assumption, the temperature and heat flux values presented in this analysis are averaged over three (3) time steps of the simulation, approximately 3.6 seconds. This is a more realistic representation of a fire scenario, and more accurately represents expected conditions. In addition, this allows for a more accurate comparison to the ASTM E-119 test method, which includes constant furnace temperatures without fluctuation.

Section V

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V. Adiabatic Surface Temperature Results

During the fire exposure described in Section III, the AST of the underside and the façades of the 2461 Broadway cantilever were compared with the acceptance criteria outlined above.

During the simulation, the various façades of the building experience varying degrees of exposure. Additionally, the cantilevered façades experience a temperature gradient. Therefore, the AST exposure calculations have been broken up into seven (7) zones of protection as described in the list below and as shown in Figure 7.

- Zone 1 – Non-cantilevered east façade
- Zone 2 – Non-cantilevered north façade
- Zone 3 – Cantilevered north façade
- Zone 4 – Non-cantilevered west façade
- Zone 5 – Underside of lower cantilever
- Zone 6 – Underside of middle cantilever
- Zone 7 – Underside of upper cantilever

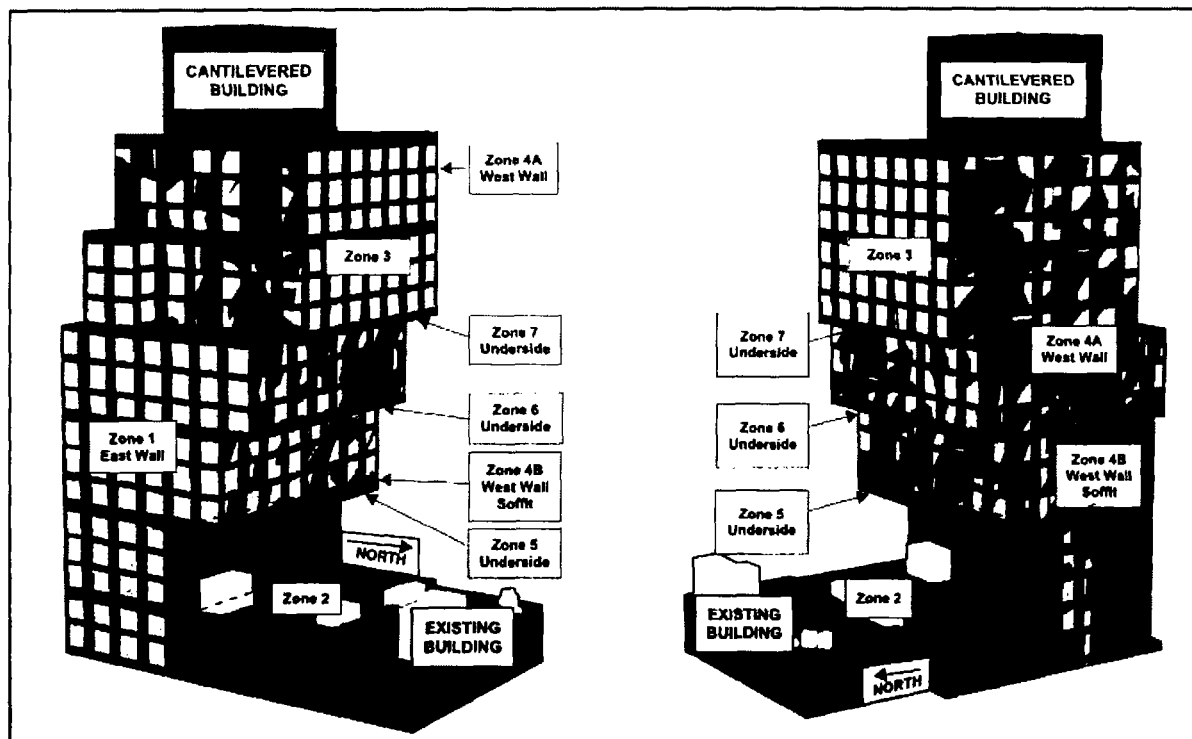


Figure 7: 2461 Broadway Cantilever Zones

A. Zone 1 – Non-Cantilevered East Façade

As shown in Figure 8 and Figure 9 below, the east façade of the building reached a maximum temperature of 201°F. Figure 8 shows the moment of maximum AST and Figure 9 shows the AST of the east façade over time.

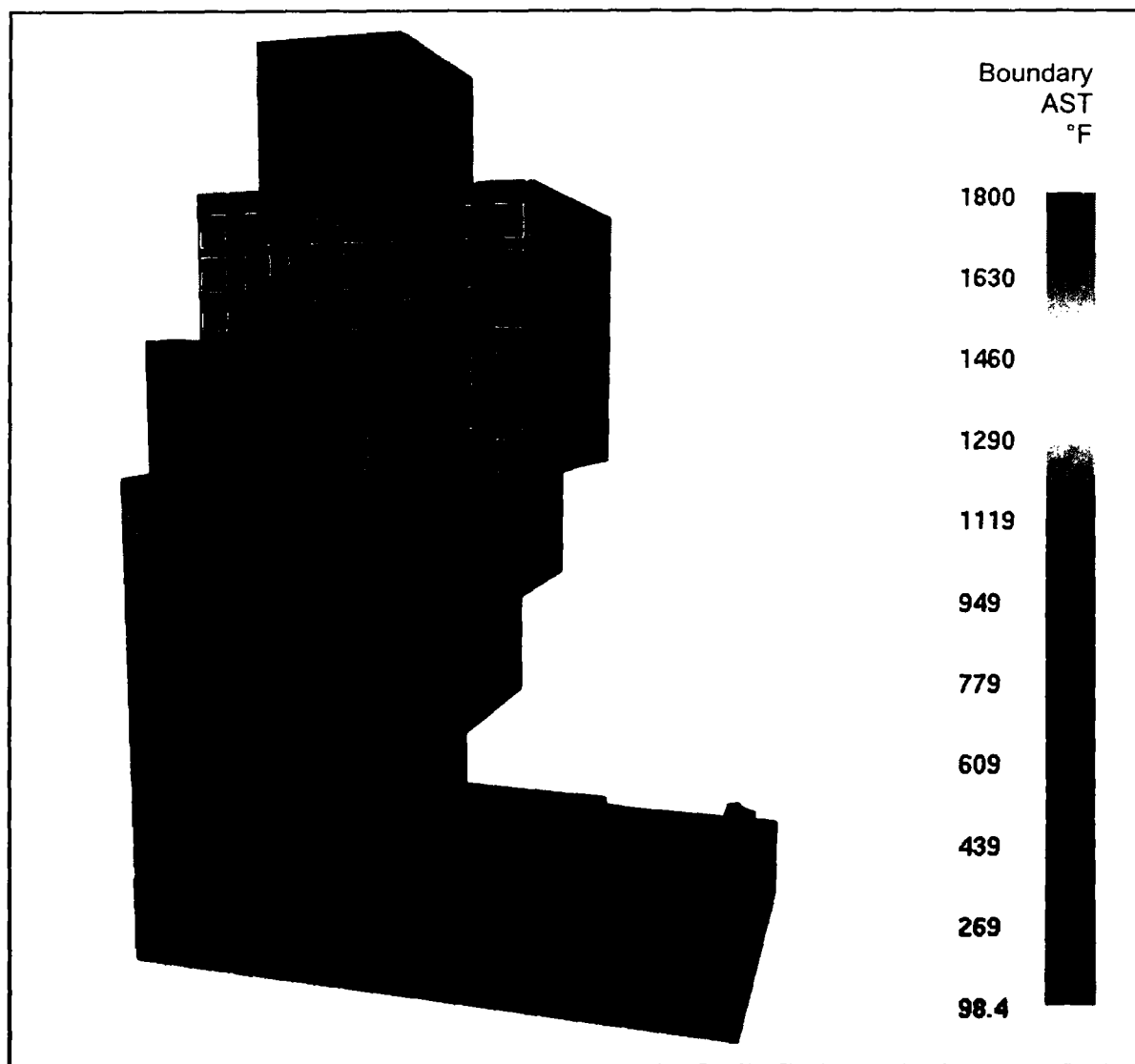


Figure 8: Maximum Adiabatic Surface Temperature

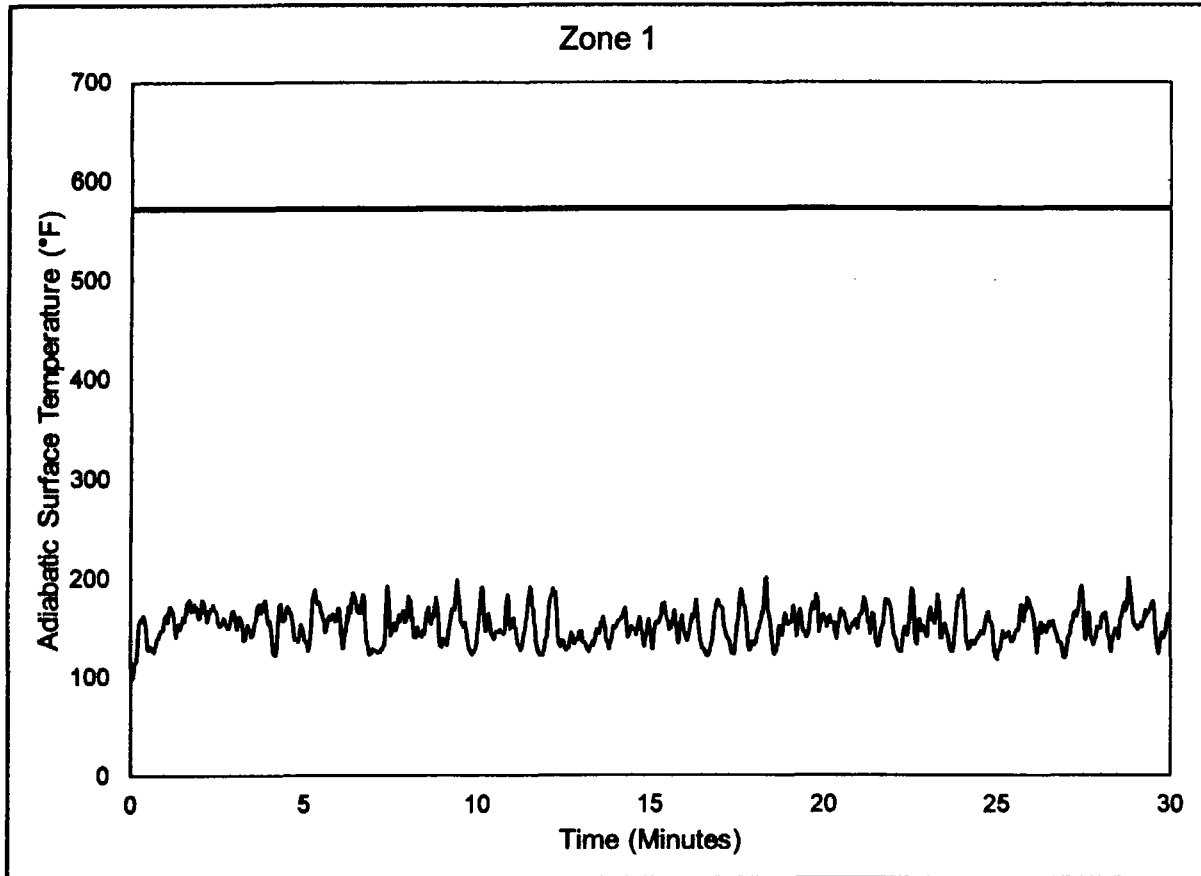


Figure 9: Adiabatic Surface Temperature over Time

The maximum AST of 201°F is less than 572°F which is the maximum temperature exposure that does not need a rating. Therefore, in accordance with this analysis, the east façade of the building is not required to have a rating.

