OCCUPANT EVACUATION ELEVATORS

Overview & Case Studies

Eric M. Camiel, P.E., CET
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ELEVATORS & THE PUBLIC’S UNDERSTANDING

Public is instructed to:
• Do not use elevators in the event of a fire!
• Use exit stairs only.

This is portrayed by:
• Signage
• Fire alarm voice messages
• People’s general knowledge
EGRESS BY STAIRS

- Stairs may be challenging for some.
  - Mobility impaired occupants
  - Elderly occupants
  - Small children
EGRESS BY STAIRS

The taller the building, the longer the evacuation time and higher probability of fatigue and other delays etc.

- Different movement speeds of occupants
  - Age
  - Mobility impairments
  - Health
    » Fatigue during longer evacuation times
CURRENT CODE PROVISIONS

- International Building Code
    • Section 3008
    • Section 7.14
- GAS PBS-P100 – Facilities Standards for Public Buildings Service
    • Section 7.10.1.4
OVERALL OCCUPANT EVACUATION
ELEVATOR REQUIREMENTS

CURRENT CODE PROVISIONS

- ASME A17.1/CSA B44 – Safety Code for Elevators and Escalators
  - 2013 Edition (Added in 2013)
    • Section 2.27.11

- NFPA 72 - National Fire Alarm & Signaling Code
  - 2013 Edition (Added in 2013)
    • Section 21.6
OVERALL OCCUPANT EVACUATION
ELEVATOR REQUIREMENTS

BUILDING REQUIREMENTS

❖ OEEs are **not** mandated to be provided in any of the current NFPA & ICC codes.

❖ OEEs **may** be provided **in lieu** of additional exit stairway required for buildings more than 420 feet in height required by IBC.

❖ GSA PBS-P100 **requires** OEEs in all **new** GSA buildings with an occupied floor higher than 120 Feet in height.
REQUIREMENT OVERVIEW

Occupant Evacuation Operation to comply with:

- ASME A17.1/CSA B44
  - OEO sequencing
  - Elevator system notifications
- NFPA 72
  - OEO activation
  - Voice message coordination
  - Signals from fire alarm system to elevator system
SPECIFIC OEO REQUIREMENTS

EVACUATION REQUIREMENTS

☯ OEO Activation
  • Automatic detection throughout the building
    – Fire alarm system
    – Sprinkler system activation
    – NOT activated on manual fire alarm boxes throughout the building
      » Only manually initiated from within fire command center
    – NOT activated on alarm from elevator discharge level (ASME A17.1 requirement)
EVACUATION REQUIREMENTS

Determination of Evacuation floor group

- First alarm:
  - Floor of incident
  - Two floors above
  - Two floors below

- Subsequent alarms: (ASME A17.1 requirement)
  - All floors between alarm floors
  - Two floors above group
  - Two floor below group

- Total building Evacuation
  - All floors

EVACUATE!!!
SPECIFIC OEO REQUIREMENTS

OEO EVACUATION FLOOR GROUPS

One Alarm:

Evacuation Group: Floors 8 - 12

Multiple Alarms:

Evacuation Group: Floors 5 - 14

Total Building Evacuation:

Evacuation Group: All Floors

Fire Floor Evacuating
Floor Evacuating
Floor Not Evacuating
SPECIFIC OEO REQUIREMENTS

NFPA 72 REQUIREMENTS

- Transmit information to elevator systems to allow for accurate OEO sequencing.
  - Relays between control equipment
  - Serial communications between control equipment  
    - Required to be listed
Functions at the fire command center:
- Annunciate evacuation status of each floor
- Provide manual controls for OEO manipulation by authorities
- Provide manual means for initiating Total Building Evacuation
ASME A17.1/B44 REQUIREMENTS

OEO Sequencing

- Automatically start OEO upon signals from fire alarm system
- All passenger elevators serve only floors evacuating
- Only discharge passengers at elevator discharge level
- Continue operation until fire alarm system is re-set
ASME A17.1/B44 REQUIREMENTS

OEO Evacuation priorities
- Assign priority to fire floors based on sequence alarms are received
  - 1st alarm floor = first evacuation priority
  - 2nd alarm floor = second evacuation priority
  - Etc.

Total building evacuation priorities
- Assign priorities based on distance from elevator discharge level
  - Highest floor = first priority
  - One floor below highest floor = second priority
  - Etc.
# SPECIFIC OEO REQUIREMENTS

## OEO EVACUATION FLOOR GROUPS

### One Alarm:

<table>
<thead>
<tr>
<th>Floor</th>
<th>Alarm</th>
<th>Evac. Priority</th>
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<tbody>
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Evacuation Group: Floors 8 - 12

### Multiple Alarms:

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Evacuation Group: Floors 5 - 14

### Total Building Evacuation:

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<thead>
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<th>Floor</th>
<th>Evac. Priority</th>
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Evacuation Group: All Floors
ASME A17.1/B44 REQUIREMENTS

Elevator system notification

• Variable message signage in each lobby
  – Normal Operation
    » “Elevators operating normally”
  – During OEO
    » Elevators available for evacuation
    » Time of arrival for elevators
    » Elevators unavailable
OEO SEQUENCE OVERVIEW
OEO RESPONSIBILITIES

FIRE ALARM SYSTEM

- Determine evacuation group of floors
- Send evacuation group to elevator system for OEO service
- Broadcast floor voice messages
  - Specific message for evacuation group
  - Other message for all other floors
- Manual OEO controls
  - Floor selection
  - Total building evacuation
- OEO annunciation in Fire Command Center
ELEVATOR SYSTEM

