

CODE RED CONSULTANTS

High-Rise Construction Code Compliance

July 20, 2016

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Who is Code Red Consultants?

- Fire Protection / Life Safety Code Consulting Firm
 - Building Code Consulting
 - Performance Based Design
 - Construction Site Safety Planning & Impairment Plans
 - Special Inspection Services on Smoke Control
- Independently owned and operated
- Currently 12 engineers with Masters Degree in FPE; 9 PE's
- Code Blog at WWW.CRCFIRE.COM
 - REGISTER TO RECEIVE AUTOMATIC EMAILS

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Presentation Overview

- What is a high-rise?
- What are the unique requirements?
 - Fire Alarm
 - Fire Protection
 - Smoke Control
 - Construction
- 2015 Changes (8th Ed → 9th Ed)
- Special Fire Protection Challenges
- Unique Boston Requirements



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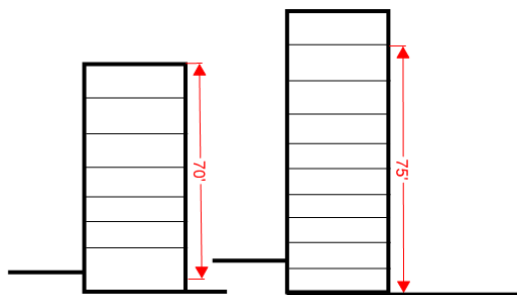
What is a high rise?

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Is Your Building a High-Rise?

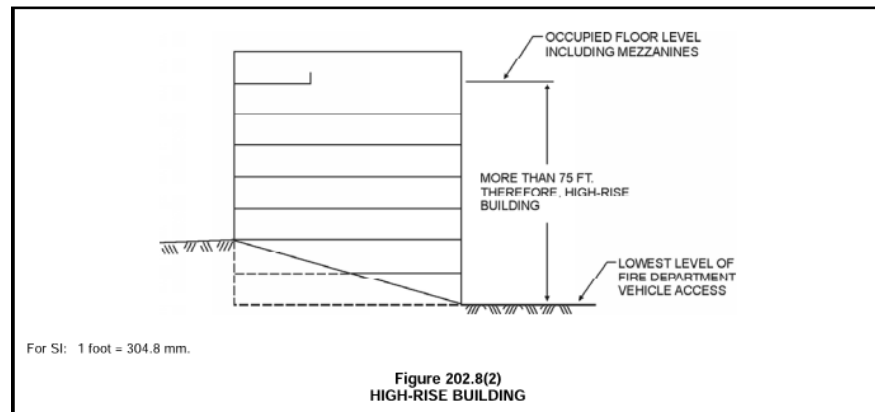
- Massachusetts:
 - Buildings more than 70 ft in height above grade plane.
- Base IBC definition differs:
 - Buildings with an occupied floor located more than 75 ft above the lowest level of fire department vehicle access



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Base IBC Methodology



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Example of Application of MA Requirement

- Height to highest occupied floor: 52'
- Roof Height 72'
- High rise under 780 CMR amendments to IBC



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MA High Rise Definition- FAQ: Roof Top Structures

- FAQ: Do you measure to the roof of a penthouse?
 - A: Not if it's a true mechanical penthouse. (1/3 of the area of the supporting roof; use restricted to mechanical equipment only)

1509.2.2 Area limitation. The aggregate area of penthouses and other rooftop structures shall not exceed **one-third the area of the supporting roof**. Such penthouses shall not contribute to either the *building area* or number of stories as regulated by Section 503.1. The area of the penthouse shall not be included in determining the *fire area* defined in Section 902.

1509.2.3 Use limitations. A *penthouse*, bulkhead or any other similar projection above the roof shall not be used for purposes **other than shelter of mechanical equipment or shelter of vertical shaft openings in the roof**. Provisions such as louvers, louver blades or flashing shall be made to protect the mechanical equipment and the building interior from the elements. Penthouses or bulkheads used for purposes other than permitted by this section shall conform to the requirements of this code for an additional *story*. The restrictions of this section shall not prohibit the placing of wood flagpoles or similar structures on the roof of any building.

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MA High Rise Definition- FAQ: Roof Parapet

- FAQ: Do you measure to the top of a parapet?
 - A: No, measurement is taken to the roof surface

HEIGHT, BUILDING. The vertical distance from *grade plane* to the average height of the highest roof surface.