B. Zone 2 – Non-Cantilevered North Façade

As shown in Figure 10 and Figure 11 below, the non-cantilevered north façade of the building reached a maximum of 641°F. Figure 10 shows the moment of maximum AST and Figure 11 shows the temperature AST of the non-cantilevered north façade over time.

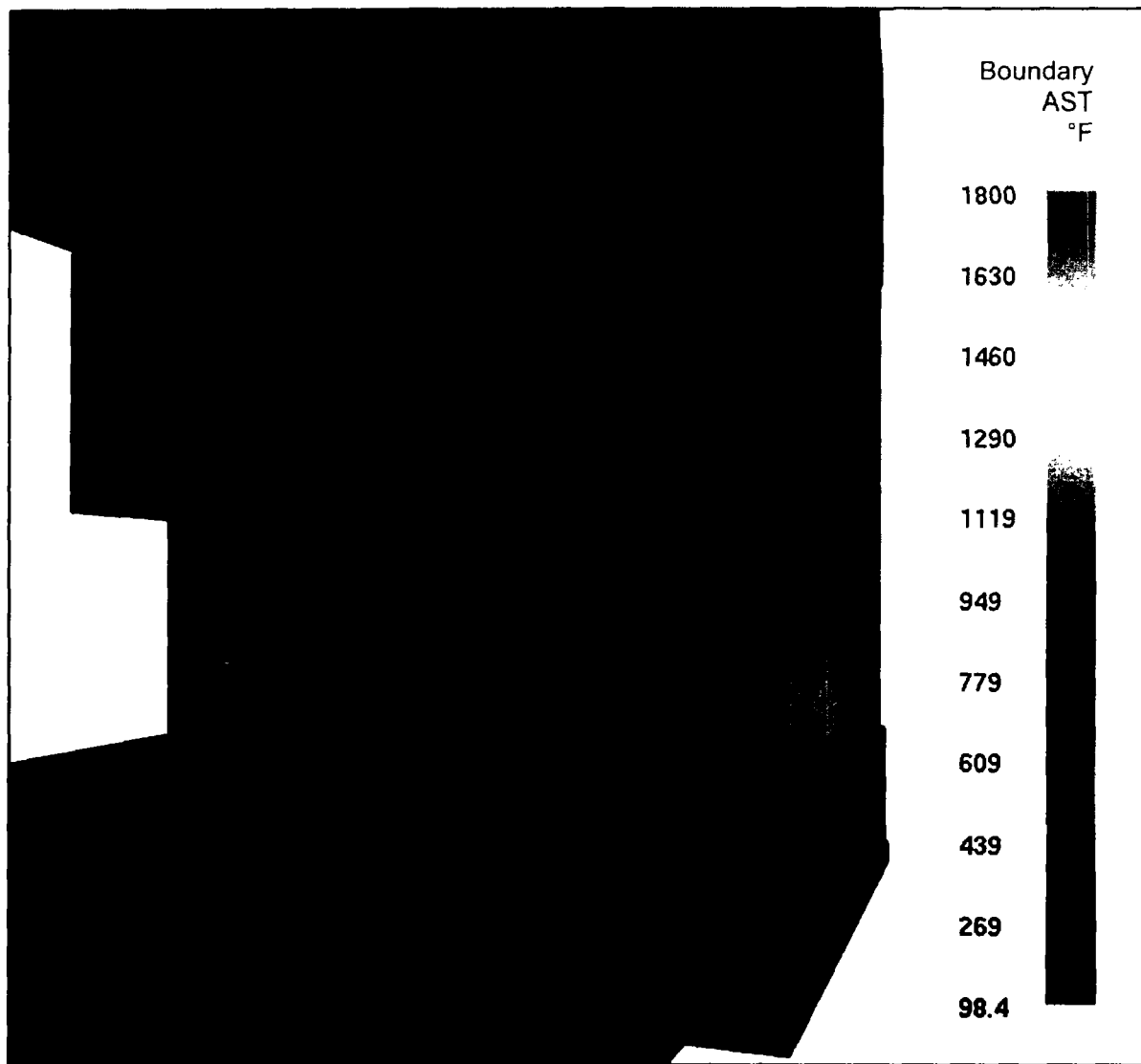


Figure 10: Maximum Adiabatic Surface Temperature

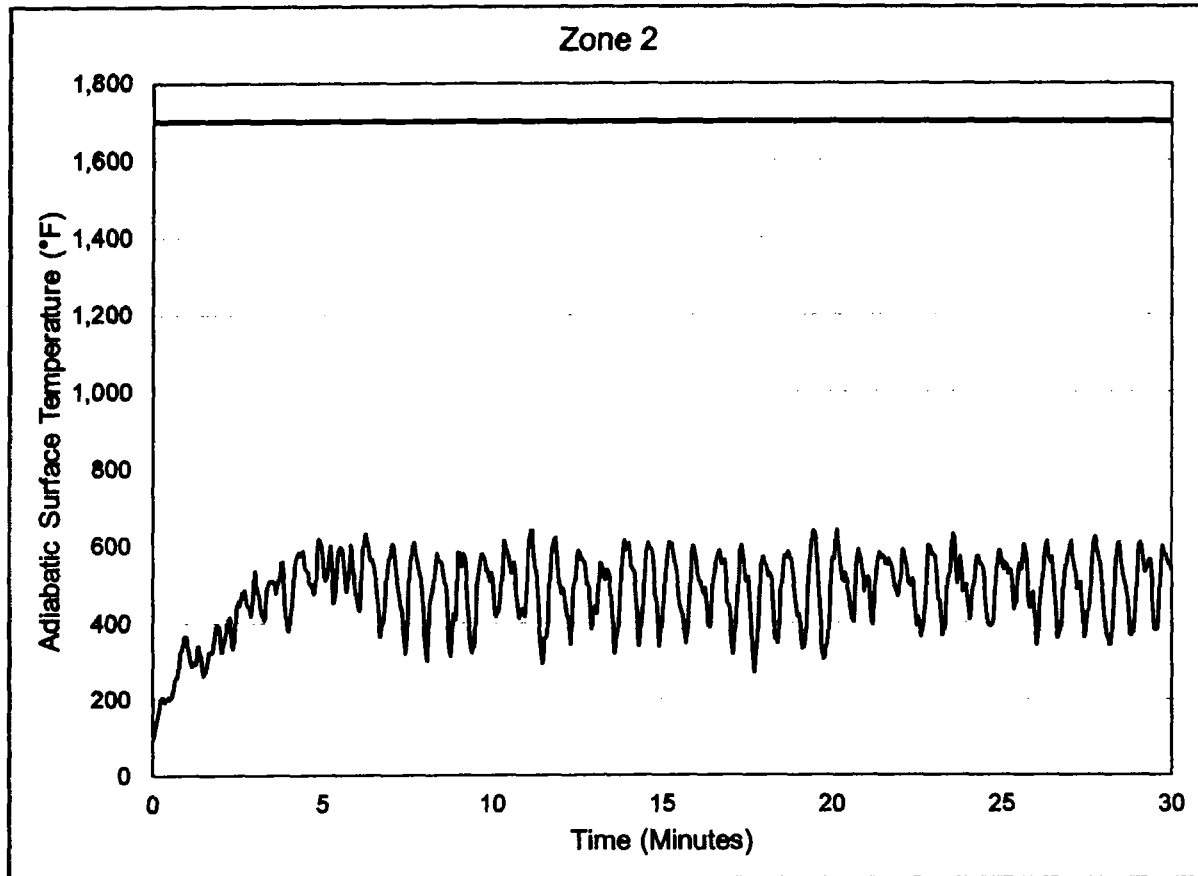


Figure 11: Adiabatic Surface Temperature over Time

The maximum AST of 641°F is more than 572°F but less than 1700°F which is the maximum temperature exposure for a 1-hour ASTM E119 test. Therefore, a minimum 1-hour fire rating for the non-cantilevered north façade is required in accordance with this analysis.

C. Zone 3 – Cantilevered North Façade

As shown in Figure 12 and Figure 13 below, the cantilevered north façade reached a maximum temperature of 409°F. Figure 12 shows the moment of maximum AST and Figure 13 shows the AST of this façade over time.

