SAFETY ENHANCEMENTS FOR SUPERTALL BUILDINGS

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Course Description

Enhancements for Supertall Buildings are beginning to be introduced in various international codes. Such enhancements often apply when buildings reach approximately 30 floors in height. This presentation highlights the fire safety challenges in supertall buildings and the fire safety features that are used to overcome such challenges.

Presenter

Aaron F. Vanney, P.E., LEED® AP is an Operations Manager for Rolf Jensen & Associates, Inc. (RJA) located in Dubai, United Arab Emirates. Mr. Vanney specializes in international projects including mixed use high-rise buildings, casinos, and convention centers. He has focused his project work in code consulting, developing building fire and life safety strategies and performance-based design.

Since joining RJA, Mr. Vanney has participated in the design of Burj Khalifa, the world's tallest building. He has lead teams in the commissioning of the newly developed casinos in Macau and has managed a number of super-tall building projects. Mr. Vanney has participated in projects throughout the world and is familiar with fire and life safety regulations in the United States, China, United Arab Emirates, Kingdom of Saudi Arabia, Qatar, Jordan, South Korea, Macau, and Hong Kong.

Learning Objectives

1. *Identify what is considered a Supertall Building*
2. *Identify examples of previous enhancements.*
3. *Identify 2015 IBC enhancements.*
4. *Identify 2015 NFPA enhancements.*

The purpose of this presentation is to convey technical knowledge to the conference participants.

The presentation also contains slides with text that summarises the content of the presentation and the main learning objectives.

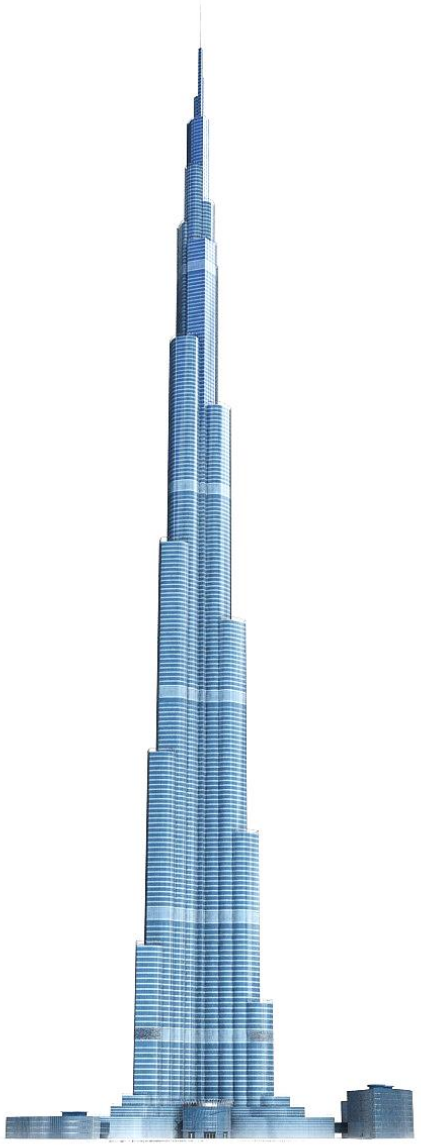
These may be used to update CPD records for relevant organisations including the Chartered Institute of Building (CIOB).

INTRODUCTION

- Super-tall Buildings
  - Buildings greater than 128 m
- Doha
  - Approximately 65 Super-tall Buildings
    - Completed
    - Under construction