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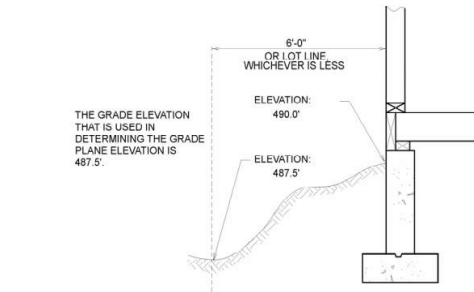
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MA High Rise Definition FAQ: Grade Plane

FAQ: How far away from the building can I measure when determining grade plane?

A: The measurement is taken from the building to the lot line or a point 6' away, whichever is less

GRADE PLANE. A reference plane representing the average of finished ground level adjoining the building at *exterior walls*. Where the finished ground level slopes away from the *exterior walls*, the reference plane shall be established by the lowest points within the area between the building and the *lot line* or, where the *lot line* is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

Figure 202.7(3)
DETERMINATION OF GRADE PLANE WHERE GRADE SLOPES AWAY FROM THE EXTERIOR WALL.

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Unique Requirements



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Special Occupancy – Section 403

- High-Rise buildings are regulated by the special occupancy provisions in Chapter 4 of the building code.
- Compliance with these requirements in addition to other common chapters.

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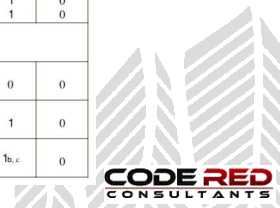
Construction Type

- Typically due to their height, most high-rise buildings are Type IA
 - Type IA FRR reduction to Type IB FRR if < 420'
 - EXCEPT Columns supporting floors!
 - Type IB FRR reduction to Type IIA FRR
 - Except Group F-1, M, S-1, open parking structures, and H Occupancies

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	Ad	B	Ad	B	HT	Ad	B
Primary structural frame ^a (see Section 202)	3 ^a	2 ^a	1	0	1	0	HT	1	0
Bearing walls Exterior ^{a, c} Interior	3 3 ^a	2 2 ^a	1 1	0 0	2 1	2 0	.2 I/HT	1 1	0 0
Nonbearing walls and partitions Exterior Interior ^a	See Table 602								
Nonbearing walls and partitions Interior ^a	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and secondary members (see Section 202)	1½ ^b	1b.c	1b.c	0c	1b.c	0	HT	1b.c	0

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Sprinkler Systems

- ALL high rises are required to be sprinklered
 - 780 CMR 403.3
 - M.G.L. Ch. 148 Sec. 26A
- Fire pumps require a supply from two mains on different streets via separate piping for independent operation of pump.
 - Two connections to same street main if isolation valve used.
 - Under 9th Edition, only required for buildings > 420 feet tall

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Sprinkler Systems

- Secondary Water Supply could be required if Seismic Category C, D,E, or F (sized for 30 minutes of sprinkler water)
- Under the 9th Edition, secondary water supplies are now required to be designed to operate automatically

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Emergency Systems

- Fire Alarm Systems
 - Smoke Detection (907.2.13.1)
 - Nonsprinklered MEP space
 - Elevator Lobbies and EMRs
 - Duct Detection
- Emergency voice/ alarm communication system
 - Required in all high-rises regardless of occupancy (Group A > 300 occupants)
- Emergency Responder Radio Coverage (907.13.2)
 - Exception to use wired system typically not permitted in Boston/Cambridge



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Fire Command Center

- 200 ft² room (min 10' dimension)
- 1-hour FRR
- AHJ approved location



Voice Alarm Control	Elevator Location Panel	Stair Door Unlocking	FD Telephone	Elevator Recall Switch
FD Communication System	Air Distribution Status/Controls	Sprinkler Valve/WF Detector Displays	Fire Pump Status	Genset Supervision and Controls
Fire Detection/Alarm Annunciator	Smoke Control Panel	Emergency/Stand by Power Status	Building Plans	Work Table

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Emergency/Standby Power

- Standby Power
 - FCC Lighting and Power
 - Smokeproof Enclosure Ventilation and Fire Detection
 - Elevators
- Emergency Power
 - Exit Signage/Egress Illumination
 - Elevator Car Lighting
 - Voice/ Alarm Communication
 - FA System
 - Fire Pump (if electric)
 - Fire Detection Systems