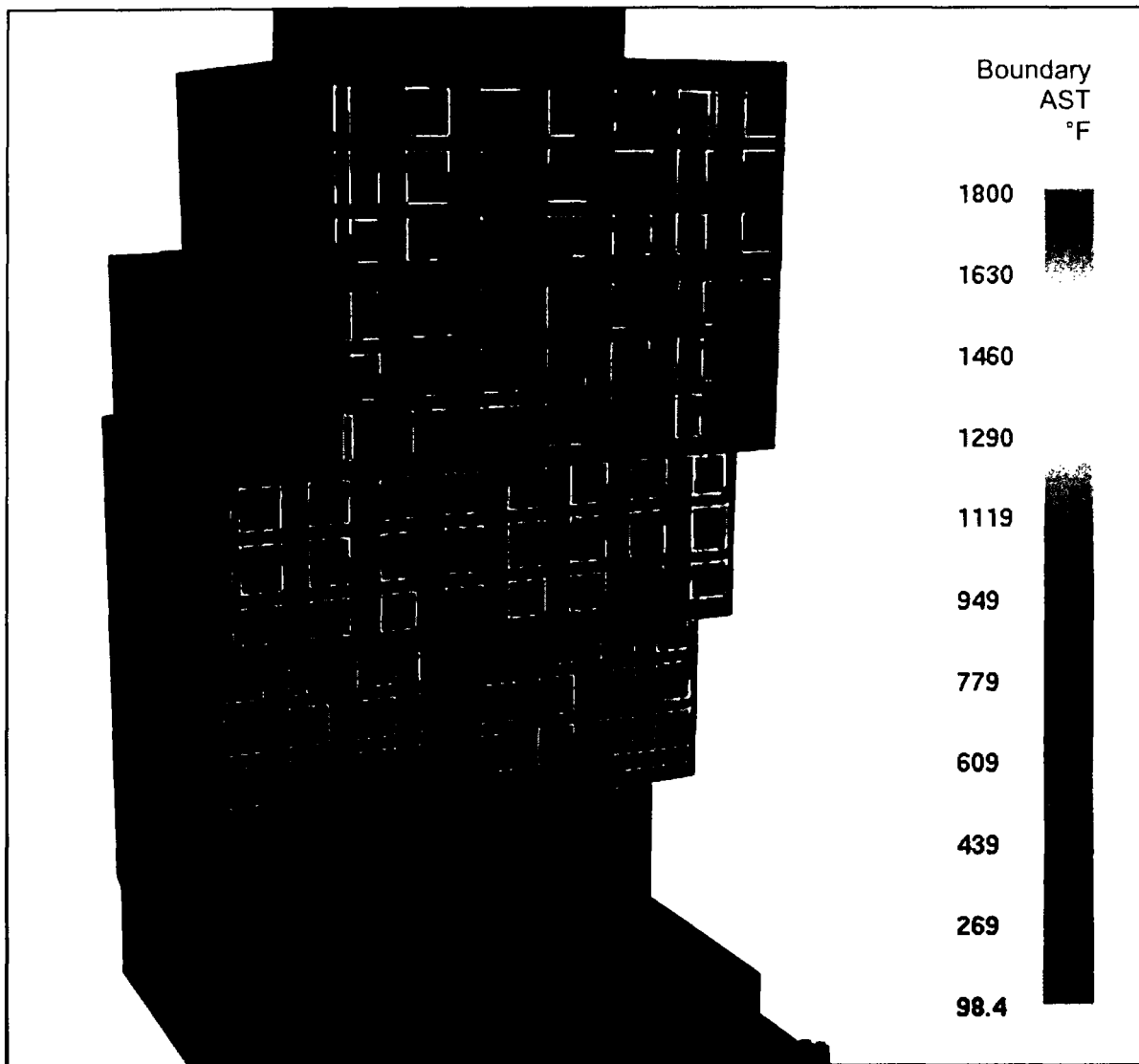


Figure 12: Maximum Adiabatic Surface Temperature

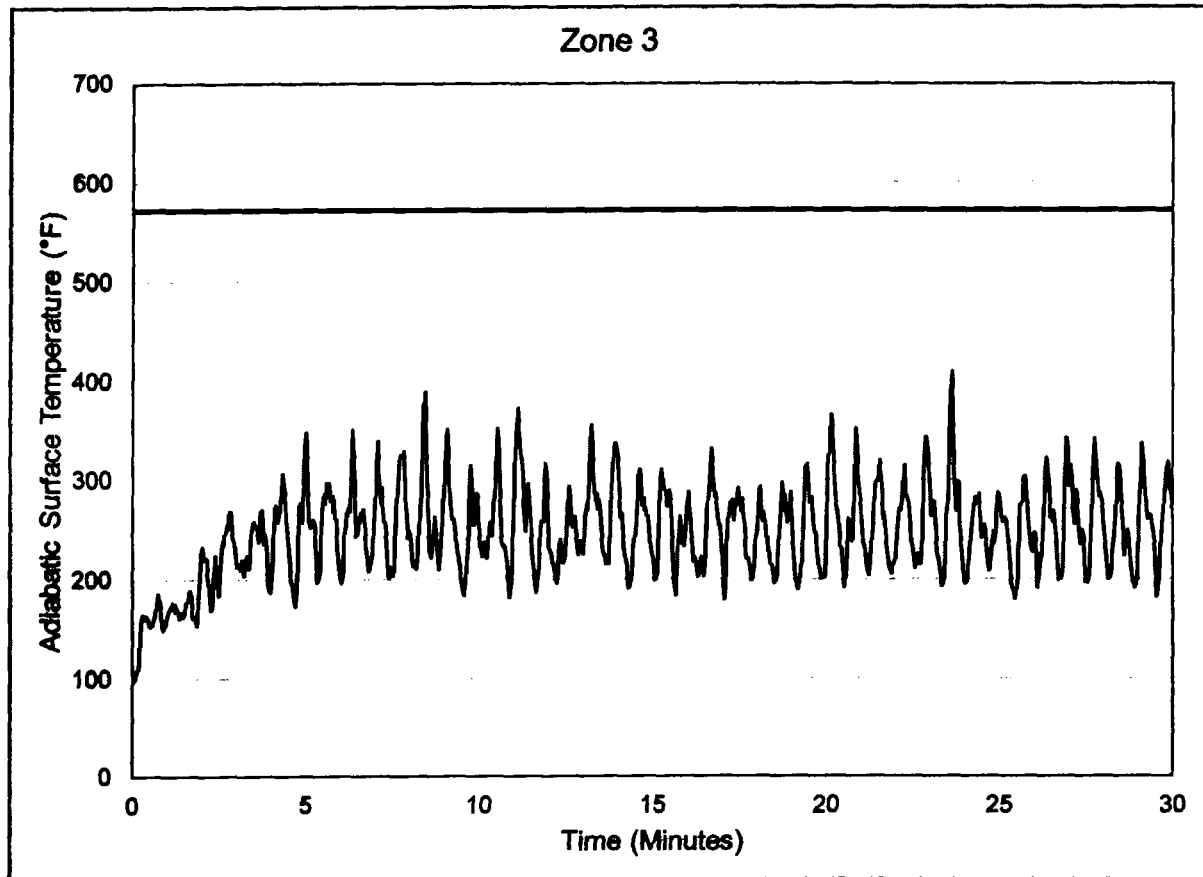


Figure 13: Adiabatic Surface Temperature over Time

The maximum AST of 409°F is less than 572°F which is the maximum temperature exposure that does not need a rating. Therefore, in accordance with this analysis, the north façade of the lower part of the cantilever is not required to have a rating.

D. Zone 4A – Non-Cantilevered West Façade

As shown in Figure 14 and Figure 15 below, the non-cantilevered west façade of the building reached a maximum temperature of 563°F. Figure 14 shows the moment of maximum AST and Figure 15 shows the AST of this façade over time.