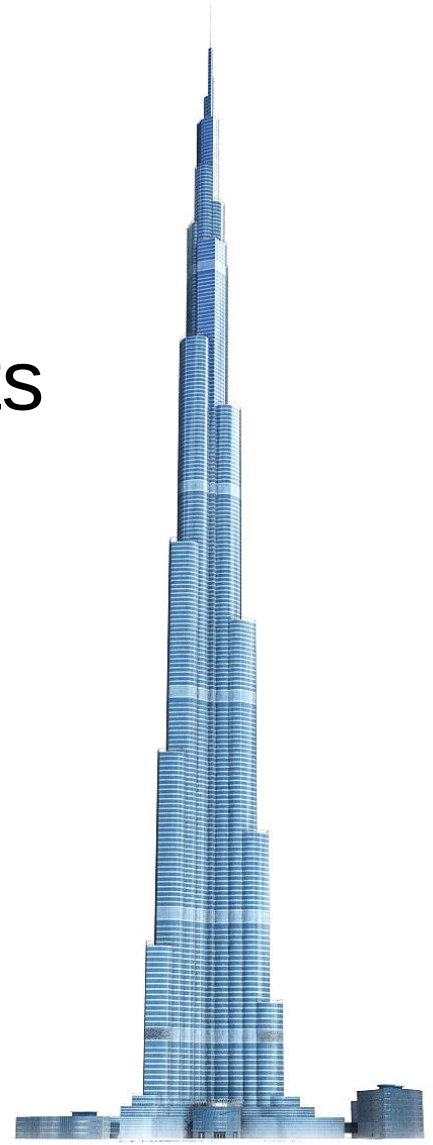
BURJ KHALIFA

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



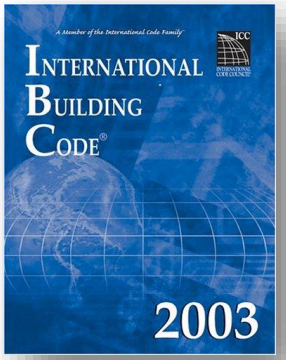
BURJ KHALIFA

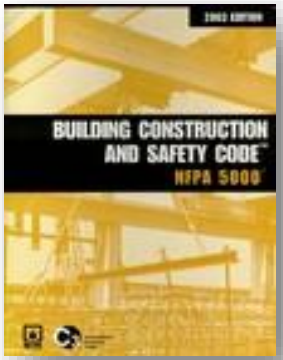
- Designed with Enhancements
  - Evacuation Elevators
  - Areas of Refuge
  - Fire Elevators
  - Redundant Water Supply
  - Dual Fire Command Centers
  - Increased Fire Resistance



2003 CODES

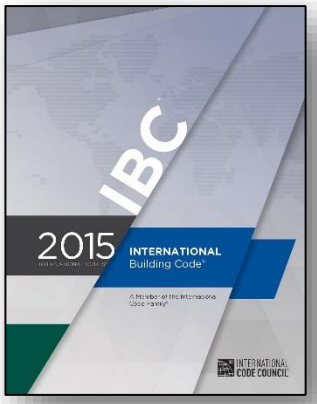
- IBC
  - No Additional Requirements
- NFPA
  - Increased Structural Fire Resistance





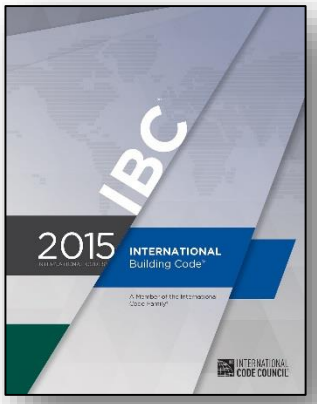
2015 CODES

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



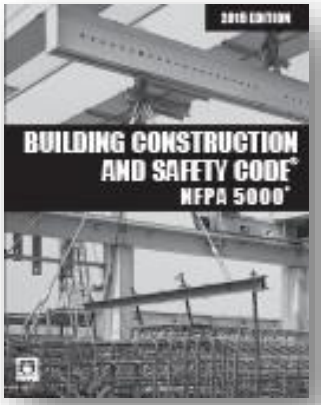
2015 CODES

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



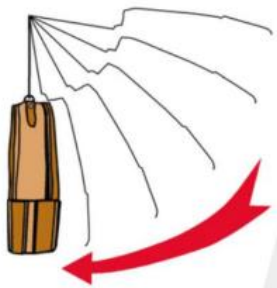
2015 CODES

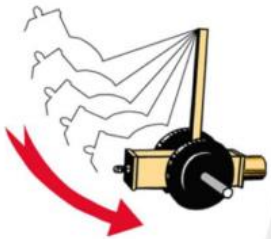
- NFPA
  - Increased Exit Stair Width
  - Stairway Video Surveillance