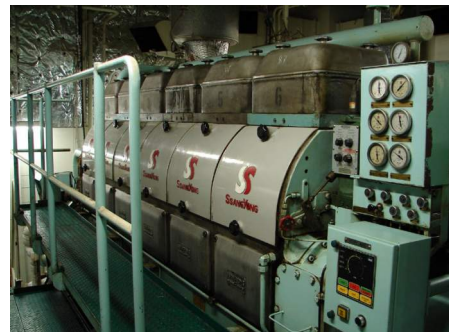


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Emergency/Standby Power

- 9th Edition Update
- Fuel lines supplying a generator required to be separated from other areas of the building with 2-hour FRR (or 1-hr if building is sprinklered)

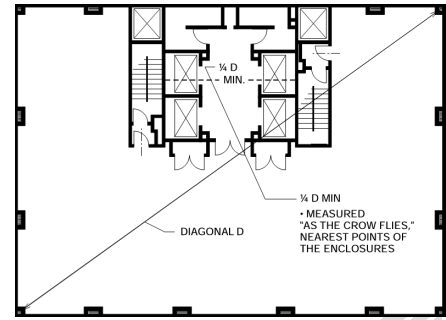


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Means of Egress

- Stair Enclosure Remoteness – at least two of the required stairs to be separated by the lesser of either of the following:
 - 30 feet between nearest points of enclosures \geq ; or
 - $\frac{1}{4}$ the maximum overall dimension of the area served.
- Section applies in addition to 1015.2,
Requiring 1/3 separation



EXAMPLE:
DIAGONAL DIMENSION = 132' - 0"
 $\frac{1}{4}$ OF DIAGONAL = 132 ÷ 4 = 33'
SINCE $\frac{1}{4}$ DIAGONAL EXCEEDS 30 FEET -
ENCLOSURES MUST BE SEPARATED BY 30 FEET

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Smokeproof Exit Enclosures

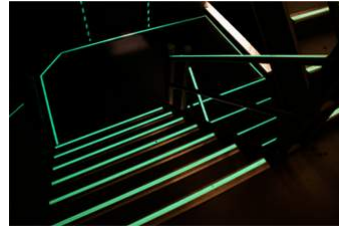
- Exit stairs serving floors in high rise buildings are to be designed as smokeproof enclosures.
 - Stair vestibule option
 - Naturally or mechanically ventilated vestibules at each floor
 - Pressurized shaft alternative
 - No vestibules
 - Positive pressurized
 - FRR separation of equipment
 - Acceptance testing required

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Luminous Egress Path Markings

- Required in High Rise Buildings with Use A, B, E , I, M, or R-1
- Provided in Exit Enclosures
 - Steps
 - Railings
 - Landings
 - Perimeter demarcation lines
 - Exit door and hardware
- Permitted to be any material, including paint or tape provided an electrical charge is not required to maintain required luminescence



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Elevator Lobbies

- Relocated to Chapter 30
 - No substantial changes to protection requirements
 - Clarifies that an elevator in a high rise that travels less than 75' (regardless of location in building) does not require elevator lobbies
 - See Section 3006 for alternatives to elevator lobbies where required
 - Smoke guard elevator doors
 - Elevator pressurization

3006.4 Means of egress. Elevator lobbies shall be provided with at least one means of egress complying with Chapter 10 and other provisions in this code. Egress through an elevator lobby shall be permitted in accordance with Item 1 of Section 1016.2.

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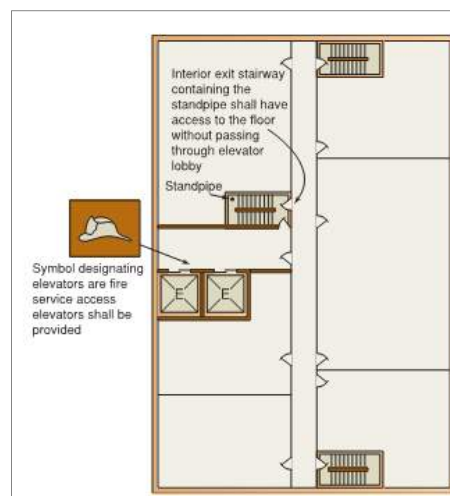
Fire Service Access Elevator Lobby (FSAEL)