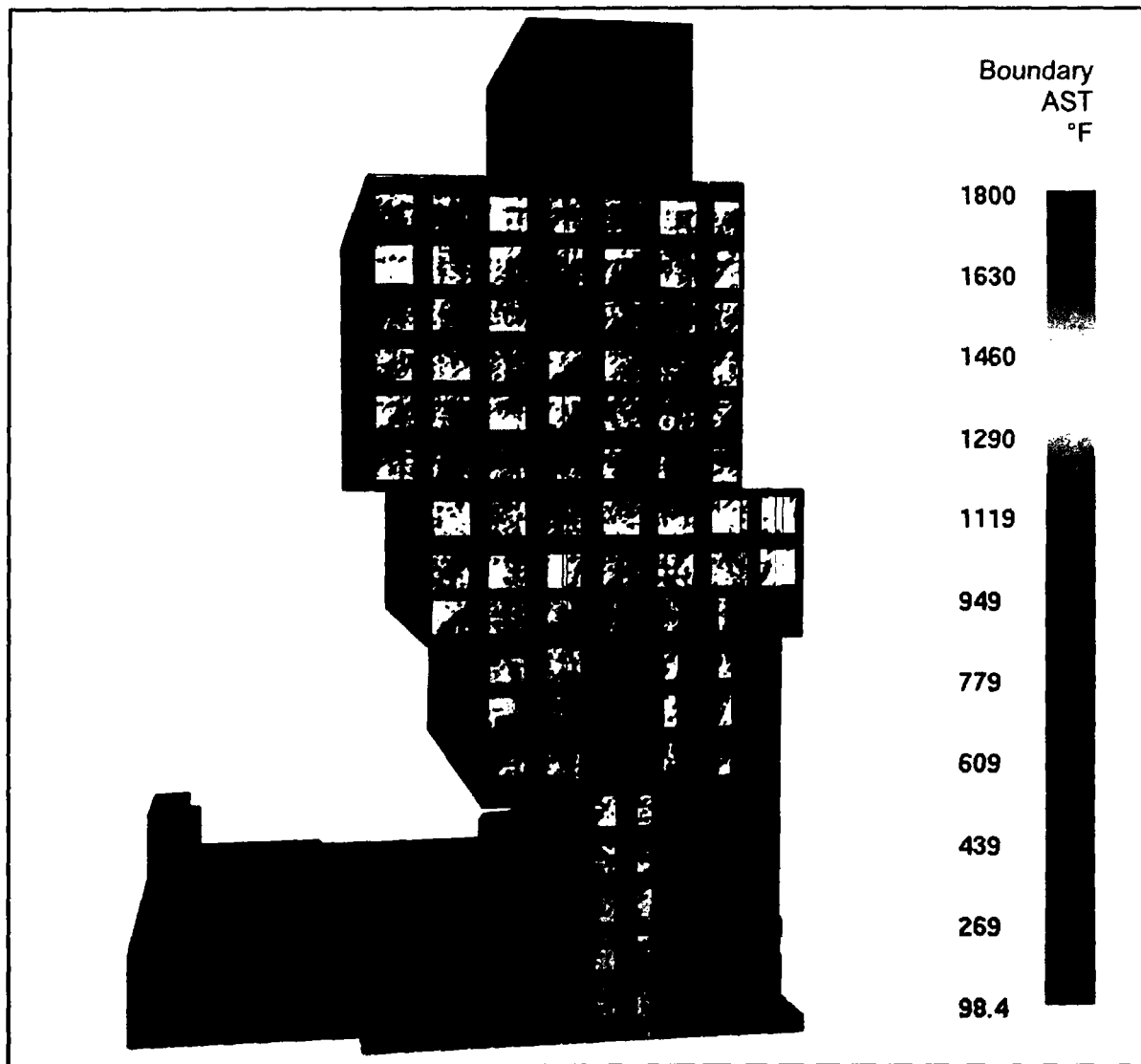


Figure 14: Maximum Adiabatic Surface Temperature

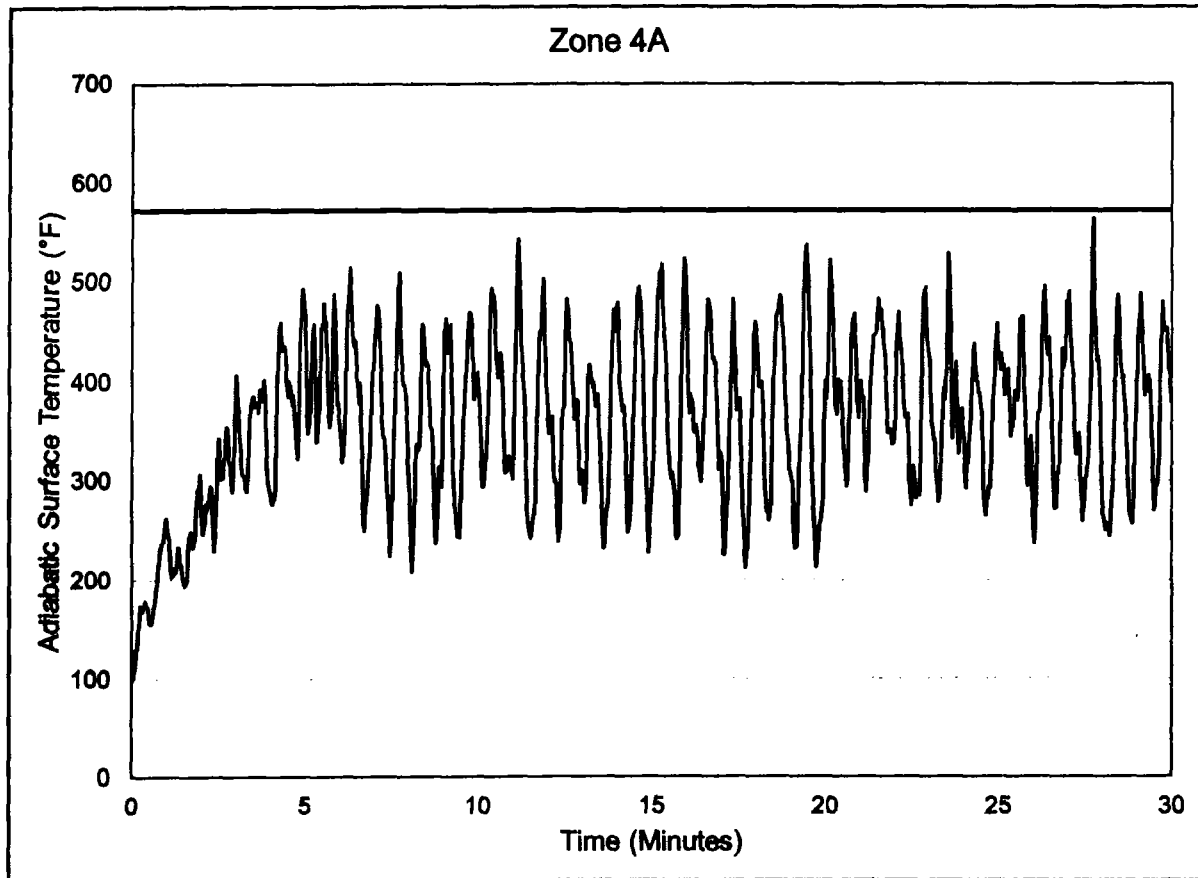


Figure 15: Adiabatic Surface Temperature over Time

The maximum AST of 563°F is less than 572°F which is the maximum temperature exposure that does not need a rating. Therefore, in accordance with this analysis, the west façade of the building is not required to have a rating.

E. Zone 4B – Cantilevered West Façade Soffit

As shown in Figure 16 and Figure 17 below, the cantilevered west façade soffit of the building reached a maximum temperature of 626°F. Figure 16 shows the moment of maximum AST and Figure 17 shows the AST of this façade over time.

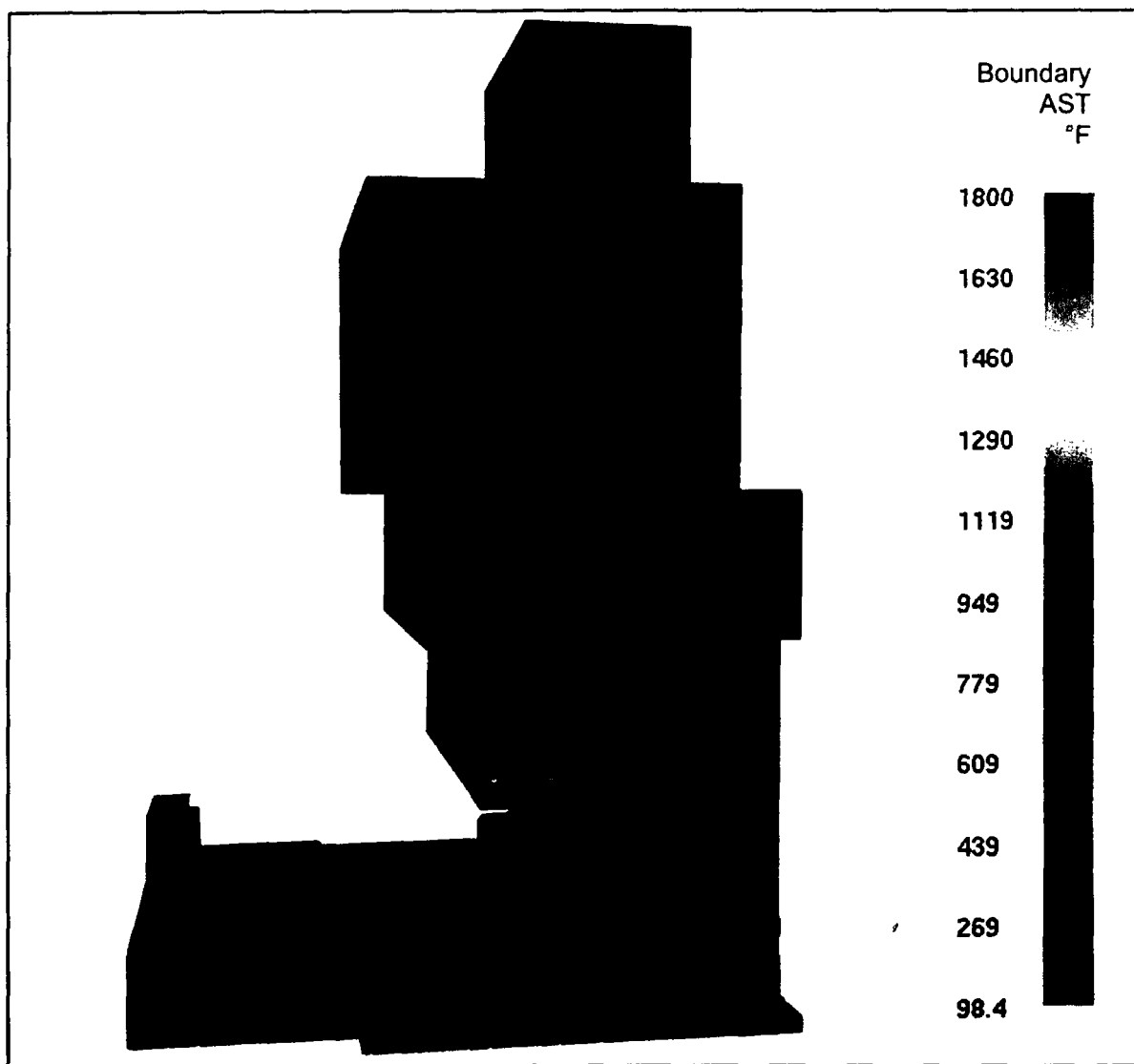


Figure 16: Maximum Adiabatic Surface Temperature

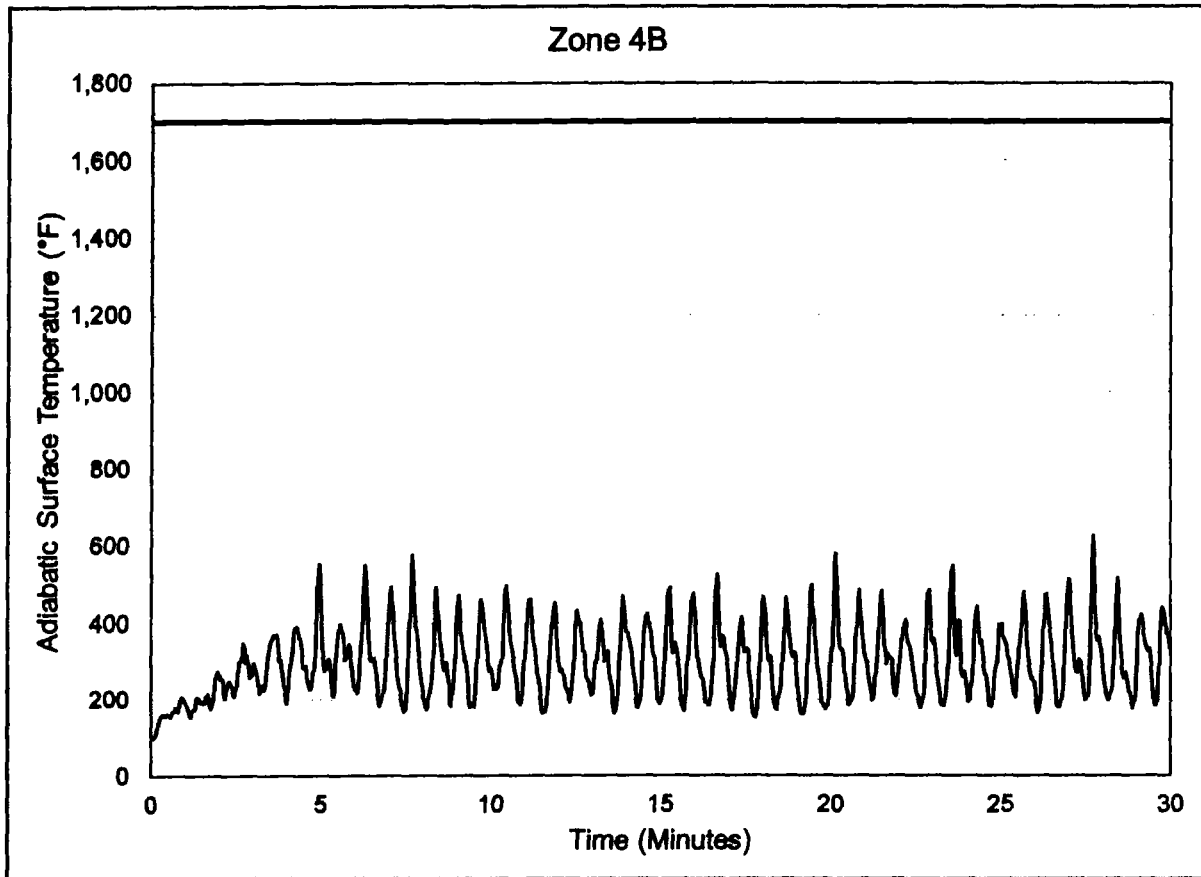


Figure 17: Adiabatic Surface Temperature over Time

The maximum AST of 626°F is more than 572°F but less than 1700°F which is the maximum temperature exposure for a 1-hour ASTM E119 test. Therefore, a minimum 1-hour fire rating for the cantilevered west façade soffit is required in accordance with this analysis. The soffit area required to be 1-hour rated extends approximately 8-feet 3-inches above of the lowest cantilever underside.

F. Zone 5 – Underside of Lower Cantilever

As shown in Figure 18 and Figure 19 below, the underside of the lower section of the cantilever reached a maximum temperature of 602°F. Figure 18 shows the moment of maximum AST and Figure 19 shows the AST of this façade over time.

