



SAFETY ENHANCEMENTS FOR SUPERTALL BUILDINGS

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INTRODUCTION

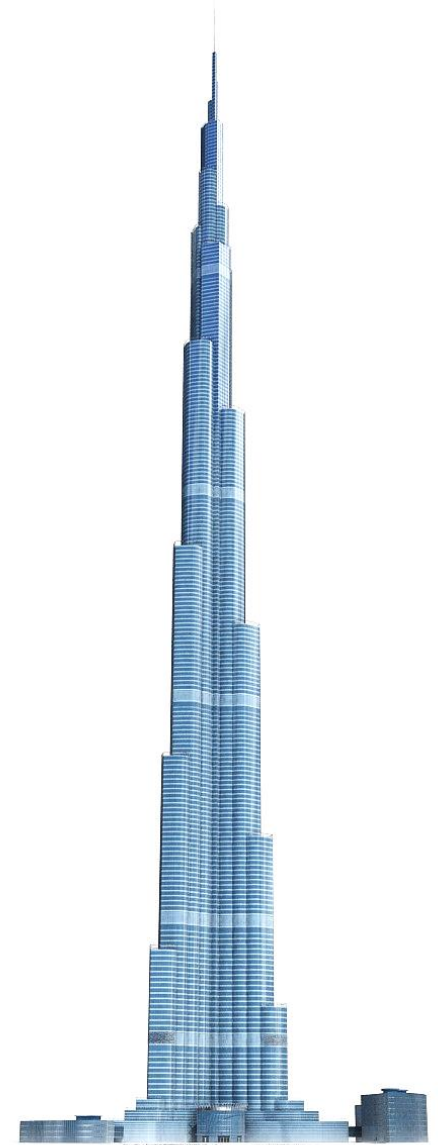
- Super-tall Buildings
 - Buildings greater than 128 m
- Dubai
 - Approximately 200 Super-tall Buildings
 - Completed
 - Under construction





BURJ KHALIFA

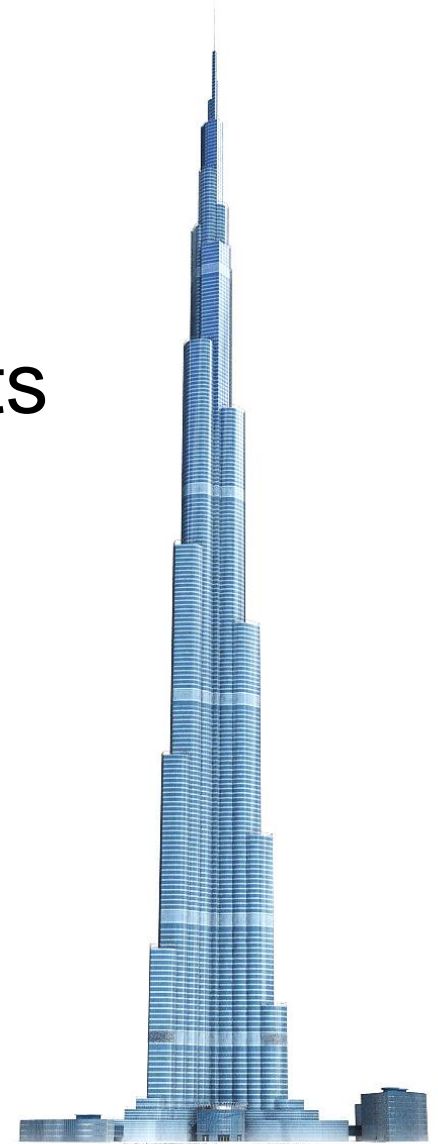
- World's Tallest Building
 - 4 January 2010
 - 5 Year Record-Holder
- Codes and Standards
 - 2003 IBC
 - 2003 NFPA





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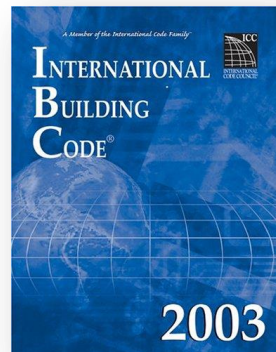
- Designed with Enhancements
 - Evacuation Elevators
 - Areas of Refuge
 - Fire Elevators
 - Redundant Water Supply
 - Dual Fire Command Centers
 - Increased Fire Resistance