- High-rise buildings are to be served by a fire service access elevator.
- FSAE Lobby:
 - 150 ft² minimum
 - 8 ft. minimum dimension
 - Direct connection to stair with standpipe
 - 1-hour smoke barrier
- 9th Edition Changes:
 - 2 FSAE are required, can share lobby.
 - Stair can be connected to lobby via protected passageway

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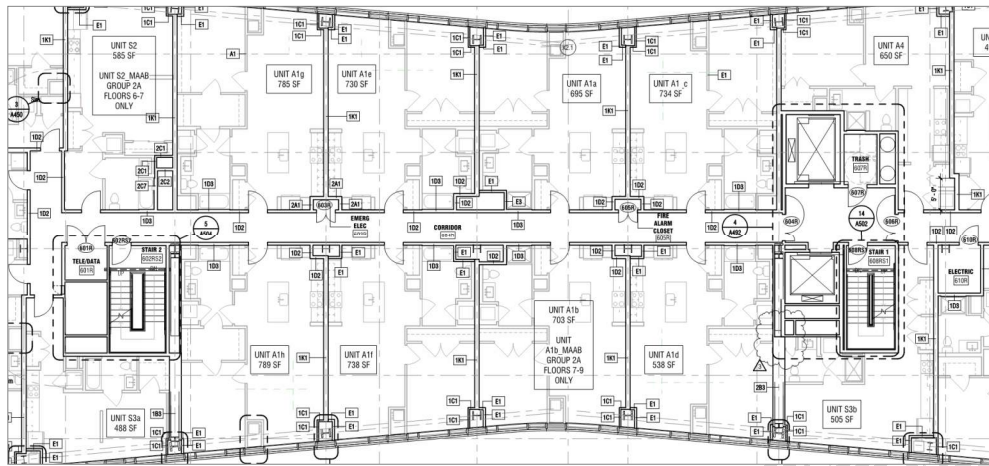
Fire Service Access Elevator Lobby (FSAEL)



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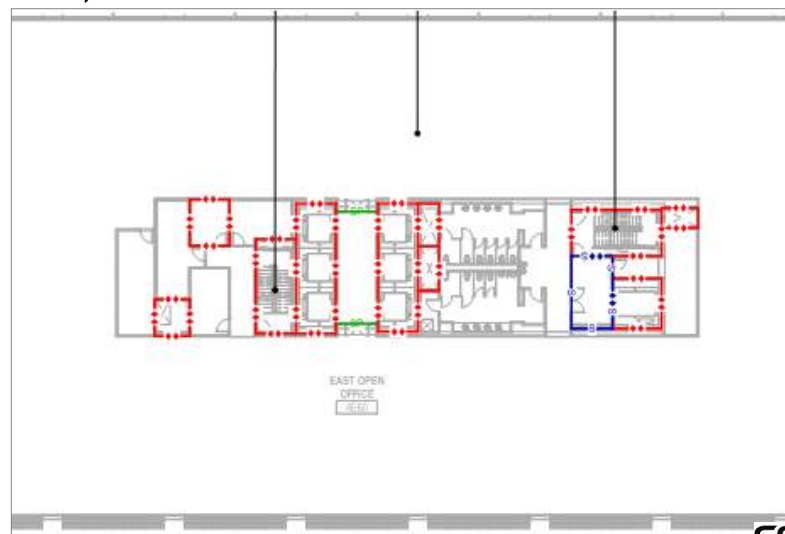
Fire Service Access Elevator Lobby (FSAEL)



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Fire Service Access Elevator Lobby (FSAEL)



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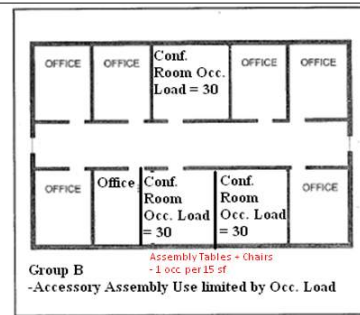
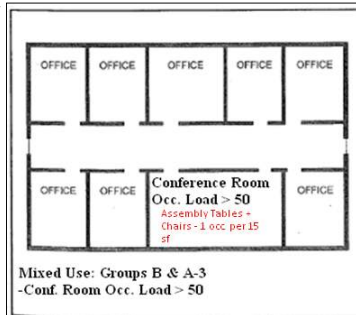