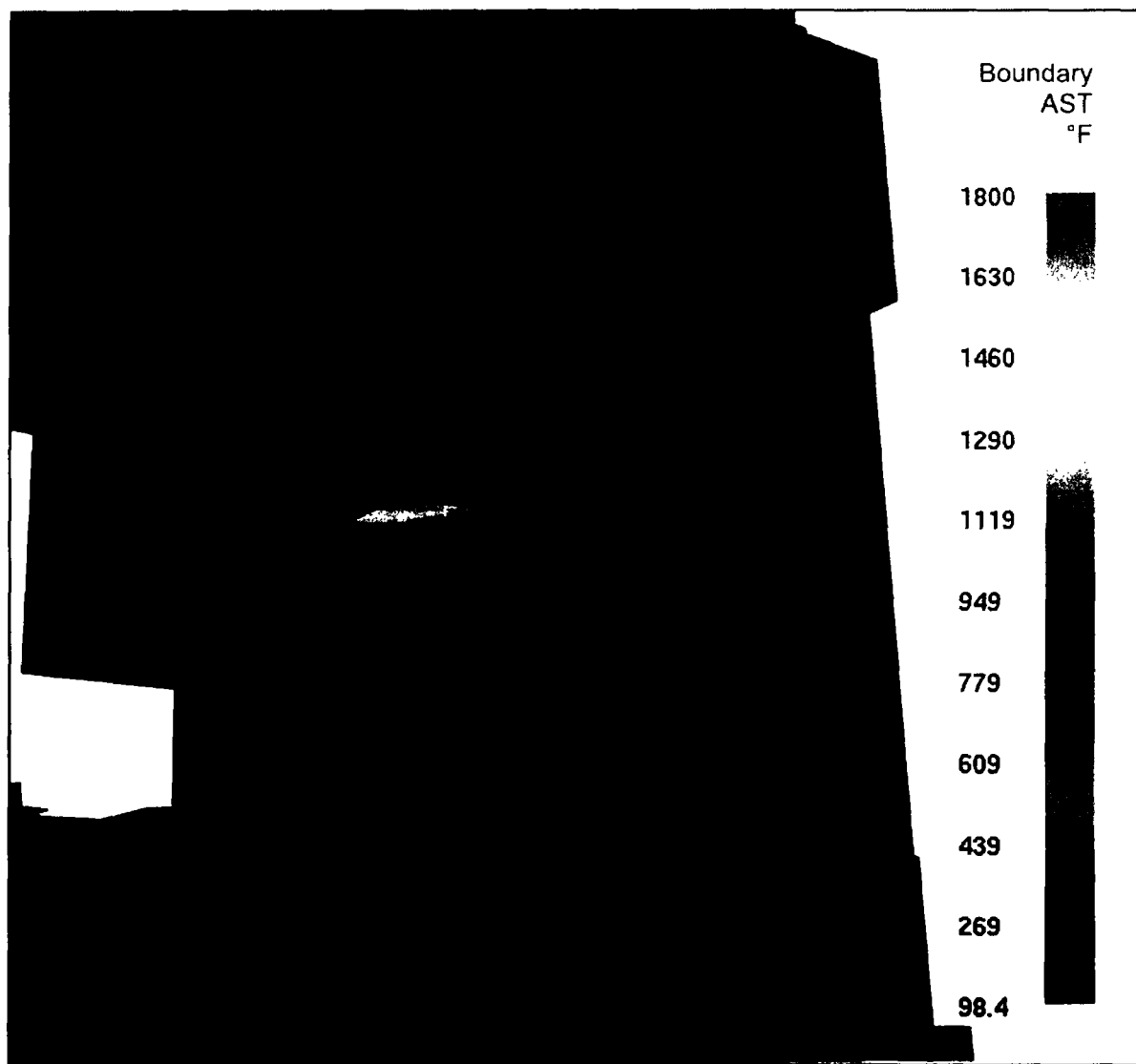


Figure 18: Maximum Adiabatic Surface Temperature

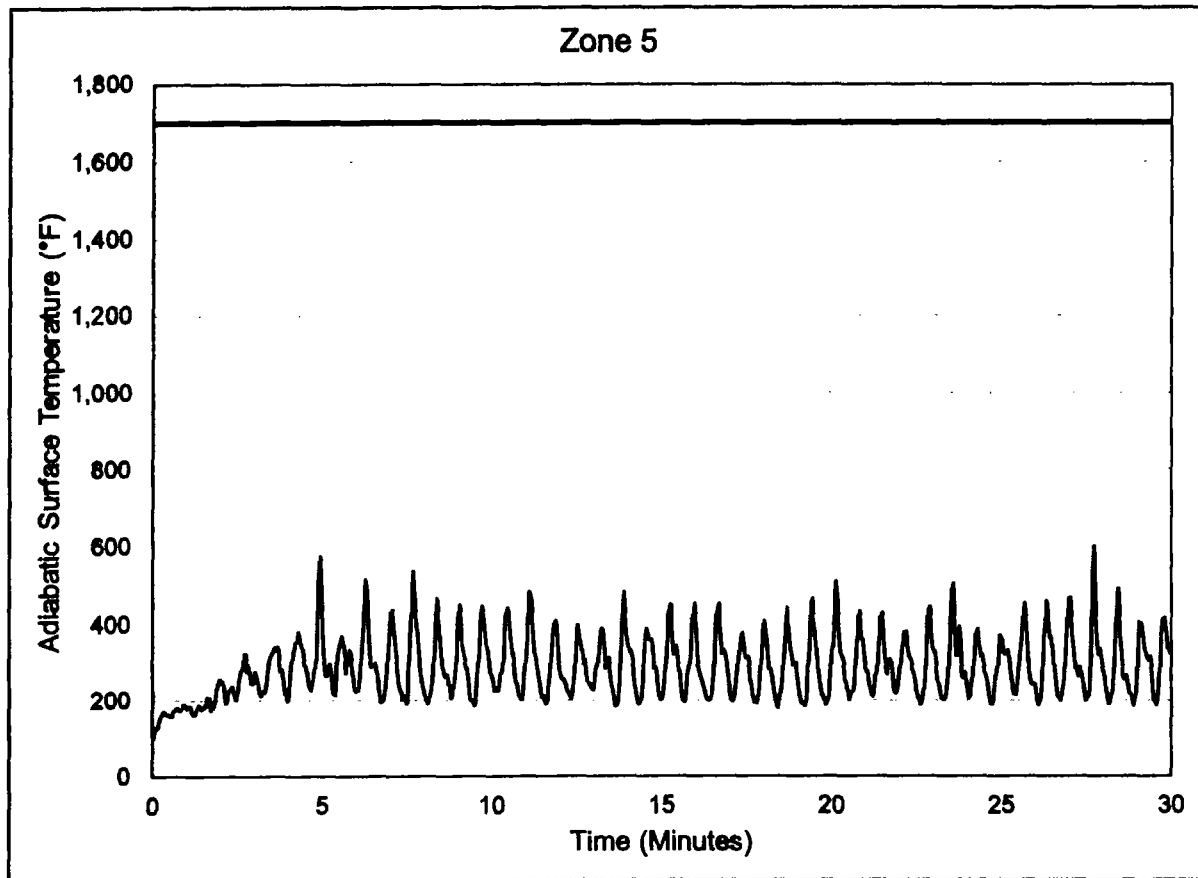


Figure 19: Adiabatic Surface Temperature over Time

The maximum AST of 602°F is more than 572°F but less than 1700°F which is the maximum temperature exposure for a 1-hour ASTM E119 test. Therefore, a minimum 1-hour fire rating for the underside of the lower section of the cantilever is required in accordance with this analysis.

G. Zone 6 – Underside of Middle Cantilever

As shown in Figure 20 and Figure 21 below, the underside of the middle section of the cantilever reached a maximum temperature of 306°F. Figure 20 shows the moment of maximum AST and Figure 21 shows the AST of this façade over time.