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



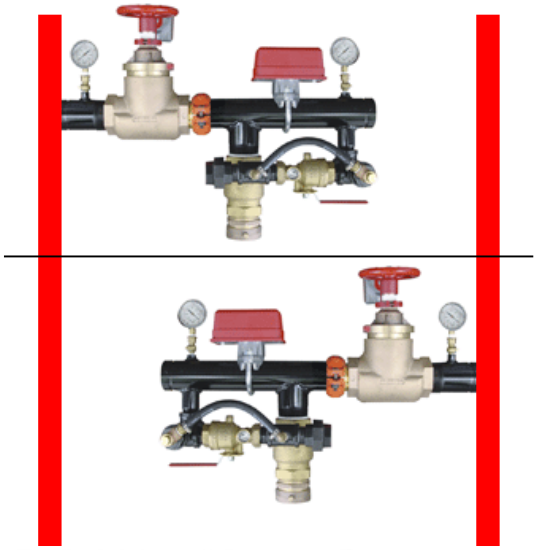


STRUCTURAL ENHANCEMENTS

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

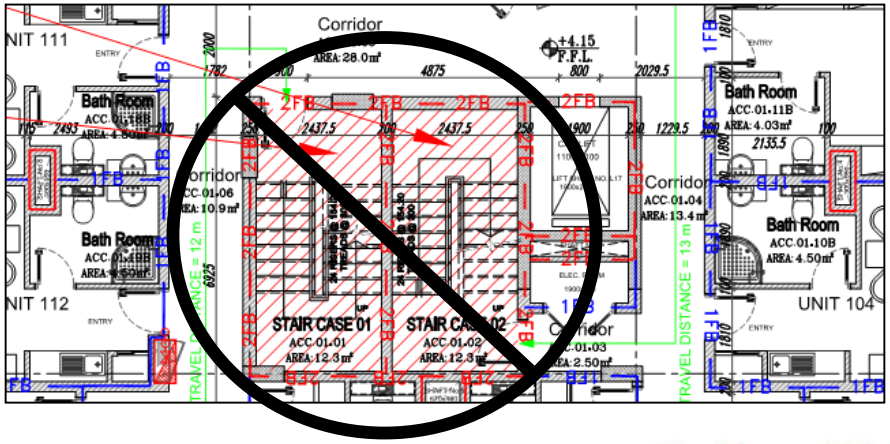
SUPPRESSION ENHANCEMENTS

- 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

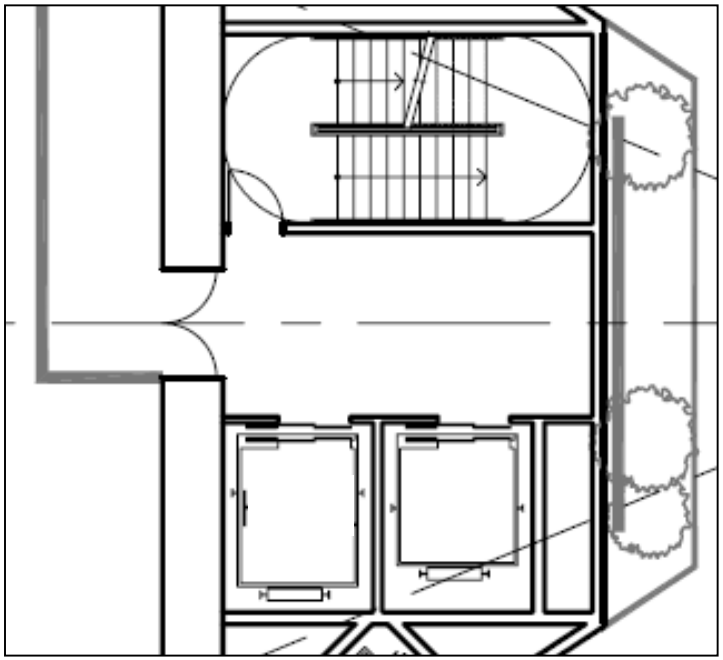
- Evacuation Elevators
  - All Passenger Elevators for Public Use
  - Fire Safety and Evacuation Plan
  - Water Protection
    - Omit Sprinkler Protection for Elevator Spaces
    - Omit Shunt Trip
    - Hoistway Protection