Occupant Load Calculations

Common Misunderstandings

Always based on function of space not occupancy classification

TABLE 1004.1.1 MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT	
FUNCTION OF SPACE	FLOOR AREA IN SQ. FT. PER OCCUPANT
Accessory storage areas, mechanical equipment room	300 gross
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal	
Baggage claim	20 gross
Baggage handling	300 gross
Concourse	100 gross
Waiting areas	15 gross
Assembly	
Gaming floors (keno, slots, etc.)	11 gross
Assembly with fixed seats	See Section 1004.7
Assembly without fixed seats	
Concentrated (chairs only—not fixed)	7 net



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Horizontal Exits - Flexibility in Existing Buildings



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Occupied Roof Decks

Considerations include:

- Occupant load & exit capacity
- Exit number & arrangement
- Fire extinguishers
- Fire alarm
- Exit signage

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Existing Building Thresholds

- Misconception that renovation in high rise building brings in all new high rise requirements
- Implications of not maintaining high-rise related systems on future work to building

704.2.1 High-rise buildings. In high-rise buildings, work areas that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection in the entire *work area* where the *work area* is located on a floor that has a sufficient sprinkler water supply system from an existing standpipe or a sprinkler riser serving that floor.

704.2.1.1 Supplemental automatic sprinkler system requirements. Where the *work area* on any floor exceeds 50 percent of that floor area, Section 704.2.1 shall apply to the entire floor on which the *work area* is located.

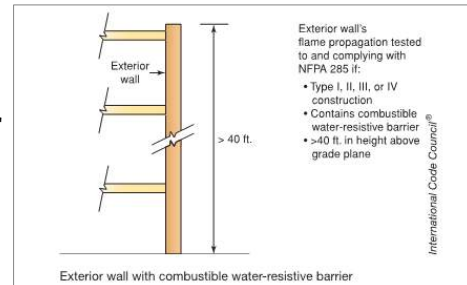
Exception: Tenant spaces that are entirely outside the *work area*.

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1403.5- Flame Propagation at Exterior Walls

- Base requirement is that in other than Type V construction, exterior walls on buildings over 40' with a combustible water resistive barrier are required to meet NFPA 285.
- MA is proposing the following exceptions:



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1403.5- Flame Propagation at Exterior Walls

- Notable exceptions:
 - 1) Unique to MA: In other than high rise buildings where an automatic sprinkler system is installed per NFPA 13 and fire flow analysis has been performed without sprinkler decrease allowance that shows adequate water is available
 - 2) Walls where the barrier is the only combustible materials and the wall is of brick, concrete, stone, terra cotta, stucco or steel
 - 3) Walls where the barrier is the only combustible component and the material properties meet the requirements of 1403.5.
 - 4) Unique to MA: Walls where the barrier is the only combustible component and fire blocking is installed per 1403.5.

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1407.11-MCM Panels

- MCM is now permitted to be installed above 50-feet.
- MCM allowance to not meet NFPA 285 in installations up to 75-feet, based on limitations to:
 - Fire separation distance
 - Allowable area of MCM material
 - Self ignition temperature requirements

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2603.5.5- Plastics in Exterior Walls

- Exterior wall assemblies using plastics are generally required to comply with NFPA 285
 - Number of exceptions now offered similar to those in 1403.5
 - Exception 1: 1 story buildings per 2603.4.1.4 (covered with steel or aluminum)
 - Exception 2: Wall assemblies where the insulation is covered with a specified thickness of non combustible material
 - Exception 3 (Unique to MA): Non-high rise sprinklered buildings per NFPA 13 with fire flow analysis
 - Exception 4 (Unique to MA): Fire blocking in specified configuration