2003 CODES

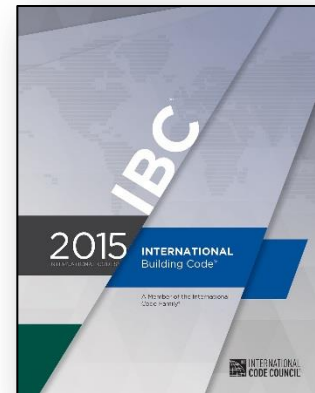
- IBC
 - No Additional Requirements
- NFPA
 - Increased Structural Fire Resistance





2015 CODES

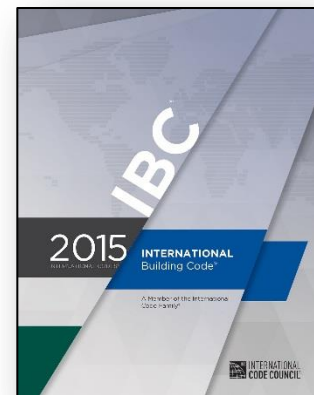
- IBC
 - No Reduction in Fire Resistance
 - Increased Structural Integrity of Exit Stairs
 - Increased Bond Strength of SFRM
 - Dual Sprinkler Risers
 - Dual Water Supplies





2015 CODES

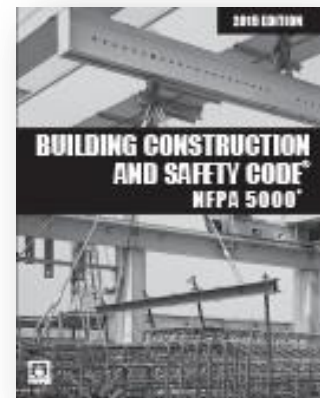
- IBC (Cont'd)
 - Remote Exit Stairs
 - Evacuation Elevators
 - Stairways Markings
 - Additional Firefighter Stair
 - Firefighting Elevators






2015 CODES

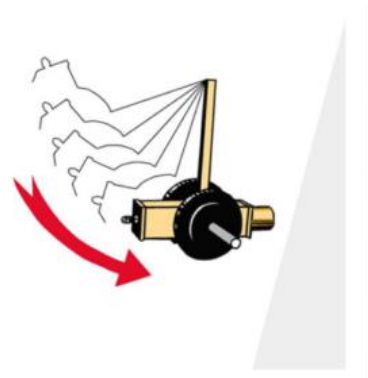
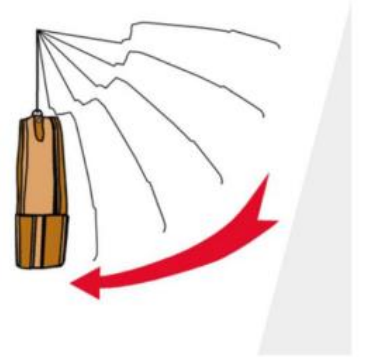
- NFPA
 - Increased Exit Stair Width
 - Stairway Video Surveillance





STRUCTURAL ENHANCEMENTS

- 4 Hour Structural Frame
 - Reduced to 3 Hour for other than Mercantile, Industrial, or Storage
- Increased Structural Integrity
 - Exit Stairs and Hoistways
 - Impact Resistance
 - Soft Body within Enclosure
 - Hard Body outside Enclosure





STRUCTURAL ENHANCEMENTS

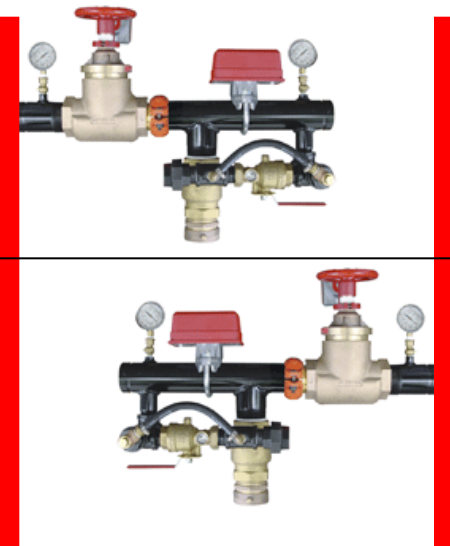
- Sprayed Fire-resistant Materials
 - Increased Bond Strength
 - Height less than 128 m: 20 kPa
 - Height greater than 128 m: 48 kPa