- Send signal(s) to fire alarm system indicating availability of elevators for OEO.
- Evacuate floors indicated by fire alarm system
- Elevator movement per A17.1 sequencing
- Variable message signage
  - Display approved messages
  - Display time of elevator arrival on evacuating floors
- In-car notification of elevator occupants
  - Voice message
  - Visual signal or variable message signage
LA FEDERAL COURTHOUSE OVERVIEW

PROJECT SPECIFICS

Federal Courthouse
- 11 stories above grade
- 2 stories below grade
- Atrium connecting floors 1-11

Los Angeles, CA
PROJECT SPECIFICS

Occupants:
- US District Court
- US Marshals Service
- US Attorneys Office
- GSA Field Office
- Homeland Security
- Public Defenders Office

Uses
- Courtrooms
- Prisoner areas
- Offices
- Mechanical Spaces
PROJECT REQUIREMENTS

OEEs required under P100
- New High Rise building
- Highest floor is 220 feet
  - Taller than 120 feet

Codes of Record
- 2010 edition of GSA PBS-P100
- 2012 IBC
- 2013 NFPA 72
- 2010 ASME A17.1 ****

**** 2010 edition of ASME A17.1 does not have language for OEEs or OEO. First edition to include this was 2013 edition.
OEE APPROACH

IBC features required for OEEs were implemented in design.
- Sprinkler water prevention from entering hoistways
- Lobby sizes
- Arrangement of lobbies and exit stairs
- Standby power
- Voice alarm communication fire alarm system
- Etc…

Variable message signage was provided by Fire Alarm System
- GSA approval was obtained to **not** provide estimated time of elevator arrival on variable message signage.

Sequencing of A17.1-2013 was not provided
EVACUATION APPROACH

- Building has a very large atrium extending from floors 1-11
  - Building is general evacuation, not partial evacuation
  - Elevators continue to serve all floors in event of fire alarm
  - Variable message signage and fire alarm system voice message indicates elevators are available for evacuation.
EVACUATION APPROACH

- Variable message signage provided by Fire Alarm System
- Specific OEO Sequencing of A17.1-2013 was not provided as 2013 edition is not adopted.
  - OEE requirements have been met except for the sequencing requirements of A17.1-2013 edition.
CONCLUSION

- Construction began in 2013
- Completion in 2016
TRANSBAY BLOCK 5 OVERVIEW
PROJECT SPECIFICS

- Mixed Use Building
  - 43 stories above grade
  - 550 feet tall
  - ~700,000 ft$^2$ Class A Office Space
  - ~10,000 ft$^2$ Retail Space
  - Transbay Development area of San Francisco
PROJECT REQUIREMENTS

- OEEs elected **in lieu** of additional exit stair
  - New High Rise building
  - Highest floor is ~550 feet
    - Taller than 420 feet

- Codes of Record
  - 2012 IBC
  - 2013 NFPA 72
  - 2010 ASME A17.1 ****

**** 2010 edition of ASME A17.1 does not have language for OEEs or OEO. First edition to include this was 2013 edition.

Approval obtained by Authorities to use 2013 Edition for OEO guidance.
OEE APPROACH

Eliminated need for 3rd exit stair

- Small footprint floor area especially on higher floors
- Freed approx. 200 ft² per floor
- Long term monetary impact of gained space
Goal for strict adherence to all OEE requirements in IBC, NFPA 72 and A17.1.

• Elevator system to provide variable message signage
  – Including time to arrival for elevators
    » Has not been provided on other OEE projects

• Fire alarm system to control OEO and provide per floor signals
  – FAS to Elevator Interface could be serial communications
    » Would be the first time this technology is utilized for OEO
CONCLUSION

- Construction began October 2015
- Expected completion in 2018
181 FREMONT STREET OVERVIEW

PROJECT SPECIFICS

○ Mixed Use Building
  • 70 stories above grade
  • 800 feet tall
  • 435,000 ft² Class A Office Space
  • 67 Residential Units
  • Transbay Development area of San Francisco

San Francisco, CA
PROJECT REQUIREMENTS

- OEEs elected **in lieu** of additional exit stair
  - New High Rise building
  - Highest floor is ~700 feet
    - Taller than 420 feet

- Codes of Record
  - 2012 IBC
  - 2013 NFPA 72
  - 2010 ASME A17.1 ****

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**OEE DECISION**

- Eliminated need for 3rd exit stair
- Small footprint floor area
- Freed ~ 200 ft² per floor.
  - Additional 116,000 ft² of space for offices and residential.
- Long term monetary impact of gained space
CONCLUSION

- Construction began in 2013
- Expected completion in 2017
CURRENT STATUS OF OEE IMPLEMENTATION

Ο OEEs are being utilized more regularly

- California is most concentrated area of OEEs (All three discussed today)
- Expected to be more widely adopted in other areas of country / internationally
  - New York City Building(s) Planned with OEEs
- As OEE awareness expands, more projects will incorporate them.
SUMMARY

NEED FOR ADDITIONAL RESEARCH

OEE installations should be analyzed once complete
- Identify future developments in requirements
- Determine level of effectiveness in real-world scenarios
  - Observation of OEO training / drills
  - Development of accurate egress models for these buildings
QUESTIONS?

Contact
Eric M. Camiel, P.E., CET
+1 401-736-8992
ecamiel@jensenhughes.com

For More Information Visit
www.jensenhughes.com