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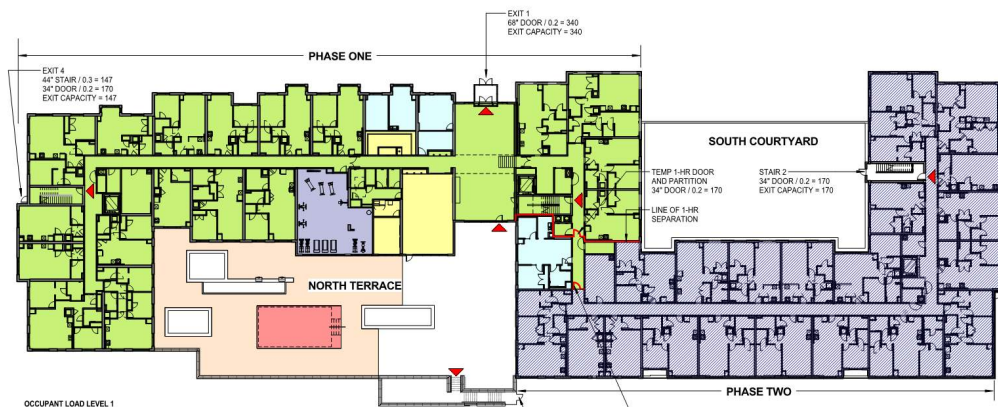


City of Boston & Permitting

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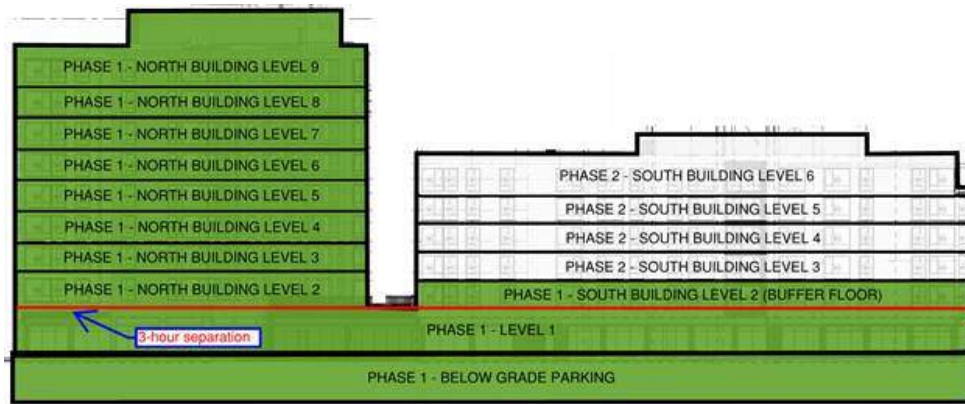
Phased Occupancy, Architectural Implications and Scope Creep