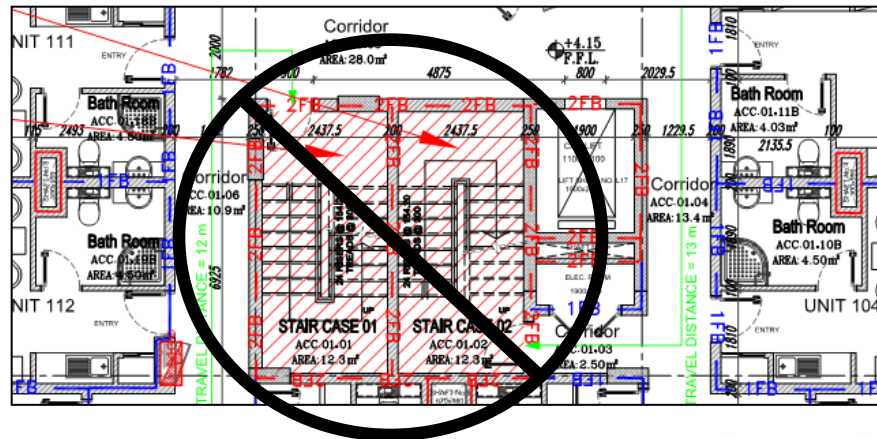
SUPPRESSION ENHANCEMENTS

- Dual Sprinkler Risers
 - Each Riser Serves Alternate Floors
 - Risers Protected within Exit Stairs
- Dual Water Supply
 - Connection to Multiple Mains
 - Redundant On-site Supply
 - 30 Minutes



MEANS OF EGRESS ENHANCEMENT

- Remote Exit Stairs
 - “Enclosures” to be Separated
 - One-fourth Maximum Overall Diagonal
 - Not Required more than 9.1 m





MEANS OF EGRESS ENHANCEMENTS

- Evacuation Elevators
 - All Passenger Elevators for Public Use
 - Fire Safety and Evacuation Plan
 - Water Protection
 - Omit Sprinkler Protection for Elevator Spaces
 - Omit Shunt Trip
 - Hoistway Protection

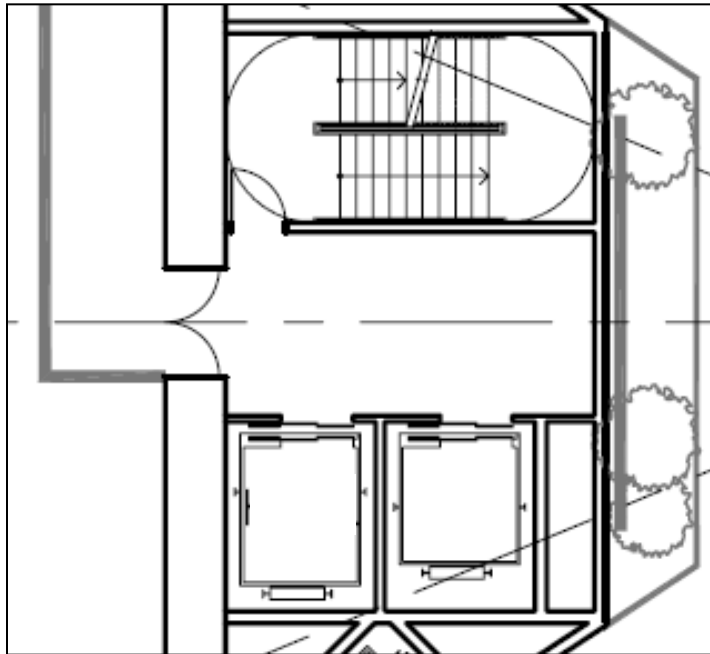


MEANS OF EGRESS ENHANCEMENTS

- Evacuation Elevators (Cont'd)
 - Elevator Lobby
 - House 25% Occ. Load (0.28 m² / Occ)
 - House Wheelchair for each 50 Occupants
 - Signage Identifying Evacuation Elevator
 - Two-way Communication with FCC
 - Direct/Protected Access to Stairs
 - 1 Hour Smoke Barrier
 - 45 Minute Smoke Doors with Vision Panels

MEANS OF EGRESS ENHANCEMENTS

- Evacuation Elevators (Cont'd)