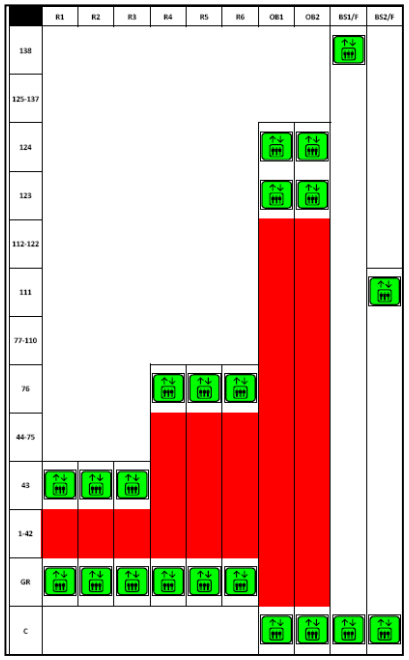
MEANS OF EGRESS ENHANCEMENTS

- Evacuation Elevators (Cont'd)
  - Elevator Lobby
    - House 25% Occ. Load (0.28 m^2 / 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

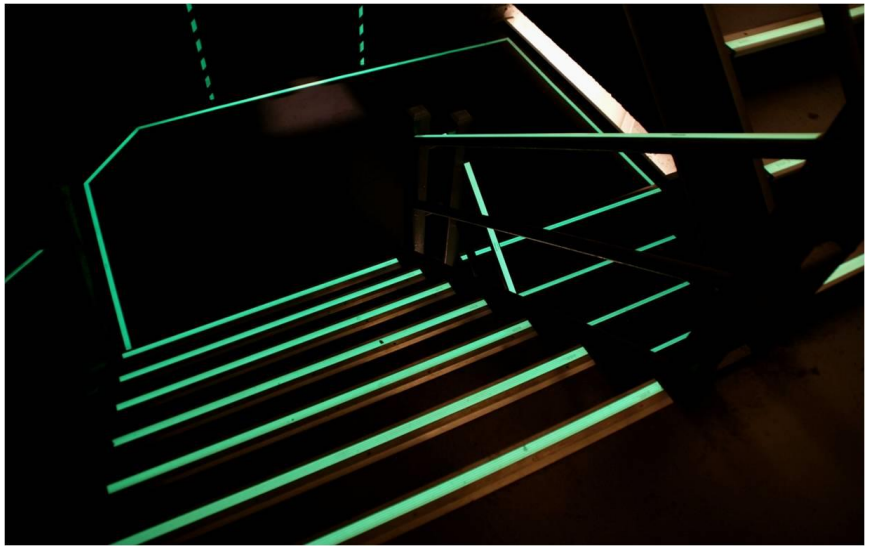
- Evacuation Elevators (Cont'd)