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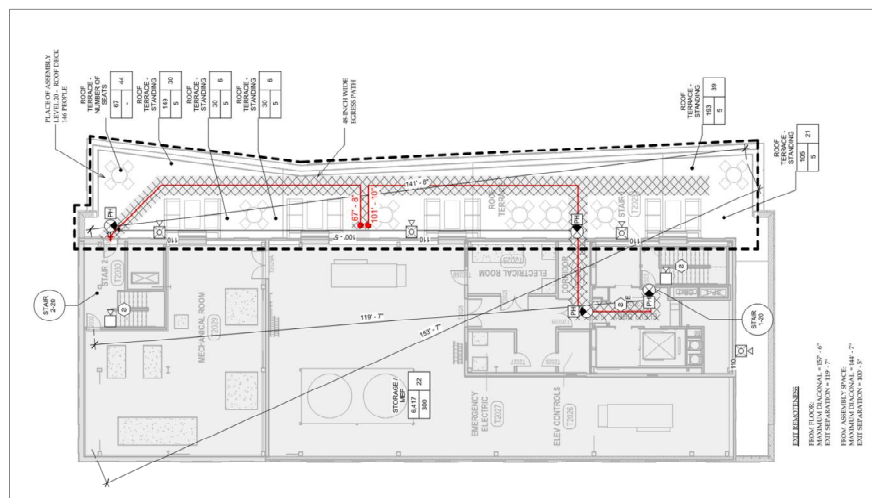
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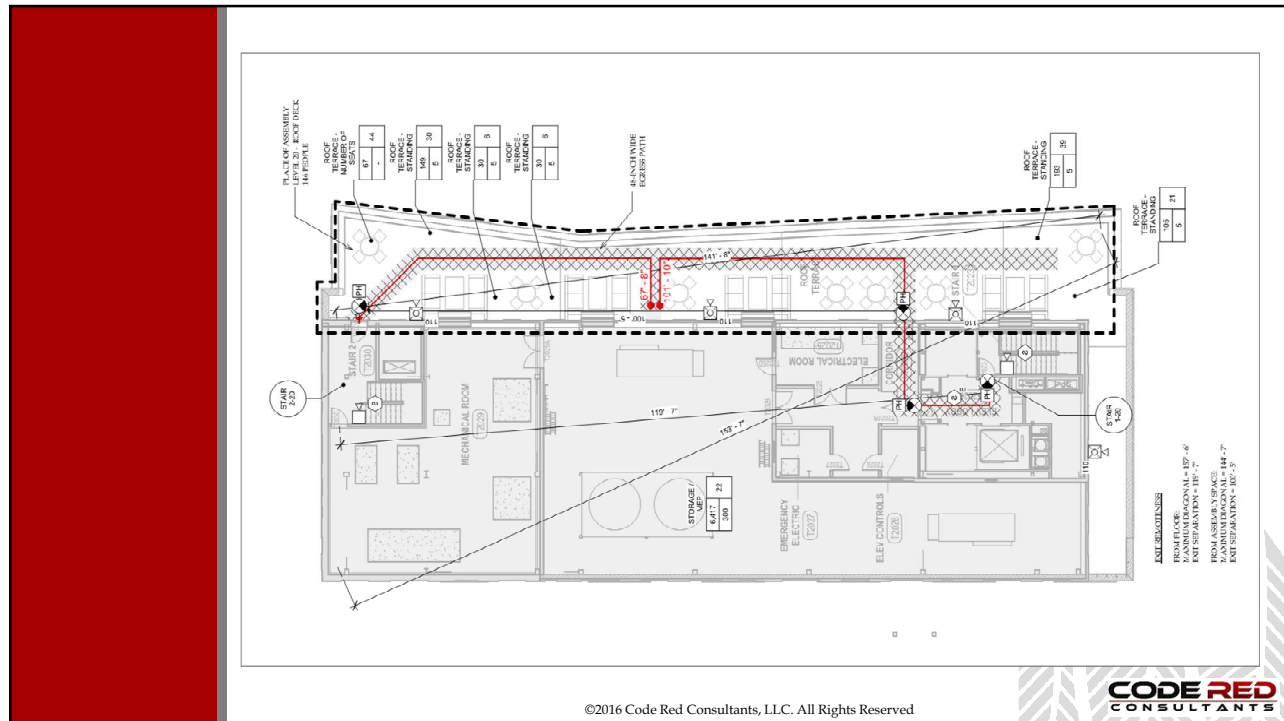


Assembly Permitting



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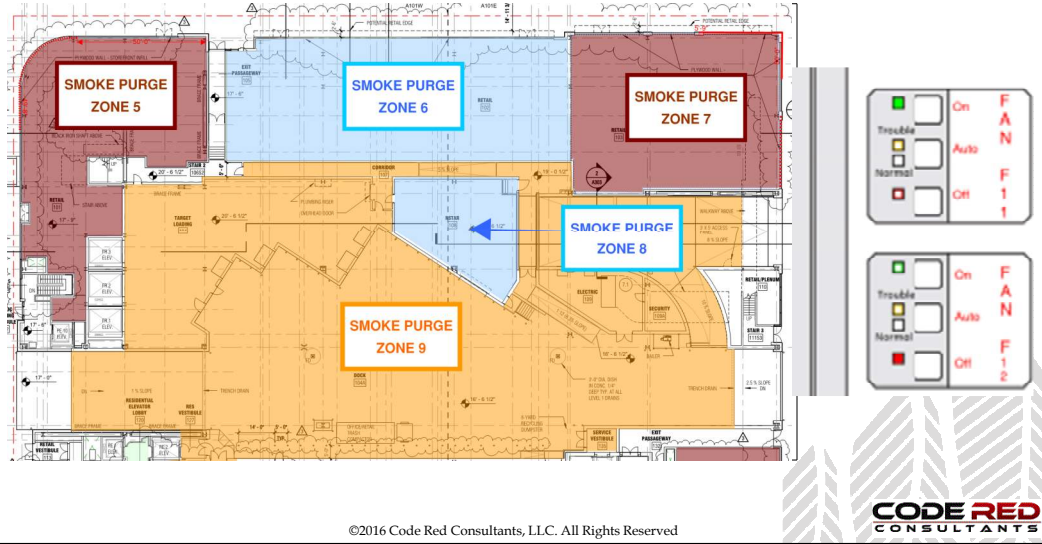