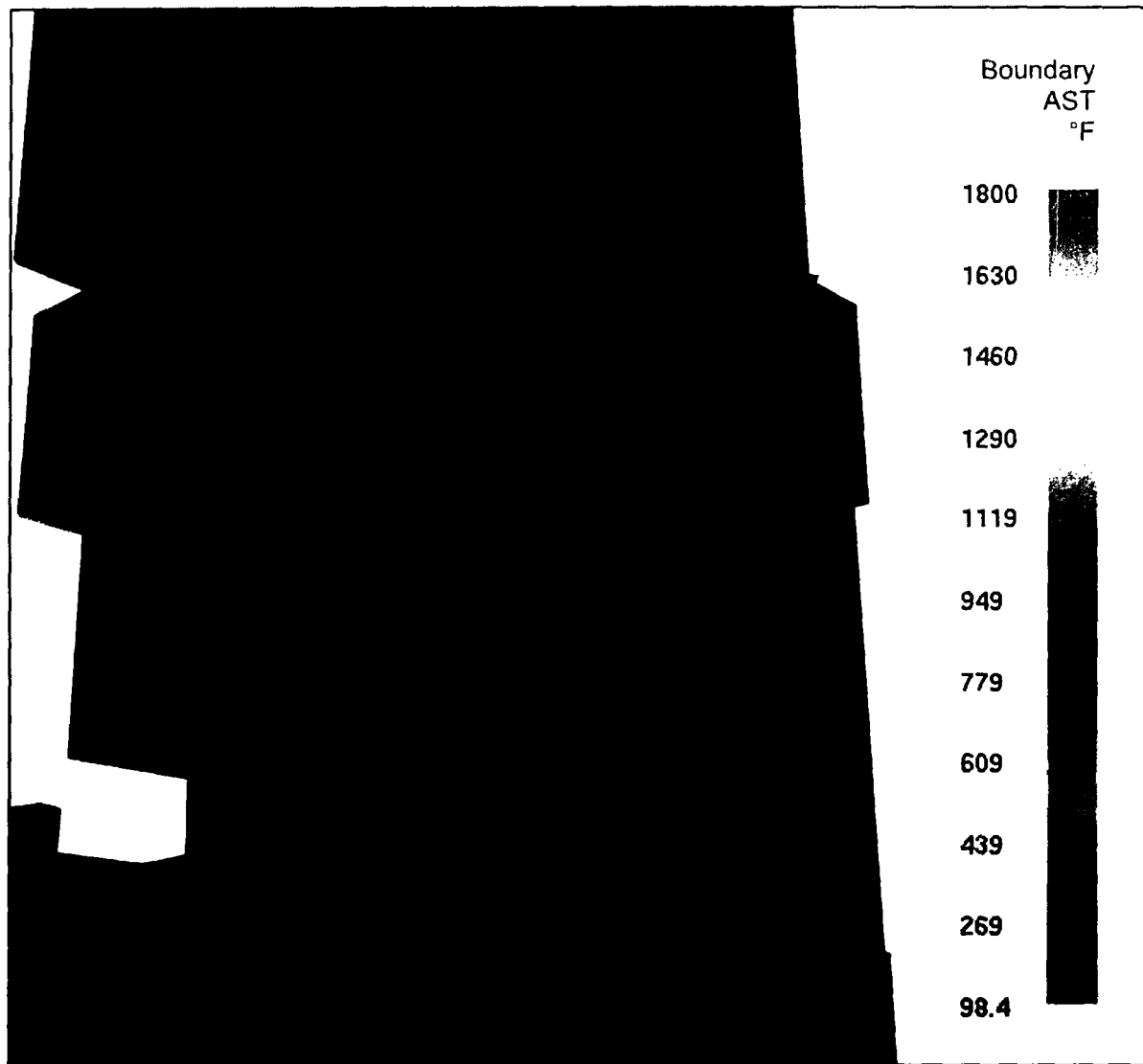


Figure 20: Maximum Adiabatic Surface Temperature

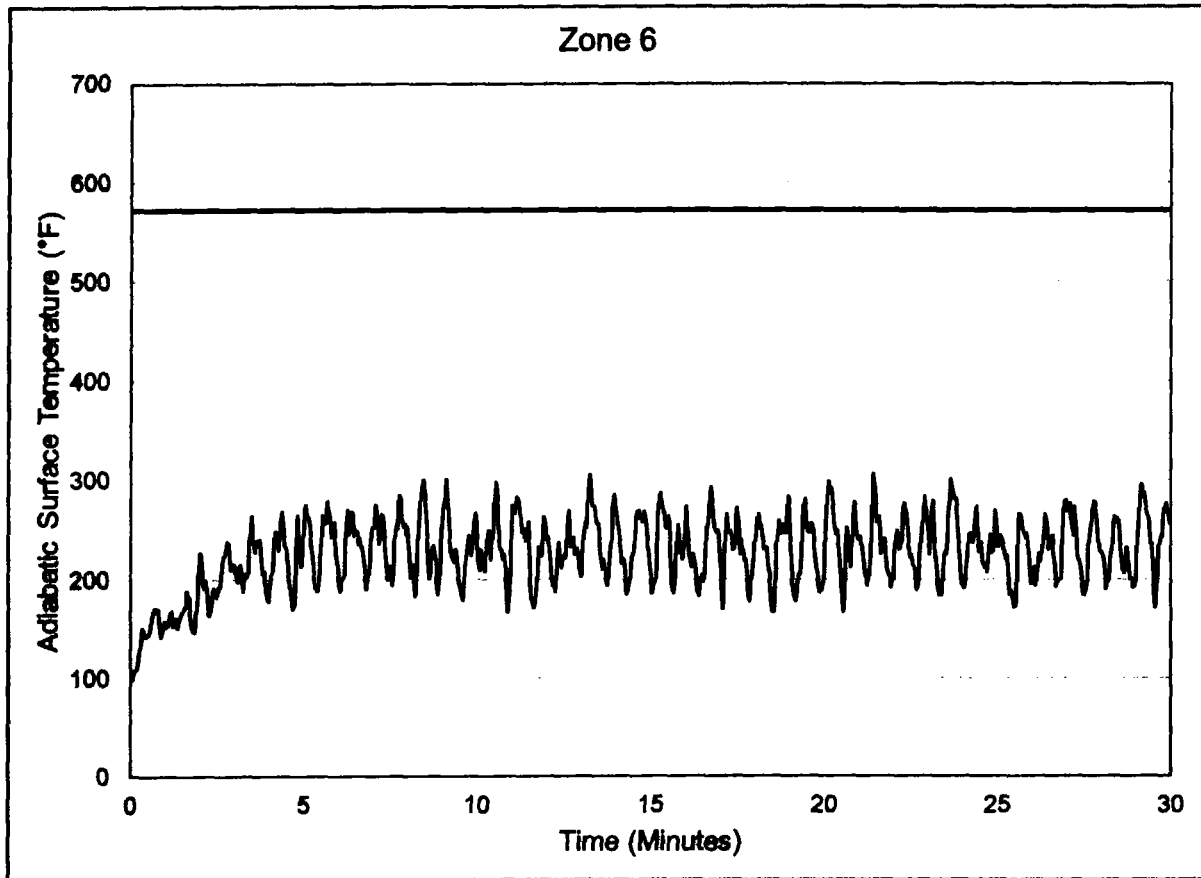


Figure 21: Adiabatic Surface Temperature over Time

The maximum AST of 306°F is less than 572°F which is the maximum temperature exposure that does not need a rating. Therefore, in accordance with this analysis, the underside of the middle section of the cantilever is not required to have a rating.

H. Zone 7 – Underside of Upper Cantilever

As shown in Figure 22 and Figure 23 below, the underside of the upper section of the cantilever reached a maximum temperature of 251°F. Figure 22 shows the moment of maximum AST and Figure 23 shows the AST of this façade over time.

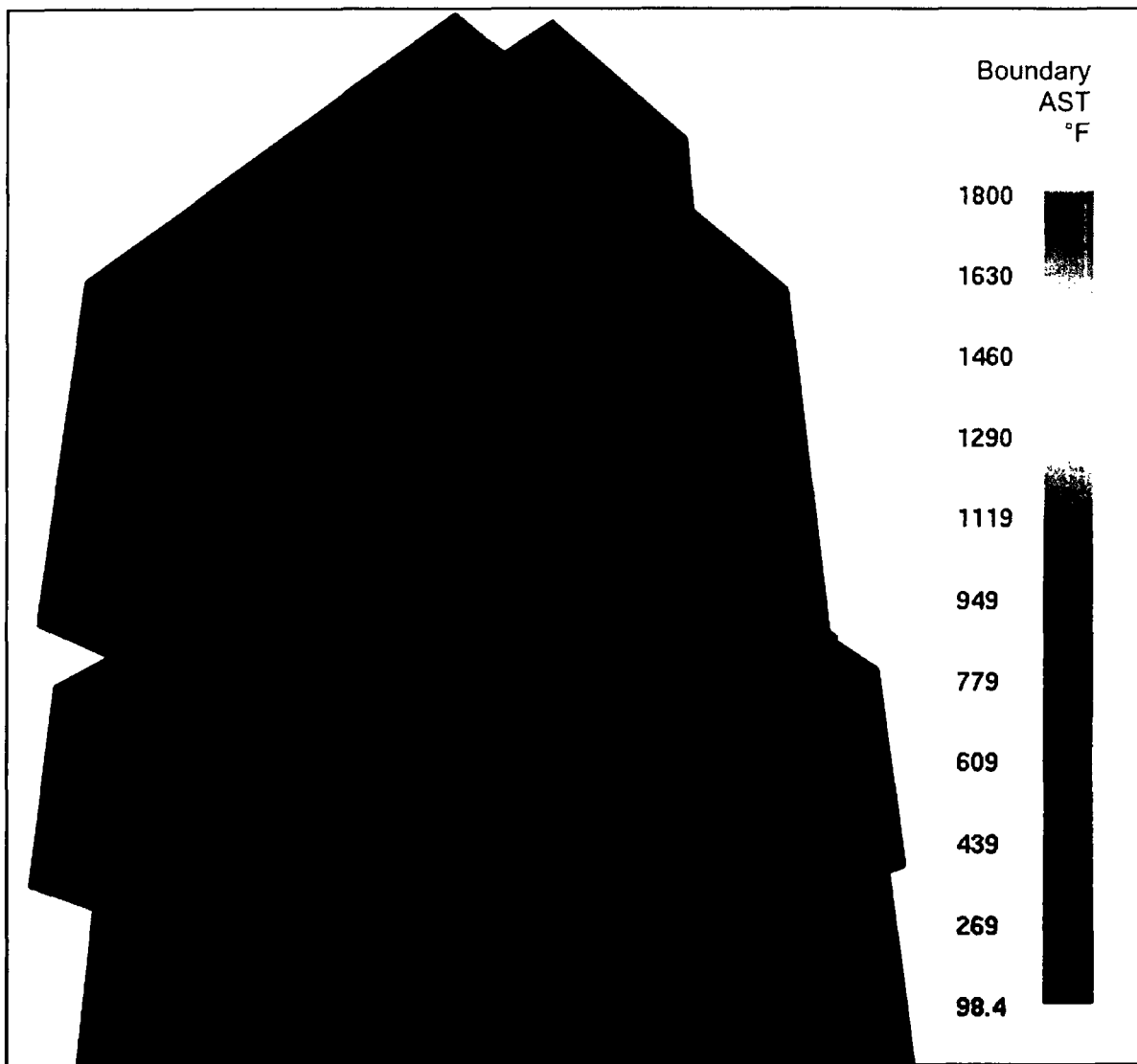


Figure 22: Maximum Adiabatic Surface Temperature

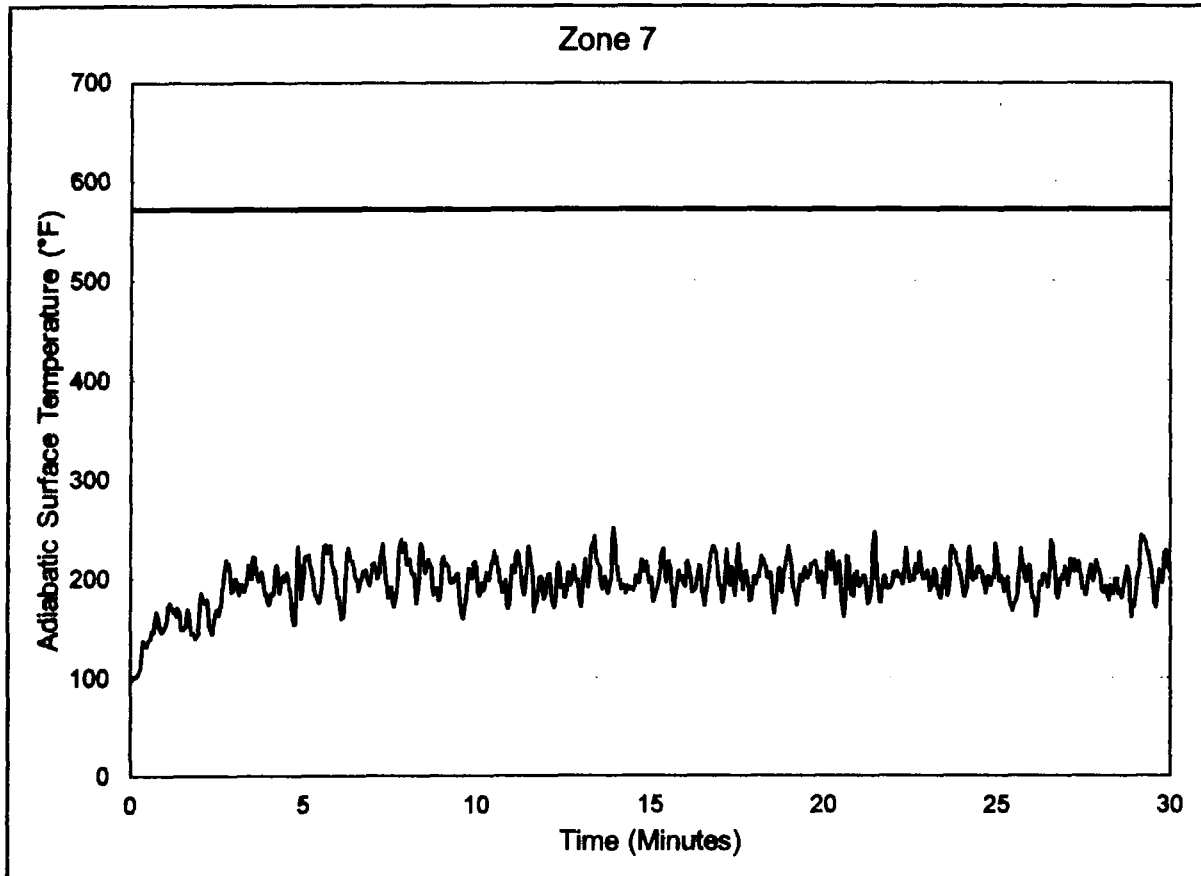


Figure 23: Adiabatic Surface Temperature over Time

The maximum AST of 251°F is less than 572°F which is the maximum temperature exposure that does not need a rating. Therefore, in accordance with this analysis, the underside of the upper section of the cantilever is not required to have a rating.