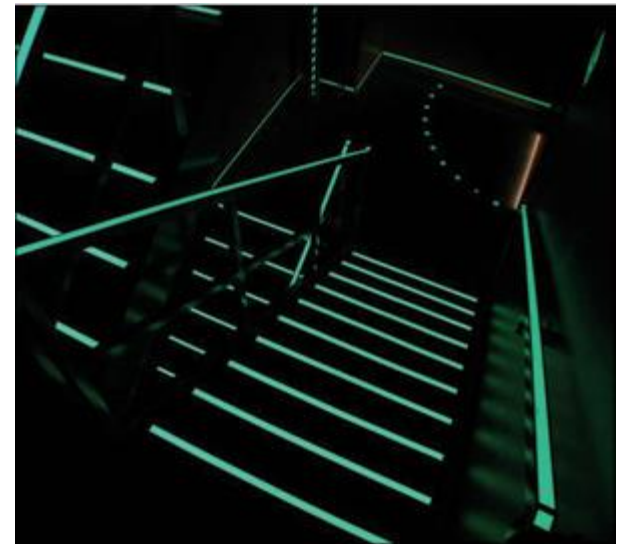
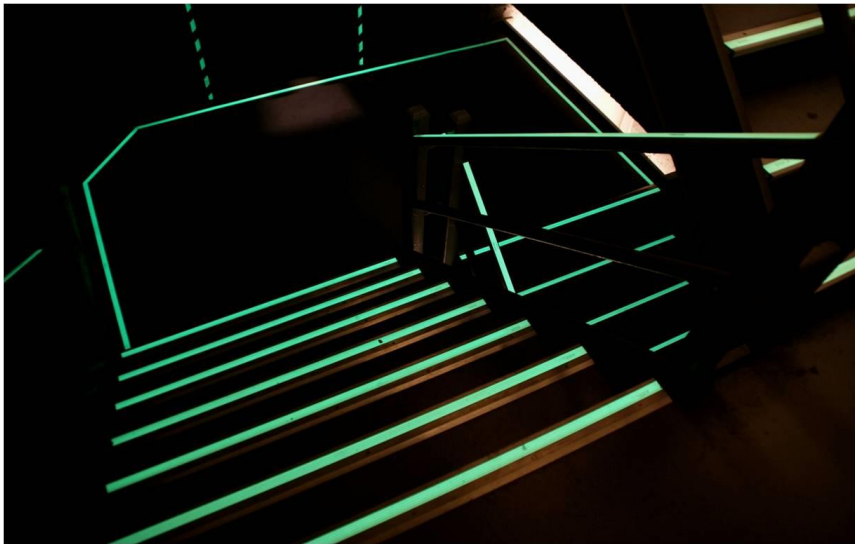


	R1	R2	R3	R4	R5	R6	OR1	OR2	BS1/F	BS2/F
138										EV
125-137										
124								EV	EV	
123								EV	EV	
112-122										
111										EV
77-110										
76							EV	EV	EV	
44-75										
43	EV	EV	EV							
1-42										
GR	EV	EV	EV	EV	EV	EV				
C							EV	EV	EV	EV