Smoke Removal - Post Fire

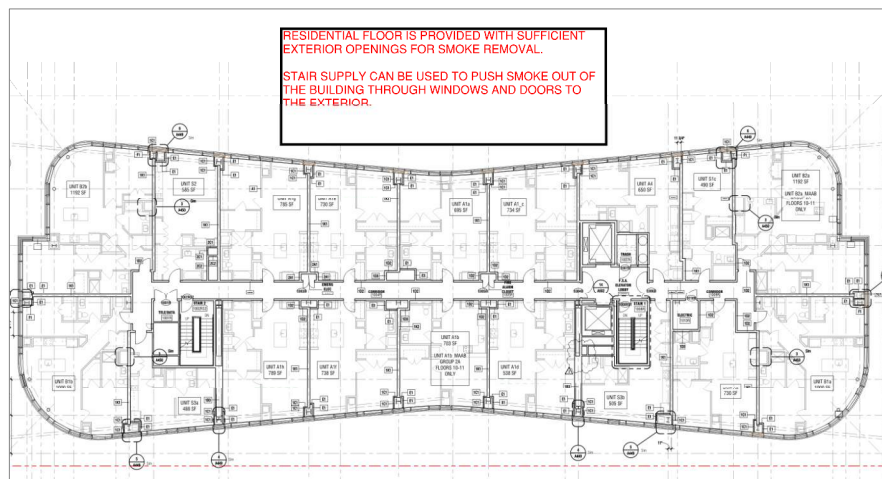
- Breakable windows are not an option in Boston
- 4 ACH or operable panels (40sqft, every 50 linear ft)
- Provide Controls on a zone by zone basis. Provide status of fans.
- The types of spaces that will not be provided with post fire smoke removal systems:
 - Rooms containing only mechanical electrical and plumbing equipment
 - Tel data and telecom rooms
 - Mechanical penthouse levels.
 - Elevator machine rooms

Post-Fire Smoke Removal – Retail Mechanical



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Post-Fire Smoke Removal – Residential Floors Natural



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Post-Fire Smoke Removal – Garage Natural

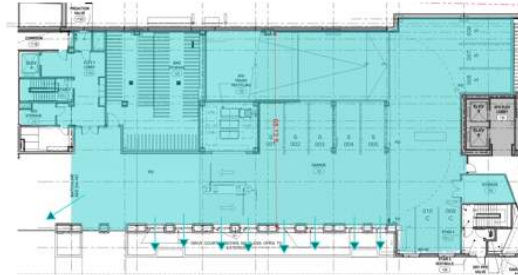


Figure 3 – Garage and Bike Storage



Figure 4 – Exterior wall openings

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Legacy Smoke Control System

- 527 CMR requirement for semi-annual testing

11.8.6 Smoke control systems shall be maintained to ensure to a reasonable degree that the system is capable of controlling smoke for the duration required. The system shall be maintained in accordance with the manufacturer's instructions and the building code.

Add the following Section:

11.8.7 A routine maintenance and operational testing program shall be initiated immediately after the smoke control system has passed the acceptance tests. A written schedule for routine maintenance and operational testing shall be established.

Add the following Section:

11.8.8 A written record of smoke control system testing and maintenance shall be maintained on the premises. The written record shall include the date of the maintenance, identification of servicing personnel, and notification of any unsatisfactory condition and the corrective action taken, including parts replaced.

Add the following Section:

11.8.9 Dedicated smoke control systems shall be operated for each control sequence semiannually. The system shall also be tested under standby power conditions.

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Legacy Smoke Control System

- BFD / ISD can ask for documentation of a maintained system anytime
 - Demo, Building Permit
 - Fire Alarm Permit,
 - Occupancy
- True for smoke control systems which may or may not be in the work area
- Can result in significant schedule impacts, and upgrades if not planned for on the project

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Legacy Smoke Control System

- Example
 - Project within building with existing atrium
 - Tenant fit out of adjacent space
 - Atrium boundary walls are unaffected by scope of work
- How will BFD evaluate project now versus 5 years ago?
- Responsibility for test reports?
- Impact to the tenant fit out project?

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Thank You For Your Time

Questions?



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