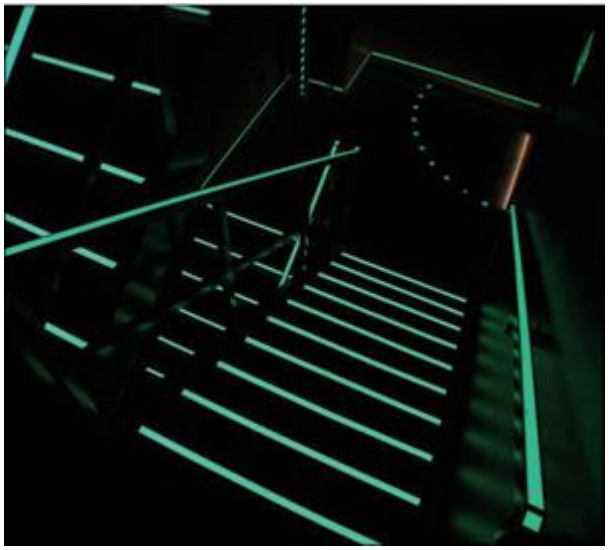




MEANS OF EGRESS ENHANCEMENTS

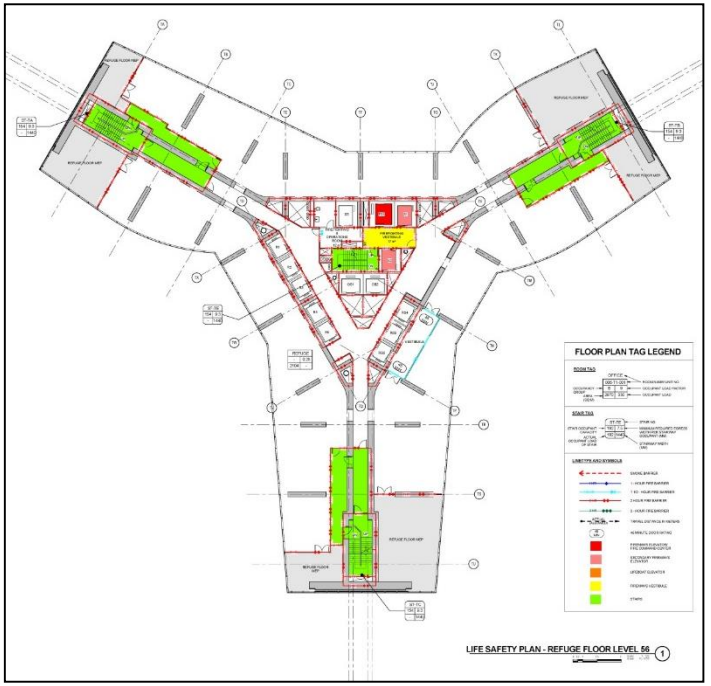
- Stairway Marking
  - Luminous Egress Path Markings





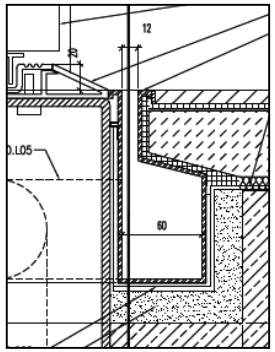
FIRE FIGHTING ENHANCEMENTS

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



FIRE FIGHTING ENHANCEMENTS

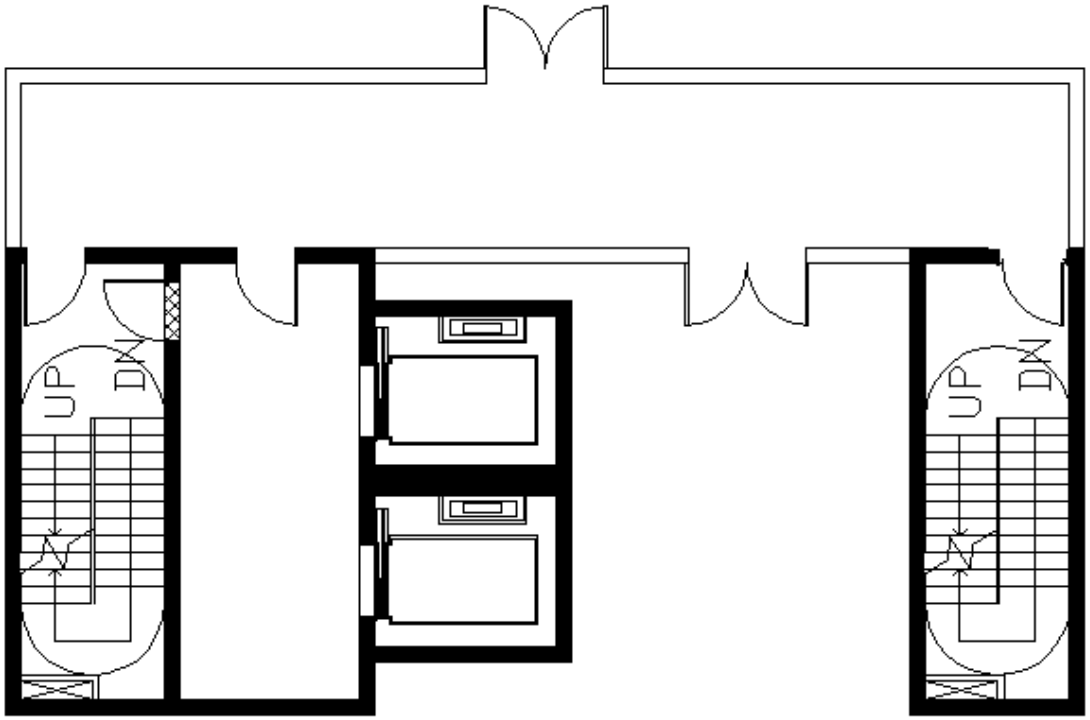
- Firefighting Elevator
  - Two 1,600 kg Elevators
  - Water Protection
    - Omit Sprinkler Protection for Elevator Spaces
    - Omit Shunt Trip
    - Hoistway Protection
  - Hoistway Illumination (11 lux)