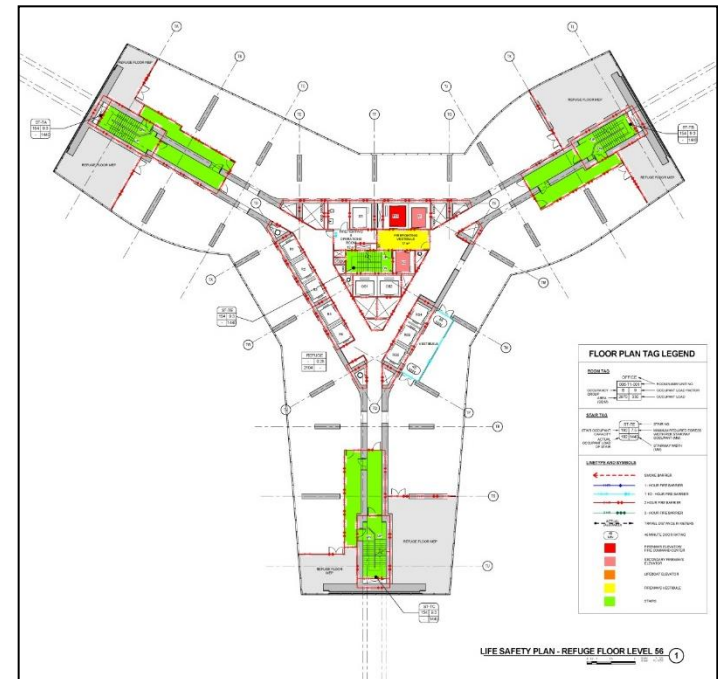
MEANS OF EGRESS ENHANCEMENTS

- Stairway Marking
 - Luminous Egress Path Markings



FIRE FIGHTING ENHANCEMENTS

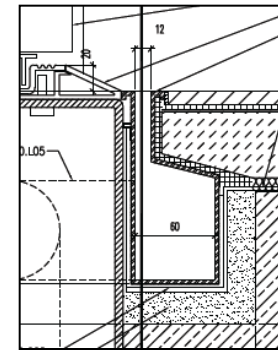
- Additional Fire Fighting Stair
 - Provided if Self-evacuation Elevators Omitted
 - Does not contribute to Exit Capacity





FIRE FIGHTING ENHANCEMENTS

- Firefighting Elevator
 - Two 1,600 kg Elevators
 - Water Protection
 - Omit Sprinkler Protection for Elevator Spaces
 - Omit Shunt Trip
 - Hoistway Protection
 - Hoistway Illumination (11 lux)





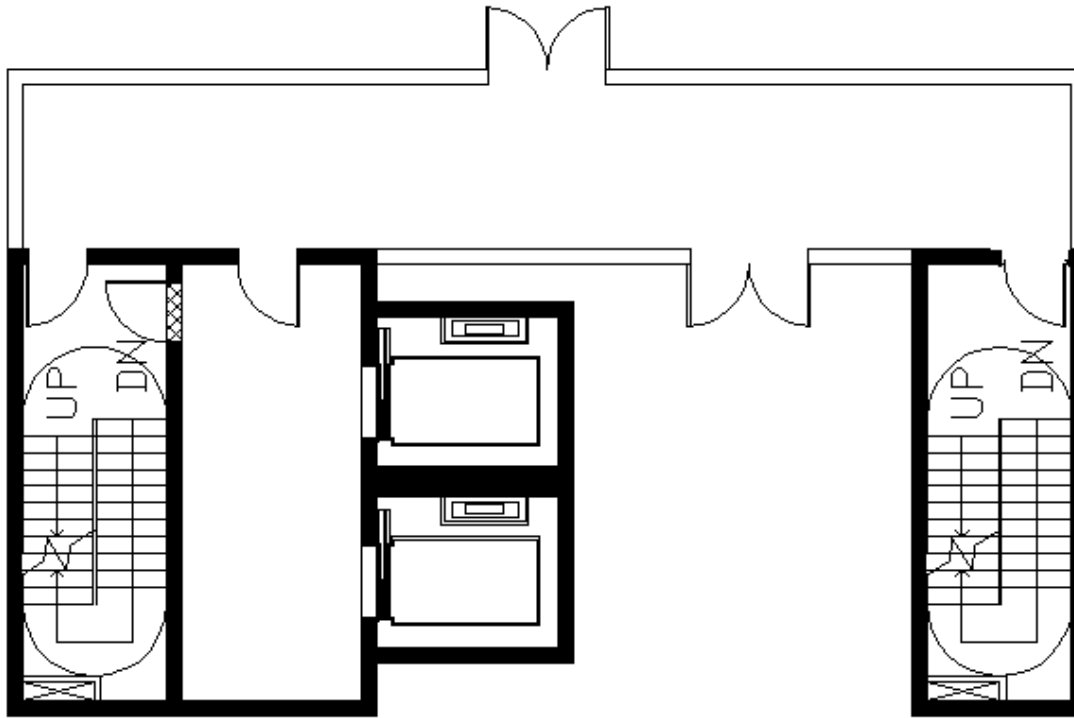
FIRE FIGHTING ENHANCEMENTS

- Firefighting Elevator (Cont'd)
 - Elevator Lobby
 - Not less than 14 m² and 2.5 m width
 - Identified as Firefighting Elevator
 - Two-way Communication with FCC
 - Direct/Protected Access to Stairs
 - Stair to also have Separate Access
 - 1 Hour Smoke Barrier
 - 45 Minute Smoke Doors