Section VI



VI. Net Heat Flux Results

An NHF exposure greater than 16 kW/m^2 represents a possibility of flame spread to the cantilevered building through broken windows/glazing, as discussed above. Figure 22 below shows the maximum NHF exposure to the various areas of the cantilevered building. Exposures of 16 kW/m^2 or greater are highlighted in black.

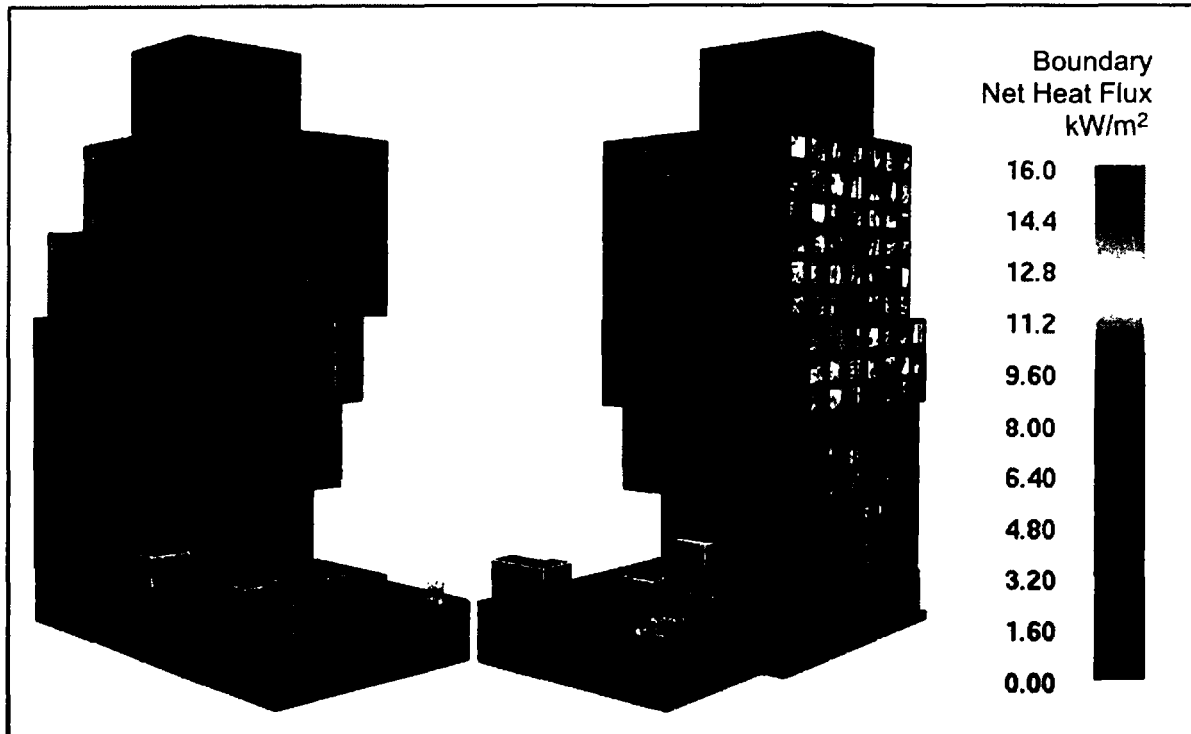


Figure 24: Maximum Net Heat Flux Exposure

As shown above, no façade is exposed to a net heat flux exceeding 16 kW/m^2 . Net heat flux measurement devices located along all exterior façades show that a maximum exposure of 10 kW/m^2 was calculated. Therefore, exterior openings located in these areas will not need to be protected by fire resistance rated assemblies or fire rated glazing tested in accordance with ASTM E119 or UL 263 based on this analysis.

Section VII

The Fire Protection and Life Safety Experts



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VII. Summary

The cantilevered portions of the 2461 Broadway building require 1-hour fire resistance rated construction in specified areas as part of the fire engineering analysis required by Section 705.12 of the NYCBC. Openings in all areas were not exposed to net heat fluxes greater than 16 kW/m^2 and are not required to be protected by assemblies listed in accordance with ASTM E-119 or UL 263 by this analysis. Openings in fire rated wall must still be protected in accordance with the building code for lot line windows and exterior wall openings.

Figure 25 below shows the minimum fire ratings required by this analysis for each zone. Although Zones 3 and 4 do not require a rating per this analysis, the façades are located on a zero-lot line condition and require at least a 1-hour rating and opening protectives (Table 602, Table 705.8). Additionally, Zones 5 through 7 do not require a rating per this analysis but must be fire resistance rated consistent with the building's construction type for floor construction and secondary members (Table 601).

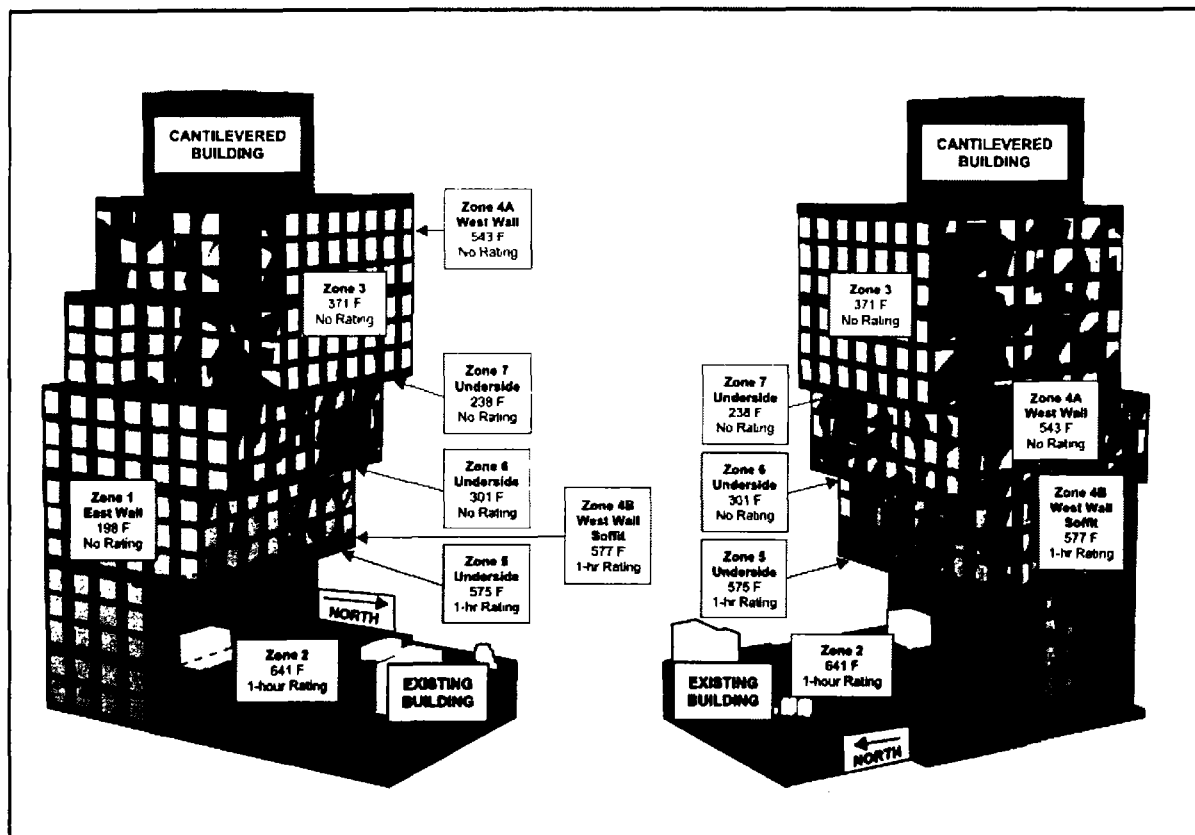
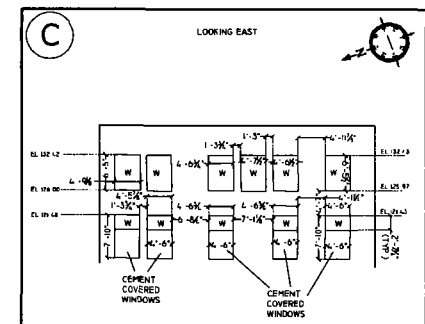
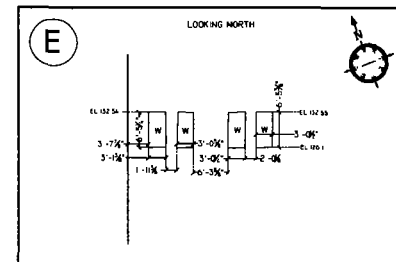
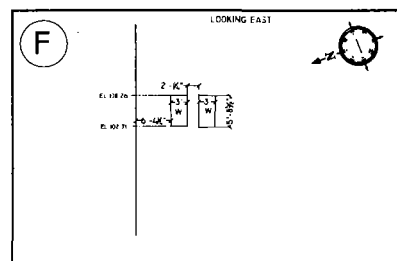
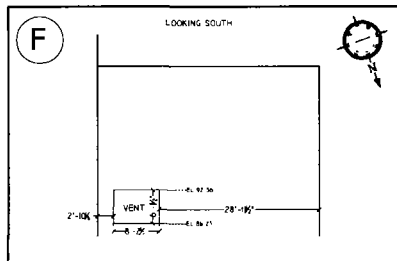
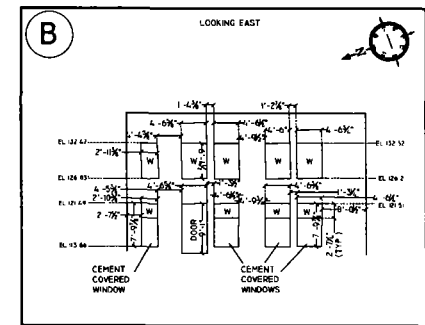
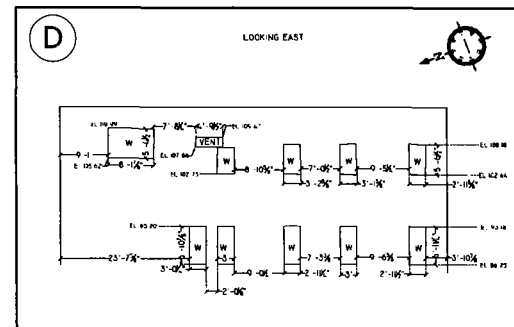
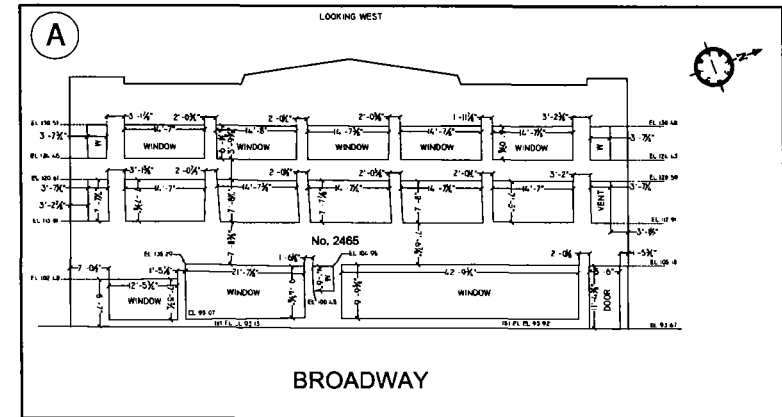
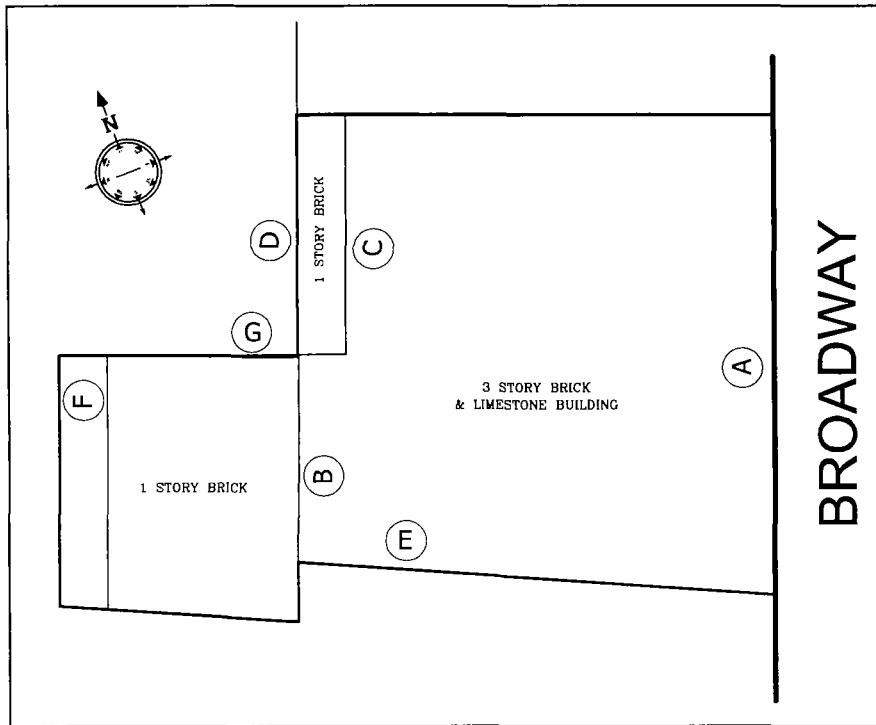