FIRE FIGHTING ENHANCEMENTS

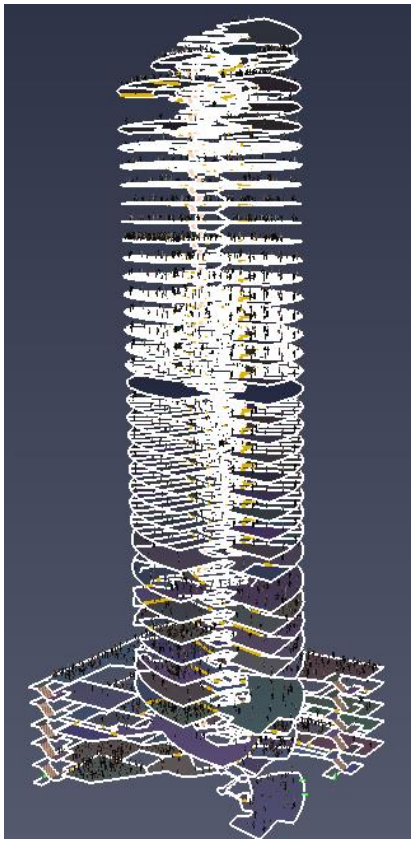
- Firefighting Elevator (Cont'd)
  - Elevator Lobby
    - Not less than 14 m^2 and 2.5 m width
    - Identified as Firefighting Elevator
    - Two-way Communication with FCC
    - Direct/Protected Access to Stairs
    - Stair to also have Separate Access
    - 1 Hour Smoke Barrier
    - 45 Minute Smoke Doors

FIRE FIGHTING ENHANCEMENTS



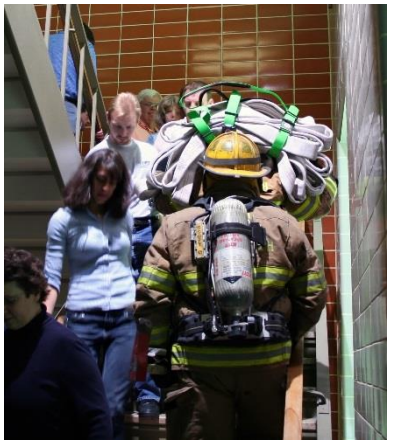
NFPA ENHANCEMENTS

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



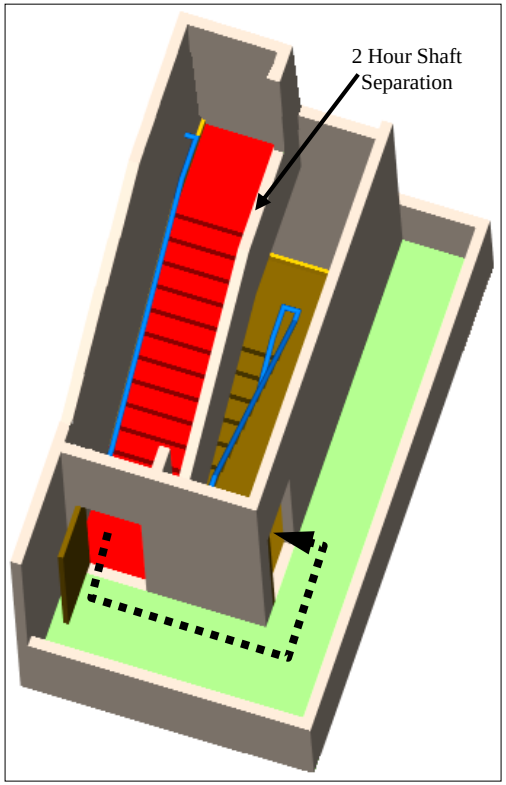
NFPA ENHANCEMENTS

- 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

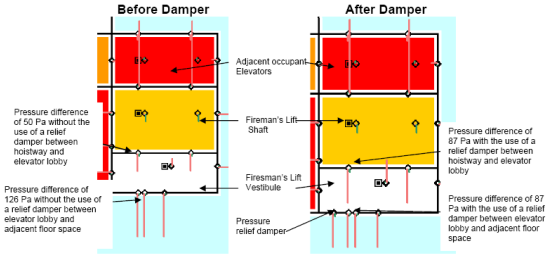


Figure 3: CONTAM output illustrating the effectiveness of pressure relief dampers on reducing pressure differentials between the Firemen's lobby, and the adjacent building areas on the Ground Level.

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