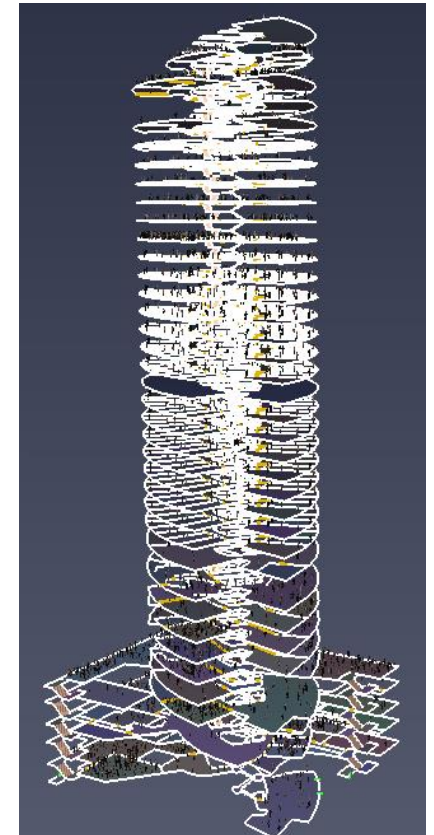
FIRE FIGHTING ENHANCEMENTS





NFPA ENHANCEMENTS

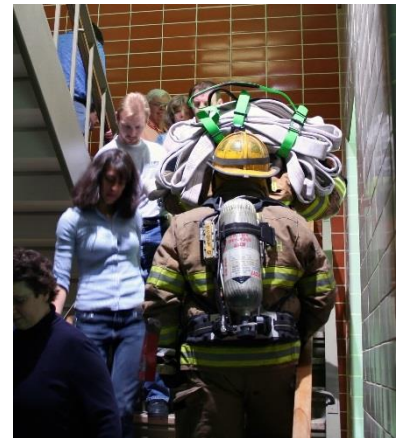
- Increased Stair Width
 - Less than 2,000 Occupants
 - 1,120 mm
 - More than 2,000 Occupants
 - 1,440 mm





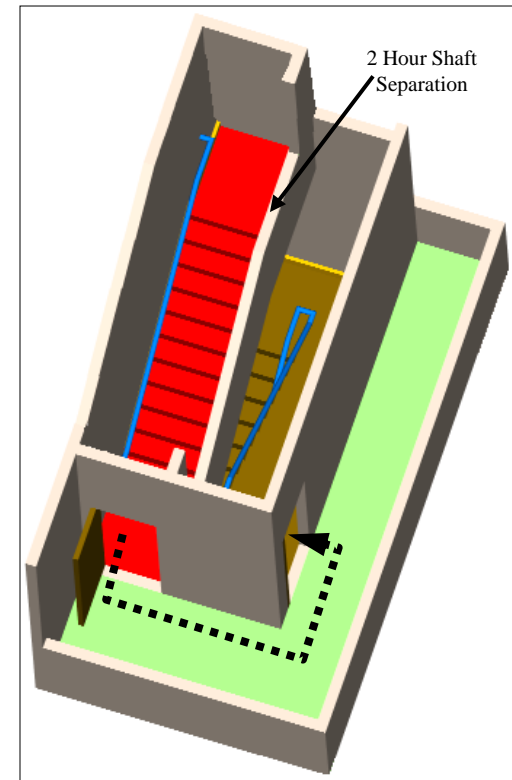
NFPA ENHANCEMENTS

- Stairway Video Surveillance
 - Buildings more than 4,000 Occupants
 - Monitoring every 5 Floors
 - Monitoring Discharge Floor
 - Displayed at FCC



ADDITIONAL ENHANCEMENTS

- Vertical Isolation
 - Terminating Stair Enclosures at Intermediate Floors
 - Refuge Area Sized for 3 Floors
- Vertically Zoned Services
 - Pressurization Systems
 - Suppression Systems
 - HVAC Services



ADDITIONAL ENHANCEMENTS

- Computer Modeling
 - Evacuation Modeling
 - Total Evacuation Time
 - Exit Stairs
 - Evacuation Elevators
 - CONTAM Modeling
 - Coordinated Airflow Analysis

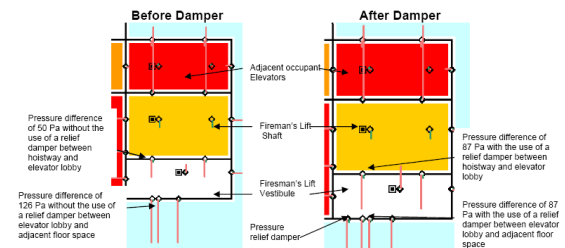


Figure 3: CONTAM output illustrating the effectiveness of pressure relief dampers on reducing pressure differentials between the Firemen's lobby, and the adjacent building areas on the Ground Level.



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