Figure 25: Fire Resistance Ratings per Cantilever Fire Study

Based on the results of the analysis documented in this report, it is the professional opinion of Code Consultants Professional Engineers, PC. that the fire protection and life safety concepts outlined in this analysis will provide a level of safety equal, if not superior, to that intended by the applicable codes.

Appendix A





DATE	DESCRIPTION
JAN. 28, 2019	WINDOW DIMENSION DWG.
BLOCK	1239
LOT	52
SECTION	4
COUNTY	NEW YORK
DWG BY	A.G.
CHKD BY	J.A.
SCALE	NOT TO SCALE

NOTE.
Unauthorized alterations or additions to this survey is a violation of section 7209 of the New York State education law. Copies of this survey map not bearing the land surveyor's inked seal or embossed seal shall not be considered to be a valid true copy. Guarantees or certifications indicated hereon shall run only to the person for whom the survey is prepared, and on his behalf to the title company, governmental agency and lending institution listed hereon, and to the assignees of the lending institution. Guarantees or certifications are not transferable to additional institutions or subsequent owners.

CAUTION.
1) Before performing any digging or drilling on this site, it is required that subsurface services, including the underground main be marked and identified by the utility involved in compliance with industrial code 53 of New York State.
2) All elevations refer to North America Vertical Datum of 1988 (NAVD 88 Datum).
3) Survey is not for title purposes.

ADDRESS
2465 BROADWAY
NEW YORK, N.Y.

56 of 63
58938

EMPIRE STATE
LAYOUT, INC.

TEL 516 679 7570 FAX 516 679 7571
1/4th MILL HOPKINS ST. NEW YORK, NY 11210
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Appendix B



TREE SYM	HYDRANT	WATER VALVE	CATCH BASIN	LIGHT POST	WATER MANHOLE	TELEPHONE MANHOLE	EL ELEVATION	BC-EL ON BOTTOM OF CURB	LG-LEGAL GRADE	C-D-CELLAR DOOR	ENT ENTRANCE	C-L CLEAR	REL ROOF EL	PLAT PLATFORM
ELECTRIC BOX	UTILITY POLE	TRAFFIC SIGN	GAS VALVE	PARKING METER	ELECTRIC MANHOLE	SEWER MANHOLE	TC-EL ON TOP OF CURB	C-EL ON CENTER OF ROAD	LA LOW AREA	F-FIRE ESCAPE	RT-RIGHT ON LINE	ENC ENCROACHMENT	T-W EL OF TOP WALL	A-C AIR CONDITION

ADDRESS
2486 BROADWAY
NEW YORK, N.Y.

WEST 92ND STREET

50'-0"

100'-0"

BROADWAY

101'-03"

EL 94.36'

EL 94.36'

EL 94.36'

EL 94.36'

EL 94.36'

EL 94.36'

EL 94.36'

EL 94.36'

CELLAR EL 81.74'
1ST FLOOR EL 93.74'
2ND FLOOR EL 109.74'
3RD FLOOR EL 122.32'
ROOF LANDING EL 134.53'

DATE	DESCRIPTION
JANUARY 28, 2019	ROOF SURVEY
BLOCK	1239
LOT	52
SECTION	4
COUNTY	NEW YORK
DWG BY	A.G.
CHKD BY	J.A.

SCALE 1"=10'
58 of 63
58938

EMPIRE STATE
LAYOUT, INC.

731 212-6710 7306 BROADWAY NEW YORK, N.Y. 10011
212 212-6710 212 212-6710 212 212-6710



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Hazardous Materials and Process Analysis
Smoke Control System Design
Due Diligence and 3rd Party Reviews

May 1, 2019

Jesse Dorfman
AARE Broadway Investors, LLC
850 3rd Avenue, Suite 13D
New York, NY 10022

RE: Peer Review for the Fire Engineering Analysis for Cantilevered Building – 2461 Broadway

Dear Mr. Dorfman:

Pursuant to the requirements of NYC Department of Buildings, Technical Buildings Bulletin 2017-014 (BB 2017-014), Cosentini has performed a peer review of the Fire Engineering Analysis performed by Code Consultants Professional Engineers, PC (CCI) for the proposed cantilevered building at 2461 Broadway. Cosentini reviewed the analysis report April 25, 2019; signed and sealed by Kevin D. Morin (NYS PE 084640). This letter constitutes our agreement with the methods demonstrated in the report. Specifically, the report was reviewed for the following:

- **Modeling Conditions** – The scope of this project is a new 19-story residential condominium building (Occupancy Group R-2) at 2461 Broadway in Manhattan. The new building will include a cantilever over an adjacent existing building at the 8th, 11th, and 14th floors. The existing building at 2465 Broadway is an Equinox Fitness Club (1968 BCCNY Occupancy Group C: Mercantile). The building is 3 stories (39 feet) in height, and is of Type I-C Non-Combustible Construction per the 1968 BCCNY. The existing building contains a sprinkler and fire alarm system. The distance between the existing noncombustible roof and the underside of the new cantilever ranges from approximately 36 to 100 feet at the three cantilevered tiers.
- **Heat Release Rate** – Since existing Equinox building is of Type I-C construction, the roof is noncombustible, with a fire-resistance rating of 1-hour. Pursuant to BB 2017-014, the model assumes a design fire on the uppermost floor, in this case the 3rd floor. Based on the limited number of exterior openings (windows) the maximum fire size on this floor would easily become ventilation-limited. The maximum fire size with optimal ventilation was determined by the SFPE Handbook as 160 MW. Based on

the total floor area of 9,267 square feet, the Heat Release per Unit Area (HRRPUA) was calculated as 186.3 kW/m².

- **Simulation Duration** – The limited fuel load density associated with the fitness use on the 3rd floor would yield a duration of less than 30 minutes. BB 2017-014 prescribes a minimum of 30 minutes. Therefore, the duration was set to 30 minutes.
- **Ventilation Conditions** – Optimal ventilation was modeled by removal of all exterior openings on the third floor (fire floor).
- **Ambient Exterior Conditions** – The model ran with a summer design condition, with an ambient temperature of 98.4°F provided by ASHRAE.
- **Exterior Enclosure Conditions** – The exterior of the new R-2 building at 2451 Broadway will be constructed of wholly noncombustible materials. A conservative temperature of 572°F was used as the maximum allowable temperature for a non-rated exterior wall. This value represents the piloted ignition of wood, the piloted ignition temperature of any exterior materials will be greater than this value.
- **Design Fire Scenario** – The design fire consisted of heat release rate per unit area of 186.3 kW/m², applied at the third floor (highest floor below the noncombustible roof) for a duration of 30 minutes. The fire reached its peak heat release rate at approximately around 5 minutes and remained at its peak for the remainder of the 30-minute duration, as shown in Figure 3. This graph indicates, that the fire was subject to maximum ventilation conditions for the entire duration. This graph also indicates that no intervention from Fire Department or other fire protection systems was accounted for.

The results of the model show that Zones 2 and 5, which represent the underside and perpendicular surface closest to the Equinox roof, exceeded the non-rated failure temperature of 572°F. Zone 4 (the west façade) also reached temperatures close to that value. Pursuant to the exterior wall requirements of the Building Code, these walls would require a 1-hour rating. The temperature values reached on these surfaces is far below the maximum temperature value for a 1-hour fire-resistance rated assembly per ASTM E119. In conclusion, the cantilever condition does not yield a fire condition which requires any additional fire-resistance ratings beyond what is required for exterior walls with a fire separation distance of zero. The model results show that all cantilever surfaces reach a maximum temperature below that required of the 1-hour rating.

May 1, 2019

In conclusion, Cosentini Associates has completed a peer review of the Fire Engineering Analysis completed by Code Consultants Professional Engineers, PC and has found it acceptable and in compliance with basic engineering principles, the Building Code, and other applicable laws and rules of the Department and its Bulletins.

Please contact me with any additional questions or comments.


Cathleen T. Childers, P.E. | Fire Protection Engineer
Code and Fire Engineering Group
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